

Usage scenarios and business opportunities for systems beyond 3G

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ABSTRACT

Within the IST MIND project, the provision of services in systems beyond 3G is being studied. In this article, the project's top-down approach is presented. It starts identifying and describing scenarios. From those, the associated value chain is derived and the business opportunities and economical trends for beyond 3G systems are analysed. It is shown that flexible service provision will play an important role in future networks and will cater for new sources of revenue.

I. INTRODUCTION

The IST project MIND (Mobile IP-based Network Developments)[1] has been formed by Europe's leading telecom operators and manufacturers to research the extension of IP-based radio access networks to include ad-hoc and wireless elements, both within and attached to the fixed infrastructure. The MIND project is a follow up to the BRAIN (Broadband Radio Access over IP Networks) project [2]. The BRAIN project developed a framework for the deployment of high bandwidth access technologies, which could be complementary to 3G cellular technologies.

A key factor for the success of future mobile systems is the availability of easy-to-create services and applications that are fully supported and customised when accessed by users from a wide range of wireless access technologies. The satisfaction of user requirements and expectations will be essential for the success of the future mobile systems. It seems thus reasonable to start the definition of those systems based on the needs and requirements of the user. For this reason, the MIND project follows a top-down approach, starting with the definition of a set of usage scenarios.

These scenarios help in the determination and specification of the issues to be solved. They allow identifying the involved elements and players, and assigning functionalities and constraints to them. They permit to derive clear technical requirements to support the user centric vision and to spot flows of services and money.

Nevertheless not only the satisfaction of user expectations will enable the successful deployment of a new technology, but also a feasible business support is required. MIND is also studying how different providers will collaborate in the future in delivering the demanded services to the end users.

II. THE APPROACH TO SERVICE CREATION

New technologies are starting to be present in our daily life. Just watching the people on the street, in the underground, at a railway station or even the people in their cars commuting every day from home to work is telling us how they are trying to struggle to process the information the new day just has brought them. These people use different kind of handsets, incorporating a whole range of functionalities like a cell phone, a scheduler, an email and instant messaging client to check their latest mails or even a built in browser to look and play around in the Internet.

This rather general and well known scenario demands a technology that is able to cover most of the activity mentioned above, regardless where the user is and where he or she wishes to go.

The key step in making this and other visions real is to give a concrete specification of the problem to be solved. Within MIND, a top down approach departing from the user perspective is taken. This procedure was successfully adopted in the predecessor project BRAIN. The IST BRAIN project proposed a set of usage scenarios [3] in order to show how services delivered

over broadband wireless networks could change everyday life and outlining services and applications that could be offered. The main reason why these scenarios were chosen, was that they cover situations, the future user could experience. Through the assessment of the defined scenarios, the basic requirements for the terminal, access network and air interface were derived. Already available technical solutions were compared with these requirements and, when necessary, new approaches were developed. Furthermore, in BRAIN, the key actors and their roles in the scenarios were identified. Figure 1 shows the outcome of that analysis. These results from BRAIN have been the input for a techno-economic evaluation of systems beyond 3G carried out by the IST project TONIC [4] that has studied the business case for UMTS supplemented by WLAN.

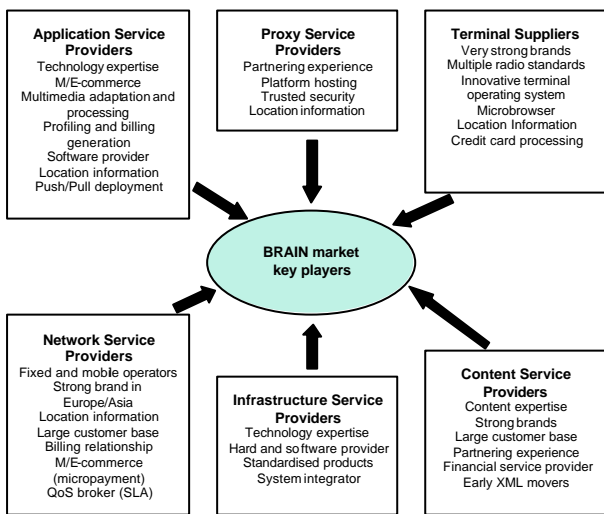


Figure 1.- BRAIN key actors and roles

The MIND usage scenarios investigate new business models, mapping the value-chain into the functional entities required for rapid and flexible multimedia service creation and support. This addresses the question of “who owns the customers”?

