

ASN1C

ASN.1 Compiler
Version 7.0
C Runtime
Reference Manual

The software described in this document is furnished under a license agreement and may be used only in accordance with the terms of this agreement.

Copyright Notice

Copyright ©1997–2016 Objective Systems, Inc. All rights reserved.

This document may be distributed in any form, electronic or otherwise, provided that it is distributed in its entirety and that the copyright and this notice are included.

Author's Contact Information

Comments, suggestions, and inquiries regarding ASN1C may be submitted via electronic mail to info@obj-sys.com.

Contents

1	C/C++ Common Runtime Classes and Library Functions	1
2	Module Documentation	3
2.1	C Runtime Common Functions	3
2.1.1	Detailed Description	5
2.1.2	Define Documentation	6
2.1.2.1	ALLOC_ASN1ARRAY	6
2.1.2.2	ALLOC_ASN1ARRAY1	6
2.1.2.3	ASN1_K_CCBMaskSize	6
2.1.2.4	ASN1_K_MaxSetElements	6
2.1.2.5	ASN1_K_MINUS_INFINITY	7
2.1.2.6	ASN1_K_NumBitsPerMask	7
2.1.2.7	ASN1_K_PLUS_INFINITY	7
2.1.2.8	ASN1DynOctStr	7
2.1.2.9	ASN_K_ENCBUFSIZ	7
2.1.2.10	ASN_K_MAXDEPTH	7
2.1.2.11	ASN_K_MAXENUM	7
2.1.2.12	ASN_K_MAXERRP	7
2.1.2.13	ASN_K_MAXERRSTK	7
2.1.2.14	ASN_K_MEMBUFSEG	7
2.1.2.15	OSCLEARBIT	7
2.1.2.16	OSCLEARBITP	8
2.1.2.17	OSRTINDENTSPACES	8
2.1.2.18	OSSETBIT	8
2.1.2.19	OSSETBITP	8
2.1.2.20	OSTESTBIT	8
2.1.2.21	OSTESTBITP	9
2.1.2.22	XM_ADVANCE	9

2.1.2.23	XM_DYNAMIC	9
2.1.2.24	XM_OPTIONAL	9
2.1.2.25	XM_SEEK	9
2.1.2.26	XM_SKIP	9
2.1.3	Typedef Documentation	9
2.1.3.1	ASN1BigInt	9
2.1.3.2	ASN1DumpCbFunc	9
2.1.4	Enumeration Type Documentation	9
2.1.4.1	ASN1ActionType	9
2.1.4.2	ASN1StrType	10
2.2	Object Identifier Helper Functions	11
2.2.1	Detailed Description	11
2.2.2	Function Documentation	11
2.2.2.1	rtAddOID	11
2.2.2.2	rtOIDsValid	11
2.2.2.3	rtOIDParseDottedNumberString	12
2.2.2.4	rtOIDsEqual	12
2.2.2.5	rtSetOID	12
2.3	Time Helper Functions	13
2.3.1	Detailed Description	13
2.3.2	Function Documentation	13
2.3.2.1	normalizeTimeZone	13
2.3.2.2	rtMakeGeneralizedTime	13
2.3.2.3	rtMakeUTCtime	14
2.3.2.4	rtParseGeneralizedTime	14
2.3.2.5	rtParseUTCtime	14
2.4	Character String Conversion Functions	16
2.4.1	Detailed Description	16
2.4.2	Function Documentation	16
2.4.2.1	rtBMPToCString	16
2.4.2.2	rtBMPToNewCString	17
2.4.2.3	rtBMPToNewCStringEx	17
2.4.2.4	rtCToBMPString	17
2.4.2.5	rtCToUCSString	18
2.4.2.6	rtIsIn16BitCharSet	18
2.4.2.7	rtIsIn32BitCharSet	18
2.4.2.8	rtUCSToCString	18

2.4.2.9	rtUCSToNewCString	19
2.4.2.10	rtUCSToNewCStringEx	19
2.4.2.11	rtUCSToWCSSString	19
2.4.2.12	rtUnivStrToUTF8	20
2.4.2.13	rtUTF8StrnToASN1DynBitStr	20
2.4.2.14	rtUTF8StrToASN1DynBitStr	20
2.4.2.15	rtValidateChars	21
2.4.2.16	rtValidateStr	21
2.4.2.17	rtWCSToUCSSString	21
2.5	Binary Coded Decimal (BCD) Helper Functions	22
2.5.1	Detailed Description	22
2.5.2	Define Documentation	22
2.5.2.1	rtDecQ825TBCDString	22
2.5.2.2	rtEncQ825TBCDString	23
2.5.2.3	rtQ825TBCDToString	23
2.5.2.4	rtTBCDBinToChar	23
2.5.2.5	rtTBCDCharToBin	24
2.5.3	Function Documentation	24
2.5.3.1	rtBCDToString	24
2.5.3.2	rtStringToBCD	25
2.5.3.3	rtStringToDynBCD	25
2.5.3.4	rtStringToTBCD	25
2.5.3.5	rtTBCDToString	26
2.6	Comparison Functions	27
2.6.1	Detailed Description	28
2.6.2	Define Documentation	28
2.6.2.1	rtCmpOID	28
2.6.2.2	rtCmpOID64	28
2.6.3	Function Documentation	28
2.6.3.1	rtCmp16BitCharStr	28
2.6.3.2	rtCmp32BitCharStr	28
2.6.3.3	rtCmpBitStr	29
2.6.3.4	rtCmpBoolean	29
2.6.3.5	rtCmpCharStr	30
2.6.3.6	rtCmpInt64	30
2.6.3.7	rtCmpInt8	30
2.6.3.8	rtCmpInteger	31

2.6.3.9	rtCmpOctStr	31
2.6.3.10	rtCmpOID64Value	32
2.6.3.11	rtCmpOIDValue	32
2.6.3.12	rtCmpOpenType	32
2.6.3.13	rtCmpOpenTypeExt	33
2.6.3.14	rtCmpOptional	33
2.6.3.15	rtCmpReal	34
2.6.3.16	rtCmpSeqOfElements	34
2.6.3.17	rtCmpSInt	34
2.6.3.18	rtCmpTag	35
2.6.3.19	rtCmpUInt64	35
2.6.3.20	rtCmpUInt8	35
2.6.3.21	rtCmpUnsigned	36
2.6.3.22	rtCmpUSInt	36
2.7	Comparison to Standard Output Functions	37
2.7.1	Detailed Description	37
2.7.2	Function Documentation	37
2.7.2.1	rtCmpToStdout16BitCharStr	37
2.7.2.2	rtCmpToStdout32BitCharStr	38
2.7.2.3	rtCmpToStdoutBitStr	38
2.7.2.4	rtCmpToStdoutBoolean	38
2.7.2.5	rtCmpToStdoutCharStr	38
2.7.2.6	rtCmpToStdoutInt64	38
2.7.2.7	rtCmpToStdoutInteger	39
2.7.2.8	rtCmpToStdoutOctStr	39
2.7.2.9	rtCmpToStdoutOID	39
2.7.2.10	rtCmpToStdoutOID64	39
2.7.2.11	rtCmpToStdoutOID64Value	39
2.7.2.12	rtCmpToStdoutOIDValue	40
2.7.2.13	rtCmpToStdoutOpenType	40
2.7.2.14	rtCmpToStdoutOpenTypeExt	40
2.7.2.15	rtCmpToStdoutOptional	40
2.7.2.16	rtCmpToStdoutReal	40
2.7.2.17	rtCmpToStdoutSeqOfElements	41
2.7.2.18	rtCmpToStdoutTag	41
2.7.2.19	rtCmpToStdoutUInt64	41
2.7.2.20	rtCmpToStdoutUnsigned	41

2.8	Copy Functions	42
2.8.1	Detailed Description	42
2.8.2	Function Documentation	42
2.8.2.1	rtCopy16BitCharStr	42
2.8.2.2	rtCopy32BitCharStr	43
2.8.2.3	rtCopyBitStr	43
2.8.2.4	rtCopyCharStr	43
2.8.2.5	rtCopyDynBitStr	44
2.8.2.6	rtCopyDynOctStr	44
2.8.2.7	rtCopyOctStr	44
2.8.2.8	rtCopyOID	45
2.8.2.9	rtCopyOID64	45
2.8.2.10	rtCopyOpenType	45
2.8.2.11	rtCopyOpenTypeExt	46
2.9	Character string functions	47
2.9.1	Detailed Description	47
2.9.2	Function Documentation	47
2.9.2.1	rtxCharStrToInt	47
2.9.2.2	rtxHexCharsToBin	48
2.9.2.3	rtxHexCharsToBinCount	48
2.9.2.4	rtxInt64ToCharStr	48
2.9.2.5	rtxIntToCharStr	49
2.9.2.6	rtxSizeToCharStr	49
2.9.2.7	rtxStrcat	49
2.9.2.8	rtxStrcpy	50
2.9.2.9	rtxStrdup	50
2.9.2.10	rtxStrDynJoin	50
2.9.2.11	rtxStricmp	51
2.9.2.12	rtxStrJoin	51
2.9.2.13	rtxStrncat	51
2.9.2.14	rtxStrncpy	52
2.9.2.15	rtxUInt64ToCharStr	52
2.9.2.16	rtxUIntToCharStr	52
2.10	Date/time conversion functions	53
2.10.1	Detailed Description	53
2.10.2	Function Documentation	54
2.10.2.1	rtxCmpDate	54

2.10.2.2	rtxCmpDate2	54
2.10.2.3	rtxCmpDateTime	54
2.10.2.4	rtxCmpDateTime2	55
2.10.2.5	rtxCmpTime	55
2.10.2.6	rtxCmpTime2	56
2.10.2.7	rtxDateIsValid	56
2.10.2.8	rtxDateTimeIsValid	56
2.10.2.9	rtxDateTimeToString	57
2.10.2.10	rtxDateToString	57
2.10.2.11	rtxDurationToMsecs	57
2.10.2.12	rtxGDayToString	58
2.10.2.13	rtxCurrDateTime	58
2.10.2.14	rtxGetDateTime	58
2.10.2.15	rtxGMonthDayToString	59
2.10.2.16	rtxGMonthToString	59
2.10.2.17	rtxGYearMonthToString	59
2.10.2.18	rtxGYearToString	60
2.10.2.19	rtxMsecsToDuration	60
2.10.2.20	rtxParseDateString	60
2.10.2.21	rtxParseDateTimeString	61
2.10.2.22	rtxParseGDayString	61
2.10.2.23	rtxParseGMonthDayString	62
2.10.2.24	rtxParseGMonthString	62
2.10.2.25	rtxParseGYearMonthString	62
2.10.2.26	rtxParseGYearString	63
2.10.2.27	rtxParseTimeString	63
2.10.2.28	rtxSetDateTime	64
2.10.2.29	rtxSetLocalDateTime	64
2.10.2.30	rtxSetUtcDateTime	64
2.10.2.31	rtxTimeIsValid	65
2.10.2.32	rtxTimeToString	65
2.11	Floating-point number utility functions	66
2.11.1	Detailed Description	66
2.11.2	Function Documentation	66
2.11.2.1	rtxGetMinusInfinity	66
2.11.2.2	rtxGetMinusZero	66
2.11.2.3	rtxGetNaN	66

2.11.2.4	<code>rtxGetPlusInfinity</code>	66
2.11.2.5	<code>rtxIsApproximate</code>	66
2.11.2.6	<code>rtxIsApproximateAbs</code>	67
2.11.2.7	<code>rtxIsMinusInfinity</code>	67
2.11.2.8	<code>rtxIsMinusZero</code>	67
2.11.2.9	<code>rtxIsNaN</code>	67
2.11.2.10	<code>rtxIsPlusInfinity</code>	67
2.12	Decimal number utility functions	68
2.12.1	Detailed Description	68
2.13	UTF-8 String Functions	69
2.13.1	Detailed Description	70
2.13.2	Define Documentation	70
2.13.2.1	<code>OSRTCHKUTF8LEN</code>	70
2.13.2.2	<code>RTUTF8STRCMPL</code>	70
2.13.3	Function Documentation	70
2.13.3.1	<code>rtxUTF8CharSize</code>	70
2.13.3.2	<code>rtxUTF8CharToWC</code>	71
2.13.3.3	<code>rtxUTF8DecodeChar</code>	71
2.13.3.4	<code>rtxUTF8EncodeChar</code>	71
2.13.3.5	<code>rtxUTF8Len</code>	71
2.13.3.6	<code>rtxUTF8LenBytes</code>	72
2.13.3.7	<code>rtxUTF8RemoveWhiteSpace</code>	72
2.13.3.8	<code>rtxUTF8StrChr</code>	72
2.13.3.9	<code>rtxUTF8Strcmp</code>	72
2.13.3.10	<code>rtxUTF8Strcpy</code>	73
2.13.3.11	<code>rtxUTF8Strdup</code>	73
2.13.3.12	<code>rtxUTF8StrEqual</code>	73
2.13.3.13	<code>rtxUTF8StrHash</code>	73
2.13.3.14	<code>rtxUTF8StrJoin</code>	74
2.13.3.15	<code>rtxUTF8Strncmp</code>	74
2.13.3.16	<code>rtxUTF8Strncpy</code>	74
2.13.3.17	<code>rtxUTF8Strndup</code>	75
2.13.3.18	<code>rtxUTF8StrnEqual</code>	75
2.13.3.19	<code>rtxUTF8StrNextTok</code>	75
2.13.3.20	<code>rtxUTF8StrnToBool</code>	76
2.13.3.21	<code>rtxUTF8StrnToDouble</code>	76
2.13.3.22	<code>rtxUTF8StrnToDynHexStr</code>	76

2.13.3.23	rtxUTF8StrnToInt	77
2.13.3.24	rtxUTF8StrnToInt64	77
2.13.3.25	rtxUTF8StrnToSize	77
2.13.3.26	rtxUTF8StrntoUInt	78
2.13.3.27	rtxUTF8StrntoUInt64	78
2.13.3.28	rtxUTF8StrRefOrDup	78
2.13.3.29	rtxUTF8StrToBool	78
2.13.3.30	rtxUTF8StrToDouble	79
2.13.3.31	rtxUTF8StrToDynHexStr	79
2.13.3.32	rtxUTF8StrToInt	79
2.13.3.33	rtxUTF8StrToInt64	80
2.13.3.34	rtxUTF8StrToNamedBits	80
2.13.3.35	rtxUTF8StrToSize	80
2.13.3.36	rtxUTF8StrtoUInt	81
2.13.3.37	rtxUTF8StrtoUInt64	81
2.13.3.38	rtxUTF8ToDynUniStr	81
2.13.3.39	rtxUTF8ToUnicode	81
2.13.3.40	rtxValidateUTF8	82
2.14	Bit String Functions	83
2.14.1	Detailed Description	83
2.14.2	Define Documentation	83
2.14.2.1	OSRTBYTEARRAYSIZE	83
2.14.3	Function Documentation	83
2.14.3.1	rtxCheckBitBounds	83
2.14.3.2	rtxClearBit	84
2.14.3.3	rtxGetBitCount	84
2.14.3.4	rtxLastBitSet	84
2.14.3.5	rtxSetBit	84
2.14.3.6	rtxSetBitFlags	85
2.14.3.7	rtxTestBit	85
2.15	Context Management Functions	86
2.15.1	Detailed Description	87
2.15.2	Define Documentation	87
2.15.2.1	OSRT_GET_FIRST_ERROR_INFO	87
2.15.2.2	OSRT_GET_LAST_ERROR_INFO	88
2.15.2.3	rtxByteAlign	88
2.15.2.4	rtxCtxtGetMsgLen	88

2.15.2.5	rtxCtxtGetMsgPtr	88
2.15.2.6	rtxCtxtPeekElemName	88
2.15.2.7	rtxCtxtSetProtocolVersion	89
2.15.2.8	rtxCtxtTestFlag	89
2.15.3	Typedef Documentation	89
2.15.3.1	OSFreeCtxtAppInfoPtr	89
2.15.3.2	OSFreeCtxtGlobalPtr	89
2.15.3.3	OSResetCtxtAppInfoPtr	89
2.15.4	Function Documentation	89
2.15.4.1	rtxCtxtCheckContext	89
2.15.4.2	rtxCtxtCopyContext	90
2.15.4.3	rtxCtxtClearFlag	90
2.15.4.4	rtxCtxtContainerHasRemBits	90
2.15.4.5	rtxCtxtGetBitOffset	90
2.15.4.6	rtxCtxtGetContainerRemBits	91
2.15.4.7	rtxCtxtGetIOByteCount	91
2.15.4.8	rtxCtxtPopAllContainers	91
2.15.4.9	rtxCtxtPopArrayElemName	91
2.15.4.10	rtxCtxtPopContainer	91
2.15.4.11	rtxCtxtPopElemName	92
2.15.4.12	rtxCtxtPopTypeName	92
2.15.4.13	rtxCtxtPushArrayElemName	92
2.15.4.14	rtxCtxtPushContainerBits	92
2.15.4.15	rtxCtxtPushContainerBytes	93
2.15.4.16	rtxCtxtPushElemName	93
2.15.4.17	rtxCtxtPushTypeName	93
2.15.4.18	rtxCtxtSetBitOffset	94
2.15.4.19	rtxCtxtSetBufPtr	94
2.15.4.20	rtxCtxtSetFlag	94
2.15.4.21	rtxCtxtFreeContext	95
2.15.4.22	rtxCtxtInitContext	95
2.15.4.23	rtxCtxtInitContextBuffer	95
2.15.4.24	rtxCtxtInitContextExt	95
2.15.4.25	rtxCtxtInitThreadContext	96
2.15.4.26	rtxCtxtMarkPos	96
2.15.4.27	rtxCtxtMemHeapClearFlags	97
2.15.4.28	rtxCtxtMemHeapSetFlags	97

2.15.4.29	rtxResetToPos	97
2.16	Memory Allocation Macros and Functions	98
2.16.1	Detailed Description	99
2.16.2	Define Documentation	100
2.16.2.1	OSRTALLOCTYPE	100
2.16.2.2	OSRTALLOCTYPEZ	100
2.16.2.3	OSRTREALLOCARRAY	100
2.16.2.4	rtxMemAlloc	100
2.16.2.5	rtxMemAllocArray	101
2.16.2.6	rtxMemAllocArrayZ	101
2.16.2.7	rtxMemAllocType	101
2.16.2.8	rtxMemAllocTypeZ	101
2.16.2.9	rtxMemAllocZ	102
2.16.2.10	rtxMemAutoPtrGetRefCount	102
2.16.2.11	rtxMemAutoPtrRef	102
2.16.2.12	rtxMemAutoPtrUnref	102
2.16.2.13	rtxMemCheck	103
2.16.2.14	rtxMemCheckPtr	103
2.16.2.15	rtxMemFreeArray	103
2.16.2.16	rtxMemFreePtr	103
2.16.2.17	rtxMemFreeType	104
2.16.2.18	rtxMemNewAutoPtr	104
2.16.2.19	rtxMemPrint	104
2.16.2.20	rtxMemRealloc	104
2.16.2.21	rtxMemReallocArray	105
2.16.2.22	rtxMemSetProperty	105
2.16.2.23	rtxMemSysAlloc	105
2.16.2.24	rtxMemSysAllocArray	105
2.16.2.25	rtxMemSysAllocType	106
2.16.2.26	rtxMemSysAllocTypeZ	106
2.16.2.27	rtxMemSysAllocZ	106
2.16.2.28	rtxMemSysFreeArray	107
2.16.2.29	rtxMemSysFreePtr	107
2.16.2.30	rtxMemSysFreeType	107
2.16.2.31	rtxMemSysRealloc	107
2.16.3	Function Documentation	108
2.16.3.1	rtxMemFree	108

2.16.3.2	rtxMemGetDefBlkSize	108
2.16.3.3	rtxMemHeapGetDefBlkSize	108
2.16.3.4	rtxMemHeapIsEmpty	108
2.16.3.5	rtxMemIsZero	109
2.16.3.6	rtxMemReset	109
2.16.3.7	rtxMemSetAllocFuncs	109
2.16.3.8	rtxMemSetDefBlkSize	109
2.17	Memory Buffer Management Functions	110
2.17.1	Detailed Description	110
2.17.2	Define Documentation	111
2.17.2.1	OSMBAPPENDSTR	111
2.17.2.2	OSMBAPPENDUTF8	111
2.17.3	Function Documentation	111
2.17.3.1	rtxMemBufAppend	111
2.17.3.2	rtxMemBufCut	111
2.17.3.3	rtxMemBufFree	112
2.17.3.4	rtxMemBufGetData	112
2.17.3.5	rtxMemBufGetDataExt	112
2.17.3.6	rtxMemBufGetDataLen	112
2.17.3.7	rtxMemBufInit	113
2.17.3.8	rtxMemBufInitBuffer	113
2.17.3.9	rtxMemBufPreAllocate	113
2.17.3.10	rtxMemBufReset	113
2.17.3.11	rtxMemBufSet	114
2.17.3.12	rtxMemBufSetExpandable	114
2.17.3.13	rtxMemBufSetUseSysMem	114
2.17.3.14	rtxMemBufTrimW	115
2.18	Print Functions	116
2.18.1	Detailed Description	117
2.18.2	Function Documentation	117
2.18.2.1	rtxByteToHexChar	117
2.18.2.2	rtxByteToHexCharWithPrefix	117
2.18.2.3	rtxHexDump	117
2.18.2.4	rtxHexDumpEx	117
2.18.2.5	rtxHexDumpFileContents	118
2.18.2.6	rtxHexDumpFileContentsToFile	118
2.18.2.7	rtxHexDumpToFile	118

2.18.2.8	rtxHexDumpToFileEx	118
2.18.2.9	rtxHexDumpToFileExNoAscii	118
2.18.2.10	rtxHexDumpToNamedFile	119
2.18.2.11	rtxHexDumpToString	119
2.18.2.12	rtxHexDumpToStringEx	119
2.18.2.13	rtxPrintBoolean	120
2.18.2.14	rtxPrintCharStr	120
2.18.2.15	rtxPrintCloseBrace	120
2.18.2.16	rtxPrintDate	120
2.18.2.17	rtxPrintDateTime	120
2.18.2.18	rtxPrintDecrIndent	120
2.18.2.19	rtxPrintFile	121
2.18.2.20	rtxPrintHexBinary	121
2.18.2.21	rtxPrintHexStr	121
2.18.2.22	rtxPrintHexStrNoAscii	121
2.18.2.23	rtxPrintHexStrPlain	122
2.18.2.24	rtxPrintIncrIndent	122
2.18.2.25	rtxPrintIndent	122
2.18.2.26	rtxPrintInt64	122
2.18.2.27	rtxPrintInteger	122
2.18.2.28	rtxPrintNull	122
2.18.2.29	rtxPrintNVP	123
2.18.2.30	rtxPrintOpenBrace	123
2.18.2.31	rtxPrintReal	123
2.18.2.32	rtxPrintTime	123
2.18.2.33	rtxPrintUInt64	123
2.18.2.34	rtxPrintUnicodeCharStr	123
2.18.2.35	rtxPrintUnsigned	124
2.18.2.36	rtxPrintUTF8CharStr	124
2.19	Print-To-Stream Functions	125
2.19.1	Detailed Description	125
2.19.2	Function Documentation	126
2.19.2.1	rtxHexDumpToStream	126
2.19.2.2	rtxHexDumpToStreamEx	126
2.19.2.3	rtxHexDumpToStreamExNoAscii	126
2.19.2.4	rtxPrintToStreamBoolean	126
2.19.2.5	rtxPrintToStreamCharStr	127

2.19.2.6	rtxPrintToStreamCloseBrace	127
2.19.2.7	rtxPrintToStreamDate	127
2.19.2.8	rtxPrintToStreamDateTime	127
2.19.2.9	rtxPrintToStreamDecrIndent	127
2.19.2.10	rtxPrintToStreamFile	128
2.19.2.11	rtxPrintToStreamHexBinary	128
2.19.2.12	rtxPrintToStreamHexStr	128
2.19.2.13	rtxPrintToStreamHexStrNoAscii	128
2.19.2.14	rtxPrintToStreamHexStrPlain	129
2.19.2.15	rtxPrintToStreamIncrIndent	129
2.19.2.16	rtxPrintToStreamIndent	129
2.19.2.17	rtxPrintToStreamInt64	129
2.19.2.18	rtxPrintToStreamInteger	129
2.19.2.19	rtxPrintToStreamNull	130
2.19.2.20	rtxPrintToStreamNVP	130
2.19.2.21	rtxPrintToStreamOpenBrace	130
2.19.2.22	rtxPrintToStreamReal	130
2.19.2.23	rtxPrintToStreamTime	130
2.19.2.24	rtxPrintToStreamUInt64	131
2.19.2.25	rtxPrintToStreamUnicodeCharStr	131
2.19.2.26	rtxPrintToStreamUnsigned	131
2.19.2.27	rtxPrintToStreamUTF8CharStr	131
2.20	TCP/IP or UDP socket utility functions	132
2.20.1	Typedef Documentation	132
2.20.1.1	OSIPADDR	132
2.20.2	Function Documentation	132
2.20.2.1	rtxSocketAccept	132
2.20.2.2	rtxSocketAddrToStr	133
2.20.2.3	rtxSocketBind	133
2.20.2.4	rtxSocketClose	133
2.20.2.5	rtxSocketConnect	134
2.20.2.6	rtxSocketConnectTimed	134
2.20.2.7	rtxSocketCreate	134
2.20.2.8	rtxSocketGetHost	134
2.20.2.9	rtxSocketListen	135
2.20.2.10	rtxSocketParseURL	135
2.20.2.11	rtxSocketRecv	135

2.20.2.12	rtxSocketRecvTimed	136
2.20.2.13	rtxSocketSelect	136
2.20.2.14	rtxSocketSend	136
2.20.2.15	rtxSocketSetBlocking	137
2.20.2.16	rtxSocketsInit	137
2.20.2.17	rtxSocketStrToAddr	137
2.21	Input/Output Data Stream Utility Functions	138
2.21.1	Detailed Description	139
2.21.2	Define Documentation	139
2.21.2.1	OSRTSTREAM_BYTEINDEX	139
2.21.3	Typedef Documentation	140
2.21.3.1	OSRTSTREAM	140
2.21.3.2	OSRTStreamBlockingReadProc	140
2.21.3.3	OSRTStreamCloseProc	140
2.21.3.4	OSRTStreamFlushProc	140
2.21.3.5	OSRTStreamGetPosProc	140
2.21.3.6	OSRTStreamMarkProc	140
2.21.3.7	OSRTStreamReadProc	140
2.21.3.8	OSRTStreamResetProc	140
2.21.3.9	OSRTStreamSetPosProc	140
2.21.3.10	OSRTStreamSkipProc	141
2.21.3.11	OSRTStreamWriteProc	141
2.21.4	Function Documentation	141
2.21.4.1	rtxStreamBlockingRead	141
2.21.4.2	rtxStreamClose	141
2.21.4.3	rtxStreamFlush	141
2.21.4.4	rtxStreamGetCapture	142
2.21.4.5	rtxStreamGetIOBytes	142
2.21.4.6	rtxStreamGetPos	142
2.21.4.7	rtxStreamInit	142
2.21.4.8	rtxStreamIsOpened	143
2.21.4.9	rtxStreamIsReadable	143
2.21.4.10	rtxStreamIsWritable	143
2.21.4.11	rtxStreamMark	143
2.21.4.12	rtxStreamMarkSupported	144
2.21.4.13	rtxStreamRead	144
2.21.4.14	rtxStreamRelease	144

2.21.4.15	rtxStreamReset	144
2.21.4.16	rtxStreamSetCapture	145
2.21.4.17	rtxStreamSetPos	145
2.21.4.18	rtxStreamSkip	145
2.21.4.19	rtxStreamWrite	145
2.22	File stream functions.	146
2.22.1	Detailed Description	146
2.22.2	Function Documentation	146
2.22.2.1	rtxStreamFileAttach	146
2.22.2.2	rtxStreamFileCreateReader	146
2.22.2.3	rtxStreamFileCreateWriter	147
2.22.2.4	rtxStreamFileOpen	147
2.23	Memory stream functions.	148
2.23.1	Detailed Description	148
2.23.2	Function Documentation	148
2.23.2.1	rtxStreamMemoryAttach	148
2.23.2.2	rtxStreamMemoryCreate	148
2.23.2.3	rtxStreamMemoryCreateReader	149
2.23.2.4	rtxStreamMemoryCreateWriter	149
2.23.2.5	rtxStreamMemoryGetBuffer	149
2.23.2.6	rtxStreamMemoryResetWriter	149
2.24	Socket stream functions.	150
2.24.1	Detailed Description	150
2.24.2	Function Documentation	150
2.24.2.1	rtxStreamSocketAttach	150
2.24.2.2	rtxStreamSocketClose	150
2.24.2.3	rtxStreamSocketCreateWriter	151
2.24.2.4	rtxStreamSocketSetOwnership	151
2.24.2.5	rtxStreamSocketSetReadTimeout	151
2.25	Doubly-Linked List Utility Functions	152
2.25.1	Detailed Description	153
2.25.2	Function Documentation	153
2.25.2.1	rtxDListAppend	153
2.25.2.2	rtxDListAppendArray	153
2.25.2.3	rtxDListAppendArrayCopy	153
2.25.2.4	rtxDListAppendCharArray	154
2.25.2.5	rtxDListAppendNode	154

2.25.2.6	rtxDListFindByData	155
2.25.2.7	rtxDListFindByIndex	155
2.25.2.8	rtxDListFindIndexByData	155
2.25.2.9	rtxDListFreeAll	155
2.25.2.10	rtxDListFreeNode	156
2.25.2.11	rtxDListFreeNodes	156
2.25.2.12	rtxDListInit	156
2.25.2.13	rtxDListInsert	156
2.25.2.14	rtxDListInsertAfter	157
2.25.2.15	rtxDListInsertBefore	157
2.25.2.16	rtxDListRemove	157
2.25.2.17	rtxDListToArray	158
2.25.2.18	rtxDListToUTF8Str	158
2.26	Linked List Utility Functions	159
2.26.1	Detailed Description	159
2.26.2	Function Documentation	159
2.26.2.1	rtxSListAppend	159
2.26.2.2	rtxSListCreate	160
2.26.2.3	rtxSListCreateEx	160
2.26.2.4	rtxSListFind	160
2.26.2.5	rtxSListFree	160
2.26.2.6	rtxSListFreeAll	161
2.26.2.7	rtxSListInit	161
2.26.2.8	rtxSListInitEx	161
2.26.2.9	rtxSListRemove	161
2.27	Stack Utility Functions	162
2.27.1	Detailed Description	162
2.27.2	Define Documentation	162
2.27.2.1	rtxStackIsEmpty	162
2.27.3	Function Documentation	162
2.27.3.1	rtxStackCreate	162
2.27.3.2	rtxStackInit	163
2.27.3.3	rtxStackPeek	163
2.27.3.4	rtxStackPop	163
2.27.3.5	rtxStackPush	163
2.28	Pattern matching functions	164
2.28.1	Detailed Description	164

2.28.2	Function Documentation	164
2.28.2.1	rtxFreeRegexpCache	164
2.28.2.2	rtxMatchPattern	164
2.29	Diagnostic trace functions	165
2.29.1	Detailed Description	166
2.29.2	Typedef Documentation	166
2.29.2.1	OSRTPrintStream	166
2.29.2.2	rtxPrintCallback	166
2.29.3	Function Documentation	166
2.29.3.1	rtxDiagEnabled	166
2.29.3.2	rtxDiagHexDump	166
2.29.3.3	rtxDiagPrint	167
2.29.3.4	rtxDiagPrintChars	167
2.29.3.5	rtxDiagSetTraceLevel	167
2.29.3.6	rtxDiagStream	167
2.29.3.7	rtxDiagStreamHexDump	168
2.29.3.8	rtxDiagStreamPrintBits	168
2.29.3.9	rtxDiagStreamPrintChars	168
2.29.3.10	rtxDiagToStream	168
2.29.3.11	rtxDiagTraceLevelEnabled	169
2.29.3.12	rtxPrintStreamRelease	169
2.29.3.13	rtxPrintStreamToFileCB	169
2.29.3.14	rtxPrintStreamToStdoutCB	169
2.29.3.15	rtxPrintToStream	170
2.29.3.16	rtxSetDiag	170
2.29.3.17	rtxSetGlobalDiag	170
2.29.3.18	rtxSetGlobalPrintStream	170
2.29.3.19	rtxSetPrintStream	171
2.29.4	Variable Documentation	171
2.29.4.1	g_PrintStream	171
2.30	Error Formatting and Print Functions	172
2.30.1	Detailed Description	173
2.30.2	Define Documentation	173
2.30.2.1	LOG_RTERR	173
2.30.2.2	OSRTASSERT	173
2.30.2.3	OSRTCHECKPARAM	173
2.30.3	Function Documentation	173

2.30.3.1	rtxErrAddCtxtBufParm	173
2.30.3.2	rtxErrAddDoubleParm	174
2.30.3.3	rtxErrAddElemNameParm	174
2.30.3.4	rtxErrAddErrorTableEntry	174
2.30.3.5	rtxErrAddInt64Parm	175
2.30.3.6	rtxErrAddIntParm	175
2.30.3.7	rtxErrAddStrnParm	175
2.30.3.8	rtxErrAddStrParm	175
2.30.3.9	rtxErrAddUInt64Parm	176
2.30.3.10	rtxErrAddUIntParm	176
2.30.3.11	rtxErrAppend	176
2.30.3.12	rtxErrAssertionFailed	177
2.30.3.13	rtxErrCopy	177
2.30.3.14	rtxErrFmtMsg	177
2.30.3.15	rtxErrFreeParms	177
2.30.3.16	rtxErrGetErrorCnt	178
2.30.3.17	rtxErrGetFirstError	178
2.30.3.18	rtxErrGetLastError	178
2.30.3.19	rtxErrGetMsgText	178
2.30.3.20	rtxErrGetMsgTextBuf	179
2.30.3.21	rtxErrGetStatus	179
2.30.3.22	rtxErrGetText	179
2.30.3.23	rtxErrGetTextBuf	180
2.30.3.24	rtxErrInit	180
2.30.3.25	rtxErrInvUIntOpt	180
2.30.3.26	rtxErrLogUsingCB	180
2.30.3.27	rtxErrNewNode	181
2.30.3.28	rtxErrPrint	181
2.30.3.29	rtxErrPrintElement	181
2.30.3.30	rtxErrReset	181
2.30.3.31	rtxErrResetLastErrors	181
2.30.3.32	rtxErrSetData	182
2.30.3.33	rtxErrSetNewData	182
2.31	Run-time error status codes	183
2.31.1	Detailed Description	184
2.31.2	Define Documentation	184
2.31.2.1	RT_OK	184

2.31.2.2	RT_OK_FRAG	184
2.31.2.3	RTERR_ADDRINUSE	185
2.31.2.4	RTERR_ATTRFIXEDVAL	185
2.31.2.5	RTERR_ATTRMISRQ	185
2.31.2.6	RTERR_BADVALUE	185
2.31.2.7	RTERR_BUFOVFLW	185
2.31.2.8	RTERR_CONNREFUSED	185
2.31.2.9	RTERR_CONNRESET	185
2.31.2.10	RTERR_CONSVIO	185
2.31.2.11	RTERR_COPYFAIL	185
2.31.2.12	RTERR_DECATTRFAIL	186
2.31.2.13	RTERR_DECELEMFAIL	186
2.31.2.14	RTERR_ENDOFBUF	186
2.31.2.15	RTERR_ENDOFFILE	186
2.31.2.16	RTERR_EXPIRED	186
2.31.2.17	RTERR_EXPNAME	186
2.31.2.18	RTERR_EXTRDATA	186
2.31.2.19	RTERR_FAILED	186
2.31.2.20	RTERR_FILNOTFOU	186
2.31.2.21	RTERR_HOSTNOTFOU	187
2.31.2.22	RTERR_HTTPERR	187
2.31.2.23	RTERR_IDNOTFOU	187
2.31.2.24	RTERR_INVATTR	187
2.31.2.25	RTERR_INVBASE64	187
2.31.2.26	RTERR_INVBOOL	187
2.31.2.27	RTERR_INVCHAR	187
2.31.2.28	RTERR_INVENUM	187
2.31.2.29	RTERR_INVFORMAT	187
2.31.2.30	RTERR_INVHEXS	188
2.31.2.31	RTERR_INVLEN	188
2.31.2.32	RTERR_INVMAC	188
2.31.2.33	RTERR_INVMSGBUF	188
2.31.2.34	RTERR_INVNULL	188
2.31.2.35	RTERR_INVOCCUR	188
2.31.2.36	RTERR_INVOPT	188
2.31.2.37	RTERR_INVPARAM	188
2.31.2.38	RTERR_INVREAL	188

2.31.2.39	RTERR_INVSOCKET	189
2.31.2.40	RTERR_INVSOCKOPT	189
2.31.2.41	RTERR_INVUTF8	189
2.31.2.42	RTERR_MARKNOTSUP	189
2.31.2.43	RTERR_MULTIPLE	189
2.31.2.44	RTERR_NOCONN	189
2.31.2.45	RTERR_NOMEM	189
2.31.2.46	RTERR_NOSECPARAMS	189
2.31.2.47	RTERR_NOTALIGNED	189
2.31.2.48	RTERR_NOTINIT	189
2.31.2.49	RTERR_NOTINSET	190
2.31.2.50	RTERR_NOTSUPP	190
2.31.2.51	RTERR_NOTYPEINFO	190
2.31.2.52	RTERR_NULLPTR	190
2.31.2.53	RTERR_OUTOFBND	190
2.31.2.54	RTERR_PARSEFAIL	190
2.31.2.55	RTERR_PATMATCH	190
2.31.2.56	RTERR_READERR	190
2.31.2.57	RTERR_REGEX	191
2.31.2.58	RTERR_SEQORDER	191
2.31.2.59	RTERR_SEQOVFLW	191
2.31.2.60	RTERR_SETDUPL	191
2.31.2.61	RTERR_SETMISRQ	191
2.31.2.62	RTERR_SOAPERR	191
2.31.2.63	RTERR_SOAPFAULT	191
2.31.2.64	RTERR_STRMINUSE	191
2.31.2.65	RTERR_STROVFLW	191
2.31.2.66	RTERR_TOOBIG	192
2.31.2.67	RTERR_TOODEEP	192
2.31.2.68	RTERR_UNBAL	192
2.31.2.69	RTERR_UNEXPELEM	192
2.31.2.70	RTERR_UNICODE	192
2.31.2.71	RTERR_UNKNOWNIE	192
2.31.2.72	RTERR_UNREACHABLE	192
2.31.2.73	RTERR_WRITEERR	192
2.31.2.74	RTERR_XMLPARSE	192
2.31.2.75	RTERR_XMLSTATE	193

3	Class Documentation	194
3.1	_OSRTSList Struct Reference	194
3.1.1	Detailed Description	194
3.1.2	Member Data Documentation	194
3.1.2.1	count	194
3.1.2.2	head	194
3.1.2.3	tail	194
3.2	_OSRTSListNode Struct Reference	195
3.2.1	Detailed Description	195
3.2.2	Member Data Documentation	195
3.2.2.1	data	195
3.2.2.2	next	195
3.3	_OSRTStack Struct Reference	196
3.3.1	Detailed Description	196
3.4	Asn116BitCharSet Struct Reference	197
3.4.1	Detailed Description	197
3.4.2	Member Data Documentation	197
3.4.2.1	alignedBits	197
3.4.2.2	charSet	197
3.4.2.3	firstChar	197
3.4.2.4	unalignedBits	197
3.5	Asn116BitCharString Struct Reference	198
3.5.1	Detailed Description	198
3.6	Asn132BitCharSet Struct Reference	199
3.6.1	Detailed Description	199
3.6.2	Member Data Documentation	199
3.6.2.1	alignedBits	199
3.6.2.2	charSet	199
3.6.2.3	firstChar	199
3.6.2.4	unalignedBits	199
3.7	Asn132BitCharString Struct Reference	200
3.7.1	Detailed Description	200
3.8	ASN1BigInt Struct Reference	201
3.8.1	Detailed Description	201
3.8.2	Member Data Documentation	201
3.8.2.1	allocated	201
3.8.2.2	dynamic	201

3.8.2.3	mag	201
3.8.2.4	numocts	201
3.8.2.5	sign	201
3.9	ASN1BitStr32 Struct Reference	202
3.9.1	Detailed Description	202
3.10	ASN1CCB Struct Reference	203
3.10.1	Detailed Description	203
3.10.2	Member Data Documentation	203
3.10.2.1	bytes	203
3.10.2.2	len	203
3.10.2.3	mask	203
3.10.2.4	ptr	203
3.10.2.5	seqx	203
3.10.2.6	stat	203
3.11	Asn1CharArray Struct Reference	204
3.11.1	Detailed Description	204
3.12	Asn1CharSet Struct Reference	205
3.12.1	Detailed Description	205
3.12.2	Member Data Documentation	205
3.12.2.1	canonicalSet	205
3.12.2.2	canonicalSetBits	205
3.12.2.3	canonicalSetSize	205
3.12.2.4	charSet	205
3.12.2.5	charSetAlignedBits	205
3.12.2.6	charSetUnalignedBits	205
3.13	ASN1DynBitStr Struct Reference	206
3.13.1	Detailed Description	206
3.14	Asn1Object Struct Reference	207
3.14.1	Detailed Description	207
3.15	ASN1OBJID Struct Reference	208
3.15.1	Detailed Description	208
3.15.2	Member Data Documentation	208
3.15.2.1	numids	208
3.15.2.2	subid	208
3.16	ASN1OctStr Struct Reference	209
3.16.1	Detailed Description	209
3.17	ASN1OID64 Struct Reference	210

3.17.1	Detailed Description	210
3.17.2	Member Data Documentation	210
3.17.2.1	numids	210
3.17.2.2	subid	210
3.18	ASN1OpenType Struct Reference	211
3.18.1	Detailed Description	211
3.19	ASN1SeqOf Struct Reference	212
3.19.1	Detailed Description	212
3.19.2	Member Data Documentation	212
3.19.2.1	elem	212
3.19.2.2	n	212
3.20	ASN1SeqOfOctStr Struct Reference	213
3.20.1	Detailed Description	213
3.20.2	Member Data Documentation	213
3.20.2.1	elem	213
3.20.2.2	n	213
3.21	DirBufDesc Struct Reference	214
3.22	OSBigInt Struct Reference	215
3.23	OSBufferIndex Struct Reference	216
3.23.1	Detailed Description	216
3.24	OSCTXT Struct Reference	217
3.24.1	Detailed Description	217
3.24.2	Member Data Documentation	217
3.24.2.1	containerEndIndexStack	217
3.25	OSRTBuffer Struct Reference	218
3.25.1	Detailed Description	218
3.26	OSRTBufSave Struct Reference	219
3.26.1	Detailed Description	219
3.27	OSRTDList Struct Reference	220
3.27.1	Detailed Description	220
3.27.2	Member Data Documentation	220
3.27.2.1	count	220
3.27.2.2	head	220
3.27.2.3	tail	220
3.28	OSRTDListBuf Struct Reference	221
3.29	OSRTDListNode Struct Reference	222
3.29.1	Detailed Description	222

3.29.2	Member Data Documentation	222
3.29.2.1	data	222
3.29.2.2	next	222
3.29.2.3	prev	222
3.30	OSRTDListUTF8StrNode Struct Reference	223
3.31	OSRTErrInfo Struct Reference	224
3.31.1	Detailed Description	224
3.32	OSRTErrInfoList Struct Reference	225
3.33	OSRTErrLocn Struct Reference	226
3.33.1	Detailed Description	226
3.34	OSRTMEMBUF Struct Reference	227
3.35	OSRTPrintStream Struct Reference	228
3.35.1	Detailed Description	228
3.36	OSRTSTREAM Struct Reference	229
3.36.1	Detailed Description	229
3.36.2	Member Data Documentation	229
3.36.2.1	blockingRead	229
3.36.2.2	bufsize	229
3.36.2.3	bytesProcessed	229
3.36.2.4	close	230
3.36.2.5	extra	230
3.36.2.6	flags	230
3.36.2.7	flush	230
3.36.2.8	getPos	230
3.36.2.9	id	230
3.36.2.10	ioBytes	230
3.36.2.11	mark	230
3.36.2.12	markedBytesProcessed	230
3.36.2.13	nextMarkOffset	230
3.36.2.14	pCaptureBuf	230
3.36.2.15	read	230
3.36.2.16	readAheadLimit	231
3.36.2.17	reset	231
3.36.2.18	segsz	231
3.36.2.19	setPos	231
3.36.2.20	skip	231
3.36.2.21	write	231

4	File Documentation	232
4.1	asn1type.h File Reference	232
4.1.1	Detailed Description	235
4.2	rtBCD.h File Reference	236
4.2.1	Detailed Description	236
4.3	rtCompare.h File Reference	237
4.3.1	Detailed Description	239
4.4	rtCopy.h File Reference	240
4.4.1	Detailed Description	240
4.4.2	Define Documentation	240
4.4.2.1	RTCHKCOPYCHARSTR	240
4.4.2.2	RTCOPYCHARSTR	241
4.5	rtxBase64.h File Reference	242
4.5.1	Detailed Description	242
4.5.2	Function Documentation	242
4.5.2.1	rtxBase64DecodeData	242
4.5.2.2	rtxBase64DecodeDataToFSB	242
4.5.2.3	rtxBase64EncodeData	243
4.5.2.4	rtxBase64EncodeURLParam	243
4.5.2.5	rtxBase64GetBinDataLen	244
4.6	rtxBigInt.h File Reference	245
4.6.1	Detailed Description	245
4.6.2	Function Documentation	245
4.6.2.1	rtxBigIntAdd	245
4.6.2.2	rtxBigIntCompare	246
4.6.2.3	rtxBigIntCopy	246
4.6.2.4	rtxBigIntDigitsNum	246
4.6.2.5	rtxBigIntFastCopy	247
4.6.2.6	rtxBigIntFree	247
4.6.2.7	rtxBigIntGetData	247
4.6.2.8	rtxBigIntGetDataLen	247
4.6.2.9	rtxBigIntInit	248
4.6.2.10	rtxBigIntMultiply	248
4.6.2.11	rtxBigIntPrint	248
4.6.2.12	rtxBigIntSetBytes	248
4.6.2.13	rtxBigIntSetInt64	249
4.6.2.14	rtxBigIntSetStr	249

4.6.2.15	rtxBigIntSetStrm	249
4.6.2.16	rtxBigIntSetUInt64	250
4.6.2.17	rtxBigIntStrCompare	250
4.6.2.18	rtxBigIntSubtract	250
4.6.2.19	rtxBigIntToString	250
4.7	rtxBitString.h File Reference	252
4.7.1	Detailed Description	252
4.8	rtxCharStr.h File Reference	253
4.8.1	Detailed Description	253
4.9	rtxCommon.h File Reference	254
4.9.1	Detailed Description	254
4.10	rtxContext.h File Reference	255
4.10.1	Detailed Description	257
4.10.2	Define Documentation	257
4.10.2.1	OSRTBUFRESTORE	257
4.10.2.2	OSRTBUFRESTORE2	257
4.10.2.3	OSRTBUFSAVE	257
4.10.2.4	OSRTBUFSAVE2	257
4.11	rtxCtype.h File Reference	258
4.11.1	Detailed Description	258
4.12	rtxDateTime.h File Reference	259
4.12.1	Detailed Description	259
4.13	rtxDecimal.h File Reference	260
4.13.1	Detailed Description	260
4.14	rtxDiag.h File Reference	261
4.14.1	Detailed Description	261
4.15	rtxDList.h File Reference	262
4.15.1	Detailed Description	263
4.15.2	Define Documentation	263
4.15.2.1	rtxDListAllocNodeAndData	263
4.15.2.2	rtxDListAppendData	263
4.15.2.3	rtxDListFastInit	263
4.16	rtxErrCodes.h File Reference	264
4.16.1	Detailed Description	265
4.17	rtxError.h File Reference	266
4.17.1	Detailed Description	267
4.18	rtxMemBuf.h File Reference	268

4.18.1 Detailed Description	268
4.19 rtxMemory.h File Reference	269
4.19.1 Detailed Description	271
4.20 rtxPattern.h File Reference	272
4.20.1 Detailed Description	272
4.21 rtxPrint.h File Reference	273
4.21.1 Detailed Description	274
4.22 rtxPrintStream.h File Reference	275
4.22.1 Detailed Description	275
4.23 rtxPrintToStream.h File Reference	276
4.23.1 Detailed Description	277
4.24 rtxReal.h File Reference	278
4.24.1 Detailed Description	278
4.25 rtxSList.h File Reference	279
4.25.1 Detailed Description	279
4.25.2 Define Documentation	279
4.25.2.1 OSALLOCELEMSNODE	279
4.26 rtxSocket.h File Reference	280
4.26.1 Detailed Description	281
4.26.2 Typedef Documentation	281
4.26.2.1 OSRTSOCKET	281
4.27 rtxStack.h File Reference	282
4.27.1 Detailed Description	282
4.28 rtxStream.h File Reference	283
4.28.1 Detailed Description	284
4.29 rtxStreamBuffered.h File Reference	285
4.29.1 Detailed Description	285
4.30 rtxStreamFile.h File Reference	286
4.30.1 Detailed Description	286
4.31 rtxStreamHexText.h File Reference	287
4.31.1 Detailed Description	287
4.31.2 Function Documentation	287
4.31.2.1 rtxStreamHexTextAttach	287
4.32 rtxStreamMemory.h File Reference	288
4.32.1 Detailed Description	288
4.33 rtxStreamSocket.h File Reference	289
4.33.1 Detailed Description	289

4.34	rtxUTF8.h File Reference	290
4.34.1	Detailed Description	291

Chapter 1

C/C++ Common Runtime Classes and Library Functions

The **ASN.1 C++ run-time classes** are wrapper classes that provide an object-oriented interface to the ASN.1 C run-time library functions. The categories of classes provided are as follows:

- Context Management classes manage the **OSCTXT** structure used to keep track of the working variables required to encode or decode ASN.1 messages.
- Message Buffer classes are used to manage message buffers.
- ASN1C Control Base classes are wrapper classes that are used as the base for compiler-generated ASN1C_ classes, including Date and Time Run-time classes.
- ASN.1 Type (ASN1T_) Base classes are used as the base for compiler-generated ASN1T_ C++ data structures.
- ASN.1 Stream classes are used to read and write ASN.1 messages from and to files, sockets, memory buffer, etc.
- TCP/IP or UDP Socket classes provide utility methods for doing socket I/O.
- Asn1NamedEventHandler classes include the base classes for user-defined error handler and event handler classes.

The **C run-time common library** contains common C functions used by the encoding rules (BER/DER, PER, and XER) low-level encode/decode functions. These functions are identified by their *rt* prefixes. The categories of functions provided are as follows:

- Memory Allocation macros and functions handle memory management for the ASN1C run-time.
- Context Management functions handle the allocation, initialization, and destruction of context variables (variables of type **OSCTXT**) that handle the working data used during encoding or decoding a message.
- Diagnostic Trace functions allow the output of trace messages to standard output that trace the execution of compiler generated functions.
- Error Formatting and Print functions allow information about the encode/decode errors to be added to a context block structure and printed out.
- Memory Buffer Management functions handle the allocation, expansion, and de-allocation of dynamic memory buffers used by some encode/decode functions.

- Object Identifier Helper functions provide assistance in working with the object identifier ASN.1 type.
- Linked List and Stack Utility functions are used to maintain linked lists and stacks used within the ASN.1 run-time library functions.
- REAL Helper functions - REAL helper functions provide assistance in working with the REAL ASN.1 type. Two functions are provided to obtain the plus and minus infinity special values.
- Formatted Printing functions allow raw ASN.1 data fields to be formatted and printed to standard output and other output devices.
- Binary Coded Decimal (BCD) helper functions provide assistance in working with BCD numbers.
- Character String Conversion functions convert between standard null-terminated C strings and different ASN.1 string types.
- Big Integer Helper functions are arbitrary-precision integer manipulating functions used to maintain big integers used within the ASN.1 run-time functions.
- Comparison functions allow comparison of the values of primitive ASN.1 types. They make it possible to compare complex structures and determine what elements within those structures are different.
- Comparison to Standard Output functions do the same actions as the other comparison functions, but print the comparison results to standard output instead of to the buffer.
- Copy functions - This group of functions allows copying values of primitive ASN.1 types.
- Print Values to Standard Output functions print the output in a "name=value" format, where the value format is obtained by calling one of the ToString functions with the given value.

Chapter 2

Module Documentation

2.1 C Runtime Common Functions

Classes

- struct [ASN1OctStr](#)
- struct [ASN1DynBitStr](#)
- struct [ASN1BitStr32](#)
- struct [ASN1SeqOf](#)
- struct [ASN1SeqOfOctStr](#)
- struct [ASN1OpenType](#)
- struct [Asn1Object](#)
- struct [Asn116BitCharString](#)
- struct [Asn132BitCharString](#)
- struct [Asn1CharArray](#)
- struct [Asn1CharSet](#)
- struct [Asn116BitCharSet](#)
- struct [Asn132BitCharSet](#)
- struct [ASN1BigInt](#)
- struct [ASN1CCB](#)

Modules

- [Object Identifier Helper Functions](#)
- [Time Helper Functions](#)
- [Character String Conversion Functions](#)
- [Comparison Functions](#)
- [Comparison to Standard Output Functions](#)
- [Copy Functions](#)

Defines

- [#define XM_SEEK 0x01](#)
- [#define XM_ADVANCE 0x02](#)
- [#define XM_DYNAMIC 0x04](#)

- #define `XM_SKIP` 0x08
- #define `XM_OPTIONAL` 0x10
- #define `ASN_K_MAXDEPTH` 32
- #define `ASN_K_MAXENUM` 100
- #define `ASN_K_MAXERRP` 5
- #define `ASN_K_MAXERRSTK` 8
- #define `ASN_K_ENCBUFSIZ` 16*1024
- #define `ASN_K_MEMBUFSEG` 1024
- #define `OSRTINDENTSPACES` 3
- #define `ASN1_K_PLUS_INFINITY` 0x40
- #define `ASN1_K_MINUS_INFINITY` 0x41
- #define `REAL_BINARY` 0x80
- #define `REAL_SIGN` 0x40
- #define `REAL_EXPLEN_MASK` 0x03
- #define `REAL_EXPLEN_1` 0x00
- #define `REAL_EXPLEN_2` 0x01
- #define `REAL_EXPLEN_3` 0x02
- #define `REAL_EXPLEN_LONG` 0x03
- #define `REAL_FACTOR_MASK` 0x0c
- #define `REAL_BASE_MASK` 0x30
- #define `REAL_BASE_2` 0x00
- #define `REAL_BASE_8` 0x10
- #define `REAL_BASE_16` 0x20
- #define `REAL_ISO6093_MASK` 0x3F
- #define `ASN1REALMAX` (OSREAL)DBL_MAX
- #define `ASN1REALMIN` (OSREAL)-DBL_MAX
- #define `ASN1DynOctStr` OSDynOctStr
- #define `OSSETBIT`(bitStr, bitIndex) rtxSetBit (bitStr.data, bitStr.numbits, bitIndex)
- #define `OSSETBITP`(pBitStr, bitIndex) rtxSetBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)
- #define `OSCLEARBIT`(bitStr, bitIndex) rtxClearBit (bitStr.data, bitStr.numbits, bitIndex)
- #define `OSCLEARBITP`(pBitStr, bitIndex) rtxClearBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)
- #define `OSTESTBIT`(bitStr, bitIndex) rtxTestBit (bitStr.data, bitStr.numbits, bitIndex)
- #define `OSTESTBITP`(pBitStr, bitIndex) rtxTestBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)
- #define `ASN1_K_CCBMaskSize` 32
- #define `ASN1_K_NumBitsPerMask` 16
- #define `ASN1_K_MaxSetElements` (ASN1_K_CCBMaskSize*ASN1_K_NumBitsPerMask)
- #define `ASN1NUMOCTS`(nbits) ((nbits>0)?(((nbits-1)/8)+1):0)

Typedefs

- typedef void * `ASN1ANY`
- typedef `Asn1Object` `ASN1Object`
- typedef OSUNICHAR `ASN116BITCHAR`
- typedef const char * `ASN1GeneralizedTime`
- typedef const char * `ASN1GeneralString`
- typedef const char * `ASN1GraphicString`
- typedef const char * `ASN1IA5String`
- typedef const char * `ASN1ISO646String`
- typedef const char * `ASN1NumericString`
- typedef const char * `ASN1ObjectDescriptor`

- typedef const char * **ASN1PrintableString**
- typedef const char * **ASN1TeletexString**
- typedef const char * **ASN1T61String**
- typedef const char * **ASN1UTCTime**
- typedef const char * **ASN1VideotexString**
- typedef const char * **ASN1VisibleString**
- typedef const OSUTF8CHAR * **ASN1UTF8String**
- typedef [Asn116BitCharString](#) **ASN1BMPSString**
- typedef [Asn132BitCharString](#) **ASN1UniversalString**
- typedef struct [ASN1BigInt](#) **ASN1BigInt**
- typedef int(* [ASN1DumpCbFunc](#))(const char *text_p, void *cbArg_p)

Enumerations

- enum [ASN1StrType](#) { **ASN1HEX**, **ASN1BIN**, **ASN1CHR** }
- enum [ASN1ActionType](#) { **ASN1ENCODE**, **ASN1DECODE** }
- #define [ALLOC_ASN1ARRAY](#)(pctx, pseqof, type)
- #define [ALLOC_ASN1ARRAY1](#)(pctx, pseqof, type)

2.1.1 Detailed Description

The **C run-time common library** contains common C functions used by the low-level encode/decode functions. These functions are identified by their *rt* and *rtx* prefixes.

The categories of functions provided are as follows:

- Context management functions handle the allocation, initialization, and destruction of context variables (variables of type [OSCTXT](#)) that handle the working data used during the encoding or decoding of a message.
- Memory allocation macros and functions provide an optimized memory management interface.
- Doubly linked list (DList) functions are used to manipulate linked list structures that are used to model repeating XSD types and elements.
- UTF-8 and Unicode character string functions provide support for conversions to and from these formats in C or C++.
- Date/time conversion functions provide utilities for converting system and structured numeric date/time values to XML schema standard string format.
- Pattern matching function compare strings against patterns specified using regular expressions (regexp's).
- Diagnostic trace functions allow the output of trace messages to standard output.
- Error formatting and print functions allow information about encode/decode errors to be added to a context block structure and printed out.
- Memory buffer management functions handle the allocation, expansion, and de-allocation of dynamic memory buffers used by some encode/decode functions.
- Formatted print functions allow binary data to be formatted and printed to standard output and other output devices.
- Big Integer helper functions are arbitrary-precision integer manipulating functions used to maintain big integers.

2.1.2 Define Documentation

2.1.2.1 #define ALLOC_ASN1ARRAY(pctxt, pseqof, type)

Value:

```
do {\
if (sizeof(type)*(pseqof)->n < (pseqof)->n) return RTERR_NOMEM; \
if (((pseqof)->elem = (type*) rtxMemHeapAllocZ \
(&(pctxt)->pMemHeap, sizeof(type)*(pseqof)->n)) == 0) return RTERR_NOMEM; \
} while (0)
```

Memory allocation functions and macros handle memory management for the ASN1C run-time. Special algorithms are used for allocation and deallocation of memory to improve the run-time performance. Allocate a dynamic array. This macro allocates a dynamic array of records of the given type. This version of the macro will return the RTERR_NOMEM error status if the memory request cannot be fulfilled.

Parameters

pctxt - Pointer to a context block

pseqof - Pointer to a generated SEQUENCE OF array structure. The *n* member variable must be set to the number of records to allocate.

type - Data type of an array record

2.1.2.2 #define ALLOC_ASN1ARRAY1(pctxt, pseqof, type)

Value:

```
do {\
if (sizeof(type)*(pseqof)->n < (pseqof)->n) (pseqof)->elem = 0; \
else (pseqof)->elem = (type*) rtxMemHeapAllocZ \
(&(pctxt)->pMemHeap, sizeof(type)*(pseqof)->n); \
} while (0)
```

Allocate a dynamic array. This macro allocates a dynamic array of records of the given type. This version of the macro will set the internal parameters of the SEQUENCE OF structure to NULL if the memory request cannot be fulfilled.

Parameters

pctxt - Pointer to a context block

pseqof - Pointer to a generated SEQUENCE OF array structure. The *n* member variable must be set to the number of records to allocate.

type - Data type of an array record

2.1.2.3 #define ASN1_K_CCBMaskSize 32

The maximum size for the context control block mask.

2.1.2.4 #define ASN1_K_MaxSetElements (ASN1_K_CCBMaskSize*ASN1_K_NumBitsPerMask)

The maximum number of set elements that can be handled by the CCB.

2.1.2.5 #define ASN1_K_MINUS_INFINITY 0x41

The ASN.1 Real value Minus Infinity.

2.1.2.6 #define ASN1_K_NumBitsPerMask 16

The number of bits that can be set per mask.

2.1.2.7 #define ASN1_K_PLUS_INFINITY 0x40

The ASN.1 Real value Plus Infinity.

2.1.2.8 #define ASN1DynOctStr OSDynOctStr

We define ASN1DynOctStr to be the common generic OSDynOctStr type.

2.1.2.9 #define ASN_K_ENCBUFSIZ 16*1024

dynamic encode buffer extent size

2.1.2.10 #define ASN_K_MAXDEPTH 32

maximum nesting depth for messages

2.1.2.11 #define ASN_K_MAXENUM 100

maximum enum values in an enum type

2.1.2.12 #define ASN_K_MAXERRP 5

maximum error parameters

2.1.2.13 #define ASN_K_MAXERRSTK 8

maximum levels on error ctxt stack

2.1.2.14 #define ASN_K_MEMBUFSEG 1024

memory buffer extent size

2.1.2.15 #define OSCLEARBIT(bitStr, bitIndex) rtxClearBit (bitStr.data, bitStr.numbits, bitIndex)

This macro clears the given bit in the given static bit string.

Parameters

bitStr The bit string to manipulate.

bitIndex The index to clear.

2.1.2.16 #define OSCLEARBITP(pBitStr, bitIndex) rtxClearBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)

This macro clears the given bit in the given dynamic bit string.

Parameters

pBitStr The pointer-to-bit string to manipulate.

bitIndex The index to clear.

2.1.2.17 #define OSRTINDENTSPACES 3

number of spaces for indent

2.1.2.18 #define OSSETBIT(bitStr, bitIndex) rtxSetBit (bitStr.data, bitStr.numbits, bitIndex)

This macro sets the given bit in the given static bit string.

Parameters

bitStr The bit string to manipulate.

bitIndex The index to set.

2.1.2.19 #define OSSETBITP(pBitStr, bitIndex) rtxSetBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)

This macro sets the given bit in the given dynamic bit string.

Parameters

pBitStr A pointer-to-bit string to manipulate.

bitIndex The index to set.

2.1.2.20 #define OSTESTBIT(bitStr, bitIndex) rtxTestBit (bitStr.data, bitStr.numbits, bitIndex)

This macro tests the given bit in the given static bit string.

Parameters

bitStr The bit string to manipulate.

bitIndex The index to test.

Returns

TRUE if the bit is on; FALSE if the bit is off.

2.1.2.21 #define OSTESTBITP(pBitStr, bitIndex) rtxTestBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)

This macro tests the given bit in the given dynamic bit string.

Parameters

pBitStr The pointer-to-bit string to manipulate.

bitIndex The index to set.

2.1.2.22 #define XM_ADVANCE 0x02

advance pointer to contents on match

2.1.2.23 #define XM_DYNAMIC 0x04

alloc dyn mem for decoded variable

2.1.2.24 #define XM_OPTIONAL 0x10

tag test is for optional element

2.1.2.25 #define XM_SEEK 0x01

seek match until found or end-of-buf

2.1.2.26 #define XM_SKIP 0x08

skip to next field after parsing tag

2.1.3 Typedef Documentation

2.1.3.1 typedef struct ASN1BigInt ASN1BigInt

A structure used to define an ASN.1 big integer. This structure is rarely, if ever, used by client code, and will instead be used by generated code to facilitate encoding and decoding integer values that cannot fit in normal C/C++ integer types.

2.1.3.2 typedef int(* ASN1DumpCbFunc)(const char *text_p, void *cbArg_p)

ASN.1 dump utility callback function definition

2.1.4 Enumeration Type Documentation

2.1.4.1 enum ASN1ActionType

An enumerated list of ASN.1 actions: encode or decode.

2.1.4.2 enum ASN1StrType

An enumerated list of the various string types: hexadecimal, binary, and character strings.

2.2 Object Identifier Helper Functions

Classes

- struct [ASN1OBJID](#)
- struct [ASN1OID64](#)

Defines

- `#define ASN_K_MAXSUBIDS 128`

Functions

- void [rtSetOID](#) ([ASN1OBJID](#) *ptarget, [ASN1OBJID](#) *psource)
- void [rtAddOID](#) ([ASN1OBJID](#) *ptarget, [ASN1OBJID](#) *psource)
- OSBOOL [rtOIDsEqual](#) (const [ASN1OBJID](#) *pOID1, const [ASN1OBJID](#) *pOID2)
- int [rtOIDParseDottedNumberString](#) (const char *oidstr, OSSIZE oidstrlen, [ASN1OBJID](#) *pvalue)
- OSBOOL [rtOIDIsValid](#) (const [ASN1OBJID](#) *pvalue)

2.2.1 Detailed Description

Object identifier helper functions provide assistance in working with the object identifier ASN.1 type.

2.2.2 Function Documentation

2.2.2.1 void [rtAddOID](#) ([ASN1OBJID](#) *ptarget, [ASN1OBJID](#) *psource)

This function appends one object identifier to another one. It copies the data from a source variable to the end of a target variable. Typically, the source variable is a compiler-generated object identifier constant that resulted from an object identifier value specification within an ASN.1 specification.

Parameters

ptarget A pointer to a target object identifier variable to receive object identifier data. Typically, this is a variable within a compiler-generated C structure.

psource A pointer to a source object identifier variable to copy to a target. Typically, this is a compiler-generated variable corresponding to an ASN.1 value specification in the ASN.1 source file.

2.2.2.2 OSBOOL [rtOIDIsValid](#) (const [ASN1OBJID](#) *pvalue)

This function determine if an OID value is valid according to ASN.1 rules. In particular it checks a) if number of subidentifiers is greater than or equal to 2, b) if the first subidentifier value is less than or equal to 2, and c) if the first subidentifier is 2 that the second subidentifier is less than 40.

Parameters

pvalue Pointer to OID value to validate.

Returns

True if OID value is valid.

2.2.2.3 int rtOIDParseDottedNumberString (const char * *oidstr*, OSSIZE *oidstrlen*, ASN1OBJID * *pvalue*)

This function parses an OID dotted number string (n.n.n) which is the form of OID XML content. Data must be in the form of numbers and dots only (i.e. OID components in other forms such as names or named number will cause a parse failure). Embedded whitespace will be ignored.

Parameters

- oidstr* OID string containing data to be parsed.
- oidstrlen* Length of the string.
- pvalue* Pointer to OID value to receive parsed OID.

Returns

Status of operation: 0 = success, negative value is failure.

2.2.2.4 OSBOOL rtOIDsEqual (const ASN1OBJID * *pOID1*, const ASN1OBJID * *pOID2*)

This function compares two OID values for equality.

Parameters

- pOID1* Pointer to first OID value to compare.
- pOID2* Pointer to second OID value to compare.

Returns

True if OID's are equal.

2.2.2.5 void rtSetOID (ASN1OBJID * *ptarget*, ASN1OBJID * *psource*)

This function populates an object identifier variable with data. It copies data from a source variable to a target variable. Typically, the source variable is a compiler-generated object identifier constant that resulted from an object identifier value specification within an ASN.1 specification.

Parameters

- ptarget* A pointer to a target object identifier variable to receive object * identifier data. Typically, this is a variable within a compiler-generated C structure.
- psource* A pointer to a source object identifier variable to copy to a target. Typically, this is a compiler-generated variable corresponding to an ASN.1 value specification in the ASN.1 source file.

2.3 Time Helper Functions

Functions

- int `rtMakeGeneralizedTime` (OSCTXT *pctx, const OSNumDateTime *dateTime, char **outdata, size_t outdataSize)
- int `rtMakeUTCTime` (OSCTXT *pctx, const OSNumDateTime *dateTime, char **outdata, size_t outdataSize)
- int `rtParseGeneralizedTime` (OSCTXT *pctx, const char *value, OSNumDateTime *dateTime)
- int `rtParseUTCTime` (OSCTXT *pctx, const char *value, OSNumDateTime *dateTime)
- void `normalizeTimeZone` (OSNumDateTime *pvalue)

2.3.1 Detailed Description

Utility functions for working with time strings in different formats. `rtMake*` functions create time strings, `rtParse*` functions parse time strings into the C `OSNumDateTime` structure defined in `osSysTypes.h`. Implementations of these functions exist for the ASN.1 `GeneralizedTime` and `UTCTime` formats.

2.3.2 Function Documentation

2.3.2.1 void `normalizeTimeZone` (OSNumDateTime * *pvalue*)

This function normalizes the time zone for the given datetime structure.

Parameters

pvalue A pointer-to an `OSNumDateTime` structure.

2.3.2.2 int `rtMakeGeneralizedTime` (OSCTXT * *pctx*, const OSNumDateTime * *dateTime*, char ** *outdata*, size_t *outdataSize*)

This function creates a time string in ASN.1 `GeneralizedTime` format as specified in the X.680 ITU-T standard.

Parameters

pctx A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

dateTime A pointer to a date/time structure that contains components of the date and time.

outdata A pointer to a pointer to a destination string. If `outdataSize` is non-zero, it should be a pointer to a pointer to an actual array. Otherwise, the memory will be allocated and the pointer will be stored in the `outdata`.

outdataSize A size of `outdata` (in octets). If zero, the memory for the `outdata` will be allocated. If not, the `outdata`'s size should be big enough to receive the generated time string. Otherwise, error code will be returned.

Returns

Completion status of operation:

- 0 (`ASN_OK`) = success,
- negative return value is error.

2.3.2.3 **int rtMakeUTCTime (OSCTXT * *pctxt*, const OSNumDateTime * *dateTime*, char ** *outdata*, size_t *outdataSize*)**

This function creates a time string in ASN.1 UTCTime format as specified in the X.680 ITU-T standard.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

dateTime A pointer to a date/time structure that contains components of the date and time.

outdata A pointer to a pointer to a destination string. If *outdataSize* is non-zero, it should be a pointer to a pointer to an actual array. Otherwise, the memory will be allocated and the pointer will be stored in the *outdata*.

outdataSize A size of *outdata* (in octets). If zero, the memory for the *outdata* will be allocated. If not, the *outdata*'s size should be big enough to receive the generated time string. Otherwise, error code will be returned.

Returns

Completion status of operation:

- 0 (ASN_OK) = success,
- negative return value is error.

