Broadband FENICS

● Tsutomu Saito ● Yukio Kawashima

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Since 2001, broadband access lines such as ADSL (Asymmetric Digital Subscriber Line), FTTH (Fiber To The Home), and CATV (Community Antenna TeleVision) have become popular in Japan. To cope with the explosion of Internet traffic, we have introduced a new broadband backbone network called B-FENICS, and we are providing many services such as the @nifty ISP (Internet Service Provider) service and Internet VPN (Virtual Private Network) service for enterprises using B-FENICS. To construct this new backbone network, we adopted three new technologies: 1) the Tag VLAN (Virtual Local Area Network), 2) Gigabit Ethernet, and 3) a fully redundant configuration. In this paper, we describe the B-FENICS backbone network and then describe some examples of its application.

1. Introduction

The Japanese Government's plans for broadband communications are laid out in the "e-Japan strategy," which was made public in January 2001 by the Governmental IT Strategy Headquarters. This strategy sets what are regarded as important numerical targets for constructing an ultra-high-speed Internet. The targets are the construction of an ultra-high-speed access (30 to 100 Mb/s) Internet infrastructure of the highest level in the world within five years and to make it available to all Japanese at low charge. We aim to construct an infrastructure that can continuously connect at least 30 million households to the high-speed Internet and at least 10 million households to the ultra-high-speed Internet.[1)]

In this paper, we first talk about the popularization of the broadband network in Japan. Next, we describe the characteristics of B-FENICS (Broadband-Fujitsu EnhaNced Information and Communication Service). Lastly, we describe some applications and some example services that use B-FENICS.

2. Popularization of the broadband network in Japan

ADSL (Asymmetric Digital Subscriber Line) services were started in Japan in 2000 at a monthly charge of about 5000 yen. Then, as a result of strong competition among the ISPs (Internet Service Providers), monthly charges fell to around 3000 yen, stimulating an explosive increase in the number of subscribers.

At the same time, to attract subscribers away from ADSL, CATV (Community Antenna TeleVision) and FTTH (Fiber To The Home) service providers have been aggressively competing with each other in terms of charges and service quality.

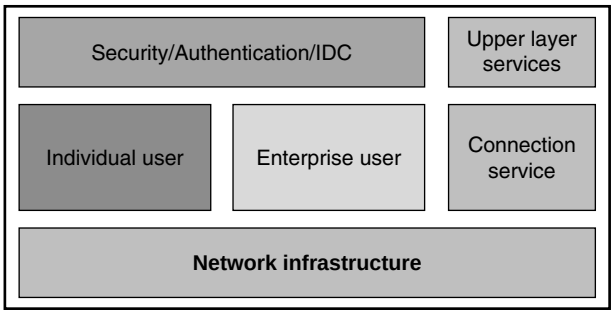
According to data from the Ministry of Public Management, Home Affairs, Posts and Telecommunications, at the end of November 2003 there were 9911 thousand ADSL subscribers, 815 thousand FTTH subscribers, and 2428 thousand CATV subscribers, making a total of 13 154 thousand.[2)] This exceeds the numerical target published by the Government. Also, in keeping with the move to high-speed access, the

number of dial-up connection users has been decreasing from November 2002.

As a result, Japan has become a country in which people can get high-speed broadband access at the lowest charge in the world. Initially, broadband was used mostly by individuals, but since 2001 its incorporation into enterprise networks has rapidly increased.

3. Characteristics of B-FENICS

The network infrastructure of FENICS must be able to cope with the rapid increase in traffic caused by the popularization of broadband access and must always maintain a high-quality backbone. To satisfy these requirements, we introduced broadband technologies such as OC-48 and Gigabit Ethernet to B-FENICS. Moreover, to make B-FENICS highly reliable, we configured it as a fully redundant network. By using these technologies, B-FENICS has been greatly strengthened into a nationwide network infrastructure (**Figures 1** and **2**).