III. THE MIND USAGE SCENARIOS

Three different scenarios have been identified in MIND considering wireless and ad hoc extensions of radio access networks. Each scenario deals with specific aspects of the users requirements:

1. **Leisure Time:** A scenario which demonstrates that users may wish to be connected to WLAN (e.g., HIPERLAN/2) for low cost and high bandwidth in the home or shopping mall but will also want to connect to cellular technologies (e.g. GPRS or UMTS) from the same terminal and access the same services. In particular, the users in this scenario create a spontaneous ad-hoc network using colleges' terminal for connecting with service providers.
2. **Nomadic Worker:** This scenario looks at a future corporate worker, demonstrating that WLAN (e.g.,

HIPERLAN/2) may be used as part of office intranets providing integration with fixed intranets. The workers involved in this scenario create a secure working session, where some people are directly connected using an ad-hoc network, and other co-workers are remotely connected through public network infrastructure.

3. **Medical Care:** This scenario demonstrates a specialised application in the MIND approach. The main point arising from this scenario is that users can have very different priorities for the supply of the same quality service – in this case the patient being monitored requires absolute priority. These priority services are supported in special disaster areas by rooftop routers.

Usage scenarios provide a vision of the behaviour of future users. Their creation starts with a story where the characters use wireless technologies in their activities. As an example, here is a piece of the story of the hard working businesswoman Stephanie, extracted from the Nomadic Worker scenario:

“Stephanie Jones is a member of a large multinational corporation based in Frankfurt and therefore constantly on the move from one place to the next, often having to cross international borders. She has a Personal Wireless Assistant (PWA), which allows her to remain connected to the Internet, no matter where in the world she decides to go next.

In the morning, Stephanie checks her PWA for any new messages. She notes that the agenda for the morning has been modified. The scheduled meeting for preparing the review of the MIND project has been moved to Munich. She decides to go there by train. Stephanie knows some other people involved in the Munich meeting will take the same train in intermediary stations, and proposes them to organise an ‘on the road’ session in the train, in order to prepare the meeting.

The first thing that happens when Stephanie enters the train is that her PWA informs her the train service provider is running a high performance mobile communication network. Stephanie logs into the train network by entering her secure pre-paid account number and set-up a videoconference to the MIND project leader to sort out some minor details.

When the other members of the MIND project gradually join Stephanie in the train they attach their terminals ad-hoc to Stephanie’s because some sections of the review have to be worked over by the project partners.

The network created in the train is secure because Stephanie has sent a temporary session key in the invitation to the train session beforehand. Because some of the partners terminals do only feature short-range radio technology (e.g., Bluetooth), they use Stephanie’s terminal to access the corporate server and ...”.

The main trends identified in these scenarios are:

- Additional support for user-, terminal- and service mobility,

- Higher coverage and availability of network access and thus to service, and
- Lower burdens for new entrepreneurs planning to provide wireless access.

IV. INNOVATIVE MIND CONCEPTS

The three scenarios analysed in MIND show how network providers can support at different scales stationary and/or mobile ad-hoc networks, not only for extending their access networks (by blurring the edge of the network infrastructure), but also for providing value added services (e.g., security, billing, location-based services, web-portals, etc.). To accomplish all these goals, the concepts of Access Network Wireless Router (ANWR) and MIND Mobile Router (MMR) are of paramount importance:

- An ANWR is a special type of Access Network Router (ANR), distinguished by it being connected to at least one of its neighbouring ANR(s) by a wireless link; in other words, at least one of an ANWR's neighbours must be another ANWR. ANWR are typically owned and/or operated by legal entities and/or organizations, like communities, universities, companies, or network operators. Among other requirements, zero-configuration issues are of particular importance for ANWR.
- The MMR is a functionality allowing unplanned, sporadic extensions of the network infrastructure by leveraging special features of the devices owned and operated by individual users, on behalf of other users, who are not able to access the network infrastructure. An MMR is a special case of Mobile Router (MR) able not only to connect to a multiplicity of heterogeneous wireless network - including (mobile) ad-hoc networks - but also to enforce user profiles/policies for dynamically configuring the routing process, with respect to third party traffic. This aspect is of key importance, since MMR resources are typically limited and that access to the network infrastructure is usually subject to charge. To this extent, specific AAA and security support is of particular importance for MMRs. It is envisioned that Network Providers may want to regulate the marketplace - as in the 2G/3G case - by allowing only homologated MMR-capable devices being retailed.

Figure 2 illustrates the concepts presented for the case where Stephanie is providing access to the corporate network to her colleagues while travelling on the train. In this case, she acts as a MMR for her colleagues and the train acts as a ANWR when connecting her to the corporate server.

The extender, a MIND Mobile Router (MMR), is not part of the BRAIN Access Network (BAN) and is "owned" by somebody other than the BAN owner. The MMR has also the standard BRAIN mobile node functionalities - since it is desirable not to modify the access routers - and it must authenticate itself with the access router in order to connect to the BAN. If the MMR and the Mobile Nodes (MNs) are "friends" - i.e.,

they have a trust relationship - then they could rely entirely on the MMR to provide access to the network resources. The trust relationship might be established by private key exchange (e.g., using proximity (IrDA)) or pre-existing configuration (like file sharing today). In this case the MMR might be called a *proxy access network provider*.

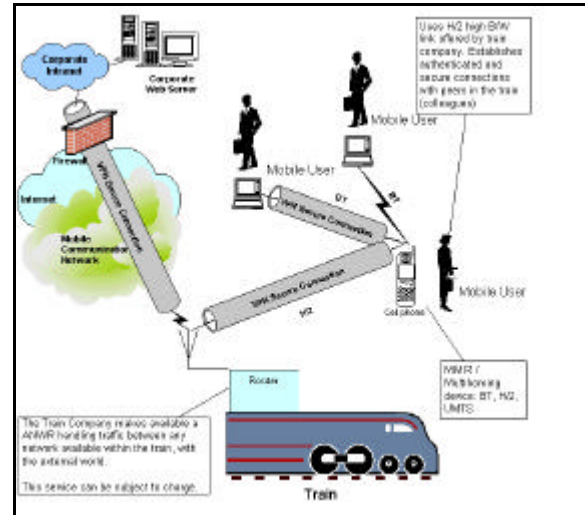


Figure 2.- Nomadic worker scenario overview

One part of the MIND scenarios is the case where a single router (mobile or otherwise) is extending the network by one hop to a group of users, see Figure 3.

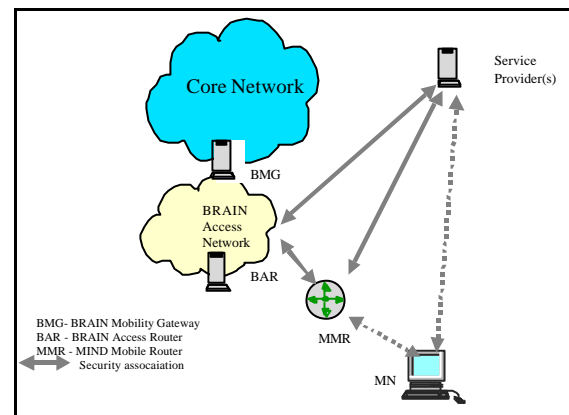


Figure 3.- Single hop BRAIN network extension.

In the case that the MMR is not trusted by the MN then it certainly can't pretend to be a base-station; this is not acceptable from a security point of view. So it must, effectively, act as a second network access provider. It is convenient to divide the relationship between the MN and the MMR into 4 classes:

- ?? Class 0: Friends - as described above - a *proxy access network provider*.
- ?? Class 1: Trusted at the service provider level - the MMR is a full peer to the MN home service provider and is fully authenticated by the home network - the MN only sees the MMR offered service and not the BAN. An *access network re-seller*.

