Technology Operation Centre as the Central Hub of Technology Management

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Abstract

A Technology Operation Centre (TOC) was established for the Olympic and Paralympic Games Tokyo 2020 to respond to all types of technology incidents of high severity, including system failures, operational issues, and cyber attacks. In addition to the large number of domestic and international affiliated companies involved in the management of technology unique to the Olympic and Paralympic Games, the Tokyo 2020 Games integrated and operated its system infrastructure in a hybrid environment of public cloud, private cloud, and on-premises for the first time in the history of the Games. This article summarizes the basic concept, operational structure, and results of the TOC.

Keywords : 24-hour operation, ITIL, Technology Operation Centre, COVID-19

1. Introduction

As in past Games, a Technology Operation Centre (TOC) was established for the Olympic and Paralympic Games Tokyo 2020 (hereinafter referred to as "Tokyo 2020 Games") to deal with technology-related issues that occur at competition venues and related facilities[(1)]. The TOC was the core centre for technology operations and responded quickly and intensively to all technology incidents and risks, including system failures, operational issues, reputation and cyber attacks.

2. Overview of the TOC

2.1 Structure of the TOC

Technology services are complex and intertwined with each service (networks, information systems, cybers ecurity, etc). It is possible that the root cause of an incident may not be apparent from the surface of incident, or that multiple incidents may actually have the same root cause. Therefore, the TOC was designed that core staff from all services are stationed in the TOC, to be able to quickly identify the impact and resolve the root cause of any incident beyond the scope of each service.

Dozens of wall-mounted monitors were placed at the front of the TOC to display a dashboard of the status of their service for each service seating area, which could be shared by relevant staff. Critical incidents were displayed on multiple monitors in the TOC, so they could be shared across service areas, as all TOC staff needed to respond to such problems proactively.

TOC was initially designed to be 715 m^2, including a war room for countermeasures in the event of major incidents, but was eventually expanded to 2 rooms with a total area of 1,415 m^2 to ensure physical distance as an infection control countermeasure against the COVID-19. In addition to a redundant power supply and network in case of equipment failure, the facility was equipped with a UPS that could operate continuously for 4 hours at least to continue operational support for ongoing games

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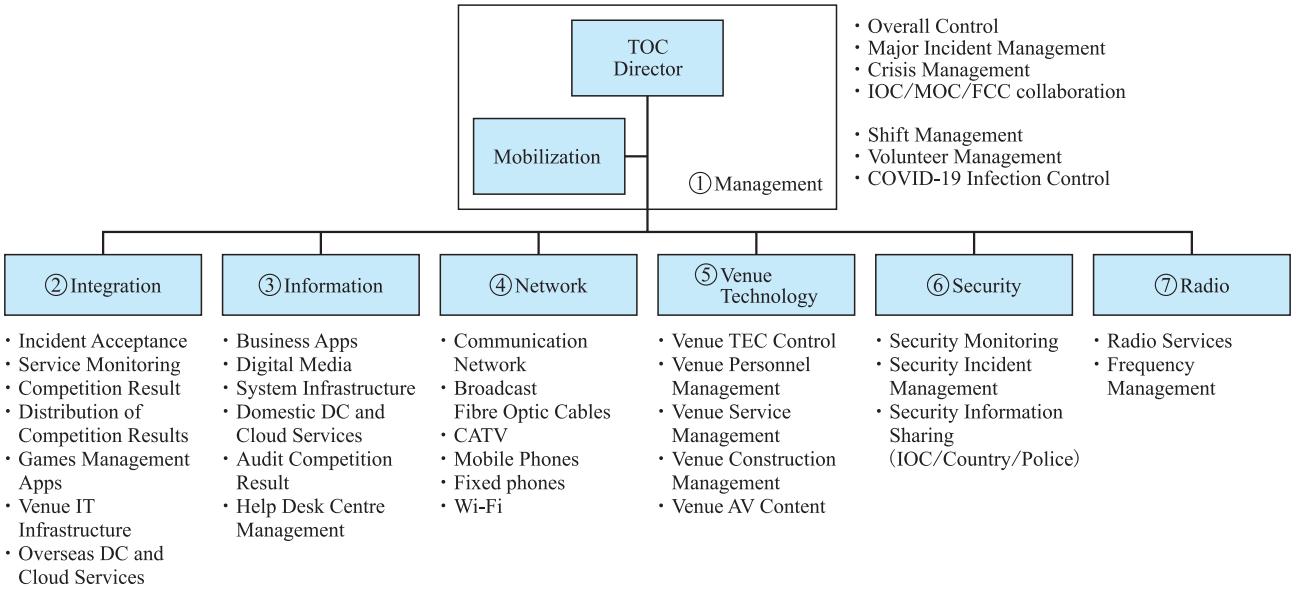

Figure 1　The TOC System

competitions and broadcasting in the event of a power outage. In addition, a backup operation centre (ATC: Alternative Technology operation Centre) was secured within the Tokyo Metropolitan area to continue operations in the event of a complete shutdown of the TOC due to fire or other reasons.

