UltraSPECT.gate
DICOM CONFORMANCE STATEMENT

P.O.Box 15010, MATAM, Haifa, 31905 ISRAEL
Tel 972-4-8546611, Fax 972-4-8546612

1 Introduction

1.1 General Information

This document is the DICOM Conformance Statement for UltraSPECT.gate manufactured UltraSPECT Ltd. The purpose of this document is to describe how the UltraSPECT.gate product line collaborates in a DICOM network with other Medical Imaging applications that conform to the DICOM 3.0 standard.

1.2 References

The digital Imaging and Communications in Medicine (DICOM) standard, parts 1 through 18 (NEMA PS 3.1-18), 2008.

1.3 Definitions

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, please refer to the 2008 revision of the Digital Imaging and Communications in Medicine (DICOM) standard, PS 3.3 and PS 3.4.

1.4 Symbols and Abbreviations

- AE Application Entity
- DICOM Digital Imaging and Communications in Medicine
- PDU Protocol Data Unit
- PET Positron Emission Tomography
- SCP Service Class Provider
- SCU Service Class User
- SOP Service-object Pair
- SPECT Single Photon Emission Computed Tomography
- TCP/IP Transmission Control Protocol/Internet Protocol
- UID Unique Identifier

2 Implementation Model

UltraSPECT.gate provides the following features:

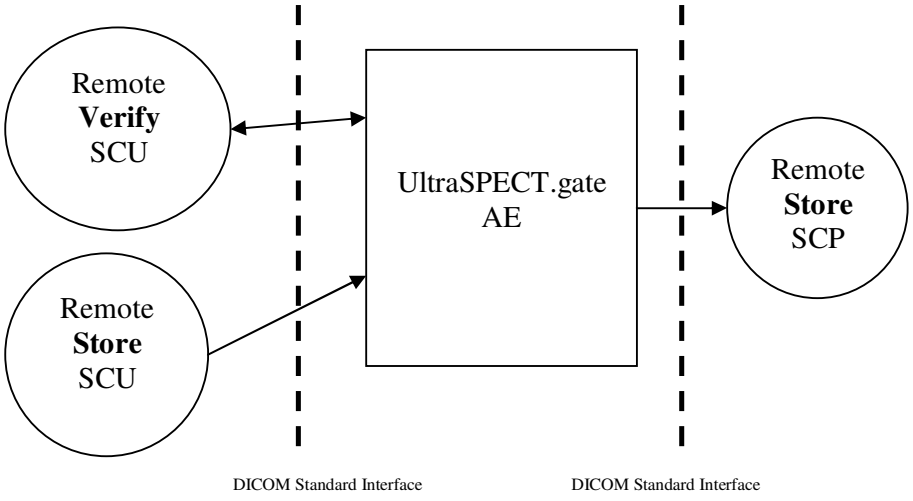
- Support of the DICOM **Verification** Service.
- Acts as a gate, which functions in the following method:
  1) All received DICOM **Store** messages are relayed to the destination DICOM station(s) exactly as they were received, provided that the destination station is configured on the UltraSPECT.gate computer.
  2) If a DICOM **Store** message contains a WBR processing request (encoded in the AE title along with the destination station AE title), the message is dealt with in one of two ways:
     a. If the message meets all prerequisite conditions for WBR processing, it is processed on the UltraSPECT.gate, and the

processing results are sent as DICOM message(s) to the destination stations(s) with the SOP Class UID: 1.2.840.10008.5.1.4.1.1.20 (NM SOP Class – only NM modality incoming DICOM is supported for WBR processing) (Provided that the station is configured). In fact, the processing result DICOM message is based on the original message, with only the pixel data and several attributes changed to match the new images created during processing.

b. If the message fails to meet all prerequisite conditions for WBR processing, an empty (no pixel data) "Error" DICOM message is sent to the destination station(s) with the following SOP Class UID: 1.2.840.10008.5.1.4.1.1.20 (NM SOP Class) (Provided that the station is configured).

3) WBR processing can also be performed on incoming ADAC native format data. If such data is received by the UltraSPECT.gate, the ADAC native format data is translated to matching DICOM data, and from this point, the flow is exactly as in (2).
4) WBR processing can also be performed on incoming PET native formats. The PET native raw data is read, checked for validity, and if it is valid, WBR processing is performed. A resulting DICOM message is sent to the destination stations(s) with the following SOP Class SOP Class UID: 1.2.840.10008.5.1.4.1.1.128 (PET Image Storage) (Provided that the station is configured).

2.1 Application Data Flow Diagram



3 AE Specifications

3.1 UltraSPECT.gate AE Specification

The UltraSPECT.gate AE provides conformance to the following DICOM SOP Classes:

Service SOP Class Name	**SOP Class UID**
Verification	1.2.840.10008.1.1
Store (Store for all object types is relayed to destination stations)	1.2.840.10008.5.1.4.1.1.XXX

3.1.1 Association Establishment Policies

3.1.1.1 General

UltraSPECT.gate will utilize and understand the following Application Context Name:

DICOM V3.0 Application Context	1.2.840.10008.3.1.1.1

Maximum PDU size is 16Kbytes.

