NewVision Fundus Medical Imaging Suite

DICOM Conformance Statement

NewVision Fundus DICOM v.3.2

BTT Bilgi Teknoloji Tasarim Ltd.
Document version: 2.0 10 November 2011

1. Overview

This document describes DICOM conformance of NewVision Fundus Medical Imaging software. NewVision Fundus Medical Imaging software is a medical imaging system that features patient data export using DICOM Network protocol as well as DICOM Modality Performed Procedure Step.

1.1. Supported Networking DICOM Services

NewVision Fundus Medical Imaging software provides Standard Conformance to the following DICOM Network services:

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Storage Service Class	Yes	No
Secondary Capture Image Storage	Yes	No
VL Photographic Image Storage	Yes	No
Ophthalmic Photography 8 Bit Image Storage	Yes	No
Ophthalmic Photography 16 Bit Image Storage	Yes	No
Workflow Management		
Modality Worklist	Yes	No
Storage Commitment Push Model	No	No
Modality Performed Procedure Step	Yes	No
Print Management		
Basic Grayscale Print Management	No	No

1.2. Supported Media Storage Application Profiles

The following media are supported by the NewVision Fundus Medical Imaging software:

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disk - Recordable		
General Purpose CD-R	Yes	Yes
General Purpose CD-RW	Yes	Yes

DVD		
General Purpose DVD-RAM	Yes	Yes
General Purpose DVD-R	Yes	Yes
General Purpose DVD+R	Yes	Yes
General Purpose DVD-RW	Yes	Yes

2. Table of Contents

3. Introduction

3.1. Revision History

3.2. Intended Audience

3.3. Terms and Definitions

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

Abstract Syntax ï the information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples : Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

Application Entity (AE) ï an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title ï the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context ï the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association ï a network communication channel set up between *Application Entities*.

Attribute ï ï a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Information Object Definition (IOD) ï the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG) – a set of standardized image compression techniques, available for use by DICOM applications.

Media Application Profile ï the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

Module ï a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation ï first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Presentation Context ï the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) ï a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

Security Profile ï a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

Service Class Provider (SCP) ï role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) ï role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

Service/Object Pair (SOP) Class ï the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance ï an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Tag ï a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the ñgroupò and the ñelementò If the ñgroupò number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

Transfer Syntax ï the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) ï a globally unique ñdotted decimalò string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) ï the format type of an individual DICOM data element, such as text, an integer, a personôs name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.4. Basics of DICOM Communication

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

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

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

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

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is

explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

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

3.5. Abbreviations

AE Application Entity
AET Application Entity Title
CAD Computer Aided Detection
CDA Clinical Document Architecture
CD-R Compact Disk Recordable
CSE Customer Service Engineer
CR Computed Radiography
CT Computed Tomography
DHCP Dynamic Host Configuration Protocol
DICOM Digital Imaging and Communications in Medicine
DIT Directory Information Tree (LDAP)
DN Distinguished Name (LDAP)
DNS Domain Name System
DX Digital X-ray
FSC File-Set Creator
FSU File-Set Updater
FSR File-Set Reader
GSDF Grayscale Standard Display Function
GSPS Grayscale Softcopy Presentation State
HIS Hospital Information System
HL7 Health Level 7 Standard
IHE Integrating the Healthcare Enterprise
IOD Information Object Definition
IPv4 Internet Protocol version 4
IPv6 Internet Protocol version 6
ISO International Organization for Standards
IO Intra-oral X-ray
JPEG Joint Photographic Experts Group
LDAP Lightweight Directory Access Protocol
LDIF LDAP Data Interchange Format

LUT Look-up Table
MAR Medication Administration Record
MPEG Moving Picture Experts Group
MG Mammography (X-ray)
MPPS Modality Performed Procedure Step
MR Magnetic Resonance Imaging
MSPS Modality Scheduled Procedure Step
MTU Maximum Transmission Unit (IP)
MWL Modality Worklist
NM Nuclear Medicine
NTP Network Time Protocol
O Optional (Key Attribute)
OP Ophthalmic Photography
OSI Open Systems Interconnection
PACS Picture Archiving and Communication System
PET Positron Emission Tomography
PDU Protocol Data Unit
R Required (Key Attribute)
RDN Relative Distinguished Name (LDAP)
RF Radiofluoroscopy
RIS Radiology Information System.
RT Radiotherapy

SC Secondary Capture
SCP Service Class Provider
SCU Service Class User
SOP Service-Object Pair
SPS Scheduled Procedure Step
SR Structured Reporting
TCP/IP Transmission Control Protocol/Internet Protocol
U Unique (Key Attribute)
UL Upper Layer
US Ultrasound
VL Visible Light
VR Value Representation

