Release Notes for
MMS-EASE *Lite*

MMS-LITE-801-001

MMS-LITE-802-001

Revision 17

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New and Changed Software Features

For information on changes and corrections for V5.0602 and V5.06, please refer to the end of this release note. For information on changes and corrections prior to V5.06, please examine Revision 15 of the Release Notes.

This release of MMS-EASE *Lite* (V5.10) contains the following changes:

1. *MMS-Lite Reference Manual* has been significantly modified.

2. SISCO has dropped support for the OSILLC driver and adopted the **WinPcap** solution for **Windows** applications. WinPcap is basically a Windows portation of the well known libpcap API on Unix. WinPcap is not present on the MMS Lite CD. There are instructions for downloading WinPcap for the 802 version of MMS-EASE Lite in the *MMS-EASE Lite Reference Manual*. Without WinPcap, the 802 sample solutions for TPX, GOOSE, GSSE and Sampled Value will not build. Unless these steps are taken, only the TCP version of MMS Lite will compile. If you are using MMS-LITE-801-001, it only has support for TCP so WinPcap is not needed.

3. To allow configuration of the network device needed by the **WinPcap** API, the **`network_device`** element was added to the **`CLNP_PARAM`** structure. This parameter is initialized by the **<Network_Device>** element added to the **osicfg.xml** file.

4. A new Windows utility called the **PCAPEthernetConfiguration** was added to the MMS-LITE-802-001 product. It configures the Ethernet Adapter needed by the WinPcap API described above. It allows the user to select a local Ethernet Adapter from a list and puts that selection in the **osicfg.xml** file. Please review the XML encoded tag <Network_Device> in **osicfg.xml** to be sure its value accurately reflects an Ethernet adapter present on the actual PC. There are a number of **osicfg.xml** files in MMS Lite sample directories. The OSI, GOOSE, GSSE, and Sampled Value capable samples all need to have the **PCAPEthernetConfiguration Utility** run on their **osicfg.xml** files. The utility is found in the **\mmslite\bin** folder. The PCAPEthernetConfiguration Utility can be executed from:

   Start→All Programs→SISCO→MMS-EASE Lite→PCAP Ethernet Configuration Utility

5. A change was made to header file **sysincs.h so** that **winsock2.h** is included before **windows.h**. It was found that **winsock2.h** must always be before **windows.h** to override defines in **winsock.h** (included by **windows.h**). Since all MMS-EASE Lite source modules include **sysincs.h**, this is the best place to include winsock2.h.

6. A change was made to the code that reads in the files **startup.cfg** and **datamap.cfg** in the **\scl_srvr** folder. The change is to only accept tabs and commas as delimiters (not spaces) and to treat extra tabs or commas as blank fields. Previous copies of the **startup.cfg** file will no longer work because they contained extra tabs. The current **startup.cfg** is not overwritten by the MMS Lite installation. This means if you are upgrading from an older version of MMS Lite, the **startup.cfg** file will have to be modified with a text editor to remove extra tabs or there will be errors reading the file. This change was done so that **startup.cfg** and **datamap.cfg** can easily be edited using Microsoft Excel.

7. The SCL parser now converts the text from the **`<EnumVal>`** elements into integer values, so you can use the text when specifying initial values.

8. Sample Client code has been changed to abort the connection after a user timeout. Normally, if a Client tries to connect to a device that is not online, eventually the stack will time out, return an error, and will clean up. If an application does not wait for the stack to time out by setting a shorter "user" timeout, it is possible for the application to attempt another connection before the stack is ready, often causing the following error:

   2008-03-14 10:58:02.921 MVLLOG_ERR (mvl_acse.c 935)
   Error - Could not get calling MVL_NET_INFO

   The problem is that the Client needs to abort the connection after the "user" timeout to free up resources immediately. The abort is not automatically done by the stack because the stack did not detect the timeout. The new Client sample code aborts the connection in this case. Most likely, other Client applications need a similar change.

9. The **`mvl61850_ctl_chk_state`** function was changed to directly set the **`AddCause`** and the **`Error`** members of the **`LastApplError`** for each error condition.

10. This version will not allow a client to delete a NVL if any Report Control Block (RCB) contains a DatSet that references the NVL. The client must first change the DatSet in the RCB before deleting the NVL.

11. If the sboClass="operate-many" (i.e., 1) in the SCL file, the Server will now allow many Operate requests without waiting for another Select (reading of SBO or writing of SBOw). Once the control is selected, it will stay selected until a Cancel is received (i.e. the "Cancel" struct is written) or until **`sboTimeout`** times out.

12. Reduced the maximum memory usage during SCL processing even further (better than V5.0602) by using a 2-pass method for type creation. The function **`ms_rt_bld_start`** and other **`ms_rt_bld*`** functions are called twice, first to compute the size of the type, then to actually create the type. Between the two calls, the required memory is allocated. There is no need to allocate extra memory and no need to reallocate later.

