

# **CODONICS**

***Virtua*** Medical Disc Publisher

*Powered by...*

**DICOM<sup>®</sup> Connectivity Framework**



**LAUREL BRIDGE**

Providing DICOM Connectivity for the Medical Community

**DICOM Conformance Statement**

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# CODONICS VIRTUA MDP — DICOM 3.0 CONFORMANCE STATEMENT

## 0. INTRODUCTION

The Codonics Virtua Medical Disc Publisher (MDP) supports storage of medical images and other instances via the DICOM 3.0 protocol, and recording of these same entities to optical disc using the DICOM Connectivity Framework (DCF) software. The DCF software is a modular software component system used for storage, processing, printing or otherwise communicating medical image data, in this case, primarily for the purpose of media exchange.

### 0.1 Scope and Intended Audience

Conformance of the Virtua MDP to the DICOM 3.0 Standard is discussed in this document. It specifies the Service Classes, Information Objects, and Communication Protocols supported by the implementation. This statement is intended to aid the system integrator in connecting the Codonics Virtua to other components which make use of the DICOM 3.0 Standard for inter-network communication and media exchange. The reader of this document should be familiar with the DICOM 3.0 Standard, the components being interconnected, and other references listed in Section 0.3 and Section 8 of this document.

### 0.2 Laurel Bridge Software DCF Storage Server (SCP) and File Set Creator (FSC)

The Laurel Bridge Software DCF Storage Server is a software function of the Codonics Virtua product. It typically interfaces a modality or other device on a TCP/IP network with the Codonics Virtua via the DCF Storage Server (SCP) software, allowing the Virtua to accept medical images and related data from the modality or other device—a DICOM Storage Client (SCU)—for the purpose of recording to an optical disc(s). This conformance statement represents the functionality of Codonics' DCF-based system.

Because the DCF is highly configurable, the OEM conformance claim for a particular realization of the DCF should not be construed to completely represent the functions or limitations of the complete DCF software package. *Once customized, the OEM conformance claim only applies to the specific OEM implementation described within, in this case, that of the Codonics Virtua products.*

For further information on the complete DCF package, one should contact Laurel Bridge Software, Inc., 409 White Clay Center Drive, Newark, DE 19711, Telephone: 302-453-0222, <http://www.laurelbridge.com>. Under the terms of the DCF Software License Agreement, this notice is required to be present in all DICOM conformance claims covering the DCF software functionality.

### 0.3 References

ACR-NEMA DICOM 3.0 Standard, Parts 1 through 14 (PS 3.1–PS 3.14); ©2004.

See Section 8 of this document for additional reference information.

### 0.4 Important Considerations for the Reader

There is no concept in DICOM of a singular “monolithic” compliance with the Standard. The DICOM Conformance Statement, is a document whose organization and content are mandated by the Standard (PS 3.2-2004, Annex A through F) and which allows users to communicate how they comply with the Standard in their implementations. The presence of specific DICOM functionality in a Conformance Statement is not sufficient to guarantee inter-operability between components. When evaluating network inter-operability between the DCF and some other DICOM component, the following should be considered:

- The DCF Conformance Claim is an appropriate starting point for ascertaining whether the DCF software can communicate with a particular component on a protocol level.
- The only way to know for certain whether the DCF can inter-operate with other DICOM components is to perform a connectivity test. This test must be completed before a field installation can occur. The OEM normally does such testing in cooperation with the suppliers of other DICOM components.
- The DCF Conformance Claim represents a best effort at documenting the DICOM functionality of commercial versions of the Codonics Virtua, but is not a functional specification of any DCF component or product. Laurel Bridge Software reserves the right to make changes at any time to the functionality of DCF components described herein. Both Laurel Bridge Software and Codonics are committed to following the evolution of the DICOM Standard with either modifications or additions to the Codonics Virtua's DICOM functionality provided by the DCF.

Note: The section numbering in this document is fixed and conforms to the numbering scheme prescribed in DICOM PS 3.2-1999, Annex A and Annex B.

### 0.5 Revision History

Revision	Date	Author	Description of Changes
0.90	6 February 2006	Rich Edwards	Adapted from the DCF Conformance Statement Template as first pre-release version.

## 0.6 Symbols, Abbreviations and Definitions

**Abstract Syntax:** A DICOM term which is identical to a DICOM SOP Class; it identifies a set of SOPs which, when taken together, represent a logical grouping. An Abstract Syntax identifies one SOP Class or Meta SOP Class.

**ACR:** American College of Radiology.

**Annotation Box:** A DICOM name for annotation text printed on the film or other media.

**ANSI:** American National Standards Institute.

**Application Entity (AE):** A DICOM term for defining a particular user at an IP address.

**Association:** A DICOM term for a communication context which is used by two Application Entities that communicate to one another.

**Association Negotiation:** The software handshaking that occurs between two DICOM Application Entities to set up an Association.

**Attribute:** Each DICOM information object has its own set of characteristics or attributes. Each attribute has a name and may have a value (see IOD), depending on its category.

**Big Endian:** A term for encoding data where the most-significant byte appears first and remaining bytes follow in descending order of significance; sometimes known as "Motorola" format (see Little Endian). (The term is used because of an analogy with the story Gulliver's Travels, in which Jonathan Swift imagined a never-ending fight between the kingdoms of the Big-Endians and the Little-Endians, whose only difference is in where they crack open a hard-boiled egg.)

**Calling (Requesting) AE Title:** The name used by the receiver in a DICOM Association to indicate which Application Entity it received the data from. It is the AE Title of the AE that is initiating the transfer.

