System Integration and Games-time Observation Remastered for Pandemic Response

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Abstract

An inside look at system integration and operations for the Olympic and Paralympic Games Tokyo 2020, a very special edition run with one year postponement and under pandemic restrictions. Teams from Atos, the IOC, the Tokyo 2020 Organising Committee and technology partners worked as one to implement innovative ways to work under these circumstances. Their rapid response—on a foundation of digital excellence—mitigated the impact on people, processes and systems. This article shows how the pandemic directly affected integration, operational readiness and operations. By the Olympic and Paralympic Games Tokyo 2020 time, the only noticeable impact was the elevated importance of observation and IT service management.

Keywords : Atos, Integration, Testing, Operations, Observation

1. Introduction

Atos, as Worldwide IT Partner to the Olympic and Paralympic Games, has overseen system integration for critical systems since 2002. This covers everything from infrastructure to applications, whether they're delivered from the cloud, dedicated data centres or servers at venues.

As integrator, we ensure that the full system meets functional requirements, meaning that all functionalities work as expected from a user's perspective. We also ensure it meets the more technical, non-functional requirements such as performance, stability, availability and, of course, security. Additionally, the integrator supports the OCOG in preparations and operations, providing processes and tools.

This article provides an inside look at system integration and operations for the Olympic and Paralympic Games Tokyo 2020 (hereinafter referred to as "Tokyo 2020 Games"), a very special edition run with one year postponement and under pandemic restrictions.

2. System Integration, Impact of the State of the Emergency Declaration and Postponement

The integration team began as usual by building a strong presence in the host city, Tokyo, supported by centralized remote resources and the Atos Integration Test Lab (ITL) in Spain.

The team in Tokyo shared a building with the Tokyo 2020 technology departments and technology partners (blue in Figure 1). Working in person without having to coordinate time zones was key to facilitating communications while addressing multiple aspects of system integration.

The centralized/remote teams (gray in Figure 1) remain in place from Games to Games, contributing vast experience to each edition. The ITL team extensively tests all critical systems and their interfaces. Testing includes delivery acceptance, standalone, end to end, multisport, technical, security, failover and disaster recovery. The full technology team peaked at around 3,500 staff at Games time.
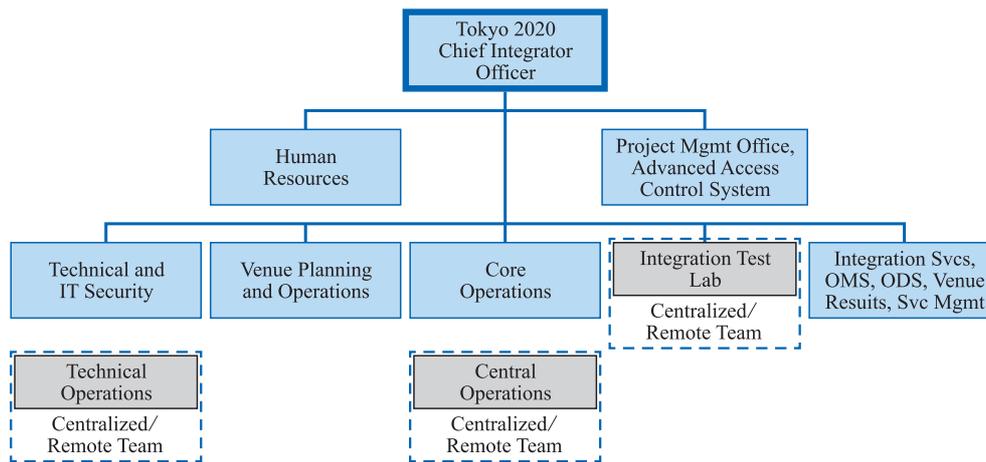
Figure 1   Integration Team Structure   Blue : on-site teams. Gray : centralized/remote teams.

When the Tokyo 2020 Games were postponed in March 2020, we activated several mechanisms in parallel to streamline the on-site presence. Some teammates were reassigned to other projects, including Beijing 2022. Others were furloughed, and there was also some natural attrition. Then, at the beginning of 2021, we progressively re-staffed to reach full capacity in March 2021.