13. The following new files have been added:

    sisco_sample.cid (Replaces scl.xml. Also modified **startup.cfg** to reference this file)
    sisco_sample_wind.cid

14. The IEC 61850 Buffered Reporting code has been modified to start buffering on startup as long as the BRCB is configured correctly with a real dataset (i.e., DatSet references a valid dataset). This leads to an increase in memory usage upon startup as the buffer is being filled. This behavior is required by Edition 2 of IEC 61850-7-2. If this behavior is ***NOT*** desired, a bit of code in **`mvl61850_create_rpt_ctrl`** must be disabled or removed.

15. The function that processes the **datamap.cfg** file (**`datamap_cfg_read`**) was modified to ignore illegal mappings and log an error. Certain leafs are automatically mapped by the libraries, so there is no need for mapping here (e.g., all RCB leafs and ..BehstVal).

16. The SCL parser makes sure the length of lnClass, prefix, and inst are within allowed limits.

17. Added functions to allow encoding IEC 61850 GOOSE messages in 2 parts (see gsei_enc.c). The "data" part of the GOOSE message does not change with each retransmission, so it can be encoded just once, but the "header" part of the GOOSE message must be re-encoded with different values for each retransmission. These functions may be used to slightly improve efficiency in some applications.

18. Added gensock2.c to the "util" or "utility" library and deleted it from all the "osi*" libraries. This allows any application to use slogipc.c (which requires gensock2.c).

19. Allow the following new **`bType`** values in the SCL file: **`ObjRef`** (convert to 129-character visible string), **`INT64`**, and **`INT64U`**.

20. Several improvements were made to the MVL object destroy functions to make sure that objects cannot be destroyed when they are still referenced (see details in **mvl_obj.c**). The destroy functions will now fail if an object is still in use and appropriate errors will be logged.

21. All optional code in **mvl_acse.c** that was enabled by defining **`OBSOLETE_AA_OBJ_INIT`**, has now been removed. This code is no longer supportable. This define must not be used.

22. Removed the makefiles and vcproj files for building the **ositcpe** and **ositpxe** libraries and any executables that link them. Projects must use the newer **ositcps** or **ositpxs** libraries.

23. On Windows, changed the name of the utility library from "**util**" to "**utility**" to reduce conflicts with libraries used in other SISCO products.

24. Added code to parse the **`SettingControl`** element in the SCL file and to automatically generate the SGCB structure under the SP functional constraint.

25. Deleted the **`CALLED_ONLY`** and **`CALLING_ONLY`** defines. These defines were used to reduce the size of code compiled for applications that had only Called connections or only Calling connections, but the savings were minimal. Now all applications include Calling and Called code.

26. Simplified the code in **`u_set_all_leaf_functions`** so it should be easier for users to customize. Also, fixed the mapping of leafs inside the **`setMag`** structure.

27. Added the function **`mplas_concl_err`** to send an error response to a Conclude indication. Modified some sample applications to call it if requests are still pending or if files are still open.

28. Automatically close all open files on an Abort indication.

29. Improved the IEC 61850 Integrity report generation. The new function **`mvl61850_integrity_timeout`** is called to build the report without scanning for new data because the data was already scanned at the start of **`mvl61850_rpt_service`**.

30. The logging configuration masks used in the "iecgoose" sample application are now configured using the **logcfg.xml** file processed by the **`logcfgx_ex`** function.

31. For IEC 61850 Edition 2, changed the Read response for the **`EntryID`** and **`TimeOfEntry`** attributes in a BRCB, to return different values depending on the value of **`RptEna`**.

32. For IEC 61850 Edition 2, if an octet string of all zeros is written to the EntryID attribute of a BRCB, the server starts sending the OLDEST entries in the report buffer.

Software Corrections

This release of MMS-Lite (V5.10) contains the following corrections:

- Allows the parsing of SCL files with nested SDOs. Nested SDOs are used in IEC 61400-25 SCL files for Wind Power.

- Numerous corrections in the SISCO standard time code (i.e., **stdtime*.c**). Also, many unnecessary "stdtime" functions were removed.

- Corrected the ODF files for IEC 61850 data models.

- Corrected a problem in SCL that did not allow the <Val> to be missing within the DAI element.

- Fixed the function **`getGnlVarNames`** (**mvl_uca.c**) that would crash if a "flattened" variable name (e.g., `CSWI1$ST$Mod$stVal`) was too long.

- Correctly initialized the **`DstAddress`** member of the GOOSE Control Block using the MAC-Address extracted from the SCL file. Also added the **`DstAddress`** member to the GSSE Control Block and initialized it with SCL information.

- The **iecgoose** sample application was corrected to compute the "tci" from the VLANPRI and VLANID configured in the SCL file. Also, made sure that StNum is always between 1 and 0xFFFFFFFF (never 0)(see **iec_tx.c**).
  NOTE: Similar changes may be needed in user applications.

