Challenges of Internet Development in Vietnam: A General Perspective

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This is a report on the evolution of a robust internet infrastructure in the developing nation of Vietnam. Given Vietnam's history and its evolution under communist rule, readers may be interested to now learn about Vietnam's Internet evolution and its concern with security, government control, and long-range plans. While significant progress has been made throughout the nation, much remains to be done. The material for this article was gleaned from Vietnamese documents and open source materials.

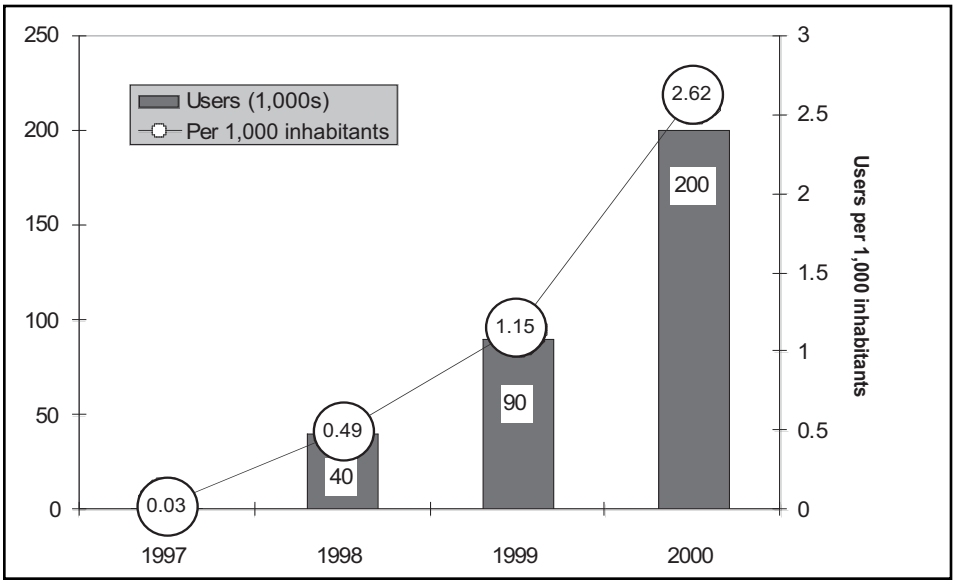
Computer networking and security is an important concern in most countries, including developing nations like Vietnam. While the Vietnamese economy is underdeveloped compared to Southeast Asia as a whole, its information technology infrastructure is growing rapidly. However, its developing economy and new technologies have introduced issues and concerns (e.g., computer engineering, network security, software engineering, and e-commerce) that are being addressed today by policy makers. This article provides an overview of the Internet infrastructure deployment activities and the evolution of computer security policies in Vietnam from 1997 to the present.

The Vietnamese government has been focusing on improving the information communication technology (ICT) of that country in order to keep up with other parts of the world. The government is actively supporting specific activities such as encouraging public and private sectors to participate in the deployment of the Internet; increasing investments by foreign ICT companies; adopting new, modern technologies; and stimulating domestic research. Initially however, development of ICT was not a governmental priority and caused the Vietnamese ICT industry to lag behind their southeast Asian counterparts. It took nearly five years – from 1997 when Vietnam obtained its first international Internet connection until 2002 – for the government to recognize the potential of ICT. The Ministry of Posts and Telematics (MPT), the highest technological government organization, was established in 2002 and began drafting policies and regulations designed to exploit this technology for economic and industrial use and to incorporate the Internet into Vietnam's cultural landscape. According to the MPT, growth of ICT in Vietnam is projected to keep pace with other countries in the region such as China, Singapore, and Korea and to be on par with the West by 2010.

Initial Development of the Internet in Vietnam

This section presents the development of ICT and the impact of the Vietnamese government's policies (or lack thereof from 1997 until 2005) on the deployment of ICT from 1997 onwards.