2.3.2.4 **int rtParseGeneralizedTime (OSCTXT * *pctxt*, const char * *value*, OSNumDateTime * *dateTime*)**

This function parses a time string that is represented in ASN.1 GeneralizedTime format as specified in the X.680 ITU-T standard. It stores the parsed result in a numeric date/time C structure.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

value A pointer to the time string to be parsed.

dateTime A pointer to the destination structure.

Returns

Completion status of operation:

- 0 (ASN_OK) = success,
- negative return value is error.

2.3.2.5 **int rtParseUTCTime (OSCTXT * *pctxt*, const char * *value*, OSNumDateTime * *dateTime*)**

This function parses a time string that is represented in ASN.1 UTCTime format as specified in the X.680 ITU-T standard. It stores the parsed result in a numeric date/time C structure.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

value A pointer to the time string to be parsed.

dateTime A pointer to the destination date/time structure.

Returns

Completion status of operation:

- 0 (ASN_OK) = success,
- negative return value is error.

2.4 Character String Conversion Functions

Functions

- int `rtValidateStr` (ASN1TAG tag, const char *pdata)
- int `rtValidateChars` (ASN1TAG tag, const char *pdata, size_t nchars)
- const char * `rtBMPToCString` (ASN1BMPString *pBMPString, char *cstring, OSUINT32 cstrsize)
- const char * `rtBMPToNewCString` (ASN1BMPString *pBMPString)
- const char * `rtBMPToNewCStringEx` (OSCTXT *pctxt, ASN1BMPString *pBMPString)
- ASN1BMPString * `rtCToBMPString` (OSCTXT *pctxt, const char *cstring, ASN1BMPString *pBMPString, Asn116BitCharSet *pCharSet)
- OSBOOL `rtIsIn16BitCharSet` (OSUNICHAR ch, Asn116BitCharSet *pCharSet)
- const char * `rtUCSToCString` (ASN1UniversalString *pUCSSString, char *cstring, OSUINT32 cstrsize)
- const char * `rtUCSToNewCString` (ASN1UniversalString *pUCSSString)
- const char * `rtUCSToNewCStringEx` (OSCTXT *pctxt, ASN1UniversalString *pUCSSString)
- ASN1UniversalString * `rtCToUCSSString` (OSCTXT *pctxt, const char *cstring, ASN1UniversalString *pUCSSString, Asn132BitCharSet *pCharSet)
- OSBOOL `rtIsIn32BitCharSet` (OS32BITCHAR ch, Asn132BitCharSet *pCharSet)
- wchar_t * `rtUCSToWCSSString` (ASN1UniversalString *pUCSSString, wchar_t *wcstring, OSUINT32 wcstrsize)
- ASN1UniversalString * `rtWCSToUCSSString` (OSCTXT *pctxt, wchar_t *wcstring, ASN1UniversalString *pUCSSString, Asn132BitCharSet *pCharSet)
- int `rtUnivStrToUTF8` (OSCTXT *pctxt, const ASN1UniversalString *pUnivStr, OSOCTET *outbuf, size_t outbufsiz)
- int `rtUTF8StrToASN1DynBitStr` (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, ASN1DynBitStr *pvalue)
- int `rtUTF8StrnToASN1DynBitStr` (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, size_t nbytes, ASN1DynBitStr *pvalue)

2.4.1 Detailed Description

Common utility functions are provided to convert between standard null-terminated C strings and different ASN.1 string types.

2.4.2 Function Documentation

2.4.2.1 const char* `rtBMPToCString` (ASN1BMPString **pBMPString*, char **cstring*, OSUINT32 *cstrsize*)

This function converts a BMP string into a null-terminated C string. Any characters that are not 8-bit characters are discarded.

Parameters

pBMPString A pointer to a BMP string structure to be converted.

cstring A pointer to a buffer to receive the converted string.

cstrsize The size of the buffer to receive the converted string.

Returns

A pointer to the returned string structure. This is the *cstring* argument parameter value.

2.4.2.2 `const char* rtBMPToNewCString (ASN1BMPString * pBMPString)`

This function converts a BMP string into a null-terminated C string. Any characters that are not 8-bit characters are discarded. This function allocates dynamic memory to hold the converted string using the standard C run-time malloc function. The user is responsible for freeing this memory.

Parameters

pBMPString A pointer to a BMP string structure to be converted.

Returns

A pointer to the returned string structure. This is the `cstring` argument parameter value.

2.4.2.3 `const char* rtBMPToNewCStringEx (OSCTXT * pctxt, ASN1BMPString * pBMPString)`

This function converts a BMP string into a null-terminated C string. Any characters that are not 8-bit characters are discarded. In contrast to `rtBMPToNewCString`, this function allocates dynamic memory to hold the converted string using the `rtMemAlloc` function. The `rtMemFreePtr` should be called to release the allocated memory or the `rtmemFree` function should be called to release all memory allocated using the specified context block.

Parameters

pctxt A pointer to a context structure.

pBMPString A pointer to a BMP string structure to be converted.

Returns

A pointer to the returned string structure. This is the `cstring` argument parameter value.

2.4.2.4 `ASN1BMPString* rtCtoBMPString (OSCTXT * pctxt, const char * cstring, ASN1BMPString * pBMPString, Asn16BitCharSet * pCharSet)`

This function converts a null-terminated C string into a 16-bit BMP string structure.

Parameters

pctxt A pointer to a context string.

cstring A pointer to a null-terminated C string to be converted into a BMP string.

pBMPString A pointer to a BMP string structure to receive the converted string.

pCharSet A pointer to a character set structure describing the character set currently associated with the BMP character string type.

Returns

A pointer to BMP string structure. This is the `pBMPString` argument parameter value.

2.4.2.5 ASN1UniversalString* rtCtoUCSString (OSCTXT * *pctxt*, const char * *cstring*, ASN1UniversalString * *pUCSString*, Asn132BitCharSet * *pCharSet*)

This function converts a null-terminated C string into a 32-bit UCS-4 (Universal Character Set, 4 bytes) string structure.

Parameters

pctxt A pointer to a context structure.

cstring A pointer to a null-terminated C string to be converted into a Universal string.

pUCSString A pointer to a Universal string structure to receive the converted string

pCharSet A pointer to a character structure describing the character set currently associated with the Universal character string type.

Returns

A pointer to a Universal string structure. This is the *pUCSString* argument parameter value.

2.4.2.6 OSBOOL rtIsIn16BitCharSet (OSUNICHAR *ch*, Asn116BitCharSet * *pCharSet*)

This function tests whether the given character is in the given 16-bit character set.

Parameters

ch A 16-bit character.

pCharSet A pointer-to [Asn116BitCharSet](#) that contains the set of valid character.

Returns

TRUE if the character is in the set, FALSE otherwise.

2.4.2.7 OSBOOL rtIsIn32BitCharSet (OS32BITCHAR *ch*, Asn132BitCharSet * *pCharSet*)

This function tests whether the given character is in the given 32-bit character set.

Parameters

ch A 32-bit character.

pCharSet A pointer-to [Asn132BitCharSet](#) that contains the set of valid character.

Returns

TRUE if the character is in the set, FALSE otherwise.

2.4.2.8 const char* rtUCStoCString (ASN1UniversalString * *pUCSString*, char * *cstring*, OSUINT32 *cstrsize*)

This function converts a Universal 32-bit string into a null-terminated C string. Any characters that are not 8-bit characters are discarded.

Parameters

pUCSString A pointer to a Universal string structure to be converted.

cstring A pointer to a buffer to receive a converted string.
cstrsize The size of the buffer to receive the converted string.

Returns

The pointer to the returned string. This is the *cstring* argument parameter value.

2.4.2.9 `const char* rtUCSToNewCString (ASN1UniversalString * pUCSString)`

This function converts a Universal 32-bit string into a null-terminated C string. Any characters that are not 8-bit characters are discarded. This function allocates dynamic memory to hold the converted string using the standard C run-time malloc function. The user is responsible for freeing this memory.

Parameters

pUCSString A pointer to a Universal 32-bit string structure to be converted.

Returns

A pointer to allocated null-terminated string. The user is responsible for freeing this memory.

2.4.2.10 `const char* rtUCSToNewCStringEx (OSCTXT * pctx, ASN1UniversalString * pUCSString)`

This function converts a Universal 32-bit string into a null-terminated C string. Any characters that are not 8-bit characters are discarded. In contrast to `rtUCSToNewCString` this function allocates dynamic memory to hold the converted string using the `rtMemAlloc` function. The `rtMemFreePtr` should be called to release the allocated memory or the `rtMemFree` function should be called to release all memory allocated using the specified context block.

Parameters

pctx A pointer to a context block.

pUCSString A pointer to a Universal 32-bit string structure to be converted.

Returns

A pointer to allocated null-terminated string. The user is responsible for freeing this memory.

2.4.2.11 `wchar_t* rtUCSToWCSSString (ASN1UniversalString * pUCSString, wchar_t * wstring, OSUINT32 wstrsize)`

This function converts a 32-bits encoded string to a wide character string.

Parameters

pUCSString A pointer to a Universal string structure.

wstring The pointer to the buffer to receive the converted string.

wstrsize The number of wide characters (`wchar_t`) the outbuffer can hold.

Returns

A character count or error status. This will be negative if the conversion fails. If the result is positive, the number of characters was written to *wstrsize*.

2.4.2.12 int rtUnivStrToUTF8 (OSCTXT * *pctxt*, const ASN1UniversalString * *pUnivStr*, OSOCTET * *outbuf*, size_t *outbufsiz*)

This function converts an ASN.1 Universal String type (32-bit characters) to UTF-8.

Parameters

- pctxt* A pointer to a context structure.
- pUnivStr* Pointer to universal string to be converted.
- outbuf* Output buffer to receive UTF-8 characters.
- outbufsiz* Output buffer size in bytes.

Returns

Zero if conversion was successful, a negative status code if failed.

2.4.2.13 int rtUTF8StrnToASN1DynBitStr (OSCTXT * *pctxt*, const OSUTF8CHAR * *utf8str*, size_t *nbytes*, ASN1DynBitStr * *pvalue*)

This function converts the given part of UTF-8 string to a bit string value. The string consists of a series of '1' and '0' characters. This is the dynamic version in which memory is allocated for the returned binary string variable. Bits are stored from MSB to LSB order.

Parameters

- pctxt* Pointer to context block structure.
- utf8str* UTF-8 string to convert. Not necessary to be null-terminated.
- nbytes* Size in bytes of utf8Str.
- pvalue* Pointer to a variable to receive the decoded boolean value.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.4.2.14 int rtUTF8StrToASN1DynBitStr (OSCTXT * *pctxt*, const OSUTF8CHAR * *utf8str*, ASN1DynBitStr * *pvalue*)

This function converts the given null-terminated UTF-8 string to a bit string value. The string consists of a series of '1' and '0' characters. This is the dynamic version in which memory is allocated for the returned binary string variable. Bits are stored from MSB to LSB order.

Parameters

- pctxt* Pointer to context block structure.
- utf8str* Null-terminated UTF-8 string to convert
- pvalue* Pointer to a variable to receive the decoded boolean value.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.4.2.15 int rtValidateChars (ASN1TAG *tag*, const char * *pdata*, size_t *nchars*)

This function ensures that a given string does not contain invalid characters.

Parameters

tag The ASN.1 Tag that identifies the string.

pdata A pointer to the character string to be examined.

nchars The number of characters in *pdata*.

Returns

This function returns 0 if the string validates or the tag is not associated with a string; it otherwise returns the integer value of the character that invalidates the string.

2.4.2.16 int rtValidateStr (ASN1TAG *tag*, const char * *pdata*)

This function ensures that a given string does not contain invalid characters.

Parameters

tag The ASN.1 Tag that identifies the string.

pdata A pointer to the character string to be examined.

Returns

This function returns 0 if the string validates or the tag is not associated with a string; it otherwise returns the integer value of the character that invalidates the string.

2.4.2.17 ASN1UniversalString* rtWCSToUCSString (OSCTXT * *pctxt*, wchar_t * *wcstring*, ASN1UniversalString * *pUCSString*, Asn132BitCharSet * *pCharSet*)

This function converts a wide-character string to a Universal 32-bits encoded string.

Parameters

pctxt A pointer to a context structure.

wcstring The pointer to the wide-character (Unicode) string to convert

pUCSString The pointer to the Universal String structure to receive the converted string.

pCharSet The pointer to the character set structure describing the character set currently associated with the Universal character string type.

Returns

If the conversion of the WCS to the UTF-8 was successful, the number of bytes in the converted string is returned. If the encoding fails, a negative status value is returned.

2.5 Binary Coded Decimal (BCD) Helper Functions

Defines

- #define `rtQ825TBCDToString`(numocts, data, buffer, bufsiz) `rtxQ825TBCDToString`(numocts, data, buffer, bufsiz)
- #define `rtDecQ825TBCDString`(pctxt, numocts, buffer, bufsiz) `rtxDecQ825TBCDString`(pctxt, numocts, buffer, bufsiz)
- #define `rtEncQ825TBCDString`(pctxt, str) `rtxEncQ825TBCDString`(pctxt, str)
- #define `rtTBCDBinToChar`(bcdDigit, pdigit) `rtxTBCDBinToChar`(bcdDigit, pdigit)
- #define `rtTBCDCharToBin`(digit, pbyte) `rtxTBCDCharToBin`(digit, pbyte)

Functions

- const char * `rtBCDToString` (OSUINT32 numocts, const OSOCTET *data, char *buffer, size_t bufsiz, OS_BOOL isTBCD)
- int `rtStringToBCD` (const char *str, OSOCTET *bcdStr, size_t bufsiz, OS_BOOL isTBCD)
- int `rtStringToDynBCD` (OSCTXT *pctxt, const char *str, ASN1DynOctStr *pocstr)
- int `rtStringToTBCD` (const char *str, OSOCTET *bcdStr, size_t bufsiz)
- const char * `rtTBCDToString` (OSUINT32 numocts, const OSOCTET *data, char *buffer, size_t bufsiz)

2.5.1 Detailed Description

Binary Coded Decimal (BCD) helper functions provide assistance in working with BCD numbers. Functions are provided to convert to a BCD values to and from string form.

2.5.2 Define Documentation

2.5.2.1 #define `rtDecQ825TBCDString`(pctxt, numocts, buffer, bufsiz) `rtxDecQ825TBCDString`(pctxt, numocts, buffer, bufsiz)

This function decodes a Q.825 TBCD value to a standard null-terminated string. TBCD digits are read from the decode buffer/stream and converted to their character equivalents. See 'rtQ825TBCDToString' for a description of the Q.825 TBCD format.

Parameters

pctxt Pointer to a context structure block.

numocts The number of octets in the BCD value to be read from input stream.

buffer The destination buffer. Should not be less than bufsiz argument is.

bufsiz The size of the destination buffer (in octets). The buffer size should be at least ((numocts * 2) + 1) to hold the BCD to String conversion.

Returns

Status of conversion: 0 = success, negative = error.

Since

6.6

2.5.2.2 **#define rtEncQ825TBCDString(pctxt, str) rtxEncQ825TBCDString(pctxt, str)**

This function encodes a null-terminated string Q.825 TBCD string. TBCD digits are converted and written to the encode buffer/stream. See 'rtQ825TBCDToString' for a description of the Q.825 TBCD format.

Parameters

pctxt Pointer to a context structure block.

str Null-terminate string to be encoded. This string may only contain valid Q.825 TBCD characters.

Returns

Status of operation: 0 = success, negative = error.

Since

6.6

2.5.2.3 **#define rtQ825TBCDToString(numocts, data, buffer, bufsiz) rtxQ825TBCDToString(numocts, data, buffer, bufsiz)**

This function converts a Q.825 TBCD value to a standard null-terminated string. Octet values can contain the filler digit to represent the odd number of BCD digits.

The encoding is as follows per Q.825:

This type (Telephony Binary Coded Decimal String) is used to represent digits from 0 through 9, *, #, a, b, c, two digits per octet, each digit encoded 0000 to 1001 (0 to 9), 1010 (*) 1011(#), 1100 (a), 1101 (b) or 1110 (c); 1111 (end of pulsing signal-ST); 0000 is used as a filler when there is an odd number of digits.

Parameters

numocts The number of octets in the BCD value.

data The pointer to the BCD value.

buffer The destination buffer. Should not be less than bufsiz argument is.

bufsiz The size of the destination buffer (in octets). The buffer size should be at least $((numocts * 2) + 1)$ to hold the BCD to String conversion.

Returns

Status of conversion: 0 = success, negative = error.

Since

6.6

2.5.2.4 **#define rtTBCDBinToChar(bcdDigit, pdigit) rtxTBCDBinToChar(bcdDigit, pdigit)**

This function converts a TBCD binary character into its ASCII equivalent.

Parameters

bcdDigit TBCD digit

pdigit Pointer to character to receive converted character

Returns

0 if conversion successful, or negative error code

Since

6.6

2.5.2.5 #define rtTBCDCharToBin(digit, pbyte) rtxTBCDCharToBin(digit, pbyte)

This function converts a TBCD character ('0'-'9', '*#abc') into its binary equivalent.

Parameters

digit TBCD digit character ('0'-'9', '*#abc')

pbyte Pointer to byte to receive binary result.

Returns

0 if conversion successful, or negative error code

Since

6.6

2.5.3 Function Documentation

2.5.3.1 const char* rtBCDToString(OSUINT32 numocts, const OSOCTET * data, char * buffer, size_t bufsiz, OSBOOL isTBCD)

This function converts a packed BCD value to a standard null-terminated string. Octet values may contain filler digits if the number of BCD digits is odd.

BCD digits can be 0(0000) to 9(1001). Filler digits can be A(1010), B(1011), C(1100), D(1101), E(1110) or F(1111)

Parameters

numocts The number of octets in the BCD value.

data The pointer to the BCD value.

buffer The destination buffer. Should not be less than bufsiz argument is.

bufsiz The size of the destination buffer (in octets). The buffer size should be atleast $((numocts * 2) + 1)$ to hold the BCD to String conversion.

isTBCD Whether the input data is formatted as a TBCD string or not.

Returns

The converted null-terminated string. NULL, if error has occurred or destination buffer is not enough.

See also

[rtTBCDToString](#)

2.5.3.2 int rtStringToBCD (const char * str, OSOCTET * bcdStr, size_t bufsiz, OSBOOL isTBCD)

This function converts a standard null-terminated string into a BCD value. The source string should contain only characters '0' - '9', 'A' - 'F', or 'a' - 'f'. Otherwise, an error will occur.

Parameters

- str* The source standard null-terminated string.
- bcdStr* The destination buffer. Should not be less than bufsiz is.
- bufsiz* The size of the destination buffer (in octets).
- isTBCD* Whether the string is a TBCD string or not.

Returns

The number of octets in the resulting BCD value or a negative value if an error occurs.

See also

[rtStringToTBCD](#)

2.5.3.3 int rtStringToDynBCD (OSCTXT * pctx, const char * str, ASN1DynOctStr * poctstr)

This function converts a standard null-terminated string into a BCD value. The source string should contain only characters '0' - '9', 'A' - 'F', or 'a' - 'f'. Otherwise, an error will occur.

Parameters

- str* The source standard null-terminated string.
- pctx* Pointer to a context structure block.
- poctstr* Pointer to a dynamic octet string variable. Memory will be allocated for the data member of this structure with rtMemAlloc.

Returns

The number of octets in the resulting BCD value or a negative value if an error occurs.

2.5.3.4 int rtStringToTBCD (const char * str, OSOCTET * bcdStr, size_t bufsiz)

This function converts a standard null-terminated string into a TBCD value. The source string should contain only characters '0' - '9', 'A' - 'F', or 'a' - 'f'. Otherwise, an error will occur. A TBCD string differs from a normal BCD string in that its bytes are flipped. The BCD string 0x12345f would be represented 0x2143f5 as a TBCD string.

Parameters

- str* The source standard null-terminated string.
- bcdStr* The destination buffer. Should not be less than bufsiz is.
- bufsiz* The size of the destination buffer (in octets).

Returns

The number of octets in the resulting BCD value or a negative value if an error occurs.

Since

6.06

2.5.3.5 `const char* rtTBCDToString (OSUINT32 numocts, const OSOCTET * data, char * buffer, size_t bufsiz)`

This function converts a packed TBCD value to a standard null-terminated string. Octet value can contain the filler digit to represent the odd number of BCD digits. A TBCD string differs from a normal BCD string in that the byte values of the octets are flipped. The BCD string 0x12345f would be represented 0x2143f5 as a TBCD string.

TBCD digits can be 0(0000) to 9(1001). Filler digits can be A(1010), B(1011), C(1100), D(1101), E(1110) or F(1111)

Parameters

numocts The number of octets in the BCD value.

data The pointer to the BCD value.

buffer The destination buffer. Should not be less than bufsiz argument is.

bufsiz The size of the destination buffer (in octets). The buffer size should be atleast $((numocts * 2) + 1)$ to hold the BCD to String conversion.

Returns

The converted null-terminated string. NULL, if error has occurred or destination buffer is not enough.

Since

6.06

2.6 Comparison Functions

Defines

- #define [rtCmpOID](#) rtCmpOIDValue
- #define [rtCmpOID64](#) rtCmpOID64Value

Functions

- OSBOOL [rtCmpBoolean](#) (const char *name, OSBOOL value, OSBOOL compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpInt8](#) (const char *name, OSINT8 value, OSINT8 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpSInt](#) (const char *name, OSINT16 value, OSINT16 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUInt8](#) (const char *name, OSUINT8 value, OSUINT8 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUSInt](#) (const char *name, OSUINT16 value, OSUINT16 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpInteger](#) (const char *name, OSINT32 value, OSINT32 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUnsigned](#) (const char *name, OSUINT32 value, OSUINT32 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpInt64](#) (const char *name, OSINT64 value, OSINT64 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUInt64](#) (const char *name, OSUINT64 value, OSUINT64 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpBitStr](#) (const char *name, OSSIZE numbits, const OSOCTET *data, OSSIZE compNumbits, const OSOCTET *compData, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOctStr](#) (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpCharStr](#) (const char *name, const char *cstring, const char *compCString, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmp16BitCharStr](#) (const char *name, [Asn116BitCharString](#) *bstring, [Asn116BitCharString](#) *compBstring, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmp32BitCharStr](#) (const char *name, [Asn132BitCharString](#) *bstring, [Asn132BitCharString](#) *compBstring, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpReal](#) (const char *name, OSREAL value, OSREAL compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOIDValue](#) (const char *name, [ASN1OBJID](#) *pOID, [ASN1OBJID](#) *pcompOID, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOID64Value](#) (const char *name, [ASN1OID64](#) *pOID, [ASN1OID64](#) *pcompOID, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOpenType](#) (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOpenTypeExt](#) (const char *name, [OSRTDList](#) *pElemList, [OSRTDList](#) *pCompElemList, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpTag](#) (const char *name, int tag, int compTag, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpSeqOfElements](#) (const char *name, OSSIZE noOfElems, OSSIZE compNoOfElems, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOptional](#) (const char *name, unsigned presentBit, unsigned compPresentBit, char *errBuff, OSSIZE errBuffSize)

2.6.1 Detailed Description

The group of functions allows comparing the values of primitive ASN.1 types. These functions are used in the comparison routines that are generated by the ASN1C compiler when the *-gencompare* option is used.

Information on elements that do not match is written to the given error buffer for each function. This makes it possible to compare complex structures and get back specific information as to what elements within those structures are different.

2.6.2 Define Documentation

2.6.2.1 #define rtCmpOID rtCmpOIDValue

For backwards compatibility, we define `rtCmpOID` to be the same as `rtCmpOIDValue`.

2.6.2.2 #define rtCmpOID64 rtCmpOID64Value

For backwards compatibility, we define `rtCmpOID64` to be the same as `rtCmpOID64Value`.

2.6.3 Function Documentation

2.6.3.1 OSBOOL rtCmp16BitCharStr (const char * name, Asn116BitCharString * bstring, Asn116BitCharString * compBstring, char * errBuff, OSSIZE errBuffSize)

The `rtCmp16BitCharStr` function compares two ASN.1 16-bit character string values (including `BMPString`).

Parameters

name The name of value. Used for constructing `errBuff` if values are not matching.

bstring The pointer to the first 16-bit character string structure to compare.

compBstring The pointer to the second 16-bit character string structure to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the `errBuff` buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.2 OSBOOL rtCmp32BitCharStr (const char * name, Asn132BitCharString * bstring, Asn132BitCharString * compBstring, char * errBuff, OSSIZE errBuffSize)

The `rtCmp32BitCharStr` function compares two 32-bit character string values (including `UniversalString`).

Parameters

name The name of value. Used for constructing `errBuff` if values are not matching.

bstring The pointer to the first 32-bit character string structure to compare.

compBstring The pointer to the second 32-bit character string structure to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.3 OSBOOL rtCmpBitStr (const char * name, OSSIZE numbits, const OSOCTET * data, OSSIZE compNumbits, const OSOCTET * compData, char * errBuff, OSSIZE errBuffSize)

The *rtCmpBitStr* function compares two ASN.1 BIT STRING values.

Parameters

name The name of value. Used for constructing *errBuff* if values are not matching.

numbits The number of bits in the first value to compare.

data The pointer to the data of the first value to compare.

compNumbits The number of bits in the second value to compare.

compData The pointer to the data of the second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.4 OSBOOL rtCmpBoolean (const char * name, OSBOOL value, OSBOOL compValue, char * errBuff, OSSIZE errBuffSize)

The *rtCmpBoolean* function compares two ASN.1 Boolean values. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing *errBuff* if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.5 OSBOOL rtCmpCharStr (const char * name, const char * cstring, const char * compCString, char * errBuff, OSSIZE errBuffSize)

The rtCmpCharStr function compares two ASN.1 8-bit character string values (including IA5String, VisibleString, PrintableString, NumericString, etc.)

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

cstring The first standard null-terminated string to compare.

compCString The second standard null-terminated string to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.6 OSBOOL rtCmpInt64 (const char * name, OSINT64 value, OSINT64 compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpInt64 function compares two 64-bit ASN.1 INTEGER values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.7 OSBOOL rtCmpInt8 (const char * name, OSINT8 value, OSINT8 compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpInt8 function compares two ASN.1 8-bit integers. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.8 OSBOOL rtCmpInteger (const char * name, OSINT32 value, OSINT32 compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpInteger function compares two ASN.1 INTEGER values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.9 OSBOOL rtCmpOctStr (const char * name, OSSIZE numocts, const OSOCTET * data, OSSIZE compNumocts, const OSOCTET * compData, char * errBuff, OSSIZE errBuffSize)

The rtCmpOctStr function compares two ASN.1 OCTET STRING values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

numocts The number of the octets in the first value to compare.

data The pointer to the data of the first value to compare.

compNumocts The number of the octets in the second value to compare.

compData The pointer to the data of the second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.10 OSBOOL rtCmpOID64Value (const char * name, ASN1OID64 * pOID, ASN1OID64 * pcompOID, char * errBuff, OSSIZE errBuffSize)

The rtCmpOID64Value function compares two 64-bit ASN.1 OBJECT IDENTIFIER or RELATIVE-OID values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

pOID The pointer to the first value to compare.

pcompOID The pointer to the second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.11 OSBOOL rtCmpOIDValue (const char * name, ASN1OBJID * pOID, ASN1OBJID * pcompOID, char * errBuff, OSSIZE errBuffSize)

The rtCmpOIDValue function compares two ASN.1 OBJECT IDENTIFIER or REALTIVE-OID values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

pOID The pointer to the first value to compare.

pcompOID The pointer to the second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.12 OSBOOL rtCmpOpenType (const char * name, OSSIZE numocts, const OSOCTET * data, OSSIZE compNumocts, const OSOCTET * compData, char * errBuff, OSSIZE errBuffSize)

The rtCmpOpenType function compares two ASN.1 values of the old (pre- 1994) ASN.1 ANY type or other elements defined in the later standards to be Open Types (for example, a variable type declaration in a CLASS construct defined in X.681).

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

numocts The number of octets in the first value to compare.

data The pointer to the data of the first value to compare.

compNumocts The number of octets in the second value to compare.

compData The pointer to the data of the second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.13 OSBOOL rtCmpOpenTypeExt (const char * name, OSRTDList * pElemList, OSRTDList * pCompElemList, char * errBuff, OSSIZE errBuffSize)

The *rtCmpOpenTypeExt* function compares two ASN.1 open type extension values.

An open type extension is defined as an extensibility marker on a constructed type without any extension elements defined (for example, SEQUENCE {a INTEGER, ...}). The difference is that this is an implicit field that can span one or more elements whereas the standard Open Type is assumed to be a single tagged field.

Parameters

name The name of value. Used for constructing *errBuff* if values are not matching.

pElemList The first pointer to a linked list structure. The list should consist of [ASN1OpenType](#) elements.

pCompElemList The second pointer to a linked list structure. The list should consist of [ASN1OpenType](#) elements.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.14 OSBOOL rtCmpOptional (const char * name, unsigned presentBit, unsigned compPresentBit, char * errBuff, OSSIZE errBuffSize)

The *rtCmpOptional* function compares two ASN.1 OPTIONAL bits. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing *errBuff* if values are not matching.

presentBit First bit to compare.

compPresentBit Second bit to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.15 OSBOOL rtCmpReal (const char * name, OSREAL value, OSREAL compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpReal function compares two ASN.1 REAL values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.16 OSBOOL rtCmpSeqOfElements (const char * name, OSSIZE noOfElems, OSSIZE compNoOfElems, char * errBuff, OSSIZE errBuffSize)

This function compares two ASN.1 SEQUENCE OF sizes. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

noOfElems First size value to compare.

compNoOfElems Second size value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.17 OSBOOL rtCmpSInt (const char * name, OSINT16 value, OSINT16 compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpSInt function compares two ASN.1 16-bit integers. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.18 OSBOOL rtCmpTag (const char * name, int tag, int compTag, char * errBuff, OSSIZE errBuffSize)

The rtCmpTag function compares two ASN.1 tag values. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

tag First tag value to compare.

compTag Second tag value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.19 OSBOOL rtCmpUInt64 (const char * name, OSUINT64 value, OSUINT64 compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpUInt64 function compares two 64-bit ASN.1 unsigned INTEGER values.

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the errBuff buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.20 OSBOOL rtCmpUInt8 (const char * name, OSUINT8 value, OSUINT8 compValue, char * errBuff, OSSIZE errBuffSize)

The rtCmpUInt8 function compares unsigned ASN.1 8-bit integers. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing errBuff if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.21 OSBOOL rtCmpUnsigned (const char * name, OSUINT32 value, OSUINT32 compValue, char * errBuff, OSSIZE errBuffSize)

The *rtCmpUnsigned* function compares two ASN.1 unsigned INTEGER values.

Parameters

name The name of value. Used for constructing *errBuff* if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.6.3.22 OSBOOL rtCmpUSInt (const char * name, OSUINT16 value, OSUINT16 compValue, char * errBuff, OSSIZE errBuffSize)

The *rtCmpUSInt* function compares ASN.1 unsigned 16-bit integers. The return value is TRUE (matched) or FALSE (unmatched).

Parameters

name The name of value. Used for constructing *errBuff* if values are not matching.

value First value to compare.

compValue Second value to compare.

errBuff The pointer to the buffer to receive the null-terminated string if the comparison fails. If the comparison failed, this buffer will contain the null-terminated string that explains the reason of comparison failure.

errBuffSize The size of the *errBuff* buffer.

Returns

The comparison result. TRUE, if values matched, otherwise FALSE.

2.7 Comparison to Standard Output Functions

Functions

- OSBOOL `rtCmpToStdoutBoolean` (const char *name, OSBOOL value, OSBOOL compValue)
- OSBOOL `rtCmpToStdoutInteger` (const char *name, OSINT32 value, OSINT32 compValue)
- OSBOOL `rtCmpToStdoutInt64` (const char *name, OSINT64 value, OSINT64 compValue)
- OSBOOL `rtCmpToStdoutUnsigned` (const char *name, OSUINT32 value, OSUINT32 compValue)
- OSBOOL `rtCmpToStdoutUInt64` (const char *name, OSUINT64 value, OSUINT64 compValue)
- OSBOOL `rtCmpToStdoutBitStr` (const char *name, OSSIZE numbits, const OSOCTET *data, OSSIZE compNumbits, const OSOCTET *compData)
- OSBOOL `rtCmpToStdoutOctStr` (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData)
- OSBOOL `rtCmpToStdoutCharStr` (const char *name, const char *cstring, const char *compCString)
- OSBOOL `rtCmpToStdout16BitCharStr` (const char *name, `Asn116BitCharString` *bstring, `Asn116BitCharString` *compBstring)
- OSBOOL `rtCmpToStdout32BitCharStr` (const char *name, `Asn132BitCharString` *bstring, `Asn132BitCharString` *compBstring)
- OSBOOL `rtCmpToStdoutReal` (const char *name, OSREAL value, OSREAL compValue)
- OSBOOL `rtCmpToStdoutOID` (const char *name, `ASN1OBJID` *pOID, `ASN1OBJID` *pcompOID)
- OSBOOL `rtCmpToStdoutOIDValue` (const char *name, `ASN1OBJID` *pOID, `ASN1OBJID` *pcompOID)
- OSBOOL `rtCmpToStdoutOID64` (const char *name, `ASN1OID64` *pOID, `ASN1OID64` *pcompOID)
- OSBOOL `rtCmpToStdoutOID64Value` (const char *name, `ASN1OID64` *pOID, `ASN1OID64` *pcompOID)
- OSBOOL `rtCmpToStdoutOpenType` (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData)
- OSBOOL `rtCmpToStdoutOpenTypeExt` (const char *name, `OSRTDList` *pElemList, `OSRTDList` *pCompElemList)
- OSBOOL `rtCmpToStdoutTag` (const char *name, int tag, int compTag)
- OSBOOL `rtCmpToStdoutSeqOfElements` (const char *name, OSSIZE noOfElems, OSSIZE compNoOfElems)
- OSBOOL `rtCmpToStdoutOptional` (const char *name, unsigned presentBit, unsigned compPresentBit)

2.7.1 Detailed Description

cmp

The `rtCmpToStdout<type>` functions do the same actions as the `rtCmp<type>` ones, but they print the comparison results to stdout instead of putting it into the buffer. The prototypes of these functions are almost the same as for the `rtCmp<type>` except the last two parameters - they re absent in the `rtCmpToStdout<type>` functions.

2.7.2 Function Documentation

2.7.2.1 OSBOOL `rtCmpToStdout16BitCharStr` (const char * name, `Asn116BitCharString` * bstring, `Asn116BitCharString` * compBstring)

Parameters

name The name of value.

bstring The first value to compare.

compBstring The second value to compare.

2.7.2.2 OSBOOL rtCmpToStdout32BitCharStr (const char * name, Asn132BitCharString * bstring, Asn132BitCharString * compBstring)

Parameters

name The name of value.
bstring The first value to compare.
compBstring The second value to compare.

2.7.2.3 OSBOOL rtCmpToStdoutBitStr (const char * name, OSSIZE numbits, const OSOCTET * data, OSSIZE compNumbits, const OSOCTET * compData)

Parameters

name The name of value.
numbits The first value to compare.
data The pointer to the first value.
compNumbits The second value to compare.
compData The pointer to the second value.

2.7.2.4 OSBOOL rtCmpToStdoutBoolean (const char * name, OSBOOL value, OSBOOL compValue)

Parameters

name The name of value.
value The first value to compare.
compValue The second value to compare.

2.7.2.5 OSBOOL rtCmpToStdoutCharStr (const char * name, const char * cstring, const char * compCstring)

Parameters

name The name of value.
cstring The first value to compare.
compCstring The second value to compare.

2.7.2.6 OSBOOL rtCmpToStdoutInt64 (const char * name, OSINT64 value, OSINT64 compValue)

Parameters

name The name of value.
value The first value to compare.
compValue The second value to compare.

2.7.2.7 OSBOOL rtCmpToStdoutInteger (const char * name, OSINT32 value, OSINT32 compValue)

Parameters

- name* The name of value.
- value* The first value to compare.
- compValue* The second value to compare.

2.7.2.8 OSBOOL rtCmpToStdoutOctStr (const char * name, OSSIZE numocts, const OSOCTET * data, OSSIZE compNumocts, const OSOCTET * compData)

Parameters

- name* The name of value.
- numocts* The first value to compare.
- data* The pointer to the data of the first value.
- compNumocts* The second value to compare.
- compData* The pointer to the data of the second value.

2.7.2.9 OSBOOL rtCmpToStdoutOID (const char * name, ASN1OBJID * pOID, ASN1OBJID * pcompOID)

Parameters

- name* The name of value.
- pOID* The first value to compare.
- pcompOID* The second value to compare.

2.7.2.10 OSBOOL rtCmpToStdoutOID64 (const char * name, ASN1OID64 * pOID, ASN1OID64 * pcompOID)

Parameters

- name* The name of value.
- pOID* The first value to compare.
- pcompOID* The second value to compare.

2.7.2.11 OSBOOL rtCmpToStdoutOID64Value (const char * name, ASN1OID64 * pOID, ASN1OID64 * pcompOID)

Parameters

- name* The name of value.
- pOID* The first value to compare.
- pcompOID* The second value to compare.

2.7.2.12 OSBOOL rtCmpToStdoutOIDValue (const char * name, ASN1OBJID * pOID, ASN1OBJID * pcompOID)

Parameters

- name* The name of value.
- pOID* The first value to compare.
- pcompOID* The second value to compare.

2.7.2.13 OSBOOL rtCmpToStdoutOpenType (const char * name, OSSIZE numocts, const OSOCTET * data, OSSIZE compNumocts, const OSOCTET * compData)

Parameters

- name* The name of value.
- numocts* The number of octets in the first value to compare.
- data* The pointer to the data in the first value to compare.
- compNumocts* The number of octets in the second value to compare.
- compData* The pointer to the data in the second value to compare.

2.7.2.14 OSBOOL rtCmpToStdoutOpenTypeExt (const char * name, OSRTDList * pElemList, OSRTDList * pCompElemList)

Parameters

- name* The name of value.
- pElemList* The first value to compare.
- pCompElemList* The second value to compare.

2.7.2.15 OSBOOL rtCmpToStdoutOptional (const char * name, unsigned presentBit, unsigned compPresentBit)

Parameters

- name* The name of value.
- presentBit* The first value to compare.
- compPresentBit* The second value to compare.

2.7.2.16 OSBOOL rtCmpToStdoutReal (const char * name, OSREAL value, OSREAL compValue)

Parameters

- name* The name of value.
- value* The first value to compare.
- compValue* The second value to compare.

2.7.2.17 OSBOOL rtCmpToStdoutSeqOfElements (const char * name, OSSIZE noOfElems, OSSIZE compNoOfElems)

Parameters

name The name of value.

noOfElems The first value to compare.

compNoOfElems The second value to compare.

2.7.2.18 OSBOOL rtCmpToStdoutTag (const char * name, int tag, int compTag)

Parameters

name The name of value.

tag The first value to compare.

compTag The second value to compare.

2.7.2.19 OSBOOL rtCmpToStdoutUInt64 (const char * name, OSUINT64 value, OSUINT64 compValue)

Parameters

name The name of value.

value The first value to compare.

compValue The second value to compare.

2.7.2.20 OSBOOL rtCmpToStdoutUnsigned (const char * name, OSUINT32 value, OSUINT32 compValue)

Parameters

name The name of value.

value The first value to compare.

compValue The second value to compare.

2.8 Copy Functions

Functions

- OSBOOL `rtCopyBitStr` (OSUINT32 `srcNumbits`, const OSOCTET `*pSrcData`, OSUINT32 `*pDstNumbits`, OSOCTET `*pDstData`)
- OSBOOL `rtCopyDynBitStr` (OSCTXT `*pctx`, const ASN1DynBitStr `*pSrcData`, ASN1DynBitStr `*pDstData`)
- OSBOOL `rtCopyOctStr` (OSUINT32 `srcNumocts`, const OSOCTET `*pSrcData`, OSUINT32 `*pDstNumocts`, OSOCTET `*pDstData`)
- OSBOOL `rtCopyDynOctStr` (OSCTXT `*pctx`, const ASN1DynOctStr `*pSrcData`, ASN1DynOctStr `*pDstData`)
- OSBOOL `rtCopyCharStr` (OSCTXT `*pctx`, const char `*srcStr`, char `**dstStr`)
- OSBOOL `rtCopy16BitCharStr` (OSCTXT `*pctx`, const Asn116BitCharString `*srcStr`, Asn116BitCharString `*dstStr`)
- OSBOOL `rtCopy32BitCharStr` (OSCTXT `*pctx`, const Asn132BitCharString `*srcStr`, Asn132BitCharString `*dstStr`)
- OSBOOL `rtCopyOID` (const ASN1OBJID `*srcOID`, ASN1OBJID `*dstOID`)
- OSBOOL `rtCopyOID64` (const ASN1OID64 `*srcOID`, ASN1OID64 `*dstOID`)
- OSBOOL `rtCopyOpenType` (OSCTXT `*pctx`, const ASN1OpenType `*srcOT`, ASN1OpenType `*dstOT`)
- OSBOOL `rtCopyOpenTypeExt` (OSCTXT `*pctx`, const OSRTDList `*srcList`, OSRTDList `*dstList`)

2.8.1 Detailed Description

This group of functions allows copying values of primitive ASN.1 types.

These functions are used in copy routines that are generated by the ASN.1 compiler when `-gencopy` option is used. Some primitive types that are mapped onto C standard primitive types (such as BOOLEAN, INTEGER REAL) do not need copy functions. The standard assignment operator can be used to copy these types.

2.8.2 Function Documentation

2.8.2.1 OSBOOL `rtCopy16BitCharStr` (OSCTXT `*pctx`, const Asn116BitCharString `*srcStr`, Asn116BitCharString `*dstStr`)

The `rtCopy16BitCharStr` function copies one ASN.1 16-bit character string value to another (generally BMPString).

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

pctx Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

srcStr The pointer to the source 16-bit character string structure to copy.

dstStr The pointer to destination 16-bit character string structure to receive the copied string. The memory will be allocated dynamically via call to `rtxMemAlloc` function.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.2 OSBOOL rtCopy32BitCharStr (OSCTXT * *pctxt*, const Asn132BitCharString * *srcStr*, Asn132BitCharString * *dstStr*)

The rtCopy32BitCharStr function copies one ASN.1 32-bit character string value to another (generally Universal-String).

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

pctxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

srcStr The pointer to the source 32-bit character string structure to copy.

dstStr The pointer to destination 32-bit character string structure to receive the copied string. The memory will be allocated dynamically via call to rtxMemAlloc function.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.3 OSBOOL rtCopyBitStr (OSUINT32 *srcNumbits*, const OSOCTET * *pSrcData*, OSUINT32 * *pDstNumbits*, OSOCTET * *pDstData*)

The rtCopyBitStr function copies one ASN.1 BIT STRING value to another.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

srcNumbits The number of bits in the source value to copy.

pSrcData The pointer to data of the source value to copy.

pDstNumbits The pointer to destination number of bits. The srcNumbits argument will be copied into it.

pDstData The pointer to the destination buffer to receive the copied data. The buffer is assumed to be already allocated or static and should be enough to receive the copying data.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.4 OSBOOL rtCopyCharStr (OSCTXT * *pctxt*, const char * *srcStr*, char ** *dstStr*)

The rtCopyCharStr function copies one ASN.1 8-bit character string value to another (including IA5String, VisibleString, PrintableString, NumericString, etc).

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

pctxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

srcStr The pointer to the source standard null-terminated string to copy.

dstStr The pointer to pointer destination string to receive the copied string. The memory will be allocated dynamically via a call to rtxMemAlloc function.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.5 OSBOOL rtCopyDynBitStr (OSCTXT * *pctxt*, const ASN1DynBitStr * *pSrcData*, ASN1DynBitStr * *pDstData*)

The rtCopyDynBitStr function is similar to the rtCopyBitStr, but it copies a dynamic ASN.1 BIT STRING value.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

pctxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pSrcData The pointer to data of the source value to copy.

pDstData The pointer to the destination dynamic bit string structure to receive the copied data. The memory will be allocated dynamically via call to rtxMemAlloc function.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.6 OSBOOL rtCopyDynOctStr (OSCTXT * *pctxt*, const ASN1DynOctStr * *pSrcData*, ASN1DynOctStr * *pDstData*)

The rtCopyDynOctStr function is similar to rtCopyOctStr, but it copies a dynamic ASN.1 OCTET STRING value.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

pctxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pSrcData The pointer to the source dynamic octet string structure to copy.

pDstData The point to destination dynamic octet string structure to receive the copied data. The memory will be allocated dynamically via a call to rtxMemAlloc function.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.7 OSBOOL rtCopyOctStr (OSUINT32 *srcNumocts*, const OSOCTET * *pSrcData*, OSUINT32 * *pDstNumocts*, OSOCTET * *pDstData*)

The rtCopyOctStr function copies one ASN.1 OCTET STRING value to another.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

srcNumocts The number of octets in the source value to copy.

pSrcData The pointer to data of the source value to copy.

pDstNumocts The pointer to the destination number of octets. The *srcNumocts* argument will be copied into it.

pDstData The pointer to the destination buffer to receive the copied data. The buffer is assumed to be already allocated or static and should be enough to receive the copying data.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.8 OSBOOL rtCopyOID (const ASN1OBJID * srcOID, ASN1OBJID * dstOID)

The *rtCopyIOD* function copies one ASN.1 OBJECT IDENTIFIER or RELATED-IOD value to another.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

srcOID The pointer to the source object identifier structure to copy.

dstOID The pointer to destination structure to receive the copied string.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.9 OSBOOL rtCopyOID64 (const ASN1OID64 * srcOID, ASN1OID64 * dstOID)

The *rtCopyOID64* function copies one 64-bit ASN.1 OBJECT IDENTIFIER or RELATIVE-OID value to another.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

srcOID The pointer to the source object identifier structure to copy.

dstOID The pointer to destination structure to receive the copied string.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.10 OSBOOL rtCopyOpenType (OSCTXT * ptxt, const ASN1OpenType * srcOT, ASN1OpenType * dstOT)

The *rtCopyOpenType* copies ASN.1 value of the old (pre- 1994) ASN.1 ANY type or other elements defined in the later standards to be Open Types (for example, a variable type declaration in a CLASS construct as defined in X.681).

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred).

Parameters

ptxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

srcOT The pointer to the source Open Type structure to copy.

dstOT The pointer to the destination Open Type structure to receive the copied data. The memory will be allocated dynamically via call to the `rtxMemAlloc` function.

Returns

The copying result. TRUE, if success, otherwise FALSE.

2.8.2.11 OSBOOL `rtCopyOpenTypeExt` (OSCTXT * *pctxt*, const OSRTDList * *srcList*, OSRTDList * *dstList*)

The `rtCopyOpenTypeExt` function copies an ASN.1 open type extension value.

The return value is one of the TRUE (copied successfully) or FALSE (error has occurred). An open type extension is defined as extensibility marker on a constructed type without any extension elements defined (for example, SEQUENCE { a INTEGER, ... }). The difference is that this is an implicit field that can span more elements whereas the standard Open Type is assumed to be a single tagged field.

Parameters

pctxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

srcList The pointer to the source linked list structure to copy. The list should consist of [ASN1OpenType](#) elements.

dstList The pointer to destination linked list structure to receive the copied data. The memory for list nodes and data will be allocated dynamically via call to the `rtxMemAlloc` function. The list nodes will contain the data of [ASN1OpenType](#) type.

2.9 Character string functions

Functions

- int `rtxStricmp` (const char *str1, const char *str2)
- char * `rtxStrcat` (char *dest, size_t bufsiz, const char *src)
- char * `rtxStrncat` (char *dest, size_t bufsiz, const char *src, size_t nchars)
- char * `rtxStrcpy` (char *dest, size_t bufsiz, const char *src)
- char * `rtxStrncpy` (char *dest, size_t bufsiz, const char *src, size_t nchars)
- char * `rtxStrdup` (OSCTXT *pctx, const char *src)
- const char * `rtxStrJoin` (char *dest, size_t bufsiz, const char *str1, const char *str2, const char *str3, const char *str4, const char *str5)
- const char * `rtxStrDynJoin` (OSCTXT *pctx, const char *str1, const char *str2, const char *str3, const char *str4, const char *str5)
- int `rtxIntToCharStr` (OSINT32 value, char *dest, size_t bufsiz, char padchar)
- int `rtxUIntToCharStr` (OSUINT32 value, char *dest, size_t bufsiz, char padchar)
- int `rtxInt64ToCharStr` (OSINT64 value, char *dest, size_t bufsiz, char padchar)
- int `rtxUInt64ToCharStr` (OSUINT64 value, char *dest, size_t bufsiz, char padchar)
- int `rtxSizeToCharStr` (size_t value, char *dest, size_t bufsiz, char padchar)
- int `rtxHexCharsToBinCount` (const char *hexstr, size_t nchars)
- int `rtxHexCharsToBin` (const char *hexstr, size_t nchars, OSOCTET *binbuf, size_t bufsize)
- int `rtxCharStrToInt` (const char *cstr, OSINT32 *pvalue)
- int `rtxCharStrToInt8` (const char *cstr, OSINT8 *pvalue)
- int `rtxCharStrToInt16` (const char *cstr, OSINT16 *pvalue)
- int `rtxCharStrToUInt` (const char *cstr, OSUINT32 *pvalue)
- int `rtxCharStrToUInt8` (const char *cstr, OSUINT8 *pvalue)
- int `rtxCharStrToUInt16` (const char *cstr, OSUINT16 *pvalue)

2.9.1 Detailed Description

These functions are more secure versions of several of the character string functions available in the standard C runtime library.

2.9.2 Function Documentation

2.9.2.1 int `rtxCharStrToInt` (const char * *cstr*, OSINT32 * *pvalue*)

This function converts the given character string to an integer value. It consumes all leading whitespace before the digits start. It then consumes digits until a non-digit character is encountered.

Parameters

cstr Character string to convert.

pvalue Pointer to integer value to receive converted data.

Returns

Number of bytes or negative status value if fail.

2.9.2.2 int rtxHexCharsToBin (const char * *hexstr*, size_t *nchars*, OSOCTET * *binbuf*, size_t *bufsize*)

This function converts the given hex string to binary. The result is stored in the given binary buffer. Any whitespace characters in the string are ignored.

Parameters

- hexstr* Hex character string to convert.
- nchars* Number of characters in string. If zero, characters are read up to null-terminator.
- binbuf* Buffer to hold converted binary data.
- bufsize* Size of the binary data buffer.

Returns

Number of bytes or negative status value if fail.

2.9.2.3 int rtxHexCharsToBinCount (const char * *hexstr*, size_t *nchars*)

This function returns a count of the number of bytes the would result from the conversion of a hexadecimal character string to binary. Any whitespace characters in the string are ignored.

Parameters

- hexstr* Hex character string to convert.
- nchars* Number of characters in string. If zero, characters are read up to null-terminator.

Returns

Number of bytes or negative status value if fail.

2.9.2.4 int rtxInt64ToCharStr (OSINT64 *value*, char * *dest*, size_t *bufsiz*, char *padchar*)

This function converts a signed 64-bit integer into a character string. It is similar to the C `itoa` function.

Parameters

- value* Integer to convert.
- dest* Pointer to destination buffer to receive string.
- bufsiz* Size of the destination buffer.
- padchar* Left pad char, set to zero for no padding.

Returns

Number of characters or negative status value if fail.

2.9.2.5 int rtxIntToCharStr (OSINT32 *value*, char * *dest*, size_t *bufsiz*, char *padchar*)

This function converts a signed 32-bit integer into a character string. It is similar to the C `itoa` function.

Parameters

- value* Integer to convert.
- dest* Pointer to destination buffer to receive string.
- bufsiz* Size of the destination buffer.
- padchar* Left pad char, set to zero for no padding.

Returns

Number of characters or negative status value if fail.

2.9.2.6 int rtxSizeToCharStr (size_t *value*, char * *dest*, size_t *bufsiz*, char *padchar*)

This function converts a value of type 'size_t' into a character string. It is similar to the C `itoa` function.

Parameters

- value* Size value to convert.
- dest* Pointer to destination buffer to receive string.
- bufsiz* Size of the destination buffer.
- padchar* Left pad char, set to zero for no padding.

Returns

Number of characters or negative status value if fail.

2.9.2.7 char* rtxStrcat (char * *dest*, size_t *bufsiz*, const char * *src*)

This function concatenates the given string onto the string buffer. It is similar to the C `strcat` function except more secure because it checks for buffer overrun.

Parameters

- dest* Pointer to destination buffer to receive string.
- bufsiz* Size of the destination buffer.
- src* Pointer to null-terminated string to copy.

Returns

Pointer to destination buffer or NULL if copy failed.

2.9.2.8 `char* rtxStrcpy (char * dest, size_t bufsiz, const char * src)`

This function copies a null-terminated string to a target buffer. It is similar to the C `strcpy` function except more secure because it checks for buffer overrun.

Parameters

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

src Pointer to null-terminated string to copy.

Returns

Pointer to destination buffer or NULL if copy failed.

2.9.2.9 `char* rtxStrdup (OSCTXT * pctxt, const char * src)`

This function creates a duplicate copy of a null-terminated string. Memory is allocated for the target string using the `rtxMemAlloc` function. The string is then copied into this memory block. It is similar to the C `strdup` function except more secure because it checks for buffer overrun.

Parameters

pctxt Pointer to a standard context structure.

src Pointer to null-terminated string to copy.

Returns

Pointer to destination buffer or NULL if copy failed.

2.9.2.10 `const char* rtxStrDynJoin (OSCTXT * pctxt, const char * str1, const char * str2, const char * str3, const char * str4, const char * str5)`

This function allocates memory for and concatenates up to five substrings together into a single string.

Parameters

pctxt Pointer to a standard context structure.

str1 Pointer to substring to join.

str2 Pointer to substring to join.

str3 Pointer to substring to join.

str4 Pointer to substring to join.

str5 Pointer to substring to join.

Returns

Composite string consisting of all parts.

2.9.2.11 `int rtxStricmp (const char * str1, const char * str2)`

This is an implementation of the non-standard `stricmp` function. It does not check for greater than/less than however, only for equality.

Parameters

str1 Pointer to first string to compare.

str2 Pointer to second string to compare.

Returns

0 if strings are equal, non-zero if not.

2.9.2.12 `const char* rtxStrJoin (char * dest, size_t bufsiz, const char * str1, const char * str2, const char * str3, const char * str4, const char * str5)`

This function concatenates up to five substrings together into a single string.

Parameters

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

str1 Pointer to substring to join.

str2 Pointer to substring to join.

str3 Pointer to substring to join.

str4 Pointer to substring to join.

str5 Pointer to substring to join.

Returns

Composite string consisting of all parts.

2.9.2.13 `char* rtxStrncat (char * dest, size_t bufsiz, const char * src, size_t nchars)`

This function concatenates the given number of characters from the given string onto the string buffer. It is similar to the C `strncat` function except more secure because it checks for buffer overrun.

Parameters

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

src Pointer to null-terminated string to copy.

nchars Number of characters to copy.

Returns

Pointer to destination buffer or NULL if copy failed.

2.9.2.14 `char* rtxStrncpy (char * dest, size_t bufsiz, const char * src, size_t nchars)`

This function copies the given number of characters from a string to a target buffer. It is similar to the C `strncpy` function except more secure because it checks for buffer overrun and ensures a null-terminator is copied to the end of the target buffer. If the target buffer is too short to hold the null terminator, the last character is overwritten and a null pointer is returned; the destination buffer can still be examined in this case.

Parameters

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

src Pointer to null-terminated string to copy.

nchars Number of characters to copy.

Returns

Pointer to destination buffer or NULL if copy failed.

2.9.2.15 `int rtxUInt64ToCharStr (OSUINT64 value, char * dest, size_t bufsiz, char padchar)`

This function converts an unsigned 64-bit integer into a character string. It is similar to the C `itoa` function.

Parameters

value Integer to convert.

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

padchar Left pad char, set to zero for no padding.

Returns

Number of characters or negative status value if fail.

2.9.2.16 `int rtxUIntToCharStr (OSUINT32 value, char * dest, size_t bufsiz, char padchar)`

This function converts an unsigned 32-bit integer into a character string. It is similar to the C `itoa` function.

Parameters

value Integer to convert.

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

padchar Left pad char, set to zero for no padding.

Returns

Number of characters or negative status value if fail.

2.10 Date/time conversion functions

Functions

- int [rtxDateToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxTimeToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxDateTimeToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGYearToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGYearMonthToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGMonthToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGMonthDayToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGDayToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGetCurrDateTime](#) (OSNumDateTime *pvalue)
- int [rtxCmpDate](#) (const OSNumDateTime *pvalue1, const OSNumDateTime *pvalue2)
- int [rtxCmpDate2](#) (const OSNumDateTime *pvalue, OSINT32 year, OSUINT8 mon, OSUINT8 day, OSBOOL tzflag, OSINT32 tzo)
- int [rtxCmpTime](#) (const OSNumDateTime *pvalue1, const OSNumDateTime *pvalue2)
- int [rtxCmpTime2](#) (const OSNumDateTime *pvalue, OSUINT8 hour, OSUINT8 min, OSREAL sec, OSBOOL tzflag, OSINT32 tzo)
- int [rtxCmpDateTime](#) (const OSNumDateTime *pvalue1, const OSNumDateTime *pvalue2)
- int [rtxCmpDateTime2](#) (const OSNumDateTime *pvalue, OSINT32 year, OSUINT8 mon, OSUINT8 day, OSUINT8 hour, OSUINT8 min, OSREAL sec, OSBOOL tzflag, OSINT32 tzo)
- int [rtxParseDateString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseTimeString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseDateTimeString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGYearString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGYearMonthString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGMonthString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGMonthDayString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGDayString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxMsecsToDuration](#) (OSINT32 msecs, OSUTF8CHAR *buf, OSUINT32 bufsize)
- int [rtxDurationToMsecs](#) (OSUTF8CHAR *buf, OSUINT32 bufsize, OSINT32 *msecs)
- int [rtxSetDateTime](#) (OSNumDateTime *pvalue, struct tm *timeStruct)
- int [rtxSetLocalDateTime](#) (OSNumDateTime *pvalue, time_t timeMs)
- int [rtxSetUtcDateTime](#) (OSNumDateTime *pvalue, time_t timeMs)
- int [rtxGetDateTime](#) (const OSNumDateTime *pvalue, time_t *timeMs)
- OSBOOL [rtxDateIsValid](#) (const OSNumDateTime *pvalue)
- OSBOOL [rtxTimeIsValid](#) (const OSNumDateTime *pvalue)
- OSBOOL [rtxDateTimIsValid](#) (const OSNumDateTime *pvalue)

2.10.1 Detailed Description

These functions handle the conversion of date/time to and from various internal formats to XML schema standard string forms.

2.10.2 Function Documentation

2.10.2.1 `int rtxCmpDate (const OSNumDateTime * pvalue1, const OSNumDateTime * pvalue2)`

This function compares the date part of two OSNumDateTime structures and returns the result of the comparison.

Parameters

pvalue1 Pointer to OSNumDateTime structure.

pvalue2 Pointer to OSNumDateTime structure.

Returns

Completion status of operation:

- 0 Dates are same
- +1 First Date/Time is greater than second.
- -1 First Date/Time is less than second.

2.10.2.2 `int rtxCmpDate2 (const OSNumDateTime * pvalue, OSINT32 year, OSUINT8 mon, OSUINT8 day, OSBOOL tzflag, OSINT32 tzo)`

This function compares the date part of OSNumDateTime structure and date components, specified as parameters.

Parameters

pvalue Pointer to OSNumDateTime structure.

year Year (-inf..inf)

mon Month (1..12)

day Day (1..31)

tzflag TRUE, if time zone offset is set (see tzo parameter).

tzo Time zone offset (-840..840).

Returns

Completion status of operation:

- 0 Dates are same
- +1 First Date/Time is greater than second.
- -1 First Date/Time is less than second.

2.10.2.3 `int rtxCmpDateTime (const OSNumDateTime * pvalue1, const OSNumDateTime * pvalue2)`

This function compares two OSNumDateTime structures and returns the result of the comparison.

Parameters

pvalue1 Pointer to OSNumDateTime structure.

pvalue2 Pointer to OSNumDateTime structure.

Returns

Completion status of operation:

- 0 Dates are same
- +1 First Date/Time is greater than second.
- -1 First Date/Time is less than second.

2.10.2.4 `int rtxCmpDateTime2 (const OSNumDateTime * pvalue, OSINT32 year, OSUINT8 mon, OSUINT8 day, OSUINT8 hour, OSUINT8 min, OSREAL sec, OSBOOL tzflag, OSINT32 tzo)`

This function compares the OSNumDateTime structure and dateTime components, specified as parameters.

Parameters

pvalue Pointer to OSNumDateTime structure.

year Year (-inf..inf)

mon Month (1..12)

day Day (1..31)

hour Hour (0..23)

min Minutes (0..59)

sec Seconds (0.0..59.(9))

tzflag TRUE, if time zone offset is set (see tzo parameter).

tzo Time zone offset (-840..840).

Returns

Completion status of operation:

- 0 Dates are same
- +1 First Date/Time is greater than second.
- -1 First Date/Time is less than second.

2.10.2.5 `int rtxCmpTime (const OSNumDateTime * pvalue1, const OSNumDateTime * pvalue2)`

This function compares the time part of two OSNumDateTime structures and returns the result of the comparison.

Parameters

pvalue1 Pointer to OSNumDateTime structure.

pvalue2 Pointer to OSNumDateTime structure.

Returns

Completion status of operation:

- 0 Times are same
- +1 First Date/Time is greater than second.
- -1 First Date/Time is less than second.

2.10.2.6 **int rtxCmpTime2 (const OSNumDateTime * *pvalue*, OSUINT8 *hour*, OSUINT8 *min*, OSREAL *sec*, OSBOOL *tzflag*, OSINT32 *tzo*)**

This function compares the time part of OSNumDateTime structure and time components, specified as parameters.

Parameters

- pvalue* Pointer to OSNumDateTime structure.
- hour* Hour (0..23)
- min* Minutes (0..59)
- sec* Seconds (0.0..59.(9))
- tzflag* TRUE, if time zone offset is set (see tzo parameter).
- tzo* Time zone offset (-840..840).

Returns

Completion status of operation:

- 0 Times are same
- +1 First Date/Time is greater than second.
- -1 First Date/Time is less than second.

2.10.2.7 **OSBOOL rtxDateIsValid (const OSNumDateTime * *pvalue*)**

This function verifies that date members (year, month, day, timezone) of the OSNumDateTime structure contains valid values.

Parameters

- pvalue* Pointer to OSNumDateTime structure to be checked.

Returns

Boolean result: true means data is valid.

2.10.2.8 **OSBOOL rtxDateTimeIsValid (const OSNumDateTime * *pvalue*)**

This function verifies that all members of the OSNumDateTime structure contains valid values.

Parameters

- pvalue* Pointer to OSNumDateTime structure to be checked.

Returns

Boolean result: true means data is valid.

2.10.2.9 `int rtxDateTimeToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a numeric date/time value of all components in the OSNumDateTime structure into XML schema standard format (CCYY-MM-DDTHH:MM:SS[.frac][TZ]).

Parameters

pvalue Pointer to OSNumDateTime structure containing date/time components to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string.

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.10 `int rtxDateToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a numeric date value consisting of individual date components (year, month, day) into XML schema standard format (CCYY-MM-DD).

Parameters

pvalue Pointer to OSNumDateTime structure containing date components to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is at least nine bytes long to hold the formatted date and a null-terminator character.

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.11 `int rtxDurationToMsecs (OSUTF8CHAR * buf, OSUINT32 bufsize, OSINT32 * msecs)`

This function converts a duration string to milliseconds. In the case of a string prepended with a minus sign (-) the duration in milliseconds will have negative value.

Parameters

buf Pointer to OSUTF8CHAR array.

bufsize OSINT32 indicates the bufsize to be read.

msecs OSINT32 updated after calculation.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_TOOBIG). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.12 `int rtxGDayToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a gregorian day value to a string (DD).

Parameters

pvalue Pointer to OSNumDateTime structure containing day value to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string (in this case, at least 3 characters long).

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.13 `int rtxGetCurrDateTime (OSNumDateTime * pvalue)`

This function reads the system date and time and stores the value in the given OSNumDateTime structure variable.

Parameters

pvalue Pointer to OSNumDateTime structure.

Returns

Completion status of operation:

- 0 in case success
- negative in case failure

2.10.2.14 `int rtxGetDateTime (const OSNumDateTime * pvalue, time_t * timeMs)`

This function converts an OSNumDateTime structure to a calendar time encoded as a value of type time_t.

Parameters

pvalue The pointed OSNumDateTime structure variable to be converted.

timeMs A pointer to time_t value to be set.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error.

2.10.2.15 `int rtxGMonthDayToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a gregorian month and day value to a string (MM-DD).

Parameters

pvalue Pointer to OSNumDateTime structure containing month and day value to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string (in this case, at least 6 characters long).

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.16 `int rtxGMonthToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a gregorian month value to a string (MM).

Parameters

pvalue Pointer to OSNumDateTime structure containing month value to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string (in this case, at least 3 characters long).

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.17 `int rtxGYearMonthToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a gregorian year and month value to a string (CCYY-MM).

Parameters

pvalue Pointer to OSNumDateTime structure containing year and month value to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string (in this case, at least 8 characters long).

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.18 `int rtxGYearToString (const OSNumDateTime * pvalue, OSUTF8CHAR * buffer, size_t bufsize)`

This function formats a gregorian year value to a string (CCYY).

Parameters

pvalue Pointer to OSNumDateTime structure containing year value to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string (in this case, at least 5 characters long).

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.10.2.19 `int rtxMsecsToDuration (OSINT32 msec, OSUTF8CHAR * buf, OSUINT32 bufsize)`

This function converts milliseconds to a duration string with format "PnYnMnDTnHnMnS". In case of negative duration a minus sign is prepended to the output string

Parameters

msecs Number of milliseconds.

buf Output buffer to receive formatted duration.

bufsize Output buffer size.

Returns

Completion status of operation: 0 successful are same -1 unsuccessful

2.10.2.20 `int rtxParseDateString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a date value from a supplied string and sets the given OSNumDateTime argument to the decoded date value.

Parameters

inpdata Date string to be parsed/decoded as OSNumDateTime.

- The format of date is CCYY-MM-DD
- The value of CCYY is from 0000-9999
- The value of MM is 01 - 12
- The value of DD is 01 - XX (where XX is the Days in MM month in CCYY year)

inpdatalen For decoding, consider inpdata string up to this length.

pvalue The OSNumDateTime structure variable will be set to the decoded date value.

- Only year, month, day value will be set.
- The value of pvalue->year is in range 0 to 9999

- The value of `pvalue->mon` is in range 1 to 12
- The value of `pvalue->day` is in range 1 to XX

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.21 `int rtxParseDateTimeString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a datetime value from a supplied string and sets the given OSNumDateTime to the decoded date and time value.

Parameters

inpdata Input date/time string to be parsed.

inpdatalen For decoding, consider the *inpdata* string up to this length.

pvalue The pointed OSNumDateTime structure variable will be set to the decoded date and time value.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.22 `int rtxParseGDayString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a gregorian day value from a supplied string and sets the day field in the given OSNumDateTime to the decoded value.

Parameters

inpdata Input string to be parsed.

inpdatalen For decoding, consider the *inpdata* string up to this length.

pvalue The day field in the given OSNumDateTime variable will be set to the decoded value.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.23 `int rtxParseGMonthDayString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a gregorian month and day value from a supplied string and sets the month and day fields in the given OSNumDateTime to the decoded values.

Parameters

inpdata Input string to be parsed.

*inpdata*len For decoding, consider the *inpdata* string up to this length.

pvalue The month and day fields in the given OSNumDateTime variable will be set to the decoded values.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.24 `int rtxParseGMonthString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a gregorian month value from a supplied string and sets the month field in the given OSNumDateTime to the decoded value.

Parameters

inpdata Input string to be parsed.

*inpdata*len For decoding, consider the *inpdata* string up to this length.

pvalue The month field in the given OSNumDateTime variable will be set to the decoded value.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.25 `int rtxParseGYearMonthString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a gregorian year and month value from a supplied string and sets the year and month fields in the given OSNumDateTime to the decoded values.

Parameters

inpdata Input string to be parsed.

*inpdata*len For decoding, consider the *inpdata* string up to this length.

pvalue The year and month fields in the given OSNumDateTime variable will be set to the decoded value.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.26 `int rtxParseGYearString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a gregorian year value from a supplied string and sets the year in the given OSNumDateTime to the decoded value.

Parameters

inpdata Input string to be parsed.

inpdatalen For decoding, consider the inpdata string up to this length.

pvalue The year field in the given OSNumDateTime structure variable will be set to the decoded value.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.27 `int rtxParseTimeString (const OSUTF8CHAR * inpdata, size_t inpdatalen, OSNumDateTime * pvalue)`

This function decodes a time value from a supplied string and sets the given OSNumDateTime structure to the decoded time value.

Parameters

inpdata The inpdata is a time string to be parsed/decoded as OSNumDateTime.

- The format of date is hh:mm:ss.ss (1) or hh:mm:ss.ssZ (2) or hh:mm:ss.ss+HH:MM (3) or hh:mm:ss.ss-HH:MM (4)
- The value of hh is from 00-23
- The value of mm is 00 - 59
- The value of ss.ss is 00.00 - 59.99
- The value of HH:MM is 00.00 - 24.00

inpdatalen For decoding, consider the inpdata string up to this length.

pvalue The OSNumDateTime structure variable will be set to the decoded time value.

- Only hour, min, sec value will be set.
- The value of *pvalue*->hour is in range 0 to 23
- The value of *pvalue*->mon is in range 0 to 59
- The value of *pvalue*->day is in range 0 to 59.99
- The value of *pvalue*->tz_flag is FALSE for format(1) otherwise TRUE

- The value of `pvalue->tzo` is 0 for format(2) otherwise Calculation of `pvalue->tzo` for format (3),(4) is `HH*60+MM`
- The value of `pvalue->tzo` is `-840 <= tzo <= 840` for format(3),(4) otherwise

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error (RTERR_NOTINIT/RTERR_INVFORMAT/RTERR_BADVALUE). Return value is taken from [rtxErrCodes.h](#) header file

2.10.2.28 int rtxSetDateTime (OSNumDateTime * *pvalue*, struct tm * *timeStruct*)

This function converts a structure of type 'struct tm' to an OSNumDateTime structure.

Parameters

pvalue The pointed OSNumDateTime structure variable will be set to time value.

timeStruct A pointer to tm structure to be converted.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error.

2.10.2.29 int rtxSetLocalDateTime (OSNumDateTime * *pvalue*, time_t *timeMs*)

This function converts a local date and time value to an OSNumDateTime structure.

Parameters

pvalue The pointed OSNumDateTime structure variable will be set to time value.

timeMs A calendar time encoded as a value of type time_t.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error.

