

4G - Towards Personalisation at home and everywhere

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1. INTRODUCTION

Mobile technologies are conquering the world. Third generation mobile systems are currently being rolled out. Given the amount of money at stake or already invested these systems are doomed to succeed on an even larger scale than current second generation mobile telecommunication systems like GSM.

Future terminals and devices will need extensive communications to provide a service. These devices will either use a mobile radio link directly to the network or, more likely be connected via e.g. Bluetooth. Future users will have a Personal Area Network (PAN) associated to them. These PANs may also change ad-hoc (e.g. to include a printer or other device available locally). In homes and offices we will find all kind of equipment that needs ad-hoc communication directly or via a network. In an environment where many devices will need to communicate, we need some kind of self-configuring network facilities. This kind of ad-hoc networking encompasses not only radio aspects, but also networking facilities, security and service discovery mechanisms.

How will this evolution continue? As history has shown, mobile systems pass through a paradigm shift roughly in a ten-year cycle. This implies that now it is the time to consider the wireless world of 2010 and beyond. Figure 1 depicts the different generations and their service characteristics.

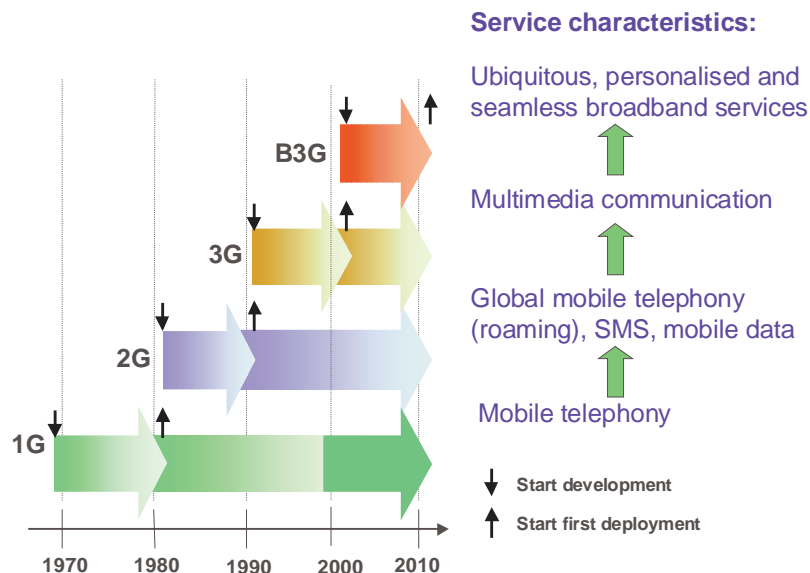


Figure 1. From 1G to 4G - expectations for B3G services

2. THE OPERATOR'S VISION

As huge investments have been undertaken to let 2G and 3G systems happen, European operators have clearly addressed that a 4G system will carry evolutionary rather than revolutionary aspects. The usage of the synonym B3G (beyond 3G) addresses this

evolutionary aspect. It also addressed the ultimate goal in having various systems (2G, 3G, WLAN, ...) playing together, expressed by the key vision:

“It works. It is simple. It is personalised”

Operators have their customers in all parts of the population, and satisfy the communication needs of each of us. Each of us has the opinion that a phone will *work* when we press a button. Even though modern phones have a wide range of applications, basic communication is established when performing a *simple* operation: pressing the green/yes button. *Personalisation* is perhaps the functionality which is hardest to achieve, because it is more than just the phone cover or ringing sounds. It affects the design of the whole system, including the creation of services.

3. KEY ELEMENTS OF THE B3G VISION

Work on the definition of the B3G systems has just started. Detailed requirements for the service creation, the access and the core network will be developed in the upcoming years. Key elements for further developments are identified as major areas for research and summarised below:

- User needs, market trends, business models

Our basic vision of communication solutions for the wireless world is that they will meet and hopefully exceed user expectations by means of simplicity and functionality. The solutions must offer holistic, converged communication appliances for fixed as well as mobile information and communication. Devices, systems and applications must operate in harmony but taking full advantage of available technologies.

