Philips Medical Systems
DICOM Conformance Statement

DSI Pro 1.0

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PHILIPS

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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 from 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. 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.
- AE   Application Entity
- ACR   American College of Radiology
- ANSI   American National Standard Institute
- CD-R   CD Recordable
- 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
- DSI   Digital Spot Imaging
- ELE   Explicit VR Little Endian
- EBE   Explicit VR Big Endian
- FSC   File Set Creator
- FSR   File Set Reader
- FSU   File Set Updater
- 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
- 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
- PACS   Picture Archiving Communication System

2 Implementation model

The DSI Pro contains a DSI 5.2.1 with autopush and a EasyVision 4.4. The DSI Pro is a digital fluorography modality. It is part of an X-ray system. Depending on the chosen configuration the functions are:
• Image acquisition and display
• Image review and processing
• Image handling, storage and networking,
• Administration of patient, physician and examination data.
• Read and write DICOM CD-R disks.
• Print Images on a DICOM printer
• Copy images from the local database to remote databases and vice versa.
• Import images for viewing.
• Storage Commitment function

The main application areas are:
• R/F examinations
• vascular and non-vascular examinations
• angiography and tomography examinations
• interventional procedures

DSI Pro Release 1.0 contains a DICOM Export function (e.g. to transfer DSI Pro image data to a remote system, Import Images) and a DICOM RIS interface (to retrieve an up-to-date Worklist from Radiology Information System).

2.1 Application Data Flow Diagram

The DSI Pro contains three Application Entity able to export DICOM images (to a Media and over a Network) and handle Modality Worklists. The related Implementation Model is shown in Figure 2-1 on page 4 and Figure 2-3 on page 6.
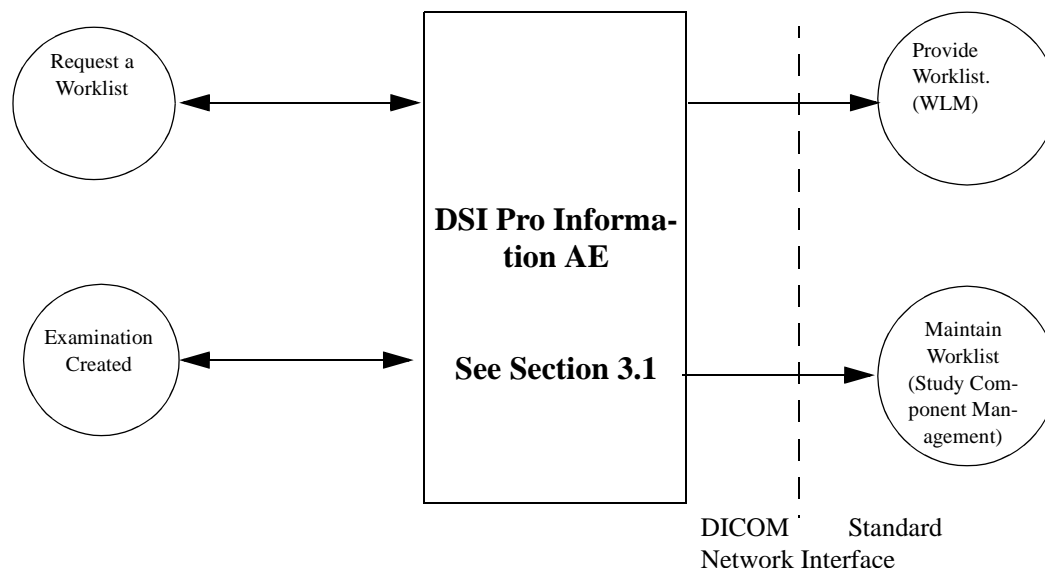
Figure 2-1: DSI Pro Information AE Implementation Model

The circles to the left represent the Local Real-World Activities and refer to the related section in this Statement.
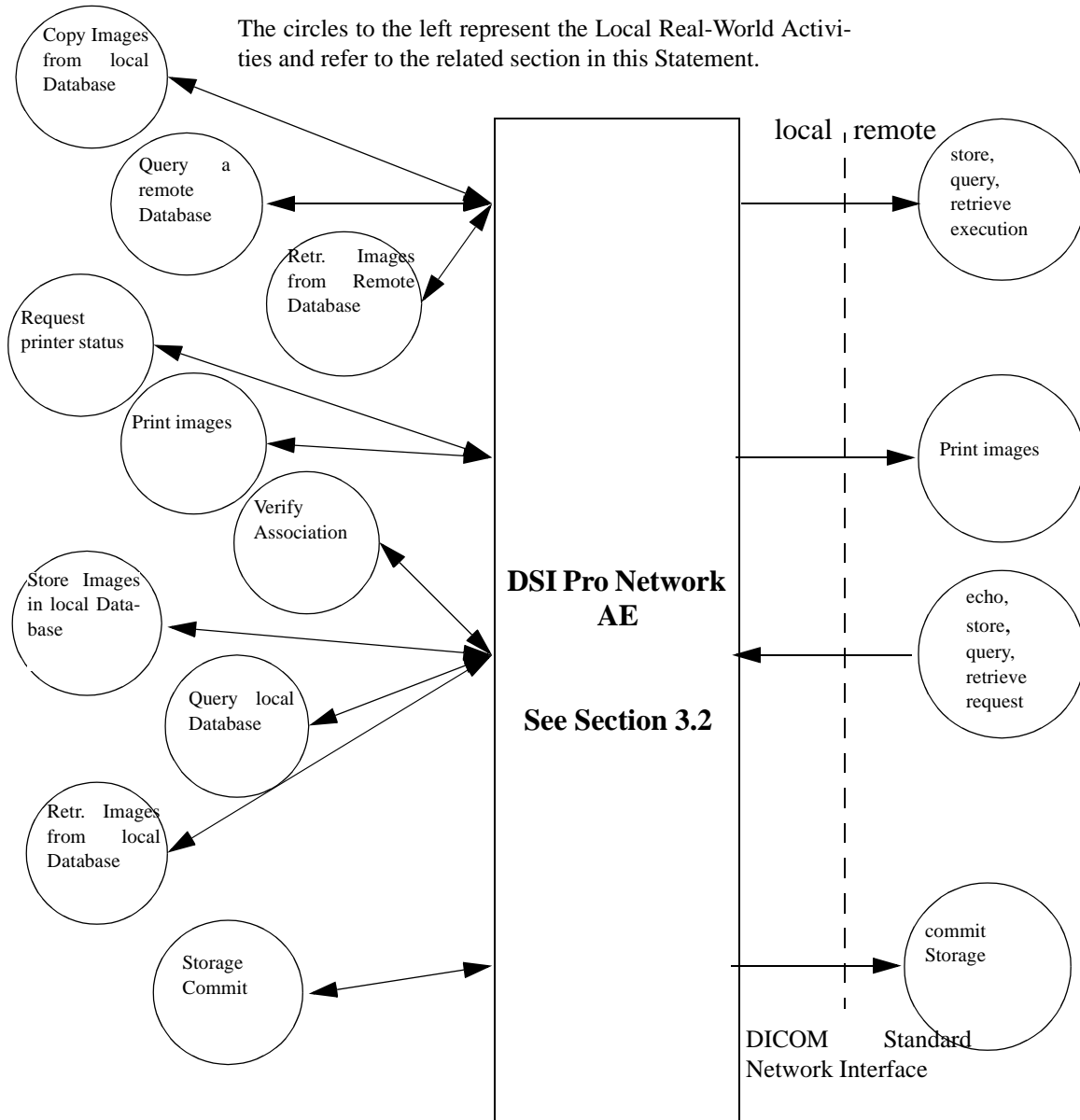
Figure 2-2: DSI Pro Network AE Implementation Model
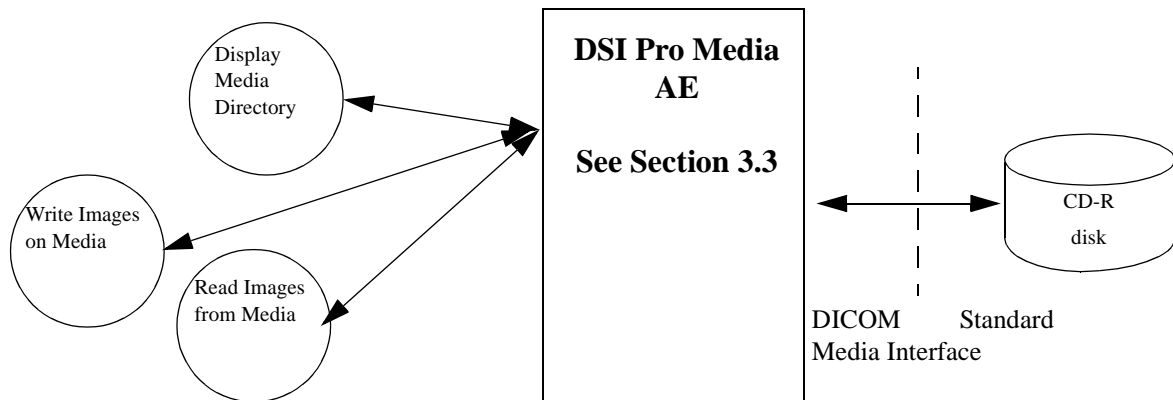
Figure 2-3: DSI Pro Media AE Implementation Model

