



Singapore – priming the digital pump

This small island-state has already built a national broadband infrastructure. During **the next five years**, it will deploy the Next Generation National Infocomm Infrastructure – a nationwide ultra-high-speed fiber access infrastructure, together with a **pervasive wireless network**.

YOU WOULD not think it hard to connect a city that's less than 50 kilometers across, especially on an island. But Singapore is different: The city is using network connectivity to develop its economy.

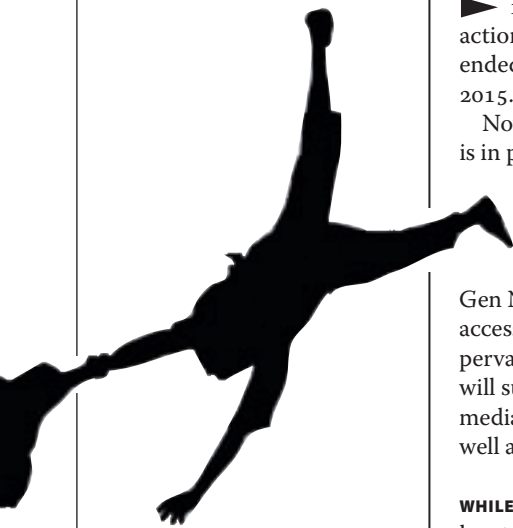
Since the 1990s, when it became the first city in the world to implement congestion-charging (long before London) and base it on smart cards and radio-frequency identification (RFID) tags, Singapore has leveraged its mobile networks, its broadband network, and the cultural diversity of its citizens to attract researchers – first in semiconductors, then in biotechnology. Upon creating a world-class semiconductor and electronics industry, Singapore has realized that this does not fully leverage the networks that already span the city.

Singapore claims to be a “digital living lab” and “launchpad to Asia.” These claims are not hollow: There is 99 percent island-wide broadband coverage, and the country ranked first in the World Economic Forum's Global Information Technology Report 2004–2005, and in the top three for five consecutive years. The household broadband penetration is over 80 percent, while internet penetration among households is 74 percent. To achieve this, Singapore has a plan: By 2015, everyone in the island nation will

find their lives transformed by technology. Reading like a slide-show presentation, the plan breaks down that goal into easily digested concepts: 3i (the three I's – Innovation, Integration, and Internationalization – which all talk about how “infocomms” will drive the Singapore economy by enabling people to get better connected, and use the network resources they are creating to drive growth); 1-2-3 (the three steps toward the main goal: 1, to become number one at harnessing infocomms to add value to the economy and society; 2, to double the value-add of the industry, up to USD 26 billion; and 3, to triple the exports of infocomm products, to USD 60 billion); and 80, 90, 100 (what success will look like: 80,000 additional jobs, 90 percent home broadband usage, and 100 percent computer ownership in homes with school-going children).

These are documented in a series of in-depth reports on how the public and private sectors work together, and how they plan to sustain the high GDP growth the island has enjoyed for several decades. The key is shifting the economy toward information technology.

Singapore's first civil service computerization program was launched in 1981, and the country started its first broadband-building project in



► 1996. The first three-year e-government action plan ran from 2000 to 2003, and the next ended in 2006 – followed by the vision plan for 2015.

Now that a national broadband infrastructure is in place, the vision plan hinges on completing the next step. During the next five years, the country will make strategic investments to deploy the Next Generation National Infocomm Infrastructure (Next Gen NII), a nationwide ultra-high-speed fiber access infrastructure, with a complementary pervasive wireless network. The Next Gen NII will support new industries such as the digital media and the biomedical sciences industries, as well as Grid computing (see separate article).

WHILE SEVERAL multinational companies have located their manufacturing, logistics, or customer support centers for Southeast Asia in Singapore, the real economic growth will come from local entrepreneurs, using the “digital living lab” to create new services and products. The government of Singapore is trying to prime the pump by creating large-scale projects with sector-wide impact.

The TradeNet project is a case in point. It streamlines information flows between logistics players and relevant government agencies. The deployment of infocomm systems and applications has contributed significantly to making Singapore one of the world’s busiest ports. Exporting the system to Saudi Arabia is one way of leveraging the government investment. To handle the volume of requests, the government created the Singapore e-Government Leadership Centre to provide education about building an infocomm-integrated public administration. ●

Turning computing into exports

Singapore is spinning its network into a resource that will help the island-state grow even further: The Grid.

► **FANS OF THE** Matrix science-fiction movie may remember it. The Terminator sprang from it. And now, Singapore looks set to create a media production resource out of Grid technology.

