

# **Rapid Deployment of the Internet by the Singapore Government**

By Ernie Quah Cheng Hai (Project Coordinator)

## **Abstract**

The paper will cover various aspects of the project by the Singapore government to rapidly deploy and exploit the Internet within its divisions and agencies and also touch upon how this has affected the Internet scene in Singapore as a whole. As of April 1995, most of the government agencies in Singapore had not heard of the Internet. Three months later, in July 1995, all 36 government ministries and organs of state had been connected. One month later, in August 1995, the first of the government Web sites and an Internet recruitment system for government positions were launched by the Prime Minister's office. Six hundred job applications were captured via the Internet over a three-month period. In February 1996, the first Web database application system (based on the Oracle Websystem) was created. To date, the Singapore government has more than 1,500 Internet users in its divisions and has some 50 Web sites. Some 80,000 e-mails are exchanged between government personnel and the Internet every month. A number of Web database applications are in construction, and Internet connections are in the process of being extended to all 87 of Singapore's Members of Parliament and top 1,000 decisionmakers.

This bold step of endorsement taken by the government has a strong cascading effect of leading the private sector and general community to investigate and discover for themselves the rich benefits and opportunities afforded by the Internet. Singapore currently has three Internet service providers (ISPs) and about 100,000 Internet users. The number of users is rising steadily. Competition has brought down connection cost to a new low of S\$6.95 per month with 12 hours of free time. For people who cannot afford a computer, a number of cybernet cafes have started business (at S\$10 per hour of access), and free Internet connections are now available at all Singapore public libraries. With that, the information technology (IT), economic, and social scenes in Singapore have been set to change forever.

## **Background**

Singapore's first encounter with the Internet came in 1991 when the National University of Singapore and the National Science and Technology Board jointly set up the Technet Unit, Singapore's first Internet service provider (ISP).

The key purpose of the venture was to provide the local R&D community with Internet access so that they could communicate and keep up with their counterparts in other parts of the world. Access was strictly limited to organizations with R&D interests. However, even with only a small group of privileged R&D organizations gaining access to the Internet, the news quickly spread; and it became increasingly apparent that the potential of the Internet extended far beyond R&D.

By 1993, more and more organizations had begun requesting access to the Internet; and by 1994, some 50 organizations comprised of R&D institutions, educational institutions, government bodies, and commercial organizations were already connected.

In 1994, the Singapore government completed a detailed study on the Internet and concluded that it should be made available to all organizations and the general public. Singapore's 3 ISPs--Singnet, Pacific Internet, and Cyberway--were launched in 1994, 1995, and 1996 respectively.

Singapore's national Web site, the Singapore Infomap (<http://www.sg>), was launched in March 1995; and the Singapore government Web site (<http://www.gov.sg/>) was launched in April 1995. Following that, the Internet was made available to the entire civil service via the Government Resources on Internet (GRIN) network.

The following sections discuss some of the activities that led to the government's support and deployment of the Internet within its departments.

#### *Convincing the top decisionmakers*

The first major task to be accomplished was to convince the top decisionmakers of the benefits of the Internet. But before they could be convinced, they needed to know what exactly the Internet was. Between October 1994 and February 1995, Internet presentations and briefings were made to all members of the Singapore Cabinet, including the Prime Minister. The various capabilities and power of the Internet were demonstrated, including e-mail, newsgroups, and the World Wide Web (WWW). The key benefits of the Internet were pitched from three angles:

*Internet as a communications tool.* By means of Internet electronic mail and newsgroups, Singaporeans would be able to directly and quickly communicate with any of the estimated 30 million people worldwide who are connected to the Internet. The list of reachable persons could range from international political leaders and decisionmakers of multinational companies, to university students and librarians, to the common man in the street.

*Internet as an information resource tool.* An enormous wealth of information resources and services are available on the Internet for access via online services like Web database queries and File Transfer Protocol (FTP). Moreover, these resources are globally standardized and available almost free-of-charge.