Figure 1: *Users Estimated on the Basis of Two Users Per Subscriber (Adapted From* [1]*)*



Roadblocks to Development

Early efforts to provide Internet service in Vietnam had to overcome several roadblocks. For example, in 1991, negotiations between an Australian university and the Hanoi Institute of Information Technology (the governmental organization dealing with networking problems in 1990) were unsuccessful. In 1996, the Vietnam government decided to delay the implementation of the first international Internet connection for general, non-governmental use because of a perceived lack of suitable rules and regulations required to control the new technology. In December of 1997, after the government issued a flurry of decrees and resolutions outlining how the Internet was to be used and controlled, Internet service providers (ISPs) were permitted to offer commercial Internet access [1, 2].

As illustrated in Figure 1, the growth rate in the number of subscribers was more than 100 percent each year. However, there were only approximately 100,000 subscribers and only 200 leased Internet lines in 2001, indicating low Internet usage by businesses and educational institutions. This was primarily because the government favored establishing regulatory control of the Internet through government-owned companies versus promoting a competitive market comprised of private companies. As a result, there were only four ISPs in Vietnam. Of these, Saigon Postel Corporation was the only private company. Furthermore, only the government-controlled Vietnam Data Communication (VDC) company was permitted to provide international connectivity [2, 3]. In 2001, the total international bandwidth through VDC was approximately 34 Mbps.

The initial Internet infrastructure was designed to accommodate e-mail and Web services over dial-up and leased lines with-

out concern for modern services such as high-speed and wireless Internet access and high-quality multimedia applications. This made deploying and applying new services, such as video-on-demand and distance learning relatively difficult [4]. The notion of quality of service became a concern towards the end of 2001, after public complaints related to lack of speed, stability, security, flexibility, and general services began to surface.

Topology and Structure

The overall network was designed centrally by the government to have a dual-layered architecture. The upper layer, called the Internet Access Point (IAP), is directly controlled by the government. The lower layer, called the Internet Service Point may be controlled by commercial entities. All network providers must follow and implement this architecture. The layers are described in detail as the following:

- **IAP.** The IAP layer provides the interface between the domestic network and the Internet at three main access locations: Ho Chi Minh City, Hanoi, and Danang. The IAP was designed to operate as a high-performance national core network. The main function of the IAP is to route all incoming and outgoing traffic between the outside Internet connections and the lower service point layer. The IAP layer also implements a cache system to increase the flow of incoming traffic and a firewall system to filter incoming and outgoing traffic.
- **Internet Service Point.** At least 57 of Vietnam's 61 large towns and cities must be covered by this layer, according to government policy. Typical Internet services, such as e-mail, Web page, and value-added services are provided at this layer. A firewall system is also placed at this layer to protect the national network and is managed by the IAP.

The information content services provided to users depend on the capabilities of individual ISPs. These services are classified into the following two groups for security management: content services and financial services. Content service includes popular services such as the Domain Name System, proxy, File Transfer Protocol servers, chat, Web, news, e-mail, and directory. Each service is required to have at least one protection system which is separate from the protection systems of other services. Two independent firewall systems are installed to manage control between content services and financial services. Financial services are separately operated and administered in order to provide enhanced security and reliability.

Although the IAP served as the core of the national network and its security was supported by an extensive firewall system at each node, the system was still subject to vulnerabilities. In 2002, concerns were expressed within the government over the possibility of private entities establishing international connections outside of direct government control (e.g., via satellite links). Furthermore, it was becoming evident that the current architectural and control structure was not conducive to the rapid expansion of Internet activity (there were still just four main providers of Internet service).

Modernization of Vietnamese ICT

In 2002, the MPT was created as the single agency responsible for Internet development and control in Vietnam. Today, the MPT remains the highest level government organization that regulates and administers the development of Vietnam's ICT.

