

Telecoms Infotech Forum

Briefing paper

Hong Kong: A Test-bed for Third Generation (3G) Wireless?

September 1999

I. The phenomenal mobiles market

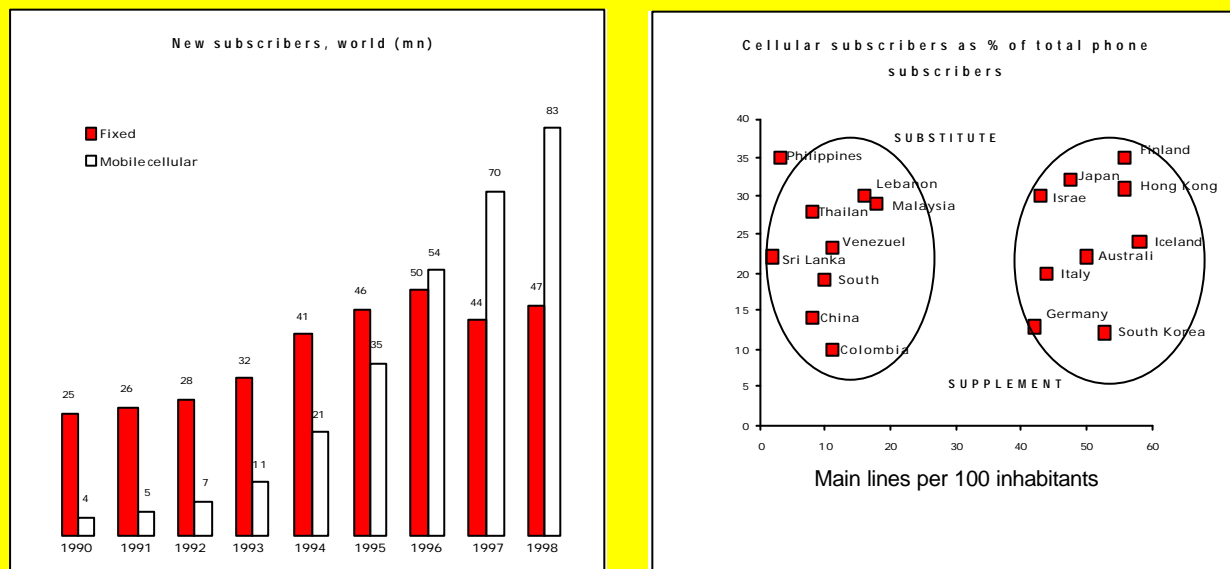
“There are twice as many mobile users in the world as there are Internet users.”

— Eden Zoller, Ovum Ltd. ¹

By 1999 there were almost 300 million mobile telephone subscribers worldwide – up from five million just a decade earlier (see figure 1, left side). And this growth is not slowing. In 1998 alone the total number of mobile subscribers grew by some 83 million; more mobile phones were sold worldwide than the number of automobiles and personal computers combined. Ericsson estimates that the total number of wireless subscribers will grow to 700 million by 2002, while Motorola estimates that there will be 1 billion subscribers by 2003.² In Asia, EMC forecasts that the number of mobile phone users will treble between 1998 and 2003, to reach 353 million.³

For many markets – particularly developing countries – the level of wireless teledensity has rapidly come to challenge the level of fixed wire teledensity, putting paid to the idea that mobile phones are either simply a complementary technology or an elite or luxury good (figure 1, right side). But even in developed markets such as Hong Kong or Australia the level of wireless penetration has been well beyond early expectations.⁴ And in Finland the number of subscribers to mobile phone services has already leapfrogged the number of fixed line subscribers. If given a choice, why pay for a phone that has to stay in one spot, when you can have one that is portable?

Figure 1: The growth of cellular



Source : ITU

¹ Ovum predicts that global revenue from mobile handset sales will more than double to US\$67 billion by 2004, with 65% of this revenue generated by smart phones and other datacentric cellular devices.

² Cited in *Wired*, September 1999, 136.

³ www.emc-journal.co.uk

⁴ As of May, there were more than 3.3 million mobile phone users in Hong Kong, with a market penetration of about 49% according to OFTA.

Walking and talking – communicating on the go – is where cellular phones have come into their own. But the Internet, and the convergence of data, voice and image, are on the verge of changing the economics and the dynamics of the mobile phone market, just as they have the PC market. Cellular phones, which were once used almost exclusively for voice, now promise a host of new service opportunities for operators.

