Providing Support Infrastructure in Consideration of IT Management

● Mitsuru Hasegawa ● Kenji Honda

(Manuscript received July 10, 2007)

In complicated network systems, system infrastructures change very quickly and there are wide-ranging problems such as burdensome infrastructure management and infection by computer viruses. Conversely, there are growing customer expectations for more sophisticated, more secure, and safer services. To meet such expectations, Fujitsu has been making great efforts to utilize IT for maintenance work on open network systems, improved efficiency, and the development of related support infrastructures. Moreover, we have received ISO27001 and ISO20000 certification in strengthening our security management of IT systems, and established advantages that allow customers to entrust our support service for open network infrastructures. This paper introduces the systems and structures (technologies) employed to meet customer demands and social needs based on the stable operation of existing systems utilizing our support infrastructures, and describes the effects on their application (in case studies).

1. Introduction

The support infrastructures of Fujitsu for realizing stable operation of the IT infrastructures of customers and support daily life-cycles consist of 850 service deposits, 8000 SEs, 300 parts centers and One-stop Solution Centers (OSCs) in Tokyo and Osaka which control the other parts. Additionally, Fujitsu LCM Service Center distributed in eight districts all over Japan provide the life-cycle supports in phases including designs, introductions, operations and removals.

The system provided as an infrastructure for supporting the quality of operations of these life-cycle support services is roughly divided into two categories.

The first is a mission-critical system for supporting the operations of the entire support services mainly by the OSC. That is called the eSUPPORT system. eSUPPORT has been operated since the age of general-purpose machines and consists of many subsystems. In this paper, the environment used in the open system will be explained.

The second is the "PowerUp-Kit" system which collects operating conditions and potential troubles of the IT infrastructures of customers, hardware and software configurations in devices from the actual environments on site and visualizes them. PowerUp-Kit is a field system for effectively providing added values to high-quality maintenances and operations.

In this paper, the outlines of eSUPPORT and PowerUp-Kit which support the IT infrastructure and the effects of their application will be explained.

2. Outline of eSUPPORT

As shown in **Figure 1**, eSUPPORT has the communicational function for connecting customers to support and service personnel and the management function for resolving

the problems of customers in rapid and secure manner and preventing troubles. The management function consists of the eSERVICE zone for supporting customers, the eREMOTE zone for remote-maintaining the systems of customers, and the ePORTAL zone for managing the operations of support and service personnel. It is connected to the eFRONT zone constituting the integrated database (CMDB) via the channel.

2.1 Characteristics of eSUPPORT zones

eSUPPORT zones have six common characteristics shown below:

1) Sophisticated security complying with ISO27001
2) Incident management complying with ISO20000 for accepting, solving and preventing troubles of the IT systems of customers in a rapid and secure manner
3) Quality management for maintaining high-quality support services
4) Knowledge management for supporting the sophisticated problem-solving ability
5) Support contact channel for supporting various remote connection environments and service patterns such as E-mail and the Internet of customers
6) Database and Web system for integrating the above into secure and safe networks

2.2 Progressive approaches

Progressive approaches which we are now developing in cooperation with Fujitsu Laboratories Ltd. will now be explained.

1) Customer support portal SDK-Web

The SupportDesk is a service desk function provided by Fujitsu. The SupportDesk provides not only a tech support line via telephone and E-mail from customers but also an Website as a support service portal for customers accessible via the Internet. Customers can obtain information about software modifications, past cases and incident corresponding states.

