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DICOM Conformance Statement

Revision: 2

TABLE OF CONTENTS

| | | |
|-------------|---|----------|
| 1 | Introduction | 4 |
| 1.1 | Revision History..... | 4 |
| 1.2 | Abbreviations and Acronyms..... | 4 |
| 1.3 | dicomPACS® | 5 |
| 1.4 | How to use this document | 5 |
| 1.5 | Warning to the reader..... | 6 |
| 2 | Implementation Model..... | 7 |
| 2.1 | Application Data Flow Diagram | 7 |
| 2.2 | Functional Definitions of AEs..... | 8 |
| 2.3 | Sequencing of Real-World Activities..... | 8 |
| 3 | AE Specifications..... | 9 |
| 3.1 | DicomCC..... | 9 |
| 3.1.1 | Association Establishment Policies | 10 |
| 3.1.1.1 | General..... | 10 |
| 3.1.1.2 | Number of Associations..... | 10 |
| 3.1.1.3 | Asynchronous Nature | 10 |
| 3.1.1.4 | Implementation Identifying Information..... | 10 |
| 3.1.2 | Association Initiation by Real-World Activity | 10 |
| 3.1.2.1 | Send Image..... | 10 |
| 3.1.2.1.1 | Associated Real-World Activity..... | 10 |
| 3.1.2.1.2 | Presentation Context table | 11 |
| 3.1.3 | Association Acceptance Policy | 11 |
| 3.1.3.1 | Receive Echo | 11 |
| 3.1.3.1.1 | Associated Read Worl Activity..... | 11 |
| 3.1.3.1.2 | Presentation Context Table..... | 11 |
| 3.1.3.1.3 | Presentation Context Acceptance Criterion..... | 11 |
| 3.1.3.2 | Receive Image or other data objects..... | 12 |
| 3.1.3.2.1 | Associated Real World Activity..... | 12 |
| 3.1.3.2.2 | Presentation Context Table..... | 12 |
| 3.1.3.2.2.1 | SOP Specific Conformance of Storage SOP Classes..... | 12 |
| 3.1.3.2.3 | Presentation Context Acceptance Criterion..... | 13 |
| 3.1.3.2.4 | Transfer Syntax Selection Policies | 13 |
| 3.1.3.3 | Query for DICOM objects..... | 13 |
| 3.1.3.3.1 | Associated Real World Activity..... | 13 |
| 3.1.3.3.2 | Presentation Context Table..... | 13 |
| 3.1.3.3.2.1 | SOP Specific Conformance for the C-Find SOP class | 13 |
| 3.1.3.3.3 | Presentation Context Acceptance Criterion..... | 14 |
| 3.1.3.3.4 | Transfer Syntax Selection Policies | 14 |
| 3.1.3.4 | Retrieval of DICOM objects | 14 |
| 3.1.3.4.1 | Associated Real World Activity..... | 14 |
| 3.1.3.4.2 | Presentation Context Table..... | 15 |
| 3.1.3.4.3 | Presentation Context Acceptance Criterion..... | 15 |
| 3.1.3.4.4 | Transfer Syntax Selection Policies | 15 |
| 3.2 | WL_Server..... | 15 |
| 3.2.1 | Association Establishment Policies | 15 |
| 3.2.1.1 | General..... | 15 |
| 3.2.1.2 | Number of Associations..... | 15 |
| 3.2.1.3 | Asynchronous Nature | 15 |
| 3.2.1.4 | Implementation Identifying Information..... | 16 |
| 3.2.2 | Association Initiation by Real-World Activity | 16 |

| | | |
|-------------|---|-----------|
| 3.2.3 | Association Acceptance Policy | 16 |
| 3.2.3.1 | Receive Echo | 16 |
| 3.2.3.1.1 | Associated Read Worl Activity..... | 16 |
| 3.2.3.1.2 | Presentation Context Table | 16 |
| 3.2.3.1.3 | Presentation Context Acceptance Criterion..... | 16 |
| 3.2.3.2 | Worklist query..... | 16 |
| 3.2.3.2.1 | Associated Real World Activity..... | 16 |
| 3.2.3.2.2 | Presentation Context Table | 16 |
| 3.2.3.2.2.1 | SOP Specific Conformance for the C-Find SOP class | 16 |
| 3.2.3.2.3 | Presentation Context Acceptance Criterion..... | 17 |
| 3.2.3.2.4 | Transfer Syntax Selection Policies | 17 |
| 3.3 | ORPrintSCU..... | 17 |
| 3.3.1 | Association Establishment Policies | 17 |
| 3.3.1.1 | General | 17 |
| 3.3.1.2 | Number of Associations..... | 17 |
| 3.3.1.3 | Asynchronous Nature | 17 |
| 3.3.1.4 | Implementation Identifying Information..... | 17 |
| 3.3.2 | Association Initiation by Real-World Activity | 17 |
| 3.3.2.1 | Send Print Job to a DICOM printer | 17 |
| 3.3.2.1.1 | Associated Real-World Activity..... | 17 |
| 3.3.2.1.2 | Presentation Context table | 17 |
| 3.3.2.1.2.1 | SOP Specific Conformance for the Basic Grayscale Print Management Meta SOP class | 18 |
| 3.4 | PrinterApp | 19 |
| 3.4.1 | Association Establishment Policies | 19 |
| 3.4.1.1 | General | 19 |
| 3.4.1.2 | Number of Associations..... | 19 |
| 3.4.1.3 | Asynchronous Nature | 19 |
| 3.4.1.4 | Implementation Identifying Information..... | 19 |
| 3.4.2 | Association Initiation by Real-World Activity | 19 |
| 3.4.3 | Association Acceptance Policy | 19 |
| 3.4.3.1 | Receive Echo | 19 |
| 3.4.3.1.1 | Associated Read Worl Activity..... | 19 |
| 3.4.3.1.2 | Presentation Context Table | 19 |
| 3.4.3.1.3 | Presentation Context Acceptance Criterion..... | 20 |
| 3.4.3.2 | Print Request..... | 20 |
| 3.4.3.2.1 | Associated Real World Activity..... | 20 |
| 3.4.3.2.2 | Presentation Context Table | 20 |
| 3.4.3.2.2.1 | SOP Specific Conformance for the C-Find SOP class | 20 |
| 3.4.3.2.3 | Presentation Context Acceptance Criterion..... | 21 |
| 3.4.3.2.4 | Transfer Syntax Selection Policies | 21 |
| 4 | Communication Profiles | 22 |
| 4.1 | TCP/IP Stack | 22 |
| 4.1.1 | Physical Media Support..... | 22 |
| 5 | Extensions / Specializations / Privatizations | 22 |
| 6 | Configurations..... | 22 |
| 6.1 | AE Title / Presentation Address Mapping..... | 22 |
| 6.1.1 | dicomCC..... | 22 |
| 6.2 | Configurable Parameters | 22 |
| 6.2.1 | dicomCC..... | 22 |
| 6.2.2 | WL_Server | 23 |
| 6.2.3 | ORPrintSCU | 23 |
| 7 | Support of extended character sets | 23 |
| 8 | Codes and Controlled Terminology | 23 |
| 9 | Security Profiles..... | 23 |

