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SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for IMT-2000

Radio-technology independent requirements for IMT-2000 layer 2 radio interface

ITU-T Recommendation Q.1731

(Formerly CCITT Recommendation)

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ITU-T RECOMMENDATION Q.1731

RADIO-TECHNOLOGY INDEPENDENT REQUIREMENTS FOR IMT-2000 LAYER 2 RADIO INTERFACE

Summary

This Recommendation defines requirements for common services, functions and primitives for the radio-technology independent parts of the Layer 2 of the IMT-2000 radio interface, to ensure maximum commonality between IMT-2000 family members.

Source

ITU-T Recommendation Q.1731 was prepared by ITU-T Study Group 11 (1997-2000) and was approved under the WTSC Resolution No. 1 procedure on 15 June 2000.

Keywords

ACK, acknowledgement, aggregation, ARQ, assured mode, control plane, data link layer, fragmentation, function, IMT-2000, L2, LAC, Layer 2, layer, link access control, LLC, logical link control, mapping, NAK, octet stream, PDU, piggybacking, primitive, protocol instance, QoS, reassembly, SAP, SDU, segmentation, service, sublayer, transparent mode, unassured mode, user plane.

FOREWORD

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The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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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Recommendation Q.1731

RADIO-TECHNOLOGY INDEPENDENT REQUIREMENTS FOR IMT-2000 LAYER 2 RADIO INTERFACE

(Geneva, 2000)

1 Scope

The scope of this Recommendation is the definition of common services, functions and primitives for the radio-technology independent parts of the Layer 2 of the IMT-2000 radio interface, to ensure maximum commonality between IMT-2000 family members, consistent with ITU-T Recommendation Q.1711 [1].

The exact division of functionality between various sublayers of Layer 2 (sometimes referred to as LAC and MAC), as well as the exact placement of functionality of the layers and the sublayers in physical components of the radio access networks is considered to be IMT-2000 family member and/or implementation dependent, and is, thus, not addressed in this Recommendation.

Specifically, this Recommendation is concerned with:

- 1) Defining specifications and requirements for Layer 2 in terms of:
 - services offered by Layer 2 to the upper layers and Layer Management;
 - functions performed by Layer 2 to deliver those services.
- 2) Defining interfaces between Layer 2 and the adjacent layers, consisting of:
 - service access points (SAPs) where the identified services are offered;
 - primitives and their associated parameters.
- 3) Identifying the functionality in the Control Plane and the User Plane, as well as the interactions with Layer Management.

All the requirements are subject to market needs and may be met in phases.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

- [1] ITU-T Recommendation Q.1711 (1999), *Network functional model for IMT-2000*.

3 Definitions

This Recommendation defines the following terms:

3.1 automatic repeat request (ARQ): Technique for providing reliable delivery of signals between communicating stations, involving autonomous retransmissions of the signals and transmission of acknowledgments until implicit or explicit confirmation of delivery is received.

3.2 function: An operational modality employed in the offering of a service.

- 3.3 information stream:** The totality of data generated and transported, in time, and associated with a specific logical communication session.
- 3.4 layer 1:** Layer 1 (Physical Layer) provides for the transmission and reception of radio signals between the radio access network and the mobile terminal.
- 3.5 layer 2:** Layer 2 (Data Link Layer) provides for the correct transport and delivery of signalling messages and user data generated by Layer 3 (see below). In some implementations, Layer 2 may be seen as divided into an upper Link Access Control (LAC) sublayer and a lower Medium Access Control (MAC) sublayer. Layer 2 makes use of the services provided by Layer 1.
- 3.6 layer 3:** Layer 3 originates and terminates signalling messages and user data according to the semantics and timing of the communication protocol between the radio access network and the mobile terminal. Layer 3 makes use of the services provided by Layer 2.
- 3.7 layering:** A method of organization for communication protocols in which the sent or received information is transferred in pipeline fashion, within each station, in well-defined, encapsulated data units between coordinated processing entities ("layers"). A layer is defined in terms of its communication protocol to the peer layer in the other station and the services it offers to the next higher layer in its own station.
- 3.8 logical channel:** A communication path between stations, described in terms of the intended use of, and access to the transferred data, and direction of transfer. A logical channel can be "mapped" to/from one or more physical channels.
- 3.9 mapping:** In this context, technique for forming associations between logical and physical channels.
- 3.10 message:** Signalling data unit being transferred between the radio access network (RAN) and the mobile terminal (MT).
- 3.11 octet stream:** An information stream where data is organized in semantically meaningful fixed-size data units (octets) which are generated in a certain order and possibly, at a given rate. The octets can be assembled in blocks prior to transmission and have to be delivered in the same order and possibly, at the same rate, upon reception.
- 3.12 physical channel:** A communication path between stations, described in terms of the RF characteristics such as coding, power control policies, etc.
- 3.13 piggybacking:** ARQ efficiency technique, where information related to the acknowledgment of a prior transmitted PDU is carried together with a data PDU sent in the opposite direction, thus saving the transmission of a separate PDU containing only the acknowledgement information.
- 3.14 primitive:** An atomic, well-defined method of transferring data and control information between two adjacent layers and sublayers. Conventionally represented as a function invocation with the data and/or control information as parameters.
- 3.15 protocol data unit:** Encapsulated data being sent/received by a layer from the peer layer on the other station.
- 3.16 protocol instance:** Set of state variables, fully describing the status of a communication session at any moment in time, and associated with the transmission/reception of a specific information stream. Multiple information stream may use the same protocol, but each will receive its own "instance".
- 3.17 protocol stack:** Conceptual model of the layered architecture for communication protocols (see Layering) in which layers within a station are represented in the order of their numeric designation and requiring that transferred data be processed sequentially by each layer, in the order of their representation. Graphically, the "stack" is drawn vertically, with the layer having the lowest numeric designation at the base.

3.18 service: A semantically meaningful, consistently performed, well-defined functionality unit, offered by an entity at the interface with another entity, to be performed on data units exchanged between the entities.

3.19 service data unit: Data being transferred to/from a layer from/to the layer immediately "above" it, in the protocol stack. Unless stated otherwise, in this Recommendation, SDU refers to the Layer 3 service data unit being transferred to/from Layer 2.

3.20 service access point (SAP): Conceptual place at the interface between two adjacent layers where services are provided to the upper layer and data and protocol information is exchanged between layers.

3.21 sublayer: A protocol layer of finer granularity, within another protocol layer or sublayer. Layer 2 may be seen as having a LAC sublayer and a MAC sublayer. In turn, those sublayers may have several sublayers of their own.

3.22 upper layers: General reference to Layer 3 and the layers above it.

4 Abbreviations

This Recommendation uses the following abbreviations:

ACK	(Positive) Acknowledgement
ARQ	Automatic Repeat Request
FCS	Frame Check Sequence
LAC	Link Access Control
L1	Layer 1
L2	Layer 2
L3	Layer 3
MAC	Medium Access Control
MT	Mobile terminal
NAK	Negative Acknowledgement
PDU	Protocol Data Unit
QoS	Quality of Service
RAN	Radio Access Network
SAP	Service Access Point
SDU	Service Data Unit

5 Services

5.1 General requirements

1) *Efficiency*

In providing services to Layer 3 and Layer Management, Layer 2 should make efficient use of resources, especially radio resources.

2) *Support for multiple protocol instances*

Layer 2 should be able to support multiple information streams, independent of each other, by assigning a different instance of the Layer 2 protocol engine to each stream.