**Success Story**

Bombela Concession Company  
Industry: Transportation

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**Goals**
- To construct a high-speed commuter railway that connected the Johannesburg city center, surrounding suburbs and international airport.
- The team needed to implement a safe and efficient tunnel ventilation system to address various emergency provisions, including fire scenarios, pressurization and smoke removal.

**Challenges**
- The project required the development and deployment of applications that could be easily viewed and controlled from a central command center.

**Solutions and Products**
- Wonderware® System Platform
- Wonderware InTouch® HMI
- Wonderware Historian
- Wonderware Historian Client

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**Results**
- The solution helped the operation of a rail line used by 62,000 riders a day, operating on 80 kilometers (km) of railway tracks.
- Bombela was able to complete this phase of the project ahead of schedule, enabling Gautrain to be up and running in time to provide service to the influx of more than 300,000 visitors attending the 2010 World Cup.
- The solution integrated the railways 11 sites, while meeting the demanding requirement for 99.7% system availability.
- The system’s object-oriented technology enables quick replication and deployment of applications among the various railway sites, reducing engineering cost when new projects are commissioned, or when modifications and upgrades to existing systems are necessary.
- The automated software allows for faster operator response times due to new navigation techniques that help them establish alarms and identify faulty equipment more quickly.

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“The flexibility of the Wonderware software made it possible to create the extra redundancy and saved a lot of engineering time. It’s truly a pleasure to develop systems with this versatile tool.”

—Sheldon Frade  
Electrical Engineer, Kentz (Pty) Ltd

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Gautrain High-speed Rail Links South Africa’s Business Centers using Wonderware Software
Background

**Johannesburg, South Africa** – Mass transit rail systems are complex networks that millions of people rely on every day as their main source of transportation. Whether it’s getting to and from work, running daily errands, touring a historical city or attending various entertainment venues, riders’ trust that these trains will operate safely, reliably and efficiently seven days a week, 365 days a year.

In 2010, the Gauteng Provincial Government (GPG) in Johannesburg, South Africa, embarked on an ambitious plan to build a high-speed rail system that would comprise of state-of-the-art technology linking Johannesburg with the metropolitan city of Tshwane in the north, as well as the OR Tambo International Airport and Sandton, a major business center in the Gauteng Province. GPG’s goal was to relieve the traffic congestion along the Johannesburg–Pretoria traffic corridor and offer commuters a viable alternative to road transportation.

Totalling approximately 80 kilometers of rail, the Bombela Concession Co. was commissioned to oversee construction, operation, and maintenance of the Gautrain rail system once it began operation. Understanding the complexity of the task to effectively manage an integrated commuter railway, Bombela partnered with Kentz (Pty) Ltd., a Schneider Electric ecosystem partner, to provide the industrial automation software system to effectively manage Gautrain operations.

To ensure reliability of the trains, safety of the railway structure as well as security of its passengers, Kentz required an integrated technology software system that could meet, and ultimately exceed these expectations. Schneider Electric Wonderware software was selected to manage this sophisticated rail network.

**Operating 80 Km of Railway Track Requires Proven Advanced Technology**

Gautrain carries more than 62,000 riders a day — not a “light” load for a new state-of-the-art rapid rail network. The project was constructed simultaneously in two phases, with the first rail section built between OR Tambo International Airport, and the cities of Midrand and Sandton. The second phase links the Hatfield station in Pretoria with Johannesburg Park.
Bombela was able to complete the project ahead of schedule, enabling Gautrain to provide service to more than 300,000 visitors attending the 2010 World Cup.

While it was not planned to be operational in time for the 2010 FIFA World Cup in Johannesburg, the Bombela Concession successfully altered the timeline by making changes to the plan that were not only less expensive, but more effective for the route between OR Tambo International Airport and Sandton. As a result, Bombela was able to complete this phase of the project ahead of schedule, enabling Gautrain to be up and running in time to provide service to the influx of more than 300,000 visitors attending the 2010 World Cup.

While moving up project completion to an earlier date posed a challenge for Kentz, it did not deter its objective to provide an advanced and comprehensive automation infrastructure to successfully manage the extensive Gautrain operations.