1 INTRODUCTION

This DICOM conformance statement specifies the behaviour and functionality of the **dicomPACS**[®] 5 application. This software provides the following capabilities:

- Receives and stores DICOM images of all modalities and image SOP classes
- Automatically forwards images in dependence of predefined parameters
- convert non-DICOM image files into DICOM-files
- viewing of images
- printing of images to standard and DICOM printers
- creation of patient CD's

The Software uses the DICOM software development kit (DCMTK) from OFFIS e.V. Oldenburg. (see <http://dicom.offis.de/software.php.en>)

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1.1 Revision History

| Revision | Date | Author | Description |
|----------|------------|---------|---|
| 001 | 2004-03-15 | Schnare | initial issue |
| 002 | 2005-06-09 | Schnare | <ul style="list-style-type: none">- add Query/Retrieve- add DicomPrint SCU- add Dicom Print SCP- compression support for Store SCP and Store SCU- renamed process 'dicomPACS Distributor' to 'dicomCC' (DICOM Control Center) |

1.2 Abbreviations and Acronyms

| | |
|----------|---|
| ASCII | American Standard Code for Information Interchange |
| AE | Application Entity |
| AE-Title | name of an AE |
| ANSI | American National Standards Institute |
| DCMTK | OFFIS DICOM Toolkit |
| DICOM | Digital Imaging and Communications in Medicine |
| ECR | European Congress of Radiology |
| GSPS | Grayscale Softcopy Presentation State |
| HIMSS | Healthcare Information and Management Systems Society |
| IE | Information Entity |

| | |
|--------|---|
| IHE | Integrating the Healthcare Enterprise |
| IOD | Information Object Definition |
| ISO | International Standards Organization |
| NEMA | National Electrical Manufacturers Association |
| OSI | Open Systems Interconnection |
| PDU | Protocol Data Unit |
| RSNA | Radiological Society of North America |
| SCP | Service Class Provider |
| SCU | Service Class User |
| SOP | Service Object Pair |
| TCP/IP | Transmission Control Protocol / Internet Protocol |
| TLS | Transport Layer Security |
| UID | Unique Identifier |
| VM | Value Multiplicity |
| VR | Value Representation |

1.3 *dicomPACS*[®]

This DICOM Conformance Statement documents the conformance of *dicomPACS*[®] 5 with the Digital Imaging and Communications in Medicine standard (DICOM). This document is essential in order to evaluate whether or not another DICOM compliant device can communicate with this software product. This statement is con formant with the recommended format as described in PS 3.2 of the DICOM standard¹.

1.4 How to use this document

This Conformance Statement consists of the following sections:

- 2 Implementation model:** The first section describes the implementation model. It explains the functional relation between the device and the DICOM services. A DICOM service is implemented on a device by a software process, which is called an "Application Entity" (AE). Each AE has a unique name called the "AE Title" which is used to identify it to other AEs. The AE Title is configurable to avoid two devices with the same name on a network. The "bubble diagram" (Application Data Flow Diagram) shows the interaction of the AE with the outside world across the dashed line, i. e. the DICOM interface. This Application Data Flow Diagram depicts graphically the relationship of the DICOM AE with local functions at the server as well as the relationship with external activities. One should compare this implementation model and its description with the model of the other devices that *dicomPACS*[®] 5 will connect to in order to determine connectivity.
- 3 AE Specifications:** Each AE supports one or more Service Object Pair (SOP) classes. A SOP class consists of a combination of an object or information model with specific DICOM services. An example of such a SOP class is the CT Image Storage Class, which consists of the combination of the DICOM C_STORE command with the CT image object. Each of these classes is uniquely identified by an Identification number (UID), which is issued by the NEMA. The role of the AE is specified, which can be a client or server (compare with a speaker or listener). In DICOM terms, this is called a Service Class User or Service Class Provider (SCU or SCP). In order to interconnect with another device, the SOP classes as well as their role (SCU or SCP) have to be matched, i. e. a SCU has to match a SCP at another device with an identical SOP class. Each SOP class supports a particular presentation context which is the combination of the SOP Class and the transfer syntax. The transfer syntax defines the encoding of the DICOM basic elements, i. e. its attributes and how the data is represented. The encoding of the data type, or Value Representation (VR), can be done in two ways – implicitly or explicitly. Explicit VR means that the transmitted data will include the VR information along with data and attribute tags.

¹ Digital Imaging and Communications in Medicine (DICOM), NEMA PS 3.1-15, 2000.

Implicit VR means the VR information will not be included, and the receiving application must determine the VR type from the Attribute Tag.

In addition, the data can be communicated in the Little Endian (Intel) or Big Endian (Motorola, Sparc, MIPS) byte ordering. This means that for certain 16 bit words, the two 8 bit bytes might have to be swapped to be able to interpret the information by a different device. The transfer syntax of two devices have to match in order to communicate.

