Visitors to this year's 3GSM World Congress in sunny Cannes could have been forgiven for being a little disorientated. Two years ago an Iridium handset was the cutting edge business tool and last year it was a WAP phone. Both were decidedly off the menu this year for delegates looking for signs of life beyond second generation (2G) wireless communication services. The search for compelling value added services continues as third generation (3G) mobile communication services stagger to their feet in Europe.

The Road to 3G

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HISTORY

Readers of *TTi* will already be familiar with the benefits of radio communication links for advanced transport telematics applications. From traffic information services to automatic fee collection and fleet management – radio communications connect the vehicle with the highway and its occupants with useful services, including Automatic Fee Collection and subscription-based broadcast of congestion alerts. The development of mass-market personal communication technology has been developed in parallel and has been extraordinarily successful - as witnessed by the explosion in numbers of GSM subscribers to 452 million globally served by 400 mobile network operators in 162 countries. Overall GSM represents almost 70% of the world's digital wireless market according to the GSM Association (www.gsmworld.com). This growth has been accompanied by the emergence of new categories of service provider and application developers that are packaging information for on-demand consumption by people on the move. GSM is only one of several second generation (2G) communication technologies currently evolving to advanced third generation (3G) technologies.

This article charts the fragile attempts to push current technology beyond its capability, users that want more than voice services, application developers looking beyond fixed line Internet services and cash-strapped operators trying to piece the whole jigsaw together.

WHAT IS 3G ANYWAY?

Many of us will remember the first generation analogue mobile phones based on circuit switched links providing callers with virtually no security. Second generation (2G) mobile networks such as GSM, CDMA and D-AMPS use digital encoding and all offer some security through encryption. Additional services include limited data capability, fax and text messaging (SMS). Future third generation (3G) networks will support much higher data rates intended for applications other than voice such as full-motion video, Internet access and other bandwidth-hungry applications. Technologies that bridge the gap between 2G and 3G are known as 2½G and as we will see later extend the capability of 2G to prime the market for future advanced applications. There are regional flavours

of 3G but put simply, Japanese consumers will be able to experience 3G services later in 2001 but Europe's rollout is now expected to be delayed to 2002 or 2003 according to recent press announcements from network infrastructure vendors and operators.

Preparation for any mass-market communications requires partitioning of radio spectrum and, as caretakers of this valuable resource; national governments guided by ITU rulings have been re-allocating spectrum from 1G and 2G services to meet the expected demand for 3G. This controversial process has occupied government regulators worldwide from 1999 onwards, mostly aiming to raise revenue from the sale of operating licenses and define the rules where 3G newcomers can compete with the ubiquitous heavyweight incumbents.

TAXING TIMES

3G license fees paid by operators effectively amounts to a government-imposed tax on future operator revenues. The UK government (www.spectrumauctions.gov.uk) must be feeling decidedly satisfied that its auction for 3G operating licenses process netted over £22bn for its coffers exceeding its most optimistic expectations. For mobile network operators the slice of radio spectrum that is licensed over a fixed period is the primary 'channel to market' and for each of the largest 2G mobile network operators £4bn was the price to protect their current brand and their future 3G business in the UK with similar fees being paid by each new market entrant to secure access to an unsuspecting wireless-enabled public.

The Value of a Subscriber

Country	3G license cost / subscriber [US$]	Population [millions]
UK	595	60
Germany	557	82
The Netherlands	158	16
Austria	98	8
Singapore	87 (expected)	4
Belgium	82	10
Switzerland	17	7

Sources include SG Securities Pte.

Table 1. UMTS License Fees per subscriber

So, as the dust settles on the record-breaking UK and German auctions other governments worldwide are preparing to ramp up their auctions with modified rules to permit 2G incumbents to fight it out without cutting out the new entrants either by reserving dedicated spectrum or sharing it. However, with less cash around and lines of credit drying up operators with global subsidiaries have found it increasingly difficult to raise the capital to compete. So, with reduced competition the value of local 3G licenses has been weakened (Table 1) and in some cases auctions postponed through lack of bidders as in Austria and Italy. Alternative methods of awarding licenses include 'beauty parades' (comparative value-based tendering) or simply providing the licenses without charge to operators selected

according their ability to deliver mass market 3G communications services to an agreed government-imposed timetable.

South East Asian governments are also playing the game although by different rules. The Hong Kong SAR government regulator OFTA (www.ofta.gov.hk) has taken the innovative step of announcing that it will charge 3G operators a royalty with a guaranteed minimum payment. In effect, a combination of risk sharing with a fixed fee. To further encourage competition and service innovation a new breed of operator, otherwise known as a Virtual Network Operator (VNO), will be permitted to access upto 30% of the Hong Kong incumbents' 3G networks to deliver competing services. If 3G services take off the VNOs will demand access. If services don't then the VNOs won't. In short the VNOs acting by the rules of Hong Kong licensing model can hardly lose although it is hoped that the winner overall will be the consumer.

