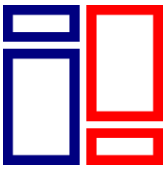
DICOM Conformance Statement

OnyxCeph³™

Version 3.2

2023-06-23



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1 CONFORMANCE STATEMENT OVERVIEW

The OnyxCeph³™ software is a native network application developed by Image Instruments for patient- and case-related management of 2D and 3D image data that can be used for evaluation, planning and consultation purposes in the course of orthodontic treatments.

OnyxCeph³™ supports various DICOM services, using the OFFIS DICOM Toolkit (DCMTK), to provide the following capabilities:

- Querying an archive system for patient demographics
- Querying an archive system for images for a selected patient
- Retrieving and importing DICOM images from an archive system
- Importing DICOM images from DICOM storage media

Table 1-1 provides an overview of the network services supported by OnyxCeph³™.

Table 1-1. Network Services

Networking SOP Classes	User of Service (SCU)	Provider of Service (SCP)
Transfer		
Computed Radiography Image Storage	No	Yes
CT Image Storage	No	Yes
Digital Intra-Oral X-Ray Image Storage - For Presentation	No	Yes
Digital Intra-Oral X-Ray Image Storage - For Processing	No	Yes
Digital X-Ray Image Storage - For Presentation	No	Yes
Digital X-Ray Image Storage - For Processing	No	Yes
Enhanced CT Image Storage	No	Yes
Enhanced MR Image Storage	No	Yes
Legacy Converted Enhanced CT Image Storage	No	Yes
Legacy Converted Enhanced MR Image Storage	No	Yes
MR Image Storage	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	No	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	No	Yes
Multi-frame Single Bit Secondary Capture Image Storage	No	Yes
Multi-frame True Color Secondary Capture Image Storage	No	Yes
Secondary Capture Image Storage	No	Yes
Ultrasound Image Storage	No	Yes
Ultrasound Multi-frame Image Storage	No	Yes
VL Photographic Image Storage	No	Yes
X-Ray 3D Craniofacial Image Storage	No	Yes
Query/Retrieve		
Patient Root Query/Retrieve Information Model – FIND	Yes	No

Patient Root Query/Retrieve Information Model – MOVE	Yes	No
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No

Table 1-2 lists all supported media services. OnyxCeph³™ also allows for storing created SOP Instances to filesystem, but does not create or update DICOM Storage Media.

Table 1-2. Media Services

Media Storage Application Profile	Write Files (FSC or FSU)	Read Files (FSR)
Compact Disc - Recordable		
CT/MR Studies on CD-R	No	Yes
Dental Radiograph Interchange	No	Yes
DVD		
CT/MR Studies on DVD Media	No	Yes
CT/MR Studies on DVD-RAM Media	No	Yes

2 TABLE OF CONTENTS

3 INTRODUCTION

This DICOM Conformance Statement specifies the behavior and functionality of OnyxCeph³™ with regard to supported DICOM networking SOP Classes, Media Storage Application Profiles and Created SOP Instances.

The OnyxCeph³™ software is a native network application for patient- and case-related management of 2D and 3D image data that can be used for evaluation, planning and consultation purposes in the course of orthodontic treatments.

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3.1 Revision History

Document Version	Date of Issue	Authors	Description
Version 1.0	2023-06-09	H. Franke, M. Heinz	Initial version of this document for release number 3.2.200 (560).and higher

3.2 Audience

This document is written for the people that need to understand how OnyxCeph³™ 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 OnyxCeph³™ and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard. 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 is not supposed to replace validation with other DICOM equipment to ensure proper exchange of intended information. In fact, the user should be aware of the following important issues:

- The comparison of different Conformance Statements is just the first step towards assessing interconnectivity and interoperability between the product and other DICOM conformant equipment.
- Test procedures should be defined and executed to validate the required level of interoperability with specific compatible DICOM equipment, as established by the healthcare facility.

3.4 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard [DICOM] 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): An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. 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 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).

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. The Attributes 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). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Joint Photographic Experts Group (JPEG): A set of standardized image compression techniques, available for use by DICOM applications.

Media 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 Name, Patient ID, Patient Birth Date, and Patient 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.

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 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. Examples: 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].

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.

3.5 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in italics below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts*. The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* – which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation information*).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies “pre-negotiated” exchange media format, Abstract Syntax, and Transfer Syntax.

3.6 Abbreviations

The following list illustrates all abbreviations that are used in this document.

ACSE	Association Control Service Element
AE	Application Entity
CD	Compact Disc
CDA	Clinical Document Architecture
CD-R	Compact Disc Recordable
CT	Computed Tomography
DICOM	Digital Imaging and Communications in Medicine
DIMSE	DICOM Message Service Element
DUL	DICOM Upper Layer
DVD	Digital Versatile Disc
DVD-RAM	DVD Random Access Memory
FSC	File-set Creator
FSR	File-set Reader
FSU	File-set Updater
ICC	International Color Consortium
ID	Identifier
IOD	Information Object Definition
IP	Internet Protocol
IPv4	Internet Protocol version 4
ISO	International Standards Organization
JPEG	Joint Photographic Experts Group
MR	Magnetic Resonance
NEMA	National Electrical Manufacturers Association
PACS	Picture Archiving and Communication System
PDU	Protocol Data Unit
PRQ	Patient Root Query
Q/R	Query/Retrieve
SCP	Service Class Provider
SCU	Service Class User
SOP	Service Object Pair
SRQ	Study Root Query
TCP/IP	Transmission Control Protocol / Internet Protocol
UCS	Universal Character Set
UID	Unique Identifier
UTF	UCS Transformation Format
VM	Value Multiplicity
VR	Value Representation

3.7 References

[DICOM] NEMA PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available free at https://www.dicomstandard.org/

4 NETWORKING

4.1 Implementation Model

4.1.1 Application Data Flow

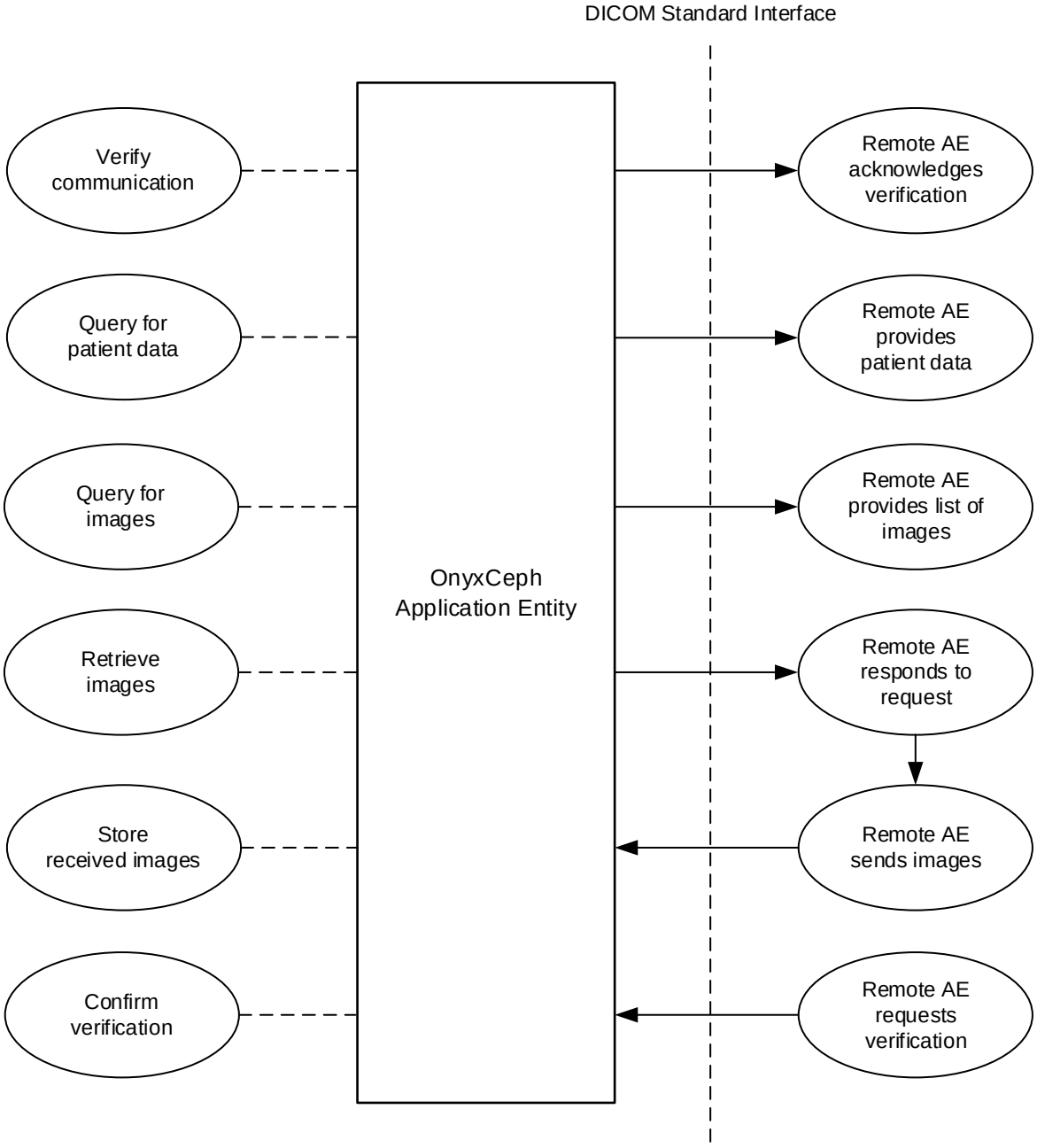

Figure 4-1. Application Data Flow Diagram

Conceptually, the networking services that are implemented by OnyxCeph³™ may be modeled as a single Application Entity (AE) as shown in Figure 4-1.

4.1.2 Functional Definitions of AEs

4.1.2.1 Functional Definition of OnyxCeph AE

OnyxCeph³™ is a native network application for patient- and case-related management of 2D and 3D image data that can be used for evaluation, planning and consultation purposes in the course of orthodontic treatments.

