Philips Medical Systems
DICOM Conformance Statement

Inturis Suite R1.1.2

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Philips
Medical
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Issued by:
Philips Medical Systems Nederland B.V.
Integrated Clinical Solutions, Marketing & Communications
Building QV-280
P.O. Box 10.000
5680 DA Best
The Netherlands
Tel.: +31 40 2762818
Fax.: +31 40 2762673
email: dicom@philips.com
Internet (with the latest versions of Conformance Statements and other DICOM information):
http://www.philips.com/ms/solution/connect
ftp://ftp.philips.com/pub/ms/dicom/Conformance_Stmnts

1 Introduction

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

1.1 Scope and field of application

The scope of this DICOM Conformance Statement is to facilitate data exchange with equipment of Philips Medical Systems. This document specifies the compliance to the DICOM standard (formally called the NEMA PS 3.X-1999 standards). It contains a short description of the applications involved and provides technical information about the data exchange capabilities of the equipment. The main elements describing these capabilities are: the supported DICOM Service Object Pair (SOP) Classes, Roles, Information Object Definitions (IOD) and Transfer Syntaxes.

The field of application is the integration of the Philips Medical Systems equipment into an environment of medical devices.
This Conformance Statement should be read in conjunction with the DICOM standard and its addenda [DICOM].

1.2 Intended audience

This Conformance Statement is intended for:
- (potential) customers,
- system integrators of medical equipment,
- marketing staff interested in system functionality,
- software designers implementing DICOM interfaces.

It is assumed that the reader is familiar with the DICOM standard.

1.3 Contents and structure

The DICOM Conformance Statement is contained in chapter 2 through 7 and follows the contents and structuring requirements of DICOM PS 3.2-1999.

1.4 Used definitions, terms and abbreviations

DICOM definitions, terms and abbreviations are used throughout this Conformance Statement. For a description of these, see NEMA PS 3.3-1999 and PS 3.4-1999.
The word Philips in this document refers to Philips Medical Systems.

1.5 References

[DICOM] The Digital Imaging and Communications in Medicine (DICOM) standard:
NEMA PS 3.X 1999
National Electrical Manufacturers Association (NEMA) Publication Sales
1300 N. 17th Street, Suite 1847
Rosslyn, Va. 22209, United States of America

1.6 Important note to the reader

This Conformance Statement by itself does not guarantee successful interoperability of Philips equipment with non-Philips equipment. The user (or user's agent) should be aware of the following issues:

- **Interoperability**
  Interoperability refers to the ability of application functions, distributed over two or more systems, to work successfully together. The integration of medical devices into a networked environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment.
  It is the user's responsibility to analyse thoroughly the application requirements and to specify a solution that integrates Philips equipment with non-Philips equipment.

- **Validation**
  Philips equipment has been carefully tested to assure that the actual implementation of the DICOM interface corresponds with this Conformance Statement.
  Where Philips equipment is linked to non-Philips equipment, the first step is to compare the relevant Conformance Statements. If the Conformance Statements indicate that successful information exchange should be possible, additional validation tests will be necessary to ensure the functionality, performance, accuracy and stability of image and image related data. It is the responsibility of the user (or user's agent) to specify the appropriate test suite and to carry out the additional validation tests.

- **New versions of the DICOM Standard**
  The DICOM Standard will evolve in future to meet the user's growing requirements and to incorporate new features and technologies. Philips is actively involved in this evolution and plans to adapt its equipment to future versions of the DICOM Standard. In order to do so, Philips reserves the right to make changes to its products or to discontinue its delivery.
  The user should ensure that any non-Philips provider linking to Philips equipment, also adapts to future versions of the DICOM Standard. If not, the incorporation of DICOM enhancements into Philips equipment may lead to loss of connectivity (in case of networking) and incompatibility (in case of media).

1.7 General Acronyms and Abbreviations.

The following acronyms and abbreviations are used in the document.

