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Title:	Liaison Statement on Status of ITU-T Draft Rec. Q.SNFB

LIAISON STATEMENT

To:	**ITU-R WP8F, ITU-T SG2, ITU-T SG4, ITU-T SG13, 3GPP, 3GPP2, WWRF, OMA, TIA TR45, T1P1, TTC, TTA**
Approval:	**SSG Meeting, Geneva, 2 – 6 June 2003**
For:	**Action**
Deadline:	**1 November 2003 or earlier**

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ITU-T Special Study Group (SSG), the lead Study Group on IMT-2000 and Beyond and for mobility, developed and approved the long-term vision (around 2010) Recommendation Q.1702, entitled "Long-term vision of network aspects for systems beyond IMT-2000," in June of 2002. To realize the long-term vision for systems beyond IMT-2000, the work within the SSG is now progressing towards the development of Stage 1 requirements.

The following two recommendations were originally slated for this purpose:

1) Proposed Draft New Recommendation (PDNR) Q.SCFN - Service capabilities framework of network aspects for systems beyond IMT-2000
2) Proposed Draft New Recommendation (PDNR) Q.NCRB - Network capability requirements for systems beyond IMT-2000

At the 6th SSG meeting held in Geneva from 2 to 6 June 2003, contributions were submitted to combine the above two PDNRs into a single document due to the close inter-relationship between services and network capabilities. This was agreed and the combined document is denoted PDNR Q.SNFB - Service and network capabilities framework of network aspects for systems beyond IMT-2000.

The scope of this PDNR is to provide a service and network capabilities and/or requirements framework, from the network aspect, for systems beyond IMT-2000 around the year 2010, as envisaged in ITU-R [Vision PDNR]* and ITU-T Recommendation Q.1702. The work on this PDNR is being carried out in Question 1/SSG (Q.1/SSG).

There are many key technical areas that require focused study in the development of PDNR Q.SNFB. Based on the market trends, technology trends, key long-term network design objectives, and long-term network architecture concepts, identified in ITU-T Recommendation Q.1702, the following study items are identified in order of priority:

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

Additional study items are expected to be identified and added during the development of PDNR Q.SNFB.

In the development of this PDNR, ITU-T SSG would continue its close collaboration with ITU-R WP 8F as in the IMT-2000 and beyond vision work activities. The SSG is also interested in close collaboration with other standards and research forums that are engaged in the Beyond 3G (or long-term vision) work activities to ensure that all inputs are captured succinctly into a cohesive Recommendation. Therefore, SSG invites all participating organizations to submit inputs towards the

development of Q.SNFB that will assist in its completion by April 2004. The current work plan for the completion of PDNR Q.SNFB is provided in Annex 1 for your reference.

Attached is the first draft of PDNR Q.SNFB produced at the 2-6 June 2003 meeting of the SSG held in Geneva. The SSG invites comments and inputs from the enlisted organization to progress this work.

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Annex 1: Current Work Plan for Q.SNFB

Attachment: ITU-T PDNR Q.SNFB Version 1.0

Annex 1: Current Work Plan for Q.SNFB

Date	Meeting Schedule	Deliv. 2 Q.SNFB
2003 June (2-6 June)	6th SSG Meeting (Geneva)	Developing 1st Draft |
July		|
August		|
September (4-16 September?)	Q.1/SSG Meeting (electronic mtg)	? 2nd Draft |
October		|
November (17-21 November)	7th SSG Meeting (Geneva)	? 3rd Draft | |
December		|
2004 January (8-20 January?)	Q.1/SSG Meeting (electronic mtg)	? 4th Draft |
February		|
March (8-12 March?)	Q1/SSG Meeting (face-to-face mtg) (location & date to be confirmed)	? 5th Draft | |
April	8th SSG Meeting (?)	? Approval of Q.SNFB

DRAFT NEW ITU-T RECOMMENDATION Q.SNFB

Service and Network Capabilities Framework of Network Aspects for Systems Beyond IMT-2000

Version 1.1

Summary

Scope

The scope of this recommendation is to provide a service and network capabilities and/or requirements framework, from the network aspect, for systems beyond IMT-2000 around the year 2010, as specified by ITU-R [Vision PDNR]* and ITU-T [Recommendation Q.1702]. It is expected that various advanced services can be offered via the combination of radio aspect of service capabilities and the ones described herein. However, due to the numerous possibilities of such advanced services, the concrete service contents will not be discussed in this recommendation.

This recommendation follows the vision described in ITU-R [Vision PDNR]* and ITU-T [Recommendation Q.1702]. To fulfill the vision and accomplish the objectives for systems Beyond IMT-2000, that support the multiple network accesses, this recommendation identifies the general capabilities and/or requirements. These capabilities and/or requirements can be studied in order to develop the detailed requirements for systems Beyond IMT-2000.

References

[1] ITU-T Recommendation Q.65 (2000): The unified functional methodology for the characterization of services and network capabilities

[2] ITU-T Recommendation Q.1214 (1995): Distributed functional plane for Intelligent Network CS-1

[3] ITU-T Recommendation E.410: 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.3000: Overview of TMN Recommendations

[6] ITU-T Recommendation M.3210.1 (2001): TMN Management Services for IMT-2000 Security Management

[6] ITU-T Recommendation Q.1701 (1999): Framework for IMT-2000 Networks

[7] ITU-T Recommendation Q.1702 (2002): Long-term vision of network aspects for systems beyond IMT-2000

[8] ITU-T Recommendation Q.1711 (1999): Network functional model for IMT-2000

[9] ITU-R Recommendation M.IMT-VIS (2003): Vision framework and overall objectives of the future development of IMT-2000 and of systems beyond IMT-2000

[10] ETSI Technical Standard ES 201 915 series: Open Service Access (OSA); Application Programming Interface

[11] ITU-T Recommendation H.323 (2000): 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 A.3 (1996), Elaboration and presentation of texts and development of terminology and other means of expression for Recommendations of the ITU Telecommunications Standardization Sector;

[15] ITU-T Recommendation M.3100 (1995), Generic network information model;

