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ITU-T

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INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

OVERALL NETWORK ASPECTS AND FUNCTIONS

FRAMEWORK RECOMMENDATION ON "NETWORK CAPABILITIES TO SUPPORT MULTIMEDIA SERVICES"

ITU-T Recommendation I.374

(Previously "CCITT Recommendation")

FOREWORD

The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of the International Telecommunication Union. The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, established the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

ITU-T Recommendation I.374 was prepared by the ITU-T Study Group XVIII (1988-1993) and was approved by the WTSC (Helsinki, March 1-12, 1993).

NOTES

1 As a consequence of a reform process within the International Telecommunication Union (ITU), the CCITT ceased to exist as of 28 February 1993. In its place, the ITU Telecommunication Standardization Sector (ITU-T) was created as of 1 March 1993. Similarly, in this reform process, the CCIR and the IFRB have been replaced by the Radiocommunication Sector.

In order not to delay publication of this Recommendation, no change has been made in the text to references containing the acronyms "CCITT, CCIR or IFRB" or their associated entities such as Plenary Assembly, Secretariat, etc. Future editions of this Recommendation will contain the proper terminology related to the new ITU structure.

2 In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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CONTENTS

			Page
1	Scope and objectives of Recommendation		1
2	Definition of terms		2
3	Functional architecture of multimedia services		4
	3.1	Functional modelling of multimedia services	4
	3.2	Service control elements	4
4	Network capabilities		5
	4.1	Control capabilities for multimedia services	5
	4.2	Multimedia interaction	6
	4.3	Media multiplexing options	6
	4.4	Multimedia resource management	7

FRAMEWORK RECOMMENDATION ON "NETWORK CAPABILITIES TO SUPPORT MULTIMEDIA SERVICES"

(Helsinki, 1993)

1 Scope and objectives of Recommendation

This study of network capabilities is undertaken to provide a consistent set of recommendations for the support of multimedia services in ISDNS.

The purpose of this Recommendation is to identify network capabilities to support multimedia services. ISDN will incorporate both broadband and 64 kbit/s based ISDN, however this Recommendation does not address the specific multimedia services that will make use of the network capabilities.

Multimedia services are those involving at least two different information types. The following concepts apply in relation to network capabilities required for the support of multimedia services:

- *Range of service types:* The extension of the telecommunication network to accommodate many new types of services commonly used in a multimedia environment results in the need to support a wide range of services. Aspects of service range and diversity include: service type (e.g. interactive, distribution) and configuration (e.g. symmetrical, asymmetrical).

- *Association between information types:* The presentation of information in a multimedia form implies some linkage between the component parts of a service, and this requirement may have a significant impact on the functionality required of a network. An example is the need for synchronization between associated audio and video channels.

- *Distributed service functions:* In achieving multimedia services, service functions could be distributed between the user terminal and the network. Network capabilities for multimedia services should allow for the distribution of service functions.

A complex call involving multiple connections and multiple parties, is shown in Figure 1. The communicating parties within the call do not share a common set of services and may require the network to provide interworking for incompatible terminals and media conversion (e.g. text to voice).

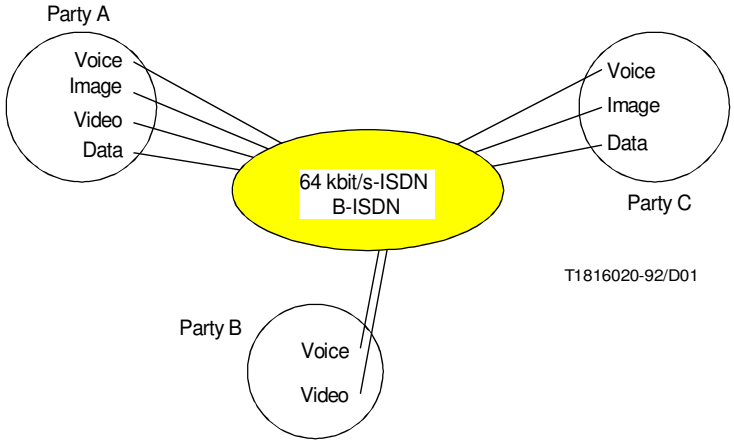

FIGURE 1/I.374

An example of a multipoint, multimedia call

2 Definition of terms

For the purpose of this recommendation, the following definitions apply.

medium (plural media): A means by which information is perceived, expressed, stored or transmitted.

The term "media" has many meanings depending on the context in which it is used. For unambiguous usage the term should always be accompanied by one of the following expressions: perception medium, representation medium, presentation medium, storage medium, transmission medium.

perception medium: The nature of the information as perceived by the user.

representation medium: The type of the interchanged data, which defines the nature of the information as described by its coded form.

presentation medium: The type of physical means which is used to reproduce information to the user (output device) or the acquired information from the user (input device).

interchange medium: The type of means to interchange data between systems can be either a storage medium, a transmission medium or a combination.

storage medium: The type of physical means to store data.

transmission medium: The type of physical means to transmit data.

multimedia: The property of a piece of information, an application, a user equipment, to handle several types of data.

