

Three Palm Software CadOne™ *DICOM Conformance Statement*

Version 3.2.0

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1. Conformance Statement Overview

Three Palm Software (TPS) CadOne is software system that implements a set of interfaces between the CadOne and digital sources and destinations. In particular it receives and temporarily stores digital mammography studies and subsequently exports the CAD reports corresponding to those studies. Specifically the CadOne provides storage for images in a digital mammography X-ray series that are pushed to it, and it pushes generated reports out to a configured storage provider.

The following table summarizes the DICOM services that are implemented by this system:

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Digital Mammography X-Ray Image Storage - For Presentation	no	yes
Digital Mammography X-Ray Image Storage - For Processing	no	yes
Mammography CAD SR Storage	yes	no
Workflow Management		
Storage Commitment Push Model SOP Class	yes	no

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3. Introduction

3.1. Revision History

The following table summarizes the history of this document:

Rev	CO	Description	Date	Author
0.1		first draft	11/21/07	pbh
0.2		updated based on build 3.2.0	10/03/08	hz
1.0		approved	10/03/08	hz
1.1		Minor cleanup	10/20/08	pbh
2.0		approved	20/25/08	hz

3.2. Audience

This document is intended for health system administrators, hospital staff, health system integrators, software designers and implementers. It is assumed that the reader has a working understanding of DICOM.

3.3. Remarks

This DICOM Conformance Statement by itself is not sufficient to guarantee successful connectivity between the TPS CadOne and equipment from other vendors. The following issues should be considered:

- The integration of equipment from different vendors (including TPS) goes beyond the scope of the DICOM 3.0 standard and the DICOM Conformance Statements from TPS and other vendors. It is the responsibility of the user (or users agent) to assess the application requirements and to design a solution that integrates TPS system with equipment from other vendors.
- When the comparison of this DICOM Conformance Statement with a DICOM Conformance Statement from another vendor indicates that connectivity should be possible, it is the responsibility of the user (or users agent) to verify this by carrying out validation tests and to check whether all required functionality (such as correct display of CAD markers) is met.
- With regard to the future evolution of the DICOM 3.0 standard TPS reserves the right to make changes to the TPS CadOne architecture described in this document. The user (or users agent) should ensure that any equipment connected via DICOM to TPS system also follows the future evolution of the DICOM 3.0 standard. Failure to do so may result in (partial) loss of connectivity.

3.4. Definitions, Terms and Abbreviations

The following acronyms and abbreviations are used in this document:

AE	Application Entity
CAD	Computer Aided Detection
CadOne	TPS CAD system
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
MG	Mammography
PDU	Protocol Data Unit
SCU	Service Class User
SCP	Service Class Provider
SOP	Service-Object Pair
SR	Structured Report
TCP/IP	Transmission Control Protocol/Internet Protocol
TPS	Three Palm Software
UID	Unique Identifier

3.5. References

This conformance statement follows the template specified in:

- Digital Imaging and Communications in Medicine (DICOM) PS 3-2007.

4. Networking

4.1. Implementation Model

The TPS CadOne is implemented as a Windows service, and this service hosts a number of instances. Each instance utilizes one or more DICOM services in order to implement some real world activity. CadOne can host any number of types (here referred to as "classes") of instance, and each class can be present multiple times (e.g., each can use a different communication port and a different AE title). This release of CadOne includes 2 instance classes:

- DcmStore - a class which acts as a Storage SCP in order to receive and temporarily store mammography x-ray studies for subsequent CAD processing, and
- SrOutput - a class which sends CAD reports to a configured destination as Mammography CAD SR.

4.1.1. Application Data Flow

The following diagram illustrates the application data flow:

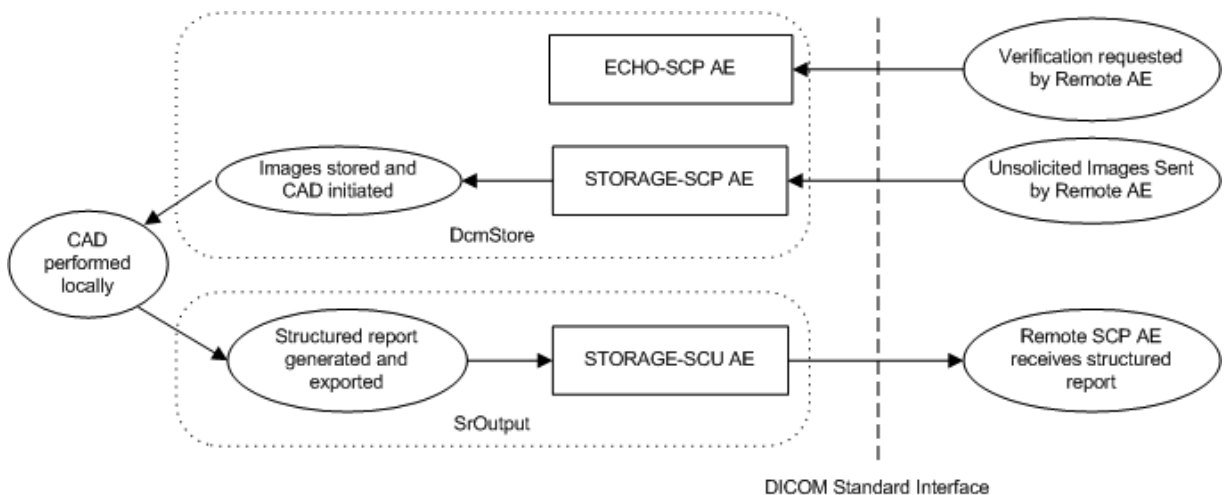


Figure 4.1 - Implementation Model

where the left side of the DICOM interface is the functionality implemented locally within CadOne. This diagram shows two application entities - one storage SCP and one storage SCU. The required echo SCP is also implemented (in the same class that implements the Storage SCP).

The dotted borders surround the functionality implemented in the DcmStore and SrOutput instances. A default configuration of CadOne has one instance each of these two classes - but there can be any number of instances of each in a single CadOne system. Each instance of one of these instances thus includes the corresponding DICOM AE, and each of those has its own AE title.

As can be seen from the diagram, the ECHO-SCP and STORAGE-SCP are part of the same instance, and so they share a single AE title. The implemented application entities are:

- ECHO-SCP - this corresponds to the real world activity "Verification requested by Remote AE". This activity is initiated by the Remote SCU AE to verify communications with a configured DcmStore AE destination.
- STORAGE-SCP - this corresponds to the real world activity "Unsolicited Images Sent by Remote AE". This AE supports the reception of the composite SOP classes discussed below in section 4.2.1.1. It responds as a Service Class Provider to C-STORE requests from a Remote SCU AE.
- STORAGE-SCU - this corresponds to the real world activity "Structured report generated and exported". This AE sends the generated structured reports to a configured Remote SCP AE (for storage and subsequent display).

