Digital Imaging and Communications in Medicine (DICOM)

Supplement 44: Clarification of network addressing

and the retirement of non-TCP/IP communication.

VERSION: Final Text, September 6, 2002

DICOM Standards Committee, Working Group 6 Base Standard

1300 N. 17th Street, Suite 1847

Rosslyn, Virginia 22209 USA

Foreword

This Supplement has been prepared by the DICOM Working Group 6 (Base Standard) according to the procedures of the DICOM Committee.

The DICOM Standard is structured as a multi-part document using the guidelines established in the following document:

- ISO/IEC Directives, 1989 Part 3 : Drafting and Presentation of International Standards.

This document is a Supplement to the DICOM Standard. It removes PS 3.9 and PS 3.13 and OSI support from PS 3.8 and any references to those Parts or their contents from the published DICOM Standard which consists of the following parts:

PS 3.1	-	Introduction and Overview
PS 3.2	-	Conformance
PS 3.3	-	Information Object Definitions
PS 3.4	-	Service Class Specifications
PS 3.5	-	Data Structures and Encoding
PS 3.6	-	Data Dictionary
PS 3.7	-	Message Exchange
PS 3.8	-	Network Communication Support for Message Exchange
PS 3.9	-	Retired (Point-to-Point Communication Support for Message Exchange)
PS 3.10	-	Media Storage and File Format for Data Interchange
PS 3.11	-	Media Storage Application Profiles
PS 3.12	-	Media Formats and Physical Media for Data Interchange
PS 3.13	-	Retired (Print Management Point-to-Point Communication Support)
PS 3.14	-	Grayscale Standard Display Function
PS 3.15	-	Security Profiles
PS 3.16	-	Content Mapping Resource

These parts are related but independent documents.

Scope and Field of Application

This supplement retires obsolete and unimplemented communication protocols from DICOM Standard, in particular:

DICOM Supplement 44 Clarify Network Addressing and Retire Non-TCP/IP Communication

- The point-to-point (50 pin connector) protocol that has not been used to exchange DICOM messages, and the concensus of the industry and user community is that it never will be used.
- The point-to-point protocol for print management that provided a place to document a popular hardware interface but has not been used as an interoperable DICOM print solution.
- The OSI protocols that had not been deployed for production DICOM applications. TCP/IP is now ubiquitous and OSI is no longer mandated by government regulations.

Item: 0.1	*Remove PS 3.9 from the DICOM Standard:*

Item: 0.2	*Remove PS 3.13 from the DICOM Standard:*

Item: 0.3	*In the foreword of each of PS 3.1,2,3,4,5,6,7,8,10,11,12,14,15,&16 change the following*

PS 3.9: ~~Point-to-Point Communication Support for Message Exchange~~ **(Retired)**

PS 3.13: ~~Print Management Point-to-Point Communication Support~~ **(Retired)**

Changes to NEMA Standards Publication PS 3.1-2001

Digital Imaging and Communications in Medicine (DICOM)

Part 1: Introduction and Overview

Item: 1.1 Modify Part 1 as follows:

INTRODUCTION

History

With the introduction of computed tomography (CT) followed by other digital diagnostic imaging modalities in the 1970's, and the increasing use of computers in clinical applications, the American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) recognized the emerging need for a standard method for transferring images and associated information between devices manufactured by various vendors. These devices produce a variety of digital image formats.

The American College of Radiology (ACR) and the National Electrical Manufacturers Association (NEMA) formed a joint committee in 1983 to develop a standard to:

— Promote communication of digital image information, regardless of device manufacturer

— Facilitate the development and expansion of picture archiving and communication systems (PACS) that can also interface with other systems of hospital information

— Allow the creation of diagnostic information data bases that can be interrogated by a wide variety of devices distributed geographically.

ACR-NEMA Standards Publication No. 300-1985, published in 1985 was designated version 1.0. The Standard was followed by two revisions: No. 1, dated October 1986 and No. 2, dated January 1988.

ACR-NEMA Standards Publication No. 300-1988, published in 1988 was designated version 2.0. It included version 1.0, the published revisions, and additional revisions. It also included new material to provide command support for display devices, to introduce a new hierarchy scheme to identify an image, and to add data elements for increased specificity when describing an image.

These Standards Publications specified a hardware interface, a minimum set of software commands, and a consistent set of data formats.

The DICOM Standard

This Standard, ~~now~~ **which is currently** designated Digital Imaging and Communications in Medicine (DICOM) ~~Version 3.0~~, embodies a number of major enhancements to previous versions of the **ACR-NEMA** Standard:

a. It is applicable to a networked environment. The ~~previous versions were~~ **ACR-NEMA Standard was** applicable in a point-to-point environment only; for operation in a networked environment a Network Interface Unit (NIU) was required. DICOM **~~Version 3.0~~** supports operation in a networked environment using **the** industry standard networking protocol~~s such as OSI and~~ TCP/IP.

b. **It is applicable to an off-line media environment. The ACR-NEMA Standard did not specify a file format or choice of physical media or logical filesystem. DICOM supports operation in an off-line media environment using the industry standard media such as CD-R and MOD and logical filesystems such as ISO 9660 and PC File System (FAT16).**

c. It specifies how devices claiming conformance to the Standard react to commands and data being exchanged. **The ACR-NEMA Standard was** ~~Previous versions were~~ confined to the transfer of data, but DICOM **~~Version 3.0~~** specifies, through the concept of Service Classes, the semantics of commands and associated data.

d. It specifies levels of conformance. **The ACR-NEMA Standard** ~~Previous versions~~ specified a minimum level of conformance. DICOM ~~**Version 3.0**~~ explicitly describes how an implementor must structure a Conformance Statement to select specific options.

e. It is structured as a multi-part document. This facilitates evolution of the Standard in a rapidly evolving environment by simplifying the addition of new features. ISO directives which define how to structure multi-part documents have been followed in the construction of the DICOM Standard.

f. It introduces explicit Information Objects not only for images and graphics but also for ~~studies~~**waveforms**, reports, **printing,** etc.

g. It specifies an established technique for uniquely identifying any Information Object. This facilitates unambiguous definitions of relationships between Information Objects as they are acted upon across the network.

Current Direction~~**Future directions**~~

~~**It is anticipated that the**~~ **The** DICOM Standard ~~**will be**~~ **is** an evolving standard **and it is maintained in accordance with the Procedures of the DICOM Standards Committee.** ~~**and that p**~~**Proposals** for enhancements ~~will be~~ **are** forthcoming from the **DICOM Committee** member organizations based on input from users of the Standard. These proposals ~~**will be**~~ **are** considered for **inclusion in** future ~~versions~~ editions of the Standard. A requirement in updating the Standard is to maintain effective compatibility with previous editions.

~~**In the preparation of this Standard, suggestions and comments from users, vendors, and other interested parties have been sought, evaluated, and included. Inquiries, comments, and proposed or recommended revisions should be submitted to the Diagnostic Imaging and Therapy Systems Division of NEMA by contacting:**~~

~~**Vice-President, Engineering Department**~~
~~**National Electrical Manufacturers Association**~~
~~**2101 L Street, N.W. Suite 300**~~
~~**Washington, D.C. 20037 USA**~~

1 Scope and field of application

PS 3.1 provides an overview of the entire Digital Imaging and Communications in Medicine (DICOM) Standard. It describes the history, scope, goals, and structure of the Standard. In particular, it contains a brief description of the contents of each part of the Standard.

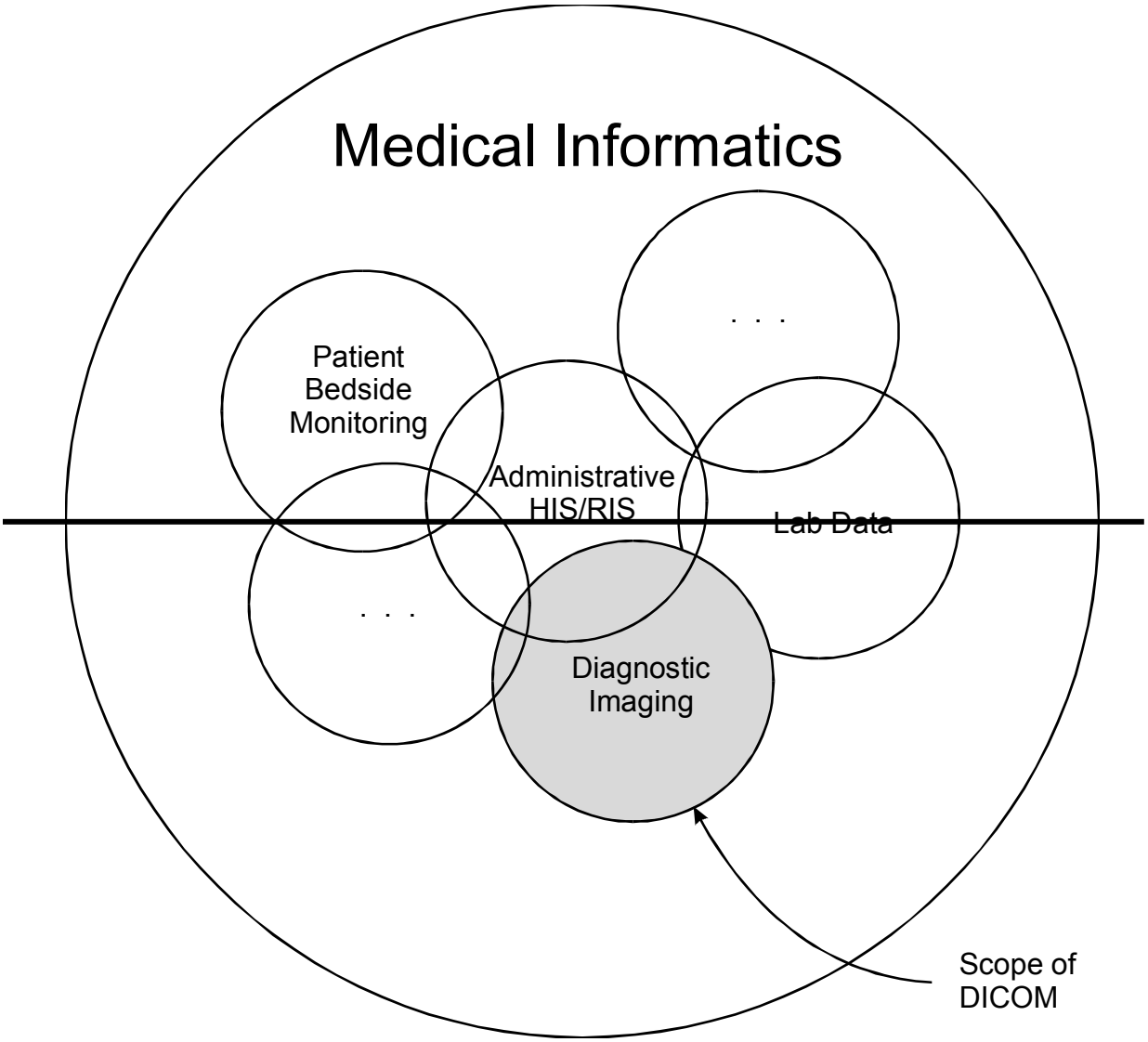
The DICOM Standard facilitates interoperability of medical imaging equipment by specifying:

- **For network communications, a**~~A~~ set of protocols to be followed by devices claiming conformance to the Standard.
- The syntax and semantics of Commands and associated information which can be exchanged using these protocols.
- **For media communication, a set of media storage services to be followed by devices claiming conformance to the Standard, as well as a File Format and a medical directory structure to facilitate access to the images and related information stored on an interchange media.**
- Information that must be supplied with an implementation for which conformance to the Standard is claimed.

The DICOM Standard does not specify:

- The implementation details of any features of the Standard on a device claiming conformance.
- The overall set of features and functions to be expected from a system implemented by integrating a group of devices each claiming DICOM conformance.
- A testing/validation procedure to assess an implementation's conformance to the Standard.

The DICOM Standard pertains to the field of Medical Informatics. Within that field, it addresses the exchange of digital information between medical imaging equipment **and other systems**. Because ~~**medical imaging**~~ **such** equipment may interoperate with other medical devices, the scope of this Standard needs to overlap with other areas of medical informatics~~, as shown in figure 1-1~~. However, the DICOM Standard does not address the breadth of this field.



180

181

182 **~~Figure 1-1~~**

183 **~~SCOPE OF DICOM IN MEDICAL INFORMATICS~~**

184 ## 2 Normative references

185 ISO/IEC Directives, 1989 Part 3 - Drafting and presentation of International Standards.

186 ACR-NEMA 300-1988 Digital Imaging and Communications

187 ISO 8822, Information Processing Systems - Open Systems Interconnection - Connection Oriented
188 Presentation Service Definition.

ISO 8649, Information Processing Systems - Open Systems Interconnection - Service Definition for the Association Control Service Element.

3 Definitions

Attribute: A property of an Information Object. An Attribute has a name and a value which are independent of any encoding scheme.

Command: A ~~**generic means to convey a**~~ request to operate on **~~I~~information** ~~Objects~~ across a ~~an interface or~~ network.

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.

Conformance Statement: A formal statement **that describes** ~~associated with~~ a specific **product** implementation ~~of~~ **that uses** the DICOM Standard. It specifies the Service Classes, Information Objects, and Communication Protocols supported by the implementation.

Data Dictionary: A registry of DICOM Data Elements which assigns a unique tag, a name, value characteristics, and semantics to each Data Element.

Data Element: A unit of information as defined by a single entry in the data dictionary.

Data Set: Exchanged information consisting of a structured set of Attribute**s** ~~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).

Information Object: An abstraction of a real information entity (e.g., CT Image, ~~Study~~ **Structured Report,** etc.) which is acted upon by one or more DICOM Commands.

Note: This term is primarily used in PS 3.1., with a few references in PS 3.3. It is an informal term corresponding to a formal term that is introduced in PS 3.3. In all other parts of the DICOM Standard this formal term is known as Information Object Definition.

Information Object Class: A formal description of an Information Object which includes a description of its purpose and the Attributes it posseses. It does not include values for these attributes.

Note: This term is only used in PS 3.1. It is an informal term corresponding to a formal term that is introduced in PS 3.4. This formal term is known as Service-Object Pair Class or more commonly as SOP Class.

Information Object Instance: A representation of an **occura~~a~~ence** of a~~n~~ real-world entity, which includes values for the Attributes of the Information Object Class to which the entity belongs.

Note: This term is only used in PS 3.1. It is an informal term corresponding to a formal term that is introduced in PS 3.4. This formal term is known as Service-Object Pair Instance or more commonly as SOP Instance.

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

Service Class: A structured description of a service which is supported by cooperating DICOM applications ~~Entities~~ using specific DICOM Commands acting on a specific class of Information Object.