- ACC American College of Cardiology
- AE Application Entity
- ACR American College of Radiology
- ANSI American National Standard Institute
- BOT Basic Offset Table
- CD-R CD Recordable
- CD-M CD Medical
- DCR Dynamic Cardio Review
- DICOM Digital Imaging and Communication in Medicine
- DIMSE DICOM Message Service Element
- DIMSE-C DICOM Message Service Element-Composite
- DIMSE-N DICOM Message Service Element-Normalized
- ELE Explicit VR Little Endian
- EBE Explicit VR Big Endian
- FSC File Set Creator
- GUI Graphic User Interface
- HIS Hospital Information System
- HL7 Health Level Seven
- ILE Implicit VR Little Endian
- IOD Information Object Definition
- ISIS Information System - Imaging System
- NEMA National Electrical Manufacturers Association
- PDU Protocol Data Unit
- RIS Radiology Information System
- RWA Real World Activity
- SC Secondary Capture
- SCM Study Component Management
- SCP Service Class Provider
- SCU Service Class User
- SOP Service Object Pair
- TCP/IP Transmission Control Protocol/Internet protocol
- UID Unique Identifier
- WLM Worklist Management

2 Implementation model

This document is the DICOM Conformance statement for the Philips Medical Systems Inturis Suite R1.0, later referred to as Inturis Suite.

The Inturis Suite is primarily intended for viewing of X-Ray Angiographic multi-frame and SC images and archiving, storage and retrieving images. Images may be viewed that reside on the local file system or directly from CD media.

All of the DICOM features presented in this document are optional and may not be available on all Inturis Suite related products.

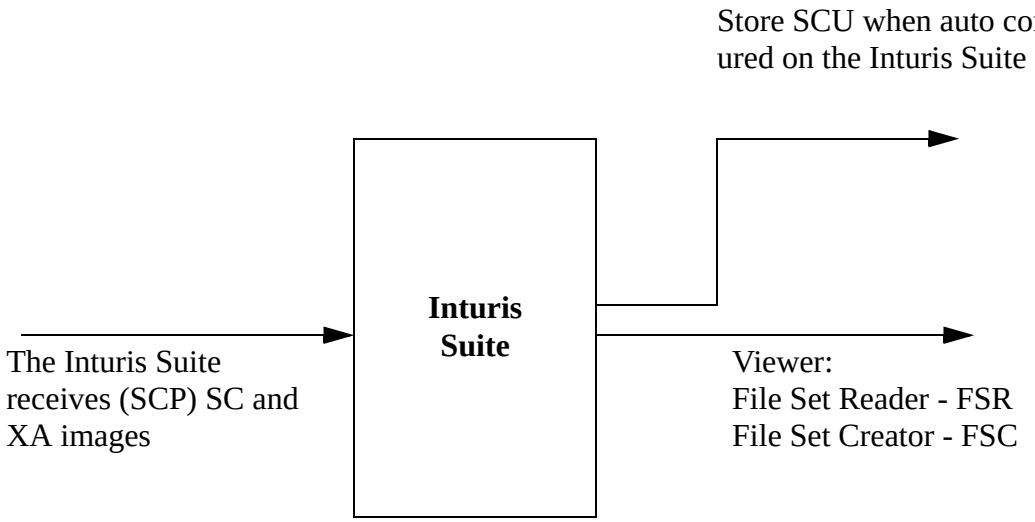

Figure 2-1: Topology of the Inturis Suite system

2.1 Application Data Flow Diagram

The Inturis Suite related Implementation Model is shown in Figure 2-2 on page 10.

As documented in the PS3.4-1999, the arrows in the diagram on the following page have the following meanings:

- A double headed arrow indicates user interaction with the local application entity.
- An arrow pointing to the right indicates the local application entity initiates an association
- An arrow pointing to the left indicates the local application entity accepts an association.

2.2 Functional definition of Application Entities

2.2.1 Application Entity: C-STORE SCP/SCU

The Inturis Suite accepts an association with a remote DICOM AE when the remote system requests image storage using the DICOM Storage service class. The images are transmitted to the local file system and added to the study database associated with the image. A message is logged pertaining to the new image added that specifies the remote AE title and file path.

