NORTEL NETWORKS

Nortel Networks Submission to

HOUSE OF REPRESENTATIVES

STANDING COMMITTEE ON SCIENCE AND INNOVATION

Inquiry into Business Commitment to Research and Development (R&D) in Australia

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Nortel Networks is a global corporation focused on transforming how the world communicates and exchanges information, and on leveraging technology to drive business profitability and better the lives of people all over the world.

Nortel Networks supplies service provider customers and business enterprises and institutions of all types and sizes with communications technology and infrastructure – enabling value-added IP (Internet Protocol) data, voice and multimedia services across high-performance optical, wireless and metro and enterprise networks. Customers in more than 150 countries recognize Nortel Networks as a pioneer, innovator and benchmarking pacesetter in global telecommunications.

R&D and the commercialisation of new or improved technologies drive an innovative economy. A country's R&D performance is also a key factor in establishing international competitiveness, and is an essential component in generating long-term productivity and higher standards of living.

Broadband Revolution

A powerful shift is currently underway in the telecommunications industry, and it is a swing that is more structural than cyclical. Internet and data traffic continue to grow – shaped by end-users demanding that applications evolve from static, low-speed content to the real-time dynamism of streaming video; from fixed-line connectivity to full anywhere, anytime wireless mobility; and from one-size-fits-all solutions to personalized, individually-tailored services.

To differentiate themselves in the marketplace, enterprises worldwide are demanding new services, and service providers, keen to enhance competitive advantage in today's deregulated markets, are actively seeking more profitable, value-adding services to deploy and more cost-effective ways to deliver them. This translates into a strong demand for technology solutions that reduce the total cost of network ownership by lowering capital and operational expenditures, optimise network utilization, and power a customer-driven move from voice-centric to data-centric business models.

This opportunity to transform telecommunications networks is fuelling innovation in the industry. Drivers include the transition from multiple networks to converged multiservice networks, from circuit-based networks designed for voice traffic to packet networks where voice is just another data application, to new wireless networks capable of delivering data services, to optical-based delivery systems, and to the provision of intelligent IP services. Today's end-user wants access to these new services from any location – at the office, in an airport lounge, or on the road in between – and is utterly indifferent as to how the services are delivered. From a technology viewpoint, this means common infrastructures, network management capabilities and services, whether the delivery medium is wireline or wireless.

The telecommunications industry is on the threshold of the next big development in global communications: the advent of affordable and infinite bandwidth-on-demand and always-on wireless access – in other words, the broadband revolution. The broadband revolution means we will be able to receive any amount of information we want and in any form we want it, and do so at any time and in any place.

Broadband must be viewed holistically, as a functionality rather than a platform that a number of technologies can deliver. Effective broadband must encompass both wireline and wireless access. It must include bandwidth availability from end-to-end, from the data centre to the core and metro networks that allow the new multimedia, mobile and personalized services to be delivered across the network and straight to the desktop or to the user's wireless device, wherever he/she may be. Effective broadband is about the reliability, support and security that promotes trust in the use of applications and protects an individual's privacy.

Various technologies fulfil the technical requirements for building these high capacity networks. Each has its advantages and disadvantages, and each offers a credible business case to support the unique needs of its users. These technologies often compete with one another and it is up to individuals and organizations to decide which option best serves their respective requirements.

Governments at all levels have a constructive role to play in helping communications networks evolve into the realm of broadband. At the very least, this includes establishing a vision, formulating a national framework, and actively promoting the benefits of full broadband capability. A recent study undertaken for the U.S. Government expects that widespread broadband deployment in that country will have an economic impact of US$500 billion as small to medium-size enterprises (SMEs) acquire new network tools to accelerate innovation, enhance productivity and reduce the costs of doing business. Other studies focus on the cost-effective delivery of government services, on the reduction of healthcare costs, and the enriching of educational and training programs.

To move beyond today's broadband into the era of infinite bandwidth and always-on wireless access will require many breakthroughs and investments in key areas, including optical technology, wireless, high spectrum communications, and high-performance network infrastructure. Nortel Networks is currently leading the move towards these next-generation systems – and the challenge of "Broadband" is rapidly rising to the top of government economic agendas in North America, Europe and Asia.

Nortel Networks is in the business of high-performance networking. Our corporate mission is to optimise network performance, network economics and network services, and to drive innovations that improve productivity and enhance profitability for our enterprise and service provider customers. Nortel Networks' three core business categories – Metro and Enterprise Networks, Wireless Networks and Optical Networks - deliver all the building blocks required to power the broadband revolution.

