The Marketing Intelligence Behind Effective Decisions

(Presented by Mr Leon Perera, Group Managing Director, Spire Research and Consulting Pte. Ltd during CA EXPO HK 2002)

Speech on Wireless WAN to CA Expo Hong Kong 2002

A very good afternoon to one and all. It's my pleasure and privilege to be addressing the guests and participants at the CA EXPO Hong Kong 2002. My company Spire Research and Consulting is proud to be the Research Partner for this exciting event. Please allow me to outline the coverage of my short talk today.

Spire Research and consulting provides Market Environment Research and Consulting services across the Asia Pacific region, with a heavy focus on Information and Communications Technology. By Market Environment Research, I mean marketing intelligence on aspects of specific product or service markets in specific countries, such as market size, trend, competitive environment, pricing and regulation.

Our company is not a technical or IT consultancy and I must apologize that I suffer from the major disadvantage of not being an engineer. Therefore my remarks today will be from the standpoint of a market research and marketing consulting company. We shall primarily address trends in demand and supply and we shall examine technology issues in so far as they impact demand and supply.

My remarks will address the following areas:
- Definitions and brief history of W-WAN
- Trends in penetration of W-WAN technologies
- Vertical and horizontal segments outlook – case studies in W-WAN applications
- Issues in distribution
- Issues in regulation
- Outlook for the future role of W-WAN in Asia and what it means for business

First let me start with some definitions, so as to outline the scope of my remarks today.

There are many of WANs from sources such as the Alliances for Telecommunications Industry Solutions and Computer Networking. For example,

techdictionary.com defines a WAN as "A physical or logical network that provides capabilities for a number of independent devices to communicate with each other over a common transmission-interconnected topology in geographic areas larger than those served by local area networks. "A wireless WAN is a WAN which spans a considerable physical distance. The distance demarcation between a LAN and WAN may be 1km or one mile, or longer, depending on which definitions we use. For the purpose of our speech today, we shall define a W-WAN as a network that spans at least 1km and has wireless connectivity. My remarks will focus more on W-WANs which have high-speed connectivity, of 100kbps to 2 Mgps or more. The need to develop wireless wide network stems for the needs to cover a large area, larger than the previous available wireless area network such as personal area and local area network.

The PAN (Personal Area Network) is intended for close proximity device communication for ranges of less than 30ft. This standard is meant for low-level device recognition and communication and utilizes the 2.4 GHz frequency range. A popular example of a PAN is bluetooth, which transfer data of 721 Kbps. The bluetooth capability is faster than serial infrared which can go up to 4 mega bits per second.

For further distances, the wireless LAN is used as a median range wireless application for distances of less than 1000ft. Typically used within a building, a W-LAN system is based on the basic network infrastructure of a traditional Ethernet system.

Multiple 802.11 protocols are currently being deployed for these systems, utilizing both the 2.4GHz(802.11b) and the 5.2 GHz (802.11a) radio frequency. The primary difference between the protocols is bandwidth and range.

Cellular or Wireless WAN is meant for wireless applications covering longer distances than LANs. The range is basically counted in miles or kilometers. A number of different standards apply, depending on the country of implementation. Currently, mobile phone companies are the most common wireless WAN applications and they use various protocols for inter-connectivity between base stations and exchanges, such as GSM and CDMA.

Depending on the country, the deployment of some W-WAN requires the user to hold government licenses while others are unlicensed.

W-WANs comes in two forms – fixed or point-to-point and mobile or multipoint. Currently fixed accounts for most installations but we expect that the growth for mobile will be greater as the technology matures.

A **fixed** W-WAN is a wireless link that employs specified parts of radio spectrum to transmit and receive data, where "line-of-sight" positioning of fixed equipment is needed. The frequency standards include RF IEEE802.11a, 802.11b, GSM and GPRS.

A **<u>mobile</u>** W-WAN is a wireless link that employs terminals or receiving units that are mobile and not in a fixed position, such as a cellular phone.

Next, let me turn to a brief overview of the history of W-WANs globally.

Wireless WANs originated to connect over distances which were larger than what could be covered by a wireless LAN. The telecommunications market has been and continues to be a major vertical market for W-WAN due to the need to connect base stations to one another and to central exchanges, over large geographic distances and all kinds of terrain.
Other vertical segments have arisen around:

- Interconnecting LANs through wireless bridges, for purposes of data transfer; back up, email, collaboration, etc.
- Providing broadband access to remote end-users
- Providing inter-building connectivity in a multi-building or industrial park setting
- Creating private networks – intranets, extranets etc.