- Service architectures, service elements, -creation, -provision and -discovery

The aim of the service architectures in a wireless world is to devise a framework that is able to realise services according to information and communication needs of the user. Human beings are interacting and communicating with “objects” in their “environment” in certain “contexts”. A service architecture shall have the ability to define and to manage contexts that are tailored to the preferences of single users in its individual way to interact with the information and communication system. Based on the evaluation of profiles that describe user preferences, service capabilities and on sensing information about its actual environment, the user can be provided with individualised services adapted to his present environment. Personalised services are key to user acceptance of new technology.

- Next generation networks and network integration

The progress in the area of Next Generation Networks (NGN) is closely related to mobile and wireless systems beyond 3G. A key feature of the NGN concept is the de-coupling of services and networks by the definition of multiple layers and planes. This separation and the use of open interfaces offer operators/providers a platform that enables them to create, deploy and manage innovative services. Current NGN ideas also represent a shift from circuit-switched to packet-switched networks. They address the use of IP as the transport protocol in telecommunication networks. The adoption of IPv6 and SIP as signalling protocols in 3GPP rel. 5 standard underline that mobile networks beyond first deployments of UMTS will evolve towards this concept. However, packet based transport presents major challenges, such as Quality of Service, usage metering and charging. A major issue for operators/providers is the smooth evolution of existing systems. It is expected that legacy networks should co-exist and inter-operate with NGN (forming a Hybrid Network) for a considerable amount of time.

- Self configuring wireless networks and ad-hoc networking

The IP core of NGN will seamlessly support a variety of wireless access networks. These complex and heterogeneous access networks cannot be controlled by conventional network management systems. Self-configuration, ad-hoc networking and seamless traffic management are key issues to supply broadband services over heterogeneous wireless access networks. Developing the technology for self-configuration, ad-hoc networking as well as the corresponding traffic management methodologies forms a major challenge for future research.

- Future access networks

W-CDMA and TD-CDMA are the access technologies in UMTS in Europe. The recent past has, however, shown that also alternative access networks can provide 3G and 3G-like services. Amongst the different access technologies the one that best supports the specific demands of the service scenario has to be dynamically selected. Communication in the Personal Area Network (PAN) might be best supported by Bluetooth. 802.11b might serve best the wireless data exchange while Hiperlan/2 and 802.11h might support higher bandwidth requirements. Common information might best be distributed using DAB or DVB type of services. Systems beyond 3G will have to supply an optimum and adaptive wireless access for each service scenario. For the evolution beyond 3G new access technologies need to be developed and it has to be investigated how these technologies can be integrated.

