



# **Technical Publications**

**Direction DOC1144827  
Revision 1**

## **Centricity<sup>TM</sup> RIS-i MedoraCom 5.0 DICOM CONFORMANCE STATEMENT**

**Copyright© 2012 by General Electric Co.**

**Do not duplicate**

**REVISION HISTORY**

<b>REV</b>	<b>DATE</b>	<b>REASON FOR CHANGE</b>
1	26-JUN-2012	Initial Release for Centricity RIS-i 5.0



## CONFORMANCE STATEMENT OVERVIEW

MedoraCom is implemented as a collection of one or several components and each of these components provide the support of one or several DICOM Service Classes - SOPs. With this component architecture, MedoraCom can be configured as really demanded in a concrete installation site.

Table 0.1 provides an overview of the network services supported by MedoraCom.

**Table 0.1 – NETWORK SERVICES**

SOP Classes	User of Service (SCU)	Provider of Service (SCP)
<b>Query/Retrieve</b>		
Study Root Query/Retrieve Information Model – FIND	Yes	No
Study Root Query/Retrieve Information Model – MOVE	Yes	No
<b>Workflow Management</b>		
Modality Performed Procedure Step SOP Class	Yes	Yes
Modality Worklist Information Model – FIND SOP Class	No	Yes
Basic Study Content Notification SOP Class	No	Yes
Virtua Codonics Report Management - FIND	No	Yes

MedoraCom does not provide any Media Storage Application Profiles

## TABLE OF CONTENTS

<b>1. INTRODUCTION .....</b>	<b>5</b>
1.1 Overview .....	5
1.2 Overall DICOM Conformance Statement Document Structure.....	6
1.3 Intended Audience .....	7
1.4 Scope and Field of Application .....	7
1.5 Important Remarks .....	7
1.6 References.....	8
1.7 Definitions.....	8
1.8 Symbols and Abbreviations.....	10
<b>2. NETWORK CONFORMANCE STATEMENT .....</b>	<b>11</b>
2.1 Introduction.....	11
2.2 Implementation Model.....	14
2.3 AE Specifications .....	22
2.4 Communication Profiles .....	61
2.5 Extensions / Specializations/ Privatizations .....	62
2.6 Configuration .....	62
2.7 Support of Extended Character Sets.....	63
2.8 Codes and Controlled Terminology.....	63
2.9 Security Profiles .....	63

## 1. INTRODUCTION

### 1.1 OVERVIEW

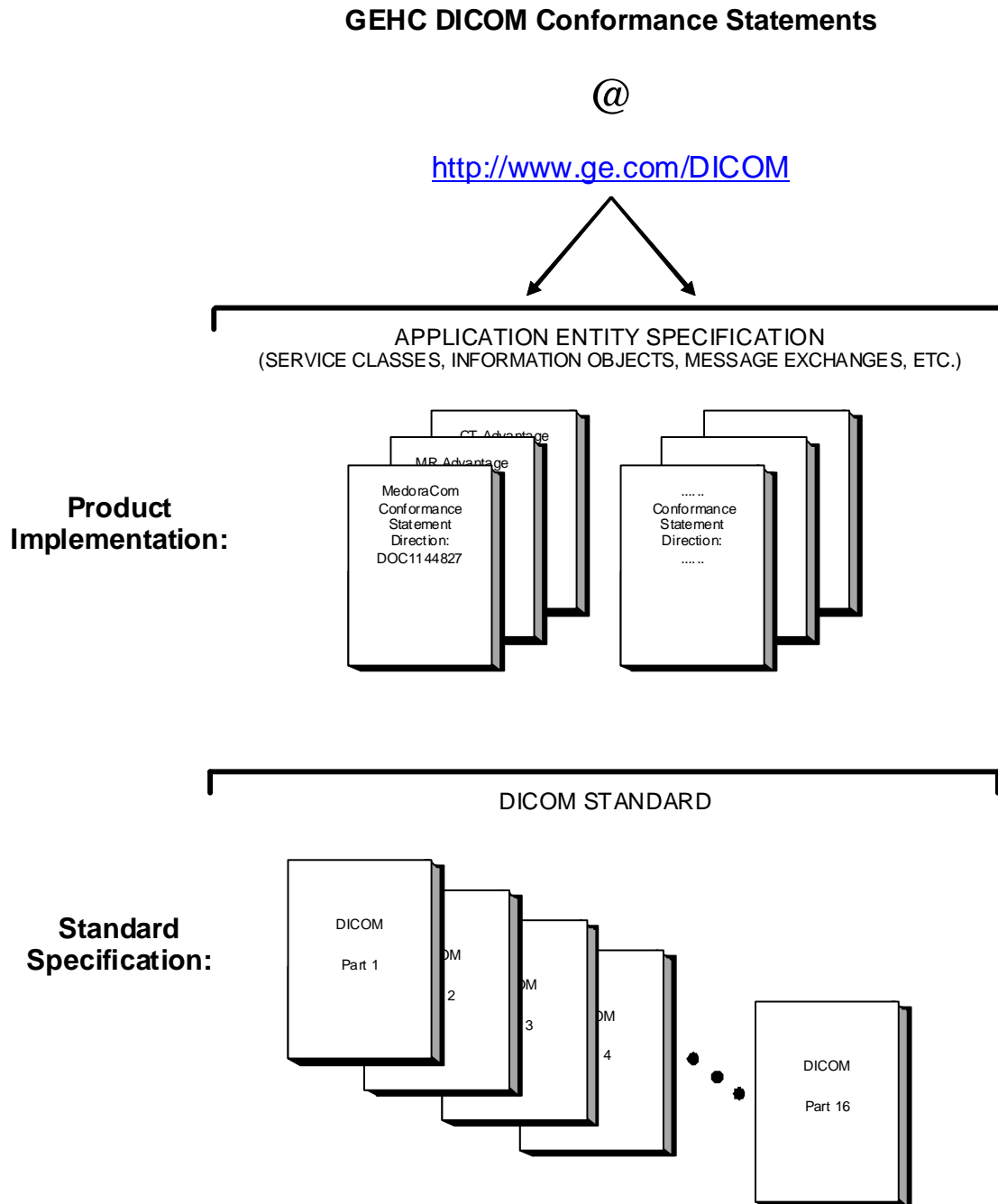
This DICOM Conformance Statement is divided into Sections as described below:

**Section 1 (Introduction)**, which describes the overall structure, intent, and references for this Conformance Statement

**Section 2 (Network Conformance Statement)**, which specifies the GEHC equipment compliance to the DICOM requirements for the implementation of Networking features.

## 1.2 OVERALL DICOM CONFORMANCE STATEMENT DOCUMENT STRUCTURE

The Documentation Structure of the GEHC DICOM Conformance Statements is shown in the Illustration below.



This document specifies the DICOM implementation. It is entitled:

*Centricity™ RIS-i MedoraCom 5.0  
Conformance Statement for DICOM  
Direction DOC1144827*

This DICOM Conformance Statement documents the DICOM Conformance Statement and Technical Specification required to interoperate with the GEHC network interface.

The GEHC Conformance Statement, contained in this document, also specifies the Lower Layer communications which it supports (e.g., TCP/IP). However, the Technical Specifications are defined in the DICOM Part 8 standard.

For more information regarding DICOM, copies of the Standard may be obtained on the Internet at <http://medical.nema.org>. Comments on the Standard may be addressed to:

DICOM Secretariat  
NEMA  
1300 N. 17<sup>th</sup> Street, Suite 1752  
Rosslyn, VA 22209  
USA  
Phone: +1.703.841.3200

### 1.3 INTENDED AUDIENCE

The reader of this document is concerned with software design and/or system integration issues. It is assumed that the reader of this document is familiar with the DICOM Standard and with the terminology and concepts which are used in that Standard.

### 1.4 SCOPE AND FIELD OF APPLICATION

It is the intent of this document to provide an unambiguous specification for GEHC implementations. This specification, called a Conformance Statement, includes a DICOM Conformance Statement and is necessary to ensure proper processing and interpretation of GEHC medical data exchanged using DICOM. The GEHC Conformance Statements are available to the public.

The reader of this DICOM Conformance Statement should be aware that different GEHC devices are capable of using different Information Object Definitions. For example, a GEHC CT Scanner may send images using the CT Information Object, MR Information Object, Secondary Capture Object, etc.

Included in this DICOM Conformance Statement are the Module Definitions which define all data elements used by this GEHC implementation. If the user encounters unspecified private data elements while parsing a GEHC Data Set, the user is well advised to ignore those data elements (per the DICOM standard). Unspecified private data element information is subject to change without notice. If, however, the device is acting as a "full fidelity storage device", it should retain and re-transmit all of the private data elements which are sent by GEHC devices.

### 1.5 IMPORTANT REMARKS

The use of these DICOM Conformance Statements, in conjunction with the DICOM Standards, is intended to facilitate communication with GE imaging equipment. However, **by itself, it is not sufficient to ensure that inter-operation will be successful.** The **user (or user's agent)** needs to proceed with caution and address at least four issues:

- **Integration** - The integration of any device into an overall system of interconnected devices goes beyond the scope of standards (DICOM v3.0), and of this introduction and associated DICOM Conformance Statements when interoperability with non-GE equipment is desired. The responsibility to analyze the applications requirements and to design a solution that integrates GE imaging equipment with non-GE systems is the **user's** responsibility and should not be underestimated. The **user** is strongly advised to ensure that such an integration analysis is correctly performed.
- **Validation** - Testing the complete range of possible interactions between any GE device and non-GE devices, before the connection is declared operational, should not be overlooked. Therefore, the **user** should ensure that any non-GE provider accepts full responsibility for all validation required for their connection with GE devices. This includes the accuracy of the image data once it has crossed the interface between the GE imaging equipment and the non-GE device and the stability of the image data for the intended applications.

Such a validation is required before any clinical use (diagnosis and/or treatment) is performed. It applies when images acquired on GE imaging equipment are processed/displayed on a non-GE device, as well as when images acquired on non-GE equipment is processed/displayed on a GE console or workstation.

- **Future Evolution** - GE understands that the DICOM Standard will evolve to meet the user's growing requirements. GE is actively involved in the development of the DICOM Standard. DICOM will incorporate new features and technologies and GE may follow the evolution of the Standard. The GEHC protocol is based on DICOM as specified in each DICOM Conformance Statement. Evolution of the Standard may require changes to devices which have implemented DICOM. **In addition, GE reserves the right to discontinue or make changes to the support of communications features (on its products) described by these DICOM Conformance Statements.** The **user** should ensure that any non-GE provider, which connects with GE devices, also plans for the future evolution of the DICOM Standard. Failure to do so will likely result in the loss of function and/or connectivity as the DICOM Standard changes and GE Products are enhanced to support these changes.
- **Interaction** - It is the sole responsibility of the **non-GE provider** to ensure that communication with the interfaced equipment does not cause degradation of GE imaging equipment performance and/or function.

## 1.6 REFERENCES

NEMA PS3      Digital Imaging and Communications in Medicine (DICOM) Standard, available free at <http://medical.nema.org/>

## 1.7 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, Computed Radiography Image Storage SOP Class.



**Application Entity (AE)** – an end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

**Application Entity Title** – the externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

**Application Context** – the specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

**Association** – a network communication channel set up between *Application Entities*.

**Attribute** – a unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

**Information Object Definition (IOD)** – the specified set of *Attributes* that comprise a type of data object; does not represent a specific instance of the data object, but rather a class of similar data objects that have the same properties. The *Attributes* may be specified as Mandatory (Type 1), Required but possibly unknown (Type 2), or Optional (Type 3), and there may be conditions associated with the use of an Attribute (Types 1C and 2C). Examples: MR Image IOD, CT Image IOD, Print Job IOD.

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

**Media Application Profile** – the specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs)

**Module** – a set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

**Negotiation** – first phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

**Presentation Context** – the set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

**Protocol Data Unit (PDU)** – a packet (piece) of a DICOM message sent across the network. Devices must specify the maximum size packet they can receive for DICOM messages.

**Security Profile** – a set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data

**Service Class Provider (SCP)** – role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

**Service Class User (SCU)** – role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU)

**Service/Object Pair (SOP) Class** – the specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

**Service/Object Pair (SOP) Instance** – an information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

**Tag** – a 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the “group” and the “element”. If the “group” number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element]

**Transfer Syntax** – the encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

**Unique Identifier (UID)** – a globally unique “dotted decimal” string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

**Value Representation (VR)** – the format type of an individual DICOM data element, such as text, an integer, a person’s name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

## 1.8 SYMBOLS AND ABBREVIATIONS

ACN	Application Context Name
AE	Application Entity
AET	Application Entity Title
DHCP	Dynamic Host Configuration Protocol
DICOM	Digital Imaging and Communications in Medicine
HIS	Hospital Information System
IHE	Integrating the Healthcare Enterprise
IS	Information System
IOD	Information Object Definition

MCARI	MedoraCom ARI Report SCP
MCPPS	MedoraCom PPS Manager
MCQRS	MedoraCom Query/Retrieve Services
MCSCNP	MedoraCom Study Content Notification Provider
MCSR	MedoraCom Server
MCWLP	MedoraCom Worklist Provider
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
O	Optional (Key Attribute)
PACS	Picture Archiving and Communication System
R	Required (Key Attribute)
RIS	Radiology Information System
SCN	Study Content Notification
SCP	Service Class Provider
SCU	Service Class User
SOP	Service-Object Pair
SPS	Scheduled Procedure Step
TCP/IP	Transmission Control Protocol/Internet Protocol
VR	Value Representation

## 2. NETWORK CONFORMANCE STATEMENT

### 2.1 INTRODUCTION

This section of the DICOM Conformance Statement specifies the Centricity RIS-i MedoraCom 5.0 compliance to DICOM requirements for **Networking** features.