The wireless WAN market is still immature even in North America and Europe where the core technologies originated. This is because end-user awareness and acceptance is still not very high and the technology is seen as still requiring development to overcome issues such as the line of sight problem, interference from adverse weather conditions, and so on.

In the US and Europe, most installed W-WAN systems are still fixed rather than mobile, and operates on frequencies licensed from the US Federal Communications Commission of the European Telecommunications Standards Institute.

In the US, the adoption of W-WAN has to face keen competitors from alternative technologies for high-speed data connectivity such as fibre optic cable in the ground (of which there is about 100 million miles already laid in the US), and XDSL packages from telcoes.

It's is a common view and one which we agree with, that the greatest potential for W-WAN expansion lies in those geographies where population density is high, incomes are rising, commercial or industrial activity is growing, and, at the same time, teledensity is low – that is to say that the ratio of installed telephone connections per head of population is low.

W-WAN would need to meet the thirst for connectivity while avoiding the huge infrastructure costs and disruptions to urban life caused by the laying of new cable in the ground. For high-speed connections, W-WANs would also avoid the bottlenecks in supply and delivery of fibre optic cable which are often faced.

Many of the emerging cities of Asia, particularly **_in or around_** large metropolitan areas in countries like China, India and Indonesia, would fit these criteria. The

relatively high penetration of satellite TV as opposed to cable TV in Indonesia, for example, illustrates the way in which wireless connectivity can meet the demand for connectivity in a manner that is competitive with cable.

Next, I shall move to key trends which are shaping the wireless WAN world. These trends relate to technology, government regulation and the advent of 3G.

First, I shall discuss factors which tend to drive the demand for W-WANs.

● **1stly, An affordable Alternative Communication Link** A fixed W-WAN can provide high-speed data networking and sharing between buildings, with the deployment of antennae. A fixed W-WAN is more cost effective as there is no need to install fibre to link up two buildings. Thus fixed W-WAN avoid the monthly toll charges from telecom companies for leased lines. In addition, a fixed W-WAN lessens the end user's reliance on third parties for net work availability and charges when the fixed line deployment of Optics fibre and cable is required.

● **2ndly, To Satisfy Intensive Bandwidth Applications** The increasing need to transmit intensive multimedia application leads to a corresponding demand for a higher speed and full broadband connectivity. Wireless Broadband provides higher throughput. (Note: Throughput is the actual transmission speed of accurate and useful data over a connection.) A fixed wireless WAN can provide a transfer speed up to 1.2Mbps over a distance of 20km, operating in the 5.7 GHz frequency band.

● **3rdly, Deployment Ease** A wireless bridge is easy to install compared to cabling of fibre optics. The antennae and equipment can be installed and linked up with the existing Local Area Network in the building. This avoids labour costs and disruption incurred in laying cable. The normal deployment procedure for W-WANs only involves a site survey to determine two sites while considering factors such as line of sight and the possibility of interference to the radio frequency. In addition, the wireless bridge is easy to move or grow when the organization relocates or expands. Thus the investment on the wireless bridge can be retained by the end-user as the organization grows or relocates.

● **4thly, Widening Corporate Network and Client's Support** Expanding corporate networks pose a challenge to provide access to offices located remotely. Cost of leased lines and satellites stations are costly. Wireless bridges are a cost effective and rapid alternative. Furthermore, the public mobile network can support a large population of users depending on modem capability and the technology capability if the service providers.

● **5thly, Wireless Bridges Not Restrained by Terrain and Geographical Boundaries** Wireless linkages are not restricted to different terrain. Thus they

can be implemented for remote industrial areas such as mining and offshore oil fields.

In order to underline the thirst for information and connectivity, I shall provide a few statistic on the Hong Kong market.

This slide shows that in June last year, 60.6% of households had PCs at home, 49% were connected to the internet and of these households, about 40%, or about 20% of total households, were connected at broadband speeds.

However by Feb 02, the no. of households connected to broadband had surged by about 50% to reach 30% of the total, or over 600,000 households. This is an incredible leap in the broadband household base in less than one year, and demonstrates the thirst for content.

Let me now discuss some of the factors inhibiting the adoption of W-WAN.

