

Information Technology Map and IT Road Map (Second Half of Fiscal 2005)

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1 Information Technology Map

2 IT Road Map

- 1 Road Map for Next-Generation IP Networks
- 2 Road Map for Open Source Software

3 Conclusion

In the midst of the rapid development of information technology (IT), the environment surrounding IT, which includes broadband networks, mobile terminal devices and information devices, has also been changing at a rapid pace. In order for a business enterprise to make a suitable IT investment, it is necessary to understand the objective positioning of the technology that is usable at present. At the same time, an enterprise must map out a technical strategy that predicts the trends of the important technologies available in the future. Nomura Research Institute, Ltd. (NRI) names such activity "IT navigation." Since 2001, we have been creating the information technology map and the IT road map as part of this activity.

Keywords: Information technology map, IT road map, IPv6, NGN (next-generation networks), open source

1 Information Technology Map

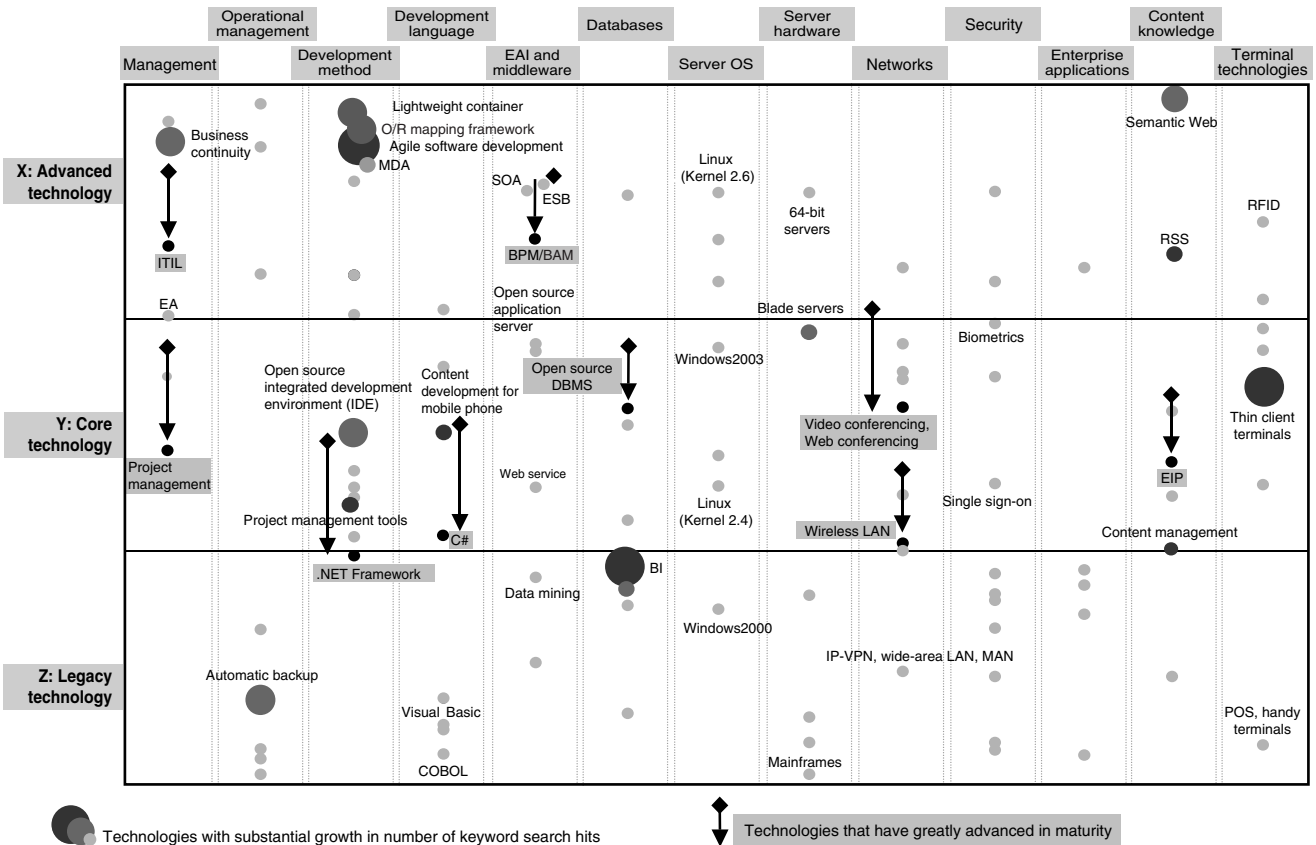
The information technology map is designed to provide guidelines for activities that make the best use of each type of information technology. This map provides a bird's eye view of numerous information technologies that are currently available and objectively positions these technologies. NRI has been regularly creating this map since 2001.