[16] ITU-R Recommendation M.687-2 (1997), International Mobile Telecommunications-2000 (IMT-2000);

[17] ITU-T Recommendation Q. 1241 CS4

[18] ITU-T Recommendation Q. 1721

Definitions

Access Mobility	The ability to move within and between various radio access networks and technologies in real-time without service interruption.
Attachment Mobility	The ability to power on and gain access to a serving network, home or visited.
Billing	Administrative function to prepare bills to service customers, to prompt payments, to obtain revenues and to take care of customer reclaims.
Macro mobility	The ability of a mobile terminal to move between networks.
Micro mobility	The ability of a mobile terminal to move within a network.
Mobility	The ability to provide services irrespective of changes that may occur by user/terminal's activities.
Personal Mobility:	The ability for a user to change his association with one or more terminals.
Quality of Service (QoS)	[to be defined]
Seamless Service	Seamless Service will prevent users experiencing any service disruptions while maintaining mobility or portability.
Service	an offering of a service provider or network operator to the end user based on a set of service applications and possibly including the bundling of various services with business aspects like pricing, bundling, subsidisation of terminals and the provisioning of the sales channels, end-user consulting.
Service Application	Capabilities available to the end-user.
Service Capabilities	Features of the network and the terminal that allow the competitive service offering.
Service Interface	This is the interface between a service application and the core network capabilities used by that service application in delivering a service to a user.
Service level agreement	An agreement between operators/service providers defining the level of service as a basis for a business contract.

Session Mobility	The ability of the user to maintain sessions while changing terminal devices.
Subscription Portability	Consistency of certain service attributes when a subscriber changes service provider (e.g., mobile number, email address.)
Terminal	[to be defined]
Traffic Flows Control	[to be defined]
Virtual Home Environment (VHE) in mobile network	(1) The provision of a service experience to the subscriber identical to, or as similar as possible to the service environment the subscriber experiences when served at his/her home location (reference Q.1721 (00), 3.10).
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.
Virtual Reality Environment (VRE)	[to be defined]

Abbreviations

2G	Second Generation
3G	Third Generation
API	Application Programming Interface
AS	Application Server
ATM	Asynchronous Transfer Mode
CAMEL	Customized Applications for Mobile Enhanced Logic
CD-ROM	Compact Disc - Read only Memory
CS	Call Server (also Control Server)
CS	Circuit Switched
CSCF	Call State Control Function
DNS	Domain name Server
DRM	Digital Rights Management
DSL	Digital Subscriber Line
EMT	Emergency Medical Technician
ETSI	European Telecommunications Standards Institute
FIGS	Fraud Information Gathering System
ID	Identity
IETF	Internet Engineering Task Force
IMT-2000	International Mobile Telecommunications 2000
INI	Intra-Network Interface
IP	Internet Protocol
IPv6	Internet Protocol version 6
ISP	Internet Service Provider
LAN	Local Area Network
LCS	Location based Service
MExE	Mobile Execution Environment
NAI	Network Access Identifier
NGN	Next Generation Network
NNI	Network - Network Interface
OAM&P	Operations, Administration, Maintenance and Provisioning (not used presently)
OSA	Open Services Architecture
OSMM	One-Service Multi-Methods
OTASP	Over The Air Service Provisioning
PPP	Point-to-Point Protocol
PS	Packet Switched
QoS	Quality of Service
SAT	(no expansion provided in text)
SCM	Session Control Manager

SDH	Synchronous Digital Hierarchy
SDR	Software Defined Radio
SIP	Session Initiation Protocol
SONET	Synchronous Optical NETwork
SP	Service Provider
SS	Subscription Server
TMN	Telecommunications Management Network
UE	User Equipment
UIM	User Identity Module
UNI	User Network Interface
URL	Uniform Record Locater
VAS	Value Added Service
VHE	Virtual Home Environment
VoIP	Voice over IP
VRE	Virtual Reality Environment
WDM	Wavelength Division Multiplexing
WIN	Wireless Intelligent Network
WLAN	Wireless Local Area Network

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 Recommendations 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. This 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.

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 Recommendation M.IMT-VIS and ITU-T Recommendations Q.1701 and Q.1702.

As noted before, there are many key technical areas that require focused study over the next several years leading to the establishment of standards for systems BI2K. Based on the market trends, technology trends, key long-term network design objectives, and long-term network architecture concepts, identified in Recommendation Q.1702, the following study items are identified in order of priority:

7) Advanced mobility management:
    a. 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 QoS during handover, etc.
    b. Support of moving network consisting of several nodes
    c. Support of mobility across heterogeneous access technologies
8) Separate control and transport functions:
    a. Separation of control and bearer planes for scalability and architectural flexibility
    b. Transport functions should fully utilize IP transport capability to direct user traffic
    c. Open interface between control and transport functions
9) Diversified radio access support:
    a. Access independent network
    b. Support heterogeneous access technologies with plug and access
10) Seamless service support:

a. Support services seamlessly across wireless networks, fixed networks, Internet Service Providers (IPSs), and private networks (e.g., WLAN)

b. Terminal-seamless service capability (i.e., session continuity even with environment change)

c. Content-seamless service capability (i.e., video/audio to audio only or vice-versa)

11) Application service support:

a. Support diversified ASPs by supporting their services and offering additional values to them

b. Simplify service expansion and dynamic creation of multi-facet services at session level.

12) Enhanced security and location privacy:

a. Seamless security protection across heterogeneous systems.

b. Enhanced location privacy in a fully IP-based network.

Envisaged service capabilities of network aspects

Value-added services (VAS)

The VAS services offered by the All IP network include both subscribed and un-subscribed services. These services are provides by application servers residing on platforms either internal or external to the network as described below:

The application server platform(s) of the All IP service architecture offering value-added services and/or operator specific services may reside in the home or the visited networks. Platform offering subscribed VAS are 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 authorised to visiting/roaming users through a flexible and real-time access authorisation scheme.