MedoraCom is available on Microcoft Windows® Operating systems. In summary MedoraCom supports the following DICOM functions for the demographic data exchange, work flow management and image communication:

- Service Class Provider (SCP) of the DICOM Verification Service Class
- Service Class User (SCU) of the DICOM Verification Service Class

- Service Class Provider (SCP) of the DICOM Basic Modality Worklist Service Class
- Service Class Provider (SCP) of the DICOM Basic Study Content Notification Service Class
- Service Class User (SCU) of the DICOM Query / Retrieve Service Class
- Service Class User (SCU) of the DICOM Modality Performed Procedure Step Service Class
- Service Class Provider (SCP) of the DICOM Modality Performed Procedure Step Service Class
- Service Class Provider (SCP) of the private Virtua Codonics Service Class

MedoraCom is implemented as a collection of one or several components and each of these components provide the support of one or several DICOM Service Classes - SOPs. With this component architecture, MedoraCom can be configured as really demanded in a concrete installation site. The components can be configured as separate DICOM Application Entities, or they can share one same AE Title. All above listed SCPs are using a different predefined Port to listen for incoming associations. The installation and configuration manual of MedoraCom provides the configuration information of a concrete installation.

- Basic Modality Worklist

The SCP of the DICOM Basic Modality Worklist Service Class for modality worklist sending after having received a request from a remote DICOM application entity.

- Basic Study Content Notification

The SCP of the DICOM Basic Study Content Notification Service Class for study content notification receiving from a remote DICOM node.

- Image Query & Retrieve

The SCU of the DICOM Query & Retrieve Service Class for either Centricity RIS-i users or internal server processes to query/retrieve image information/images from a remote DICOM Query & Retrieve Service Class Provider.

- Modality Performed Procedure Step (MPPS)

This component has been implemented to provide reception of information related to a performed procedure step from medical modalities or other systems that are acting as an SCU of the Modality Performed Procedure Step Service Class. Furthermore the MedoraCom PPS manager is able to forward the received information to a third system in order to fulfil the requirements to a PPS manager in terms of IHE.

- ARI Report SCP (MCARI)

MCARI provides access to reports maintained in Centricity RIS-i using DICOM protocols and messages. More specifically, it implements the private Virtua Codonics SOP Class as a SCP.

## **2.2 IMPLEMENTATION MODEL**

### **2.2.1 Application Data Flow Diagrams**

#### **2.2.1.1 Application Data Flow Diagram of MedoraCom Server**

The MCSRVS has been implemented to act as a Service Class Provider (SCP) of the DICOM Standard Basic Worklist Management Service Class and the Basic Study Content Notification SOP Class. In a client-server-environment, a DICOM SCP acts as a server. In the MedoraCom documents, therefore, MCSRVS may be also called MedoraCom Server. The MedoraCom Server supports one AE Title. The AE Title can be the same AE Title that other components of MedoraCom support, or another specialised AE Title.

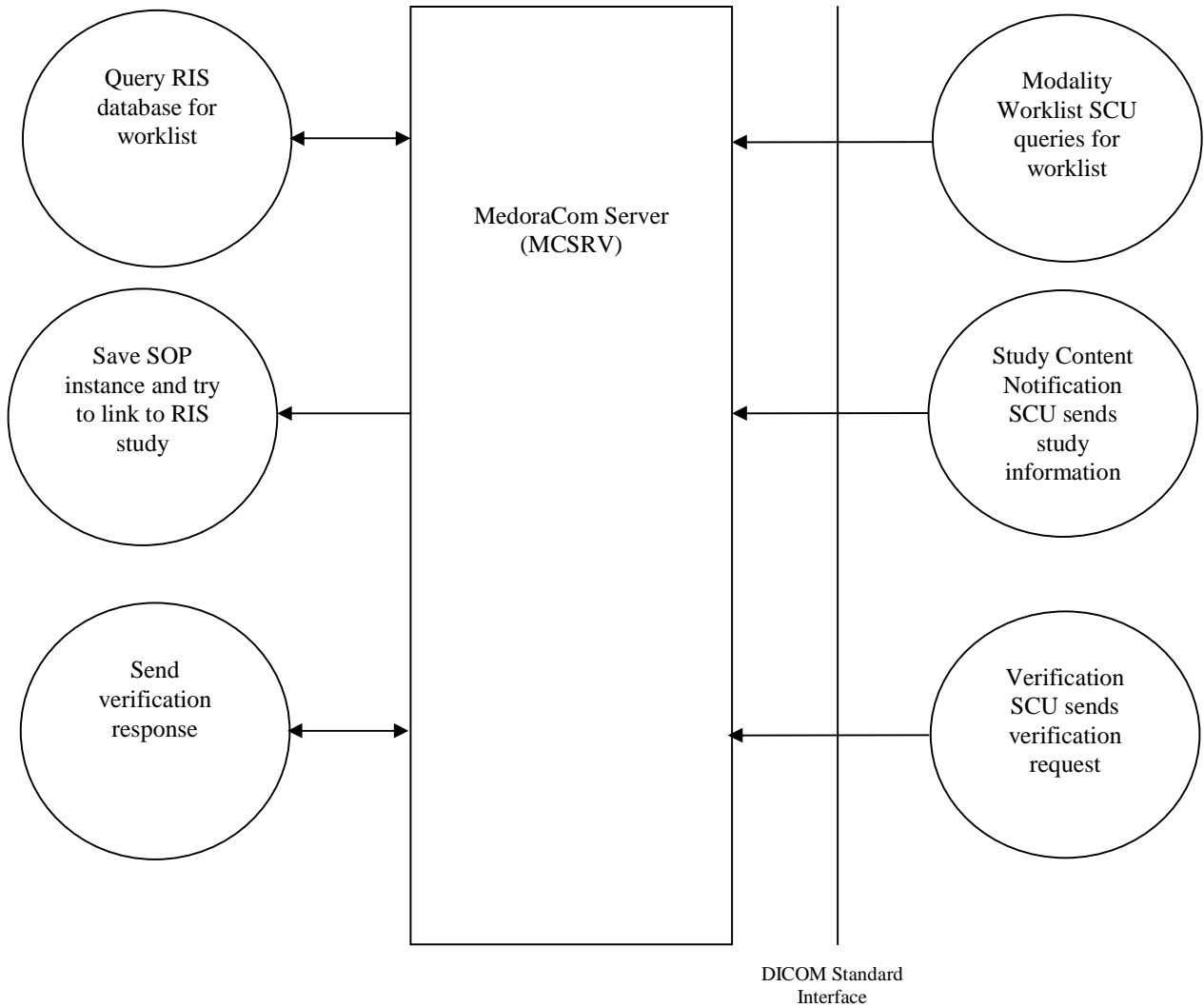
MedoraCom Server may be automatically started when the machine is booted or it may be started when the Centricity RIS-i server processes are launched what means that no user login is required.

A remote DICOM Application Entity initiates an association for DICOM Modality Worklist Service Class to MedoraCom. When MCSRVS accepts the association, the remote AE transmits the DICOM information objects within the worklist request to MCSRVS. Using these attributes MCSRVS queries the Centricity RIS-i database for worklist according to the matching keys given in the worklist request. Afterwards MCWLP transmits the worklist item(s) within the worklist response back to the remote DICOM node.

A remote DICOM Application Entity initiates an association for DICOM Study Content Notification to MedoraCom. When MCSRVS accepts the association, the remote AE transmits the study information to MCSRVS. If an SOP instance is successfully received on the association, MCSRVS saves the study information in the Centricity RIS-i database and tries to build a link between the received data and the corresponding study object in the RIS.

The network application model for the MedoraCom Server is shown in the following Illustration:

**ILLUSTRATION 2-1**  
MEDORACOM SERVER NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM



### 2.2.1.2 Application Data Flow Diagram of MedoraCom Image Query/Retrieve Services

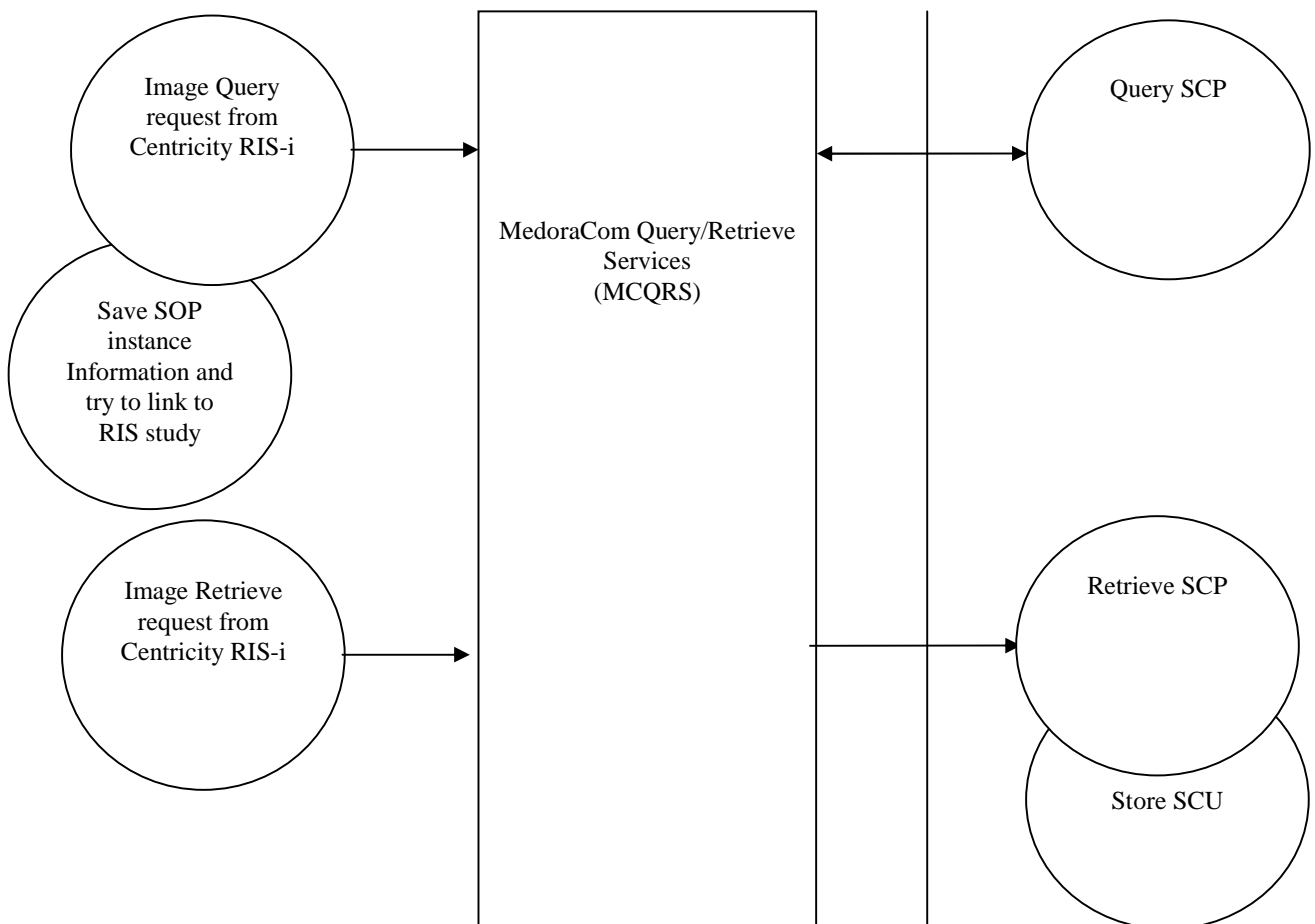
The Centricity RIS-i application provides a user interface for defining pre-fetching and auto-routing rules and initiating image retrieval on demand. The user-defined rules are stored in several tables of the RIS database. The detailed specification is already available within the Centricity RIS-i user manual.

Using the study, series and image information received either by the study content notification or by a query using C-FIND, the RIS is able to control the image workflow by supporting mechanisms to automatically auto-route and pre-fetch of images as well as transfer images on demand. Therefore the DIMSE service C-FIND is used to gain the study, series and image information and the C-MOVE is used to request sending the images to any other remote DICOM node known by the RIS.