2.1   Business Requirements

The decision to postpone came just weeks before the Uniform and Accreditation Centre opening in Tokyo, with all Olympic Management System (OMS) modules live with external users. Immediately, our customers—Tokyo 2020 functional areas, press, broadcasters, International Sports Federations (IFs)—reviewed their business plans and requirements. All had to adapt to the new schedule, cascading significant changes in configuration and business processes in the six months before the Tokyo 2020 Games.

Big organizations were limiting travel to Tokyo or reducing their venue presence. Therefore, requests for remote access to the information systems for press and broadcasters increased significantly, modifying the service-level agreement (SLA) and testing targets. Notably, the video press conference system, an innovation for Tokyo, became a critical feature preferred to physical presence at the conferences.

The IFs defined competition format changes for some disciplines, impacting Olympic Diffusion System (ODS) outputs and the results system. (See in this special issue "3-6 Olympic Diffusion and Management Systems : Tokyo 2020, Bringing Agility into Critical Application Delivery", for details about OMS and ODS.)

Because of the one-year postponement, some platforms became obsolete and new versions of browsers, operating systems and other base software had to be considered.

2.2   System Integration

To cope with the postponement impact, the results system altogether was frozen until the beginning of 2021. At unfreeze time, the challenge was to absorb the impact on the planning and integration of the results system.

Postponement also forced Tokyo 2020 preparations to overlap with Beijing 2022 and Paris 2024 preparations. While the OCOG is dedicated to a single Olympic Games edition ; Atos, the IOC and other technology partners are organized and staffed according to Olympic cycles. This overlap, combined with the changes and uncertainty of the pandemic, generated a high level of risk.

The full rescheduling of integration milestones (marked by each testing event) was monitored closely through strong integration governance involving Atos, the IOC, Tokyo 2020 and technology partners.

A continuous risk analysis was run, materialized by periodic stakeholder meetings. Key performance indicators (KPIs) including defect tables, testing progress and milestone achievements were available weekly, supporting the definition of mitigation actions.

2.3   Integration Testing

The ITL, the heart of integration testing, occupies a 1,000-square-meter, access-controlled facility that operates 24/7. It is divided into cells for virtual sports,

Games venues, ODS testing and OMS testing.

Having the ITL in Spain strengthened relationships with providers, partners and clients because most of them are based in Europe. When travel outside the EU was restricted, they could easily visit the ITL. One of the most beneficial aspects of this location was the frequency with which broadcasters were able to visit. They could regularly check the status of sports, review requirements with the testing team, follow end-to-end testing closely and perform validation tests on-site without travelling.

On the other hand, this generated a challenge to the integration team as a whole, with one part based in Japan and the other in Spain. Working in different time zones, we ensured close communication through a strict underlying governance, but meetings at odd hours for both teams were still unavoidable.

2.3.1 Virtual Environment

The virtual sport cells occupied a space (as shown in Figure 2) with physical terminals to access virtual environments that simulated the results system in the cloud. There was also an additional desktop machine per cell with dual graphic cards to reproduce the results scoreboard graphic screens. From any virtual sport cell, it was possible to simulate and test any sport competition by accessing each ODS and result application in the cloud. This enabled enormous flexibility when testing.

When the pandemic started in March 2020, a challenge was promptly overcome : setting up enough equipment at each tester's home to test remotely in the virtual environment. Fortunately, most of the applications could be tested virtually, and we had all the means

Figure 2   Volleyball Cell in Integration Test Lab (©2021-International Olympic Committee-All Rights Reserved)

to continue the integration test of the results system with few exceptions. The integration team was able to test from home and still run testing milestones with clients by accessing the machines remotely without stopping the project. Paralympic broadcasters' user acceptance tests and the Paralympic results and information system validations with the International Paralympic Committee and the IFs also happened remotely with successful outcomes.

2.3.2 Games Venue Cells (GVC)

In the ITL, several cells were equipped with hardware provided by Tokyo 2020 specifically for the results system. They were called Games venue cells (GVCs).