The diagram covers a usage with its own set of basic interactions:

- reception of a study pushed to the system, with CAD performed, and the resultant report exported, which has the following basic interactions:
 - a remote AE (typically a digital mammography acquisition device) opens an association with CadOne (with a configured DcmStore instance, using a known port and AE title). It may use the echo service at this time to

- verify connectivity.
- the local AE (the connected DcmStore instance) accepts (or rejects, depending on the configuration) the requested association, and waits for images to be sent.
- the remote AE sends a number of images from a series or a number of series that comprise a study for which CAD processing is desired.
- the local AE (the DcmStore instance) receives those images, and stores them temporarily on the local disk.
- the local AE (DcmStore instance) submits the images for initiation of CAD processing.
- the remote AE indicates that the study is completely sent by implementing (perhaps implicitly) one of the following:
 - closing the association (if DcmStore is configured to use this as a "study end" mechanism),
 - sending a different study on the same association (where "different" depends configurably on whether the study identification is to be considered as the study or series instance UID), or
 - not sending another image for the study (either on the same of a different association, if so configured) for longer than a configured period of time.
- the local AE (DcmStore instance) acts on the association closure to complete the study for completion of CAD processing.
- the local CAD algorithm processes the study, and subsequently reports back to CadOne that it has completed.
- one or more configured local instances of the SrOutput classes are notified on completion of the CAD processing, and each such instance then retrieves the CAD reports and ancillary information, generating a corresponding DICOM object - a mammography CAD structured report object in the study of each SrOutput instance.
- the SrOutput instance opens an association to a configured remote AE that implements a STORAGE-SCP.
- the generated DICOM object which encoded the CAD report is sent over the association.
- if storage commitment is configured for this instance, storage commitment is used to indicate the completion of the transfer.
- the association is closed, and any temporary information related to the study is discarded.

The system does not have fixed limits on the number of input or output connections, nor on the number of simultaneous connections or pending jobs that can be handled. Naturally the system is still constrained by physical resources (memory, network bandwidth, disk space).

4.1.2. Functional Definition of AEs

The CadOne allocates a thread for the execution of each instance, and each instance may utilize additional threads for simultaneous connections to that AE. However within the limits of system resources, it is appropriate to consider each service in isolation. The following subsections contain a functional definition for each individual local Application Entity.

4.1.2.1. ECHO-SCP

The ECHO-SCP (which is available in each DcmStore instance) listens for connections on the configured port for that instance. It accepts associations with Presentation Contexts for SOP Class of the Verification Service Class, and responds successfully to echo requests.

4.1.2.2. STORAGE-SCP

The STORAGE-SCP (which is available in each DcmStore instance) listens for connections on the configured port for that instance. It accepts associations with Presentation Contexts for SOP Classes of the Storage Service Class (see 4.2.1.1 below for the accepted SOP Classes), and stores the received images to the local file store from where they are subsequently retrieved for CAD processing, and later automatically deleted when the processing is completed.

4.1.2.3. STORAGE-SCU

A STORAGE-SCU is implemented in each SrOutput instance. On completion of CAD processing, CadOne passes the generated CAD report to each output instance (configured by routing rules), and then any output instance of the class SrOutput formats the report as a Mammography CAD SR. This AE then opens an association with a configured remote Storage SCP, and sends the SR instance to that AE.

The storage SCU entity also supports storage commitment as a user. This is a configurable option for each, but if configured, at the completion of the sending of the DICOM objects, a STORAGE-SCU instance issues an N-ACTION request to the SCP, which indicates the intent to transfer ownership of the objects to the SCP. The SCU then waits for the subsequent N-EVENT-REPORT request from the SCP, which indicates agreement to transfer the ownership of the requested instances.

4.1.3. Sequencing of Real World Activities

The following diagram (4.2) summarizes the real-world interactions between two remote application entities, and the corresponding CadOne agents.

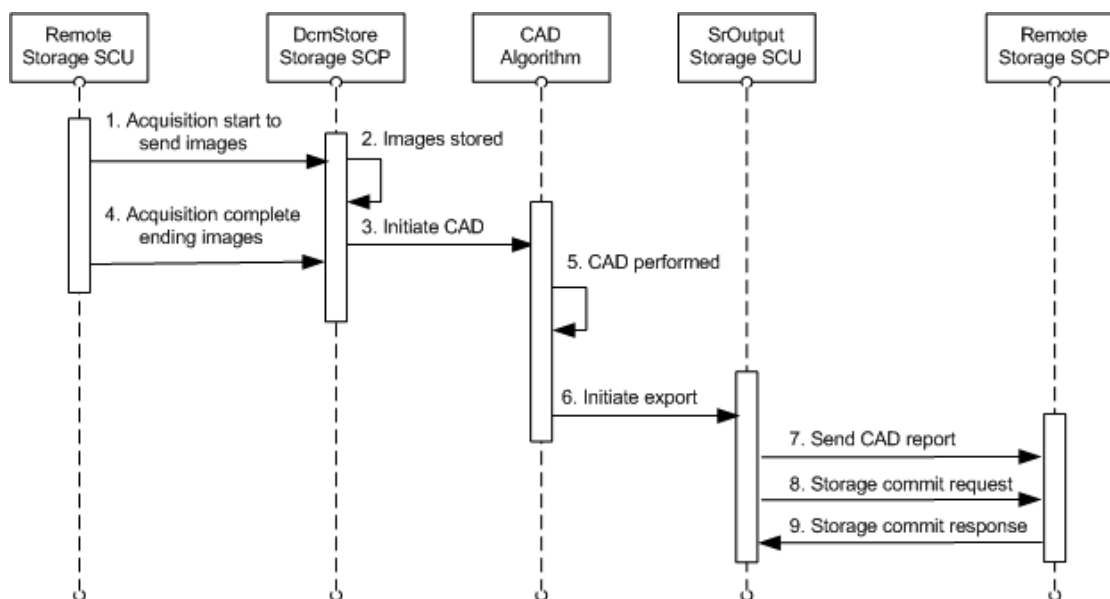


Figure 4.2 - Sequencing of real-world activities for a study pushed through the system for CAD processing.

The remote entities (the sender of the images and the receiver of the reports) may be implemented in the same or different systems. This sequence of activities can overlap asynchronously with any number of cycles of the same activities - i.e., there can be multiple of these work-flows active at any time - with the same or different remote entities, and with one or more instances of the local DcmStore and SrOutput instances.

4.2. AE Specifications

The following sub-sections specify the implemented application entities.

4.2.1. DcmStore Application Entity Specification

This subsection specifies the DcmStore application entity.

4.2.1.1. SOP Classes

An instance of the DcmStore Application Entity provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Digital Mammography X-Ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	no	yes
Digital Mammography X-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.2	no	yes

4.2.1.2. Association Policies

The following sub-sections describe the Association Establishment and Acceptance policies of an instance of DcmStore.

4.2.1.2.1. General

A DcmStore AE accepts associations that are initiated by a remote AE. It accepts any PDU size offered by the calling SCU, up a maximum of 128K Bytes (the maximum accepted PDU size is configurable).

The DICOM standard application context name for DICOM version 3.0 is accepted:

Application Context Name	1.2.840.10008.3.1.1.1
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4.2.1.2.2. Number of Associations.

Each instance of DcmStore can support any number of associations (subject to memory constraints), and there can be multiple DcmStore instances in a single CadOne deployment (each instance has a unique AE title and port). There are no explicit rules governing number or simultaneity of associations.

Maximum number of simultaneous associations	Not Limited
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4.2.1.2.3. Asynchronous Nature

Each association with an instance of DcmStore can perform a maximum of one transaction - each association is implicitly tied to the transfer of a single "study".

