



PRIMO DICOM Conformance Statement			
Foglio: 1 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

1. INTRODUCTION

This document applies to the PRIMO System.

The following DICOM SOP Classes are supported:

Table 1.1 Supported DICOM SOP Classes

SOP Class Name	SOP Class UID	Service Class Role
Verification SOP Class	1.2.840.10008.1.1	SCU SCP
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	
Modality Work List Information Model – FIND	1.2.840.10008.5.1.4.31	SCU
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	SCU
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1	SCU
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	SCU
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	SCU

1.1 REVISION HISTORY

The revision history provides dates and differences of the different releases of the product and the Conformance Statement.

Document Version	Date of Issue	Author	Description
1.0	30-11-2010	F.C.	Preliminary Version

1.2 AUDIENCE

This document is written for the people that need to understand how <PRIMO> will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 2 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

1.2.1 Accessing this Conformance Statement on the World Wide Web

As the PRIMO System product changes, changes to this DICOM Conformance Statement are inevitable. To obtain the most recent revision of this DICOM Conformance Statement, access the following URL:

<http://www.atsmed.it/ITA/primo.html>

1.3 REMARKS

The scope of this DICOM Conformance Statement is to facilitate integration between <PRIMO> and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. DICOM by itself does not guarantee interoperability. The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.

This Conformance Statement is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

If the product has an IHE Intergration Statement, the following statement may be applicable:

<PRIMO> has participated in an industry-wide testing program sponsored by Integrating the Healthcare Enterprise (IHE). The IHE Integration Statement for <PRIMO>, together with the IHE Technical Framework, may facilitate the process of validation testing.



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 3 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

1.4 BASIC OF DICOM COMMUNICATION

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network “handshake”. One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* – which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information). The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies “pre-negotiated” exchange media format, Abstract Syntax, and Transfer Syntax.

1.5 Term and Definitions

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

Abstract Syntax – generally equivalent to an *Information Object Definition* (IOD), the specification used to define the information to exchange in a message; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. Examples: MR image object definition, CT image object definition, image query information model.



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 4 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

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 (AET) – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the 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 – smallest unit of information in an object definition; a data element identified by a tag. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004).

Information Object Definition (IOD) – the specified set of *Attributes* that comprise a type of data object (see *Abstract Syntax*). 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).

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 includes Patient 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)



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 5 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

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 Image Storage 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.

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; 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.

1.6 Abbreviations

AE	Application Entity
AET	Application Entity Title
ASCII	American Standard Code for Information Interchange
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



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 6 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

HIS	Hospital Information System
HL7	Health Level 7 Standard
IHE	Integrating the Healthcare Enterprise
IOD	Information Object Definition
ISO	International Organization for Standards
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format
LUT	Look-up Table
MPEG	Moving Picture Experts Group
MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NTP	Network Time Protocol
O	Optional (Key Attribute)
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
R	Required (Key Attribute)
RDN	Relative Distinguished Name (LDAP)
RIS	Radiology Information System.
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
VR	Value Representation



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 7 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

1.7 References

Referenced documents should be listed here, including appropriate product manuals (such as service manuals that specify how to set DICOM communication parameters). References to the DICOM Standard should provide the URL for the free published version of the Standard, but should not specify a date of publication:

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

2. NETWORK CONFORMANCE STATEMENT

Primo is a computed radiography modality device capable to acquire up to 3072x2560 pixels images. Primo is equipped with a *Dicom Interface Network (DIN)* that allows the transfer of images according with DICOM 3.0 standard.

This document describes the conformance of DIN to DICOM 3.0 standard.