Figure 1 shows an information technology map that was created in the second half of fiscal 2005. The horizontal axis of the map categorizes the technologies by field. Specifically, it is broadly divided into 13 fields covering areas from "management" to "terminal technologies." The vertical axis shows the maturity of the technology. It is divided into three fields: the "advanced field," which includes technologies that are used in projects requiring state-of-the-art technology; the "core field," which includes technolo-

gies commonly used in many projects; and the "legacy field," which includes matured technologies with few technological changes. Generally, a technology appears from the advanced field in the upper portion of the map and gradually moves down to the legacy field in the lower portion.

Each point indicated on the map corresponds to a single technology. Names of some of the technologies that have recently seen some changes are plotted on the map as representative technologies. Technologies marked with an arrow are those that have greatly advanced in maturity in the past six months. They are "ITIL (Information Technology Infrastructure Library)," ".NET Framework," "BPM/BAM," "open source DBMS," "video conferencing, Web conferencing" and "enterprise information portal (EIP)." The arrows indicate the extent of

Figure 1. Information Technology Map for the Second Half of Fiscal 2005



Notes: EAI = enterprise application integration, EIP = enterprise information portal.

changes in maturity; the starting point of an arrow represents the maturity of a technology six months ago, and its ending point represents current maturity. These technologies, which have greatly advanced in maturity in the past six months, are already widely distributed and can be used on a secure basis. Technologies such as "business continuity," "light-weight container," "O/R mapping framework," "agile software development," "open source integrated development environment (IDE)," "business

intelligence (BI)," "semantic Web" and "thin client terminal" have seen substantial growth in the number of hits in keyword searches of magazines such as those published by Nikkei BP and are receiving increased attention. With respect to these technologies, according to the maturity of a technology, consideration must be given to conducting surveys on technological trends, acquiring technology through R&D activities and promoting the widespread use of the acquired technology.

2 IT Road Map

The IT road map is designed to support client companies and the NRI Group in making decisions on IT strategies by presenting a highly precise view of each technology field up to five years in the future. NRI is continuously creating road maps for technology fields that are expected to play important roles in the future. This paper introduces the trends of next-generation IP (Internet protocol) networks and open source software from among these technologies.

1 Road Map for Next-Generation IP Networks

For five years, from 2000 to 2004, progress has been made in the field of wired communications technologies with the aim of promoting the spread of broadband services. These efforts have contributed to the development of general broadband-related technologies. In June 2005, the domestic household penetration rate of broadband services (DSL, CATV, FTTH) reached 44 percent (20.58 million subscribers), making broadband services commonplace, even at home.

During the period from 2005 to 2010, technologies to achieve the ubiquitous network society are expected to enter the stage of practical use. For example, the retail industry plans to implement RFID (radio frequency identification) technology around 2008. If this plan is realized, a system will emerge in

which a vast amount of objects is connected to IP networks. However, because such a plan faces two major problems at the network level, seamless use of these systems will not be made possible easily.

The first issue relates to the fact that various networks are separated. The other issue involves that the IT industry has no experience in developing a system in which 20,000 – 300,000 objects are connected to IP networks by means of IPv6. The following section explains these problems in detail.

(1) Problem 1: Various networks are separated.

Currently, networks are separated for specific purposes, such as mobile phone networks, fixed telephone networks, broadcasting networks, closed IP data networks for each carrier (broadband, public wireless LAN, etc.) and the Internet. Mobile phone networks, fixed telephone networks and broadcasting networks are non-IP networks, and cannot use IP to connect devices. On the other hand, while the Internet enables IP connections all over the world, the level of connection quality and security differs depending on location. Under the status of separated networks, it is not easy to operate applications requiring high reliability on a network.