The main goal of the GVCs was to install as many sports as possible to validate that the results system would run properly on the actual hardware used at the venues. Simulating the sports competition in a GVC also allowed validation of base images and actual capacity of ODS physical venue servers as well as touchscreen laptop functionalities for the Commentator Information System and printed results reports.

The ITL followed government instructions in terms of maximum number of staff, hygiene rules, etc. Procedures were adapted to allow access to the GVC for minimal necessary activities while respecting safety rules. This included rotation of staff to limit the number of people in the space at any given time.

2.3.3 Increase of Volume

Another challenge, arising very late in the project life cycle, was to accommodate a much bigger volume of customers using ODS applications remotely due to the coronavirus disease 2019 (COVID-19) situations. It happened late in the project and required much more emphasis on nonfunctional validation. This increased the complexity of the cloud test and required setting up a number of extra simulators in the lab to generate load.

3. Operational Readiness, Impact of the State of the Emergency Declaration and Postponement

3.1 Technology Rehearsals

Technology rehearsals 1 and 2 (TR1 and TR2) are key exercises to check the technology team's operational readiness, taking place in the ITL and the venues. The busiest days of Olympic competitions are simulated while Technology Rehearsal Officials (TROs) trigger

scenarios to check team reactions, effectiveness of policies and procedures, and team understanding of the policies and procedures.

Travel restrictions and the state of the emergency declaration hit just before TR1 in March 2020, preventing some teams from traveling to Tokyo or to ITL. In a few days, the Atos team proposed and prepared to run the results system TR1 virtually by triggering scenarios remotely from the ITL. That way, TR activities among the on-site teams took place in the venues as planned.

These digital TRs brought many learnings that improved communication and operations between the on-site Technology Operations Centre (TOC) and venues. It was our first technology success to overcome the pandemic impact and progress our Tokyo 2020 preparations. It sent a strong message that technology would adapt and be ready to deliver.

TR2 took place from May 31 to June 4, 2021. During the pandemic, the venues operated with different teams in bubbles that could not mix. Bubbles at the venues for TR2 prevented the TROs from fully observing the results activities.

Atos came with an innovative approach : One of the two Venue Results Managers located inside the results bubble was selected to become the Results TRO, complementing the initially planned TRO. This allowed the results technology partners who could go to Tokyo, to go and have a meaningful exercise.

3.2 Training

Traditionally, our training strategy is built on a variety of delivery means : hands-on classroom training, face-to-face classroom training, table-top exercise and e-learning.

During and after the COVID-19 suspension period, all training was delivered by e-learning or online meetings. Some presentation courses, such as the Atos Venue IT Manager (VITM) in-person presentation courses, were converted into e-learning courses.

While the number of new resources without experience was increased by the postponement, the effort required to convert classroom training to e-learnings paid off with a good level of training.

4. Tokyo 2020 Games Operations, Impact of the State of the Emergency Declaration and Postponement

4.1 Communication Tools

Games operations are structured in 2 layers :

- Central, provided by the TOC in Tokyo and its satellites, such as the Central Technology Operations Centre (CTOC) for Atos mission-critical systems, based in Barcelona.
- Venue-based, with a technology team in the competition and non-competition venues.

In all previous Games editions, one of the challenges has been to ensure fluid, well balanced communication and coordination :

- Inside the TOC, where 130 staff are working per shift.
- Between the TOC and its satellites.
- Between the TOC and the venues.

For the Tokyo 2020 Games, the use of communication, knowledge and collaboration tools spiked. These tools were always used during preparations, test events and TRs ; but they were a lifesaver during the pandemic.

4.2 Virtual Meetings

The need to respect social distancing in the TOC led to replacing traditional standup meetings, held at shift change, with virtual meetings where the key Duty Managers in the TOC were reporting twice per day. This was very successful, also allowing a broader audience to join the meetings. Duty Managers who were not on shift, and executives from the IOC and technology partners could join virtual meetings to easily increase their dynamic understanding of the operations.