- Fixed the maximum length of **`GoCBRef`**, **`DatSet`**, and **`GoID`** in all IEC 61850 GOOSE code.

- Fixed the alignment of the pointer passed to **`mvlu_clone_objname`** (**mvl_uca.c**). Previously, it could point to a memory location that was not a legal address for a structure on some platforms.

- Deleted the function **`strncat_safe`** and changed all code to use **`strncat_maxstrlen`**. The **`strncat_safe`** function did not interpret the 3rd argument correctly, possibly leading to confusing results.

- Corrected the interpretation of the "Check" type when parsing SCL files. It is now correctly converted to BVstring2 (i.e., 2-bit variable length bitstring). Previously, it was converted to a "fixed length" bitstring.

- Corrected the handling of a VMD-Specific DatSet value in an IEC 61850 URCB or BRCB and the handling of an Application Association-Specific DatSet in an URCB. An AA-Specific DatSet is automatically cleared in the URCB when the connection is lost or when Resv is set to 0.

- Corrected the retransmission of IEC 61850 Buffered Reports. The variable list index was not getting reset after transmission, so the retransmission contained no variables (see **mvl61850_rpt.c**).

- Fixed the IEC 61850 Controls code to NOT send the LastApplError information report if the control model is direct-with-normal-security or sbo-with-normal-security. In IEC 61850 Edition 2, this will likely be allowed as an option, but in Edition 1 it is not allowed.

- For IEC 61850 SBO controls, a second Select request is not allowed until the first Select times out or an Operate request is processed.

- The IEC 61850 Controls code now handles sboClass=operate-many.

- The maximum length of **`CntrlObj`** in all IEC 61850 Controls code has been corrected.

- The function **`_mvl_clear_aa_objs`** is automatically called to destroy all AA-Specific objects any time a connection is released or aborted. If this was not done, memory would be wasted, and the objects might be illegally accessed later.

- Fixed the handling of DefineNamedVariableList indications containing variables that are NOT named. Instead of crashing, the new code just sends an error response.

- Fixed the **`typedef`** statements generated by Foundry for arrays.

- Fixed all the sample **mmsop_en.h** files. Changed the value of **`MPARAM_VADR`** and **`MPARAM_TPY`** to 0. These parameters are sent in MMS Initiate requests and responses. Many applications ignore these values, but this change makes sure the correct value is sent.
  IMPORTANT: For optimum compatibility, users should change their **mmsop_en.h** files the same way.

- Eliminated the following IEC 61850 reporting bug:
  If one RCB was configured to trigger on Integrity or GI, and another RCB with the same DatSet triggered on dchg or qchg, when the dchg/qchg event occurred, the Integrity or GI data was also sent in the report (even though Integrity or GI was NOT enabled in the second RCB).

- If an error occurs decoding the data for a MMS Write indication, the appropriate failure code is sent in the Write response.

- Fixed a memory leak that would occur after a "PDU size too small" error that could occur while trying to send IEC 61850 Reports (see **mvl61850.c** or **mvl61850_rpt.c**).

- The initial values in "Enum" type definitions of the SCL file are now saved (i.e., a Val element in a DA in a DOType, or a Val element in a BDA in a DAType). The old code did not correctly save initial values for "Enum" types.

- The **scl_srvr** sample application was fixed to delay sending the IEC 61850 **CommandTermination** message until after the Write response is sent.
  NOTE: A similar change may be needed in user applications.

- Reason codes sent in Transport Class 0 (TP0) Disconnect requests were changed to be legal values for Class 0.

IEC 61850 Tissues

This release of MMS-Lite (V5.10) addresses the following IEC 61850 Tissues.

General

141 – name length, object reference

Verified that LDName is extended to 64 characters. The MMS variable name is also extended up to 64 characters per changes made in Annex G of IEC61850-8-1. The object reference is therefore limited to 129 characters, including the '/' separator.

Part 6

425 – SCL does not support VisString65

The final proposal for this Tissue was to allow bType="ObjRef" and map it to a 65 character visible string. But the ObjectReference length was changed to 129 by Tissue 141, so 129 was used. The SCL parser now allows "ObjRef" (and maps it to VisString129). It also allows "VisString65" and "VisString129" (only to avoid the need for code changes if these are added later).

Part 7-2

52 – Ambiguity GOOSE SqNum

Following a StNum change, the counter SqNum shall be set to a value of 0. If the counter SqNum overruns, it shall be set to a value of 1. The second statement, "*The initial value for SqNum upon a transition of GoEna to TRUE shall be 1" cannot be verified, so no code changes were necessary.*

53 - Add DstAddr to GsCB, SV

Attribute DstAddress (Type: PHYCOMADDR, FC:GS) has been added to the GSSE control block. To avoid interoperability problems with Edition 1 implementations of SampledValues, the SampledValue control block was NOT changed.
NOTE: All Edition 2 features of SampledValues will be implemented together in a future release.

