

Digital Network Manager¹ (DNET)

DICOM Conformance Statement

**(as used with the SONOLINE Versa Pro, Versa Plus, Sienna, Omnia,
Prima or Adara ultrasound systems)**

¹ Manufactured by ALI Technologies Inc., for Siemens Medical Systems, Inc., Ultrasound Group

Contents

1.0	Introduction	3
2.0	Implementation Model	4
2.1	Application Data Flow Diagram	4
2.2	Functional Definitions of Application Entities	4
2.3	Sequencing of Real-World Events.....	5
3.0	AE Specifications	5
3.1	The DNET AE	5
3.1.1	<i>Association Establishment Policies</i>	<i>5</i>
3.1.1.1	General	5
3.1.1.2	Number of Associations.....	5
3.1.1.3	Asynchronous Nature	6
3.1.1.4	Implementation Identifying Information.....	6
3.1.2	<i>Association Initiation by Real-World Activity.....</i>	<i>6</i>
3.1.2.1	Association Initiation - Storage	6
3.1.2.1.1	Real-World Activity - Storage.....	7
3.1.2.1.1.1	Associated Real-World Activity - Storage	7
3.1.2.1.1.2	Proposed Presentation Contexts - Storage	7
3.1.2.1.1.2.1	SOP Specific Conformance - Storage	8
3.1.2.2	Association Initiation - Printing.....	10
3.1.2.2.1	Real-World Activity - Printing	10
3.1.2.2.1.1	Associated Real-World Activity - Printing	10
3.1.2.2.1.2	Proposed Presentation Contexts - Printing.....	10
3.1.2.2.1.2.1	SOP Specific Conformance - Basic Print Management.....	11
3.1.3	<i>Association Acceptance Policy.....</i>	<i>12</i>
3.1.4	<i>Real World Activity - Removable Media</i>	<i>12</i>
3.1.4.1	Presentation Contexts - Removable Media	12
4.0	Communication Profiles	12
4.1	Supported Communication Stacks	12
4.2	TCP/IP	13
4.2.1	<i>Physical Media Support</i>	<i>13</i>
5.0	Extensions/Specializations/Privatizations	13
6.0	Configuration.....	13
6.1	Title/Presentation Address Mapping.....	13
6.2	Configurable Parameters.....	13
7.0	Support for Extended Character Sets	13

1.0 Introduction

This document describes the conformance to the ACR-NEMA DICOM 3.0 Standard for the Digital Network Manager (DNET) from Siemens Medical Systems, Inc. Ultrasound Group. It shall establish the conformance specifications for this system only, and does not apply to other products offered by Siemens Medical Systems, or its affiliates.

The DNET is a compact computer that acquires images from an ultrasound system and sends them using DICOM standard protocols and definitions to centralized network archive servers, printers, and workstations. This DICOM Conformance Statement applies to the DNET when used as an option with the SONOLINE Versa Pro, Versa Plus, Sienna, Omnia, Prima or Adara systems.

The DNET is also capable of creating DICOM-compliant media when an optional Magneto Optical Disk drive is installed in the DNET. It is capable of handling 90mm (3.5-inch) MB Magneto-Optical Disk (MOD) media with capacities of 128 MB, 230 MB, 540 MB, and 640 MB. The DNET is capable of creating images that conform to the Composite Ultrasound Image IOD, Retired Composite Ultrasound Image IOD, and Secondary Capture Image IOD. In addition, a DICOM DIR can be created on removable media.

1.1 DICOM and the SONOLINE ultrasound products

The DICOM standard provides a well-defined set of structures and protocols that allow inter-operability to take advantage of distributed services offered by a wide variety of medical imaging devices.

When configured with the DNET option, the ultrasound systems provide support for essential services related to ultrasound scanning and connectivity to DICOM compliant devices. The DNET product will not support all features supported by the DICOM standard. This document clearly states the DICOM services and data classes that are supported by the applications included with the DNET. The intent of this document is to allow users and other vendors who also support the DICOM standard to exchange information within the specific context of those elements of the DICOM standard that the DNET system supports.