2.1 IMPLEMENTATION MODEL

2.1.1 Application data flow diagram

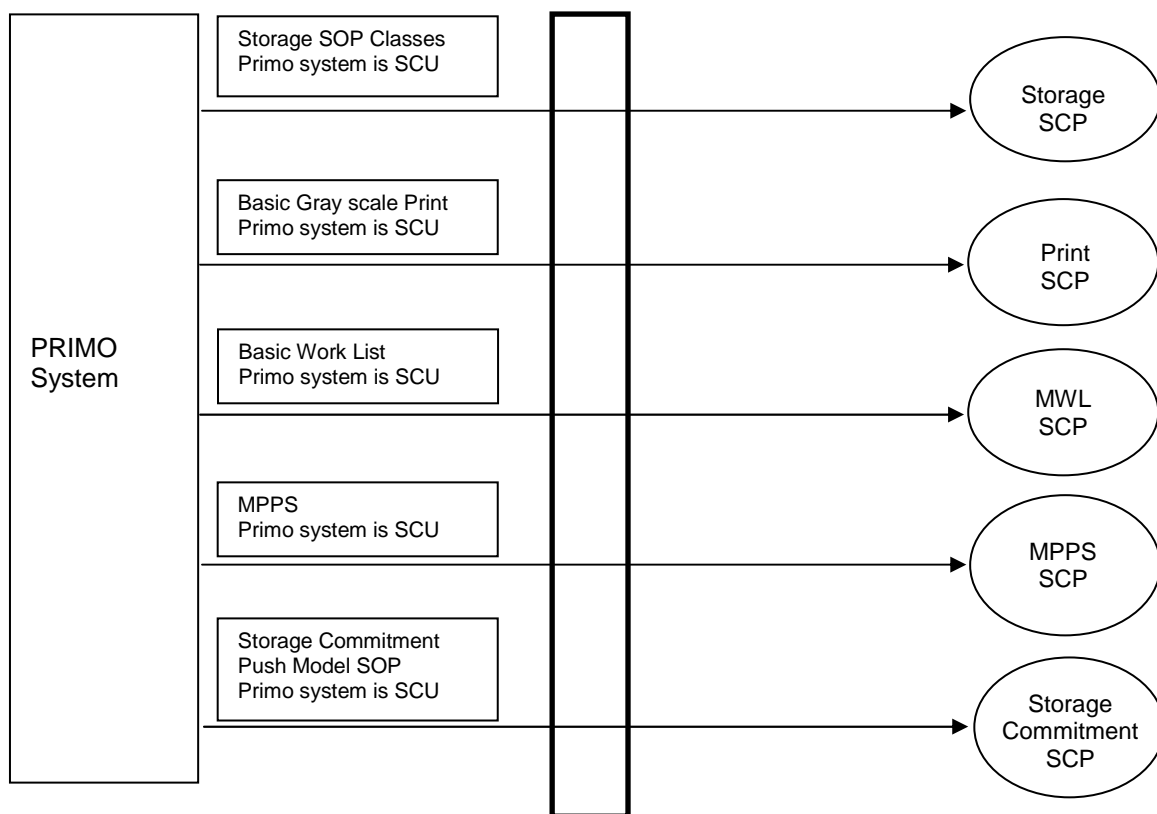
This implementation model uses:

- the **Verification SOP Class** to verify application level communication between two DICOM 3.0 peers,
- the **DICOM Basic Print Management Meta SOP Class** to deliver studies to remote printers,
- the **CR / DX Image Storage SOP Classes** to deliver studies to archives.
- **Basic Work List Management service** for the acquisition of patient demographics,
- the **MPPS SOP Class** to send a report about a performed examination including data about the images acquired, beginning/end time, dose delivered, etc
- the **Storage Commitment SOP Class** to confirm that an image has been permanently stored by a device



PRIMO DICOM Conformance Statement			
Foglio: 8 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Dicom Interface
Network





PRIMO DICOM Conformance Statement			
Foglio: 9 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.1.2 Functional Definitions of AE's

The PRIMO System is a digital radiographic image acquisition product utilizing a 3rd party X-Ray detector based on GdOS technology. The system allows the technologist to acquire and identify images, review images, add markers, adjust image processing, manipulate images (flip, rotate, etc.), pan/zoom and route images to their final destinations. The system is capable of obtaining patient demographic information manually from the user interface, or via a DICOM Work List.

2.1.3 Sequencing of Real –Word Activities

Not applicable.

2.2. AE SPECIFICATIONS

The PRIMO System generates a single association establishment request and operates as application entity.

2.2.1 AE Specifications

Primo provides Standard Conformance to the following DICOM V3.0 SOP Class as a SCU:

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1
Computed Radiography Storage SOP Class	1.2.840.10008.5.1.4.1.1.1
Digital X-Ray Image Storage – For Presentation SOP Class	1.2.840.10008.5.1.4.1.1.1.1
Storage Commitment Service Class	1.2.840.10008.1.20.1
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
Modality Worklist Information Model - FIND SOP Class	1.2.840.10008.5.1.4.31
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3



PRIMO DICOM Conformance Statement			
Foglio: 10 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Primo provides Standard Conformance to the following DICOM V3.0 SOP Class as a SCP:

SOP Class Name	SOP Class UID
Verification SOP Class	1.2.840.10008.1.1

2.2.2 Association establishment policy

2.2.2.1 General

Primo generates association establishment request whenever is invoked by with a valid "destination" field. The list of "destination" known by the system is configurable.

The maximum PDU size, which the *Primo* will negotiate, is 64KB.

2.2.2.2 Number of associations

Only one association a time is allowed.

2.2.2.3 Asynchronous nature

Asynchronous mode is not supported.

2.2.2.4 Implementation identifying information

Primo supplies the Implementation Class UID 1.3.6.1.4.1.34656.1.1

The version name provided is " ATSDICOMV1.0".

2.2.3 Association Initiation Policy

2.2.3.1 Association initiation by real-world activity

The *Primo* initiates Associations for the purpose of sending images and associated information for printing to a Basic Grayscale Print Management SCP and archiving to an SC Image Storage SCP

The request to verify DICOM communication starts an association negotiation



PRIMO DICOM Conformance Statement			
Foglio: 11 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.3.2 Presentation Context Table

The Primo proposes the Presentation Contexts shown in Table 2.1.