*Internet as an information disseminating tool.* Information published on the Internet by means of the WWW or anonymous FTP would be accessible to some 30 million users worldwide. Publishing on the Internet is a relatively simple and low-cost process.

It did not take long for the ministers to realize that gaining access to the Internet could be critical to the competitiveness of the nation in time to come. A green light was given for the deployment of the Internet in public and private sector organizations.

#### *Competition with the telecommunications industry*

Widespread use of the Internet by local enterprises and Singaporeans for overseas communications could mean a drop in international direct dialing profits for the Singapore telecommunications monopoly, Singapore Telecoms (ST), unless

Internet access pricing were kept at a comparable level. So initially, when the Internet was first introduced to the public via Singnet (which was owned by ST), Internet prices were among the highest in Asia, if not the world. However, with two new ISPs licensed by the government (Pacific Internet and Cyberway) arriving on the scene, Internet access in Singapore is now available at S\$6.95 per month with 12 hours of free access time. The release of the additional ISP licenses created competition in the marketplace, thus bringing down the prices. In essence, the government recognizes that the long-term benefits to be gained from the Internet are more important than the short-term profits generated by ST.

*Comparison with other existing and planned forms of network technologies*

Singapore was already in the process of testing a number of network technologies when the Internet started to gain prominence. These included Teleview (frame based); Singatouch and PAM (kiosk based); INTv (teletext based); an intergovernmental IBM SNA-based network known as the Inter-Departmental Network or IDNET, run by the National Computer Board (NCB); and another government agency-private companies SNA network run by the Singapore Network Services. NCB was also testing out an advanced network technology known as Livewire. An evaluation was done to see how these network technologies would compare with the Internet. The evaluation showed that the Internet is still relevant in spite of all these developments because:

The Internet's connectivity is global.

The Internet is based on license-free and standardized protocols/software.

Nobody owns the Internet, reducing the risk of vendor lock-in.

The Internet is comparatively powerful and user-friendly.

It is easy to publish information on the Internet.

The Internet offers a rich set of tools and functions (WWW, news, e-mail, FTP, Archie, search engines, etc.) unparalleled by the rest of the technologies.

New technologies introduced on the Internet in other parts of the world could be quickly adopted for use in the local context due to the standardized protocols and software.

### **Pilot project**

With the above issues resolved, the first step to introduce the Internet to the government was taken. But before the Internet was introduced to the entire government, a small pilot project was first introduced in the Department of Statistics (DOS), Ministry of Trade and Industry, in November 1994. The project would serve to test out, on a small scale, the activities that were being planned for the implementation of the Internet in the entire government.

The pilot project involved giving the staff of the department dial-in access to the Internet and putting up a Web site for the department, which was to be done by the users themselves. The results of the three-month trial were extremely encouraging, with the DOS users indicating that the Internet was helpful in their work and that they had no problems using it. A DOS Web site was also successfully set up by the DOS users themselves, after attending a short training course conducted by NCB. As a

result of the success of the pilot project, GRIN was subsequently introduced to the entire government.

### **Policies and guidelines**

To ensure the smooth implementation of the project, a set of policies and guidelines pertaining to the use of the Internet was released by the government. These policies apply to the general public as well as government agencies.

#### **(a) Access to the Internet**

Access to the Internet is deemed to be important to Singapore competitiveness in the short term and critical to Singapore's relevance in the Information Age in the long term. All Singaporeans should have a chance to access the Internet if they wish to. Accordingly, Internet machines have since been set up at all national libraries, and cybernet cafes have sprung up overnight. Opening up the ISP market to competition has also led to very low prices of S\$6.95 per month with 12 hours of free usage.

#### **(b) Freedom of speech**

While freedom of speech on the Internet will not be curbed or censored, measures will be taken to ensure that all parties are accountable for what they say on the Internet. Basically, the message is: With this freedom comes responsibility, and freedom of speech is not synonymous with freedom to make irresponsible remarks and be totally divorced from any implications or damage caused by those remarks.