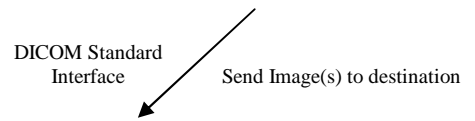
MCQRS initiates an association to a remote DICOM Application Entity (PACS or other IS). If the association is accepted by the remote AE, MCQRS sends either image query request or an image retrieve request based on one of the supported DICOM Retrieve Information Model (see later) by specifying the move destination.

**ILLUSTRATION 2-2**

MEDORACOM IMAGE QUERY/RETRIEVE SERVICES NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM







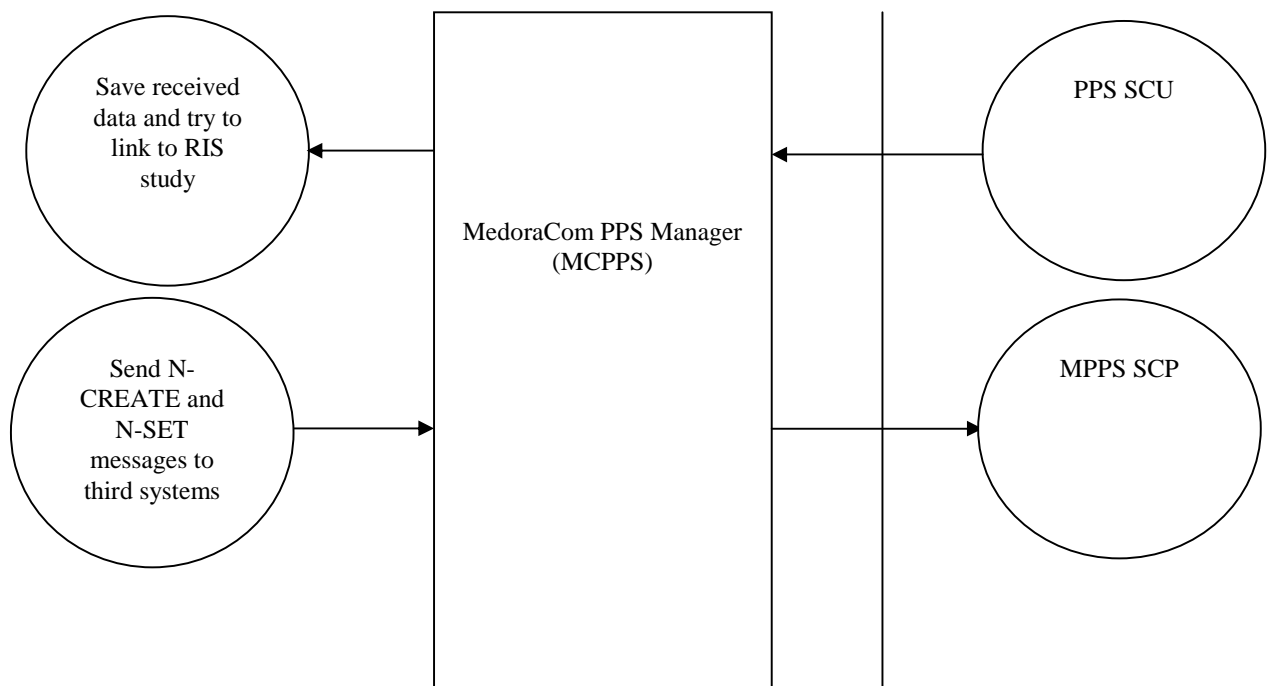
### 2.2.1.3 Application Data Flow Diagram of MedoraCom Modality Performed Procedure Step

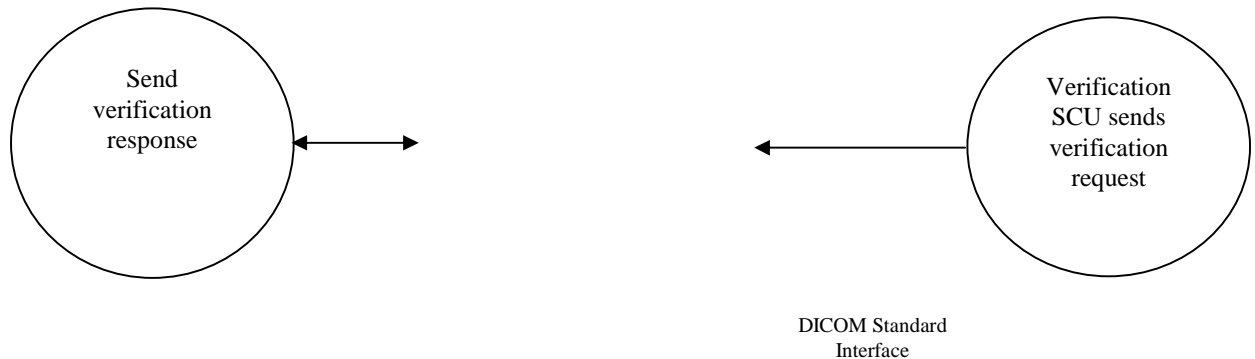
MCPPS implements a PPS Manager as defined in the IHE Year 2 Technical Framework, which has the limitation that the PPS Manager does not simultaneously forward received messages to a Report Manager and an Image Manager, as described in IHE Year 9 Technical Framework. It consists of two processes one provides a DICOM Modality Performed Procedure Step SCP listening on a TCP port waiting for DICOM associations requested by SCUs. If configured, this process tries to act also as an SCU in order to forward the received messages to a third system. The second process provides a DICOM Modality Performed Procedure Step SCU in order to send PPS messages to a third system in case the first attempt which is carried out by the PPS Manager process directly after reception has failed.

A remote DICOM Application Entity initiates an association for a DICOM Modality Performed Procedure Step Service Class.

When MCPPS accepts the association, the remote AE transmits the MPPS message to MCPPS. If configured MCPPS is acting as DICOM Modality Performed Procedure Step SCU sending the PPS messages to a third system. The received data is stored in the RIS database and if possible automatically assigned to a patient/procedure in Centricity RIS-i.

**ILLUSTRATION 2-3**  
MEDORACOM PPS MANAGER NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM





**2.2.1.4 Application Data Flow Diagram of Medoracom ARI Report SCP**

MedoraCom ARI Report SCP may be automatically started when the machine is booted or it may be started when the Centricity RIS-i server processes are launched what means that no user login is required.

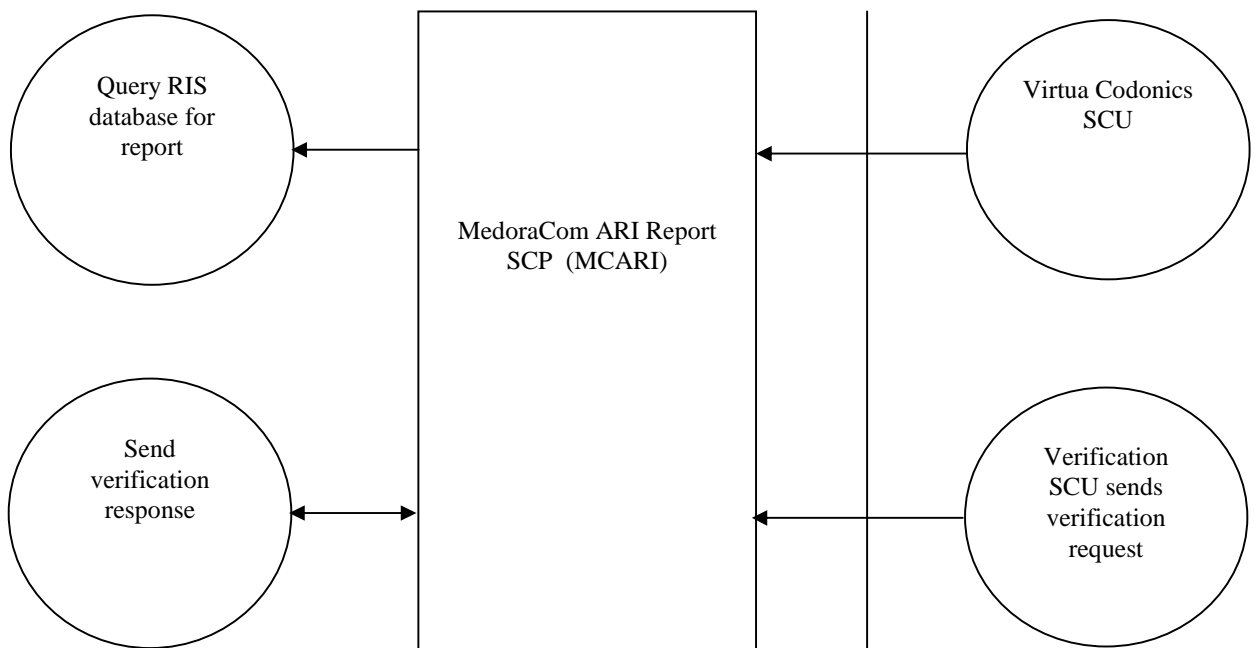
The component MCARI has been implemented to act as a Service Class Provider (SCP) of the private Virtua Codonics SOP Class.

The MedoraCom ARI Report SCP supports one AE Title. The AE Title can be the same AE Title that other components of MedoraCom support, or another specialised AE Title.

MCARI provides access to reports maintained in Centricity RIS-i using DICOM protocols and messages. More specifically, it implements the private Virtua Codonics SOP Class as a SCP.

A remote DICOM Application Entity initiates an association for the private Virtua Codonics SOP Class to MedoraCom. When MCARI accepts the association, the remote AE transmits study information objects within the find request to MCARI. Using these attributes MCARI queries the Centricity RIS-i database for reports to the matching attributes given in the find request. Afterwards MCARI transmits the report within the find response back to the remote DICOM node.

**ILLUSTRATION 2-4**  
**MEDORACOM ARI REPORT SCP NETWORK APPLICATION MODEL AND DATA FLOW DIAGRAM**



## **2.2.2 Functional Definition of AE's**

### **2.2.2.1 MCSRVAE**

After being started, MCSRVAE is always waiting for an association request from a remote DICOM application entity. MCSRVAE will accept an association with the supported SOP classes only for those remote DICOM applications, which are specified in the configuration of MedoraCom. This means that not all remote DICOM application entities are permitted for example to query a modality worklist from MedoraCom.

### **2.2.2.2 MCQRS AE**

MedoraCom Query/Retrieve Services may be automatically started when the machine is booted or it may be started when the Centricity RIS-i server processes are launched. Upon a service request coming from the Centricity RIS-i System, MCQRS is triggered to perform the DIMSE service operation.

Having been triggered, MCQRS initiates an association to the remote DICOM AE (PACS or other IS) which parameters are defined during the installation of MedoraCom. If there are more than one remote DICOM AEs to which the Centricity RIS-i System wants to communicate through MedoraCom, a concrete remote AE shall be specified with the trigger event. If the association is successfully accepted by the remote AE, MCQRS then performs the concrete job specified in the request.

### **2.2.2.3 MCPPS AE**

After being started, MCPPS is always waiting for an association request from a remote DICOM application entity. MCPPS will accept an association with the supported SOP class only for those remote DICOM applications, which are specified in the configuration of MedoraCom. This means that not all remote DICOM application entities are permitted to transmit PPS messages to MedoraCom.

In case of a successful N-CREATE and N-SET operation, MCPPS saves all UIDs identifying the received performed procedure step in the RIS and uses the Study Instance UID and the patient information for trying to build a link between the performed procedure step and a scheduled procedure step/study object in the RIS. The RIS may use these UIDs to move the images at a later time.

The SCP behaviour as a result of receiving the Performed Procedure Step information consists of storing the data assigned to the PPS SOP Instance in the RIS database. The PPS SOP Instance will remain in the RIS database – there is no deletion mechanism in place. After receiving a PPS SOP Instance with status COMPLETED or

DISCONTINUED the corresponding SPS is flagged as completed or discontinued respectively. In case that no PPS SOP Instance with status COMPLETED or DISCONTINUED will be received, the SPS remains in status IN PROGRESS within the RIS database.

#### **2.2.2.4 MCARI AE**

After being started, MCARI is always waiting for an association request from a remote DICOM application entity. MCARI will accept an association with the supported private Virtua Codonics SOP class only for those remote DICOM applications, which are specified in the configuration of MedoraCom. This means that not all remote DICOM application entities are permitted to query for a report from MedoraCom.

### **2.2.3 Sequencing of Real-World Activities**

#### **2.2.3.1 Basic Modality Worklist**

With the Centricity RIS-i application a radiological examination can be scheduled either by user interaction or by receiving the data by the HIS interface. Based on these actions a study object is created in the RIS and stored in the RIS database. Based on the configuration of the basic data “workplace” and “medical device” and the dependence between these data also a worklist item is created in the RIS database. In the configuration of the medical device also the DICOM application entity title of the remote modality worklist SCU has to be specified.

Note: Centricity RIS-i and MedoraCom support multiple scheduled AE titles per study object. Therefore a single RIS study object can be available as a worklist item in the responses of different modality worklist SCUs. This option may be very useful for scenarios in which the user is not able to decide on what imaging equipment the examination shall take place at the time the study is scheduled.

From the time on the patient is admitted the study will appear in every worklist message, which is transmitted if the given matching keys of a worklist request match the study parameters. After the status of the RIS study object has changed to completed, the study will be no longer included as an item in the worklist message.