Table 2.1. Presentation Context Table					
Abstract Syntax		Transfer Syntax			Ext.
Name	UID	Name List	UID	Role	Negot
Verification	1.2.840.10008.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU/SCP	None
Basic Grayscale Print Management	1.2.840.10008.5.1.1.9	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Work List	1.2.840.10008.5.1.4.31	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Computer Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Digital x-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

2.2.3.3 SOP Specific Conformance

2.2.3.3.1 Verification

The Primo provides standard conformance to the DICOM Verification Service Class (1.2.840.10008.1.1):

- When prompted by a user, the *Primo* will request verification of communication to a remote DICOM AE using the C-ECHO primitive.
- Upon receipt from an SCU of a verification of communication request, the *Primo* will issue confirmation.

PRIMO accepts status codes from C-ECHO service and performs actions as:

- 0000H Success. The writing "OK" is displayed and the association is closed.



PRIMO DICOM Conformance Statement			
Foglio: 12 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.4 Association Acceptance Policy

Upon receipt from an SCU of a verification of communication request, the *Primo* will issue confirmation.

2.2.5 Store Service Classes

Table 1.1 lists all the Storage SOP Classes that are supported by the *Primo*. The following tables list, for each Storage SOP Class, the attributes that the *Primo* supports.

2.2.5.1 Computed Radiography Image Storage

2.2.5.1.1 Associated real-world activity

If *Primo* is configured to use the CR Storage service, the request to transfer a CR still image starts an association negotiation for the *CR Storage Service*.

2.2.5.1.2 CR Image IOD Modules

Primo uses following IOD modules for Computed Radiography Image SOP Class:

IE	Module	Reference	Usage
Patient	Patient	2.2.5.3	M
Study	General Study	2.2.5.4	M
Series	General Series	2.2.5.5	M
	CR Series	2.2.5.6	M
Equipment	General Equipment	2.2.5.8	M
Image	General Image	2.2.5.9	M
	Image Pixel	2.2.5.10	M
	Contrast/bolus	2.2.5.11	C
	CR Image	2.2.5.12	M
	SOP Common	2.2.5.13	M



PRIMO DICOM Conformance Statement			
Foglio: 13 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.5.2 Digital X-Ray Image Storage For Presentation

Primo uses following IOD modules for Computed Radiography Image SOP Class.

2.2.5.2.1 Associated real-world activity

If Primo is configured to use the DX Storage service, the request to transfer a DX still image starts an association negotiation for the *DX Storage Service*.

2.2.5.2.2 DX Image IOD Modules

Primo uses following IOD modules for Digital X-Ray Image SOP Class:

IE	Module	Reference	Usage
Patient	Patient	2.2.5.3	M
Study	General Study	2.2.5.4	M
Series	General Series	2.2.5.5	M
	DX Series	2.2.5.7	M
Equipment	General Equipment	2.2.5.8	M
Image	General Image	2.2.5.9	M
	Image Pixel	2.2.5.10	M
	Contrast/bolus	2.2.5.11	U
	DX Anatomy Imaged	2.2.5.14	M
	DX Image	2.2.5.15	M
	DX Detector	2.2.5.16	M
	DX Positioning	2.2.5.17	U
	X-Ray Acquisition Dose	2.2.5.18	U
	VOI LUT	2.2.5.19	C (Required if Presentation Intent Type (0008,0068) is FOR PRESENTATION. Shall not be present otherwise).
	Acquisition Context	2.2.5.20	M
SOP Common	2.2.5.13	M	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 14 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.5.3 Patient

Attribute Name	Tag		Type	Value
	Group	Element		
Patient Name	0010	0010	2	
Patient ID	0010	0020	2	
Patient's Birth Date	0010	0030	2	
Patient's Sex	0010	0040	2	

2.2.5.4 General Study

Attribute Name	Tag		Type	Value
	Group	Element		
Study Instance UID	0020	000D	1	
Study Date	0008	0020	2	
Study Time	0008	0030	2	
Referring Physician's Name	0008	0090	2	
Study ID	0020	0010	2	
Accession Number	0008	0050	2	
Study Description	0008	1030	3	

2.2.5.5 General Series

Attribute Name	Tag		Type	Value
	Group	Element		
Modality	0008	0060	1	CR for CR Modality DX for DX Modality
Series Instance UID	0020	000E	1	
Series Number	0020	0011	2	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 15 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Laterality	0020	0060	2C	R = RIGHT L = LEFT
Protocol Name	0018	1030	3	
Serie Description	0008	103E	3	

2.2.5.6 CR Series

Attribute Name	Tag		Type	Value
	Group	Element		
Body Part Examined	0018	0015	2	
View Position	0018	5101	2	AP = Anterior/Posterior PA = Posterior/Anterior LL = Left Lateral RL = Right Lateral RLD = Right Lateral Decubitus LLD = Left Lateral Decubitus RLO = Right Lateral Oblique LLO = Left Lateral Oblique

2.2.5.7 DX Series

Attribute Name	Tag		Type	Value
	Group	Element		
Presentation Intent Type	0008	0068	1	Fixed: "FOR PRESENTATION"



