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Health informatics — Interoperability of telehealth systems and networks —

Part 1: Introduction and definitions

Informatique de santé — Interopérabilité des systèmes et des réseaux de télésanté —

Partie 1: Introduction et définitions

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Contents

Page

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

In exceptional circumstances, when a technical committee has collected data of a different kind from that which is normally published as an International Standard ("state of the art", for example), it may decide by a simple majority vote of its participating members to publish a Technical Report. A Technical Report is entirely informative in nature and does not have to be reviewed until the data it provides are considered to be no longer valid or useful.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO/TR 16056-1 was prepared by Technical Committee ISO/TC 215, *Health informatics*.

ISO/TR 16056 consists of the following parts, under the general title *Health informatics — Interoperability of telehealth systems and networks*:

— *Part 1: Introduction and definitions*

— *Part 2: Real-time systems*

INTRODUCTION

Delivery of health care services by means of telehealth is advancing rapidly. Telehealth enables providing these services with the use of information and telecommunications technologies. This includes a broad spectrum of capabilities including acquisition, storage, presentation, and management of patient information (represented in different digital forms such as video, audio, or data), and communication of this information between care facilities with the use of communications links.

Telehealth interactions may be carried out in three ways: **real-time**, **store-and-forward** or with the use **media streaming** methods. While real-time interactions imply that all parties directly participate in the telehealth session, store-and-forward interactions involve sending, reviewing, and returning an opinion over a period of time. Streaming is a method of delivery real-time or stored data such as audio, video, documents, still images, or other data type across networks with a reasonable amount of Quality of Services (QoS). With streaming, a receiving system can start displaying (or playing) the data before the entire content arrives.

Real-time telehealth sessions usually involve **synchronous** data transmission while store-and-forward can usually be regarded as **asynchronous**. Streaming uses time-synchronized streams of continuous media during transmission. However, data presentation uses buffering, if the receiving system receives data more quickly than required. If the data is not received quickly enough, the presentation of the data is interrupted.

Interoperability of telehealth systems and networks is critical in ensuring the telehealth technology serves well the care recipients and providers and meets their expectations. While this requirement is essential to the long-term sustainability of telehealth, interoperability is difficult to achieve. There are many reasons that make telehealth interoperability difficult, however, the following three need urgent addressing: (1) too broad definition of telehealth, (2) lack of standards specifically designed for telehealth, and (3) collaboration between the information technology and telecommunications industries.

There are multiple definitions of telehealth. The services provided by telehealth cover a broad spectrum of activities ranging from videoconferencing through exchange of health information to providing care services in emergency and complex clinical cases. From a technology perspective, the scope of these services is too broad and this makes it difficult to develop telehealth standards and products.

There is no ‘official’ telehealth standard. The telehealth industry uses high-level health care guidelines and technical standards developed for various technology sectors including multimedia conferencing, information technology, data communications, and security. These guidelines and standards focus on functional and operational requirements and do not address interoperability. To further complicate the problem, all of these standards as well as the telehealth needs and practices are rapidly changing.

Telehealth, more than any other recent development, bridges the boundaries between telecommunications and information technologies. The business goals and attitudes of these two industries are different. Telecommunications industry has a history of regulation, standardization, and control of the customer premises equipment. Interoperability and reliability have been the key factors to growth. The information technology industry (the desktop computing industry in particular) has achieved success through encouraging innovation, diversity, and tremendous cost-efficiency not always paying attention to interoperability aspects of the technology. The marriage of these two cultures and the integration of their respective technologies proved to be challenging.

To address the needs for interoperable telehealth systems and networks, telehealth services must be clearly defined in terms of their scope and interrelationships with other health-related services, a set of telehealth-specific standards must be developed, and subsequently implemented by the respective industries.

This two-part ISO Technical Report addresses interoperability issues in telehealth systems and networks. This document has been structured as follows:

Part 1: Introduction and Definitions. Covers an introduction to telehealth and includes the definitions of telehealth, interoperability, and related terms.

Part 2: Real-Time Systems. Defines the scope of the technical standards related to real-time applications, (including video, audio, and data conferencing), identifies gaps and overlaps in the standards, defines requirements for interoperable telehealth systems and networks, and identifies building blocks for interoperable telehealth solutions.

This Technical Report is to be complemented by two other documents that will cover interoperability of store-and-forward and media streaming telehealth applications.

The target users of these documents are care providers and health care organizations, telehealth equipment vendors and implementers of telehealth solutions, professional organizations, and governments.

Health informatics — Interoperability of telehealth systems and networks — Part 1: Introduction and definitions

1 SCOPE

This Technical Report entitled *Interoperability of telehealth systems and networks - Part 1: Introduction and definitions* includes a brief introduction to interoperability of telehealth systems and networks, along with definitions of telehealth and related terms.

