The Future of Mobile Communications in the EU: Assessing the potential of 4G

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EXECUTIVE SUMMARY
This report examines some of the technological and business trends in mobile communications systems, taking into account both developments currently underway and the longer term outlook for so-called fourth-generation (4G) mobile communications technologies. How mobile communications unfold over the coming years will depend on the interaction of a number of factors. These include the progress made in developing the various technologies, the emergence of new applications, and the adoption of new services by users. Although the technology is an essential element, a viable business model is clearly the crucial factor.

Focusing on the development of the technology, two broad scenarios have been identified for further analysis.

- The first scenario is an extrapolation from current trends towards increasing the bandwidth delivered by mobile communications and envisages the widespread availability of 4G mobile communications some time around 2010. This scenario projects forward the view of mobile communications as having evolved through a series of successive generations, a view that is implicit in the term “fourth generation”. (This scenario is referred to in the report as the “linear 4G vision”).

- The alternative scenario (referred to in the report as the “concurrent 4G vision”) considers the possibly disruptive impact of the emergence of public wireless local area network (WLAN) access. To a limited extent WLAN access is already available today, and plans are afoot to deploy large numbers of so-called “hot-spots” offering semi-mobile Internet access. This approach enables a high-bandwidth service to be offered at relatively low cost in specific locations where usage is likely to be concentrated.

After reviewing current and future technological trends, the analysis given here examines some of the proposed business plans, focussing on those of telecom operators, telecoms equipment vendors, and IT companies. It also takes into account the implications for value propositions and organisational structures.

Clearly it is in the long-term interests of the European telecommunications industry to remain up-to-date with emerging trends in the mobile communications field, even if that may involve difficult choices about how to best recoup their past investments. And it is in the interests of Europe’s citizens and businesses to have access to affordable mobile information society technologies in order for European businesses to remain competitive and European citizens to enjoy full participation in the information society. The situation is perhaps still changing too rapidly for specific policy recommendations to be possible, but clearly promoting research, facilitating the standards-setting process, and the allocation of spectrum are all areas in which policy-makers can exert some influence over the future direction of the industry. Overall, one of the key enablers for mobile data communications as a viable business will be a sufficiently strong base of computer literate users, therefore any measures building these skills are to be welcomed.
Technology Roadmaps for the next generation of mobile networks

The transition from a first generation of analogue mobile telephony in the 1970s-80s to the second generation of digital in the 1990s (in the form of the global standard for mobile, GSM, in Europe and many other countries) engendered a view of the development of mobile communications as a sequence of successive generations. On this view the next stage of mobile communications (based on the universal mobile telecommunications system, UMTS) after digital mobile telephony became widespread, which would enable full multimedia data transmission as well as voice communications, was dubbed the third generation (3G). However, the high cost and technical difficulties faced have led to delays in deployment. Meanwhile, the neat model of a succession of generations began to break down, first with the intercalation of a 2.5G in the form of GPRS (general packet radio service), enabling rudimentary Internet access from mobile phones, and then with the emergence of public wireless LAN technologies as potential competitors. Against this backdrop, the concept of a fourth generation is increasingly difficult to pin down precisely. Indeed, beyond UMTS or 3G, looking at the 2010-2015 timeframe, the scenario is almost certainly going to be one of numerous interoperating systems each filling different niches of the mobile communications market. Factors that could have a significant impact on the deployment of mobile telecommunications technologies in this timeframe include radio access techniques enabling greater intelligence and flexibility to be built into transmitters and receivers (so as to use spectrum more efficiently), improved power supply technologies, and ad-hoc networking between mobile devices. The latter two factors could contribute to substantially cheaper phones and improved coverage, respectively.

The most significant emerging technology at the moment is public wireless LAN. Wireless LAN technologies such as IEEE 802.11b (popularly known as “WiFi”) were originally developed as a means of creating local area networks for homes, businesses, university campuses, etc. These networks use unlicensed spectrum and operate over short distances. There is no built-in security or charging mechanism, but encryption (using the wireless equivalent protocol, WEP, or the WiFi Protected Access, WPA protocol, for example) enables a degree of security and authentication to be implemented, opening up the way for access on a fee-paying basis. In their present state, WLANs cannot compete with UMTS (3G) in terms of Quality of Service (QoS), coverage and security, but their low deployment cost (particularly for fixed-line operators with spare backbone capacity) makes them attractive to users who are mobile but not necessarily in motion (for example, using a laptop from a café, hotel or airport). The equation could change, however, if cheap voice over IP (VoIP) communication materialises as a viable alternative for voice communications, as this could transform WLANs into direct competitors with 3G in the lucrative voice segment of the mobile communications business. As WLANs expand in urban areas, users with dual-mode phones might take advantage of the lower cost of calls while in town, leaving 3G operators to cover sparsely populated and hence less profitable areas. However the slow take-up of VoIP over fixed Internet connections places a question mark over the likelihood of this scenario.

