

Telecoms Infotechnology Forum

**Hong Kong: A Test-Bed For
Third Generation (3-G) Wireless?**

7 September 1999

Furama Hotel

Summary Paper

Programme

2:00 – 3:30 **Session One: What is the 3G Market?**

Chairperson: Richard Midgett, General Manager, Mobile Services, International Business, Cable & Wireless HKT, and Chair 1998/99 of the GSM MOU

Speakers: Jan Malm, Executive Vice President, Mobile Systems, Ericsson China Ltd
Paul Calcott, Director of Marketing, Asia-Pacific, Lucent
Mr. KS Wong, Assistant Director, OFTA

3:30 – 4:00 Coffee Break

4:00 – 5:30 **Session Two: Wireless, the Next Internet Wave — What Will be on Offer?**

Chairperson: John Ure, Director of the Telecommunications Research Project

Speakers: George Darby, President, Eidetic Technology, Inc.
Stephen Chau, Director of Engineering,
Andrew Constantinidis, Citibank

List Of Participants

ACA Consulting
Alcatel China Holding Limited
Andersen Consulting
Andersen Consulting
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Asia Net Group Limited
Asia Online
Asian Wall Street Journal
AVITEL Limited
Booz Allen & Hamilton
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Cable & Wireless HKT
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Chevalier
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China Motion Telecom
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Hong Kong Daily NewsGroup
Hong Kong Economic Times
Hong Kong Information Technology Federation
Hong Kong Information Technology Federation
Hong Kong Standard
Hong Kong University of Science and Technology
Hongkong Land Limited
HSBC
HSBC Asset Management
HSBC Securities Asia Limited
Hutchison Telecommunications HK Limited
Hutchison Telecommunications HK Limited
Hutchison Telecommunications HK Limited
Information Technology and Broadcasting Bureau
Institute for International Research
Intel Semiconductor Limited.
Intel Semiconductor Limited.
Kintak Enterprises Limited
KPMG Management Consulting
Legislative Council (Panel on
Information Technology & Broadcasting)
Lombard Investments Inc
Lucent Technologies
Ming Pao Newspapers Limited
NEC Hong Kong Limited
NEC Hong Kong Limited
New York Life Insurance
Newbridge Networks Asia Limited
Nokia HK Limited
Nortel Networks
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Executive Summary

1. It is appropriate that **Smartone**, one of Hong Kong's three cellular GSM and six PCN operators, and **Ericsson**, Smartone's strategic equipment supply partner, were the sponsors of this forum on third generation mobile as they will be pioneers of GPRS in 2000. This has a double meaning. On the one hand, they yet again establish Hong Kong at the forefront of mobile cellular global development. Hong Kong's tricky high-rise and densely populated environment make it a testbed for all kinds of radio-equipped communications products and services, and as of May 1999, according to OFTA there were 3.3 million mobile telephones to serve a population of 6.5 million in Hong Kong. Most of these are GSM handsets, and it was equally appropriate, therefore, that the chair of the first session, **Richard Midgett**, general manager of **Cable & Wireless HKT's** international mobile business, until very recently chaired the GSM MOU forum. The other meaning of GPRS is that a two-and-a-half generation mobile development, offering rates up to 168 Kbps, will mark the transition to UMTS or 'third generation' universal mobile tele-communications services.
2. **Paul Calcott (Lucent)** opened the forum (so that he could catch a flight to Jakarta later in the evening!) threw down the challenge facing both equipment suppliers and service providers: when we tell consumers that they can expect 'any time, anywhere at speeds that suit their lifestyles, are we creating an expectation that we cannot ultimately deliver?' There were two sides to this issue: equipment was one, but the market was the other. Despite longer-term forecasts, it was still the case that data rarely exceeded 1-2% of mobile traffic today. The real driver was not technology, but operator profitability, and that was really an issue of business models still emerging. Paul identifies general communications, entertainment, electronic commerce, travel information systems, and machine-to-machine communications as key areas of business opportunities for mobile operators. Backing these up will be technology convergence of terminals and access devices.
3. **Jan Malm (Ericsson)** laid stress on the switch to packet networks, showing one forecast of up to 350 million packet-switched wireless subscribers globally by 2004. The key to a successful business case lay in traffic volumes, and Jan gives the example from Europe where 20% of revenues come from non-voice traffic, such as messaging which is of growing popularity. As this change kicks in, services and applications will shift from being integral to the networks themselves as they emerge as a new layer within in network. In effect, the entire GSM/Wideband CDMA network will come to be seen as an access network, interfacing with an IP transport layer, an applications and services layer, and the control layer where most of the intelligent functions will reside. Thus, a new value chain is emerging (the concomitant of Paul Calcott's new business models) and 'really to take the right position here is the major and most costly decision that needs to be taken by operators.' Jan agreed with Paul that terminal technology could be a bottleneck to the take off of demand for new services and applications, and that was now the crucial issue.

4. Both Paul and Jan agreed that third generation broadband was unlikely to substitute for fixed wireline or home and office access devices. Jan saw one as a sub-set of the other. Paul saw one as mirroring the other in terms of the services provided. They also concurred that the primary task of equipment suppliers like Ericsson and Lucent was to support the operators make the transition from 2G to 2.5G to 3G in the most cost-effective and commercially viable way. On one other issue they also agreed, on what might be termed the 'economy of time'. The functionality of mobility saved time, and fitted into a lifestyle. This may be reinforced by the 'always-on' aspect of broadband services of which 3G will play a major part.
5. **K.S.Wong (OFTA)** spoke on behalf of the telecoms regulator in Hong Kong, reviewing the ITU's considerations of 3G standards and in particular of spectrum allocation recommendations. The issue of how many 3G licences will be available remains uncertain, but 'there is on the table a request for a total of 160 Megahertz more, so if that is agreed it will be good news.' OFTA had held focus group meetings with interested parties in Hong Kong and he presents a summary of the, mostly technical, points of consensus and points where opinions still differ. Maybe four, five or even six licences could eventually be issued, but the criteria for awarding licences was still a matter of consultation and a paper will be issued. KS ended by stressing the growing complexity of the market, the growing challenge of competition among operators, and therefore the need to revisit the basis upon which spectrum, and licences, are allocated to reach policies which will maximize investment. In response to one thorny question concerning the rights of property developers and managers to negotiate their own terms for the location of base stations, K.S. reminded his audience that the Government's commitment was to promote the widest possible growth of access to the cellphone market. As ever, there remains no consensus as to the best way to achieve this result.
6. **George Darby (EideticTechnology)** provided not just a fascinating review of the various technologies and platforms available for applications over mobile access devices, but provided also a briefing paper (see presentations) to accompany it. George argues that Wireless Access Protocol, or WAP, upon which 3G mobile phones are currently being planned by the Symbian consortium of companies, requires a conversion of HTML WebPages to WML WebPages with a subsequent loss of graphics, and he speculates that Microsoft's Windows CE will prove more popular among users who want the graphics. From that point he argues that alternative access devices, such as handheld personal computers (HPC) and palm personal computers (PPC) running on Windows CE, or something like it, will make a future. He goes on to identify five varieties of smartphones which are variants of HPCs or PPCs. This view is consistent with the idea that multiple types of access will co-exist, as opposed to the view that access will consolidate into one all-purpose mobile device.
7. **Stephen Chau (Smartone)** then outlined Smartone's own rollout plans for 2.5G and the transition to 3G. He agreed with Paul's figure of 1-2% data traffic, but argues that this has a lot to do with low data rates currently available. Currently 9.6 Kbps is available. Eventually 3G will offer up to 384 Kbps. But equally he makes the important point that '3G by itself is

not thought to be a success. It needs a lot of enablers together'. Among those enablers he places particular stress on voice-recognition 'in the coming two to three years.' Taking up the theme of Jan Malm, Stephen also stresses the likelihood of service operators like Smartone becoming increasingly involved in the provision of content (Smartone, like other operators in Hong Kong, is already forging partnerships with content providers, such as CNN, and web-access providers, like Yahoo) and possibly even with terminal development. Unambiguously, he sees the future as an IP world and one in which data takes over from voice. Smartone's carefully phased rollout plans for 2.5G and 3G are illustrated in the slides (see presentation).

8. **Andrew Constantinidis (Citibank)** shifted the focus to online service applications in which **Citibank** is a leader, having been the pioneer of Internet banking in Hong Kong and is one of four banks now offering mobile phone banking. But as far as Internet banking is concerned, although banks like it because it is much cheaper per transaction than alternatives, many customers don't yet like it. One-third of all bank customer Internet accounts opened were closed again within a year, mainly because the sites are too complicated to navigate. And very few transactions are conducted by Internet, mostly looking at account balances. It took ATM usage 15 years to get to the point today where roughly one-third each of transactions go to account balances, taking money and transferring money to pay bills. On the other hand, Citibank's most high-value customers were the one's adopting Internet banking most readily. Andrew made the point that customers are actually demand online and especially mobile banking because they just 'really don't have the time any more to find a branch, go in and stand in line.' The economy of time again is the issue of modern lifestyles. Andrew also points out that security is one of the biggest issues for banks, and in his view public key infrastructure (PKI) applications will be widely adopted by the financial community, especially because alternatives such as SET are just too costly and complicated. In this area in particular, as the subsequent discussion brought out, future mobile phones with encryption built-in have a real advantage.
9. **Overall** an interesting picture emerged. On the one hand there is general agreement about the direction of the technologies and the business case for 2.5G and 3G, although on the details, such as access devices and terminals, much remains an open question. A familiar chicken-an-egg question arises as to which comes first, the capacity or the demand, and how far will applications development on the one hand, and terminals development on the other, synchronize with the emergence of broadband networks? As Stephen Chau said, there have to be enablers. Regulations play a part here, not least the regulations governing sectors like banks, encouraging competition and innovation. These are important also for financial institutions supporting the growth of e-commerce. (See TIF 8th June 1999 and the subsequent Position Paper *Hong Kong as an Internet Financial Hub*.) Lifestyle issues also figure prominently in the underlying discussion, the 'economy of time' issue. Finally, it may be said that mobile service operators, and equipment suppliers, by moving into a mobile broadband world are charting uncertain waters, but they are also pioneering new busi-

ness models and adding an important complimentary element to the environment which will very soon take off as electronic commerce.

Session One

PAUL CALCOTT
DIRECTOR OF MARKETING, ASIA-PACIFIC
LUCENT

(full transcript of presentation follows)

How quickly do we need to go to wideband wireless? What are the alternatives? I think as I've travelled recently around the world we've looked at different operators and the different stages of the technology curves for them and their decisions to go to wideband. The drivers at the moment still are spectrum efficiency and capacity issues. So when we look at Japan and their move towards wideband CDMA that's driven by capacity and spectrum efficiency and if we look at the UK that's driven now by the same issues, primarily in London. So operators that I've talked to recently still don't really understand what the business case is for wideband and whether it actually flies. I just want to put out some thoughts about how we go forward into wideband and what the rate of uptake should be.

If we look at the market drivers for 3G services there is an increasing expectation of the consumer for higher bit rates to enable wider choice of applications driven by the rise of network computing and the increased use of the internet. There is still a consumer expectation that wireless cost per bit is going to be comparable with fixed networks. There is an expectation of faster response time and access time than is currently experienced in the mobile network, particularly for non-voice services. There is an expectation of global mobility, terminal service, personal access to the usual information, and services when away from the home or office and from the user's normal terminal. There is an expectation of personalized services incorporating PDA-type features (diaries, schedulers, address books) and there is an expectation of multi-media services (more text than images, internet information retrieval etc), there is an expectation that it is going to be easy to use and user friendly. We as an industry have created a lot of hype around 3G and services and what's to come. I sometimes question whether we are setting ourselves up to overpromise and underdeliver in some ways with the consumer. The consumer's expectations going forward look to data anytime, anywhere at a speed that suits their lifestyle and I just question somewhere in the back of my mind whether we're creating something that we cannot ultimately deliver. That's very controversial.