The scope of this document does not include the conformity and interoperability tests or functional specifications for telehealth systems and networks.

A more detailed description of issues concerning the interoperability of telehealth systems and networks capable of operating in real-time mode (including audio, video, and data conferencing) is included in *Part 2. Real-Time Systems*. That document identifies standards for real-time telehealth systems, examines interoperability aspects of telehealth applications, and defines interoperability requirements for telehealth systems and networks. Other documents will describe the issues surrounding interoperability of telehealth systems that use store-and-forward and media streaming technologies.

An informative annex describing the Telehealth Technical Reference Architecture has been also been included to describe more clearly the various components of a telehealth system and the elements that need to be addressed in formulating a set of requirements for these various components.

2 NORMATIVE REFERENCES

This Technical Report incorporates by dated or undated reference, provisions from other publications. These normative references are cited in the appropriate places in the text, and the publications are listed hereafter.

For dated references, subsequent amendments and revisions of any of these publications apply to this ISO Technical Report only when incorporated in it by amendment and revision. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TC 251/N99-097 (1999)	*Health Informatics - Interoperability of Healthcare Multimedia Report Systems. Final draft CEN Report*
ISO/IEC 17000:2004	*Conformity assessment – Vocabulary and general principles*
ITU-T Recommendation G.711 (1988)	*Pulse code modulation (PCM) of voice frequencies*.
ITU-T Recommendation G.722 (1993)	*7 KHz audio - coding within 64 kbit/s*.
ITU-T Recommendation G.728 (1992)	*Coding of speech at 16 kbit/s using low-delay code excited linear prediction.*
ITU-T Recommendation H.221 (1993)	*Frame structure for a 64 to 1920 kbit/s channel in audiovisual teleservices*.
ITU-T Recommendation H.230 (1997)	*Frame-synchronous control and indication signals for audiovisual systems.*
ITU-T Recommendation H.242 (1996)	*System for establishing communication between audiovisual terminals using digital channels up to 2 Mbit/s*.
ITU-T Recommendation H.243 (1997)	*Procedures for establishing communication between three or more audiovisual terminals using digital channels up to 1920 kbit/s*.

ITU-T Recommendation H.224 (1994)	*A real time control protocol for simplex applications using the H.221 LSD/HSD/HLP channels*.
ITU-T Recommendation H.281 (1994)	*A far end camera control protocol for videoconferences using H.224*.
ITU-T Recommendation H.233 (1996)	*Confidentiality System for Audiovisual Services.*
ITU-T Recommendation H.234 (1996)	*Encryption key management and authentication system for audiovisual services.*
ITU-T Recommendation H.320 (1996)	*Narrow-band visual telephone systems and terminal equipment*.
ITU-T Recommendation T.120 (1996)	*Data protocols for multimedia conferencing.*
ITU-T Recommendation T.121 (1996)	*Generic application template.*
ITU-T Recommendation T.122 (1993)	*Multipoint communication service for audiographics and audiovisual conferencing service definition.*
ITU-T Recommendation T.123 (1994)	*Protocol stacks for audiographic and audiovisual teleconference applications.*
ITU-T Recommendation T.124 (1995)	*Generic conference control.*
ITU-T Recommendation T.125 (1994)	*Multipoint communication service protocol specification.*
ITU-T Recommendation T.126 (1995)	*Multipoint still image and annotation protocol.*
ITU-T Recommendation T.127 (1995)	*Multipoint binary file transfer protocol.*

3 TERMS AND DEFINITIONS

For the purposes of this Technical Report, the following definitions apply.

3.1
accreditation
third party attestation related to a conformity assessment body conveying formal demonstration of its competence to carry out specific conformity assessment tasks

3.2
A-law
variant of the G.711 audio encoding used primarily in North America and Japan

NOTE Related terms include μ-law and G.711

3.3
asynchronous transmission
transmission of individual bytes without time-dependency between the bytes

3.4
audiographics terminal
terminal that has audio and graphics capabilities, but no video capability

3.5
audiovisual terminal
terminal that has audio, video, and graphics capabilities

3.6
basic rate interface
BRI
ISDN service comprising two B (bearer) channels operating at 64 Kbps each and one D (data) channel operating at 16 Kbps

3.7
call
point-to-point multimedia communication between two H.32x endpoints

3.8
call setup
process of establishing a group of communication users and includes the initialization of any shared application and other resources which the user may require to be available

3.9
call signalling channel
reliable channel used to convey call setup messages following Q.931

3.10
call teardown
process of ending a call and freeing any resources reserved for that call

3.11
centralized multipoint conference
conference call in which all participating terminals communicate in a point-to-point fashion with an MCU

3.12
certification
third-party attestation related to products, processes, systems or persons

NOTE 1 Certification of a management system is sometimes also called registration.