2.10.2.30 int rtxSetUtcDateTime (OSNumDateTime * *pvalue*, time_t *timeMs*)

This function converts a UTC date and time value to an OSNumDateTime structure.

Parameters

pvalue The pointed OSNumDateTime structure variable will be set to time value.

timeMs A calendar time encoded as a value of type time_t. The time is represented as seconds elapsed since midnight (00:00:00), January 1, 1970, coordinated universal time (UTC).

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error.

2.10.2.31 OSBOOL rtxTimeIsValid (const OSNumDateTime * *pvalue*)

This function verifies that time members (hour, minute, second, timezone) of the OSNumDateTime structure contains valid values.

Parameters

pvalue Pointer to OSNumDateTime structure to be checked.

Returns

Boolean result: true means data is valid.

2.10.2.32 int rtxTimeToString (const OSNumDateTime * *pvalue*, OSUTF8CHAR * *buffer*, size_t *bufsize*)

This function formats a numeric time value consisting of individual time components (hour, minute, second, fraction-of-second, time zone) into XML schema standard format (HH:MM:SS[.frac][TZ]).

Parameters

pvalue Pointer to OSNumDateTime structure containing time components to be formatted.

buffer Buffer into which date is to be formatted. This is a fixed-sized buffer. The user must provide a buffer that is large enough to hold the formatted time string.

bufsize Size of the buffer to receive the formatted date.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.11 Floating-point number utility functions

Functions

- OSREAL [rtxGetMinusInfinity](#) (OSVOIDARG)
- OSREAL [rtxGetMinusZero](#) (OSVOIDARG)
- OSREAL [rtxGetNaN](#) (OSVOIDARG)
- OSREAL [rtxGetPlusInfinity](#) (OSVOIDARG)
- OSBOOL [rtxIsMinusInfinity](#) (OSREAL value)
- OSBOOL [rtxIsMinusZero](#) (OSREAL value)
- OSBOOL [rtxIsNaN](#) (OSREAL value)
- OSBOOL [rtxIsPlusInfinity](#) (OSREAL value)
- OSBOOL [rtxIsApproximate](#) (OSREAL a, OSREAL b, OSREAL delta)
- OSBOOL [rtxIsApproximateAbs](#) (OSREAL a, OSREAL b, OSREAL delta)

2.11.1 Detailed Description

Floating-point utility function provide run-time functions for handling floating-point number types defined within a schema.

2.11.2 Function Documentation

2.11.2.1 OSREAL [rtxGetMinusInfinity](#) (OSVOIDARG)

Returns the IEEE negative infinity value. This is defined as 0xffff000000000000 in IEEE standard 754. We assume the presence of the IEEE double type, that is, 64-bits of precision.

2.11.2.2 OSREAL [rtxGetMinusZero](#) (OSVOIDARG)

Returns the IEEE minus zero value. This is defined as 0x8000000000000000 in IEEE standard 754. We assume the presence of the IEEE double type, that is, 64-bits of precision.

2.11.2.3 OSREAL [rtxGetNaN](#) (OSVOIDARG)

Returns the IEEE Not-A-Number (NaN) value. This is defined as 0x7ff8000000000000 in IEEE standard 754. We assume the presence of the IEEE double type, that is, 64-bits of precision.

2.11.2.4 OSREAL [rtxGetPlusInfinity](#) (OSVOIDARG)

Returns the IEEE positive infinity value. This is defined as 0x7ff0000000000000 in IEEE standard 754. We assume the presence of the IEEE double type, that is, 64-bits of precision.

2.11.2.5 OSBOOL [rtxIsApproximate](#) (OSREAL *a*, OSREAL *b*, OSREAL *delta*)

A utility function that return TRUE when first number are approximate to second number with given precision.

Parameters

- a* The input real value.

b The input real value.

delta difference must be low than $\text{delta} * a$ 1E-7 - set best precision for float; 1E-15 - set best precision for double.

2.11.2.6 OSBOOL `rtxIsApproximateAbs` (OSREAL *a*, OSREAL *b*, OSREAL *delta*)

A utility function that return TRUE when first number are approximate to second number with given absolute precision.

Parameters

a The input real value.

b The input real value.

delta difference must be low than *delta*

2.11.2.7 OSBOOL `rtxIsMinusInfinity` (OSREAL *value*)

A utility function that compares the given input value to the IEEE 754 value for negative infinity.

Parameters

value The input real value.

2.11.2.8 OSBOOL `rtxIsMinusZero` (OSREAL *value*)

A utility function that compares the given input value to the IEEE 754 value for minus zero.

Parameters

value The input real value.

2.11.2.9 OSBOOL `rtxIsNaN` (OSREAL *value*)

A utility function that compares the given input value to the IEEE 754 value for Not-A-Number (NaN).

Parameters

value The input real value.

2.11.2.10 OSBOOL `rtxIsPlusInfinity` (OSREAL *value*)

A utility function that compares the given input value to the IEEE 754 value for positive infinity.

Parameters

value The input real value.

2.12 Decimal number utility functions

Functions

- const char * **rtxNR3toDecimal** ([OSCTXT](#) *pctx, const char *object_p)

2.12.1 Detailed Description

Decimal utility function provide run-time functions for handling decimal number types defined within a schema.

2.13 UTF-8 String Functions

Defines

- #define **rtxUTF8StrToInt32** rtxUTF8StrToInt
- #define **rtxUTF8StrToUInt32** rtxUTF8StrToUInt
- #define **RTUTF8STRCMPL**(name, lstr) rtxUTF8Strcmp(name,(const OSUTF8CHAR*)lstr)
- #define **OSRTCHKUTF8LEN**(str, lower, upper, stat)

Functions

- long **rtxUTF8ToUnicode** (OSCTXT *pctxt, const OSUTF8CHAR *inbuf, OSUNICHAR *outbuf, size_t outbufsiz)
- int **rtxValidateUTF8** (OSCTXT *pctxt, const OSUTF8CHAR *inbuf)
- size_t **rtxUTF8Len** (const OSUTF8CHAR *inbuf)
- size_t **rtxCalcUTF8Len** (const OSUTF8CHAR *inbuf, size_t inbufBytes)
- size_t **rtxUTF8LenBytes** (const OSUTF8CHAR *inbuf)
- int **rtxUTF8CharSize** (OS32BITCHAR wc)
- int **rtxUTF8EncodeChar** (OS32BITCHAR wc, OSOCTET *buf, size_t bufisz)
- int **rtxUTF8DecodeChar** (OSCTXT *pctxt, const OSUTF8CHAR *pinbuf, int *pInsize)
- OS32BITCHAR **rtxUTF8CharToWC** (const OSUTF8CHAR *buf, OSUINT32 *len)
- OSUTF8CHAR * **rtxUTF8StrChr** (OSUTF8CHAR *utf8str, OS32BITCHAR utf8char)
- OSUTF8CHAR * **rtxUTF8Strdup** (OSCTXT *pctxt, const OSUTF8CHAR *utf8str)
- OSUTF8CHAR * **rtxUTF8Strndup** (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, size_t nbytes)
- OSUTF8CHAR * **rtxUTF8StrRefOrDup** (OSCTXT *pctxt, const OSUTF8CHAR *utf8str)
- OSBOOL **rtxUTF8StrEqual** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2)
- OSBOOL **rtxUTF8StrnEqual** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2, size_t count)
- int **rtxUTF8Strcmp** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2)
- int **rtxUTF8Strncmp** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2, size_t count)
- OSUTF8CHAR * **rtxUTF8Strcpy** (OSUTF8CHAR *dest, size_t bufisz, const OSUTF8CHAR *src)
- OSUTF8CHAR * **rtxUTF8Strncpy** (OSUTF8CHAR *dest, size_t bufisz, const OSUTF8CHAR *src, size_t nchars)
- OSUINT32 **rtxUTF8StrHash** (const OSUTF8CHAR *str)
- const OSUTF8CHAR * **rtxUTF8StrJoin** (OSCTXT *pctxt, const OSUTF8CHAR *str1, const OSUTF8CHAR *str2, const OSUTF8CHAR *str3, const OSUTF8CHAR *str4, const OSUTF8CHAR *str5)
- int **rtxUTF8StrToBool** (const OSUTF8CHAR *utf8str, OSBOOL *pvalue)
- int **rtxUTF8StrnToBool** (const OSUTF8CHAR *utf8str, size_t nbytes, OSBOOL *pvalue)
- int **rtxUTF8StrToDouble** (const OSUTF8CHAR *utf8str, OSREAL *pvalue)
- int **rtxUTF8StrnToDouble** (const OSUTF8CHAR *utf8str, size_t nbytes, OSREAL *pvalue)
- int **rtxUTF8StrToInt** (const OSUTF8CHAR *utf8str, OSINT32 *pvalue)
- int **rtxUTF8StrnToInt** (const OSUTF8CHAR *utf8str, size_t nbytes, OSINT32 *pvalue)
- int **rtxUTF8StrToUInt** (const OSUTF8CHAR *utf8str, OSUINT32 *pvalue)
- int **rtxUTF8StrnToUInt** (const OSUTF8CHAR *utf8str, size_t nbytes, OSUINT32 *pvalue)
- int **rtxUTF8StrToSize** (const OSUTF8CHAR *utf8str, size_t *pvalue)
- int **rtxUTF8StrnToSize** (const OSUTF8CHAR *utf8str, size_t nbytes, size_t *pvalue)
- int **rtxUTF8StrToInt64** (const OSUTF8CHAR *utf8str, OSINT64 *pvalue)
- int **rtxUTF8StrnToInt64** (const OSUTF8CHAR *utf8str, size_t nbytes, OSINT64 *pvalue)
- int **rtxUTF8StrToUInt64** (const OSUTF8CHAR *utf8str, OSUINT64 *pvalue)
- int **rtxUTF8StrnToUInt64** (const OSUTF8CHAR *utf8str, size_t nbytes, OSUINT64 *pvalue)

- int `rtxUTF8ToDynUniStr` (`OSCTXT` *pctxt, const `OSUTF8CHAR` *utf8str, const `OSUNICHAR` **ppdata, `OSUINT32` *pnchars)
- int `rtxUTF8RemoveWhiteSpace` (const `OSUTF8CHAR` *utf8instr, `size_t` nbytes, const `OSUTF8CHAR` **putf8outstr)
- int `rtxUTF8StrToDynHexStr` (`OSCTXT` *pctxt, const `OSUTF8CHAR` *utf8str, `OSDynOctStr` *pvalue)
- int `rtxUTF8StrnToDynHexStr` (`OSCTXT` *pctxt, const `OSUTF8CHAR` *utf8str, `size_t` nbytes, `OSDynOctStr` *pvalue)
- int `rtxUTF8StrToNamedBits` (`OSCTXT` *pctxt, const `OSUTF8CHAR` *utf8str, const `OSBitMapItem` *pBitMap, `OSOCKET` *pvalue, `OSUINT32` *pnbits, `OSUINT32` bufsize)
- const `OSUTF8CHAR` * `rtxUTF8StrNextTok` (`OSUTF8CHAR` *utf8str, `OSUTF8CHAR` **ppNext)

2.13.1 Detailed Description

The UTF-8 string functions handle string operations on UTF-8 encoded strings. This is the default character string data type used for encoded XML data. UTF-8 strings are represented in C as strings of unsigned characters (bytes) to cover the full range of possible single character encodings.

2.13.2 Define Documentation

2.13.2.1 #define OSRTCHKUTF8LEN(str, lower, upper, stat)

Value:

```
do { size_t nchars = rtxUTF8Len (str); \
stat = (nchars >= lower && nchars <= upper) ? 0 : RTERR_CONSVIO; } while(0)
```

2.13.2.2 #define RTUTF8STRCMPL(name, lstr) rtxUTF8Strcmp(name,(const OSUTF8CHAR*)lstr)

Compare UTF-8 string to a string literal.

Parameters

name UTF-8 string variable.

lstr C string literal value (quoted contant such as "a")

2.13.3 Function Documentation

2.13.3.1 int rtxUTF8CharSize (OS32BITCHAR wc)

This function will return the number of bytes needed to encode the given 32-bit universal character value as a UTF-8 character.

Parameters

wc 32-bit wide character value.

Returns

Number of bytes needed to encode as UTF-8.

2.13.3.2 OS32BITCHAR rtxUTF8CharToWC (const OSUTF8CHAR * buf, OSUINT32 * len)

This function will convert a UTF-8 encoded character value into a wide character.

Parameters

buf Pointer to UTF-8 character value.

len Pointer to integer to receive decoded size (in bytes) of the UTF-8 character value sequence.

Returns

Converted wide character value.

2.13.3.3 int rtxUTF8DecodeChar (OSCTXT * pctxt, const OSUTF8CHAR * pinbuf, int * pInsize)

This function will convert an encoded UTF-8 character byte string into a wide character value.

Parameters

pctxt A pointer to a context structure.

pinbuf Pointer to UTF-8 byte sequence to be decoded.

pInsize Number of bytes that were consumed (i.e. size of the character).

Returns

32-bit wide character value.

2.13.3.4 int rtxUTF8EncodeChar (OS32BITCHAR wc, OSOCTET * buf, size_t bufsiz)

This function will convert a wide character into an encoded UTF-8 character byte string.

Parameters

wc 32-bit wide character value.

buf Buffer to receive encoded UTF-8 character value.

bufsiz Size of the buffer to receive the encoded value.

Returns

Number of bytes consumed to encode character or negative status code if error.

2.13.3.5 size_t rtxUTF8Len (const OSUTF8CHAR * inbuf)

This function will return the length (in characters) of a null-terminated UTF-8 encoded string.

Parameters

inbuf A pointer to the null-terminated UTF-8 encoded string.

Returns

Number of characters in string. Note that this may be different than the number of bytes as UTF-8 characters can span multiple-bytes.

2.13.3.6 `size_t rtxUTF8LenBytes (const OSUTF8CHAR * inbuf)`

This function will return the length (in bytes) of a null-terminated UTF-8 encoded string.

Parameters

inbuf A pointer to the null-terminated UTF-8 encoded string.

Returns

Number of bytes in the string.

2.13.3.7 `int rtxUTF8RemoveWhiteSpace (const OSUTF8CHAR * utf8instr, size_t nbytes, const OSUTF8CHAR ** putf8outstr)`

This function removes leading and trailing whitespace from a string.

Parameters

utf8instr Input UTF-8 string from which to removed whitespace.

nbytes Size in bytes of *utf8instr*.

putf8outstr Pointer to receive result string.

Returns

Positive value = length of result string, negative value = error code.

2.13.3.8 `OSUTF8CHAR* rtxUTF8StrChr (OSUTF8CHAR * utf8str, OS32BITCHAR utf8char)`

This function finds a character in the given UTF-8 character string. It is similar to the C `strchr` function.

Parameters

utf8str Null-terminated UTF-8 string to be searched.

utf8char 32-bit Unicode character to find.

Returns

Pointer to the first occurrence of character in string, or NULL if character is not found.

2.13.3.9 `int rtxUTF8Strcmp (const OSUTF8CHAR * utf8str1, const OSUTF8CHAR * utf8str2)`

This function compares two UTF-8 character strings and returns a trinary result (equal, less than, greater than). It is similar to the C `strcmp` function.

Parameters

utf8str1 UTF-8 string to be compared.

utf8str2 UTF-8 string to be compared.

Returns

-1 if *utf8str1* is less than *utf8str2*, 0 if the two string are equal, and +1 if the *utf8str1* is greater than *utf8str2*.

2.13.3.10 OSUTF8CHAR* rtxUTF8Strcpy (OSUTF8CHAR * *dest*, size_t *bufsiz*, const OSUTF8CHAR * *src*)

This function copies a null-terminated UTF-8 string to a target buffer. It is similar to the C `strcpy` function except more secure because it checks for buffer overrun.

Parameters

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

src Pointer to null-terminated string to copy.

Returns

Pointer to destination buffer or NULL if copy failed.

2.13.3.11 OSUTF8CHAR* rtxUTF8Strdup (OSCTXT * *pctxt*, const OSUTF8CHAR * *utf8str*)

This function creates a duplicate copy of the given UTF-8 character string. It is similar to the C `strdup` function. Memory for the duplicated string is allocated using the `rtxMemAlloc` function.

Parameters

pctxt A pointer to a context structure.

utf8str Null-terminated UTF-8 string to be duplicated.

Returns

Pointer to duplicated string value.

2.13.3.12 OSBOOL rtxUTF8StrEqual (const OSUTF8CHAR * *utf8str1*, const OSUTF8CHAR * *utf8str2*)

This function compares two UTF-8 string values for equality.

Parameters

utf8str1 UTF-8 string to be compared.

utf8str2 UTF-8 string to be compared.

Returns

TRUE if equal, FALSE if not.

2.13.3.13 OSUINT32 rtxUTF8StrHash (const OSUTF8CHAR * *str*)

This function computes a hash code for the given string value.

Parameters

str Pointer to string.

Returns

Hash code value.

2.13.3.14 `const OSUTF8CHAR* rtxUTF8StrJoin (OSCTXT * pctxt, const OSUTF8CHAR * str1, const OSUTF8CHAR * str2, const OSUTF8CHAR * str3, const OSUTF8CHAR * str4, const OSUTF8CHAR * str5)`

This function concatenates up to five substrings together into a single string.

Parameters

pctxt Pointer to a context block structure.

str1 Pointer to substring to join.

str2 Pointer to substring to join.

str3 Pointer to substring to join.

str4 Pointer to substring to join.

str5 Pointer to substring to join.

Returns

Composite string consisting of all parts. Memory is allocated for this string using `rtxMemAlloc` and must be freed using either `rtxMemFreePtr` or `rtxMemFree`. If memory allocation for the string fails, `NULL` is returned.

2.13.3.15 `int rtxUTF8Strncmp (const OSUTF8CHAR * utf8str1, const OSUTF8CHAR * utf8str2, size_t count)`

This function compares two UTF-8 character strings and returns a trinary result (equal, less than, greater than). In this case, a maximum count of the number of bytes to compare can be specified. It is similar to the C `strncmp` function.

Parameters

utf8str1 UTF-8 string to be compared.

utf8str2 UTF-8 string to be compared.

count Number of bytes to compare.

Returns

-1 if *utf8str1* is less than *utf8str2*, 0 if the two string are equal, and +1 if the *utf8str1* is greater than *utf8str2*.

2.13.3.16 `OSUTF8CHAR* rtxUTF8Strncpy (OSUTF8CHAR * dest, size_t bufsiz, const OSUTF8CHAR * src, size_t nchars)`

This function copies the given number of characters from a UTF-8 string to a target buffer. It is similar to the C `strncpy` function except more secure because it checks for buffer overrun and ensures a null-terminator is copied to the end of the target buffer

Parameters

dest Pointer to destination buffer to receive string.

bufsiz Size of the destination buffer.

src Pointer to null-terminated string to copy.

nchars Number of characters to copy.

Returns

Pointer to destination buffer or `NULL` if copy failed.

2.13.3.17 OSUTF8CHAR* rtxUTF8Strndup (OSCTXT * *pctxt*, const OSUTF8CHAR * *utf8str*, size_t *nbytes*)

This function creates a duplicate copy of the given UTF-8 character string. It is similar to the `rtxUTF8Strdup` function except that it allows the number of bytes to convert to be specified. Memory for the duplicated string is allocated using the `rtxMemAlloc` function.

Parameters

- pctxt* A pointer to a context structure.
- utf8str* UTF-8 string to be duplicated.
- nbytes* Number of bytes from `utf8str` to duplicate.

Returns

Pointer to duplicated string value.

2.13.3.18 OSBOOL rtxUTF8StrnEqual (const OSUTF8CHAR * *utf8str1*, const OSUTF8CHAR * *utf8str2*, size_t *count*)

This function compares two UTF-8 string values for equality. It is similar to the `rtxUTF8StrEqual` function except that it allows the number of bytes to compare to be specified.

Parameters

- utf8str1* UTF-8 string to be compared.
- utf8str2* UTF-8 string to be compared.
- count* Number of bytes to compare.

Returns

TRUE if equal, FALSE if not.

2.13.3.19 const OSUTF8CHAR* rtxUTF8StrNextTok (OSUTF8CHAR * *utf8str*, OSUTF8CHAR ** *ppNext*)

This function returns the next whitespace-separated token from the input string. It also returns a pointer to the first non-whitespace character after the parsed token. Note that the input string is altered in the operation as null-terminators are inserted to mark the token boundaries.

Parameters

- utf8str* Null-terminated UTF-8 string to parse. This string will be altered. Use `rtxUTF8Strdup` to make a copy of original string before calling this function if the original string cannot be altered.
- ppNext* Pointer to receive next location in string after parsed token. This can be used as input to get the next token. If NULL returned, all tokens in the string have been parsed.

Returns

Pointer to next parsed token. NULL if no more tokens.

2.13.3.20 `int rtxUTF8StrnToBool (const OSUTF8CHAR * utf8str, size_t nbytes, OSBOOL * pvalue)`

This function converts the given part of UTF-8 string to a boolean (true/false) value. It is assumed the string contains only the tokens 'true', 'false', '1', or '0'.

Parameters

utf8str Null-terminated UTF-8 string to convert
nbytes Size in bytes of *utf8Str*.
pvalue Pointer to boolean value to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.21 `int rtxUTF8StrnToDouble (const OSUTF8CHAR * utf8str, size_t nbytes, OSREAL * pvalue)`

This function converts the given part of UTF-8 string to a double value. It is assumed the string contains only numeric digits, whitespace, and other special floating point characters. It is similar to the C `atof` function except that the result is returned as a separate argument and an error status value is returned if the conversion cannot be performed successfully.

Parameters

utf8str UTF-8 string to convert. Not necessary to be null-terminated.
nbytes Size in bytes of *utf8Str*.
pvalue Pointer to double to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.22 `int rtxUTF8StrnToDynHexStr (OSCTXT * pctxt, const OSUTF8CHAR * utf8str, size_t nbytes, OSDynOctStr * pvalue)`

This function converts the given part of UTF-8 string to a octet string value. The string consists of a series of hex digits. This is the dynamic version in which memory is allocated for the returned octet string variable.

Parameters

pctxt Pointer to context block structure.
utf8str Null-terminated UTF-8 string to convert
nbytes Size in bytes of *utf8Str*.
pvalue Pointer to a variable to receive the decoded octet string value.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.13.3.23 `int rtxUTF8StrnToInt (const OSUTF8CHAR * utf8str, size_t nbytes, OSINT32 * pvalue)`

This function converts the given part of UTF-8 string to an integer value. It is assumed the string contains only numeric digits and whitespace. It is similar to the C `atoi` function except that the result is returned as a separate argument and an error status value is returned if the conversion cannot be performed successfully.

Parameters

utf8str UTF-8 string to convert. Not necessary to be null-terminated.

nbytes Size in bytes of `utf8Str`.

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.24 `int rtxUTF8StrnToInt64 (const OSUTF8CHAR * utf8str, size_t nbytes, OSINT64 * pvalue)`

This function converts the given part of UTF-8 string to a 64-bit integer value. It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str UTF-8 string to convert. Not necessary to be null-terminated.

nbytes Size in bytes of `utf8Str`.

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.25 `int rtxUTF8StrnToSize (const OSUTF8CHAR * utf8str, size_t nbytes, size_t * pvalue)`

This function converts the given part of UTF-8 string to a size value (type `size_t`). It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str UTF-8 string to convert. Not necessary to be null-terminated.

nbytes Size in bytes of `utf8Str`.

pvalue Pointer to `size_t` value to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.26 `int rtxUTF8StrnToUInt (const OSUTF8CHAR * utf8str, size_t nbytes, OSUINT32 * pvalue)`

This function converts the given part of UTF-8 string to an unsigned integer value. It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str UTF-8 string to convert. Not necessary to be null-terminated.

nbytes Size in bytes of utf8Str.

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.27 `int rtxUTF8StrnToUInt64 (const OSUTF8CHAR * utf8str, size_t nbytes, OSUINT64 * pvalue)`

This function converts the given part of UTF-8 string to an unsigned 64-bit integer value. It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str UTF-8 string to convert. Not necessary to be null-terminated.

nbytes Size in bytes of utf8Str.

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.28 `OSUTF8CHAR* rtxUTF8StrRefOrDup (OSCTXT * pctx, const OSUTF8CHAR * utf8str)`

This function check to see if the given UTF8 string pointer exists on the memory heap. If it does, its reference count is incremented; otherwise, a duplicate copy is made.

Parameters

pctx A pointer to a context structure.

utf8str Null-terminated UTF-8 string variable.

Returns

Pointer to string value. This will either be the existing UTF-8 string pointer value (*utf8str*) or a new value.

2.13.3.29 `int rtxUTF8StrToBool (const OSUTF8CHAR * utf8str, OSBOOL * pvalue)`

This function converts the given null-terminated UTF-8 string to a boolean (true/false) value. It is assumed the string contains only the tokens 'true', 'false', '1', or '0'.

Parameters

utf8str Null-terminated UTF-8 string to convert

pvalue Pointer to boolean value to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.30 `int rtxUTF8StrToDouble (const OSUTF8CHAR * utf8str, OSREAL * pvalue)`

This function converts the given null-terminated UTF-8 string to a floating point (C/C++ double) value. It is assumed the string contains only numeric digits, special floating point characters (+,-,E,.), and whitespace. It is similar to the C `atof` function except that the result is returned as a separate argument and an error status value is returned if the conversion cannot be performed successfully.

Parameters

utf8str Null-terminated UTF-8 string to convert

pvalue Pointer to double to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.31 `int rtxUTF8StrToDynHexStr (OSCTXT * pctxt, const OSUTF8CHAR * utf8str, OSDynOctStr * pvalue)`

This function converts the given null-terminated UTF-8 string to a octet string value. The string consists of a series of hex digits. This is the dynamic version in which memory is allocated for the returned octet string variable.

Parameters

pctxt Pointer to context block structure.

utf8str Null-terminated UTF-8 string to convert

pvalue Pointer to a variable to receive the decoded octet string value.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.13.3.32 `int rtxUTF8StrToInt (const OSUTF8CHAR * utf8str, OSINT32 * pvalue)`

This function converts the given null-terminated UTF-8 string to an integer value. It is assumed the string contains only numeric digits and whitespace. It is similar to the C `atoi` function except that the result is returned as a separate argument and an error status value is returned if the conversion cannot be performed successfully.

Parameters

utf8str Null-terminated UTF-8 string to convert

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.33 `int rtxUTF8StrToInt64 (const OSUTF8CHAR * utf8str, OSINT64 * pvalue)`

This function converts the given null-terminated UTF-8 string to a 64-bit integer value. It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str Null-terminated UTF-8 string to convert
pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.34 `int rtxUTF8StrToNamedBits (OSCTXT * pctxt, const OSUTF8CHAR * utf8str, const OSBitMapItem * pBitMap, OSOCTET * pvalue, OSUINT32 * pnbits, OSUINT32 bufsize)`

This function converts the given null-terminated UTF-8 string to named bit items. The token-to-bit mappings are defined by a bit map table that is passed into the function. It is assumed the string contains a space-separated list of named bit token values.

Parameters

pctxt Context structure
utf8str Null-terminated UTF-8 string to convert
pBitMap Bit map defining bit to token mappings
pvalue Pointer to byte array to receive result.
pnbits Pointer to integer to received number of bits.
bufsize Size of byte array to received decoded bits.

Returns

Status: 0 = OK, negative value = error

2.13.3.35 `int rtxUTF8StrToSize (const OSUTF8CHAR * utf8str, size_t * pvalue)`

This function converts the given null-terminated UTF-8 string to a size value (type `size_t`). It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str Null-terminated UTF-8 string to convert
pvalue Pointer to `size_t` value to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.36 `int rtxUTF8StrToUInt (const OSUTF8CHAR * utf8str, OSUINT32 * pvalue)`

This function converts the given null-terminated UTF-8 string to an unsigned integer value. It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str Null-terminated UTF-8 string to convert

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.37 `int rtxUTF8StrToUInt64 (const OSUTF8CHAR * utf8str, OSUINT64 * pvalue)`

This function converts the given null-terminated UTF-8 string to an unsigned 64-bit integer value. It is assumed the string contains only numeric digits and whitespace.

Parameters

utf8str Null-terminated UTF-8 string to convert

pvalue Pointer to integer to receive result

Returns

Status: 0 = OK, negative value = error

2.13.3.38 `int rtxUTF8ToDynUniStr (OSCTXT * pctxt, const OSUTF8CHAR * utf8str, const OSUNICHAR ** ppdata, OSUINT32 * pnchars)`

This function converts the given UTF-8 string to a Unicode string. Memory is allocated for the Unicode string using the `rtxMemAlloc` function. This memory will be freed when the context is freed (`rtxFreeContext`) or it can be freed using `rtxMemFreePtr`.

Parameters

pctxt A pointer to a context structure.

utf8str UTF-8 string to convert, null-terminated.

ppdata Pointer to pointer to receive output string.

pnchars Pointer to integer to receive number of chars decoded.

Returns

Status: 0 = OK, negative value = error

2.13.3.39 `long rtxUTF8ToUnicode (OSCTXT * pctxt, const OSUTF8CHAR * inbuf, OSUNICHAR * outbuf, size_t outbufsiz)`

This function converts a UTF-8 string to a Unicode string (UTF-16). The Unicode string is stored as an array of 16-bit characters (unsigned short integers).

Parameters

pctxt A pointer to a context structure.

inbuf UTF-8 string to convert.

outbuf Output buffer to receive converted Unicode data.

outbufsiz Size of the output buffer in bytes.

Returns

Completion status of operation:

- number of Unicode characters in the string
- negative return value is error.

2.13.3.40 `int rtxValidateUTF8 (OSCTXT * pctxt, const OSUTF8CHAR * inbuf)`

This function will validate a UTF-8 encoded string to ensure that it is encoded correctly.

Parameters

pctxt A pointer to a context structure.

inbuf A pointer to the null-terminated UTF-8 encoded string.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.14 Bit String Functions

Defines

- `#define OSRTBYTEARRAYSIZE(numbits) ((numbits+7)/8)`

Functions

- OSUINT32 `rtxGetBitCount` (OSUINT32 value)
- int `rtxSetBit` (OSOCKET *pBits, OSSIZE numbits, OSSIZE bitIndex)
- OSUINT32 `rtxSetBitFlags` (OSUINT32 flags, OSUINT32 mask, OSBOOL action)
- int `rtxClearBit` (OSOCKET *pBits, OSSIZE numbits, OSSIZE bitIndex)
- OSBOOL `rtxTestBit` (const OSOCKET *pBits, OSSIZE numbits, OSSIZE bitIndex)
- OSSIZE `rtxLastBitSet` (const OSOCKET *pBits, OSSIZE numbits)
- int `rtxCheckBitBounds` (OSCTXT *pctx, OSOCKET **ppBits, OSSIZE *pNumocts, OSSIZE minRequiredBits, OSSIZE preferredLimitBits)

2.14.1 Detailed Description

Bit string functions allow bits to be set, cleared, or tested in arbitrarily sized byte arrays.

2.14.2 Define Documentation

2.14.2.1 `#define OSRTBYTEARRAYSIZE(numbits) ((numbits+7)/8)`

This macro is used to calculate the byte array size required to hold the given number of bits.

2.14.3 Function Documentation

2.14.3.1 `int rtxCheckBitBounds (OSCTXT * pctx, OSOCKET ** ppBits, OSSIZE * pNumocts, OSSIZE minRequiredBits, OSSIZE preferredLimitBits)`

Check whether the given bit string is large enough, and expand it if necessary.

Parameters

pctx The context to use should memory need to be allocated.

ppBits *ppBits is a pointer to the bit string, or NULL if one has not been created. If the string is expanded, *ppBits receives a pointer to the new bit string.

pNumocts pNumocts points to the current size of the bit string in octets. If the bit string is expanded, *pNumocts receives the new size.

minRequiredBits The minimum number of bits needed in the bit string. On return, pBits will point to a bit string with at least this many bits.

preferredLimitBits The number of bits over which we prefer not to go. If nonzero, no more bytes will be allocated than necessary for this many bits, unless explicitly required by minRequiredBits.

Returns

If successful, 0. Otherwise, an error code.

2.14.3.2 int rtxClearBit (OSOCKET * *pBits*, OSSIZE *numbits*, OSSIZE *bitIndex*)

This function clears the specified zero-counted bit in the bit string.

Parameters

pBits Pointer to octets of bit string.

numbits Number of bits in the bit string.

bitIndex Index of bit to be cleared. The bit with index 0 is a most significant bit in the octet with index 0.

Returns

If successful, returns the previous state of bit. If bit was set the return value is positive, if bit was not set the return value is zero. Otherwise, return value is an error code:

- RTERR_OUTOFBND = *bitIndex* is out of bounds

2.14.3.3 OSUINT32 rtxGetBitCount (OSUINT32 *value*)

This function returns the minimum size of the bit field required to hold the given integer value.

Parameters

value Integer value

Returns

Minimum size of the the field in bits required to hold value.

2.14.3.4 OSSIZE rtxLastBitSet (const OSOCKET * *pBits*, OSSIZE *numbits*)

This function returns the zero-counted index of the last bit set in a bit string.

Parameters

pBits Pointer to the octets of the bit string.

numbits The number of bits in the bit string.

Returns

Index of the last bit set in the bit string.

2.14.3.5 int rtxSetBit (OSOCKET * *pBits*, OSSIZE *numbits*, OSSIZE *bitIndex*)

This function sets the specified zero-counted bit in the bit string.

Parameters

pBits Pointer to octets of bit string.

numbits Number of bits in the bit string.

bitIndex Index of bit to be set. The bit with index 0 is a most significant bit in the octet with index 0.

Returns

If successful, returns the previous state of bit. If bit was set the return value is positive, if bit was not set the return value is zero. Otherwise, return value is an error code:

- `RTERR_OUTOFBND = bitIndex` is out of bounds

2.14.3.6 OSUINT32 `rtxSetBitFlags` (OSUINT32 *flags*, OSUINT32 *mask*, OSBOOL *action*)

This function sets one or more bits to TRUE or FALSE in a 32-bit unsigned bit flag set.

Parameters

flags Flags to which mask will be applied.

mask Mask with one or more bits set that will be applied to `pBitMask`.

action Boolean action indicating if bits in flags should be set (TRUE) or cleared (FALSE).

Returns

Updated flags after mask is applied.

2.14.3.7 OSBOOL `rtxTestBit` (const OSOCTET * *pBits*, OSSIZE *numbits*, OSSIZE *bitIndex*)

This function tests the specified zero-counted bit in the bit string.

Parameters

pBits Pointer to octets of bit string.

numbits Number of bits in the bit string.

bitIndex Index of bit to be tested. The bit with index 0 is a most significant bit in the octet with index 0.

Returns

True if bit set or false if not set or array index is beyond range of number of bits in the string.

2.15 Context Management Functions

Classes

- struct [OSRTerrLocn](#)
- struct [OSRTerrInfo](#)
- struct [OSRTerrInfoList](#)
- struct [OSRTBuffer](#)
- struct [OSRTBufSave](#)
- struct [OSBufferIndex](#)
- struct [OSCTXT](#)

Defines

- #define **OSRTERRSTKSIZ** 8
- #define **OSRTMAXERRPRM** 5
- #define **OSDIAG** 0x80000000
- #define **OSTRACE** 0x40000000
- #define **OSDISSTRM** 0x20000000
- #define **OSNOSTRMBACKOFF** 0x08000000
- #define **OS3GMOBORIG** 0x04000000
- #define **OSCONTCLOSED** 0x02000000
- #define **OSRESERVED1** 0x01000000
- #define **OSCDECL**
- #define **OSRT_GET_FIRST_ERROR_INFO**(pctxt)
- #define **OSRT_GET_LAST_ERROR_INFO**(pctxt)
- #define **rtxCtxtGetMsgPtr**(pctxt) (pctxt)->buffer.data
- #define **rtxCtxtGetMsgLen**(pctxt) (pctxt)->buffer.byteIndex
- #define **rtxCtxtTestFlag**(pctxt, mask) (((pctxt)->flags & mask) != 0)
- #define **rtxCtxtPeekElemName**(pctxt)
- #define **rtxByteAlign**(pctxt)
- #define **rtxCtxtSetProtocolVersion**(pctxt, value) (pctxt)->version = value
- #define **rtxMarkBitPos**(pctxt, ppos, pbitoff) (*(pbitoff) = (OSUINT8) (pctxt)->buffer.bitOffset, rtxMarkPos (pctxt, ppos))
- #define **rtxResetToBitPos**(pctxt, pos, bitoff) ((pctxt)->buffer.bitOffset = (OSUINT8) bitoff, rtxResetToPos (pctxt, pos))
- #define **RTXCTXTTPUSHARRAYELEMNAME**(pctxt, name, idx) rtxCtxtPushArrayElemName(pctxt, OSUTF8(name), idx)
- #define **RTXCTXTPOPARRAYELEMNAME**(pctxt) rtxCtxtPopArrayElemName(pctxt)
- #define **RTXCTXTPUSHELEMNAME**(pctxt, name) rtxCtxtPushElemName(pctxt, OSUTF8(name))
- #define **RTXCTXTPOPELEMNAME**(pctxt) rtxCtxtPopElemName(pctxt)
- #define **RTXCTXTPUSHTYPENAME**(pctxt, name) rtxCtxtPushTypeName(pctxt, OSUTF8(name))
- #define **RTXCTXTPOPTYPENAME**(pctxt) rtxCtxtPopTypeName(pctxt)

Typedefs

- typedef OSUINT32 **OSRTFLAGS**
- typedef int(* [OSFreeCtxtAppInfoPtr](#))(struct [OSCTXT](#) *pctxt)
- typedef int(* [OSResetCtxtAppInfoPtr](#))(struct [OSCTXT](#) *pctxt)
- typedef void(* [OSFreeCtxtGlobalPtr](#))(struct [OSCTXT](#) *pctxt)
- typedef struct [OSCTXT](#) **OSCTXT**

Functions

- int `rtxInitContext` (`OSCTXT *pctx`)
- int `rtxInitContextExt` (`OSCTXT *pctx`, `OSMallocFunc malloc_func`, `OSReallocFunc realloc_func`, `OSFreeFunc free_func`)
- int `rtxInitThreadContext` (`OSCTXT *pctx`, const `OSCTXT *pSrcCtx`)
- int `rtxInitContextBuffer` (`OSCTXT *pctx`, `OSOCKET *bufaddr`, `OSSIZE bufsiz`)
- int `rtxCtxtSetBufPtr` (`OSCTXT *pctx`, `OSOCKET *bufaddr`, `OSSIZE bufsiz`)
- `OSSIZE rtxCtxtGetBitOffset` (`OSCTXT *pctx`)
- int `rtxCtxtSetBitOffset` (`OSCTXT *pctx`, `OSSIZE offset`)
- `OSSIZE rtxCtxtGetIOByteCount` (`OSCTXT *pctx`)
- int `rtxCheckContext` (`OSCTXT *pctx`)
- void `rtxFreeContext` (`OSCTXT *pctx`)
- void `rtxCopyContext` (`OSCTXT *pdest`, `OSCTXT *psrc`)
- void `rtxCtxtSetFlag` (`OSCTXT *pctx`, `OSUINT32 mask`)
- void `rtxCtxtClearFlag` (`OSCTXT *pctx`, `OSUINT32 mask`)
- int `rtxCtxtPushArrayElemName` (`OSCTXT *pctx`, const `OSUTF8CHAR *elemName`, `OSSIZE idx`)
- int `rtxCtxtPushElemName` (`OSCTXT *pctx`, const `OSUTF8CHAR *elemName`)
- int `rtxCtxtPushTypeName` (`OSCTXT *pctx`, const `OSUTF8CHAR *typeName`)
- `OSBOOL rtxCtxtPopArrayElemName` (`OSCTXT *pctx`)
- const `OSUTF8CHAR * rtxCtxtPopElemName` (`OSCTXT *pctx`)
- const `OSUTF8CHAR * rtxCtxtPopTypeName` (`OSCTXT *pctx`)
- `OSBOOL rtxCtxtContainerHasRemBits` (`OSCTXT *pctx`)
- `OSSIZE rtxCtxtGetContainerRemBits` (`OSCTXT *pctx`)
- int `rtxCtxtPushContainerBytes` (`OSCTXT *pctx`, `OSSIZE bytes`)
- int `rtxCtxtPushContainerBits` (`OSCTXT *pctx`, `OSSIZE bits`)
- void `rtxCtxtPopContainer` (`OSCTXT *pctx`)
- void `rtxCtxtPopAllContainers` (`OSCTXT *pctx`)
- int `rtxPreInitContext` (`OSCTXT *pctx`)
- void `rtxMemHeapSetFlags` (`OSCTXT *pctx`, `OSUINT32 flags`)
- void `rtxMemHeapClearFlags` (`OSCTXT *pctx`, `OSUINT32 flags`)
- int `rtxMarkPos` (`OSCTXT *pctx`, `OSSIZE *ppos`)
- int `rtxResetToPos` (`OSCTXT *pctx`, `OSSIZE pos`)

2.15.1 Detailed Description

Context initialization functions handle the allocation, initialization, and destruction of context variables (variables of type `OSCTXT`). These variables hold all of the working data used during the process of encoding or decoding a message. The context provides thread safe operation by isolating what would otherwise be global variables within this structure. The context variable is passed from function to function as a message is encoded or decoded and maintains state information on the encoding or decoding process.

2.15.2 Define Documentation

2.15.2.1 `#define OSRT_GET_FIRST_ERROR_INFO(pctx)`

Value:

```
((pctx)->errInfo.list.head == 0) ? (OSRTErrInfo*)0 : \
(OSRTErrInfo*)((pctx)->errInfo.list.head->data)
```

2.15.2.2 #define OSRT_GET_LAST_ERROR_INFO(pctxt)

Value:

```
((pctxt)->errInfo.list.tail == 0) ? (OSRTErrInfo*)0 : \
(OSRTErrInfo*)(pctxt)->errInfo.list.tail->data)
```

2.15.2.3 #define rtxByteAlign(pctxt)

Value:

```
if ((pctxt)->buffer.bitOffset != 8) { \
(pctxt)->buffer.byteIndex++; (pctxt)->buffer.bitOffset = 8; }
```

This macro will byte-align the context buffer.

2.15.2.4 #define rtxCtxtGetMsgLen(pctxt) (pctxt)->buffer.byteIndex

This macro returns the length of an encoded message. It will only work for in-memory encoding, not for encode to stream.

Note that this macro will not work with ASN.1 BER in-memory encoding. In this case, the BER-specific version of the function must be used.

Parameters

pctxt Pointer to a context structure.

2.15.2.5 #define rtxCtxtGetMsgPtr(pctxt) (pctxt)->buffer.data

This macro returns the start address of an encoded message. If a static buffer was used, this is simply the start address of the buffer. If dynamic encoding was done, this will return the start address of the dynamic buffer allocated by the encoder.

Note that this macro will not work with ASN.1 BER in-memory encoding. In this case, the BER-specific version of the function must be used.

Parameters

pctxt Pointer to a context structure.

2.15.2.6 #define rtxCtxtPeekElemName(pctxt)

Value:

```
((pctxt)->elemNameStack.count > 0) ? \
(const OSUTF8CHAR*)(pctxt)->elemNameStack.tail->data : (const OSUTF8CHAR*)0
```

This macro returns the last element name from the context stack.

Parameters

pctxt Pointer to a context structure.

Returns

Element name from top of stack or NULL if stack is empty.

2.15.2.7 **#define rtxCtxtSetProtocolVersion(pctxt, value) (pctxt)->version = value**

This macro sets the protocol version in the context. This version number may be used in application code to do version specific operations. It is used in generated ASN.1 code with the extension addition version numbers to determine if an addition should be decoded.

For example, if this value is set to 8 and an extension addition group exists with version number 9 ([[9: ...]]), its contents will not be decoded.

Parameters

pctxt Pointer to a context structure.

value The version number value.

2.15.2.8 **#define rtxCtxtTestFlag(pctxt, mask) (((pctxt)->flags & mask) != 0)**

This macro tests if the given bit flag is set in the context.

Parameters

pctxt - A pointer to a context structure.

mask - Bit flag to be tested

2.15.3 **Typedef Documentation**

2.15.3.1 **typedef int(* OSFreeCtxtAppInfoPtr)(struct OSCTXT *pctxt)**

OSRTFreeCtxtAppInfoPtr is a pointer to pctxt->pAppInfo free function, The pctxt->pAppInfo (pXMLInfo and pASN1Info) should contain the pointer to a structure and its first member should be a pointer to an appInfo free function.

2.15.3.2 **typedef void(* OSFreeCtxtGlobalPtr)(struct OSCTXT *pctxt)**

OSRTFreeCtxtGlobalPtr is a pointer to a memory free function. This type describes the custom global memory free function generated by the compiler to free global nmemory. A pointer to a function of this type may be stored in the context gblFreeFunc field in order to free global data (pGlobalData) when rtxFreeContext is called.

2.15.3.3 **typedef int(* OSResetCtxtAppInfoPtr)(struct OSCTXT *pctxt)**

OSRTResetCtxtAppInfoPtr is a pointer to pctxt->pAppInfo reset function, The pctxt->pAppInfo (pXMLInfo and pASN1Info) should contain the pointer to a structure and its second member should be a pointer to appInfo reset function.

2.15.4 **Function Documentation**

2.15.4.1 **int rtxCheckContext (OSCTXT * pctxt)**

This function verifies that the given context structure is initialized and ready for use.

Parameters

pctxt Pointer to a context structure.

Returns

Completion status of operation:

- 0 = success,
- RTERR_NOTINIT status code if not initialized

2.15.4.2 void rtxCopyContext (OSCTXT * *pdest*, OSCTXT * *psrc*)

This function creates a copy of a context structure. The copy is a "shallow copy" (i.e. new copies of dynamic memory blocks held within the context are not made, only the pointers are transferred to the new context structure). This function is mainly for use from within compiler-generated code.

Parameters

pdest - Context structure to which data is to be copied.

psrc - Context structure from which data is to be copied.

2.15.4.3 void rtxCtxtClearFlag (OSCTXT * *pctxt*, OSUINT32 *mask*)

This function is used to clear a processing flag within the context structure.

Parameters

pctxt - A pointer to a context structure.

mask - Mask containing bit(s) to be cleared.

2.15.4.4 OSBOOL rtxCtxtContainerHasRemBits (OSCTXT * *pctxt*)

Return true iff there are bits remaining to be decoded in the current length-constrained container, which is possibly the outer PDU.

See also rtxCtxtPushContainer(Bits|Bytes)/rtxCtxtPopContainer

Parameters

pctxt Pointer to context structure.

2.15.4.5 OSSIZE rtxCtxtGetBitOffset (OSCTXT * *pctxt*)

This function returns the total bit offset to the current element in the context buffer.

Parameters

pctxt Pointer to a context structure.

Returns

Bit offset.

2.15.4.6 `OSSIZE rtxCtxtGetContainerRemBits (OSCTXT * pctxt)`

Return the number of bits remaining to be decoded in the current length-constrained container, which is possibly the outer PDU.

See also `rtxCtxtPushContainer(Bits|Bytes)/rtxCtxtPopContainer`

Parameters

pctxt Pointer to context structure.

2.15.4.7 `OSSIZE rtxCtxtGetIOByteCount (OSCTXT * pctxt)`

This function returns the count of bytes either written to a stream or memory buffer.

Parameters

pctxt Pointer to a context structure.

Returns

I/O byte count.

2.15.4.8 `void rtxCtxtPopAllContainers (OSCTXT * pctxt)`

Pop all containers from the container stack. This is useful for clearing the stack when an error has occurred. It is invoked automatically by `rtxErrReset`.

Parameters

pctxt Pointer to context structure.

2.15.4.9 `OSBOOL rtxCtxtPopArrayElemName (OSCTXT * pctxt)`

This function pops the last element name from the context stack. This name is assumed to be an array element name pushed by the `rtxCtxtPushArrayElemName` function. The name is therefore dynamic and memory is freed for it using the `rtxMemFreePtr` function.

Parameters

pctxt Pointer to a context structure.

Returns

True if name popped from stack or false if stack is empty.

2.15.4.10 `void rtxCtxtPopContainer (OSCTXT * pctxt)`

Notify the runtime layer of the end of decoding of a length-constrained container of the given length. This method should be called when the final bit to be decoded has been decoded.

This pops an entry off of `pctxt->containerEndIndex`

Parameters

pctxt Pointer to context structure.

2.15.4.11 **const OSUTF8CHAR* rtxCtxtPopElemName (OSCTXT * *pctxt*)**

This function pops the last element name from the context stack.

Parameters

pctxt Pointer to a context structure.

Returns

Element name popped from stack or NULL if stack is empty.

2.15.4.12 **const OSUTF8CHAR* rtxCtxtPopTypeName (OSCTXT * *pctxt*)**

This function pops the type name from the context stack. The name is only popped if the item count is one.

Parameters

pctxt Pointer to a context structure.

Returns

Type name popped from stack or NULL if stack count not equal to one.

2.15.4.13 **int rtxCtxtPushArrayElemName (OSCTXT * *pctxt*, const OSUTF8CHAR * *elemName*, OSSIZE *idx*)**

This function is used to push an array element name onto the context element name stack. The name is formed by combining the given element name with the index to create a name of format name[index]. Dynamic memory is allocated for the resulting name using the rtxMemAlloc function.

Parameters

pctxt Pointer to a context structure.

elemName Name of element to be pushed on stack.

idx Index of the array element.

Returns

Completion status of operation:

- 0 = success,
- RTERR_NOMEM if mem alloc for name fails.

2.15.4.14 **int rtxCtxtPushContainerBits (OSCTXT * *pctxt*, OSSIZE *bits*)**

Notify the runtime layer of the start of decoding of a length-constrained container of a given length. This method should be called when the next bit to be decoded is the first bit of the length-constrained content.

This pushes an entry onto *pctxt*->containerEndIndex.

Parameters

pctxt Pointer to context structure.

bits Number of bits in the length-constrained container.

Returns

Completion status of operation:

- zero (0) = success,
- negative return value is error.

2.15.4.15 `int rtxCtxtPushContainerBytes (OSCTXT * pctxt, OSSIZE bytes)`

Notify the runtime layer of the start of decoding of a length-constrained container of a given length. This method should be called when the next bit to be decoded is the first bit of the length-constrained content.

This pushes an entry onto `pctxt->containerEndIndex`.

Parameters

pctxt Pointer to context structure.

bytes Number of bytes of the length-constrained container.

Returns

Completion status of operation:

- zero (0) = success,
- negative return value is error.

2.15.4.16 `int rtxCtxtPushElemName (OSCTXT * pctxt, const OSUTF8CHAR * elemName)`

This function is used to push an element name onto the context element name stack.

Parameters

pctxt Pointer to a context structure.

elemName Name of element to be pushed on stack. Note that a copy of the name is not made, the pointer to the name that is passed is stored.

Returns

Completion status of operation:

- 0 = success,
- `RTERR_NOMEM` if mem alloc for name fails.

2.15.4.17 `int rtxCtxtPushTypeName (OSCTXT * pctxt, const OSUTF8CHAR * typeName)`

This function is used to push a type name onto the context element name stack. The name is only added for the top-level type. This is determined by testing to ensure that there are no existing names on the stack.

Parameters

pctxt Pointer to a context structure.

typeName Name of type to be pushed on stack. Note that a copy of the name is not made, the pointer to the name that is passed is stored.

Returns

Completion status of operation:

- 0 = success,
- RTERR_NOMEM if mem alloc for name fails.

2.15.4.18 int rtxCtxtSetBitOffset (OSCTXT * *pctxt*, OSSIZE *offset*)

This function sets the bit offset in the context to the given value.

Parameters

pctxt Pointer to a context structure.

offset Bit offset.

Returns

Completion status of operation:

- 0 = success,
- Negative status code if error

2.15.4.19 int rtxCtxtSetBufPtr (OSCTXT * *pctxt*, OSOCTET * *bufaddr*, OSSIZE *bufsiz*)

This function is used to set the internal buffer pointer for in-memory encoding or decoding. It must be called after the context variable is initialized before any other compiler generated or run-time library encode function.

Parameters

pctxt Pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

bufaddr A pointer to a memory buffer to use to encode a message or that holds a message to be decoded. The buffer should be declared as an array of unsigned characters (OCTETs). This parameter can be set to NULL to specify dynamic encoding (i.e., the encode functions will dynamically allocate a buffer to hold the encoded message).

bufsiz The length of the memory buffer in bytes. Should be set to zero if NULL was specified for *bufaddr* (i.e. dynamic encoding was selected).

2.15.4.20 void rtxCtxtSetFlag (OSCTXT * *pctxt*, OSUINT32 *mask*)

This function is used to set a processing flag within the context structure.

Parameters

pctxt - A pointer to a context structure.

mask - Mask containing bit(s) to be set.

2.15.4.21 void rtxFreeContext (OSCTXT * *pctxt*)

This function frees all dynamic memory associated with a context. This includes all memory allocated using the rtxMem functions using the given context parameter.

Parameters

pctxt Pointer to a context structure.

2.15.4.22 int rtxInitContext (OSCTXT * *pctxt*)

This function initializes an OSCTXT block. It sets all key working parameters to their correct initial state values. It is required that this function be invoked before using a context variable.

Parameters

pctxt Pointer to the context structure variable to be initialized.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.15.4.23 int rtxInitContextBuffer (OSCTXT * *pctxt*, OSOCTET * *bufaddr*, OSSIZE *bufsiz*)

This function assigns a message buffer to a context block. The block should have been previously initialized by rtxInitContext.

Parameters

pctxt The pointer to the context structure variable to be initialized.

bufaddr For encoding, the address of a memory buffer to receive the encoded message. If this address is NULL (0), encoding to a dynamic buffer will be done. For decoding, the address of a buffer that contains the message data to be decoded.

bufsiz The size of the memory buffer. For encoding, this argument may be set to zero to indicate a dynamic memory buffer should be used.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.15.4.24 int rtxInitContextExt (OSCTXT * *pctxt*, OSMallocFunc *malloc_func*, OSReallocFunc *realloc_func*, OSFreeFunc *free_func*)

This function initializes an OSCTXT block. It sets all key working parameters to their correct initial state values. It is required that this function be invoked before using a context variable.

Parameters

pctxt Pointer to the context structure variable to be initialized.

malloc_func Pointer to the memory allocation function.

realloc_func Pointer to the memory reallocation function.

free_func Pointer to the memory deallocation function.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.15.4.25 `int rtxInitThreadContext (OSCTXT *pctxt, const OSCTXT *pSrcCtxt)`

This function initializes a context for use in a thread. It is the same as `rtxInitContext` except that it copies the pointer to constant data from the given source context into the newly initialized thread context. It is assumed that the source context has been initialized and the custom generated global initialization function has been called. The main purpose of this function is to prevent multiple copies of global static data from being created within different threads.

Parameters

pctxt Pointer to the context structure variable to be initialized.

pSrcCtxt Pointer to source context which has been fully initialized including a pointer to global constant data initialized via a call to a generated 'Init_<project>_Global' function.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.15.4.26 `int rtxMarkPos (OSCTXT *pctxt, OSSIZE *ppos)`

This function saves the current position in a message buffer or stream.

Parameters

pctxt Pointer to a context block.

ppos Pointer to saved position.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.15.4.27 void rtxMemHeapClearFlags (OSCTXT * *pctxt*, OSUINT32 *flags*)

This function clears memory heap flags.

Parameters

pctxt Pointer to a memory block structure that contains the list of dynamic memory block maintained by these functions.

flags The flags

2.15.4.28 void rtxMemHeapSetFlags (OSCTXT * *pctxt*, OSUINT32 *flags*)

This function sets flags to a heap. May be used to control the heap's behavior.

Parameters

pctxt Pointer to a memory block structure that contains the list of dynamic memory block maintained by these functions.

flags The flags.

2.15.4.29 int rtxResetToPos (OSCTXT * *pctxt*, OSSIZE *pos*)

This function resets a message buffer or stream back to the given position.

Parameters

pctxt Pointer to a context block.

pos Context position.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.16 Memory Allocation Macros and Functions

Defines

- #define **OSRTALLOCTYPE**(pctxt, type) (type*) rtxMemHeapAlloc (&(pctxt)->pMemHeap, sizeof(type))
- #define **OSRTALLOCTYPEZ**(pctxt, type) (type*) rtxMemHeapAllocZ (&(pctxt)->pMemHeap, sizeof(type))
- #define **OSRTREALLOCARRAY**(pctxt, pseqof, type)
- #define **OSCRTMALLOC0**(nbytes) malloc(nbytes)
- #define **OSCRTFREE0**(ptr) free(ptr)
- #define **OSCRTMALLOC** rtxMemAlloc
- #define **OSCRTFREE** rtxMemFreePtr
- #define **rtxMemAlloc**(pctxt, nbytes) rtxMemHeapAlloc(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemSysAlloc**(pctxt, nbytes) rtxMemHeapSysAlloc(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemAllocZ**(pctxt, nbytes) rtxMemHeapAllocZ(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemSysAllocZ**(pctxt, nbytes) rtxMemHeapSysAllocZ(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemRealloc**(pctxt, mem_p, nbytes) rtxMemHeapRealloc(&(pctxt)->pMemHeap, (void*)mem_p, nbytes)
- #define **rtxMemSysRealloc**(pctxt, mem_p, nbytes) rtxMemHeapSysRealloc(&(pctxt)->pMemHeap,(void*)mem_p,nbytes)
- #define **rtxMemFreePtr**(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemSysFreePtr**(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemAllocType**(pctxt, ctype) (ctype*)rtxMemHeapAlloc(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemSysAllocType**(pctxt, ctype) (ctype*)rtxMemHeapSysAlloc(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemAllocTypeZ**(pctxt, ctype) (ctype*)rtxMemHeapAllocZ(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemSysAllocTypeZ**(pctxt, ctype) (ctype*)rtxMemHeapSysAllocZ(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemFreeType**(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemSysFreeType**(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemAllocArray**(pctxt, n, type) (type*)rtxMemHeapAlloc (&(pctxt)->pMemHeap, sizeof(type)*n)
- #define **rtxMemSysAllocArray**(pctxt, n, type) (type*)rtxMemHeapSysAlloc (&(pctxt)->pMemHeap, sizeof(type)*n)
- #define **rtxMemAllocArrayZ**(pctxt, n, type) (type*)rtxMemHeapAllocZ (&(pctxt)->pMemHeap, sizeof(type)*n)
- #define **rtxMemFreeArray**(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemSysFreeArray**(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemReallocArray**(pctxt, mem_p, n, type) (type*)rtxMemHeapRealloc(&(pctxt)->pMemHeap, (void*)mem_p, sizeof(type)*n)
- #define **rtxMemNewAutoPtr**(pctxt, nbytes) rtxMemHeapAlloc(&(pctxt)->pMemHeap, nbytes)
- #define **rtxMemAutoPtrRef**(pctxt, ptr) rtxMemHeapAutoPtrRef(&(pctxt)->pMemHeap, (void*)(ptr))
- #define **rtxMemAutoPtrUnref**(pctxt, ptr) rtxMemHeapAutoPtrUnref(&(pctxt)->pMemHeap, (void*)(ptr))
- #define **rtxMemAutoPtrGetRefCount**(pctxt, ptr) rtxMemHeapAutoPtrGetRefCount(&(pctxt)->pMemHeap, (void*)(ptr))
- #define **rtxMemCheckPtr**(pctxt, mem_p) rtxMemHeapCheckPtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemCheck**(pctxt) rtxMemHeapCheck(&(pctxt)->pMemHeap, __FILE__, __LINE__)
- #define **rtxMemPrint**(pctxt) rtxMemHeapPrint(&(pctxt)->pMemHeap)
- #define **rtxMemSetProperty**(pctxt, propId, pProp) rtxMemHeapSetProperty (&(pctxt)->pMemHeap, propId, pProp)

Functions

- void **rtxMemHeapAddRef** (void **ppvMemHeap)
- void * **rtxMemHeapAlloc** (void **ppvMemHeap, size_t nbytes)
- void * **rtxMemHeapAllocZ** (void **ppvMemHeap, size_t nbytes)
- void * **rtxMemHeapSysAlloc** (void **ppvMemHeap, size_t nbytes)
- void * **rtxMemHeapSysAllocZ** (void **ppvMemHeap, size_t nbytes)
- int **rtxMemHeapCheckPtr** (void **ppvMemHeap, const void *mem_p)
- int **rtxMemHeapCreate** (void **ppvMemHeap)
- int **rtxMemHeapCreateExt** (void **ppvMemHeap, OSMallocFunc malloc_func, OSReallocFunc realloc_func, OSFreeFunc free_func)
- void **rtxMemHeapFreeAll** (void **ppvMemHeap)
- void **rtxMemHeapFreePtr** (void **ppvMemHeap, void *mem_p)
- void **rtxMemHeapSysFreePtr** (void **ppvMemHeap, void *mem_p)
- void * **rtxMemHeapRealloc** (void **ppvMemHeap, void *mem_p, size_t nbytes_)
- void * **rtxMemHeapSysRealloc** (void **ppvMemHeap, void *mem_p, size_t nbytes_)
- void **rtxMemHeapRelease** (void **ppvMemHeap)
- void **rtxMemHeapReset** (void **ppvMemHeap)
- void **rtxMemHeapSetProperty** (void **ppvMemHeap, OSUINT32 propId, void *pProp)
- void * **rtxMemNewArray** (size_t nbytes)
- void * **rtxMemNewArrayZ** (size_t nbytes)
- void **rtxMemDeleteArray** (void *mem_p)
- void * **rtxMemHeapAutoPtrRef** (void **ppvMemHeap, void *ptr)
- int **rtxMemHeapAutoPtrUnref** (void **ppvMemHeap, void *ptr)
- int **rtxMemHeapAutoPtrGetRefCount** (void **ppvMemHeap, void *mem_p)
- void **rtxMemHeapInvalidPtrHook** (void **ppvMemHeap, const void *mem_p)
- void **rtxMemHeapCheck** (void **ppvMemHeap, const char *file, int line)
- void **rtxMemHeapPrint** (void **ppvMemHeap)
- void **rtxMemSetAllocFuncs** (OSMallocFunc malloc_func, OSReallocFunc realloc_func, OSFreeFunc free_func)
- void **rtxMemFreeOpenSeqExt** (OSCTXT *pctxt, struct OSRTDList *pElemList)
- OSUINT32 **rtxMemHeapGetDefBlkSize** (OSCTXT *pctxt)
- void **rtxMemSetDefBlkSize** (OSUINT32 blkSize)
- OSUINT32 **rtxMemGetDefBlkSize** (OSVOIDARG)
- OSBOOL **rtxMemHeapIsEmpty** (OSCTXT *pctxt)
- OSBOOL **rtxMemIsZero** (const void *pmem, size_t memsiz)
- void **rtxMemFree** (OSCTXT *pctxt)
- void **rtxMemReset** (OSCTXT *pctxt)

2.16.1 Detailed Description

Memory allocation functions and macros handle memory management for the XBinder C run-time. Special algorithms are used for allocation and deallocation of memory to improve the run-time performance.

2.16.2 Define Documentation

2.16.2.1 **#define OSRTALLOCTYPE(*pctxt*, *type*) (type*) rtxMemHeapAlloc (&(*pctxt*)->pMemHeap, sizeof(*type*))**

This macro allocates a single element of the given type.

Parameters

pctxt - Pointer to a context block
type - Data type of record to allocate

2.16.2.2 **#define OSRTALLOCTYPEZ(*pctxt*, *type*) (type*) rtxMemHeapAllocZ (&(*pctxt*)->pMemHeap, sizeof(*type*))**

This macro allocates and zeros a single element of the given type.

Parameters

pctxt - Pointer to a context block
type - Data type of record to allocate

2.16.2.3 **#define OSRTREALLOCARRAY(*pctxt*, *pseqof*, *type*)**

Value:

```
do { \
if (sizeof(type)*(pseqof)->n < (pseqof)->n) return RTERR_NOMEM; \
if (((pseqof)->elem = (type*) rtxMemHeapRealloc \
(&(pctxt)->pMemHeap, (pseqof)->elem, sizeof(type)*(pseqof)->n)) == 0) \
return RTERR_NOMEM; \
} while (0)
```

Reallocate an array. This macro reallocates an array (either expands or contracts) to hold the given number of elements. The number of elements is specified in the *n* member variable of the *pseqof* argument.

Parameters

pctxt - Pointer to a context block
pseqof - Pointer to a generated SEQUENCE OF array structure. The *n* member variable must be set to the number of records to allocate.
type - Data type of an array record

2.16.2.4 **#define rtxMemAlloc(*pctxt*, *nbytes*) rtxMemHeapAlloc(&(*pctxt*)->pMemHeap,*nbytes*)**

Allocate memory. This macro allocates the given number of bytes. It is similar to the C `malloc` run-time function.

Parameters

pctxt - Pointer to a context block
nbytes - Number of bytes of memory to allocate

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.5 #define rtxMemAllocArray(pctxt, n, type) (type*)rtxMemHeapAlloc (&(pctxt)->pMemHeap, sizeof(type)*n)

Allocate a dynamic array. This macro allocates a dynamic array of records of the given type. The pointer to the allocated array is returned to the caller.

Parameters

pctxt - Pointer to a context block
n - Number of records to allocate
type - Data type of an array record

2.16.2.6 #define rtxMemAllocArrayZ(pctxt, n, type) (type*)rtxMemHeapAllocZ (&(pctxt)->pMemHeap, sizeof(type)*n)

Allocate a dynamic array and zero memory. This macro allocates a dynamic array of records of the given type and writes zeros over the allocated memory. The pointer to the allocated array is returned to the caller.

Parameters

pctxt - Pointer to a context block
n - Number of records to allocate
type - Data type of an array record

2.16.2.7 #define rtxMemAllocType(pctxt, ctype) (ctype*)rtxMemHeapAlloc(&(pctxt)->pMemHeap,sizeof(ctype))

Allocate type. This macro allocates memory to hold a variable of the given type.

Parameters

pctxt - Pointer to a context block
ctype - Name of C typedef

Returns

- Pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.8 #define rtxMemAllocTypeZ(pctxt, ctype) (ctype*)rtxMemHeapAllocZ(&(pctxt)->pMemHeap,sizeof(ctype))

Allocate type and zero memory. This macro allocates memory to hold a variable of the given type and initializes the allocated memory to zero.

Parameters

pctxt - Pointer to a context block
ctype - Name of C typedef

Returns

- Pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.9 **#define rtxMemAllocZ(pctxt, nbytes) rtxMemHeapAllocZ(&(pctxt)->pMemHeap,nbytes)**

Allocate and zero memory. This macro allocates the given number of bytes and then initializes the memory block to zero.

Parameters

pctxt - Pointer to a context block
nbytes - Number of bytes of memory to allocate

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.10 **#define rtxMemAutoPtrGetRefCount(pctxt, ptr) rtxMemHeapAutoPtrGetRefCount(&(pctxt)->pMemHeap, (void*)(ptr))**

This function returns the reference count of the given pointer. goes to zero, the memory is freed.

Parameters

pctxt Pointer to a context structure.
ptr Pointer on which reference count is to be fetched.

Returns

Pointer reference count.

2.16.2.11 **#define rtxMemAutoPtrRef(pctxt, ptr) rtxMemHeapAutoPtrRef(&(pctxt)->pMemHeap, (void*)(ptr))**

This function increments the auto-pointer reference count.

Parameters

pctxt Pointer to a context structure.
ptr Pointer on which reference count is to be incremented.

Returns

Referenced pointer value (*ptr* argument) or NULL if reference count could not be incremented.

2.16.2.12 **#define rtxMemAutoPtrUnref(pctxt, ptr) rtxMemHeapAutoPtrUnref(&(pctxt)->pMemHeap, (void*)(ptr))**

This function decrements the auto-pointer reference count. If the count goes to zero, the memory is freed.

Parameters

pctxt Pointer to a context structure.
ptr Pointer on which reference count is to be decremented.

Returns

Positive reference count or a negative error code. If zero, memory held by pointer will have been freed.

2.16.2.13 `#define rtxMemCheck(pctx) rtxMemHeapCheck(&(pctx)->pMemHeap, __FILE__, __LINE__)`

Check memory heap.

Parameters

pctx - Pointer to a context block

2.16.2.14 `#define rtxMemCheckPtr(pctx, mem_p) rtxMemHeapCheckPtr(&(pctx)->pMemHeap, (void*)mem_p)`

Check memory pointer. This macro check pointer on presence in heap.

Parameters

pctx - Pointer to a context block

mem_p - Pointer to memory block.

Returns

1 - pointer refer to memory block in heap; 0 - pointer refer not memory heap block.

2.16.2.15 `#define rtxMemFreeArray(pctx, mem_p) rtxMemHeapFreePtr(&(pctx)->pMemHeap, (void*)mem_p)`

Free memory pointer. This macro frees memory at the given pointer. The memory must have been allocated using the `rtxMemAlloc` (or similar) macros or the `rtxMem` memory allocation macros. This macro is similar to the C `free` function.

Parameters

pctx - Pointer to a context block

mem_p - Pointer to memory block to free. This must have been allocated using the `rtxMemAlloc` or `rtxMemAlloc` macro or the `rtxMemHeapAlloc` function.

2.16.2.16 `#define rtxMemFreePtr(pctx, mem_p) rtxMemHeapFreePtr(&(pctx)->pMemHeap, (void*)mem_p)`

Free memory pointer. This macro frees memory at the given pointer. The memory must have been allocated using the `rtxMemAlloc` (or similar) macros or the `rtxMem` memory allocation macros. This macro is similar to the C `free` function.

Parameters

pctx - Pointer to a context block

mem_p - Pointer to memory block to free. This must have been allocated using the `rtxMemAlloc` macro or the `rtxMemHeapAlloc` function.

2.16.2.17 #define rtxMemFreeType(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)

Free memory pointer. This macro frees memory at the given pointer. The memory must have been allocated using the `rtxMemAlloc` (or similar) macros or the `rtxMem` memory allocation macros. This macro is similar to the C `free` function.

Parameters

pctxt - Pointer to a context block

mem_p - Pointer to memory block to free. This must have been allocated using the `rtxMemAlloc` or `rtxMemAlloc` macro or the `rtxMemHeapAlloc` function.

2.16.2.18 #define rtxMemNewAutoPtr(pctxt, nbytes) rtxMemHeapAlloc(&(pctxt)->pMemHeap, nbytes)

This function allocates a new block of memory and creates an auto-pointer with reference count set to one. The `rtxMemAutoPtrRef` and `rtxMemAutoPtrUnref` functions can be used to increment and decrement the reference count. When the count goes to zero, the memory held by the pointer is freed.

Parameters

pctxt Pointer to a context structure.

nbytes Number of bytes to allocate.

Returns

Pointer to allocated memory or NULL if not enough memory is available.

2.16.2.19 #define rtxMemPrint(pctxt) rtxMemHeapPrint(&(pctxt)->pMemHeap)

Print memory heap structure to stderr.

Parameters

pctxt - Pointer to a context block

2.16.2.20 #define rtxMemRealloc(pctxt, mem_p, nbytes) rtxMemHeapRealloc(&(pctxt)->pMemHeap, (void*)mem_p, nbytes)

Reallocate memory. This macro reallocates a memory block (either expands or contracts) to the given number of bytes. It is similar to the C `realloc` run-time function.

