

Systems Beyond 3G – Operator's Vision*

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Abstract

This paper summarises the major findings from the Eurescom Project P1203 "The TelCo's Vision of Systems Beyond 3G". Activities towards next generation mobile communication are up to now technology driven. But, especially from an operator's point of view, a system B3G has to deal with various aspects like user preferences, system requirements, network architecture, business model, security, and standardisation. The Eurescom project P1203 analyses the opportunities and potentials of systems beyond 3G in terms of user requirements, technology development and business models. Starting from the user expectation of "It is simple! It works! It is personalised!" the focus of the co-operation is to derive operator requirements and to provide operators background knowledge as a basis for strategic decisions. Therefore, starting from a B3G roadmap based on the P1145 study results, P1203 has identified several scenarios as key drivers and describes the resulting system and operator requirements, accompanied by an analysis of business models.

Motivation

Mobile technologies are dominating the modern communication world. Third generation mobile systems are currently being rolled out. So far, most vision documents and discussions about B3G are focusing on wireless transmission technology issues. And in fact, generations were mainly characterized by the air interface in the past. But, the provisioning of mobile communication means more than just maintenance of the air interface. Various user expectations have to be met. Innovative services have to be developed to distinguish the operator's offer from competitors. Complex value chains require reconsideration of business models and alliances. New technologies, especially in software technology, allow a more flexible reaction on changing market demands.

This paper describes considerations and provides an analysis on systems beyond 3G from an operator's perspective. We include strategic discussions and technical evolution. We start with a roadmap for Beyond 3G to illustrate our vision. To investigate the operator requirements for B3G, we have identified key B3G drivers: personalisation, seamless access, quality of service and intelligent billing. A discussion about business models concludes this paper.

The P1203 project results are intended to clarify the operators' position regarding B3G. Strategic discussions aim at strengthening this position and to develop concrete operators' requirements and to derive system requirements for B3G. Final result will be a technical and business oriented roadmap for the evolution towards next generation mobile communication for operators.

Concepts for the Roadmap towards B3G

Mobile users have already outnumbered fixed users – at least in (Western) Europe – and this trend is expected to continue. These expectations and the experiences made in the industry by the 3G licensing

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underline the importance of having a realistic view on a roadmap towards the future. The industry players are developing possible roadmaps from their individual perspectives. An example of such a roadmap developed in Eurescom Study P1145 [1] is given in Figure 1.