An Intelligent Solution for Gautrain’s Critical Operations

Gautrain’s stations and tunnels are linked, monitored and controlled through triple-redundant and distributed industrial automation systems provided by Schneider Electric Wonderware software applications. Responsible for security, safety, ventilation, fire detection and prevention, as well as energy and escalator/lift monitoring and control, Wonderware suite of automation software provided an innovative, scalable solution which could meet the needs of the high-speed rail system as it evolved and grew.

Kentz successfully managed development of two key projects during construction of Gautrain. These included:

- Design of the tunnel ventilation system from Park Station to Marlboro Portal, which included ventilation for various fire scenarios and provisions for pressurization and the removal of smoke.
- The Station and Tunnel Management System (STMS) and Security Access Management System (SAMS) for the entire project.

These complex, yet critical, systems meant the commissioning and integration of 11 sites located along Gautrain’s 80 km railway route. At the same time, the system had to meet a demanding requirement of 99.7% system availability and innovative operator interface approaches with multiple-domain alarming functionality.

“One of the most challenging aspects of the implementation was the requirement for 99.7% availability,” Frade said. "But who doesn’t like a challenge? So far, the Wonderware-based system’s real-time availability has exceeded this demanding specification by a significant margin.”

—Sheldon Frade  
Electrical Engineer, Kentz (Pty) Ltd.
The solution integrated the railways 11 sites, while meeting the demanding requirement for 99.7% system availability.

To meet this challenge, Kentz implemented the Wonderware suite of software solutions at the 11 stations, where each had its own independent PLC/SCADA system and redundant server. The software solutions included Wonderware System Platform, Wonderware InTouch, Wonderware Historian and Wonderware Historian Client, to provide a scalable software platform featuring open architecture, permitting Bombela to upgrade the overall systems management network as the needs of Gautrain grew.

Object-Oriented Solution Provides Easy Management

Wonderware System Platform delivers a single, scalable architecture that enables Gautrain system managers to control and supervise operations using object-based technology. It also allows easy configuration, logging, and maintenance by delivering and storing real-time and historical information.

Gautrain’s entire operation is built and managed within the same Wonderware System Platform software infrastructure — dramatically reducing development times and ongoing system maintenance costs.

Wonderware System Platform provides critical collaborative processes such as configuration, deployment, communication, security, data connectivity, and resource allocation, allows operators to build a single, unified process model. This model logically represents Gautrain’s overall operations, including physical equipment and industrial systems. Providing an integrated, scalable software system makes the design and maintenance of the overall operation more efficient, more flexible and less risky.

Delivering essential context to critical railway operations information, Wonderware System Platform greatly assists management by providing diagnostics and troubleshooting data, as well as valuable operations documentation throughout the system lifecycle.

Designed as an object-based application development environment the, Wonderware System Platform enables users to build, test, deploy and maintain a wide range of industrial applications using re-usable application objects. This object approach, allows the management team to add functional capabilities, typically found in point solutions, and combining them with Wonderware InTouch’s supervisory/HMI system.

“Although the initial development time is naturally quite long because everything such as graphics screens had to be developed from scratch, when it came to implementation, it’s very easy and quick to develop new objects from existing templates using Wonderware’s object-oriented technology.”

—Sheldon Frade
Electrical Engineer, Kentz (Pty) Ltd.
Visualization Critical to Ensure Reliable Train Operation and Safety

Operating in conjunction with Wonderware System platform, Wonderware InTouch is a sophisticated HMI solution that provides graphic visualization of the entire Gautrain rail system. Designed as an open and extensible Supervisory HMI and SCADA application, InTouch enables Gautrain system managers to quickly create standardized, reusable visualization applications, and then deploy them across the railway’s entire enterprise quickly and efficiently.

Each station has its own Wonderware InTouch-based system, with the entire train network represented by a single, global InTouch application which provides an overview of the complete operation, as well as the information for each individual station. Before going “live,” the Kentz team developed a mock-up of the system to “test drive” the automation applications before the system was formally rolled out.

Wonderware InTouch delivers advanced engineering tools that provide faster time to value, more effective HMI design, better trouble shooting, and ease of application maintenance. Offering numerous visual enhancements, railway managers have the ability to quickly identify and address abnormal situations before they impact operations.

