CENTER for MEDICAL INTEROPERABILITY

The Center for Medical Interoperability Specification ASUM Solution for IHE PCD Clients Using MEM DMC

CMI-SP-F-ASUM-MEM-DMC-D01-20190311

DRAFT

Notice

This specification is the result of a cooperative effort undertaken at the direction of The Center for Medical Interoperability for the benefit of the healthcare industry and its customers. You may download, copy, distribute, and reference the documents herein only for the purpose of developing products or services in accordance with such documents, and educational use. Except as granted by The Center in a separate written license agreement, no license is granted to modify the documents herein (except via the Engineering Change process), or to use, copy, modify or distribute the documents for any other purpose.

This document may contain references to other documents not owned or controlled by The Center. Use and understanding of this document may require access to such other documents. Designing, manufacturing, distributing, using, selling, or servicing products, or providing services, based on this document may require intellectual property licenses from third parties for technology referenced in this document. To the extent this document contains or refers to documents of third parties, you agree to abide by the terms of any licenses associated with such third-party documents, including open source licenses, if any.

©2019, Center for Medical Interoperability (The Center™)

DISCLAIMER

This document is furnished on an "AS IS" basis and neither The Center nor its members provides any representation or warranty, express or implied, regarding the accuracy, completeness, noninfringement, or fitness for a particular purpose of this document, or any document referenced herein. Any use or reliance on the information or opinion in this document is at the risk of the user, and The Center and its members shall not be liable for any damage or injury incurred by any person arising out of the completeness, accuracy, or utility of any information or opinion contained in the document.

The Center reserves the right to revise this document for any reason including, but not limited to, changes in laws, regulations, or standards promulgated by various entities, technology advances, or changes in equipment design, manufacturing techniques, or operating procedures described, or referred to, herein.

This document is not to be construed to suggest that any company modify or change any of its products or procedures, nor does this document represent a commitment by The Center or any of its members to purchase any product whether or not it meets the characteristics described in the document. Unless granted in a separate written agreement from The Center, nothing contained herein shall be construed to confer any license or right to any intellectual property. This document is not to be construed as an endorsement of any product or company or as the adoption or promulgation of any guidelines, standards, or recommendations.

Document Status Sheet

Document Control Number:	CMI-SP-F-ASUM-MEM-DMC-D01-20190311			
Document Title:	ASUM Solution for IHE PCD Clients Using MEM DMC			
Revision History:	D01			
Date:	March 11, 2019			
Status:	~~Work in Progress~~	**Draft**	~~Issued~~	~~Closed~~
Distribution Restrictions:	~~Author Only~~	~~The Center/Member~~	~~The Center/ Member/ NDA Vendor~~	**Public**

Key to Document Status Codes

Work in Progress	An incomplete document designed to guide discussion and generate feedback that may include several alternative requirements for consideration.
Draft	A document in specification format considered largely complete, but lacking review by Members and vendors. Drafts are susceptible to substantial change during the review process.
Issued	A generally public document that has undergone Member and Technology Supplier review, cross-vendor interoperability, and is for Certification testing if applicable. Issued Specifications are subject to the Engineering Change Process.
Closed	A static document, reviewed, tested, validated, and closed to further engineering change requests to the specification through The Center.

Trademarks

CMI™ and The Center™ are trademarks of Center for Medical Interoperability. All other marks are the property of their respective owners.

Contents

1 Scope 6
1.1 Introduction and Purpose 6
1.2 Requirements 6
2 References 7
2.1 Normative References 7
2.2 Reference Acquisition 8
3 Terms and Definitions 9
4 Abbreviations and Acronyms 9
5 Overview 9
6 ASUM Solution using MEM DMC 10
6.1 Client and ASUM Management Entity Communications 10
6.1.1 ASUM Management Entity Discovery 11
6.1.2 Periodicity 11
6.1.3 Client Information 11
6.1.4 Normal Flow ACK 11
6.1.5 ACK with Command Extension 11
6.2 Software Update Command 12
6.2.1 Software Update Command Status 13
6.3 Secure Software Transport 14
6.4 Software Image Verification 14
7 ASUM Client Configuration using MEM DMC 14
7.1 Configure Interval Command 14
7.2 Configure Management Entity Command 15
7.3 Cancel Software Update 16
8 Security Requirements 16
Appendix I. ASUM IHE MEM DMC Message Examples (INFORMATIVE) 17
I.1 IHE PCD Infrastructure Attributes 17
I.2 Sample PCD-15 Message in Normal Flow 18
I.3 Sample PCD-15 ACK in Normal Flow 18
I.4 Sample PCD-15 ACK with Update Software Command 19
I.5 Sample PCD-15 Message with Software Update Success Indication 19
I.6 Sample PCD-15 Message with Software Update Failure Indication 20
I.7 Sample PCD-15 ACK with Configure Interval Command 21
I.8 Sample PCD-15 ACK with Configure Management Entity Command 21