- ?? Class 2: Trusted at the service provider level – the MMR is a full peer to the MN home service provider and is fully authenticated by the home network – the MN, however, also has a full relationship with the BAN (obtaining IP address, etc). An *access network relay service provider*.
- ?? Class 3: No trust – the MMR might have a digital certificate and belong to a “well known” organization or just be an old laptop. An *access network repeater service provider*.

A much more complicated scenario is the case of a MANET (Mobile Ad hoc NETWORK) attached to the BAN, see Figure 4.

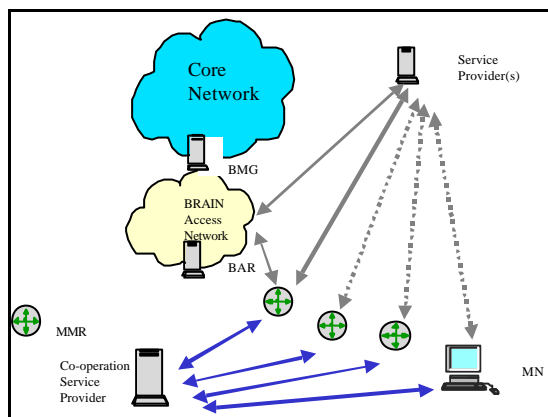


Figure 4.- MIND MANET attachment

Here MIND envisages that all the nodes of the MANET run a specific routing protocol, which the MIND project will develop from existing protocols. Also, because it is not a stand alone ad hoc network, there will be some common relationship between the members of the MANET – e.g., in an emergency scenario the terminals are all members of the emergency services. Another example might be that all nodes belong to students on a campus and to get access to the WLAN and Intranet they must run certain software, including the MIND ad-hoc routing protocol. In that case there would be a relationship between the ad-hoc nodes, and, additionally, the active nodes would all have a full relationship with the access network provider, since they would have to have MIND terminal software. The relationship between the nodes might include a new player – the *co-operation service provider* (e.g., a university server). This would ensure cheats were excluded and could perform load-balancing and QoS functions within the MANET. Pure MANETs would not have the advantage of always having a central service, such as this, available.

V. THE MIND BUSINESS CONSIDERATIONS

In parallel with the usage scenarios the MIND project is also analysing the commercial impact of beyond 3G systems. This analysis is organized in two main directions: study of market opportunities and analysis of possible Value Chains (VC) for supporting business models.

The next issues have been identified as relevant opportunities and challenges for the success of systems beyond 3G:

- Drivers

- o Business models and mobility
- o Growth in communications, commerce and entertainment services, influenced by increased Internet usage and falling costs
- o Demand for rapid, remote access to information, driven by increasing need for business productivity, greater personalisation and increased mobility

- Barriers

- o High costs and limited availability of spectrum
- o Failure to resolve security issues and re-assure consumers re-security
- o Acceptance of the users (willingness to share/offer infrastructure)
- o Pay system
- o Lack of control over transmitted content
- o Slow development of IT literacy in the mass market

- Enablers

- o Early exploitation of 3G and systems beyond 3G technologies (UMTS, HIPERLAN/2, etc.)
- o Improvements in user interface design and display technologies
- o Lightweight and attractive user terminals (PDAs, etc.)
- o Zero configuration, easy to install unmanaged component
- o Technologies that enhance spectrum efficiency

- Uncertainties

- o Rate of growth of the mobile multimedia market
- o The network paradigm – network or device centric?
- o Regulation
- o Administrative boundaries
- o Degree of asymmetry in communications

A further part of the work concerning business opportunities intends to understand the new chances that arise from beyond 3G mobile systems and the associated dynamic but complex ad-hoc-network market that will be created. It addresses the most important enablers and drivers that will ensure that the vision of systems beyond 3G becomes a reality.

