

## Smart Stadiums Take the Lead in Profitability, Fan Experience, and Security

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### Super-connected stadiums revolutionize the live event experience

Smart stadiums increase profitability, enhance the fan experience, and improve stadium security.

Stadium operators are in a squeeze play between fans expecting a more captivating experience and host cities looking for higher returns on their sports complex investments. With today's sophisticated home entertainment systems and the latest stats and updates available on mobile devices, they need to find new ways to fill the stadium, compel fans to spend more, and keep everyone safe.

Smart stadiums are the answer. They provide fans and staff with a wealth of information on parking availability, bathroom and concession lines, seat upgrades, special offers, and more. Fans get a convenient, personalized experience with shorter lines and directions to navigate faster through crowded stadiums and parking facilities. The staff receives immediate updates on what's happening in the venue, increasing their efficiency and ability to secure the premises.

This can be done cost-effectively by networking sensors and existing systems in the stadium using Intel Internet of Things (IoT) technologies.

#### Competing Against the At-Home Experience

Although there's nothing like a live sports or entertainment event, stadium operators are still challenged to lure fans away from the comfort of their homes, big-screen TVs, surround sound, and refrigerators nearby. As high-tech consumer devices have raised the bar considerably, it's increasingly important to offer technologically sophisticated services.

Because many fans are staying home to watch games, state-of-the-art stadiums are being designed to dramatically improve the fan experience. Significantly increasing fan interactivity with Intel technology, new capabilities such as augmented reality, interactive seats, and big screens go well beyond what's possible at home.<sup>1</sup> With literally thousands of state-of-the-art monitors installed throughout the venue, fans won't miss a play regardless of whether they are in their seats. Fans can also have real-time access to player profiles, statistical data, and fantasy performances of teams and players on their smartphones, tablets, and stadium kiosks.

#### Solution Overview

A smart stadium integrates a large number of sensors, cameras, and digital signs (Figure 1) that connect to wired and wireless networks, and servers. Sensors provide up-to-date information on empty parking spots, waiting lines, the number of hot dogs available at concession stands, and other stadium data. Cameras are used to monitor all corners of the venue and keep people safe.

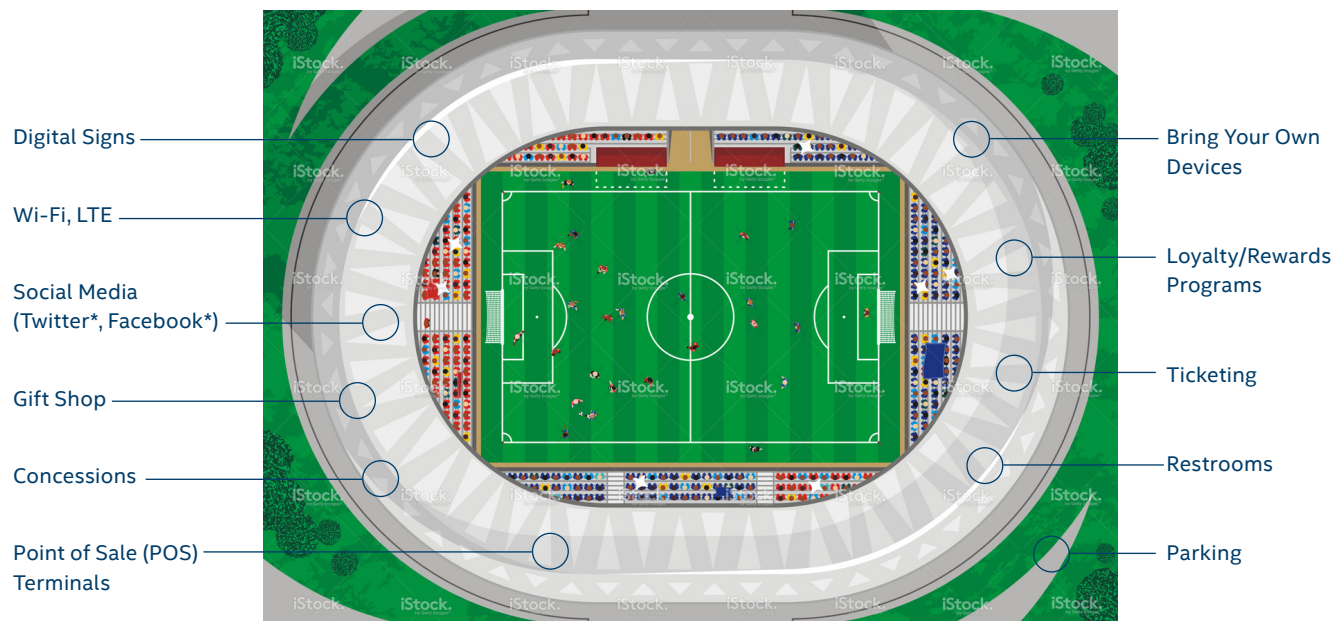


Figure 1. Typical smart stadium touch points

### Smart Stadium Benefits

The economic, entertainment, and safety impact of smart stadiums can be felt in a number of ways:

#### Profitability

Stadiums are multimillion-dollar venues, most often paid for by taxpayers with the understanding they will yield big economic dividends for the host city. This puts pressure on stadium operators to focus on profitability, which is done, in part, by maximizing revenue from fans and sponsorships, and minimizing operating costs.

In the area of revenue generation, smart stadiums can help operators make the purchase of tickets, food, and merchandise easier, faster, and more personalized. For example, fans can order food and drink from any seat in the stadium and have it delivered directly to their seats. People also have the option of ordering food from their seats and going to an express line at the concession stands to pick up their food in person.<sup>2</sup> With more convenient purchase options, operators can boost concession and merchandise sales.

Much like online shopping websites today, smart stadiums can personalize the fan experience through loyalty programs that reward them for previous purchases or suggest new items to buy based on their purchase history. This can be done with data analytics software that allows stadium operators to learn more about their patrons, as well as anticipate their behavior (Fan A always buys a hot dog after halftime). Smart stadiums can alert the staff to changing conditions (e.g., traffic, parking, weather, and concession shortages) so they can respond more quickly to fans' needs.

The infrastructure of a smart stadium can also be used to modernize the building management systems that control the heating, ventilation, and air conditioning (HVAC) and lighting systems. To keep operating costs low, the systems can be automated to conserve energy and reduce the number of people needed to run them.

To lower maintenance costs, the staff can monitor the health of everything from deep fryers to toilets, and detect when equipment is showing signs of wear. This lets them preemptively replace equipment so it won't break at the worst possible moment. Smart stadiums can also monitor traffic in bathrooms and dispatch cleaning crews when usage has reached a threshold.

#### Fan Experience

Fans have grown to expect extreme levels of digital connectedness, convenience, and customer service. They want fast Internet connections, shorter lines, better directions, and less hassle overall when entering and leaving the stadium.

Tech companies are reshaping the sports and entertainment experience for fans and sponsors by introducing new tools and mobile platforms.<sup>1</sup> Wi-Fi and LTE networks inside the stadium give fans access to the information they desire.

Stadium networks and apps enable the marketing staff to connect with fans on a whole new level, building important bridges with their customer base. Once fans opt in to an app that runs on their mobile devices, the staff can interact with them individually and intelligently. A stadium app can direct fans to the best place to park as they approach the stadium. Once inside, it can lead them to their seats, offer upgrades, order food, or guide them to the concession stand or bathroom with the shortest line.

## EXPERIENCE THE SMART STADIUM AT INTEL

The Intel “Smart Building and Venue Experience Center” in Chandler, Arizona hosts SmartVenue\*, a collection of over a dozen smart stadium capabilities built on the Intel® IoT Platform. Visitors can experience the following validated use models running in the center:

### Operational Efficiency

#### Cleaner restrooms

- Trigger a maintenance work order when the visit count exceeds a set threshold.

#### Optimized energy usage

- Allow building managers to monitor and change temperatures throughout the stadium using a mobile app.
- Use smart lights to change lighting conditions based upon certain predefined occupancy levels.

#### Improved building management

- Monitor all building systems from a single console that tracks building performance.

### Fan Experience

#### Valuable information

- Help fans navigate (e.g., wayfinding) to various points of interest on the property using a mobile app.
- Make it easier for fans to find their friends at the venue.
- Inform fans of parking space availability and direct them to lots that have open spaces.
- Ensure fans don't miss any of the action or special offers with HD monitors (i.e., digital signage).

#### Convenience

- Allow fans to order concession items from their seats to avoid concession queues.
- Enable cashless payment via mobile phones with intelligent vending machines.