Appendix II. Acknowledgements 22

Figures

Figure 1 - Architecture showing periodic MEM-DMC message 10

Tables

Table 1 – ERR Segment Parameters for Software Update 12
Table 2 – Configure Interval Command Parameter 15
Table 3 – Configure Management Entity Parameter 15
Table 4 – Reference IDs for Client to Report System and Version Information 17

1 Scope

1.1 Introduction and Purpose

This document specifies an Automated and Secure Update and Management (ASUM) solution for clients that support Integrating the Healthcare Enterprise (IHE) Patient Care Device (PCD).

1.2 Requirements

Throughout this document, the words that are used to define the significance of particular requirements are capitalized. These words are:

"SHALL"	This word means that the item is an absolute requirement of this specification.
"SHALL NOT"	This phrase means that the item is an absolute prohibition of this specification.
"SHOULD"	This word means that there may exist valid reasons in particular circumstances to ignore this item, but the full implications should be understood and the case carefully weighed before choosing a different course.
"SHOULD NOT"	This phrase means that there may exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behavior described with this label.
"MAY"	This word means that this item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because it enhances the product; for example, another vendor may omit the same item.

2 References

2.1 Normative References

In order to claim compliance with this specification, it is necessary to conform to the following standards and other works as indicated, in addition to the other requirements of this specification. Notwithstanding, intellectual property rights may be required to use or implement such normative references.

All references are subject to revision, and parties to agreement based on this specification are encouraged to investigate the possibility of applying the most recent editions of the documents listed below.

[CMI-DOC-TD]	"Terms and Definitions", Center for Medical Interoperability, Mar. 2019 https://medicalinteroperability.org/specifications/D01/CMI-DOC-TD-D01-20190311.pdf
[CMI-SP-F-ASUM]	"Automated Secure Update and Management Framework", Center for Medical Interoperability, Mar. 2019 https://medicalinteroperability.org/specifications/D01/CMI-SP-F-ASUM-D01-20190311.pdf
[CMI-SP-F-PF]	"Provisioning Flows", Center for Medical Interoperability, Mar. 2019 https://medicalinteroperability.org/specifications/D01/CMI-SP-F-PF-D01-20190311.pdf
[CMI-TR-F-SEC]	"Security Considerations for Foundational Efforts", Center for Medical Interoperability, Mar. 2019 https://medicalinteroperability.org/specifications/D01/CMI-TR-F-SEC-D01-20190311.pdf
[CMI-SP-CDI-IHE-PCD-IST]	"Clinical Data Interoperability using IHE PCD – Identity and Secure Transport Specification", Center for Medical Interoperability. , Mar. 2019 https://medicalinteroperability.org/specifications/D01/CMI-SP-CDI-IHE-PCD-IST-D01-20190311.pdf
[HL7-FHIR]	"Fast Healthcare Interoperability Resources", https://www.hl7.org/fhir/overview.html

[IEEE-10101a-2015]	Health informatics – Point-of-care medical device communication – Part 10101: Nomenclature – Amendment 1: Additional Definitions http://standards.ieee.org/findstds/standard/11073-10101a-2015.html
[IETF-RFC2818]	"HTTP over TLS", https://tools.ietf.org/html/rfc2818
[IETF-RFC5246]	"The Transport Layer Security (TLS) Protocol Version 1.2", https://tools.ietf.org/html/rfc5246
[IHE-PCD-MEM-DMC]	"Integrating the Healthcare Enterprise (IHE) Medical Equipment Management (MEM) Device Management Communication (DMC)", https://www.ihe.net/uploadedFiles/Documents/PCD/IHE_Suppl_PCD_MEM-DMC.pdf
[IHE-PCD]	"Integrating the Healthcare Enterprise (IHE) Patient Care Device (PCD)", https://www.ihe.net/Patient_Care_Devices/
[OWASP]	"Open Web Application Security Project (OWASP)", https://owasp.org/

2.2 Reference Acquisition

Center for Medical Interoperability, 8 City Boulevard, Suite 203 | Nashville, TN 37209;
Phone +1-615-257-6410; http://medicalinteroperability.org/

3 Terms and Definitions

This document specifies the following terms and definitions.