3.1.1.2 Number of Associations

UltraSPECT.gate can establish only one association at a time. (???)

3.1.1.3 Asynchronous Nature

No support for negotiation of multiple outstanding transactions (???).

3.1.1.4 Implementation Information

Implementation Class UID	1.2.840.113654.2.3.1995.3.0.6
Implementation Version	MIRCTN11MAR2003

3.1.2 DICOM Attributes modified

3.1.2.1 NM Attributes

For NM studies, the processing result DICOM message is based on the original received DICOM message, with the following attributes changed:

Attribute Name	Tag	Notes
Image Type	(0008,0008)	Component 3 is changed to "RECON TOMO" or "RECON GATED TOMO" for SPECT/GATED SPECT processing results.
SOP Instance UID	(0008,0018)	
Study Name	(0008,1030)	For “Mirage” type destination stations - Set for processing results, so that study name differs from original (unprocessed) DICOM data and can be distinguished on destination station.
Study Description	(0008,103e)	Set for processing results, so that study description differs from original (unprocessed) DICOM data and can be distinguished on destination station.
Slice Thickness	(0018,0050)	
Spacing Between Slices	(0018,0088)	Depends on type of reconstruction result slicing (Transversal/Coronal/Sagittal) and destination station.
Series Instance UID	(0020,000E)	
Relative Study Name	(0020,0010)	Set for processing results, so that relative study name differs from original (unprocessed) DICOM data and can be distinguished on destination station.
Image Position	(0020,0032)	For studies where Image Position was all zeroes.
Image Orientation	(0020,0037)	Depends on type of reconstruction result slicing (Transversal/Coronal/Sagittal).
Number of Frames	(0028,0008)	Set for SPECT/GATED SPECT processing according to reconstruction number of layers.
Vertical Image Size	(0028,0010)	Only for SPECT/GATED SPECT processing.
Horizontal Image Size	(0028,0011)	Only for SPECT/GATED SPECT processing.
Pixel Spacing	(0028,0030)	
Image High Bit	(0028,0102)	Set according to reconstruction bytes per pixel.
Smallest Image Pixel	(0028,0106)	

Attribute Name	Tag	Notes
Value		
Largest Image Pixel Value	(0028,0107)	
Window Center	(0028,1050)	
Window Width	(0028,1051)	
Number of Energy Windows	(0054,0011)	Reconstruction results always have only 1 energy window.
RadioPharmaceutical Sequence	(0054,0016)	Only set for studies arriving from Ventri.
Detector Vector	(0054,0020)	Set for GenieAcq reconstructions.
Number of Detectors	(0054,0021)	Set to 1 for GenieAcq reconstructions.
Number of Rotations	(0054,0051)	Set to 1 for SPECT/GATED SPECT processing.
Rotation Information Sequence	(0054,0052)	Only set for studies arriving from GenieAcq.
RR Interval Vector	(0054,0060)	Set for GATED SPECT processing.
Time Slot Vector	(0054,0070)	Set for GATED SPECT processing.
Slice Vector	(0054,0080)	Only for SPECT/GATED SPECT processing.
Number of Slices	(0054,0081)	Only for SPECT/GATED SPECT processing.
Radionuclide Sequence	(0054,0300)	Only set for Ventri processing if the attribute is missing.
Image ID	(0054,0400)	Set for processing results, so that Image ID differs from original (unprocessed) DICOM data and can be distinguished on destination station.
Pixel Data	(7FE0,0010)	

3.1.2.2 NM Error Message Attributes

For NM input data which, for some reason, was not accepted for WBR processing, an error DICOM message is created, based on a template, containing no pixel data, and with the following attributes set:

Attribute Name	Tag	Notes
Study Name	(0008,1030)	Contains the Error Number.
Patient Name	(0010,0010)	Only changed for "Error" messages where patient name could not be retrieved.
Patient ID	(0010,0020)	Only changed for "Error" messages where patient ID

Attribute Name	Tag	Notes
		could not be retrieved.
Relative Study Name	(0020,0010)	

3.1.2.3 NM Private Attributes

Some providers (e.g. GE) have private DICOM attributes, which must be set in some cases:

Attribute Name	Tag	Notes
GE Private Dataset Name	(0011,0012)	Used for Dataset name in Xeleris and Entegra
GE Private Slicing Type	(0011,0013)	Depends on type of reconstruction result slicing (Transversal/Coronal/Sagittal).
GE Private Source Translator	(0013,0011)	Used for Dataset name in Xeleris and Entegra
GE Original SOD Instance UID	(0033,0007)	Set for planar GenieAcq studies that contain more than one UID in this attribute

3.1.2.4 PET Attributes

PET processing result DICOM messages are based on templates, with the following attributes set:

Attribute Name	Tag	Notes
Instance Creation Date	(0008,0012)	
Instance Creation Time	(0008,0013)	
SOP Instance UID	(0008,0018)	
Study Date	(0008,0020)	Based on PET raw data
Series Date	(0008,0021)	Based on PET raw data
Acquisition Date	(0008,0022)	Based on PET raw data
Image Date	(0008,0023)	Based on PET raw data
Study Time	(0008,0030)	Based on PET raw data
Series Time	(0008,0031)	Based on PET raw data
Acquisition Time	(0008,0032)	Based on PET raw data
Image Time	(0008,0033)	Based on PET raw data
Accession Number	(0008,0050)	Based on PET raw data
Study Name	(0008,1030)	Based on PET raw data
Operator Name	(0008,1070)	Based on PET raw data
Patient Name	(0010,0010)	Based on PET raw data
Patient ID	(0010,0020)	Based on PET raw data
Patient Birth Date	(0010,0030)	Based on PET raw data
Patient Sex	(0010,0040)	Based on PET raw data
Patient Age	(0010,1010)	Based on PET raw data
Patient Size	(0010,1020)	Based on PET raw data
Patient Weight	(0010,1030)	Based on PET raw data

Attribute Name	Tag	Notes
Radiopharmaceutical Start Time	(0018,1072)	Based on PET raw data
Radionuclide Total Dose	(0018,1074)	Based on PET raw data
Table Height	(0018,1130)	Based on PET raw data
Actual Frame Duration	(0018,1242)	Based on PET raw data
Study Instance UID	(0020,000D)	Based on PET raw data
Series Instance UID	(0020,000E)	
Relative Study Name	(0020,0010)	Based on PET raw data
Image Number	(0020,0013)	
Image Position	(0020,0032)	Based on PET raw data
Frame Reference UID	(0020,0052)	If raw data contains frame reference UID, use it, otherwise create new UID.
Slice Location	(0020,1041)	Based on PET raw data
Rows	(0028,0010)	
Columns	(0028,0011)	
Rescale Slope	(0028,1053)	
Number of Slices	(0054,0081)	
Number of Time Slices	(0054,0101)	Based on PET raw data
Frame Reference Time	(0054,1300)	Based on PET raw data
Slice Sensitivity Factor	(0054,1320)	Based on PET raw data
Decay Factor	(0054,1321)	Based on PET raw data
Scatter Fraction Factor	(0054,1323)	
Image Index	(0054,1330)	
Pixel Data	(7FE0,0010)	

3.1.2.5 PET Private Attributes

Some providers (e.g. GE) have private DICOM attributes, which must be set in some cases. All attributes are based on PET raw data:

Attribute Name	Tag	Notes
GE Private Patient ID	(0009,1002)	
GE Private Patient Date/Time	(0009,1005)	
GE Private Exam ID	(0009,1007)	
GE Private Scan ID	(0009,100A)	
GE Private Scan Date/Time	(0009,100D)	
GE Private Scan Ready	(0009,100E)	
GE Private Scan Description	(0009,100F)	
GE Private Scan For Identifier	(0009,1013)	
GE Private Scan Measured Date/Time	(0009,1039)	
GE Private Scan Administered Date/Time	(0009,103B)	

Attribute Name	Tag	Notes
GE Private Scan Post Injection Date/Time	(0009,103D)	
GE Private Frame UID	(0009,105C)	
GE Private Scan UID	(0009,105D)	
GE Private Exam UID	(0009,105E)	
GE Private Patient UID	(0009,105F)	
GE Private Where is Frame	(0009,1062)	
GE Private Landmark Date/Time	(0009,1068)	
GE Private Acquisition Start	(0009,106C)	
GE Private Image Duration	(0009,106D)	
GE Private Imageset Date/Time	(0009,107B)	
GE Private Imageset Transmission Scan ID	(0009,1097)	
GE Private Slice Number	(0009,10A6)	
GE Private Transmission Scan UID	(0009,10AD)	
GE Private Overlap	(0009,10C7)	
GE Private Overlap Frame UID	(0009,10C8)	
GE Private UID	(0009,111E)	
GE Private UID	(0009,1146)	

4 Communication Profiles

4.1 TCP/IP Stack

The TCP/IP stack is inherited from the Fedora Operating System. (???)

4.2 Physical Media Support

IEEE 802.3 (10BASE-T) / IEEE 802.3U (100BASE-TX) (???)

5 Configuration

The following parameters can be configured for the UltraSPECT.gate by a service specialist only:

- IP Address
- AE Title
- DICOM Port
- DICOM send file timeout

Remote DICOM Stations can be configured with the following parameters:

- AE Title
- IP Address
- DICOM Port
- Type of station: (Acquisition/Processing) + (ENTEGRA/ XELERIS/ MIRAGE/ MAYO/ XPERT/ GENIEACQ/ ESOFT/ VENRIACQ/ MEDISO/ JETSTREAM/ BRIGHTVIEW/ EBW/ OTHER)