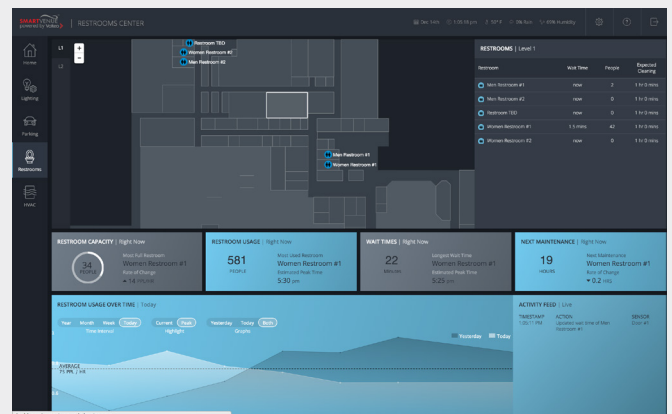
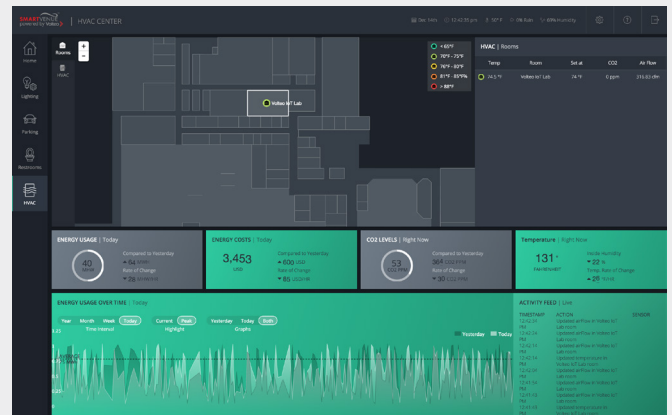
#### More fun

- Use sensors to detect cheering fans and show them on monitors throughout the stadium.
- Install wireless networks that allow fans to post on social media during the event.

### Stadium Security

#### Safer environment

- Use surveillance cameras to monitor crowd behavior and quickly detect unruly fans.
- Add facial recognition to existing ID badge process to better restrict access to sensitive areas.



Smart stadium apps can allow fans to watch replays during the game, seeing the exact replays shown by the studio as if they were watching at home on their TV. It's possible to watch the game live and get stats and other info related to the game.

Fans also want to be fully engaged with friends outside, so smart stadiums have ample Internet bandwidth to allow fans to stay connected while watching the game. The marketing staffs of sports teams, entertainers, and sponsors can dynamically interact with fans on social media, take part in discussions, post photos, tweet, etc.

Digital signage is also a key part of the digitally connected experience. Stadium operators can broadcast advertising offers and even safety tips on attractive, high-definition screens. Digital signage can announce that a fresh batch of hot popcorn or pizza is ready or when nachos are 30 percent off. This contributes to both a better fan experience and increased revenues.

### Stadium Security

With 60,000 to 100,000 excited people packed into a relatively small space, stadium operators have to be ready for anything. They need to have eyes and ears everywhere, and clear evacuation plans and crisis mitigation strategies in place for a range of situations.

Outfitted with numerous cameras and sensors, smart stadiums feed real-time data to the security staff monitoring the crowd. Security problems can be addressed preemptively since smart stadiums enable dozens (or hundreds) of staff members and external police to communicate and collaborate on problematic situations once they occur. If children get separated from their parents, stadium security can broadcast their photos to all team members' smartphones so they can be found more quickly.

### Solution Architecture

Smart stadiums require a sophisticated mix of hardware, software, and wireless connectivity to establish communication links between stadium operators, fans, and social networks. In short, they quickly collect and analyze data using cloud infrastructure, allowing stadium operators to make data-driven decisions that impact many aspects of the business. The building blocks shown in Figure 2 include:

- **Sensors:** Parking, sound, temperature, and other sensors detect and measure what's happening in and around stadiums. Sensors manufactured in volume are inexpensive enough to put on everything from soda bottles to footballs.
- **Cameras:** Infrared and video cameras are used to monitor crowd behavior, detect movement in parking garages, capture plays, secure entry into restricted areas or premium seating zones, and more, making operations more efficient.
- **Intel® IoT Gateways:** Gateways connect sensors, cameras, and other devices in the stadium to one another and the cloud.

- **Network and Cloud:** Ethernet, Wi-Fi, and mobile networks send stadium data over the Internet to the cloud, which is capable of collecting and processing massive amounts of sensor and video data generated during live events.
- **Cloud Analytics:** Cloud-based analytics software analyzes data and feeds results back into operational processes and automated systems, possibly to trigger actions: reduce the playing field temperature by five degrees or notify the inventory staff that a concession stand only has three pizzas left. Analytics software also helps stadium staff visualize trends and drive strategic insight for long-term planning.
- **Data Security:** State-of-the-art data security technologies ensure personal data, like credit card numbers, is securely transmitted over communications networks. Smart stadiums need to implement strong physical security measures, such as secure access to servers and the data center, and strong policy management to prevent unauthorized access to devices and applications.