ASUM Management Entity	A logical network element that implements the non-client portion of the ASUM interface as described in this document.
Software Repository	The logical network entity from which a client can obtain the software updates.
Vendor Software Update Server	A logical network component that is part of the client manufacturer's network that can provide information related to software updates.

4 Abbreviations and Acronyms

This document uses the following abbreviations:

ASUM	Automated Software Update and Management
CMI	Center For Medical Interoperability
IP	Internet Protocol
URL	Uniform Resource Locator

5 Overview

The foundational ASUM framework specification ([CMI-SP-F-ASUM]) illustrates the components, requirements, and recommendations that are used to specify ASUM solutions. The reasoning of the ASUM framework is that we will be able to leverage a multitude of protocols for specific client types and the protocols that they support. Accordingly, this document specifies the ASUM solution for clients that support [IHE-PCD]. It accomplishes this by leveraging the device management communications provided via [IHE-PCD-MEM-DMC].

Specifically, the ASUM solution in this document leverages [IHE-PCD-MEM-DMC] to establish communications between the ASUM Management Entity and the Client. The [IHE-PCD-MEM-DMC] PCD-15 message is sent periodically from the Client to the ASUM management entity. The management entity returns a response, which has been extended to notify the client of the availability of updated software and associated information. As with the ASUM framework, this document then allows Clients to use an ASUM framework compliant secure transport mechanism, or use the one specified by the ASUM framework. Finally, the client provides the status of update via an [IHE-PCD-MEM-DMC] PCD-15 message immediately after the update succeeds or fails.

The benefits of re-using [IHE-PCD-MEM-DMC] are:

- no open port requirement on the Client which eliminates certain security concerns,
- eliminates the need for unspecified or new messages specific for ASUM.

One drawback to the periodic message is there will be a slight delay as to when the ASUM management entity may deliver the software update command to the Client. While this may be acceptable in various settings, we have also allowed for the periodicity to be configurable to meet deployment requirements.

The high-level logical flows associated with the ASUM solution specified in this document are summarized in Figure 1.