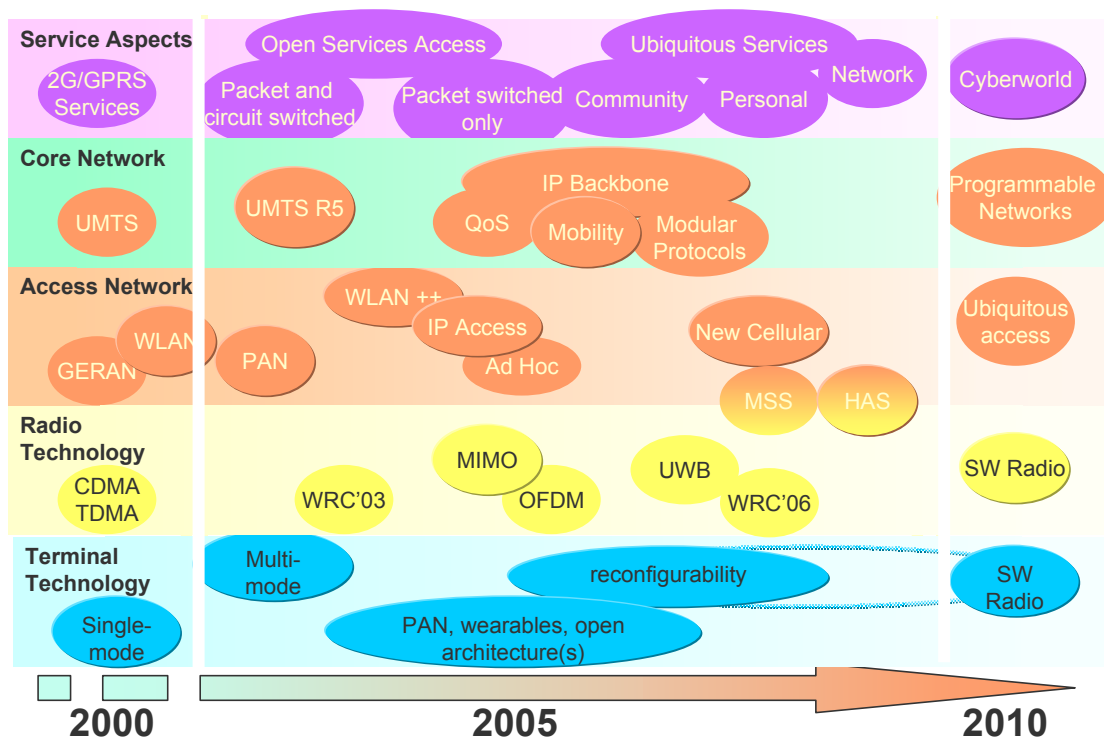


Figure 1: From today (left) to the vision (right) of systems beyond 3G

In addition to such technology-oriented study and when considering other vision documents like [2, 3, 4] several other areas complement a complete B3G vision: Business model, user expectations, service and applications, networking, terminals and air interface. High attention should be paid to the services that are provided by B3G systems. It is the traditional role of the operator to bring these services to the customers. In this respect, the Eurescom Project P1145 has shown, that a B3G system has to put the user and his or her services into the focus, not only the technology supporting it. The vision developed is “It is simple, it works, it is personalised”, combining the quality of the Telecom world (“it works”) with the possibilities of the IT world (“It is simple”). Personalisation to reflect the user preferences and the user context is the third issue [1].

The Eurescom P1203 puts this vision into a more concrete context by deriving functional requirements and finally operator requirements illustrated in Figure 2, backed by business evaluation.

Key Drivers

Rather than to come up with yet another general vision, we have identified several scenarios for key drivers of systems beyond 3G:

- Personalisation
- Seamless Access
- Quality of Service
- Intelligent Billing

These key drivers result from an analysis of existing vision documents, B3G projects and from workshops that were performed with European operators [5]. We will briefly explain the scenarios and their requirements in the following.

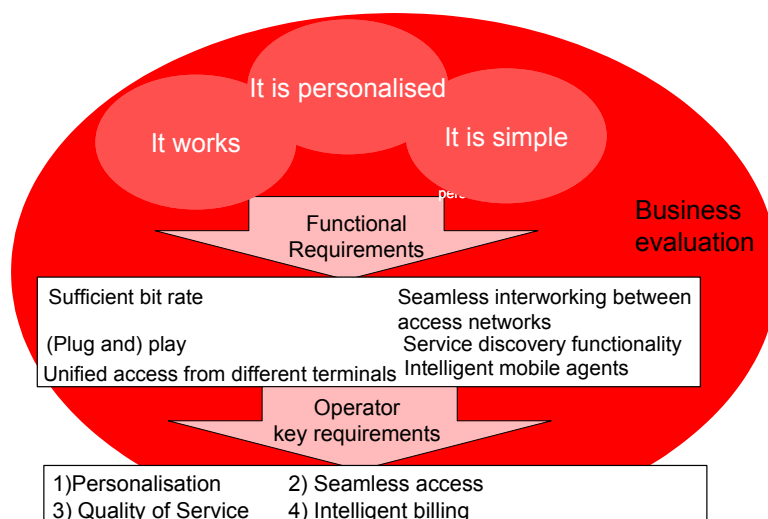


Figure 2: Creating the operator's vision

Personalisation

We are rapidly heading towards a world of mobile services in which the computing infrastructure will contain billions of various devices that are carried by different users as they go through their daily routine. In this context, service personalisation will be a key success factor for forthcoming data and communication services: exclusive support of individual users, personal access to mobile information portals or seamless service adaptation according to the varying context of a user can only be achieved through a powerful personalisation framework.

In today's information society the need for personalized information goes far beyond the mere storage and access of digital content or media via traditional database systems. However, major standardization efforts like ebXML and MPEG-7 leave open, how personalisation should be dealt with. In addition, recent standardization efforts concerned with user identity and personal access include only very basic user modelling and profiling. This includes W3C's CC/PP, .NET PASSPORT, profiling as discussed within the Liberty Alliance Project or user profiles proposed in the 3GPP, ETSI and the Parlay Group.

Beyond user modelling and profiling there are a number of further challenges for service and network infrastructure involved in personalisation. Pervasive computing scenarios provide us with the vision of millions of interconnected devices. Not only that we have to deal with device heterogeneity but those devices are providing an overwhelming amount of context information. Appropriate signalling mechanisms and service discovery technologies have to make sure that the right information is consumed at the right place in time.

Moreover networks have to be designed for reconfiguration to allow dynamic adaptability. New network paradigms like ad hoc networks increase this demand.

