Platform Architecture for Networked Businesses

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OVERVIEW: Today's enhanced competitive business environment is forcing enterprises to concentrate on their core businesses. To support this, they are splitting off the commodity functions of their business systems in order to configure a new business platform. The network infrastructure is the key component of the business platform; it can no longer be a simple IP-packet transfer system, as it is in the Internet era. Instead, it must be a sophisticated value-adding virtual networking system utilizing IP and information technologies. This paper considers the architecture of the new business platform, emphasizing the role of the network infrastructure from the viewpoint of virtual networking as a service-enabling technology. It also describes solutions for businesses to prepare for their individual future, in which each business will need advanced system engineering to adapt its core business to the new business environment it will face.

INTRODUCTION

CHANGES in the business environment are accelerating in this age of global competition. The Internet is greatly improving the speed, amount, and reachability of information transfer, so that networking capabilities are becoming an essential part of business systems. Network and information systems are being merged into consolidated business platforms. At the same time, networks are evolving towards seamless value-added systems, not only in terms of bandwidth and mobility, but also in terms of management framework such as enterprise-network and carrier-network. These new enterprise- and carrier-networks are impacting network architectures and network functionalities significantly, resulting in many technological innovations in networking[1)].

In this paper, we describe the trend and future of the business platform architecture, emphasizing the role of networking technologies. We also present an overall view of Hitachi's solutions for business platforms.

BUSINESS SYSTEM EVOLUTION

Enterprise systems are evolving so that they can accommodate demands and requirements from customers agilely and globally, making use of the information and networking technologies that are advancing at an exponential rate. In this dynamic and competitive environment, it would be unrealistic for each enterprise itself to develop and maintain all the components of its business systems.

Each enterprise must concentrate on its core business area, expanding the scale and speed of its business activities globally. To support this effort, the commodity functions of the business systems should be separated out, and the platform for enterprise activities should be reconfigured (Fig. 1).

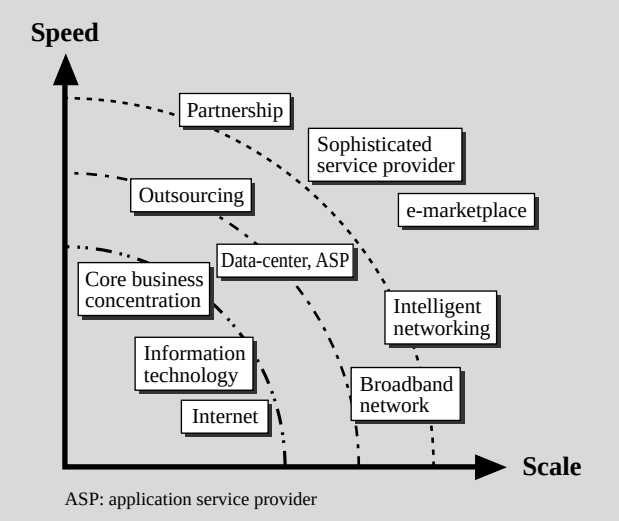


Fig. 1—Business System Environment.
Advanced networking and partnership are keys to the success of an enterprise.

Although the origin of the business platform was the combination of information technologies and the Internet, networking technologies are advancing toward high-speed, intelligent, and mobile networking, going beyond the capabilities of the conventional Internet. The concentration on core business areas has led to the outsourcing of commodity business functions, and moreover to new value addition through partnerships between enterprises. This trend has also led to the horizontal segmentation of service providers, enabling them to respond to the various and sophisticated demands of enterprises.

In addition, many areas of enterprise activities are becoming network-based, for example, customer-relationship management, B-to-B (business to business) transactions, and intranets. At the same time as networks are evolving towards intelligent and high-speed systems, many new functions are being added to them, such as data-center and application service provider (ASP). Skill at utilizing smarter network systems and these functions has become a key factor in the success of an enterprise.

IP INFRASTRUCTURE

Network Architecture

Since the Internet became an essential part of business systems, the role of the network infrastructure in the business platform has changed significantly.

Legacy business systems use various protocols such as for on-line transaction processing. Each application has a specific networking protocol suite that is used to offer networking services to its users. The network infrastructure simply provides bit-transfer capability, like that provided by modem systems.

The explosive expansion of the Internet, however, has brought about the unification of application programming interfaces (APIs) based on TCP/IP, and moreover, Web protocols like HTTP on it. The unified APIs have accelerated the enhancement of networking functions. They are no longer restricted to only TCP/IP services and now include services like virtual private networking and "Directory Service." In addition, IP (Internet protocol) networks now need various advanced networking capabilities like QoS (quality of service) control, traffic engineering, and mobility support. Other new service provider functions like data-center and ASP have emerged on top of the IP-centric network infrastructure (Fig. 2).