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Modernization Initiatives

The MPT has initiated significant actions in order to improve Vietnam's ICT and to promote technological development. The initiatives include the following:

- Developing and implementing a plan for developing Vietnam's Internet services [2] with the following three objectives: 1) to promote the deployment of high quality Internet connectivity in all economic, cultural, social, security, and defense activities at a cost comparable to those of other countries in the region; 2) to develop the national network infrastructure into an application environment conducive to all forms of online services (e.g., trade, administration, finance, banking, mass media, and education); 3) to create a competitive environment for public and private enterprise in terms of providing Internet exchange services, access services, and online services.
- To integrate the national data network with the networks of commercial providers while allowing the government to manage and regulate control at a high level [5] and to supplement and modify the regulations that had been in place since 1997 as necessary [2].
- To regulate and apply the latest technologies for public use and to provide these technologies at the highest level of quality. Today, ISPs must obtain quality certificates from the Department of General Post and Telecommunications, must abide by certain service parameters, and must provide quarterly reports of service to the government.

Government oversight has helped usher in a new period of ICT development in Vietnam. Currently there are four IAPs (two of these are private enterprises). As Figure 2 (see page 18) illustrates, the number of ISPs has increased from four in 2002 to eight in 2005 (four of these are public enterprises). Additionally, a large number of Internet content providers have been granted a license to operate. Although government-controlled ISPs still maintain a majority of the national ICT market, Internet use in Vietnam is growing as illustrated by the following statistics from 2005:

- Number of Internet users: 8,560,799.
- Internet users as a percentage of the national population: 10.31 percent.
- International connectivity bandwidth: 2,997 Mbps.
- Number of domain names assigned (.vn is the top-level domain for Vietnam): 12,611.
- Number of IP address assigned: 607,744.

Modern Internet Infrastructure

The government has also proposed the New Generation Network (NGN) as the standard for the modern national network infrastructure. The backbone layer of this model is organized into the following two levels:

1. **National core backbone.** Using multi-protocol label switching technology for switching between the three main nodes at Ho Chi Minh City, Hanoi, and Danang, this level serves as the core national network. For this reason, it must guarantee gigabyte switching speed, high-level security, extensibility, and recovery functions.

2. **Regional backbone.** This level receives and forwards all traffic transferred between end-users and the national core backbone network. As an intermediate level, it must also guarantee security, stability, and congestion recovery during periods of peak usage.

Flexibility to enable interconnection of networks from disparate segments of the Vietnamese Internet markets (e.g., ISPs, universities, banks, and mass media) has been the central goal of the NGN standard. This is in direct contrast with the closed, non-standard, small scale, network infrastructure with poor quality and security that was initially deployed between 1997 and 2002.

Network and Computer Security Concerns

The appearance of the first Vietnamese hackers in 2001 did not initially cause concern among the ISPs and financial institutions [7]. However, the Vietnamese government began to take notice of security vulnerabilities when hacker groups discussed the vulnerabilities of Vietnam's Internet infrastructure on a large scale in 2002 [8]. In a workshop in November 2002, Vietnamese hackers provided evidence of their penetrations into important systems such as the billing systems of Hanoi Telecom Company (the largest local provider of telephone lines) and the VDC Company (the national ISP). Furthermore, more than 80 percent of the Web site for domestic companies (e.g., The Bank for Foreign Trade of Vietnam, a large Vietnamese bank) had been penetrated. This workshop and additional security problems from domestic hacking from 2001 to 2003 influenced the government to make internal networks more secure. In June 2004, the government formally introduced a directive for the assurance of safety and security for postal, telecommunication, and Internet information [2]. This directive focused on the following three main points:

- The guarantee of information and communication for the party, state agencies, and the armed forces.
- Controls on the procurement of equipment needed to safeguard postal and telecommunication networks and all functions under their management control.
- Halting ICT services in coordination with the Ministry of Public Security during instances of national violence or riots, and when the use of postal, telecommunication, and Internet services threaten to infringe upon national security is detected.

