



INTERNATIONAL TELECOMMUNICATION UNION

# ITU-T

TELECOMMUNICATION  
STANDARDIZATION SECTOR  
OF ITU

# Q.1703

(05/2004)

SERIES Q: SWITCHING AND SIGNALLING

Signalling requirements and protocols for IMT-2000

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## **Service and network capabilities framework of network aspects for systems beyond IMT-2000**

ITU-T Recommendation Q.1703

ITU-T Q-SERIES RECOMMENDATIONS  
SWITCHING AND SIGNALLING

|                                                                                |                      |
|--------------------------------------------------------------------------------|----------------------|
| SIGNALLING IN THE INTERNATIONAL MANUAL SERVICE                                 | Q.1–Q.3              |
| INTERNATIONAL AUTOMATIC AND SEMI-AUTOMATIC WORKING                             | Q.4–Q.59             |
| FUNCTIONS AND INFORMATION FLOWS FOR SERVICES IN THE ISDN                       | Q.60–Q.99            |
| CLAUSES APPLICABLE TO ITU-T STANDARD SYSTEMS                                   | Q.100–Q.119          |
| SPECIFICATIONS OF SIGNALLING SYSTEMS No. 4, 5, 6, R1 AND R2                    | Q.120–Q.499          |
| DIGITAL EXCHANGES                                                              | Q.500–Q.599          |
| INTERWORKING OF SIGNALLING SYSTEMS                                             | Q.600–Q.699          |
| SPECIFICATIONS OF SIGNALLING SYSTEM No. 7                                      | Q.700–Q.799          |
| Q3 INTERFACE                                                                   | Q.800–Q.849          |
| DIGITAL SUBSCRIBER SIGNALLING SYSTEM No. 1                                     | Q.850–Q.999          |
| PUBLIC LAND MOBILE NETWORK                                                     | Q.1000–Q.1099        |
| INTERWORKING WITH SATELLITE MOBILE SYSTEMS                                     | Q.1100–Q.1199        |
| INTELLIGENT NETWORK                                                            | Q.1200–Q.1699        |
| <b>SIGNALLING REQUIREMENTS AND PROTOCOLS FOR IMT-2000</b>                      | <b>Q.1700–Q.1799</b> |
| SPECIFICATIONS OF SIGNALLING RELATED TO BEARER INDEPENDENT CALL CONTROL (BICC) | Q.1900–Q.1999        |
| BROADBAND ISDN                                                                 | Q.2000–Q.2999        |

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# **ITU-T Recommendation Q.1703**

## **Service and network capabilities framework of network aspects for systems beyond IMT-2000**

### **Summary**

This Recommendation specifies the service and network capability framework for systems beyond IMT-2000, from the network aspects, in order to attend the high level end-user needs delineated in the ITU long-term vision for systems beyond IMT-2000, as specified in ITU-T Recs Q.1701 and Q.1702 and ITU-R Rec. M.1645.

### **Source**

ITU-T Recommendation Q.1703 was approved on 29 May 2004 by ITU-T Special Study Group (SSG) (2001-2004) under the ITU-T Recommendation A.8 procedure.

### **Keywords**

Network capability framework, service capability framework, systems beyond IMT-2000.