**Called (Receiving) AE Title:** The name used by the sender in a DICOM Association to indicate which Application Entity it wants to transmit its data to. It is the AE Title of the AE that is receiving the transfer.

**Command Element:** An encoding of a parameter of a command which conveys this parameter's value.

**Command Stream:** The result of encoding a set of DICOM Command Elements using the DICOM encoding scheme.

**Composite Information Object:** A DICOM information object (see IOD) whose attributes contain multiple real world objects.

**Conformance:** Conformance in the DICOM sense means to be in compliance with the parts of the DICOM Standard.

**Conformance Statement:** A document whose organization and content are mandated by the DICOM Standard, which allows users to communicate how they have chosen to comply with the Standard in their implementations (see Section 8).

**Combined Print Image:** a pixel matrix created by superimposing an image and an overlay, the size of which is defined by the smallest rectangle enclosing the superimposed image and overlay.

**Data Dictionary:** A registry of DICOM Data Elements which assigns a unique tag, a name, value characteristics, and semantics to each Data Element (see the DICOM Data Element Dictionary in DICOM PS 3.6-1999).

**Data Element:** A unit of information as defined by a single entry in the data dictionary. An encoded Information Object Definition (IOD) Attribute that is composed of, at a minimum, three fields: a



Data Element Tag, a Value Length, and a Value Field. For some specific Transfer Syntaxes, a Data Element also contains a VR Field where the Value Representation of that Data Element is specified explicitly.

**Data Set:** Exchanged information consisting of a structured set of Attribute values directly or indirectly related to Information Objects. The value of each Attribute in a Data Set is expressed as a Data Element.

**Data Stream:** The result of encoding a Data Set using the DICOM encoding scheme (Data Element Numbers and representations as specified by the Data Dictionary).

**DICOM:** Digital Imaging and Communications in Medicine.

**DICOM File:** A DICOM File is a file with a content formatted according to the requirements of DICOM PS 3.10-1999.

**DICOM File Format:** The DICOM File Format provides a means to encapsulate in a File the Data Set representing a SOP Instance related to a DICOM Information Object.

**DIMSE:** DICOM Message Service Element. This represents an abstraction of a common set of things that a user would do to a data element, would likely use over and over, and would appear in various different contexts.

**DIMSE-C:** DICOM Message Service Element—Composite.

**DIMSE-C services:** A subset of the DIMSE services which supports operations on Composite SOP Instances related to composite Information Object Definitions with peer DIMSE-service-users.

**DIMSE-N:** DICOM Message Service Element—Normalized.

**DIMSE-N services:** A subset of the DIMSE services which supports operations and notifications on Normalized SOP Instances related to Normalized Information Object Definitions with peer DIMSE-service-users.

**File Set Creator (FSC):** Creates or modifies a DICOM file set (DICOMDIR file) and its corresponding DICOM data files.

**File Set Reader (FSR):** Reads a DICOM file set (DICOMDIR file) and its corresponding DICOM data files.

**File Set Updater (FSU):** Creates, modifies or deletes a DICOM file set (DICOMDIR file) and its corresponding DICOM data files.

**Film Box:** A Normalized Information Object which is the DICOM name for the equivalent of a sheet of physical film.

**Film Session:** A Normalized Information Object which is the DICOM name for the equivalent of a typical “study” or “series”.

**Image Box:** A Normalized Information Object which is the DICOM name for the equivalent of a typical “frame” or “image”.

**Imager:** A term synonymous with printer, meaning a hardcopy output device.

#### **Information Object Class or**

**Information Object [Definition] (IOD):** A software representation of a real object (e.g., CT Image, Study, etc.). An Information Object is generally a list of characteristics (Attributes) which completely describe the object as far as the software is concerned. The formal description of an Information Object generally includes a description of its purpose and the Attributes it possesses.

#### **Information Object Instance or**

**Instance (of an IOD):** A software representation of a specific occurrence of a real object or entity, including values for the Attributes of the Information Object Class to which the entity belongs..

**IP (Internet Protocol) Address:** A unique identifier for the network interface of a computer on a TCP/IP network. An IP address is typically comprised of four octets, separated by dots (.), with each octet capable of representing a number from 0 to 255. For example: 192.168.10.1

**Little Endian:** A term for encoding data where the least-significant byte appears first and remaining bytes follow in ascending order of significance; sometimes known as "Intel" format (see Big Endian).

**LUT:** Lookup Table.

**Message:** A data unit of the Message Exchange Protocol exchanged between two cooperating DICOM Application Entities. A Message is composed of a Command Stream followed by an optional Data Stream.

**Meta SOP Class:** A collection or group of related SOP Classes identified by a single Abstract Syntax UID, which, when taken together, represent a logical grouping and which are used together to provide a high-level functionality, e.g., for the purpose of negotiating the use of the set with a single item.

**Module:** A logical group of the valid attributes of DICOM information objects.

**NEMA:** National Electrical Manufacturers Association.

**Normalized Information Object:** A DICOM Information Object (see IOD) whose attributes contain a single real world object. *Note: the differentiation of normalized versus composite information object definitions is not strongly enforced in DICOM 3.0.*

**Presentation Context:** A Presentation Context consists of an Abstract Syntax plus a list of acceptable Transfer Syntaxes. The Presentation Context defines both what data will be sent (Abstract Syntax) and how the data are encoded to be sent (Transfer Syntax).

**Print Job SOP Class:** A DICOM representation of a Print Job which consists of a set of IODs which describe a Print Job and a set of services which can be performed on those IODs.

