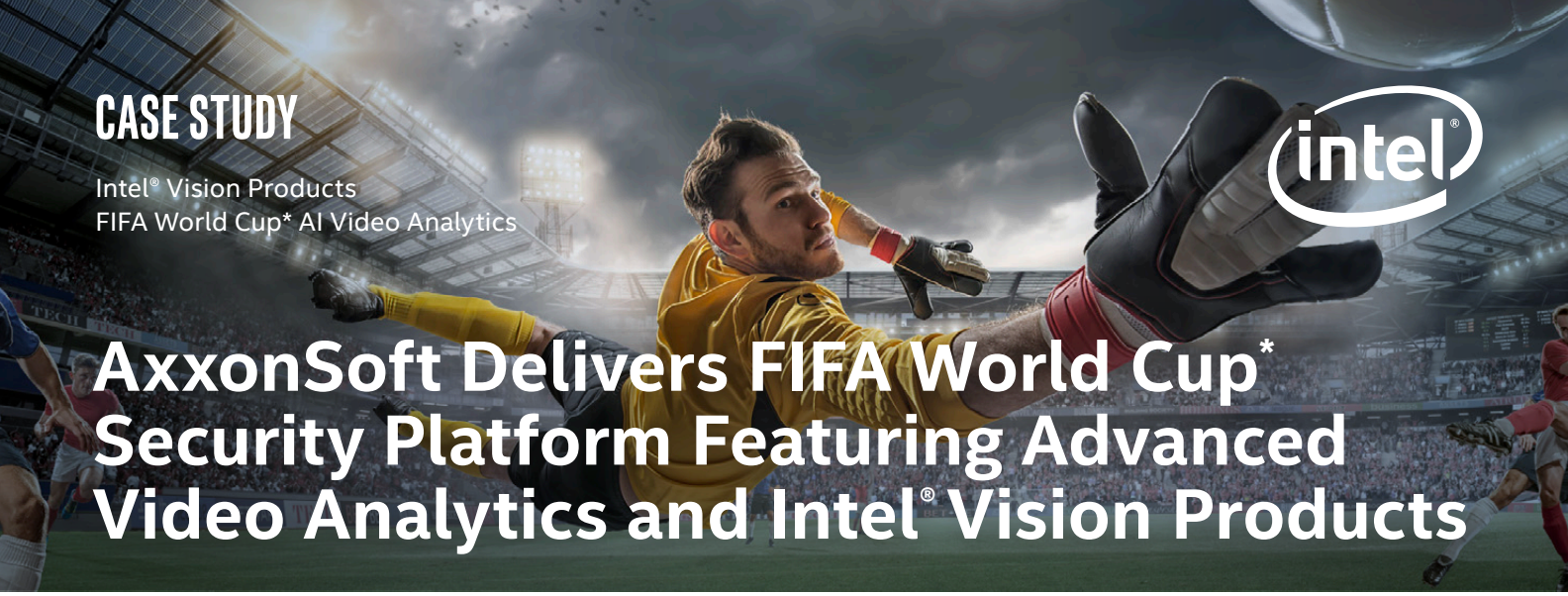


CASE STUDY

Intel® Vision Products
FIFA World Cup* AI Video Analytics

AxxonSoft Delivers FIFA World Cup* Security Platform Featuring Advanced Video Analytics and Intel® Vision Products

AI enables broad, accurate, near-real-time security for massive event

"FIFA president, Gianni Infantino, called the 2018 World Cup 'the best in its history.' In addition to commenting on match attendance and television viewership numbers, Infantino gave high praise to the quality of infrastructure and security. AxxonSoft is proud of its commitment to keeping the best World Cup in history safe. Our contribution is thanks, in large part, to our partnership with Intel."

—Alan Ataev, U.S. global sales director, AxxonSoft

Smart security and surveillance brings challenges

Large-scale surveillance and security deployments from sporting events to smart cities bring unique technology challenges. Consider the magnitude of running tens of thousands of video streams and managing devices and systems across dozens of locations throughout a city or a region. Solution providers must handle massive amounts of data; efficiently perform safety and security services at scale; detect a broad range of ever-changing threats; and continually adapt and leverage new technologies to ensure investment protection.

City operators and venue security personnel are also addressing complex issues as they integrate technology into procedures for detection, prevention, and fast response. In order to increase operational efficiency, they must achieve automation of security services at scale; ensure reliable operations; maximize productivity by avoiding false alarms; and solve a growing set of security issues with increased precision, speed, and accuracy.

In addition, IT personnel must address the considerable costs and complexity of running analytics with deep learning inference workloads at the edge. Hardware and software costs can run high, especially for specialized deep learning configurations. Solutions are frequently proprietary, requiring vendor lock-in, and difficult to integrate into legacy environments without additional investments for essentials such as power, equipment, and server cards, as well as qualified support.