Let's look at the migration path right now for an uptake in GSM, as an example. From the current speed of 9.6 kilobits, basic text messaging can be sent using existing infrastructure and handsets. So enhancements to the GSM specification will soon increase the bearer speed of data up to 14.4 kilobits which will be increased again with the introduction of GPRS. UMTS

and other third-generation technologies will bring further bandwidth increases. Operators and vendors should consider developing applications in which the underlying data capability is transparent to the end-user. The key being to introduce services and applications that are easy to use and bring real value to the user's lifestyle from a business and personal perspective. If an application provides a useful service to a customer even though it may run at 9.6 kilobits, then its method and speed of delivery is really irrelevant. As new technologies and faster speeds become available the user will continue to access the same applications with faster delivery and response times. These technologies all provide the capabilities for operators to utilize in order to address the needs of their customers. Evolution of the GPRS platform will allow the evolution to higher bandwidths and applications, as we speed towards UMTS and ATM. It is embedding GSM as a platform that has different services and providing anytime, anywhere coverage that is expanding all over the world.

Growth in mobile data is expected to grow at 70% per annum over the next 5 years. GPRS will tend to be a key element to remove barriers to mobile data usage. Back in the days when I was an operator and we set up a new GSM network the greatest buzzword was data. We thought that data was going to be one of the greatest things that ever happened to us. I still don't know too many operators around the world that run more than 1% or 2% traffic on a GSM network as data traffic. What we did in those days was not make it very easy for the end-user. We made it complicated for them. They didn't understand it and the rates were too slow.

Here are some examples of applications with bandwidth requirements. This table shows typical data applications and the data speeds shown are examples of bandwidth needed for each application. Note that the bandwidth requirements may be different for up and down link for Internet browsing, for example. They may also be variable. For example, if remote access is made to an e-mail server. There may also be a requirement to keep the delay to a minimum acceptable level in relation to the application (eg, video). Note that the variety of applications that can be offered at relatively low speeds and all are within the speeds offered by GPRS. Operators will gain early experience of offering, managing and tariffing third-generation types of services to help play in the future. End users will also get used to having data services that will demand more and greater bandwidth to be made available.

If we look at the wireless networks of today I think we all acknowledge that they must change. As a wireless industry our market messages should be that we have continued worldwide subscriber and usage growth (some market penetrations are increasing or exceeding 50%); marketing of wireless services to new segments (eg, the introduction of the casual user with pre-paid); and shifts from wireline occurring at a flat-rate pricing and large-minute bundling. There is increasing demand for information anytime, anywhere. Landline Internet experience is creating a desire for easy access and wireless services have become an important means of access to communication networks. Consumers' increased utilization of data networks for accessing information has led to ever-increasing demands. Wireless must continue to evolve to meet these increasing needs.

As we move to change the wireless networks we have created a lot of new challenges. In this industry we talk about technology and I think sometimes we forget that technology is not necessarily the driver, but profit margins are. We often, from the vendors' perspective, forget about that with our customers. So I think we need to be more concerned that when we release new products and new technology to operators, that we are concerned with maintaining the operator profit margin, or giving products and technology that allow the operator to increase profit margins.

As we move forward, we have seen recently tariffs everywhere in the world for wireless networks decrease. So for future players to innovate new sources of revenue to build a business case to rollout new networks it means the new players that come into the market necessarily cannot rely on revenue from just voice traffic anymore. The established operators will, of course, be generating still a sizable amount of their revenue from voice but profit is being eroded.

What is Lucent's approach to 3G? We are placing a very strong emphasis on convergence and operators commercial aspect of the business. We are going to place IP/ATM at the centre of all of our architecture. We are working now to understand what the business case is for third-generation and we are currently doing trials with Bell Atlantic, Vodafone and Telstra in Australia, to better understand how we should rollout and how the operator makes money from that. When going towards new wideband technology of course, there are new market segments that open up to the operator. We are looking in future to improve our network and investment. We are certainly concentrating on end-user applications. I don't believe that there will be a killer application for 3-G. I think what 3-G will allow us to do on wireless is to mirror fixed-line applications for mobility. I think that's always been the case for wireless networks.

There is in fact going to be a new industry value chain. So there are going to be third parties that come between the operator and the end-user. An operator will need to decide now how they approach that. Whether they take on the content provider role themselves or they farm that out to a third party. I don't think there's a consensus among operators about what will happen with that. But if an operator doesn't get involved in content provision for services then it could simply become a commodity pipe that everything's funnelled through.

3-G will enable a new class of applications from multimedia streaming to location-based transactions on the move. I think that because of the convergence of 3-G we can offer voice and data together. Very high data speeds. Links to transaction systems, information-type systems, links to the Internet, automatic visual displays etc. 3-G will offer people new mobile communication possibilities. Reservations and purchasing from the Internet to electronic monitoring services, portable-monitoring aids for security at home. But there are really six types of groups that services will come in to. General communications; entertainment; electronic commerce; travel information systems; and machine-to-machine communications.

As our industry changes so will the business environment in which we operate. Right now we have a very vertical industry, generally, in which the different types of technology operate independently. As we move to the next generation of communications services, everything is really vertical. So the networks (the fixed, broadband, wireless, Internet ISPs) will all converge together into one single network. They'll generally be content-driven environments with seamless integrated services.

The advantage of a unified architecture are: a single integrated interface for voice and data, allowing you lower maintenance and line costs; integrated packet and voice handling; common mobility management; easier accounting systems and billing; the ability to support a dynamic mix of voice and data traffic; and a common platform for packet and voice-type services.

When we come to the wireless overview for 3-G we really see a convergence of services, networks and terminals. The vendors of today will start working on partnerships a lot more to create the terminals that are required to support 3-G services. The likes of Compaq or Toshiba or generally players who are not in the terminal market right now for handsets, are going to be dominant players in the terminals of the future. And networks and services will start to converge.

Some conclusions. Services are evolving and speeds are increasing. But many applications can be enabled at lower data rates and there is scope for growing revenues now. We need to create the market for the next generation of wireless. That market's not here now and the evolution platforms like 3-G, the migration path for CDMA 2000 and GPRS provide the ability to create that market now. 3-G will bring you spectrum for converging industries. So not every operator will get a UMTS licence and I think that it's important that operators consider now where they're going to fit with their technology on the technology curve. Whether they get to UMTS or whether they create their business case around GPRS now. And wideband will be driven by a packet-based technology that can be introduced at any time to suit your market needs.

So my overall conclusion – do we need to go to wideband wireless? I don't think there's a specific answer in there. I think every operator will determine what they need to do on their own case. But there is certainly a case to say that operators may not necessarily need to go to UMTS to provide services that the market requires.

JAN MALM
EXECUTIVE VICE PRESIDENT, MOBILE SYSTEMS
ERICSSON CHINA LTD

(full transcription of presentation follows)

I will start with a couple of slides to remind you of the tremendous platform we have among networks globally today. Still the global penetration is as low as 5% but we see now in the Nordic countries and in Hong Kong we have passed 50%, and we don't see any stop in this. Our perspective is that 100% can be achieved and we can even pass that mark in the future. We believe the mobility is there and is a very, very strong movement. Looking at standards, we can see that GSM technology now is the global standard which, I think, is a good platform for 3-G and for wideband CDMA development for the future. The volumes are there, the market is there, it's global, and it's a true global standard. Looking into the different regions here we see that in our predictions we will reach about 1 billion subscribers in the different mobile networks in the year 2004.

Looking a little bit to other important trends here. We have mobility and tremendous growth. Still wireline is actually growing at around 5% to 10% annually. But an even faster area is Internet access which uses both wireline and wireless access. The interesting thing here is that the wireline actually took more than 100 years to reach 1 billion subscriber lines, wireless around 25 years and the internet more or less will have achieved this in 10-15 years. There are two important trends: mobility and Internet. Also speed is another important issue. We believe strongly at Ericsson that a great deal of Internet access will take place over the wireless networks. I will try to give you the basis for our standpoint. We believe there is a wireless multimedia future for sure. Looking to the prediction of subscribers here, we have actually started as we have done with the mobile subscribers before, to try to predict what will happen and here we have a prediction of packet-switched customers in the coming networks. As you can see here we have almost 350 million packet-switched wireless subscribers in the global networks by the year 2004. If we then compare it with the total number of subscribers, we believe that more than 30% of the global subscribers in 5 years time would be connected by packet switch and using other types of services than pure voice application.

As was pointed out before, this makes it very important from the operator point of view to look to the traffic more than to the number of subscribers. Traffic is the important key figure really to secure the growth for the future and be a successful operator. We can say that this perhaps is the future. You can see the fixed networks in some cases are already here. Looking to the traffic between Europe and the US already today the data traffic has exceeded the voice traffic. This is happening more and more now in the fixed networks and we are sure that this will also be the trend for the mobile networks. We think another important thing is the maturity of the operators. Because the operators will actually move into much more complicated situations in the future, and maturity is very important. We see now in many markets that things are taking off. We have

some successful operators in Europe that today have more than 20% of their revenue from services besides voice. Messaging now in Europe is very popular.

We think that the operators forced by competition, forced by the mass-market situation will mature and will also be a good carrier and good handler of the future data communications possibilities. Another important enabler for this wireless multimedia future is the evolution of the networks. First looking into the air interfaces: these days we have the capability to offer some competitive transmission rates and this slide shows how the different standards relate, moving into the third-generation. The whole strategy arising from standardization and from the GSM MOU and development people is to secure a good migration path which wastes a minimum of investment and makes all the different standards backwards compatible, which I think is very important. I would say that more important from an operator's point of view is the introduction of GPRS which will be the first packet-switched system, rather than the introduction of wide-band CDMA, because the latter will be a continuation of the packet-switched trend, even if it is a new radio network. So this migration path is to ensure that we don't waste any investment by moving up this chain here. I think this is a very cost-efficient way to make the migration.

Looking into the pure network situation we think there will be a major change in the network structure. Today we are used to working with different networks. We have the land mobile networks, we have the PSTN networks, data networks, cable tv networks. What we will see is some new type of networks. What happens here is that the services and applications that today are integrated into the networks will actually move out and become a new layer in the network. The conductivity network will be a pure transportation network. We will see more movement into the IP-based transmission. That will be probably quite rapid. The whole GSM network will be looked upon more as an access network. This, we think, is a very important move that will happen. It is very important for the future. So actually we see the network now in three layers in the future: a layer of conductivity, a transport layer and an access layer of networks (GSM, wideband CDMA, etc). We will have a control layer where the servers, the intelligence, connected to any of these access networks will be situated. Packet handling etc will be on this layer. And then we will have the service layers, more or less separated. So the service intelligence will probably move out of the networks, principally because web technology now provides a very cost-effective alternative way to create services and applications.

Looking to the impact concerning investment, as I said before the development is to protect investments, to really make as little waste as possible. And looking back to the GPRS we can say that that is a minor investment today. The only thing we do is some sort of software upgrades and then we introduce the packet handling into the core network. Very minor. It's also a very simple upgrade in the network, very little more than changing transceivers, although there is one little obstacle with the UMTS and that is the capacity of a transceiver which actually 8 times less than GSM technology. Which means of course that the introduction of UMTS needs to be calculated carefully. I think that if there are investments in the networks our opinion at Ericsson is that those investments are minor. Major investments for the operators will be to position them-

selves in the new value chain of the business. Really to take the right position here is the major and most costly decision that needs to be taken by the operators.

Many content providers of course want to reach all the wireless operators and in our view of the future I believe, and this is a personal view, that the operators will be like magazines. There will be a selection of good content. You can't bring in everyone. You will bring in a good selection of content which fits into your profile and end-users interest. And there will be a mix of services that the operators provide themselves and that the operator only is relaying.

What we think is very key to the operators is to own the user interface. What's on the portal, so to speak, when the subscriber is logged on. And in the future it will be on all the time in the packet-switched world. What is up here? Is it the operators' name or is it Yahoo! or somebody else, with the operator being only a small part? That is probably one of the key challenges for the operators. We are seeing the operators starting to position themselves, to be really the owner of the portal. They do that by starting with an ISP and a fixed network. Because we think that to have a homogeneous environment for the end-user is very important. When he is home and using his pc it should be the same services, the same menus so to speak as on the mobile menu. Even if the selection speeds are a little bit different.

One subject I haven't touched on which is critical for the future is terminal development. That is a key enabler and perhaps as important as the network. I think the end-users are there, the demands are there. I think the network capabilities are there, I think the terminals will actually be a delaying point unless something dramatic happens. That is my message.

Open Discussion

During the discussion period the following points were raised:

***Participant:** Protocol conversion and payload conversion are very important in the wireless/wireline convergence. I didn't hear much said about their approaches to making it an IP world, for instance. Do you plan to put all voice to IP? What are your thoughts on that.*

Paul Calcott: we're putting IP/ATM at the centre of all our architecture, for everything. So everything will be IP based.