Nortel Networks R&D in Australia

The Nortel Networks Technology Centre was established in 1989 on the campus of the University of Wollongong. New, well-resourced premises were opened in 2000 to house what has become the largest of Nortel Networks' R&D operations in the Asia Pacific region. The Technology Centre in Wollongong is the primary focus of Nortel Networks' R&D investment in Australia.

The mission of Australia's Nortel Networks Technology Centre is to build an R&D program of strong local and global value, leveraging activities to grow business across the Asia Pacific region.

Engineers at the Nortel Networks Technology Centre are actively involved in developing a wide range of advanced products and enabling technologies. The lab program includes:

- Mobile location determination.
- Wireless Internet capabilities.
- Collaborative R&D projects.
- IP multimedia platform
- Business and network planning services for Nortel Networks' Asia Pacific customers.

The Technology Centre has increasingly become a showcase for Nortel Networks R&D in the region. It is also being used as a centre for briefing Asia Pacific customer executives on our products, technology developments and our directions in R&D.

A key strength of the Technology Centre is the mix of technology innovation and product development. This enables leading edge technology and methods to be continuously integrated into Nortel Networks products throughout the development process.

Fostering and acknowledging innovation in product, management and engineering is a core element of this development process, and plays a significant role in generating the differentiation and added value new products require to succeed in today's rapidly evolving and competitive telecommunications market.

The Technology Centre also has a firm customer focus and works to develop specific solutions to meet the business needs of particular customers as well as provide practical demonstrations of new and emerging technologies.

In addition, Nortel Networks actively partners with other R&D organizations and leading customers in developing innovative solutions to telecommunications challenges.

Technology Centre Programs and Activities

Mobile Location Centre

The Technology Centre in Wollongong has developed a total location-based wireless services solution, the Mobile Location Centre (MLC), for worldwide markets. The MLC provides the coordinates of mobile subscribers within a wireless network and allows wireless operators to leverage this location information to evolve new, revenue-generating consumer and business services such as personal navigation, mapping, corporate fleet tracking and roadside assistance, as well as enable emergency services customers like ambulance, police and fire departments to respond more quickly and accurately to calls for help. The MLC has been sold to carriers in North America and Europe and provides an excellent example of a global product developed in Australia.

Wireless Internet Lab

The Technology Centre also features a wireless Internet lab for the development of end-to-end wireless Internet applications and services for CDMA and other wireless access technologies. The purpose of this lab is to demonstrate wireless Internet applications, provide staff with an open environment for fast prototyping of application ideas, and offer third party application developers an interoperability testing facility for product evaluation. The lab has access to the most advanced equipment, as well as core and terminal equipment to support a wide range of wireless-based Internet services.

Interactive Media Services

Nortel Networks is deploying industry-leading IP telephony/multimedia service platforms to its global customers. The Wollongong Technology Centre is a key contributor to this effort by providing trial and first-market application support to carrier customers across Asia Pacific. This activity includes testing new releases before delivery to customers and initiating solutions to problems that have been discovered. As a result of this activity, a fully operational lab for IP multimedia services is available in Wollongong for regional customers to explore this capability and to support the generation of innovative ideas for deployment of IP multimedia services across wireline and wireless networks.

Network Planning Tools

Over the past five years, a team of engineers from the Technology Centre has developed three advanced networking tools to assist carriers with network planning in highly targeted ways. These are:

- A spatial analysis tool that combines GIS (geographic information system) technology with an extensive IT (information technology) database to allow wireless service providers to pinpoint optimal customer prospects and build business cases for leveraging this tool to offer new, revenue-generating services.
- A planning tool that enables carriers to compare the cost of classical TDM (time division multiplexing) networking with the cost of a move to an IP model. This

comparison scenario delivers year-on-year cost summaries, tangibly demonstrating how carriers can save millions of dollars within three to four years of migrating to packet technology.

- The Intelligent Internet Planning Tool, which looks at the Internet applications a carrier wishes to offer, such as media streaming, unified messaging, e-commerce or infotainment, and enables the cost optimisation of key network functionalities such as firewalls, load balancing, security and storage.

Partnerships and Collaborations

The technology centre has been involved in a range of partnerships, collaborations and outsourced research activities in Australia. Today the most significant involvement is with the Centre for Networking Technologies for the Information Economy (CeNTIE).

