



Dx Server for Windows NT
DICOM 3.0 Conformance Statement

| | NAME | FONCTION | VISA |
|-----------------|------------------------|-----------------|---------------------|
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1 Introduction

1.1 Scope and audience

This document is a DICOM Conformance Statement for DxServer. DxServer is a DICOM server that can store DICOM images from modalities and DICOM clients can access it to retrieve these images. This document has been written using the guidelines provided in the DICOM standard [2 – part 2].

Note: The French ISO member body AFNOR has provided Medasys Digital Systems with an UID root. This UID root is only in numerical form as following: **1.2.250.1.38**

1.2 References

- [1] Dx Server Installation and Configuration Guide
- [2] ACR/NEMA Standards Publications, No PS3, DICOM Standards:
 - Part 1 - Introduction
 - Part 2 - Conformance
 - Part 3 - Information Object Definitions
 - Part 4 - Service Class Specifications
 - Part 5 - Data Structures and Encoding
 - Part 6 - Data Dictionary
 - Part 7 - Message Exchange
 - Part 8 - Network Communication Support
 - Part 9 - Point to Point Communication Support for Message Exchange
 - Part 10 - Media Storage and File Format for Media Interchange
 - Part 11 - Media Storage Application Profiles
 - Part 12 - Storage Functions and Media Formats for Data Interchange
 - Part 13 - Print Management Point-to-Point Communication Support

1.3 Acronyms and abbreviations

The following symbols and abbreviations are used in this conformance statement:

| | |
|---------|---|
| AE: | Application Entity |
| DICOM: | Digital Imaging and Communication in Medicine |
| DIMSE: | DICOM Message Service Element |
| SCP: | Service Class Provider |
| SCU: | Service Class User |
| SOP: | Service-Object Pair |
| TCP/IP: | Transmission Control Protocol / Internet Protocol |
| UID | Unique Identifier |

2 Implementation model

The primary functions provided by DxServer are:

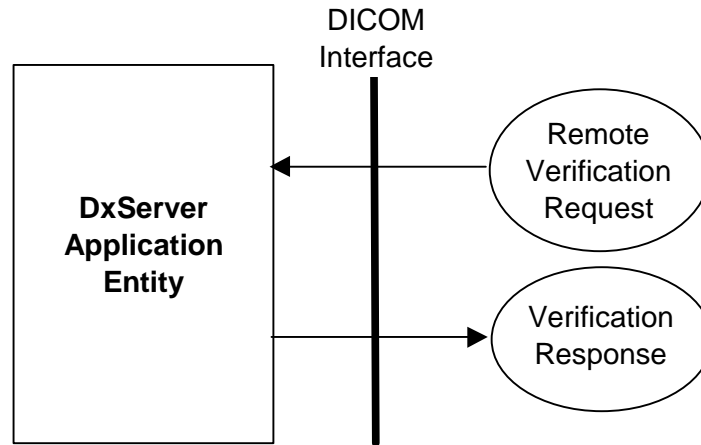
1. Respond to verification requests from a DICOM Verification SCU
2. Accept objects from a DICOM storage service class user. Place the objects in an images folder. Maintain an object database containing attributes of the objects.
3. Respond to requests from DICOM Query/Retrieve service class users for retrieval of objects.
4. Act as a DICOM Storage Service class user in response to prefetching or routing requests for sending objects to a remote DICOM AE.

The primary function provided by DxBroker

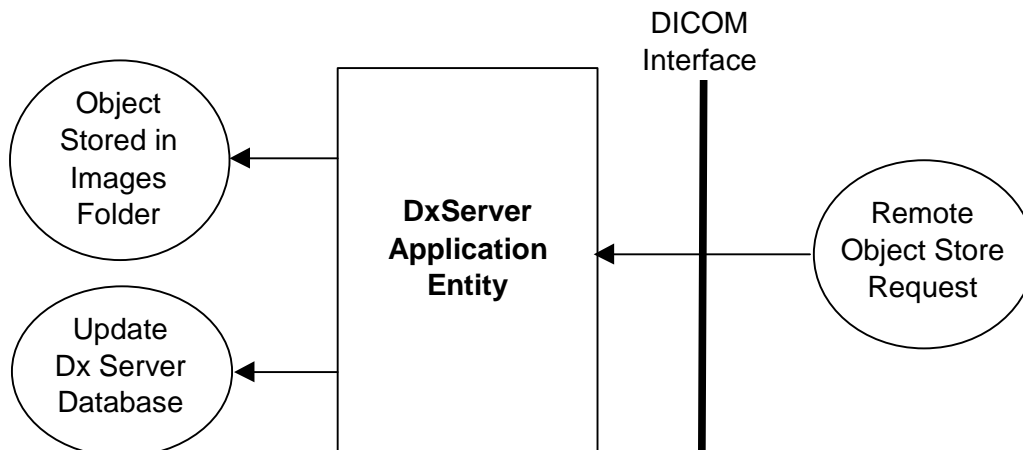
1. Respond to DICOM Basic Modality Worklist queries when connected to DxBroker.

