GE Healthcare

Brivo CT315 and Brivo CT325 Dicom Conformance Statement

for DICOM 2008 (ID/Net v3.0)

* Refer to section 1 for a list of products in the Brivo families to which this Conformance Statement applies.

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REVISON HISTORY

REV.	DATE	REASON FOR CHANGE
R1 V1	10/15/2009	Initial version
R2 V1	11/23/2009	Remove MOD descriptions
R3 V1	12/09/2009	Section 2：update timeout values based on linglong SW settings Section 5: Remove Enhanced SR,Dose SR SOP and GSPS class Section 6: Remove "64 characters" except patient name Update C_FIND Request message from li glong system Update 6.11 based on linglong system Section 7: Remove 7.6.3 Update get MPPS SOP instance mapping table from CT/e Dicom CS Change the maximum of 15 SPS to 5 SPS Appendix A: updates back to original CT/e content Correct the document format issues
R3V2	02/02/2010	Updated document by DCS_Review_HHComments2.xls

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CONFORMANCE STATEMENT OVERVIEW

Table 0.1 provides an overview of the network services supported by Brivo CT315/325 system

Table 0.1 – Network Services

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Verification (Echo)	Yes	Yes
CT Image Storage	Yes	Yes
MR Image Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
PET Image Information Storage	Yes	Yes
Query/Retrieve		
Study Root Query/Retrieve Information Model – FIND	Yes	Yes
Study Root Query/Retrieve Information Model – MOVE	Yes	Yes
Print Management		
Basic Film Session SOP Class	Yes	No
Basic Film Box SOP Class	Yes	No
Basic Grayscale Image Box SOP Class	Yes	No
Basic Color Image Box SOP Class	Yes	No
Basic Grayscale Print Management Meta SOP Class	Yes	No
Basic Color Print Management Meta SOP Class	Yes	No
Print Job SOP Class	Yes	No
Printer SOP Class	Yes	No
Workflow Management		
Storage Commitment Push Model SOP Class	Yes	No
Modality Performed Procedure Step SOP Class	Yes	No
Modality Worklist Information Model – FIND SOP Class	Yes	No

Table 0.2 provides an overview of the Media Storage Application Profiles supported by Brivo CT315/325 system

Table 0.2 - MEDIA SERVICES

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk - Recordable		
General Purpose CD-R	Yes	Yes
DVD		
General Purpose JPEG DVD	Yes	Yes
USB		
General Purpose JPEG USB	Yes	Yes

TABLE OF CONTENTS

1 INTRODUCTION 11
1.1 OVERVIEW 11
1.2 OVERALL CONFORMANCE STATEMENT DOCUMENTATION STRUCTURE 13
1.3 INTENDED AUDIENCE 14
1.4 SCOPE AND FIELD OF APPLICATION 14
1.5 IMPORTANT REMARKS 15
1.6 REFERENCES 16
1.7 DEFINITIONS 16
1.8 SYMBOLS AND ABBREVIATIONS 18
2 NETWORK CONFORMANCE STATEMENT 21
2.1 INTRODUCTION 21
2.2 IMPLEMENTATION MODEL 21
2.2.1 Application Data Flow Diagram 22
2.2.2 Functional Definition of AE's 23
2.2.3 Sequencing of Real-World Activities 24
2.3 AE SPECIFICATIONS 24
2.3.1 DICOM Server AE Specification 24
2.4 COMMUNICATION PROFILES 39
2.4.1 Supported Communication Stacks (parts 8,9) 39
2.4.2 TCP/IP Stack 39
2.4.3 Point-to-Point Stack 39
2.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS 39
2.5.1 Specialized Information Object Definition 39
2.5.2 Private Data Elements 40
2.6 CONFIGURATION 40
2.6.1 AE Title/Presentation Address Mapping 40
2.6.2 Configurable Parameters 40
2.7 SUPPORT OF EXTENDED CHARACTER SETS 41
2.8 CODES AND CONTROLLED TERMINOLOGY 41
2.8.1 Mapped Coded Terminology 41
2.9 SECURITY PROFILES 41
3 MEDIA STORAGE CONFORMANCE STATEMENT 42
3.1 INTRODUCTION 42
3.2 IMPLEMENTATION MODEL: DICOM INTERCHANGE SERVER 42
3.2.1 Application Data Flow Diagram 42
3.2.2 Functional Definitions of AE's 43
3.2.3 Sequencing of Real World Activities 44
3.2.4 File Meta Information for Implementation Class and Ver on 44
3.3 AE SPECIFICATIONS 44
3.3.1 DICOM CD/DVD/USB SERVER AE Specification 44
4 PRINT SCU CONFORMANCE 47
4.1 INTRODUCTION 47
4.2 IMPLEMENTATION MODEL: PRINT SCU 47
4.2.1 Application Data Flow Diagram 47
4.2.2 Functional Definition of AE's 48
4.2.3 Sequencing of Real-World Activities 48
4.3 AE SPECIFICATIONS 50

4.3.1 DICOM Print SCU AE Specification 50
4.4 COMMUNICATION PROFILES 57
4.4.1 Supported Communication Stacks (parts 8,9) 57
4.5 STANDARD EXTENDED / SPECIALIZED / PRIVATE SOPS 58
4.6 CONFIGURATION 58
4.6.1 AE Title/Presentation Address Mapping 58
4.6.2 Configurable Parameters 58
4.7 SUPPORT OF EXTENDED CHARACTER SET 59
5 DICOM STORAGE COMMITMENT SCU CONFORMANCE 60
5.1 INTRODUCTION 60
5.2 IMPLEMENTATION MODEL 60
5.2.1 Application data flow diagram 60
5.2.2 Functional definitions 61
5.2.3 Sequencing of real-world activities 61
5.3 AE SPECIFICATIONS 61
5.3.1 DICOM Storage Commitment SCU specifications 61
5.4 COMMUNICATION PROFILES 65
5.4.1 Supported Communication Stacks (parts 8,9) 65
5.4.2 TCP/IP Stack 65
5.4.3 Point-to-Point Stack 66
5.5 EXTENSIONS/SPECIALIZATION/PRIVATIZATIONS 66
5.6 CONFIGURATION 66
5.6.1 AE Title/Presentation Address Mapping 66
5.6.2 Configurable Parameters 66
5.7 SUPPORT OF EXTENDED CHARACTER SETS 66
6 MODALITY WORKLIST INFORMATION MODEL DEFINITION 67
6.1 INTRODUCTION 67
6.2 IMPLEMENTATION MODEL 67
6.2.1 Application Data Flow Diagram 67
6.2.2 Functional definitions 68
6.2.3 Sequencing of Real-World Activities 68
6.3 AE SPECIFICATIONS 68
6.3.1 Worklist Server AE Specification 68
6.4 COMMUNICATION PROFILES 72
6.4.1 Supported Communication Stacks (PS 3.8, PS 3.9) 72
6.4.2 OSI Stack 72
6.4.3 TCP/IP Stack 72
6.4.4 Point-to-Point Stack 72
6.5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS 73
6.5.1 Standard Extended /Specialized/Private SOPs 73
6.5.2 Private Transfer Syntaxes 73
6.6 CONFIGURATION 73
6.6.1 AE Title/Presentation Address Mapping 73
6.6.2 Configurable Parameters 73
6.7 SUPPORT OF EXTENDED CHARACTER SETS 74
6.8 MODALITY WORKLIST INFORMATION MODEL DEFINITION 74
6.8.1 Introduction 74
6.8.2 Modality Worklist Information Model Description 74
6.8.3 Modality Worklist Information Model Entity-Relationship Model 74
6.8.4 Entity Descriptions 75
6.8.5 ModalityWorklist Mapping of DICOM Entities 76
6.8.6 Information Model Module Table 76
6.8.7 Information Model Keys 77
6.8.8 Supported Matching 78

6.8.9 Scheduled Procedure Step Entity 78
6.8.10 Requested Procedure Entity 80
6.8.11 Imaging Service Request Entity 80
6.8.12 Visit Entity 81
6.8.13 Patient Entity 82
6.9 PRIVATE DATA DICTIONARY 83
6.10 USE OF SPECIFIC DICOM DATA 86
6.11 SETTING USER PREFERENCES 87
6.11.1 Setting "Use MWL Study UID " Option 87
6.11.2 Setting Custom Query Option 87
7 PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT 89
7.1 INTRODUCTION 89
7.2 IMPLEMENTATION MODEL 89
7.2.1 Application Data Flow Diagram 89
7.2.2 Functional Definition of AEs 90
7.2.3 Sequencing of Real-World Activities 90
7.3 AE SPECIFICATION 92
7.3.1 PPS Server AE Specification 92
7.4 COMMUNICATION PROFILES 94
7.4.1 Supported Communication Stacks (PS 3.8) 94
7.4.2 OSI Stack 94
7.4.3 TCP/IP Stack 94
7.4.4 Point-to-Point Stack 95
7.5 EXTENSIONS/SPECIALIZATION/PRIVATIZATION 95
7.5.1 Standard Extended/Specialized/Private SOPs 95
7.5.2 Private Transfer Syntaxes 95
7.6 CONFIGURATION 95
7.6.1 AE Title/Presentation address Mapping 96
7.6.2 Configurable Parameters 96
7.7 SUPPORT OF EXTENDED CHARACTER SETS 96
7.8 N-CREATE & N-SET REQUEST MESSAGE 96
7.9 ERROR HANDLING AND RECOVERY 98
7.10 MPPS SOP INSTANCE MAPPING 99
7.11 USE OF SPECIFIC DICOM DATA 102
7.11.1 Patient Level 102
7.11.2 Study Level 102
7.11.3 Series Level 103
APPENDIX A: CT IMAGE AND SECONDARY CAPTURE MODULES/ATTRIBUTES 104
A.1 CT IMAGE IOD 104
A.1.1 CT Image IOD Modules 104
A.2 SC IMAGE IOD 105
A.2.1 SC Image IOD Modules 105
A.3 COMMON MODULES 107
A.3.1 Patient Module 107
A.3.2 General Study Module 107
A.3.3 Patient Study Module 108
A.3.4 General Series Module 108
A.3.5 General Equipment Module 110
A.3.6 General Image Module 111
A.3.6.1 Derivation Description and Source Image Sequence 111
A.3.7 VOI LUT Module 112
A.3.8 SOP Common Module 112
A.4 CT IMAGE MODULES 112
A.4.1 Image Plane Module 112

A.4.1.1 Image Position And Image Orientation 113
A.4.2 Image Pixel Module 113
A.4.3 Contrast Bolus Module 114
A.4.4 CT Image Module 114
A.4.4.1 Image Type 116
A.4.4.2 Calculation of Dicom Exposure Field 116
A.4.5 Frame of Reference Module 117
A.4.5.1 Frame of Reference Attribute Descriptions 117
A.4.5.1.1 Frame of Reference UID 117
A.4.5.1.2 Position Reference Indicator 117
A.5 SC IMAGE MODULES 118
A.5.1 SC Equipment Module 118
A.5.2 Image Pixel Module 118
A.5.3 Modality LUT Module 118
APPENDIX B: PRIVATE DATA ELEMENTS 120
B.1 CT IMAGE IOD PRIVATE DATA ELEMENTS DEFINITION 120
APPENDIX C: DICOMDIR DIRECTORY INFORMATION 123
C.1 DICOMDIR DIRECTORY INFORMATION 123
C.1.1 Basic Directory IOD Definition 123
C.1.2 Directory Information Module 123
C.1.3 Directory Record Selection Keys 124
C.1.3.1 Patient Keys 124
C.1.3.2 Study Keys 125
C.1.3.3 Series Keys 125
C.1.3.4 Image Keys 126
APPENDIX D: IMPLEMENTATION UID FOR PRODUCT VERSIONS 128

1 INTRODUCTION

Note: Throughout this entire document the term "GEHC CT" refers to the following products:

Brivo CT315
Brivo CT325

This document applies to the following software releases for each product:

Brivo CT315	1.5x
Brivo CT325	1.5x

Note: The Brivo CT315 and Brivo CT325 product lines present an Image Works desktop, which contains advanced applications offered on the Advantage Workstation. The DICOM Conformance Statements related to these applications can be found at the following website:

http://www.gehealthcare.com/usen/interoperability/dicom/products/workstation_dicom.html

Advanced Application	DICOM Conformance Statement Reference on website
CT Perfusion	CT Perfusion V1.0 2264091-100 Rev. 0
Reformat	Volume Viewer version 1 2393233-100 Rev. 1
Volume Viewer	Volume Viewer version 1 2393233-100 Rev. 1
Advantage CT Colonography Pro	Volume Viewer version 1 2393233-100 Rev. 1
Advanced Vessel Analysis	Volume Viewer version 1 2393233-100 Rev. 1

Note: All references to DICOM refer to year 2008.

1.1 Overview

Section 1, Introduction, provides general information about the content and scope of this document.

Section 2, *Network Conformance Statement,* is the DICOM Conformance Statement related to this product Conformance Statements defines the subset of options selected from those offered by the DICOM standard.

Section 3, *Media Storage Conformance Statement*, is the DICOM Conformance Statement related to Media Storage Application Profile.

Section 4, *Print SCU Conformance Statement,* is the DICOM Conformance Statement related to DICOM Print SCU Application. This product uses DICOM Print SCU to print the images to DICOM Compliant Printers.

Section 5, *DICOM Storage Commitment SCU*, is the DICOM Conformance Statement related to DICOM Storage Commitment SCU Application. This product uses DICOM

Storage Commitment Push Model to store the images using remote DICOM entity, which is Storage Commitment SCP.

Section 6, HIS/RIS (Modality Worklist) The ModalityWorklist option for GEHC CT allows a user to query for and display DICOM modality worklist information. ModalityWorklist is providing the DICOM C-FIND service as a service class user (SCU).

Section 7, Performed Procedure Step. The PPS option for GEHC CT, allows a Modality Performed Procedure Step to be communicated to the Hos l/Radiology information system. The PPS feature is providing the DICOM Modality Performed Procedure Step service as a service class user (SCU).

Appendix A specifies the CT IOD information object.

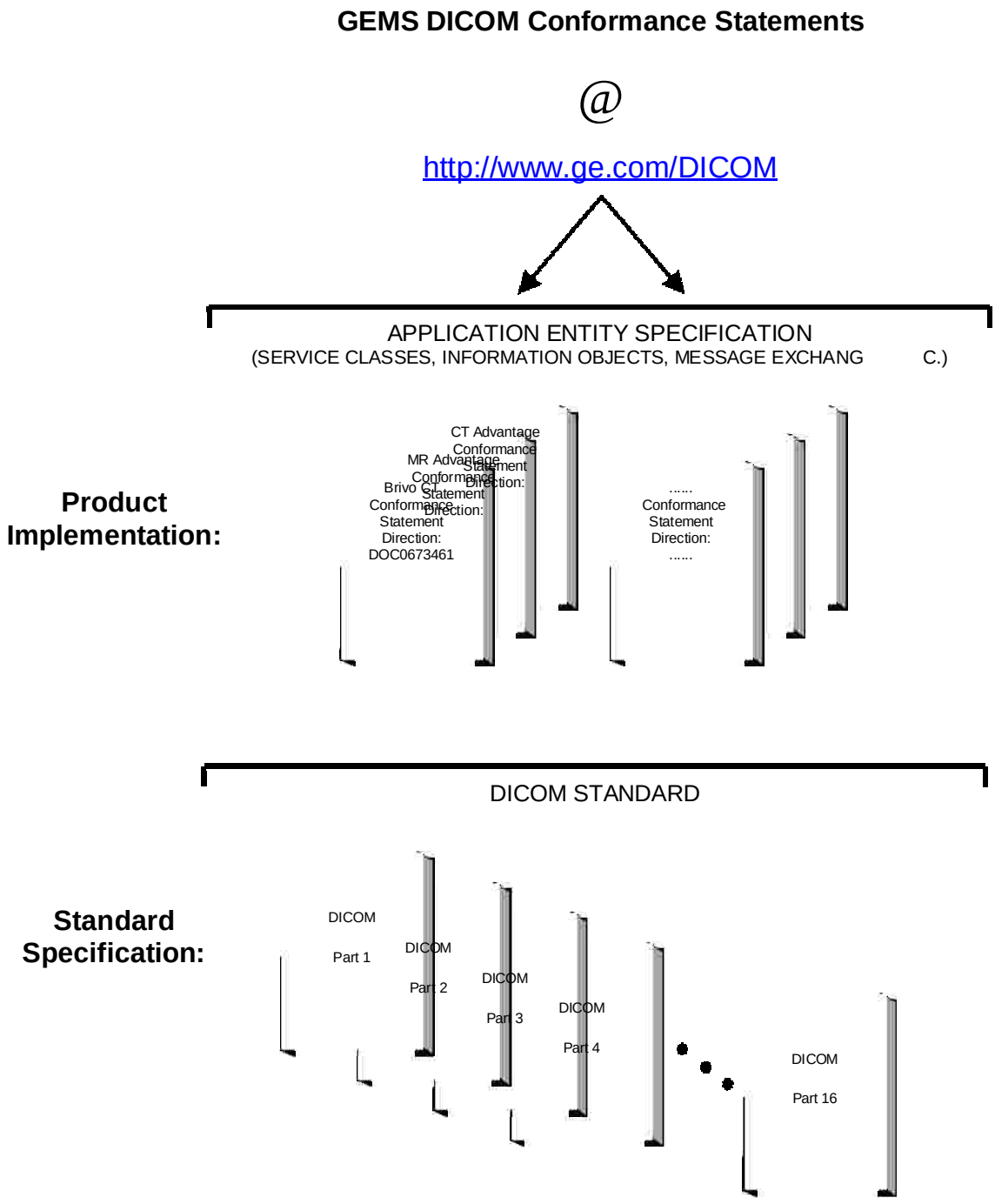
Appendix B specifies the private data element definition for CT IOD.

Appendix C specifies the DICOMDIR directory information.

Appendix D specifies Implementation UIDs for different product versions.

1.2 Overall Conformance Statement Documentation Structure

The Documentation Structure of the GEMS DICOM Conformance Statements is shown in the Illustration below.



This document specifies the DICOM implementation. It is entitled:

Brivo CT315/CT325 1.4x

Conformance Statement for DICOM

Direction DOC0673461

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEMS network interface.

The GEMS Conformance Statement, contained in this docu lso specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at http://medical.nema.org. Comments on the Standard may be addressed to:

DICOM Secretariat

NEMA

1300 N. 17th Street, Suite 1847

Rosslyn, VA 22209

USA

Phone: +1.703.841.3200

1.3 Intended Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

1.4 Scope and Field of Application

It is the intent of this document to provide an unambiguous specification for GEMS implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEMS medical data exchanged using DICOM. The GEMS Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEMS devices are capable of using different Information Object Definitions. For example, a GEMS CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEMS implementation. If the user encounters unspecified private data elements while parsing a GEMS Data Set, t is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEMS devices..

1.5 Important Remarks

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, by itself, it is not sufficient to ensure that inter-operation will be successful. The user (or user's agent) needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non–GE systems is the user's responsibility and should not be underestimated. The user is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non–GE devices, before the connection is declared operational, should not be overlooked. Therefore, the user should ensure that any non–GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non–GE device and the stability of the image data for the intended applications.

  Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.
- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is ively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEMS protocol is based n DICOM as specified in each DICOM Conformance Statement Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of**

communications features (on its products) described by these DICOM Conformance Statements. The **user** should ensure that any non–GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and Products are enhanced to support these changes.

- **Interaction** - It is the sole responsibility of the **non–GE provider** to ensure that communication with the interfaced equip ent does not cause degradation of GE imaging equipment performance and/or function.

1.6 References

NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at http://medical.nema.org/

1.7 Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definitons of these terms.

Abstract Syntax – the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP C s, Computed Radiography Image Storage SOP Class.

Application Entity (AE) – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – the externally known name of an Application Entity, used to identify a DICOM application to other DICOM applicatio e network.

Application Context – the specification of the type of communication used between Application Entities. Example: DICOM network protocol.

Association – a network communication channel set up between Application Entities.

Attribute – – a unit of information in an object definition; a data element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) – the specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The Attributes may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module – a set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module include tient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – first phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context – the set of DICOM network services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.

Protocol Data Unit (PDU) – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) – role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – role of an Application Entity that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound I Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific x-ray image.

Tag – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax – the encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), little endian explicit value representation.

Unique Identifier (UID) – a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

A set of definitions applicable to all ID/Net v3.0 Conformance Statements is included in the *Introduction to the Integrated DICOM/Network (ID/Net v3.0) Conformance Statements Direction 2118780.*

1.8 Symbols and Abbreviations

AE Application Entity

AET Application Entity Title

CAD Computer Aided Detection

CDA Clinical Document Architecture

CD-R Compact Disk Recordable

CSE Customer Service Engineer

CR Computed Radiography

CT Computed Tomography

DHCP Dynamic Host Configuration Protocol

DICOM Digital Imaging and Communications in Medicine

DIT Directory Information Tree (LDAP)

DN Distinguished Name (LDAP)

DNS Domain Name System

DX Digital X-ray

FSC File-Set Creator

FSU File-Set Updater

FSR File-Set Reader

GSDF Grayscale Standard Display Function

GSPS Grayscale Softcopy Presentation State

HIS Hospital Information System

HL7 Health Level 7 Standard

IHE Integrating the Healthcare Enterprise

IOD Information Object Definition

IPv4 Internet Protocol version 4

IPv6 Internet Protocol version 6

ISO International Organization for Standards

IO Intra-oral X-ray

JPEG Joint Photographic Experts Group

LDAP Lightweight Directory Access Protocol

LDIF LDAP Data Interchange Format

LUT Look-up Table

MAR Medication Administration Record

MPEG Moving Picture Experts Group

MG Mammography (X-ray)

MPPS Modality Performed Procedure Step

MR Magnetic Resonance Imaging

MSPS Modality Scheduled Procedure Step

MTU Maximum Transmission Unit (IP)

MWL Modality Worklist

NM Nuclear Medicine

NTP Network Time Protocol

O Optional (Key Attribute)

OP Ophthalmic Photography

OSI Open Systems Interconnection

PACS Picture Archiving and Communication System

PET Positron Emission Tomography

PDU Protocol Data Unit

R Required (Key Attribute)

RDN Relative Distinguished Name (LDAP)

RF Radiofluoroscopy

RIS Radiology Information System

RT Radiotherapy

SC Secondary Capture

SCP Service Class Provider

SCU Service Class User

SOP Service-Object Pair

SPS Scheduled Procedure Step

SR Structured Reporting

TCP/IP Transmission Control Protocol/Internet Protocol

U Unique (Key Attribute)

UL Upper Layer

US Ultrasound

VL Visible Light

VR Value Representation

XA X-ray Angiography

2 NETWORK CONFORMANCE STATEMENT

2.1 Introduction

This Conformance Statement (CS) specifies the Brivo CT315 and Brivo CT325 compliance to DICOM. It details the DICOM Service Classes and roles that are supported by this product.

The GEHC CT product uses DICOM services to import images for possible further analysis and/or processing. It also uses DICOM services to export images to other DICOM-compliant machines.