Jan Malm: What we see is that for the future it's more cost-efficient to use new technologies like routing technologies etc. So what will happen is a gradual moving to less switching in the transport networks for the future. However, we believe in a greater interface. We still believe the IP interface is too inefficient to be used directly out of the terminals.

***Participant:** On that inefficiency do you see new protocols other than IP H.323 as the way to handle voice over IP? You know it takes 18 half-circuit exchanges to set up a call.*

Jan Malm: I'm not an expert at this. But as I recall we can't say that will happen in the coming years.

Paul Calcott: I'm not a protocol specialist so I don't really want to comment on that.

***Participant:** When you introduce GPRS into an existing operator's GSM network does it require a reduction in the voice switching capacity or voice capacity of the network or are there other mechanisms that can be used to allow that to transparently happen?*

Paul Calcott: when you integrate GPRS into a current Lucent network then you're not taking anything away from existing TRX voice capacity, you're actually just adding.

Jan Malm: but of course, when the traffic is growing heavily you need to add transceivers sooner or later. But the good part of the story is that you are starting out with increased efficiency and then you can continue to invest when you really need it.

***Participant:** So you would start by making your cell sizes smaller to handle the same amount of voice capacity as you currently do in addition to the new data traffic, or you would assume data would be a small component of it?*

Paul Calcott: It would depend how many TRXs you take out of your existing cell and dedicate it to GPRS data. We look at plans at packeting voice over GPRS for further efficiencies. But there are some major network tunings that would need to take place for that to happen. So right

at this time we are really unsure what the real value is of doing that. But we are investigating that at the current times.

Jan Malm: in our system we of course give priority for the packet-switched traffic in transceivers but you can use them for both packet-switch and for voice.

***Participant:** You made an interesting comment that the telecom vendors would have to move into content provision, basically software, to add on to their hardware because their hardware was going to become very much a commodity. I certainly agree that the hardware looks very much like it might be a commodity but generally speaking all the companies that have tried to do both hardware and software – particularly in the computer business – have had a really hard time doing it. They do one or the other well and then lose money on the other one. So it's an interesting comment that you made but I don't think there are really any examples of that being done well.*

Jan Malm: I don't think the major content provision will come from the operators but I think they have a few assets in their network which is very key and can be very useful in many of the applications. One is that we really know in the network where the customers are positioned which is very important. We have data integrity in the network. We also have the SIM card which is a good identity of all the users of the network. And with these three components I think that gives a good opportunity to be in some stronger involvement in the application business from the mobile operator's point of view compared with the fixed network. Looking into the fixed network you can see that the operators are more or less out of everything in terms of content – they are just capacity providers. I think the mobile operators are in a different position. The mobile operators have the future ahead of them and the fixed networks have the future behind them.

***Participant:** You showed a slide that talked about the user interface and what it is going to be. You are suggesting that the same user interface should appear on a handset that would appear on the home pc. The question here is do you see that over a period of time these appliances will replace home pcs or business pcs, or do you see mobile devices as being complimentary to the pc?*

Jan Malm: we believe that it is important that you have a set-up that makes it as convenient as possible for the subscriber to move between his different environments. We believe that the mobile is a sub-set of something else. It can be a sub-set partly put together from his office, from his home environment, to make his use of time as efficient as possible. That is very much a driver behind it. Time is the most limited thing in life and if we can do things more conveniently and more efficiently that will always be a strong driver.

***Participant:** I would like to do more things but I'd like to do them with fewer devices! Will the day come when we'll have one device.*

Jan Malm: I don't think so. One enabler for this mobile data to take off is the mobile terminal and I believe there needs to be some standardization of the screens in such things. This happened in the pc industry before. I think there needs to be some sort of standardization otherwise the applications need to be adapted to each terminal and that will never be any good for this business.

***Participant:** As equipment vendors, could you comment in what Asian markets you are seeing the most aggressive.*

Paul Calcott: I guess the most advanced is Japan. I think the spin-off of their voice capacity problems has been that they're getting networks that have become data-capable with faster data rates than they're allowing applications. I don't think that was the initial thought or the initial driver but that's been a spin-off. I think Korea has become an incredibly competitive market now and I think the operators there are looking to differentiate on data and services. They are becoming very aggressive. Then I would suggest Hong Kong and Singapore. Certainly Singapore's looking to become much more data driven. Hong Kong, Australia are becoming much more sophisticated at a very fast rate. And the slowest? I guess the Philippines, India have not still embraced or taken the wireless mobility aspect that other countries have done.

Jan Malm: I agree with what you say. The Japanese example is very interesting. NTT DoCoMo is very successful in the service industry here based on mobile telephony. They have standardized the screens on their telephones involved in this service. They have a good business and more than 100 content providers and several hundreds wanting to get in. They are showing the way.

***Participant:** Mainland China hasn't been mentioned. The ITU has recently accepted the Chinese standard for wideband CDMA. I was wondering what you see are the implications there, given the size of the Chinese capacity to produce as well as its capacity as a market in the future. How significant is that decision by the ITU?*

Jan Malm: are you referring to the TDD proposal? We are still a little bit uncertain about that. We think that the latest compromise about TDD is a little too complex. At least we are internally not convinced that that proposal now will make it possible to do the really killer products in wireless local loop area. We think this will be a problem. The volumes in cellular still have a risk to outcompete this solution. I think it is a little bit early. We are not convinced that this final decision was perfect in the TDD area. Too complex. Too ambitious.

KS WONG
ASSISTANT DIRECTOR
OFTA

(full transcript of presentation follows)

You have heard Paul's remark about the market on data. A little bit is missing. Also you have heard Jan's remark about the data market too. Not optimistic. I would like to share a piece of experience with you. Some years ago I was looking at applications for licences. In the application there was a market survey. It came to two conclusions. One was there would be a total of 50,000 (if I'm not mistaken) portable phones in Hong Kong eventually. Second conclusion was the portable phones would be for those who own Mercedes or Rolls Royces.

Now back to my speech about spectrum and licences. First I would like to recap about what is happening now in the international forum and in the regional forum about spectrum. Seven years ago we had a meeting in Spain and there was a decision that a total of 230 megahertz would be set aside for "flims" or now called INT200. The second area of development is standards. Now authorized by ITU, also we have heard vendors saying there will be products by 2001. Now on the standards, there was an important decision in the meeting in May this year. ITU is going to adopt a flexible standard. If everything goes well that should be approved by this November in Finland. That should be able to adopt both the European and US standards. So we are keeping our fingers crossed on this one. I was saying that in the Spain meeting the decision was to have 230 megahertz for the third generation. There would be a total of 60 megahertz for the terrestrial and then 30 megahertz for the satellite in the upper band and a little bit more in the lower band. Let's look at the situation in Hong Kong. The transmit and receive block for the upper and lower block for the duplex operation it's quite clear we should have the spectrum by 2001. But on the time-division portion we have in the past used about 33 megahertz for private systems for the DECT system and also the Japanese PHS system) so there should be a limitation in that area. A piece of good news is nowadays a lot of countries are thinking that we should ask for more spectrum for the third generation. There is on the table a request for a total of 160 megahertz more, so if that is agreed it will be good news.

You may ask what the government should do in the face of all these developments. We started off the exercise last year by having a focus group. This is in fact a two-step approach. We like the focus group to let the industry talk about other expectations in terms of spectrum and also standards. And then in the second step we looked at the factors that we should look at in terms of market.

Let me go through some of the findings of the focus group. By the way these findings will be published either tomorrow or the day after tomorrow in the form of a report. The focus group found that the co-siting of the second and third generation is quite possible. And they expect some multiple handsets to offer both 2-G and 3-G services. By the way we did not have a con-

sensus on everything. The third bullet point is the first where we did not have consensus and that is about flexibility. So participants thought that this would leave the operator to make the choice, to find out the market. Let them choose whatever standard they are going to use. Others thought that it would be quite expensive for the operators to flip around between standards and at the end of the day there would be a price for the customer to pay. So this is the area where we did not have consensus.

There was also consensus on a couple of other points. Because we are so near to the Shenzhen and Guangdong area it was thought that there should be some kind of coordination in terms of frequencies with mainland China. The other thing is that we should use all the spectrum available at the international level for 3-G in the domestic market (ie, the Hong Kong market). There was also an idea about whether we could make use of the flexibility to have services between the frequency division and also time division blocks. The reason is there are not many products around so the conclusion of the focus group was to have some more discussion in this area. Hopefully we will have this flexibility eventually.

There was quite a lengthy debate on how much spectrum we should set aside for each operator. Technically speaking we could start with 2 x 5 megahertz but the downside in that case is that we will not be able to offer wideband services. Definitely for offering 2-megabit services we have to go to at least 15 megahertz. There was some request saying that we should look for 20 megahertz, very much like what Japan is going to do. But there was consensus in the group that we should set aside 2 x 15 megahertz for each operator and that there should be 5 megahertz working in the time division multiplex block for the operator. There is another area where we did not have consensus and this is the transmit and receive block. In the international forum there was a decision to set aside 230 megahertz for services, but there was no requirement on whether you are going to use it for transmit or receive. In the case of the European system the lower block will be used for the handset uplink. Unfortunately it's the reverse in the US environment now. Some participants thought that we should again have flexibility. Leave the choice to the operator. Let them sort it out and let them make a choice. The same decision will be made in the case of PCS. Of course there is a price to pay because if we adopt the upper block for both transmit and receive, some participants thought that there should be some reserve for guardbands. Now there was not much discussion on how wide we need this guardband. We had some experience in the case of PCS in the past. Personally I think it needs 2.5 megahertz.

Licences: I think you will be more interested in licences. I said earlier that the purpose of the focus group was to look at technical issues, now in the coming few months we will be looking at the market issues. There will be a consultation paper. We would like to put that out by the end of this year. In this exercise we should be looking at how many licences we should issue; four, five or six. Secondly, we are going to consult those who are eligible for the licences. Of course, you have heard about the migration from 2G to 3G, there are some issues we have to consult about this migration. If everything goes well we should have this licensing policy and also the framework ready by next summer, that is middle of next year. Then we will invite licence applications by third quarter of next year and we should be able to grant the licences by the end of

next year, or early 2001. So the expectation is that we should be able to match the delivery of products by 2001.

Now finally, a bit about challenges. I think the challenge is for the vendors because 3-G will have a lot of features. It is a challenge for the vendors to make it simple and also small, while the challenge for the operator will be profit margins going down and competition growing stronger. This is also a challenge for the regulators. Going into 3-G is getting more complex. The market is getting more complex. The applications and also the spectrum issues are getting more complex. The challenge for the regulator is we should devise some rules which will eventually attract investments. Because without investment there will be no service.