4 Symbols and abbreviations

ACSE Association Control Service Element

CT Computed Tomography

DICOM Digital Imaging and Communications in Medicine

HIS Hospital Information System

~~**NIU** Network Interface Unit~~

OSI Open Systems Interconnection

PACS Picture Archiving and Communication Systems

RIS Radiology Information System

TCP/IP Transmission Control Protocol/Internet Protocol

5 Goals of the DICOM standard

The DICOM Standard facilitates interoperability of devices claiming conformance. In particular, it:

- Addresses the semantics of ~~C~~commands and associated data. For devices to interact, there must be standards on how devices are expected to react to ~~C~~commands and associated data, not just the information which is to be moved between devices;
- **Addresses the semantics of file services, file formats and information directories necessary for off-line communication;**
- Is explicit in defining the conformance requirements of implementations of the Standard. In particular, a conformance statement must specify enough information to determine the functions for which interoperability can be expected with another device claiming conformance.
- Facilitates operation in a networked environment~~, **without the requirement for Network Interface Units**~~**.**
- Is structured to accommodate the introduction of new services, thus facilitating support for future medical imaging applications.
- Makes use of existing international standards wherever applicable, and itself conforms to established documentation guidelines for international standards.

Even though the DICOM Standard has the potential to facilitate implementations of PACS solutions, use of the Standard alone does not guarantee that all the goals of a PACS will be met. This Standard

facilitates interoperability of systems claiming conformance in a multi-vendor environment, but does not, by itself, guarantee interoperability.

This Standard has been developed with an emphasis on diagnostic medical imaging as practiced in radiology**, cardiology** and related disciplines; however, it is ~~**thought to be**~~ **also** applicable to a wide range of image **and non-image** related information exchanged in ~~a~~ clinical **and other medical** environment**s**.

Figure 5-1 presents the general communication model of the Standard which spans both network (on-line) and media storage interchange (off-line) communication. Applications may rely on either one of the following boundaries:

- **the Upper Layer Service, which provides independence from specific physical networking communication support and protocols such as TCP/IP.**

- **the Basic DICOM File Service, which provides access to Storage Media independently from specific media storage formats and file structures.**

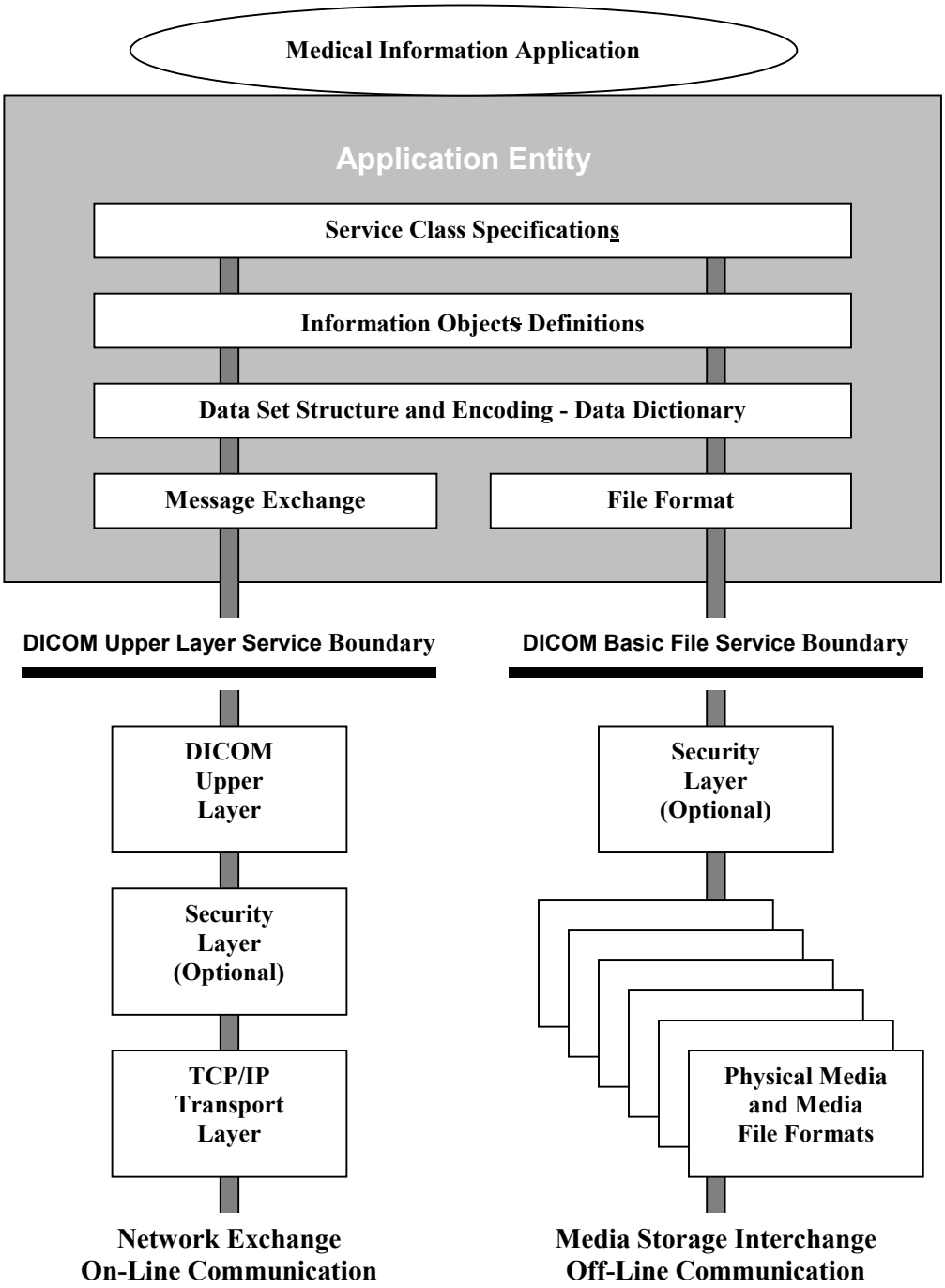


Figure 5-1 General Communication Model

6 Overview of the Content of the DICOM Standard

6.1 DOCUMENT STRUCTURE

DICOM ~~version 3.0~~ consists of the following ~~nine~~ parts:

PS 3.1: Introduction and Overview (this document)

PS 3.2: Conformance

PS 3.3: Information Object Definitions

PS 3.4: Service Class Specifications

PS 3.5: Data Structure and Encoding

PS 3.6: Data Dictionary

PS 3.7: Message Exchange

PS 3.8: Network Communication Support for Message Exchange

PS 3.9: **Retired** ~~**Point-to-Point Communication Support for Message Exchange**~~

PS 3.10: Media Storage and File Format for Data Interchange

PS 3.11: Media Storage Application Profiles

PS 3.12: Media Formats and Physical Media for Data Interchange

PS 3.13: Retired

PS 3.14: Grayscale Standard Display Function

PS 3.15: Security Profiles

PS 3.16: Content Mapping Resource

These parts of the Standard are related but independent documents. A brief description of **each Part** ~~**Parts 2 through 9**~~ is provided in this section.

6.2 PS 3.2: CONFORMANCE

PS 3.2 of the DICOM Standard defines principles that implementations claiming conformance to the Standard shall follow:

- Conformance requirements. PS 3.2 specifies the general requirements which must be met by any implementation claiming conformance. It references the conformance sections of other parts of the Standard.
- Conformance Statement. PS 3.2 defines the structure of a Conformance Statement. It specifies the information which must be present in a Conformance Statement. It references the Conformance Statement sections of other parts of the Standard.

PS 3.2 does not specify a testing/validation procedure to assess an implementation's conformance to the Standard.

Figure**s 6.2-1 and 6.2-2** ~~6-1~~ depict~~s~~ the construction process for a Conformance Statement **for both network communications and media exchange**. A Conformance Statement consists of ~~three~~ **the following** ~~major~~ parts:

- Set of Information Objects which is recognized by this implementation
- Set of Service Classes which this implementation supports
- Set of communications protocols **or physical media** which this implementation supports
- **Set of security measures which this implementation supports.**

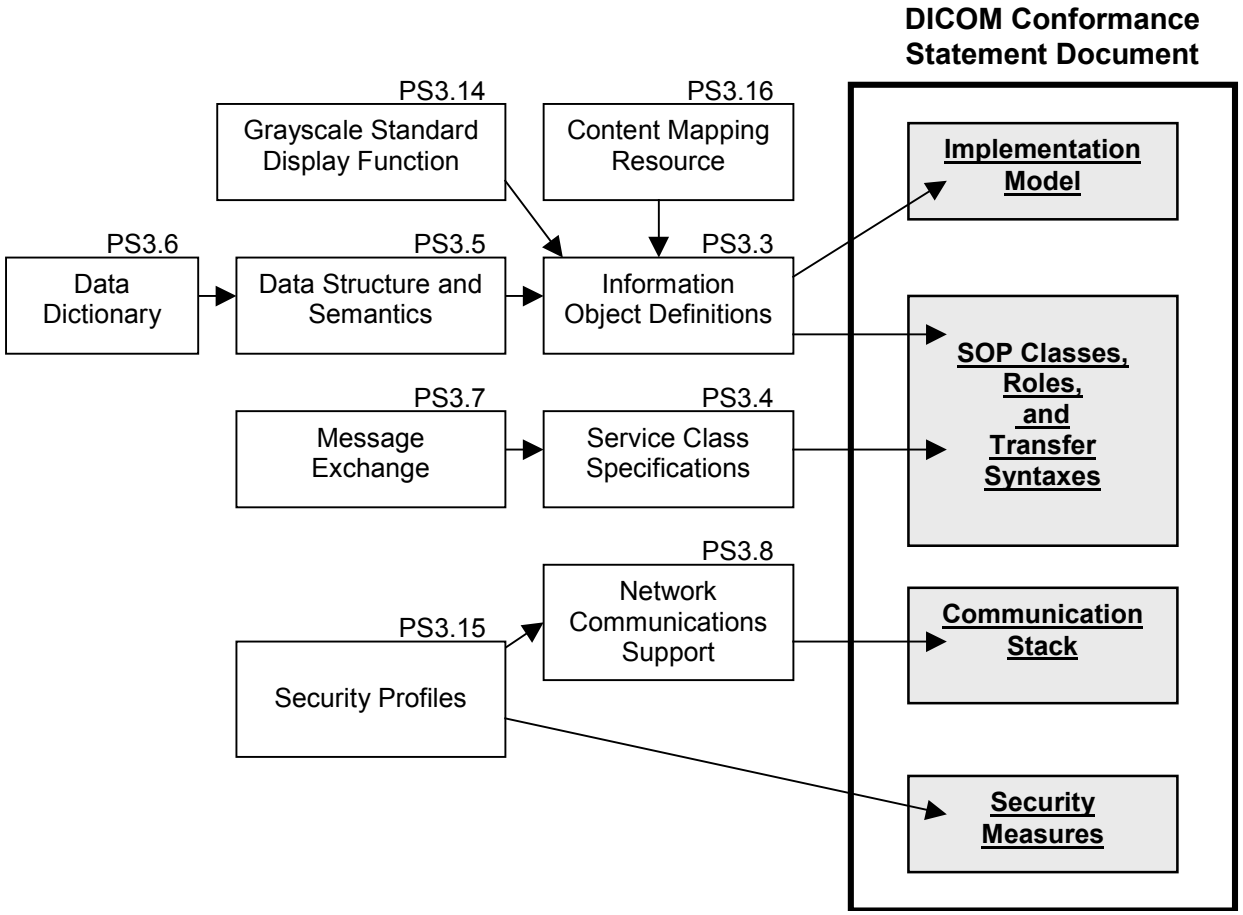


Figure 6.2-1:
Construction Process for a Network Conformance Claim

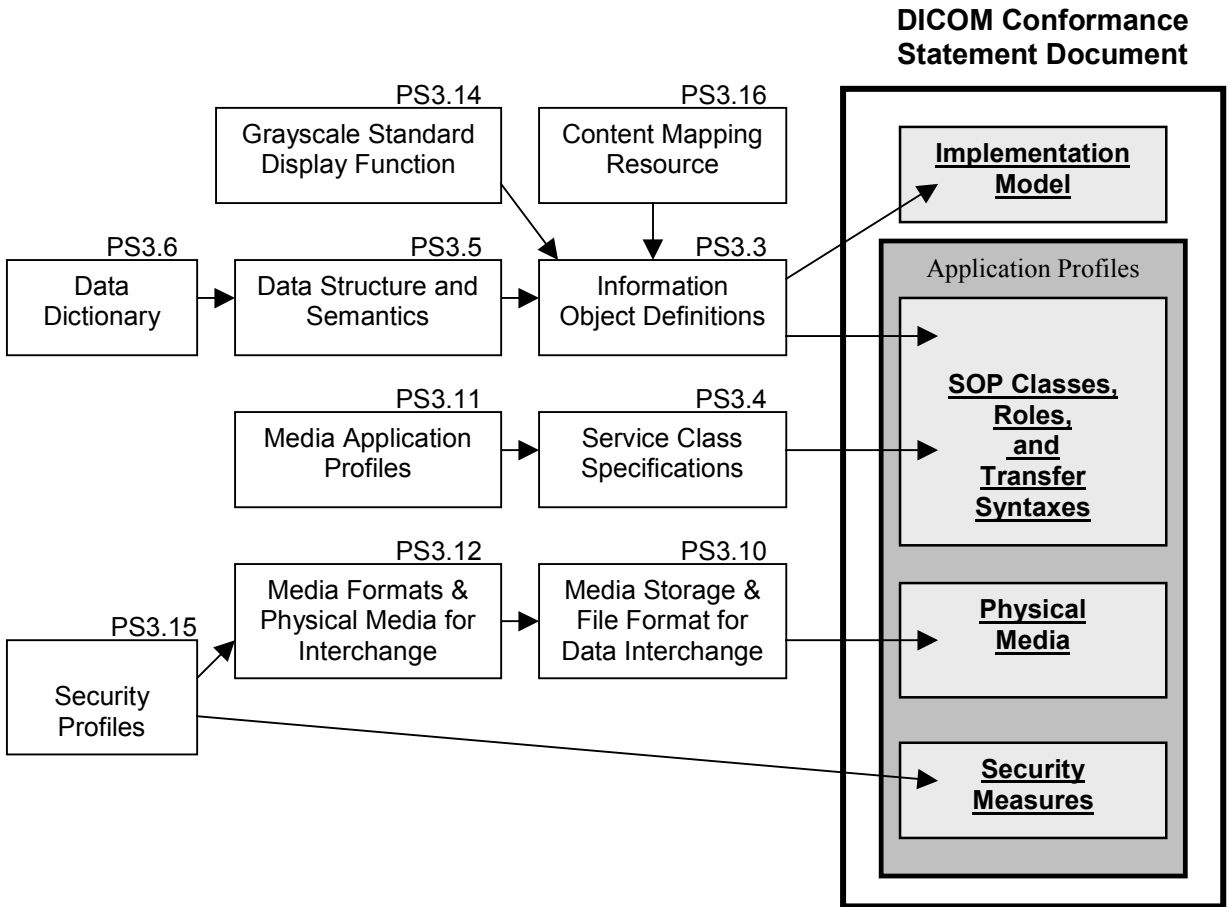


Figure 6.2-2:
Construction Process for a Media Interchange Conformance Claim

6.3 PS 3.3: INFORMATION OBJECT DEFINITIONS

PS 3.3 of the DICOM Standard specifies a number of Information Object Classes which provide an abstract definition of real-world entities applicable to communication of digital medical images **and related information (e.g., waveforms, structured reports, radiation therapy dose, etc.)**. Each Information Object Class definition consists of a description of its purpose and the Attributes which define it. An Information Object Class does not include the values for the Attributes which comprise its definition.