2.1.1 Description of the DSI Pro Functionality

Figure 2-5 on page 7 gives an overview of all the DICOM functionality of the DSI Pro.
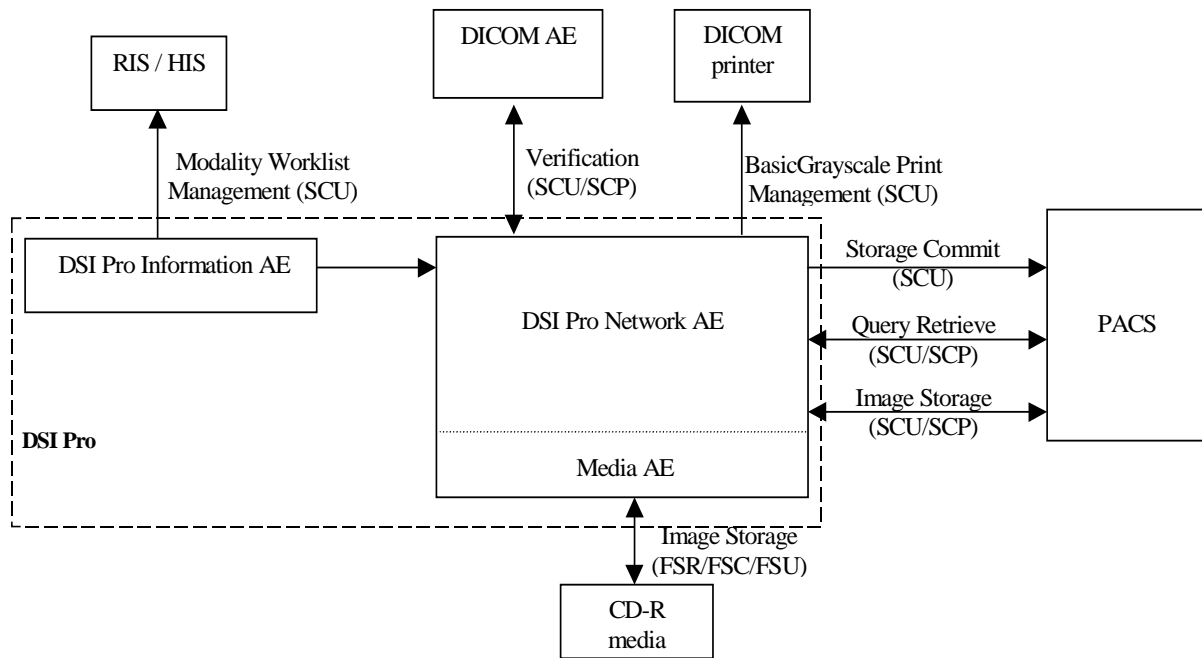
Figure 2-4: DSI Pro in a DICOM network

DSI Pro Information AE is able to retrieve the modality Worklist from a RIS. This is done at request of the operator. From the received list a selection of one Worklist item is made; the examination to be performed.

After selecting a Worklist item, the RIS is informed about this creation of the study component.

The DSI Pro can display a maximum of 42 patients in the worklist. When the system receives more then 42 patients in the worklist the system acts as a FIFO system (First In First Out), so

information about the first patient in the worklist is lost.

The DSI Pro Network an Media AE function are activated by an operator request. A selection of parts of the examination are choosen, followed by the selection of the remote destination.

With DSI Pro systems an examination corresponds to the DICOM Patient and Study level. Each examination contains one or more runs, corresponding to the DICOM Series level. Each run contains one or more images, corresponding to the DICOM Image level.

DSI   DICOM

```
                                        ┌──────────────┐
                                   ┌───▶│   Patient    │
                 ┌──────────────┐  │    └──────────────┘
                 │ Examination  │◀─┤           │
                 └──────────────┘  │    ┌──────────────┐
                        │          └───▶│    Study     │
                        │               └──────────────┘
                        │                      │
                 ┌──────────────┐       ┌──────────────┐
                 │     Run      │◀─────▶│    Series    │
                 └──────────────┘       └──────────────┘
                        │                      │
                 ┌──────────────┐       ┌──────────────┐
                 │    Image     │◀─────▶│    Image     │
                 └──────────────┘       └──────────────┘
```
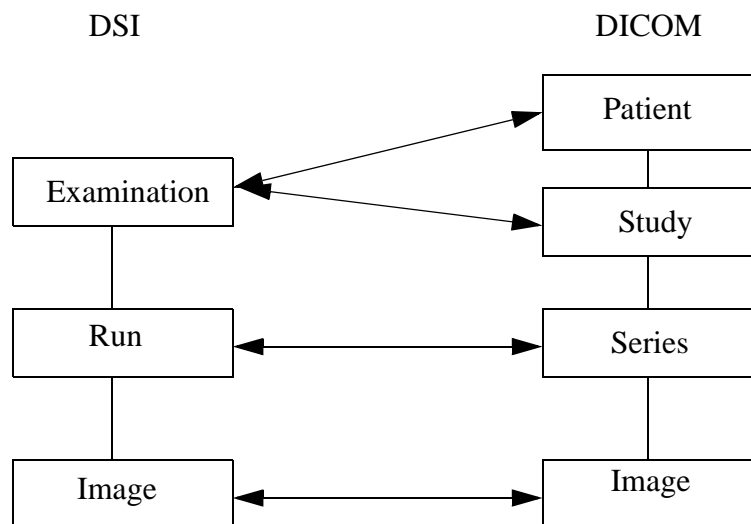
Figure 2-5: Relationship between the DSI and DICOM levels

The DSI Pro transfers a complete or parts of an examination to a remote DICOM node. The transfer of a subset of images in an examination is possible. During the DICOM store operation it is possible to perform a cancel operation on the store.

The DSI Pro operator can request to query a selected remote system, request to copy images from DSI Pro to a selected remote system, request to retrieve selected images from remote systems and can request to print images. This results in Associations initiated by DSI Pro.
DSI Pro is able to reply on verification requests, to execute a requested query, to store received images into DSI Pro and retrieve requested images from DSI Pro. These requests from remote systems are done via Associations initiated by the remote systems.

DSI Pro is also able to display the contents (i.e. directory listing) of DICOM CD-Recordable disks and to write, read and update images on/from a DICOM CD-Recordable disk.

2.2 Functional definition of Application Entities

The DSI Pro Network Application Entity acts as a Service Class User (SCU) of the Storage Service Class. After invoking it will open an Association to the remote system. For each image to be transported a retrieve action from the DSI Pro storage will take place followed by the conversion to a DICOM message to be transferred to the remote system.

The DSI Pro Network Application Entity acts as a Service Class User (SCU) of Query/ Retrieve and Store service classes. The application acts as a Service Class Provider (SCP) of Verification, Query/Retrieve and Store service classes.

The DSI Pro Network AE can also act as Service Class User (SCU) for the Print Service Class.

DSI Pro Media AE acts as a File Set Creator (FSC), File Set Reader (FSR) and File Set Updated (FSU) of the Media Service Class.

The DSI Pro Information Application Entity acts also as a Service Class User (SCU) of the Basic Worklist Management Service Class and the Study Component Management Service Class. After invoking it will open an Association to the remote system (usually a RIS) to request for the up-to-date modality Worklist.

After selecting a Worklist item, a new Association to the remote system is opened and that system is informed about the creation of a Study Component.

2.3 Sequencing of Real World Activities

The Request for Worklist should be done first, before a Study Component can be created. Then the generated images may be exported. However, export of DICOM images is also possible without the Worklist and Study Component activities.

All Real-World Activities as specified in Figure 2-1 and Figure 2-3 may occur independently from each other, except that the two local Print Real-World Activities are mutual exclusive: A request for the printer status is not done when a request for image printing is busy, vice versa.

3 AE Specifications

DSI Pro contains three Application Entities. An information handling AE, an Image handling network AE and an Image handling media AE.

3.1 DSI Pro Information DICOM AE Specification

The DSI Pro Information Application Entity provides Standard Conformance to the following DICOM 3.0 SOP classes as an SCU:

Table 3-1: Supported SOP classes by the DSI Pro Information DICOM AE as SCU

SOP class Name	UID
Modality Worklist Information Model - FIND	1.2.840.10008.5.2.1.4.31
Study Component Management	1.2.840.10008.3.1.2.3.2

The DSI Pro Information Application Entity does not support DICOM 3.0 SOP classes as an SCP.

3.1.1 Association Establishment Policies

3.1.1.1 General

The maximum PDU size of DSI Pro Information AE is fixed on 16K (is 16384 bytes). See also the important remark about the PDU size of the remote systems in chapter 6.

3.1.1.2 Number of Associations

DSI Pro Information AE will attempt to establish one Association at a time. DSI Pro Information AE does not accept Associations.

3.1.1.3 Asynchronous Nature

DSI Pro Information AE does not support asynchronous operations and will not perform asynchronous window negotiation.

3.1.1.4 Implementation Identifying Information

The Implementation Class UID is: "1.3.46.670589.6.1.1.5.1.2".
The Implementation Version Name is: "DSI R521, 000719".

3.1.2 Association Initiation Policy

DSI Pro Information AE initiates Associations as a result of the following events:

• The DSI Pro operator requests for the DSI Worklist, see section 3.1.2.1 on page 9;
• When a Study Component is created, see section 3.1.2.2 on page 13.

3.1.2.1 Request for a Modality Worklist

3.1.2.1.1   Associated Real-World Activity

This DSI Pro Information function will be triggered at request of the operator. An Association will be set-up to the pre-configured remote system (the RIS). After receiving the Worklist the Association is released.

3.1.2.1.2   Proposed Presentation Contexts

DSI Pro Information AE will propose the following presentation contexts:

Table 3-2: Proposed Presentation Contexts for Request for Modality Worklist

Presentation Context table					
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
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

3.1.2.1.3   SOP Specific Conformance to Modality Worklist Management

DSI Pro Information AE provides standard conformance.

If more than 42 worklist items are received (via C-FIND Responses) as result of a worklist request, DSI Pro will cancel the request by sending a C-CANCEL-FIND Request.

The status of the C-FIND Responses (Success, Refused, Error, Warning) is logged. Only general status messages are displayed on the user interface, like "RIS not responding" and "No patient available from RIS".

The following non-printable characters (hexa-decimal coded) are not supported in the received Worklist data:
    00H through 1FH,
    7FH
    80H through 9FH,
    A0H, A6H, A8H, A9H, AAH, AEH
    B1H, B4H, B8H, B9H, BEH
    C0H, C1H, C2H, C3H, C8H, CAH, CBH, CCH, CDH, CEH, CFH
    D0H. D2H, D3H, D4H, D5H, D9H, DAH, DBH, DDH, DEH
    E3H
    F0H, F5H, FDH, FEH
If one or more of these non-printable characters are present in the strings of received Worklist data, the string is not accepted. If non-printable characters are present in the Patient Name or if this attribute is empty, the worklist entry is not accepted. In case the Patient Name only contains spaces, this Worklist entry and all succeeding Worklist entries will be skipped.

This chapter specifies in detail the applied attributes in the C-FIND Service Element of this supported SOP Class

.