2.1 Application data flow diagram

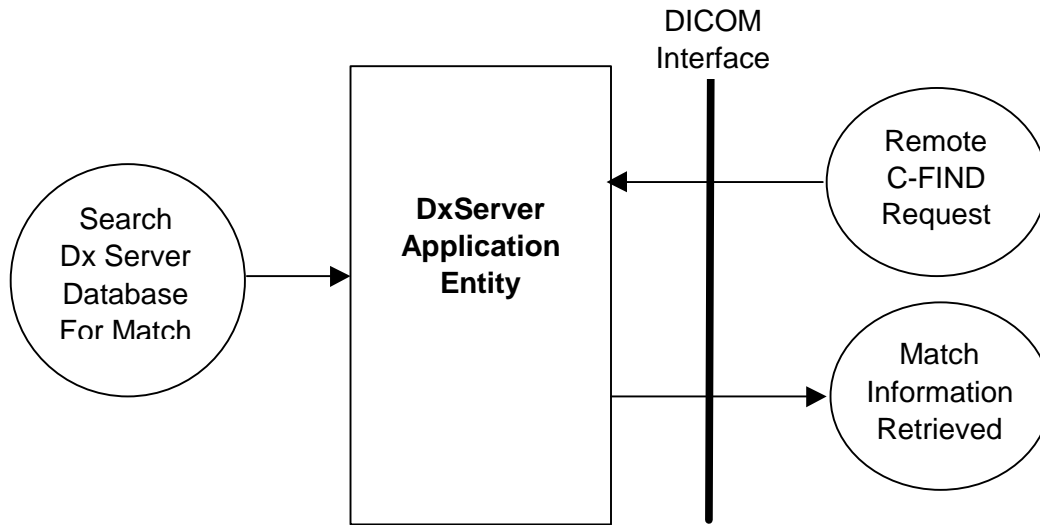
2.1.1 Respond to verification requests



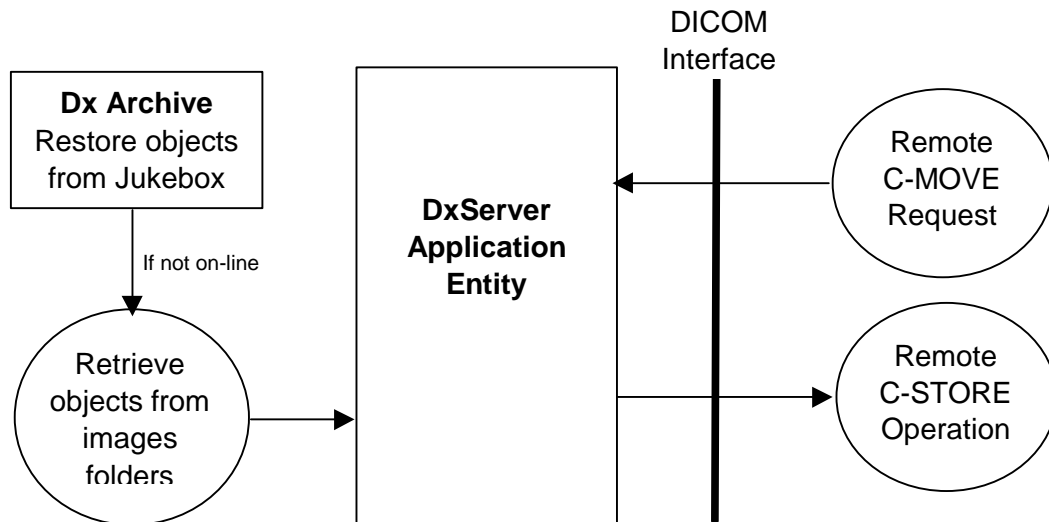
2.1.2 Accept objects received from a DICOM SCU