IDC: Internet Data Center

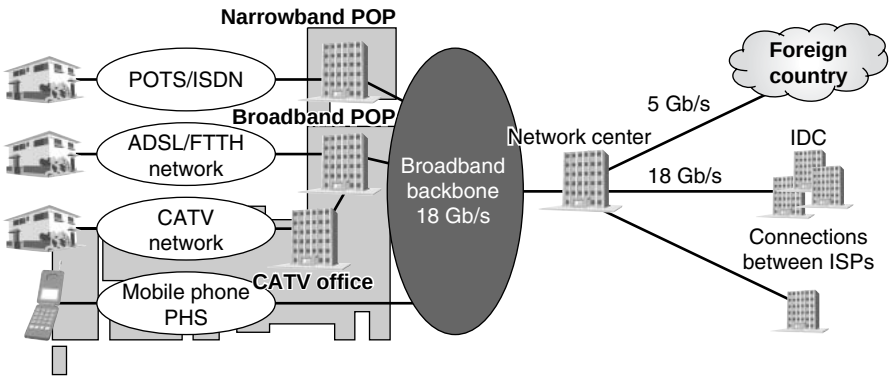
Figure 1
Concept of B-FENICS.

3.1 One of the largest backbone networks in Japan

In terms of scale and bandwidth, our wideband backbone network is one of the largest networks in Japan. It has a total capacity of 41 Gb/s or more, and we achieved this by 1) greatly increasing the bandwidth of the domestic relay network, which consists of the JPIX (JaPan Internet eXchange), NSPIXP (Network Service Provider Internet eXchange Point), and Dix-ie (Distributed IX in EDO) connection circuits; 2) greatly increasing the bandwidth of the foreign connection circuit; and 3) introducing Gigabit Ethernet.

3.1.1 Domestic relay network

We achieved an 18 Gb/s bandwidth between the network operation centers by replacing the ATM (Asynchronous Transfer Mode) based



POTS : Plain Old Telephone Service
ISDN : Integrated Service Digital Network
ADSL : Asymmetric Digital Subscriber Line
FTTH : Fiber To The Home
CATV : Community Antenna TeleVision
PHS : Personal Handyphone System

POP : Point Of Presence
IDC : Internet Data Center
ISP : Internet Service Provider

Figure 2
B-FENICS backbone network.

infrastructure with an OC-48-based 2.4 Gb/s infrastructure using SONET technology. Moreover, we achieved about 18 Gb/s between the POP (Point Of Presence) of the ADSL carrier and our network center by shifting to a LAN that uses the Tag VLAN (Virtual Local Area Network) technology of IEEE 802.1q.

3.1.2 Foreign connection circuit

To ensure good foreign connectivity, we selected reliable transit carriers and secured a 5 Gb/s bandwidth with three redundant routes.

3.2 Accommodating many kinds of broadband access technology

Although ADSL and FTTH are currently the most popular access methods, we are planning to also provide other access methods by:

1) Aggressively expanding the ADSL/FTTH access environment
   We are providing services nationwide by connecting with NTT (which consists of Nippon Telegraph and Telephone East Corporation and Nippon Telegraph and Telephone West Corporation) and ten other ADSL access carriers and by connecting with three FTTH access carriers.
2) Constructing mobile access environments
   In addition to constructing an access network for conventional mobile phones and PHS (Personal Handyphone System), we have constructed access networks for third-generation mobile phones, PHS, and public wireless LAN. We have also started new flat-rate PHS services that are based on a new business scheme called the MVNO (Mobile Virtual Network Operator). We will continuously increase the number of services with many carrier alliances.

3.3 Highly reliable networks

These days, the Internet is often used for critical data exchanges between enterprises, for example, to send and receive orders. Moreover, the Internet banking and stock trading businesses are growing. Therefore, B-FENICS must be reliable enough to support these businesses.

Since B-FENICS has a fully redundant configuration—thanks to the use of dynamic routing technology in all sections of the network—automatic switchover is realized even in an emergency. B-FENICS always provides at least 99.97% of its maximum capacity, and in addition, we perform state monitoring and quality improvement by defining the packet loss and delay limit.

3.4 Improvement of Internet connectivity

Peering (interconnection) with 100 or more major ISPs and IDC (Internet Data Center) providers is performed to secure the shortest routes around the world.

4. Internet access services for individuals

As soon as a new Internet access method emerges, Fujitsu starts a new @nifty service based on state-of-the-art technology so individuals can immediately use the new services. Fujitsu currently provides @nifty services for the following access methods:

1) ADSL (wholesale type, FLET'S ADSL)
2) FTTH (wholesale type, B-FLET'S)
3) CATV (cable@nifty)
4) IMT-2000 (FOMA)
5) Wireless LAN (hotspot, M-FLET'S, etc.)

