System Platform Supporting Major Sporting Events

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Several major international sporting events will be held in Japan around 2020. ICT is indispensable for the smooth management of these events. Thorough preparations and flawless execution during such events are required. In developing the system platform, it is also necessary to take into consideration unique aspects of major sporting events, such as the requirement that the systems run uninterruptedly, the fact that the events are one-offs, and also the fact that the preparation period is short. The conventional on-premise model often employed in system development is unsuitable with regard to these aspects as it is too onerous in terms of time required for platform arrangement and implementation, excessive system configuration, and functional redundancy. To address these issues, Fujitsu is constructing a private cloud infrastructure that leverages cloud computing technology to realize shorter installation period, high availability, and flexible scalability. We are also promoting efficient operation and management by integrating common application functions. This paper describes the development of system platforms for major sporting events that offer superior reliability and efficiency for managing such events.

1. Introduction

Several major international sporting events will be held in Japan around 2020. ICT is indispensable for the smooth management of these massive sporting events, which will be a focus of international attention, and thorough preparation and flawless execution during the events are of utmost importance.

Systems that support the management of major sporting events are used across a broad array of facilities including stadiums and related facilities. This is difficult for a single company to handle, and thus the introduction of the required systems is worked on by multiple companies. The systems are used mainly by players, event officials and personnel, administrative staff, and the media.

They provide athletes with competition information such as match schedules and who is competing with whom. Further, to the media, they provide competition results and athletes' information. Competition results in particular are delivered all over the world in real time via the media. Given the major attention such major sporting events receive from all over the world,

system shutdowns, no matter how short, are simply not permissible. Therefore, a level of service that fully ensures reliability, performance, and expandability is required for the event system platform.

This paper describes the development of system platforms that offer reliability and efficiency for managing the operation of major sporting events. To begin, we sort out the requirements that the system platform must satisfy from the standpoint of the characteristics of major sporting events, and clarify the problems of conventional platform development. Next, we introduce Fujitsu's approach to these requirements, and finally, we describe future prospects.

2. Issues arising from conventional system platform development

Major sporting events are held in different countries every few years. The specifications of event management systems differ from event to event due to differences in economic scale, business practices, domestic laws, and so on, of the host country. Therefore, past event information cannot be used as is and event

management systems have to be built from scratch. Moreover, various systems have to be built in a short period of time with very little leeway prior to event rehearsals. Owing to these characteristics of major sporting events, platform introduction based on the on-premise model often employed for conventional system platform development runs into various problems. Specific problems that can occur are as follows (**Figure 1**).

First, each department that supplies business systems to end users (hereafter, department) involved must arrange for the equipment and build the platform within a limited time, and such preparations take time. Further, the timing to start system development differs according to the department. Thus, since each department needs to arrange for the required equipment separately, each department must carry out system development within a limited time so that everything is ready by the test event date. Hence, any delays in the lead time for equipment supply and platform setup becomes a major problem. Further, owing to the separate procurement of equipment by the various departments involved, in many cases differences in terms of OS type, version, security level, and so on exist among the various systems, which introduces further operational complexity. Following development of the platform, it is necessary to allocate human resources to the operation and maintenance of the system of each department, which places a heavy burden on each department.

The second problem is the tendency to adopt system configurations that secure excessive scalability and availability. The system specifications of sporting event systems and the popular sporting categories differ for each host country, and given also that the the durations of matches vary differs, it is difficult to estimate the amount of data, and appropriate system resource sizing in a short period of time is also difficult. In such cases, a common approach is to prepare the resources based on the assumed data amount, and make subsequent increases as needed if resources become tight. Therefore, each department tends to select from the start a system configuration that allows later expansion. Moreover, departments tend also to opt for excessive configurations, such as each department building its own backup system for the same environment as protection against faults.