The expanded usage of the network infrastructure and the more competitive environment have led to the cutting of telecommunication prices, and further enhancements of networking capabilities will be induced by the reduced cost of networking.

Technologies

The components of the new business system architecture with some of the business platform functions are illustrated in Fig. 3. This featured issue of Hitachi Review includes ten articles related to technologies for the business platform. This article presents Hitachi's overall view of the trends in

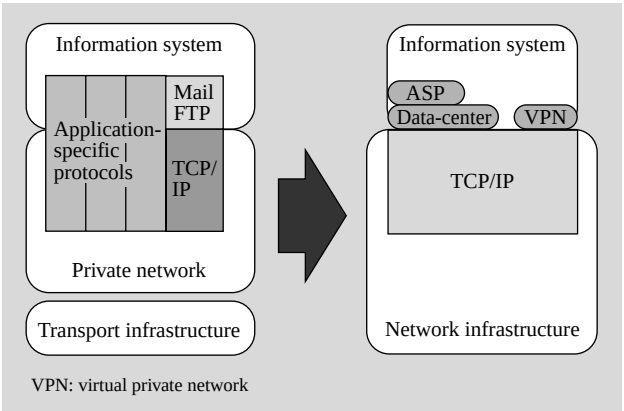


Fig. 2—Convergence of Network and Information Systems.
The range of the network infrastructure has been expanded to cover the whole range of network-related functions.

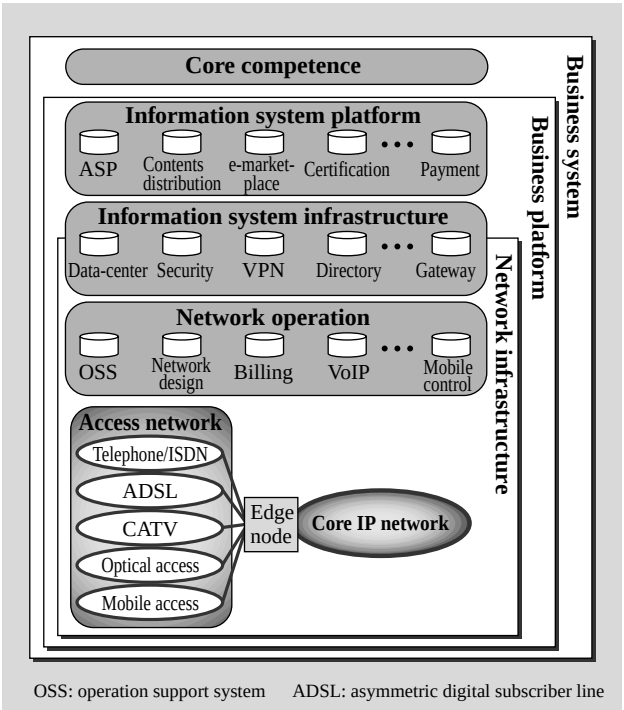
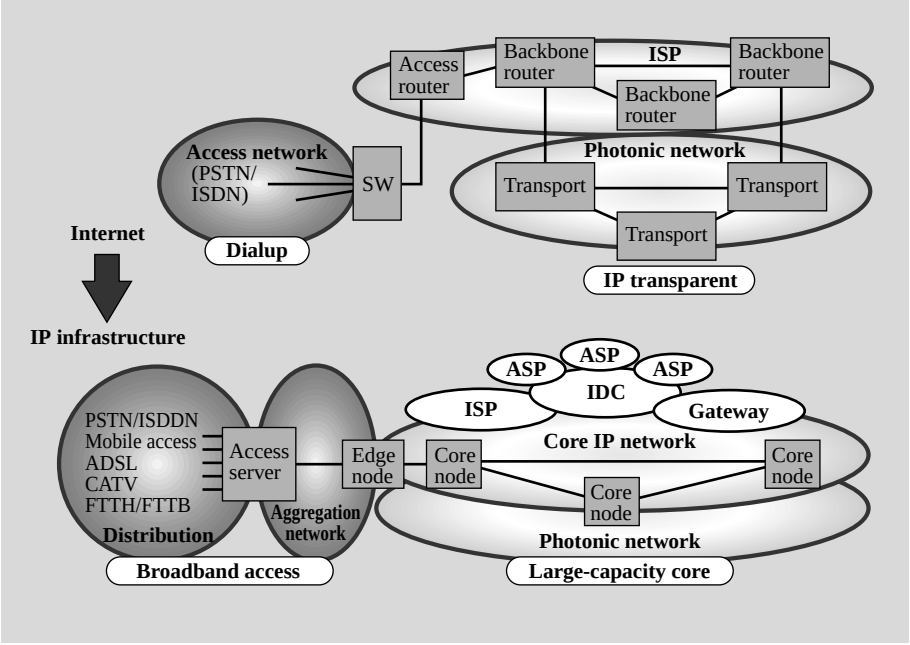