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 16 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.5.8 General Equipment

Attribute Name	Tag		Type	Value
	Group	Element		
Manufacturer	0008	0070	2	
Institution Name	0008	0080	3	
Station Name	0008	1010	3	
Manufacturer's Model Name	0008	1090	3	
Device Serial Number	0018	1000	3	
Software Version	0018	1020	3	1.0.0

2.2.5.9 General Image

Attribute Name	Tag		Type	Value
	Group	Element		
Image Type	0008	0008	3	DERIVED\PRIMARY
Acquisition Date	0008	0022	3	
Acquisition Time	0008	0032	3	
Source Image Sequence	0008	2112	3	
> Referenced SOPClassUID	0008	1150	1C	
> Referenced SOPInstanceUID	0008	1155	1C	
Image Instance Number	0020	0013	2	
Burned In Annotation	0028	0301	3	YES NO
Lossy Image Compression	0028	2110	3	00 = Image has NOT been subjected to lossy compression. 01 = Image has been subjected to lossy compression.



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 17 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.5.10 Image Pixel

Attribute Name	Tag		Type	Value
	Group	Element		
Samples per Pixel	0028	0002	1	1
Photometric Interpretation	0028	0004	1	MONOCHROME1 MONOCHROME2
Rows	0028	0010	1	
Columns	0028	0011	1	
Pixel Aspect Ratio	0028	0034	1C	
Bits Allocated	0028	0100	1	8,16 depending on Bit Stored
Bits Stored	0028	0101	1	8,12,16 (Configurable)
High Bit	0028	0102	1	Bits Stored -1
Pixel Representation	0028	0103	1	
Pixel Data	7FE0	0010	1	

2.2.5.11 Contrast/bolus

Attribute Name	Tag		Type	Value
	Group	Element		
Contrast/Bolus Agent	0018	0010	2	

2.2.5.12 CR Image

Attribute Name	Tag		Type	Value
	Group	Element		
KVP	0018	0060	3	
Exposure Time	0018	1150	3	
Exposure	0018	1152	3	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 18 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Imager Pixel Spacing	0018	1164	3	
Relative X-Ray Exposure	0018	1405	3	
Pixel Spacing	0028	0030	1C	

2.2.5.13 SOP Common

Attribute Name	Tag		Type	Value
	Group	Element		
SOP Class UID	0008	0016	1	
SOP Instance UID	0008	0018	1	

2.2.5.14 DX Anatomy Imaged

Attribute Name	Tag		Type	Value
	Group	Element		
Image Laterality	0020	0062	1	R = right L = left U = unpaired B = both left and right
Anatomic Region Sequence	0008	2218	2	

2.2.5.15 DX Image

Attribute Name	Tag		Type	Value
	Group	Element		
Pixel Spacing	0028	0030	1C	
Pixel Intensity Relationship	0028	1040	1	LIN
Pixel Intensity Relationship Sign	0028	1041	1	1/-1



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 19 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Rescale Intercept	0028	1052	1	0
Rescale Slope	0028	1053	1	1
Rescale Type	0028	1054	1	US
Presentation LUT Shape	2050	0020	1	IDENTITY / INVERSE
Lossy Image Compression	0028	2110	1	Always NO
Burned In Annotation	0028	0301	1	YES/NO
Patient Orientation	0020	0020	2C	

2.2.5.16 DX Detector

Attribute Name	Tag		Type	Value
	Group	Element		
Detector Type	0018	7004	2	SCINTILLATOR
Detector Configuration	0018	7005	3	AREA
Imager Pixel Spacing	0018	1164	1	0.139\0.139

2.2.5.17 DX Positioning

Attribute Name	Tag		Type	Value
	Group	Element		
View Position	0018	5101	2	

2.2.5.18 X-Ray Acquisition Dose

Attribute Name	Tag		Type	Value
	Group	Element		
KVP	0018	0060	3	
Exposure Time	0018	1150	3	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 20 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Exposure	0018	1152	3	
Image Area Dose Product	0018	115E	3	

2.2.5.19 VOI LUT

Attribute Name	Tag		Type	Value
	Group	Element		
VOI LUT Sequence	0028	3010	1C	
>LUT Descriptor	0028	3002	1C	
>LUT Data	0028	3006	1C	
Window Center	0028	1050	1C	
Window Width	0028	1051	1C	

2.2.5.20 Acquisition Context

Attribute Name	Tag		Type	Value
	Group	Element		
Acquisition Context Sequence	0040	0555	2	



PRIMO DICOM Conformance Statement			
Foglio: 21 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.6 Basic Print Management Meta SOP Class.

2.2.6.1 Associated real-world activity

The application's print request causes the *PRIMO* to initiate an Association.

2.2.6.2 Proposed presentation contexts

The *Primo* will propose the presentation contexts listed in the Presentation Context Table (Table 1.1).