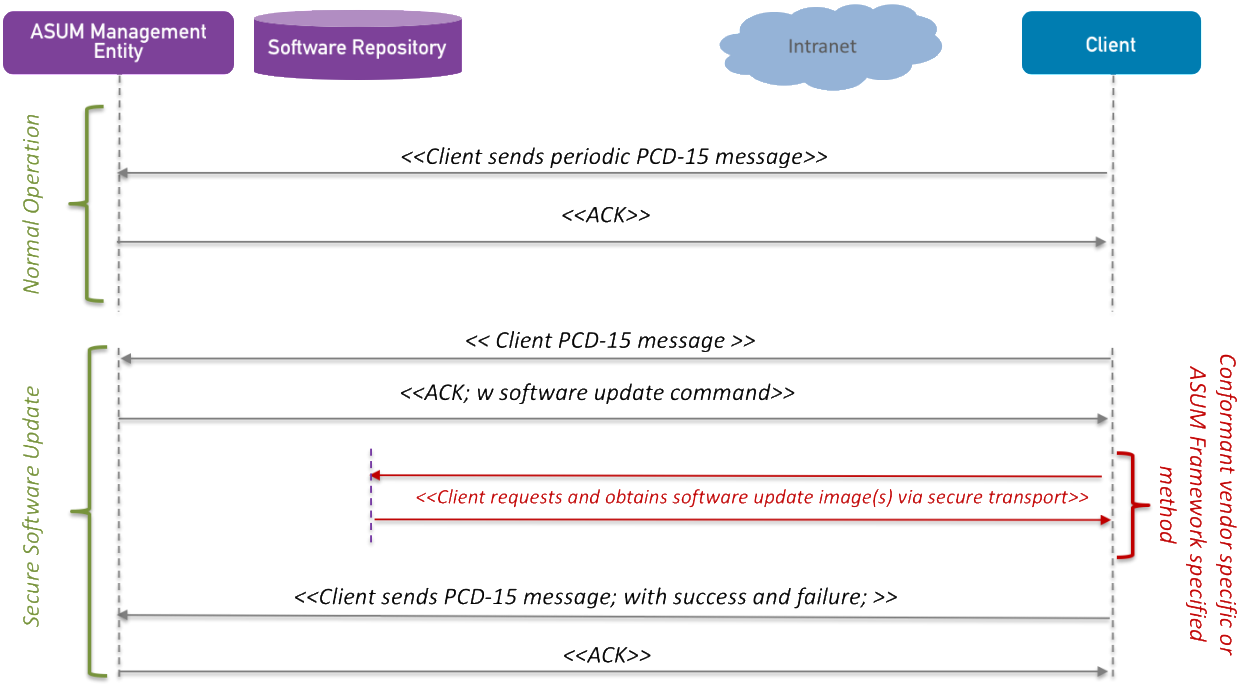

Figure 1 - Architecture showing periodic MEM-DMC message

6 ASUM Solution using MEM DMC

This document adheres to the requirements laid out in [CMI-SP-F-ASUM] and specifies the [IHE-PCD-MEM-DMC] based ASUM solution requirements within this section. Clients that support CMI architectures that leverage [IHE-PCD] SHALL support the ASUM solution specified in this document.

6.1 Client and ASUM Management Entity Communications

Client SHALL use the [IHE-PCD-MEM-DMC] PCD-15 message to communicate with the ASUM Management Entity. The Client SHALL send the first message soon after it discovers the ASUM Management Entity. All communications with the ASUM Management Entity SHALL comply with [CMI-SP-CDI-IHE-PCD-IST].

6.1.1 ASUM Management Entity Discovery

Within this ASUM solution, the Client SHALL assume that the management entity described in [CMI-SP-F-PF] is the ASUM Management Entity, unless it is reconfigured by the ASUM management entity.

6.1.2 Periodicity

Clients SHALL use a default periodicity of five minutes, unless considered by the vendor to be a constrained client (e.g., IoT device). Constrained clients SHALL use a default periodicity of one hour. Clients SHALL allow for this default to be modified as specified in 7.1.

6.1.3 Client Information

Clients SHALL report the following in the PCD-15 message:

- Software version, hardware version (unless it is a software-only client)
- Protocol version (HL7 version for Phase1)
- Model
- Operating system version (either integrated or third party OS)
- CMI compliance info (the document identifier, CMI-SP-F-ASUM-MEM-DMC-D01 for this document)

Clients MAY report any known software or hardware dependencies.

See Appendix I for [IEEE-10101a-2015] reference IDs for reporting the above information in the [IHE-PCD-MEM-DMC] PCD-15 message.

6.1.4 Normal Flow ACK

The ASUM management entity SHALL send an ACK for each PCD-15 message. Normal flow will consist of HL7 ACKs.

6.1.5 ACK with Command Extension

The ASUM management entity MAY send commands as extensions in the content of the ACK. The Application Error Code CWE (ERR-5) is used to convey the command. The identifier in ERR-5.1 may be left empty, and the ERR-5.2 text consists of simple key value pairs separated by spaces. The notation is described below in simplified BNF:

```
<syntax>      ::= <cmd> <parameters> | <syntax>

<cmd>         ::= "CMD"= "UPDATE_SW" | "CFG_INTERVAL" |
"CFG_MGMT_ENTITY" | "CANCEL_UPDATE_SW"

<parameters>  ::= <parameter> | <parameters>
```

```
<parameter>    ::= <key> "=" <value>

<key>          ::= text

<value>        ::= text
```

Restrictions beyond normal HL7 restrictions on ERR-5.2:

<key> cannot contain '=' char

<value> cannot contain '=' char unless it is escaped as %3D

<value> cannot contain ' ' char unless it is escaped as %20

Note that ERR-5.2 has a maximum length of 199.

6.2 Software Update Command

If a software update is ready for the Client, the ASUM management entity SHALL include an UPDATE_SW command in the ERR segment of the ACK with the parameters shown in Table 1.

Table 1 – ERR Segment Parameters for Software Update

Name	Description	HL7 Type	Length	Example	
URI	Software Update URL/URI	ST	85	/some/update/uri	Required; value is not further constrained
AUTH	Authentication Method and related info	ST	12	CVC	Required; value is not further constrained
DST	Start of timeframe to attempt download	TS	17	201803260100-0000	Optional and only allows time precision to the minute; if not specified, download may occur any time before DownloadEndTime or UpdateStartTime
DET	End of timeframe to attempt download	TS	17	201803260159-0000	Optional and only allows time precision to the minute; If not specified, download may occur any time after DownloadStartTime and before UpdateStartTime

Name	Description	HL7 Type	Length	Example	
UST	Start of timeframe to attempt update	TS	17	201803260500-0000	Optional and only allows time precision to the minute; If not specified, update may occur any time before UpdateEndTime
UET	End of timeframe to attempt update	TS	17	201803260559-0000	Optional and only allows time precision to the minute; If not specified, update may occur any time after UpdateStartTime

Note: Timestamps *SHALL* include a valid time-zone offset. If the civil time zone offset is unknown, then UTC time *SHALL* be specified using a time zone offset of "-0000".[1]

The Client SHALL parse the UPDATE_SW command and attempt to perform the update as requested. If the Client could not perform the update as requested (e.g. performing therapy throughout the entire specified time-range), the Client SHALL report this as a failure condition as specified in section 6.2.1.