IMT-2000

K S Wong

Office of the
Telecommunications Authority

7 September 1999

Progress

- IMT-2000 spectrum identified at the World Radiocommunication Conference in 1992
-
- Technical standards for radio transmission to be finalized by ITU end of 1999
-
- IMT-2000 products to be available around 2001

IMT-2000 Standards

- ITU likely to adopt a "single flexible standard" approach with multiple access methods including CDMA, TDMA or a combination of both
- Major standards include UMTS of Europe and cdma2000 of the US

IMT-2000 Spectrum

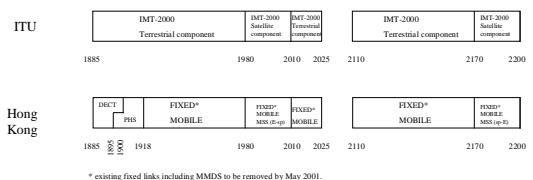
The 1992 World Radiocommunication Conference assigned 230 MHz in the 2 GHz frequency band for IMT-2000 systems

- - 60 MHz for terrestrial component and 30 MHz for satellite component in the upper band
 -
 - 110 MHz for terrestrial component and 30 MHz for satellite component in the lower band
-
-
-

IMT-2000 Spectrum

- 2 x 60 MHz spectrum for terrestrial frequency division duplex (FDD)
-
- Out of the 50 MHz unpaired spectrum (suitable for time division duplex, TDD), Hong Kong has allocated 33 MHz for DECT and PHS private systems
-
- WRC-2000 to consider additional spectrum for IMT-2000
-
-
-
-

IMT-2000 Spectrum



OFTA IMT-2000 Focus Group

To study

-
- General issues including definition of service, compatibility and transitional matters
-
- Standard issues including technology neutral approach, numbering issues, availability of regional/international standards/ products
-
- Radio spectrum issues including total spectrum requirement and spectrum requirement per operator

OFTA IMT-2000 Focus Group

Key findings of the Focus Group:

- - High speed data and multi-media services are the key drivers
 -
 - IMT-2000 systems could be deployed for fixed wireless applications
 -
 - Portable numbers could be offered
 -
 -
 -
 -
 -

OFTA IMT-2000 Focus Group

- Co-siting of 2G and 3G systems is technically feasible from the electro-magnetic compatibility point of view
-
- Multi-mode handsets could offer flexibility to both the operators and the customers
-
- Multiple 3G standards networks might increase technical complexity (including spectrum coordination with mainland China at border areas and the possible requirement of guard bands)
-

OFTA IMT-2000 Focus Group

- Preferable to co-ordinate the 3G spectrum with mainland China to avoid possible interference
-
- The total spectrum of 230 MHz as identified in WRC 92 should be made available for IMT-2000
-
- Harmonization between TDD and FDD operation and flexible use of TDD and FDD techniques should be further considered, with the aim of improving the efficient use of spectrum
-
-
-
-

OFTA IMT-2000 Focus Group

- A minimum 2 x 15 MHz FDD plus 5 MHz TDD spectrum allocation per operator is preferred
-
- WCDMA standard uses the lower band of ITU IMT-2000 spectrum for handset uplink. In the US spectrum, this band is used for handset downlink. If both the European WCDMA and the US cdma2000 systems are adopted in Hong Kong, guard bands might be required
-
-
-
-
-

Way Forward

- Public consultation on regulatory issues by end 1999/early 2000
 - number of licences
 - eligibility for applying
 - 2G-3G migration
- Licensing policy and framework ready by 2000
-
- Invitation for licence by 2000
-
- Grant of licence by end 2000/early 2001
-
- IMT-2000 service available in 2001

Open Discussion

During the discussion period the following points were raised:

Participant: What do you think will be the major criteria used for licensing for 3-G?

KS Wong: In the last case of GSM and PCS we published the criteria that we used. I remember clearly the first criterion is tariffs for the customer. Second criterion was the rollout plan (coverage and timing). This is only for GSM and PCS and might change for 3-G.

Participant: You mentioned that OFTA's present view would be for 2x15 megahertz plus 5 megahertz in the TDD band to be reserved for each licence, each operator. These numbers, which are actually quite popular – they've been established also by the UMTS Forum – are often expressed as the minimum requirement in order to offer a broadband service. Does OFTA have a view regarding the allocation of additional spectrum to licence winners so that they could expand beyond the minimum requirement to offer service?

KS Wong: It is good that I have the opportunity to clarify the 2x15. Because I said earlier that was the focus group's finding. Eventually how the spectrum will be allocated to each operator will have to be found out from the consultation at the end of the year, because the focus group's finding was purely from the technical viewpoint. For example, in the UK they set aside more spectrum for a newcomer and set aside smaller spectrum for existing operators, so that could be one option. I'm not saying that is the only option. Of course, the normal rule we have adopted in Hong Kong, in the past in the case of GSM and PCS, was we set aside an equal amount of spectrum for each operator. So that was the normal way we did things in the past. In the last part of your question you asked about what happens to the existing operator, do we set aside spectrum for them to migrate from 2-G to 3-G? I think we have to find out from the consultation. Perhaps I can add that in one of the slides I mentioned that we are looking for additional spectrum, in the coming WRC meeting next May. If that is possible from the Hong Kong perspective we should be able to find, at least in a very short term, between 80 – 100 megahertz more. So I think there should not be a shortage of spectrum.

Participant: I have a question about the radio networks required to go from 2-G to 3-G. It is my understanding that the link budget has to be different and that there has to be a greater antenna density, particularly inside premises. Is that true?

KS Wong: my understanding is that in the case of 3G if you want to provide high bandwidth services, for example 2 megabits, then you have to use smaller cells. The architecture would be quite different to the normal 2-G. But it is a mixture of all new types of offering and that goes down what the business case is for individual operators.

Participant: *I see that indoor coverage in Hong Kong is becoming quickly pervasive everywhere. We have somewhere in the area of 30 million sq ft of retail space and tunnels. It's spreading out into office space, into lifts. This was welcomed. The fact that it was welcomed has led to the success of the quick spread. Hong Kong's probably one of the best indoor-covered places in the world. Now with the move of trying to put caps on this and trying to limit the market forces that drove the spread it seems to me that this could be an inhibiting factor in the adoption of 3-G and create some kind of unanticipated backlash. Because now the same incentives will disappear and these people that were so happy to have these indoor antenna systems installed are going to say no, not again, now that you're handcuffing the attraction of doing it. Since in all there are 11 networks it's pretty easy to calculate what they'd take in a monthly fee. It's hard to justify or feel sorry for them. Has the backlash been taken into consideration before this legislation afoot gets a final hearing? And its future impact on 3-G? And the possible inhibiting factor?*

K.S Wong: Thank you. I believe you are talking about the discussion we had yesterday [*The Legislative Council panel meeting – ed.*] about access into limited areas. I do not want to guess what the outcome will be but we have in the past seen the development of cell phones and also radio paging. We have seen a lot of practices stopping access of mobile transmitting equipment. Therefore we put forward this proposal that access into closed areas would have to go through some kind of rules. Similar to the case of interconnection of networks. If there is no agreement then the network operator can ask the telecommunications authority to mediate or arbitrate. The government is expecting to see a healthy development of this access of cell-phones. It is just growing. In July this year we had more than 3.4 million cell phones in Hong Kong! It is growing very fast. We are trying to do everything to facilitate that kind of growth.

Participant: *Have you started coordinating with the Ministry of Information Industry in China on 3-G? Because the last time when you granted PCS licences I think China actually expressed some dissatisfaction on the number of licences? Will you need to coordinate more with China on this?*

KS Wong: Not yet. This is something we are going to do towards the end of the year or early next year. The service will only be available from 2001 so we still have 1.5 years to go.

Session Two

GEORGE DARBY
PRESIDENT
EIDETIC TECHNOLOGY, INC.

(full transcript of presentation follows)

We have conquered the digital convergence battle and we're now in the throes of IP convergence. As we know from the first battle the jury of vendors and users have pretty much decided that IP will be what combines data, video and voice. One of the more astounding predictions is that by 2005 more than half of the content of mobile networks will be data. The combination of wireless and wireline messaging (known as fixed mobile integration) is another driver for the predominance for data and IP protocols. But once we have a common protocol we are still faced with the interesting issue of payload conversion. I got an e-mail but I want to see it as a fax. Or I have a fax and I want it as e-mail. I have e-mail and I want to hear it as voice mail. That's payload conversion. Multimedia smartphones will support that but the jury is still out as to whether H.323, the ITU standard for multimedia, will end up as the commercially deployed standard. I think IP convergence and fixed mobile integration will happen first in Asia for the following reasons. Very high mobile phone penetration; some of the highest in the world (by the way, Honolulu is over 50% but there are only 800,000 or so people in Honolulu and far more in Hong Kong!) We have a 38% penetration in Japan and 30% in Korea. But in contrast to that we have low on-line penetrations. And that is what I believe leads us to Hong Kong as the test-bed for mobile data adoption. We have an agreement that there is going to be a wireless terminal. There will be not one operating system but several, and several different types of smartphones. The new generation of smartphones, the Ericsson R380 and others, are going to allow you to surf the web and do limited amounts of text entry from your phone. Now, that will be the extension, you might say, of smartphone features to include those we have in hand-held computing (HPC) and in palm pcs and we have another convergence at work. We have PPCs (like the palm pilot and competitors) and HPCs that will be getting smartphone features and functionality. One of the most intriguing issues for me in product planning is what operating system and what feature set will be the winning combinations as we see the deluge of wireless terminals that are coming. One thing that we haven't seen yet that I think we will see will be HPCs into which you insert a GSM or UMTS card and it gives you voice communications in addition to your data and video. Just as we can talk about a convergence of wireless terminals we have to note there is now a divergence of browsers. Nokia and Ericsson approached Microsoft to licence Win CE, a modular operating system used in HPCs and PPCs and didn't want to pay the fee that Microsoft wanted per device and talked to Psion, the British maker of PDAs. Symbian has chosen to go the way of WAP (wireless application protocol). Technically WAP is a new top four layers in the LSI protocol stack and it has some new layers for security and transactions

because it foresees the use of mobile phones as your wallet. In fact, recent developments in Europe, DeutschBank has begun a pilot in which your SIM card in your GSM phone is also your smartcard with stored value. As I was joking with John, you would walk up to a vending machine, point your smartphone at it, click it and the candy or postage stamps are dispensed! Microbrowser divergence began because smartphone screens can't support much resolution. It's a matter of pixel count. Maybe you have 100 pixels x 200 pixels at most when most of us are used to at least 800 x 600 today. The kilobytes per page would burden the user with high data rates and would take a long time to transmit at the GSM data rate of 9.6 kilobits/second. So WAP, which is now controlled by an organization called WAP Forum, filters out everything but text basically. So that you can display it in a DOS list. It uses a new mark-up language. A sort of dumbed-down HTML and you end up with what I call miniature video text. The issue is will users that want to browse the web be satisfied with browsing WAPed web pages? Is it possible to have a true HTML microbrowser? Well in fact it is. One is published by a UK company, STNC, curiously just acquired by Microsoft. Many of you may know that Sendit, another specialist in Sweden in GSM, SMS technology and messaging, was also acquired by Microsoft. Microsoft is facing the battle that nobody has announced a smartphone that uses Windows CE! WAPing works and we'll see WAP smartphones. You will browse the web in a sense using minipix. This year there's a total GSM data of 1% of overall traffic flows. It's comprised mostly of SMS and some e-mail. We'll see a trend towards chat e-mail like the NTTI mode. A mention was made in the first session by the audience of the rapid rise of the entity smartphone in Japan this year. Over 1 million were sold from March to August of 1999. That's a phenomenal adoption of a new handset. That's the handset as fashion accessory school of marketing. I think we'll see glow in the dark and handset colours like mood innovations!! There are communicators. Nokia's had the 9000 series around since '96. It runs the GIOS operating system. It's a clamshell that opens up and has a full-corded keyboard inside. In addition it has another display on the outside for pure telephony functions. So we've already seen some product differentiation in the early smartphones. The Nokia 9110 is instructive because it proves that you can have a full-corded keyboard in a reasonably sized handset. But it also has the negative message that it hasn't done well and the issue is why hasn't it done well? Next year we will see the first of the PPC smartphones, as I call them. They'll have a microbrowser, handle e-mail, have touch screens, a personal information manager (contacts lists, short notepad etc) and you'll be able to synch that with your desktop pc to keep your calendars and lists updated.

At Cbit '99 Ericsson announced the R380. It uses the new EPOC operating system. From what I understand EPOC systems development has moved from Psion to Symbian. The future Psion PDAs and PPCs will be using extensions of that Symbian EPOC system. The other new contender from out of the blue was the Qualcomm smartphone, the PDQ. It's been announced. It's not shipping yet and query whether it will ever ship. It solved the microbrowser problem by a proprietary web-clipping technique. But now Qualcomm has licenced WAP so we may well see WAP-based PDQ smartphones.

I have real problems as a techno-nerd and power user with the idea of less than a full keyboard on a smartphone, if it's going to be my portable-computing device. You can have predictive text

entry. This is what you'll see on many of the smartphones for data entry. But I have one ergonomic question: how do I take notes whilst I'm talking? Another issue is how do I see "attached file". Market research shows that people who have mobile computing devices want to be able to view attachments. Those attachments are coming from different computers. You've got to have some power in the mobile terminal to be able to open a word file. Then I want to be able to see real HTML web pages because many times there's intelligence in the graphics or even in the animation. The possibility of corrupted WAPed web pages is real. Nobody has said anything about the accuracy of WAP converted HTML pages. All the pronouncements are about if you create a page using wireless mark-up language it will perform perfectly with your smartphone. That's not the real issue because the number of native WAP servers out there in the web universe is very small. In fact, at present maybe it's a handful. Will users accept miniature videotext as the gooey when they want to search the web? Another issue is vertical industry applications. Sales force automation; insurance; financial services; real estate brokerage. How do you build that universe of vertical industry applications when there are so few applications that run on EPOC? They run on Windows so there's going to have to be an inducement for applications' developers to port their applications to EPOC. And how do you manage all those mobile devices? Every mobile terminal will be an element in some enterprise network if it's purchased and managed by the company. Are the network management applications available to manage all the smartphones in an enterprise network if they're also going to be computing platforms. You only really have to manage it if it's a computing platform and we're talking about smartphones that will be computing platforms.