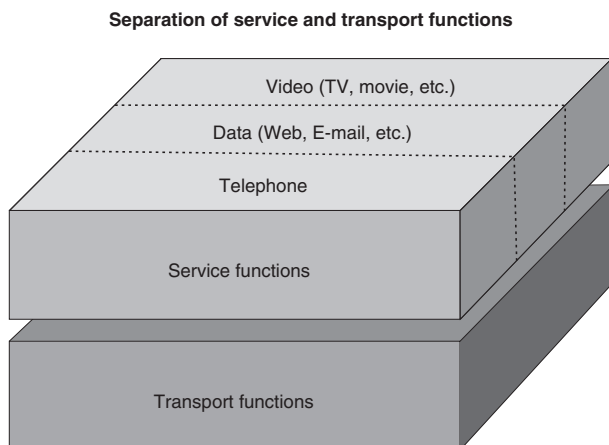
However, both domestic and overseas providers have started to give this point increased attention, and have accelerated activities for standardizing

all-packet networks known as the NGNs (next-generation networks) in place of conventional circuit-switched networks. Innovations from circuit switching to IP are under way all over the world.

While NGN is often considered the generic term for new networks in the ubiquitous network era, the ITU-T (the International Telecommunication Union; the Telecommunication Standardization Sector) considers NGN as the future infrastructural network for communications carriers and is facilitating standardization activities to develop standard technology specifications and products on a worldwide basis. An outline of the specifications developed by ITU-T for NGN is as follows:

- All-packet networks (based on IP; a shift from switching equipment to routers)
- Providing a wide range of multimedia services including voice, video and data
- Guaranteeing the quality of service for terminal-to-terminal communications according to network quality and the capabilities of user terminals
- Ensuring interoperability with existing networks
- Achieving advanced mobility such as ubiquitous access by terminals by means of IPv6, etc.
- Fixed-mobile convergence to provide fully seamless communications
- Separating service functions and transport functions to enable the independent development of application services (Figure 2)

Figure 2. Basic Principles of NGN



Accordingly, the implementation of NGN will enable system integrators to offer their users services with guaranteed communications quality and security.

(2) Problem 2: No experience to connect large numbers of objects to IP networks by IPv6.

While NGN is expected to resolve the issue of “a variety of separate networks,” the problem of how system integrators can connect 20,000 – 300,000 objects to IP networks remains. To resolve this issue, expectations are given to IPv6 that can allocate an essentially indefinite number of addresses to objects.

The current IPv4 can only assign a maximum of 255 non-unique worldwide IP addresses on a network unit (subnets). However, IPv6 can assign more than 4.3 billion unique worldwide IP addresses on a network unit. In addition, IPv6 can offer additional functions to facilitate object-to-object communications. These include automatic address setup, security functions such as authentication and encryption, QoS (quality of service) functions to guarantee the quality of communications and multicast functions to deliver voice and video signals efficiently.

However, the IT industry has little experience in developing a system that connects a vast amount of objects to IP networks by means of IPv6. The decision on whether to use IPv4 or IPv6 is generally left up to a system integrator. Many system integrators believe there will be no problem in the development of a network if the products supporting IPv6 are available when IPv6 becomes necessary. However, the introduction of new IP network technology often encounters unexpected incidents in the initial projects. There may be many system integrators who have had bitter experiences in developing wireless LAN and IP telephony systems. The introduction of IPv6 requires adequate preparations such as carefully acquiring and verifying the technology in advance. The system integrator that can take the lead ahead of other companies in preparing a specific scenario, acquiring technologies related to the design, development and management of an IPv6 network, and identifying

problems through actual device verification tests will be able to secure a firm position as a solutions provider.

At the same time, some projects that used IPv6 to develop a system suggest that the time required to design, develop and manage a system can be reduced. For example, a system integrator, FreeBit, used IPv6 for a project to introduce 20,000 IP telephones at about 300 sites throughout Japan. FreeBit reported that the use of IPv6 for the IP addresses of telephones made the system simple, substantially reducing the costs for design, implementation and operations of the network. This example will not apply in all cases. Nevertheless, it shows the possibility of generating differences in costs when a system is developed by IPv4 or IPv6. It is about time to verify the cost advantages of the use of IPv6.