6.2.1 Software Update Command Status

Clients SHALL indicate success or failure of the ASUM processs to the Management Entity upon (re)initialization for both manual and automated updates in the first IHE MEM DMC PCD-15 message after the update was attempted. The Client SHALL use the code format and the codes specified in [CMI-SP-F-ASUM]. The Client SHALL ensure that the codes corresponding to the specified conditions are used as specified in [CMI-SP-F-ASUM].

If the software update was successful, a Client SHALL report:

> An OBX with the identifier OBX-3 = |0^MDCX_NOTI_SW_UPDATE_STATUS_STRING^MDC| with the 'ST' datatype and string value specified in [CMI-SP-F-ASUM].
> For example: OBX-5 = |CMI-S-00000|.

[1] The IETF RFC 3339 "Unknown Local Offset Convention" convention is used to distinguish between the case where UTC is the preferred reference point for the specified time, denoted with +0000, and the case where the UTC time is known, but the offset to local civil time is unknown, denoted with -0000. This distinction is in some cases important to represent in device data, and in all cases, to provide a *computable* date/time value traceable to UTC, including any leap seconds up to the time the ASUM command was sent.

If the software update was unsuccessful, a Client SHALL report:

> An OBX with the identifier OBX-3 = |0^MDCX_NOTI_SW_UPDATE_STATUS_STRING^MDC| with the 'ST' datatype and string values specified in [CMI-SP-F-ASUM].

The Client SHALL continue to indicate success or failure of recent software update command to the Management Entity until a successful ACK is received.

The Client SHALL NOT become bricked if the update is unsuccessful. The Client SHALL retain all configuration information necessary prior to update to reconfigure and be functional after the update.

A software update MAY require manual intervention to complete. If so, Clients SHALL notify the Management Entity that manual support is required regardless of update success or failure.

6.3 Secure Software Transport

The Client SHALL support either an ASUM framework compliant vendor-specific secure transport mechanism or support the secure software transport mechanism in [CMI-SP-F-ASUM].

6.4 Software Image Verification

The Client SHALL support the software image verification mechanism in [CMI-SP-F-ASUM].

7 ASUM Client Configuration using MEM DMC

If the Client periodic interval or management entity configuration needs to change, the ASUM management entity SHALL include a configuration command in the ERR segment of the ACK.

The Client SHALL parse the command and perform the reconfiguration as requested. The Client SHALL maintain the configuration requested by the management entity until a subsequent reconfiguration command, or until the next system initialization.

The Clients SHALL use OBX-3 = |0^MDCX_NOTI_SW_UPDATE_STATUS_STRING^MDC| to convey success/failure codes; multiple strings may be sent using HL7 V2 '~' repetition separator

7.1 Configure Interval Command

If the periodic update interval is to be reconfigured by the Client, the ASUM management entity SHALL include a CFG_INTERVAL command with the parameter shown in Table 2.

Table 2 – Configure Interval Command Parameter

Name	Description	HL7 Type	Example	
INTERVAL	Time in seconds	NM	300	Required; value is not further constrained

The Client SHALL parse the CFG_INTERVAL command and perform the reconfiguration of the interval as requested. If the Client's attempt at reconfiguring the interval fails, the Client SHALL remain with the old interval.

Clients SHALL indicate success or failure to the Management Entity after processing the Configure Interval command in the first IHE MEM DMC PCD-15 message after the configuration change was attempted using the corresponding management codes in [CMI-SP-F-ASUM].

The Client SHALL continue to indicate success or failure of configuration command to the Management Entity, until a successful ACK is received.

7.2 Configure Management Entity Command

If the ASUM management entity is to be reconfigured by the Client, the ASUM management entity SHALL include a CFG_MGMT_ENTITY command with the parameter shown in Table 3.