- **1stly, Low awareness on Wireless Technologies.** End-users often express doubts on the security, reliability and functionality of a W-WAN. Despite the reliability of W-WAN, contingency plans are always in place.

- **2ndly, Government Regulations** The issues of limited frequencies licenses has sometimes hindered the speed of W-WAN deployment. Not many governments have introduced clear licensing regimes for W-WAN adoption in their countries. In addition, with operating conditions being dissimilar across various countries, companies installing W-WAN systems which cut across national boundaries can face difficulties.

- **3rdly, Line of Sight Limitations** Despite a clear visual line of sight, the Radio Frequency of RF transmission for W-WAN is in the shape of a cone. Thus, any object in the transmission cone can distort the data. Therefore, site surveys are needed to factor in any obstructive mountains, trees or terrain. The utilization of common RF can result in transmission conflicts with other devices operating in the same unlicensed band. This will translate to slower and unclear data transmission.

- **4thly, Performance Reliant on Service Provider** For mobile W-WANs, the end-users are highly reliant on the service provider. Thus transmission quality and W-WAN's functionality is dependent on the service level of the network company.

- **5thly, Slow Transfer Rate** For mobile W-WANs that are riding on the current GSM and CDMA platform, transfer rates are highly limited but of course this does not affect high-speed W-WANs. Transfer rate: 2G: 10kbps 2.5G: 64 – 144 kbps

As I mentioned earlier, one of the factors with the potential to slow down the deployment of W-WANs is the regulatory regimes associated with spectrum licensing.

Spectra are licensed for use by service providers or other organizations. In some countries like Singapore and Taiwan, the spectra have been auctioned off. In other cases, licenses are awarded without an auction, as was the case in Hong Kong when the OFTC awarded its four 3G licenses. However conditions applied the following :

Winners will pay 50 million HK dollars ($6.5million) per year for the first 5 years. 5 percent of their 3G revenues will be paid each year thereafter for the 15-year license period.
Among other requirements is a license condition that will force 3G operators to reserve at least 30percent of their network capacity for "mobile virtual network operators."

While governments often have sound public policy grounds for introducing such requirements, the effect can sometimes be to complicate or slow down deployment of networks which are reliant on the licensed spectra.

The issues of spectra licensing can inhibit deployment of W-WANs not only by creating time delays and limiting access to spectra, but also by creating uncertainty among manufacturers who are developing equipment to suit various spectra, particularly for systems which cut across national boundaries.

I would now like to comment on one of the inhibiting factors in a little more detail, which is the issue of sight limitations. This refers to the problems of transmitting radio waves across distances where there is no clear line of sight between two points, ie there are obstacles in the way which cause the radio waves to be deflected, diffracted and so on. Due to the presence of objects in the line-of-sight path of transmission, final signals reaching the end-users will be of various strengths, thus causing data distortion. Thus the challenge is to develop advanced modulation technology to ensure receiver getting a coherent and even signal.

Vendors have attempted to address these problems in a number of ways and the purpose of these slides is to show how this problem is on its way to being solved.

One of these solutions is known as LMDS or Local Multipoint Distribution Systems. This refers to broadband wireless that transmit bi-directional high-speed signals at competitive cost. One good example of LMDS deployment is in Philippines:

In October 2001, the Fast Food Chain, Chowking Food Corporation (a subsidiary of Jollibee Foods Corporation, which is well known here in Hong Kong) replaced its leased line connection between its head office in Pasig City and its plant in Multinlupa with a wireless connection. The wireless infrastructure is predominately

employ for email, Internet access and core applications such as distribution, inventory and financial processes. The wireless bridge removes the problems normally associated with leased lines such as frequent and time-consuming downtime.

Operating in the 5.7Ghz frequency band, the company is able to transmit data at speed of 1.2mbps over a distance of 20km. The company also indicated a possible link between its head office and 2 locations in Tunasan and along Taft Ave. The link with Taft Ave is around 10mbps.

Packet Switching, shown here, is a method of transmitting messages through a communication network, in which long messages are subdivided into short packets and routes to its final destination.

Circuit Switching is a method of communicating in which a dedicated communications path is established between two devices through one or more intermediate switching nodes. Unlike packet switching, digital data are sent as a continuous stream of bits. Bandwidth is guaranteed, and delay is essentially limited to propagation time.

