WSMGR for Web Supporting Mission-critical Applications on Smart Devices —Mainframe in Your Pocket—

● Mitsuo Fujitake ● Yukio Hirao ● Akihiko Miura

Mainframes are widely used for running mission-critical enterprise systems as they provide a high level of reliability while enabling the use of existing assets. An enterprise that combines the use of open systems and mainframes is generally more concerned about the effective use of information and communications technology (ICT) assets and in particular the use of existing mainframes than a full migration to open systems. At the same time, the surge in using smart devices for business applications in the open-system world is now bearing down on the mainframe world. The FUJITSU Software WSMGR for Web open server software provides an environment in which mainframe business applications can be used on smart devices anytime and anywhere with optimal operability without having to rewrite those applications. Introducing smart devices into business operations, however, brings up difficult issues related to security, operations know-how, etc., so Fujitsu also provides a service called Mainframe Connect as an all-in-one solution that includes network security from the terminal to the mainframe. This paper introduces WSMGR for Web technologies supporting smart devices, mainframe technologies supporting mobile use, and key services that make use of those technologies.

1. Introduction

Mainframes have long been used to run a company's mission-critical systems, and many customers continue to use mainframes due to their various advantages:

- stable and high-speed processing of large volumes of data,
- use of a great amount of existing software and database assets,
- consistent support from a single vendor, and
- reduction of total costs through development and operational know-how accumulated to date.

Combining these mainframe features on the back end with the use of smart devices directly operated by the user on the front end makes it possible to robustly and flexibly optimize an information and communications technology (ICT) infrastructure in several ways.

1) Effective business continuity

The system can be extended in a stepwise manner without touching the back-end system, thereby maintaining system compatibility and robustness.

2) Work style renaissance

Since smart devices can be used anytime and anywhere, they can be used to apply state-of-the-art ICT to fields where it has traditionally been absent and to create a work style independent of time and place.

3) Flexible response to business changes

Using state-of-the-art ICT can bring flexibility to a system, which enables a company to respond rapidly to ever-changing business needs.

This paper describes the FUJITSU Software WSMGR for Web[1)] middleware product and related technologies that help achieve the optimizations above.

2. Problems in using mainframe assets

At present, using mainframe business applications with smart devices requires the use of dedicated terminals or terminal emulation software in which operations are performed using text-based screens and keyboards. Various types of problems arise when attempting to use such conventional terminal screens in their present form with smart devices.

1) Problems originating in different terminal characteristics

In general, the content of a mainframe screen (typically an 80-column × 24-row text screen) cannot fit on the much smaller screen of a smart device. In addition, input on smart devices is achieved through touch-based operations while that on mainframes is generally keyboard based. This difference makes input troublesome and detracts from the inherit convenience of smart devices.

2) Problems related to implementation and operation

There is a need for operational technologies and know-how not previously needed in mainframe systems such as those related to security (outside use, loss, theft) and implementation/operation (mobile circuits, service level agreement [SLA]). Despite a general desire to introduce smart devices, a company may discover that, when implementation actually becomes necessary, it does not know where to start.

3. Features of WSMGR for Web

WSMGR for Web is server-based mainframe terminal emulation software that enables mainframe connections to be achieved and mission-critical work to be performed from Web browsers via PCs or smart devices. It supports both 6680 emulation for FUJITSU Server GS21[2)] mainframes and 3270 emulation for IBM mainframes (**Figure 1**).

The mobile optimization technology and screen customization function provided by WSMGR for Web make it possible to access mission-critical systems with smart devices anytime and anywhere without having to rewrite existing mainframe business applications.

The following sections describe the main technologies and services provided by WSMGR for Web.

