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DISCUSSION PAPER

Fixed-Mobile Convergence

Comments are welcome and should be sent by 1 March 2007 to GSR07@itu.int





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FIXED-MOBILE CONVERGENCE

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1 Introduction

Although termed the “mobile” service, cellular wireless handsets are often used for non-telecommunications functions and can more accurately be considered personal communications devices. They are used so frequently in fixed locations, primarily the home and the office, that some operators are offering special “home zone” tariffs while in others mobile competes direct with the limited range of Fixed Wireless Access (FWA).

While customers increasingly use a Radio Access Network (RAN) over short distances, most of the backhaul traffic is carried on core networks constructed with optic fibre cables. These offer a high capacity and low unit cost that present many advantages. In the many Small Island Developing States (SIDS) the use of satellite is unavoidable because there are no undersea cables, significantly increasing the costs. In much of Africa there is limited provision of undersea cable or access to those cables is controlled by a monopoly.

The strength of continuing innovation has required efforts to outline the patterns of technological development, for example, in the evolution of broadband access networks and services.^{1,2} These attempts at forecasting indicate a future that will continue to change. The maps will have to be modified once they come into contact with consumers whose responses have proved to be so unpredictable.

Given the delays and uncertainties in the introduction of Third Generation (3G) mobile services, manufacturers have developed plans for the Long Term Evolution (LTE) to 3.5G and beyond.³ These are intended to avoid a hiatus over the introduction of 4G and potentially highly unpopular demands to finance massive investments in new infrastructure. Yet in avoiding the term 4G it is left open for use by suppliers of alternative technologies seeking to gain a marketing advantage over 3G operators. On fixed networks, the terminology is the vaguer Next Generation Network (NGN) is used even though some of the technology is shared.⁴

IP Multimedia Sub-system (IMS) was originally devised for 3G networks then adopted by some manufacturers of fixed networks.⁵ However, the evidence remains uncertain about how quickly it is being used on fixed networks and whether the two will be truly integrated.

In many developing countries and Least Developed Countries (LDCs) there are low fixed teledensities, with little prospect of further investment in traditional narrowband networks. Moreover vast numbers of people have access to neither a fixed nor to a mobile network. As a result Fixed Mobile Convergence (FMC), as conceived in the developed countries, is at best misleading and often meaningless. Nonetheless, there is progress towards convergence of voice and Internet access in developing countries, though with much greater emphasis on delivery of the services over wireless networks.

This chapter considers first the different classes of convergence. It then analyses the consumer markets and enterprise markets. The policies used for Fixed Mobile Convergence are then considered. Finally, conclusions are drawn.

2 Classes of convergence

While convergence is often thought of as fixed and mobile, it can take and often has taken other forms. For example, considerable attention has been given to the convergence of telecommunications and broadcasting.

A significant problem has been that the approaches taken by manufacturers and operators to convergence have often been to create “hype” around specific platforms and products in order to promote them to financial institutions, to policy-makers and to customers. For all that such propositions sound plausible at the time, the reality has invariably proved different because of the rapidity of change and the profusion of alternatives. Nonetheless, convergence has been an enduring aspiration for market players and something given serious attention in public policy.

Convergence has often been confused with substitution – notably in the claims that mobile was displacing fixed telecommunications. An extreme example is that some manufacturers of watches are concerned that the mobile phone, along with other electronic devices, is substituting for their more traditional products – fixed and mobile, analogue and digital.

Fixed and mobile telecommunications markets are both subject to regulation by the same laws and institutions, but with considerable differences in treatment. These arose from the presumption that the mobile “market” was competitive while fixed markets required regulated access regimes.

Elements of mobility or at least of portability were added to the fixed network with the use of cordless telephones. The Digital European Cordless Telephony (DECT) standard has been used extensively for networks in offices and factories and also in homes and gardens.⁶ Gradually DECT is being replaced by multipurpose Wireless Fidelity (Wi-Fi) networks.

It is possible to have the convergence of many different RANs in a portable or handheld device including:

- Near Field Communications (NFC):
 - Ultra Wide Band (UWB)
 - Radio Frequency IDentification (RFID)
- Hot spots:
 - DECT
 - Wi-Fi
 - WiMAX
 - Orthogonal Frequency Division Multiplexing (OFDM)
- Cellular:
 - Global Standard for Mobile (GSM)
 - Code Division Multiple Access (CDMA)
- Broadcast:
 - Digital Audio Broadcasting (DAB)
 - Digital Multimedia Broadcasting (DMB)
 - Digital Video Broadcasting – Handheld (DVB-H)

A physical constraint on the inclusion of these in one device is the power each draws off the battery and consumer perceptions of how frequently they should be recharged. The dictates of fashion require the designs of handsets and thus batteries to be small and especially to be thin. A leading manufacturer recently announced a model only 6.5 mm thick. The battery must be shared with an array of other functions. The use of a Software Defined Radio (SDR) reduces the complexity of the electronics and thus the load on the battery.

There are also problems of space for the various antennae. Visible and protruding antennae were abandoned because they spoiled the design. The difficulties are being reduced by the use of Multiple Input Multiple Output (MIMO) aerials.

The availability of low cost chip-sets means that radio interfaces can be included in a wide range of devices, notably in consumer electronics. With a Wi-Fi chip a consumer electronic device can be connected to the network of the residence or of the car and from there, through a gateway, to the Internet. This allows control of the device from other locations. It also permits the provision of value-added services, such as remote diagnostics of the device, upgrades to software and control over the use of electricity.

Similar arguments apply to the use of RFID, where sharply falling costs allow the use of RFID tags on individual items. This has been termed the “Internet of things” as an extension to include inanimate objects.⁷ It is argued to be the next “logical” step, after connecting people anytime, anywhere, to connect inanimate objects to a communication network. The use of RFID and sensors serves to extend the communication and monitoring potential of the Internet, as will the introduction of computing power in everyday items such as razors, shoes and packaging. It is far from clear what comes next, but one possibility is implants in humans and animals that connect directly to the Internet.

The use of RFID tags on individual products raises important questions of privacy.⁸ For example, the ability of third parties to read the tags and by their location or proximity to a person or residence draw inferences that infringe on the private life of an individual.

The inclusion of an RFID tag and also an RFID sensor in a handheld device open the possibility of many additional services. Many Japanese handsets can already read two-dimensional barcodes, allowing a quick link to be made from an object to a web site with information about the object or a related service. This can be further extended with the ability to read RFID tags. With an embedded RFID tag in the handset it can be used as an electronic purse or a means of identification.

An obvious problem in service convergence arises where there are significant differences in unit costs of networks, or indeed in the type of units used to charge for access on different networks. If access is unlimited on fixed networks and billed per second or per kilobyte on mobile networks, then there will be a strong economic incentive to use the fixed network. Yet this appears to reflect real differences in the underlying costs.

It presents the problem for operators of having to advise customers of the differences or offer common pricing and to absorb the differences in cost.

What might be considered a technologically crude form of convergence is already available in many countries, with the appearance of offers and invoices that merely bundle services together as triple and, with the addition of mobile telephony, quadruple play. These have become a matter of the branding of the service and the use of a shared billing platform.

Such bundles of services and hardware can run far ahead of the technology and of corporate structures, provided there are flexible and competitive wholesale markets which allow operators to aggregate the various components into an interesting offer.