Advanced Modulation Technology: Orthogonal Frequency Division Multiplexing (OFDM) is a digital modulation technology where a signal is split into several narrowband channels at different frequencies, the reflected signals reaching the receiver at the same time.

To maintain a high bit rate, multiple carriers are employed to send multiple low speed messages simultaneously and then combined by the receiver as a high-speed message. Before each low speed message, there is a prefix to cushion the variations caused by multipath or reflections.

These then, are examples of how the Line of Sight issue is being addressed in the W-WAN world.

DSSS and FHSS are two other solutions which I want to touch on briefly, without getting into too much technical detail about which others are better qualified to speak than myself. These solutions are encryption technologies which address the issue of security.

- In Direct Sequence Spread Spectrum (DSSS), the signal is expanded over a wide band channel and this is accomplished by combining the data signal with a much higher bit rate signal. The actual data is buried in the form of white noise.

- In Frequency Hopping Spread Spectrum (FHSS), the 2 to 4 frequency bands are employed in, which the signals hop among the various frequency bands during transmission. Only remote stations participating in the communications will know the exact sequence of information.

I share earlier that W-WAN technology is still seen as immature by many end-users. In spite of the solutions I outlined earlier, packet loss and quality distortion can still occur due to objects in the line of sight, adverse weather conditions and so on. However, the advent of 3G promises to address these problems comprehensively.

The popularity of wireless WAN is expected to grow with the roll out of 3G services, to which we must turn our attention.

The current 2 and 2.5G technologies are facing issues, such as:
- Data Packet Loss and quality distortion
- Slow transfer speed. 2G: 10kbps and 2.5G: 64 – 144 kbps

However, with 3G technologies in place, the technological limitations will be alleviated. The four main factors that are expected to power the 3G W-WAN adoptions include the following:

- **1stly, Increasing Broadband Connectivity and Higher PC Penetration**: With a high PC penetration, PC users are hungering for broadband connectivity to fully enjoy applications like

  - Video Conferencing
  - Streaming Videos
  - Voice over IP
  - Offsite data storage

The increasing demand for high-speed transmission will encourage service providers to explore new full broadband connections such as a 3G W-WAN.

- **2ndly, Less Costly 3G licenses in Asia**. In Asian countries, the auction costs of 3G licenses have been much cheaper compared to those of Western counterparts. (Refer to figure on slide)

Companies that paid large sums of money for their 3G licenses might suffer financial constraints due to debt servicing costs, resulting in possible delay in the deployment of Wireless WAN infrastructure. However, Asian auction prices are much lower and thus the Asian 3G service providers have greater financial strength to build their architecture.

3G is able to transmit 2 Megabits/second or higher of data for indoor traffic. Some other technical specifications of the 3G standard are outlined in this slide, but I shall not repeat them here in detail.

In the evolving 3G W-WAN industry, Spire foresees 3 key challenges for W-WANs system integrators and vendors. They include

- **$$$$ Infrastructure Costs** With huge capital used for the 3G auctions, how are the service carriers able to fund the infrastructure costs?

- **3G Handsets availability** Are the 3G handsets or handheld apparels widely available for users of various purchasing powers?
- **Alternative standards 2.5G** Will service providers willingly to shift from 2.5G to 3G? Is demand mature enough to support 3G? Service providers might go with alternative 2.5G standard as a way to get funding for upfront capital for 3G infrastructure implementation.

Now that we've discussed the technology and regulatory factors behind the deployment of W-WANs systems, let us now turn our attention to what wireless WANs are being used for, and by whom. This next section looks at vertical segments and horizontal applications segments together with a few examples of deployments.

To date, most wireless applications have focused on vertical industries within nine industries accounting for the majority of wireless data subscribers. The industries are:
- Transportation
- Utilities
- Retail Trade/ Point of Sale (POS)
- Wholesale Trade
- Financial/ Insurance/ Real Estate
- Health Care
- Communications
- Professional Services
- Durable Manufacturing

A significant but small minority of employees in these industries already use wireless date communications on the job. In terms of wireless revenues, the financial/insurance/real estate, transportation and professional services industries will probably generate the greatest revenue of all nine industries (excluding the communications sector, of course).

Several business trends are driving the wireless revenue growth for the financial services industry. Among them are direct selling of financial products such as stocks and bonds via the Web and call centers; wireless access of bank accounts; and a push toward transacting as much business as possible over the Internet.