CeNTIE

The CeNTIE project – linking metropolitan Australian sites with optical fibre and offering high-speed interstate capacity from collaborating carriers and consortia – is led by CSIRO and supported by the Commonwealth of Australia through Building on IT Strengths (BITS) and the Advanced Networks Program (ANP). Nortel Networks is a founding member of this consortium.

CeNTIE is building an advanced network for research into networking technologies that will enable "information economy" business systems based on the next-generation Internet. A foundation network consisting of advanced LAN, MAN and transcontinental networks will be constructed and used to implement business-system test beds and conduct networking research.

The Nortel Networks Technology Centre is participating in two of the CeNTIE business systems test beds between 2001 and 2004:

Telehealth Business System

The Telehealth Business System project is designed to deliver surgical training via a shared virtual reality system, allowing students to be trained in surgical procedures by a mentor in another location. These devices require several different types of traffic with different combinations of QoS (Quality of Service) requirements, such as high bandwidth, low latency, low loss and access to massive computing power.

In January 2002, a Nortel Networks 10-gigabit Optical Ethernet solution played a pivotal role in a dramatic demonstration of this networked virtual environment technology. Two people – one at CSIRO's Virtual Environments laboratory at the Australian National University in Canberra and another several kilometres away at the CSIRO corporate headquarters – were able to work together on a virtual 3D human organ. Each was able to feel the object and see what the other was doing while communicating via a studio-quality video link. The two functions were tested in a simulated real-world traffic situation in which they competed against a volume of network traffic equivalent to Sydney's telephone system at peak levels.

Media Systems

Post-production enterprises have particularly challenging networking problems requiring the provision of high-bandwidth, on-demand communications with stringent and variable QoS requirements at reasonable cost. This also requires a rapid amalgamation of companies with different skills into "virtual enterprises" for the length of a project such as a feature film. This CeNTIE project will connect members of the media user group over its research network to put the future of networking into their hands today. The research network will give CeNTIE immediate clarity on the issues, challenges and solutions offered by this capability, supporting a more effective focus on work in this area.

Changes in Global Telecommunications Equipment Market

Since its peak in 2000, the global telecommunications equipment market has experienced a sustained and significant decline. While this has been the result of many factors, the outcome is that carriers and service providers have significantly reduced their capital expenditure budgets. Even now, the industry is seeing major carriers announce reductions in their capital budgets. This has resulted in decreased revenues for telecommunications equipment and solutions vendors such as Nortel Networks. The commitment to R&D by the major telecommunications equipment vendors is usually in the range of 12 to 15 percent of revenues. In the current market environment some suppliers have further reduced this proportion. The net effect is that the total amount of R&D expenditure by telecommunications equipment vendors is significantly reduced.

A similar change, but not to the same extent, has been occurring in the wider IT industry. Globally, some one million jobs have been eliminated since the end of 2000.

Impact on Australia

Australia has not been immune to these changes. Australia has lost some telecommunications and ICT (Information and Communications Technology) R&D facilities and seen most of the remaining facilities reduced in size. Until there is a sustained and significant improvement in the telecommunications systems market, those **facilities remaining in Australia are still at risk.**

Given the very limited global investment in new telecommunications R&D facilities, Australia needs to focus the majority of its R&D commitment to supporting the retention of existing facilities.

Factors Influencing Choice of R&D Investment Locations

As part of its decision to undertake an R&D activity, a multinational corporation (MNC) will usually base its decision on expected return on investment (ROI). The decision of where to locate an R&D facility will be based on similar factors – but they are not fixed, and their significance will change relative to market conditions and competitive forces.

As a result, **it is essential both industry and economic policy, as well as investment attraction and retention incentives, are guided by close interaction with industry** and a good knowledge of the current market and R&D investment drivers. To do otherwise will result in misdirected policies. Marketing Australia as an investment location by basing the marketing program on the wrong issues will not only be ineffective but unnecessary as well.

An understanding of current factors that MNCs take into account when making R&D investment decisions must be fundamental to the development and implementation of government policies and programs that aim to promote the establishment of R&D facilities and programs in Australia.