To enforce the freedom of speech policy, the following guidelines apply:

#### **(a) Singapore media law**

Singapore law, as it applies to other media, also applies on the Internet. Already, Singapore has seen the first case of a libel suit taken up by one Singaporean against another pertaining to a newsgroup posting.

#### **(b) Political organizations**

Individuals are free to discuss politics openly on the Internet. Political organizations are also free to discuss politics over the Internet; but as political organizations, they are accountable for what they say on the Internet. For example, if a political party makes a certain claim or accusation, it should not be able to turn around the next day and claim that it was just an individual opinion and not a party stand. Thus, a regulation was passed requiring all political organizations broadcasting on the Internet to be registered with the Singapore Broadcasting Authority (SBA).

#### **(c) Religious organizations**

The same stand applies to religious discussions. In multiracial Singapore, where the current state of religious harmony has taken years to build up, religious issues are treated very seriously and with the utmost sensitivity. Like political organizations, religious organizations need to register with the SBA to ensure that they are responsible with their Web publications and are accountable for what they say on the Internet.

#### **(d) Pornography**

In a country where pornographic material is essentially unavailable, the issue of pornography being freely available on the Internet is a big one. However, the government accepts that there is no way to completely censor the Internet of

pornographic materials short of barring total access to the Internet. What it tries to ensure, therefore, is keeping the main highways relatively clean so that, say, a surfing kid would not accidentally blunder into undesirable material. In effect, major and obvious pornographic sites are blocked by the ISPs. New sites to be blocked out might be added to the list now and again, but balanced with the cost of filtering. Steps are taken to test out client-side filtering tools like Netnanny that could be implemented in schools and homes, instead of cutting off entire sites.

### **Network configuration**

To take advantage of the economy of scale and facilitate quick deployment, the government initially set up and operated its own Internet network, known as GRIN (Government Resources and Information Network), for all its departments. This allowed Internet resources to be centrally funded, which relieved the government agencies from bureaucratic delays in getting funding for their own connections. The result: immediate free Internet connections and Web space for all government organizations since April 1995. A Web server is also set up for free use by GRIN Web publishing sites.

#### *Standalone connection policy*

Though the government recognizes the importance of letting its staff have connection to the Internet, it is also fully aware of the risks posed by the connection. Apart from the accidental download of viruses, a machine connected to the Internet would also be susceptible to malicious intruders and hackers operating from the various corners of the world. The government needs to ensure that its internal computerized systems are not exposed to the inherent risks and attacks that might come in via the Internet. As a result, a standalone policy was issued--all machines and network connected to the Internet must NOT be also connected to the government's internal systems. Private companies in Singapore are also advised to adopt the same stand.

#### *Limited user policy*

When the Internet was first introduced to the government, many frameworks and guidelines were not yet in place; and it was unclear as to whether there would be any major negative impact (e.g., staff doing excessive surfing during office hours, possibility of pornographic information being downloaded and sold, etc.). As a conservative measure, each government site initially was given a maximum of only five Internet accounts (a total of 150 accounts), mainly to be used by government researchers. However, as the Internet scene in Singapore has matured, this five-account policy has since been removed. Government organizations can now have an unlimited number of Internet accounts.

#### *Dial-in users*

The government network, GRIN, is made up of two portions: dial-in connection components and leased-line components. For the dial-in component, a bank of 64 units of 28.8-kilobits-per-second (kbps) modems was set up to facilitate dial-in Internet connections from about 35 government sites. According to the policy, only standalone personal computers that are not on the organization's local area network

(LAN) are used for dialing-in to the Internet. This meant that existing equipment could not be used and new machines had to be purchased for connection to the Internet. As an interim measure, some existing machines were removed from the LAN and used as standalone dial-in Internet machines instead. Each organization usually has 5 to 15 standalone dial-in machines situated at convenient locations for the staff to connect to the Internet.

