

# DICOM Conformance Statement

## 2.3.1

Company Name: VivaScope GmbH

Product Name: VivaScope 2500M-G4

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# 1 Overview

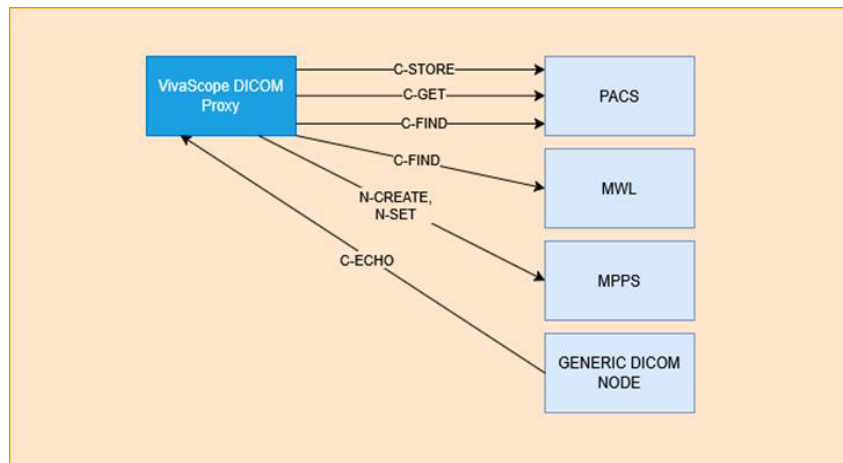
This DICOM conformance statement provides technical information concerning the software known as the “VivaScan DICOM/HL7 proxy”. The proxy is a platform-independent, intermediate layer between the VivaScan Application and a medical institution’s PACS and HIS. Written in Kotlin and Java, it is delivered as a Docker image running in a containerized environment and operates as a standalone application separate from the VivaScan Application.

The implementation supports the DICOM 226 Cutaneous Confocal Microscopy supplement for confocal imaging. Although our generated DICOM files are tag-compliant with the 226 supplement, the SOP classes used for both Confocal and Pyramidal Confocal images are configurable. This flexibility is crucial because many PACS systems are unable to store the native SOP classes for these image types. By default, our software utilizes the Secondary Capture Image Storage SOP class for both Confocal and Confocal Pyramid images, but it can be configured to generate DICOM files with alternative SOP classes as required.

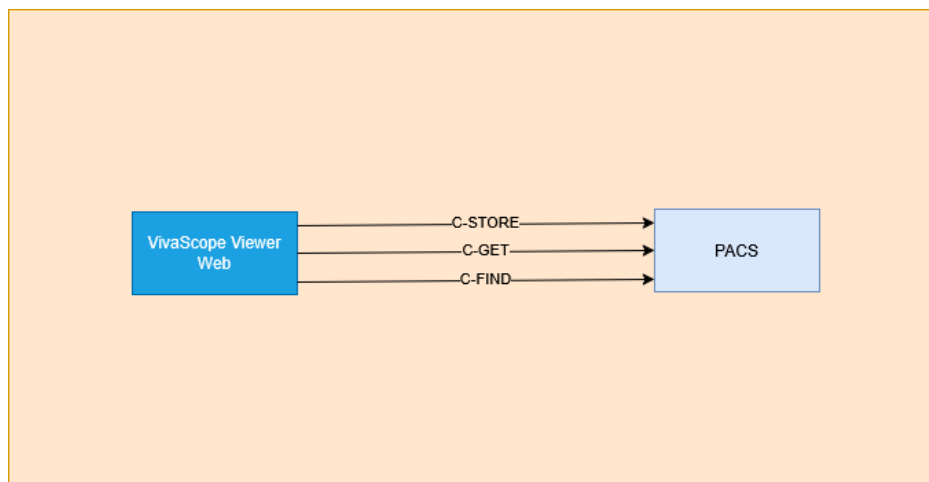
Since our DICOM files are multi-frame images, they remain viewable in standard multi-frame viewers. However, the pyramidal images combine WSI conformance with multi-channel data—merging multiple tiles from different pyramids into a single pseudocolored image—thus requiring our custom viewer for full diagnostic evaluation. This viewer can be installed directly on the modality or deployed on a hospital server, available both as a desktop application and as a web-based application accessible to authorized users, connecting to PACS as the image source.

Additional HL7 capabilities allowed for the querying of HIS for patient data and seamless integration with the VivaScan Application.

- **Image Transformation:** Configurable transformation of images from the internal VivaScan format into DICOM multi-frame files conforming to the DICOM 226 Cutaneous Confocal Microscopy supplement. By default, the Secondary Capture Image Storage SOP class is used, but this can be configured to any SOP class as required.
- **Image Transmission:** Sending transformed images from the VivaScope devices to PACS or any other DICOM node (SCU).
- **Scheduling:** Periodically querying PACS (or any MWL-compatible DICOM node) for modality worklists and scheduling studies in the VivaScan Application.
- **HL7 Integration:** Querying the HIS for patient data and transferring it to the VivaScan Application.
- **Configuration Interface:** Providing a web-based interface for configuration.



**Figure 1-1. Overview of Implemented Services – VivaScan DICOM Proxy**



**Figure 1-2. Overview of Implemented Services – VivaScope Image Viewer Web**

The VivaScan system consists of two main DICOM-enabled components:

- **VivaScan DICOM/HL7 Proxy**
  - Acts as an intermediary between the VivaScan Application and external DICOM services.
  - Implements C-STORE to send images to PACS.
  - Uses C-FIND to query Modality Worklist (MWL) for scheduled procedures.
  - Supports C-ECHO for connectivity checks.
  - Communicates with MPPS (Modality Performed Procedure Step) using N-CREATE and N-SET to report procedure status.
- **VivaScope Image Viewer Web**
  - A web-based DICOM viewer that allows users to interact with PACS.
  - Uses C-FIND to search for studies in PACS.
  - Implements C-GET to retrieve images from PACS.
  - Can optionally use C-STORE to save reviewed images back to PACS.

## System Overview

The VivaScan System is a DICOM-compliant imaging solution designed for confocal microscopy. It facilitates study retrieval, image visualization, and integration with PACS, Modality Worklist servers, and other hospital systems. The system consists of two key Application Entities (AEs):

- VivaScan DICOM Proxy – A transparent communication bridge between imaging devices and external DICOM services.
- VivaScan Image Viewer Web – A DICOM web-based viewer designed for querying, retrieving, and analyzing confocal images.

These components ensure smooth DICOM interoperability, leveraging DICOM Supplement 226 SOP Classes for confocal imaging while supporting fallback SOP Classes for PACS compatibility.

## System Architecture and Interaction

The VivaScan System interacts with multiple hospital systems using DICOM services as follows:

### VivaScan DICOM Proxy

The VivaScan DICOM Proxy ensures integration between VivaScan Image Viewer Web, PACS, Modality Worklist servers, and MPPS.

- DICOM Services Implemented:

- C-STORE (SCU): Sends confocal images to PACS.
- C-FIND (SCU): Queries Modality Worklist (MWL) for scheduled procedures.
- N-CREATE, N-SET (SCU): Reports performed procedure steps to MPPS servers.
- C-ECHO (SCP): Responds to verification requests.

### **VivaScope Image Viewer Web**

The VivaScope Image Viewer Web enables users to search for and retrieve imaging studies stored in PACS.

- DICOM Services Implemented:
  - C-FIND (SCU): Queries PACS for studies based on Patient ID, Study UID, etc.
  - C-GET (SCU): Retrieves selected studies from PACS.
  - C-STORE (SCU) [Optional]: Sends modified images (and annotations) back to PACS (if enabled).
  - LDAP/Active Directory Authentication: Ensures secure user access.
  - Image Caching: Temporarily stores retrieved images for fast access, with auto-deletion.

### **Workflow Overview**

#### **Image Acquisition & PACS Storage**

- The DICOM Proxy queries the Modality Worklist Server (if configured) via C-FIND.
- The VivaScan Application generates confocal DICOM images.
- The DICOM Proxy transmits images to PACS via C-STORE.

#### **Study Retrieval & Visualization**

- Users search for studies in VivaScan Image Viewer Web using C-FIND.
- If found, the user selects a study, and C-GET is used to retrieve images.
- Images are temporarily cached for fast access.
- Images are rendered in the viewer, allowing zoom, contrast adjustment, and analysis.

#### **MPPS Reporting (If Enabled)**

- The DICOM Proxy reports procedure completion via N-SET to the MPPS server.

#### **DICOM SOP Class & Compatibility Strategy**

- The VivaScan System supports DICOM Supplement 226 (Confocal Microscopy SOP Classes) but falls back to Secondary Capture SOP Classes for maximum PACS compatibility.
- Primary SOP Classes: Confocal Microscopy Image Storage, Tiled Pyramidal Image Storage.
- Fallback SOP Classes: Secondary Capture Image Storage (stored as JPEG) and other type listed later.
- Compression Strategy: Currently, JPEG compression is used (not JPEG 2000 yet, but planned).

#### **Security & Access Control**

- VivaScan DICOM Proxy does not implement authentication but relies on network security.
- VivaScan Image Viewer Web supports LDAP/Active Directory authentication for user access.
- TLS Encryption is not implemented, so network-level security (e.g., VPN) is recommended.

## **1.1 Content and Transfer**

Table 1-1 lists all Storage SOP Classes and the supported transfer mechanisms as well as the usage scenarios for those instances.

The "Transfer Syntax Set" column lists the sets of Transfer Syntaxes defined in Table 1-2 that are applicable to each SOP Class. The "DIMSE", "DICOM Web" and "Media Services" columns indicate the roles supported for each SOP Class.

The "Function" columns indicate how the instances are used by the system:

- Create: The system creates instances of the SOP Class. The type of the created SOP Class is indicated by one of the following abbreviations:

- S: Standard SOP Class
- SE: Standard Extended SOP Class
- SP: Specialized SOP Class
- P: Private SOP Class
- Display: The system displays the instances of the SOP Class to the user, either by displaying the SOP Instances natively or by applying instances of another suitable SOP Class to the image instances (e.g., a Presentation State or CAD SR).
- Process: The system processes the instances of the SOP Class to derive some further information that is made available to the user (e.g., a CAD processing algorithm, or a 3D Rendering).
- Archive: The system stores the instances of the SOP Class and makes them available again.

