

Olympic Diffusion and Management Systems : Tokyo 2020, Bringing Agility into Critical Application Delivery

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The Olympic and Paralympic Games are a unique event that moves from host city to host city every two years, between Summer and Winter editions. Every host city starts from scratch to plan and implement all the needed systems to ensure successful delivery of these celebrated historic events. Atos, as Worldwide IT Partner to the Olympic and Paralympic Games, supports each host city's Organising Committee for the Olympic Games (OCOG) by providing integration services and managing applications. This article focuses on our application services, which have delivered the critical Olympic Management System (OMS) and Olympic Diffusion System (ODS) since the Olympic Games Barcelona 1992. The article begins with some highlights of the critical applications we deliver. Then it describes the transformations we have introduced to optimize delivery quality, timing and outcomes.

Keywords : Atos, Application transformation, OMS, ODS.

1. Introduction : What are Critical Applications?

OMS and ODS are the two categories of applications called "critical International Olympic Committee (IOC) applications" as they support the Olympic Games' core functionality. They ensure the Games are run consistently from one edition to the next, following business processes and standards defined by the IOC.

1.1 Olympic Management System

OMS is a set of applications that support the OCOGs in preparation for the Games. These applications include :

- Workforce Management System :

Workforce Management implements a proven business process to support the OCOG in defining the

staffing plan for the Games. It balances the needs of all OCOG functional areas, venues and facilities. It coordinates coverage for extended Games-time work hours, and supports selection and allocation of staff (volunteers, contractors and paid staff) to fit in the needs of all required positions.

Then the system supports the OCOG in assigning staff, following up with training needs and assigning a roster for each person. Once that's done, it transfers the information to the Accreditations system to obtain secure venue access for the entire workforce.

- Volunteer Portal :

The volunteer program of each host city is a vital part of the Games, providing a unique opportunity for locals to be active participants. In turn, they help the OCOG to cover its big, temporary workforce demand. The Volunteer Portal is the engagement platform from which the OCOG identifies potential volunteers, interacts with them to organize interviews and training, and offers them positions. For the Olympic and Paralympic Games

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Tokyo 2020 (hereinafter referred to as “Tokyo 2020 Games”), it ensured the OCOG could effectively and efficiently manage more than 200,000 applications, which exceeded all expectations, and accept and assign more than 70,000 volunteers.

- Accreditations :

Knowing who is participating in the Games — workforce, press, media, sponsors, athletes and officials — is critical to ensuring that only authorized personnel can access the venues. It also ensures that those personnel have the access that they need to perform their duties. The Accreditations system helps the OCOG keep track of participants for the Games. It ensures that defined attendee quotas are respected, validates that participants have cleared their security risk assessments, assigns the right privileges and finally issues the Olympic ID card (Figure 1). The Olympic ID card is the only piece of identification required during the Games. It permits access to venues and many services like Games-specific transportation, and acts as a visa to enter the country.

- Uniform Management :

Halfway between Workforce Management and Accreditations, the Uniform Management system collects information from both systems to help the OCOG plan for uniform requirements and control their distribution to the different collectives.

- Competition Schedule :

Defining the schedule for the Games is not a trivial activity, as it balances the needs of many different stakeholders. Scheduling ensures the events are properly spread to comply with International Sports Federation (IF) rules as well as broadcasting and ticketing expectations. The Competition Schedule application supports the OCOG in defining the stages and progression of the Games’ final schedule. It starts at the day level and ends with a detailed, minute-by-minute plan that ensures at each step, that needed validations and approvals from external stakeholders are covered.

- Sport Entries and Qualifications :

Participating in the Olympic Games is not an opportunity any athlete can take. In order to be allowed to participate in the Olympics, each IF together with the IOC defines a set of qualification criteria to ensure fair participation of countries and athletes. They follow an



Figure 1 Olympic ID Card Presented to Advanced Access Control System (©2021-International Olympic Committee-All Rights Reserved)

iterative and incremental process beginning years before the Games to track the results of all athletes aiming to participate, to see who qualifies. They discuss and validate the resulting participants with each National Olympic Committee (NOC) and IF to generate the final list of athletes for each sport and NOC. This is all supported by the Sport Entries and Qualifications application, which has been increasingly allowing the full process to be online and automated.

