

**DICOM 3.0 Conformance Statement  
for  
Waypoint**



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# 1. Conformance Statement Overview

Waypoint is a software application which receives and sends medical worklist orders. It implements the necessary DICOM services and HL7 message processing to receive and store those instances from the RIS and DICOM entities and use that repository to process subsequent queries and updates.

The purpose of Waypoint is to provide services to allow clients on the network to create, query and update the worklist items. The communication protocols with Waypoint are based on DICOM 3.2 2018c and HL7 version 2. Specifically, Waypoint implements the following protocols:

- DICOM DIMSE Messages
  - Modality Worklist Information Model - FIND
  - Unified Procedure Step
  - Modality Performed Procedure Step
- HL7 ORM, ORU and ADT messages
- HTTP RESTful services

The worklist repository in Waypoint processes HL7 messages as the most common method to create and update worklist items. DICOM entities use the Modality Worklist Information Model (MWL) to query this data. The DICOM standard also specifies the Unified Procedure Step to acquire and update worklist data through the Unified Procedure Step DIMSE N-CREATE service. In addition, the DICOM standard specifies the Unified Procedure Step as a RESTful service. The DICOM standard also specifies the Modality Performed Procedure Step which is a DIMSE N-CREATE service.

Table 1-1 provides an overview of the DICOM network services supported by Waypoint.

**Table 1-1**  
**Network Services**

| SOP Classes                                | User of Service (SCU) | Provider of Service (SCP) |
|--|-----------------------|---------------------------|
| <b>Workflow Management</b>                 |                       |                           |
| Modality Worklist Information Model - FIND | Yes                   | Yes                       |
| Modality Performed Procedure Step          | No                    | Yes                       |
| Modality Performed Procedure Step Retrieve | No                    | Yes                       |
| Unified Procedure Step – Push              | No                    | Yes                       |
| Unified Procedure Step – Pull              | No                    | Yes                       |
| Verification                               | Yes                   | Yes                       |

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## 3. Introduction

### 3.1. Revision History

| Document Version | Date of Issue | Author | Description              |
|------------------|---------------|--------|--------------------------|
| 1.0              | 26 Apr 2018   | BAC    | Initial creation         |
| 1.1              | 27 April 2018 | BAC    | Fixed Table of Contents  |
| 1.2              | 24 Sep 2018   | BAC    | Update following review  |
| 1.2.5            | 25 Jan 2019   | BAC    | Update for version 1.2.5 |
| 1.2.6            | 29 May 2019   | BAC    | Update for version 1.2.6 |
| 1.3.0            | 31 Jan 2020   | BAC    | Update for version 1.3.0 |
| 1.5.0            | 1 Apr 2020    | BAC    | Update for version 1.5.0 |
| 1.5.1            | 17 April 2020 | BAC    | Update for version 1.5.1 |

### 3.2. Audience

This document is written for the people that need to understand how Waypoint 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. References

DICOM PS3 Digital Imaging and Communications in Medicine (DICOM) Standard, available for free at <http://www.dicomstandard.org>

Waypoint User Manual  
Laurel Bridge Waypoint User Manual version 1.2.6, available for free at <http://www.laurelbridge.com/pdf/Waypoint-User-Manual.pdf>

HL7 HL7 Version 2 Product Suite, available for free at [http://www.hl7.org/implement/standards/product\\_brief.cfm?product\\_id=185](http://www.hl7.org/implement/standards/product_brief.cfm?product_id=185)

### 3.4. Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between Waypoint 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.

### 3.5. Terms and Definitions

Informal definitions are provided for the following terms used in 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.

**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** – 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.

**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). Example: 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 (modality worklist SCU)

**Service/Object Pair (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: Modality Worklist Information Model - Find. **Service/Object Pair (SOP) Instance** – an information object; a specific occurrence of information exchanged in a SOP Class. Examples: a specific procedure step.