**Table 1-1. Storage SOP Classes**

SOP Classes		Transfer Syntax Set	DIMSE Services		DICOM Web Services		Media Services			Function			
			SCU	SCP	UA	OS	FSC	FSU	FSR	Create	Display	Process	Archive
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	U; L	X	X <sup>1</sup>	N/A	N/A	N/A	N/A	N/A	X	X	N/A	N/A
Confocal Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.8	U; L	X	X <sup>1</sup>	N/A	N/A	N/A	N/A	N/A	X	X	N/A	N/A
Confocal Microscopy Tiled Pyramidal Image Storage	1.2.840.10008.5.1.4.1.1.77.1.9	U; L	X	X <sup>1</sup>	N/A	N/A	N/A	N/A	N/A	X	X	N/A	N/A
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	NI	X <sup>2</sup>	X <sup>1</sup>	N/A	N/A	N/A	N/A	N/A	X <sup>2</sup>	X	N/A	N/A
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	U; L	X	X <sup>1</sup>	N/A	N/A	N/A	N/A	N/A	X	X	N/A	N/A
Multi-frame Grayscale Byte Secondary Capture Storage	1.2.840.10008.5.1.4.1.1.7.2	U; L	X	X <sup>1</sup>	N/A	N/A	N/A	N/A	N/A	X	X	N/A	N/A

Notes (policy):

- **SCP = X<sup>1</sup>** only for objects received as the **return association of C-GET** initiated by the Viewer back-end; the Viewer is **not** a general-purpose Storage SCP.
- **SCU = X<sup>2</sup> / Create = X<sup>2</sup>** for Basic Text SR **only when annotation export is enabled** in the Viewer back-end (JSON stored as free-text in Basic Text SR).
- **All SOP classes above are configurable** in the VivaScan DICOM/HL7 proxy.
- Most PACS servers do not natively support the Supplement 226 SOP Classes. Therefore we can use as fallback:
  - **confocal non-pyramid** - Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.2

- **confocal pyramid** - Multi-frame Grayscale Byte Secondary Capture Image Storage 1.2.840.10008.5.1.4.1.1.7.2

If a fallback is used your PACS might be able to save VivaScope confocal images for regulatory reasons, but your Viewers will not be able to display them.

**Table 1-2. Supported Transfer Syntaxes**

Transfer Syntax Set	Transfer Syntax Name	Transfer Syntax UID	DICOM Web Service Bulkdata Media Type
Lossless Compressed Transfer Syntax Set (LL)	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70	image/jpeg
	JPEG-LS Lossless	1.2.840.10008.1.2.4.80	Image/jls
	JPEG 2000 Image Compression (Lossless Only)	1.2.840.10008.1.2.4.90	image/jp2
	RLE Lossless	1.2.840.10008.1.2.5	application/dicom
Lossy Compressed Transfer Syntax Set (L)	JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50	image/jpeg
	JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51	image/jpeg
	JPEG 2000 Lossy (Planned)	1.2.840.10008.1.2.4.91	image/jp2
Uncompressed Transfer Syntax Set (U)	Implicit VR Little Endian	1.2.840.10008.1.2	application/dicom
	Explicit VR Little Endian	1.2.840.10008.1.2.1	application/dicom
	Explicit VR Big Endian (Retired)	1.2.840.10008.1.2.2	application/dicom
Confocal Microscopy Transfer Syntax Set (Uncompressed) (CU)	Confocal Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.8	application/dicom
	Confocal Microscopy Tiled Pyramidal Image Storage (JPEG)	1.2.840.10008.5.1.4.1.1.77.1.9	application/dicom
Confocal Microscopy Transfer Syntax Set (Compressed) (CC)	Confocal Microscopy Image Storage	1.2.840.10008.5.1.4.1.1.77.1.8	image/jpeg
	Confocal Microscopy Tiled Pyramidal Image Storage (JPEG)	1.2.840.10008.5.1.4.1.1.77.1.9	image/jpeg
Fallback Transfer Syntax Set (Compressed by Default) (FC)	Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	image/jpeg
	Multiframe Grayscale Byte Secondary Capture	1.2.840.10008.5.1.4.1.1.7.2	Image/jpeg

- Confocal Microscopy SOP Classes include both uncompressed and JPEG-compressed options.
- JPEG 2000 (both lossless and lossy) is planned for future support but **not yet implemented**.
- All fallback SOP classes (like Secondary Capture) are currently stored using standard JPEG compression

### 1.1.1 Structured Reporting Root Template IDs – N/A

N/A

## 1.2 DIMSE Services

### 1.2.1 Verification

Table 1-4 lists support for the Verification SOP Class.

**Table 1-3. Verification SOP Class<sup>1</sup>**

SOP Classes		Transfer Syntax		SCU	SCP
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	N	Y
		Explicit VR Little Endian	1.2.840.10008.1.2.1	N	Y

### 1.2.2 Storage

For details on supported Storage SOP Classes see Section 1.1.

### 1.2.3 Workflow Management

Table 1-4 lists all supported Workflow Management SOP Classes.

**Table 1-4. Workflow Management SOP Classes**

SOP Classes		Transfer Syntax		SCU	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Implicit VR Little Endian	1.2.840.10008.1.2	Y	N
		Explicit VR Little Endian	1.2.840.10008.1.2.1	Y	N
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Implicit VR Little Endian	1.2.840.10008.1.2	Y	N
		Explicit VR Little Endian	1.2.840.10008.1.2.1	Y	N

### 1.2.4 Query/Retrieve

Table 1-5 lists all supported Query/Retrieve SOP Classes.

**Table 1-5. Query/Retrieve SOP Classes**

SOP Classes		Transfer Syntax		SCU	SCP
Study Root Query/Retrieve - Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	Y	N
		Explicit VR Little Endian	1.2.840.10008.1.2.1	Y	N

<sup>1</sup> Only DICOM Proxy AE

SOP Classes		Transfer Syntax		SCU	SCP
Study Root Query/Retrieve - Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	Implicit VR Little Endian	1.2.840.10008.1.2	Y	N
		Explicit VR Little Endian	1.2.840.10008.1.2.1	Y	N

### 1.2.5 Printing – N/A

N/A

### 1.3 DICOM Web Services – N/A

N/A

### 1.4 Media Services -N/A

N/A

### 1.5 Real-Time Video Service – N/A

N/A

### 1.6 De-identification Profiles -N/A

N/A

### 1.7 Specific Character Sets

VivaScan DICOM/HL7 proxy supports all extended character sets defined in the DICOM 2017 standard, including single-byte and multi-byte character sets as well as code extensions techniques using ISO 2022 escapes in DIOM messages.

Support extends to correctly decoding and displaying the correct symbol for all names and strings found in storage instances received over the network, and in the local database.

In addition to the default character repertoire, the Defined Terms for Specific Character Set in Table 1-6 are supported:

**Table 1-6. Supported Specific Character Sets**

Defined Term	IANA	Description
Single-Byte Character Sets without Code Extensions		
ISO_IR 6	ISO-646 or US-ASCII	Default Repertoire
ISO_IR 100	ISO-8859-1	Latin Alphabet No.1 (West Europe)
Single-Byte Character Sets with Code Extension		
ISO 2022 IR 6		Default Repertoire
ISO 2022 IR 100		Latin Alphabet No. 1 (West Europe)
Multi-Byte Character Sets without Code Extensions		
ISO_IR 192	UTF-8	Unicode in UTF-8 Level 3

Defined Term	IANA	Description
GB18030	GB18030	GB18030-2000 (P.R China Norm GB18030)
Multi-Byte Character Sets with Code Extensions		
ISO 2022 IR 87	ISO-2022-JP	Japanese JIS X 0208
ISO 2022 IR 149	ISO-2022-KR	Korean

Escape sequences supporting multiple character sets in HL7 v2 messages are not supported.

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## 3 Introduction

### 3.1 Revision History

Revision	Date	Product Version(s)	Change
0.1	23.02.2022	VivaScope 2500M-G4	Initial draft
1.0	17.03.2022	VivaScope 2500M-G4	First version
2.0	06.03.2025	VivaScope 2500M-G4	Second version
2.1	24.10.2025	VivaScope 2500M-G4	Corrected 2 <sup>nd</sup> version
2.2	05.02.2026	VivaScope 2500M-G4	Adjustments to fit the template

### 3.2 Audience

This document is intended for the audience listed below. It is assumed that the reader has a working knowledge of the DICOM Standard.

- This document is written for the technical and non-technical personnel that need to understand how VivaScope 2500M-G4 will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product.
- This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features

### 3.3 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between Vivascope 2500M-G4 and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard [1]. DICOM by itself does not guarantee interoperability.

- The Conformance Statement does, however, facilitate a first-level comparison for interoperability between different applications supporting compatible DICOM functionality.
- This Conformance Statement should not replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, it is the user's responsibility to perform the following validation activities:
  - The comparison of Conformance Statements from *<Product>* and other DICOM conformant equipment is the first step towards assessing interconnectivity and interoperability between those systems.
  - Test procedures should be defined and executed to validate the required level of interoperability with specific DICOM conformant equipment, as established by the healthcare facility.
  - An extensive effort was made to follow the DICOM standard and if the software has an issue with the standard, then VivaScope GmbH reserves the right to make any necessary changes to the software to ensure it complies with the standard.

### 3.4 Terms and Definitions

The following list includes DICOM Terms, that are used throughout this Conformance Statement. The DICOM Standard is the authoritative source for formal definitions of these terms.:

Abstract Syntax	The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.
Application Entity (AE)	A representation of the external behavior of an application process in terms of DICOM Network Services, Web Services and/or media exchange capabilities implemented in one or more roles. A single device may have multiple Application Entities.
Application Entity Title (AET)	The externally known name of an Application Entity, used to identify a DICOM application to other DICOM applications on the network.
Application Context	The specification of the type of communication used between Application Entities. Example: DICOM network protocol.
Association	A network communication channel set up between Application Entities.
Attribute	A unit of information in an Information Object Definition; a Data Element identified by a tag. The information may be a complex data structure (Sequence), itself composed of lower-level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

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Data Element	A unit of information as defined by a single entry in the data dictionary. An encoded Information Object Definition (IOD) Attribute that is composed of, at a minimum, three fields: a Data Element Tag, a Value Length, and a Value Field. For some specific Transfer Syntaxes, a Data Element also contains a VR Field where the Value Representation of that Data Element is specified explicitly
Information Object Definition (IOD)	The specified set of Attributes that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. Examples: MR Image IOD, CT Image IOD, Print Job IOD. The Attributes within an IOD may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C).
Media Storage Application Profile	The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs).
Module	A set of Attributes within an Information Object Definition that are logically related to each other. Example: Patient Module includes Patient's Name, Patient ID, Patient's Birth Date, and Patient's Sex.
Negotiation	First phase of Association establishment that allows Application Entities to agree on the types of data to be exchanged and how that data will be encoded.
Origin Server	Refers to the program that can originate authoritative responses to HTTP requests for a given Target Resource. The term "server" refers to any implementation that receives a web service request message from a user agent.
Presentation Context	The set of DICOM Network Services used over an Association, as negotiated between Application Entities; includes Abstract Syntaxes and Transfer Syntaxes.
Protocol Data Unit (PDU)	A packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.
Security Profile	A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an Application Entity to ensure confidentiality, integrity, and/or availability of exchanged DICOM data.
Service Class Provider (SCP)	Role of an Application Entity that provides a DICOM network service; typically, a server that performs operations requested by another Application Entity (Service Class User). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).
Service Class User (SCU)	Role of an Application Entity that uses a DICOM Network Service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU).
Service/Object Pair Class (SOP Class)	The specification of the network or media transfer (service) of a particular type of data (object) ; the fundamental unit of a DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.
Service/Object Pair Instance (SOP Instance)	An information object; a specific occurrence of information exchanged in a SOP Class. E.g., a specific X-ray image.
Tag	A 32-bit identifier for a Data Element, represented as a pair of four-digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element].