After a round of evaluation, Internet Chameleon and Netscape were chosen as the standard TCP/IP stack and browser, respectively. Chameleon Mail, which supports multiple accounts on a single machine, is used for e-mail. Netscape is also used for reading newsgroups. To beef up the security of the dial-in network, an authentication system was introduced using a fairly sophisticated one-time password scheme. This also ensures that no spoofing of identities can happen on GRIN--that is, a dial-in user cannot send out mail or news while claiming to be someone else.

#### *Network users*

For sites with a large number of users, a standalone LAN (which is, again, not linked to the organization's LAN) with a leased-line connection to GRIN is set up. The LAN is usually made up of about 8 to 15 personal computers whose sole purpose is connecting to the Internet. A Unix box is usually required to administer the large number of accounts (300 to 500) that a standalone LAN is expected to support. GRIN currently has six network sites with about 700 users.

#### *Training support personnel*

An immediate problem experienced by the government for being ahead on the Internet scene is the lack of expertise in the industry. Extensive seminars, training sessions, and train-the-trainers courses had to be conducted by the government itself to familiarize its staff with the Internet. A network of technical support staff was also built to provide technical support to government officers who are mostly non-IT professionals.

To tackle the problem, a small group of professionals from NCB first familiarized themselves with all aspects of the Internet and took on the roles of Internet evangelists. Seminars were conducted for about 1,000 officers from government organizations and their information systems departments to first raise their awareness level and sell them on the Internet.

Next, some 100 IT officers from the computer departments of these organizations were trained as Internet specialists to prepare them for supporting Internet users from their respective organizations. The training ranged from lectures, to bringing them up to speed on the Internet, to procedures for installing and maintaining Internet software and accounts on PCs. A train-the-trainer approach was adopted; these specialists would later go back to their respective organizations and conduct training for potential Internet users. With this framework in place, the floodgate to Internet access was opened to all the government organizations.

One of the lessons learned from this vast training experience is that many of the specialists will later be lost to industry, as the Internet catches on in industry as well.

#### *Web publishing*

Communications and reaping information from the Internet constitutes only

two-thirds of the benefits of using the Internet. To enjoy the full benefits, government organizations are trained to put up information on the Internet as well, for both the growing local Internet population and the world audience. Publishing to the world audience has the additional benefit of giving the government an avenue to present its side of the story when international incidents involving Singapore--like the Michael Fay, Contemplacion, or William Safire episodes--crop up.

Training and encouraging government organizations to build and maintain Web sites, however, is a much more difficult and complex subject than just getting them to use the Internet, chiefly because of the substantial resource commitment required. The effort made by NCB paid off in the end, however; the Singapore government now has more than 50 Web sites.

Government Web sites in Singapore are either constructed in-house or outsourced to the private sector. In the early days when expertise was scarce, NCB had to evolve a life cycle that would enable interested government organizations to systematically develop their Web sites by themselves. Its efforts resulted in the GRIN Web Publishing Cycle.

### **GRIN Web Publishing Cycle**

The following 16-step process describes the GRIN Web Publishing Cycle that has been used to build many in-house governmental sites:

*1. Decide to set up a Web site.* For a Web publishing project to be successful, it is important to solicit management's support and involvement right from day one. This is necessary because organizational resources will need to be deployed to build the Web site. Information published on an Internet Web site could also reach out to a large number of people; thus, it is in management's interest that the information published reflects the mind-set, goals, and philosophy of the organization. Experience has shown that not getting management's input early in the project could lead to substantial reworking later and, in the worst case, rebuilding the entire Web site from scratch. GRIN Web publishing projects are normally approved and endorsed by the ministers or heads of the respective government organizations before work commences.