- 4 **Extensions/Specializations/Privatizations:** This section specifies implementation specific extensions to the Standard SOP classes as well as so-called specialized and private SOP classes, which are essentially proprietary services that make use of the underlying DICOM infrastructure such as DICOM network communication and association negotiation.
- 5 **Configuration:** This section specifies how the system configuration of an implementation affects its behavior at the DICOM network interface. DICOM implementations often support a multitude of configuration options which might be helpful in solving communication or interoperability problems.
- 6 **Support of Extended Character Sets:** DICOM supports a large number of character sets, including ASCII (the default), some of the ISO 8859 character sets for use with most European languages and a number of character sets for use in the Far East. This section of the conformance statement specifies the character sets that an implementation actually supports.
The supported character sets should be compared carefully if extended character sets are to be used, since the inability of a system to handle extended characters might affect the way names and identifiers can be entered, displayed, queried etc.

1.5 Warning to the reader

If another device matches this Conformance Statement based on the comparison with its own Conformance Statement, there is a chance, but no guarantee that they interoperate. DICOM only deals with communication, it is not a standard which specifies what is needed for certain applications to run on a device.

2 IMPLEMENTATION MODEL

2.1 Application Data Flow Diagram

dicomPACS[®] 5 consists of a set of independent processes.

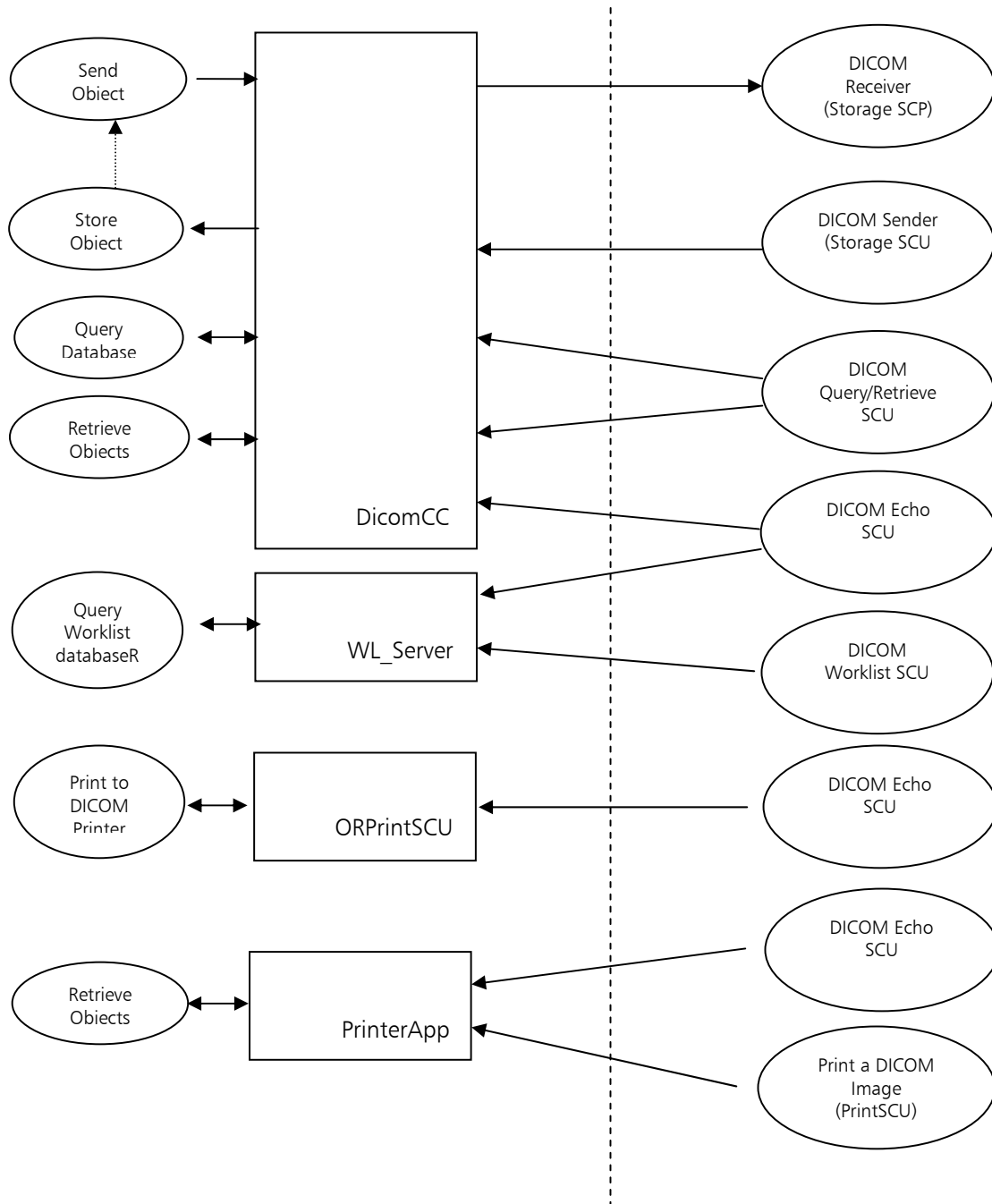


Figure 1. Implementation Model

2.2 Functional Definitions of AEs

dicomCC is an application entity that implements the following service classes:

- DICOM Verification Service Class (SCP)
- DICOM Storage Service Class (SCU and SCP)
- DICOM Query/Retrieve (SCP)

WL_Server is an application entity which implements the DICOM Modality Worklist service class as SCP.

ORPrintSCU implements the Basic Gsraayscale Print Management service class as SCU

ORPrintSCU implements the Basic Gsraayscale Print Management service classes as SCP. It is used to redirect DICOM prints to a standard system printer.

All processes are started with a automatically logon of a default user via autostart. When a service is terminated, it stops to accept any further associations and terminates as soon as all currently active associations are closed. **dicomCC** spawns a worker thread for each incoming DICOM association request. The association remains open until the remote application entity closes the association or until an error condition occurs that leads to an association abort.

2.3 Sequencing of Real-World Activities

Not Applicable.