#### **2.2.3.2 Basic Study Content Notification**

If MCSRV receives a valid Study Content Notification SOP instance, the related tables of the database will be updated to keep the track of the images archived in the client’s data. Using the information in the database tables, Centricity RIS-i users can retrieve these images at any later time.

#### **2.2.3.3 Image Query & Retrieve**

MedoraCom can be set up to perform a image query to a remote DICOM AE for getting study, series and image information similar to the DICOM study contents notification. MedoraCom can be configured to initiate a query after the RIS study status has been changed to

- Patient arrived
- Study started
- Study completed
- Report transcribed and

- Report approved.

MCQRS also performs image retrieve requests. In case of unsuccessful completion MedoraCom will retry the operation certain times or for a certain time depending on the configuration of MedoraCom.

#### **2.2.3.4 Modality Performed Procedure Step**

Normally the medical modality (MPPS SCU) indicates

- the beginning of the PPS by sending a N-CREATE message to the MPPS SCP
- the intermeditate of the PPS by sending a N-SET message with the status “IN PROGRESS”
- and the end of the PPS by sending a N-SET message with the status “DISCONTINUED” or “COMPLETED”

If MCPPS receives a valid Modality Performed Procedure Step SOP instance the information is stored into a structure of several database tables directly depicting the structure of the DICOM Modality Performed Procedure Step SOP Class and - if configured - forwarded to a third device. If possible the received MPPS SOP instance is assigned to a previously scheduled procedure step in the database of Centricity RIS-i.

#### **2.2.3.5 ARI Report SCP**

MCARI perform only a single attempt to query the RIS database for the report, if no report could be retrieved, for whatever reason, no retry will be performed.

## 2.3 AE SPECIFICATIONS

### 2.3.1 MCSRVAE Specification

MCSRVAE is one functional component of MedoraCom and supports the DICOM Basic Worklist Service Class and the DICOM Study Content Notification SOP Class. All operational parameters (such as AE titles, port numbers) can be accessed and changed by using the MedoraCom Monitor application.

The MCSRVAE Application Entity provides Standard Conformance to the following DICOM SOP Classes as a SCP:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Worklist Information Model - FIND	1.2.840.10008.5.1.4.31	No	Yes
Basic Study Content Notification	1.2.840.10008.1.9	No	Yes
Verification SOP Class	1.2.840.10008.1.1	No	Yes

Note: Basic Study Content Notification is retired from DICOM, but it is still supported from MCSRVAE.

#### 2.3.1.1 Association Establishment Policies

##### 2.3.1.1.1 General

MCSRVAE accepts associations for the purposes of Modality Worklist Management - query and the Study Content Notification - store. MCSRVAE accepts association requests from a remote DICOM AE only when it is registered in the configuration of MCSRVAE (including AE Title (mandatory), optional TCP Port Number and Network Address) but MCSRVAE does not initiate any association to a remote DICOM application entity.

The DICOM Application Context Name (ACN), which is always proposed, is:

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

The maximum length PDU receive size for the MCSRVAE is:

Maximum Length PDU	16kB (Configurable)
--------------------	---------------------

##### 2.3.1.1.2 Number of Associations

MCSRVAE does not support simultaneous association handling.

### 2.3.1.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

### 2.3.1.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

<b>Implementation UID</b>	<b>1.2.840.113619.6.95</b>
<b>Implementation Version Name</b>	<b>MDRCOM50</b>

### 2.3.1.2 Association Initiation Policy

MCSRVR does not initiate associations.

### 2.3.1.3 Association Acceptance Policy

MCSRVR accepts associations for the purposes of retrieving worklist information, saving study, series and image information. MCSRVR accepts an association request only from remote DICOM application entities, which are known in the configuration of MedoraCom. The default association acceptance parameter like timeout, ports etc. are configurable and are described in the installation and configuration manual.

#### 2.3.1.3.1 Real-World Activities

##### 2.3.1.3.1.1 Real-World Activity for Basic Modality Worklist

###### 2.3.1.3.1.1.1 Associated Real-World Activity

MCSRVR supports a client to query the modality worklist database of the Centricity RIS-i. The client is usually an imaging modality or a system, which is delegated by imaging modalities. Each worklist item (organised as a Scheduled Procedure Step defined in the DICOM Standard) represents a scheduled imaging examination for a particular patient. To achieve a minimum of user interaction for assignments of PACS study objects to RIS study objects within a complete RIS-PACS workflow, it is recommended that all returned key attributes will be encoded in the generated images. MCSRVR does not support multiple requested procedures per Imaging Service Request and multiple scheduled procedure steps per requested procedure.

###### 2.3.1.3.1.1.2 Accepted Presentation Context Table

<b>Presentation Context Table - Accepted by AE MCSRVR for Activity Query RIS database for worklist</b>			
<b>Abstract Syntax</b>	<b>Transfer Syntax</b>	<b>Role</b>	<b>Extended</b>

Name	UID	Name List	UID List		Negotiation
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		

### 2.3.1.3.1.1.2.1 SOP Specific DICOM Conformance Statement to the Modality Worklist Information Model - FIND SOP Class

The MCSRVR provides matching against Modality Worklist query keys listed in the following table.

The MCSRVR supports case-insensitive matching for the attributes of Value Representation PN in the following table.

The MCSRVR does support C-FIND cancel requests from SCU equipment.

Description/Module	Tag	Matching Key Type	Remark/Matching Type
<b>Scheduled Procedure Step</b>			
Scheduled Procedure Step Sequence	(0040,0100)	R	The Attributes of the Scheduled Procedure Step shall only be retrieved with Sequence Matching. The Scheduled Procedure Step Sequence shall contain only a single Item.
>Scheduled Station AE Title	(0040,0001)	R	The attribute Scheduled Station AE Title shall be retrieved with Single Value Matching or Universal Matching.
>Scheduled Procedure Step Start Date	(0040,0002)	R	Scheduled Step Start Date shall be retrieved with Single Value Matching, Range Matching or Universal Matching. See remark under Scheduled Procedure Step Start Time (0040,0003)
>Scheduled Procedure Step Start Time	(0040,0003)	R	Scheduled Step Start Time shall be retrieved with Single Value Matching, Range Matching or Universal Matching. Scheduled Step Start Date and Scheduled Step Start Time are subject to Range Matching. If both keys are specified for Range Matching, e.g. the date range "20101016-20101019" and the time range "100000-141800" specifies the time period starting on 16-OCT-2010 10:00:00 until 19-OCT-2010 14:18:00.
>Modality	(0008,0060)	R	The attribute Modality shall be retrieved with Single Value Matching, Universal Matching or Wildcard Matching. Using Wildcard Matching allows only to use * as



			a Wildcard.
>Scheduled Station Name	(0040,0010)	O	The attribute Scheduled Station Name shall be retrieved with Single Value Matching or Universal Matching.
>Scheduled Procedure Step Location	(0040,0011)	O	The attribute Scheduled Procedure Step Location shall be retrieved with Single Value Matching, Universal Matching or Wildcard Matching. Using Wildcard Matching allows only to use * as a Wildcard.
>Scheduled Performing Physician's Name	(0040,0006)	R	The attribute Scheduled Performing Physician's Name shall be retrieved with Single Value Matching, Universal Matching or Wildcard Matching. Using Wildcard Matching allows only to use * as a Wildcard.
<b>Patient Identification</b>			
Patient's Name	(0010,0010)	R	Patient's Name shall be retrieved with Single Value Matching, Wild Card Matching or Universal Matching. Using Wildcard Matching allows only to use * as a Wildcard. Patient's Name requires a ^ as separator, e.g "Doe^John" or "Do*^Jane"
Patient ID	(0010,0020)	R	Patient ID shall be retrieved with Single Value Matching, Wildcard Matching or Universal Matching. Using Wildcard Matching allows only to use * as a Wildcard.
<b>Imaging Service Request</b>			
Accession Number	(0008,0050)	O	Accession Number shall be retrieved with Single Value Matching, Wildcard Matching or Universal Matching. Using Wildcard Matching allows only to use * as a Wildcard.
<b>Patient Demographic</b>			
Patients Birth Date	(0010,0030)	O	Patients Birth Date shall be retrieved with Single Value Matching or Universal Matching.
Patient Sex	(0010,0040)	O	Patient Sex shall be retrieved with Single Value Matching or Universal Matching.

The MCSRVS supports the Return Key Attributes listed in the following table.

The return value of the attribute Specific Character Set (0008,0005) is configurable in MedoraCom and described more in detail in the installation and configuration manual of MedoraCom.

MCSRVR returns return keys of Type 2 as empty if no data is available in RIS.

Description/Module	Tag	Return Key Type	Remark
<b>SOP Common</b>			
Specific Character Set	(0008,0005)	1C	
<b>Scheduled Procedure Step</b>			
Scheduled Procedure Step Sequence	(0040,0100)	1	
>Scheduled Station AE Title	(0040,0001)	1	
>Scheduled Procedure Step Start Date	(0040,0002)	1	
>Scheduled Procedure Step Start Time	(0040,0003)	1	
>Modality	(0008,0060)	1	
>Scheduled Performing Physician's Name	(0040,0006)	2	
>Scheduled Procedure Step Description	(0040,0007)	1C	
>Scheduled Protocol Code Sequence	(0040,0008)	2	
>>Code Value	(0008,0100)	1C	
>>Coding Scheme Designator	(0008,0102)	1C	
>>Code Meaning	(0008,0104)	3	
>Scheduled Station Name	(0040,0010)	2	
>Scheduled Procedure Step Location	(0040,0011)	2	
>Pre-Medication	(0040,0012)	2C	
>Scheduled Procedure Step ID	(0040,0009)	1	
>Requested Contrast Agent	(0032,1070)	2C	
>Comments on the Scheduled Procedure Step	(0040,0400)	3	
Referenced Study Sequence	(0008,1110)	2	
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	The attribute Referenced SOP Instance UID has the same value as Study Instance UID (0020,000D).
<b>Requested Procedure</b>			
Requested Procedure ID	(0040,1001)	1	
Requested Procedure Code Sequence	(0032,1064)	1C	
>Code Value	(0008,0100)	1C	
>Coding Scheme Designator	(0008,0102)	1C	
>Code Meaning	(0008,0104)	3	

Requested Procedure Description	(0032,1060)	1C	
Study Instance UID	(0020,000D)	1	The following DICOM Root UID is used to generate Study Instance UIDs: <b>1.2.840.113619.6.95.31.0.3.4.1</b>
Requested Procedure Priority	(0040,1003)	2	
Patient Transport Arrangements	(0040,1004)	2	
<b>Imaging Service Request</b>			
Accession Number	(0008,0050)	2	
Requesting Physician	(0032,1032)	2	
Referring Physician's Name	(0008,0090)	2	
Placer Order Number / Imaging Service Request	(0040,2016)	3	
Referring Physician's Name	(0008,0090)	2	
<b>Visit Identification</b>			
Admission ID	(0038,0010)	2	
<b>Visit Status</b>			
Current Patient Location	(0038,0300)	2	
<b>Visit Relationship</b>			
Referenced Patient Sequence	(0008,1120)	2	
>Referenced SOP Class UID	(0008,1150)	1C	
>Referenced SOP Instance UID	(0008,1155)	1C	
<b>Patient Identification</b>			
Patient's Name	(0010,0010)	1	
Patient ID	(0010,0020)	1	
<b>Patient Demographic</b>			
Patients Birth Date	(0010,0030)	2	
Patient's Sex	(0010,0040)	2	
Patient's Weight	(0010,1030)	2	
Confidentiality constraint on patient data	(0040,3001)	2	
<b>Patient Medical</b>			
Patient State	(0038,0500)	2	
Pregnancy Status	(0010,21C0)	2	
Medical Alerts	(0010,2000)	2	
Contrast Allergies	(0010,2110)	2	
Special Needs	(0038,0050)	2	

Note: MCSRVR does not support the return keys Issuer of Patient ID (0010,0021) and Other Patient IDs Sequence (0010,1002).

Following are the status codes the Application may send back to the SCU Equipment while performing the requested **Modality Worklist Query**:

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700	Refused: Out of resources	Indicates that the mechanism to query the RIS database for worklist failed. Recovery from this condition is left to the administrator of MedoraCom.	None
	A900	Error: Identifier does not match SOP Class	Indicates wrong keys within the request identifiers. This indicates a problem with SCU of the Service Class	None
	C000	Error: Unable to process	Indicates that the mechanism to query the RIS database for worklist failed. Recovery from this condition is left to the administrator of MedoraCom.	None
Cancel	FE00	Matching terminated due to cancel	Matching terminated due to cancel request from the SCU.	None
Success	0000	Matching is complete - No final identifier is supplied	Query RIS database for worklist was successfully completed and worklist was provided to the SCU.	None
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	None
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	Indicates unsupported keys within the request identifiers.	None

#### 2.3.1.3.1.1.3 Presentation Context Acceptance Criterion

MCSRVR will always accept a Presentation Context for the Modality Worklist SOP Class with the DICOM Default Transfer Syntax.