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# CONTENTS

## Page

|      |                                                                                                                                           |    |
|------|-------------------------------------------------------------------------------------------------------------------------------------------|----|
| 1    | Scope .....                                                                                                                               | 1  |
| 2    | References.....                                                                                                                           | 1  |
| 2.1  | Normative references.....                                                                                                                 | 1  |
| 2.2  | Informative references.....                                                                                                               | 2  |
| 3    | Definitions .....                                                                                                                         | 2  |
| 4    | Abbreviations.....                                                                                                                        | 4  |
| 5    | Introduction .....                                                                                                                        | 5  |
| 5.1  | Envisaged capabilities for systems beyond IMT-2000 .....                                                                                  | 5  |
| 5.2  | Key study items for systems beyond IMT-2000 .....                                                                                         | 6  |
| 6    | Service capability framework from network aspects.....                                                                                    | 7  |
| 6.1  | Service capability design objectives.....                                                                                                 | 7  |
| 6.2  | Service creation .....                                                                                                                    | 7  |
| 6.3  | Service provisioning.....                                                                                                                 | 8  |
| 6.4  | Service management.....                                                                                                                   | 10 |
| 6.5  | Virtual environment service .....                                                                                                         | 11 |
| 7    | Network capability framework.....                                                                                                         | 12 |
| 7.1  | Network design objectives .....                                                                                                           | 12 |
| 7.2  | Mobility management.....                                                                                                                  | 14 |
| 7.3  | Session management .....                                                                                                                  | 18 |
| 7.4  | QoS management.....                                                                                                                       | 20 |
| 7.5  | Transportation control .....                                                                                                              | 24 |
| 7.6  | Traffic transportation.....                                                                                                               | 26 |
| 7.7  | Network resource management .....                                                                                                         | 27 |
| 7.8  | System interoperability.....                                                                                                              | 27 |
| 7.9  | Multiple access support and radio resource management .....                                                                               | 28 |
| 7.10 | Enhanced accounting, charging and billing support.....                                                                                    | 29 |
| 7.11 | Enhanced OAM&P support.....                                                                                                               | 30 |
| 7.12 | Security provisioning and management .....                                                                                                | 30 |
| 7.13 | Global roaming.....                                                                                                                       | 34 |
| 7.14 | Virtual environment support.....                                                                                                          | 36 |
| 8    | User platform capability framework.....                                                                                                   | 37 |
| 8.1  | User platform design objectives .....                                                                                                     | 37 |
| 8.2  | User platform capability framework .....                                                                                                  | 37 |
|      | Appendix I – Use case scenarios for Systems Beyond IMT-2000 – Use case scenario for<br>Seamless service support – Session continuity..... | 38 |
|      | Appendix II – All IP network and Virtual Home Environment (VHE).....                                                                      | 40 |
|      | Appendix III – User selectable service methods.....                                                                                       | 41 |



# ITU-T Recommendation Q.1703

## Service and network capabilities framework of network aspects for systems beyond IMT-2000

### 1 Scope

The scope of this Recommendation is to provide a service and network capabilities and requirements framework, from the network aspect, for systems beyond IMT-2000 around the year 2010, as specified by ITU-R (Rec. M.1645) and ITU-T (Rec. Q.1702). It is expected that various advanced services can be offered via the combination of radio aspect of service capabilities and network aspect of service capabilities, the ones described herein. However, due to the numerous possibilities of such advanced services, the concrete service contents but the framework to support those will not be discussed in this Recommendation.

This Recommendation follows the vision described in ITU-R (Rec. M.1645) and ITU-T (Rec. Q.1702). To fulfil the vision and accomplish the objectives for systems beyond IMT-2000, this Recommendation identifies the general capabilities and/or requirements framework. These capabilities and/or requirements framework can be studied in order to develop the detailed capabilities and/or requirements for systems beyond IMT-2000.

### 2 References

#### 2.1 Normative 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; 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. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [1] ITU-T Recommendation Q.65 (2000), *The unified functional methodology for the characterization of services and network capabilities including alternative object oriented techniques*.
- [2] ITU-T Recommendation Q.1214 (1995), *Distributed functional plane for intelligent network CS-1*.
- [3] ITU-T Recommendation E.410 (1998), *International network management – General information*.
- [4] ITU-T Recommendation E.418 (2003), *Framework for network management of IMT-2000 networks*.
- [5] ITU-T Recommendation M.3400 (2000), *TMN management functions*.
- [6] ITU-T Recommendation M.3210.1 (2001), *TMN management services for IMT-2000 security management*.
- [7] ITU-T Recommendation Q.1701 (1999), *Framework for IMT-2000 networks*.
- [8] ITU-T Recommendation Q.1702 (2002), *Long-term vision of network aspects for systems beyond IMT-2000*.
- [9] ITU-T Recommendation Q.1711 (1999), *Network functional model for IMT-2000*.