2.1 Mergers and acquisitions

Recognizing that convergence is taking place, some market players have moved to acquire companies in upstream, downstream or complementary markets.⁹

If a telecommunications operator sees that it will need content, then it might be tempted to acquire a broadcasting company or a games software house or a music label in order to secure its supply and to ensure that it will continue to make profits in the future.

One of the great fears of telecommunications companies and their boards is that they might be reduced to being a utility with no special status in financial markets, perceived merely as a bulk carrier of undifferentiated bits. It does not present the same level of difficulty for public policy objectives and may offer some advantages. However, there is a risk into which a couple of fixed operators have fallen of being

taken over by financial interests concerned only with “sweating the assets” with little apparent regard either for customers or regulation.

A constraint on acquisitions lies with the views of the financial markets, though these can change quite quickly. At one time they told fixed telecommunications operators to spin off their mobile network operators to maximize shareholder value. Later they were told to re-integrate mobile with fixed.

The financial markets are generally happy to approve operators seeking competitive advantage over rivals and new ways to distinguish themselves from competitors. At the same time, they consider that firms should “stick to their knitting”, that is to their core activities. Financial analysts and markets tend to see difficulties and heightened risks when telecommunications companies move into manufacturing or creative industries. Moreover, the failure of international alliances in the late 1990s ought to act as a reminder, from the recent past, that operators have made serious mistakes in assessing their ability to create value within their own industry. To cross borders into content generation raises much more serious issues about their ability to manage differences in organizational cultures and values.

Competition law, in the form of merger control, also plays an important role. There are extensive analyses and experiences from its application to vertical and horizontal mergers.^{10, 11} Where there is a significant risk of the reduction of competition by the leveraging of power from one market into another, national competition authorities will be reluctant to permit acquisitions. They are likely to seek to block such mergers or to require commitments that ensure wholesale access to any essential facilities and key inputs.

2.2 The evolution of convergence

The reaction of consumers to devices and services that offer convergence is still emerging. Clearly, many innovations or combinations of elements will fail, because of lack of interest, poor value for money, concerns over privacy or the introduction of something even more innovative. This market filtering process is as inevitable as it is pitiless.

Convergence does not stand still rather it evolves or morphs under pressure from the upstream markets in the supply of chips and their application in innovative hardware and services. Market players try to respond to the changing views of the various groups of customers, whether consumers or business.

There is no reason to expect these changes to stop or even to slow down, given those underlying forces. At one time mobile was to substitute for fixed, then they were to converge, it is unclear what will come next.

3 Consumer markets

From the days of the black Bakelite telephone we have jumped to fast moving consumer goods and services. New models, devices and services appear with great rapidity, many lasting relatively short periods of time. What was once a rather staid state-provided utility has become part of a consumer market kept moving by technological innovations funded in part by venture capitalists.

Consumers have expressed clear preferences for brands in handsets and services, accessible from different platforms.¹² Leading search engine companies have recently entered into deals with mobile operators and handset manufacturers to make their services available on mobile handsets. On a mobile device searching takes on a complex challenge of having to consider location, which can be determined in many ways, and the profile of the user, since it is a personal device. Searches for video material also appear to require an element of personalization.

While the mobile network operators see an increased role for themselves in such value-added activities, customers appear to want the same brands regardless of the device or interface.

This section looks at the fusion of television and telephony, quadruple play, at telecommunications in motor cars and in homes, plus consideration of Web 2.0.¹³

3.1 Telephony and television

One of the earliest examples of convergence was based on the view that most homes in developed countries had both a telephone and television. This led to videotex systems with a modem into which the television could be plugged as a monitor.¹⁴ The service came too soon, when most households still had only one television which other family members were reluctant to see diverted to this seemingly exotic service.

The most famous and successful example was the French Minitel system which generated enormous interest and traffic. It used a simple kiosk system that was later to be used by a Japanese mobile network operator to allow content providers to offer services with the operator billing customers on their behalf using a very simple set of fixed rates. However, Minitel used a dedicated terminal, rather than a television and adapter as had originally been envisaged.

An unanticipated example of convergence came with the use of Short Message Service (SMS) for voting and competitions on television shows, on both satellite and terrestrial networks.¹⁵ This provided a means for viewers to participate in the shows making them more attractive. It also generated considerable revenues, since many of the numbers used were charged at premium prices. A committee of the United Kingdom House of Commons has recently proposed reclassifying some of these activities as gambling, being based on luck and not skill.¹⁶

The addition of SMS provides an early impression of how more interactive forms of television might develop.

Many newspapers and television stations have invited customers to submit their own photos and videos taken using mobile cameras. While the quality may be less than the usual standards, there is an immediacy and a sense of participation that adds considerable value.

While both fixed and mobile operators are experimenting with television, the approaches taken appear to be separate. On fixed networks operators are offering IP Television and Video On Demand (VOD), usually bundled with broadband Internet access.¹⁷ The limitations and the costs of offering television on 3G networks, using Multimedia Broadcast Multicast Service (MBMS), have encouraged operators to try to obtain separate allocations of spectrum for mobile television using one of a number of technologies. This may also be a means of pre-empting competition from broadcasters offering mobile television. One result is that it pushes the convergence from the network into the handset, the billing and the commercial arrangements with broadcasters.

To date, there is limited evidence of operators creating seamless fixed and mobile television offers. Indeed some operators provide what might be considered competing offers with similar content on fixed and mobile. There remains enormous uncertainty about developments, for example, on the scalability of television from the widescreen down to the mobile phone and from the full length movie down to the video clip.

3.2 Quadruple play

Convergence, of a sort, has arrived in the form of triple and quadruple play offers, spanning:

- television
- Internet access
- fixed telecommunications
- mobile telephony

The speed with which these have appeared and spread across the developed countries has been very rapid, and this is now extending into developing markets.

Operators have been reluctant to reduce prices below a level of between USD 25 and USD 40, so they switched to other forms of competition by increasing the speed and adding other services. Many previously

distinct elements, not least voice telephony, are being lost in a flat fee with discretionary spending on services and content.¹⁸ However, the offers are usually limited to calls to fixed networks because of the high cost of wholesale mobile termination rates (MTRs). Some mobile operators have created similar bundles with unlimited calls to fixed networks.

Many operators are upgrading their infrastructure for 3G or 3.5G with services launched in almost all the developed and many developing countries. The OECD has reported that around 30 per cent of operators provided an option with an unlimited flat rate data services, though high prices had been a disincentive to faster uptake.¹⁹

The OECD argued for the introduction of Mobile Virtual Network Operators (MVNOs) in order to reduce entry barriers for specialized mobile data services and to generate competition. It suggested they would also play an important role especially in the context of fixed-mobile convergence. Unfortunately, the experiences have been very mixed and almost exclusively in developed countries.

It is open to question whether MVNOs would work in developing countries. There is, so far, little evidence of success that would encourage infrastructure owners to open their networks. There are no legal models in place to require access for MVNOs and this would be resisted by operators. The most obvious strategy for an MVNO would be to lower prices, putting unwelcome pressure on operators.

Offering broadband Internet access over cellular networks raises complex questions. An obvious difference from the fixed network is that there is no regulated or wholesale access, with a very small number of operators, rather than a range of Internet Service Providers (ISPs). Moreover, there is very limited prospect for further market entry. Mobile operators have shown much more interest in providing value added services than “raw” IP access.

While manufacturers claim 3G and 3.5G networks can provide very high speeds there is little evidence from the field to show what is being delivered. The level of infrastructure investment will constrain the extent to which multiple users can access the higher speeds. This is very different from the contention ratios on fixed networks.