2) Efforts for the ubiquitous networks

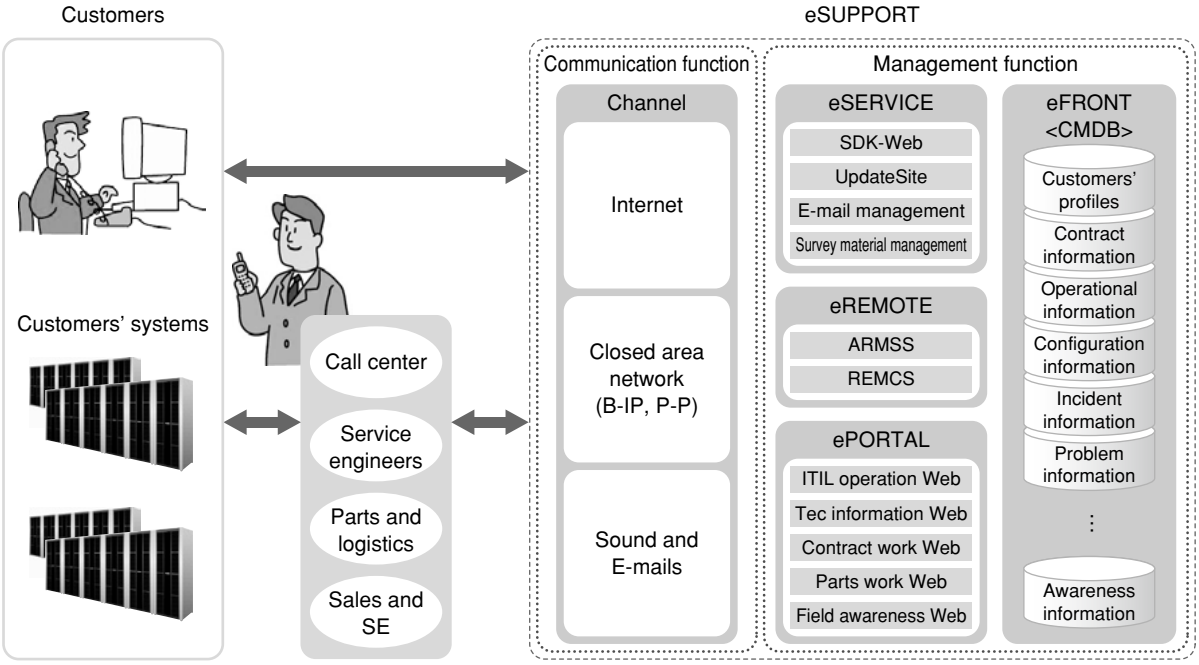


Figure 1
General outline of eSUPPORT.

Fujitsu considers that the ubiquitous networks as new infrastructures in the support services and utilizes them mainly in the two fields including the traceabilities and offices.

The eSUPPORT Web-systematizes all support service operations. Based on this, the eSUPPORT utilizes all support service operations in cellular phones and mobile devices (e.g., PDA) with keywords such as understanding situations and behaviors on the field and supplementing memories of humans which are uncertain and is promoting integrations of all support service operations with position detection systems and the RFID tag presence services, etc.

3) Realizations of searches proposing problem resolutions in a moment

We have realized an integrated search system that can at once pull up customers' contracts, operations, configurations, telephone calls, past cases and technical information for solving problems by customers while maintaining security. 41 million cases of product information and more than 50 million cases of incident information are registered. This system can search them within three seconds.

4) Realizing the constantly advancing knowledge system

Service engineers (SEs) visit customers and perform maintenance works (e.g., part replacements) if any failures occur in systems of customers. It is important to present frequent failures and highly possible causes to SEs by analyzing the past maintenance cases in order to minimize the period from gaining complaints to maintenance works. The eSUPPORT prepares technical information for solving problems from the product design phase and realizes the knowledge management system which automatically evolves by connecting the system to parts repair plants, the product design department and the quality assurance department in order to carefully examine problem resolutions accumulated on a day-to-day basis.

With this system, call centers and servicepersons readily understand the replacement parts and optimum maintenance work procedures against occurred failures resulting in shortening maintenance work time.

5) Realizing daily improvements through the operation process analysis technology

We have developed a technology for visualizing operation processes as a mechanism for daily improvements in order to speed up problem resolutions of customers.

As shown in examples of analyses in **Figure 2**, we have become able to analyze the number of transitions and transition time as well as transition states of operation processes based on the system analysis logs and improve operation processes in all segments such as human resources, organizations, information, technologies and operation systems.

3. Outline of PowerUp-Kit

The PowerUp-Kit is a system which SEs utilize in the field. Currently, four types of tool are provided. Functions of each tool will now be overviewed.

1) REMote Customer Support system (REMCS)

By introducing the software "REMCS" agent included as standard equipment in servers and storage products provided by Fujitsu, the Simple Mail Transfer Protocol (SMTP) notifies OSC of failures via E-mail when failures were found while monitoring the changes of hardware configurations and the states of redundant parts. E-mails are encrypted by our own encryption algorithm.

The OSC rapidly analyzes the information notified from the devices at customers by utilizing the eSUPPORT and takes expeditious steps toward troubles.