Figure 3 shows a road map for next-generation IP networks. This figure also includes giga broadband networks in addition to NGN and IPv6. This is because a shortage of communications bands is assumed as a result of using a variety of applications requiring large-capacity networks. The assumed usage includes the exchange of a vast volume of

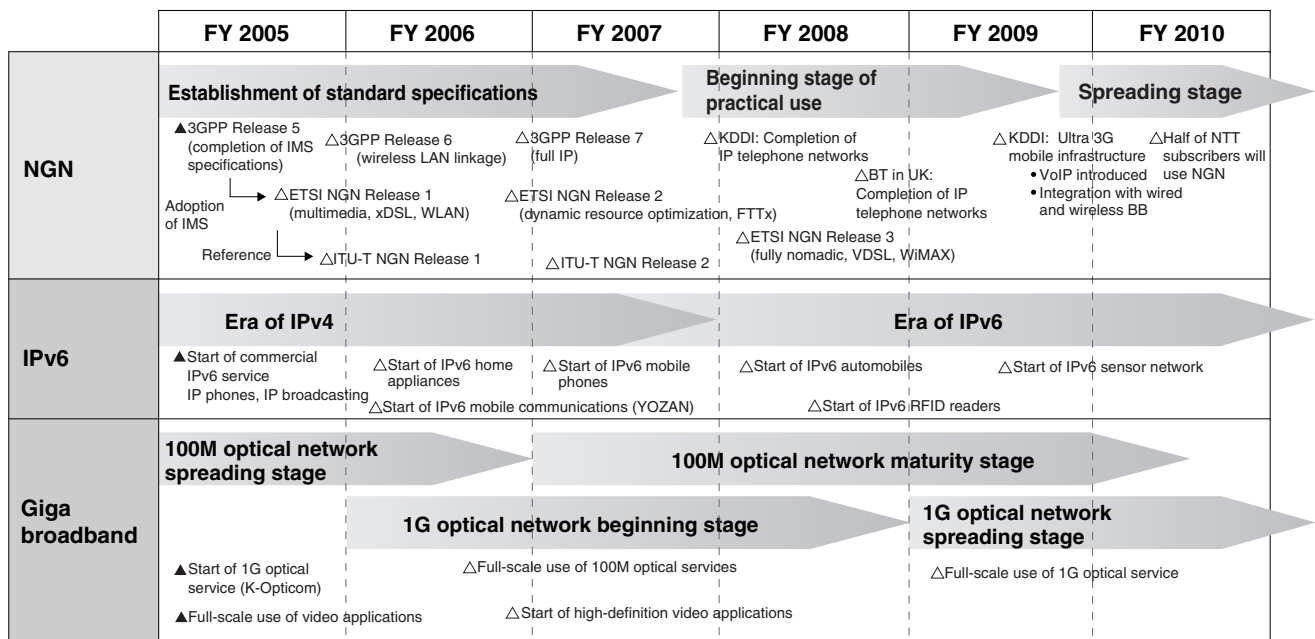
data between objects, simultaneous usage of multiple content distributions by means of IP cameras, IP speakers and IP displays, and the use of high-definition, life-size video conferencing for telemedicine and distance learning such as for piano lessons.

a. Fiscal 2005 – 2006: Start of practical use of IPv6 and 1 Gbps optical service

Some communications carriers including NTT East are already providing commercial IPv6 services for consumers. By fiscal 2006, the use of IPv6 will be expanded to a wide variety of objects such as IP video telephone sets, IP cameras and digital home appliances. Further, innovative providers will also use IPv6 for wireless communications.

With respect to broadband networks, ADSL-based 10M network services will enter the maturity stage in fiscal 2005, and FTTH-based 100M optical network services will move to the spreading stage. While the representative application in the 10M network era was IP telephony, the use of video applications such as video distribution and video conferencing will expand in the 100M optical network era. In addition, some communications carriers have already started 1Gbps

Figure 3. Road Map for Next-Generation IP Networks



Notes: ETSI = European Telecommunications Standards Institute, TISPAN = Telecoms & Internet Converged Service & Protocols for Advanced Networks, FGNGN = Focus Group on Next Generation Networks, 3GPP = 3rd Generation Partnership Project, IMS = IP Multimedia Subsystem.

optical network services, signifying the launching of large-screen, high-definition video distribution. For example, by employing the industrial standard GE-PON (Gigabit Ethernet-Passive Optical Network) technology, in July 2005, K-Opticom began the world's first optical network service offering a maximum communications speed of 1 Gbps for PCs at home on an interactive basis, although this is best-effort service.

b. Fiscal 2007 – 2009: NGN beginning stage (start of phased implementation by carriers)

Standard NGN specifications are being released on a phased basis, and the preparation of standard specifications is slated for completion in 2008. Actual implementation of these specifications by carriers will start around 2007 on a phased basis. At the first stage, a fixed telephone network owned by a carrier and closed IP data networks for each carrier will be integrated. During this period, seamless connections of networks of different carriers will not yet be achieved.