2.2.6.3 SOP specific conformance statement for DICOM Print Service Classes

The *Primo* support the following mandatory SOP classes which are defined under the Basic Grayscale Print Management Meta SOP Class (1.2.840.10008.5.1.1.9) of the DICOM Print Management Service Class:

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
Printer SOP Class	1.2.840.10008.5.1.1.16

The *Primo* supports the following SOP class attributes and DIMSE services for Basic Grayscale Print Management Meta SOP Class.

2.2.6.3.1 Basic Film Session SOP Class

The *Primo* supports the following mandatory and optional attributes values in this SOP class:

SOP Class	Basic Film Session SOP Class			
DIMSE Service	N-CREATE			
	N-ACTION			
	N-DELETE			
Attribute Name	Tag		Type	Value
	Group	Element		
Number of Copies	2000	0010	3	Number of copies to be printed for each film of the film session
Print Priority	2000	0020	3	Specifies the priority of the print job. Enumerated Values: HIGH MED LOW



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 22 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Medium Type	2000	0030	3	Medium type: PAPER CLEAR FILM BLUE FILM
Film Destination	2000	0040	3	Film destination: MAGAZINE = the exposed film is stored in film magazine PROCESSOR = the exposed film is developed in film processor

2.2.6.3.2 Basic Film Box SOP Class

The *Primo* supports the following mandatory and optional attributes values in this SOP class:

SOP Class	Basic Film Box SOP Class			
DISME Service	N-CREATE			
	N-ACTION			
Attribute Name	Tag		Type	Value
	Group	Element		
Image Display Format	2010	0010	1	Type of image display format STANDARD\c,r ROW\R1,R2,R3... COL\C1,C2,C3... SLIDE, SUPERSLIDE, CUSTOMi
Film Orientation	2010	0040	3	Film orientation. PORTRAIT = vertical film position LANDSCAPE = horizontal film position



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 23 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Film Size ID	2010	0050	3	Film size identification. 8INX10IN, 8_5INX11IN, 10INX12IN, 10INX14IN, 11INX14IN, 11INX17IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, A4, A3
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2.2.6.3.3 Basic Grayscale Image Box SOP Class

The *Primo* supports the following mandatory and optional attributes values in this SOP class:

SOP Class	Basic Grayscale Image Box SOP Class			
DISME Service	N- SET			
Attribute Name	Tag		Type	Value
	Group	Element		
Image Position	2020	0010	1	Position of the image on the film

2.2.6.3.4 Printer SOP Class

The *Primo* can monitor the status of the Printer in terms of successfully or unscuccefully media print.

The *Primo* makes use of the following attributes and attribute value in this SOP class:

SOP Class	Printer SOP Class			
Attribute Name	DISME Service	Tag		Value
		Group	Element	
Printer Status Info	N-EVENT-REPORT	2110	0020	Normal Warning Failure



PRIMO DICOM Conformance Statement			
Foglio: 24 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.7 Uploading wordlist

2.2.7.1 Associated real-world activity

Dicom worklist issue a FIND request when the user wishes to view patient information of a remote DICOM C-FIND SCP.

The request to get the worklist starts an association negotiation for the *Basic Worklist Management Service*.

2.2.7.2 Proposed presentation contexts

The *Primo* will propose the presentation contexts listed in the Presentation Context Table (Table 1.1).

2.2.7.3 SOP specific conformance statement for Modality Worklist SOP Class

Standard Conformance is provided to the Modality Worklist Information Model - FIND SOP Class (1.2.840.10008.5.1.4.31) of the DICOM Basic Worklist Management Service.

All the attributes listed in the next table will be requested.

Worklist C-FIND-REQ/RSP Data Set				
Attribute Name	Tag		Type	Matching Type
	Group	Element		
Accession Number	0008	0050	3	
Study Description	0008	1030	3	
Patient Name	0010	0010	1	Single value / Wildcard
Patient ID	0010	0020	1	
Patient Birth Date	0010	0030	2	
Patient Sex	0010	0040	3	
Study Instance UID	0020	000D	1	
Study ID	0020	0010	3	
Requested Procedure Description	0032	1060	1C	
Requested Procedure Code Sequence	0032	1064	3	
Scheduled Procedure Step Sequence	0040	0100	1	
> Modality	0008	0060	1	Single value or no filter
> Scheduled Station AE title	0040	0001	1	No value. Filter is applied when worklist is received
> Scheduled Procedure Step Start Date	0040	0002	1	Single value / Range matching
> Scheduled Procedure Step Start Time	0040	0003	1	Single value / Range matching
> Scheduled Performing Physiscian Name	0040	0006	2	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 25 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

> Scheduled Procedure Step Description	0040	0007	1C	
> Scheduled Protocol Code Sequence	0040	0008	3	
> Scheduled Procedure Step ID	0040	0009	3	
> Scheduled Station Name	0040	0010	3	
> Scheduled Procedure Step Location	0040	0011	3	
Requested Procedure ID	0040	1001	3	



PRIMO DICOM Conformance Statement			
Foglio: 26 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.8 Modality Performed Procedure Step

2.2.8.1 Associated real-world activity

The system can be configured to request the creation and/or setting of remote MPPS on typical events related to examination/images life cycle. These requests start an association negotiation for the *Modality Performed Procedure Step Service*.