The OnyxCeph Application Entity allows for:

- Verifying the communication with a remote AE
- Querying a remote AE for patient data
- Querying a remote AE for images
- Retrieving images from a remote AE

In order to achieve this, the OnyxCeph Application Entity implements a Service Class User (SCU) for the following DICOM services:

- Verification
- Patient Root Query/Retrieve Information Model – FIND
- Patient Root Query/Retrieve Information Model – MOVE
- Study Root Query/Retrieve Information Model – FIND
- Study Root Query/Retrieve Information Model – MOVE

The OnyxCeph Application Entity also implements a Service Class Provider (SCP) for the following DICOM services:

- Verification
- Computed Radiography Image Storage
- CT Image Storage
- Digital Intra-Oral X-Ray Image Storage - For Presentation
- Digital Intra-Oral X-Ray Image Storage - For Processing
- Digital X-Ray Image Storage - For Presentation
- Digital X-Ray Image Storage - For Processing
- Enhanced CT Image Storage
- Enhanced MR Image Storage
- Legacy Converted Enhanced CT Image Storage
- Legacy Converted Enhanced MR Image Storage
- MR Image Storage
- Multi-frame Grayscale Byte Secondary Capture Image Storage
- Multi-frame Grayscale Word Secondary Capture Image Storage
- Multi-frame Single Bit Secondary Capture Image Storage
- Multi-frame True Color Secondary Capture Image Storage
- Secondary Capture Image Storage
- Ultrasound Image Storage
- Ultrasound Multi-frame Image Storage
- VL Photographic Image Storage
- X-Ray 3D Craniofacial Image Storage

4.1.3 Sequencing of Real-World Activities

All SCP activities are performed asynchronously in the background, but are only available while the OnyxCeph Application Entity is retrieving images.

All SCU activities are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed. Details on the user interactions are described in the section of the respective activity.

Figure 4-2 illustrates the sequencing of real-world activities in the general case.

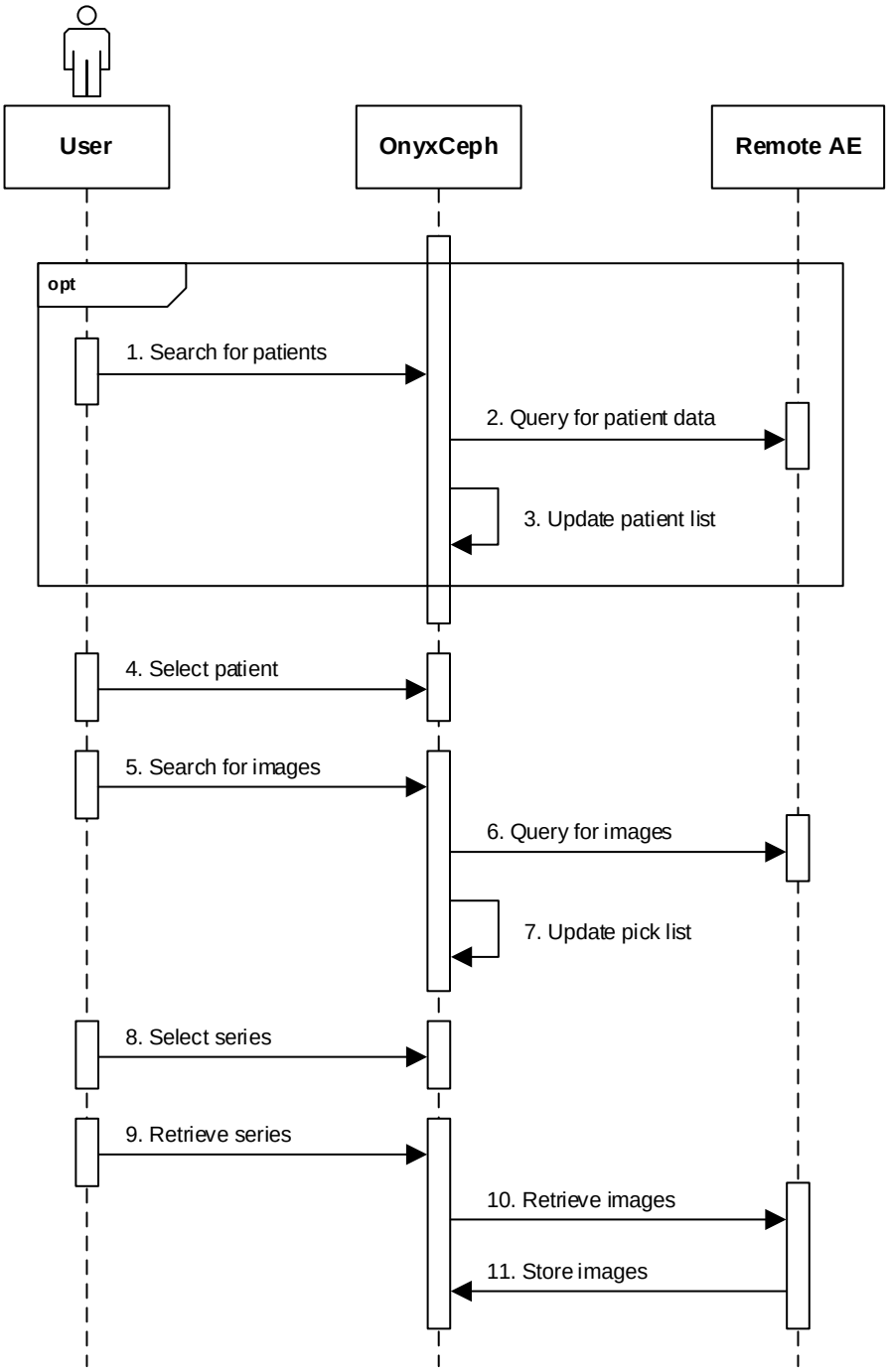

Figure 4-2 Sequencing of Real-World Activities Diagram

4.2 AE Specifications

4.2.1 OnyxCeph AE Specification

4.2.1.1 SOP Classes

The OnyxCeph Application Entity provides Standard Conformance to the following DICOM SOP Classes.

Table 4-1. SOP Classes for OnyxCeph AE

SOP Class Name	SOP Class UID	SCU	SCP
Verification	1.2.840.10008.1.1	Yes	Yes
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	No	Yes
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	No	Yes
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	No	Yes
Digital Intra-Oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	No	Yes
Digital Intra-Oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	No	Yes
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	No	Yes
CT Image Storage	1.2.840.10008.5.1.4.1.1.2	No	Yes
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	No	Yes
Legacy Converted Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.2	No	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	No	Yes
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	No	Yes
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	No	Yes
Legacy Converted Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.4	No	Yes
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	No	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	No	Yes
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	No	Yes
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	No	Yes
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	No	Yes
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	No	Yes
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	No	Yes
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Yes	No
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	No
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

4.2.1.2 Association Policies

4.2.1.2.1 General

The OnyxCeph Application Entity both initiates and accepts Associations.

The only Application Context Name that is proposed and accepted is the one for the DICOM Standard:

Table 4-2. DICOM Application Context for OnyxCeph AE

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The OnyxCeph Application Entity initiates and accepts a single Association at a time.

Table 4-3. Number of Associations as an Association Initiator and Acceptor for OnyxCeph AE

Maximum number of simultaneous Associations initiated to remote AEs	1
Maximum number of simultaneous Associations accepted from remote AEs	1

4.2.1.2.3 Asynchronous Nature

Asynchronous mode of operation is not supported.

4.2.1.2.4 Implementation Identifying Information

The OnyxCeph Application Entity uses the following implementation information:

Table 4-4. DICOM Implementation Class and Version for OnyxCeph AE

Implementation Class UID	1.2.276.0.7230010.3.0.3.6.7
Implementation Version Name	OFFIS_DCMTK_367

4.2.1.3 Association Initiation Policy

The OnyxCeph Application Entity attempts to initiate a new Association each time one of the activities described in the following subsections comes into use. However, in the following cases an existing Association will be reused:

- If the activity “Verify communication” is executed multiple times, the same Association will be used as long as the “PACS configuration” dialog is not closed, the configuration has not been changed and the Association still exists.
- If the activity “Query for patient data” is executed multiple times, the same Association will be used as long as the “Select patient – PACS” dialog is not closed and the Association still exists.
- If the activity “Query for images” or “Retrieve images” is executed multiple times, the same Association will be used as long as the “Image acquisition – PACS” dialog is not closed and the Association still exists.

4.2.1.3.1 Activity – Verify communication

4.2.1.3.1.1 Description and Sequencing of Activities

The OnyxCeph Application Entity uses this activity during the configuration phase. It facilitates the setup and management of the DICOM Application Entities, both the local and the remote one. After configuring and enabling the DICOM network interface, the OnyxCeph Application Entity issues a verification request to the remote AE when the authorized user presses the “Echo” button. A message is displayed on the user interface indicating whether the request was successful or not.

Figure 4-3 illustrates the sequencing of activities in detail.

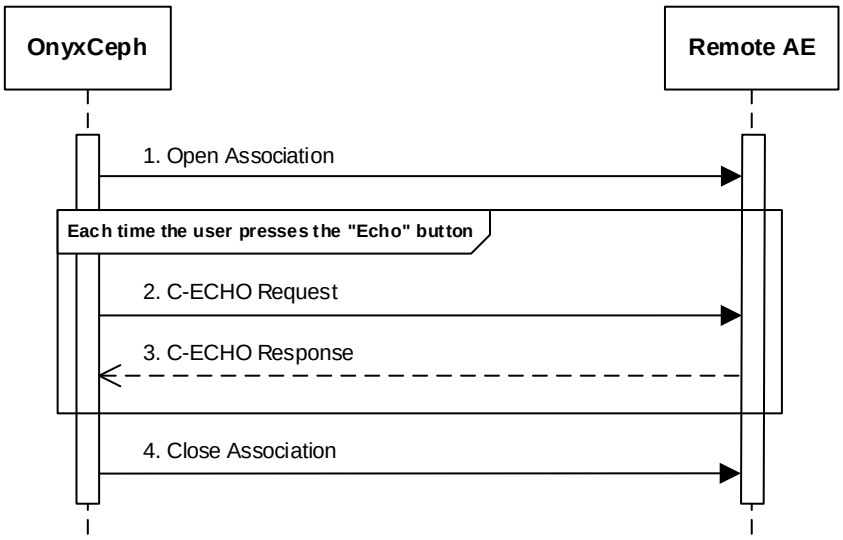

Figure 4-3. Sequencing of Activity “Verify communication”

4.2.1.3.1.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association. However, only the Verification SOP Class is actually used for this activity.