In summary the following requirements characterize a "personalisation architecture"

- Support of personal context: user profiling, context awareness
- Seamless service provisioning: advanced signalling and session control, AAA
- Open third party access (e.g., web services)
- Control intelligence on a service platform level to glue the functionalities
- Adaptability (on all levels): content, communication (protocols), service logic
- Reconfigurable terminals: new strategies for pervasive/ubiquitous computing
- Programmable open platforms, e.g., [7]

In addition, personalisation in terms of seamless service usage across communication environments and adaptable applications would require an extended information exchange between system components on all layers. Such cross-layer interfaces allow taking the best advantage from a current situation to fulfil user requirements (cf. [7]).

Seamless Access

Conceptually, seamless access is somewhat akin to roaming as we can experience it today in mobile telephony networks of the second generation, in particular GSM. However, seamless access in B3G will go much beyond the roaming as we know it today and will be a much more sophisticated affair. Seamless Access in B3G will mean connectivity to the end-user across a wide range of access technologies and access networks with minimal input from the user [8]. With the advent of 3G systems and a view of wireless that continues to grow and evolve, we see and will continue to see significant changes in wireless systems and services. Accompanying is an emerging paradigm shift: The shift is seen as driven by both a growing wireless market for higher speed and higher quality services and the trend to combine the wireless world with the ubiquitous nature of the Internet.

The following requirements characterize "seamless access":

- Seamless network integration based on IP
- Terminal mobility, personal mobility, service mobility, session mobility
- New B3G wireless technologies should be IP-centric
- Dynamic resource allocation at all network/system levels
- Adaptability/Programmability of network components
- Secure but simple service agreements
- SIM-card like universal authentication (cf. [6])

Seamless access penetrates into every part of future mobile communication systems. The main requirements are adaptability and dynamic resource allocation, together with the possibility for simple and universal access regardless of the access technology. Advanced mobility concepts allow the users to reach their personal services and preferences anywhere, anytime, and over all access networks. This includes the strategy to open for wireless access at home to all authenticated users ("Open Access Network"). The "Open Access Network" concept is based on a co-operation between the fixed and the mobile operator, where authentication is taken from the mobile operator (SIM-card authentication) and capacity from the fixed network.

Quality of Service

B3G service quality will be the collective effect of the performance of all system elements in combination with the user expectations, which determines the degree of satisfaction of the B3G customer. The operator's perspective is characterised by the customer service requirements, the customer perception of QoS, the offered QoS, and the actually delivered QoS.

Customer QoS requirements are described on an end-to-end basis in terms of the B3G service and are expressed in non-technical language. Beneath transmission parameters like data rate, customer requirements will also include availability. Furthermore, they will depend on the customer type, with business customers having the most stringent requirements for service availability and exceptional quality.

Customer perception describes if and how the customer is satisfied with the received QoS. It is very much dependent on the user expectations rather than on objective parameters. This is a crucial issue for operators particularly when considering service deployment in unlicensed spectrum.

Offered QoS is expressed in operator language and indicated on a per service basis. It should equate to the customer QoS requirements and may be mandated in a Service Level Agreement. Offered QoS represents a significant factor in forming the customers' expectations for B3G service quality, especially in the case of new innovative services.

Delivered QoS measures the effectiveness of the service provided by the B3G operator. It drives the customer perception of B3G service quality and provides a technical basis for determining offered QoS for each service. While basic B3G network integrity may be ensured by suitable conformance testing, suitable performance indicators are needed to monitor delivered QoS. In the B3G environment, such performance indicators must address the access network due to its complexity, heterogeneous nature, lack of robustness (particularly when using unlicensed spectrum) and its role as an intrinsic bottleneck (finite radio spectrum). However, as the access network approaches the reliability of wire-line components, the core network will become a more significant factor in determining the delivered quality of service.

From a technical point of view, QoS modelling and QoS signalling would be crucial factors for a future B3G system that integrates heterogeneous network types. Suitable abstractions have to be found for different system layers and they have to be mapped onto each other to fulfil and dynamically adapt to the customer requirements. A multi-layer approach has to be taken for a comprehensive solution here.

From the B3G operator perspective, the revenue will be affected by all of the above types of QoS. Customer satisfaction as a result of customer requirements vs. customer perception will always be based on the price, the willingness to pay, respectively. On the other hand, there will be a financial cost associated with the offered quality of services, reflecting both capital and operational expenditures. Overall, market positioning will therefore reflect a trade-off of quality versus price. Regarding personalisation and seamless access this would mean to provide always the right QoS in the right situation.

Intelligent Billing

Billing is not only a key issue to an operator's business. It also plays an important role in the way users perceive service provision as described above. With 3G evolution several aspects contribute to increase the necessity for more intelligence in the billing systems. Those are for example the variety of access modes, the increasing popularity of non time-based services (messaging, download), more elaborated provision chains (service and content providers), a choice of QoS levels by the user and the trend towards pre-paid solutions.