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Transfer Syntax	The encoding used for exchange of DICOM information objects and messages. Examples: JPEG compressed (images), Little Endian Explicit Value Representation.
Unique Identifier (UID)	A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.
Value Representation (VR)	The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR) ; with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

The following list includes product specific definitions used throughout this Conformance Statement

Joint Photographic Experts Group (JPEG)	A set of standardized image compression techniques, available for use by DICOM applications.
VivaScope 2500M-G4	The device made by VivaScope GmbH capable of making confocal images of human tissue.
VivaScan Application	Application that is responsible for image acquisition on VivaScope 2500M-G4 device.
VivaScan DICOM/HL7 proxy	Proxy application that helps VivaScan Application and DICOM nodes to communicate.
VivaScope Image Viewer - Desktop	Desktop image viewer installed on modality. New capabilities compared to VivaScan image viewer
VivaScope Image Viewer - Web	Web version of our Viewer. Connects to PACS as a source of image data

### 3.5 Abbreviations

Abbreviations that are used in this DICOM Conformance Statement are listed here.

AE	Application Entity
AET	Application Entity Title
CAD	Computer Aided Detection
CDA	Clinical Document Architecture
CD-R	Compact Disk Recordable
CSE	Customer Service Engineer
CR	Computed Radiography
CT	Computed Tomography
DCS	DICOM Conformance Statement
DHCP	Dynamic Host Configuration Protocol

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DICOM	Digital Imaging and Communications in Medicine
DIT	Directory Information Tree (LDAP)
DN	Distinguished Name (LDAP)
DNS	Domain Name System
DX	Digital X-ray
FSC	File-Set Creator
FSU	File-Set Updater
FSR	File-Set Reader
GSDF	Grayscale Standard Display Function
GSPS	Grayscale Softcopy Presentation State
HIS	Hospital Information System
HL7	Health Level 7 Standard
IANA	Internet Assigned Numbers Authority
IHE	Integrating the Healthcare Enterprise
ILE	Implicit VR Little Endian
IOD	Information Object Definition
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISO	International Organization for Standardization
IO	Intra-oral X-ray
JPEG	Joint Photographic Experts Group
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format
LUT	Look-up Table
MAR	Medication Administration Record
MPEG	Moving Picture Experts Group
MG	Mammography (X-ray)

MPPS	Modality Performed Procedure Step
MR	Magnetic Resonance Imaging
MSPS	Modality Scheduled Procedure Step
MTU	Maximum Transmission Unit (IP)
MWL	Modality Worklist
NM	Nuclear Medicine
NTP	Network Time Protocol
O	Optional (Key Attribute)
OP	Ophthalmic Photography
OSI	Open Systems Interconnection
PACS	Picture Archiving and Communication System
PET	Positron Emission Tomography
PDU	Protocol Data Unit
PHI	Protected Health Information
R	Required (Key Attribute)
RDN	Relative Distinguished Name (LDAP)
RIS	Radiology Information System
RT	Radiotherapy
SC	Secondary Capture
SCP	Service Class Provider
SCU	Service Class User
SDP	Service Description Protocol
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
SR	Structured Reporting
STOW-RS	Store Over the Web by RESTful Services
TCP/IP	Transmission Control Protocol/Internet Protocol

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U	Unique (Key Attribute)
UL	Upper Layer
US	Ultrasound
VL	Visible Light
VR	Value Representation
VSDS	VivaScope DICOM Service
XA	X-ray Angiography

### 3.6 References

- [1] National Electrical Manufacturers Association (NEMA), Rosslyn, VA USA. PS3 / ISO 12052 Digital Imaging and Communications in Medicine (DICOM) Standard. <http://www.dicomstandard.org> .
- [2] National Electrical Manufacturers Association (NEMA), Sup145 -Whole Slide Imaging in Pathology <https://www.dicomstandard.org/News-dir/ftsup/docs/sups/sup145.pdf>
- [3] National Electrical Manufacturers Association (NEMA), Sup226 - Confocal Microscopy Image <https://www.dicomstandard.org/News-dir/ftsup/docs/sups/sup226.pdf>

## 4 Implementation Model

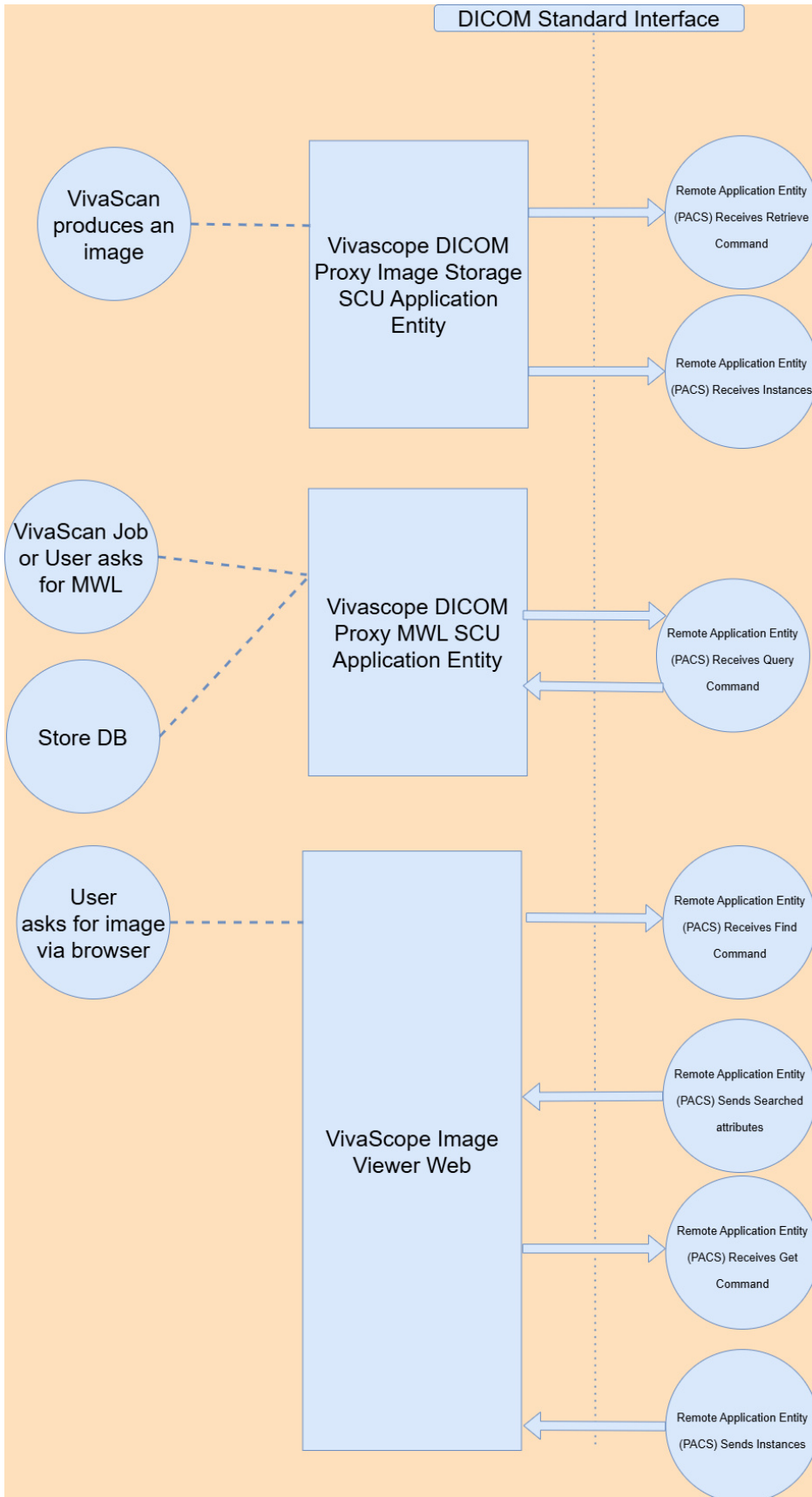
The VivaScan DICOM/HL7 Proxy now runs as a Windows Service and acts as a proxy between the VivaScope Application and the medical institution's PACS. In addition, the VivaScope Image Viewer Desktop is available as a desktop application whose back-end also runs as a Windows Service. It features a built-in web interface that enables medical staff and IT specialists to configure and modify its behavior. The system still consists of multiple AEs operating under a single common AET.:

- VivaScan DICOM Proxy Image Storage SCU Application Entity
  - Converts images produced by VivaScan Application into DCM files in the appropriate (previously described) DICOM format.
  - Uses C-STORE (SCU) to send images to PACS.
  - Automatically retries failed transfers using a job-based mechanism.
- VivaScan DICOM Proxy Verification SCP Application Entity
  - Provides SCP services for C-ECHO (verification requests) from external DICOM nodes.
- VivaScan DICOM Proxy MWL SCU Application Entity
  - Periodically or on-demand, queries the Modality Worklist (MWL) server.
  - Uses C-FIND (SCU) to fetch the scheduled procedures.
  - Updates or creates corresponding studies in the local VivaScan database
- VivaScope Image Viewer Web
  - Provides a DICOM-compliant web-based viewer for retrieving and displaying images from PACS.
  - Uses C-FIND (SCU) to query PACS for available studies.

- Uses C-GET (SCU) to retrieve images from PACS, which are received via C-STORE (SCP).
- Implements a caching mechanism to temporarily store retrieved images for fast access.
- Supports LDAP / Active Directory authentication for user access control.
- (Optional) Enables direct study access via a generated URL if integrated with hospital systems for workflow automation.

## 4.1 Application Entities and Data Flow

The network and media interchange application model for the VivaScan DICOM/HL7 proxy and the VivaScope Image Viewer is shown in Figure 4-1 VivaScope DICOM Application Data Flow Diagram.



### Figure 4-1. VivaScope DICOM Application Data Flow Diagram

This section describes the organization of the supported Services into Application Entities based on the default configuration of the system. This may change based on the actual setup at the customer site. See Section 6 for details about the configurability of Services into AEs.

#### 4.1.1 Functional Definition of “VivaScan DICOM Proxy Verification SCP Application Entity” – (VERIFICATION SCP AE)

DIMSE services are used for verifying the local SCU. The C-ECHO request is performed by a remote DICOM node such as a PACS server. “VivaScan DICOM/HL7 proxy” responds in conformance with DICOM PS3.7 9.3.5.