The third problem is the scattered nature of the functional deployment due to the duplication of application functions by the various departments as each separately designs its system, and the resulting inefficiency of operation processes. Major sporting events often introduce a sponsorship program scheme wherein each department has various related corporate partners. As each corporate partner introduces its own system, information sharing and coordination are made difficult, and the tendency is for corporate partners to introduce systems independently of one another, which tends to result in a siloed state of mutual isolation of the various systems. Each siloed system is individually
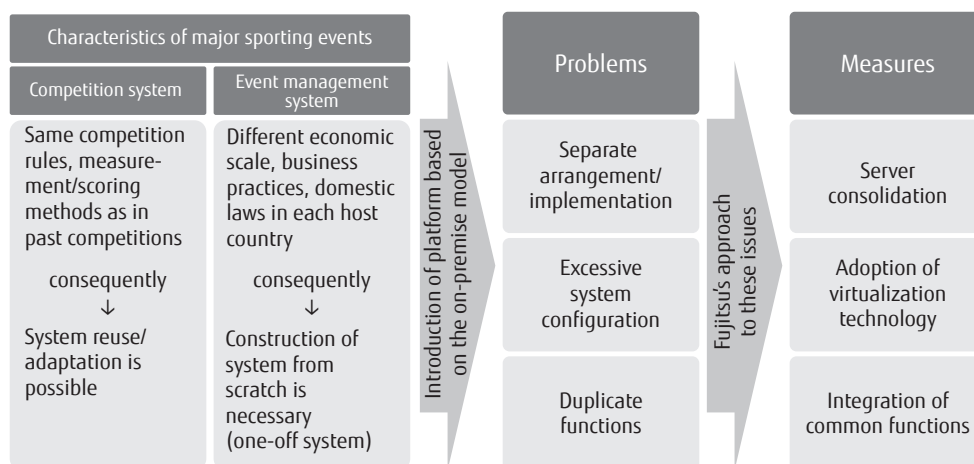
Characteristics of major sporting events		Introduction of platform based on the on-premise model	Problems	Fujitsu's approach to these issues	Measures
Competition system	Event management system				
Same competition rules, measurement/scoring methods as in past competitions consequently ↓ System reuse/adaptation is possible	Different economic scale, business practices, domestic laws in each host country consequently ↓ Construction of system from scratch is necessary (one-off system)		Separate arrangement/implementation Excessive system configuration Duplicate functions		Server consolidation Adoption of virtualization technology Integration of common functions

Figure 1
Sporting event system challenges and measures.

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optimized for its department, and redundancy can result as functions are duplicated across many systems.

3. System platform development according to event characteristics

This section addresses the three problems mentioned in the preceding section by presenting three points to develop system platforms for major sporting events.

The first point is to promptly supply the platform and reduce the operational burden. Ideally, when a platform is needed, the platform environment should be supplied instantaneously instead of the various departments each having to individually arrange a platform on their own. To that end, a platform environment that each department can utilize should be prepared, and an integrated and centralized platform that can be jointly used by the various departments is indispensable. At the same time, it is also necessary to realize the integrated operation of the system through integration and consolidation of the platform, and to reduce operational loads by increasing the efficiency of operations such as backup and monitoring.

The second point is to provide a common platform that allows flexible securing of availability and scalability. To eliminate excessive sizing on the platform, it is necessary to have a system that allows flexible scaling of resources even after operation to efficiently secure availability.

The third point is the integration of common application function and flexible collaboration with related services. This requires selecting functions that extend across various systems for provision as common functions that can be shared by multiple systems, and the introduction of a platform that allows flexible collaboration.

4. Fujitsu's approach to system platform development

To realize the development of the system platform described in the previous section, Fujitsu is conducting various activities such as the following.

4.1. Development of private cloud platform

As a foundation for supporting major sporting events, Fujitsu provides a shared-use private cloud platform that consolidates network, server, and storage functions and devices. The introduction, in advance, of a private cloud platform that each department can utilize frees departments from the need to independently arrange for equipment and greatly shortens the lead time required for the procurement of equipment and the time required for platform construction.

As this private cloud platform, Fujitsu provides FUJITSU Integrated System PRIMEFLEX for Cloud, a vertically integrated virtualization and cloud platform that leverages Fujitsu's cloud service introduction/operation technology and know-how (**Figure 2**). PRIMEFLEX integrates high-performance/high-reliability hardware such as servers, storage, and network equipment, and virtualization software that offers excellent operability. This allows resources to be used more effectively by sharing them among systems.

Also, the use of integrated devices makes it possible to construct systems that are highly compatible with one another, and makes it possible to achieve unification in terms of OS type, version, and security level. Hardware failures and resource thresholds can also be monitored centrally. By unifying operation management in this way, each department can reduce man-hours spent on monitoring and operation (**Figure 3**).

