

Development System and Introduction Results of Business Applications at the Tokyo 2020 Games

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The Organising Committees had to design and develop dozens of business applications in addition to the common information system (e.g., OMS: Olympic Management System) provided by the global partners for the two Games due to the wide range of tasks involved in the management of the Olympic and Paralympic Games, and because the requirements of each host city are different. This article introduces the structure of the Software Factory, which realized agile development of applications on the development platform adopted for the Olympic and Paralympic Games Tokyo 2020, as well as the operational results during the Games. Although the business applications development system is for an international sporting event, we believe that some findings should be referred to when introducing systems in ordinary businesses.

Keywords : Information system, Agile development, In-house development, CoE, DX promotion

1. Introduction

The Organising Committees of recent Games have adopted existing development frameworks and platforms for developing and deploying dozens of business applications. For example, the London 2012 Games adopted an existing website development package and Rio 2016 Games adopted a development framework from a major vendor, which was developed from scratch in an on-premise environment under a standardized process. From Rio 2016 Games, an in-house development team called the “Software Factory” was established, where a

common team accumulates knowledge of application development and operations across multiple applications.

In analyzing these precedents, the Tokyo 2020 Organising Committee noted that many of the business applications introduced were relatively small in scale and used only during the Games and that the requirements of the business divisions were not necessarily determined early on. In other words, we concluded that development from scratch in an on-premise environment is not necessarily optimal, but rather, agile development can be easily achieved with fewer resources by adopting PaaS (Platform as a Service), which has abundant functional modules, as a development platform.

In launching the Software Factory, an in-house development team on this development platform, we decided to establish a Centre of Excellence (CoE) as an architectural team to improve the productivity of the entire development project and to support project management.

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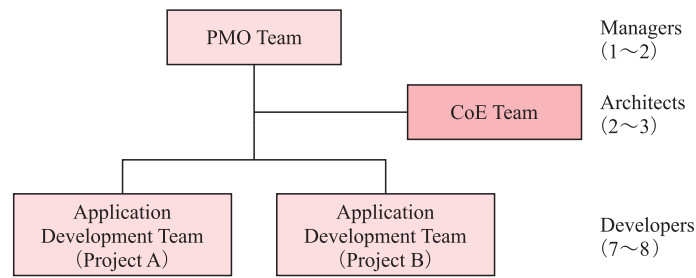


Figure 1 Software Factory Structure Approximately one year after the launch, the CoE Team was increased from two to three members to three to four members.

2. Software Factory and CoE

The Software Factory system was launched in the summer of 2017, three years before the Games, to formulate the overall development plan for approximately three years and design applications that require an early start. To secure the human resources necessary on a somewhat regular basis, a schedule was established to equalize the development project load as much as possible, with a standard structure of seven to eight members from the contractor for the Application Development Team and two to three members from the supplier of the development platform employed for the CoE Team, respectively. Under this structure, there were more than ten application projects in progress in parallel at most (Figure 1).

2.1 Development Rules and Processes

Since Software Factory is a multi-vendor system, the standardization of the development processes was a key point that had a significant impact on not only the productivity of each development project but also the quality and reliability of applications introduced in large numbers. Because of the wide range of organizations involved in large-scale international events such as the Olympic and Paralympic Games, they handle a vast amount of personal information and the event organizers frequently request changes to the workflow even after the development has begun. Under these conditions, agile development does not mean that documents such as design documents are entirely unnecessary. Especially in the case of large-scale applications, it is important to have progress where development documents such as Business Flow, Data Models, Sequence Diagrams, etc., are created and then reviewed by all parties involved.

The CoE Team helped develop and compile these

processes into development rules such as Business Application Development Guidelines and overall operational processes.

2.2 Overall Architecture Design

Based on the findings from past Games, the CoE Team analyzed the high-level requirements for each business application and conducted a suitability assessment for development on the PaaS development platform. The evaluation measures included the suitability of standard function modules, the volume of customization required for the user interface, and the complexity of the business processing logic. As a result of the evaluation, it was found that approximately 80% of the applications could be covered by the common functions of PaaS, which enables low-code development, and that the Software Factory system is suitable for the development of these applications because it can reduce the number of man-hours required for the development.

Several functions are commonly used and referenced in many business applications, and designing and building these as common functions would lead to more efficient development. Specifically, there is an integrated database function that manages information commonly used by multiple applications, such as information on Games officials, vehicle information for officials, management codes for asset management, and service catalogs provided to officials with rate cards (paid menu), as well as a user authentication function that users inside and outside the Organising Committee are required to use for each application in accordance with the confidentiality of the information being handled. Some of the user authentication and data integration functions with external systems were implemented on the on-premise system infrastructure. The CoE Team collaborated with the System Infrastructure Development Team to design this entire hybrid on-premise and PaaS architecture.

