Sonovision DICOM Conformance Statement

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REVISION HISTORY

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1.0	February 15, 2011	Muhammad Shafiq	Review the document

1 Contents

2 Introduction

This chapter provides general information about the purpose, scope and contents of this Conformance Statement.

It shall establish the conformance specifications for the Sonovision system only, and does not apply to other products offered by Peridot Technologies.

2.1 DICOM and Sonovision Software

The DICOM 2008 standard provides a well-defined set of structures and protocols that allow inter-operability of a wide variety of medical imaging devices.

The Sonovision application supports querying a remote SCP systems (i.e. PACS Server or DICOM Server) for a list of DICOM objects that may then be retrieved to the Sonovision and displayed, in the case of images. It also supports sending locally acquired, captured or loaded studies across the network to another system (i.e. PACS Server or DICOM Server). Only hierarchical study root query and retrieval is supported for both SCP and SCU query operations.

The application is capable of storing, retrieving and displaying:

- All image storage SOP Classes defined as of DICOM 2008, including multi-frame Study.
- Images of Both ***MONOCHROME2*** *and* ***RGB*** photometric interpretation.
- Images compressed with the Explicit VR Little Endian Transfer Syntaxes.
- Key object selection documents containing image entries
- Grayscale softcopy presentation states and color softcopy presentation states for images in a key object selection document.

This document is written with respect to the adopted portions of the DICOM 2008 standard. The following sections of this document follow the outline specified in the DICOM Standard NEMA publication PS3.2.

2.2 Audience

This Conformance Statement is intended for:

1. Customers (Potential).
2. System integrators of medical equipment.
3. Marketing staff interested in system functionality.
4. Software designers implementing DICOM interfaces.

2.3 Definitions, terms, and abbreviations

- **AE - A**pplication **E**ntity - The program (SONOVISIONAE) which implements DICOM.
- **DICOM -** The **D**igital **I**maging and **C**ommunications in **M**edicine standard. DICOM files on the media.
- **Association Establishment -** An Association Establishment is the first phase of communication between two DICOM Application Entities (AEs). The AEs use the Association Establishment to negotiate how data will be encoded and the type of data to be exchanged.
- **Called Application Entity Title** - The Called AE Title defines the intended receiver of an Association.
- **Calling Application Entity Title** - The Calling AE Title defines the requestor of an Association.

- **Information Object Definition (IOD)** - An IOD is the data model which is an abstraction of the real-world information. This data model defines the nature and attributes relevant to the class of real-world objects represented.
- **Service Class Provider (SCP)** - A SCP plays the **server** role to perform operations and invoke notifications during an Association. An example of a Storage Class Provider would be an image storage device. In this case, the image storage device is storing the image that was sent by a Service Class User.
- **Service Class User (SCU)** - A SCU plays the **client** role to invoke operations and perform notifications during an Association. An example of a SCU would be an image acquisition device. In this case, the image acquisition device will create and send DICOM image by requesting that a SCP store the image.
- **Service/Object Pair (SOP) Class** - A SOP Class is defined by the union of an Information Object Definition and set of DIMSE Services. A DICOM Application Entity may support one or more SOP Classes. Each SOP Class is uniquely identified by a SOP Class UID.
- **SOP Instance** - A specific occurrence of an Information Object.
- **Transfer Syntax** – The Transfer Syntax is a set of encoding rules that allow DICOM Application Entities to negotiate the encoding techniques (e.g. data element structure, byte ordering, compression) they are able to support. The Transfer Syntax is negotiated during Association Negotiation.
- **Unique Identifier (UID)** – A UID is a globally unique, ISO compliant. ASCII – numeric string. It guarantees uniqueness across multiple countries, sites, vendors and equipment.
- **DIMSE - D**ICOM **M**essage **S**ervice **E**lement Media - the storage media – hard disk
- **NEMA - N**ational **E**quipment **M**anufacturer's **A**ssociation
- **PDU - P**rotocol **D**ata **U**nit
- **RWA - R**eal **W**orld **A**ctivity
- **TCP/IP - T**ransmission **C**ontrol **P**rotocol/**I**nternet **P**rotocol
- **MWL - M**odality **W**ork **L**ist