This document is written with respect to the adopted portions of the DICOM standard, Revision 3.0. The outline of the following sections of this document follows the outline specified in the DICOM Standard NEMA publication PS3.2.²

² Second part of the DICOM standard: NEMA Standards Publication PS 3.2-1998, Digital Imaging and Communications in Medicine (DICOM), Part 2: Conformance

2.0 Implementation Model

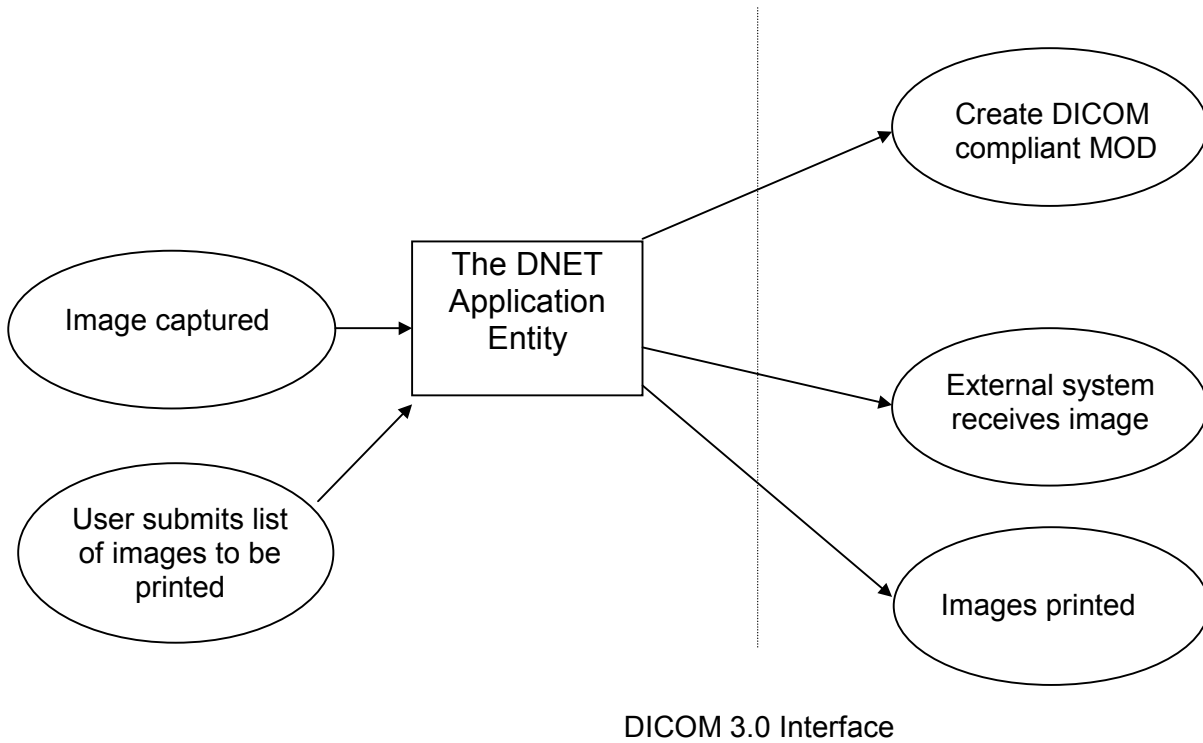
2.1 Application Data Flow Diagram

When an image is captured, the DNET can be configured to automatically route a captured image to an external system for image review and archive. Users can also manually request that all the images of an examination or a list of selected images of an examination be sent to the external system.

The DNET can automatically route captured images to a DICOM-compliant printer. Users can also manually request that all the images of an examination or a list of selected images be printed.

The DNET can act as a File Set Creator (FSC), to initialize MOD media and create a DICOM File-set on the media.

Figure 1 - The DNET DICOM Data Flow Diagram



2.2 Functional Definitions of Application Entities

The DNET AE implements the Storage and Print Management Service Classes as a Service Class User (SCU). It also implements the File-set Creator, File-set Updater, and File-set Reader.

2.3 Sequencing of Real-World Events

Not applicable.