**Print Management Service Class or**

**Print Service Class (PSC):** A DICOM term for a logical grouping of Service Classes which all involve printing, also referred to as Print Management Service Class (an example of a Meta SOP Class).

**Printer SOP Class:** A DICOM representation of a Printer which consists of a set of IODs which describe a Printer and a set of services which can be performed on those IODs.

**Protocol Data Unit (PDU):** A data object which is exchanged by software protocol devices (entities, machines) within a given layer of the protocol stack.

**Real-World Activity:** Something which exists in the real world and which pertains to specific area of information processing within the area of interest of the DICOM Standard. A Real-World Activity may be represented by one or more SOP Classes.

**Real-World Object:** Something which exists in the real world and upon which operations may be performed which are within the area of interest of the DICOM Standard. A Real-World Object may be represented through a SOP Instance.

**Service Class:** A group of operations that a user might want to perform on particular Information Objects. Formally, a structured description of a service which is supported by cooperating DICOM Application Entities using specific DICOM Commands acting on a specific class of Information Object.

**Service Class Provider (SCP, Provider, Server):** A device which provides the services of a DICOM Service Class or Classes which are utilized by another device (SCU) and which performs operations and invokes notifications on a specific Association.

**Service Class User (SCU, User, Client):** A device which utilizes the DICOM Service Class or Classes which are provided by another device (SCP) and which invokes operations and performs notifications on a specific Association.

**Service-Object Pair (SOP):** The combination of a DICOM Information Object and the Service Class which operates upon that object.

**SOP Class:** A DICOM term which is identical to an Abstract Syntax; it identifies a set of SOPs which, when taken together, represent a logical grouping (see Meta SOP Class).

**Storage Service Class (SSC):** A DICOM term for a logical grouping of Service Classes which all involve storage of images and other DICOM instances.

**Tag:** A unique identifier for an element of information composed of an ordered pair of numbers (a Group Number followed by an Element Number), which is used to identify Attributes and corresponding Data Elements.

**TCP/IP:** Transmission Control Protocol / Internet Protocol.

**Transfer Syntax:** A part of the DICOM Presentation Context which specifies a set of encoding rules that allow Application Entities to unambiguously negotiate the encoding techniques (e.g., Data Element structure, byte ordering, compression) they are able to support, thereby allowing these Application Entities to communicate.

**Unique Identifier (UID):** A globally unique identifier (based on the structure defined by ISO 8824 for OSI Object Identifiers) which is assigned to every DICOM information object as specified by the DICOM Standard (see Section 2.1.1.4) and which guarantees global unique identification for objects across multiple countries, sites, vendors and equipment.

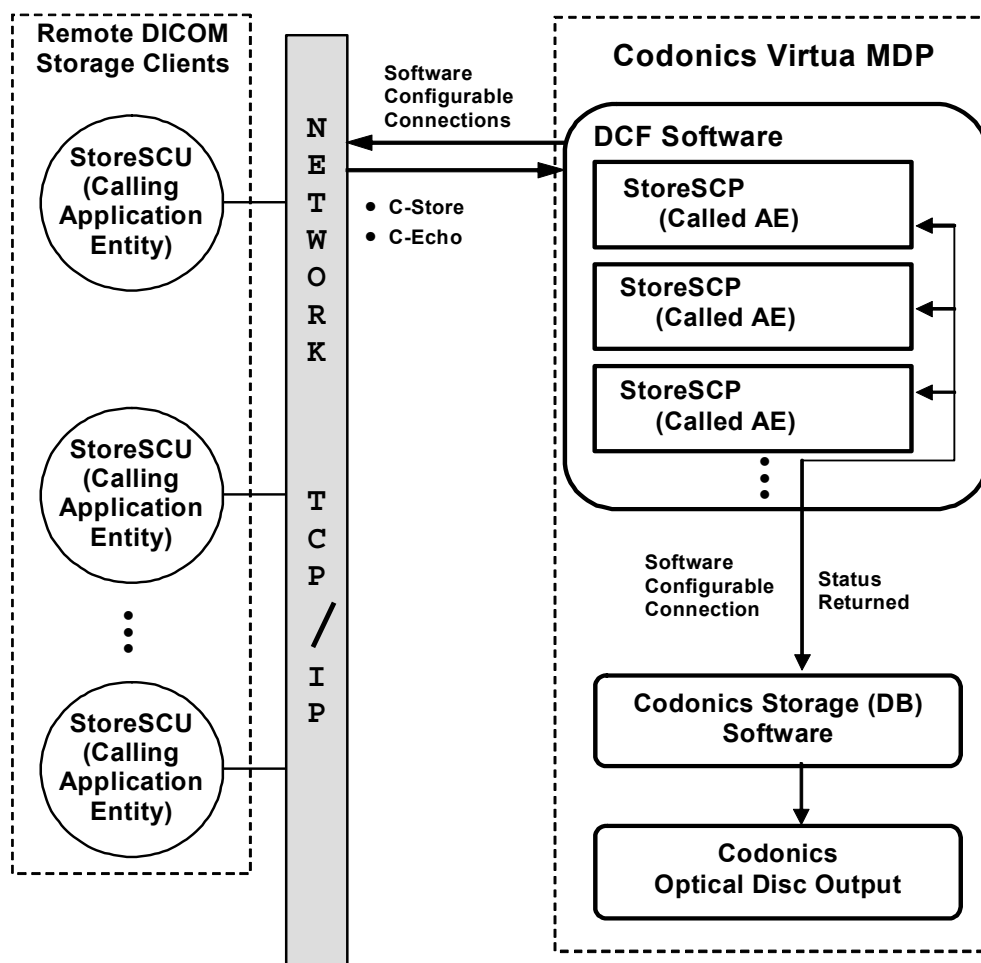
**Value Representation (VR):** A VR is the defined format of a particular data element.