Table 4-5. Proposed Presentation Contexts for Activity “Verify communication”

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		

4.2.1.3.1.2.1 Extended Negotiation

No Extended Negotiation is performed.

4.2.1.3.1.3 SOP Specific Conformance

4.2.1.3.1.3.1 SOP Specific Conformance to Verification SOP Class

The OnyxCeph Application Entity provides Standard Conformance to the Verification SOP Class as an SCU.

The OnyxCeph Application Entity will behave as described in Table 4-9 when receiving the C-ECHO response command message.

Table 4-6. C-ECHO Response Status Handling Behavior for Activity “Verify communication”

Service Status	Further Meaning	Error Code	Behavior
Success	Success	0000	The requested Verification was confirmed by the remote AE. A message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
		all other codes	The remote AE returned a different status code. This is not treated as an error. A message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

Table 4-7. Communication Failure Behavior for Activity “Verify communication”

Exception	Behavior
TCP/IP connection could not be established within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Data could not be sent or received on a network socket within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
ASCE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
DIMSE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

4.2.1.3.2 Activity – Query for patient data

4.2.1.3.2.1 Description and Sequencing of Activities

The OnyxCeph Application Entity uses this activity to query a remote Query/Retrieve SCP for patient data. When the user presses the “Search” button in the “Select patient – PACS” dialog, either a Patient Root Query (PRQ) or a Study Root Query (SRQ) is executed, depending on which SOP Classes have been negotiated. If successful, the resulting patient data is shown in a pick list. If no patient data is returned because there are no matches, a message is displayed on the user interface.

After a successful query, the user can select one of the patients as the current one. If the patient ID of the selected patient is already known to OnyxCeph³™, a consistency check is performed with the patient data stored. If the patient ID is not yet known, the user is prompted to create a new patient.

Figure 4-4 illustrates the sequencing of activities in detail, assuming that the query is successful.

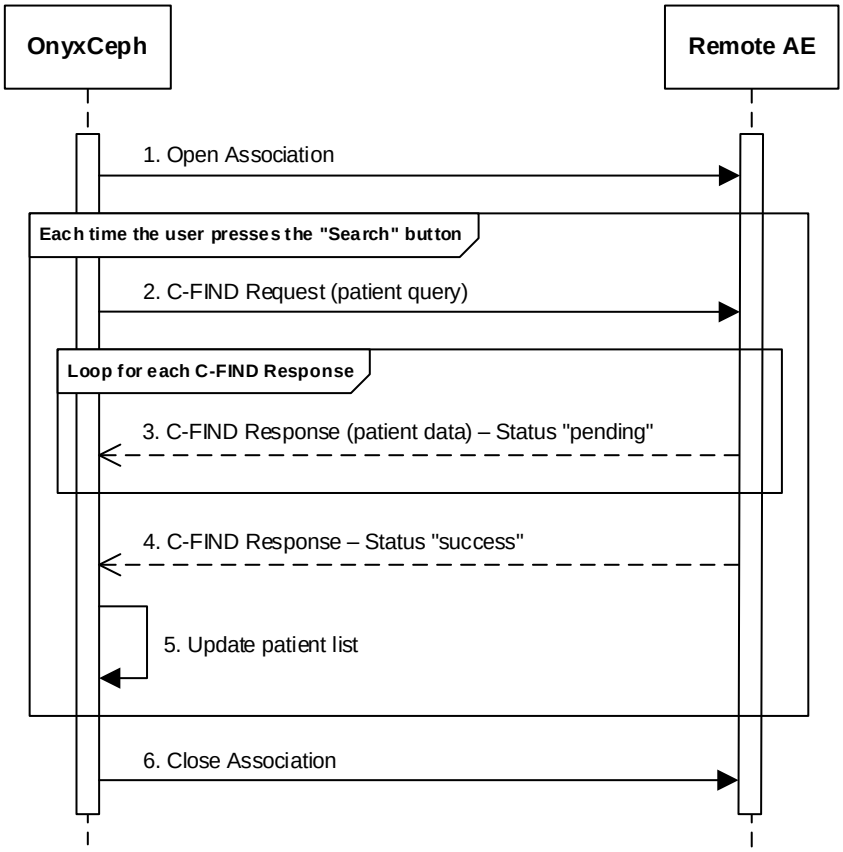

Figure 4-4. Sequencing of Activity “Query for patient data”

4.2.1.3.2.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association. However, only one of the two Query/Retrieve FIND SOP Classes is actually used for this activity, depending on which Presentation Contexts are accepted by the remote AE.

Table 4-8. Proposed Presentation Contexts for Activity “Query for patient data”

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		

If offered a choice in the accepted Presentation Contexts, the OnyxCeph Application Entity will prefer the Patient Root Query/Retrieve Information Model – FIND SOP Class.

4.2.1.3.2.2.1 Extended Negotiation

No Extended Negotiation is performed. In particular, relational queries are not supported.

4.2.1.3.2.3 SOP Specific Conformance

4.2.1.3.2.3.1 SOP Specific Conformance to Query/Retrieve FIND SOP Classes

The OnyxCeph Application Entity provides Standard Conformance to the Patient Root Query/Retrieve Information Model – FIND SOP Class and to the Study Root Query/Retrieve Information Model – FIND SOP Class as an SCU.

The OnyxCeph Application Entity will behave as described in Table 4-9 when receiving C-FIND response command messages.

Table 4-9. C-FIND Response Status Handling Behavior for Activity “Query for patient data”

Service Status	Further Meaning	Error Code	Behavior
Failure	Refused: Out of resources	A7xx	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Refused: SOP Class not supported	0122	This is treated as an error.

			An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Error: Data Set does not match SOP Class	A9xx	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Failed: Unable to process	Cxxx	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
		Axxx, 01xx [1], 02xx	This is treated as an error. An error message with “Unknown Status” is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Cancel	Matching terminated due to Cancel request	FE00	Should never occur since cancel requests are never issued. If it occurs nevertheless, it is treated as an error. An error message is displayed. Details are reported to a log file if enabled by service personnel.
Success	Matching is complete – No final identifier is supplied	0000	The current query is completed successfully. The patient list on the user interface is updated with the received patient data. Details are reported to a log file if enabled by service personnel.
Pending	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Current patient data is added to an internal list, but not yet presented to the user. Details are reported to a log file if enabled by service personnel.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Current patient data is added to an internal list, but not yet presented to the user. Details are reported to a log file if enabled by service personnel.
		all other codes	The remote AE returned an unknown status code. This is not treated as an error. No message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.

[1] With the exception of 0107 and 0116, which are assigned to the Status Class “Warning”.

Table 4-10. Communication Failure Behavior for Activity “Query for patient data”

Exception	Behavior
TCP/IP connection could not be established within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

Data could not be sent or received on a network socket within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
ASCE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
DIMSE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

When using the Patient Root Query/Retrieve Information Model – FIND SOP Class, all queries are performed on PATIENT level. When using the Study Root Query/Retrieve Information Model – FIND SOP Class, all queries are performed on STUDY level. Other query/retrieve levels are not supported.

Unexpected Attributes returned in a C-FIND response are ignored in the same manner as requested (optional) Attributes not returned by the SCP. Duplicate responses are not filtered out. The C-FIND response dataset is checked for "compatibility" with the application before being further processed, i.e. it is checked whether the value field length is within the specified limits and whether all required Attributes are actually present.

The Specific Character Set (0008,0005) Attribute will be included in the C-FIND request if extended characters are used.

No cancel requests are ever issued for this activity.

Table 4-11 and Table 4-12 list the Attributes that are requested from the remote AE, depending on the SOP Class that is used. They also show in detail the respective types of matching and which of these Attributes are imported into the application, displayed on the user interface and copied to the created SOP Instance.

Table 4-11. Patient Root Query/Retrieve C-FIND Request Identifiers
for Activity "Query for patient data"

Attribute Name	Tag	Types of Matching	Interactive Query Key	Imported	Displayed	Copied to SOP Instance
Query/Retrieve Level PATIENT						
Patient's Name	(0010,0010)	Universal, Single Value, Wild Card	X	X [1]	X [1,2]	X [1]
Patient ID	(0010,0020)	Universal, Single Value, Wild Card	X	X	X	X
Patient's Birth Date	(0010,0030)	Universal, Single Value, Range	X	X	X	X
Patient's Sex	(0010,0040)	Universal, Single Value	X	X	X	X

[1] All three component groups are supported.
[2] Only the first name, middle name and last name are shown.

Table 4-12. Study Root Query/Retrieve C-FIND Request Identifiers
for Activity “Query for patient data”

Attribute Name	Tag	Types of Matching	Interactive Query Key	Imported	Displayed	Copied to SOP Instance
Query/Retrieve Level STUDY						
Patient's Name	(0010,0010)	Universal, Single Value, Wild Card	X	X [1]	X [1,2]	X [1]
Patient ID	(0010,0020)	Universal, Single Value, Wild Card	X	X	X	X
Patient's Birth Date	(0010,0030)	Universal, Single Value, Range	X	X	X	X
Patient's Sex	(0010,0040)	Universal, Single Value	X	X	X	X
Study Instance UID	(0020,000D)	Universal				

[1] All three component groups are supported.
[2] Only the first name, middle name and last name are shown.

4.2.1.3.3 Activity – Query for images

4.2.1.3.3.1 Description and Sequencing of Activities

The OnyxCeph Application Entity uses this activity to query a remote Query/Retrieve SCP for a list of images series of the currently selected patient. When the user selects “PACS” as the image source, either a number of Patient Root Queries (PRQ) or Study Root Queries (SRQ) are executed, depending on which SOP Classes have been negotiated. First, the available studies for the current patient are queried, then the all series for the individual studies returned. If successful, the resulting image series are shown in a pick list. If no studies or series are returned because there are no matches, a message is displayed on the user interface.

All queries are performed on the same Association.

Figure 4-5 illustrates the sequencing of activities in detail, assuming that the queries are successful.

