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«health-engine» DICOM Conformance Statement

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Abstract	This document provides information about the DICOM Conformance of the Health Engine.
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1. Conformance Statement Overview

Health Engine is a suite that implements a full featured Hospital Information System (HIS). Health Engine includes features typically associated with a HIS, including interfaces to various Hospital Information Systems, Patient Tracking, Results Reporting, Film Tracking, Management Reporting, PACS Integration, etc.

Health Engine is also used for archiving diagnostic medical images and other DICOM objects, therefore acts as a PACS. It allows external systems to send or retrieve various DICOM objects. Health Engine does not modify or create any DICOM objects. The system conforms to the DICOM standard to allow sharing of medical information with other digital imaging, diagnosis or other medical systems.

Health Engine supports several DICOM Service Classes, using MergeCOM DICOM library, to provide the following capabilities:

Allowing Modalities to query for patient demographics. Health Engine processes these queries by directly accessing the Health Engine database, which is automatically updated with appropriate data through the normal operations of the RIS.

The Health Engine acts as Query/Retrieve SCU and allows to send IODs to 3rd party systems.

Health Engine allows other systems to send DICOM IODs to the Health Engine using C-STORE Requests.

Note: Relational Queries are not supported either as an SCU or SCP.

Table 1-1: Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Basic Film Session SOP Class	Yes	Yes
Computed Radiography Image Storage	Yes	Yes
Digital X-Ray Image Storage - For Presentation	Yes	Yes
Digital X-Ray Image Storage - For Processing	Yes	Yes
Digital Mammography X-Ray Image Storage - For Presentation	Yes	Yes
Digital Mammography X-Ray Image Storage - For Processing	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Presentation	Yes	Yes
Digital Intra-oral X-Ray Image Storage - For Processing	Yes	Yes
CT Image Storage	Yes	Yes
Enhanced CT Image Storage	Yes	Yes
Ultrasound Multi-frame Storage (Retired)	Yes	Yes
Ultrasound Multi-frame Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Enhanced MR Image Storage	Yes	Yes
NM Image Storage (Retired)	Yes	Yes
Ultrasound Image Storage (Retired)	Yes	Yes

Table 1-1: Network Services		
SOP Classes	**User of Service (SCU)**	**Provider of Service (SCP)**
MR Spectroscopy Storage	Yes	Yes
Enhanced MR Color Image Storage SOP Class	Yes	Yes
Ultrasound Image Storage	Yes	Yes
Enhanced US Volume Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Multi-frame Single Bit Secondary Capture Image Storage	Yes	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes
12-lead ECG Waveform Storage	Yes	Yes
General ECG Waveform Storage	Yes	Yes
Ambulatory ECG Waveform Storage	Yes	Yes
Hemodynamic Waveform Storage	Yes	Yes
Cardiac Electrophysiology Waveform Storage	Yes	Yes
Basic Voice Audio Waveform Storage	Yes	Yes
General Audio Waveform Storage	Yes	Yes
Arterial Pulse Waveform Storage	Yes	Yes
Respiratory Waveform Storage	Yes	Yes
Grayscale Softcopy Presentation State Storage SOP Class	Yes	Yes
Color Softcopy Presentation State Storage SOP Class	Yes	Yes
Pseudo-Color Softcopy Presentation State Storage SOP Class	Yes	Yes
Blending Softcopy Presentation State Storage SOP Class	Yes	Yes
XA/XRF Grayscale Softcopy Presentation State Storage	Yes	Yes
Grayscale Planar MPR Volumetric Presentation State Storage SOP Class	Yes	Yes
Compositing Planar MPR Volumetric Presentation State Storage SOP Class	Yes	Yes
X-Ray Angiographic Image Storage	Yes	Yes
Enhanced XA Image Storage	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	Yes	Yes
Enhanced XRF Image Storage	Yes	Yes
X-Ray 3D Angiographic Image Storage	Yes	Yes
X-Ray 3D Craniofacial Image Storage	Yes	Yes
Breast Tomosynthesis Image Storage	Yes	Yes
Breast Projection X-Ray Image Storage - For Presentation	Yes	Yes

Table 1-1: Network Services		
SOP Classes	**User of Service (SCU)**	**Provider of Service (SCP)**
Breast Projection X-Ray Image Storage - For Processing	Yes	Yes
Intravascular Optical Coherence Tomography Image Storage - For Presentation	Yes	Yes
Intravascular Optical Coherence Tomography Image Storage - For Processing	Yes	Yes
Nuclear Medicine Image Storage	Yes	Yes
Parametric Map Storage SOP Class	Yes	Yes
Raw Data Storage	Yes	Yes
Spatial Registration Storage	Yes	Yes
Spatial Fiducials Storage	Yes	Yes
Deformable Spatial Registration SOP Class	Yes	Yes
Segmentation SOP Class	Yes	Yes
Surface Segmentation Storage	Yes	Yes
Tractography Results Storage	Yes	Yes
Real World Value Mapping Storage	Yes	Yes
Surface Scan Mesh Storage	Yes	Yes
Surface Scan Point Cloud Storage	Yes	Yes
VL Endoscopic Image Storage	Yes	Yes
Video Endoscopic Image Storage	Yes	Yes
VL Microscopic Image Storage	Yes	Yes
Video Microscopic Image Storage	Yes	Yes
VL Slide-Coordinates Microscopic Image Storage	Yes	Yes
VL Photographic Image Storage	Yes	Yes
Video Photographic Image Storage	Yes	Yes
Ophthalmic Photography 8 Bit Image Storage	Yes	Yes
Ophthalmic Photography 16 Bit Image Storage	Yes	Yes
Stereometric Relationship Storage	Yes	Yes
Ophthalmic Tomography Image Storage	Yes	Yes
Wide Field Ophthalmic Photography Stereographic Projection Image Storage	Yes	Yes
Wide Field Ophthalmic Photography 3D Coordinates Image Storage	Yes	Yes
VL Whole Slide Microscopy Image Storage	Yes	Yes
Lensometry Measurements Storage	Yes	Yes
Autorefraction Measurements Storage	Yes	Yes
Keratometry Measurements Storage	Yes	Yes
Subjective Refraction Measurements Storage	Yes	Yes