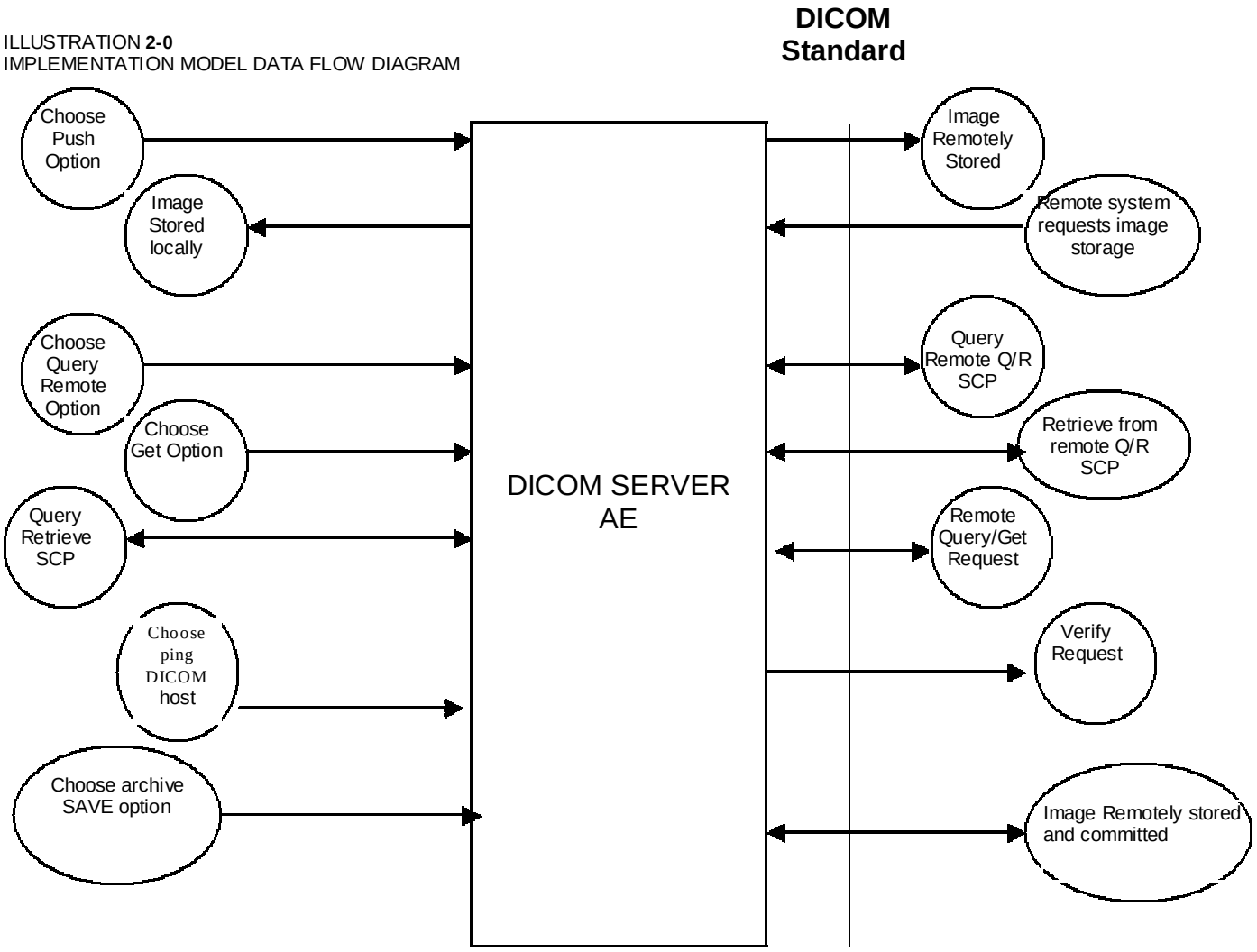
Note the format of this section follows the format of the DICOM Standard Part 2 (conformance) Annex A hence the paragraph numbering sc me. Please refer to that part of the standard while reading this section.

2.2 Implementation Model

All DICOM functionality on the GEHC CT product is handled by the DICOM Server Application Entity (AE). The DICOM Server AE is commanded to perform DICOM services through the buttons and menu selections on the main user interface panel. The DICOM Server AE is also listening to a pre-defined port for incoming connections.

2.2.1 Application Data Flow Diagram

ILLUSTRATION **2-0**
IMPLEMENTATION MODEL DATA FLOW DIAGRAM



There are five Real-World Activities that will cause the DICOM Server Application Entity (DICOM Server AE) to initiate a DICOM association to a remote DICOM Application Entity.

(1) The *Choose "Push" Option* Real-World activity consists of an operator selecting one or more study, series or image in the local database manager and choosing either "Push Examination", "Push Series" or "Push Image from the "Network" pull-down menu on the local database manager to send the image(s) to a selected destination.

(2) Real-World Activity, *Query Remote*, causes the DICOM Server AE to initiate an association to the Remote DICOM AE and request the list of all studies. Once the DICOM Server AE receives the list of studies, it will select the first study (as determined through the local database manager list sort criterion) and request the list of series for that study. After receiving the list of series the DICOM Server AE will ask for the list of images for the first series in the list. The operator can then select any study in the study list to retrieve the list of series and images.

(3) Real-World Activity, *Choose "Get" Option*, will be available once the *Query Remote* activity is performed. The operator can now select one or more study (series or image) and ask the DICOM Server AE to retrieve the selected image(s) from the Remote DICOM AE by choosing "Get Examination", "Get Series", or "Get Images".

(4) Real-World Activity, *Choose "Ping DICOM host"* Option, consists of an operator selecting "Ping DICOM host" from the "Network" pull do n menu. This will cause the DICOM Server AE to initiate a "DICOM Verification Request" to the remote AE, to verify the remote system activeness.

(5) The *Choose "storage commitment"* Option Real-World activity consists of an operator configuring the remote node as an *"archive node."* Select "choose media" option under "Archive" pull down menu. Select "Remote Node" in that menu. Select one or more study, series or image in the local database manager and choo her *"Save Exam"* or *"Save Series"* from the "Archive" pull down menu. This will cause the DICOM server AE to send the image(s) to the selected destination and wait for the storage commitment from the remote node. The remote node should be a storage commitment provider.

There is no Real-World activity required for the DICOM Server AE to respond to an incoming DICOM store, query or retrieve. The DICOM Ser r AE is always prepared to respond to a DICOM Store, Query, or Retrieve by any remote DICOM AE.

The DICOM Server AE will perform the Real-World activity Image Installation after the remote AE sends an image to the GEHC CT product.

Once a Query request is received, the DICOM Server AE will search the local database for all entries that match the keys requested by the Remote DICOM AE and send back the list of matches. The DICOM Server AE will also respond to an incoming retrieval request from a Remote AE by sending the image(s) to th ination AE.

2.2.2 Functional Definition of AE's

DICOM Server Application Entity initiates the followin s:

- *Ping DICOM Host (Verification):* The DICOM Server initiates an association and sends a C-ECHO-RQ message to the remote DICOM AE; the remote DICOM Server will send back a C-ECHO-RSP message with a status of "success".

- *Push:* Initiate an association to a Remote AE to send image(s). If the Remote AE accepts the presentation context applicable to the image(s) being DICOM Server AE will send the image(s) by invoking C-STORE-RQ operation for each image on the same association.

- *Query:* Initiate an association with a Remote AE to query for images on the remote host. A Study-Root Study-Level C-FIND-RQ request will be sent to the Remote AE once an association has been established. After all responses are received, DICOM Server AE will issue a Series-Level C-FIND-RQ request to get the series for a study in the list. An Image-Level C-FIND-RQ will be issued for the first series in the series list.

- *Get:* Send a C-MOVE-RQ request to a Remote AE after successful association establishment. The DICOM Server AE's Storage SCP will receive the images over a separate association.

  The DICOM Server AE waits for association requests fro mote AEs that wish to perform the following operations:

- *Verification*: If a C-ECHO-RQ message is received, the DICOM Server AE will send back a C-ECHO-RSP message with a status of "success".

- *Image Storage*: If a C-STORE-RQ message is received, the DICOM Server AE will receive the image and try to update the local database. If the image is stored successfully on storage media and the database updated a status of "success" will be returned in a C-STORE-RSP message.

- *Query*: If a C-FIND-RQ message is received the DICOM Server AE will search the database for the requested attributes and send back a C-FIND-RSP message containing a match and a status of "pending". After all matching records have been sent, a status of "success' will be returned in a C-FIND-RSP message. The Remote AE can terminate the query by sending a C-CANCEL-FIND-RQ message.

- *Retrieve*: If a C-MOVE-RQ message is received the DICOM Server AE will lookup its list of configured Remote AEs for the Destination AE. If the Destination AE is configured, the DICOM Server AE will open a new association to the Destination AE and use C-STORE-RQ to send the image(s). The DICOM Server AE will send a C-MOVE-RSP message with a status of "pending" after every five images are sent. When all images are sent or if DICOM Server AE receives a C-CANCEL-MOVE-RQ a final C-STORE-RSP will be sent back with an appropriate status.

2.2.3 Sequencing of Real-World Activities

Real-World Activity *Query Remote* must be performed before *Choose Get Option* can be performed.

2.3 AE Specifications

2.3.1 DICOM Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an SCU:

SOP Class Name (SCU)	SOP Class UID
Verification (Echo)	1.2.840.10008.1.1
CT Image Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Study Root Query/Retrieve – FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve – MOVE	1.2.840.10008.5.1.4.1.2.2.2

Storage Commitment Push Model	1.2.840.10008.1.20.1
PET Image Information Storage	1.2.840.10008.5.1.4.1.1.128

This Application Entity provides Standard Conformance to the following DICOM SOP classes as an SCP:

SOP Class Name (SCP)	SOP Class UID
Verification (Echo)	1.2.840.10008.1.1
CT Image Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Study Root Query/Retrieve – FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve – MOVE	1.2.840.10008.5.1.4.1.2.2.2
PET Image Information Storage	1.2.840.10008.5.1.4.1.1.128

2.3.1.1 Association Establishment Policy

2.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for association initiated by the DICOM Server AE is:

Maximum Length PDU	51 Kbytes

SOP class Extended Negotiation is not supported.

Maximum PDU Length of Zero (0) is not supported. The association request will be rejected when a request with “Maximum PDU length of zero” is received.

The maximum number of Presentation Context Items that is supported is 60. Note that the same Abstract Syntax may be offered multiple times with different Transfer Syntax.

The user information items sent by this product are:

- Maximum PDU Length and,
- Implementation UID

2.3.1.1.2 Number of Associations

The DICOM Server AE (SCU) will initiate only one DICOM association at a time to perform an image store to a remote host or retrieve image(s) from a Remote AE.

The DICOM Server AE (SCP) can have a maximum of four DICOM associations open simultaneously to receive and store image store or respond to an echo.

2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

2.3.1.1.4 Implementation Identifying Information

The Implementation UID allows unique identification of a set of products that share the same implementation.

The table in Appendix D identifies the Implementation UID for this product version.

2.3.1.2 Association Initiation by Real-World Activity

This AE attempts to initiate a new association due to a " Ping DICOM Host" or "Push" operation initiated by the user. A new association is so initiated when the user performs a "Query Remote" operation or issues a retrieve operation by performing a "Get" operation at Study/Series/Image level.

2.3.1.2.1 Push Image(s) to Remote AE

2.3.1.2.1.1 Associated Real-World Activity

The operator must first select a destination by choosing "Select Remote Host" from the "Network" pull-down menu on the local database manager and then choose a hostname.

The "Push" operation will cause the DICOM server AE to initiate an Association when the operator selects one or more study, series, or images local database manager and then chooses either "Push Examination", "Push Series", or "Push Image" from the "Network" pull-down menu on the local database manager.

Note: If multiple study, series, or images are chosen to be pushed, one association will be established for each of the studies, series, or images.

2.3.1.2.1.2 Proposed Presentation Contexts

The following table shows the proposed presentation contexts for the DICOM Server AE after Real-World Activity "Push" Operation has been performed.

Table 2.2.1.2.1.2-1 Proposed Presentation Contexts for DICOM Server AE and Real-World activities Push, Query, Pull (Get Images) and Verification (Dicom Ping) SCUs

Presentation Context Table – Proposal					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Implicit VR Big Endian (GE Private)	1.2.840.10008.1.2 1.2.840.113619.5.2	SCU	None

Presentation Context Table – Proposal					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
		Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Study Root Query/Retrieve FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

2.3.1.2.1.2.1 SOP Specific Conformance Statement C_STORE SCU

This implementation can perform multiple C-STORE operations over a single association.

Upon receiving a C-STORE confirmation containing a successful status, this implementation will perform the next C-STORE operation. The association will be maintained if possible.

Upon receiving a C-STORE confirmation containing a Refused status, this i ementation will terminate the association.

Upon receiving a C-STORE confirmation containing any status that is not Success or Refused, this implementation will consider the current request to be a failure but will continue to attempt to send the remaining images in the request on the same association.

Each C-STORE operation supports an “Association Timer”. This timer starts when the association request is sent or received and stops when the association is established. The time-out is 900 seconds.

Each C-STORE operation also supports an “Operation Inactivity Timer”. This time-out starts once the first C-STORE request has been issued (on association) or received and is reset each time a C-STORE response has been received or when subsequent C-STORES are sent. This time-out is 300 seconds.

Each C-STORE operation also supports a “Session Timer”. This timer starts when the association is established and stops when the association is ended. This time-out is 60 minutes.

If any of the three timers mentioned above expires, the connection is closed and the operation in progress is considered failed.

Note: The time-outs are configurable.

When DICOM Server AE initiates an association to issue a C-STORE, the following will occur:

1. The image will be transmitted by the DICOM Server AE with the same elements as was originally received or created locally (for the standard elements only).

2.3.1.2.2 Query Remote AE

2.3.1.2.2.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. To do custom queries select "***Yes***" for "***Custom search***" option.

Note: Custom queries can be done on the following fields *"Last Name contains", "Exam Number", "Patient Id", "Accession Number".*

To initiate a Query select "***Receive***" from "***Network***" pull-down menu.

Note: If "Custom Search" option is set then a small GUI will show up. Operator will be able to enter custom query fields. Entering values in "Last Name contains" field will initiate wild card query for patient name.

The *"Query"* operation will cause the DICOM Server AE to initiate an association to the selected Remote AE when the *"Query Remote Host"* entry is selected from the *"Network"* pull-down menu. Once a list of Study/Series/Image is retrieved, the operator can invoke the *"Get"* operation by choosing *"Get Exam"* or *"Get Series"* or *"Get Image"* from the *"Network"* pull-down menu.

2.3.1.2.2.2 Proposed Presentation Contexts

When the Real-World activity *"Query"* or *"Get"* is initiated all presentation contexts shown in table 2.2.1.2.1.2-1 are proposed during association establishment, but only the Query/Retrieve-FIND related contexts are applicable to this activity.

2.3.1.2.2.2.1 SOP Specific Conformance Statement for C-FIND SCU

After the *Query* operation is initiated, the DICOM Server AE will perform a study-root C-FIND-RQ request at each of the three levels (Study, Series, and Image) in succession. The Initial Study-Level request will ask for all studies in the Remote database.

The C-FIND SCU will not perform any extended negotiation and so will only perform hierarchical query. Relational Queries are not supported. C-CANCEL-FIND-RQ is not supported.

Each C-FIND SCU operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 300 seconds and 60 minutes respectively.

If a “Cancel” or “Refused” status is returned from the Remote AE the association is closed and the operation terminated.

The DICOM Server AE will parse each matching C-FIND-RSP reply and ignore the entries it fails to parse. Tables 2.2.1.2.2.2.1-1 - 2.2.1.2.2.2.1-3 shows the various fields that are requested at the Study, Series, and Image levels of the C-FIND request.

Query results are filtered based on the Modality field. Only CT/MR Screen Save images are supported.

Table 2.2.1.2.2.2.1-1: Requested Study Level Keys

Description	Type	Tag	Value
Study date	R	0008,0020	Zero length
Study time	R	0008,0030	Zero length
Patient’s name	R	0010,0010	Zero length
Patient ID	R	0010,0020	Zero length
Study id	R	0020,0010	Zero length
Study Instance UID	U	0020,000D	Zero length
Study description	O	0008,1030	Zero length
Private Creator Identification	P	0009,0010	GEMS_IDEN_01
Suite Id	P	0009,1002	Zero Length

Table 2.2.1.2.2.2.1-2: Requested Series Level Keys

Description	Type	Tag	Value
Modality	R	0008,0060	Zero length
Series number	R	0020,0011	Zero length
Series Instance UID	U	0020,000E	Series UID
Series description	O	0008,103E	Zero length
Manufacturer	O	0008,0070	Zero length
Images in series	O	0020,1002	Zero length

Table 2.2.1.2.2.2.1-3: Requested Image Level Keys

Description	Type	Tag	Value
Image number	R	0020,0013	Zero length
Image Instance UID	U	0008,0018	Image UID
Image type	O	0008,0008	Zero length
Rows	O	0028,0010	Zero length
Columns	O	0028,0011	Zero length
Image position	O	0020,0032	Zero length
Image orientation	O	0020,0037	Zero length
Slice thickness	O	0018,0050	Zero length
Slice spacing	O	0018,0088	Zero length
Gantry tilt (Digital tilt)	O	0018,1120	Zero length

Description	Type	Tag	Value
Convolution kernel	O	0018,1210	Zero length
Reconstruction diameter	O	0018,1100	Zero length
Data collection diameter	O	0018,0090	Zero length
Flip angle	O	0018,1314	Zero length
Echo number	O	0018,0086	Zero length
Echo time	O	0018,0081	Zero length
Inversion time	O	0018,0082	Zero length
Repetition time	O	0018,0080	Zero length
Private Creator Identification	P	0019,0010	GEMS_ACQU_01
Dfov Rect	P	0019,001E	Zero Length
Midscan Time	P	0019,1024	Zero Length
Azimuth	P	0019,1026	Zero Length
Number of Echo	P	0019,107E	Zero Length
Private Creator Identification	P	0021,0010	GEMS_RELA_01
Scout Anref	P	0021,104A	Zero Length
Private Creator Identification	P	0027,0010	GEMS_IMAG_01
Location RAS	P	0027,1040	Zero Length
Location	P	0027,1041	Zero Length
Center R Coordinate	P	0027,1042	Zero Length
Center A Coordinate	P	0027,1043	Zero Length
Table Start Location	P	0027,1050	Zero Length
Table End Location	P	0027,1051	Zero Length
RAS Letter for Side of Image	P	0027,1052	Zero Length
RAS Letter for Anterior/Posterior	P	0027,1053	Zero Length
RAS Letter for Scout Start Location	P	0027,1054	Zero Length
RAS Letter for Scout End Location	P	0027,1055	Zero Length
Image Dimension X	P	0027,1060	Zero Length
Image Dimension Y	P	0027,1061	Zero Length

Note1: Refer to section 2.3.1.2.2.1 for Custom Search/Query option.

Note2: Type P refers to a private dicom element.

2.3.1.2.3 Get Image(s) from Remote AE

2.3.1.2.3.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. The operator then has to perform the Real-World activity *"Query"* to get a list of Study/Series/Image. Once the list of Study/Series/Image is retrieved, the operator can invoke the *"Get"* operation by choosing *"Get Exam"* or *"Get Series"* or *"Get Image"* from the *"Network"* pull-down menu.

2.3.1.2.3.2 Proposed Presentation Contexts

When the Real-World activity *"Get"* is initiated all presentation contexts shown in table 2.2.1.2.1.2-1 are proposed during association establishment, but only the Query/Retrieve-MOVE related contexts are applicable to this activity.

2.3.1.2.3.2.1 SOP Specific Conformance Statement for C-MOVE SCU

When the operator starts a *Get* operation at any level (Study, Series, Image) the DICOM Server AE will initiate a C-MOVE-RQ request to the Remote AE with the DICOM Server AE as the Destination AE. The Storage SCP will handle the incoming images as described in section 2.3.1.3.1. A user attention pop-up will be posted if a failure status is received. The specific error message for the failure ill be logged.

Each C-MOVE SCU operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 300 seconds and 60 minutes respectively.

The DICOM Server AE will send a C-CANCEL-MOVE-RQ to the Remote AE if the operator *"Pauses"* or *"Clears"* the job from the local database manager Network queue.

2.3.1.2.4 Real-World Activity: Verify (DICOM Ping)

2.3.1.2.4.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname.

The operator must then select the "*Ping DICOM host*" form "*Network*" pull-down menu.

The DICOM server will initiate an association with the remote DICOM AE in order to verify communication at the application level. The success or failure of the verification process is displayed to the user.

2.3.1.2.4.2 Proposed Presentation Context Table

Refer to the Table 2.2.1.2.1.2-1 for the Proposed Presentation Contexts for DICOM Server AE and Real-World activity Verification

2.3.1.2.4.2.1 SOP Specific DICOM Conformance C_ECHO SCU

The GEHC CT DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 15 seconds and 60 minutes respectively

2.3.1.2.5 Real-World Activity: Storage Commitment

2.3.1.2.5.1 Associated Real-World Activity

The operator must first select a destination by choosing *"Select Remote Host"* from "*Network"* pull-down menu on the local database manager and then choose a hostname. Select the "*Update*" option, if the hostname is already present. Set the "*Archive Node*" option to "*Yes*". If the remote host is not present add the remote host in the local database with "*Archive Node*" option set to "*Yes*".

Note: The remote node should be a Storage Commitment SCP.

The operator must then select " Archive " pull-down menu on the local database manager. Select "*Select Media*" option menu. Select "*Remote Node*" in the menu.

Note: Only if you configure the remote node as a "*archive node"* will you see the remote node option in the archive menu.

The operator then selects one or more study, series, or images in the local database manager and then chooses "Save Examination", "Save Series", or "Save Image" from the "Archive" pull-down menu on the local database manager.

Note: Also refer to section 5.3.1.3

2.3.1.2.5.2 Proposed Presentation Context Table

Refer to section 5.3.1.4

2.3.1.2.5.3 SOP Specific Conformance Statement Storage Commitment SCU

Refer to section 5.3.1.4

2.3.1.3 Association Acceptance Policy

The DICOM Server AE places limitations on who may connect to it.

If the Remote AE needs to "Push Images" or "Query/Retrieve Images", to the local system then it has to be configured in the Local system to do the same.

To configure a remote AE choose "Select Remote Host" in the "network" pull down menu. Select the Remote Host and choose "Update" option, if the Remote AE is already present. If the Remote AE is not present choose "Add" option to add the Remote AE.

Set "Push Images" option to "Yes", if the Remote AE needs to push images to the Local system

Set "Query/Retrieve" option to "Yes", if the Remote AE needs to "Query/Retrieve" the local system.

When the DICOM Server AE accepts an association for image storage, it will receive any images transmitted on that association and store the i s on disk.

It will also respond to queries from Remote AEs by sending matching entries. Any Remote AE can request and receive a list of images on the local database. The Remote AE must be configured in the local database manager's list of Remote A be able to retrieve images from DICOM Server AE.

Any remote AE can open an association to the DICOM Server AE for the purpose of verification.

2.3.1.3.1 Receive Image(s)

This AE is indefinitely listening for associations. No operator action is required to receive an image.

2.3.1.3.1.1 Associated Real-World Activity

The Real-World Activity associated with the Receive Image(s) operation is the storage of the image on the disk drive of the GEHC CT.

2.3.1.3.1.2 Presentation Context Table

Table 2.2.1.3.1.2-1: Accepted Presentation Contexts for DICOM Server AE and Real-World Activity Receive Image(s)

Presentation Context Table - Accepted					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian Implicit VR Big Endian (GE Private) Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.113619.5.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

Note: Sequence of the transfer syntax depends on the dcs.cfg file present on the host machine.

By default, sequence is:

"1.2.840.10008.1.2.1" - ELE
"1.2.840.10008.1.2.2" - EBE
"1.2.840.10008.1.2" - ILE
"1.2.840.113619.5.2" – GEIBE

Based on the above sequence an transfer syntax table is created.
The transfer syntax table is iterated until it gets a match after getting the response from the remote host in the Association,

2.3.1.3.1.2.1 SOP Specific Conformance to C_STORE SCP

The DICOM Server AE conforms to the SOP's of the Storage Service Class at level 1 (base). Private elements will be discarded from the image when receiving images containing non-GE private data elements. All of the **standard** type elements (1,1c,2,2c,3) will be retained.

Each C-STORE SCP operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 900 seconds and 60 minutes respectively.

Association Timer – duration for SCP to respond to an association request.

Session Timer – duration from association to first command sent by SCU.