Maximum number of outstanding asynchronous transactions on each association	1
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4.2.1.2.4. Implementation Identifying Information

DcmStore uses the following for Implementation Class UID and implementation version:

Implementation Class UID	1.3.6.1.4.1.29552.1.9
Implementation version name	<i>version string</i>

where the version string is formed as the name of this instance ("DcmStore") with the major.minor version information of the release appended.

4.2.1.3. Association Initiation Policy

An instance of DcmStore never initiates an association.

4.2.1.4. Association Acceptance Policy

Each instance of DcmStore waits and listens for incoming connection requests (on a configured port). When a connection request is accepted, a storage provider service (a separate thread within DcmStore) is started by the listener, and DcmStore continues to listen for additional incoming connection requests. The storage provider within DcmStore negotiates the association using the list of supported presentation contexts. If the association is accepted, then the DcmStore instance proceeds to process the subsequent image storage requests.

A DcmStore instance will reject an association attempt if the called AE title does not match the title of this instance, and the instance is not set to match any called AE title. Similarly, the association will be rejected if the calling AE title does not match a configured calling AE title for this instance, and the instance is not set to allow connections from any calling AE.

The following two sub-sections describe the acceptance policies for the echo and storage activities implemented by DcmStore.

4.2.1.4.1. Activity - Verification requested by remote AE

The following sub-sections describe how the real world activity Verification requested by remote AE is handled by a DcmStore instance.

4.2.1.4.1.1. Description and sequencing of Activities

A DcmStore instance responds to C-ECHO requests to verify communication from a Remote SCU AE. This capability can be used as a diagnostic service tool for trouble shooting network communication issues.

If the incoming association contains a command field with a C-ECHO and an SOP Class of Verification SOP Class, the assumed role of the DcmStore instance will become that of an ECHO-SCP.

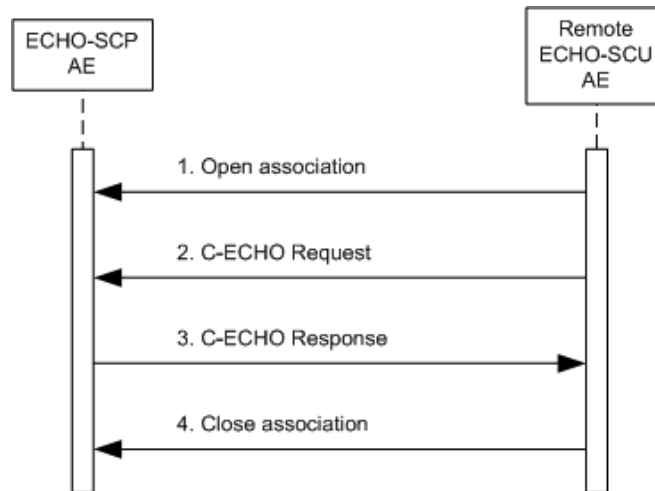


Figure 4.3 - Sequencing of activity: Verification requested by remote AE

The following sequencing interactions apply to the ECHO-SCP server when handling C-ECHO Requests:

1. The ECHO-SCP server accepts an association from a remote ECHO-SCU entity.
2. The remote ECHO-SCU entity sends a C-ECHO-RQ Message.
3. The ECHO-SCP server returns a C-ECHO-RSP Message to the remote ECHO-SCU entity.
4. The ECHO-SCP server closes the association.

4.2.1.4.1.2. Accepted Presentation Contexts

The ECHO-SCP server accepts the Presentation Contexts shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification SOP Class	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.1.4.1.3. SOP Specific Conformance for SOP Class

The ECHO-SCP server provides standard conformance as an SCP to the DICOM C-ECHO Operation Service defined in Part 7 and the Verification Service Class defined in Part 4 of the DICOM Standard.

The ECHO-SCP server returns the status codes shown in the next table:

Service Status	Further Meaning	Error Code	Reason
Success	Success	0	The echo request is considered to have been successfully handled, and the association can now be released.

4.2.1.4.2. Activity - Unsolicited images sent by remote AE

The following sub-sections describe how the real world activity Unsolicited images sent by remote AE is handled by a DcmStore instance.

4.2.1.4.2.1. Description and sequencing of Activities

A DcmStore instance accepts DICOM images sent to it from a Remote SCU AE.

If the incoming association contains a command field with a C-STORE and a SOP Class of a Composite Image SOP, the assumed role of the DcmStore instance will become that of a STORAGE-SCP server.

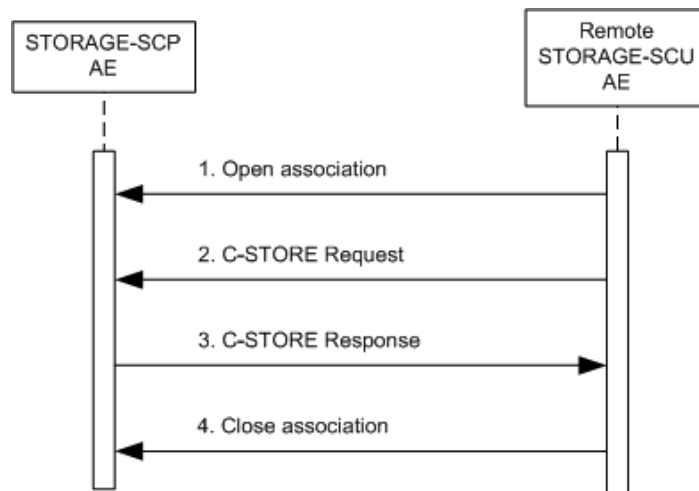


Figure 4.4 - Sequencing of activity: Unsolicited images sent by remote AE

The following sequencing interactions apply to the STORAGE-SCP server for handling C-STORE Requests. Steps 2 and 3 can be repeated for each composite SOP instance.

1. The STORAGE-SCP server accepts an association from the remote STORAGE SCU entity.
2. The remote STORAGE-SCU entity sends a C-STORE-RQ message containing a Composite SOP Instance.
3. The STORAGE-SCP server returns a C-STORE-RSP message to the STORAGE-SCU entity.
4. The STORAGE-SCU entity closes the association.

As shown above (see section 4.1.1) closure of the association is one (configurable) way to indicate completion of the study, and this in turn indicates the last image in that study for CAD processing. However the STORAGE-SCP server can also determine study complete when the study identity changes (which is configurably interpreted as a change in the series or study instance UID), or when there is no activity for this study for more than a configured period of time (see section 4.4.2 below for details on the configurable settings of DcmStore).

4.2.1.4.2.1. Accepted Presentation Contexts

The STORAGE-SCP server accepts the Presentation Contexts shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Digital Mammography X-Ray Image Storage For Processing	1.2.840.10008.5.1.4.1.1.1.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossless Non Hierarchical	1.2.840.10008.1.2.4.57		
		JPEG Lossless Non Hierarchical First Order Prediction	1.2.840.10008.1.2.4.70		
Digital Mammography X-Ray Image Storage For Presentation	1.2.840.10008.5.1.4.1.1.1.2	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		JPEG Lossless Non Hierarchical	1.2.840.10008.1.2.4.57		
		JPEG Lossless Non Hierarchical First Order Prediction	1.2.840.10008.1.2.4.70		

4.2.1.4.2.2. SOP Specific Conformance for SOP Class

The STORAGE-SCP server provides standard conformance as a SCP to the DICOM C-STORE Operation Service defined in Part 7 and the Storage Service Class defined in Part 4 of the DICOM Standard.