4.3 Planning and Policies

COVID-19-positive cases within the Atos TOC team were immediately isolated and, following Japanese confinement rules, moved to a specific accommodation. Luckily, all of our cases were either asymptomatic or lightly symptomatic. Infected teammates could work from the government accommodations using our monitoring tools, chats, calls and online documentation related to their specific areas. To allow that, we implemented a policy of TOC members taking their

laptops with them after every shift. This policy increased the planned equipment requirements from one laptop per TOC role to one laptop per person.

We also had a few positive cases in the venue teams, where presence at the venues is mandatory due to the dynamic of the results activity. When evaluating the impact of the pandemic, we had anticipated extra resources available to cover temporary attrition. This allowed us to efficiently mitigate the impact.

4.4 Crisis Communications

The traditional bridge opened to manage high-severity incidents and crises involves the TOC Duty Managers and executives of the concerned parties. For Tokyo, our bridge was enhanced with a chat that remained open for each high-severity incident's duration, allowing updates between formal calls to all involved stakeholders. This was extremely efficient, helping to meet two goals : limiting the number of calls, which allows teams to focus on resolution, and providing the required level of visibility.

5. Tokyo 2020 Games Operations Observation

5.1 Monitoring

Considering the extent of adaptation required to deliver this edition of the Olympic and Paralympic Games, observation and monitoring were relatively unchanged-but never more critical.

5.1.1 System Monitoring

System monitoring covered all systems hosted in Atos cloud and was heavily used by Tokyo 2020 as well as key Competition Network (CPN) and back-office OCOG Network (BON) providers such as Fujitsu, NEC and

Figure 3 Monitoring in the TOC sharing simple and effective dashboards on the display wall. (©2021-International Olympic Committee-All Rights Reserved)

NTT.

The initial Flash-based solution was nearing the end of its life but would have supported Tokyo 2020. The one-year postponement allowed us to migrate it to a modern software-as-a-service platform between Q3 2020 and Q1 2021, before the obsolescence could block the new schedule. The new solution provided quick value and supported a smooth transition for all parties involved.

System monitoring was projected onto walls in the TOC and CTOC (shown in Figure 3), and each key team had its own dashboard displaying the main resources supporting its services.

5.1.2 Virtual User Monitoring

Virtual user monitoring (VUM) was a new addition to the monitoring solution for Tokyo 2020. It leverages the W3C WebDriver protocol to orchestrate a web browser to monitor web applications.

It does so by executing functional scenarios (e.g., login to application, click on menu, check displayed text) to assess the health of the service. If the scenario fails (e.g., a button does not show, or page shows an error message) or if health indicators are bad (e.g., an HTTP 500 error), an alert is raised.

This solution was put in place to address the growing complexity of IT services, particularly modern applications that use JavaScript frameworks and REST APIs instead of static pages. Assessing the health of such applications via traditional system monitoring can be inefficient as it cannot detect complex failures.

VUM monitors all OMS/ODS applications, as well as ITSM and documentation management. It was the key monitoring tool shown on the TOC display wall.

5.1.3 Venue Device Monitoring

Venue device monitoring (VDM) consisted of an agent that regularly (every 5 minutes) executed probes on a device to collect KPIs or perform sanity checks. This was then reported to a central management server that published a dashboard made available to teams in the venues, TOC and CTOC.

The VDM's simple red/amber/green status dashboard was heavily used during operations to efficiently monitor venue device health. It also covered the venue data centres for basic monitoring in complement of their system and application monitoring tools.

5.1.4 Application Monitoring

Detailed application monitoring was provided to the

Figure 4　Tickets Logged Per Day and Per Severity　Note : The Opening ceremony took place July 23, 2021.

CTOC team in Barcelona using an open-source analytics and monitoring solution.

6.　IT Service Management

Atos provided the IT service management（ITSM）tool used by all technology teams in the TOC, CTOC and venues, as well as in the technology call centre. ITSM is the backbone of the technology operations, supporting the key processes that federate necessary evolutions and incident resolutions.

6.1　Incident Management

Our incident management activities focused on logging, sharing and tracking the progress of all incidents and service requests until resolution. High-severity incidents, severity 1 and 2（shown in Figure 4）, were displayed on the TOC wall and made available online for support staff, alerting all teams about urgent actions to be taken. An SLA is in place for each severity.