The country aims to catalyze the resources of Grid Service Providers (GSPs), which make Grid-enabled software, computing, and storage services, through a national project leveraging government investment in commercial consortia. For example, animation rendering requires huge, dedicated data centers, and the animation companies do not always have new films in the pipeline. Grid services provide a way to distribute the processing and reuse the infrastructure when it is not needed.

In 2007, the Infocomm Development Autho-

rity (IDA) launched a “call for collaboration” to industry. Companies and government institutions, as well as academia, were given the opportunity to create computing services that could be easily resold. The IDA buys a portion of the service capacity, thus guaranteeing that there will be a base load in the system – and a basis for financing the investment.

In June 2008, the IDA appointed three consortia to lead the Grid development, creating shared resources using networks. The consortia are mandated to offer commercial services by the end of 2008, and make their systems available for other businesses that are interested in working with the technology.

By 2013, Singapore envisions a Grid Market Hub, an infocomm-enabled marketplace of Grid service providers offering the global community a platform for sharing, buying, and selling infocomm resources such as software, computing, and storage, on an on-demand and a pay-per-use basis.

This is not the Grid of the research world, however. “Grid” here should be taken figuratively, with the stress on resource sharing, not interconnectivity. One of the first to start services, a consortium involving the Singapore internet service provider New Media Express and its longtime partner, Microsoft, has elected to build its Grid solution on another buzzword:



Alan Woo

“virtualization,” according to Alan Woo, who is Chief Technology Officer at New Media Express and responsible for the Grid project.

Users will be able to purchase storage by the gigabyte and computing by the hour, making it easy for a software-as-a-service (SAAS) house to grow quickly when demand escalates – and easy for the Grid consortium to get paid. Charging is per CPU core – USD 1 per hour; USD 8 per gigabyte per month (cheaper for Serial Advanced Technology Attachment, or SATA, disks). Prices are fixed through the agreement with the IDA and run for the next three years.

The SAAS provider will be responsible for all front-end integration to customers, who may not even notice when there are spikes in demand if the system works right. At the back end, the VMware virtualized Fujitsu blade servers, running Microsoft Windows Cluster or Linux, will look like a single computing resource to the customers.

The consortium’s main customer, apart from the IDA, is the national broadcaster of Singapore, which wants a reliable, cheap, and on-demand way of turning its analog TV archives into a digital resource. Encoding video archives into different formats is an excellent Grid application, as the video can be queued up when load is high. But the consortium will also apply digital rights management to the media.

Other video providers are welcome. For a provider with a small operation, looking to

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ALAN WOO, CHIEF TECHNOLOGY OFFICER AT NEW MEDIA EXPRESS

grow without high costs, the development being done by New Media Express sounds like a good fit: a Grid that is optimized for video, capable of delivering many different streaming services at once.

"After video, we are looking at gaming," says Woo. The rendering of virtual worlds, such as Second Life, is similar to video. Because video is "bursty," Grid computing, with its built-in load balancing, suits it well. When the load is low, low-priority jobs can be switched in; or servers can simply be shut off. There will still be a single systems image for the customers. And the Grid system scales quickly. But networks do not.

"We have multiple data centers, multiple connections and peering points into the other ISPs and network providers here in Singapore," says Woo. And while the network may be sufficient for now, the government is already planning an upgrade of the national network.

The estimate in their marketing plan looks for rapid growth – almost double the number of cores available by the end of the contract period, when they will be on their own and the market self-sustaining, according to government hopes.

"But that is not a problem, we can just continue to expand the systems as the market demands. When we fill up the infrastructure, we can think about prioritization," says Woo.

There seems to be little risk that the usage will be too low. Already, the consortium has plans to expand outside Singapore, looking at other data centers as potential partners. On Woo's wish list is the creation of a backbone for the entire Southeast Asian region, with Singapore as the hub – selling Grid services, of course. ●

The automated government

The government tries very hard to get citizens online, even exploring cartoon illustrations to make its websites popular. All services are available everywhere to everyone on the island – even on their mobile devices.

► **IN 1981,** THE Singapore government began using mainframes to automate government business, much like any company would at the time. Integrating these in the 1990s, they created a set of applications that were intended to

facilitate not only business but also citizens' lives: TradeNet, MediNet, and LawNet. TradeNet, for instance, shortened the time of applying for an export license from 15 days to 15 seconds.

This productivity gain fell directly into the hands of local businesses. But the behind-the-scenes work did not stop there. The government of Singapore continued to re-engineer its processes, so that today it is natural for citizens to contact ministers directly – something unthinkable 20 years ago.

