Question(s):	1/13	Geneva, 29 October - 8 November 2002

STUDY GROUP 13 – DELAYED CONTRIBUTION 322

Source:	France Telecom
Title:	Inter-network mobility requirements considerations in NGN environments

1. Introduction

No one can ignore that nowadays fixed networks with xDSL access technologies and mobile networks with GPRS are slowly evolving towards IP based networks capable of offering multimedia services with seamless mobility. This prepares the smooth evolution towards the NGN that is dealt within SG 13. As these network capabilities increase, more and more services will be offered to users. On fixed accesses and on mobile networks users are proposed with similar services; this situation also exists on various fixed accesses: xDSL, cable, narrow-band access, etc. However they are still considered as different customers, which imply that they have different service configurations and that no bridging is made possible between the different services. This is a severe drawback from the user perspective who would like to move between the different access technologies with the minimum configuration required.

A major step in the future service offering will be the consistent service provision for users, i.e. the users will be regarded as a single person when they use different access technologies, allowing them to use and manage consistently their services across the current network boundaries.
At present, the user may be able to roam between similar public wireless accesses, and nomadism is allowed between some fixed accesses, with strong limitations; however mobility management is currently possible within homogenous environment and in particular in mobile networks.. In the future, users will be proposed more and more access technologies (e.g. WLAN is emerging as a public access technology) and they will require soon to move between different fixed (e.g. xDSL to cable) and public wireless access of various technologies (e.g. UMTS to WLAN) and to get access consistently to their set of services.

Contacts:	Frédéric Delmond	Tel: +33 1 45 29 48 64
	France Telecom	Fax: +33 1 46 29 31 42
	France	Email:
		frederic.delmond@rd.francetelecom.com
	Jean-Claude Samou	Tel: +33 1 45 29 58 40
	France Telecom	Fax: +33 1 46 29 31 42
	France	Email:
		jeanclaude.samou@rd.francetelecom.com

This contribution is focused on a broader environment for NGN systems, which is considered as the evolution path for the currently specified networks. After the evolution from the initial point, characterised by the current 3GPPP and 3GPP2 specifications for mobile networks, and xDSL and IP specifications for the fixed networks with discrete mobility, the main goal is to broaden the service access to users, in order to allow mobility across heterogeneous environments. It mainly relies on the interoperability with other access means, and the efficient core network interoperability to support a wider range of services. Some initiatives, on specific interoperability issues, exist, e.g. WLAN-UMTS, but no global and harmonised solutions has been developed.

These aspects may have several implications at many layers in the networks (control, mobility management, applications, etc.) and are not presently covered within UIT-T in a broader sense.

2. Top level Network requirements

2.1. Network environment for mobile users

The broad environment for upcoming networks is mainly focused on the coexistence of complementary technologies, in particular for access techniques, and the future development of multimode and adaptable terminals and adaptable services. In a first step, these various technologies needs to be linked to achieve interoperability, and in a further step, integration should be considered.

Among the access means for consideration:
- several public cellular systems : e.g. UMTS (W-CDMA, cdma2000) and GPRS, etc. including their interworking with WLAN (currently under study in 3GPP)
- fixed accesses, with seamless mobility with mobile systems : xDSL, Cable, narrowband (for IP services), WLAN in hot spots (e.g. WISP), etc.
- DAB broadcast.

It can be noted that the various systems listed above encompass very different bandwidth capability, as well as very different access technologies (GPRS radio, W-CDMA, cdma 2000 and other private radio systems, but also xDSL, cable, etc.). It is therefore not expected to have a single multimode terminal to handle so many accesses. But users will be granted access to the network by using a wide range of terminals, some of them being multimode. Consequently mobility across the heterogeneous environment requires service adaptation (VHE) for terminal mobility as well as personal mobility.

The general user requirements for mobility should include:
- users ability to change access point and/or terminal, and who benefits from the requirements below, can be marked as *mobile/nomadic* users (see definition in next section). This implies that the mobility management functions may be applicable only to those users marked as *mobile/nomadic*.
- users get access from any network access point. This includes all access technologies identified above, and the ability to use other networks (see definition of roaming below). These possibilities may be limited by subscription
- users get their services in a consistent manner, depending on the constraints they experience in their current situations. This is required for services provided by their network operator as well as services provided by a third party

- users availability and reachability should be known to network functions, and possibly to services and applications, including those provided by a third party.

2.2. Definitions and service levels

Several service levels should be considered for mobility:
- personal vs. terminal mobility: in *personal mobility* it is assumed that the user moves and is able to change his terminal, whereas in *terminal mobility*, it is assumed that the user moves with his terminal (we actually consider the terminal from a network point of view). When the user changes his network access point, it is assumed that
  - in personal mobility: the user has changed location and/or terminal and/or access technique (WLAN, UMTS, Bluetooth, etc.)
  - in terminal mobility: the user has changed location or access technique, while keeping the same terminal.
- *nomadism*: the user is able to change his network access point, as he moves; when changing of network access point, the user service session is completely stopped and started again, i.e. there is no hand-over possible. We assume the usage is that users shut down their service session before moving to another access point or changing terminal.
- *Mobility*: the user is able to change his network access point, as he moves, without interrupting his current service session, i.e. handovers are possible. In some situations, the handover may lead to a shortly suspended service session.
- *Roaming*: the user is able to get access from a network different from the network he has subscribed to: this defines the visited and the home networks.

2.3. Drawbacks of current approaches

One can claim that the above requirements can be supported somehow with already existing solutions (without the NGN) for instance with overlay techniques. The examples below are not exhaustive but intend to show that these claims are not fully correct.