2) Hardware Resource Monitor (HRM)

We can confirm the mounted CPUs, memories and adopters, etc. mounted without opening housings of UNIX servers, Windows servers and PC clients by introducing the "HRM agent" into each device.

This function communicates a PC client for monitoring called (Field Support Tool [FST] which is a tool containing a function used by SEs for investigations) with investigated devices (e.g., servers into which the agent is introduced) via the TCP/9977 port. The FST displays the configuration information. If a part is failed, it is highlighted in order to distinguish the failed part realizing sophisticated maintenances.

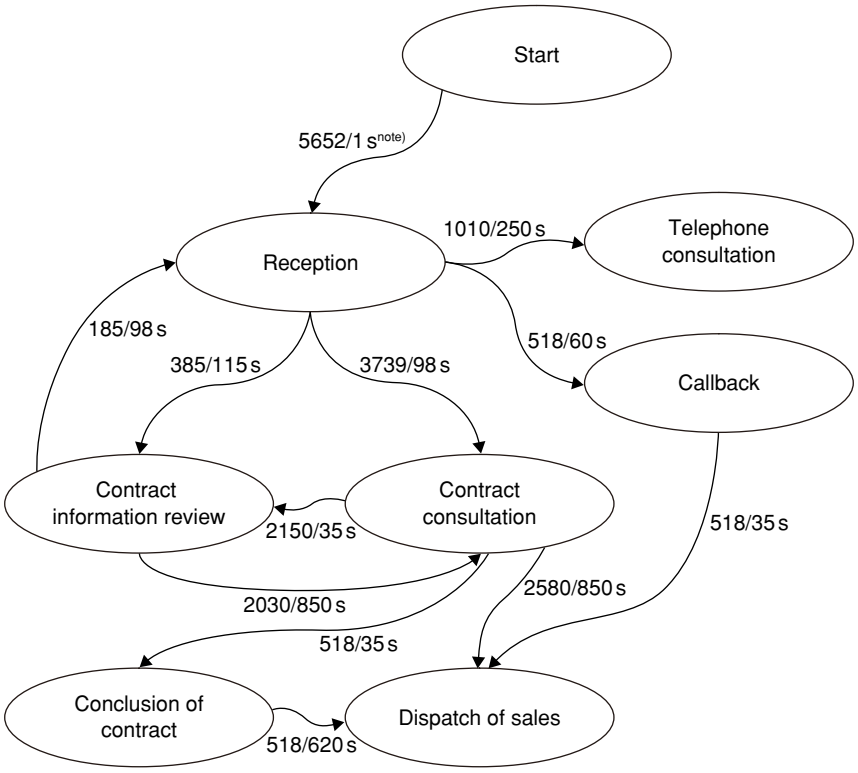
Additionally, the FST tabulates information such as "IP address", "MAC address", "host name", and "OS type" of devices connected to the network of customers with the network diagnostic function using the Internet Control Message Protocol (ICMP) and Simple Network Management Protocol (SNMP), Common Internet File System (CIFS), and TELNET. Thus, it is readily possible to confirm device resources operating in each network.

3) SystemDefenderBox (SDB)

The SDB is a dedicated device to be installed in the network of customers for collecting information in order to understand the operational statuses of the system infrastructures of customers comprehensively (**Figure 3**).

SEs can confirm the add-on devices and operational statuses by accumulating the operational statuses of devices connected to the network as "IP crawling log" with the ICMP (ping command) used on a regular basis for the network address of customers and analyzing the logs on a regular basis.

Additionally, SEs can collect information about operations of devices from the resource states and event logs of each server by introducing the "SDB agent" into devices such as servers



note) Number and time of transition shown as ○/○ are assumptions and different from actual states.

Figure 2
Example of analyzing business process in technology of making to visible.

to be researched and accumulating "system (event) logs" and "resource logs" in the SDB by using the UDP/514 port and TCP/18000 port respectively. The information can also visualize the changes occurring in devices through periodical analyses, prevent troubles and propose effective operating resource layouts.

Further, a function for rapidly understanding potential events in systems is also installed. This function reports the occurrence of the event to specified E-mail addresses through the SMTP from the SDB by defining target messages or IP addresses in the SDB immediately after the event occurred.

4) UpdateSite

UpdateSite is a function for supporting extractions and applications of only required information modified about OS of the open system (other than Windows), middleware, drivers, etc. which can be applied by easy operations allowing significantly increased speed for reducing software update time and improved quality of works.