Table 1-1: Network Services		
SOP Classes	**User of Service (SCU)**	**Provider of Service (SCP)**
Visual Acuity Measurements Storage	Yes	Yes
Spectacle Prescription Report Storage	Yes	Yes
Ophthalmic Axial Measurements Storage	Yes	Yes
Intraocular Lens Calculations Storage	Yes	Yes
Macular Grid Thickness and Volume Report Storage SOP Class	Yes	Yes
Ophthalmic Visual Field Static Perimetry Measurements Storage	Yes	Yes
Ophthalmic Thickness Map Storage	Yes	Yes
Corneal Topography Map Storage	Yes	Yes
Basic Text SR	Yes	Yes
Enhanced SR	Yes	Yes
Comprehensive SR	Yes	Yes
Comprehensive 3D SR	Yes	Yes
Procedure Log Storage	Yes	Yes
Mammography CAD SR	Yes	Yes
Key Object Selection Document	Yes	Yes
Chest CAD SR	Yes	Yes
X-Ray Radiation Dose SR	Yes	Yes
Radiopharmaceutical Radiation Dose SR	Yes	Yes
Colon CAD SR	Yes	Yes
Implantation Plan SR Document Storage	Yes	Yes
Encapsulated PDF Storage SOP Class	Yes	Yes
Encapsulated CDA Storage SOP Class	Yes	Yes
Positron Emission Tomography Image Storage	Yes	Yes
Enhanced PET Image Storage	Yes	Yes
Basic Structured Display Storage	Yes	Yes
RT Image Storage	Yes	Yes
RT Dose Storage	Yes	Yes
RT Structure Set Storage	Yes	Yes
RT Beams Treatment Record Storage	Yes	Yes
RT Plan Storage	Yes	Yes
RT Brachy Treatment Record Storage	Yes	Yes
RT Treatment Summary Record Storage	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve – FIND	Yes	Yes
Study Root Query/Retrieve – MOVE	Yes	Yes

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3. Introduction

3.1 Revision History

1.1 Rev B	May 1, 2019	Minor format changes
1.1 Rev A	Jun 03, 2016	Added newly supported SOP Class UIDs
1.0 Rev A	Apr 12, 2016	Initial Version for Health Engine

3.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between the Health Engine and other DICOM systems.

The user should be aware of the following important issues:

- The comparison of different Conformance Statements is the first step towards assessing interconnectivity between Health Engine and other DICOM conformant equipment.
- Test procedures should be defined to validate the desired level of connectivity.

DICOM is an evolving standard, constantly being amended and augmented. In consideration of this fact, The i-engineers reserves the right to make changes to Health Engine as it sees fit to keep abreast of these changes.

The Conformance Statement should be read and understood in conjunction with the DICOM standard 1.

3.4 Definitions and Abbreviations

There are a variety of terms and abbreviations used in the document that are defined in the DICOM Standard. Additional abbreviations and terms are as follows:

AE	Application Entity
DICOM	Standard for Digital Imaging and Communications in Medicine
HE	Health Engine
HIS	Hospital Information System
IOD	Information Object Definition
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
TCP/IP	Transmission Control Protocol/Internet Protocol
UID	Unique Identifier
VR	Value Representation

3.5 References

1. Digital Imaging and Communications in Medicine (DICOM)
National Electrical Manufacturers Association (NEMA)
Rosslyn, VA, USA
http://dicom.nema.org/standard.html

4. Networking

4.1 Implementation Model

4.1.1 Application Data Flow

4.1.1.1 Health Engine Q/R Import

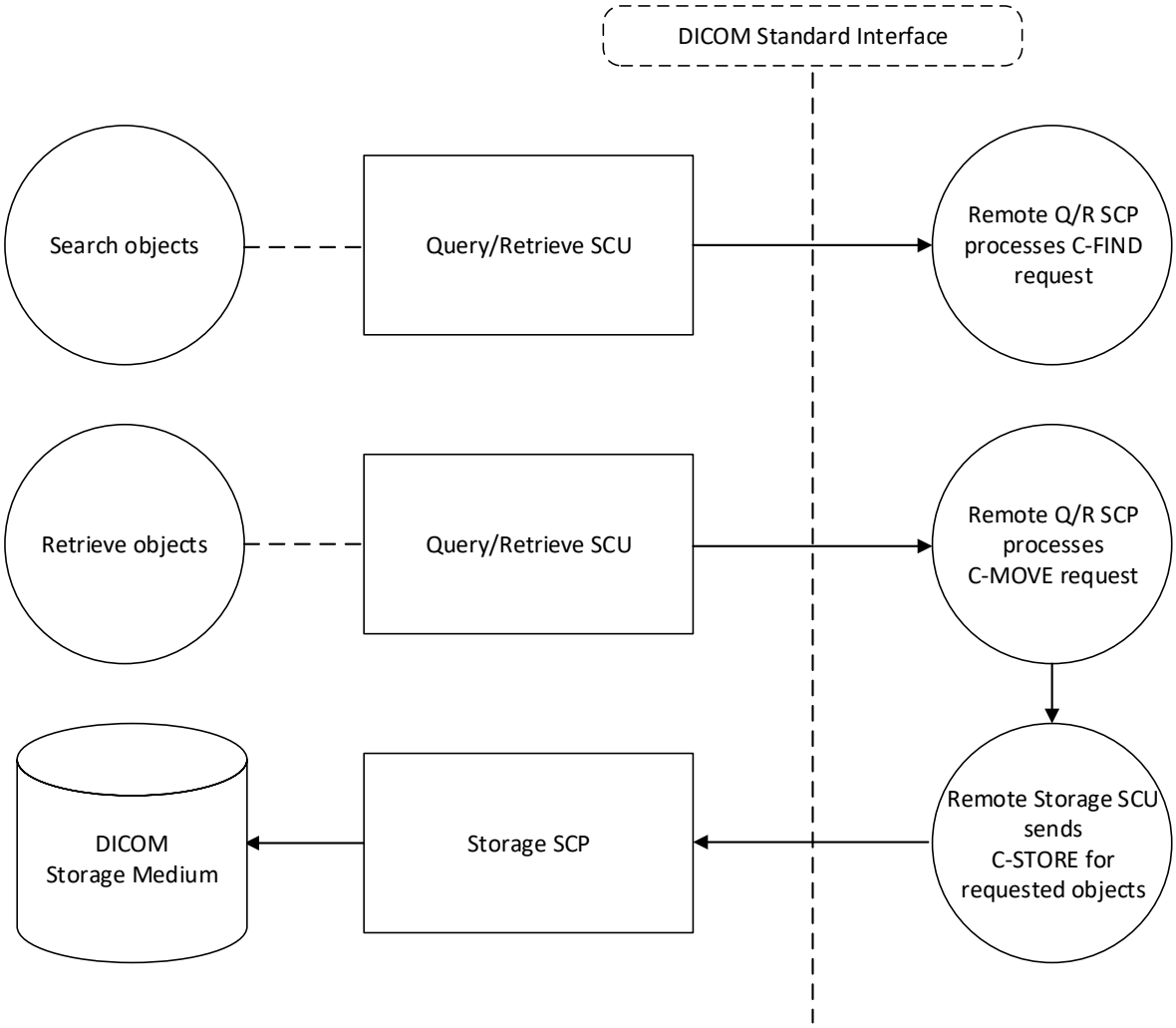

Figure 4-1: Application Data Flow Diagram during Q/R Import

Health Engine invokes a C-FIND Request to find the objects to be imported. Once found, the objects are being requested with a C-MOVE, the remote AE initiates a C-STORE Request to store the requested objects.

