DICOM

Conformance Statement

BV Family software R1.6 - system R1.2 with integrated VF Surgical Workstation

PHILIPS

1. DICOM CONFORMANCE STATEMENT OVERVIEW

The BV Family software R1.6 - system R1.2 with integrated VF Surgical Workstation, later referred to as BV Family, is a mobile surgical X-ray image generating system. Members of the BV family product line are: BV Endura, BV Libra, and BV Pulsera.

The BV Family implements a worklist management function to communicate with a RIS/HIS, an export function to transfer image data from the local system to a remote system, and a print function to print image data from the local system. The integrated surgical workstation offers an additional viewing function for images from the local system, images retrieved from remote systems, and images read from DVD. Viewed images can be written to DVD.

Thus the BV Family provides the following DICOM data exchange features:

- Print images from the local database on a DICOM printer
  (Standard DICOM package).
- Export images from the local database to a remote database
  (Standard DICOM package).
- Automatically send a storage commitment request
  (Advanced DICOM package).
- Query an information system for a modality worklist
  (Advanced DICOM package).
- Send Modality Performed Procedure Step details to an information system
  (Advanced DICOM package).
- Query and retrieve images from a remote database
  (Surgical Workstation).
- Read and write DICOM media
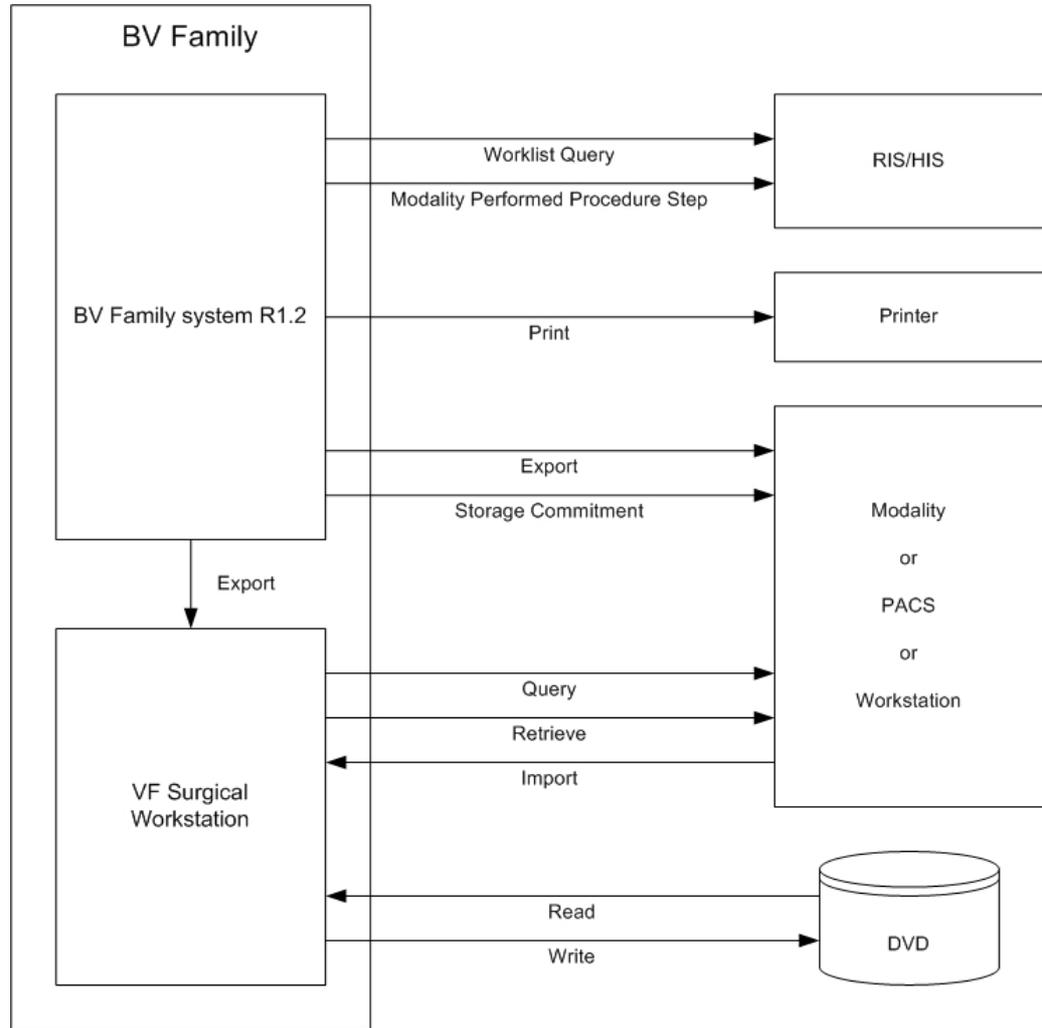 (Surgical Workstation).

Figure 1: System Overview of the BV Family

Table 1 provides an overview of all network services as provided by the BV Family.

Table 1: Network Services

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
Transfer			
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Specialized X-Ray	1.3.46.670589.2.3.1.1	No	Yes

SOP Class		User of Service (SCU)	Provider of Service (SCP)
Name	**UID**		
CX Image	1.3.46.670589.2.4.1.1	No	Yes
3D Volume Storage	1.3.46.670589.5.0.1.1	No	Yes
3D Volume Object Storage	1.3.46.670589.5.0.2.1	No	Yes
Surface Storage	1.3.46.670589.5.0.3.1	No	Yes
MR Cardio Storage	1.3.46.670589.5.0.8.1	No	Yes
CT Synthetic Image	1.3.46.670589.5.0.9	No	Yes
MR Synthetic Image	1.3.46.670589.5.0.10	No	Yes
MR Cardio Analysis Storage	1.3.46.670589.5.0.11.1	No	Yes
CX Synthetic Image	1.3.46.670589.5.0.12	No	Yes
Perfusion	1.3.46.670589.5.0.13	No	Yes
Perfusion Analysis	1.3.46.670589.5.0.14	No	Yes
Query/Retrieve			
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Patient/Study Only Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	No
Patient/Study Only Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	No
Workflow Management			
Storage Commitment Push Model	1.2.840.10008.1.20.1	Option	No
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Option	No
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Option	No
Print Management			
Basic Grayscale Print Management (Meta)	1.2.840.10008.5.1.1.9	Yes	No
> Basic Film Session	1.2.840.10008.5.1.1.1	Yes	No
> Basic Film Box	1.2.840.10008.5.1.1.2	Yes	No
> Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	Yes	No
> Printer	1.2.840.10008.5.1.1.16	Yes	No

The Transfer SCU and Print Management SCU services are part of the Standard DICOM package. (Note that this package is optional though required for DICOM functionality.)
The optional Workflow Management SCU services are part of the Advanced DICOM package.
The Transfer SCP and Query/Retrieve SCU services are part of the integrated VF Surgery Workstation.

Table 2 provides an overview of all media services as provided by the BV Family.

Table 2: Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
DVD		
General Purpose DVD Interchange with JPEG	Yes	Yes

2. TABLE OF CONTENTS

3. INTRODUCTION

3.1. Revision History

Table 3: Revision History

Document Version	Date of Issue	Author	Description
1.0	7 July 2005	PMS MIT-IO	Final version of the DICOM Conformance Statement for BV Family software R1.6 - system R1.2 with integrated VF Surgical Workstation.

3.2. 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.

3.3. Remarks

The DICOM Conformance Statement is contained in chapter 4 through 8 and follows the contents and structuring requirements of [DICOM] PS 3.2.

This DICOM 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 an IT environment may require application functions that are not specified within the scope of DICOM. Consequently, using only the information provided by this Conformance Statement does not guarantee interoperability of Philips equipment with non-Philips equipment.
  It is the user's responsibility to analyze 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).

3.4. Definitions, Terms and Abbreviations

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

The following acronyms and abbreviations are used in this document.

AE	Application Entity
AP	Application Profile
BV Family	BV Family software R1.6 - system R1.2 with integrated VF Surgical Workstation
BWLM	Basic Worklist Management (service)
DFI	Digital Fluoroscopy Imaging
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DVD	Digital Versatile Disc
EBE	DICOM Explicit VR Big Endian
ELE	DICOM Explicit VR Little Endian
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
GUI	Graphic User Interface
HIS	Hospital Information System
ILE	DICOM Implicit VR Little Endian
IOD	Information Object Definition
MPPS	Modality Performed Procedure Step
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
XA	X-Ray Angiographic

3.5.   References

[DICOM]   Digital Imaging and Communications in Medicine (DICOM), Part 1 – 18
             (NEMA PS 3.1-XXXX – PS 3.18-XXXX),
             National Electrical Manufacturers Association (NEMA)
             Publication Sales 1300 N. 17th Street, Suite 1847
             Rosslyn, Virginia. 22209, United States of America

[VFRB]   Release Bulletin ViewForum 4.1, 4522 981 27301, PMSN

4. NETWORKING

4.1. Implementation model

4.1.1. Application Data Flow

The BV Family consists of two application entities: the BV Family AE and the VF Surgical Workstation AE.

- The BV Family AE is responsible for all networking functionality concerning acquisitions by the BV Family. It consists of two packages (ref. Section 1): the (optional) Standard DICOM package, and the Advanced DICOM package as an optional extension to the Standard DICOM package. Using both packages the BV Family AE offers the following functionality.

  The operator can send a worklist query. (Get Worklist)

  The operator can select and perform an examination (may be scheduled per worklist), resulting in an MPPS record. Then the operator can export the acquisition images; the images in the examination may be transmitted as separate Secondary Capture images or as XA images. If applicable, the BV Family AE automatically sends a Storage Commitment request for those images. The operator can also send a selection of images to a DICOM printer. (Export)

  In service mode the service operator can verify application level communication. (Check)

- The VF Surgical Workstation AE is included to view images. Those images may be imported from the BV Family AE, or from a foreign storage SCU. (Query/Retrieve Image)

The BV Family can work both on-line and off-line. Therefore MPPS data and acquired images that have to be transferred by the BV Family AE are put in a queue (so only for RWA Export).
If the BV Family is connected to the network, then all queued jobs will be executed immediately.
If the BV Family is disconnected from the network, then Query/Retrieve and Worklist Queries are disabled. MPPS, storage, and print jobs will stay in the queue. When the system is connected to the network again, the user can resume the queued jobs. Then the jobs in the queue will be executed (FIFO).

The networking application data flow is shown in Figure 2.
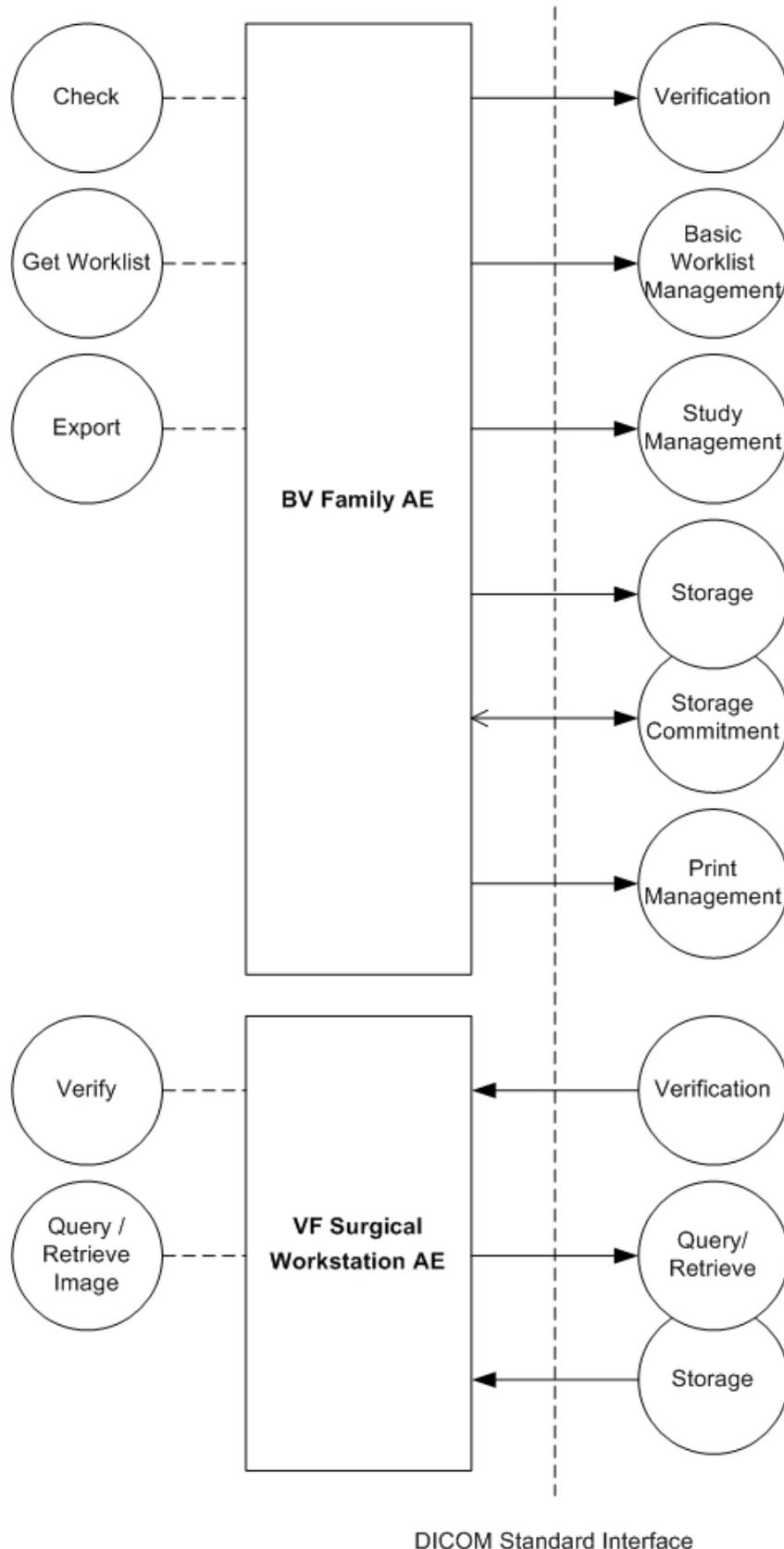
Figure 2: Application Data Flow Diagram

4.1.2. Functional Definition of AE's

4.1.2.1.   Functional Definition of the BV Family AE

The BV Family AE has no SCP implementation, and will act as SCU for Verification (Check), for Basic Worklist Management (Get Worklist), and for Study Management, Storage and Storage Commitment, and Print Management (Export).
Initiated by the operator the BV Family AE will propose the required presentation contexts for an association with the peer SCP.
For Storage Commitment the BV Family AE may accept associations for asynchronous event reports.