2.3 On-premise Support for Agile Development

In the early days of the project, requirements definition by the business department did not always proceed as planned, rework and inefficient processes often occurred in the development process. Therefore, in many development projects of applications, mockups were created instead of simply listening to the Business Department's requirements, and the approach adopted was to "show them the model" and have them "agree on the requirements" to streamline the development process.

The CoE Team pointed out that even when a development platform with an excellent track record in the market is used, but the Application Development Team is not familiar with the functional details and external connection requirements of the standard function modules, they cannot accurately determine whether they can be adopted and the conditions under which they can be adopted, which often leads to unnecessary and proprietary development processes.

Therefore, to promote the agile development process

more effectively, approximately one year after establishing the system, the resources of the CoE Team were enhanced to provide support for application development, including technical verification, before development. For relatively small-scale applications, the CoE Team can complete the product as is, as an extension of the mock-ups created by them.

In addition, the CoE Team members conducted training for the staff members of the Organising Committee, judging that in-house development of simple applications was possible by the staff. A system to support the management of lost and found items at the venues and a system to manage the distribution of tickets to Games officials, which was not implemented due to the coronavirus disease 2019 (COVID-19), are examples of in-house development by the staff.

These measures allowed the Application Development Team to focus resources and time on developing applications of a larger scale, such as the rate card acceptance portal, which required multi-stage function releases, and the asset and logistics management

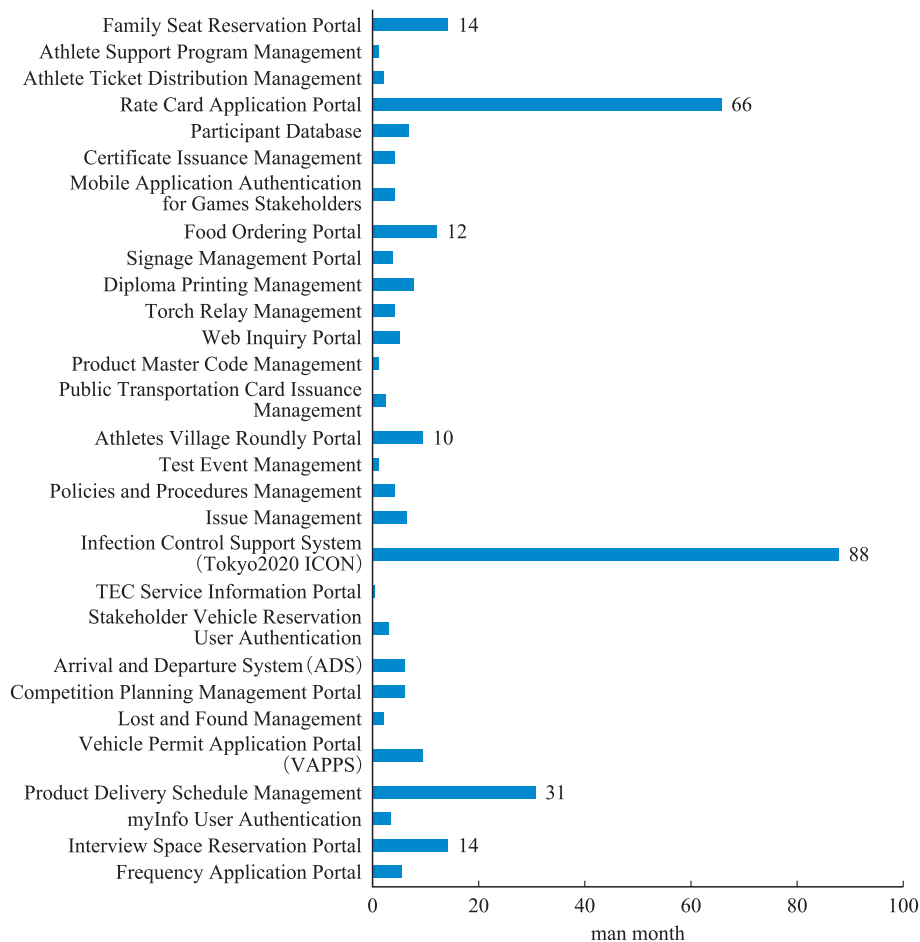


Figure 2 Business Applications Developed by Software Factory and Development Effort

system, which required complex requirements to be defined.

3. Application Development Achievements

In the end, 29 business applications were independently developed and implemented on the development platform for the Tokyo 2020 Games. These included many applications that were not envisioned in the initial planning (e.g., competition-related planning and management tools that had previously been replaced by spreadsheet software) and additional functions and improvements to the user interfaces that had not been realized in past Games (Figure 2).