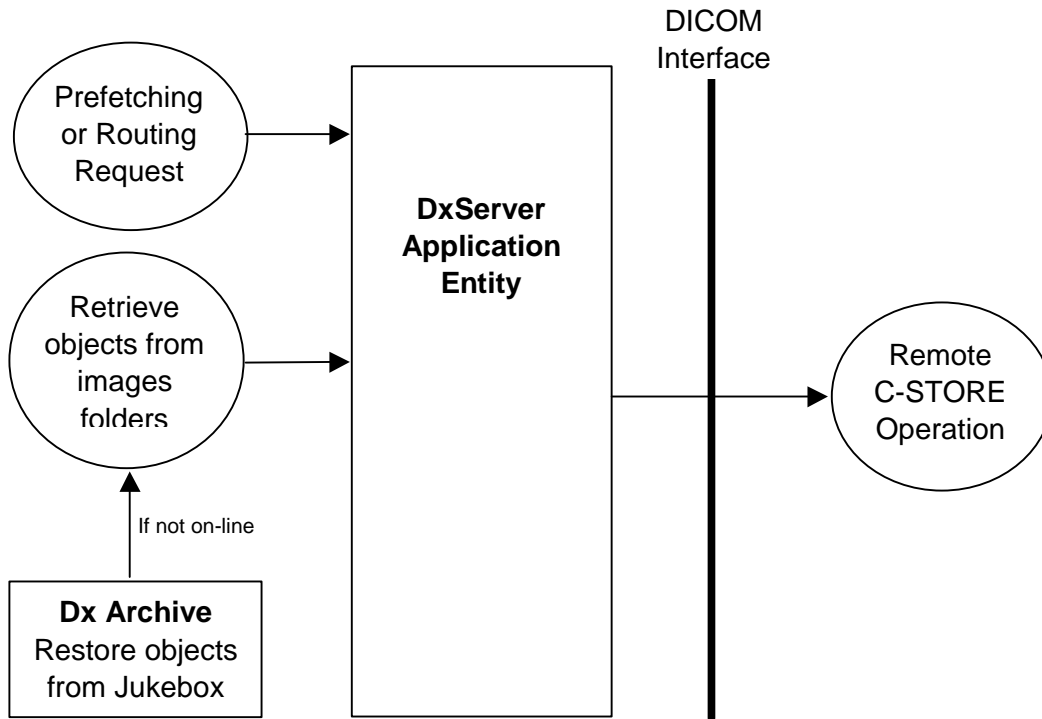
2.1.3 Respond to C-FIND queries



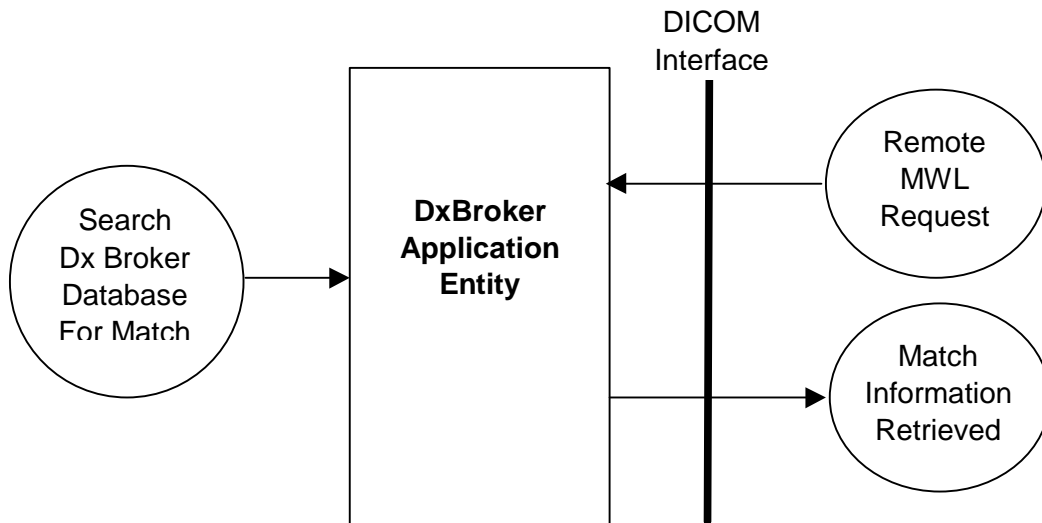
2.1.4 Respond to C-MOVE queries



2.1.5 Respond to Prefetching or Routing requests



2.1.6 Respond to DICOM Basic Modality Worklist queries



2.2 Functional definition of Application Entities

DxServer application entity acts as a Service Class Provider (SCP) for the following service classes:

- Verification Service Class
- Storage Service Class
- Query/Retrieve Service Class

DxServer application entity acts as a Service Class User (SCU) for the following service classes:

- Verification Service Class
- Storage Service Class

DxBroker application entity acts as a Service Class Provider (SCP) for the following service classes:

- Verification Service Class
- Basic Modality Worklist Service Class

2.3 Sequencing of Real World Activities

Not applicable.

3 Application Entity specifications

3.1 DxServer AE Specifications

Verification SOP Class

The **DxServer** AE provides standard conformance to the following DICOM V3.0 Service Object Pair (SOP) Class as a Verification Service Class User (SCU) and Provider (SCP). As an SCU it sends an Echo request when routing image to a remote AE. As an SCP it sends an Echo response when it receives an Echo request from a remote AE.

Table 1: Valid SCU/SCP Verification SOP Class for DxServer AE

| SOP Class UID | SOP Class Name |
|-------------------|------------------------|
| 1.2.840.10008.1.1 | Verification SOP Class |

Storage SOP Classes

The **DxServer** AE provides standard conformance to the following DICOM V3.0 SOP Classes as an SCP when servicing requests to store objects. It also supports these SOP Classes as an SCU when servicing move requests and routing requests.

Table 2: Valid SCU/SCP Storage SOP Classes for DxServer AE

| SOP Class UID | SOP Class Name |
|-------------------------------|--|
| 1.2.840.10008.5.1.4.1.1.1 | Computed Radiography Image Storage |
| 1.2.840.10008.5.1.4.1.1.2 | CT Image Storage |
| 1.2.840.10008.5.1.4.1.1.3 | Ultrasound Multi-frame Image Storage (retired) |
| 1.2.840.10008.5.1.4.1.1.3.1 | Ultrasound Multi-frame Image Storage |
| 1.2.840.10008.5.1.4.1.1.4 | MR Image Storage |
| 1.2.840.10008.5.1.4.1.1.5 | Nuclear Medicine Image Storage (retired) |
| 1.2.840.10008.5.1.4.1.1.6 | Ultrasound Image Storage (retired) |
| 1.2.840.10008.5.1.4.1.1.6.1 | Ultrasound Image Storage |
| 1.2.840.10008.5.1.4.1.1.7 | Secondary Capture Image Storage |
| 1.2.840.10008.5.1.4.1.1.12.1 | X-Ray Angiographic Image Storage |
| 1.2.840.10008.5.1.4.1.1.12.2 | X-Ray Radiflouroscopic Image Storage |
| 1.2.840.10008.5.1.4.1.1.12.3 | X-Ray Angiographic Bi-plane Image Storage |
| 1.2.840.10008.5.1.4.1.1.20 | Nuclear Medicine Image Storage |
| 1.2.840.10008.5.1.4.1.1.128 | Positron Emission Tomography (PET) Image Storage |
| 1.2.840.10008.5.1.4.1.1.481.1 | Radiotherapy (RT) Image Storage |
| 1.2.840.10008.5.1.4.1.1.481.2 | Radiotherapy (RT) Dose Storage |
| 1.2.840.10008.5.1.4.1.1.481.3 | Radiotherapy (RT) Structure Set Storage |
| 1.2.840.10008.5.1.4.1.1.481.4 | Radiotherapy (RT) Beams Treatment Record Storage |
| 1.2.840.10008.5.1.4.1.1.481.5 | Radiotherapy (RT) Plan Storage |
| 1.2.840.10008.5.1.4.1.1.481.6 | Radiotherapy (RT) Brachy Treatment Record Storage |
| 1.2.840.10008.5.1.4.1.1.481.7 | Radiotherapy (RT) Summary Treatment Record Storage |
| 1.2.840.10008.5.1.4.1.1.1.1 | Digital X-Ray Image Storage – For Presentation |
| 1.2.840.10008.5.1.4.1.1.1.1.1 | Digital X-Ray Image Storage – For Processing |

Query/Retrieve SOP Classes

The **DxServer** AE provides standard conformance to the following DICOM V3.0 SOP Classes as a Query/Retrieve SCP, when servicing queries about objects that have been stored. Extended negotiation for relational queries is not supported.