So I predict that we'll see new market segmentation for smartphones. Yes, we'll see the initial EPOC based, WAP microbrowser smartphones. But we'll also, I think, in conjunction with the higher data rates (GPRS, EGDE and UMTS) see smartphones that take advantage of those data rates. After all, if the goal of WAPing is to reduce the kilobytes per page so the transmission time is shorter, if you have 115 or 160 kilobits/second with GPRS you don't need to cut the kilobytes per page down and you can handle real HTML. The need to view attachments will drive the introduction of Win CE based terminals. They may not be smartphones. They may be HPCs that have a GSM card and these HPCs, I predict, may have "bluetooth" or some other local RF interface earsets so that you get the RF, or high-power RF away from the cranium. This will enable a component-based approach – like we have component sound systems, we'll have component mobile terminal systems.

Most of the initial smartphones will be the lower end. I can view something that once was a web page, that is a WAP web page, and I can talk and that is really what I want the terminal for. There will be other people that want a high-speed data interface to talk occasionally but the objective is going to be to carry one device and you plug that into a cradle, whether it's in your car or your office. We'll see this really emerge when we have higher data rates. I think until we have the higher data rates, at least GPRS, nobody is going to think seriously about video conferencing from their smartphone or from their HPC. You can already buy HPCs with digital cameras in them and of course HPCs with half-VGA screens (that is 640 x 240) are available with lid-mounted digital cameras. I use that a lot when I travel since I have a virtual law practice

and I videoconference over the Internet on a daily basis. I think this will become more common. So we have higher data rates, good power management in HPCs, and we'll have "bluetooth" and other what I call proximate networking technologies so that you can tie together a group of mobile terminals from a master terminal. You can essentially run a microcell wireless local loop from a server HPC that is serving several "bluetooth" earsets! You can be reselling bandwidth from an HPC to several voice users that are within the range of your "bluetooth" RF system. We may even see foldable keyboards. After all if you are doing serious text entry you need a good keyboard to get that information in in a timely fashion.

I therefore predict we'll have at least 5 different product segments in smartphones. The voice-centric smartphone that supports some minimal data feature such as notepad, synching with your desktop pc, will have a new lower end smartphone that is essentially a data port. If you want to get out there and get 2 megabits/second in the UMTS because you're video conferencing that will drive your purchase of a less-featured smartphone. Then we'll have HPC smartphones. Then what I call smartphone HPCs; that is handheld personal computers that you drop an INT2000 card in. And we may even see HPC servers that are running proximate RF networks around them. We'll see cradles for all of these things so that you can drop your HPC smartphone into a cradle in your car and you have voice telephony via speakerphone as well as your auto-pc functions. We'll see "bluetooth" earsets and payload and protocol conversion performed on a custom basis by servers. We may see credit management. I mentioned the DeutscheBank program. I think that will spread rapidly.

I think all of that is going to happen first in Hong Kong, and in Asia generally, because there is the gap between high penetration and low on-line penetration. And that gap is closed most easily by mobile data devices.

John Ure: I've noticed the 14% on-line in Hong Kong quoted in a number of cases. Just as a matter of information, the very latest figures that we've done at the TRP suggest that it may be over 30% now.

Mobile Phones as Desktop Computers

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TIF
9/99

Digital Convergence becomes IP Convergence

- By 2005, Mobile >50% Data
- Fixed/Mobile Integration
- Payload Conversion
 - Multimedia Smart Phones
 - Avoidance of Protocol Conversion
 - H.323 Packetized Voice and Video

IP Convergence will happen first in Asia

- Mobile phone penetration (1999)
 - 50% in Hong Kong
 - 33% in Japan, S. Korea
- Online penetration (1999)
 - 14% in Hong Kong
 - 12% in Japan
 - 5% in S. Korea

Wireless Terminal Convergence

- Smart phone features extend to PPC and HPC computing
 - WAP and HTML microbrowsers
 - PIM and office suite syncing
- PPC and HPC features extend to telephony
 - CDPD Radio PC Cards (NDIS intf.)
 - GSM Stack/PC Card -> Radio Card

Microbrowser Divergence

- Wireless Application Protocol
 - Replaces OSI layers above Layer 3
 - Includes new Security and Transaction Layers
 - Removes graphics to reduce Kb/Webpage
 - Requires dedicated WAP servers
 - Uses Wireless Markup Language
 - GUI is like “miniature videotex”

Microbrowser Divergence

- Wireless Application Protocol
 - Browsing WAPed Webpages is very different from browsing HTML pages
 - HTML microbrowsers, e.g, STNC's Hitchhiker, are available
 - WAPing helps response and paint time with 56 Kbps or slower and weak CPUs
 - With higher data rates, issue is low pixel count on smart phone LCDs

"Somewhat smart" phones - 1999

- Total GSM data (1999): <1%
- SMS and email
- SMS, email, and microbrowser (accesses only "low fat" Websites)
 - NTT i-mode PDC phones (NTT OS)
- Communicators
 - Keyboard, half-VGA display, clamshell
 - Nokia 9110 (GEOS OS)

Smart phones - 2000

- PPC Smart Phones
 - Microbrowser, email, touchscreen, PIM, PIM syncing
 - Ericsson R380 (EPOC OS)
 - EPOC OS published by Symbian, a joint venture begun in 1998 by Ericsson, Nokia, Motorola, and Psion. Joined by Matsushita, Sun Microsystems, Oracle, and Sybase.
 - WAP microbrowser
 - Qualcomm pdQ (Palm OS)
 - Palm OS published by 3Com's Palm Computing subsidiary
 - "Web clipping" microbrowser. Qualcomm recently licensed WAP.
 -

Smart phones - 2000

- PPC Smart Phone Issues
 - Non-trivial text entry
 - Composing email
 - Viewing and revising attached files
 - WAPped Webpages
 - Miniature videotex GUI
 - Possible corruption of native HTML Webpages
 - Few EPOC applications developers
 - Enterprise network management
 -

Smart phones - 2001

- Advent of HPC smart phones to address PPC smart phone issues
 - Keyboards, half-VGA displays, USB and network interfaces
 - Windows CE operating system
 - Office suite "pocket" applications, syncing, and network "element managers"
 - HTML browsers; many Win32 developers
 - Benefit from GPRS, EDGE, and fast CPUs

Smart phones - 2001

- HPC smart phones may begin as "smart phone HPCs"
 - HPCs already have WinCE, office suites, network interfaces, keyboards, big displays
 - "Component approach" to wireless data
 - Mobile phone and HPC or PPC (IrDA)
 - Phone upgrades to track GPRS, EDGE, UMTS
 - "Integral approach" would use GSM, EDGE, and UMTS PC radio cards, plus earsets

Smart phones - 2002

- UMTS arrives (384 Kbps to 2 Mbps data)
- EDGE (384 Kbps) available where UMTS is not
- Bluetooth, IEEE 802.11, or HomeRF for proximate networking
- Better voice recognition, foldable membrane keyboards and displays?

Smart phones - Segmentation

- Plain smart phone (voice and data port – various RTOS)
- PPC smart phone (EPOC, Palm)
- HPC smart phone (WinCE, EPOC)
- Smart phone HPC (WinCE)
- Smart phone HPC server (server edition of WinCE; or embedded Win2K)

Smart phones - Segmentation

- Smart phone/AutoPC (cradle)
- Bluetooth easet (earphone, boom mic, and short range RF link)
- Smart phone HPC server services
 - Payload conversion
 - Upgrading client smart phone software
 - Stored credit management
 - Sharing airlink with client smart phones

Conclusion

- Online access will drive smart phone boom, beginning in Hong Kong, Japan, and S. Korea
- Smart phone market will rapidly segment to reflect voice-centric, data-centric, and multimedia user groups; segments will reflect OS, application SW, and datarate preferences/budgets
-

Mobile Phones as Desktop Computers

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9/99

STEPHEN CHAU
DIRECTOR OF ENGINEERING
SMARTONE

(full transcript of presentation follows)

By second generation we are referring to the current digital GSM network, CDMA or TDMA. Today we see already more than 50% penetration in Hong Kong but I think as some of the other speakers already mentioned, the data rate pick up is still extremely minimal. Less than 1% or 2%. One of the reasons we believe for this is because the data rate of 9600 is not really attractive enough to encourage people to use data over the wireless. Of course, it is not enough to support multimedia and transmission. The second limitation we see is there are so many standards available. Even in Hong Kong we have 11 networks and several standards: TDMA, CDMA and GSM. No interworking or globalisation can be done at the moment. There's limited personalization capability and also there's limits on the service roaming capability. When we travel around the world we want to enjoy the same service as we enjoy in Hong Kong, but today it's very difficult if not impossible. And it's not an internet-compatible core network. Still very much circuit-switched base technology.

What are the drivers for 3-G? There is demand for interactive multimedia service picking up, especially the web growth in the Internet application environment. There is a strong demand for personalization together with mobility. Universal service access refers to when we travel around the world and want to enjoy a "virtual home service" – that is the same quality as at home. Of course, we would like to have a top quality service. CD-quality audio signal is an example, a DVD type of video. And very much from the business point of view the productivity efficiency is also one of the major driving forces. And of course we see also in some parts of the world, like Japan, 3-G means a lot to capacity in the future. However we also believe that 3-G by itself is not thought to be a success. It needs a lot of enablers together so as to ensure that 3-G will be on the right track.

Some of the areas we believe are very important and positive in terms of future developments:

Semi-conductor development: the processor is going to be more powerful, cheaper and smaller in size. This means we will have handy phones that will have wideband/broadband capability to surf the net, send a message, read and listen to CD-type quality audio.

User-interface technological development: such as display technology, this will not only give us a more enjoyable visual feeling but also give us a much more positive trend in terms of battery consumption.

User-interface usage: voice recognition, hand writing technology is already hot in this industry. I strongly believe that voice recognition applications will be very popular in the coming two or three years.

Multimedia technological development: the compression, like the MPEG4 and MPEG2 technology already people use a lot. We see this as actually part of the success for the future 3-G.

Software technology: computer graphics. Virtual reality is coming into the picture. Very important of course is the configurable radio. What we refer to here is a software-controlled configurable radio which can enable a multi-band terminal to come into reality.

IP Internet development: is one of the very important directions for the future. And for the 3-G for the new IP next generation development and also mobile IP. We also see 3-G very much fit in the development path.

Bluetooth: how can we on the one hand talk to our friends and also write text in the device. Bluetooth actually just fits and that sort of short-range radio technology we believe can have a major impact on our daily lives.

Convergence of fixed and mobile telecoms: in Hong Kong we are seeing regulatory development is very much encouraging competition. This means it will drive operators to always move ahead of the others to try to come into the new area, like 3-G. This is a social trend.

So what are the implications of 3-G? We see 3-G as a global standard which offers universal service access throughout the world. It can provide at least 384 kilobit / second for the wireweb area for full mobility and at least 2 megabit/second for an indoor non-mobility environment. It's a kind of broadband multirate service capability.

Virtual home environment: same look and feel anywhere when we want to access home service even if out of the country.

Security: it enhances security: very much an issue of data integrity. It allows the personalization of telecoms service to come into the real picture. We can have our own tone set-up that's different from the others, for example. I see important lessons for us as operators also. Our role will probably change. Not just providing a carrier service but rather we will gradually move into being service creators of provider environment. And very much involved in the solution integration.

Terminals: and of course we also see mobile terminals and devices playing a major role. I, myself, am not surprised if operators like us actually tap into this terminal development environment.

Packet-mode IP mobile networks: we cannot avoid this. We see in the future that it's very much IP-driven. Packet-switch traffic: it actually also highlights some issues. We are looking for a broadband transmission facility widely available in the whole territory. We need to ensure that

the entry barrier is low which means we need to ensure the transmission facility can be available to us at a reasonable price. With that it actually means to Hong Kong as a telecommunications hub, if 3-G is going to be a success.