Supplementary services

[Editor' note: asking for contributions to this topic, emphasizing that this 3GPP text could be used as a base text to the construction of an ITU SSG text for Supplementary services for Systems Beyond IMT-2000]

[Editor' note: refer to 3GPP TS 22.105 V6.1.0 (2003-03) "Service aspects; Services and Service Capabilities (Release 6)" section 7 "Supplementary Services"]

Service creation

[Editor' note: asking for contributions to this topic.]

Service Creation Support

The All IP service architecture 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 shall 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

Custom Call Features

[Editor' note: asking for contribution to this text.]

Service provisioning

[Editor' note: asking for contribution to this text.]

Service provisioning model

[Editor' note: asking for contribution to this text.]

User customisation of services

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

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

Virtual home services

[Editor' note: asking for contribution to this text.]

The "Virtual Home Service" includes two abilities as follows:

(1) A user will be able to use his/her own terminal as same as at home area, wherever he/she goes.

(2) A user will be able to use another person's terminal as same as his/her own terminal, wherever he/she goes.

Session continuity

[Editor' note: asking for contribution to this text.]

An example of a typical user in year 2010: A user of the IMT-2000 and beyond systems is likely to carry a hand-held device with a full alphanumeric keypad and a high-resolution display, which can connect to any of several wireless and wired access networks.

During a busy workday, this user connects to a company-provided in building wired server to access email and high-volume archived storage. Also, through this server the user is able to connect to an intranet-based site that handles travel reservations. However, while engaged in making travel plans, the user notices that the user is nearly late for an appointment at a trade show at the city's convention center. The user quickly disconnects his/her "docked" hand-held device and hurries towards the convention center with a colleague, who offers to drive. In the automobile, the user accesses the local wide-area wireless service provider and obtains a link to the packet network, albeit at a reduced bandwidth.

The user then re-accesses the travel server and continues making travel plans. Once a convenient termination point is reached, the user disconnects prior to arrival at the convention center. Later, the user re-connects to a high-bandwidth (public) wireless LAN at the convention center in order to process his/her email. Finally, as the user journeys home on the commuter train, the user may entertain himself/herself by playing an interactive game that is available through a web site, again using the wide-area service provider as an access link.

The case cited above serves to illustrate that, although the term "global roaming" suggests extensive travel, it would be frequently utilized even while the end-user remains in a constricted geographic area. In the example case, this user has accessed three distinct Internet link mechanisms; the wired service within her company offices, the public wide-area (cellular) provider, and the WLAN that was set up to accommodate users at the convention center. Furthermore, the user has accessed both his/her email and the travel server, both provided by his/her company, through different link mechanisms. (Note: This situation is sometimes being described as "network convergence.") The user has also entered the Internet protocol Multimedia (IM) domain, which is provided by a third party that is not directly associated with any particular link provider.

The above example illustrates that during a busy day the user has invoked complex access protocols across multiple heterogeneous networks. These heterogeneous networks will satisfy Beyond IMT-2000 systems' requirements and will be capable of offering session continuity as the user moves across different domains using different access technologies. The above example is shown via a pictorial view (see Figure 0-1 below).

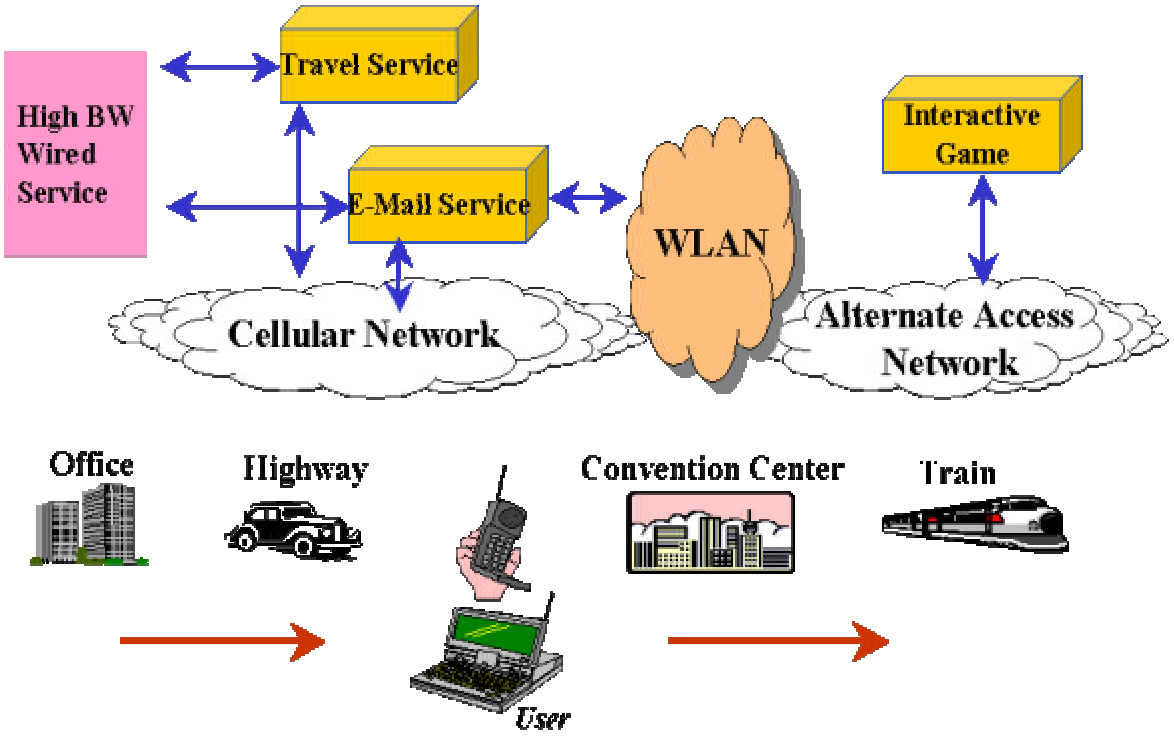

Figure 0-1 An example of a typical user in year 2010

Seamless service support

For many years, roaming has been implemented between mobile networks so that mobile users can be reached via their own telecommunication numbers in any visited networks. Moreover, "Virtual Home Environment" is being implemented so that mobile users can enjoy the same services, Virtual Home Services, in visited networks as in home networks. Thus network-seamless services have until now only been offered under partnerships between mobile networks. In the future partnerships for network-seamless services are envisaged to be extended to include fixed networks, ISPs (Internet Service Providers), and complementary networks such as wired/wireless LANs. This is the concept of network-seamless service capabilities between heterogeneous networks.