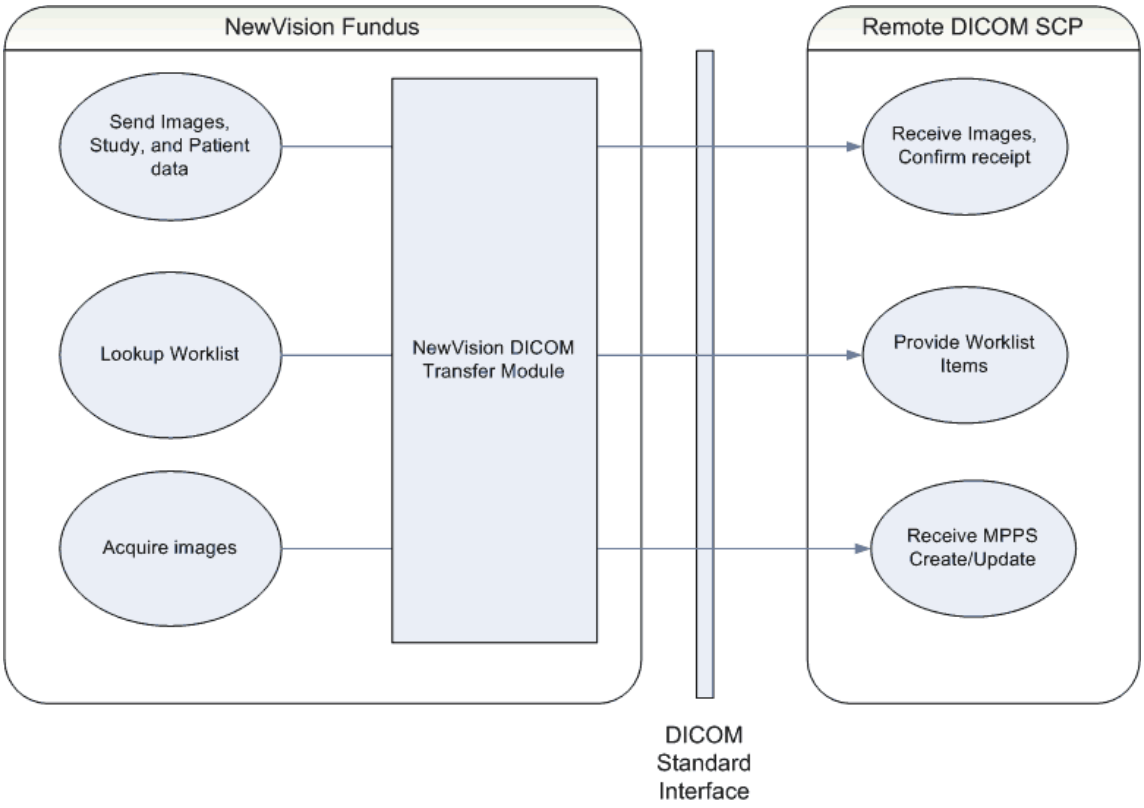
3.6. References

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

4. Networking

4.1. Implementation Model

Application Data flow in the NewVision model can be visualized in the diagram below:



Note that all DICOM operations are performed via ñNewVision DICOM Transfer Moduleò Entity. All local event trigger the related DICOM operation directly.

Step 1 describes ñSend Imagesò operation where patient, study, and image data are stored to a DICOM Storage server independent of the DICOM Modality Worklist specification. ñSend Imagesò operation is invoked when a study is completed or when NewVision Fundus software is being closed (configurable in settings).