- eVoting :

The eVoting application supports the election of the Athlete Representatives to the IOC Athletes Commission for each edition of the Olympic and Paralympic Games. It is one of the few OMS applications that reaches peak usage during the Games and not prior, even though preparation and setup of the voting process starts well before. eVoting offers a simple and convenient set of voting booths mainly at the Olympic Villages where athletes cast votes for their representatives in the IOC Athletes Commission. The system ensures the votes are secret and immutable, offering full transparency and reliability to the voting process.

- Access Control :

Security of the Games depends on ensuring that only authorized people can access restricted venue areas, and that their access is smooth and fluid. The Access Control

solution takes a simple approach to properly implementing the complex validation needed to grant or restrict a person's access to a venue upon display of the Olympic ID card (Figure 1). The Access Control solution manages perimeter validation at venue entrances as well as in-venue access to more tightly restricted areas.

For the Tokyo 2020 Games, Atos reinforced the security systems at the event with delivery of the Advanced Access Control System (AACS) project led by Atos. AACS was supported by key partners Panasonic, contributing solutions and equipment; and NEC, contributing its facial recognition system. AACS further improved operations by allowing access to the venues without human intervention. It also enhanced security by ensuring that the Olympic ID cardholder was indeed the person who was accredited. Altogether, AACS reduced fraud, errors and wait times at entry points.

1.2 Olympic Diffusion System

ODS applications focus on distributing information from the On Venue Results system delivered by Olympic Games Official Timekeeper, which captures and generates the official results of the events. ODS relays those results to different target systems at the right moment to ensure reliability and integrity. ODS comprises the following applications :

- Commentator Information System (CIS):

This is how commentators in the venues or broadcast centres have endless data and information at hand during live broadcasts. CIS is deployed to be always available in the venues, even in cases where connectivity is lost outside a venue, allowing commentators to continue broadcasting without interruption. In order to ensure accuracy, data is available on their screens in fewer than 0.3 seconds from the moment it is captured by On Venue Results system (Figure 2).

- Remote Commentator Information System :

Similar to CIS in venues and broadcast centres, Remote CIS is offered worldwide to commentators in their home locations to support remote broadcasting units. This service delivers event data to them anywhere, anytime in fewer than 2.5 seconds. For the Tokyo 2020 Games, demand for Remote CIS spiked compared to previous Games, because of pandemic restrictions limiting travel and on-site team sizes.

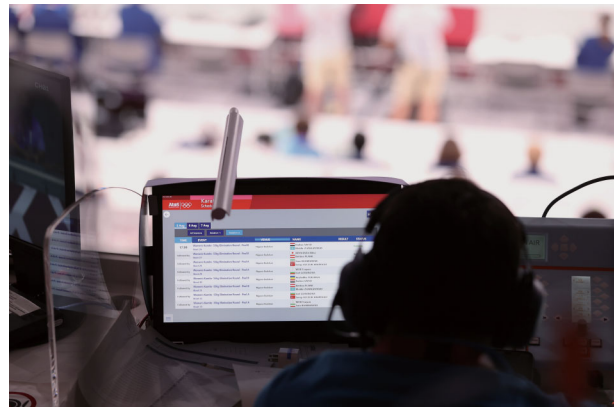


Figure 2 Karate Commentator Information System (©2021-International Olympic Committee-All Rights Reserved)

- Results Pages for the official website :

The Results Pages must provide accurate information and present it according to IOC and IF rules. This includes up-to-date information on schedules, medals, live results, data and records as well as biographical information of all athletes and officials. The results are embedded into the official Olympic website and mobile app for people around the world to access.

- Olympic Data Feed :

All the ODS systems presented thus far transform and prepare the data to be consumed by end users. But there are also many stakeholders that require the results data to be distributed in a machine-readable format. The IOC, together with Atos and the Olympic Games Official Timekeeper Partner, defines the Olympic Data Feed (ODF) standard protocol to relay all information about the Games to different stakeholders including press agencies, broadcasters and sports federations. ODF offers a pull-and-push service by which stakeholders can receive or fetch the data to be used by their systems as soon as it is available. Their feeds are customized to ensure that data will always follow the proper sequence and content for their needs.