Inactivity Timer – duration between two commands after the association.

Image Reception

If the DICOM Server AE returns one of the following status codes, then the C-STORE operation was unsuccessful and no image will be installed:

- 0110 (Processing Failure) Indicates that an internal system call has failed while processing an image.
- A711 (Out of Resources) Indicates that probably there not enough disk space to store the image. The user should attempt recovery by removing some images from the GEHC CT system.
- A712 (Out of Resources) Indicates that there was not enough resource (such as memory) to store the image.
- A800 (SOP Class not supported)

In the event of a successful C-STORE operation, the image has successfully been written to disk. The image will then be accessed in the same manner as any other image by the applications on the GEHC CT system.

Images may be deleted when instructed to do so by the user. Thus the duration of the storage of the image is determined by the users of the GEHC CT system.

Image Installation

If the image installation is unsuccessful, a message w l appear in the Message Log informing the user of the failure and the image will be removed.

If the image installation process finds that an element is not encoded according to the DICOM standard, it will fail to install the image and the file will be removed.

Image Installation of non-GE Created MR or CT Images

Images received from non-GE products are installed as appropriate image object without any of their private data elements. Also if some critical fields (mandatory) are missing, then the image will not be installed.

2.3.1.3.2 Verification Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *verification* message.

2.3.1.3.2.1 Associated Real-World Activity

The Real-World Activity associated with the verification request is to send a C-ECHO response message with a status of "success" to the requesting AE.

2.3.1.3.2.2 Presentation Context Table

Table 2.2.1.3.2.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Verification Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.3.1.3.2.2.1 SOP Specific Conformance to C_ECHO SCP

The DICOM Server AE provides standard conformance to the DICOM Verification Service Class.

Each ECHO operation supports an "Operation Inactivity ith time out value of 15 seconds.

2.3.1.3.3 Query Request from Remote AE

This AE is indefinitely listening for associations. No operator action is required to respond to a *query* request.

2.3.1.3.3.1 Associated Real-World Activity

The Real-World Activity associated with the query request is to search the local database for entries that match the request and send a C-FIND response message with a status of "pending" for each matching entry.

2.3.1.3.3.2 Presentation Context Table

Table 2.3.1.3.3.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Query Request

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		

Study Root Query/Retrieve FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.3.1.3.3.2.1 SOP Specific Conformance to C-FIND SCP

All Required (R) and Unique (U) study, series, and image level keys for the Study-Root Query/Retrieve information model are supported. Some optional (O) keys are also supported as described in the following tables.

Table 2.3.1.3.3.2.1-1 Supported study level keys

Description	Type	Tag	Usage
Study date	R	0008,0020	Matched
Study time	R	0008,0030	Matched
Accession number	R	0008,0050	Matched
Patient's name	R	0010,0010	Matched
Patient id	R	0010,0020	Matched
Study id	R	0020,0010	Matched
Study Instance UID	U	0020,000D	Matched
Study description	O	0008,1030	Returned
Suite Id	P	0009,0002	Returned

Table 2.3.1.3.3.2.1-2 Supported series level keys

Description	Type	Tag	Usage
Modality	R	0008,0060	Matched
Series number	R	0020,0011	Matched
Series Instance UID	U	0020,000E	Matched
Series description	O	0008,103E	Returned
Manufacturer	O	0008,0070	Returned
Images in series	O	0020,1002	Returned

Table 2.3.1.3.3.2.1-3 Supported image level keys

Description	Type	Tag	Usage
Image number	R	0020,0013	Matched
Image Instance UID	U	0008,0018	Matched
Image type	O	0008,0008	Returned
Rows	O	0028,0010	Returned
Columns	O	0028,0011	Returned
Image position	O	0020,0032	Returned
Image orientation	O	0020,0037	Returned
Slice thickness	O	0018,0050	Returned
Slice spacing	O	0018,0088	Returned
Gantry tilt (Digital tilt)	O	0018,1120	Returned
Convolution kernel	O	0018,1210	Returned

Description	Type	Tag	Usage
Reconstruction diameter	O	0018,1100	Returned
Data collection diameter	O	0018,0090	Returned
Flip angle	O	0018,1314	Returned
Echo number	O	0018,0086	Returned
Echo time	O	0018,0081	Returned
Inversion time	O	0018,0082	Returned
Repetition time	O	0018,0080	Returned
Trigger time	O	0018,1060	Returned
Dfov Rect	P	0019,101E	Returned
Midscan Time	P	0019,1024	Returned
Azimuth	P	0019,1026	Returned
Number of Echo	P	0019,107E	Returned
Scout Anref	P	0021,104A	Returned
Location RAS	P	0027,1040	Returned
Location	P	0027,1041	Returned
Center R Coordinate	P	0027,1042	Returned
Center A Coordinate	P	0027,1043	Returned
Table Start Location	P	0027,1050	Returned
Table End Location	P	0027,1051	Returned
RAS Letter for Side of Image	P	0027,1052	Returned
RAS Letter for Anterior/Posterior	P	0027,1053	Returned
RAS Letter for Scout Start Location	P	0027,1054	Returned
RAS Letter for Scout End Location	P	0027,1055	Returned
Image Dimension X	P	0027,1060	Returned
Image Dimension Y	P	0027,1061	Returned

Note: In the above tables the type field has the following meaning:
R = Required **U** = Unique **O** = Optional **P** = Private

Only keys with Usage type *Matched* will be matched against values in the database.

Values in keys of type Returned will be ignored and will be filled in with data from the database.

If an optional key is requested that does not appear in any of the tables above, that key will be ignored and no corresponding element will be returned.

If the database does not have a value corresponding to any requested optional key a zero-length element will be returned.

Sequence matching is not supported.

Range matching is supported for attributes of type date and time.

Only hierarchical query is supported.

Special character ? can be used to match any single character and special character * can be used to match any character or set of characters for (0008, 0050) Accession Number, (0010, 0010) Patient's Name, (0010, 0020) Patient ID and (0020, 0010) Study ID.**Retrieve Request From Remote AE**

This AE is indefinitely listening for associations. No operator action is required to respond to a *retrieve* request.

2.3.1.3.4.1 Associated Real-World Activity

The Real-World Activity associated with the Retrieve Request is to send all images corresponding to the C-MOVE request to the destination AE through a separate association.

2.3.1.3.4.2 Presentation Context Table

Table 2.3.1.3.4.2-1: Acceptable Presentation Contexts for DICOM Server AE and Real-World Activity Retrieve Request.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None

2.3.1.3.4.2.1 SOP Specific Conformance to C-MOVE SCP

The DICOM Server AE provides standard conformance to the baseline Study-root C-MOVE Service Class SCP.

Each C-MOVE SCP operation supports an "Association Timer", "Operation Inactivity Timer" and "Session Timer" with time out values of 900 seconds, 300 seconds and 60 minutes respectively. These time-outs are configurable in dcs.cfg as *bi_assoc_tio*, *bi_move_tio* and *bi_session*_tio respectively

All images requested in a C-MOVE-RQ will be sent over a single association. A C-MOVE-RSP with a "pending" status will be returned to the requester every five images.

The C-MOVE SCP will invoke C-STORE requests for the following SOP classes:

SOP Class Name	SOP Class UID
CT Image Information Storage	1.2.840.10008.5.1.4.1.1.2
MR Image Information Storage	1.2.840.10008.5.1.4.1.1.4
Secondary Capture image storage	1.2.840.10008.5.1.4.1.1.7
Standalone Overlay storage	1.2.840.10008.5.1.4.1.1.8
PET Image Information Storage	1.2.840.10008.5.1.4.1.1.128

In addition to the C-MOVE response status values defined in DICOM part 4 the following status values will be returned:

- C000 Indicates that an error occurred while retrieving records from the local database.
- C001 Indicates all other processing error.
- C011 If the Destination AE returns a *"Storage Full"* condition this status will be returned. This status will only be sent if the Destination AE returns a status of A711 and is only applicable if the Destination AE is another GE Medical Systems product.

2.3.1.3.4.3 Presentation Context Acceptance Criteria

No criterion.

2.3.1.3.4.4 Transfer Syntax Selection Policy

All protocols detailed above in the tables are supported; no priority selection is given.

2.4 Communication Profiles

2.4.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

2.4.2 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

2.4.2.1 Physical Media Support

Ethernet v2.0, IEEE 802.3. Auto senses 10/100 Base T Ethernet connection.

2.4.3 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

2.5 Extensions / Specializations / Privatizations

2.5.1 Specialized Information Object Definition

Following is a list of additional private attributes d or a standard **CT IOD**.

(0008,0008) Value 3: CT Image IOD specific specializations
AXIAL
LOCALIZER
SEGMENTED
REFORMATTED
PROCESSED
COMBINED
CTINTERVENTION

Value 4: GE CT Image implementation specific
MIN IP
MIP
AVERAGE
VOLREN
INTEGRAL
HD MIP
RAYSUM
SURFACE
MINMAX
ADD
DIGITALTILT

(0018,0022) Scan Options: Defined Terms

CINE MODE
HELICAL MODE
ASYNMETRIC MODE

2.5.2 Private Data Elements

Refer to ***Appendix B*** for a complete listing of private data elements used this implementation.

2.6 Configuration

2.6.1 AE Title/Presentation Address Mapping

The GEHC CT system allows the user to “add”, “Remove”, or “Update the mapping of remote AE Titles to IP Addresses and Ports. These options can be selected from the “Remote Host Selection” menu displayed by choosing “Se mote Host” from the “Network” pull-down menu from the local database manager.

2.6.2 Configurable Parameters

The following fields are configurable for the DICOM Server AE:

- Local AE Title (the machine hostname)
- Local IP Address
- Local IP Netmask
- Max PDU length
- Time-outs, which are set for all hosts, are configurable in dcs.cfg:
  *Association time-out - *bi_assoc_tio*
  **Inactivity time-out* - *bi_store_tio*

*Session timeout - *bi_session_tio*
**Move operation time-out* - *bi_move_tio*
*Create timeout - *bi_ncreate_tio*
**Find time-out* - *bi_find_tio*

Note: All configurations should be performed by a GE Field Service Engineer.

Note: The local port on which the GEHC CT system receives DICOM incoming TCP connections is port 4006.

2.7 Support of Extended Character Sets

In addition to the DICOM default character set, *GEHC CT* supports the ISO IR 100 Latin alphabet #1 supplementary set for the purpose of interchange.

2.8 Codes and Controlled Terminology

The product uses coded terminology as defined below.

2.8.1 Mapped Coded Terminology

The product maps, without change, coded terminology values supplied in Modality Worklist Scheduled Procedure Steps into Image SOP Instance and Modality Performed Procedure Step attributes, as described in Sections 6 and 7.

2.9 Security Profiles

The product does not conform to any defined DICOM Security Profiles.
It is assumed that the product is used within a secured environment. It is assumed that a secured environment includes at a minimum:

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

3 MEDIA STORAGE CONFORMANCE STATEMENT

3.1 Introduction

This conformance statement specifies the GEHC CT conformance to the DICOM Media Interchange. It details the DICOM Media Storage Application Profiles and roles that are supported by this product.

3.2 Implementation Model: Dicom Export Application.

All DICOM functionality on the GEHC CT product is handled by the DICOM Server Application Entity (AE). The DICOM Server AE is commanded to perform DICOM services through the buttons and menu selections on the main user interface panel.

3.2.1 Application Data Flow Diagram

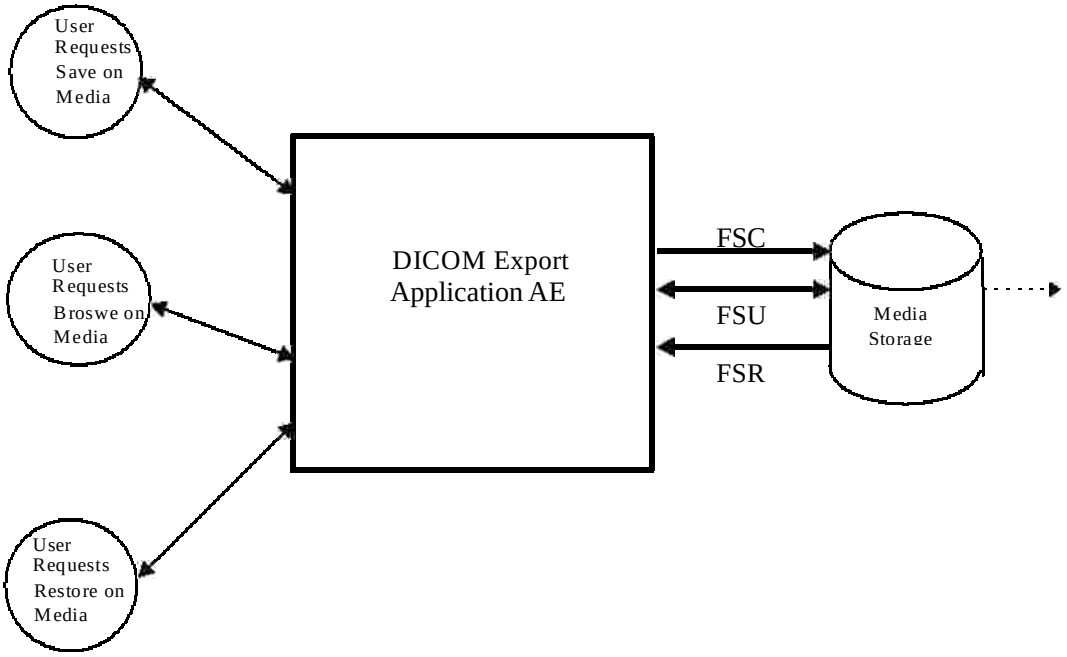
The Basic and Specific Application models for the CD, DVD and USB devices are shown in the following Illustrations:

The CD/DVD/USB DICOM Media Server Application Entity (AE) handles the DICOM CREATE CD/RESTORE CD functionality for the CD-R device as well as the DICOM CREATE DVD/RESTORE DVD functionality for the DVD-R device and the DICOM CREATE USB/RESTORE USB functionality for the USB device. The CD/DVD/USB DICOM Media Server Application Entity (AE) is commanded by the user to perform DICOM services operating on the DICOM media through the use of buttons and menu selections on the graphical user interface of the station.

The user selects the type of media (either CD, DVD or USB) and then requests the creation of a DICOM File Set and the writing of this DICOM File Set on blank media by selecting images in the local Browser and inserting them in the Media Composer. Then, the images of the different media to burn will be generated. Once the generation has been done, the user can ask to burn the complete set of data on one or more media of the same type (CD, DVD or USB)

The user can request the reading of a DICOM file set written on an interchange media by selecting the CD/DVD/USB drive as the active device, and browsing the media or restore the selected items by clicking restore button.

Illustration 3-1: Specific AE Application Model



3.2.2 Functional Definitions of AE's

This Server has only one Application Entity: the Dicom Export Application.

The Dicom Export Application can perform these functions:

- It can initialize a piece of media, writing a new label and DICOM File-set onto the media. (“LABEL”)
- It can update a piece of media(USB) by adding new SOP instances to an already existing DICOM File-set from local storage. (“SAVE”)
- It can display a directory listing of the File-set on CD-R,DVD-R,USB media (QUERY)
- It can copy SOP instance from the CD-R/DVD-R/USB media onto local storage. (“RESTORE”)
- The supported CD/DVD medium for “SAVE” are CD-R, DVD-R.
- The supported CD/DVD medium for “RESTORE” and “QUERY” are CD-R, DVD-R,DVD+R,DVD-RW,DVD+RW.

Note: This software support multi-session DVD burning, so you can also update DVD if you don’t finalize it.

Note: Due to technology issues, it is possible that some types of DVDs cannot be read or burnt on the Brivo CT SW. The function of reading and generating DICOM interchange DVDs is also dependent of the hardware on which the Brivo CT is installed

3.2.3 Sequencing of Real World Activities

The updating function can only be performed on a piece of media that has already had a DICOM File- set created.

The display function can only be performed on a piece media that has already has a DICOM File-set created. With no SOP instances having been added, the directory will be displayed empty.

The copy function can only be performed with a piece of media that has DICOM SOP instances in the File-set.

There are no other sequencing requirements.

3.2.4 File Meta Information for Implementation Class and Version

The File Meta-Information for this implementation is:

- File Meta-Information Version..... 1
- Implementation Version Name 1.5x

The table in Appendix D identifies the Implementation UID for this product version.

Note: The Implementation Version Name could be changed to new version number if release new version of SW for some bug fix.

3.3 AE Specifications

3.3.1 DICOM CD/DVD/USB SERVER AE Specification

The Dicom Export Application provides standard conformance to DICOM Media Storage Service Class. The Application Profiles and roles are listed in Table 3.1-1.

Table 3.3-1: Application Profile, Activities and Roles for CD/DVD/USB Update

Application Profiles Supported	Real World Activity	Role	Description
STD-GEN-CD	Browse CD	FSR	Interchange
STD-GEN-CD	Restore CD	FSR	Interchange
STD-GEN-CD	Create CD	FSC	Interchange
STD-GEN-DVD-JPEG	Browse DVD	FSR	Interchange
STD-GEN-DVD-JPEG	Restore DVD	FSR	Interchange
STD-GEN-DVD-JPEG	Create DVD	FSC	Interchange
STD-GEN-USB -JPEG	Browse USB	FSR	Interchange

STD-GEN-USB-JPEG	Restore USB	FSR	Interchange
STD-GEN-USB-JPEG	Create USB	FSC	Interchange
STD-GEN-USB-JPEG	Update USB	FSC	Interchange

3.3.1.1 File Meta Information for the Application Entity

Following are the values set in the File Meta Information for this AE:

- Source Application Entity Title ..... Not used by the DICOM Export Application
- Implementation Class UID……1.2.276.0.7230010.3.0.3.5.2
- Implementation Version Name…….OFFIS_DCMTK_352

3.3.1.2 Real World Activities

3.3.1.2.1 Real World Activity: "Browser Media"

The CD/DVD/USB DICOM Media Server AE acts as an FSR using the DICOM Export Application when requested to browse the media.

When the CD/DVD/USB DICOM Media Server AE is requested to provide a directory listing, it reads the File-set and displays the DICOMDIR directory entries, according to the PATIENT, STUDY, SERIES, IMAGE paradigm.

3.3.1.2.1.1 Application Profiles for "Browser Media"

For the list of Application Profiles that invoke this AE for the "Browse Media" see Section 3.3.1.

3.3.1.2.1.1.1 Options:

Following are the SOP Classes supported by the RWA "Browse Media":

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1

3.3.1.2.2 Real World Activity: "Restore Media"

The CD/DVD/USB DICOM Media Server AE acts as an FSR us interchange option when requested to copy SOP instances from the media to the local database.

The user selects the SOP instances that he wants the CD/DVD/USB DICOM Media Server AE to copy on the local database by clicking on the restore button. Once selected, the SOP instances are copied from the media to the local database.

Only, the SOP classes supported by the station are declared to the database in a transfer syntax supported by the station

3.3.1.2.2.1 Application Profiles for the RWA: "Restore Media"

For the list of Application Profiles that invoke this AE for the "Browse Media" see Section 3.3.1.

3.3.1.2.2.1.1 Options:

Following are the SOP Classes supported by the RWA "Restore Media":

TABLE 3-1

TRANSFER SYNTAX LIST FOR MEDIA READ

Transfer Syntax	Transfer Syntax UID
Explicit VR Little Endian	1.2.840.10008.1.2.1
Implicit VR Little Endian	1.2.840.10008.1.2
Explicit VR Big Endian	1.2.840.10008.1.2.2
JPEG Lossy, Baseline Sequential with Huffman Coding (process 1)	1.2.840.10008.1.2.4.50
JPEG Lossy Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
JPEG Lossless Process 14	1.2.840.10008.1.2.4.70

Information Object Definition	SOP Class UID	Transfer Syntax
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	See Table 3-1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	See Table 3-1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	See Table 3-1

3.3.1.2.3 Real World Activity: "Create Media"

The CD/DVD/USB DICOM Media Server AE acts as an FSC us interchange option when requested to copy SOP Instances from the local database to one or multiple interchange media.

The user selects the entries in the local database that he wants the CD/DVD/USB DICOM Media Server AE to copy onto interchange media.

The graphic interface allows the user to select the entries in the local database to be copied onto one or more interchange media. He/she may

• Add patients, studies, series or images from the local database onto the CD/DVD/USB Composer

• Remove patients, studies, series or images from the CD/DVD/USB Composer.

The CD/DVD/USB Composer will create one File Set per generated interchange media.

3.3.1.2.3.1 Application Profiles for the RWA: Update USB Request

For the list of Application Profiles that invoke this AE for the “Browse Media” see Section 3.3.1

3.3.1.2.3.1.1 Options:

Following are the SOP Classes supported by the RWA “Create Media”:

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Media Storage Directory Storage	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian	1.2.840.10008.1.2.1
PET Image Storage	1.2.840.10008.5.1.4.1.1.128	Explicit VR Little Endian	1.2.840.10008.1.2.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1

4 PRINT SCU CONFORMANCE

4.1 Introduction

This conformance statement specifies the GEHC CT conformance to the DICOM Print SCU Application Profile. The GEHC CT product uses DICOM Print SCU to print images on DICOM Compliant Printers.

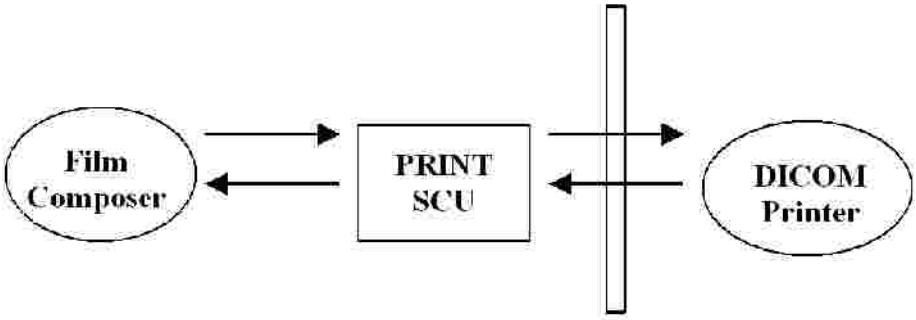
4.2 Implementation Model: PRINT SCU

The DICOM Print SCU is a DICOM print filter that provides the cap lity to print images to DICOM printers. The DICOM Print filter acts as an SCU of the DICOM print management SOP class.

4.2.1 Application Data Flow Diagram

DICOM print SCU Implementation model

DICOM INTERFACE



The Film Composer is the User interface and this is used to initiate the local real world activity. The user issues the print request using Film mposer. Film composer allows printer selection and it composes the pre-formatted film file. This film file is interpreted by Print SCU and it sends the appropriate messages to DICOM print SCP running on a DICOM printer.

4.2.2 Functional Definition of AE's

DICOM Print SCU Establishes the Association to the requested printer for printing the composed film.

4.2.3 Sequencing of Real-World Activities

- The DICOM printer is installed through a camera installation process. The DICOM printer is selected from the Film Composer Interface for Manual F ming. Autofilming is enabled using the camera setup via the camera installation process.

- Images may be acquired for printing in the following manner:
  - Images to be printed may be manually dropped from Viewing applications into the manual film composer slots.
  - Images to be printed may be automatically dropped from wing applications into the manual film composer slots.
  - Images to be printed may be manually dropped from Viewing applications into the auto film composer slots.
  - Image series to be printed may be automatically dropped from the PrintSeries application into the manual film composer slots.
  - Images to be printed may be automatically dropped from the Scanning Application into the auto film composer slots.

- Based upon the filming mode (and the attributes) used to acquire images into the film composer, films will be automatically printed when the film session is full, or the user must press the Print Button to print the images.

- The Print SCU retrieves the Print SCP status by using the N-GET service of Printer SOP Class. If the printer returns a FAILURE status the print session will be terminated. The printer status is not read.