Infrastructure: micro-cell, pico-cell infrastructure which actually means we can enjoy a 2 megabit environment in the home zone and also we can enjoy about 384 kilobit/second in the microcell or macrocell environment. And of course we will have internet with roaming between 2-G and 3-G and also multi 1-G standards and networks.

Spectrum requirements: to implement a 3-G network HCS hierarchical structure is very important to ensure multirate data capability can be covered in the network. With that we believe that 2x15 megahertz blocks in the pair spectrum and also 1x5 megahertz block in the unpaired spectrum is the bare minimum to support it. Just highlight why, in order to implement the hierarchical cell structure we need 2 x 15 megahertz in the pair spectrum. We need a 5-megahertz block for the pico cell and also 5-megahertz block in the micro as well as the macro cell.

Second generation migration to 3-G: There will be a different migration path. It depends on different operators' strategy of course and we believe there will be very much a phased approach before we actually offer a comprehensive 3-G network. Very much demanding 2-G and 3-G interworking because when we start 3-G we believe 2-G still offers a very high quality voice network. It doesn't make sense for us simply to go and replace the 2-G network. Which drive for the multimodal, multiband terminal: operators like us already have a 2-G network fully deployed in Hong Kong. We are also seeing the co-site between 2-G and 1-G is very important to ensure a fast rollout. This is a possible migration path that operators can adopt. We can go through from 2-G direct to 3-G, of course. I think, more realistically, like us it will go through "enhanced 2-G network", likely GPRS or HSCSD, questionably, before we land at 3-G.

A phased approach: to start with we believe there will be several island coverages for 3-G and then gradually go to the full-blown 3-G network. The core of the network is connected from the fixed network PSTN through the 3-G infrastructure, go through the 3-G air interface, and then connect to the phone. When the call actually is used as a basic voice service the system will enable the handover between 3-G and then pass the call back to the 2-G network. However, we have to see if the data rate is reduced. Just to emphasize on the multimode, multiband terminal, we are already saying that one of the beauties of 3-G is universal service. Basically you can carry one device and can travel around the world using the same device. Instead today we have to change device if we travel to a country like Japan or Korea. It's really achievable by means of multimode, multiband terminals. That's why we say it's very important to globalization. The fact that the frequency allocation over the world is mismatched like the European allocation is not the same as the US. So we are seeing a multiband which can switch between different frequency bands. It is very important when we travel from Europe to the US. It is actually a mandatory requirement for terminal suppliers to manufacture these multimode, multiband terminal in the second phase. And the handover between UMTS and GSM is virtually a day-one requirement. Co-site: SmartTone has carried out a 3-G trial in Hong Kong since April this year. We are

in the process of compiling the final report which we will make public by the end of this month latest. During the trial we focussed on testing what will be the impact between 2-G equipment and 1-G equipment when they locate together. The result we find is very positive. We don't see any impact of interference between two types of equipment when they are put together. So it gave us a very positive signal that we can assume there can be a fast rollout 3-G infrastructure, based on the 2-G infrastructure.

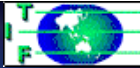
Evolution: we believe that 2-G to 3-G evolution means a new market for the mobile multimedia services. There will be a lot of machine-to-machine communications. Mobile e-commerce will be a reality. Location data service and also personalization services. More than that we believe mobile data will gradually take over the voice traffic and mobile will be very much the mainstream. And also from the transport network point of view the circuit-switch based transport network will gradually convert and migrate to ATM based broadband network.

The road map: the licence can already be issued in 2000 and the network may be in service before 2002. We should try to catch up with Japan and some of the Nordic countries.

As a conclusion, we think there are already a lot of enabler/drivers already available for 3-G to use. Mobile interactive multimedia will be the main focus. Packet traffic very much dominant. Service provider/creator role will play a very important position. We also see with the 3-G development it creates a lot of opportunity for small software houses and venture capital companies to invest. And really 3-G will shape our life-style.

Telecoms InfoTech Forum

7 Sept. 1999



What the migration for 2G to 3G will mean for operators

Stephen Chau
Director of Engineering
SmarTone Mobile Communications Ltd

SHAROTONE

Agenda

- √ 2G Limitations
- √ Drivers/Enablers for 3G
- √ 3G Implications
- √ Frequency Spectrum Requirement
- √ Migration Consideration
- √

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Agenda

- √ 2G to 3G Evolution
- √ 3G Roadmap
- √ Conclusion
- √

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2G Limitations

- √ Low data rate capability
 - not enough to support multimedia transmission
- √ Many standards
 - no interworking or globalization
- √ Limited personalization capability
- √ Limited VAS service roaming
- √ Non Internet-compatible core network
- √

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Drivers for 3G

- √ Demand in Interactive Multi-media services
- √ Rapid growth in Internet usage / applications
- √ Need in Personalization and Mobility
- √ Universal Service Access
- √ High Quality of Service
 - e.g. CD quality audio signal
- √ High Business Productivity
- √ Demand in Capacity

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Enablers for 3G (1/3)

- √ Semiconductor development
 - Processor is going to be more powerful, cheaper, smaller in size.
- √ User interface technological development
 - new display technology
 - √ Cholesteric Liquid Crystal Display (Ch-LCD)
 - √ Plasma Display Panels (PDP)
 - handwriting and voice recognition

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Enablers for 3G (2/3)

- √ Multi-media technological development
 - Compression & Presentation technology
 - √ MPEG4 & its successors, Fractal coding
 - Software technology
 - √ Computer Graphic - Virtual Reality
- √ Configurable Radio (software radio)
 - enable multi-mode terminal/base station

Enablers for 3G (3/3)

- √ IP/Internet technological development
 - IPng, Mobile IP and Next Generation Internet
- √ Short range RF cable replacement - Bluetooth
 - complement with 3G to achieve application level end-to-end wireless communication
- √ Convergence of fixed and mobile telecoms
- √ Regulation to encourage competition
- √ Social trends

3G Implications (1/3)

- √ Global standards
 - universal service access
- √ Broadband multi-rate services
 - at least 384kbps for wide area/full mobility
 - at least 2Mbps for indoor/low mobility
- √ Virtual Home Environment
 - same "look & feel" in anywhere (service portability)

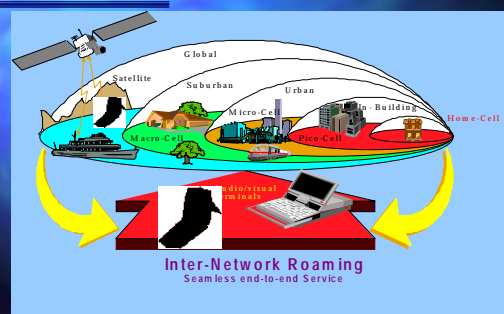
3G Implications (2/3)

- √ Security on Privacy, integrity of information transfer
- √ Personalization of telecom services
- √ Operator role change
 - Service creator/provider for different market segment
 - Solution Integrator
- √ Mobile terminal/device play a major role

3G Implications (3/3)

- √ Full packet mode mobile network
 - end-to-end packet switch connection
 - coherent with IP or Internet
- √ Packet switch traffic out-weight circuit switch traffic
- √ Expensive broadband transmission facility
 - barrier to operator for 3G
- √ Important to HK as a telecommunication hub

3G Coverage Model



Terrestrial Spectrum Requirement (1/2)

- For optimal frequency efficiency, Hierarchical Cell Structure (HCS) is required
- For full 3G service rollout, the initial allocation per operator requires at least
 - 2 x 15 MHz in paired spectrum (continuous block); and
 - 1 x 5MHz in unpaired spectrum (asymmetric traffic, e.g. Internet access, video on demand)

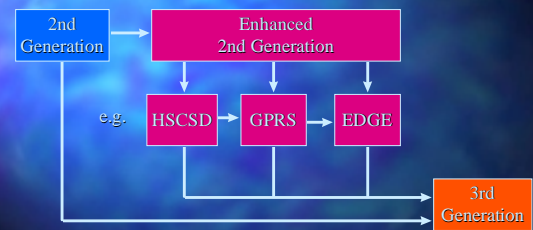
Terrestrial Spectrum Requirement (2/2)

- Hierarchical Cell Structure :
 - Macro Cellular Layer 2 x 5 MHz (paired spectrum)
 - Micro Cellular Layer 2 x 5 MHz (paired spectrum)
 - Pico Cellular Layer 2 x 5 MHz (paired spectrum)
 - Total** 2 x 15 MHz (paired spectrum)

Migration Considerations

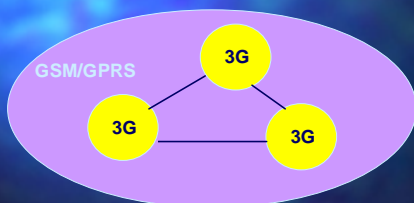
- Different migration paths
- Phase approach => smooth migration
- 2G/3G Inter-working
- Multi-mode/Multi-band terminal
- 2G & 3G Co-siting
-
-

Different Migration Paths



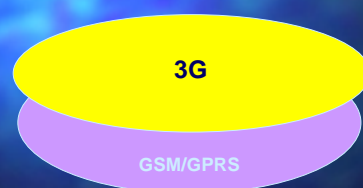
Phase Approach GSM Evolution to 3G

- Step 1 : GSM/GPRS + small scale 3G Network



Phase Approach GSM Evolution to 3G

- Step 2 : Full blown 3G network



3G Roadmap

- v Radio Technology Standard will be finalized this year
- v In Japan and Europe, commercial system will be in operation in 2001
- v In HK
 - license may be issued in 2001
 - network in operation expects in 2002

Conclusion

- v Many enablers/drivers are ready for 3G
- v Mobile interactive multimedia era will emerge
- v Packet traffic will be dominant
- v Service provider/ creator play important role
- v Nurture the business opportunity to local software company for innovative applications
- v Create job opportunities
- v Shape our living style

ANDREW CONSTANTINIDIS
CITIBANK

(full transcript of presentation follows)

I want to talk a little bit about remote financial services. Citibank I think throughout the world is well known for being technologically quite innovative and so we have quite a bit of experience in this area. Although most of it so far really has been on the Internet, rather than with mobile phones. So sometimes you will see me switching back and forth talking about the two.

Citibank has generally been recognized as the best, or one of the best at least, within the area of Internet banking. This particular slide points out Worth magazine. We came out first there. That was fairly recent. And Smart Money also recently did a poll and actually this week Fortune just did another one. And Citibank in their Internet banking quite consistently comes out number 1 in that area. We continue to get pretty good accolades for services we're providing. That's primarily in the States. Here in Hong Kong Citibank was the first internet banking service in Hong Kong in November last year. There have been a few others that have joined us since then but I think we have pretty well the largest usage in that area. 1 out of 5 of our banking customers have used it so it's a pretty good response. In the mobile phone area there are about 4 banks that are offering mobile phone banking and Citibank is one of those as well. The mobile phone banking so far has basic transactions (transferring money between accounts, paying credit cards, looking at balances etc) and has not been too broadly accepted here yet. But at least we're early in the market for it. That's the good news. Really being the best, from my position, is really not good enough. If you look at Citibank globally we have over 100 million customers throughout the world. On the Internet the latest numbers show 1.2 million users, using the Internet. So if you look at that from a percentage point of view it's 1%. Frankly that's very low. Even though we may have some of the best coverage it's still not good enough.

One third of all bank customers who have opened an on-line bank account in the last 12 months have since closed their account. I will tell you that is not the case for us. We have got a much better response rate than that, but that is for all banks in general. Also when asked why they discontinued their accounts half said that they found the sites too complicated to navigate and customer service was not satisfactory. Which really suggests that the importance of ease of use and that Internet only is not particularly popular right now – you need some service and support beyond that. In the last year on-line brokerage customers have increased by 53%, insurance 47%, even credit card applications 27%. In the same period on-line banking customers have increased 2%. So I think what we're looking at here is that we think of Internet broking where clearly the Internet has totally transformed that industry. It has shaken it up right to the core. If we look at banking, Internet has done nothing. We've moved some customers off of traditional channels into that but we really haven't fundamentally changed the banking industry at all. Frankly I don't think it will last that way for much longer.

Let's take a look at the business environment and why I say that. The three key drivers/elements that are driving remote channels; technology, consumer requirements and the business environment. And remote channels include not just Internet but Internet mobile banking and some of the other devices that will be coming onto the market pretty soon.