**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.

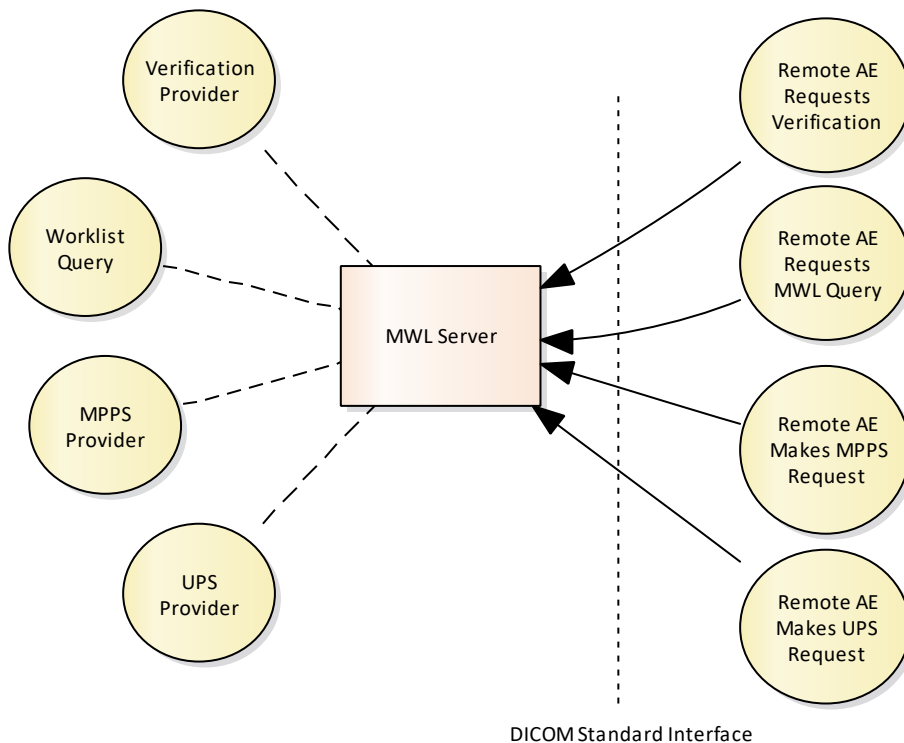
### 3.6. Abbreviations

|        |   |
|--------|---|
| AE     | Application Entity                              |
| AET    | Application Entity Title                        |
| DHCP   | Dynamic Host Configuration Protocol             |
| DICOM  | Digital Imaging and Communications in Medicine  |
| DNS    | Domain Name System                              |
| HIS    | Hospital Information System                     |
| HL7    | Health Level 7 Standard                         |
| IHE    | Integrating the Healthcare Enterprise           |
| IOD    | Information Object Definition                   |
| IPv4   | Internet Protocol version 4                     |
| IPv6   | Internet Protocol version 6                     |
| ISO    | International Organization for Standards        |
| LDAP   | Lightweight Directory Access Protocol           |
| MPPS   | Modality Performed Procedure Step               |
| MR     | Magnetic Resonance Imaging                      |
| MSPS   | Modality Scheduled Procedure Step               |
| MWL    | Modality Worklist                               |
| NTP    | Network Time Protocol                           |
| O      | Optional (Key Attribute)                        |
| PACS   | Picture Archiving and Communication System      |
| PDU    | Protocol Data Unit                              |
| R      | Required (Key Attribute)                        |
| RIS    | Radiology Information System.                   |
| SCP    | Service Class Provider                          |
| SCU    | Service Class User                              |
| SOP    | Service-Object Pair                             |
| SPS    | Scheduled Procedure Step                        |
| TCP/IP | Transmission Control Protocol/Internet Protocol |
| U      | Unique (Key Attribute)                          |
| UL     | Upper Layer                                     |
| VR     | Value Representation                            |

## 4. Networking

### 4.1. Implementation Model

#### 4.1.1. Application Data Flow



**Figure 1- Modality Worklist Server Workflow**

The MWL Server provides access to create and update scheduled procedure information in its database as orders are created and procedures are performed. The various flows in the diagram above are described as follows:

MWL Server accepts associations for Verification from Verification SCUs and responds with Success if all configuration parameters for the association are valid. Possible reasons for failure are unknown Calling AE, unknown Calling AE, invalid or expired TLS certificate, etc..

MWL Server accepts associations for Modality Worklist queries from MWL SCUs and invokes the Worklist Query activity to generate the list of matching responses and return them to the MWL SCU.

MWL Server accepts associations for Modality Performed Procedure Step requests from MPPS SCUs and invokes the MPPS Provider activity to process N-CREATE and N-SET messages to create and update worklist items.

MWL Server accepts associations for Modality Performed Procedure Step Retrieve requests from MPPS SCUs and invokes the MPPS Provider activity to process N-GET messages to respond with the values for the requested attribute identifier list.

MWL Server accepts associations for Unified Procedure Step requests from UPS SCUs and invokes the UPS Provider activity to process N-CREATE and N-SET messages to create and update worklist items.

## 4.1.2. Functional Definition of AE's

### 4.1.2.1. Functional Definition of SCP Application Entity (SCP AE)

The SCP AE waits for another application to connect at the presentation address configured for its Application Entity Title. When another application connects, the SCP AE expects it to be a DICOM application. The SCP AE will accept Associations with Presentation Contexts for SOP Classes of the Workflow Management service classes.

#### 4.1.2.1.1. MWL Workflow

The Modality Worklist Information Model SOP class is a find request which causes the SCP AE to search the repository for matching records to build and return the C-Find responses.

#### 4.1.2.1.2. MPPS Workflow

The Modality Performed Procedure Step SOP class accepts N-CREATE requests on the association. The N-CREATE request must contain a new unique Affected SOP Instance UID. Attempts to create a MPPS with an existing Affected SOP Instance UID will fail. Waypoint will create a new worklist item using the data set from the N-CREATE request.

Modality Performed Procedure Step SOP class also accepts N-SET requests on the association. The N-SET request must contain a matching Requested SOP Instance UID that was created in a previous N-CREATE request. Attempts to set an MPPS that do not provide an existing Affected SOP Instance UID will fail. Waypoint will update the existing worklist item using the data set from the N-SET request.

Modality Performed Procedure Step Retrieve SOP class accepts N-GET requests on the association. The N-GET request must contain a matching Requested SOP Instance UID that was created in a previous N-CREATE request. Attempts to get an MPPS that do not provide an existing Affected SOP Instance UID will fail. Waypoint will retrieve the DICOM elements from the existing worklist item using the Attribute Identifier List from N-SET request as well as any elements from Waypoint's AE Rule that matched the DICOM Rule for the association.

