Fujitsu's Approach toward the Broadband Internet Era

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Technological progress is enabling businesses and individual users to communicate with each other at ever-increasing speeds. Due to the strong competition between service providers, the charges for high-speed Internet communication services are low and are being further reduced. Because of the growth in the number of users with access to high-speed communications, a wide variety of services are becoming feasible from the standpoint of business. For example, in addition to text, still pictures, and audio, it is now practical to distribute movies, which contain large amounts of data. New technologies are needed to support the creation, management, and retrieval of multimedia contents, and new security mechanisms will be indispensable for Internet safety. This paper introduces Fujitsu's approach toward providing solutions based on the broadband Internet and introduces the other papers in this special issue.

1. Introduction

One of the topics of the June 1996 issue of the Fujitsu Scientific & Technical Journal was "Broadband Telecommunications,"[1] and three of the titles under this topic were:

- SONET Network Evolution toward ATM in the USA,
- ATM Multimedia System for Private Network, and
- AMICS: ATM-based Integrated Platform for Multimedia Services.

At that time, one of the keywords was "ATM (Asynchronous Transfer Mode)." ATM is no longer a star, but it is still a key technology for supporting recent high-speed communication services. Some of the keywords that frequently appear in today's media are "ADSL (Asymmetric Digital Subscriber Line)," "FTTH (Fiber To The Home)," "grid," and "security."

According to a press release[2] by the Japanese Ministry of Public Management, Home Affairs, Posts and Telecommunications, the number of subscribers to DSL services has increased explosively to more than 9.9 million as of the end of November 2003. The Japanese governmental policy on the dissemination of the broadband Internet is described in the "e-Japan Priority Policy Program – 2002,"[3] issued on June 18, 2002. The target of this program is to build high-speed access networks for at least 30 million households and ultra-high-speed access networks for at least 10 million households.

Although the data rate of most mobile phones is not high enough to be called "broadband," more than 66 million people in Japan are using mobile phones to access the Internet. Also, 3G (3rd Generation) mobile phones are becoming popular. For example, NTT DoCoMo announced that on September 30, 2003 the number of subscribers to its FOMA service exceeded 1 million.[4] Moreover, KDDI announced that on September 17, 2003 the number of 3G mobile phone users exceeded 10 million.[5]

As these figures indicate, the number of sub-

scribers to broadband communication services has been steadily increasing, and there has also been a steady increase in data rates. Taking these trends into account, Fujitsu has been developing new hardware and software products for realizing broadband Internet services.

In Section 2 of this paper, we describe Fujitsu's approach to the broadband Internet. Then, in Sections 3 to 5, we outline the papers presented in this special issue.

2. Fujitsu's approach

2.1 A strong infrastructure that supports a wide range of solutions

One of Fujitsu's main businesses is to provide IT-based systems and services that satisfy the following customer needs: 1) system construction within a short period, 2) stable and reliable systems, and 3) reduction of TCO (Total Cost of Ownership). To meet these needs, Fujitsu has established the "TRIOLE" IT infrastructure, which integrates software and hardware components. TRIOLE is explained in Section 2.2.

As shown in **Figure 1**, Fujitsu provides a wide range of broadband Internet solutions. These solutions are realized using the OSs, middleware, and XML software technologies that Fujitsu is constantly acquiring. The software is executed on stable Fujitsu infrastructures that include servers, storages, networks, and other Fujitsu products.

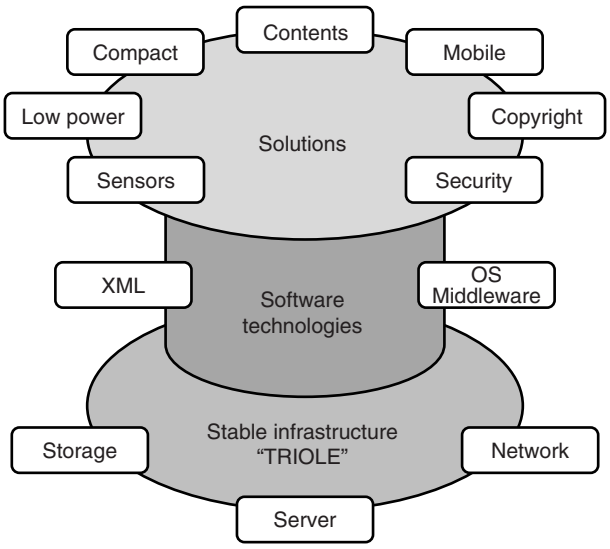

Figure 1
Fujitsu's approach for broadband Internet solutions.