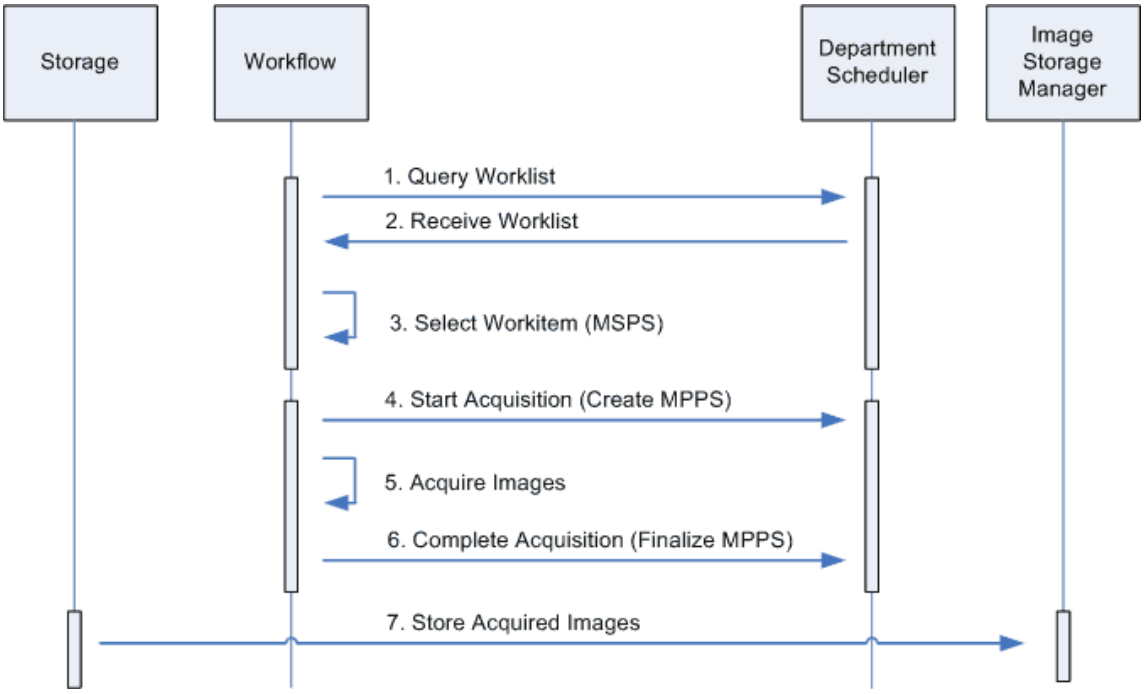
Step 2, describes how NewVision Fundus connects to the DICOM Worklist-compatible SCP and queries for a worklist. The operator is supposed to select the corresponding patient from the list and perform the study and measurements.

Step 3 describes how NewVision Fundus connects to the SCP and transfers the study results (acquired images and additional data) for the selected worklist. Acquisition of images results in automated creation of Modality Performed Procedure Step instance. Completion of MPPS is performed as a result of operator action.

Functional Definition

NewVision Fundus functions as an SCU requesting a worklist, acquiring the images and storing them to a DICOM SCP.

Sequencing of Real-world Activities



Usual operation with DICOM Worklist-compatible PACS can be briefly described as follows:

- A patient (optionally having an appointment; optionally having a previous record in PACS system) makes a visit to doctor.
- Doctor (or an operator) starts NewVision Fundus and creates a new record for the patient:
    - NewVision queries PACS for worklist (Step 1);
    - PACS responds with a Worklist of Modality Specified Procedure Steps (MSPS) (Step 2);
    - Operator selects the patient from the worklist and creates a new study record (Step 3);
    - When new study item is created NewVision automatically creates and sends MPPS (Modality Performed Procedure Step) (Step 4)
- NewVision acquires the images, operator performs measurement and annotations; (Step 5)
- Operator closes the study, NewVision automatically finalizes the MPPS (Step 6);
- NewVision stores the acquired images any associated information (study, patient data, etc) (Step 7);

4.2 AE Specifications

4.2.1. Storage Application Entity Specification

4.2.1.1. SOP Classes

NewVision Fundus provides Standard Conformance to the following SOP classes:

SOP Class UID	SOP Class Name	User of Service (SCU)
1.2.840.10008.1.20.1	Storage Commitment Push Model	Option

1.2.840.10008.4.2	Storage Service Class	Yes
1.2.840.10008.5.1.4.1.1.7	Secondary Capture Image Storage	Yes
1.2.840.10008.5.1.4.1.1.77.1.4	VL Photographic Image Storage	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.1	Ophthalmic Photography 8 Bit Image Storage	Yes
1.2.840.10008.5.1.4.1.1.77.1.5.2	Ophthalmic Photography 16 Bit Image Storage	Yes
1.2.840.10008.1.1	Verification	Yes

4.2.1.2. Association Policies

4.2.1.2.1. General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2. Number Of Associations

NewVision Fundus supports a single association at any time. The associated DICOM SCP entity is configured in the settings. NewVision Fundus will not accept any associations, it will only request associations. Only a single operation can be performed at any time, all subsequent operations will have to wait until active operation is completed, failed, or canceled.

Maximum number of simultaneous Associations	1 (configurable)

4.2.1.2.3. Asynchronous Nature

NewVision Fundus does not support asynchronous communication. All image store operations are synchronous including confirmation.

Maximum number of outstanding asynchronous transactions	1

4.2.1.2.4. Implementation Identifying Information

The NewVision Fundus software is an SCU that uses the AE Title óBTT_NEW_VISIONô.

AE Title	BTT_NEW_VISION
Implementation Class UID	1.2.392.200046.100
Implementation Version Name	BTT_TECH_DSGN_01

4.2.1.3. Association Initiation Policy

4.2.1.3.1. Activity – Send Images

4.2.1.3.1.1. Description and Sequencing of Activities

Basic concepts:

Each Image acquired by NewVision Fundus is supposed to be stored to a remote DICOM SCP ï most probably a PACS system.