~~**To facilitate future Standard growth and to maintain compatibility with previous versions of the Standard, t**~~ **T**wo types of Information Object Classes are defined: normalized and composite.

Normalized Information Object Classes include only those Attributes inherent in the real-world entity represented. For example the study Information Object Class, which is defined as normalized, contains study date and study time Attributes because they are inherent in an actual study. Patient name, however, is not an Attribute of the study Information Object Class because it is inherent in the patient on which the study was performed and not the study itself.

Composite Information Object Classes may additionally include Attributes which are related to but not inherent in the real-world entity. For example, the Computed Tomography Image Information Object Class, which is defined as composite, contains both Attributes which are inherent in the image (e.g.

image date) and Attributes which are related to but not inherent in the image (e.g. patient name). Composite Information Object Classes provide a structured framework for expressing the communication requirements of images ~~which were defined in previous versions of the Standard~~ **where image data and related data needs to be closely associated**.

To simplify the Information Object Class definitions, the Attributes of each Information Object Class are partitioned with similar Attributes being grouped together. These groupings of Attributes are specified as independent modules and may be reused by **other** ~~one or more~~ Composite Information Object Classes.

PS3.3 defines a model of the Real World along with the corresponding Information Model that is reflected in the Information Object definitions. Future editions of this Standard may extend this set of Information Objects to support new functionality.

To represent an occurrence of a real-world entity, an Information Object Instance is created, which includes values for the Attributes of the Information Object Class. The Attribute values of this Information Object Instance may change over time to accurately reflect the changing state of the entity which it represents. This is accomplished by performing different basic operations upon the Information Object Instance to render a specific set of services defined as a Service Class. These Service Classes are defined in PS 3.4 of the Standard.

~~**PS 3.3 also is related to other parts of the DICOM Standard in that:**~~

- ~~**PS 3.5, Data Structure and Semantics, defines the Data Set structure and encoding to convey DICOM Information Object Attributes**~~
- ~~**PS 3.6, Data Dictionary, defines the semantics of DICOM Data Elements which convey the Information Object Attributes defined in PS 3.3.**~~

6.4 PS 3.4: SERVICE CLASS SPECIFICATIONS

PS 3.4 of the DICOM Standard defines a number of Service Classes. A Service Class associates one or more Information Objects with one or more Commands to be performed upon these objects. Service Class Specifications state requirements for Command Elements and how resulting Commands are applied to Information Objects. Service Class specifications state requirements for both providers and users of communications services.

PS 3.4 of the DICOM Standard defines the characteristics shared by all Service Classes and how a Conformance Statement to an individual Service Class is structured. It contains a number of normative annexes which describe individual Service Classes in detail.

Examples of Service Classes include the following:

- Storage Service Class ~~**(which support for modality specific storage SOP Classes)**~~
- Query **/ Retrieve** Service Class
- **Basic Worklist Management** ~~**Retrieval**~~ Service Class
- **Print** ~~**Study**~~ Management Service Class

PS 3.4 defines the operations performed upon the Information Objects defined in PS 3.3. PS 3.7 defines the Commands and protocols for using the Commands to accomplish the operations **and notifications** described in PS 3.4.

6.5 PS 3.5: DATA STRUCTURE AND SEMANTICS

PS 3.5 of the DICOM Standard specifies how DICOM ~~A~~**a**pplication**s** ~~Entities~~ construct and encode the Data Set information resulting from the use of the Information Objects and Services Classes defined in

~~Parts~~ **PS 3.**3 and **PS 3.**4 of the DICOM Standard. **The support of a number of standard image compression techniques (e.g., JPEG lossless and lossy) is specified.**

PS 3.5 addresses the encoding rules necessary to construct a Data Stream to be conveyed in a Message as specified in PS 3.7 of the DICOM Standard. This Data Stream is produced from the collection of Data Elements making up the Data Set. ~~**Several Data Sets may be referenced or folded in a compounded Data Set. A compounded Data Set is used to transfer in "one package" the content of Information Objects, offering a folder capability.**~~

PS 3.5 also defines the semantics of a number of generic functions that are common to many Information Objects. **PS 3.5 defines the encoding rules for international character sets used within DICOM.**

6.6 PS 3.6: DATA DICTIONARY

PS 3.6 of the DICOM Standard is the centralized registry which defines the collection of all DICOM Data Elements available to represent information**, along with elements utilized for interchangeable media encoding and a list of all uniquely identified items that are assigned by DICOM** .

For each ~~Data E~~**e**lement, PS 3.6 **specifies**:

- **its** ~~**Assigns it a**~~ unique tag, which consists of a group and element number
- **its** ~~**Gives it a**~~ name
- ~~**Specifies**~~ **its** value **representation** ~~**characteristics**~~ (character string, integer, etc)
- **its value multiplicity (how many values per attribute)**
- **whether it is retired**
- ~~**Defines its semantics (i.e. how it is to be interpreted).**~~

For each uniquely identified item, PS 3.6 specifies:

- **its unique value, which is numeric with multiple components separated by decimal points and limited to 64 characters**
- **its name**
- **its type, either Information Object Class, definition of encoding for data transfer, or certain well known Information Object Instances**
- **in which part of the DICOM Standard it is defined**

~~**PS 3.6, in conjunction with PS 3.5, is used to construct Data Sets, and to represent Information Objects as Data Sets in conjunction with PS 3.3 and PS 3.5.**~~

6.7 PS 3.7: MESSAGE EXCHANGE

PS 3.7 of the DICOM Standard specifies both the service and protocol used by an ~~A~~**a**pplication ~~Entity~~ in a medical imaging environment to exchange Messages over the communications support services defined in PS 3.8 ~~or PS 3.9~~. A Message is composed of a Command Stream defined in PS 3.7 followed by an optional Data Stream as defined in PS 3.5.

PS 3.7~~**This Part**~~ specifies ~~**the following**~~:

- **the operations and notifications (DIMSE Services) made available to Service Classes defined in PS 3. 4,**

- **r**~~R~~ules that govern the exchange of Command requests and responses
- **e**~~E~~ncoding rules necessary to construct Command Streams and Messages.
- **r**~~R~~ules to establish and terminate associations provided by the communications support specified in PS 3.8 ~~**or PS 3.9**~~**,** and the impact on outstanding transactions

~~**Additionally, PS 3.7 is related to other parts of the DICOM Standard.**~~

- ~~**PS 3.3, Information Object Definitions, specifies the set of Information Object Classes to which the Commands defined in PS 3.7 may be applied**~~
- ~~**PS 3.5, Data Structure and Semantics, addresses the encoding rules necessary to construct a Data Stream to be conveyed in a Message specified in PS 3.7 of the DICOM Standard**~~

6.8 PS 3.8: NETWORK COMMUNICATION SUPPORT FOR MESSAGE EXCHANGE

PS 3.8 of the DICOM Standard specifies the communication services and the upper layer protocols necessary to support, in a networked environment, communication between DICOM ~~A~~**a**pplication**s** ~~Entities~~ as specified in PS 3.3, PS 3.4, PS 3.5, PS 3.6, and PS 3.7. These communication services and protocols ensure that communication between DICOM ~~A~~**a**pplication**s** ~~Entities~~ is performed in an efficient and coordinated manner across the network.

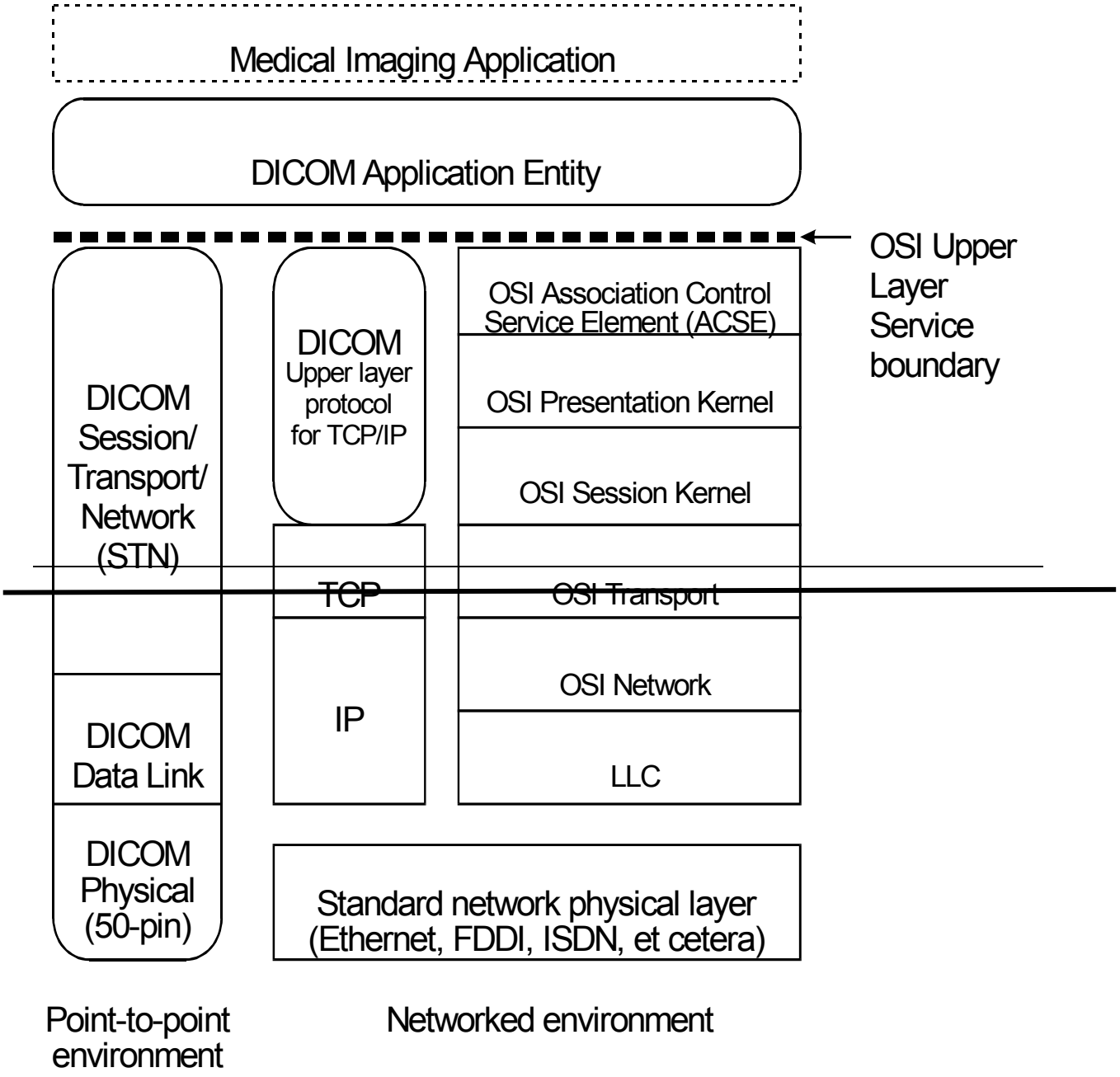
The communication services specified in PS 3.8 are a proper subset of the services offered by the OSI Presentation Service (ISO 8822) and of the OSI Association Control Service Element (ACSE) (ISO 8649). They are referred to as the Upper Layer Service, which allows peer ~~A~~**a**pplication**s** ~~Entities~~ to establish associations, transfer messages and terminate associations.

This definition of the Upper Layer Service ~~**allows**~~ **specifies** the use of ~~**a fully conformant stack of OSI protocols (Layers 1 through 6 plus ACSE) to achieve robust and efficient communication. It supports a large variety of international standards-based network technologies using a wide choice of physical networks such as ISO 8802-3 CSMA/CD (often referred to as Ethernet), FDDI, ISDN, X.25, dedicated digital circuits, and many other LAN and WAN network technologies.**~~

~~**In addition, this same Upper Layer Service can also be provided by**~~ the DICOM Upper Layer Protocol ~~**used**~~ in conjunction with TCP/IP transport protocols~~**. Therefore, a broad range of existing networked environments can be used.**~~

