There are many different flavours of convergence. It can be achieved in:

- packets (everything carried by IP)
- devices (heterogeneous services in one device)
- services (applications, programmes and searching using many devices)
- companies (combining ownership of some or all of the devices, networks and services)
- legislation, regulations and the responsible agencies.

One of the earliest examples of convergence was based on the view that most homes in developed countries had both a telephone and television, leading to the development of videotex systems [1]. 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 in i-mode by DoCoMo, allowing content providers to offer services with the operator billing customers on their behalf. However, Minitel used a dedicated terminal, rather than a television adapter as had originally been envisaged.

A problem has been that the financial markets take quite short term views of the various market players and these views change, sometimes dramatically. Financial analysts expect to identify winners and losers, rather than a happy conjoining of interests.

Most of the backhaul traffic is or will soon be carried by optic fibre cables, because of its low unit cost and high capacity, with only a few exceptions where microwave and satellite have advantages. The gap from these to the customer will be filled by a mixture of wireless interfaces:

- short-range (e.g. UWB)
- hotspot (e.g. Wi-Fi)
- cellular (e.g. GSM and CDMA)
- broadcast (e.g. DMB and DVB-H).

Convergence, of a sort, has already arrived in the form of triple and quadruple play offers, spanning television, internet access, fixed and mobile telephony [2]. The speed with which these have appeared across the developed countries has been very rapid, with many previously distinct elements, not least voice telephony, being lost in a flat fee with discretionary spending on services and content.

The least welcome form of convergence has been that of criminal activity. What began as a few mildly annoying unsolicited mail messages has grown to a constant inundation, with around 80% of mail now being spam and having to be filtered out at the destination rather than being suppressed at or close to the source. From simple spam, the forms have been diversified to include more obviously illegal attempts to gain personal information through phishing and fraud. Spam on instant messaging (SPIM) was developed at an early stage. Methods have also been developed to fill comment spaces on web logs, known as Splog. There are justifiable fears of SPIT or spam over internet telephony.

Portable devices now face the heavy burden of supporting anti-virus software and firewalls, of interminable scans of files and of repeated updates with the risk that such loads will cripple them. So far, the saving grace has been that unlike the monoculture of Microsoft Windows on personal computers, which invites infections and parasites, mobile devices are much more diverse in their operating systems.

The policy model being used by Japan and the Republic of Korea is the Ubiquitous Network Society (UNS) [3,4]. This aims to ensure the provision of services for any device, any network, any time and anywhere. Operators are expected to provide services over fibre to the home, wireless cellular networks, wireless broadband and digital broadcasting. In particular it also includes the widespread use of RFID tags and universal sensor networks (UNS) for a range of new services. UNS is clearly driven by the intention to export large volumes of equipment and the associated systems in order to drive economic growth.

A number of countries have attempted to create convergence legislation, though it has generally proved difficult because of conflicting interests. In South Africa, the Convergence Bill became the Electronic Communications Act of
2005 but takes only very modest steps towards either effective competition or convergence, the regulators having already been combined. The United Kingdom merged its broadcasting and telecommunications regulators and added competition law powers, but with an array of specialist independent regulatory bodies such as the ombudsman and premium content regulator. Likewise, Malaysia fused its regulators into one body, far ahead of the industry which is still far from converged. In Germany, the convergence was on networks, with the Bundesnetzagentur being given regulation of electricity, gas, posts and telecommunications.

The issues involved, the very different 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 [5,6].

This article considers the different forms of convergence in devices and in content, then it examines issues specific to South Africa, then contrasts them with the rest of Africa, before drawing conclusions.

Devices

The idea of a converged device is comparatively old. The example of the videotex terminal provided both telephony and access to information services in the 1980s. There were also PCs at that time which, even before Ethernet and Token Ring local area networks, connected as remote terminals to minicomputers and mainframes.

The Fusion project from British Telecommunications looks very much like the GSM/DECT combined handsets from the 1990s. This time it combines Wi-Fi while at home with GSM elsewhere. What is missing, so far, has been the volumes of demand that will drive down the prices and trigger widespread adoption.

Sony has long been known for its Walkman range of music players and for its PlayStation games devices. In 2001, Sony merged its mobile phone interests with those of Ericsson. It has chosen to combine the range of available technologies in different ways. The recent Sony Mylo (My Life Online) comes with Wi-Fi, web browser, instant messaging and Skype (for VoIP). It has a conventional, if rather small, slide-down keyboard, and gigabytes of storage for music and video, which it can play in several formats on its high resolution display. The PSP3 and several MP3-enabled phones have different ranges of functionalities, being aimed at different market segments.

Phones now take on supplementary roles that are unrelated to any telecommunications. They can replace a watch, often with a time display showing even when closed. They can be a camera which may seldom be used for MMS or video telephony, but is used to upload video clips to MySpace and YouTube. There are also television receivers and banking instruments.