- myInfo :

myInfo is the private website for press, media, broadcasters and the Olympic Family. It provides extended content like news items, recorded interviews with athletes and — available for the first time in Tokyo 2020 — video press conferences. Similar to Remote CIS, the myInfo service saw a significant usage increase during the Tokyo 2020 Games. It provided remote professionals all the relevant information as if they were



Figure 3 MyInfo Applications on Screens at the Main Press Centre in Tokyo (©2021-International Olympic Committee-All Rights Reserved)

in the host city.

2. Modernizing Application Delivery for Tokyo 2020

Atos has been delivering critical IOC applications (e.g., those in Figures 2 and 3) for 30 years. The applications as well as the delivery model have been evolving since then, aligned with technology advancements and best practices from the market. When planning delivery for the pinnacle of competitive sporting events, our guiding principle is always: The Olympic and Paralympic Games are not a technology showcase. Our goal is to be as invisible as possible, making everything work as expected without showing the technology behind it. With this in mind, we always perform a detailed evaluation of risks and benefits before pushing forward any changes.

When planning for Tokyo 2020 delivery, we assessed the maturity and status of the different solutions in our scope. Out of our assessment, reinforced after Pyeongchang 2018, we concluded that certain aspects could be significantly improved by transforming parts of the delivery model. After risk assessment and planning validation, we decided to launch three projects for Tokyo 2020:

- ① Transition OMS and ODS delivery to agile and DevOps.
- ② Modernize ODS applications.
- ③ Transform infrastructure as a service (IaaS) delivery of ODS applications to platform as a service (PaaS).

2.1 Project One : Transition OMS and ODS Delivery to Agile and DevOps

Up until the Tokyo 2020 project, application delivery followed a pure waterfall model by which there were several phases in the project focused on different goals:

- Requirements gathering.
- Application design.
- Application implementation.
- Testing and release.

This approach was successfully applied for many Olympic Games editions but required a long wait between the moment users provided requirements and when they could really see the expected outcomes. The normal cycle was six to nine months from requirements to release, and the number of changes delivered at once was significant. This was exacerbated by the host city changing every two years.

With each new host, our clients on the different Organising Committees are learning what it means to deliver the Games, and gaining experience over time. Along their learning journey, our waterfall model was leading to requirements not being properly understood or prioritized during initial phases. That led to outcomes not aligning with expectations at the release and requiring further changes on top of initial requirements.

Moving to agile delivery would give our clients shorter incremental releases with more participation in the full process, allowing them to react more quickly if requirements were misunderstood. With incremental releases would come regular review cycles allowing them to refine or prioritize requirements as they gain more insight into their needs. Agile was clearly the better choice for our situation.

The transformation project started with a definition of the to-be state for Tokyo 2020. Then we defined an onboarding plan, team by team and customer by customer, to ensure a smooth and progressive approach. At this phase we also identified the tools and reskilling programs needed. These steps ensured that:

- Development teams worked on the most critical items based on Tokyo 2020 priorities.
- OCOG functional area and technology teams could see what the development team was working on including early releases of the changes requested.
- OCOG functional area technology teams could adjust the requirements during development

stages, significantly reducing the number of late changes raised in the project.

Internally, the transformation to agile forced the team structure to change significantly. They had been organized by skills and expertise, with individual teams focused on requirements analysis, development and testing; and one team on application deployment and client support. With the move to agile, the teams were decomposed and re-built into multidisciplinary teams with experts in all the aspects needed to deliver the applications. This ensured that each team was as autonomous as possible and minimized the handover of work.

Having a multidisciplinary team greatly helped in promoting continuous improvement, as all team members were aware of issues end-to-end. It also increased their awareness of how services were designed, developed, tested and delivered by all team members.

Initially, these changes reduced the performance of the team while everyone was learning and adapting to the new way of working. But the benefits of the changes have been materializing over time. Now the teams are stronger and able to deliver our services with great autonomy.

While the simultaneous transformation of OMS and ODS delivery was first seen as a risk, our staged and incremental approach ensured that issues were tackled immediately and the process improved continuously.