5. Network services for enterprises[3)]

The needs of enterprise customers vary depending on their environment, type of enterprise, scale, purpose, and other factors. FENICS provides network services to satisfy various customer needs and effectively combines services to provide optimal network solutions for over 3000 enterprises (**Figure 3**).

5.1 Internet services for enterprises

FENICS provides two types of services for

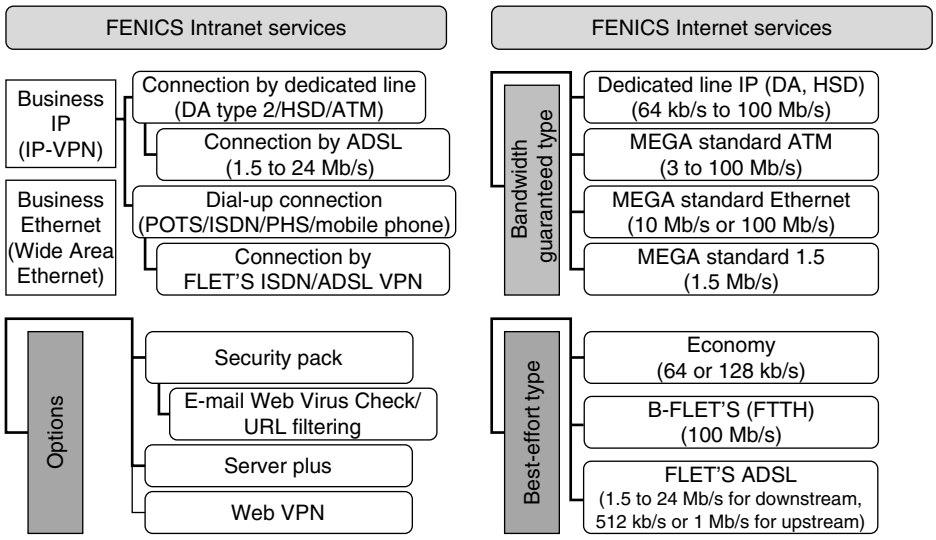


Figure 3
Services of FENICS.

broadband access to enterprises. One is a guaranteed-bandwidth MEGA standard Ethernet that uses an Ethernet interface, and the other is a service that uses a best-effort type B-FLET'S provided by NTT. Global IP addresses can be used in both services, and e-mail and public Web servers can be constructed at the customers' premises.

5.2 Intranet services for enterprises

Up to now, because of the importance of security and reliability, the private backbone networks of enterprises have been constructed with dedicated lines and frame-relay services. However, recent technological innovations have dramatically reduced the cost of constructing a backbone network. As a result, two types of shared, cost-effective WAN (Wide Area Network) services have emerged: the IP-VPN (Internet Protocol-Virtual Private Network) and Wide Area Ethernet (**Table 1**).

In FENICS, IP-VPN services are offered under the brand name "Business IP" and Wide Area Ethernet services are offered under the brand name "Business Ethernet."

5.2.1 Accommodating remote access

In the Business IP service, we are providing a VPN connection service for flat-rate access lines such as FLET'S ISDN/ADSL B-FLET'S using IPSec (IP Security) technology in addition to dial-up connection to an intranet via the telephone network, ISDN (Integrated Service Digital Network), and PHS.

5.2.2 Additional services

Our Business IP service has a connection option for accessing the Internet from an intranet. It also has a "Server-plus" option that provides customers with e-mail servers. We also provide two services to protect against computer

Table 1
Comparison of Internet services.

	IP-VPN (Business IP)	Wide Area Ethernet (Business Ethernet)
Bit rate	64 kb/s to 135 Mb/s	128 kb/s to 1 Gb/s
Protocols available	IP only	Multi protocol
Technology	MPLS	VLAN
Advantage	There are various optional services such as a priority mechanism, remote access, and ADSL.	Can be used as a LAN. Can connect without routers.
Disadvantage	BGP4 (Border Gateway Protocol version 4) is indispensable when operating by dynamic routing.	Broadcast and bandwidth control must be considered.