Table 3: Valid SCP Query/Retrieve SOP Class for DxServer AE

| SOP Class UID | SOP Class Name |
|-----------------------------|--|
| 1.2.840.10008.5.1.4.1.2.1.1 | Patient Root Query/Retrieve Information Model – Find |
| 1.2.840.10008.5.1.4.1.2.1.2 | Patient Root Query/Retrieve Information Model – Move |
| 1.2.840.10008.5.1.4.1.2.1.3 | Patient Root Query/Retrieve Information Model – Get |
| 1.2.840.10008.5.1.4.1.2.2.1 | Study Root Query/Retrieve Information Model – Find |
| 1.2.840.10008.5.1.4.1.2.2.2 | Study Root Query/Retrieve Information Model – Move |
| 1.2.840.10008.5.1.4.1.2.2.3 | Study Root Query/Retrieve Information Model – Get |

3.1.1 Association establishment policies for DxServer AE

3.1.1.1 General

All associations with the DxServer AE shall be established using the DICOM 3.0 Application Context. A single DICOM Application Context Name is defined for this version of the DICOM standard. This name is “**1.2.840.10008.3.1.1.1**”.

The DxServer AE accepts association for the following purposes:

- Supports the **C-ECHO** service to allow end-to-end verifications.
- Supports the **C-STORE** service to store objects into the database.
- Supports the **C-FIND** service to search the database.
- Supports the **C-MOVE** service to retrieve objects from the database.
- Supports the **C-GET** service to retrieve objects from the database.

The DxServer AE initiates associations for the following purposes:

- Invokes the **C-STORE** service to send objects, as sub-operations of a remote C-MOVE service request, or when DxBroker sends a routing or prefetching request.
- Invokes the **C-ECHO** service before invoking a C-STORE (can be disabled by configuration).

The maximum length PDU negotiation shall be included in all association establishments.

The SCU/SCP role negotiation is not supported.

Refer to the following paragraph for extensions, specializations, and privatizations management.

3.1.1.2 Number of associations

The number of simultaneous DICOM associations that is accepted is theoretically unlimited, but is actually limited by the Windows NT operating system. A new process or a new thread is created for each new association.

3.1.1.3 Asynchronous nature

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

3.1.1.4 Implementation identifying information

By default, the DxServer Application Entity is identified by:

- Implementation Class UID: **1.2.250.1.38.1.3.1.1.1**
- Implementation Version Name: **DXS2_0**

3.1.2 Association initiation for DxServer AE

The DxServer AE initiates an association for the appropriate Storage SOP Class(es) that corresponds to the set of objects that have been requested for transfer. The association is closed when all objects have been sent to the remote DICOM AE.

Following the configuration, the DxServer AE will initiate an association for the Verification Services before responding to a routing or prefetching request.

3.1.2.1 Verify Communication with a Remote System

The DxServer AE initiates an association for the echo service. The association is closed either when a correct response is received or when a time-out occurs.

3.1.2.1.1 Associated real-world activity

The DxServer AE does not perform the routing or prefetching request if the DICOM Echo failed.

3.1.2.1.2 Proposed Presentation Contexts

DxServer supports the Verification SOP Class fully as specified in the DICOM Standard.

The presentation context proposed by the DxServer AE for the Echo Check operation is specified in the following table:

Table 4: Echo Check Presentation Contexts of DxServer

| Presentation Context Table | | | | | |
|----------------------------|-------------------|---------------------------|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |

3.1.2.1.3 SOP specific conformance

None.

3.1.2.2 Send Objects to a Remote System

The DxServer AE initiates associations for the transfer of objects to a DICOM Image Storage Server. The types of objects that can be transferred correspond to the SOP Classes listed in table 2.

3.1.2.2.1 Associated real-world activity

The DxServer AE will initiate associations for the following reasons:

1. A C-MOVE request is received from a remote DICOM AE and an association is initiated to perform the C-STORE sub-operation.

2. DxBroker requests (routing or prefetching) that a set of objects be sent to a remote DICOM AE and an association is initiated to perform the C-STORE operation.

3.1.2.2.2 Proposed Presentation Contexts

The presentation contexts that may be proposed by the DxServer AE for the Object operation are specified in table 5.

All these SOP classes conform to the standard Storage Services as specified in the DICOM Standard.

Table 5: Send Object Presentation Contexts of DxServer

| Presentation Context Table | | | | | |
|-------------------------------------|-----------------------------------|--|--|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| See Note | See Note | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCU | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| | | Explicit VR Little Endian, JPEG baseline encoded | 1.2.840.10008.1.2.4.50 | | |
| | | Explicit VR Little Endian, JPEG baseline encoded | 1.2.840.10008.1.2.4.51 | | |
| | | Explicit VR Little Endian, JPEG lossless encoded | 1.2.840.10008.1.2.4.70 | | |
| | | Explicit VR Little Endian, RLE lossless | 1.2.840.10008.1.2.5 | | |
| RT Dose Storage | 1.2.840.10008.5.1.4 .1.1.481.2 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| RT Structure Set Storage | 1.2.840.10008.5.1.4 .1.1.481.3 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| RT Beams Treatment Record Storage | 1.2.840.10008.5.1.4 .1.1.481.4 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| RT Plan Storage | 1.2.840.10008.5.1.4 .1.1.481.5 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| RT Brachy Treatment Record Storage | 1.2.840.10008.5.1.4 .1.1.481.6 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |
| RT Summary Treatment Record Storage | 1.2.840.10008.5.1.4 .1.1.481.7 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCU | None |

Note: Include all abstract syntaxes from table 2, except those explicitly listed.