Business economics: I don't know if any of you know this but Citibank's corporate goal is to have 1 billion profitable customers by the year 2012. That's a pretty ambitious objective and really there's actually no way we can do that with brick and mortar branches. The cost of building that many branches is unbelievable and the number of branches we would have to have would be the same as the number Starbucks Coffee houses there are in the States! If we are going to look at how we're going to handle, to address that many customers, we really have to rethink our distribution channel, and that means remote banking. At the bottom there I have a chart that tries to outline the cost of the various channels. It is not exactly the same as the one in your TIF handout but broadly it's about the same. I've also rounded those numbers pretty generally so you can't go back if you're another bank here and use them for comparison, just in case! What it does show is on the one side you have the types of transactions that involve people, where you're using a human to receive or input the transaction, including manned telephone service (the least expensive of the three manned services shown). In comparison I have ATM machines, automated voice systems which tend to be quite a bit less expensive and finally the Internet. The Internet number there of US\$0.01 / transaction is really the US number. It is actually a bit higher in Hong Kong as we don't have quite as many people for spreading out the cost. Mobile banking is not here on this list because we don't really know but I would expect it to be somewhere between the automated voice system and the Internet system, ie, very inexpensive. So basically remote channels are saving us about 90% in the cost of a transaction and what that will allow us to offer some of the sophisticated quality services that we're offering now to some of our more valuable customers, right down to the middle and perhaps the top of the low-end within the banking industry. So from an economic point of view, remote services are absolutely critical and the only way that we believe we can achieve our corporate objective.

Let's take a look at the customers for a moment. The customers are actually demanding mobile services. I've listed 4 of the factors that are really contributing to that:

Changing lifestyle: I think we all know that we really don't have time anymore to find a branch, go in and stand in line.

Also generally within the Western countries the amount of wealth that's available has been increasing quite a bit. And the growth in individual wealth requires more active management of that wealth. So that is driving people to take more time and more interest in looking after their money. There's also just a general feeling the people seem to be having that they need to be personally responsible for their own money. I think that's because there's a lot of concern about whether the pension systems will be there when the baby boomers hit retirement age. It also might be just a little bit of a trend. It's the in-thing to do to say that you have your own brokerage or banking account to look after your own money. But certainly that is resulting in people taking a lot more interest in their money and they're not interested in doing that at a branch. Fi-

nally, the consumer has a lot more knowledge about not just banking but also about technology and they're willing to use both of those to manage their money better. So there's a lot of factors coming from the customer that are forcing us to do it. At the bottom of this page I've tried to give you an idea of where the channels are today. Again, I've rounded these numbers broadly in case there are any bank competitors here. Generally speaking we're seeing our remote channels taking about 60% of our transactions currently. And of that 60%, I've broken it out there between ATM, automated voice response system and Internet banking. So you can see there that the ATMs which are considered a remote channel because there's no person involved still have the bulk of transactions. I was comparing the ATM machines with Internet banking to see the kinds of transactions. On an ATM machine you can roughly say that one-third of transactions goes into these three categories: account balances, taking out money and transferring money to pay bills. Roughly a third each. That means that a third of them are financial or currency transactions, moving money from one place to another. If you look at Internet banking transactions, the vast majority (at least 95%) are still just looking at balances and transactions. So actual currency transactions don't represent the bulk as yet. I think that reflects the degree of comfort that customers have with the technology. They're comfortable to look. They feel that if they look at the balance it's the right number but to actually make a transaction they're still a little bit nervous. It took ATM 15 years to get to the point it is today. I think the Internet will get there a lot faster.

Technology: all of the speakers today have spent a lot more time on the technology than I will. Other than to say that technology is critical to our being able to offer these remote channels. If the technology is not there to offer services of the quality that our customers expect, we can't get anywhere. If we look at what has been happening we've seen that certainly within the internet we started with the very basics: browsing, looking at information – not even personal information, just general. We then saw some financial data. Typically that would actually be stock quotes or sometimes we started to see personal data for an individual customer being made available. That moved on to simple transactions where we are today with mobile phone banking in Hong Kong. That is transferring balances from one account to another, paying your credit cards and other basic things. And finally where we are today with the Internet, some very sophisticated financial services broking, currency management. Different banks in different areas are offering pretty well anything you could want from a financial service somewhere on the Internet. So the services there are really very sophisticated. On the technology side, take a moment and think of Hong Kong. I have some numbers up here. Part of what I did for today was look at the US numbers. I got a think called the E-Global report. It was very interesting because it had a selection of different companies' projections for number of Internet users, number of mobile phones etc and it's just amazing. Even for the current estimate of number of Internet users in the US it ranged from 60 million to 110 million! But the numbers I have here for Internet population in Hong Kong, 1.25 million, that comes from the latest AC Nielsen report. The mobile phone population at 3.3 million I have heard today and read in Hong Kong Technology Post. Those are the numbers that we're looking at today. I think that it's been eluded to earlier but I put the numbers up here percentage. The percentage there where we get such a high number, at 79%, is a percentage of adult population, 15 and above, for Hong Kong. And 11% for

the US. That number might be a little bit out for the US but you see there's a huge variance there. In terms of Internet we have 31% which is still lower than the US. So what we see here in terms of the usage is that in Hong Kong the mobile phone has a significantly higher penetration than Internet does. Which leads me to believe that use of mobile phone banking is going to be extremely popular. More popular than it is in the States relative to Internet banking. That covers the three areas that we look at and why we're doing it. The business issues. And even the technology I'm looking at it primarily from the business side, as asked to do, but I certainly can, if there are questions answer some more technical questions later.

Let's talk about mobile financial services specifically. There's a quote there: consumers have spoken. They want wireless access. That's coming from Ed Horowitz who is the head of what we call E-Citi. It is our technology group. They are the ones that develop all kinds of Internet banking etc. for us. So clearly we are fully embracing the fact that our consumers want to use mobile phone banking because as a bank we feel we have some of the best products and the technology to get there in front.

If we look at the mobile devices, Ericsson also gave the number of 1 billion mobile phones in 4-6 years. I also think that it is key to point out that it's not just mobile phones, there's a whole slew of devices out there that are going to be wireless. And we are very interested in providing services to all of them. I actually saw an example, a prototype, in Singapore which was using Bluetooth which had an ear device and a microphone and the handset itself was in your hands. On the other hand, within the mobile financial area there are way too many standards. I think we just read about 50 of them today. And for a bank we aren't really here to pick one technology over the other. So we are moving forward with a specific approach, which I'll just briefly explain. I took all of the technical complexity out of it so there are only 3 boxes left. Basically Citibank has purchased an equity interest in a company called 7/24 Solutions. This is a company that is providing a mechanism for us to address the issue of so many standards and so many devices. We communicate with them using OFX, which is one of the many standards, but a message-based communication about financial information. The record includes what kind of a financial transaction it is and that tells you what kind of data is included. All of our backend systems will be able to pump out messages according to this standard. So we, as a bank, only have to write to one format. Then 7/24 will take that standard message and will format it for whatever devices are out there. Now in this slide I picked 5. Don't go making any assumptions on the five that I picked. I merely picked them because I had the little gifts and it seemed to look nice. 7/24 actually has all of the various mobile phone standards available as well as SEGA devices, tv desk tops, they've even got some Internet working. So we're going to take that approach. If I do my job right, Hong Kong will be one of, if not the first Citibank affiliate to go ahead with this technology. We would like to be out there in front because of what I showed you in terms of the penetration of mobile phone devices in Hong Kong.

This is announcement between Citibank and Scenario which is a telecoms company from the Scandinavia area. Their specialty really is on PKI and making the mobile phone services secure. Both bought a significant interest in 7/24 Solutions. I did hear some people talking about PKI

and whether or not that would be something that would be important and they weren't too sure. I want to assure you that as soon as it becomes usable we'll be using it. We're pretty strong in that area.

This last slide is an attempt to try to separate what sometimes can be a little bit confusing, that is where does internet versus mobile fit in terms of banking services. There really is a lot of overlap in the services but I try to think of the internet where you're talking about a large screen device that sits in one place primarily as control. Yes, it is anytime. You can sit down and use that machine 24 hours a day but it isn't really totally mobile. You've got to be in one place. The one thing you get out of that, as it's a large thing and you typically have fast communications, is a lot of detail. A lot of detail about your accounts, or about rates and various other information that you might want to use, that you're not going to be able to get off of a small screen mobile device. The mobile devices on the other hand really do fit in to the anytime, anywhere category. You're probably going to get less information on that smaller screen but what you are going to be able to do is use it anywhere. So the issue of how you position these two classes of devices becomes quite interesting to us.

Remote Financial Services

Telecoms Infotech Forum

Andrew Constantinidis, VP
New Development and Marketing Analytics
Citibank Hong Kong

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Agenda

- Citibank Leadership
- Business Environment
 - Business Economics
 - Consumer Requirements
 - Technology
- Mobile Financial Services
- Questions and Answers

Telecoms Infotech Forum Presentation



Citibank Named Best Internet Bank

CITIBANK NAMED BEST ONLINE

Citibank was chosen as 1999's best online bank by Worth Magazine's annual Readers' Choice Survey of financial services. Approximately 4,000 of Worth's subscribers responded to the poll. The award follows on the heels of SmartMoney.com's survey of online banking, where Citibank took the top spot among traditional, full-service consumer banks. When it comes to online banking honors, you won't catch the Citi napping.

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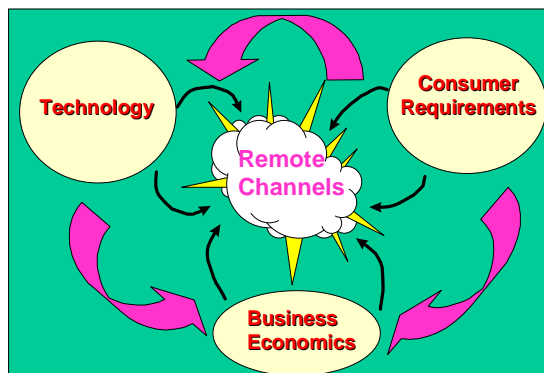
Best Is Not Good Enough

- κ Citigroup has over 100 million customers worldwide. However, only 1 million (1%) use Internet Banking.
- κ One third of all bank customers (all banks) who opened an online bank account in the last 12 months have since closed their account. (Source: Cybercitizen Finance)
- κ When asked why they discontinued their accounts, 50% said they found the sites too complicated to navigate and customer service was dissatisfactory.
- κ In the last year online brokerage customers have increased by 53%, online insurance services by 47%, online credit-card applications by 27%. In the same period online banking customers have increased by 2%.

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Business Environment



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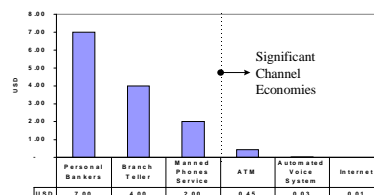
Business Economics

Citibank Corporate Goal:

♦ 1 Billion profitable customers by 2012.

We must restructure distribution to meet customer needs and reduce cost of delivery.

The only way to achieve this objective is through remote channels.



Remote channels achieve 90% cost savings

Enabling us to offer services to mid market segments at competitive prices.

Telecoms Infotech Forum Presentation

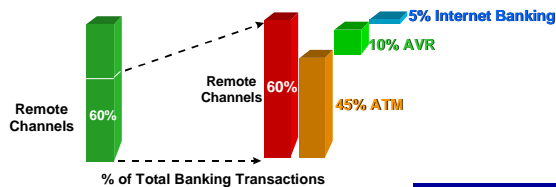


Customer Requirements

Contributing Factors

- Lifestyle changes create need for remote channels
- Increasing wealth requires additional management
- Personal responsibility for finances (retirement etc.)
- Increased customer knowledge and experience

Usage of Remote Channels Reflect Consumer Confidence



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Technology

Technology Evolving to Support Secured Transactions

Informational



Transactional

- ◇ Web Browsing
- ◇ Online Financial Data
- ◇ Simple Transactions
- ◇ Sophisticated Financial Services

4 Rapid Proliferation of remote devices in Hong Kong

- Internet population at 1.25 million.
- Mobile Phone population at 3.3 million.

Penetration of Adult Populations (15+)	Hong Kong	USA
Mobile Phone	79%	11%
Internet	31%	38%

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CITIBANK

Mobile Financial Services

"Consumers have spoken: they want wireless access."