Fig. 3—Business System Architecture.
The network infrastructure is the basis of the business platform; it includes information system functions.



SW: switching system
ISP: Internet service provider
IDC: Internet data center

Fig. 4—Transition to IP Infrastructure.
Network infrastructure functionality is changing from transparent packet transfer to value-added path service provision to various service providers on the network.

technology and the allocation of various functions in the business platform.

In the network infrastructure,
(1) the access network[5, 6] handles connection and termination of the access media, such as ADSL (asymmetric digital subscriber line) and CATV, and controls mobile access;
(2) the core IP network[2–4] provides high-capacity and scalable routing;
(3) the edge node[4] provides a gateway between the access and core IP networks;
(4) the optical network[7] supports high-capacity and long-distance transport; and
(5) the network operation[8] handles operation, administration, and maintenance of the network and controls the value-added services.

As we explained above, the role of the network infrastructure has changed with the unification of the API into the Internet-based one. The next-generation network infrastructure, however, will not be identical to the current Internet. It will include more sophisticated systems, as shown in Fig. 4.

Internet service is currently provided by ISPs (Internet service providers) with routers utilizing such carrier-transport services as leased lines between routers. The ISPs provide only end-to-end IP-packet-transfer capabilities. The packets are transparently stored and forwarded. No additional value is added by the network infrastructure.

In contrast, the next-generation network infrastructure will support various value-added services. Technologies for the IP infrastructure will be enhanced based on the Internet, and many advanced features like QoS and mobility will be developed and implemented.

The core IP network will likely be based on photonic and IP technologies and offer high-speed high-volume transport. The access network will be enhanced to support broadband services to enable it to accommodate and aggregate various media technologies. It will likely be decomposed into distribution and aggregation components due to the limited transmission range of each medium's technology. An access server residing between them will perform media transmission termination and traffic aggregation.

SERVICE PROVIDER ARCHITECTURE

The next-generation network infrastructure will be a value-adding one composed of an IP infrastructure and service providers. The IP infrastructure will provide the packet transport service needed by the service providers. It will not manipulate the contents of the IP packets, just as the current Internet does not. However, IP path networking will be introduced, as shown in Fig. 5, to make the packet transfer more efficient and to add value for the users of the network infrastructure.

The path networking service can be configured using multi-protocol label switching (MPLS) and the

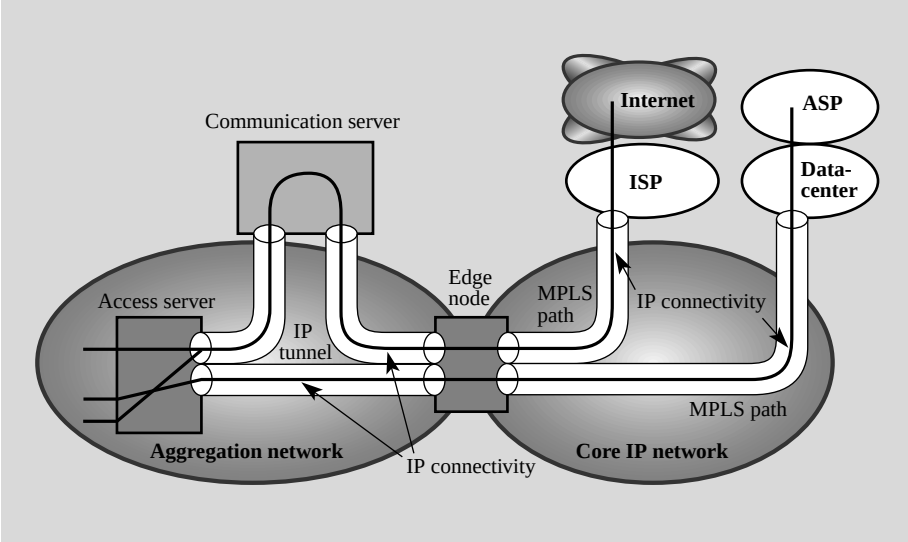


Fig. 5—Service Provider Architecture. The IP infrastructure provides various additional services by utilizing a virtual networking architecture.