Alternatively, as the Health Engine acts as a PACS it might also be confronted with a C-STORE Request initiated by the Remote SCU, see Figure 4-2.

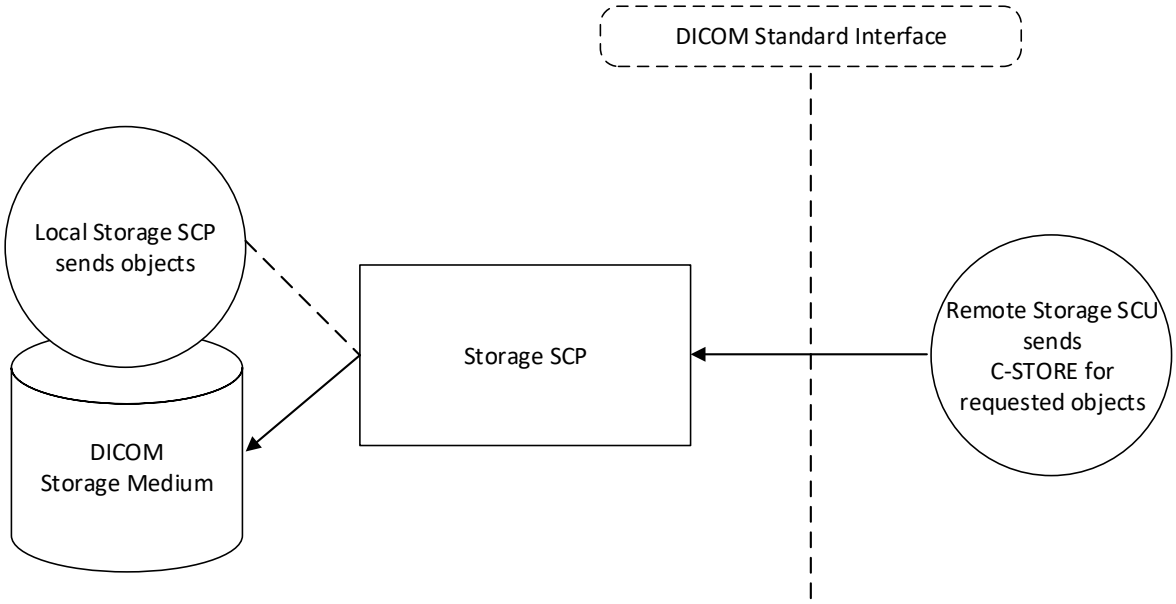

Figure 4-2: Application Data Flow Diagram during Q/R Import pushed by Remote SCU

4.1.1.2 Health Engine Q/R Export

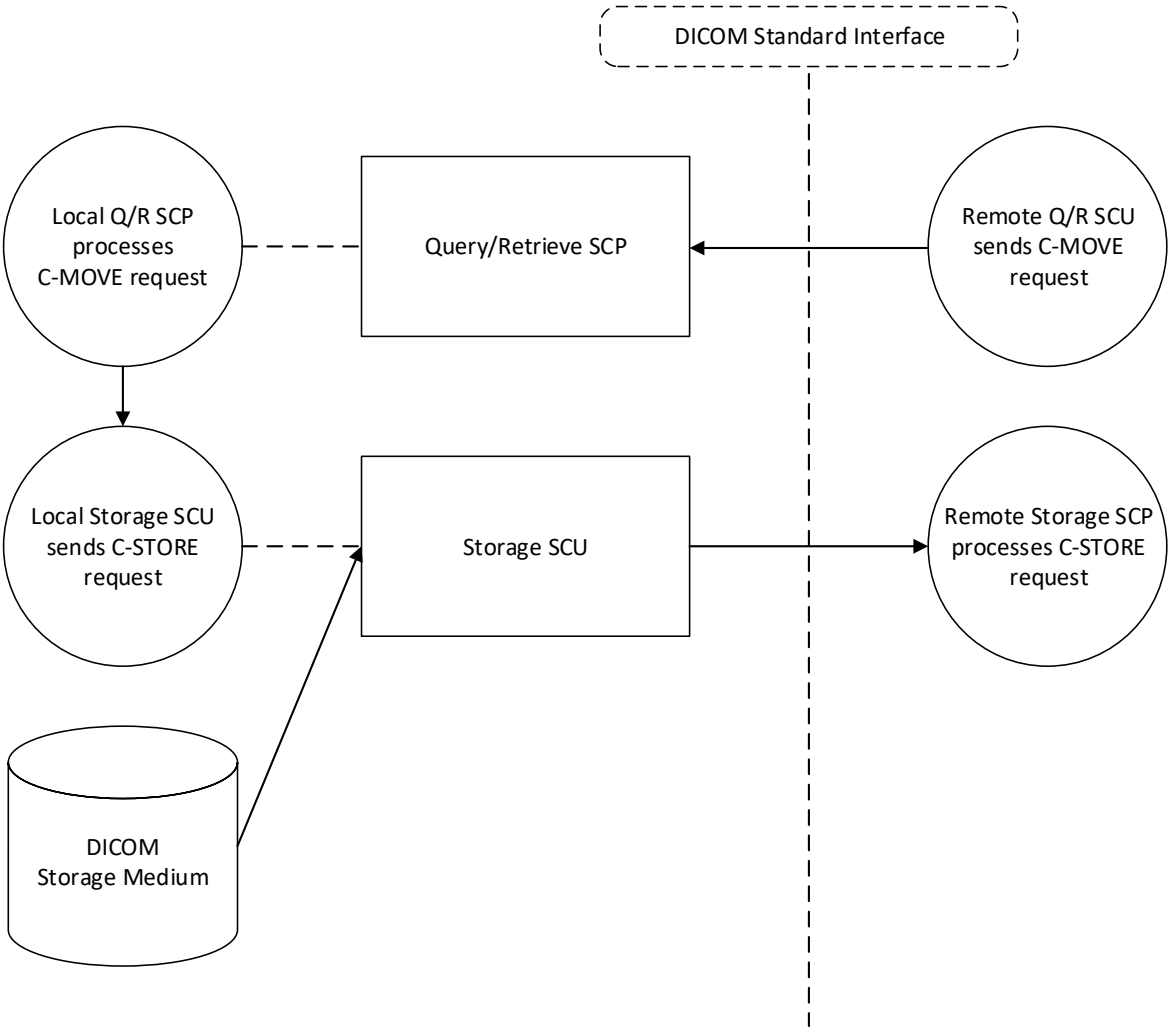

Figure 4-3: Health Engine Application Data Flow Diagram during Q/R Export

The Remote Q/R SCU invokes a C-MOVE Request to ask for specific DICOM objects from the Health Engine. The Health Engine then initiates a C-STORE Request to send the requested objects to a Remote Storage SCP.