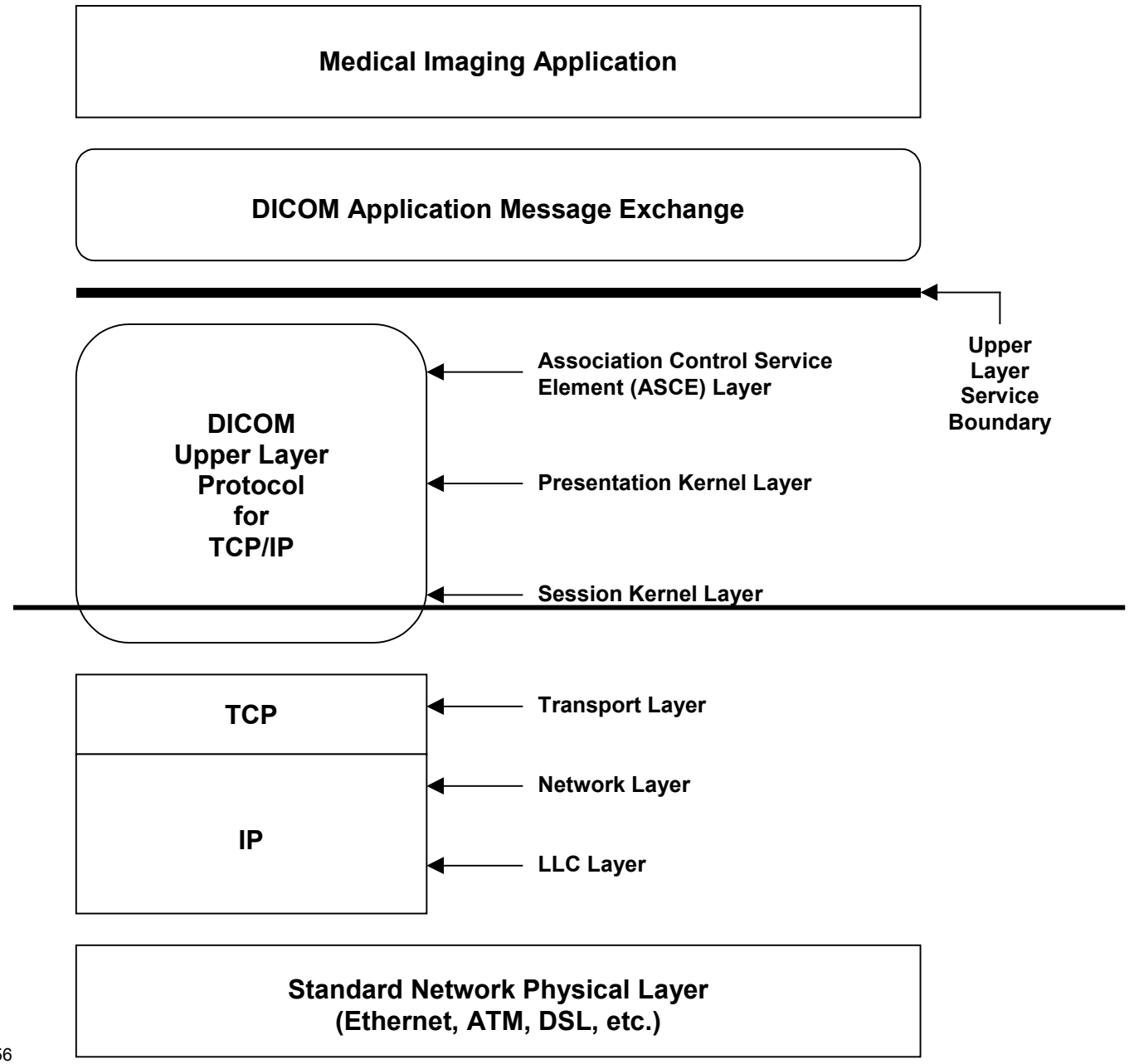
~~**The definition of a Upper Layer Service common to both OSI and TCP/IP environments allows migration from a TCP/IP to an OSI environment without impacting DICOM Application Entities.**~~

~~**These**~~ **The TCP/IP** communication protocol~~**s**~~ specified by PS 3.8 ~~are~~**is a** general purpose communication protocol~~**s (OSI, TCP/IP) and** not **versions**~~ specific to the DICOM Standard. Figure **5-1** ~~6-2~~ shows **this**~~**these two**~~ protocol ~~**stacks with the third (point-to-point)**~~ stack ~~**defined in PS 3.9 of the DICOM Standard.**~~



Note: The DICOM STN supports a subset of the OSI upper layer service

455



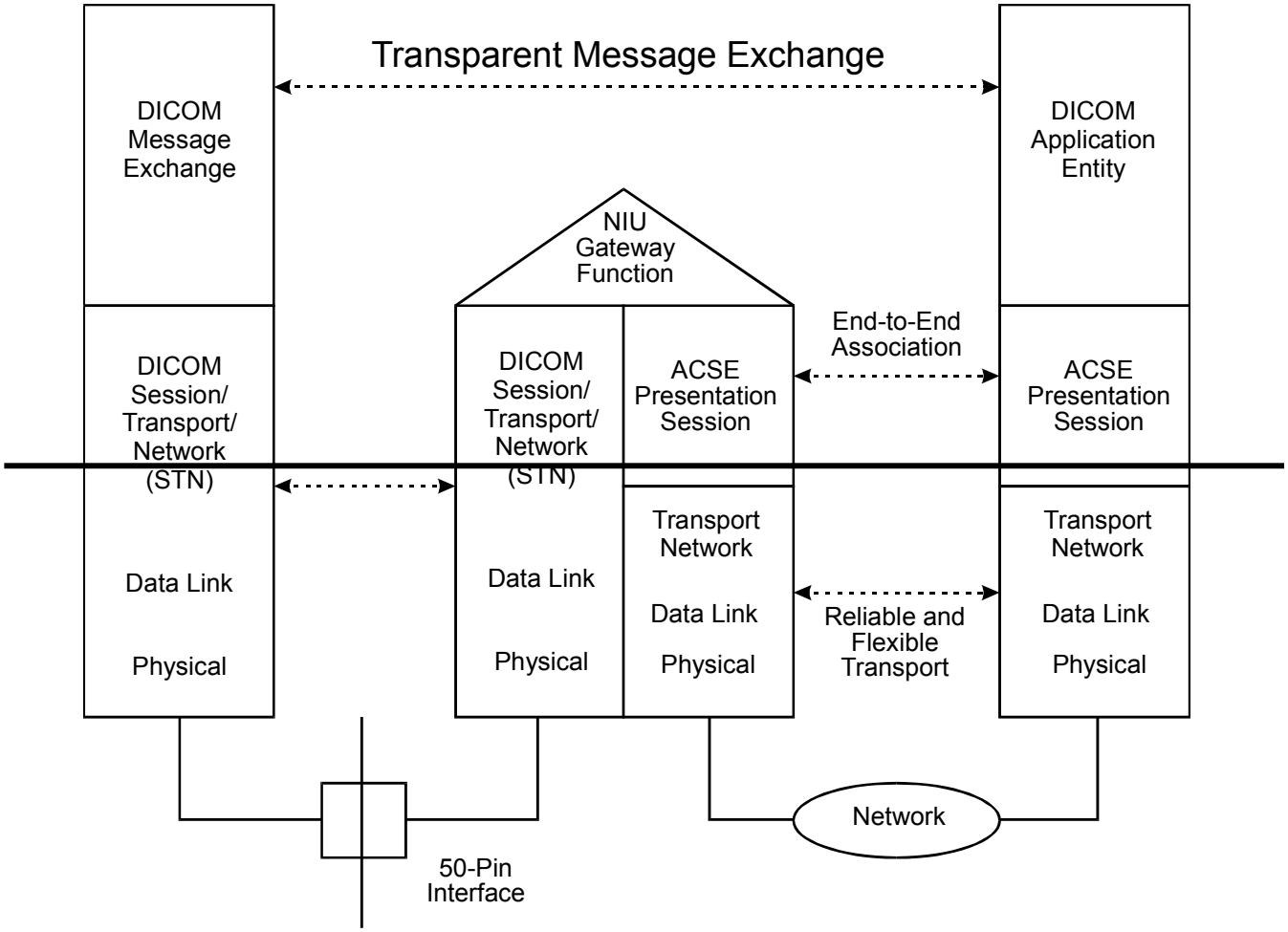
~~Figure 6-2~~
~~DICOM VERSION 3.0 PROTOCOL ARCHITECTURE~~

6.9 PS 3.9: RETIRED (FORMERLY POINT-TO-POINT COMMUNICATION SUPPORT FOR MESSAGE EXCHANGE)

PS 3.9 of the DICOM Standard **previously** specifie**d**~~s~~ the services and protocols used for point-to-point communications in a manner compatible with ACR-NEMA 2.0. It **has been retired**~~specifies a physical interface and signaling protocols. It defines the OSI-like Data link and Session/Transport/Network protocols and the services of the protocol stack to be used on this physical interface~~.

~~The specified Session/Transport/Network Layer Services and protocols support communication between DICOM Application Entities as specified in Parts 3, 4, 5, 6, and 7. These services are a~~

~~**subset of the Upper Layer Services specified in PS 3.8 of the DICOM Standard. This subset property permits the interconnection of a device with a point-to-point interface to a fully networked communication environment supported by OSI and TCP/IP. Such an interconnection requires an intervening Network Interface Unit (NIU). Figure 6-3 presents how a point-to-point interface and a networked environment coexist.**~~



~~**Figure 6-3**~~
~~**USING POINT-TO-POINT IN A NETWORK ENVIRONMENT**~~

6.10 PS3.10: MEDIA STORAGE AND FILE FORMAT

PS 3.10 of the DICOM Standard specifies a general model for the storage of medical imaging information on removable media (see Figure 6.10-1). The purpose of this Part is to provide a framework allowing the interchange of various types of medical images and related information on a broad range of physical storage media.

Note: See Figure 5-1 for understanding how the media interchange model compares to the network model.

PS 3.10 specifies:

- **a layered model for the storage of medical images and related information on storage media. This model introduces the concept of media storage application profiles, which specify application specific subsets of the DICOM Standard to which a media storage implementation may claim conformance. Such a conformance applies only to the writing, reading and updating of the content of storage media.**
- **a DICOM file format supporting the encapsulation of any Information Object;**
- **a secure DICOM file format supporting the encapsulation of a DICOM file format in a cryptographic envelope;**
- **a DICOM file service providing independence from the underlying media format and physical media.**

PS 3.10 defines various media storage concepts:

a) the method to identify a set of files on a single medium

b) the method for naming a DICOM file within a specific file system

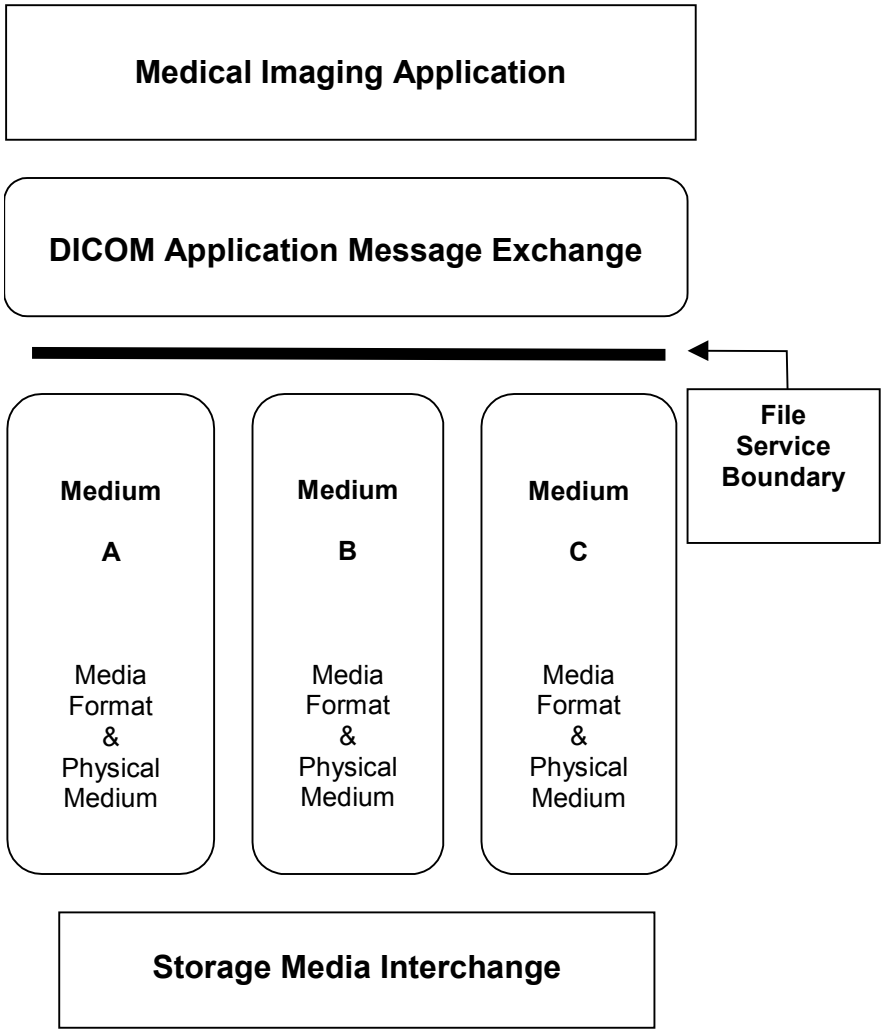


Figure 6.10-1
DICOM Media Communication Model

6.11 PS3.11: MEDIA STORAGE APPLICATION PROFILES

PS 3.11 of the DICOM Standard specifies application specific subsets of the DICOM Standard to which an implementation may claim conformance. These application specific subsets will be referred to as Application Profiles in this section. Such a conformance statement applies to the interoperable interchange of medical images and related information on storage media for specific clinical uses. It follows the framework, defined in PS 3.10, for the interchange of various types of information on storage media.

An Application Profile annex is organized into the following major parts:

a. The name of the Application Profile, or the list of Application Profiles grouped in a related class

b. A description of the clinical context of the Application Profile

c. The definition of the media storage Service Class with the device roles for the Application Profile and associated options

d. Informative section describing the operational requirements of the Application Profile

e. Specification of the Information Object Classes and associated Information Objects supported and the encoding to be used for data transfer

f. The selection of media formats and physical media to be used

g. Other parameters which need to be specified to ensure interoperable media interchange

h. Security parameters which select the cryptographic techniques to be used with secure media storage Application Profiles

The structure of DICOM and the design of the Application Profile mechanism is such that extension to additional Information Object Classes and new exchange media is straightforward.

Note: Figure 6.11-1 shows how individual aspects of an Application Profile map to the various parts of the DICOM Standard.

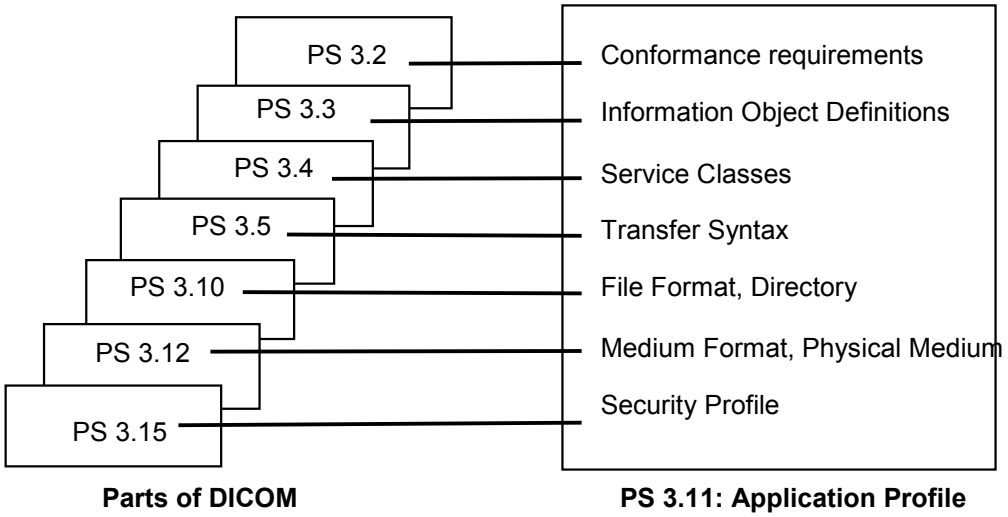


Figure 6.11-1
RELATIONSHIP BETWEEN AN APPLICATION PROFILE AND PARTS OF DICOM

6.12 PS3.12: STORAGE FUNCTIONS AND MEDIA FORMATS FOR DATA INTERCHANGE

This part of the DICOM Standard facilitates the interchange of information between applications in medical environments by specifying:

a) A structure for describing the relationship between the media storage model and a specific physical media and media format

b) Specific physical media characteristics and associated media formats.