3.0 AE Specifications

3.1 The DNET AE

The DNET AE provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU:

Table 1: SOP Class Conformance as SCU

SOP Class Name	SOP Class UID
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1
US Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Basic Greyscale Print Management	1.2.840.10008.5.1.1.9
Basic Color Print Management	1.2.840.10008.5.1.1.18

The Print Management Classes corresponds to conformance to the following SOP classes as an SCU:

Table 2: SOP Class Conformance as SCU

SOP Class Name	SOP Class UID
Basic Film Session	1.2.840.10008.5.1.1.1
Basic Film Box	1.2.840.10008.5.1.1.2
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4
Basic Color Image Box	1.2.840.10008.5.1.1.4.1

The DNET provides conformance to the DICOM Interchange Option of the Media Storage Service Class.

Table 3: Media Storage Application Profiles

Supported Aps	Real-World Activity	Role
APL-US-ID-SF-MOD128	Create MOD	FSC

3.1.1 Association Establishment Policies

3.1.1.1 General

The maximum PDU size is configurable. The default PDU size that will be offered is 16,386 bytes.

3.1.1.2 Number of Associations

The DNET will use the Storage and Print Management Services. The DNET, in general, will not have more than one association active to perform a service (e.g. will not have two associations using the Storage service, but can have simultaneous

associations handling printing and storage). It is also possible to have Color and Grayscale Print Management associations active simultaneously.

3.1.1.3 Asynchronous Nature

The Storage AE does not provide asynchronous behavior.

3.1.1.4 Implementation Identifying Information

An implementation class UID and version name is configured at the time of installation. The default implementation class UID is 1.2.840.113711.1.1 and the default version name is V1.0.

3.1.2 Association Initiation by Real-World Activity

3.1.2.1 Association Initiation - Storage

Behavior when sending images is configurable and depends on whether “live” sending is enabled or not. Live sending means that images will be sent over a DICOM Association as soon as they are captured. The alternative configurable behavior is that images are sent all at once only after an Exam has been closed. An association will contain images from at most one study.

If live sending is enabled, a new Association will be requested as soon as an Exam is opened, whether it is an existing Exam or a new one. For the DNET, an Exam corresponds to a DICOM Series. As long as this Association remains open, new images will be sent over the Association until the Exam is closed. The DNET can be configured to automatically request a new Association if the Association is dropped at any time. If this new Association is established, the DNET will send all unsent images beginning from the image for which the C-STORE failed (it will not resend all the prior images). If the DNET is not configured as such, no attempt will be made to re-establish the Association and the entire Exam will be marked as not sent. The exam must then be manually re-sent at a later time.

If live sending is not enabled, the system can be configured to operate in two different modes. In one mode the user will always be queried when an Exam is closed as to whether they wish to send the images to another AE or export them to media. In the other mode the exam is simply marked as not sent and it is up to the user to select that Exam for sending at a later time. If an error occurs during the transmission of an image, the association will be closed and the user will be alerted of the error. The Series will be marked afterwards that it has images that have not been sent. Users always have the option to resend the entire Series after a send has been completed. To make it easier to send Exams in this mode the user can choose to send all ‘new’ (those that have not been successfully sent) Exams rather than having to select each Exam.

Whether live sending is configured or not, when an Association is requested the DNET AE will request that a set of modalities be supported. If the DNET is configured as an Ultrasound capture device then it will request that US, US Retired, and Secondary

Capture SOP Classes be accepted. Otherwise, it will only request that the Secondary Capture SOP Class be supported. The preferred SOP Class is US followed by US Retired and finally Secondary Capture. It is possible to alter this list so that only a subset are requested but the order of preference always remains.

3.1.2.1.1 Real-World Activity - Storage

3.1.2.1.1.1 Associated Real-World Activity - Storage

An association is initiated when image(s) of an examination need to be transferred to an external system. The DNET users also have the option to send the images of completed and closed Exams. See section 3.1.2.2 for specifics of Association management.

3.1.2.1.1.2 Proposed Presentation Contexts - Storage

The following presentation context list applies when the DNET is configured to support the Storage Service Class:

Table 6: Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
US Image Storage	1.2.840.10008.5.1.4.1.1.6.1	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
US Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.6	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.1.2.1.1.2.1 SOP Specific Conformance - Storage

In the case of a successful C-STORE response from the SCP, the DNET AE will continue to send any subsequently captured image on the same association if the examination is in progress. If the examination is closed, the DNET AE will continue to send the rest of the images that have been marked for transmission. The association will be properly released after all relevant images have been sent.