After an image is successfully stored it is marked as ñstoredò.

Usual operation:

Operator acquires the images and performs several operations on the images: deletes or enhances some images, performs measurements, takes printouts, etc. After operator is done working with images he/she will close the study.

When the study is closed NewVision will ask if the images should be transferred now (or start transfer automatically). Transfer process is synchronous i.e. all other operations will be blocked until transfer is completed or stopped by user.

When operator closes NewVision Fundus, software will check if there are any images that were not transferred and (if any) alert operator and ask if the images should be transferred now. Transfer process is synchronous i.e. all other operations will be blocked until transfer is completed or stopped by user.

After the image is successfully transferred it will be marked as ñtransferredò to avoid duplicate transfer operations.

C-STORE requests:

NewVision Fundus will create a new association and issue a separate C-STORE request for each images scheduled for transfer.

4.2.1.3.1.2. Proposed Presentation Contexts

NewVision Fundus is capable of proposing the Presentation Contexts shown in the table below:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Lossy JPEG 8-bit	1.2.840.10008.1.2.4.50	SCU	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	Lossless JPEG non-hierarchical	1.2.840.10008.1.2.4.57	SCU	None

4.2.1.3.1.3. Storage Response Handling Behaviour

NewVision Fundus will handle the response status codes in accordance with the table shown below:

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The SCP has successfully stored the SOP Instance. If all SOP Instances in a send job have status success then the job is marked as complete.
Refused	Out of Resources	A700-A7FF	The Association is aborted using A-ABORT and the send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application. This is a transient failure.
Error	Data Set does not match SOP Class	A900-A9FF	The Association is aborted using A-ABORT and the send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application.
Error	Cannot Understand	C000-CFFF	The Association is aborted using A-ABORT and the send job is marked as failed. The status meaning is logged and the job failure is reported to the user via the job control application.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful but the status meaning is logged.
Warning	Data Set does not match SOP Class	B007	Image transmission is considered successful but the status meaning is logged.
Warning	Elements Discarded	B006	Image transmission is considered successful but the status meaning is logged.
*	*	Any other status code.	The Association is aborted using A-ABORT and the send job is marked as failed. The status code is logged and the job failure is reported to the user via the job control application.

Behavior of NewVision Fundus in case of communication failure is described in table below:

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the send job is marked as failed. The reason is logged and the job failure is reported to the user via the job control application.
Association aborted by the SCP or network layers	The send job is marked as failed. The reason is logged and the job failure is reported to the user via the job control application.

4.2.1.3.1.4. Identifier Data Associated With Transferred Image

NewVision Fundus will transfer the data associated with image. Included Identifier types are listed in the table below:

Tag	Attribute Name	Notes
(0008:0008)	Image type	
(0008:0016)	SOP Class UID	
(0008:0018)	SOP Instance UID	
(0008:0020)	Study Date	

(0008:0021)	Series Date	
(0008:0023)	Content Date	
(0008:0030)	Study Time	
(0008:0031)	Series Time	
(0008:0033)	Content Time	
(0008:0050)	Accession Number	
(0008:0060)	Modality	Constant, configurable
(0008:0070)	Manufacturer	Constant, ñBTTò
(0008:0080)	Institution Name	Constant, configurable
(0008:1010)	Station Name	Constant, configurable
(0008:103E)	Series Description	Constant, ñColor/Lò
(0008:1040)	Institutional Department Name	Constant, configurable
(0008:1050)	Performing Physicianôs Name	
(0008:1070)	OperatorsôName	
(0008:1090)	Manufacturerôs Model Name	Constant, ñNEW VISION FUNDUSò
(0010:0010)	Patientôs Name	
(0010:0020)	Patient ID	
(0010:0040)	Patientôs Sex	
(0018:1000)	Device Serial Number	Constant, ñ3.2ò
(0018:1020)	Software Version(s)	Constant, ñ3.2.5.8ò
(0018:1030)	Protocol Name	Constant, ñColorò
(0020:000D)	Study Instance UID	
(0020:000E)	Series Instance UID	
(0020:0010)	Study ID	
(0020:0011)	Series Number	
(0020:0012)	Acquisition Number	
(0020:0013)	Instance Number	
(0020:0020)	Patient Orientation	Constant, ñL\Fò
(0020:0060)	Laterality	Constant, ñLò
(0020:4000)	Image Comments	

4.2.2. Workflow Application Entity Specification

4.2.2.1. SOP Classes

NewVision Fundus provides Standard Conformance to the following SOP classes:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model ï FIND	1.2.840.10008.5.1.4.31	Yes	No
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No

4.2.2.2. Association Policies

4.2.2.2.1. General

The DICOM standard application context name for DICOM 3.0 is always proposed:

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2. Number Of Associations

NewVision Fundus supports a single association at any time. The associated DICOM SCP entity is configured in the settings. NewVision Fundus will not accept any associations, it will only request associations. Only a single operation can be performed at any time, all subsequent operations will have to wait until active operation is completed, failed, or canceled.