Users may need or desire to change terminals depending on changes of environments. For example a user may wish to use a big terminal with a high-resolution screen in the home. When the user gets

on a vehicle, the user may be obliged to use a portable terminal with a low-resolution screen. Even when the environments change from a home to a vehicle, the user may wish to continue enjoying services. This is the concept of terminal-seamless service capabilities between heterogeneous terminals.

A change of environments may lead to a necessity of a content change. Let us assume that a user attends a TV conference in office and then the user has to leave for a business trip by car. The user may wish to continue attending the conference in the car even by changing contents, or media, from video to only voice or text. This is the concept of content-seamless service capabilities between heterogeneous contents.

User Selectable Service Methods

This "User Selectable Service Methods" is the ability that a user will be able to choose appropriate one among various service grades and provided methods to suit the users own convenience. This concept is called "One-Service Multi-Methods" (OSMM), and "User Selectable Service Methods" is a mechanism that user can choose some methods in several methods according to user's convenience.

Figure 0-2 shows the image of "Service Methods Selection" in "One-Service Multi-Methods"(OSMM) concept.

Shall we assume as follows:

One service A (e.g. News delivery service) is consisted of visual, audio and text methods. Each general method is consisted of several concrete methods with selector that can be chosen by user or service provider's requirements.

User will be able to choose appropriate concrete methods combination in Visual, Audio and Text methods according to the ability of user's environment he/she can use, or according to user's desire.

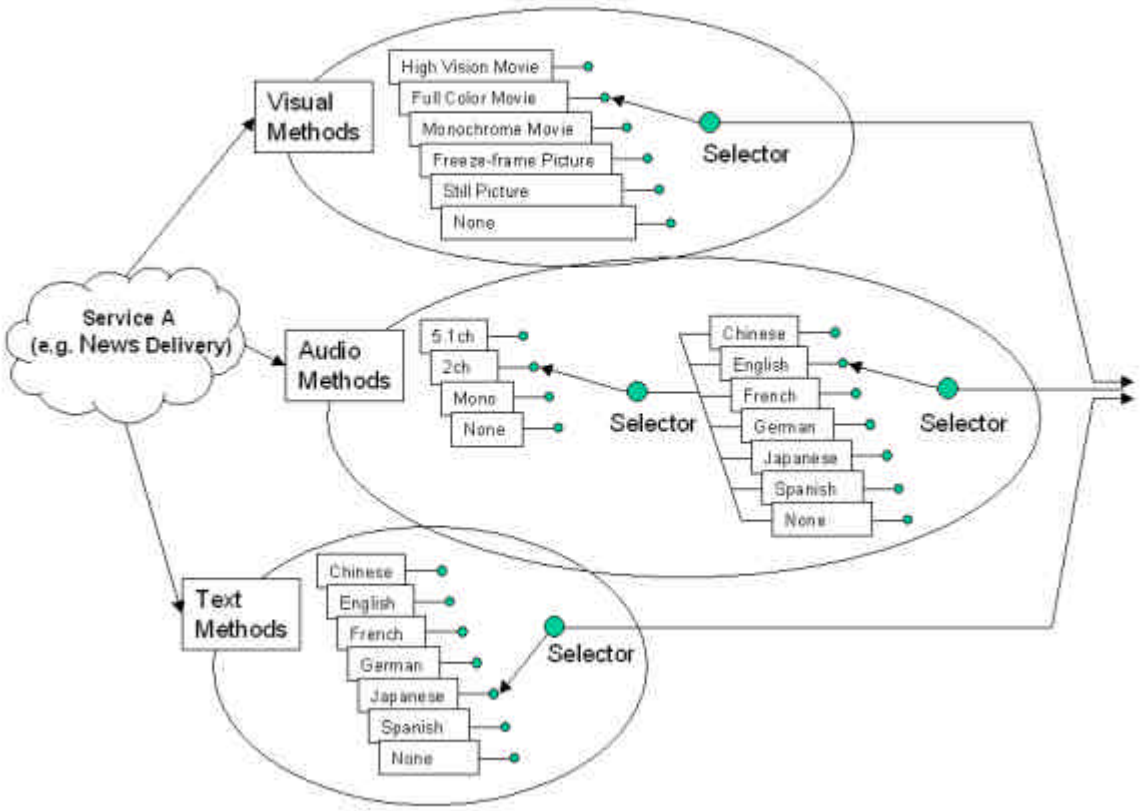

Figure 0-2 An image of "User Selectable Service Methods" in "One-Service Multi-Methods"(OSMM) concept

Multi-facet services

?? With the multiple service combination capability, service provision components in the IP-based network platform should be to provide unlimited service expansion.

?? Not only users can enjoy multimedia multi-facet services that service provision components supported, but also should be possible to participate the provision of their unique services within the framework of service provision components when regulation permits.

?? The role of service providers within service provision framework is not static, that is, one service provider may become the user of another service provider in one particular service session, and then, exchange their role later during another service session.

Network capabilities

Mobility management

Mobility Aspects

Terminal Mobility

The target architecture will support the ability of a terminal to move within and across network domains while continuing to receive access to telecommunication services and to perceive feature transparency. Terminal mobility will be of three types: inter-administrative domain terminal mobility, macro terminal

mobility, and micro terminal mobility[1]. The support of these types of mobility will be independent of each other. With respect to the terminal mobility, the following additional features shall be supported:

- ?? Personal Mobility: Changing association with one or more terminal
- ?? Access Mobility: Ability to move within and between various radio access networks and technologies in real-time with no service interruption.
- ?? Attachment Mobility: The ability to power on and gain access to any serving network, home or visited.

Session Mobility

The target architecture will support the ability of the user to maintain sessions while changing between terminal devices. For example, the user of a mobile terminal will be able to transition to a laptop/DSL connection without losing a specific session.