4.2. Utilization of cloud computing technology

The private cloud solutions proposed by Fujitsu adopt virtualization technology based on our know-how cultivated in cloud services. Our virtualization technology makes it possible to operate multiple OSs on a single piece of hardware so that physical resources such as CPUs and memory can be distributed as logical resources and assigned to a plurality of OSs. As a result, server resources such as CPU and memory that could not be used to full capacity in one system can be effectively shared among multiple OSs. The use of this virtualization technology ensures the availability and scalability of the system platform according to the characteristics of major sporting events.

For operation of this virtualization technology, we provide FUJITSU ServerView Resource Orchestrator (ROR), which is dynamic resource management software. This software allows effective use of resources and improvement of operation and management efficiency. For example, when resources such as CPUs and

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Vertically integrated virtualization and cloud platform
FUJITSU Integrated System PRIMEFLEX for Cloud
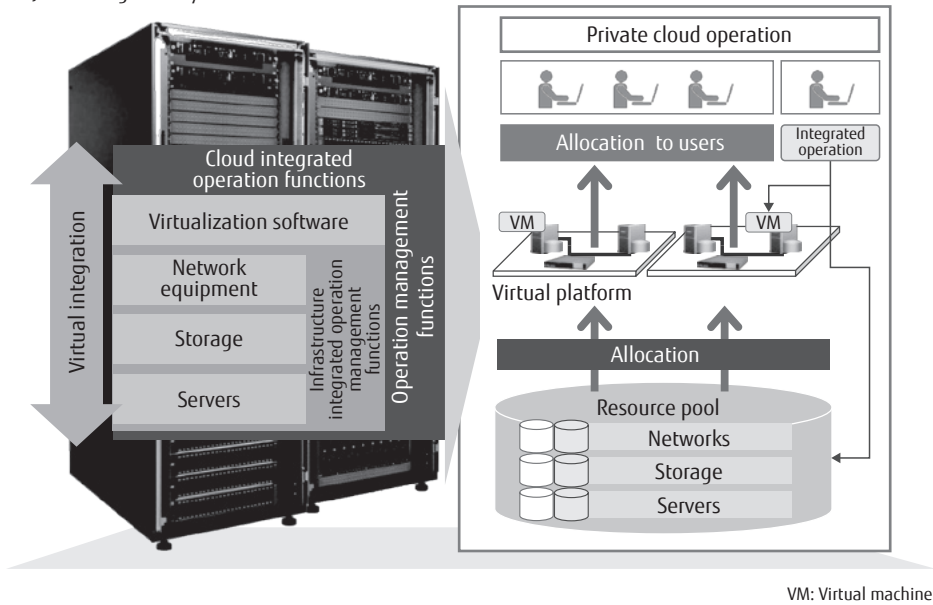

VM: Virtual machine
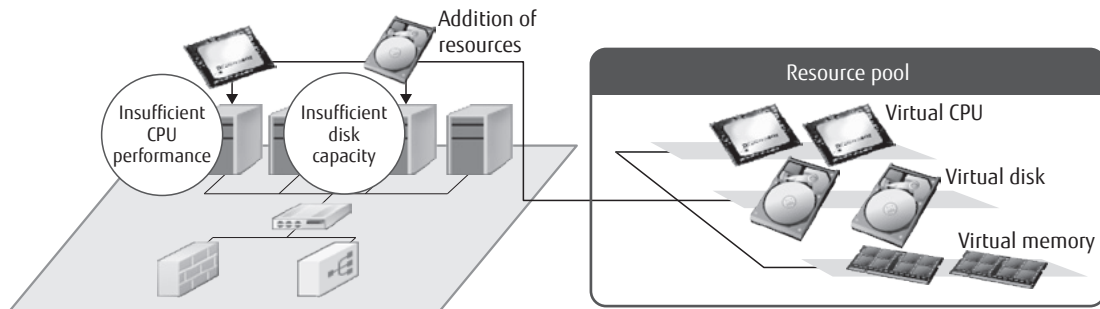
Figure 2
Private cloud integration.

Figure 3
Function to realize high scalability.

memory allocated to a virtual OS run short, it is possible to allocate additional resources from the resource pool (Figure 3). Since resources can be visualized and demand forecast can be performed, the situation of the system can be analyzed and resources can be optimized accordingly. Furthermore, by predicting resource shortages, problems due to insufficient performance can be prevented in advance and stable system operation can be achieved.

When a hardware failure occurs, ROR moves the virtual OS that was running on the affected hardware to different hardware with the capacity to run it. This realizes high availability and enables early recovery from system failures (**Figure 4**).