Maximum number of simultaneous Associations	1 (configurable)

4.2.2.2.3. Asynchronous Nature

NewVision Fundus does not support asynchronous communication. Worklist find and Patient find operations are asynchronous.

Maximum number of outstanding asynchronous transactions	1

4.2.2.2.4. Implementation Identifying Information

The NewVision Fundus software is an SCU that uses the AE Title óBTT_NEW_VISIONô.

AE Title	BTT_NEW_VISION
Implementation Class UID	1.2.392.200046.100
Implementation Version Name	BTT_TECH_DSGN_01

4.2.2.3. Association Initiation Policy

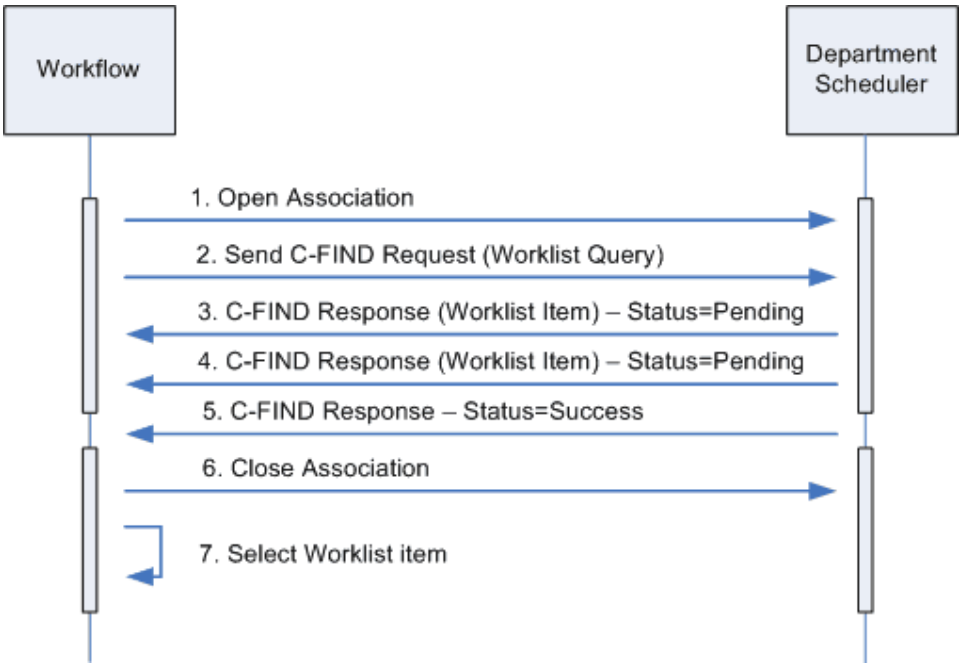
4.2.2.3.1. Activity – Worklist Update

4.2.2.3.1.1. Description and Sequencing of Activities

The request for Worklist is initiated by user interaction, i.e. by pressing ñLookup Worklistò button. User will be allowed to enter search criteria, or leave search criteria empty in order to view all worklist entries.

Upon initiation of request NewVision Fundus will initiate a C-FIND request and wait until all Worklist entries are received. The list of available worklist entries will be presented to the user; after user select a worklist item it will be entered to the local database (if not exists) and a new study item created in NewVision Fundus. The user will be able to start acquiring images immediately.

Sample operation can be summarized in the Table below:



1. NewVision Fundus opens an association with department scheduler.

2. NewVision Fundus sends a C-FIND request containing the Worklist Query attributes.

3. Departmental Scheduler returns a C-FIND response containing the first matching Worklist item. C-FIND Status is set to Pending to indicate that more response messages are coming.

4. Departmental Scheduler returns a C-FIND response containing the second matching Worklist item. C-FIND Status is set to Pending to indicate that more response messages are coming.

5. Departmental Scheduler returns a C-FIND response with Status set to Success to indicate that no more Worklist items are available. No Worklist item is included in this message. In this example we assume that only two matching Worklist items were available.