With InTouch, Bombela application engineers can create valuable content, and easily assemble effective HMI applications for simplicity, agility and performance,” Frade said. “In addition, its user-friendly interface allows both experienced and entry-level operators to easily identify, understand, react to and resolve abnormal situations.”

—Sheldon Frade
Electrical Engineer, Kentz (Pty) Ltd.

“We ran the mock-up system separately from the live system to test the overall operation of the automated software application and work out any issues. When it came time to commission the actual railway system, we simply transferred all the objects, templates, graphics screens, and everything else onto the live system. It took only eight hours to complete the entire migration. Stressful doesn’t quite describe this process, but I’m sure that we couldn’t have done all this in time if it wasn’t for the Wonderware technology.”

—Sheldon Frade
Electrical Engineer, Kentz (Pty) Ltd.

Gautrain Operations Control Center (OCC) in Midrand.
“Choosing Wonderware System Platform and its suite of applications enabled our team to build a triple redundancy system that could achieve the Bombela’s requirement of 99.7 percent system availability. Downtime was not an option when thousands of people depend on Gautrain each day.”

—Sheldon Frade
Electrical Engineer, Kentz (Pty) Ltd.

“Emergency Response and Power Backup Dependent on Alarming Performance
One of the key features of the STMS is providing rapid response by the operators in case of critical alarms or emergencies.

For example, if a train operator spots a fire, he will immediately contact the OCC and inform them of its location. The OCC, which also has closed circuit TV video monitoring the event, will, in the case of fire at a station, place that station into “Fire Presumption” mode, which switches off all nonessential equipment. In the case of a tunnel fire, the OCC operator will select a fire scenario which best suits the information he has received to date.

The selected scenario will initiate the appropriate sequence of actions to be taken, such as pressurizing the tunnel to blow the smoke away from the train or station, operating fire doors, guiding passengers to safe havens, etc.

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Another vital aspect of the system is power management and distribution. For above-ground installations, power isn’t as crucial as for those underground where passengers can find themselves trapped in cases of emergency. Four large generators at the Marlboro Portal supply the necessary power in the event of power failures at Park Station and/or Sandton.

**Maintenance Essential for Successful Operation**

Kentz also is responsible for corrective as well as preventive maintenance on the systems at STMS and SAMS. The Kentz team must respond immediately to maintenance issues by being on-site within two hours, and resolve the issue within four hours.

The Wonderware solution permits the Kentz team to address these maintenance issues immediately, as well as develop a systematic program to maintain the railway system for optimum performance and upgrades. With the use of Wonderware Historian and Historian Clients, large amounts of process data can be aggregated into highly informative production reports tailored to the needs of rail management personnel.

Wonderware Historian is the Invensys high-performance, real-time database for collecting and storing historical information. It combines the power and flexibility of a relational database with the speed and compression of a true process historian connecting the rail system processes with management teams. The software is designed to collect a wide variety of process information, ensuring that decision makers at all levels have the historical data needed to make effective operation decisions.

Wonderware Historian Client works in conjunction with Wonderware Historian and provides data analysis and reporting capabilities to maximize the value of information stored in the Wonderware Historian to deliver data-trend and numerical data analysis reports.

**Staying on “Track” with Wonderware**

Maintaining a technologically advanced network of systems for a commuter railway system servicing more than 65,000 riders each day, is made easy with the suite of Wonderware industrial automation software solutions. By creating reusable objects and engineering configurations throughout the Gautrain rail enterprise, the engineering team at Kentz, along with Wonderware, can support the growth of this state-of-the-art railway system well into the next century.
Overcoming its complexity, strict safety and performance requirements, time constraints and civil engineering challenges has resulted in nothing less than engineering milestone for Bombela Concessions and Kentz, with help from Wonderware.

“Kentz implemented Wonderware Historian and Historian Client to detect trends and potential problem areas. This is extremely useful because all maintenance tasks require a permit which takes 24 hours to process, so detecting issues early, we are able to apply for permits well in advance, and minimize delays.”

—Hennie van Tonder
Maintenance Technician, Kentz (Pty) Ltd.