- [10] ITU-R Recommendation M.1645 (2003), *Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000*.
- [11] ITU-T Recommendation H.323 (2003), *Packet-based multimedia communications systems*.
- [12] ITU-T Recommendation G.1010 (2001), *End-user multimedia QoS categories*.
- [13] ITU-T Recommendation Y.1541 (2002), *Network performance objectives for IP-based services*.
- [14] ITU-T Recommendation M.3100 (1995), *Generic network information model*.
- [15] ITU-R Recommendation M.687-2 (1997), *International Mobile Telecommunications-2000 (IMT-2000)*.
- [16] ITU-T Recommendation Q.1241 (2001), *Introduction to Intelligent Network Capability Set 4*.
- [17] ITU-T Recommendation Q.1721 (2000), *Information flows for IMT-2000 Capability Set 1*.

## 2.2 Informative references

- [18] ITU-T *Handbook on Quality of Service and Network Performance* (1993).
- [19] ETSI ES 201 915 series: *Open Service Access (OSA); Application Programming Interface (API)*.

## 3 Definitions

This Recommendation defines the following terms:

- 3.1 attachment and access capability:** The ability of a terminal to power on and gain access to a serving network, home or visited.
- 3.2 billing:** Administrative function to prepare bills to service customers, to prompt payments, to obtain revenues and to take care of customer reclaims.
- 3.3 continuous mobility (handover):** The ability of a mobile user/terminal/network to change location while media streams are active. Handover is further called seamless when the mobile entity's location change does not result in delay or loss of data that would be perceived by the user as degradation of quality of service.
- 3.4 discrete mobility (roam):** The ability of a mobile user/terminal/network to make discrete changes of location, i.e., to change location while no media streams are active.
- 3.5 mobility:** The ability to provide services irrespective of environment changes that may occur by mobile user/terminal/network's activities.
- 3.6 mobility management:** The set of functions used to manage a mobile user accessing a network other than that user's home network. These functions include communication with the home network for purposes of authentication, authorization, location updating and download of user information.
- 3.7 network capability:** A capability of a network that is utilized to support service capabilities but which is not itself a service capability.
- 3.8 network mobility:** The ability of a network, where a set of fixed or mobile nodes are networked to each other, to change, as a unit, its point of attachment to the corresponding network upon the network's movement itself.
- 3.9 personal mobility:** The ability of a user to receive subscribed service independent of the terminal in use as long as that terminal and access network can support the subscribed service.

**3.10 Quality of Service (QoS):** The collective effect of service performance which determine the degree of satisfaction of a user of a service. It is characterized by the combined aspects of performance factors applicable to all services, such as bandwidth, latency, jitter, traffic loss, etc.

**3.11 QoS parameters:** QoS parameters are quantifiable characteristics of a service that can be specified by users of that service and which collectively determine the quality of the users experience, e.g., bandwidth, delay, jitter, packet loss, priority, traffic class, etc. QoS parameters are non-subjective characteristics of a service and are specified in terms of numeric values.

**3.12 seamless service:** Seamless Service will prevent users experiencing any service disruptions while maintaining mobility or portability.

**3.13 service:** A stand-alone commercial offering, characterized by one or more core service features, and can be optionally enhanced by other service features. Business aspects of a service offering may include bundling of various services, pricing, terminal subsidies, the provisioning of the sales channels, end-user consulting, etc.

**3.14 service capability:** The capability of a network to offer a service or service feature to subscribers. A service capability becomes visible to a user or subscriber as part of a service or service feature provided by a network operator. Service capabilities depend on network capabilities.

**3.15 service creation:** The conception, design and implementation of a capability to provide a service.

**3.16 service feature:** A specific aspect of a telecommunication service that can also be used in conjunction with other telecommunication services/service features.

**3.17 service interface:** The interface between a service application and the core network capabilities used by that service application in delivering a service to a user.

**3.18 service level agreement:** An agreement between operators/service providers or between users and service providers defining the level of service to a user(s), that is used as a basis for a business contract.

