



Singapore TradeNet: The Tale Continues

"We are quite pleased with our success so far," observed Pearleen Chan, CEO of Singapore Network Services (SNS). "We've been profitable since our second year of operations. Our revenues grew from about US\$2 million in 1989 to more than US\$10 million, with a US\$1.6 million profit, in 1992.¹ We have no debt. Our paid-up share capital of US\$12 million was financed from funds provided by our owning boards. We never borrowed a cent from the banks. Our owners told us to concentrate on the business and they would provide the funds we need. We moved into a new building some months ago. We are now up to 150 full-time staff. We installed our own mainframe computer, an IBM ES/9121 Model 440 with a capacity of 30 MIPS, in mid-1991. Most important, we have implemented a large number of the value-added network services we envisioned four years ago."

Singapore Network Services Pte. Ltd. was created in March 1988 to initiate and manage the creation of value-added networks for trade and other aspects of commerce in the island nation of Singapore. Company stock was owned by four "statutory boards," quasi-government agencies with focused missions in the Singapore economy: the Trade Development Board guided development and management of external trade in Singapore (55%); the Civil Aviation Authority of Singapore owned and operated Changi Airport (15%); the Port of Singapore Authority managed Singapore's huge container port (15%); Singapore Telecom was the country's local and long-distance telephone utility (15%).

The TradeNet System

Singapore is the seventeenth-largest trading nation in the world, with total trade exceeding US\$110 billion in 1992. Documentation is an expensive aspect of trade; delay in processing documentation not only increases expenses, but also lowers utilization of warehouse and port facilities. TradeNet, an electronic data interchange (EDI) system that links multiple parties to external

¹During this time period, one United States dollar was equal to approximately two Singapore dollars.

Professor Boon-Siong Neo of Nanyang Technological University, Professor John L. King of the University of California at Irvine, and Professor Lynda M. Applegate prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

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trade transactions creating a single point-of-transaction for most trade documentation tasks, was SNS's first product. Studies suggested that TradeNet reduced the time required to process most trade applications (requests for approval to export or import) from between two to four days to as little as 15 minutes and reduced the trade documentation processing costs by 20% or more. Changes in trade processing secondary to implementation of TradeNet are detailed in **Exhibit 1**.

In December 1989, after one year of operation, TradeNet was serving 800 of the estimated 2,400 trade-related organizations in Singapore and was being used for approximately 45% of trade document transactions. By the end of 1990, 1,500 trade-related organizations were using TradeNet to process about 90% of trade documentation requirements. The numbers reached 1,800 and 95% by mid-1991. (The remaining 5% of trade documents pertained to disparate elements, such as personal effects of ship and airline crews and diplomatic staffs, and commodities such as rice that were subject to sensitive regulations.)

Trade-related services subsequently added to TradeNet included, in March 1990, a module to enable exporters to apply electronically for certificates of origin (COs), which enabled preferential tax treatment in importing countries. Automation of CO applications reduced the approval process from two days to half a day and eliminated for exporters one of the two trips needed to collect approved COs. (Printed COs persisted only because many countries of destination, including the United States, continued to require paper COs on arrival.)

SNS expanded its network activity considerably following the launch of TradeNet, which was designed from the beginning to be the first step in the broader strategic objective of learning to build value-added networks. The skills developed in designing and implementing TradeNet were to be applied to the creation of other value-added networks for Singapore and, eventually, other customers. Yeo Seng Teck, CEO of the Trade Development Board and chairman of SNS, observed that SNS's primary contribution to the Singapore economy was not the improvement of trade, *per se*, but a larger vision. "What SNS is really doing," he explained, "is building information infrastructure."

We leveraged the trade documentation application to give us a beachhead. But we knew right from the start that we were investing in an information infrastructure to achieve higher efficiency and productivity. We decided to go ahead with TradeNet even though initial calculations indicated that the payback would take many years. Singapore as a country has never been stingy on infrastructural developments—look at how aggressively we have invested in building our highways, container port facilities, airport, and telecommunications network. We know we have a small population and limited land and, therefore, we have to leverage what we have to the fullest. We knew that EDI was the way to go, but we were unsure how it would be perceived by the business community. When the response to TradeNet surpassed our expectations, we became more confident and decided to hasten the pace of EDI usage in trade and other business sectors after the first year of TradeNet operation.