4.1.2 Functional Definition of AEs

4.1.2.1 Functional Definition of the Health Engine Application Entity

The Health Engine Application Entity can serve as Storage SCU, Query/Retrieve SCU, Storage SCP and Query/Retrieve SCP.

Parameters for the desired local and remote AE have to be configured using the Health Engine database.

Health Engine can handle objects of types listed in Table **1-1**.

4.1.3 Sequencing of Real World Activities

4.1.3.1 Sequence of Health Engine Q/R Import

Import being initialized by Health Engine, Figure 4-4.

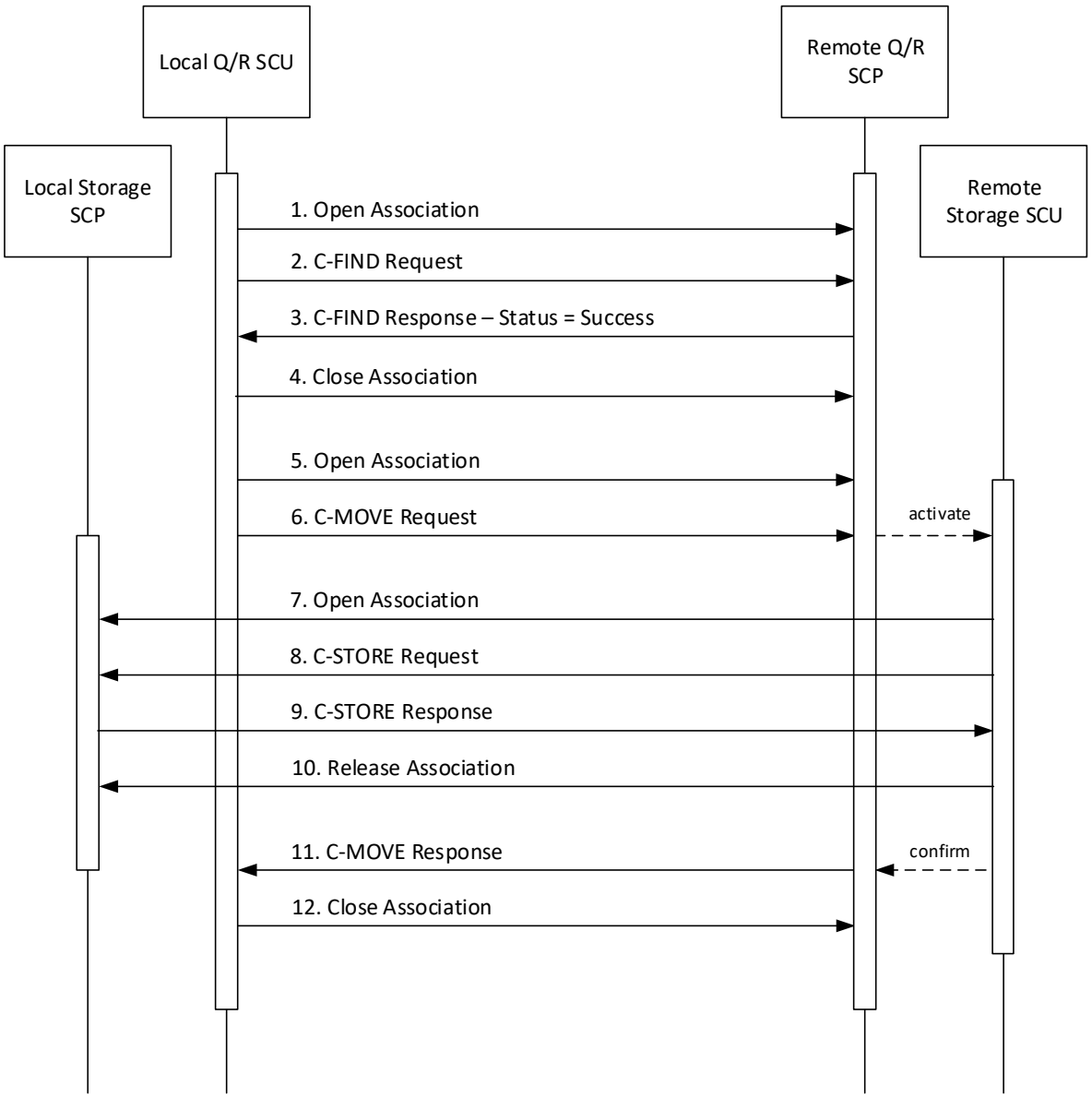

Figure 4-4: Sequencing Constraints – Health Engine Q/R Import

Alternatively, as the Health Engine acts as a PACS it might also be confronted with a C-STORE Request initiated by the Remote SCU, see Figure 4-5.