- The film session is created using the N-CREATE service. The print session will be terminated if the printer fails to create the film session.

- The film box is created using the N-CREATE service. The print session will be terminated if the printer fails to create the film box.

- The images are placed on the film box by using the N-SET. If the printer fails to place the image on the film box, the print session will be terminated.

- The film will be printed using the N-ACTION. Only film box printing is supported. If the printer fails to print the film, the print session will be ter inated.

- After the successful N-ACTION, the film box will be deleted using the N-DELETE. Any N-EVENT-REPORTS given to the PRINT SCU will be received but the data is ignored. After the film box is deleted, the association will be closed.

- Upon the successful completion of the above sequencing ssociation is closed, the user will be notified of the successful print session.

4.3 AE Specifications

4.3.1 DICOM Print SCU AE Specification

Print SCU provides Standard Conformance to the following DICOM 3.0 SOP classes as an SCU:

SOP CLASS Name	SOP CLASS UID
Basic grayscale print management meta SOP class	**1.2.840.10008.5.1.1.9**
Basic color print management meta SOP class	**1.2.840.10008.5.1.1.18**
Print Job SOP class	**1.2.840.10008.5.1.1.14**

4.3.1.1 Association Establishment Policy

4.3.1.1.1 General

The Film Composer provides options to indicate the printer AE title and Printer host name. These parameters are used by the Print SCU to establish the association with the desired printer.

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	**1.2.840.10008.3.1.1.1**

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for association initiated by the DICOM Print SCU AE is:

Maximum Length PDU	**16 Kbytes**

4.3.1.1.2 Number of Associations

The Print SCU will initiate only one association with printer. Multiple associations are not supported.

4.3.1.1.3 Asynchronous Nature

The print SCU does not support asynchronous operations. All operations will be performed synchronously.

4.3.1.1.4 Implementation identifying information

The Implementation UID allows unique identification of a set of products that share the same implementation.

The table in Appendix D identifies the Implementation UID for this product version.

4.3.1.2 Association Establishment Policy

Print SCU initiates the association with the Printer.

4.3.1.2.1 Real World Activity

4.3.1.2.1.1 Associated Real-World Activity – "Print"

The Film Composer allows the user to select printers a lso allows the user to drag and drop the images (from the viewer application) into the film. It also allows the user to manipulate some print parameters like film format and number of copies to print. When the user presses the "Print" Button, the Film composer communicates this request to Print SCU, which then tries to establish the association with the requested printer and transmits the images for printing.

4.3.1.2.1.2 Proposed Presentation Contexts

The Proposed Presentation Context Table for the Print SCU is as shown in following Table.

Presentation Context Table – Proposed					
Abstract Syntax		**Transfer Syntax**		**Role**	**Extended Negotiation**
Name	UID	Name	UID		
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Basic Color Print Management Meta SOP Class	1.2.840.10008.5.1.1.18	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Verification SOP Class	1.2.840.10008.1.1	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Printer SOP Class	1.2.840.10008.5.1.1.16	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None
Print Job SOP Class	1.2.840.10008.5.1.1.14	DICOM Implicit VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

Note: Certain Presentation Contexts may be negotiated that are not used during the association. See the following sections for the DICOM Print services performed by the GEHC CT.

4.3.1.2.2 SOP Specific Conformance Statement

The Print SCU supports the following mandatory SOP cla s, which are defined under the Basic Grayscale Print Management Meta SOP Class and Basic Color Print Management Meta SOP Class.

The Print SOP Classes supported by Print SCU:

NAME	**UID**

Basic Film Session SOP Class	1.2.840.10008.5.1.1.1
Basic Film Box SOP Class	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box SOP Class	1.2.840.10008.5.1.1.4
Basic Color Image Box SOP Class	1.2.840.10008.5.1.1.4.1
Printer SOP Class	1.2.840.10008.5.11.16

The Print SCU does not support any optional SOP Classes.

Note: The asterisk (*) preceding some of the SOP attributes in the following sections indicates optional SCP attributes. The SCU is aware of these optional attributes and will not fail on the receipt of a response without the optional attributes; the limitation being that this information is not available for the User. Some SCP's will terminate the association with a failure upon the receipt of an optional attribute it does not support.

4.3.1.2.2.1 Basic Film Session SOP Class

The Print SCU supports the following DIMSE Service Ele ents for the Basic Film Session SOP Class.

N-CREATE – Requests the Print SCP to create an instance of Basic Film Session.

The following Attribute values are supported by the N-CREATE:

Attribute	DICOM Tag	Valid Range	Default Value
* Number of Copies	(2000, 0010)	1-99	Set by user
* Print Priority	(2000, 0020)	HIGH / MED / LOW	Set in Configuration file (Default value is HIGH)
* Medium Type	(2000, 0030)	CLEAR FILM BLUE FILM PAPER	Set in Configuration File
* Film Destination	(2000, 0040)	MAGAZINE PROCESSOR	Set in Configuration File

Note: ***** denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-CREATE operation of Film session the following action will be taken by Print SCU:

0x213 "Resource Limitation" message will be logged.

All other status "Failure" message will be logged.

In all the cases the print session will be terminated.

4.3.1.2.2.2 Basic Film box SOP Class

The Print SCU supports the following DIMSE Service Elements for the Basic Film Box SOP Class.

N-CREATE – Requests the Print SCP to create an instance of Film Box.

N-ACTION – Requests the Print SCP to print the Film Box onto Printer.

N-DELETE – Requests the Print SCP to delete the Film Box Instance.

The Following Attribute values are supported:

Attribute	DICOM Tag	Valid Range	Default Value
Image Display Format	(2010, 0010)	STANDARD/C,R Printer Dependent	Set in User Interface
Reference Film Session Sequence	(2010, 0500)		
Referenced Image Box Sequence	(2010,0510)	NA	NA
*Film Orientation	(2010, 0040)	PORTRAIT	Set in Configuration File
Film Size ID	(2010, 0050)	Sent zero length	Sent zero length
*Magnification type	(2010, 0060)	BILINEAR CUBIC REPLICATE NONE	Set in Configuration File
*Max Density	(2010, 0130)	0-4095	Set in Configuration File
Configuration Information	(2010, 0150)	Printer Dependent	Set in Configuration File
*Smoothing type	(2010, 0080)	Printer Dependent	Set in Configuration File
*Border density	(2010, 0100)	BLACK WHITE	Set in Configuration File
*Empty image density	(2010, 0110)	BLACK WHITE	Set in Configuration File
*Min density	(2010, 0120)	0-4094	Set in Configuration File
*Trim	(2010, 0140)	NO	NO

Note: Attributes “sent zero length” use the camera default values.

Note: ***** denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-CREATE operation of Film box following action will be taken by Print SCU.

0x213: “Resource Limitation” message will be sent.

0x106: “Unsupported Film Format” message will be sent.

All other status: “Failure” message will be sent

In all the cases the print session will be terminated.

If Failure status is returned during N-ACTION operation of Film box following action will be taken by Print SCU.

0xC602: “Unable to Create Print Job” message will be sent.

All other status: “Failure” message will be sent.

In all the cases the print session will be terminated.

If Failure status is returned during N-DELETE operation of Film box following action will be taken by Print SCU.

All the return status: “Failure” message will be sent and the print session will be terminated.

4.3.1.2.2.3 Basic Grayscale Image Box SOP Class

The Print SCU supports the following DIMSE Service Ele ents for Grayscale Image Box SOP Class.

N-SET – Requests the Printer to set the image box attributes.

The Following Attribute values are supported:

Attribute	DICOM Tag	Valid Range	Default Value
Image Position	(2020, 0010)	Based on Image Display Format	No Default Value
Pre-formatted Grayscale Image Sequence	(2020, 0110)		
Samples per pixel	(0028, 0002)	1	1
Photometric Interpretation	(0028, 0004)	MONOCHROME2	MONOCHROME2
Rows	(0028, 0010)	Image Dependent	Image Dependent
Columns	(0028, 0011)	Image Dependent	Image Dependent
Pixel Aspect Ratio	(0028, 0034)	1/1	1/1
Bits Allocated	(0028, 0100)	8	8
Bits Stored	(0028, 0101)	8	8
High Bit	(0028, 0102)	7	7
Pixel Representation	(0028, 0103)	0 (unsigned integer)	0 (unsigned integer)
Pixel Data	(7FE0,0010)	Pixel data	Pixel data
*Polarity	(2020, 0020)	NORMAL	NORMAL

Note: * denotes that the attribute is optional for the SCU. However, we do provide values for all of these optional attributes and if the SCP does not support the requested value it may choose to either return a failure status or ignore the value provided and use its default value.

If Failure status is returned during N-SET operation of Image Box following action will be taken by Print SCU.

0xC605: “Resources temporarily not available” message ill be sent.

All other status: “Failure” message will be sent.

In all the cases the print session will be terminated.

4.3.1.2.2.4 Printer SOP Class

N-GET DIMSE service is supported for the Printer SOP Class. If an N-EVENT-REPORT DIMSE service is received when the association is active, Print SCU handles the relevant states but the data received is ignored.

Print SCU issues the request to retrieve the following attributes:

Optional Attribute	DICOM Tag	Default Value
Printer Status	(2110, 0010)	Printer shall return Value
Printer Status Info	(2110, 0020)	Printer may return Value
Printer Name	(2110, 0030)	Printer may return Value
Manufacturer	(0008, 0070)	Printer may return Value
Manufacturer Model Name	(0008, 1090)	Printer may return Value
Device Serial No.	(0018, 1000)	Printer may return Value
Software Versions	(0018, 1020)	Printer may return Value
Date Last Calibrated	(0018, 1200)	Printer may return Value
Time Last Calibrated	(0018, 1201)	Printer may return Value

The Print SCU issues the N-GET service to retrieve the printer status. The status is processed as follows:

- If Printer status (2110, 0010) is NORMAL, the film is printed.
- If Printer status (2110, 0010) is FAILURE, the print job is terminated. The Printer Status Info (2110, 0020) attribute is not processed.
- If Printer status (2110, 0010) is WARNING, one of three things will happen:

  a) If the Printer Status Info (2110, 0020) is “SUPPLY LOW” the status is displayed to the user and the print job continues.

  b) If the Printer Status Info (2110, 0020) is “RECEIVER FULL” or “SUPPLY EMPTY” or “FILM JAM” the status is displayed to the user and the print job is aborted.
  For all other Printer Status Info (2110, 0020) values, the status is ignored and the print job continues.

4.3.1.2.2.5 Print Job SOP Class

Print SCU looks for following attributes in N-EVENT REPORT data received from Print SCP. If Print SCU does not receive N-EVENT_REPORT it requests the Print SCP to retrieve the following set of attributes using N-GET.

Attribute Name	DICOM Tag	Default Value
Execution Status	(2100, 0020)	Value returned by Print SCP
Execution Status info	(2100, 0030)	Value returned by Print SCP
Print Priority	(2000, 0020)	Value returned by Print SCP
Creation Date	(2100, 0040)	Value returned by Print SCP
Creation Time	(2100, 0050)	Value returned by Print SCP
Printer Name	(2110, 0030)	Value returned by Print SCP
Originator	(2100, 0070)	Value returned by Print SCP

4.3.1.2.2.6 Basic Color Image Box SOP Class

The Basic Color Image Box SOP Instance is created by the SCP at the time the Basic Film Box SOP Instance is created, based on the value of the Basic Film Box Attribute Image Display Format (2010,0010).

The following DIMSE Services are applicable to the IOD:

N-SET - The N-SET may be used to update an instance of the Basic Color Image Box SOP Class.

Note: There is no N-CREATE because Instances of the Basic Color Image Box SOP Class are created by the SCP as a result of the N-CREATE of the Film Box SOP Instance.

Attribute Name	DICOM Tag	Default Value
Image Box Position	(2020,0010)	SCU shall send Value to printer
Basic Color Image Sequence	(2020,0111)	SCU shall send Value to printer
>Samples Per Pixel	(0028,0002)	SCU shall send Value to printer
>Photometric Interpretation	(0028,0004)	SCU shall send Value to printer
>Planar Configuration	(0028,0006)	SCU shall send Value to printer
>Rows	(0028,0010)	SCU shall send Value to printer
>Columns	(0028,0011)	SCU shall send Value to printer
>Pixel Aspect Ratio	(0028,0034)	SCU shall send Value to printer
>Bits Allocated	(0028,0100)	SCU shall send Value to printer
>Bits Stored	(0028,0101)	SCU shall send Value to printer
>High Bit	(0028,0102)	SCU shall send Value to printer
>Pixel Representation	(0028,0103)	SCU shall send Value to printer

>Pixel Data	(7FE0,0010)	SCU shall send Value to printer
Polarity	(2020,0020)	SCU shall send Value to printer
Magnification Type	(2010,0060)	SCU shall send Value to printer
Smoothing Type	(2010,0080)	SCU shall send Value to printer
Requested Image Size	(2020,0030)	SCU shall send Value to printer
Requested Decimate/Crop Behavior	(2020,0040)	SCU shall send Value to printer

The status values which are specific for this SOP Class are defined as follows.

Status	**Meaning**	
Warning	Image size larger than image box size, the imagehas been demagnified.	B604
	Image size is larger than the Image Box size. The Image has been cropped to fit.	B609
	Image size or Combined Print Image size is larger than the Image Box size. The Image or combined Print Image has been decimated to fit.	B60A
Failure	Image size is larger than image box size	C603
	Insufficient memory in printer to store the image	C605
	Combined Print Image size is larger than the Image Box size.	C613

4.3.1.3 Association Acceptance Policy

The Print SCU does not accept associations.

4.4 Communication Profiles

4.4.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

4.4.1.1 TCP/IP Stack

The TCP/IP stack is inherited from the UNIX Operating System.

4.4.1.1.1 API

Not Applicable

4.4.1.1.2 Physical Media Support

Ethernet v2.0, IEEE 802.3**.**

4.5 Standard Extended / Specialized / Private SOPs

None.

4.6 Configuration

4.6.1 AE Title/Presentation Address Mapping

The Local AE title is "hostname_DCP", where “hostname” is the unique hostname within the network.

The GEHC CT system allows the user to “add”, “Remove”, or “Update” the mapping of remote DICOM Printer AE Titles to IP Addresses and Ports. These options can be selected from the Service Desktop camera installation utility.

Note: If “hostname_DCP” is greater than 16 characters then the name of the local AE title is limited to first 16 characters.

4.6.2 Configurable Parameters

The following fields are configurable for the DICOM Print SCU AE:

Note: All configurations should be performed by a GE Field Service Engineer.

- Local IP Address
- Local IP Netmask
- Max PDU length
- The following DICOM print parameters are configurable. The valid ranges are shown in earlier sections of this conformance statement.
    - Medium Type (2000, 0030)
    - Film Destination (2000, 0040)
    - Magnification Type (2010, 0060)
    - Min Density (2010, 0120)
    - Max Density (2010, 0130)
    - Empty Image Density (2010, 0110)
    - Border Density (2010, 0100)
    - Configuration Information (2010, 0150)
    - Smoothing Type (2010, 0080)
- The following network timers are supported and are configurable. When these timers expire the association is terminated. The default values are:
    - Association Time out = 120 seconds
    - Session Time out = 1200 seconds (total time for open association)
    - N-SET Time out = 300 seconds
    - N-ACTION Time out = 300 seconds

- N-CREATE Time out = 300 seconds
- N-DELETE Time out = 300 seconds
- N-GET Time out = 100 seconds

- Time-outs, which are set for all hosts, are configurable in dprint.cfg:
  *Association time-out - *bi_assoc_tio*
  *Session timeout - *bi_session_tio*
  *Create timeout - *bi_ncreate_tio*

Note: All configurations are performed by a GE Field Service Engineer.

4.7 Support of Extended Character Set

The Print SCU does not support any Extended Character Set.

5 DICOM Storage Commitment SCU Conformance

5.1 Introduction

This section of the DICOM conformance statement specif e Storage Commitment Push Model SOP class as user, the optional attributes and service elements supported.

5.2 Implementation Model

5.2.1 Application data flow diagram

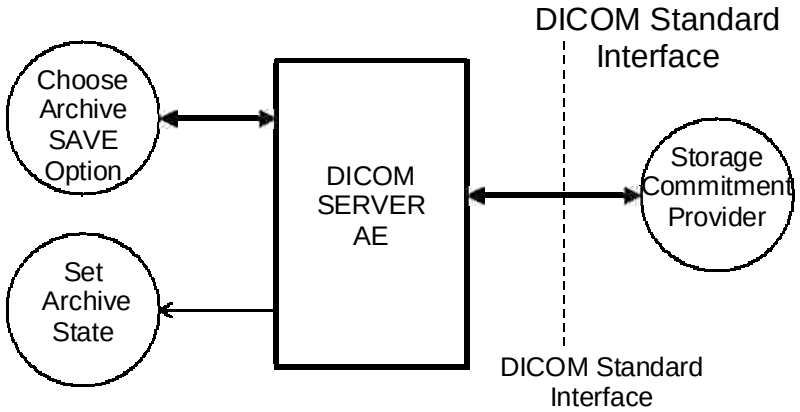
Illustration 5.1.1 shows the data flow diagram of Storage Commitment SCU. There is only one Real-World activity that will cause the DICOM Server Application Entity (DICOM Server AE) to initiate an association to a remote DICOM entity that is a Service Class Provider (SCP) of the Storage Commitment SOP class.

The *Choose Archive save Option* Real-World activity consists of an operator choosing a remote DICOM AE that supports Storage Commitment as provider as the archive device and selecting one or more exam or series from the loca se and choosing either *Save Exam* or *Save Series* from the archive menu. The images to be committed are sent to the remote provider entity first. The Commitment request for the transferred image instances is sent after the complete image transfer. The Commitment response must come on a different association.

There is no Real-World activity required for the DICOM Server AE to respond to an incoming Storage Commitment response from the remote DICOM AE.

Illustration 5.2.1

Application Data Flow Diagram



5.2.2 Functional definitions

DICOM Server AE initiates the following operations:

- Negotiates and establishes association with remote Storage Commitment Provider
- Sends the selected images to the remote DICOM AE.
- Closes the association.
- If all the images are transferred without failures the following steps will be executed. If there are any failures the job will be marked as failed and the Storage Commitment request will not be sent.
- Establishes a new association for sending the commitment request. Here note that a storage commitment request does not imply that the acquisition of images is complete.
- Closes the association for sending the commitment request. Receives the response on a different association.
- Updates the archive flag information for successful in ces. The archive flag is shared with the local archive and the two cannot be distinguished.

5.2.3 Sequencing of real-world activities

The user has to select the remote commitment provider and the exams/series to be pushed before clicking Save Exam/Series button on the Archive menu.

5.3 AE Specifications

5.3.1 DICOM Storage Commitment SCU specifications

Provides Standard Conformance to the following DICOM 3.0 SOP class as an SCU:

SOP class name	SOP class UID
Storage Commitment Push model SOP class	1.2.840.10008.1.20.1

5.3.1.1 Association establishment policies

5.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all assoc n establishment requests. The maximum length PDU for association initiated by the DICOM Storage Commitment SCU AE is:

Maximum Length PDU	**10 Kbytes**

5.3.1.1.2 Number of associations

A single association is used to send the commitment request. This commitment request association is closed after the request is successfully acknowledged. It accepts an association for receiving the response from commitment provider at any time.

5.3.1.1.3 Asynchronous nature

Asynchronous window negotiation is not supported.

5.3.1.1.4 Implementation identifying information

The table in Appendix D identifies the Implementation UID for this product version.

5.3.1.2 Association initiation policy

An association is initiated by the Storage SCU to the provider to send the images to be committed. A separate association is established to send the commitment request.

5.3.1.3 Real World Activity

5.3.1.3.1 Associated Real World Activity - ”Save exam/series”

The user selects the exam/series to be committed. All the images currently in the selected exam/series will be sent to the selected remote archive node (which is also the Storage commitment SCP) using DICOM C-STORE operations. Once all the images are transferred the commitment request will be sent on a separate association.

5.3.1.3.2 Associated Real World Activity - ”Auto Archive exam/series”

The Auto archive API’s are used to archive the exams/series onto local archive media or the remote archive node (which shall be a Storage Commitment SCP) without manual interface. If the default device selected for Auto Archive is a remote Storage Commitment SCP then all the images currently in the specified exam/series will be sent to the selected Storage commitment SCP using C-STORE operations. On successful transfer of all the images the Storage Commitment request will be sent.

5.3.1.4 Proposed Presentation Contexts

The Proposed Presentation Context table for the DICOM Storage Commitment SCU is as shown in following Table.

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended
Name	UID	Name	UID		Negotiation

Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	DICOM Implict VR Little Endian Transfer Syntax	1.2.840.10008.1.2	SCU	None

The Storage Commitment SCU can send the commitment request for following DICOM 3.0 SOP classes.

NAME	UID
CT Image Storage SOP Class	1.2.840.10008.5.1.4.1.1.2
Secondary Capture Storage SOP Class	1.2.840.10008.5.1.4.1.1.7

5.3.1.5 Request Processing

The images in the selected exam/series are sent to the remote commitment provider entity using DICOM C-STORE operations. If there are any failures in the image transfers the Storage commitment request will not be sent. The corresponding job will be marked as failed and user will be notified of the status of job.

If all the images are successfully transferred then the commitment request will be sent on a different association with the list of sop instances.

If the N-Action request fails, the job will be marked as failed otherwise following sequence of actions will take place.

The SCU waits for N-Action-Rsp from provider on the same association for a configurable amount of time. If it does not receive N-Action-Rsp during this time it will close the association. It changes the Job state to ”Wait” indicating the job is waiting for the response from commitment provider. The job will be marked as failed if the response is not received by stop job time. Stop job time is the maximum duration the job can wait for responses.

A New transaction uid will be created for each retry by user. The old transaction uid is not applicable for these requests.

The Following DIMSE service Elements are supported for the Storage Commitment request and response processing.

N-ACTION – Requests the remote Storage Commitment SCP to commit to storing the image instances.

N-EVENT-REPORT – The response sent by the remote Storage Commitment SCP.

The following attributes are sent as part of the **DATA Set** for the **N-Action request**.

Attribute	Tag	Value
Transaction UID	(0008,1195)	Transaction UID
Referenced SOP Sequence	(0008,1199)	
SOP Class UID	(0008,1150)	
SOP Instance UID	(0008,1155)	

§ Referenced Study Component sequence attribute is not sent.

§ Storage Media File-Set ID and Storage Media File-Set UID attributes are not supported.

5.3.1.6 Response Processing

Once the N-EVENT REPORT response is received, the following actions will be taken depending on the status of response.

5.3.1.6.1 Commit response with SUCCESS status

The Archive flag information in the browser for all the successful instances will be updated. The status will be changed to “Y”.

The job queue entry will be removed

Note: The following attributes are expected as part of **DATA Set** for **N-Event-Request** from SCP

Attribute	Tag	Value
Transaction UID	(0008,1195)	Value received from SCP
Referenced SOP Sequence	(0008,1199)	Value received from SCP
SOP Class UID	(0008,1150)	Value received from SCP
SOP Instance UID	(0008,1155)	Value received from SCP

N-Event-Response will be sent on the same association itself. No DATA Set will be sent along with the response.

5.3.1.6.2 Commit response with FAILURE status

The following attributes are expected as part of **DATA Set** for **N-Event-Request** from SCP:

Attribute	Tag	Value
Transaction UID	(0008,1195)	Value received from SCP
Failed SOP Sequence	(0008,1198)	Value received from SCP
SOP Class UID	(0008,1150)	Value received from SCP
SOP Instance UID	(0008,1155)	Value received from SCP
Failure Reason	(0008,1197)	Value received from SCP

In case of complete/partial failure the user will be n ied about the status and the job entry will be paused. There is no attempt made to retry automatically the failed sop instances. However the user can manually retry the failed jobs. Such requests will be treated as new requests. This will go through the whole sequence of operations once again.