Table 3-3: Modality Worklist Information Model - FIND SOP Class - Patient Identification Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	
Patient ID	0010,0020	

Table 3-4: Modality Worklist Information Model - FIND SOP Class - Patient Demographic Module

Attribute Name	Tag	Note
Patient's Birth Date	0010,0030	
Patient's Sex	0010,0040	

Table 3-5: Modality Worklist Information Model - FIND SOP Class - Scheduled Procedure Step Module

Attribute Name	Tag	Note
Scheduled Procedure Step Sequence	0040,0100	
> Modality	0008,0060	Can be used as matching key. Applied value(s): RF
> Scheduled Station AE Title	0040,0001	Is used as fixed Single Value key.
> Scheduled Procedure Step Start Time	0040,0003	
> Scheduled Performing Physician's Name	0040,0006	
> Scheduled Procedure Step Description	0040,0007	

Table 3-6: Modality Worklist Information Model - FIND SOP Class - Requested Procedure Module

Attribute Name	Tag	Note
Study Instance UID	0020,000D	

Table 3-7: Modality Worklist Information Model - FIND SOP Class - Imaging Service Request Module

Attribute Name	Tag	Note
Accession Number	0008,0050	
Referring Physician's Name	0008,0090	

3.1.2.2 Create a Study Component

3.1.2.2.1   Associated Real-World Activity

This DSI Pro Information function will be triggered when a Worklist item is selected, i.e. a Study Component will be created. An Association will be set-up to the pre-configured remote system (usually a RIS). After informing the remote system about the created Study Component, the Association is released.

3.1.2.2.2   Proposed Presentation Contexts

DSI Pro will propose the following presentation contexts:

Table 3-8: Proposed Presentation Contexts for Create a Study Component

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Component Management SOP Class	1.2.840.10008.3.1.2.3.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCU	None

3.1.2.2.3   SOP Specific Conformance to Study Component Management

DSI Pro Information AE provides standard conformance.

Only the N-CREATE Service Element is used (as SCU), so no use of the N-GET and N-SET Service Elements.

No optional attributes are applied in the N-CREATE Service Element. The Specific Character Set (conditional in DICOM) will always be present.

The status of the DIMSE Responses (Success, Refused, Error, Warning) is logged. No status messages are displayed on the user interface.

This chapter specifies in detail the applied attributes in the N-CREATE Service Element of this supported SOP Class.

Table 3-9: Study Component Management SOP Class - Study Component Module

Attribute Name	Tag	Note
Referenced Series Sequence	0008,1115	Is always empty
Study ID	0020,0010	Is always empty

Table 3-10: Study Component Management SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied value(s):ISO_IR 100

Table 3-11: Study Component Management SOP Class - Study Component Relationship Module

Attribute Name	Tag	Note
Referenced Study Sequence	0008,1110	
> Referenced SOP Class UID	0008,1150	Applied value(s): 1.2.840.10008.3.1.2.3.1
> Referenced SOP Instance UID	0008,1155	Value from Study Instance UID in C-FIND Response of Modality Worklist.

Table 3-12: Study Component Management SOP Class - Study Component Acquisition Module

Attribute Name	Tag	Note
Modality	0008,0060	Applied value(s): RF, RG
Study Description	0008,1030	Description of the classification of the Study (Component) performed, entered by institution.
Study Component Status ID	0032,1055	

3.1.3 Association Acceptance Policy

DSI Pro Information AE does not accept Associations.

3.2 DSI Pro AE Network Specification

The DSI Pro Network and Media Application Entity provides Standard Extended Conformance to the DICOM V3.0 SOP classes as an SCU specified in Table 3-13. The following remarks are important:

- The SOP Classes to be used as SCU can be configured per remote station.
- In case the remote system does not support the import of a specific Image Storage SOP Class, DSI Pro will convert (if configured to do so) these images and sends them via the SC Image SOP Class.
- The Private SOP Classes are be stored in image archives but are to be used in DSI Pro systems only.
- The DSI Pro requests for a Storage Commitment.

Table 3-13: Supported SOP classes by the DSI Pro AE as SCU

SOP class Name	UID
Storage Commitment Push Model	1.2.840.10008.1.20.1
SC Image Storage	1.2.840.10008.5.1.4.1.1.7
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2
Patient Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Study Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Patient/Study Only Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2
Basic Grayscale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9
>[a] 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

a. The '>' sign indicates that the SOP Class is part of the above mentioned Meta SOP Class.

The DSI Pro Network and Media Application Entity provides Standard Conformance to the following DICOM V3.0 SOP classes as an SCP specified in Table 3-14.

Table 3-14: Supported SOP classes by the DSI Pro AE as SCP

SOP class Name	UID
Verification	1.2.840.10008.1.1

Table 3-14: Supported SOP classes by the DSI Pro AE as SCP (Continued)

SOP class Name	UID
CR Image Storage	1.2.840.10008.5.1.4.1.1.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
US Multi Frame Image Storage (**retired standard class**)	1.2.840.10008.5.1.4.1.1.3
US Multi Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
NM Image Storage (**retired standard class**)	1.2.840.10008.5.1.4.1.1.5
NM Image Storage	1.2.840.10008.5.1.4.1.1.20
US Image Storage (**retired standard class**)	1.2.840.10008.5.1.4.1.1.6
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1
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
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2
XA Bi-Plane Image Storage (**retired standard class**)	1.2.840.10008.5.1.4.1.1.12.3
Patient Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.1.1
Study Root Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.2.1
Patient/Study Only Query/Retrieve Info Model - FIND	1.2.840.10008.5.1.4.1.2.3.1
Patient Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.1.2
Study Root Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2
Patient/Study Only Query/Retrieve Info Model - MOVE	1.2.840.10008.5.1.4.1.2.3.2

3.2.1 Association Establishment Policies

3.2.1.1 General

DSI Pro Network AE as SCU will offer unrestricted maximum PDU size on Associations initiated by DSI Pro itself. This is also configurable per remote station. DSI Pro as SCP will offer the same PDU size as offered on Associations initiated by remote applications (SCU), this is not configurable, and will then use that same value as its own maximum PDU size.

3.2.1.2 Number of Associations

The number of simultaneous Associations supported by DSI Pro as a Service Class Provider is in principle not limited. The practical maximum number of supported Associations is determined by the amount of resources (CPU, memory, hard disk size).

As a result of local activities, DSI Pro will initiate at most 3 simultaneous Associations. One Association is used to issue query requests. The other Association is used to issue store or retrieve and one for print requests.

DSI Pro will further initiate an Association for each remote retrieve request executed by DSI

Pro as a MOVE Service Class Provider. These Associations are used to issue the store sub-operations implied by the retrieve requests. The number of simultaneous store Associations for this retrieve purpose is in principle not limited.

Storage Commitment can keep open a configurable number of associations.

3.2.1.3 Asynchronous Nature

DSI Pro Network AE does not support asynchronous operations and will not perform asynchronous window negotiation.

3.2.1.4 Implementation Identifying Information

The Implementation Class UID is: 1.3.46.670589.5.2.13
The implementation version name is: "EV44

3.2.2 Association Initiation Policy

DSI Pro Network AE initiates Associations as a result of the following events:
- The DSI Pro operator or a remote application copies selected images from the DSI Pro database to another database (i.e. image export), see section 3.2.2.1 on page 18;
- The DSI Pro operator queries a remote database, see section 3.2.2.2 on page 30;
- The DSI Pro operator copies selected images from a remote database to another database, see section 3.2.2.3 on page 31.
- The DSI Pro operator requests to print selected images in the DSI Pro database, see section 3.2.2.4 on page 32.
- The DSI Pro operator requests for the status of a selected printer, see section 3.2.2.5 on page 37.

3.2.2.1 Copy Images from DSI Pro (i.e. Image Export)

3.2.2.1.1   Associated Real-World Activity

The operator is able to copy all/selected images in a patient folder from the local DSI Pro database to a another database (i.e. image export) by means of the copy tool in the DSI Pro data handling facility. DSI Pro initiates for each selected patient an Association to the selected peer entity and uses it to send C-STORE requests (and receive the associated store replies). The Association is released when all selected images in the selected folder have been transmitted. DSI Pro handles operator copy requests one after another.

A DICOM copy action can also be initiated indirectly on some other Philips equipment by means of private protocols (like PMSnet, the Philips proprietary communication protocol). This is the auto-forward function. DSI Pro is able to simultaneously handle these auto-forward requests.

A remote application copies images from the local DSI Pro database to a another database by sending a C-MOVE request to DSI Pro. DSI Pro initiates for each received retrieve request an Association to the requested move destination and uses it to send C-STORE requests (and receive the associated store replies). The Association is released when all images selected by the retrieve request identifier have been transmitted. DSI Pro is able to simultaneously handle C-MOVE requests.

3.2.2.1.2   Proposed Presentation Contexts

DSI Pro will propose the following presentation contexts:

Table 3-15: Proposed Presentation Contexts for DSI Pro Network AE

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE	1.2.840.10008.1.2	SCU	None
See Note	See Note	ELE	1.2.840.10008.1.2.1	SCU	None
See Note	See Note	EBE	1.2.840.10008.1.2.2	SCU	None
See Note	See Note	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
See Note	See Note	JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51	SCU	None
See Note	See Note	JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57	SCU	None
See Note	See Note	JPEG Lossless, Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70	SCU	None

Note: Any of the Standard Image Storage SOP classes listed in Table 3-1, "Supported SOP classes by the

DSI Pro Information DICOM AE as SCU," on page 9. For performance reasons the EBE is preferred.

3.2.2.1.3   C-STORE SCU Conformance

Options:
Extended negotiation is not supported.

Status display and error handling:
The store response status is saved in the log file, a user error will be displayed in the GUI.
DSI Pro will stop the transfer of the images and release the Association as soon as it receives an unsuccessful or warning store response status. In case a remote application requested the transfer (by means of a C-MOVE request), a move response with status unsuccessful is sent to the retrieve requester.

Important remarks about the exported images:
- Export of imported images can result in differences between imported and exported data.
- Before the DSI Pro exports the images, the image processing (except for the shutters) is burnt into the exported images.
- Images viewed on the DSI Pro use circular shutters, these shutters are not exported in the processed image.
- DSI Pro allows the operator to modify attributes of the stored images. DSI Pro does not modify the pixel values of the stored images. The DSI Pro system can be configured to either:
  - Always change the SOP Instance UID when exporting an Image.
  - Never change the SOP Instance UID when exporting an Image.
- In case the remote system does not support a modality specific Image Storage SOP Class, DSI Pro will convert (if configured to do so) the images and sends them via the SC Image SOP Class. These Secondary Capture images and additional information (like graphics, text and important attribute information) are burnt-in (if configured). The original bit depth of the Secondary Capture image is kept.
- Attributes e.g. Study Date and Study Time will be added to images to be exported (if not yet present).
  This is done because there are imaging systems relying on the existence of these attributes.
- The exported DSI Pro images do not contain Image Number if the original images received from modalities (possibly via a non-DICOM interface) do not contain this attribute or provide information in other attributes to DSI Pro to generate it.
- For SC images only one Window Width and Window Centre value is exported.
- DSI Pro always exports images with the Image Type as DERIVED.
- The mandatory DICOM attribute Laterality is not supported.