3 AE SPECIFICATIONS

3.1 DicomCC

The dicomCC of **dicomPACS**[®] 5 provides standard conformance to the following DICOM SOP classes:

| <u>SOP Class Name</u> | <u>SOP Class UID</u> | <u>SCU</u> | <u>SCP</u> |
|---|--------------------------------|------------|------------|
| Verification | | | |
| Verification | 1.2.840.10008.1.1 | - | X |
| Storage | | | |
| CT Image Storage | 1.2.840.10008.5.1.4.1.1.2 | X | X |
| Computed Radiography Image Storage | 1.2.840.10008.5.1.4.1.1.1 | X | X |
| Digital X ray Image Storage For Presentation | 1.2.840.10008.5.1.4.1.1.1.1 | X | X |
| Digital X ray Image Storage For Processing | 1.2.840.10008.5.1.4.1.1.1.1.1 | X | X |
| Digital Mammography X-ray Image Storage For Present. | 1.2.840.10008.5.1.4.1.1.1.2 | X | X |
| Digital Mammography X-ray Image Storage For Processing | 1.2.840.10008.5.1.4.1.1.1.2.1 | X | X |
| Digital Intra Oral X-ray Image Storage For Presentation | 1.2.840.10008.5.1.4.1.1.1.3 | X | X |
| Digital Intra Oral X-ray Image Storage For Processing | 1.2.840.10008.5.1.4.1.1.1.3.1 | X | X |
| Hardcopy Color Image Storage | 1.2.840.10008.5.1.1.30 | X | X |
| Hardcopy Grayscale Image Storage | 1.2.840.10008.5.1.1.29 | X | X |
| MR Image Storage | 1.2.840.10008.5.1.4.1.1.4 | X | X |
| Nuclear Medicine Image Storage | 1.2.840.10008.5.1.4.1.1.20 | X | X |
| Positron Emission Tomography Image Storage | 1.2.840.10008.5.1.4.1.1.128 | X | X |
| Nuclear Medicine Image Storage (Retired) | 1.2.840.10008.5.1.4.1.1.5 | X | X |
| Ultrasound Image Storage (Retired) | 1.2.840.10008.5.1.4.1.1.6 | X | X |
| Ultrasound Multi-frame Image Storage (Retired) | 1.2.840.10008.5.1.4.1.1.3 | X | X |
| X-ray Angiographic Bi-Plane Image Storage (Retired) | 1.2.840.10008.5.1.4.1.1.12.3 | X | X |
| RT Image Storage | 1.2.840.10008.5.1.4.1.1.481.1 | X | X |
| Secondary Capture Image Storage | 1.2.840.10008.5.1.4.1.1.7 | X | X |
| Stored Print Storage | 1.2.840.10008.5.1.1.27 | X | X |
| Ultrasound Image Storage | 1.2.840.10008.5.1.4.1.1.6.1 | X | X |
| Ultrasound Multi-frame Image Storage | 1.2.840.10008.5.1.4.1.1.3.1 | X | X |
| Visible Light Endoscopic Image Storage | 1.2.840.10008.5.1.4.1.1.77.1.1 | X | X |
| Visible Light Microscopic Image Storage | 1.2.840.10008.5.1.4.1.1.77.1.2 | X | X |
| Visible Light Slide Coordinates Microscopic Image Storage | 1.2.840.10008.5.1.4.1.1.77.1.3 | X | X |
| Visible Light Photographic Image Storage | 1.2.840.10008.5.1.4.1.1.77.1.4 | X | X |
| X-ray Angiographic Image Storage | 1.2.840.10008.5.1.4.1.1.12.1 | X | X |
| X-ray Radiofluoroscopic Image Storage | 1.2.840.10008.5.1.4.1.1.12.2 | X | X |
| Draft Visible Light Image Storage (sup15 fz 1997) | 1.2.840.10008.5.1.4.1.1.77.1 | X | X |
| Draft Visible Light Multi Frame Image Storage (sup15 fz 97) | 1.2.840.10008.5.1.4.1.1.77.2 | X | X |
| Query/Retrieve | | | |
| Patient Root Query/Retrieve Information Model – FIND | 1.2.840.10008.5.1.4.1.2.1.1 | - | X |
| Patient Root Query/Retrieve Information Model – MOVE | 1.2.840.10008.5.1.4.1.2.1.2 | - | X |
| Study Root Query/Retrieve Information Model – FIND | 1.2.840.10008.5.1.4.1.2.2.1 | - | X |

| <u>SOP Class Name</u> | <u>SOP Class UID</u> | <u>SCU</u> | <u>SCP</u> |
|--|-----------------------------|------------|------------|
| Study Root Query/Retrieve Information Model – MOVE | 1.2.840.10008.5.1.4.1.2.2.2 | - | X |
| Patient/Study Only Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.3.1 | - | X |
| Patient/Study Only Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.3.2 | - | X |

3.1.1 Association Establishment Policies

3.1.1.1 General

dicomCC accepts an association when it receives an association request from a remote DICOM Storage, Query/Retrieve or Verification SCU which contains at least one supported presentation context. The support of the Query/Retrieve SOP class may be disabled by the configuration or license limitations..

It accepts incoming association requests on a set of port numbers defined in the configuration file.

dicomCC will attempt to establish an association whenever an image was received by StoreSCP and the image must be forwarded by the predefined rules. dicomCC also handles manual send requests initiated by a user via the **dicomPACS**[®]-Viewer.

The maximum PDU length can be configured in the range 4096..131072 bytes. The default is 16384 bytes.

3.1.1.2 Number of Associations

There is no enforced limit on number of associations of the SCP function. System configuration (CPU, memory, Disk) may enforce practical limitations. The maximum number of connections is configurable.

StoreSCU will attempt only one association establishment at a time.

3.1.1.3 Asynchronous Nature

dicomCC does not support asynchronous transactions.

3.1.1.4 Implementation Identifying Information

The implementation UID is 1.2.826.0.1.3680043.2.876.0.1.1.0, the implementation version is O+R_DICOMAPI_110

3.1.2 Association Initiation by Real-World Activity

StoreSCU attempts to initiate a new association if an incoming connection (of the StoreSCP) was completed successfully and received images addressed by a predefined forwarding role. StoreSCU also attempts to initiate a new association if an image is manually queued for sending..

3.1.2.1 Send Image

The Store SCU initiates an association to a foreign StoreSCP and transmits the selected images. StoreSCU will only propose a single association.

3.1.2.1.1 Associated Real-World Activity

The associated Real-World Activity is the attempt to transfer a image file.