These vertical segments have demand for different horizontal applications. What we would like to do now is to share with you some examples to show how specific wireless WAN applications have benefited different vertical segments in specific industries.

As highlighted in a recent feature in Fortune Magazine, a company based in Bangalore and known as Encore Software has helped make handheld devices available to farmers in India.

Simputer, a term for Simple Inexpensive Mobile Computer, combines the functionality of an Internet connected computer and a personal digital assistant. Simputer were first deployed as a security device to transfer deposits from India farmers to the bank, because roving deposit collectors had been cheating illiterate farmers by issuing doctored receipts. The bank then asked Encore Software to deliver a handheld device that can print a receipt on the spot and record the amount electronically for less than 10,000 rupees (about US$200).

The result was a 32MB Linx-based handheld to voice device that runs on three AAA batteries. When a farmer touches a potato's image on the screen, a voice will tell him in any of radio's 16 official languages, the latest market price. One Simputer is typically used by a group of ten villagers so that they can share the price of US$20 each. For an additional US$2, each co-owner receives a smart card to insert to the Simputer for other transaction – money transfer, email, downloading MP3 songs, and so on.

In 1996, UPS began its wireless implementation to provide same-day package-tracking information for all air and ground packages. By providing UPS staff with its delivery information acquisition device (or DIAD, a custom-built electronic data collector), UPS is able to capture both delivery information and customers' signatures. This data is entered into the cellular network through cellular telephone modems and transmitted to the UPS mainframe in Mahwah, New Jersey. Once the information is incorporated into the delivery-status database, it is available to the company's customer service representatives. Utilizing cellular technology and a broad alliance of more than 70 cellular carriers, it is possible to provide this service across countries. UPS has extended this service to the Asia Pacific region, to cover data capturing in national languages, which means people in Japan can receive their package information in Kanji Script. Hong Kong was in fact the first market outside the United States to implement this technology in 1999. The service has been extended to other ports of Asia Pacific including Japan, Korea, Australia and Singapore. UPS has reported several gains it experienced through implementing this strategy, namely:

- UPS enjoyed a significant boost in operational flexibility with the introduction of the DIAD. The device enables immediate two-way communication between the driver and the UPS customer service center. Customer pick-up requests can be quickly forwarded through text messages for timely manpower arrangements.

- Customer complaints were reduced as customer can sign for packages received using a digital method, enabling the shippers to see the electronic signature samples as proof of delivery.

- Reduction in the amount of paperwork involved in various delivery procedures as data entered and information storage plus report generation are all automated. The data entered at one point can be automatically used in all phases of the delivery cycle, saving time and ensuring efficiency.

Following their success with the DIAD, UPScan – brand name of UPS's future parcel tracking application, has started investigating both Bluetooth and wireless LAN technologies for local area access within its warehouses and customer drop off centers in order to automate various business processes to a greater degree than what it was able to do before.

This example shows how wireless WAN enabled a wine vendor to improve the productivity and effectiveness of its sales force. Up until 2001, the sales representatives of South Wines and Spirits of California were writing their orders on hand and generating 500,000 sheets of paperwork per week. They could place the orders electronically over phone lines using a slow-moving data transfer system known as a Brick. But the system led to errors and fulfillment delays of up to seven days.

SWS tackled the problem by hiring a system integrator known as Advanced BusinessLink to develop handheld computers called Pocket StrategIT. The applications of this device allow sales reps to use browser-like functions on the Windows CE device that links to an IBM iSeries server. The handheld can store most of the information sales representatives need on clients and product availability. When the device is connected to the server. Pocket StrategIT also allows the sales reps to automatically send orders and update data that is stored on their hand-helds.

Pocket StrategIT can transmit data on a wireless network so that orders could be made in real time and other information could be updated continuously. With just 700 sales representatives using the device, SWS has started realizing significant cost savings, along with gains in employee productivity. For example:

- Sales reps who use the handheld device now make one to three additional sales calls per day.
- The new ordering system helped generate an annual sales increase of more than 5 percent. Additionally, thanks to greater order accuracy, customer returns have declined by 12 percent.

The examples of the Simputer, UPS and Southern Wines and Spirits has shown how the spread of W-WANs to more vertical segments will fuel the deployment of more horizontal applications.