NOTE 2 Certification is applicable to all objects of conformity assessment except for conformity assessment bodies themselves, to which accreditation is applicable.

3.13
channel service unit
CSU
interface used to connect a terminal or computer to a digital medium in the same way that a modem is used for connection to an analogue medium

3.14
charge coupled device
CCD
device used in cameras as an optical scanning mechanism.

NOTE It consists of a shift register that stores samples of analog signals. An analog charge is sequentially passed along the device by the action of stepping voltages and stored in potential wells formed under electrodes. The charge is moved from one well to another by the stepping voltages.

3.15
common intermediate format
CIF
ITU-T standard video picture scanning format where information is stored in luminance (brightness) and two color difference (chrominance) components

NOTE CIF represents 352 pixels/line by 288 lines/image for luminance and 176 pixels/line by 144 lines/image for chrominance. See also QCIF.

3.16
codec
device used to covert analog signals into digital (and vice versa), and perform encoding / decoding and compression / decompression of the digital data

3.17
composite video
type of video signal in which all information -- the red, blue, and green signals, and sometimes audio signals as well, are mixed together

NOTE Composite video is used by NTSC-compliant devices (see NTSC Standard).

3.18
conformity assessment
demonstration that specified requirements relating to a product, process, system, person or body are fulfilled

NOTE Conformity to a set of specifications is a prerequisite to interoperability. However, conformity to the specifications alone does not guarantee interoperability of systems.

3.19
data service unit
DSU
device used in digital transmission for connecting a CSU to data terminal equipment (a terminal or computer), in the same way that a modem is used for connection to an analogue medium

Note See also CSU.

3.20
decentralized multipoint conference
conference in which the participating terminals multicast to all other participating terminals without an MCU

3.21
endpoint
terminal, gateway, or MCU

3.22
G.711
ITU-T recommendation for the digital representation of speech up to 3.4 KHz of frequency producing a 64 Kbps data stream

NOTE Commonly used in telephone networks. It comes in two variants: A-law and μ-law.

3.23
G.722
ITU-T recommendation for the digital representation of audio up to 7 KHz of frequency producing a 64 Kbps data stream with a much higher quality than G.711

3.24
G.728
ITU-T recommendation for the digital representation of audio producing a 16 Kbps data stream producing near-telephone quality audio.

3.25
gatekeeper
H.323 entity that provides address translation, control access, and sometimes bandwidth management to the LAN for H.323 terminals, gateways, and MCUs

3.26
gateway
H.323 entity, which provides real-time, two-way communications between H.323 terminals on the LAN and other ITU terminals on a WAN, or to another H.323 gateway

3.27
generic conference call
GCC
set of conference services described in the ITU-T T.124 Recommendation

3.28
H.221
ITU-T recommendation defining how to multiplex video and audio into frames using 64-1920 Kbps channels for switched and leased network services, excluding packetized networks

3.29
H.225D
ITU-T recommendation that specifies messages for call control including signaling, registration and admissions, and packetization/synchronization of media systems

3.30
H.230
ITU-T recommendation that specifies the frame-synchronous control and indication signals for audiovisual systems

3.31
H.231
ITU-T recommendation that specifies the multipoint control unit

3.32
H.235
ITU-T recommendation that defines the security framework used to provide authentication, encryption, and integrity for H.323 systems

3.33
H.242
ITU-T recommendation that specifies how to establish the communication between audiovisual terminals using digital channels with speeds up to 2 Mbps

3.34
H.243
ITU-T recommendation that specifies the establishment of communication between three or more audiovisual terminals using digital channels with speeds up to 2 Mbps

3.35
H.245
ITU-T recommendation that specifies messages for opening and closing channels for media streams, and other commends, requests and indications between two H.323 endpoints

3.36
H.261
ITU-T recommendation that specifies the video encoding and compression algorithm for two video resolutions: 352 x 288 CIF and 176 x 144 QCIF

NOTE H.261 is used in both H.320 and T.120.

3.37
H.263
ITU-T recommendation that specifies a new video codec for video over packet-switched networks or POTS

NOTE H.263 optimizes H.261 for very low bit rate of video coding below 64 Kbps. H.263 provides better motion compensation, more accurate motion vectors, optimized quantization for very low bit rates, and arithmetic coding.

3.38
H.310
family of ITU-T standards ratified in 1995 that describes the technical specifications for adapting narrow-band ISDN visual telephone terminals, as defined in H.320, to broadband ISDN (BISDN) and ATM environments

NOTE H.310 adds the MPEG-2 video-compression algorithm that provides MPEG-2 video quality.