3.1.2.1.2 Presentation Context table

The default behavior of the Store SCU is to propose the SOP class of the images to be sent in combination with the *Implicit VR Little Endian* transfer syntax and one of the other following transfer syntaxes. The transfer syntax is selected according to the definition in the configuration file:

| <u>Transfer Syntax</u> | <u>UID</u> |
|--|-------------------------------|
| Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Explicit VR Big Endian | 1.2.840.10008.1.2.2 |
| Implicit VR Little Endian | 1.2.840.10008.1.2 |
| JPEG Baseline (Process 1): Lossy JPEG 8 Bit Image Compression | 1.2.840.10008.1.2.4.50 |
| JPEG Extended (Process 2 & 4): Lossy JPEG 12 Bit Image Compression (Process 4 only) | 1.2.840.10008.1.2.4.51 |
| <i>JPEG Extended (Process 3 & 5)</i> | <i>1.2.840.10008.1.2.4.52</i> |
| <i>JPEG Spectral Selection, Non-Hierarchical (Process 6 & 8)</i> | <i>1.2.840.10008.1.2.4.53</i> |
| JPEG Lossless, Non-Hierarchical (Process 14) | 1.2.840.10008.1.2.4.57 |
| 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-LS Lossy (Near-Lossless) Image Compression | 1.2.840.10008.1.2.4.81 |
| JPEG 2000 Image Compression (Lossless Only) | 1.2.840.10008.1.2.4.90 |
| JPEG 2000 Image Compression | 1.2.840.10008.1.2.4.91 |

The Implicit Little Endian VR transfer syntax will always be the last in the list of the proposed transfer syntaxes.

The supported Storage SOP classes are listed in section 3.1.

3.1.3 Association Acceptance Policy

When StoreSCP accepts an association, it will receive any images transmitted on that association and store the images on disk in the file system using the same transfer syntax as during transmission.

3.1.3.1 Receive Echo

3.1.3.1.1 Associated Read Work Activity

A C-Echo response is sent to the calling AE.

3.1.3.1.2 Presentation Context Table

dicomPACS[®] 5 will accept any presentation context containing the Verification SOP class and following transfer syntax:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|-----------------|-------------------|---------------------------|---------------------|------|---------------|
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | 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 | | |

3.1.3.1.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.1.3.2 Receive Image or other data objects

3.1.3.2.1 Associated Real World Activity

Received images are stored to the Incoming Pool within the local file system. The following processing forwards the image files to predefined destinations and archives it in the image database. Image Studies are marked as 'Unread'. They are available for viewing now.

3.1.3.2.2 Presentation Context Table

Store SCP supports following transfer syntaxes:

| <u>Transfer Syntax</u> | <u>UID</u> |
|--|-------------------------------|
| Implicit VR Little Endian | 1.2.840.10008.1.2 |
| Explicit VR Little Endian | 1.2.840.10008.1.2.1 |
| Explicit VR Big Endian | 1.2.840.10008.1.2.2 |
| JPEG Baseline (Process 1): Lossy JPEG 8 Bit Image Compression | 1.2.840.10008.1.2.4.50 |
| JPEG Extended (Process 2 & 4): Lossy JPEG 12 Bit Image Compression (Process 4 only) | 1.2.840.10008.1.2.4.51 |
| <i>JPEG Extended (Process 3 & 5) (retired)</i> | <i>1.2.840.10008.1.2.4.52</i> |
| <i>JPEG Spectral Selection, Non-Hierarchical (Process 6 & 8) (retired)</i> | <i>1.2.840.10008.1.2.4.53</i> |
| JPEG Lossless, Non-Hierarchical (Process 14) | 1.2.840.10008.1.2.4.57 |
| 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-LS Lossy (Near-Lossless) Image Compression | 1.2.840.10008.1.2.4.81 |
| JPEG 2000 Image Compression (Lossless Only) | 1.2.840.10008.1.2.4.90 |
| JPEG 2000 Image Compression | 1.2.840.10008.1.2.4.91 |

Any presentation context containing one of the supported transfersyntax and one of the Storage SOP classes listed in section 3.1 are accepted as SCP.

Extended negotiations are not supported.

3.1.3.2.2.1 SOP Specific Conformance of Storage SOP Classes

StoreSCP conforms to the SOPs of the Storage Service Class at Level 2 (Full). No elements are discarded or coerced. In the event of a successful C-STORE operation, the image has successfully been written to the incoming directory.

The further processing implies the forwarding of the image to predefined destinations and the archiving of the image in the image database. StoreSCP removes the image from the Incoming directory if the further processing was successful.

If inserting of images into the incoming directory failes the association is aborted and a suitable error code is returned.

Association requests can be rejected with the following status codes and reasons:

| Result | Source | Reason | Description |
|--------------------|----------------------------|---------------------------------|---|
| rejected permanent | provider, present. related | temporary congestion | Resource limitation: thread creation Failed, memory failure, limited local disk space |
| rejected transient | user | app. context name not supported | Incorrect application context name |
| rejected permanent | user | no reason | Unknown AE-Titles, hostnames or IP addresses |

The following error/warning status codes can be sent by the Store SCP in the context of a C-STORE-RSP message:

| Code | Name | Severity | Description |
|------|--|----------|--|
| a700 | refused: out of resources | failure | Application out of memory, file system or database write error (e. g. full) |
| a800 | refused: SOP class not supported | failure | Received C-STORE-RQ for non-storage SOP class |
| a900 | error: data set does not match SOP class | failure | SOP class or instance UID in C-STORE-RQ does not match UIDs in the received dataset |
| c000 | error: cannot understand | failure | Received dataset without SOP class or instance UID; received Presentation State that failed syntax check; internal application error |

3.1.3.2.3 Presentation Context Acceptance Criterion

StoreSCP will accept every supported presentation context as long as system resources (disk space) are available.

3.1.3.2.4 Transfer Syntax Selection Policies

StoreSCP prefers to receive images encoded in a lossless compressed transfer syntax. dicomPACS will select proposed transfer syntax in following order:

1. lossless compressed transfer syntax
2. if enabled: lossy compressed transfer syntax
3. Explicit VR Little Endian transfer syntax
4. Implicit VR Little Endian transfer syntax

3.1.3.3 Query for DICOM objects

3.1.3.3.1 Associated Real World Activity

If dicomCC receives a C-Find request it performs a search in the database and returns a list of matching SOP instances in a C-Find response.