Turning to IPv6, some carriers will use IPv6 for mobile phones, which will greatly facilitate the spread of IPv6. At the end of fiscal 2007, networks used to link information equipment such as a car navigation system in a car and those used for various types of control will also be developed by IPv6.

c. Fiscal 2009 – 2010: Spreading stage of NGN, IPv6 and 1G optical networks

Regarding NGN, in addition to fixed telephone networks, mobile phone networks and broadcasting networks will be integrated into closed IP data networks for each carrier. NGN-based networks will also start to be used for services requiring high reliability in terms of quality of service (QoS) and security from among data communications services.

Regarding IPv6, most devices such as RFID readers and devices consisting of sensor networks will support IPv6, and a full-scale shift from IPv4 to IPv6 will occur.

By that time, 1G optical network service will become commonplace, and further high-speed communications service will be offered around 2009.

By using NGN as an infrastructure, system integrators will be able to offer highly reliable systems to

users. However, because the existing Internet will remain, it is not the case that all systems will be developed on the NGN infrastructure. While the Internet is basically a best-effort network with no guarantee for QoS and security, it nevertheless provides the advantage of low usage costs.

Accordingly, when NGN starts to spread, system integrators must decide which to use, NGN or the Internet, for each service. For example, a highly reliable NGN-based network will be selected for applications requiring real-time data exchange although costs will increase. At the same time, the Internet, offering best-effort quality but at low costs, will be used for applications whose principal purpose is simple, large-volume data transfer.

While this is only one example, system integrators are required to make full preparations to enable the quick selection of NGN and/or the Internet. Such preparations include the identification of system requirements such as QoS, security level, costs, communications areas, etc.

In addition, a company ordering the development of a system should also keep in mind these differences in order to avoid extra costs by selecting NGN.