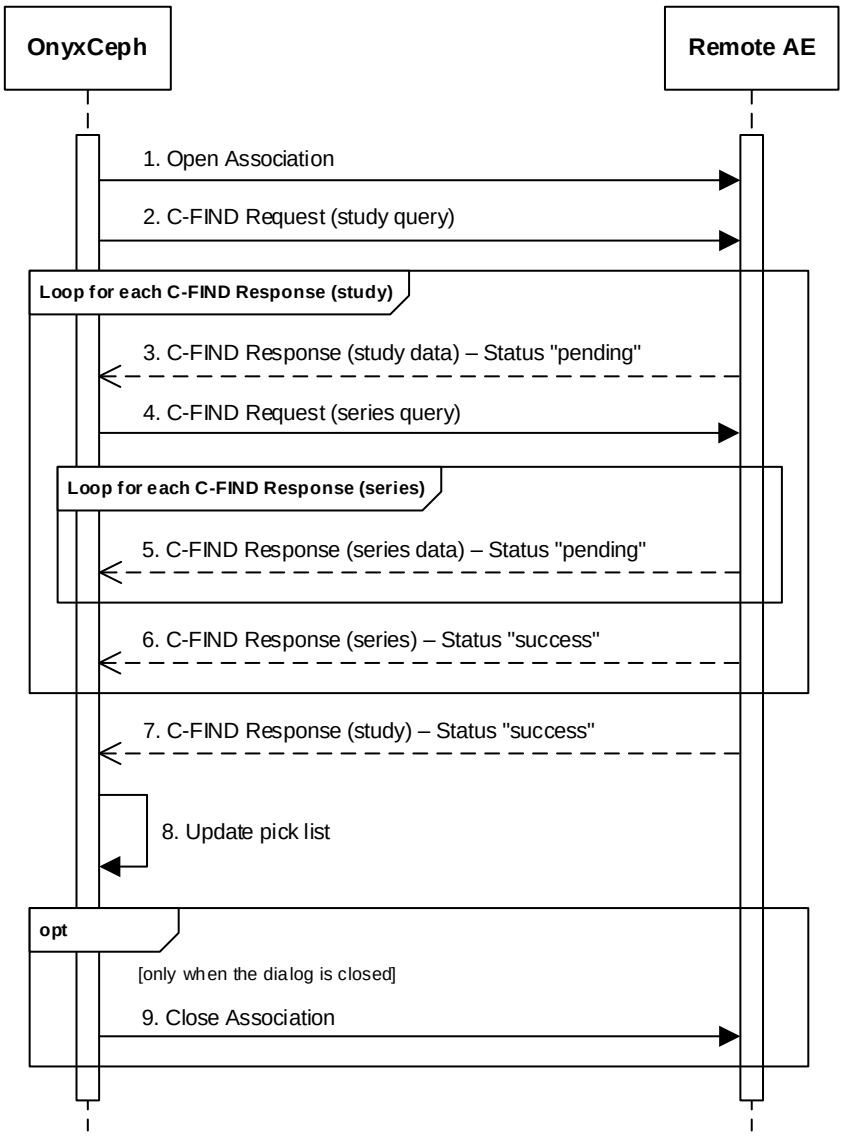

Figure 4-5. Sequencing of Activity “Query for images”

4.2.1.3.3.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association. However, only one of the two Query/Retrieve FIND SOP Classes is actually used for this activity, depending on which Presentation Contexts are accepted by the remote AE.

Table 4-13. Proposed Presentation Contexts for Activity “Query for images”

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		

If offered a choice in the accepted Presentation Contexts, the OnyxCeph Application Entity will prefer the Study Root Query/Retrieve Information Model – FIND SOP Class.

4.2.1.3.3.2.1 Extended Negotiation

No Extended Negotiation is performed. In particular, relational queries are not supported.

4.2.1.3.3.3 SOP Specific Conformance

4.2.1.3.3.3.1 SOP Specific Conformance to Query/Retrieve FIND SOP Classes

The OnyxCeph Application Entity provides Standard Conformance to the Patient Root Query/Retrieve Information Model – FIND SOP Class and to the Study Root Query/Retrieve Information Model – FIND SOP Class as an SCU.

The OnyxCeph Application Entity will behave as described in Table 4-14 when receiving C-FIND response command messages.

Table 4-14. C-FIND Response Status Handling Behavior for Activity “Query for images”

Service Status	Further Meaning	Error Code	Behavior
Failure	Refused: Out of resources	A7xx	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Refused: SOP Class not supported	0122	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Error: Data Set does not match SOP Class	A9xx	This is treated as an error.

			An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Failed: Unable to process	Cxxx	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
		Axxx, 01xx [1], 02xx	This is treated as an error. An error message with “Unknown Status” is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Cancel	Matching terminated due to Cancel request	FE00	Should never occur since cancel requests are never issued. If it occurs nevertheless, it is treated as an error. An error message is displayed. Details are reported to a log file if enabled by service personnel.
Success	Matching is complete – No final identifier is supplied	0000	The current query is completed successfully. Depending on the current query/retrieve level, either a number of queries is issued on the next lower level or the resulting list of image series is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Pending	Matches are continuing – Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Current data is added to an internal list, but not yet presented to the user. Details are reported to a log file if enabled by service personnel.
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	FF01	Current data is added to an internal list, but not yet presented to the user. Details are reported to a log file that if enabled by service personnel.
		all other codes	The remote AE returned an unknown status code. This is not treated as an error. No message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.

[1] With the exception of 0107 and 0116, which are assigned to the Status Class “Warning”.

Table 4-15. Communication Failure Behavior for Activity “Query for images”

Exception	Behavior
TCP/IP connection could not be established within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Data could not be sent or received on a network socket within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

ASCE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
DIMSE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

All queries are performed on STUDY or SERIES level. Other query/retrieve levels are not supported. For the Patient ID (0010,0020) Attribute, the value of the current patient is used.

Unexpected Attributes returned in a C-FIND response are ignored in the same manner as requested (optional) Attributes not returned by the SCP. Duplicate responses are not filtered out, but a local filtering takes place to limit the responses to those that are relevant to the application. The C-FIND response dataset is also checked for "compatibility" with the application before being further processed, i.e. it is checked whether the value field length is within the specified limits and whether all required Attributes are actually present.

The Specific Character Set (0008,0005) Attribute will be included in the C-FIND request if extended characters are used.

No cancel requests are ever issued for this activity.

Table 4-16 and Table 4-17 list the Attributes that are requested from the remote AE, depending on the SOP Class that is used. They also show in detail the respective types of matching and which of these Attributes are imported into the application, displayed on the user interface and copied to the created SOP Instance.

Table 4-16. Patient Root Query/Retrieve C-FIND Request Identifiers
for Activity "Query for images"

Attribute Name	Tag	Types of Matching	Interactive Query Key	Imported	Displayed	Copied to SOP Instance
Query/Retrieve Level PATIENT						
Patient ID	(0010,0020)	Single Value				
Query/Retrieve Level STUDY						
Study Instance UID	(0020,000D)	Unique Key [1]		X		
Study Date	(0008,0020)	Universal		X	X [2]	
Study Time	(0008,0030)	Universal		X		
Study Description	(0008,1030)	Universal		X		
Query/Retrieve Level SERIES						
Series Instance UID	(0020,000E)	Universal		X	X	
Series Date	(0008,0021)	Universal		X	X	
Series Number	(0020,0011)	Universal		X		
Modality	(0008,0060)	Universal		X	X	

[1] Unique Key means Universal or Single Value Matching depending on the Query/Retrieve Level.

[2] Study Date is only shown if no or an invalid Series Date has been received.

Table 4-17. Study Root Query/Retrieve C-FIND Request Identifiers for Activity "Query for images"

Attribute Name	Tag	Types of Matching	Interactive Query Key	Imported	Displayed	Copied to SOP Instance
Query/Retrieve Level STUDY						
Patient ID	(0010,0020)	Single Value				
Study Instance UID	(0020,000D)	Unique Key [1]		X		
Study Date	(0008,0020)	Universal		X	X [2]	
Study Time	(0008,0030)	Universal		X		
Study Description	(0008,1030)	Universal		X		
Query/Retrieve Level SERIES						
Series Instance UID	(0020,000E)	Universal		X	X	
Series Date	(0008,0021)	Universal		X	X	
Series Number	(0020,0011)	Universal		X		
Modality	(0008,0060)	Universal		X	X	

[1] Unique Key means Universal or Single Value Matching depending on the Query/Retrieve Level.
[2] Study Date is only shown if no or an invalid Series Date has been received.

4.2.1.3.4 Activity – Retrieve images

4.2.1.3.4.1 Description and Sequencing of Activities

The OnyxCeph Application Entity uses this activity to retrieve DICOM images from a remote Query/Retrieve SCP. After the activity "Query for images" (see Section 4.2.1.3.3) was used to get a list of images series for the current patient, the user can select one of the series for retrieval. When the user presses the "Retrieve Images" button, either a Patient Root retrieval or a Study Root retrieval is executed, depending on which SOP Classes have been negotiated. If successful, the retrieved images are received to OnyxCeph³™ as part of the SCP activity "Store received images" (see Section 4.2.1.4.2) and then offered for import.

Only a single attempt will be made to retrieve the images from the remote AE. If the retrieval fails, no retry will be performed. However, this does not apply if a new Association is required because the previous one has been closed.

Figure 4-6 illustrates the sequencing of activities in detail, assuming that the retrieval is successful.