Use of optional, private and retired attributes:
The transmitted Storage SOP instances may include all optional elements specified in the DICOM standard, depending on the source of the images.

During the selection and export of an examination, the user can inspect the status of the DSI Pro by clicking on the workstation status button. The following processes can be monitored:
- Incoming images
- Image processing g during reception of images

- Storage
- Printing
- Transferring images

If a RIS connection is present, Patient and Study related information will be retrieved by DSI Pro Information AE from the RIS and will be put in the image headers of the exported images.

3.2.2.1.3.1   Overview of the applied X-Ray Fluoroscopy (RF) Image IOD

Note: This section only applies for export of images created by the DSI Pro and for exported images send to the DSI Pro system by the PMSNET protocol.

Table 3-16 lists the applied optional modules and attributes in the RF images.

Table 3-16: Applied optional Modules and Attributes of the RF Image IOD

IE	Module	Conditional Attributes	Optional Attributes
Patient	Patient		-
Study	General Study		Study Description, Name of Physician(s) Reading Study
Series	General Series		Series Date, Series Time, Protocol Name
Equipment	General Equipment		Institution Name, Station Name, Manufacturer's Model name, Device Serial Number, Software Version(s)
Image	General Image	Image Date, Image Time, Patient Orientation	Acquisition Date, Acquisition Time, Acquisition Number, Image Comments
	Image Pixel		-
	Display Shutter (applied optional Module)	Shutter Left Vertical Edge, Shutter Right Vertical Edge, Shutter Upper Horizontal Edge, Shutter Lower Horizontal Edge, Center of Circular Shutter, Radius of Circular Shutter.	-
	X-Ray Image		-
	X-Ray Acquisition	Exposure	-
	VOI LUT (applied optional Module)	Window Width	Window Center
	SOP Common		Specific Character Set

The modules selected from the IOD module table of DICOM 3.0 are given in the table below.

Table 3-17: Applied Modules in the RF IOD

Information Entity	Module
Patient	Patient
Study	General Study
Series	General Series
Equipment	General Equipment
Image	General Image
	Image Pixel
	Display Shutter
	X-Ray Image
	X-Ray Acquisition
	VOI LUT
	SOP Common

The details of these applied modules are given in the tables below. The list of possible values are given. The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value, is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables.

Note: The shaded attributes are received from the RIS with the Worklist Management Query.

Table 3-18: X-Ray Radiofluoroscopic Image Storage SOP Class - Patient Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	Received from RIS or entered by user.
Patient ID	0010,0020	Received from RIS or entered by user.
Patient's Birth Date	0010,0030	Received from RIS or entered by user.
Patient's Sex	0010,0040	Received from RIS or entered by user.

Table 3-19: X-Ray Radiofluoroscopic Image Storage SOP Class - General Study Module

Attribute Name	Tag	Note
Study Date	0008,0020	

Table 3-19: X-Ray Radiofluoroscopic Image Storage SOP Class - General Study Module (Continued)

Attribute Name	Tag	Note
Study Time	0008,0030	Format: HHMMSS0000
Accession Number	0008,0050	Zero length value if not received from RIS.
Referring Physician's Name	0008,0090	Zero length value if not received from RIS.
Name of Physician(s) Reading Study	0008,1060	Received from RIS as "Performing Physician's Name", or entered by user.
Study Description	0008,1030	Received from RIS as "study description", or entered by user.
Study Instance UID	0020,000D	Generated at creation of the Study (Component) or received from RIS.
Study ID	0020,0010	Applied value is the DateTime from the DSI Pro Network AE.

Table 3-20: X-Ray Radiofluoroscopic Image Storage SOP Class - General Series Module

Attribute Name	Tag	Note
Series Date	0008,0021	
Series Time	0008,0031	Format: HHMMSS0000
Modality	0008,0060	Applied value(s): RF
Protocol Name	0018,1030	Received from RIS as "study description", the attribute is truncated to 6 characters or filled in by operator.
Series Instance UID	0020,000E	Generated at creation of the Series.
Series Number	0020,0011	

Table 3-21: X-Ray Radiofluoroscopic Image Storage SOP Class - General Equipment Module

Attribute Name	Tag	Note
Manufacturer	0008,0070	Applied value(s): Philips Medical Systems (Netherlands)
Institution Name	0008,0080	DSI Information AE Institution Name
Network ID	0008,1000	
Station Name	0008,1010	DSI Information AE Station Name
Manufacturer's Model Name	0008,1090	Applied value(s):EasyVision

Table 3-21: X-Ray Radiofluoroscopic Image Storage SOP Class - General Equipment Module (Continued)

Attribute Name	Tag	Note
Device Serial Number	0018,1000	
Software Version(s)	0018,1020	Applied value(s):DSI R5.2.1

Table 3-22: X-Ray Radiofluoroscopic Image Storage SOP Class - General Image Module

Attribute Name	Tag	Note
Acquisition Date	0008,0022	
Image Date	0008,0023	
Acquisition Time	0008,0032	Format: HHMMSS0000
Image Time	0008,0033	Format: HHMMSS0000
Acquisition Number	0020,0012	
Image Number	0020,0013	Applied Value(s):1.. N
Patient Orientation	0020,0020	Always zero length value.

Table 3-23: X-Ray Radiofluoroscopic Image Storage SOP Class - Image Pixel Module

Attribute Name	Tag	Note
Samples per Pixel	0028,0002	Applied value(s): 1
Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME1, MONOCHROME2
Rows	0028,0010	The actual size in 60 Hz DSI Pro systems is smaller: 480 or 960. Applied value(s): 1024, 512
Columns	0028,0011	Equal to the value of Rows (512 or 1024). The actual image size in 60 Hz DSI Pro systems is smaller: 480 or 960. Applied value(s): 1024, 512
Bits Allocated	0028,0100	Applied value(s): 8
Bits Stored	0028,0101	Applied value(s): 8
High Bit	0028,0102	Applied value(s): 7
Pixel Representation	0028,0103	Applied value(s): 0000H
Pixel Data	7FE0,0010	

Table 3-24: X-Ray Radiofluoroscopic Image Storage SOP Class - Display Shutter Module

Attribute Name	Tag	Note
Shutter Shape	0018,1600	Applied value(s): CIRCULAR RECTANGULAR
Shutter Left Vertical Edge	0018,1602	
Shutter Right Vertical Edge	0018,1604	
Shutter Upper Horizontal Edge	0018,1606	
Shutter Lower Horizontal Edge	0018,1608	
Center of Circular Shutter	0018,1610	
Radius of Circular Shutter	0018,1612	

Table 3-25: X-Ray Radiofluoroscopic Image Storage SOP Class - X-Ray Image Module

Attribute Name	Tag	Note
Image Type	0008,0008	Applied value(s): DERIVED
Pixel Intensity Relationship	0028,1040	Applied value(s): DISP

Table 3-26: X-Ray Radiofluoroscopic Image Storage SOP Class - X-Ray Acquisition Module

Attribute Name	Tag	Note
KVP	0018,0060	Always zero length value.
Exposure	0018,1152	always zero length value.
Radiation Setting	0018,1155	Applied value(s): GR, SC

Table 3-27: X-Ray Radiofluoroscopic Image Storage SOP Class - VOI LUT Module

Attribute Name	Tag	Note
Window Center	0028,1050	This attribute is related to the DSI Pro Contrast / Brightness.
Window Width	0028,1051	This Attribute is related to the DSI Pro Contrast / Brightness.

Table 3-28: X-Ray Radiofluoroscopic Image Storage SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied value(s): ISO_IR 100
SOP Class UID	0008,0016	Applied value(s): 1.2.840.10008.5.1.4.1.1.12.2
SOP Instance UID	0008,0018	Depending on configuration: - Unique for each image. - Never changed (also after post processing)

3.2.2.1.3.2   Overview of the applied Secondary Capture (SC) Image IOD

Note: This section only applies for export of images created by the DSI Pro and for exported images send to the DSI Pro system by the PMSNET protocol.

Table 3-29 lists the applied optional modules and attributes in the SC images.

Table 3-29: Applied optional Modules and Attributes of the SC Image IOD

IE	Module	Conditional Attributes	Optional Attributes
Patient	Patient		-
Study	General Study		Study Description, Name of Physician(s) Reading Study
Series	General Series		Series Date, Series Time, Protocol Name
Equipment	SC Equipment		Secondary Capture Device Manufacturer, Secondary Capture Device Manufacturer's Model Name, Secondary Capture Software Version(s)
Image	General Image	Image Date, Image Time, Patient Orientation.	Acquisition Date, Acquisition Time, Acquisition Number, Image Comments
	Image Pixel		-
	SC Image		Date of Secondary Capture, Time of Secondary Capture
	SOP Common		Specific Character Set

The modules selected from the IOD module table of DICOM 3.0 are given in the table below.

Table 3-30: Applied Modules in the SC IOD

Information Entity	Module
Patient	Patient
Study	General Study
Series	General Series
Equipment	SC Equipment
Image	General Image
	Image Pixel
	SC Image
	VOI LUT
	SOP Common

The details of these applied modules are given in the tables below. The list of possible values are given (if applicable). The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value, is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables.

Note: The shaded attributes are received from the RIS with the Worklist Management Query.

Table 3-31: Secondary Capture Image Storage SOP Class - Patient Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	Received from RIS or entered by user.
Patient ID	0010,0020	Received from RIS or entered by user.
Patient's Birth Date	0010,0030	Received from RIS or entered by user.
Patient's Sex	0010,0040	Received from RIS or entered by user.

Table 3-32: Secondary Capture Image Storage SOP Class - General Study Module

Attribute Name	Tag	Note
Study Date	0008,0020	
Study Time	0008,0030	Format: HHMMSS0000
Accession Number	0008,0050	Zero length value if not received from RIS.