Admittedly, the pundits have been predicting for some time that mobile data was going to be big. Really big. And for some time they've been wrong. By early 1999 there were still only some 2.5 million mobile data users in the US, compared to more than 70 million voice subscribers, and data represented less than 2% of all wireless traffic.⁵

The difference now is that the newly designed microbrowsers built into the next generation of mobile phones – the so-called third generation (3G) of mobile phones – allows for specially formatted Web information to be viewed on cell phone displays. And this, combined with high-speed wireless data technologies – including high-speed circuit-switched data (HSCSD), general packet radio service (GPRS) and enhanced data rates for global evolution (EDGE) – promises to overcome the crippling 9.6 kbps transmission speeds of existing cellular connections.

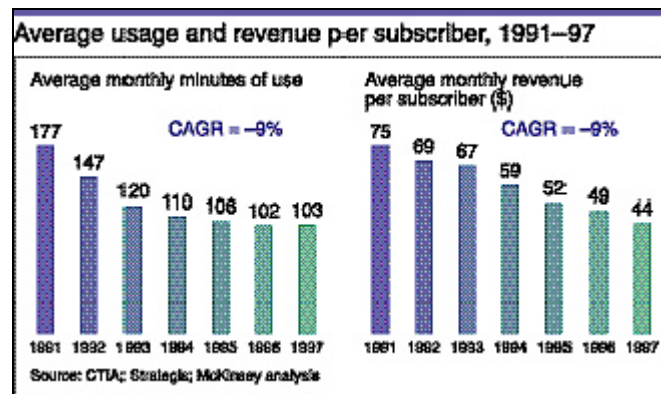
Transmitting data over cell phones isn't entirely new – Short Message Services (SMS) in existing GSM networks,⁶ and AT&T's PocketNet news and weather retrieval service have been around for some time. But, generating revenue out of many of these value added mobile services will not be easy. Early mobile data technologies have been clumsy to use, and wireless access to information services has been limited.

Three new criteria are combining to create a new playing field. First, the transmission speeds associated with 3G will make data exchange more feasible than they have been. Second, the Internet and the Web have already opened the public's eyes to what is possible and what is accessible – how many people now feel unable to live without access to their email? Third, rapidly declining revenue structures for mobile operators have meant that mobile systems are not now the cash cows that they once were. For the last several years the average revenue per user of mobile phones has been falling precipitously (figure 2), such that in competitive markets like Hong Kong, operators have found themselves running just to stay in place. In earlier, first and second generation mobile systems, hefty revenue streams were generated by high handset prices, high usage tariffs, or a combination of the two. Now consumers have come to expect comparatively cheap handsets, marginal usage costs, and – when mobile Internet access arrives – flat-priced (and in some markets, free) Internet access.

Data transmission, and the provision of information and entertainment services, promise to generate new revenue streams – but this is far from assured. Nevertheless, taken together, the new technological and social criteria mean that the push for market penetration is about happen in earnest.

⁵ Lowenstein, Mark, "Wire Cutters," *Business 2.0*, August 1999, 84.

⁶ Many existing GSM users have already had a taste of what is to come. SMS lets users send and receive messages of up to 160 characters on their handsets, and has proved to be increasingly popular, especially among young Europeans. More than one billion SMS calls were being made each month in Europe by early 1999. In fact, the mobile unit of Sonera Ltd. (Helsinki) was registering more SMS calls than voice calls. Blau, John, "A Movable Feast – WAP Technology Has Enticed Mobile Operators To Whip Up A Banquet Of Wireless Content Services," *Communications International*, August 9, 1999.



But market creation is not a given. Many questions remain if the success of first and second generation telephony is to be seen all over again. These include important issues of technological and manufacturing standardization, regulatory facilitation, and both inter-national and inter-network interconnection. In addition there are issues of content for the new platforms, and of funding to build the new platforms. In this background briefing paper we outline some of the major issues facing the developers of next generation mobile telephony along with some of the perceived opportunities. The following section overviews briefly just what 3G encompasses and how it differs from existing cellular services. Section III examines the 3G promise of anytime, anywhere connectivity and Section IV looks at the issues confronting policy regulators.

II. Third Generation

“Mobile is the Internet with billing built in.”

— Mato Valtonen, founder of WapIT.