Subscription Portability

The target architecture will allow subscribers to maintain service attributes when the subscriber changes administrative service provider (e.g., number portability). Examples include mobile number, email address, and/or change of ISP for application services.

Registration management

[Editor' note: asking for contributions to this topic.]

Location Management

[Editor' note: asking for contributions to this topic.]

Location registration and update

[Editor' note: asking for contributions to this topic.]

Routing Management

[Editor' note: asking for contributions to this topic.]

Traffic flow control

Congestion control

The network must be able to function under peak loads while maintaining fairness to all subscribers based on the services and capabilities they are paying for. Network congestion should be handled so that users will not be aware of it until it reaches a level where it becomes essential to the health of the network that some traffic is slowed or stopped.

Call control

Emergency call

The wireless terminal will be able to link to emergency places (ambulance, fire and police stations). IMT-2000 networks will enable priority access to identified emergency services calls (overriding

[1] Editor's Interpretation: The "macro mobility" and micro mobility" are referred to the mobility of the terminal within a network and between networks, respectively, without session or service disruption.

the normal access and charging procedures) and provide the emergency services bureaus with enhanced capabilities (call back) and information (location or geographical position) about the user. Emergency calls have a much reduced authentication requirement, but may have more stringent privacy requirements. Such calls may also require specific routing. Anyone can make an emergency call free of charge.

Service portability

[Editor' note: asking for contributions to this topic.]

Virtual Home Environment (VHE)

A question for the VHE capability in an All IP network is whether or not the VHE concept have as strong presence in a global "All IP" network system as it would in the networks of today or in the 3G networks? The speed of computing and data transport capacity has been growing exponentially. The Internet phenomenon and the IP are emerging as the dominant choices for the network and the protocol for future telecommunication systems, respectively. With these, the distance and home association and roaming are losing their meaning and their technical significance except for commercial purposes. When a full and complete All IP system prevails, the question that comes to one's mind is that: "Why creating a virtual home environment when there can be a presence of the real home environment everywhere?"

One answer to this question is that the VHE of the future will not tend to duplicate the home environment in the visited networks. It will, instead, establish a service delivery tunnel from the application server to the terminal client. The VHE in an All IP environment will take a more of commercial significance, and its technical solutions will be geared to solving the commercial problems. The dynamism of the All IP paradigm reduces the need for the multiple VHE scenarios to only one, and that is the "Actual Home Service" scenario. This scenario is consistent with home control scheme for realization of the VHE capability. All other scenarios will perhaps remain relevant to the "All CS", "CS-PS", and "non-IP PS" networks.

At first glance, these functions are similar to traditional 2G cellular systems and current IMT-2000 3G Systems. However, in Systems Beyond IMT-2000, we envision a network in which the number of communicating mobile endpoints (mobile devices) will far exceed the number of fixed endpoints.
The problems of mobility management need to be critically re-examined and new architecture and design approaches developed to handle billions of mobile endpoints. The ideal network design for Systems Beyond IMT-2000 should incorporate the best aspects of mobility management from cellular networks and IP networks and extend them to handle the challenges of *large scale, multimedia, mobile-dominated networks of the future*.

The future network must support an efficient and adaptive combination of location registration and IP paging functions. Systems Beyond IMT-2000 may have users with multiple preference choices for their applications and service classes. In order to handle varying user preferences as well as system objectives, a key goal of network design should be to accommodate hybrid and flexible, adaptive combination location registration and paging algorithms for location management.

Another important consideration in mobility management is that the signaling overhead to handle large numbers of mobile users (several hundred million to a few billion) should be minimized through adoption of suitable powerful architectural concept. Management of changes should be localized to the maximum extent possible. Important factors to consider in design should include: speed of movement of user, data rate of application, cell sizes, etc.

Handovers occur when path(s) to reach a mobile user must change because of changes in physical accessibility of the user. In Systems Beyond IMT-2000 , there will be a continuing need for routing and re-routing of traffic to large numbers of mobile users. Path changes need to be executed quickly and in a manner that results in efficient use of system resources (including network and radio).

Virtual Reality Environment (VRE)

A virtual reality system is the electronic creation of an actual system. Presently, some virtual reality fixed real-time services such as video conferencing and internet-meeting with limited features are offered. The virtual reality environment (VRE) capability in "Systems Beyond IMT-2000" is defined as a new network capability to allow mobile and wireless as well as fixed and wire-line network users to access to the sights and sounds of complex and live systems in real-time.

There are three major components required for realizing the VRE vision.

1) VRE capable user terminal equipment or toolkit,
2) Super high-speed data transmission over the air, and
3) Network functional elements for initiating, establishing, maintaining, and terminating VRE calls, sessions, events or episodes[2].

The first two components are beyond the scope of this document, and they will be addressed as the terminal technology improves and the present radio access and data transmission speed evolves. The third component, however, requires development of a network capability for controlling and managing the VRE service applications. Furthermore, the long-term vision of the network capability for VRE requires the design of suitable network architecture and the development of the software platform capable of controlling and managing the VRE service applications.

Global roaming

Figure 0-1 presents a global roaming environment for two call parties in two separate domains of mobile originated call and mobile terminated call. Detailed description of the network elements of Figure 0-1 can be found in ITU-T recommendation Q.1711, IMT-2000 Functional Architecture.

Various aspects of the global roaming requirements can be outlined as follows:

?? Subscribers shall be able to register and obtain services in networks other than home network.

?? The target architecture shall accommodate call control/session management with different capabilities (e.g., forwards and backwards compatibility with different stages of network upgrades).

?? The target network operators shall be able to hide or reveal their internal network structure to another network. This includes network entities' names, their capabilities and their number.

?? The target network operators shall be able to hide or reveal the explicit IP addresses of nodes within the network (excluding firewalls and border gateways.)

?? The target network shall support common, from a subscriber or terminal perspective, registration procedures across home and visited serving networks.

