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Information technology — Future Network — Problem statement and requirements —

Part 6: Media transport

Technologies de l'information — Réseaux du futur — Énoncé du problème et exigences —
Partie 6: Transport des médias

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Foreword

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

In exceptional circumstances, when the joint 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 to publish a Technical Report. A Technical Report is entirely informative in nature and shall be subject to review every five years in the same manner as an International Standard.

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ISO/IEC TR 29181-6 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 6, *Telecommunications and information exchange between systems*.

ISO/IEC TR 29181 consists of the following parts, under the general title *Information technology — Future Network — Problem statement and requirements*:

— *Part 1: Overall aspects*

— *Part 3: Switching and routing*

— *Part 4: Mobility*

— *Part 6: Media transport*

— *Part 7: Service composition*

The following parts are under preparation:

— *Part 2: Naming and addressing*

— *Part 5: Security*

Introduction

ISO/IEC TR 29181-1 describes the definition, general concept, problems and requirements for the Future Network (FN). The other parts of ISO/IEC TR 29181 provide details of various components of the technology.

This part of ISO/IEC TR 29181 identifies problem of the media transport in the IP-based networks and examines the requirements for the transport of media data over the Future Network.

Information technology — Future Network — Problem statement and requirements —

Part 6:
Media transport

1 Scope

This part of ISO/IEC TR 29181 describes the problem statement and requirements for the Future Network in the perspective of Media Transport. This part of ISO/IEC TR 29181 specifies:

a) detailed description of the media transport requirements in the Future Network;

b) identification and definition of services, basic and media services, which will fit the requirements for communications over heterogeneous environments supporting various user preferences, for any kind of media content, either time-dependent or time-independent;

c) requirements and functionalities of Media Aware Network Elements, which are intended to be nodes in the network to provide seamless media experiences to users.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC TR 29181-1, *Information technology — Future Network — Problem statement and requirements — Part 1: Overall aspects*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC TR 29181-1 and the following apply.

3.1
data
sequence of octets which is conveyed across the network as a single unit

[SOURCE: ISO/IEC TR 29181-3, 3.1]

3.2
media
sequence of bits in a defined format which encodes physical entities such as images, sounds, and text.

3.3
time-independent media
media where the semantic of the content does not depend upon a presentation according to the time domain

EXAMPLE 1 text

EXAMPLE 2 still image

3.4
time-dependent media
media where there exists a temporal relation amongst the media units

EXAMPLE 1 audio

EXAMPLE 2 video

3.5
content
media media that is carried in the payload of datagrams sent over the network

3.6
static content
time-independent media that is carried in the payload of datagrams sent over the network

3.7
streamed content
time-dependent media that is carried in the payload of datagrams sent over the network but does not have requirements for latency

EXAMPLE 1 MP3 files

EXAMPLE 2 Video-on-Demand

3.8
live content
time-dependent media that is carried in the payload of datagrams sent over the network and has requirements for latency.

EXAMPLE 1 telephone conversation

EXAMPLE 2 video conference

3.9
encapsulation
additional octets or other symbols associated with a data unit which serve to delimit it or to identify aspects of the service it should receive

[SOURCE: ISO/IEC TR 29181-3, 2.15]

3.10
container
encapsulation structure containing a payload, either data units or content, and the header composed by two parts, what refers to the payload and to the underlying network

NOTE Container has attributes as header fields, which some are related to particular services, and others are general and specific for a sort of communication.

3.11
context
set of data or information that completely describes a particular communication environment at a particular point in time

[SOURCE: ISO 16484-5:2007 (Identifier: CDB-00119069-001)]

3.12
context-awareness
ability of a network to be aware of the context and react accordingly in order to adapt either itself or the data conveyed over

3.13
modular paradigm
paradigm where complex functions are composed by well-known and deterministic basic functions

NOTE In network realm, protocols are breaking down into its fundamental (also called atomic) functions, such as sequencing, cyclic redundant coding, addressing, and so on, which combined results into complex functions (or protocols).

3.14
MANE (Media Aware Network Element)
content and context aware network element capable of processing media content passing through to accommodate a given content or service according to the context

NOTE This element may handle all attributes of containers taking into account the content type and properties, networking properties and status, and other environmental and conditional properties that may have effect in routing of the contents and services.