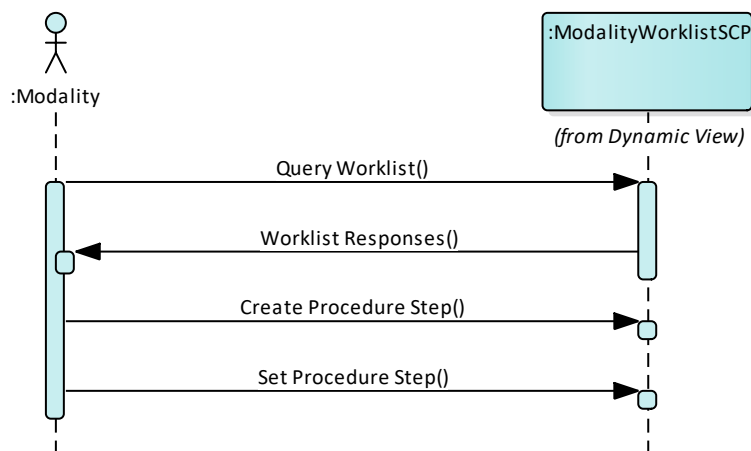
#### 4.1.2.1.3. UPS Workflow

The Unified Procedure Step Push SOP class accepts N-CREATE requests on the association. The N-CREATE request must contain a new unique Affected SOP Instance UID. Attempts to create a UPS with an existing Affected SOP Instance UID will fail. Waypoint will either create a new worklist item or update an existing worklist item using the data set from the N-CREATE request.

Unified Procedure Step Push SOP class also accepts N-SET requests on the association. The N-Set request must contain a matching Affected SOP Instance UID that was present in a previous N-CREATE request. Attempts to set a UPS that do not provide an existing Affected SOP Instance UID will fail. Waypoint will update an existing worklist item using the data set from the N-SET request

## 4.1.3. Sequencing of Real-World Activities

### 4.1.3.1. Modality Worklist SCP Workflow





The normal operation is for the Modality to query for worklists from the Modality Worklist SCP (MWL). Waypoint searches its database for items that match the query and returns the responses. Waypoint also implements MPPS and UPS, allowing the Modality to optionally create and update procedure steps within Waypoint.

## 4.2. AE Specifications

### 4.2.1. SCP Application Entity (SCP AE) Specification

#### 4.2.1.1. SOP Classes

Waypoint provides Standard Conformance to the following DICOM V3.0 SOP Classes:

**Table 4.2.1.1-1**  
**SOP Classes for Workflow Management**

| SOP Classes  | SOP Class UID              | SCU | SCP |
|--|----------------------------|-----|-----|
| <b>Workflow Management</b>                           |                            |     |     |
| Verification   | 1.2.840.10008.1.1          | No  | Yes |
| Modality Worklist Information Model - FIND           | 1.2.840.10008.5.1.4.31     | No  | Yes |
| Modality Performed Procedure Step SOP Class          | 1.2.840.10008.3.1.2.3.3    | No  | Yes |
| Modality Performed Procedure Step Retrieve SOP Class | 1.2.840.10008.3.1.2.3.4    | No  | Yes |
| Unified Procedure Step Push SOP Class                | 1.2.840.10008.5.1.4.34.6.1 | No  | Yes |
| Unified Procedure Step Pull SOP Class                | 1.2.840.10008.5.1.4.34.6.3 | No  | Yes |

#### 4.2.1.1.1. Proposed Presentation Contexts

Waypoint is capable of proposing or receiving a presentation context consisting of any SOP class listed in Table 4.2.1.1-1 and any transfer syntax listed in Table 4.2.1.1.1-1 below:

**Table 4.2.1.1.1-1**

| Abstract Syntax Name | Transfer Syntax Name      | Transfer Syntax UID | SCU | SCP | Ext. Neg. |
|----------------------|---------------------------|---------------------|-----|-----|-----------|
| *                    | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | No  | Yes | None      |
| *                    | Implicit VR Little Endian | 1.2.840.10008.1.2   | No  | Yes | None      |
| *                    | Explicit VR Big Endian    | 1.2.840.10008.1.2.2 | No  | Yes | None      |

#### 4.2.1.2. Association Policies

##### 4.2.1.2.1. General

The SCP AE can both accept and propose Association Requests. The SCP AE will accept Association Requests for the Workflow Management services. The DICOM standard Application Context Name for DICOM 3.0 is always accepted and proposed:

**Table 4.2.1.2.1-1**  
**DICOM Application Context For MWL-SCP AE**

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

#### 4.2.1.2.2. Number of Associations

The SCP AE can support multiple simultaneous Associations requested by peer AEs. Each time the SCP AE receives an Association, a child process will be spawned to process the Workflow Management service requests. The maximum number of child processes, and thus the maximum number of simultaneous Associations that can be processed, is set by configuration. The default maximum number is 25 in total. This maximum number of simultaneous Associations can be either an absolute number or a maximum number for each requesting external Application Entity. The latter flexibility can be useful if communication with one external AE is unreliable and one does not wish 'hung' connections with this AE to prevent Associations with other client AEs.

**Table 4.2.1.2.1-2  
Number Of Simultaneous Associations For SCP AE**

|   |                   |
|---|-------------------|
| Maximum number of simultaneous Associations requested by peer AEs | 25 (Configurable) |
|---|-------------------|

#### 4.2.1.2.3. Asynchronous Nature

The SCP AE does not support asynchronous communication (multiple outstanding transactions over a single Association).

