

**Philips Medical Systems  
DICOM Conformance Statement**

**Inturis Online R2.1  
InDirect Serve Work-/Viewstations  
DICOM Store, Query/Retrieve**

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# 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-1996 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]. The conformance to the DICOM standard is a key element of the Inturis Program (see [INTURIS]).

## 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 3.2-1996.

## 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 3.3-1996 and PS 3.4-1996.

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 1996  
National Electrical Manufacturers Association (NEMA) Publication Sales  
1300 N. 17th Street, Suite 1847  
Rosslyn, Va. 22209, United States of America

[INTURIS] Inturis for Cardiology  
On-Line Image Access  
Doc. nr. 4522 982 69681  
Philips Medical Systems Nederland BV

[EV REL BUL] EasyVision Release Bulletin, Document Number 4522 220 84541  
Easy Vision Modules (EVM)  
Philips Medical Systems Nederland B.V. (see address at page ii)

## 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
- DCI Digital Cardio Imaging
- 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
- ELE Explicit 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 Viewstation line of products that includes the following products:

- IDS DWS
- CVS
- CVS SP

All Philips Viewstation related products are simply referred to as the Viewstation throughout the remainder of this document.

The Viewstation is primarily intended for the view of X-Ray Angiographic multi-frame images. Images may be viewed that reside on the local file system or directly from CD media. DICOM network functionality is supported which enables the user to find and retrieve studies from remote DICOM Archives or other DICOM Workstation devices.

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

### 2.1 Application Data Flow Diagram

The Viewstation related Implementation Model is shown in Figure 2-1 on page 10.

As documented in the PS3.4-1998, 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

The DICOM echo functionality enables the user to verify the DICOM network communication/protocol stack is properly working. An association is established with the remote DICOM AE and a C-ECHO operation is carried out as specified by the DICOM Verification service class.

The find study functionality enables the user to find a particular study on a remote DICOM AE. The Viewstation forms a C-FIND request that contains a set of search parameters as specified by the DICOM Query/Retrieve service class. The Viewstation receives each matching C-FIND response corresponding to a study and displays the information to the user.

The retrieve study functionality enables the user to retrieve a study from a remote DICOM AE. The Viewstation forms a C-MOVE request as specified in the Query/Retrieve service class. The retrieve AE title and study UID that is required in the C-MOVE request is determined based on information returned in a previous C-FIND response.



The Viewstation accepts an association with a remote DICOM AE when the remote system requests network communication verification using the DICOM Verification service class. A message is logged that specifies the source AE title of the verification request. No other local real-world activity occurs.

The Viewstation accepts an association with a remote DICOM AE when the remote system requests image storage using the DICOM Storage service class. The image copied is written 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.

The Viewstation accepts an association with a remote DICOM AE when the remote system requests commitment of a list of images using the DICOM Storage Commit service class. The N-ACTION request is processed as specified by the Storage Commit Push Model of the service class. The N-EVENT response is sent over another association initiated by the Viewstation.

### **2.3 Sequencing of Real World Activities**

All Real-World Activities as specified in Figure 2.1 may occur independently from each other.