3.39
H.320
family of ITU-T standards, ratified in 1990, that specifies how voice and video conferencing systems communicate over ISDN or leased networks, using a bandwidth from 64 Kbps to 1920 Kbps

3.40
H.323
family of ITU-T standards, ratified in 1996, that extends H.320 to computer networks, including LANs and the Internet

NOTE H.323 supports both point-to-point and multipoint operations. In addition, H.323 shares many components of the H.32x specification, such as the H.261 video codec, the G.711 audio codec, the H.263 video codec, G.722, G.723 and G.728. As a new feature, H.323 specifies a gatekeeper component that allows LAN administrators to manage video traffic for QoS. The H.323 specification also defines a LAN/H.320 gateway that permits a H.323 node to interoperate with H.320/H.324 terminals.

3.41
H.324
family of ITU-T standards, ratified in 1996, that allows video conferencing over standard analog phone lines with features similar to those in H.320

NOTE The H.324 standard uses H.263, which contains a better codec for POTS than H.261. H.263 is an improved version of H.261 that adds a 128 x 96 sub-QCIF (SQCIF) format. By using a 28.8 or 36.6 Kbps modem, H.263 may produce frame rates approaching those achieved by H.320 systems over ISDN.

3.42
interoperability
the ability of two or more systems (computers, communication devices, networks, software, and other information technology components) to interact with one another and exchange information according to a prescribed method in order to achieve predictable results

3.43
interoperability testing
an assessment of the ability of two or more systems to interact with one another and exchange usable electronic data

NOTE As conformity to the specifications alone does not guarantee interoperability of systems, interoperability testing is required to assess the ability of two or more systems to interact with one another and exchange usable electronic data. Interoperability testing does not include assessment of performance, robustness or reliability nor does it measure the conformity of an implementation. Two systems can be interoperable but still not compliant to the standard or specification.

3.44
μ-law
variant of the G.711 audio encoding used primarily in North America and Japan

NOTE See also G.711 and A-law.

3.45
multipoint control unit
MCU
endpoint on the LAN which enables three or more terminals and gateways to participate in a multipoint conference

NOTE The MCU includes a mandatory MC and optional MPs.

3.46
multipoint controller
MC
An entity that provides for the control of three or more terminals in a multipoint conference

3.47
multipoint processor
MP
entity that provides for the processing of audio, video, and/or data streams in a multipoint conference

NOTE The MP provides for the mixing, switching, or other processing of media streams under the control of the MC.

3.48
multipoint conference
conference between three or more terminals, which may be on the LAN or on the circuit switched network

3.49
NTSC Standard
standard for television broadcasting established by the National Television Standards Committee (NTSC)

NOTE Used in North America, Japan and some other countries. NTSC format: Lines / frame: 525; Frames per second (fps): 30; Interlace ratio: 2:1; Aspect ratio: 4:3; Color matrix equation: Y = 0.3*R + 0.59*G + 0.11*B; I = 0.6*R – 0.28*G - 0.32*B; Q = 0.21*R – 0.52*G + 0.31 * B; where R = red, G = green, and B = blue.

3.50
point-to-point protocol
protocol defined in RFC 1661, the Internet standard for transmitting network layer datagrams (e.g. IP packets) over serial point-to-point links

3.51
primary rate interface
PRI
ISDN service comprising 23 B (bearer) channels operating at 64 Kbps each and one D (data) channel operating at 16 Kbps

3.52
pulse code modulation
technique of used for the digital sampling of sound

NOTE The input waveform with a bandwidth up to 4.0 KHz is sampled at the recommended rate of 8,000 samples per second. Each sample is converted to one of 212 digital values and then compressed on either the A-law or the μ-law. This sampling scheme is adequate for voice communication.

3.53
quality of service
QoS
set of network technologies that enable a network to handle data traffic with a minimum amount of negative effects in a network environment used by many other users

NOTE Subscribers of QoS specify requirements in service-level agreements (SLAs) regarding throughput, packet loss, latency, and jitter.

3.54
quarter common intermediate format
QCIF
represents 176 pixels/line by 144 lines/image for luminance and 88 pixels/line by 72 lines/image for chrominance

NOTE See also CIF.

3.55
real-time streaming protocol
RTSP
application-level protocol that establishes and controls one or more time-synchronized streams of continuous media

NOTE RTSP has been designed to serve up multimedia from a cluster of hosts and acts as a network remote control for multimedia servers.

3.56
real-time transport protocol
RTP
data communication protocol capable of delivering real-time data such as live or interactive audio and video over IP packet-switched networks

NOTE RTP runs over UDP and uses its multiplexing and error checking features.

3.57
specified requirement
need or expectation that is stated

NOTE Specified requirements can be stated in normative documents such as regulations, standards and technical specifications. Specific requirements are intended to define some feature of a real implementation and offer the possibility of testing.

3.58
synchronized multimedia integration language
SMIL
enables simple authoring of interactive audiovisual presentations

NOTE SMIL is typically used for rich media/multimedia presentations, which integrate streaming audio and video with images, text or any other media type.

