Harnessing the Power of Data

Data analytics is transforming nearly every industry, providing the answers companies need to boost throughput, lower operational costs, and increase worker safety and efficiency. Healthcare, transportation, and manufacturing are just some of the industries that have made huge strides in more thoroughly collecting and analyzing data to improve decision making.

But integrating big data analytics into many industrial settings is no easy task. Data is often distributed and siloed, residing in machines, employee spreadsheets, or isolated databases. A lack of convergence between operational technology (OT) and information technology (IT) infrastructure commonly impedes data sharing. In all, there could be a number of issues that inhibit a company from bringing all of its pertinent data together for real-time analysis.

Helping companies overcome these issues and better harness their data, GE created Predix® — an Industrial Internet platform and operating system (OS) that is optimized for Intel® architecture. This
open and standards-based solution simplifies the task of connecting industrial devices to the cloud in a way that is secure, scalable, and manageable. Once the data is in the cloud, companies can create innovative apps on Predix that turn real-time operational data into actionable insights. The scalability of Intel® processor-based solutions, satisfying low-power edge to high-performance cloud requirements, allows Predix to scale across industries and from industrial equipment to cloud infrastructure.

The conference brief describes how this edge-to-cloud, industrial Internet of Things (IIoT) solution from GE and Intel can help companies increase their operational efficiency and profitability.

**What Data Can Do For You**
Use key insights derived from corporate-wide data to:

**Boost throughput** – Achieve new levels of productivity by increasing operational efficiency and resolving issues faster through a more in-depth understanding of industrial processes.

**Lower costs** – Increase equipment return on investment (ROI) by driving higher performance, reliability, and availability through real-time monitoring and predictive maintenance.

**Increase worker safety and efficiency** - Ensure field workers have the information they need at their fingertips to make them safer and more efficient.

![Figure 1. Key objectives across various industries](image-url)
Digital Transformation by Industry

The following examples show GE and Intel are helping accelerate innovation across several industries using IIoT technologies.

1. Industry: Transportation

Key Challenge
Today's locomotives lack sufficient on-board processing power to make full use of the data from as many as 200 sensors.

Situation
Modern locomotives generate incredible amounts of data – on the order of a billion data points per second – from vibration sensors surrounding each critical component; video cameras scanning the track and cab; and sensors measuring RPM, power, temperature, the fuel mix, exhaust characteristics, and more. But if this data was used to its full potential, dispatchers and power planners could make better and faster decisions to improve utilization and mission outcomes. For example, it would be possible to predict on-board problems and make quick adjustments, such as reducing speed so a train can make it home before a critical part fails.

Solution
The GE Predix platform enables locomotive operators to perform sophisticated analysis on massive data sets. Data from years of sensor readings across thousands of locomotives and millions of miles of track can be combined and analyzed to identify trends, patterns, and hidden relationships that impact all aspects of performance and logistics.

Since sensor data is filtered and analyzed on-board, only critical alerts and other small messages need to be sent over costly cellular connections. High-volume data transfers are performed at stations to take advantage of fast, low-cost Wi-Fi connections. Given the size of the data sets, the savings can be substantial.

Benefits
These more sophisticated insights can help operators safely run more trains at faster speeds and higher capacities on existing track while orchestrating resources more efficiently to eliminate bottlenecks, reduce wait times, and lower maintenance costs. They can help identify subtle problems, such as minor track irregularities or manufacturing weakness in one component that might lead to failures in another. Issues can be detected and responded to instantly, before they escalate into more serious problems.
Key Challenge
Integrating big data analytics into complex healthcare environments can be a difficult task.

Situation
Healthcare costs are rising at an unsustainable rate, which is driving healthcare providers to find new ways to cut costs without limiting patient access or treatment options. One answer may be to use big data technologies, but the amount of data can be overwhelming, with some data that is distributed or isolated, making it difficult to collect. What’s needed is an efficient, cost-effective way to generate a holistic view of a single patient and bring all the pertinent data together for real-time analysis.

Solution
Big data analytics will transform every industry, and none more than healthcare. To simplify integration, GE, with help from Intel, developed Predix for Healthcare, a computing platform designed specifically for integrating applications and for sharing and analyzing large, complex data sets. Predix will help healthcare providers turn mountains of isolated data into actionable insights across the full continuum of care.

The solution provides support for HIPPA compliance, medical device integration, and healthcare IT standards, such as HL7, CDA/CCDA, DICOM, XML, and more. This support simplifies integration into healthcare environments, with reduced risk and better interoperability between both new and existing devices, applications, and data sources.

Benefits
Predix makes it easier to deploy, manage, and integrate new and existing applications and devices; to unify and analyze all available data; and to deliver insights to the right people at the right time to improve outcomes. The solution has the potential to transform healthcare by enabling more accurate diagnoses, improving operational efficiency, and identifying evidence-based treatment plans that deliver better results with reduced risk.
Key Challenge
Gas turbine manufacturing requires careful temperature monitoring to reliably bind pieces together and keep workers safe.