"…as markets reach saturation and subscriber growth slows down it will not be possible to depend entirely on new subscribers for new revenue…"

The celebrations by successful tenderers in some European countries have been short-lived. Operators are now facing upto the reality that they will recover the cost of the licenses later than expected and will still need to pay for 3G infrastructure roll-out and all this to be funded by consumers that have already been educated to pay less and less for calls. The estimated time to recover costs ranges from 4 to 6 years. In addition, a combination of intense competition from upstream suppliers serving operators with reduced purchasing budgets presents the prospect of reduced infrastructure prices and network sharing. Another contribution to accelerate the downward spiral of telecom stock, divestment and downsizing. So where will future revenues come from?

The value of a consumer to an operator can be expressed by Average Revenue Per User (ARPU) and the objective is to grow this over time from each user group that the operator serves. So, as markets reach saturation and subscriber growth slows down it will not be possible to depend entirely on new subscribers for new revenue sources. In short, operators need to increase ARPU by delivering compelling added-value services. And therein lies a tale.

HYPE v REALITY

The industry body The UMTS Forum (www.umts-forum.org) recently published its study of possible applications that will drive 3G revenues and fund infrastructure roll out. Top of the list are high-speed mobile Internet access and multimedia messaging. The much-vaunted technology Wireless Application Protocol (WAP) was presented as an interim step to future broadband content-rich services although initially targeted at 2G. WAP was developed under the auspices of the WAP Forum (www.wapforum.org)

and describes the method by which internet-style content is packaged and transferring for display or further manipulation by so called WAP-enabled mobile phones - a 'must have' for GSM operators today.

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User expectations were high – many expecting to be able to surf the Internet whilst on the move. Reality was far short of expectation however as the other components such as high-speed network infrastructure and a critical mass of content providers and applications failed to materialise in Europe leaving WAP to slide gracefully down the far side of the 'hype curve' to lie in waiting for these other building blocks to be assembled. The importance of linking the availability of these transitional technologies, matched by new business models and contractual relationships with content and application providers cannot be underestimated. A partial solution is unlikely to work as the experience with WAP highlights.

As we saw earlier the road to 3G includes transitional technologies known collectively as 2½G. In addition to WAP this includes technologies such as HSCSD, GPRS and EDGE (Table 2). Companion technologies and building blocks for mobile devices and terminals include Bluetooth (www.bluetooth.com) for localised communications and operating systems (OS) such as Symbian EPOC, Microsoft Pocket CE and the recently announced Microsoft *Stinger* complete with a small application suite for voice-centric terminals.

Building Blocks

HSCSD (High Speed Circuit Switch Data) permits the terminal device to use multiple time slots to enable data transfer upto 57.6 kilobits per second, three time higher than the current single slot mechanisms. Over 30 operators, including SingTel and Orange offer HSCSD-based services at 28.8 kilobits per second or above.

GPRS (General Packet Radio System) breaks the data stream into packets and permits terminals to set up connections almost instantly. Users are billed only for the amount of data transferred not the time taken to complete the transfer. As an upgrade to GSM data rates upto 115 kilobits per second is possible. Dual mode GSM and GPRS terminals are now entering the market.

EDGE (Enhanced Data Rate for GSM Evolution) optimized GPRS to permit rates upto 384 kilobits per second, suitable for broadband multi-media services and applications such as videoconferencing and video broadcast. Its US variant is known as 'Compact' EDGE.

Table 2. 2½G Access Technologies

NTT DoCoMo (www.nttdocomo.com) has already shown what is possible to achieve with Japan's existing 'PDC-P' 2G wireless technology. DoCoMo has already assembled

a critical mass of component technologies ahead of its European and US counterparts. Backed up by several news aggregators and Time Warner for content, AOL's email and internet delivery systems and 14 distinctive mobile phones DoCoMo has captured 19.7 million users since the launch of *i-mode* (www.nttdocomo.com/imode/) 2 years ago Current growth now exceeds 45,000 new *i-mode* subscribers every day. *I-mode* now embraces interactive games, restaurant guides and shortly location-based services. DoCoMo has also announced that it will launch phones embedding the Java software platform to make it easier for mobile application developers to put an application in the hands of the user.

The success of *i-mode* is therefore not dependent on any one component but a whole package. Furthermore DoCoMo's willingness to enter into revenue-sharing contracts with application providers to spur application development is a model that only a few European operators, KPN included, are willing to try.