In order to safeguard everything from players and spectators to venues and equipment, the Russian World Cup* organizers needed to deploy video surveillance across many cameras and sensors. The event required a technology partner that could support comprehensive security while delivering ongoing, actionable information to event security personnel. The task was further complicated by costly, specialized legacy equipment from multiple vendors, including IP cameras and network video recorders (NVRs) based on disparate protocols, and existing systems not designed to handle the increased performance and bandwidth requirements of deep learning inference and analytics.

Securing the 2018 FIFA World Cup*

The sheer scale of hosting the 2018 FIFA World Cup in Moscow was immense, involving many agencies, vendors, installations, and cities. Moscow's 145-hectare Olympic complex is one of the largest sports complexes in the world.[1] Over the course of the event, 32 teams from around the world played 64 matches in 12 stadiums located in 11 Russian cities.[2] More than three million fans packed stadiums, while tens of millions more followed the action in fan zones and other venues set up for the championship games.[2]

To meet these demands, 2018 FIFA World Cup organizers required high-quality security services and capabilities at low cost, along with the greater accuracy and precision provided by AI deep learning at the edge. Achieving these goals was possible with Intel® products, including Intel® Core™ and Intel® Xeon® processor-based servers and cameras, as well as the OpenVINO™ toolkit, which supports delivery of deep learning software and inferencing for video use cases at the edge.

With the AxxonSoft and Intel solution, the World Cup achieved new AI deep learning analytics capabilities and investment protection. Their existing CPU processors gained an 8x performance boost running deep learning workloads at the edge on Intel Core processors.[3] Intel Xeon processor-based video surveillance servers achieved an 8.3x performance increase running deep learning workloads using the OpenVINO toolkit to support human detection, perimeter security, and improved safety and security in the stadiums.[4]

All of this was supported using existing installed Intel® hardware and software at the stadiums, operating with the AxxonSoft software that brought together all of the security aspects and information sources with a single unified user interface and set of services for operational management.

Solution

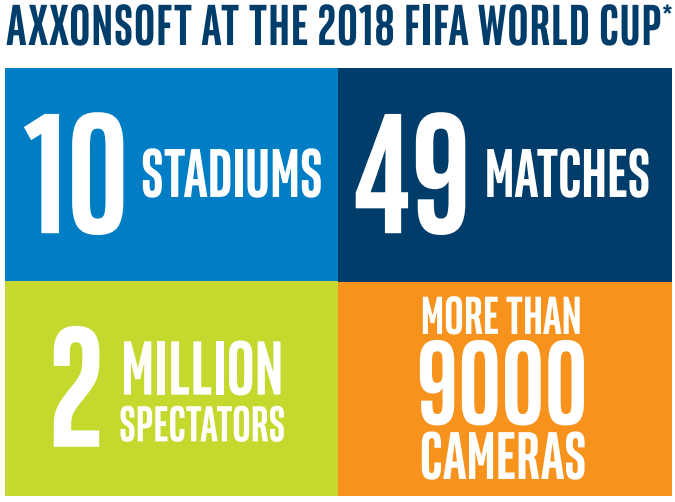
The Axxon Intellect PSIM* platform, powered by Intel® Vision Products, was the basis for an integrated video surveillance system designed to meet the monitoring needs of Russia's Ministry of Internal Affairs (MIA) across diverse World Cup sites.

The solution was deployed in various areas of 10 out of the 12 stadiums where 49 World Cup matches were played. More than 9,000 Intellect PSIM-powered video surveillance cameras were used to monitor the security of more than three million spectators who attended these games. The MIA's central monitoring station, powered by the platform, pooled over 390 video channels from all 11 World Cup host cities with video feeds displayed on an interactive map. Videos were streamed from stadiums and surrounding territories, training camps, transportation infrastructure, and other locations deemed critical for security for the participants and guests of the World Cup. Intel® technology-powered clients and servers were used at all locations. In addition, Auto Intellect* and Face Intellect* software modules were deployed to conduct automatic number plate recognition and face recognition at stadium gates.

AxxonSoft software was used as the basis for a network of operational headquarters for the MIA deployed specifically for the World Cup. The Intellect PSIM software was connected to video surveillance systems at each of the 12 stadiums via a dedicated interface complex. Video streams from interface complexes were transmitted to MIA operational headquarters set up in each host city. MIA operational headquarters also received video from cities' official fan zones. In turn, information made its way from regional headquarters to the video walls at MIA's main situation room in Moscow, as well as to the Center for International Police Cooperation (located in Domodedovo, a city in the Moscow region).