3.59
synchronous transmission
data communications in which transmissions are sent at a fixed rate, with the sending and receiving devices synchronized

3.60
T.120
family of ITU-T standards, ratified in 1996, that defines collaborative document sharing and whiteboard activities

NOTE The T.120 standards provide the audiographic portion of the H.320, H.323 and H.324 families. They also work independently as an audiographic conference for a low-bandwidth channel. The whiteboard capability provides document-sharing functions for multiple users so that they can simultaneously view and annotate a document with pens, highlighters and drawing tools. This specification also allows data-only T.120 sessions when no video communications are required or provided. In addition, T. 120 supports multipoint meetings in which the participants use different transmission media.

3.61
T.121
ITU-T standard that provides a generic application template (GAT), which specifies a common set of guidelines for building application protocols and the management facility that controls the resources used by the application

NOTE T.121 also describes how an application protocol, such as T.127 for file transfer, performs the following functions:

- Registers itself with the conference.
- Applies its capabilities locally and remotely.
- Interoperates and negotiates capabilities with other applications.

To ensure application consistency, T.121 is a required standard for products developed under T.120. The ITU also recommends that non-standard applications incorporate T.121 to provide product interoperability.

3.62
T.122
ITU-T standard that defines the multipoint services, which allow one or more participants to send data as part of a conference

NOTE These multipoint services are implemented by T.125, which provides the mechanism for transporting the data. Together, the T.122 and T.125 standards make up the T.120 multipoint communication services (MCS).

3.63
T.123
ITU-T standard that defines the transport and sequencing of data, and for controlling the flow of data across networks, including connect, disconnect, send, and receive functions

NOTE For data transport, T.123 defines a series of network interface profiles. Also, T.123 provides an error-correcting mechanism that ensures accurate and reliable data delivery. T.123 Annex B, an addition to the T.123 data conferencing standard, also defines the protocol for secure data conferencing.

3.64
T.124
ITU-T standard that provides the generic conference control (GCC) for initiating and administering multipoint data conferences.

NOTE The GCC performs the following functions:

- Serves as the information centre, directing users and data in and out of conferences and monitoring progress so that the latest conference information is always available,

- Maintains lists of conference participants and their applications; the GCC identifies compatible applications and features so that products can interoperate, and

- Tracks MCS resources so that conflicts do not occur when conference participants use multiple application protocols, such as T.127 for file transfer and T.128 for application sharing.

3.65
T.125
ITU-T standard that specifies how data is transmitted within a conference

NOTE T.125 defines the private and broadcast channels that transport the data, and ensures accurate and efficient communication among multiple users. T.125 also implements the multipoint services defined by T.122.

3.66
T.126
ITU-T standard that specifies how an application sends and receives whiteboard information, in either compressed or uncompressed form, for viewing and updating among multiple conference participants

NOTE The role of T.126 is to manage the multi-user workspace provided by the whiteboard.

3.67
T.127
ITU-T standard that defines how files are transferred simultaneously among conference participants

NOTE T.127 (also known as T.MBTF for Multipoint binary file transfer) enables one or more files to be selected and transmitted in compressed or uncompressed form to all or selected participants during a conference.

3.68
T.128
ITU-T standard that specifies the program sharing protocol, defining how participants in a T.120 conference can share local programs. Specifically, T.128 enables multiple conference participants to view and collaborate on shared programs.

3.69
T.134
protocol that provides point-to-point and multipoint distribution of text messages within the T.120 conference

NOTE It provides real-time or near-real-time text communications for those applications where audio communication is not available.

3.70
T.135
protocol that allows a user to reserve and control multipoint conference resources

NOTE It defines conferencing reservation protocols in a T.120 environment, typically between a client application and a scheduling system which reserves resources for multipoint control units (MCUs) or bridges.

3.71
T.136
protocol that specifies how Remote Device Control and configuration may be performed using T.120 as the transport protocol

3.72
T.140
protocol for multimedia application text conversation

NOTE The protocol for text chat within T.120, goes with T.134.

3.73
T.AVC
protocol that describes the control of audio and video capabilities present in a desktop or videoconference

NOTE This standard extends the capabilities offered by H.320.

3.74
T.RDC
recommendation that provides control of remote audio and video devices during a conference

NOTE A relatively new recommendation, T.RDC is an extension of H.281 for far-end camera control.

3.75
telehealth
use of telecommunication techniques for the purpose of providing telemedicine, medical education, and health education over a distance

NOTE See GATES 1994.

3.76
telemedicine
use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers

NOTE See Reid 1996.

3.77
terminal
endpoint system, which provides for real-time, two-way communications with another terminal, gateway, or MCU

NOTE A terminal must provide audio and may also provide video and/or data.