4.1.2.2.   Functional Definition of the VF Surgical Workstation AE

The VF Surgical Workstation AE can retrieve and view images from a foreign storage SCU (Query/Retrieve Image).
The operator initiates a query request and selects examinations from the query response. The operator initiates a retrieve request for the selected images. The VF Surgical Workstation AE as storage SCP waits for an association to import the requested images.

4.1.3. Sequencing of Real-World Activities

The following illustration describes the sequencing constraints of a typical acquisition of a scheduled procedure step.
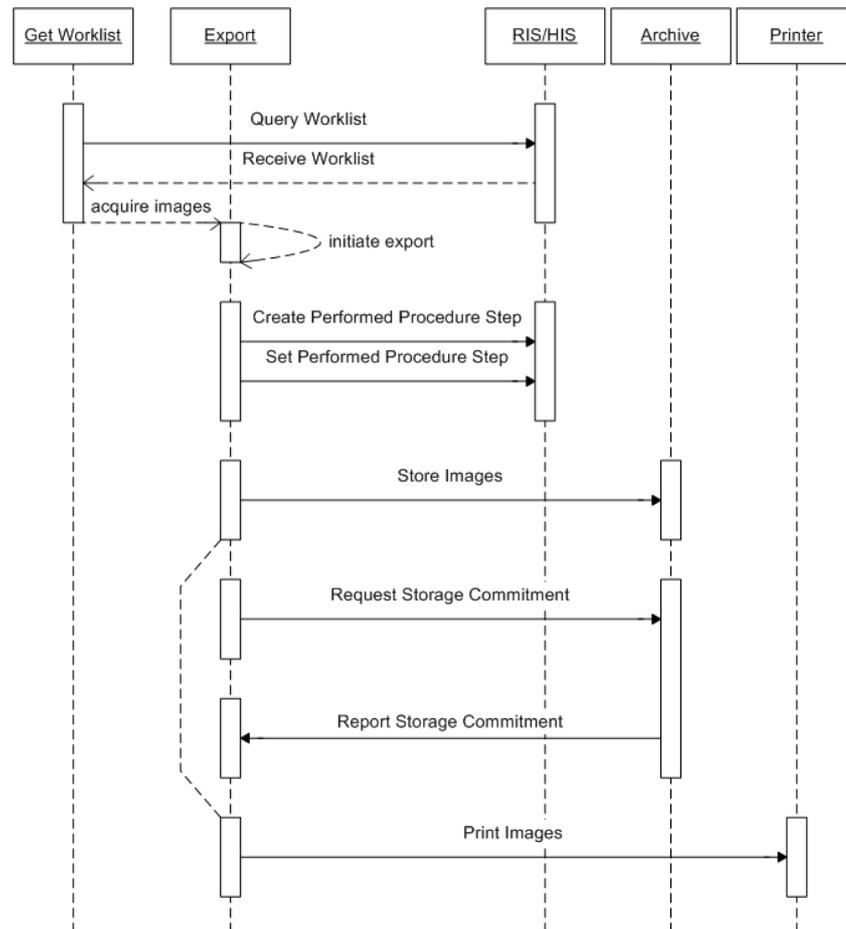
Figure 3: Typical Acquisition Sequencing Constraint

Note that an acquisition may also be started manually, i.e. without using a worklist. And the acquired images may be exported and printed manually too.

The following illustration describes the sequencing constraints of a typical query/retrieve action.
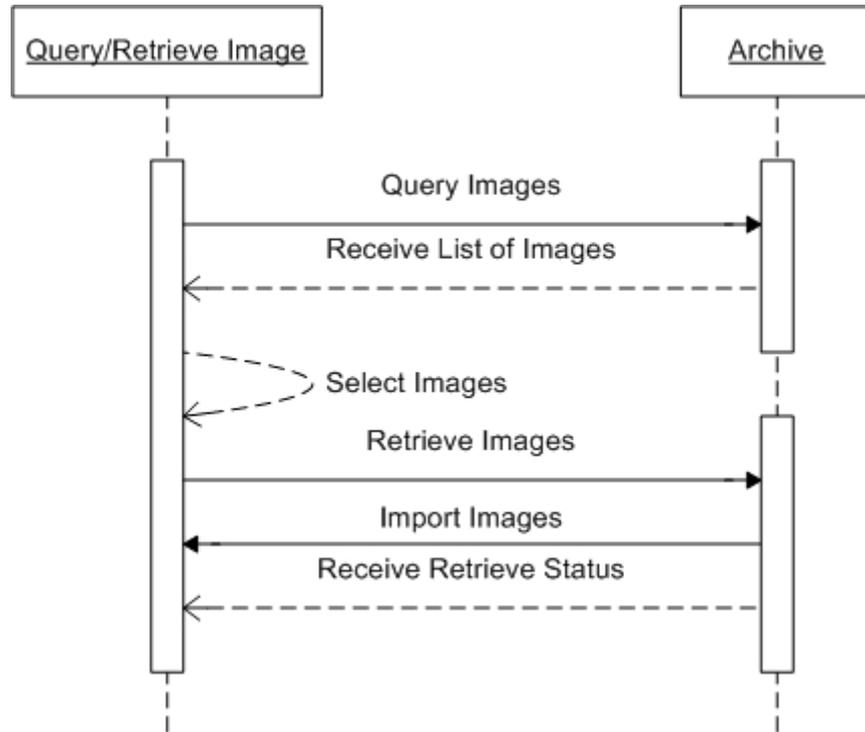
Figure 4: Typical Query/Retrieve Sequencing Constraint

Note that Import Images will be using a separate association.

4.2. AE Specifications

4.2.1. BV Family AE

4.2.1.1. SOP Classes

This application entity provides standard conformance to the following SOP classes.

Table 4: SOP Classes for BV Family AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	No
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	No
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	No
Basic Grayscale Print Management (Meta)	1.2.840.10008.5.1.1.9	Yes	No
> Basic Film Session	1.2.840.10008.5.1.1.1	Yes	No
> Basic Film Box	1.2.840.10008.5.1.1.2	Yes	No
> Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	Yes	No
> Printer	1.2.840.10008.5.1.1.16	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	No
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	No
Modality Worklist Information Model – FIND	1.2.840.10008.5.1.4.31	Yes	No

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.

Table 5: DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2. Number of Associations

The BV Family AE may initiate and accept one association simultaneously.

Table 6: Number of Associations as an Association Initiator for BV Family AE

Maximum number of simultaneous associations	1

Table 7: Number of Associations as an Association Acceptor for BV Family AE

Maximum number of simultaneous associations	1

4.2.1.2.3. Asynchronous Nature

The BV Family AE only supports asynchronous operations for Storage Commitment report. It will not perform asynchronous window negotiation.

4.2.1.2.4. Implementation Identifying Information

For identification of the BV Family AE the following Implementation Class UID and Implementation Version Name are supplied.

Table 8: DICOM Implementation Class and Version for BV Family AE

Implementation Class UID	1.3.46.670589.8.15.1.6.1
Implementation Version Name	BV Family R1.6.1

4.2.1.2.5. Communication Failure Handling

The behavior of the AE during communication failure is summarized in Table 9.

Table 9: Communication Failure Behavior

Exception	Behavior
General	In the DFI the error is logged including a description of the problem. Those are the standard notifications when an association cannot be established.
Not connected	MC_NETWORK_SHUTDOWN is logged.

4.2.1.3.   Association Initiation Policy

The behavior of the AE during DICOM communication failure is summarized in Table 10.

Table 10: DICOM Command Communication Failure Behavior

Exception	Behavior
Association setup failure	The association is aborted and the command marked as failed. The reason is logged and reported in the log file.
Network timeout behavior	See section 4.4.1.2.1 for corresponding configurable time to wait parameters.

4.2.1.3.1. Check

4.2.1.3.1.1. Description and Sequencing of Activities

In service mode the BV Family AE can send a verification request (C-ECHO) to verify application level communication. This verification is initiated on a separate service system by using the "check" function of the BV Scope program.
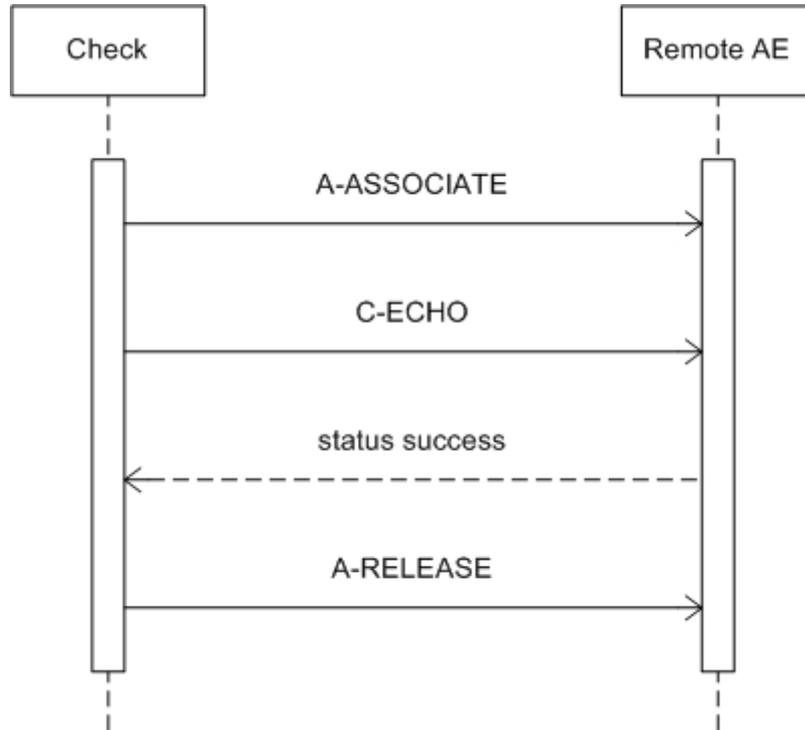
Figure 5: Sequencing of RWA Check

4.2.1.3.1.2. Proposed Presentation Contexts

For Check the BV Family AE will propose the following presentation contexts.

Table 11: Proposed Presentation Contexts for Check

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

4.2.1.3.1.3. SOP Specific Conformance for SOP Classes

4.2.1.3.1.3.1.   Verification

The BV Family AE provides standard conformance to the Verification service class.

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 12.

Table 12: C-ECHO Command Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Confirmation	The SCP has successfully returned a verification response.

4.2.1.3.2. Get Worklist

4.2.1.3.2.1. Description and Sequencing of Activities

The BV Family AE can send a modality worklist query (C-FIND) to update the BV Family worklist.
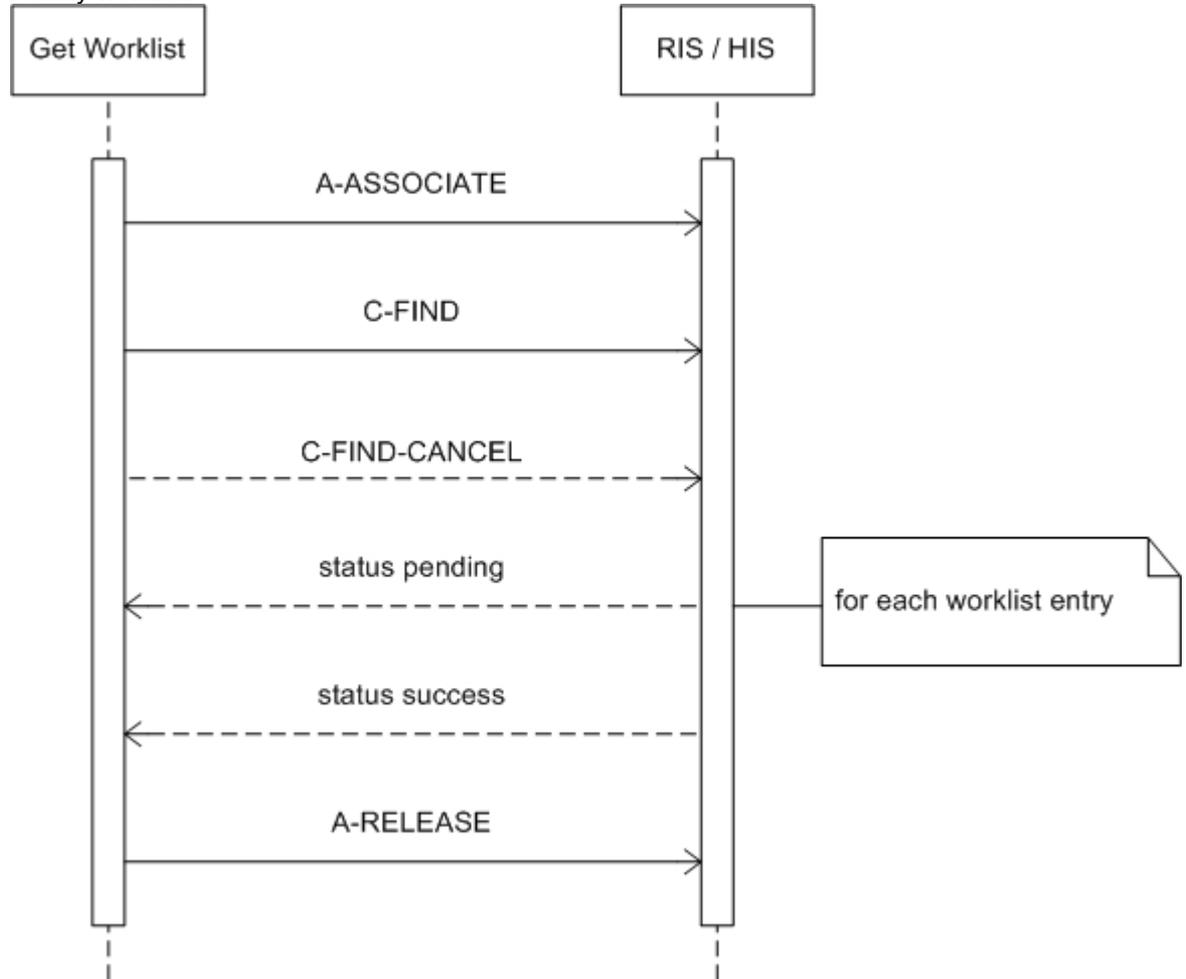
Figure 6: Sequencing of RWA Get Worklist

The worklist query is initiated by selecting "Get Worklist". Then the BV Family AE opens an association and sends a modality worklist query. The BWLM SCP (RIS/HIS) returns the applicable worklist; a response with status Pending is received for each new entry, the final response has status Success. After the final response the BV Family AE releases the association.