Axxon Intellect PSM benefits

- **Open platform:** Integrates any security applications, systems, and devices—whether new IP-based systems or legacy software—into a single environment.
- **Scalable:** The platform design makes it possible to connect any type of digital system or hardware, regardless of the equipment type, manufacturer, or technical features.
- **Smart:** Intelligent interpretation of data and events, combined with fast, automatic responses to any security situation, provides reliable levels of security even in complex or densely populated environments.
- **Modular:** Functional modules, such as POS, face recognition, and LPR, simplify solving specific business and security challenges.
- **Reliable and high performing:** Running on robust Intel® architecture, AxxonSoft helps ensure that quality and performance are high, even in installations with thousands of cameras on one network, or in environments with difficult conditions.



"Facial recognition can be applied to antiterrorist security at mass events, to limit access to sporting venues to fans prohibited by legal action, and to link biometric data to seats in the stadium bowl (through tickets) should information be needed to investigate incidents or riots."

—Andrey Khristoforov, commercial director in Russia, AxxonSoft

Increasing performance and capacity with Intel® Vision Products

The AxxonSoft software platform was powered by Intel Vision Products to accelerate intelligent video analytics. This allowed the Russian event organizers to leverage existing hardware and infrastructure investments while gaining the insight of deep learning inference based on convolutional neural networks (CNN) and machine learning. Across the venues, AxxonSoft's situational video analytics were employed on 250 video channels to monitor the stadiums, 41 LPR channels to monitor vehicle traffic, and nine facial recognition channels to monitor for individuals prohibited from accessing the stadiums.

High-performance Intel® technology was essential for handling the huge video streams and provided a reliable foundation for AI analytics, improving detection and accuracy to identify and prevent threats. Powered by Intel® Core™ i7-6700, processors, video streams were decoded using Intel® Quick Sync Video at monitoring centers and operational headquarters that allowed them to display 3.1x more full HD video channels per workstation.[3] Efficient use of client processing power was critical with such large numbers of cameras—by delivering added efficiency, Intel Quick Sync Video increased cost savings for the 2018 World Cup security apparatus.

Integration with the OpenVINO toolkit allowed AxxonSoft to use neural network video analytics to detect objects of a selected type (e.g., people, cars, abandoned objects). With the OpenVINO toolkit, inference performance rises by 8.3x when using Intel® Xeon® E5-2630 v3 with 32 GB RAM versus using the Caffe* library without OpenVINO toolkit.[4] For future use cases, AxxonSoft is confident that adding the latest Intel® Vision Accelerator Design with Intel® Movidius™ VPU or Intel® Arria® 10 FPGA will achieve even better results.

"Start-up was done as part of our full post-installation testing and adjusting services. Our team completed this enormous undertaking within just one month. Along with these services, we provided consultation to partners during post-installation start-up and handled requests to customize the software application. When a customized feature will be valuable for other users, we include it in the development plan."

—Roman Khristoforov, head of the Technical Support Department, AxxonSoft

AxxonSoft's Intellect PSIM is an open platform enabling integration with more than 10,000 IP video devices and more than 80 access control and security systems. Automation possibilities are virtually endless: fire alarm and perimeter security can talk to one security system; facial recognition can be correlated with LPR; alarms can automatically activate a response; and cameras in an area with an alert can be displayed on a video wall in near-real time for fast response by security personnel. Because of its open, modular design, the AxxonSoft solution achieves levels of comprehensive, accurate insight possible only when a wide variety of equipment and systems can communicate with each other.

To help ensure data privacy and security, all data is owned by the end customer and data collection follows the compliance requirements of legacy security policies. AxxonSoft does not collect data from the platform.

AXXON INTELLECT PSIM* TOOLS	
Smart video detection	• Process video footage and identify events that match certain criteria, including motion, object appearance or disappearance, line crossing, and more. • Attach events to specific system actions, such as beginning recording, sending a signal to the operator, displaying the image on a separate monitor, or starting a complicated custom script.
Smart search	• Set criteria (e.g., line crossing, motion in an area, movement from one area to another) at the time of search. • Quickly find archived video that matches custom criteria.
Face recognition and search	• Recognition engine powered by deep neural networks (DNN). • Face Intellect* automatically picks out faces in the video feed from cameras, compares them to a database (white or black list), and triggers certain scenario. • Quickly find faces that match a picture or video image and jump to event video.
People counting	• Count the number of people who go from a specified area to another and back again.
Queue length estimation	• Count the number of people standing in view of a video camera that is aimed at a customer queuing area. • Count the people who stay in the specified area for a specified length of time.
Heat mapping	• Determine where visitors stop and measures how long they spend in areas of interest. • Identify the "warmest" places at a retail store or any other trafficked location via corresponding visual cues on screen.