3.78
testing of conformity
determination of whether one or more characteristics of an object of conformity assessment fulfils specified requirements, according to a procedure

NOTE "Testing" typically applies to materials, products or processes. The primary output of conformity testing is a test report, which includes the specified requirements, the actual results of testing, and the conformity status (i.e., whether or not the given product passed the test).

3.79
transport control protocol/internet protocol
TCP/IP
de facto standard ethernet protocols incorporated into 4.2BSD Unix

NOTE TCP/IP was developed by DARPA for internetworking and encompasses both network layer and transport layer protocols. While TCP and IP specify two protocols at specific protocol layers, TCP/IP is often used to refer to the entire DoD protocol suite based upon these, including telnet, FTP, UDP and RDP.

3.80
user datagram protocol
unreliable networking layer that sits at the same level of the networking stack as TCP

3.81
videoconferencing
electronic form of communications that permits people in different locations to engage in face-to-face audio and visual communication. Also, a collection of technologies that integrate video with audio, data, or both to convey in real-time over distance for meeting between dispersed sites

3.82
video streaming
method of delivery of multimedia data (eg audio, video, images, text, alphanumeric data, time-series, waveform data) across the networks with a reasonable amount of QoS

NOTE The receiving system presents (displays or plays) the data while the data is being transmitted in the background. Typically no storage of data occurs during streaming. The following protocols have been created by the IETF and W3C to achieve data streaming:

- RTP (Real-time Transport Protocol),
- RTSP (Real-time Streaming Protocol), and
- SMIL (Synchronized Multimedia Integration Language).

3.83
zone
collection of all terminals, gateways, and MCUs managed by a single gatekeeper

NOTE A zone must include at least one terminal and may include LAN segments connected using routers.

4 ABBREVIATIONS

ACR	American College of Radiologists
ADSL	Asynchronous Digital Subscriber Line
ANSI	American National Standards Institute
ATM	Asynchronous Transfer Mode
B-ISDN	Broadband ISDN (See H.310)
BRI	Basic Rate Interface
CCD	Charge Coupled Device
CIF	Common Intermediate Format
CMS	Control, Management and Signalling
CSU	Channel Service Unit

DARPA	Defense Advanced Research Projects Agency (USA)
DOD	Department of Defense (USA)
DSU	Data Service Unit
GCC	Generic Conference Call
IETF	Internet Engineering Task Force
IP	Internet Protocol
ISDN	Integrated Services Digital Networks
ITU-T	International Telecommunications Union – Telecommunications
LAN	Local Area Network
MC	Multipoint Controller
MCU	Multipoint Controller Unit
MP	Multipoint Processor
NTSC	National Television Standards Committee
POTS	Plain Old Telephone System
PRI	Primary Rate Interface
QCIF	Quarter Common Intermediate Format
QoS	Quality of Service
RTCP	Real-Time Control Protocol
RTP	Real-time Transport Protocol
RTSP	Real-time Streaming Protocol
SCN	Switched Circuit Network
SW56	Switched 56 Network
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
WAN	Wide Area Network

5 TELEHEALTH AND TELEMEDICINE

The terms **telehealth** and **telemedicine** mean many things to many people. Many definitions of these terms found in the literature attempt to be all-embracing and are therefore vague. Some current definitions of telemedicine and telehealth include the following:

> "Telehealth - the use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers." (Reid, 1996).

> "Telemedicine involves the use of modern information technology, especially two-way interactive audio/video communications, computers, and telemetry, to deliver health services to remote patients and to facilitate information exchange between primary care physicians and specialists at some distances from each other." (Bashshur, et al., 1997).

> "Telemedicine is a system of health care delivery in which physicians examine distance patients through the use of telecommunications technology. Telemedicine, in a strict sense, means live, interactive audiovisual communications between physician and patient or between physician and physician." (Preston, 1993).

In a report concerning the telehealth industry in Canada generated by Industry Canada in 2000 telehealth was defined as:

> "Telehealth is the use of communications and information technology to deliver health and health care services and information over large and small distances." (Picot and Cradduck, 2000).

The World Health Organization (WHO) makes a distinction between telemedicine and telehealth.

> "If telehealth is understood to mean the integration of telecommunications systems into the practice of protecting and promoting health, while telemedicine is the incorporation of these systems into curative medicine, then it must be acknowledged that telehealth corresponds more closely to the international activities of WHO in the field of public health. It covers education for health, public and community health, health systems development and epidemiology, whereas telemedicine is oriented more towards the clinical aspect." (Antezana, 1997).

The participants of the Global Access Telehealth and Education System (GATES) study sponsored by the UN defined telemedicine as a subset of telehealth, as reflected in the following definitions:

> "Telemedicine: a subset of telehealth, telemedicine involves the use of telecommunication techniques for the purpose of providing medical and health care, enhancing diagnoses, expanding research, and improving treatment of illness over a distance." (GATES, 1994).