2.2.2 Application Entity: DICOM Reading/Recording

The AE “DICOM Reader” supports the following functions;

- Read the DICOMDIR file that represents the contents of the (image) data as recorded. This information is displayed as an ordered list of icon images together with pertinent identifying information (patient name, etc.).
- Read the selected image *SOP (Service Object Pair)* instance from CD-R device and display it on the monitor of the View Station. This information is displayed as an ordered list of frames of the selected image or as a dynamic review of the selected image.

The AE “DICOM Recording” supports the following functions:

- Initialization of the CD-R Media, writing a DICOM File-set onto the media.
- Copying of *SOP (Service Object Pair)* instances from the local (buffer) storage to the CD-R device.
- Creation of a DICOMDIR file that represents the contents of the (image) data as recorded.

2.3 Sequencing of Real World Activities

All Real-World Activities as specified in Figure 2.2 may occur independently from each other.

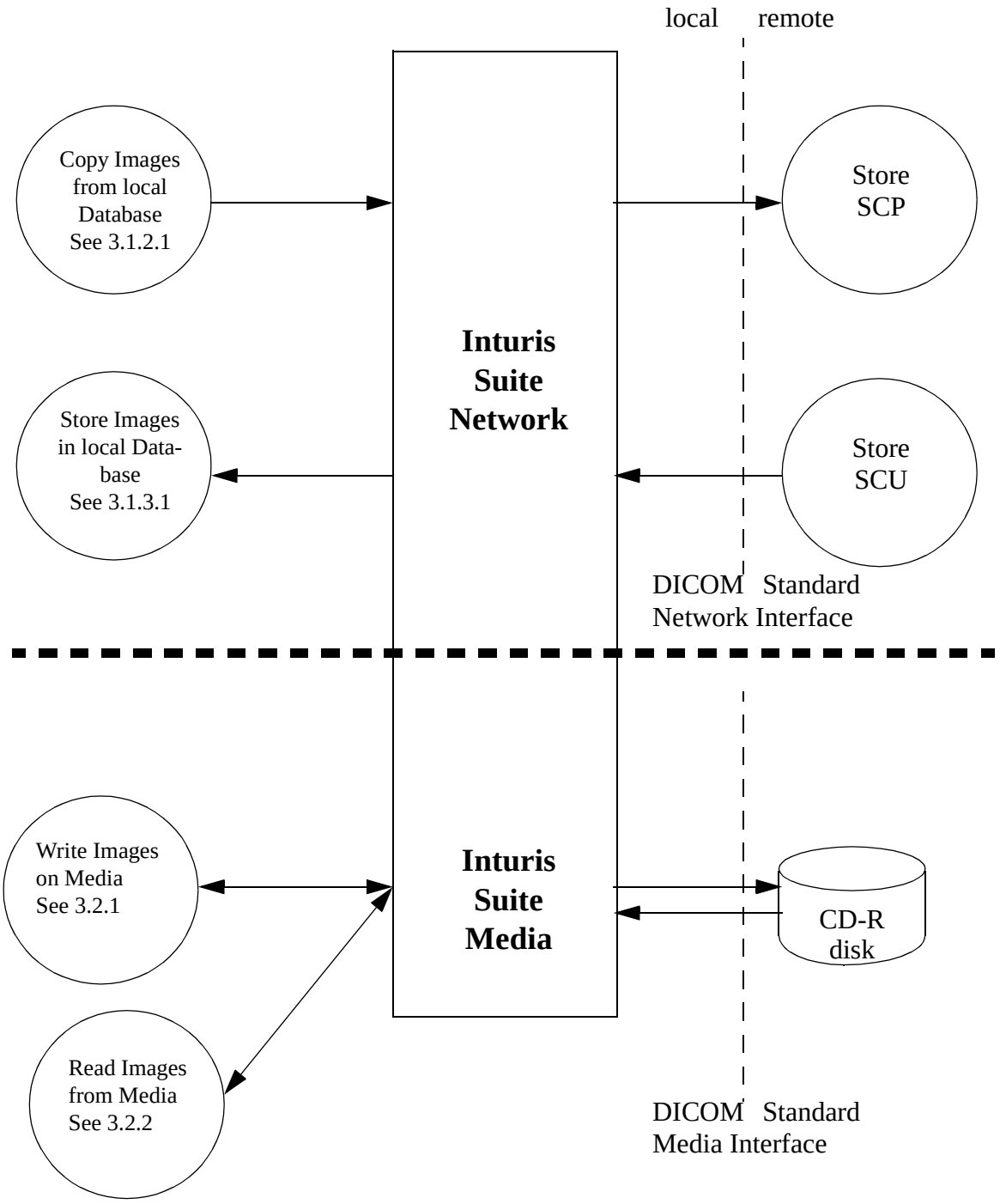

Figure 2-2: The Inturis Suite Implementation Model

3 AE Specifications

The Network capabilities of the Inturis Suite DICOM Application Entity are specified in section 3.1.

3.1 Inturis Suite AE Network Specification

The Inturis Suite Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCU and SCP specified in Table 3.1.

Table 3-1: Supported SOP classes by the Inturis Suite AE as SCP and SCU

SOP class Name	UID
SC Image Storage	1.2.840.10008.5.1.4.1.1.7
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1

3.1.1 Association Establishment Policies

3.1.1.1 General

The Inturis Suite always proposes the following DICOM Application Context Name (ACN): 1.2.840.10008.3.1.1.1

The maximum length PDU negotiation is included in all association establishment requests. The default maximum length PDU for an association initiated by the Inturis Suite is: 28 kB.

3.1.1.2 Number of Associations

The number of associations that may be active simultaneously is 10.

3.1.1.3 Asynchronous Nature

DICOM asynchronous mode is not supported meaning that only one transaction may be outstanding over an association at any given point in time.

3.1.1.4 Implementation Identifying Information

The Implementation Class UID is: 1.3.46.670589.7.11.1.1