6.2　Change Management

Although stability is a token of quality for Games services, there are always changes that need to be carefully evaluated and managed. The Tokyo 2020 Games operations teams followed a stringent change-management process supported by the ITSM tool. When the risk was too high, changes were rejected and
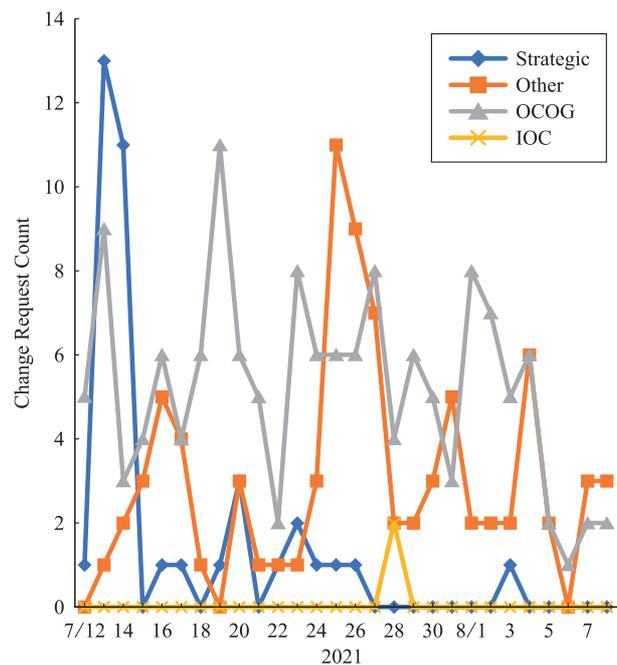

Figure 5　Change Requests

alternative workarounds were provided to ensure systems stability.

6.3　Interruption of Services

For each approved change that needs to be applied in production（illustrated in Figure 5）, a formal Interruption of Service (IOS) notice must be issued and approved
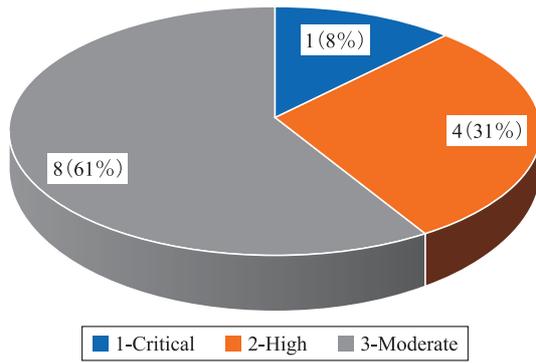
Figure 6　Logged Problems

1-Critical　2-High　3-Moderate

by all stakeholders, including end users.

This was broadly in place for the Tokyo 2020 Games, and successfully ensured awareness among all stakeholders, including the support teams, about implementation changes. This process accelerated the troubleshooting of the rare, unexpected side effects.

6.4　Problem Management

When the service is restored following an incident but the root cause is still not clear, then the resolution is flagged and followed through as a problem. The distribution of problem severity at the Tokyo 2020 Games is shown in Figure 6. We followed our normal standards to ensure all problems were closely followed up and resolved by the end of the operations.

7.　Conclusion

Technology delivery was outstanding for the Tokyo 2020 Games, under an extremely difficult situation. There may not have been spectators in the venues, but the technology teams allowed far more fans across the globe to enjoy the events and celebrate the athletes' determination through this challenging exercise.

Atos has delivered the highest levels of integration services and innovative methods to operate under the state of the emergency declaration, and implemented strong governance to mitigate risks generated by overlapping the Tokyo 2020 Games with Beijing 2022 and Paris 2024 preparation. This is paving the way for future editions. The lessons learned during this public safety crisis will help to streamline the preparation and operations of big and complex projects, with more flexible and efficient ways to work.

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Michèle HYRON, as Atos Chief Integrator for the Olympic Games, leads the consortium of technology partners that designs, builds and operates its mission-critical IT infrastructure and systems. She has managed various aspects of the Games' integration and operations for 20 years, dedicating the last 10 to her current role. Michèle graduated from Ecole Polytechnique Feminine in France with a degree in Computer Science.