2.2 Project two : Modernize ODS Applications

Up until the Pyeongchang 2018 Games, most ODS applications were designed and implemented for London 2012, with some components aging since Beijing 2008. By 2018, they had accumulated significant technical debt that required much team effort to manage.

That, combined with the fact that cloud services had significantly evolved since the applications were designed, showed us that ODS was not leveraging all the benefits of current cloud services.

Just after Pyeongchang delivery, we fully re-assessed the ODS solution, starting with a greenfield approach to get a totally new design for all ODS applications based on these transformation principles :

- Use off-the-shelf components as much as possible.
- Adopt microservices-based architectures with well-defined APIs.
- Ensure all components can be fully tested in

isolation.

- Leverage automation for continuous integration and continuous delivery (CI/CD).

The four objectives of this modernization project were to increase flexibility, reduce technical debt, rationalize cloud resource utilization and increase scalability options.

Once the greenfield design was complete, risk assessment and assurance allowed us to select design elements that would bring major benefits to the Tokyo 2020 project. It also allowed us to address the biggest identified issues of the solution delivered so far, and to factor in enough time to ensure secure delivery of the project.

The end design contained a combination of :

- New components developed from scratch.
- Legacy components re-architected to increase isolation and scalability.
- Off-the-shelf components replacing retired legacy components.
- Legacy components maintained as they were, interfacing with the new components.

This mixed approach allowed a staged and progressive delivery that transformed the applications, added business value and progressed incrementally without disrupting overall readiness for the Games.

The implemented architecture (Figure 4) is based on a set of legacy services together with a set of microservices replacing legacy components that had been retired. They're all connected via a message broker based on Apache Kafka and supported by MS SQL Server as relational database and Redis as in-memory database.

2.3 Project Three : Transform IaaS Delivery of ODS Applications to PaaS Delivery

We had a new software architecture and autonomous agile teams. The infrastructure delivery model needed to match in terms of increased independence between the application and infrastructure delivery teams.

In IaaS environments, it's hard to draw a line between infrastructure configuration and application configuration, as most changes performed by infrastructure teams are needed for applications to work. Moving to a PaaS environment, specifically a contained orchestrated platform, the line is much easier to draw. The platform