[2] An episode is defined as "1. an incident in the course of a person's life or experience. 2. An incident, scene, etc., within a narrative, usually fully developed and either integrated within the main story or digressing from it. . . . ". ETSI's NGN document uses the word "Event" instead of "Call." ***ETSI/NGN-SG02(01)12*** 27 June 2001.

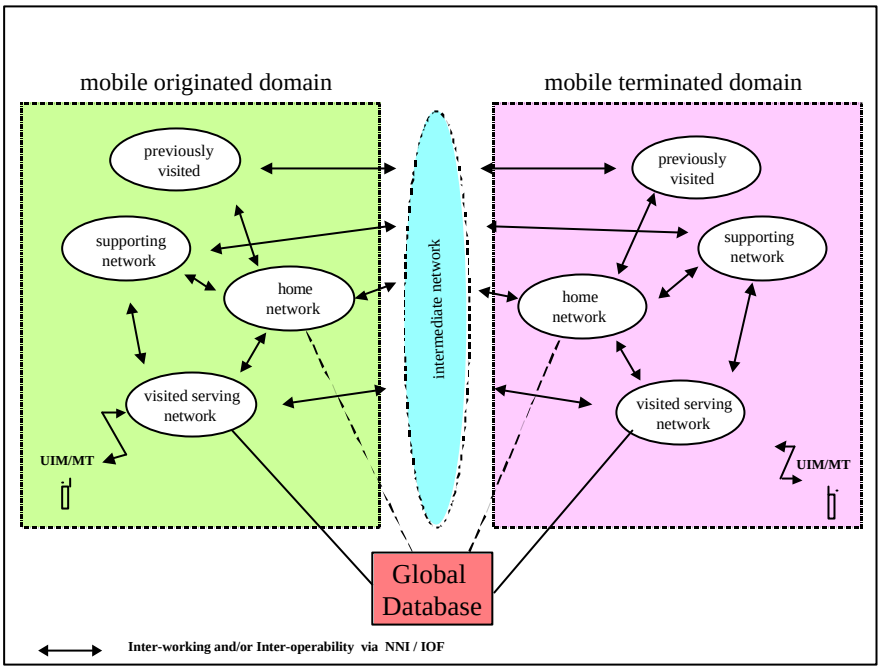

Figure 0-1 A Two-domain Global Roaming Environment for a two mobile party call

Eliminate regional/country differences in key interfaces

In setting up calls and provisioning services, no country and regional differences is recognised via the use of open interfaces between the functional entities identified within the Layered Functional Architecture of the target system.

Global Access to Services

In order to ensure the widest level of services for subscribers, the target architecture should support globally accessible services, through the support of VHE capability, independent of the access technology or the serving network. The target architecture will support global access to services when roaming (regardless of access type) via the support of

- ?? common protocols (e.g., CAMEL/WIN, SIP, and OSA API),
- ?? a common representation of user service profiles, and
- ?? access to services from any network or server utilising service brokering (i.e. the user can negotiate access to services from servers or networks that are neither in the home nor in the visited network).

Directories/Databases

The implementation of the target architecture will undoubtedly use many data types including user ID, UE identity, service authorisation, inter-administration business profiles, service profile, location information and policy data. These data will operate on database systems that are global and/or local, scaleable to network and subscriber growth and operated with open interfaces to other target architecture service platforms and control layer functional entities that interact with such data.

Service provisioning to roaming users

The target architecture will support provisioning of home subscribed services as well as services that have not been subscribed but are offered by the networks/platforms within the user's roaming domain and in real time.

Home Subscribed Service Provisioning

Figure 0-2 presents a schematic architectural view of service provisioning for a roaming user or user equipment (UE). The term “application server” (AS) used in this figure is defined as a service platform in either the home, visited or supporting network. The AS may also be a stand alone service platform. The term "Control Server" (CS) is the network entity in control of calls, sessions, and services (e.g., Call State Control Function (CSCF) in 3GPP and Session Control Manager (SCM) in 3GPP2). The Subscription Server (SS) is a database providing information on user’s service profile, subscription status, UE’s location information, mobile terminal status, etc.

Visited serving network operators will support the virtual home environment (VHE) capability to provide roaming users with services identical to those available in the users' home network. This capability should exist within the target architecture in conjunction with a certain set of guidelines. An example of such guideline with possible architectural implications is given below:

?? The decision on the choice of service provision party should reside with the home network.

?? The visited network should provide access through a proxy call server to the home network.

?? The visited network must provide emergency service support regardless of VHE agreement between the home and visited networks.

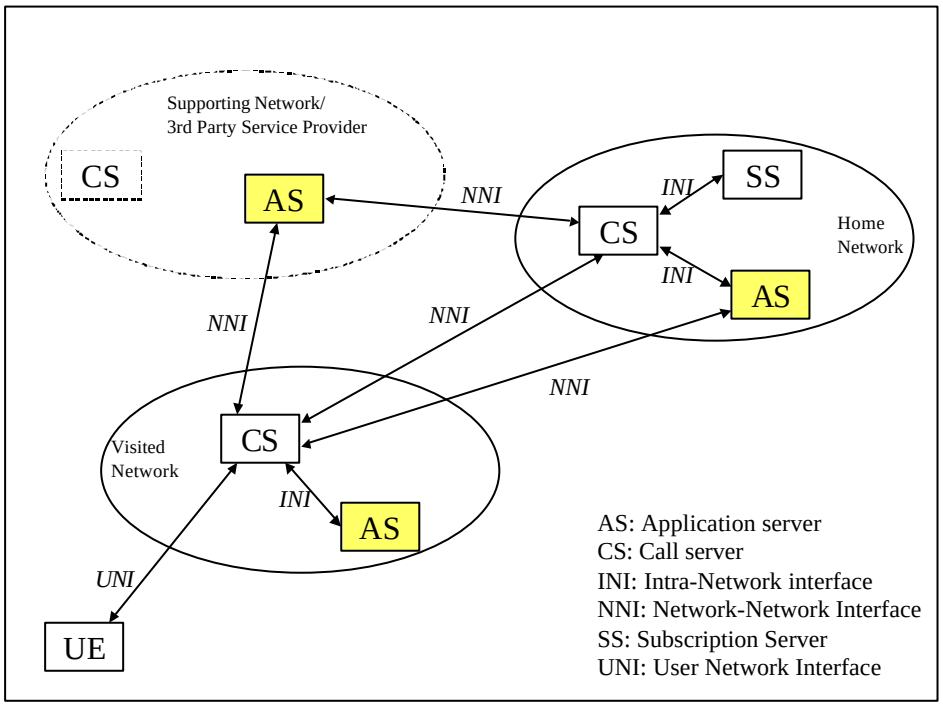

Figure 0-2 A Schematic Architectural View of AS Platform in a Mobile Terminal Roaming Environment

Real-Time Service Provisioning

The target network will support "supporting network" operators as well as stand alone AS operators for having by-lateral commercial agreements with the home and/or visited networks to advertise, push and/or offer to the roaming users the services available in their AS in real-time.