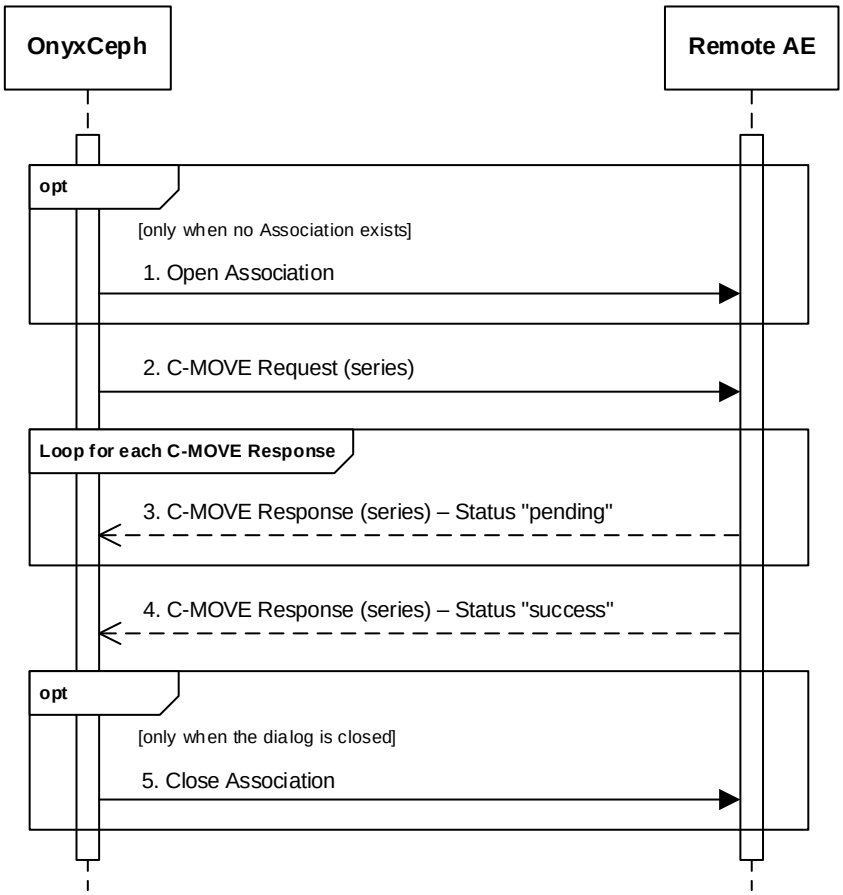

Figure 4-6. Sequencing of Activity “Retrieve images”

4.2.1.3.4.2 Proposed Presentation Contexts

The following Presentation Contexts are proposed for each initiated Association. However, only one of the two Query/Retrieve MOVE SOP Classes is actually used for this activity, depending on which Presentation Contexts are accepted by the remote AE.

Table 4-18. Proposed Presentation Contexts for Activity “Retrieve images”

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		Implicit VR Little Endian	1.2.840.10008.1.2		
Patient Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None

Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Patient Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	SCU	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		
		Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99		

If offered a choice in the accepted Presentation Contexts, the OnyxCeph Application Entity will prefer the Study Root Query/Retrieve Information Model – MOVE SOP Class.

4.2.1.3.4.2.1 Extended Negotiation

No Extended Negotiation is performed. In particular, relational retrievals are not supported.

4.2.1.3.4.3 SOP Specific Conformance

4.2.1.3.4.3.1 SOP Specific Conformance to Query/Retrieve MOVE SOP Classes

The OnyxCeph Application Entity provides Standard Conformance to the Patient Root Query/Retrieve Information Model – MOVE SOP Class and to the Study Root Query/Retrieve Information Model – MOVE SOP Class as an SCU.

The OnyxCeph Application Entity will behave as described in Table 4-19 when receiving C-MOVE response command messages.

Table 4-19. C-MOVE Response Status Handling Behavior for Activity “Retrieve images”

Service Status	Further Meaning	Error Code	Behavior
Failure	Refused: Out of resources – Unable to calculate number of matches	A701	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Refused: Out of resources – Unable to perform sub-operations	A702	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Refused: SOP Class not supported	0122	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Refused: Move Destination unknown	A801	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

	Error: Data Set does not match SOP Class	A900	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
	Failed: Unable to process	Cxxx	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
		Axxx, 01xx [1], 02xx	This is treated as an error. An error message “Unknown Status” is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Cancel	Sub-operations terminated due to Cancel Indication	FE00	Should never occur since cancel requests are never issued. If it occurs nevertheless, it is treated as an error. An error message is displayed. Details are reported to a log file if enabled by service personnel.
Warning	Sub-operations Complete – One or more Failures	B000	This is treated as an error. An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Success	Sub-operations Complete – No Failures	0000	The current retrieval is completed successfully. The resulting image series are displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Pending	Sub-operations are continuing	FF00	The current retrieval continues. Details are reported to a log file if enabled by service personnel.
		all other codes	The remote AE returned an unknown status code. This is not treated as an error. No message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.

[1] With the exception of 0107 and 0116, which are assigned to the Status Class “Warning”.

Table 4-20. Communication Failure Behavior for Activity “Retrieve images”

Exception	Behavior
TCP/IP connection could not be established within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Data could not be sent or received on a network socket within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
ASCE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

DIMSE response message could not be received within the specified time range.	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.
Association aborted by the SCP using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	An error message is displayed on the user interface. Details are reported to a log file if enabled by service personnel.

All retrievals are performed on SERIES level. Other query/retrieve levels are not supported. That means, all SOP Instances of the selected series are retrieved.

The retrieval is not performed from one of the remote AEs that were specified in the Retrieve AE Title (0008,0054) Attribute returned from the image query (see Section 4.2.1.3.3), but from the same remote AE that was used for the image query. The SOP Instances are retrieved to the OnyxCeph Application Entity by specifying its own AE Title as the Move Destination. This implies that the remote AE must be pre-configured to determine the presentation address corresponding to the local AE. The OnyxCeph Application Entity will accept storage requests addressed to it from anywhere, so no pre-configuration of the local application to accept from the remote AE is necessary.

The Specific Character Set (0008,0005) Attribute will be included in the C-MOVE request if extended characters are used, which may only be the case for the Patient ID (0010,0020) Attribute.

No cancel requests are ever issued for this activity.

Table 4-21 and Table 4-22 list the Attributes that are included in the C-MOVE request, depending on the SOP Class that is used.

Table 4-21. Patient Root Query/Retrieve C-MOVE Request Identifiers
for Activity “Retrieve images”

Attribute Name	Tag	Attribute Type
Query/Retrieve Level PATIENT		
Patient ID	(0010,0020)	Unique Key
Query/Retrieve Level STUDY		
Study Instance UID	(0020,000D)	Unique Key
Query/Retrieve Level SERIES		
Series Instance UID	(0020,000E)	Unique Key

Table 4-22. Study Root Query/Retrieve C-MOVE Request Identifiers
for Activity “Retrieve images”

Attribute Name	Tag	Attribute Type
Query/Retrieve Level STUDY		
Study Instance UID	(0020,000D)	Unique Key
Query/Retrieve Level SERIES		
Series Instance UID	(0020,000E)	Unique Key

Since the C-MOVE operation is dependent on completion of C-STORE sub-operations that are occurring on a separate Association, the question of failure of operations on the other Association must be considered. Once the C-MOVE has been initiated, it runs to completion (or failure) as described in the final C-MOVE response command message. At least for this activity, there is no attempt to confirm that SOP Instances have actually been successfully received or locally stored. However, this confirmation is made as part of the activity “Store received images” (see Section 4.2.1.4.2).

4.2.1.4 Association Acceptance Policy

The OnyxCeph Application Entity accepts any Association for which at least one Presentation Context is accepted. It neither checks the Calling AE Title nor the Called AE Title, and always responds with the AE Title it was called with by the remote AE. Association requests may be rejected with the following status codes and reasons.

Result	Source	Reason / Diagnostic	Description
rejected-permanent	DUL service-provider (ACSE related function)	protocol-version-not-supported	The Association request used an unsupported DUL protocol version. An Association request with the same parameters will not succeed at a later time.
rejected-permanent	DUL service-user	application-context-name-not-supported	The Association request contained an unsupported Application Context Name. An Association request with the same parameters will not succeed at a later time.

4.2.1.4.1 Activity – Confirm verification

4.2.1.4.1.1 Description and Sequencing of Activities

The OnyxCeph Application Entity confirms the receipt of verification requests while the SCP process is running (see Section 4.1.3).

Figure 4-7 illustrates the sequencing of activities in detail, assuming that a new Association is initiated by the remote AE each time this activity is used.

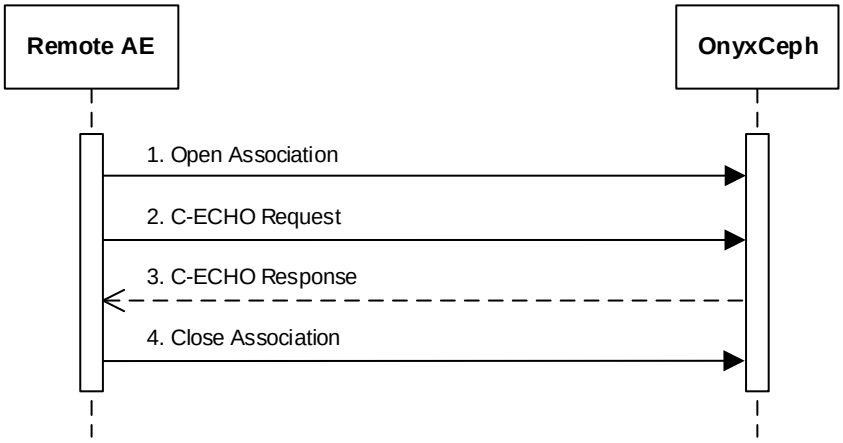

Figure 4-7. Sequencing of Activity “Confirm verification”

4.2.1.4.1.2 Accepted Presentation Contexts

The following Presentation Contexts are accepted for this activity when proposed by a remote AE.

Table 4-23. Accepted Presentation Contexts for Activity “Confirm verification”

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Verification		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None

	1.2.840.10008.5.1.4.1.2.2.1	Explicit VR Big Endian	1.2.840.10008.1.2.2		
		Implicit VR Little Endian	1.2.840.10008.1.2		

The OnyxCeph Application Entity will accept all Presentation Contexts that contain one of the supported SOP Classes and one of the supported Transfer Syntaxes. If multiple Transfer Syntaxes are proposed for one of the supported SOP Classes, the first matching Transfer Syntax from the above list will be selected as the accepted Transfer Syntax for that Presentation Context, e.g. Explicit VR Little Endian.

4.2.1.4.1.2.1 Extended Negotiation

No Extended Negotiation is performed.

4.2.1.4.1.3 SOP Specific Conformance

4.2.1.4.1.3.1 SOP Specific Conformance to Verification SOP Class

The OnyxCeph Application Entity provides Standard Conformance to the Verification SOP Class as an SCP.

The OnyxCeph Application Entity will behave as described in Table 4-26 when sending the C-ECHO response command message.

Table 4-24. C-ECHO Response Status Handling for Activity “Confirm verification”

Service Status	Further Meaning	Error Code	Reason / Behavior
Success	Success	0000	The requested Verification is confirmed. No message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.