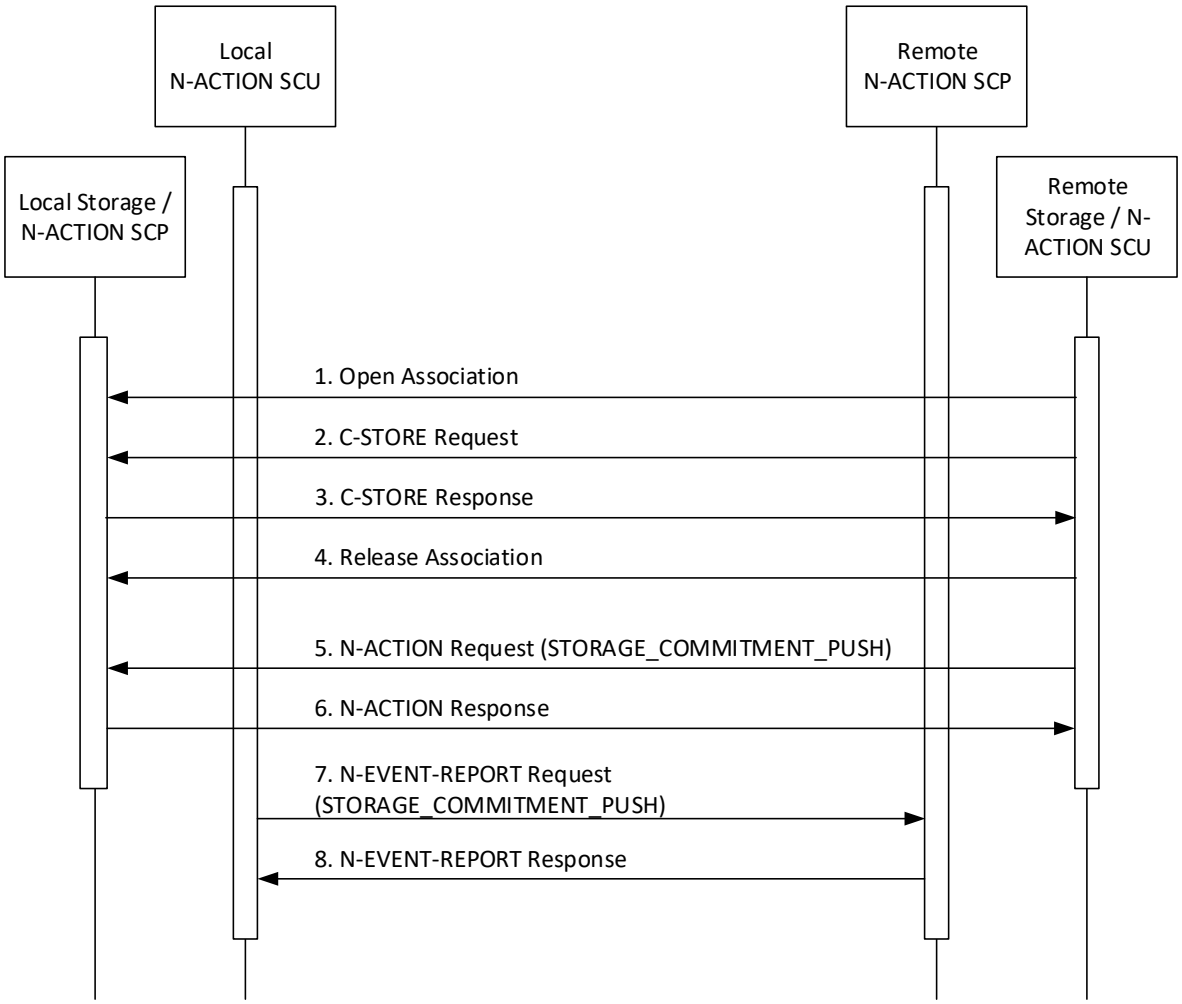

Figure 4-5: Sequencing Constraints – Health Engine Q/R Import pushed by Remote SCU

4.1.3.2 Sequence of Health Engine Q/R Export

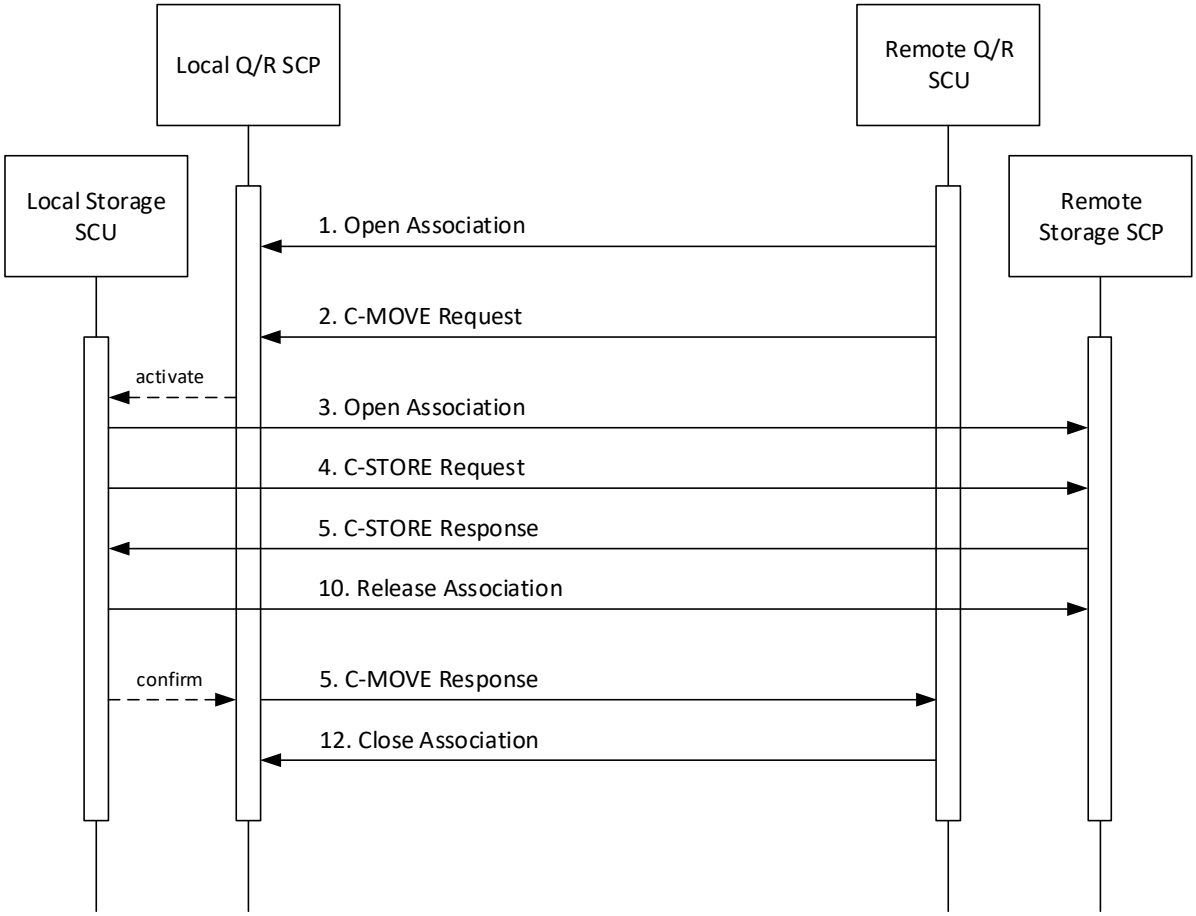

Figure 4-6: Sequencing Constraints – Health Engine Q/R Export

4.2 AE Specifications

4.2.1 Health Engine Specification

This application provides Standard Conformance to the following DICOM V3.0 SOP Classes:

4.2.1.1 SOP Classes

The Health Engine provides standard conformance to the following SOP Classes.