## 1. IMPLEMENTATION MODELS

The DCF Storage Server is implemented as independent, functional, and configurable components. The DCF Storage Server supports multiple Application Entities. Multiple DICOM Storage Clients may concurrently initiate and/or maintain associations to the DCF Storage Server. The number of associations to the DCF Storage Server that can be simultaneously active is unlimited, though the number of unique host systems that may establish associations is controlled by DICOM Feature Keys. After the maximum number of hosts have established associations, the DCF Storage Server will reject any further client association requests from additional hosts, until the Virtua MDP is rebooted (see Section 2.1.1.2 for more details).

### 1.1 Application Data Flow Diagram—DCF Storage Server

The implementation model of the DCF Storage Server is depicted in the following figure:



### 1.2 Functional Definitions of Application Entities (AEs)

The DCF Storage Server creates a StoreSCP (Application Entity or AE) to handle each requested association (unless the configurable maximum associations is exceeded). Each StoreSCP can be configured independently, based on a flexible policy that takes both Called and Calling AE Titles into account.

Once the configuration for the StoreSCP is selected and the StoreSCP is created, the StoreSCP continues with the association negotiation, independent of the DCF Storage Server. The StoreSCP's configuration specifies which SOP classes are to be supported, which transfer syntaxes are to be supported, as well as many other parameters, such as what type of validation is to be performed on incoming messages.

If the StoreSCP accepts the association, then it will service requests from the client SCU until the association is ended. As the StoreSCPs receive storage requests from their corresponding SCUs they commit the stored entities to an internal database, grouping them by Patient, Study, Series and Instance identities. Once the SCU has completed its set of storage requests, it can close the association, or keep the association open for subsequent storage requests.

The association ends when either the SCU releases the association or there is an unrecoverable error. Optionally, if the SCU does not send a request for a period in excess of the StoreSCP configurable timeout, then the StoreSCP will terminate the association.

### **1.3 Sequencing of Real World Activities—DCF Storage Server**

The sequence of events for a typical transaction are listed below:

Storage Client (modality, workstation, or other device) requests association with Storage Server.

Storage Client stores DICOM Instances to Storage Server.

Storage Client terminates the association.

Storage Server releases any resources allocated during association.

## 2. AE SPECIFICATIONS

The DCF Storage Server supports multiple Application Entities or AEs. Each AE in this case is an instance of StoreSCP using a particular configuration.

### 2.1 DCF StoreSCP AE Specification

The DCF Storage Server provides standard conformance to the following DICOM 3.0 SOP Classes as an SCP. The SOP classes that are supported by a particular installation are configurable, as described in Section 5. (For example, for a given AE Title, a configuration might be selected that does not support the various RT SOP classes.)

**Table 2.1.1 - Supported SOP Classes**

SOP Class Name	SOP Class UID
Verification	1.2.840.10008.1.1
Stored Print Storage	1.2.840.10008.5.1.1.27
Hardcopy Grayscale Image Storage	1.2.840.10008.5.1.1.29
Hardcopy Color Image Storage	1.2.840.10008.5.1.1.30
Computed Radiography Image Storage	1.2.840.10008.5.1.4.1.1.1
Digital X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.1
Digital X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.1.1
Digital Mammography X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.2
Digital Mammography X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.2.1
Digital Intra-oral X-Ray Image Storage – For Presentation	1.2.840.10008.5.1.4.1.1.1.3
Digital Intra-oral X-Ray Image Storage – For Processing	1.2.840.10008.5.1.4.1.1.1.3.1
CT Image Storage	1.2.840.10008.5.1.4.1.1.2
Ultrasound Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.3
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1
MR Image Storage	1.2.840.10008.5.1.4.1.1.4
Enhanced MR Image Storage	1.2.840.10008.5.1.4.1.1.4.1
MR Spectroscopy Storage	1.2.840.10008.5.1.4.1.1.4.2
Standalone Modality LUT Storage	1.2.840.10008.5.1.4.1.1.10
Standalone VOI LUT Storage	1.2.840.10008.5.1.4.1.1.11
Grayscale Softcopy Presentation State Storage	1.2.840.10008.5.1.4.1.1.11.1
X-Ray Angiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1
X-Ray Radiofluoroscopic Image Storage	1.2.840.10008.5.1.4.1.1.12.2
X-Ray Angiographic Bi-Plane Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.12.3
Nuclear Medicine Image Storage	1.2.840.10008.5.1.4.1.1.20
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66

VL Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.1
VL Multi-frame Image Storage (Retired)	1.2.840.10008.5.1.4.1.1.77.2
VL Endoscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.1
VL Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.2
VL Slide-Coordinates Microscopic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.3
VL Photographic Image Storage	1.2.840.10008.5.1.4.1.1.77.1.4
Basic Text SR	1.2.840.10008.5.1.4.1.1.88.11
Enhanced SR	1.2.840.10008.5.1.4.1.1.88.22
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33
Mammography CAD SR	1.2.840.10008.5.1.4.1.1.88.50
Key Object Selection Document	1.2.840.10008.5.1.4.1.1.88.59
Positron Emission Tomography Image Storage	1.2.840.10008.5.1.4.1.1.128
Standalone PET Curve Storage	1.2.840.10008.5.1.4.1.1.129
RT Image Storage	1.2.840.10008.5.1.4.1.1.481.1
RT Dose Storage	1.2.840.10008.5.1.4.1.1.481.2
RT Structure Set Storage	1.2.840.10008.5.1.4.1.1.481.3
RT Beams Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.4
RT Plan Storage	1.2.840.10008.5.1.4.1.1.481.5
RT Brachy Treatment Record Storage	1.2.840.10008.5.1.4.1.1.481.6
RT Treatment Summary Record Storage	1.2.840.10008.5.1.4.1.1.481.7