187 – OptFlds in SV CB's not exposed for client specification

The OptFlds attribute is included in the SV control block get and set services (i.e., the client may read and optionally write this attribute).

190 - BRCB: EntryId and TimeOfEntry

The text in the Draft Edition 2 of IEC 61850-7-2 (2008-04-24) does not exactly match the text in the Tissue, and the text is quite complex, so MMS-EASE Lite implements the text from the Draft.

191 – BRCB: Integrity and buffering reports

The text in the Draft Edition 2 of IEC 61850-7-2 (2008-04-24) does not exactly match the text in the Tissue, and the text is quite complex, so MMS-EASE Lite implements the text from the Draft.

236 – Name Length

64 characters for LD (Domain) name, and 64 char for LN (Variable) name are now allowed. We also allow 129 char for ObjectReference which includes LD and LN separated by "/".

278 – EntryId not valid for a server

The text in the Draft Edition 2 of IEC 61850-7-2 (2008-04-24) does not exactly match the text in the Tissue, and the text is quite complex, so MMS-EASE Lite implements the text from the Draft.

297 – Sequence Number

This is basically the Tissue to require that the sequence number (SqNum) in a BRCB is only incremented when a Report is sent (not when it is buffered). It is set to 0 each time the BRCB is enabled. And it rolls over to 0 at its maximal value. The new code implements all these requirements.

334 - Select a SBO Object Twice

This was corrected with the following clarifications:

- For SBO control with Normal Security, the LastApplError containing AddCause is not sent. The client can only see that the read of SBO fails.
- Currently, there is no "AddCause" value of "Already-selected", so if the second select occurs BEFORE the Operate request, the server sends AddCause=3 (Select-Failed).
- If the second select occurs AFTER the operate request, then the server sends AddCause=12 (command-already-in-execution), as the Tissue states..
- If using AX-S4 MMS and the MMS Object Explorer as the client (maybe with other clients too), the new behavior may look a bit confusing. For sbo-with-normal-security, the first read of SBO should return the normal string, but then the next read (1 sec later if you have a 1 sec poll rate) will fail and keep failing until you either write Oper or the select times out. Similarly, the first write of SBOw should succeed, but subsequent writes will fail until you write Oper or the select times out.

349 - BRCB TimeOfEntry has two definitions

The text in the Draft Edition 2 of IEC 61850-7-2 (2008-04-24) does not exactly match the text in the Tissue, and the text is quite complex, so MMS-EASE Lite implements the text from the Draft.

498 – Release Association

This is the Tissue that requires the server to send a negative Release response if services are pending. The ACSI Release maps to the MMS Conclude service. This requires only User application changes, but we changed the Conclude indication processing (see **`u_mvl_concl_ind`**) in the samples (**scl_srvr.c**, **server.c**, and **uca_srvr.c**) to demonstrate the correct behavior.

Part 8-1

177 – Ignoring OptFlds bits for URCB

This Tissue basically states that the buffer-overflow and entryID bits in the OptFlds of a URCB shall be ignored. That is, the server ignores the bits in a write request and the value is always 0 when reading these bits. MMS-EASE Lite was already doing exactly that.

198 - Instantiation of URCB

This Tissue talks about the new “indexed” option added to the ReportControl element in SCL to define the naming scheme for RCBs. MMS-EASE Lite only supports indexed=”true” (i.e., all RCBs have indices added). This is also the default mode, so configuring a ReportControl with “indexed” NOT present has the same effect. The “non-indexed” mode is too complicated to implement with all other IEC 61850 options, so it is not supported by MMS-EASE Lite.

General Application Upgrade Notes for MMS-EASE *Lite*

Known Software Anomalies

Managing Abort and Release indications in Client applications

When an Abort or Release indication occurs, the user function pointed to by **`u_mvl_disc_ind_fun`** is called. If the user does not set this function pointer or the function ignores the indication, it is likely that the connection will be re-used the next time the client establishes a connection. In this case, it would appear to the user application that there are actually 2 connections but both would reference the same MVL_NET_INFO structure. Requests for both connections would be sent to the second server.

To avoid this problem, the user application should be sure to set the **`u_mvl_disc_ind_fun`** function pointer and make sure the function it references manages all connections. Since this function is called from the MVL library and there is no way to pass information back through the library, the best way for the user application to manage connections is to create its own global array of connection pointers, like:

```
MVL_NET_INFO *net_info_array[64];
```

When the user function is called, the user must find the connection pointer in the array, and set the pointer to NULL. When the main application sees that the pointer is NULL, it can assume that the connection was lost.

NamedVariableLists created by Foundry may not be used in Reports

The MMS-EASE *Lite* Reporting Subsystem does not work if the NamedVariableList (Data Set) is created by Foundry. The NamedVariableList must be created dynamically using **`mvlu_derive_rpt_ds`** or **`mvl_vmd_nvl_add`**, as in the sample applications.