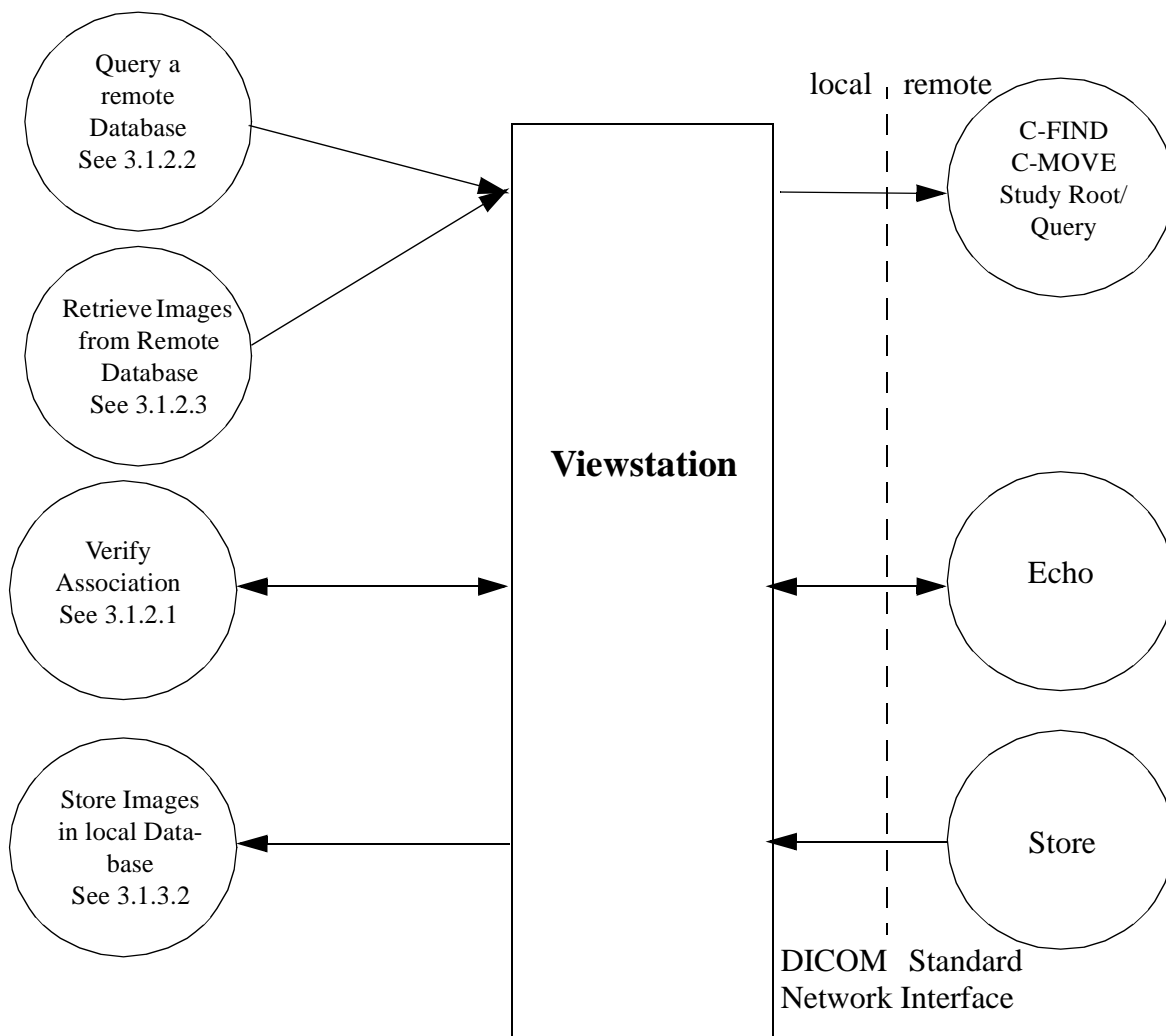


Figure 2-1: The Viewstation Implementation Model

## 2.4 Sequencing of Real-World Activities

The user must query for a list of studies prior to retrieving a study.

### 3 AE Specifications

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

#### 3.1 Viewstation AE Network Specification

The Viewstation Application Entity provides Standard Conformance to the DICOM V3.0 SOP classes as an SCU specified in Table 3-1.

**Table 3-1: Supported SOP classes by the Viewstation AE as SCU**

SOP class Name	UID
Verification	1.2.840.10008.1.1
Study Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Study Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2

**Table 3-2: Supported SOP classes by the Viewstation AE as SCP**

SOP class Name	UID
Verification	1.2.840.10008.1.1
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 Viewstation 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 Viewstation is: 1 MB

##### 3.1.1.2 Number of Associations

The default number of associations that may be active simultaneously is 20.

##### 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: 1.2.840.113697.6.8

The implementation version name: “IWS”

### 3.1.2 Association Initiation Policy

The Viewstation AE establishes an association for the following user requests.

- Verification (C-ECHO) request to remote DICOM AE
- Find a study on a remote DICOM AE database
- Retrieve a study from a remote DICOM AE

#### 3.1.2.1 Real-World Activity “User Selects DICOM Echo”

##### 3.1.2.1.1 Associated Real-World Activity

A user who is a member of the Philips service group selects the DICOM preferences tab. The user may then select a remote DICOM application entity and press the “DICOM Echo” button. An association will be initiated with the selected remote DICOM application entity. Upon successful association establishment, the C-ECHO request/response operation occurs over the association.

##### 3.1.2.1.2 Proposed Presentation Contexts

The Viewstation will propose the following presentation contexts:

**Table 3-3: Proposed Presentation Contexts for the 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	ILE	1.2.840.10008.1.2	SCU	None

##### 3.1.2.1.3 SOP specific conformance

An appropriate error message is logged if the C-ECHO request/response operation fails for any reason. The operator is notified of the success or failure of the DICOM Echo request.