Table 4-25. Communication Failure Behavior for Activity “Confirm verification”

Exception	Behavior
Data could not be sent or received on a network socket within the specified time range.	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
ASCE response message could not be sent within the specified time range.	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
DIMSE response message could not be sent within the specified time range.	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
Association aborted by the SCU using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.

4.2.1.4.2 Activity – Store received images

4.2.1.4.2.1 Description and Sequencing of Activities

The OnyxCeph Application Entity stores received images while the SCP process is running (see Section 4.1.3). The SOP Instances are stored to a temporary directory and then presented to the user and offered for import. In case of a 2D import from a 3D image volume, the user manually selects a layer to be imported into OnyxCeph³™.

This activity is typically the result of the SCU activity “Retrieve images” (see Section 4.2.1.3.4).

Figure 4-8 illustrates the sequencing of activities in detail.

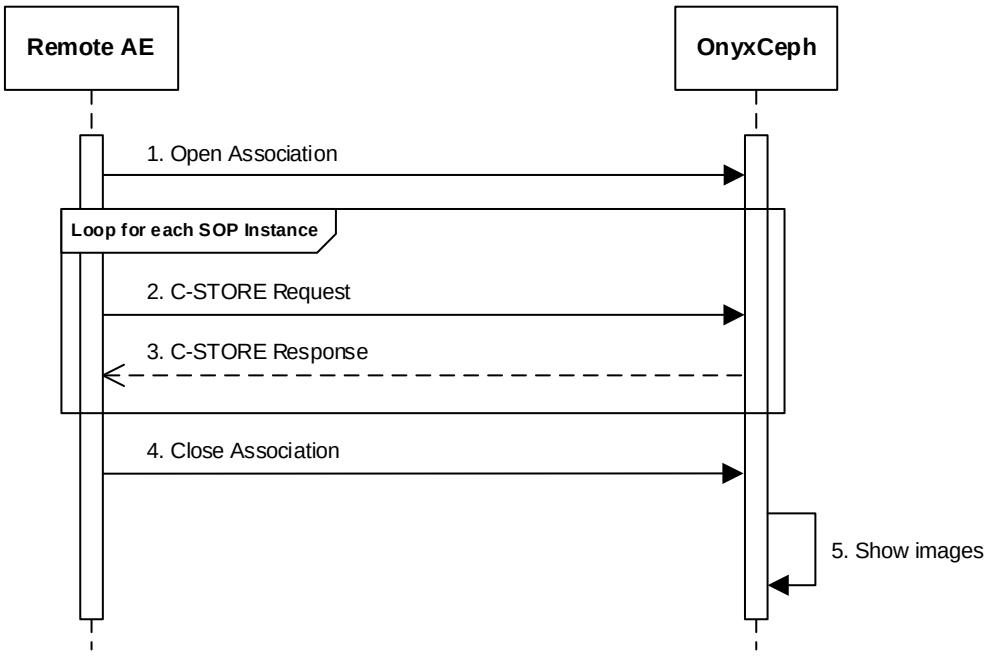

Figure 4-8. Sequencing of Activity “Store received images”

4.2.1.4.2.2 Accepted Presentation Contexts

The following Presentation Contexts are accepted for this activity when proposed by a remote AE.

Table 4-26. Accepted Presentation Contexts for Activity “Store received images”

Presentation Context Table					
Abstract Syntax		**Transfer Syntax**		**Role**	**Ext. Neg.**
Name	**UID**	**Name List**	**UID List**		
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1	*See Table 4-27 for the list of Transfer Syntaxes.*		SCP	None
Digital X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.1	*See Table 4-27 for the list of Transfer Syntaxes.*		SCP	None
Digital X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.1.1	*See Table 4-27 for the list of Transfer Syntaxes.*		SCP	None
Digital Intra-Oral X-Ray Image Storage - For Presentation	1.2.840.10008.5.1.4.1.1.1.3	*See Table 4-27 for the list of Transfer Syntaxes.*		SCP	None
Digital Intra-Oral X-Ray Image Storage - For Processing	1.2.840.10008.5.1.4.1.1.1.3.1	*See Table 4-27 for the list of Transfer Syntaxes.*		SCP	None
X-Ray 3D Craniofacial Image Storage	1.2.840.10008.5.1.4.1.1.13.1.2	*See Table 4-27 for the list of Transfer Syntaxes.*		SCP	None

CT Image Storage	1.2.840.10008.5.1.4.1.1.2	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.1	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Legacy Converted Enhanced CT Image Storage	1.2.840.10008.5.1.4.1.1.2.2	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
MR Image Storage	1.2.840.10008.5.1.4.1.1.4	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Legacy Converted Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.4	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Multi-frame Single Bit Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.1	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Multi-frame Grayscale Byte Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.2	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Multi-frame Grayscale Word Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.3	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
Multi-frame True Color Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7.4	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4	*See Table 4-27 for the list of Transfer Syntaxes.*	SCP	None

Table 4-27. Acceptable Transfer Syntaxes for Image Storage SOP Classes

Transfer Syntax Name	Transfer Syntax 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
Deflated Explicit VR Little Endian	1.2.840.10008.1.2.1.99

RLE Lossless	1.2.840.10008.1.2.5
JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70
JPEG-LS Lossless Image Compression	1.2.840.10008.1.2.4.80
JPEG Extended (Process 2 & 4)	1.2.840.10008.1.2.4.51
JPEG Baseline (Process 1)	1.2.840.10008.1.2.4.50
JPEG-LS Lossy (Near-Lossless) Image Compression	1.2.840.10008.1.2.4.81

The OnyxCeph Application Entity will accept all Presentation Contexts that contain one of the supported SOP Classes and at least one of the supported Transfer Syntaxes. If multiple Transfer Syntaxes are proposed for one of the supported SOP Classes, the first matching Transfer Syntax from the above ordered list will be selected as the accepted Transfer Syntax for that Presentation Context, e.g. Explicit VR Little Endian.

4.2.1.4.2.2.1 Extended Negotiation

No Extended Negotiation is performed.

4.2.1.4.2.3 SOP Specific Conformance

4.2.1.4.2.3.1 SOP Specific Conformance to Storage SOP Classes

The OnyxCeph Application Entity provides Standard Conformance to the supported Storage SOP Classes (see Table 4-26) as an SCP.

Although no Extended Negotiated is performed (see Section 4.2.1.4.2.2.1), the OnyxCeph Application Entity implements in principle a Storage Level 2 (Full) SCP, i.e. all Type 1, Type 2, and Type 3 Attributes defined in the IOD associated with the SOP Class, as well as any Standard Extended Attributes (including Private Attributes) included in the SOP Instance, will be stored. However, the SOP Instances are only stored temporarily and the user decides which of them are actually imported.

The OnyxCeph Application Entity will behave as described in Table 4-28 when sending C-STORE response command messages.

Table 4-28. C-STORE Response Status Handling for Activity “Store received images”

Service Status	Further Meaning	Error Code	Reason / Behavior
Failure	Refused: Out of resources	A700	The received SOP Instance could not be store to file, i.e. in the temporary directory. No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
	Error: Data Set does not match SOP Class	A900	The values of the SOP Class UID (0008,0016) and/or SOP Instance UID (0008,0018) Attribute in the received SOP Instance (dataset) do not match the values in the C-STORE request command message. No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
	Error: Cannot understand	C000	The received SOP Instance does not contain the SOP Class UID (0008,0016) and/or SOP Instance UID (0008,0018) Attribute.

			No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
Success	Success	0000	The SOP Instance has been received successfully. It is added to the list of images that will be presented to the user. Details are reported to a log file if enabled by service personnel.

Table 4-29. Communication Failure Behavior for Activity “Store received images”

Exception	Behavior
Data could not be sent or received on a network socket within the specified time range.	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
ASCE response message could not be sent within the specified time range.	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
DIMSE response message could not be sent within the specified time range.	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.
Association aborted by the SCU using A-ABORT or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	No error message is displayed on the user interface, but details are reported to a log file if enabled by service personnel.

The OnyxCeph Application Entity does not perform any validation of the received SOP Instances beyond checking for very basic structural integrity. In particular, the remote AE is not prevented from sending incomplete or incorrect SOP Instances (based on the respective underlying IOD).

OnyxCeph³™ will only import SOP Instances that belong to the current patient. This is usually ensured since the triggering activity “Retrieve images” (see Section 4.2.1.3.4) only retrieves images for the current patient. OnyxCeph³™ also performs local filtering to limit the image series to be imported to those that can be actually processed.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The DICOM applications of OnyxCeph³™ are indifferent to the physical medium over which TCP/IP is used.

4.3.2 Additional Protocols

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

4.3.3 IPv4 and IPv6 Support

OnyxCeph³™ only supports IPv4 connections.

4.4 Configuration

The configuration can only be changed by authorized users.

4.4.1 AE Title / Presentation Address Mapping

The mapping from AE Titles to IP addresses (or hostnames) and TCP/IP ports is configurable as described in the following subsections.

4.4.1.1 Local AE Titles

The local AE Title and TCP/IP port of the device can be configured on the user interface. There are no default values as Table 4-30 shows.

Table 4-30. AE Title Configuration Table

Application Entity	Default AE Title	Default TCP/IP Port
OnyxCeph	–	–

4.4.1.2 Remote AE Titles

The AE Title, IP address (or hostname) and TCP/IP port of a single remote Application Entity can be configured on the user interface. There are no default values.

4.4.2 Configurable Parameters

The following parameters are configurable by authorized users.

Table 4-31. Configuration Parameters Table

Parameter	Configurable	Default Value
General Parameters		
Time-out for connection request	No	Unlimited
Time-out for network socket	No	60 seconds
Time-out for ACSE messages	No	30 seconds
Time-out for DIMSE messages	No	Unlimited
Maximum PDU size the AE can receive (as an SCU)	No	16,384 bytes
Maximum PDU size the AE can receive (as an SCP)	No	16,384 bytes
Query/Retrieve Parameters		
Value for the Specific Character Set (0008,0005) Attribute used in a C-FIND request	Yes	ISO_IR 192 (see Table 7-2)
Default value for the Specific Character Set (0008,0005) Attribute used as fallback when missing but needed in a C-FIND response	Yes	ISO_IR 100 (see Table 7-3)

5 MEDIA STORAGE

5.1 Implementation Model

5.1.1 Application Data Flow

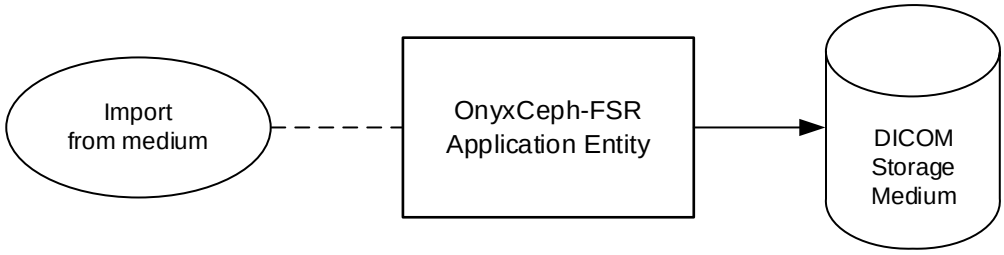

Figure 5-1. Application Data Flow Diagram

Conceptually, the media services that are implemented by OnyxCeph³™ may be modeled as a single Application Entity (AE) as shown in Figure 5-1.