3.15
quality of service (QoS)
set of qualities related to the collective behaviour of one or more objects

[SOURCE: ITU-T Rec. X.902 | ISO/IEC 10746-2]

NOTE QoS is usually defined regarding to three parameters: bandwidth, delay and error. In conversational communications, bandwidth consumption is related to the chosen technology (although the lower one is desired), the delay has to be bounded to assure conversational interactivity among participants, and should be provided a high error resilience to assure a good data delivery in front of any change on the network.

3.16
quality of experience (QoE)
set of subjective and/or objective qualities related to user perception about consumed media content

NOTE QoE is usually referred to how the user perceives the consumed content. QoE is more related to subjective quality estimation rather than objective measurements, although they can be related by different mapping schemes.

3.17
connection-oriented
communication between peer protocol entities by means of a connection or association established by an underlying layer

[SOURCE: ISO/IEC 11582:2002 (Identifier: CDB-00009275-001)]

3.18
connectionless
communication between peer protocol entities by means of an unacknowledged, unidirectional transport mechanism provided by an underlying layer

[SOURCE: ISO/IEC 11582:2002 (Identifier: CDB-00009276-001)]

3.19
layer coding (LC)
coding technique in which the video stream is split into several hierarchical layers consisting of base layer and one or more enhancement layers

3.20
multiple description coding (MDC)
coding technique in which a single media stream is fragmented into multiple substreams which can be delivered over the network in different paths

4 Symbols (and abbreviated terms)

3D	Three Dimensional
AIMD	Additive Increase / Multiplicative Decrease
CABCC	Content-Aware Based Congestion Control
CLD	Cross-layer design
CLO	Cross-layer Optimization
FEC	Forward Error Correction
HD	High Definition
HTTP	Hypertext Transfer Protocol
LC	Layered Coding
MDC	Multimedia Description Coding
MEDIEVAL	MultimEDia transport for mobIlE Video AppLications
MMT	MPEG Media Transport
MPEG	Moving Picture Experts Group
MPEG-TS	MPEG-Transport Stream
OSI	Open Systems Interconnection
P2P	Peer to Peer
RTCP	Real-Time Control Protocol
RTP	Real-Time Protocol
SMART	Smart Multimedia Routing and Transport
SMS	Short Messages Services
STREP	Small or medium-scale focused research project
SVC	Scalable Video Coding
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
UDP	User Datagram Protocoll
UHD	Ultra-High definition
VoIP	Voice over IP
WWW	World Wide Web

5 Overview

5.1 Networks evolving to support of media

During the last few decades, the various research communities have carried out large research activities in networking and grid e-Infrastructures, which have concluded with the needs of new types of networks and distributed computing models of communication. In the mid-80s, the research activity was focused on the Networking Layer (the lower layers of the stack) in order to improve overall quality of the end-to-end transmission. In the mid-90s, the telecom boom has arrived and started advertising that networks were ready for the end user. The trend of collaborative environments appeared, where networks were used only as a transport tool, and it was necessary to work on distributed solutions. The Supercomputing or more recently the P2P (peer-to-peer) were, and still are, the research lines for searching these solutions, in the layer called GRID or distributed computing.

Today, the research is focused on the two emerging layers. The first layer is the Scientific Data Layer, where all the data to be processed and transported will be collected. Scientific Data Layer deploys data repositories for the scientific community and future generations of scientist supporting. The data repositories are implemented in a coordinated way to be used as digital libraries, archives, data storage, access to information and the necessary pooling of resources [6]. The second layer is a new Multimedia Layer, specifically focused on the convergence of advanced graphics, media and live videoconferencing, which enables any kind of multimedia data exchange between users on a computer network. Multimedia Layer can communicate directly with the Scientific Layer, GRID Layer, or Network Layer. It is dependent on the multimedia application and/or the type of network which it runs on.

