

DICOM Conformance Statement

Application Annex:

VMS+

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1. Overview

The following DICOM Conformance Statement describes Ventripoint Medical System (VMS+) operation with respect to DICOM implementation for inter-operability with other DICOM based systems.

1.1. Network Services

| SOP Classes | User of Service (SCU) | Provider of Service (SCP) |
|--------------------------------------|-----------------------|---------------------------|
| Transfer | | |
| Secondary Capture Image Storage | YES | YES |
| Encapsulated Pdf Storage | YES | YES |
| Ultrasound Multi Frame Image Storage | YES | YES |
| MR Image Storage | YES | YES |

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2. Introduction

VMS+ is a Windows client application platform composed of Software and Hardware sub-systems. It attaches to 2D ultrasound machines; records cine loops and produces 3D reconstruction results. VMS+ can be configured to operate at different capacities as follows:

- Console – computer system with image acquisition and analysis.
- Workstation - Software only for analysis to be installed on a computer running Microsoft Windows.

Installations may be configured optionally to permit sending VMS+ studies to DICOM PACS servers for further storage and analysis.

2.1. Intended Audience

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standards and with the terminology and concepts.

2.2. Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication between Ventripoint, Inc. and other vendors' Medical equipment.

2.3. Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard.

Abbreviations and terms are as follows:

| AE | DICOM Application Entity |
|-------------|---|
| AET | Application Entity Title |
| ASCE | Association Control Service Element |
| DICOM | Digital Imaging and Communications in Medicine |
| FSC | File-Set Creator |
| FSU | File-Set Updater |
| FSR | File-Set Reader |
| GUI | Graphical User Interface |
| IOD | Information Object Definition |
| ISO | International Standard Organization |
| LOINC | Logical Observation Identifiers Names and Codes |
| MAC Address | Ethernet address of NIC |
| NIC | Network Interface Card |
| PACS | Picture Archiving and Communication System |

| | |
|-----|---|
| PDF | Adobe Acrobat PDF Document |
| SCU | DICOM Service Class User (DICOM client) |
| SCP | DICOM Service Class Provider (DICOM server) |
| SOP | DICOM Service-Object Pair |
| US | Ultrasound |