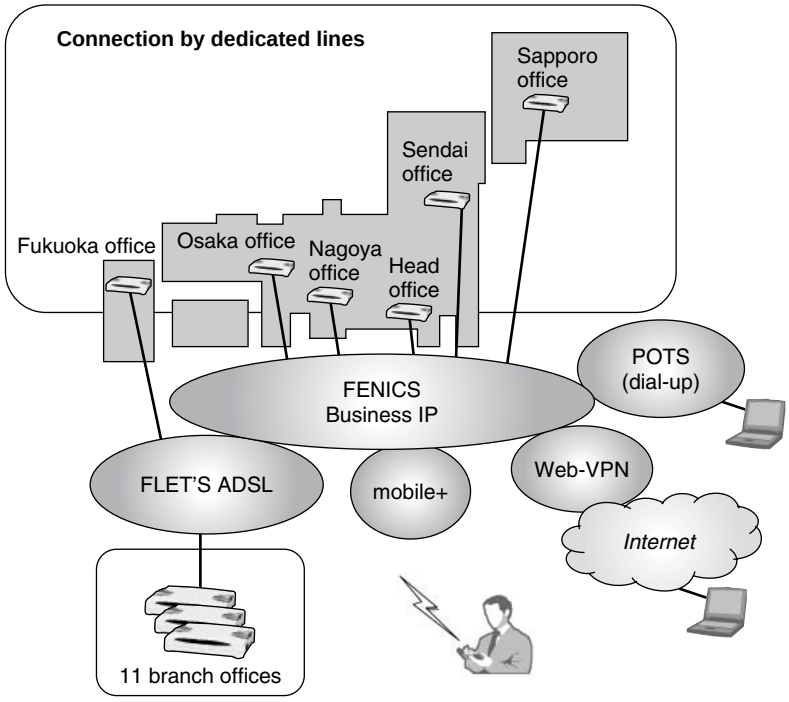


Figure 4
Example of business IP application.

viruses, which can enter an intranet via, for example, e-mail, HTTP (HyperText Transfer Protocol) connections, and FTP (File Transfer Protocol) connections. The two services are called Virus Check for E-mail and Virus Check for Web.

Many enterprises are concerned that productivity and moral standards are being degraded because their employees are accessing Web sites that are not related to their business. Therefore, we also offer a URL filtering service that categorizes Web sites into one of 23 categories and prohibits access to specified sites.

We are currently concentrating on the IP phone service. Recently, we have been providing a WebVPN: SSL (Secure Socket Layer) based VPN option and a client VPN: Ipsec (Security Architecture for Internet Protocol) based VPN option for remote access to an intranet via the Internet.

6. B-FENICS application examples

Business IP is now being used by about 1000 enterprises, and it is helping our customers reduce their costs and improve their business. In one example application of Business IP, there are three types of connections (**Figure 4**):

1) Connection using dedicated lines: The head office and five computer data centers around the country are interconnected by dedicated lines because the reliability and stability of these connections are crucial.
2) Connection using FLET'S ADSL: Twelve offices have been changed from dial-up connections to ADSL connections. These offices use high-speed access at a fixed charge. The dial-up connection network has been left in place as a backup in case there is a problem with the ADSL network.
3) Dial-up, mobile+ ™, and WebVPN access connections that we provide for business trips and home use.

7. Conclusion

Before ADSL services were started, the local circuit between the carrier office and user premises was regarded as a bottleneck. The situation now, however, has been reversed.

In the future, we will improve B-FENICS so it can serve the needs of the super-high-speed broadband age. At the same time, we will reinforce its services to meet customer needs such as guaranteed bandwidth, high security, and ubiquity.

References

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Tsutomu Saito received the B.E. degree in Electronics and Communication Engineering from Waseda University, Tokyo, Japan in 1980. He joined Fujitsu Ltd., Tokyo, Japan in 1980, where he has been engaged in providing FENICS (Fujitsu EnhaNced Information and Communication Service) to customers.

Yukio Kawashima received the B.E. degree in Industrial Engineering from Tokai University, Kanagawa, Japan in 1986. He joined Fujitsu Ltd., Tokyo, Japan in 1997, where he has been engaged in providing FENICS to customers.