MCSRVR will accept any number of presentation context specified in section 2.3.1.3.1.1.2 above. MCSRVR will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCSRVR. The policy of making this choice is described in the next section.

#### 2.3.1.3.1.1.4 Transfer Syntax Selection Policy

MCSRVR selects the transfer syntax to accept for the worklist query with the following general rules: First of all, it prefers a transfer syntax, which provides the explicit VR representation. After the VR choice has been made, the MCSRVR will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected.

### 2.3.1.3.1.2 Real-World Activity for Basic Study Content Notification

#### 2.3.1.3.1.2.1 Associated Real-World Activity

The associated Real-World Activity is to notify the RIS on the content of an imaging study.

#### 2.3.1.3.1.2.2 Accepted Presentation Context Table

Presentation Context Table - Accepted by AE MCSRVR for Activity Save SOP instance and try to link to RIS study					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Basic Study Content Notification	1.2.840.10008.1.9	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		

#### 2.3.1.3.1.2.2.1 SOP Specific DICOM Conformance Statement to the Basic Study Content Notification

MCSRVR provides the Standard Conformance to the DICOM Study Content Notification Service Class.

In the event of a successful C-STORE operation, MCSRVR saves all UIDs identifying the notified imaging study in the RIS and uses the Study Instance UID and the patient information for trying to build a link between the study and a study object in the RIS. The RIS may use these UIDs to move the images at a later time.

In order to facilitate to link the notified imaging study appropriately to a study object in the RIS, this implementation of MCSRVR prefers that the remote DICOM application should submit a Basic Study Content Notification IOD instance with some extension, which is listed in the next chapter. In general, MCSRVR can handle any additional attributes included in the SOP instance. **Those attributes not listed in section 2.3.1.3.1.2.2.2 below will be simply ignored.**

The SCP behaviour as a result of receiving the Study Content Notification information consists of storing study, series and image identification data in the RIS database to provide the ability studies, series and/or images to be retrieved by the RIS. Therefore the SCP support the 2C attribute Retrieve AE title (0008,0054).

Following are the status codes the Application may send back to the SCU Equipment while performing the requested **C-STORE**:

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	A700	Refused: Out of resources	Indicates that there was not enough disk space to store the information included in the SOP instance. Recovery from this condition is left to the administrator of MedoraCom.	None
	A800	Refused: SOP Class not supported	Indicates that the SOP Class of the instance dataset in the C-STORE operation did not match the Abstract Syntax negotiated for the Presentation Context. This indicates a problem with the SCU of the Service Class.	None
	A900	Error: Identifier does not match SOP Class	Indicates that the Data Set does not encode an instance of the SOP Class specified. This indicates a problem with SCU of the Service Class.	None
	C000	Error: Unable to process	Indicates that the mechanism to query the RIS database for worklist failed. Recovery from this condition to the administrator of MedoraCom.	None
Success	0000	Complete Study Content exists on RIS.	Indicates that the Data Set cannot be parsed into elements by MCSRV. This indicates a problem with the SCU.	None

#### 2.3.1.3.1.2.2.2 Extensions of the Basic Study Content Notification IOD

Additional to the attributes, which are defined for Basic Study Content Notification SOP Class in DICOM, MCSRV supports the following extended data attributes in DICOM Standard Extended Basic Study Content Notification IOD instances:

Description/Module	Tag
<b>SOP Common</b>	
Specific Character Set	(0008,0005)
<b>Patient Level</b>	
Patient's Sex	(0010,0040)
Patient's Birth Date	(0010,0030)
<b>Study Level</b>	
Accession Number	(0008,0050)
Study Date	(0008,0020)
Study Time	(0008,0030)
Study Description	(0008,1030)
<b>Series Level</b>	
Modality	(0008,0060)
Series Date	(0008,0021)
Series Time	(0008,0031)

Series Description	(0008,103E)
--------------------	-------------

MCSRVR will make use of these additional data attributes to facilitate the link between the notified imaging study and a study object in the RIS.

**2.3.1.3.1.2.3 Presentation Context Acceptance Criterion**

MCSRVR will always accept a Presentation Context for the Study Content Notification SOP Class with the DICOM Default Transfer Syntax.

MCSRVR will accept any number of presentation contexts specified in section 2.3.1.3.1.2.2 above. MCSRVR will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCSRVR. The policy of making this choice is described in the next section.

**2.3.1.3.1.2.4 Transfer Syntax Selection Policy**

MCSRVR selects the transfer syntax to accept for the receiving study information or retrieving a diagnostic report with the following general rules: First of all, it prefers a transfer syntax, which provides the explicit VR representation. After the VR choice has been made, the MCSRVR will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected.

**2.3.1.3.1.3 Real-World Activity for Verification**

**2.3.1.3.1.3.1 Associated Real-World Activity**

MCSRVR allows another DICOM application to verify whether a DICOM association can be established between MCSRVR and the application.

**2.3.1.3.1.3.2 Accepted Presentation Context Table**

Presentation Context Table - Accepted by AE MCSRVR for Activity Send verification response					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
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		

**2.3.1.3.1.3.2.1 SOP Specific DICOM Conformance Statement to the Verification SOP Class**

MCSRVR provides standard conformance.

**2.3.1.3.1.3.3 Presentation Context Acceptance Criterion**

MCSRVR will always accept a Presentation Context for Verification SOP Class with the DICOM Default Transfer Syntax.

MCSRVR will accept any number of presentation contexts specified in sections 2.3.1.3.1.3.2 above. MCSRVR will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCSRVR. The policy of making this choice is described in the next section.

**2.3.1.3.1.3.4 Transfer Syntax Selection Policy**

MCSRVR selects the transfer syntax to accept for the verification with the following general rules: First of all, it prefers a transfer syntax, which provides the explicit VR representation. After the VR choice has been made, the MCSRVR will select Transfer Syntaxes according to the following priority (highest priority first):

- 4. Explicit VR Little Endian
- 5. Explicit VR Big Endian
- 6. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected.

**2.3.2 MCQRS AE Specification**

MedoraCom Query/Retrieve Services may be automatically started when the machine is booted or it may be started when the Centricity RIS-i server processes are launched. Upon a service request coming from the Centricity RIS-i System, MCQRS is triggered to perform the DIMSE service operation.

Having been triggered, MCQRS initiates an association to the remote DICOM AE (PACS or other IS) which parameters are defined during the installation of MedoraCom. If there are more than one remote DICOM AEs to which the Centricity RIS-i System wants to communicate through MedoraCom, a concrete remote AE shall be specified with the trigger event. If the association is successfully accepted by the remote AE, MCQRS then performs the concrete job specified in the request.

SOP Class Name	SOP Class UID	SCU	SCP
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No

Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No
--	-----------------------------	-----	----

### 2.3.2.1 Association Establishment Policies

#### 2.3.2.1.1 General

MCQRS will attempt to establish an association whenever a request is coming from the Centricity RIS-i System with all valid parameters, including the AE title, TCP port number, host name or network address. It will only attempt to establish associations if it determines that the request / retrieve parameters are valid with respect to this Conformance Statement.

The DICOM Application Context Name (ACN), which is always proposed, is:

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
---------------------------------	------------------------------

The maximum length PDU receive size for the MCSRV is:

<b>Maximum Length PDU</b>	<b>16kB (Configurable)</b>
---------------------------	----------------------------

#### 2.3.2.1.2 Number of Associations

MedoraCom keeps at most four instances of MCQRS running - one for querying a remote AE, one for image auto-routing, one for image pre-fetching and one for image transfer on demand - simultaneously. If a new request comes when such an association is still in process, the new request is queued and will be processed later.

#### 2.3.2.1.3 Asynchronous Nature

Asynchronous mode is not supported. All operations will be performed synchronously.

#### 2.3.2.1.4 Implementation Identifying Information

The Implementation UID for this DICOM Implementation is:

<b>Implementation UID</b>	<b>1.2.840.113619.6.95</b>
<b>Implementation Version Name</b>	<b>MDRCOM50</b>

**2.3.2.2 Association Initiation Policy**

MedoraCom Query/Retrieve Services (MCQRS) attempt to initiate a new association each time it is requested by the internal event management of Centricity RIS-i. The default association initiation parameter like timeout, ports etc. are configurable and are described more in detail in the installation and configuration manual of MedoraCom.

**2.3.2.2.1 Real-World Activities**

**2.3.2.2.1.1 Real-World Activity for Query Request (C-FIND)**

**2.3.2.2.1.1.1 Associated Real-World Activity**

The associated Real-World Activity is to gain study, series and/or image information from remote using DIMSE-C-FIND applications. If the information is successfully received, MCQRS saves the study information in the Centricity RIS-i database and tries to build a link between the received study to the corresponding study object in the RIS.

**2.3.2.2.1.1.2 Proposed Presentation Context Table**

<b>Presentation Context Table – Proposed by AE MCQRS for Activity Image Query Request from Centricity RIS-i</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCU	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1		
		Explicit VR Big Endian	1.2.840.10008.1.2.2		

**2.3.2.2.1.1.2.1 SOP Specific DICOM Conformance Statement for Study Root Query/Retrieve Information Model - FIND SOP Class**

The MCQRS includes matching keys in the queries as listed in the following table.

MCQRS does not generate C-FIND CANCEL requests.

<b>Key</b>	<b>Tag</b>	<b>Level</b>	<b>Matching Key</b>	<b>Return Key</b>	<b>Matching Type</b>
Study Instance UID	(0020,000D)	STUDY	Yes	Yes	Single Value
Study ID	(0020,0010)	STUDY	Yes	Yes	Single Value

Study Date	(0008,0020)	STUDY	No	Yes	Universal
Accession Number	(0008,0050)	STUDY	Yes	Yes	Single Value
Series Instance UID	(0020,000E)	SERIES	Yes	Yes	Single Value
Series Number	(0020,0011)	SERIES	No	Yes	Universal
Modality	(0008,0060)	SERIES	No	Yes	Universal
Instance Number	(0020,0013)	IMAGE	No	Yes	Universal
Overlay Number	(0020,0022)	IMAGE	No	Yes	Universal
Curve Number	(0020,0024)	IMAGE	No	Yes	Universal
Lookup Table Number	(0020,0026)	IMAGE	No	Yes	Universal
SOP Instance UID	(0008,0018)	IMAGE	No	Yes	Universal

Following are the status codes that are more specifically processed when receiving messages from a **Query** SCP equipment :

<b>Service Status</b>	<b>Status Code</b>	<b>Further Meaning</b>	<b>Application Behavior When Receiving Status Code</b>
Failure	XXXX	Any error received from the Query SCP.	In any case of an error, the MCQRS tries to re-initiate the current query if no more new query jobs are present in the internal processing queue. How many retries shall be performed is configurable. The configuration is described more in detail in the configuration and installation manual of MedoraCom.
Success	0000	Matching is complete - No final	The MCQRS destructs association to the Query

		identifier is supplied	SCP.
Pending	FF00	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys.	The MCQRS continues receiving further matches from the Query SCP.
	FF01	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this Identifier	The MCQRS continues receiving further matches from Query SCP.

**2.3.2.2.1.2 Real-World Activity for Retrieve Request (C-MOVE)**

**2.3.2.2.1.2.1 Associated Real-World Activity**

The associated Real-World Activity is the attempt to perform the service operation DIMSE-C-MOVE issued by MedoraCom. If MCQRS successfully establishes an association to a remote AE, it will request it to move images to the specified destination.

MedoraCom will be informed about the move results.

**2.3.2.2.1.2.2 Proposed Presentation Context Table**

<b>Presentation Context Table – Proposed by AE MCQRS for Activity Image Retrieve Request from Centricity RIS-i</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCU	None

**2.3.2.2.1.2.3 SOP Specific DICOM Conformance Statement for the Study Root Query/Retrieve Information Model - MOVE SOP Class**

In general the Destination Move AE Title is configurable within Centricity RIS-I but the destination cannot be Centricity RIS-i itself, for more information please refer to the installation and configuration manual.

MCQRS does not generate C-MOVE CANCEL requests.

Following are the status codes that are more specifically processed when receiving messages from a **Retrieve** SCP equipment :

<b>Service Status</b>	<b>Status Code</b>	<b>Further Meaning</b>	<b>Application Behavior When Receiving Status Code</b>
Failure	XXXX	Any error received from the Retrieve SCP.	In any case of an error, the MCQRS tries to re-initiate the current move job if no more new move jobs are present in the internal processing queue. How many retries shall be performed is configurable. The configuration is described more in detail in the configuration and installation manual of MedoraCom.
Success	0000	Sub-operations Complete - No Failure.	The MCQRS destructs association to the Retrieve SCP.
Pending	FF00	Sub-operations are continuing -	The MCQRS continues receiving further status updates from Move SCP

**2.3.3 MCPPS AE Specification**

The MCPPS Application Entity provides Standard Conformance to the following DICOM SOP Classes as a **SCU** and/or **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
Modality Performed Procedure Step	1.2.840.10008.3.1.2.3.3	Yes	Yes
Verification SOP Class	1.2.840.10008.1.1	No	Yes

**2.3.3.1 Association Establishment Policies**

**2.3.3.1.1 General**

MCPPS accepts associations for the purposes of Modality Performed Procedure Step SOP Class. MCPPS accepts association requests from a remote DICOM AE only when it is registered in the configuration of MCPPS (including AE Title (mandatory), optional TCP Port Number and Network Address).