3 Implementation Model

3.1 Application Data Flow

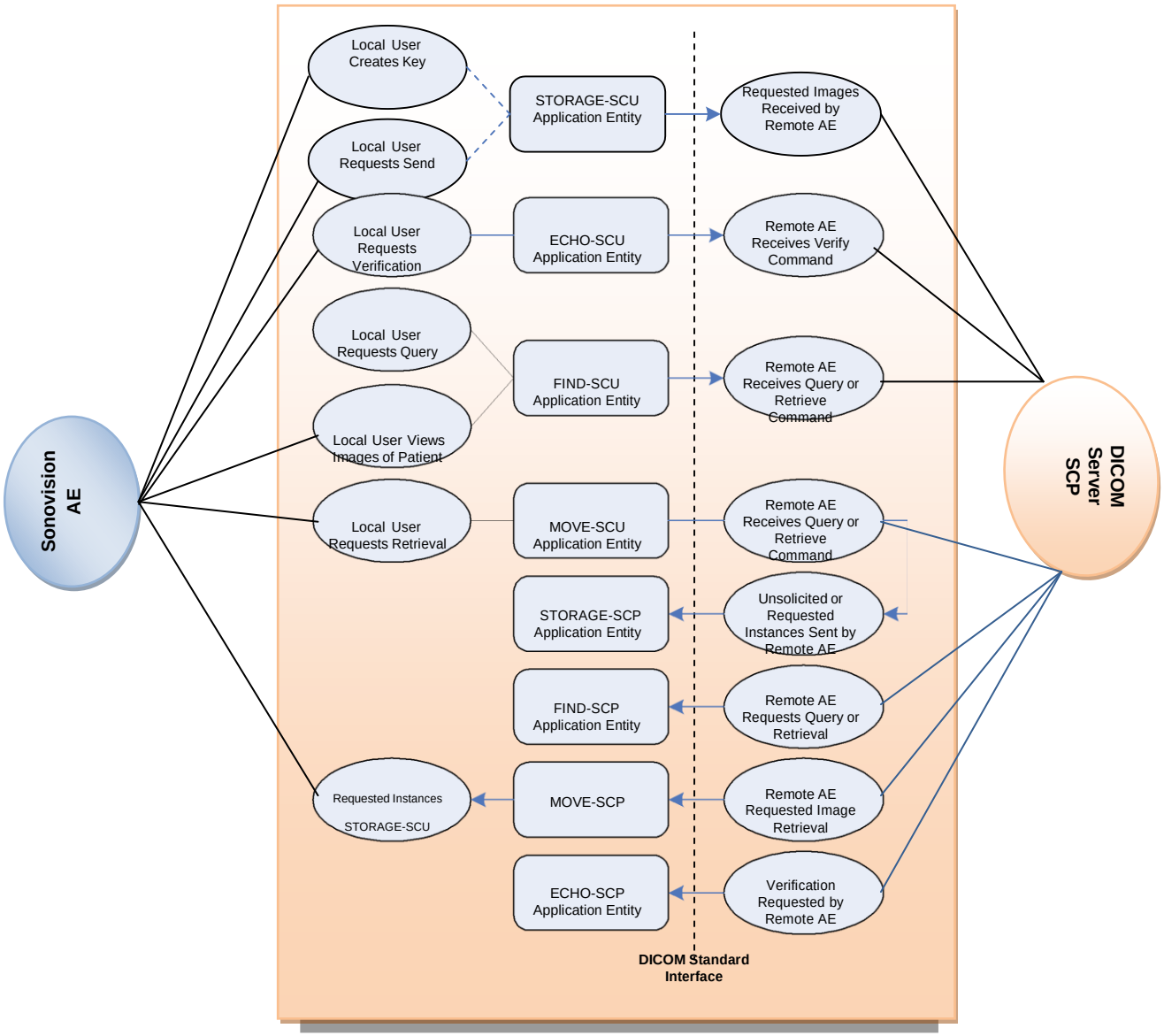

Figure 3.1-1 Implementation Model

The application is a .NET application that provides a user interface, internal database and network listener that spawns additional threads as necessary to handle incoming connections, as well as limited media support.

Conceptually, the network services may be modeled as the following separate AEs, though in fact all the AEs share a single (configurable) AE Title:

- ECHO-SCP, which responds to verification requests
- ECHO-SCU, which sends a verification request
- STORAGE-SCP, which receives incoming composite instances
- STORAGE-SCU, which sends outbound composite instances
- FIND-SCP, which receives incoming queries for lists of studies
- FIND-SCU, which queries remote AEs for lists of studies
- MOVE-SCP, which responds to requests for studies
- MOVE-SCU, which retrieves selected studies

3.1.1 Functional Definitions of AEs

3.1.1.1 ECHO-S CP

ECHO-SCP waits in the background for connections, will accept associations with Presentation Contexts for the SOP Class of the Verification Service Class, and will respond successfully to echo requests.

3.1.1.2 ECHO-SCU

ECHO-SCU is activated through the user interface when a user selects a remote AE to verify (from a pre-configured list), then initiates a verification.

3.1.1.3 STORAGE-SCP

STORAGE-SCP waits in the background for connections, will accept associations with Presentation Contexts for SOP Classes of the Storage Service Class, and will store the received instances to the local database where they may subsequently be listed and viewed through the user interface.

