Lucent Technologies submission on Wireless Broadband Communications in Australia

Introduction

It is Lucent's belief that in a country, such as Australia, it is useful to provide technology and networks that can efficiently meet more than one need in the market place. Utilising 3rd generation mobile technology to provide broadband access where wireline access systems are not available makes sense if this network can also provide normal mobility voice and data access.

For a technology to be viable for the Australian environment it must meet a number of criteria:

1. Be economically viable, that is, capable of providing a return to an operator.
2. Be environmentally efficient: within the Australian environment this means minimising the infrastructure i.e., base stations. In rural Australia the coverage of a technology is a significant requirement.
3. Common infrastructures that meet more than one market need will arguably be more viable than a unique solution that meets only one need.
4. A network capable of being open access that allows competition in service offerings rather than duplicating costly infrastructure.
5. Be affordable and available, affordability being driven primarily from large economies of scale, i.e., the need to pull customer equipment from a global pool.
6. Be a robust and proven technology. Technology tends to be delayed beyond normal expectations. GPRS handsets were delayed more than 2 years and 2 years ago, it was thought that we would all be using 3G devices by now. Using technology that is not currently available or in high demand is fraught with risk given the continuing refocusing of R&D resources by major vendors.

7. A stable technology that is not subject to outside interference, therefore the use of licensed spectrum is desirable. Any technology that is operating in unregulated spectrum will be subject to risk of interference, e.g., 802.11.

The needs of Australia are unique, yet the standards we try to comply with are developed primarily out of the densely populated European market. UMTS, the European IMT-2000 compliant 3G standard, will never be viable in rural Australia due to the limited coverage of one base-station in the relatively high 2.1GHz frequency band. As the primary bands for mobile technology have become crowded, new bands have been added that are higher in frequency, e.g., GSM was originally deployed at 900MHz, to increase capacity it is now deployed at 1800MHz. As frequency increases, coverage decreases, this is the primary limitation of 3G (UMTS) in the Australian environment. It is time to examine technology suited to Australia's unique circumstances; a vast country with a small population base and with a requirement to cover vast areas of very sparsely populated country with a minimum level of broadband access.

Lucent Technologies CDMA 450

Introduction

Lucent Technologies has recently introduced a high-speed wireless data and voice network solution that addresses the needs of governments, carriers and investors to provide low-cost, high-performance Internet access. The solution is based on the latest generation of CDMA 2000 technology that is "downbanded" to the 400-500 MHz spectrum range, including CDMA 3G-1X and CDMA EV-DO (data optimised). CDMA 3G-1X allows for both data and voice capabilities, with data speeds of up to 153 Kbps per user, while CDMA EV-DO provides broadband speeds up to 2.4 Mbps per user.

This solution is being utilised in frequency bands in Eastern Europe that had previously hosted NMT (Nordic Mobile Telephony) analogue cellular systems. NMT networks are now being phased out in favour of more advanced

technology. NMT systems are located in the 410-483 spectrum range with banding schemes of 4.5MHz each for the uplink and downlink and 10MHz duplex separation. In most countries, the Lucent solution would provide services with as little as 2 x 1.75 MHz of spectrum (enough to host two 1.25 MHz CDMA carriers with guardband), while 2 x 3 MHz of capacity would be adequate to meet the needs of most urban areas.

This technology can be configured for data and/or voice, as well as for fixed, portable or mobile service. Given the widespread coverage and robust competition in mobile voice services in Australia, the most compelling fit for this technology is likely to be fixed data services. However, depending upon the regulations and carrier mandate and business plan, the incorporation of voice and/or mobility capabilities may make sense.

Specific benefits of CDMA 450 are:

- Low total system cost (including network equipment, installation and end-user equipment) relative to other data access solutions;
- Low initial capital costs, which allow the operator to scale capital investment in parallel with subscriber growth. This is due to the highly favourable radiowave propagation performance in this frequency range;
- Ideally suited for broad rural, low-density coverage due to long-range propagation (up to 100 kilometres);
- Excellent ability to provide in-building and urban coverage due to good "line of sight" propagation characteristics (which allows for self-configuration),
- Need for minimal radio frequency spectrum, e.g., as little as 3.5 MHz total, to provide commercial service;
- Current ability to provide 153 Kbps maximum peak output per user (with an average of around 70 Kbps), increasing to 2.4 Mbps peak data rates (and an average of 800 Kbps) with the introduction of CDMA EV-DO in early-2003;

- Flexibility in providing either data and/or voice capabilities and fixed or mobile service with the same network infrastructure, depending upon regulatory and business case requirements;
- Proven track record with current commercial availability of a CDMA 450 1X network in Romania and extensive trialing in Russia and Hungary. Several other network launches are planned in 2002. Moreover, over 100 million customers are on CDMA 2000 earlier-generation networks worldwide, with 4 million on CDMA 1X high-speed data networks;
- The technology is mature and has been internationally standardised for several years. A broad "footprint" ensures its continued evolution and decrease in costs based on global economies of scale.