For the response to be sent back these conditions have to be met:

- VivaScope 2500M-G4 PC must be reachable (this can be tested by a TCP ping)
- “VivaScan DICOM/HL7 proxy” on the VivaScope 2500M-G4 PC must be running, accept echo requests, and be correctly configured (AE Title and port)
- The firewall on the VivaScope 2500M-G4 PC must be configured to open the DICOM port used by the VivaScope 2500M-G4 PC
- Your testing software must use the correct address, AE Title, and port number of the VivaScope 2500M-G4 PC

#### 4.1.2 Functional Definition of “VivaScan DICOM Proxy MWL SCU Application Entity - (MWL SCU AE)

“VivaScan DICOM/HL7 proxy” is able to query a remote Modality Worklist Server. It provides Standard Conformance to the following DICOM SOP Classes (the uncompressed transfer Syntax list is used):

**Table 4-1 VivaScan DICOM Proxy MWL**

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	Y	N

AE responsible for querying for modality worklist for our machine’s AET. “VivaScan DICOM/HL7 proxy” will call the remote work list DICOM node with these keys as return keys:

- (0008,0050) VR=SH VM=1 Accession Number
- (0008,0051) VR=SQ VM=1 Issuer of Accession Number Sequence
- (0008,0090) VR=PN VM=1 Referring Physician’s Name
- (0010,0010) VR=PN VM=1 Patient’s Name
- (0010,0020) VR=LO VM=1 Patient ID
- (0010,0021) VR=LO VM=1 Issuer of Patient ID
- (0010,0030) VR=DA VM=1 Patient’s Birth Date
- (0010,0040) VR=CS VM=1 Patient’s Sex
- (0020,000D) VR=UI VM=1 Study Instance UID
- (0040,0100) VR=SQ VM=1 Scheduled Procedure Step Sequence (PARENT TAG)
  - (0010,1030) VR=DS VM=1 Patient’s Weight
  - (0010,2000) VR=LO VM=1-n Medical Alerts
  - (0010,2110) VR=LO VM=1-n Allergies
  - (0010,21C0) VR=US VM=1 Pregnancy Status
  - (0032,1032) VR=PN VM=1 Requesting Physician
  - (0032,1033) VR=LO VM=1 Requesting Service
  - (0032,1060) VR=LO VM=1 Requested Procedure Description
  - (0032,1064) VR=SQ VM=1 Requested Procedure Code Sequence
  - (0038,0010) VR=LO VM=1 Admission ID
  - (0038,0014) VR=SQ VM=1 Issuer of Admission ID Sequence
  - (0038,0050) VR=LO VM=1 Special Needs
  - (0038,0300) VR=LO VM=1 Current Patient Location
  - (0038,0500) VR=LO VM=1 Patient State
  - (0040,1001) VR=SH VM=1 Requested Procedure ID

- (0040,1003) VR=SH VM=1 Requested Procedure Priority
- (0040,1004) VR=LO VM=1 Patient Transport Arrangements
- (0040,2016) VR=LO VM=1 Placer Order Number / Imaging Service Request
- (0040,2017) VR=LO VM=1 Filler Order Number / Imaging Service Request
- (0040,3001) VR=LO VM=1 Confidentiality Constraint on Patient Data Description
- (0008,0060) VR=CS VM=1 Modality
- (0032,1070) VR=LO VM=1 Requested Contrast Agent
- (0040,0002) VR=DA VM=1 Scheduled Procedure Step Start Date
- (0040,0003) VR=TM VM=1 Scheduled Procedure Step Start Time
- (0040,0006) VR=PN VM=1 Scheduled Performing Physician's Name
- (0040,0007) VR=LO VM=1 Scheduled Procedure Step Description
- (0040,0009) VR=SH VM=1 Scheduled Procedure Step ID
- (0040,0010) VR=SH VM=1-n Scheduled Station Name
- (0040,0011) VR=SH VM=1 Scheduled Procedure Step Location
- (0040,0012) VR=LO VM=1 Pre-Medication
- (0040,0020) VR=CS VM=1 Scheduled Procedure Step Status
- (0040,0008) VR=SQ VM=1 Scheduled Protocol Code Sequence

And these keys are arguments for work list query:

- (0040,0001) VR=AE VM=1-n Scheduled Station AE Title

### 4.1.3 Functional Definition of “VivaScan DICOM Proxy Image Storage SCU Application Entity” - (STORE SCU AE)

After VivaScan Application finishes image acquisition the images are converted into DICOM format (DCM files). They are stored on the VivaScope 2500M-G4 PC at a location defined by window registry key:

- HKEY\_CURRENT\_USER\Software\Caliber Imaging & Diagnostics\RIS\vivascan\LocalImageDir

Example of location of DCM files:

- C:\vivanet\images\1.2.276.0.7230010.3.1.2.3428888297.3010614.1619547571.258125\VivaBlock#1\viva\_dicom

In the above example HKEY\_CURRENT\_USER\Software\Caliber Imaging & Diagnostics\RIS\vivascan\LocalImageDir = C:\vivanet\images

Stored DICOM confocal images are created in conformance with the Confocal Microscopy Image Storage (SOP Class UID 1.2.840.10008.5.1.4.1.1.77.1.8) or Confocal Microscopy Tiled Pyramidal Image Storage (SOP Class UID 1.2.840.10008.5.1.4.1.1.77.1.9) from Supplement 226, or any of the SOP Classes listed in Table 4.2.1.1 2, depending on the system configuration. Because many PACS systems do not natively support these specialized SOP Classes, the “VivaScan DICOM/HL7 proxy” often defaults to Secondary Capture or Multi-frame Grayscale Byte Secondary Capture. The Tiled Pyramidal Confocal class (1.2.840.10008.5.1.4.1.1.77.1.9) is the only one that provides full support for large, pyramid-form images with seamless zooming, but it is not widely supported. Hence, a simpler fallback mode is available that enables standard DICOM viewers to handle non-pyramidal images. Remote Storage SCPs can negotiate the necessary SOP Classes with the “VivaScan DICOM/HL7 proxy” Storage SCU as listed in Table 4.1.3.

**Table 4-2. Necessary SOP Classes with the “VivaScan DICOM/HL7 proxy” Storage SCU**

SOP Class Name	SOP Class UID	Transfer Syntax (SCU)	Optional
Confocal Microscopy Image Storage (Supplement 226)	1.2.840.10008.5.1.4.1.1.77.1.8	UNCOMP/COMP	Y
Confocal Microscopy Tiled Pyramidal Image Storage (Supplement 226)	1.2.840.10008.5.1.4.1.1.77.1.9	UNCOMP/COMP	Y
Secondary Capture Image Storage (Fallback for Confocal)	1.2.840.10008.5.1.4.1.1.7	UNCOMP/COMP	Y

SOP Class Name	SOP Class UID	Transfer Syntax (SCU)	Optional
Multi-frame Grayscale Byte Secondary Capture Image Storage (Fallback for Pyramidal Confocal)	1.2.840.10008.5.1.4.1.1.7.2	UNCOMP/COMP	Y
VL Photographic Image Storage (Default for Macroscopic)	1.2.840.10008.5.1.4.1.1.77.1.4	UNCOMP/COMP	Y
Basic Text SR Storage (Annotations)	1.2.840.10008.5.1.4.1.1.88.11	UNCOMP/COMP	Y
VL Whole Slide Microscopy Image Storage (Legacy WSI, no longer used)	1.2.840.10008.5.1.4.1.1.77.1.6	-	N

## Notes:

- **Confocal Microscopy Image Storage (1.2.840.10008.5.1.4.1.1.77.1.8) and Confocal Microscopy Tiled Pyramidal Image Storage (1.2.840.10008.5.1.4.1.1.77.1.9)** are from Supplement 226 and represent the primary SOP Classes for confocal imaging.
- Because many PACS systems do not support these newer SOP Classes, the proxy can default to **Secondary Capture or Multi-frame Grayscale Byte Secondary Capture**.
- **VL Photographic Image Storage** is typically used for macroscopic images.
- **Basic Text SR Storage** is used for annotations.
- The older **VL Whole Slide Microscopy Image Storage** is listed only for reference and is no longer in active use.

#### 4.1.4 Functional Definition of "VivaScan Image Viewer Web Query/Retrieve SCU Application Entity" - (QUERY/RETRIEVE SCU AE)

The "VivaScan Image Viewer Web" provides Standard Conformance to the DICOM Query/Retrieve Service Class as an SCU (Service Class User). This AE is responsible for querying a remote PACS server to locate studies and subsequently retrieving DICOM files associated with a specific study.

##### 4.1.4.1 Query Functionality (C-Find)

The "VivaScan Image Viewer Web" AE supports the C-FIND operation for querying patient studies from a remote PACS server. It provides conformance to the following DICOM SOP Class:

**Table 4-3. VivaScan Image Viewer Web" AE**

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Y	N

The AE can perform queries at the Study Level using either a specific Study Instance UID or more general query parameters such as Patient ID or Patient Name. This enables users to locate relevant studies in the PACS before retrieving image data.

The following DICOM attributes may be used in C-FIND requests:

**Table 4-4. DICOM attributes**

Tag	VR	VM	Attribute Name	Query Level
(0020,000D)	UI	1	Study Instance UID	Study
(0010,0020)	LO	1	Patient ID	Patient
(0010,0010)	PN	1	Patient Name	Patient

Tag	VR	VM	Attribute Name	Query Level
(0008,0050)	SH	1	Accession Number	Study
(0008,0020)	DA	1	Study Date	Study
(0008,1030)	LO	1	Study Description	Study
(0008,0060)	CS	1	Modality	Study
(0020,0010)	SH	1	Study ID	Study

C-FIND queries can be initiated based on:

- Study Instance UID (exact match)
- Patient ID (exact match or wildcard search)
- Patient Name (wildcard search)
- Other optional attributes as supported by the PACS server

The AE expects responses containing matching studies with relevant metadata, which it presents to the user for study selection.

#### 4.1.4.2 Retrieve Functionality (C-GET)

Once a relevant study has been identified, "VivaScan Image Viewer Web" can retrieve DICOM images using the C-GET DIMSE service. This AE supports Standard Conformance to the following SOP Class:

**Table 4-5. AE supported SOP Class**

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - GET	1.2.840.10008.5.1.4.1.2.2.3	Y	N

The C-GET request is always performed in the context of a single study, meaning that only images belonging to the previously queried Study Instance UID are requested from the PACS.

The C-GET operation requests image retrieval using the following key:

**Table 4-6. C-GET operation requests**

Tag	VR	VM	Attribute Name	Query Level
(0020,000D)	UI	1	Study Instance UID	Study

Once a C-GET request is issued, the remote PACS server sends the requested DICOM images back to "VivaScan Image Viewer Web" using C-STORE operations. The AE accepts all incoming instances that belong to the study being retrieved.

#### 4.1.4.3 Transfer Syntax Support

The "VivaScan Image Viewer Web" SCU supports the following DICOM Transfer Syntaxes:

**Table 4-7. Transfer Syntax Support**

Transfer Syntax Name	UID
Explicit VR Little Endian	1.2.840.10008.1.2.1
Explicit VR Big Endian	1.2.840.10008.1.2.2
Implicit VR Little Endian	1.2.840.10008.1.2
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
JPEG Lossless (Process 14)	1.2.840.10008.1.2.4.57
JPEG-LS Lossless	1.2.840.10008.1.2.4.80
JPEG-LS Near-Lossless	1.2.840.10008.1.2.4.81

The AE supports decompression of compressed images when necessary, allowing them to be displayed in the viewer.

#### 4.1.4.4 Association and Network Communication

The "VivaScan Image Viewer Web" AE follows these association parameters:

**Table 4-8. VivaScan Image Viewer Web" AE association parameters**

Parameter	Value
Max PDU Size	64 KB
Max Open Associations	1
Max Outstanding C-FIND Requests	5
Max Outstanding C-GET Requests	2

The AE communicates using TCP/IP and requires the PACS server to be configured with:

- The correct AE Title
- The IP address and port of the PACS
- Proper firewall settings allowing DICOM communication

The AE only initiates associations and does not accept incoming DICOM requests.