6. NewVision Fundus closes association.

7. User selects a Worklist entry.

4.2.2.3.1.2. Proposed Presentation Contexts

NewVision Fundus will propose the presentation contexts listed in the table below:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Modality Worklist Information Model ï FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.2.3.1.3. SOP Specific Conformance for Modality Worklist

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the matches. Worklist items are available for display or further processing.
Refused	Out of Resources	A700-A7FF	The Association is aborted using A-ABORT and the worklist query is marked as failed. The status meaning is logged and reported to the user. Any additional error information in the Response will be logged.
Failed	Identifier does not match SOP Class	A900-A9FF	The Association is aborted using A-ABORT and the worklist query is marked as failed. The status meaning is logged and reported to the user. Any additional error information in the Response will be logged.
Failed	Unable to Process	C000-CFFF	The Association is aborted using A-ABORT and the worklist query is marked as failed. The status meaning is logged and reported to the user. Any additional error information in the Response will be logged.
Cancel	Matching terminated due to Cancel request	FE00	If the query was cancelled due to too may worklist items then the SCP has completed the matches. Worklist items are available for display or further processing. Otherwise, the Association is aborted using A-ABORT and the worklist query is marked as failed. The status meaning is logged and reported to the user.
Pending	Matches are continuing	FF00	The worklist item contained in the Identifier is collected for later display or further processing.
Pending	Matches are continuing ï Warning that one or more Optional Keys were not supported	FF01	The worklist item contained in the Identifier is collected for later display or further processing. The status meaning is logged only once for each C-FIND operation.
*	*	Any other status code.	The Association is aborted using A-ABORT and the worklist query is marked as failed. The status meaning is logged and reported to the user. Any additional error information in the Response will be logged.

Behavior of NewVision Fundus in case of communication failure is described in table below:

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the worklist query is marked as failed. The reason is logged and the failure is reported to the user.
Association aborted by the SCP or network layers	The worklist query is marked as failed. The reason is logged and the failure reported to the user.

Acquired images will always use the Study Instance UID specified for the Scheduled Procedure Step (if available). If an acquisition is unscheduled, a Study Instance UID will be generated locally.

The Table below provides a description of the EXAMPLEINTEGRATED-MODALITY Worklist Request Identifier and specifies the attributes that are copied into the images. Unexpected attributes returned in a C-FIND response are ignored.

Requested return attributes not supported by the SCP are set to have no value. Non-matching responses returned by the SCP due to unsupported optional matching keys are ignored. No attempt is made to filter out possible duplicate entries.

The table below provides a description of the Worklist Identifiers sent by NewVision Fundus in a C-FIND request:

Module Name **Attribute Name**	**Tag**	**VR**	**M**	**Q**	**D**	**IOD**
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)	SQ				
> Scheduled Station AET	(0040,0001)	AE				
> Scheduled Procedure Step Start Date	(0040,0002)	DA	S			
> Scheduled Procedure Step Start Time	(0040,0003)	TM				
> Modality	(0008,0060)	CS	S			x
> Scheduled Performing Physicianõs Name	(0040,0006)	PN				
> Scheduled Procedure Step Description	(0040,0007)	LO				
> Scheduled Station Name	(0040,0010)	SH	S			
> Scheduled Procedure Step Location	(0040,0011)	SH				
> Scheduled Protocol Code Sequence	(0040,0008)	SQ				
> Scheduled Procedure Step ID	(0040,0009)	SH				
Requested Procedure						
Requested Procedure ID	(0040,1001)	SH				x *
Requested Procedure Description	(0032,1060)	SH			x	x
Study Instance UID	(0020,000D)	UI				x
Imaging Service Request						
Accession Number	(0008,0050)	SH				x **
Requesting Physician	(0032,1032)	PN				
Referring Physician's Name	(0008,0090)	PN				
Visit Identification						
Admission ID	(0038,0010)	LO				x ***
Patient Identification						
Patient Name	(0010,0010)	PN		x	x	x
Patient ID	(0010,0020)	LO		x	x	x
Patient Demographic						
Patientõs Birth Date	(0010,0030)	DA			x	x
Patientõs Sex	(0010,0040)	CS			x	x

The above table should be read as follows:

Module Name: The name of the associated module for supported worklist attributes.
Attribute Name: Attributes supported to build a NewVision Fundus Worklist Request Identifier.
Tag: DICOM tag for this attribute.
VR: DICOM VR for this attribute.

M: Matching keys that will be automatically provided in each C-FIND Worklist request. ñScheduled Procedure Step Start Dateòwill be equal to the current date, other parameters will be read from NewVision Fundus settings. Note that these tags may be skipped if the values are not provided in NewVision Fundus settings.

Q: Optional Interactive Query key. An ñxò" will indicate that NewVision Fundus may supply these keys if a value is provided by the user. For example, if a Patient Name or Patient ID is provided NewVision expects the SCP to narrow the result set accordingly.

D: Displayed keys. An ñxòindicates that this worklist attribute is displayed to the user during Patient / Worklist lookup.