If configured, MCPPS also will attempt to establish an association to the configured peer SCP whenever a wellformed – according to the DICOM standard - N-CREATE or N-SET message is received from the PPS Manager SCP.

The DICOM Application Context Name (ACN), which is always proposed, is:

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
---------------------------------	------------------------------

The maximum length PDU receive size for the MCQRS is:

<b>Maximum Length PDU</b>	<b>16kB (Configurable)</b>
---------------------------	----------------------------

**2.3.3.1.2 Number of Associations**

MCPPS does not support simultaneous association handling.

**2.3.3.1.3 Asynchronous Nature**

Asynchronous mode is not supported. All operations will be performed synchronously.

**2.3.3.1.4 Implementation Identifying Information**

The Implementation UID for this DICOM Implementation is:

<b>Implementation UID</b>	<b>1.2.840.113619.6.95</b>
<b>Implementation Version Name</b>	<b>MDRCOM50</b>

### 2.3.3.2 Association Initiation Policy

MCPPS attempts to initiate a new association to a peer PPS SCP each time it receives a wellformed – according to the DICOM standard - N-CREATE/N-SET message. The default association initiation parameter like timeout, ports etc. are configurable and are described more in detail in the installation and configuration manual of MedoraCom.

#### 2.3.3.2.1 Real-World Activity for Modality Performed Procedure Step SCU

##### 2.3.3.2.1.1 Associated Real-World Activity

If MCPPS (SCP) receives a valid Modality Performed Procedure Step SOP instance MCPPS (SCU) forwards the information - if configured - to a third device.

##### 2.3.3.2.1.2 Proposed Presentation Context Table

Presentation Context Table - Proposed by AE MCPPS for Activity Send N-CREATE and N-SET messages to third systems					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	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		

##### 2.3.3.2.1.2.1 SOP Specific DICOM Conformance Statement for Modality Performed Procedure Step SOP Class

MCPPS provides the Standard Conformance to the DICOM Modality Performed Procedure Step Service Class as an SCU. MCPPS does not provide extended negotiation. The SCU behaviour as a result of receiving the Performed Procedure Step information (by MCPPS SCP) consists of forwarding the data to a third device.

MCPPS SCU forwards N-SET messages event if the prior attempt of sending of the corresponding N-CREATE message was not successful.

The MCPPS SCU includes attributes in the Modality Performed Procedure Step N-CREATE as described below.

Description/Module	Tag	Type N-CREATE
<b>SOP Common Module</b>		
SOP Class UID	(0008,0016)	3
SOP Instance UID	(0008,0018)	3
Specific Character Set	(0008,0005)	1C (Required if an extended or replacement character set is used)
Instance Creation Date	(0008,0012)	3
Instance Creation Time	(0008,0013)	3



Instance Creator UID	(0008,0014)	3
<b>Performed Procedure Step Relationship Module</b>		
Patient's Name	(0010,0010)	3
Patient ID	(0010,0020)	3
Patient's Birth Date	(0010,0030)	3
Patient's Sex	(0010,0040)	3
Referenced Patient Sequence	(0008,1120)	3
>Referenced SOP Class UID	(0008,1150)	1C
>Referenced SOP Instance UID	(0008,1155)	1C
Scheduled Step Attribute Sequence	(0040,0270)	1
>Study Instance UID	(0020,000D)	1
>Referenced Study Sequence	(0008,1110)	3
>>Referenced SOP Class UID	(0008,1150)	1C
>>Referenced SOP Instance UID	(0008,1155)	1C
>Accession Number	(0008,0050)	3
>Placer Order Number/ Imaging Service Request	(0040,2006)	3
>Filler Order Number/ Imaging Service Request	(0040,2007)	3
>Requested Procedure ID	(0040,1001)	3
>Requested Procedure Description	(0032,1060)	3
>Placer Order Number/ Procedure	(0040,1006)	3
>Filler Order Number/ Procedure	(0040,1007)	3
>Scheduled Procedure Step ID	(0040,0009)	3
>Scheduled Procedure Step Description	(0040,0007)	3
>Scheduled Protocol Code Sequence	(0040,0008)	3
>>Code Value	(0008,0100)	1C
>>Coding Scheme designator	(0008,0102)	1C
>>Code Meaning	(0008,0104)	3
<b>Performed Procedure Step Information</b>		
Performed Procedure Step ID	(0040,0253)	1
Performed Station AE Title	(0040,0241)	1
Performed Station Name	(0040,0242)	3

Performed Location	(0040,0243)	3
Performed Procedure Step Start Date	(0040,0244)	1
Performed Procedure Step Start Time	(0040,0245)	1
Performed Procedure Step Status	(0040,0252)	1
Performed ProcedureStep Description	(0040,0254)	3
Performed Procedure Type Description	(0040,0255)	3
Procedure Code Sequence	(0008,1032)	3
>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)
>Code Meaning	(0008,0104)	3
Performed Procedure Step End Date	(0040,0250)	3
Performed Procedure Step End Time	(0040,0251)	3
Comments on the Performed Procedure Step	(0040,0280)	3
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3
>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)
>Code Meaning	(0008,0104)	3
<b>Image Acquisition Results</b>		
Modality	(0008,0060)	1
Study ID	(0020,0010)	3
Performed Protocol Code Sequence	(0040,0260)	3
>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)
>Code Meaning	(0008,0104)	3
Performed Series Sequence	(0040,0340)	3
>Performing Physician's Name	(0008,1050)	3
>Performing Physician Identification Sequence	(0008,1052)	3
>>Person Identification Code Sequence	(0040,1101)	1
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)

>>>Code Meaning	(0008,0104)	3
>>Person's Address	(0040,1102)	3
>>Person's Telephone Numbers	(0040,1103)	3
>>Institution Name	(0008,0080)	1C
>>Institution Address	(0008,0081)	3
>>Institution Code Sequence	(0008,0082)	1C
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)
>>>Code Meaning	(0008,0104)	3
>Protocol Name	(0018,1030)	1C (Required if Sequence Item is present)
>Operator's Name	(0008,1070)	3
>Operator Identification Sequence	(0008,1072)	3
>>Person Identification Code Sequence	(0040,1101)	1
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)
>>>Code Meaning	(0008,0104)	3
>>Person's Address	(0040,1102)	3
>>Person's Telephone Numbers	(0040,1103)	3
>>Institution Name	(0008,0080)	1C (Required if Sequence Item is present)
>>Institution Address	(0008,0081)	3
>>Institution Code Sequence	(0008,0082)	1C
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)
>>>Code Meaning	(0008,0104)	3
>Series Instance UID	(0020,000E)	1C (Required if Sequence Item is present)
>Series Description	(0008,103E)	3
>Retrieve AE Title	(0008,0054)	3
>Referenced Image Sequence	(0008,1140)	3
>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	3
>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)
>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)
>All other attributes from Performed Series Sequence		3
All other attributes from Radiation Dose		3

Module and Billing and Material Code Module		
---	--	--

Following are the status codes that are more specifically processed when receiving messages from a PPS SCP equipment while processing N-CREATE :

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	XXXX	Any error received from the remote MPPS SCP.	In case of any error received from the third system, the PPS information objects are queued and the PPS-Manager SCU attempts later to forward the information. This is repeated until the data could be forwarded successfully or the system administrator deletes the PPS object from the queue.
Success	0000	Forwarding and processing of PPS was successful.	The MCPSS destructs association to the remote MPPS SCP.

The MCPSS SCU includes attributes in the Modality Performed Procedure Step N-SET as described below.

Description/Module	Tag	Type N-SET	Requirement Type Final State
<b>SOP Common Module</b>			
SOP Class UID	(0008,0016)	3	
SOP Instance UID	(0008,0018)	3	
Specific Character Set	(0008,0005)	3	
Instance Creation Date	(0008,0012)	3	
Instance Creation Time	(0008,0013)	3	
Instance Creator UID	(0008,0014)	3	
<b>Performed Procedure Step Information</b>			
Performed Procedure Step Status	(0040,0252)	3	
Performed ProcedureStep Description	(0040,0254)	3	
Performed Procedure Type Description	(0040,0255)	3	
Procedure Code Sequence	(0008,1032)	3	
>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>Code Meaning	(0008,0104)	3	

Performed Procedure Step End Date	(0040,0250)	3	1
Performed Procedure Step End Time	(0040,0251)	3	1
Comments on the Performed Procedure Step	(0040,0280)	3	
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3	
>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>Code Meaning	(0008,0104)	3	
<b>Image Acquisition Results</b>			
Performed Protocol Code Sequence	(0040,0260)	3	
>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	3	1
>Performing Physician's Name	(0008,1050)	3	2
>Performing Physician Identification Sequence	(0008,1052)	3	
>>Person Identification Code Sequence	(0040,1101)	1	
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>>>Code Meaning	(0008,0104)	3	
>>Person's Address	(0040,1102)	3	
>>Person's Telephone Numbers	(0040,1103)	3	
>>Institution Name	(0008,0080)	1C	
>>Institution Address	(0008,0081)	3	
>>Institution Code Sequence	(0008,0082)	1C	
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>>>Code Meaning	(0008,0104)	3	

>Protocol Name	(0018,1030)	1C (Required if Sequence Item is present)	1
>Operator's Name	(0008,1070)	3	2
>Operator Identification Sequence	(0008,1072)	3	
>>Person Identification Code Sequence	(0040,1101)	1	
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>>>Code Meaning	(0008,0104)	3	
>>Person's Address	(0040,1102)	3	
>>Person's Telephone Numbers	(0040,1103)	3	
>>Institution Name	(0008,0080)	1C	
>>Institution Address	(0008,0081)	3	
>>Institution Code Sequence	(0008,0082)	1C	
>>>Code Value	(0008,0100)	1C (Required if Sequence Item is present)	
>>>Coding Scheme Designator	(0008,0102)	1C (Required if Sequence Item is present)	
>>>Code Meaning	(0008,0104)	3	
>Series Instance UID	(0020,000E)	1C (Required if Sequence Item is present)	1
>Series Description	(0008,103E)	3	2
>Retrieve AE Title	(0008,0054)	3	2
>Referenced Image Sequence	(0008,1140)	3	See F.7.2.2.2. (DICOM Standard)
>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)	
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	3	See F.7.2.2.2. (DICOM Standard)
>>Referenced SOP Class UID	(0008,1150)	1C (Required if Sequence Item is present)	
>>Referenced SOP Instance UID	(0008,1155)	1C (Required if Sequence Item is present)	
>All other attributes from Performed Series Sequence		3	
All other attributes from Radiation Dose Module and Billing and Material Code		3	

Module			
--------	--	--	--

Following are the status codes that are more specifically processed when receiving messages from a PPS SCP equipment while processing N-SET :

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	XXXX	Any error received from the remote MPPS SCP.	In case of any error received from the third system, the PPS information objects are queued and the PPS-Manager SCU attempts later to forward the information. This is repeated until the data could be forwarded successfully or the system administrator deletes the PPS object from the queue.
Success	0000	Forwarding and processing of PPS was successful.	The MCPPS destructs association to the remote MPPS SCP.

### 2.3.3.3 Association Acceptance Policy

MCPPS accepts associations for the purposes of receiving modality performed procedure step information. MCPPS accepts an association request only from remote DICOM application entities, which are known in the configuration of MedoraCom. The default association acceptance parameter like timeout, ports etc. are configurable and are described more in detail in the installation and configuration manual of MedoraCom.

#### 2.3.3.3.1 Real-World Activities

##### 2.3.3.3.1.1 Real-World Activity for Modality Performed Procedure Step SCP

###### 2.3.3.3.1.1.1 Associated Real-World Activity

After an imaging modality has started the performance of a Procedure Step it should inform the IS by sending an N-CREATE service request to MCPPS (SCP). At the end of the Performed Procedure Step the imaging modality shall send a N-SET command with all other mandatory attributes to MCPPS (SCP).

If MCPPS (SCP) receives a valid Modality Performed Procedure Step SOP instance the information is stored into a structure of several database tables directly depicting the structure of the DICOM Modality Performed Procedure Step SOP Class. If possible the received MPPS SOP instance is assigned to a previously scheduled procedure step in the database of Centricity RIS-i.

###### 2.3.3.3.1.1.2 Accepted Presentation Context Table

<b>Presentation Context Table - Accepted by AE MCPPS for Activity Save received data and try to link to RIS study</b>
---

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Modality Performed Procedure Step SOP Class	1.2.840.10008.3.1.2.3.3	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		

### 2.3.3.3.1.1.2.1 SOP Specific DICOM Conformance Statement for Modality Performed Procedure Step SOP Class

Standard Extended Elements which may be added by third system are ignored.

Note: MCPSS SCP and MCPSS SCU do not support the return keys Issuer of Patient ID (0010,0021).

The MCPSS SCP includes attributes in the Modality Performed Procedure Step N-CREATE as described below.