Building MMS-LITE-802-001

In building the MMS-Lite 802 solution on Windows only, the project will fail on the first build but will build correctly on the second build with no alterations. The following error list is generated:

```
Done
Compiling...
slogipc.c
reject.c
MVLOP_EN.C
mvl_acse.c
mmsop_en.c
mmslvar.c
logcfgx.c
event.c
client.c
cli_rpt.c

Generating Code...
Compiling manifest to resources...

Linking...
LINK : fatal error LNK1104: cannot open file '.\mmslite802\cositcps0 client app
(nul security)\debug\Clntobj.obj'

Creating browse information file...
Microsoft Browse Information Maintenance Utility Version 8.00.50727
Copyright (C) Microsoft Corporation. All rights reserved.
```

```
BSCMAKE: error BK1506 : cannot open file '.\mmslite802\cositcps0  client app
(nul security)\debug\Clntobj.sbr': No such file or directory

Build log was saved at
"file://c:\mmslite\cmd\win32\mmslite802\cositcps0  Client App (NUL
Security)\Debug\BuildLog.htm"

cositcps0  Client App (NUL Security) - 2 error(s), 0 warning(s)

------ Build started: Project: scl_srvr  SCL Server App, Configuration:
Debug Win32 ------

Executing Foundry ...

                  MMS-EASE Lite Object Foundry
(c) Copyright Systems Integration Specialists Company, Inc.,
                  1998 - 2004, All Rights Reserved
Done
```

Notes for Phar Lap TNT ETS Operating System Only

heap checking

The heap checking function **`_heapwalk`** does not work correctly on the Phar Lap TNT ETS operating system. You should disable the heap checking code by setting the following:

```
m_heap_check_enable = SD_FALSE;
```

This is usually done in **client.c**, **server.c**, or **uca_srvr.c**.

Changes and Corrections in V5.0602 and V5.06

MMS-EASE *Lite* (V5.0602) contained the following changes:

1. Reduced the maximum memory usage significantly by reallocating some temporary buffers to a smaller size during SCL processing.
   NOTE: V5.10 does even better by avoiding the reallocation altogether.

2. Changed some members of the **`RUNTIME_TYPE`** structure to **`ST_INT`** so that Octet Strings and Visible Strings longer than 32K can be configured.

MMS-EASE *Lite* (V5.06) contained the following changes:

1. For Windows – MMS-Lite now uses Microsoft Visual Studio .NET version 2005. All MMS-Lite Samples have been converted from Visual C++ V6.0 workspaces (dsw) to Visual Studio .NET 2005 solutions (sln).
   Note that libraries from this product release cannot be linked with applications using Visual C++ V6.0 or Visual Studio .NET 2003 compiler.

2. Added support for IEC 61850 Sampled Values (see later on in the document for details). Test code may be enabled in **client.c** and **scl_srvr.c** by defining **`SMPVAL_SUPPORT`** in the makefiles.

3. Added support for IEC 61850 GSE Management (see the section *IEC 61850 GSE Management Data and Functions* for details).

4. Deleted the unimplemented **`gs_wait_mult_event_sem`** function on UNIX, so that problems are detected at compile time, not at runtime.

5. Improved Foundry so that the initialization code generated for NamedVariableLists completely resolves all Variables. This improves efficiency because there is no need to resolve the Variables each time the NamedVariableList is accessed.

6. Added more **`mvlu_get_leaf_*`** utility functions (see **mvl_uca.c**). These are used by the MVL library and the **scl_srvr** sample application.

7. Added code to parse and process the "SampledValueControl" and "Communication" elements of an SCL file.

8. The **`gse_iec_control_create`** function was modified to allocate and copy the caller's strings, so the caller does not need to make sure the strings persist for the life of the GOOSE message.

9. The functions **`clnp_snet_write`** and **`clnp_etype_write`** were replaced with a simpler, more flexible function, **`clnp_snet_write_raw`**. The function was ported to Windows and LINUX, but users will need to port it to other platforms. Users should look at **clnp_linux.c** to see the changes for LINUX.

10. Added the option to use the "Expat" XML parser by simply defining **`USE_EXPAT`** when compiling **sx_dec.c** and linking to an appropriate "Expat" library. The "Expat" parser seems to be much better at detecting errors in XML files and dealing with unexpected whitespace characters. Please refer to the *MMS-Lite Reference Manual* for detailed information.

11. The "Expat" library is not included with the product, but it should be easy to download version 2.0.1 of the "expat" package from http://expat.sourceforge.net/. On Windows, it should be easy to integrate it with the "Visual Studio 2005" solution – please refer to the *MMS-Lite Reference Manual*.

12. Changed the SCL processing to create multiple RCBs for each ReportControl (Buffered or Unbuffered) in the SCL file. The number of RCBs depends on the value of the "max" attribute of the "RptEnabled" element. This change makes it possible to allow each client to change the DatSet element as needed.