3.1.2.2.3 SOP specific conformance

DxServer preserves all private attributes that are encoded according to the DICOM Standard. Private attributes are always stored and are treated as Type 3 attributes. If a DICOM client of DxServer stores sends objects with private attributes using an Implicit VR, these attributes will be returned with an UN (unknown) VR in subsequent exports of this object when explicit VR is negotiated.

3.1.3 Association acceptance policy for DxServer AE

The DxServer Application Entity accepts associations for the Verification Service, Storage Services, and Query/Retrieve Services.

DxServer rejects association requests from application of which the AE Title is not registered within DxServer. The same applies to the case where the remote system uses a wrong AE Title to connect with DxServer.

An association is closed when there is no activity (i.e., no message received) for a configurable amount of time.

3.1.3.1 Verify Communication with a Remote System

The DxServer Application Entity waits for an association request and accepts associations to do, among other things, the Verification Service. The association is aborted if an error occurs and is closed when the initiator requests that it be closed.

3.1.3.1.1 Associated real-world activity

DxServer performs an echo response after it receives a DICOM Echo request.

3.1.3.1.2 Accepted Presentation Contexts

Only the presentation context listed in the following table will be accepted by DxServer for the Verification SOP Class.

Table 6: Echo Response Presentation Contexts of DxServer

| Presentation Context Table | | | | | |
|----------------------------|-------------------|---------------------------|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

3.1.3.1.3 SOP Specific Conformance

DxServer AE provides standard conformance to the DICOM Verification Service Class.

3.1.3.1.4 Presentation Context Acceptance Criterion

The shown presentation context above is always accepted.

3.1.3.2 Receive Objects from a Remote System

The DxServer Application Entity waits for an association request and accepts associations to do, among other things, the Image Storage Service. The association is aborted if an error occurs and is closed when the initiator requests that it be closed.

3.1.3.2.1 Associated real-world activity

Once the association has been established, the DxServer AE waits for transmission of conformant Storage Service messages. Objects received are decoded, most important attributes are stored in the database, and the file is store in a local folder.

3.1.3.2.2 Accepted Presentation Contexts

The presentation contexts that will be accepted by the DxServer AE for the Receive Object operation are listed in following table:

Table 7: Receive Object Presentation Contexts of DxServer

| Presentation Context Table | | | | | |
|-------------------------------------|-----------------------------------|--|--|-------------|-----------------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| See Note | See Note | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| | | Explicit VR Little Endian, JPEG baseline encoded | 1.2.840.10008.1.2.4.50 | | |
| | | Explicit VR Little Endian, JPEG baseline encoded | 1.2.840.10008.1.2.4.51 | | |
| | | Explicit VR Little Endian, JPEG lossless encoded | 1.2.840.10008.1.2.4.70 | | |
| | | Explicit VR Little Endian, RLE lossless | 1.2.840.10008.1.2.5 | | |
| RT Dose Storage | 1.2.840.10008.5.1.4 .1.1.481.2 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |
| RT Structure Set Storage | 1.2.840.10008.5.1.4 .1.1.481.3 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |
| RT Beams Treatment Record Storage | 1.2.840.10008.5.1.4 .1.1.481.4 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |
| RT Plan Storage | 1.2.840.10008.5.1.4 .1.1.481.5 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |
| RT Brachy Treatment Record Storage | 1.2.840.10008.5.1.4 .1.1.481.6 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |
| RT Summary Treatment Record Storage | 1.2.840.10008.5.1.4 .1.1.481.7 | Implicit VR Little Endian Explicit VR Little Endian | 1.2.840.10008.1.2 1.2.840.10008.1.2.1 | SCP | None |

Note: Include all abstract syntaxes from table 2, except those explicitly listed.

3.1.3.2.3 SOP Specific Conformance

The DxServer AE conforms to the SOP's of the Storage SOP Class at Level 2 (Full). No elements are discarded or coerced by DxServer AE. In addition private attributes will be stored and included when the object is sent out again.

The DxServer AE responds to a C-STORE request with one of these response codes:

Table 8: C-STORE Response Codes

| Service Status | Status Description | Status Code (0000,0900) | Related Fields |
|-----------------------|--|--------------------------------|--|
| Refused | Out of Resources – There were insufficient resources to process the request. The request was not processed. | A765 | (0000,0902) contains a short description of the condition. |
| Success | | 0000 | None |

3.1.3.2.4 Presentation context acceptance criterion

The shown presentation context above is always accepted.

3.1.3.2.5 Transfer syntax selection policies

The DxServer AE selects the first proposed transfer syntax as soon as it is compatible with table 7.

3.1.3.3 Query the Dx Server Database and Retrieve Objects

The DxServer Application Entity waits for an association request and accepts associations to do, among other things, the DICOM Query/Retrieve Service. The association is closed after an error or when the initiator requests that it be closed.

3.1.3.3.1 Associated real-world activity

Once the association has been established, DxServer waits for transmission of conformant Query Service messages. If a valid Find is received, then the DxServer database is searched and the requested information is returned to the Query SCU. If a valid Move request is received, then the DxServer database is searched for the requested objects and they are sent to the remote network node specified by the SCU. If a valid Get request is received, then the DxServer database is searched for the requested objects and they are sent to the SCU.