2.2 TRIOLE

In the recent, so-called "open standard" age, customers select the best components for their needs and combine them into a system. However, this often leads to problems with system reliability, stability, and performance. When such a system becomes larger, it requires an enormous amount of time and effort to solve all of the problems. In response, in February 2002, Fujitsu released an IT infrastructure platform called TRIOLE.[6)]

The goal of TRIOLE is to help customers obtain the greatest possible value from their investments in IT systems as quickly as possible. To meet this goal, TRIOLE is designed to meet four key requirements: 1) quick adaptation to changes in business conditions, 2) development and rapid deployment of new applications, 3) stable and reliable systems, and 4) IT systems with a reduced TCO. TRIOLE has three core technologies (**Figure 2**):

1) Automation

This is an optimization technology that en-

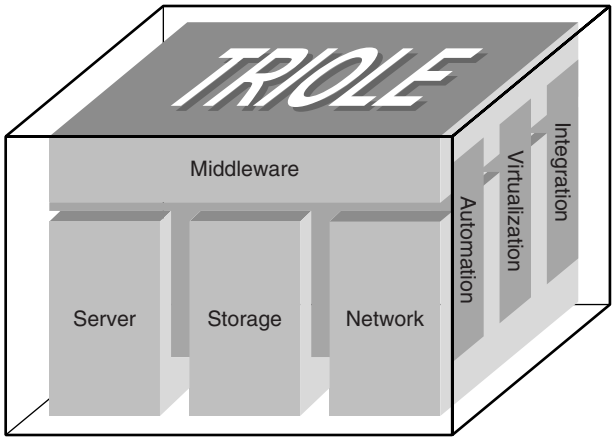

Figure 2
Components of TRIOLE.

ables components within a TRIOLE system to operate without stopping. The status of hardware and software are monitored for failures, resource shortages, unauthorized accesses, availability, reliability, performance, and other factors. Corrective action is taken automatically to keep applications available.

2) Virtualization
This is a technology for creating virtual and logical resources, either by aggregating multiple units of the same resource or by allocating parts of a larger physical resource. This technology enables customers to increase their utilization of a given set of resources, as well as the overall reliability of their systems.

3) Integration
This is a technology for creating value by linking the data and processes of multiple systems into one seamless system. It includes streamlining the management of an IT infrastructure through holistic control of servers, storages, and networks.

TRIOLE is a family of four types of products: servers, storages, networks, and middleware. The family is shown in **Figure 3**, and more information is available on Fujitsu's Web pages.[7] Some of the papers in this issue are directly related to TRIOLE, while the remainder are about broadband services and applications.

3. The papers in this special issue

Figure 4 shows a map of the technologies and services covered by the papers of this special issue. There are two main topics: the Service Infrastructure and the Platform. The papers under the first topic are arranged in three groups: Network Service Infrastructure, IDC Service Infrastructure, and Technology Components. The papers under the second topic are also arranged in three groups: Network Systems, Computer Systems, and Ubiquitous Appliances. The papers under these two topics are introduced in Sections 4 and 5, respectively.

4. Service Infrastructure

4.1 Network Service Infrastructure

The first paper in this special issue, "Broadband FENICS," describes a new broadband backbone network called B-FENICS that can cope