The Solution

Lucent's CDMA 450 technology offers operators a means to provide ubiquitous, low-cost Internet access. It offers major benefits over proprietary fixed wireless, DSL and cable modem solutions. For example a CDMA450 1X solution could provide a residential user 50Mbytes of usage per month at an average total capital cost to the network operator of under AUD$950 per user. This would provide typical speeds from 70-120 Kbps. Moreover, this could be done with as little as 3.5 MHz of spectrum. It also offers the additional advantage of being "always on." With the introduction of CDMA EV-DO in 2003, average throughput speeds will increase to 800 Kbps and cost per Mbyte will drop substantially.

An equally important advantage of CDMA 450 technology that its initial capital costs can be kept low even while covering very large geographic areas with low subscriber density. This allows the network operator to incrementally invest in line with subscriber and traffic growth. This is due to the fact that propagation characteristics are highly favourable in this spectrum range. It should be noted that there is some trade-off between maximum speeds and transmission range. A comparison of propagation performance of the 450 MHz band, compared with those of other spectrum bands that have been used for wireless is detailed in Table 1

	450 MHz	850 MHz	1.9 GHz	3.5 GHz
Average base station radius	40 km	16 km	7 km	4 km
Number of base stations to cover 50,000 km2	127	318	728	1270
Line–of-sight constraints (degree of blockage by obstacles)	none	minimal	some	significant
In-building penetration	excellent	very good	adequate	poor

Table 1

Propagation comparisons in Table 1 highlight that there is up to a tenfold increase in geographic coverage with 450 MHz compared to other spectrum. Moreover, with high-powered antenna boosters, transmission in this spectrum can easily propagate beyond 100 kilometres in flat areas , which make it particularly suitable to the geography of inland regional areas

In summary, CDMA 450 - including CDMA 3G-1X currently and CDMA EV-DO in the near future – represents the most cost-effective technology for providing wireless Internet access, especially in a “greenfield” network situation. The competitive cost structure is particularly important in this time of reduced global capital availability and bankruptcies in the telecommunications and Internet industries. Availability of 450 MHz spectrum will ensure that investors and operators can attract the necessary corporate or investment capital for a broad-based network deployment.

Availability

The CDMA 450 1X solution is functioning today in Romania (commercial) following over a year of trial efforts there and in Russia and Hungary. The next-generation offering, CDMA EV-DO, offering data rates of up to 2.4 Mbps, will be available in early 2003. There are currently over sixty CDMA 3G-1X end-user devices, ensuring global economies of scale and low-cost. It is important to note that this product leverages all the global research and

development and follows the same technology migration plan as CDMA 2000 used in other frequency bands.

The current Lucent product can currently operate in three of the eight allocated NMT band classes – A, B and H – as per Table 2. Products for additional bands would require a six-month development lead time, while products in bands outside these allocations would take longer for filter and software development.

Band Sub-class	Mobile Station Frequency	Base Station Frequency	Applicable Countries
A	452.5-457.475	462.5-467.475	Bulgaria, China (Dajing), Denmark, Estonia, Finland, Iceland, Indonesia, Latvia, Lithuania, Moldova, Norway, Poland, Portugal, Romania, Russia, Spain, Sweden, Tunisia, Ukraine
B	452-456.475	462-466.475	Malaysia
C	450-454.8	460-464.8	France
D	411.675-415.850	421.675-425.850	Croatia, Slovenia
E	415.5-419.975	425.5-429.975	Turkey
F	479-483.48	489-493.48	Thailand
G	455.23-455.99	465.23-469.99	Hungary
H	451.31-455.73	461.31-465.73	Austria, Belgium, Czech Republic, Netherlands, Slovakia

Table 2

Market Needs

The importance of the Internet as a tool to promote economic growth is undeniable. It is particularly significant in rural Australia where currently Internet access is slow dial-up, unlike the cities that have access to a number of providers of high speed Internet access. This inability to offer access at a reasonable speed can have an impact on the economic growth of regional Australia. Tremendous strides have been made in expanding access to voice networks in Australia, the USO ensuring that Australians have access to basic voice communications. However, in metropolitan Australia, consumers are now expecting high-speed data connections. The reach of wireline high-speed data is limited to approximately 5kms from the exchange. In regional Australia, a significant amount of people live outside this radius. Dial-up for these people is even poorer with data speeds well below 30Kbps not unusual.