3.1.3.3.2 Accepted Presentation Contexts

The presentation contexts that will be accepted by the DxServer AE for the Find operation are listed in following table:

Table 9: Query/Retrieve Response Presentation Contexts of DxServer

| Presentation Context Table | | | | | |
|--|-----------------------------|----------------------------|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Patient Root Query/Retrieve Model - FIND | 1.2.840.10008.5.1.4.1.2.1.1 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Patient Root Query/Retrieve Model – MOVE | 1.2.840.10008.5.1.4.1.2.1.2 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Patient Root Query/Retrieve Model – GET | 1.2.840.10008.5.1.4.1.2.1.3 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Study Root Query/Retrieve Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Study Root Query/Retrieve Model - MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Study Root Query/Retrieve Model – GET | 1.2.840.10008.5.1.4.1.2.2.3 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |

3.1.3.3.3 SOP Specific Conformance

DxServer supports only hierarchical queries.

DxServer supports the C-CANCEL request during a query operation.

The following table identifies the match support used by the DxServer AE. The values in this table indicate how the DxServer AE processes the received query attribute data.

Table 10: Matching Key Types

| | |
|-----|--------------------|
| RV | Range Value match |
| SV | Single Value match |
| WC | Wild Card match |
| RET | Return value only |

DxServer AE supports the following elements for Query/Retrieve service. DICOM attributes not listed in these table are handled in that a zero-length attribute will be returned in response to a query for the specified attribute.

Table 11: Supported keys for Patient Root Query/Retrieve

| Level (0008,0052) | Description | Tag | Support |
|---------------------------|------------------------------------|-------------|---------|
| PATIENT | Patient's Name | (0010,0010) | WC |
| | Patient ID | (0010,0020) | WC |
| | Patient's Birth Date | (0010,0030) | RET |
| | Patient's Sex | (0010,0040) | RET |
| STUDY | Study Date | (0008,0020) | RV |
| | Study Time | (0008,0030) | RET |
| | Accession Number | (0008,0050) | WC |
| | Study ID | (0020,0010) | WC |
| | Study Instance UID | (0020,000D) | SV |
| | Modalities in Study ⁽¹⁾ | (0008,0061) | SV |
| | Referring | (0008,0090) | RET |
| | Study Description | (0008,1030) | RET |
| | Number of Study Related Series | (0020,1206) | RET |
| | Number of Study Related Instances | (0020,1208) | RET |
| SERIES | Modality | (0008,0060) | SV |
| | Series Description | (0008,103E) | RET |
| | Body Part Examined | (0018,0015) | RET |
| | Series Number | (0020,0011) | SV |
| | Series Instance UID | (0020,000E) | SV |
| | Number of Series Related Instances | (0020,1209) | RET |
| COMPOSITE OBJECT INSTANCE | Instance Number | (0020,0060) | SV |
| | SOP Instance UID | (0008,0018) | SV |
| | SOP Class UID | (0008,0016) | RET |
| IMAGE SPECIFIC | Rows | (0028,0010) | RET |
| | Columns | (0028,0011) | RET |
| | Bits Allocated | (0028,0100) | RET |
| | Number of Frames | (0028,0008) | RET |

Table 12: Supported keys for Study Root Query/Retrieve

| Level (0008,0052) | Description | Tag | Support |
|---------------------------|------------------------------------|-------------|---------|
| STUDY | Patient's Name | (0010,0010) | WC |
| | Patient ID | (0010,0020) | WC |
| | Patient's Birth Date | (0010,0030) | RET |
| | Patient's Sex | (0010,0040) | RET |
| | Study Date | (0008,0020) | RV |
| | Study Time | (0008,0030) | RET |
| | Accession Number | (0008,0050) | WC |
| | Study ID | (0020,0010) | WC |
| | Study Instance UID | (0020,000D) | SV |
| | Modalities in Study ⁽¹⁾ | (0008,0061) | SV |
| | Referring | (0008,0090) | RET |
| | Study Description | (0008,1030) | RET |
| | Number of Study Related Series | (0020,1206) | RET |
| | Number of Study Related Instances | (0020,1208) | RET |
| SERIES | Modality | (0008,0060) | SV |
| | Series Description | (0008,103E) | RET |
| | Body Part Examined | (0018,0015) | RET |
| | Series Number | (0020,0011) | SV |
| | Series Instance UID | (0020,000E) | SV |
| | Number of Series Related Instances | (0020,1209) | RET |
| COMPOSITE OBJECT INSTANCE | Instance Number | (0020,0060) | SV |
| | SOP Instance UID | (0008,0018) | SV |
| | SOP Class UID | (0008,0016) | RET |
| IMAGE SPECIFIC | Rows | (0028,0010) | RET |
| | Columns | (0028,0011) | RET |
| | Bits Allocated | (0028,0100) | RET |
| | Number of Frames | (0028,0008) | RET |

(1) Modalities in Study: This tag is only used as a search criterion. The tag in the response contains the same values given in the request.

C-FIND Response Codes

The DxServer AE responds to a C-FIND request with one of these response codes:

Table 13: C-FIND Response Codes

| Service Status | Status Description | Status Code (0000,0900) | Related Fields |
|----------------|--|-------------------------|--|
| Refused | Out of Resources – There were insufficient resources to process the request. The request was not processed. | A700 | (0000,0902) contains a short description of the condition. |
| Failed | Unable to Process – A condition arose which prevented the processing of the request. | C000 | (0000,0902) contains a short description of the condition. |
| Cancel | Matching terminated – No more response messages will be sent as a result of a Cancel request from the SCU. | FE00 | None |

| | | | |
|---------|---|------|------------|
| Success | Matching is complete – No final identifier is supplied | 0000 | None |
| Pending | Matches are continuing – Current match is supplied | FF00 | Identifier |
| | Matches are continuing – Warning that one or more Optional Keys were not supported | FF01 | Identifier |

Table 14: C-MOVE Response Codes

| Service Status | Status Description | Status Code (0000,0900) | Related Fields* |
|-----------------------|---|--------------------------------|--|
| Refused | Out of Resources – Unable to calculate number of matches | A701 | (0000,0902) |
| | Out of Resources – Unable to perform sub-operations | A702 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |
| | Move Destination unknown | A801 | (0000,0902) |
| Failed | Identifier does not match SOP Class – A required attribute is not present in the message. The request was not processed. | A900 | (0000,0902) |
| | Unable to Process – A condition arose which prevented the processing of the request. | C002 | (0000,0902) |
| Cancel | Sub-operations terminated due to Cancel indication | FE00 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |
| Warning | Sub-operations complete – One or more Failures were encountered | B000 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |
| Success | Sub-operations complete – No Failure | 0000 | None |
| Pending | Sub-operations are continuing | FF00 | (0000,1020) (0000,1021) (0000,1022) (0000,1023) |

*Related fields:

(0000,0902): Contains a text description of the error detected.