6.13 PS3.13: RETIRED (FORMERLY PRINT MANAGEMENT POINT-TO-POINT COMMUNICATION SUPPORT)

PS 3.13 of the DICOM Standard previously specified the services and protocols used for point-to-point communication of print management services. It has been retired.

6.14 PS3.14: GRAYSCALE STANDARD DISPLAY FUNCTION

PS 3.14 specifies a standardized display function for consistent display of grayscale images. This function provides methods for calibrating a particular display system for the purpose of presenting images consistently on different display media (e.g. monitors and printers).

The chosen display function is based on human visual perception. Human eye contrast sensitivity is distinctly non-linear within the luminance range of display devices. This standard uses Barten's model of the human visual system.

6.15 PS3.15: SECURITY PROFILES

PS 3.15 of the DICOM Standard specifies security profiles to which implementations may claim conformance. Security profiles are defined by referencing externally developed security standards, which may use security techniques like public keys and "smart cards". Data encryption can use various standardized data encryption schemes.

This part does not address issues of security policies. The standard only provides mechanisms that can be used to implement security policies with regard to the interchange of DICOM objects. It is the local administrator's responsibility to establish appropriate security policies.

6.16 PS3.16: CONTENT MAPPING RESOURCE

PS 3.16 of the DICOM Standard specifies:

- **templates for structuring documents as DICOM Information Objects**
- **sets of coded terms for use in Information Objects**
- **a lexicon of terms defined and maintained by DICOM**
- **country specific translations of coded terms**

~~**7 Relationships of parts of the standard**~~

~~**Figure 7-1 depicts the relationships of the various parts of the Standard which have been described in the preceding paragraphs.**~~

~~**The following relationships exist between parts of the Standard:**~~

~~**PS 3.1: Introduction and Overview describes the overall structure of the Standard.**~~

~~**PS 3.2: Conformance specifies the general requirements which must be met by implementations claiming conformance and contents of a Conformance Statement.**~~

~~**PS 3.3: Information Object Definitions specifies the structure and attributes of objects which are operated upon by Service Classes (PS 3.4). These objects include images, studies, and patients.**~~

~~**PS 3.4: Service Class Specifications defines the operations that can be performed on instances of Information Objects (PS 3.3) to provide a specific service. These services include image storage, retrieval, and printing.**~~

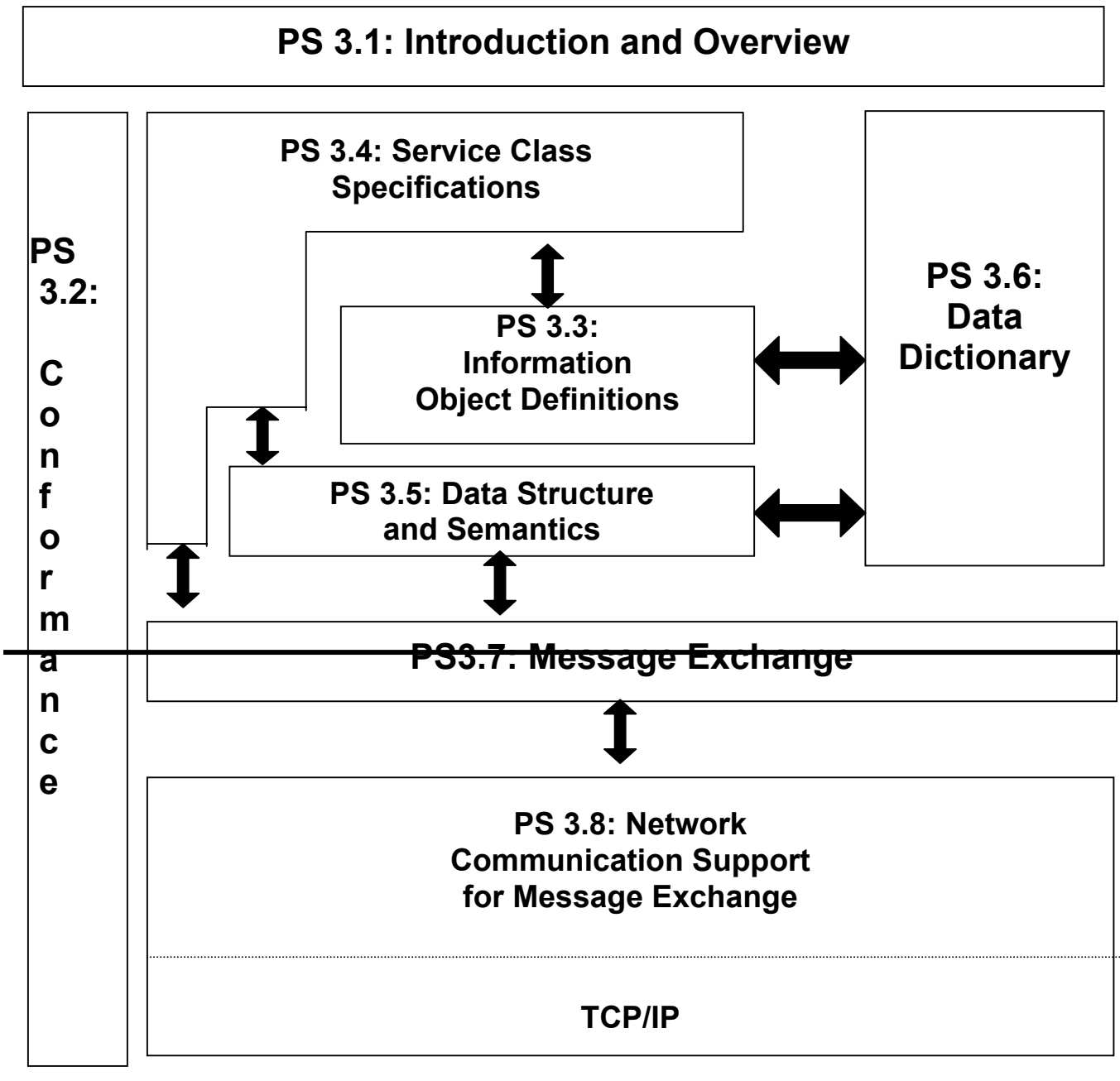
~~**PS 3.5: Data Structure and Semantics specifies the encoding of the data content of messages which are exchanged to accomplish the operations used by the Service Classes (PS 3.4).**~~

~~**PS 3.6: Data Dictionary defines the individual information Attributes that represent the data content (PS 3.5) of instances of Information Objects.**~~

~~**PS 3.7: Message Exchange specifies the operations and protocol used to exchange messages. These operations are used to accomplish the services defined by the Service Classes (PS 3.4).**~~

~~**PS 3.8: Network Communication Support for Message Exchange defines the services and protocols used to exchange messages (PS 3.7) directly on OSI and TCP/IP networks.**~~

~~**PS 3.9: Point-to-Point Communication Support for Message Exchange defines the services and protocols used to exchange messages (PS 3.7) on the DICOM 50-pin interface.**~~



~~Figure 7-1~~
~~RELATIONSHIPS OF PARTS 1-916 OF THE DICOM STANDARD~~

626

627

628

629

630

631

632

633

634

635

636 **Changes to NEMA Standards Publication PS 3.7-2001**

637 **Digital Imaging and Communications in Medicine (DICOM)**

638 **Part 7: Message Exchange**

639

Item: 7.1 Make the changes to section 6.1 as follows:

6.1 DICOM AND THE OSI BASIC REFERENCE MODEL

The OSI Basic Reference Model is used to model the interconnection of medical imaging equipment. As shown in Figure 6.1-1 seven layers of communication protocols are distinguished. DICOM uses the OSI Upper Layer Service to separate the exchange of DICOM Messages at the Application Layer from the communication support provided by the lower layers.

This OSI Upper Layer Service boundary allows peer Application Entities to establish Associations, transfer Messages and terminate Associations. For this boundary, DICOM has adopted the OSI Standards (Presentation Service augmented by the Association Control Service Element). It is a simple service that isolates the DICOM Application Layer from the specific stack of protocols used in the communication support layers.

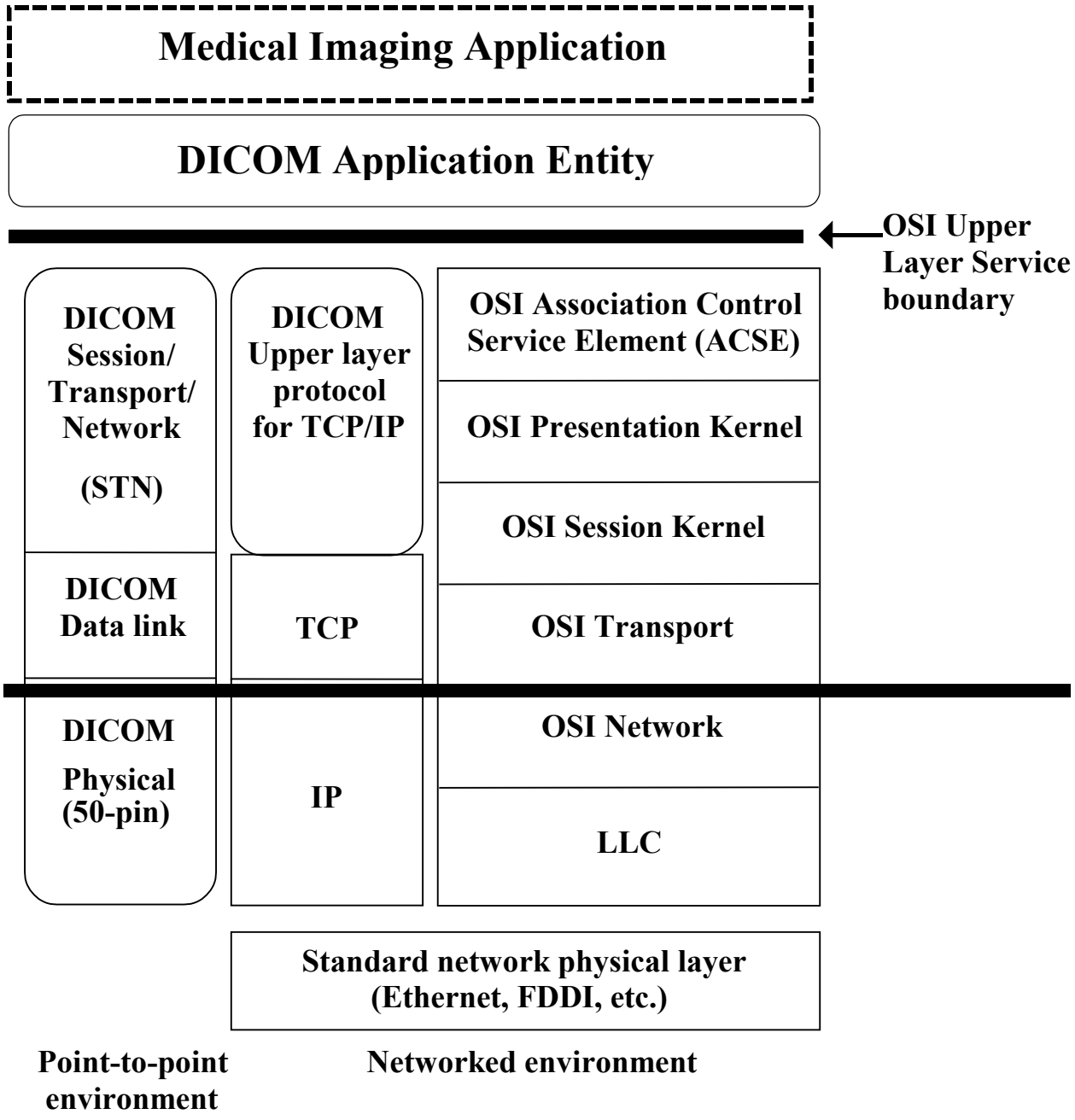
~~**Three communications options are offered:**~~

- ~~**a minimum OSI stack of protocols with a full duplex Session Kernel, Presentation Kernel, and ACSE. This reduces upper layer overhead while maintaining full conformance to the OSI protocol Standards**~~

The DICOM Upper Layer protocol augment**s**~~**ing**~~ TCP/IP. It combines the OSI upper layer protocols into a simple-to-implement single protocol while providing the same services and functions offered by the OSI stack

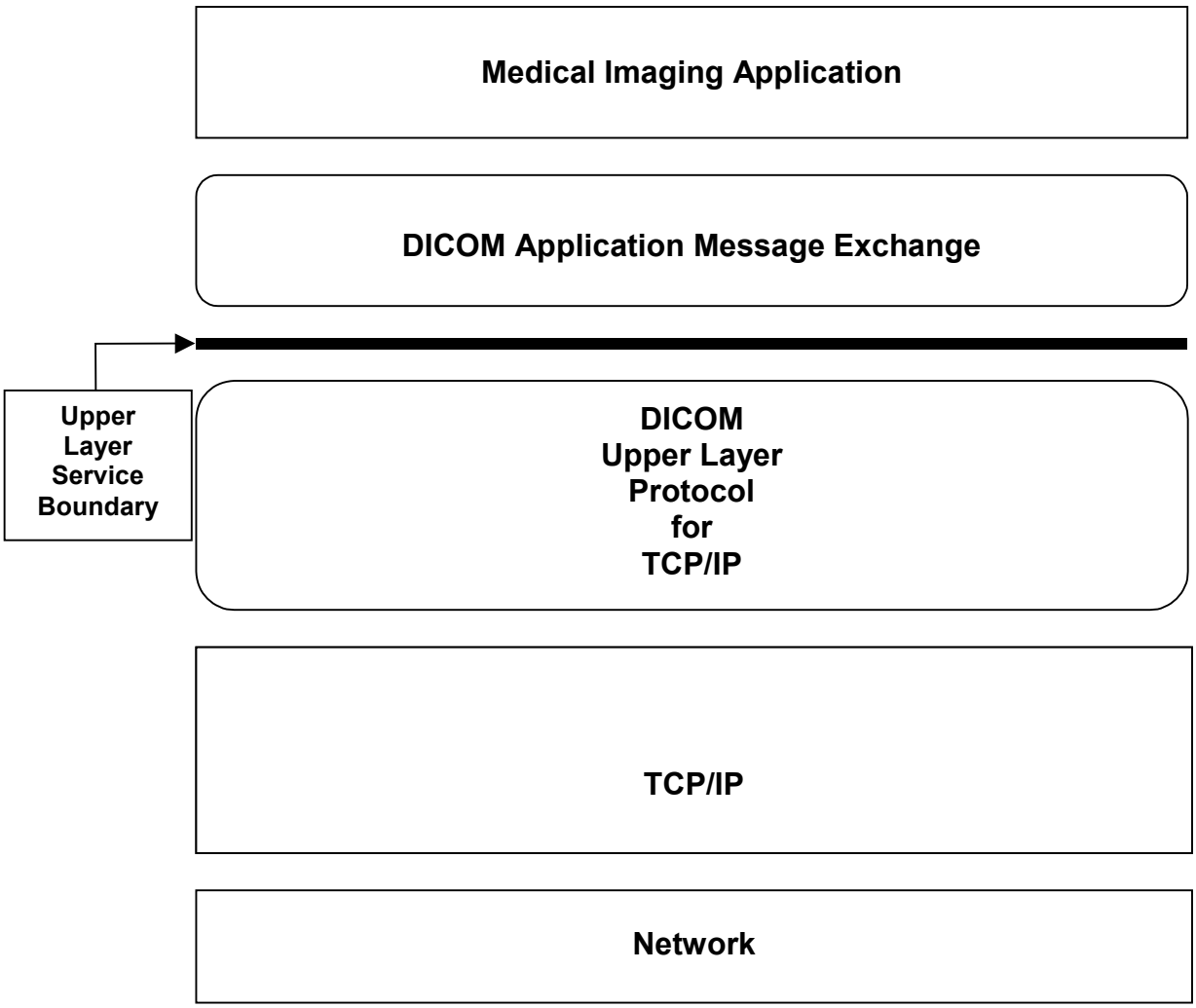
- ~~**a point-to-point protocol stack compatible with the previous versions of the Standard**~~

The DICOM Upper Layer Service is defined in PS 3.8.