The contents of the received worklist are compared with the contents of the previous worklist. In case there are any changes, the BV Family patient file is updated. A unique match of the following attributes identifies a worklist entry.

Table 13: Matching Criteria for Identifying Worklist Entries

Attribute	
Name	**Tag**
Scheduled Procedure Step ID	(0040,0009)
Accession Number	(0008,0050)

Attribute	
Name	**Tag**
Requested Procedure ID	(0040,1001)

If none of these identification attributes is present then the received worklist entry is ignored.

4.2.1.3.2.2. Proposed Presentation Contexts

For Get Worklist the BV Family AE will propose the following presentation contexts.

Table 14: Proposed Presentation Contexts for Get 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	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	ILE ELE EBE	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

4.2.1.3.2.3. SOP Specific Conformance for SOP Classes

4.2.1.3.2.3.1.   Modality Worklist Information Model – FIND

The BV Family AE provides standard conformance to the Modality Worklist SOP class. Table 15 provides a description of the BV Family AE worklist request identifier.

Table 15: Worklist Request Identifier

Attribute Name	Tag	VR	M	R	DW	DP	IOD
Patient Identification Module							
Patient's Name	0010,0010	PN		x	x	x	x
Patient ID	0010,0020	LO		x	x	x	x
Patient Demographic Module							
Patient's Birth Date	0010,0030	DA		x	x	x	x
Patient's Birth Time	0010,0032	TM		x			x
Patient's Sex	0010,0040	CS		x	x	x	x
Other Patient IDs	0010,1000	LO		x			x
Other Patient Names	0010,1001	PN		x	x		x
Patient's Weight	0010,1030	DS		x	x		x
Patient Medical Module							
Medical Alerts	0010,2000	LO		x	x		
Contrast Allergies	0010,2110	LO		x	x		
Special Needs	0038,0050	LO		x	x		
Visit Relationship Module							
Referenced Patient Sequence	0008,1120	SQ		x			x
>Referenced SOP Class UID	0008,1150	UI		x			x
>Referenced SOP Instance UID	0008,1155	UI		x			x
Scheduled Procedure Step Module							
Scheduled Procedure Step Sequence	0040,0100	SQ		x			

Attribute Name	Tag	VR	M	R	DW	DP	IOD
>Modality	0008,0060	CS	S		x		x
>Scheduled Station AE Title	0040,0001	AE	S				
>Scheduled Procedure Step Start Date	0040,0002	DA	R				
>Scheduled Procedure Step Start Time	0040,0003	TM		x			
>Scheduled Performing Physician's Name	0040,0006	PN		x			
>Scheduled Procedure Step Description	0040,0007	LO		x	x		x
>Scheduled Action Item Code Sequence	0040,0008	SQ		x			
>>Code Value	0008,0100	SH		x			
>>Coding Scheme Designator	0008,0102	SH		x			
>>Coding Scheme Version	0008,0103	LO		x			
>>Code Meaning	0008,0104	LO		x			
>Scheduled Procedure Step ID	0040,0009	SH		x			x
>Scheduled Station Name	0040,0010	SH	S				
>Scheduled Procedure Step Location	0040,0011	SH		x	x		
>Requested Contrast Agent	0032,1070	LO		x	x		
>Pre-Medication	0040,0012	LO		x	x		
Requested Procedure Module							
Study Instance UID	0020,000D	UI		x			x
Referenced Study Sequence	0008,1110	SQ		x			x
>Referenced SOP Class UID	0008,1150	UI		x			x
>Referenced SOP Instance UID	0008,1155	UI		x			x
Requested Procedure Description	0032,1060	LO		x	x		
Requested Procedure Code Sequence	0032,1064	SQ		x			
>Code Value	0008,0100	SH		x			
>Coding Scheme Designator	0008,0102	SH		x			
>Coding Scheme Version	0008,0103	LO		x			
>Code Meaning	0008,0104	LO		x			
Requested Procedure ID	0040,1001	SH		x	x		x
Imaging Service Request Module							
Accession Number	0008,0050	SH		x	x	x	x
Referring Physician's Name	0008,0090	PN		x	x		x
SOP Common Module							
Specific Character Set	0008,0005	CS					

The following abbreviations are used in the table:

Tag: DICOM tag for this attribute.
VR: DICOM VR for this attribute.
M: Matching keys for Worklist Update. An "S" will indicate that BV Family AE will
     supply an attribute value for Single Value Matching; an "R" will indicate Range
     Matching. The matching Keys must be configured.
R: Return keys. An "x" will indicate that BV Family AE will supply this attribute as
     Return Key with zero length for Universal Matching.
DP: Displayed keys on the Patient Administration screen. An "x" indicates that this
     worklist attribute is displayed to the user in the main patient administration panel.
     For example, Patient's Name will be displayed when registering the patient prior
     to an examination.
DW: Displayed keys on the Worklist Administration screen. An "x" indicates that this
     worklist attribute is displayed to the user in the worklist review panel.
IOD: An "x" indicates that this Worklist attribute is included into other Object Instances
     created during performance of the related Procedure Step.

The default Query Configuration is set to Modality (OT) and Date (today +/- 1 day).
Optionally, additional matching for the own AET is configurable.

The BV Family AE can only contain a limited number of 99 worklist entries. If the sum of current and new worklist entries exceeds 99 then the BV Family AE will abort the association immediately using A-ABORT.

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 16.

Table 16: C-FIND Command Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Matching is complete – No final identifier is supplied	The association is released and the matches are stored.
Failure	A700	Refused – Out of resources	Processing of the matches and the association is terminated. A message appears in the GUI.
	A900	Failed – Identifier does not match SOP class	The association is terminated and the status is logged into the system error log. A message appears in the GUI.
	Cxxx	Failed – Unable to process	Processing of the matches and the association is terminated. A message appears in the GUI.
Pending	FF00	Matches are continuing – Current match is supplied and any optional keys were supported in the same manner as required keys	Processing of the matches continues.
	FF01	Matches are continuing – Warning that one or more optional keys were not supported for existence for this identifier	Processing of the matches continues without any warnings or errors.

4.2.1.3.3. Export

4.2.1.3.3.1. Description and Sequencing of Activities

After an acquisition the BV Family AE sends related MPPS data to a Study Management SCP (RIS/HIS). Then the acquired image is stored and printed according the settings as specified by the operator.
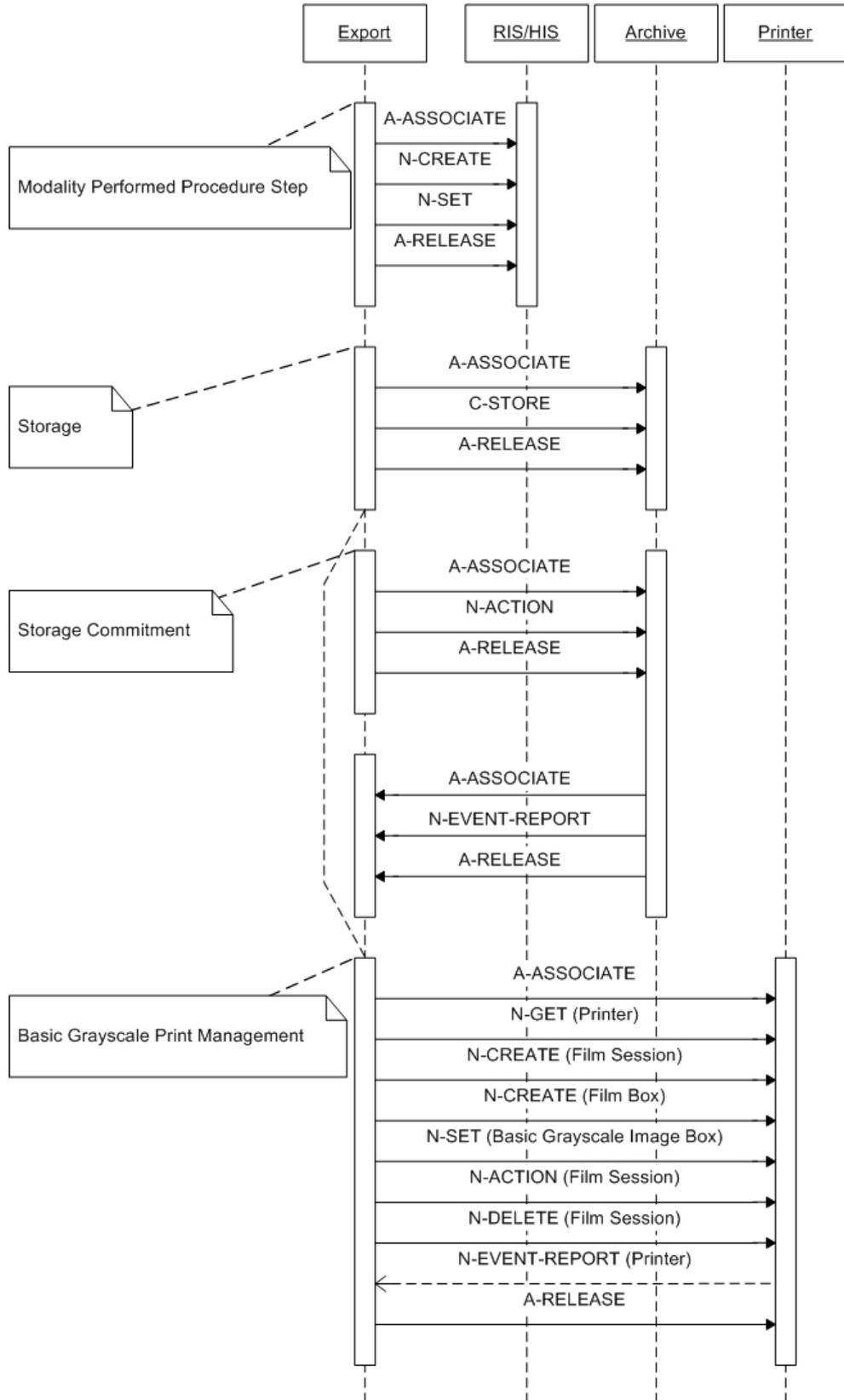
Figure 7: Sequencing of RWA Export

The acquisition is initiated by selecting an examination for export. After selecting "MPPS & OK" the protocol name and study status have to be selected. Then the BV Family AE opens an association and sends an N-CREATE service request, followed by an N-SET service request, and then releases the association.

If the operator specified export to a storage SCP then the BV Family AE opens a new association and sends a C-STORE service request, and then releases the association. If Storage Commitment is enabled then the BV Family AE opens another association to send an N-ACTION service request, and then releases the association. When the Storage Commitment SCP requests an association, the BV Family AE will accept an association for the N-EVENT-REPORT service request (ref. section 4.2.1.4.1).

Meanwhile, if the operator specified export to a print SCP then the BV Family AE opens a new association to send the printer service requests, and then releases the association.

4.2.1.3.3.2. Proposed Presentation Contexts

For Export the BV Family AE will propose the following presentation contexts.

Table 17: Proposed Presentation Contexts for Study Management

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	ELE ILE EBE	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	ELE ILE EBE	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None

Table 18: Proposed Presentation Contexts for Storage

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
XA Image Storage	1.2.840.10008.5.1.4.1.1.12.1	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

Table 19: Proposed Presentation Contexts for Storage Commitment

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	ELE ILE EBE	1.2.840.10008.1.2.1 1.2.840.10008.1.2 1.2.840.10008.1.2.2	SCU	None

Table 20: Proposed Presentation Contexts for Print Management

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Printer	1.2.840.10008.5.1.1.16	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Film Session	1.2.840.10008.5.1.1.1	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Film Box	1.2.840.10008.5.1.1.2	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Grayscale Image Box	1.2.840.10008.5.1.1.4	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Basic Grayscale Print Management (Meta)	1.2.840.10008.5.1.1.9	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

4.2.1.3.3.3. SOP Specific Conformance for SOP Classes

4.2.1.3.3.3.1. Modality Performed Procedure Step

The BV Family AE provides standard conformance to the Modality Performed Procedure Step SOP class. Table 21 provides a description of the BV Family AE MPPS request identifier for N-CREATE and N-SET services.

Table 21: MPPS Request Identifiers

Attribute Name	Tag	VR	N-CREATE	N-SET
SOP Common Module				
Specific Character Set	0008,0005	CS	ISO_IR 100	ISO_IR 100
Image Acquisition Results Module				
Modality	0008,0060	CS	From WLM	-
Study ID	0020,0010	SH	EMPTY	-
Performed Protocol Code Sequence	0040,0260	SQ	EMPTY	-
Performed Series Sequence	0040,0340	SQ	EMPTY	X
>Retrieve AE Title	0008,0054	AE	-	EMPTY
>Series Description	0008,103E	LO	-	EMPTY
>Performing Physician's Name	0008,1050	PN	-	User selectable
>Operator's Name	0008,1070	PN	-	User selectable in MPPS panel

Attribute Name	Tag	VR	N-CREATE	N-SET
>Referenced Image Sequence	0008,1140	SQ	-	Reference to all sent images
>>Referenced SOP Class UID	0008,1150	UI	-	Reference to all sent images
>>Referenced SOP Instance UID	0008,1155	UI	-	Reference to all sent images
>Protocol Name (Technologist)	0018,1030	LO	-	User selectable in MPPS panel
>Series Instance UID	0020,000E	UI	-	Reference to series
>Referenced Standalone SOP Instance Sequence	0040,0220	SQ	-	EMPTY
Performed Procedure Step Information Module				
Procedure Code Sequence	0008,1032	SQ	EMPTY	-
Performed Station AE Title	0040,0241	AE	System AE Title	-
Performed Station Name	0040,0242	SH	Station Name	-
Performed Location	0040,0243	SH	EMPTY	-
Performed Procedure Step Start Date	0040,0244	DA	Exam date	-
Performed Procedure Step Start Time	0040,0245	TM	Exam time (format: hhmm)	-
Performed Procedure Step End Date	0040,0250	DA	EMPTY	X
Performed Procedure Step End Time	0040,0251	TM	EMPTY	X (format: hhmm)
Performed Procedure Step Status	0040,0252	CS	Value: IN PROGRESS	Value: COMPLETED or DISCONTINUED
Performed Procedure Step ID	0040,0253	SH	Running Counter	-
Performed Procedure Step Description	0040,0254	LO	EMPTY	EMPTY
Performed Procedure Type Description	0040,0255	LO	EMPTY	EMPTY
Performed Procedure Step Relationship Module				
Referenced Patient Sequence	0008,1120	SQ	EMPTY or from WLM	-
>Referenced SOP Class UID	0008,1150	UI	From WLM	-
>Referenced SOP Instance UID	0008,1155	UI	From WLM	-
Patient's Name	0010,0010	PN	Patient Name	-
Patient ID	0010,0020	LO	Registration number	-
Patient's Birth Date	0010,0030	DA	Date of Birth	-
Patient's Sex	0010,0040	CS	Value: F, M, or O	-
Scheduled Step Attribute Sequence	0040,0270	SQ	X	-
>Accession Number	0008,0050	SH	From WLM or entered by the user.	-
>Referenced Study Sequence	0008,1110	SQ	EMPTY or from WLM	-
>>Referenced SOP Class UID	0008,1150	UI	From WLM	-
>>Referenced SOP Instance UID	0008,1155	UI	From WLM	-
>Study Instance UID	0020,000D	UI	Newly generated or from WLM	-
>Requested Procedure Description	0032,1060	LO	EMPTY or from WLM	-
>Scheduled Procedure Step Description	0040,0007	LO	EMPTY or from WLM	-
>Scheduled Protocol Code Sequence	0040,0008	SQ	EMPTY or from WLM	-
>>Code Value	0008,0100	SH	From WLM	-
>>Coding Scheme Designator	0008,0102	SH	From WLM	-
>>Coding Scheme Version	0008,0103	SH	From WLM	-
>>Code Meaning	0008,0104	LO	From WLM	-
>Scheduled Procedure Step ID	0040,0009	SH	EMPTY or from WLM	-
>Requested Procedure ID	0040,1001	SH	EMPTY or from WLM	-

"-" indicates that the attribute is not sent; "EMPTY" indicates that the attribute is sent with zero length; "X" or an explicit value indicate that the attribute is sent with an appropriate value.