Other Networks

SNS built on its TradeNet experience to develop and implement networks for other sectors of the Singapore economy, mostly in profit-sharing partnership arrangements with government departments and industry associations. Government was particularly keen for such arrangements because SNS could speed implementation of needed systems. Moreover, having a private company bear development costs and business risks made it unnecessary for the cooperating government agency to petition the Finance Ministry to underwrite the projects, a process that takes considerable time. "Each deal is structured differently," explained Chan about arrangements with partners:

If we invest in the development of the systems, we take equity interests in the products and ensure that they have sufficient payback to justify the investments. We try to make sure that new projects pay back within three years, although there have been projects that we intentionally invested in for the long term. If we just provide the network service, we do not take equity interests but charge for usage. If the service involves access to information provided by third parties, they get a cut from the service. We try to work out arrangements that are equitable to all parties.

Concepts for systems originated from a variety of sources—government departments, private firms, and SNS—but the expertise required for design resided with SNS, which offered its network as a delivery mechanism for services provided by new systems. Industry associations were enlisted to offer new services to their members and proved effective in persuading their members to use the new services. SNS not only provided the technical infrastructure for new services, but also added those new services to its portfolio. SNS reached new groups of customers through its government and industry partners, which marketed new services, recruited customers to make the new services viable, and utilized SNS network capacity more fully and economically.

With TradeNet running, the National Computer Board began to look for opportunities to apply similar network concepts in other industries. Major initiatives were subsequently begun in the medical and legal sectors.

MediNet was a national computer network that linked hospitals, clinics, drug and surgical equipment stores, the Ministry of Health (MOH), and the Central Provident Fund (CPF), which administered the use of individual retirement funds, a portion of which (termed "Medisave") could be used to pay hospitalization charges prior to retirement. Developed jointly with MOH and the National Computer Board (NCB), MediNet provided for electronic submission of hospital claims to the CPF Board and medical information to the Ministry of Health, reducing the need for paper-based forms and speeding the processing of claims. The system was implemented in July 1990.

Like many successful innovations, MediNet was a product that was developed from ideas generated by many sources. NCB proposed the idea for MediNet in 1988; at the same time experiments were under way in such countries as New Zealand, Sweden, and the United States. Of particular interest were experiments in Taiwan, where national patient master indexes and other medical databases were being developed, and the United Kingdom, where EDI was being used for procurement of medicines and medical supplies. Impetus for MediNet in Singapore grew when a new medical insurance scheme, Medishield, was approved. Medishield, to be administered by the CPF Board, was to deduct premiums from CPF individual retirement accounts. Discussions on the implementation of Medishield raised considerations that it and Medisave might use a similar form. Lau Chee Chong, head of the accounts department at the Ministry of Health, recalled how the electronic processing of claims became the core function of MediNet:

In discussing the use of a form for the submission of Medishield claims, there were concerns that the administrative costs of computing Medisave and Medishield claimable expenses separately could be very high in view of 1.7 million Medisave account holders and with Medishield expected to cover more than one million people. When the issue of using the same form to submit claims for both Medisave and Medishield was resolved, we began to ask whether the claims should be submitted electronically. Although claim processing was listed in the original proposal for MediNet, it was not a feature that was considered to be central to the system. To reduce cost and time for claims, we decided to launch the electronic claims processing module of MediNet at the same time as the launch of Medishield. That was at the end of 1989, giving us only about six months to build and implement MediNet. With cooperation from NCB, SNS, and CPF, we met the target launch date.

SNS was able to implement MediNet quickly, observed Chan Kah Khuen, deputy CEO of SNS, by leveraging the available TradeNet infrastructure. He explained:

When we implemented TradeNet, we were fortunate to be able to rely on Singapore's public telecommunication lines for transmission of EDI messages. We bought the EDI message manager ("engine") from IBM to perform the role of a giant electronic mailbox for TradeNet messages. Once that was in place, applications like MediNet could be built on top of the EDI engine very quickly. The logic was the same. Just as TradeNet enabled electronic messages to be exchanged between traders and government trade bodies, MediNet enabled electronic exchange between hospitals and MOH and CPF. Every electronic message has a six-byte alpha code that identifies message type. When the message is sent to the SNS computer, the message code identifies the application, in this case, TradeNet or MediNet, to be used to process the message. For MediNet, we defined the information required for claims processing, created a new message code to identify and route it, programmed the application to perform the necessary processing and front-end edit checks, and added new electronic mailboxes for hospitals, MOH, and CPF. We used the same TradeNet mainframe computer, operating systems, network control software, and message manager to implement MediNet. This approach has since been used to develop and implement other SNS products and services.