Note: The DICOM STN supports a subset of the OSI upper layer service.

Figure 6.1-1
DICOM AND THE OSI BASIC REFERENCE MODEL



667

668 **Figure 6.1-1**
669 **DICOM NETWORK PROTOCOL ARCHITECTURE**

670

671

Changes to NEMA Standards Publication PS 3.8-2000

Digital Imaging and Communications in Medicine (DICOM)

Part 8: Network Communication Support for Message Exchange

Item: 8.1 Remove the following from the end of the FOREWORD:

~~**Note: PS 3.8 may be used by implementors interested in providing ACR-NEMA Version 2.0 Application Message Exchange in a Networked Environment. Implementors need to define their own Abstract Syntaxes, Transfer Syntaxes and Application Contexts.**~~

~~**It is anticipated that this will be an evolving standard and that proposals for enhancements will be forthcoming from the member organizations based on input from users of this Standard. These proposals will be considered for future version of the Standard.**~~

~~**In the preparation of this Standard, suggestions and comments from users, vendors, and other interested parties have been sought, evaluated, and included. Inquiries, comments, and proposed or recommended revisions should be submitted to the Diagnostic Imaging and Therapy Systems Division of NEMA by contacting:**~~

~~**National Electrical Manufacturers Association**~~
~~**1300 N. 17th Street**~~
~~**Rossyln, Virginia 22209**~~
~~**USA**~~

~~**The DICOM Standard**~~

~~**This part (Part 8) of PS 3 specifies the services and the upper layer protocols necessary to support the communication of DICOM Application Entities in a networked environment. This part is used in conjunction with other related parts of PS 3 as presented in PS 3.1: Introduction and Overview.**~~

~~**The Network Communication Services and Protocols specified ensure that the communication of DICOM Application Entities is performed in an efficient and coordinated manner across the network. It allows peer Application Entities (AE) to establish associations, transfer data and terminate associations.**~~

Item: 8.2 Change section 1 as shown below:

1 Scope and field of application

The Communication Protocols specified in this part of PS 3 closely fit the ISO Open Systems Interconnection Basic Reference Model (ISO 7498-1, see Figure 1-1). They relate to the following layers: Physical, Data Link, Network, Transport, Session, Presentation and the Association Control Services (ACSE) of the Application layer. The communication protocols specified by this part are general purpose communication protocols (~~OSI,~~ TCP/IP) and not specific to this standard. The other aspects of the Application Layer protocols are addressed in other parts of this standard as discussed in PS 3.1: Introduction and Overview.

Item: 8.3 Change section 3.7 as shown below:

3.7 DICOM COMMUNICATION SUPPORT DEFINITIONS

The following definitions are commonly used in this part of the Standard:

~~**Network interface unit:** A gateway system which offers a Network Interface and a DICOM Point-to-Point Interface. It relays the messages from one interface to the other.~~

Unique identifier (UID): The scheme used to provide global unique identification for objects. It uses the structure defined by ISO 8824 for OSI Object Identifiers.

DICOM upper layer: The Upper Layer protocols are related to the Session, Presentation and part of the Application Layer of the ISO reference model. These protocols provide the Upper Layer Service. This Service is a proper subset of the ACSE Service and OSI Presentation Layer Service.

Item: 8.4 Change section 4 as shown below:

4 Symbols and abbreviations

The following symbols and abbreviations are used in this part of the Standard.

ACR American College of Radiology

ACSE Association Control Service Element

ASCII American Standard Code for Information Interchange

AE Application Entity

ANSI American National Standards Institute

AP Application Process

ASE Application Service Element

ARTIM Association Request/Reject/Release Timer

CEN TC251 Comite Europeen de Normalisation-Technical Committee 251 - Medical Informatics

~~**CSMA/CD** Carrier Sense Multiple Access/Collision Detection~~

DICOM Digital Imaging and Communications in Medicine

~~**EPHOS** European Procurement Handbook for Open Systes~~

~~**EWOS** European Workshop for Open Systems~~

~~**EWOS EG MED** EWOS Expert Group Healthcare~~

FDDI Fiber Distributed Data Interface

HL7 Health Level 7

IEC International Electrotechnical Commission

IEEE Institute of Electrical and Electronics Engineers

ISDN Integrated Services Digital Network

ISO International Organization for Standardization

ISP International Standardized Profile

JIRA Japan Industries Association of Radiation Apparatus

LAN Local Area Network

~~**MAP** Manufacturing Automation Protocol~~

NEMA National Electrical Manufacturers Association

NIST National Institute of Standards and Technology

~~**NIU** Network Interface Unit~~

OSI Open Systems Interconnection

PDU Protocol Data Unit

PDV Presentation Data Values

SAP Service Access Point

TCP/IP Transmission Control Program/Internet Protocol

~~**TOP** Technical and Office Protocols~~

UID Unique Identifier

UL Upper Layers

~~**US GOSIP** United States Government Open Systems Interconnection Profile~~

WAN Wide Area Network

Item: 8.5 Change section 6 as shown below:

6 Network communication support environment

The Network Communication Services specified in PS 3.8 are a set of generic services provided to support the communication of DICOM Application Entities. They are a proper subset of the services offered by the OSI Presentation Service (ISO 8822) and of the OSI Association Control Service Element (ACSE) (ISO 8649). They shall be referred to as the Upper Layer Service or UL Service. The DICOM UL Service is specified in Section 7.

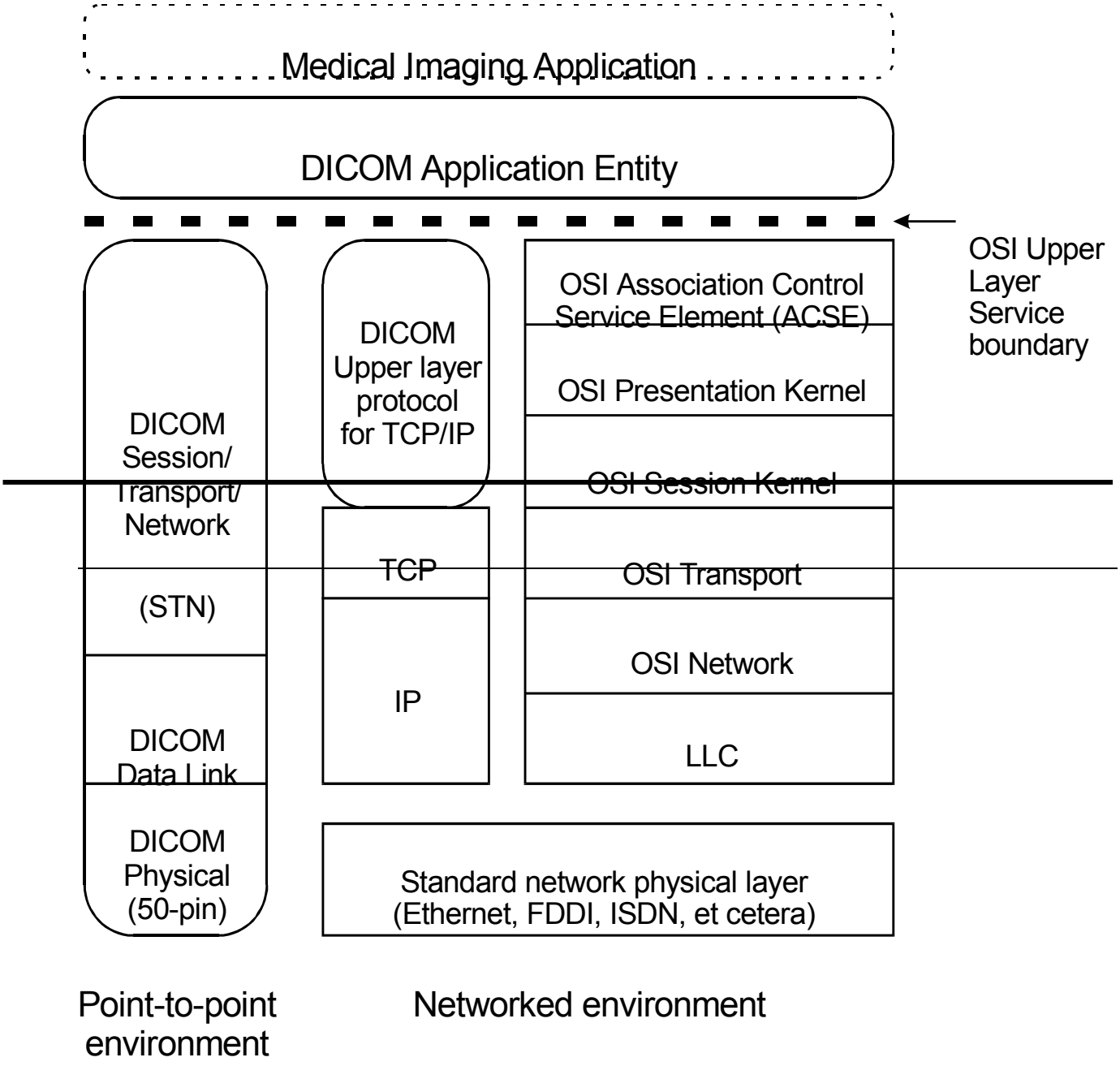
~~**This definition of the Upper Layer Service allows the use of a fully conformant stack of OSI protocols (Layers 1 through 6 plus ACSE) to achieve robust and efficient communication. It supports a large variety of international standards based network technologies using the widest choice of physical networks such as ISO 8802-3 CSMA/CD (often referred to as Ethernet), FDDI, ISDN, X.25, dedicated digital circuits and many other LAN and WAN network technologies. This DICOM stack of OSI protocols is specified in Section 8.**~~

~~**When this**~~ **This** UL Service is provided by the Upper Layer Protocol for TCP/IP (see Section 9~~**) a broad range of existing networking environments can also be used for DICOM based medical imaging communication.**~~

~~**The definition of an UL Service common to both OSI and TCP/IP environments allows migration from a TCP/IP to an OSI environment without impacting the DICOM Application Service Elements.**~~

~~**This UL Service is also a superset of the DICOM Session/Transport/Network Service defined in PS 3.9 to support a point-to-point interface ("50 pin interface"). This superset property of the UL Service permits the interconnection of a device with a point-to-point interface to a fully networked communication environment supported by OSI and TCP/IP. PS 3.1 discusses how a point-to-point interface and a networked environment coexist.**~~

Figure 6-1 shows the ~~**three**~~ **TCP/IP** protocol stack~~s~~ that ~~are~~ **is** available to support the communication of DICOM Application Entities.



Note: The DICOM STN supports a subset of the OSI upper layer service.

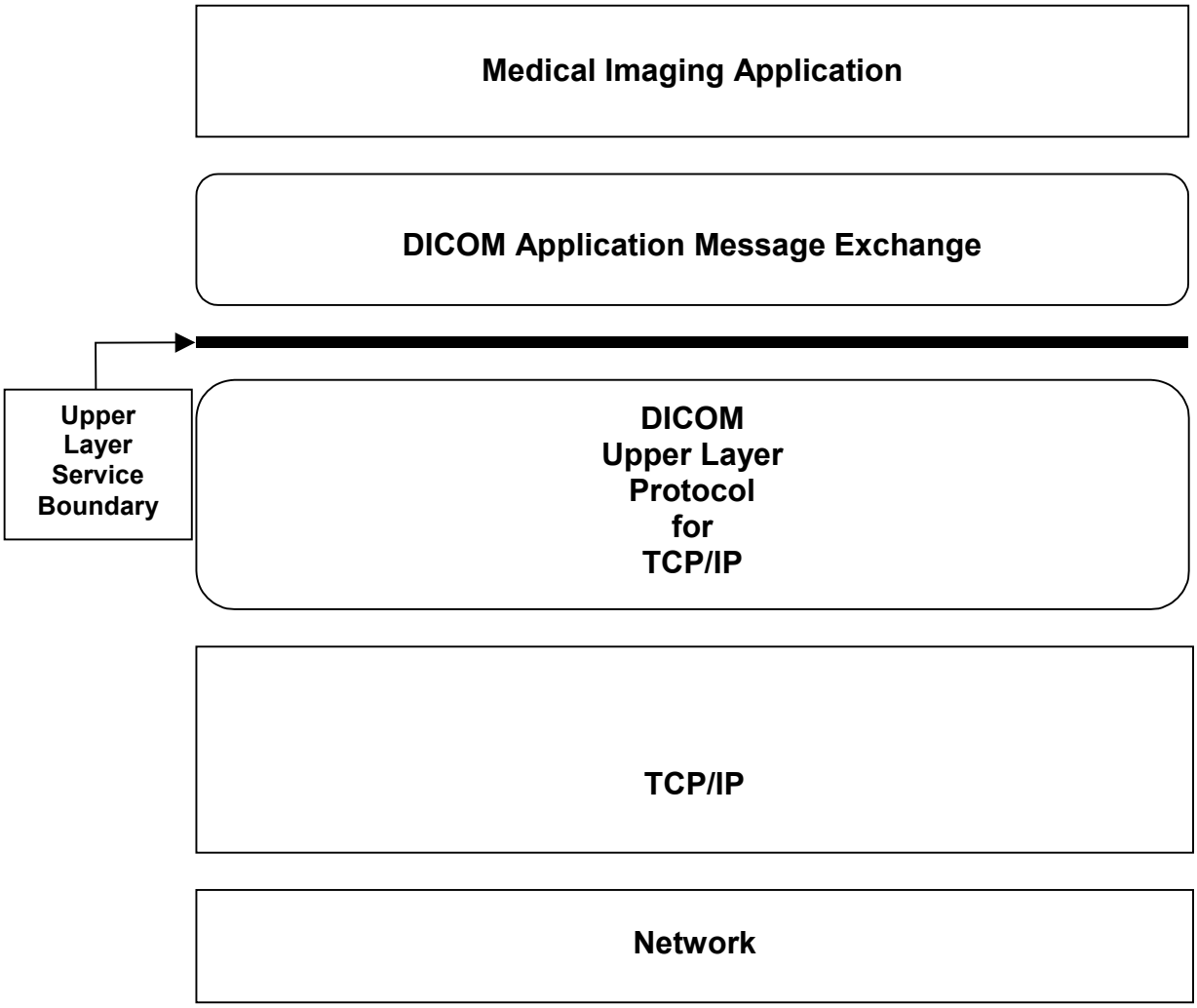


Figure 6-1
DICOM NETWORK ~~V3.0~~ PROTOCOL ARCHITECTURE

Item: 8.3 Change the following in sections 7.1.1.10 through 7.1.1.11:

7.1.1.10 Calling presentation address

This parameter shall contain a structured destination address unambiguous within the global network address structure. This shall be **~~either an OSI Presentation Address or~~** a TCP/IP Address. See Annex C.