Situation
When building a turbine, components are stacked one at a time, and some are heated, fit into the assembly, and then cooled at a uniform rate to ensure proper binding. The assembly and cooling process may last between 12 and 36 hours, and unsteady temperatures can create defects that require costly rework. In addition, workers need to know when the turbine assembly is too hot to touch to avoid injury. Therefore, the ability to tightly control the temperature across the assembly environment can lower operations costs and protect workers.

Solution
Intel and GE came up with the idea of using “intelligent” LED lights capable of collecting temperature data from locations near the turbine assembly stand. A third partner, Tata Consultancy Services*, built a Predix app that connects the intelligent LEDs in the factory to the cloud, and provides data visualization and analytics for the project. Temperature measurements are streamed from the sensors to Predix using an Intel® IoT Gateway.

Benefits
The system makes it possible to analyze component temperature at multiple points as they are assembled and cooled, allowing employees to know when it's safe to continue working with the components. Since lighting is ubiquitous in industrial environments, there are many fixed locations with power running through them, making it easy to add sensors and collect data. Sensors in LED lights can detect ambient temperature, humidity, carbon monoxide, and occupancy, among other things.

Sensor data may be used in other ways as well. For example, if the system detects a desk is unoccupied over a period of time, it could mark it as free in a company's flex-space database. The system could also adjust the lighting or air conditioning based on how many people are present.

GE ran an LED light pilot in one of its gas turbine assembly sites, which indicated the possibility of saving weeks of rework and hundreds of thousands of dollars.¹
**Predix* Advancing the Industrial Internet of Things**

GE’s Predix is an operating system (OS) for the IIoT and is similar to the OS found in smart phones and laptops. It is also a purpose-built software platform-as-a-service (PaaS) for developing, deploying, operating, and monetizing Industrial Internet applications. In industrial settings, Predix can handle large amounts of data coming from a lot of places at once and keep it secure. The solution also includes features that allow developers to create and run applications that are optimized for the Industrial Internet.

Predix can run on Intel IoT Gateways or in the cloud, as shown in **Figure 2**. For machine controllers and sensors, there is Predix Machine*, which provides security, authentication, and governance services for endpoint devices. Its primary responsibility is to provide secure, bi-directional connectivity to industrial assets (GE or non-GE), while also enabling applications (analytical and operational services) at the edge.

For those designing an IIoT solution, the Intel® IoT Platform provides a foundation for seamlessly and securely connecting devices, delivering trusted data to the cloud. By using Intel’s reference architecture and deploying Intel® processors from edge to cloud, Predix developers can write their application once and run it anywhere, thus reducing software development cost. Scalable Intel®-based Predix solutions can help accelerate time to insight and drive better business outcomes, such as higher throughput, lower operational costs, and increased worker safety and efficiency.

*Figure 2. IIoT solution*
Intel Booth Demo #1:  
**Smart Stadium Is a Game Changer**

Arizona State University is undertaking a multiyear renovation of its football stadium with help from Intel and Volteo to bring state-of-the-art technology that will improve the game day experience and increase operational efficiency.

The smart stadium delivers an enhanced spectator experience via mobile applications for ordering food and merchandise from seats, wayfinding guidance to points of interest within the stadium, help finding friends and families, and smart parking. Stadium operations optimization will be achieved via energy/building management system (e.g., HVAC, lighting) control based on occupancy, and the creation of maintenance requests based on actual facility usage—in real time. In order to simplify their deployment, the university installed open IoT platform infrastructure, including additional sensors under the seats, sensor hubs, wireless gateways, and a cloud-based data and application platform. The new stadium IoT infrastructure also enables the “Victory Cheer”, a fun competition to see which section can cheer the loudest. Sensors installed underneath the bleachers send sound data to the cloud, and the data is displayed as a colorful heat map on a Jumbotron within a few seconds.

The demo shows the mobile apps used to enhance the fan experience as well as some of the operational dashboards used to automate and optimize facility management.

Intel Booth Demo #2:  
**Scoring Platform Helps Optimize IoT Implementations**

In IoT solutions, gateways collect, process, and analyze data from sensors and machines at the edge. How much computing power and I/O bandwidth a gateway requires depends on the number of connections, data rates, and the level of data analytics it must support, among other things.

To help solution developers choose the right gateway for the job, Intel developed the SCORE platform, which offers gateway feature guidance (e.g., CPU, memory size, I/O speed, etc.). This tool, based on Intel® CoFluent™ technology, takes into account the number of sensors, throughput and latency expectations, and how analytics is provisioned at different points in the solution. With this information, developers can properly size their end-to-end IoT solution in order to optimize cost and performance, satisfy critical service level agreement (SLA) requirements, and efficiently partition their analytics processing from edge to cloud.

**Digital Industrial Transformation Starts Here**

A one-of-a-kind industrial operation system, Predix is helping companies make better use of real-time data to increase their operational efficiency and profitability. The solution is powered by scalable Intel processors to deliver an edge-to-cloud industrial solution. Predix-based applications are connecting industrial assets, collecting, and analyzing data, and enabling real-time insights for optimizing operations and industrial infrastructure, including GE and non-GE assets.
More Information

For more information about Intel solutions for the IIoT, visit www.intel.com/iot
For more information about GE’s Predix, visit https://www.ge.com/digital/predix