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 22 and
Table 23.

Table 22: N-CREATE Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Success	The SCP has completed the MPPS service request successfully.
Failure	0105	No such attribute	The association is aborted and the MPPS service request is marked as failed in the export queue.
	0110	Processing failure – Performed procedure step object may no longer be updated	The association is aborted and the MPPS service request is marked as failed in the export queue.
Warning	0107	Attribute list error	The MPPS service request is considered successful.
	0116	Attribute value out of range	The MPPS service request is considered successful.

Table 23: N-SET Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Success	The SCP has completed the MPPS service request successfully.
Failure	0105	No such attribute	The association is aborted and the MPPS service request is marked as failed in the export queue.
	0110	Processing failure – Performed procedure step object may no longer be updated	The association is aborted and the MPPS service request is marked as failed in the export queue.
Warning	0107	Attribute list error	The MPPS service request is considered successful.
	0116	Attribute value out of range	The MPPS service request is considered successful.

4.2.1.3.3.3.2.   Storage

The BV Family AE provides standard conformance to the Storage SOP classes.

Note that a Secondary Capture Series can contain one or more Secondary Capture images, where an XA Series can contain only one XA image of one or more frames.

Upon receiving a C-STORE response with status Error or Refused, the BV Family AE will release the association. The transfer of all of the selected images of the examination will be considered failed. The operator may retry export jobs manually.

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 24.

Table 24: C-STORE Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Success	The SCP has completed the Storage service request successfully.
Failure	A7xx	Refused – Out of resources	Image transfer is considered failed. Images remain in queue. User can initiate retry. Status is logged in system file.

Service Status	Code	Further Meaning	Behavior
	A9xx	Error – Data set does not match SOP class	Image transfer is considered failed. Images remain in queue. User can initiate retry. Status is logged in system file.
	C000	Error – Cannot understand	Image transfer is considered failed. Images remain in queue. User can initiate retry. Status is logged in system file.
Warning	B000	Coercion of data elements	Image transfer is considered successful. Status is logged in system file.
	B006	Elements discarded	Image transfer is considered successful. Status is logged in system file.
	B007	Data set does not match SOP class	Image transfer is considered successful. Status is logged in system file.

4.2.1.3.3.3.3.   Storage Commitment

The BV Family AE provides standard conformance to the Storage Commitment Push Model SOP class for asynchronous storage commitment.

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 25.

Table 25: N-ACTION Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Success	The SCP has completed the Storage Commitment service request successfully.
	xxxx	Any other status code	The association is aborted and the storage commitment is marked as failed.

The following table lists the contents of the N-ACTION request.

Table 26: Storage Commitment N-ACTION Request Identifiers

Attribute Name	Tag	Note
Transaction UID	0008,1195	Generated Unique UID
Referenced SOP Sequence	0008,1199	References to all images sent
>Referenced SOP Class UID	0008,1150	References to all images sent
>Referenced SOP Instance UID	0008,1155	References to all images sent

4.2.1.3.3.3.4.   Basic Grayscale Print Management

Based on the selected layout, the BV Family AE will create a Film Session containing a single Film Box. The content of the Image Box will be filled for the print request (Film Box level). Once the print session has completed the Film Session will be deleted. A new Film Box is created for each successive film within the Film Session.

The BV Family AE is implemented to acquire greyscale images and thus to negotiate for Basic Grayscale Print Management. The processing of a print job can be cancelled at any time; then the BV Family AE will abort the processing immediately.

Before a queued print job is actually started, the system will retrieve the printer status. Upon receiving a normalised service response (N-GET) containing a Failure or Warning status, the BV Family AE does not start the export job.

Upon receiving a print command response with failure status, the BV Family AE will release the association. The transfer of all of the selected images of the examination will be considered failed. The operator may retry export jobs manually.

The following DIMSE services have been implemented.

Table 27: Basic Grayscale Print Management DIMSE Services

SOP Class	Supported DIMSE Service Element
Printer SOP Class	N-GET, N-EVENT-REPORT
Basic Film Session SOP Class	N-CREATE, N-ACTION, N-DELETE
Basic Film Box SOP Class	N-CREATE
Basic Greyscale Image Box SOP Class	N-SET

The implemented attributes can be found sorted per IOD module in next the tables.
The following abbreviations are used.

ALWAYS	Always Present
USER	the attribute value source is from User input
AUTO	the attribute value is generated automatically
CONFIG	the attribute value source is a configurable parameter

Table 28: Printer SOP Class - N-GET-RQ - Printer Module

Attribute Name	Tag	VR	Note	Presence of Value	Source
Printer Status	2110,0010	CS	Printer Status provided by printer	ALWAYS	PRINTER
Printer Status Info	2110,0020	CS	Printer Status Info provided by printer	ALWAYS	PRINTER

Note: Only in case that the printer responds with a Printer status of "NORMAL" or "WARNING" the BV Family AE continues printing of the images.

Table 29: Basic Film Session SOP Class - N-CREATE-RQ - Basic Film Session Presentation Module

Attribute Name	Tag	VR	Note	Presence of Value	Source
Number of Copies	2000,0010	IS	Integer (1-99), DEFAULT	ALWAYS	CONFIG
Print Priority	2000,0020	CS	LOW, MED, HIGH, DEFAULT	ALWAYS	CONFIG
Medium Type	2000,0030	CS	CURRENT, BLUE FILM, CLEAR FILM, PAPER, TRANSPARENCY, DEFAULT	ALWAYS	CONFIG
Film Destination	2000,0040	CS	CURRENT, PROCESSOR, MAGAZINE, BIN (integer), DEFAULT	ALWAYS	CONFIG
Film Session Label	2000,0050	LO	Equal to Exam. Type	ALWAYS	AUTO

Note: The Value Range and DEFAULT values are printer type dependent.

Table 30: Basic Film Box SOP Class - N-CREATE-RQ - Basic Film Box Presentation Module

Attribute Name	Tag	VR	Note	Presence of Value	Source
Image Display Format	2010,0010	ST	STANDARD\1,1, STANDARD\1,2, STANDARD\2,2, STANDARD\2,3	ALWAYS	USER
Film Orientation	2010,0040	CS	LANDSCAPE, PORTRAIT	ALWAYS	CONFIG
Film Size ID	2010,0050	CS	CURRENT, 10INX12IN, 10INX14IN, 11INX11IN, 11INX14IN, 11INX17IN, 14INX14IN, 14INX17IN, 24CMX24CM, 24CMX30CM, 8INX10IN, 8_5INX11IN, A4, A3, DEFAULT	ALWAYS	CONFIG
Magnification Type	2010,0060	CS	BILINEAR, CUBIC, NONE, REPLICATE, DEFAULT	ALWAYS	CONFIG
Smoothing Type	2010,0080	CS	0, 1, 10, 11, 12, 13, 14, 140, 15, 2, 3, 4, 5. 6. 7. 8. 9. ENHANCED.	ALWAYS	CONFIG

Attribute Name	Tag	VR	Note	Presence of Value	Source
			ENHANCED1, MEDIUM, NORMAL, SHARP, SMOOTH		
Border Density	2010,0100	CS	BLACK, WHITE, OD (Integer), DEFAULT	ALWAYS	CONFIG
Empty Image Density	2010,0110	CS	BLACK, WHITE,DEFAULT	ALWAYS	CONFIG
Min Density	2010,0120	US	0...1000, DEFAULT	ALWAYS	CONFIG
Max Density	2010,0130	US	0...1000, DEFAULT	ALWAYS	CONFIG
Trim	2010,0140	CS	NO, YES, DEFAULT	ALWAYS	CONFIG
Configuration Information	2010,0150	ST	Printer configurable: Character string (max. 1024 char.), DEFAULT	ALWAYS	CONFIG

Note: The Value Range and DEFAULT values are printer type dependent

Table 31: Basic Film Box SOP Class - N-CREATE-RQ - Basic Film Box Relationship Module

Attribute Name	Tag	VR	Note	Presence of Value	Source
Referenced Film Session Sequence	2010,0500	SQ		ALWAYS	AUTO
>Referenced SOP Class UID	0008,1150	UI	Applied Value(s): 1.2.840.10008.5.1.1.1	ALWAYS	AUTO
>Referenced SOP Instance UID	0008,1155	UI		ALWAYS	PRINTER

Table 32: Basic Grayscale Image Box SOP Class - N-SET-RQ - Image Box Pixel Presentation Module

Attribute Name	Tag	VR	Note	Presence of Value	Source
Image Position	2020,0010	US	Generated	ALWAYS	AUTO
Polarity	2020,0020	CS	NORMAL, REVERSE, DEFAULT	ALWAYS	CONFIG
Preformatted Grayscale Image Sequence	2020,0110	SQ		ALWAYS	AUTO
>Samples per Pixel	0028,0002	US	Applied Value(s): 1	ALWAYS	AUTO
>Photometric Interpretation	0028,0004	CS	Applied Value(s): MONOCHROME2	ALWAYS	AUTO
>Rows	0028,0010	US	See Table 33	ALWAYS	AUTO
>Columns	0028,0011	US	See Table 33	ALWAYS	AUTO
>Pixel Aspect Ratio	0028,0034	IS	See Table 33	ANAP	AUTO
>Bits Allocated	0028,0100	US	Applied Value(s): 8	ALWAYS	AUTO
>Bits Stored	0028,0101	US	Applied Value(s): 8	ALWAYS	AUTO
>High Bit	0028,0102	US	Applied Value(s): 7	ALWAYS	AUTO
>Pixel Representation	0028,0103	US	Applied Value(s): 0x0000	ALWAYS	AUTO
>Pixel Data	7FE0,0010	OW		ALWAYS	AUTO

Note: The Value Range and DEFAULT values are printer type dependent

Table 33: Applied values for Rows, Columns and Aspect Ratio

Interpolation On - Off	Rows	Columns	Pixel Aspect Ratio
On	768	1008	Not sent
Off	560	1008	753\549

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 34 to Table 37.

Table 34: Basic Film Session N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Film Session successfully created	0000	Normal Completion.
Warning		B6XX	Print Film Session considered successful. Status logged in system file.
Failure			Print Film Session considered failed. Status logged in system file.

Table 35: Basic Film Box N-CREATE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Film Box successfully created	0000	Normal Completion.
Warning		B6XX	Print Film Session considered successful. Status logged in system file.
Failure		C6XX	Print Film Session considered failed. Status logged in system file.

Table 36: Basic Grayscale Image Box N-SET Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Image successfully stored in Image Box	0000	Normal Completion.
Warning		B6XX	Print Film Session considered successful. Status logged in system file.
Failure		C6XX	Print Film Session considered failed. Status logged in system file.

Table 37: Basic Film Session N-ACTION Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Film accepted for printing	0000	Normal Completion.
Warning		B6XX	Print Film Session considered successful. Status logged in system file.
Failure		C6XX	Print Film Session considered failed. Status logged in system file.

4.2.1.4. Association Acceptance Policy

The AE association rejection policies are summarized in Table 38.

Table 38: DICOM Association Rejection Policies

Result	Source	Reason/Diagnosis	Explanation
1 – rejected-permanent	1 – DICOM UL service-user	1 – no-reason-given	-
		2 – application-context-name-not-supported	The association request contained an unsupported Application Context Name. An association request with the same parameters will not succeed at a later time.