The implementation version name: “Inturis Suite R1.1.2”

3.1.2 Association Initiation Policy

3.1.2.1 Copy Images from Inturis Suite (Image Export)

3.1.2.1.1 Associated Real-World Activity

The Inturis Suite will only export the XA and SC images when configured so. Via the Configuration file on the system, 1 destination can be declared/configured. On association as SCP the received images will be automatically send to the destination as well as stored in the internal database of the Inturis Suite.

3.1.2.1.2 Proposed presentation Contexts

The following table illustrates the proposed presentation contexts for the Image Storage request.

Table 3-2: Proposed Presentation Contexts for Image Export and Image Export (SCU/SCP)

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
X-Ray Angiographic Image Storage	1.2.840.1008.5.1.4.1.1.12.1	ELE JPEG Lossless First-Order Prediction (Process 14) (Selection Value 1)	1.2.840.10008.1.2.1 1.2.840.10008.1.2.4.70	SCU/SCP SCU/SCP	None None
Secondary Capture Image Storage	1.2.840.1008.5.1.4.1.1.7	ELE	1.2.840.10008.1.2.1	SCU/SCP	None

Note: The JPEG process 14 transfer syntax is preferred.

3.1.2.1.3 SOP Specific Conformance

The Inturis Suite conforms to the SOP's of the Storage Service Class at level 2 (full). No data elements are discarded or coerced by the Inturis Suite.

3.1.2.1.4 Presentation Context Acceptance Criterion

Not Applicable.

3.1.3 Association Acceptance Policy

3.1.3.1 Store Images in the Inturis Suite (Image import)

3.1.3.1.1 Associated Real-World Activity

The Inturis Suite is always ready to accept a new transport connection and create a thread to process the Image Storage request. The Inturis Suite will accept the presentation context associated with the Image Storage request and reply with a C-STORE response when the complete image has been received on the established association.

The image will be accepted only, if the next tags are available (present):

Patient Name	0010,0010
Patient Sex	0010,0040
Patient Birthdate	0010,0030
Patient ID	0010,0020
Study UID	0020,0010
Study Date	0008,0020
Study ID	0020,0010
Institution Name	0008,0080

3.1.3.1.2 Accepted presentation Contexts

The table Table 3-2, “Proposed Presentation Contexts for Image Export and Image Export (SCU/SCP),” on page 12 illustrates the accepted presentation contexts for the Image Storage request.