WALLED GARDENS

Meanwhile in Europe, mobile operators are busy assembling portfolios of mobile commerce (*m-commerce*) applications available through mobile portals that permit users to pay for services via their mobile phone or credit card bill. The tightly controlled bundle of Wireless Application Service Providers (WASPs) selected and sponsored by the host network operator and its portal is known as a 'walled garden'. A user wishing to purchase goods and services is guided to play only in the walled garden with limited or no access to other service providers. Growth of m-commerce will depend on the early success of these ever-growing wireless portals such as Mviva (www.mviva.com) but one question remains: for how long can mobile operators retain control of content and service delivery?

There are alternatives. Credit card companies such as Visa are taking the initiative in Europe by accepting responsibility for user authentication for some of its authorised merchants. The desire to carve out a stake in the future m-commerce arena may further stimulate the providers of good and services to accept this new distribution channel, with the reassurance and the backing of a recognisable and credible credit card brand, so that users can comfortably pay for goods on-line with their phone.

> "A recent trial in Denmark by Sonofon showed that 75% of its postpaid mobile subscribers chose to pay for goods purchased on online with their mobile phone bill."

Demonstrating that mobile network operators can also be innovative, a recent trial in Denmark by Sonofon (www.sonofon.dk) backed up by 17 banks showed that 75% of postpaid mobile subscribers participating chose to pay for goods purchased on online with their mobile phone bill.

The continuing battle between operator-controlled portals and third party alliances will be played out in earnest on a mobile phone near you from the summer of this year. So watch this space.

MASS MARKET APPLICATIONS

So how will cash-strapped mobile network operators make the leap into a 3G wireless multi-media future that we have all been promised? A new paradigm may be required - I guess that we could call this mass personalisation of content and services. A sort of *Content To Go* (I may well trademark this). Mass personalisation of service delivery by time of day, user's location or lifestyle will be trademark of profitable applications each competing for space on the display on every user's mobile phone. The battlefield is becoming more active and even traditional banks are being threatened as two UK mobile phone operators recently applied for banking licenses.

The jury is still out on whether high quality live video can be transmitted efficiently. However interworking with Digital Audio Broadcasting (DAB) and Digital Video Broadcasting (DVB) is being considered for such applications since DAB and DVB systems have a much higher bandwidth. This suggests multi-mode terminals for some specialist applications.

"Mass personalisation of service delivery by time of day, user's location or lifestyle will be trademark of profitable applications each competing for space on the display on every user's mobile phone."

Just in case user expectations float skywards again NTT DoCoMo itself has played down any suggestions that 3G phones, at least the first versions, will enable users to sit glued to watching live video on a small screen for any length of time. Instead, voice calls, advanced mobile messaging and simple graphics-based phones will initially provide the majority of revenues for 3G mobile operators. Beyond that the mobile phone that we know today will, according to major handset manufacturers, morph into embedded data terminals, video-centric mobile terminals and wireless-enabled wearable computers. Market leading PDA manufacturers such as Palm (www.palm.com), Handspring (www.handspring.com) and Psion (www.psion.co.uk) have already added wireless connectivity for mobile workforces. GPS vendors such as Garmin (www.garmin.com) and Benefon (www.benefon.fi) have already created hybrid phone/navigation handsets for outdoor pursuits. This specialisation by lifestyle provides an indication of what a 3G future could look like. Major revenue earners for operators such as voice messaging will initially spawn voice and video clip transmission followed by streaming video and, no doubt, the video answering machine.

The possibilities are endless but this time, operators may well remember the recent experience with WAP as roll-out plans are developed. Any initial enthusiasm for 3G has already been limited by the expected late availability of 3G handsets. Packing dual mode GSM/3G transceivers, batteries and displays into handsets the size and cost of current generation 2G phones will be expensive and so initially limit their main use to corporate applications, coincidentally the source of high ARPU, high value niche segments.

NEXT STEPS

Since network infrastructure vendors are now ramping up to provide 2½G and 3G technologies (mostly with significant delays), it now requires innovation by application developers, content providers and other service providers to create service-related benefits to mobile users. The introduction of 2½G technologies and a more realistic view of the roll-out timetable of 3G infrastructure will give network operators and third party mobile portal operators a little more time to assemble the necessary pieces for compelling mobile services.

When 3G infrastructure and handset availability becomes reality from late 2002 onwards the early adopters are likely to be biased towards high ARPU corporate users. By that time many of the early services will have been proven and business models fine-tuned to the 3G environment based on experience gained on the 2½G battlefield. The combination of increased liberalisation of wireless telecommunication markets and recognition of the increasing importance of retaining mobile customers this may just provide the impetus for competition based on more dependable voice coverage and new content-rich multi-media services.

As we enter this 3G arena you can rest assured that *TTi* will keep you informed on the impact of 3G service roll-out and convergence with transport telematics in future editions.

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