Parameters

pctxt - Pointer to a context block

mem_p - Pointer to memory block to reallocate. This must have been allocated using the `rtxMemAlloc` macro or the `rtxMemHeapAlloc` function.

nbytes - Number of bytes of memory to which the block is to be resized.

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request. This may be the same as the `mem_p` pointer that was passed in if the block did not need to be relocated.

2.16.2.21 #define rtxMemReallocArray(pctx, mem_p, n, type) (type*)rtxMemHeapRealloc(&(pctx)->pMemHeap, (void*)mem_p, sizeof(type)*n)

Reallocate memory. This macro reallocates a memory block (either expands or contracts) to the given number of bytes. It is similar to the C `realloc` run-time function.

Parameters

pctx - Pointer to a context block

mem_p - Pointer to memory block to reallocate. This must have been allocated using the `rtxMemAlloc` macro or the `rtxMemHeapAlloc` function.

n - Number of items of the given type to be allocated.

type - Array element data type (for example, int).

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request. This may be the same as the `pmem` pointer that was passed in if the block did not need to be relocated.

2.16.2.22 #define rtxMemSetProperty(pctx, propId, pProp) rtxMemHeapSetProperty (&(pctx)->pMemHeap, propId, pProp)

Set memory heap property.

Parameters

pctx - Pointer to a context block

propId - Property Id.

pProp - Pointer to property value.

2.16.2.23 #define rtxMemSysAlloc(pctx, nbytes) rtxMemHeapSysAlloc(&(pctx)->pMemHeap,nbytes)

This macro makes a direct call to the configured system memory allocation function. By default, this is the C `malloc` function, but it is possible to configure to use a custom allocation function.

Parameters

pctx - Pointer to a context block

nbytes - Number of bytes of memory to allocate

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.24 #define rtxMemSysAllocArray(pctx, n, type) (type*)rtxMemHeapSysAlloc (&(pctx)->pMemHeap, sizeof(type)*n)

Allocate a dynamic array. This macro allocates a dynamic array of records of the given type. The pointer to the allocated array is returned to the caller.

This macro makes a direct call to the configured system memory allocation function. By default, this is the C `malloc` function, but it is possible to configure to use a custom allocation function.

Parameters

pctxt - Pointer to a context block
n - Number of records to allocate
type - Data type of an array record

2.16.2.25 `#define rtxMemSysAllocType(pctxt, ctype) (ctype*)rtxMemHeapSysAlloc(&(pctxt)->pMemHeap,sizeof(ctype))`

Allocate type. This macro allocates memory to hold a variable of the given type.

This macro makes a direct call to the configured system memory allocation function. By default, this is the C malloc function, but it is possible to configure to use a custom allocation function.

Parameters

pctxt - Pointer to a context block
ctype - Name of C typedef

Returns

- Pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.26 `#define rtxMemSysAllocTypeZ(pctxt, ctype) (ctype*)rtxMemHeapSysAllocZ(&(pctxt)->pMemHeap,sizeof(ctype))`

Allocate type and zero memory. This macro allocates memory to hold a variable of the given type and initializes the allocated memory to zero.

This macro makes a direct call to the configured system memory allocation function. By default, this is the C malloc function, but it is possible to configure to use a custom allocation function.

Parameters

pctxt - Pointer to a context block
ctype - Name of C typedef

Returns

- Pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.27 `#define rtxMemSysAllocZ(pctxt, nbytes) rtxMemHeapSysAllocZ(&(pctxt)->pMemHeap,nbytes)`

Allocate and zero memory. This macro allocates the given number of bytes and then initializes the memory block to zero.

This macro makes a direct call to the configured system memory allocation function. By default, this is the C malloc function, but it is possible to configure to use a custom allocation function.

Parameters

pctxt - Pointer to a context block

nbytes - Number of bytes of memory to allocate

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request.

2.16.2.28 `#define rtxMemSysFreeArray(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)`

Free memory pointer. This macro frees memory at the given pointer. The memory must have been allocated using the `rtxMemSysAlloc` (or similar) macros or the `rtxMemSys` memory allocation macros. This macro is similar to the C `free` function.

Parameters

pctxt - Pointer to a context block

mem_p - Pointer to memory block to free. This must have been allocated using the `rtxMemSysAlloc` or `rtxMemSysAlloc` macro or the `rtxMemSysHeapAlloc` function.

2.16.2.29 `#define rtxMemSysFreePtr(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)`

This macro makes a direct call to the configured system memory free function. By default, this is the C `free` function, but it is possible to configure to use a custom free function.

Parameters

pctxt - Pointer to a context block

mem_p - Pointer to memory block to free. This must have been allocated using the `rtxMemSysAlloc` macro or the `rtxMemHeapSysAlloc` function.

2.16.2.30 `#define rtxMemSysFreeType(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)`

Free memory pointer. This macro frees memory at the given pointer. The memory must have been allocated using the `rtxMemSysAlloc` (or similar) macros or the `rtxMemSys` memory allocation macros. This macro is similar to the C `free` function.

Parameters

pctxt - Pointer to a context block

mem_p - Pointer to memory block to free. This must have been allocated using the `rtxMemSysAlloc` or `rtxMemSysAlloc` macro or the `rtxMemSysHeapAlloc` function.

2.16.2.31 `#define rtxMemSysRealloc(pctxt, mem_p, nbytes) rtxMemHeapSysRealloc(&(pctxt)->pMemHeap, (void*)mem_p, nbytes)`

This macro makes a direct call to the configured system memory reallocation function to do the reallocation.. By default, this is the C `realloc` function, but it is possible to configure to use a custom reallocation function.

Parameters

pctxt - Pointer to a context block

mem_p - Pointer to memory block to reallocate. This must have been allocated using the `rtxMemSysAlloc` macro or the `rtxMemHeapSysAlloc` function.

nbytes - Number of bytes of memory to which the block is to be resized.

Returns

- Void pointer to allocated memory or NULL if insufficient memory was available to fulfill the request. This may be the same as the *mem_p* pointer that was passed in if the block did not need to be relocated.

2.16.3 Function Documentation

2.16.3.1 void rtxMemFree (OSCTXT * *pctxt*)

Free memory associated with a context. This macro frees all memory held within a context. This is all memory allocated using the `rtxMemAlloc` (and similar macros) and the `rtxMem` memory allocation functions using the given context variable.

Parameters

pctxt - Pointer to a context block

2.16.3.2 OSUINT32 rtxMemGetDefBlkSize (OSVOIDARG)

This function returns the actual granularity of memory blocks.

Returns

The currently used minimum size and the granularity of memory blocks.

2.16.3.3 OSUINT32 rtxMemHeapGetDefBlkSize (OSCTXT * *pctxt*)

This function returns the actual granularity of memory blocks in the context.

Parameters

pctxt Pointer to a context block.

2.16.3.4 OSBOOL rtxMemHeapIsEmpty (OSCTXT * *pctxt*)

This function determines if the memory heap defined in the give context is empty (i.e. contains no outstanding memory allocations).

Parameters

pctxt Pointer to a context block.

Returns

Boolean true value if heap is empty.

2.16.3.5 OSBOOL rtxMemIsZero (const void * *pmem*, size_t *memsiz*)

This helper function determines if an arbitrarily sized block of memory is set to zero.

Parameters

pmem Pointer to memory block to check
memsiz Size of the memory block

Returns

Boolean result: true if memory is all zero

2.16.3.6 void rtxMemReset (OSCTXT * *pctxt*)

Reset memory associated with a context. This macro resets all memory held within a context. This is all memory allocated using the rtxMemAlloc (and similar macros) and the rtxMem memory allocation functions using the given context variable.

The difference between this and the OSMEMFREE macro is that the memory blocks held within the context are not actually freed. Internal pointers are reset so the existing blocks can be reused. This can provide a performance improvement for repetitive tasks such as decoding messages in a loop.

Parameters

pctxt - Pointer to a context block

2.16.3.7 void rtxMemSetAllocFuncs (OSMallocFunc *malloc_func*, OSReallocFunc *realloc_func*, OSFreeFunc *free_func*)

This function sets the pointers to standard allocation functions. These functions are used to allocate/reallocate/free memory blocks. By default, standard C functions - 'malloc', 'realloc' and 'free' - are used. But if some platforms do not support these functions (or some other reasons exist) they can be overloaded. The functions being overloaded should have the same prototypes as the standard functions.

Parameters

malloc_func Pointer to the memory allocation function ('malloc' by default).
realloc_func Pointer to the memory reallocation function ('realloc' by default).
free_func Pointer to the memory deallocation function ('free' by default).

2.16.3.8 void rtxMemSetDefBlkSize (OSUINT32 *blkSize*)

This function sets the minimum size and the granularity of memory blocks for newly created memory heaps.

Parameters

blkSize The minimum size and the granularity of memory blocks.

2.17 Memory Buffer Management Functions

Classes

- struct [OSRTMEMBUF](#)

Defines

- #define **OSMBDFLTSEGSIZE** 1024
- #define **OSMEMBUFPTR**(pmb) ((pmb)->buffer + (pmb)->startidx)
- #define **OSMEMBUFENDPTR**(pmb) ((pmb)->buffer + (pmb)->startidx + (pmb)->usedcnt)
- #define **OSMEMBUFUSEDSize**(pmb) ((OSSIZE)(pmb)->usedcnt)
- #define **OSMBAPPENDSTR**(pmb, str)
- #define **OSMBAPPENDSTR**(pmb, str) rtxMemBufAppend(pmb,(OSOCTET*)str,OSCTRLSTRLEN(str))
- #define **OSMBAPPENDUTF8**(pmb, str)

Typedefs

- typedef struct [OSRTMEMBUF](#) **OSRTMEMBUF**

Functions

- int [rtxMemBufAppend](#) ([OSRTMEMBUF](#) *pMemBuf, const OSOCTET *pdata, OSSIZE nbytes)
- int [rtxMemBufCut](#) ([OSRTMEMBUF](#) *pMemBuf, OSSIZE fromOffset, OSSIZE nbytes)
- void [rtxMemBufFree](#) ([OSRTMEMBUF](#) *pMemBuf)
- OSOCTET * [rtxMemBufGetData](#) (const [OSRTMEMBUF](#) *pMemBuf, int *length)
- OSOCTET * [rtxMemBufGetDataExt](#) (const [OSRTMEMBUF](#) *pMemBuf, OSSIZE *length)
- OSSIZE [rtxMemBufGetDataLen](#) (const [OSRTMEMBUF](#) *pMemBuf)
- void [rtxMemBufInit](#) (OSCTXT *pCtxt, [OSRTMEMBUF](#) *pMemBuf, OSSIZE segsize)
- void [rtxMemBufInitBuffer](#) (OSCTXT *pCtxt, [OSRTMEMBUF](#) *pMemBuf, OSOCTET *buf, OSSIZE bufsize, OSSIZE segsize)
- int [rtxMemBufPreAllocate](#) ([OSRTMEMBUF](#) *pMemBuf, OSSIZE nbytes)
- void [rtxMemBufReset](#) ([OSRTMEMBUF](#) *pMemBuf)
- int [rtxMemBufSet](#) ([OSRTMEMBUF](#) *pMemBuf, OSOCTET value, OSSIZE nbytes)
- OSBOOL [rtxMemBufSetExpandable](#) ([OSRTMEMBUF](#) *pMemBuf, OSBOOL isExpandable)
- OSBOOL [rtxMemBufSetUseSysMem](#) ([OSRTMEMBUF](#) *pMemBuf, OSBOOL value)
- OSSIZE [rtxMemBufTrimW](#) ([OSRTMEMBUF](#) *pMemBuf)

2.17.1 Detailed Description

Memory buffer management functions handle the allocation, expansion, and deallocation of dynamic memory buffers used by some encode/decode functions. Dynamic memory buffers are buffers that can grow or shrink to hold variable sized amounts of data. This group of functions allows data to be appended to buffers, to be set within buffers, and to be retrieved from buffers. Currently, these functions are used within the generated SAX decode routines to collect data as it is parsed by an XML parser.

2.17.2 Define Documentation

2.17.2.1 #define OSMBAPPENDSTR(pmb, str)

Value:

```
if (0 != str) \  
rtxMemBufAppend(pmb, (OSOCKET*)str, OSCRTLSTRLEN(str))
```

2.17.2.2 #define OSMBAPPENDUTF8(pmb, str)

Value:

```
if (0 != str) \  
rtxMemBufAppend(pmb, (OSOCKET*)str, rtxUTF8LenBytes(str))
```

2.17.3 Function Documentation

2.17.3.1 int rtxMemBufAppend (OSRTMEMBUF *pMemBuf, const OSOCKET *pdata, OSSIZE nbytes)

This function appends the data to the end of a memory buffer. If the buffer was dynamic and full then the buffer will be reallocated. If it is static (the static buffer was assigned by a call to rtxMemBufInitBuffer) or it is empty (no memory previously allocated) then a new buffer will be allocated.

Parameters

pMemBuf A pointer to a memory buffer structure.

pdata The pointer to the buffer to be appended. The data will be copied at the end of the memory buffer.

nbytes The number of bytes to be copied from pData.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.17.3.2 int rtxMemBufCut (OSRTMEMBUF *pMemBuf, OSSIZE fromOffset, OSSIZE nbytes)

This function cuts off the part of memory buffer. The beginning of the cutting area is specified by offset "fromOffset" and the length is specified by "nbytes". All data in this part will be lost. The data from the offset "fromOffset + nbytes" will be moved to "fromOffset" offset.

Parameters

pMemBuf A pointer to a memory buffer structure.

fromOffset The offset of the beginning part, being cut off.

nbytes The number of bytes to be cut off from the memory buffer.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.17.3.3 void rtxMemBufFree (OSRTMEMBUF * *pMemBuf*)

This function frees the memory buffer. If memory was allocated then it will be freed. Do not use the memory buffer structure after this function is called.

Parameters

pMemBuf A pointer to a memory buffer structure.

2.17.3.4 OSOCTET* rtxMemBufGetData (const OSRTMEMBUF * *pMemBuf*, int * *length*)

This function returns the pointer to the used part of a memory buffer.

Parameters

pMemBuf A pointer to a memory buffer structure.

length The pointer to the length of the used part of the memory buffer.

Returns

The pointer to the used part of the memory buffer.

2.17.3.5 OSOCTET* rtxMemBufGetDataExt (const OSRTMEMBUF * *pMemBuf*, OSSIZE * *length*)

This function returns the pointer to the used part of a memory buffer. The extended version returns length in a size-typed argument which is a 64-bit value on many systems.

Parameters

pMemBuf A pointer to a memory buffer structure.

length The pointer to the length of the used part of the memory buffer.

Returns

The pointer to the used part of the memory buffer.

2.17.3.6 OSSIZE rtxMemBufGetDataLen (const OSRTMEMBUF * *pMemBuf*)

This function returns the length of the used part of a memory buffer.

Parameters

pMemBuf A pointer to a memory buffer structure.

Returns

The length of the used part of the buffer.

2.17.3.7 void rtxMemBufInit (OSCTXT * *pCtxt*, OSRTMEMBUF * *pMemBuf*, OSSIZE *segsz*)

This function initializes a memory buffer structure. It does not allocate memory; it sets the fields of the structure to the proper states. This function must be called before any operations with the memory buffer.

Parameters

- pCtxt* A provides a storage area for the function to store all working variables that must be maintained between function calls.
- pMemBuf* A pointer to the initialized memory buffer structure.
- segsz* The number of bytes in which the memory buffer will be expanded incase it is full.

2.17.3.8 void rtxMemBufInitBuffer (OSCTXT * *pCtxt*, OSRTMEMBUF * *pMemBuf*, OSOCTET * *buf*, OSSIZE *bufsize*, OSSIZE *segsz*)

This function assigns a static buffer to the memory buffer structure. It does not allocate memory; it sets the pointer to the passed buffer. If additional memory is required (for example, additional data is appended to the buffer using rtxMemBufAppend), a dynamic buffer will be allocated and all data copied to the new buffer.

Parameters

- pCtxt* A pointer to a context structure. This provides a storage area for the function t store all working variables that must be maintained between function calls.
- pMemBuf* A pointer to a memory buffer structure.
- buf* A pointer to the buffer to be assigned.
- bufsize* The size of the buffer.
- segsz* The number of bytes on which the memory buffer will be expanded in case it is full.

2.17.3.9 int rtxMemBufPreAllocate (OSRTMEMBUF * *pMemBuf*, OSSIZE *nbytes*)

This function allocates a buffer with a predetermined amount of space.

Parameters

- pMemBuf* A pointer to a memory buffer structure.
- nbytes* The number of bytes to be copied from pData.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.17.3.10 void rtxMemBufReset (OSRTMEMBUF * *pMemBuf*)

This function resets the memory buffer structure. It does not free memory, just sets the pointer to the beginning and the used length to zero.

Parameters

- pMemBuf* A pointer to a memory buffer structure.

2.17.3.11 `int rtxMemBufSet (OSRTMEMBUF * pMemBuf, OSOCTET value, OSSIZE nbytes)`

This function sets part of a memory buffer to a specified octet value. The filling is started from the end of the memory buffer. If the buffer is dynamic and full, then the buffer will be reallocated. If it is static (a static buffer was assigned by a call to `rtxMemBufInitBuffer`) or it is empty (no memory previously was allocated) then a new buffer will be allocated.

Parameters

pMemBuf A pointer to a memory buffer structure.

value The pointer to the buffer to be appended. The data will be copied at the end of the memory buffer.

nbytes The number of bytes to be copied from `pData`.

Returns

Completion status of operation:

- 0 = success,
- negative return value is error.

2.17.3.12 `OSBOOL rtxMemBufSetExpandable (OSRTMEMBUF * pMemBuf, OSBOOL isExpandable)`

This function sets "isExpandable" flag for the memory buffer object. By default, this flag is set to TRUE, thus, memory buffer could be expanded, even if it was initialized by static buffer (see `rtMemBufInitBuffer`). If flag is cleared and buffer is full the `rtMemBufAppend`/`rtMemBufPreAllocate` functions will return error status.

Parameters

pMemBuf A pointer to a memory buffer structure.

isExpandable TRUE, if buffer should be expandable.

Returns

Previous state of "isExpandable" flag.

2.17.3.13 `OSBOOL rtxMemBufSetUseSysMem (OSRTMEMBUF * pMemBuf, OSBOOL value)`

This function sets a flag to indicate that system memory management should be used instead of the custom memory manager. This should be used if the allocated buffer must be preserved after calls to `rtxMemFree` or `rtxMemReset`.

Parameters

pMemBuf A pointer to a memory buffer structure.

value Boolean indicating system memory management to be used.

Returns

Previous state of "useSysMem" flag.

2.17.3.14 OSSIZE rtxMemBufTrimW (OSRTMEMBUF * *pMemBuf*)

This function trims white space of the memory buffer.

Parameters

pMemBuf A pointer to a memory buffer structure.

Returns

Length of trimmed buffer.

2.18 Print Functions

Functions

- int [rtxByteToHexChar](#) (OSOCKET byte, char *buf, OSSIZE bufsize)
- int [rtxByteToHexCharWithPrefix](#) (OSOCKET byte, char *buf, OSSIZE bufsize, const char *prefix)
- void [rtxPrintBoolean](#) (const char *name, OSBOOL value)
- void [rtxPrintDate](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintTime](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintDateTime](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGYear](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGYearMonth](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGMonth](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGMonthDay](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGDay](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintInteger](#) (const char *name, OSINT32 value)
- void [rtxPrintInt64](#) (const char *name, OSINT64 value)
- void [rtxPrintUnsigned](#) (const char *name, OSUINT32 value)
- void [rtxPrintUInt64](#) (const char *name, OSUINT64 value)
- void [rtxPrintHexStr](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintHexStrPlain](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintHexStrNoAscii](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintHexBinary](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintCharStr](#) (const char *name, const char *cstring)
- void [rtxPrintUTF8CharStr](#) (const char *name, const OSUTF8CHAR *cstring)
- void [rtxPrintUnicodeCharStr](#) (const char *name, const OSUNICHAR *str, int nchars)
- void [rtxPrintReal](#) (const char *name, OSREAL value)
- void [rtxPrintNull](#) (const char *name)
- void [rtxPrintNVP](#) (const char *name, const OSUTF8NVP *value)
- int [rtxPrintFile](#) (const char *filename)
- void [rtxPrintIndent](#) (OSVOIDARG)
- void [rtxPrintIncrIndent](#) (OSVOIDARG)
- void [rtxPrintDecrIndent](#) (OSVOIDARG)
- void [rtxPrintCloseBrace](#) (OSVOIDARG)
- void [rtxPrintOpenBrace](#) (const char *)
- int [rtxHexDumpToNamedFile](#) (const char *filename, const OSOCKET *data, OSSIZE numocts)
- void [rtxHexDumpToFile](#) (FILE *fp, const OSOCKET *data, OSSIZE numocts)
- void [rtxHexDumpToFileEx](#) (FILE *fp, const OSOCKET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- void [rtxHexDumpToFileExNoAscii](#) (FILE *fp, const OSOCKET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- void [rtxHexDump](#) (const OSOCKET *data, OSSIZE numocts)
- void [rtxHexDumpEx](#) (const OSOCKET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- int [rtxHexDumpToString](#) (const OSOCKET *data, OSSIZE numocts, char *buffer, OSSIZE bufferSize, OSSIZE bufferIndex)
- int [rtxHexDumpToStringEx](#) (const OSOCKET *data, OSSIZE numocts, char *buffer, OSSIZE bufferIndex, OSSIZE bufferSize, OSSIZE bytesPerUnit)
- int [rtxHexDumpFileContents](#) (const char *inFilePath)
- int [rtxHexDumpFileContentsToFile](#) (const char *inFilePath, const char *outFilePath)

2.18.1 Detailed Description

These functions simply print the output in a "name=value" format. The value format is obtained by calling one of the ToString functions with the given value.

2.18.2 Function Documentation

2.18.2.1 int rtxByteToHexChar (OSOCKET *byte*, char * *buf*, OSSIZE *bufsize*)

This function converts a byte value into its hex string equivalent.

Parameters

byte Byte to format.

buf Output buffer.

bufsize Output buffer size.

2.18.2.2 int rtxByteToHexCharWithPrefix (OSOCKET *byte*, char * *buf*, OSSIZE *bufsize*, const char * *prefix*)

This function converts a byte value into its hex string equivalent. The hex string for this function is prefixed with the given parameter.

Parameters

byte Byte to format.

buf Output buffer.

bufsize Output buffer size.

prefix The string prefix.

2.18.2.3 void rtxHexDump (const OSOCKET * *data*, OSSIZE *numocts*)

This function outputs a hexadecimal dump of the current buffer contents to stdout.

Parameters

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed.

2.18.2.4 void rtxHexDumpEx (const OSOCKET * *data*, OSSIZE *numocts*, OSSIZE *bytesPerUnit*)

This function outputs a hexadecimal dump of the current buffer contents to stdout, but it may display the dump as an array or bytes, words, or double words.

Parameters

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed.

bytesPerUnit The number of bytes in one unit. May be 1 (byte), 2 (word), or 4 (double word).

2.18.2.5 `int rtxHexDumpFileContents (const char * inFilePath)`

This function outputs a hexadecimal dump of the contents of the named file to stdout.

Parameters

inFilePath Name of file to be dumped.

2.18.2.6 `int rtxHexDumpFileContentsToFile (const char * inFilePath, const char * outFilePath)`

This function outputs a hexadecimal dump of the contents of the named file to a text file.

Parameters

inFilePath Name of file to be dumped.

outFilePath Name of file to which dump contents will be written.

2.18.2.7 `void rtxHexDumpToFile (FILE * fp, const OSOCTET * data, OSSIZE numocts)`

This function outputs a hexadecimal dump of the current buffer contents to a file.

Parameters

fp A pointer to FILE structure. The file should be opened for writing.

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed

2.18.2.8 `void rtxHexDumpToFileEx (FILE * fp, const OSOCTET * data, OSSIZE numocts, OSSIZE bytesPerUnit)`

This function outputs a hexadecimal dump of the current buffer to a file, but it may output the dump as an array of bytes, words, or double words.

Parameters

fp A pointer to FILE structure. The file should be opened for writing.

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed.

bytesPerUnit The number of bytes in one unit. May be 1 (byte), 2 (word), or 4 (double word).

2.18.2.9 `void rtxHexDumpToFileExNoAscii (FILE * fp, const OSOCTET * data, OSSIZE numocts, OSSIZE bytesPerUnit)`

This function outputs a hexadecimal dump of the current buffer to a file, but it may output the dump as an array of bytes, words, or double words. This function never contains an ASCII dump.

Parameters

fp A pointer to FILE structure. The file should be opened for writing.

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed.

bytesPerUnit The number of bytes in one unit. May be 1 (byte), 2 (word), or 4 (double word).

2.18.2.10 int rtxHexDumpToNamedFile (const char *filename, const OSOCTET *data, OSSIZE numocts)

This function outputs a hexadecimal dump of the current buffer contents to the file with the given name. The file is opened or created and then closed after the writer operation is complete.

Parameters

filename Full path to file to which data should be output.

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed

2.18.2.11 int rtxHexDumpToString (const OSOCTET *data, OSSIZE numocts, char *buffer, OSSIZE bufferIndex, OSSIZE bufferSize)

This function formats a hexadecimal dump of the current buffer contents to a string.

Parameters

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed.

buffer The destination string buffer.

bufferIndex The starting position in the destination buffer. The formatting of the dump will begin at this position.

bufferSize The total size of the destination buffer.

Returns

The length of the final string.

2.18.2.12 int rtxHexDumpToStringEx (const OSOCTET *data, OSSIZE numocts, char *buffer, OSSIZE bufferIndex, OSSIZE bufferSize, OSSIZE bytesPerUnit)

This function formats a hexadecimal dump of the current buffer contents to a string, but it may output the dump as an array of bytes, words, or double words.

Parameters

data The pointer to a buffer to be displayed.

numocts The number of octets to be displayed.

buffer The destination string buffer.

bufferIndex The starting position in the destination buffer. The formatting of the dump will begin at this position.

bufferSize The total size of the destination buffer.

bytesPerUnit The number of bytes in one unit. May be 1 (byte), 2 (word), or 4 (double word).

Returns

The length of the final string.

2.18.2.13 void rtxPrintBoolean (const char * *name*, OSBOOL *value*)

Prints a boolean value to stdout.

Parameters

name The name of the variable to print.

value Boolean value to print.

2.18.2.14 void rtxPrintCharStr (const char * *name*, const char * *cstring*)

Prints an ASCII character string value to stdout.

Parameters

name The name of the variable to print.

cstring A pointer to the character string to be printed.

2.18.2.15 void rtxPrintCloseBrace (OSVOIDARG)

This function closes a braced region by decreasing the indent level, printing indent spaces, and printing the closing brace.

2.18.2.16 void rtxPrintDate (const char * *name*, const OSNumDateTime * *pvalue*)

Prints a date value to stdout.

Parameters

name Name of the variable to print.

pvalue Pointer to a structure that holds numeric DateTime value to print.

2.18.2.17 void rtxPrintDateTime (const char * *name*, const OSNumDateTime * *pvalue*)

Prints a dateTime value to stdout.

Parameters

name Name of the variable to print.

pvalue Pointer to a structure that holds numeric DateTime value to print.

2.18.2.18 void rtxPrintDecrIndent (OSVOIDARG)

This function decrements the current indentation level.

2.18.2.19 `int rtxPrintFile (const char * filename)`

This function prints the contents of a text file to stdout.

Parameters

filename The name of the text file to print.

Returns

Status of operation, 0 if success.

2.18.2.20 `void rtxPrintHexBinary (const char * name, OSSIZE numocts, const OSOCTET * data)`

Prints an octet string value in hex binary format to stdout.

Parameters

name The name of the variable to print.

numocts The number of octets to be printed.

data A pointer to the data to be printed.

2.18.2.21 `void rtxPrintHexStr (const char * name, OSSIZE numocts, const OSOCTET * data)`

This function prints the value of a binary string in hex format to standard output. If the string is 32 bytes or less, it is printed on a single line with a '0x' prefix. If longer, a formatted hex dump showing both hex and ascii codes is done.

Parameters

name The name of the variable to print.

numocts The number of octets to be printed.

data A pointer to the data to be printed.

2.18.2.22 `void rtxPrintHexStrNoAscii (const char * name, OSSIZE numocts, const OSOCTET * data)`

This function prints the value of a binary string in hex format to standard output. In contrast to `rtxPrintHexStr`, it never contains an ASCII dump.

Parameters

name The name of the variable to print.

numocts The number of octets to be printed.

data A pointer to the data to be printed.

2.18.2.23 void rtxPrintHexStrPlain (const char * name, OSSIZE numocts, const OSOCTET * data)

This function prints the value of a binary string in hex format to standard output. In contrast to rtxPrintHexStr, it is always printed on a single line with a '0x' prefix.

Parameters

- name* The name of the variable to print.
- numocts* The number of octets to be printed.
- data* A pointer to the data to be printed.

2.18.2.24 void rtxPrintIncrIndent (OSVOIDARG)

This function increments the current indentation level.

2.18.2.25 void rtxPrintIndent (OSVOIDARG)

This function prints indentation spaces to stdout.

2.18.2.26 void rtxPrintInt64 (const char * name, OSINT64 value)

Prints a 64-bit integer value to stdout.

Parameters

- name* The name of the variable to print.
- value* 64-bit integer value to print.

2.18.2.27 void rtxPrintInteger (const char * name, OSINT32 value)

Prints an integer value to stdout.

Parameters

- name* The name of the variable to print.
- value* Integer value to print.

2.18.2.28 void rtxPrintNull (const char * name)

Prints a NULL value to stdout.

Parameters

- name* The name of the variable to print.

2.18.2.29 void rtxPrintNVP (const char * *name*, const OSUTF8NVP * *value*)

Prints a name-value pair to stdout.

Parameters

name The name of the variable to print.

value A pointer to name-value pair structure to print.

2.18.2.30 void rtxPrintOpenBrace (const char *)

This function opens a braced region by printing indent spaces, printing the name and opening brace, and increasing the indent level.

2.18.2.31 void rtxPrintReal (const char * *name*, OSREAL *value*)

Prints a REAL (float, double, decimal) value to stdout.

Parameters

name The name of the variable to print.

value REAL value to print.

2.18.2.32 void rtxPrintTime (const char * *name*, const OSNumDateTime * *pvalue*)

Prints a time value to stdout.

Parameters

name Name of the variable to print.

pvalue Pointer to a structure that holds numeric DateTime value to print.

2.18.2.33 void rtxPrintUInt64 (const char * *name*, OSUINT64 *value*)

Prints an unsigned 64-bit integer value to stdout.

Parameters

name The name of the variable to print.

value Unsigned 64-bit integer value to print.

2.18.2.34 void rtxPrintUnicodeCharStr (const char * *name*, const OSUNICHAR * *str*, int *nchars*)

This function prints a Unicode string to standard output. Characters in the string that are within the normal Ascii range are printed as single characters. Characters outside the Ascii range are printed as 4-byte hex codes (0xnxxx).

Parameters

name The name of the variable to print.

str Pointer to unicode string to be printed. String is an array of C unsigned short data variables.

nchars Number of characters in the string. If value is negative, string is assumed to be null-terminated (i.e. ends with a 0x0000 character).

2.18.2.35 void rtxPrintUnsigned (const char * *name*, OSUINT32 *value*)

Prints an unsigned integer value to stdout.

Parameters

name The name of the variable to print.

value Unsigned integer value to print.

2.18.2.36 void rtxPrintUTF8CharStr (const char * *name*, const OSUTF8CHAR * *cstring*)

Prints a UTF-8 encoded character string value to stdout.

Parameters

name The name of the variable to print.

cstring A pointer to the character string to be printed.

2.19 Print-To-Stream Functions

Functions

- void `rtxPrintToStreamBoolean` (`OSCTXT *pctxt`, const char *name, OSBOOL value)
- void `rtxPrintToStreamDate` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamTime` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamDateTime` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamGYear` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamGYearMonth` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamGMonth` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamGMonthDay` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamGDay` (`OSCTXT *pctxt`, const char *name, const OSNumDateTime *pvalue)
- void `rtxPrintToStreamInteger` (`OSCTXT *pctxt`, const char *name, OSINT32 value)
- void `rtxPrintToStreamInt64` (`OSCTXT *pctxt`, const char *name, OSINT64 value)
- void `rtxPrintToStreamUnsigned` (`OSCTXT *pctxt`, const char *name, OSUINT32 value)
- void `rtxPrintToStreamUInt64` (`OSCTXT *pctxt`, const char *name, OSUINT64 value)
- void `rtxPrintToStreamHexStr` (`OSCTXT *pctxt`, const char *name, OSSIZE numocts, const OSOCTET *data)
- void `rtxPrintToStreamHexStrPlain` (`OSCTXT *pctxt`, const char *name, OSSIZE numocts, const OSOCTET *data)
- void `rtxPrintToStreamHexStrNoAscii` (`OSCTXT *pctxt`, const char *name, OSSIZE numocts, const OSOCTET *data)
- void `rtxPrintToStreamHexBinary` (`OSCTXT *pctxt`, const char *name, OSSIZE numocts, const OSOCTET *data)
- void `rtxPrintToStreamCharStr` (`OSCTXT *pctxt`, const char *name, const char *cstring)
- void `rtxPrintToStreamUTF8CharStr` (`OSCTXT *pctxt`, const char *name, const OSUTF8CHAR *cstring)
- void `rtxPrintToStreamUnicodeCharStr` (`OSCTXT *pctxt`, const char *name, const OSUNICHAR *str, int nchars)
- void `rtxPrintToStreamReal` (`OSCTXT *pctxt`, const char *name, OSREAL value)
- void `rtxPrintToStreamNull` (`OSCTXT *pctxt`, const char *name)
- void `rtxPrintToStreamNVP` (`OSCTXT *pctxt`, const char *name, const OSUTF8NVP *value)
- int `rtxPrintToStreamFile` (`OSCTXT *pctxt`, const char *filename)
- void `rtxPrintToStreamIndent` (`OSCTXT *pctxt`)
- void `rtxPrintToStreamIncrIndent` (`OSCTXT *pctxt`)
- void `rtxPrintToStreamDecrIndent` (`OSCTXT *pctxt`)
- void `rtxPrintToStreamCloseBrace` (`OSCTXT *pctxt`)
- void `rtxPrintToStreamOpenBrace` (`OSCTXT *pctxt`, const char *)
- void `rtxHexDumpToStream` (`OSCTXT *pctxt`, const OSOCTET *data, OSSIZE numocts)
- void `rtxHexDumpToStreamEx` (`OSCTXT *pctxt`, const OSOCTET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- void `rtxHexDumpToStreamExNoAscii` (`OSCTXT *pctxt`, const OSOCTET *data, OSSIZE numocts, OSSIZE bytesPerUnit)

2.19.1 Detailed Description

These functions print typed data in a "name=value" format. The output is redirected to the print stream defined within the context or to a global print stream. Print streams are set using the `rtxSetPrintStream` or `rtxSetGlobalPrintStream` function.

2.19.2 Function Documentation

2.19.2.1 void rtxHexDumpToStream (OSCTXT * *pctxt*, const OSOCTET * *data*, OSSIZE *numocts*)

This function outputs a hexadecimal dump of the current buffer contents to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- data* The pointer to a buffer to be displayed.
- numocts* The number of octets to be displayed

2.19.2.2 void rtxHexDumpToStreamEx (OSCTXT * *pctxt*, const OSOCTET * *data*, OSSIZE *numocts*, OSSIZE *bytesPerUnit*)

This function outputs a hexadecimal dump of the current buffer to a print stream, but it may output the dump as an array of bytes, words, or double words.

Parameters

- pctxt* A pointer to a context structure.
- data* The pointer to a buffer to be displayed.
- numocts* The number of octets to be displayed.
- bytesPerUnit* The number of bytes in one unit. May be 1 (byte), 2 (word), or 4 (double word).

2.19.2.3 void rtxHexDumpToStreamExNoAscii (OSCTXT * *pctxt*, const OSOCTET * *data*, OSSIZE *numocts*, OSSIZE *bytesPerUnit*)

This function outputs a formatted hexadecimal dump of the current buffer to a print stream. It outputs the dump as an array of bytes, words, or double words. It does not output any ASCII equivalent.

Parameters

- pctxt* A pointer to a context structure.
- data* The pointer to a buffer to be displayed.
- numocts* The number of octets to be displayed.
- bytesPerUnit* The number of bytes in one unit. May be 1 (byte), 2 (word), or 4 (double word).

2.19.2.4 void rtxPrintToStreamBoolean (OSCTXT * *pctxt*, const char * *name*, OSBOOL *value*)

Prints a boolean value to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- value* Boolean value to print.

2.19.2.5 void rtxPrintToStreamCharStr (OSCTXT * *pctxt*, const char * *name*, const char * *cstring*)

Prints an ASCII character string value to a print stream.

Parameters

pctxt A pointer to a context structure.

name The name of the variable to print.

cstring A pointer to the character string to be printed.

2.19.2.6 void rtxPrintToStreamCloseBrace (OSCTXT * *pctxt*)

This function closes a braced region by decreasing the indent level, printing indent spaces, and printing the closing brace.

2.19.2.7 void rtxPrintToStreamDate (OSCTXT * *pctxt*, const char * *name*, const OSNumDateTime * *pvalue*)

Prints a date value to a print stream.

Parameters

pctxt A pointer to a context structure.

name Name of the variable to print.

pvalue Pointer to a structure that holds numeric DateTime value to print.

2.19.2.8 void rtxPrintToStreamDateTime (OSCTXT * *pctxt*, const char * *name*, const OSNumDateTime * *pvalue*)

Prints a dateTime value to a print stream.

Parameters

pctxt A pointer to a context structure.

name Name of the variable to print.

pvalue Pointer to a structure that holds numeric DateTime value to print.

2.19.2.9 void rtxPrintToStreamDecrIndent (OSCTXT * *pctxt*)

This function decrements the current indentation level.

Parameters

pctxt A pointer to a context data structure that holds the print stream.

2.19.2.10 `int rtxPrintToStreamFile (OSCTXT * pctxt, const char * filename)`

This function prints the contents of a text file to a print stream.

Parameters

pctxt A pointer to a context structure.
filename The name of the text file to print.

Returns

Status of operation, 0 if success.

2.19.2.11 `void rtxPrintToStreamHexBinary (OSCTXT * pctxt, const char * name, OSSIZE numocts, const OSOCTET * data)`

Prints an octet string value in hex binary format to a print stream.

Parameters

pctxt A pointer to a context structure.
name The name of the variable to print.
numocts The number of octets to be printed.
data A pointer to the data to be printed.

2.19.2.12 `void rtxPrintToStreamHexStr (OSCTXT * pctxt, const char * name, OSSIZE numocts, const OSOCTET * data)`

This function prints the value of a binary string in hex format to standard output. If the string is 32 bytes or less, it is printed on a single line with a '0x' prefix. If longer, a formatted hex dump showing both hex and ascii codes is done.

Parameters

pctxt A pointer to a context structure.
name The name of the variable to print.
numocts The number of octets to be printed.
data A pointer to the data to be printed.

2.19.2.13 `void rtxPrintToStreamHexStrNoAscii (OSCTXT * pctxt, const char * name, OSSIZE numocts, const OSOCTET * data)`

This function prints the value of a binary string in hex format to standard output. In contrast to `rtxPrintToStreamHexStr`, it contains no ASCII output, but instead is a formatted block of hex text printed on multiple lines if needed.

Parameters

pctxt A pointer to a context structure.
name The name of the variable to print.
numocts The number of octets to be printed.
data A pointer to the data to be printed.

2.19.2.14 void rtxPrintToStreamHexStrPlain (OSCTXT * *pctxt*, const char * *name*, OSSIZE *numocts*, const OSOCKET * *data*)

This function prints the value of a binary string in hex format to standard output. In contrast to rtxPrintToStreamHexStr, it is always printed on a single line with a '0x' prefix.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- numocts* The number of octets to be printed.
- data* A pointer to the data to be printed.

2.19.2.15 void rtxPrintToStreamIncrIndent (OSCTXT * *pctxt*)

This function increments the current indentation level.

Parameters

- pctxt* A pointer to a context data structure that holds the print stream.

2.19.2.16 void rtxPrintToStreamIndent (OSCTXT * *pctxt*)

This function prints indentation spaces to a print stream.

2.19.2.17 void rtxPrintToStreamInt64 (OSCTXT * *pctxt*, const char * *name*, OSINT64 *value*)

Prints a 64-bit integer value to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- value* 64-bit integer value to print.

2.19.2.18 void rtxPrintToStreamInteger (OSCTXT * *pctxt*, const char * *name*, OSINT32 *value*)

Prints an integer value to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- value* Integer value to print.

2.19.2.19 void rtxPrintToStreamNull (OSCTXT * *pctxt*, const char * *name*)

Prints a NULL value to a print stream.

Parameters

pctxt A pointer to a context structure.

name The name of the variable to print.

2.19.2.20 void rtxPrintToStreamNVP (OSCTXT * *pctxt*, const char * *name*, const OSUTF8NVP * *value*)

Prints a name-value pair to a print stream.

Parameters

pctxt A pointer to a context structure.

name The name of the variable to print.

value A pointer to name-value pair structure to print.

2.19.2.21 void rtxPrintToStreamOpenBrace (OSCTXT * *pctxt*, const char *)

This function opens a braced region by printing indent spaces, printing the name and opening brace, and increasing the indent level.

2.19.2.22 void rtxPrintToStreamReal (OSCTXT * *pctxt*, const char * *name*, OSREAL *value*)

Prints a REAL (float, double, decimal) value to a print stream.

Parameters

pctxt A pointer to a context structure.

name The name of the variable to print.

value REAL value to print.

2.19.2.23 void rtxPrintToStreamTime (OSCTXT * *pctxt*, const char * *name*, const OSNumDateTime * *pvalue*)

Prints a time value to a print stream.

Parameters

pctxt A pointer to a context structure.

name Name of the variable to print.

pvalue Pointer to a structure that holds numeric DateTime value to print.

2.19.2.24 void rtxPrintToStreamUInt64 (OSCTXT * *pctxt*, const char * *name*, OSUINT64 *value*)

Prints an unsigned 64-bit integer value to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- value* Unsigned 64-bit integer value to print.

2.19.2.25 void rtxPrintToStreamUnicodeCharStr (OSCTXT * *pctxt*, const char * *name*, const OSUNICHAR * *str*, int *nchars*)

This function prints a Unicode string to standard output. Characters in the string that are within the normal Ascii range are printed as single characters. Characters outside the Ascii range are printed as 4-byte hex codes (0xnxxx).

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- str* Pointer to unicode string to be printed. String is an array of C unsigned short data variables.
- nchars* Number of characters in the string. If value is negative, string is assumed to be null-terminated (i.e. ends with a 0x0000 character).

2.19.2.26 void rtxPrintToStreamUnsigned (OSCTXT * *pctxt*, const char * *name*, OSUINT32 *value*)

Prints an unsigned integer value to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- value* Unsigned integer value to print.

2.19.2.27 void rtxPrintToStreamUTF8CharStr (OSCTXT * *pctxt*, const char * *name*, const OSUTF8CHAR * *cstring*)

Prints a UTF-8 encoded character string value to a print stream.

Parameters

- pctxt* A pointer to a context structure.
- name* The name of the variable to print.
- cstring* A pointer to the character string to be printed.

2.20 TCP/IP or UDP socket utility functions

Defines

- #define **OSIPADDR_ANY** ((**OSIPADDR**)0)
- #define **OSIPADDR_LOCAL** ((**OSIPADDR**)0x7f000001UL)

Typedefs

- typedef unsigned long **OSIPADDR**

Functions

- int **rtxSocketAccept** (**OSRTSOCKET** socket, **OSRTSOCKET** *pNewSocket, **OSIPADDR** *destAddr, int *destPort)
- int **rtxSocketAddrToStr** (**OSIPADDR** ipAddr, char *pbuf, size_t bufsize)
- int **rtxSocketBind** (**OSRTSOCKET** socket, **OSIPADDR** addr, int port)
- int **rtxSocketClose** (**OSRTSOCKET** socket)
- int **rtxSocketConnect** (**OSRTSOCKET** socket, const char *host, int port)
- int **rtxSocketConnectTimed** (**OSRTSOCKET** socket, const char *host, int port, int nsecs)
- int **rtxSocketCreate** (**OSRTSOCKET** *psocket)
- int **rtxSocketCreateUDP** (**OSRTSOCKET** *psocket)
- int **rtxSocketGetHost** (const char *host, struct in_addr *inaddr)
- int **rtxSocketsInit** (OSVOIDARG)
- int **rtxSocketListen** (**OSRTSOCKET** socket, int maxConnection)
- int **rtxSocketParseURL** (char *url, char **protocol, char **address, int *port)
- int **rtxSocketRecv** (**OSRTSOCKET** socket, OSOCTET *pbuf, size_t bufsize)
- int **rtxSocketRecvTimed** (**OSRTSOCKET** socket, OSOCTET *pbuf, size_t bufsize, OSUINT32 secs)
- int **rtxSocketSelect** (int nfd, fd_set *readfds, fd_set *writefds, fd_set *exceptfds, struct timeval *timeout)
- int **rtxSocketSend** (**OSRTSOCKET** socket, const OSOCTET *pdata, size_t size)
- int **rtxSocketSetBlocking** (**OSRTSOCKET** socket, OSBOOL value)
- int **rtxSocketStrToAddr** (const char *pIPAddrStr, **OSIPADDR** *pIPAddr)

2.20.1 Typedef Documentation

2.20.1.1 typedef unsigned long OSIPADDR

The IP address represented as unsigned long value. The most significant 8 bits in this unsigned long value represent the first number of the IP address. The least significant 8 bits represent the last number of the IP address.

2.20.2 Function Documentation

2.20.2.1 int rtxSocketAccept (**OSRTSOCKET** *socket*, **OSRTSOCKET** * *pNewSocket*, **OSIPADDR** * *destAddr*, int * *destPort*)

This function permits an incoming connection attempt on a socket. It extracts the first connection on the queue of pending connections on socket. It then creates a new socket and returns a handle to the new socket. The newly created socket is the socket that will handle the actual connection and has the same properties as original socket. See description of 'accept' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) function.

pNewSocket The pointer to variable to receive the new socket handle.

destAddr Optional pointer to a buffer that receives the IP address of the connecting entity. It may be NULL.

destPort Optional pointer to a buffer that receives the port of the connecting entity. It may be NULL.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.2 int rtxSocketAddrToStr (OSIPADDR *ipAddr*, char * *pbuf*, size_t *bufsize*)

This function converts an IP address to its string representation.

Parameters

ipAddr The IP address to be converted.

pbuf Pointer to the buffer to receive a string with the IP address.

bufsize Size of the buffer.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.3 int rtxSocketBind (OSRTSOCKET *socket*, OSIPADDR *addr*, int *port*)

This function associates a local address with a socket. It is used on an unconnected socket before subsequent calls to the [rtxSocketConnect](#) or [rtxSocketListen](#) functions. See description of 'bind' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) function.

addr The local IP address to assign to the socket.

port The local port number to assign to the socket.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.4 int rtxSocketClose (OSRTSOCKET *socket*)

This function closes an existing socket.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) or [rtxSocketAccept](#) function.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.5 int rtxSocketConnect (OSRTSOCKET *socket*, const char * *host*, int *port*)

This function establishes a connection to a specified socket. It is used to create a connection to the specified destination. When the socket call completes successfully, the socket is ready to send and receive data. See description of 'connect' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) function.

host The null-terminated string with the IP address in the following format: "NNN.NNN.NNN.NNN", where NNN is a number in the range (0..255).

port The destination port to connect.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.6 int rtxSocketConnectTimed (OSRTSOCKET *socket*, const char * *host*, int *port*, int *nsecs*)

This function establishes a connection to a specified socket. It is similar to the [rtxSocketConnect](#) function except that it will only wait the given number of seconds to establish a connection before giving up.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) function.

host The null-terminated string with the IP address in the following format: "NNN.NNN.NNN.NNN", where NNN is a number in the range (0..255).

port The destination port to connect.

nsecs Number of seconds to wait before failing.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.7 int rtxSocketCreate (OSRTSOCKET * *psocket*)

This function creates a TCP socket.

Parameters

psocket The pointer to the socket handle variable to receive the handle of new socket.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.8 int rtxSocketGetHost (const char * *host*, struct in_addr * *inaddr*)

This function resolves the given host name to an IP address. The resulting address is stored in the given socket address structure.

Parameters

host Host name to resolve

inaddr Socket address structure to receive resolved IP address

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.9 int rtxSocketListen (OSRTOCKET *socket*, int *maxConnection*)

This function places a socket a state where it is listening for an incoming connection. To accept connections, a socket is first created with the [rtxSocketCreate](#) function and bound to a local address with the [rtxSocketBind](#) function, a *maxConnection* for incoming connections is specified with [rtxSocketListen](#), and then the connections are accepted with the [rtxSocketAccept](#) function. See description of 'listen' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) function.

maxConnection Maximum length of the queue of pending connections.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.10 int rtxSocketParseURL (char * *url*, char ** *protocol*, char ** *address*, int * *port*)

This function parses a simple URL of the form <protocol>://<address>:<port> into its individual components. It is assumed that the buffer the URL is provided in is modifiable. Null-terminators are inserted in the buffer to delimit the individual components. If the user needs to use the URL in unparsed form for any other purpose, they will need to make a copy of it before calling this function.

Parameters

url URL to be parsed. Buffer will be altered.

protocol Protocol string parsed from the URL.

address IP address or domain name parsed from URL.

port Optional port number. Zero if no port provided.

Returns

Zero if parse successful or negative error code.

2.20.2.11 int rtxSocketRecv (OSRTOCKET *socket*, OSOCTET * *pbuf*, size_t *bufsize*)

This function receives data from a connected socket. It is used to read incoming data on sockets. The socket must be connected before calling this function. See description of 'recv' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) or [rtxSocketAccept](#) function.

pbuf Pointer to the buffer for the incoming data.

bufsize Length of the buffer.

Returns

If no error occurs, returns the number of bytes received. Otherwise, the negative value is error code.

2.20.2.12 `int rtxSocketRecvTimed (OSRTSOCKET socket, OSOCKETET * pbuf, size_t bufsize, OSUINT32 secs)`

This function receives data from a connected socket on a timed basis. It is used to read incoming data on sockets. The socket must be connected before calling this function. If no data is available within the given timeout period, an error is returned. See description of 'recv' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) or [rtxSocketAccept](#) function.

pbuf Pointer to the buffer for the incoming data.

bufsize Length of the buffer. *secs* Amount of time to wait, in seconds, for data to be received.

Returns

If no error occurs, returns the number of bytes received. Otherwise, the negative value is error code.

2.20.2.13 `int rtxSocketSelect (int nfds, fd_set * readfds, fd_set * writefds, fd_set * exceptfds, struct timeval * timeout)`

This function is used for synchronous monitoring of multiple sockets. For more information refer to documentation of the "select" system call.

Parameters

nfds The highest numbered descriptor to be monitored plus one.

readfds The descriptors listed in readfds will be watched for whether read would block on them.

writefds The descriptors listed in writefds will be watched for whether write would block on them.

exceptfds The descriptors listed in exceptfds will be watched for exceptions.

timeout Upper bound on amount of time elapsed before select returns.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.20.2.14 `int rtxSocketSend (OSRTSOCKET socket, const OSOCKETET * pdata, size_t size)`

This function sends data on a connected socket. It is used to write outgoing data on a connected socket. See description of 'send' socket function for further details.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) or [rtxSocketAccept](#) function.

pdata Buffer containing the data to be transmitted.

size Length of the data in *pdata*.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.15 int rtxSocketSetBlocking (OSRTOCKET *socket*, OSBOOL *value*)

This function turns blocking mode for a socket on or off.

Parameters

socket The socket handle created by call to [rtxSocketCreate](#) or [rtxSocketAccept](#) function.

value Boolean value. True = turn blocking mode on.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.16 int rtxSocketsInit (OSVOIDARG)

This function initiates use of sockets by an application. This function must be called first before use sockets.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.20.2.17 int rtxSocketStrToAddr (const char * *pIPAddrStr*, OSIPADDR * *pIPAddr*)

This function converts the string with IP address to a double word representation. The converted address may be used with the [rtxSocketBind](#) function.

Parameters

pIPAddrStr The null-terminated string with the IP address in the following format: "NNN.NNN.NNN.NNN", where NNN is a number in the range (0..255).

pIPAddr Pointer to the converted IP address.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.21 Input/Output Data Stream Utility Functions

Classes

- struct [OSRTSTREAM](#)

Defines

- #define **OSRTSTRMF_INPUT** 0x0001
- #define **OSRTSTRMF_OUTPUT** 0x0002
- #define **OSRTSTRMF_BUFFERED** 0x8000
- #define **OSRTSTRMF_UNBUFFERED** 0x4000
- #define **OSRTSTRMF_POSMARKED** 0x2000
- #define **OSRTSTRMF_FIXINMEM** 0x1000
- #define **OSRTSTRMF_BUF_INPUT** (OSRTSTRMF_INPUT|OSRTSTRMF_BUFFERED)
- #define **OSRTSTRMF_BUF_OUTPUT** (OSRTSTRMF_OUTPUT|OSRTSTRMF_BUFFERED)
- #define **OSRTSTRMID_FILE** 1
- #define **OSRTSTRMID_SOCKET** 2
- #define **OSRTSTRMID_MEMORY** 3
- #define **OSRTSTRMID_BUFFERED** 4
- #define **OSRTSTRMID_DIRECTBUF** 5
- #define **OSRTSTRMID_CTXTBUF** 6
- #define **OSRTSTRMID_ZLIB** 7
- #define **OSRTSTRMID_USER** 1000
- #define **OSRTSTRM_K_BUFSIZE** 1024
- #define **OSRTSTRM_K_INVALIDMARK** ((size_t)-1)
- #define **OSRTSTREAM_BYTEINDEX**(pctxt)
- #define **OSRTSTREAM_ID**(pctxt) ((pctxt)->pStream->id)
- #define **OSRTSTREAM_FLAGS**(pctxt) ((pctxt)->pStream->flags)

Typedefs

- typedef long(* [OSRTStreamReadProc](#))(struct [OSRTSTREAM](#) *pStream, OSOCTET *pbuffer, size_t bufSize)
- typedef long(* [OSRTStreamBlockingReadProc](#))(struct [OSRTSTREAM](#) *pStream, OSOCTET *pbuffer, size_t toReadBytes)
- typedef long(* [OSRTStreamWriteProc](#))(struct [OSRTSTREAM](#) *pStream, const OSOCTET *data, size_t numocts)
- typedef int(* [OSRTStreamFlushProc](#))(struct [OSRTSTREAM](#) *pStream)
- typedef int(* [OSRTStreamCloseProc](#))(struct [OSRTSTREAM](#) *pStream)
- typedef int(* [OSRTStreamSkipProc](#))(struct [OSRTSTREAM](#) *pStream, size_t skipBytes)
- typedef int(* [OSRTStreamMarkProc](#))(struct [OSRTSTREAM](#) *pStream, size_t readAheadLimit)
- typedef int(* [OSRTStreamResetProc](#))(struct [OSRTSTREAM](#) *pStream)
- typedef int(* [OSRTStreamGetPosProc](#))(struct [OSRTSTREAM](#) *pStream, size_t *ppos)
- typedef int(* [OSRTStreamSetPosProc](#))(struct [OSRTSTREAM](#) *pStream, size_t pos)
- typedef struct [OSRTSTREAM](#) [OSRTSTREAM](#)

Functions

- int `rtxStreamClose` (OSCTXT *pctx)
- int `rtxStreamFlush` (OSCTXT *pctx)
- int `rtxStreamInit` (OSCTXT *pctx)
- long `rtxStreamRead` (OSCTXT *pctx, OSOCTET *pbuffer, size_t bufSize)
- long `rtxStreamBlockingRead` (OSCTXT *pctx, OSOCTET *pbuffer, size_t readBytes)
- int `rtxStreamSkip` (OSCTXT *pctx, size_t skipBytes)
- long `rtxStreamWrite` (OSCTXT *pctx, const OSOCTET *data, size_t numocts)
- int `rtxStreamGetIOBytes` (OSCTXT *pctx, size_t *pPos)
- int `rtxStreamMark` (OSCTXT *pctx, size_t readAheadLimit)
- int `rtxStreamReset` (OSCTXT *pctx)
- OSBOOL `rtxStreamMarkSupported` (OSCTXT *pctx)
- OSBOOL `rtxStreamIsOpened` (OSCTXT *pctx)
- OSBOOL `rtxStreamIsReadable` (OSCTXT *pctx)
- OSBOOL `rtxStreamIsWritable` (OSCTXT *pctx)
- int `rtxStreamRelease` (OSCTXT *pctx)
- void `rtxStreamSetCapture` (OSCTXT *pctx, OSRTMEMBUF *pmembuf)
- OSRTMEMBUF * `rtxStreamGetCapture` (OSCTXT *pctx)
- int `rtxStreamGetPos` (OSCTXT *pctx, size_t *ppos)
- int `rtxStreamSetPos` (OSCTXT *pctx, size_t pos)

2.21.1 Detailed Description

Stream functions are used for unbuffered stream operations. All of the operations with streams are performed using a context block to maintain state information.

These functions may be used for any input/output operations with streams. Each stream should be initialized first by call to the `rtxStreamInit` function. After initialization, the stream may be opened for reading or writing by calling one of the following functions:

- `rtxStreamFileOpen`
- `rtxStreamFileAttach`
- `rtxStreamSocketAttach`
- `rtxStreamMemoryCreate`
- `rtxStreamMemoryAttach`

2.21.2 Define Documentation

2.21.2.1 #define OSRTSTREAM_BYTEINDEX(pctx)

Value:

```
((pctx)->pStream->id == OSRTSTRMID_DIRECTBUF) ? \
((pctx)->pStream->bytesProcessed + (pctx)->buffer.byteIndex) : \
((pctx)->pStream->bytesProcessed /* was ioBytes */) )
```

2.21.3 Typedef Documentation

2.21.3.1 typedef struct OSRTSTREAM OSRTSTREAM

The stream control block. A user may implement a customized stream by defining read, skip, close functions for input streams and write, flush, close for output streams.

2.21.3.2 typedef long(* OSRTStreamBlockingReadProc)(struct OSRTSTREAM *pStream, OSOCTET *pbuffer, size_t toReadBytes)

Stream blockingRead function pointer type. A user may implement a customized read function for specific input streams. The blockingRead function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.3 typedef int(* OSRTStreamCloseProc)(struct OSRTSTREAM *pStream)

Stream close function pointer type. A user may implement a customized close function for any specific input or output streams. The close function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.4 typedef int(* OSRTStreamFlushProc)(struct OSRTSTREAM *pStream)

Stream flush function pointer type. A user may implement a customized flush function for any specific output streams. The flush function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.5 typedef int(* OSRTStreamGetPosProc)(struct OSRTSTREAM *pStream, size_t *ppos)

Stream get position function pointer type. A user may implement a customized function for a specific input stream type. The mark function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.6 typedef int(* OSRTStreamMarkProc)(struct OSRTSTREAM *pStream, size_t readAheadLimit)

Stream mark function pointer type. A user may implement a customized function for a specific input stream type. The mark function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.7 typedef long(* OSRTStreamReadProc)(struct OSRTSTREAM *pStream, OSOCTET *pbuffer, size_t bufSize)

Stream read function pointer type. A user may implement a customized read function for specific input streams. The read function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.8 typedef int(* OSRTStreamResetProc)(struct OSRTSTREAM *pStream)

Stream reset function pointer type. A user may implement a customized function for a specific input stream type. The reset function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.9 typedef int(* OSRTStreamSetPosProc)(struct OSRTSTREAM *pStream, size_t pos)

Stream set position function pointer type. A user may implement a customized function for a specific input stream type. The mark function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.10 `typedef int(* OSRTStreamSkipProc)(struct OSRTSTREAM *pStream, size_t skipBytes)`

Stream skip function pointer type. A user may implement a customized function for a specific input stream type. The skip function is defined in the [OSRTSTREAM](#) control structure.

2.21.3.11 `typedef long(* OSRTStreamWriteProc)(struct OSRTSTREAM *pStream, const OSOCTET *data, size_t numocts)`

Stream write function pointer type. A user may implement a customized write function for any specific output streams. The write function is defined in the [OSRTSTREAM](#) control structure.

2.21.4 Function Documentation

2.21.4.1 `long rtxStreamBlockingRead (OSCTXT * pctxt, OSOCTET * pbuffer, size_t readBytes)`

This function reads up to 'bufsize' bytes of data from the input stream into an array of octets. An attempt is made to read as many as bufsize octets, but a smaller number may be read, possibly zero. The number of octets actually read is returned as an integer. This functions blocks until input data is available, end of file is detected, or another error is occurred.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to [rtxStreamInit](#).

pbuffer Pointer to a buffer to receive data.

readBytes Number of bytes to read.

Returns

The total number of octets read into the buffer, or negative value with error code if any error is occurred.

2.21.4.2 `int rtxStreamClose (OSCTXT * pctxt)`

This function closes the input or output stream and releases any system resources associated with the stream. For output streams this function also flushes all internal buffers to the stream.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to [rtxStreamInit](#).

2.21.4.3 `int rtxStreamFlush (OSCTXT * pctxt)`

This function flushes the output stream and forces any buffered output octets to be written out.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to [rtxStreamInit](#).

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.4 OSRTMEMBUF* rtxStreamGetCapture (OSCTXT * *pctxt*)

This function returns the capture buffer currently assigned to the stream.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

Pointer to memory buffer that was previously assigned as a capture buffer to the stream.

2.21.4.5 int rtxStreamGetIOBytes (OSCTXT * *pctxt*, size_t * *pPos*)

This function returns the number of processed octets. If the stream was opened as an input stream, then it returns the total number of read octets. If the stream was opened as an output stream, then it returns the total number of written octets. Otherwise, this function returns an error code.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to `rtxStreamInit`.

pPos Pointer to argument to receive total number of processed octets.

Returns

The total number of processed octets or error code (negative value).

2.21.4.6 int rtxStreamGetPos (OSCTXT * *pctxt*, size_t * *pPos*)

Get the current position in input stream.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pPos Pointer to a variable to receive position.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.7 int rtxStreamInit (OSCTXT * *pctxt*)

This function initializes a stream part of the context block. This function should be called first before any operation with a stream.

Parameters

pctxt Pointer to context structure variable, for which stream to be initialized.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.8 OSBOOL rtxStreamIsOpened (OSCTXT * *pctxt*)

Tests if this stream opened (for reading or writing).

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

TRUE if this stream is opened for reading or writing; FALSE otherwise.

2.21.4.9 OSBOOL rtxStreamIsReadable (OSCTXT * *pctxt*)

Tests if this stream opened for reading.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

TRUE if this stream is opened for reading; FALSE otherwise.

2.21.4.10 OSBOOL rtxStreamIsWritable (OSCTXT * *pctxt*)

Tests if this stream opened for writing.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

TRUE if this stream is opened for writing; FALSE otherwise.

2.21.4.11 int rtxStreamMark (OSCTXT * *pctxt*, *size_t readAheadLimit*)

Marks the current position in this input stream. A subsequent call to the [rtxStreamReset](#) function repositions this stream at the last marked position so that subsequent reads re-read the same bytes. The *readAheadLimit* argument tells this input stream to allow many bytes to be read before the mark position gets invalidated.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

readAheadLimit The maximum limit of bytes that can be read before the mark position becomes invalid.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.12 OSBOOL rtxStreamMarkSupported (OSCTXT * *pctxt*)

Tests if this input stream supports the mark and reset methods. Whether or not mark and reset are supported is an invariant property of a particular input stream instance. By default, it returns FALSE.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

TRUE if this stream instance supports the mark and reset methods; FALSE otherwise.

2.21.4.13 long rtxStreamRead (OSCTXT * *pctxt*, OSOCTET * *pbuffer*, size_t *bufSize*)

This function reads up to 'bufsize' bytes of data from the input stream into an array of octets. An attempt is made to read as many as bufsize octets, but a smaller number may be read, possibly zero. The number of octets actually read is returned as an integer. This functions blocks until input data is available, end of file is detected, or another error is occurred.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to [rtxStreamInit](#).

pbuffer Pointer to a buffer to receive data.

bufSize Size of the buffer.

Returns

The total number of octets read into the buffer, or negative value with error code if any error is occurred.

2.21.4.14 int rtxStreamRelease (OSCTXT * *pctxt*)

This function releases the stream's resources. If it is opened for reading or writing it will be closed.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.15 int rtxStreamReset (OSCTXT * *pctxt*)

Repositions this stream to the position recorded by the last call to the [rtxStreamMark](#) function.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.16 void rtxStreamSetCapture (OSCTXT * *pctxt*, OSRTMEMBUF * *pmembuf*)

This function sets a capture buffer for the stream. This is used to record all data read from the stream.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pmembuf Pointer to an initialized memory buffer structure. This argument may be set to NULL to disable capture if previously set.

2.21.4.17 int rtxStreamSetPos (OSCTXT * *pctxt*, size_t *pos*)

Set the current position in input stream.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pos Stream position.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.18 int rtxStreamSkip (OSCTXT * *pctxt*, size_t *skipBytes*)

This function skips over and discards the specified amount of data octets from this input stream.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to [rtxStreamInit](#).

skipBytes The number of octets to be skipped.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.21.4.19 long rtxStreamWrite (OSCTXT * *pctxt*, const OSOCTET * *data*, size_t *numocts*)

This function writes the specified amount of octets from the specified array to the output stream.

Parameters

pctxt Pointer to a context structure variable which has been initialized for stream operations via a call to [rtxStreamInit](#).

data The pointer to data to be written.

numocts The number of octets to write.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.22 File stream functions.

Functions

- int `rtxStreamFileAttach` (`OSCTXT *pctx`, `FILE *pFile`, `OSUINT16 flags`)
- int `rtxStreamFileOpen` (`OSCTXT *pctx`, `const char *pFilename`, `OSUINT16 flags`)
- int `rtxStreamFileCreateReader` (`OSCTXT *pctx`, `const char *pFilename`)
- int `rtxStreamFileCreateWriter` (`OSCTXT *pctx`, `const char *pFilename`)

2.22.1 Detailed Description

File stream functions are used for stream operations with files.

2.22.2 Function Documentation

2.22.2.1 `int rtxStreamFileAttach (OSCTXT * pctx, FILE * pFile, OSUINT16 flags)`

Attaches the existing file structure pointer to the stream. The file should be already opened either for the reading or writing. The 'flags' parameter specifies the access mode for the stream - input or output.

Parameters

pctx Pointer to a context structure variable that has been initialized for stream operations.

pFile Pointer to FILE structure. File should be already opened either for the writing or reading.

flags Specifies the access mode for the stream:

- `OSRTSTRMF_INPUT` = input (reading) stream;
- `OSRTSTRMF_OUTPUT` = output (writing) stream.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.22.2.2 `int rtxStreamFileCreateReader (OSCTXT * pctx, const char * pFilename)`

This function creates an input file stream using the specified file name.

Parameters

pctx Pointer to a context structure variable that has been initialized for stream operations.

pFilename Pointer to null-terminated string that contains the name of file.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.22.2.3 int rtxStreamFileCreateWriter (OSCTXT * *pctxt*, const char * *pFilename*)

This function creates an output file stream using the file name.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pFilename Pointer to null-terminated string that contains the name of file.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.22.2.4 int rtxStreamFileOpen (OSCTXT * *pctxt*, const char * *pFilename*, OSUINT16 *flags*)

Opens a file stream. The 'flags' parameter specifies the access mode for the stream - input or output.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pFilename Pointer to null-terminated string that contains the name of file.

flags Specifies the access mode for the stream:

- OSRTSTRMF_INPUT = input (reading) stream;
- OSRTSTRMF_OUTPUT = output (writing) stream.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.23 Memory stream functions.

Functions

- int `rtxStreamMemoryCreate` (OSCTXT *pctx, OSUINT16 flags)
- int `rtxStreamMemoryAttach` (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize, OSUINT16 flags)
- OSOCTET * `rtxStreamMemoryGetBuffer` (OSCTXT *pctx, size_t *pSize)
- int `rtxStreamMemoryCreateReader` (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize)
- int `rtxStreamMemoryCreateWriter` (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize)
- int `rtxStreamMemoryResetWriter` (OSCTXT *pctx)

2.23.1 Detailed Description

Memory stream functions are used for memory stream operations.

2.23.2 Function Documentation

2.23.2.1 int `rtxStreamMemoryAttach` (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize, OSUINT16 flags)

Opens a memory stream using the specified memory buffer. The 'flags' parameter specifies the access mode for the stream - input or output.

Parameters

pctx Pointer to a context structure variable that has been initialized for stream operations.

pMemBuf The pointer to the buffer.

bufSize The size of the buffer.

flags Specifies the access mode for the stream:

- OSRTSTRMF_INPUT = input (reading) stream;
- OSRTSTRMF_OUTPUT = output (writing) stream.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.23.2.2 int `rtxStreamMemoryCreate` (OSCTXT *pctx, OSUINT16 flags)

Opens a memory stream. A memory buffer will be created by this function. The 'flags' parameter specifies the access mode for the stream - input or output.

Parameters

pctx Pointer to a context structure variable that has been initialized for stream operations.

flags Specifies the access mode for the stream:

- OSRTSTRMF_INPUT = input (reading) stream;
- OSRTSTRMF_OUTPUT = output (writing) stream.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.23.2.3 `int rtxStreamMemoryCreateReader (OSCTXT * pctxt, OSOCTET * pMemBuf, size_t bufSize)`

This function creates an input memory stream using the specified buffer.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pMemBuf The pointer to the buffer

bufSize The size of the buffer

Returns

Completion status of operation: 0 = success, negative return value is error.

2.23.2.4 `int rtxStreamMemoryCreateWriter (OSCTXT * pctxt, OSOCTET * pMemBuf, size_t bufSize)`

This function creates an output memory stream using the specified buffer. If *pMemBuf* or *bufSize* is NULL then new buffer will be allocated.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pMemBuf The pointer to the buffer. Can be NULL - new buffer will be allocated in this case.

bufSize The size of the buffer. Can be 0 - new buffer will be allocated in this case.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.23.2.5 `OSOCTET* rtxStreamMemoryGetBuffer (OSCTXT * pctxt, size_t * pSize)`

This function returns the memory buffer and its size for the given memory stream.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

pSize The pointer to `size_t` to receive the size of buffer.

Returns

The pointer to memory buffer. NULL, if error occurred.

2.23.2.6 `int rtxStreamMemoryResetWriter (OSCTXT * pctxt)`

This function resets the output memory stream internal buffer to allow it to be overwritten with new data. Memory for the buffer is not freed.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.24 Socket stream functions.