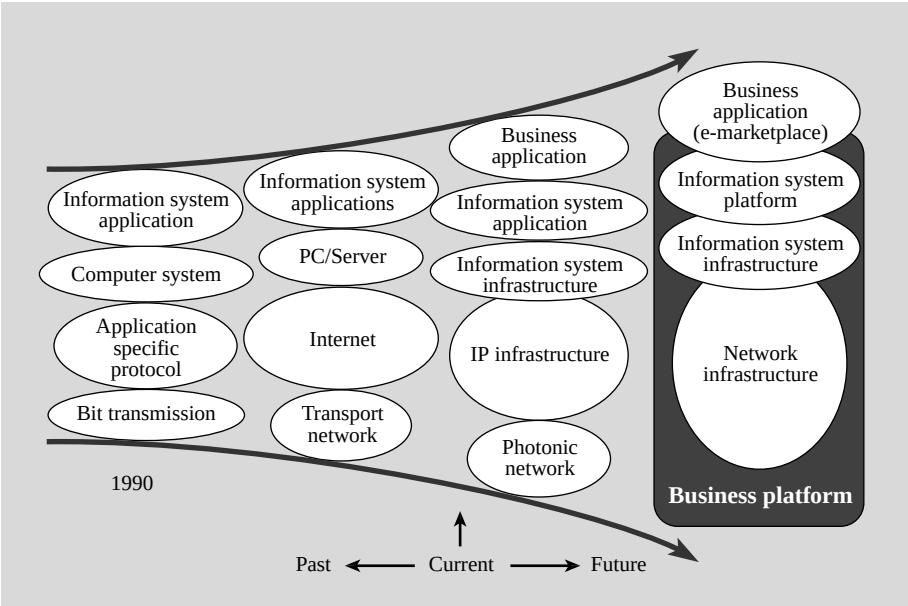


Fig. 6—Business System Enhancements. Business systems are being enhanced rapidly.

layer 2 tunneling protocol (L2TP). MPLS would be used in the core IP network to provide scalable virtual networking, and the L2TP would provide secure virtual networking and traffic aggregation in the access network. The edge node would act as a gateway, converting the virtual networking protocols between the access and core IP networks. We define this architecture of logical networking as the path service provider function of the IP infrastructure. The path service provider offers virtual networks with various attributes to service providers, like ISPs and data centers, on top of the IP infrastructure. The virtual networks are not static. They support dynamic path configuration such as path restoration after a network failure and traffic distribution to other paths during congestion.

MPLS and L2TP are capsuling techniques with Layer 2.5 (MPLS) and Layer 3 (L2TP) routing capabilities. Virtual networking could also be provided in an upper layer. The communications server in Fig. 5 manipulates the contents using extensible markup language (XML) to enable more sophisticated value-added services to be provided. Server mirroring is an example of a communications server: a mirror server is used to transfer rich contents a short distance to avoid TCP bottlenecks. One of the articles in this issue presents an example of this feature[9].

NETWORKED-BUSINESS PLATFORM

Information system infrastructure in Fig. 3 is a set

of network related commodity functions of information systems.

Any business system needs such basic business functions as settlement and certification, customer-relationship management, and demand-to-supply matching. As illustrated in Fig. 3, the information system platform is the ensemble of such commodity functions.

These functions have traditionally been supported by the individual business. However, they are better outsourced because they have to be enhanced to handle such requirements as risk management, and such enhancement can be done more efficiently by companies dedicated to that task.

The business platform should be configured to achieve a fast and scalable core business. Each business platform must therefore be customized, adapting the company's core business to its environment. Advanced systems engineering is the key to configuring the functions of the IP infrastructure and the information system platform into a business platform. Enterprise networks must utilize the business platform[10, 11], even though telecommunication carriers construct the IP infrastructure as path service providers.

CONCLUSIONS

We have described the trend in the development of the business platform, emphasizing the role of network infrastructure. We depicted the transition from the Internet to an IP infrastructure for business systems as inevitable in today's enhanced competitive environment (Fig. 6). We explained why service providers as outsourcing resources should provide many of the commodity functions of business systems. We proposed using virtual networks to support these providers on the IP infrastructure. Hitachi is working to enhance business systems by merging information and network systems to make our customers' core businesses faster and more scalable.

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