**3.19 service portability:** The ability to access any services offered anywhere within the roaming domain of the users at any time.

**3.20 session mobility:** The ability of the mobile user/terminal/network to maintain sessions while changing between terminal devices and across various access and core networks.

**3.21 subscription portability:** Consistency of certain service attributes when a subscriber changes service provider (e.g., mobile number, email address).

**3.22 terminal:** The customer's access equipment used to request and terminate network associated connectivity services.

**3.23 terminal mobility:** The ability of a terminal to access telecommunication services from different locations and while in motion, and the capability of the network to identify and locate that terminal. Terminal mobility can be further classified into: continuous terminal mobility (handover) and discrete terminal mobility (roam).

**3.24 traffic flows control:** A set of mechanisms used to control the flow of packets. Traffic Flow Control can be used to prevent the network from becoming overloaded by regulating the input rate transmissions, or to prevent unauthorized use of network resources.

**3.25 transport:** The functional process of transferring information between different locations.

**3.26 Virtual Home Environment (VHE):** The provision of a service experience to the mobile subscriber identical to, or as similar as possible to the service environment the subscriber experiences when served at his/her home location.

**3.27 virtual home services:** The ability of users to receive their home services with the same look and feel from any network and on any terminal on the basis of personal (private) identification.

**3.28 Virtual Reality Environment (VRE):** The ability for users to access the sights and sounds of remotely located complex systems in real-time.

## 4 Abbreviations

This Recommendation uses the following abbreviations:

|          |                                                          |
|----------|----------------------------------------------------------|
| 2G       | Second Generation                                        |
| 3G       | Third Generation                                         |
| API      | Application Programming Interface                        |
| AS       | Application Server                                       |
| CS       | Capability Set/Circuit Switched                          |
| CaS      | Call Server                                              |
| DoS      | Denial of Service                                        |
| DSL      | Digital Subscriber Line                                  |
| ETSI     | European Telecommunications Standards Institute          |
| ID       | Identity                                                 |
| IETF     | Internet Engineering Task Force                          |
| IMS      | IP Multimedia Subsystem                                  |
| IMT-2000 | International Mobile Telecommunications-2000             |
| IP       | Internet Protocol                                        |
| IPv6     | Internet Protocol version 6                              |
| ISP      | Internet Service Provider                                |
| LAN      | Local Area Network                                       |
| NNI      | Network-Network Interface                                |
| OAM&P    | Operations, Administration, Maintenance and Provisioning |
| OSA      | Open Service Access                                      |
| PS       | Packet Switched                                          |
| QoS      | Quality of Service                                       |
| SIP      | Session Initiation Protocol                              |
| SLA      | Service Level Agreement                                  |
| SS       | Subscription Server                                      |
| TMN      | Telecommunications Management Network                    |
| UE       | User Equipment                                           |
| UIM      | User Identity Module                                     |
| VAS      | Value-Added Service                                      |
| VHE      | Virtual Home Environment                                 |
| VoIP     | Voice over IP                                            |

|      |                              |
|------|------------------------------|
| VRE  | Virtual Reality Environment  |
| WIN  | Wireless Intelligent Network |
| WLAN | Wireless Local Area Network  |

## 5 Introduction

In defining a vision for the future of mobile telecommunications, a number of layers of detail are required. The highest layer is an overall end-user service oriented perspective. This is provided in ITU-T Recs Q.1701 and Q.1702.

In order to progress towards the realization of the architecture and interface specifications to achieve these services, the next level of detail is the definition of the service capabilities that are required, and along with these service capabilities, the network capabilities that are required to realize these service capabilities.<sup>1</sup>

This Recommendation provides a service and network capability framework, from the network aspect, in support of the envisaged service needs and key network design objectives for systems beyond IMT-2000, as specified in ITU-R Rec. M.1645 and ITU-T Recs Q.1701 and Q.1702.