In telecom-speak, analog cellular was the first wave, and digital networks the second. The third generation of data and voice communications represents the convergence of mobile phones and the Internet, high-speed wireless data access, intelligent networks, and pervasive computing. It is suggested that because of its increased accessibility and convenience, this new generation of mobile technology will not only shape how we communicate, but how we work, shop, do our banking, pay our bills, send our messages and schedule our appointments. But that is only the thin edge of the wedge. It will also shape how we gamble, have sex, conduct war and write poetry.⁷

In effect, this is because 3G is being sold as broadband. But then, in the age of Internet, many new telecommunication access technologies are being pushed as broadband. (Ironically, of course, the Internet has, until now, been a largely narrowband phenomenon.)

‘Broadband’ traditionally referred to anything above a T3 or E3 link. Nowadays it is much more casually used to refer to anything above a 64 kbps circuit. In reality the distinctions between narrowband (<64 kbps), wideband (<45 mbps) and broadband services have become blurred by technology as much as by marketing hype. For fixed wire connections, throughput has become a function not just of raw bandwidth, but also compression technology. Similarly, carriers looking to use multiple channels to provide mobile customers with higher bit rates will run into problems if they attempt to see incremental airtime on a pro-rata basis.

Mobiles get wappified

However, the next wave of telecom products *will* employ three kinds of data and voice transmission – i.e., three layers of radio. The comparatively slowest layer of coverage will be available anywhere a mobile phone can be used. A series of upgrades to mobile-phone networks in the next couple of years will bring bit rates from the current 9.6 kbps to three times the speed of ISDN connections, or 384 kbps.

The next notch up in speed, but with more limited areas of coverage will be wireless local area networks. To this end, telecom companies such as Nokia, Ericsson and Motorola are pitching wireless LANs to hotels and airports to create high-bandwidth ‘hot spots’ where business travelers can log on.

The third layer is a limited-range, low-power radio network that will allow every device carried in a user’s pockets or briefcase to communicate with every other device in the immediate area.

The driving force in these developments is what is known as the Wireless Application Protocol (WAP). WAP is a protocol and application environment designed for handheld devices that can be built on any operating system. Adoption of WAP is the first stage in building wireless multimedia, whetting users’ appetites for more and paving the way for 3G.

WAP-compatible mobile phones translate incoming Internet data to match the capabilities of the small screen mobile phone by turning HTML, the computer language in which Web sites are written, into wireless markup language (WML), which has been designed for mobile phones. In industry jargon, existing Web sites will be ‘wappified’. WAP essentially functions to minimize graphics and many of the Web’s other bells and whistles, so as to accommodate the limited screen size and functionality of mobile terminals. The technology requires a WAP server at the operator’s end and a WAP-enabled handset at the user’s end.

⁷ See Silberman, Steve, “Just Say Nokia,” *Wired*, September 1999, 138.

A de facto global WAP standard, version 1.1, was approved in June by the WAP Forum (www.wapforum.com), an association of vendors and service providers promoting the protocol. WAP is bearer independent, meaning that it runs on all network systems, such as GSM, CDMA and TDMA.

The protocol has already attracted the cooperation of software vendors Microsoft, Oracle and Sun Microsystems. But more importantly, manufacturers responsible for 95% of the world's handsets have announced the launch of WAP phones, and several service providers have already begun to integrate the technology into their networks (or plan to do so by the end of the year).⁸

The WAP and Bluetooth

In 1998, Nokia, Ericsson, Motorola and Psion formed the Symbian alliance, a private consortium for the development of 3G wireless systems. Symbian's aims are to increase bit rates in mobile-phone networks so as to be able to tie the accelerated networks into the 'Net. If successful, they will have "put the Internet into every pocket".⁹ The Symbian alliance's protocol of choice for the 'personal networking' layer (layer 3) referred to above is named 'Bluetooth'.¹⁰

Bluetooth (www.bluetooth.com) is built around a simple concept: lodging a radio transmitter in a chip. The result? Bluetooth is premised on the ability to enable cable-less communication between any two or more Bluetooth-enabled devices. This could run the gamut of peripherals, from printers, PDAs and desktops, through to phones and virtually any other digital device.

Bluetooth will allow a PC to 'zap' documents directly to a printer, for example, or to contact the user's list in the nearby Palm Pilot so as to automatically "sync up" with the PC database as soon as the user walks into their office. And then, when there's new mail, the computer will notify the user's cellular handset, which will display an alert message. Moreover, users could stay wired whenever they are – in the car, on the train or just in someone's waiting room.