3.1.3.3.2 Presentation Context Table

dicomCC supports following presentation contexts:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotia |
|--|-----------------------------|---------------------------|---------------------|------|--------------|
| Name | UID | Name List | UID List | | |
| Patient Root Query/ Retrieve Information 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 |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | SCP | none |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | SCP | none |
| Patient Root Query/ Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.2.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | none |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | SCP | none |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | SCP | none |
| Patient/Study Only Query/Retrieve Information Model - FIND | 1.2.840.10008.5.1.4.1.2.3.1 | Implicit VR Little Endian | 1.2.840.10008.1.2 | SCP | none |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | SCP | none |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | SCP | none |

3.1.3.3.2.1 SOP Specific Conformance for the C-Find SOP class

dicomCC conforms to the C-Find service class baseline behavior. It does not support extended negotiation nor priority processing.

dicomCC can limit the number of response datasets if a search on patient or study level is performed. The maximum number is configurable in the configuration file.

The software supports matching and retrieval of some optional attributes. The following table list all supported attributes while the column 'Type' has following meanings:

| Type | Meaning |
|------|--|
| U | Unique key - Matching is supported |
| M | Matching is supported |
| R | Key can be returned but no matching is performed |

| Attribute | Tag | Type |
|-------------------------------------|-------------|------|
| Patient Level Attributes | | |
| Patient Name | (0010,0010) | M |
| Patient ID | (0010,0020) | U |
| Patient Birth Date | (0010,0030) | M |
| Patient's Sex | (0010,0040) | M |
| Number of Patient Related Studies | (0020,1200) | R |
| Number of Patient Related Series | (0020,1202) | R |
| Number of Patient Related Instances | (0020,1204) | R |
| StudyLevel Attributes | | |
| Study Date | (0008,0020) | M |
| Study Time | (0008,0030) | M |
| Accession Number | (0008,0050) | M |
| Study ID | (0020,0010) | M |
| Study Instance UID | (0020,000d) | U |
| Study Description | (0008,1030) | R |
| Number of Study Related Series | (0020,1206) | R |
| Number of Study Related Instances | (0020,1208) | R |
| Series Level Attributes | | |
| Modality | (0008,0060) | M |
| Series Number | (0020,0011) | M |
| Series Instance UID | (0020,000e) | U |
| Number of Series Related Instances | (0020,1209) | R |
| Instance Level Attributes | | |
| Instance Number | (0020,0013) | M |
| SOP Instance UID | (0008,0018) | U |
| SOP class UID | (0008,0016) | M |

3.1.3.3.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.1.3.3.4 Transfer Syntax Selection Policies

The Little Endian Explicit transfer syntax is preferred.

3.1.3.4 Retrieval of DICOM objects

3.1.3.4.1 Associated Real World Activity

If dicomCC receives a C-Move request it sends all requested SOP instances to the requested DICOM AE. The AE must be configured in the configuration file.

3.1.3.4.2 Presentation Context Table

dicomCC supports following presentation contexts:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|--|-----------------------------|---------------------------|---------------------|------|---------------|
| Name | UID | Name List | UID List | | |
| Patient Root Query/ Retrieve Information 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 |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| Patient Root Query/ Retrieve Information 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 |
| | | Explicit VR Little Endian | 1.2.840.10008.1.2.1 | | |
| | | Explicit VR Big Endian | 1.2.840.10008.1.2.2 | | |
| Patient/Study Only Query/Retrieve Information Model - MOVE | 1.2.840.10008.5.1.4.1.2.3.2 | 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 | | |

3.1.3.4.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.1.3.4.4 Transfer Syntax Selection Policies

The Little Endian Explicit transfer syntax is preferred.

3.2 WL_Server

WL_Server provides standard conformance to the following DICOM SOP class as SCP

| SOP Class Name | SOP Class UID | SCU | SCP |
|--|------------------------|-----|-----|
| Modality Worklist Information Model - FIND | 1.2.840.10008.5.1.4.31 | - | X |

3.2.1 Association Establishment Policies

3.2.1.1 General

WL_Server accepts an association when it receives an association request from a remote DICOM Query SCU which contains at least one supported presentation context.

It accepts incoming association requests on the configured port number defined in the configuration file.

The maximum PDU length can be configured in the range 4096..131072 bytes. The default is 16384 bytes.

3.2.1.2 Number of Associations

WL_Server accepts only one association at a time.

3.2.1.3 Asynchronous Nature

WL_Server does not support asynchronous transactions.

3.2.1.4 Implementation Identifying Information

The implementation UID is 1.2.826.0.1.3680043.2.876.0.1.1.0, the implementation version is O+R_DICOMAPI_110

3.2.2 Association Initiation by Real-World Activity

WL_Server never attempts to initiate an association.

3.2.3 Association Acceptance Policy

3.2.3.1 Receive Echo

3.2.3.1.1 Associated Read World Activity

A C-Echo response is send to the calling AE.

3.2.3.1.2 Presentation Context Table

dicomPACS[®] 5 will accept any presentation context containing the Verification SOP class and following transfer syntax:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|-----------------|-------------------|---------------------------|---------------------|------|---------------|
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | 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 | | |

3.2.3.1.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.2.3.2 Worklist query

3.2.3.2.1 Associated Real World Activity

When WL_Server receives a Worklist query it queries the Worklist database and returns the results to the calling AE.

3.2.3.2.2 Presentation Context Table

WL_Server supports following presentation contexts:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|--|------------------------|---------------------------|---------------------|------|---------------|
| Name | UID | Name List | UID List | | |
| Modality Worklist Information Model – FIND | 1.2.840.10008.5.1.4.31 | 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 | | |

3.2.3.2.2.1 SOP Specific Conformance for the C-Find SOP class

WL_Server conforms to the Modality Worklist SOP Class.

Extended negotiations are not supported.

It does not support matching on Optional Matching Key Attributes.

WL_Server only supports case sensitive search. Specific Character Set are not interpreted.

3.2.3.2.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.2.3.2.4 Transfer Syntax Selection Policies

The Little Endian Explicit transfer syntax is preferred.