South Korea has been working on digital multimedia broadcast (DMB), both terrestrial and satellite. Handsets such as the Samsung SCH-B500 combine CDMA2000 1x EVDO and S-DMB, with a 2 Megapixel digital still camera, high resolution display, MP3 player, Bluetooth, document viewer and television output. The satellite DMB service is provided by Tu-Media to complement the terrestrial cellular networks.

Sony has developed the Felica system for contactless identification at very close range. This allows the user of a mobile phone fitted with an RFID chip, to pay for certain transactions from stored credit, for example, for tickets on Japan Railways, for concerts and cinemas, and also for purchases in some shops. The same system can also be used as an access control for schools, gyms and businesses.

NTT DoCoMo, a leading cellular operator in Japan, uses the “ID” credit card brand for card issuers, enabling DoCoMo customers to make credit card payments with the Osafu-Keitai mobile phone. Payments from a “wallet phone” are linked to the card, in addition to conventional payments with their plastic credit card. Similarly, in South Korea there is Moneta, combining several cards with a mobile phone for contactless payments.

The success of the RIM Blackberry is the obvious counter-example, since it is a specialist or dedicated device. Behind the Blackberry is some very limited convergence on the mail server, which allows remote access to an electronic mailbox that is also accessible from a personal computer. Nonetheless it has been very successful.

It is comparatively easy to combine many functions in one device, especially as the capability is built into the hardware and into software-defined radio. The addition of an RFID tag is straightforward and inexpensive. The result for the user can be the appearance of convergence, even if the device is using quite different networks and services depending on the specific application and the circumstances. The key to success lies in manufacturing on a vast scale and in achieving the right combination of features for consumers without overstretching the capacity of the battery.

Content

In some respects the content accessed by customers through converged services will be the same, but it will also be different in terms of its production, distribution, its regulation and its consumption.

Sling Media has developed NTSC, PAL and HD versions of its Slingbox, which sits in the home of the customer to allow remote access to satellite or terrestrial television and also to a DVD player or personal video recorder, streamed to them over the internet. The software client was initially on a conventional PC with fixed broadband connection. Sling Media even suggests it can be used in planes equipped with Wi-Fi. Access was later extended using a client for handheld devices.

The importance of searching for content has created a tension between the powerful search engines and the mobile network operators. There is no obvious victor, though convergence suggests that customers will want the same search brand regardless of the device or interface. On a mobile device searching takes

![Fig. 2: International roaming from South Africa.](image-url)
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.

Searching is increasingly for video content, highlighted by the merger of Google and YouTube or “Gooïble”. A significant proportion of that content is being generated by users, often using mobile phones, but uploading over fixed broadband links, because cellular networks are too slow and too expensive.

Already there is one contribution to the language with “mobisode” for a specially constructed episode of a television programme for viewing on a mobile device. This hints, but perhaps no more, at the types of changes we will see in the forms of presentation. Servers will have to distinguish between small screens of mobile phones and massive displays in the home. Not only will the content be scaled, but it has to be tailored to fit the different modes of consumption. Mobile television will have to converge with fixed IP television.

In Japan the list of popular handset manufacturers is unlike other countries, largely because the operators have tightly coupled the handsets to the services on their networks. This has been essential to ensure that the services are accessible and that a high quality experience is delivered.

The development of new forms of content will require considerable time as many technologies, social and business models are brought together. Social networking and searching are the fashionable elements in 2006, but more will be added next year.

South Africa

At one time South Africa had the best and largest telecommunications network in Africa, even if access to that network was far from equitable. Since the mid-1990s there has been considerable growth in the numbers of GSM customers, though the market is a virtual duopoly. The country has a strong content creation sector. All of these should have put it in a strong position for convergence.

However, the adoption of fixed broadband has shown very poor performance, largely because of the monopoly of the incumbent operator (see Fig. 1). In the absence of competitive cable television networks, the only broadband network has been the PSTN of the incumbent which chose to price ADSL at levels that give even the middle classes pause for thought. Sentech has a wholesale wireless broadband offer, but not one widely adopted. With no competitive check on its behaviour, the incumbent has failed to create a market for broadband internet access, beyond a very selective niche.

HSDPA has been pushed by the “3GSM” operators as a sort of substitute for ADSL: a data card for internet access, rather than applications on a handheld device. The result is high prices that address a small niche of mobile business executives. 3GSM is itself a strange hybrid of two quite different technologies forced together in the handset.

It would be very expensive if customers were to take their HSDPA cards abroad. Fig. 2 shows the prices charged by one operator for international mobile roaming. The Megabytes for which the customer is charged include the TCP/IP overhead, so that one Megabyte of user data will generate charges of 150 to 250 %. Given that HSDPA will deliver data at up to 1,8 Mbps, a customer could generate punitive charges in a matter of minutes.