Once a decision has been made to undertake a particular R&D activity, the prime criterion in deciding the location is the ability of the R&D investment to deliver an ROI by producing a quality output in a timely manner. Another key factor involves a close assessment of any risks that may stand in the way of achieving this outcome. This is determined by:

- Total cost compared to other locations, including staff, facility, utilities, travel costs, taxation and proximity to manufacturing facilities.
- Availability of R&D resources with relevant expertise and experience, including university, government and commercial research institutions.
- Track record of existing R&D team in producing quality products on time.
- Capital investment required.
- Project-specific training requirements.
- Government incentives, such as R&D tax concessions and other programs.
- Clustering of companies that can function as partners when the R&D project requires the use of outside resources.

In general, a comparative evaluation of competing locations will favour existing facilities over new ones – unless total costs differ greatly or the investment is taking place at a time when there is a shortage of skilled R&D personnel with the specific expertise required. An existing facility has numerous advantages over a new one, including:

- Lower capital costs for building and equipment.
- Familiarity with existing products, systems and procedures.
- R&D track record for production of quality products on time.
- Lower training requirements due to knowledge and experience of existing staff.
- Existing alliances with local companies and research institutions.

One factor that is often overlooked is **the availability of a world-class telecommunications infrastructure** for the development and testing of real-world solutions for global markets. **This can be a fundamental criterion in the decision to select a location for an R&D project.** In this case Australia is well placed, with a national telecommunications infrastructure that is very similar to that deployed in North America and Europe. This provides Australia with a competitive advantage over other

competing locations, and is an advantage that needs to be fully exploited. Measures to simplify access to these networks for R&D purposes also need to be considered.

An excellent example of how the Australian telecommunications infrastructure can provide the basis for leading-edge R&D activities can be found in Nortel Networks' work with CeNTIE to develop the media systems described earlier. Nortel Networks believes that such a product will have numerous applications globally.

The ability of governments to influence decisions on the location of R&D facilities is limited. Certain areas are amenable to government action, and can be leveraged to improve Australia's competitiveness as an investment location. These include:

- Improving relative costs by tax concessions and incentives.
- Effective marketing of Australia as an internationally competitive R&D location – making it easier for local executives to call attention to Australia's advantages.
- Developing a highly skilled workforce through a tertiary education system that produces high quality graduates focused on innovation and commercialisation.
- Maintaining an environment in which universities conduct primary research, and where researchers are encouraged and supported in commercialising their discoveries and inventions. This primary research can lead the commercialisation of inventions, by local companies, that attract the attention of MNCs.
- Creating a culture of innovation among SMEs – one that engenders interest by MNCs.
- Assisting in retaining key researchers in Australia, by offering internationally competitive personal tax and tax systems favouring employee share options.

In the late 1980s and early 1990s, Australia was able to secure some ICT R&D facilities by use of government purchasing power, at least in part; however, many of the facilities and investments have not been sustained. Use of government purchasing power is no longer an effective option for Australia. Australia accounts for less than 2 percent of the global ICT market and government procurement is only a small fraction of that. **Australia now has to win R&D investments in a highly competitive international market, one in which many countries are competing for investments and most have some advantages over Australia. To win in this environment, both Australia's marketing of itself as an investment location and the policy decision-making of the telecommunications industry must be well informed about the local market, about international markets, about industry trends, about the advantages of competitors, and the like.**

Acquiring an R&D investment is not a one-off win for Australia; ongoing attention to retention of the investment is essential. At every discontinuity, the future of the investment will be questioned or new opportunities will present themselves. Australian R&D centres will need to compete with overseas facilities on each and every occasion. There is no guarantee of ongoing work for any R&D facility, particularly because a great deal of R&D activity is readily portable and there are often many locations competing for R&D investment and business.

Discontinuities that may occur include:

- Completion of a specific R&D project.
- Availability of new R&D projects.
- End of a particular product line
- Creation of a new product.
- Market contraction and expansion.
- Company restructurings.

R&D facilities require ongoing attention; otherwise, governments will not be aware of threats to, and opportunities for R&D investment. **The availability of an up-to-date package that sells Australia as an internationally competitive R&D location is essential,** because a discontinuity can quickly arise and Australian-based executives who are willing to promote investment in Australia will need to be able to react immediately.

Conclusion

Nortel Networks has made a substantial and ongoing investment in R&D in Australia. The Wollongong Technology Centre is developing products for the global market.

To attract and retain R&D investment, governments must provide and effectively market an internationally competitive R&D environment that encompasses economic, industry, innovation, taxation and education policies. This is a continuing process, one that will need to evolve constantly, and be always ready to respond to a rapidly changing international investment environment and to the measures initiated by other countries to attract investment. A greater focus on R&D investment retention is a mandatory component of long-term success.