Functions

- int `rtxStreamSocketAttach` (`OSCTXT *pctxt`, `OSRTSOCKET socket`, `OSUINT16 flags`)
- int `rtxStreamSocketClose` (`OSCTXT *pctxt`)
- int `rtxStreamSocketCreateWriter` (`OSCTXT *pctxt`, `const char *host`, `int port`)
- int `rtxStreamSocketSetOwnership` (`OSCTXT *pctxt`, `OSBOOL ownSocket`)
- int `rtxStreamSocketSetReadTimeout` (`OSCTXT *pctxt`, `OSUINT32 nsecs`)

2.24.1 Detailed Description

Socket stream functions are used for socket stream operations.

2.24.2 Function Documentation

2.24.2.1 int `rtxStreamSocketAttach` (`OSCTXT *pctxt`, `OSRTSOCKET socket`, `OSUINT16 flags`)

Attaches the existing socket handle to the stream. The socket should be already opened and connected. The 'flags' parameter specifies the access mode for the stream - input or output.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

socket The socket handle created by `rtxSocketCreate`.

flags Specifies the access mode for the stream:

- `OSRTSTRMF_INPUT` = input (reading) stream;
- `OSRTSTRMF_OUTPUT` = output (writing) stream.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.24.2.2 int `rtxStreamSocketClose` (`OSCTXT *pctxt`)

This function closes a socket stream.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.24.2.3 `int rtxStreamSocketCreateWriter (OSCTXT * pctxt, const char * host, int port)`

This function opens a socket stream for writing.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

host Name of host or IP address to which to connect.

port Port number to which to connect.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.24.2.4 `int rtxStreamSocketSetOwnership (OSCTXT * pctxt, OSBOOL ownSocket)`

This function transfers ownership of the socket to or from the stream instance. The socket will be closed and deleted when the stream is closed or goes out of scope. By default stream socket owns the socket.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

ownSocket Boolean value.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.24.2.5 `int rtxStreamSocketSetReadTimeout (OSCTXT * pctxt, OSUINT32 nsecs)`

This function sets the read timeout value to the given number of seconds. Any read operation attempted on the stream will timeout after this period of time if no data is received.

Parameters

pctxt Pointer to a context structure variable that has been initialized for stream operations.

nsecs Number of seconds to wait before timing out.

Returns

Completion status of operation: 0 = success, negative return value is error.

2.25 Doubly-Linked List Utility Functions

Classes

- struct [OSRDTListNode](#)
- struct [OSRDTList](#)
- struct [OSRDTListBuf](#)
- struct [OSRDTListUTF8StrNode](#)

Typedefs

- typedef struct [OSRDTListNode](#) **OSRDTListNode**
- typedef struct [OSRDTList](#) **OSRDTList**
- typedef struct [OSRDTListBuf](#) **OSRDTListBuf**
- typedef struct [OSRDTListUTF8StrNode](#) **OSRDTListUTF8StrNode**
- typedef int(* **PEqualsFunc**)(const void *a, const void *b, const void *sortCtxt)

Functions

- void [rtxDListInit](#) ([OSRDTList](#) *pList)
- [OSRDTListNode](#) * [rtxDListAppend](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, void *pData)
- [OSRDTListNode](#) * [rtxDListAppendCharArray](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, size_t length, char *pData)
- [OSRDTListNode](#) * [rtxDListAppendNode](#) ([OSRDTList](#) *pList, [OSRDTListNode](#) *pListNode)
- [OSRDTListNode](#) * [rtxDListInsert](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, OSSIZE idx, void *pData)
- [OSRDTListNode](#) * **[rtxDListInsertNode](#)** ([OSRDTList](#) *pList, OSSIZE idx, [OSRDTListNode](#) *pListNode)
- [OSRDTListNode](#) * [rtxDListInsertBefore](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, [OSRDTListNode](#) *node, void *pData)
- [OSRDTListNode](#) * [rtxDListInsertAfter](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, [OSRDTListNode](#) *node, void *pData)
- [OSRDTListNode](#) * [rtxDListFindByIndex](#) (const [OSRDTList](#) *pList, OSSIZE idx)
- [OSRDTListNode](#) * [rtxDListFindByData](#) (const [OSRDTList](#) *pList, void *data)
- int [rtxDListFindIndexByData](#) (const [OSRDTList](#) *pList, void *data)
- void [rtxDListFreeNode](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, [OSRDTListNode](#) *node)
- void [rtxDListRemove](#) ([OSRDTList](#) *pList, [OSRDTListNode](#) *node)
- void [rtxDListFreeNodes](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList)
- void [rtxDListFreeAll](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList)
- int [rtxDListToArray](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, void **ppArray, OSSIZE *pElemCount, OSSIZE elemSize)
- int [rtxDListAppendArray](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, void *pArray, OSSIZE numElements, OSSIZE elemSize)
- int [rtxDListAppendArrayCopy](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, const void *pArray, OSSIZE numElements, OSSIZE elemSize)
- int [rtxDListToUTF8Str](#) (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, OSUTF8CHAR **ppstr, char sep)
- [OSRDTListNode](#) * **[rtxDListInsertSorted](#)** (struct [OSCTXT](#) *pctxt, [OSRDTList](#) *pList, void *pData, [PEqualsFunc](#) equalsFunc, void *sortCtxt)
- [OSRDTListNode](#) * **[rtxDListInsertNodeSorted](#)** ([OSRDTList](#) *pList, [OSRDTListNode](#) *pListNode, [PEqualsFunc](#) equalsFunc, void *sortCtxt)

2.25.1 Detailed Description

The doubly-linked list utility functions provide common routines for managing linked lists. These lists are used to model XSD list and repeating element types within the generated code. This list type contains forward and backward pointers allowing the list to be traversed in either direction.

2.25.2 Function Documentation

2.25.2.1 OSRTDListNode* rtxDListAppend (struct OSCTXT * *pctxt*, OSRTDList * *pList*, void * *pData*)

This function appends an item to the linked list structure. The data item is passed into the function as a void pointer that can point to an object of any type. The `rtxMemAlloc` function is used to allocate memory for the list node structure; therefore, all internal list memory will be released whenever `rtxMemFree` is called. The pointer to the data item itself is stored in the node structure - a copy is not made.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pList A pointer to a linked list structure onto which the data item will be appended.

pData A pointer to the data item to be appended to the list.

Returns

A pointer to an allocated node structure used to link the given data value into the list.

2.25.2.2 int rtxDListAppendArray (struct OSCTXT * *pctxt*, OSRTDList * *pList*, void * *pArray*, OSSIZE *numElements*, OSSIZE *elemSize*)

This function appends pointers to items in the given array to a doubly linked list structure. The array is assumed to hold an array of values as opposed to pointers. The actual address of each item in the array is stored - a copy of each item is not made.

Parameters

pctxt A pointer to a context structure.

pList A pointer to the linked list structure onto which the array items will be appended.

pArray A pointer to the source array to be converted.

numElements The number of elements in the array.

elemSize The size of one element in the array. Use the `sizeof()` operator to pass this parameter.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.25.2.3 int rtxDListAppendArrayCopy (struct OSCTXT * *pctxt*, OSRTDList * *pList*, const void * *pArray*, OSSIZE *numElements*, OSSIZE *elemSize*)

This function appends a copy of each item in the given array to a doubly linked list structure. In this case, the `rtxMemAlloc` function is used to allocate memory for each item and a copy is made.

Parameters

pctxt A pointer to a context structure.

pList A pointer to the linked list structure onto which the array items will be appended.

pArray A pointer to the source array to be converted.

numElements The number of elements in the array.

elemSize The size of one element in the array. Use the `sizeof()` operator to pass this parameter.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.25.2.4 OSRTDListNode* rtxDListAppendCharArray (struct OSCTXT *pctxt, OSRTDList *pList, size_t length, char *pData)

This function appends an item to the linked list structure. The data item is passed into the function as a void pointer that can point to an object of any type. The `rtxMemAlloc` function is used to allocate memory for the list node structure; therefore, all internal list memory will be released whenever `rtxMemFree` is called. The array passed in is copied and a pointer to the copy is stored in the list.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pList A pointer to a linked list structure onto which the data item will be appended.

length The size of the character array to be appended.

pData A pointer to the character array.

Returns

A pointer to an allocated node structure used to link the given data value into the list.

2.25.2.5 OSRTDListNode* rtxDListAppendNode (OSRTDList *pList, OSRTDListNode *pListNode)

This function appends an `OSRTDListNode` to the linked list structure. The node data is a void pointer that can point to an object of any type. The `rtxMemAlloc` function is used to allocate memory for the list node structure; therefore, all internal list memory will be released whenever `rtxMemFree` is called. The pointer to the data item itself is stored in the node structure - a copy is not made.

Parameters

pList A pointer to a linked list structure onto which the data item will be appended.

pListNode A pointer to the node to be appended to the list.

Returns

A pointer to an allocated node structure used to link the given data value into the list.

2.25.2.6 OSRTDListNode* rtxDListFindByData (const OSRTDList * *pList*, void * *data*)

This function will return the node pointer of the given data item within the list or NULL if the item is not found.

Parameters

pList A pointer to a linked list structure.

data Pointer to the data item to search for. Note that comparison of pointer values is done; not the items pointed at by the pointers.

Returns

A pointer to an allocated linked list node structure.

2.25.2.7 OSRTDListNode* rtxDListFindByIndex (const OSRTDList * *pList*, OSSIZE *idx*)

This function will return the node pointer of the indexed entry in the list.

Parameters

pList A pointer to a linked list structure.

idx Zero-based index into list where the specified item is located. If the list contains fewer items than the index, NULL is returned.

Returns

A pointer to an allocated linked list node structure. To get the actual data item, the *data* member variable pointer within this structure must be dereferenced.

2.25.2.8 int rtxDListFindIndexByData (const OSRTDList * *pList*, void * *data*)

This function will return the index of the given data item within the list or -1 if the item is not found.

Parameters

pList A pointer to a linked list structure.

data Pointer to the data item to search for. Note that comparison of pointer values is done; not the items pointed at by the pointers.

Returns

Index of item within the list or -1 if not found.

2.25.2.9 void rtxDListFreeAll (struct OSCtxt * *pctx*, OSRTDList * *pList*)

This function will free all of the dynamic memory used to hold the list node pointers and the data items. In this case, it is assumed that the `rtxMemAlloc` function was used to allocate memory for the data items.

Parameters

pctx A pointer to a context structure.

pList A pointer to a linked list structure.

2.25.2.10 void rtxDListFreeNode (struct OSCTXT * *pctxt*, OSRTDList * *pList*, OSRTDListNode * *node*)

This function will remove the given node from the list and free memory. The data memory is not freed. It might be released when the `rtxMemFree` or `rtFreeContext` function is called with this context.

Parameters

- pctxt* A pointer to a context structure.
- pList* A pointer to a linked list structure.
- node* Pointer to the list node to be removed.

2.25.2.11 void rtxDListFreeNodes (struct OSCTXT * *pctxt*, OSRTDList * *pList*)

This function will free all of the dynamic memory used to hold the list node pointers. It does not free the data items because it is unknown how the memory was allocated for these items.

Parameters

- pctxt* A pointer to a context structure.
- pList* A pointer to a linked list structure.

2.25.2.12 void rtxDListInit (OSRTDList * *pList*)

This function initializes a doubly linked list structure. It sets the number of elements to zero and sets all internal pointer values to NULL. A doubly linked-list structure is described by the `OSRTDList` type. Nodes of the list are of type `OSRTDListNode`.

Memory for the structures is allocated using the `rtxMemAlloc` run-time function and is maintained within the context structure that is a required parameter to all `rtDList` functions. This memory is released when `rtxMemFree` is called or the context is released. Unless otherwise noted, all data passed into the list functions is simply stored on the list by value (i.e. a deep-copy of the data is not done).

Parameters

- pList* A pointer to a linked list structure to be initialized.

2.25.2.13 OSRTDListNode* rtxDListInsert (struct OSCTXT * *pctxt*, OSRTDList * *pList*, OSSIZE *idx*, void * *pData*)

This function inserts an item into the linked list structure. The data item is passed into the function as a void pointer that can point to an object of any type. The `rtxMemAlloc` function is used to allocate memory for the list node structure; therefore, all internal list memory will be released when the `rtxMemFree` function is called.

Parameters

- pctxt* A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.
- pList* A pointer to a linked list structure into which the data item is to be inserted.
- idx* Zero-based index into list where the specified item is to be inserted.
- pData* A pointer to the data item to be inserted to the list.

Returns

- A pointer to an allocated node structure used to link the given data value into the list.

2.25.2.14 OSRTDListNode* rtxDListInsertAfter (struct OSCTXT * *pctxt*, OSRTDList * *pList*, OSRTDListNode * *node*, void * *pData*)

This function inserts an item into the linked list structure after the specified element. The `rtxMemAlloc` function is used to allocate memory for the list node structure; therefore, all internal list memory will be released when the `rtxMemFree` function is called.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pList A pointer to a linked list structure into which the data item is to be inserted.

node The position in the list where the item is to be inserted. The item will be inserted after this node or added as the head element if node is null.

pData A pointer to the data item to be inserted to the list.

Returns

A pointer to an allocated node structure used to link the given data value into the list.

2.25.2.15 OSRTDListNode* rtxDListInsertBefore (struct OSCTXT * *pctxt*, OSRTDList * *pList*, OSRTDListNode * *node*, void * *pData*)

This function inserts an item into the linked list structure before the specified element. The `rtxMemAlloc` function is used to allocate memory for the list node structure; therefore, all internal list memory will be released when the `rtxMemFree` function is called.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pList A pointer to a linked list structure into which the data item is to be inserted.

node The position in the list where the item is to be inserted. The item will be inserted before this node or appended to the list if node is null.

pData A pointer to the data item to be inserted to the list.

Returns

A pointer to an allocated node structure used to link the given data value into the list.

2.25.2.16 void rtxDListRemove (OSRTDList * *pList*, OSRTDListNode * *node*)

This function will remove the given node from the list. The node memory is not freed. It will be released when the `rtxMemFree` or `rtFreeContext` function is called with this context.

Parameters

pList A pointer to a linked list structure.

node Pointer to the list node to be removed.

2.25.2.17 `int rtxDListToArray (struct OSCTXT * pctxt, OSRTDList * pList, void ** ppArray, OSSIZE * pElemCount, OSSIZE elemSize)`

This function converts a doubly linked list to an array.

Parameters

pctxt A pointer to a context structure.

pList A pointer to a linked list structure.

ppArray A pointer to a pointer to the destination array.

pElemCount A pointer to the number of elements already allocated in *ppArray*. If *pElements* is NULL, or *pElements* is less than the number of nodes in the list, then a new array is allocated and the pointer is stored in *ppArray*. Memory is allocated via calls to the `rtxMemAlloc` function.

elemSize The size of one element in the array. Use the `sizeof()` operator to pass this parameter.

Returns

The number of elements in the returned array.

2.25.2.18 `int rtxDListToUTF8Str (struct OSCTXT * pctxt, OSRTDList * pList, OSUTF8CHAR ** ppstr, char sep)`

This function concatenates all of the components in the given list to form a UTF-8 string. The list is assumed to contain null-terminated character string components. The given separator character is inserted after each list component. The `rtxMemAlloc` function is used to allocate memory for the output string.

Parameters

pctxt A pointer to a context structure.

pList A pointer to the linked list structure onto which the array items will be appended.

ppstr A pointer to a char pointer to hold output string.

sep Separator character to add between string components.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

2.26 Linked List Utility Functions

Classes

- struct `_OSRTSListNode`
- struct `_OSRTSList`

Typedefs

- typedef struct `_OSRTSListNode` `OSRTSListNode`
- typedef struct `_OSRTSList` `OSRTSList`

Functions

- void `rtxSListInit` (`OSRTSList *pList`)
- void `rtxSListInitEx` (`OSCTXT *pctxt`, `OSRTSList *pList`)
- void `rtxSListFree` (`OSRTSList *pList`)
- void `rtxSListFreeAll` (`OSRTSList *pList`)
- `OSRTSList * rtxSListCreate` (`OSVOIDARG`)
- `OSRTSList * rtxSListCreateEx` (`OSCTXT *pctxt`)
- `OSRTSListNode * rtxSListAppend` (`OSRTSList *pList`, `void *pData`)
- `OSBOOL rtxSListFind` (`OSRTSList *pList`, `void *pData`)
- void `rtxSListRemove` (`OSRTSList *pList`, `void *pData`)

2.26.1 Detailed Description

Singly linked list structures have only a single link pointer and can therefore only be traversed in a single direction (forward). The node structures consume less memory than those of a doubly linked list.

Another difference between the singly linked list implementation and doubly linked lists is that the singly linked list uses conventional memory allocation functions (C malloc and free) for less storage instead of the rtxMem functions. Therefore, it is not a requirement to have an initialized context structure to work with these lists. However, performance may suffer if the lists become large due to the use of non-optimized memory management.

2.26.2 Function Documentation

2.26.2.1 `OSRTSListNode* rtxSListAppend (OSRTSList *pList, void *pData)`

This function appends an item to a linked list structure. The data item is passed into the function as a void parameter that can point to an object of any type.

Parameters

pList A pointer to a linked list onto which the data item is to be appended.

pData A pointer to a data item to be appended to the list.

Returns

A pointer to the allocated linked list structure.

2.26.2.2 OSRTSList* rtxSListCreate (OSVOIDARG)

This function creates a new linked list structure. It allocates memory for the structure and calls rtxSListInit to initialize the structure.

Returns

A pointer to the allocated linked list structure.

2.26.2.3 OSRTSList* rtxSListCreateEx (OSCTXT * *pctxt*)

The rtxSListAppend function appends an item to linked list structure. The data is passed into the function as a void that can point to an object of any type.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

Returns

A pointer to the allocated linked list structure.

2.26.2.4 OSBOOL rtxSListFind (OSRTSList * *pList*, void * *pData*)

This function finds an item in the linked list structure. The data item is passed into the function as a void pointer that can point to an object of any type. If the appropriate node is found in the list this function returns TRUE, otherwise FALSE.

Parameters

pList A pointer to a linked list onto which the data item is to be appended.

pData A pointer to a data item to be appended to the list.

Returns

TRUE, if the node is found, otherwise FALSE.

2.26.2.5 void rtxSListFree (OSRTSList * *pList*)

This function removes all nodes from the linked list structure and releases memory that was allocated for storing node structures (OSRTSListNode). The data will not be freed.

Parameters

pList A pointer to a linked list onto which the data item is to be appended.

2.26.2.6 void rtxSListFreeAll (OSRTSList * *pList*)

This function removes all nodes from the linked list structure and releases memory that was allocated for storing node structures (OSRTSListNode). It also frees the data structures which are assumed to have been allocated using the rtxMemAlloc function.

Parameters

pList A pointer to a linked list onto which the data item is to be appended.

2.26.2.7 void rtxSListInit (OSRTSList * *pList*)

This function initializes a singly linked list structure. It sets the number of elements to zero and sets all internal pointer values to NULL.

Parameters

pList A pointer to a linked list structure to be initialized.

2.26.2.8 void rtxSListInitEx (OSCTXT * *pctxt*, OSRTSList * *pList*)

This function is similar to rtxSListInit but it also sets the *pctxt* (pointer to a context structure member of OSRTSList structure). This context will be used for further memory allocations; otherwise the standard malloc is used.

Parameters

pctxt A pointer to a context structure. This provides a storage area for the function to store all working variables that must be maintained between function calls.

pList A pointer to a linked list structure to be initialized.

2.26.2.9 void rtxSListRemove (OSRTSList * *pList*, void * *pData*)

This function finds an item in the linked list structure and removes it from the list. The data item is passed into the function as a void pointer that can point to an object of any type.

Parameters

pList A pointer to a linked list onto which the data item is to be appended.

pData A pointer to a data item to be appended to the list.

2.27 Stack Utility Functions

Classes

- struct `_OSRTStack`

Defines

- #define `rtxStackIsEmpty(stack)` (OSBOOL)((stack).dlist.count == 0)

Typedefs

- typedef struct `_OSRTStack` `OSRTStack`

Functions

- `OSRTStack *` `rtxStackCreate` (struct `OSCTXT` *`pctxt`)
- void `rtxStackInit` (struct `OSCTXT` *`pctxt`, `OSRTStack` *`pStack`)
- void * `rtxStackPop` (`OSRTStack` *`pStack`)
- int `rtxStackPush` (`OSRTStack` *`pStack`, void *`pData`)
- void * `rtxStackPeek` (`OSRTStack` *`pStack`)

2.27.1 Detailed Description

This is a simple stack structure with supporting push and pop functions. Different initialization routines are provided to permit different memory management schemes.

2.27.2 Define Documentation

2.27.2.1 #define `rtxStackIsEmpty(stack)` (OSBOOL)((stack).dlist.count == 0)

This macro tests if the stack is empty.

Parameters

stack Stack structure variable to be tested.

2.27.3 Function Documentation

2.27.3.1 `OSRTStack*` `rtxStackCreate` (struct `OSCTXT` * `pctxt`)

This function creates a new stack structure. It allocates memory for the structure and calls `rtxStackInit` to initialize the structure.

Parameters

pctxt A pointer to the context with which the stack is associated.

Returns

A pointer to an allocated stack structure.

2.27.3.2 void rtxStackInit (struct OSCTXT * *pctxt*, OSRTStack * *pStack*)

This function initializes a stack structure. It sets the number of elements to zero and sets all internal pointer values to NULL.

Parameters

pctxt A pointer to the context with which the stack is associated.

pStack A pointer to a stack structure to be initialized.

2.27.3.3 void* rtxStackPeek (OSRTStack * *pStack*)

This functions returns the data item on the top of the stack.

Parameters

pStack A pointer to the structure onto which the data item is to be pushed. The pointer updated to the stack structure

Returns

Pointer to data item at top of stack or NULL if stack empty.

- 0 (0) = success,
- negative return value is error.

2.27.3.4 void* rtxStackPop (OSRTStack * *pStack*)

This function pops an item off the stack.

Parameters

pStack The pointer to the stack structure from which the value is to be popped. Pointer to the updated stack structure.

Returns

The pointer to the item popped from the stack

2.27.3.5 int rtxStackPush (OSRTStack * *pStack*, void * *pData*)

This function pushes an item onto the stack.

Parameters

pStack A pointer to the structure onto which the data item is to be pushed. The pointer updated to the stack structure

pData A pointer to the data item to be pushed on the stack.

Returns

Completion status of operation:

- 0 (0) = success,
- negative return value is error.

2.28 Pattern matching functions

Functions

- OSBOOL `rtxMatchPattern` (OSCTXT *pctxt, const OSUTF8CHAR *text, const OSUTF8CHAR *pattern)
- OSBOOL `rtxMatchPattern2` (OSCTXT *pctxt, const OSUTF8CHAR *pattern)
- void `rtxFreeRegexpCache` (OSCTXT *pctxt)

2.28.1 Detailed Description

These functions handle pattern matching which is required to to process XML schema pattern constraints.

2.28.2 Function Documentation

2.28.2.1 void rtxFreeRegexpCache (OSCTXT * pctxt)

This function frees the memory associated with the regular expression cache. The regular expression cache is designed to use memory that survives calls to `rtxMemFree` and `rtxMemReset`, therefore it is necessary to call this function to free that memory. (Note that `rtxFreeContext` invokes this.)

2.28.2.2 OSBOOL rtxMatchPattern (OSCTXT * pctxt, const OSUTF8CHAR * text, const OSUTF8CHAR * pattern)

This function compares the given string to the given pattern. It returns true if match, false otherwise.

Parameters

- pctxt* Pointer to context structure.
- text* Text to be matched.
- pattern* Regular expression.

Returns

Boolean result.

2.29 Diagnostic trace functions

Classes

- struct [OSRTPrintStream](#)

Defines

- #define **RTDIAG1**(pctxt, msg)
- #define **RTDIAG2**(pctxt, msg, a)
- #define **RTDIAG3**(pctxt, msg, a, b)
- #define **RTDIAG4**(pctxt, msg, a, b, c)
- #define **RTDIAG5**(pctxt, msg, a, b, c, d)
- #define **RTDIAGU**(pctxt, ucstr)
- #define **RTHEXDUMP**(pctxt, buffer, numocts)
- #define **RTDIAGCHARS**(pctxt, buf, nchars)
- #define **RTDIAGSTRM2**(pctxt, msg)
- #define **RTDIAGSTRM3**(pctxt, msg, a)
- #define **RTDIAGSTRM4**(pctxt, msg, a, b)
- #define **RTDIAGSTRM5**(pctxt, msg, a, b, c)
- #define **RTHEXDUMPSTRM**(pctxt, buffer, numocts)
- #define **RTDIAGSCHARS**(pctxt, buf, nchars)

Typedefs

- typedef void(* [rtxPrintCallback](#))(void *pPrntStrmInfo, const char *fmtspec, va_list arglist)
- typedef struct [OSRTPrintStream](#) **OSRTPrintStream**

Enumerations

- enum **OSRTDiagTraceLevel** { **OSRTDiagError**, **OSRTDiagWarning**, **OSRTDiagInfo**, **OSRTDiagDebug** }

Functions

- int [rtxSetPrintStream](#) (**OSCTXT** *pctxt, [rtxPrintCallback](#) myCallback, void *pStrmInfo)
- int [rtxSetGlobalPrintStream](#) ([rtxPrintCallback](#) myCallback, void *pStrmInfo)
- int [rtxPrintToStream](#) (**OSCTXT** *pctxt, const char *fmtspec,...)
- int [rtxDiagToStream](#) (**OSCTXT** *pctxt, const char *fmtspec, va_list arglist)
- int [rtxPrintStreamRelease](#) (**OSCTXT** *pctxt)
- void [rtxPrintStreamToStdoutCB](#) (void *pPrntStrmInfo, const char *fmtspec, va_list arglist)
- void [rtxPrintStreamToFileCB](#) (void *pPrntStrmInfo, const char *fmtspec, va_list arglist)
- **OSBOOL** [rtxDiagEnabled](#) (**OSCTXT** *pctxt)
- **OSBOOL** [rtxSetDiag](#) (**OSCTXT** *pctxt, **OSBOOL** value)
- **OSBOOL** [rtxSetGlobalDiag](#) (**OSBOOL** value)
- void [rtxDiagPrint](#) (**OSCTXT** *pctxt, const char *fmtspec,...)
- void [rtxDiagStream](#) (**OSCTXT** *pctxt, const char *fmtspec,...)
- void [rtxDiagHexDump](#) (**OSCTXT** *pctxt, const **OSOCKET** *data, size_t numocts)
- void [rtxDiagStreamHexDump](#) (**OSCTXT** *pctxt, const **OSOCKET** *data, size_t numocts)
- void [rtxDiagPrintChars](#) (**OSCTXT** *pctxt, const char *data, size_t nchars)

- void `rtxDiagStreamPrintChars` (`OSCTXT *pctxt`, const char *data, size_t nchars)
- void `rtxDiagStreamPrintBits` (`OSCTXT *pctxt`, const char *descr, const OSOCTET *data, size_t bitIndex, size_t nbits)
- void `rtxDiagSetTraceLevel` (`OSCTXT *pctxt`, OSRTDiagTraceLevel level)
- OSBOOL `rtxDiagTraceLevelEnabled` (`OSCTXT *pctxt`, OSRTDiagTraceLevel level)

Variables

- OSRTPrintStream `g_PrintStream`

2.29.1 Detailed Description

These functions add diagnostic tracing to the generated code to assist in finding where a problem might occur. Calls to these macros and functions are added when the `-trace` command-line argument is used. The diagnostic message can be turned on and off at both C compile and run-time. To C compile the diagnostics in, the `_TRACE` macro must be defined (`-D_TRACE`). To turn the diagnostics on at run-time, the `rtxSetDiag` function must be invoked with the `value` argument set to `TRUE`.

2.29.2 Typedef Documentation

2.29.2.1 typedef struct OSRTPrintStream OSRTPrintStream

Structure to hold information about a global PrintStream.

2.29.2.2 typedef void(* rtxPrintCallback)(void *pPrntStrmInfo, const char *fmtspec, va_list arglist)

Callback function definition for print stream.

2.29.3 Function Documentation

2.29.3.1 OSBOOL rtxDiagEnabled (OSCTXT * pctxt)

This function is used to determine if diagnostic tracing is currently enabled for the specified context. It returns true if enabled, false otherwise.

Parameters

pctxt Pointer to context structure.

Returns

Boolean result.

2.29.3.2 void rtxDiagHexDump (OSCTXT * pctxt, const OSOCTET * data, size_t numocts)

This function is used to print a diagnostics hex dump of a section of memory.

Parameters

pctxt Pointer to context structure.

data Start address of memory to dump.

numocts Number of bytes to dump.

2.29.3.3 void rtxDiagPrint (OSCTXT * *pctxt*, const char * *fmspec*, ...)

This function is used to print a diagnostics message to `stdout`. Its parameter specification is similar to that of the C runtime `printf` method. The `fmspec` argument may contain % style modifiers into which variable arguments are substituted. This function is called in the generated code via the RTDIAG macros to allow diagnostic trace call to easily be compiled out of the object code.

Parameters

pctxt Pointer to context structure.

fmspec A printf-like format specification string describing the message to be printed (for example, "string %s, ival %d\n"). A special character sequence (~L) may be used at the beginning of the string to select a trace level (L would be replaced with E for Error, W for warning, I for info, or D for debug).

... Variable list of parameters to be substituted into the format string.

2.29.3.4 void rtxDiagPrintChars (OSCTXT * *pctxt*, const char * *data*, size_t *nchars*)

This function is used to print a given number of characters to standard output. The buffer containing the characters does not need to be null-terminated.

Parameters

pctxt Pointer to context structure.

data Start address of character string.

nchars Number of characters to dump (this assumes 1-byte chars).

2.29.3.5 void rtxDiagSetTraceLevel (OSCTXT * *pctxt*, OSRTDiagTraceLevel *level*)

This function is used to set the maximum trace level for diagnostic trace messages. Values are ERROR, WARNING, INFO, or DEBUG. The special string start sequence (~L) described in `rtxDiagPrint` function documentation is used to set a message level to be compared with the trace level.

Parameters

pctxt Pointer to context structure.

level Trace level to be set.

2.29.3.6 void rtxDiagStream (OSCTXT * *pctxt*, const char * *fmspec*, ...)

This function conditionally outputs diagnostic trace messages to an output stream defined within the context. A code generator embeds calls to this function into the generated source code when the `-trace` option is specified on the command line (note: it may embed the macro version of these calls - `RTDIAGSTREAMx` - so that these calls can be compiled out of the final code).

See also

[rtxDiagPrint](#)

2.29.3.7 void rtxDiagStreamHexDump (OSCTXT * *pctxt*, const OSOCTET * *data*, size_t *numocts*)

This function is used to print a diagnostics hex dump of a section of memory to a print stream.

Parameters

- pctxt* Pointer to context structure.
- data* Start address of memory to dump.
- numocts* Number of bytes to dump.

2.29.3.8 void rtxDiagStreamPrintBits (OSCTXT * *pctxt*, const char * *descr*, const OSOCTET * *data*, size_t *bitIndex*, size_t *nbits*)

This function is used to print a given number of bits as '1' or '0' values to a print stream.

Parameters

- pctxt* Pointer to context structure.
- descr* Descriptive text to print before bits
- data* Start address of binary data.
- bitIndex* Zero-based offset to first bit to be printed
- nbits* Number of bits to dump

2.29.3.9 void rtxDiagStreamPrintChars (OSCTXT * *pctxt*, const char * *data*, size_t *nchars*)

This function is used to print a given number of characters to a print stream. The buffer containing the characters does not need to be null-terminated.

Parameters

- pctxt* Pointer to context structure.
- data* Start address of character string.
- nchars* Number of characters to dump (this assumes 1-byte chars).

2.29.3.10 int rtxDiagToStream (OSCTXT * *pctxt*, const char * *fmspec*, va_list *arglist*)

Diagnostics print-to-stream function. This is the same as the `rtxPrintToStream` function except that it checks if diagnostic tracing is enabled before invoking the callback function.

Parameters

- pctxt* Pointer to context to be used.
- fmspec* A printf-like format specification string describing the message to be printed (for example, "string %s, ivalue %d\n").
- arglist* A variable list of arguments passed as `va_list`

Returns

Completion status, 0 on success, negative value on failure

2.29.3.11 OSBOOL rtxDiagTraceLevelEnabled (OSCTXT * *pctxt*, OSRTDiagTraceLevel *level*)

This function tests if a given trace level is enabled.

Parameters

pctxt Pointer to context structure.

level Trace level to check.

Returns

True if enabled.

2.29.3.12 int rtxPrintStreamRelease (OSCTXT * *pctxt*)

This function releases the memory held by PrintStream in the context

Parameters

pctxt Pointer to a context for which the memory has to be released.

Returns

Completion status, 0 on success, negative value on failure

2.29.3.13 void rtxPrintStreamToFileCB (void * *pPrntStrmInfo*, const char * *fmtspeg*, va_list *arglist*)

Standard callback function for use with print-to-stream for writing to a file.

Parameters

pPrntStrmInfo User-defined information for use by the callback function. This is supplied by the user at the time the callback is registered. This parameter should be set to the file pointer (FILE*) to which data is to be written.

fmtspeg Format specification of the data to be printed. This is supplied by the print-to-stream utility.

arglist Variable argument list. This is supplied by the print-to-stream utility.

2.29.3.14 void rtxPrintStreamToStdoutCB (void * *pPrntStrmInfo*, const char * *fmtspeg*, va_list *arglist*)

Standard callback function for use with print-to-stream for writing to stdout.

Parameters

pPrntStrmInfo User-defined information for use by the callback function. This is supplied by the user at the time the callback is registered. In this case, no user-defined information is required, so the argument can be set to NULL when the callback is registered.

fmtspeg Format specification of the data to be printed. This is supplied by the print-to-stream utility.

arglist Variable argument list. This is supplied by the print-to-stream utility.

2.29.3.15 `int rtxPrintToStream (OSCTXT * pctxt, const char * fmspec, ...)`

Print-to-stream function which in turn calls the user registered callback function of the context for printing. If no callback function is registered it prints to standard output by default.

Parameters

pctxt Pointer to context to be used.

fmspec A printf-like format specification string describing the message to be printed (for example, "string %s, ivalue %d\n").

... A variable list of arguments.

Returns

Completion status, 0 on success, negative value on failure

2.29.3.16 `OSBOOL rtxSetDiag (OSCTXT * pctxt, OSBOOL value)`

This function is used to turn diagnostic tracing on or off at run-time on a per-context basis. Code generated using ASN1C or XBinder or a similar code generator must use the -trace command line option to enable diagnostic messages. The generated code must then be C compiled with `_TRACE` defined for the code to be present.

Parameters

pctxt Pointer to context structure.

value Boolean switch: TRUE turns tracing on, FALSE off.

Returns

Prior setting of the diagnostic trace switch in the context.

2.29.3.17 `OSBOOL rtxSetGlobalDiag (OSBOOL value)`

This function is used to turn diagnostic tracing on or off at run-time on a global basis. It is similar to `rtxSetDiag` except tracing is enabled within all contexts.

Parameters

value Boolean switch: TRUE turns tracing on, FALSE off.

Returns

Prior setting of the diagnostic trace switch in the context.

2.29.3.18 `int rtxSetGlobalPrintStream (rtxPrintCallback myCallback, void * pStrmInfo)`

This function is for setting the callback function for a `PrintStream`. This version of the function sets a callback at the global level.

Parameters

myCallback Pointer to a callback print function.

pStrmInfo Pointer to user defined PrintInfo structure where users can store information required by the callback function across calls. Ex. An open File handle for callbak function which directs stream to a file.

Returns

Completion status, 0 on success, negative value on failure

2.29.3.19 int rtxSetPrintStream (OSCTXT * *pctxt*, rtxPrintCallback *myCallback*, void * *pStrmInfo*)

This function is for setting the callback function for a PrintStream. Once a callback function is set, then all print and debug output ia sent to the defined callback function.

Parameters

pctxt Pointer to a context in which callback print function will be set

myCallback Pointer to a callback print function.

pStrmInfo Pointer to user defined PrintInfo structure where users can store information required by the callback function across calls. Ex. An open File handle for callbak function which directs stream to a file.

Returns

Completion status, 0 on success, negative value on failure

2.29.4 Variable Documentation

2.29.4.1 OSRTPrintStream g_PrintStream

Global PrintStream

2.30 Error Formatting and Print Functions

Defines

- #define `LOG_RTERR`(pctxt, stat) `rtxErrSetData(pctxt,stat,__FILE__,__LINE__)`
- #define `LOG_RTERRNEW`(pctxt, stat) `rtxErrSetNewData(pctxt,stat,__FILE__,__LINE__)`
- #define `OSRTASSERT`(condition) `if (!(condition)) { rtxErrAssertionFailed(#condition,__LINE__,__FILE__); }`
- #define `OSRTCHECKPARAM`(condition) `if (condition) { /* do nothing */ }`
- #define `LOG_RTERR1`(pctxt, stat, a) `(a,LOG_RTERR (pctxt, stat),stat)`
- #define `LOG_RTERRNEW1`(pctxt, stat, a) `(a,LOG_RTERRNEW (pctxt, stat),stat)`
- #define `LOG_RTERR2`(pctxt, stat, a, b) `(a,b,LOG_RTERR (pctxt, stat),stat)`
- #define `LOG_RTERRNEW2`(pctxt, stat, a, b) `(a,b,LOG_RTERRNEW (pctxt, stat),stat)`

Typedefs

- typedef int(* `OSErrCbFunc`)(const char *pctxt, void *cbArg_p)

Functions

- OSBOOL `rtxErrAddCtxtBufParm` (`OSCTXT` *pctxt)
- OSBOOL `rtxErrAddDoubleParm` (`OSCTXT` *pctxt, double errParm)
- OSBOOL `rtxErrAddErrorTableEntry` (const char *const *ppStatusText, OSINT32 minErrCode, OSINT32 maxErrCode)
- OSBOOL `rtxErrAddElemNameParm` (`OSCTXT` *pctxt)
- OSBOOL `rtxErrAddIntParm` (`OSCTXT` *pctxt, int errParm)
- OSBOOL `rtxErrAddInt64Parm` (`OSCTXT` *pctxt, OSINT64 errParm)
- OSBOOL `rtxErrAddStrParm` (`OSCTXT` *pctxt, const char *pErrParm)
- OSBOOL `rtxErrAddStrmParm` (`OSCTXT` *pctxt, const char *pErrParm, size_t nchars)
- OSBOOL `rtxErrAddUIntParm` (`OSCTXT` *pctxt, unsigned int errParm)
- OSBOOL `rtxErrAddUInt64Parm` (`OSCTXT` *pctxt, OSUINT64 errParm)
- void `rtxErrAssertionFailed` (const char *conditionText, int lineNo, const char *fileName)
- const char * `rtxErrFmtMsg` (`OSRTErrInfo` *pErrInfo, char *bufp, size_t bufsiz)
- void `rtxErrFreeParms` (`OSCTXT` *pctxt)
- char * `rtxErrGetText` (`OSCTXT` *pctxt, char *pBuf, size_t *pBufSize)
- char * `rtxErrGetTextBuf` (`OSCTXT` *pctxt, char *pbuf, size_t bufsiz)
- char * `rtxErrGetMsgText` (`OSCTXT` *pctxt)
- char * `rtxErrGetMsgTextBuf` (`OSCTXT` *pctxt, char *pbuf, size_t bufsiz)
- `OSRTErrInfo` * `rtxErrNewNode` (`OSCTXT` *pctxt)
- void `rtxErrInit` (OSVOIDARG)
- int `rtxErrReset` (`OSCTXT` *pctxt)
- void `rtxErrLogUsingCB` (`OSCTXT` *pctxt, `OSErrCbFunc` cb, void *cbArg_p)
- void `rtxErrPrint` (`OSCTXT` *pctxt)
- void `rtxErrPrintElement` (`OSRTErrInfo` *pErrInfo)
- int `rtxErrSetData` (`OSCTXT` *pctxt, int status, const char *module, int lineno)
- int `rtxErrSetNewData` (`OSCTXT` *pctxt, int status, const char *module, int lineno)
- int `rtxErrGetFirstError` (const `OSCTXT` *pctxt)
- int `rtxErrGetLastError` (const `OSCTXT` *pctxt)
- OSSIZE `rtxErrGetErrorCnt` (const `OSCTXT` *pctxt)
- int `rtxErrGetStatus` (const `OSCTXT` *pctxt)

- int `rtxErrResetLastErrors` (`OSCTXT *pctxt`, int `errorsToReset`)
- int `rtxErrCopy` (`OSCTXT *pDestCtxt`, const `OSCTXT *pSrcCtxt`)
- int `rtxErrAppend` (`OSCTXT *pDestCtxt`, const `OSCTXT *pSrcCtxt`)
- int `rtxErrInvUIntOpt` (`OSCTXT *pctxt`, `OSUINT32 ident`)

2.30.1 Detailed Description

Error formatting and print functions allow information about encode/decode errors to be added to a context block structure and then printed when the error is propagated to the top level.

2.30.2 Define Documentation

2.30.2.1 `#define LOG_RTERR(pctxt, stat) rtxErrSetData(pctxt,stat,__FILE__,__LINE__)`

This macro is used to log a run-time error in the context. It calls the `rtxErrSetData` function to set the status and error parameters. The C built-in `__FILE__` and `__LINE__` macros are used to record the position in the source file of the error.

Parameters

- pctxt* A pointer to a context structure.
- stat* Error status value from `rtxErrCodes.h`

2.30.2.2 `#define OSRTASSERT(condition) if (!(condition)) { rtxErrAssertionFailed(#condition,__LINE__,__FILE__); }`

This macro is used to check an assertion. This is a condition that is expected to be true. The `rtxErrAssertionFailed` function is called if the condition is not true. The C built-in `__FILE__` and `__LINE__` macros are used to record the position in the source file of the failure.

Parameters

- condition* Condition to check (for example, "(ptr != NULL)")

2.30.2.3 `#define OSRTCHECKPARAM(condition) if (condition) { /* do nothing */ }`

This macro check a condition but takes no action. Its main use is to suppress VC++ level 4 "argument not used" warnings.

Parameters

- condition* Condition to check (for example, "(ptr != NULL)")

2.30.3 Function Documentation

2.30.3.1 `OSBOOL rtxErrAddCtxtBufParm (OSCTXT * pctxt)`

This function adds the contents of the context buffer to the error information structure in the context. The buffer contents are assumed to contain only printable characters.

Parameters

pctxt A pointer to a context structure.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.2 OSBOOL rtxErrAddDoubleParm (OSCTXT * *pctxt*, double *errParm*)

This function adds a double parameter to an error information structure.

Parameters

pctxt A pointer to a context structure.

errParm The double error parameter.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.3 OSBOOL rtxErrAddElemNameParm (OSCTXT * *pctxt*)

This function adds an element name parameter to the context error information structure. The element name is obtained from the context element name stack. If the stack is empty, a question mark character (?) is inserted for the name.

Parameters

pctxt A pointer to a context structure.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.4 OSBOOL rtxErrAddErrorTableEntry (const char *const * *ppStatusText*, OSINT32 *minErrCode*, OSINT32 *maxErrCode*)

This function adds a set of error codes to the global error table. It is called within context initialization functions to add errors defined for a specific domain (for example, ASN.1 encoding/decoding) to be added to the global list of errors.

Parameters

ppStatusText Pointer to table of error status text messages.

minErrCode Minimum error status code.

maxErrCode Maximum error status code.

Returns

The status of the operation (TRUE if entry successfully added to table).

2.30.3.5 OSBOOL rtxErrAddInt64Parm (OSCTXT * *pctxt*, OSINT64 *errParm*)

This function adds a 64-bit integer parameter to an error information structure. Parameter substitution is done in much the same way as it is done in C printf statements. The base error message specification that goes along with a particular status code may have variable fields built in using " modifiers. These would be replaced with actual parameter data.

Parameters

pctxt A pointer to a context structure.
errParm The 64-bit integer error parameter.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.6 OSBOOL rtxErrAddIntParm (OSCTXT * *pctxt*, int *errParm*)

This function adds an integer parameter to an error information structure. Parameter substitution is done in much the same way as it is done in C printf statements. The base error message specification that goes along with a particular status code may have variable fields built in using " modifiers. These would be replaced with actual parameter data.

Parameters

pctxt A pointer to a context structure.
errParm The integer error parameter.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.7 OSBOOL rtxErrAddStrnParm (OSCTXT * *pctxt*, const char * *pErrParm*, size_t *nchars*)

This function adds a given number of characters from a character string parameter to an error information structure.

Parameters

pctxt A pointer to a context structure.
pErrParm The character string error parameter.
nchars Number of characters to add from pErrParm.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.8 OSBOOL rtxErrAddStrParm (OSCTXT * *pctxt*, const char * *pErrParm*)

This function adds a character string parameter to an error information structure.

Parameters

pctxt A pointer to a context structure.

pErrParm The character string error parameter.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.9 OSBOOL rtxErrAddUInt64Parm (OSCTXT * *pctxt*, OSUINT64 *errParm*)

This function adds an unsigned 64-bit integer parameter to an error information structure.

Parameters

pctxt A pointer to a context structure.

errParm The unsigned 64-bit integer error parameter.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.10 OSBOOL rtxErrAddUIntParm (OSCTXT * *pctxt*, unsigned int *errParm*)

This function adds an unsigned integer parameter to an error information structure.

Parameters

pctxt A pointer to a context structure.

errParm The unsigned integer error parameter.

Returns

The status of the operation (TRUE if the parameter was successfully added).

2.30.3.11 int rtxErrAppend (OSCTXT * *pDestCtxt*, const OSCTXT * *pSrcCtxt*)

This function appends error information from one context into another. Error information is added to what previously existed in the destination context.

Parameters

pDestCtxt Pointer to destination context structure to receive the copied error information.

pSrcCtxt Pointer to source context from which error information will be copied.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.30.3.12 void rtxErrAssertionFailed (const char * *conditionText*, int *lineNo*, const char * *fileName*)

This function is used to record an assertion failure. It is used in conjunction with the `OTRTASSERT` macro. It outputs information on the condition to `stderr` and then calls `exit` to terminate the program.

Parameters

- conditionText* The condition that failed (for example, `ptr != NULL`)
- lineNo* Line number in the program of the failure.
- fileName* Name of the C source file in which the assertion failure occurred.

2.30.3.13 int rtxErrCopy (OSCTXT * *pDestCtxt*, const OSCTXT * *pSrcCtxt*)

This function copies error information from one context into another. Any error information that may have existed in the destination context prior to the operation is lost.

Parameters

- pDestCtxt* Pointer to destination context structure to receive the copied error information.
- pSrcCtxt* Pointer to source context from which error information will be copied.

Returns

- Completion status of operation:
- 0(RT_OK) = success,
 - negative return value is error

2.30.3.14 const char* rtxErrFmtMsg (OSRTErrInfo * *pErrInfo*, char * *bufp*, size_t *bufsiz*)

This function formats a given error structure from the context into a finished status message including substituted parameters.

Parameters

- pErrInfo* Pointer to error information structure.
- bufp* Pointer to a destination buffer to receive text.
- bufsiz* Size of the buffer.

Returns

Pointer to the buffer (*bufp*).

2.30.3.15 void rtxErrFreeParms (OSCTXT * *pctxt*)

This function is used to free dynamic memory that was used in the recording of error parameters. After an error is logged, this function should be called to prevent memory leaks.

Parameters

- pctxt* A pointer to a context structure.

2.30.3.16 `OSSIZE rtxErrGetErrorCnt (const OSCTXT * pctxt)`

This function returns the total number of error records.

Parameters

pctxt A pointer to a context structure.

Returns

The total number of error records in the context.

2.30.3.17 `int rtxErrGetFirstError (const OSCTXT * pctxt)`

This function returns the error code, stored in the first error record.

Parameters

pctxt A pointer to a context structure.

Returns

The first status code; zero if no error records exist.

2.30.3.18 `int rtxErrGetLastError (const OSCTXT * pctxt)`

This function returns the error code, stored in the last error record.

Parameters

pctxt A pointer to a context structure.

Returns

The last status code; zero if no error records exist.

2.30.3.19 `char* rtxErrGetMsgText (OSCTXT * pctxt)`

This function returns error message text in a memory buffer. It only returns the formatted error message, not the error status nor stack trace information. Memory is dynamically allocated using the `rtxMemAlloc` function. It should be freed using `rtxMemFreePtr` or it will be freed when the context is freed.

Parameters

pctxt A pointer to a context structure.

Returns

A pointer to a buffer with error text. Dynamic memory will be allocated for this buffer using `rtxMemAlloc`. It should be freed using `rtxMemFreePtr`.

2.30.3.20 `char* rtxErrGetMsgTextBuf (OSCTXT * pctxt, char * pbuf, size_t bufsiz)`

This function returns error message text in a static memory buffer. It only returns the formatted error message, not the error status nor stack trace information. If the formatted text will not fit in the buffer, it is truncated.

Parameters

- pctxt* A pointer to a context structure.
- pbuf* Pointer to a destination buffer to receive text.
- bufsiz* Size of the buffer.

Returns

Pointer to the buffer (*pbuf*).

2.30.3.21 `int rtxErrGetStatus (const OSCTXT * pctxt)`

This function returns the status value from the context. It examines the error list to see how many errors were logged. If none, OK (zero) is returned; if one, then the status value in the single error record is returned; if more than one, the special code `RTERR_MULTIPLE` is returned to indicate that multiple errors occurred.

Parameters

- pctxt* A pointer to a context structure.

Returns

Status code corresponding to errors in the context.

2.30.3.22 `char* rtxErrGetText (OSCTXT * pctxt, char * pBuf, size_t * pBufSize)`

This function returns error text in a memory buffer. If buffer pointer and buffer size are specified in parameters (not NULL) then error text will be copied in the passed buffer. Otherwise, this function allocates memory using the `'rtxMemAlloc'` function. This memory is automatically freed at the time the `'rtxMemFree'` or `'rtxFreeContext'` functions are called. The calling function may free the memory by using `'rtxMemFreePtr'` function.

Parameters

- pctxt* A pointer to a context structure.
- pBuf* A pointer to a destination buffer to obtain the error text. If NULL, dynamic buffer will be allocated.
- pBufSize* A pointer to buffer size. If *pBuf* is NULL and this parameter is not, it will receive the size of allocated dynamic buffer. If *pBuf* is not null, this is expected to be set and hold the size of the buffer.

Returns

A pointer to a buffer with error text. If *pBuf* is not NULL, the return pointer will be equal to it. Otherwise, returns newly allocated buffer with error text. NULL, if error occurred.

2.30.3.23 `char* rtxErrGetTextBuf (OSCTXT * pctxt, char * pbuf, size_t bufsiz)`

This function returns error text in the given fixed-size memory buffer. If the text will not fit in the buffer, it is truncated.

Parameters

- pctxt* A pointer to a context structure.
- pbuf* Pointer to a destination buffer to receive text.
- bufsiz* Size of the buffer.

Returns

Pointer to the buffer (*pbuf*).

2.30.3.24 `void rtxErrInit (OSVOIDARG)`

This function is a one-time initialization function that must be called before any other error processing functions can be called. It adds the common error status text codes to the global error table.

2.30.3.25 `int rtxErrInvUIntOpt (OSCTXT * pctxt, OSUINT32 ident)`

This function create an 'invalid option' error (RTERR_INVOPT) in the context using an unsigned integer parameter.

Parameters

- pctxt* Pointer to context structure.
- ident* Identifier which was found to be invalid.

2.30.3.26 `void rtxErrLogUsingCB (OSCTXT * pctxt, OSErrCbFunc cb, void * cbArg_p)`

This function allows error information to be logged using a user-defined callback routine. The callback routine is invoked IMMEDIATELY; it is not a "callback" in the ordinary use of that word. The callback routine is invoked with error information in the context allowing the user to do application-specific handling (for example, it can be written to an error log or a Window display). After invoking the callback, this method will invoked `rtxErrFreeParms` to free memory associated with the error information.

The prototype of the callback function to be passed is as follows:

```
int cb (const char* pctxt, void* cbArg_p);
```

where *pctxt* is a pointer to the formatted error text string and *cbArg_p* is a pointer to a user-defined callback argument.

Parameters

- pctxt* A pointer to a context structure.
- cb* Callback function pointer.
- cbArg_p* Pointer to a user-defined argument that is passed to the callback function.

2.30.3.27 OSRTErrInfo* rtxErrNewNode (OSCTXT * *pctxt*)

This function creates a new empty error record for the passed context. `rtxErrSetData` function call with `bAllocNew = FALSE` should be used to set the data for this node.

Parameters

pctxt A pointer to a context structure.

Returns

A pointer to a newly allocated error record; NULL, if error occurred.

2.30.3.28 void rtxErrPrint (OSCTXT * *pctxt*)

This function is used to print the error information stored in the context to the standard output device. Parameter substitution is done so that recorded parameters are added to the output message text.

Parameters

pctxt A pointer to a context structure.

2.30.3.29 void rtxErrPrintElement (OSRTErrInfo * *pErrInfo*)

This function is used to print the error information stored in the error information element to the standard output device. Parameter substitution is done so that recorded parameters are added to the output message text.

Parameters

pErrInfo A pointer to an error information element.

2.30.3.30 int rtxErrReset (OSCTXT * *pctxt*)

This function is used to reset the error state recorded in the context to successful. It is used in the generated code in places where automatic error correction can be done.

Parameters

pctxt A pointer to a context structure.

2.30.3.31 int rtxErrResetLastErrors (OSCTXT * *pctxt*, int *errorsToReset*)

This function resets last '*errorsToReset*' errors in the context.

Parameters

pctxt A pointer to a context structure.

errorsToReset A number of errors to reset, starting from the last record.

Returns

Completion status of operation:

- 0(RT_OK) = success,
- negative return value is error

2.30.3.32 `int rtxErrSetData (OSCTXT * pctxt, int status, const char * module, int lineno)`

This function is used to record an error in the context structure. It is typically called via the `LOG_RTERR` macro in the generated code to trap error conditions.

Parameters

- pctxt* A pointer to a context structure.
- status* The error status code from `rtxErrCodes.h`
- module* The C source file in which the error occurred.
- lineno* The line number within the source file of the error.

Returns

The status code that was passed in.

2.30.3.33 `int rtxErrSetNewData (OSCTXT * pctxt, int status, const char * module, int lineno)`

This function is used to record an error in the context structure. It is typically called via the `LOG_RTERRNEW` macro in the generated code to trap error conditions. It always allocates new error record.

Parameters

- pctxt* A pointer to a context structure.
- status* The error status code from `rtxErrCodes.h`
- module* The C source file in which the error occurred.
- lineno* The line number within the source file of the error.

Returns

The status code that was passed in.

2.31 Run-time error status codes.

Defines

- #define RT_OK 0
- #define RT_OK_FRAG 2
- #define RTERR_BUFOVFLW -1
- #define RTERR_ENDOFBUF -2
- #define RTERR_IDNOTFOU -3
- #define RTERR_INVENUM -4
- #define RTERR_SETDUPL -5
- #define RTERR_SETMISRQ -6
- #define RTERR_NOTINSET -7
- #define RTERR_SEQOVFLW -8
- #define RTERR_INVOPT -9
- #define RTERR_NOMEM -10
- #define RTERR_INVHEXS -11
- #define RTERR_INVREAL -12
- #define RTERR_STROVFLW -13
- #define RTERR_BADVALUE -14
- #define RTERR_TOODEEP -15
- #define RTERR_CONSVIO -16
- #define RTERR_ENDOFFILE -17
- #define RTERR_INVUTF8 -18
- #define RTERR_OUTOFBND -19
- #define RTERR_INVPARAM -20
- #define RTERR_INVFORMAT -21
- #define RTERR_NOTINIT -22
- #define RTERR_TOOBIG -23
- #define RTERR_INVCHAR -24
- #define RTERR_XMLSTATE -25
- #define RTERR_XMLPARSE -26
- #define RTERR_SEQORDER -27
- #define RTERR_FILNOTFOU -28
- #define RTERR_READERR -29
- #define RTERR_WRITEERR -30
- #define RTERR_INVBASE64 -31
- #define RTERR_INVSOCKET -32
- #define RTERR_INVATTR -33
- #define RTERR_REGEXP -34
- #define RTERR_PATMATCH -35
- #define RTERR_ATTRMISRQ -36
- #define RTERR_HOSTNOTFOU -37
- #define RTERR_HTTPERR -38
- #define RTERR_SOAPERR -39
- #define RTERR_EXPIRED -40
- #define RTERR_UNEXPELEM -41
- #define RTERR_INVOCUR -42
- #define RTERR_INVMSGBUF -43
- #define RTERR_DECELEMFAIL -44

- #define `RTERR_DECATTRFAIL` -45
- #define `RTERR_STRMINUSE` -46
- #define `RTERR_NULLPTR` -47
- #define `RTERR_FAILED` -48
- #define `RTERR_ATTRFIXEDVAL` -49
- #define `RTERR_MULTIPLE` -50
- #define `RTERR_NOTYPEINFO` -51
- #define `RTERR_ADDRINUSE` -52
- #define `RTERR_CONNRESET` -53
- #define `RTERR_UNREACHABLE` -54
- #define `RTERR_NOCONN` -55
- #define `RTERR_CONNREFUSED` -56
- #define `RTERR_INVSOCKOPT` -57
- #define `RTERR_SOAPFAULT` -58
- #define `RTERR_MARKNOTSUP` -59
- #define `RTERR_NOTSUPP` -60
- #define `RTERR_UNBAL` -61
- #define `RTERR_EXPNAME` -62
- #define `RTERR_UNICODE` -63
- #define `RTERR_INVBOOL` -64
- #define `RTERR_INVNULL` -65
- #define `RTERR_INVLEN` -66
- #define `RTERR_UNKNOWNIE` -67
- #define `RTERR_NOTALIGNED` -68
- #define `RTERR_EXTRDATA` -69
- #define `RTERR_INVMAC` -70
- #define `RTERR_NOSECPARAMS` -71
- #define `RTERR_COPYFAIL` -72
- #define `RTERR_PARSEFAIL` -73

2.31.1 Detailed Description

This is a list of status codes that can be returned by the common run-time functions and generated code. In many cases, additional information and parameters for the different errors are stored in the context structure at the time the error is raised. This additional information can be output using the `rtxErrPrint` or `rtxErrLogUsingCB` run-time functions.

2.31.2 Define Documentation

2.31.2.1 #define `RT_OK` 0

Normal completion status.

2.31.2.2 #define `RT_OK_FRAG` 2

Message fragment return status. This is returned when a part of a message is successfully decoded. The application should continue to invoke the decode function until a zero status is returned.

2.31.2.3 #define RTERR_ADDRINUSE -52

Address already in use. This status code is returned when an attempt is made to bind a socket to an address that is already in use.

2.31.2.4 #define RTERR_ATTRFIXEDVAL -49

Attribute fixed value mismatch. The attribute contained a value that was different than the fixed value defined in the schema for the attribute.

2.31.2.5 #define RTERR_ATTRMISREQ -36

Missing required attribute. This status code is returned by the decoder when an XML instance is missing a required attribute value as defined in the XML schema.

2.31.2.6 #define RTERR_BADVALUE -14

Bad value. This status code is returned anywhere where an API is expecting a value to be within a certain range and it not within this range. An example is the encoding or decoding date values when the month or day value is not within the legal range (1-12 for month and 1 to whatever the max days is for a given month).

2.31.2.7 #define RTERR_BUFOVFLW -1

Encode buffer overflow. This status code is returned when encoding into a static buffer and there is no space left for the item currently being encoded.

2.31.2.8 #define RTERR_CONNREFUSED -56

Connection refused. This status code is returned when an attempt to communicate on an open socket is refused by the host.

2.31.2.9 #define RTERR_CONNRESET -53

Remote connection was reset. This status code is returned when the connection is reset by the remote host (via explicit command or a crash).

2.31.2.10 #define RTERR_CONSVIO -16

Constraint violation. This status code is returned when constraints defined the schema are violated. These include XSD facets such as min/maxOccurs, min/maxLength, patterns, etc.. Also ASN.1 value range, size, and permitted alphabet constraints.

2.31.2.11 #define RTERR_COPYFAIL -72

Copy failed. This occurs when generated copy functions are unable to complete a copy operation due to a runtime library failure.

2.31.2.12 #define RTERR_DECATTRFAIL -45

Attribute decode failed. This status code and parameters are added to the failure status by the decoder to allow the specific attribute on which a decode error was detected to be identified.

2.31.2.13 #define RTERR_DECELEMFAIL -44

Element decode failed. This status code and parameters are added to the failure status by the decoder to allow the specific element on which a decode error was detected to be identified.

2.31.2.14 #define RTERR_ENDOFBUF -2

Unexpected end-of-buffer. This status code is returned when decoding and the decoder expects more data to be available but instead runs into the end of the decode buffer.

2.31.2.15 #define RTERR_ENDOFFILE -17

Unexpected end-of-file error. This status code is returned when an unexpected end-of-file condition is detected on decode. It is similar to the ENDOFBUF error code described above except that in this case, decoding is being done from a file stream instead of from a memory buffer.

2.31.2.16 #define RTERR_EXPIRED -40

Evaluation license expired. This error is returned from evaluation versions of the run-time library when the hard-coded evaluation period is expired.

2.31.2.17 #define RTERR_EXPNAME -62

Expected name. This error code is returned when parsing a name/value pair and the name part is expected, but instead a value is encountered.

2.31.2.18 #define RTERR_EXTRDATA -69

Extraneous data. This error is returned when after decoding is complete, additional undecoded data is still present in the message buffer.

2.31.2.19 #define RTERR_FAILED -48

General failure. Low level call returned error.

2.31.2.20 #define RTERR_FILNOTFOU -28

File not found. This status code is returned if an attempt is made to open a file input stream for decoding and the given file does not exist.

2.31.2.21 #define RTERR_HOSTNOTFOU -37

Host name could not be resolved. This status code is returned from run-time socket functions when they are unable to connect to a given host computer.

2.31.2.22 #define RTERR_HTTPERR -38

HTTP protocol error. This status code is returned by functions doing HTTP protocol operations such as SOAP functions. It is returned when a protocol error is detected. Details on the specific error can be obtained by calling `rtxErrPrint`.

2.31.2.23 #define RTERR_IDNOTFOU -3

Expected identifier not found. This status is returned when the decoder is expecting a certain element to be present at the current position and instead something different is encountered. An example is decoding a sequence container type in which the declared elements are expected to be in the given order. If an element is encountered that is not the one expected, this error is raised.

2.31.2.24 #define RTERR_INVATTR -33

Invalid attribute. This status code is returned by the decoder when an attribute is encountered in an XML instance that was not defined in the XML schema.

2.31.2.25 #define RTERR_INVBASE64 -31

Invalid Base64 encoding. This status code is returned when an error is detected in decoding base64 data.

2.31.2.26 #define RTERR_INVBOOL -64

Invalid boolean keyword. This error code is returned when an invalid boolean keyword in the format of the language being parsed is encountered. For example, 'true' or 'false' in all lowercase letters may be all that is acceptable.

2.31.2.27 #define RTERR_INVCHAR -24

Invalid character. This status code is returned when a character is encountered that is not valid for a given data type. For example, if an integer value is being decoded and a non-numeric character is encountered, this error will be raised.

2.31.2.28 #define RTERR_INVENUM -4

Invalid enumerated identifier. This status is returned when an enumerated value is being encoded or decoded and the given value is not in the set of values defined in the enumeration facet.

2.31.2.29 #define RTERR_INVFORMAT -21

Invalid value format. This status code is returned when a value is received or passed into a function that is not in the expected format. For example, the time string parsing function expects a string in the form "nn:nn:nn" where n's are numbers. If not in this format, this error code is returned.

2.31.2.30 #define RTERR_INVHEXS -11

Invalid hexadecimal string. This status code is returned when decoding a hexadecimal string value and a character is encountered in the string that is not in the valid hexadecimal character set ([0-9A-Fa-f] or whitespace).

2.31.2.31 #define RTERR_INVLEN -66

Invalid length. This error code is returned when a length value is parsed that is not consistent with other lengths in a message. This typically happens when an inner length within a constructed type is larger than the outer length value.

2.31.2.32 #define RTERR_INVMAC -70

Invalid Message Authentication Code. This error is returned when a given message's MAC is not the expected value.

2.31.2.33 #define RTERR_INVMSGBUF -43

Invalid message buffer has been passed to decode or validate method. This status code is returned by decode or validate method when the used message buffer instance has type different from OSMMessageBufferIF::XMLDecode.

2.31.2.34 #define RTERR_INVNULL -65

Invalid null keyword. This error code is returned when an invalid null keyword in the format of the language being parsed is encountered. For example, 'null' in all lowercase letters may be all that is acceptable.

2.31.2.35 #define RTERR_INVOCUR -42

Invalid number of occurrences. This status code is returned by the decoder when an XML instance contains a number of occurrences of a repeating element that is outside the bounds (minOccurs/maxOccurs) defined for the element in the XML schema.

2.31.2.36 #define RTERR_INVOPT -9

Invalid option in choice. This status code is returned when encoding or decoding an ASN.1 CHOICE or XSD xsd:choice construct. When encoding, it occurs when a value in the generated 't' member variable is outside the range of indexes of items in the content model group. It occurs on the decode side when an element is received that is not defined in the content model group.

2.31.2.37 #define RTERR_INVPARAM -20

Invalid parameter passed to a function of method. This status code is returned by a function or method when it does an initial check on the values of parameters passed in. If a parameter is found to not have a value in the expected range, this error code is returned.

2.31.2.38 #define RTERR_INVREAL -12

Invalid real number value. This status code is returned when decoding a numeric floating-point value and an invalid character is received (i.e. not numeric, decimal point, plus or minus sign, or exponent character).

2.31.2.39 #define RTERR_INVSOCKET -32

Invalid socket. This status code is returned when an attempt is made to read or write from a socket and the given socket handle is invalid. This may be the result of not having established a proper connection before trying to use the socket handle variable.

2.31.2.40 #define RTERR_INVSOCKOPT -57

Invalid option. This status code is returned when an invalid option is passed to socket.

2.31.2.41 #define RTERR_INVUTF8 -18

Invalid UTF-8 character encoding. This status code is returned by the decoder when an invalid sequence of bytes is detected in a UTF-8 character string.

2.31.2.42 #define RTERR_MARKNOTSUP -59

This error is returned when an attempt is made to mark a stream position on a stream type that does not support it.

2.31.2.43 #define RTERR_MULTIPLE -50

Multiple errors occurred during an encode or decode operation. See the error list within the context structure for a full list of all errors.

2.31.2.44 #define RTERR_NOCONN -55

Not connected. This status code is returned when an operation is issued on an unconnected socket.

2.31.2.45 #define RTERR_NOMEM -10

No dynamic memory available. This status code is returned when a dynamic memory allocation request is made and an insufficient amount of memory is available to satisfy the request.

2.31.2.46 #define RTERR_NOSECPARAMS -71

No security parameters provided. This error is returned when a NAS message with either integrity protection or ciphering (or both) is received and the required security parameters needed to decrypt it or validate it have not been provided.

2.31.2.47 #define RTERR_NOTALIGNED -68

Not aligned error. This is returned when an element is expected to start on a byte-aligned boundary and is found not to start on an unaligned boundary.

2.31.2.48 #define RTERR_NOTINIT -22

Context not initialized. This status code is returned when the run-time context structure ([OSCTXT](#)) is attempted to be used without having been initialized. This can occur if `rtxInitContext` is not invoked to initialize a context variable

before use in any other API call. It can also occur if there is a license violation (for example, evaluation license expired).

2.31.2.49 #define RTERR_NOTINSET -7

Element not in set. This status code is returned when encoding or decoding an ASN.1 SET or XSD xsd:all construct. When encoding, it occurs when a value in the generated `_order` member variable is outside the range of indexes of items in the content model group. It occurs on the decode side when an element is received that is not defined in the content model group.

2.31.2.50 #define RTERR_NOTSUPP -60

Feature is not supported. This status code is returned when a feature that is currently not supported is encountered. Support may be added in a future release.

2.31.2.51 #define RTERR_NOTYPEINFO -51

This error is returned when decoding a derived type definition and no information exists as to what type of data is in the element content. When decoding XML, this normally means that an `xsi:type` attribute was not found identifying the type of content.

2.31.2.52 #define RTERR_NULLPTR -47

Null pointer. This status code is returned when a null pointer is encountered in a place where it is expected that the pointer value is to be set.

2.31.2.53 #define RTERR_OUTOFBND -19

Array index out-of-bounds. This status code is returned when an attempt is made to add something to an array and the given index is outside the defined bounds of the array.

2.31.2.54 #define RTERR_PARSEFAIL -73

Parse failed. This error is raised when an application receives a text or binary message it is unable to parse.

2.31.2.55 #define RTERR_PATMATCH -35

Pattern match error. This status code is returned by the decoder when a value in an XML instance does not match the pattern facet defined in the XML schema. It can also be returned by numeric encode functions that cannot format a numeric value to match the pattern specified for that value.

2.31.2.56 #define RTERR_READERR -29

Read error. This status code is returned if a read I/O error is encountered when reading from an input stream associated with a physical device such as a file or socket.

2.31.2.57 #define RTERR_REGEXP -34

Invalid regular expression. This status code is returned when a syntax error is detected in a regular expression value. Details of the syntax error can be obtained by invoking `rtxErrPrint` to print the details of the error contained within the context variable.

2.31.2.58 #define RTERR_SEQORDER -27

Sequence order error. This status code is returned when decoding an ASN.1 SEQUENCE or XSD `xsd:sequence` construct. It is raised if the elements were received in an order different than that specified in the content model group definition.

2.31.2.59 #define RTERR_SEQOVFLW -8

Sequence overflow. This status code is returned when decoding a repeating element (ASN.1 SEQUENCE OF or XSD element with `min/maxOccurs > 1`) and more instances of the element are received than were defined in the constraint.

2.31.2.60 #define RTERR_SETDUPL -5

Duplicate element in set. This status code is returned when decoding an ASN.1 SET or XSD `xsd:all` construct. It is raised if a given element defined in the content model group occurs multiple times in the instance being decoded.

2.31.2.61 #define RTERR_SETMISRQ -6

Missing required element in set. This status code is returned when decoding an ASN.1 SET or XSD `xsd:all` construct and all required elements in the content model group are not found to be present in the instance being decoded.

2.31.2.62 #define RTERR_SOAPERR -39

SOAP error. This status code when an error is detected when trying to execute a SOAP operation.

2.31.2.63 #define RTERR_SOAPFAULT -58

This error is returned when decoded SOAP envelope is fault message

2.31.2.64 #define RTERR_STRMINUSE -46

Stream in-use. This status code is returned by stream functions when an attempt is made to initialize a stream or create a reader or writer when an existing stream is open in the context. The existing stream must first be closed before initializaing a stream for a new operation.

2.31.2.65 #define RTERR_STROVFLW -13

String overflow. This status code is returned when a fixed-sized field is being decoded as specified by a size constraint and the item contains more characters or bytes than this amount. It can occur when a run-time function is called with a fixed-sized static buffer and whatever operation is being done causes the bounds of this buffer to be exceeded.