> "Telehealth: the use of telecommunication techniques for the purpose of providing telemedicine, medical education, and health education over a distance." (GATES, 1994).

While the word telemedicine that became prominent in the early 1990s focuses on the delivery of medical care at a distance, telehealth is considered more generic and broader. It extends beyond the delivery of medical care and includes health protection, health promotion, medical education, and health education. For the purpose of this report, the term telehealth will be used.

6 INTEROPERABILITY

Although several definitions of interoperability exist, there is no generally accepted definition of this term. Examples of definitions along with their sources are included below:

> "The ability of two or more systems or components to exchange information and to use the information that has been exchanged." (IEEE Dictionary).

> "A state which exists between two application entities, with regard to a specific task, when one application entity can accept data from the other and perform that task in an appropriate and satisfactory manner without the need for extra operator intervention." (CEN/TC 251/N99-097).

For the purpose of this document, interoperability is defined as follows:

> "Interoperability refers to the ability of two or more systems (computers, communication devices, networks, software, and other information technology components) to interact with one another and exchange information according to a prescribed method in order to achieve predictable results."

As this definition implies, there are two aspects of interoperability:

1. The conceptual aspect, which focuses on WHAT, namely:

   a) WHAT information is being exchanged. This is defined by means of information models, which model data entities, their attributes, and the relationships between the entities.

   b) WHAT tasks actually exchange the information. This is defined by means of functional models, which model processes and activities performed by the systems.

2. The implementation aspect, which focuses on HOW to achieve expected results through defining the behavior of the participating systems. This is defined by describing how the tasks actually co-operate and communicate, and how to handle the information communicated by the participating systems.

This document takes into account both aspects of interoperability.

7 CONFORMITY WITH STANDARDS AND INTEROPERABILITY

Standards and interoperability are critical in ensuring that telehealth deployed at health care facilities meets users' expectations. Standards are needed to ensure that the telehealth systems meet functional, operational, and clinical requirements. They are a means by which interoperability can be achieved. Conformity to standards is not enough for assuring interoperability but is a prerequisite for interoperability.

A successful implementation of the telehealth interoperability standards depends on the maturity of the clinical and technical standards, the level of conformity of the telehealth products to the standards, and the interoperability-focused implementation methodology. The telehealth interoperability standards provide tools and techniques for addressing interoperability of telehealth systems and networks and lead to the development of interoperability-focused implementation methodology.

Annex A

(Informative)

Telehealth Technical Reference Architecture

A technical architecture is the minimal set of requirements governing the arrangement, interaction, and interdependence of technical system parts or elements. The Telehealth Technical Reference Architecture (TTRA) shown in Figure 1 guides the acquisition and development of new and emerging functionality and provides a baseline toward which existing systems should move. It has been used to develop telehealth requirements for service areas.