4.3. Integration of common application functions

To resolve the problem of inefficiency of operation processes due to duplications of functions, we provide a common platform that integrates authentication functions and data linkage application features used in common in business systems. This common platform realizes flexible cooperation with related services, and can consolidate common functions of each system.

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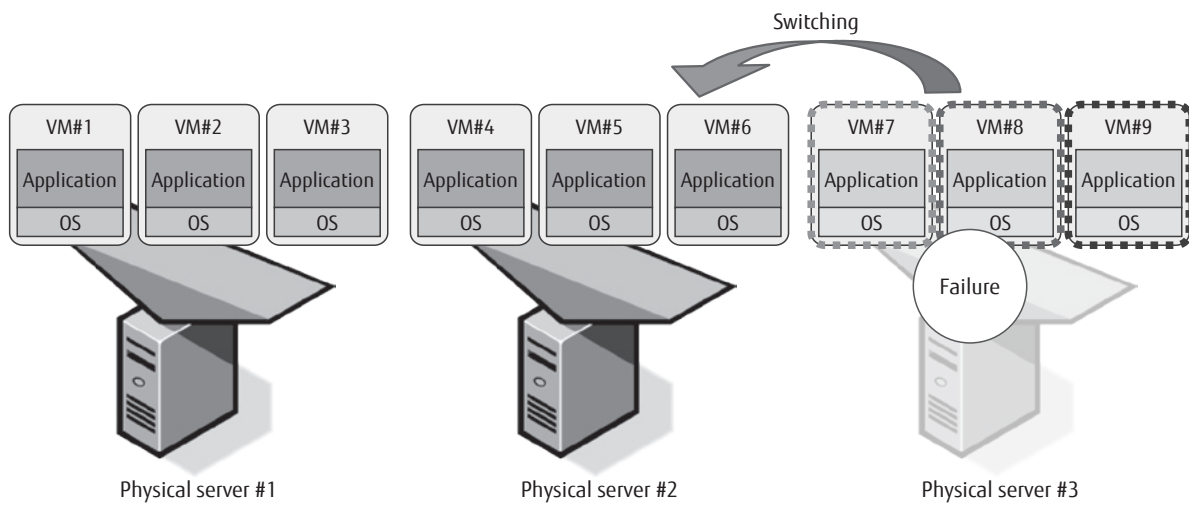ICT in Sports