Over-the-Air Service Provisioning (OTASP)

The target architecture will support over the air activation, authorization and provisioning of services, such as terminal code download of preferred roaming lists, configuration of software defined radio (SDR), MExE, SAT upgrades.

System Interoperability

Interoperability with existing and non-IP networks and services

The target architecture will provide support for roaming users (removable UIM) and roaming terminals (with appropriate multi-mode and multi-band functions). This will include users roaming into a target network from 2G or 3G (3GPP/3GPP2) networks, and target network users roaming into 2G or 3G networks. In this respect, the target architecture will support inter-working with both 2G and 3G signalling networks and protocols.

The target architecture will provide gateways to existing (2G/3G) networks (circuit mode bearers, packet mode bearers and signalling gateways).

Session continuity

[Editor' note: asking for contributions to this topic.]

WLAN integration

[Editor' note: asking for contributions to this topic.]

Flexibility

[Editor' note: asking for contributions to this topic, emphasizing that this ITU text could be used as a base text to the construction of an ITU SSG text for "Flexibility" for Systems Beyond IMT-2000]

?? Support Moving Networks:

  ?? A Moving Network is a network that can move in the same manner as a terminal in mobile systems. For example, a Moving Network could be in a train, ship or aeroplane, etc.

?? Accommodate diverse access technologies/schemes.

  ?? A key long-term network design objective for Systems Beyond IMT-2000 should be its flexibility to accommodate diverse access technologies/schemes.

  ?? Future mobile devices are expected to support numerous access technologies (including a variety of wireless and/or wire-line choices.) A key network design goal should be to facilitate a judicious choice of appropriate access technology for a particular usage environment. The choice should be based on:

?? availability of access technologies at the mobile user location,

?? speed and QoS requirements of the user application,

?? cost of using the access technology, etc.

?? Separate control and transport functions.

  ?? Control functions in the IP-based network platform should be open to support various existing and future evolution signalling systems, and its function will be more focus on signaling processing.

  ?? Transport functions should fully utilize IP transport capability to direct user traffic flows to their proper destinations.

  ?? The interface between control and transport functions should be open and standardized.

  ?? When the control and transport functions are implemented in the same physical equipment, the interface(s) between them still should be opened.

?? Facilitate support of multiple switching control methods, signalling at different layers and their combinations.

- ?? Switching components in the IP-based network platform may provide multiple switching control methods, and may also provide interoperation among these methods.
- ?? Switching control methods may be implemented according to their service support requirements, and thus, may be functioning at different internetworking layers.
- ?? The usage of IP transport for various switching control signalling should be used according to service requirements.

?? Support open interface for roaming and handover among various networks.

?? Automatically manage the access means (including both wired access and wireless access) based on user defined criteria such as cost, speed, QoS, privacy, applications, etc.

?? Have flexible, efficient, and integrated mobility management, i.e., flexibility to support advanced mobility management schemes including:

- ?? Location Management

?? Location Registration;

?? Paging.

- ?? Routing Management

?? Handover.

- ?? Session Continuity

?? Seamless Session Transfer;

?? Diversity Handover across access and core networks;

?? Having a flexible, efficient, and integrated mobility management, i.e., flexibility to support advanced mobility management.

?? Support an efficient and adaptive combination of location registration and IP paging functions.

?? Support dynamic network capacity changes.

Scalability

[Editor' note: asking for contributions to this topic.]

Robustness

[Editor' note: asking for contributions to this topic.]

Transport of data

[Editor's note: This is a new proposed section. This section provides the requirements for transport of data in systems BI2K and is for further study.

All IP network and VHE

[Editor' note: asking for contributions to this topic.]

Multiple access support and radio resource management

[Editor' note: asking for contributions to this topic.]

General Requirements

Natural communication-oriented man-machine interface

- With the support of IP-based network platform, multimedia communication will be easy to reach the end users. Under this situation, a more user-friendly, communication-oriented man-machine interface should be adopted.
- The interface should use advanced intelligent recognition technologies, such as natural language recognition, voice-text translation, etc.
- Service combination capability will make use, and even depend on adopted interface technologies.

Terminal

It is expected that there will be a large variety of 3G terminals, some with limited capabilities similar to today's terminals, others with larger screens for displaying Internet pages or the face of the person being talked to, and yet others which will support extensive user interaction and display capabilities. (For example, there will be small "smart-phones" with web browsing). A single user can have multiple IMT-2000 terminals that are in use together or a user may utilize a single terminal to access different applications. Terminal identification will help to locate stolen and non-approved terminals. It is anticipated that IPv6 capabilities will be utilized to support the addressing of the multiplicity of devices and terminals required for anticipated applications. Keyboard and mouse may be available for user input along with other options such as drawing tablets and touch sensitive screens, as well as innovative voice-based interfaces which will allow people to control their mobile communication services with voice commands. Terminals are "always on" although a terminal will be able to go to a sleep or enter standby mode to optimise battery power consumption. The terminal will be able to immediately come back to the normal mode whenever it wants to send or receive data. The terminal has low power consumption and the battery can be charged in a short and reasonable time.