## 2.1.1 Association Establishment Policies

### 2.1.1.1 General

The DCF Storage Server (SCP) listens to the transport (TCP) port which has been configured and accepts associations from DICOM Storage Clients (SCUs). If the maximum number of unique IP addresses is exceeded then the association is refused and the A-ASSOCIATE-RJ PDU will specify result = rejected-transient, reason = temporary-congestion. An accepted association remains connected until the client disconnects by sending either an A-RELEASE-RQ or A-ABORT PDU, or there is an unrecoverable error detected by the Storage Server. If the association remains idle for a configurable period of time, the association will be broken by the DCF Storage Server. In the event of an idle timeout, the Storage Server will close the transport connection, but will not send any notification (e.g., P-ABORT PDU).

The maximum PDU size which can be received by the DCF Storage Server is configurable, with a default value of 16,384 (16K) bytes (see Table 5.3.3).

### 2.1.1.2 Number of Unique IP Addresses

The DCF Storage Server can support multiple concurrent associations from multiple unique hosts. Each association request contains information about the calling entity, to include the IP address of the host system making that request. The DCF Storage Server keeps a table of unique IP addresses, with one slot in the table for each system that has established a successful association since the Virtua was last rebooted, or powered up. The size of the table is determined by the type of DICOM Feature Key installed on the Virtua (see Table 5.2.1). A standard DICOM Feature Key allows up to 24 unique hosts, a DICOM Lite 2 Feature Key allows up to 2 unique hosts, and a DICOM Lite 1 Feature Key allows only a single unique host to establish associations. Note that there is no limit to the number of concurrent associations allowed by the DCF Storage Server, only to the number of unique hosts that can connect.

If all of the slots in the table are taken, then an SCU attempting to establish an association from a host not already indicated by one of the slots will be rejected, as described above in Section 2.1.1.1. However, in order to accommodate host systems which occasionally alter their IP address, such as those that use the Dynamic Host Configuration Protocol (DHCP) to obtain their address, the slots in the table can expire if they are not used for an hour or more. Each time an association is established from a host in the table, that host's slot is tagged with a timestamp. When the table is full, and a new host attempts to establish an association, the DCF Storage Server looks for slots that have not been used for at least an hour, and if one is found, it is considered to be expired. This expired slot is then used for the new host's IP address, and the previous IP address for that slot is forgotten.

### **2.1.1.3 Asynchronous Nature**

The DCF Storage Server does not support asynchronous operations.

### **2.1.1.4 Implementation Identifying Information**

The implementation UID for the DCF Storage Server is returned in the A-ASSOCIATE-AC PDU. The value for that UID will be "1.2.840.114089.1.1.0.X.Y.Z", where X.Y.Z is the version number (for example, 1.5.0). The implementation version name is also returned and has the form "DCF X.Y.Zz" where X.Y.Zz is the full version identifier (for example, 1.4.0b for beta version 1.4.0).

All internally generated UID's will be prefixed 1.2.840.xxxxxx, where the identification code "xxxxxx"="114089.1.1" is Laurel Bridge Software's ANSI registered organization identification code for the DCF software. See DICOM PS 3.5-1999, Section 9 for further information.

### **2.1.1.5 Called Titles**

The DCF Storage Server operates in a "promiscuous" mode, accepting any valid called title (as defined by the AE VR type). If the called title matches the name of a Codonics Job Profile, then the parameters are used to determine the manner in which stored items within that association are handled. See Section 5.4 for more details on this aspect of system configuration.

If no special behavior is required through the use of the called title, then it is customary to use the title "STORE\_SCP", although this is arbitrary, and holds no special meaning to the Storage Server.

## **2.1.2 Association Initiation by Real-World Activity**

The DCF Storage Server does not initiate associations.

### **2.1.3 Association Acceptance Policy**

#### **2.1.3.1 Real-World Activity—Verification**

##### **2.1.3.1.1 Associated Real World Activity—Verification**

The Verification Service Class is a feature used for network diagnostic purposes to verify application level communication between peer DICOM AEs. The DCF Storage Server responds to Verification requests to provide an SCU with the ability to determine if the DCF Storage Server is receiving DICOM requests. This verification is accomplished on an established Association using the C-ECHO DIMSE-C service.

An example of a typical real world activity to initiate a Verification association is a service person invoking a DICOM-Echo client on a remote host, specifying the transport address and AE Title of an instance of the DCF Storage Server as the target.



### 2.1.3.1.2 Presentation Context Table—Verification

**Table 2.1.3.1.2.1 – Supported Verification Presentation Contexts**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
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	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

### 2.1.3.1.3 SOP Specific Conformance—Verification

#### 2.1.3.1.3.1 SOP Specific Conformance to Verification SOP Class

The DCF Storage Server provides standard conformance to the DICOM Verification Service Class.

The Verification SOP Class consists of the C-ECHO DIMSE-C service. No associated Information Object Definition is defined. No Specialized SOP Classes and/or Meta SOP Classes are defined for the Verification SOP Class.

#### 2.1.3.1.4 Presentation Context Acceptance Criterion

The Verification SOP class can be requested on its own, or in combination with other supported SOP classes.