The associated activity handled by the STORAGE-SCP server is the storage of the image data received over the network to the local hard disk. The STORAGE-SCP server returns a failure status if it is unable to perform this task.

The STORAGE-SCP has no limit on the number of associations it can accept. However all images transferred over a single association (from open to close) are considered to be part of one study for CAD processing.

The STORAGE-SCP server is Level 0 (local) conformant as a Storage SCP. A subset of the elements are stored in a local database (called the "procedure log") to support subsequent export of the generated CAD report. Refer to the Annex 8.2 for the list of elements that are stored in the procedure log when a composite SOP instance is received.

The behavior for handling a duplicate SOP Instance if it conflicts with an existing SOP Instance UID is to process the new SOP again - as a study is completely received, CAD is processed on it. Thus if the same SOP arrives twice, then likewise, there will be two CAD reports exported.

The average throughput performance has been determined to be approximately 2.5 MBytes per second on a 100-Megabit Ethernet network. Actual performance depends greatly on the performance of the local disk, the number of simultaneous active associations, and the underlying network performance.

The STORAGE-SCP server returns the status codes shown in the following table when sending a C-STORE response.

Service Status	Further Meaning	Error Code	Reason
Success	Success	0	Images received and stored OK
Error	Out of resources	0xA700	Saving of one or more images failed.

4.2.2. SrOutput Application Entity Specification

This subsection specifies the SrOutput application entity.

4.2.2.1. SOP Classes

An instance of the SrOutput Application Entity provides Standard Conformance to the following SOP Classes:

SOP Class Name	SOP Class UID	SCU	SCP
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	yes	no
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	yes	no

4.2.2.2. Association Policies

The following sub-sections describe the Association Establishment and Acceptance policies of an instance of SrOutput.

4.2.2.2.1. General

A SrOutput AE initiates associations to a remote AE. It uses a PDU size of 256K Bytes.

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

Application Context Name	1.2.840.10008.3.1.1.1
--------------------------	-----------------------

4.2.2.2.2. Number of Associations.

Each instance of SrOutput supports a single association at one time, but there can be multiple SrOutput instances in a single CadOne deployment (each instance has a unique AE title and destination AE title and network port).

Maximum number of simultaneous associations per instance	1
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4.2.2.2.3. Asynchronous Nature

Each association from an instance of SrOutput performs a maximum of one transaction at any time - each association is implicitly tied to the transfer of a single "study".

Maximum number of outstanding asynchronous transactions on each association	1
---	---

4.2.2.2.4. Implementation Identifying Information

SrOutput uses the following for Implementation Class UID and implementation version:

Implementation Class UID	1.3.6.1.4.1.29552.1.4
Implementation version name	<i>version string</i>

where the version string is formed as the name of this instance ("SrOutput") with the major.minor version information of the release appended.

4.2.2.3. Association Initiation Policy

Internally to the CadOne, requests to export CAD reports are queued and dispatched sequentially to the identified output instances. The routing of CAD reports to specific output instances is configurable, using an internal rules database. The net result is that any instance of the SrOutput instance class is passed a single output request at a time, and no others until that is completed. There can be several instances of SrOutput, each with different configuration parameters, but from the viewpoint of a single instance (a single configuration), output processing is sequential.

Once an instance of SrOutput receives a request from the CadOne to perform an export, it initiates an association with the configured destination (Storage SCP). Note that SrOutput may re-initiate an association as part of its error recovery procedure (see 4.2.2.3.1.3 below).

4.2.2.3.1. Structured Report generated and exported

A SrOutput instance sends a DICOM CAD Mammography Structured Report to a configured remote SCP AE.

4.2.2.3.1.1. Description and Sequencing of Activities

A SrOutput instance initiates a DICOM association using a command field of C-STORE and a SOP class of a Mammography CAD SR SOP. The assumed role of a SrOutput is a STORAGE-SCU server, as shown below in figure 4.5.

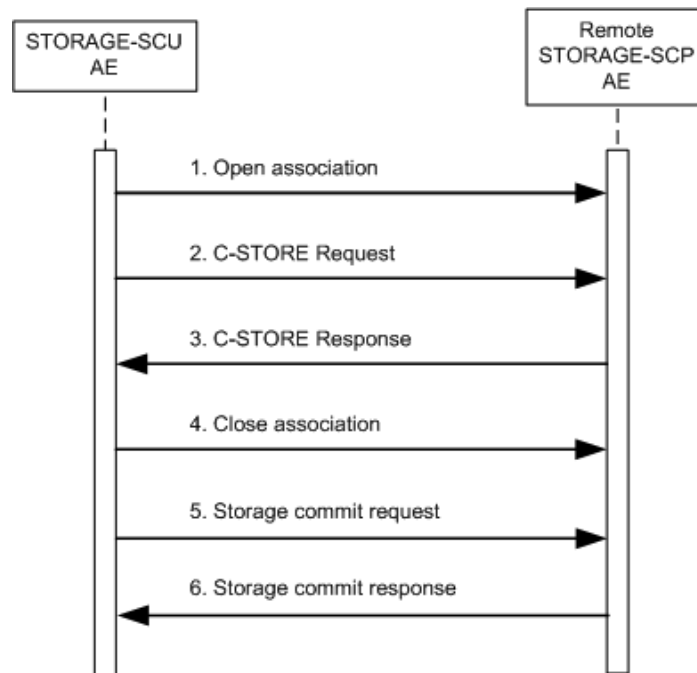


Figure 4.5 - Sequencing of activity: Report sent to a remote AE

The following sequencing interactions are performed by the STORAGE-SCU server when exporting a report:

1. The STORAGE-SCU server opens an association with the remote STORAGE-SCP server.
2. The STORAGE-SCU server sends a C-STORE-RQ message to the STORAGE-SCP server.
3. The STORAGE-SCP server returns a C-STORE-RSP message to the STORAGE-SCU server.
4. The STORAGE-SCU server closes the association.
5. Optionally (this is configurable), SrOutput opens an association with the storage commitment SCP, and sends an N-ACTION request to the SCP.
6. The STORAGE SCP sends an N-EVENT-REPORT request to the SCU, indicating that the ownership of the stored objects can be transferred to it.

4.2.2.3.1.2. Proposed Presentation Contexts

Each time an association is initiated, SrOutput (as a STORAGE-SCU) proposes the following Presentation Contexts:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Storage Commitment Push Model SOP Class	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		

4.2.2.3.1.3. SOP Specific Conformance for Storage SOP Classes

SrOutput handles DICOM error status during export as described in the following table:

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The storage of the structured report to the SCP is considered to have been successful. This association can now be closed by the SCU.
Refused	Out of Resources	A700-A7FF	The storage of the structured report to the SCP is considered to have been unsuccessful, due to a temporary lack of resources. The send will be retried. *
Error	Data Set does not match SOP Class	A900-A9FF	The storage of the structured report to the SCP is considered to have been unsuccessful, and it will not be resent to this destination. This association can now be closed by the SCU.
	Can not understand	C000-CFFF	
Warning	Coercion of Data Elements	B000	The storage of the structured report is considered to have been successful. This association can now be closed by the SCU.
	Data Set does not match SOP Class	B007	The storage of the structured report to the SCP is considered to be complete (whether successful or not cannot be determined by the SCU). This association can now be closed by the SCU.
	Elements Discarded	B006	The storage of the structured report to the SCP is considered to have been successful. This association can now be closed by the SCU.

and low-level failures:

Error condition	Behavior
Timeout expires for an expected DICOM PDU or TCP/IP packet.	An error message is output to the CadOne DICOM service trace log. *
Association A-REJECTed by the SCP.	
Association A-ABORTed by the SCP.	
Network layer indicates communication loss (i.e., low-level TCP/IP socket closure).	

where: * means that the following retry model is followed:

The instance retries the export a configured number of times ("RetryTimes" - see 4.4.2 below), pausing a configured number of seconds ("RetryInterval" - see 4.4.2 below) between retries.