Ed Horowitz, Citigroup senior officer and head of e-Citi.

- 4 Explosive growth of mobile devices.
- 4 1 Billion mobile phones in 4 to 6 years.

Too Many Standards.

- 724 Solutions offers method to address multiple standards easily.



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CITIBANK

Citibank, Sonera and 724 Solutions

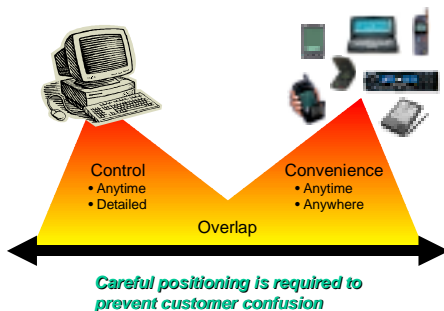
- ✕ Aug. 10, 1999 -- Citigroup's e-Citi unit and Sonera Ltd. today announced they are entering into a strategic partnership with 724 Solutions Inc. to drive secure wireless access to financial services on a worldwide scale. As part of the agreement, e-Citi and Sonera will each make a strategic investment in 724 Solutions.
- ✕ Analysts predict explosive growth for the mobile device market in the next few years, with most predicting 1 billion mobile phones in use in the next four to six years.
- ✕ "Wireless banking will be the biggest challenge and opportunity for financial institutions since the Internet. The highly advanced applications and insight on financial markets and services of 724 Solutions combined with Citigroup's powerful global brands and extensive customer base and Sonera's leading-edge wireless security solutions positions each of us for the significant growth of wireless banking and brokerage." Harri Vatanen, head and founder, Sonera SmartTrust

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Internet Banking Vs Mobile Banking

◇ Market Positioning



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Remote Financial Services

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Question & Answers

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Open Discussion

During the discussion period the following points were raised:

A Participant: I was intrigued that you all made particularly strong statements about what we might call trust management. PKI got a mention at the end so maybe this question is how far will 3-G and new technology push PKI issues away from the consumer? If I try to take it in the order of the three speakers. If we assume a Bluetooth proximate network, and one component part of that network is a biometric enabled smartcard authenticator (which exists), how would that then change the need for a digital certificate mechanism within the proximate network? If we then move along to the SmarTone belief that within a couple of years handwriting and voice recognition, and probably face recognition, could be part of the phone. So again, the authentication of the individual could be biometric. The question then I'm driving at is the mapping from the knowledge of the individual to the secret key in the digital certificate seems to be pushable away from the individual. But is it in the bank? Is it in some intermediary, like Hong Kong Post? Or is it in SmarTone as an operator? Or can we say that PKI, because of this technology is pushed much further away? And the political footnote is since smartcards are so low penetration in the US, and since mobile phones are so low penetration in the US, has Hong Kong and Asia been misled about the importance of PKI because Americans don't understand 3-G impact on biometric security?

George Darby: I'll respond with a question. Why hasn't SET succeeded, since it's over two year's old now and nobody's using it? Secure Electronic Transaction was a thing that was supposed to sweep the world with using any credit card that's part of the SET organization. My take is that there will be trust authorities. There will be other trust authorities who are affiliated with financial institutions and you will trust a Citibank trust authority or a USPS trust authority (in the US the postal service is operating as a trust authority) more than you will trust the Acme trust authority of the Cook Islands. Not that I have anything against the Cook Islands, it's just not a global name.

Andrew Constantindis: We've had a lot of internal discussions on that issue. SET was wiped out because it's just way too hard to use. We have a SET mall running on Hongkong Telecom's IMS and it's just too hard to use. So that's why that hasn't got anywhere. What are we doing in terms of PKI? A scenario from Finland Telecom has it that a SIM 16k chip can have a PKI on it and still have room for banking applications. So you'll be able to have that on your phone. The good thing about that is your phone is a more inherently secure device, as opposed to the pc where it's been quite difficult. The pc is a much more inherently insecure device. Let me give you an example. You've got your channel to channel encryption with SSL. We actually add another little piece in there for our internet banking because even inside your pc there's still a period between the keyboard and when it's encrypted where certain information is open. We add an extra little piece in there at the front end and then at the back end to keep those secure. So

there's quite a bit more work that needs to be done on the pc to get full security. Whereas on the phone it's built in right from scratch so I think you'll see a tremendous amount of security. Not to get back to PKI itself, you've actually got two pieces there. The PKI says officially who you are and so on. The thumbprint says "I am the right person using it". You actually need both. You can't do one or the other. So, for instance, you have smartcards with PKI and with a thumbprint so that you can say both of those things at the same time. A) this card has the authority to do whatever and I'm the right person to be using it. Because if you just have the card then somebody else could take that card. If you just have the thumbprint then you're not really sure at any given time what authority you have. So you really need both.

Stephen Chau: I'd just like to add that as a mobile operator we also spend a lot of time talking internally about what we mean by secure transactions. We believe that PKI is one of the ways forward, of course. And also we believe strongly that PKI within the SIM is in our interest because it is actual identity within the phone or even the SIM card. And talking about user interface technology like the voice recognition, we very much agree that it actually identifies you as a user to utilize the device. Rather than trying to authenticate whether you are allowed to send or complete a transaction. We see this as different. So it's not a matter of 3-G or 2-G.

George Darby: I have a footnote. I think smartcards will come to the US with smartphones.

A Participant: (to Citibank) you highlighted the cost of transactions on the Internet as opposed to other channels. Clearly it's entirely self-serving and so it should be. But what you are suggesting is that there should be a change in consumer behaviour to serve an interest of the bank. So fundamentally, if I'm a consumer, you're asking me to change the way I do things just because the cost to you is lower and you'll be more profitable. That's fine but are you incentivising me in any way if I were to use any alternative channel? The second question is related to using the Internet infrastructure to actually deliver any service, your wireless or mobile service doesn't really use the Internet structure. It uses another proprietary infrastructure.

Andrew Constantindis: It is absolutely correct the Internet is good for Citibank because it costs less. But that does not mean that our customers are going there because of that. Our customers are not going there. They can continue to use any of the existing channels. We have not created separate customer sets where you can only use one or the other. So right now it's totally voluntary. The customers go there because they want to. And an interesting indication that we are providing a service that these customers want, is the use of the internet is correlated with the value of that customer – the total amount of money that customer has with the bank. Which is to say that those customers that have more money are spending proportionally more time using the Internet than any other customer segment. Which is a convoluted way of saying: we like it because it saves us money. But we also like it because it gives our customers better service. And that's demonstrated by the fact that our wealthiest customers are using it more than any other segment.

Your second question is the current mobile phone system is not really Internet. I, as a banker, don't really care what the technology is. And in fact the further away I can get from worrying about the technology the better. I'm much more interested in simply giving transactional or financial services that our customers are interested in. My objective there is to push that worry onto someone else which is why we've entered into the JV with 7/24.

A Participant: you say that remote channels do offer lower costs. Does this proprietary solution of not using the Internet infrastructure lower costs?

Andrew Constantindis: the Internet is one of the ways you can get out from 7/24. You've got your banking transaction on one side that has the information. For example, let's say you're going for a balance on one of your accounts. This is a balance transaction. This is the account. This is the customer. This is the balance. Whatever security information. So then we have another device that then is formatting that one message for all the different devices ranging from Internet right through to phone. So that takes the emphasis or the responsibility for that off of us. For our Internet services we are actually currently going directly to the Internet because that's the most popular one. We're not doing that today nor do I envision us doing that immediately through 7/24. But we certainly could.

A participant echoed a comment made about the possible impediment for implementation of 3-G, that is broadband being expensive. Give you an example. With GSM PCS you probably have 100 – 1000 base stations to cover Hong Kong and each base station probably will have an E1 interconnection with PSTN. So you are already paying a lot of money for interconnection. Now, from an engineering point of view if you go to 3-G with the same power level and increase in speed, you possibly need about 10,000 – 100,000 base stations to cover the whole of Hong Kong. Now with each station interconnecting with the ATM network from 45 megabits to 150 megabits you will pay a lot of money for infrastructure. You'll pay a lot of money for broadband access. Will the broadband access be one major obstacle in terms of implementation of 3-G?

Stephen Chau: I can only agree. We talk about gradual migration to 3-G. What is the cost structure. In particular just to get the transmission facility from the incumbent fixed operators. It's not just SmarTone's interest it's really in the interest of the whole industry to ensure that wireless broadband will fly. We think that if all the industry players work together we should manage to get the entry barrier down. I guess with the regulator supporting the development of 3-G in Hong Kong that is actually all the effort we need to put in to ensure a reasonable cost structure. We shouldn't try to discourage the development of 3-G in Hong Kong. Also, regarding the number of base stations, our study tells us it will be more but maybe not two or three-fold more.

A Participant (to George Darby) you painted a vision for high-end usage for business workers. Do you envisage that to become a mainstream capability at any point in time for business workers in mature markets? A comment here is that the prices of desktop

computers are really decreasing at a more rapid rate in the last 12 months than they have done in the last 5 years and broadband is still going down in cost. So given that do you see high-end usage model that you painted ever becoming a mainstream capability from a price point standpoint? And what's your take on it for emerging markets?

George Darby: if there's a market that's going to be important it's going to be the introduction of pcs into China and perhaps the way that happens is smartphones that are actually pcs to which you attach a keyboard or display. In Japan I think I-Mode this year is very instructive. There was no I-Mode until March. In August 1 million phones had been sold, including the development of a little companion device from Sharp (an MT200 – The Communicator) which has a display screen LCD, half VGA, and a keyboard and you plug it into your phone. So suddenly you have at least an HPC capability as a mobile terminal. So I think high-end devices will track desktop devices very closely in fact with shorter delay than we have now. We see a 600-megahertz Pentium III now. How soon could there be a mobile version of that and how soon could it be in something the size of a Nokia 9000?

***A Participant:** the speakers seem to overlook one trend, the dual-slot phone. The second slot can fit a SIM card or a smartcard inside a mobile terminal. It can immediately deploy mobile applications. Do you see that as a trend?*

Andrew Constantindis: I would eventually like to see that second card be a Citibank credit card with your credit card information and your Visa cash to pay your phone bill right on it!!

George Darby: current HPCs and PPCs have a pc card slot and a compact flash slot and the balance seems to be using the pc card for network interface and the compact flash for more memory. In the future I think the pc card will be a GSM or a UMTS card and the compact flash slot could be security, a ROM-based application. Compact flash is already up to 160 megabytes. That should be plenty for PKI plus an application, plus stored value.

Stephen Chau; Our business is very unusual here. The dual slot phone actually still needs some momentum to push its popularity. There is some project ongoing to work on these dual slot phones to work on a secure transaction based application, as well as normal SIM usage. But I don't see in the next 6-12 months time that it will be in any way popular at all in Hong Kong or in the world. We have to take a wait and see approach.

***A Participant** I just have a question about the market. We've talked a lot about the technology, the concept and where we're going to go. But I'd like to bring it right back to Hong Kong and I just wondered if you could give us a brief analysis on how you see the market developing over the course of the next 18 months. Do you have any feeling who you think the winners are going to be and who will be the losers from this new move to 3-G? I ask that because one of the first speakers earlier, made a comment which I found a bit surprising. That it's not going to be essential to move to 3-G to remain competitive.*

My feeling as a non-techy is that this really is something that's going to be essential. That you're going to have to grasp this new technology if you're going to compete and win.

Andrew Constantindis: It's not really a banking question but if you want to know winners and losers then financial institutions that embrace the new technology, particularly as everybody has one of those devices in their pocket, the faster we adopt and embrace it that's going to give us a competitive advantage. That's not quite the answer to your question but it relates to it.

George Darby: there's almost a too easy technical answer and that is EDGE is for operators that don't get a UMTS licence. So, no you don't have to go to 3-G to survive. Another dodgy technical answer would be the near-term winner's going to be GPRS as opposed to a high-speed circuit switch because if you're paying by the packet you can leave your device up 7/24 and get your e-mail only when it comes in. And as far as the bigger picture of whose 3-G technology will win, I think that was the first panel that had that answer.

Stephen Chau: I think it's actually quite a debatable question. There's probably two different views. If you take a look at compression technology today and in the coming future, you can argue whether 3-G is really necessary to actually come in the picture. But if you take a look from the other direction, I think 3-G really is a new concept – an IP based, ATM based, broadband core network.