7.1.1.11 Called presentation address

This parameter shall contain a structured destination address unambiguous within the global network address structure. This shall be **~~either an OSI Presentation Address or~~** a TCP/IP Address. See Annex C.

Item: 8.4 Retire section 8:

8 ~~DICOM OSI upper layer profile~~Retired

~~The DICOM OSI Upper Layer Profile (see note 1) defines the Upper Layer Service which supports the communication of DICOM Application Entities. These UL Services are a proper subset of the OSI Presentation Service (ISO 8822) augmented by the OSI Association Control Service Element (ACSE) Services (ISO 8649).~~

~~This DICOM OSI Upper Layer Profile can be supported by the various OSI Connection-mode Transport Service Profiles corresponding to a wide range of physical networks, such as ISO 8802-3 CSMA/CD, FDDI, X.25, ISDN, dedicated digital circuits, and many other LAN and WAN network technologies (see note 2).~~

~~This DICOM OSI Upper Layer Profile specifies the subset of the OSI Protocols pertaining to Layer 5 (Session), Layer 6 (Presentation), and Layer 7 (ACSE) necessary to provide the Upper Layer Service as defined in Section 7. The specification of such a profile, in addition to one or more Transport Profiles, is necessary to ensure interoperability of implementations.~~

~~Notes: 1. This concept of a "Profile" is defined by the ISO/IEC TR 10000. When developed, harmonized, and ratified by ISO/IEC it is called an International Standardized Profile or ISP. This same concept is defined as a "Functional Standard" by CEN and the European Workshop for Open Systems (EWOS). In the USA, the National Institute of Standards and Technology (NIST) is hosting an OSI Implementors Workshop which defines such profiles as "Implementor Agreements." These profiles are used as the basis of Government Procurement Profiles (e.g. US GOSIP or EPHOS) or Industry Procurement Profiles (e.g. MAP or TOP).~~

~~2. A number of International Standardized Profiles (ISPs) may be used, examples of such ISPs are:~~

~~a) TA51 (Transport over CSMA/CD)~~

~~1 ISO/IEC 10608-1, International Standardized Profile TA - Connection-mode Transport Service over Connection less Network Service, Part 1: General Overview and Subnetwork-independent Requirements.~~

~~2 ISO/IEC 10608-2, Part 2: TA51 Profile Including Subnetwork-dependent Requirements for CSMA/CDLANs~~

~~b) TB 1111/1121 (Transport over X.25)~~

~~1 ISO/IEC 10609-1, International Standardized Profiles TB, TC, TD, and TE - Connection-mode Transport Service over Connection-mode Network Service, Part 1: Subnetwork-type Independent Requirements for Group TB~~

~~2 ISO/IEC 10609-5, Part 5: Definition of Profile TB 1111/TB 1121~~

~~3. The DICOM OSI Upper Layer Profile specified in this section is a candidate to become an "International Standardized Profile." In this initial version, technical content has been the primary focus using a simplified format. It is mainly intended to be a set of technical agreements.~~

~~8.1 NAMING AND ADDRESSING~~

~~The ISO 7498-3 addressing principles shall be followed. See Annex C for more information.~~

~~8.2 ACSE PROTOCOL REQUIREMENTS~~

~~The conformance requirements of ISO 8650:1987 shall be met with the following:~~

~~a) Application Contexts shall be supported as defined by the UL Service. Application Context Names are defined in PS 3.7 and Annex A.~~

~~b) Only the parameters defined in Section 7 as Mandatory, Mandatory Fixed, User Option, User Option with a fixed value, and Conditional need to be supported in the corresponding PDUs.~~

~~8.3 PRESENTATION PROTOCOL REQUIREMENTS~~

~~The Conformance Requirements of ISO 8823:1988 shall be met with the following:~~

~~a) The Kernel Presentation Functional Unit shall be supported.~~

~~b) At least 16 presentation contexts per presentation connection must be supported (either accepted or rejected).~~

~~c) Abstract Syntaxes shall be supported as defined by the UL Service. Abstract Syntax Names are defined in PS 3.4 and Annex B.~~

~~d) Transfer Syntaxes shall be supported as defined by the UL Service definition. Transfer Syntax Names are defined in PS 3.5 and Annex B.~~

~~e) The general Presentation Protocol agreements documented in the Stable Implementors Agreements of the OSI Implementors Workshop (NIST Special Publication 500-150) apply.~~

~~8.4 SESSION PROTOCOL REQUIREMENTS~~

~~The Conformance Requirements of ISO 8327:1987 and AM 2 shall be met with the following:~~

~~a) The Session Kernel and Full Duplex Functional Units shall be supported.~~

~~b) Session Version 2 shall be used.~~

~~c) Maximum size of the User Data parameter of the S-Connect PDU is 10,240 octets.~~

~~d) The general Session Protocol agreements documented in the Stable Implementors Agreements of the OSI Implementors Workshop (NIST Special Publication 500-150) apply.~~

Item: 8.5 Change section 9 as follows:

9 DICOM upper layer protocol for TCP/IP

The DICOM Upper Layer Protocol specified in this section shall be used in conjunction with the TCP/IP transport layers**. ~~It is intended to be used only in network environments where OSI support is not available.~~**

~~Note: The DICOM Upper Layer Protocol should not be used in conjunction with the OSI transport layers. OSI upper layers in conjunction with OSI Transport Layers should be used as defined in Section 8.~~

Item: 8.6 Modify Section 10 as follows:

10 Conformance

10.1 CONFORMANCE REQUIREMENTS

10.1.1 Retired ~~OSI NETWORK COMMUNICATION SUPPORT~~

~~An implementation claiming conformance to *DICOM V3.0 OSI Network Communication Support* shall:~~

~~a) Meet the OSI ACSE, Presentation and Session Protocols requirements as defined in Section 8.~~

~~b) Use registered Application Context Names, Abstract Syntax Names and Transfer Syntax Names as defined for OSI Object Identifiers (ISO 8824 and ISO 9834-3).~~

~~c) Use one of the International Standardized Profiles for OSI Transport over specific physical networks.~~

10.1.2 TCP/IP NETWORK COMMUNICATION SUPPORT

An implementation claiming conformance to *DICOM **~~V3.0~~** TCP/IP Network Communication Support* shall:

a) Meet the DICOM Upper Layers Protocol requirements as defined in Section 9.

b) Use registered Application Context Names, Abstract Syntax Names and Transfer Syntax Names as defined for OSI Object Identifiers (ISO 8824 and ISO 9834-3).

Note: Annex F defines the DICOM Upper Layer Protocol encoding for the Application Context Names, Abstract Syntax Names, and Transfer Syntax Names. ISO 8825 defined encoding is not used.

c) Use one of the published and approved RFCs defining the operation of TCP/IP over specific physical networks.

10.2 CONFORMANCE STATEMENT

An implementation claiming conformance to DICOM **~~V3.0~~** for communication support in a networked environment shall state

~~a) DICOM V3.0 OSI Network Communication Support with the following list of Transport ISPs:(ISPxxx, ISPyyy, etc.) and relevant implementation information. This implies that the conformance requirements defined in Section 10.1.1 are met.~~

~~b)~~ DICOM TCP/IP Network Communication Support with the ~~following~~ list of physical networks and corresponding ~~RFC/~~relevant implementation information. This implies that the conformance requirements defined in Section 10.1.2 are met.

Item: 8.7 Change Annex A, sections A.2 and A2.2 as follows:

A.2 DICOM APPLICATION CONTEXT NAME ENCODING AND REGISTRATION

The Application Context Name structure is based on the OSI Object Identification (numeric form) as defined by ISO 8824. Application Context Names are registered values as defined by ISO 9834-3 to ensure global uniqueness**. ~~Application Context Names are encoded as defined in ISO 8825 (Object Identifiers of numeric form) when the OSI network communication support is used as defined in~~**

~~Section 8.~~ They are encoded as defined in Annex F when the TCP/IP network communication support is used as defined in Section 9.

A.2.2 Retired~~Privately defined application context names~~

~~Privately defined Application Context Names may also be used, however, they will not be registered by NEMA. Organizations which define private Application Context Names are responsible to obtain their proper registration as defined for OSI Object Identifiers. National Standards Organizations representing a number of countries (e.g. UK, France, Germany, Japan, USA, etc.) to the International Standards Organization act as a registration authority as defined by ISO 9834-3.~~

~~Note: For example, in the USA, ANSI assigns (for a fee) Organization Identifiers to any requesting organization. This identifier is made of a series of four numeric components; 1 (identifies ISO), 2 (identifies the ISO member bodies branch), 840 (identifies ANSI as the ISO member body representing the USA), and xxxxxx (identifies a specific organization and is issued by ANSI). Such an identifier may be used by the identified organization as a root to which it may add a suffix made of one or more numeric components. The identified organization accepts the responsibility to properly register these suffixes to ensure uniqueness.~~ **~~The ANSI contact is as follows:~~**

~~ANSI~~
~~Registration Coordinator~~
~~11 West 42nd Street, New York, New York 10036~~
~~Tel. (212) 642-4900~~

Item: 8.8 Change Annex B Section B.3.2 as follows:

B.3.2 Privately defined abstract and transfer syntax names

Privately defined Abstract and Transfer Syntax Names may also be used, however, they will not be registered by NEMA. Organizations which define private Abstract and Transfer Syntax Names are responsible to obtain their proper registration defined for OSI Object Identifiers. National Standards Organizations representing a number of countries (e.g. UK, France, Germany, Japan, USA, etc.) to the International Standards Organization act as a registration authority as defined by ISO 9834-3.

Note: For example, in the USA, ANSI assigns (for a fee) Organization Identifiers to any requesting organization. This identifier is made of a series of four numeric components; 1 (identifies ISO), 2 (identifies the ISO member bodies branch), 840 (identifies ANSI as the ISO member body representing the USA), and xxxxxx (identifies a specific organization and is issued by ANSI). Such an identifier may be used by the identified organization as a root to which it may add a suffix made of one or more numeric components. The identified organization accepts the responsibility to properly register these suffixes to ensure uniqueness**.** **~~The ANSI contact is as follows:~~**

~~ANSI~~
~~Registration Coordinator~~
~~11 West 42nd Street, New York, New York 10036~~
~~Tel. (212) 642-4900~~

Item: 8.9 Change Annex C as follows:

Annex C DICOM addressing (Normative)

C.1 DICOM APPLICATION ~~NAMES~~ ENTITY TITLES

A DICOM Application ~~Names~~ **Entity Title uniquely** identifi**es**~~y~~ a ~~unique~~ service or application on a specific system in the network. Application **Entity Titles** ~~names~~ are independent of network topology so a device may be physically moved while its corresponding **A**pplication ~~name(s)~~ **Entity Title** may remain the

same~~. A DICOM Application Name is often a set of acronyms or abbreviations which may convey some meaning to a user.~~ See PS 3.5 for the encoding of DICOM Application ~~Names~~ **Entity Titles**.

Note: DICOM Application ~~Name~~ **Entity Title** was called Logical Address in the ~~**previous version of this**~~**ACR-NEMA** Standard.

DICOM Application ~~Names~~ **Entity Titles** are used in ~~**two**~~ **three** instances of communication ~~**as shown in Figure C.1-1**~~:

a) to identify the Called/Calling Application Entit**ies**~~y~~ ~~Titles~~. They are used to establish an association and to ensure that the association is established with the expected application. ~~The method of mapping to **OSI or** TCP/IP addresses is implementation specific (e.g. static definition, name server, etc.). **OSI or** TCP/IP addresses are conveyed to the UL Service as the Called and Calling Presentation Address parameters of the A-ASSOCIATE request/indication.~~

b) to identify the ~~**Initiator/Receiver**~~ **originator and intended destination** of **DICOM** ~~**Messages**~~ **Retrieve Services (see PS3.4).** They are conveyed in DICOM Commands with ~~**each**~~ message**s of the DIMSE C-MOVE and C-STORE Services** exchanged over an established association.

c) to identify the location of a Retrieve Service SCP for one or more SOP Instances. They are conveyed in DICOM Data Sets of various services.