Table 3 – Configure Management Entity Parameter

Name	Description	HL7 Type	Example	
NAME	FQDN of Management Entity	ST	MgmtEntityXYZ.domain.com	Required; value is not further constrained

The Client SHALL parse the CFG_MGMT_ENTITY command and send all future messages to the newly specified management entity as requested. If the Client's attempt at reconfiguring the management entity fails, the Client SHALL remain with the prior configured value.

Clients SHALL indicate success or failure to the Management Entity after processing the Configure Management Entity command in the first IHE MEM DMC PCD-15 message after the configuration change was attempted using the corresponding management codes in [CMI-SP-F-ASUM].

The Client SHALL continue to indicate success or failure of configuration command to the Management Entity, until a successful ACK is received.

7.3 Cancel Software Update

To cancel a prior software update request to a Client, the ASUM management entity SHALL include a CANCEL_UPDATE_SW command.

The Client SHALL attempt to cancel the software update when this command is received. Clients SHALL indicate success or failure to the Management Entity in the first IHE MEM DMC PCD-15 message after the configuration change was attempted using the corresponding management codes in [CMI-SP-F-ASUM].

The Client SHALL continue to indicate success or failure of configuration command to the Management Entity, until a successful ACK is received.

8 Security Requirements

Clients SHALL secure the IHE PCD transport as specified in [CMI-SP-CDI-IHE-PCD-IST]. Clients SHALL either securely transport software images performed as specified in [CMI-SP-F-ASUM], Annex A; or, support an equivalent transport mechanism that complies with [CMI-SP-F-ASUM], Section 6.

Clients SHALL authenticate software images as specified in [CMI-SP-F-ASUM], Annex B. Vendors may choose to use single files (e.g., binary blobs), packages, or multiple files.

Appendix I. ASUM IHE MEM DMC Message Examples (INFORMATIVE)

The Appendix provides examples of ASUM IHE MEM DMC PCD-15 messages.

I.1 IHE PCD Infrastructure Attributes

The Reference IDs shown in Table 4, from [IEEE-10101a-2015] (Table A.11.2.1), are used in the PCD-15 message when the Client reports system and version information.

Table 4 – Reference IDs for Client to Report System and Version Information

Reference ID	Description/Definition	Part::Code	CF_CODE10
MDC_ID_MODEL_NUMBER	The **model number** sub-element of the MDC_ATTR_ID_MODEL attribute.	8::7681	531969
MDC_ID_MODEL_MANUFACTURER	The **manufacturer** sub-element of the MDC_ATTR_ID_MODEL attribute.	8::7682	531970
MDC_ID_PROD_SPEC_SERIAL	The **serial-number** component id group of the MDC_ATTR_ID_PROD_SPECN attribute.	8::7684	531972
MDC_ID_PROD_SPEC_PART	The **part-number** component id group of the MDC_ATTR_ID_PROD_SPECN attribute.	8::7685	531973
MDC_ID_PROD_SPEC_HW	The **hardware-revision** component id group of the MDC_ATTR_ID_PROD_SPECN attribute.	8::7686	531974
MDC_ID_PROD_SPEC_SW	The **software-revision** component id group of the MDC_ATTR_ID_PROD_SPECN attribute.	8::7687	531975
MDC_ID_PROD_SPEC_FW	The **firmware-revision** component id group of the MDC_ATTR_ID_PROD_SPECN attribute.	8::7688	531976
MDC_ID_PROD_SPEC_PROTOCOL_REV	The **protocol-revision** component id group of the MDC_ATTR_ID_PROD_SPECN attribute.	8::7689	531977
MDC_ATTR_SYS_ID	System ID	1::2436	67972

Informative note: In addition to the IHE PCD infrastructure attributes noted above, the ASUM solution based on IHE PCD MEM-DMC will use elements from HL7 V2.8.2 regarding the use of the PRT segment to convey the FDA-defined 'Universal Device Identifier' (UDI).

I.2 Sample PCD-15 Message in Normal Flow

```
MSH|^~\&|VendorXYZ^001A010000000001^EUI-
64||HealthSystemABC||20150119221713-
0000||ORU^R01^ORU_R01|1421727433|P|2.6|||AL|NE||UNICODE UTF-
8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

PID|1|||||||||||||||||||||||||||Y

PV1|1|N

OBR|1|2000101^Medfusion 4000^001A010000000001^EUI-64|2000101^Medfusion
4000^001A010000000001^EUI-
64|0^MDCX_EVT_SW_VER_REPORT|||20150119221713-0000

OBX|1|ST|69985^MDC_DEV_PUMP_INFUS_MDS^MDC|1.0.0.1|||||||X

OBX|2|EI|67972^MDC_ATTR_SYS_ID^MDC|1.0.0.2|2000101^Medfusion
4000^001A010000000001^EUI-64||20150119221713-0000||||F

OBX|3|ST|531970^MDC_ID_MODEL_MANUFACTURER^MDC|1.0.0.3|Smiths
Medical||20150119221713-0000||||F

OBX|4|ST|531969^MDC_ID_MODEL_NUMBER^MDC|1.0.0.4|Medfusion
4000||20150119221713-0000||||F

OBX|5|ST|531975^MDC_ID_PROD_SPEC_SW^MDC|1.0.0.5|01-229-01-
01||20150119221713-0000||||F
```