Table 3-32: Secondary Capture Image Storage SOP Class - General Study Module (Continued)

Attribute Name	Tag	Note
Referring Physician's Name	0008,0090	Zero length value if not received from RIS.
Name of Physician(s) Reading Study	0008,1060	Received from RIS as "Performing Physician's Name", or entered by user.
Study Description	0008,1030	Received from RIS as "study description", or entered by user.
Study Instance UID	0020,000D	Generated at creation of the Study (Component) or received from RIS.
Study ID	0020,0010	Applied value is the DateTime of the DSI Pro Network AE.

Table 3-33: Secondary Capture Image Storage SOP Class - General Series Module

Attribute Name	Tag	Note
Series Date	0008,0021	
Series Time	0008,0031	Format: HHMMSS0000
Modality	0008,0060	Applied value(s): OT
Protocol Name	0018,1030	Received from RIS as "study description", the attribute is truncated to 6 characters or filled in by operator.
Series Instance UID	0020,000E	Generated at creation of the series.
Series Number	0020,0011	

Table 3-34: Secondary Capture Image Storage SOP Class - SC Equipment Module

Attribute Name	Tag	Note
Conversion Type	0008,0064	Applied value(s): DV
Secondary Capture Device Manufacturer	0018,1016	Applied value(s): Philips Medical Systems (Netherlands)
Secondary Capture Device Manufacturer's Model Name	0018,1018	
Secondary Capture Device Software Version(s)	0018,1019	Applied value(s):DSI R5.2.1

Table 3-35: Secondary Capture Image Storage SOP Class - General Image Module

Attribute Name	Tag	Note
Acquisition Date	0008,0022	
Image Date	0008,0023	
Acquisition Time	0008,0032	Format: HHMMSS0000
Image Time	0008,0033	Format: HHMMSS0000
Acquisition Number	0020,0012	
Image Number	0020,0013	Applied value(s): 1.. N
Patient Orientation	0020,0020	Always zero length value

Table 3-36: Secondary Capture Image Storage SOP Class - Image Pixel Module

Attribute Name	Tag	Note
Samples per Pixel	0028,0002	Applied value(s): 1
Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME1, MONOCHROME2
Rows	0028,0010	512 or 1024. The actual image size in 60 Hz DSI Pro systems is smaller: 480 or 960. Applied value(s): 1024, 512
Columns	0028,0011	Equal to the value of Rows (512 or 1024). The actual image size in 60 Hz DSI Pro system is smaller: 480 or 960. Applied value(s): 1024, 512
Bits Allocated	0028,0100	Applied value(s): 8
Bits Stored	0028,0101	Applied value(s): 8
High Bit	0028,0102	Applied value(s): 7
Pixel Representation	0028,0103	Applied value(s): 0000H
Pixel Data	7FE0,0010	

Table 3-37: Secondary Capture Image Storage SOP Class - SC Image Module

Attribute Name	Tag	Note
Date of Secondary Capture	0018,1012	

Table 3-37: Secondary Capture Image Storage SOP Class - SC Image Module (Continued)

Attribute Name	Tag	Note
Time of Secondary Capture	0018,1014	

Table 3-38: X-Ray Radiofluoroscopic Image Storage SOP Class - VOI LUT Module

Attribute Name	Tag	Note
Window Center	0028,1050	This attribute is related to the DSI Pro Contrast / Brightness.
Window Width	0028,1051	This Attribute is related to the DSI Pro Contrast / Brightness.

Table 3-39: Secondary Capture Image Storage SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied value(s): ISO_IR 100
SOP Class UID	0008,0016	Applied value(s): 1.2.840.10008.5.1.4.1.1.7
SOP Instance UID	0008,0018	Depending on configuration: - Unique for each image. - Never changed (also after post processing)

3.2.2.2 Query a Remote Database

3.2.2.2.1   Associated Real-World Activity

The operator queries a remote database by means of the query tool in the DSI Pro data handling facility. DSI Pro initiates an Association to the selected peer entity and uses it to send C-FIND requests (and receive the associated find replies). The Association is released when the find execution completes.

3.2.2.2.2   Proposed Presentation Contexts

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-40: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

Note: Any of the Standard Query Retrieve SOP classes listed in Table 3-1, "Supported SOP classes by the DSI Pro Information DICOM AE as SCU," on page 9.
For performance reasons the EBE is preferred.

3.2.2.2.3   C-FIND SCU Conformance

DSI Pro will not generate queries containing optional keys. DSI Pro will not generate relational queries.

3.2.2.3 Retrieve Images from a Remote Database

3.2.2.3.1   Associated Real-World Activity

The operator is able to copy all/selected images in a patient folder from a remote database to another, local or remote, database by means of the copy tool in the DSI Pro data handling facility. DSI Pro initiates for each selected study an Association to the selected peer entity and uses it to send C-MOVE requests (and receive the associated move replies). The Association is released when all selected images have been transmitted.

3.2.2.3.2   Proposed Presentation Contexts

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-41: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

Note: Any of the Standard Query Retrieve SOP classes listed in Table 3-1, "Supported SOP classes by the DSI Pro Information DICOM AE as SCU," on page 9.
For performance reasons the EBE is preferred.

3.2.2.3.3   C-MOVE SCU Conformance

The AE provides standard conformance.

3.2.2.4 Print images

3.2.2.4.1   Associated Real-World Activity

There are three ways to request for image printing:
- Print Compose
  The operator is able to select one or more images from the internal database (via the Data Handling facility) and perform the Print operation on them.
- Print Protocol
  The operator is also able to print images via the various clinical applications of DSI Pro.
- Quick Print
  Print images with a predefined protocol according to scheduled examination type.

The operator will select the print destination (out of choice list of configured printers) and some print parameters (depending on the configuration and the selected printer) these setting can also be configured.

As a result, DSI Pro will initiate an association to the selected printer and uses it to send the Print Service Elements of the Print SOP Classes.

DSI Pro allows to have a print preview first except for quick print.

3.2.2.4.2   Proposed Presentation Contexts

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-42: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Gray-scale Print Management Meta SOP Class	1.2.840.10008.5.1.1.9	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

For performance reasons the EBE is preferred.

3.2.2.4.3   Conformance to the Print SOP Classes

DSI Pro provides standard conformance to the Basic Grayscale Print Management Meta SOP Class.

The applied order of Print Service Elements (DIMSE) is specified in Table 3-43. A description and the applied optional (i.e. non-mandatory attributes as Print SCU) attributes in these Service Elements are specified too. Note that the Service Elements order is not specified by the DICOM standard.

An explicit N-DELETE Request on the created instances is not done by DSI Pro; these are deleted implicitly when releasing the association.

Overlay, annotation (showing the values of some major identifying attributes) and shutter information is processed in the images sent to the printer (i.e. burnt-in in the image).

Table 3-43: The applied order of Print Service Elements and its optional attributes

Service Element of SOP Class	Description and applied optional attributes
N-GET of the Printer SOP Class	Purpose is to retrieve printer information.
N-CREATE of the Basic Film Session SOP Class	DSI Pro sends some general presentation parameters, applicable for all films in the Film Session to the DICOM Printer. Applied optional attributes are: Number of Copies, Print Priority, Medium Type, Film Destination
N-CREATE of the Basic Film Box SOP Class	DSI Pro sends some general presentation parameters, applicable for all images in the Film Box to the DICOM Printer. Applied optional attributes are: Film Orientation, Film Size ID, Magnification Type, Max. Density, Configuration Information, Trim.
N-SET of the Basic Grayscale/ Color Image Box SOP Class	DSI Pro will send the images to be printed. Applied optional attributes are: Polarity
N-ACTION of the Basic Film Box SOP Class	DSI Pro triggers the DICOM Printer to print, this actual print action is done at film box level. No (optional) attributes are present.

The table below specifies the supported Service Elements which may be generated by the Printer at any time during the association.

Table 3-44: The applied sequence of Print Service Elements and its optional attributes

Service Element of SOP Class	Note
N-EVENT-REPORT of the Printer SOP Class	May be sent at any moment by the Printer SCP (i.e. the DICOM Printer). DSI Pro will ignore the contents of these events. However, the printer status is polled via a separate association, see section 3.2.2.5.

The Status Codes of DIMSE Responses (Success, Warning, Failure) as returned by the printer will also be logged (for service purposes) and they are mapped onto general print job status messages towards the operator. These User Interface messages indicate:
- "Job Completed" and has the meaning that the print job is accepted by the printer; the actual printing will be done afterwards.
- "General Print Error" indicating that a failure occurred during the DICOM Print.
- Most warning cases (like default printer values applied on optional print attributes) are interpreted as a print error because this will mostly result in a different print quality or print layout than expected.
- The only warning code on which the Print Job is continued is 0x0107 (Attribute list error) in the N-GET-RSP.

The following implementation remarks are important to achieve successful printing:
- The number of Film Boxes per Film Session is **one**.
- The number of images per Film Box is **one**.
  The images to be printed on one film are rendered by DSI Pro into one logical image. This logical image is very large, depending on the pixel matrix size (pixels per line, lines per image). A rough indication is 20 MByte. One should take this into account when selecting the DICOM printer and the printer configuration (e.g. the amount of memory).
- DSI Pro will release the association when the print command is given (i.e. the N-ACTION Request); the association is not kept open for receiving N-EVENT-REPORTs of the Printer SOP Class.
- On status-errors/warnings in a DIMSE response, the data transfer will be stopped and film will not be printed.

This section gives an overview of the applied attributes in the applied Service Elements of the supported SOP Classes.

The list of possible attribute values are given. The situation that an attribute is present conditionally. The standard DICOM Conditions and Defined Terms and Enumerated Values are applicable
.

Table 3-45: Basic Film Session SOP Class - N-CREATE

Attribute Name	Tag	Note
Number of Copies	2000,0010	Between 1 and 99.
Print Priority	2000,0020	Applied value(s): HIGH
Medium Type	2000,0030	Applied value(s): BLUE FILM, CLEAR FILM, PAPER
Film Destination	2000,0040	Applied value(s): MAGAZINE, PROCESSOR

Table 3-46: Basic Film Box SOP Class - N-CREATE

Attribute Name	Tag	Note
Image Display Format	2010,0010	The applied value below is an DSI Pro specific value indicating that one (large) image is contained in a Film Box. Applied value(s): CUSTOM\1, STANDARD\1,1 (I is a vendor specific index, i.e.an integer) is applied if the Standard Image Display Format does not result in acceptable films. Purpose of this value is to use the film surface as much as possible for image printing (and avoid large margins). This should be agreed per printer vendor.
Film Orientation	2010,0040	Applied value(s): LANDSCAPE, PORTRAIT

Table 3-46: Basic Film Box SOP Class - N-CREATE (Continued)

Attribute Name	Tag	Note
Film Size ID	2010,0050	DICOM specifies a number of Defined Terms; more values are possible and is print configuration dependent.
Magnification Type	2010,0060	Normally sent out, however sometimes send out empty because some DICOM printers are not able to handle (value NONE for) this attribute. Applied value(s): NONE
Trim	2010,0140	
Configuration Information	2010,0150	Contains a vendor specific Lookup-table (LUT); should be applied by the DICOM printer if LUT data is present.
Max Density	2010,0130	Maximum density of the images on the film, expressed in hundredths of OD. If Max Density is higher than maximum printer density than Max Density is set to maximum printer density.