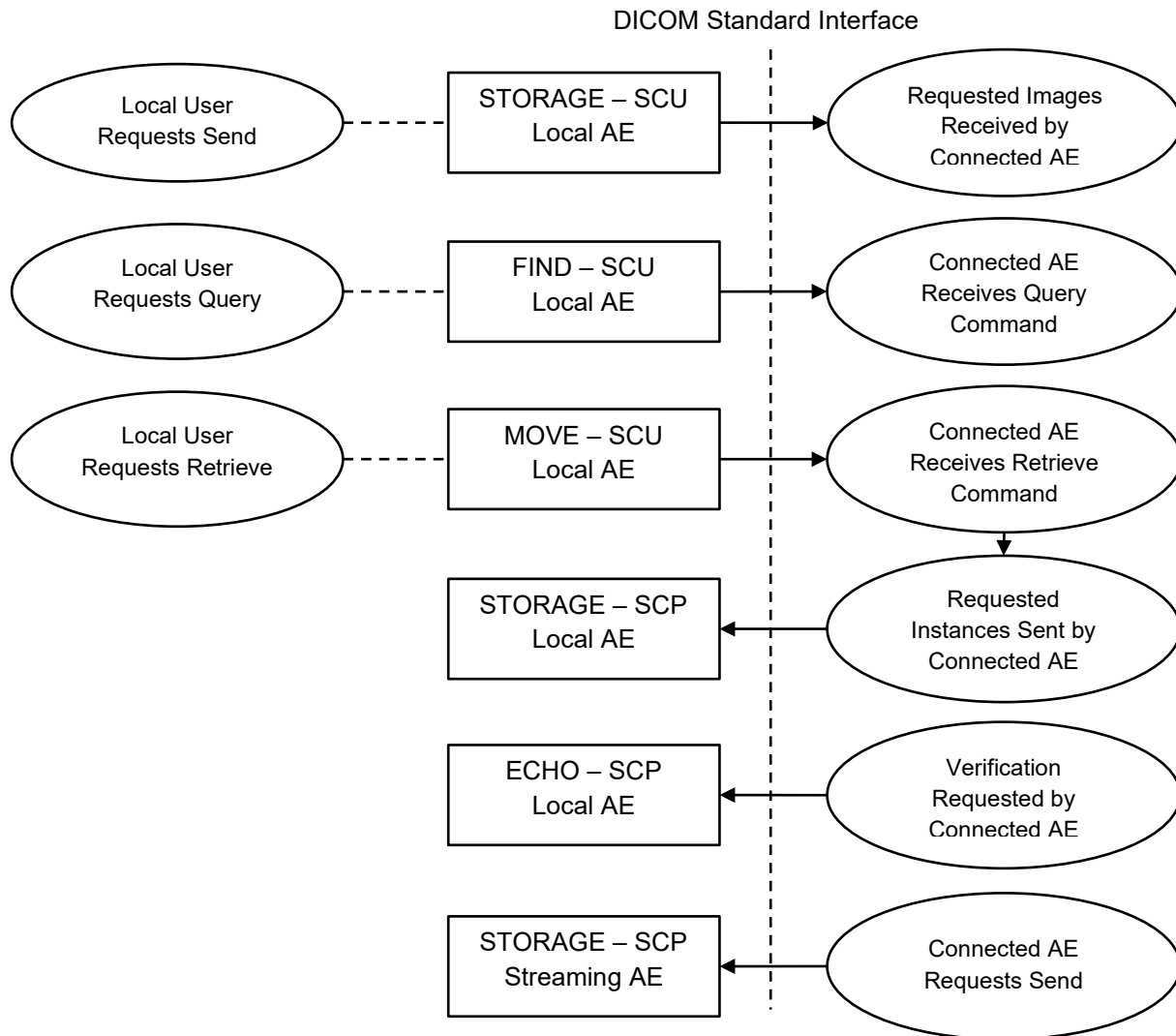
2.4. References

- [DICOM] Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-3.18, 2006

3. Networking

3.1. Implementation Model

3.1.1. Application Data Flow



The **Storage Application Entity** can be either the acquisition console or the workstation and sends **Images** and **Report information** to a remote AE. It is associated with the local real-world activity “Send to PACS” or “Get from PACS”. Sending of images may occur automatically when configured to do so by setting the Send after Study Acquisition is complete or by initiate a “Send to PACS” from the Study screen. Any calculations that are performed are sent automatically with the study.

There are several available mechanisms for importing images acquired on other devices, including Ultrasound images and images of other modalities:

- When configured, images may be retrieved using the Query/Retrieve service
- DICOM images may be imported directly from local media

- DICOM images may be pushed onto the VMS+ by another Storage SCU device. This could be an Ultrasound machine capturing images in an exam room or another source.

The network services are modelled as the following:

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

3.1.2. Functional Definition of AEs

3.1.2.1. Functional Definition of Local AE

When VMS+ is configured to enable “Send to PACS”, VMS+ will expose the corresponding button on the Study List. The following sequence describes the set of actions associated with “Send to PACS” command:

- VMS+ Sends and receives a C-ECHO Verification command to PACS to ensure connectivity. Operation is aborted if failure is detected and a message is presented.
- The requested study is converted to DICOM according to this specification.
- The DICOM-encoded study is stored on the hard-disk in a staging area.
- The staged DICOM study folder file-set is sent to the configured PACS server.
- The staged directory is deleted.

3.1.2.2. Functional Definition of Streaming AE

When VMS+ is configured as a console the Streaming AE runs as an SCP. The Streaming AE 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 system where they may subsequently be imported into the Ventripoint study format.

3.1.3. DICOM Encoding Map for VMS+ Information

VMS+ Studies will be converted into DICOM format exposing VMS+ study information as follows. Users will have access to VMS+ study information as follows:

| What | Where |
|--|-----------------------------|
| Equipment | Native DICOM tags |
| Patient & study information | Native DICOM tags + in PDF* |
| Cine loops series | Native DICOM tags |
| Cine loops metadata: dimensions, annotations | Native DICOM tags |
| Frame markers (ED/ES) & 2D image dimensions | Native DICOM tags |
| 2D and 3D snapshot images (w/ or w/o borders, annotations, & points per user capture action) | In PDF |
| All study metadata including analysis (ESV, EDV, EF, SV, CO, etc.), points, calibration, etc. – necessary for future inbound import feature. | DICOM private Tags |

* PDF Report is stored as native SopClass.EncapsulatedPdfStorageUid.

3.1.4. VMS+ PACS Use Case

For example, a typical user experience would work as follows Immediately after the end of an exam, images and measurements are sent to the hospital PACS through the LAN and reviewed by the sonographer or a cardiologist, using the same software image reviewing and reported used for studies performed in the echo-lab at the console.

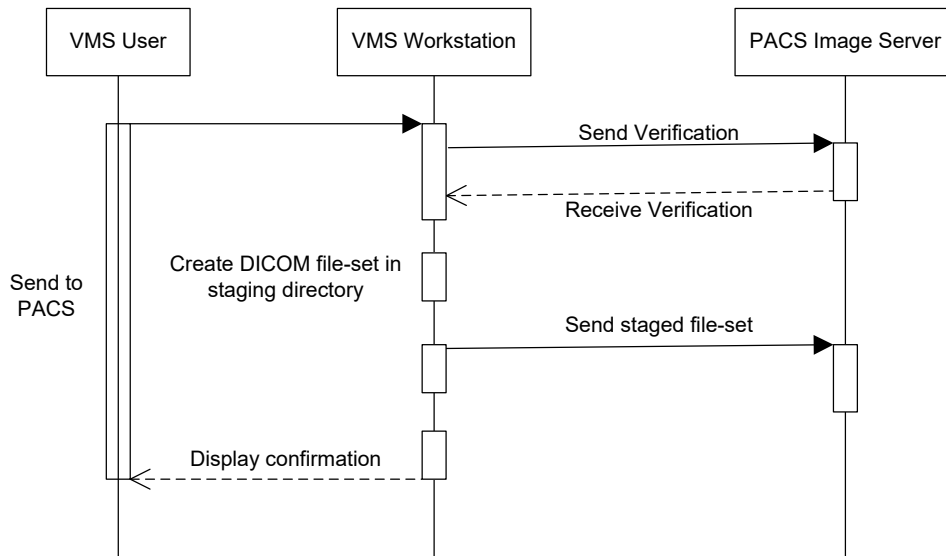
The system is configured with selected network destinations.