C.2 NAMING AND ADDRESSING USAGE RULES

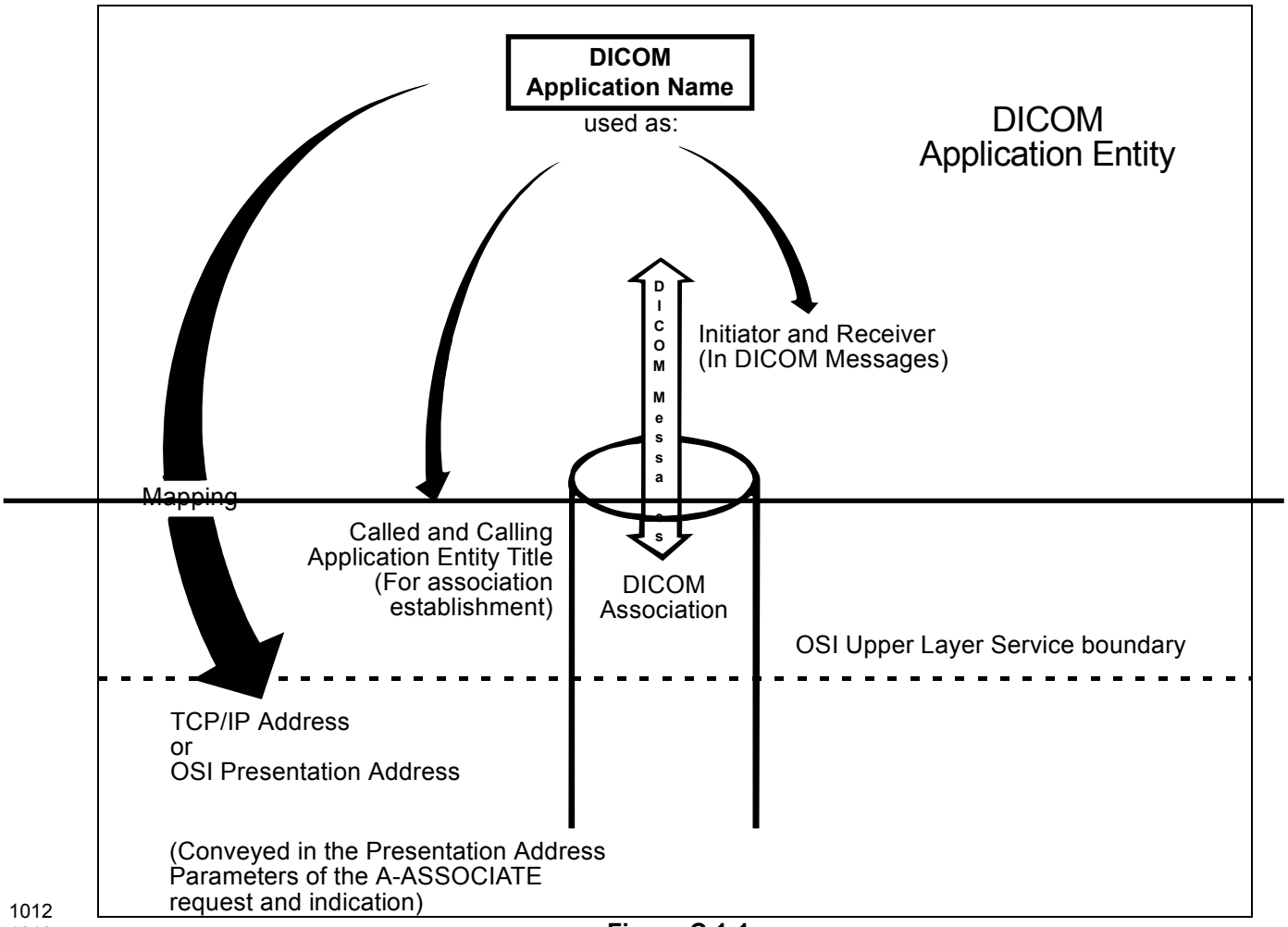
~~**C.2.1**~~ DICOM Application **Entity Titles** ~~Names~~ are used in ~~**both**~~ the Called/Calling Application Entity Title fields of the ~~**Generic OSI**~~ U**pper** L**ayer** Service**, in** ~~**and**~~ the ~~**DICOM Message Initiator/Receiver**~~ **Move Destination and Move Originator Application Entity Title** data elements in the DICOM Message **Command Set, and in various Attributes of the DICOM Message Data Set**. ~~**DICOM Called/Calling Application Entity Title fields used when establishing an association may or may not contain the same name as the corresponding DICOM Message Initiator/Receiver fields of messages exchanged over this association**~~.

Notes: 1. A single Application Entity Title can be associated with multiple network addresses assigned to a single system (e.g., multi-homed host).
2. A single Application Entity Title can be associated with multiple TCP Ports using the same or different IP Addresses.
3. A single network access point (IP Address and TCP Port) can support multiple Application Entity Titles.

~~**C.2.2**~~ A DICOM system on a network may support several application processes identified by different DICOM Application **Entity Titles** ~~Names~~.

~~**C.2.3**~~ Upon receiving an association request, the Called Application Entity Title shall be validated so an association can be rejected when the corresponding local application does not exist.

~~**C.2.4 A DICOM Application Entity, upon receiving a message, shall validate the DICOM Receiver data element in the command group to be sure the message has reached the correct local DICOM application.**~~



~~Figure C.1-1~~
~~NAMING AND ADDRESSING~~

Item: 8.10 Change Annex F as follows:

F.1 ENCODING RULES

Application Context Names, Abstract Syntax Names, Transfer Syntax Names, and Service Class UIDs are OSI Object Identifiers in a numeric form as defined by ISO 8824. The encoding of these names in the DICOM UL protocol is specified in this Annex. **~~This is not applicable to OSI Upper Layer protocols.~~**

Each component of a Name or UID is encoded as an ISO 646:1990-Basic G0 Set Numeric String of bytes (characters 0-9). Leading 0's of each component are not significant and shall not be sent. Components shall not be padded. Components shall be separated by the character "." (2EH). "Null" components (no numeric value between two separators) shall not exist. Components with the value zero (0) shall be encoded as (nnn.0.ppp). No separator nor padding shall be present before the first digit of the first component or after the last digit of the last component.

Item: 8.11 Change Annex G as follows:

Annex G Overview of the OSI layer and services concepts (Informative)

In a layered communication model, such as the OSI 7 layer reference model, each layer uses the service provided by the layer immediately below. The operation of a protocol layer on top of the lower layer service provides a new service to the layer above. The service is the “glue” between the layers of protocols.

Services describe the resulting effects of the operation of a protocol without requiring knowledge of the detailed specifications of the protocol itself. A protocol specifies a horizontal dialogue between two computing systems across a network, while a service describes a vertical relationship within a system. See Figure G-1.

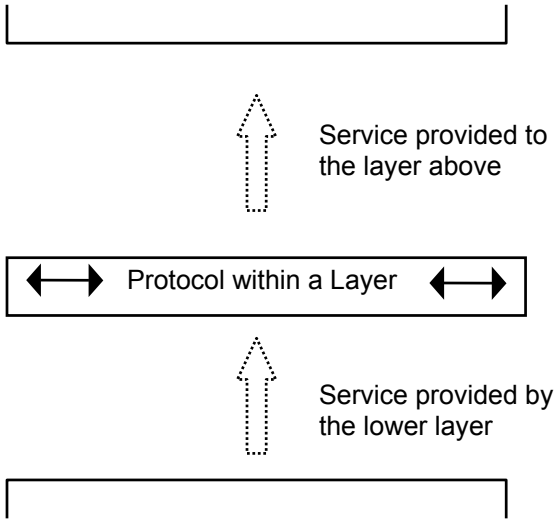


Figure G-1
RELATIONSHIP OF SERVICES TO PROTOCOL

The OSI Upper Layer Service is described by a number of service primitives. They each model one of the functional interactions between the service-user in the layer above and the service-provider. In the context of this Standard, the service-user is called the DICOM Application Service Element. The service-provider is called the Upper Layer and performs the Upper Layer Protocol.

Note: The OSI UL Services defined in this standard ~~**can be**~~ **are** provided ~~**either**~~ by ~~**the DICOM OSI Upper Layer Profile (Section 8) or**~~ the DICOM Upper Layer Protocol for TCP/IP (Section 9).

These service primitives cross the layer boundary at what is called a Service Access Point (SAP). In most cases a direct relationship exists between service primitives in two Application Entities (AEs). This is reflected in the names of these primitives:

1062

1063

1064

1065

1066

1067

1068 **Changes to NEMA Standards Publication PS 3.10-2000**

1069 **Digital Imaging and Communications in Medicine (DICOM)**

1070 **Part 10: Media Storage and File Format for Media Interchange**

1071

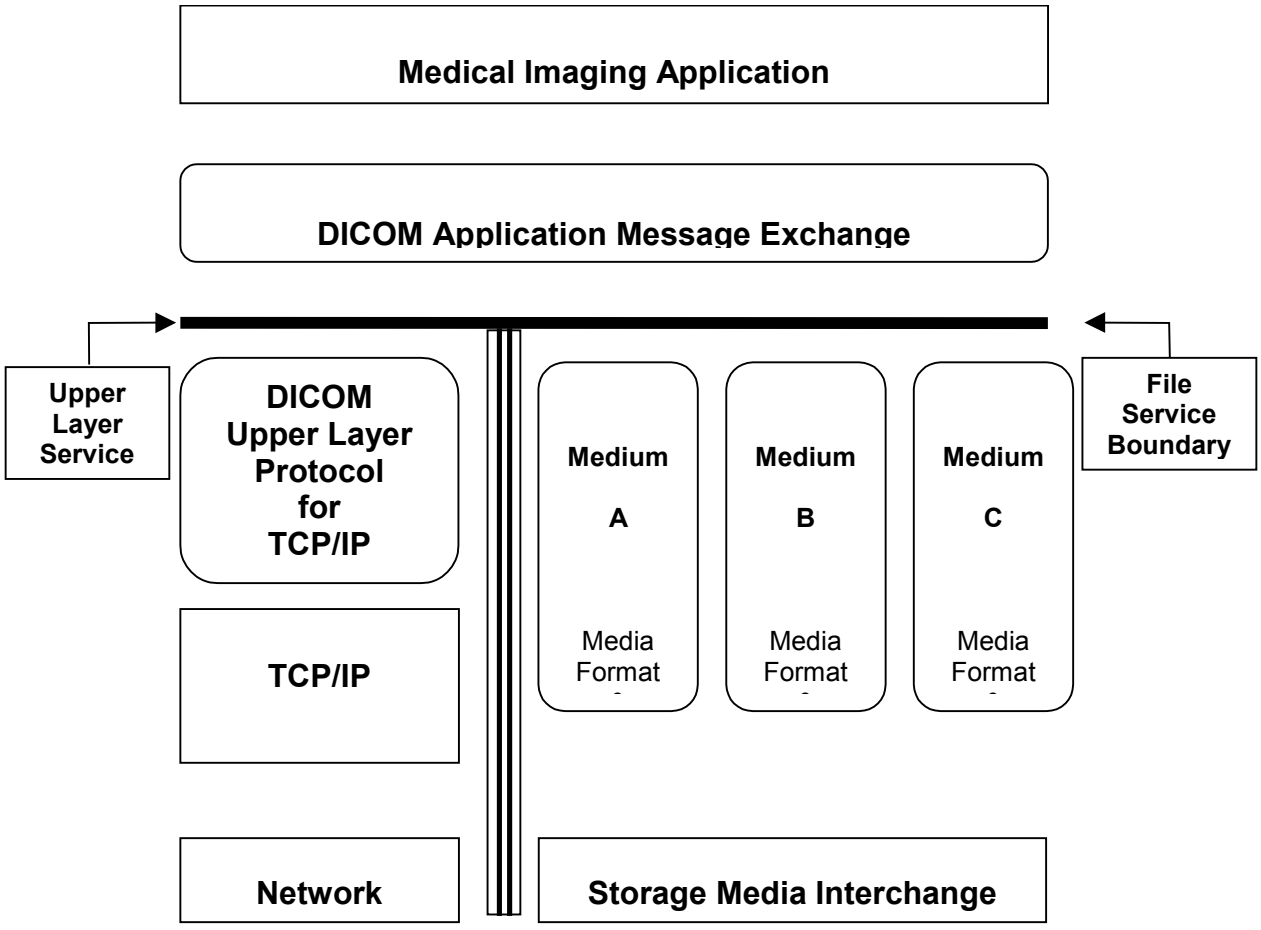
Item: 10.1 Modify section 6.1 as follows:

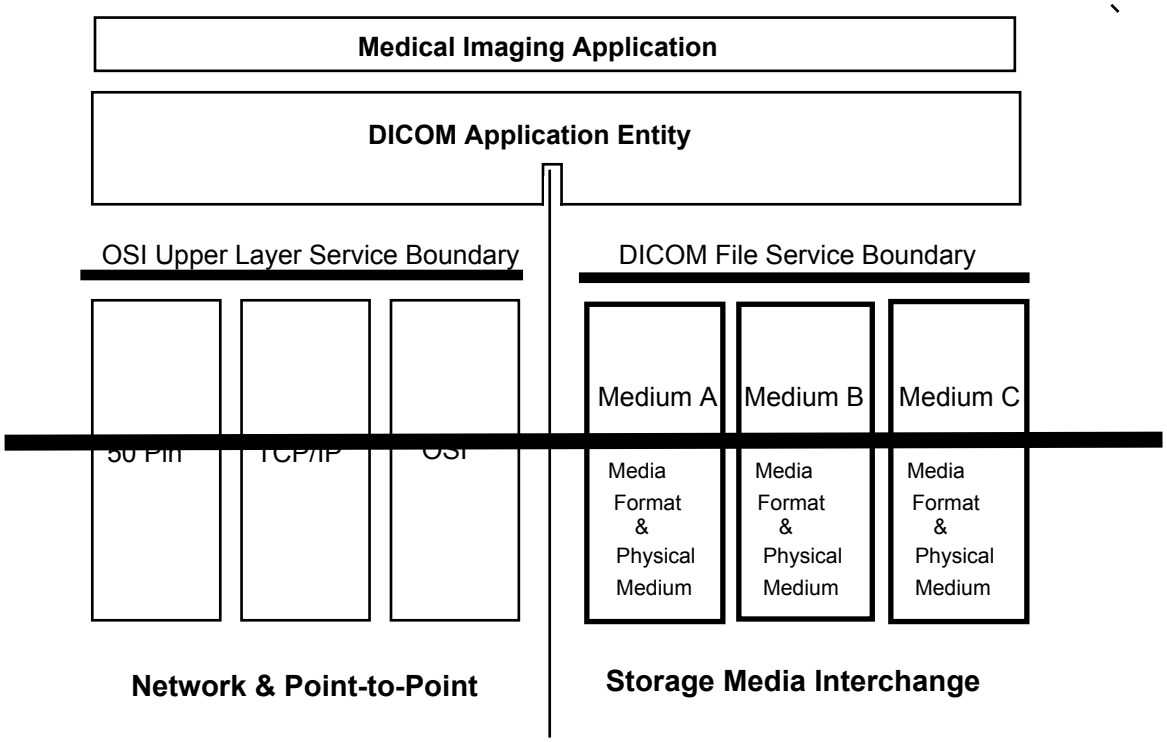
6.1 GENERAL DICOM COMMUNICATION MODEL

Figure 6.1-1 presents the general communication model of DICOM which spans network~~, point-to-point~~ and storage media interchange communications. The DICOM Application Entities may rely on either one of the following boundaries:

a. the OSI Upper Layer Service, which provides independence from specific physical networking ~~and point-to-point~~ communication support

b. the DICOM File Service, which provides access to Storage Media independently from specific physical media storage formats and file structures.




Medical Imaging Application
DICOM Application Entity
OSI Upper Layer Service Boundary
DICOM File Service Boundary
50 Pin
TCP/IP
OSI
Medium A
Medium B
Medium C
Media Format & Physical Medium
Media Format & Physical Medium
Media Format & Physical Medium
Network & Point-to-Point
Storage Media Interchange

1083