A form of triple play has been delivered in Cape Verde combining cellular, fixed and digital television.²⁰ Another recent announcement in the Caribbean suggests developments in adding television over GPRS and 3G to voice and Internet access.²¹ The questions which remain to be answered concern the experience delivered to the customer and the economics of meeting demand for the services.

A significant problem is delivering the bandwidth over a radio access network. While there is considerable hope placed in WiMAX, the delivery of low cost handsets and affordable networks has yet to be achieved on the scale needed to deliver a service equivalent to the multiple play offers described above.

3.3 Cars

The high level of competition in the automobile industry has led manufacturers to concentrate on Information and Communications Technologies (ICTs) as a way to add value to their products and supporting services. A car lacks the constraints of a mobile handset in terms of the available space and the source of power, allowing a much greater range of possibilities.²²

Manufacturers have added Global Positioning Systems (GPS) with satellite navigation for drivers. GPS has also been used to discourage theft by warning of the ability to locate stolen vehicles. ICTs have been used to add value with services to improve vehicle maintenance, fuel efficiency, fault diagnosis and customer care. One leading manufacturer is advertising its full range of vehicles as being Bluetooth-enabled.

Mobile telephony has been integrated with cars through kits to supply power and hands-free operation to avoid the driver having to use the handset. In some cars there is an embedded phone with a supplementary Subscriber Identification Module (SIM) card using the same number, so that the car becomes the phone.

There is continuing controversy over the safety of telephony while driving, even without use of the handset. A growing number of countries have banned the use of handsets while driving with some evidence suggesting it is as dangerous as driving under the influence of alcohol.²³ However, many developing countries have been slow to adopt legislation to ban the use of telephone handsets while driving. Such regulations require to be technologically neutral, including cellular, satellite and FWA devices – especially the watching of videos.

The primary area of attention amongst automobile manufacturers is now In-Car Entertainment (ICE). For example, many vehicles in the North America are supplied with a satellite radio requiring customers to pay a small monthly charge for a service that offers one hundred channels of music and news. Increasingly, satellite video will be available to entertain the passengers. New ICT applications are also being developed to improve safety of the vehicle by reducing the risks of accidents.

Cars were the original place for mobile phones, given their size and power requirements. Today, they retain an important place, though with a much increased range of services.

3.4 Homes

With an increasing number of high-capacity broadband connections, that is 100 Megabits/second and more, especially with Fibre To The Home (FTTH), there is a potential market for sophisticated and powerful Home Gateways (HGs).²⁴ These would go far beyond an:

- IP router
- gateway to the Internet
- Wi-Fi and WiMAX transceivers
- storage capacity for video and audio
- heavily defended firewall

This would allow any device in the home to be connected to the Internet. Manufacturers of chips and electronics, plus service providers, are all positioned to fight out which will win in the market place.

A number of service providers and device manufacturers have already entered the market with innovative services. One company has developed a standalone device to allow the residential customer to stream any audio or video available in the home to the individual when elsewhere. Almost inevitably, this has been extended to other family members and sometimes beyond. Initially, this was only available for National Television System Committee (NTSC) video, but later extended to Phase Alternating Line (PAL) and even to High Definition (HD).²⁵ The software clients were initially for a conventional Personal Computer (PC) with a fixed broadband connection, but these have been extended to smaller devices, including mobile phones which have Internet access. It can even be accessed in planes equipped with Wi-Fi.

The manufacturers of Personal Video Recorders (PVR) have begun to incorporate a similar function, allowing customers to store and to stream video across the Internet.²⁶ This allows remote access to satellite or terrestrial broadcast television and also to DVDs and recorded programmes when out of the home.

This place-shifting, to complement the well-established time-shifting of Video Cassette Recorders, bypasses any offers or constraints of local operators and service providers. It may also bypass regulatory constraints and the geographical limits of any licensing of content.

Such consumer-led and almost anarchistic innovations can only be expected to multiply. Viral marketing and peer-to-peer are strong models that together have proved very successful.

3.5 Web 2.0

In picking up the pieces from the crash that followed the dot com bubble, the idea of Web 2.0 was floated by Tim O'Reilly and others.²⁷ It was to identify those elements of the new business models that might endure and thrive. Web 2.0 stressed the use of underlying databases and interfaces that were subject to constant new releases, some never emerging from a trial status. A problem here for developing countries is the traffic this generates in repeated downloads.

The most conspicuous success of Web 2.0 has been in the creation of the so-called "blogosphere" and other social-networking applications. It is estimated that there are already over twenty million people in China with their own weblogs. This is now being extended to video-logs, though mobile logs seem to be slower in taking off.

While there is considerable debate about Web 2.0 for the fixed Internet, this seems to be distinct from the initiatives of the cellular wireless operators who have their own vision.²⁸ While these are in conflict and the players have different economic incentives it seems unlikely there can be true convergence.

Instant Messaging (IM) has been available for over a decade on the fixed Internet. However, there have been problems of inter-working between the various systems. It is not merely the capability to exchange messages between individuals, it is also the availability of their status, whether they are free to communicate or busy or even off-line. Service providers do not want customers of their rivals to be able to see the availability status and "buddy lists" of their own customers, rather they want customers to use their system.

No government has yet forced the inter-working of instant messaging or equivalent systems. However, commitments were obtained in the approval of an acquisition of one messaging provider by another.²⁹ These were supposed to have ensured better inter-working, though the progress has been limited.

Some handset manufacturers and cellular wireless operators are offering conventional IM services on handsets. This is, in part, a response to the fear that the large revenues from SMS could disappear into cheaper and more competitive messaging services carried over IP networks. The business model tends to be a monthly subscription, rather than a payment for the data used. Some mobile networks are providing access to social networking, again for a monthly subscription.

Many VoIP services have capabilities based on IM, in that they show the status of friends and colleagues. It would require not merely interconnection, but a much richer range of inter-working to provide equivalent functionality. Similar characteristics can also be found in some Massively Multiplayer Online Role-Playing Games (MMORPG), though inter-working here could be very complicated.

There has been a rapid and widely discussed growth of social networking systems, with some high value acquisitions of firms. In some ways, these have only re-invented the idea of a personal web page, but with much easier software and convenient links into networks of friends. Following concerns about abuse and crimes, parental controls are being introduced.

A number of systems have developed which allow interaction in a three dimensional landscape and an artificial geography.³⁰ Here individuals participate as an avatar, which they can design and personalize.

While many of the applications are recreational there are also the beginnings of business applications.³¹ A leading news agency was one of the first corporations to open a commercial presence in a social networking space, followed by others exploring the possibilities of using avatars in cyberspace for internal business processes and for engagement with customers.

The usual generational argument applies here, with younger users taking the lead. 2006 saw not only a rapid growth in social networking, but also an extension of the age and socio-demographic range, extending to older users, those over twenty-five. While mobile devices are used to create still and moving images to be uploaded across the fixed network to social networking sites, there are only the beginnings of Mobile Social networking Software (Mososo).

3.6 Device convergence

Manufacturers of handheld electronic devices have sought to add more features to attract customers in their highly competitive markets. For example, games consoles have seen the addition of Wi-Fi and audio, allowing them to become, in effect, telephones with client software for IM and VoIP.

There has been rapid progress in a range of countries to turn mobile handsets into banking instruments. With the addition of an RFID tag, the handset can be linked to the identity of the customer and used for debit and credit card payments. In least developed countries there are generally more mobile phones than bank accounts, with mobile telephony growing faster than banking. Thus it is an attractive option for network operators to try to boost their low Average Revenue Per User (ARPU).