According to the consortium, the WAP concept itself will be further strengthened once Bluetooth has been implemented in other small electronic devices. The combination of WAP and Bluetooth technologies will enable content providers, such as banks for example, to distribute small, branded calculators with keys that are dedicated to different services. In the banking context, a user will be able to press a certain key on the calculator to retrieve their bank balance. By pressing another key and entering the appropriate account number, the user will be able to transfer money to or from the account.

If this scenario begins to pan out, WAP-enabled devices could prove to be an even greater boost for E-commerce than the Web has been – because the payment systems are already in place.

However, while Bluetooth-enabled products may be commercially available by the latter half of 1999, adoption of the technology is not a foregone conclusion. Neither Microsoft nor Apple, which combined make more than 90% of operating systems that run on computers today, are part of the consortium developing the radio technology, nor are they in the list of companies which pledge to support the technology.¹¹ The initial cost of the Bluetooth transceiver chip is also steep at about US\$20 each. And herein lies the problem facing the purveyors of next generation options: prices of Bluetooth products

⁸ Japanese cellular carriers DDI and IDO have launched mobile Internet services based on an early WAP technology from Phone.com, formerly Unwired Planet.

⁹ Jorma Ollila, CEO Nokia.

¹⁰ The codename comes from King Harald Bluetooth of Denmark who united Denmark and Norway in the late 10th century.

¹¹ Microsoft is said to have backed away from the SIG because of a requirement that all members release the rights to any patents on which the technology is based. Indeed, to see the argument that the availability of GPRS favours the Microsoft standard, WinCE, over WAP, see the accompanying TIF briefing paper by George Darby, "Mobile Phones as Desktop Computers".

will not go down until mass adoption occurs, but consumers will only buy Bluetooth-enabled devices when it becomes more affordable. Convergence appears closer – but not quite in the hand.

High Speed Circuit Switched Data (HSCSD) transfer, which is already online from some European operators and should become widely available next year, will boost wireless data access speeds on phone networks from 9.6 kbps up to 57.6 kbps. General Packet Radio Service (GPRS), rolling out on GSM networks in 2000, will jack up bit rates to at least twice that. More impressively, GPRS will also allow devices to stay connected to the network all the time, while users are billed only for the time actually spent sending or receiving bursts of data. With higher-speed continuous connections, users will be able to do on their mobile devices what they've gotten used to doing online – have real-time conversations with databases, and scroll and click through menus that live not on their terminals but on the Net.¹² Thus, when a user picks up their mobile, email will be there waiting for them.

Another cellular network upgrade, EDGE, will boost bit rates on GSM and TDMA networks up to 2 mbps, and will also allow for the introduction of true 'world phones' – phones that roam anywhere without falling off the map.¹³

¹² See cover stories in *Wired*, September 1999 and *Business 2.0*, August 1999.

¹³ Gruber, Harald and Marion Hoenicke, "The road ahead: towards third generation mobile telecommunications," *info*, June 1999.

In June, Omnitel launched a Web portal with more than 150 different services-including news, stock quotations and travel information-accessible by a PC, a mobile phone using WAP or either a mobile or wireline phone via voice recognition. Telecom Italia Mobile SpA began testing similar services, with a commercial launch slated for the end of the year.

In October, once WAP-enabled handsets from Nokia become available, the UK's Orange PCS network plans to kick off its Internet-based media and information services. The services include an exclusive partnership with the broadcaster Independent Television News for news and entertainment programs and news feeds from news and financial service agency Reuters; a cooperative effort with Associated Newspapers to provide a restaurant review guide, cinema and theater listings and local news; and a travel service that lets customers access traffic reports and information on rail and air schedules. The rollout of the new wireless Internet services is being accompanied by the launch of Orange's new HSCSD service, which will initially offer speeds of 28.8 kbps.

Ericsson has revealed a range of new services that will be available through its Mobile Internet portal, built on WAP. Service providers include: online CD vendor Boxman; city information and services platform provider, Citikey; and Pactive, a news broker.

On the collaborative front, US cable network, CNN, has launched what it claims to be the first wireless news and information service available globally. CNN Mobile provides news to handsets either as short takes via SMS or in greater depth using WAP. The company has signed up more than a dozen service providers to offer the service worldwide. But what about further, entertainment-based services? Software providers, equipment manufacturers, carriers, and the emerging 'dot-com' fraternity are engaged in a frenzy of mergers and partnerships, gearing up for the shift to wireless. Are these opportunities and expected service offerings a given?

To bring streaming video to wireless devices, transmission speeds must get significantly faster. And with 3G products not about to hit the market before 2001, there are a number of critical hurdles for 3G operators.