Description/Module	Tag	Type N-CREATE
<b>SOP Common Module</b>		
SOP Class UID	(0008,0016)	3
SOP Instance UID	(0008,0018)	3
Specific Character Set	(0008,0005)	1C (Required if an extended or replacement character set is used)
Instance Creation Date	(0008,0012)	3
Instance Creation Time	(0008,0013)	3
Instance Creator UID	(0008,0014)	3
<b>Performed Procedure Step Relationship Module</b>		
Patient's Name	(0010,0010)	3 <sup>1</sup>
Patient ID	(0010,0020)	3 <sup>1</sup>
Patient's Birth Date	(0010,0030)	3 <sup>1</sup>
Patient's Sex	(0010,0040)	3 <sup>1</sup>
Referenced Patient Sequence	(0008,1120)	3
>Referenced SOP Class UID	(0008,1150)	1C
>Referenced SOP Instance UID	(0008,1155)	1C
Scheduled Step Attribute Sequence	(0040,0270)	1

<sup>1</sup> The original attribute type defined in the DICOM Standard is 2/2 or 2C/2. The PPS Manager SCP handles these attributes like type 3 attributes in case some tags are missing. **However** the PPS Manager SCU forwards the message as it was received by the SCP, what means that the PPS Manager does not add any information that is missing. In other words, those attributes accepted in later N-SET messages, even if they were not provided by prior N-CREATE messages.



>Study Instance UID	(0020,000D)	1
>Referenced Study Sequence	(0008,1110)	3 <sup>1</sup>
>>Referenced SOP Class UID	(0008,1150)	1C
>>Referenced SOP Instance UID	(0008,1155)	1C
>Accession Number	(0008,0050)	3 <sup>1</sup>
>Placer Order Number/ Imaging Service Request	(0040,2006)	3
>Filler Order Number/ Imaging Service Request	(0040,2007)	3
>Requested Procedure ID	(0040,1001)	3 <sup>1</sup>
>Requested Procedure Description	(0032,1060)	3 <sup>1</sup>
>Placer Order Number/ Procedure	(0040,1006)	3
>Filler Order Number/ Procedure	(0040,1007)	3
>Scheduled Procedure Step ID	(0040,0009)	3 <sup>1</sup>
>Scheduled Procedure Step Description	(0040,0007)	3 <sup>1</sup>
>Scheduled Protocol Code Sequence	(0040,0008)	3 <sup>1</sup>
>>Code Value	(0008,0100)	1C
>>Coding Scheme designator	(0008,0102)	1C
>>Code Meaning	(0008,0104)	3
<b>Performed Procedure Step Information</b>		
Performed Procedure Step ID	(0040,0253)	1
Performed Station AE Title	(0040,0241)	1
Performed Station Name	(0040,0242)	3 <sup>1</sup>
Performed Location	(0040,0243)	3 <sup>1</sup>
Performed Procedure Step Start Date	(0040,0244)	1
Performed Procedure Step Start Time	(0040,0245)	1
Performed Procedure Step Status	(0040,0252)	1
Performed ProcedureStep Description	(0040,0254)	3 <sup>1</sup>
Performed Procedure Type Description	(0040,0255)	3 <sup>1</sup>
Procedure Code Sequence	(0008,1032)	3 <sup>1</sup>

>Code Value	(0008,0100)	1
>Coding Scheme Designator	(0008,0102)	1
>Code Meaning	(0008,0104)	3
Performed Procedure Step End Date	(0040,0250)	3 <sup>1</sup>
Performed Procedure Step End Time	(0040,0251)	3 <sup>1</sup>
Comments on the Performed Procedure Step	(0040,0280)	3
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3
>Code Value	(0008,0100)	1
>Coding Scheme Designator	(0008,0102)	1
>Code Meaning	(0008,0104)	3
<b>Image Acquisition Results</b>		
Modality	(0008,0060)	1
Study ID	(0020,0010)	3 <sup>1</sup>
Performed Protocol Code Sequence	(0040,0260)	3 <sup>1</sup>
>Code Value	(0008,0100)	1
>Coding Scheme Designator	(0008,0102)	1
>Code Meaning	(0008,0104)	3
Performed Series Sequence	(0040,0340)	3 <sup>1</sup>
>Performing Physician's Name	(0008,1050)	3 <sup>1</sup>
>Performing Physician Identification Sequence	(0008,1052)	3
>>Person Identification Code Sequence	(0040,1101)	1
>>>Code Value	(0008,0100)	1
>>>Coding Scheme Designator	(0008,0102)	1
>>>Code Meaning	(0008,0104)	3
>>Person's Address	(0040,1102)	3
>>Person's Telephone Numbers	(0040,1103)	3
>>Institution Name	(0008,0080)	1
>>Institution Address	(0008,0081)	3
>>Institution Code Sequence	(0008,0082)	1
>>>Code Value	(0008,0100)	1
>>>Coding Scheme Designator	(0008,0102)	1
>>>Code Meaning	(0008,0104)	3

>Protocol Name	(0018,1030)	1
>Operator's Name	(0008,1070)	3 <sup>1</sup>
>Operator Identification Sequence	(0008,1072)	3
>>Person Identification Code Sequence	(0040,1101)	1
>>>Code Value	(0008,0100)	1
>>>Coding Scheme Designator	(0008,0102)	1
>>>Code Meaning	(0008,0104)	3
>>Person's Address	(0040,1102)	3
>>Person's Telephone Numbers	(0040,1103)	3
>>Institution Name	(0008,0080)	1
>>Institution Address	(0008,0081)	3
>>Institution Code Sequence	(0008,0082)	1
>>>Code Value	(0008,0100)	1
>>>Coding Scheme Designator	(0008,0102)	1
>>>Code Meaning	(0008,0104)	3
>Series Instance UID	(0020,000E)	1
>Series Description	(0008,103E)	3 <sup>1</sup>
>Retrieve AE Title	(0008,0054)	3 <sup>1</sup>
>Referenced Image Sequence	(0008,1140)	3 <sup>1</sup>
>>Referenced SOP Class UID	(0008,1150)	1
>>Referenced SOP Instance UID	(0008,1155)	1
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	3 <sup>1</sup>
>>Referenced SOP Class UID	(0008,1150)	1
>>Referenced SOP Instance UID	(0008,1155)	1
>All other attributes from Performed Series Sequence		3
All other attributes from Radiation Dose Module and Billing and Material Code Module		3

Following are the status codes the Application may send back to the SCU Equipment while processing N-CREATE:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	0111	Duplicate SOP Instance	The new managed SOP Value supplied by the invoking DIMSE-service-user was already registered for a managed SOP Instance of the specified SOP Class.

	0106	Invalid attribute value	The value of DICOM Tag Performed Procedure Step Status (0040,0252) is not "IN PROGRESS"
	0120	Missing attribute	A required Attribute was missing (Type 1 and 2).
	0121	Missing attribute value	A required Attribute Value was empty (Type 1).
	0105	No such attributes	A <b>MPPS Attribute</b> was included in the message, which is <b>not defined for N-CREATE messages</b> within Table F.7.2-1 of the DICOM Standard.
	0110	Processing failure	A general failure in processing the operation was encountered.
	0211	Unrecognized operation	Any other error during parsing message was encountered.
Success	0000		Receiving and processing of PPS was successful.

The requirement for the final state is that which applies at the time that the Performed Procedure Step Status (0040,0252) is N-SET to a value of COMPLETED or DISCONTINUED, as described in F.7.2.2.2 (DICOM Standard). It is only described if it is different from the SCP requirement for the N-CREATE.

The MCPSS SCP includes attributes in the Modality Performed Procedure Step N-SET as described below.

Description/Module	Tag	Type N-SET	Requirement Type Final State
<b>SOP Common Module</b>			
SOP Class UID	(0008,0016)	3	
SOP Instance UID	(0008,0018)	3	
Specific Character Set	(0008,0005)	3	
Instance Creation Date	(0008,0012)	3	
Instance Creation Time	(0008,0013)	3	
Instance Creator UID	(0008,0014)	3	
<b>Performed Procedure Step Information</b>			
Performed Procedure Step Status	(0040,0252)	1	
Performed ProcedureStep Description	(0040,0254)	2	
Performed Procedure Type Description	(0040,0255)	2	
Procedure Code Sequence	(0008,1032)	2	
>Code Value	(0008,0100)	1	
>Coding Scheme Designator	(0008,0102)	1	

>Code Meaning	(0008,0104)	3	
Performed Procedure Step End Date	(0040,0250)	1	1
Performed Procedure Step End Time	(0040,0251)	1	1
Comments on the Performed Procedure Step	(0040,0280)	3	
Performed Procedure Step Discontinuation Reason Code Sequence	(0040,0281)	3	
>Code Value	(0008,0100)	1	
>Coding Scheme Designator	(0008,0102)	1	
>Code Meaning	(0008,0104)	3	
<b>Image Acquisition Results</b>			
Performed Protocol Code Sequence	(0040,0260)	2	
>Code Value	(0008,0100)	1	
>Coding Scheme Designator	(0008,0102)	1	
>Code Meaning	(0008,0104)	3	
Performed Series Sequence	(0040,0340)	1	1 <sup>2</sup>
>Performing Physician's Name	(0008,1050)	3 <sup>1</sup>	2
>Performing Physician Identification Sequence	(0008,1052)	3	
>>Person Identification Code Sequence	(0040,1101)	1	
>>>Code Value	(0008,0100)	1	
>>>Coding Scheme Designator	(0008,0102)	1	
>>>Code Meaning	(0008,0104)	3	
>>Person's Address	(0040,1102)	3	
>>Person's Telephone Numbers	(0040,1103)	3	
>>Institution Name	(0008,0080)	1	
>>Institution Address	(0008,0081)	3	
>>Institution Code Sequence	(0008,0082)	1	
>>>Code Value	(0008,0100)	1	
>>>Coding Scheme Designator	(0008,0102)	1	

<sup>2</sup> The Performed Series Sequence (0040,0340) may not be empty (zero length) at the time that the Performed Procedure Step Status (0040,0252) is N-SET to a value of COMPLETED or DISCONTINUED. In other words a Series must exist for every Performed Procedure Step, though it may contain no Images or Standalone objects, if none were created, as described in F.7.2.2.2. (DICOM Standard).

>>>Code Meaning	(0008,0104)	3	
>Protocol Name	(0018,1030)	1	1
>Operator's Name	(0008,1070)	3 <sup>1</sup>	2
>Operator Identification Sequence	(0008,1072)	3	
>>Person Identification Code Sequence	(0040,1101)	1	
>>>Code Value	(0008,0100)	1	
>>>Coding Scheme Designator	(0008,0102)	1	
>>>Code Meaning	(0008,0104)	3	
>>Person's Address	(0040,1102)	3	
>>Person's Telephone Numbers	(0040,1103)	3	
>>Institution Name	(0008,0080)	1	
>>Institution Address	(0008,0081)	3	
>>Institution Code Sequence	(0008,0082)	1	
>>>Code Value	(0008,0100)	1	
>>>Coding Scheme Designator	(0008,0102)	1	
>>>Code Meaning	(0008,0104)	3	
>Series Instance UID	(0020,000E)	1	1
>Series Description	(0008,103E)	3 <sup>1</sup>	2
>Retrieve AE Title	(0008,0054)	3 <sup>1</sup>	2
>Referenced Image Sequence	(0008,1140)	3 <sup>1</sup>	See F.7.2.2.2. (DICOM Standard)
>>Referenced SOP Class UID	(0008,1150)	1	
>>Referenced SOP Instance UID	(0008,1155)	1	
>Referenced Non-Image Composite SOP Instance Sequence	(0040,0220)	3 <sup>1</sup>	See F.7.2.2.2. (DICOM Standard)
>>Referenced SOP Class UID	(0008,1150)	1	
>>Referenced SOP Instance UID	(0008,1155)	1	
>All other attributes from Performed Series Sequence		3	
All other attributes from Radiation Dose Module and Billing and Material Code Module		3	

Following are the status codes the Application may send back to the SCU Equipment while processing N-SET:

Service Status	Status Code	Further Meaning	Application Behavior When Receiving Status Code
Failure	0106	Invalid attribute value	The value of DICOM Tag Performed Procedure Step Status (0040,0252) is not "IN PROGRESS",

		“COMPLETED” or “DISCONTINUED”.
0120	Missing Attribute	A required Attribute was missing (Type 1 and 2).
0121	Missing attribute value	A required Attribute Value was empty (Type 1).
0105	No such attributes	A MPPS Attribute was included in the message, which is not defined for N-SET messages within Table F.7.2-1 of the DICOM Standard.
0112	No such SOP Instance	The SOP Instance was not recognized.
0110	Processing failure	A general failure in processing the operation was encountered.
0211	Unrecognized operation	Any other error during parsing message was encountered.
Success	0000	Receiving and processing of PPS was successful.

#### 2.3.3.3.1.1.3 Presentation Context Acceptance Criterion

MCPPS (SCP) will always accept a Presentation Context for the Modality Performed Procedure SOP Class with the DICOM Default Transfer Syntax.