Multimedia is an adjective and must be attached to a noun to define a precise context, e.g. multimedia service, multimedia network, multimedia application.

multimedia service: A service in which the interchanged information consists of more than one type (e.g. video, data, voice, graphics).

Multimedia services have multivalued attributes which distinguish them from traditional telecommunications services such as voice or data. A multimedia service may involve multiple parties, multiple connections, the addition/deletion of resources and users within a single communications session. In this Recommendation, multimedia is used in the sense of multiple information types supported within what the user sees as a single call.

service component: A part of a service which describes a monomedia communication related to a single information type. A multimedia service contains one or more service components. Such telecommunications services can have a predefined set of service components (e.g. teleservices, bearer services) corresponding to a particular type (e.g. telephony, videotelephony, data) or can have any new combination of service components to develop new applications. It should be possible for users to invoke service components separately. The rules for assembling service components within a service are specific for each teleservice.

An example of the use of service components (audio, video and data) within a telecommunications service (video-telephony) is shown in Table 1.

In this example video and audio components are mandatory and data is optional. Optional service components can be added or deleted during the call. However, the mandatory service components are set-up during call establishment and cannot be deleted during the call. Since a videotelephony service is defined with a set of service components, a single component of audio can be selected during call establishment for interworking with a voice-only telephone. See also Figure 2.

TABLE 1/I.374

The service components and transfer capabilities for an example videotelephony service

Service component	Transfer capability
Video component	Peak cell rate, reference number, max delay, virtual channel identifier/virtual path identifier
Audio component	Peak cell rate, reference number, max delay, virtual channel identifier/virtual path identifier
Data component	Peak cell rate, reference. number, bit error ratio, virtual channel identifier/virtual path identifier

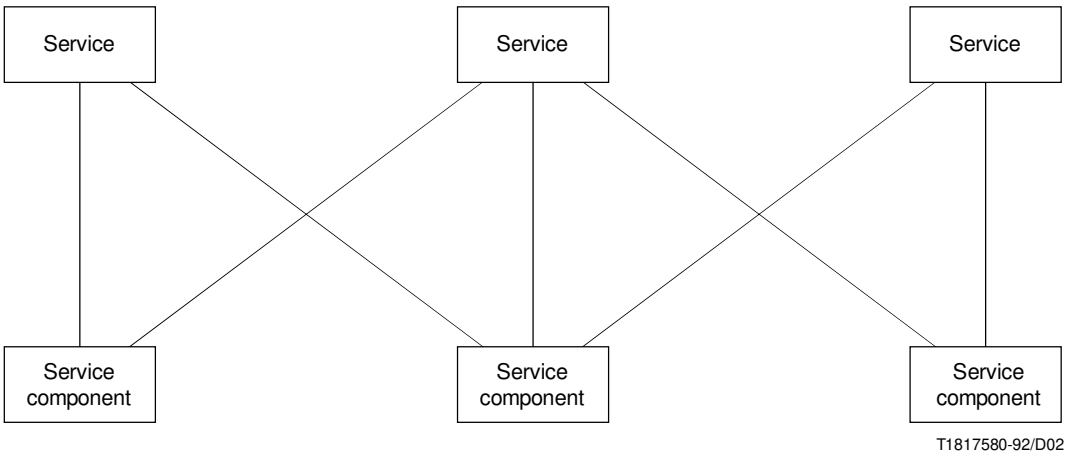

FIGURE 2/I.374

Example of many services using the same set of service components

service control elements: The primitives needed to control a multimedia service, for example to start a call, to add or release a service component.

service attributes: Multimedia bearer services and teleservices supported by an Asynchronous Transfer Mode network may offer several virtual channels, one virtual channel for each service component. Adapted to the special requirements of service components to be supported, each of the virtual channel may have particular characteristics described by particular attribute values. For the consideration of multimedia aspects most of the service attributes should be amended by sub-attributes describing the characteristics of the individual virtual channel or service component where applicable.

The following service attributes, as defined in Recommendations I.140 and I.210, are examples of attributes which could be multivalued in a multimedia call:

- information transfer rate;
- traffic type;
- timing end-to-end;
- structure;
- symmetry;
- type of user information;
- higher layer protocols (layer 4 though 7 protocol functions);
- Quality of Service;
- information access protocol.

transfer capability: Each service component of a telecommunications service is associated with transfer capability information. Transfer capability is handled at an interface between two adjacent nodes (including the user-network interface), in the form of transfer capability parameters. If the transfer capability parameters cannot be supported within a part of the network, the call may not be accepted.

Transfer capability also includes connection information for low layer compatibility between terminals. For service component connectivity one major parameter is the virtual channel identifier/virtual path identifier value used to identify the link which carries the service component.

Transfer capability parameters for an ATM connection may include:

- telecommunication service class;
- network resources;
- Quality of Service;
- symmetrical/asymmetrical connection;
- reference number associated with the service component.