MediNet had functionality beyond its original conception. It enabled hospitals to submit medical statistics to MOH and provided access to a number of medical information services, including a data base for cancer treatment procedures and care. Among new services being developed for MediNet were a poison and drug information data base, a health care professional register, information on medical service providers, and a utility to allow hospitals to order pharmaceutical and medical supplies directly from suppliers. Development of a national database of patient biographic and other medical information, access to which was to be subject to patient permission, was also undertaken.

Almost immediately upon MediNet's launch, 13 major hospitals began using it to submit claims to CPF. Within a month, more than 90% of the 1,200 daily Medisave and Medishield claims were being processed through MediNet; and, within a year, smaller hospitals and clinics were using MediNet to submit Medisave/Medishield claims. By 1991, the number of hospitals had risen to 24 and the proportion of claims processed via MediNet came to close to 100%. Claims approval was also accelerated, with about 80% of claims approved within two hours, compared with a minimum of one week under the paper-based system. Payment by check, which was executed within one week of approval, was expected to be done more quickly when the direct bank crediting module of MediNet was implemented.

LawNet, which provided electronic access to legal statutes, was launched in July 1990. "We had begun computerizing the Attorney General's [AG] Chambers in 1988," explained Lee Seiu Kin, deputy state counsel in the AG's Chambers.

We had started to work on putting legal statutes on-line so that lawyers could access them electronically. When we began to look into the resources needed to offer statutes on-line, we realized that it would not be feasible for the AG's Chambers to do it. We approached SNS in 1989 and coined the name LawNet to sell this service. SNS knew that usage for electronic access to legal statutes would not be high, but was willing to do it in the interest of introducing network services for sectors beyond trade. We said that other services might be added later, but there were no concrete plans. We appreciated SNS's commitment to the introduction of LawNet. In late 1990, Robin Hu, NCB's information systems manager for the legal sector, proposed

that many of the applications and information services that had been planned or developed by individual government departments in the legal sector be integrated and offered to the public as part of LawNet. This included services in the AG's Chambers, Judiciary, Registry of Trademarks and Patents, and Registry of Land Titles and Deeds. In our study visit to the United States in late 1990, we had seen many applications of IT in law firms and county courts, including the Lexis system that contains legal judgments of the United States, United Kingdom, and Australia. But we did not see any integrated system that catered to the needs of the legal community. The concept of LawNet was to allow users to access a host of applications and services through the same screen. When we presented the integrated LawNet system to the Chief Justice, the Law Minister, and AG, they were all for it. The "second phase" of LawNet was launched in November 1992.

LawNet subsequently provided modules to facilitate legal research and provide bankruptcy and litigation information and access to corporate law information (profiles of company directors, and so forth). Of special importance is LawNet's recent support of electronic submission of documents to courts and electronic conveyancing, whereby documents required by 11 different government departments in many property-related transactions are automated and can be submitted by entering the data on one screen—an especially useful system for law firms. When LawNet was first implemented in July 1990, only about 200 lawyers in about 30 firms, out of a pool of 2,400 lawyers in 600 firms, used it to access statutes electronically. With the new services added to LawNet since November 1992, the number of subscribers increased to 1,300 lawyers in about 180 law firms.

The success of TradeNet, MediNet, and LawNet gave rise to network projects in manufacturing and engineering, business, real estate, and cargo transport. Among these were GraphNet, BizNet, EPCNet, RealNet, and StarNet.

GraphNet supported electronic exchange of computer-aided design (CAD) drawings and other graphics and facilitated translation among different types of computer-aided design/computer-aided manufacturing (CAD/CAM) software. Developed by SNS in partnership with Nanyang Technological University's CIM Research Institute and the Construction Industry Development Board, GraphNet enabled companies to access graphical libraries containing drawings of components, symbols, and designs and to exchange product designs among dispersed divisions or business partners. This reduced the need for redrawing, shortened drafting and design time, and speeded up the product development cycle. GraphNet also accommodated the exchange of engineering specifications between manufacturers and contractors and architectural drawings between architects, contractors, and government agencies. The use of GraphNet after about two years is relatively low. SNS attributed this to the high cost of transmission (graphics files are very large) and lack of local technical infrastructure among users.