User selects a study to be sent from the Studies screen and requests it be sent to a destination.

Then, any member of the team can quickly search through this information and then retrieve images/studies at will.

3.1.5. Sequencing of Real-World Activities

The following sequence diagram illustrates the order of events resulting from “Send to PACS”.



3.2. AE Specifications

3.2.1. Local Application Entity Specifications

3.2.1.1. SOP Classes

VMS+ utilizes the following SOP classes:

SOP CLASSES FOR AE STORAGE

| SOP Class Name | SOP Class UID | SCU | SCP |
|---|-------------------------------|-----|-----|
| Verification SOP Class | 1.2.840.10008.1.1 | No | Yes |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Yes | Yes |
| Encapsulated PDF Storage | 1.2.840.10008.5.1.4.1.1.104.1 | Yes | Yes |
| Ultrasound Multi Frame Image Storage | 1.2.840.10008.5.1.4.1.1.3.1 | Yes | Yes |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | Yes | Yes |

3.2.1.2. Association Policies

3.2.1.2.1. General

DICOM APPLICATION CONTEXT FOR AE STORAGE

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

3.2.1.2.2. Number of Associations

NUMBER OF ASSOCIATIONS INITIATED FOR AE STORAGE

| | |
|--|----------|
| Maximum number of simultaneous associations | 1 |
|--|----------|

NUMBER OF ASSOCIATIONS ACCEPTED FOR AE STORAGE

| | |
|--|----------|
| Maximum number of simultaneous associations | 0 |
|--|----------|

3.2.1.2.3. Asynchronous Nature

VMS+ does not support asynchronous communications.

ASYNCHRONOUS NATURE AS A SCU FOR AE STORAGE

| | |
|--|----------|
| Maximum number of outstanding asynchronous transactions | 0 |
|--|----------|

3.2.1.2.4. Implementation Identifying Information

The implementation information for this Application Entity is as follows:

DICOM IMPLEMENTATION CLASS AND VERSION FOR AE STORAGE

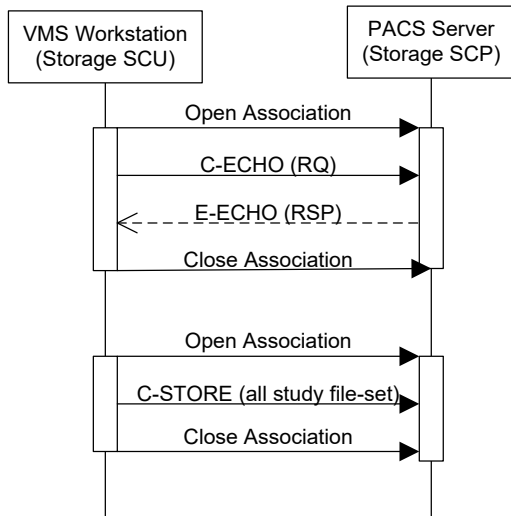
| | |
|---------------------------------|---|
| Implementation Class UID | 1.2.826.0.1.3680043.8.1288.1111.10 |
| Implementation Version Name | VMS+ DICOM 1.1 |

3.2.1.3. Association Initiation Policy

3.2.1.3.1. Activity – Store Study File-Set

3.2.1.3.1.1. Description and Sequencing of Activities

VMS+ Initiates two associations: one for Verification (C-ECHO) to ensure connectivity to PACS server followed upon success by Storage association for transmitting complete study file-set data (C-STORE).



3.2.1.3.1.2. Proposed Presentation Contexts

VMS+ is capable of proposing the presentation contexts shown in the following table.

PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY “STORE STUDY FILE-SET”

| Presentation Context Table | | | | | |
|--------------------------------------|-------------------------------|--|--|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Name | UID | Name List | UID List | | |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| Encapsulated PDF Storage | 1.2.840.10008.5.1.4.1.1.104.1 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| Ultrasound Multi-frame Image Storage | 1.2.840.10008.5.1.4.1.1.3.1 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |

3.2.1.3.1.3. SOP Specific Conformance for SOP Class File-Set Storage

The following table describes C-STORE response behavior.

STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR

| Service Status | Further Meaning | Error Code | Behavior |
|----------------|-----------------|-----------------------|--|
| Success | Success | 0000 | The SCP successfully stored the SOP Instances. Export is considered complete |
| . | . | Any other status code | The association is aborted using A-ABORD and the transfer fails. The status is logged and the user is notified of the failure. |

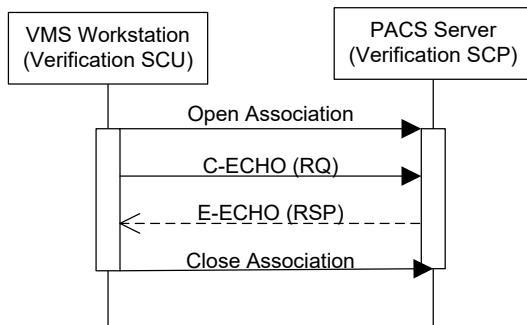
STORAGE COMMUNICATIONS FAILURE BEHAVIOR

| Exception | Behavior |
|--|---|
| Timeout | Same as failure description in previous table |
| Association aborted by the SCP or network layers | Same as failure description in previous table |

3.2.1.3.2. Activity – Verify PACS Server availability

3.2.1.3.2.1. Description and Sequencing of Activities

User may select to verify connectivity to the PACS server from the options dialog thereby issuing C-ECHO request/response roundtrip.