IOD: An "x" indicates that this Worklist attribute is included into all Object Instances created during performance of the related Procedure Step. Note that this is a small subset of the actual data

that will be included in an IOD. For the full list of included data please refer to the table in section 4.2.1.3.1.4.

* Performed Procedure Step ID shall be equal to Study ID. Can be modified on request.

** Accession Number shall be equal to the Patient ID (if available). If Patient ID is not available Accession Number shall be used as Patient ID. If none are provided, NewVision Fundus will assign an automatic Patient ID locally.

*** Admission ID shall be equal to Study ID. Can be modified on request.

4.2.2.3.2. Activity – Acquire Images

4.2.2.3.2.1. Description and Sequencing of Activities

After the user selects a Worklist Item NewVision Fundus will find the corresponding Patient or create a new on in the local database. A new Study entry will be created for this patient and the Study ID matched with the one received from Worklist (Study Instance UID) if available. If Study Instance UID is not available Study ID will be assigned automatically.

It is possible to initiate a Study locally, in this case Study ID will be assigned automatically.

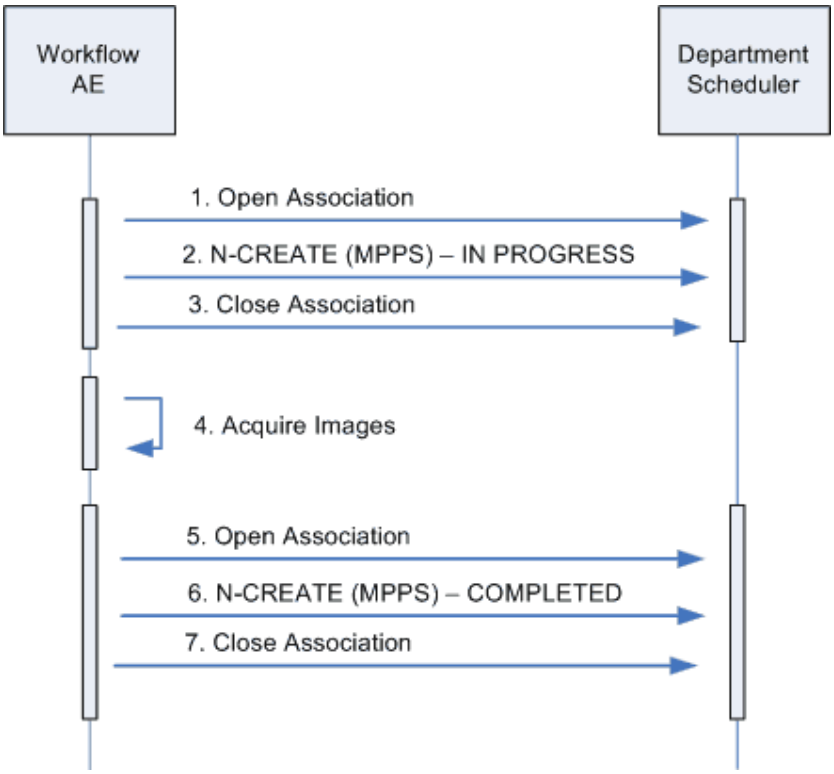
NewVision Fundus supports creation of ñunscheduled casesò and allows locally created MPPS Instances to be communicated to SCP.

NewVision Fundus will initiate an association to issue an N-CREATE and N-SET requests.

Sample Image Acquisition operation in NewVision Fundus can be summarized as follows:

- User creates a new study
- N-CREATE message is sent to the SCP to create a new MPPS and indicate that MPPS is in progress. This part is optional and can be turned on/off in the settings.
- User acquires images
- User performs analysis, measurements, takes notes, makes annotations, image enhancement, burns select images to a CD/DVD, and takes printouts, etc.
- User closes the study
- N-SET message is sent to the SCP to indicate that MPPS has been completed. This part is optional and can be turned on/off in the settings. Note that NewVision Fundus does not support MPPS failure. However it is possible to mark a study as failed in case the insitution requires such behavior.
- Images are stored to SCP. (Optional, can be turned on/off in the settings).

Possible sequence of interactions between NewVision Fundus and Departmental Scheduler that supports MPPS SOP classes as SCP is depicted in diagram below:



1. NewVision Fundus opens Association with Department Scheduler.
2. NewVision Fundus sends N-CREATE request to create an MPPS instance with status ñIN PROGRESSò and create necessary attributes. The Departmental Scheduler acknowledges the MPPS creation with an N-CREATE response (status success).
3. NewVision Fundus closes the Association with Department Scheduler.
4. All images are acquired, stored locally, and user analysis actions performed.
5. NewVision Fundus opens Association with Department Scheduler.
6. NewVision Fundus sends N-SET request to update the MPPS instance with status ñCOMPLETEDò and set all necessary attributes. The Departmental Scheduler acknowledges the MPPS creation with an N-SET response (status success).
7. NewVision Fundus closes the Association with Department Scheduler.