Intel® Vision Products

Intel Vision Products accelerate the capabilities of IoT vision systems and deep learning inference from the camera to the cloud through leading heterogeneous hardware and software combinations. Intel offers a broad range of vision products and software tools to help solution providers scale vision technology across infrastructure, matching specific needs with the right performance, cost, and power efficiency at every point in an AI solution. By providing essential insights when and where they are needed, Intel is helping businesses unlock new possibilities for their visual data.

OpenVINO™ toolkit

The OpenVINO toolkit includes the Intel® Deep Learning Deployment Toolkit with a model optimizer and inference engine, along with optimized computer vision libraries and functions for OpenCV* and OpenVX*. This comprehensive toolkit supports the full range of vision solutions, speeding computer vision workloads; streamlining deep learning deployments; and enabling easy, heterogeneous execution across Intel platforms from device to cloud.

Conclusion

2018 World Cup FIFA president, Gianni Infantino, called the 2018 World Cup the best in its history. In addition to commenting on match attendance and television viewership numbers, Infantino gave high praise to the quality of the infrastructure and security.

Together with high-performance Intel architecture, Intel Vision Products, and the OpenVINO toolkit, the AxxonSoft solution helps users deploy precise, effective, and automated security systems even in massive and complex environments.

About AxxonSoft

AxxonSoft is one of the world's leading producers of intelligent VMS and PSIM software. Since 2003, the company has been creating disruptive technologies that push the safety and security industry forward.

axxonsoft.com

Learn more

Explore Intel Vision Products at intel.com/visionproducts.

Find out more about Intel innovation for AI at intel.com/ai.

Download the free OpenVINO toolkit.

Discover AxxonSoft solutions at axxonsoft.com or contact us at info@axxonsoft.com.

1. fifa.com/worldcup/destination/cities/city=1559/index.html.
2. axxonsoft.com/company/pressroom/news/72319/.
3. Number achieved using full CPU load. **Base configuration:** Quad-core Intel® Core™ i7-6700 processor at 3400 MHz (34 x 100); 4 GB Kingston 9905622-024.A00G* DDR4-2133 x 2 (8 GB); Intel® SSD SC2BB120G6 (120 GB, SATA-III); Intel® HD Graphics 530; Windows® 10 Pro; Axxon Intellect Enterprise*; video feed: 1920 x 1080, H.264, 25 fps, 7.3 Mbps.

   Test configuration: Quad-core Intel® Core™ i7-6700 processor at 3400 MHz (34 x 100); 4 GB Kingston 9905622-024.A00G* DDR4-2133 x 2 (8 GB); Intel® SSDSC2BB120G6 (120 GB, SATA-III); Intel® HD Graphics 530; Windows® 10 Pro; Axxon Intellect Enterprise*; Intel® Quick Sync Video; video feed: 1920 x 1080, H.264, 25 fps, 7.3 Mbps.
4. **Base configuration:** 2x octa-core Intel® Xeon® processors E5-2630 v3 at 2400 MHz (24 x 100); 4 GB SK hynix HMA451R7MFR8N-TF*, DDR4-2133 RDIMM x 8 (32 GB); Intel® SSDSC2BB120G4 (120 GB, SATA-III); Seagate ST32000641AS* HHD (2 TB, 7200 RPM, SATA-III); Windows* Server 2016 Standard; Axxon Intellect Enterprise*; Caffe* 1; GoogLeNet* Inception* v1; video feed: 1920 x 1080, H.264, 30 fps, 6.5 Mbps.

   Test configuration: 2x octa-core Intel® Xeon® processors E5-2630 v3 at 2400 MHz (24 x 100); 4 GB SK hynix HMA451R7MFR8N-TF*, DDR4-2133 RDIMM x 8 (32 GB); Intel® SSDSC2BB120G4 (120 GB, SATA-III); Seagate ST32000641AS* HHD (2 TB, 7200 RPM, SATA-III); Windows* Server 2016 Standard; Axxon Intellect Enterprise*; OpenVINO™ 2018.0.200; Caffe* 1; GoogLeNet* Inception* v1; video feed: 1920 x 1080, H.264, 30 fps, 6.5 Mbps.

Performance results are based on testing as of September 2018 and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information about benchmarks and performance test results, go to intel.com/benchmarks.

Intel technologies' features and benefits depend on system configuration and may require enabled hardware, software, or service activation. Performance varies depending on system configuration. No computer system can be absolutely secure. Check with your system manufacturer or retailer, or learn more at intel.com/ai.

Cost reduction scenarios described are intended as examples of how a given Intel-based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction.

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