Clearly the Government recognises the importance of the Internet as an economic enabler, given its increasing importance as an information, communications, business and entertainment tool. The request for these papers and the formation of the Broadband Advisory Group, are clear examples of the Governments interest in encouraging the use of broadband. However, achieving the full potential of expanded Internet access will not be possible without the availability of high-speed access that is both cost-effective and covers large areas of geography and population.

Also, high-speed access is required to fully leverage the ability to provide remote education, telemedicine, agricultural and industrial support and government services. Such networks will also offer businesses improved productivity in the areas of electronic procurement, supply chain management, sales and customer relations management, virtual private networks and corporate email and communications. Consumer applications include multimedia entertainment (music and video), e-commerce and email.

An even broader perspective to the importance of providing adequate broadband infrastructure for Internet access is exemplified in the Canadian Province of Alberta's 'SuperNet' initiative. Alberta has taken a 'public policy' approach to the provision of high-speed Internet and is executing a bold joint initiative to provide competitive broadband services to some 4,700 facilities through the Province. The effect will be to provide access to every hospital, school, library and government office in the Province across some 422 communities of which 395 are rural. The initiative has only been possible because the infrastructure providing the access, is viewed by the Government as an enabling resource that must not be augmented and not duplicated. In citing this initiative Lucent strongly believes the there are similar opportunities for the Australian Government to lead a similar initiative to provide effective and economic internet access to under serviced regional and remote communities via the use of wireless in the 400-500 MHz spectrum across Australia.

Alternate Technologies

To date, most high-speed Internet access has been provided through DSL and cable modem technologies. Both these solutions first require existing copper or coaxial cable plant whose networks must then be upgraded. The average cost per subscriber for these technology upgrades is expensive, at an estimated AUD$1900 per user in urban areas (including network equipment, installation and end-user equipment). In rural areas, the cost is prohibitive.

For several years, there has been great hope for fixed wireless to fill this need. This is particularly relevant in Latin America where wireless voice networks have quickly come to substitute for landline usage. Major fixed wireless initiatives to provide bundled voice plus high-speed data were launched in the US by Sprint, with its MMDS network, and AT&T's "Project Angel." After five years of significant investment, these projects were recently cancelled due to high capital costs (estimated at above US$1000 per

subscriber). In general, in markets with highly developed wireline infrastructure, fixed wireless solutions have not succeeded.

There is little doubt that it will not be viable to deploy UMTS based 3G technology outside the main population areas of Australia. The cell density required to provide coverage is prohibitive, the minimum 2 X 5MHz of spectrum required is wasteful and the capacity afforded will be well under utilised.

While 802.11 would, on the surface, provide LAN type speeds, the throughput quickly diminishes as you move even a short distance from the source. It is also currently deployed in unregulated spectrum and hence could be subject to outside interference. 802.11 is best used, as it was originally designed, as a Wireless LAN, not as a public access network.

Lucent Technologies' CDMA450 Proposal

Throughout Australia much of the 400-500 MHz spectrum has hosted private trunking radio systems, typically serving industries such as construction, taxis and oil, as well as government agencies. These are primarily low-capacity analogue systems providing group voice communications with minimal data capability. Globally, private trunked radio has seen relatively little innovation and growth, at the same time cellular has grown explosively. The migration path for these services may be to a common, more spectrum efficient packet mobile solution. In the US, a major public trunking company, Nextel, has indicated a progressive migration from their current platform to CDMA 3G-1X.

An operator could operate with a small allocation, such as 2 x 1.75 MHz to serve lower density areas and 2 x 3.5 MHz for urban areas. It is also possible that existing corporate or government users of private trunking services could benefit from the enhanced capabilities and data offerings of CDMA 450 and would welcome an alternative technology under favourable terms.
Lucent proposes to work with the relevant regulatory authorities to assess spectrum availability and user needs and to develop an appropriate proposal.

Further Information

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