Security

User Authentication

Authentication has different personalities depending on the type of network to which the authentication server is connected. When an authentication server is connected to a service provider network, its major role is to pass authentication requests from the PDSN to the home IP network, and authorize responses from the home IP network to the PDSN. It also stores accounting information for the MS and provides user profiles and QoS information to the PDSN. An authentication server connected to a home IP network authenticates and authorizes the mobile station based on requests from the local authentication.

Authentication server provisioned in the broker network forwards requests and responses between service provider network and the home IP network which do not have bilateral associations.

Privacy and security

Authentication and Authorization are required between the network and the user for security. User data is private, and both the terminal and the network capabilities will ensure that information generated by or relating to a user is effectively protected against misuse. It will be possible for the users to confirm whether or not their traffic and related information are protected. This should require minimum user involvement.

Separation of Contents Delivery Function and Mobile Rights Management

This "Separation of Contents Delivery Function and Mobile Rights Management" is the ability that it can be separated the security/rights management function part from the contents delivery function. Therefore these functions can be handled and provided by the service providers independently. eg. The distribution systems are for the contents providers, and the mobile rights management systems (the permission control systems, the tickets/billing systems) for tickets providers. The purpose of this rights management is to enable the secure delivery of information to mobile terminals.

It is adopted the "ticket" (deciphering key) method for the permission control.

In order to access or make use of these contents, user must purchase a "ticket. This allows users to freely decode and enjoy the benefits of the contents, while also offering providers a high degree of protection against the corruption and unauthorized copying of their contents. Providers also benefits from a more flexible, more secure billing system.

The distribution management systems encrypt the information contents and distribute it, and then the ticket management systems manage subscriber database and provide the ticket for users.

Therefore introducing this management, the encrypted information contents will be able to be distributed not only by various ways; e.g. download from web site, attached file of email, and supplement CD-ROM to a magazine, etc, but also having various types of tickets; e.g. One-time use, "Adult only" access, Discount ticket and Multiple use, etc.

An example of Mobile Digital Rights Management is shown in APPENDIX A for information.

Quality of Service (QoS)

Bandwidth

"Bandwidth" in the form of an average, maximum or combination average + maximum data transfer rate and QoS will be allocated per user demand derived from the needs of the applications being run. The network will be able to support simultaneous real-time and non-real-time IP multimedia (voice, data and video.) The services can have equal bit rates upstream and downstream (symmetrical) or can be asymmetrical. A "lightweight" yet sufficient protocol stack should be used to minimize the overhead required to support the bandwidth needed by the user's applications.

End-to-End Quality of Service

Services will need to meet end-to-end quality-of-service requirements. The quality of service should be the same (or greater) than services that were offered in a pre-3G environment. The same quality of service for a given application will be expected in all places and at all times, real time and non-real time, with minimum delay and minimum error per the needs of the application. User terminals should clearly display performance indicators whenever actively communicating with the network. The system will allocate resources based on requested QoS. QoS subscription parameters are stored where they can be accessed by the network. They identify the maximum permissible QoS that a user may negotiate with the network based on the subscription parameters paid for.

Enhanced billing support

Billing data is private. Assuming that the user is being charged by use of bandwidth (data rate, volume, and QoS), the network will try to find optimal packet routing. Charging may depend on the location of the user or may become distance insensitive. A user could ask a third party to be charged. A user will have real-time access to billing information and may be notified of charges before, during and after significant events.

Enhanced OAM&P support

Performance management

1. A System Beyond IMT-2000 shall support the following performance management capabilities:

   A) Real time monitoring of current network status and performance, and

   B) Taking prompt action to control network resources and improve network performance (e.g., through traffic controls that affect the routing and processing of calls), as required.

2. Performance management capabilities of a System Beyond IMT-2000 shall be built upon the IMT-2000 network status checking and performance monitoring functions specified in Recommendation E.418, Framework for Network Management of IMT-2000 Networks.

Fault management

[Editor' note: asking for contributions to this topic.]

Configuration management

[Editor' note: asking for contributions to this topic.]

Accounting management

Billing data is private. Assuming that the user is being charged by use of bandwidth (data rate, volume, and QoS), the network will try to find optimal packet routing. Charging may depend on the location of the user or may become distance insensitive. A user could ask a third party to be charged. A user will have real-time access to billing information and may be notified of charges before, during and after significant events.

Security management

1. A System Beyond IMT-2000 shall support the following security management capabilities:

   A) Detection and prevention of intrusion.

   B) Denying access to an intruder, repairing damage done by an intruder, and recovering losses

   C) Security administration (e.g., management of security policy, security alarms, encryption keys, etc.)

2. Security management capabilities of a System Beyond IMT-2000 shall be built upon the IMT-2000 Fraud Information Gathering System (FIGS) functions specified in Recommendation M.3210.1, TMN Management Services for IMT-2000 Security Management, January 2001.

Enhanced naming and addressing

The target architecture will provide the capability to separate IP address (e.g., SIP URL) from subscriber name or device number. The name or number is used to uniquely identify the call parties whereas addresses are used to determine routing of the call or session.

Addressing will remain the link between different network technologies while naming (and numbering) may evolve towards a higher level common identification mechanisms covering all communication systems (IP, mobile, fixed). The target architecture needs to support such evolution.

Although a called party may be addressable via different means, the target architecture will allow the user to be reachable through a given name, independent of her/his location.

The target architecture will, therefore, support the following:

?? static and dynamic IP addresses for mobile terminals

?? associating public IP addresses with mobile terminals

?? associating private IP addresses with mobile terminals

?? mapping Network Access Identifiers (NAI) to mobile terminals

?? connection of subscribers to private IP networks.

?? common user ID independent of the user or user equipment’s location

Global database System

For the purpose of routing and address resolution/translation, the target architecture will support a multi-level database system (e.g., Domain Name Server (DNS)). Such a hierarchical database system will offer mapping of user/subscriber's name or number to its IP address and vice versa.

Change History

Note: The Table below provides the development history of this document. It will be deleted when the document is ready for approval.

Version #	Date developed	Meeting
1.0	4 June, 2003	6th SSG Meeting in Geneva
1.1	5 June, 2003	6th SSG Meeting in Geneva