**Table 4.2.1.2.1-3  
Asynchronous Nature For SCP AE**

|   |                      |
|---|----------------------|
| Maximum number of outstanding asynchronous transactions | 1 (Not configurable) |
|---|----------------------|

#### 4.2.1.2.4. Implementation Identifying Information

The implementation information for this Application Entity is:

**Table 4.2.1.2.1-5  
DICOM Implementation Class and Version for SCP AE**

|                             |                             |
|-----------------------------|-----------------------------|
| Implementation Class UID    | 1.2.840.114089.1.0.0.3.3.40 |
| Implementation Version Name | DCF 3.4.30c                 |

#### 4.2.1.3. Association Initiation Policy

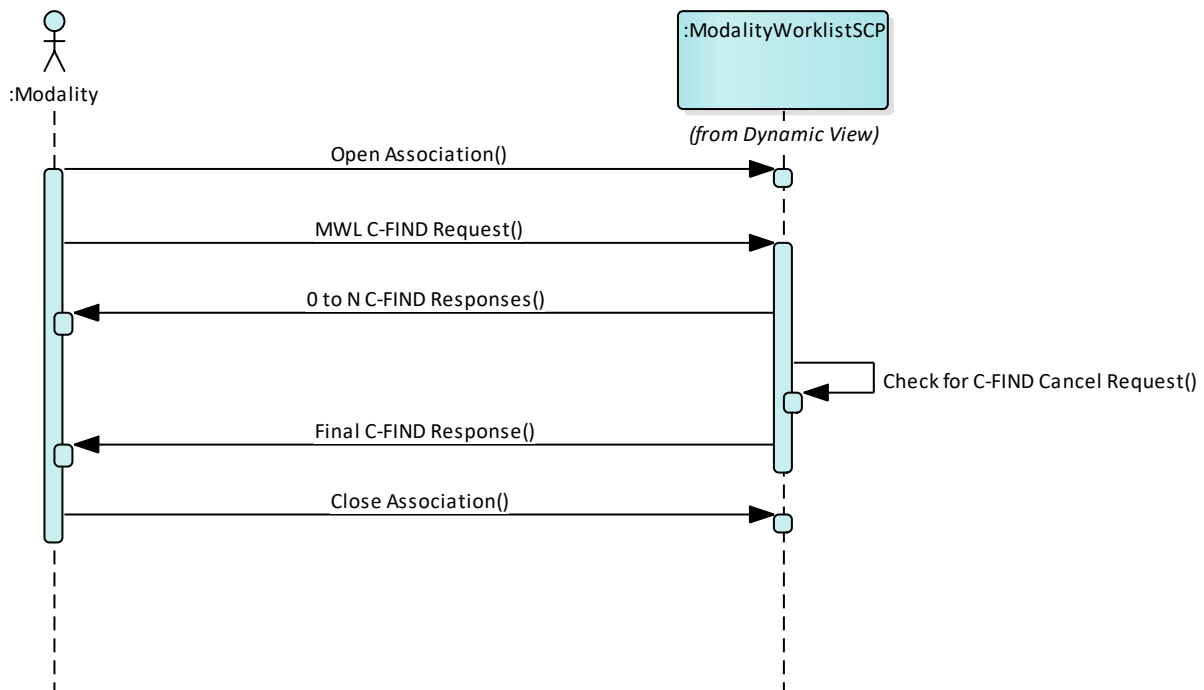
Waypoint SCP Application Entities do not initiate Associations.

#### 4.2.1.4. Association Acceptance Policy

##### 4.2.1.4.1. Activity – Configured AE Requests MWL Query

###### ▪ 4.2.1.4.1.1 Description and Sequencing of Activity

The SCP AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted then the Association Request itself is rejected. It can be configured to only accept Associations with certain hosts (using TCP/IP address or hostname), ports, and/or Application Entity Titles.



**Figure 4.2.1.4.1.1-1**

The figure above is a possible sequence of messages between a Modality Worklist SCU and Waypoint.

1. The Modality opens an Association with Waypoint for the purpose of querying for a Modality Worklist
2. The Modality sends an MWL C-FIND query to Waypoint
3. Waypoint queries its database using the attributes from the C-FIND Request and returns 0 to N C-FIND responses depending on matches returned from the database. Waypoint checks for a C-FIND Cancel Request after a configured number of responses are sent. If a Cancel is received then no further Pending responses are sent.
4. Waypoint sends the final C-FIND response
5. The Modality closes the Association

The SCP AE may reject Association attempts as shown in the Table below. The Result, Source and Reason/Diag columns represent the values returned in the corresponding fields of an ASSOCIATE-RJ PDU (see PS 3.8, Section 9.3.4). The following abbreviations are used in the Source column:

- a. 1 – DICOM UL service-user
- b. 2 – DICOM UL service-provider (ASCE related function)
- c. 3 – DICOM UL service-provider (Presentation related function)

Table 4.2.1.4.1.1-1

| Result                    | Source | Reason/Diag                                | Explanation  |
|---------------------------|--------|--|--|
| 2 –<br>rejected-transient | c      | 2 – local-limit-exceeded                   | The (configurable) maximum number of simultaneous Associations has been reached. An Association request with the same parameters may succeed at a later time.  |
| 2 –<br>rejected-transient | c      | 1 – temporary congestion                   | No Associations can be accepted at this time due to the real-time requirements of higher priority activities because insufficient resources are available (e.g. memory, processes, threads). An Association request with the same parameters may succeed at a later time.  |
| 1 –<br>rejected-permanent | a      | 2 – 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.   |
| 1 –<br>rejected-permanent | a      | 7 – called-AE-title-not-recognized         | The Association request contained an unrecognized Called AE Title. An Association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the Association initiator is incorrectly configured and attempts to address the Association acceptor using the wrong AE Title. |
| 1 –<br>rejected-permanent | a      | 3 – calling-AE-title-not-recognized        | The Association request contained an unrecognized Calling AE Title. An Association request with the same parameters will not succeed at a later time unless configuration changes are made. This rejection reason normally occurs when the Association acceptor has not been configured to recognize the AE Title of the Association initiator.                      |

| Result                    | Source | Reason/Diag         | Explanation  |
|---------------------------|--------|---------------------|--|
| 1 –<br>rejected-permanent | b      | 1 – no-reason-given | The Association request could not be parsed. An Association request with the same format will not succeed at a later time. |