The first of these is the need to build a market base fast enough to be able to amortize costs and enjoy the necessary economies of scale and scope. As the mobiles data market grows, consumers will undoubtedly begin to explore emerging interim products. At around 100 kbps – or slower – they lack 3G's multimedia capabilities, but are quick enough to send and receive email, check news, and trade stock. Will this erode the market for 3G, particularly given the cost of network build-out?

2.5G: interim or alternative?

A number of operators have begun focusing on what is known as '2.5G' technologies, such as GSM's GPRS and CDMA's IS-95B which are claimed to boost 2G cell phone data rates to around 115 kbps. A Motorola spokesman noted at the fourth annual CDMA World Congress that 115 kbps "is more than enough bandwidth to handle most of the 3G broadband services being proposed, with the exception of high-quality video".

2.5G services could provide a comfortable ramp-up for users not yet accustomed to using advanced value added services on their cell phones. On the other hand, this perspective could equally prove to be damaging to operators who invest in 3G only to find customers balking. For investment in the conversion to 3G networks is not cheap. Analysts put the price for most GSM networks at between US\$1-3 billion – although how much of that is attributable to network upgrades and how much to partnering (for content) and marketing is far from clear.

SK Telecom launches IS-95B

Claimed as the world's first high speed wireless multimedia service, South Korea's SK Telecom earlier this year launched a 115 kbps wireless voice and data capability based on IS-95B technology. Using new multimedia handsets SK Telecom subscribers are able to send and receive voice and data transmissions through the new service. SK Telecom also plans to provide content which can be viewed on the small screen of an existing mobile handset.

Both Korea Telecom Freetel and Hansol PCS are expected to launch wireless multimedia services in September, demonstrating the intensity of competition in the Korean wireless market.

Combined with network costs is the 'politicization' of the spectrum management. Distribution of new broadband wireless frequencies has been used in some markets as a competitive tool, whereby incumbent operators have been excluded from auctions in the interests of developing alternative local loop services. In addition, some governments are motivated to enhance the value of spectrum – and government revenues – regardless of the business case for 3G.¹⁴ As regulators begin the licensing processes for 3G operators, carriers need to understand now how the evolving broadband wireless environment is likely to affect their 2G investment decisions and how the development of 3G services will change the operating environment in, say, five years' time.

On the other hand, the potential pitfall of 2.5G is that it may distract operators from the path to 3G – like 2G GSM CDMA and D-AMPS, 2.5G technologies are proprietary, and their adoption might make eventual migration to 3G more difficult and costly – particularly, it is now said, if 2.5G vendors don't bear IMT-2000 migration in mind.

¹⁴ In the US, it should be noted, spectrum value has declined from as high as US\$208 million per MHz for a nationwide license to less than US\$1 million per MHz.

IV. The third wave: Hong Kong as a test-bed

Even with 3G networks, the wireless world will still be technologically fragmented. The conundrum for carriers, therefore, is whether to offer interim wireless data services now, or wait for a global 3G standard.

The great hope of the communications world is that 3G wireless networks will cut the 'technology knot', conforming to a uniform worldwide standard. Indeed, for 3G wireless technology to become practical, a single global communications standard is needed to replace today's many competing standards. To this end, the ITU is pushing to finalize their 3G standard, called IMT-2000, by year-end (www.itu.int).¹⁵ Effectively, the ITU will formulate a set of recommendations for which will form the basis of a 'family of standards' for broadband wireless. "To accommodate competing commercial interests and infrastructure, IMT-2000 will probably be a set of three optional airlink interfaces: (1) Direct Sequence Frequency Division Duplex ('DS-FDD', a type of CDMA based on ETSI UTRA and supported by GSM carriers); (2) Multi-Carrier Frequency Division Duplex ('MC-FDD', a second type of CDMA based on cdma2000 and supported by cdmaOne carriers); and (3) time division duplex ('TDD', a third type of CDMA based on second mode of ETSI UTRA and 'harmonized' with TD-SCDMA, an approach favored by China)."¹⁶

The role of government

Given that this process is well on track, and the major vendors have now resolved their patent disputes, it appears to be up to individual governments to create the right competitive incentives to jump-start the new market for wireless broadband services. As such, regulators from Japan to Europe are busy crafting licensing policies that will determine the success of third-generation (3G) mobile networks in their own markets.

The big challenge facing national regulators is how to attract the right blend of players. Governments usually have two basic options: (1) give licenses to the incumbent mobile operators so that they may use precious spectrum to resolve capacity problems with their second-generation networks; or (2) reserve a few licenses for new players and run the risk that newcomers may fail to capture substantial market share from the incumbents.