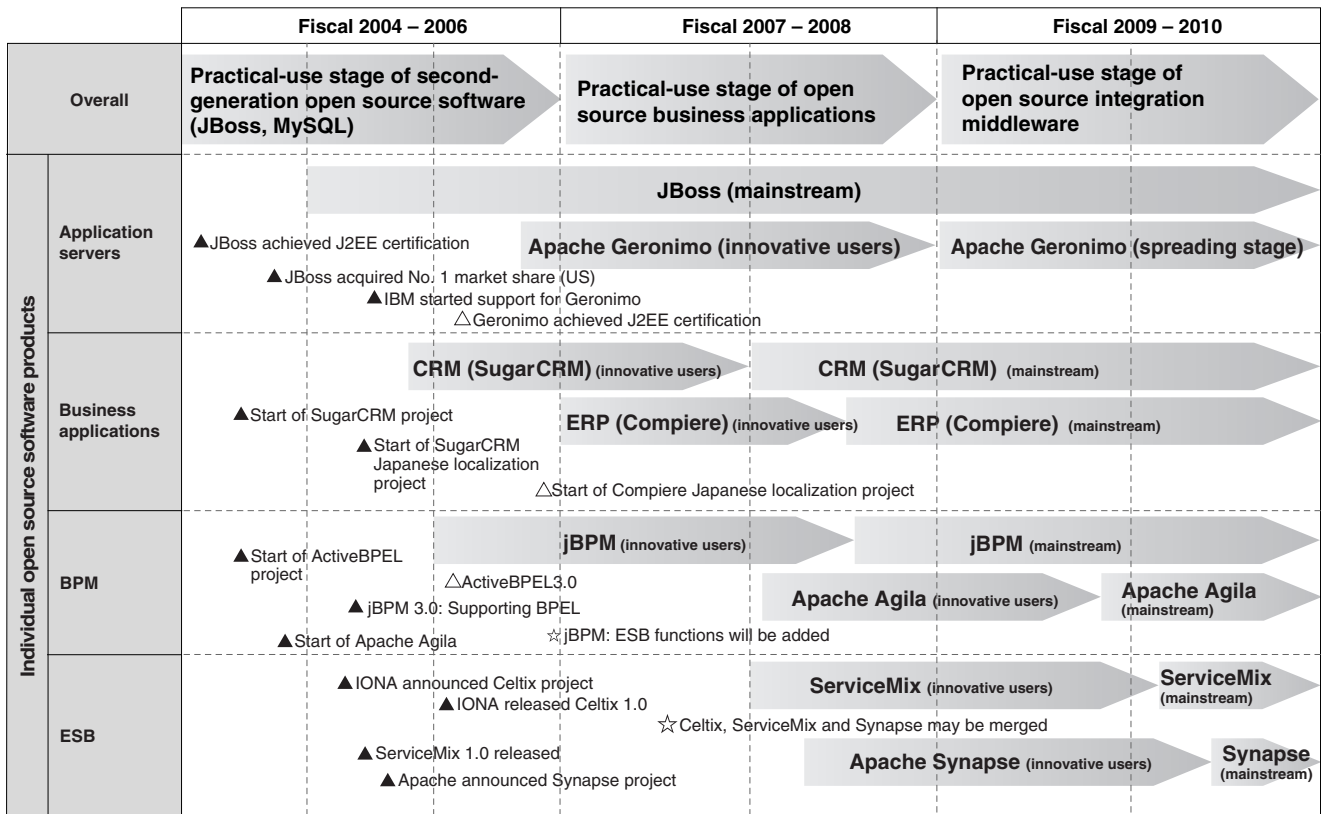
2 | Road Map for Open Source Software

A wide array of open source software as represented by Linux has already been used in the fields of OSs and programming languages. The use of open source software will continue to expand in the future. The following section introduces trends in open source software, chiefly in the fields of business applications and integration middleware (Figure 4).

a. Open source business applications

Open source software is also being increasingly used in the field of package applications such as ERP (enterprise resource planning) and CRM (customer relationship management). In particular, the struggle for a share with commercial products will become intense in the SMB (small and medium business)

Figure 4. Road Map for Open Source Software



market where high licensing costs impede the introduction of commercial software.

Currently, one promising open source business application is SugarCRM. This software has already been downloaded more than 260,000 times worldwide. The number of customers who have purchased SugarCRM Professional that consists of the commercial version (with strengthened functions) provided by SugarCRM Inc. linked with support services amounts to 250. The business model adopted by SugarCRM Inc. is to enable users to examine ease of use and quality based on the open source version with only the core functions and to generate profits by selling the multi-function commercial version (including support services) for enterprises.

b. Open source integration middleware: BPM and ESB

BPM (business process management) and ESB (enterprise service bus) play an important role in effectively introducing SOA (service oriented architecture). Some open source projects have already been

launched to develop integration middleware such as BPM and ESB.

A point worthy of note in the field of open source BPM engines is compliance with the BPEL (Business Process Execution Language) standard specifications. All representative open source BPM projects such as ActiveBPEL and jBPM either conform to BPEL or are under which development to achieve compliance is under way. In particular, ActiveBPEL is highly matured in terms of technology. In October 2004, jBPM joined the JBoss family and supports BPEL in its latest version, jBPM3.0, released in June 2005. In the future, jBPM is expected to strengthen integration with other JBoss middleware products as represented by JBoss application servers. Besides these moves, the Apache Software Foundation is developing Apache Agila in its incubator project. Even though the first version is not yet released, future progress deserves attention because this is the project implemented by ASF that has many achievements in this field.

In the ESB field, in June 2005, IONA Technologies announced its Celtix open source ESB project based

on its commercial ESB product, Artix. The company plans to release the first version this year. Gluecode Software, which developed Apache Geronimo (an application server), is also promoting the ServiceMix project. It released its first version in August. Service Mix has a high affinity with Geronimo and supports JBI (Java Business Integration), which is the Java standard specification. Other projects worthy of attention include the Synapse project, which is undergoing incubation at the Apache Software Foundation. Commercial ESB vendors such as Sonic Software, Blue Titan and IONA Technologies have been cooperating in this project. Because vendors that already have expertise in ESB are taking the lead in this project, it is highly likely that Synapse may reach the level of practical use at a surprisingly fast pace.

c. Fiscal 2004 – 2006: Practical-use stage of second-generation open source software

Between 2004 and 2005, second-generation open source software such as JBoss, MySQL and PostgreSQL emerged and vitalized the open source software market. As explained previously, such software has already been adopted by many enterprises principally in the United States and Europe, and is even being used in mission-critical areas.

The fact that many enterprises endorse such software is due not only to advantages specific to open source software such as no costs and the ability to acquire source codes but also to features such as good performance and scalability. Most companies that have implemented such software conducted benchmark tests prior to its introduction to verify performance. In many cases, they decided on its adoption after ensuring that such software can perform in a way that is not at all inferior to commercial products although it is affected by the environment to some extent.