3.3 ORPrintSCU

The ORPrintSCU provides standard conformance to the following DICOM SOP classes:

| SOP Class Name | SOP Class UID | SCU | SCP |
|---------------------------------------|-----------------------|-----|-----|
| Print Management | | | |
| Basic Grayscale Print Management Meta | 1.2.840.10008.5.1.1.9 | X | - |

3.3.1 Association Establishment Policies

3.3.1.1 General

ORPrintSCU sends print jobs to a DICOM compatible printer. Print jobs are buffered by the software.

The maximum PDU length can be configured in the range 4096..131072 bytes. The default is 16384 bytes.

3.3.1.2 Number of Associations

ORPrintSCU will establish only one association at a time.

3.3.1.3 Asynchronous Nature

The software does not support asynchronous transactions.

3.3.1.4 Implementation Identifying Information

The implementation UID is 1.2.826.0.1.3680043.2.876.0.1.1.0, the implementation version is O+R_DICOMAPI_110

3.3.2 Association Initiation by Real-World Activity

ORPrintSCU attempts to initiate a new association if a print job is generated by a **dicomPACS**[®] Viewer. Print jobs are queued by the software and processed sequential.

3.3.2.1 Send Print Job to a DICOM printer

3.3.2.1.1 Associated Real-World Activity

The associated Real-World Activity is the receipt of a print job. ORPrintSCU prepares the received image data and initiates an association to the specified DICOM printer.

3.3.2.1.2 Presentation Context table

ORPrintSCU supports following presentation contexts:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|---|-----------------------|---------------------------|---------------------|------|---------------|
| Name | UID | Name List | UID List | | |
| Basic Grayscale Print Management Meta SOP class | 1.2.840.10008.5.1.1.9 | 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 | | |

3.3.2.1.2.1 SOP Specific Conformance for the Basic Grayscale Print Management Meta SOP class

ORPrintSCU supports the following mandatory SOP classes as defined by the Basic Grayscale Print Management Meta Class:

| SOP Class Name | SOP Class UID |
|-------------------------------------|------------------------|
| Basic Film Session SOP class | 1.2.840.10008.5.1.1.1 |
| Basic Film Box SOP Class | 1.2.840.10008.5.1.1.2 |
| Basic Grayscale Image Box SOP Class | 1.2.840.10008.5.1.1.4 |
| Printer SOP Class | 1.2.840.10008.5.1.1.16 |

It is configured by the file 'PrinterConfig.xml' which is located in the installation directory of the **dicomPACS**® Viewer.

The following tables list the attributes supported for the different SOP classes. The values in the *Usage* column are used as follows:

| Usage | Meaning |
|-------|--|
| A | Attribute is always sent |
| C | The attribute is only send if it is defined in the print job |

| Attribute Description | Tag | Usage |
|---|-----------|-------|
| Basic Film Session Attributes | | |
| Number of Copies | 2000,0010 | A |
| Print Priority | 2000,0020 | C |
| Medium Type | 2000,0030 | C |
| Film Destination | 2000,0040 | C |
| Film Session Label | 2000,0050 | A |
| Basic Film Box SOP Class Attributes | | |
| Image Display Format | 2010,0010 | A |
| Referenced Film Session Sequence | 2010,0500 | A |
| > Referenced SOP class UID | 0008,1150 | A |
| > Referenced SOP Instance UID | 0008,1155 | A |
| Film Orientation | 2010,0040 | C |
| Filme Size ID | 2010,0050 | C |
| Magnification Type | 2010,0060 | C |
| Min Density | 2010,0120 | C |
| Max Density | 2010,0130 | C |
| Configuration Information | 2010,0150 | C |
| Smoothing Type | 2010,0080 | C |
| Border Density | 2010,0100 | C |
| Empty Image Density | 2010,0110 | C |
| Trim | 2010,0140 | C |
| Illumination | 2010,015e | C |
| Reflect Ambient Light | 2010,0160 | C |
| Basic Grayscale Image Box Attributes | | |
| Image Position | 2020,0010 | A |
| Basic Grayscale Image Sequence | 2020,0110 | A |
| > Samples per Pixel | 0028,0002 | A |
| > Photometric Interpretation | 0028,0004 | A |
| > Rows | 0028,0010 | A |
| > Columns | 0028,0011 | A |
| > Pixel Aspect Ratio | 0028,0034 | A |
| > Bits Allocated | 0028,0100 | A |

| | | |
|------------------------|-----------|---|
| > Bits Stored | 0028,0101 | A |
| > High Bit | 0028,0102 | A |
| > Pixel Representation | 0028,0103 | A |
| > Pixel Data | 7fe0,0010 | A |

3.4 PrinterApp

The ORPrintSCU provides standard conformance to the following DICOM SOP classes:

| <u>SOP Class Name</u> | <u>SOP Class UID</u> | <u>SCU</u> | <u>SCP</u> |
|---------------------------------------|-----------------------|------------|------------|
| Print Management | | | |
| Basic Grayscale Print Management Meta | 1.2.840.10008.5.1.1.9 | X | - |

3.4.1 Association Establishment Policies

3.4.1.1 General

PrinterApp receives print jobs. Print jobs are stored on the local hard disc and are printed to a local system printer (e.g. A laser printer).

The maximum PDU length can be configured in the range 4096..131072 bytes. The default is 16384 bytes.

3.4.1.2 Number of Associations

PrinterApp can handle multiple association at a time. The maximum number of associations can be configured. By default there is no limitation..

3.4.1.3 Asynchronous Nature

The software does not support asynchronous transactions.

3.4.1.4 Implementation Identifying Information

The implementation UID is 1.2.826.0.1.3680043.2.876.0.1.1.0, the implementation version is O+R_DICOMAPI_110

3.4.2 Association Initiation by Real-World Activity

PrinterApp never attempts to initiate an association.

3.4.3 Association Acceptance Policy

3.4.3.1 Receive Echo

3.4.3.1.1 Associated Read Work Activity

A C-Echo response is send to the calling AE.