3.2.1.3.2.2. Proposed Presentation Contexts

VMS+ is capable of proposing the presentation contexts shown in the following table.

PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY “VERIFY PACS SERVER AVAILABILITY”

| Presentation Context Table | | | | | |
|----------------------------|-------------------|--|--|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Name | UID | Name List | UID List | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |

3.2.1.3.2.3. SOP Specific Conformance for SOP Class Verify PACS Server Availability

The following table describes C-STORE response behavior.

VERIFICATION C-ECHO RESPONSE STATUS HANDLING BEHAVIOR

| Service Status | Further Meaning | Error Code | Behavior |
|----------------|-----------------|-----------------------|--|
| Success | Success | 0000 | The SCP successfully stored the SOP Instances. Export is considered complete |
| . | . | Any other status code | The association is aborted using A-ABORD and the transfer fails. The status is logged and the user is notified of the failure. |

VERIFICATION COMMUNICATIONS FAILURE BEHAVIOR

| Exception | Behavior |
|--|---|
| Timeout | Same as failure description in previous table |
| Association aborted by the SCP or network layers | Same as failure description in previous table |

3.2.2. Streaming Application Entity Specifications**3.2.2.1. SOP Classes**

VMS+ utilizes the following SOP classes:

SOP CLASSES FOR AE STORAGE

| SOP Class Name | SOP Class UID | SCU | SCP |
|--------------------------------------|-----------------------------|-----|-----|
| Ultrasound Multi Frame Image Storage | 1.2.840.10008.5.1.4.1.1.3.1 | No | Yes |

3.2.2.2. Association Policies**3.2.2.2.1. General**

DICOM APPLICATION CONTEXT FOR AE STORAGE

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

3.2.2.2.2. Number of Associations

NUMBER OF ASSOCIATIONS INITIATED FOR AE STORAGE

| | |
|---|---|
| Maximum number of simultaneous associations | 0 |
|---|---|

NUMBER OF ASSOCIATIONS ACCEPTED FOR AE STORAGE

| | |
|---|---|
| Maximum number of simultaneous associations | 1 |
|---|---|

3.2.2.2.3. Asynchronous Nature

VMS+ does not support asynchronous communications.

ASYNCHRONOUS NATURE AS A SCP FOR AE STORAGE

| | |
|---|---|
| Maximum number of outstanding asynchronous transactions | 0 |
|---|---|

3.2.2.2.4. Implementation Identifying Information

The implementation information for this Application Entity is as follows:

DICOM IMPLEMENTATION CLASS AND VERSION FOR AE STORAGE

| | |
|--------------------------|-------------------------|
| Implementation Class UID | 1.3.6.1.4.1.25403.1.1.1 |
|--------------------------|-------------------------|

| | |
|-----------------------------|-----------|
| Implementation Version Name | Dicom 0.1 |
|-----------------------------|-----------|

3.2.2.3. Association Initiation Policy

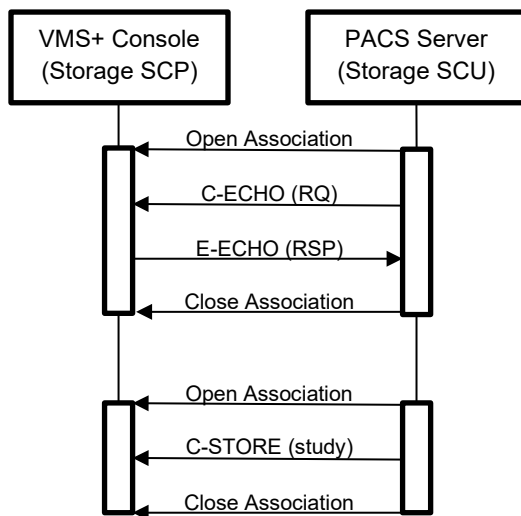
Streaming AE does not initiate any associations.

3.2.2.4. Association Acceptance Policy

3.2.2.4.1. Activity – Store Study File-Set

3.2.2.4.1.1. Description and Sequencing of Activities

VMS+ accepts two associations: one for Verification (C-ECHO) to ensure connectivity to PACS server followed upon success by Storage association for transmitting complete study data (C-STORE).



3.2.2.4.1.2. Proposed Presentation Contexts

VMS+ is capable of proposing the presentation contexts shown in the following table.

PROPOSED PRESENTATION CONTEXTS FOR ACTIVITY “STORE STUDY FILE-SET”

| Presentation Context Table | | | | | |
|--------------------------------------|-----------------------------|--|--|------|-----------|
| Abstract Syntax | | Transfer Syntax | | Role | Ext. Neg. |
| Name | UID | Name List | UID List | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |
| Ultrasound Multi-frame Image Storage | 1.2.840.10008.5.1.4.1.1.3.1 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |

3.2.2.4.1.3. SOP Specific Conformance for SOP Class File-Set Storage

The following table describes C-STORE response behavior.