In general, the behavior of SrOutput following a communication failure is to try to re-initiate an association with the remote SCP. The number of retry attempts is configurable.

In addition, SrOutput outputs status and error information into a trace log file that can be used to monitor and diagnose any problems that may arise. If any errors occur during DICOM communication, then appropriate messages are added to the trace log.

4.2.2.3.1.4. SOP Specific Conformance for Storage Commitment SOP Class

4.2.2.3.1.4.1. Storage Commitment Operations (N-ACTION)

if so configured, SrOutput requests storage commitment for instances of the Mammography CAD SR SOP Class if the Remote AE is configured as an archive device and a presentation context for the Storage Commitment Push Model has been accepted.

SrOutput considers Storage Commitment to have failed if no N-EVENT-REPORT is received for a Transaction UID within a configurable time period after receiving a successful N-ACTION response.

SrOutput does not send the optional Storage Media FileSet ID & UID Attributes or the Referenced Study Component Sequence Attribute in the N-ACTION.

The behavior of SrOutput when encountering status codes in an N-ACTION response is summarized in the Table below:

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The storage commitment request is considered successful, and the association can be closed by the SCU.
Resource limitation	Out of Resources	0213	The storage commitment request is considered unsuccessful, the SR will be re-sent to the SCP, and a storage commitment request will be re-issued if the object is stored successful by the SCP.
Others	Others	others	The storage commitment request is considered unsuccessful, the association will be closed, and the SR will not be re-sent and storage commitment request will not be re-tried later.

The behavior of SrOutput during communication failure is summarized in the following table:

Exception	Behavior
Timeout	The commit operation is retried.
Association aborted by the SCP or network layers	The send job is marked as failed.

4.2.2.3.1.4.2. Storage Commitment Notifications (N-EVENT-REPORT)

SrOutput is capable of receiving an N-EVENT-REPORT notification if it has successfully negotiated a Presentation Context for the Storage Commitment Push Model.

Upon receipt of a N-EVENT-REPORT the timer associated with the Transaction UID is canceled.

The behavior of SrOutput when receiving Event Types within the N-EVENT-REPORT is summarized in the Table below:

Event Type Name	Event Type ID	Behavior
Storage Commitment Request Successful	1	The operation is considered to be successful - ownership of the requested SR has passed to the storage provider.
Storage Commitment Request Complete - Failures Exist	2	Only one SR is sent at a time by SrOutput, so the failed sequence contains only that object, and the corresponding reasons and their responses are listed below. In most cases the failure is considered to be permanent, but in the cases of "Resource limitation" and "Duplicate transaction UID" the commitment is retried.

The interpretation and action on specific N-EVENT-REPORT status codes is summarized in the following table:

Service	Further	Error	Interpretation and any action
---------	---------	-------	-------------------------------

Status	Meaning	Code	
Success	Success	0000	The operation is considered to be successful - ownership of the requested SR has passed to the storage provider.
Failure	Processing Failure	0110H	These are considered to indicate a permanent failure, and there is no retry. A message is logged to the system trace.
Failure	No such object instance	0112H	
Failure	Class / Instance conflict	0119H	
Failure	Referenced SOP Class not supported	0122H	
Failure	Resource limitation	0213H	This is considered to be a transient problem, and the commit is retried.
Failure	Duplicate transaction UID	0131H	
Failure		other	This is considered to be a permanent failure, and there is no retry. A message is logged to the system trace.

4.2.2.4. Association Acceptance Policy

4.2.2.4.1. Activity - Receive Storage Commitment Response

4.2.2.4.1.1 Description and Sequencing of Activities

SrOutput accepts associations in order to receive responses to a Storage Commitment Request.

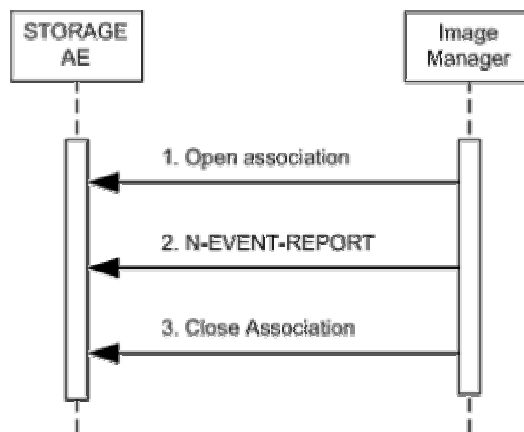


Figure 4.6 - Sequencing of activity: Receive storage commitment response

Where:

1. The remote image manager opens a new association with SrOutput ,
2. The image manager sends a N-EVENT-REPORT request notifying SrOutput of the status of a previous Storage Commitment Request. SrOutput replies with an N-EVENT_REPORT response confirming receipt.
3. The Image Manager closes the association with SrOutput.

4.2.2.4.1.2. Accepted Presentation Contexts

SrOutput accepts the Presentation Contexts shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
Storage Commitment	1.2.840.10008.1.20.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

Push Model		Explicit VR Little Endian	1.2.840.10008.1.2.1	
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SrOutput preferentially selects Explicit VR Little Endian Transfer Syntax if multiple transfer syntaxes are offered. SrOutput 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.

4.2.2.4.1.3. SOP Specific Conformance to Storage Commitment SOP Class

Upon receipt of an N-EVENT-REPORT, the internal timer associated with the transaction UID is canceled. See section 4.2.2.3.1.4 above for detailed explanations of the handling of the commitment status codes.

4.2.2.4.1.4. SOP Specific Conformance for Verification SOP Class

SrOutput provides standard conformance to the Verification SOP Class as an SCP. If the C-ECHO request is successfully received, a 0000 (Success) status code is returned in the C-ECHO response. Otherwise, a C000 (Error - Cannot Understand) status code is returned in the C-ECHO response.

4.3. Network Interfaces

4.3.1. Physical Network Interface

The AE hosted within the CadOne provide DICOM V3.0 TCP/IP Network Communication Support as defined in Part 8 of the DICOM Standard.

The AE inherit their TCP/IP stacks from the computer operating system upon which they execute (the currently supported operating systems are Windows XP, XP x64 and Windows Vista).

4.3.2. Additional Protocols

The AE hosted within the CadOne do not directly utilize support any additional protocols such as DHCP, DNS, NTP or LDAP for communication with other entities. However the system itself may well use these protocols - e.g., the network IP address, domain name, and name lookup are typically configured by default to utilize DHCP and DNS. Similarly, time synchronization may be performed at the operating system level using active directory, or NTP. User authentication (for the service user) may be local to the machine, or resolved using Active Directory. The use of these mechanisms is orthogonal to setup and configuration of the CadOne - those mechanisms are considered to operate at the operating system level, and can be changed independently of the CadOne configuration.