Overall, the fastest growing horizontal applications in the WWAN space include:

- **Email and Document Distribution** to enhance communication, collaboration and work flexibility within end-user organizations. Wireless network-based email has become a popular application. It allows mobile workers and professionals stay in touch with their home offices and customers.

● **Database query, backup storage** – concerns over back-up have been heightened in the wake of the 11 Sept attacks in the USA. Companies increasingly deploy off-site storage and back-up.

● Field Service and Sales **Automation – as the examples from the wine industry** showed, W-WAN can benefit the sales function, but also the field service function. This application will allow the sales force to access corporate and client information while on the road and submit sales orders without returning to the office. Inventory can be committed in real time and the shipping process can start immediately. The ROI on this can be very tangible. A second application that has attracted interest is the service and dispatch application. Wireless WAN allows the capability to monitor the whereabouts of service representatives, collect information about the completion of the service call and then be able to dispatch them electronically to the next call.

● The third application in this area is time and expense entry for field assignments whereby you can record this information in the field and send it in electronically. Therefore all manual paper-based record entry processes can be replaced by electronic processes – saving time, reducing errors and enabling faster billing.

● **Wireless CRM (Customer Relationship Management)** Application deals with keeping track of customers' purchases, preferences. It can enable the user to respond more quickly to customer queries and provide a high level of service using modern technology tools, including a web-interface, e-commerce, data mining, and business intelligence.

● **Information-Based Systems** such as private networks like intranets and extranets are another growth area. In particular, we feel that extranets, which are intra-company networks using internet protocols and which are partially accessible to outsiders, will increasingly be deployed for SCM purposes to co-ordinate activity between buyers and suppliers.

● And lastly, **data-rich applications** such as VoIP, video-conferencing and streaming video for both business and consumer applications.

We will see more horizontal applications in the W-WAN space. I have not, for example, touched on consumer applications such as Stock Quotes, News, Weather Reports & others. The possibilities are endless.

And lastly a quick word on distribution trends for W-WAN systems.

W-WAN systems are sold through value-added resellers and systems integrators or directly from the vendor to the end-user. Sales through solution partners have the advantage of the solution partner being able to offer a broader total solution. In some cases, local solution partners also have better local knowledge

and customer relationships as compared to vendors, which can drive sales. In some cases, solution partners are also seen as more neutral and objective.

However some vendors have a preference for direct sales for certain types of systems. This may enable them to manage the end-user experience better. It may also enable them to gain access to real-time knowledge about the product performance, which is a form of market research.

We see the trend in sales of W-WAN software and hardware to be in favour of more joint work in sales, implementation and support between vendors and solution partners. This is because of the immaturity of wireless WAN products and the need for hand-holding end-users in the implementation and post-sales support phases.

I shall conclude this short talk by sharing some thoughts on the outlook for wireless WAN in Asia going forward.

As the CEO of Computer Associates stressed in his keynotes address yesterday, the advent of mobile high speed network access is a potentially revolutionary development in society because it may bring about the arrival of the true mobile office or mobile multimedia device. In the past, mobile devices could provide network access that was limited to voice, or data connections that were limited in speed, bandwidth and reliability. Truly effective W-WANs have the potential to change our lifestyles, our habits and the way we do business.

We believe that the areas where the impact will be felt the most are:

- Firstly in business **1stly, supply chain management tracking.** Asia is the emerging manufacturing superpower of the world due to competitive costs, good infrastructure and conducive regulatory environments. The jobs of co-ordinating the manufacturing supply chain from the parts or materials suppliers to the end-user is increasingly complex. Doing this job well is also an increasingly important competitive success factor in industries like personal computers and notebooks. By enabling high-speed data transfer between remote sites separated by great distances, W-WANs can revolutionize SCM.

- **2ndly, Empowerment of field sales or technical force.** By effectively enabling field executives to access the company LAN, they are given access to real time data and multimedia content in the field. This can be a powerful tool not only for sales but also for post-sales support, just as telemedicine has proven to be a powerful tool in clinical medicine.

- **3rdly, facilitating collaboration** – by being able to share data and content across many individuals in different remote locations and different organizations, not limited to those physically in the office or those in major metropolitan areas, company can boost productivity.

● Next, in the **consumer and lifestyle space**, there are few implications: In the wake of success of MMS in Japan and Korea, we believe that live video-phone many become high sought-after, initially in the business sector but later on in the consumer space. Mobile gaming may also be the next logical step for the world's gaming population, which has shown a great thirst for early adoption.