#### 4.1.4.5 Security Considerations

The "VivaScan Image Viewer Web" AE does not implement DICOM Transport Layer Security (TLS). Secure communication should be ensured by external means such as VPN tunnels or network-level encryption. User authentication is handled externally by the web application.

## 5 Service and Interoperability Description

### 5.1 Mapping of Services to Application Entities

Table 5-1 provides an overview of the Application Entities and the Services supported by each AE.

**Table 5-1. Service to AE Mapping**

Application Entity	Supported Services	Role									Notes
		DIMSE		DICOM Web		DICOM Media			Real-Time Video		
		SCU	SCP	Origin Server	User Agent	FSC	FSU	FSR	SCU	SCP	
VivaScan DICOM Proxy	Verification	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Responds to C-ECHO.
	Modality Worklist	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Queries MWL provider.
	Modality Performed Procedure Step (MPPS)	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Sends N-CREATE / N-SET.
	Storage	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Sends C-STORE to archive.
	Query/Retrieve (Study Root)	X (C-FIND only)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No C-MOVE; Viewer handles GET.
VivaScope Image Viewer Web	Query/Retrieve (Study Root)	X	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Initiates GET; accepts C-STORE only for requested study.
	Storage	N/A	X (only during C-GET)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Not a general Storage SCP; §7.3.2.5.2 remains N/A.

### 5.2 DIMSE Services

The VivaScan family uses the DIMSE services below; roles per AE are indicated in the subsections.

**Table 5.2. DIMSE Services**

Service	Application Entity	Role
Basic Worklist Management (MWL FIND)	VivaScan DICOM Proxy	SCU
Modality Performed Procedure Step (MPPS)	VivaScan DICOM Proxy	SCU
Storage	VivaScan DICOM Proxy	SCU

Service	Application Entity	Role
Study-Root Query/Retrieve (FIND + GET)	VivaScope Image Viewer Web	SCU

## 5.2.1 Basic Worklist Management Service

### 5.2.1.1 SCU of the Modality Worklist Information Model - FIND SOP Class

As a Service Class User of the Modality Worklist Information Model - FIND SOP Class, the VivaScan DICOM Proxy uses the C-FIND message to query the SCP. It supports the Query Keys listed in Table 5-2.

- **SOP Class UID** 1.2.840.10008.5.1.4.31
- **DIMSE message** C-FIND (one association at a time)
- **Transfer syntaxes** Implicit VR LE (default) and Explicit VR LE
- **Query level** Scheduled Procedure Step (single-study)
- **Matching keys** Scheduled Station AE Title (0040,0001), Patient ID, Patient Name, Accession Number, Modality, Scheduled Start Date / Time, Study Instance UID, etc.
- **Return keys** Accession Number, Study Instance UID, Modality, SPS Start Date/Time, Performing Physician, Station Name, Procedure Step ID/Description/Status, Requested Procedure ID/Description/Code Seq, Patient Name/ID/Sex/Birth Date, Admission ID, Current Patient Location, Requested Contrast Agent ... (full 0032/0038/0040 key set)
- **Association behaviour** Proxy opens the MWL association at study initialisation, waits for the complete response list, then releases. Idle-response timeout 30 s.

**Table 5-3. SCU of the Modality Worklist Information Model**

Tag	DICOM Attribute	Type	Notes
(0008,0050)	Accession Number	2	Alphanumeric ≤ 16 chars
(0010,0020)	Patient ID	2	Supports wildcard '*'
(0010,0010)	Patient Name	2	Family^Given
(0040,0100)	Scheduled Procedure Step Sequence	2	Includes (0008,0060) Modality & (0040,0001) ID

**Table 5-4. Supported C-FIND Query Parameters for Modality Worklist - SCU**

Attribute Name	Tag	Matching Type	Query Value Source	Value	Display on UI	Comments
Scheduled Procedure Step						
Scheduled Procedure Step Sequence	(0040,0100)	SEQUENCE	N/A	N/A	N/A	Container for ">" attributes
> Scheduled Station AE Title	(0040,0001)	SINGLE_VALUE	CONFIGURATION	thisModalityAet	N/A	Only query key used to filter to this modality
> Modality	(0008,0060)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Procedure Step Start Date	(0040,0002)	UNIVERSAL	EMPTY	N/A	N/A	Return key

Attribute Name	Tag	Matching Type	Query Value Source	Value	Display on UI	Comments
> Scheduled Procedure Step Start Time	(0040,0003)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Performing Physician's Name	(0040,0006)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Procedure Step Description	(0040,0007)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Protocol Code Sequence	(0040,0008)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Procedure Step ID	(0040,0009)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Station Name	(0040,0010)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Procedure Step Location	(0040,0011)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Pre-Medication	(0040,0012)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Procedure Step Status	(0040,0020)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Requested Contrast Agent	(0032,1070)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Scheduled Procedure Step Sequence	(0040,0100)	SEQUENCE	N/A	N/A	N/A	Container for ">" attributes
> Scheduled Station AE Title	(0040,0001)	SINGLE_VALUE	CONFIGURATION	thisModalityAet	N/A	Only query key used to filter to this modality
> Modality	(0008,0060)	UNIVERSAL	EMPTY	N/A	N/A	Return key
> Scheduled Procedure Step Start Date	(0040,0002)	UNIVERSAL	EMPTY	N/A	N/A	Return key
<b>Patient</b>						
Patient's Name	(0010,0010)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Patient ID	(0010,0020)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Issuer of Patient ID	(0010,0021)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Patient Birth Date	(0010,0030)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Patient Sex	(0010,0040)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Patient Weight	(0010,1030)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Medical Alerts	(0010,2000)	UNIVERSAL	EMPTY	N/A	N/A	Return key

Attribute Name	Tag	Matching Type	Query Value Source	Value	Display on UI	Comments
Allergies	(0010,2110)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Pregnancy Status	(0010,21C0)	UNIVERSAL	EMPTY	N/A	N/A	Return key
<b>Requested / Ordering</b>						
Requesting Physician	(0032,1032)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Requesting Service	(0032,1033)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Requested Procedure Description	(0032,1060)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Requested Procedure Code Sequence	(0032,1064)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Requested Procedure ID	(0040,1001)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Requested Procedure Priority	(0040,1003)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Patient Transport Arrangements	(0040,1004)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Placer Order Number / Imaging Service Request	(0040,2016)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Filler Order Number / Imaging Service Request	(0040,2017)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Confidentiality Constraint on Patient Data Description	(0040,3001)	UNIVERSAL	EMPTY	N/A	N/A	Return key
<b>Admission/Visit</b>						
Admission ID	(0038,0010)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Issuer of Admission ID Sequence	(0038,0011)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Special Needs	(0038,0050)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Current Patient Location	(0038,0300)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Patient State	(0038,0500)	UNIVERSAL	EMPTY	N/A	N/A	Return key
<b>Study Context</b>						
Accession Number	(0008,0050)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Issuer of Accession Number Sequence	(0008,0051)	UNIVERSAL	EMPTY	N/A	N/A	Return key

Attribute Name	Tag	Matching Type	Query Value Source	Value	Display on UI	Comments
Study Instance UID	(0020,000D)	UNIVERSAL	EMPTY	N/A	N/A	Return key
Referring Physician's Name	(0008,0090)	UNIVERSAL	EMPTY	N/A	N/A	Return key

### 5.2.1.2 SCP of the Modality Worklist Information Model - FIND SOP Class - N/A

N/A

## 5.2.2 Modality Performed Procedure Step Service

### 5.2.2.1 SCU of the Modality Performed Procedure Step SOP Class

As a Service Class User of the Modality Performed Procedure Step SOP Class, the Product supports the Attributes listed in Table 5-5.

**Table 5-5. Supported N-CREATE and N-SET Attributes for Modality Performed Procedure Step - SCU**

Attribute Name	Tag	Source	Value N-CREATE	Value N-SET	Comments
Specific Character Set	(0008,0005)	EMPTY	N/A	N/A	Not sent in MPPS; peer defaults to ISO 2022 IR 6 when absent.
<b>Performed Procedure Step Relationship</b>					
Scheduled Step Attributes Sequence	(0040,0270)	N/A	(one item)	N/A	Single item is created.
> Study Instance UID	(0020,000D)	MWL	Copied from matched MWL study	N/A	Also copied to top-level Study Instance UID.
> Requested Procedure ID	(0040,1001)	GENERATED	Extracted from Study Description (if present)	N/A	Parsed by RequestProcedureIdExtractor; omitted if not found.
> Scheduled Procedure Step ID	(0040,0009)	MWL	From MWL entry	N/A	
> Scheduled Station Name	(0040,0010)	MWL	From MWL entry	N/A	Uses MWL "scheduled AE name".
Patient's Name	(0010,0010)	MWL	From MWL	N/A	
Patient ID	(0010,0020)	MWL	From MWL	N/A	
Study Instance UID	(0020,000D)	MWL	From MWL	N/A	Top-level attribute mirrors SSA item.
<b>Performed Procedure Step Information</b>					
Performed Procedure Step Status	(0040,0252)	GENERATED	COMPLETED	N/A	MPPS is sent directly as COMPLETED; no IN-PROGRESS / N-SET used.
Performed Procedure Step Start Date	(0040,0244)	GENERATED	Current date (now)	N/A	Start/End timestamps set to the same "now".

Attribute Name	Tag	Source	Value N-CREATE	Value N-SET	Comments
Performed Procedure Step Start Time	(0040,0245)	GENERATED	Current time (now)	N/A	
Performed Procedure Step End Date	(0040,0250)	GENERATED	Current date (now)	N/A	
Performed Procedure Step End Time	(0040,0251)	GENERATED	Current time (now)	N/A	
<b>(SOP Common – for completeness)</b>					
SOP Class UID	(0008,0016)	FIXED	Modality Performed Procedure Step (1.2.840.10008.3.1.2.3.3)	N/A	Set explicitly in dataset.
SOP Instance UID	(0008,0018)	GENERATED	New UID using VivaScope root	N/A	Created via UIDUtils.createUID(CompanyUID.VIVASCOPE.rootUID).

### 5.2.2.2 SCP of the Modality Performed Procedure Step SOP Class –N/A

N/A

### 5.2.3 Unified Worklist and Procedure Step Service- N/A

N/A

### 5.2.4 Instance Availability Notification Service- N/A

N/A

## 5.2.5 Storage Service

### 5.2.5.1 SCU of the Storage SOP Classes

As a Service Class User of the Storage Service Class, the VivaScope DICOM Proxy uses the C-STORE-RQ message to request storage of DICOM objects by a remote SCP. See Section 1.1 Content and Transfer in the Overview for the list of supported SOP Classes.

**Table 5.6. Viewer Storage SCU – Presentation Contexts (Annotation SOPs)**

SOP Class	UID	Transfer Syntaxes
Basic Text SR Storage	1.2.840.10008.5.1.4.1.1.88.11	Implicit VR Little Endian (1.2.840.10008.1.2) Explicit VR Little Endian (1.2.840.10008.1.2.1)

As a Service Class User of the Storage Service Class, the product uses the C-STORE-RQ message to request storage of DICOM objects by a remote SCP. See Section 1.1 Content and Transfer for the list of supported SOP Classes.