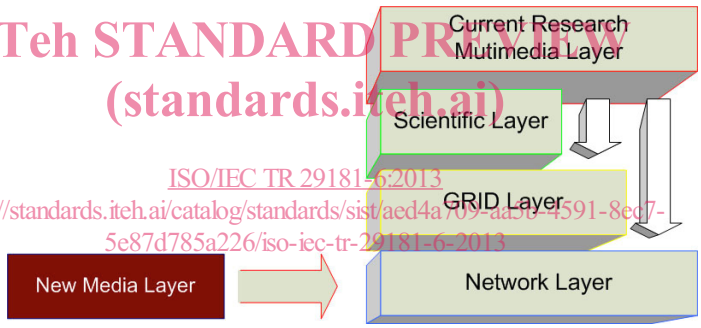

Figure 1 — Layers of research activity

Current multimedia research activities have focused on how to adapt the diverse characteristics of media to the running network architecture by defining middle layer that provides particular features for this sort of traffic. RTP/RTCP, RTP for uncompressed video, MPEG-TS, and so on, are well-known examples of these mid layers designed for this reason, to adapt the media content to the TCP/IP network. New middle layers are in continuous evolution to adapt themselves basically to users and underlying network requirements. All these middle layers are designed to adapt the media data to the Internet, over the classical stack of communications designed in the 70s to transmit computer data from end-to-end user.

The middle layers or protocols are presented in the Figure 2. Starting from the left side is the the OSI model, the TCP/IP stack, and the protocols adopted for the media transport.

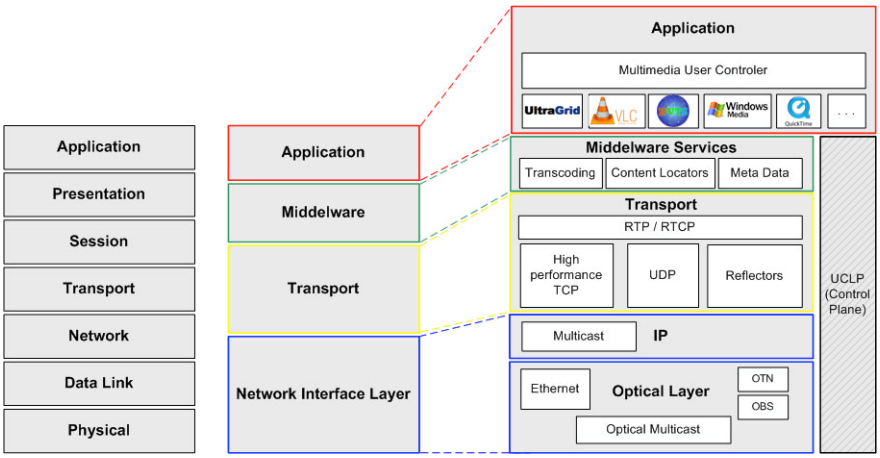

Figure 2 — Current middle layers or protocols used for media

5.2 User demand for media-based services

Few years ago, after the revolution of the WWW and the spreading of the Internet to the end user, the highest percentage of the traffic in the backbone was based on raw data or time-independent content. Nowadays, this trend has changed towards the exchange of time-dependent media content, either streamed or live, between users themselves or between content providers and users. This change to the traffic types has affected the current Internet framework, where intelligence is in the edges not in the core of the network, communication model changed from the server client model to the P2P model, as well as to the types of contents transmitted. In fact, Internet is already a media network based on P2P media traffic and time-dependent content applications such as VoD (Video on Demand), videostreaming, and broadcasting. It is in this Internet where a little part of users generates the major part of the global IP traffic. In this regard, in 2009, media content, from P2P and video services, represented the 80 % and 90 % of the global Internet traffic, respectively. Due to the convergence of television, video, graphics, and audio, it is expected that video traffic will continuously increase as with the increasing demand of media content such as HD, 3D, face-to-face video conferencing, video gaming, etc.

Content Delivery Network is an example reflecting this demand, because network operators are starting to set-up customized infrastructures, composed by clusters of VoD servers and high capacity network resources, to enable a network to feed and deliver streamed and live media content to end users in a faster and more reliable way. The CDN is an associated hybrid-networking infrastructure that requires an enormous amount of effort in realization and fine-tuning to enable high quality media stream to be delivered along the network.