*2. Identify a project sponsor.* After high-level endorsement has been given by the organization, it is time to look for a project sponsor or champion. The project sponsor is usually a senior officer in the government organization who can commit the staff resources and funds necessary to see the project through its implementation and maintenance. Usually, the project sponsor is empowered to deploy the necessary resources based on the organization's endorsement to build a Web site. The project sponsor should preferably be an influential, forward-looking person with an interest in IT. One of the first tasks a project sponsor would do is set up the project team.

*3. Form a publishing project team.* Depending on the amount of information to be published, a GRIN Web publishing project team usually comprises 5 to 15 people. Reporting to the project sponsor, the team is normally made up of the following categories of people working on a part-time basis to build the site:

(a) a project leader

- (b) Internet specialists from the organization
- (b) users belonging to the organization (main bulk)
- (d) a graphics artist

The team may comprise officers from different departments or organizations. Once the project team is formed, the users are given Internet accounts and taught to surf around so that they have a good idea of what to put up for their own site. Among other things, the users get to experience the slow loading time afforded by large images in the Web pages and plan accordingly for the contents of their own Web pages.

4. *Identify information to be published.* Once the project team has been formed, the first task at hand is identification of the information that will be published at the Web site. This task is primarily in the domain of the users, who would run through with the project sponsor and management what information is to be put up--whether it be the organization's yearbook, information generated and owned by the organization of interest to the public, general information pertaining to a department, etc. However, one key point that the users need to be aware of: The amount of maintenance required for the site later is directly dependent on how quickly the information put up expires and becomes obsolete. For example, daily satellite photographs of Singapore put up by the Meteorological Services Section (MSS) would need to be updated daily, whereas evergreen general information about the mission statement of MSS need not be updated at all.

5. *Organize information to be published.* After the information has been identified, it needs to be organized. In GRIN, organizing the information means compiling all the information that has been identified for publishing into a file or book, so that the project can be scoped and all parties are clear on exactly what is going to be in the Web site. The organized information would include underlined keywords that would be made into hyperlinks later, the sections that these keywords would link to, and boxes (with description) for images that are planned to be inserted into the page. The consolidated information in the file is then cleared with management and any changes incorporated.

From our experience, identifying and organizing the information to be published takes up about 60 percent of the time and effort required for a Web site project. Note that up to this point, no Web publishing expertise is actually involved. However, the users are told to keep the soft copy of the information in Microsoft Word as far as possible.

6. *Estimate staff-hours and costs.* Once the scope of the information to be published is cleared by management and finalized, the project leader, who should be familiar with the Web publishing cycle, estimates the amount of hours and costs required for the project for each of the parties on the project team--the project leader, Internet specialists, users, and graphics artist. GRIN projects usually last from two to four months and take about 15 to 40 days per person. The amount of recurrent maintenance effort needed to keep the site running is also estimated. Disk space on the government Web server and the Internet dial-in and Web publishing account are provided free of charge for all GRIN sites.

7. *Sign-off.* At this juncture, looking at the one-time and recurrent cost estimates, the project sponsor would make a final decision as to whether the project is go or no-go. If the figures are too high, the amount of information put up might be trimmed down. However, if management feels that the Web site is important enough, more resources may be allocated. Whatever the outcome, once an agreement is made, it should be signed off so that all parties involved in the project (most of whom have their own work to do as well) are fully aware of what is expected of them. This step would preclude situations whereby the project hits problems later due to some of its members being tied up with other work.

For an outsourced project, a file containing the information to be published would be used for calling tenders or quotations.

8. *User training.* GRIN in-house projects are normally end-user computing projects--that is, they are built and maintained by the users themselves. So once the green light for a project has been given, user training would commence. The one-day training, composed of 20 exercises, is conducted by the Internet specialists and centers on markup using Microsoft Word's Internet Assistant, which converts Microsoft Word documents directly into Web pages. After the conversion, the users are taught how to touch up the Web pages by inserting hyperlinks and images and adjusting the sizes and arrangements of the headers, lists, horizontal rules, etc. Also included in the training are the basics of hand-tagging to insert tags such as <blink> or <font size> that are not yet supported by Microsoft Word's Internet Assistant.