13. Changed **`ObjectReference`** attributes of some of the **`DatSet`** and **`LogRef`** to Vstring129.

14. Added new ASN.1 encoding functions: **`ms_local_to_asn1_2`**, **`ms_adl_to_asn1_2`**, and **`ms_aa_to_asn1_2`**. These are very similar to the existing functions **`ms_local_to_asn1`**, **`ms_adl_to_asn1`**, and **`ms_aa_to_asn1`**, but they are easier to use in most cases.

15. IEC 61850 Reporting changes:
    For IEC 61850 Reporting, the new functions **`mvl61850_create_rpt_ctrl`**, **`mvl61850_free_rpt_ctrl`**, and **`mvl61850_rpt_service`** ***must be used***. The older functions **`mvlu_create_rpt_ctrl`**, **`mvlu_free_rpt_ctrl`**, and **`mvlu_rpt_service`** now work ***only for UCA Reporting***.

    a. Buffered reports are now segmented only when sending, so that changing PDU size does not cause a problem.

    b. The **SqNum** attribute is reset to 0 when a BRCB is enabled. It is only incremented when a report is sent, so that if the BRCB is disabled, **SqNum** will NOT increment, even though reports are still being buffered.

    c. The Report buffer is purged when **DatSet**, **TrgOps**, **IntgPd**, **BufTm**, or **RptID** is written, but only if the value is changed (for Tissue #322).

    d. A BRCB is now reserved only when **RptEna** is written.

    e. Attribute types needed for reporting are now automatically created if not found.

    f. If the Data or Quality Changes are being saved waiting for the **BufTim** to expire, they will be published before the Integrity Report is sent. All saved changes are reported prior to the Integrity report. This prevents Data and Quality changes from being received out of order. This applies to Buffered as well as unbuffered Reports.

    g. If the **RptID** in the RCB is NULL, a **RptID** is automatically generated to send in Reports.

h. Writing the GI attribute is allowed only if the RCB is enabled. A GI Report is generated only if the general-interrogation bit in **TrgOps** is 1.

i. Writing the **DatSet** attribute is now allowed and it causes the new data set to be used when generating subsequent reports.

j. Changed the Report Buffering scheme to save "raw" data in the buffer and encode reports only when sending, so that **SqNum**, etc., can be set/changed each time a report is sent.

k. The BRCB **EntryID** is automatically initialized with the current time in the first 4 bytes and 0 in the last 4 bytes, so that after a reboot, the initial EntryID is almost always unique. If you want a different initial **EntryID**, you can call **`mvl61850_brcb_entryid_init`** after **`mvl61850_rpt_ctrl_create`** (see usage example in **uca_srvr.c**). The value in the last 4 bytes of **EntryID** is incremented as each report is generated.

l. When a new GI report is buffered, any older GI report in the buffer is discarded.

m. The **Resv** attribute of a URCB is now used to reserve the URCB for one client. If a client writes a value of 1 to **Resv**, the server will not allow other clients to write members of the URCB until the first client writes a value of 0. If **Resv**=0, and a client enables the URCB, the server automatically sets **Resv**=1.

n. 'A pointer to **`MVL_TYPE_CTRL`** is saved in the new **`type_ctrl`** member of **`MVL_VAR_ASSOC`**, so that type information is easier to access.

16. Deleted the functions **`u_mvl_get_nvl`** and **`u_mvl_free_nvl`** from **mvl_uca.c**. Instead, **`mvl_vmd_find_nvl`** is used.
NOTE: these functions are still used in some code dependent on the **`USE_MANUFACTURED_OBJS`** define, but this is never defined in IEC 61850 or UCA applications.

17. Improved the setting of error codes in MMS Write responses to be more accurate.

18. Changed the IEC 61850 GOOSE sample application to be configured using SCL.

19. Applications using SCL must now include a callback function **`u_mvl_scl_set_initial_value`** (see **scl_srvr.c**). This function is only called if the SCL parser cannot convert the initial value according to the standard. The user may implement a special conversion in this function, but usually it should just return an error so that parsing stops.

20. Simplified the ODF file for the **scl_srvr** sample application, so that all MMS objects created from SCL.

21. Added the **`mvl61850_datset_wr_ind`** function to **leafmap.xml** so that it is included in the leaf function pointer table. This is ***important*** because the SCL parsing code must automatically map this function.

22. **IMPORTANT**: Data changes for IEC 61850 Reports are no longer automatically detected by the MVL library. The change detection was flawed because it treated Quality changes as Data changes, and detected changes in irrelevant attributes. Instead, it is now required that the "leaf" functions detect changes, and set the appropriate reason by setting the **`rpt_reason`** member of **`MVL_VAR_ASSOC`** (see example in **`set_rpt_reason`** in **userleaf.c**).

23. Changed **`mvlu_find_comp_type`** to find 'non-dynamic' types as well as 'dynamic' types. Previously, the function would only find 'dynamic' types.

24. Added the **`reserved_1`** member to the **`RUNTIME_CTRL`** structure. It allows the flexibility to store additional type information, and it is very useful during SCL processing.