Result	Source	Reason/Diagnosis	Explanation
		3 – calling-AE-title-not-recognized	The association request contained an unrecognized Calling AE Title. This rejection reason normally occurs when the association acceptor has not been configured to recognize the AE Title of the association initiator.
		7 – called-AE-title-not-recognized	The association request contained an unrecognized Called AE Title. This rejection reason normally occurs when the association initiator is incorrectly configured and attempts to address the association acceptor using the wrong AE Title.
	2 – DICOM UL service-provider (ACSE related function)	1 – no-reason-given	The association request could not be parsed. An association request with the same format will not succeed at a later time.
		2 – protocol-version-not-supported	-
	3 – DICOM UL service-provider (presentation related function)	1 – temporary-congestion	-
		2 – local-limit-exceeded	-
2 – rejected-transient	1 – DICOM UL service-user	1 – no-reason-given	-
		2 – application-context-name-not-supported	-
		3 – calling-AE-title-not-recognized	-
		7 – called-AE-title-not-recognized	-
	2 – DICOM UL service-provider (ACSE related function)	1 – no-reason-given	No associations can be accepted at this time. An association request with the same parameters may succeed at a later time.
		2 – protocol-version-not-supported	The maximum number of simultaneous associations has been reached. An association request with the same parameters may succeed at a later time.
	3 – DICOM UL service-provider (presentation related function)	1 – temporary-congestion	-
		2 – local-limit-exceeded	-

4.2.1.4.1. Export

4.2.1.4.1.1. Description and Sequencing of Activities

After requesting storage commitment the BV Family AE will accept an association for the storage commitment report.
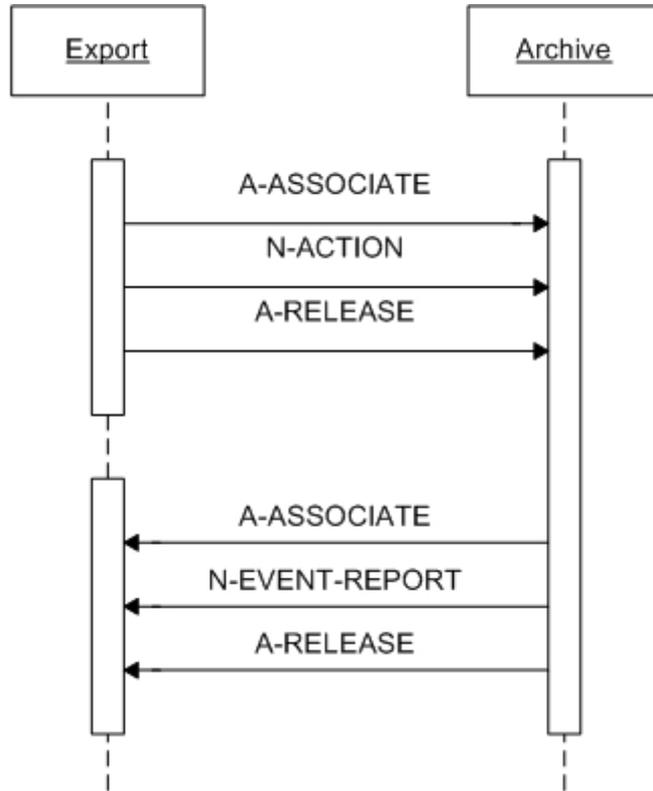
Figure 8: Sequencing of RWA Export

4.2.1.4.1.2. Accepted Presentation Contexts

The BV Family AE will accept presentation contexts as shown in Table 39.

Table 39: Acceptable Presentation Contexts for Export

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	ELE	1.2.840.10008.1.2.1	SCU	None
		ILE	1.2.840.10008.1.2		
		EBE	1.2.840.10008.1.2.2		

The BV Family AE will only accept the SCU role (which must be proposed via SCP/SCU Role Selection Negotiation) within a Presentation Context for the Storage Commitment Push Model SOP Class.

4.2.1.4.1.3. SOP Specific Conformance for SOP Classes

4.2.1.4.1.3.1.   Storage Commitment Push Model

The behavior of the BV Family AE when receiving Event Types within the N-EVENT-REPORT is summarized in Table 40.

Table 40: Storage Commitment - N-EVENT-REPORT Behavior

Event Type Name	Event Type ID	Behavior
Storage Commitment Request Successful	1	The Referenced SOP Instances under Referenced SOP Sequence (0008,1199) are marked within the database as "Stored & Committed (SC)" to the value of Retrieve AE Title (0008,0054).
Storage Commitment Request Complete – Failures Exist	2	In case of a "Failure Exist" situation (Referenced SOP Instances under Failed SOP Sequence (0008,1198)), all of the stored SOP Instances for that examination are considered as failed for storage commitment. A send job that failed storage commitment will not be automatically restarted but can be resumed by the user.

The status response behavior of the BV Family AE is as summarized in Table 41.

Table 41: Storage Commitment - N-EVENT-REPORT Status Response

Service Status	Code	Further Meaning	Description
Success	Success	0000	The BV Family AE has completed the operation successfully.
Failure	*	Any other Failure status code	The association is aborted and the storage commit N-EVENT-REPORT is marked as failed.

4.2.2. VF Surgical Workstation AE

4.2.2.1.   SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes.

Table 42: SOP Classes for VF Surgical Workstation AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	No	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage – for Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1	No	Yes
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	No	Yes
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2	No	Yes
Specialized X-Ray	1.3.46.670589.2.3.1.1	No	Yes
CX Image	1.3.46.670589.2.4.1.1	No	Yes
3D Volume Storage	1.3.46.670589.5.0.1.1	No	Yes
3D Volume Object Storage	1.3.46.670589.5.0.2.1	No	Yes
Surface Storage	1.3.46.670589.5.0.3.1	No	Yes
MR Cardio Storage	1.3.46.670589.5.0.8.1	No	Yes
CT Synthetic Image	1.3.46.670589.5.0.9	No	Yes
MR Synthetic Image	1.3.46.670589.5.0.10	No	Yes
MR Cardio Analysis Storage	1.3.46.670589.5.0.11.1	No	Yes
CX Synthetic Image	1.3.46.670589.5.0.12	No	Yes
Perfusion	1.3.46.670589.5.0.13	No	Yes
Perfusion Analysis	1.3.46.670589.5.0.14	No	Yes
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
Patient/Study Only Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	Yes	No
Patient/Study Only Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	Yes	No

4.2.2.2.   Association Policies

4.2.2.2.1. General

The DICOM standard application context shall be specified.

Table 43: DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2. Number of Associations

The VF Surgical Workstation AE may initiate and accept one association simultaneously.

Table 44: Number of Associations as an Association Initiator for VF Surgical Workstation AE

Maximum number of simultaneous associations	3

Table 45: Number of Associations as an Association Acceptor for VF Surgical Workstation AE

Maximum number of simultaneous associations	configurable

4.2.2.2.3. Asynchronous Nature

The VF Surgical Workstation AE does not support asynchronous operations and will not perform asynchronous window negotiation.

4.2.2.2.4. Implementation Identifying Information

For identification of the VF Surgical Workstation AE the following Implementation Class UID and Implementation Version Name are supplied.

Table 46: DICOM Implementation Class and Version for VF Surgical Workstation AE

Implementation Class UID	1.3.46.670589.5.2.23
Implementation Version Name	ViewForum R4.1

4.2.2.2.5. Communication Failure Handling

The behavior of the AE during communication failure is summarized in Table 47.

Table 47: Communication Failure Behavior

Exception	Behavior
ARTIM Timeout	The job fails in case of association setup. The reason is logged and reported to the operator.
Reply Timeout	The job fails and the association is aborted. The reason is logged and reported to the operator.
Association Timeout	The association is released.
Association Aborted	The job fails. The reason is logged and reported to the operator.

4.2.2.3. Association Initiation Policy

This describes the conditions under which the AE will initiate an association.

4.2.2.3.1. Query/Retrieve Image

4.2.2.3.1.1. Description and Sequencing of Activities

For viewing images, the operator can use the VF Surgical Workstation AE to query a remote archive and select the images to retrieve. The VF Surgical Workstation AE then sends a retrieve request and accepts the related images.
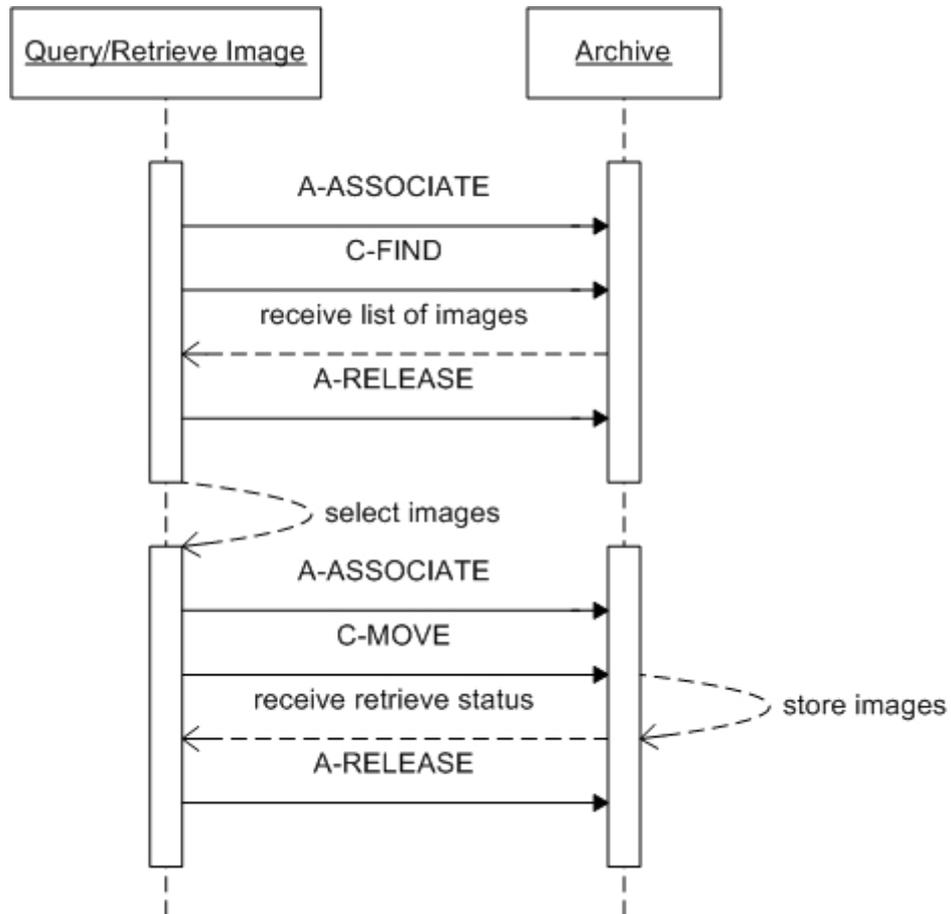
Figure 9: Sequencing of RWA Query/Retrieve Image

The operator queries a remote archive, using the query tool in the data handling facility. The VF Surgical Workstation AE initiates an association to the selected peer entity (Archive) and uses it to send Query (C-FIND) requests and receive subsequent responses. The association is released when the execution of the query completes and the Query/Retrieve dialog on the GUI is closed. The matching images are then displayed in a patient folder for the remote archive.

The required images can now be selected for copying to the BV Family, using the copy tool in the data handling facility. For each copy request the VF Surgical Workstation AE initiates an association to the selected peer entity (Archive) and uses it to send Retrieve (C-MOVE) requests and receive subsequent responses; an examination may contain both images and presentation states. The association is released after the final Retrieve (C-MOVE) response for the related request has been received (no more pending).

4.2.2.3.1.2. Proposed Presentation Contexts

For Query/Retrieve Image the VF Surgical Workstation AE will propose the following presentation contexts.

Table 48: Proposed Presentation Contexts for Query/Retrieve Image

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Patient/Study Only Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.3.1	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Patient/Study Only Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.3.2	ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None
Any other defined SOP class		ELE EBE ILE	1.2.840.10008.1.2.1 1.2.840.10008.1.2.2 1.2.840.10008.1.2	SCU	None

Note: For performance reasons the ELE transfer syntax is preferred.

4.2.2.3.1.3. SOP Specific Conformance for SOP Classes

This section includes the SOP specific behavior, i.e. error codes, error and exception handling, time-outs, etc. The information shall be as described in the SOP specific Conformance Statement section of [DICOM] PS 3.4 (or relevant private SOP definition). It shall include the content of any extended negotiation. Keys shall be specified including how they are used (matching, return keys, interactive query, whether they are displayed to the user, universal and/or list matching, etc.).

4.2.2.3.1.3.1.   Query/Retrieve Information Model – FIND

The VF Surgical Workstation AE will not generate queries containing optional keys. The VF Surgical Workstation AE will not generate relational queries.

In the following table the supported query keys for each query level are described. Universal matching shall be supported as default.

Table 49: Supported Query Keys

Query Level	Query Key		Type of Matching
	Name	Tag	
Patient	Patient's Name	0010,0010	Wild Card/ Universal
	Patient ID	0010,0020	Wild Card/ Universal

Query Level	Query Key		Type of Matching
	Name	**Tag**	
	Patient's Birth Date	0010,0030	-
	Patient's Sex	0010,0040	-
Study	Study Date	0008,0020	-
	Study Time	0008,0030	-
	Accession Number	0008,0050	-
	Modalities in Study	0008,0061	-
	Referring Physician's Name	0008,0090	-
	Study Description	0008,1030	-
	Study Instance UID	0020,000D	-
	Study ID	0020,0010	-
Series	Modality	0008,0060	-
	Station Name	0008,1010	-
	Performing Physician's Name	0008,1050	-
	Body Part Examined	0018,0015	-
	Protocol Name	0018,1030	-
	Series Instance UID	0020,000E	-
	Series Number	0020,0011	-
	Performed Procedure Step Start Date	0040,0244	-
	Performed Procedure Step ID	0040,0253	-
Image	SOP Class UID	0008,0016	-
	SOP Instance UID	0008,0018	-
	Content Date	0008,0023	-
	Content Time	0008,0033	-
	Instance Number	0020,0013	-

Do note that the query results screen will display all patients that have an empty
Patient ID as one patient entry.

All details regarding the specific conformance, including response behavior to all
status codes, both from an application level and communication errors are provided in
Table 50.

Table 50: C-FIND Command Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Matching is complete	The find results are displayed.
Failure	A700	Refused – Out of resources	No find results are displayed. The reason is logged.
	A900	Failed – Identifier does not match SOP class	No find results are displayed. The reason is logged.
	Cxxx	Failed – Unable to process	No find results are displayed. The reason is logged.
Cancel	FE00	Matching terminated due to Cancel Request	No find results are displayed. The reason is logged.

Service Status	Code	Further Meaning	Behavior
Pending	FF00	Matches are continuing – Current match is supplied and any optional keys were supported in the same manner as required keys	The find command continues.
	FF01	Matches are continuing – Warning that one or more optional keys were not supported for existence and/or matching for this identifier	The find command continues.

4.2.2.3.1.3.2.   Query/Retrieve Information Model – MOVE

The VF Surgical Workstation AE provides standard conformance.

All details regarding the specific conformance, including response behavior to all status codes, both from an application level and communication errors are provided in Table 51.

Table 51: C-MOVE Command Response Status Handling Behavior

Service Status	Code	Further Meaning	Behavior
Success	0000	Sub-operations complete – No Failures	The move job is marked as completed. The association is released.
Failure	A701	Refused – Out of Resources – Unable to calculate number of matches	The move job is marked as failed. The association is released. The reason is logged and reported to the user.
	A702	Refused – Out of Resources – Unable to perform Sub-operations	The move job is marked as failed. The association is released. The reason is logged and reported to the user.
	A801	Refused – Move Destination unknown	The move job is marked as failed. The association is released. The reason is logged and reported to the user.
	A900	Failed – Identifier does not match SOP class	The move job is marked as failed. The association is released. The reason is logged and reported to the user.
	Cxxx	Failed – Unable to process	The move job is marked as failed. The association is released. The reason is logged and reported to the user.
Cancel	FE00	Sub-operations terminated due to Cancel Indication	The move job is marked as failed. The association is released. The reason is logged and reported to the user.
Warning	B000	Sub-operations complete – One or more Failures	The move job is marked as completed. The association is released.
Pending	FF00	Sub-operations are continuing	The move job continues.