#### 4.2.1.4.1.2 Accepted Presentation Contexts

The default Behavior of the SCP AE supports all of the presentation contexts listed in Table 4.2.1.1.1-1. The SCP AE can be configured to accept a subset or a superset of these presentation contexts by adding or removing SOP Classes and/or transfer syntaxes.

If multiple Transfer Syntaxes are proposed per Presentation Context then only the most preferable Transfer Syntax is accepted. The order of Transfer Syntax preference for the SCP AE is configurable.

- 4.2.1.4.1.3 **SOP Specific Conformance for Verification SOP Class**

The SCP AE provides standard conformance to the Verification SOP Class as an SCP.

- 4.2.1.4.1.4 **SOP Specific Conformance for MWL C-Find SOP**

Available Transfer Syntaxes are shown in Table 4.2.1.1.1-1. Additional Transfer Syntaxes may be configured for a given DICOM Source through Waypoint Client DICOM Options. When this is done, the first Transfer Syntax encountered which matches a Transfer Syntax offered for a given Presentation Context, will be selected as the accepted Transfer Syntax for that Presentation Context. Optionally, the DICOM Source can be configured to “Favor Source’s Transfer Syntax.” In this case, the first requested Transfer Syntax that is enabled will be used.

## 4.2.2. SCU Application Entity (SCU AE) Specification

### 4.2.2.1. SOP Classes

Waypoint provides Standard Conformance to the following DICOM V3.0 SOP Classes:

**Table 4.2.2.1-1**  
**SOP Classes for SCU AE**

| SOP Classes                                | SOP Class UID          | SCU | SCP |
|--|------------------------|-----|-----|
| <b>Workflow Management</b>                 |                        |     |     |
| Modality Worklist Information Model - FIND | 1.2.840.10008.5.1.4.31 | Yes | No  |
| Verification                               | 1.2.840.10008.1.1      | Yes | No  |

#### 4.2.2.1.1. Proposed Presentation Contexts

Waypoint is capable of proposing or receiving a presentation context consisting of any SOP class listed in Table 4.2.2.1-1 and any transfer syntax listed in Table 4.2.2.1.1-1 below:

**Table 4.2.2.1.1-1**

| Abstract Syntax Name | Transfer Syntax Name      | Transfer Syntax UID | SCU | SCP |
|----------------------|---------------------------|---------------------|-----|-----|
| *                    | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | Yes | No  |
| *                    | Implicit VR Little Endian | 1.2.840.10008.1.2   | Yes | No  |
| *                    | Explicit VR Big Endian    | 1.2.840.10008.1.2.2 | Yes | No  |

### 4.2.2.2. Association Establishment Policies

#### 4.2.2.2.1. General

The SCU AE can only request the opening of an Association. It cannot accept requests to open Associations from external Application Entities.

The DICOM standard Application Context Name for DICOM is always proposed:

**Table 4.2.2.2.1-1**  
**DICOM Application Context For SCU AE**

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

#### 4.2.2.2.2. Number of Associations

The maximum number of simultaneous Associations is configurable. The SCU AE can initiate simultaneous Associations to a given external Destination AE up to the maximum number configured. Each Destination AE can have its own configurable maximum number of simultaneous Associations, but not more than the system-wide maximum number of simultaneous Associations will be honored.

**Table 4.2.2.2.2-1**  
**Number of Associations For SCU AE**

|   |                   |
|---|-------------------|
| Maximum number of simultaneous Associations | 25 (Configurable) |
|---|-------------------|

#### 4.2.2.2.3. Asynchronous Nature

The SCU AE does not support asynchronous communication (multiple outstanding transactions over a single Association). All Association requests must be completed and acknowledged before a new operation can be initiated.

**Table 4.2.2.2.3-1**  
**Asynchronous Nature For SCU AE**

|   |                      |
|---|----------------------|
| Maximum number of outstanding asynchronous transactions | 1 (Not Configurable) |
|---|----------------------|

#### 4.2.2.2.4. Implementation Identifying Information

**Table 4.2.2.2.4-1**  
**DICOM Implementation Class and Version For SCU AE**

|                             |                             |
|-----------------------------|-----------------------------|
| Implementation Class UID    | 1.2.840.114089.1.0.0.3.3.40 |
| Implementation Version Name | DCF 3.4.30c                 |

Note that the SCU AE and SCP AE use the same Implementation Class UID and Implementation Version Name. This Version Name is updated with each new release of the product software, as the different AE versions are never released independently.