#### 2.1.3.1.5 Transfer Syntax Selection Policies

The transfer syntax for each DICOM presentation context is negotiated independently. The DCF Storage Server can be configured to support any or all of the transfer syntaxes listed in Table 2.1.3.1.2.1. The order of preference for selecting a transfer syntax is also configurable. This configuration may vary between associations; however, for a given association, it is shared between all SOP classes or presentation contexts.

### 2.1.3.2 Real-World Activity—Storage

#### 2.1.3.2.1 Associated Real World Activity—Storage

As instances are received they are copied to the local file system and a record inserted into the local database. If the received instance is a duplicate of a previously received instance, the old file and database record will be overwritten with the new one.

#### 2.1.3.2.2 Presentation Context Table—Storage

The DCF Storage Server will accept association establishment, using one of the presentation contexts listed below:

**Table 2.1.3.2.2.1 - Supported Storage Presentation Contexts**

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name	UID		
See Table 2.1.1	See Table 2.1.1	Implicit VR Little Endian	1.2.840.10008.1.2	SCP	None
		Explicit VR Little Endian	1.2.840.10008.1.2.1	SCP	None
		Explicit VR Big Endian	1.2.840.10008.1.2.2	SCP	None

### 2.1.3.2.3 SOP Specific Conformance—Storage

The DCF Storage Server incorporates a configurable validation service. It utilizes reasonable default values for any attribute which is not valid for a given destination and will, in general, always try to complete a storage job rather than failing it. Section 5 lists attributes which are Virtua dependent and configurable.

For every operation requested on a SOP class of the Storage Service Classes, a status code is returned. They are grouped into success, warning or failure categories (see DICOM PS 3.7-1999):

**Success** - Indicates that the SCP performed the requested operation as requested.

**Warning** - Indicates that the SCP has received the request and will process it. However, immediate processing of the request, or processing in the way specified by the SCU, may not be possible. The SCP expects to be able to complete the request without further action by the SCU across the DICOM interface. The exact behavior of the SCP is described within this Conformance Statement.

**Failure** - Indicates that the SCP is unable to perform the request. The request will not be processed unless it is repeated successfully by the SCU at a later time. The exact behavior of the SCP is described in this Conformance Statement.

Certain errors may be reported for any DIMSE message sent to any SOP Class, in some cases, failures or warnings will only be generated if the Storage Server has message validation enabled. Status codes that are unique to a particular DIMSE message for particular SOP classes are described for each SOP Class in its sub-section entitled DIMSE Specific Behavior. Statuses include:

<u>Status</u>	<u>Code</u>	<u>Description</u>
INVALID_ATTRIBUTE	0106H	Failure status—Indicates an attribute has been received that is not valid for this message. Processing of the message will fail.
UNRECOGNIZED_ATTRIBUTE	0107H	Warning status—Indicates an attribute has been received that is not valid for this message. The attribute will be discarded and processing of the message will continue
DUPLICATE_INSTANCE	0111H	Failure status—The SCU has specified an instance UID for an object that already exists (N-CREATE only). Processing of the message will fail
NO_SUCH_INSTANCE	0112H	Failure status—No object with this instance UID exists. Processing of the message will fail
ATTRIBUTE_OUT_OF_RANGE	0116H	Warning status—An attribute has been received whose value is not within the legal set of possible values (see tables below). If a default has been configured, it will be substituted for the offending value. The validation component can be configured to treat a missing attribute in this manner (i.e. warn and

<u>Status</u>	<u>Code</u>	<u>Description</u>
INVALID_OBJECT_INSTANCE	0117H	Failure status—The SOP instance UID field in the message is invalid. Processing of the message will fail
NO_SUCH_CLASS	0118H	Failure status—The SOP class UID field in the message is invalid. Processing of the message will fail
MISSING_ATTRIBUTE	0120H	Failure status—A required attribute was not included in the message data set. Processing of the message will fail.
UNRECOGNIZED_OP	0211H	Failure status—The received DIMSE message is not valid for the specified presentation context (see SOP class specific interpretations for this error code below). Processing of the message will fail

### 3. COMMUNICATION PROFILES

#### 3.1 TCP/IP Stack

The DCF Storage Server provides DICOM 3.0 TCP/IP Network Communication Support as defined in part 8 of the standard.

#### 3.2 Physical Media Support

The DCF Storage Server supports DICOM over any IP network supported by the Operating System running on the Codonics device (computer) where the DCF Storage Server is installed and running.

### 4. EXTENSIONS/SPECIALIZATIONS/PRIVATIZATIONS

The DCF does not define any private elements.

### 5. CONFIGURATION

See Section 1.2 for an overview of the DCF Storage Server start-up and configuration process.

#### 5.1 AE Title Presentation Address Mapping

AE Titles are used only during association negotiation with the DCF Storage Server. That is, no DIMSE messages or data sets reference other hosts or servers using AE Titles as is common with certain other SOP classes. There is no need for AE Title to presentation address mapping with the Storage SOP classes.

#### 5.2 DCF Storage Server Configurable Parameters—Global

The following items are configurable on a global basis and apply to all associations serviced by the DCF Storage Server.

**Table 5.2.1 - Global Configuration Parameters**

Parameter Name	Range	Defaults	Comments
tcp_port	1–32767	104	The TCP port on which the DCF Storage Server will listen for incoming DICOM Association requests.
max_unique_ip_addresses	1–24	1, 2, 24	The maximum number of unique IP addresses that are allowed to connect to the DCF Storage Server. A Virtua MDP equipped with a DICOM Lite 1 key allows only 1 IP address, with a DICOM Lite 2 key allows 2 IP addresses, and with a standard DICOM key allows 24.
first_pdu_read_timeout	N/A	30	Association request timeout period—the time is measured from socket accept until an a-assoc-rq PDU is read.  Functions as the ARTIM (Association/Request/Reject/Release Timer) timer from DICOM PS 3.8-9.1.2
debug_flags	N/A	0x00000	This parameter is intended for Codonics developer and field-service use only.