### 5.1 Envisaged capabilities for systems beyond IMT-2000

The prospective network for systems beyond IMT-2000, as noted in ITU-T Rec. Q.1702 and ITU-T Rec. M.1645, consists of diverse and different access systems and IP-based core network, such that the network can support interworking between these diverse access systems and should have the following features:

- Systems Beyond IMT-2000 will be flexible, versatile and new services will be easy-to-deploy.
- Systems Beyond IMT-2000 will use the modular construction using expandable components.
- Systems Beyond IMT-2000 will employ the open interfaces between various systems.

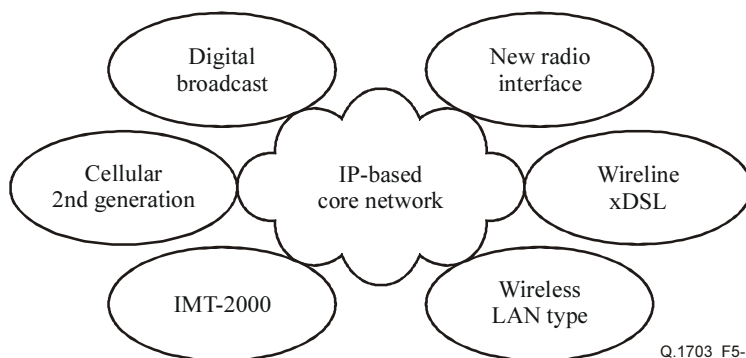


**Figure 5-1/Q.1703 – Network of systems beyond IMT-2000**

<sup>1</sup> This layered approach closely parallels the Intelligent Network Conceptual Model described in the Q.1200-series of Recommendations, where a Service Plane, a Global Functional Plane, a Distributed Functional Plane and a Physical Plane are described, each representing a different level of abstraction of the whole of the Intelligent Network.

Systems beyond IMT-2000 may be envisaged to include:

- service provisioning platform;
- IP-based network platform, composed of:
  - access network components;
  - core network components;
- user platform.

## 5.2 Key study items for systems beyond IMT-2000

As noted in ITU-T Rec. Q.1702 and ITU-R Rec. M.1645, there are many key technical areas that require focused study over the next several years leading to the establishment of standards for Systems Beyond IMT-2000. Based on the market trends, technology trends, key long-term network design objectives, and long-term network architecture concepts, as identified in ITU-T Rec. Q.1702, the following study items are identified in order of priority:

- 1) Advanced mobility management:
  - To allow flexible, efficient, and integrated mobility management that supports advanced location management, advanced routing management, session continuity, efficient and adaptive location registration, dynamic handling of Quality of Service (QoS) during handover, etc.
  - Support of moving network consisting of several nodes.
  - Support of mobility across heterogeneous access technologies.
- 2) Separate control and transport functions:
  - Separation of control and bearer planes for scalability and architectural flexibility.
  - Transport functions should fully utilize IP transport capability to direct user traffic.
  - Open interface between control and transport functions.
- 3) Diversified radio access support:
  - Access independent network.
  - Support heterogeneous access technologies with plug and access.
- 4) Seamless service support:
  - Network-seamless service capability to support services in the same way across wireless networks, fixed networks, Internet Service Providers (ISPs), and private networks (e.g., Wireless LAN (WLAN)).
  - Terminal-seamless service capability (i.e., session continuity even with environment change).
  - Content-seamless service capability (i.e., video/audio to audio only or vice versa).
- 5) Application service support:
  - Support diversified Application Service Providers (ASPs) by supporting their services and offering additional values to them.
  - Simplify service expansion and dynamic creation of multi-facet services at session level.
- 6) Enhanced security and location privacy:
  - Seamless security protection across heterogeneous systems.
  - Enhanced location privacy in a fully IP-based network.

## **6 Service capability framework from network aspects**

The following service capability framework from network aspects is envisaged to facilitate the identification of service capabilities around the year 2010.