9. *Markup.* After the training, the job is divided and users proceed to mark up their respective portions of the Web site in their own time. Here, the fact that the government has adopted Microsoft Word as its standard word processor provides a bonus for the project. For information already in Microsoft Word, the conversion and touch-up is done as taught in the user training. For information not in Word, a clerical assistant or typist is engaged to key the text into Microsoft Word. Documents from WordPerfect and other word processors can usually be imported into Microsoft Word, and the process carries on from there. All work is done on the personal machines of the users at this point, and no connection to the Internet is necessary yet.

10. *Link-up.* After the Word pages have been converted to Web pages, they need to be hyperlinked to form a Web site. Individual users link up and test their own portions of the Web site on their personal computers. It has been drilled into the users during the training that relative hyperlink addresses should be used rather than physical hyperlink addresses. The excitement of seeing their hyperlinks work back and forth is usually enough to give progress a boost at this point.

11. *Jazz-up.* At this point, the graphics artist, who has been hard at work since the sign-off, would be ready with some of the planned graphics images. The images are inserted into the Web pages built so far to give the builders an idea of how the final product will look. More adjustments may follow to make the graphics and page look good together. For GRIN, images usually come from scanned-in original photographs taken by the users, touched up icons from purchased CD-ROM libraries, or free-use clip art from Microsoft Word or Powerpoint libraries, although some organizations have spent tens of thousands of dollars to purchase images from professional artists.

Since, unlike desktop publishing equipment, items like scanners are not easily available in government offices, NCB's Digital Media Centre was made available to any government organization setting up a Web site that requires using scanners and graphics software like Adobe Photoshop. To ensure that all government Web sites are fairly well done (after all, the image of the government is at stake), NCB works hand-in-hand with the publishing site to jazz up their pages and assists them in any advanced media work, like converting a video to quicktime or building clickable image maps.

12. *Local testing.* All the individual portions of the Web site built by the various users are now integrated into a single Web site on a single personal computer, and a second round of testing is done to make sure that the hyperlinks are all right. Cross-module hyperlinks from one user's pages to another's are also built and tested, and any errors are rectified. At the same time, the Web site is proofread on screen and also demonstrated to management for feedback.

13. *FTP upload.* By this time, the organization would have applied for and received an Internet Web publishing account and official Web site address (in the form <http://www.gov.sg/???>). A designated user, who would be the webmaster of the site and who would be solely responsible for what appears at the site, is trained to upload the constructed Web pages from the personal computer to the government Web server.

14. *Live Internet testing.* Once the Web site has been uploaded, a third round of testing is done live via the Internet. One of the key components to be tested here is the retrieval time of the pages over a 14.4-kbps or 28.8-kbps modem, which is very different from the time taken to read in a local page. Pages deemed to take too long to load might be redone and reuploaded. Another key test area is to ensure that all the hyperlinks still work at the remote machine.

15. *Delivery and broadcast or uniform resource locator.* Unlike traditional broadcast, where the information literally pounces on the audience, Internet publishing requires the audience to come to you--and they can only come to you if they know about you and where you are. Once live Internet testing is successful, a day is chosen by the organization to launch its Web site. A press release is usually arranged, and major sites may even receive television coverage in order to broadcast the Web site address to as many people as possible. On the Internet, the site address is registered with the various search engines, like Yahoo or Lycos, and news postings are made in the relevant newsgroups.

16. *Maintenance activities.* After the Web site has gone live, the scheduled maintenance activities kick in. Depending on the amount of resources allocated earlier, the Web pages would be updated accordingly. As the popularity and importance of the Internet as a communications and information dissemination medium grows, organizations are starting to devote more resources to keeping their Web sites relevant and updated. Though most of the government sites are still staffed by part-timers, we anticipate that full-time staff will be needed to update the Web sites in the near future.