STORAGE C-STORE RESPONSE STATUS HANDLING BEHAVIOR

| Service Status | Further Meaning | Error Code | Behavior |
|----------------|-----------------|-----------------------|--|
| Success | Success | 0000 | The SCP successfully stored the SOP Instances. Export is considered complete |
| . | . | Any other status code | The association is aborted using A-ABORD and the transfer fails. The status is logged and the user is notified of the failure. |

STORAGE COMMUNICATIONS FAILURE BEHAVIOR

| Exception | Behavior |
|--|---|
| Timeout | Same as failure description in previous table |
| Association aborted by the SCP or network layers | Same as failure description in previous table |

3.3. Network Interfaces

VMS+ operates on top of the TCP/IP stack provided by Windows Operating System (Windows 7 and Windows 10).

3.3.1. Physical Network Interface

VMS+ supports standard PC Network interface. On VMS+ Workstation, the network interface is as provided by the hardware platform on which it is installed provided that it is running on the Windows Operating System as specified above.

3.4. Configuration

VMS+ configuration is set in the Settings dialog in the VMS+ application Studies screen.

VMS+ CONFIGURATION PARAMETERS

| Name | Values | Meaning |
|-------------|--------------|----------------------------------|
| PacsEnabled | True False | Determines if feature is enabled |

3.4.1. AE Title/Presentation Address Mapping**3.4.1.1. Local AE Titles**

The Local AE Title and Port is configurable by the VMS+ software. The Streaming AE Title and Port is configurable by the VMS+ software.

3.4.1.2. Remote AE Title/Presentation Address Mapping

The following parameters are configurable by the VMS+ software:

| Name | Values | Meaning |
|----------|----------------|---------------------------------|
| PacsAE | String | Name of PACS Application Entity |
| PacsHost | String | DNS Address of PACS Server |
| PacsPort | Integer String | Port number of PACS Server |

3.4.2. Parameters

In addition to the parameters described above, the following table describes parameters per DICOM Supplement 64 specifications.

CONFIGURATION PARAMETERS TABLE

| Parameter Configurable | (Yes/No) | Default Value ¹ |
|---|----------|--------------------------------------|
| General Parameters | | |
| Time-out waiting for response to TCP/IP connect request. (Low-level timeout) | No | 10 seconds |
| Time-out waiting for acceptance of a TCP/IP message over the network. (Low-level timeout) | No | 10 seconds |
| Other configurable parameters | -- | -- |
| AE Specific Parameters | | |
| Size constraint in maximum object size | No | None |
| Maximum PDU size the AE can receive | No | 116794 bytes |
| Maximum PDU size the AE can send | No | 116794 bytes |
| AE specific DIMSE level time-out values | No | 30 seconds |
| Number of simultaneous Associations by Service and/or SOP Class | No | -- |
| SOP Class support | No | As specified in 1.1.Network Services |
| Transfer Syntax support | No | As specified in 1.1.Network Services |
| General Parameters | | |
| Other parameters that are configurable | -- | -- |

4. Media Interchange

VMS+ does not support any media exchange; only staging and transmission to assigned server per specifications in the sections above.

5. Support of Character Sets

Ventripoint is a Windows .NET Framework Unicode based application. VMS+ supports character sets per ISO_IR 100, ISO_IR 101, ISO_IR 109, ISO_IR 110, ISO_IR 144, ISO_IR 127, ISO_IR 126, ISO_IR 138, ISO_IR 148, ISO_IR 13, ISO_IR 166, ISO_IR 192, ISO 2022 IR 6, ISO 2022 IR 100, ISO 2022 IR 101, ISO 2022 IR 109, ISO 2022 IR 110, ISO 2022 IR 144, ISO 2022 IR 127, ISO 2022 IR 126, ISO 2022 IR 138, ISO 2022 IR 148, ISO 2022 IR 13, ISO 2022 IR 166, ISO 2022 IR 87, ISO 2022 IR 159, ISO 2022 IR 149 and GB18030 specifications for DICOM.

6. Annexes

6.1. Created SOP Instances

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

VNAP Value Not Always Present
ANAP Attribute Not Always Present
ALWAYS Always Present

¹ Default value is as specified by underlying platform.

ALWAYSUA Always present, unless anonymized
 EMPTY Attribute is sent without a value

The abbreviations used in the —Source column:

MWL the attribute value source Modality Worklist
 USER the attribute value source is from User input
 AUTO the attribute value is generated automatically
 MPPS attribute value is the same as the Modality Performed Procedure Step service
 CONFIG the attribute value source is a configurable parameter

6.1.1. Information-Entity Modules Created VMS+ Study File-Set

VMS+ creates the following principal IOD content packages.

| SOP Classes | Transfer Purpose |
|---|-----------------------------------|
| Secondary Capture Image Storage | Snapshots; Private study metadata |
| Encapsulated Pdf Storage | PDF Report |
| Multi Frame Grayscale Byte Secondary Capture Image Storage | Cine loops |

The IODs are using the Information Entities and modules as specified below.