For details regarding the content of SOP Instances that are created by the system, see Section 9, which describes the underlying IODs of the supported SOP Classes.

#### Triggering of storage requests.

Storage is automatic. The VivaScan DICOM Proxy monitors the acquisition output (HDF5 “.h5” files) produced by the microscope software. When a new file is detected and conversion completes, the Proxy creates the corresponding DICOM instance(s) and immediately initiates C-STORE to the configured remote AE (PACS). No user interaction is required.

#### **Association and transfer policy.**

The SCU initiates the association and proposes presentation contexts for the supported Storage SOP Classes using the site-configured transfer syntaxes (Explicit VR Little Endian and/or JPEG Baseline [Process 1]). The SCU does not negotiate asynchronous operations; one C-STORE sub-operation is outstanding at a time. Multiple instances may be sent over the same association; the association is released when the current batch completes or upon peer request.

#### **Transcoding and SOP Class fallback.**

Instances are encoded at creation time according to configuration; the SCU does not transcode on the network path. If the peer does not accept the offered transfer syntax, the association will fail and the send is logged. If the peer does not accept the configured image SOP Class (e.g., Supplement 226 UIDs), the product can be configured to create and send Secondary Capture objects instead; see Section 9 for SOP Class selection per image type.

#### **Series/Study creation and ordering.**

When a Modality Worklist (MWL) item was used, Study Instance UID is taken from MWL and propagated to all created instances. If MWL is not available, the Proxy generates a new Study Instance UID for the acquisition. Series Instance UIDs are generated by the Proxy. Series and instance ordering follow the converter’s creation sequence for the acquired data (e.g., per image type such as flat, stack, or pyramidal). Any Series/Study Descriptions are derived from available acquisition metadata or configuration.

#### **C-STORE status handling and retry.**

Success (0000) marks the instance sent. Warnings (Bxxx) are treated as success and logged. Failures (A7xx/A9xx/Cxxx, association abort, or network error) are logged; the remaining items proceed on the current or a new association as appropriate. Where enabled, the scheduler applies a bounded retry policy; otherwise, operator action is required to re-queue.

#### **Referenced pixel data transfer syntaxes.**

The product does not create or send datasets using referenced pixel data transfer syntaxes (e.g., JPIP Referenced Pixel Data). All pixel data are embedded in the dataset; therefore, no validity interval for external pixel references applies.

#### **Security.**

C-STORE is performed over DICOM TCP within the institution’s protected network. TLS is not negotiated by the application; if encrypted transport is required, it must be provided by site infrastructure (e.g., VPN or TLS gateway).

#### **5.2.5.1.1 Transcoding of Transfer Syntaxes**

Pixel data are never re-encoded. If all negotiated syntaxes are rejected, the proxy aborts the association and retries to the next destination.

#### **5.2.5.2 SCP of the Storage SOP Classes – N/A**

N/A

#### **5.2.6 Storage Commitment Service-N/A**

N/A

#### **5.2.7 Query/Retrieve Service Class – N/A**

N/A

#### **5.2.8 Print Management Service – N/A**

N/A

### 5.3 DICOM Web Services - N/A

N/A

### 5.4 Media Services - N/A

N/A

### 5.5 Real-Time Video Services - N/A

N/A

### 5.6 Cross Service Considerations – N/A

N/A

### 5.7 Specific Character Sets

See Section 1.7 for supported Values for Specific Character Set (0008,0005).

Generic configuration for Specific Character Sets is covered in Section 6.1. Service specific configuration for Specific Character Sets is addressed in respective subsections of Section 6.2 or Section 6.3.

## 6 Configuration

The VivaScan system is configured via an installer interface that sets system environment variables, which are read at startup. These variables control the behavior of both the Viewer back-end and the DICOM Proxy. No direct YAML editing is required by the customer.

### 6.1 General Configuration Parameters

Table 6-1 lists general configuration parameters applicable across all supported DICOM Services.

**Table 6-1. General Configuration Parameters**

Parameter	Configurable	Default Value	Comments
<b>General Parameters</b>			
Association open timeout	SERVICE	30s	Time to wait for A-ASSOCIATE-AC or RJ
Association release timeout	SERVICE	5s	Time to wait for A-RELEASE-RP
DIMSE message timeout	SERVICE	15s	Time to wait for C-* / N-* reply
Max simultaneous associations	SERVICE	Proxy: 5 Viewer: 1	Applies system-wide

### 6.2 Configuration of DIMSE Services

This section describes the configuration parameters related to DIMSE-based services supported by the product. General configuration parameters that apply to all DIMSE services are described in **Section 6.1**. Service-specific configuration parameters are described in the following subsections.

**Table 6-2. Configuration of DIMSE Services**

<b>Local Configuration Parameters - Storage SCU</b>			
<b>Parameter</b>	<b>Configurable</b>	<b>Default Value</b>	<b>Comments</b>
	<<USER, SERVICE, FIXED>>	<i>[If there is no default, leave blank.]</i>	<i>[Provide comments or Values/ranges if applicable.]</i>
<i>Calling AE Title (SCU)</i>	<i>SERVICE</i>	VivaScope	
<i>Port</i>	<i>SERVICE</i>	12003	
<i>IP</i>	<i>SERVICE</i>	0.0.0.0	
<i>originalVLLImageSOPClass</i>	<i>SERVICE</i>	1.2.840.10008.5.1.4.1.1.77.1.4	<i>VLPhotographicImageStorage</i>
<i>originalConfocalImageSOPClasses</i>	<i>SERVICE</i>	1.2.840.10008.5.1.4.1.1.77.1.8	<i>ConfocalMicroscopyImageStorage</i>
<i>originalPyramidImagesSOPClasses</i>	<i>SERVICE</i>	1.2.840.10008.5.1.4.1.1.77.1.9	<i>ConfocalMicroscopyTiledPyramidallImageStorage</i>
<i>annotationSOPClass</i>	<i>SERVICE</i>	1.2.840.10008.5.1.4.1.1.88.11	<i>BasicTextSRStorage</i>
<i>cMoveOverCGet</i>	<i>SERVICE</i>	true	Prefer C-MOVE over usage of C-GET
<i>cMoveOverCFind</i>	<i>SERVICE</i>	true	Prefer C-MOVE over usage of C-FIND
<b>Remote Configuration Parameters - Storage SCU</b>			
<i>[Either document the number of supported remote hosts, e.g &lt;Product&gt; supports configuration of up to &lt;X&gt; remote hosts, or state that there is no limitation other than the ones mandated by the operating system.]</i>			
<b>Parameter</b>	<b>Configurable</b>	<b>Default Value</b>	<b>Comments</b>
	<<USER, SERVICE, FIXED>>	<i>[If there is no default, leave blank.]</i>	<i>[Provide comments or Values/ranges if applicable.]</i>
<i>Called AE Title (SCP)</i>	<i>SERVICE</i>	ORTHANC	
<i>Port</i>	<i>SERVICE</i>	4242	
<i>Host</i>	<i>SERVICE</i>	0.0.0.0	
<i>Web Port</i>	<i>SERVICE</i>	8042	
<i>Protocol</i>	<i>SERVICE</i>	http	

]

<b>Local Configuration Parameters - Modality Worklist SCU</b>			
<b>Parameter</b>	<b>Configurable</b>	<b>Default Value</b>	<b>Comments</b>
	<<USER, SERVICE, FIXED>>	[If there is no default, leave blank.]	[Provide comments or Values/ranges if applicable.]
Calling AE Title (SCU)	SERVICE	VivaScope	
Port	SERVICE	12003	
IP	SERVICE	0.0.0.0	
<b>Remote Configuration Parameters - Modality Worklist SCU</b>			
<i>[Either document the number of supported remote hosts, e.g &lt;Product&gt; supports configuration of up to &lt;X&gt; remote hosts, or state that there is no limitation other than the ones mandated by the operating system.]</i>			
<b>Parameter</b>	<b>Configurable</b>	<b>Default Value</b>	<b>Comments</b>
	<<USER, SERVICE, FIXED>>	[If there is no default, leave blank.]	[Provide comments or Values/ranges if applicable.]
Called AE Title (SCP)	SERVICE	ORTHANC	
Port	SERVICE	4242	
Host	SERVICE	0.0.0.0	
Web Port	SERVICE	8042	
Protocol	SERVICE	http	

## 6.2.1 Basic Worklist Management Service Configuration

Table 6-3 lists Worklist Service configuration parameters:

**Table 6-3. Worklist Service Parameters<sup>2</sup>**

<b>Parameter</b>	<b>Configurable</b>	<b>Default Value</b>	<b>Comments</b>
<b>Local Configuration Parameters – Worklist Service</b>			
Calling AE Title	INSTALLER	exvivo0	application.dicom.thisModalityAet
Scheduler enabled	INSTALLER	false	application.dicom.modalityWorklistSchedulerActive

<sup>2</sup> DICOM Proxy only

Parameter	Configurable	Default Value	Comments
Scheduler rate	INSTALLER	6000 ms	application.dicom.modalityWorklistSchedulerRate
Storage location for C-FIND results	INSTALLER	./build/cFindStorage	Directory where MWL results are cached
<b>Remote Configuration Parameters – Worklist Service</b>			
Called AE Title (MWL PACS)	INSTALLER	ORTHANC	application.dicom.modalityWorklistPacsAet
PACS IP	INSTALLER	0.0.0.0	application.dicom.modalityWorklistPacsIp
PACS Port	INSTALLER	4242	application.dicom.modalityWorklistPacsPort

## 6.2.2 Modality Performed Procedure Step Service Configuration

Implemented: SCU only (N-CREATE / N-SET).