Internally, the CadOne uses additional protocols for communication with other TPS entities. In particular, http is used to communicate with the "procedure log" (which is a local database mechanism that is typically installed on the same machine as CadOne), and the Microsoft Message Queue is used for communication with the TPS CAD Algorithm.

4.4. Configuration

The configuration of CadOne is implemented using a file stored locally within the installed files. The basic configuration is set as part of the install (the installation wizards allow some parameters to be tailored). After installation, a service tool (user interface) is available for changing the configuration. The use of the configuration tool requires login permission for the system, and this is reserved for use only by qualified service personnel.

4.4.1. AE Title/Presentation Address Mapping

Configuration information related to the CadOne application entities is viewed and changed using the "Instances" tab of the service UI. The base system includes two classes (types) of instance - DcmStore, and SrOutput. A typical installation will have a minimum of one instance of each of those two classes, and may have any number of each. Each such instance can have its own unique properties (AE Title, etc).

Each class defines a set of configurable properties, and their default values. A single instance of one such class by default has the same properties, and hence values, as the class. However each instance can specialize - have its own unique values for any property (in fact the reason for having multiple instances is so that some can have different properties). The following sub-sections list the default properties for each instance class - which are also used by a default (single) instance of each.

4.4.1.1. Local AE Titles

The following table lists the default titles and ports used by the basic entities implemented within the instances:

Application Entity	Default AE Title	Default TCP/IP Port
DcmStore	DcmStore	5004
SrOutput	SrOutput	8104

4.4.1.2. Remote AE Title/Presentation Address Mapping

The configurable properties (settable using the service tool's "instances" tab) are summarized below.

4.4.1.2.1. DcmStore

The following DICOM parameters are settable for the DcmStore instance - the listed default values are the settings for the class, and any of those can be over-ridden in any instance of DcmStore:

Parameter	Default	Meaning
SourceAE	*	The AE title of the allowed remote (source) AE. A setting of "*" means that any AE may connect.
AETitle	DcmStore	The AE title of this instance of DcmStore.
Port	5004	The TCP/IP port that this instance of DcmStore uses to listen for new connections.
PDULengthKilo	128	The size in KB of the maximum PDU length that will be negotiated by this instance.

4.4.1.2.2. SrOutput

The following DICOM parameters are settable for the SrOutput instance - the listed default values are the settings for the class, and any of those can be over-ridden in any instance of SrOutput:

Parameter	Default	Meaning
DestinationAE	STORAGE	The AE title of the remote storage provider that will be used to store the CAD reports exported by this instance of SrOutput.
AETitle	SrOutput	The AE title of this instance of SrOutput
DestinationHost	localhost	The host to which this instance of SrOutput will attempt to connect, when it exports a CAD report.
DestinationPort	8104	The TCP/IP port that this instance of SrOutput will use to connect to the remote storage provider when it is exporting a CAD report.
CommitDestinationAE	STORAGE	AE Title for destination storage commitment service
CommitAETitle	SrOutput	AE Title of the SrOutput instance when it performs storage commitment
CommitDestinationHost	localhost	IP address/host name for storage commitment service
CommitDestinationPort	8105	port used to connect to storage commitment service

4.4.2. Parameters

The following table lists the key parameters of this implementation:

Parameter	Configurable (Yes/No)	Default Value
General Parameters		
Time-out waiting for response to TCP/IP connect request (low-level timeout).	no	n/a
Time-out waiting for acceptance of a TCP/IP message over the network (low-level timeout).	no	n/a
Time-out for waiting for data between TCP-IP packets (low-level timeout).	no	n/a
Any changes to default TCP/IP settings, such as configurable stack parameters.	no	n/a
DcmStore Specific Parameters		
AE Title of the DcmStore instance	yes [AETitle]	DcmStore
Listening port	yes [Port]	5004
AE Title for accepted source	yes [SourceAE]	*
The size in KB of the maximum PDU length that will be	yes [PDULengthKilo]	128

negotiated by this instance.		
The default behavior is to use the Series or Study UID (depending on "StudyEndChange") as the study identifier. However it is configurable to have the study identification string instead be the "PatientID", "StudyID", or "AccessionNumber" from that study.	yes [MapCaseID]	no
The number of seconds to wait after an image is received. If this time expires with no new data received, the study is considered to be complete.	Yes [IdleTimeOut]	60 seconds
The name of a configured set of rules to be used to check study tags against (if they do not match, the this association will be rejected).	yes [RuleSet]	all
Consider study to be complete when "Series" or "Study" instance UID changes	yes [CaseEndChange]	Study
Consider study to be complete when the association closes	yes [caseEndWhenAssociationDown]	yes
Allow negotiation of the lossless compression transfer syntaxes.	yes [AllowCompressed]	no
Accept requests to store MG for-processing images.	yes [AcceptMGproc]	yes
Accept requests to store MG for-presentation images.	yes [AcceptMGpres]	no
Accept requests to store DX for-processing images.	yes [AcceptDXproc]	no
Accept requests to store DX for-presentation images.	yes [AcceptDXpres]	no
Accept requests to store CR images.	yes [AcceptCR]	no
Accept requests to store SC images.	yes [AcceptSC]	no
SrOutput Specific Parameters		
AE Title of the SrOutput instance	yes [AETitle]	SrOutput
AE Title for destination storage	yes [DestinationAE]	STORAGE
IP address/host name destination storage	yes [DestinationHost]	localhost
port used to connect to destination	yes [DestinationPort]	8104
Time-out waiting for acceptance or rejection Response to an association Open Request (application level timeout).	no	10 seconds
General DIMSE level time-out values	yes [StorageTimeOut]	10 seconds
Maximum time to wait for a response to a release request.	no	10 seconds
Time between re-connection attempts when there is a communication error.	yes [RetryInterval]	5 seconds
Number of times to retry the send on a communication error.	yes [RetryTimes]	3
Send to storage device using DICOM storage commitment ("yes" or "no")	yes [UseStorageCommit]	no
AE Title of the SrOutput instance when it performs storage commitment	yes [CommitAETitle]	SrOutput
AE Title for destination storage commitment service	yes [CommitDestinationAE]	STORAGE
IP address/host name for storage commitment service	yes [CommitDestinationHost]	localhost
port used to connect to storage commitment service	yes [CommitDestinationPort]	8105
Time-out used when waiting for the N-ACTION response from the storage commitment SCP.	yes [CommitActionTimeOut]	10
Time-out used when waiting for the N-EVENT-REPORT request from the storage commitment SCP.	yes [CommitReportTimeOut]	30

where the names in brackets "[]" are the names of the configuration parameters (which appear on the user interface of the CadOne service tool, where they can be changed).

5. Media Interchange

CadOne does not support media interchange. Internally the DcmStore instance temporarily stores received images as DICOM part-10 files, but no claim is made as to whether they are DICOM compliant.

6. Support of Character Sets

For studies received using DcmStore (Storage SCP), no character processing is performed, and so the received character set is irrelevant.

On output of a CAD structured report using SrOutput (which is a Storage SCU) the character set is specified as "ISO_IR 100".

7. Security

7.1. Security Profiles

CadOne does not implement any of the "Secure Use Profiles" defined in PS 3.15 (section 6.1 and Annex A).

CadOne does not implement any of the "Secure Transport Connection Profiles" as defined in PS 3.15 (section 6.2 and Annex B).