First movers

Finland has already issued four wireless multimedia licenses, deciding against auctions in favor of a technical evaluation model. The country, which boasts a mobile penetration of more than 70 percent, apparently doesn't want to stop the mobile revolution. By comparison, the United Kingdom has decided to auction five licenses early next year, hoping to raise around UKP2.5 billion (US\$4 billion). The telecommunications minister has indicated that the government will reserve the largest portion of available radio spectrum for a newcomer. The United Kingdom currently has four cellular operators. New entrants will be able to roam – i.e., have their calls and data traffic carried by at least one of the existing mobile networks – until their own infrastructure is in place.

¹⁵ IMT-2000 is more commonly referred to as Universal Mobile Telecommunications System (UMTS). The Holy Grail of global mobile telephony, at least for the next 5 years, is the third generation ("3G") standard commonly called Universal Mobile Telecommunications System ("UMTS") and referred to in ITU Recommendations as IMT-2000.

¹⁶ George Darby, "Mobile Phones as Desktop Computers" TIF Briefing Paper, 7th September; PTC conference paper, Honolulu, Hawaii, January 2000.

The German regulatory agency is expected to pursue auctions and will also allocate spectrum for at least two new players. Germany currently has four mobile operators. Competitive local service providers in the country are lobbying intensively for regional licenses. So far, the agency has shown little interest in regional licensing or in creating additional incentives to help new players.

Still foggy are the plans of the Japanese government, which has been pushing for the launch of next-generation mobile services by January 2001, one year earlier than Europe. The MPT indicated in draft guidelines published last year that it plans to grant up to three licenses based on the technical evaluation model.

Hong Kong

Hong Kong provides a good case to study for all of these developments because it stands at the forefront of many of the changes identified above. With six companies operating 11 mobile networks in such a compact territory, Hong Kong has long been a weather vein for industry change.

As Ure notes in a recent article ¹⁷:

For the first time since its listing in 1987, Cable & Wireless HKT posted a fall in profits for the financial year ended March 1999, from HK\$17.02 billion (US\$2.2 billion) to HK\$11.5 billion (US\$1.5 billion) in profits attributable to shareholders, while operating profits were down from HK\$13.3 billion to HK\$11.8 billion. The chief causes were a drop in revenue from international traffic by twenty-two per cent, and from mobile cellphone services, down by three per cent. By contrast, Internet and multimedia services earnings were up 146 per cent, but as yet they account for only two per cent of total revenue. The significance of these results extends beyond the purely financial, as they encapsulate the changes overtaking the entire telecommunication industry globally.

Ure goes on to point out that where “in the second wave, the digital wave, revenues from basic carriage were no-risk, and revenues from value-added services low-risk. In the third wave, the Internet wave, revenues from basic carriage, including cellphones and Internet access, will fall to the point of disappearance, while new sources of revenues will involve considerable risk (because of copyright piracy, exchange rate and payment risk, etc.) and high uncertainty (because of new entry, of process and product innovation, etc., on the supply side, while the hierarchy of future needs and desires is unknown on the demand side). In the Internet wave, the only certainty is uncertainty, and this ‘principle of uncertainty’ is expressed in many ways, for example in haphazard industrial restructuring, in the valuation of company assets, in the price of Internet stock.

The full implications of this shift are as little understood – yet – in Hong Kong, as in the rest of the world. However, circumstances place Hong Kong very much in the forefront of these developments, albeit on a far smaller scale than in the US.

OFTA has been examining next generation mobile issues with the help of the Wireless Local Loop (WLL) Working Group since September 1998 and is due to release a consultancy paper later this year. It seems that with compression techniques the spectrum available could support between 3 and 5 operators. But will this provide a viable business model or should it be assumed – perhaps initially – that there is no room for new entrants? Could a competitive solution focused upon interconnection offer an answer? Or should an entirely new model be introduced, such as a wholesaler-retailer arrangement?

Credits

This document was prepared for the Telecoms Infotech Forum by the Telecommunications Research Project (TRP) @ www.trp.hku.hk, a leading Asia Pacific policy focused IT research body. For further information on the TRP, please contact Peter Lovelock, Deputy Director (852) 2881 1274 or email lovelock@hkusua.hku.hk

¹⁷ John Ure, “The Era of International Simple Resale: not waving, but drowning?”
Policy, forthcoming.