Table 4-1: Media File SOP Classes			
SOP Class UID	**SOP Class Name**	**SCU**	**SCP**
Transfer			
1.2.840.10008.5.1.1.1	Basic Film Session SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.1	Computed Radiography Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.1.1	Digital X-Ray Image Storage - For Presentation	Yes	Yes
1.2.840.10008.5.1.4.1.1.1.1.1	Digital X-Ray Image Storage - For Processing	Yes	Yes
1.2.840.10008.5.1.4.1.1.1.2	Digital Mammography X-Ray Image Storage - For Presentation	Yes	Yes
1.2.840.10008.5.1.4.1.1.1.2.1	Digital Mammography X-Ray Image Storage - For Processing	Yes	Yes
1.2.840.10008.5.1.4.1.1.1.3	Digital Intra-oral X-Ray Image Storage - For Presentation	Yes	Yes

Table 4-1: Media File SOP Classes			
SOP Class UID	**SOP Class Name**	**SCU**	**SCP**
Transfer			
1.2.840.10008.5.1.4.1.1.1.3.1	Digital Intra-oral X-Ray Image Storage - For Processing	Yes	Yes
1.2.840.10008.5.1.4.1.1.2	CT Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.2.1	Enhanced CT Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.3	Ultrasound Multi-frame Storage (Retired)	Yes	Yes
1.2.840.10008.5.1.4.1.1.3.1	Ultrasound Multi-frame Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.4	MR Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.4.1	Enhanced MR Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.4.2	MR Spectroscopy Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.4.3	Enhanced MR Color Image Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.5	NM Image Storage (Retired)	Yes	Yes
1.2.840.10008.5.1.4.1.1.6	Ultrasound Image Storage (Retired)	Yes	Yes
1.2.840.10008.5.1.4.1.1.6.1	Ultrasound Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.6.2	Enhanced US Volume Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.7.1	Multi-frame Single Bit Secondary Capture Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.7.2	Multi-frame Grayscale Byte Secondary Capture Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.7.3	Multi-frame Grayscale Word Secondary Capture Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.7.4	Multi-frame True Color Secondary Capture Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.1.1	12-lead ECG Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.1.2	General ECG Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.1.3	Ambulatory ECG Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.2.1	Hemodynamic Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.3.1	Cardiac Electrophysiology Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.4.1	Basic Voice Audio Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.4.2	General Audio Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.5.1	Arterial Pulse Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.9.6.1	Respiratory Waveform Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.1	Grayscale Softcopy Presentation State Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.2	Color Softcopy Presentation State Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.3	Pseudo-Color Softcopy Presentation State Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.4	Blending Softcopy Presentation State Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.5	XA/XRF Grayscale Softcopy Presentation State Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.6	Grayscale Planar MPR Volumetric Presentation State Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.11.7	Compositing Planar MPR Volumetric Presentation State Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.12.1	X-Ray Angiographic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.12.1.1	Enhanced XA Image Storage	Yes	Yes

Table 4-1: Media File SOP Classes			
SOP Class UID	**SOP Class Name**	**SCU**	**SCP**
Transfer			
1.2.840.10008.5.1.4.1.1.12.2	X-Ray Radiofluoroscopic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.12.2.1	Enhanced XRF Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.13.1.1	X-Ray 3D Angiographic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.13.1.2	X-Ray 3D Craniofacial Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.13.1.3	Breast Tomosynthesis Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.13.1.4	Breast Projection X-Ray Image Storage - For Presentation	Yes	Yes
1.2.840.10008.5.1.4.1.1.13.1.5	Breast Projection X-Ray Image Storage - For Processing	Yes	Yes
1.2.840.10008.5.1.4.1.1.14.1	Intravascular Optical Coherence Tomography Image Storage - For Presentation	Yes	Yes
1.2.840.10008.5.1.4.1.1.14.2	Intravascular Optical Coherence Tomography Image Storage - For Processing	Yes	Yes
1.2.840.10008.5.1.4.1.1.20	Nuclear Medicine Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.30	Parametric Map Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.66	Raw Data Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.66.1	Spatial Registration Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.66.2	Spatial Fiducials Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.66.3	Deformable Spatial Registration SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.66.4	Segmentation SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.66.5	Surface Segmentation Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.66.6	Tractography Results Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.67	Real World Value Mapping Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.68.1	Surface Scan Mesh Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.68.2	Surface Scan Point Cloud Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.1	VL Endoscopic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.1.1	Video Endoscopic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.2	VL Microscopic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.2.1	Video Microscopic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.3	VL Slide-Coordinates Microscopic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.4.1	Video Photographic Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.1	Ophthalmic Photography 8 Bit Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.2	Ophthalmic Photography 16 Bit Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.3	Stereometric Relationship Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.4	Ophthalmic Tomography Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.5	Wide Field Ophthalmic Photography Stereographic Projection Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.6	Wide Field Ophthalmic Photography 3D Coordinates Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.77.1.6	VL Whole Slide Microscopy Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.1	Lensometry Measurements Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.2	Autorefraction Measurements Storage	Yes	Yes

Table 4-1: Media File SOP Classes			
SOP Class UID	**SOP Class Name**	**SCU**	**SCP**
Transfer			
1.2.840.10008.5.1.4.1.1.78.3	Keratometry Measurements Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.4	Subjective Refraction Measurements Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.5	Visual Acuity Measurements Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.6	Spectacle Prescription Report Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.7	Ophthalmic Axial Measurements Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.78.8	Intraocular Lens Calculations Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.79.1	Macular Grid Thickness and Volume Report Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.80.1	Ophthalmic Visual Field Static Perimetry Measurements Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.81.1	Ophthalmic Thickness Map Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.82.1	Corneal Topography Map Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.11	Basic Text SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.22	Enhanced SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.33	Comprehensive SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.34	Comprehensive 3D SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.40	Procedure Log Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.50	Mammography CAD SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.59	Key Object Selection Document	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.65	Chest CAD SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.67	X-Ray Radiation Dose SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.68	Radiopharmaceutical Radiation Dose SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.69	Colon CAD SR	Yes	Yes
1.2.840.10008.5.1.4.1.1.88.70	Implantation Plan SR Document Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.104.1	Encapsulated PDF Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.104.2	Encapsulated CDA Storage SOP Class	Yes	Yes
1.2.840.10008.5.1.4.1.1.128	Positron Emission Tomography Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.130	Enhanced PET Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.131	Basic Structured Display Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.1	RT Image Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.2	RT Dose Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.3	RT Structure Set Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.4	RT Beams Treatment Record Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.5	RT Plan Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.6	RT Brachy Treatment Record Storage	Yes	Yes
1.2.840.10008.5.1.4.1.1.481.7	RT Treatment Summary Record Storage	Yes	Yes
Query/Retrieve			
1.2.840.10008.5.1.4.1.2.2.1	Study Root Query/Retrieve – FIND	Yes	Yes
1.2.840.10008.5.1.4.1.2.2.2	Study Root Query/Retrieve – MOVE	Yes	Yes

Yes	supported
No	Not supported
Option	Purchase Option

Note

Verification SCP (C-Echo) is not included in the table above because it is required for any Acceptor of an Association. The Verification SCU details are covered in the details of the conformance statement.

Retired objects (Ultrasound Multi-frame Storage, 1.2.840.10008.5.1.4.1.1.3; NM Image Storage, 1.2.840.10008.5.1.4.1.1.5 and Ultrasound Image Storage, 1.2.840.10008.5.1.4.1.1.6) are supported by the Health Engine Storage SCU and Storage SCP.

4.2.1.2 Association Policies

4.2.1.2.1 General

The Application Context Name for DICOM 3.0 is the only Application Context proposed.