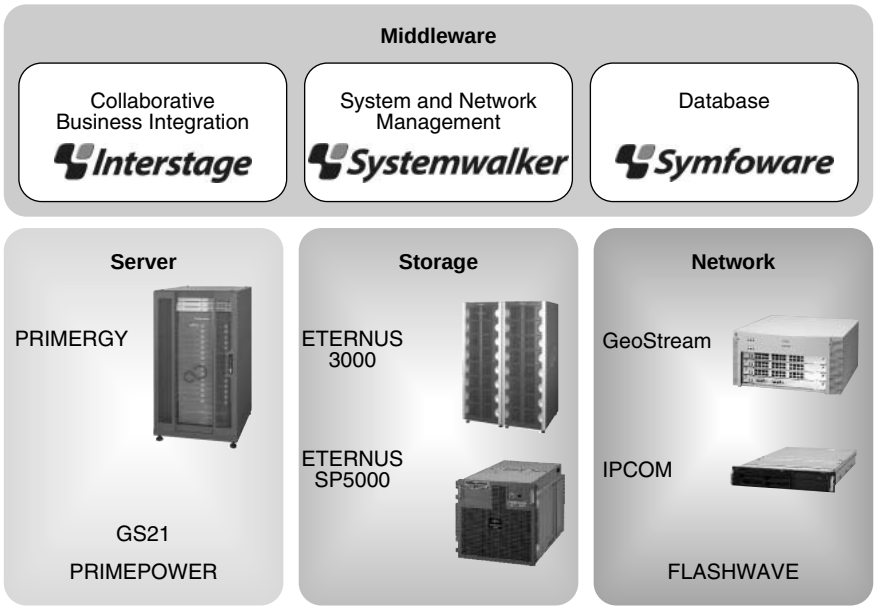

Figure 3
TRIOLE family of products.

with the ongoing explosion of Internet traffic. B-FENICS is being used to provide many services to enterprises, for example, the @nifty ISP (Internet Service Provider) service and the services of Internet VPNs (Virtual Private Networks). B-FENICS uses new technologies such as the Tag VLAN (Virtual Local Area Network) and Gigabit Ethernet and also has a redundant configuration with automatic switchover for high reliability.

The next paper, "FENICS IP Telephony Services," is about IP telephony services. In Japan, IP telephony services are increasing dramatically because of their low costs and charges. Fujitsu created the FENICS IP Telephony Services for enterprise customers to exploit IP telephony technology, broadband Internet technology, and Fujitsu's knowledge of outsourcing and the network services business. The key feature of the FENICS IP Telephony Services is that it enables customers to reduce their total costs and accelerate their business operations at the same time.

4.2 IDC Service Infrastructure

The paper, "Utility Computing Technology for IDC Operation," is about a new operating technology for the IDCs (Internet Data Centers) of future outsourcing businesses that will enable users to enjoy stable, high-quality services without needless investments. This paper describes the benefits that utility computing technology can provide to users of IDCs and the basic requirements for IDCs. It also describes some of the components of utility computing technology, for example, system monitoring, resource reallocation, and system control.

4.3 Technology Components

The first paper of the next group, "Firewall-Friendly VoIP Secure Gateway and VoIP Security Issues," describes the technologies of the VoIP Secure Gateway, which makes IP telephony protocols firewall-friendly and enables an enterprise IP-PBX service to interoperate with a consumer IP telephony service through a firewall. This paper also describes other security problems that need to be solved for future expansions of IP telephony services.

The next paper, "Directory Management for

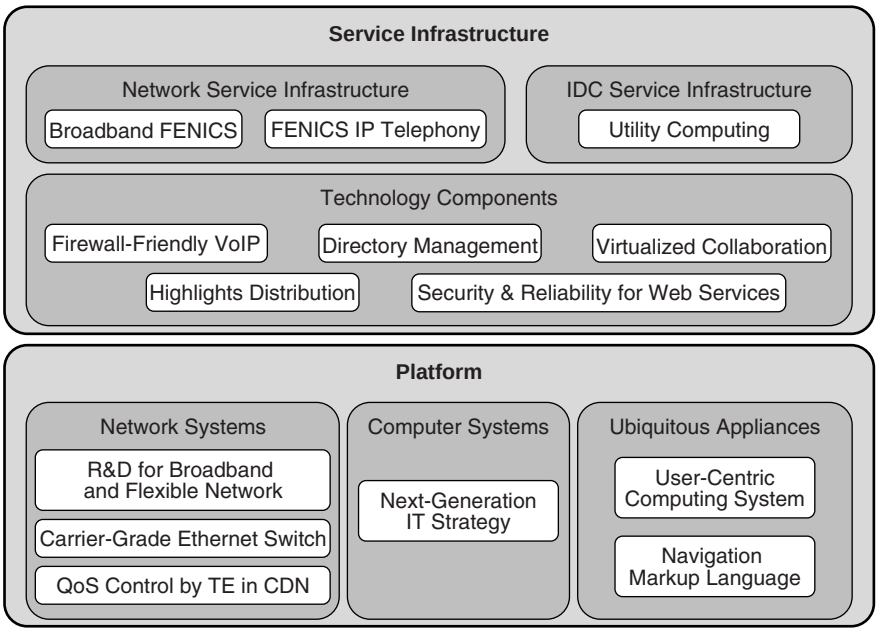

Figure 4
Layered mapping of papers.

