i2O
Calm water

Use Case: Internet Of Things
Refers to the revolution of a growing number of internet-connected devices that can network and communicate with each other.

Industry
Utility

Challenges
- Unable to handle massive volumes of time-series data (1.5 TB and growing)
- Need to search and analyze high velocity, streaming data in near real time
- Rigid data model of SQL Server can result in massive loss in performance
- Can't ensure 100% uptime across data centers and clouds

Solution
- Apache Cassandra as a distributed data store purpose built for IOT and time-series data
- Ability to handle structured and unstructured real-time streaming data
- Masterless architecture ensures continuous availability and reliability
- Predictable scalability that can scale in and out according to business needs

Results
- High performance: 50,000 - 60,000 writes per second and 20,000 - 40,000 reads per second
- 235 millions of liters of water saved every day, and growing
- Able to handle massive volumes of data from over 15,000 devices globally without latency or downtime
- Fault tolerance delivers continuous uptime even during upgrades and node failures

INTERNET OF THINGS

I2O WATER TACKLES WATER CRISIS WITH APACHE CASSANDRA™

The amount of water being wasted every day around the world is astounding. A staggering 46 billion liters (about 12.15 billion gallons) of drinking water are lost globally every day. At a macro-level, this trend is only increasing with a projected 40% global shortfall between water demand and supply by 2030. i2O Water provides intelligent solutions for water utility companies around the world, to help solve water leakage problems in the distribution systems, to save water.

The Challenge

i2O Water is on a mission to solve the water crisis by helping utility companies operate more efficiently through the use of Internet of Things (IOT) technology. i2O Water has developed a data management platform that captures high-velocity, streaming data generated by their smart water pressure systems. By optimizing water pressure in the network, utility companies can reduce water leakage, the frequency of pipe bursts, and even energy waste within pumping station to deliver only what is needed.

i2O Water originally built their IOT platform on Microsoft SQL Server, but quickly realized its limitations when it came to scale and performance. "Time-series and IOT data can not be handled adequately by relational database technology," explained Mike Williams, Software and IT Director at i2O Water. "And when you start to scale, the rigidity of the database can cause a massive impact in performance."

"We handle over 1.5 TB of time-series data and growing," said Williams. "This data needs to be stored and analyzed in close to real time." As more devices are deployed across utility companies around the world, the volume of time-series data is massive and they really struggled to keep up with their relational technology.

i2O Water also experienced availability issues as they weren't easily able to shard the data across multiple servers without impacting application stability. So they decided to migrate away from SQL Server and move towards a modern distributed database purpose-built for IOT and time-series data.

The Solution

Key to their success was the ability to easily handle time-series data, scale predictably to meet changing customer demands, to deliver continuous availability so their platform never goes down, and to ensure data is protected and the water supply is never at risk. "Many customers are extremely sensitive to security because the provision of water to humans can be a potential target for terrorist attack," said Williams.

In addition, Williams and his team were looking for a database that offered more cost effective storage (compared to expensive storage requirements of relational databases), as well as much faster write and read performance - all while remaining extremely simple to manage and maintain.

They evaluated a number of common NoSQL technologies including HBase, MongoDB, RavenDB and Apache Cassandra™. i2O Water selected Cassandra for its ability to handle time-series data, flexible data model, predictable scalability, and masterless architecture that ensures 100% uptime.
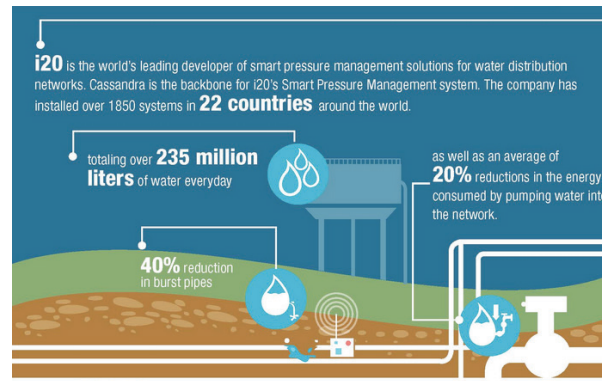
HBase was qualified out because of performance and a weak community. They also had issues with MongoDB's inability to scale to the levels they needed as well as serious concerns over sharding of data and writes being lost during their benchmark test. RavenDB just didn't meet their standards in terms of performance and the level of sophistication needed for IOT. The last database standing was Apache Cassandra.

From a performance perspective, i2O Water claimed that Cassandra blew away the competition based on their internal benchmarking which claimed performance in a production environment reaching 50,000 - 60,000 writes per second and 20,000 - 40,000 reads per second. For comparison, their previous SQL Server database provided 0.5 writes per second and only 5 reads per second. In addition, they found Cassandra easy to maintain, upgrade and was operationally simple to manage.

"Cassandra really stood out in handling time-series data at scale. We looked at other options, but by far and away Cassandra had the best reputation and performance," said Williams.

The Results

Today, with an IOT data platform built on Cassandra, i2O Water is truly able to make a difference in the world - helping over 70 utility companies save over 235 million liters of water every day and growing - resulting in a 40% reduction in burst pipes, an average of 20% reduction in leakage levels due to the removal of excess pressure, and a 20% reduction in the energy consumed by pumping water into the network. They have now scaled their offering to include over 15,000 sensor devices distributed across 20+ countries around the world without having any concern for performance or availability issues.

"Since our launch, we've been able to ensure greater than 99.9% uptime of our platform, even during upgrades and node failures," explained Williams. "If we can continue to help countries consume water more efficiently, we can rest a little easier knowing that what we've built is making a real impact in our global community."