4. Technologies for optimizing WSMGR for Web for mobile use

Mainframe screen data consist of attributes and a character code set particular to mainframes. These data are sent to a client as a data stream using rows and columns on the screen as an addressing scheme, and as such, they cannot be directly displayed on a smart device that runs on a different platform. In response to this problem, WSMGR for Web is placed between the mainframe and the smart device so that mainframe screen data can be sequentially converted into HTML and JavaScript that can be displayed on smart devices (**Figures 2 and 3**). Several technologies are used to optimize mainframe screen data for the mobile environment of smart devices.

4.1 Optimization for mobile circuits

When connecting a smart device to a mobile circuit or a Wi-Fi router, sufficient communication speeds may not necessarily be obtained. To therefore ensure a practical level of performance, WSMGR for Web provides

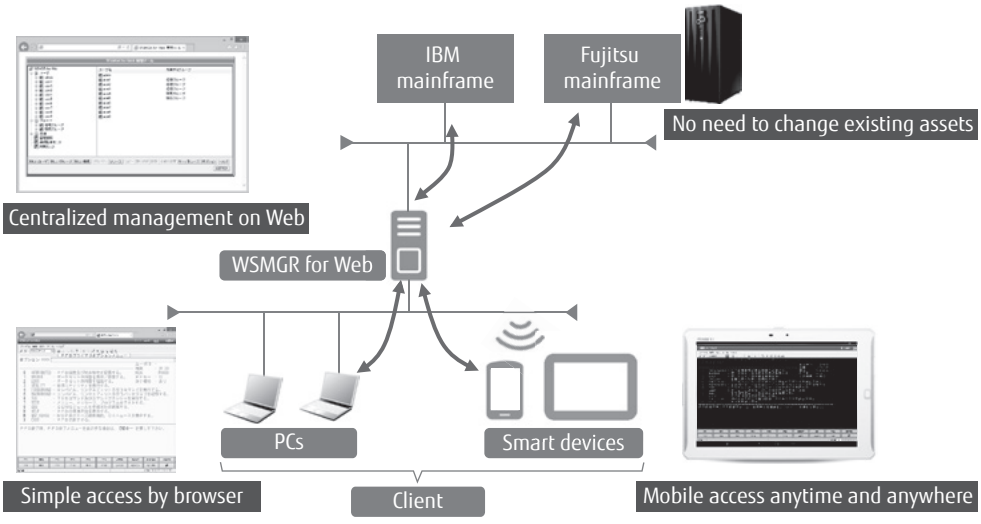

Figure 1
Overview of WSMGR for Web.

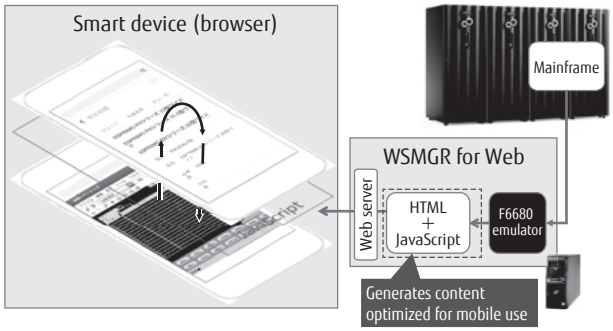

Figure 2
Mobile optimization of mainframe screens.

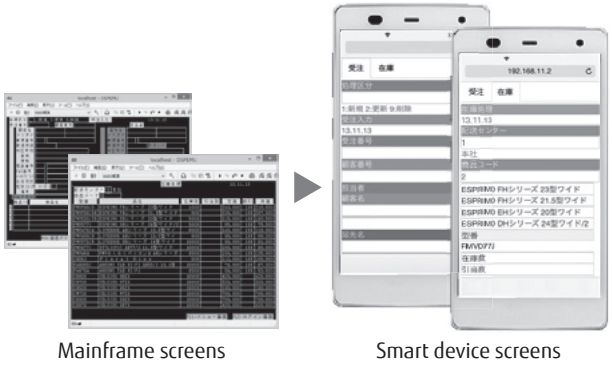

Figure 3
Screen shots reflecting responsive Web design.

for server-side data compression and optimization processing to minimize the number of transmissions.