To resolve complex, critical incidents, it is necessary to discuss with staff at the data centre in Europe and development teams across several countries. Therefore, mulitiple online conferencing systems were deployed as a countermeasure for communication tool failure. In addition, a teleconferencing system was deployed in case of internet failure.

2.2 The TOC System

The TOC was divided into seven service areas (see Figure 1), with 114 positions and a total of 171 staff members working simultaneously during the Games, including both regular and deputy staff. The TOC operated on a 24-hour basis, but some positions were only available during competition hours, resulting in a total of 551 staff members working during the Games.

① Management Division, with the Chief Technology Operations Officer.
② Integration Division, to manage competition result system, the competition result distribution system, and competition management applications.
③ Information Division, to manage the business applications, digital media, system infrastructure, and audits competition result data.
④ Network Division, to manage communication and network services.
⑤ Venue Technology Division, to manage technology services at each venue.
⑥ Security Division, to detect cyber attacks and vulnerabilities and ensure the cyber security of the Games in cooperation with the national government, the police, and the IOC.
⑦ Radio Division, to manage the radio services used at venues, and to support the application and licensing of unique frequencies used by the Tokyo2020 Organising Committee, in cooperation with the Japanese Ministry of Internal Affairs and Communications.

For the first time at the Tokyo 2020 Games, a Results Accessibility QA (Quality Assurance) Expert, as a position to manage web accessibility, was established within the Information Division ③. The purpose of this position was to improve the Web accessibility of the official competition results page on the official Games website so that not only people with disabilities but also those who are not accustomed to Web information could freely access the information they needed. Checks were conducted with the goal of WCAG 2.1 (Web Content Accessibility Guideline) compliance. During the construction phase of the website, user acceptance tests were conducted with the cooperation of students from the University of Tsukuba. As a result, 90% of the

remaining Web accessibility issues from past Games were resolved. The people involved in past Games also commented that "a new Web accessibility standard for the Olympic and Paralympic Games has been established, and can be used as a legacy for future Games".

2.3 Infection Control Countermeasures for Coronavirus Disease 2019 (COVID-19)

In March 2021, one month before the final phase of the test event began, Japan entered the fourth wave of the coronavirus pandemic. Overseas staff members who arrive in Japan just before the event are the core of event management and cannot be replaced. An infection could have had a significant impact on the event operations. Therefore, more than just standard infection control countermeasures, we had to hastily develop COVID-19 infection control countermeasures to prevent a shortage of operational personnel due to the pandemic during the Games.

As mentioned above, the spacing between seats was increased to ensure physical distance. A room was secured to allow temporary evacuation and continued operations in the event of a cluster of infected persons in TOC. It was necessary to secure meal space for overseas staff, install acrylic panels to prevent the droplets from spreading, conduct PCR tests for overseas staff at regular intervals (later expanded to regular testing of Japanese residents during the Games time), and isolate them during lodging and transportation. For this reason, a dedicated infection control position as a new mobilaization team was added to the Management Division in TOC to formulate plans for the above COVID-19 infection control countermeasures and to manage and support the activities of overseas staff.

The COVID-19 infection control contermeasures were implemented reliably by full-time staff without adding new duties to the operations of existing positions, resulting in the suppression of large-scale COVID-19 infections during the Games.

The need for a dedicated COVID-19 infection control position and the COVID-19 infection control standards developed for the Tokyo 2020 Games was passed on to the Beijing and Paris Olympic and Paralympic Organising Committees after the Games.

3. Operations of the TOC

3.1 Incident Management

Technology incidents were discovered and reported through various channels, including technology staff at venues, reports from technology service users to the Technology Call Centre (TCC), maintenance centres of partner companies, and cloud service companies including those overseas. All porblem information was fed into an ITSM (IT Service Management) tool compliant with the ITIL international operation standards for centralized management of incidents, problems, and change management.

All incidents were classified into five categories according to the severity of the failure, Severity 1-4 and Service Request. Incidents with a significant impact or risk to the competition, broadcasting, or reputation were defined as Severity 1 or 2 incidents. TOC managed Severity 1 and 2 incidents as a series of lifecycles from recovery confirmation, root cause investigation, and recurrence prevention, while other incidents were resolved at the venue or TCC.