The failure reason is ignored.

Failed SOP instances will have their archive flag information unaltered.

Note: The archive status flag in the browser is a shared flag with local archive. When the status is “Y”, it means that the images are archived but doesn’t specify whether on local archive device or remote archive device. It is left to the user’s discretion whether the local sop instances (with their archive flag set to “Y”) are to be deleted.

N-Event-Response will be sent on the same association itself. No DATA Set will be sent along with the response.

Note: (0008, 1199) Reference SOP Sequence is not handled.

5.3.1.7 Association Acceptance Policy

A single association will be accepted at any time to receive Storage Commitment responses.

5.4 Communication Profiles

5.4.1 Supported Communication Stacks (parts 8,9)

DICOM Upper Layer (Part 8) is supported using TCP/IP.

5.4.2 TCP/IP Stack

The TCP/IP stack is inherited from a UNIX Operating System.

5.4.2.1 Physical Media Support

Ethernet v2.0, IEEE 802.3**.**

5.4.3 Point-to-Point Stack

A 50-pin ACR-NEMA connection is not applicable to this product.

5.5 Extensions/Specialization/Privatizations

None.

5.6 Configuration

Ethernet v2.0, IEEE 802.3**.**

5.6.1 AE Title/Presentation Address Mapping

The system allows the user to “add”, “Remove”, or “Update the mapping of remote AE Titles to IP Addresses and Ports. These options can be selected from the “Remote Host Selection” menu displayed by choosing “Select Remote Host” from the “Network” pull-down menu from the local database manager. A remote DICOM host can be designated as a “remote archive device” by setting the “Remote archive node” radio button on the remote host configuration panel. Once a DICOM host is designated as a “remote archive device” the host will be available in the “Archive” de ction menu and can be chosen for any subsequent archive operation.

5.6.2 Configurable Parameters

The following fields are configurable for the DICOM Server AE:

- Local AE Title (the machine hostname)
- Local IP Address
- Local IP Netmask
- Max PDU length
- Time-outs, which are set for all hosts, are configurable in dcs.cfg:

Note: * denotes any SOP class (time in sec)
*Association time-out - *bi_assoc_tio*
* Inactivity time-out - *bi_store_tio*
*Session time-out - *bi_session_tio*

Note: All configurations should be performed by a GE Field Service Engineer.

5.7 Support of Extended Character Sets

This does not support any Extended Character set.

6 Modality Worklist Information Model Definition

6.1 Introduction

This section of the DICOM Conformance Statement specif s the compliance to DICOM conformance requirements for the relevant **Networking** features on this GEHC product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the while reading this section.

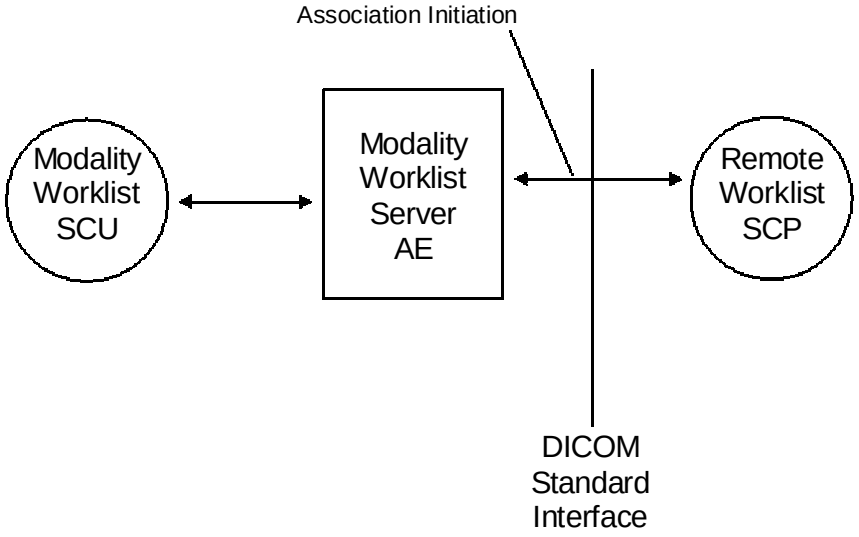
The ModalityWorklist option for GEHC CT allows a user to query for and display DICOM modality worklist information from a remote hospital or radiology department information system computer. For example, a user may wish to query for all procedures scheduled to be performed on the scanner. In this situation, ModalityWorklist is providing the DICOM C-FIND service as a service class user (SCU).

6.2 Implementation Model

All DICOM functionality provided by the ModalityWorkli is logically provided by the Worklist Server DICOM AE. The Worklist Server DICOM AE is commanded to perform DICOM modality worklist query services through the use of the GEHC CT user interface.

6.2.1 Application Data Flow Diagram

The Basic and Specific Application models for this device are shown in the following illustration:



6.2.2 Functional definitions

The ModalityWorklist Worklist Server AE is implemented as an application process on the scanner host computer. It runs as a daemon serving requests from the user interface to obtain modality worklists, query remote AE's and return the results to the user interface.

The ModalityWorklist Worklist Server AE initiates the following functions:

- *Query*: Initiates a DICOM association in order to query a re E. If the remote AE accepts a presentation context applicable to modality worklist, the Worklist Server AE will issue a modality worklist query request via the C-FIND service.

6.2.3 Sequencing of Real-World Activities

1. The user or the system initiates a modality worklist q odality worklist SCU) to the modality worklist SCP with a given set of query parameters.
2. The modality worklist SCP returns responses that match the query parameters.
3. Items from the returned worklist responses are presented to the user.
4. A subset of the returned worklist responses is included in acquired DICOM images related to the responses.

6.3 AE Specifications

6.3.1 Worklist Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an **SCU**:

SOP Class Name	SOP Class UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31

6.3.1.1 Association Establishment Policies

6.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU for an association initiated by the DICOM Worklist Server is:

Maximum Length PDU	50 Kbytes

The SOP Class Extended Negotiation is not supported.

The maximum number of Presentation Context Items that will be proposed is 1.

The user information Items sent by this product are:

- Maximum PDU Length
- Implementation UID

6.3.1.1.2 Number of Associations

The Worklist Server AE (SCU) will initiate only one DICOM association at a time to perform a modality worklist query of a single remote AE.

6.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

6.3.1.1.4 Implementation Identifying Information

The table in Appendix D identifies the Implementation UID for this product version.

6.3.1.2 Association Initiation Policy

The Worklist Server AE initiates a new association due to an update operation being initiated from the GEHC CT user interface.

6.3.1.2.1 Real-World Activity: Worklist Query

6.3.1.2.1.1 Associated Real-World Activity

The operator of the system initiates a query for a modality worklist by either opening the Schedule screen or by opening the Schedule screen and pressing the Update button. The choice of which of these two behaviors occurs is user configurable. The Worklist Server will then initiate an association with the remote AE in order to query for the worklist

A user can configure a number of parameters that directly control the worklist query request. The user can request worklist items that are intended for the scanner the user is working at, all items that apply to the modality of the scanner the user is g at or all worklist items available. These selections and their affects on worklist query parameters are given below:

This Scanner:	• Modality, (0008,0060) - set to CT • Scheduled Station AE Title, (0040,0001) - set to local AE title
This Modality:	• Modality, (0008,0060) - set to CT • Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)
All Scanners	• Modality, (0008,0060) - zero-length (universal matching) • Scheduled Station AE Title, (0040,0001) - zero-length (universal matching)

The scheduled dates of procedures of interest can be specified for query by selecting a specific date range. The date ranges available are Today, Days Before Today, Days After Today and All Days. These selections and their affects on worklist query parameters are given below:

Today:	Scheduled Procedure Step Start Date (0040,0002) - set to YYYYMMDD, where this date is the current date.
Days Before Today and Days After Today:	Scheduled Procedure Step Start Date (0040,0002) - set to YYYYMMDD-YYYYMMDD, where this date range represents the specified number of days before today and/or after today. Note that number of days both before and after can be specified in the same query and that each always includes today.
All Days:	Scheduled Procedure Step Start Date (0040,0002) - zero-length (universal matching)

6.3.1.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the Worklist Server AE after real-world activity "Worklist Query" has been initiated:

Presentation Context Table - Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

6.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for the Worklist SOP Class

If the remote AE does not support the proposed Presentation Context, an appropriate error is logged and the operator is notified.

This implementation can receive multiple C-FIND results over a single association. Only one association is opened at a time.

Each C-FIND response received from the remote AE is parsed to verify the length/type of the items in the response). Upon detecting any error in the response data, the Worklist Server AE will save worklist entry in binary format for investigative purposes and the Worklist Server AE will continue receiving worklist entries. Note: All worklist entries, valid and invalid, can be configured to be saved in binary format.

On receipt of any error from the remote AE, the Worklist Server will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained. Warnings received from the remote AE are ignored.

Each C-FIND operation supports a configurable “Association Timer.” This timer starts when the association request is sent or received and stops when the association is established. The default time-out value is 30 seconds.

Each C-FIND operation supports a configurable “Session Timer.” This timer starts when an association is established and stops when the association is ended. The default time-out value is 3600 seconds.

If any of the above timers expires, the association is aborted (A-ABORT) and the operation in progress is considered to be failed. Any previously received worklist items are discarded.

6.3.1.2.1.2.2 Record Acceptance Policy

The GEHC CT implementation adheres to strict value che ng of incoming query responses from the remote AE. Each response received is examined to verify that all Type 1 attributes are present with non-zero length, that all Type 2 attributes are present (possibly with zero length) and that the data for all attributes is consistent with respect to the attributes’ value representation (VR).

Any inconsistencies in the response data, with respect categories described above, are considered errors. Upon detecting any such errors in the response data, the Worklist Server AE will issue a C-FIND-CANCEL and, upon receipt of a C-FIND-RSP (or if an applicable timer expires), will abort the association. All previously received worklist items are retained. Note that the absence of requested Type 3 attributes is not considered an error.

Fields considered Type 1 by the Worklist Server include:

- (0010,0010), Patient Name
- (0010,0020), Patient ID
- (0020,000D), Study Instance UID
- (0040,0001), Scheduled Station AE Title
- (0040,0002), Scheduled Procedure Step Start Date [1]
- (0040,0003), Scheduled Procedure Step Start Time [1]
- (0040,0009), Scheduled Procedure Step ID
- (0040,1001), Requested Procedure ID

[1] Start Date must be of the form YYYYMMDD, exactly eight numeric characters, and Start Time must be of the form HHMMSS, exactly six numeric characters.

Fields considered Type 2 by Worklist Server include:

- (0008,0050), Accession Number
- (0008,0060), Modality
- (0008,0090), Referring Physician Name
- (0010,0030), Patient Date of Birth
- (0010,0040), Patient Sex
- (0010,1030), Patient Weight in kg

- (0010,2000), Medical Alerts
- (0010,2110), Contrast Allergies
- (0010,21C0), Pregnancy Status
- (0032,1032), Requesting Physician
- (0032,1070), Requested Contrast Agent
- (0038,0010), Admission ID
- (0038,0050), Special Needs
- (0038,0300), Current Patient Location
- (0038,0500), Patient State
- (0040,0006), Performing Physician
- (0040,0010), Scheduled Station Name
- (0040,0011), Scheduled Procedure Step Location
- (0040,0012), Pre-order Medication
- (0040,1003), Requested Procedure Priority
- (0040,1004), Patient Transport Arrangements
- (0040,3001), Confidentiality Constraint

6.3.1.3 Association Acceptance Policy

The Worklist Server AE does not respond to attempts by a remote AE to open an association.

6.4 Communication Profiles

6.4.1 Supported Communication Stacks (PS 3.8, PS 3.9)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

6.4.2 OSI Stack

The OSI Communication Stack is not supported by this imp mentation.

6.4.3 TCP/IP Stack

The TCP/IP Communication Stack is inherited from the operating system.

6.4.3.1 API

Not applicable to this product.

6.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

6.4.4 Point-to-Point Stack

The Point-to-Point Communication Stack is not supported by this implementation.

6.5 Extensions / Specializations / Privatizations

6.5.1 Standard Extended /Specialized/Private SOPs

ModalityWorklist for GEHC CT does not implement any private transfer SOP classes.

6.5.2 Private Transfer Syntaxes

ModalityWorklist for GEHC CT does not implement any private transfer syntaxes.

6.6 Configuration

The ModalityWorklist feature is configured by GEHC Field Service engineers. The DICOM configuration items below are configurable or re-configurable by a Field Service Engineer and are not accessible by users through the GEHC CT user interface.

6.6.1 AE Title/Presentation Address Mapping

ModalityWorklist allows for the configuration of the following parameters that pertain to the remote AE.

- Remote AE (HIS/RIS) IP address – IP address used to contact the remote AE
- Remote AE (HIS/RIS) IP port – IP port used to contact the remote AE

These parameters define where worklist queries will be directed. Configuration of these parameters is performed by GEHC Field Service engineers using the ModalityWorklist installation facilities.

6.6.2 Configurable Parameters

The following parameters are configurable for the DICOM Worklist Server AE:

- Local (Worklist Server) AE Title (automatically set to host name of scanner)
- Local IP address
- Local IP netmask
- Local IP gateway

The following parameters are configurable by changing their values in the configuration file **/usr/g/config/WLdcm.cfg**. Note that these parameters typically need not be changed. Furthermore, no support is provided for retaining changed settings: the values will require changing again after a system software upgrade.

- Implementation UID
- PDU size
- Association time-out period
- Session time-out period
- C-FIND time-out period

6.7 Support of Extended Character Sets

ModalityWorklist will support only the ISO_IR 100 (ISO 8859-1:1987 Latin alphabet N 1. supplementary set) as extended character sets.

6.8 Modality Worklist Information Model Definition

6.8.1 Introduction

This section specifies the use of the DICOM Modality Worklist Information Model used to organize data and against which a Modality Worklist Query will be performed. The contents of this section are:

6.8.2 - Information Model Description

6.8.3 - Information Model Entity-Relationship Model

6.8.4 - Information Model Module Table

6.8.5 - Information Model Keys

6.8.2 Modality Worklist Information Model Description

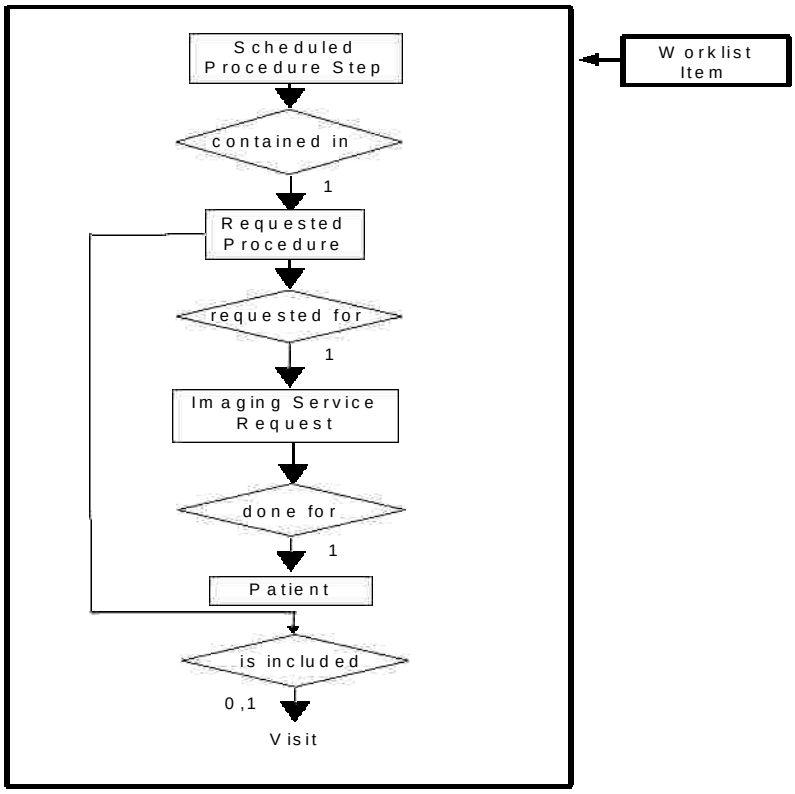
In order to serve as a Service Class Provider (SCP) of the Modality Worklist Service Class, a DICOM Application Entity (AE) possesses information about the attributes of a number of managed worklist items. These items are organized into Modality Worklist Information Modules. In this Service Class, the Information Model plays a role similar to an Information Object Definition of most other DICOM Service Classes.

6.8.3 Modality Worklist Information Model Entity-Relationship Model

The Entity-Relationship diagram for the Modality Worklist Information Model schema is shown in Illustration 6.8.3-1. It represents the information that composes a Worklist Item. In this figure, the following diagrammatic convention is established to represent the information organization:

- Each entity is represented by a rectangular box
- Each relationship is represented by a diamond shaped box.
- The fact that a relationship exists between two entities is depicted by lines connecting the corresponding entity boxes to the relationship boxes.

Illustration 6.8.3-1 – Modality Worklist Information Model E/R DIAGRAM



6.8.4 Entity Descriptions

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

6.8.4.1 Scheduled Procedure Step

A Scheduled Procedure Step is an arbitrarily defined scheduled unit of service that is specified by the Procedure Plan for a Requested Procedure. It specifies one or more Action Items (events) involving equipment (i.e. imaging modality equipment), human resources, location and time (i.e. start time, stop time, duration).

6.8.4.2 Requested Procedure Entity Description

A Requested Procedure is an instance of a Procedure of a given Procedure Type. An instance of a Requested Procedure includes all of the items of information that are specified by an instance of a Procedure Plan that is selected for the Requested Procedure by the imaging service provider.

6.8.4.3 Imaging Service Request Entity Description

An Imaging Service Request is a set of one or more Requested Procedures selected from a list of Procedure Types. An Imaging Service Request is submitted by one authorized

imaging service requester to one authorized imaging service provider in the context of one Service Episode.

6.8.4.4 Visit Entity Description

A Visit is the context in which the treatment or management of an arbitrary subset of a Patient's medical conditions occurs. A Visit is limited to the description of a Patient's activities at a single facility.

6.8.4.5 Patient Entity Description

A Patient is a person receiving, or registered to receive, healthcare services.

6.8.5 ModalityWorklist Mapping of DICOM Entities

Table 6.8.5-1 —Mapping of DICOM Entities to ModalityWorklist Entities

DICOM	ModalityWorklist Entity
Scheduled Procedure Step	Exam
Requested Procedure	Exam
Imaging Service Request	Exam
Visit	Exam
Patient	Patient

6.8.6 Information Model Module Table

Within an entity of the DICOM Modality Worklist Inform odel, attributes are grouped together into related set of attributes called modules. A module facilitates the understanding of the semantics concerning the attributes and how the attributes relate to one another. A module grouping does not infer any encoding of information into datasets.

Table 6.8.6-1 identifies the defined modules within the entities that comprise the DICOM Modality Worklist Information Model. Modules are identified by Module Name.

See DICOM PS 3.3 and PS 3.4 for a complete definition of the entities, modules, and attributes.

Table 6.8.6-1 – Modality Worklist Information Model Modules

Entity Name	Module Name	Reference
Scheduled Procedure Step	SOP Common	6.8.9.1
	Scheduled Procedure Step	6.8.9.2
Requested Procedure	Requested Procedure	6.8.10.1
Imaging Service Request	Imaging Service Request	6.8.11.1
Visit	Visit Identification	6.8.12.1
	Visit Status	6.8.12.2
	Visit Relationship	6.8.12.3
	Visit Admission	6.8.12.4
Patient	Patient Relationship	6.8.13.1
	Patient Identification	6.8.13.2
	Patient Demographic	6.8.13.3
	Patient Medical	6.8.13.4

6.8.7 Information Model Keys

Please refer to DICOM Standard PS 3.3. (Information Object Definitions) and PS 3.4 (Service Class Specifications) for a description of each of the Entities contained within the Modality Worklist Information Model.

The following Module descriptions contain the attributes that are present in a C-FIND request message sent by the Worklist Server AE to a remote AE. It should be noted that they are the same as those defined in the DICOM Standard, PS 3.4 (Service Class Specifications) and include:

- Name
- Tag group and element numbers
- Expected Matching Key Type: R-required, O-optional

- Expected Return Key Type:
  - 1 - non-zero value required
  - 1C - conditionally of type 1
  - 2 - required to be present, possibly with zero-length value
  - 3 - optional
- Mapped into The Image - whether this data is mapped into subsequently acquired images
- Notes - clarification of this implementation's use/treatment of this attribute

All data elements in the following Module descriptions are requested by the Worklist Server AE. Values of data elements that are not mapped into images, and are not otherwise dealt with (displayed on the user interface, etc.), are not used and are, thus, discarded upon receipt. See Table B-1 for further information.

Data elements for which values can be sent for matching purposes are described as such. Data elements for which values are not sent are sent with zero length and universal

matching will apply. This is the default case if no ot cription to the contrary is provided.

6.8.8 Supported Matching

The following are the types of matching that can be request by the implementation:

- Single Value matching
- Universal Matching
- Range of date/time

6.8.9 Scheduled Procedure Step Entity

6.8.9.1 SOP Common Module

Table 6.8.9-1 – SOP Common Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Specific Character Set	(0008,0005)	O	1C	Yes	Matching for this item is supported only for the character set ISO_IR 100, if a patient name in the query includes characters from the IR-100 set.

6.8.9.2 Scheduled Procedure Step Module

Table 6.8.9-2 – Scheduled Procedure Step Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Scheduled Procedure Step Sequence	(0040,0100)	R	1	No	
Scheduled Station AE Title	(0040,0001)	R	1	No	Matching is supported as follows: either no AE title is supplied (universal matching), or the scanner's Worklist Server AE title is supplied for matching; this is user selectable.

Scheduled Procedure Step Start Date	(0040,0002)	R	1	No	Matching is supported as one of the following; this is user selectable: • all days, • today only, • today and a number of days before today, • today and a number of days after today, • today and a number of days before today and a number of days after today. Number of days before/after is specified by the user. Returned values must be exactly 8 numeric characters in YYYYMMDD format.
Scheduled Procedure Step Start Time	(0040,0003)	R	1	No	This attribute is sent with zero-length. Returned values must be exactly 6 numeric characters in HHMMSS format.
Modality	(0008,0060)	R	1	Yes	Matching is supported as follows: either no Modality is supplied (universal matching), or the scanner's Modality is supplied for matching; this is user selectable.
Scheduled Performing Physician's Name	(0040,0006)	R	2	No	This attribute is sent with zero-length.
Scheduled Procedure Step Description	(0040,0007)	O	1C	No	
Scheduled Station Name	(0040,0010)	O	2	No	
Scheduled Procedure Step Location	(0040,0011)	O	2	No	
Scheduled Protocol Code Sequence	(0040,0008)	O	1C	No	
Code Value	(0008,0100)	O	1C	No	
Coding Scheme Designator	(0008,0102)	O	1C	No	
Code Meaning	(0008,0104)	O	3	No	
Pre-Medication	(0040,0012)	O	2C	No	
Scheduled Procedure Step ID	(0040,0009)	O	1	No	
Requested Contrast Agent	(0032,1070)	O	2C	No	Displayed on "More Info..." screen.