2.2.8.2 Proposed presentation contexts

A single Presentation Context is offered for an association, with Abstract Syntax related to the "Modality Performed Procedure Step SOP Class" (1.2.840.10008.3.1.2.3.3) and Transfer Syntax "Implicit VR Little Indian". No extended negotiation is performed. Default SCU role is assumed.

2.2.8.2.1 SOP specific conformance statement for Modality Performed Procedure Step SOP Class

The supported attributes building the data set of N-CREATE and N-SET messages are listed in the tables below. All type 1 attributes will be sent with a length different from zero; all type 2 attributes listed in the table will be sent, possibly with a length of zero. All type 3 attributes may or may not be transmitted, possibly with a length of 0, depending on the parameters passed to HNDI by the application requesting the service. Furthermore all attributes labeled with "Final State" 1 or 2 in the Dicom Standard, will be sent according with that state at least in the data set of one message; the choice of the message including these attributes (N-CREATE or N-SET) will be done according with the availability of the parameters at the moment of the request.

MPPS N-CREATE Data Set				
Attribute Name	Tag		Type	Matching Type
	Group	Element		
SOP Class UID	0008	0016	1	1.2.840.10008.3.1.2.3.3
SOP Instance UID	0008	0018	1	
Modality	0008	0060	1	
Procedure Code Sequence	0008	1032	2	
> Code Value	0008	0100	1	
> Coding Scheme Designator	0008	0102	1	
> Code Meaning	0008	0104	3	
Referenced Study Sequence	0008	1110	3	Always empty
Patient Name	0010	0010	2	
Patient ID	0010	0020	2	
Patient Birth Date	0010	0030	2	
Patient Sex	0010	0040	2	
Image Area Dose Product	0018	115E	3	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 27 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Study ID	0020	0010	2	
Performed Station AE title	0040	0241	1	
Performed Station Name	0040	0242	2	
Performed Location	0040	0243	2	
Performed Procedure Step Start Date	0040	0244	1	
Performed Procedure Step Start Time	0040	0245	1	
Performed Procedure Step End Date	0040	0250	2	
Performed Procedure Step End Time	0040	0251	2	
Performed Procedure Step Status	0040	0252	1	
Performed Procedure Step ID	0040	0253	1	
Performed Procedure Step Description	0040	0254	2	
Performed Procedure Type Description	0040	0255	2	
Performed Protocol Code Sequence	0040	0260	2	Always empty
Scheduled Step Attribute Sequence	0040	0270	1	
>Accession Number	0008	0050	2	
> Referenced Study Sequence	0008	1110	2	Always empty
> Study Instance UID	0020	000D	1	
> Requested Procedure Description	0032	1060	2	
> Scheduled Procedure Step Description	0040	0007	2	
> Scheduled Protocol Code Sequence	0040	0008	2	
>> Code Value	0008	0100	1	
>> Coding Scheme Designator	0008	0102	1	
>> Code Meaning	0008	0104	3	
> Scheduled Procedure Step ID	0040	0009	2	
> Requested Procedure ID	0040	1001	2	
Total Time of Fluoroscopy	0040	0300	3	
Total Number of Exposures	0040	0301	3	
Exposure Dose sequence	0040	030E	3	
> KVp	0018	0060	3	
> Exposure Time	0018	1150	3	
Comments on Radiation Dose	0040	0310	3	dGy*cm2



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 28 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

Performed Series Sequence	0040	0340	2	
> Retrieve AE Title	0008	0054	2	
> Series Description	0008	103E	2	
> Performing Physician's Name	0008	1050	2	
> Operator's Name	0008	1070	2	
> Referenced Image Sequence	0008	1140	2	
>> Referenced SOP Class UID	0008	1150	1	
>> Referenced SOP Instance UID	0008	1155	1	
> Protocol Name	0018	1030	1	
> Series Instance UID	0020	000E	1	
> Referenced Non-Image Composite SOP Instance Sequence	0040	0220	2	Always empty

MPPS N-SET Data Set				
Attribute Name	Tag		Type	Matching Type
	Group	Element		
SOP Instance UID	0008	0018	1	
Image Area Dose Product	0018	115E	3	
Performed Procedure Step End Date	0040	0250	2	
Performed Procedure Step End Time	0040	0251	2	
Performed Procedure Step Status	0040	0252	1	
Total Time of Fluoroscopy	0040	0300	3	
Total Number of Exposures	0040	0301	3	
Exposure Dose Sequence	0040	030E	3	
> KVp	0018	0060	3	
> Exposure Time	0018	1150	3	
Performed Series Sequence	0040	0340	3	
> Retrieve AE Title	0008	0054	2	
> Series Description	0008	103E	2	
> Performing Physician's Name	0008	1050	2	
> Operator's Name	0008	1070	2	
> Referenced Image Sequence	0008	1140	2	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 29 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

>> Referenced SOP Class UID	0008	1150	1	
>> Referenced SOP Instance UID	0008	1155	1	
> Protocol Name	0018	1030	1	
> Series Instance UID	0020	000E	1	
> Referenced Non-Image Composite SOP Instance Sequence	0040	0220	2	Always empty

HNDI accepts status codes from N-CREATE and N-SET service and performs actions as in the following list:

- 0000H Success. The MPPS notification is internally marked as "successful".
- Any other error code is managed by closing the association and collecting bad MPPS transaction in the local database.