5.1.2 Functional Definitions of AEs

5.1.2.1 Functional Definition of OnyxCeph-FSR AE

The OnyxCeph-FSR Application Entity allows for reading patient-related information from a DICOM storage medium and offers the supported series for import. The local real-world activity “Import from medium” is performed on user’s request.

OnyxCeph³™ also allows for reading DICOM images from a local directory (without DICOMDIR file) and from a DICOMDIR file selected by the user.

5.1.3 Sequencing of Real-World Activities

All FSR activities are sequentially initiated in the user interface, and another activity may not be initiated until the prior activity has completed.

5.1.4 File Meta Information for Implementation Class and Version

Not applicable since the OnyxCeph-FSR Application Entity does not create or update storage media.

5.2 AE Specifications

5.2.1 OnyxCeph-FSR AE Specification

The OnyxCeph-FSR Application Entity provides Standard Conformance to the Media Storage Service Class. It supports the following Application Profiles and Roles for the given Real-World Activities.

Table 5-1. Application Profiles, Real-World Activities and Roles for OnyxCeph-FSR AE

Supported Application Profile	Real-World Activity	Roles
STD-CTMR-CD	Import from medium	FSR
STD-DEN-CD	Import from medium	FSR
STD-CTMR-DVD	Import from medium	FSR
STD-CTMR-DVD-RAM	Import from medium	FSR

5.2.1.1 Real-World Activities

5.2.1.1.1.1 Activity – Import from medium

The OnyxCeph-FSR Application Entity reads the DICOMDIR file from the storage medium when the user selects the respective drive. In a first step, all series found are filtered according to their modality and the matching series are offered for import. In a second step, the user selects the series to be imported and, if the patient-related data is consistent with the data of the current patient, the associated DICOM images are further processed and may be later imported into OnyxCeph³™ on the user's request. If the patient data is not consistent, a warning message is displayed and the user is requested to confirm that the images should be assigned to the current patient.

Alternatively, the user can select a local directory (without DICOMDIR file) or a DICOMDIR file that is stored somewhere in the filesystem. In both cases, the DICOM series found are offered for import.

The OnyxCeph-FSR Application Entity only imports DICOM images for the current patient and only those types of images that are actually supported (see Table 5-2 and Table 5-3).

5.2.1.1.1.1 Media Storage Application Profiles

As listed in Table 5-1, the OnyxCeph-FSR Application Entity supports the following Application Profiles as a File-set Reader (FSR):

- CT/MR Studies on CD-R (STD-CTMR-CD)
- CT/MR Studies on DVD Media (STD-CTMR-DVD)
- CT/MR Studies on DVD-RAM Media (STD-CTMR-DVD-RAM)
- Dental Radiograph Interchange (STD-DEN-CD)

In the following, the first three Application Profiles are referred to collectively as STD-CTMR.

5.2.1.1.1.1.1 STD-CTMR Options

In addition to the mandatory combinations of SOP Class and Transfer Syntax, the OnyxCeph-FSR Application Entity also supports some optional combinations for the STD-CTMR Application Profiles. All supported combinations are listed in Table 5-2.

Table 5-2. STD-CTMR SOP Classes and Transfer Syntaxes for OnyxCeph-FSR AE

Information Object Definition	SOP Class UID	Transfer Syntax Name	Transfer Syntax UID	Optional
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1	No
CT Image	1.2.840.10008.5.1.4.1.1.2	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70	No
CT Image	1.2.840.10008.5.1.4.1.1.2	Explicit VR Little Endian	1.2.840.10008.1.2.1	No
MR Image	1.2.840.10008.5.1.4.1.1.4	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70	No
MR Image	1.2.840.10008.5.1.4.1.1.4	Explicit VR Little Endian	1.2.840.10008.1.2.1	No
Secondary Capture Image *(grayscale)*	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless, Non-Hierarchical, First-Order	1.2.840.10008.1.2.4.70	No

		Prediction (Process 14 [Selection Value 1])		
Secondary Capture Image *(grayscale)*	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	No
Secondary Capture Image *(palette color)*	1.2.840.10008.5.1.4.1.1.7	JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14 [Selection Value 1])	1.2.840.10008.1.2.4.70	Yes
Secondary Capture Image *(palette color)*	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	1.2.840.10008.1.2.1	Yes

5.2.1.1.1.1.1.2 STD-DEN-CD Options

For the STD-DEN-CD Application Profile, the OnyxCeph-FSR Application Entity only supports the mandatory combinations of SOP Class and Transfer Syntax. All supported combinations are listed in Table 5-3.

Table 5-3. STD-DEN-CD SOP Classes and Transfer Syntaxes for OnyxCeph-FSR AE

Information Object Definition	SOP Class UID	Transfer Syntax Name	Transfer Syntax UID	Optional
Basic Directory	1.2.840.10008.1.3.10	Explicit VR Little Endian	1.2.840.10008.1.2.1	No
Digital Intra-Oral X-Ray Image *(for presentation)*	1.2.840.10008.5.1.4.1.1.1.3	Explicit VR Little Endian	1.2.840.10008.1.2.1	No
Digital X-Ray Image *(for presentation)*	1.2.840.10008.5.1.4.1.1.1.1	Explicit VR Little Endian	1.2.840.10008.1.2.1	No

5.3 Augmented and Private Application Profiles

5.3.1 Augmented Application Profiles

The OnyxCeph-FSR Application Entity does not support any Augmented Application Profiles.

5.3.2 Private Application Profiles

The OnyxCeph-FSR Application Entity does not support any Private Application Profiles.

5.4 Media Configuration

OnyxCeph³™ does not support any configurable parameters for Media Storage.

6 TRANSFORMATION OF DICOM TO CDA

OnyxCeph³™ does not support transforming DICOM SR objects to HL7 CDA.

7 SUPPORT OF CHARACTER SETS

In addition to the Default Character Repertoire (ASCII), the OnyxCeph Application Entity supports the character sets listed in Table 7-1 when importing DICOM images, either from a DICOM storage medium or received from an archive system, and when receiving a response dataset for a Patient or Study Root Query. All these DICOM datasets are converted to UTF-8 encoding before further processing. If a response dataset does not include the Specific Character Set (0008,0005) Attribute, but does contain non-ASCII characters, a configurable default value for this Attribute is used (see Section 4.4.2). If the conversion fails, e.g. because the specified value for the Specific Character Set (0008,0005) Attribute is not supported, non-ASCII characters are not guaranteed to be interpreted correctly, or they are mapped to a specific replacement character. Patient data will not be imported without user confirmation.

Table 7-1. Supported Character Sets when Importing DICOM Images and Receiving Response Datasets

Character Set Description	Defined Term
Latin alphabet No. 1	ISO_IR 100
Latin alphabet No. 2	ISO_IR 101
Latin alphabet No. 3	ISO_IR 109
Latin alphabet No. 4	ISO_IR 110
Greek	ISO_IR 126
Arabic	ISO_IR 127
Hebrew	ISO_IR 138
Cyrillic	ISO_IR 144
Latin alphabet No. 5	ISO_IR 148
Japanese	ISO_IR 13
Thai	ISO_IR 166
Chinese	GB18030
Chinese	GBK
Unicode in UTF-8	ISO_IR 192
Default repertoire	ISO 2022 IR 6
Latin alphabet No. 1	ISO 2022 IR 100
Latin alphabet No. 2	ISO 2022 IR 101
Latin alphabet No. 3	ISO 2022 IR 109
Latin alphabet No. 4	ISO 2022 IR 110
Greek	ISO 2022 IR 126
Arabic	ISO 2022 IR 127
Hebrew	ISO 2022 IR 138
Cyrillic	ISO 2022 IR 144
Latin alphabet No. 5	ISO 2022 IR 148
Japanese	ISO 2022 IR 13
Japanese	ISO 2022 IR 87
Japanese	ISO 2022 IR 159
Thai	ISO 2022 IR 166
Korean	ISO 2022 IR 149
Simplified Chinese	ISO 2022 IR 58

Table 7-2 lists the character sets that are supported when issuing a Patient or Study Root Query. The value of the Specific Character Set (0008,0005) Attribute in the request dataset is a configurable parameter (see Section 4.4.2). If the conversion from the character set of the user interface (UTF-16) to the selected character set for the query fails, non-ASCII characters are mapped to the replacement character defined for the local code page.

Table 7-2. Supported Character Sets when Issuing a Patient or Study Root Query

Character Set Description	Defined Term
Default repertoire (ASCII)	
Latin alphabet No. 1	ISO_IR 100
Latin alphabet No. 2	ISO_IR 101
Latin alphabet No. 3	ISO_IR 109
Latin alphabet No. 4	ISO_IR 110
Latin alphabet No. 5	ISO_IR 148
Greek	ISO_IR 126
Arabic	ISO_IR 127
Hebrew	ISO_IR 138
Cyrillic	ISO_IR 144
Unicode in UTF-8	ISO_IR 192

Table 7-3 lists the character sets that can be selected as a default value for the Specific Character Set (0008,0005) Attribute when it is missing but needed in a response dataset, or when it the specified value for the Specific Character Set (0008,0005) Attribute is not supported (see Section 4.4.2).