If the "UpdateSiteAdviser" (an agent function of the UpdateSite) is installed in a server device to which SEs want to apply modifications, required modification information is automatically extracted from the Website of Fujitsu (the portal of Fujitsu UpdateSite) and SEs can confirm the information about procedures of modification works, importance and urgency of modified information, etc.

Additionally, for modification application works for each server, only required modifications specified are applied automatically while application histories are managed.

Figure 3
Appearance of SDB.

4. Effects of applications of support infrastructure

In this section, the effects of the eSUPPORT system which is operating as an infrastructure system supporting the life-cycle support services and the PowerUp-Kit applied to the field are instantiated.

4.1 Reduction of restoration time when hardware trouble occurred

For the effects of maintenance works using the eSUPPORT and PowerUp-Kit, the time from an occurrence of a trouble to restoration can be surely shortened. The major factor for shorten the amount of time is the initial reaction of the 1st-Line of the OSC which receives reports from the REMCS.

The 1st-Line can investigate troubles in the E-mails and hardware trouble information (log) attached to the E-mails by using eSUPPORT, requests shipments of replacement parts and call-out for relevant SEs at the same time within about five minutes.

The time required to ship target parts is shortened even if simply compared to the actions in which customer operation managers confirm the errors in operations management software and notify SEs of details of errors (**Figure 4**).

Then, we will compare and analyze the restoration time between a customer with the system specifically applied to (with a remote report) and a customer with the system not applied to (no remote report) based on the maintenance report (a report with which SEs report customers of the details of restoration works). For example, in the case of the PRIMEPOWER which is a UNIX server of Fujitsu, assuming that the restora-

tion time for a device to which the system is not applied is 100, the restoration time of a device to which the system is applied is 83. Thus, the restoration time of a device to which the system is applied is shortened so much as 17% on an average (**Figure 5**).

In a similar way, the restoration time for the PRIMERGY (an IA server by Fujitsu) and the ETERNUS (a storage device by Fujitsu) is shortened by 10% or more on an average.

4.2 Preventions of serious troubles by predictive function

The recent IT infrastructures operated as a core of business infrastructures contain devices so that operations are not stopped by minor troubles (e.g., failures of devices or individual parts) when constructing systems.

The storage devices are representative devices. In the case of the RAID configuration, even if one disk unit is failed, the operation is automatically switched to a preliminary disk and the operation continues by separating the failed disk.

Most of systems which are cores of businesses use the RAID function. A type of troubles in which the first disk unit is failed, the failed disk is not investigated, operations are continued, and the second unit also fails, affecting serious effects on the businesses often occurs even now.

In the REMCS, if a redundant part is failed, it is reported to the OSC. Thus, detections and restorations of failures are performed in a secure manner and broken parts can be fixed according to the plan before a system halt.

If connections to external devices are prohibited by the policy of customers, no report by the REMCS can be used. Under such circumstances, SEs can find faults in the sites of customers by using the HRM periodical diagnosis function from the FST in the routine checks by themselves.

If compared to customers to which the system is not applied, when the trouble occurrence ratio is analyzed using serious troubles including about 1000 units (system down: SD, online down: OD), the PRIMERGY and the