6.8.10 Requested Procedure Entity

6.8.10.1 Requested Procedure Module

Table 6.8.10.1-1 Requested Procedure Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Requested Procedure ID	(0040,1001)	O	1	No	User can enter the value for Requested Procedure Id prior to query. If user has entered the value then that value will be sent as part of the query. The value returned in the response shall be mapped to the image.
Requested Procedure Description	(0032,1060)	O	1C	No	Truncated to 22 characters.
Requested Procedure Code Sequence	(0032,1064)	O	1C	No	
Code Value	(0008,0100)	O	1C	No	
Coding Scheme Designator	(0008,0102)	O	1C	No	
Code Meaning	(0008,0104)	O	3	No	
Study Instance UID	(0020,000D)	O	1	Yes	User can select whether this value is used or not. In case that it is not use, scanner generates study instance UID locally.
Referenced Study Sequence	(0008,1110)	O	2	No	
Ref. SOP class uid	(0008,1150)				
Ref. SOP Instance uid	(0008,1155)				
Requested Procedure Priority	(0040,1003)	O	2	No	
Patient Transport Arrangements	(0040,1004)	O	2	No	
Requested Procedure Location	(0040,1005)	O	3	No	
Confidentiality Code	(0040,1008)	O	3	No	

6.8.11 Imaging Service Request Entity

6.8.11.1 Imaging Service Request Module

Table 6.8.11.1-1 – Imaging Service Request Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note

Accession Number	(0008,0050)	O	2	Yes	User will be able to enter value for Accession Number prior to query to be sent as part of C-FIND request. Truncated to 16 characters.
Requesting Physician	(0032,1032)	O	2	No	
Referring Physician's Name	(0008,0090)	O	2	Yes	Truncated to 26 characters
Requesting Service	(0032,1033)	O	3	No	

6.8.12 Visit Entity

6.8.12.1 Visit Identification

Table 6.8.12.1-1 – Visit Identification Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Admission ID	(0038,0010)	O	2	No	
Institution Name	(0008.0080)	O	3	No	

6.8.12.2 Visit Status

Table 6.8.1.12.2-1 – Visit Status Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Current Patient Location	(0038,0300)	O	2	No	Displayed on “More Info...” screen.

6.8.12.3 Visit Relationship

Table 6.8.12.3-1 – Relationship Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Referenced Patient Sequence	(0008,1120)	O	2	No	
Referenced SOP Class UID	(0008,1150)	O	2	No	
Referenced SOP Instance UID	(0008,1155)	O	2	No	

6.8.12.4 Visit Admission

No data elements are requested from the Visit Admissio e.

6.8.13 Patient Entity

6.8.13.1 Patient Relationship

No data elements are requested from the Patient Relationship Module.

6.8.13.2 Patient Identification

Table 6.8.13.2-1 – Patient Identification Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient's Name	(0010,0010)	R	1	Yes	This attribute is sent with zero-length. Truncated to 64 characters.
Patient ID	(0010,0020)	R	1	Yes	This attribute is sent with zero-length. Truncated to 16 characters.

6.8.13.3 Patient Demographic

Table 6.8.13.3-1 – Patient Demographic Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient's Birth Date	(0010,0030)	O	2	Yes	
Patient's Sex	(0010,0040)	O	2	Yes	
Patient's Weight	(0010,1030)	O	2	Yes	Limited to maximum value of 999 kg.
Confidentiality constraint on patient data	(0040,3001)	O	2	No	
Patient's Size	(0010,1020)	O	3	No	
Patient's Address	(0010,1040)	O	3	No	
Patient's Telephone Numbers	(0010,2154)	O	3	No	

6.8.13.4 Patient Medical

Table 6.8.13.4-1 – Patient Medical Module Attributes

Attribute Name	Tag	Expected Matching Key Type	Expected Returned Key Type	Mapped into the Image	Note
Patient State	(0038,0500)	O	2	No	
Pregnancy Status	(0010,21C0)	O	2	No	Displayed on "More Info..." screen.
Medical Alerts	(0010,2000)	O	2	No	Displayed on "More Info..." screen.
Contrast Allergies	(0010,2110)	O	2	No	Displayed on "More Info..." screen.
Special Needs	(0038,0050)	O	2	No	Displayed on "More Info..." screen.
Additional Patient History	(0010,21B0)	O	3	No	Displayed on "More Info..." screen.

6.9 Private Data Dictionary

The ModalityWorklist implementation does not define any Private Attributes within the Modality Worklist Information Model.C-FIND Request Message

This section provides a detailed description of the C-FIND request message data that is provided to the remote AE during a worklist query operation. The dump in Table 6.10-1 below lists, in exact message order, the fields transferred as part of the C-FIND request message for a typical query.

In this particular dump, no values are specified for the Scheduled Procedure Step Start and End Dates (the attributes are sent with zero length). In DICOM this is interpreted as meaning all dates (i.e. universal matching). The Modality is also not specified in this particular dump, meaning all modalities. Note that the user, through the use of the GEHC CT user interface, can submit a worklist query that will cause non-zero values to be sent for these attributes.

Table 6.10-1 – C-FIND Request Message Dump

```
(0008,0000) UL 108                              #   4, 1 IdentifyingGroupLength
(0008,0005) CS [ISO_IR 100]                     #  12, 1 SpecificCharacterSet
(0008,0050) SH (no value available)             #   0, 0 AccessionNumber
(0008,0080) LO (no value available)                0, 0 InstitutionName
(0008,0090) PN (no value available)             #   0, 0 ReferringPhysicianName
(0008,1110) SQ (Sequence explicit length #=1)          24, 1 ReferencedStudySequence
  (fffe,e000) na (Item with explicit length #=2)    #  16, 1 Item
    (0008,1150) UI (no value available)             #   0, 0 ReferencedSOPClassUID
    (0008,1155) UI (no value available)             #   0, 0 ReferencedSOPInstanceUID
  (fffe,e00d) na (ItemDelimitationItem for re-encoding)  #   0, 0 ItemDelimitationItem
(fffe,e0dd) na (SequenceDelimitationItem for re-encod.) #   0, 0 SequenceDelimitationItem
(0008,1120) SQ (Sequence explicit length #=1)          24, 1 ReferencedPatientSequence
  (fffe,e000) na (Item with explicit length #=2)    #  16, 1 Item
    (0008,1150) UI (no value available)             #   0, 0 ReferencedSOPClassUID
    (0008,1155) UI (no value available)             #   0, 0 ReferencedSOPInstanceUID
  (fffe,e00d) na (ItemDelimitationItem for re-encoding)  #   0, 0 ItemDelimitationItem
(fffe,e0dd) na (SequenceDelimitationItem for re-encod.) #   0, 0 SequenceDelimitationItem
(0010,0000) UL 120                              #   4, 1 PatientGroupLength
(0010,0010) PN (no value available)             #   0, 0 PatientName
(0010,0020) LO (no value available)             #   0, 0 PatientID
(0010,0030) DA (no value available)             #   0, 0 PatientBirthDate
(0010,0040) CS (no value available)             #   0, 0 PatientSex
(0010,1000) LO (no value available)             #   0, 0 OtherPatientID
(0010,1020) DS (no value available)             #   0, 0 PatientSize
(0010,1030) DS (no value available)             #   0, 0 PatientWeight
(0010,1040) LO (no value available)                0, 0 PatientAddress
(0010,2000) LO (no value available)                0, 0 MedicalAlerts
(0010,2110) LO (no value available)                0, 0 ContrastAllergies
(0010,2154) SH (no value available)             #   0, 0 PatientTelephoneNumber
(0010,2160) SH (no value available)             #   0, 0 EthnicGroup
(0010,21b0) LT (no value available)                0, 0 AdditionalPatientHistory
(0010,21c0) US (no value available)             #   0, 0 PregnancyStatus
(0010,4000) LT (no value available)             #   0, 0 PatientComments
(0020,0000) UL 8                                #   4, 1 ImageGroupLength
(0020,000d) UI (no value available)             #   0, 0 StudyInstanceUID
(0032,0000) UL 64                               #   4, 1 StudyGroupLength
(0032,1032) PN (no value available)             #   0, 0 RequestingPhysician
(0032,1033) LO (no value available)                0, 0 RequestingService
(0032,1060) LO (no value available)             #   0, 0 RequestedProcedureDescription
(0032,1064) SQ (Sequence explicit length #=1)          32, 1 RequestedProcedureCodeSequence
  (fffe,e000) na (Item with explicit length #=3)    #  24, 1 Item
    (0008,0100) SH (no value available)             #   0, 0 CodeValue
    (0008,0102) SH (no value available)             #   0, 0 CodingSchemeDesignator
    (0008,0104) LO (no value available)             #   0, 0 CodeMeaning
  (fffe,e00d) na (ItemDelimitationItem for re-encoding)  #   0, 0 ItemDelimitationItem
(fffe,e0dd) na (SequenceDelimitationItem for re-encod.) #   0, 0 SequenceDelimitationItem
(0038,0000) UL 32                                  4, 1 VisitGroupLength
```

```
(0038,0010) LO (no value available)                 #   0, 0 Adm      nID
(0038,0050) LO (no value available)                     0, 0 SpecialNeeds
(0038,0300) LO (no value available)                     0, 0 CurrentPatientLocation
(0038,0500) LO (no value available)                 #   0, 0 PatientState
(0040,0000) UL 228                                  #   4, 1 ModalityWorklistGroupLength
(0040,0100) SQ (Sequence explicit length #=1)           148, 1 ScheduledProcedureStepSequence
  (fffe,e000) na (Item with explicit length #=12)     # 140, 1 Item
    (0008,0060) CS [CT]                             #   2, 1 Modality
    (0032,1070) LO (no value available)             #   0, 0 RequestedContrastAgent
    (0040,0001) AE (no value available)             #   0, 0 ScheduledStatio  AETitle
    (0040,0002) DA [-20091208]                      #  10, 1 ScheduledProcedureStepStartDate
    (0040,0003) TM (no value available)             #   0, 0 ScheduledProcedureStepStartTime
    (0040,0006) PN (no value available)             #   0, 0 ScheduledPerformingPhysiciansName
    (0040,0007) LO (no value available)             #   0, 0 ScheduledProcedureStepDescription
    (0040,0008) SQ (Sequence explicit length #=1)       #  32, 1 ScheduledActionItemCodeSequence
      (fffe,e000) na (Item with explicit length #=3)    #  24, 1 Item
        (0008,0100) SH (no value available)             #   0, 0 CodeValue
        (0008,0102) SH (no value available)             #   0, 0 CodingSchemeDesignator
        (0008,0104) LO (no value available)             #   0, 0 CodeMeaning
      (fffe,e00d) na (ItemDelimitationItem for re-encoding)  #   0, 0 ItemDelimitationItem
    (fffe,e0dd) na (SequenceDelimitationItem for re-encod.) #   0, 0 SequenceDelimitationItem
    (0040,0009) SH (no value available)             #   0, 0 ScheduledProcedureStepID
    (0040,0010) SH (no value available)             #   0, 0 ScheduledStationName
    (0040,0011) SH (no value available)             #   0, 0 ScheduledProcedureStepLocation
    (0040,0012) LO (no value available)             #   0, 0 PreMedication
  (fffe,e00d) na (ItemDelimitationItem for re-encoding)  #   0, 0 ItemDelimitationItem
(fffe,e0dd) na (SequenceDelimitationItem for re-encod.) #   0, 0 SequenceDelimitationItem
(0040,1001) SH (no value available)                 #   0, 0 RequestedProcedureID
(0040,1003) SH (no value available)                 #   0, 0 RequestedProcedurePriority
(0040,1004) LO (no value available)                     0, 0 PatientTransportArrangements
(0040,1005) LO (no value available)                     0, 0 RequestedProcedureLocation
(0040,1008) LO (no value available)                 #   0, 0 ConfidentialityCode
(0040,1010) PN (no value available)                 #   0, 0 NamesOfIntendedRecipientsOfResults
(0040,1400) LT (no value available)                 #   0, 0 RequestedProcedureComments
(0040,2400) LT (no value available)                 #   0, 0 ImagingServiceRequestComments
(0040,3001) LO (no value available)                     0, 0 ConfidentialityConstraintOnPatientData
```

If the query is for a particular date range, the ScheduledProcedureStepStartDate will be filled with a valid date range. If either the start or end date are left blank by the user, they will simply be blank in the query.

Below is an example of a date range for August 30, 1997 through October 12, 1997.

```
(0040,0002) DA    [19970830-19971012]   #    18,  1  ScheduledProcedureStepStartDate
```

Below is an example of a date range for August 30, 1997 through the end of time.

```
(0040,0002) DA    [19970830-]   #    18,  1  ScheduledProcedureStepStartDate
```

Below is an example of a date range from the beginning of time through August 30, 1997.

```
(0040,0002) DA    [-19970830]   #    18,  1  ScheduledProcedureStepStartDate
```

If the query is for records for this modality, the Modality will be filled in as follows:

```
(0008,0060) CS    [CT]                #     2,  1  Modality
```

If the query is for records for this Scanner, the Moda y will be filled in with CT as above and the Scheduled Station AE Title will be filled in with the lue configured for this system. For example, this station was configured as CTRoom1.

```
(0040,0001) AE    [CTRoom1]            #     8,  1  ScheduledStationAETitle
```

User will be able to enter the values for “Accession Number” prior to the query. If value is entered then that value will be sent as part of the query. For example, if “1234” is entered then

```
(0008,0050) SH    [1234]  #     4,  1  AccessionNumber
```

User will be able to enter the values for “Requested Procedure Id” prior to the query. If value is entered then that value will be sent as part of the query. For example, if “3456” is entered then

```
(0040,1001) SH    [3456]  #    4, 1  RequestedProcedureID
```

User will be able to enter the values for “Patient Id” prior to the query. If value is entered then that value will be sent as part of the query. For example, if “6789” is entered then

```
(0010,0020) LO    [6789]  #    4, 1  PatientID
```

User will be able to enter the values for “Patient Name” prior to the query. If value is entered then that value will be sent as part of the query. For example, if “Lastname^Firstname” is entered then

```
(0010,0010) PN    [Lastname^Firstname]  #    18, 1  PatientName
```

6.10 Use of Specific DICOM Data

This section details the use of the DICOM data returned by remote AEs during worklist queries. The GEHC CT user interface fields that display the data, along with the data’s mapping into resulting acquired and transferred DICOM images, are presented in following table 6.11-1.

Table 6.10-1 – Specific Data Usage

DICOM Worklist Data Element	Patient Schedule Screen Field	GEHC CT DICOM Image Data Element
Accession Number (0008,0050)	Req Number	Accession Number Truncated to 16 characters.
Patient ID (0010,0020)	Patient ID	Truncated to 16 characters.
Patient Name (0010,0010)	Patient Name	Truncated to 64 characters..
Patient’s Birth Date (0010,0030)	Patient Age (Patient Birth Date user to calculate age)	Patient Birth Date
Patient's Sex (0010,0040)	Sex	Patient’s Sex
Patient's Weight (0010,1030)	Weight in Kg	Patient's Weight
Referring Physician’s Name (0008,0090)	Referring Physician	Referring Physician’s Name Truncated to 26 characters
Requested Procedure Description (0032,1060)	Exam Description	Not available.
Scheduled Procedure Step Start Date (0040,0002)	Date	Not available.
Scheduled Procedure Step Start Time (0040,0003)	Time	Not available.

Scheduled Performing Physician's Name (0040,0006)	Performing Physician (only displayed on the "More Info.." screen)	Not available.
Study Instance UID (0020,000d)	Study instance UID (only displayed on the "More Info..." screen)	Study Instance UID, **if User has set the preference to "Use MWL Study UID".**
Requested Procedure Id (0040,1001)	Requested Proc ID	Not available.
Pregnancy Status (0010,21C0)	Pregnancy Status (only displayed on the "More Info..." screen)	Not available.
Medical Alerts (0010,2000)	Medical Alerts (only displayed on the "More Info..." screen)	Not available.
Contrast Allergies (0010,2110)	Contrast Allergies (only displayed on the "More Info..." screen)	Not available.
Special Needs (0038,0050)	Special Needs (only displayed on the "More Info..." screen)	Not available.
Requested Contrast Agent (0032,1070)	Requested Contrast Agent (only displayed on the "More Info..." screen)	Not available.
Current Patient Location (0038,0300)	Current Patient Location (only displayed on the "More Info..." screen)	Not available.
Additional Patient History (0010,21B0)	Additional Patient History (only displayed on the "More Info..." screen)	Patient History.

Note that the display of a specific data item on the "More Info..." screen is contingent on the item being enabled for display. Depending on the preferences of each specific site, data can either be displayed or not. A GE field service engineer can assist in setting these site preferences.

6.11 Setting User Preferences

6.11.1 Setting "Use MWL Study UID " Option

Setting this option to "**Yes**" copies the **Study Instance UID** from Worklist into the final **DICOM Image header**. If this option is set to "**No**" then a new study instance uid will be generated locally.

1. Click on "Patient Schedule"
2. Click on "Preferences" button
3. Set the option "Use Study UID", to either "Yes" or "No"

6.11.2 Setting Custom Query Option

This option allows the user to enter values for "Acces n Number" and / or " Requested Procedure Id" , which are used for Custom Query.

1. Click on "Patient Schedule"
2. Click on "Preferences" button

3. Set the option "**Show Update Parameters** ", to "**Yes"**

4. To do a query click on "Update" button.
   A User Interface appears, with provision to enter values for:

   a) Accession Number

   b) Requested Procedure Id

7 PERFORMED PROCEDURE STEP CONFORMANCE STATEMENT

7.1 Introduction

This section of the DICOM Conformance Statement specifies the compliance to DICOM conformance requirements for the Performed Procedure Step feature on this GEHC product. Note that the format of this section strictly follows the format defined in DICOM Standard PS 3.2 (Conformance). Please refer to that part of the standard while reading this section. The PPS option for GEHC CT allows a Moda med Procedure Step to be communicated to the Hospital/Radiology information system. The PPS feature is providing the DICOM Modality Performed Procedure Step service as a service class user (SCU).

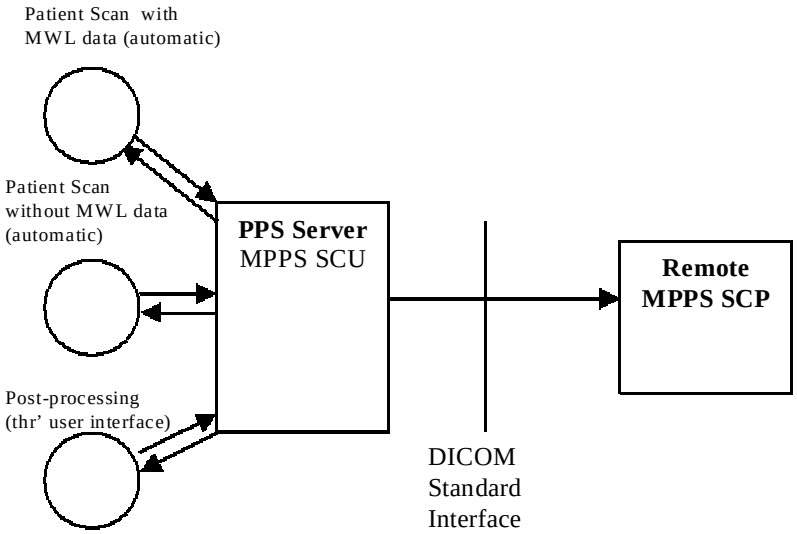
This feature works in conjunction with DICOM Modality orklist feature, if installed. However the conformance of this feature is independent of Modality Worklist feature. For information on conformance of Modality Worklist feature to DICOM standard please refer to the appropriate section or document.

7.2 Implementation Model

The DICOM 'Performed Procedure Step' service is provided by the PPS Server DICOM AE. The PPS Server DICOM AE is commanded to perform Performed Procedure Step services either automatically or through the user interface.

7.2.1 Application Data Flow Diagram

The basic Application models for the feature are shown in the following illustration:



7.2.2 Functional Definition of AEs

The PPS Server AE is implemented as an application pro s on the scanner host computer. It runs as a daemon serving requests from other applications to send the PPS information to the remote AE and return the results to the requesting application.

The PPS Server AE initiates the following functions.

- *Start PPS*: Initiates a DICOM association in order to create a DICOM Modality Performed Procedure Step SOP instance in the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to create the SOP instance in the remote AE via the N-CREATE service.

- *Complete PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with the remote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'COMPLETED'.

- *Discontinue PPS*: Initiates a DICOM association in order to update a DICOM Modality Performed Step instance that is already created with t mote AE. If the remote AE accepts a presentation context applicable to Modality performed Procedure Step, the PPS Server AE will issue a request to update the SOP instance in the remote AE via the N-SET service. The PPS Status is set to 'DISCONTINUED'.

7.2.3 Sequencing of Real-World Activities

7.2.3.1 PPS from Acquisition System with MWL data

The system has a Modality Worklist Server AE installed. Worklist information is obtained from HIS/RIS system through the use of Basic Worklist Management Service. Use of the information retrieved in the creation of Image SOP instance is described in the Modality Worklist Conformance statement. Use of the information retrieved in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a s e. when the image acquisition is started. The system retrieves necessary information related to the Scheduled Procedure Step from Modality Worklist Server. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.

- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user. ***The DICOM association is closed.***

- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.

- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also

given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance that is already created**. The N-SET is sent over a new DICOM association**

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might wish to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section. **PPS messages N-CREATE (if applicable) and N-SET will be sent over the same DICOM association**

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

7.2.3.2 PPS from acquisition system without MWL data

The system either does not have a Modality Worklist Server AE installed or a Modality Worklist Server AE installed but no Worklist information is obtained from HIS/RIS system for the current procedure that is being performed. The information required for performing the procedure is supplied through the user interface of the system. The use of this information in MPPS SOP instances is described later in this document.

- The system initiates a 'Start PPS' before starting a s e. when the image acquisition is started. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE.

- The MPPS SCP returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

- System includes the necessary information related to Scheduled Procedure Steps and the Performed procedure Step in the image instances created.

- At the end of image acquisition, system initiates a 'Complete PPS' or 'Discontinue PPS' based on the choice selected by the user using the user interface provided. The user is also given a choice 'Defer PPS' which is described below. PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance that is already created.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

- At the end of image acquisition, if the user has chosen 'Defer PPS', the user is provided with an interface to 'Complete PPS' or 'Discontinue PPS' at any later time. The user might wish to alter the image set generated through acquisition, before invoking these operations. Note that the user explicitly uses the user interface provided to invoke this operation, as in the case of PPS generated for post-processing, which is described in the following section.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

7.2.3.3 PPS from post-processing system

- The user initiates post-processing on the images generated through acquisition.

- The system creates a Modality performed Procedure Step instance locally in the system. If the source image instance has the Scheduled Procedure Step information, it is copied into the image instances created. Also the system includes the necessary information related to the Modality Performed Procedure Step into the image instance.

- At the end of (one or more) post-processing, the user initiates 'Complete PPS' or 'Discontinue PPS' through the user interface provided. PPS Server AE initiates a MPPS (Modality Performed Procedure Step) N-CREATE request to the remote AE (MPPS SCP), in-order to create a MPPS SOP instance at the remote AE (ch is actually a replica of the locally created MPPS SOP instance).

- The remote AE returns response indicating the success/failure of the request execution. If the response indicates success, PPS Server AE initiates a MPPS N-SET request to the remote AE, in-order to update the MPPS SOP instance that is already created, with the additional information.

- The remote AE returns response indicating the success/failure of the request execution. The PPS state information is updated in the system based on the response data, and is presented to the user.

7.3 AE Specification

7.3.1 PPS Server AE Specification

This Application Entity provides Standard Conformance to the following DICOM SOP Classes as an SCU:

SOP Class Name	SOP Class UID
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3

7.3.1.1 Association Establishment Policies

7.3.1.1.1 General

The DICOM Application Context Name (ACN), which is always proposed, is:

Application Context Name	1.2.840.10008.3.1.1.1

The Maximum Length PDU negotiation is included in all association establishment requests. The maximum length PDU from an association initiated by the PPS Server AE is:

Maximum Length PDU	128 Kbytes

The SOP Class Extended negotiation is not supported.

The maximum number of presentation negotiation items that will be proposed is 1.

The user information items sent by this AE are

- Maximum PDU Length
- Implementation UID

7.3.1.1.2 Number of Associations

The PPS Server will initiate only one DICOM associatio me to perform a PPS operation to the remote AE.

7.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations are performed synchronously.

7.3.1.1.4 Implementation Identifying information

The table in Appendix D identifies the Implementation UID for this product version.