INFORMATION ENTITY MODULE OF VMS+ STUDY

| IE | Module | Presence |
|------------------------------|------------------------------|--------------------------------------|
| Patient | Patient | ALWAYS |
| Study | General Study | ALWAYS |
| | Patient Study | ALWAYS |
| Series | General Series | ALWAYS |
| | Encapsulated Document Series | PDF Report only |
| Equipment | General Equipment | ALWAYS |
| | SC Equipment | ALWAYS |
| Image | General Image | Multi-Frame and Secondary Image Only |
| | SC Image | Secondary Image |
| | Image Pixel | Multi-Frame and Secondary Frame |
| | SOP Common | Multi-Frame and SC Image |
| | Multi-Frame | Multi-Frame only |
| | Frame Pointers | Multi-Frame |
| | Private tags | Private study metadata |
| Encapsulated Document | Encapsulated Document | PDF Report and private Raw Data |
| | SOP Common | PDF Report |

6.1.2. IOD Modules Attributes Definitions

6.1.2.1. Patient Module

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|----------------------|-------------|----|--|-------------------|--------|
| Patient's Name | (0010,0010) | PN | Patient's full name. As entered in VMS+. | ALWAYS | USER |
| Patient's ID | (0010,0020) | | Hospital identification for the patient. As entered in VMS+. | ALWAYS | USER |
| Issuer of Patient ID | (0010,0021) | LO | Hospital name as configured at installation. | ALWAYS | AUTO |
| Patient's Birth Date | (0010,0030) | DA | As entered in VMS+. | ALWAYS | USER |
| Patient's Sex | (0010,0040) | CS | Enumerated Values: M = male F = female O = other | ALWAYS | USER |
| Patient's Size | (0010,1020) | DS | As entered in VMS+. | ALWAYS | USER |
| Patient's Weight | (0010,1030) | DS | As entered in VMS+. | ALWAYS | USER |

6.1.2.2. General Study Module

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|------------------------------------|-------------|----|--|-------------------|--------|
| Study Instance UID | (0020,000D) | UI | Auto Generated in VP UID Space | ALWAYS | AUTO |
| Study Date | (0008,0020) | DA | Generated at creation | ALWAYS | AUTO |
| Study Time | (0008,0030) | TM | Generated at creation | ALWAYS | AUTO |
| Referring Physician's Name | (0008,0090) | PN | As entered, all in family name component | VNAP | USER |
| Study ID | (0020,0010) | SH | VMS+ study ID | ALWAYS | AUTO |
| Accession Number | (0008,0050) | SH | Set to empty | EMPTY | AUTO |
| Study Description | (0008,1030) | LO | Entered by user as comments | VNAP | USER |
| Name of Physician(s) Reading Study | (0008,1060) | PN | Only last name field as entered in VMS+ | VNAP | USER |

6.1.2.3. Patient Study

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|---------------------------------|-------------|----|--|-------------------|--------|
| Admitting Diagnoses Description | (0008,1080) | LO | Admitting diagnoses VP code name. Derived from user selection and software configuration. Possible values: TetralogyOfFalot SystemicRV SystemicRVMirror | ALWAYS | USER |

| | | | | | |
|-------------------------|-------------|----|--|--------|------|
| | | | Conduit PulmonaryArterialHypertension | | |
| Patient's Size | (0010,1020) | DS | Height entered by user | ALWAYS | USER |
| Patient's Weight | (0010,1030) | DS | Weight entered by user | ALWAYS | USER |

6.1.2.4. General Series

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|------------------------------------|-------------|----|---|-------------------|--------|
| Modality | (0008,0060) | CS | One of: US – Multi-Frame DOC – PDF OT – Snapshots, Metadata | ALWAYS | AUTO |
| Series Instance UID | (0020,000e) | UI | Generated in VP UID space | ALWAYS | AUTO |
| Series Number | (0020,0011) | UI | Generated in VP UID space | ALWAYS | AUTO |
| Laterality | (0020,0060) | CS | Always 'R' for Right Ventricle | ALWAYS | AUTO |
| Series Date | (0008,0021) | DA | Date of study creation | ALWAYS | AUTO |
| Series time | (0008,0031) | TM | Time of study creation | ALWAYS | AUTO |
| Performing Physician's Name | (0008,1050) | PN | Performing sonographer | VNAP | USER |
| Protocol Name | (0008,1030) | LO | VMS+ | ALWAYS | AUTO |
| Series Description | (0008,103e) | LO | Cine loop identifier string of the form "Scan<number>" where the number is sequential count of captured scans. | ALWAYS | AUTO |
| Study Instance UID | (0020,000d) | UI | Instance UID of Study to which the related Series belongs | ALWAYS | AUTO |
| Series Instance UID | (0020,000d) | UI | Instance UID of Related Series | ALWAYS | AUTO |
| Smallest Image Pixel Value | (0028,0106) | XS | Auto-specified for image types. In MONOCHROME2, always 0. | | |
| Largest Image Pixel Value | (0028,0107) | XS | Auto-specified for image types. In MONOCHROME2, always 255. | ANAP | AUTO |

6.1.2.5. Encapsulated Document Series

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|----------------|-----|----|-------|-------------------|--------|
|----------------|-----|----|-------|-------------------|--------|