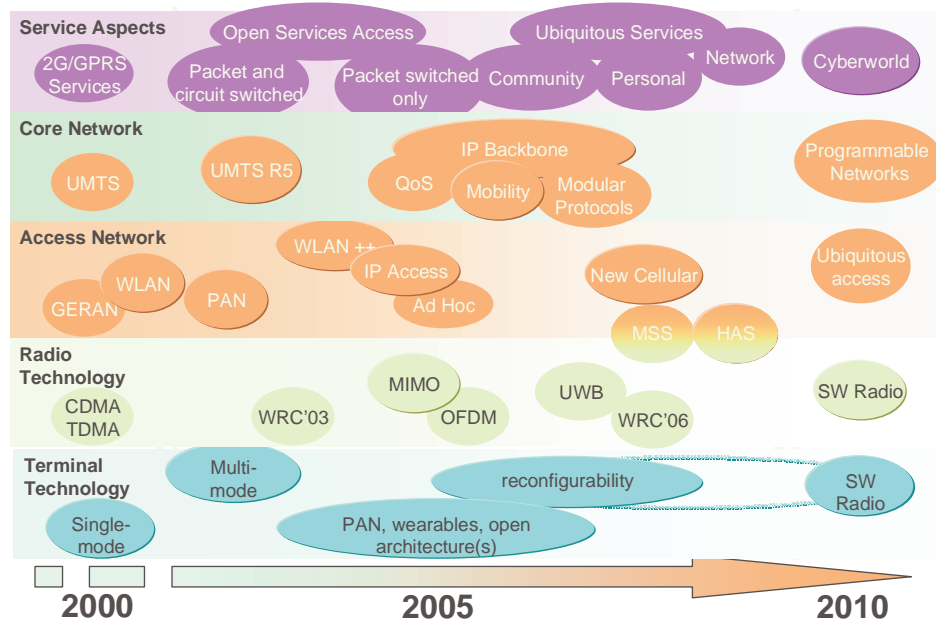


Figure 2. Roadmap towards the vision of a system beyond 3G

- Innovative radio interfaces, smart spectrum and antennas

The 3G/UMTS radio interfaces were developed to provide flexible access bit-rates for new services varying from low bit-rate messaging to high bit-rate video streaming applications. W-CDMA is the appropriate technology for that today but future services will require even more flexible radio interfaces with a high degree of Quality of Service (QoS) management. These requirements may end up in the recognition of a new radio interface, which is completely adaptable to both the QoS requirements of the application and the characteristics of the radio channel. Such an adaptive radio interface needs to be dynamically reconfigurable, adjust to available spectrum and provide the user with a ubiquitous access. The server and the clients have to support this flexible adaptation as well. Due consideration must be paid to the exploitation of unlicensed spectrum. Spectrum requirements and suitable frequency bands that are compatible with existing radio service applications have to be found for the promising ultra-wide-band (UWB) technologies.

- Mobile security architecture

Today security systems are mostly isolated and the user is required to authorise him-self for each and every service he uses. In the future we will very likely see integrated security infrastructures, thus reducing the number of different passwords and PINs the users are required to remember. Mobile security architecture in the broader sense must address trust and confidence of the eEuropean citizen into the infrastructure supporting the vision of ambient intelligence. Leveraging on the European strengths on mobile services, research has to be conducted on the role of the ubiquitous mobile devices as a security token (digital signatures) and as part of a seamless security infrastructure, supporting identity management and commerce. Future ad-hoc and self-configuring networks will have an impact on the mobile security architecture.

4. PERSONALISATION

There are two confluent areas/paths where research is necessary to make the visions of a future wireless world a reality: Personalisation and context awareness (in space and time). Personalisation is the key factor for success (or failure) of future mobile services and devices. Research has to focus on architectural concepts that are neutral to the serving network and terminal technologies. Further studies are needed to know what users experience as useful and what they consider as value add. Users must get in control of their personal profiles; hence, issues around security, privacy and trust are key.

Context awareness goes far beyond location awareness. The provision of information being of timely relevance to the user in his actual situation is equally important. Research in this area is necessary to define and provide generic support for exchanging context information. The description of specific types of context factors/data such as user activity, geographical location and mobility and physical circumstances are part of this. Furthermore, the issue of incomplete context information must be solved.

Adaptability is one of the key research areas of nomadic computing. When the circumstances (i.e. environment and context) change, the behaviour of the service or application should change according (adapt) to the desires of the user. This is a very challenging objective and although research in e.g. artificial intelligence has made significant progress, there is still a long way to go. A crucial problem is the size and computational complexity of the knowledge base that has to be build up and maintained for each individual user.

5. FURTHER INFORMATION

The current paper concentrates on the vision of the European Operators. These visions were and are developed in the Eurescom projects P1145 "4G-the next frontier" and P1203 "The operator's vision on systems beyond 3G" (www.eurescom.de).

The Wireless World Research Forum (WWRF) started in 2001 and established a.o. the "Book of Visions" (www.wireless-world-research.org).

The ITU-R Working Party 8F is planned as international focal point for the continuing vision of next generation wireless services and systems. Having defined the IMT-2000 radio interfaces for 3G systems, ITU will also be responsible for the coordination of B3G systems.