MCPPS (SCP) will accept any number of presentation contexts specified in section 2.3.1.3.1.2.2 above. MCPPS will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCPPS. The policy of making this choice is described in the next section.

#### 2.3.3.3.1.1.4 Transfer Syntax Selection Policy

MCPPS (SCP) selects the transfer syntax to accept for receiving a Performed Procedure Step with the following general rules: First of all, it prefers a transfer syntax which provides the explicit VR representation. After the VR choice has been made, MCPPS (SCP) will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected.

**2.3.3.3.1.2 Real-World Activity for Verification**

**2.3.3.3.1.2.1 Associated Real-World Activity**

MCPPS allows another DICOM application to verify whether a DICOM association can be established between MCPPS and the application.

**2.3.3.3.1.2.2 Accepted Presentation Context Table**

<b>Presentation Context Table - Accepted by AE MCPPS for Activity Send verification response</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
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		

**2.3.3.3.1.2.2.1 SOP Specific DICOM Conformance Statement to the Verification SOP Class**

MCPPS provides standard conformance.

**2.3.3.3.1.2.3 Presentation Context Acceptance Criterion**

MCPPS will always accept a Presentation Context for Verification SOP Class with the DICOM Default Transfer Syntax.

MCPPS will accept any number of presentation contexts specified in section 2.3.3.3.1.2.2 above.. MCPPS will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCPPS. The policy of making this choice is described in the next section.

**2.3.3.3.1.2.4 Transfer Syntax Selection Policy**

MCPPS selects the transfer syntax to accept for the verification with the following general rules: First of all, it prefers a transfer syntax, which provides the explicit VR representation. After the VR choice has been made, the MCPPS will select Transfer Syntaxes according to the following priority (highest priority first):

1. .Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected.



**2.3.4 MCARI AE Specification**

MCARI is one functional component of MedoraCom and supports the private Virtua Codonics SOP Class. All operational parameter (such as AE Title, port numbers etc.) can be accessed and changed by using the MedoraCom Monitor application.

The MCARI Application Entity provides Standard Conformance to the following DICOM SOP Classes as a **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
Virtua Codonics Report Management - FIND	1.2.840.113532.3500.8	No	Yes
Verification SOP Class	1.2.840.10008.1.1	No	Yes

**2.3.4.1 Association Establishment Policies**

**2.3.4.1.1 General**

MCARI accepts associations for the purpose Virtua Codonics Report Management query. MCARI accepts association requests from a remote DICOM AE only when it is registered in the configuration of MCARI (including AE Title (mandatory), optional TCP Port Number and Network Address) but MCARI does not initiate any association to a remote DICOM application entity.

The DICOM Application Context Name (ACN), which is always proposed, is:

<b>Application Context Name</b>	<b>1.2.840.10008.3.1.1.1</b>
---------------------------------	------------------------------

The maximum length PDU receive size for the MCARI is:

<b>Maximum Length PDU</b>	<b>16kB (Configurable)</b>
---------------------------	----------------------------

**2.3.4.1.2 Number of Associations**

MCARI does not support simultaneous association handling.

**2.3.4.1.3 Asynchronous Nature**

MCARI will not perform asynchronous operations.

**2.3.4.1.4 Implementation Identifying Information**

The Implementation UID for this DICOM Implementation is:

<b>Implementation UID</b>	<b>1.2.840.113619.6.95</b>
<b>Implementation Version Name</b>	<b>MDRCOM50</b>

**2.3.4.2 Association Initiation Policy**

MCARI does not initiate associations.

**2.3.4.3 Association Acceptance Policy**

MCARI accepts associations for the purpose of retrieving and providing reports. MCARI accepts an association request only from remote DICOM application entities, which are known in the configuration of MedoraCom.

**2.3.4.3.1 Real-World Activities**

**2.3.4.3.1.1 Real-World Activity for ARI Report SCP**

**2.3.4.3.1.1.1 Associated Real-World Activity**

MCARI supports a client to query for a report within the Centricity RIS-i database. The client is usually a Virtua Media Disc Publisher or any other system that supports the private Virtua Codonics Report Management SOP Class.

**2.3.4.3.1.1.2 Accepted Presentation Context Table**

<b>Presentation Context Table - Accepted by AE MCARI for Activity Query RIS database for report</b>					
<b>Abstract Syntax</b>		<b>Transfer Syntax</b>		<b>Role</b>	<b>Extended Negotiation</b>
<b>Name</b>	<b>UID</b>	<b>Name List</b>	<b>UID List</b>		
Virtua Codonics Report Management - FIND	1.2.840.113532.3500.8	Implicit VR Little Endian Explicit VR Little Endian Explicit VR Big Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1 1.2.840.10008.1.2.2	SCP	None

**2.3.4.3.1.1.2.1 SOP Specific Conformance Statement to the Virtua Codonics Report Management - FIND SOP Class**

MCARI supports the attributes listed in the following tables for matching and returning respectively.

MCARI does not support the attribute Specific Character Set (0008,0005) as matching key. The return value for this attribute is configurable in MedoraCom.

The MCARI does support C-FIND cancel requests from Virtua Codonics SCU equipment.

Description/Module	Tag	Matching Key Type	Remark/Matching Type
<b>Study Level</b>			
Accession Number	(0008,0050)	R	The Attributes of the Accession Number shall only be retrieved with Single Value Matching.
<b>Patient Identification</b>			
Patient ID	(0010,0020)	R	The Attributes of the Patient ID shall only be retrieved with Single Value Matching.

The MCARI supports the Return Key Attributes listed in the following table.

The return value of the attribute Specific Character Set (0008,0005) is configurable in MedoraCom and described more in detail in the installation and configuration manual of MedoraCom.

Description/Module	Tag	Return Key Type
<b>SOP Common</b>		
Specific Character Set	(0008,0005)	1
<b>Study Information</b>		
Study Date	(0008,0020)	2
Accession Number	(0008,0050)	1
Query Retrieve Level	(0008,0052)	1
Referring Physicians Name	(0008,0090)	2
Study Description	(0008,1030)	2
Study Instance UID	(0020,000D)	1
Reason for Study	(0032,1030)	2
Requested Procedure Description	(0032,1060)	2
<b>Patient Identification</b>		
Patient's Name	(0010,0010)	1
Patient ID	(0010,0020)	1
<b>Patient Demographic</b>		
Patients Birth Date	(0010,0030)	2
<b>Report Information</b>		
Interpretation Recorder	(4008,0102)	2
Interpretation Text	(4008,010B)	2
Interpretation Author	(4008,010C)	2
Interpretation Diagnosis Description	(4008,0115)	1

Interpretation ID	(4008,0200)	1
Interpretation Type ID	(4008, 0210)	1
Impressions	(4008, 0300)	2

**NOTE:** Please note that the group 4008 is retired in DICOM Standard, but is still supported by the MCARI AE.

Following are the status codes the Application may send back to the Virtua Codonics SCU Equipment while performing the requested **Report Query**:

Service Status	Status Code	Further Meaning	Status Code Explanation	Related Fields Sent Back to the SCU
Failure	C000	Error: Unable to process	Indicates that requested report is not present.	None
Success	0000	Matching is complete - No final identifier is supplied	Query RIS database for worklist was successfully completed and worklist was provided to the SCU.	None

#### 2.3.4.3.1.1.3 Presentation Context Acceptance Criterion

MCARI will always accept a Presentation Context for the Virtua Codonics Report Management SOP Class with the DICOM Default Transfer Syntax.

MCARI will accept any number of presentation context specified in section 2.3.4.3.1.1.2 above. MCARI will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCARI. The policy of making this choice is described in the next section.

#### 2.3.4.3.1.1.4 Transfer Syntax Selection Policy

MCARI selects the transfer syntax to accept for retrieving a report with the following general rules: First of all, it prefers a transfer syntax, which provides the explicit VR representation. After the VR choice has been made, the MCARI will select Transfer Syntaxes according to the following priority (highest priority first):

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected

#### 2.3.4.3.1.2 Real-World Activity for Verification

##### 2.3.4.3.1.2.1 Associated Real-World Activity

MCARI allows other DICOM application to verify whether a DICOM association can be established between MCARI and the application.

### 2.3.4.3.1.2.2 Accepted Presentation Context Table

For verification MCARI will accept the presentation contexts shown in the following table.

Presentation Context Table - Accepted by AE MCARI for Activity Query RIS database for report					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
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		

#### 2.3.4.3.1.2.2.1 SOP Specific Conformance Statement to the Verification SOP Class

MCARI provides standard conformance.

#### 2.3.4.3.1.2.3 Presentation context Acceptance Criterion

MCARI will always accept a Presentation Context for the Verification SOP Class with the DICOM Default Transfer Syntax.

MCARI will accept any number of presentation contexts specified in section 2.3.4.3.1.2.2 above. MCARI will examine proposed Presentation contexts in the order proposed. For the presentation contexts of the same abstract syntax but different transfer syntaxes, only one of these presentation contexts will be accepted with the most preferred transfer syntax chosen by MCARI. The policy of making this choice is described in the next section.

#### 2.3.4.3.1.2.4 Transfer Syntax Selection Policy

MCARI selects the transfer syntax to accept for verification with the following general rules: First of all, it prefers a transfer syntax, which provides the explicit VR representation. After the VR choice has been made, MCARI tries to select the transfer syntax using following preference in descending order:

1. Explicit VR Little Endian
2. Explicit VR Big Endian
3. Implicit VR Little Endian

Different Transfer Syntaxes will not be selected.

## 2.4 COMMUNICATION PROFILES

### 2.4.1 Supported Communication Stacks

The DICOM Upper Layer Protocol is supported using TCP/IP, as specified in DICOM PS3.8.

The TCP/IP stack is inherited from the base Operating System.

### 2.4.2 Physical Media Support

MedoraCom is indifferent to the physical medium over which TCP/IP executes. Support for the physical network medium is provided by the underlying base operating system.

### 2.4.3 Additional Protocols

DHCP support is not provided, all RIS-I servers shall be assigned static IP addresses.

### 2.4.4 IPv4 and IPv6 Support

This product supports IPv4.

## 2.5 EXTENSIONS / SPECIALIZATIONS/ PRIVATIZATIONS

### 2.5.1 MedoraCom ARI Report SCP

MedoraCom ARI Report SCP supports the private Virtua Codonics Report Management – FIND SOP Class.

The MCARI Application Entity provides Standard Conformance to the following DICOM SOP Classes as a **SCP**:

SOP Class Name	SOP Class UID	SCU	SCP
Virtua Codonics Report Management - FIND	1.2.840.113532.3500.8	No	Yes
Verification SOP Class	1.2.840.10008.1.1	No	Yes

Please refer to section 2.3.4 above for detailed description of MCARI.

## 2.6 CONFIGURATION

### 2.6.1 AE Title/Presentation Address Mapping

#### 2.6.1.1 Configurable Parameters

The following fields are configurable for the AEs: MCSRV, MCPPS SCP and MCARI (local):

- Local AE Title
- Local Listening Port Number

The following fields are configurable for the AEs: MCQRS and MCPPS SCU (local):

- Local AE Title
- Remote Port Number
- Remote IP Address

The following fields are configurable for every remote DICOM AE:

- Remote AE Title
- Remote IP Address
- Listening TCP/IP Port Number

The following fields are configurable:

- Association Establishment Timer
- Maximum Length PDU

**Note:** All configurations must be performed by a GE Field Engineer.

## 2.7 SUPPORT OF EXTENDED CHARACTER SETS

MedoraCom supports the ISO-IR 100 character set in addition to the default character repertoire.

As a SCP the product will accept SOP Instances with any value of Specific Character Set (0008,0005). As a SCU, it will similarly accept response items with any value of Specific Character Set. However, it will display in the user interface only characters specified within ISO\_IR 6 (ASCII) or the configured extended character set.

## 2.8 CODES AND CONTROLLED TERMINOLOGY

All code sequences in the MWL response are configurable for the specific institution. The user is able to add and change these values using the Centricity RIS-i application. Thus the value for Coding Scheme Designator (0008,0102) is always 'L'.

## 2.9 SECURITY PROFILES

The product does not conform to any defined DICOM Security Profiles.

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

1. Firewall or router protections to ensure that only approved external hosts have network access to the product.
2. Firewall or router protections to ensure that the product only has network access to approved external hosts and services.
3. Any communications with external hosts and services outside the locally secured environment use appropriate secure network channels (such as a Virtual Private Network (VPN))

## **GE Healthcare**

### ***Corporate Headquarters***

*GE Healthcare  
540 West Northwest Highway  
Barrington, IL 60010 USA  
Tel: +1 847 277-5000  
Fax: +1 847 277-5240*

### ***Authorized European Representative***

*GE Medical Systems SCS  
283 rue de la Minière  
78530 BUC, France*

### ***Asia Headquarters***

*GE Healthcare  
1 BLD-3F  
No.1 Hua Tuo Road,  
Zhang Jiang Hi-Tech Park  
Shanghai 201203 China  
Tel: 8621-38777888  
Fax: 8621-38777499*

***gehealthcare.com***



**GE imagination at work**