| | | | | | |
|---|-------------|----|--|--------|------|
| Modality | (0008,0060) | CS | DOC – PDF | ALWAYS | AUTO |
| Series Instance UID | (0020,000e) | UI | Generated in VP UID space | ALWAYS | AUTO |
| Series Number | (0020,0011) | UI | Generated in VP UID space | ALWAYS | AUTO |
| Series Description | (0008,103e) | LO | Pdf file name in VMS+ in the form of “Report_<ddd>.pdf” where <ddd> is 3 digit report number | ALWAYS | AUTO |
| Instance Number | (0020,0013) | IS | Corresponding incremented number of generated instance in study file-set | ALWAYS | AUTO |
| Content Date | (0008,0023) | DA | Date of document creation | ALWAYS | AUTO |
| Content Time | (0008,0033) | TM | Time of document creation | ALWAYS | AUTO |
| Acquisition Date Time | (0008,002a) | DT | Time of study creation | ALWAYS | AUTO |
| Burned In Annotation | (0028,0301) | CS | YES | ALWAYS | AUTO |
| Document Title | (0042,0010) | ST | VMS+ Report | ALWAYS | AUTO |
| Concept Name Code Sequence | (0040,a043) | SQ | Sequence ² of Code Value, Coding Scheme Designator, and Code Meaning | ALWAYS | AUTO |
| Code Value | (008,0100) | SH | 1089.1.5 – Fragment of complete ISO_OID UID (omitting 1.2.826.0 prefix) | ALWAYS | AUTO |
| Coding Scheme Designator | (0008,0102) | SH | ISO_OID | ALWAYS | AUTO |
| Code Meaning | (0008,0104) | LO | Adobe Acrobat PDF (1.2.826.0.1089.1.5) | ALWAYS | AUTO |
| MIME Type of Encapsulated Document | (0042,0012) | LO | application/pdf | Always | AUTO |
| Encapsulated Document | (0042,0011) | OB | Contents of pdf document | ALWAYS | AUTO |

6.1.2.6. General Equipment

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|-----------------------|-------------|-----------|--------------|--------------------------|---------------|
| Manufacturer | (0008,0070) | LO | Ventripoint | ALWAYS | AUTO |

² Issue: For Pdf document, it is not clear what the correct values are in concept name code sequence field values. For now, values are set to ISO_OID (1.2.826.0.1089.1.5).

| | | | | | |
|----------------------------------|-------------|----|--|--------|------|
| Institution Name | (0008,0080) | LO | As configured at installation | ALWAYS | AUTO |
| Station Name | (0008,1010) | SH | VID:<facility-id>.<station-id> where ID's are specified in VP ID space. Generated at installation. | ALWAYS | AUTO |
| Manufacturer's Model Name | (0008,1090) | LO | VMS+ | ALWAYS | AUTO |
| Software Version(s) | (0018,1020) | LO | Full software build version number (e.g. 1.1.5019.1274) | ALWAYS | AUTO |

6.1.2.7. SC Equipment [DEPRECATED]

The following IE was deprecated. Ventripoint will report the multi-frame as an original/

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|---|-------------|----|--|-------------------|--------|
| Conversion Type | (0008,0064) | CS | WSD | ALWAYS | AUTO |
| Modality | (0008,0060) | CS | US | ALWAYS | AUTO |
| Secondary Capture Device ID | (0018,1010) | LO | VID:<facility-id>.<station-id> where ID's are specified in VP ID space. Generated at installation. | ALWAYS | AUTO |
| Secondary Capture Device Manufacturer | (0018,1016) | LO | Ventripoint | ALWAYS | AUTO |
| Secondary Capture Device Software Versions | (0018,1019) | LO | Full software build version number (e.g. 1.1.5019.1274) | ALWAYS | AUTO |

6.1.2.8. General Image

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|----------------------------|-------------|----|---|-------------------|--------|
| Instance Number | (0020,0013) | IS | Corresponding incremented number of generated instance in study file-set | ALWAYS | AUTO |
| Patient Orientation | (0020,0020) | CS | <Empty> | EMPTY | AUTO |
| Content Date | (0008,0023) | DA | Date of image creation | ALWAYS | AUTO |
| Content Time | (0008,0033) | TM | Time of image creation | ALWAYS | AUTO |
| Image Type | (0008,0008) | CS | DERIVED\PRIMARY for multi-frame and DERIVED\SECONDARY for snapshot SC Image | ALWAYS | AUTO |

| | | | | | |
|--------------------------------|-------------|----|---|--------|------|
| Acquisition Date Time | (0008,002a) | DT | Study creation time | ALWAYS | AUTO |
| Derivation Description | (0008,2111) | DT | For multi-frame: VMS+ real-time image capture For SC image: VMS+ Analysis Snapshot | ALWAYS | AUTO |
| Images in Acquisition | (0020,1002) | IS | Number of frames in multi-frame. Not present in SC image | ANAP | AUTO |
| Burned In Annotation | (0028,0301) | CS | YES | ALWAYS | AUTO |
| Lossy Image Compression | (0028,2110) | CS | 00 | ALWAYS | AUTO |
| Presentation LUT Shape | (2050,0020) | CS | IDENTITY | ALWAYS | AUTO |

6.1.2.9. SC Image

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|----------------------------------|-------------|----|---------------------|-------------------|--------|
| Date of Secondary Capture | (0018,1012) | DA | Image creation date | ALWAYS | AUTO |
| Time of Secondary Capture | (0018,1014) | TM | Image creation time | ALWAYS | AUTO |

6.1.2.10. Image Pixel

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|-----------------------------------|-------------|----|---|-------------------|--------|
| Samples per Pixel | (0028,0002) | US | 1 | ALWAYS | AUTO |
| Photometric Interpretation | (0028,0004) | CS | MONOCHROME2 | ALWAYS | AUTO |
| Rows | (0028,0010) | US | Number of rows in the image. | ALWAYS | AUTO |
| Columns | (0028,0011) | US | Number of columns in the image | ALWAYS | AUTO |
| Bits Allocated | (0028,0100) | US | 8 | ALWAYS | AUTO |
| Bits Stored | (0028,0100) | US | 8 | ALWAYS | AUTO |
| High Bit | (0028,0102) | US | 7 | ALWAYS | AUTO |
| Pixel Representation | (0028,0103) | US | 0 | ALWAYS | AUTO |
| Pixel Data | (7fe0,0010) | OW | A data stream of the pixel samples that comprise the Image. | ALWAYS | AUTO |
| Planar Configuration | (0028,0006) | US | 0 | ALWAYS | AUTO |