##### 3.1.2.1.4 Association Termination

The Viewstation will release the association when the C-ECHO Response from the remote DICOM AE is received.

#### 3.1.2.2 Real-World Activity “User Selects Find Study”

##### 3.1.2.2.1 Associated Real-World Activity

The Viewstation will initiate an association when the user presses the Find Study button from the Find Study dialog. Upon successful association establishment, a C-FIND request is formed based on selection criteria entered by the user. Each C-FIND response is displayed to the user as one line on the list of studies found.

### 3.1.2.2.2 Proposed Presentation Contexts

The Viewstation will propose the following presentation contexts:

**Table 3-4: Proposed Presentation Contexts for the Verification Request**

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query Retrieve Information Model (C-FIND)	1.2.840.10008.5.1.4.1.2.2.1	ILE	1.2.840.10008.1.2	SCU	None

### 3.1.2.2.3 SOP Specific Conformance

An appropriate error message is logged if the C-FIND request/response operation fails for any reason. The operator is notified of the success or failure DICOM C- FIND request.

The Query/Retrieve Level (0008,0052) always has a value of “STUDY”.

The relational query option is not supported.

The C-FIND request for the Study Root Query Retrieve information model is composed of the following required and optional keys.

**Table 3-5: C-FIND Request for Study Root Query/Retrieve**

Attribute Name	Tag	VR	VM	Req	Notes
Specific Character Set	0008,0005	CS	1	O	value returned only
Number of Study Related Images	0020,1208	IS	1	O	value returned only
Retrieve AE Title	0008,0054	AE	1	O	value returned only
Storage Media File-Set ID	0088,0130	SH	1	O	value returned only
Storage Media File-Set UID	0088,0140	UI	1	O	value returned only
Study Instance UID	0020,000D	UI	1	U	Value returned only
Study Date	0008,0020	DA	1	R	User may enter start and/or end date
Study Time	0008,0030	TM	1	R	value returned only
Accession Number	0008,0050	SH	1	R	user may specify
Patient Name	0010,0010	PN	1	R	user may specify
Patient ID	0010,0020	LO	1	R	user may specify
Study ID	0020,0010	SH	1	R	user may specify
Referring Physician	0008,0090	PN	1	O	user may specify
Study Description	0008,1030	LO	1	O	value returned only
Modalities in Study	0008,0061	CS	1	O	user may specify
Performing Physician's Name	0008,1050	PN	1	O	user may specify
Physicians(s) of Record	0008,1048	PN	1-n	O	
Patient's Birth Date	0010,0030	DA	1	O	
Study Status ID	0032,0004	CS	1	O	

### 3.1.2.2.4 Association Termination

The Viewstation will release the association when the final C-FIND Response is received over the association. The association will be abnormally terminated if any error is encountered or the user cancels the Find Study request.

### 3.1.2.3 Real-World Activity "User Selects Retrieve Study"

#### 3.1.2.3.1 Associated Real-World Activity

The user selects a study from the list of studies returned from the previous find study user request and then presses the Retrieve Study button to queue the retrieval request. The study selected for retrieval is associated with a previous C-FIND response which contains a Retrieve AE title and Study UID. An association will be initiated with the Retrieve AE title associated with the user selected study. Upon successful association establishment, a C-MOVE request is

formed which contains the study UID corresponding to the user selected study.

Progress information is displayed to the user in the retrieve queue dialog based on C-MOVE pending and final responses received from the remote Retrieval AE.

### 3.1.2.3.2 Proposed Presentation Contexts

The Viewstation will propose the following presentation contexts:

**Table 3-6: Proposed Presentation Contexts for the Verification Request**

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	ILE	1.2.840.10008.1.2	SCU	None

### 3.1.2.3.3 SOP Specific Conformance

An appropriate error message is logged if the C-MOVE request/response operation fails for any reason. The operator is notified if the Move request fails for any reason.

The Query/Retrieve Level (0008,0052) always has a value of "STUDY".

### 3.1.2.3.4 Association Termination

The Viewstation will release the association when the final C-MOVE Response from the remote DICOM Retrieve AE is received. A C-CANCEL request is sent over the association if the user cancels the Retrieve Study request from the Retrieve Queue dialog.