If secondary objects are transferred, all the mandatory modules of the Secondary Capture Image Information Object Definition are provided. No non-mandatory modules are provided. Of the mandatory modules, all Type 1 and Type 2 elements are provided. Specific optional data elements (elements of Type 3) are provided if the DNET is configured to do so. Refer to Table 7 for such elements.

If ultrasound objects are transferred, all the mandatory modules of the Ultrasound Image Information Object Definition are provided. No non-mandatory modules are provided (e.g. Frame of Reference, US Region Calibration, Overlay Plane, etc.). Of the mandatory modules, all Type 1 and Type 2 data elements are provided. Specific optional data elements (elements of Type 3) are provided if the DNET is configured to do so. Refer to Table 7 for such elements.

The following attributes are of particular importance in transmitted images:

Table 7: Significant Elements in Sent Images

Attribute Name	Tag ID	Significance
Patient Name	(0010,0010)	Always specified. Only first and last names are entered on the PCU. Names can be set using carat, '^', or comma, ',', delimiters depending on the configuration. Thus names can be either in the format of 'lname^fname' or 'lname, fname'. Note that for removable media names are always in the carat format.
Patient ID	(0010,0010)	Always specified.
Patient's Birth Date	(0010,0030)	Can be empty
Patient's Sex	(0010,0040)	Can be empty.
Study Date	(0008,0020)	Always specified.
Accession Number	(0008,0050)	Can be empty.
Modality	(0008,0060)	Always specified. The field is configurable with the default being 'US'.
Study Description	(0008,1030)	Can be present if configured. Can be empty if present. Value corresponds to exam types. Can be 1 to 3 exam types delimited by '\s'.
Series Description	(0008,103E)	Can be present if configured. Can be empty if present. Value is identical to Study Description.
Operators' Name	(0008,1070)	Can be present if configured. Can be empty if present. Only first and last names are entered on the PCU. Names can be set using carat, '^', or comma, ',', delimiters depending on the configuration.
Samples per pixel	(0028,0002)	Always specified. 3 for RGB. 1 for MONOCHROME2.
Photometric Interpretation	(0028,0004)	The following photometric interpretations can be specified: MONOCHROME2 or RGB.
Rows	(0028,0010)	Always specified. 486 for NTSC. 576 for PAL.
Columns	(0028,0011)	Always specified. 640 for NTSC. 768 for PAL.
Bits Allocated	(0028,0100)	Always specified as 8.
Bits Stored	(0028,0101)	Always specified as 8.
Pixel Representation	(0028,0103)	Always specified as 0, unsigned integer.
Planar Configuration	(0028,0034)	If image is RGB will be specified as 0, color by pixel.
Attribute Name	Tag ID	Significance

Window Center	(0028,1050)	System can be configured to specify a value for this
Window Width	(0028,1051)	System can be configured to specify a value for this.
Rescale Intercept	(0028,1052)	If Window Center and Window Width are defined then will be set to 0.0.
Rescale Slope	(0028,1053)	If Window Center and Window Width are defined then will be set to 1.0.

3.1.2.2 Association Initiation - Printing

Associations with printers can be initiated either on a “live” or a “buffered” basis.

“Live” printing means images are routed to printers when they are captured. In this case, the Association is initiated when the first image of the examination is captured. If color images are captured, an attempt will be made to form an Association with the Basic Color Print Management SOP Class presentation context, and all subsequent color images will be routed along this Association. This “color” Association will be maintained independently from the “gray” Association.

“Buffered” printing means images are held on the local hard disk until a sufficient number of images have been captured to fill a page. When this occurs, an Association will be formed with the printer, all the images for the page transferred, and the Association will be closed.

3.1.2.2.1 Real-World Activity - Printing

3.1.2.2.1.1 Associated Real-World Activity - Printing

An Association is initiated when image(s) of an Exam need to be printed on a DICOM 3.0 compliant printer. See section 3.1.2.3.1 for initiation specifics.