Table 3-47: Basic Film Box SOP Class - Basic Film Box Relationship Module

Attribute Name	Tag	Note
Referenced Film Session Sequence	2010,0500	Parent Film Session.
> Referenced SOP Class UID	0008,1150	
> Referenced SOP Instance UID	0008,1155	

Table 3-48: Basic Film Box SOP Class - N-ACTION

Attribute Name	Tag	Note
No attributes present		

Table 3-49: Basic Grayscale Image Box SOP Class - N-SET

Attribute Name	Tag	Note
Image Position	2020,0010	Applied value(s): 1
Polarity	2020,0020	Applied value(s): NORMAL
Preformatted Grayscale Image Sequence	2020,0110	
> Samples per Pixel	0028,0002	Applied value(s): 1

Table 3-49: Basic Grayscale Image Box SOP Class - N-SET (Continued)

Attribute Name	Tag	Note
> Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME2
> Rows	0028,0010	Depending on the selected printer type and film size.
> Columns	0028,0011	Depending on the selected printer type and film size.
> Bits Allocated	0028,0100	Applied value(s): 16, 8
> Bits Stored	0028,0101	Applied value(s): 12, 8
> High Bit	0028,0102	Applied value(s): 11, 7
> Pixel Representation	0028,0103	Applied value(s): 0x0000
> Pixel Data	7FE0,0010	

3.2.2.5 Request for the Printer Status

3.2.2.5.1   Associated Real-World Activity

DSI Pro will periodically request for the printer status. This is only done when no association is set-up for a print job. In case of a print job association the printer status is requested in that association.
The received printer status is displayed in the Printer Status Tool.

3.2.2.5.2   Proposed Presentation Contexts

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-50: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Printer SOP Class	1.2.840.10008.5.1.1.16	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

For performance reasons the EBE is preferred.

3.2.2.5.3   Conformance to the Printer SOP Class

DSI Pro provides standard conformance to this SOP Class.
The applied optional attributes in the N-GET Service Element are specified in Table 3-51..

Table 3-51: The applied optional attributes in the N-GET Service Element

Service Element of SOP Class	Note
N-GET of the Printer SOP Class	Purpose is to retrieve printer information. Applied optional attributes are: Printer Status, Printer Status Info, Printer Name, Manufacturer, Manufacturer Model Name

The Status Codes of Printer N-GET Responses (Success, Warning, Failure) as returned by the printer will also be logged (for service purposes) and they are not indicated towards the operator.

This section gives an overview of the applied attributes in the applied Service Elements of the supported SOP Classes.

Table 3-52: Printer SOP Class - N-EVENT-REPORT[a]

Attribute Name	Tag	Note
Printer Status Info	2110,0020	Conditionally sent by the Printer. DSI Pro will ignore this status information. However, polling this status via the N-GET Service Element is done.

a. This Service Element is sent by the printer and interpreted by DSI Pro.

Table 3-53: Printer SOP Class - N-GET

Attribute Name	Tag	Note
Printer Status	2110,0010	
Printer Status Info	2110,0020	

The DSI Pro does not send an attribute list to the printer, therefore the only attributes which are needed to be supported by the printer, are the mandatory attributes listed in Table 3-53, "Printer SOP Class - N-GET," on page 38

3.2.2.6 Storage Commitment

3.2.2.6.1   Associated Real-World Activity

After every C-STORE a new association concerning Storage Commitment will be started. This association will be open till the remote archive sends a commit response or when the configured maximum time is passed. When this maximum configured period is passed it is the responsibility of the archive to setup a connection with DSI Pro and send the commit response. It is also possible to configure the maximum number of parallel associations which will be kept open to receive commit responses.

3.2.2.6.2   Presentation Context Table

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-54: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

For performance reasons the EBE is preferred.

3.2.2.6.3   Storage Commitment Push Conformance

The DSI Pro provides standard conformance.

3.2.3 Association Acceptance Policy

DSI Pro accepts Associations for the following purposes:
- To allow remote applications to verify application level communication with DSI Pro, see section 3.2.3.1 on page 41;
- To allow remote applications to store images in the DSI Pro database (i.e. image import), see section 3.2.3.2 on page 42;
- To allow remote applications to query the DSI Pro database, see section 3.2.3.3 on page 44;
- To allow remote applications to retrieve images from the DSI Pro database, see section 3.2.3.2 on page 42.

The DSI Pro Application Entity rejects Association requests from unknown applications, i.e. applications that offer an unknown "calling AE title". An application is known if and only if it is defined during configuration of the DSI Pro system.

The DSI Pro Application Entity rejects Association requests from applications that do not address the DSI Pro AE, i.e. that offer a wrong "called AE title". The DSI Pro AE title is defined during configuration of the DSI Pro system.

Any of the presentation contexts shown in Table 3-15 are acceptable.

3.2.3.1 Verify Application Level Communication

3.2.3.1.1   Associated Real-World Activity

DSI Pro accepts Associations from systems that wish to verify application level communication using the C-ECHO command.

3.2.3.1.2   Presentation Context Table

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-55: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

For performance reasons the EBE is preferred.

3.2.3.1.3   C-ECHO SCP Conformance

DSI Pro provides standard conformance.

3.2.3.1.4   Presentation Context Acceptance Criterion

DSI Pro accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that multiple proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes are accepted by DSI Pro.
There is no check for duplicate contexts and they are therefore accepted.

3.2.3.1.5   Transfer Syntax Selection Policies

Any of the presentation context show in Table 3-15, are acceptable.

3.2.3.2 Store Images in the DSI Pro Database (i.e. Image Import)

3.2.3.2.1   Associated Real-World Activity

DSI Pro accepts Associations from systems that wish to store images in the DSI Pro database using the C-STORE command.

3.2.3.2.2   Presentation Context Table

DSI Pro will propose the following presentation contexts:

Table 3-56: Proposed Presentation Contexts for DSI Pro

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE	1.2.840.10008.1.2	SCU	None
See Note	See Note	ELE	1.2.840.10008.1.2.1	SCU	None
See Note	See Note	EBE	1.2.840.10008.1.2.2	SCU	None
See Note	See Note	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
See Note	See Note	JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51	SCU	None
See Note	See Note	JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57	SCU	None
See Note	See Note	JPEG Lossless, Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70	SCU	None

Note: Any of the Standard Image Storage and Private SOP classes listed in Table 3-14, "Supported SOP classes by the DSI Pro AE as SCP," on page 15.

For performance reasons the EBE is preferred.

3.2.3.2.3   C-STORE SCP Conformance

Options:

DSI Pro provides conformance for the Storage Service Class. In the event of a successful C-STORE operation, the image has been stored in the DSI Pro database. The duration of the storage of the image is determined by the operator of the DSI Pro system.

If DSI Pro receives improper DICOM, DSI Pro tries as much as possible (if configured so), to make them proper DICOM. However, DSI Pro also tries to remain as transparent on images as possible. So, on export the images must be changed only as far as really necessary.

Therefore, it is not guaranteed that all DICOM violations of incoming images are repaired (e.g. attributes as one with enumerated values, are not changed). So, improper DICOM input to the DSI Pro can result in improper DICOM output.

Important implementation remarks and restrictions:
• Imported non-DSI images are only intend for viewing purposes.
• Export of imported images can result in differences between imported and exported data.

- DSI Pro stores XA Bi-Plane as two Single Plane images.
- DSI Pro stores US multi-frame images as a series of single frame images.
- DSI Pro assumes that High Bit (0x0028, 0x0102) = Bits Stored (0x0028, 0x0101) - 1. If this is not the case in received images, the images are not accepted or the DSI Pro applications cannot process/view them.
- Acquisition number can be changed on import with a value related to the image number.

Support for additional Standard, Private and Retired attributes:
DSI Pro stores additional Standard, Private and Retired attributes in received images. Retrieval of these attributes is only possible (by means of a C-MOVE request) if the following conditions are satisfied:
- The image was encoded (when DSI Pro was C-STORE SCP) using one of the explicit value representations or
- The image was encoded (when DSI Pro was C-STORE SCP) using implicit value representation and the move destination (i.e. a C-STORE Service Class Provider) has accepted implicit value representation as the only transfer syntax applicable to the storage SOP class of the image (when DSI Pro is C-STORE SCU).

Error handling:
The C-STORE is unsuccessful if DSI Pro returns one of the following status codes:
- A700 - Indicates the database is full. Recovery from this condition is left to the Service Class User.
- A900 - Indicates that the SOP class of the image does not match the abstract syntax negotiated for the presentation context.
- C000 - Indicates that the image cannot be parsed.

3.2.3.2.4   Presentation Context Acceptance Criterion

DSI Pro accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that multiple proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes are accepted by DSI Pro.
There is no check for duplicate contexts and they are therefore accepted.

3.2.3.3 Query the DSI Pro Database

3.2.3.3.1   Associated Real-World Activity

DSI Pro accepts Associations from systems that wish to query the DSI Pro database using the C-FIND command.

3.2.3.3.2   Presentation Context Table

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-57: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

Note: Any of the Standard Query Retrieve SOP classes listed in Table 3-14, "Supported SOP classes by the DSI Pro AE as SCP," on page 15.

For performance reasons the EBE is preferred.

3.2.3.3.3   C-FIND SCP Conformance

DSI Pro provides standard conformance. Optional keys are not supported. Relational queries are not supported. DSI Pro simultaneously handles simultaneous C-FIND requests.

The DSI Pro database distinguishes two patients with the same Patient ID but different Patient Name or Patient Birth Date. Because the DICOM Query model has Patient ID as Unique Key at patient level, two patients with the same Patient ID cannot be distinguished via the DICOM Standard Query SOP Class.

DSI Pro DICOM query as SCP:
• All optional attributes are supported on all levels.