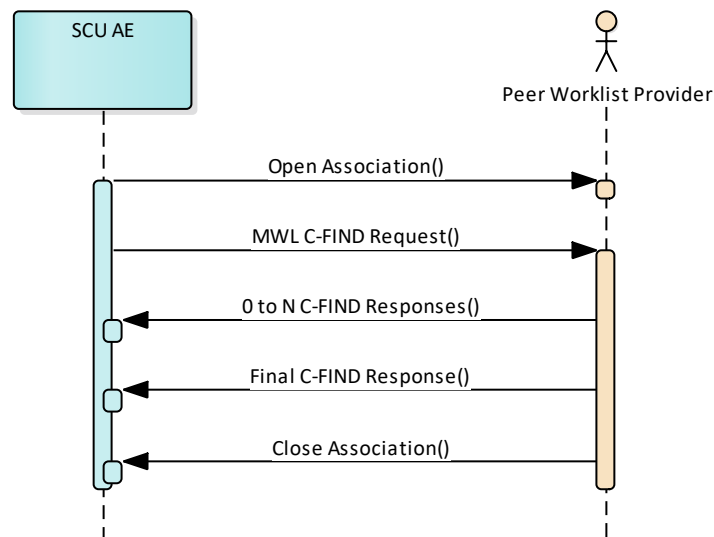
### 4.2.2.3. Association Initiation Policy

#### 4.2.2.3.1. Activity – Send MWL C-FIND Requests to an External Peer Worklist Provider

##### 4.2.2.3.1.1 Description and Sequencing of Activity

The SCU AE will initiate a new Association to send queries. An Association Request is sent to the specified Worklist Provider Destination AE and upon successful negotiation of the required Presentation Context modality worklist query is started. The Association will be released when final response is received by the SCU AE.

**Figure 4.2.2.3.1.1-1**  
**Sequencing of Activity – Send C-FIND Requests to an External Peer AE**



The following sequencing constraints illustrated in Figure 4.2.2.3.1.1-1 apply to the SCU AE:

1. SCU AE opens a new Association with the Peer Worklist Provider SCP AE.
2. SCU AE sends an MWL C-FIND Request.

3. SCU AE receives the pending C-FIND Responses.
4. SCU AE receives the final response.
5. SCU AE closes the Association.

#### 4.2.2.3.1.2 SOP Specific Conformance for Verification SOP Class

Standard conformance is provided to the DICOM Verification Service Class as an SCU. The Verification Service as an SCU is actually only supported as a diagnostic service tool for network communication issues.

#### 4.2.2.3.1.3 SOP Specific Conformance for MWL FIND SOP Classes

Data elements are extracted from the C-FIND Responses and optionally stored in the Waypoint database. Alternately, if Use Waypoint Database option is not selected, the C-FIND Responses from the MWL SCP are forwarded back to the SCU that made an association with Waypoint.

The SCU AE will exhibit the following Behavior according to the Status Code value returned in a C-FIND Response from a destination MWL FIND SCP:

**Table 4.2.2.3.1.2-1  
SCU AE MWL C-FIND Response Status Handling Behavior**

| Service Status | Further Meaning    | Error Code  | Behavior  |
|----------------|--------------------|-------------|---|
| Success        | Success            | 0000        | The SCP has successfully stored the SOP Instance. If all SOP Instances in a store job have status Success then the store job is marked as Sent. |
| Refused        | Out of Resources   | A700 – A7FF | This is treated as a failure.   |
| Error          | Processing Failure | 0110        | Internal Error within Waypoint. The response status code and error are logged in the Waypoint Service log.                                      |

### 4.2.3. Physical Network Interface

Waypoint supports any network interface that implements the TCP/IP protocol.

### 4.2.4. Additional Protocols

None.

### 4.2.5. IPv4 and IPv6 Support

This product only supports IPv4 connections.

## 4.3. Configuration

### 4.3.1. AE Title/Presentation Address Mapping

#### 4.3.1.1. Local AE Titles

The specification of AE titles, TCP/IP addresses, and ports is configurable.

**Table 4.4.1.1-1**

| Application Entity | Role | Default AE Title | Default TCP/IP Port |
|--------------------|------|------------------|---------------------|
| SCU AE             | SCU  | Waypoint         | <None>              |
| SCP AE             | SCP  | CALLED           | 11114               |

The SCU and SCP Application Entities can be configured to have the same AE title. The SCP Application Entity has a default Application Entity of CALLED. It can be configured to accept any Called AE Title.

### 4.3.2. Parameters

**Table 4.4.2-1**



**SCP AE Configuration Parameters**

| Parameter                                   | Configurable | Default Value |
|---|--------------|---------------|
| Maximum Send PDU Size                       | Yes          | 32768         |
| Maximum Receive PDU Size                    | Yes          | 32768         |
| Maximum number of simultaneous Associations | Yes          | 32            |

**Table 4.4.2-2****SCU AE Configuration Parameters**

| Parameter                                   | Configurable | Default Value |
|---|--------------|---------------|
| Maximum Send PDU Size                       | Yes          | 32768         |
| Maximum Receive PDU Size                    | Yes          | 32768         |
| Maximum number of simultaneous Associations | Yes          | 32            |

## 5. Media Interchange

Waypoint does not support Media Interchange.

## 6. Support of Extended Character Sets

Waypoint supports the following character sets in addition to the default:  
ISO\_IR 100 (ISO 8859-1:1987 Latin Alphabet No. 1 supplementary set)

## 7. Security

It is assumed that Waypoint is used within a secured environment. It is assumed that a secured environment includes at a minimum:

- a. Firewall or router protections to ensure that only approved external hosts have network access to Waypoint.
- b. Firewall or router protections to ensure that Waypoint only has network access to approved external hosts and services.
- c. Any communication with external hosts and services outside the locally secured environment use appropriate secure network channels (e.g. such as a Virtual Private Network (VPN)). Alternatively, Waypoint can be configured to send and receive DIMSE messages via an encrypted mechanism such as TLS.