However, it raises interesting issues concerning the interaction between banking and telecommunications regulators. Many banking regulators may require assistance to understand the implications of network economics and technologies.

Convergence in handsets, with platform-based competition, brings firms into competition that were once in separate markets. Despite a growing overlap in functionality, firms can expect that prices will initially increase and that profits will rise through increased value. Later, as substitution takes over and dominating any perception by consumers of an increase in value, it causes prices and profits to fall. Most of the factors influencing this are outside the control of even the larger firms, requiring them to be very careful in whether and how they deploy specific technologies, carefully evaluating whether they will gain a competitive advantage. Much of the benefits for the firm will be competed away, to the benefit of the consumer.³²

A group of manufacturers and operators under the Fixed-Mobile Convergence Alliance (FMCA) is sharing experiences of convergence.³³ Its mission is to “abolish the distinction between fixed and mobile” irrespective of the underlying networks.

Manufacturers are currently developing dual GSM and Wi-Fi handsets. Some commentators believe they resemble the earlier combination of GSM and DECT from the 1990s which were not successful³⁴. These earlier dual handsets were both late in hitting the market as well as being large and unattractive. The commercial logic of both dual-mode devices is the same, with an attempt to eliminate the need to carry two handsets. The renewed GSM-Wi-Fi handset, however, uses much more sophisticated technology, with seamless transfer of calls between technologies, for example, in the use of Unlicensed Mobile Access (UMA).³⁵

In the intervening years GSM has become much more commonplace and is more heavily used. There is also a strong incentive for operators, since the use of Wi-Fi for calls allows traffic to be moved onto the fixed network bypassing GSM networks and reducing costs. This may allow the operators to compete with providers of VoIP. However, for the customer the technology is largely irrelevant, with the interest being in flat rate pricing models.

Part of the logic of dual-mode phones for corporations is the potential cost savings made from around half of all business calls being made from cellphones while employees are at their desks. This preference on the part of customers is usually because the handset contains the numbers in an address book. The attraction for the corporation is to achieve the savings.

As ever, the appearance of the new handsets has been delayed. Consequently, what is missing has been the volumes of demand that will drive down the prices and trigger widespread adoption.

4 Corporate networks

The market to supply corporations with networks and network services is much less susceptible to the whims of fashion than consumer markets, the trends are stronger and more predictable. The high levels of expenditure are subject to rigorous tests such as Return On Investment (ROI) and Total Cost of Ownership (TCO).

Although FMC for corporations has been discussed for years, progress has proved limited and slow. Amongst the reasons for this are the high prices for the termination of calls on mobile networks in many countries, the very high cost of the cellular data service and the absence of Service Level Agreements (SLAs). While mobile network operators continue to stress substitution rather than convergence these issues will remain unresolved, causing corporations to look elsewhere for mobility or nomadicity, to Wi-Fi and DSL technologies.

This section considers fixed and then mobile business telecommunications, followed by enterprise applications and some conclusions.

4.1 Business communications services

The supply of Business Communication Services (BCS) is a highly competitive market and one that is close to being global. Market players provide good coverage in developed countries and in key emerging markets. In addition to global operators there are a few strong regional players and some virtual network operators. From these, enterprises are able to pick the “best of breed” suppliers, those that are best able to deliver their requirements, with a strong emphasis on reliability, security and cost, plus a good match on geographic coverage.³⁶

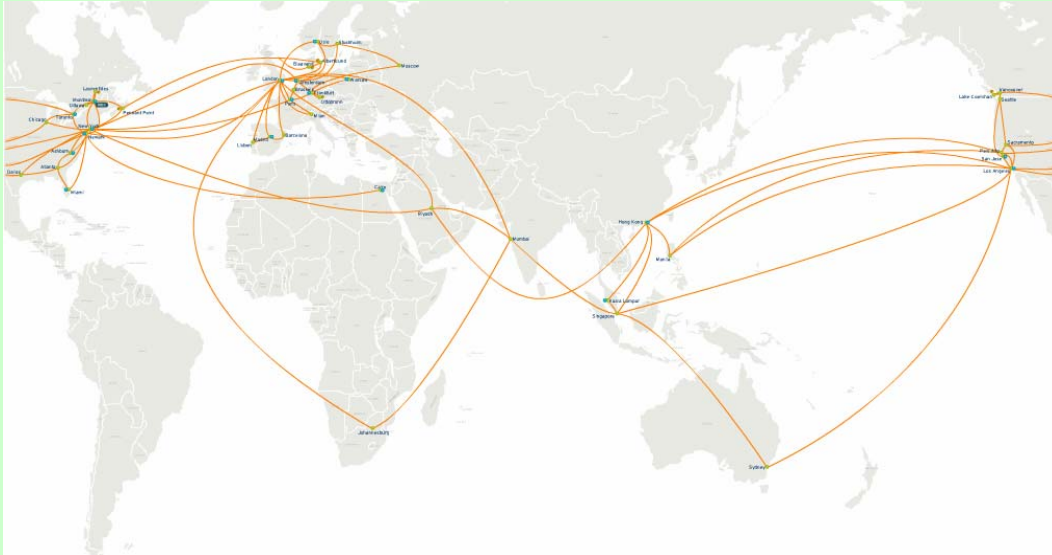
These requirements are specified in detail in the contracts and SLAs which set out not only technical parameters, but also penalties for failure to comply. Networks are required to have diverse routing to limit the effects of disasters and accidents, to ensure business continuity. A high quality of voice call is required, while very low latency is required for enterprise applications.

The supply of business communications services is weak in most of Africa and much of Central Asia, where there is limited demand and where wholesale access to infrastructure is limited. Even in rural areas of Europe and North America the global operators have problems in delivering services, being reliant on reselling infrastructure obtained from national incumbent operators. Nonetheless, the global and regional service providers will meet the requirements of a large customer regardless of the location, even if they are obliged to use unreliable infrastructure provided by a reluctant or less than fully cooperative local operator.

Videsh Sanchar Nigam Ltd (VSNL)

VSNL is the former state monopoly provider of international telecommunications in India. In 2002 the Tata Group acquired majority control of VSNL, with the Government of India remaining a significant shareholder. Established by Jamsetji Tata in the second half of the 19th century, the Tata Group has grown into the largest conglomerate in India. Through VSNL, the Tata Group acquired Teleglobe International Holdings Ltd for USD 239 million and Tyco Global Network for USD 130 million. These give VSNL the capability to collect traffic from many parts of the world in order to supply the call centres and business outsourcing centres run in India by the Tata Group (see Figure 1).

Figure 1 VSNL International Network



VSNL has a formidable partner in Tata Consulting Services (TCS). For the third quarter of the calendar year 2006 it reported quarter-on-quarter growth of over 9 per cent, the equivalent of almost 50 per cent annual growth, continuing a run of quite remarkable results (see Table 1).

Table 1 Revenues of Tata consultancy Services (INR millions)

	2004	2005	2006
Consultancy services	69,269	94,856	120,953
Sale of equipment & software licenses	6,868	10,381	8,468
Other revenues	896	1,158	3,034
Total revenues	77,033	106,394	132,454

Source: TCS annual reports, USA GAAP conventions. Year to 31 March.