In mobile use, the Web browser engine on the smart device side subjects the HTML content generated on the server side to a rendering process for eventual display on the screen of PCs or smart devices. However, the speed of this rendering process depends on the performance of the PC or smart device and on that of the implemented browser. To minimize differences in performance, WSMGR for Web optimizes this content for transmission on mobile circuits beforehand on the server side by generating a data structure that can be easily interpreted by a browser engine.

4.2 Display of mainframe character set and external characters

The character code used by Fujitsu mainframes is Fujitsu's Japanese Language Information System, also known as Japanese processing Extended Feature (JEF).

Personal computers and smart devices, on the other hand, generally use Unicode, which means that they cannot represent all mainframe characters. Furthermore, Japan's unique writing system calls for the use of many external characters to represent names in family registers, special symbols, etc. In WSMGR for Web, character patterns in JEF code that exist in Unicode are displayed by the standard method on the terminal side in Unicode. For characters not in Unicode and external characters, WSMGR for Web generates image data (in GIF format) for the character patterns on the server side and embeds them in the HTML. This obviates the need for installing special software on the smart device side, thereby maintaining display compatibility among a variety of smart devices.

4.3 Support of responsive Web design

Screen resolution on a smart device with respect to the fixed 80-column × 24-row mainframe screen varies with the device model. In addition, the display area on a smart device differs between a vertically held smart device (portrait view) and a horizontally held terminal (landscape view), so there are limits to the classical technique of determining the smart device model to fit content on the screen. In response to these issues, WSMGR for Web uses a system that breaks down the screen layout into a grid consisting of 12 columns crosswise and automatically arranges screen items so that they fit into this 12-columns-per-row format. This approach enables "responsive Web design" supporting a variety of screen sizes and screen aspect ratios through simple screen content independent of device model.

This linking of items arranged on a grid and actual mainframe display data is achieved by using JavaScript on the basis of the client model-view-controller (MVC) model. Applying front-end technology in this way enables conventional mainframe screens to be displayed on various terminals with optimal operability.

5. Screen customization

The previous section described the standard screen generation technology provided by WSMGR for Web, but it is also possible for users themselves to customize the screen display on smart devices. WSMGR for Web provides a customization support tool, a script editor, based on a graphical user interface (GUI). This

script editor enables a user to customize the mainframe screen in accordance with the work being performed without having to write any HTML or JavaScript.

Customization can be applied in a stepwise manner after introducing WSMGR for Web. For example, a frequently used work screen can be partially customized at first and then further customized after receiving feedback from end users. In this way, customization can be applied in a flexible manner while assessing its cost-effectiveness closely.

The script editor enables either "client script" or "server script" to be selected as a customization method in accordance with the application of concern.

1) Client script

Client script generates a script to run on the browser with various components for customizing the mainframe screen and assisting input. It also enables user-generated HTML to be overlaid on the mainframe screen. The script editor generates JavaScript code for the client script.

2) Server script

Server script generates a script to run on a server and to obtain and manipulate mainframe screens. The script editor generates C# code—the language used by .NET Framework—for the server script.

6. Mainframe technologies supporting mobile use

The increase in the number of users and the amount of data due to the proliferation of mobile devices is generating a need for improved response. Several implementations have been performed to further improve the processing ability of the mainframe infrastructure and to achieve stable operation.

1) Improved access to system storage unit (SSU) shared by multiple clusters

Fujitsu's System storage Coupled Multi-Processor (SCMP)[note 1)] system places various types of database information in an SSU for sharing among multiple clusters. Access to the multiple buffers of the SSU is performed simultaneously "in-batch" to improve SSU access performance and improve transaction performance across the entire SCMP system (**Figure 4**).