3.1.1.4 STORAGE-SCU

STORAGE-SCU is typically activated through the user interface when a user selects studies from the local database or acquires study from connected modality and requests that they be sent to a remote AE (selected from a pre-configured list). STORAGE-SCU can also be activated internally when a user closes a viewed study and there are pending images marked as key objects. Softcopy presentation states created at the time the images were marked as key objects are referenced alongside the source images to create a key object selection document. The key object selection document and any softcopy presentation states are sent to remote AE(s) marked as "Default" in the configuration or user selected remote AE(s) from menu.

3.1.1.5 FIND-SCP

FIND-SCP waits in the background for connections, will accept associations with Presentation Contexts for the SOP Class of the Study Root Query/Retrieve Information model – FIND Service Class, and will respond successfully to query requests.

3.1.1.6 FIND-SCU

FIND-SCU is typically activated through the user interface when a user selectss a remote AE to query (from a pre-configured list), then initiates a query. FIND-SCU can also be activated internally when a user opens a study for viewing and there is at least one remote AE marked as a "Default" in the configuration. A query is initiated to list prior studies related to the current patient(s) being viewed.

3.1.1.7 MOVE-SCP

MOVE-SCP waits in the background for connections, will accept associations with Presentation Contexts for the SOP Class of the Study Root Query/Retrieve Information Model – MOVE Service Class, and will respond successfully to move requests by initiating storage of instances to the remote AE.

3.1.1.8 MOVE-SCU

MOVE-SCU is activated through the user interface when a user selects a study for retrieval. A connection to the remote AE is established to initiate the retrieval

3.1.2 Sequencing of Real-World Activities

All SCP activities are performed asynchronously in the background and are not dependent on any sequencing. All SCU activities are initiated through the user interface with the following exceptions:

- STORAGE-SCU is also initiated internally by both MOVE-SCP and a Send Key Object Selection operations.
- FIND-SCU is also initiated internally by a Query for Prior Studies operation.

ECHO-SCU and FIND-SCU activities are typically synchronous and blocking except when FIND-SCU is invoked as a Query for Prior Studies operation, in which case it is asynchronous and non-blocking. STORAGE-SCU and MOVE-SCU activities are asynchronous and non-blocking.

4 Application Entity Specifications

The Sonovision AE provide Standard Conformance to the following DICOM 2008 SOP

SOP classes supported by Sonovision

SOP Class Name	SOP Class UID
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1

4.1 Association Establishment Policies

The Sonovision AE uses TCP/IP. The Maximum Length PDU negotiation is included in all association establishment requests.

MAXIMUM PDU SIZE

Maximum PDU size received	114kB (approximate)

4.1.1 Number of Associations

NUMBER OF ASSOCIATIONS

Maximum number of simultaneous associations	One

4.1.2 Asynchronous Nature

Sonovision will only allow a single outstanding operation on an Association. Therefore, Sonovision will not perform asynchronous operations window negotiation.

4.1.3 Implementation Identifying Information

DICOM IMPLEMENTATION CLASS AND VERSION

Implementation Class UID	1.2.276.0.7230010.3.5.4
Implementation Version Name	Sonovision_2

4.2 Association Acceptance Policy

When Sonovision accepts an association, it will respond to echo requests. The association will be rejected if:

- The Called AE Title does not match the AE Title shared by all the SCPs of the application.
- The Calling AE Title is not in the application's pre-configured list.

4.2.1 Application Entity Title

The default AE Title used is "SONOVISIONAE" but this can be modified in the DICOM Server Setting under Configuration Screen.

4.2.2 Activity – Receive Request

4.2.2.1 Description and Sequencing of Activities

As requests are received, they are responded to immediately.

4.2.2.2 Accepted Presentation Contexts

ACCEPTABLE PRESENTATION CONTEXTS AND RECEIVE REQUEST

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
Verification	1.2.840.10008.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None

4.2.2.3 Extended Negotiation

No extended negotiation is performed.

4.2.2.4 SOP Specific Conformance

4.2.2.4.1 SOP Specific Conformance to Verification SOP Class

Sonovision provides standard conformance to the Verification Service Class.

4.2.2.4.2 Presentation Context Acceptance Criterion

Sonovision will only accept a Presentation Context compatible with the one listed in above Table.

4.2.2.4.3 Transfer Syntax Selection Policies

Sonovision will select the first Transfer Syntax proposed by the client that is supported by the SCP, per Presentation Context.

Sonovision will accept duplicate Presentation Contexts; that is, if it is offered multiple Presentation Contexts, each of which offers acceptable Transfer Syntaxes, it will accept all Presentation Contexts, applying the same method for selecting a Transfer Syntax for each.

4.3 Required and optionally applied Attributes

The following table denotes the attributes included in the Ultrasound Image Object as implemented in the Sonovision AE. Attributes not listed are not used.