In addition to the originally developed systems, there were more than 30 cases in which third-party packaged applications were introduced (e.g., financial accounting systems) or existing systems were used by suppliers (e.g., systems provided as part of outsourcing contracts to transportation and logistics-related partner companies), depending on the business field. However, even when using third-party systems, the common functional parts of the Organising Committee (e.g., integrated database function, user authentication function, etc.) were required in many cases; hence it was necessary to link the systems through the system infrastructure of the Organising Committee. Therefore, a project for system interconnectivity was launched within the Software Factory structure to promote interface design,

interconnectivity testing, and security testing.

4. Application Operation Results

4.1 Operation System

Including the partial release of functions, several business applications were introduced during the competition preparation period (e.g., coordination of details of competition operation plans with the International Federation), which began in earnest in 2018, and to improve the maturity of competition operation work (e.g., management of goods transportation to each venue) in the test event that began in the summer of 2019. During this phase, a portion of the Software Factory structure (including staff involved in in-house development) responded to incidents and support requests that arose during operations.

During the early operation phase, we received requests from the IOC and other games stakeholders for improvements in functionality and user interface and changes in requirements for some of the applications. While obvious additions to the functionality required additional development resources, many minor modifications and screen design changes could be handled quickly within the regular operational support system.

As an operational support system during the Games, the personnel and staff of the outsourcing company responsible for the Software Factory responded efficiently with a limited number of staff (Figure 3). This

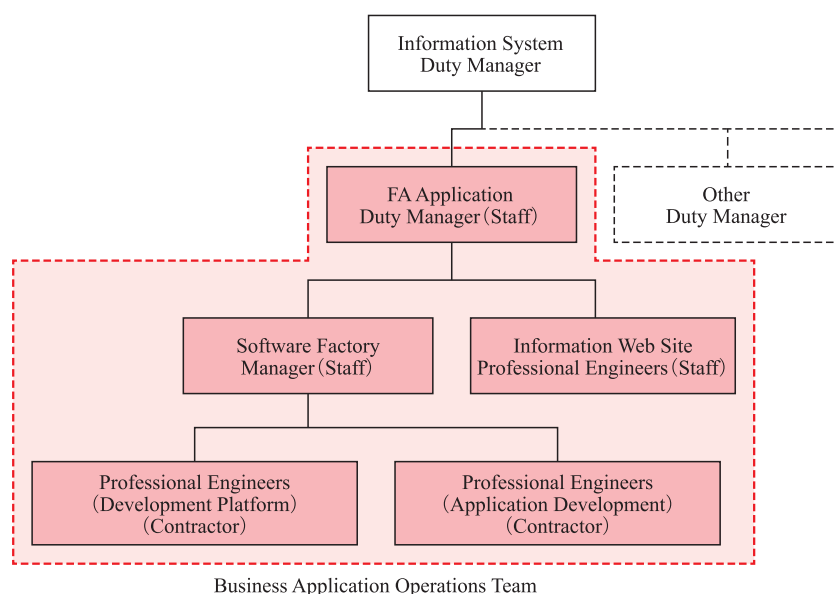


Figure 3 Business Application Operation Support System during the Critical Period
A mixed team of staff and contractors provided efficient operational support.

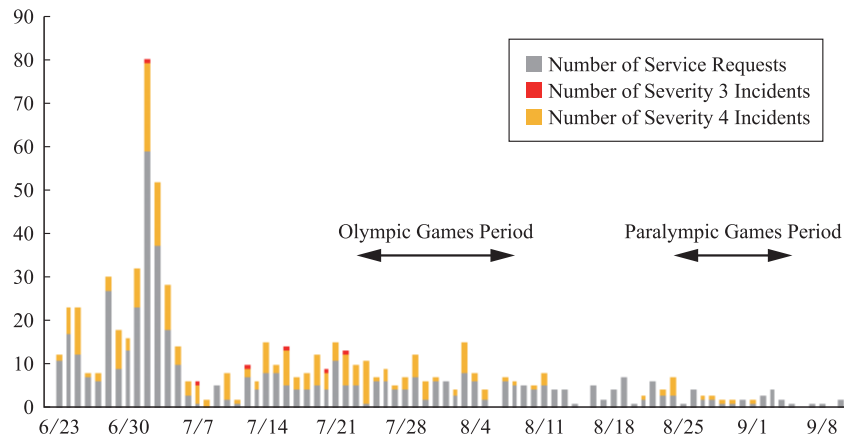


Figure 4 Number of Incidents and Service Requests Number of incidents and service requests assigned to the business application operation team during the critical period (June 23, 2021 to September 10, 2021).

was because applications and common functions were implemented on the same development platform. Thus, a considerable portion of the know-how and skills necessary for dealing with incidents and issues were standardized.

4.2 Results

If we look at the period from June 23, 2021, when the Technology Operation Centre (TOC) began its extensive support system, to September 10, 2021, when the TOC was closed (hereafter referred to as the critical period), including the Games period, there were no incidents of high importance during the critical period.