I.3 Sample PCD-15 ACK in Normal Flow

The MSA-1 code ‘AA’ is used to acknowledge acceptance by the management entity.

```
MSH|^~\&|MgmtEntityABC||VendorXYZ ^001A010000000001^EUI-
64||20150119221714-0000||ACK^015^ACK|1421727433|P|2.6|||NE|NE||UNICODE
UTF-8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

MSA|AA|
```

I.4 Sample PCD-15 ACK with Update Software Command

The MSA-1 code 'AA' is used to acknowledge acceptance by the management entity. An ERR segment is present and ERR-3.1 has a value of 0 and ERR-4 has a value of 'I' indicating "Informational'. ERR-5.1 is left blank and ERR-5.2 contains the structured command.

```
MSH|^~\&|MgmtEntityABC||VendorXYZ ^001A010000000001^EUI-
64||20150119221714-0000||ACK^015^ACK|1421727433|P|2.6|||NE|NE||UNICODE
UTF-8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

MSA|AA|1421727433

ERR||0^Message Accepted^HL70357|I|^CMD=UPDATE_SW URI=/some/uri
AUTH=CVC DST=201803260100-0000 DET=201803260159-0000 UST=201803260500-
0000 UET=201803260559-0000
```

I.5 Sample PCD-15 Message with Software Update Success Indication

The last OBX returns a Software Update Success Indication of |CMI-E-00000|, indicating that the software update succeeded as requested.

```
MSH|^~\&|VendorXYZ^001A010000000001^EUI-
64||HealthSystemABC||20150119221713-
0000||ORU^R01^ORU_R01|1421727433|P|2.6|||AL|NE||UNCODE UTF-
8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

PID|1||||||||||||||||||||||||||||Y

PV1|1|N

OBR|1|2000101^Medfusion 4000^001A010000000001^EUI-64|2000101^Medfusion
4000^001A010000000001^EUI-
64|0^MDCX_EVT_SW_VER_REPORT|||20150119221713-0000

OBX|1|ST|69985^MDC_DEV_PUMP_INFUS_MDS^MDC|1.0.0.1|||||||X

OBX|2|EI|67972^MDC_ATTR_SYS_ID^MDC|1.0.0.2|2000101^Medfusion
4000^001A010000000001^EUI-64||20150119221713-0000||||F

OBX|3|ST|531970^MDC_ID_MODEL_MANUFACTURER^MDC|1.0.0.3|Smiths
Medical||20150119221713-0000||||F

OBX|4|ST|531969^MDC_ID_MODEL_NUMBER^MDC|1.0.0.4|Medfusion
4000||20150119221713-0000||||F

OBX|5|ST|531975^MDC_ID_PROD_SPEC_SW^MDC|1.0.0.5|01-229-01-
01||20150119221713-0000||||F
```

```
OBX|6|ST|0^MDCX_NOTI_SW_UPDATE_STATUS_STRING^MDC|1.0.0.6|CMI-S-
00000||20150119221713-0000||||F
```