Table 6-4 lists Modality Performed Procedure Step Service configuration parameters:

**Table 6-4. MPPS Service Parameters**

Parameter	Configurable	Default Value	Comments
<b>Local Configuration Parameters - MPPS Service</b>			
Calling AE Title	INSTALLER	exvivo0	application.dicom.thisModalityAet
<b>Remote Configuration Parameters - MPPS Service</b>			
MPPS SCP AE Title	INSTALLER	WORKLIST	application.dicom.mpps.aet
MPPS SCP IP	INSTALLER	0.0.0.0	application.dicom.mpps.ip
MPPS SCP Port	INSTALLER	4242	application.dicom.mpps.port

## 6.2.3 Unified Worklist and Procedure Step Service Configuration-N/A

N/A

## 6.2.4 Instance Availability Notification Service Configuration- N/A

N/A

## 6.2.5 Storage Service Configuration

Table 6-5 lists Storage Service configuration parameters:

**Table 6-5. Storage Service Parameters**

<b>Configuration Parameters – Query/Retrieve Service</b>			
<b>Parameter</b>	<b>Configurable</b>	<b>Default Value</b>	<b>Comments</b>
Proxy's Calling AE Title	INSTALLER	exvivo0	application.dicom.thisModalityAet
Viewer's AE Title	INSTALLER	VivaScope	application.dicom.thisModalityAet
Proxy's Images base path	INSTALLER	C:\vivanetimages	Location for image data
Proxy's Pyramid image tile size	Application	2048 × 2048 px	pyramidTileWidth, pyramidTileHeight
Proxy's Pyramid image compression rate	Application	75	JPEG compression rate
Proxy's Flat grid shrink factor	Application	8	Grid cell size divisor
Proxy's Flat grid cell size	Application	8192 × 8192 px	
Proxy's Flat grid compression rate	Application	70	
Proxy's Stack multi-frame file size limit	Application	50 MB	
Viewer's PACS AE Title	INSTALLER	ORTHANC	application.dicom.imageStoragePacsAet
Viewer's PACS IP	INSTALLER	localhost	application.dicom.imageStoragePacsIP
Viewer's PACS Port	INSTALLER	4242	application.dicom.imageStoragePacsPort
Proxy's PACS AE Title (storage)	INSTALLER	ORTHANC	application.dicom.imageStoragePacsAet
Proxy's PACS IP (storage)	INSTALLER	0.0.0.0	application.dicom.imageStoragePacsIP
Proxy's PACS Port (storage)	INSTALLER	4242	application.dicom.imageStoragePacsPort

## 6.2.6 Storage Commitment Service Configuration-N/A

N/A

## 6.2.7 Query/Retrieve Service Configuration

Table 6-6 lists Query/Retrieve Service configuration parameters (implemented on Viewer (SCU only)):

**Table 6-6. Query/Retrieve Service Parameters**

Configuration Parameters - Query/Retrieve Service			
Parameter	Configurable	Default Value	Comments
Calling AE Title	INSTALLER	VivaScope	application.dicom.thisModalityAet
Remote Configuration Parameters - Query/Retrieve Service			
Parameter	Configurable	Default Value	Comments
PACS AE Title	INSTALLER	ORTHANC	application.dicom. imageStoragePacsAet
PACS IP	INSTALLER	localhost	application.dicom. imageStoragePacsIP
PACS Port	INSTALLER	4242	application.dicom. imageStoragePacsPort
Preferred SOP Classes	FIXED	See below	Configured via installer or code constants

This AE accepts C-STORE only as sub-operations of a C-GET it initiated; it is not a general Storage SCP.

## 6.2.8 Print Management Service Configuration-N/A

N/A

## 6.3 Configuration of DICOM Web Services- N/A

N/A

## 6.4 Configuration of Media Storage Service - N/A

N/A

## 6.5 Configuration of Real-Time Video Service – N/A

N/A

## 6.6 Configuration of Audit Trail – Syslog

Local logging only. SYSLOG has not been implemented.

## 7 Network and Media Communication Details

### 7.1 General

All VivaScan components communicate via the DICOM upper-layer protocol over TCP/IP (IPv4 or IPv6). No DICOM TLS transport layer is implemented; sites that require encryption must place the system inside a secure network segment or VPN. Each AE negotiates its own presentation contexts. The standard DICOM Application Context Name 1.2.840.10008.3.1.1.1 is used by every association.

#### 7.1.1 General Association Parameters

Table 7-1 lists Association parameters applicable to all AEs on the system.

**Table 7-1. General Association Parameters**

	Name	Value
Networking Services	Application Context Name	1.2.840.10008.3.1.1.1
	Implementation Class UID	Proxy: 1.2.840.114434.1.1; Viewer: 1.2.840.114434.1.2
	Implementation Version Name	Proxy: VIVASCAN20; Viewer: VIVAVIEW20
	Maximum PDU Length	Default: 65536
	ARTIM Timeout	Default: 30s
	Maximum number of simultaneous Associations as Association Initiator	Proxy: 5 Viewer 1
	Async operations window	Not supported
	Extended-negotiation support	None

Because each AE also proposes its own Presentation Context list, the full details remain in 7.2.1.2 and 7.2.2.2.

## 7.2 Specifications

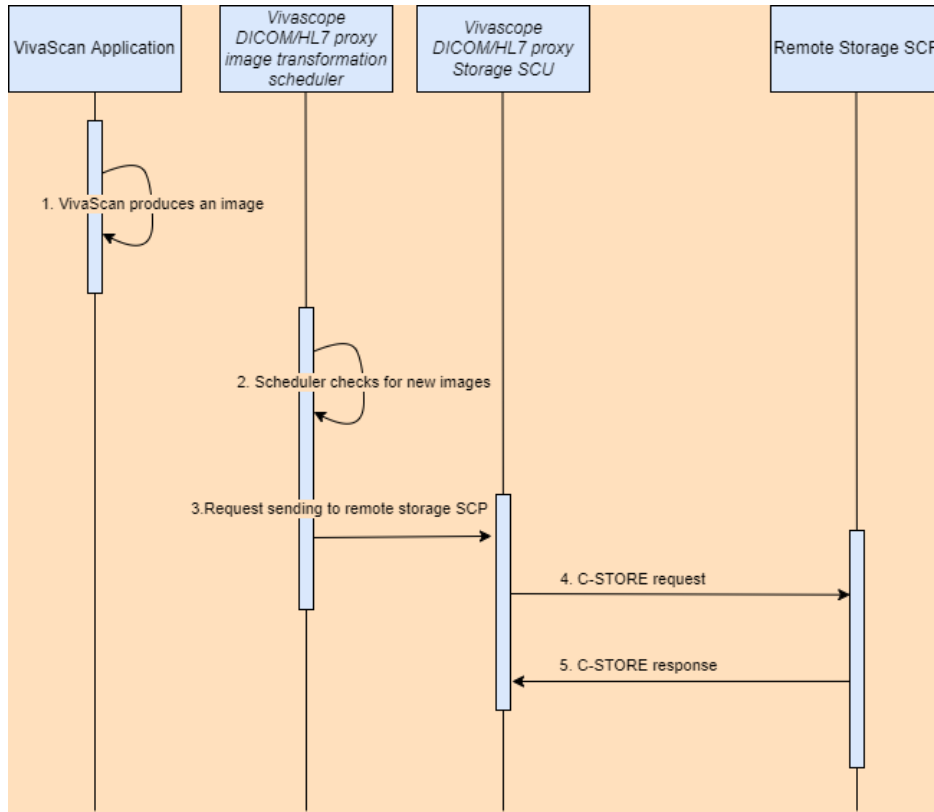
Two Application Entities (AEs) are delivered with the product:

**Table 7-2. Specifications**

AE	Primary role(s)	Typical AET
VivaScan DICOM Proxy	SCU – C-STORE (images), SCU – C-FIND (MWL), optional SCU – N-CREATE/N-SET (MPPS), SCP – C-ECHO	EXVIVO0 (configurable)
VivaScope Image Viewer Web	SCU – C-FIND / C-GET (Study Root QR), optional SCU – C-STORE (annotations)	VIVASCOPE (configurable)

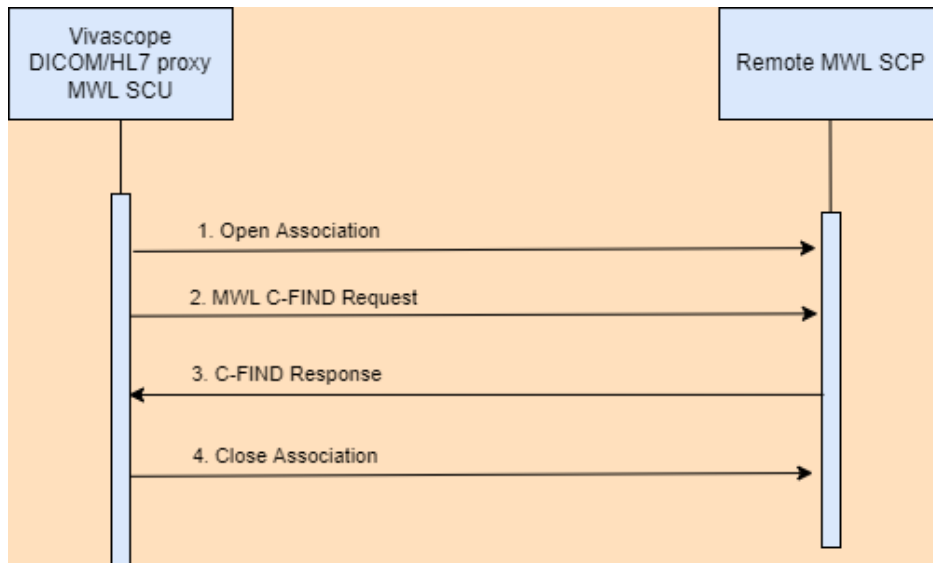
### 7.2.1 VivaScan DICOM Proxy Application Entity

#### 7.2.1.1 Sequencing of Real-World Activities for VivaScan DICOM Proxy



**Figure 7-1. Sequencing of Real-World Activities for *Imaging Storage to Remote SCP***

- **Image Generation** – VivaScan Scan produces an image and writes an *.h5* or *.vhs* file to C:\vivanet\images (this folder is configurable).
- **Detection & Transformation** – Proxy scheduler detects the new file, converts it to DICOM (JPEG baseline, JPEG 2000, JPEG XL, Supplement 226 SOP if accepted, else Secondary Capture – each compression type and SOP Class is configurable).
- **C-STORE Transfer** – Proxy opens one Association, sends up instances (images)
- **Storage Confirmation** – Proxy receives confirmation and changes internal status kept in database that images were sent



**Figure 7-2. Sequencing of Real-World Activities for Modality Worklist Retrieval**

- **C-FIND Query** – Proxy (SCU) sends a request filtered by its Station AE Title and Today's date/time window.
- **Response Handling** – Proxy receives list of modality worklist entries and creates all necessary database structures based on them. This allows later to open VivaScan and select Study of a Patient scheduled in one of those entries that were retrieved.

**7.2.1.2 Association Parameters of VivaScan DICOM Proxy**

Table 7-3 lists Association parameters applicable to VivaScan DICOM Proxy:

**Table 7-3. Association Parameters for VivaScan DICOM Proxy**

	Name	Value
Networking Services	Application Context Name	1.2.840.10008.3.1.1.1
	Implementation Class UID	1.2.40.0.13.1.3
	Implementation Version Name	vivascan-dicom-proxy-2.0
	Maximum PDU Length	65536
	Maximum open associations	5 (initiator)
	ARTIM timeout	30 s
	Asynchronous operations	not supported
	Supported presentation contexts	see SOP-Class list below

Table 7-4. lists Association parameters applicable of VivaScope Image Viewer Web AE:

**Table 7-4. Association Parameters of VivaScope Image Viewer Web AE**

	Name	Value
Networking Services	Application Context Name	1.2.840.10008.3.1.1.1
	Implementation Class UID	1.2.40.0.13.1.3
	Implementation Version Name	vivascan-viewer-web-1.0
	Maximum PDU Length	65 536 bytes (64 KB)
	Maximum open associations	1 (initiator only)
	Max outstanding C-FIND	5
	Max outstanding C-GET	2
	Asynchronous operations	not supported
	TLS transport	not supported (network-level security recommended)

### 7.2.1.3 Association Initiation

All real-world activities are implemented using dcm4che library. Please refer to its own conformance statement as our services do not implement any special behavior: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

### 7.2.1.4 Association Acceptance

All real-world activities are implemented using dcm4che library. Please refer to its own conformance statement as our services do not implement any special behavior: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

## 7.3 Status Codes

The following sections describe the Status Codes supported by the system for each implemented service as well as the reason for issuing specific Status Codes or the associated behavior when receiving it.