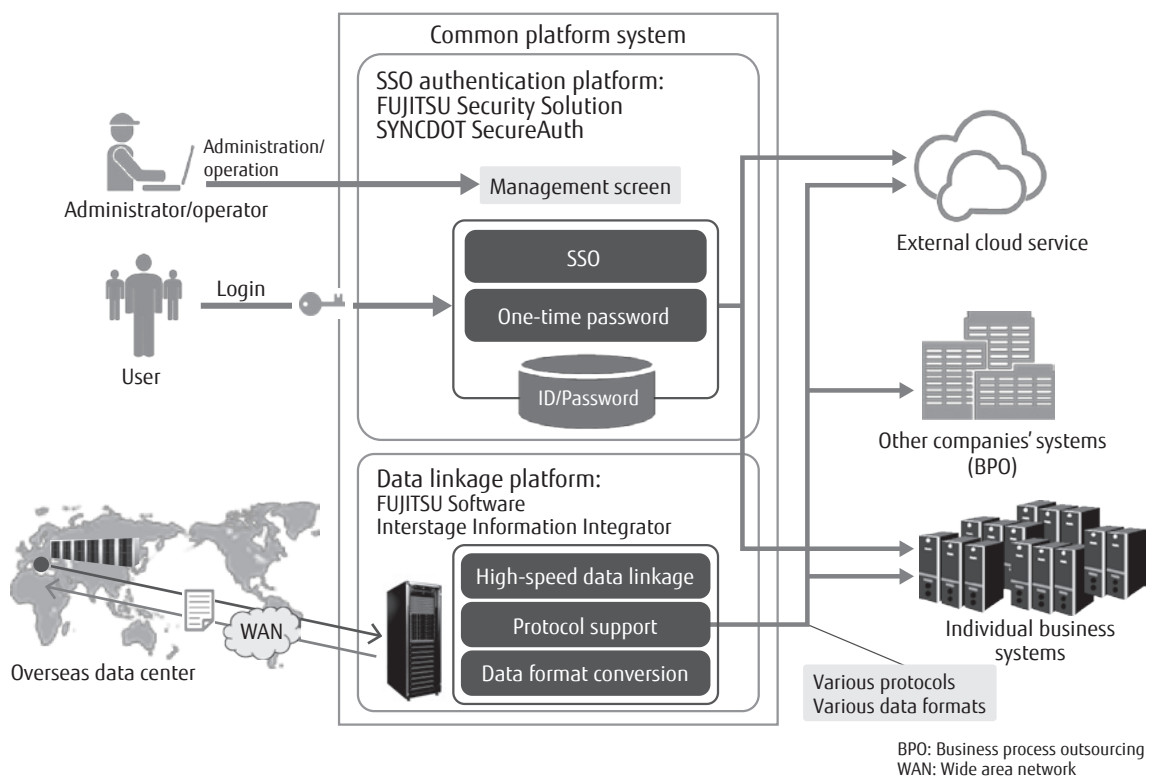53

Figure 4
Function to realize high availability.

Figure 5
Image of introduction of SSO authentication platform and data linkage platform.

For the authentication functions, which are among the common functions, we integrate the authentication functions required by the various systems into a single sign-on (SSO) authentication platform (**Figure 5**). The introduction of this SSO authentication platform makes one-stop SSO authentication possible even in environments where authentication functions are scattered across various systems such as public

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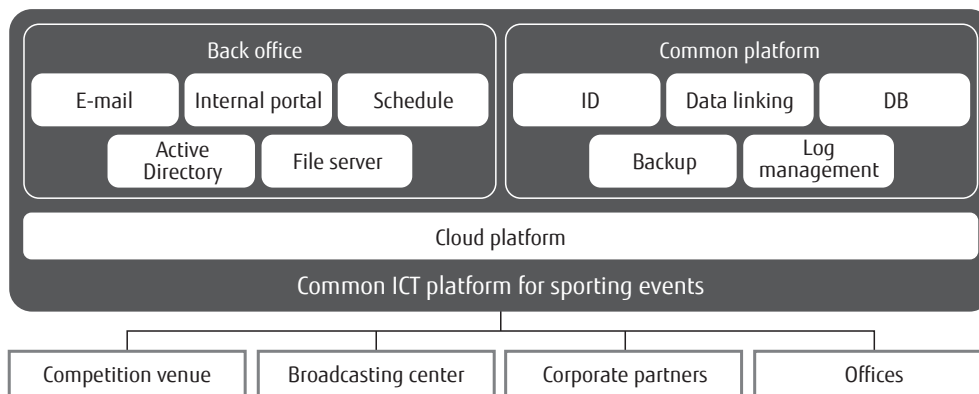ICT in Sports

Figure 6
Common ICT platform for sporting events.

clouds, on-premise systems, and systems owned by outside contractors.

Data linking, another common function, is integrated into a data linkage platform that allows inter-system cooperation not only with operating systems on public clouds but also with on-premise business systems and the systems of other companies such as contractors (Figure 5). For the data linkage platform, we provide FUJITSU Interstage Information Integrator, which is data collection and integration software. This ensures data collaboration at major events requiring cooperation with various kinds of systems, which it accomplishes through cooperation among public clouds, supporting various protocols and multiple data formats.

5. Tasks and prospects for future sports system platform development

As mentioned earlier, system interruptions during major sporting events are not permitted. As Japan is prone to various natural disasters, disaster countermeasures are indispensable. Going forward, we will work to develop a disaster recovery system that allows continued operation of the system platform, covering even the possibility of a disaster happening in the lead-up to the event rehearsal, while minimizing any impact on event operation.

The system platforms such as back office systems, common platforms, and virtual platforms built this time, which are indispensable for the operation of major sporting events, can be used in common with any sporting events. Therefore, we plan to promote the introduction of common ICT platforms for one-off sporting events such as the FIFA World Cup, Rugby World Cup, and world championships in various sports (**Figure 6**).

6. Conclusion

This paper introduced the development of system platforms that offer reliability and efficiency for managing the operation of major sporting events. First, we identified the unique aspects of major sporting events and explained the problems such as excessive system configuration that can occur when constructing system platforms based on the conventional on-premise model. Next, it introduced Fujitsu's activities, including the utilization of cloud computing technology, to solve issues such as securing availability and scalability.

We aim to further evolve this approach to realize platforms capable of supporting all kinds of major sporting events, and thereby contribute to the further development of sports.

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