### 5.3 DCF Storage Server Configurable Parameters—Per Association

The following items are configurable on a per association basis and apply to an association based on the Calling AE Title. Each software component has debug flags that may be set for diagnostic purposes; these flags may be dynamically accessed via a browser based interface, but are not listed below. Other configuration parameters which are used to control SCP internal behavior are omitted from the lists as well.

The SOP Classes that the DCF Storage Server supports are configured by their presence in the appropriate configuration file. See Section 1.2 for additional description of the configuration process. Any of the SOP Classes from Table 2.1.1 can be individually enabled or disabled in this way.

The transfer syntax for each DICOM presentation context is negotiated independently. The DCF Storage Server can be configured to support any or all of the transfer syntaxes listed in Table 2.1.3.2.2.1. The order of preference for selecting a transfer syntax is also configurable. This configuration may vary between associations; however, for a given association, it is shared between all SOP classes or presentation contexts.

**Table 5.3.3 - Per Association Configuration Parameters—DCF Components**

Parameter Name	Range	Defaults	Comments
<b>DPS</b> <b>scp_association_options:</b>			
dvs_enable	YES NO	NO	Enables or disables the DICOM Validation Services component.
dvs_configuration_group		/dicom/dvs/ StoreSCP.dvs  /dicom/dvs/ DicomDefs.dvs	Filename of the configuration group for the DICOM Validation Service component.

Parameter Name	Range	Defaults	Comments
<b>DCS:</b>			
pdu_read_timeout	0 .. 2**32	30	Association request timeout period—number of seconds to block trying to read a PDU fragment, after a connect or read-data-ready poll notification. Functions as the ARTIM (Association/Request/Reject/Release Timer) timer from DICOM PS 3.8-9.1.2.
association_idle_timeout_period	-1, 0, 1..3600	3600	-1 = Never release association unless the SCU requests it, or an error has occurred. 0 = Time-out immediately 1–3600 (seconds) Maximum number of seconds that the DCF Storage Server will allow an idle client to maintain an association when no print jobs are pending.
max_pdu_length	1K–16K Bytes (1024–16384)	16K Bytes (16384 Bytes)	The largest PDU that will be sent.
pre_association_script	Shell command	None	Command line of program to be run at the start of an association.
post_association_script	Shell command	None	Command line of program to be run at the end of an association.

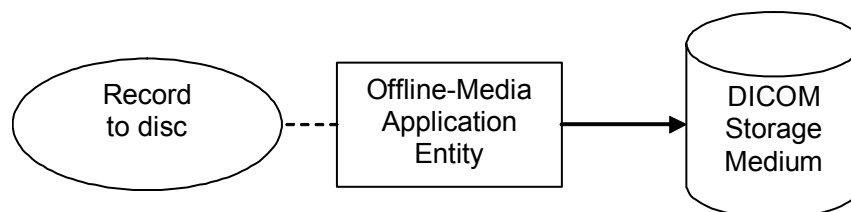
#### 5.4 Called AE Titles and Codonics Job Profiles

The Codonics Virtua supports multiple parameter sets known as Job Profiles, which affect the parameters associated with a given recording job. These are general-purpose, configurable parameter sets that are described in detail in the Virtua User's Manual. When a recording job is submitted, a Job Profile parameter set is selected via the Called AE Title used to establish the storage association.

## 6. MEDIA INTERCHANGE

### 6.1 IMPLEMENTATION MODEL

#### 6.1.1 Application Data Flow



**Figure B.5.1-1**  
**APPLICATION DATA FLOW DIAGRAM FOR MEDIA STORAGE**

- The Offline-Media Application Entity exports images and Presentation States to an optical disc Storage medium (CD or DVD). It is associated with the local real-world activity “Record to Disc”. “Record to Disc” is performed upon user request for selected patients, studies, series or instances (images or presentation states). It may optionally be performed on a Study boundary, based on a Study storage timeout value.

#### 6.1.2 Functional Definition of AEs

##### 6.1.2.1 Functional Definition of Offline-Media Application Entity

Activation of the “Record to Disc” function will pass the currently selected Study instances (images and/or presentation states) to the Offline-Media Application Entity. The SOP Instances associated with the selection will be collected into one or more record jobs. The contents of each record job will be written to one or more of the selected disc media (CD or DVD).

#### 6.1.3 Sequencing of Real-World Activities

At least one Study must exist and be selected before the Offline-Media Application Entity can be invoked. The user interface allows selection of the optical disc type, or can optionally select the appropriate type based on the size of the record request. Entity will wait indefinitely for a media to be inserted before starting to write to the disc if it is not currently loaded in the system. If no media is available the record job can be canceled from the job queue.

#### 6.1.4 File Meta Information Options

The implementation information written to the File Meta Header in each file is detailed in section 2.1.1.4.