Table 4-2: DICOM Application Context	
Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

Health Engine will support as many simultaneous associations as SCP as are requested by Workflow SCUs up to a configurable maximum. Health Engine limits the number of concurrent associations to a given Workflow SCU as described below.

Table 4-3: Number of Associations as an SCP for AE “Health Engine”	
Maximum number of simultaneous associations	50

4.2.1.2.3 Asynchronous Nature

Asynchronous communication (multiple outstanding transactions over a single association) is not supported.

4.2.1.2.4 Implementation Identifying Information

Table 4-4: DICOM Implementation Class And Version For AE “Health Engine”	
Implementation Class UID	2.16.840.1
Implementation Version Name	MergeCOM3_430

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity - Import

4.2.1.3.1.1 Description and Sequencing of Activities

The user initiates a C-FIND, new association is opened. The user then requests objects to be imported (C-MOVE-RQ) which opens a new association.

The association is being released once the C-MOVE-RSP has been sent.

4.2.1.3.1.2 Proposed Presentation Contexts

Health Engine Query/Retrieve SCU is capable of proposing the Presentation Contexts shown in the following table.

Table 4-5: Proposed Presentation Contexts – Q/R SCU

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Study Root Query/Retrieve information model - C-FIND	1.2.840.10008.5.1.4.1. 2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve information model - C-MOVE	1.2.840.10008.5.1.4.1. 2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.1.3.1.3 SOP Specific Conformance for C-FIND SOP Classes

Table 4-6: Health Engine C-FIND Response Status Handling

Service Status	Further Meaning	Error Code	Behavior
Refused	Out of Resources	A7xx	Association cancelled, error being logged.
Failure	Data Set does not match SOP Class	A9xx	Association cancelled, error being logged.
	Cannot understand	Cxxx	Association cancelled, error being logged.
Cancel	Matching terminated due to Cancel Request	FE00	Request is being dropped, association released. Cancel Request is being logged.
Success	Matching is complete – no final identifier is supplied	0000	

Table 4-6: Health Engine C-FIND Response Status Handling			
Service Status	**Further Meaning**	**Error Code**	**Behavior**
Pending	Matches are continuing – Current Match is supplied and any Options Keys were supported in the same manner as Required Keys.	FF00	Waiting for further results/action.
	Matches are continuing – Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier.	FF01	Not supported.
*	*	Any other status code.	No results are displayed in the Query/Retrieve object browser.

Max number of Study Root UIDs is 1000. In case more results are being returned, HE issues a C-CANCEL Request.

Relational-queries are not supported.

Table 4-7: Health Engine C-FIND Response Exception Handling	
Exception	**Behavior**
Timeout	Waiting for 60 seconds. Association is being released, event is being logged.
Association aborted by the SCP or network layers	Exception is being logged.

Table **4-8** below lists the attributes supported by the C-FIND SCU. Only a subset of the attributes in this table will be sent in a specific C-FIND request, depending on Query Level and, if applicable, Modality.

Table 4-8: Health Engine C-FIND Matching Criteria		
Name	**Tag**	**VR**
Study Level		
Study Date	(0008, 0020)	DA
Study Time	(0008,0030)	TM
Accession Number	(0008,0050)	SH
Modality	(0008,0060)	CS
Patient's Name	(0010,0010)	PN
Patient ID	(0010,0020)	LO
Study ID	(0020,0010)	SH
Study Instance UID	(0020,000D)	UI
Series Number	(0020,0011)	IS

Series Instance UID	(0020,000E)	UI

4.2.1.3.1.4 SOP Specific Conformance for C-MOVE SOP Classes

Table 4-9: Health Engine C-MOVE Response Status Handling			
Service Status	**Further Meaning**	**Error Code**	**Behavior**
Cancel	Sub-operations terminated due to Cancel indication	FE00	Association is being released. Event is being logged.
Warning	Sub-operations complete – One or more failures	B000	Logging number of successful and unsuccessful sub-operations. Association is being released.
Success	Sub-operations complete – No failures	0000	Association is being released. Success is being logged.
Pending	Sub-operations are continuing	FF00	Waiting for further results/action.
*	*	Any other status code.	Any other status code is handled like Failure by logging unknown response. Association is being released.

After having received all requested SOP Instances or when the user aborts the operation the Association is released using A-RELEASE.

No C-CANCEL-MOVE requests are ever issued.

Table 4-10: Health Engine C-MOVE Response Exception Handling	
Exception	**Behavior**
Timeout	Waiting for 60 seconds. Association is being released, event is being logged.
Association aborted by the SCP or network layers	Exception is being logged.

The table below lists the Attributes that will be sent by the C-MOVE SCU. Only a subset of the Attributes in this table will be sent in a specific C-MOVE request, depending on Query Level.

Table 4-11: Health Engine C-MOVE Identifier		
Name	**Tag**	**VR**
Study Level		
Patient ID	(0010,0020)	LO
Study Instance UID	(0020,000D)	UI

4.2.1.3.2 Activity - Export

4.2.1.3.2.1 Description and Sequencing of Activities

C-STORE Requests are sent only as sub-operations to transfer the IODs requested by a C-MOVE Request.

4.2.1.3.2.2 Proposed Presentation Contexts

The Storage SCU is capable of proposing the Presentation Contexts shown in the following table.

Table 4-12: Proposed Presentation Contexts for C-STORE-RQ					
Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
See Table **1-1** for a list of supported DICOM SOP Classes.		Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

4.2.1.3.2.3 SOP Specific Conformance for all Storage SOP Classes

The behavior of the storage SCU is summarized below.

Table 4-13: Health Engine C-STORE Response Status Handling			
Service Status	**Further Meaning**	**Error Code**	**Behavior**
Refused	Out of Resources	A7xx	Exception is being logged.
Failure	Data Set does not match SOP Class	A9xx	Exception is being logged.
	Cannot understand	Cxxx	Exception is being logged.
Warning	Coercion of Data Elements	B000	Exception is being logged.
	Elements Discarded	B006	Exception is being logged.
	Data Set does not match SOP Class	B007	Exception is being logged.
Success	Success	0000	-
*****	*	Any other status code.	Error Codes other than listed above in this table should not occur, as they are not defined for C-STORE (see [1], PS 3.4, Table B.2-1).

After sending all SOP Instances, either successfully or not, the association is released using A-RELEASE.

Table 4-14: Health Engine C-STORE Response Exception Handling	
Exception	**Behavior**
Timeout	Association is being released. Event is being logged.
Association aborted by the SCP or network layers	Event is being logged.

4.2.1.4 Association Acceptance Policy

Health Engine accepts C-STORE Requests from all allowed application entities.

4.2.1.4.1 Activity – Receive Storage Request

See Figure 4-4 and Figure 4-5 for a complete sequence diagram.