When looking at developments outside Europe, the US appears to lack a shared industry-wide view of how mobile telecommunications are likely to develop. The trend in the US is towards new proprietary technologies deployed over unlicensed spectrum, co-existing with new standards developed for use on both unlicensed and licensed spectrum. At the same time, more unlicensed spectrum is being made available and flexible spectrum management is supporting the interoperability of products and technologies offered by a more fragmented industry. It should come as no surprise, therefore, that the US is leading the way in the deployment of potentially disruptive technologies such as public WLAN.
The main players in Asia (particularly Japan and Korea) are taking an entirely different approach by promoting a vision of a high data-rate public standard for the 4G system as a whole, building on strong demand for advanced data and entertainment services. Both Korea and China have adopted industrial policies intended to enable them to achieve leadership in mobile telecommunications. China, in particular, has the potential to produce very cheap equipment. Chinese mobile phone system operators offer low prices for calls over their 2G systems and even aim to undercut fixed line systems.

**Is there a business case for 4G?**

Doubts about the market potential for mobile data and multimedia have lowered expectations for 3G, and the roll out of 3G services has run into difficulties. Nevertheless, 3G is still expected to be deployed in Europe, although launch dates have been pushed back considerably. A survey of emerging 3G strategies and services in Europe reveals two main approaches. The first is to offer multimedia applications as a means of increasing revenues and the second, to use the technology to relieve congestion so as to better support and/or combine existing applications and services, and offer cheap mobile voice calls. In terms of the value proposition, operators also face something of a dilemma as to whether to position 3G as a complement to, or a substitute, for 2.5G.

In the short term, 3G in Europe will be driven by ‘traditional’ telecoms players, i.e. mobile operators and especially telecoms equipment suppliers. This approach, which emphasises an evolution based on 3G and the integration of heterogeneous networks, constitutes a definite opportunity and a potential strength in that it allows past investments to be recouped.

Viable business models for public wireless LAN will depend on the cost of access to the backbone network, security, and charging mechanisms. As a public mobile technology, it could potentially evolve as a separate competitor to cellular networks (whether 3G or 4G) in the form of a network of hotspots or it could become more closely integrated within the cellular network. Although public WLANs cannot substitute entirely for 3G in terms of functionality, if they are able to offer most of the services users might want from 3G at lower cost, and before 3G has had time to become established, they may undermine 3G’s already fragile business model. On the other hand, WLANs might stimulate demand for mobile broadband and create a cohort of users willing to pay to upgrade to higher quality 3G when they tire of the limited coverage, high demands on battery power, patchwork of hotspot ownership and congestion of WLAN access points. What seems less likely today, however, in the light of the problems faced by 3G deployment and in the context of emerging technologies, is a smooth linear transition to a homogeneous and universal fourth generation at some point in the medium term.

The model put forward by Eurescom, the European Institute for Research and Strategic Studies in Telecommunications, which is mainly backed by the European Telecoms Operators, builds upon the operators’ existing strength in terms of their customer relationships, access provisioning, billing and branding, so they can act as trusted third parties in payments for data and service delivery. This approach would oblige operators to move away from competing on the basis of their geographical coverage and price towards competition on the basis of the services they offer, thus increasing cooperation between access network providers, service providers and mobile or wireless service users through service integration and personalisation. It is also foreseen that existing operators will face tough competition from unlicensed wireless access providers, virtual service providers who rent network capacity and newcomers who could acquire radio bands if further spectrum is released for mobile communications. In terms of timing, Eurescom sketches a
migration path, where functionality is added to 3G from 2005 onwards, with a move to a system “beyond 3G” some time after 2008/2010.

Moreover, the vision of 4G shared by both the WWRF (Wireless World Research Forum) and WSI (Wireless Strategic Initiative) –which represent telecoms equipment manufacturers more than operators– emphasise the heterogeneity of networks and new service infrastructures, rather than increased bandwidth per se. The WWRF Book of Visions, in contrast to the network management oriented view expressed by operator-driven organisations, includes long-term visions with innovative approaches to wireless systems architecture and forecasts the commercial introduction of 4G in 2011/12.