4.2.2.4.   Association Acceptance Policy

4.2.2.4.1. *Query/Retrieve Image*

4.2.2.4.1.1. Description and Sequencing of Activities

For viewing images, the VF Surgical Workstation AE accepts the retrieved images.
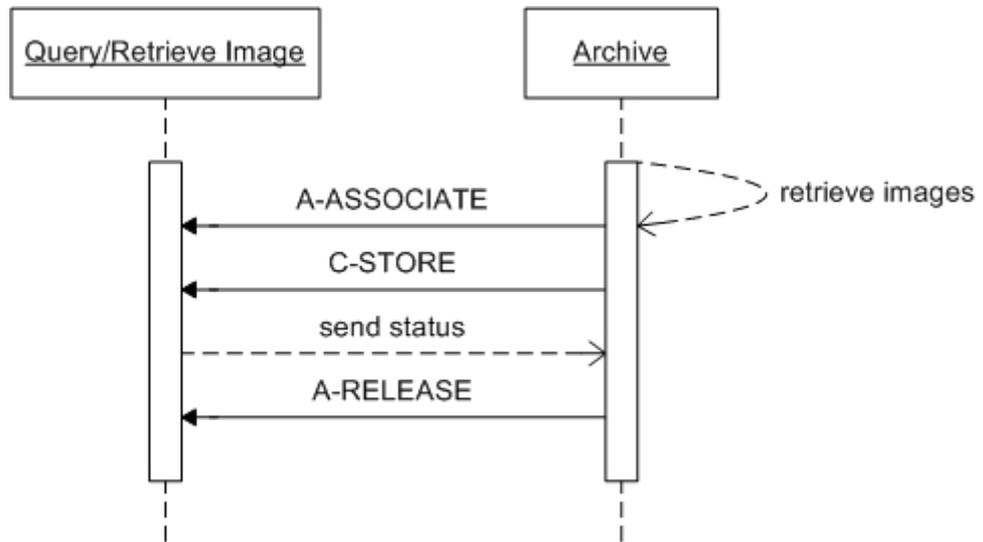
Figure 10: Sequencing of RWA Query/Retrieve Image

For each retrieve request (selected from query results) the VF Surgical Workstation AE accepts an association from the selected peer entity (Archive) and uses it to receive image Storage (C-STORE) requests and send subsequent responses. On request of the Storage SCU (Archive) the association is released.

4.2.2.4.1.2. Accepted Presentation Contexts

The VF Surgical Workstation AE will accept Presentation Contexts as shown in Table 52.

Table 52: Acceptable Presentation Contexts for Query/Retrieve Image

Presentation Context Table				
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Any defined SOP class		ELE	1.2.840.10008.1.2.1	SCP	None
		EBE	1.2.840.10008.1.2.2		
		ILE	1.2.840.10008.1.2		

Note: For performance reasons the ELE transfer syntax is preferred and shall be chosen in case multiple transfer syntaxes are proposed in the association negotiation.

The VF Surgical Workstation AE shall accept aal contexts in the intersection of the proposed and acceptable presentation contexts. This means that the VF Surgical Workstation AE accepts multiple proposed presentation contexts with the same SOP class but different transfer syntaxes.
There is no check for duplicate contexts, and these will therefore be accepted.

4.2.2.4.1.3. SOP Specific Conformance for SOP Classes

4.2.2.4.1.3.1. Verification

The VF Surgical Workstation AE provides standard conformance to the Verification service class.

The behavior of an Application Entity SOP class shall be summarized as shown in Table 53. The standard as well as the manufacturer specific status codes and their corresponding behavior shall be specified.

Table 53: C-ECHO Status Response

Service Status	Code	Further Meaning	Description
Success	0000	Confirmation	Standard verification response.

4.2.2.4.1.3.2. Image Storage

The VF Surgical Workstation AE provides standard level 1 (Base) conformance to the Storage service class.

If the VF Surgical Workstation AE imports an image and during the association negotiation the Presentation State SOP class was not negotiated, then the VF Surgical Workstation AE creates a presentation state instance for the imported image.

The VF Surgical Workstation AE standard supports the Photometric Interpretation MONOCHROME1, MONOCHROME2, and RGB.

The behavior of an Application Entity SOP class shall be summarized as shown in Table 54. The standard as well as the manufacturer specific status codes and their corresponding behavior shall be specified.

Table 54: C-STORE Status Response

Service Status	Code	Further Meaning	Description
Success	0000	Storage is complete	The images are stored in the VF Surgical Workstation AE database.
Failure	A700	Refused – Out of resources	The VF Surgical Workstation AE database is full – recovery from this condition is left to the SCU. The VF Surgical Workstation AE sends a notification, log the condition, and abort the association.
	A900	Error – Data set does not match SOP class	The SOP class of the image(s) does not match the negotiated abstract syntax. The VF Surgical Workstation AE sends a notification, log the condition, and abort the association.
	C000	Error – Cannot understand	The image(s) cannot be parsed. The VF Surgical Workstation AE sends a notification, log the condition, and abort the association.
Warning	B000	Coercion of data elements	N/A
	B006	Elements discarded	N/A
	B007	Data set does not match SOP class	N/A

4.3.   Network Interfaces

4.3.1. Physical Network Interface

The BV Family provides DICOM 3.0 TCP/IP Network Communication Support as defined in [DICOM] PS 3.8.
For the BV Family AE the TCP/IP stack is inherited from the VxWorks operating system.
For the VF Surgical Workstation AE the TCP/IP stack is inherited from the Windows XP operating system.

The BV Family supports Ethernet and IEEE 802.3, 10/100 BASE-T.

4.3.2. Additional Protocols

No additional protocols are used.

4.4. Configuration

The configuration of a BV Family AE is done by means of a web-based service program, called BV-Scope.
The configuration of a VF Surgical Workstation AE is done by means of a configuration program, which is accessible at start-up (password protected, intended to be used by Philips Customer Support Engineers only).

4.4.1. AE Title/Presentation Address Mapping

An important installation issue is the translation from AE title to Presentation Address. How this is to be performed is described in this section.

4.4.1.1. Local AE Titles

Per default the BV Family AE Application Entity Title is "No Name". At installation the Customer Support Engineer can change the host name. The BV Family AE can be changed independently.

Table 55: AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
BV Family AE	"No Name"	104
VF Surgical Workstation AE	<IP host name>	3010

Note that the TCP/IP port addresses are not configurable.

4.4.1.2. Remote AE Title/Presentation Address Mapping

4.4.1.2.1. Remote Association Initiators

The following information must be provided for all relevant remote applications that are able to initiate DICOM associations to the BV Family.
- The Application Entity Title.
- The host name/IP address on which the remote application resides
- The port number at which the remote application has to send association requests
- The SOP classes and transfer syntaxes for which the VF Surgical Workstation AE accepts associations.

4.4.1.2.2. Remote Association Acceptors

The following information must be provided for all relevant remote applications that are able to accept DICOM associations from BV Family AE:
- 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.

4.4.2. Parameters

The specification of important operational parameters, and if configurable, their default value and range, are specified here.

The configuration parameters are given in Table 56, categorized in the following sections:

- Local system Configurable Parameters of the BV Family AE
- Export Target (Store) Configurable Parameters
- Export Target (Print) Configurable Parameters
- Worklist Management Target Configurable Parameters
- MPPS Target Configurable Parameters

Table 56: Configuration Parameters table for BV Family AE

Parameter		Configurable	Default Value, comment
Local System Parameters			
AE Title		Yes	"No Name"
Host Name		Yes	"No Name"
IP Address		Yes	0.0.0.0
Subnet Mask		Yes	0.0.0.0
Default Gateway		Yes	0.0.0.0
Interpolation (on/off)		Yes	On
Max. PDU size		Yes	28672
Receive Message Timeout		Yes	60 [s]
Association Close Timeout		Yes	1 [s]
Association Reply Timeout		Yes	60 [s]
Association Release Timeout		Yes	60 [s]
Write Timeout		Yes	60 [s]
Connect Timeout		Yes	60 [s]
Export Target(s) (Store)			
AE Title		Yes	"No Name"
Name		Yes	Max. 25 char. Unique
IP Address		Yes	
Port number		Yes	
Type		Yes	STORE
Storage Commit	AE Title	Yes	"No Name"
	IP Address	Yes	
	Port number	Yes	
	Enable/Disable	Yes	
Export Target(s) (Print)			
AE Title		Yes	"No Name"
Name		Yes	Max. 25 char. Unique
IP Address		Yes	
Port number		Yes	
Type		Yes	PRINT
Printer type		Yes	Predefined List
Printer Priority		Yes	MED
Film Destination		Yes	PROCESSOR
Film Orientation		Yes	PORTRAIT
Film Size		Yes	Depending on Printer Type
Border Density		Yes	BLACK
Border Density Value		Yes	1
Number of Copies		Yes	1
Magnification Type		No	Depending on Printer Type
Smoothing Type		No	Depending on Printer Type
Minimum Density		No	Depending on Printer Type
Maximum Density		No	Depending on Printer Type
Empty Image Density		No	Depending on Printer Type

Parameter	Configurable	Default Value, comment
Polarity	No	Depending on Printer Type
Trim	No	Depending on Printer Type
Configuration Information	No	Depending on Printer Type
Modality Worklist Management Target		
AE Title	Yes	"No Name"
Name	Yes	Max. 25 char. Unique
IP Address	Yes	
Port number	Yes	
Type	Yes	MWL
Select Query	Yes	Predefined Query List, maximum 4 items in the list
Define Query	Yes	Defines the queries that can be selected
MPPS Target		
AE Title	Yes	"No Name"
Name	Yes	Max. 25 char. Unique
IP Address	Yes	
Port number	Yes	
Type	Yes	MPPS
Automatic MPPS	Yes	If configured, always start MPPS panel directly after selection of Export function
Protocol Names	Yes	List with Protocol Names that can be selected in the MPPS panel
Storage commit (N-EVENT-REPORT)		
AE Title	Yes	Local System AE-Title
IP Address	Yes	Local System IP address
Port number	No	Fixed: 8104

Note: Parameters that are part of a specific DICOM IOD are specified in section 4 and 8

Table 57: Configuration Parameters table for VF Surgical Workstation AE

Parameter	Configurable	Default Value
General Parameters		
Time-out waiting for acceptance or rejection Response to an Association Open Request. (Application Level timeout)	No	-
General DIMSE level time-out values	No	-
Time-out waiting for response to TCP/IP connect request. (Low-level timeout)	No	-
Time-out waiting for acceptance of a TCP/IP message over the network. (Low-level timeout)	No	-
Time-out for waiting for data between TCP/IP packets. (Low-level timeout)	No	-
Any changes to default TCP/IP settings, such as configurable stack parameters.	No	-
Local Configurable AE Specific Parameters		
Size constraint in maximum object size (see note 1)	No	-
Maximum PDU size the AE can receive	Yes	0 (unlimited)
Maximum PDU size the AE can send	No	-
AE specific DIMSE level time-out values	No	-
Number of simultaneous Associations by Service and/or SOP Class	No	-
SOP Class support	Yes	none
Transfer Syntax support	Yes	ELE

Parameter	Configurable	Default Value
Remote Configurable AE Specific Parameters		
Size constraint in maximum object size (see note 1)	No	-
Maximum PDU size the AE can receive	Yes	0 (unlimited)
Maximum PDU size the AE can send	No	-
AE specific DIMSE level time-out values	No	-
Number of simultaneous Associations by Service and/or SOP Class	No	-
<SOP Class support (e.g. Multi-frame vs single frame vs SC support), when configurable>	Yes	none
<Transfer Syntax support, e.g. JPEG, Explicit VR, when configurable>	Yes	ELE

5. MEDIA INTERCHANGE

5.1. Implementation Model

5.1.1. Application Data Flow Diagram

The media interchange implementation of the BV Family is implemented in the VF Surgical Workstation AE. Figure 11 shows the Media Interchange Application Data Flow as a functional overview of the VF Surgical Workstation AE for DVD.
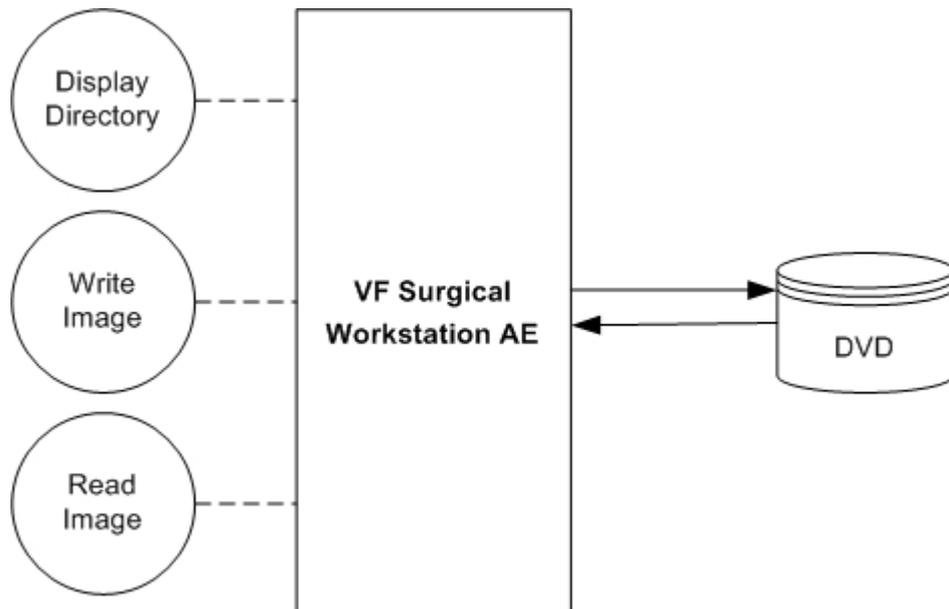
Figure 11: Application Data Flow Diagram

Table 59 shows the Media Interchange overview of the VF Surgical Workstation AE and the supporting roles for DVD.