For instance, a user can attach to xDSL access (based on its xDSL subscription) and get authenticated (via the mechanism supported at this access). He can then start a multimedia session. Later on the same user can move to an UMTS access and get authenticated via the UMTS mechanism. He will try to start a multi media session. This session will be handled in the UMTS access network (i.e. according to the user profile known in the UMTS network). Since differences may exist between these profiles in both domains, the seamless mobility and service offering may not be properly provided. Another drawback is that you may need as many as authentication mechanisms (with different identities, logins and passwords) as access technologies. One more drawback is that for xDSL an access connexion has to be kept alive in order to track the movement of the user (since no location management, which is one of the major functionalities for mobility, cannot be done outside a session) thereby consuming resources. One can surely find other drawbacks that exist with current networks because mobility management functions and user profile updating are not provided in a generic manner across these network boundaries.

In other words, by using nomadic functions and a single user profile for every type of access will certainly simplify the identification, authentication and mediation between the access network and service provision (e.g. for resource allocation).

3. Overall network requirements for NGN

3.1. Global network requirements

The goals listed above require significant evolutions of the current network architectures. Enabling more transparent fixed-wireless broadband communications and mobility across various access technologies appears as a major issue: users will be able to move between several types of access means along their needs, wherever and whenever possible.

The following requirements for the NGN systems can be derived from the above objectives, in a mobility management perspective:
- a consistent approach from initial 3G systems and fixed systems
- cost reduction (network deployment and operation)
- increased spectrum efficiency
- nomadism, mobility and roaming among different access systems, fixed or mobile.

3.2. Mobility management functions

In particular, an IP-based federating core network for the transfer plane would allow to bridge diverse fixed and wireless technologies (listed above). However, the interoperability of the various access means at the transfer layer is not sufficient to achieve the above goals. In order to support global mobility in such heterogeneous environment, further work is needed to develop network functions at the control layer:

- *identification and authentication mechanisms*
    - the definition of such functions should consider already existing identification & authentication mechanism in current networks, in order to avoid duplication of control mechanisms from the user point of view.
- *access control and authorisation function*
    - the result of the authorisation function is a yes/no to connection request made by the user and in a next step the global access network configuration adapted to the mobile/nomadic user. This include global QoS level set for the user connection : it is determined with the user subscription and the technical constraints of the access network.
- *Location management*
    - the scope of the location management function consists of network location and geographical location management. The network location management provides location data (e.g. network access point) which are normally used by network functions (e.g. for incoming traffic routing); the geographical location management provides location data which are normally used by services and applications (e.g. zipcode for local services, such as "closest restaurant and movie theatres")
- *IP address allocation and management*
    - some solutions accept user keep a fixed IP address, which requires specific mobility management scheme to handle a local IP address granted to the user (e.g. Mobile IP)

- *User environment management (VHE)*
  - user environment is defined as the global "access network + terminal". This environment determines the global constraints of a nomadic/mobile user to get his services. The purpose of this function is to give an abstract view of the main user environment characteristics. These data may be used by services in order to be adapted and to provide a relevant service rendering to mobile/nomadic users.
  - this function is of major importance in a heterogeneous environment, and appears quite new, while homogeneous systems (e.g. 3GPP systems, xDSL, etc.) do not require such data per se, because they are implicitly the same for all users. In the case of a broad network environment for NGN, this will no longer be true for nomadic/users.
  - this function realizes a first stage of Virtual Home Environment: determining the characteristics of the user environment and enabling services to adapt to the current user environment.
- *User profile management*
  - the above functions are all based on some user data, which are either "subscription data" or "network data" (e.g. current network access point, i.e. network location). The storage and the update of these data are handle by the user profile management functions.
  - it is therefore required to determine exactly the data and which functions (above mobility management functions) manipulate them.
- *Access to user data*
  - services and other network functions require some user data in order to be customized. These can be either "user subscription data" or "network data". This function provides filtered access to the user data, which may be restricted to some interrogating entities (restricted rights to access user data), in order to guarantee user data privacy.
  - this function is a necessary for VHE, as described above.

4. Current standardisation work

This section focuses on some current standardization work in the area of mobility:

3GPP and 3GPP2 are focusing on IMS evolution. Mobility management offered in those systems are specific to those systems. In order to offer IMS access between 3GPP and 3GPP2, harmonization has first to be done between the two multimedia systems.

IETF is focusing on Mobile IP for macro-mobility between routers. But how this can be applied in other situations such as with wireless networks is a question mark.

SSG in ITU-T is looking on harmonization and convergence issues for IMT-2000. It has started to write requirements for those. Recommendations are needed to progress the work for the support of nomadic users where we can use preliminary material available within SSG.

5. Conclusion

This contribution shows how the evolution of the existing networks towards NGN networks with inter-access nomadism and mobility, the role of and the interoperability requirements between complementary technologies, in the current networks and their broader environment. Beyond the transfer layer, this contribution points out that the support of mobility management has to be solved rapidly at the control layer to fulfil the inter-access mobility user requirements.

Nevertheless, this contribution indicates that no standardisation body within ITU-T or outside ITU-T is addressing directly those important issues in a focused manner. Therefore, France Telecom recommends that SG 13 includes these detailed requirements in their work for the support of mobility across various access domains in the scope of the NGN architecture and functional requirements studies, takes a leading role in ITU-T in these issues and interacts with the appropriate bodies within ITU-T such as SSG (and SG11 concerning control functional requirements and signalling protocols) to come up with a complete set of networks standards to fulfil the mobility requirements. This contribution has also been submitted to SSG in order to inform them about the issues where probably interactions may be necessary.

—————————