4.2.1.4.1.1 Accepted Presentation Contexts

The Presentation Contexts shown in the following table are accepted.

Table 4-15: Accepted Presentation Contexts for AE “Health Engine” C-STORE RQ					
Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
All storage SOP Classes in Table **1-1** and Table **4-1**		Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None
Video Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1.1	MPEG2 MP@ML	1.2.840.10008.1.2.4.100	SCP	None
		MPEG2 MP@HL	1.2.840.10008.1.2.4.101	SCP	None
		MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCP	None
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	SCP	None
Video Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2.1	MPEG2 MP@ML	1.2.840.10008.1.2.4.100	SCP	None
		MPEG2 MP@HL	1.2.840.10008.1.2.4.101	SCP	None
		MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCP	None
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	SCP	None
Video Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4.1	MPEG2 MP@ML	1.2.840.10008.1.2.4.100	SCP	None
		MPEG2 MP@HL	1.2.840.10008.1.2.4.101	SCP	None
		MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCP	None
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	SCP	None
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1	MPEG2 MP@ML	1.2.840.10008.1.2.4.100	SCP	None
		MPEG2 MP@HL	1.2.840.10008.1.2.4.101	SCP	None
		MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCP	None

Table 4-15: Accepted Presentation Contexts for AE “Health Engine” C-STORE RQ					
Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	SCP	None
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2	MPEG2 MP@ML	1.2.840.10008.1.2.4.100	SCP	None
		MPEG2 MP@HL	1.2.840.10008.1.2.4.101	SCP	None
		MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCP	None
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	MPEG2 MP@ML	1.2.840.10008.1.2.4.100	SCP	None
		MPEG2 MP@HL	1.2.840.10008.1.2.4.101	SCP	None
		MPEG-4 AVC/H.264 High Profile / Level 4.1	1.2.840.10008.1.2.4.102	SCP	None
		MPEG-4 AVC/H.264 BD-compatible High Profile / Level 4.1	1.2.840.10008.1.2.4.103	SCP	None

Note: If the images are stored in JPEG Baseline or JPEG Extended, they will be transmitted by the server in the transfer syntax they are stored. There is no conversion from Implicit VR Little Endian or Explicit VR Little Endian images to JPEG Baseline or JPEG Extended.

4.2.1.4.1.2 SOP Specific Conformance for all Storage SOP Classes

4.2.1.4.1.2.1 Presentation Context Acceptance Criterion

Any Presentation Context for the supported SOP Classes with the supported Transfer Syntaxes is accepted. More than one proposed Presentation Context is accepted for the same Abstract Syntax if the Transfer Syntax is supported.

4.2.1.4.1.2.2 Transfer Syntax Selection Policies

If offered a choice of Transfer Syntaxes in a Presentation Context, then the first supported Transfer Syntax of those listed in the Presentation Context is accepted. If multiple Presentation Contexts with acceptable Transfer Syntaxes are offered, then the same rule for selecting a Transfer Syntax as described above is applied for each Presentation Contexts.

4.2.1.4.1.2.3 Response Status

The table below describes the behavior for generating C-STORE response messages.

Table 4-16: Health Engine C-STORE SCP Response Status Handling			
Service Status	**Further Meaning**	**Error Code**	**Reason**
Failure	Failure writing to destination.	0011	Failure writing to destination.
Success		0000	Successfully transferred.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The health engine's DICOM applications are indifferent to the physical medium over which TCP/IP executes.

4.3.2 Additional Protocols

DHCP support can be configured using the Configuration application. If DHCP is not configured a static IP address is assigned.

If DNS support exists on the local network, then DNS is used for address resolution. The address of the DNS server is retrieved using DHCP if the DHCP option is enabled. If DNS is not supported, then the hostnames and addresses are configured in the local hosts file.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

Remote AE Titles, host names and port numbers are defined in the configuration file mergecom.app. The local AE Title and port is defined in the Health Engine database.

4.4.1.1 Local AE Titles

Table 4-17: AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
Health Engine	No default. Must be configured.	104 (configurable)

4.4.1.2 Remote AE Title/Presentation Address Mapping

Remote AE Titles, host names and port numbers are defined in the configuration file mergecom.app.

Supported Presentation Contexts are defined in the mergecom.app file provided by Merge.com.

4.4.2 Parameters

Health Engine configuration parameters related to DICOM communications are below. A blank cell under the 'Default Value' heading indicates that there is no default value for the specific configuration attribute.

Table 4-18: Configuration Parameters Table

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
Maximum PDU receive size	No	64234 bytes
Maximum PDU send size	No	64234 bytes
Time-out waiting for acceptance or rejection Response to an Association Open Request. (Application Level timeout)	No	15s
General DIMSE level time-out values	No	30s
Time-out waiting for response to TCP/IP connect request. (Low-level timeout)	No	15s

Table 4-18: Configuration Parameters Table		
Parameter	**Configurable (Yes/No)**	**Default Value**
General Parameters		
Time-out waiting for acceptance of a TCP/IP message over the network. (Low-level timeout)	No	15s
Time-out for waiting for data between TCP/IP packets. (Low-level timeout)	No	15s

5. Media Interchange

Health Engine Application Entity allows importing and exporting of DICOM Media Files.

The DICOM files being imported are not being modified by the Health Engine. DICOM Media files being exported are not being modified by the Health Engine.

The Health Engine itself does not create any DICOM Media Files.

6. Support Of Character Sets

The Health Engine DICOM application supports any Specific Character Set

If none is set, Health Engine sets the Specific Character Set to ISO_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set).

6.1 Query Capabilities

6.1.1 SCU handling of extended character sets in C-FIND

6.1.1.1 Encoding C-FIND requests

The SCU encodes attributes of a C-FIND request with ISO_IR 100.

6.1.1.2 Decoding C-FIND responses

The SCU decodes attributes of a C-FIND response as described in Section 6.

6.1.2 SCP handling of extended character sets in C-FIND

6.1.2.1 Decoding C-FIND requests

The SCU decodes attributes of a C-FIND response as described in Section 6.

6.1.2.2 Encoding C-FIND responses

The SCU encodes attributes of a C-FIND request with ISO_IR 100.

7. Security Profiles

Health Engine does not support any specific security measures.

It is assumed that Health Engine is used within a secured environment. It is assumed that a secured environment includes at a minimum:

a. Firewall or router protections to ensure that only approved external hosts have network access to Health Engine.

b. Firewall or router protections to ensure that Health Engine only has network access to approved external hosts and services.

c. Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN))

Other network security procedures such as automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

Appendix A Specialization

A.1 IOD Contents

A.1.1 Created SOP Instances

Health Engine does not create any SOP Instances.

A.1.2 Data Dictionary of Private Attributes

Health Engine imports and exports private attributes without change. The attributes are not read or interpreted by the Health Engine.