Table 7-3. Character Sets to be Selected as Default Value (Fallback)

Character Set Description	Defined Term
Default repertoire (ASCII)	
Latin alphabet No. 1	ISO_IR 100
Latin alphabet No. 2	ISO_IR 101
Latin alphabet No. 3	ISO_IR 109
Latin alphabet No. 4	ISO_IR 110
Latin alphabet No. 5	ISO_IR 148
Greek	ISO_IR 126
Arabic	ISO_IR 127
Hebrew	ISO_IR 138
Cyrillic	ISO_IR 144
Unicode in UTF-8	ISO_IR 192
Unspecified (local code page)	–

Textual data entered by the user is expected to be encoded with UTF-16. This character encoding is also used for the internal representation of textual data.

8 SECURITY

8.1 Security Profiles

OnyxCeph³™ does not support any security profiles.

8.2 Association Level Security

OnyxCeph³™ does not support any Association level security.

8.3 Application Level Security

OnyxCeph³™ does not support any application level security.

9 ANNEXES

9.1 IOD Contents

9.1.1 Created SOP Instances

The tables in the following subsections describe the supported IODs with their Modules and included Attributes. Most Attributes that are never present in a created SOP Instance are omitted from the tables in order to increase the readability.

Abbreviations used for the “Presence of Value” column in the Module tables:

VNAP	Value Not Always Present (attribute sent zero length if no value is present)
ANAP	Attribute Not Always Present
ALWAYS	Always present with a value
EMPTY	Attribute is sent without a value
NEVER	Attribute never present

Abbreviations used for the “Source (of the data values)” column in the Module tables:

USER	the Attribute value source is from User input
AUTO	the Attribute value is generated automatically
CONFIG	the Attribute value source is a configurable parameter
ACQ	the Attribute value is generated from a data acquisition process
IMPORT	the Attribute value is imported from an existing SOP Instance
PRQ, SRQ	the Attribute value is the same as the value received using a DICOM service such as Patient Root Query/Retrieve or Study Root Query/Retrieve

Please note that the created SOP Instances are only stored on the local system and not exported to remote AEs using a DICOM network or media service.

9.1.1.1 Secondary Capture Image IOD

OnyxCeph³™ creates instances of the Secondary Capture Image IOD when exporting 2D images in DICOM format.

Table 9-1. Secondary Capture Image IOD Modules

IE	Module	Reference	Presence of Module
Patient	Patient	Table 9-2	ALWAYS
	Clinical Trial Subject	–	NEVER
Study	General Study	Table 9-3	ALWAYS
	Patient Study	–	NEVER
	Clinical Trial Study	–	NEVER
Series	General Series	Table 9-4	ALWAYS
	Clinical Trial Series	–	NEVER
Equipment	General Equipment	Table 9-5	ALWAYS
	SC Equipment	Table 9-8	ALWAYS
Acquisition	General Acquisition	Table 9-6	ALWAYS
Image	General Image	Table 9-7	ALWAYS
	General Reference	–	NEVER
	Image Pixel	Table 9-9	ALWAYS
	Device	–	NEVER

	Specimen	–	NEVER
	SC Image	–	NEVER
	Overlay Plane	–	NEVER
	Modality LUT	–	NEVER
	VOI LUT	–	NEVER
	ICC Profile	–	NEVER
	SOP Common	Table 9-10	ALWAYS
	Common Instance Reference	–	NEVER

9.1.1.2 Common Modules

Table 9-2. Patient Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Patient's Name	(0010,0010)	PN		ALWAYS	PRQ, SRQ, IMPORT, USER
Patient ID	(0010,0020)	LO		VNAP	PRQ, SRQ, IMPORT, USER
Patient's Birth Date	(0010,0030)	DA		ALWAYS	PRQ, SRQ, IMPORT, USER
Patient's Sex	(0010,0040)	CS		ALWAYS	PRQ, SRQ, IMPORT, USER

Table 9-3. General Study Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Study Instance UID	(0020,000D)	UI	Generated automatically	ALWAYS	AUTO
Study Date	(0008,0020)	DA	Date of the session	ALWAYS	AUTO, USER
Study Time	(0008,0030)	TM		EMPTY	–
Referring Physician's Name	(0008,0090)	PN		VNAP	USER
Consulting Physician's Name	(0008,009C)	PN		ANAP	USER
Study ID	(0020,0010)	SH	Identifier of the session	ALWAYS	AUTO
Accession Number	(0008,0050)	SH		EMPTY	–
Study Description	(0008,1030)	LO	Generic text describing the session (language dependent)	ALWAYS	AUTO

Table 9-4. General Series Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Modality	(0008,0060)	CS	*See IOD-specific Modules in Section 9.1.1.3.*		
Series Instance UID	(0020,000E)	UI	Generated automatically	ALWAYS	AUTO
Series Number	(0020,0011)	IS	Identifier of the type of series	ALWAYS	AUTO
Laterality	(0020,0060)	CS		NEVER	–
Series Description	(0008,103E)	LO	Description of the type of series (language dependent)	ALWAYS	AUTO
Request Attributes Sequence	(0040,0275)	SQ		ANAP	AUTO
>Reason for the Requested Procedure	(0040,1002)	LO		ALWAYS	USER

Table 9-5. General Equipment Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Manufacturer	(0008,0070)	LO	Image Instruments GmbH	ALWAYS	AUTO
Institution Name	(0008,0080)	LO		VNAP	CONFIG
Manufacturer's Model Name	(0008,1090)	LO	OnyxCeph	ALWAYS	AUTO
Device Serial Number	(0018,1000)	LO		NEVER	–
Software Versions	(0018,1020)	LO	Two values: internal version number followed by official release number, e.g. “3.2.61 (67)\Release 3.2.200 (560)”	ALWAYS	AUTO

Table 9-6. General Acquisition Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Acquisition UID	(0008,0017)	UI		NEVER	–
Acquisition Number	(0020,0012)	IS		NEVER	–
Acquisition Date	(0008,0022)	DA	Acquisition date of the image	ALWAYS	AUTO, USER
Acquisition Time	(0008,0032)	TM		NEVER	–
Acquisition DateTime	(0008,002A)	DT		NEVER	–

Table 9-7. General Image Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Instance Number	(0020,0013)	IS	Continuous number	ALWAYS	AUTO
Patient Orientation	(0020,0020)	CS		EMPTY	–
Content Date	(0008,0023)	DA		NEVER	–
Content Time	(0008,0033)	TM		NEVER	–
Image Type	(0008,0008)	CS	DERIVED\ SECONDARY	ALWAYS	AUTO
Image Comments	(0020,4000)	LT		NEVER	–
Image Laterality	(0020,0062)	CS	R, L or U	ALWAYS	ACQ
Burned In Annotation	(0028,0301)	CS		NEVER	–
Recognizable Visual Features	(0028,0302)	CS	YES or NO YES for pictures of the patient's face, NO otherwise (e.g. X-ray or model images).	ALWAYS	AUTO
Lossy Image Compression	(0028,2110)	CS	01	ALWAYS	AUTO
Lossy Image Compression Ratio	(0028,2112)	DS		ALWAYS	AUTO
Lossy Image Compression Method	(0028,2114)	CS	ISO_10918_1	ALWAYS	AUTO

9.1.1.3 IOD-specific Modules

9.1.1.3.1 Secondary Capture Image IOD Modules

Table 9-8. Secondary Capture Image IOD – SC Equipment Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Conversion Type	(0008,0064)	CS	WSD	ALWAYS	AUTO
Modality	(0008,0060)	CS	OT	ALWAYS	AUTO

Table 9-9. Secondary Capture Image IOD – Image Pixel Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
Samples per Pixel	(0028,0002)	US	3	ALWAYS	AUTO
Photometric Interpretation	(0028,0004)	CS	YBR_FULL_422	ALWAYS	AUTO
Rows	(0028,0010)	US		ALWAYS	AUTO
Columns	(0028,0011)	US		ALWAYS	AUTO
Bits Allocated	(0028,0100)	US	8	ALWAYS	AUTO
Bits Stored	(0028,0101)	US	8	ALWAYS	AUTO

Hight Bit	(0028,0102)	US	7	ALWAYS	AUTO
Pixel Representation	(0028,0103)	US	0	ALWAYS	AUTO
Pixel Data	(7FE0,0010)	OB		ALWAYS	ACQ

Table 9-10. Secondary Capture Image IOD –
SOP Common Module of Created SOP Instances

Attribute Name	Tag	VR	Value	Presence of Value	Source
SOP Class UID	(0008,0016)	UI	1.2.840.10008.5.1.4.1.1.7	ALWAYS	AUTO
SOP Instance UID	(0008,0018)	UI	Generated automatically	ALWAYS	AUTO
Specific Character Set	(0008,0005)	CS	ISO_IR 192	ANAP	AUTO
Instance Creation Date	(0008,0012)	DA		NEVER	–
Instance Creation Time	(0008,0013)	TM		NEVER	–
Instance Creator UID	(0008,0014)	UI		NEVER	–
Timezone Offset From UTC	(0008,0201)	SH		NEVER	–
Contributing Equipment Sequence	(0018,A001)	SQ		NEVER	–
Content Qualification	(0018,9004)	CS		NEVER	–

9.1.2 Usage of Attribute from Received IODs

The usage of Attributes received via Patient or Study Root Query is described in Section 4.2.1.3.2.3.1.

9.1.3 Attribute Mapping

If a Patient or Study Root Query has been issued, the values of the following Attributes are copied from the selected result dataset (column “Query Result”) to the created SOP Instances (column “Instance IOD”).

Table 9-11. Attribute Mapping between Patient or Study Root Query and Instance IOD

Query Result	Instance IOD
Patient’s Name	Patient’s Name
Patient ID	Patient ID
Patient’s Birth Date	Patient’s Birth Date
Patient’s Sex	Patient’s Sex

9.1.4 Coerced / Modified Fields

OnyxCeph³™ does not coerce or modify any fields.

9.2 Data Dictionary of Private Attributes

OnyxCeph³™ does not use or support private Attributes

9.3 Coded Terminology and Templates

OnyxCeph³™ does not use or support any coded terminology or Templates.

9.4 Grayscale Image Consistency

OnyxCeph³™ does not make use of the DICOM Grayscale Standard Display Function.

9.5 Standard Extended / Specialized / Private SOP Classes

OnyxCeph³™ does not use or support any Standard Extended, Specialized or Private SOP Classes.

9.6 Private Transfer Syntaxes

OnyxCeph³™ does not use or support any private Transfer Syntaxes.