### **6.1 Service capability design objectives**

The service capability for Systems Beyond IMT-2000 should support, if needed, the existing services for current IMT-2000 Family Member Systems. In addition, Systems Beyond IMT-2000 network will provide both a number of new and diverse sets of services and an adequate service environment through its service capability framework, whose key long-term design objectives are listed in the following clauses. The service capability framework for Systems Beyond IMT-2000 will:

- Encourage appearances of diversified ASPs by supporting their services and offering additional values to them.
- Provide multiple service combination capabilities with appropriate mechanisms to handle service interaction and service invocation.
- Support modularized service control and open service architecture.
- Simplify service expansion and dynamic creation of multi-facet services at session level.
- Support flexibility for adoption of new services.
- Provide network seamless service capabilities across different networks.
- Provide content seamless service capabilities to adapt service to the suitable format or type for each user in accordance with its location, its status, its preference or terminal capability.
- Provide terminal seamless service capabilities across various terminal environments.
- Support the applications with diverse QoS needs, e.g., non-real time/best effort service.
- Support the secure mechanisms to protect application services.
- Provide the service based on the environment information of a user such as location information with high precision and/or attendant information.
- Provide the service which depends on the validation and/or invalidation of user's preference.

### **6.2 Service creation**

The envisaged service creation in Systems Beyond IMT-2000 should include a well-defined service architecture support and a specific handling to the different categories of service created in those systems. In addition, the network should have a capability to provide the environmental information in response to the request from the service creation support.

#### **6.2.1 Service creation support**

The service architecture of Systems Beyond IMT-2000 will support the capability for rapid service creation. Rapid is considered from real-time to a week rather than from weeks to months.

The support should include for joint or independent rapid service creation by the following entities:

- User/Terminals;
- Network Operators;
- Service Providers;
- Independent Third Party Platforms (brokered by Network Operators);
- Manufacturers/Vendors; and
- Content Providers.

### 6.2.2 Envisaged service category

The services created in Systems Beyond IMT-2000 will, but not limited to, fall into the following category:

#### 6.2.2.1 Basic telecommunication service

Systems Beyond IMT-2000 network should provide the basic telecommunication services, such as tele-services and bearer-services. Tele-services may be offered in a value-added form through possible service combinations, e.g., video telephony.

#### 6.2.2.2 Value-Added Services (VAS)

The VAS services offered by Systems Beyond IMT-2000 network will include multimedia services such as streaming video. It will be divided into subscribed and unsubscribed services. These services may be provided by application servers residing on platforms either internal or external to the network as described below:

The application server platform(s) of the service architecture of Systems Beyond IMT-2000 offering value-added services and/or operator specific services may reside in the home or the visited networks. Platform offering subscribed VAS will be considered to be within the user's home environment. When offered from a third party service provider's platform, these VAS services may not be available/offered by either of the home or the visited networks. They are services offered and authorized to visiting/roaming users through a flexible and real-time access authorization scheme. The VAS will be enabled through the distributed functionalities over the network.

#### 6.2.2.3 Supplementary services

Supplementary services are used to complement, modify and personalize the usage of basic telecommunication services. The same supplementary service may be offered with a number of different telecommunication services. It cannot be offered to a user as a standalone service and must be offered together with or in association with a basic telecommunication service. Multiple supplementary services within a call will be supported and the interactions between them will be handled accordingly based on prioritization.

Systems Beyond IMT-2000 may provide a brand new supplementary service. Systems Beyond IMT-2000 should support the existing IMT-2000 supplementary services mainly for backward compatibility purpose, e.g., call deflection, call line identification, call forwarding, call hold, multi-party calling and advice of charge, etc.

Operator specific supplementary services may at first, not be standardized, but be created using Virtual Home Environment (VHE) capability.