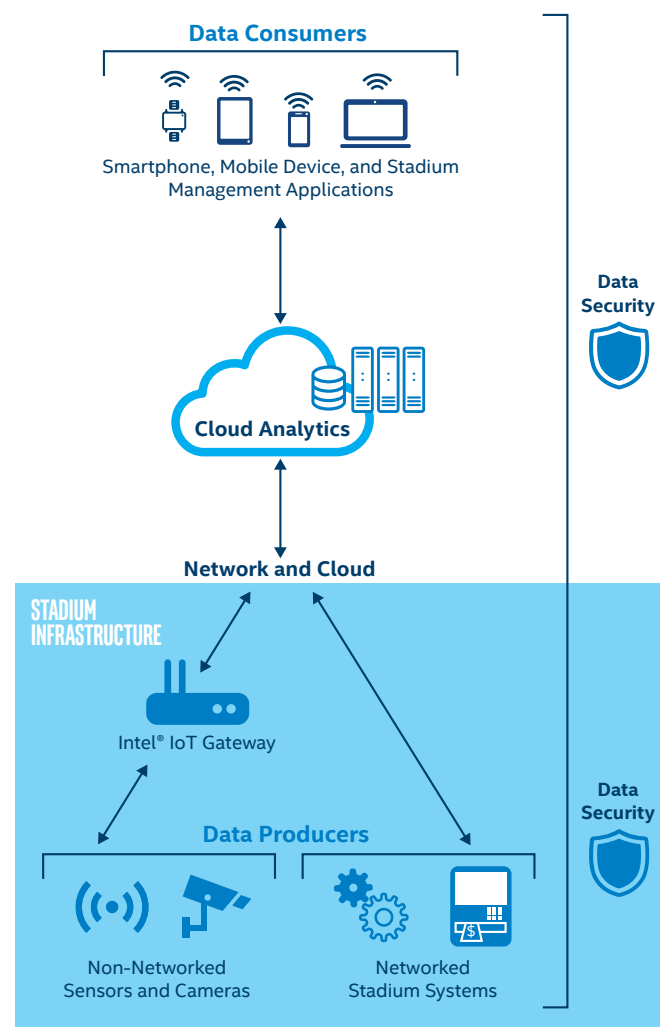


Figure 2. Smart stadium architecture example

- **Smartphone applications:** Smartphone apps (Figure 3) are central to delivering outstanding fan experiences, with services such as push notifications, social networking, navigation, and food and merchandise ordering.

## Summary

Stadiums are big business and can play a vital role in the long-term financial viability of the host sports organization. The key is to attract more fans and provide an experience that encourages them to increase their spending. This is being done with smart stadiums, which enable stadium operators to increase profitability, enhance the fan experience, and improve stadium security.

To learn more about smart buildings, visit [intel.com/iot/smartbuilding](http://intel.com/iot/smartbuilding).

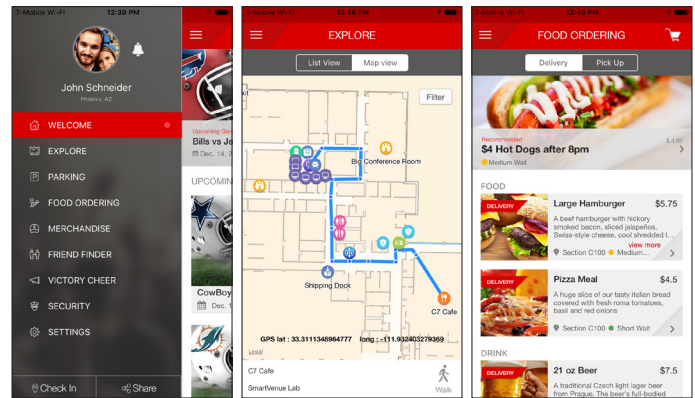


Figure 3. Smartphone applications

## About Volteo

Volteo provides products and services to simplify and power business transformations for customers in a digitally connected world. SmartVenue\* is a suite of products and service offerings from Volteo aimed at transforming sports arenas, office complexes, and other sites into smart spaces within which humans can enjoy a more connected experience by interacting seamlessly with things around them.

The suite supports venue occupants (e.g., sports fans and building clients), energy-efficiency managers, operations managers, and the support personnel from information and operations technology (IT and OT) organizations. SmartVenue suite enables incremental revenue for the venue operator, enhanced safety, and security and enjoyment for the venue occupant.



1. Robert Roble, "The Fan Experience Is Changing as Tech Is Making Game Interactive," June 26, 2014, <http://iq.intel.com/tech-firms-plug-sports-fans-into-the-game>.  
 2. Tim Bajarin for Time Magazine, "Meet Levi's Stadium, the Most High-Tech Sports Venue Yet," August 18, 2014, <http://time.com/3136272/levis-stadium-tech>.

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