Both voice and data are carried on Virtual Private Networks (VPNs), increasingly these are IP-VPNs using Multi-Protocol Label Switching (MPLS).³⁷ They offer corporations a low and declining unit cost for traffic. MPLS allows the network to be configured to carry many different types of traffic, ensuring that policies about the priorities for particular traffic are enforced.³⁸ In this way corporations can give an appropriate priority to voice and enterprise application software, while also allowing for video conferencing and messaging.

There remain significant barriers to the implementation of voice and data convergence for corporations (see Table 2). Work on these issues and the technical challenges will be sufficient to keep corporations busy for some time, after that they can look at integration of cellular wireless services.

Table 2 Significant and major barriers to converged IP networks³⁹

	<i>Global</i>	<i>USA</i>	<i>Europe</i>	<i>Asia-Pacific</i>
Network security	58.2%	45.3%	61.5%	64.7%
Cost of implementation	55.6%	52.6%	53.7%	59.2%
Cost of new equipment/technology	54.0%	58.1%	47.4%	53.3%
Complexity of implementation	53.6%	46.6%	52.9%	58.3%
Disruption to business while migrating	50.4%	46.2%	50.7%	53.3%

Source: AT&T EIU survey of multinational corporations, June 2006.

The move to voice and data integration is encouraging corporations to outsource the supply of BCS. The scale of the conversion and the associated risks, together with the management of the merged network present an opportunity for MNCs to leave the business of self-supply. Behind this is the view of most enterprises that telecommunications is not a core function and therefore something that ought to be outsourced to third parties.

IP-VPNs present problems for corporations seeking to ensure positive regulatory compliance. Many countries continue to use regulations that are technologically obsolete and that make no mention of the types of networks and services currently in use. For example, the use of IP telephony and connections from an IP-VPN to the PSTN and the Internet may neither be legal nor illegal but left in a regulatory limbo.

4.2 Enterprise cellular services

Cellular mobile networks remain distinct and separate from fixed networks for multi-national corporations. The offers by the mobile operators are national in scope and they focus on voice and value-added services, rather than access to enterprise applications and integration with corporate fixed VPNs. Even combining numbering for mobile services with a corporate numbering plan can be very difficult.

The criticism of large corporate clients is that operators appear to have limited interest in their requirements and future plans. For example, it is almost impossible to obtain an SLA for mobile, something available on fixed networks for more than a decade. Such an SLA would be expected to specify the coverage, the data rates available, the limits of jitter and packet loss, in order that customers could ensure their various applications would work properly.

The mobile network operators make national offers and provide services country by country. Although a number of geographically extensive groups have developed footprints through acquisition and network construction, they continue to treat their customers as being national. Sometimes this is because the footprint is an incomplete patchwork. It is often aggravated by the lack of integration of national management teams.

The recent decisions by one of the largest GSM operators to withdraw from key markets makes clear its lack of interest in providing the seamless trans-national services sought by multi-national corporations. Instead it appears to be concentrating on growth in consumer markets.

The significance of trans-national offers varies greatly by continent because of differences in travel patterns. It is in Europe, with the high level of trans-national integration of the European Union and its single market that travel is the most intense and thus trans-national offers most important. By comparison, there are much lower levels of travel and therefore lesser concerns about roaming in Africa, Asia and Latin America. However, the overall arguments for continental contracts remain strong, in terms of a single point of contact, one interface to billing software and one supplier with whom to discuss future needs.

Over many years corporations have built up their use of roaming for voice, generally with very limited financial controls. Despite this, there are established patterns that are, after a fashion, allowed for in budgets. However, the prospect of adding to this large and entirely unpredictable bills for data roaming has caused

corporations to be extremely cautious in allowing employees to use data services. Instead, corporations have sought alternatives with more predictable spending patterns.

There are signs in Africa that operators are abandoning the practice of charging for international roaming. Two operators have abandoned voice roaming surcharges in East Africa, with one having dropped surcharges for GPRS on a much wider footprint.⁴⁰ It remains the approach of a tiny minority of network operators, aimed at consumers with limited spending power, rather than the needs of corporations.

While initial access to data application was by dial-up to dedicated numbers this was gradually widened to add access from broadband and Wi-Fi hot spots. In many corporations this is outsourced to third party suppliers able to ensure the widest possible access with simple and seamless access for end customers.

There are very few MVNOs aimed at enterprise customers because of the difficulties in obtaining the wholesale access from licensed operators.⁴¹ One small West European MVNO offers a multi-country service, without roaming charges, in four and soon six countries in Western Europe.⁴²

Given the lack of progress with cellular operators, corporations have found alternative solutions. Corporate mobility is now provided with a wide range of technologies, notably broadband access from homes and hotels, plus Wi-Fi hot spots where they are available, falling back on dial-up where there is nothing else available.

4.3 Mobile enterprise applications

One of the technologies that supports secure remote access from different networks is Session Initiation Protocol (SIP) which is now being deployed by corporations. In particular, it allows access to voice and instant messaging services and to enterprise software applications over DSL and Wi-Fi, and eventually WiMAX, with potentially significant cost savings.

The development of Mobile Enterprise Applications (MEA) or of mobile access to conventional enterprise applications has been very slow. In part this is due to the technical characteristics of the cellular networks which are very different from the fixed business networks, with problems of jitter and latency. Most efforts have tended to focus on support for applications that would boost sales.

One exception to this has been the introduction, from the late 1990s, of dedicated devices for electronic mail. Initially these operated on bi-directional pager networks, but were later moved to run on Internet Protocol over cellular networks. With a flat monthly fee they have been seen as both relatively affordable and a valuable personal productivity tool. However, the latter claim is unmeasured and open to doubt given the somewhat obsessive use made of the service by many executives, often well beyond conventional office hours.⁴³

An area of increasing concern for corporations is the security of their fleets of mobile devices. This includes protection against viruses, trojans, worms, phishing attacks and the like. Increasingly corporations seek integrated solutions that ensure proper protection before a device connects to their network with a series of verifications that the device and the user should be connected and the privileges they should have while connected. Where a device is lost, corporations want to destroy the data remotely, even if it is encrypted. These challenges are quite different from their fixed networks and the solutions are not integrated.

There has been a string of disclosures of personal data in the United States from the loss or theft of portable devices. These have occurred across all sectors, including branches of government, universities, private sector companies and telecommunications operators. These emphasize the inadequacy of policies and security measures imposed on devices and users by these organizations.

Information systems directed by corporations towards their customers remain unconverged. For example, banks will offer notification of transactions by SMS, while allowing a much wider range of interactive facilities when the customer uses the fixed Internet. Some European railway companies allow customers to

make reservations using the Internet then present the SMS as their ticket. The two technologies are seen as distinct channels to the customer, with different economies and social characteristics.

Similarly, customer services are usually distinguished between fixed and mobile. There are different charges for customers, with few freephone or toll-free numbers on mobile networks. Mobile operators also use separate short code number ranges from the fixed networks.

4.4 Separate and different

The forces on the enterprise market in terms of demand and supply have resulted in quite different outcomes from retail or consumer markets. However, examples such as the slow adoption of weblogs and instant messaging indicate that businesses will, to some extent, follow the lead of consumer markets in applications.

Voice and data are converging on fixed networks, with high levels of assured quality. Mobile networks remain quite separate, with cellular wireless operators focused on national offers of voice services, with some messaging services. In particular, operators have been reluctant to offer affordable tariffs for data with SLAs. As a result corporations have had to achieve a significant degree of nomadic access with non-cellular solutions in the absence of offers of quadruple play.