Compared to Europe and North America, South Africa is years behind in liberalisation of telecommunications markets, with very slow progress being made and no clear timetable for the future. The multi-play offers seen in the north are not available in South Africa. For example, illiad, under the free.it brand in France, offers a package for €29.99 (approx. R270) per month, several television channels, up to 28 Mbps ADSL2+ and free telephony to fixed networks in France and a dozen other countries. Even Vodafone, which traditionally eschewed copper lines as obsolete, has moved into triple and quadruple play to meet customer demand.

Such multiplay offers pre-suppose effective competition on mobile markets combined with either commercial wholesale negotiations with fixed operators or regulated access to those networks. Unbundling has evolved into a range of different categories:

• shared access
• bitstream access
• unbundled local loop
• naked copper.

Each country attempting implementation has faced tough resistance from its incumbent operator. At its most extremo, operators threaten a strike on further investment if regulation is not eased, most recently in Australia and Germany. Local loop unbundling is not a policy for the faint of heart. It requires robust legal powers, a dogged determination to enforce them and persistence to refine the enforcement. Incumbent operators have shown a remarkable strength in resisting such policies and in frustrating the efforts of governments and regulators to introduce competition. In the case of South Africa, it would be a careful judgement to decide that the rewards of opening the existing substantial copper local loops to competition would open up the market for broadband.

The failure of the broadband market requires action by government to kick start competition. There are several lines of attack of which one is likely to be local loop unbundling. Other infrastructure will also be important, including spectrum for wireless services. Additional and more effective competition in mobile networks will also be essential.

The rest of Africa

GSM has been an enormous success, Fig. 3 shows the growth in recent years. Even though this is systematically overstated by operators, the growth and totals are impressive. Access is further
Verde Islands, some 420,000 people on 4,000
networks, but these have still to reach a critical
pushing WiMAX as an alternative to copper
countries having cable television. Intel has been
There are seldom alternative networks, with few
ADSL, with mobile operators moving to multi-
Egypt is planning a significant expansion of its
One area where the GSM operators are keen
to see convergence is in banking. They already
have many more customers and are growing
much faster than the banks and they present
m-commerce as an alternative to traditional
banking. Offering financial services to the
“unbanked” would be a means for them to
increase their revenues. Once again, this
emphasises the importance of competition
in the mobile sector.

While 3G has been deployed in a couple of
countries and licensed in several more it is far
from clear what the business models will be. At
present, it appears to be a substitute for fixed
Internet access. However, this is a relatively low
value proposition, compared with the value-
added services being deployed in countries
such as Japan and the Republic of Korea. Where
literacy rates are low, selling text-based services
will be a problem.

There is relatively little fixed broadband in Africa,
with some xDSL and a few WiMAX networks. The
leader at mid-2006 was Morocco, which had
over 300,000 ADSL lines or around 1% broadband
teledensity (see Fig. 4). Menara, the incumbent
operator, offers monthly tariffs including:
- 128 kbps for the equivalent of R135
- 2 Mbps or the equivalent of R450
- 7 Mbps or the equivalent of R720

Egypt is planning a significant expansion of its
ADSL with mobile operators moving to multi-
play.

There are seldom alternative networks, with few
countries having cable television. Intel has been
pushing WiMAX as an alternative to copper
networks, but these have still to reach a critical
mass.

An offer of triple play can be found in the Cape
Verde Islands, some 420,000 people on 4,000
square kilometers, far out into the Atlantic. CV
Telekom offers ADSL and through CV Multimedia
provides DVB-H. Cabo Verde Digital, part of
Xiamen Sinonets Electronics, has a competing
DVB-H package. This suggests that business
models will emerge that are widely applicable
across the continent.

There are many problems in developing
broadband in Africa. The dearth of copper
networks and their poor quality means that
ADSL technologies are applicable only in some
countries and only in some parts of those
countries. Electricity supplies are often not
available and even when they are can be far
from reliable requiring protection for computers.
Beyond these basic concerns, markets have to
be created for Internet access and for value-
added services, generally amongst people with
limited income and no experience of purchasing
such services. Satellite will play a role, both in
backhaul, but also in digital broadcasting.

Conclusion
Convergence invariably sounds convincing but
on closer examination has turned out to mean
that one party or one technology was expected
to beat or absorb others and this has proved
tougher to achieve in practice. The forecasts of
who will be the winners change quite rapidly.
The mass market of handsets and the enormous
industry behind this have proved to be one winner.
They have engaged in considerable
competition and shown themselves able to
find new features that appeal to consumers
and have brand names we all know. The recent
collapse of the RenQ-Siemens handset business
proves the difficulties for those unable to keep
pace with the leaders.

For all the talk of convergence amongst
regulators they continue to treat fixed and
mobile separately. Broadcasting is even clearly
separate, with regulators, where they exist, clearly
struggling with the pace of change.

For all the progress, Africa falls behind, especially
North-East Asia. The GSM model is reaching its
limits, in coverage and in business models. It is
necessary to find something new for rural and
for 3G, operators cannot go with high MTRs and
expensive pre-paid calls for much longer. In
many countries mobile operators may become
the leading banking institution and potentially an
important broadcaster.

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