Another of the features is that any platform can be used. For example, in the case of Database (DB) software, a user can select any hardware or OS (Linux, Windows or Unix) according to its business and technical requirements. In contrast, Microsoft's commercial DB, SQL Server, only runs on Windows. While

this limitation can conversely bring about an advantage of close links among family products, the fact that there are more options is attractive for a user who is considering the use of other OSs such as Linux.

In and after 2006, the number of adoptions of open source software is expected to smoothly increase in Japan through further maturity of products, the improvement of support quality and support (in the case of DB) for business applications such as ERP and CRM offered by major vendors including SAP.

With the expansion of market share of these open source products, vendors offering commercial products will be forced to take countermeasures such as lowering licensing fees to maintain price competitiveness.

d. Fiscal 2007 – 2008: Practical-use stage of open source business applications

As explained in the previous section, a number of open source projects have been launched in the United States for business applications such as CRM and ERP. Among these projects, Japanese localization is under way for two promising applications of SugarCRM and Compiere that already have many customers, principally in the United States. Some vendors will offer support services for these applications in Japan. However, these vendors will focus their efforts on the SMB market, which is not fully covered by major vendors including SAP.

Because small and medium businesses will have the advantage of reduced licensing fees, it is highly likely that these applications will also penetrate into the Japanese market if support by reliable vendors becomes available. Moreover, in the same way as with DB software, the spread of these applications may also affect the setting of prices by major vendors.

During this period, continued efforts will be made to enhance the functions under the open source BPM and ESB projects that commenced one after another from 2004 to 2005 through repeated release of new versions. With respect to jBPM offered by JBoss, whose application servers are also penetrating into the Japanese market, plans include the addition of

visual design tools and the integration of ESB functions in addition to the native BPEL support that was realized in Version 3.0. When version upgrades decline in frequency, support service for jBPM will be started in Japan chiefly by vendors providing support services for JBoss application servers. Concurrently with such moves, some innovative users will start using this software.

Open source ESB projects will still be in their dawn-ing stage during this period. ESB projects that were launched in 2005 are likely to be consolidated because of overlapped participating vendors and similar project concepts.

e. Fiscal 2009 – 2010: Open source integration middleware (BPM and ESB) entering the stage of practical use

Around this period, open source for enterprise appli-cations will enter the stage of practical use, will pene-trate principally into small and medium businesses and will acquire a certain level of market share.

BPM and ESB will also be entering the stage of practical use. jBPM will grow to the level of threaten-ing commercial products in the same way that JBoss application servers do.

Three ESB projects, namely Celtix, ServiceMix and Synapse, are highly likely to be integrated. If not, respective developer companies such as IONA Technologies and Sonic Software will position their open source versions as entry models of their com-mercial products. In either case, during this period, functions will mature and will reach the level of practi-cal use. Some users may adopt this middleware in place of commercial products. There is also a possi-bility that—in the same way as it did for its Geronimo

application server—IBM may commit to the develop-ment of ServiceMix (Gluecode Software acquired by IBM is a core member of the ServiceMix development project) and strongly promote its development and support. In this case, IBM is expected to position this open source version as the entry model of its commer-cial ESB products as it did for Geronimo.

In the future, it will become possible to integrate individual applications developed on an open-source basis such as SugarCRM at low costs and control their business processes by using open source inte-gration middleware such as ESB and BPM.

However, many points require careful attention in the development of systems through combining the open source software that is appearing one after another. Performance, reliability and security of indi-vidual software applications differ substantially. On top of this, it becomes increasingly more difficult to guaran-tee such attributes when multiple open source software products are combined. In addition, frequent version upgrades and frequently implemented security patches make it further difficult to ensure such vital factors.

In order to overcome these points for the spread of open source software in the future, vendors must establish an environment and structure enabling users to use open source software without concern and enhance support services. Specifically, vendors should conduct verification tests on any open source software combinations in addition to individual open source software items, and should guarantee opera-tion and conduct fault management.

In the United States, venture firms such as Source Labs and SpikeSource have already been offering such services. In the future, the emergence of vendors providing similar services in Japan is anticipated.

3 Conclusion

This paper introduced the information technology map and the IT road map as part of NRI's IT naviga-tion activities. By carefully monitoring any future envi-ronmental changes involving information technology,

NRI hopes to contribute to the formulation of IT strate-gies by our client companies as well as by the NRI Group.