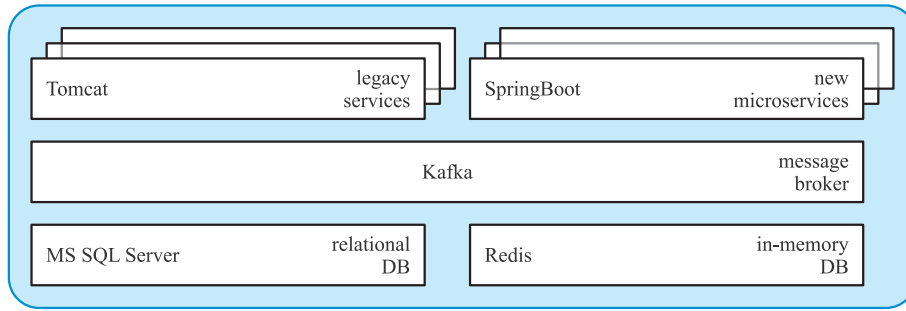


Figure 4 New ODS Software Architecture

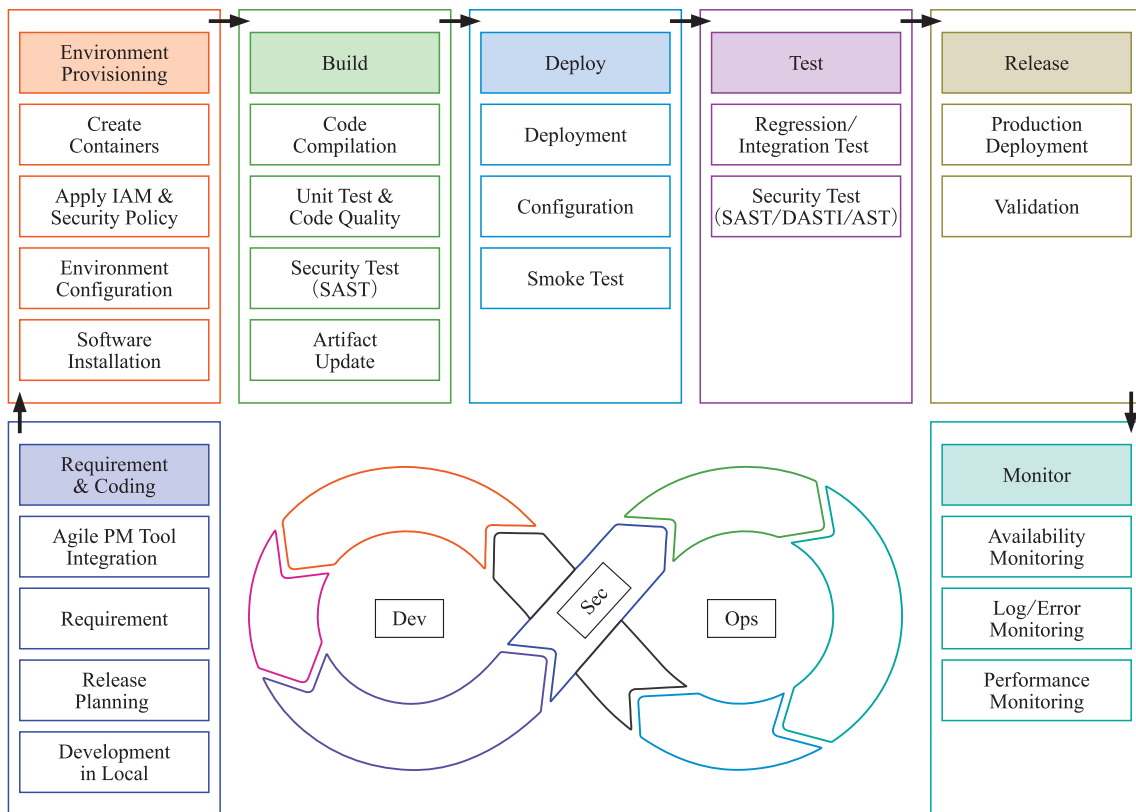


Figure 5 CI/CD Pipeline Used for Tokyo 2020 Delivery

team ensures that the container orchestration platform is available and healthy while the application team is fully in charge of application deployment.

This clear separation, together with a fully automated CI/CD pipeline, accelerated our delivery from two releases per year to one per month — with automatic availability of the new releases in the integration test environments.

The CI/CD pipeline grew during the project to incorporate more automation and controls including package generation, functional testing, security testing and deployment in testing environments.

Another important part of the pipeline that grew significantly during the project: Monitoring has been enriched to provide each team the information they need to monitor the services being delivered.

Overall, the CI/CD pipeline for the project covered the end-to-end CI/CD life cycle (Figure 5).

3. Observed Results after All Changes

The three transformation projects showed benefits, especially visible on the latest phases of the project. While at the start, introducing three transformations

caused certain delivery disruptions, during the last six months of the project we reached a stable delivery pace. That was when the coronavirus disease 2019 (COVID-19) pandemic appeared and pushed the Tokyo 2020 Games to 2021. It also brought several challenges to application delivery.

Pandemic restrictions and the new way of delivering the Tokyo 2020 Games remotely created new requirements for the application team. For some sports, new rules were announced a few months before the events to address potential COVID-19 situations during competition. Having a reliable delivery process that provides assurance on released applications was a key asset to approaching and minimizing the risks of such late changes. A strict change-control process also provided extra assurance to avoid disruptive late changes and the unnecessary risks they introduce to delivery.

Another significant observation after the transformation has been the autonomy of the different teams due to their end-to-end ownership of the applications being delivered. It's similar to what we observed with application delivery initially disrupted and then signifi-

cantly improved. From requirements gathering to live system support, having all team members familiar with all environments has enabled them to provide more effective end-to-end support with fewer incident handovers.

These transformations were key to delivering smooth and successful Olympic and Paralympic Games during the pandemic. Even with the potential risks and challenges, we not only delivered the three projects successfully but also proved the benefits of the changes during the project itself.

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