3.2.3.3.4   Presentation Context Acceptance Criterion

DSI Pro accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that multiple proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes are accepted by DSI Pro.
There is no check for duplicate contexts and they are therefore accepted.

3.2.3.4 Retrieve Images from the DSI Pro Database

3.2.3.4.1   Associated Real-World Activity

DSI Pro accepts Associations from systems that wish to retrieve images from the DSI Pro database using the C-MOVE command.

3.2.3.4.2   Presentation Context Table

DSI Pro will propose the presentation contexts as given in the next table.

Table 3-58: Proposed Presentation Contexts

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU SCU SCU	None None None

Note: Any of the Standard Query Retrieve SOP classes listed in Table 3-14, "Supported SOP classes by the DSI Pro AE as SCP," on page 15.
For performance reasons the EBE is preferred.

3.2.3.4.3   C-MOVE SCP Conformance

DSI Pro supports all the Storage SOP classes listed in Table 3-1.
DSI Pro does not send Intermediate C-MOVE response with status pending.

3.2.3.4.4   Presentation Context Acceptance Criterion

DSI Pro accepts all contexts in the intersection of the proposed and acceptable Presentation Contexts. This means that multiple proposed Presentation Contexts with the same SOP Class but different Transfer Syntaxes are accepted by DSI Pro.
There is no check for duplicate contexts and they are therefore accepted.

3.3 DSI Pro AE Media Specification

The DSI Pro 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) STD-GEN-CD, STD-XABC-CD and STD-XA1K-CD, both for reading and writing.
DSI Pro supports **multi-patient** and **multi-session** (both for reading and writing) CD-R disks. Additionally, the reading of the Philips CD-Medical Basic Cardiac disks is supported (non private DICOM only), the writing of this type of disks is not supported.

The supported Application Profiles, their Roles and the Service Class (SC) options, all defined in DICOM terminology, are listed in Table 3-59.

Table 3-59: Application Profile, Activities and Roles of the DICOM Media part of DSI Pro

Application Profile	Identifier	Real World Activity	Role	SC Option
General Purpose CD-R Image Interchange Profile	STD-GEN-CD	Display Directory of CD-R disk	FSR	Interchange
	STD-GEN-CD	Write image(s) on CD-R disk	FSC/ FSU	Interchange
	STD-GEN-CD	Read image(s) from CD-R disk	FSR	Interchange
Basic Cardiac X-ray Angiographic Studies on CD-R Media	STD-XABC-CD	Transfer of X-ray Examination	FSC/ FSU	Interchange
1024*1024 X-Ray Angiographic Studies on CD-R Media.	STD-XA1K-CD	Write image(s) on CD-R disk	FSC/ FSU	Interchange

3.3.1 File Meta Information

The (Source) Application Entity Title is specified in section 6.2.1 on page 59.
The Implementation Class UID and the Implementation Version Name in the File Meta Header is specified in section 3.2 on page 15.

3.3.2 Media related Real-World Activities

3.3.2.1 RWA Display Directory

The DSI Pro AE will act as a FSR when reading the directory of the medium. This will result in an overview of the patients, studies, series and images on the DSI Pro screen.

3.3.2.1.1   Application Profile(s) for this RWA

See Table 3-59.

3.3.2.1.2   Required and optionally DICOMDIR Keys

The Mandatory DICOMDIR Keys are required for the correct display of Directory information. The display is structured according the DICOM Composite Information Model: Patient, Study, Series, Image. Possibly present optional DICOMDIR Keys are not displayed.

3.3.2.2 RWA Write images on CD-R disk

The DSI Pro AE will act as a FSC/FSU when writing all/selected images in a patient folder onto the CD-R medium.

Implementation remarks and restriction:
- The DSI Pro can write CD's conform the DICOM 1024 X-ray Angiographic profile. This implies that conversion from RF single frame to XA multiframe is required for copies of High Speed Angio images. Only Images from the DSI that are imported by a private Link can be converted. Series containing only one RF image must be converted to a multifame image with one frame.
- When writing the DICOMDIR records the keys values are generated when no value of the corresponding attribute is supplied:
  -PATIENT_ID
  -STUDY_ID
  -STUDY_INSTANCE_UID
  -SERIES_NUMBER
  -SERIES_INSTANCE_UID
  -IMAGE_NUMBER
  -SOP_INSTANCE_UID
- The mechanism of generating a value for PATIENT_ID creates each time a new value based on PATIENT_NAME for each new study written to the CD-R, even if this study belongs to a patient recorded earlier.
- The default value for the Pixel Intensity Relationship (0028,1040) is set to DISP.
- For Implementation restriction see "C-STORE SCU Conformance" on page 19.

3.3.2.2.1   Application Profile(s) for this RWA

See Table 3-59.

3.3.2.2.2   Support for Attributes in the images

The same remarks as in section 3.2.2.1 on page 18 about the existence of Optional, Retired and Private Attributes are applicable.

The SOP Classes supported by the DSI Pro Media AE are given in Table 3-60, "Supported SOP classes by the DSI Pro Media AE," on page 47

Table 3-60: Supported SOP classes by the DSI Pro Media AE

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
RF Image Storage	1.2.840.10008.5.1.4.1.1.12.2

Table 3-61 gives a overview of the supported Presentation Context for the DSI Pro Media AE.
:

Table 3-61: Proposed Presentation Contexts for DSI Pro AE

Presentation Context table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
See Note	See Note	ILE	1.2.840.10008.1.2	SCU	None
See Note	See Note	ELE	1.2.840.10008.1.2.1	SCU	None
See Note	See Note	EBE	1.2.840.10008.1.2.2	SCU	None
See Note	See Note	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	SCU	None
See Note	See Note	JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51	SCU	None
See Note	See Note	JPEG Lossless, Non-Hierarchical (Process 14)	1.2.840.10008.1.2.4.57	SCU	None
See Note	See Note	JPEG Lossless, Hierarchical, First-Order Prediction	1.2.840.10008.1.2.4.70	SCU	None

Note: Any of the Standard Image Storage SOP classes listed in Table 3-60, "Supported SOP classes by the
      DSI Pro Media AE," on page 47. For performance reasons the EBE is preferred.

The DICOMDIR file will be extended when new images are written. In case some attributes
are not present in the images but are specified as Mandatory in the DICOMDIR definition in
DICOM Media, a dummy value will be filled in.

A detailed list of all applied attributes for the RF Image SOP Class is given in section
3.2.2.1.3.1 on page 20. A detailed list of all applied attributes for the SC Image SOP Class is
given in section 3.2.2.1.3.2 on page 25.

The next section gives A detailed overview of all applied attributes for the XA Image SOP
Class.

3.3.2.2.2.1   Overview of the applied X-Ray Angiographic (XA) Image IOD

Note: This section only applies for export to CD-R disks of images created by the DSI Pro.

Table 3-16 lists the applied optional modules and attributes in the XA images.

Table 3-62: Applied optional Modules and Attributes of the XA Image IOD

IE	Module	Conditional Attributes	Optional Attributes
Patient	Patient	-	-
Study	General Study	-	Study Description, Name of Physician(s) Reading Study
Series	General Series		Series Date, Series Time, Protocol Name
Equipment	General Equipment	-	Institution Name, Station Name, Manufacturer's Model name, Device Serial Number, Software Version(s)
Image	General Image	Image Date, Image Time, Patient Orientation	Acquisition Date, Acquisition Time, Acquisition Number, Image Comments
	Image Pixel	-	-
	Multi-Frame	-	-
	Display Shutter (applied optional Module)	Shutter Left Vertical Edge, Shutter Right Vertical Edge, Shutter Upper Horizontal Edge, Shutter Lower Horizontal Edge, Center of Circular Shutter, Radius of Circular Shutter.	-
	X-Ray Image	-	-
	X-Ray Acquisition	Exposure	-
	XA Positioner	-	-
	VOI LUT (applied optional Module)	Window Width	Window Center
	SOP Common	-	Specific Character Set

The modules selected from the IOD module table of DICOM 3.0 are given in the table below.

Table 3-63: Applied Modules in the XA IOD

Information Entity	Module
Patient	Patient
Study	General Study
Series	General Series

Table 3-63: Applied Modules in the XA IOD (Continued)

Information Entity	Module
Equipment	General Equipment
Image	General Image
	Image Pixel
	Display Shutter
	Mulit-Frame
	X-Ray Image
	X-Ray Acquisition
	XA Positioner
	VOI LUT
	SOP Common

The details of these applied modules are given in the tables below. The list of possible values are given. The situation that an attribute is present conditionally/optionally or that an attribute may contain a zero length value, is indicated too. Conditions and Defined/Enumerated Values of DICOM 3.0 are applicable but are not shown in the tables.

Note: The shaded attributes are received from the RIS with the Worklist Management Query.

Table 3-64: X-Ray Angiographic Image Storage SOP Class - Patient Module

Attribute Name	Tag	Note
Patient's Name	0010,0010	Received from RIS or entered by user.
Patient ID	0010,0020	Received from RIS or entered by user.
Patient's Birth Date	0010,0030	Received from RIS or entered by user.
Patient's Sex	0010,0040	Received from RIS or entered by user.

Table 3-65: X-Ray Angiographic Image Storage SOP Class - General Study Module

Attribute Name	Tag	Note
Study Date	0008,0020	
Study Time	0008,0030	Format: HHMMSS0000
Accession Number	0008,0050	Zero length value if not received from RIS.
Referring Physician's Name	0008,0090	Zero length value if not received from RIS.

Name of Physician(s) Reading Study	0008,1060	Received from RIS as "Performing Physician's Name", or entered by user.
Study Description	0008,1030	Received from RIS as "study description", or entered by user.
Study Instance UID	0020,000D	Generated at creation of the Study (Component) or received from RIS.

Table 3-68: X-Ray Angiographic Image Storage SOP Class - General Image Module

Attribute Name	Tag	Note
Acquisition Date	0008,0022	
Image Date	0008,0023	
Acquisition Time	0008,0032	Format: HHMMSS0000
Image Time	0008,0033	Format: HHMMSS0000
Acquisition Number	0020,0012	
Image Number	0020,0013	Applied Value(s):1.. N
Patient Orientation	0020,0020	Always zero length value.