5 Policy frameworks

While the scope of legislation and regulations invariably covers both fixed and mobile it does so in different and asymmetric ways. Ensuring the determination of location from which calls are being made to emergency services may be strictly enforced for VoIP operators in some countries, while mobile operators have been granted more time to resolve engineering issues.⁴⁴ Likewise, mobile operators may be relieved of directory service obligations that are imposed on fixed line operators. Often, the presumption has been that mobile was or would be more competitive than fixed, and would therefore require less regulation.

As a result, fixed operators have often sought to obtain the perceived privileges of mobile operators while they in turn resisted the imposition of “legacy” regulation. In time and after careful analyses the differences in the levels of competition have proved to be less than was once supposed, requiring the judicious imposition of some of the tried and tested regulatory measures on mobile operators, in order to resolve the market problems.⁴⁵

This section considers numbers, relevant markets, the ubiquitous network society policy model, unified licensing, voice over Internet protocol and legacy regulation.

5.1 Numbers

The telephone numbers used for fixed and mobile networks have been kept separate in most countries, though these could easily have been combined. There are a few exceptions, such as North America and Hong Kong, China.

Number ranges have typically distinguished fixed or geographic numbers from mobile networks. While the number ranges for fixed networks indicated the location, mobile ranges have often identified particular operators. Indeed, many mobile operators prefer this because it allows them to use the number as part of the brand and assists their efforts to keep groups of customers on the same network by offering lower prices for on-net calls.

As tariff plans have gradually lost the distinction between local and long distance the value of a number as a geographic locator has become less important on fixed networks.

Where the Calling Party Pays (CPP) system is used, then the number ranges must be kept separate because of the considerable price differences in calls to fixed networks and to mobile networks. The numbers are

required to act as a warning about the price of the call. However, many number plans are too complex to be generally understood.

In many countries number portability has been introduced in order to increase consumer choice, to reduce switching costs and intensify competition. In countries with RPP it is possible to have portability between fixed and mobile. In the case of CPP it is much more problematic, since it is unlikely that the receiving party would want to pay the cost of the MTR on incoming calls. It would therefore be necessary to warn the caller that the call would be more expensive. This is generally considered a strong disincentive to its application.

A previous generation of national assignments of numbers for personal services failed. This was due to the rapid growth of second generation mobile, the inconvenience of having to update contact numbers for call forwarding in real time on a remote server and the high cost of the service.

5.2 Relevant markets

In approaches based on or using competition law, the unit of analysis is the relevant market. This has a much stricter definition than used in marketing, in policy formulation or in *ex ante* regulation.

The European Commission has undertaken a review of its Recommendation on the markets to be analysed by national regulatory authorities. This document has a complex history, emerging from *ad hoc* regulatory measures in the 1990s and brought together in the Framework Directive in 2002.⁴⁶ The markets were then analysed under competition law principles, then opened for comments by operators, before being adopted as a Recommendation in 2003.⁴⁷

In mid-2006, the EC made its proposal to revise the list of markets.⁴⁸ It removed several retail markets, in order to concentrate on wholesale markets. It retained separate markets for call termination, access and call origination on fixed and mobile networks. It noted that:

*In the initial Recommendation, a general division was made between services provided at fixed locations and those provided to non-fixed locations. Overwhelmingly, despite some moves towards converged offerings, this distinction remains valid.*⁴⁹

Among the differences are that on fixed networks customers have the possibilities of broadband Internet access, can use carrier selection or pre-selection for outgoing calls, while mobile is purchased as a bundle or cluster of services without a choice of alternative operators for outbound calls.

A supporting report noted that previous attempts at narrowband integration had failed, but that renewed efforts were being made with dual-mode handsets. It also observed that convergence could be considered to comprise both integration and substitution.⁵⁰ Despite a forward-looking analysis, call origination on fixed and mobile were seen as remaining distinct markets.

While noting that operators planned to deploy Next Generation Networks (NGN), no account was taken by the EC of the possible changes. It was left to future revisions of the recommendation to consider the effects of NGN, perhaps in 2009. The basis for this was that while the technical developments were considered interesting, at the level of economic analysis the effects on markets could safely be ignored in the short term.

In the United States the recent acquisition by one large operator of another required approval for the transfer of the licences from the Federal Communications Commission (FCC). In doing so, the FCC accepted separate commitments on fixed and mobile services.⁵¹ While broadband roll-out undertakings were made, these were to be provided by a mixture of ADSL and WiMAX. Likewise, the undertakings on network neutrality applied only to fixed networks and not to mobile, despite there being well-established offers of Internet access on mobile. The merger itself was approved by the Department of Justice in a consent decree which similarly kept the fixed and mobile apart.⁵²

In 1997 and 1998 the incumbent operators in Belgium and Denmark, launched “duet” services on fixed and mobile networks offering one number, one voice mail service, one subscription, one bill and one point of

contact. Both were discussed in parliaments and investigations were made by the public authorities because of concerns that other operators were unable to match the offers based on control of essential facilities and cross subsidization. As the Danish telecommunications regulator (Telestyrelsen) admitted the case was “characterized by great complexity and an exceedingly intricate process”.

The matter was raised in the Danish Parliament, the subject of a complaint by a competitor to Telestyrelsen, referred to the competition authority for an opinion and taken to the telecommunications appeals tribunal.⁵³ The matter was also raised in the Belgian Senate and the subject of a complaint to the telecommunications regulator, the Belgian Institute for Posts and Telecommunications (BIPT/IBPT).⁵⁴

The view of Telestyrelsen was that competitors had access to a number of products from the incumbent operator that could be combined with their mobile offers, by the wholesale purchase of minutes or of subscriptions, plus the possibility of taking over the “raw” copper local loops of the customer. Minor changes were made to the interconnection agreements to ensure competitors had sufficient access. One mobile competitor argued that the incumbent should become a service provider on its network, in order to provide the duet service, rather than it merely reselling service of the incumbent operator. Service providers on the fixed network were in an even weaker position, with no access to the wireless networks.

In retrospect, there seems to have been limited demand for the duet service, with fixed mobile convergence not having proved very attractive to customers. This may have been because there is not always a one-to-one mapping of fixed and mobile phone lines, with many fixed lines being shared with colleagues (e.g., group pick-up) and with family members. The complexity of the regulatory processes clearly delayed speedy and decisive roll-out of the service.

In 2006, the Commission for Communications Regulation (ComReg) in Ireland noted potential offers of ‘home-zone’ services from mobile operators. These enabled mobile phone customers to make and receive calls on their mobile phones in or near their homes at fixed line prices. Given the expressions of interest ComReg conducted a consultation to ensure they are introduced in the way that best suited consumers.⁵⁵

5.3 Ubiquitous network society

The policy model used by Japan and the Republic of Korea is the Ubiquitous Network Society (UNS).^{56, 57} These policies were both developed by collaboration between government and industry, including manufacturers, operators and service providers. They have the extremely ambitious aim to ensure the provision of services on any device, any network, any time and anywhere. Unlike the frameworks used in most countries the stakeholders look at markets from semiconductors through the complete value chain to value added services provided to consumers. In both countries UNS is driven by the intention to export large volumes of equipment and the associated systems in order to drive economic growth and the creation of jobs – effectively part of industrial policy.

An important difference from the European and North American perspectives is that it encompasses the widespread provision and use of Radio Frequency IDentification (RFID) tags and Universal Sensor Networks (USN).⁵⁸ These are seen as providing manufacturing opportunities, through to value-added services for consumers. It raises interesting issues about privacy in order to reduce risks of rejection by consumers.