#### Deployment of intranets

The Singapore government intranet was implemented in early 1996, riding on an existing civil service-wide backbone known as IDNET, which has just been converted

to host TCP/IP traffic. Like all intranets, the web pages published were restricted to government officers who use Netscape to view the information. Major applications that have gone online on the intranet include:

*The Singapore Government Directory*, a searchable directory of all government officers.

*The Instruction Manual*, the administrative handbook used by all government officers as a guideline for their day-to-day operations and procedures.

*The Hansard*, recordings of past parliamentary and judiciary sittings.

### **Government newsletters.**

The use of Internet-based technologies for the government's in-house network offers several advantages. First, the fact that it is based on Internet technologies means that it enjoys the same benefits as the Internet: open systems, no lock-in to any particular vendor, lots of freeware and shareware to exploit, widely available expertise. Second, any system or software that is designed to run on the Internet would be able to run on the intranet. That means budding Internet technologies like CU-SeeMe could be tried out on the intranet as well, without a vendor passing down R&D costs to the government. Third, if and when the Internet becomes more secure in the future, there is an opportunity that the external Web-based systems could be seamlessly integrated with the internal intranet system, resulting in fully integrated electronic government services for the public.

### **Latest developments: Fast Internet via cable**

Presently, some 86 percent of Singapore's population of three million live in public housing units known as Housing Development Board (HDB) flats. To date, one housing estate of about 200,000 residents in 52,000 households (Tampines New Town, which, incidentally, is the winner of the World Habitat Award) has already been completely cabled. By 1998, all HDB flat units in Singapore will have a cable connection that can be plugged into television sets to receive cable TV.

A development that has excited the Internet community in Singapore is the recent announcement that the cables will also carry data apart from cable TV channels. In a test on 18 April 1996, history was made in Singapore when a video-conferencing session was hosted between Tampines East Community Club and an HDB flat unit. Involving channelworks cable modems from digital and video-conferencing equipment from PictureTel, the data-over-cable trial was a first in the Asia Pacific Region. The following week, fast Internet, at 10 megabits per second (Mbps), was also successfully tested over the cables, bringing the reality of an Intelligent Island much closer to Singapore.

Once the entire island of Singapore is cabled by 1998, one possible plan would be to turn the entire cable network into one big national intranet, with data exchanged at 10 to 30 Mbps. Web servers and other services (e.g., FTP) residing on the cable would be able to serve out large amounts of information quickly to machines directly connected to the cable. For overseas Internet access, speed would be limited by the T1 (1.544 Mbps) and E1 lines currently connecting Singapore to the U.S. and Asia

Pacific backbone. If a faster international circuit such as a T3 becomes available, then all Singaporeans would be able to enjoy real 10 Mbps Internet access from their homes. The interim solution might be to put up local cache servers where popular information requested by the island from the Internet would be cached and then served out on the cable backbone at 10 Mbps.

### **Future plans and issues**

The use of the Internet by the Singapore government to date constitutes only the tip of the iceberg. Plans for an entire host of electronic government applications to be delivered via Internet involving confidential information, secured transactions, and electronic payments are being drawn up and considered. With the development of the cable project, the implementation of Singapore's IT2000 vision of an Intelligent Island could well be based on TCP/IP and Internet technologies. However, the U.S. government's current restriction on the export of powerful encryption technology is hindering the development of some of these applications. There are also issues involving national security in making use of foreign products (which might come with key escrow) for national applications. To overcome these problems, the government is taking the following steps:

The National University of Singapore, NCB, Institute of Systems Science, and a consortium of private enterprises with a stake in the Internet have come together to develop a public key cryptography system that would employ 1,024 bits and operate over the Internet.

NCB is looking into means to implement a certification authority system for Singapore, with the possibility of the government holding the master certificate. Whatever the events that may follow from here, the Singapore government has demonstrated that it recognizes the importance of the Internet and is going all out to encourage the country to exploit it.

Source: <http://www.isoc.org/>, 05/31/2002