2) Increase in number of connectable I/O devices for a virtual machine (VM)

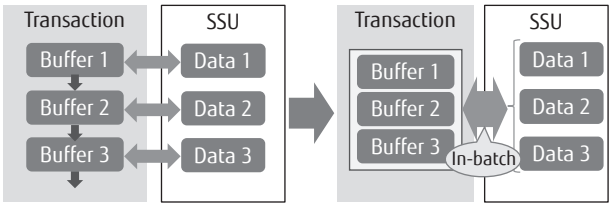

Figure 4
Improved SSU access performance.

Stable operation is achieved by extending the number of I/O devices that can be connected to a VM by ten times and enabling the construction of a VM for development purposes on the same scale as an actual VM.

3) Expanded capacity of logical volumes

Various types of control information within each logical volume on a disk have been extended, and volume capacity has been expanded by 16 times. This reduces the number of steps in backup operations and promotes stable operation (**Figure 5**).

4) Enhanced guarding against invalid network telegrams

In the event that an invalid telegram is emitted from a faulty network device in the periphery of a mainframe, an Open Network Adapter (ONA)[note 2)] discards that telegram to prevent it from reaching the mainframe. This scheme helps to provide even more stability to system operations (**Figure 6**).

7. Mainframe Connect

The actual introduction of smart devices to a company's business operations requires networks, security measures, and servers, which can be obtained through a monthly charged service from Fujitsu called Mainframe Connect[3)] (**Figure 7**). This service provides a secure mobile-connect environment and cloud services as an all-in-one solution without having to own any hardware or software assets for this purpose.

Mainframe Connect enables smart devices to be used anytime and anywhere to securely access mission-critical data located in a mainframe environment. As a result, mainframe-related work that has traditionally been limited to the office can now be performed in various ways (diverse work styles) without regard to time

note 1) System configuration for sharing an SSU and achieving a hot standby system.

note 2) LAN adapter supporting connection to Gigabit Ethernet.

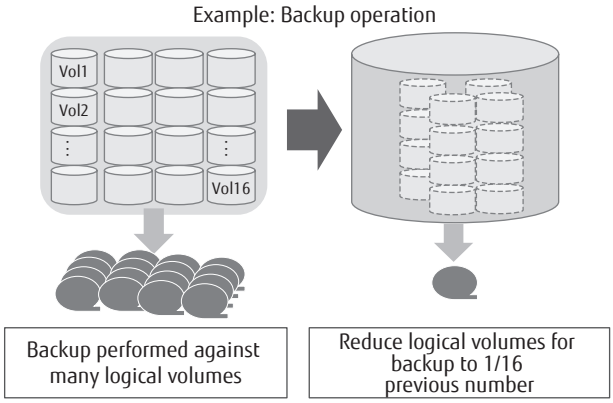

Figure 5
Expansion of logical volume capacity.

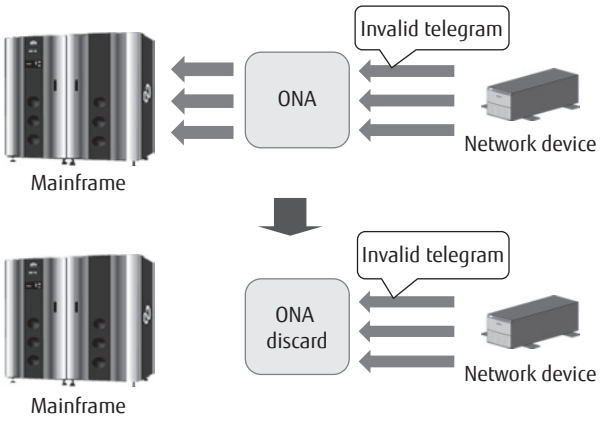

Figure 6
Enhanced guarding against invalid telegrams.