Currently most of the installed based for W-WAN is in Europe and North America, with Asia accounting for probably well under 20% of installations. However, Asia may become a key growth engine for W-WANs in future, for the following reasons:

● Asian countries with GDP per capita levels of US$5000 or less generally have low tele-density and yet are experiencing high rates of economic growth. This includes countries spanning large physical distances and large populations like China, India and Indonesia. This will make W-WANs an attractive solution for wireless local loop purposes, ie connecting remote locations to an existing telecom backbone.

● Asian countries with high GDP per capita of over US$20,000 or US$30,000 rank among some of the most affluent countries in the world. Some of these countries also have high levels of IT literacy and large populations of early adopters – I am talking of countries like, Japan, Korea, Australia, Hong Kong and Singapore. These countries will be a source for growing demand for data-rich applications such as MMS, streaming video and mobile video conferencing.

● Asian countries with relatively low teledensities will see a thirst for private networks that cannot be satisfied by existing fibre or copper wires. This is particularly so in countries where a great deal of manufacturing takes place, such as China, which creates the need for complex SCM. We believe this will drive the demand for applications such as extranets that can be run over W-WANs. Asia is also home to government which consciously and sometimes very successfully try to act as catalysts to increase penetration of IT in their societies, such as Hong Kong, Singapore and Malaysia. Thus the government sector may drive W-WAN demand as well – I am speaking of vertical segments such as the Police, Education service, State Healthcare and Library services.

So far, I have spoken about the upside of W-WAN in Asia but what about the barriers to growth? The adoption of W-WAN in Asia faces several potential inhibitors, such as:

● The often long time lags for governments to license spectra and create proper regulatory regimes for W-LAN or W-WAN.

● The issue of technical reliability of W-WAN networks, such as their performance under adverse weather conditions. Although many of these

technical issues are well on their way to being solved through technologies like LMDs and OFDM, reliability often remains a question mark in the mind of end-users, holding them back from entrusting mission-critical functions to W-WANs.

- Security is a major issue for both corporate and government end-users. There is a strong demand for security solutions for mobile networks, and this will continue for the foreseeable future. Freespace optics transmission technology for wireless WANs promise much higher levels of security compared to radio frequency. However, the viability of freespace optics over distance further than a few KM, in adverse weather conditions and where line of sight is blocked is still limited.

- Creating user-friendly applications is a major challenge to increasing acceptance of W-WAN. However the example of the Simputer from India shows that this technology can be made useful and easy to use for a vertical segment with a traditionally low level of IT literacy.

- Roll out 3G – to date, 3G services are only commercially available in a few countries in Asia. Although licenses have been awarded in a number of countries, the deployments are costly and often delayed.

However, we should bear in mind that just as every cloud has a silver lining, every problem also carries with it an opportunity. There will be tremendous demand in the medium-term for vendors and solution partners which can jointly address these problems.

We see the following 4 vertical segments as being key to driving W-WAN growth in Asia in the short-term:

- Telcos and ISPs, mainly for wireless local loop connections
- Manufacturing supply chain management, given the importance of export-oriented manufacturing in many East Asian economies
- Financial services – both on the front-end (e.g. e-trading of securities and mobile banking) and back-end (e.g. private networks for banks)
- And lastly, Institutional and government

In conclusion, may I pose the question – what does all this mean for you? What will the W-WANs of the future change for you?

Short-term: Prepare for organizations increasingly using W-WANs for data transfer, back-up and storage, as they become a feasible, cost effective alternative to leased lines.

Medium-term:
Prepare for the advent of W-WAN networks as a new medium for connecting to your mobile sales force, your suppliers and your customers in sectors as disparate

as logistics, manufacturing and banking. Extra-nets may drive W-WAN adoption in the corporate segment.

Medium-term: Prepare for the W-WAN as a medium for intra-and-inter company collaboration over secure pathways.

Long-term: Prepare for the advent of new 3G-enabled applications.

(both consumer and B2B) like streaming video on demand.

Long-term: Prepare for W-WAN facilitating staff spending less time in the office and more time working in the field or at home, a trend which may develop in Asian cities where real estates is at a premium.

This concludes my remarks today. My colleagues at Spire and myself would be pleased to take any questions you may have. Thank you very much for your attendance of the CA Expo Hong Kong 2002 and for your attention during my remarks.

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