Each incident was dispatched to the TOC staff as a problem ticket. The staff who received the ticket handled it following the operational design document called Policy and Procedure (PNP) for each position, the activity list described in the operation manual, and the troubleshooting procedures.

To deal with problems that could not be solved by technology, such as power outages, TOC used a higher-level incident management system that was separate from tecnology incidents ITSM and shared information with the Main Operation Centre (MOC), which was the headquarters for Games operations, and the operation centres established for each field, such as energy, security, transportation and sports, to address all problems.

Since TOC had many overseas staff members, all communication, PNP, ITSM input, daily operation reports, etc., were conducted in English. On the other hand, operations at the higher-level Main Operation Centre and the operation centres for each business field were conducted in Japanese.

3.2 System Architecture Framework

The systems related to the Olympic and Paralympic Games were so large that it was difficult to understand the impact of a single infrastructure service failure quickly. Therefore, a matrix of system architecture

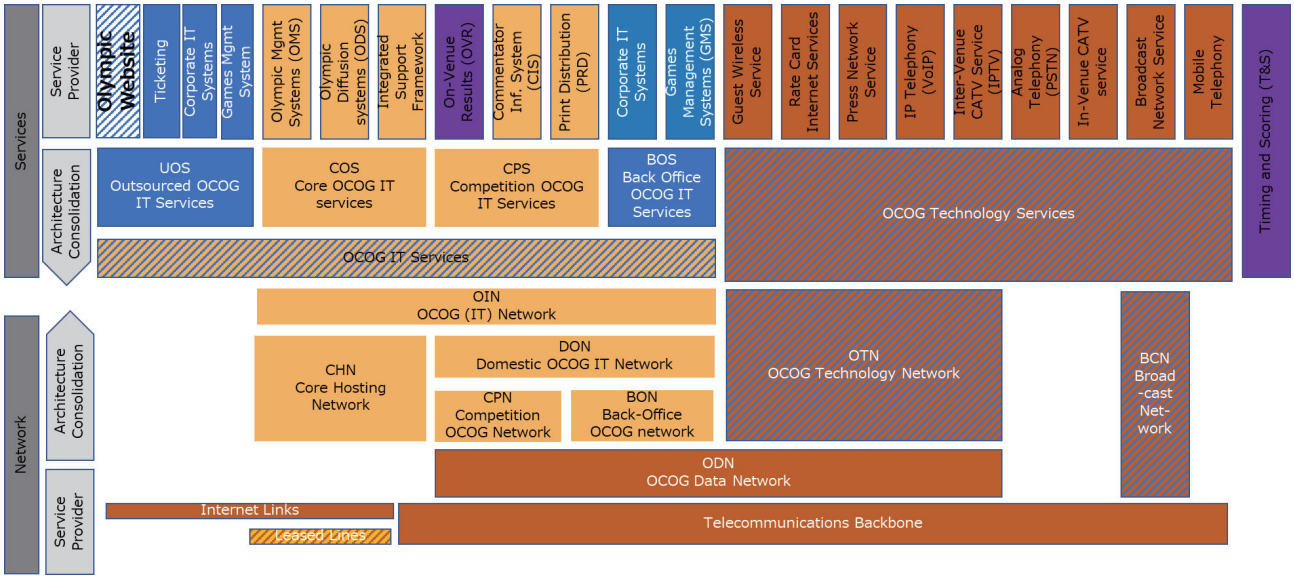

Figure 2　System Architecture Framework

framework was created to provide a bird's-eye view of which networks each service at the application level was implemented on, which service infrastructure it was built on, and which parties were using it, in conjunction with Technology Rehearsal 2, which was the final operational test for the entire technology (Figure 2).

In the event of a system problem, TOC staff could quickly and appropriately understand the impact of the problem by referring to this matrix and contacting the affected users and the Games stakeholders supporting the users.

3.3　Use of SNS for Communication

Communication between TOC and external parties, such as venues, was conducted via cell phones and emails. However, SNS was also used mainly for following two purposes at the TOC, taking advantage of the characteristics that enable effective one-to-many communication,.

(1)　Communication between the TOC and Venues

In addition to handling severe incidents escalated from venues, TOC was also responsible for daily management, such as the start and end of work reports from each venue, requests for extension of work hours, and notification of the completion of daily reports. All of these were done by cell phone or e-mail, which were often complicated and burdensome for the operational staff. There were also occasions when it was necessary to provide support for incidents to multiple venues simultaneously. For these reasons, closed SNS group chats were often used.