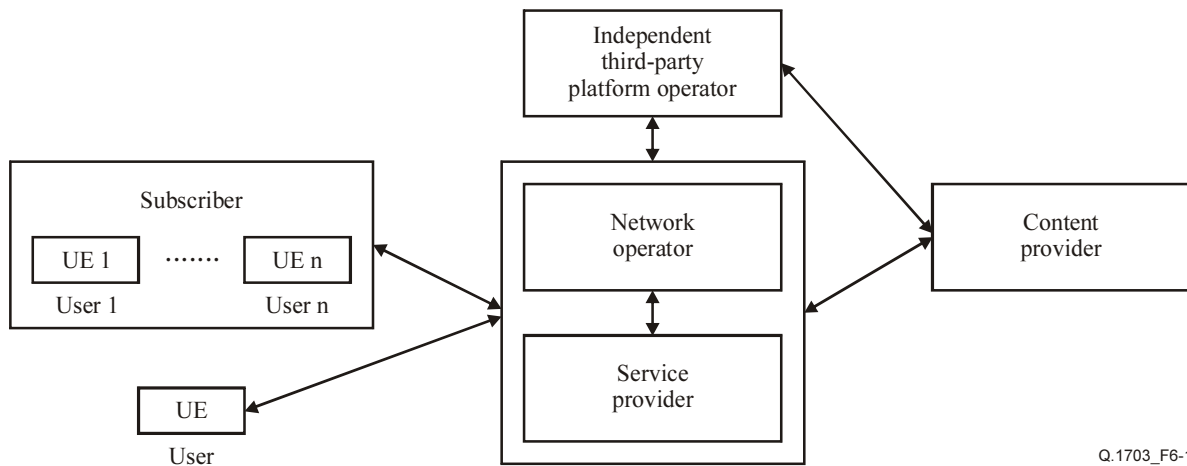
### 6.3 Service provisioning

#### 6.3.1 Service provisioning model

The service provisioning model of Systems Beyond IMT-2000 is envisaged to have a modularized approach to increase flexibility and scalability, so that the services are provisioned through dynamic cooperation of each entities in such a manner to maximize user satisfaction. Those entities would include: User, Subscriber, Service Provider, Content Provider, Network Operator and Independent Third-Party Platform Operator, as shown in Figure 6-1.

Clearly, this model ensures the functional separation of each entity, which, however, is a logical one and thus more than one function might be implemented in a real entity.

Users may directly subscribe their desired services to each network entities. In most cases, however, it is envisaged that they will utilize the Subscriber such that it manages the contract stuffs between network entities on behalf of users. Therefore, the users would be able to choose services only, remaining transparent to the complicated network related details.



Q.1703\_F6-1

**Figure 6-1/Q.1703 – Service provisioning model for Systems Beyond IMT-2000**

The Subscriber is the customer of the Service Provider. Commercial agreements are set up and maintained between them for the provision of services from the Service Provider to the User Equipment. The Subscriber may have contracts with multiple Service Providers. The Subscriber informs the Service Provider as which services each user should have access to. The Subscriber may also choose to set limits for users on the user of a particular service and at a pre-assigned QoS level.

The Service Providers may enter into a static or dynamic commercial agreement with one or more network operators in order to deliver services to its subscribers. A company wishing to sell services without having a contract with a network operator, may adopt the role of "Third-Party Platform Operator" and provide services via the Service Provider. A company intending to sell and provide just service contents, i.e., the Content Provider, may develop a commercial relationship with either a Service Provider or a Third-Party Platform Operator.

A user initiates a service by requesting it to the Service Provider (not from the Network Operator). On receipt of a service request, the Service Provider uses the Network Operator or Third-Party Platform Operator to serve the request in the best way possible. An independent Service Provider may choose to use different Network Operators for services with various QoS levels.

### 6.3.2 User customization of services

It will enable the subscriber and/or user to change the behaviour of their services to suit their requirements. That is, it will support the capability for the subscriber and/or user to modify their service profile (within the limits of their subscription) in both dynamic (real-time) and static (non real-time or semi-permanent) manner as required.

Modification of the user's service profile should be possible through various schemes (e.g., voice, text, DTMF and graphical interface) and independent of the access technologies.

For example, when applied to the basic telecommunication service, user customization of services should allow end users to customize their call features (such as when they want to be called, on what device, under what user or device condition, and by whom).

An example method of user customization of services can be found in Appendix III.