(0000,1020): The number of remaining C-STORE sub-operation to be invoked for the operation.

(0000,1021): The number of C-STORE sub-operation associated with this operation which have been completed successfully.

(0000,1022): The number of C-STORE sub-operation associated with this operation which have failed.

(0000,1023): The number of C-STORE sub-operation associated with this operation which generated warning responses.

3.1.3.3.4 Presentation Context Acceptance Criterion

The shown presentation contexts above are always accepted.

3.2 DxBroker AE Specifications

Verification SOP Class

The **DxBroker** AE provides standard conformance to the following DICOM V3.0 Service Object Pair (SOP) Class as a Verification Service Class Provider (SCP). As an SCP it sends an Echo response when it receives an Echo request from a remote AE.

Table 15: Valid SCP Verification SOP Class for DxBroker AE

| SOP Class UID | SOP Class Name |
|-------------------|------------------------|
| 1.2.840.10008.1.1 | Verification SOP Class |

Basic Modality Worklist SOP Class

The **DxBroker** AE provides standard conformance to the following DICOM V3.0 Service Object Pair (SOP) Class as a Basic Modality Worklist Class Provider (SCP), when servicing queries about scheduled procedure steps.

Table 16: Valid SCP Basic Modality Worklist SOP Class for DxBroker AE

| SOP Class UID | SOP Class Name |
|------------------------|-----------------------------------|
| 1.2.840.10008.5.1.4.31 | Basic Modality Worklist SOP Class |

3.2.1 Association establishment policies for DxBroker AE

3.2.1.1 General

All associations with the DxBroker AE shall be established using the DICOM 3.0 Application Context. A single DICOM Application Context Name is defined for this version of the DICOM standard. This name is “**1.2.840.10008.3.1.1.1**”.

The DxBroker AE accepts association for the following purposes:

- Supports the **C-ECHO** service to allow end-to-end verifications.
- Supports the **Basic Modality Worklist** service to query the scheduled procedure steps.
-

The DxServer AE does not initiate association.

The maximum length PDU negotiation shall be included in all association establishments.

The SCU/SCP role negotiation is not supported.

Refer to the following paragraph for extensions, specializations, and privatizations management.

3.2.1.2 Number of associations

The number of simultaneous DICOM associations that is accepted is theoretically unlimited, but is actually limited by the Windows NT operating system. A new process is created for each new association.

3.2.1.3 Asynchronous nature

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

3.2.1.4 Implementation identifying information

By default, the DxBroker Application Entity is identified by:

- Implementation Class UID: **1.2.250.1.38.1.3.1.1.1**
- Implementation Version Name: **DXWORK1_1**

3.2.2 Association initiation for DxBroker AE

Not applicable.

3.2.3 Association acceptance policy for DxBroker AE

The DxBroker Application Entity accepts associations for the Verification Service and Basic Modality Worklist Services.

DxBroker rejects association requests from application of which the AE Title is not registered within DxBroker. The same applies to the case where the remote system uses a wrong AE Title to connect with DxBroker.

An association is closed when there is no activity (i.e., no message received) for a configurable amount of time.

3.2.3.1 Verify Communication with a Remote System

The DxBroker Application Entity waits for an association request and accepts associations to do, among other things, the Verification Service. The association is aborted if an error occurs and is closed when the initiator requests that it be closed.

3.2.3.1.1 Associated real-world activity

DxBroker performs an echo response after it receives a DICOM Echo request.

3.2.3.1.2 Accepted Presentation Contexts

Only the presentation context listed in the following table will be accepted by DxBroker for the Verification SOP Class.

Table 17: Echo Response Presentation Contexts of DxBroker

| Presentation Context Table | | | | | |
|----------------------------|-------------------|---------------------------|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Verification SOP Class | 1.2.840.10008.1.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | None |

3.2.3.1.3 SOP Specific Conformance to Verification SOP Class

DxBroker AE provides standard conformance to the DICOM Verification Service Class.

3.2.3.1.4 Presentation Context Acceptance Criterion

The shown presentation context above is always accepted.

3.2.3.2 Query the Dx Broker Work list

The DxBroker Application Entity waits for an association request and accepts associations to do, among other things, the Basic DICOM Worklist Service. The association is closed after an error or when initiator requests that it be closed.

3.2.3.2.1 Associated real-world activity

Once the association has been established, DxBroker waits for transmission of conformant Query Service messages. If a valid Find is received, then the DxBroker work list is searched and the requested information is returned to the Query SCU.

Table 18: Modality Worklist Response Presentation Contexts of DxBroker

| Presentation Context Table | | | | | |
|----------------------------|---------------|-------------------------------|-------------------|------|----------------------|
| Abstract Syntax | | Transfer Syntax | | Role | Extended Negotiation |
| Name | UID | Name | UID | | |
| Modality | 1.2.840.10008 | Implicit VR, Little Endian | 1.2.840.10008.1.2 | SCP | None |
| Worklist C-FIND | .5.1.4.31 | | | | |

3.2.3.2.2 SOP Specific Conformance

DxBroker supports the C-CANCEL request during a query operation.