4.2.2.3.2.2. Proposed Presentation Contexts

NewVision Fundus will propose the presentation contexts listed in the table below:

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None

4.2.2.3.2.3. SOP Specific Conformance for Modality Worklist

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	The SCP has completed the operation successfully.
Failure	Processing Failure ï Performed Procedure Step Object may no longer be updated	0110	The Association is aborted using A-ABORT and the MPPS is marked as failed. The status meaning is logged and reported to the user. Additional information in the Response will be logged (i.e. Error Comment and Error ID).
Warning	Attribute Value Out of Range	0116	The MPPS operation is considered successful but the status meaning is logged. Additional information in the Response identifying the attributes out of range will be logged (i.e. Elements in the Modification List/Attribute List)
*	*	Any other status code.	The Association is aborted using A-ABORT and the MPPS is marked as failed. The status meaning is logged and reported to the user. Any additional error information in the Response will be logged.

Behavior of NewVision Fundus in case of communication failure is described in table below:

Exception	Behavior
Timeout	The Association is aborted using A-ABORT and the MPPS is marked as failed. The reason is logged and the failure is reported to the user.
Association aborted by the SCP or network layers	The MPPS is marked as failed. The reason is logged and the failure reported to the user.

The below table provides description of of the MPPS N-CREATE and N-SET request identifiers sent by NewVision Fundus. Empty cells in th N-CREATE and N-SET columns indicate that attribute is not sent. Each entry describes the appropriate value that will be sent. A ñZero lengthò attribute means that attribute will be sent, its óvalue lengthô will be present and set to ó0ô, and the value will not be included.

Attribute Name	Tag	VR	N-CREATE	N-SET
Modality	(0008,0060)	CS	Constant: ñNVò	
Referenced Patient Sequence	(0008,1120)	SQ	Zero length	
Patient Name	(0010,0010)	PN	From Modality Worklist or user input. User may modify the values obtained from the Worklist.	
Patient ID	(0010,0020)	LO	From Modality Worklist or user input. User may modify the values obtained from the Worklist.	

Patientôs Birth Date	(0010,0030)	DA	From Modality Worklist or user input. User may modify the values obtained from the Worklist.	
Patientôs Sex	(0010,0040)	CS	From Modality Worklist or user input. User may modify the values obtained from the Worklist.	
Study ID	(0020,0010)	SH	From Modality Worklist or locally auto-assigned.	
Performed Station AE Title	(0040,0241)	AE	Constant: ñBTT_NEW_VISIONò	
Performed Station Name	(0040,0242)	SH	From configuration	
Performed Location	(0040,0243)	SH	From configuration	
Performed Procedure Step Start Date	(0040,0244)	DA	Actual start date	
Performed Procedure Step Start Time	(0040,0245)	TM	Actual start time	
Performed Procedure Step End Date	(0040,0250)	DA	Zero length	Actual end date
Performed Procedure Step End Time	(0040,0251)	TM	Zero length	Actual end time
Performed Procedure Step Status	(0040,0252)	CS	Constant: ñIN PROGRESSò	ñDISCONTINUEDò or ñCOMPLETEDò
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	SQ	Zero length	If Performed Procedure Step Status (0040,0252) is ñDISCONTINUEDò then a single item will be present containing a user-selected entry drawn from Context Group 9300.
Performed Procedure Step ID	(0040,0253)	SH	Automatically created but can be modified by the user.	
Performed Procedure Step Description	(0040,0254)	LO	From Modality Worklist or user input. The user can modify the description provided via Modality Worklist.	
Performed Procedure Type Description	(0040,0255)	LO	Zero length	
Performed Protocol Code Sequence	(0040,0260)	SQ	Zero length	
Scheduled Step Attribute Sequence	(0040,0270)	SQ	Zero length	
Performed Series Sequence	(0040,0340)	SQ	Zero length	

4.3. Network Interfaces

NewVision Fundus is a software that makes use of the Personal Computer that itôs installed on. Typical PC will possess a Ethernet 100baseT network interface and support DHCP protocol, although some insitutions may wish to configure the network interfaces manually.

4.4. Configuration

DICOM-related settings of NewVision Fundus can be configured in the DICOM section of Settings window. Configurable parameters are listed in the table below:

Setting Name	**Default Value**
Remote AE Title	
Modality	
Institution Name	
Station Name	
Institutional Department Name	

5. Support of Character Sets

NewVision Fundus supports UTF-8 character set.

6. Security

NewVision Fundus provide or support any security measures. It assumes that all operations are provided in a secured environment.