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

### 7.1. Security Profiles

#### 7.1.1. TLS Security

Waypoint supports the Basic TLS Secure Transport Connection Profile (See DICOM PS3.15 2015c Security and System Management Profiles, Appendix B.1) for authentication and encryption of communication between it and other DICOM clients and servers. Waypoint supports TLS version 1.0 as required by this profile, as well as TLS versions 1.1 and 1.2.

Within the Waypoint application, for secure DICOM communication on the sending copy of Waypoint one should select any/all of the Enable TLS options under the Advanced section of the DICOM Destinations pane. On the receiving copy of Waypoint one should select any/all of the Enable TLS options under the DICOM Incoming section of the DICOM System pane; additionally, one must configure the TLS options in the Advanced Settings section of this pane.

To properly configure incoming TLS connections, on the DICOM System pane, the Listen Port, TLS Certificate path and certificate Password must be set. The Listen Port default is port 2762, as recommended by the standard (chapter 15 section B.1: The Basic TLS Secure Transport Connection Profile); it is the port on which Waypoint will receive TLS encrypted communications (e.g., DICOM associations). The TLS Certificate path should be set to the file system location of the certificate that Waypoint should present for identification to clients. It is suggested that the certificate be a standard PKCS#12 certificate and it must contain an exportable private key. The Password must be set to the password for the private key in the certificate. Note: using a certificate format that does not password protect the private key allows the password setting to be ignored.

### **7.1.2. Anonymization**

See the document named CNF-LBS-DICOM-Anonymizer.pdf for conformance statement information regarding de-identification and re-identification.

## **7.2. Association Level Security**

The SCP AE can be configured to check the following values when determining whether to accept Association Open Requests:

- Calling AE Title
- Called AE Title
- Remote IP Address
- Application Context

## 8. Annexes

### 8.1. IOD Contents

#### 8.1.1. Created SOP Instances

Waypoint does not create SOP instances

#### 8.1.2. Usage of Attributes From Received IODs

Fields from UPS or MPPS have the same default mapping and configuration rules as used for HL7 message processing, see Table 8.1.3-1 for the Modality Worklist Attribute Mappings.

#### 8.1.3. Attribute Mapping

The mapping between attributes received via HL7 from the HIS and those supplied in Modality Worklist is configurable. The default mapping is contained in the table below. Empty cells indicate that there is no mapping for the specific attribute

**Table 8.1-3-1 HL7/Modality Worklist Attribute Mapping**

| DICOM Attribute                   | DICOM Tag   | HL7 Field          | Notes |
|-----------------------------------|-------------|--------------------|-------|
| <b>Patients Group</b>             |             |                    |       |
| Additional Patient History        | (0010,21B0) |                    |       |
| Custom1                           |             |                    |       |
| Custom2                           |             |                    |       |
| Custom3                           |             |                    |       |
| Custom4                           |             |                    |       |
| Custom5                           |             |                    |       |
| Patient's Birth Date              | (0010,0030) | PID 7              |       |
| Patient's Name                    | (0010,0010) | PID 5              |       |
| Patient's Sex                     | (0010,0040) | PID 8              |       |
| <b>OtherPatientIds Group</b>      |             |                    |       |
| Ipid                              | (0010,0021) | MSH 4              |       |
| PatientId                         | (0010,0020) | PID 3 ?? PID 2     |       |
| <b>WorklistOrders Group</b>       |             |                    |       |
| Accession Number                  | (0008,0050) | ZDS 1.1.2 ?? OBR 2 |       |
| Custom1                           |             |                    |       |
| Custom2                           |             |                    |       |
| Custom3                           |             |                    |       |
| Custom4                           |             |                    |       |
| Custom5                           |             |                    |       |
| FillerOrderNumber                 | (0040,2017) |                    |       |
| InstitutionName                   | (0008,0080) | OBR 20.4           |       |
| Scheduled Procedure Step Sequence | (0040,0100) |                    |       |
| ➤ Modality                        | (0008,0060) | OBR 21.1 ?? "SC"   |       |
| ➤ ScheduledStationAeTitle         | (0040,0001) | \${CALLING_AE}     |       |
| ➤ ScheduledProcedureStepStartDate | (0040,0002) | OBR 7 ?? OBR 36    |       |
| ➤ ScheduledProcedureStepStartTime | (0040,0003) |                    |       |
| ➤ ScheduledPerformingPhysician    | (0040,0006) | MSH 6              |       |
| ➤ ScheduledProcedureDescription   | (0040,0007) | OBR 4              |       |
| ➤ ScheduledStation                | (0040,0010) |                    |       |