2.31.2.66 #define RTERR_TOOBIG -23

Value will not fit in target variable. This status is returned by the decoder when a target variable is not large enough to hold a decoded value. A typical case is an integer value that is too large to fit in the standard C integer type (typically a 32-bit value) on a given platform. If this occurs, it is usually necessary to use a configuration file setting to force the compiler to use a different data type for the item. For example, for integer, the `<isBigInteger/>` setting can be used to force use of a big integer type.

2.31.2.67 #define RTERR_TOODEEP -15

Nesting level too deep. This status code is returned when a preconfigured maximum nesting level for elements within a content model group is exceeded.

2.31.2.68 #define RTERR_UNBAL -61

Unbalanced structure. This error code is returned when parsing formatted text such as XML or JSON and a block is not properly terminated. For JSON, this occurs when a '{' or '[' character does not have a corresponding '}' or ']' respectively. For XML, it occurs when an open element does not have a corresponding end element.

2.31.2.69 #define RTERR_UNEXPELEM -41

Unexpected element encountered. This status code is returned when an element is encountered in a position where something else (for example, an attribute) was expected.

2.31.2.70 #define RTERR_UNICODE -63

Invalid Unicode sequence. The sequence of characters received did not comprise a valid unicode character.

2.31.2.71 #define RTERR_UNKNOWNIE -67

Unknown information element. This error code is returned when an unknown information element or extension is received and the protocol specification indicates the element must be understood.

2.31.2.72 #define RTERR_UNREACHABLE -54

Network failure. This status code is returned when the network or host is down or otherwise unreachable.

2.31.2.73 #define RTERR_WRITEERR -30

Write error. This status code is returned if a write I/O error is encountered when attempting to output data to an output stream associated with a physical device such as a file or socket.

2.31.2.74 #define RTERR_XMLPARSE -26

XML parser error. This status code is returned when the underlying XML parser application (by default, this is Expat) returns an error code. The parser error code or text is returned as a parameter in the `errInfo` structure within the context structure.

2.31.2.75 #define RTERR_XMLSTATE -25

XML state error. This status code is returned when the XML parser is not in the correct state to do a certain operation.

Chapter 3

Class Documentation

3.1 `_OSRTSList` Struct Reference

```
#include <rtxSList.h>
```

Public Attributes

- OSUINT32 `count`
- OSRTSListNode* `head`
- OSRTSListNode* `tail`
- struct OSCTXT* `pctxt`

3.1.1 Detailed Description

This is the main list structure. It contains a count of the number of elements in the list and pointers to the list head and tail elements.

3.1.2 Member Data Documentation

3.1.2.1 OSUINT32 `_OSRTSList::count`

Count of items in the list.

3.1.2.2 OSRTSListNode* `_OSRTSList::head`

Pointer to first entry in list.

3.1.2.3 OSRTSListNode* `_OSRTSList::tail`

Pointer to last entry in list.

The documentation for this struct was generated from the following file:

- [rtxSList.h](#)

3.2 `_OSRTSListNode` Struct Reference

```
#include <rtxSList.h>
```

Public Attributes

- `void * data`
- `struct _OSRTSListNode * next`

3.2.1 Detailed Description

This structure is used to hold a single data item within the list. It contains a void pointer to point at any type of data item and forward pointer to the next entry in the list.

3.2.2 Member Data Documentation

3.2.2.1 `void* _OSRTSListNode::data`

Pointer to list data item.

3.2.2.2 `struct _OSRTSListNode* _OSRTSListNode::next`

Pointer to next node in list.

The documentation for this struct was generated from the following file:

- [rtxSList.h](#)

3.3 `_OSRTStack` Struct Reference

```
#include <rtxStack.h>
```

Public Attributes

- struct [OSCTXT](#) * `pctxt`
- [OSRTDList](#) `dlist`

3.3.1 Detailed Description

This is the main stack structure. It uses a linked list structure.

The documentation for this struct was generated from the following file:

- [rtxStack.h](#)

3.4 Asn116BitCharSet Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- [Asn116BitCharString charSet](#)
- OSUINT16 [firstChar](#)
- OSUINT16 [lastChar](#)
- unsigned [unalignedBits](#)
- unsigned [alignedBits](#)

3.4.1 Detailed Description

Describes an ASN.1 character set whose characters are 16-bits wide instead of 8-bits wide.

3.4.2 Member Data Documentation

3.4.2.1 unsigned Asn116BitCharSet::alignedBits

The number of bits required by this set in aligned applications.

3.4.2.2 Asn116BitCharString Asn116BitCharSet::charSet

A character string describing the whole character set.

3.4.2.3 OSUINT16 Asn116BitCharSet::firstChar

16-bit integers describing the first and last characters in the set.

3.4.2.4 unsigned Asn116BitCharSet::unalignedBits

The number of bits required by this set in unaligned applications.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.5 Asn16BitCharString Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 **nchars**
- OSUNICHAR * **data**

3.5.1 Detailed Description

A structure that holds a 16-bit ASN.1 character string. This contains the number of characters and a pointer to 16-bit characters that hold the string data.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.6 Asn132BitCharSet Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- [Asn132BitCharString charSet](#)
- OSUINT32 [firstChar](#)
- OSUINT32 [lastChar](#)
- unsigned [unalignedBits](#)
- unsigned [alignedBits](#)

3.6.1 Detailed Description

Describes an ASN.1 character set whose characters are 32-bits wide instead of 8-bits wide.

3.6.2 Member Data Documentation

3.6.2.1 unsigned Asn132BitCharSet::alignedBits

The number of bits required by this set in aligned applications.

3.6.2.2 Asn132BitCharString Asn132BitCharSet::charSet

A character string describing the whole character set.

3.6.2.3 OSUINT32 Asn132BitCharSet::firstChar

32-bit integers describing the first and last characters in the set.

3.6.2.4 unsigned Asn132BitCharSet::unalignedBits

The number of bits required by this set in unaligned applications.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.7 Asn132BitCharString Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 **nchars**
- OS32BITCHAR * **data**

3.7.1 Detailed Description

A structure that holds a 32-bit ASN.1 character string. This contains the number of characters and a pointer to 32-bit characters that hold the string data.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.8 ASN1BigInt Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- `size_t numocts`
- `OSOCTET * mag`
- `int sign`
- `size_t allocated`
- `OSBOOL dynamic`

3.8.1 Detailed Description

A structure used to define an ASN.1 big integer. This structure is rarely, if ever, used by client code, and will instead be used by generated code to facilitate encoding and decoding integer values that cannot fit in normal C/C++ integer types.

3.8.2 Member Data Documentation

3.8.2.1 `size_t ASN1BigInt::allocated`

The number of octets allocated for the magnitude.

3.8.2.2 `OSBOOL ASN1BigInt::dynamic`

A flag that tells whether the buffer is dynamically allocated.

3.8.2.3 `OSOCTET* ASN1BigInt::mag`

The magnitude value.

3.8.2.4 `size_t ASN1BigInt::numocts`

The number of octets used in the magnitude.

3.8.2.5 `int ASN1BigInt::sign`

The sign: either -1, 0, or 1.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.9 ASN1BitStr32 Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 **numbits**
- OSOCTET **data** [4]

3.9.1 Detailed Description

fixed-size bit string that can hold up to 32 bits

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.10 ASN1CCB Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSOCTET * [ptr](#)
- long [len](#)
- int [seqx](#)
- OSUINTEGER16 [mask](#) [ASN1_K_CCBMaskSize]
- size_t [bytes](#)
- int [stat](#)

3.10.1 Detailed Description

The ASN.1 Context Control Block.

This structure is used to help facilitate decoding in SEQUENCE and SET structures. It is rarely (if ever) used directly by client code, and will instead be used in generated code.

3.10.2 Member Data Documentation

3.10.2.1 size_t ASN1CCB::bytes

The bytes processed by the block, used for streaming.

3.10.2.2 long ASN1CCB::len

The constructor length.

3.10.2.3 OSUINTEGER16 ASN1CCB::mask[ASN1_K_CCBMaskSize]

The set mask value.

3.10.2.4 OSOCTET* ASN1CCB::ptr

The constructor pointer.

3.10.2.5 int ASN1CCB::seqx

The sequence element index.

3.10.2.6 int ASN1CCB::stat

The status, as returned by BS_CHKEND.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.11 Asn1CharArray Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- int **nchars**
- char **data** [255]

3.11.1 Detailed Description

A generic character array. The array data holds up to 255 characters, with the actual number of characters being provided by the nchars member.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.12 Asn1CharSet Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- [Asn1CharArray charSet](#)
- `const char *` [canonicalSet](#)
- `int` [canonicalSetSize](#)
- `unsigned` [canonicalSetBits](#)
- `unsigned` [charSetUnalignedBits](#)
- `unsigned` [charSetAlignedBits](#)

3.12.1 Detailed Description

Describes an ASN.1 character set, use primarily for PER encodings whose alphabet constraints can be used to encode more compact representations of their strings.

3.12.2 Member Data Documentation

3.12.2.1 `const char*` [Asn1CharSet::canonicalSet](#)

A character string describing the canonical set of characters.

3.12.2.2 `unsigned` [Asn1CharSet::canonicalSetBits](#)

The number of bits taken up by the canonical set.

3.12.2.3 `int` [Asn1CharSet::canonicalSetSize](#)

The size of the canonical character set.

3.12.2.4 [Asn1CharArray](#) [Asn1CharSet::charSet](#)

The array of characters that comprise this particular character set; at most this takes up 255 characters.

3.12.2.5 `unsigned` [Asn1CharSet::charSetAlignedBits](#)

The number of bits required in aligned applications for this character set.

3.12.2.6 `unsigned` [Asn1CharSet::charSetUnalignedBits](#)

The number of bits required in unaligned applications for this character set.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.13 ASN1DynBitStr Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 **numbits**
- const OSOCTET * **data**

3.13.1 Detailed Description

generic bit string structure (dynamic)

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.14 Asn1Object Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- [ASN1OpenType](#) **encoded**
- void * **decoded**
- OSINT32 **index**

3.14.1 Detailed Description

A generic table constraint value holder. This structure contains the encoded open type value, a pointer-to-void that holds the decoded content, and the integer-valued index of the table constraint value.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.15 ASN1OBJID Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 [numids](#)
- OSUINT32 [subid](#) [ASN_K_MAXSUBIDS]

3.15.1 Detailed Description

This structure describes an object identifier with 32-bit arcs.

3.15.2 Member Data Documentation

3.15.2.1 OSUINT32 ASN1OBJID::numids

The number of sub-identifiers in the OID.

3.15.2.2 OSUINT32 ASN1OBJID::subid[ASN_K_MAXSUBIDS]

An array of sub-identifiers.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.16 ASN1OctStr Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 **numocts**
- OSOCTET **data** [1]

3.16.1 Detailed Description

A generic octet string structure. This contains the number of octets and a data array with a size of one.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.17 ASN1OID64 Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 [numids](#)
- OSUINT64 [subid](#) [ASN_K_MAXSUBIDS]

3.17.1 Detailed Description

This structure describes an object identifier with 64-bit arcs.

3.17.2 Member Data Documentation

3.17.2.1 OSUINT32 ASN1OID64::numids

The number of sub-identifiers in the OID.

3.17.2.2 OSUINT64 ASN1OID64::subid[ASN_K_MAXSUBIDS]

An array of sub-identifiers.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.18 ASN1OpenType Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 **numocts**
- const OSOCTET * **data**

3.18.1 Detailed Description

A generic open type structure. This structure contains a number of octets and the data that compose the open type information.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.19 ASN1SeqOf Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 [n](#)
- void * [elem](#)

3.19.1 Detailed Description

A generic SEQUENCE OF structure that contains a number of elements and a pointer-to-void that contains the contents.

3.19.2 Member Data Documentation

3.19.2.1 void* ASN1SeqOf::elem

The pointer-to-void that contains the elements.

3.19.2.2 OSUINT32 ASN1SeqOf::n

The number of elements.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.20 ASN1SeqOfOctStr Struct Reference

```
#include <asn1type.h>
```

Public Attributes

- OSUINT32 [n](#)
- OSDynOctStr * [elem](#)

3.20.1 Detailed Description

A generic SEQUENCE OF dynamic OCTET STRING.

This structure is used to hold a sequence of octet strings. The elements are pointers-to-OSDynOctStr.

3.20.2 Member Data Documentation

3.20.2.1 OSDynOctStr* ASN1SeqOfOctStr::elem

A pointer-to-OSDynOctStr that contains the elements.

3.20.2.2 OSUINT32 ASN1SeqOfOctStr::n

The number of elements.

The documentation for this struct was generated from the following file:

- [asn1type.h](#)

3.21 DirBufDesc Struct Reference

Public Attributes

- [OSCTXT](#) * **pctxt**
- [OSRTSTREAM](#) * **pUnderStream**
- `size_t` **savedIndex**

The documentation for this struct was generated from the following file:

- [rtxStreamMemory.h](#)

3.22 OSBigInt Struct Reference

Public Attributes

- OSSIZE **numocts**
- OSOCTET * **mag**
- int **sign**
- OSSIZE **allocated**
- OSBOOL **dynamic**

The documentation for this struct was generated from the following file:

- [rtxBigInt.h](#)

3.23 OSBufferIndex Struct Reference

```
#include <rtxContext.h>
```

Public Attributes

- OSSIZE **byteIndex**
- OSINT16 **bitOffset**

3.23.1 Detailed Description

This structure can be used as an index into the buffer.

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.24 OSCTXT Struct Reference

```
#include <rtxContext.h>
```

Public Attributes

- void * **pMemHeap**
- [OSRTBuffer](#) **buffer**
- [OSRTBufSave](#) **savedInfo**
- [OSRTErrInfoList](#) **errInfo**
- OSUINT32 **initCode**
- OSRTFLAGS **flags**
- OSOCTET **level**
- OSOCTET **state**
- OSOCTET **diagLevel**
- OSOCTET **lastChar**
- struct [OSRTSTREAM](#) * **pStream**
- struct [OSRTPrintStream](#) * **pPrintStrm**
- [OSRTDList](#) **elemNameStack**
- [OSRTDList](#) **regExpCache**
- [OSRTStack](#) **containerEndIndexStack**
- const OSOCTET * **key**
- OSSIZE **keylen**
- OSVoidPtr **pXMLInfo**
- OSVoidPtr **pASN1Info**
- OSVoidPtr **pLicInfo**
- OSVoidPtr **pUserData**
- OSVoidPtr **pGlobalData**
- struct OS3GPPSecParams * **p3gppSec**
- [OSFreeCtxtGlobalPtr](#) **gblFreeFunc**
- OSVoidPtr **ssl**
- struct [OSRTDiagBitFieldList](#) * **pBitFldList**
- OSUINT16 **indent**
- OSUINT16 **version**

3.24.1 Detailed Description

Run-time context structure

This structure is a container structure that holds all working variables involved in encoding or decoding a message.

3.24.2 Member Data Documentation

3.24.2.1 OSRTStack OSCTXT::containerEndIndexStack

Stack of [OSBufferIndex](#), representing pointers to the end of currently open containers having length determinants. Each [OSBufferIndex](#) represents the value of the buffer's `byteIndex` and `bitOffset` after the container has been decoded (i.e. the location of the first bit beyond the container). Used by 3GPP decoders.

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.25 OSRTBuffer Struct Reference

```
#include <rtxContext.h>
```

Public Attributes

- OSOCTET * **data**
- OSSIZE **byteIndex**
- OSSIZE **size**
- OSINT16 **bitOffset**
- OSBOOL **dynamic**
- OSBOOL **aligned**

3.25.1 Detailed Description

Run-time message buffer structure

This structure holds encoded message data. For an encode operation, it is where the message being built is stored. For decode, it holds a copy of the message that is being decoded.

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.26 OSRTBufSave Struct Reference

```
#include <rtxContext.h>
```

Public Attributes

- **OSSIZE** **byteIndex**
- **OSINT16** **bitOffset**
- **OSRTFLAGS** **flags**

3.26.1 Detailed Description

Structure to save the current message buffer state

This structure is used to save the current state of the buffer.

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.27 OSRDTList Struct Reference

```
#include <rtxDList.h>
```

Public Attributes

- `OSSIZE count`
- `OSRDTListNode * head`
- `OSRDTListNode * tail`

3.27.1 Detailed Description

This is the main list structure. It contains a count of the number of elements in the list and pointers to the list head and tail elements.

3.27.2 Member Data Documentation

3.27.2.1 `OSSIZE OSRDTList::count`

Count of items in the list.

3.27.2.2 `OSRDTListNode* OSRDTList::head`

Pointer to first entry in list.

3.27.2.3 `OSRDTListNode* OSRDTList::tail`

Pointer to last entry in list.

The documentation for this struct was generated from the following file:

- [rtxDList.h](#)

3.28 OSRTDListBuf Struct Reference

Public Attributes

- OSSIZE **n**
- OSSIZE **nMax**
- OSSIZE **nAll**
- OSSIZE **firstSegSz**
- OSSIZE **elemSize**
- [OSRTDList](#) **tmplist**
- void ** **dataArray**

The documentation for this struct was generated from the following file:

- [rtxDList.h](#)

3.29 OSRTDListNode Struct Reference

```
#include <rtxDList.h>
```

Public Attributes

- void * [data](#)
- struct [OSRTDListNode](#) * [next](#)
- struct [OSRTDListNode](#) * [prev](#)

3.29.1 Detailed Description

This structure is used to hold a single data item within the list. It contains a void pointer to point at any type of data item and forward and backward pointers to the next and previous entries in the list.

3.29.2 Member Data Documentation

3.29.2.1 void* OSRTDListNode::data

Pointer to list data item.

3.29.2.2 struct OSRTDListNode* OSRTDListNode::next

Pointer to next node in list.

3.29.2.3 struct OSRTDListNode* OSRTDListNode::prev

Pointer to previous node in list.

The documentation for this struct was generated from the following file:

- [rtxDList.h](#)

3.30 OSRTDListUTF8StrNode Struct Reference

Public Attributes

- [OSRTDListNode](#) **node**
- OSUTF8CHAR **utf8chars** [1]

The documentation for this struct was generated from the following file:

- [rtxDList.h](#)

3.31 OSRErrInfo Struct Reference

```
#include <rtxContext.h>
```

Public Attributes

- [OSRErrLocn](#) **stack** [OSRERRSTKSIZ]
- OSINT16 **status**
- OSUINT8 **stkx**
- OSUINT8 **parment**
- OSUTF8CHAR * **parms** [OSRTMAXERRPRM]
- OSUTF8CHAR * **elemName**

3.31.1 Detailed Description

Run-time error information structure

This structure is a container structure that holds information on run-time errors. The stack variable holds the trace stack information that shows where the error occurred in the source code. The parms variable holds error parameters that are substituted into the message that is returned to the user.

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.32 OSRTErrInfoList Struct Reference

Public Attributes

- [OSRTDList](#) list
- [OSRTErrInfo](#) reserved
- [OSRTDListNode](#) reservedNode

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.33 OSRTErrLocn Struct Reference

```
#include <rtxContext.h>
```

Public Attributes

- const OSUTF8CHAR * **module**
- OSINT32 **lineno**

3.33.1 Detailed Description

Run-time error location structure

This structure is a container structure that holds information on the location within a C source file where a run-time error occurred.

The documentation for this struct was generated from the following file:

- [rtxContext.h](#)

3.34 OSRTMEMBUF Struct Reference

Public Attributes

- [OSCTXT](#) * **pctxt**
- OSSIZE **segsz**
- OSSIZE **startidx**
- OSSIZE **usedcnt**
- OSSIZE **bufsz**
- OSSIZE **bitOffset**
- OSUINT32 **userState**
- OSOCTET * **buffer**
- OSBOOL **isDynamic**
- OSBOOL **isExpandable**
- OSBOOL **useSysMem**

The documentation for this struct was generated from the following file:

- [rtxMemBuf.h](#)

3.35 OSRTPrintStream Struct Reference

```
#include <rtxPrintStream.h>
```

Public Attributes

- [rtxPrintCallback](#) **pfPrintFunc**
- void * **pPrntStrmInfo**

3.35.1 Detailed Description

Structure to hold information about a global PrintStream.

The documentation for this struct was generated from the following file:

- [rtxPrintStream.h](#)

3.36 OSRTSTREAM Struct Reference

```
#include <rtxStream.h>
```

Public Attributes

- OSRTStreamReadProc read
- OSRTStreamBlockingReadProc blockingRead
- OSRTStreamWriteProc write
- OSRTStreamFlushProc flush
- OSRTStreamCloseProc close
- OSRTStreamSkipProc skip
- OSRTStreamMarkProc mark
- OSRTStreamResetProc reset
- OSRTStreamGetPosProc getPos
- OSRTStreamSetPosProc setPos
- void * extra
- size_t bufsize
- size_t readAheadLimit
- size_t bytesProcessed
- size_t markedBytesProcessed
- size_t ioBytes
- size_t nextMarkOffset
- size_t segsize
- OSUINT32 id
- OSRTMEMBUF * pCaptureBuf
- OSUINT16 flags

3.36.1 Detailed Description

The stream control block. A user may implement a customized stream by defining read, skip, close functions for input streams and write, flush, close for output streams.

3.36.2 Member Data Documentation

3.36.2.1 OSRTStreamBlockingReadProc OSRTSTREAM::blockingRead

pointer to blockingRead function

3.36.2.2 size_t OSRTSTREAM::bufsize

physical size of pctxt->buffer.data buffer

3.36.2.3 size_t OSRTSTREAM::bytesProcessed

the number of bytes processed by the application program

3.36.2.4 OSRTStreamCloseProc OSRTSTREAM::close

pointer to close function

3.36.2.5 void* OSRTSTREAM::extra

pointer to stream-specific data

3.36.2.6 OSUINT16 OSRTSTREAM::flags

flags (see OSRTSTRMF_* macros)

3.36.2.7 OSRTStreamFlushProc OSRTSTREAM::flush

pointer to flush function

3.36.2.8 OSRTStreamGetPosProc OSRTSTREAM::getPos

pointer to getPos function

3.36.2.9 OSUINT32 OSRTSTREAM::id

id of stream (see OSRTSTRMID_* macros)

3.36.2.10 size_t OSRTSTREAM::ioBytes

the actual number of bytes read from or written to the stream

3.36.2.11 OSRTStreamMarkProc OSRTSTREAM::mark

pointer to mark function

3.36.2.12 size_t OSRTSTREAM::markedBytesProcessed

the marked number of bytes already processed

3.36.2.13 size_t OSRTSTREAM::nextMarkOffset

offset of next appropriate mark position

3.36.2.14 OSRTMEMBUF* OSRTSTREAM::pCaptureBuf

Buffer into which data read from stream can be captured for debugging purposes.

3.36.2.15 OSRTStreamReadProc OSRTSTREAM::read

pointer to read function

3.36.2.16 `size_t OSRTSTREAM::readAheadLimit`

read ahead limit (used by [rtxStreamMark](#)/[rtxStreamReset](#))

3.36.2.17 `OSRTStreamResetProc OSRTSTREAM::reset`

pointer to reset function

3.36.2.18 `size_t OSRTSTREAM::segsz`

size of decoded segment

3.36.2.19 `OSRTStreamSetPosProc OSRTSTREAM::setPos`

pointer to setPos function

3.36.2.20 `OSRTStreamSkipProc OSRTSTREAM::skip`

pointer to skip function

3.36.2.21 `OSRTStreamWriteProc OSRTSTREAM::write`

pointer to write function

The documentation for this struct was generated from the following file:

- [rtxStream.h](#)

Chapter 4

File Documentation

4.1 `asn1type.h` File Reference

```
#include <limits.h>
#include <stdio.h>
#include <string.h>
#include <stddef.h>
#include <setjmp.h>
#include <stdlib.h>
#include <time.h>
#include <wchar.h>
#include "rtxsrc/rtxExternDefs.h"
#include "rtxsrc/rtxSList.h"
#include "rtxsrc/rtxStack.h"
#include "rtxsrc/rtxUTF8.h"
#include "rtsrc/asn1tag.h"
#include "rtsrc/asn1ErrCodes.h"
#include "rtsrc/asn1version.h"
#include "rtsrc/rtExternDefs.h"
#include <float.h>
#include "rtxsrc/rtxBitString.h"
#include "rtsrc/rtContext.h"
#include "rtxsrc/rtxCommonDefs.h"
#include "rtxsrc/rtxError.h"
#include "rtxsrc/rtxMemory.h"
```


Classes

- struct [ASN1OBJID](#)
- struct [ASN1OID64](#)
- struct [ASN1OctStr](#)
- struct [ASN1DynBitStr](#)
- struct [ASN1BitStr32](#)
- struct [ASN1SeqOf](#)
- struct [ASN1SeqOfOctStr](#)
- struct [ASN1OpenType](#)
- struct [Asn1Object](#)
- struct [Asn116BitCharString](#)
- struct [Asn132BitCharString](#)
- struct [Asn1CharArray](#)
- struct [Asn1CharSet](#)
- struct [Asn116BitCharSet](#)
- struct [Asn132BitCharSet](#)
- struct [ASN1BigInt](#)
- struct [ASN1CCB](#)

Defines

- #define [XM_SEEK](#) 0x01
- #define [XM_ADVANCE](#) 0x02
- #define [XM_DYNAMIC](#) 0x04
- #define [XM_SKIP](#) 0x08
- #define [XM_OPTIONAL](#) 0x10
- #define [ASN_K_MAXDEPTH](#) 32
- #define [ASN_K_MAXENUM](#) 100
- #define [ASN_K_MAXERRP](#) 5
- #define [ASN_K_MAXERRSTK](#) 8
- #define [ASN_K_ENCBUFSIZ](#) 16*1024
- #define [ASN_K_MEMBUFSEG](#) 1024
- #define [OSRTINDENTSPACES](#) 3
- #define [ASN1_K_PLUS_INFINITY](#) 0x40
- #define [ASN1_K_MINUS_INFINITY](#) 0x41
- #define [REAL_BINARY](#) 0x80
- #define [REAL_SIGN](#) 0x40
- #define [REAL_EXPLEN_MASK](#) 0x03
- #define [REAL_EXPLEN_1](#) 0x00
- #define [REAL_EXPLEN_2](#) 0x01
- #define [REAL_EXPLEN_3](#) 0x02
- #define [REAL_EXPLEN_LONG](#) 0x03
- #define [REAL_FACTOR_MASK](#) 0x0c
- #define [REAL_BASE_MASK](#) 0x30
- #define [REAL_BASE_2](#) 0x00
- #define [REAL_BASE_8](#) 0x10
- #define [REAL_BASE_16](#) 0x20
- #define [REAL_ISO6093_MASK](#) 0x3F
- #define [ASN1REALMAX](#) (OSREAL)DBL_MAX

- #define **ASN1REALMIN** (OSREAL)-DBL_MAX
- #define **ASN_K_MAXSUBIDS** 128
- #define **ASN1DynOctStr** OSDynOctStr
- #define **OSSETBIT**(bitStr, bitIndex) rtxSetBit (bitStr.data, bitStr.numbits, bitIndex)
- #define **OSSETBITP**(pBitStr, bitIndex) rtxSetBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)
- #define **OSCLEARBIT**(bitStr, bitIndex) rtxClearBit (bitStr.data, bitStr.numbits, bitIndex)
- #define **OSCLEARBITP**(pBitStr, bitIndex) rtxClearBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)
- #define **OSTESTBIT**(bitStr, bitIndex) rtxTestBit (bitStr.data, bitStr.numbits, bitIndex)
- #define **OSTESTBITP**(pBitStr, bitIndex) rtxTestBit ((pBitStr)->data, (pBitStr)->numbits, bitIndex)
- #define **ASN1_K_CCBMaskSize** 32
- #define **ASN1_K_NumBitsPerMask** 16
- #define **ASN1_K_MaxSetElements** (ASN1_K_CCBMaskSize*ASN1_K_NumBitsPerMask)
- #define **ASN1NUMOCTS**(nbits) ((nbits>0)?(((nbits-1)/8)+1):0)
 - #define **ALLOC_ASN1ARRAY**(pctxt, pseqof, type)
 - #define **ALLOC_ASN1ARRAY1**(pctxt, pseqof, type)

Typedefs

- typedef void * **ASN1ANY**
- typedef **Asn1Object** **ASN1Object**
- typedef OSUNICHAR **ASN116BITCHAR**
- typedef const char * **ASN1GeneralizedTime**
- typedef const char * **ASN1GeneralString**
- typedef const char * **ASN1GraphicString**
- typedef const char * **ASN1IA5String**
- typedef const char * **ASN1ISO646String**
- typedef const char * **ASN1NumericString**
- typedef const char * **ASN1ObjectDescriptor**
- typedef const char * **ASN1PrintableString**
- typedef const char * **ASN1TeletexString**
- typedef const char * **ASN1T61String**
- typedef const char * **ASN1UTCTime**
- typedef const char * **ASN1VideotexString**
- typedef const char * **ASN1VisibleString**
- typedef const OSUTF8CHAR * **ASN1UTF8String**
- typedef **Asn116BitCharString** **ASN1BMPSString**
- typedef **Asn132BitCharString** **ASN1UniversalString**
- typedef struct **ASN1BigInt** **ASN1BigInt**
- typedef int(* **ASN1DumpCbFunc**)(const char *text_p, void *cbArg_p)

Enumerations

- enum **ASN1StrType** { **ASN1HEX**, **ASN1BIN**, **ASN1CHR** }
- enum **ASN1ActionType** { **ASN1ENCODE**, **ASN1DECODE** }

Functions

- void `rtSetOID` (`ASN1OBJID *ptarget`, `ASN1OBJID *psource`)
- void `rtAddOID` (`ASN1OBJID *ptarget`, `ASN1OBJID *psource`)
- OSBOOL `rtOIDsEqual` (`const ASN1OBJID *pOID1`, `const ASN1OBJID *pOID2`)
- int `rtOIDParseDottedNumberString` (`const char *oidstr`, `OSSIZE oidstrlen`, `ASN1OBJID *pvalue`)
- OSBOOL `rtOIDsValid` (`const ASN1OBJID *pvalue`)
- int `rtMakeGeneralizedTime` (`OSCTXT *pctxt`, `const OSNumDateTime *dateTime`, `char **outdata`, `size_t outdataSize`)
- int `rtMakeUTCTime` (`OSCTXT *pctxt`, `const OSNumDateTime *dateTime`, `char **outdata`, `size_t outdataSize`)
- int `rtParseGeneralizedTime` (`OSCTXT *pctxt`, `const char *value`, `OSNumDateTime *dateTime`)
- int `rtParseUTCTime` (`OSCTXT *pctxt`, `const char *value`, `OSNumDateTime *dateTime`)
- void `normalizeTimeZone` (`OSNumDateTime *pvalue`)
- int `rtValidateStr` (`ASN1TAG tag`, `const char *pdata`)
- int `rtValidateChars` (`ASN1TAG tag`, `const char *pdata`, `size_t nchars`)
- `const char *` `rtBMPToCString` (`ASN1BMPString *pBMPString`, `char *cstring`, `OSUINT32 cstrsize`)
- `const char *` `rtBMPToNewCString` (`ASN1BMPString *pBMPString`)
- `const char *` `rtBMPToNewCStringEx` (`OSCTXT *pctxt`, `ASN1BMPString *pBMPString`)
- `ASN1BMPString *` `rtToBMPString` (`OSCTXT *pctxt`, `const char *cstring`, `ASN1BMPString *pBMPString`, `Asn116BitCharSet *pCharSet`)
- OSBOOL `rtIsIn16BitCharSet` (`OSUNICHAR ch`, `Asn116BitCharSet *pCharSet`)
- `const char *` `rtUCSToCString` (`ASN1UniversalString *pUCSString`, `char *cstring`, `OSUINT32 cstrsize`)
- `const char *` `rtUCSToNewCString` (`ASN1UniversalString *pUCSString`)
- `const char *` `rtUCSToNewCStringEx` (`OSCTXT *pctxt`, `ASN1UniversalString *pUCSString`)
- `ASN1UniversalString *` `rtToUCSString` (`OSCTXT *pctxt`, `const char *cstring`, `ASN1UniversalString *pUCSString`, `Asn132BitCharSet *pCharSet`)
- OSBOOL `rtIsIn32BitCharSet` (`OS32BITCHAR ch`, `Asn132BitCharSet *pCharSet`)
- `wchar_t *` `rtUCSToWCSSString` (`ASN1UniversalString *pUCSString`, `wchar_t *wcstring`, `OSUINT32 wcstrsize`)
- `ASN1UniversalString *` `rtWCSToUCSString` (`OSCTXT *pctxt`, `wchar_t *wcstring`, `ASN1UniversalString *pUCSString`, `Asn132BitCharSet *pCharSet`)
- int `rtUnivStrToUTF8` (`OSCTXT *pctxt`, `const ASN1UniversalString *pUnivStr`, `OSOCTET *outbuf`, `size_t outbufsiz`)
- int `rtUTF8StrToASN1DynBitStr` (`OSCTXT *pctxt`, `const OSUTF8CHAR *utf8str`, `ASN1DynBitStr *pvalue`)
- int `rtUTF8StrnToASN1DynBitStr` (`OSCTXT *pctxt`, `const OSUTF8CHAR *utf8str`, `size_t nbytes`, `ASN1DynBitStr *pvalue`)

4.1.1 Detailed Description

Common ASN.1 runtime constants, data structure definitions, and run-time functions to support the BER/DER/PER/XER as defined in the ITU-T standards.

4.2 rtBCD.h File Reference

```
#include "rtsrc/asn1type.h"
#include "rtxsrc/rtxBBCD.h"
```

Defines

- #define [rtQ825TBCDToString](#)(numocts, data, buffer, bufsiz) `rtxQ825TBCDToString(numocts, data, buffer, bufsiz)`
- #define [rtDecQ825TBCDString](#)(pctxt, numocts, buffer, bufsiz) `rtxDecQ825TBCDString(pctxt, numocts, buffer, bufsiz)`
- #define [rtEncQ825TBCDString](#)(pctxt, str) `rtxEncQ825TBCDString(pctxt, str)`
- #define [rtTBCDBinToChar](#)(bcdDigit, pdigit) `rtxTBCDBinToChar(bcdDigit, pdigit)`
- #define [rtTBCDCharToBin](#)(digit, pbyte) `rtxTBCDCharToBin(digit, pbyte)`

Functions

- `const char * rtBCDToString (OSUINT32 numocts, const OSOCTET *data, char *buffer, size_t bufsiz, OSBOOL isTBCD)`
- `int rtStringToBCD (const char *str, OSOCTET *bcdStr, size_t bufsiz, OSBOOL isTBCD)`
- `int rtStringToDynBCD (OSCTXT *pctxt, const char *str, ASN1DynOctStr *pocstr)`
- `int rtStringToTBCD (const char *str, OSOCTET *bcdStr, size_t bufsiz)`
- `const char * rtTBCDToString (OSUINT32 numocts, const OSOCTET *data, char *buffer, size_t bufsiz)`

4.2.1 Detailed Description

Binary-decimal conversion functions.

4.3 rtCompare.h File Reference

```
#include "asn1type.h"
#include <limits.h>
#include <stdio.h>
#include <string.h>
#include <stddef.h>
#include <setjmp.h>
#include <stdlib.h>
#include <time.h>
#include <wchar.h>
#include "rtxsrc/rtxExternDefs.h"
#include "rtxsrc/rtxSList.h"
#include "rtxsrc/rtxStack.h"
#include "rtxsrc/rtxUTF8.h"
#include "rtsrc/asn1tag.h"
#include "rtsrc/asn1ErrCodes.h"
#include "rtsrc/asn1version.h"
#include "rtsrc/rtExternDefs.h"
#include <float.h>
#include "rtxsrc/rtxBitString.h"
#include "rtsrc/rtContext.h"
#include "rtxsrc/rtxCommonDefs.h"
#include "rtxsrc/rtxError.h"
#include "rtxsrc/rtxMemory.h"
#include "rtsrc/asn1type.h"
```

Defines

- #define [rtCmpOID](#) rtCmpOIDValue
- #define [rtCmpOID64](#) rtCmpOID64Value

Functions

- OSBOOL [rtCmpBoolean](#) (const char *name, OSBOOL value, OSBOOL compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpInt8](#) (const char *name, OSINT8 value, OSINT8 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpSInt](#) (const char *name, OSINT16 value, OSINT16 compValue, char *errBuff, OSSIZE errBuffSize)

- OSBOOL [rtCmpUInt8](#) (const char *name, OSUINT8 value, OSUINT8 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUSInt](#) (const char *name, OSUINT16 value, OSUINT16 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpInteger](#) (const char *name, OSINT32 value, OSINT32 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUnsigned](#) (const char *name, OSUINT32 value, OSUINT32 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpInt64](#) (const char *name, OSINT64 value, OSINT64 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpUInt64](#) (const char *name, OSUINT64 value, OSUINT64 compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpBitStr](#) (const char *name, OSSIZE numbits, const OSOCTET *data, OSSIZE compNumbits, const OSOCTET *compData, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOctStr](#) (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpCharStr](#) (const char *name, const char *cstring, const char *compCString, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmp16BitCharStr](#) (const char *name, [Asn116BitCharString](#) *bstring, [Asn116BitCharString](#) *compBstring, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmp32BitCharStr](#) (const char *name, [Asn132BitCharString](#) *bstring, [Asn132BitCharString](#) *compBstring, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpReal](#) (const char *name, OSREAL value, OSREAL compValue, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOIDValue](#) (const char *name, [ASN1OBJID](#) *pOID, [ASN1OBJID](#) *pcompOID, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOID64Value](#) (const char *name, [ASN1OID64](#) *pOID, [ASN1OID64](#) *pcompOID, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOpenType](#) (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOpenTypeExt](#) (const char *name, [OSRTDList](#) *pElemList, [OSRTDList](#) *pCompElemList, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpTag](#) (const char *name, int tag, int compTag, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpSeqOfElements](#) (const char *name, OSSIZE noOfElems, OSSIZE compNoOfElems, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpOptional](#) (const char *name, unsigned presentBit, unsigned compPresentBit, char *errBuff, OSSIZE errBuffSize)
- OSBOOL [rtCmpToStdoutBoolean](#) (const char *name, OSBOOL value, OSBOOL compValue)
- OSBOOL [rtCmpToStdoutInteger](#) (const char *name, OSINT32 value, OSINT32 compValue)
- OSBOOL [rtCmpToStdoutInt64](#) (const char *name, OSINT64 value, OSINT64 compValue)
- OSBOOL [rtCmpToStdoutUnsigned](#) (const char *name, OSUINT32 value, OSUINT32 compValue)
- OSBOOL [rtCmpToStdoutUInt64](#) (const char *name, OSUINT64 value, OSUINT64 compValue)
- OSBOOL [rtCmpToStdoutBitStr](#) (const char *name, OSSIZE numbits, const OSOCTET *data, OSSIZE compNumbits, const OSOCTET *compData)
- OSBOOL [rtCmpToStdoutOctStr](#) (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData)
- OSBOOL [rtCmpToStdoutCharStr](#) (const char *name, const char *cstring, const char *compCString)
- OSBOOL [rtCmpToStdout16BitCharStr](#) (const char *name, [Asn116BitCharString](#) *bstring, [Asn116BitCharString](#) *compBstring)
- OSBOOL [rtCmpToStdout32BitCharStr](#) (const char *name, [Asn132BitCharString](#) *bstring, [Asn132BitCharString](#) *compBstring)
- OSBOOL [rtCmpToStdoutReal](#) (const char *name, OSREAL value, OSREAL compValue)

- OSBOOL `rtCmpToStdoutOID` (const char *name, ASN1OBJID *pOID, ASN1OBJID *pcompOID)
- OSBOOL `rtCmpToStdoutOIDValue` (const char *name, ASN1OBJID *pOID, ASN1OBJID *pcompOID)
- OSBOOL `rtCmpToStdoutOID64` (const char *name, ASN1OID64 *pOID, ASN1OID64 *pcompOID)
- OSBOOL `rtCmpToStdoutOID64Value` (const char *name, ASN1OID64 *pOID, ASN1OID64 *pcompOID)
- OSBOOL `rtCmpToStdoutOpenType` (const char *name, OSSIZE numocts, const OSOCTET *data, OSSIZE compNumocts, const OSOCTET *compData)
- OSBOOL `rtCmpToStdoutOpenTypeExt` (const char *name, OSRTDList *pElemList, OSRTDList *pCompElemList)
- OSBOOL `rtCmpToStdoutTag` (const char *name, int tag, int compTag)
- OSBOOL `rtCmpToStdoutSeqOfElements` (const char *name, OSSIZE noOfElems, OSSIZE compNoOfElems)
- OSBOOL `rtCmpToStdoutOptional` (const char *name, unsigned presentBit, unsigned compPresentBit)

4.3.1 Detailed Description

Functions for comparing the values of primitive ASN.1 types.

4.4 rtCopy.h File Reference

```
#include "rtsrc/asn1type.h"
```

Defines

- #define [RTCOPYCHARSTR](#)(pctxt, src, dst) do { char* ptr; rtCopyCharStr (pctxt, src, &ptr); *dst = ptr; } while(0)
- #define [RTCHKCOPYCHARSTR](#)(pctxt, src, dst, log)

Functions

- OSBOOL [rtCopyBitStr](#) (OSUINT32 srcNumbits, const OSOCTET *pSrcData, OSUINT32 *pDstNumbits, OSOCTET *pDstData)
- OSBOOL [rtCopyDynBitStr](#) (OSCTXT *pctxt, const [ASN1DynBitStr](#) *pSrcData, [ASN1DynBitStr](#) *pDstData)
- OSBOOL [rtCopyOctStr](#) (OSUINT32 srcNumocts, const OSOCTET *pSrcData, OSUINT32 *pDstNumocts, OSOCTET *pDstData)
- OSBOOL [rtCopyDynOctStr](#) (OSCTXT *pctxt, const [ASN1DynOctStr](#) *pSrcData, [ASN1DynOctStr](#) *pDstData)
- OSBOOL [rtCopyCharStr](#) (OSCTXT *pctxt, const char *srcStr, char **dstStr)
- OSBOOL [rtCopy16BitCharStr](#) (OSCTXT *pctxt, const [Asn116BitCharString](#) *srcStr, [Asn116BitCharString](#) *dstStr)
- OSBOOL [rtCopy32BitCharStr](#) (OSCTXT *pctxt, const [Asn132BitCharString](#) *srcStr, [Asn132BitCharString](#) *dstStr)
- OSBOOL [rtCopyOID](#) (const [ASN1OBJID](#) *srcOID, [ASN1OBJID](#) *dstOID)
- OSBOOL [rtCopyOID64](#) (const [ASN1OID64](#) *srcOID, [ASN1OID64](#) *dstOID)
- OSBOOL [rtCopyOpenType](#) (OSCTXT *pctxt, const [ASN1OpenType](#) *srcOT, [ASN1OpenType](#) *dstOT)
- OSBOOL [rtCopyOpenTypeExt](#) (OSCTXT *pctxt, const [OSRTDList](#) *srcList, [OSRTDList](#) *dstList)

4.4.1 Detailed Description

Functions for copying values of primitive ASN.1 types.

4.4.2 Define Documentation

4.4.2.1 #define RTCHKCOPYCHARSTR(pctxt, src, dst, log)

Value:

```
do { \
    char* ptr; \
    if (! rtCopyCharStr (pctxt, src, &ptr)) { \
        if (log) return LOG_RTERR (pctxt, RTERR_COPYFAIL); \
        else return RTERR_COPYFAIL; \
    } \
    *dst = ptr; \
} while(0)
```

This macro copies the source string to the destination string by calling the common runtime function [rtCopyCharStr](#). This function allocates memory on the managed heap to store the string that will be released when [rtxMemFree](#) or [rtFreeContext](#) are called. This macro contains an error status check and will return a failure if needed.

Parameters

- pctxt* A pointer to an [OSCTXT](#) data structure.
- src* The source string.
- dst* The destination string.
- log* Whether to log the error or just return the code.

4.4.2.2 `#define RTCOPYCHARSTR(pctxt, src, dst) do { char* ptr; rtCopyCharStr (pctxt, src, &ptr); *dst = ptr; } while(0)`

This macro copies the source string to the destination string by calling the common runtime function [rtCopyCharStr](#). This function allocates memory on the managed heap to store the string that will be released when [rtxMemFree](#) or [rtFreeContext](#) are called.

Parameters

- pctxt* A pointer to an [OSCTXT](#) data structure.
- src* The source string.
- dst* The destination string.

4.5 rtxBase64.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Functions

- long [rtxBase64EncodeData](#) (OSCTXT *pctx, const char *pSrcData, size_t srcDataSize, OSOCTET **ppDstData)
- long [rtxBase64EncodeURLParam](#) (OSCTXT *pctx, const char *pSrcData, size_t srcDataSize, OSOCTET **ppDstData)
- long [rtxBase64DecodeData](#) (OSCTXT *pctx, const char *pSrcData, size_t srcDataSize, OSOCTET **ppDstData)
- long [rtxBase64DecodeDataToFSB](#) (OSCTXT *pctx, const char *pSrcData, size_t srcDataSize, OSOCTET *buf, size_t bufsiz)
- long [rtxBase64GetBinDataLen](#) (const char *pSrcData, size_t srcDataSize)

4.5.1 Detailed Description

4.5.2 Function Documentation

4.5.2.1 long [rtxBase64DecodeData](#) (OSCTXT *pctx, const char *pSrcData, size_t srcDataSize, OSOCTET **ppDstData)

Decode base64 string to binary form into a dynamic buffer.

Parameters

pctx Pointer to context structure.

pSrcData Pointer to base64 string to decode.

srcDataSize Length of the base64 string.

ppDstData Pointer to pointer variable to hold address of dynamically allocated buffer to hold data.

Returns

Completion status of operation:

- number of binary bytes written
- negative return value is error.

4.5.2.2 long [rtxBase64DecodeDataToFSB](#) (OSCTXT *pctx, const char *pSrcData, size_t srcDataSize, OSOCTET *buf, size_t bufsiz)

Decode base64 string to binary form into a fixed-size buffer.

Parameters

pctx Pointer to context structure.

pSrcData Pointer to base64 string to decode.

srcDataSize Length of the base64 string.

buf Address of buffer to receive decoded binary data.

bufsiz Size of output buffer.

Returns

Completion status of operation:

- number of binary bytes written
- negative return value is error.

4.5.2.3 long rtxBase64EncodeData (OSCTXT * *pctxt*, const char * *pSrcData*, size_t *srcDataSize*, OSOCTET ** *ppDstData*)

Encode binary data into base64 string form to a dynamic buffer.

Parameters

pctxt Pointer to context structure.

pSrcData Pointer to binary data to encode.

srcDataSize Length of the binary data in octets.

ppDstData Pointer to pointer variable to hold address of dynamically allocated buffer the encoded base64 string.

Returns

Completion status of operation:

- number of binary bytes written
- negative return value is error.

4.5.2.4 long rtxBase64EncodeURLParam (OSCTXT * *pctxt*, const char * *pSrcData*, size_t *srcDataSize*, OSOCTET ** *ppDstData*)

Encode binary data into base64 string form to a dynamic buffer. In this case, the encoded string may be used in a query string parameter in a URL.

Parameters

pctxt Pointer to context structure.

pSrcData Pointer to binary data to encode.

srcDataSize Length of the binary data in octets.

ppDstData Pointer to pointer variable to hold address of dynamically allocated buffer the encoded base64 string.

Returns

Completion status of operation:

- number of binary bytes written
- negative return value is error.

4.5.2.5 long rtxBase64GetBinDataLen (const char * *pSrcData*, size_t *srcDataSize*)

Calculate number of byte required to hold a decoded base64 string in binary form.

Parameters

pSrcData Pointer to base64 string to decode.

srcDataSize Length of the base64 string.

Returns

Completion status of operation: If success, positive value is number of bytes, If failure, negative status code.

4.6 rtxBigInt.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Classes

- struct [OSBigInt](#)

Typedefs

- typedef struct [OSBigInt](#) **OSBigInt**

Functions

- void [rtxBigIntInit](#) ([OSBigInt](#) *pInt)
- int [rtxBigIntSetStr](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *pInt, const char *value, int radix)
- int [rtxBigIntSetStrn](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *pInt, const char *value, OSSIZE len, int radix)
- int [rtxBigIntSetInt64](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *pInt, OSINT64 value)
- int [rtxBigIntSetUInt64](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *pInt, OSUINT64 value)
- int [rtxBigIntSetBytes](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *pInt, OSOCTET *value, OSSIZE vallen)
- OSSIZE [rtxBigIntGetDataLen](#) (const [OSBigInt](#) *pInt)
- int [rtxBigIntGetData](#) ([OSCTXT](#) *pctxt, const [OSBigInt](#) *pInt, OSOCTET *buffer, OSSIZE bufSize)
- OSSIZE [rtxBigIntDigitsNum](#) (const [OSBigInt](#) *pInt, int radix)
- int [rtxBigIntCopy](#) ([OSCTXT](#) *pctxt, const [OSBigInt](#) *pSrc, [OSBigInt](#) *pDst)
- int [rtxBigIntFastCopy](#) ([OSCTXT](#) *pctxt, const [OSBigInt](#) *pSrc, [OSBigInt](#) *pDst)
- int [rtxBigIntToString](#) ([OSCTXT](#) *pctxt, const [OSBigInt](#) *pInt, int radix, char *str, OSSIZE strSize)
- int [rtxBigIntPrint](#) (const OSUTF8CHAR *name, const [OSBigInt](#) *bigint, int radix)
- int [rtxBigIntCompare](#) (const [OSBigInt](#) *arg1, const [OSBigInt](#) *arg2)
- int [rtxBigIntStrCompare](#) ([OSCTXT](#) *pctxt, const char *arg1, const char *arg2)
- void [rtxBigIntFree](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *pInt)
- int [rtxBigIntAdd](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *result, const [OSBigInt](#) *arg1, const [OSBigInt](#) *arg2)
- int [rtxBigIntSubtract](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *result, const [OSBigInt](#) *arg1, const [OSBigInt](#) *arg2)
- int [rtxBigIntMultiply](#) ([OSCTXT](#) *pctxt, [OSBigInt](#) *result, const [OSBigInt](#) *arg1, const [OSBigInt](#) *arg2)
- unsigned short **rtxBigIntBitsPerDigit** (int radix)
- short **rtxBigIntByteRadix** (int halfRadix)

4.6.1 Detailed Description

4.6.2 Function Documentation

4.6.2.1 int rtxBigIntAdd ([OSCTXT](#) * *pctxt*, [OSBigInt](#) * *result*, const [OSBigInt](#) * *arg1*, const [OSBigInt](#) * *arg2*)

This function is used to add two big integer values.

Parameters

pctxt Pointer to a context structure.

result Pointer to big integer structure to receive result.

arg1 First big integer to add.
arg2 Second big integer to add.

Returns

Result of operation: 0 = success, negative error code if error.

4.6.2.2 int rtxBigIntCompare (const OSBigInt * *arg1*, const OSBigInt * *arg2*)

This function is used to compare two big integer values.

Parameters

arg1 First big integer to compare.
arg2 Second big integer to compare.

Returns

Result of comparison: -1 = $arg1 < arg2$, 0 = $arg1 == arg2$, +1 = $arg1 > arg2$

4.6.2.3 int rtxBigIntCopy (OSCTXT * *pctxt*, const OSBigInt * *pSrc*, OSBigInt * *pDst*)

This function is used to copy a big integer data value from one structure to another.

Parameters

pctxt Pointer to a context structure.
pSrc Pointer to source big integer structure.
pDst Pointer to destination big integer structure.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.4 OSSIZE rtxBigIntDigitsNum (const OSBigInt * *pInt*, int *radix*)

This function is used to get the number of digits in the binary big integer data value based on radix.

Parameters

pInt Pointer to big integer structure.
radix Radix of the string value, Valid values are 2, 8, 10, or 16.

Returns

Number of digits in the binary data value.

4.6.2.5 int rtxBigIntFastCopy (OSCTXT * *pctxt*, const OSBigInt * *pSrc*, OSBigInt * *pDst*)

This function is used to copy one BigInt to another. This function will not allocate memory for the byte buffer if the destination BigInt already has a large enough allocated array to hold the data. The destination BigInt must have been initialized using the rtxBigIntInit function.

Parameters

- pctxt* Pointer to a context structure.
- pSrc* Pointer to source big integer structure.
- pDst* Pointer to destination big integer structure.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.6 void rtxBigIntFree (OSCTXT * *pctxt*, OSBigInt * *pInt*)

This function frees internal memory within the big integer structure.

Parameters

- pctxt* Pointer to a context structure.
- pInt* Pointer to big integer structure in which memory is to be freed.

4.6.2.7 int rtxBigIntGetData (OSCTXT * *pctxt*, const OSBigInt * *pInt*, OSOCTET * *buffer*, OSSIZE *bufSize*)

This function is used to get the binary big integer data value in a byte array.

Parameters

- pctxt* Pointer to a context structure.
- pInt* Pointer to big integer structure.
- buffer* Buffer into which binary big integer value is to be copied.
- bufSize* Size of the data buffer.

Returns

If success, number of bytes in byte array; if error, negative error code.

4.6.2.8 OSSIZE rtxBigIntGetDataLen (const OSBigInt * *pInt*)

This function is used to get the size in bytes of the binary big integer data value.

Parameters

- pInt* Pointer to big integer structure.

Returns

Length in bytes of the binary data value.

4.6.2.9 void rtxBigIntInit (OSBigInt * *pInt*)

This function initializes a big integer structure. It must be called prior to working with the structure.

Parameters

pInt Pointer to big integer data structure.

4.6.2.10 int rtxBigIntMultiply (OSCTXT * *pctxt*, OSBigInt * *result*, const OSBigInt * *arg1*, const OSBigInt * *arg2*)

This function is used to multiply two big integer values.

Parameters

pctxt Pointer to a context structure.

result Pointer to big integer structure to receive result.

arg1 First big integer to be multiplied.

arg2 Second big integer to be multiplied.

Returns

Result of operation: 0 = success, negative error code if error.

4.6.2.11 int rtxBigIntPrint (const OSUTF8CHAR * *name*, const OSBigInt * *bigint*, int *radix*)

This function is used to print a big integer value to standard output.

Parameters

name Name to print in "name=value" format.

bigint Pointer to big integer value to be printed.

radix Radix of the string value, Valid values are 2, 8, 10, or 16.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.12 int rtxBigIntSetBytes (OSCTXT * *pctxt*, OSBigInt * *pInt*, OSOCTET * *value*, OSSIZE *vallen*)

This function sets a big integer binary value from a byte array. The array is assumed to hold the value in binary form.

Parameters

pctxt Pointer to a context structure.

pInt Pointer to big integer structure to receive converted value.

value Buffer containing binary integer value.

vallen Number of byte in the value buffer.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.13 `int rtxBigIntSetInt64 (OSCTXT * pctxt, OSBigInt * pInt, OSINT64 value)`

This function sets a big integer binary value from a signed 64-bit integer value.

Parameters

pctxt Pointer to a context structure.

pInt Pointer to big integer structure to receive converted value.

value 64-bit integer value to convert.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.14 `int rtxBigIntSetStr (OSCTXT * pctxt, OSBigInt * pInt, const char * value, int radix)`

This function sets a big integer binary value from a null-terminated string.

Parameters

pctxt Pointer to a context structure.

pInt Pointer to big integer structure to receive converted value.

value Numeric string to convert.

radix Radix of the string value, Valid values are 2, 8, 10, or 16.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.15 `int rtxBigIntSetStrn (OSCTXT * pctxt, OSBigInt * pInt, const char * value, OSSIZE len, int radix)`

This function sets a big integer binary value from a character string using the given number of characters.

Parameters

pctxt Pointer to a context structure.

pInt Pointer to big integer structure to receive converted value.

value Numeric string to convert.

len Number of bytes from character string to use.

radix Radix of the string value, Valid values are 2, 8, 10, or 16.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.16 `int rtxBigIntSetUInt64 (OSCTXT * pctxt, OSBigInt * pInt, OSUINT64 value)`

This function sets a big integer binary value from an unsigned 64-bit integer value.

Parameters

pctxt Pointer to a context structure.

pInt Pointer to big integer structure to receive converted value.

value 64-bit integer value to convert.

Returns

Status of the operation, 0 = success, negative code if error.

4.6.2.17 `int rtxBigIntStrCompare (OSCTXT * pctxt, const char * arg1, const char * arg2)`

This function is used to compare two big integer numeric strings.

Parameters

pctxt Pointer to a context structure.

arg1 First big integer string to compare.

arg2 Second big integer string to compare.

Returns

Result of comparison: -1 = $\text{arg1} < \text{arg2}$, 0 = $\text{arg1} == \text{arg2}$, +1 = $\text{arg1} > \text{arg2}$

4.6.2.18 `int rtxBigIntSubtract (OSCTXT * pctxt, OSBigInt * result, const OSBigInt * arg1, const OSBigInt * arg2)`

This function is used to subtract one big integer value from another.

Parameters

pctxt Pointer to a context structure.

result Pointer to big integer structure to receive result.

arg1 Big integer value that *arg2* is subtracted from (minuend).

arg2 Big integer to be subtracted from *arg1* (subtrahend).

Returns

Result of operation: 0 = success, negative error code if error.

4.6.2.19 `int rtxBigIntToString (OSCTXT * pctxt, const OSBigInt * pInt, int radix, char * str, OSSIZE strSize)`

This function is used to convert a binary big integer value to a string.

Parameters

pctxt Pointer to a context structure.

pInt Pointer to big integer structure to convert.

radix Radix of the string value, Valid values are 2, 8, 10, or 16.

str Character string buffer to receive converted value.

strSize Size, in bytes, of the character string buffer.

Returns

Status of the operation, 0 = success, negative code if error.

4.7 rtxBitString.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Defines

- #define [OSRTBYTEARRAYSIZE](#)(numbits) ((numbits+7)/8)

Functions

- OSUINT32 [rtxGetBitCount](#) (OSUINT32 value)
- int [rtxSetBit](#) (OSOCKETET *pBits, OSSIZE numbits, OSSIZE bitIndex)
- OSUINT32 [rtxSetBitFlags](#) (OSUINT32 flags, OSUINT32 mask, OSBOOL action)
- int [rtxClearBit](#) (OSOCKETET *pBits, OSSIZE numbits, OSSIZE bitIndex)
- OSBOOL [rtxTestBit](#) (const OSOCKETET *pBits, OSSIZE numbits, OSSIZE bitIndex)
- OSSIZE [rtxLastBitSet](#) (const OSOCKETET *pBits, OSSIZE numbits)
- int [rtxCheckBitBounds](#) (OSCTXT *pctxt, OSOCKETET **ppBits, OSSIZE *pNumocts, OSSIZE minRequiredBits, OSSIZE preferredLimitBits)

4.7.1 Detailed Description

- Contains utility functions for setting, clearing, and testing bits at any position in an arbitrarily sized array of bytes.

4.8 rtxCharStr.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Functions

- int [rtxStricmp](#) (const char *str1, const char *str2)
- char * [rtxStrcat](#) (char *dest, size_t bufsiz, const char *src)
- char * [rtxStrncat](#) (char *dest, size_t bufsiz, const char *src, size_t nchars)
- char * [rtxStrcpy](#) (char *dest, size_t bufsiz, const char *src)
- char * [rtxStrncpy](#) (char *dest, size_t bufsiz, const char *src, size_t nchars)
- char * [rtxStrdup](#) (OSCTXT *pctx, const char *src)
- const char * [rtxStrJoin](#) (char *dest, size_t bufsiz, const char *str1, const char *str2, const char *str3, const char *str4, const char *str5)
- const char * [rtxStrDynJoin](#) (OSCTXT *pctx, const char *str1, const char *str2, const char *str3, const char *str4, const char *str5)
- int [rtxIntToCharStr](#) (OSINT32 value, char *dest, size_t bufsiz, char padchar)
- int [rtxUIntToCharStr](#) (OSUINT32 value, char *dest, size_t bufsiz, char padchar)
- int [rtxInt64ToCharStr](#) (OSINT64 value, char *dest, size_t bufsiz, char padchar)
- int [rtxUInt64ToCharStr](#) (OSUINT64 value, char *dest, size_t bufsiz, char padchar)
- int [rtxSizeToCharStr](#) (size_t value, char *dest, size_t bufsiz, char padchar)
- int [rtxHexCharsToBinCount](#) (const char *hexstr, size_t nchars)
- int [rtxHexCharsToBin](#) (const char *hexstr, size_t nchars, OSOCTET *binbuf, size_t bufsize)
- int [rtxCharStrToInt](#) (const char *cstr, OSINT32 *pvalue)
- int [rtxCharStrToInt8](#) (const char *cstr, OSINT8 *pvalue)
- int [rtxCharStrToInt16](#) (const char *cstr, OSINT16 *pvalue)
- int [rtxCharStrToUInt](#) (const char *cstr, OSUINT32 *pvalue)
- int [rtxCharStrToUInt8](#) (const char *cstr, OSUINT8 *pvalue)
- int [rtxCharStrToUInt16](#) (const char *cstr, OSUINT16 *pvalue)

4.8.1 Detailed Description

4.9 rtxCommon.h File Reference

```
#include "rtxsrc/osSysTypes.h"
#include "rtxsrc/osMacros.h"
#include "rtxsrc/rtxExternDefs.h"
#include "rtxsrc/rtxBigInt.h"
#include "rtxsrc/rtxBitString.h"
#include "rtxsrc/rtxBuffer.h"
#include "rtxsrc/rtxCharStr.h"
#include "rtxsrc/rtxCommonDefs.h"
#include "rtxsrc/rtxDateTime.h"
#include "rtxsrc/rtxDiag.h"
#include "rtxsrc/rtxEnum.h"
#include "rtxsrc/rtxError.h"
#include "rtxsrc/rtxFile.h"
#include "rtxsrc/rtxMemory.h"
#include "rtxsrc/rtxPattern.h"
#include "rtxsrc/rtxReal.h"
#include "rtxsrc/rtxUTF8.h"
#include "rtxsrc/rtxUtil.h"
```

4.9.1 Detailed Description

Common runtime constants, data structure definitions, and run-time functions to support various data encoding standards.

4.10 rtxContext.h File Reference

```
#include "rtxsrc/rtxDList.h"  
#include "rtxsrc/rtxStack.h"
```

Classes

- struct [OSRTErrLocn](#)
- struct [OSRTErrInfo](#)
- struct [OSRTErrInfoList](#)
- struct [OSRTBuffer](#)
- struct [OSRTBufSave](#)
- struct [OSBufferIndex](#)
- struct [OSCTXT](#)

Defines

- #define **OSRTENCBUFSIZ** 1024
- #define **OSRTERRSTKSIZ** 8
- #define **OSRTMAXERRPRM** 5
- #define **OSDIAG** 0x80000000
- #define **OSTRACE** 0x40000000
- #define **OSDISSTRM** 0x20000000
- #define **OSNOSTRMBACKOFF** 0x08000000
- #define **OS3GMOBORIG** 0x04000000
- #define **OSCONTCLOSED** 0x02000000
- #define **OSRESERVED1** 0x01000000
- #define **OSCDECL**
- #define **OSRT_GET_FIRST_ERROR_INFO**(pctxt)
- #define **OSRT_GET_LAST_ERROR_INFO**(pctxt)
- #define **OSRTISSTREAM**(pctxt) ((pctxt)->pStream != 0 && !((pctxt)->flags & OSDISSTRM))
- #define **OSRTBUFCUR**(pctxt) (pctxt)->buffer.data[(pctxt)->buffer.byteIndex]
- #define **OSRTBUFPTR**(pctxt) &(pctxt)->buffer.data[(pctxt)->buffer.byteIndex]
- #define **OSRTBUFFER**(pctxt) (pctxt)->buffer.data
- #define **OSRTBUFSIZE**(pctxt) (pctxt)->buffer.size
- #define **OSRTBUFSAVE**(pctxt)
- #define **OSRTBUFSAVE2**(pctxt, pSavedBuf)
- #define **OSRTBUFRESTORE**(pctxt)
- #define **OSRTBUFRESTORE2**(pctxt, pSavedBuf)
- #define **OSRTBYTEALIGNED**(pctxt) ((pctxt)->buffer.bitOffset == 8 || (pctxt)->buffer.bitOffset == 0)
- #define **rtxCtxtGetMsgPtr**(pctxt) (pctxt)->buffer.data
- #define **rtxCtxtGetMsgLen**(pctxt) (pctxt)->buffer.byteIndex
- #define **rtxCtxtTestFlag**(pctxt, mask) (((pctxt)->flags & mask) != 0)
- #define **rtxCtxtPeekElemName**(pctxt)
- #define **rtxByteAlign**(pctxt)
- #define **rtxCtxtSetProtocolVersion**(pctxt, value) (pctxt)->version = value
- #define **rtxMarkBitPos**(pctxt, ppos, pbitoff) (*(pbitoff) = (OSUINT8) (pctxt)->buffer.bitOffset, rtxMarkPos (pctxt, ppos))

- #define **rtxResetToBitPos**(pctxt, pos, bitoff) ((pctxt)->buffer.bitOffset = (OSUINT8) bitoff, rtxResetToPos (pctxt, pos))
- #define **RTXCTXTPUSHARRAYELEMNAME**(pctxt, name, idx) rtxCtxtPushArrayElemName(pctxt, OSUTF8(name), idx)
- #define **RTXCTXTPOPARRAYELEMNAME**(pctxt) rtxCtxtPopArrayElemName(pctxt)
- #define **RTXCTXTPUSHELEMNAME**(pctxt, name) rtxCtxtPushElemName(pctxt, OSUTF8(name))
- #define **RTXCTXTPOPELEMNAME**(pctxt) rtxCtxtPopElemName(pctxt)
- #define **RTXCTXTPUSHTYPENAME**(pctxt, name) rtxCtxtPushTypeName(pctxt, OSUTF8(name))
- #define **RTXCTXTPOPTYPENAME**(pctxt) rtxCtxtPopTypeName(pctxt)

Typedefs

- typedef OSUINT32 **OSRTFLAGS**
- typedef int(* **OSFreeCtxtAppInfoPtr**)(struct **OSCTXT** *pctxt)
- typedef int(* **OSResetCtxtAppInfoPtr**)(struct **OSCTXT** *pctxt)
- typedef void(* **OSFreeCtxtGlobalPtr**)(struct **OSCTXT** *pctxt)
- typedef struct **OSCTXT** **OSCTXT**
- typedef void *OSCDECL * **OSMallocFunc** (OSSIZE size)
- typedef void *OSCDECL * **OSReallocFunc** (void *ptr, OSSIZE size)

Functions

- typedef **void** (OSCDECL ***OSFreeFunc**)(void *ptr)
- int **rtxInitContext** (**OSCTXT** *pctxt)
- int **rtxInitContextExt** (**OSCTXT** *pctxt, **OSMallocFunc** malloc_func, **OSReallocFunc** realloc_func, **OSFreeFunc** free_func)
- int **rtxInitThreadContext** (**OSCTXT** *pctxt, const **OSCTXT** *pSrcCtxt)
- int **rtxInitContextBuffer** (**OSCTXT** *pctxt, **OSOCKET** *bufaddr, **OSSIZE** bufsiz)
- int **rtxCtxtSetBufPtr** (**OSCTXT** *pctxt, **OSOCKET** *bufaddr, **OSSIZE** bufsiz)
- **OSSIZE** **rtxCtxtGetBitOffset** (**OSCTXT** *pctxt)
- int **rtxCtxtSetBitOffset** (**OSCTXT** *pctxt, **OSSIZE** offset)
- **OSSIZE** **rtxCtxtGetIOByteCount** (**OSCTXT** *pctxt)
- int **rtxCheckContext** (**OSCTXT** *pctxt)
- void **rtxFreeContext** (**OSCTXT** *pctxt)
- void **rtxCopyContext** (**OSCTXT** *pdest, **OSCTXT** *psrc)
- void **rtxCtxtSetFlag** (**OSCTXT** *pctxt, **OSUINT32** mask)
- void **rtxCtxtClearFlag** (**OSCTXT** *pctxt, **OSUINT32** mask)
- int **rtxCtxtPushArrayElemName** (**OSCTXT** *pctxt, const **OSUTF8CHAR** *elemName, **OSSIZE** idx)
- int **rtxCtxtPushElemName** (**OSCTXT** *pctxt, const **OSUTF8CHAR** *elemName)
- int **rtxCtxtPushTypeName** (**OSCTXT** *pctxt, const **OSUTF8CHAR** *typeName)
- **OSBOOL** **rtxCtxtPopArrayElemName** (**OSCTXT** *pctxt)
- const **OSUTF8CHAR** * **rtxCtxtPopElemName** (**OSCTXT** *pctxt)
- const **OSUTF8CHAR** * **rtxCtxtPopTypeName** (**OSCTXT** *pctxt)
- **OSBOOL** **rtxCtxtContainerHasRemBits** (**OSCTXT** *pctxt)
- **OSSIZE** **rtxCtxtGetContainerRemBits** (**OSCTXT** *pctxt)
- int **rtxCtxtPushContainerBytes** (**OSCTXT** *pctxt, **OSSIZE** bytes)
- int **rtxCtxtPushContainerBits** (**OSCTXT** *pctxt, **OSSIZE** bits)
- void **rtxCtxtPopContainer** (**OSCTXT** *pctxt)
- void **rtxCtxtPopAllContainers** (**OSCTXT** *pctxt)
- int **rtxPreInitContext** (**OSCTXT** *pctxt)

- void `rtxMemHeapSetFlags` (`OSCTXT *pctxt`, `OSUINT32 flags`)
- void `rtxMemHeapClearFlags` (`OSCTXT *pctxt`, `OSUINT32 flags`)
- int `rtxMarkPos` (`OSCTXT *pctxt`, `OSSIZE *ppos`)
- int `rtxResetToPos` (`OSCTXT *pctxt`, `OSSIZE pos`)

4.10.1 Detailed Description

Common run-time context definitions.