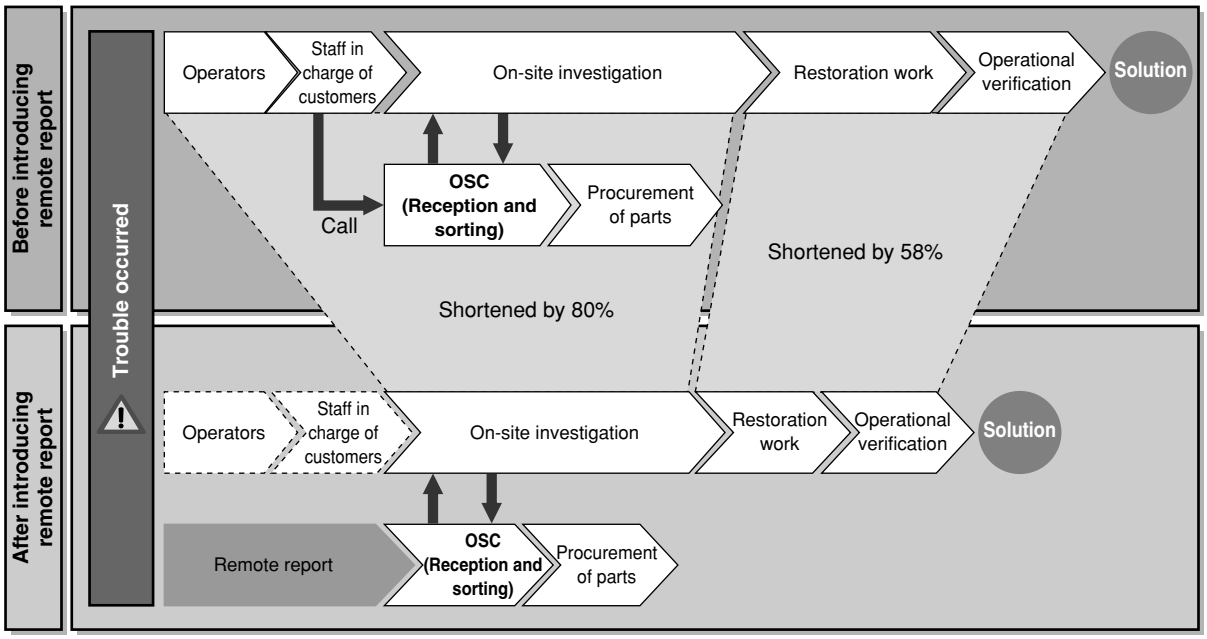


Figure 4
Shortening of working hours by REMCS use.

PRIMEPOWER can reduce serious troubles by 25% and 12% respectively. Thus, the system shows beneficial effects (**Figure 6**).

4.3 Software restoration time reduced by UpdateSite

Information about modifications about security is frequently provided for recent open systems. Therefore, software of systems is often modified according to plans.

For example, the following work items can be considered for modifying the common standby cluster type system:

1) Collecting information about modifications to be applied from Websites
2) Investigating non-compatible items for applying information about modifications
3) Operational validations by applying modifications to systems for validations
4) Applying modifications to operation system (system A)
5) Switching clusters
6) Applying modifications to the standby system (system B)
7) Switching to the operational system (system A) as required

As shown above, it takes about two or three weeks for performing the procedures including the validation (running) period.

Actually, modifications were applied to the eSUPPORT by UpdateSite. In the step 1) shown above, it took about 16 hours because information about modifications were collected from related multiple Websites manually in the past. Meanwhile, UpdateSite could shorten the work time to about one hour by automatic extractions of required information about modifications.

In a similar way, UpdateSite was applied to the works for applying modifications to the Solaris server of a customer who was operating the Internet Data Center (IDC) and the conventional working time of 10 hours could be shortened to 5.5 hours.

The system can modify software on site effectively in order to prevent serious troubles.

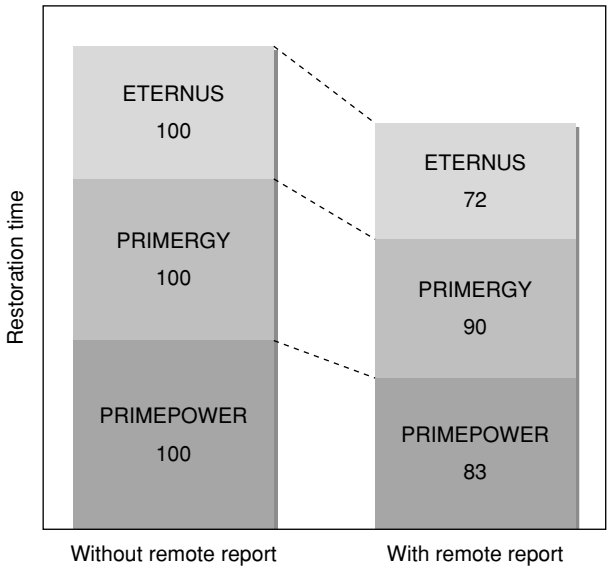


Figure 5
Comparison of hardware trouble restoration time.