Knowledge Sharing in Enterprises," describes a system that makes it easier for editors to maintain a Web directory. This type of system is becoming increasingly important, because many large organizations are installing their own Web servers to promote and support knowledge sharing.

The title of the next paper is "VizGrid: Virtualized Collaboration Environment with 3D Images." This paper introduces a national project called VizGrid, in which universities and companies are cooperating to develop a new communication technology for handling 3D images and a new remote collaboration system. The main objective of the VizGrid project is to develop technologies for generating, transmitting, displaying, and searching for 3D images. Because 3D images can convey so much information, we expect the new technology will prove extremely useful in many areas.

Next, "Highlights Distribution Service: Providing Records of the Memorable Events in People's Lives," describes the development of a service that enables a service provider operating in areas such as sports and amusement events to extract significant and memorable scenes of people's lives from video data. The service provider can then use the service to distribute the scenes on-demand or customize them for individual users and provide them on recorded disks.

The last paper under the Service Infrastructure topic, "Security and Reliability for Web Services," looks at security problems such as interception, disguise, and repudiation that will emerge when Web services become widely used on the Internet. It then introduces latest technologies such as XML digital signatures and XML encryption that can overcome these problems. This paper finishes by describing work being done to establish two standards for these technologies: Web Services Security and Web Services Reliability.

5. Platform

5.1 Network Systems

The first paper under the Platform topic, "R&D for a Broadband and Flexible Network Infrastructure," surveys the R&D trends of broadband communication and describes some of the associated activities at Fujitsu Laboratories Ltd. for both fixed and mobile networks. This paper describes some of the key achievements in network architecture and network management, photonic networks, and mobile communication.

The next paper, "Carrier-Grade Ethernet Switch for Reliable Wide-Area Ethernet Service," describes the technical requirements of an Ethernet switch for building a reliable Ethernet; especially the redundancy needed for enhanced reliability and the QoS (Quality of Service) capabilities. This paper also proposes two new features: the virtual port and the directing VWAN.

The paper, "QoS Control by Traffic Engineering in Content Delivery Networks," proposes a dynamic TE (Traffic Engineering) architecture that provides QoS-guaranteed services in addition to existing best-effort services in CDNs (Content Delivery Networks). This architecture continuously analyzes the traffic in a network and uses the results to select the optimum routes and servers to meet the users' communication requests. The goal of dynamic TE is guaranteed QoS and effective utilization of network resources and is based on the dynamic load balancing technique.

5.2 Computer Systems

The paper, "Next-Generation IT Strategy Based on ALL-IP Strategy," presents one of Fujitsu's key approaches for next-generation IT systems. In these systems, all IT resources are interconnected through IP networks to provide high-performance access to resources at reasonable cost. This paper also discusses three technologies for realizing ALL-IP systems: a 10 Gbit Ethernet switch, organic computing, and grid computing.

5.3 Ubiquitous Appliances

The paper, "Approaches to User-Centric Computing System for Ubiquitous Solutions,"

describes the features of ubiquitous computing systems. It also describes two key elements for user-centric ubiquitous solutions: gateway functionality for RFID (Radio Frequency Identification) and a prototype personal mobile terminal.

The last paper of this special issue, "NVML: NaVigation Markup Language," introduces an XML proposed by Fujitsu for describing navigation information such as the position and route of a moving object (e.g., a person or car) and related information. This XML enables people to use LBSs (Location Based Services) with mobile appliances such as cellular phones and PDAs (Personal Digital Assistants) and also use positioning technology based on GPS (Global Positioning System) and base-station information.

6. Conclusion

Broadband communication services will be continuously enhanced for both business and personal use to the stage where users will be unaware of any bandwidth limitations. This is clearly a one-way trend that will not stop. To fully utilize the potentials of the broadband Internet, it is obviously necessary to improve the relevant technologies. In addition, the need to gradually migrate from conventional systems must be considered, especially in cases where sudden changes might adversely affect the social infrastructure.

Fujitsu has been providing software and hardware ranging from small devices to large-scale systems and also a wide range of services based on these components. We will continue to contribute to the world by providing superior solutions based on advanced Internet technologies.

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