5.1.2. Functional Definitions of AE's

The VF Surgical Workstation AE implements the following functions for DICOM media.
- Write a DICOM file-set onto media;
- Create a DICOMDIR on media;
- Read the DICOMDIR from media;
- Read selected images from media;

5.1.3. Sequencing of Real World Activities

Whenever DICOM media (DVD) has to be written, the VF Surgical Workstation AE first tries to read the DICOMDIR. The VF Surgical Workstation AE will compile the updated DICOMDIR and any required DICOM images into a DVD session image; this session image will be written to the DICOM media.
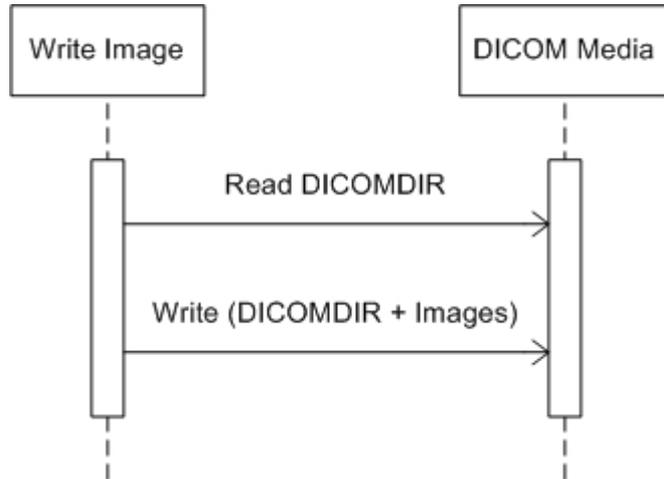
Figure 12: Sequencing of RWA Write Image

5.1.4. File Meta Information for Implementation Class and Version

The Implementation Class UID and Implementation Version Name are supplied as specified for the VF Surgical Workstation AE for networking.
Conform [DICOM], using File Meta Information Header version 1 requires the File Meta Information Version to be set as specified below.

Table 58: File Meta Information for VF Surgical Workstation AE

File Meta Information Version	00,01
Implementation Class UID	1.3.46.670589.5.2.23
Implementation Version Name	ViewForum R4.1

5.2.   AE Specifications

5.2.1. VF Surgical Workstation AE

The VF Surgical Workstation AE provides standard conformance to the DICOM interchange option of the Media Storage service class, and follows the specifications as defined in [DICOM] Media Storage and File Format for Data Interchange (PS 3.10) and Media Storage Application Profiles (PS 3.11).
The VF Surgical Workstation AE supports multi-patient and multi-session for DVD, both for reading and writing. Table 59 shows for each Application Profile in the first column the Real-World Activities in the second column, the roles required for each of these Real-World Activities in the third column, and the related Service Class Option in the fourth column.

Table 59: AE Related Application Profiles, Real-World Activities, and Roles

Supported Application Profile	Real-World Activity	Roles	SC Option
STD-GEN-DVD-JPEG	Display Directory	FSR	Interchange
	Read Image	FSR	Interchange
	Write Image	FSC	Interchange

5.2.1.1.   File Meta Information for the VF Surgical Workstation AE

The Source Application Entity Title is configurable (ref. section 5.4).

5.2.1.2. Real-World Activities

5.2.1.2.1. Display Directory

When a Database Open action is initiated on DICOM media then the VF Surgical Workstation AE acts as an FSR using the interchange option to read the DICOMDIR of the DICOM media.
This will result in an overview of the patients, studies, series, and images on the GUI.

5.2.1.2.1.1. Media Storage Application Profile

As depicted in Table 59, the VF Surgical Workstation AE supports the RWA Display Directory for STD-GEN-DVD-JPEG application profiles.

5.2.1.2.1.1.1. Options

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, and Image.

5.2.1.2.2. Read Image

When an image transfer from DICOM media is initiated then the VF Surgical Workstation AE acts as an FSR using the interchange option to import SOP instances from the DICOM media.

5.2.1.2.2.1. Media Storage Application Profile

As depicted in Table 59, the VF Surgical Workstation AE supports the RWA Read Image for STD-GEN-DVD-JPEG application profiles.

5.2.1.2.2.1.1. Options

The mandatory attributes of the DICOM images are required for the correct storage of the images in the local database. Optional 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.

5.2.1.2.3. Write Image

When an image transfer to DICOM media is initiated then the VF Surgical Workstation AE acts as an FSC using the interchange option to write SOP instances on the DICOM media.

5.2.1.2.3.1. Media Storage Application Profile

As depicted in Table 59, the VF Surgical Workstation AE supports the RWA Write Image for STD-GEN-DVD-JPEG application profiles.

5.2.1.2.3.1.1. Options

The DICOMDIR file will be extended when new images are written. In case some attributes are not present in an image but are specified as mandatory in the DICOMDIR definition of DICOM media, a generated value will be filled in.

<u>Implementation remarks an restrictions</u>
When writing the DICOMDIR records, key values are generated when no value of the corresponding attribute is supplied, according to the following table.

Table 60: Generated Keys

Key	Tag	Generated Value
Patient Keys		
Patient ID	0010,0020	At import the VF Surgical Workstation AE each time creates a new value based on the Study Instance UID for each new study written to DICOM media (even if this study belongs to a patient recorded earlier). Otherwise the default generated value shall be a succession of "UNKNOWN", the Patient's Name, the Patient's Birth Date, and the Patient's Sex, concatenated by using underscore characters.
Study Keys		
Study Date	0008,0020	Current date.
Study Time	0008,0030	Current time.
Study ID	0020,0010	"UNKNOWN"
Series Keys		
Series Number	0020,0011	1
Image Keys		
Instance Number	0020,0013	1

The default value for (0028,1040) Pixel Intensity Relationship is set to DISP.

The VF Surgical Workstation AE can write volumes of the media to that media.
If spanning is required then the VF Surgical Workstation AE asks for a new media.

5.3. Augmented and Private Application Profiles

Not applicable.

5.4. Media Configuration

Any configuration issues may be found in the Networking section 4.4.

6. SUPPORT OF CHARACTER SETS

Following table lists the supported character sets of the BV Family.

Table 61: Supported DICOM Character Sets of the BV Family

Character Set Description	Defined Term	ESC Sequence	ISO Registration Number	Code Element	Character Set
Single-byte Character Sets without Code Extensions					
Default repertoire	-	-	ISO-IR 6	G0	ISO 646
Latin alphabet No. 1	ISO_IR 100	-	ISO-IR 6	G0	ISO 646
		-	ISO-IR 100	G1	Supplementary set of ISO 8859
Single-byte Character Sets with Code Extensions					
Default repertoire	ISO 2022 IR 6	ESC 02/08 04/02	ISO-IR 6	G0	ISO 646
Latin alphabet No. 1	ISO 2022 IR 100	ESC 02/08 04/02	ISO-IR 6	G0	ISO 646
		ESC 02/13 04/01	ISO-IR 100	G1	Supplementary set of ISO 8859

7. SECURITY

Not applicable.

8. ANNEXES

8.1. IOD Contents

8.1.1. Created SOP Instances

This section specifies each IOD created by the BV Family AE.

Defined abbreviations are:

ALWAYS	the module is always present
CONDITIONAL	the module is used under specified condition

ALWAYS	the attribute is always present with a value
EMPTY	the attribute is always present without any value (attribute sent zero length)
VNAP	the attribute is always present and its Value is Not Always Present (attribute sent zero length if no value is present)
ANAP	the attribute is present under specified condition – if present then it will always have a value
ANAPCV	the attribute is present under specified condition – if present then its Value is Not Always Present (attribute sent zero length if condition applies and no value is present)
ANAPEV	the attribute is present under specified condition – if present then it will not have any value

AUTO	the attribute value is generated automatically
CONFIG	the attribute value source is a configurable parameter
COPY	the attribute value source is another SOP instance
FIXED	the attribute value is hard-coded in the application
IMPLICIT	the attribute value source is a user-implicit setting
MPPS	the attribute value source is a Modality Performed Procedure Step
MWL	the attribute value source is a Modality Worklist
USER	the attribute value source is explicit user input

8.1.1.1. Secondary Capture Image Storage SOP Class

Table 62: Modules of the Secondary Capture Image Storage SOP Class

Information Entity	Module Name	Usage
Patient	Patient Module	ALWAYS
Study	General Study Module	ALWAYS
	Patient Study Module	CONDITIONAL
Series	General Series Module	ALWAYS
Equipment	General Equipment Module	ALWAYS
	SC Equipment Module	ALWAYS
Image	General Image Module	ALWAYS
	Image Pixel Module	ALWAYS
	SC Image Module	ALWAYS
	SOP Common Module	ALWAYS

Table 63: Created Secondary Capture Image Storage SOP Class Attributes

Name	Tag	VR	Definition	Comment
Patient Module				
Patient's Name	0010,0010	PN	ALWAYS, MWL / USER	-
Patient ID	0010,0020	LO	ALWAYS, MWL / USER	-
Patient's Birth Date	0010,0030	DA	ALWAYS, MWL / USER	-
Patient's Birth Time	0010,0032	TM	VNAP, MWL	-
Patient's Sex	0010,0040	CS	ALWAYS, MWL / USER	-
Other Patient IDs	0010,1000	LO	VNAP, MWL	-
Other Patient Names	0010,1001	PN	VNAP, MWL	-
General Study Module				
Study Date	0008,0020	DA	ALWAYS, AUTO	Examination date.
Study Time	0008,0030	TM	ALWAYS, AUTO	Examination time (format <hhmm>).
Accession Number	0008,0050	SH	ALWAYS, MWL / USER	-
Referring Physician's Name	0008,0090	PN	VNAP, MWL	-
Study Description	0008,1030	LO	ALWAYS, USER	Selected examination type.
Referenced Study Sequence	0008,1110	SQ	VNAP, MWL	-
>Referenced SOP Class UID	0008,1150	UI	ALWAYS, MWL	-
>Referenced SOP Instance UID	0008,1155	UI	ALWAYS, MWL	-
Study Instance UID	0020,000D	UI	ALWAYS, AUTO / MWL	-
Study ID	0020,0010	SH	EMPTY, AUTO	-
Patient Study Module				
Patient's Weight	0010,1030	DS	VNAP, MWL	-
General Series Module				
Performing Physician's Name	0008,1050	PN	ALWAYS, USER	-
Series Instance UID	0020,000E	UI	ALWAYS, AUTO	-
Series Number	0020,0011	IS	ALWAYS, AUTO	Increasing number that identifies series (run).
Laterality	0020,0060	CS	EMPTY, AUTO	-
Performed Procedure Step Start Date	0040,0244	DA	ALWAYS, AUTO	Examination date.
Performed Procedure Step Start Time	0040,0245	TM	ALWAYS, AUTO	Examination time (format <hhmm>).

Name	Tag	VR	Definition	Comment
General Equipment Module				
Manufacturer	0008,0070	LO	ALWAYS, AUTO	Applied value: Philips Medical Systems
Institution Name	0008,0080	LO	ALWAYS, CONFIG	Hospital name.
Station Name	0008,1010	SH	ALWAYS, CONFIG	-
Manufacturer's Model Name	0008,1090	LO	ALWAYS, AUTO	Applied value: BV Family
SC Equipment Module				
Modality	0008,0060	CS	ALWAYS, AUTO	Applied values: OT (Dose report only); XA
Conversion Type	0008,0064	CS	ALWAYS, AUTO	Applied value: DI
Secondary Capture Device ID	0018,1010	LO	ALWAYS, CONFIG	BV System ID.
Secondary Capture Device Manufacturer	0018,1016	LO	ALWAYS, AUTO	Applied value: Philips Medical Systems
Secondary Capture Device Manufacturer's Model Name	0018,1018	LO	ALWAYS, AUTO	Applied value: BV Family
Secondary Capture Device Software Version	0018,1019	LO	ALWAYS, AUTO	Applied value: BV Family R1.6
General Image Module				
Image Type	0008,0008	CS	ALWAYS, AUTO	Applied value: DERIVED\SECONDARY
Instance Number	0020,0013	IS	ALWAYS, AUTO	Generated running number.
Patient Orientation	0020,0020	CS	EMPTY, AUTO	-
Image Pixel Module				
Samples per Pixel	0028,0002	US	ALWAYS, AUTO	Applied value: 1
Photometric Interpretation	0028,0004	CS	ALWAYS, AUTO	Applied value: MONOCHROME2
Rows	0028,0010	US	ALWAYS, AUTO	Applied values: 560 (if interpolation off) 768 (if interpolation on)
Columns	0028,0011	US	ALWAYS, AUTO	Applied value: 1008
Pixel Aspect Ratio	0028,0034	IS	ANAP, AUTO	If interpolation off. Applied value: 753\549
Bits Allocated	0028,0100	US	ALWAYS, AUTO	Applied value: 8
Bits Stored	0028,0101	US	ALWAYS, AUTO	Applied value: 8
High Bit	0028,0102	US	ALWAYS, AUTO	Applied value: 7
Pixel Representation	0028,0103	US	ALWAYS, AUTO	Applied value: 0
Pixel Data	7FE0,0010	OW	ALWAYS, AUTO	-
SC Image Module				
Date of Secondary Capture	0018,1012	DA	ALWAYS, AUTO	-
Time of Secondary Capture	0018,1014	TM	ALWAYS, AUTO	(format <hhmm>)

Name	Tag	VR	Definition	Comment
SOP Common Module				
Specific Character Set	0008,0005	CS	ALWAYS, AUTO	Applied value: ISO_IR 100
SOP Class UID	0008,0016	UI	ALWAYS, AUTO	Applied value: 1.2.840 .10008.5.1.4.1.1.7 (Secondary Capture Image Storage)
SOP Instance UID	0008,0018	UI	ALWAYS, AUTO	-

8.1.1.2. X-Ray Angiographic Image Storage SOP Class

Table 64: Modules of the X-Ray Angiographic Image Storage SOP Class

Information Entity	Module Name	Usage
Patient	Patient Module	ALWAYS
Study	General Study Module	ALWAYS
	Patient Study Module	CONDITIONAL
Series	General Series Module	ALWAYS
Equipment	General Equipment Module	ALWAYS
Image	General Image Module	ALWAYS
	Image Pixel Module	ALWAYS
	Cine Module	ALWAYS
	Multi-Frame Module	ALWAYS
	X-Ray Image Module	ALWAYS
	X-Ray Acquisition Module	ALWAYS
	XA Positioner Module	ALWAYS
	SOP Common Module	ALWAYS

Table 65: Created X-Ray Angiographic Image Storage SOP Class Attributes

Name	Tag	VR	Definition	Comment
Patient Module				
Patient's Name	0010,0010	PN	ALWAYS, MWL / USER	-
Patient ID	0010,0020	LO	ALWAYS, MWL / USER	-
Patient's Birth Date	0010,0030	DA	ALWAYS, MWL / USER	-
Patient's Birth Time	0010,0032	TM	VNAP, MWL / USER	(format <hhmm>)
Patient's Sex	0010,0040	CS	ALWAYS, MWL / USER	-
Other Patient IDs	0010,1000	LO	VNAP, MWL	-
Other Patient Names	0010,1001	PN	VNAP, MWL	-
General Study Module				
Study Date	0008,0020	DA	ALWAYS, AUTO	Examination date.
Study Time	0008,0030	TM	ALWAYS, AUTO	Examination time (format <hhmm>).