The following tables use a number of abbreviations. The abbreviations used in the "Presence of Module" column are:

- ALWAYS: Module is always present

The abbreviations used in the "Presence of Value" column are:

- ALWAYS: Attribute is always present with a non-zero-length value
- ANAP: Attribute is not always present
- EMPTY: Attribute is included without a value
- NEVER: Attribute is never included
- VNAP: Value not always present (attribute sent zero-length if no value)

The abbreviations used in the "Source" column are:

- AUTO: The attribute value is generated automatically, or indirectly from previous user input
- COPY: The attribute value is copied verbatim from the referenced SOP instances
- USER: The attribute value is taken directly from user input

PATIENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN	From Referenced Image(s)	ANAP	COPY
Patient ID	(0010,0020)	LO	From Referenced Image(s)	ANAP	COPY
Issuer of Patient ID	(0010,0021)	LO	From Referenced Image(s)	ANAP	COPY
Patient's Birth Date	(0010,0030)	DA	From Referenced Image(s)	ANAP	COPY
Patient's Sex	(0010,0040)	CS	From Referenced Image(s)	ANAP	COPY
> Include 'SOP Instance Reference Macro'					
> Patient ID	(0010,0020)	LO	From Referenced Image(s)	ANAP	COPY
Patient Comments	(0010,4000)	LT	From Referenced Image(s)	ANAP	COPY
Patient Species Description	(0010,2201)	LO	From Referenced Image(s)	ANAP	COPY
> Include 'Code Sequence Macro'			*No Baseline Context ID is defined.*		

GENERAL STUDY MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	From Referenced Image(s)	ANAP	COPY
Study Date	(0008,0020)	DA	From Referenced Image(s)	ANAP	COPY
Study Time	(0008,0030)	TM	From Referenced Image(s)	ANAP	COPY
Referring Physician's Name	(0008,0090)	PN	From Referenced Image(s)	ANAP	COPY
> Include 'Person Identification Macro'					
Study ID	(0020,0010)	SH	From Referenced Image(s)	ANAP	COPY
Accession Number	(0008,0050)	SH	From Referenced Image(s)	ANAP	COPY
Study Description	(0008,1030)	LO	From Referenced Image(s)	ANAP	COPY
Modality	(0080,0060)	CS	US	ALWAYS	AUTO

GENERAL EQUIPMENT MODULE OF CREATED SOP INSTANCES

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Peridot tech	ALWAYS	AUTO
Manufacturer's Model Name	(0008,1090)	LO	Sonovision	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO	Not Included	NEVER	AUTO
Software Versions	(0018,1020)	LO	Version of Sonovision software	ALWAYS	AUTO
Institution Name	(0008,0080)	LO	Configuration listed	NEVER	AUTO
Institution Address	(0008,0081)	ST	Configuration listed	NEVER	AUTO
Institutional Department Name	(0008,1040)	LO	Not Included	NEVER	AUTO
Station Name	(0008,1010)	SH	Computer Name	NEVER	AUTO

4.4 Communication Profiles

4.4.1 Supported Configuration Stacks

The SONOVISIONAE provides DICOM 2008 TCP/IP Network Communication Support as defined in PS 3.8.

4.4.2 TCP/IP Stack

The SONOVISIONAE inherits the TCP/IP stack from the Windows operating system upon which it executes. Port number 104 is used as a default for DICOM communication but can be configured to use any port.

4.4.3 Physical Network Interface

The application is indifferent to the physical medium over which TCP/IP executes; which is dependent on the underlying operating system and hardware.

4.4.4 Additional Protocols

When host names rather than IP addresses are used in the configuration properties to specify presentation addresses for remote AEs, the application is dependent on the name resolution mechanism of the underlying operating system.

4.5 CONFIGURATION

All configuration of the application is performed through the use of Configuration Menu.

4.5.1 Called AE Title/Presentation Address Mapping

The DICOM Server AE Title “Called AE” of the remote system is configurable in the DICOM server Setting Screen. The mapping of the logical name by which remote AEs are described (AE Title, IP address and port number) is configurable in the DICOM server Setting Screen. The user can be defined multiple DICOM Servers Information. The selected DICOM Server AE title is marks as “Default” SERVER.

4.5.2 Calling AE Title/Port

The DICOM Client AE Title “Calling AE” of the local Application is configurable in the DICOM server Setting Screen. The Port number 104 is used as a default for DICOM communication but can be configured to use any port. If Application is Mark as DICOM Server SCP then port number must be other then 104. The “SONOVISIONAE” is used as default for DICOM communication but can be configured to use any AE title but it should be same as described in Remote System.

4.5.3 Sonovision SCP Configuration

The Sonovision can be configured as DICOM SCP store. The user can configure the storage type by selecting checkbox “Set as DICOM server (SCP)” at Configuration →DICOM Server Setting Screen. The default value is DICOM Client (SCU)”.