I.6 Sample PCD-15 Message with Software Update Failure Indication

The last OBX returns a Software Update Failure Indication of |CMI-E-00060|, indicating that the software update was rejected during the specified timeframe since the client was in use.

```
MSH|^~\&|VendorXYZ^001A010000000001^EUI-
64||HealthSystemABC||20150119221713-
0000||ORU^R01^ORU_R01|1421727433|P|2.6|||AL|NE||UNICODE UTF-
8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

PID|1||||||||||||||||||||||||||||Y

PV1|1|N

OBR|1|2000101^Medfusion 4000^001A010000000001^EUI-64|2000101^Medfusion
4000^001A010000000001^EUI-
64|0^MDCX_EVT_SW_VER_REPORT|||20150119221713-0000

OBX|1|ST|69985^MDC_DEV_PUMP_INFUS_MDS^MDC|1.0.0.1|||||||X

OBX|2|EI|67972^MDC_ATTR_SYS_ID^MDC|1.0.0.2|2000101^Medfusion
4000^001A010000000001^EUI-64||20150119221713-0000||||F

OBX|3|ST|531970^MDC_ID_MODEL_MANUFACTURER^MDC|1.0.0.3|Smiths
Medical||20150119221713-0000||||F

OBX|4|ST|531969^MDC_ID_MODEL_NUMBER^MDC|1.0.0.4|Medfusion
4000||20150119221713-0000||||F

OBX|5|ST|531975^MDC_ID_PROD_SPEC_SW^MDC|1.0.0.5|01-229-01-
01||20150119221713-0000||||F

OBX|6|ST|0^MDCX_NOTI_SW_UPDATE_STATUS_STRING^MDC|1.0.0.6|CMI-E-
00060||20150119221713-0000||||F
```

I.7 Sample PCD-15 ACK with Configure Interval Command

The MSA-1 code 'AA' is used to acknowledge acceptance by the management entity. A ERR segment is present and ERR-3.1 has a value of 0 and ERR-4 has a value of 'I' indicating "Informational'. ERR-5.1 is left blank and ERR-5.2 contains the structured command.

```
MSH|^~\&|MgmtEntityABC||VendorXYZ ^001A010000000001^EUI-
64||20150119221714-0000||ACK^015^ACK|1421727433|P|2.6|||NE|NE||UNICODE
UTF-8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

MSA|AA|1421727433

ERR||0^Message Accepted^HL70357|I|^CMD=CFG_INTERVAL INTERVAL=180
```

I.8 Sample PCD-15 ACK with Configure Management Entity Command

The MSA-1 code 'AA' is used to acknowledge acceptance by the management entity. An ERR segment is present and ERR-3.1 has a value of 0 and ERR-4 has a value of 'I' indicating "Informational'. ERR-5.1 is left blank and ERR-5.2 contains the structured command.

```
MSH|^~\&|MgmtEntityABC||VendorXYZ ^001A010000000001^EUI-
64||20150119221714-0000||ACK^015^ACK|1421727433|P|2.6|||NE|NE||UNICODE
UTF-8|en^English^ISO639||IHE_PCD_015^IHE
PCD^1.3.6.1.4.1.19376.1.6.1.15.1^ISO

MSA|AA|1421727433

ERR||0^Message Accepted^HL70357|I|^CMD=CFG_MGMT_ENTITY
NAME=MgmtEntityXYZ.somedomain.com
```

Appendix II. Acknowledgements

The Center and its member companies would like to extend a heartfelt thanks to all those who participated in the development of this document.

The primary authors of this document were **Eldon Metz**, **Paul Schluter** and **Steve Goeringer;** with technical and editorial contributions from **Sumanth Channabasappa**. Special thanks to those who were directly involved via a variety of discussions, reviews and input: **Ken Fuchs, Kai Hassing and Jeffrey Brown.**

This effort was conducted within The Center's **Architecture and Requirements, Security,** and **Connectivity** Working Groups, whose members have included the following part-time and full-time participants during the time period that we discussed this version of the document:

WG Participant	**Company Affiliation**
Ali Nakoulima	Cerner
Barry Brown	Mortara
Bill Pelletier	GE
Brionna Lopez	CableLabs
Bruce Friedman	GE Healthcare
Corey Spears	Infor
David Niewolny	RTI
Doug Smith	Laird
Eldon Metz	Innovision Medical
George Cragg	Draeger
Ian Sherlock	TI
James Surine	Smiths Medical
Jay White	Laird
Jeffrey Brown	GE
JF Lancelot	Airstrip
Kai Hassing	Philips
Ken Fuchs	Draeger

WG Participant	Company Affiliation
Massimiliano Pala	CableLabs
Matthew Pekarske	GE
Mike Krajnak	GE
Neil Puthuff	RTI
Phil Raymond	Philips
Scott Coleman	Welch Allyn
Scott Eaton	Mindray
Song Chung	Welch Allyn
Soundharya Nagasubramanian	Welch Allyn
Stefan Karl	Philips
Stuart Hoggan	CableLabs

- *Sumanth Channabasappa (Architecture & Requirements Working Group Lead), Steve Goeringer (Security Working Group Lead), David Fann, Trevor Pavey, Paul Schluter, John Williams, Katy Hoyer (Document Editor); and, Ed Miller (CTO) -- The Center*