WWT BROWNFIELD MODERNIZATION DEMONSTRATION

ILLUSTRATING AN INDUSTRIAL IOT SOLUTION FOR MANUFACTURERS

World Wide Technology

Factory automation can help manufacturers increase productivity, but replacing existing equipment with next-generation machines can be cost prohibitive. To keep up with industry advances, manufacturers often must execute brownfield modernization initiatives.

Successful brownfield modernization requires bringing together groups such as operations, industrial automation and information technology, all of whom must work together to connect machines to a converged network. From there, data can be collected, stored and forwarded to a centralized location for analysis related to production availability, yield and quality, predictive maintenance and individual machine performance.

BROWNFIELD MODERNIZATION IN ACTION

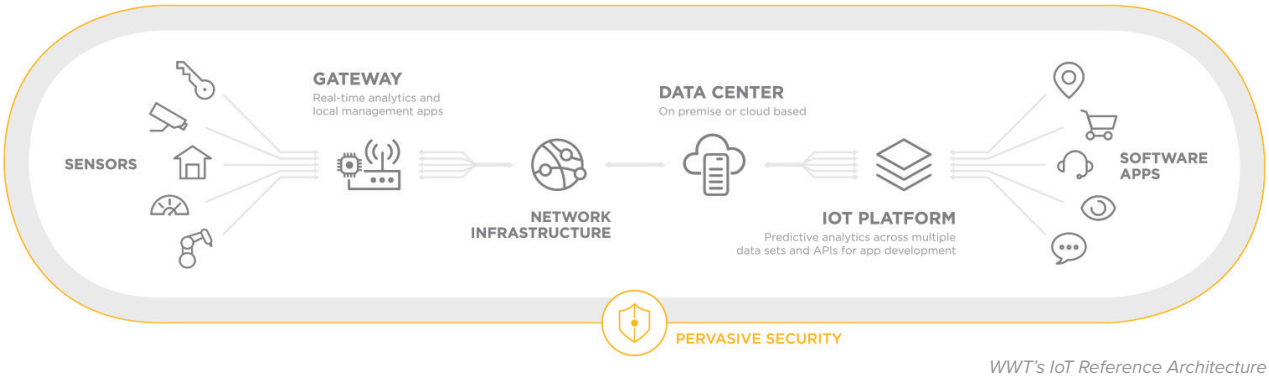
To make brownfield modernization real for our customers and partners, we integrated an external Ethernet card into a 2004 six-axis Mitsubishi robotic arm and reverse-engineered messaging and data, first demonstrating the arm at GE Minds + Machines 2016 as a GE Digital Alliance Partner. The demo met with interest from various stakeholders due to its ability to illustrate the many elements of brownfield production environments and the potential for gathering previously unknown insights about the machine.

The arm portrays industrial automation by performing a sort, pick and place operation. A camera system guides the arm, identifying components based on color and shape, while also providing spatial coordinates that direct the robot to an object's precise location for handling. Industrial elements are integrated into the IT infrastructure stack of network, wireless, security, compute and storage, illustrating the importance of IT and OT working together on automation projects.

Leveraging GE Predix, WWT Asynchrony Labs developed a mobile application that provides real-time feedback of the health of the robot as well as the digital factory infrastructure to which the robot is connected. An HMI display allows the robot operator to see relevant activity, control functions and the state of various mechanical components. This allows for quick response to error/status messages and as a result, a reduction in expensive factory operation delays and shutdowns.

SOLVING FOR IIOT

The robotic arm demonstration illustrates the many considerations of an industrial Internet of Things (IIoT) solution, from sensors through application development.



WWT's IoT Reference Architecture

SENSORS. Infrared cameras identify components based on color and shape, while also providing spatial coordinates that direct the robot to the object's precise location for handling. Measurements taken by sensors on the arm's motor include voltage and current draws, position of the arm and imputed stress. LIDAR is becoming increasingly popular for component identification and may be added to the arm in the future.

GATEWAY AND EDGE DEVICES. An integrated services router (ISR) reflects a highly-condensed version of technologies found throughout the plant's network and data center. For the purposes of the robotic arm demonstration, computations occur on the ISR, however it's common for computations to occur in a plant's data center. It should be noted that edge computing is often applied to many real-world applications. Additionally, a gateway would be required in many manufacturing scenarios.

NETWORK INFRASTRUCTURE. RestFul and MQTT collect the messages to be stored in the database. Typical network infrastructure involves converged plant-wide Ethernet, including an industrial access layer, industrial/enterprise-grade distribution layer and an enterprise-grade core layer. Elements connected to this converged infrastructure include industrial devices, compute, storage, wireless and other various technologies required for customer-specific use cases and solutions.

DATA CENTER AND CLOUD. Store-and-forward functionality is accomplished through a Postgres database which allows for data transmission to the cloud when bandwidth is available. In the cloud, a Predix time-series service works in conjunction with a Predix predictive analytics service to generate relevant information about the health of the robot and the underlying digital factory technology infrastructure.

Store-and-forward functionality allows for data to be transferred when the network is not constrained. This especially applies to network outages, remote stations or stations with limited connectivity.

IOT PLATFORM. Predictive model data is processed with local elements before being passed to Predix analytics services for visualization of the data using D3.

SOFTWARE APPLICATIONS. WWT Asynchrony Labs created a mobile app, giving IT operations the ability to track the health of the industrial infrastructure stack utilizing Predix-based analytics. WWT Asynchrony Labs also created a human machine interface (HMI), so line operators can see key indicators of health for the robot. These include:

AVERAGE SERVO RPM	CURRENT BY SERVO	SYSTEM LOAD
CPU USAGE BY COMPONENT	BRAKING BY SERVO	AVERAGE VOLTAGE DRAW
DISK USAGE	PROCESS CPU TIME	SPEED BY SERVO

However, these key health indicators are not the only data sets measured. A wide variety of indicators can be captured and delivered into the Predix Cloud.

SECURITY. For a typical network implementation, several security features would be incorporated, such as enterprise firewall security at the borders of the network, identity services and industrial firewall security at the machine layer. Other security elements integrated into the network include antivirus, malware protection and intrusion prevention.

NEXT STEPS

For more on brownfield modernization, holistic IIoT solutions or our robotic arm demonstration, email manufacturing@wwt.com.

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