In the ubiquitous network society, operators are expected to provide:

- fibre to the home
- wireless cellular networks
- wireless broadband
- digital broadcasting

Consequently, the framework has to ensure competitive access for service providers across all of these networks. In particular it has to avoid operators leveraging power from one market to another. In some

respects the two governments have taken the easy option by ensuring that operators have opportunities to deploy all of these technologies, rather than having to develop access regulations.

The UNS framework is the most comprehensive set of policies created by any country. Moreover these are dynamic policies to allow for the introduction of new technologies and services as they become practicable, but before they are deployed. It is a long term evolution view of policy.

Some countries will be reluctant to adopt an approach that is clearly industrial policy. For many countries, the absence of large scale manufacturing and service industries may make the UNS approach inappropriate. It may also be difficult to conduct the same debate over policy, which would be dominated by network operators without the balancing manufacturing interests.

5.4 Unified licences

A small number of developing countries have created a policy of “unified licences”.⁵⁹ It is an endeavor to create a “future proof” licensing regime, building on strengths and especially competition in mobile markets to reinvigorate fixed networks. It also helps to expand providers of broadband Internet access. In many countries the fixed network operators are moribund and the introduction of a second fixed network operator has proved a very difficult and unsatisfactory process.

In the case of India the unified access licensing policy proposed by the TRAI in November 2003 was intended to calm some of the controversy between the GSM and FWA operators.⁶⁰ The number of lines on FWA networks has already overtaken the number on the copper fixed network, though still lagging GSM customer numbers.

The conversion to unified licensing has also been used to simplify licensing procedures, to ensure flexibility and efficient use of resources. Licensing can also be made scaleable, allowing and encouraging smaller and more efficient operators to serve niche markets. The success of this approach in rural or remote areas remains to be seen.

In Nigeria the mobile network operators had a period when there was to be no further market entry.⁶¹ This ended in 2005 with the Nigerian Communications Commission (NCC) moving to a system of unified licences. Within any geographical restrictions of their licences, the mobile and fixed wireless access operators were allowed and encouraged to compete with each other with restrictions on the types of services being lifted. Spectrum could be used for voice, data, Internet access and the like in particular, with no restrictions on handover between cells. These changes were subject to consultation with the operators.⁶²

The objectives of the unified licensing policy were:

- encouragement of the growth of new applications and services
- simplification of existing licensing procedures to ease market entry
- flexibility for operators in addressing market and technological developments
- efficient utilization of network resources, so that individual networks could be used to provide a broad range of ICT services
- admitting a full range of operators, including micro-entrepreneurs

A unified service licence permits an operator to provide fixed telephony (wired and wireless), mobile, long distance and international services. In particular, mobile operators were allowed to offer fixed services and Internet access. A continuing constraint on the number of licences is the available spectrum and the affordability of network equipment and customer premises equipment.

Unified licensing leaves spectrum policy to be decided in ways that encourage competition and ensure market entry for new players. This requires caps on the amount of spectrum held by any one player, with mechanisms to reclaim unused or underused spectrum in order that it can be re-assigned. There remain

difficult questions about the number of players the market can or will support and whether gradually to increase the number or to admit too many and to exercise control by means of merger control.

5.5 Voice over Internet Protocol

While considerable progress has been made in the provision of Voice over Internet Protocol (VoIP) on fixed networks, the same cannot be said for cellular wireless networks. The mobile network operators have been very reluctant to admit this possibility and have often prohibited it in contracts with customers and taken technical measures to block access. For the present, there has been very little policy work on mobile VoIP.

There are two obvious threats to the revenues of mobile operators from IP-based services. One is a shift from SMS to IM, with a payment per month or per byte at a fraction of the price charged for an SMS. The other is a similar process with voice over IP on mobile or at least wireless networks. The cellular operators have been extremely reluctant to allow access by their customers to VoIP and there are no obvious legal obligations that require them to do so. A primary concern is that the low unit costs and flat rate pricing plans could do considerable damage to their revenues. In particular, their long tail of low spending and especially younger customers could jump to flat rate price plans leading to significant reductions in ARPU. While cellular operators are able to control their networks to block or to degrade such services, it forces market entrants to look to other networks such as Wi-Fi and WiMAX. However, the equipment for these is not yet widely available or affordable.

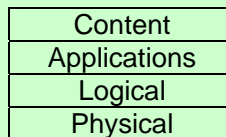
The other side of this potential collapse in revenues is that it would be much more affordable for customers and thus greatly widen the potential base of customers.

5.6 Legacy regulation

A number of countries have attempted to create convergence legislation, aimed at bringing together broadcasting and telecommunications. This invariably faces difficulties because of conflicting economic and political interests of the players and also the regulators.

Traditional regulation focuses on the type of network, and with convergence, the regulations often no longer fit the infrastructure. Instead, a layered model of regulation has been proposed, reflecting IP-network design, and policy makers in a range of countries have been encouraged to adopt it, especially by operators. In the United States it has been proposed as an alternative to the continuing exegesis of long-standing definitions of and distinctions between services.⁶³ Particularly in the more litigious jurisdictions, the uncertainty of the application of older legislation and case law presents opportunities for defensive plays in court, by operators seeking to delay or to disadvantage potential competitors.

Figure 2 Layered model of regulation



Some operators and service providers have survived and prospered in the gaps and holes in the legislative framework. Unintentionally, national and international frameworks can create regulatory niches that favor those players clever enough to devise a service that permits them to combine aggressive competition against incumbent service providers, but which qualifies them for arbitrary and anomalous loopholes. This can reduce or even exempt them from the costs and burdens of regulatory compliance and limitations in the market.⁶⁴

Much of this debate has been characterized, especially by operators, in pejorative terms as “legacy” regulation, something unnecessary and inappropriate for Internet and mobile services. Such arguments have often relied more on political and economic assertions than on detailed proof of the competitiveness of the markets.

Where there are asymmetries in the burdens or opportunities created by legislation and regulation it creates the potential for artificial competitive advantages for certain firms. They will also seek to avoid certain classifications that create a bias toward more pervasive and costly regulatory burdens. Asymmetrical regulation has the potential to tilt the competitive playing field in favor of one category of stakeholder over others. Some operators have found ways to create arbitrage opportunities based on regulation in order to generate revenues and profits.

5.7 Converged regulation

The OECD has addressed the challenges in developing policies for effective regulation in this dynamic field.⁶⁵ It noted that audio-visual content was now accessible over all sorts of networks and devices, with national borders less effective as barriers. An international multi-platform environment was emerging with audio-visual content available anywhere, any time and in any way.

The United Kingdom merged its broadcasting and telecommunications regulators and added some competition law powers.⁶⁶ However, there is also a complex array of specialist independent regulatory bodies such as the ombudsman, premium content regulator and the advertising regulator. Malaysia also fused its broadcasting and telecommunications regulators into one body. This appears to remain some distance ahead of the industry, which is still far from converged.

In Germany, the convergence of regulators was based on networks, an approach intended to achieve economies of scale in economic regulation. The *Bundesnetzagentur* being given responsibility for electricity, gas, posts and telecommunications. Questions of moral regulation for content were left to the administrations in the *Länder*.*

The issues involved, the very different cultural and legal traditions and the uncertainties have made it hard to create legislative and regulatory structures that are politically acceptable and sufficiently abstract in their principles to apply to all services.⁶⁷, ⁶⁸ Expertise in economic regulation is not especially helpful and possibly unhelpful in the regulation of content. Issues concerning specific pieces of content can distract attention from longer term economic issues. The example of the potential overlap with banking regulation can hardly be solved by convergence.