Table 3-69: X-Ray Angiographic Storage SOP Class - Image Pixel Module

Attribute Name	Tag	Note
Samples per Pixel	0028,0002	Applied value(s): 1
Photometric Interpretation	0028,0004	Applied value(s): MONOCHROME1, MONOCHROME2
Rows	0028,0010	The actual size in 60 Hz DSI Pro systems is smaller: 480 or 960. Applied value(s): 1024, 512
Columns	0028,0011	Equal to the value of Rows (512 or 1024). The actual image size in 60 Hz DSI Pro systems is smaller: 480 or 960. Applied value(s): 1024, 512
Bits Allocated	0028,0100	Applied value(s): 8
Bits Stored	0028,0101	Applied value(s): 8
High Bit	0028,0102	Applied value(s): 7
Pixel Representation	0028,0103	Applied value(s): 0000H
Pixel Data	7FE0,0010	

Table 3-70: X-Ray Angiographic Image Storage SOP Class - Display Shutter Module

Attribute Name	Tag	Note
Shutter Shape	0018,1600	Applied value(s): CIRCULAR RECTANGULAR
Shutter Left Vertical Edge	0018,1602	
Shutter Right Vertical Edge	0018,1604	
Shutter Upper Horizontal Edge	0018,1606	
Shutter Lower Horizontal Edge	0018,1608	
Center of Circular Shutter	0018,1610	
Radius of Circular Shutter	0018,1612	

Table 3-71: X-Ray Angiographic Image Storage SOP Class - Mulit-Frame Module

Attribute Name	Tag	Note
Number of Frames	0028,0008	
Frame Increment Pointer	0028,0009	

Table 3-72: X-Ray Angiographic Image Storage SOP Class - X-Ray Image Module

Attribute Name	Tag	Note
Image Type	0008,0008	Applied value(s): DERIVED
Pixel Intensity Relationship	0028,1040	Applied value(s): DISP

Table 3-73: X-Ray Angiographic Image Storage SOP Class - X-Ray Acquisition Module

Attribute Name	Tag	Note
KVP	0018,0060	Always zero length value.
Exposure	0018,1152	always zero length value.
Radiation Setting	0018,1155	Applied value(s): GR, SC

Table 3-74: X-Ray Angiographic Image Storage SOP Class - XA Positioner Module

Attribute Name	Tag	Note
Positioner Motion	0018,1500	Applied value(s): STATIC
Positioner Primary Angle	0018,1510	
Positioner Secondary Angle	0018,1511	

Table 3-75: X-Ray Angiographic Image Storage SOP Class - VOI LUT Module

Attribute Name	Tag	Note
Window Center	0028,1050	This attribute is related to the DSI Pro Contrast / Brightness.
Window Width	0028,1051	This Attribute is related to the DSI Pro Contrast / Brightness.

Table 3-76: X-Ray Angiographic Image Storage SOP Class - SOP Common Module

Attribute Name	Tag	Note
Specific Character Set	0008,0005	Applied value(s): ISO_IR 100
SOP Class UID	0008,0016	Applied value(s): 1.2.840.10008.5.1.4.1.1.12.1
SOP Instance UID	0008,0018	Depending on configuration: - Unique for each image. - Never changed (also after post processing)

3.3.2.3 RWA Read images from CD-R disk

The DSI Pro AE will act as a FSR when reading all/selected images from the CD-R medium.

Implementation remarks and restriction:
• DSI Pro is also able to read images coded in all of the JPEG codes as specified in Table 3-61, "Proposed Presentation Contexts for DSI Pro AE," on page 48.

3.3.2.3.1   Application Profile(s) for this RWA

See Table 3-59.

3.3.2.3.2   Support for Attributes in the images

The Mandatory Attributes of the DICOM images are required for the correct storage of the images in the DSI Pro internal image database. Optionally Attributes and Retired/Private Attributes are stored too if present; this is equivalent with the Level 2 (Full) conformance for the Storage Service Class in the Network support, see section 3.2.3.2 on page 42.

The same remarks as in section 3.2.3.2.3 on page 42 about the storage of read multi-frame/Bi-plane images and about requirements to process read images via the dedicated DSI Pro application functions, are applicable.

3.3.3 Augmented Application Profile

DSI Pro supports all transfer syntaxes as mentioned Table 3-61 on page 48.

4 Communication Profiles

4.1 Supported Communication Stacks

The DSI Pro Information AE provides DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.2 TCP/IP Stack

The DSI Pro Network AE inherits its TCP/IP stack from the SUN Solaris system upon which it executes.

4.2.1 Physical Media Support

The DSI Pro Information AE supports ISO 8802-3 10 MB Ethernet. The DSI Pro Network AE supports Ethernet ISO.8802-3 10 and 100 MB Ethernet.

5 Extensions/Specializations/Privatizations

The Standard DICOM SOP Classes may be Extended with additional attributes:
- Standard attributes of other SOP Classes; the presence of these attributes in exported images can be configured.
- Retired (from ACR NEMA 1.0 or 2.0) attributes; the presence of these attributes in exported images can be configured.
- Private attributes; the presence of these attributes in exported images can be configured.

6 Configuration

6.1 DSI Pro Information Configuration

6.1.1 AE Title/Presentation Address mapping

6.1.1.1 Local AE Titles and Presentation Addresses

The local (so of DSI Pro itself) Application Entity Title, local System Name and local (System) IP Address are selected by the service configuration program.

6.1.1.2 Remote AE Titles and Presentation Addresses

All remote applications to be selected as image export destination or as Worklist supplier are configurable for the following items:
- The Application Entity Title of the remote application.
- The IP Address and Port Number at which the remote application should accept Association requests.

6.1.2 Configurable parameters

- The PDU size of DSI Pro(i.e. the maximum allowed size of PDU messages received by DSI) is fixed on 16K.
  For optimal performance of the communication DSI - remote system, it is advised to configure the PDU size on the remote system as large as possible: unlimited and 64K are preferred (in that order). PDU size of 32K on the remote system should **not** be taken due to an implementation restriction of DSI, PDU size of 32K is allowed for DSIs with supperMEN board.
- "Hospital Name" (configurable) is mapped on "Institution Name" see Table 3-21 on page 22.
- "System Name" (configurable) is mapped on "Station Name" see Table 3-21 on page 22.

6.2 DSI Pro Network and Media Configuration

6.2.1 AE Title/Presentation Address mapping

6.2.1.1 Local AE Title and Presentation Address

The DSI Pro AE title is default equal to the IP host name. This host name can be changed by the Customer Support Engineer at installation.

DSI Pro listens on port **3010**. This port number is **not** configurable.

6.2.1.2 Remote AE Titles and Presentation Addresses

All relevant remote applications able to setup a DICOM Association towards DSI Pro must be configured at DSI Pro configuration time. The Customer Support Engineer must provide the following information for each remote application:
• The Application Entity title.
• The SOP classes and Transfer Syntaxes for which DSI Pro accepts Associations.

All relevant remote applications able to accept DICOM Associations from DSI Pro, the following information must be provided:
• The Application Entity title.
• The host name/IP address on which the remote application resides.
• The port number at which the remote application accepts Association requests.

6.2.2 Configurable parameters

6.2.2.1 Configuration per DSI Pro Network and Media system

The following items are configurable **per DSI Pro installation**:
• The SOP classes (out of the full list of SOP Classes in Table 3-1 on page 9 and Table 3-14 on page 15) and Transfer Syntaxes (out of the full list in Presentation Context tables in this Statement) to be used.
• The maximum PDU size for associations initiated by DSI Pro (default is 0 meaning unlimited PDU size)
• Storage Commitment request must be send after Storage request.
• Conversion from Multi to Single Frame.
• DSI Pro allows the operator to modify attributes of the stored images. DSI Pro does not modify the pixel values of the stored images. The DSI Pro system can be configured to either:
  • Always change the SOP Instance UID when exporting an Image.
  • Never change the SOP Instance UID when exporting an Image.

6.2.2.2 Configuration per remote system

The following items are configurable **per remote system**:
• The SOP classes and Transfer Syntaxes for which DSI Pro sets-up and accepts Associations.
• Automatic conversion of images of SOP classes not supported by remote systems into SC Image Storage SOP instances,
• The maximum PDU size for Associations initiated by DSI Pro,

- Export of 'pure' DICOM images (i.e. only the standard DICOM attributes defined in the related IOD) or extended DICOM images (with additional Standard DICOM, Private and Retired Attributes)
- Support of Overlays

6.2.2.3 Print Configuration

Configurable per DSI Pro installation:
- DICOM printers to be selected by the operator.

The following print parameters are configurable per DICOM printer type:
- Medium Type
- Film Size ID (i.e. Media Size)
- Film Orientation
- Image Display Format
- Film Size in X an Y direction (this influences the Rows and Columns in the Image Box instances)
- Configuration Information (configurable per print destination)
  This is a character string containing implementation specific print parameters.
- Magnification Type.
- Trim.
- Film Destination.
- Max. Density.

These print parameters can be selected from choice lists. These choice lists are defined via so-called prototypes for each type of printer and print medium. These prototype are also configurable.

7 Support of Extended Character Sets

7.1 DSI Pro Information AE

DSI supports the Extended Character Set "ISO_IR 100" (Latin alphabet No 1, supplementary set) for the Image Export function.

The support of characters at import of Modality Worklist data is specified in section 3.1.2.1.3 on page 10.

7.2 DSI Pro Network and Media AE

DSI Pro Network and Media AE supports Extended Character Set "ISO_IR 100" which is the Latin alphabet No 1, supplementary set.

8 Remarks, Implementation Restrictions and Choices.

Table 8-1: Matching of the Data Model of the DSI Pro User interface to DICOM (Export/RIS)

DSI User Interface	DICOM	Table Reference	RIS/Export
Name	Patient's Name	Table 3-18, Table 3-31, Table 3-64	RIS and Export
Birthdate	Patients's Birth Date	Table 3-18, Table 3-31, Table 3-64	RIS and Export
S	Patient's Sex	Table 3-18, Table 3-31, Table 3-64	RIS and Export
Patient ID	Patient ID	Table 3-18, Table 3-31, Table 3-64	RIS and Export
Exam	Scheduled Procedure Step Description	Table 3-5	RIS
	Study Description	Table 3-19, Table 3-32, Table 3-65	Export
	Protocol Name	Table 3-20, Table 3-33, Table 3-66	Export
Physician Name	Referring Physician's Name	Table 3-7	RIS
	Referring Physician's name	Table 3-19, Table 3-32, Table 3-65	Export
	Performing Physician's Name	Table 3-19, Table 3-32, Table 3-65	Export