### 3.1.3 Association Acceptance Policy

A new thread is created for each accepted transport connection. The new thread lives for the life of the association over the transport connection. Hence, the Viewstation is able to process the following types of incoming DICOM requests simultaneously:

- Request for Verification (C-ECHO)
- Request for Image Storage (C-STORE)

#### 3.1.3.1 Real World Activity “Verification Server”

##### 3.1.3.1.1 Associated Real-World Activity

The Viewstation is always ready to accept a new transport connection and create a thread to process the Verification request. The presentation context corresponding with the Verification request is accepted and a C-ECHO response is sent over the established association.

##### 3.1.3.1.2 Presentation Context Table

The following table illustrates the accepted presentation context for the DICOM Verification request.

**Table 3-7: Proposed Presentation Contexts for the 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	ILE	1.2.840.10008.1.2	SCU	None

##### 3.1.3.1.3 SOP Specific Conformance

The Viewstation provides standard conformance to the DICOM verification service class.

##### 3.1.3.1.4 Presentation Context Acceptance Criterion

Not Applicable.

##### 3.1.3.1.5 Transfer Syntax Selection Policies

Not Applicable.

#### 3.1.3.2 Real World Activity “Image Storage Server”

##### 3.1.3.2.1 Associated Real-World Activity

The Viewstation is always ready to accept a new transport connection and create a thread to process the Image Storage request. The Viewstation 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.



### 3.1.3.2.2 Accepted presentation Contexts

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

**Table 3-8: Proposed Presentation Contexts for the Verification Request**

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
X-Ray Angiographic Image Storage	1.2.840.1008.5.	- ILE	1.2.840.10008.1.2	SCP	None
	1.4.1.1.12.1	- JPEG Lossless Process 14 (Selection Value 1)	1.2.840.10008.1.2.4.70	SCP	None
		- ELE	1.2.840.10008.1.2.1	SCP	None
Secondary Capture Image Storage	1.2.840.1008.5.	ILE	1.2.840.10008.1.2	SCP	None
	1.4.1.1.7	ELE	1.2.840.10008.1.2.1	SCP	None
		EBE	1.2.840.10008.1.2.2	SCP	None

Note: The JPEG process 14 transfer syntax is preferred over the ILE VR (baseline) transfer syntax.

### 3.1.3.2.3 SOP Specific Conformance

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

Demographics for the first image received are represented to the user as demographics for the entire study. Demographics for subsequent images received for a study are ignored. The user has the ability to edit patient/study level demographics.

The following status codes indicate the Viewstation was unable to locally install the image file.

**Table 3-9: Status Codes**

Status Code	Description
A700	Insufficient free space is available to install the image.
A701	Insufficient processing resources to install the image (e.g. CD being authored).
C001	Unable to parse the image. The image is not installed.

A successful C-STORE operation indicates the image was written to the Viewstation's local file system. A patient and study level is created for the first image that belongs to a new study on the local file system. The new study will appear on the study list view when the first image for a new study is successfully installed on the local file system.

A series level is also created for the first image that belongs to a new series within the study. In addition, an icon image will be present for each image that locally resides in the study on the study information view.

#### **3.1.3.2.4 Presentation Context Acceptance Criterion**

Not Applicable.

## **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.

### **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 system sends a specific SCU and SCP role. The system send a “0” for the SCP-role (meaning that this role is not supported while it is) and sends a “1” for the SCU role (default role is 256).
- Every Multi Frame Image gets a different acquisition number.

## 6 Configuration

The table below lists the Application wide DICOM related configurable parameters.

**Table 6-1: Configurable Attributes**

Parameter	Notes
Institution Name	Written on all Image SOP Instances created
Institution Address	Written on all image SOP instances created

The table below lists the DICOM related parameters that are configurable for each DICOM Application Entity (i.e. both Local and Remote).

**Table 6-2: Configurable for each DICOM AE (Local and Remote)**

Parameter	Parameters subtype	Notes
AE Alias		User visible name associated with AE title.
AE Title		
IP Address		Dotted decimal format. An internet host name address is also allowed.
TCP Port		104 is the default for other nodes, is fixed for local nodes.
Lab Name		Associate the configured lab name with the AE Title.
Query Service Provider		Boolean value
	Default	Boolean value. Default query service provider displayed on Find Study Dialog.
Storage Service Provider		Boolean value.
	Default	Boolean value. Default storage service provider displayed on Send Study Dialog.
	Primary Archive	Boolean value.

## 7 Support of Extended Character Sets

The Viewstation supports Extended Character Set “ISO\_IR 100” which is the Latin alphabet No 1, supplementary set.