## 6.2 AE SPECIFICATIONS

### 6.2.1 Offline-Media Application Entity Specification

The Offline-Media Application Entity provides standard conformance to the DICOM Interchange Option of the Media Storage Service Class. The Application Profiles and roles are listed below:

**Table B.5.2-1  
APPLICATION PROFILES, ACTIVITIES AND ROLES FOR OFFLINE-MEDIA**

<b>Application Profiles Supported</b>	<b>Real World Activity</b>	<b>Role</b>	<b>SC Option</b>
STD-GEN-CD	Record to CD-R	FSC/FSU	Interchange
STD-GEN-DVD-RAM	Record to DVD-R	FSC/FSU	Interchange

### 6.2.1.1 File Meta Information for the Application Entity

The Source Application Entity Title included in the File Meta Header is configurable (see section 5.4).

### 6.2.1.2 Real-World Activities

#### 6.2.1.2.1 Activity – Record to Disc

The Offline-Media Application Entity acts as an FSC using the interchange option when requested to export SOP Instances from the local database to an optical disc medium.

A dialogue will be presented allowing the user to modify the suggested media label and provides control over the available media capacity. If the contents of the current selection do not fit on a single media an automatic separation into multiple export jobs will be suggested which can be adapted by the user.

The system will use preloaded optical media blanks as available, or the user will be prompted to insert an empty disc for each record job that can not be fulfilled based on the currently loaded media. The contents of the record job will be written together with a corresponding DICOMDIR to a single-session disc. Writing in multi-session mode is not supported. The user can cancel a record job in the job queue.

#### 6.2.1.2.1.1 Media Storage Application Profiles

The Offline-Media Application Entity supports the STD-GEN-CD and STD-GEN-DVD-RAM Application Profiles.

#### 6.2.1.2.1.1.1 Options

The Offline-Media Application Entity supports the SOP Classes listed in the Table 2.1.1. The Transfer Syntax of all entities stored on optical disc shall be Explicit VR Little Endian (1.2.840.10008.1.2.1).

## 6.3 AUGMENTED AND PRIVATE APPLICATION PROFILES

Virtua does not support any augmented or private application profiles.

## 6.4 MEDIA CONFIGURATION

Media selection is available via the user interface, and through Codonics Job Profiles. Media can be auto-selected for a particular record job, or can be overridden at the time of job submission.

## 7. SUPPORT OF EXTENDED CHARACTER SETS

### 7.1 Overview

The DCF supports all extended character sets defined in the DICOM 2002 standard, including single-byte and multi-byte character sets as well as code extension techniques using ISO 2022 escapes.

Support extends to correctly decoding and displaying the correct symbol for all names and strings found in the storage instances received over the network, and in the local database.

No specific support for sorting of strings other than in the default character set is provided in the browsers.

### 7.2 Character Sets

In addition to the default character repertoire, the Defined Terms for Specific Character Set in Table 7.2.1 are supported:

**Table 7.2.1**  
**SUPPORTED SPECIFIC CHARACTER SET DEFINED TERMS**

Character Set Description	Defined Term
Latin alphabet No. 1	ISO_IR 100
Latin alphabet No. 2	ISO_IR 101
Latin alphabet No. 3	ISO_IR 109
Latin alphabet No. 4	ISO_IR 110
Cyrillic	ISO_IR 144
Arabic	ISO_IR 127
Greek	ISO_IR 126
Hebrew	ISO_IR 138
Latin alphabet No. 5	ISO_IR 148
Japanese	ISO_IR 13
Thai	ISO_IR 166
Default repertoire	ISO 2022 IR 6
Latin alphabet No. 1	ISO 2022 IR 100
Latin alphabet No. 2	ISO 2022 IR 101
Latin alphabet No. 3	ISO 2022 IR 109
Latin alphabet No. 4	ISO 2022 IR 110
Cyrillic	ISO 2022 IR 144
Arabic	ISO 2022 IR 127
Greek	ISO 2022 IR 126
Hebrew	ISO 2022 IR 138
Latin alphabet No. 5	ISO 2022 IR 148
Japanese	ISO 2022 IR 13
Thai	ISO 2022 IR 166
Japanese	ISO 2022 IR 87
Japanese	ISO 2022 IR 159



Korean	ISO 2022 IR 149
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### 7.3 Character set Configuration

Whether or not characters are displayed correctly depends on the presence of font support in the underlying operating system. Typically, as described in the Release Notes, it may be necessary for the user to add one of the "all Unicode" fonts to their system configuration in order to correctly display characters that would not typically be used in the default locale.

## 8. CODES AND CONTROLLED TERMINOLOGY

The DCF uses the Baseline Context Groups defined in DICOM PS 3.3-1999. No alternative or private Context Groups or Coding Schemes are used.

## 9. SECURITY

### 9.1 Security Profiles

None supported.

### 9.2 Association level security

None supported.

Any Calling AE Titles and/or IP addresses may open an Association.

### 9.3 Application level security

None supported.

## 10. REFERENCES

Quoted below are references to and portions of the sections of DICOM PS 3.0-1999 that relate to the preparation of a conformance statement. In addition, a list of DICOM Change Proposals that have been incorporated within this release of the DCF Storage Server is provided.

### 10.1 DICOM PS 3.2-1999, Annex A (Normative) DICOM Conformance Statement Template

*This Annex is a template which shall be used to generate a DICOM Conformance Statement. A DICOM Conformance Statement shall begin with an introduction which sets the framework. The introduction shall describe the implementation and how, in general terms, it uses DICOM to achieve its purposes. ...*

**10.2 DICOM PS 3.2-1999, Annex B (Informative) DICOM Conformance Statement Sample**

*This Annex is a sample DICOM Conformance Statement for a fictitious DICOM Implementation. It is presented as an example only. The viability of such an implementation should not be assumed as the purpose of this Annex is only to guide the writer of DICOM Conformance Statements by providing a Conformance Statement example. ...*

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