BizNet provided users access to business information lodged with the Registry of Companies and Businesses (RCB). New business enterprises were required by law to register with RCB and provide information about the business's nature and profile, its officers, and so forth. Changes were submitted periodically. All businesses were required to file statistical and financial information (turnover, profits, and so forth) annually. Developed jointly with RCB, BizNet enabled users to electronically submit information RCB required and access information about other business enterprises for planning and transaction purposes. This eliminated the need to make physical trips to RCB. Within the first three months of operation, more than 200 firms used BizNet to access RCB information. BizNet was upgraded in mid-1991 to allow firms to file their returns to RCB electronically. A new service, DunsLink, was added in 1991 to enable firms considering overseas business ventures to obtain Dun & Bradstreet reports on international companies and markets.

EPCNet was developed in partnership with seven chambers of commerce and industry associations that jointly established the Enterprise Promotion Center (EPC) to promote development of local Singapore enterprises, particularly smaller-sized firms. The network enabled firm members of the seven associations to communicate and complete transactions electronically and access trade and business opportunities and information about potential trading partners. EPCNet is being extended to the other five countries in the ASEAN regional economic grouping (Malaysia, Indonesia, Philippines, Brunei, and Thailand) at the end of 1991.

RealNet enabled the real estate community to list properties for sale and search for properties that matched client specifications. Developed in collaboration with the real estate industry, RealNet institutionalized co-brokerage practices among real estate agents, whereby the commission is split between buying and selling agents. The co-brokerage agreement provided the financial incentive for agents to use RealNet for both buying and selling client properties. RealNet-listed properties tended to sell faster because it became *the* database used by prospective buyers. Buying agents could serve clients faster and better by reducing the time and cost of their searches. By matching client specifications (budget, type of property, size, age, location, and so forth) to the characteristics of properties listed, they could select for viewing only the most appropriate properties and thereby reduce time, cost, and inconvenience to the client. In 1992, RealNet was enhanced to provide price comparisons to past sales records of agents and to past sale prices and present asking prices of similar properties in a particular location.

StarNet supported communication and exchange of information and documents among air cargo agents. Developed in partnership with the Singapore Aircargo Agents Association, StarNet facilitated planning and operations by enabling air cargo agents to buy and sell cargo space electronically, report on lost and found cargo to expedite tracking, communicate changes in clientele, and post notification of cargo arrival. Moreover, it provided E-mail facilities for communication among cargo agents, airlines, consignees, and ground handling agents. Because it was not essential to air cargo agents' operations, StarNet did not meet expectations for usage, leading SNS to explore with customers how StarNet might be enhanced to better serve the operational needs of air cargo agents.

Subsequent projects suggested that SNS was making headway in its expansion program. In 1992, SNS launched jointly with the Ministry of Defense (MINDEF) a new procurement network, **ProfNet**, to link MINDEF to its suppliers, vendors, and contractors. ProfNet enabled MINDEF and its suppliers to electronically exchange invitations, awards, purchase and work orders, proposals, invoices, and other documents.

ApparelNet, developed jointly with the Textile and Garment Manufacturers Association, supported communication between manufacturers and suppliers, and provided a database of available products and services needed by the apparel industry. It also facilitated quota management, an important function for a textile producer such as Singapore. ApparelNet allowed manufacturers to offer excess quota to others who needed it in a given period.

ColnNet, the first phase of a system developed for the construction industry in collaboration with the Singapore Contractors Association, was implemented in July 1992. Material prices were updated weekly to enable contractors to more accurately estimate costs in bidding for tenders. More information services were to be added in subsequent phases, including tender results, contractor profiles, and market analyses.