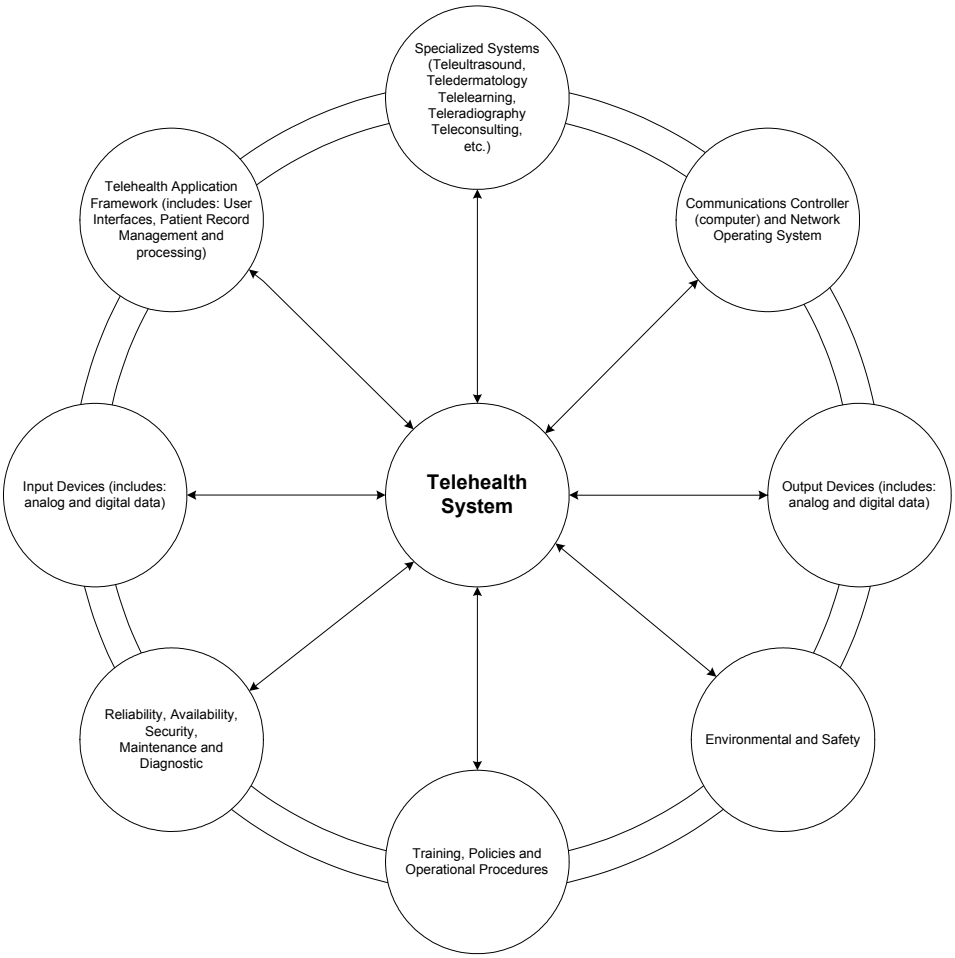

Figure 1 - Telehealth technical reference architecture

The **Communications Controller and NOS** (Network Operating System) represent one or many processing units that allow its local devices to communicate with other devices internal to the subsystem or external to that subsystem. Considering the inherited need to network these devices an NOS is recommended as it covers most of the Open Systems Interconnection (OSI) layered model. This subsystem permits coupling with the telehealth application enabling real-time and/or store and forward processing of patient data.

The **Applications Framework** is a collection of software applications, scripts and APIs (Application Program Interface) that allow the user to interact with a specialized software applications and the rest of the subsystems.

The **Input Devices** subsystem represents all analog and digital input devices used to provide data into the system.

The **Output Devices** subsystem represents all analog and digital devices used to provide data for analysis, monitoring, control, recording and archiving.

The **Environmental and Safety** provides the physical requirements as captured in various standards and regulations to ensure a secure and safe operation of system components.

The **Reliability, Security, Maintenance and Diagnostic** represent system level quality factors like reliability requirements; policy based mandated security settings and built in maintenance and diagnostic requirements.

The **Training, Policies and Operational Procedures** are operational requirements carried-forward to the technical architecture establishing a defined set of process and functional requirements. These requirements are non-physical but are required in order to operate the system components in a specific medical environment.

BIBLIOGRAPHY

Antezana, F. (1997), *Telehealth and telemedicine will henceforth be part of the strategy for health for all*. 1997 Press Release. http://www.who.int/archives/int-pr-1997/en/pr97-98.html.

Bashshur, R., Sanders, J., and Shannon, G. (1997), *Telemedicine Theory and Practice*. Springfield, IL: Charles C Thomas.

Coiera, E. (1997). *Guide to Medical Informatics, The Internet and Telemedicine*. Arnold A Member of the Hodder Headline Group. Copublished in the USA by Oxford University Press. ISBN 0-412-75710-9.

Darkins, A. W. and Cary, M. A. (2000). *Telemedicine and Telehealth. Principles, Policies, Performance, and Pitfalls*. Springler Publishing Company. ISBN 0-8261-1302-8.

Field, M. J. (Editor) (1996). *Telemedicine. A Guide to Assessing Telecommunications in Health Care*. Institute of Medicine. ISBN 0-309-05531-8.

GATES (1994), *Global Access Telehealth and Education System. Final Report*. The International Space University. Summer Session, The Universitat Autȯnoma de Barcelona, Spain.

Halsall, F. (2001). *Multimedia Communications. Applications, Networks, Protocols and Standards*. Addison-Wesley, ISBN 0-201-39818-4.

Igras, E. (1999), *Alberta Telehealth Network. Interoperability Guidelines*. Alberta Research Council, Calgary, Alberta, Canada.

Maheu, M., Whitten, P. and Allen, A. (2001). *E-Health, Telehealth, and Telemedicine. A Guide to Start-up and Success*. Jossey-Bass W Wiley Company. ISBN 0-7879-4420-3.

Picot, J. and Cradduck, T. (2000). *The Telehealth Industry in Canada: Industry Profile and Capability Analysis*. Industry Canada, March 2000.

Preston, J. (1993), *The Telemedicine Handbook*. Telemedical Interactive Consultative Services.

Reid, J. (1996), *A Telemedicine Primer: Understanding the Issues*. Innovative Medical Communications.

Riesmeier, J., Eichelberg, M., Punys, J., Punys V., Lemoine, D., and Balogh, N. (2000), *Guidelines for open scaleable applications in telemedicine*. D11.1. 8-27-2000. INCO-COPERNICUS Project NR. PL961144-SAMTA.

Wu, C-H. and Irwin, J. D. (1998). *Emerging Multimedia Computer Communication Technologies*. Prentice Hall PTR. ISBN 0-13-079967-X.

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