3.4.3.1.2 Presentation Context Table

dicomPACS[®] 5 will accept any presentation context containing the Verification SOP class and following transfer syntax:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|------------------------|-------------------|---------------------------|---------------------|-------------|----------------------|
| Name | UID | Name List | UID List | | |
| Verification | 1.2.840.10008.1.1 | 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 | | |

3.4.3.1.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.4.3.2 Print Request

3.4.3.2.1 Associated Real World Activity

If PrinterApp receives a print request the printing information and the image data is stored on the local disk and the response is send back to the requesting devioece. Then a print job for the configered system printer is created and the print job is enqueued.

3.4.3.2.2 Presentation Context Table

PrinterApp supports following presentation contexts:

| Abstract Syntax | | Transfer Syntax | | Role | Ext. Negotiat |
|---------------------------------------|-----------------------|---------------------------|---------------------|------|---------------|
| Name | UID | Name List | UID List | | |
| Basic Grayscale Print Management Meta | 1.2.840.10008.5.1.1.9 | 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 | | |

3.4.3.2.2.1 SOP Specific Conformance for the C-Find SOP class

PrinterApp supports the following mandatory SOP classes as defined by the Basic Grayscale Print Management Meta SOP Class:

| SOP Class Name | SOP Class UID |
|-------------------------------------|------------------------|
| Basic Film Session SOP class | 1.2.840.10008.5.1.1.1 |
| Basic Film Box SOP Class | 1.2.840.10008.5.1.1.2 |
| Basic Grayscale Image Box SOP Class | 1.2.840.10008.5.1.1.4 |
| Printer SOP Class | 1.2.840.10008.5.1.1.16 |

PrinterApp can be adapted to the capabilities of the used printer. The configuration file '*PrintSCP.ini*' is used to define which of the following attributes are supported and which values are supported.

It is configured by the file 'PrinterConfig.xml' which is located in the installation directory of the **dicomPACS**® Viewer.

The following tables list the attributes supported for the different SOP classes. The values in the *Usage* column are used as follows:

| <u>Usage</u> | <u>Meaning</u> |
|--------------|---|
| A | Attribute is always needed |
| C | The attribute or values may be configured |

| <u>Attribute Description</u> | <u>Tag</u> | <u>Usage</u> |
|--------------------------------------|------------|--------------|
| Basic Film Session Attributes | | |
| Number of Copies | 2000,0010 | A |
| Print Priority | 2000,0020 | C |
| Medium Type | 2000,0030 | C |
| Film Destination | 2000,0040 | C |
| Film Session Label | 2000,0050 | A |

| Basic Film Box SOP Class Attributes | | |
|---|-----------|---|
| Image Display Format | 2010,0010 | A |
| Referenced Film Session Sequence | 2010,0500 | A |
| > Referenced SOP class UID | 0008,1150 | A |
| > Referenced SOP Instance UID | 0008,1155 | A |
| Film Orientation | 2010,0040 | C |
| Film Size ID | 2010,0050 | C |
| Magnification Type | 2010,0060 | C |
| Min Density | 2010,0120 | C |
| Max Density | 2010,0130 | C |
| Configuration Information | 2010,0150 | C |
| Smoothing Type | 2010,0080 | C |
| Border Density | 2010,0100 | C |
| Empty Image Density | 2010,0110 | C |
| Trim | 2010,0140 | C |
| Illumination | 2010,015e | C |
| Reflect Ambient Light | 2010,0160 | C |
| Basic Grayscale Image Box Attributes | | |
| Image Position | 2020,0010 | A |
| Basic Grayscale Image Sequence | 2020,0110 | A |
| > Samples per Pixel | 0028,0002 | A |
| > Photometric Interpretation | 0028,0004 | A |
| > Rows | 0028,0010 | A |
| > Columns | 0028,0011 | A |
| > Pixel Aspect Ratio | 0028,0034 | A |
| > Bits Allocated | 0028,0100 | A |
| > Bits Stored | 0028,0101 | A |
| > High Bit | 0028,0102 | A |
| > Pixel Representation | 0028,0103 | A |
| > Pixel Data | 7fe0,0010 | A |

3.4.3.2.3 Presentation Context Acceptance Criterion

There are no specific rules for acceptance of presentation contexts.

3.4.3.2.4 Transfer Syntax Selection Policies

The Little Endian Explicit transfer syntax is preferred.

4 COMMUNICATION PROFILES

dicomPACS[®] 5 provides DICOM V3.0 TCP/IP Network Communication Support as defined in PS 3.8.

4.1 TCP/IP Stack

4.1.1 Physical Media Support

Any physical media supporting TCP/IP may be used to connect to *dicomPACS*[®] 5

5 EXTENSIONS / SPECIALIZATIONS / PRIVATIZATIONS

Not Applicable.

6 CONFIGURATIONS

6.1 AE Title / Presentation Address Mapping

6.1.1 dicomCC

The application dicomCC obtains the configuration information from the file 'DicomCC.ini' in the directory 'dicomCC' below the installation directory.

The AE title of all send destinations must be defined in the key AETitles within section [PARTNERS]. The AE title itself is used as a section name which contains the mapping to the presentation address.

Example:

```
...
[PARTNERS]
AETitles=TEST_AE1, TEST_AE2
...
[TEST_AE1]
host=testhost
port=104

[TEST_AE2]
host=192.168.115.7
port=3040
...
```

6.2 Configurable Parameters

6.2.1 dicomCC

Following parameters are configurable within the configuration file *dcmVerteiler.ini*

- Listening IP port number(s) - section [SCP], key: SCP_Port
- Application entity title(s) – section: [SCU], key: AETitle
- list of destination AEs (see section 6.1)

6.2.2 WL_Server

Following parameters are configurable in the configuration file *wl_server.ini* within section [Parameter]

- Listening IP port number – key: port
- Application entity title(s) – key: localAET

6.2.3 ORPrintSCU

- All parameters dealing with DICOM communication are set in the configuration file *PrinterConfig.xml*. The file is located in the installation directory of the **dicomPACS**[®] Viewer. See the Service Manual for further explanation.

7 SUPPORT OF EXTENDED CHARACTER SETS

This application supports only ISO_IR 100 (ISO 8859-1 Latin 1) as extended character set.

8 CODES AND CONTROLLED TERMINOLOGY

No Mapping Resources or Coding Schemes are used.

9 SECURITY PROFILES

No security profiles are supported.