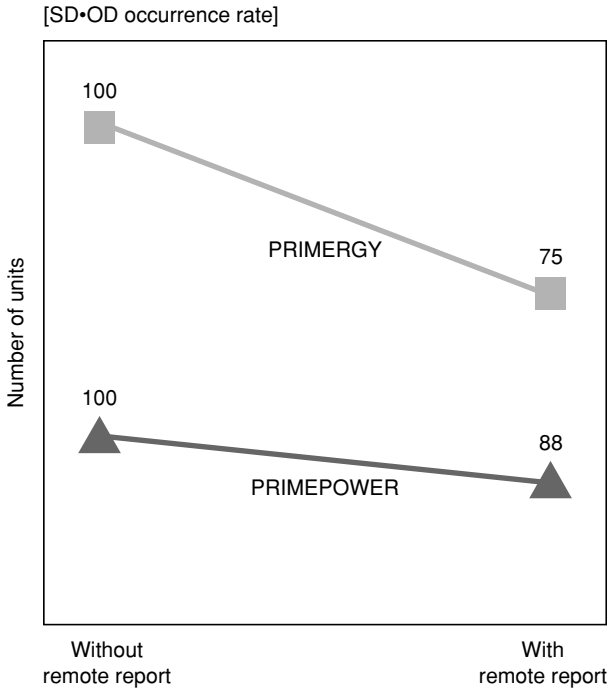


Figure 6
Serious trouble occurrence ratio.

5. Further proposals for stable operations

The IT infrastructures consisting of multi-vendors have many troubles affecting operations other than failures of hardware. Customers are responsible for operating and managing them.

For example, customers should purchase the operations management software such as the Systemwalker for Fujitsu products when constructing systems. Operators find and fix troubles by using operations management software.

However, considering troubles which occur in environments in which operators are absent or there is no operator in charge, we sometimes readily propose improvements by installing the SDB in the IT infrastructures of customers.

Examples:

1) Operations are stopped because the disk capacity of the POS terminals in a store is insufficient.
2) Personal terminals are taken in and connected to the network without prior consent.

As shown above, there are many potential problems.

Ideally, we should review the operations management policy and perform it radically. However, we propose the SDB if customers request improvements through simple measures against events because of operational costs.

We can prevent troubles caused by the disk capacity shortages by analyzing the "resource logs" accumulated in the SDB at fixed intervals, visualize the status of operating resources and create a plan for purchasing resources by design.

Additionally, when we find a person who is using the system from the "IP crawling logs" (IP addresses connecting illegally from the SDB), we can notify related persons of the facts via E-mails and discipline unauthorized users.

For these settings and analyses of information accumulated in the SDB, SEs in charge of customers provide the "SupportDesk Expert IT resource management service"[1] in which they notify customers of the details sparing customers the trouble at reasonable cost (i.e., 10 000 per month).

6. Conclusion

In this paper, the activities of the life-cycle support service infrastructures by Fujitsu for supporting security, safety and stability of the IT infrastructures of customers and effects of their applications are explained. Further, we will provide effective information to customers and through the provisions, establish a value-added system for managing the IT system infrastructures of customers.

There is a major item to be studied for constructing the CMDB defined by the ITIL, "All details about constituent items (CI)[2] and information about mutual relationship should be retained by the CMDB exclusively. This single repository of information will be accessed from every point of service management processes and a major factor for promoting the consistency among processes". Fujitsu will evolve the system for collecting the CI of the IT infrastructures which are operating into the PowerUp-Kit. At the same time, Fujitsu will integrate information designed by customers and system engineers into the CMDB, register it in the eSUPPORT and develop an environment in which customers can use the information.

We will use the information for rapidly solving troubles, as a matter of course, extract challenges from the design information and changes in CI on site for generating the next proposals.

Fujitsu will improve the operation-oriented service infrastructure system for supporting stable operations of the IT infrastructures of customers also in the future.

References

1) Fujitsu: SupportDesk Expert IT resource

management service. (in Japanese).
http://segroup.fujitsu.com/fs/services/sd-expert/itresource/

2) Ivor Macfarlane Colin Rudd: IT infrastructure library IT service management version 2.1.a. (in Japanese), itSMF JAPAN, 2001.

Mitsuru Hasegawa, *Fujitsu Ltd.*
Mr. Hasegawa joined Fujitsu Ltd. in 1975, where he has been engaged in reforming the workflow in building IT system infrastructure and promoting the LCM Business projects.

Kenji Honda, *Fujitsu Ltd.*
Mr. Honda graduated from Fujitsu Career College in 1980. He joined Fujitsu Ltd. in 1977. Since then, he has been engaged in business supports for LCM services and promoting their service infrastructures.