To describe the business model we have to examine the value chain (VC). Based on the VC studied in BRAIN[3], and including special elements related to ad-hoc networks, the VC outlined in Figure 5 is proposed. This VC shows how net revenues paid by the end-user are shared between the service providers and operators. The percentages assume a similar split as in the present mobile Internet world.

Currently the service provider offers a service or a bundle of services. He earns the money from the end-user. From these revenues he has to pay the network provider, the ASP and the content provider. In our example the network provider gets a share of 10% of the

whole revenue. With this amount he has to cover all his costs and has to realize profit. The application provider who develops software for service-applications receives 20% of the service providers income for supplying the special applications. The content provider receives 40% for his service what is the major part of the income.

The mentioned percentages should only be used for orientation. It is very hard to estimate how the revenue for services discussed in this paper will be split in the future. But it is quite clear that market shares will move. Several European network providers recognize that margins in their core business of voice communication will become smaller. This fact of smaller margins and the current competitive situation of network providers will substantially influence the telecommunications industry in the next years.

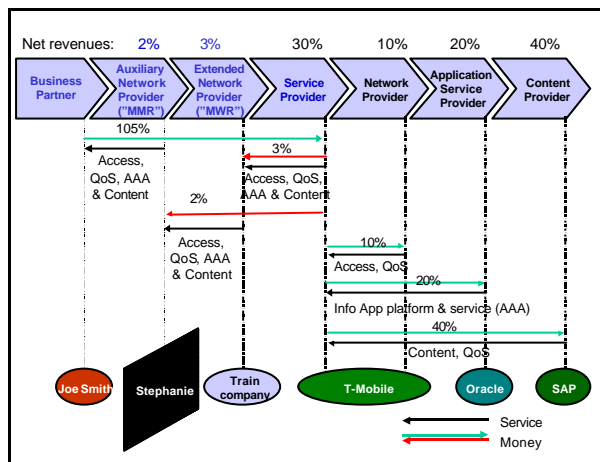


Figure 5: The MIND Value Chain

In Figure 5 streams of services and cash are represented as well. Joe who is one of Stephanie's business partners (remember the introductory story) is using the service offered by an auxiliary network provider who is implementing the MMR functionality. Because we assume that Stephanie would like to get something for her offered services, Joe has to pay for the service. The 105% illustrates that he has to pay more than for using the same service from e.g. at home. This procedure is not new; if today somebody uses a hot spot service (e.g., telephone box or internet cafe) it is more expensive than using the service from home. In our example we suppose a 5% additionally to the basic price. This surcharge is necessary to clear debts to different operators.

The auxiliary network provider, implementing the ANWR functionality, has additional expenditure when providing a service to a business partner over an ad-hoc network. It has to send a session key to ensure integrity and confidentiality for communication. Also the auxiliary network provider has to watch the system e.g. for QoS during the session. For these services it receives a proportion of the revenue, let's call it transaction fee. In our example we suppose a share of 2%.

Within the Nomadic Worker scenario different types of network providers exist. Thus the business model will

only be successful if the essential question "Who pays for What to Whom?" is cleared. Joe who is the end-user in this scenario pays for the connectivity and the services. Thereby different kinds of authentication for charging are conceivable e.g. a mobile phone number or a credit card or a specially company card. Joe is using the equipment of Stephanie who is acting as the auxiliary network provider, but he does not have a billing contract with her. He pays directly to the service provider and the bill he receives will display the positions "auxiliary network provider", "duration", "volume" and "price" among others.

VI. CONCLUSION

Three scenarios have been studied in MIND. They illustrate how users will access beyond 3G services and enable the study of business strategies for a successful deployment of these advanced systems. These scenarios provide a project wide common vision on the network and terminal functionalities that MIND is working on.

The provision of services between network providers (e.g., UMTS, Hiperlan/2) must take place transparently for the user. At the business section a feasible VC is proposed where the end users do not have to manage contracts with each of the providers, and where providers cooperate between them to offer smooth and "always-on" coverage to every user.

Most of these services offer the best result when the network provides support for horizontal and vertical hand-over. For providers horizontal and vertical hand-over can be a possibility for revenues, as an added value service.

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