3.1.3.1.3 SOP Specific Conformance

The Inturis Suite conforms to the SOP’s of the Storage Service Class at level 2 (full). No data elements are discarded or coerced by the Inturis Suite.

3.1.3.1.4 Presentation Context Acceptance Criterion

Not Applicable.

3.2 Inturis Suite AE Media Specification

The Inturis Suite AE provides Standard Conformance to the DICOM Media Storage Service and File Format (PS 3.10) and the Media Storage Application Profiles (PS 3.11).

The supported Application Profiles, their Roles and the Service Class (SC) options, all defined in DICOM terminology, are listed in Table 3-3.

Table 3-3: Application Profile, Activities and Roles of the of the Inturis Suite

Application Profile	*Identifier*	*Real World Activity*	*Role*	*SC Option*
Basic cardiac X-Ray Angiographic Studies on CD-R media.	STD-XABC-CD	Write image(s) on CD-R disk	FSC	Interchange
	STD-XABC-CD	Read image(s) from CD-R disk	FSR	Interchange
1024 X-Ray Angiographic Studies on CD-R Media.	STD-XA1K-CD	Write image(s) on CD-R disk	FSC	Interchange
	STD-XA1K-CD	Read image(s) on CD-R disk	FSR	Interchange

3.2.1 AE Specification: DICOM Recording

3.2.1.1 Application Entity Title

The Application Entity title is registered into the DICOM File Meta Information header and is supported by the CD-writer (CD write option) acting as a FSC.

Application Entity Title: “INTURISPRO_FSU”

3.2.1.2 RWA Transfer of an Examination

The SOP instances as provided by the RWA are written to the CD-R media and a corresponding DICOMDIR is created.

3.2.1.3 Application Profile(s) for this RWA

Refer to Table 3-3 for the list of Application Profiles that invoke this AE.

3.2.1.4 DICOMDIR keys.

In the DICOMDIR file a Basic Directory IOD is present, containing Directory records at the patient, study, series and image level.

3.2.2 AE Specification: DICOM Reading

3.2.2.1 Application Entity Title

Not applicable.

3.2.2.2 RWA Review and Analysis of an Examination

The “DICOM Reader” AE will act as a FSR using the Interchange option when reading the directory of the medium and when reading the requested images.
Reading images send to the Inturis Suite and viewed on the viewer will only be properly displayed for:

XA 512*512 and 1024*1024 8 bits uncompressed or lossless JPEG
SC 512*512 and 1024*1024 8 bits and 1280*1028 8 bit (uncompressed)

3.2.2.3 Application Profile(s) for this RWA

Refer to Table 3-3 for the list of Application Profiles that invoke this AE.

4 Communication Profiles

4.1 Supported Communication Stacks

TCP/IP is the only protocol stack supported.

4.2 TCP/IP Stack

The TCP/IP stack as supported by the Windows NT Operating System or the TCP/IP stack is supported by the SGI IRIX operating system.

4.3 API

The API is the WinSock 2 interface as supported by the Windows NT Operating System.

4.3.1 Physical Media Support

Supported physical medium include:
- IEEE 802.3-1995 (Fast Ethernet) 100BASE-TX.
- IEEE 802.3-1995 10BASE-TX

5 Extensions/Specializations/Privatizations

- The Inturis Viewer will only display 512x512 8 bit uncompressed or lossless (JPEG 14) compressed or 1024x1024 8 bit uncompressed or lossless (JPEG14) compressed - other formats are not supported.
- Multi session CD’s are not supported.
- The viewer can only write complete studies to a CD - not a subselection from a study.

6 Configuration

6.1 AE Title/Presentation Address mapping

The Network AE title as well as the IP Address and the TCP listen port associated with this AE is configurable.

7 Support of Extended Character Sets

The Inturis Suite supports Extended Character Set “ISO_IR 100” which is the Latin alphabet No 1, supplementary set.

8 Remarks

- When no date is entered, the user interface will display the date "01-01-1800". Images are sent out with empty date attributes.
- Viewing station only supports 8 bits-allocated images.
- Viewing station tries to display incorrect images. There is no message that images are not correct.