



Innovating in IoT to Better Connect the World

Enabling real-time visibility to manage millions of connected enterprise devices at Verizon

We live in a connected world, and today's users expect superior experiences. Taking advantage of a wide array of sensors and ever more connected mobile devices helps enterprises deliver innovative and engaging user experiences – and better compete. But in order to gain meaning and extract trends from the vast amount of data created by all these machines, businesses need to be able to collect and aggregate the data in real time. As Verizon Labs, the research and development arm of global communications company Verizon, launched a web-based enterprise IoT development resource for its customers, it sought a powerful NoSQL data platform that could support over 16,000 developers and 3.5 million operations per second.



The Challenge: Streamline time to market while accelerating response times and stabilizing performance

A typical IoT platform involves a device and a client on that device sensing and collecting data. Data is then pushed to the cloud through a connectivity layer, which is where Verizon's IoT platform team had a vision. By allowing the sensor to be mobile – anywhere, anytime – and still reliably transfer data to the cloud, Verizon knew it could harness the power of IoT. "Today, there are six billion IoT connected devices, with projections of 20 billion connected devices by 2020," says Mohan Umapathy, director of the IoT platform that develops highly available and scalable IoT services at Verizon Labs. "This magnitude of devices and data requires cutting-edge technology that meets unprecedented needs of scale and responsiveness. Couchbase technology helps us provide the enterprise-grade stability, predictable performance, scalability, and flexibility necessary to gain real-time actionable insights and information into the millions of connected devices we support on our IoT platform."

So in 2015, Verizon Labs launched ThingSpace, an innovative, end-to-end IoT development platform to help enterprise customers build and deploy IoT solutions. Devices onboarded into the ThingSpace platform can take advantage of services like connectivity management, device management, reporting and analytics, and security and compliance. "That's where Verizon's most reliable network can help our customers," says Umapathy. "To make that sensor be mobile – making sure it can be anywhere at anytime and still be able to take the data from the device and transmit it to a cloud reliably and securely – that's the power of connectivity for IoT."

Verizon had the reliable network. But to enable the real-time dashboards, reports, notifications, alerts, and other capabilities customers would require in order to take advantage of ThingSpace, the company needed a highly available data platform scalable enough to support exponential growth, along with the unique data collection and reporting required for each customer.

Verizon's legacy relational database simply couldn't meet the challenge. Its response times were slow and unpredictable, query optimization was overly complex, rigid schemas were required, and time-to-market for new features was too long.

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Director of System/
Architecture, Verizon

As Verizon began to develop its innovative ThingSpace platform, the company needed to overcome IoT challenges that threatened usability for customers:

- ✓ **To make ThingSpace truly usable for customers, they would need access to real-time dashboards, reports, notifications, alerts, and other capabilities**
- ✓ **The data platform needed to be both customizable and scalable for unique customer needs**
- ✓ **Enterprise performance and stability was an absolute requirement for the project in order to support millions of connected devices**
- ✓ **To better compete in a crowded IoT landscape, Verizon needed to get to market quickly with a solution that essentially worked right out of the box with only minor tweaking**



The Solution: A database partner with the right amount of customization and scalability - and no downtime risk

Verizon chose Couchbase to support ThingSpace primarily because it allowed the company to provide customers with real-time dashboards with drilldown capabilities, reports, and notifications in a highly reliable environment. "Couchbase gives us predictable performance, horizontal scalability, and a flexible data model that you don't have to change each time you add new functionality to your application," says Umopathy.

Verizon adopted its own best practices as it implemented Couchbase:

- **Tune Couchbase only when absolutely necessary.** "Couchbase works really great right out of the box," says Umopathy, "Couchbase is one of the easiest NoSQL databases to deploy, maintain, and scale out."
- **Turn to the experts.** In isolated instances where Verizon found a need to tune Couchbase, they went straight to their Couchbase consultant for advanced expertise, advice, and tuning parameters.
- **Benchmarking is pivotal.** "One thing we learned is that every use case is different," says Umopathy about Verizon's insistence on benchmarking every detail: "You need to benchmark your workflow, your application, and yourself to feel comfortable that any solution you implement is going to work for you."

Every connected device and sensor has unique and varying characteristics. Utilizing Couchbase's JSON flexibility and schema-free architecture, enterprises can easily represent complex and varying data. Additionally, any new devices or changes to device characteristics can be easily made without application downtime or redesigning the data model.

Unlike relational databases, Couchbase's data platform enables enterprises to scale quickly to support billions of connected devices and to achieve sub-millisecond latency lookups. Enterprises rely on Verizon's IoT platform to support mission-critical applications and capabilities, requiring a continuously available platform. Couchbase's cross datacenter replication (XDCC) ensures the platform is available 24x7.

With its flexible schema, scale of deployment, and ease of use, Couchbase was the right fit for Verizon.



The Result: A scalable, flexible solution that can keep up with the rapidly evolving world of IoT

High-performance analytics with Elasticsearch integration

With some customers having millions of devices, Verizon's IoT users want to be able to search and sort on a number of arbitrary fields. With its previous solution, the situation was becoming more and more complex for Verizon - and the performance less and less predictable. Verizon's relational solution simply couldn't scale to meet the company's latency requirements. As a result, customers were experiencing time-outs, and Verizon's engineers were forced to manually patch the code for each specific query.

About Verizon:

Verizon Communications Inc., headquartered in New York City, has a diverse workforce of nearly 162,700 and generated nearly \$132 billion in 2015 revenues. Verizon operates America's most reliable wireless network, with 113.2 million retail connections nationwide. The company also provides communications and entertainment services over mobile broadband and the nation's premiere all-fiber network, and delivers integrated business solutions to customers worldwide.



To solve the challenge, Verizon built a datagrid cluster to support ThingSpace. The datagrid integrates Couchbase with Elasticsearch analytics and runs on a distributed, memory-first, and modular architecture to ensure performance scales easily as customers add IoT devices. "By integrating Couchbase and Elasticsearch, Verizon was able to better report on real-time data and present users with a functional view of their device data despite growing numbers of devices in our customer environments," says Umapathy.

An utterly flexible database model

Verizon needed the ability to add new functionality to the application in an ad hoc way and bring it to market as quickly as possible. Couchbase's JSON flexibility and schema-free architecture allows IoT-centric data developers to represent complex and varying data. Additionally, any new devices or changes to device characteristics can be more easily made without application downtime or redesigning the data model. "Our data model needs to be flexible because every connected device and sensor has unique and varying characteristics," says Umapathy. "That's one of the important criteria we get from Couchbase - applying a rigid data model to the world of IoT wouldn't make sense since we're still in the early days."

Cost-effective scalability to support exponential IoT growth

Traditional data systems cannot keep up with the explosive growth of IoT devices when it comes to scalability and cost. Verizon chose Couchbase to power its platform because of its need for high availability, flexibility, and sub-millisecond latency - all in a platform that can easily scale out in a way that best accommodates the rapidly growing ThingSpace platform. With Couchbase's Multi-Dimensional Scaling, Verizon can separate, isolate, and scale individual database services for an intuitive, cost-effective approach to growth.



Looking Ahead: A world where constant connection is a given

Building on the backbone of Couchbase's technology, Verizon Labs will continue to innovate their IoT platform for the enterprise. Verizon is looking ahead to evaluating new Couchbase releases to take advantage of advanced features like memory-optimized indexes, built-in full-text search, and built-in analytics. With a flexible and scalable platform as the basis for ThingSpace, Verizon's visionary engineers know that the future of telecom connectivity will be vast and unhindered.

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, Dillons, 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.