4.10.2 Define Documentation

4.10.2.1 #define OSRTBUFRESTORE(pctxt)

Value:

```
{ \
(pctxt)->buffer.byteIndex = (pctxt)->savedInfo.byteIndex; \
(pctxt)->flags = (pctxt)->savedInfo.flags; }
```

4.10.2.2 #define OSRTBUFRESTORE2(pctxt, pSavedBuf)

Value:

```
{ \
(pctxt)->buffer.byteIndex = (pSavedBuf)->byteIndex; \
(pctxt)->buffer.bitOffset = (pSavedBuf)->bitOffset; \
(pctxt)->flags = (pSavedBuf)->flags; }
```

4.10.2.3 #define OSRTBUFSAVE(pctxt)

Value:

```
{ \
(pctxt)->savedInfo.byteIndex = (pctxt)->buffer.byteIndex; \
(pctxt)->savedInfo.flags = (pctxt)->flags; }
```

4.10.2.4 #define OSRTBUFSAVE2(pctxt, pSavedBuf)

Value:

```
{ \
(pSavedBuf)->byteIndex = (pctxt)->buffer.byteIndex; \
(pSavedBuf)->bitOffset = (pctxt)->buffer.bitOffset; \
(pSavedBuf)->flags = (pctxt)->flags; }
```

4.11 rtxCtype.h File Reference

Defines

- #define **OS_ISASCII**(c) ((unsigned)(c) < 0x80)
- #define **OS_ISUPPER**(c) (c >= 'A' && c <= 'Z')
- #define **OS_ISLOWER**(c) (c >= 'a' && c <= 'z')
- #define **OS_ISDIGIT**(c) (c >= '0' && c <= '9')
- #define **OS_ISALPHA**(c) (OS_ISUPPER(c) || OS_ISLOWER(c))
- #define **OS_ISSPACE**(c) ((c >= 0x09 && c <= 0x0d) || (c == ' '))
- #define **OS_ISPUNCT**(c) (c >= 0 && c <= 0x20)
- #define **OS_ISALNUM**(c) (OS_ISALPHA(c) || OS_ISDIGIT(c))
- #define **OS_ISPRINT**(c) (c >= ' ' && c <= '~')
- #define **OS_ISGRAPH**(c) (c >= '!' && c <= '~')
- #define **OS_ISCNTRL**(c) ((c >= 0 && c <= 0x1F) || c == 0x7F)
- #define **OS_ISXDIGIT**(c) (OS_ISDIGIT(c) || (c >= 'A' && c <= 'F') || (c >= 'a' && c <= 'f'))
- #define **OS_ISBASE64**(c) (OS_ISALNUM(c) || c == '+' || c == '/' || c == '=')
- #define **OS_TOLOWER**(c) (OS_ISUPPER(c) ? (c) - 'A' + 'a' : (c))
- #define **OS_TOUPPER**(c) (OS_ISLOWER(c) ? (c) - 'a' + 'A' : (c))

4.11.1 Detailed Description

4.12 rtxDateTime.h File Reference

```
#include <time.h>
#include "rtxsrc/rtxContext.h"
```

Functions

- int [rtxDateToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxTimeToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxDateTimeToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGYearToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGYearMonthToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGMonthToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGMonthDayToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxGDayToString](#) (const OSNumDateTime *pvalue, OSUTF8CHAR *buffer, size_t bufsize)
- int [rtxCurrDateTime](#) (OSNumDateTime *pvalue)
- int [rtxCmpDate](#) (const OSNumDateTime *pvalue1, const OSNumDateTime *pvalue2)
- int [rtxCmpDate2](#) (const OSNumDateTime *pvalue, OSINT32 year, OSUINT8 mon, OSUINT8 day, OSBOOL tzflag, OSINT32 tzo)
- int [rtxCmpTime](#) (const OSNumDateTime *pvalue1, const OSNumDateTime *pvalue2)
- int [rtxCmpTime2](#) (const OSNumDateTime *pvalue, OSUINT8 hour, OSUINT8 min, OSREAL sec, OSBOOL tzflag, OSINT32 tzo)
- int [rtxCmpDateTime](#) (const OSNumDateTime *pvalue1, const OSNumDateTime *pvalue2)
- int [rtxCmpDateTime2](#) (const OSNumDateTime *pvalue, OSINT32 year, OSUINT8 mon, OSUINT8 day, OSUINT8 hour, OSUINT8 min, OSREAL sec, OSBOOL tzflag, OSINT32 tzo)
- int [rtxParseDateString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseTimeString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseDateTimeString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGYearString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGYearMonthString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGMonthString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGMonthDayString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxParseGDayString](#) (const OSUTF8CHAR *inpdata, size_t inpdatalen, OSNumDateTime *pvalue)
- int [rtxMsecsToDuration](#) (OSINT32 msecs, OSUTF8CHAR *buf, OSUINT32 bufsize)
- int [rtxDurationToMsecs](#) (OSUTF8CHAR *buf, OSUINT32 bufsize, OSINT32 *msecs)
- int [rtxSetDateTime](#) (OSNumDateTime *pvalue, struct tm *timeStruct)
- int [rtxSetLocalDateTime](#) (OSNumDateTime *pvalue, time_t timeMs)
- int [rtxSetUtcDateTime](#) (OSNumDateTime *pvalue, time_t timeMs)
- int [rtxGetDateTime](#) (const OSNumDateTime *pvalue, time_t *timeMs)
- OSBOOL [rtxDateIsValid](#) (const OSNumDateTime *pvalue)
- OSBOOL [rtxTimeIsValid](#) (const OSNumDateTime *pvalue)
- OSBOOL [rtxDateTimeIsValid](#) (const OSNumDateTime *pvalue)

4.12.1 Detailed Description

Common runtime functions for converting to and from various standard date/time formats.

4.13 rtxDecimal.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Functions

- const char * **rtxNR3toDecimal** ([OSCTXT](#) *pctxt, const char *object_p)

4.13.1 Detailed Description

Common runtime functions for working with xsd:decimal numbers.

4.14 rtxDiag.h File Reference

```
#include <stdarg.h>
#include "rtxsrc/rtxContext.h"
```

Defines

- #define **RTDIAG1**(pctxt, msg)
- #define **RTDIAG2**(pctxt, msg, a)
- #define **RTDIAG3**(pctxt, msg, a, b)
- #define **RTDIAG4**(pctxt, msg, a, b, c)
- #define **RTDIAG5**(pctxt, msg, a, b, c, d)
- #define **RTDIAGU**(pctxt, ucstr)
- #define **RTHEXDUMP**(pctxt, buffer, numocts)
- #define **RTDIAGCHARS**(pctxt, buf, nchars)
- #define **RTDIAGSTRM2**(pctxt, msg)
- #define **RTDIAGSTRM3**(pctxt, msg, a)
- #define **RTDIAGSTRM4**(pctxt, msg, a, b)
- #define **RTDIAGSTRM5**(pctxt, msg, a, b, c)
- #define **RTHEXDUMPSTRM**(pctxt, buffer, numocts)
- #define **RTDIAGSCHARS**(pctxt, buf, nchars)

Enumerations

- enum **OSRTDiagTraceLevel** { **OSRTDiagError**, **OSRTDiagWarning**, **OSRTDiagInfo**, **OSRTDiagDebug** }

Functions

- OSBOOL **rtxDiagEnabled** (OSCTXT *pctxt)
- OSBOOL **rtxSetDiag** (OSCTXT *pctxt, OSBOOL value)
- OSBOOL **rtxSetGlobalDiag** (OSBOOL value)
- void **rtxDiagPrint** (OSCTXT *pctxt, const char *fmtspec,...)
- void **rtxDiagStream** (OSCTXT *pctxt, const char *fmtspec,...)
- void **rtxDiagHexDump** (OSCTXT *pctxt, const OSOCTET *data, size_t numocts)
- void **rtxDiagStreamHexDump** (OSCTXT *pctxt, const OSOCTET *data, size_t numocts)
- void **rtxDiagPrintChars** (OSCTXT *pctxt, const char *data, size_t nchars)
- void **rtxDiagStreamPrintChars** (OSCTXT *pctxt, const char *data, size_t nchars)
- void **rtxDiagStreamPrintBits** (OSCTXT *pctxt, const char *descr, const OSOCTET *data, size_t bitIndex, size_t nbits)
- void **rtxDiagSetTraceLevel** (OSCTXT *pctxt, OSRTDiagTraceLevel level)
- OSBOOL **rtxDiagTraceLevelEnabled** (OSCTXT *pctxt, OSRTDiagTraceLevel level)

4.14.1 Detailed Description

Common runtime functions for diagnostic tracing and debugging.

4.15 rtxDList.h File Reference

```
#include "rtxsrc/osSysTypes.h"
#include "rtxsrc/rtxExternDefs.h"
#include "rtxsrc/rtxCommonDefs.h"
```

Classes

- struct [OSRTDListNode](#)
- struct [OSRTDList](#)
- struct [OSRTDListBuf](#)
- struct [OSRTDListUTF8StrNode](#)

Defines

- #define **OSRTDLISTNODESIZE** ((sizeof([OSRTDListNode](#))+7)&(~7))
- #define **rtxDListAllocNodeAndData**(pctx, type, ppnode, pdata)
- #define **rtxDListAppendData**(pctx, pList, pData)
- #define **rtxDListFastInit**(pList)
- #define **rtxDListFreeTailNode**(pctx, pList) rtxDListFreeNode(pctx,pList,(pList)->tail)
- #define **rtxDListFreeHeadNode**(pctx, pList) rtxDListFreeNode(pctx,pList,(pList)->head)

Typedefs

- typedef struct [OSRTDListNode](#) **OSRTDListNode**
- typedef struct [OSRTDList](#) **OSRTDList**
- typedef struct [OSRTDListBuf](#) **OSRTDListBuf**
- typedef struct [OSRTDListUTF8StrNode](#) **OSRTDListUTF8StrNode**
- typedef int(* **PEqualsFunc**)(const void *a, const void *b, const void *sortCtx)

Functions

- void [rtxDListInit](#) ([OSRTDList](#) *pList)
- [OSRTDListNode](#) * [rtxDListAppend](#) (struct [OSCTXT](#) *pctx, [OSRTDList](#) *pList, void *pData)
- [OSRTDListNode](#) * [rtxDListAppendCharArray](#) (struct [OSCTXT](#) *pctx, [OSRTDList](#) *pList, size_t length, char *pData)
- [OSRTDListNode](#) * [rtxDListAppendNode](#) ([OSRTDList](#) *pList, [OSRTDListNode](#) *pListNode)
- [OSRTDListNode](#) * [rtxDListInsert](#) (struct [OSCTXT](#) *pctx, [OSRTDList](#) *pList, OSSIZE idx, void *pData)
- [OSRTDListNode](#) * **rtxDListInsertNode** ([OSRTDList](#) *pList, OSSIZE idx, [OSRTDListNode](#) *pListNode)
- [OSRTDListNode](#) * [rtxDListInsertBefore](#) (struct [OSCTXT](#) *pctx, [OSRTDList](#) *pList, [OSRTDListNode](#) *node, void *pData)
- [OSRTDListNode](#) * [rtxDListInsertAfter](#) (struct [OSCTXT](#) *pctx, [OSRTDList](#) *pList, [OSRTDListNode](#) *node, void *pData)
- [OSRTDListNode](#) * [rtxDListFindByIndex](#) (const [OSRTDList](#) *pList, OSSIZE idx)
- [OSRTDListNode](#) * [rtxDListFindByData](#) (const [OSRTDList](#) *pList, void *data)
- int [rtxDListFindIndexByData](#) (const [OSRTDList](#) *pList, void *data)
- void [rtxDListFreeNode](#) (struct [OSCTXT](#) *pctx, [OSRTDList](#) *pList, [OSRTDListNode](#) *node)
- void [rtxDListRemove](#) ([OSRTDList](#) *pList, [OSRTDListNode](#) *node)

- void `rtxDListFreeNodes` (struct `OSCTXT` *pctx, `OSRTDList` *pList)
- void `rtxDListFreeAll` (struct `OSCTXT` *pctx, `OSRTDList` *pList)
- int `rtxDListToArray` (struct `OSCTXT` *pctx, `OSRTDList` *pList, void **ppArray, `OSSIZE` *pElemCount, `OSSIZE` elemSize)
- int `rtxDListAppendArray` (struct `OSCTXT` *pctx, `OSRTDList` *pList, void *pArray, `OSSIZE` numElements, `OSSIZE` elemSize)
- int `rtxDListAppendArrayCopy` (struct `OSCTXT` *pctx, `OSRTDList` *pList, const void *pArray, `OSSIZE` numElements, `OSSIZE` elemSize)
- int `rtxDListToUTF8Str` (struct `OSCTXT` *pctx, `OSRTDList` *pList, `OSUTF8CHAR` **ppstr, char sep)
- `OSRTDListNode` * `rtxDListInsertSorted` (struct `OSCTXT` *pctx, `OSRTDList` *pList, void *pData, `PEqualsFunc` equalsFunc, void *sortCtx)
- `OSRTDListNode` * `rtxDListInsertNodeSorted` (`OSRTDList` *pList, `OSRTDListNode` *pListNode, `PEqualsFunc` equalsFunc, void *sortCtx)
- void `rtxDListBufInit` (`OSRTDListBuf` *pBuf, `OSSIZE` segSz, void **ppdata, `OSSIZE` elemSz)
- int `rtxDListBufExpand` (struct `OSCTXT` *pctx, `OSRTDListBuf` *pBuf)
- int `rtxDListBufToArray` (struct `OSCTXT` *pctx, `OSRTDListBuf` *pBuf)

4.15.1 Detailed Description

Doubly-Linked List Utility Functions.

4.15.2 Define Documentation

4.15.2.1 #define rtxDListAllocNodeAndData(pctx, type, pnode, pdata)

Value:

```
do { \
    *ppnode = (OSRTDListNode*) \
    rtxMemAlloc (pctx, sizeof(type)+OSRTDLISTNODESIZE); \
    if (0 != *ppnode) { \
        (*ppnode)->data = (void*)((char*)(*ppnode)+OSRTDLISTNODESIZE); \
        *ppdata = (type*)((*ppnode)->data); \
    } else { *ppdata = 0; } \
    } while (0)
```

4.15.2.2 #define rtxDListAppendData(pctx, pList, pData)

Value:

```
do { \
    rtxDListAppend (pctx, pList, pData); \
    } while (0);
```

4.15.2.3 #define rtxDListFastInit(pList)

Value:

```
do { \
    if ((pList) != 0) { \
        (pList)->head = (pList)->tail = (OSRTDListNode*) 0; \
        (pList)->count = 0; } \
    } while (0)
```

4.16 rtxErrCodes.h File Reference

Defines

- #define [RT_OK](#) 0
- #define [RT_OK_FRAG](#) 2
- #define [RTERR_BUFOVFLW](#) -1
- #define [RTERR_ENDOFBUF](#) -2
- #define [RTERR_IDNOTFOU](#) -3
- #define [RTERR_INVENUM](#) -4
- #define [RTERR_SETDUPL](#) -5
- #define [RTERR_SETMISRQ](#) -6
- #define [RTERR_NOTINSET](#) -7
- #define [RTERR_SEQOVFLW](#) -8
- #define [RTERR_INVOPT](#) -9
- #define [RTERR_NOMEM](#) -10
- #define [RTERR_INVHEXS](#) -11
- #define [RTERR_INVREAL](#) -12
- #define [RTERR_STROVFLW](#) -13
- #define [RTERR_BADVALUE](#) -14
- #define [RTERR_TOODEEP](#) -15
- #define [RTERR_CONSVIO](#) -16
- #define [RTERR_ENDOFFILE](#) -17
- #define [RTERR_INVUTF8](#) -18
- #define [RTERR_OUTOFBND](#) -19
- #define [RTERR_INVPARAM](#) -20
- #define [RTERR_INVFORMAT](#) -21
- #define [RTERR_NOTINIT](#) -22
- #define [RTERR_TOOBIG](#) -23
- #define [RTERR_INVCHAR](#) -24
- #define [RTERR_XMLSTATE](#) -25
- #define [RTERR_XMLPARSE](#) -26
- #define [RTERR_SEQORDER](#) -27
- #define [RTERR_FILNOTFOU](#) -28
- #define [RTERR_READERR](#) -29
- #define [RTERR_WRITEERR](#) -30
- #define [RTERR_INVBASE64](#) -31
- #define [RTERR_INVSOCKET](#) -32
- #define [RTERR_INVATTR](#) -33
- #define [RTERR_REGEXP](#) -34
- #define [RTERR_PATMATCH](#) -35
- #define [RTERR_ATTRMISRQ](#) -36
- #define [RTERR_HOSTNOTFOU](#) -37
- #define [RTERR_HTTPERR](#) -38
- #define [RTERR_SOAPERR](#) -39
- #define [RTERR_EXPIRED](#) -40
- #define [RTERR_UNEXPELEM](#) -41
- #define [RTERR_INVOCUR](#) -42
- #define [RTERR_INVMSGBUF](#) -43
- #define [RTERR_DECELEMFAIL](#) -44

- #define `RTERR_DECATTRFAIL` -45
- #define `RTERR_STRMINUSE` -46
- #define `RTERR_NULLPTR` -47
- #define `RTERR_FAILED` -48
- #define `RTERR_ATTRFIXEDVAL` -49
- #define `RTERR_MULTIPLE` -50
- #define `RTERR_NOTYPEINFO` -51
- #define `RTERR_ADDRINUSE` -52
- #define `RTERR_CONNRESET` -53
- #define `RTERR_UNREACHABLE` -54
- #define `RTERR_NOCONN` -55
- #define `RTERR_CONNREFUSED` -56
- #define `RTERR_INVSOCKOPT` -57
- #define `RTERR_SOAPFAULT` -58
- #define `RTERR_MARKNOTSUP` -59
- #define `RTERR_NOTSUPP` -60
- #define `RTERR_UNBAL` -61
- #define `RTERR_EXPNAME` -62
- #define `RTERR_UNICODE` -63
- #define `RTERR_INVBOOL` -64
- #define `RTERR_INVNULL` -65
- #define `RTERR_INVLEN` -66
- #define `RTERR_UNKNOWNIE` -67
- #define `RTERR_NOTALIGNED` -68
- #define `RTERR_EXTRDATA` -69
- #define `RTERR_INVMAC` -70
- #define `RTERR_NOSECPARAMS` -71
- #define `RTERR_COPYFAIL` -72
- #define `RTERR_PARSEFAIL` -73

4.16.1 Detailed Description

List of numeric status codes that can be returned by common run-time functions and generated code.

4.17 rtxError.h File Reference

```
#include "rtxsrc/rtxContext.h"
#include "rtxsrc/rtxErrCodes.h"
```

Defines

- #define **LOG_RTERR**(pctxt, stat) rtxErrSetData(pctxt,stat,__FILE__,__LINE__)
- #define **LOG_RTERRNEW**(pctxt, stat) rtxErrSetNewData(pctxt,stat,__FILE__,__LINE__)
- #define **OSRTASSERT**(condition) if (!(condition)) { rtxErrAssertionFailed(#condition,__LINE__,__FILE__); }
- #define **OSRTCHECKPARAM**(condition) if (condition) { /* do nothing */ }
- #define **LOG_RTERR1**(pctxt, stat, a) (a,LOG_RTERR (pctxt, stat),stat)
- #define **LOG_RTERRNEW1**(pctxt, stat, a) (a,LOG_RTERRNEW (pctxt, stat),stat)
- #define **LOG_RTERR2**(pctxt, stat, a, b) (a,b,LOG_RTERR (pctxt, stat),stat)
- #define **LOG_RTERRNEW2**(pctxt, stat, a, b) (a,b,LOG_RTERRNEW (pctxt, stat),stat)

Typedefs

- typedef int(* **OSErrCbFunc**)(const char *pctxt, void *cbArg_p)

Functions

- OSBOOL **rtxErrAddCtxtBufParm** (OSCTXT *pctxt)
- OSBOOL **rtxErrAddDoubleParm** (OSCTXT *pctxt, double errParm)
- OSBOOL **rtxErrAddErrorTableEntry** (const char *const *ppStatusText, OSINT32 minErrCode, OSINT32 maxErrCode)
- OSBOOL **rtxErrAddElemNameParm** (OSCTXT *pctxt)
- OSBOOL **rtxErrAddIntParm** (OSCTXT *pctxt, int errParm)
- OSBOOL **rtxErrAddInt64Parm** (OSCTXT *pctxt, OSINT64 errParm)
- OSBOOL **rtxErrAddStrParm** (OSCTXT *pctxt, const char *pErrParm)
- OSBOOL **rtxErrAddStrnParm** (OSCTXT *pctxt, const char *pErrParm, size_t nchars)
- OSBOOL **rtxErrAddUIntParm** (OSCTXT *pctxt, unsigned int errParm)
- OSBOOL **rtxErrAddUInt64Parm** (OSCTXT *pctxt, OSUINT64 errParm)
- void **rtxErrAssertionFailed** (const char *conditionText, int lineNo, const char *fileName)
- const char * **rtxErrFmtMsg** (OSRTErrInfo *pErrInfo, char *bufp, size_t bufsiz)
- void **rtxErrFreeParms** (OSCTXT *pctxt)
- char * **rtxErrGetText** (OSCTXT *pctxt, char *pBuf, size_t *pBufSize)
- char * **rtxErrGetTextBuf** (OSCTXT *pctxt, char *pbuf, size_t bufsiz)
- char * **rtxErrGetMsgText** (OSCTXT *pctxt)
- char * **rtxErrGetMsgTextBuf** (OSCTXT *pctxt, char *pbuf, size_t bufsiz)
- OSRTErrInfo * **rtxErrNewNode** (OSCTXT *pctxt)
- void **rtxErrInit** (OSVOIDARG)
- int **rtxErrReset** (OSCTXT *pctxt)
- void **rtxErrLogUsingCB** (OSCTXT *pctxt, OSErrCbFunc cb, void *cbArg_p)
- void **rtxErrPrint** (OSCTXT *pctxt)
- void **rtxErrPrintElement** (OSRTErrInfo *pErrInfo)
- int **rtxErrSetData** (OSCTXT *pctxt, int status, const char *module, int lineno)
- int **rtxErrSetNewData** (OSCTXT *pctxt, int status, const char *module, int lineno)

- int `rtxErrGetFirstError` (const `OSCTXT` *pctxt)
- int `rtxErrGetLastError` (const `OSCTXT` *pctxt)
- `OSSIZE` `rtxErrGetErrorCnt` (const `OSCTXT` *pctxt)
- int `rtxErrGetStatus` (const `OSCTXT` *pctxt)
- int `rtxErrResetLastErrors` (`OSCTXT` *pctxt, int errorsToReset)
- int `rtxErrCopy` (`OSCTXT` *pDestCtxt, const `OSCTXT` *pSrcCtxt)
- int `rtxErrAppend` (`OSCTXT` *pDestCtxt, const `OSCTXT` *pSrcCtxt)
- int `rtxErrInvUIntOpt` (`OSCTXT` *pctxt, `OSUINT32` ident)

4.17.1 Detailed Description

Error handling function and macro definitions.

4.18 rtxMemBuf.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Classes

- struct [OSRTMEMBUF](#)

Defines

- #define **OSMBDFLTSEGSIZE** 1024
- #define **OSMEMBUFPTR**(pmb) ((pmb)->buffer + (pmb)->startidx)
- #define **OSMEMBUFENDPTR**(pmb) ((pmb)->buffer + (pmb)->startidx + (pmb)->usedcnt)
- #define **OSMEMBUFUSEDSize**(pmb) ((OSSIZE)(pmb)->usedcnt)
- #define **OSMBAPPENDSTR**(pmb, str)
- #define **OSMBAPPENDSTR**(pmb, str) rtxMemBufAppend(pmb,(OSOCKET*)str,OSCTRLSTRLEN(str))
- #define **OSMBAPPENDUTF8**(pmb, str)

Typedefs

- typedef struct [OSRTMEMBUF](#) **OSRTMEMBUF**

Functions

- int [rtxMemBufAppend](#) ([OSRTMEMBUF](#) *pMemBuf, const OSOCKET *pdata, OSSIZE nbytes)
- int [rtxMemBufCut](#) ([OSRTMEMBUF](#) *pMemBuf, OSSIZE fromOffset, OSSIZE nbytes)
- void [rtxMemBufFree](#) ([OSRTMEMBUF](#) *pMemBuf)
- OSOCKET * [rtxMemBufGetData](#) (const [OSRTMEMBUF](#) *pMemBuf, int *length)
- OSOCKET * [rtxMemBufGetDataExt](#) (const [OSRTMEMBUF](#) *pMemBuf, OSSIZE *length)
- OSSIZE [rtxMemBufGetDataLen](#) (const [OSRTMEMBUF](#) *pMemBuf)
- void [rtxMemBufInit](#) (OSCTXT *pCtxt, [OSRTMEMBUF](#) *pMemBuf, OSSIZE segsize)
- void [rtxMemBufInitBuffer](#) (OSCTXT *pCtxt, [OSRTMEMBUF](#) *pMemBuf, OSOCKET *buf, OSSIZE bufsize, OSSIZE segsize)
- int [rtxMemBufPreAllocate](#) ([OSRTMEMBUF](#) *pMemBuf, OSSIZE nbytes)
- void [rtxMemBufReset](#) ([OSRTMEMBUF](#) *pMemBuf)
- int [rtxMemBufSet](#) ([OSRTMEMBUF](#) *pMemBuf, OSOCKET value, OSSIZE nbytes)
- OSBOOL [rtxMemBufSetExpandable](#) ([OSRTMEMBUF](#) *pMemBuf, OSBOOL isExpandable)
- OSBOOL [rtxMemBufSetUseSysMem](#) ([OSRTMEMBUF](#) *pMemBuf, OSBOOL value)
- OSSIZE [rtxMemBufTrimW](#) ([OSRTMEMBUF](#) *pMemBuf)

4.18.1 Detailed Description

4.19 rtxMemory.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Defines

- #define **RT_MH_DONTKEEPFREE** 0x1
- #define **RT_MH_VALIDATEPTR** 0x2
- #define **RT_MH_CHECKHEAP** 0x4
- #define **RT_MH_TRACE** 0x8
- #define **RT_MH_DIAG** 0x10
- #define **RT_MH_DIAG_DEBUG** 0x20
- #define **RT_MH_ZEROONFREE** 0x40
- #define **OSRTMH_PROPID_DEFBLKSIZE** 1
- #define **OSRTMH_PROPID_SETFLAGS** 2
- #define **OSRTMH_PROPID_CLEARFLAGS** 3
- #define **OSRTMH_PROPID_KEEPPFREEUNITS** 4
- #define **OSRTMH_PROPID_USER** 10
- #define **OSRTXM_K_MEMBLKSIZ** (4*1024)
- #define **OSRTALLOCTYPE**(pctxt, type) (type*) rtxMemHeapAlloc (&(pctxt)->pMemHeap, sizeof(type))
- #define **OSRTALLOCTYPEZ**(pctxt, type) (type*) rtxMemHeapAllocZ (&(pctxt)->pMemHeap, sizeof(type))
- #define **OSRTREALLOCARRAY**(pctxt, pseqof, type)
- #define **OSCRTMALLOC0**(nbytes) malloc(nbytes)
- #define **OSCRTFREE0**(ptr) free(ptr)
- #define **OSCRTMALLOC** rtxMemAlloc
- #define **OSCRTFREE** rtxMemFreePtr
- #define **rtxMemAlloc**(pctxt, nbytes) rtxMemHeapAlloc(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemSysAlloc**(pctxt, nbytes) rtxMemHeapSysAlloc(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemAllocZ**(pctxt, nbytes) rtxMemHeapAllocZ(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemSysAllocZ**(pctxt, nbytes) rtxMemHeapSysAllocZ(&(pctxt)->pMemHeap,nbytes)
- #define **rtxMemRealloc**(pctxt, mem_p, nbytes) rtxMemHeapRealloc(&(pctxt)->pMemHeap, (void*)mem_p, nbytes)
- #define **rtxMemSysRealloc**(pctxt, mem_p, nbytes) rtxMemHeapSysRealloc(&(pctxt)->pMemHeap,(void*)mem_p,nbytes)
- #define **rtxMemFreePtr**(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemSysFreePtr**(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemAllocType**(pctxt, ctype) (ctype*)rtxMemHeapAlloc(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemSysAllocType**(pctxt, ctype) (ctype*)rtxMemHeapSysAlloc(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemAllocTypeZ**(pctxt, ctype) (ctype*)rtxMemHeapAllocZ(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemSysAllocTypeZ**(pctxt, ctype) (ctype*)rtxMemHeapSysAllocZ(&(pctxt)->pMemHeap,sizeof(ctype))
- #define **rtxMemFreeType**(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemSysFreeType**(pctxt, mem_p) rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)
- #define **rtxMemAllocArray**(pctxt, n, type) (type*)rtxMemHeapAlloc (&(pctxt)->pMemHeap, sizeof(type)*n)
- #define **rtxMemSysAllocArray**(pctxt, n, type) (type*)rtxMemHeapSysAlloc (&(pctxt)->pMemHeap, sizeof(type)*n)
- #define **rtxMemAllocArrayZ**(pctxt, n, type) (type*)rtxMemHeapAllocZ (&(pctxt)->pMemHeap, sizeof(type)*n)
- #define **rtxMemFreeArray**(pctxt, mem_p) rtxMemHeapFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)

- #define `rtxMemSysFreeArray`(pctxt, mem_p) `rtxMemHeapSysFreePtr(&(pctxt)->pMemHeap, (void*)mem_p)`
- #define `rtxMemReallocArray`(pctxt, mem_p, n, type) `(type*)rtxMemHeapRealloc(&(pctxt)->pMemHeap, (void*)mem_p, sizeof(type)*n)`
- #define `rtxMemNewAutoPtr`(pctxt, nbytes) `rtxMemHeapAlloc(&(pctxt)->pMemHeap, nbytes)`
- #define `rtxMemAutoPtrRef`(pctxt, ptr) `rtxMemHeapAutoPtrRef(&(pctxt)->pMemHeap, (void*)(ptr))`
- #define `rtxMemAutoPtrUnref`(pctxt, ptr) `rtxMemHeapAutoPtrUnref(&(pctxt)->pMemHeap, (void*)(ptr))`
- #define `rtxMemAutoPtrGetRefCount`(pctxt, ptr) `rtxMemHeapAutoPtrGetRefCount(&(pctxt)->pMemHeap, (void*)(ptr))`
- #define `rtxMemCheckPtr`(pctxt, mem_p) `rtxMemHeapCheckPtr(&(pctxt)->pMemHeap, (void*)mem_p)`
- #define `rtxMemCheck`(pctxt) `rtxMemHeapCheck(&(pctxt)->pMemHeap, __FILE__, __LINE__)`
- #define `rtxMemPrint`(pctxt) `rtxMemHeapPrint(&(pctxt)->pMemHeap)`
- #define `rtxMemSetProperty`(pctxt, propId, pProp) `rtxMemHeapSetProperty (&(pctxt)->pMemHeap, propId, pProp)`

Functions

- void `rtxMemHeapAddRef` (void **ppvMemHeap)
- void * `rtxMemHeapAlloc` (void **ppvMemHeap, size_t nbytes)
- void * `rtxMemHeapAllocZ` (void **ppvMemHeap, size_t nbytes)
- void * `rtxMemHeapSysAlloc` (void **ppvMemHeap, size_t nbytes)
- void * `rtxMemHeapSysAllocZ` (void **ppvMemHeap, size_t nbytes)
- int `rtxMemHeapCheckPtr` (void **ppvMemHeap, const void *mem_p)
- int `rtxMemHeapCreate` (void **ppvMemHeap)
- int `rtxMemHeapCreateExt` (void **ppvMemHeap, OSMallocFunc malloc_func, OSReallocFunc realloc_func, OSFreeFunc free_func)
- void `rtxMemHeapFreeAll` (void **ppvMemHeap)
- void `rtxMemHeapFreePtr` (void **ppvMemHeap, void *mem_p)
- void `rtxMemHeapSysFreePtr` (void **ppvMemHeap, void *mem_p)
- void * `rtxMemHeapRealloc` (void **ppvMemHeap, void *mem_p, size_t nbytes_)
- void * `rtxMemHeapSysRealloc` (void **ppvMemHeap, void *mem_p, size_t nbytes_)
- void `rtxMemHeapRelease` (void **ppvMemHeap)
- void `rtxMemHeapReset` (void **ppvMemHeap)
- void `rtxMemHeapSetProperty` (void **ppvMemHeap, OSUINT32 propId, void *pProp)
- void * `rtxMemNewArray` (size_t nbytes)
- void * `rtxMemNewArrayZ` (size_t nbytes)
- void `rtxMemDeleteArray` (void *mem_p)
- void * `rtxMemHeapAutoPtrRef` (void **ppvMemHeap, void *ptr)
- int `rtxMemHeapAutoPtrUnref` (void **ppvMemHeap, void *ptr)
- int `rtxMemHeapAutoPtrGetRefCount` (void **ppvMemHeap, void *mem_p)
- void `rtxMemHeapInvalidPtrHook` (void **ppvMemHeap, const void *mem_p)
- void `rtxMemHeapCheck` (void **ppvMemHeap, const char *file, int line)
- void `rtxMemHeapPrint` (void **ppvMemHeap)
- void `rtxMemSetAllocFuncs` (OSMallocFunc malloc_func, OSReallocFunc realloc_func, OSFreeFunc free_func)
- void `rtxMemFreeOpenSeqExt` (OSCTXT *pctxt, struct OSRTDList *pElemList)
- OSUINT32 `rtxMemHeapGetDefBlkSize` (OSCTXT *pctxt)
- void `rtxMemSetDefBlkSize` (OSUINT32 blkSize)
- OSUINT32 `rtxMemGetDefBlkSize` (OSVOIDARG)
- OSBOOL `rtxMemHeapIsEmpty` (OSCTXT *pctxt)
- OSBOOL `rtxMemIsZero` (const void *pmem, size_t memsiz)
- void `rtxMemFree` (OSCTXT *pctxt)
- void `rtxMemReset` (OSCTXT *pctxt)

4.19.1 Detailed Description

Memory management function and macro definitions.

4.20 rtxPattern.h File Reference

```
#include "rtxsrc/osSysTypes.h"  
#include "rtxsrc/rtxExternDefs.h"  
#include "rtxsrc/rtxContext.h"
```

Functions

- OSBOOL [rtxMatchPattern](#) (OSCTXT *pctxt, const OSUTF8CHAR *text, const OSUTF8CHAR *pattern)
- OSBOOL [rtxMatchPattern2](#) (OSCTXT *pctxt, const OSUTF8CHAR *pattern)
- void [rtxFreeRegexpCache](#) (OSCTXT *pctxt)

4.20.1 Detailed Description

Pattern matching functions.

4.21 rtxPrint.h File Reference

```
#include <stdio.h>
#include "rtxsrc/osSysTypes.h"
#include "rtxsrc/rtxExternDefs.h"
#include "rtxsrc/rtxDList.h"
```

Defines

- #define OSRTINDENTSPACES 3

Functions

- int [rtxByteToHexChar](#) (OSOCKET byte, char *buf, OSSIZE bufsize)
- int [rtxByteToHexCharWithPrefix](#) (OSOCKET byte, char *buf, OSSIZE bufsize, const char *prefix)
- void [rtxPrintBoolean](#) (const char *name, OSBOOL value)
- void [rtxPrintDate](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintTime](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintDateTime](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGYear](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGYearMonth](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGMonth](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGMonthDay](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintGDay](#) (const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintInteger](#) (const char *name, OSINT32 value)
- void [rtxPrintInt64](#) (const char *name, OSINT64 value)
- void [rtxPrintUnsigned](#) (const char *name, OSUINT32 value)
- void [rtxPrintUInt64](#) (const char *name, OSUINT64 value)
- void [rtxPrintHexStr](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintHexStrPlain](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintHexStrNoAscii](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintHexBinary](#) (const char *name, OSSIZE numocts, const OSOCKET *data)
- void [rtxPrintCharStr](#) (const char *name, const char *cstring)
- void [rtxPrintUTF8CharStr](#) (const char *name, const OSUTF8CHAR *cstring)
- void [rtxPrintUnicodeCharStr](#) (const char *name, const OSUNICHAR *str, int nchars)
- void [rtxPrintReal](#) (const char *name, OSREAL value)
- void [rtxPrintNull](#) (const char *name)
- void [rtxPrintNVP](#) (const char *name, const OSUTF8NVP *value)
- int [rtxPrintFile](#) (const char *filename)
- void [rtxPrintIndent](#) (OSVOIDARG)
- void [rtxPrintIncrIndent](#) (OSVOIDARG)
- void [rtxPrintDecrIndent](#) (OSVOIDARG)
- void [rtxPrintCloseBrace](#) (OSVOIDARG)
- void [rtxPrintOpenBrace](#) (const char *)
- int [rtxHexDumpToNamedFile](#) (const char *filename, const OSOCKET *data, OSSIZE numocts)
- void [rtxHexDumpToFile](#) (FILE *fp, const OSOCKET *data, OSSIZE numocts)
- void [rtxHexDumpToFileEx](#) (FILE *fp, const OSOCKET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- void [rtxHexDumpToFileExNoAscii](#) (FILE *fp, const OSOCKET *data, OSSIZE numocts, OSSIZE bytesPerUnit)

- void [rtxHexDump](#) (const OSOCTET *data, OSSIZE numocts)
- void [rtxHexDumpEx](#) (const OSOCTET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- int [rtxHexDumpToString](#) (const OSOCTET *data, OSSIZE numocts, char *buffer, OSSIZE bufferSize, OSSIZE bufferIndex, OSSIZE bufferSize)
- int [rtxHexDumpToStringEx](#) (const OSOCTET *data, OSSIZE numocts, char *buffer, OSSIZE bufferSize, OSSIZE bufferIndex, OSSIZE bufferSize, OSSIZE bytesPerUnit)
- int [rtxHexDumpFileContents](#) (const char *inFilePath)
- int [rtxHexDumpFileContentsToFile](#) (const char *inFilePath, const char *outFilePath)

4.21.1 Detailed Description

4.22 rtxPrintStream.h File Reference

```
#include <stdarg.h>
#include "rtxsrc/rtxContext.h"
```

Classes

- struct [OSRTPrintStream](#)

Typedefs

- typedef void(* [rtxPrintCallback](#))(void *pPrntStrmInfo, const char *fmtspec, va_list arglist)
- typedef struct [OSRTPrintStream](#) [OSRTPrintStream](#)

Functions

- int [rtxSetPrintStream](#) (OSCTXT *pctxt, [rtxPrintCallback](#) myCallback, void *pStrmInfo)
- int [rtxSetGlobalPrintStream](#) ([rtxPrintCallback](#) myCallback, void *pStrmInfo)
- int [rtxPrintToStream](#) (OSCTXT *pctxt, const char *fmtspec,...)
- int [rtxDiagToStream](#) (OSCTXT *pctxt, const char *fmtspec, va_list arglist)
- int [rtxPrintStreamRelease](#) (OSCTXT *pctxt)
- void [rtxPrintStreamToStdoutCB](#) (void *pPrntStrmInfo, const char *fmtspec, va_list arglist)
- void [rtxPrintStreamToFileCB](#) (void *pPrntStrmInfo, const char *fmtspec, va_list arglist)

Variables

- [OSRTPrintStream g_PrintStream](#)

4.22.1 Detailed Description

Functions that allow printing diagnostic message to a stream using a callback function.

4.23 rtxPrintToStream.h File Reference

```
#include <stdio.h>
#include "rtxsrc/rtxContext.h"
```

Defines

- #define OSRTINDENTSPACES 3

Functions

- void [rtxPrintToStreamBoolean](#) (OSCTXT *pctxt, const char *name, OSBOOL value)
- void [rtxPrintToStreamDate](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamTime](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamDateTime](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamGYear](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamGYearMonth](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamGMonth](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamGMonthDay](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamGDay](#) (OSCTXT *pctxt, const char *name, const OSNumDateTime *pvalue)
- void [rtxPrintToStreamInteger](#) (OSCTXT *pctxt, const char *name, OSINT32 value)
- void [rtxPrintToStreamInt64](#) (OSCTXT *pctxt, const char *name, OSINT64 value)
- void [rtxPrintToStreamUnsigned](#) (OSCTXT *pctxt, const char *name, OSUINT32 value)
- void [rtxPrintToStreamUInt64](#) (OSCTXT *pctxt, const char *name, OSUINT64 value)
- void [rtxPrintToStreamHexStr](#) (OSCTXT *pctxt, const char *name, OSSIZE numocts, const OSOCTET *data)
- void [rtxPrintToStreamHexStrPlain](#) (OSCTXT *pctxt, const char *name, OSSIZE numocts, const OSOCTET *data)
- void [rtxPrintToStreamHexStrNoAscii](#) (OSCTXT *pctxt, const char *name, OSSIZE numocts, const OSOCTET *data)
- void [rtxPrintToStreamHexBinary](#) (OSCTXT *pctxt, const char *name, OSSIZE numocts, const OSOCTET *data)
- void [rtxPrintToStreamCharStr](#) (OSCTXT *pctxt, const char *name, const char *cstring)
- void [rtxPrintToStreamUTF8CharStr](#) (OSCTXT *pctxt, const char *name, const OSUTF8CHAR *cstring)
- void [rtxPrintToStreamUnicodeCharStr](#) (OSCTXT *pctxt, const char *name, const OSUNICHAR *str, int nchars)
- void [rtxPrintToStreamReal](#) (OSCTXT *pctxt, const char *name, OSREAL value)
- void [rtxPrintToStreamNull](#) (OSCTXT *pctxt, const char *name)
- void [rtxPrintToStreamNVP](#) (OSCTXT *pctxt, const char *name, const OSUTF8NVP *value)
- int [rtxPrintToStreamFile](#) (OSCTXT *pctxt, const char *filename)
- void [rtxPrintToStreamIndent](#) (OSCTXT *pctxt)
- void [rtxPrintToStreamIncrIndent](#) (OSCTXT *pctxt)
- void [rtxPrintToStreamDecrIndent](#) (OSCTXT *pctxt)
- void [rtxPrintToStreamCloseBrace](#) (OSCTXT *pctxt)
- void [rtxPrintToStreamOpenBrace](#) (OSCTXT *pctxt, const char *)
- void [rtxHexDumpToStream](#) (OSCTXT *pctxt, const OSOCTET *data, OSSIZE numocts)
- void [rtxHexDumpToStreamEx](#) (OSCTXT *pctxt, const OSOCTET *data, OSSIZE numocts, OSSIZE bytesPerUnit)
- void [rtxHexDumpToStreamExNoAscii](#) (OSCTXT *pctxt, const OSOCTET *data, OSSIZE numocts, OSSIZE bytesPerUnit)

4.23.1 Detailed Description

4.24 rtxReal.h File Reference

```
#include "rtxsrc/osSysTypes.h"  
#include "rtxsrc/rtxExternDefs.h"
```

Functions

- OSREAL [rtxGetMinusInfinity](#) (OSVOIDARG)
- OSREAL [rtxGetMinusZero](#) (OSVOIDARG)
- OSREAL [rtxGetNaN](#) (OSVOIDARG)
- OSREAL [rtxGetPlusInfinity](#) (OSVOIDARG)
- OSBOOL [rtxIsMinusInfinity](#) (OSREAL value)
- OSBOOL [rtxIsMinusZero](#) (OSREAL value)
- OSBOOL [rtxIsNaN](#) (OSREAL value)
- OSBOOL [rtxIsPlusInfinity](#) (OSREAL value)
- OSBOOL [rtxIsApproximate](#) (OSREAL a, OSREAL b, OSREAL delta)
- OSBOOL [rtxIsApproximateAbs](#) (OSREAL a, OSREAL b, OSREAL delta)

4.24.1 Detailed Description

Common runtime functions for working with floating-point numbers.

4.25 rtxSList.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Classes

- struct [_OSRTSListNode](#)
- struct [_OSRTSList](#)

Defines

- #define [OSALLOCELEMSNODE](#)(pctx, type)

Typedefs

- typedef struct [_OSRTSListNode](#) [OSRTSListNode](#)
- typedef struct [_OSRTSList](#) [OSRTSList](#)

Functions

- void [rtxSListInit](#) ([OSRTSList](#) *pList)
- void [rtxSListInitEx](#) ([OSCTXT](#) *pctx, [OSRTSList](#) *pList)
- void [rtxSListFree](#) ([OSRTSList](#) *pList)
- void [rtxSListFreeAll](#) ([OSRTSList](#) *pList)
- [OSRTSList](#) * [rtxSListCreate](#) ([OSVOIDARG](#))
- [OSRTSList](#) * [rtxSListCreateEx](#) ([OSCTXT](#) *pctx)
- [OSRTSListNode](#) * [rtxSListAppend](#) ([OSRTSList](#) *pList, void *pData)
- [OSBOOL](#) [rtxSListFind](#) ([OSRTSList](#) *pList, void *pData)
- void [rtxSListRemove](#) ([OSRTSList](#) *pList, void *pData)

4.25.1 Detailed Description

4.25.2 Define Documentation

4.25.2.1 #define [OSALLOCELEMSNODE](#)(pctx, type)

Value:

```
(type*) (((char*)rtxMemAllocZ (pctx, sizeof(type) + \
sizeof(OSRTSListNode)) + sizeof(OSRTSListNode))
```

4.26 rtxSocket.h File Reference

```
#include <sys/types.h>
#include <sys/time.h>
#include <sys/socket.h>
#include <netinet/in.h>
#include <netdb.h>
#include <unistd.h>
#include <arpa/inet.h>
#include "rtxsrc/osSysTypes.h"
#include "rtxsrc/rtxExternDefs.h"
```

Defines

- #define **OSRTSOCKET_INVALID** ((**OSRTSOCKET**)-1)
- #define **OSIPADDR_ANY** ((**OSIPADDR**)0)
- #define **OSIPADDR_LOCAL** ((**OSIPADDR**)0x7f000001UL)

Typedefs

- typedef int **OSRTSOCKET**
- typedef unsigned long **OSIPADDR**

Functions

- int **rtxSocketAccept** (**OSRTSOCKET** socket, **OSRTSOCKET** *pNewSocket, **OSIPADDR** *destAddr, int *destPort)
- int **rtxSocketAddrToStr** (**OSIPADDR** ipAddr, char *pbuf, size_t bufsize)
- int **rtxSocketBind** (**OSRTSOCKET** socket, **OSIPADDR** addr, int port)
- int **rtxSocketClose** (**OSRTSOCKET** socket)
- int **rtxSocketConnect** (**OSRTSOCKET** socket, const char *host, int port)
- int **rtxSocketConnectTimed** (**OSRTSOCKET** socket, const char *host, int port, int nsecs)
- int **rtxSocketCreate** (**OSRTSOCKET** *psocket)
- int **rtxSocketCreateUDP** (**OSRTSOCKET** *psocket)
- int **rtxSocketGetHost** (const char *host, struct in_addr *inaddr)
- int **rtxSocketsInit** (OSVOIDARG)
- int **rtxSocketListen** (**OSRTSOCKET** socket, int maxConnection)
- int **rtxSocketParseURL** (char *url, char **protocol, char **address, int *port)
- int **rtxSocketRecv** (**OSRTSOCKET** socket, OSOCTET *pbuf, size_t bufsize)
- int **rtxSocketRecvTimed** (**OSRTSOCKET** socket, OSOCTET *pbuf, size_t bufsize, OSUINT32 secs)
- int **rtxSocketSelect** (int nfd, fd_set *readfds, fd_set *writefds, fd_set *exceptfds, struct timeval *timeout)
- int **rtxSocketSend** (**OSRTSOCKET** socket, const OSOCTET *pdata, size_t size)
- int **rtxSocketSetBlocking** (**OSRTSOCKET** socket, OSBOOL value)
- int **rtxSocketStrToAddr** (const char *pIPAddrStr, **OSIPADDR** *pIPAddr)

4.26.1 Detailed Description

4.26.2 Typedef Documentation

4.26.2.1 typedef int OSRTSOCKET

Socket handle type definition

4.27 rtxStack.h File Reference

```
#include "rtxsrc/rtxDList.h"
```

Classes

- [struct _OSRTStack](#)

Defines

- [#define rtxStackIsEmpty\(stack\)](#) (OSBOOL)((stack).dlist.count == 0)

Typedefs

- [typedef struct _OSRTStack OSRTStack](#)

Functions

- [OSRTStack * rtxStackCreate](#) (struct [OSCTXT](#) *pctxt)
- [void rtxStackInit](#) (struct [OSCTXT](#) *pctxt, [OSRTStack](#) *pStack)
- [void * rtxStackPop](#) ([OSRTStack](#) *pStack)
- [int rtxStackPush](#) ([OSRTStack](#) *pStack, void *pData)
- [void * rtxStackPeek](#) ([OSRTStack](#) *pStack)

4.27.1 Detailed Description

Simple FIFO stack for storing void pointers to any type of data.

4.28 rtxStream.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

```
#include "rtxsrc/rtxMemBuf.h"
```

Classes

- struct [OSRTSTREAM](#)

Defines

- #define **OSRTSTRMF_INPUT** 0x0001
- #define **OSRTSTRMF_OUTPUT** 0x0002
- #define **OSRTSTRMF_BUFFERED** 0x8000
- #define **OSRTSTRMF_UNBUFFERED** 0x4000
- #define **OSRTSTRMF_POSMARKED** 0x2000
- #define **OSRTSTRMF_FIXINMEM** 0x1000
- #define **OSRTSTRMF_BUF_INPUT** (OSRTSTRMF_INPUT|OSRTSTRMF_BUFFERED)
- #define **OSRTSTRMF_BUF_OUTPUT** (OSRTSTRMF_OUTPUT|OSRTSTRMF_BUFFERED)
- #define **OSRTSTRMID_FILE** 1
- #define **OSRTSTRMID_SOCKET** 2
- #define **OSRTSTRMID_MEMORY** 3
- #define **OSRTSTRMID_BUFFERED** 4
- #define **OSRTSTRMID_DIRECTBUF** 5
- #define **OSRTSTRMID_CTXTBUF** 6
- #define **OSRTSTRMID_ZLIB** 7
- #define **OSRTSTRMID_USER** 1000
- #define **OSRTSTRM_K_BUFSIZE** 1024
- #define **OSRTSTRM_K_INVALIDMARK** ((size_t)-1)
- #define **OSRTSTREAM_BYTEINDEX**(pctxt)
- #define **OSRTSTREAM_ID**(pctxt) ((pctxt)->pStream->id)
- #define **OSRTSTREAM_FLAGS**(pctxt) ((pctxt)->pStream->flags)

Typedefs

- typedef long(* [OSRTStreamReadProc](#))(struct [OSRTSTREAM](#) *pStream, OSOCTET *pbuffer, size_t bufSize)
- typedef long(* [OSRTStreamBlockingReadProc](#))(struct [OSRTSTREAM](#) *pStream, OSOCTET *pbuffer, size_t toReadBytes)
- typedef long(* [OSRTStreamWriteProc](#))(struct [OSRTSTREAM](#) *pStream, const OSOCTET *data, size_t numocts)
- typedef int(* [OSRTStreamFlushProc](#))(struct [OSRTSTREAM](#) *pStream)
- typedef int(* [OSRTStreamCloseProc](#))(struct [OSRTSTREAM](#) *pStream)
- typedef int(* [OSRTStreamSkipProc](#))(struct [OSRTSTREAM](#) *pStream, size_t skipBytes)
- typedef int(* [OSRTStreamMarkProc](#))(struct [OSRTSTREAM](#) *pStream, size_t readAheadLimit)
- typedef int(* [OSRTStreamResetProc](#))(struct [OSRTSTREAM](#) *pStream)
- typedef int(* [OSRTStreamGetPosProc](#))(struct [OSRTSTREAM](#) *pStream, size_t *ppos)
- typedef int(* [OSRTStreamSetPosProc](#))(struct [OSRTSTREAM](#) *pStream, size_t pos)
- typedef struct [OSRTSTREAM](#) [OSRTSTREAM](#)

Functions

- int `rtxStreamClose` (`OSCTXT *pctxt`)
- int `rtxStreamFlush` (`OSCTXT *pctxt`)
- int `rtxStreamInit` (`OSCTXT *pctxt`)
- long `rtxStreamRead` (`OSCTXT *pctxt`, `OSOCKET *pbuffer`, `size_t bufSize`)
- long `rtxStreamBlockingRead` (`OSCTXT *pctxt`, `OSOCKET *pbuffer`, `size_t readBytes`)
- int `rtxStreamSkip` (`OSCTXT *pctxt`, `size_t skipBytes`)
- long `rtxStreamWrite` (`OSCTXT *pctxt`, `const OSOCKET *data`, `size_t numocts`)
- int `rtxStreamGetIOBytes` (`OSCTXT *pctxt`, `size_t *pPos`)
- int `rtxStreamMark` (`OSCTXT *pctxt`, `size_t readAheadLimit`)
- int `rtxStreamReset` (`OSCTXT *pctxt`)
- OSBOOL `rtxStreamMarkSupported` (`OSCTXT *pctxt`)
- OSBOOL `rtxStreamIsOpened` (`OSCTXT *pctxt`)
- OSBOOL `rtxStreamIsReadable` (`OSCTXT *pctxt`)
- OSBOOL `rtxStreamIsWritable` (`OSCTXT *pctxt`)
- int `rtxStreamRelease` (`OSCTXT *pctxt`)
- void `rtxStreamSetCapture` (`OSCTXT *pctxt`, `OSRTMEMBUF *pmembuf`)
- `OSRTMEMBUF * rtxStreamGetCapture` (`OSCTXT *pctxt`)
- int `rtxStreamGetPos` (`OSCTXT *pctxt`, `size_t *ppos`)
- int `rtxStreamSetPos` (`OSCTXT *pctxt`, `size_t pos`)

4.28.1 Detailed Description

Input/output data stream type definitions and function prototypes.

4.29 rtxStreamBuffered.h File Reference

```
#include "rtxsrc/rtxStream.h"
```

Defines

- #define **OSRTSTRMCM_RESTORE_UNDERLAYING_AFTER_RESET** 0x0001

Functions

- int **rtxStreamBufferedCreate** (OSCTXT *pctxt, OSUINT32 mode)
- int **rtxStreamBufferedRelease** (OSCTXT *pctxt)
- int **rtxStreamBufferedSetPreReadBuf** (OSCTXT *pctxt, const OSOCTET *pdata, size_t datalen)
- int **rtxStreamBufferedPrependReadBuf** (OSCTXT *pctxt, const OSOCTET *pdata, size_t datalen)

4.29.1 Detailed Description

4.30 rtxStreamFile.h File Reference

```
#include <stdio.h>
#include "rtxsrc/rtxStream.h"
```

Functions

- int [rtxStreamFileAttach](#) (OSCTXT *pctx, FILE *pFile, OSUINT16 flags)
- int [rtxStreamFileOpen](#) (OSCTXT *pctx, const char *pFilename, OSUINT16 flags)
- int [rtxStreamFileCreateReader](#) (OSCTXT *pctx, const char *pFilename)
- int [rtxStreamFileCreateWriter](#) (OSCTXT *pctx, const char *pFilename)

4.30.1 Detailed Description

4.31 rtxStreamHexText.h File Reference

```
#include "rtxsrc/osSysTypes.h"  
#include "rtxsrc/rtxExternDefs.h"  
#include "rtxsrc/rtxStream.h"
```

Functions

- int [rtxStreamHexTextAttach](#) (OSCTXT *pctx, OSUINT16 flags)

4.31.1 Detailed Description

4.31.2 Function Documentation

4.31.2.1 int rtxStreamHexTextAttach (OSCTXT * *pctx*, OSUINT16 *flags*)

This function initializes a hexText stream and attaches it to the existing stream defined within the context. This type of stream object can only be used with an existing stream. It acts as a filter to perform conversion to/from hex characters to binary data.

Parameters

pctx Pointer to context structure variable.

flags Specifies the access mode for the stream:

- OSRTSTRMF_INPUT = input (reading) stream;
- OSRTSTRMF_OUTPUT = output (writing) stream.

Returns

Completion status of operation: 0 (0) = success, negative return value is error.

4.32 rtxStreamMemory.h File Reference

```
#include "rtxsrc/rtxStream.h"
```

Classes

- struct [DirBufDesc](#)

Typedefs

- typedef struct [DirBufDesc](#) **DirBufDesc**

Functions

- int [rtxStreamMemoryCreate](#) (OSCTXT *pctx, OSUINT16 flags)
- int [rtxStreamMemoryAttach](#) (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize, OSUINT16 flags)
- OSOCTET * [rtxStreamMemoryGetBuffer](#) (OSCTXT *pctx, size_t *pSize)
- int [rtxStreamMemoryCreateReader](#) (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize)
- int [rtxStreamMemoryCreateWriter](#) (OSCTXT *pctx, OSOCTET *pMemBuf, size_t bufSize)
- int [rtxStreamMemoryResetWriter](#) (OSCTXT *pctx)

4.32.1 Detailed Description

4.33 rtxStreamSocket.h File Reference

```
#include "rtxsrc/rtxStream.h"
```

```
#include "rtxsrc/rtxSocket.h"
```

Functions

- int [rtxStreamSocketAttach](#) (OSCTXT *pctx, OSRTSOCKET socket, OSUINT16 flags)
- int [rtxStreamSocketClose](#) (OSCTXT *pctx)
- int [rtxStreamSocketCreateWriter](#) (OSCTXT *pctx, const char *host, int port)
- int [rtxStreamSocketSetOwnership](#) (OSCTXT *pctx, OSBOOL ownSocket)
- int [rtxStreamSocketSetReadTimeout](#) (OSCTXT *pctx, OSUINT32 nsecs)

4.33.1 Detailed Description

4.34 rtxUTF8.h File Reference

```
#include "rtxsrc/rtxContext.h"
```

Defines

- #define **rtxUTF8StrToInt32** rtxUTF8StrToInt
- #define **rtxUTF8StrToUInt32** rtxUTF8StrToUInt
- #define **RTUTF8STRCMP**(name, lstr) rtxUTF8Strcmp(name,(const OSUTF8CHAR*)lstr)
- #define **OSRTCHKUTF8LEN**(str, lower, upper, stat)

Functions

- long **rtxUTF8ToUnicode** (OSCTXT *pctxt, const OSUTF8CHAR *inbuf, OSUNICHAR *outbuf, size_t outbufsiz)
- int **rtxValidateUTF8** (OSCTXT *pctxt, const OSUTF8CHAR *inbuf)
- size_t **rtxUTF8Len** (const OSUTF8CHAR *inbuf)
- size_t **rtxCalcUTF8Len** (const OSUTF8CHAR *inbuf, size_t inbufBytes)
- size_t **rtxUTF8LenBytes** (const OSUTF8CHAR *inbuf)
- int **rtxUTF8CharSize** (OS32BITCHAR wc)
- int **rtxUTF8EncodeChar** (OS32BITCHAR wc, OSOCTET *buf, size_t bufisz)
- int **rtxUTF8DecodeChar** (OSCTXT *pctxt, const OSUTF8CHAR *pinbuf, int *pInsize)
- OS32BITCHAR **rtxUTF8CharToWC** (const OSUTF8CHAR *buf, OSUINT32 *len)
- OSUTF8CHAR * **rtxUTF8StrChr** (OSUTF8CHAR *utf8str, OS32BITCHAR utf8char)
- OSUTF8CHAR * **rtxUTF8Strdup** (OSCTXT *pctxt, const OSUTF8CHAR *utf8str)
- OSUTF8CHAR * **rtxUTF8Strndup** (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, size_t nbytes)
- OSUTF8CHAR * **rtxUTF8StrRefOrDup** (OSCTXT *pctxt, const OSUTF8CHAR *utf8str)
- OSBOOL **rtxUTF8StrEqual** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2)
- OSBOOL **rtxUTF8StrnEqual** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2, size_t count)
- int **rtxUTF8Strcmp** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2)
- int **rtxUTF8Strncmp** (const OSUTF8CHAR *utf8str1, const OSUTF8CHAR *utf8str2, size_t count)
- OSUTF8CHAR * **rtxUTF8Strcpy** (OSUTF8CHAR *dest, size_t bufisz, const OSUTF8CHAR *src)
- OSUTF8CHAR * **rtxUTF8Strncpy** (OSUTF8CHAR *dest, size_t bufisz, const OSUTF8CHAR *src, size_t nchars)
- OSUINT32 **rtxUTF8StrHash** (const OSUTF8CHAR *str)
- const OSUTF8CHAR * **rtxUTF8StrJoin** (OSCTXT *pctxt, const OSUTF8CHAR *str1, const OSUTF8CHAR *str2, const OSUTF8CHAR *str3, const OSUTF8CHAR *str4, const OSUTF8CHAR *str5)
- int **rtxUTF8StrToBool** (const OSUTF8CHAR *utf8str, OSBOOL *pvalue)
- int **rtxUTF8StrnToBool** (const OSUTF8CHAR *utf8str, size_t nbytes, OSBOOL *pvalue)
- int **rtxUTF8StrToDouble** (const OSUTF8CHAR *utf8str, OSREAL *pvalue)
- int **rtxUTF8StrnToDouble** (const OSUTF8CHAR *utf8str, size_t nbytes, OSREAL *pvalue)
- int **rtxUTF8StrToInt** (const OSUTF8CHAR *utf8str, OSINT32 *pvalue)
- int **rtxUTF8StrnToInt** (const OSUTF8CHAR *utf8str, size_t nbytes, OSINT32 *pvalue)
- int **rtxUTF8StrToUInt** (const OSUTF8CHAR *utf8str, OSUINT32 *pvalue)
- int **rtxUTF8StrnToUInt** (const OSUTF8CHAR *utf8str, size_t nbytes, OSUINT32 *pvalue)
- int **rtxUTF8StrToSize** (const OSUTF8CHAR *utf8str, size_t *pvalue)
- int **rtxUTF8StrnToSize** (const OSUTF8CHAR *utf8str, size_t nbytes, size_t *pvalue)
- int **rtxUTF8StrToInt64** (const OSUTF8CHAR *utf8str, OSINT64 *pvalue)
- int **rtxUTF8StrnToInt64** (const OSUTF8CHAR *utf8str, size_t nbytes, OSINT64 *pvalue)
- int **rtxUTF8StrToUInt64** (const OSUTF8CHAR *utf8str, OSUINT64 *pvalue)

- int [rtxUTF8StrnToUInt64](#) (const OSUTF8CHAR *utf8str, size_t nbytes, OSUINT64 *pvalue)
- int [rtxUTF8ToDynUniStr](#) (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, const OSUNICHAR **ppdata, OSUINT32 *pnchars)
- int [rtxUTF8RemoveWhiteSpace](#) (const OSUTF8CHAR *utf8instr, size_t nbytes, const OSUTF8CHAR **putf8oustr)
- int [rtxUTF8StrToDynHexStr](#) (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, OSDynOctStr *pvalue)
- int [rtxUTF8StrnToDynHexStr](#) (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, size_t nbytes, OSDynOctStr *pvalue)
- int [rtxUTF8StrToNamedBits](#) (OSCTXT *pctxt, const OSUTF8CHAR *utf8str, const OSBitMapItem *pBitMap, OSOCTET *pvalue, OSUINT32 *pnbits, OSUINT32 bufsize)
- const OSUTF8CHAR * [rtxUTF8StrNextTok](#) (OSUTF8CHAR *utf8str, OSUTF8CHAR **ppNext)

4.34.1 Detailed Description

Utility functions for handling UTF-8 strings.