6.1.2.11. SOP Common

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|------------------------|-------------|----|--|-------------------|--------|
| SOP Class UID | (0008,0016) | UI | One of supported SOP classes: 1.2.840.10008.5.1.4.1.1.7 1.2.840.10008.5.1.4.1.1.104.1 1.2.840.10008.5.1.4.1.1.66 1.2.840.10008.5.1.4.1.1.7.2 | ALWAYS | AUTO |
| SOP Instance UID | (0008,0018) | UI | Uniquely identifies the SOP Instance. | ALWAYS | AUTO |
| Specific Character Set | (0008,0005) | CS | ISO_IR 100 | ALWAYS | AUTO |
| Instance Creation Date | (0008,0012) | DA | Date of DICOM export | ALWAYS | AUTO |
| Instance Creation Time | (0008,0013) | TM | Time of DICOM export | ALWAYS | AUTO |
| Operators' Name | (0008,1070) | PN | User name (default: logged in VMS+NET domain) | VNAP | AUTO |

6.1.2.12. Multi-Frame

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|---------------------------------------|-------------|----|--|-------------------|--------|
| Number of Frames | (0028,0008) | IS | Number of frames in a Multi-frame Image. | ALWAYS | AUTO |
| Frame Increment Pointer | (0028,0009) | AT | (0018,1063) | ALWAYS | AUTO |
| Pixel Spacing | (0028,0030) | DS | Physical distance in the patient between the center of each pixel, specified by a numeric pair - adjacent row spacing (delimiter) adjacent column spacing in mm. | ALWAYS | AUTO |
| Pixel Spacing Calibration Type | (0028,0a02) | CS | FIDUCIAL | ALWAYS | AUTO |
| Pixel Spacing Calibration Description | (0028,0a04) | LO | Ventripoint Medical System calibration | ALWAYS | AUTO |
| Frame Time | (0018,1063) | DS | Frame time in milliseconds | ALWAYS | AUTO |

6.1.2.13. Frame Pointers

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|----------------|-----|----|-------|-------------------|--------|
|----------------|-----|----|-------|-------------------|--------|

| | | | | | |
|--|-------------|----|---|------|------|
| Representative Frame Number | (0028,6010) | US | The ED Frame if identified by user | ANAP | AUTO |
| Frame Numbers of Interest (FOI) | (0028,6020) | US | Frame number of ED and ES if selected by user | ANAP | USER |
| Frame of Interest Description | (0028,6022) | LO | End Diastole\End Systole | ANAP | AUTO |
| Frame of Interest Type | (0028,6023) | CS | RWAVE\ENDSYSTOLE | ANAP | AUTO |

6.1.2.14. Private Metadata

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|------------------------|-------------|----|--|-------------------|--------|
| Instance Number | (0020,0013) | IS | Corresponding incremented number of generated instance in study file-set | ALWAYS | AUTO |
| Content Date | (0008,0023) | DA | Date of study creation | ALWAYS | AUTO |
| Content Time | (0008,0033) | TM | Time of study creation | ALWAYS | AUTO |
| Private Tag | (0F87,0010) | LO | Ventripoint Medical System | VNAP | AUTO |
| Private Tag | (0F87,1010) | SH | 1.1 | VNAP | AUTO |
| Private Tag | (0F87,1011) | OB | Private XML study summary | VNAP | AUTO |
| Private Tag | (0F78,1012) | OB | Private compressed XML VP study metadata | VNAP | AUTO |
| Private Tag | (0F87,1013) | SH | Snapshot filename | ANAP | AUTO |

6.1.2.15. Encapsulated Document

| Attribute Name | Tag | VR | Value | Presence of Value | Source |
|---|-------------|----|--|-------------------|--------|
| Instance Number | (0020,0013) | IS | Corresponding incremented number of generated instance in study file-set | ALWAYS | AUTO |
| Content Date | (0008,0023) | DA | Date of study creation | ALWAYS | AUTO |
| Content Time | (0008,0033) | TM | Time of study creation | ALWAYS | AUTO |
| Acquisition Date Time | (0008,002a) | DT | Time of study creation | ALWAYS | AUTO |
| Burned In Annotation | (0028,0301) | CS | YES | ALWAYS | AUTO |
| Document Title | (0042,0010) | ST | VMS+ Metadata | ALWAYS | AUTO |
| Encapsulated Document | (0042,0011) | OB | Internal XML summary description of study | ALWAYS | AUTO |
| MIME Type of Encapsulated Document | (0042,0012) | LO | application/octet-stream | Always | AUTO |

7. Revision History

The revision history below provides dates and differences among individual document versions

| DOCUMENT VERSION | DATE OF ISSUE | DESCRIPTION | STATUS |
|------------------|---------------|-------------------------------------|------------|
| 1 | November 2018 | Final Version. | Authorized |
| 2 | November 2019 | Added Streaming Application Entity. | Authorized |