Generic EDI/Network Services

SNS moved beyond its targeted approach to specific communities by building a range of generic network and information services. **OrderLink**, for example, enabled business firms to

electronically exchange business documents related to the procurement and delivery of goods. Buyers could use the network to call for quotations or tenders, issue purchase orders to suppliers, and pay suppliers upon receipt of goods. Suppliers could respond to requests for quotations or tenders, confirm orders, and issue invoices to buyers. OrderLink was begun early, shortly after TradeNet went on-line. One of its first users, Changi International Airport Services (CIAS), employed the system to send purchase orders to suppliers of food, material, and other services to the international airlines that it served. A first step toward an integrated procurement system, OrderLink grew from 5 users in 1990 to more than 130 in 1992.

MaiLink provided users such routine E-mail services as sending and receipt of messages, maintenance of distribution lists, fax interface, calendaring, and bulletin boards. It, too, was begun shortly after TradeNet. Among the services added since early 1990 were **SLink** and **InfoLink**. SLink enabled businesses to instruct their banks to collect or pay commercial bills on their behalf, thereby minimizing checkwriting and issuance, and simplifying check receiving and banking procedures. Businesses can use SLink to have their banks perform much of the mundane payroll function and manage their funds electronically. Begun initially with DBS, one of the four local banks, SLink subsequently was made available by Citibank and the Hong Kong Bank. Many government departments and statutory boards used SLink to pay bills with an eye towards a totally checkless environment. InfoLink provided access to a range of external databases, including stock prices, currency rates, vessel and flight schedules, world news, and trade statistics.

SNS pioneered Singapore's international networking as well. The country's first international linkage became available in March 1990 through an electronic connection to the local node of General Electric Information Services (GEIS), which provided access to more than 5,000 users in 750 cities. The uses made of this system were impressive. Apple Computer's manufacturing division in Singapore, for example, used the GEIS connection to send orders directly to a Motorola subsidiary in Hong Kong, eliminating the need to go through Motorola's Singapore division and reducing the order confirmation turnaround from three weeks to three days. Three additional international links were established in early 1991. A link to Fujitsu's EDI network enabled users to communicate with 18,000 business users in Japan's retail and manufacturing sectors; a link to the INTIS network in the Rotterdam port in the Netherlands supported electronic transmission of all trade-related documents for shipments between Singapore and Rotterdam and provided the needed gateway for communication with businesses in Europe; a link to the Ministry of Information in Indonesia enabled businesses in both countries to exchange documents needed in trade activities. In late 1991, SNS linked to the Intertrade network in Hong Kong, allowing traders in both countries to exchange all documents necessary for trade transactions.

SNS moved beyond community-oriented network services for business users with the August 1992 launch of **Comet**, a community network that provided individuals and households with low-cost, 24-hour access to electronic services. Marketed as a "community service" and operated on equipment donated by DEC and Racal Electronics, a local vendor, Comet services included self-learning tutorials, bulletin board services, E-mail, on-line chatting, on-line shopping, access to PC shareware, current events, and access to other information and network services. SNS hoped through Comet to familiarize a new generation of computer users with network services; within three months, more than 2,500 individuals had signed on and used Comet.

Services Under Development

SNS plans to expand value-added network services for specific sectors of the Singapore economy and has targeted, among other sectors, manufacturing. SNS undertook with the Economic Development Board and Institute of Manufacturing Technology the development of **ManuNet**, which was to link manufacturing firms together in a network.

SNS was also exploring new services that catered to the tourist and leisure sectors. In response to a request from the Singapore Tourist Promotion Board, SNS invested in a prototype tourist information terminal and smart card application that was demonstrated at a major tourism and travel conference in Singapore in December 1992. SNS collected feedback from conference participants to help develop a full-scale application for the tourist and travel industry.

In a joint study with the Information Management Research Center of the Nanyang Technological University, SNS investigated the feasibility of moving beyond TradeNet and StarNet by electronically linking all parties in the trading sector. The proposed network would link traders, transportation companies, freight forwarders, warehouse operators, banks, insurance companies, and government agencies, allowing for total integrated cargo, logistics, and information management.