Asia, Japan, South Korea, and China, on the other hand, are taking a proactive role in promoting a standardised model of 4G. Their 4G visions have many points in common with those of Europe, but on the whole, they tend to be more in line with the original linear vision of 4G’s developing as the next stage in the sequential evolution of mobile communications. They focus more on increasing mobile system data rates, and on developing new systems or system components, and less on the seamless operation of existing systems (though this latter strategy is increasingly included as the visions are developed further). These countries also envisage their governments taking an active role in driving domestic manufacturers to set early 4G standards.

The situation in the US tells a completely different story. Although there is no representative body that articulates US visions for 4G, statements made by individual US IT companies, telecoms operators and standards organisations lead to the following observations. Some US mobile operators see 4G as a way of leapfrogging to next-generation mobile networks. Standards for broadband wireless access such as IEEE 802.16 and 802.20 have developed very rapidly. Also, a number of US-based IT vendors, such as IBM, Oracle, Sun and Microsoft, have explicitly identified mobile communications as a strategic target market.

Financial analysis

As the lack of demand for 3G has shown, it is extremely difficult to predict the likely market adoption of mobile wireless communications and the revenues that can be expected. Added to this uncertainty is the potential impact of Public WLANs. However, as yet, although operators have been deploying public WLAN networks for some years now, most have been unable to turn them into a profitable business. Calculations suggest that standalone public WLAN services will probably not provide a sustainable business in the short-term, despite the free use of spectrum and relatively small investments required compared to 3G. As well as the technical limitations alluded to above, the intrinsic problem of achieving efficient usage of free bandwidth, in the absence of any sort of coordination (such as the market mechanism opted for in the case of UMTS bandwidth), could become critical as more players enter the field. Nevertheless, WLANs may prove to be of high strategic value and an important source of competitive differentiation. Even if the direct revenue impact of public WLAN is low, they may be important for subscriber retention, or as the means by which a fixed line operator could enter the mobile market.

The business case for a linear evolution to 4G relies on customers’ generating significant additional revenue from advanced 4G-type services. The question therefore arises as to how these future investments will be financed. The downturn in the telecommunications sector caused by excessive operator debt and disappointment over market growth, as well as the extreme cases of vendor financing, makes it highly likely that it will be more difficult to secure financial backing for new investments in a future generation of mobile communications systems. It has been suggested that several 3G operators may not recoup their investments at all, and this will reduce
the likelihood of operators’ investing in 4G by 2011, the date tentatively set by several equipment vendors for its introduction. Instead, for most operators, this investment is likely to be postponed a long way into the future. However, before more accurate predictions of operator investments in 4G can be made, 3G adoption will have to take off. It does not seem likely that a very high-speed mobile data network will gain user acceptance unless successful mobile data applications have been developed and commercialised with 3G.

**Overall conclusions**

The foregoing analysis suggests that three main issues need to be addressed in Europe:

- Firstly, operators in Europe have limited experience of advanced mobile data communications and there are as yet no signs of any increase in demand from users for these services (in contrast to Japan, which is the world's most advanced mobile market). There is clearly a need to abandon the technology push approach that has so far characterised European mobile communications in favour of a more user-focused perspective.

- Secondly, new technologies will emerge that will increase competition, and the pressure on prices will lead to cheaper mobile communications. However, the right balance is needed as too much competition could limit the possibilities for economies of scale. The right balance is also needed to harmonise operators' and vendors' diverging strategic visions.

- Finally, on a regional basis, several countries are aiming for a leading role in 4G and Europe runs the risks of being a late starter in the race to deploy 4G. In this situation, mobile telecommunications equipment will be built cheaply in Asia, causing Europe to fall behind in the production and deployment of mobile communications systems.

The development and adoption of 4G in Europe will require the prior large-scale adoption of 3G. While European actors should certainly aim for a leading role in 4G in the future to avoid missing opportunities, efforts should also be made to consolidate 3G infrastructure as a means of supporting a multitude of co-existing applications and enable the continuous incorporation of emerging standards and technologies. The standardisation made possible by Europe-wide UMTS adoption is an opportunity, but does not mean that other emerging technologies and standards should be ignored. On the contrary, UMTS integration should be the priority in the coming years, encouraging other standards to be made compatible with UMTS, promoting its enhancement and ensuring the removal of any barriers to its adoption. It should include provisions for micropayments, spectrum regulation harmonisation and interconnection issues, which would allow investments in 3G infrastructure to be recouped without missing the opportunities stemming from technological innovation in other areas.

4G should form a part of Europe's long-term plans for mobile telecommunications. However, the fragile business case suggests efforts should concentrate on creating a dynamic and sophisticated market for advanced mobile data and voice services based on 3G technologies. If this can be achieved, at the same time as integrating new technologies to improve the user experience further, the evolutionary path towards 4G will become clearer and will maintain its momentum.