25. Added several new functions (**`ms_rt_bld_*`**) to construct a type definition without TDL.

26. Added functions to create and maintain multiple VMDs to make client applications easier to implement (the old functions assumed there was only one global VMD). Several functions were changed to take an additional VMD argument and some were replaced with new functions (see *Changes to Support more than one VMD* in a later section details).

27. Deleted the **MVL_DYN_ASN1_TYPES** define and all code that depended on it. This define enabled code to dynamically generate the ASN.1 encoding of type definitions for GetVariableAccessAttributes responses, instead of using static encoding generated by Foundry. From now on, only the dynamic code is provided.

28. Added the functions **mvlu_rpt_ctrl_destroy_all** and **mvl61850_rpt_ctrl_destroy_all**.

29. Changed IEC 61850 control handling so that when an **Oper** is being written, the write is only allowed if the entire **Oper** structure is written in a single MMS Write request. You cannot write a higher level structure that contains an **Oper** structure and you cannot write individual elements of an **Oper** structure.

30. Deleted the global variables **_mvl_curr_net_info** and **_mvl_curr_usr_ind_ctrl**.

31. Completely changed arguments for **scl2_datatype_create_all** and **scl2_ld_create_all**, so that multiple SCL files may be processed and multiple VMDs created.

32. Improved the code that generates type definitions from SCL so that it now properly saves initial values specified in <Val> elements inside <DA> or <BDA> elements. The initial values are written to any variable referencing the type definition. To implement this change, the code was mostly rewritten to use the new **ms_rt_bld_*** functions.

33. Added test code in **client.c** to configure using SCL. The code is triggered by a new command line argument.

34. Reduced the number of different versions of each sample application, built with different versions of the “stack” library.

35. **FILE_LOG_EN** is no longer a default option in **sLogCtrl**. Applications using SISCO logging need to turn this flag **ON** if logging to a log file is desired:

    ```
    sLogCtrl->logCtrl |= LOG_FILE_EN;
    ```

36. MMS_LITE samples were revised to use IPC Logging. The source file slogipc.c was added to the vcproj and makefiles for all sample applications. Please refer to **logcfgx.c**, **client.c**, **server.c**, **uca_srvr.c**, and **scl_srvr.c** for additions/changes to the sample source code.

37. Removed **logcfg.xsd** and **logcfg.dtd** from this product distribution.

38. Changed the IEC 61850 server code to allow the **stVal** attribute of the **Mod** attribute (INC class) or **Beh** attribute (INS class) to be configured in SCL as “Enum” or “INT32”. Because the Tissues regarding **CtxInt** (120, 146, 171, and 234) are not entirely clear at this date, this change should allow users to configure whatever type is finally clarified in the standard.

39. The define **ALLOW_MULTIPLE_REQUESTS_OUT**, documented in the Reference Manual, is no longer used. It was deleted from the source code sometime before V4.2951, but the change may not have been documented in earlier releases.

40. Changed the functions in **gensock2.c**, **tp0_socks.c**, and **slogipc.c** to use only one mutex semaphore to avoid potential deadlocks. The semaphore is controlled by the macros **S_LOCK_UTIL_RESOURCES** and **S_UNLOCK_UTIL_RESOURCES** (these macros replace **S_LOCK_RESOURCES** and **S_UNLOCK_RESOURCES**).

41. Changed the "gensock2" interface (in **gensock2.c**) as follows:

    a. Added the capability to manage multiple "gensock" contexts by passing a pointer to a **`GEN_SOCK_CTXT`** structure to most functions.

    b. Replaced the **`uSockConnect`** function pointer with 2 separate pointers **`uSockConnectInd`** (called only when a connect "Indication" is received) and **`uSockConnectConf`** (called only when a connect "Confirm" is received).

    c. Added the optional functions **`sockEventPut`** and **`sockEventGet`**. The **`sockEventPut`** function puts a socket event on a list. It may be called from a callback function to save an event for later processing. The **`sockEventGet`** function gets a socket event from the list when the application is ready to process it. These 2 functions are thread-safe.

    d. Removed the **`gs_poll_mode`** flag that controlled an undocumented and confusing gensock option.

42. Changed the function **`u_ml_get_rt_type`** in the **mmsl** library to just log an error and return **`SD_FAILURE`**. The library contains a "default" function which may be replaced by a user-customized function. In the past, the "default" function called "mvl" functions, so it required linking to the **mvl** library, even though most applications never executed this function. Any user that depends on the old behavior must create their own "customized" function which will override the library function (see example in **uca_srvr.c**).