In late 1992, SNS concluded an agreement to provide "managed network services" to NTUC Supermarkets, the largest retail chain in Singapore, with more than 40 outlets and annual revenues in excess of US\$20 million. James Kang, SNS's director for business development, explained how SNS won the NTUC deal:

In contrast to services like LawNet, for example, where SNS was approached to provide the delivery mechanism after it was conceived and deliberated in the AG Chambers, SNS targeted and pursued NTUC Supermarkets for nine months before it was awarded the job. We have wanted to go into the retail sector for a long time and NTUC was a logical target because it was the largest chain in Singapore. In the first phase, we will be linking all 40 branches to headquarters for electronic communication. We will then link the headquarters and branches to their suppliers. NTUC sends more than 4,000 orders to suppliers daily. The new network will have significant benefits to NTUC, and we are pleased to be able to do it for them.

A link to SITA, the airline telecommunications and information services organization, expected to be launched in early 1993, would enable users to electronically communicate with more than 25,000 airlines, freight forwarders, customs administrators, and travel-related businesses in 184 countries and provide access to international cargo booking services and databases and freight tracking applications. By mid-1993, SNS expected to be linked to Spectrum, a cargo community system that would enable SNS customers to book cargo space with airlines and track the status of cargo shipments worldwide.

Business Plans

SNS was developing its own mainframe EDI engine. Its existing engine, licensed from IBM in 1988, had satisfied SNS's needs for the first few years. As TradeNet's reputation grew, and as SNS's success became more visible, many countries in the region sought its advice about implementing EDI networks within their borders. In trying to provide EDI consulting in the region, SNS found that it could not provide a total service package to clients because the licensing agreement with IBM prohibited it from licensing or selling the EDI engine to a third party. By 1990, SNS had begun to see the lack of its own EDI engine as a potential hurdle to future growth and decided to devote its resources to developing one. More than 40 IT professionals worked on the project for two years. A PC version of the EDI engine was released in late 1992. When its mainframe EDI engine is available in 1993, it will be a major milestone toward SNS's objective of being a total provider of EDI and value-added network services.

With more Singapore businesses expanding into the Southeast Asian region, SNS foresees growing demand for electronic network services and access to information databases and wants to be a recognized player in the local market of the regional countries. It hopes to expand revenue from its

international business from less than 5% of its total business to 20% over five years. Toward the end of 1992, Chan and her directors began traveling to neighboring countries to make contacts, close some deals, and negotiate others. SNS, she explained, hopes to enter more regional markets while maintaining its dominant position in Singapore:

We want to be the EDI provider for Singapore. We are in overdrive. We are ahead and we keep moving. We want to make inter-organizational networking a way of doing business for every business sector in Singapore. We are now very strong in the trade and distribution sectors, and we are penetrating the manufacturing sector. But we have made few inroads into the financial services sector because it is a mature market. We still have the consumer market that is largely untapped. We also aim to be a major regional player in the local markets of the Asian countries. We are discussing deals with local partners in Korea, Taiwan, the Philippines, Indonesia, and other Asian countries. The region recognizes SNS's head start in EDI and network technology and is keen to learn from our experience in setting up network services within their countries. SNS tries to respond to all requests for information and services. We expand the business through new projects, but without adding people. I have frozen new hires since last year. We roll our people over from project to project. We have just reorganized and now have three business development groups. I give the groups complete freedom to decide on how to grow the business in SNS. As long as the new projects are commercially viable and we can do them without adding people and without overtaxing the management structure, we will go for it.

Exhibit 1 Trade Processing Before and After TradeNet

Characteristics	Before TradeNet	After TradeNet
Submission of documents	By dispatch clerks	By electronic transmission
Trips per document	At least two trips	No trips needed
Interpersonal interactions	Dispatch clerk and TDB counter clerk; TDB supervisor and data processing clerks	No interpersonal interactions needed
Knowledge of trade codes	Resident in TDB processing clerks	Resident in TradeNet system
Checking and approval process	Manual	Automatic
Turnaround time for document processing	4 hours (urgent) to 2 days (normal)	15 minutes
Fees charged users	US\$3-5	US\$3
Accuracy of data on declaration vis-a-vis documents	100% manually checked prior to approval	Automatic system edit checks; no manual checks; sample audit checks of supporting documents
Dutiable good handling	Separate document for Customs processing	Same electronic document automatically routed to Customs based on Harmonized System codes
Controlled goods handling	Separate documents to different controlling agencies for processing	Same electronic document to controlling agencies automatically
Number of staff in TDB documentation department	134	88 (as of July 1992)
Floor space used by TDB documentation department	1,390 sq. meters	985 sq. meters