



🔴 Building Custom Industrial Applications That Don't Rely on a Network

Applications at GE always work – even in the most remote locations

When mobile is the norm and connectivity is taken for granted, it can be easy to forget that many of the world's workers are not connected 24/7. Industrial workers often spend their time out in the field managing equipment to keep us all on the grid and industry humming along. For an industrial thought leader like General Electric (GE) – constantly innovating in the areas of power generation, power distribution, oil and gas, wind energy, hydropower, aviation, rail, healthcare, manufacturing, and mining – bringing digital transformation to wherever work might be stands to revolutionize the world as we know it.



The Challenge: Enable a revolutionary software platform to work regardless of network connectivity

Industrial assets are getting more and more sophisticated. Sensors on state-of-the-art machines generate copious data that can be collected in the cloud, opening up opportunities for business intelligence to help enterprises improve efficiencies in real time. “In the Industrial Internet of Things,” says Michael Hart, director of Predix mobile engineering at GE Digital, “we’re talking about major assets, and they’re all getting smarter.” The increasing intelligence of industrial machines has created a data explosion – but how best to wrangle, parse, and quickly disseminate this data in an actionable way?

GE Digital's software team was charged with tackling this IoT predicament head-on. They had an ambitious vision for an innovative software solution that would allow their customers to build custom mobile apps specific to their team and equipment requirements. The cornerstone of this effort was a cloud-based platform called Predix, designed to make it easier to build industrial internet mobile applications. Predix talks to a backend service running in the cloud, meshing device connectivity, data integration and management, data analytics, cloud connectivity, and mobility to give GE customers a one-stop shop for their applications. The GE team released the first version of Predix knowing that typical industrial applications are mission critical, must connect back to an enterprise system – often a legacy system that's not in the cloud – and must be intuitive and easy to use for workers in remote locations like a wind turbine, train track, or oil rig.

GE's initial release of Predix was a great step in the right direction towards helping field workers monitor, maintain, and troubleshoot equipment. But it came with a few hard lessons learned:

- **Predix needed more advanced caching mechanisms.** In the first release, GE cached the data on the client so that information synced when the user transacted. But the engineering team needed more advanced caching that could be used for local storage and control over how long an object stayed cached.
- **Offline mobile access would make or break Predix's success.** As Hart says, “In developing Predix, we knew providing strong mobile capability was important, given the remote locations where users need access to Predix, such as on wind farms, oil rigs, or in power plants. But we soon learned that offline was critical. Providing a solution that would work all the time, regardless of location or network availability, became the key challenge we had to solve for.”



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— Michael Hart
Director of Predix Mobile Engineering, GE Digital

To empower its customers to build custom mobile apps through its innovative Predix platform, GE Digital needed to overcome the unique data challenges of industrial IoT:

- ✔ **Unpredictable access meant GE needed advanced caching for more control over how long objects stayed cached**
- ✔ **Support for offline access was a must-have to deliver reliable mobile functionality for extreme work conditions and remote workers**
- ✔ **GE couldn't compromise on the complexity of data while supporting remote connectivity - it needed both robust data modeling in addition to offline connectivity**

- **It needed a more flexible data model.** GE had greatly simplified their data model in order to make it easy to build an initial, rudimentary offline feature. "When we chose to build it ourselves, we had to put our best engineers on it," says Hart. Upon release, it became obvious that the data model and the offline capabilities had to be more robust.

The bottom line was clear: the people that take care of industrial assets - those in the field maintaining, servicing, and operating machines - need a stable platform that doesn't rely on internet connectivity. GE knew that better offline capability, managing, using, and storing massive amounts of data locally, and the ability to sync this massive amount of data to the cloud were needed to make Predix an effective tool. Being able to access, use, and analyze all this data efficiently isn't just interesting - it can help reveal equipment failure threats faster and result in safer workplaces.



The Solution: Transform with Couchbase for proven offline-enabled apps, automatic data syncing, advanced caching, and a more flexible data model - in less than 90 days

GE quickly realized they were limited by their internal resources and needed to find an existing external solution they could build on. Couchbase's NoSQL data platform for mobile and web offered the synchronization capability GE needed. With no time to waste, GE did a proof of concept in just five days to demonstrate that it would work. Thanks to the flexible base model provided by Couchbase, they were able to migrate to the new solution, replacing all of the functionality they'd built with the first version, in just 30 days. "With Couchbase, my top engineers didn't have to focus on the mobile sync and data management challenges anymore," says Hart. "That meant I could instead focus our engineering resources on the core features of our platform."

GE's Predix platform today acts as an operating system for the Industrial Internet of Things, powering the digital industrial businesses that drive the global economy. By connecting industrial equipment, analyzing data, and delivering real-time insights, Predix-based apps are unleashing new levels of performance for GE's customers. And by securely collecting data from the edge to the data center and back, these companies can make sure machines in the field are functioning at their optimal levels, take quick action to prevent downtime and failures, and make sure remote technicians are working where they're needed most.