CadOne does not implement the "Digital Signature Profile" as defined in PS 3.15 (section 6.3 and Annex C).

The "Media Storage Security Profiles" as defined in PS 3.15 (section 6.4 and Annex D) are not applicable to the CadOne.

7.2. Association Level Security

Each DcmStore instance can be configured to accept association requests from any calling AE, or only a specifically configured source AE.

The remote AE that is the destination for the storage of a CAD report (via SrOutput) must be configured with an AE Title, port and host name (or IP address).

7.3. Application Level Security

CadOne does not directly provide or support any specific security measures related to DICOM communication. However it is assumed that this service is installed on a secured system within a secured environment. Such an environment minimally includes:

1. Firewall or router protections to ensure that only approved external hosts have network access to the local system.
2. Firewall or router protections to ensure that the local system only has network access to approved external hosts and services.
3. Any communication with external hosts and services outside the locally secured environment uses appropriate secure network channels.

Other network security procedures such as anti-virus protection, or automated intrusion detection may be appropriate in some environments. Additional security features may be established by the local security policy and are beyond the scope of this conformance statement.

8. Annexes

8.1. IOD Contents

8.1.1. Created SOP Instance

SrOutput instances are capable of generating IOD instances. The following subsection details the contents of those (SR) IOD instances.

Abbreviations used in the tables include:

- VNAP Value Not Always Present (attribute sent zero length if no value is present)
- ANAP Attribute Not Always Present
- ALWAYS Always Present with a value
- EMPTY Attribute is sent without a value
- OPT indicates that the module is provided if the image data contains those DICOM tags.

Abbreviations used for the source of the data values in the tables are:

- AUTO the attribute is generated automatically by the CadOne.
- IMAGES the attribute value comes from the received study.
- IS the attribute comes from an information system (this is the local procedure log, which in turn is populated either manually or indirectly using a Modality Worklist query).
- CONFIG the attribute value source is a configurable parameter

8.1.1.1. SrOutput

The SrOutput instance generates IOD that conform to the Mammography CAD SR SOP Class. Those objects are exported to the configured remote storage class providers. The following subsections specify the attributes that are contained in these objects.

The following table summarizes the modules that are present in the created IOD.

IE	Module	Reference	Presence of Module
Patient	Patient	8.1.1.1.1	ALWAYS
	Specimen Identification	8.1.1.1.2	ANAP
	Clinical Trial Subject	8.1.1.1.3	ANAP
Study	General Study	8.1.1.1.4	ALWAYS
	Patient Study	8.1.1.1.5	ALWAYS
	Clinical Trial Study	8.1.1.1.6	ANAP
Series	SR Document Series	8.1.1.1.7	ALWAYS
	Clinical Trial Series	8.1.1.1.8	ANAP
Equipment	General Equipment	8.1.1.1.9	ALWAYS
Document	SR Document General	8.1.1.1.10	ALWAYS
	SR Document Content	8.1.1.1.11	ALWAYS
	SOP Common	8.1.1.1.12	ALWAYS

8.1.1.1.1. Patient Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	Passed to output without interpretation from	VNAP	IMAGES
Patient ID	(0010,0020)	LO		VNAP	IMAGES

Patient's Birth Date	(0010,0030)	DA	the received value.	VNAP	IMAGES
Patients Sex	(0010,0040)	CS		VNAP	IMAGES

8.1.1.1.2. Specimen Identification

Attribute Name	Tag	VR	Value	Presence of Value	Source
Specimen Accession Number	(0040,050A)	LO	Passed to output without interpretation from the received value.	ANAP	IMAGES

8.1.1.1.3. Clinical Trial Subject

Attribute Name	Tag	VR	Value	Presence of Value	Source
Clinical Trial Sponsor Name	(0012,0010)	LO	Passed to output without interpretation from the received value.	ANAP	IMAGES
Clinical Trial Protocol ID	(0012,0020)	LO		ANAP	IMAGES

8.1.1.1.4. General Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	Passed to output without interpretation from the received value.	ALWAYS	IMAGES
Study Date	(0008,0020)	DA		VNAP	IMAGES
Study Time	(0008,0030)	TM		VNAP	IMAGES
Study ID	(0020,0010)	SH		VNAP	IMAGES
Accession number	(0008,0050)	SH	Passed on if present in the source images.	VNAP	IMAGES
Referring physician's name	(0008,0090)	PN		VNAP	IMAGES
Referring Physician Identification Sequence	(0008,0096)	SQ		ANAP	IMAGES

8.1.1.1.5. Patient Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Admitting Diagnoses Description	(0008,1080)	LO	Passed on if present in the source images.	ANAP	IMAGES
Admitting Diagnoses Code Sequence	(0008,1084)	SQ		ANAP	IMAGES

8.1.1.1.6. Clinical Trial Study Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Clinical Trial Time Point ID	(0012,0050)	LO	Passed on if present in the source images.	ANAP	IMAGES

8.1.1.1.7. SR Document Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	SR	ALWAYS	AUTO
Series Instance UID	(0020,000E)	UI	a new UID created for this series instance	ALWAYS	AUTO

8.1.1.1.8. Clinical Trial Series Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Clinical Trial Coordinating Center Name	(0012,0060)	LO	Passed on if present in the source images.	ANAP	IMAGES

8.1.1.1.9. General Equipment Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	"Three Palm Software"	ALWAYS	AUTO
Software version	(0018,1020)	LO	"CadOne x.y.zzzz"	ALWAYS	AUTO

8.1.1.1.10. SR Document General Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	1	ALWAYS	AUTO
Completion Flag	(0040,A491)	CS	"PARTIAL"	ALWAYS	AUTO
Verification Flag	(0040,A493)	CS	"UNVERIFIED"	ALWAYS	AUTO
Content Date	(0008,0023)	DA	Date and time at which the CAD report is generated	ALWAYS	AUTO
Content Time	(0008,0033)	TM		ALWAYS	AUTO
Performed Procedure Code Sequence	(0040,A372)	SQ	Currently no value set.	EMPTY	AUTO
Current Requested Procedure Evidence Sequence	(0040,A375)	SQ	Full set of Composite SOP Instances created to satisfy the current Requested Procedure (s) for which this SR Document is generated.	ALWAYS	AUTO
>Referenced Series Sequence	(0008,1115)	SQ	Contains references to all images processed by CadOne	ALWAYS	AUTO
>> Study Instance UID	(0020,000D)	UI	Unique identify for the study of the images and the SR	ALWAYS	IMAGES
>>Referenced SOP Sequence	(0008,1199)	SQ	Sequence of Repeating Items where each Item includes the Attributes of a Series containing referenced Composite Object(s).	ALWAYS	AUTO
>>> Referenced SOP Class UID	(0008,1150)	UI	UID of the referenced Digital Mammography X-ray Storage class: 1.2.840.10008.5.1.4.1.1.1.2 or 1.2.840.10008.5.1.4.1.1.1.2.1	ALWAYS	IMAGES
>>> Referenced SOP Instance UID	(0008,1155)	UI	SOP Instance UID of the referenced Digital Mammography Image instance	ALWAYS	IMAGES
>> Series Instance UID	(0020,000E)	UI	UID of the series to which the referenced image belongs	ALWAYS	IMAGES

8.1.1.1.11. SR Document Content Module

The SrOutput instance of the TPS CadOne implements the Mammography CAD SR IOD using Template ID 4000 (DICOM Part 16). The Image Library references all MG images processed for a single study. Single image findings are reported, including Calcification Clusters, Densities, and Breast Geometry outlines. Detections and Analyses are not included in this report.