The relationship between service components and transfer capability is important. Under normal conditions it would be expected that a one-to-one relationship applied, i.e. a service component would use a single transfer capability for a given call. However, it is possible that the characteristics at the user network interface may differ from those used within the network for the same service component. One example is the need to use a local transfer rate which may exceed the actual throughput rate available globally in the network.

3 Functional architecture of multimedia services

3.1 Functional modelling of multimedia services

The detailed functional modelling of multimedia service support is for further study and will provide a means of describing the network impact of support for multimedia services. For example, signalling may be required to indicate specific relationships, such as synchronization, between connections.

3.2 Service control elements

Service control elements are procedures executed at the calling and called sides to provide a multimedia service.

Service control elements are used for:

- call control;
- connection control;
- media control.

Call control includes

- *Call set-up:* Covers the establishment of a call.
- *Call release:* Corresponds to the complete release of a call (including all media and connections).

The user who sets up the call becomes the call owner or main user. Transfer of ownership of a call, during a call, is for further study.

Call control will be supported by the signalling system.

Connection control includes

- *Establish connection:* Covers the establishment of a connection between two or more users.
- *Join:* May be invoked in multipoint configurations to add other users to the call.
- *Leave:* Can be used by any party to be disconnected.
- *Disconnect:* Corresponds to the complete release of a connection within a call.

Connection control sets up and disconnects connections for each media. Detailed specification for the connections (e.g. bit rate, information format, Quality of Service) are negotiated and confirmed between the connection control entities.

Media control includes

- *Allocate:* Add another medium to an existing call.
- *De-allocate:* Remove a medium from a call.

4 Network capabilities

This clause describes the network capabilities expected to be possible in 64 kbit/s and B-ISDN networks offering multimedia service support. These networks may use switching techniques such as 64 kbit/s or $n \times 64$ kbit/s circuit switching or may use asynchronous transfer mode switching of connections in the case of broadband integrated services digital networks.

Separation of call, connection and media control, as described in 3.2, is expected to be applicable to any network; however, the extent of application may be constrained by the available network infrastructure, e.g. switching and signalling capable of supporting multiple connections. The need for, and extent of, separate definition for networks without a broadband service support capability is for further study.

4.1 Control capabilities for multimedia services

Some examples of control capabilities are identified below:

Connection management

- support for any combination of traffic, with no network imposed limits to the number of media combined within a single call. Network imposed limits will be applied if bandwidth constraints are exceeded or if certain services are not subscribed to;
- capability to control virtual channel connections;
- support of point-to-point, point-to-multipoint and broadcast communication configurations;
- modification of media from within a call by all parties;

– modification of Quality of Service values, on agreement and by request, by either the user or the network;

– symmetric and asymmetric calls;

– establishment and removal of connections within an existing call;

– correlation of connections composing a multiconnection call;

– reconfiguration of a multiparty call;

– support different communication configurations for different media;

– allow for different media to be used with different parties in a multiparty call, e.g. an audio with one and data with another.

Service management

– synchronization

Many multimedia services will require mechanisms to ensure specific information types (e.g. data, image, video, audio) to remain synchronized and receive the appropriate Quality of Service. The network must maintain, within agreed bounds, the timing relationship of the various information streams as they are transported. Different information types may experience different delay through a network because of routing via different paths or the provision of different grades of service. The problem is even more complex if more than two parties are involved because the timing relationship among information streams of the different parties must be maintained.

The issue of synchronization between the service components of a multimedia call is for further study. Associated issues include

a) bounded differential time delay between continuous media streams carried on separate virtual or physical channels;

b) inter-channel synchronization;

c) equalisation for transit delay between channels;

– support for interworking between different coding scheme;

– support for service interworking;

– service control support using user-to-user signalling.

4.2 Multimedia interaction

Media interaction may be provided using event synchronization. It may be classified into two categories:

1) One media stream includes timing information to initiate and control activity in another stream, e.g. text or voice activated graphics.

2) A user indication initiates and controls activity in another stream.

4.3 Media multiplexing options

There are two options under consideration for media multiplexing:

– Channel multiplexing, using either the physical channels of 64 kbit/s-ISDN or the virtual channels of B-ISDN.

– User multiplexing based on multiplexing into a single multimedia stream before entering the network.

From a network perspective, user multiplexed media are considered as being carried over monomedia bearer services.

The distribution of service functions between terminals and networks may result in more than one media multiplexing option being exercised within an individual service or application.

4.4 Multimedia resource management

For established calls, the addition of further media or parties is subject to the availability of appropriate network resources. Where the resources may not be available in the form required, the following options may apply:

- maintenance of the existing call, without the additional requested functions and facilities;
- clear down the existing call;
- allow the customer to respecify the additional requirements, e.g. select an audio-only connection rather than video and audio;
- where applicable, allow the customer to renegotiate the parameters of the existing call, e.g. reduce the video quality, to accommodate the additional requirements.