On the other hand, the most frequent severity 4 incidents (minor incidents) and service requests (Figure 4 and Figure 5), which occurred mainly in early July, were related to the Infection Control Business Support System (Tokyo 2020 ICON), which was developed by the additional software company members and was introduced for the COVID-19. (The trouble ticket is categorized in the "Participant database"). This confusion was caused by a lack of information regarding the pre-registration of users to the system and delays in the procedures for the entry of Games officials, and not by any problems with Tokyo 2020 ICON.

The IOC requested a relatively significant change in the database of Games officials to modify the data processing logic to reflect the special requirements of athletes' entries to the competition, even during the critical period. In this case, it should be noted that the CoE Team members' extensive knowledge of the functionality of the development platform enabled them to implement the modification in a short period while

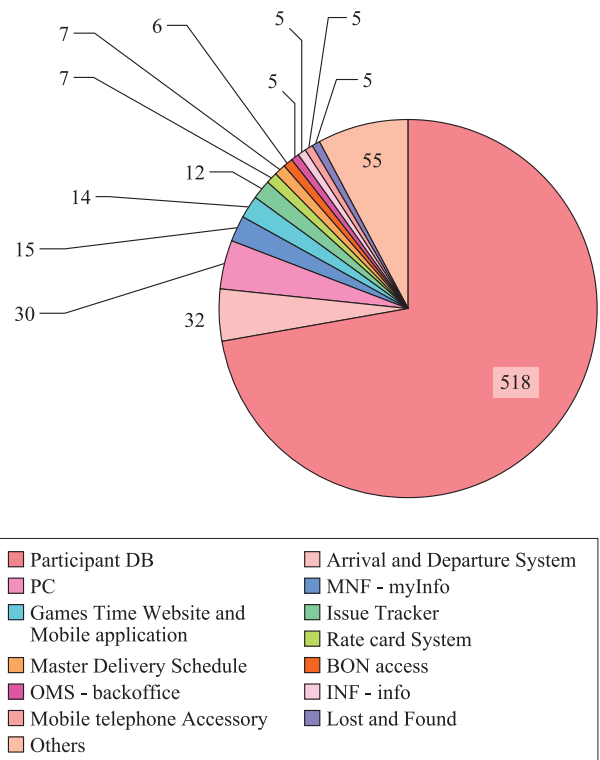


Figure 5 Breakdown of Incidents and Service Requests Breakdown of incidents and service requests assigned to the Business Application Operations Team during the critical period (June 23, 2021 to September 10, 2021) by the system.

keeping the system in operation.

5. Conclusion

The operations of the Olympic and Paralympic Games continue to evolve based on the knowledge gained from each event, and each host city has its requirements that

reflect its circumstances. In introducing business applications, each Organising Committee needs an agile development system that can flexibly respond to modification requests.

The Tokyo 2020 Organising Committee devoted sufficient time and resources to analyzing case studies of business applications implemented in past Games, thanks partially to the arrival in 2014 of seconded staff with expertise and experience from technology-related partner companies. This led to establishing a specialized system for software development and operation oriented toward agile development at a relatively early stage compared to past Games.

On the other hand, in launching the Software Factory, we tried to equalize the workload of development projects to secure joint development and architectural human resources regularly. However, some of the applications for which requirements definition and design were started early due to these efforts were not fully organized by the business department, or the timing of requirements elicitation from the participants of the Games was too early.

If a clear goal is not set for systemization based on sufficient analysis by the business department, the investment may be wasted if systemization is initiated based solely on abstract expectations for digitizing business operations. We have heard that many applications ended up not being used at past Games. On the other hand, it was clear that if the development project were launched later, the workload would be concentrated in the busy period before the Games, and there would be problems in securing human resources and learning the development and operation processes.

We believe that the CoE Team's activities within the development structure described in this report partially helped resolve this issue. However, more fundamentally, it is a problem that needs to be solved by the entire organization, including the operations department. For example, just as architect teams were necessary for the productivity of development projects, "business process design teams" were established relatively early on, mainly in the planning department, to promote business start-up projects. Unfortunately, however, the "need to determine business processes ahead of time," emphasized by the technology department, was not always

well understood.

Incidentally, the most compelling case in which the CoE Team was incorporated into a fully-fledged business process design system that spanned the major business divisions of the Organising Committee was the project for an Infection Control Business Support System (Tokyo 2020 ICON), which was hurriedly launched after the postponement of the Games. The project required additional development staff and CoE members on short notice. It is clear that behind the sufficient functioning of the system was the accumulation of the Software Factory system and standardized development process that had been established up to that point, as well as the database of Games officials that had been maintained and operated as a common function.

We believe that this knowledge can be applied to the digital transformation of organizations, which has been the focus of much attention recently.

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