Name	Tag	VR	Definition	Comment
Accession Number	0008,0050	SH	ALWAYS, MWL / USER	-
Referring Physician's Name	0008,0090	PN	VNAP, MWL	-
Study Description	0008,1030	LO	ALWAYS, USER	Selected examination type.
Referenced Study Sequence	0008,1110	SQ	VNAP, MWL	-
>Referenced SOP Class UID	0008,1150	UI	ALWAYS, MWL	-
>Referenced SOP Instance UID	0008,1155	UI	ALWAYS, MWL	-
Study Instance UID	0020,000D	UI	ALWAYS, AUTO / MWL	-
Study ID	0020,0010	SH	EMPTY, AUTO	-
Patient Study Module				
Patient's Weight	0010,1030	DS	VNAP, MWL	-
General Series Module				
Modality	0008,0060	CS	ALWAYS, AUTO	Applied value: XA
Series Description	0008,103E	LO	ALWAYS, AUTO	User provided description of the series.
Performing Physician's Name	0008,1050	PN	ALWAYS, USER	-
Series Instance UID	0020,000E	UI	ALWAYS, AUTO	-
Series Number	0020,0011	IS	ALWAYS, AUTO	Increasing number that identifies series (run).
Laterality	0020,0060	CS	EMPTY, AUTO	-
Performed Procedure Step Start Date	0040,0244	DA	ALWAYS, AUTO	Examination date.
Performed Procedure Step Start Time	0040,0245	TM	ALWAYS, AUTO	Examination time (format <hhmm>).
General Equipment Module				
Manufacturer	0008,0070	LO	ALWAYS, AUTO	Applied value: Philips Medical Systems
Institution Name	0008,0080	LO	ALWAYS, CONFIG	Hospital name.
Station Name	0008,1010	SH	ALWAYS, CONFIG	-
Manufacturer's Model Name	0008,1090	LO	ALWAYS, AUTO	Applied value: BV Family
General Image Module				
Content Date	0008,0023	DA	ALWAYS, AUTO	-
Content Time	0008,0033	TM	ALWAYS, AUTO	(format <hhmm>)
Instance Number	0020,0013	IS	ALWAYS, AUTO	-
Patient Orientation	0020,0020	CS	EMPTY, AUTO	-
Image Pixel Module				
Rows	0028,0010	US	ALWAYS, AUTO	Applied values: 560 (if interpolation off) 768 (if interpolation on)

Name	Tag	VR	Definition	Comment
Columns	0028,0011	US	ALWAYS, AUTO	Applied value: 792
Pixel Aspect Ratio	0028,0034	IS	ANAP, AUTO	If interpolation off. Applied value: 753\549
Pixel Data	7FE0,0010	OW	ALWAYS, AUTO	-
Cine Module				
Start Trim	0008,2142	IS	ALWAYS, AUTO	Applied value: 1
Stop Trim	0008,2143	IS	ALWAYS, AUTO	Number of images in the run.
Recommended Display Frame Rate	0008,2144	IS	ALWAYS, AUTO	Acquisition speed.
Cine Rate	0018,0040	IS	ALWAYS, AUTO	Calculated from acquisition speed.
Frame Time	0018,1063	DS	ALWAYS, AUTO	Calculated from acquisition speed [ms].
Multi-Frame Module				
Number of Frames	0028,0008	IS	ALWAYS, AUTO	Number of exported images in the run.
X-Ray Image Module				
Image Type	0008,0008	CS	ALWAYS, AUTO	Applied value: ORIGINAL\PRIMARY
Samples per Pixel	0028,0002	US	ALWAYS, AUTO	Applied value: 1
Photometric Interpretation	0028,0004	CS	ALWAYS, AUTO	Applied value: MONOCHROME2
Frame Increment Pointer	0028,0009	AT	ALWAYS, AUTO	Applied value: 0x00181063 (Frame Time)
Bits Allocated	0028,0100	US	ALWAYS, AUTO	Applied value: 8
Bits Stored	0028,0101	US	ALWAYS, AUTO	Applied value: 8
High Bit	0028,0102	US	ALWAYS, AUTO	Applied value: 7
Pixel Representation	0028,0103	US	ALWAYS, AUTO	Applied value: 0
Pixel Intensity Relationship	0028,1040	CS	ALWAYS, AUTO	Applied value: LIN
X-Ray Acquisition Module				
KVP	0018,0060	DS	EMPTY, AUTO	-
Field of View Shape	0018,1147	CS	ALWAYS, AUTO	Applied value: ROUND
Exposure	0018,1152	IS	EMPTY, AUTO	-
Radiation Setting	0018,1155	CS	ALWAYS, AUTO	Applied values: GR, SC
Type of Filters	0018,1161	LO	ALWAYS, AUTO	Applied value: NONE
Intensifier Size	0018,1162	DS	ALWAYS, AUTO	Applied values: 150, 230, 310
Grid	0018,1166	CS	ALWAYS, AUTO	Applied value: IN
XA Positioner Module				
Distance Source to Detector	0018,1110	DS	ALWAYS, AUTO	Applied value: 995

Name	Tag	VR	Definition	Comment
Positioner Motion	0018,1500	CS	EMPTY, AUTO	-
Positioner Primary Angle	0018,1510	DS	ALWAYS, AUTO	Applied value: 0
Positioner Secondary Angle	0018,1511	DS	ALWAYS, AUTO	Applied value: 0
SOP Common Module				
Specific Character Set	0008,0005	CS	ALWAYS, AUTO	Applied value: ISO_IR 100
SOP Class UID	0008,0016	UI	ALWAYS, AUTO	Uniquely identifies the SOP Class. Applied value: 1.2.840 .10008.5.1.4.1.1.12.1 (X-Ray Angiography Image Storage)
SOP Instance UID	0008,0018	UI	ALWAYS, AUTO	-

8.1.2. Usage of Attributes from Received IOD's

No specifics; the received IOD's have to be conform DICOM.

8.1.3. Attribute Mapping

Not applicable.

8.1.4. Coerced/Modified fields

In general, the VF Surgical Workstation AE will try and optimize the imported image data. This may involve the removal of redundant data, either or not due to the creation of a Presentation State object for the image data. This may also involve the creation of extra attributes. As it is not the intention of the VF Surgical Workstation AE to export this data as such, the SOP Instance UID shall not be changed.

If not available at import then the VF Surgical Workstation AE will create the additional attributes as listed in Table 66.

Table 66: Additional Attributes for VF Surgical Workstation AE

Name	Tag	Generated Value
Performed Procedure Step Start Date	0040,0244	Copied from (0008,0020) Study Date.
Performed Procedure Step Start Time	0040,0245	Copied from (0008,0030) Study Time.
Performed Procedure Step ID	0040,0253	Copied from (0020,0010) Study ID.
Performed Procedure Step Description	0040,0254	Copied from (0008,1030) Study Description.

If the SCU does not propose a presentation context for the Grayscale Softcopy Presentation State storage SOP class, then the VF Surgical Workstation AE will derive Presentation State data from the imported image data and store this data in a new series within the examination of the imported image.
However, if during import the image is accompanied by Presentation State data, the VF Surgical Workstation AE database shall avoid data overlap by only storing the relevant data from the first object received; either the first image or its Presentation State!
Thus it will omit data received by succeeding objects concerning the optional attributes (VT=3) listed in Table 67, and clear all mandatory attributes (VT=2) listed in Table 68.

Table 67: Omitted Attributes for VF Surgical Workstation AE

Name	Tag
Patient Module	
Referenced Patient Sequence	0008,1120
Patient's Birth Time	0010,0032
Other Patient Ids	0010,1000
Other Patient Names	0010,1001
Ethnic Group	0010,2160
Patient Comments	0010,4000
General Study Module	
Referring Physician Identification Sequence	0008,0096
Study Description	0008,1030
Procedure Code Sequence	0008,1032
Physician(s) of Record	0008,1048
Physician(s) of Record Identification Sequence	0008,1049
Name of Physician(s) Reading Study	0008,1060
Physician(s) Reading Study Identification Sequence	0008,1062
Referenced Study Sequence	0008,1110
Patient Study Module	
Admitting Diagnoses Description	0008,1080
Admitting Diagnoses Code Sequence	0008,1084
Patient's Age	0010,1010
Patient's Size	0010,1020
Patient's Weight	0010,1030
Occupation	0010,2180
Additional Patient History	0010,21B0
Clinical Trial Study Module	
Clinical Trial Time Point Description	0012,0051
General Series Module	
Series Date	0008,0021
Series Time	0008,0031
Series Description	0008,103E
Performing Physicians' Name	0008,1050
Performing Physician Identification Sequence	0008,1052
Operators' Name	0008,1070
Operators Identification Sequence	0008,1072
Referenced Performed Procedure Step Sequence	0008,1111
Body Part Examined	0018,0015
Protocol Name	0018,1030
Smallest Pixel Value in Series	0028.0108
Largest Pixel Value in Series	0028.0109
Performed Procedure Step Start Date	0040,0244
Performed Procedure Step Start Time	0040,0245
Performed Procedure Step ID	0040,0253
Performed Procedure Step Description	0040,0254
Performed Protocol Code Sequence	0040,0260
Request Attributes Sequence	0040,0275
Comments on the Performed Procedure Step	0040,0280
General Equipment Module	
Institution Name	0008,0080
Institution Address	0008,0081
Station Name	0008,1010
Institutional Department Name	0008,1040
Manufacturer's Model Name	0008,1090
Device Serial Number	0018,1000

Name	Tag
Software Versions	0018,1020
Spatial Resolution	0018,1050
Date of Last Calibration	0018,1200
Time of Last Calibration	0018,1201
Pixel Padding Value	0028,0120
Display Shutter Module	
Shutter Presentation Value	0018,1622
Overlay Plane Module	
Overlay Description	60xx,0022
Overlay Subtype	60xx,0045
ROI Area	60xx,1301
ROI Mean	60xx,1302
ROI Standard Deviation	60xx,1303
Overlay Label	60xx,1500
SOP Common Module	
Instance Creation Date	0008,0012
Instance Creation Time	0008,0013
Instance Creator UID	0008,0014
Coding Scheme Identification Sequence	0008,0110
Timezone Offset From UTC	0008,0201
Contributing Equipment Sequence	0018,A001
Instance Number	0020,0013
SOP Instance Status	0100,0410
SOP Authorization Date and Time	0100,0420
SOP Authorization Comment	0100,0424
Authorization Equipment Certification Number	0100,0426
MAC Parameters Sequence	4FFE,0001
Digital Signatures Sequence	FFFA,FFFA

Table 68: Cleared Attributes for VF Surgical Workstation AE

Name	Tag
Patient Module	
Patient's Name	0010,0010
Patient ID	0010,0020
Patient's Birth Date	0010,0030
Patient's Sex	0010,0040
Clinical Trial Subject Module	
Clinical Trial Protocol Name	0012,0021
Clinical Trial Site ID	0012,0030
Clinical Trial Site Name	0012,0031
General Study Module	
Study Date	0008,0020
Study Time	0008,0030
Accession Number	0008,0050
Referring Physician's Name	0008,0090
Study ID	0020,0010
Clinical Trial Study Module	
Clinical Trial Time Point ID	0012,0050
General Series Module	
Patient Position	0018,5100
Series Number	0020,0011
Laterality	0020,0060

Name	Tag
Clinical Trial Series Module	
Clinical Trial Coordinating Center Name	0012,0060
General Equipment Module	
Manufacturer	0008,0070
Mask Module	
Recommended Viewing Mode	0028,1090
Overlay/Curve Activation Module	
Curve Activation Layer	50xx,1001
Overlay Activation Layer	60xx,1001

The VF Surgical Workstation AE allows the operator to modify attributes of the stored images; see Table 69.
The VF Surgical Workstation AE does not modify the pixel values of the stored images. Modified images retain their original Study, Series and Image UID.

Table 69: Modifiable Attributes

Name	Tag
Patient	
Patient's Name	0010,0010
Patient ID	0010,0020
Patient's Birth Date	0010,0030
Patient's Sex	0010,0040
Medical Alerts	0010,2000
Contrast Allergies	0010,2110
Patient Comments	0010,4000
Study	
Accession Number	0008,0050
Referring Physician's Name	0008,0090
Study Description	0008,1030
Physician(s) of Record	0008,1048
Name of Physician(s) Reading Study	0008,1060
Admitting Diagnoses Description	0008,1080
Patient's Age	0010,1010
Occupation	0010,2180
Additional Patient History	0010,21B0
Examination	
Performed Station Name	0040,0242
Performed Location	0040,0243
Performed Procedure Step Description	0040,0254
Performed Procedure Type Description	0040,0255
Comments on the Performed Procedure Step	0040,0280
Series	
-	-

8.2. Data Dictionary of Private Attributes

Not applicable.

8.3. Coded Terminology and Templates

The BV Family does not support any coded terminology or templates.

8.4. Grayscale Image consistency

The high-resolution display monitor attached to the BV Family can be calibrated by using the service tool together with a light probe. See the [VFRB] for details on the calibration procedure.

8.5. Standard Extended/Specialized/Private SOPs

The VF Surgical Workstation AE supports the following private SOP classes.

Table 70: Private SOP Classes

SOP Class	
Name	**UID**
Specialized X-Ray	1.3.46.670589.2.3.1.1
CX Image	1.3.46.670589.2.4.1.1
3D Volume Storage	1.3.46.670589.5.0.1.1
3D Volume Object Storage	1.3.46.670589.5.0.2.1
Surface Storage	1.3.46.670589.5.0.3.1
MR Cardio Storage	1.3.46.670589.5.0.8.1
CT Synthetic Image	1.3.46.670589.5.0.9
MR Synthetic Image	1.3.46.670589.5.0.10
MR Cardio Analysis Storage	1.3.46.670589.5.0.11.1
CX Synthetic Image	1.3.46.670589.5.0.12
Perfusion	1.3.46.670589.5.0.13
Perfusion Analysis	1.3.46.670589.5.0.14

8.6. Private Transfer Syntaxes

The BV Family does not support any private transfer syntaxes.