At the same time evolution towards an IP based infrastructure means that communications billing needs to accommodate and evolve from circuit to packet switched oriented billing. All these aspects pose new requirements on B3G billing. Some are user related, some others operator related.

User related requirements include

- QoS dependent charging
- Billing support to diverse access
- Support to real time billing information
- Support to interworking of prepaid systems
- Support to "per-call" service situations.

Operator related requirements include

- Billing support to IP traffic
- Flexibility of costs calculations (time, volume, QoS dependent, access dependent)
- Distribution of revenue by value chain operators
- Customer relationship management
- Reliability of billing operations
- Instant fraud detection and cut-off.

Business Concepts

Within the B3G environment, we regard the operator's role in future mobile communication to aggregate services and partner products beyond sole provisioning of connectivity. Customer needs are satisfied by personalized service packages. Furthermore, the operators could act as a trusted point for payment for transport and service provisioning. The existing customer relationship is the basis for such orchestration role of an operator (see Figure 3).

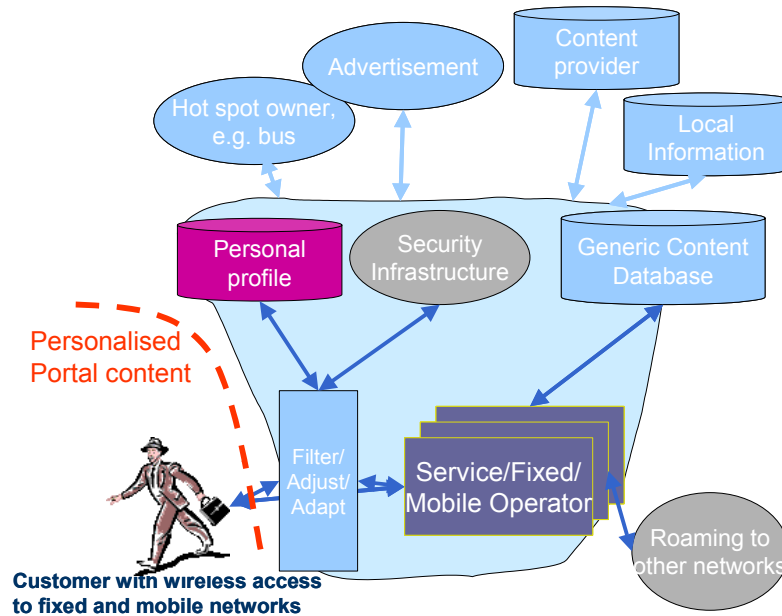


Figure 3: The operator's role in B3G

B3G will imply a co-operation between content providers and (wireless) access providers. New actors will enter the market. The focus will shift from competition on geographical coverage and price to competition on services. In conclusion, the role of traditional mobile operators is likely to vanish. Traditional operators are therefore recommended to take new business roles that will emerge, for instance through partnership and venture activities. By venture capital, new companies are formed, and more companies stimulate more activity, more activity results in more applications and services, which in turn will attract more customers. It is important to establish and maintain a close relationship to the customer. One way of obtaining this is to shift from pre-paid to ordinary subscriptions. The billing models for B3G could be more complex than the ones known today, and it is recommended to study various approaches to this issue.

In addition to analysis, a business evaluation of the use case of personalized service delivery on open access points is performed. Broadband access is available at all companies and more and more private homes. A potential B3G concept is to open this broadband access and support the access with a wireless (WLAN, Bluetooth) link supporting all element of your PAN. The wireless access opens also for visiting access, e.g. providing visitors with local information of the site/company or general access to the Internet. Companies have identified the provision of this local and global information as a service to their visitors. Eurescom P1118 has taken the idea further, and has established concepts for an open visitor access to the private home. A detailed business model is missing for that concept so far.

Conclusion

Eurescom P1203 is developing operator requirements for systems beyond 3G regarding technical and market aspects. Starting with a roadmap for Beyond 3G based on the vision "It's simple, it works, it is personalized", key drivers have been identified and are investigated to derive operator requirements

and strategies. Main items to be covered for B3G systems are: personalisation, seamless access, quality of service and intelligent billing.

These main items have to be supported by more specific working items, to be identified in further activities in the project. In detail, the following items will be covered:

- Establishment of a common vision on B3G
- Identification and system requirements description of key drivers
- Derivation of operator requirements
- Analysis of appropriate business models
- The validation of a scenario via prototyping and business case study.

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