Attribute Name	Tag	VR	Value	Presence of Value	Source
Value Type	(0040,A040)	CS	"CONTAINER"	ALWAYS	AUTO
Concept Name Code Sequence	(0040,A043)	SQ	(111036, DCM, Mammography CAD Report)	ALWAYS	AUTO
Continuity of Content	(0040,A050)	CS	"SEPARATE"	ALWAYS	AUTO
Content Template Sequence	(0040,A504)	SQ	Template that describes the content of this Content Item.	ALWAYS	AUTO

>Mapping Resource	(0008,0105)	CS	"DCMR"	ALWAYS	AUTO
> Template Identifier	(0040,DB00)	CS	"TID 4000"	ALWAYS	AUTO
Content Sequence	(0040,A730)	SQ	Contains the details of the SR information	ALWAYS	AUTO
>Relationship Type	(0040, A010)	CS	HAS CONCEPT MOD	ALWAYS	AUTO
> Value Type	(0040, A040)	CS	CODE	ALWAYS	AUTO
> Concept Name Code Sequence	(0040,A043)	SQ	(121049, DCM, Language of Content Item and Descendants)	ALWAYS	AUTO
> Concept Code Sequence	(0040,A168)	SQ	(eng, RFC3066, English)	ALWAYS	AUTO
>Relationship Type	(0040,A010)	CS	CONTAINS	ALWAYS	AUTO
> Value Type	(0040,A040)	CS	CONTAINER	ALWAYS	AUTO
>> Concept Name Code Sequence	(0040,A043)	SQ	(111028, DCM, Image Library)	ALWAYS	AUTO
<i>Details from Template ID 4020</i>					
>Relationship Type	(0040,A010)	CS	CONTAINS	ALWAYS	AUTO
> Value Type	(0040,A040)	CS	CODE	ALWAYS	AUTO
>> Concept Name Code Sequence	(0040,A043)	SQ	(111017, DCM, CAD Processing and Findings Summary)	ALWAYS	AUTO
<i>Details of Template IDs 4002 and 4003</i>					
>Relationship Type	(0040,A010)	CS	CONTAINS	ALWAYS	AUTO
> Value Type	(0040,A040)	CS	CODE	ALWAYS	AUTO
>> Concept Name Code Sequence	(0040,A043)	SQ	(111064, DCM, Summary of Detections)	ALWAYS	AUTO
>> Concept Code Sequence	(0040,A168)	SQ	(111222, DCM, Succeeded) or (111224, DCM, "Failed")	ALWAYS	AUTO
>Relationship Type	(0040,A010)	CS	CONTAINS	ALWAYS	AUTO
> Value Type	(0040,A040)	CS	CODE	ALWAYS	AUTO
>> Concept Name Code Sequence	(0040,A043)	SQ	(111065, DCM, Summary of Analyses)	ALWAYS	AUTO
>> Concept Code Sequence	(0040,A168)	SQ	(111225, DCM, Not Attempted)	ALWAYS	AUTO

Note that this follows Mammography CAD Report root template TID 4000. The following templates from DICOM Part 16 are implemented:

- 4000,
- 4001,
- 4003,
- 4006,
- 4008,
- 4015,
- 4017,
- 4019,
- 4020, and
- 4021

8.1.1.1.12. SOP Common Module

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UID	1.2.840.10008.5.1.4.1.1.88.50	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UID	< a new UID created for this instance >	ALWAYS	AUTO
Specific					

Character Set	(0008,0005)	CS	"ISO_IR 100"	ALWAYS	AUTO
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8.1.2. Usage of Attributes from received IODs

The CadOne system utilizes the following attributes from the images received (by an instance of the DcmStore instance):

Module	Attribute Name	Tag ID	Type	Significance
General series	Modality	(0008,0060)	1	Only studies of type MG are accepted and processed (see 4.2.1.1 above).
	Series Instance UID	(0020,000E)	1	Used internally to identify each study that is processed.
DX Positioning	View Code Sequence	(0054,0220)	3	Used for the interpretation of the images in the CAD processing for the study.
DX Detector	Imager Pixel Spacing	(0018,1164)	1	
Mammography Image	Image Laterality	(0020,0062)	1	
	Implant Present	(0028,0013)	3	
Image Pixel	Samples per pixel	(0028,0002)	1	
	Photometric Interpretation	(0028,0004)	1	
	Rows	(0028,0010)	1	
	Columns	(0028,0011)	1	
	Bits Allocated	(0028,0100)	1	
	Bits Stored	(0028,0101)	1	
	High Bit	(0028,0102)	1	
	Pixel Representation	(0028,0103)	1	
	Pixel Data	(7FE0,0010)	1	

8.1.3. Attribute Mapping

CadOne (in particular the DcmStore and SrOutput instances) does not utilize any external protocols such as HL7, so the mapping of attributes is not applicable (except as already described above).

8.1.4. Coerced/Modified fields

The following table lists attributes whose value may be modified on export from SrOutput- i.e., the element may have a different value in the exported structured report compared to the corresponding element in a received image object.

Module	Attribute Name	Tag ID	Coercion conditions
SR General content Module	Content Date	(0008,0023)	These are set as the the date and time when the SR is created.
	Content Time	(0008,0033)	
General Series Module	Series instance UID	(0020,000e)	The result of the CAD processing is a new series for the mammography study, and so a new series instance UID is generated to uniquely identify this series.
	Series number	(0020,0011)	The series number is generated as an increment of one on the series number of the input study.
	Modality	(0008,0060)	The modality of the structured report is set as "SR".
General Equipment Module	Manufacturer	(0008,0070)	This is the manufacturer of the system that creates the structured report - so it is set to "Three Palm Software".
	Software version	(0018,1020)	This is set as the version of the CadOne software that generates the SR from the CAD report.
SOP Common Module	SOP class UID	(0008,0016)	This is the SOP class for the mammography CAD structured report, and so it is set to the value "1.2.840.10008.5.1.4.1.1.88.50".
	SOP instance UID	(0008,0018)	This is a created SR, and so it is a new SOP instance. A new SOP instance UID is created to uniquely identify this SOP instance.
	Instance number	(0020,0013)	The instance number of this created SR is set to "1".

8.2. Data Dictionary of Private Attributes

CadOne (in particular the SrOutput instance) does not place any private attributes in the created SOP Instances.

8.3. Coded Terminology and Templates

Support for Coded Terminology and templates is described in the following sub-sections.

8.3.1. Context Groups

The Context Groups defined in DICOM PS 3.16 are used.

No additional Codes or Controlled Terminology are used in CadOne.

No private context groups are used in CadOne.

8.3.2. Template Specifications

No extensions to templates are used in CadOne.

No private templates are used in CadOne.

8.3.3. Private Code definitions

No private codes are used in CadOne.

8.4. Grayscale Image Consistency

There is no support for the DICOM Grayscale Standard Display function in the CadOne.

8.5. Standard Extended/Specialized/Private SOP Classes

CadOne does not support any Specialized or Private SOP Classes.

8.6. Private Transfer Syntaxes

CadOne does not implement any private Transfer Syntaxes.