3.1.2.2.1.2 Proposed Presentation Contexts - Printing

The following list applies when the DNET is configured to support the Print Management Service Class:

Table 8: Proposed Presentation Contexts

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Basic Grayscale Print Mngmt.	1.2.840.10008.5.1.1.9	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
Basic Color Print Mngmt.	1.2.840.10008.5.1.1.1.1.1.1.8	DICOM Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

3.1.2.2.1.2.1 SOP Specific Conformance - Basic Print Management

Standard conformance is provided to the Basic Greyscale and Basic Color Print Management Meta SOP Classes as an SCU. All mandatory elements for film sessions, basic film boxes, and basic greyscale image boxes are provided. The User Optional attributes that can be set are listed below:

Table 9: Optional Attributes Set for Film Sessions

Name	Tag	Possible Values
Number of Copies	(2000,0010)	Any non-negative integer
Print Priority	(2000,0020)	HIGH, MED, LOW
Medium Type	(2000,0030)	PAPER, CLEAR FILM, BLUE FILM
Film Destination	(2000,0040)	MAGAZINE, PROCESSOR

Table 10: Optional Attributes Set for Film Boxes

Name	Tag	Possible Values
Film Orientation	(2010,0040)	PORTRAIT, LANDSCAPE
Film Size ID	(2010,0050)	8INX10IN, 10INX12IN, 10INX14IN, 11INX14IN, 14INX14IN, 14INX17IN, 24CMX30CM, 24CMX24CM
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	values depend on printer
Empty Image Density	(2010,0010)	BLACK, WHITE
Min Density	(2010,0120)	nnn
Max Density	(2010,0130)	nnn
Trim	(2010,0140)	YES, NO
Configuration Information	(2010,0150)	values depend on printer

Table 11: Optional Attributes Set for Image Boxes

Name	Tag	Possible Values
Magnification Type	(2010,0060)	REPLICATE, BILINEAR, CUBIC, NONE
Smoothing Type	(2010,0080)	values depend on printer
Polarity	(2020,0020)	NORMAL, REVERSE
Requested Image Size	(2020,0030)	values depend on printer

3.1.3 Association Acceptance Policy

The DNET AE does not accept Associations.

3.1.4 Real World Activity - Removable Media

A DICOM conformant Magneto-Optical Disk (MOD) is created when a non-conformant MOD is inserted into the DNET and one or more DICOM Exams are transferred to the MOD. When Exams are first transferred, their files are added to the MOD in DICOM Part 10 format and a valid DICOMDIR is created and saved to the MOD. The DNET can add images to an existing DICOM conformant MOD and update its DICOMDIR. The DNET, however, does not have the capability of inquiring the date and time of file creation for any file within the File-set and thus can only be considered a File-set Creator and not a Reader or Updater.

3.1.4.1 Presentation Contexts - Removable Media

The following list applies when the DNET is configured to support DICOM Removable Media:

Abstract Syntax		Transfer Syntax	
Name	UID	Name	UID
DICOMDIR	1.2.840.10008.1.3.10	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1
US Image Storage.	1.2.840.10008.5.1.4.1.1.6.1	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	DICOM Explicit VR Little Endian	1.2.840.10008.1.2.1

4.0 Communication Profiles

4.1 Supported Communication Stacks

The DNET AE provides DICOM 3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

4.2 TCP/IP

The DNET AE inherits its TCP/IP stack from the Windows 95 system upon which it executes.

4.2.1 Physical Media Support

The DNET AE is indifferent to the physical medium over which TCP/IP executes as it inherits this support from the Windows 95 system upon which it executes.

5.0 Extensions/Specializations/Privatizations

Not applicable.

6.0 Configuration

6.1 Title/Presentation Address Mapping

The mapping from AE Title to TCP/IP addresses and ports is configurable and set at the time of installation by ALI Installation Personnel.

The default settings are as follows:

The DNET Application Entity	AE Title
Storage Service Class SCU	PCU_STORE_SCU
Removable Media Creator	PCU_STORE_SCU
Print Service Class SCU	PCU_PRINT_SCU

6.2 Configurable Parameters

The following items are configurable:

The AE Title, ports of SCP's, implementation class UID, implementation version name of local and external DICOM entities.

The print parameters of the Print Management modules, e.g. film session, film box, etc., are configurable via the PCU's user interface.

7.0 Support for Extended Character Sets

No support for Extended Character Sets.