In deploying the world's first congestion-charging solution, entirely based on RFID tags, Singapore was the first to have several e-government applications. At the turn of the 21st century, 130 government services were online; now there are 1600, available around the clock. But it would be an ideal world where everyone could use all services without help. That ideal world is described in the iGov 2010 report, where the vision of the connected government is outlined.

One of the main drivers is the national competitive advantage: Government is to be an engine in the transformation of the economy. But there are still efficiency kinks to be ironed out, and there is still some way to go when it comes to increasing the quality of the services and how many people they actually reach. Turning citizens into stakeholders, actively engaging with the government through networked applications, is the ultimate goal.

In the world of 2015, according to the wise men and women writing the report, there will be two drivers for what e-government will look like. First, the back-end of all systems will be integrated, so that once initiated, a transaction can take place without human involvement. Second, there will be "sentient devices" that can communicate to create a cocoon around the person, always ready and always at their service. All services will be completely personalized, and when you need a service, you just wave your fingers – and the government delivers. According to the report.

If this scares privacy advocates, consider that citizens of Singapore already have a single password and user ID to access all government services. Three million users are registered, out of a population of 4.5 million. And they are frequent users of government services, easily accessible through one portal. That also goes for a number of mobile services, where the government does not take the proactive stance of Seoul, but tries to leverage the ubiquitous

One of the tigers

► With 4.4 million inhabitants, Singapore is often referred to as one of Asia's economic "tigers". Its economy is driven by electronics manufacturing and financial services and it has the busiest port in the world in terms of tonnage shipped.

Good English

► The government encourages Singaporeans to have more babies and to be more courteous. Citizens are urged to "Speak Good English" in place of a local slang known as "Singlish".

Chinese dominate

► Chinese constitute more than 75 percent of the community; Malays and Indians are the largest minority groups. There are many foreign workers.

Electronics rule

► Singapore's core sectors of industry are manufacturing, oil refining and the travel and tourism industry. The manufacturing sector alone accounts for about 45 percent of Singapore's GDP. Electronics manufacturing has been the key industry since the country's reconstruction following independence in 1965.

Digital technologies manufacturing is the thriving industry sector of the current decade. Apart from electronics, Singapore manufacturing industry includes a biomedical sector, chemicals and engine parts.

► capacity of Short Message Service (SMS), available to all mobile users.

The government is trying hard to group services by usage instead of by which government branch they belong to. There are a number of one-stop-shops catering to user needs, including forums where citizens can discuss various aspects of daily life, including dating (the government also runs a dating agency, hoping to increase the number of citizens).

The government encourages people to stay healthy and think ahead about retirement, and requests feedback on how it's doing and how the government is run. Although the results are published in the FAQ section on the website, the answers are probably what would be expected (what should a government official answer when a citizen suggests reducing waste in government by reducing ministers' salaries?).

The government recently took the first step in that direction by creating a special portal for citizens to interact with the government: REACH, which stands for Reaching Everyone for Active Citizenry @ Home. The REACH portal has given government an additional dimension through the deployment of Web 2.0 applications – blogs, social networking, online chats, and short message texting.

But in 2015, according to the report, there will be no complaints. The government will focus on user experience, using relationship-building technologies to strengthen customer-centric delivery. The government will be able to intelligently predict each customer's needs and make useful recommendations without compromising the customer's privacy. (Singapore sees the citizens of the future as customers of the government, it would seem.) All services will be available everywhere, to everyone on the island, on their mobile devices. But for those who are uncertain, there will be staff to help at the CitizenConnect centers in the neighbor-

hood Community Clubs (which already exist).

The government in 2015 will not just create services and push them to the users, though. There will be an open channel for users to voice their views and provide feedback, and new policies and programs will be the focus of regular online consultations. The vision document is even daring enough to foresee a government that has moved away from being perceived as dry and boring. It expects eight out of ten users to be very satisfied with the overall quality of the e-government services, and nine out of ten to be willing to encourage the tenth to yield to peer pressure and use the government services online.

Government representatives were thinking hard when they wrote the report about how to make the online medium more attractive than traditional paper-based communication. Already, the government is exploring the use of cartoon illustrations on their websites. The back-end integration is helped by a common metadata infrastructure for all government, which enables automatic processing. To be able to share services with enterprises, a blueprint has been created for government services that identifies the areas where public agencies and business can collaborate, and sets common data and application standards. All government offices will work together in a common standardized environment. ●