7.3.1.2 Association Initiation Policy

The PPS Server AE initiates a new association for ever initiated.

7.3.1.2.1 Real-World Activity: Performed Procedure Step creation and update

7.3.1.2.1.1 Associated Real-World Activity

The real-world activities are mentioned in section 7*.2.3 Sequencing of Real-World Activities*. Each of the real world activity results in either creating a new Performed procedure Step SOP instance at the remote SCP or updating an already created Performed Procedure Step SOP instance as per the DICOM standard.

7.3.1.2.1.2 Proposed Presentation Context Table

The following table shows the proposed presentation contexts for the PPS Server AE after any of the real-world activity listed in section 7*.2.3 Sequencing of Real-World Activities*, is initiated.

Presentation Context Table – Proposed					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		

Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

7.3.1.2.1.2.1 SOP Specific DICOM Conformance Statement for MPPS SOP class

If the remote AE does not support the proposed Presentation context, an appropriate error message logged. Only one association is opened at a time.

All the operations used by this SOP class support an association timer, which is configurable. The timer is started when a request (association request, N-CREATE request or N-SET request) is send and stopped when the respective response is received. The default time-out value is 300 seconds.

All the operations used by this SOP class support a “Session Timer”. This timer is started when the association is established and stopped when association is ended. The default time-out value is 3000 seconds.

If any of the above timers expires the association is aborted and the operation in-progress is considered FAILED.

In any case an operation (N-CREATE or N-SET) fails, system updates the state to enable operator to manually invoke the operation at any later time.

7.3.1.3 Association Acceptance Policy

The PPS Server AE does not respond to attempts by remote AE to open an association.

7.4 Communication Profiles

7.4.1 Supported Communication Stacks (PS 3.8)

DICOM Upper Layer (PS 3.8) is supported using TCP/IP.

7.4.2 OSI Stack

The OSI Communication stack is not supported by this i plementation.

7.4.3 TCP/IP Stack

The TCP/IP stack is inherited from the operating system

7.4.3.1 API

Not Applicable to this product.

7.4.3.2 Physical Media Support

Ethernet 802.3 provides the physical network layer for this product.

7.4.4 Point-to-Point Stack

The Point-to-Point Stack is not supported by this implementation.

7.5 Extensions/Specialization/Privatization

7.5.1 Standard Extended/Specialized/Private SOPs

PPS for GEHC CT does not implement any private SOP cla s.

7.5.2 Private Transfer Syntaxes

PPS for GEHC CT does not implement any private Transfer Syntaxes.

7.6 Configuration

The PPS feature is configured by GEHC Field Service Engineers. The DICOM configuration items below are configurable or re-configurable by the Field Service Engineer and are not accessible by users through the GEHC CT's user interface.

7.6.1 AE Title/Presentation address Mapping

PPS allows for the configuration of the following para hat pertain to the remote AE.

- Remote MPPS AE IP Address: IP Address used to contact the remote MPPS AE
- Remote AE (HIS/RIS) IP Port: IP Port used to contact the remote MPPS AE
- Remote MPPS AE Title: Application Entity Title used to contact the remote MPPS AE

These parameters define where the MPPS requests will be directed. Configuration of these parameters is performed by GEHC Field Service engineers, using the installation facilities.

7.6.2 Configurable Parameters

The following are configurable for the PPS Server AE:

- Local (PPS Server AE) AE Title (The default is host na e scanner appended with string "_PPS". If the length exceeds 16 characters the AE Title is truncated to a length of 16.)
- Local IP Address
- Local IP net-mask
- Local IP gateway
- The following parameters are configurable, but need change only in case of a system software upgrade:
- Implementation UID
- PDU size
- Association time-out period
- Session time-out period

7.7 Support of Extended Character Sets

PPS supports ISO_IR 100 character set.

7.8 N-create & N-set Request Message

PPS Feature for GEHC CT supports all named attributes listed in Table F.7.2.1 in PS3.4 of DICOM standard. That is, attributes that are not explicitly referenced by name in the table are not supported. (Example is last row in the table reads "All other attributes from Radiation Dose Module and Billing and Material Code Module". The attributes referenced here are not supported).

For the MPPS associated with an acquisition, the follo ibutes are copied from the Modality Worklist SCU into the MPPS request Message, if procedure performed corresponds to the SPS information retrieved through the Modality Worklist.

GEHC Brivo CT supports the selection of single SPS for a scan. The following are applicable.

- Single SPS selection results in single PPS message
- Multiple SPS selection is not allowed.
- Referenced Study Sequence - a maximum of ten Item's is supported. *This attribute will be present only if SPS information is available from Modality Worklist SCU.*
- At the end of acquisition the user might choose to 'Defer PPS' and later choose to 'Complete PPS' or 'Discontinue PPS' from the user interface provided in the system. In this case, the date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of acquisition)
- Mapping of SPS data to **MPPS SOP instance** is explained in section 7.10
- Mapping of specific SPS data to **CT DICOM IMAGE HEADER** , for PPS is explained in section 7.11

For the MPPS associated with a post-processing the following restrictions apply on the attributes listed below.

- Referenced Study Sequence – The sequence is not sent in the MPPS message
- Scheduled Step Attribute Sequence – a maximum of ONE item is supported. The attribute will be send only if SPS information is available in the image instance.
- Referenced Patient Sequence – This sequence is not added
- Scheduled Protocol Code Sequence – The sequence is not send in the MPPS message
- Performed Procedure Step Start date & Performed Procedure Step start time – The exam date and exam time that is the Start date and Start Ti ssociated Study Component (Exam) is used, not the actual time when post-processing started.
- Performed Procedure Step end date & Performed Procedure Step end time - The date and time when user chooses to 'Complete PPS' or 'Discontinue PPS' is taken as the Performed Procedure Step End Date and Performed Procedure Step End Time respectively (Not the actual end date and end time of post-processing).
- Procedure Code Sequence – This sequence is sent with ZERO items in the MPPS message
- Performed Protocol Code Sequence – This sequence is sent with ZERO items in the MPPS message.
- Referenced Standalone SOP Instance Sequence – The sequence is sent with ZERO items in the MPPS message.

7.9 Error Handling and Recovery

PPS Server AE does not define any extended error codes. The standard error codes are handled. On a response with status 'success' for the N-CREATE or N-SET request, the system updates the state and indicates the same on the user interface. On a response with status other than 'success' the operation is deem led' and the system updates the state and indicates the same on the user interface. If the request has failed or response is not received before the association timeout, the operation is deemed 'Failed' and the system updates the state and indicates the same on the user interface.

If the operation is 'Failed', detailed message is logged into system log-file and system provides an alternative mechanism to retry the failed operation through the user interface to ensure that transient failures do not affect the feature performance.

7.10 MPPS SOP Instance Mapping

The following table gives specific usage of some of attributes in the MPPS SOP instance.

Attribute Name	Tag	Usage in MPPS Instance		
		Acquisition with MWL data	**Acquisition without MWL data**	**Post-Processing**
Specific Character Set	(0008,0005)	Not used, but copied into MPPS object	Not used, but copied into MPPS object	Not used, but copied into MPPS object
Scheduled Step Attribute Sequence	(0040,0270)	Only 1 item		Only 1 item
>Study Instance UID	(0020,000D)	Copied from SPS, if option to copy is selected or else created at the scanner	Created at the scanner	Copied from source image
>Referenced Study Sequence	(0008,1110)	Copied from SPS, if selected	Sent as empty element	Sent as empty element
>Accession Number	(0008,0050)	Copied from SPS, if selected	User input on the scanner	Copied from source image
>Placer Order Number/Imaging Service Request	(0040,2016)	Not sent as part of MPPS object	Not sent as part of MPPS object	Not sent as part of MPPS object
>Filler Order Number/Imaging Service Request	(0040,2017)	Not sent as part of MPPS object	Not sent as part of MPPS object	Not sent as part of MPPS object
>Requested Procedure ID	(0040,1001)	Copied from SPS, if selected	User input on the scanner	Copied from source image
>Requested Procedure Description	(0032,1060)	Copied from SPS, if selected	Not used	Not sent as part of MPPS object
>Placer Order Number/Procedure	(0040,1006)	Not sent as part of MPPS object	Not used	Not sent as part of MPPS object
>Filler Order Number/Procedure	(0040,1007)	Not sent as part of MPPS object	Not used	Not sent as part of MPPS object
>Scheduled Procedure ID	(0040,0009)	Copied from SPS, if selected	Not used	Copied from source image
>Scheduled Procedure	(0040,0007)	Copied from SPS, if selected	Not used	Copied from source image

Description				
>Scheduled Action Item Code Sequence	(0040,0008)	Copied from SPS, if selected	Not used	Not sent as part of MPPS object
Patient's Name	(0010,0010)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Patient ID	(0010,0020)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Patient's Birth Date	(0010,0032)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Patient's Sex	(0010,0040)	Copied from SPS, if selected	User input on the scanner	Copied from source image
Referenced Patient Sequence	(0008,1120)	Copied from SPS, if selected	Not used	No Item
Performed Procedure Step ID	(0040,0253)	Created at the scanner. Will have the following“PPS_ID_<exam number”	Created at the scanner. Will have the following“PPS_ID_<exam number”	New generated, may not be unique
Performed Station AE Title	(0040,0241)	Local system AE Title	Local system AE Title	Local system AE Title
Performed Station Name	(0040,0242)	Local system suite id	Local system suite id	Local system host-name
Performed Location	(0040,0243)	Local system suite id	Local system suite id	Sent as empty element
Performed Procedure Step Start Date	(0040,0244)	Same as exam start date	Same as exam start date	Same as exam start date
Performed Procedure Step Start Time	(0040,0245)	Same as exam start time	Same as exam start time	Same as exam start time
Performed Procedure Step Description	(0040,0254)	Copied from SPS, if selected	Not sent as part of MPPS object	Not sent as part of MPPS object
Performed Procedure Step status	(0040,0252)	See Note 1.	See Note 1.	See Note 1.
Performed Procedure Type Description	(0040,0255)	Sent as empty element	Sent as empty element	Sent as empty element
Procedure Code Sequence	(0008,1032)	Sent as empty element	Sent as empty element	Sent as empty element
Performed Procedure Step End Date	(0040,0250)	Date when all images got installed	Date when all images got installed	The date “Complete PPS” or “Discontinue PPS” is invoked, not the

				actual end of post-processing
Performed Procedure Step End Time	(0040,0251)	Time when all images got installed	Time when all images got installed	The time “Complete PPS” or “Discontinue PPS” is invoked, not the actual end of post-processing
Modality	(0008,0060)	Value “CT” is stored in MPPS object	Value “CT” is stored in MPPS object	Value “CT” is stored in MPPS object
Study ID	(0020,0010)	Same as exam number	Same as exam number	Copied from source image
Performed Protocol Code Sequence	(0040,0260)	Copied from SPS, if selected	Sent with zero length	Sent with zero length
Performed Series Sequence	(0040,0340)	One item for each series created	One item for each series created	One item for each series created with post-processing
>Performing Physician's Name	(0008,1050)	Copied from SPS, if selected	User input on the scanner	Sent as empty element
>Protocol Name	(0018,1030)	The name of the protocol selected on the scanner	The name of the protocol selected on the scanner	Copied from source image
>Operator's Name	(0008,1070)	User input on the scanner	User input on the scanner	Sent as empty element
> Series Instance UID	(0020,000E)	Created at the scanner	Created at the scanner	Created at the scanner
> Series Description	(0008,103E)	User input on the scanner	User input on the scanner	Unique name generated by post-processing
>Retrieve AE Title	(0008,0054)	Local system AE Title	Local system AE Title	AE Title of the system
>Referenced Image Sequence	(0008,1140)	One item for each image created within the series	One item for each image created within the series	One item for each image generated by post-processing
>Referenced Standalone SOP Instance Sequence	(0040,0220)	Sent as empty element	Sent as empty element	Sent as empty element
>All other attributes from Performed Series Sequence		Not sent as part of MPPS object	Not sent as part of MPPS object	Not sent as part of MPPS object

All other attributes from Radiation Dose Module and Billing and Material Code Module		Not sent as part of MPPS object	Not sent as part of MPPS object	Not sent as part of MPPS object

Note 1:
- When PPS start (N-CREATE) message is sent, this element will have the value “IN PROGRESS”
- When PPS end (N-SET) message is sent, this element will have either “COMPLETED” or “DISCONTINUED” based on user selection

7.11 Use of Specific DICOM Data

7.11.1 Patient Level

Attribute Name	Tag	Usage in CT DICOM Image Header
Patient Name	(0010,0010)	Copied from SPS, if selected
Patient ID	(0010,0020)	Copied from SPS, if selected, truncated to 16 characters.
Patient Birthdate	(0010,0030)	Copied from SPS, if selected
Patient Sex	(0010,0040)	Copied from SPS, if selected
Referenced Patient Sequence	(0008,1120)	Not used

7.11.2 Study Level

Attribute Name	Tag	Usage in CT DICOM Image Header
Study Instance UID	(0020,000D)	Copied from SPS, if selected. See 6.11.1 for details.
Study ID	(0020,0010)	Scanner generated study ID
Referring Physicians name	(0008,0090)	Copied from SPS, if selected
Accession Number	(0008,0050)	If multiple SPS’s are selected, then accession number from the first selection (determined by the user) is used, however, it is configurable to be set to zero length. Default is to use the accession number from the first selection.
Referenced Study Sequence	(0008,1110)	Not used

7.11.3 Series Level

Attribute Name	Tag	Usage in CT DICOM Image Header
Modality	(0008,0060)	Value “CT” is copied
Protocol Name	(0018,1030)	Name of the selected protocol is copied
Operator Name	(0008,1070)	Copied from SPS if selected and present otherwise generated from user input on scanner
Referenced Performed Procedure Step Sequence	(0008,1111)	Will be present only if SPS obtained form HIS/RIS is selected for scanning
Ref. SOP class uid	(0008,1150)	Value of MPPS SOP class UID
Ref. SOP Instance uid	(0008,1155)	Scanner generated unique UID
Requested Attribute Sequence	(0040,0275)	Will be present only if SPS obtained from HIS/RIS is selected for scanning. If multiple SPS’s are selected then this will contain multiple items one for each SPS. For all other cases this element will not be present
Requested Procedure Id	(0040,1001)	Not Used
Scheduled Procedure Step Id	(0040,0009)	Not Used
Scheduled Procedure Step description	(0040,0007)	Not used
Scheduled Protocol Code Sequence	(0040,0008)	Not used
Performed Procedure Step Id	(0040,0253)	Created at the scanner. The string “***PPS_ID_<examnumber>”*** is used.
Performed Procedure Step start date	(0040,0244)	Same as exam start date
Performed Procedure Step start time	(0040,0245)	Same as exam start time
Performed Procedure Step description	(0040,0254)	Exam description is used

APPENDIX A: CT Image and Secondary Capture Modules/Attributes

The tables below specify the attributes of the CT Image and Secondary Capture Image transmitted by the Storage SCU AE.

A.1 CT Image IOD

A.1.1 CT Image IOD Modules

Entity Name	Module Name	Référence	Usage
Patient	Patient	A.3.1	M
Study	General Study	A.3.2	M
	Patient Study	A.3.3	U
Series	General Series	A.3.4	M
Frame of Reference	Frame of Reference	A.4.5	M
Equipment	General Equipment	A.3.5	M
Image	General Image	A.3.6	M
	Image Plane	A.4.1	M
	Image Pixel	A.4.2	M
	Contrast/Bolus	A.4.3	C
	CT Image	A.4.4	M
	VOI LUT	A.3.7	U
	SOP Common	A.3.8	M

A.1.1.1 Implementation Specific details

- For all CT Images created by GEHC CT patient birth date element (0010,0030) is sent, if the operator has entered the details. If the operator has not entered the details it will be sent as a "Zero length element"
- The length of Accession number element (0008,0050) is a maximum of 16 characters
- Window Center (0028,1050) and Window Width (0028,1051) are sent for all CT Images created by GEHC CT
- Based on whether contrast was used or not the following applies for CT Images created by GEHC CT

Mode	(0018,0010)	(0018,1040)
No Contrast	Not sent	Not sent
Oral Contrast	Oral Contrast Agent name	The string "Oral"
IV Contrast	IV Contrast agent name	The String "IV"
Oral and IV contrast	Oral contrast agent " & " IV Contrast agent	The string "Oral & IV"

- Supported field length for DICOM fields

DICOM Tag	Field Name	Field Length
(0008, 0050)	Accession Number	16 characters
(0010, 0010)	Patient Name	Truncated to 64 characters
(0010, 0020)	Patient Id	Truncated to 16 characters

A.2 SC Image IOD

A.2.1 SC Image IOD Modules

Entity Name	Module Name	Reference	Usage
Patient	Patient	A.3.1	M
Study	General Study	A.3.2	M
	Patient Study	A.3.3	U
Series	General Series	A.3.4	M
Equipment	General Equipment	A.3.5	U
	SC Equipment	A.5.1	M
Image	General Image	A.3.6	M
	Image Pixel	A.5.2	M

	SC Image	Not sent (consists entirely of type 3 element).	M
	Modality LUT	A.5.3	U
	VOI LUT	A.3.7	U
	SOP Common	A.3.8	M

A.3 Common Modules

A.3.1 Patient Module

Attribute Name	Tag	Type	Attribute Description
Patient's Name	(0010,0010)	2	Patient's full legal name. Truncated to 64 characters.
Patient ID	(0010,0020	2	Primary hospital identification number or code for the patient. Truncated to 16 characters.
Patient's Birth Date	(0010,0030)	2	Patient's birth date.
Patient's Sex	(0010,0040)	2	Sex of the patient.
Referenced Patient Sequence	(0008,1120)	3	A sequence which provides reference to a Patient SOP Class/Instance pair.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance.

A.3.2 General Study Module

Attribute Name	Tag	Type	Attribute Description
Study Instance UID	(0020,000D)	1	Unique identifier for the Study.
Study Date	(0008,0020)	2	Date the Study started.
Study Time	(0008,0030)	2	Time the study started.
Referring Physician's Name	(0008,0090)	2	Patient's referring physician. Truncated to 26 characters.
Study ID	(0020,0010)	2	User or equipment generated Study Identifier.
Accession Number	(0008,0050)	2	Patient's accession number. Truncated to 16 characters.

Study Description	(0008,1030)	3	Institution-generated description or classification of the Study performed. Truncated to 22 characters.
Name of Physician(s) Reading Study	(0008,1060)	3	Physician(s) reading the Study. Truncated to 26 characters.
Referenced Study Sequence	(0008,1110)	3	A sequence which provides reference to a Study SOP Class/Instance pair.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP class.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP instance.

A.3.3 Patient Study Module

Attribute Name	Tag	Type	Attribute Description
Patient's Age	(0010,1010)	3	Age of the patient. Limited to 150.
Patient's Weight	(0010,1030)	3	Weight of the patient. Limited to 204kg
Additional Patient's History	(0010,21B0)	3	Additional information about the Patient's medical history. Truncated to 60 characters.

A.3.4 General Series Module

Attribute Name	Tag	Type	Attribute Description
Modality	(0008,0060)	1	Type of equipment that originally acquired the data used to create the images in this Series.
Series Instance UID	(0020,000E)	1	Unique identifier of the Series.
Series Number	(0020,0011)	2	A number that identifies this Series.
Laterality	(0020,0060)	2C	Laterality of (paired) body part examined.
Series Date	(0008,0021)	3	Date the Series started.
Series Time	(0008,0031)	3	Time the Series started.
Performing Physicians'	(0008,1050)	3	Name of the physicians administering the

Name			Series. Truncated to 26 characters.
Series Description	(0008,103E)	3	User provided description of the Series. Truncated to 29 characters.
Operators' Name	(0008,1070)	3	Technologist (s) supporting the Series. Truncated to 3 characters.
Referenced Study Component Sequence	(0008,1111)	3	Uniquely identifies the study Component SOP Instances to which the Series is related.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance.
Body Part Examined	(0018,0015)	3	Text description of the part of the body examined. Sent as either “HEAD”,”ORBITS”, ”CSPINE”, ”SHOULDER”, ”CHEST”, ”ABDOMEN”, ”LSPINE”, ”PELVIS” or “EXTREMITY”.
Patient Position	(0018,5100)	2C	Patient position descriptor relative to the equipment.
Performed Procedure Step Start Date	(0040,0244)	3	Sent when MPPS option is enabled
Performed Procedure Step Start Time	(0040,0245)	3	Sent when MPPS option is enabled
Performed Procedure Step ID	(0040,0253)	3	Sent when MPPS option is enabled
Performed Procedure Step Description	(0040,0254)	3	Sent when MPPS option is enabled
Requested Attributes Sequence	(0040,0275)	3	Sent when MPPS option is enabled and filled in based on what RIS provides to scanner. Number of items relates to number of items selected from Patient Schedule.
> Requested Procedure ID	(0040,1001)	1C	Always sent, copied from RIS
> Accession Number	(0008,0050)	3	Value from worklist sent
> Referenced Study Sequence	(0008,1110)	3	Value from worklist sent
> Study Instance UID	(0020,000D)	3	Value from worklist sent
> Requested Procedure Desc	(0032,1060)	3	Value from worklist sent
> Requested Procedure Code Sequence	(0032,1064)	3	Value from worklist sent
> Scheduled Procedure Step Desc	(0040,0007)	3	Value from worklist sent
> Scheduled Protocol Code Sequence	(0040,0008)	3	Value from worklist sent
> Scheduled Procedure Step ID	(0040,0009)	3	Value from worklist sent

> Reason for Requested Procedure	(0040,1002)	3	Value from worklist sent
> Reason for Requested Procedure Code sequence	(0040,1004)	3	Value from worklist sent

A.3.5 General Equipment Module

Attribute Name	Tag	Type	Attribute Description
Manufacturer	(0008,0070)	2	"GE MEDICAL SYSTEMS"
Institution Name	(0008,0080)	3	Institution where the equipment is located that produced the digital images. Truncated to 32 characters.
Station Name	(0008,1010)	3	User defined name identifying the machine that produced the digital images. Truncated to 8 characters.
Institutional Department Name	(0008,1040)	3	Department in the institution where the equipment is located that produced the digital images. Always sent as "CT" in this implementation.
Manufacturer's Model Name	(0008,1090)	3	Manufacturer's model number of the equipment that produced the digital images. Sent as "BRIVO CT315 " for BRIVO CT315, "BRIVO CT325 " for BRIVO CT355.
Device Serial Number	(0018,1000)	3	Manufacturer's serial number of the equipment that produced the digital images. Sent as 315.XXXXXXX for BRIVO CT315,325.XXXXXXX for BRIVO CT 325
Software Versions	(0018,1020)	3	Manufacturer's designation of software version of the equipment that produced the digital images. Sent "1.xx" for BRIVO system. X is either 0-9.
Spatial Resolution	(0018,1050)	3	The inherent limiting resolution in mm of the equipment for high contrast objects for the data gathering and reconstruction technique chosen. If variable across the images of the series, the value at the image center. Always sent as "0.350000" in this implementation.
Pixel Padding Value	(0028,0120)	3	Pixel Padding Value(0028, 0120) is used to pad non-rectangular images to rectangle format. The native format of some images is not rectangular, for instance circular. It is common for devices with this format to pad the

			images to the rectangular format required by the DICOM Standard with a specific pixel value that is not contained in the native image. This attribute specifies the value of this padding value

A.3.6 General Image Module

Attribute Name	Tag	Type	Attribute Description
Image Number	(0020,0013)	2	A number that identifies this image
Image Date	(0008,0023)	2C	The date the image pixel creation started. Required if image is part of a series in which the images are temporally related.
Image Time	(0008,0008)	2C	The time the image pixel creation started. Required if image is part of a series in which the images are temporally related.
Image Type	(0008,0008)	3	Always sent.
Acquisition Number	(0020,0012)	3	A number identifying the single continuous gathering of data over a period of time which resulted in this image.
Acquisition Date	(0008,0022)	3	The date the acquisition of data that resulted in this image started.
Acquisition Time	(0008,0032)	3	The time the acquisition of data that resulted in this image started.
>Referenced SOP Class UID	(0008,1150)	1C	Uniquely identifies the referenced SOP Class.
>Referenced SOP Instance UID	(0008,1155)	1C	Uniquely identifies the referenced SOP Instance.
Derivation Description	(0008,2111)	3	See A.3.6.1
Source Image Sequence	(0008,2112)	3	See A.3.6.1
Image Comment	(0020,4000)	3	Image Comment. “reconAlgo=n”, where n is recon algorithm number ,is sent in this implementation.