(2)　Emergency Communication within the TOC

Severe incidents required information to be shared with the staff working in the TOC at the time of the incident and with the staff of the next shift and off-duty highly skilled professional staff. Therefore, whenever a serious incident occurred, the progress status of the incident was shared with everyone via SNS every 15 minutes, which was effective for quick handover and problem-solving.

The use of closed SNS as a communication tool for large-scale operations such as event operations is expected to expand in the future.

4.　Operational Results

TOC began operations in April 2021 for the final phase of the test event during daytime hours only, and then shifted to 24-hour support operations in conjunction with the opening of the Olympic and Paralympic Village, Main Press Centre, and International Broadcast Centre. Total working hours were 53,000 hours for the Olympic Games and 29,000 hours for the Paralympic Games, with the participation of 17 partner companies and other related organizations in Japan and overseas.

Table 1 shows the severe incidents that occurred during the Tokyo 2020 Games. Severity 1 incidents, having the highest severity, occurred once on the day of

Table 1 Severe Incidents

Classification	Severity1	Severity2	Overview
Competition Result	5	16	Failure of the competition result system, failure to distribute data required for broadcast, data registration errors
Competition Result Distribution	3	4	Failure of the Olympic diffusion system
Power Supply	1	6	Breaker down
Digital Media	1	2	Problems with the official Games Website
Other	0	9	Failure of the Games management application, failure of AV and video, failure of cloud services
Total	10	37	

the Opening Ceremony and five on the following day, with the last incident occurring on July 28, all of which were concentrated immediately after the start of the Games.

There were 21 incidents in which data was not correctly registered or distributed due to the failure of the On-Venue Result System as a competition result system. In 5 cases, the competition was temporarily halted because the data were judged to be important for the competition. In the other 16 cases, the On-Venue Result system distributed operations between two systems in active use. By switching to backups within the service level standard, there were no significant interruptions to the competition operations.

All 7 incidents in the Olympic Diffusion System as a competition result distribution system were caused by insufficient CPU, memory, and disk resources. This may have been due to a more than anticipated increase in system usage by users because of the remote participation of media, press, and other Games stakeholders from outside the competition venues due to the Games being held during the coronavirus pandemic. The system was restored without problems by adding resources and tuning the system performance.

All of the power supply incidents were due to power breakers going down. It was not until the preparation phase, just before the Games, that it was discovered that the breakers went down due to insufficient capacity of the detection circuit for the leakage current capacity of the IT equipment. Most countermeasures were implemented before the competitions began, but one Severity 1 case occurred on the first day of the Games due to an omission in the processing of the scoreboard. The other 6 cases Severity 2 caused breakers to go down for reasons unknown, but the backup system continued all services.

5. Conclusion

For the Tokyo 2020 Games, the systems to be used throughout multiple Games were deployed in data centres outside Japan provided by a worldwide partner. The systems to be used only for the Tokyo 2020 Games were deployed in data centres in Japan. Furthermore, SaaS (Software as a Service) was utilized to reduce the amount of development, and a public cloud was used for system backup. This was the first project in the Olympic and Paralympic Games history to integrate operations in a hybrid environment. In addition to the large number of services provided, there were many people involved in the construction and operation of the Olympic and Paralympic technologies. The experience of operating IT systems with multiple vendors both domestic and international is rare case in Japan, and it was a major challenge to manage the technology.

Although the Tokyo 2020 Games had fewer severe incidents than past Games, they were all resolved within the stipulated timeframe, minimizing the impact on the Games. This was due to several factors, including the test events and technology rehearsals held before the Games, which provided practical experience with an operational structure and system equivalent to the actual Games, and that sufficient training was conducted during the preparation phase of the competition, including the repeated simulations of tabletop exercises during the postponement period to ensure basic operational behavior. TOC also functioned effectively because instructions from TOC to each venue were accurately communicated to ensure smooth operations, even concerning the everchanging COVID-19 and typhoon measures.

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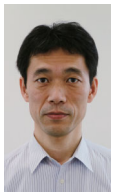

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He graduated from Utsunomiya University in 1989 with a Bachelor's degree in Engineering and Information Technology and completed his Master's at the same University in 1991. He joined Nippon Telegraph and Telephone Corporation in the same year. Since then, he has been engaged in research on databases and open-source software. During the Games, he was seconded to the Tokyo Organising Committee of the Olympic and Paralympic Games, where he was in charge of technology related to venues.