PRIMO DICOM Conformance Statement			
Foglio: 30 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

2.2.9 Storage Commitment

2.2.9.1 Associated real-world activity

The system can be configured to request the storage commitment of each image transferred to a remote DICOM STORE SCP. This request starts an association negotiation for the *Storage Commitment Service*.

2.2.9.2 Proposed presentation contexts

A single Presentation Context is offered for an association, with Abstract Syntax related to the "Storage Commitment Push Model SOP Class" (1.2.840.10008.2.20.1) and Transfer Syntax "Implicit VR Little Indian". No extended negotiation is performed. Default SCU role is assumed.

2.2.9.2.1 SOP specific conformance statement for Storage Commitment SOP Class

HNDI accepts N-EVENT-REPORT only on an association separated from the N-ACTION one. The supported attributes building the data set of N-ACTION sent and N-EVENT-REPORT received messages are listed in the tables below. All type 1 attributes will be sent with a length different from zero; all type 2 attributes listed in the table will be sent, possibly with a length of zero. All type 3 attributes may or may not be transmitted, possibly with a length of 0, depending on the parameters passed to HNDI by the application requesting the service.

Storage Commitment N-ACTION Data Set				
Attribute Description	Tag		Type	Matching Type
	Group	Element		
Transaction UID	0008	1195	1	
Referenced SOP Sequence	0008	1199	1	
> Referenced SOP Class UID	0008	1150	1	
> Reference SOP Instance UID	0008	1155	1	

Storage Commitment N-EVENT-REPORT Data Set				
Attribute Description	Tag		Type	Matching Type
	Group	Element		
Transaction UID	0008	1195	1	
Failed SOP Sequence	0008	1198	1	
> Retrieve AE Title	0008	0054	3	
> Referenced SOP Class UID	0008	1150	1	
> Reference SOP Instance UID	0008	1155	1	
Referenced SOP Sequence	0008	1199	1	
> Retrieve AE Title	0008	0054	3	
> Referenced SOP Class UID	0008	1150	1	



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 31 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

> Reference SOP Instance UID	0008	1155	1	
------------------------------	------	------	---	--

HNDI accepts status codes from N-ACTION service and performs actions as in the following list:

- 0000H Success. The system close association and wait for N-EVENT-REPORT message on a separate association.
- Any other error code is managed by closing the association and displaying an explicative icon on the STUDY LIST and in the LOG file.

HNDI accepts N-EVENT-REPORT messages and performs actions as in the following list:

- Replays with a status code of 0000H. If the transaction is still active and the commitment has been accepted, the images listed in the transaction are marked as committed.
- Any other error code is managed by closing the association and displaying an explicative icon on the STUDY LIST and in the LOG file.



PRIMO DICOM Conformance Statement			
Foglio: 32 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

3 COMMUNICATION PROFILES

3.1 Supported communication stacks

The *Primo* provides TCP/IP Network Communication Support as defined in Part 8 of the DICOM standard.

3.1.1 TCP/IP stack

The *Primo* uses the TCP/IP stack of the Windows 7 Pro operating system under which it executes.

3.1.2 API

The *Primo* is not designed to be ported on different computers.

3.2. Physical media support

Current implementation uses Ethernet physical medium, but any medium and low level protocol supported by Windows O.S. TCP/IP can be adopted in future.

4 EXTENSIONS/SPECIALIZATIONS/PRIVATISATIONS

Not applicable.

5. CONFIGURATION

The *Primo* configuration is loaded into the PRIMO database present on HD.

5.1 AE Title/ Presentation Address Mapping

DICOM SCPs are identified by a "custom name" with associated parameters as AE title, IP address and port number.

The correspondence between "AE Title" and <Host><port> names/numbers shall be setup before any attempt to transmit. Furthermore it has to be configured the map of Internet Address and Router Address.



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 33 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

5.2 Configurable parameters

The following parameters may be configured by a qualified service provider for the *Primo*:

Configurable Network Attributes	Value
IP address	Mandatory
Subnet Mask	Mandatory
Local Network Host Name	Not Mandatory/ Not used
SCP DICOM Called Application Entity Title	Mandatory
Socket Port number	Mandatory
Router Address (Gateway)	If necessary to reach endpoint
DICOM Service(s) available	Y
Private Tag Support	N
P-Value Encoding Support	N
Other destination properties	Print: Layout
SCPM separate association support	N
GSPS support	N
Alternate IOD (Secondary Capture) for the SCP that does not support CR	N
Length of the communication time out	Typically 30s
CR / DX Store selection	Y
CR / DX bit Stored	Y

The number of bits stored in an image box send during a print session can be configured to 8 fixed or to best fit the set of the values accepted by the printer.