A.3.6.1 Derivation Description and Source Image Sequence

If an image is identified to be a Derived image, Derivation description is an optional text description of the way the image was derived. It may be used whether or not the Source Image Sequence is provided. It may also be used in cases when the Derived Image pixel data is not significantly changed from one of the source images and the SOP Instance UID of the Derived Image is the same as the one used for the source image. If an Image is identified to be a Derived image , Source Image Sequence(0008,2112) is an optional list of Referenced SOP Class UID (0008,1150)/ Referenced SOP Instance UID (0008,1150) pairs

which identify the source images used to create the Derived image. It may be used whether or not there is a description of the way the image was derived in Derivation Description (0008,2111).

A.3.7 VOI LUT Module

Attribute Name	Tag	Type	Notes
Window Center	(0028,1050)	1C	Window Center for display. Always sent.
Window Width	(0028,1051)	1C	Window Width for display. Always sent.

A.3.8 SOP Common Module

Attribute Name	Tag	Type	Attribute Description
SOP Class UID	(0008,0016)	1	Uniquely identifies the SOP Class.
SOP Instance UID	(0008,0018)	1	Uniquely identifies the SOP Instance.
Specific Character Set	(0008,0005)	1C	Character Set that expands or replaces the Basic Graphic Set. Required if an expanded or replacement character set is used. Always ISO_IR 100 is sent.
Instance Creation Date	(0008,0012)	3	Date the image file was created shall be encoded. This element shall always be encoded.
Instance Creation Time	(0008,0013)	3	Time the image file was created shall be encoded. This element shall always be encoded.
Instance Creator UID	(0008,0014)	3	Uniquely identifies device which created the SOP Instance.

A.4 CT Image Modules

A.4.1 Image Plane Module

Attribute Name	Tag	Type	Attribute Description
Pixel Spacing	(0028,0030)	1	Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm.
Image Orientation (Patient)	(0020,0037)	1	The direction cosines of the first row and the first column with respect to the patient. If (0008,0008) value 3 is set as “CTINTERVENTION” , this value is prescribed value and may not be actual value. Do not use this element

			for any calculations.
Image Position (Patient)	(0020,0032)	1	The x, y, and z coordinates of the upper left hand corner (first pixel transmitted) of the image, in mm. Note that it is NOT center of the first pixel but upper left hand corner of the first pixel. If (0008,0008) value 3 is set as "CTINTERVENTION" , this value is prescribed value and may not be actual value. Do not use this element for any calculations.
Slice Thickness	(0018,0050)	2	Nominal slice thickness, in mm.
Slice Location	(0020,1041)	3	Relative position of exposure expressed in mm. If (0008,0008) value 3 is set as "CTINTERVENTION" , this value is prescribed value and may not be actual value. Do not use this element for any calculations.

A.4.1.1 Image Position And Image Orientation

The Image Position (0020,0032) specifies the x, y, and coordinates of the upper left hand corner of the image; it is the first pixel transmitted. Image Orientation (0020,0037) specifies the direction cosines of the first row and the first column with respect to the patient. These Attributes shall be provide as a pair. Row value for the x, y, and z axes respectively followed by the Column value for the x, y, and z axes respectively.

The direction of the axes are defined fully by the patient's orientation. The x-axis is increasing to the left hand side of the patient. The y-axis is increasing to the posterior side of the patient. The z-axis is increasing toward the head of the patient.

The patient based coordinate system is a right handed system, i.e. the vector cross product of a unit vector along the positive x-axis and a unit vector along the positive y-axis is equal to a unit vector along the positive z-axis.

However, with regard to Image Position, reference point of each axis is not fully patient oriented in this system. As long as table height is changed and landmark button is not pressed between images, it does not cause any practical problem. To determine if two images are spatially related, implementation must see Frame of Reference UID (0020,0052).

CAUTION : It is possible for the operator of this system to change the table height or change the landmark position while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjuction with Image Posision to determine if two images are spatially related.

A.4.2 Image Pixel Module

Attribute Name	Tag	Type	Attribute Description

Samples per Pixel	(0028,0002)	1	1 is sent in this implementation.
Photometric Interpretation	(0028,0004)	1	MONOCHROME2
Rows	(0028,0010)	1	512 or 256
Columns	(0028,0011)	1	512 or 256
Bits Allocated	(0028,0100)	1	16
Bits Stored	(0028,0101)	1	16
High Bit	(0028,0102)	1	15.
Pixel Representation	(0028,0103)	1	0001H = 2's complement
Pixel Data	(7FE0,0010)	1	A data stream of the pixel samples which comprise the Image.

A.4.3 Contrast Bolus Module

Attribute Name	Tag	Type	Attribute Description
Contrast/Bolus Agent	(0018,0010)	2	Contrast or bolus agent. Sent as “XX..XX & YY..YY” form. XX..XX is agent name for oral contrast and truncated to 16 characters. YY..YY is agent name for IV contrast and truncated to 16 characters. Not sent if (0018,1040) is not specified.
Contrast/Bolus Route	(0018,1040)	3	Administration route of contrast agent Sent as either “Oral”, “IV” or “Oral & IV”. Not sent if no contrast is prescribe by user.

A.4.4 CT Image Module

Attribute Name	Tag	Type	Attribute Description
Image Type	(0008,0008)	1	See A.4.4.1 and 2.5.1
Samples per Pixel	(0028,0002)	1	Number of samples (planes) in this image.1 is sent in this implementation.
Photometric	(0028,0004)	1	MONOCHROME2 is sent

Interpretation			
Bits Allocated	(0028,0100)	1	Number of bits allocated for each pixel sample. Each sample shall have the same number of bits allocated. 16 is sent in this implementation.
Bits Stored	(0028,0101)	1	Number of bits stored for each pixel sample. Each sample shall have the same number of bits stored. 16 is sent in this implementation.
High Bit	(0028,0102)	1	Most significant bit for pixel sample data. Each sample shall have the same high bit. 15 is sent in this implementation.
Rescale Intercept	(0028, 1052)	1	The value b in relationship between stored values (SV) and Hounsfield (HU). HU = m*SV+b 0 is sent in this implementation.
Rescale Slope	(0028,1053)	1	m in the equation specified in Rescale Intercept (0028,1052). 1 is sent in this implementation.
Scan Options	(0018,0022)	3	A label for special scan type taken. Sent as either ”HELICAL MODE”,”ASYNMETRIC MODE”, “CINE MODE” or not set for other scan type.
KVP	(0018,0060)	2	Peak kilo voltage output of the x-ray generator used
Acquisition Number	(0020,0012)	2	A number identifying the single continuous gathering of data over a period of time which resulted in this image
Reconstruction Diameter	(0018,1100)	3	Diameter in mm of the region from within which data were used in creating the reconstruction of the image. Data may exist outside this region and portions of the patient may exist outside this region.
Distance Source to Detector	(0018,1110)	3	Distance in mm from source to detector center
Distance Source to Patient	(0018,1111)	3	Distance in mm from source to isocenter (center of field of view)
Gantry/Detector Tilt	(0018,1120)	3	Nominal angle of tilt in degrees of the scanning gantry. Not intended for mathematical computations. If (0008,0008) value 3 is set as “CTINTERVENTION” , this value is prescribed value and may not be actual value. Do not use this element for any calculations.
Table Height	(0018,1130)	3	The distance in mm of the top of the patient table to the center of rotation ; below the center is positive.

Rotation Direction	(0018,1140)	3	Direction of rotation of the source when relevant, about nearest principal axis of equipment. Enumerated Values : CW = clockwise CC = counter clockwise
Exposure Time	(0018,1150)	3	Time of x-ray exposure in msec. When ImageType Value3 is SEGMENTED, it is calculated by formula Rotation Speed (0019,1027) x 0.652 to set equivalent exposure time for segmented recon.
X-ray Tube Current	(0018,1151)	3	X-ray Tube Current in mA.
Exposure	(0018,1152)	3	The product of exposure time and X-ray Tube Current expressed in mas.
Filter Type	(0018,1160)	3	Label for the type of filter inserted into the x-ray beam.
Generator Power	(0018,1170)	3	Power in kW to the x-ray generator.
Focal Spot	(0018,1190)	3	Size of the focal spot in mm. 1.200000 or x.xxxxxx in this system
Convolution Kernel	(0018,1210)	3	A label describing the convolution kernel or algorithm used to reconstruct the data. Sent as either “SOFT”,”STND”,”STD+”,”EDGE”,”BONE”,”DETL”,”CHST”, or “PFRM”.

A.4.4.1 Image Type

Value 1: Identifies an image to be either an ORIGINAL image or a DERIVED image An ORIGINAL image is an image whose pixel values represent original, non-transformed data. A DERIVED image is an image which has been created by combining two or more images together.

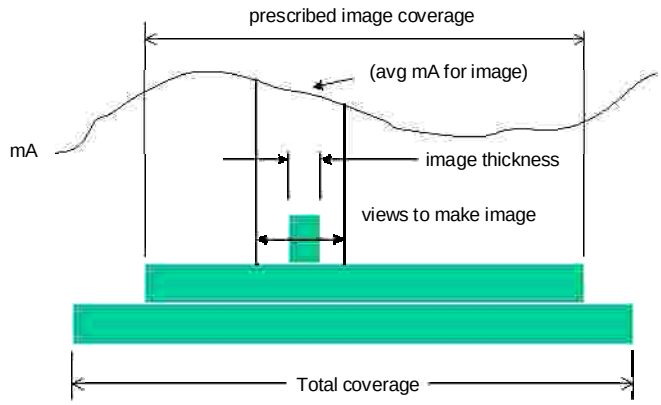
Value 2: Identifies an image to be either a PRIMARY image or a SECONDARY image A PRIMARY image is an image whose pixel values represent original, non-transformed data. A SECONDARY image is an image which has been created by combining two or more images together.

Value 3: Identifies the type of processing which created the image. An AXIAL image is an image which was created as a result of axial CT scanning. A LOCALIZER is an image which was created with the intent of being used as a prescription image for AXIAL scanning. A SEGMENTED image is an AXIAL image whose reconstruction provides time segmented information. A REFORMATTED image is an image which represents a cut plane across a set of AXIAL ima image which was created as a result of CT Fluoroscopy image capture and NOT the intent of being used for diagnostics.

Value 4: Identifies the type of optional processing which created the image. An ADD image is an image which was created as a result of multiple axial CT scanning.

A.4.4.2 Calculation of Dicom Exposure Field

Decsciption of how to calculate the Dicom Exposure field (0018,1152)



exposure = (exposure time) * (image avg mA)* (slice thickness)/(total coverage)

exposure time = total x-ray on time
helical total coverage= (exposure time * table velocity)
axial or cine total coverage = macro row thickness * no of active rows
Slice thickness = nominal prospective reconstructed slice selection

Exposure.ppt
T. Toth 03-Aug-04

Note:

A.4.5 Frame of Reference Module

This section specifies the Attributes necessary to uniquely identify a frame of reference which insures the spatial relationship of Images within a Series. It also allows Images across multiple Series to share the same Frame Of Reference. This Frame Of Reference (or coordinate system) shall be constant for all Images related to a specific Frame Of Reference.

Attribute Name	Tag	Type	Notes
Frame of Reference UID	(0020,0052)	1	See A.4.5.1.1
Position Reference Indicator	(0020,1040)	2	See A.4.5.1.2

A.4.5.1 Frame of Reference Attribute Descriptions

A.4.5.1.1 Frame of Reference UID

The Frame of Reference UID (0020, 0052) shall be used to uniquely identify a frame of reference for a series. Each series shall have a single Frame of Reference UID. However, multiple series within a Study may share a Frame of Reference UID. All images in a Series which share the same Frame of Reference UID shall be spatially related to each other.

A.4.5.1.2 Position Reference Indicator

The Position Reference Indicator (0020, 1040) specifie e part of the patient's anatomy which was used as an anatomical reference point associated with a specific Frame of

Reference UID. The Position Reference Indicator may or may not coincide with the origin of the mixed frame of reference related to the Frame of Reference UID.

CAUTION

It is possible for the operator of GEHC CT system to change the table height while scanning a series of images. Therefore, implementations must use the Frame of Reference UID (0020,0052) in conjunction with the Table Height (0018,1130) to determine if two images are spatially related.

A.5 SC Image Modules

A.5.1 SC Equipment Module

Attribute Name	Tag	Type	Notes
Conversion Type	(0008,0064)	1	Always sent with value WSD
Modality	(0008,0060)	3	Modality of original image

A.5.2 Image Pixel Module

Attribute Name	Tag	Type	Notes
Samples per Pixel	(0028,0002)	1	Always sent with value = 1
Photometric Interpretation	(0028,0004)	1	Always sent.
Rows	(0028,0010)	1	Always sent
Columns	(0028,0011)	1	Always sent
Bits Allocated	(0028,0100)	1	Always sent with value = 16
Bits Stored	(0028,0101)	1	Always sent with value = 16
High Bit	(0028,0102)	1	Always sent with value = 15
Pixel Representation	(0028,0103)	1	Always sent with value = 1
Pixel Data	(7FE0,0010)	1	Always sent

A.5.3 Modality LUT Module

Attribute Name	Tag	Type	Notes
Rescale intercept	(0028,1052)	1C	Always sent
Rescale Slope	(0028,1053)	1C	Always sent
Rescale Type	(0028,1054	1C	Always sent with value = HU

APPENDIX B: Private Data Elements

Enclosed is a listing of private data elements used in this implementation for CT Image IOD definition.

B.1 CT IMAGE IOD PRIVATE DATA ELEMENTS DEFINITION

Attribute Name	Tag	Type	VR	VM	Description
Private Creator ID (group 19)	0019,00xx	3	LO	1	Character string "GEMS_ACQ_01" shall be encoded.
Detector Channel	0019,xx02	3	SL	1	816 shall always be encoded.
Table Speed [mm/rotation]	0019,xx23	3	DS	1	Real table speed of the scan shall be encoded, that is, following values are to be encoded. axial : 0 helical : beam thickness [mm] * pitch cine: 0 This element shall be encoded only for axial images.
Mid Scan Time [sec]	0019,xx24	3	DS	1	Time difference between acquisition time of the first axial scan (including helical or cine scan) in the exam and acquisition time of the first view data that resulted the image shall be encoded. This element shall be encoded only for axial images.
Tube Azimuth [degree]	0019,xx26	3	SL	1	Tube angle shall be encoded if the image is LOCALIZER image.
Rotation Speed [msec]	0019,xx27	3	DS	1	Gantry rotation period shall be encoded. This element shall be encoded only for axial images.
SFOV Type	0019,xx39	3	SS	1	One of the following SFOV type value shall be encoded. This element shall always be encoded. 1: "Ped Head", 2: "Head", 4: "Small", 8: "Medium", 16: "Large", 32: "Wild", 64: "Shoulder L", 128: "No Sfovtype"
Segment Number	0019,xx42	3	SS	1	Segment number shall be encoded if the image is SEGMENTED image.1
Total Segments Required	0019,xx43	3	SS	1	Total number of segments shall be encoded if the image is SEGMENTED image. 2

Attribute Name Tag Type VR VM Description Private Creator ID (group 27)	0027,00xx	1C	LO	1	Character string "GEMS_IMAG_01" shall always be encoded. This element shall be encoded only when any data element in this group is encoded.
Scan Start Location	0027,xx50	3	FL	1	Table position when x-ray started shall be encoded. This element shall be encoded only for scout images.
Scan End Location	0027,xx51	3	FL	1	Table position when x-ray terminated shall be encoded. This element shall be encoded only for scout images.
Private Creator ID (group 43)	0043,00xx	1C	LO	1	Character string "GEMS_PARM_01" shall be encoded.
Delta Start Time [msec]	0043,xx1E	3	DS	1	Delta start time shall be encoded if the scan option is HELICAL MODE ,CINE MODE or CARDIAC MODE.
Scan Pitch Ratio	0043,xx27	3	SH	1	For helical scan, "0.75:1" or "1.5:1 " shall be encoded. For other scan type, nothing shall be encoded.
Recon Center Coordinates	0043,xx31	3	DS	3	Reconstruction center shall be encoded.
Raw Data ID	0043,xx63	3	SH	1	Raw data ID shall be encoded.
Image Filter	0043,xx64	3	CS	1-n	Image filter names that applied on the image shall be encoded.
Motion Correction Indicator	0043,xx65	3	US	1	"1" shall be encoded if motion correction was applied on the image, otherwise "0" shall be encoded.
Helical Correction Indicator	0043,xx66	3	US	1	"1" shall be encoded if helical correction was applied on the image, otherwise "0" shall be encoded.
IBO Correction Indicator	0043,xx67	3	US	1	"1" shall be encoded if IBO correction was applied on the image, otherwise "0" shall be encoded.
XT Correction Indicator	0043,xx68	3	US	1	"1" shall be encoded if XT correction was applied on the image, otherwise "0" shall be encoded.
Q-cal Correction Indicator	0043,xx69	3	US	1	"1" shall be encoded if Q-cal correction was applied on the image, otherwise "0" shall be encoded.
AV Correction Indicator	0043,xx6A	3	US	1	"1" shall be encoded if AV correction was applied on the image, otherwise "0" shall be encoded.
L-MDK Correction Indicator	0043,xx6B	3	US	1	"1" shall be encoded if L-MDK correction was applied on the image, otherwise "0" shall be encoded.
Detector Row	0043,xx6C	3	IS	1	"2" shall be encoded.

Area Size	0043,xx6D	3	US	1	Area size shall be encoded. For SEGMENTED or LOCALIZER image, this element shall not be encoded.
Auto mA Mode	0043,xx6E	3	SH	1	Auto mA Mode label shall be encoded.
Private Creator ID (group 4B)	004B,00xx	1C	LO	1	Character string "GEMS_HINO_CT_01" shall be encoded.
Beam Thickness	004B,xx01	3	DS	1-n	Beam Thickness shall be encoded
R Time	004B,xx02	3	DS	1-n	Previous and next R time from center time of the time values is acquisition start time.(for Cardiac Scan only)
HBC number	004B,xx03	3	IS	1	HBC number from acquisition start time, starts with 0. (for Cardiac Scan only)

APPENDIX C: DICOMDIR Directory Information

C.1 DICOMDIR DIRECTORY INFORMATION

Enclosed here is a listing of only the optional (conditional) modules and optional attributes used by this implementation in the DICOMDIR definition. All standard attributes as defined in Part 3 Addendum (Basic Directory Information Object) are supported by this implementation but not listed here.

C.1.1 Basic Directory IOD Definition

Module	Reference	Usage	Notes
Directory Information	C.1.2	U	

C.1.2 Directory Information Module

This Module contains a sequence of Directory Records forming one or more Directory Entities.This Module defines at least one Directory Entity, the Root Directory Entity (which may be empty).Each Directory Record is composed of Directory Elements (marked by a ">"). They include:

a. an offset pointer to another Directory Record of the me Directory Entity

b. an offset pointer to a lower level Directory Entity

c. a Referenced File pointed to by the Directory Record

d. a set of keys representative of the information contained in the Referenced File

Attribute Name	Tag	Type	Notes
Offset of the First Directory Record of the Root Directory Entity	(0004,1200)	1	Set by application
Offset of the Last Directory Record of the Root Directory Entity	(0004,1202)	1	Set by application
File-set Consistency Flag	(0004,1212)	1	0000H: no known inconsistencies

Directory Record Sequence	(0004,1220)	2	Supported
>Offset of the Next Directory Record	(0004,1400)	1C	
>Record In-use Flag	(0004,1410)	1C	
>Offset of Referenced Lower-Level Directory Entity	(0004,1420)	1C	
>Directory Record Type	(0004,1430)	1C	PATIENT, STUDY, SERIES and IMAGE
>Referenced File ID	(0004,1500)	1C	Only found in IMAGE Directory Record
>Referenced SOP Class UID in file	(0004,1510)	1C	Only found in IMAGE Directory Record
>Referenced SOP Instance UID in File	(0004,1511)	1C	Only found in IMAGE Directory Record
>Referenced Transfer Syntax UID in File	(0004,1512)	1C	Only found in IMAGE Directory Record

C.1.3 Directory Record Selection Keys

Given below are the list of attributes supported under each of these directories.

C.1.3.1 Patient Keys

C.1.3.1.1 Patient Keys for STD-GEN-CD

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Patient's Name	(0010,0010)	2	
Patient ID	(0010,0020)	1	

C.1.3.1.2 Patient Keys for STD-GEN-DVD/USB

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Patient's Name	(0010,0010)	2	
Patient ID	(0010,0020)	1	
Patient Sex	(0010,0040)	1C	
Patient Birth Date	(0010,0030)	1C	

C.1.3.2 Study Keys

C.1.3.2.1 Study Keys for STD-GEN-CD

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Study Date	(0008,0020)	1	
Study Time	(0008,0030)	1	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	2	
Study ID	(0020,0010)	1	
Study Instance UID	(0020,000D)	1C	

C.1.3.2.2 Study Keys for STD-GEN-DVD/USB

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Study Date	(0008,0020)	1	
Study Time	(0008,0030)	1	
Accession Number	(0008,0050)	2	
Study Description	(0008,1030)	2	
Study ID	(0020,0010)	1	
Study Instance UID	(0020,000D)	1C	

C.1.3.3 Series Keys

C.1.3.3.1 Series Keys for STD-GEN-CD

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Modality	(0008,0060)	1	
Series Instance UID	(0020,000E)	1	

Series Number	(0020,0011)	1	

C.1.3.3.2 Series Keys for STD-GEN-DVD/USB

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Modality	(0008,0060)	1	
Series Instance UID	(0020,000E)	1	
Series Number	(0020,0011)	1	
Institution Name	(0008,0080)	1C	
Institution Address	(0008,0081)	1C	
Performing Physician's Name	(0008,1050)	1C	

C.1.3.4 Image Keys

C.1.3.4.1 Image Keys for STD-GEN-CD

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Instance Number	(0020,0013)	1	
Image Position (Patient)	(0020,0032)	1C	
Image Type	(0008,0008)	1C	
Referenced Image Sequence	(0008,1140)	1C	
> Referenced SOP Class UID	(0008,1150)	1C	
> Referenced SOP Instance UID	(0008,1155)	1C	

C.1.3.4.2 Image Keys for STD-GEN-DVD/USB

Attribute Name	Tag	Type	Notes
Specific Character Set	(0008,0005)	1C	ISO_IR 100
Instance Number	(0020,0013)	1	
Image Position (Patient)	(0020,0032)	1C	
Image Type	(0008,0008)	1C	
Calibration Image	(0050,0004)	1C	
Referenced Image Sequence	(0008,1140)	1C	
Lossy Image Compression Ratio	(0028,2112)	1C	

Image Orientation (Patient)	(0020,0037)	1C	
Frame of Reference UID	(0020,0052)	1C	
Synchronization Frame of Reference UID	(0020,0200)	1C	
Rows	(0028,0010)	1	
Columns	(0028,0011)	1	
Acquisition Datetime	(0008,002A)	1C	
Pixel Spacing	(0028,0030)	1C	

APPENDIX D: Implementation UID for Product Versions

Product Model	Software Revision	Implementation UID
Brivo CT315	1.5x	1.2.840.113619.6.282
Brivo CT325	1.5x	1.2.840.113619.6.282

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