Clearly all regulators need a sufficient understanding of the technologies and market trends. However, that does not require convergence of the regulatory bodies.

6 Conclusion

Convergence invariably sounds plausible but on closer examination has turned out to be inconstant, changing and often impossible to predict. There is no reason to expect these trends to stop or even to slow down.

The proponents of a new business model or a new technology expect to overwhelm existing players or to absorb all or a significant part of their revenues. Yet this has proved much tougher to achieve in practice or someone else has quickly appeared with an idea to steal their market. There has been no shortage of venture capital to fund market entry for disruptive players; the constraint has been on access to the networks. The forecasts of who would be the winners have constantly changed.

While strong demand exists for increased mobility in the provision of services, it is not always synonymous with cellular wireless networks. There is a range of user experiences on different devices with connections to

* Roughly translates as provinces.

the Internet. These offer degrees of mobility from fixed and residential through nomadic and to mobile and automobile networks.

Sometimes the mobile element is superfluous, or nomadicity is sufficient. Many people in LDCs can travel only on foot, by animal powered cart or, perhaps, by bus, so that seamless cell-to-cell mobility is hardly relevant. Equally, many business users are content with nomadic access to enterprise applications in offices, hotels and airports.

The ways in which people use services on networks are very different for cultural and economic reasons. Younger customers are playing an ever more important role in leading the market, notably in social networking, with parents and bosses following their examples.

The mass market for handsets and the enormous industry that supplies it have proved to be a continuing winner. They have engaged in considerable competition and shown themselves able to find a stream of new features that appeals, however briefly, to consumers. Yet while these are all portable many features are unconnected to a cellular network. The manufacturers have brand names known throughout the world. The recent collapse into bankruptcy of a formerly leading handset business proves the difficulties for those unable to keep pace with the leaders.⁶⁹ Yet there are more manufacturers willing to enter the market.

In developed countries fixed and mobile services continue to be treated separately in *ex post* economic analyses, a view supported by both competition authorities and telecommunications regulators. Conditions of demand and supply remain quite distinct. By contrast, some developing countries are moving towards *ex ante* convergence by the creation of service neutral or unified licences, a response to very different economic conditions. This latter approach may prove successful in bringing competition from mobile into fixed and could in time achieve convergence.

An example of the continuing distinctiveness of mobile is the attempt to boost .mobi, a global top level domain name created by mobile operators and manufacturers. This risks a repetition of WAP which after a being hyped disappeared from public view some years ago. Logically, web servers should be able to tailor content and services based on the device being used, without having to be addressed separately by the customer. Moreover, it means customers will have to type and to store different URLs on mobile and fixed devices, the antithesis of convergence. While the servers will know that the devices is mobile, they will have to work out the languages to be used and any geographical element to be used to tailor services.

For the moment, advertisers continue to view the fixed and mobile Internet in different ways and as different markets, with the mobile device seen as being personal. Given that many consumers cannot or will not pay for services, then advertising revenues are essential. While the demographics and responses of the two media are different, they will continue to be kept apart, attracting different revenue flows.

Corporate networks continue to add more flexibility in access, but with cellular wireless networks providing only one element of increased mobility. The requirements are too different from the consumer markets on which the mobile operators seem so fixed in their attention. There is not always a need for seamless mobility, nomadic access is often sufficient.

Tempting as NGN can seem, the implications for public policy remain nebulous and difficult to identify. On fixed networks it may be that IMS is adopted with the same rationale as on 3G, to facilitate the rapid introduction of services, with significantly increased control over access. Nonetheless, it appears that there will be two implementations of IMS in parallel. Given that there are almost no retail customers for NGN it is difficult to identify market problems that require resolution.

The challenge at the policy level is to allow the markets to flow and, where it is appropriate, to converge without taking sides. This means removing obstacles, promoting competition and protecting consumers all without prejudicing outcomes. Much as consumers and enterprises are enthusiastic about new devices and services, their appetite for convergence has been limited. Where there is demand, in multi-play, mobile and fixed become just channels in a mix that seems mostly to be about entertainment.

The concatenation of the terms fixed, mobile and convergence creates enormous vagueness, given the uncertainties of each term. In particular, the often highly misleading equation of mobile with cellular leads to unnecessary complications. Rather, there is a range of technologies that offer degrees of mobility, which meet a range of customer needs.

7 Abbreviations

2G	Second Generation
3G	Third Generation
3GSM	GSM plus UMTS
ADSL	Asymmetric Digital Subscriber Line
BCS	Business Communications Services
CDMA	Code Division Multiple Access
CPP	Calling Party Pays
DAB	Digital Audio Broadcast
DECT	Digital European Cordless Telephone
DMB	Digital Multimedia Broadcast
DSL	Digital Subscriber Line
DVB	Digital Video Broadcast
DVD	Digital Video Disc
EC	European Commission
ETSI	European Telecommunications Standardisation Institute
EU	European Union
FMC	Fixed Mobile Convergence
FTTC	Fibre to the Kerb
FTTH	Fibre to the Home
FTTP	Fibre to the Premises
FTTx	Fibre to the x (or anywhere)
FWA	Fixed Wireless Access
GPRS	General Packet Radio System
GPS	Global Positioning System
GSM	Groupe Speciale Mobile
GSM	Global Standard for Mobile communications
HD	High Definition
HG	Home Gateway
ICE	In Car Entertainment
ICT	Information and Communications Technologies
IEEE	Institute for Electrical and Electronic Engineers
IM	Instant Messaging
IMS	IP Multimedia Subsystem
IP	Internet Protocol
IP-VPN	Internet Protocol – Virtual Private Network
LTE	Long Term Evolution
MBMS	Multimedia Broadcast Multicast Service
MEA	Mobile Enterprise Application
MIMO	Multiple Input Multiple Output
MMORG	Massively Multi-user On-line Role-playing Games
MPLS	Multi-Protocol Label Switching
MoSoSo	Mobile Social networking Software
MVNO	Mobile Virtual Network Operator
NFC	Near Field Communications
NGN	Next Generation Network
NTSC	National Television System Committee
OECD	Organisation for Economic Cooperation and Development
OFCOM	Office of Communications (United Kingdom)

OFDM	Orthogonal Frequency Division Multiplexing
PAL	Phase Alternating Line
PC	Personal Computer
PTT	Push To Talk
PDA	Personal Digital Assistant
QoS	Quality of Service
RAN	Radio Access Network
RFID	Radio Frequency IDentification
RPP	Receiving Party Pays
ROI	Return on Investment
SECAM	Séquential Couleur à Mémoire
SDR	Software Defined Radio
SDSL	Symmetric Digital Subscriber Line
SIDS	Small Island Developing States
SIP	Session Initiation Protocol
SLA	Service Level Agreement
SIM	Subscriber Identification Module
SMS	Short Message Service
TCO	Total Cost of Ownership
UNS	Ubiquitous Network Society
USN	Universal Service Network
UWB	Ultra Wide Band
VDSL	Video Digital Subscriber Line
VPN	Virtual Private Network
VoD	Video on Demand
Wi-Fi	Wireless Fidelity

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and also the CDMA Development Group (CDG) LTE.

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⁵ See the IP Multimedia Subsystem Forum <http://www.imsforum.org/>

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