6 SUPPORT OF EXTENDED CHARACTER SETS

The *Primo* provides no support for extended character sets in the communication with DICOM SCPs.



PRIMO DICOM Conformance Statement			
Foglio: 34 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

MEDIA INTERCHANGE CONFORMANCE STATEMENT

7 MEDIA INTERCHANGE: INTRODUCTION

Primo is equipped with a *Media Storage Interface* (MSI) that allows the creation of a CD/DVD file-set according with DICOM 3.0 standard.

This document describes the conformance of MSI to DICOM 3.0 standard.

8 IMPLEMENTATION MODEL

MSI is an application capable to convert local storage images in a file set on exam base and to write the file set to a CD-R.

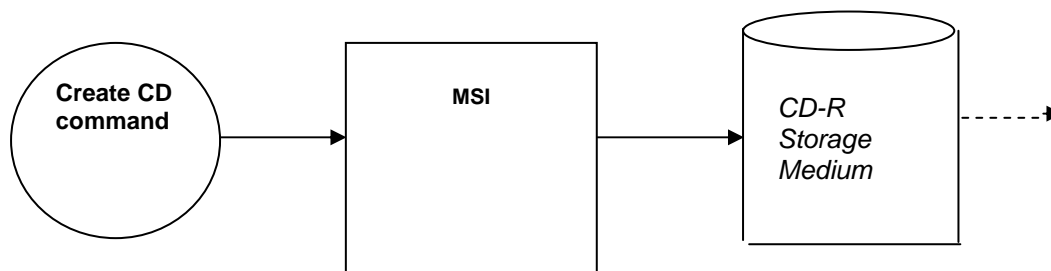


Figure 8.1-1 HMSI Implementation Model

8.1 Application data flow diagram

A dedicated menu command starts CD image creation and CD/DVD writing. See figure 8.1-1.

8.2 Functional definitions of AE's

When MSI is invoked, it starts CD image construction and formatting. Then it let the user execute a standard CD/DVD writer application. It returns the command exit status to be displayed on the main monitor (depending on status return code).

8.3 Sequencing of Real-World Activities

Not applicable.

8.4 File Meta Information options

Primo supplies the Implementation Class UID 1.3.6.1.4.1.34656.1.1

The version name provided is " ATSDICOMV1.0".



PRIMO DICOM Conformance Statement			
Foglio: 35 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

9 AE SPECIFICATIONS

9.1 MSI specifications

MSI provides standard conformance to DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed in Table 9.1-1.

Table 9.1-1 Application Profiles, Activities and Roles for HMSI

Application Profiles supported	Real World Activity	Role	SC Option
STD-GEN-CD/DVD	Create CD/DVD	FSC	Interchange

9.1.1 File Meta Information for MSI

The Source Application Entity Title is set by the user in the Dicom Setup dialog.

9.1.2 Real-World Activity for HMSI

9.1.2.1 Real-World Activity: "Create CD"

MSI acts as an FSC using the Interchange Option when requested to create a new CD/DVD
MSI uses all the SOP Instances of the selected exam to build a file-set to be written to the media. A corresponding DICOMDIR is created and the file set is written to an empty CD/DVD

9.1.2.1.1 Application Profiles for the RWA: "Create CD"

The Application Profiles using MSI for "Create CD" RWA are listed in table 9.1-1. There are no extensions or specializations.

9.1.2.1.1.1 Options

Table 9.1.2.1.1.1-1 lists the SOP Classes supported by the "Create CD" RWA for each of the selectable profiles.

Table 9.1.2.1.1.1-1 IOD and Transfer Syntax for STD-GEN-CD

Information Object Definition	SOP Class UID	Transfer Syntax	Transfer Syntax UID
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1 .1	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1 .1.1	Explicit VR Little Endian Uncompressed	1.2.840.10008.1.2.1



APPLICAZIONE TECNOLOGIE SPECIALI SRL

PRIMO DICOM Conformance Statement			
Foglio: 36 di 36	Data originale: 04-07-2012	Revisione: 0	Data Revisione:
Preparato: Davide P. and Marilina C.		Approvato: Franco C.	

10 AUGMENTED AND PRIVATE PROFILES

10.1 Augmented Profiles

None.

10.2 Private Profiles

None.

11 EXTENSIONS, SPECIALIZATIONS, PRIVATIZATIONS OF SOP CLASSES AND TRANSFER SYNTAXES

None.

12 CONFIGURATION

A number of operating parameters can be configured by the operator. The "Primo User Manual" describes how to setup media storage parameters from the "DICOM Setup dialog".

Configurable parameters are for example:

- source AE title
- enable overlay embedded in pixel data

13 CHARACTER SET

No specific extended character set is supported.