In reality, not all providers are qualified to meet the security standards issued by the government that the public and private national network providers are expected to follow. Furthermore, certain providers also ignore security standards when required in order to improve the performance of their networks. Therefore, instead of striving to completely satisfy the government's security requirements, most providers comply as best they can. Because of this, resolving computer security and information assurance problems is still a major challenge faced by Vietnamese ICT officials, providers, and users.

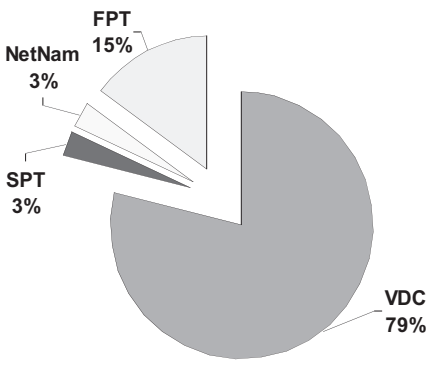
Another roadblock to secure computing in Vietnam is the lack of personnel trained in computer and network security. In an effort to improve its software development capability (using India as a model), the Vietnamese government has focused on producing software engineers. The training of personnel and research and development of security engineers in cooperation with Vietnamese educational institutions has not been a priority. Currently, there are only three network and Internet training centers (operated by Cisco) [6], one each in Ho Chi Minh City, Hanoi, and Danang. This is in contrast to the nearly 100 software development centers around the country. The high cost of establishing and operating training centers has also been an inhibiting factor. As a result, there are approximately 13 Vietnamese Cisco Certified Internetworking Experts with security training of which only a few are helping the government resolve network security issues.

Recognizing the importance of secure networks, the government is now beginning to address security issues. In 2004, Vietnam established IPv6 links with Japan in order to research and experiment with the new services available in IPv6 [9]. The government also began the construction of the Internet Data Center (IDC) of Vietnam that is expected to be completed by 2007 [10]. The IDC will be the central location that will connect the Vietnamese Internet infrastructure to the international Internet (an unsecured environment). The IDC will be a challenge for the MPT because the IDC will have to satisfy the security and operational requirements of the Vietnamese government and commercial entities as well as the requirements of foreign partners [5, 10].

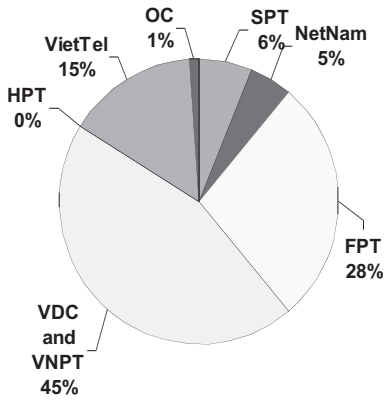
Conclusion

The material presented in this article is specific to Vietnam. However, the difficulties encountered by the Vietnamese government in balancing the conflicting needs of establishing tight control over access and content while simultaneously promoting the economical, educational, and cul-

Figure 2 A and B: *Comparison of the Vietnamese Internet Market* [2, 6]



(A) ISP market share in November 2002



(B) ISP market share in September 2005

ISP Name	Region
FPT: Financial Promoting Technology Corporation	Countrywide
HPT: Hanoi Post and Telecommunications Company	Northern Vietnam
NetNam: NetNam Company	Northern Vietnam
OC: One Connection	Southern Vietnam
SPT: Saigon Postel Corporation	Southern Vietnam
VDC: Vietnam Data Communication Company	Countrywide
VietTel: VietTel Comany	Northern Vietnam
VNPT: Vietnam Posts and Telecommunications Company	Countrywide

ISP service regions in 2005

tural use of the Internet can be generalized to other developing communist nations. It is interesting to study the control structures and the regulatory environment established in Vietnam. The Vietnamese government has an ambitious agenda for establishing a modern Internet infrastructure while simultaneously exercising governmental control on international connectivity and content. Learning from its mistakes that hampered the early adoption and growth of the Internet in Vietnam, the government is now actively engaged in activities such as the planned growth of the national network, construction of new network connections, extension of interconnectivity with other countries, and improvement of software development capabilities.◆

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