The following table identifies the match support used by the DxBroker AE. The values in this table indicate how the DxBroker AE processes the received query attribute data.

Table 19: Matching Key Types

| | |
|-----|--------------------|
| RV | Range Value match |
| SV | Single Value match |
| WC | Wild Card match |
| RET | Return value only |

DxBroker AE supports the following elements for the MWL SOP class. DICOM attributes not listed in this table are handled in that a zero-length attribute will be returned in response to a query for the specified attribute.

Table 20: Supported keys for MWL Query

| MWL Attributes | | | |
|--|-------------|-------------------|-----------------|
| Description / Module | Tag | Matching Key Type | Return Key Type |
| Scheduled Procedure Step | | | |
| Scheduled Procedure Step Sequence | (0040,0100) | | 1 |
| >Scheduled Station AE Title | (0040,0001) | SV | 1 |
| >Scheduled Procedure Step Start Date | (0040,0002) | SV, RV | 1 |
| >Scheduled Procedure Step Start Time | (0040,0003) | SV,RV | 1 |
| >Scheduled Procedure Step Location | (0040,0011) | RET | 2 |
| >Modality | (0008,0060) | SV | 1 |
| >Scheduled Performing Physician's Name | (0040,0006) | RET | 2 |
| >Scheduled Procedure Step Description | (0040,0007) | RET | 1C |
| >Scheduled Station Name | (0040,0010) | RET | 2 |

| | | | |
|--|-------------|--------|----|
| >Scheduled Procedure Step ID | (0040,0009) | RET | 1 |
| >Scheduled Protocol Code Sequence | (0040,0008) | RET | 1C |
| >>Code Value | (0008,0100) | RET | 1C |
| >>Coding Scheme Designator | (0008,0102) | RET | 1C |
| >>Code Meaning | (0008,0104) | RET | 3 |
| Requested Procedure | | | |
| Requested Procedure ID | (0040,1001) | SV | 1 |
| Requested Procedure Description | (0032,1060) | RET | 1C |
| Requested Procedure Code Sequence | (0032,1064) | RET | 1C |
| >>Code Value | (0008,0100) | RET | 1C |
| >>Coding Scheme Designator | (0008,0102) | RET | 1C |
| >>Code Meaning | (0008,0104) | RET | 3 |
| Study Instance UID | (0020,000D) | RET | 1 |
| Referenced Study Sequence | (0008,1110) | RET | 2 |
| >Referenced SOP Class UID | (0008,1150) | RET | 1C |
| >Referenced SOP Instance UID | (0008,1155) | RET | 1C |
| Patient Transport Arrangements | (0040,1004) | RET | 2 |
| Imaging Service Request | | | |
| Accession Number | (0008,0050) | SV | 2 |
| Requesting Physician | (0032,1032) | RET | 2 |
| Requesting Service | (0032,1033) | RET | 3 |
| Requesting Physician's Name | (0008,0090) | RET | 2 |
| Visit Identification | | | |
| Admission ID | (0038,0010) | RET | 2 |
| Visit Status | | | |
| Current Patient Location | (0038,0300) | RET | 2 |
| Patient Identification | | | |
| Patient's Name | (0010,0010) | SV, WC | 1 |
| Patient ID | (0010,0020) | SV | 1 |
| Patient Demographic | | | |
| Patient's Birth Date | (0010,0030) | RET | 2 |
| Patient's Sex | (0010,0040) | RET | 2 |
| Confidentiality constraint on patient data | (0040,3001) | RET | 2 |
| Patient Medical | | | |
| Patient State | (0038,0500) | RET | 2 |
| Pregnancy Status | (0010,21C0) | RET | 2 |
| Contrast Allergies | (0010,2110) | RET | 2 |
| Patient's Weight | (0010,1030) | RET | 2 |
| Special Needs | (0038,0050) | RET | 2 |

Table 21: MWL C-FIND Response Codes

| Service Status | Status Description | Status Code (0000,0900) | Related Fields |
|----------------|--|-------------------------|--|
| Refused | Out of Resources – There were insufficient resources to process the request. The request was not processed. | A700 | (0000,0902) contains a short description of the condition. |
| Failed | Unable to Process – A condition arose which | C000 | (0000,0902) contains a short |

| | prevented the processing of the request. | | description of the condition |
|---------|---|------|------------------------------|
| Cancel | Matching terminated – No more response messages will be sent as a result of a Cancel request from the SCU. | FE00 | None |
| Success | Matching is complete – No final identifier is supplied | 0000 | None |
| Pending | Matches are continuing – Current match is supplied | FF00 | Identifier |
| | Matches are continuing – Warning that one or more Optional Keys were not supported | FF01 | Identifier |

MWL Search Constraints

The MWL search is a function of the criterion (data attributes) specified in the incoming C-FIND. The MWL SCP does not apply any default constraints on an incoming query, with the exception of the following:

1. If the incoming query is a time range with no date constraint, the current date will be used as the date constraint and the time range query will be executed under the current (today's) date.
2. For time ranges, a missing lower bound is substituted by 000000 and the missing upper bound is substituted by 235959.
3. If the incoming query is a time and date range, the time range is ignored if the date range is over more than one day.

4 Communication Profiles

4.1 Supported Communications Stacks

DxServer provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8.

4.2 TCP/IP Stack

DxServer inherits the TCP/IP stack from the MS Windows system upon which it executes.

4.3 Physical Media Support

DxServer is indifferent to the physical medium over which TCP/IP executes; they inherit this from the MS Windows system upon which they execute.

5 Extensions / Specializations / Privatizations

No extended, specialized or private SOP classes are supported.

No private transfer syntaxes are supported.

6 Configuration

See [1] for full details.