| DICOM Attribute                   | DICOM Tag   | HL7 Field              | Notes |
|-----------------------------------|-------------|------------------------|-------|
| ➤ ScheduledLocation               | (0040,0011) | OBR 20.4               |       |
| ➤ OrderControlCode                | (0040,0020) | ORC 5                  |       |
| PlacerOrderNumber                 | (0040,2016) |                        |       |
| ReferencedSopClassUid             | (0020,000D) | 1.2.840.10008.5.1.4.31 |       |
| ReferencedSopInstanceUid          | (0020,000D) | \${UUID}               |       |
| Requested Procedure Code Sequence | (0032,1064) |                        |       |
| ➤ CodeMeaning                     | (0008,0104) | OBR 4.1.2              |       |
| ➤ CodeValue                       | (0008,0100) | OBR 4.1.3              |       |
| ➤ CodingSchemeDesignator          | (0008,0102) |                        |       |
| ➤ CodingSchemeVersion             | (0008,0103) |                        |       |
| RequestedProcedureComments        | (0040,1400) |                        |       |
| RequestedProcedureDescription     | (0032,1060) | OBR 4                  |       |
| RequestedProcedureId              | (0040,1001) | OBR 2                  |       |
| RequestingPhysician               | (0032,1032) |                        |       |
| RequestingService                 | (0032,1033) |                        |       |
| ScheduledProcedureStepId          | (0040,0009) | OBR 4                  |       |
| Scheduled Protocol Code Sequence  | (0040,0008) |                        |       |
| ➤ CodeMeaning                     | (0008,1004) |                        |       |
| ➤ CodeValue                       | (0008,1000) |                        |       |
| ➤ CodingSchemeDesignator          | (0008,1002) |                        |       |
| ➤ CodingSchemeVersion             | (0008,1003) |                        |       |
| Requested Procedure Code Sequence | (0032,1064) |                        |       |
| StudyDate                         | (0008,0020) | OBR 7 ?? OBR 36        |       |
| StudyInstanceUid                  | (0020,000D) | {UUID}                 |       |
| StudyTime                         | (0008,0030) |                        |       |
| <b>Visits Group</b>               |             |                        |       |
| Custom1                           |             |                        |       |
| Custom2                           |             |                        |       |
| Custom3                           |             |                        |       |
| Custom4                           |             |                        |       |
| Custom5                           |             |                        |       |
| ReferringPhysiciansName           | (0008,0090) | OBR 16                 |       |
| VisitStatusId                     | (0038,0008) |                        |       |

### 8.1.4. Coerced/Modified Fields

Waypoint offers an elaborate ability to coerce data extracted from the incoming HL7 or DICOM message into the value that is stored in the database. The HL7 Tag, from the table above, is used to create a string from the concatenation of HL7 field values, string constant, and macro substitutions. In addition, a Pattern Replacement table can be configured to apply a list of regular expressions to the generated string then use the corresponding format to create the stored value. This is best explained by the following example.

#### 8.1.4.1. Coerce Modality from Requested Procedure Description

For this example, the Requested Procedure description is taken from the HL7 message field OBR|4.1.2. Here is a snippet of the OBR segment:

```
OBR|1|placer number|filler number|service code^CT Head w/o contrast|...
```

The HL7 Tag for Requested Procedure Description is OBR|4.1.2, producing “CT Head w/o contrast”. To capture the first word as the Modality, use the following configuration for Modality:

| Mapping Group | Dicom Tag             | HL7 Tag   | Match       | Format |
|---------------|-----------------------|-----------|-------------|--------|
| Modality      | (0040,0100.0008,0060) | OBR 4.1.2 | ^(.*?) .*\$ | {1}    |

- Get value for field OBR|4.1.2 from HL7 message
- Apply regular expression: `^(.*?) .*$` to the value to capture all characters up to the first space
- Use the captured data from the regular expression as the value for Modality

## 8.2. Data Dictionary of Private Attributes

There is no restriction on the DICOM Tag value in the Attribute Mapping configuration, any standard or private tag value can be used.

## 8.3. Coded Terminology and Templates

Waypoint’s usage of Macros is specified in the table below. This table lists the Macros used by Waypoint for attributes it originates. If the DICOM C-Find request or the HL7 message does not contain a value for a DICOM Attribute, the HL7 Tag can be specified using a Macro. This allows Modalities to access and incorporate these codes if so desired.

**Table C.8.3-1 Macro Name Usage**

| Macro Name                     | Note   |
|--------------------------------|--|
| <code>\${CALLING_AE}</code>    | Calling AE title used for the association, VR AE   |
| <code>\${CALLED_AE}</code>     | Called AE title used for the association, VR AE  |
| <code>\${CONNECTION_ID}</code> | Connection ID used for the association   |
| <code>\${IP_ADDRESS}</code>    | IP Address used for the association  |
| <code>\${SOURCE_NAME}</code>   | Source Name used for the association   |
| <code>\${TIMESTAMP}</code>     | Date and time now, encoded as DICOM date and time, VR DT   |
| <code>\${YESTERDAY}</code>     | Yesterday’s date encoded as a DICOM date, VR DA  |
| <code>\${TODAY}</code>         | Today’s date encoded as a DICOM date, VR DA  |
| <code>\${TODAY-n}</code>       | Date corresponding to today’s date <i>minus n days</i> .   |
| <code>\${TODAY+n}</code>       | Date corresponding to today’s date <i>plus n days</i> .  |
| <code>\${TOMORROW}</code>      | Tomorrow’s date encoded as a DICOM date, VR DA   |
| <code>\${UUID}</code>          | Generate a derived UID with the format “2.25.xxxx”. Used for Study Instance UID and Referenced SOP Instance UID, VR UI |

## **8.4. Standard Extended/Specialized/Private SOP Classes**

Waypoint does not claim conformance to any Extended, Specialized or Private SOP Classes.

## **8.5. Private Transfer Syntaxes**

Waypoint does not employ any Private Transfer Syntaxes.