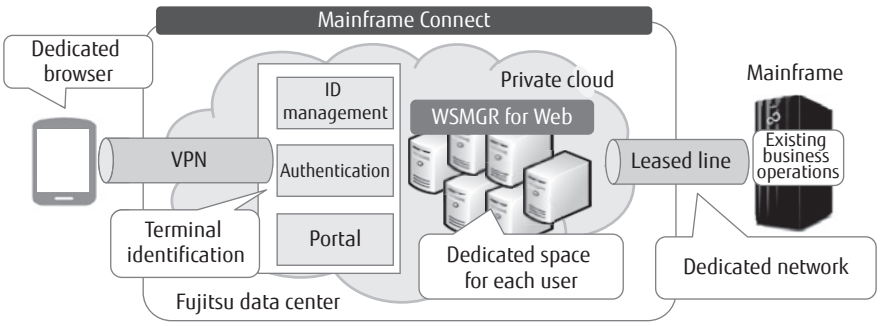

Figure 7
Mainframe Connect.

or place with a "mainframe in your pocket" sensation.

1) Multiple secure connection methods

Mainframe Connect provides connection formats tailored to user requirements. In addition to ones for the Internet, Wi-Fi, and mobile phone networks, Mainframe Connect provides ones for private closed-carrier networks.

This feature enables the use of a wide variety of terminals including smartphones, tablets, and personal computers, making for flexible operation. For example, a user could use a laptop in the office and a smartphone outside the office.

Mainframe Connect also provides robust security measures for terminal connections. Communications are performed over a virtual private network (VPN) and include, of course, encryption and ID authentication as well as the ability to identify individual smart devices to limit the devices that can be used. In addition, the use of a dedicated browser inhibits copy and paste operations on the smart device and automatically deletes data on the completion of work.

2) High-reliability execution environment

Mainframe Connect runs in a virtual environment on a high-reliability, high-availability, and high-security private cloud managed within a robust data center. It achieves 99.99% infrastructure utilization thanks to a high-availability, redundant configuration and provides a user-dedicated environment with high confidentiality connected over a high-security, leased-line network.

3) Operation and maintenance services supporting mission-critical work

Mainframe Connect provides an operation environment and maintenance services for day-in-and-day-out support of mission-critical work that demands a high level of reliability. Integrated operation and management functions enable a system manager to

use a browser-based dashboard to perform access control, log management, and other user-management functions.

The maintenance services support mission-critical work on a 24/365 basis. An implementation support service is also provided to assist in entering definitions, customizing screens, etc. when introducing Mainframe Connect.

8. Conclusion

Mainframes constitute an important system for daily execution of mission-critical applications, and using them in a more effective manner makes it possible to apply mission-critical systems at low cost to areas in which ICT has not traditionally been used. In addition, the "anytime and anywhere" feature of smart devices helps to create a renaissance in work style in which work traditionally limited to the office can be performed on the go while in the field. This renaissance in work style is promoting the application of mainframe systems to new business fields, and it will help expand business opportunities and improve our customers' business ventures into the future. Through such value-added usage scenarios, our customers will become more competitive in their business environment.

Fujitsu is committed to continuing its in-house development of mainframe hardware and software to support its customers' mission-critical systems and to provide hardware, networks, middleware, security measures, and a mobile environment all in an integrated manner. At Fujitsu, we aim to expand the use of ICT by providing products and services that facilitate the convergence of mainframes and the latest ICT environment.

References

1) Fujitsu: FUJITSU Software WSMGR for Web (in Japanese). *http://software.fujitsu.com/jp/wsmgrweb/*
2) Fujitsu: FUJITSU Server GS21 (in Japanese). *http://globalserver.fujitsu.com/jp/*
3) Fujitsu: FUJITSU Server GS21 mainframe connect (in Japanese). *http://globalserver.fujitsu.com/jp/topics/mf-connect/*

Mitsuo Fujitake
Fujitsu Ltd.
Mr. Fujitake is engaged in the development of mainframe infrastructure software.

Akihiko Miura
Fujitsu Ltd.
Mr. Miura is engaged in the planning, construction, and provision of services and solutions for effective use of mainframe systems.

Yukio Hirao
Fujitsu Ltd.
Mr. Hirao is engaged in the development of middleware for linking mainframes and open systems.