The Result: Secure, seamless data delivery from even the most remote locations

Easy offline support

With Couchbase integrated into Predix, data is stored locally on worker mobile devices so their Predix-powered app continues to work, even when they're offline. When the network becomes available, data is automatically synced to the cloud in a process that's secure, seamless, and invisible to the user. It's a fundamental capability for an Internet of Things platform, especially when that platform is supporting industrial machines like wind turbines, rail cars, power plants, and more that need 100% uptime, regardless of internet connection. "Offline support is hard to do right," says Hart. "Couchbase Mobile gave us a great starting place and allows us to better support our customers."

Performance and integration make complex customer analytics easy

Predix not only allows GE's customers to build mobile apps - it also serves as an analytics platform. By collecting and evaluating data from applications, GE helps customers ensure that equipment is operating normally and notifies workers if maintenance is needed. The overall goal is to prevent downtime on machines and systems that are often extremely critical, such as aircraft, pipelines,

About GE:

General Electric is the world's Digital Industrial Company, transforming industry with software-defined machines and solutions that are connected, responsive and predictive. GE is organized around a global exchange of knowledge, the "GE Store," through which each business shares and accesses the same technology, markets, structure, and intellect. Each invention further fuels innovation and application across our industrial sectors. With people, services, technology, and scale, GE delivers better outcomes for customers by speaking the language of industry.



and even medical equipment. For these kinds of analytics to work, Predix needed the ability to integrate with customers' enterprise resource planning software and other back-end systems. With Couchbase, GE can allow organizations to write custom logic in Predix to sync data between Couchbase's Sync Gateway and their own enterprise systems. GE built the integration component on Predix using Couchbase's APIs to ensure that data flows smoothly without impacting the user experience. "Predix needed to be a central point of aggregation for customer data regardless of how complex our client's systems are," says Hart.

Complexity and ease of use, without compromise

Couchbase Mobile allows the Predix platform to provide richer, more complex, and more flexible data modelling because all of the data is stored and transmitted as JSON. JSON is supported on the device, in the database, and across all of the APIs. "To deliver a fully featured platform for our customers, we couldn't make a trade-off between data complexity and offline access," says Hart. "Couchbase allows us to offer both."

Rich data management and processing options

Every Predix customer use case may have different requirements. Couchbase Mobile opened up a world of flexible data management and processing options for Predix - local storage, mobile sync, and backend database server processing, as well as a variety of REST, streaming, and batch APIs. "Our customer use cases are all unique - we can't limit ourselves to a limited set of simplistic data processing options," says Hart. "Couchbase allows us to offer a variety of solutions within the same data management platform to support the diverse kinds of solutions that connect workers in very harsh environments."



Looking Ahead: Award-winning IoT and streamlined, worker-friendly processes

Keeping things like oil rigs and rail cars up and running isn't just good for ROI; it's crucial to human safety and the environment. To expedite equipment servicing and create safe work environments, the mobile workforce needs applications that are always on - even when there is no network connectivity, or where wireless connectivity is hampered by the interference of other equipment.

Thanks to its digital innovations in the industrial arena, General Electric's implementation of Couchbase Mobile was named a winner of TechTarget's 2017 Modern Mobility Innovation Awards for its ability to provide offline and synchronization capabilities for Predix. "Predix is a cornerstone of our commitment to innovation in the Digital Economy," says Hart. "Couchbase delivers the technology that allows us to connect vast parts of the economy that were previously remote and isolated - it's a revolutionary way to engage with the machines powering our lives."

Learn More

Visit couchbase.com to learn more about the world's most powerful NoSQL data platform.



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About Couchbase

Couchbase delivers the database for the Digital Economy. Developers around the world choose Couchbase for its advantages in data model flexibility, elastic scalability, performance, and 24x365 availability to build enterprise web, mobile, and IoT applications. The Couchbase platform includes Couchbase, Couchbase Lite - the first mobile NoSQL database, and Couchbase Sync Gateway. Couchbase is designed for global deployments, with configurable cross data center replication to increase data locality and availability. All Couchbase products are open source projects. Couchbase customers include industry leaders like AOL, AT&T, Cisco, Comcast, Concur, Disney, Dixons, eBay, General Electric, Marriott, Nordstrom, Neiman Marcus, PayPal, Ryanair, Rakuten / Viber, Tesco, Verizon, Wells Fargo, as well as hundreds of other household names. Couchbase investors include Accel Partners, Adams Street Partners, Ignition Partners, Mayfield Fund, North Bridge Venture Partners, Sorenson Capital and WestSummit Capital.