Index

- [_OSRTSList](#), 194
 - [count](#), 194
 - [head](#), 194
 - [tail](#), 194
- [_OSRTSListNode](#), 195
 - [data](#), 195
 - [next](#), 195
- [_OSRTStack](#), 196
- [alignedBits](#)
 - [Asn116BitCharSet](#), 197
 - [Asn132BitCharSet](#), 199
- [ALLOC_ASN1ARRAY](#)
 - [cruntime](#), 6
- [ALLOC_ASN1ARRAY1](#)
 - [cruntime](#), 6
- [allocated](#)
 - [ASN1BigInt](#), 201
- [Asn116BitCharSet](#), 197
 - [alignedBits](#), 197
 - [charSet](#), 197
 - [firstChar](#), 197
 - [unalignedBits](#), 197
- [Asn116BitCharString](#), 198
- [Asn132BitCharSet](#), 199
 - [alignedBits](#), 199
 - [charSet](#), 199
 - [firstChar](#), 199
 - [unalignedBits](#), 199
- [Asn132BitCharString](#), 200
- [ASN1_K_CCBMaskSize](#)
 - [cruntime](#), 6
- [ASN1_K_MaxSetElements](#)
 - [cruntime](#), 6
- [ASN1_K_MINUS_INFINITY](#)
 - [cruntime](#), 6
- [ASN1_K_NumBitsPerMask](#)
 - [cruntime](#), 7
- [ASN1_K_PLUS_INFINITY](#)
 - [cruntime](#), 7
- [ASN1ActionType](#)
 - [cruntime](#), 9
- [ASN1BigInt](#), 201
 - [allocated](#), 201
 - [cruntime](#), 9
 - [dynamic](#), 201
 - [mag](#), 201
 - [numocts](#), 201
 - [sign](#), 201
- [ASN1BitStr32](#), 202
- [ASN1CCB](#), 203
 - [bytes](#), 203
 - [len](#), 203
 - [mask](#), 203
 - [ptr](#), 203
 - [seqx](#), 203
 - [stat](#), 203
- [Asn1CharArray](#), 204
- [Asn1CharSet](#), 205
 - [canonicalSet](#), 205
 - [canonicalSetBits](#), 205
 - [canonicalSetSize](#), 205
 - [charSet](#), 205
 - [charSetAlignedBits](#), 205
 - [charSetUnalignedBits](#), 205
- [ASN1DumpCbFunc](#)
 - [cruntime](#), 9
- [ASN1DynBitStr](#), 206
- [ASN1DynOctStr](#)
 - [cruntime](#), 7
- [Asn1Object](#), 207
- [ASN1OBJID](#), 208
 - [numids](#), 208
 - [subid](#), 208
- [ASN1OctStr](#), 209
- [ASN1OID64](#), 210
 - [numids](#), 210
 - [subid](#), 210
- [ASN1OpenType](#), 211
- [ASN1SeqOf](#), 212
 - [elem](#), 212
 - [n](#), 212
- [ASN1SeqOfOctStr](#), 213
 - [elem](#), 213
 - [n](#), 213
- [ASN1StrType](#)
 - [cruntime](#), 9
- [asn1type.h](#), 232
- [ASN_K_ENCBUFSIZ](#)
 - [cruntime](#), 7

- ASN_K_MAXDEPTH
 - cruntime, 7
- ASN_K_MAXENUM
 - cruntime, 7
- ASN_K_MAXERRP
 - cruntime, 7
- ASN_K_MAXERRSTK
 - cruntime, 7
- ASN_K_MEMBUFSEG
 - cruntime, 7
- bcdHelper
 - rtBCDToString, 24
 - rtDecQ825TBCDString, 22
 - rtEncQ825TBCDString, 22
 - rtQ825TBCDToString, 23
 - rtStringToBCD, 24
 - rtStringToDynBCD, 25
 - rtStringToTBCD, 25
 - rtTBCDBinToChar, 23
 - rtTBCDCharToBin, 24
 - rtTBCDToString, 25
- Binary Coded Decimal (BCD) Helper Functions, 22
- Bit String Functions, 83
- bitstrhelpers
 - OSRTBYTEARRAYSIZE, 83
 - rtxCheckBitBounds, 83
 - rtxClearBit, 83
 - rtxGetBitCount, 84
 - rtxLastBitSet, 84
 - rtxSetBit, 84
 - rtxSetBitFlags, 85
 - rtxTestBit, 85
- blockingRead
 - OSRTSTREAM, 229
- buffermanfun
 - OSMBAPPENDSTR, 111
 - OSMBAPPENDUTF8, 111
 - rtxMemBufAppend, 111
 - rtxMemBufCut, 111
 - rtxMemBufFree, 111
 - rtxMemBufGetData, 112
 - rtxMemBufGetDataExt, 112
 - rtxMemBufGetDataLen, 112
 - rtxMemBufInit, 112
 - rtxMemBufInitBuffer, 113
 - rtxMemBufPreAllocate, 113
 - rtxMemBufReset, 113
 - rtxMemBufSet, 113
 - rtxMemBufSetExpandable, 114
 - rtxMemBufSetUseSysMem, 114
 - rtxMemBufTrimW, 114
- bufsize
 - OSRTSTREAM, 229
- bytes
 - ASN1CCB, 203
- bytesProcessed
 - OSRTSTREAM, 229
- C Runtime Common Functions, 3
- canonicalSet
 - Asn1CharSet, 205
- canonicalSetBits
 - Asn1CharSet, 205
- canonicalSetSize
 - Asn1CharSet, 205
- ccfDateTime
 - rtxCmpDate, 54
 - rtxCmpDate2, 54
 - rtxCmpDateTime, 54
 - rtxCmpDateTime2, 55
 - rtxCmpTime, 55
 - rtxCmpTime2, 55
 - rtxDateIsValid, 56
 - rtxDateTimeIsValid, 56
 - rtxDateTimeToString, 56
 - rtxDateToString, 57
 - rtxDurationToMsecs, 57
 - rtxGDayToString, 57
 - rtxGetCurrDateTime, 58
 - rtxGetDateTime, 58
 - rtxGMonthDayToString, 58
 - rtxGMonthToString, 59
 - rtxGYearMonthToString, 59
 - rtxGYearToString, 59
 - rtxMsecsToDuration, 60
 - rtxParseDateString, 60
 - rtxParseDateTimeString, 61
 - rtxParseGDayString, 61
 - rtxParseGMonthDayString, 61
 - rtxParseGMonthString, 62
 - rtxParseGYearMonthString, 62
 - rtxParseGYearString, 63
 - rtxParseTimeString, 63
 - rtxSetDateTime, 64
 - rtxSetLocalDateTime, 64
 - rtxSetUtcDateTime, 64
 - rtxTimeIsValid, 65
 - rtxTimeToString, 65
- ccfDiag
 - g_PrintStream, 171
 - OSRTPrintStream, 166
 - rtxDiagEnabled, 166
 - rtxDiagHexDump, 166
 - rtxDiagPrint, 167
 - rtxDiagPrintChars, 167
 - rtxDiagSetTraceLevel, 167
 - rtxDiagStream, 167

- rtxDiagStreamHexDump, 167
- rtxDiagStreamPrintBits, 168
- rtxDiagStreamPrintChars, 168
- rtxDiagToStream, 168
- rtxDiagTraceLevelEnabled, 168
- rtxPrintCallback, 166
- rtxPrintStreamRelease, 169
- rtxPrintStreamToFileCB, 169
- rtxPrintStreamToStdoutCB, 169
- rtxPrintToStream, 169
- rtxSetDiag, 170
- rtxSetGlobalDiag, 170
- rtxSetGlobalPrintStream, 170
- rtxSetPrintStream, 171
- ccfDList
 - rtxDListAppend, 153
 - rtxDListAppendArray, 153
 - rtxDListAppendArrayCopy, 153
 - rtxDListAppendCharArray, 154
 - rtxDListAppendNode, 154
 - rtxDListFindByData, 154
 - rtxDListFindByIndex, 155
 - rtxDListFindIndexByData, 155
 - rtxDListFreeAll, 155
 - rtxDListFreeNode, 155
 - rtxDListFreeNodes, 156
 - rtxDListInit, 156
 - rtxDListInsert, 156
 - rtxDListInsertAfter, 156
 - rtxDListInsertBefore, 157
 - rtxDListRemove, 157
 - rtxDListToArray, 157
 - rtxDListToUTF8Str, 158
- ccfErr
 - LOG_RTERR, 173
 - OSRTASSERT, 173
 - OSRTCHECKPARAM, 173
 - rtxErrAddCtxtBufParm, 173
 - rtxErrAddDoubleParm, 174
 - rtxErrAddElemNameParm, 174
 - rtxErrAddErrorTableEntry, 174
 - rtxErrAddInt64Parm, 174
 - rtxErrAddIntParm, 175
 - rtxErrAddStrnParm, 175
 - rtxErrAddStrParm, 175
 - rtxErrAddUInt64Parm, 176
 - rtxErrAddUIntParm, 176
 - rtxErrAppend, 176
 - rtxErrAssertionFailed, 176
 - rtxErrCopy, 177
 - rtxErrFmtMsg, 177
 - rtxErrFreeParms, 177
 - rtxErrGetErrorCnt, 177
 - rtxErrGetFirstError, 178
 - rtxErrGetLastError, 178
 - rtxErrGetMsgText, 178
 - rtxErrGetMsgTextBuf, 178
 - rtxErrGetStatus, 179
 - rtxErrGetText, 179
 - rtxErrGetTextBuf, 179
 - rtxErrInit, 180
 - rtxErrInvUIntOpt, 180
 - rtxErrLogUsingCB, 180
 - rtxErrNewNode, 180
 - rtxErrPrint, 181
 - rtxErrPrintElement, 181
 - rtxErrReset, 181
 - rtxErrResetLastErrors, 181
 - rtxErrSetData, 181
 - rtxErrSetNewData, 182
- ccfPattern
 - rtxFreeRegexpCache, 164
 - rtxMatchPattern, 164
- ccfSList
 - rtxSListAppend, 159
 - rtxSListCreate, 159
 - rtxSListCreateEx, 160
 - rtxSListFind, 160
 - rtxSListFree, 160
 - rtxSListFreeAll, 160
 - rtxSListInit, 161
 - rtxSListInitEx, 161
 - rtxSListRemove, 161
- ccfSocket
 - OSIPADDR, 132
 - rtxSocketAccept, 132
 - rtxSocketAddrToStr, 133
 - rtxSocketBind, 133
 - rtxSocketClose, 133
 - rtxSocketConnect, 133
 - rtxSocketConnectTimed, 134
 - rtxSocketCreate, 134
 - rtxSocketGetHost, 134
 - rtxSocketListen, 135
 - rtxSocketParseURL, 135
 - rtxSocketRecv, 135
 - rtxSocketRecvTimed, 136
 - rtxSocketSelect, 136
 - rtxSocketSend, 136
 - rtxSocketSetBlocking, 137
 - rtxSocketsInit, 137
 - rtxSocketStrToAddr, 137
- ccfStack
 - rtxStackCreate, 162
 - rtxStackInit, 162
 - rtxStackIsEmpty, 162
 - rtxStackPeek, 163
 - rtxStackPop, 163

- rtxStackPush, 163
- ccfUTF8
 - OSRTCHKUTF8LEN, 70
 - RTUTF8STRCmpl, 70
 - rtxUTF8CharSize, 70
 - rtxUTF8CharToWC, 70
 - rtxUTF8DecodeChar, 71
 - rtxUTF8EncodeChar, 71
 - rtxUTF8Len, 71
 - rtxUTF8LenBytes, 71
 - rtxUTF8RemoveWhiteSpace, 72
 - rtxUTF8StrChr, 72
 - rtxUTF8Strcmp, 72
 - rtxUTF8Strcpy, 72
 - rtxUTF8Strdup, 73
 - rtxUTF8StrEqual, 73
 - rtxUTF8StrHash, 73
 - rtxUTF8StrJoin, 73
 - rtxUTF8Strncmp, 74
 - rtxUTF8Strncpy, 74
 - rtxUTF8Strndup, 74
 - rtxUTF8StrnEqual, 75
 - rtxUTF8StrNextTok, 75
 - rtxUTF8StrnToBool, 75
 - rtxUTF8StrnToDouble, 76
 - rtxUTF8StrnToDynHexStr, 76
 - rtxUTF8StrnToInt, 76
 - rtxUTF8StrnToInt64, 77
 - rtxUTF8StrnToSize, 77
 - rtxUTF8StrntoUInt, 77
 - rtxUTF8StrntoUInt64, 78
 - rtxUTF8StrRefOrDup, 78
 - rtxUTF8StrToBool, 78
 - rtxUTF8StrToDouble, 79
 - rtxUTF8StrToDynHexStr, 79
 - rtxUTF8StrToInt, 79
 - rtxUTF8StrToInt64, 79
 - rtxUTF8StrToNamedBits, 80
 - rtxUTF8StrToSize, 80
 - rtxUTF8StrtoUInt, 80
 - rtxUTF8StrtoUInt64, 81
 - rtxUTF8ToDynUniStr, 81
 - rtxUTF8ToUnicode, 81
 - rtxValidateUTF8, 82
- Character String Conversion Functions, 16
- Character string functions, 47
- charSet
 - Asn116BitCharSet, 197
 - Asn132BitCharSet, 199
 - Asn1CharSet, 205
- charSetAlignedBits
 - Asn1CharSet, 205
- charSetUnalignedBits
 - Asn1CharSet, 205

- charstrcon
 - rtBMPToCString, 16
 - rtBMPToNewCString, 16
 - rtBMPToNewCStringEx, 17
 - rtCToBMPString, 17
 - rtCToUCSSString, 17
 - rtIsIn16BitCharSet, 18
 - rtIsIn32BitCharSet, 18
 - rtUCSToCString, 18
 - rtUCSToNewCString, 19
 - rtUCSToNewCStringEx, 19
 - rtUCSToWCSSString, 19
 - rtUnivStrToUTF8, 19
 - rtUTF8StrnToASN1DynBitStr, 20
 - rtUTF8StrToASN1DynBitStr, 20
 - rtValidateChars, 20
 - rtValidateStr, 21
 - rtWCSToUCSSString, 21
- close
 - OSRTSTREAM, 229
- cmp
 - rtCmp16BitCharStr, 28
 - rtCmp32BitCharStr, 28
 - rtCmpBitStr, 29
 - rtCmpBoolean, 29
 - rtCmpCharStr, 29
 - rtCmpInt64, 30
 - rtCmpInt8, 30
 - rtCmpInteger, 31
 - rtCmpOctStr, 31
 - rtCmpOID, 28
 - rtCmpOID64, 28
 - rtCmpOID64Value, 31
 - rtCmpOIDValue, 32
 - rtCmpOpenType, 32
 - rtCmpOpenTypeExt, 33
 - rtCmpOptional, 33
 - rtCmpReal, 33
 - rtCmpSeqOfElements, 34
 - rtCmpSInt, 34
 - rtCmpTag, 35
 - rtCmpUInt64, 35
 - rtCmpUInt8, 35
 - rtCmpUnsigned, 36
 - rtCmpUSInt, 36
- cmpStdout
 - rtCmpToStdout16BitCharStr, 37
 - rtCmpToStdout32BitCharStr, 37
 - rtCmpToStdoutBitStr, 38
 - rtCmpToStdoutBoolean, 38
 - rtCmpToStdoutCharStr, 38
 - rtCmpToStdoutInt64, 38
 - rtCmpToStdoutInteger, 38
 - rtCmpToStdoutOctStr, 39

- rtCmpToStdoutOID, [39](#)
- rtCmpToStdoutOID64, [39](#)
- rtCmpToStdoutOID64Value, [39](#)
- rtCmpToStdoutOIDValue, [39](#)
- rtCmpToStdoutOpenType, [40](#)
- rtCmpToStdoutOpenTypeExt, [40](#)
- rtCmpToStdoutOptional, [40](#)
- rtCmpToStdoutReal, [40](#)
- rtCmpToStdoutSeqOfElements, [40](#)
- rtCmpToStdoutTag, [41](#)
- rtCmpToStdoutUInt64, [41](#)
- rtCmpToStdoutUnsigned, [41](#)
- Comparison Functions, [27](#)
- Comparison to Standard Output Functions, [37](#)
- containerEndIndexStack
 - OSCTXT, [217](#)
- Context Management Functions, [86](#)
- copy
 - rtCopy16BitCharStr, [42](#)
 - rtCopy32BitCharStr, [42](#)
 - rtCopyBitStr, [43](#)
 - rtCopyCharStr, [43](#)
 - rtCopyDynBitStr, [44](#)
 - rtCopyDynOctStr, [44](#)
 - rtCopyOctStr, [44](#)
 - rtCopyOID, [45](#)
 - rtCopyOID64, [45](#)
 - rtCopyOpenType, [45](#)
 - rtCopyOpenTypeExt, [46](#)
- Copy Functions, [42](#)
- count
 - _OSRTSList, [194](#)
 - OSRTDList, [220](#)
- cruntime
 - ALLOC_ASNIARRAY, [6](#)
 - ALLOC_ASNIARRAY1, [6](#)
 - ASN1_K_CCBMaskSize, [6](#)
 - ASN1_K_MaxSetElements, [6](#)
 - ASN1_K_MINUS_INFINITY, [6](#)
 - ASN1_K_NumBitsPerMask, [7](#)
 - ASN1_K_PLUS_INFINITY, [7](#)
 - ASN1ActionType, [9](#)
 - ASN1BigInt, [9](#)
 - ASN1DumpCbFunc, [9](#)
 - ASN1DynOctStr, [7](#)
 - ASN1StrType, [9](#)
 - ASN_K_ENCBUSIZ, [7](#)
 - ASN_K_MAXDEPTH, [7](#)
 - ASN_K_MAXENUM, [7](#)
 - ASN_K_MAXERRP, [7](#)
 - ASN_K_MAXERRSTK, [7](#)
 - ASN_K_MEMBUFSEG, [7](#)
 - OSCLEARBIT, [7](#)
 - OSCLEARBITP, [8](#)
 - OSRTINDENTSPACES, [8](#)
 - OSSETBIT, [8](#)
 - OSSETBITP, [8](#)
 - OSTESTBIT, [8](#)
 - OSTESTBITP, [8](#)
 - XM_ADVANCE, [9](#)
 - XM_DYNAMIC, [9](#)
 - XM_OPTIONAL, [9](#)
 - XM_SEEK, [9](#)
 - XM_SKIP, [9](#)
- data
 - _OSRTSListNode, [195](#)
 - OSRTDListNode, [222](#)
- Date/time conversion functions, [53](#)
- Decimal number utility functions, [68](#)
- Diagnostic trace functions, [165](#)
- DirBufDesc, [214](#)
- Doubly-Linked List Utility Functions, [152](#)
- dynamic
 - ASN1BigInt, [201](#)
- elem
 - ASN1SeqOf, [212](#)
 - ASN1SeqOfOctStr, [213](#)
- Error Formatting and Print Functions, [172](#)
- extra
 - OSRTSTREAM, [230](#)
- File stream functions., [146](#)
- firstChar
 - Asn116BitCharSet, [197](#)
 - Asn132BitCharSet, [199](#)
- flags
 - OSRTSTREAM, [230](#)
- Floating-point number utility functions, [66](#)
- flush
 - OSRTSTREAM, [230](#)
- g_PrintStream
 - ccfDiag, [171](#)
- getPos
 - OSRTSTREAM, [230](#)
- head
 - _OSRTSList, [194](#)
 - OSRTDList, [220](#)
- id
 - OSRTSTREAM, [230](#)
- Input/Output Data Stream Utility Functions, [138](#)
- ioBytes
 - OSRTSTREAM, [230](#)
- len

- ASN1CCB, [203](#)
- Linked List Utility Functions, [159](#)
- LOG_RTERR
 - ccfErr, [173](#)
- mag
 - ASN1BigInt, [201](#)
- mark
 - OSRTSTREAM, [230](#)
- markedBytesProcessed
 - OSRTSTREAM, [230](#)
- mask
 - ASN1CCB, [203](#)
- Memory Allocation Macros and Functions, [98](#)
- Memory Buffer Management Functions, [110](#)
- Memory stream functions., [148](#)
- n
 - ASN1SeqOf, [212](#)
 - ASN1SeqOfOctStr, [213](#)
- next
 - _OSRTSListNode, [195](#)
 - OSRTDListNode, [222](#)
- nextMarkOffset
 - OSRTSTREAM, [230](#)
- normalizeTimeZone
 - timeutilf, [13](#)
- numids
 - ASN1OBJID, [208](#)
 - ASN1OID64, [210](#)
- numocts
 - ASN1BigInt, [201](#)
- Object Identifier Helper Functions, [11](#)
- objidhelpers
 - rtAddOID, [11](#)
 - rtOIDsValid, [11](#)
 - rtOIDParseDottedNumberString, [11](#)
 - rtOIDsEqual, [12](#)
 - rtSetOID, [12](#)
- OSALLOCELEMSNODE
 - rxSList.h, [279](#)
- OSBigInt, [215](#)
- OSBufferIndex, [216](#)
- OSCLEARBIT
 - cruntime, [7](#)
- OSCLEARBITP
 - cruntime, [8](#)
- OSCTXT, [217](#)
 - containerEndIndexStack, [217](#)
- OSFreeCtxtAppInfoPtr
 - rxCtxt, [89](#)
- OSFreeCtxtGlobalPtr
 - rxCtxt, [89](#)
- OSIPADDR
 - ccfSocket, [132](#)
- OSMBAPPENDSTR
 - buffermanfun, [111](#)
- OSMBAPPENDUTF8
 - buffermanfun, [111](#)
- OSResetCtxtAppInfoPtr
 - rxCtxt, [89](#)
- OSRT_GET_FIRST_ERROR_INFO
 - rxCtxt, [87](#)
- OSRT_GET_LAST_ERROR_INFO
 - rxCtxt, [87](#)
- OSRTALLOCTYPE
 - rtmem, [100](#)
- OSRTALLOCTYPEEZ
 - rtmem, [100](#)
- OSRTASSERT
 - ccfErr, [173](#)
- OSRTBuffer, [218](#)
- OSRTBUFRESTORE
 - rxContext.h, [257](#)
- OSRTBUFRESTORE2
 - rxContext.h, [257](#)
- OSRTBUFSAVE
 - rxContext.h, [257](#)
- OSRTBufSave, [219](#)
- OSRTBUFSAVE2
 - rxContext.h, [257](#)
- OSRTBYTEARRAYSIZE
 - bitstrhelpers, [83](#)
- OSRTCHECKPARAM
 - ccfErr, [173](#)
- OSRTCHKUTF8LEN
 - ccfUTF8, [70](#)
- OSRTDList, [220](#)
 - count, [220](#)
 - head, [220](#)
 - tail, [220](#)
- OSRTDListBuf, [221](#)
- OSRTDListNode, [222](#)
 - data, [222](#)
 - next, [222](#)
 - prev, [222](#)
- OSRTDListUTF8StrNode, [223](#)
- OSRTErrInfo, [224](#)
- OSRTErrInfoList, [225](#)
- OSRTErrLocn, [226](#)
- OSRTINDENTSPACES
 - cruntime, [8](#)
- OSRTMEMBUF, [227](#)
- OSRTPrintStream, [228](#)
 - ccfDiag, [166](#)
- OSRTREALLOCARRAY
 - rtmem, [100](#)
- OSRTSOCKET

- rtxSocket.h, 281
- OSRTSTREAM, 229
 - blockingRead, 229
 - bufsize, 229
 - bytesProcessed, 229
 - close, 229
 - extra, 230
 - flags, 230
 - flush, 230
 - getPos, 230
 - id, 230
 - ioBytes, 230
 - mark, 230
 - markedBytesProcessed, 230
 - nextMarkOffset, 230
 - pCaptureBuf, 230
 - read, 230
 - readAheadLimit, 230
 - reset, 231
 - rtxStream, 140
 - segsz, 231
 - setPos, 231
 - skip, 231
 - write, 231
- OSRTSTREAM_BYTEINDEX
 - rtxStream, 139
- OSRTStreamBlockingReadProc
 - rtxStream, 140
- OSRTStreamCloseProc
 - rtxStream, 140
- OSRTStreamFlushProc
 - rtxStream, 140
- OSRTStreamGetPosProc
 - rtxStream, 140
- OSRTStreamMarkProc
 - rtxStream, 140
- OSRTStreamReadProc
 - rtxStream, 140
- OSRTStreamResetProc
 - rtxStream, 140
- OSRTStreamSetPosProc
 - rtxStream, 140
- OSRTStreamSkipProc
 - rtxStream, 140
- OSRTStreamWriteProc
 - rtxStream, 141
- OSSETBIT
 - cruntime, 8
- OSSETBITP
 - cruntime, 8
- OSTESTBIT
 - cruntime, 8
- OSTESTBITP
 - cruntime, 8

- Pattern matching functions, 164
- pCaptureBuf
 - OSRTSTREAM, 230
- prev
 - OSRTDListNode, 222
- Print Functions, 116
- Print-To-Stream Functions, 125
- prtToStrm
 - rtxHexDumpToStream, 126
 - rtxHexDumpToStreamEx, 126
 - rtxHexDumpToStreamExNoAscii, 126
 - rtxPrintToStreamBoolean, 126
 - rtxPrintToStreamCharStr, 126
 - rtxPrintToStreamCloseBrace, 127
 - rtxPrintToStreamDate, 127
 - rtxPrintToStreamDateTime, 127
 - rtxPrintToStreamDecrIndent, 127
 - rtxPrintToStreamFile, 127
 - rtxPrintToStreamHexBinary, 128
 - rtxPrintToStreamHexStr, 128
 - rtxPrintToStreamHexStrNoAscii, 128
 - rtxPrintToStreamHexStrPlain, 128
 - rtxPrintToStreamIncrIndent, 129
 - rtxPrintToStreamIndent, 129
 - rtxPrintToStreamInt64, 129
 - rtxPrintToStreamInteger, 129
 - rtxPrintToStreamNull, 129
 - rtxPrintToStreamNVP, 130
 - rtxPrintToStreamOpenBrace, 130
 - rtxPrintToStreamReal, 130
 - rtxPrintToStreamTime, 130
 - rtxPrintToStreamUInt64, 130
 - rtxPrintToStreamUnicodeCharStr, 131
 - rtxPrintToStreamUnsigned, 131
 - rtxPrintToStreamUTF8CharStr, 131
- ptr
 - ASN1CCB, 203
- read
 - OSRTSTREAM, 230
- readAheadLimit
 - OSRTSTREAM, 230
- reset
 - OSRTSTREAM, 231
- RT_OK
 - rtxErrCodes, 184
- RT_OK_FRAG
 - rtxErrCodes, 184
- rtAddOID
 - objidhelpers, 11
- rtBCD.h, 236
- rtBCDToString
 - bcdHelper, 24
- rtBMPToCString

charstrcon, 16
 rtBMPToNewCString
 charstrcon, 16
 rtBMPToNewCStringEx
 charstrcon, 17
 RTCHKCOPYCHARSTR
 rtCopy.h, 240
 rtCmp16BitCharStr
 cmp, 28
 rtCmp32BitCharStr
 cmp, 28
 rtCmpBitStr
 cmp, 29
 rtCmpBoolean
 cmp, 29
 rtCmpCharStr
 cmp, 29
 rtCmpInt64
 cmp, 30
 rtCmpInt8
 cmp, 30
 rtCmpInteger
 cmp, 31
 rtCmpOctStr
 cmp, 31
 rtCmpOID
 cmp, 28
 rtCmpOID64
 cmp, 28
 rtCmpOID64Value
 cmp, 31
 rtCmpOIDValue
 cmp, 32
 rtCmpOpenType
 cmp, 32
 rtCmpOpenTypeExt
 cmp, 33
 rtCmpOptional
 cmp, 33
 rtCmpReal
 cmp, 33
 rtCmpSeqOfElements
 cmp, 34
 rtCmpSInt
 cmp, 34
 rtCmpTag
 cmp, 35
 rtCmpToStdout16BitCharStr
 cmpStdout, 37
 rtCmpToStdout32BitCharStr
 cmpStdout, 37
 rtCmpToStdoutBitStr
 cmpStdout, 38
 rtCmpToStdoutBoolean
 cmpStdout, 38
 rtCmpToStdoutCharStr
 cmpStdout, 38
 rtCmpToStdoutInt64
 cmpStdout, 38
 rtCmpToStdoutInteger
 cmpStdout, 38
 rtCmpToStdoutOctStr
 cmpStdout, 39
 rtCmpToStdoutOID
 cmpStdout, 39
 rtCmpToStdoutOID64
 cmpStdout, 39
 rtCmpToStdoutOID64Value
 cmpStdout, 39
 rtCmpToStdoutOIDValue
 cmpStdout, 39
 rtCmpToStdoutOpenType
 cmpStdout, 40
 rtCmpToStdoutOpenTypeExt
 cmpStdout, 40
 rtCmpToStdoutOptional
 cmpStdout, 40
 rtCmpToStdoutReal
 cmpStdout, 40
 rtCmpToStdoutSeqOfElements
 cmpStdout, 40
 rtCmpToStdoutTag
 cmpStdout, 41
 rtCmpToStdoutUInt64
 cmpStdout, 41
 rtCmpToStdoutUnsigned
 cmpStdout, 41
 rtCmpUInt64
 cmp, 35
 rtCmpUInt8
 cmp, 35
 rtCmpUnsigned
 cmp, 36
 rtCmpUSInt
 cmp, 36
 rtCompare.h, 237
 rtCopy.h, 240
 RTCHKCOPYCHARSTR, 240
 RTCOPYCHARSTR, 241
 rtCopy16BitCharStr
 copy, 42
 rtCopy32BitCharStr
 copy, 42
 rtCopyBitStr
 copy, 43
 RTCOPYCHARSTR
 rtCopy.h, 241
 rtCopyCharStr

copy, [43](#)
 rtCopyDynBitStr
 copy, [44](#)
 rtCopyDynOctStr
 copy, [44](#)
 rtCopyOctStr
 copy, [44](#)
 rtCopyOID
 copy, [45](#)
 rtCopyOID64
 copy, [45](#)
 rtCopyOpenType
 copy, [45](#)
 rtCopyOpenTypeExt
 copy, [46](#)
 rtCToBMPString
 charstrcon, [17](#)
 rtCToUCSString
 charstrcon, [17](#)
 rtDecQ825TBCDString
 bcdHelper, [22](#)
 rtEncQ825TBCDString
 bcdHelper, [22](#)
 RTERR_ADDRINUSE
 rtxErrCodes, [184](#)
 RTERR_ATTRFIXEDVAL
 rtxErrCodes, [185](#)
 RTERR_ATTRMISRQ
 rtxErrCodes, [185](#)
 RTERR_BADVALUE
 rtxErrCodes, [185](#)
 RTERR_BUFOVFLW
 rtxErrCodes, [185](#)
 RTERR_CONNREFUSED
 rtxErrCodes, [185](#)
 RTERR_CONNRESET
 rtxErrCodes, [185](#)
 RTERR_CONSVIO
 rtxErrCodes, [185](#)
 RTERR_COPYFAIL
 rtxErrCodes, [185](#)
 RTERR_DECATTRFAIL
 rtxErrCodes, [185](#)
 RTERR_DECELEMFAIL
 rtxErrCodes, [186](#)
 RTERR_ENDOFBUF
 rtxErrCodes, [186](#)
 RTERR_ENDOFFILE
 rtxErrCodes, [186](#)
 RTERR_EXPIRED
 rtxErrCodes, [186](#)
 RTERR_EXPNAME
 rtxErrCodes, [186](#)
 RTERR_EXTRDATA
 rtxErrCodes, [186](#)
 RTERR_FAILED
 rtxErrCodes, [186](#)
 RTERR_FILNOTFOU
 rtxErrCodes, [186](#)
 RTERR_HOSTNOTFOU
 rtxErrCodes, [186](#)
 RTERR_HTTPERR
 rtxErrCodes, [187](#)
 RTERR_IDNOTFOU
 rtxErrCodes, [187](#)
 RTERR_INVATTR
 rtxErrCodes, [187](#)
 RTERR_INVBASE64
 rtxErrCodes, [187](#)
 RTERR_INVBOOL
 rtxErrCodes, [187](#)
 RTERR_INVCHAR
 rtxErrCodes, [187](#)
 RTERR_INVENUM
 rtxErrCodes, [187](#)
 RTERR_INVFORMAT
 rtxErrCodes, [187](#)
 RTERR_INVHEXS
 rtxErrCodes, [187](#)
 RTERR_INVLEN
 rtxErrCodes, [188](#)
 RTERR_INVMAC
 rtxErrCodes, [188](#)
 RTERR_INVMSGBUF
 rtxErrCodes, [188](#)
 RTERR_INVNULL
 rtxErrCodes, [188](#)
 RTERR_INVOCCUR
 rtxErrCodes, [188](#)
 RTERR_INVOPT
 rtxErrCodes, [188](#)
 RTERR_INVPARAM
 rtxErrCodes, [188](#)
 RTERR_INVREAL
 rtxErrCodes, [188](#)
 RTERR_INVSOCKET
 rtxErrCodes, [188](#)
 RTERR_INVSOCKOPT
 rtxErrCodes, [189](#)
 RTERR_INVUTF8
 rtxErrCodes, [189](#)
 RTERR_MARKNOTSUP
 rtxErrCodes, [189](#)
 RTERR_MULTIPLE
 rtxErrCodes, [189](#)
 RTERR_NOCONN
 rtxErrCodes, [189](#)
 RTERR_NOMEM

- rtxErrCodes, [189](#)
- RTERR_NOSECPARAMS
 - rtxErrCodes, [189](#)
- RTERR_NOTALIGNED
 - rtxErrCodes, [189](#)
- RTERR_NOTINIT
 - rtxErrCodes, [189](#)
- RTERR_NOTINSET
 - rtxErrCodes, [190](#)
- RTERR_NOTSUPP
 - rtxErrCodes, [190](#)
- RTERR_NOTYPEINFO
 - rtxErrCodes, [190](#)
- RTERR_NULLPTR
 - rtxErrCodes, [190](#)
- RTERR_OUTOFBND
 - rtxErrCodes, [190](#)
- RTERR_PARSEFAIL
 - rtxErrCodes, [190](#)
- RTERR_PATMATCH
 - rtxErrCodes, [190](#)
- RTERR_READERR
 - rtxErrCodes, [190](#)
- RTERR_REGEX
 - rtxErrCodes, [190](#)
- RTERR_SEQORDER
 - rtxErrCodes, [191](#)
- RTERR_SEQOVFLW
 - rtxErrCodes, [191](#)
- RTERR_SETDUPL
 - rtxErrCodes, [191](#)
- RTERR_SETMISRQ
 - rtxErrCodes, [191](#)
- RTERR_SOAPERR
 - rtxErrCodes, [191](#)
- RTERR_SOAPFAULT
 - rtxErrCodes, [191](#)
- RTERR_STRMINUSE
 - rtxErrCodes, [191](#)
- RTERR_STROVFLW
 - rtxErrCodes, [191](#)
- RTERR_TOOBIG
 - rtxErrCodes, [191](#)
- RTERR_TOODEEP
 - rtxErrCodes, [192](#)
- RTERR_UNBAL
 - rtxErrCodes, [192](#)
- RTERR_UNEXPELEM
 - rtxErrCodes, [192](#)
- RTERR_UNICODE
 - rtxErrCodes, [192](#)
- RTERR_UNKNOWNIE
 - rtxErrCodes, [192](#)
- RTERR_UNREACHABLE
 - rtxErrCodes, [192](#)
- RTERR_WRITEERR
 - rtxErrCodes, [192](#)
- RTERR_XMLPARSE
 - rtxErrCodes, [192](#)
- RTERR_XMLSTATE
 - rtxErrCodes, [192](#)
- rtIsIn16BitCharSet
 - charstrcon, [18](#)
- rtIsIn32BitCharSet
 - charstrcon, [18](#)
- rtMakeGeneralizedTime
 - timeutilf, [13](#)
- rtMakeUTCTime
 - timeutilf, [13](#)
- rtmem
 - OSRTALLOCTYPE, [100](#)
 - OSRTALLOCTYPEZ, [100](#)
 - OSRTREALLOCARRAY, [100](#)
 - rtxMemAlloc, [100](#)
 - rtxMemAllocArray, [100](#)
 - rtxMemAllocArrayZ, [101](#)
 - rtxMemAllocType, [101](#)
 - rtxMemAllocTypeZ, [101](#)
 - rtxMemAllocZ, [101](#)
 - rtxMemAutoPtrGetRefCount, [102](#)
 - rtxMemAutoPtrRef, [102](#)
 - rtxMemAutoPtrUnref, [102](#)
 - rtxMemCheck, [102](#)
 - rtxMemCheckPtr, [103](#)
 - rtxMemFree, [108](#)
 - rtxMemFreeArray, [103](#)
 - rtxMemFreePtr, [103](#)
 - rtxMemFreeType, [103](#)
 - rtxMemGetDefBlkSize, [108](#)
 - rtxMemHeapGetDefBlkSize, [108](#)
 - rtxMemHeapIsEmpty, [108](#)
 - rtxMemIsZero, [108](#)
 - rtxMemNewAutoPtr, [104](#)
 - rtxMemPrint, [104](#)
 - rtxMemRealloc, [104](#)
 - rtxMemReallocArray, [104](#)
 - rtxMemReset, [109](#)
 - rtxMemSetAllocFuncs, [109](#)
 - rtxMemSetDefBlkSize, [109](#)
 - rtxMemSetProperty, [105](#)
 - rtxMemSysAlloc, [105](#)
 - rtxMemSysAllocArray, [105](#)
 - rtxMemSysAllocType, [106](#)
 - rtxMemSysAllocTypeZ, [106](#)
 - rtxMemSysAllocZ, [106](#)
 - rtxMemSysFreeArray, [107](#)
 - rtxMemSysFreePtr, [107](#)
 - rtxMemSysFreeType, [107](#)

- rtxMemSysRealloc, 107
- rtOIDIsValid
 - objidhelpers, 11
- rtOIDParseDottedNumberString
 - objidhelpers, 11
- rtOIDsEqual
 - objidhelpers, 12
- rtParseGeneralizedTime
 - timeutilf, 14
- rtParseUTCTime
 - timeutilf, 14
- rtQ825TBCDToString
 - bcdHelper, 23
- rtSetOID
 - objidhelpers, 12
- rtStringToBCD
 - bcdHelper, 24
- rtStringToDynBCD
 - bcdHelper, 25
- rtStringToTBCD
 - bcdHelper, 25
- rtTBCDBinToChar
 - bcdHelper, 23
- rtTBCDCharToBin
 - bcdHelper, 24
- rtTBCDToString
 - bcdHelper, 25
- rtUCSToCString
 - charstrcon, 18
- rtUCSToNewCString
 - charstrcon, 19
- rtUCSToNewCStringEx
 - charstrcon, 19
- rtUCSToWCSStr
 - charstrcon, 19
- rtUnivStrToUTF8
 - charstrcon, 19
- RTUTF8STRCMP
 - ccfUTF8, 70
- rtUTF8StrnToASN1DynBitStr
 - charstrcon, 20
- rtUTF8StrToASN1DynBitStr
 - charstrcon, 20
- rtValidateChars
 - charstrcon, 20
- rtValidateStr
 - charstrcon, 21
- rtWCSToUCSStr
 - charstrcon, 21
- rtxBase64.h, 242
 - rtxBase64DecodeData, 242
 - rtxBase64DecodeDataToFSB, 242
 - rtxBase64EncodeData, 243
 - rtxBase64EncodeURLParam, 243
- rtxBase64GetBinDataLen, 243
- rtxBase64DecodeData
 - rtxBase64.h, 242
- rtxBase64DecodeDataToFSB
 - rtxBase64.h, 242
- rtxBase64EncodeData
 - rtxBase64.h, 243
- rtxBase64EncodeURLParam
 - rtxBase64.h, 243
- rtxBase64GetBinDataLen
 - rtxBase64.h, 243
- rtxBigInt.h, 245
 - rtxBigIntAdd, 245
 - rtxBigIntCompare, 246
 - rtxBigIntCopy, 246
 - rtxBigIntDigitsNum, 246
 - rtxBigIntFastCopy, 246
 - rtxBigIntFree, 247
 - rtxBigIntGetData, 247
 - rtxBigIntGetDataLen, 247
 - rtxBigIntInit, 247
 - rtxBigIntMultiply, 248
 - rtxBigIntPrint, 248
 - rtxBigIntSetBytes, 248
 - rtxBigIntSetInt64, 248
 - rtxBigIntSetStr, 249
 - rtxBigIntSetStrn, 249
 - rtxBigIntSetUInt64, 249
 - rtxBigIntStrCompare, 250
 - rtxBigIntSubtract, 250
 - rtxBigIntToString, 250
- rtxBigIntAdd
 - rtxBigInt.h, 245
- rtxBigIntCompare
 - rtxBigInt.h, 246
- rtxBigIntCopy
 - rtxBigInt.h, 246
- rtxBigIntDigitsNum
 - rtxBigInt.h, 246
- rtxBigIntFastCopy
 - rtxBigInt.h, 246
- rtxBigIntFree
 - rtxBigInt.h, 247
- rtxBigIntGetData
 - rtxBigInt.h, 247
- rtxBigIntGetDataLen
 - rtxBigInt.h, 247
- rtxBigIntInit
 - rtxBigInt.h, 247
- rtxBigIntMultiply
 - rtxBigInt.h, 248
- rtxBigIntPrint
 - rtxBigInt.h, 248
- rtxBigIntSetBytes

- rtxBigInt.h, 248
- rtxBigIntSetInt64
 - rtxBigInt.h, 248
- rtxBigIntSetStr
 - rtxBigInt.h, 249
- rtxBigIntSetStrn
 - rtxBigInt.h, 249
- rtxBigIntSetUInt64
 - rtxBigInt.h, 249
- rtxBigIntStrCompare
 - rtxBigInt.h, 250
- rtxBigIntSubtract
 - rtxBigInt.h, 250
- rtxBigIntToString
 - rtxBigInt.h, 250
- rtxBitString.h, 252
- rtxByteAlign
 - rtxCtxt, 88
- rtxByteToHexChar
 - valsToStdout, 117
- rtxByteToHexCharWithPrefix
 - valsToStdout, 117
- rtxCharStr
 - rtxCharStrToInt, 47
 - rtxHexCharsToBin, 47
 - rtxHexCharsToBinCount, 48
 - rtxInt64ToCharStr, 48
 - rtxIntToCharStr, 48
 - rtxSizeToCharStr, 49
 - rtxStrcat, 49
 - rtxStrcpy, 49
 - rtxStrdup, 50
 - rtxStrDynJoin, 50
 - rtxStricmp, 50
 - rtxStrJoin, 51
 - rtxStrncat, 51
 - rtxStrncpy, 51
 - rtxUInt64ToCharStr, 52
 - rtxUIntToCharStr, 52
- rtxCharStr.h, 253
- rtxCharStrToInt
 - rtxCharStr, 47
- rtxCheckBitBounds
 - bitstrhelpers, 83
- rtxCheckContext
 - rtxCtxt, 89
- rtxClearBit
 - bitstrhelpers, 83
- rtxCmpDate
 - ccfDateTime, 54
- rtxCmpDate2
 - ccfDateTime, 54
- rtxCmpDateTime
 - ccfDateTime, 54
- rtxCmpDateTime2
 - ccfDateTime, 55
- rtxCmpTime
 - ccfDateTime, 55
- rtxCmpTime2
 - ccfDateTime, 55
- rtxCommon.h, 254
- rtxContext.h, 255
 - OSRTBUFRESTORE, 257
 - OSRTBUFRESTORE2, 257
 - OSRTBUFSAVE, 257
 - OSRTBUFSAVE2, 257
- rtxCopyContext
 - rtxCtxt, 90
- rtxCtxt
 - OSFreeCtxtAppInfoPtr, 89
 - OSFreeCtxtGlobalPtr, 89
 - OSResetCtxtAppInfoPtr, 89
 - OSRT_GET_FIRST_ERROR_INFO, 87
 - OSRT_GET_LAST_ERROR_INFO, 87
 - rtxByteAlign, 88
 - rtxCheckContext, 89
 - rtxCopyContext, 90
 - rtxCtxtClearFlag, 90
 - rtxCtxtContainerHasRemBits, 90
 - rtxCtxtGetBitOffset, 90
 - rtxCtxtGetContainerRemBits, 90
 - rtxCtxtGetIOByteCount, 91
 - rtxCtxtGetMsgLen, 88
 - rtxCtxtGetMsgPtr, 88
 - rtxCtxtPeekElemName, 88
 - rtxCtxtPopAllContainers, 91
 - rtxCtxtPopArrayElemName, 91
 - rtxCtxtPopContainer, 91
 - rtxCtxtPopElemName, 91
 - rtxCtxtPopTypeName, 92
 - rtxCtxtPushArrayElemName, 92
 - rtxCtxtPushContainerBits, 92
 - rtxCtxtPushContainerBytes, 93
 - rtxCtxtPushElemName, 93
 - rtxCtxtPushTypeName, 93
 - rtxCtxtSetBitOffset, 94
 - rtxCtxtSetBufPtr, 94
 - rtxCtxtSetFlag, 94
 - rtxCtxtSetProtocolVersion, 88
 - rtxCtxtTestFlag, 89
 - rtxFreeContext, 94
 - rtxInitContext, 95
 - rtxInitContextBuffer, 95
 - rtxInitContextExt, 95
 - rtxInitThreadContext, 96
 - rtxMarkPos, 96
 - rtxMemHeapClearFlags, 96
 - rtxMemHeapSetFlags, 97

- rtxResetToPos, 97
- rtxCtxtClearFlag
 - rtxCtxt, 90
- rtxCtxtContainerHasRemBits
 - rtxCtxt, 90
- rtxCtxtGetBitOffset
 - rtxCtxt, 90
- rtxCtxtGetContainerRemBits
 - rtxCtxt, 90
- rtxCtxtGetIOByteCount
 - rtxCtxt, 91
- rtxCtxtGetMsgLen
 - rtxCtxt, 88
- rtxCtxtGetMsgPtr
 - rtxCtxt, 88
- rtxCtxtPeekElemName
 - rtxCtxt, 88
- rtxCtxtPopAllContainers
 - rtxCtxt, 91
- rtxCtxtPopArrayElemName
 - rtxCtxt, 91
- rtxCtxtPopContainer
 - rtxCtxt, 91
- rtxCtxtPopElemName
 - rtxCtxt, 91
- rtxCtxtPopTypeName
 - rtxCtxt, 92
- rtxCtxtPushArrayElemName
 - rtxCtxt, 92
- rtxCtxtPushContainerBits
 - rtxCtxt, 92
- rtxCtxtPushContainerBytes
 - rtxCtxt, 93
- rtxCtxtPushElemName
 - rtxCtxt, 93
- rtxCtxtPushTypeName
 - rtxCtxt, 93
- rtxCtxtSetBitOffset
 - rtxCtxt, 94
- rtxCtxtSetBufPtr
 - rtxCtxt, 94
- rtxCtxtSetFlag
 - rtxCtxt, 94
- rtxCtxtSetProtocolVersion
 - rtxCtxt, 88
- rtxCtxtTestFlag
 - rtxCtxt, 89
- rtxCtype.h, 258
- rtxDateIsValid
 - ccfDateTime, 56
- rtxDateTime.h, 259
- rtxDateTimeIsValid
 - ccfDateTime, 56
- rtxDateTimeToString
 - ccfDateTime, 56
- rtxDateToString
 - ccfDateTime, 57
- rtxDecimal.h, 260
- rtxDiag.h, 261
- rtxDiagEnabled
 - ccfDiag, 166
- rtxDiagHexDump
 - ccfDiag, 166
- rtxDiagPrint
 - ccfDiag, 167
- rtxDiagPrintChars
 - ccfDiag, 167
- rtxDiagSetTraceLevel
 - ccfDiag, 167
- rtxDiagStream
 - ccfDiag, 167
- rtxDiagStreamHexDump
 - ccfDiag, 167
- rtxDiagStreamPrintBits
 - ccfDiag, 168
- rtxDiagStreamPrintChars
 - ccfDiag, 168
- rtxDiagToStream
 - ccfDiag, 168
- rtxDiagTraceLevelEnabled
 - ccfDiag, 168
- rtxDList.h, 262
 - rtxDListAllocNodeAndData, 263
 - rtxDListAppendData, 263
 - rtxDListFastInit, 263
- rtxDListAllocNodeAndData
 - rtxDList.h, 263
- rtxDListAppend
 - ccfDList, 153
- rtxDListAppendArray
 - ccfDList, 153
- rtxDListAppendArrayCopy
 - ccfDList, 153
- rtxDListAppendCharArray
 - ccfDList, 154
- rtxDListAppendData
 - rtxDList.h, 263
- rtxDListAppendNode
 - ccfDList, 154
- rtxDListFastInit
 - rtxDList.h, 263
- rtxDListFindByData
 - ccfDList, 154
- rtxDListFindByIndex
 - ccfDList, 155
- rtxDListFindIndexByData
 - ccfDList, 155
- rtxDListFreeAll

- ccfDList, [155](#)
- rtxDListFreeNode
 - ccfDList, [155](#)
- rtxDListFreeNodes
 - ccfDList, [156](#)
- rtxDListInit
 - ccfDList, [156](#)
- rtxDListInsert
 - ccfDList, [156](#)
- rtxDListInsertAfter
 - ccfDList, [156](#)
- rtxDListInsertBefore
 - ccfDList, [157](#)
- rtxDListRemove
 - ccfDList, [157](#)
- rtxDListToArray
 - ccfDList, [157](#)
- rtxDListToUTF8Str
 - ccfDList, [158](#)
- rtxDurationToMsecs
 - ccfDateTime, [57](#)
- rtxErrAddCtxtBufParm
 - ccfErr, [173](#)
- rtxErrAddDoubleParm
 - ccfErr, [174](#)
- rtxErrAddElemNameParm
 - ccfErr, [174](#)
- rtxErrAddErrorTableEntry
 - ccfErr, [174](#)
- rtxErrAddInt64Parm
 - ccfErr, [174](#)
- rtxErrAddIntParm
 - ccfErr, [175](#)
- rtxErrAddStrnParm
 - ccfErr, [175](#)
- rtxErrAddStrParm
 - ccfErr, [175](#)
- rtxErrAddUInt64Parm
 - ccfErr, [176](#)
- rtxErrAddUIntParm
 - ccfErr, [176](#)
- rtxErrAppend
 - ccfErr, [176](#)
- rtxErrAssertionFailed
 - ccfErr, [176](#)
- rtxErrCodes
 - RT_OK, [184](#)
 - RT_OK_FRAG, [184](#)
 - RTERR_ADDRINUSE, [184](#)
 - RTERR_ATTRFIXEDVAL, [185](#)
 - RTERR_ATTRMISRQ, [185](#)
 - RTERR_BADVALUE, [185](#)
 - RTERR_BUFOVFLW, [185](#)
 - RTERR_CONNREFUSED, [185](#)
 - RTERR_CONNRESET, [185](#)
 - RTERR_CONSVIO, [185](#)
 - RTERR_COPYFAIL, [185](#)
 - RTERR_DECATTRFAIL, [185](#)
 - RTERR_DECELEMFAIL, [186](#)
 - RTERR_ENDOFBUF, [186](#)
 - RTERR_ENDOFFILE, [186](#)
 - RTERR_EXPIRED, [186](#)
 - RTERR_EXPNAME, [186](#)
 - RTERR_EXTRDATA, [186](#)
 - RTERR_FAILED, [186](#)
 - RTERR_FILNOTFOU, [186](#)
 - RTERR_HOSTNOTFOU, [186](#)
 - RTERR_HTTPERR, [187](#)
 - RTERR_IDNOTFOU, [187](#)
 - RTERR_INVATTR, [187](#)
 - RTERR_INVBASE64, [187](#)
 - RTERR_INVBOOL, [187](#)
 - RTERR_INVCHAR, [187](#)
 - RTERR_INVENUM, [187](#)
 - RTERR_INVFORMAT, [187](#)
 - RTERR_INVHEXS, [187](#)
 - RTERR_INVLEN, [188](#)
 - RTERR_INVMAC, [188](#)
 - RTERR_INVMSGBUF, [188](#)
 - RTERR_INVNULL, [188](#)
 - RTERR_INVOCUR, [188](#)
 - RTERR_INVOPT, [188](#)
 - RTERR_INVPARAM, [188](#)
 - RTERR_INVREAL, [188](#)
 - RTERR_INVSOCKET, [188](#)
 - RTERR_INVSOCKOPT, [189](#)
 - RTERR_INVUTF8, [189](#)
 - RTERR_MARKNOTSUP, [189](#)
 - RTERR_MULTIPLE, [189](#)
 - RTERR_NOCONN, [189](#)
 - RTERR_NOMEM, [189](#)
 - RTERR_NOSECPARAMS, [189](#)
 - RTERR_NOTALIGNED, [189](#)
 - RTERR_NOTINIT, [189](#)
 - RTERR_NOTINSET, [190](#)
 - RTERR_NOTSUPP, [190](#)
 - RTERR_NOTYPEINFO, [190](#)
 - RTERR_NULLPTR, [190](#)
 - RTERR_OUTOFBND, [190](#)
 - RTERR_PARSEFAIL, [190](#)
 - RTERR_PATMATCH, [190](#)
 - RTERR_READERR, [190](#)
 - RTERR_REGEXP, [190](#)
 - RTERR_SEQORDER, [191](#)
 - RTERR_SEQOVFLW, [191](#)
 - RTERR_SETDUPL, [191](#)
 - RTERR_SETMISRQ, [191](#)
 - RTERR_SOAPERR, [191](#)

- RTERR_SOAPFAULT, 191
- RTERR_STRMINUSE, 191
- RTERR_STROVFLW, 191
- RTERR_TOOBIG, 191
- RTERR_TOODEEP, 192
- RTERR_UNBAL, 192
- RTERR_UNEXPELEM, 192
- RTERR_UNICODE, 192
- RTERR_UNKNOWNIE, 192
- RTERR_UNREACHABLE, 192
- RTERR_WRITEERR, 192
- RTERR_XMLPARSE, 192
- RTERR_XMLSTATE, 192
- rtxErrCodes.h, 264
- rtxErrCopy
 - ccfErr, 177
- rtxErrFmtMsg
 - ccfErr, 177
- rtxErrFreeParms
 - ccfErr, 177
- rtxErrGetErrorCnt
 - ccfErr, 177
- rtxErrGetFirstError
 - ccfErr, 178
- rtxErrGetLastError
 - ccfErr, 178
- rtxErrGetMsgText
 - ccfErr, 178
- rtxErrGetMsgTextBuf
 - ccfErr, 178
- rtxErrGetStatus
 - ccfErr, 179
- rtxErrGetText
 - ccfErr, 179
- rtxErrGetTextBuf
 - ccfErr, 179
- rtxErrInit
 - ccfErr, 180
- rtxErrInvUIntOpt
 - ccfErr, 180
- rtxErrLogUsingCB
 - ccfErr, 180
- rtxErrNewNode
 - ccfErr, 180
- rtxError.h, 266
- rtxErrPrint
 - ccfErr, 181
- rtxErrPrintElement
 - ccfErr, 181
- rtxErrReset
 - ccfErr, 181
- rtxErrResetLastErrors
 - ccfErr, 181
- rtxErrSetData
 - ccfErr, 181
- rtxErrSetNewData
 - ccfErr, 182
- rtxFreeContext
 - rtxCtxt, 94
- rtxFreeRegexpCache
 - ccfPattern, 164
- rtxGDayToString
 - ccfDateTime, 57
- rtxGetBitCount
 - bitstrhelpers, 84
- rtxGetCurrDateTime
 - ccfDateTime, 58
- rtxGetDateTime
 - ccfDateTime, 58
- rtxGetMinusInfinity
 - rtxReal, 66
- rtxGetMinusZero
 - rtxReal, 66
- rtxGetNaN
 - rtxReal, 66
- rtxGetPlusInfinity
 - rtxReal, 66
- rtxGMonthDayToString
 - ccfDateTime, 58
- rtxGMonthToString
 - ccfDateTime, 59
- rtxGYearMonthToString
 - ccfDateTime, 59
- rtxGYearToString
 - ccfDateTime, 59
- rtxHexCharsToBin
 - rtxCharStr, 47
- rtxHexCharsToBinCount
 - rtxCharStr, 48
- rtxHexDump
 - valsToStdout, 117
- rtxHexDumpEx
 - valsToStdout, 117
- rtxHexDumpFileContents
 - valsToStdout, 117
- rtxHexDumpFileContentsToFile
 - valsToStdout, 118
- rtxHexDumpToFile
 - valsToStdout, 118
- rtxHexDumpToFileEx
 - valsToStdout, 118
- rtxHexDumpToFileExNoAscii
 - valsToStdout, 118
- rtxHexDumpToNamedFile
 - valsToStdout, 119
- rtxHexDumpToStream
 - prtToStrm, 126
- rtxHexDumpToStreamEx

- prtToStrm, 126
- rtxHexDumpToStreamExNoAscii
 - prtToStrm, 126
- rtxHexDumpToString
 - valsToStdout, 119
- rtxHexDumpToStringEx
 - valsToStdout, 119
- rtxInitContext
 - rtxCtxt, 95
- rtxInitContextBuffer
 - rtxCtxt, 95
- rtxInitContextExt
 - rtxCtxt, 95
- rtxInitThreadContext
 - rtxCtxt, 96
- rtxInt64ToCharStr
 - rtxCharStr, 48
- rtxIntToCharStr
 - rtxCharStr, 48
- rtxIsApproximate
 - rtxReal, 66
- rtxIsApproximateAbs
 - rtxReal, 67
- rtxIsMinusInfinity
 - rtxReal, 67
- rtxIsMinusZero
 - rtxReal, 67
- rtxIsNaN
 - rtxReal, 67
- rtxIsPlusInfinity
 - rtxReal, 67
- rtxLastBitSet
 - bitstrhelpers, 84
- rtxMarkPos
 - rtxCtxt, 96
- rtxMatchPattern
 - ccfPattern, 164
- rtxMemAlloc
 - rtmem, 100
- rtxMemAllocArray
 - rtmem, 100
- rtxMemAllocArrayZ
 - rtmem, 101
- rtxMemAllocType
 - rtmem, 101
- rtxMemAllocTypeZ
 - rtmem, 101
- rtxMemAllocZ
 - rtmem, 101
- rtxMemAutoPtrGetRefCount
 - rtmem, 102
- rtxMemAutoPtrRef
 - rtmem, 102
- rtxMemAutoPtrUnref
 - rtmem, 102
- rtxMemBuf.h, 268
- rtxMemBufAppend
 - buffermanfun, 111
- rtxMemBufCut
 - buffermanfun, 111
- rtxMemBufFree
 - buffermanfun, 111
- rtxMemBufGetData
 - buffermanfun, 112
- rtxMemBufGetDataExt
 - buffermanfun, 112
- rtxMemBufGetDataLen
 - buffermanfun, 112
- rtxMemBufInit
 - buffermanfun, 112
- rtxMemBufInitBuffer
 - buffermanfun, 113
- rtxMemBufPreAllocate
 - buffermanfun, 113
- rtxMemBufReset
 - buffermanfun, 113
- rtxMemBufSet
 - buffermanfun, 113
- rtxMemBufSetExpandable
 - buffermanfun, 114
- rtxMemBufSetUseSysMem
 - buffermanfun, 114
- rtxMemBufTrimW
 - buffermanfun, 114
- rtxMemCheck
 - rtmem, 102
- rtxMemCheckPtr
 - rtmem, 103
- rtxMemFree
 - rtmem, 108
- rtxMemFreeArray
 - rtmem, 103
- rtxMemFreePtr
 - rtmem, 103
- rtxMemFreeType
 - rtmem, 103
- rtxMemGetDefBlkSize
 - rtmem, 108
- rtxMemHeapClearFlags
 - rtxCtxt, 96
- rtxMemHeapGetDefBlkSize
 - rtmem, 108
- rtxMemHeapIsEmpty
 - rtmem, 108
- rtxMemHeapSetFlags
 - rtxCtxt, 97
- rtxMemIsZero
 - rtmem, 108

- rtxMemNewAutoPtr
 - rtmem, [104](#)
- rtxMemory.h, [269](#)
- rtxMemPrint
 - rtmem, [104](#)
- rtxMemRealloc
 - rtmem, [104](#)
- rtxMemReallocArray
 - rtmem, [104](#)
- rtxMemReset
 - rtmem, [109](#)
- rtxMemSetAllocFuncs
 - rtmem, [109](#)
- rtxMemSetDefBlkSize
 - rtmem, [109](#)
- rtxMemSetProperty
 - rtmem, [105](#)
- rtxMemSysAlloc
 - rtmem, [105](#)
- rtxMemSysAllocArray
 - rtmem, [105](#)
- rtxMemSysAllocType
 - rtmem, [106](#)
- rtxMemSysAllocTypeZ
 - rtmem, [106](#)
- rtxMemSysAllocZ
 - rtmem, [106](#)
- rtxMemSysFreeArray
 - rtmem, [107](#)
- rtxMemSysFreePtr
 - rtmem, [107](#)
- rtxMemSysFreeType
 - rtmem, [107](#)
- rtxMemSysRealloc
 - rtmem, [107](#)
- rtxMSecsToDuration
 - ccfDateTime, [60](#)
- rtxParseDateString
 - ccfDateTime, [60](#)
- rtxParseDateTimeString
 - ccfDateTime, [61](#)
- rtxParseGDayString
 - ccfDateTime, [61](#)
- rtxParseGMonthDayString
 - ccfDateTime, [61](#)
- rtxParseGMonthString
 - ccfDateTime, [62](#)
- rtxParseGYearMonthString
 - ccfDateTime, [62](#)
- rtxParseGYearString
 - ccfDateTime, [63](#)
- rtxParseTimeString
 - ccfDateTime, [63](#)
- rtxPattern.h, [272](#)
- rtxPrint.h, [273](#)
- rtxPrintBoolean
 - valsToStdout, [119](#)
- rtxPrintCallback
 - ccfDiag, [166](#)
- rtxPrintCharStr
 - valsToStdout, [120](#)
- rtxPrintCloseBrace
 - valsToStdout, [120](#)
- rtxPrintDate
 - valsToStdout, [120](#)
- rtxPrintDateTime
 - valsToStdout, [120](#)
- rtxPrintDecrIndent
 - valsToStdout, [120](#)
- rtxPrintFile
 - valsToStdout, [120](#)
- rtxPrintHexBinary
 - valsToStdout, [121](#)
- rtxPrintHexStr
 - valsToStdout, [121](#)
- rtxPrintHexStrNoAscii
 - valsToStdout, [121](#)
- rtxPrintHexStrPlain
 - valsToStdout, [121](#)
- rtxPrintIncrIndent
 - valsToStdout, [122](#)
- rtxPrintIndent
 - valsToStdout, [122](#)
- rtxPrintInt64
 - valsToStdout, [122](#)
- rtxPrintInteger
 - valsToStdout, [122](#)
- rtxPrintNull
 - valsToStdout, [122](#)
- rtxPrintNVP
 - valsToStdout, [122](#)
- rtxPrintOpenBrace
 - valsToStdout, [123](#)
- rtxPrintReal
 - valsToStdout, [123](#)
- rtxPrintStream.h, [275](#)
- rtxPrintStreamRelease
 - ccfDiag, [169](#)
- rtxPrintStreamToFileCB
 - ccfDiag, [169](#)
- rtxPrintStreamToStdoutCB
 - ccfDiag, [169](#)
- rtxPrintTime
 - valsToStdout, [123](#)
- rtxPrintToStream
 - ccfDiag, [169](#)
- rtxPrintToStream.h, [276](#)
- rtxPrintToStreamBoolean

- prtToStrm, 126
- rtxPrintToStreamCharStr
 - prtToStrm, 126
- rtxPrintToStreamCloseBrace
 - prtToStrm, 127
- rtxPrintToStreamDate
 - prtToStrm, 127
- rtxPrintToStreamDateTime
 - prtToStrm, 127
- rtxPrintToStreamDecrIndent
 - prtToStrm, 127
- rtxPrintToStreamFile
 - prtToStrm, 127
- rtxPrintToStreamHexBinary
 - prtToStrm, 128
- rtxPrintToStreamHexStr
 - prtToStrm, 128
- rtxPrintToStreamHexStrNoAscii
 - prtToStrm, 128
- rtxPrintToStreamHexStrPlain
 - prtToStrm, 128
- rtxPrintToStreamIncrIndent
 - prtToStrm, 129
- rtxPrintToStreamIndent
 - prtToStrm, 129
- rtxPrintToStreamInt64
 - prtToStrm, 129
- rtxPrintToStreamInteger
 - prtToStrm, 129
- rtxPrintToStreamNull
 - prtToStrm, 129
- rtxPrintToStreamNVP
 - prtToStrm, 130
- rtxPrintToStreamOpenBrace
 - prtToStrm, 130
- rtxPrintToStreamReal
 - prtToStrm, 130
- rtxPrintToStreamTime
 - prtToStrm, 130
- rtxPrintToStreamUInt64
 - prtToStrm, 130
- rtxPrintToStreamUnicodeCharStr
 - prtToStrm, 131
- rtxPrintToStreamUnsigned
 - prtToStrm, 131
- rtxPrintToStreamUTF8CharStr
 - prtToStrm, 131
- rtxPrintUInt64
 - valsToStdout, 123
- rtxPrintUnicodeCharStr
 - valsToStdout, 123
- rtxPrintUnsigned
 - valsToStdout, 124
- rtxPrintUTF8CharStr
 - valsToStdout, 124
- rtxReal
 - rtxGetMinusInfinity, 66
 - rtxGetMinusZero, 66
 - rtxGetNaN, 66
 - rtxGetPlusInfinity, 66
 - rtxIsApproximate, 66
 - rtxIsApproximateAbs, 67
 - rtxIsMinusInfinity, 67
 - rtxIsMinusZero, 67
 - rtxIsNaN, 67
 - rtxIsPlusInfinity, 67
- rtxReal.h, 278
- rtxResetToPos
 - rtxCtxt, 97
- rtxSetBit
 - bitstrhelpers, 84
- rtxSetBitFlags
 - bitstrhelpers, 85
- rtxSetDateTime
 - ccfDateTime, 64
- rtxSetDiag
 - ccfDiag, 170
- rtxSetGlobalDiag
 - ccfDiag, 170
- rtxSetGlobalPrintStream
 - ccfDiag, 170
- rtxSetLocalDateTime
 - ccfDateTime, 64
- rtxSetPrintStream
 - ccfDiag, 171
- rtxSetUtcDateTime
 - ccfDateTime, 64
- rtxSizeToCharStr
 - rtxCharStr, 49
- rtxSList.h, 279
 - OSALLOCELEMSNODE, 279
- rtxSListAppend
 - ccfSList, 159
- rtxSListCreate
 - ccfSList, 159
- rtxSListCreateEx
 - ccfSList, 160
- rtxSListFind
 - ccfSList, 160
- rtxSListFree
 - ccfSList, 160
- rtxSListFreeAll
 - ccfSList, 160
- rtxSListInit
 - ccfSList, 161
- rtxSListInitEx
 - ccfSList, 161
- rtxSListRemove

- ccfSList, 161
- rtxSocket.h, 280
 - OSRTSOCKET, 281
- rtxSocketAccept
 - ccfSocket, 132
- rtxSocketAddrToStr
 - ccfSocket, 133
- rtxSocketBind
 - ccfSocket, 133
- rtxSocketClose
 - ccfSocket, 133
- rtxSocketConnect
 - ccfSocket, 133
- rtxSocketConnectTimed
 - ccfSocket, 134
- rtxSocketCreate
 - ccfSocket, 134
- rtxSocketGetHost
 - ccfSocket, 134
- rtxSocketListen
 - ccfSocket, 135
- rtxSocketParseURL
 - ccfSocket, 135
- rtxSocketRecv
 - ccfSocket, 135
- rtxSocketRecvTimed
 - ccfSocket, 136
- rtxSocketSelect
 - ccfSocket, 136
- rtxSocketSend
 - ccfSocket, 136
- rtxSocketSetBlocking
 - ccfSocket, 137
- rtxSocketsInit
 - ccfSocket, 137
- rtxSocketStrToAddr
 - ccfSocket, 137
- rtxStack.h, 282
- rtxStackCreate
 - ccfStack, 162
- rtxStackInit
 - ccfStack, 162
- rtxStackIsEmpty
 - ccfStack, 162
- rtxStackPeek
 - ccfStack, 163
- rtxStackPop
 - ccfStack, 163
- rtxStackPush
 - ccfStack, 163
- rtxStrcat
 - rtxCharStr, 49
- rtxStrcpy
 - rtxCharStr, 49
- rtxStrdup
 - rtxCharStr, 50
- rtxStrDynJoin
 - rtxCharStr, 50
- rtxStream
 - OSRTSTREAM, 140
 - OSRTSTREAM_BYTEINDEX, 139
 - OSRTStreamBlockingReadProc, 140
 - OSRTStreamCloseProc, 140
 - OSRTStreamFlushProc, 140
 - OSRTStreamGetPosProc, 140
 - OSRTStreamMarkProc, 140
 - OSRTStreamReadProc, 140
 - OSRTStreamResetProc, 140
 - OSRTStreamSetPosProc, 140
 - OSRTStreamSkipProc, 140
 - OSRTStreamWriteProc, 141
 - rtxStreamBlockingRead, 141
 - rtxStreamClose, 141
 - rtxStreamFlush, 141
 - rtxStreamGetCapture, 141
 - rtxStreamGetIOBytes, 142
 - rtxStreamGetPos, 142
 - rtxStreamInit, 142
 - rtxStreamIsOpened, 142
 - rtxStreamIsReadable, 143
 - rtxStreamIsWritable, 143
 - rtxStreamMark, 143
 - rtxStreamMarkSupported, 143
 - rtxStreamRead, 144
 - rtxStreamRelease, 144
 - rtxStreamReset, 144
 - rtxStreamSetCapture, 144
 - rtxStreamSetPos, 145
 - rtxStreamSkip, 145
 - rtxStreamWrite, 145
- rtxStream.h, 283
- rtxStreamBlockingRead
 - rtxStream, 141
- rtxStreamBuffered.h, 285
- rtxStreamClose
 - rtxStream, 141
- rtxStreamFile
 - rtxStreamFileAttach, 146
 - rtxStreamFileCreateReader, 146
 - rtxStreamFileCreateWriter, 146
 - rtxStreamFileOpen, 147
- rtxStreamFile.h, 286
- rtxStreamFileAttach
 - rtxStreamFile, 146
- rtxStreamFileCreateReader
 - rtxStreamFile, 146
- rtxStreamFileCreateWriter
 - rtxStreamFile, 146

- rtxStreamFileOpen
 - rtxStreamFile, 147
- rtxStreamFlush
 - rtxStream, 141
- rtxStreamGetCapture
 - rtxStream, 141
- rtxStreamGetIOBytes
 - rtxStream, 142
- rtxStreamGetPos
 - rtxStream, 142
- rtxStreamHexText.h, 287
 - rtxStreamHexTextAttach, 287
- rtxStreamHexTextAttach
 - rtxStreamHexText.h, 287
- rtxStreamInit
 - rtxStream, 142
- rtxStreamIsOpened
 - rtxStream, 142
- rtxStreamIsReadable
 - rtxStream, 143
- rtxStreamIsWritable
 - rtxStream, 143
- rtxStreamMark
 - rtxStream, 143
- rtxStreamMarkSupported
 - rtxStream, 143
- rtxStreamMemory
 - rtxStreamMemoryAttach, 148
 - rtxStreamMemoryCreate, 148
 - rtxStreamMemoryCreateReader, 148
 - rtxStreamMemoryCreateWriter, 149
 - rtxStreamMemoryGetBuffer, 149
 - rtxStreamMemoryResetWriter, 149
- rtxStreamMemory.h, 288
- rtxStreamMemoryAttach
 - rtxStreamMemory, 148
- rtxStreamMemoryCreate
 - rtxStreamMemory, 148
- rtxStreamMemoryCreateReader
 - rtxStreamMemory, 148
- rtxStreamMemoryCreateWriter
 - rtxStreamMemory, 149
- rtxStreamMemoryGetBuffer
 - rtxStreamMemory, 149
- rtxStreamMemoryResetWriter
 - rtxStreamMemory, 149
- rtxStreamRead
 - rtxStream, 144
- rtxStreamRelease
 - rtxStream, 144
- rtxStreamReset
 - rtxStream, 144
- rtxStreamSetCapture
 - rtxStream, 144
- rtxStreamSetPos
 - rtxStream, 145
- rtxStreamSkip
 - rtxStream, 145
- rtxStreamSocket
 - rtxStreamSocketAttach, 150
 - rtxStreamSocketClose, 150
 - rtxStreamSocketCreateWriter, 150
 - rtxStreamSocketSetOwnership, 151
 - rtxStreamSocketSetReadTimeout, 151
- rtxStreamSocket.h, 289
- rtxStreamSocketAttach
 - rtxStreamSocket, 150
- rtxStreamSocketClose
 - rtxStreamSocket, 150
- rtxStreamSocketCreateWriter
 - rtxStreamSocket, 150
- rtxStreamSocketSetOwnership
 - rtxStreamSocket, 151
- rtxStreamSocketSetReadTimeout
 - rtxStreamSocket, 151
- rtxStreamWrite
 - rtxStream, 145
- rtxStricmp
 - rtxCharStr, 50
- rtxStrJoin
 - rtxCharStr, 51
- rtxStrncat
 - rtxCharStr, 51
- rtxStrncpy
 - rtxCharStr, 51
- rtxTestBit
 - bitstrhelpers, 85
- rtxTimeIsValid
 - ccfDateTime, 65
- rtxTimeToString
 - ccfDateTime, 65
- rtxUInt64ToCharStr
 - rtxCharStr, 52
- rtxUIntToCharStr
 - rtxCharStr, 52
- rtxUTF8.h, 290
- rtxUTF8CharSize
 - ccfUTF8, 70
- rtxUTF8CharToWC
 - ccfUTF8, 70
- rtxUTF8DecodeChar
 - ccfUTF8, 71
- rtxUTF8EncodeChar
 - ccfUTF8, 71
- rtxUTF8Len
 - ccfUTF8, 71
- rtxUTF8LenBytes
 - ccfUTF8, 71

- rtxUTF8RemoveWhiteSpace
 - ccfUTF8, [72](#)
- rtxUTF8StrChr
 - ccfUTF8, [72](#)
- rtxUTF8Strcmp
 - ccfUTF8, [72](#)
- rtxUTF8Strecpy
 - ccfUTF8, [72](#)
- rtxUTF8Strdup
 - ccfUTF8, [73](#)
- rtxUTF8StrEqual
 - ccfUTF8, [73](#)
- rtxUTF8StrHash
 - ccfUTF8, [73](#)
- rtxUTF8StrJoin
 - ccfUTF8, [73](#)
- rtxUTF8Strncmp
 - ccfUTF8, [74](#)
- rtxUTF8Strncpy
 - ccfUTF8, [74](#)
- rtxUTF8Strndup
 - ccfUTF8, [74](#)
- rtxUTF8StrnEqual
 - ccfUTF8, [75](#)
- rtxUTF8StrNextTok
 - ccfUTF8, [75](#)
- rtxUTF8StrnToBool
 - ccfUTF8, [75](#)
- rtxUTF8StrnToDouble
 - ccfUTF8, [76](#)
- rtxUTF8StrnToDynHexStr
 - ccfUTF8, [76](#)
- rtxUTF8StrnToInt
 - ccfUTF8, [76](#)
- rtxUTF8StrnToInt64
 - ccfUTF8, [77](#)
- rtxUTF8StrnToSize
 - ccfUTF8, [77](#)
- rtxUTF8StrnToUInt
 - ccfUTF8, [77](#)
- rtxUTF8StrnToUInt64
 - ccfUTF8, [78](#)
- rtxUTF8StrRefOrDup
 - ccfUTF8, [78](#)
- rtxUTF8StrToBool
 - ccfUTF8, [78](#)
- rtxUTF8StrToDouble
 - ccfUTF8, [79](#)
- rtxUTF8StrToDynHexStr
 - ccfUTF8, [79](#)
- rtxUTF8StrToInt
 - ccfUTF8, [79](#)
- rtxUTF8StrToInt64
 - ccfUTF8, [79](#)

- rtxUTF8StrToNamedBits
 - ccfUTF8, [80](#)
- rtxUTF8StrToSize
 - ccfUTF8, [80](#)
- rtxUTF8StrToUInt
 - ccfUTF8, [80](#)
- rtxUTF8StrToUInt64
 - ccfUTF8, [81](#)
- rtxUTF8ToDynUniStr
 - ccfUTF8, [81](#)
- rtxUTF8ToUnicode
 - ccfUTF8, [81](#)
- rtxValidateUTF8
 - ccfUTF8, [82](#)
- Run-time error status codes., [183](#)
- segsize
 - OSRTSTREAM, [231](#)
- seqx
 - ASN1CCB, [203](#)
- setPos
 - OSRTSTREAM, [231](#)
- sign
 - ASN1BigInt, [201](#)
- skip
 - OSRTSTREAM, [231](#)
- Socket stream functions., [150](#)
- Stack Utility Functions, [162](#)
- stat
 - ASN1CCB, [203](#)
- subid
 - ASN1OBJID, [208](#)
 - ASN1OID64, [210](#)
- tail
 - _OSRTSList, [194](#)
 - OSRTDList, [220](#)
- TCP/IP or UDP socket utility functions, [132](#)
- Time Helper Functions, [13](#)
- timeutilf
 - normalizeTimeZone, [13](#)
 - rtMakeGeneralizedTime, [13](#)
 - rtMakeUTCTime, [13](#)
 - rtParseGeneralizedTime, [14](#)
 - rtParseUTCTime, [14](#)
- unalignedBits
 - Asn116BitCharSet, [197](#)
 - Asn132BitCharSet, [199](#)
- UTF-8 String Functions, [69](#)
- valsToStdout
 - rtxByteToHexChar, [117](#)
 - rtxByteToHexCharWithPrefix, [117](#)
 - rtxHexDump, [117](#)

- rtxHexDumpEx, 117
- rtxHexDumpFileContents, 117
- rtxHexDumpFileContentsToFile, 118
- rtxHexDumpToFile, 118
- rtxHexDumpToFileEx, 118
- rtxHexDumpToFileExNoAscii, 118
- rtxHexDumpToNamedFile, 119
- rtxHexDumpToString, 119
- rtxHexDumpToStringEx, 119
- rtxPrintBoolean, 119
- rtxPrintCharStr, 120
- rtxPrintCloseBrace, 120
- rtxPrintDate, 120
- rtxPrintDateTime, 120
- rtxPrintDecrIndent, 120
- rtxPrintFile, 120
- rtxPrintHexBinary, 121
- rtxPrintHexStr, 121
- rtxPrintHexStrNoAscii, 121
- rtxPrintHexStrPlain, 121
- rtxPrintIncrIndent, 122
- rtxPrintIndent, 122
- rtxPrintInt64, 122
- rtxPrintInteger, 122
- rtxPrintNull, 122
- rtxPrintNVP, 122
- rtxPrintOpenBrace, 123
- rtxPrintReal, 123
- rtxPrintTime, 123
- rtxPrintUInt64, 123
- rtxPrintUnicodeCharStr, 123
- rtxPrintUnsigned, 124
- rtxPrintUTF8CharStr, 124

write

- OSRTSTREAM, 231

XM_ADVANCE

- cruntime, 9

XM_DYNAMIC

- cruntime, 9

XM_OPTIONAL

- cruntime, 9

XM_SEEK

- cruntime, 9

XM_SKIP

- cruntime, 9