### 7.3.1 General AE Communication and Failure Behavior and Handling

#### 7.3.1.1 Communication Failure Behavior as Association Initiator

The behavior is determined by the main library used. Please refer to its own conformance statement: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

#### 7.3.1.2 Communication Failure Handling as Association Acceptor – N/A

N/A

### 7.3.2 DIMSE Services

#### 7.3.2.1 Basic Worklist Management Service

The definition is identical to main library used in services. Please refer to its own conformance statement: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

#### 7.3.2.2 Modality Performed Procedure Step Service

##### 7.3.2.2.1 SCU of the Modality Performed Procedure Step SOP Class - N-CREATE

The definition is identical to main library used in services. Please refer to its own conformance statement: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

#### **7.3.2.2.2 SCU of the Modality Performed Procedure Step SOP Class - N-SET**

The definition is identical to main library used in services. Please refer to its own conformance statement: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

#### **7.3.2.2.3 SCP of the Modality Performed Procedure Step SOP Class - N-CREATE – N/A**

N/A

#### **7.3.2.2.4 SCP of the Modality Performed Procedure Step SOP Class - N-SET – N/A**

N/A

#### **7.3.2.3 Unified Worklist und Procedure Step Service – N/A**

N/A

#### **7.3.2.4 Instance Availability Notification Service – N/A**

N/A

#### **7.3.2.5 Storage Service**

##### **7.3.2.5.1 SCU of the Storage SOP Classes - C-STORE**

The definition is identical to main library used in services. Please refer to it's own conformance statement: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

##### **7.3.2.5.2 SCP of the Storage SOP Classes - C-STORE – N/A**

N/A

#### **7.3.2.6 Storage Commitment Service – N/A**

N/A

#### **7.3.2.7 Query/Retrieve Service**

##### **7.3.2.7.1 SCU of the Query/Retrieve FIND SOP Classes - C-FIND**

The definition is identical to main library used in services. Please refer to it's own conformance statement: <https://dcm4chee-arc-cs.readthedocs.io/en/latest/>

##### **7.3.2.7.2 SCU of the Query/Retrieve MOVE SOP Classes - C-MOVE -N/A**

N/A

##### **7.3.2.7.3 SCP of the Query/Retrieve FIND SOP Classes - C-FIND – N/A**

N/A

##### **7.3.2.7.4 SCP of the Query/Retrieve MOVE SOP Classes - C-MOVE – N/A**

N/A

#### **7.3.2.8 Print Management Service - N/A**

N/A

### 7.3.3 DICOM Web Services – N/A

## 8 Security

This section describes the security characteristics of the VivaScan system in its current release. The information applies to both runtime components:

- VivaScan DICOM Proxy (runs on the microscope workstation or on a server)
- VivaScope Image Viewer back-end (runs on the hospital network as a web service)

## 8.1 Introduction

The security section describes security features implemented by this product.

Note: VivaScan relies on placement inside the hospital's secure LAN / VLAN or VPN. No DICOM TLS or HTTPS endpoints are provided by the software itself. If encrypted transport is mandatory, the customer must deploy an external TLS gateway, VPN tunnel, or overall network isolation.

### 8.2 External Network Requirements – N/A

N/A

### 8.3 TCP Port Configuration – N/A

N/A

### 8.4 DICOM Security Profiles Support – N/A

N/A

### 8.5 User Identity Negotiation Support – N/A

N/A

### 8.6 Web Services Security Features

DICOM Proxy on it's own does not implement any web security features as it is pure DICOM Dimse Service. VivaScope Viewer has a RESTful backend. Depending on the needs of the customer LDAP authentication and SSO can be supplied.

### 8.7 Other Security Features – N/A

N/A

## Annexes

### Annex A Information Object Definitions (IODs)

The VivaScan DICOM Proxy converts native microscope data to DICOM. For maximum PACS compatibility, the SOP Class used for each image-type is **configurable** in the web UI and the YAML keys shown below. Defaults are indicated in each table.

#### Annex A.1 Information Shared Across Multiple IODs

##### Annex A.1.1 Common Modules – N/A

N/A

##### Annex A.1.2 Common Functional Group Macros – N/A

N/A

## Annex A.1.3 Common Private Modules

The tables below list private Attributes that are used in multiple IODs generated by the system.

**Table A-1. Private Module 1**

Attribute Name	Tag	VR	VM	Identifiable Information	Source	Presence of Attribute	Presence of Value	Value	Conditions	Comments
Private Creator	(2501,0010)	LO	1			CONDITIONAL	CONDITIONAL	VivaScopeTagCreator		
Pyramid level	(2501,0017)	SL	1			CONDITIONAL	CONDITIONAL			
Minimum Pyramid level	(2501,0018)	SL	1			CONDITIONAL	CONDITIONAL			
Maximum Pyramid level	(2501,0019)	SL	1			CONDITIONAL	CONDITIONAL			
Total Image Height	(2501,0020)	SL	1			CONDITIONAL	CONDITIONAL			
Total Image Width	(2501,0021)	SL	1			CONDITIONAL	CONDITIONAL			
Channel color type	(2501,0022)	LO	1			CONDITIONAL	CONDITIONAL			
Image Position	(2501,0023)	SL	1			CONDITIONAL	CONDITIONAL			
Depth In Microns	(2501,0024)	SL	1			CONDITIONAL	CONDITIONAL			
Stage Rectangle	(2501,0025)	SL	1			CONDITIONAL	CONDITIONAL			
Total Number Of Frames (Stack or Movie)	(2501,0026)	SL	1			CONDITIONAL	CONDITIONAL			
Time point	(2501,0011)	SL	1			CONDITIONAL	CONDITIONAL			
Wavelength	(2501,0012)	SL	1			CONDITIONAL	CONDITIONAL			
Depth level (slice no.)	(2501,0013)	SL	1			CONDITIONAL	CONDITIONAL			
Frame column (x)	(2501,0014)	SL	1			CONDITIONAL	CONDITIONAL			

Attribute Name	Tag	VR	VM	Identifiable Information	Source	Presence of Attribute	Presence of Value	Value	Conditions	Comments
Frame row (y)	(2501,0015)	SL	1			<i>CONDITIONAL</i>	<i>CONDITIONAL</i>			

**Annex A.1.4 Coded Values – N/A**

N/A

**Annex A.2 – N/A**

N/A

**Annex A.3 – N/A**

N/A

**Annex A.4. – N/A**

N/A

**Annex A.5 Basic Directory IOD – N/A**

N/A

**Annex A.6 <Private IOD 1> - N/A**

N/A

**Annex B Structured Report Content Encoding – N/A**

N/A

## **Annex C Security Details**

This section provides additional details about security features that are formally described in Section N.8.

### **Annex C.1 External Network Requirement Details**

#### **Annex C.1.1 Basic Time Synchronization**

- The DICOM Proxy and Viewer back-end obtain time from the host operating system.
- OS clocks must be synchronized to the hospital NTP service.
- No built-in NTP client is supplied by VivaScan.

#### **Annex C.1.2 Basic Network Address Management**

- IP addressing is configured by the hospital: static IPv4 or DHCP.
- The installer records the chosen address and populates the DICOM "Remote Node" fields.
- IPv6 is supported but not required.

#### **Annex C.1.3 Application Configuration Management – N/A**

N/A

#### **Annex C.1.4 DNS Service Discovery**

- DNS is used only to resolve the PACS host name.
- No DNS-SD (mDNS / Zeroconf) is broadcast or listened for.

#### **Annex A.C.2 DICOM Security Profile Details – N/A**

N/A

## Annex D Mapping of Attributes

This section shows how VivaScan copies or derives DICOM attributes as it moves from Modality Worklist (MWL) to Modality Performed Procedure Step (MPPS). Only attributes actually handled by the current software are listed. All others are ignored or generated internally.

### Annex D.1 Mapping Between Modality Worklist Instances and MPPS

Table 12-1 describes the mapping of Attributes between Modality Worklist Instances and MPPS messages.

**Table D-1. Mapping of Attributes from Modality Worklist to Instance and MPPS**

Attribute Name in Image/MPPS	Tag	Scenario	Image		MPPS		Comments
			Value Source	Destination	Value Source	Destination	
Patient Name	(0010,0010)	SCHEDULED	DB (copied from MWL before images)	Patient Module (Top)	MWL (patient.patientName)	Top	Persisted with Study prior to images.
Patient ID	(0010,0020)	SCHEDULED	DB (copied from MWL)	Patient Module (Top)	MWL (patient.patientIdentifier)	Top	Same patient identity across MPPS and Images.
Accession Number	(0008,0050)	SCHEDULED	DB → WorklistStudy.accessionNumber	Study Module (Top)	—	—	
Study Instance UID	(0020,000D)	SCHEDULED	DB → WorklistStudy.studyInstanceUid	Study Module (Top)	MWL → StudyInstanceUID	Top + Scheduled Step Attributes (0040,0270)	
Study Date / Study Time	(0008,0020)/ (0008,0030)	SCHEDULED	DB: set at study creation (current time)	Study Module (Top)	—	—	
Requested Procedure ID	(0040,1001)	SCHEDULED	From DB (derived; proxy to populate)	Request Attributes Seq (0040,0275) or Top (per IOD)	Derived from Study Description via extractor	Top + SSA	
Scheduled Procedure Step ID	(0040,0009)	SCHEDULED	From DB (if proxy reads WorklistRequestedProcedure)	Request Attributes Seq (0040,0275)	MWL (scheduledProcedureStepId)	Scheduled Step Attributes (0040,0270)	
Scheduled Station Name	(0040,0010)	SCHEDULED	—	—	MWL (scheduledAeName)	Scheduled Step Attributes (0040,0270)	

Attribute Name in Image/MPPS	Tag	Scenario	Image		MPPS		Comments
			Value Source	Destination	Value Source	Destination	
Performed Procedure Step Status	(0040,0252)	—	—	—	Generated: COMPLETED	Top	
PPS Start Date / Time	(0040,0244)/ (0040,0245)	—	—	—	Generated: current time	Top	
PPS End Date / Time	(0040,0250)/ (0040,0251)	—	—	—	Generated: current time	Top	
Performed Procedure Step ID	(0040,0253)	—	—	—	—	—	
Series Instance UID	(0020,000E)	SCHEDULED	Generated by proxy during H5→DICOM	Series Module (Top)	—	—	
SOP Instance UID	(0008,0018)	—	Generated by proxy per image	Image (Top)	—	—	
Performed Series Sequence	(0040,0340)	—	—	—	— (not set in current MPPS)	—	

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## Annex E Code Set Usage

Only two VivaScope components ever create or modify DICOM files:

- **VivaScan DICOM Proxy** – converts microscope .h5 images into DICOM and sends them to PACS or RIS
- **VivaScope Image Viewer Back-end** – queries / retrieves images and, if enabled, stores annotation SRs back to PACS