43. New files:

cmd\gnu\gse_mgmt_test.mak	Builds IEC 61850 GSE Mgmt test executable for LINUX, etc.
cmd\gnu\gse_mgmt.mak	Builds IEC 61850 GSE Mgmt library for LINUX, etc.
cmd\gnu\scl_tpxs0.mak	Builds IEC 61850 Sampled Value test executable for LINUX, etc.
cmd\gnu\smpval.mak	Builds IEC 61850 Sampled Value library for LINUX, etc.
cmd\gnu\ositpxs.mak	Builds new stack library for LINUX, etc.
cmd\gnu\cositpxs0.mak	Builds new sample client including IEC 61850 Sampled Value test code.
cmd\gnu\sositpxs0.mak	Builds sample server with ositpxs stack library.
cmd\gnu\uositpxs0.mak	Builds sample UCA server with ositpxs stack library.
cmd\gnu\scl_tpxs0.mak	Builds new sample SCL server including IEC 61850 Sampled Value test code.
cmd\win32\gse_mgmt_test.vcproj	Builds IEC 61850 GSE Mgmt test executable for Windows.
cmd\win32\gse_mgmt.vcproj	Builds IEC 61850 GSE Mgmt library for Windows.
cmd\win32\scl_tpxs0.vcproj	Builds IEC 61850 Sampled Value test executable for Windows.
cmd\win32\smpval.vcproj	Builds IEC 61850 Sampled Value library for Windows.
inc\gse_mgmt.h	Prototypes, etc for IEC 61850 GSE Management support.
mvl\src\mvl61850_rpt.c	Most IEC 61850 reporting code moved from **mvlu_rpt.c** to this file.
mvl\usr\gse_mgmt*.*	IEC 61850 GSE Management sample application.
src\smpval\smpval_dec.c	Functions to decode IEC 61850 Sampled Value messages.
src\smpval\smpval_enc.c	Functions to encode IEC 61850 Sampled Value messages.
uca\goose\gse_mgmt_dec.c	Functions to decode IEC 61850 GSE Management messages.
uca\goose\gse_mgmt_enc.c	Functions to decode IEC 61850 GSE Management messages.

Deleted file:

clnp_dos.c	Old subnet interface code – no longer used.

MMS Lite (V5.0602) contained the following corrections:

- The handling of MMS Alternate Access on arrays in the **mvlu** library was corrected. The data pointer passed to each "leaf" function (i.e., primData) was changed to point to the correct data.

MMS *Lite* (V5.06) contained the following corrections:

- An assertion was removed from the transaction queuing algorithm in **ethsub.c**.

- The spelling of the IEC 61850 “BufTm” attribute was corrected from “BufTim” when processing SCL.
- Fixed the handling of the “Specification With Result” parameter when processing a MMS Read indication (please refer to **spec_in_result** handling in the **mvlas_read_resp** function in **s_read.c**).
- The code generated by Foundry for Domain-specific Journals was corrected.
- Fixed buffer overflow problems in the SCL parser when reading attribute values longer than 64 characters. Also eliminated unnecessary copying of SCL data.
- The initial value of DatSet generated from SCL for GOOSE and LOG control blocks was corrected.
- Fixed a memory leak in the **clnp_read** function.
- The **LastApplError** variable is no longer created at startup but created temporarily only when needed. This prevents clients from seeing the variable in a GetNameList response.
- In **iec_rx.c**, a call to **clnp_snet_free** was added to fix a memory leak. Any user application based on this code might need a similar change.
- The Foundry does NOT create **mvl_rt_tables** if it would be empty (empty array is illegal).
- Corrected the DeleteNamedVariableList indication processing so that if the “Scope of Delete” is “SPECIFIC”, the deletable flag is checked for each NVL before allowing the deletion.
- Changed the type of the “T” attribute of controls from "EntryTime" to "Timestamp", to resolve Tissue #35. Changed the sample SCL file and **iec_cdc.odf**.
- Changed the CMV attribute from “mcval” (incorrect) to “cVal” (correct) in the sample SCL file.
- Fixed the error class and code sent in Error responses for GetVariableAccessAttributes and GetNamedVariableListAttributes indications.
- The length of USERST was corrected in **gentypes.odf**.
- Corrected memory leaks on error conditions in **mvlu_rt.c** and **mvl_typ2.c**.
- The IEC 61850 Controls code was fixed to send a LastApplError report if a write to **Oper**, **SBOw**, or **Cancel** fails. This code depends on the user “leaf” functions to set the report data by filling in the LastApplError member of the **MVLAS_WR_VA_CTRL** structure. To see how this should be done, look for LastApplError in **userleaf.c**.
- Corrected a memory leak in **mvl_obj.c** module for the **last_data** field.
- Corrected a memory leak in **u_a_associate_ind** (**mvl_acse.c**) when the **u_mvl_connect_ind_ex** function returned a failure.
- Corrected an ASN.1 decoding problem with ASN.1 Generalized Time values near “1970-01-01 00:00:00” in timezones east of GMT. The problem often occurred when receiving a MMS File Directory response from a server that had uninitialized file timestamps.
- Fixed the handling of **sboTimeout** for IEC 61850 controls to use milliseconds (not seconds).
- Corrected the initial value of **LogRef** for IEC 61850 Logs to be an ObjectReference.