HPCC SYSTEMS®

LexisNexis® RISK SOLUTIONS

CASE STUDY

GuardHat: a wearable IoT platform for managing worker safety in real time

> In 2016, more than 4000 workers died on the job in the US, and there were nearly 3 million private-sector work-related injuries.* Yet a key component of workplace safety, the protective hard hat, has remained largely unchanged over the past 60 years.

***2016 recordable incident report from OSHA, Bureau of Labor Statistics - www.bls.gov**

SUMMARY

Startup company GuardHat Inc. manufactures a smart hardhat that has the potential to redefine worker safety. Sensors in the hardhat continuously transmit data to a safety control center, enabling the system to pinpoint each worker's location and detect dangerous conditions. The challenge for the safety control center is to process and analyze vast amounts of incoming data from smart hardhats in near real time so as to prevent injury. After evaluating other big-data platforms, GuardHat found that HPCC Systems® uniquely enabled the rapid green-field development that is crucial for a startup seeking to minimize time to market. HPCC Systems provided the combination of real-time processing and big data analytics capabilities that GuardHat required.

Guardhat Case Study

CHALLENGE:

In 2016, more than 4000 workers died on the job in the US, and there were nearly 3 million private-sector work-related injuries. Yet a key component of workplace safety, the protective hard hat, has remained largely unchanged over the past 60 years. Startup company GuardHat Inc. aims to save lives and prevent injuries with a smart hardhat — a wearable, Internet of Things platform in an industrial hardhat form-factor. Each GuardHat contains up to a dozen sensors, local processing and storage, and audio and video communication. This embedded technology enables the system to pinpoint a worker's location to less than a foot, monitor vital signs, video the immediate surroundings, and instantly detect impacts and sounds such as blasts.

GuardHat's goal is to improve worker safety by preventing or quickly responding to incidents. For example, the system can warn of a toxic gas buildup, alert workers when they're about to enter a dangerous area, and instantly detect a fall from elevation.

Each helmet continuously transmits data to a GuardHat safety control center for monitoring and rapid response. In the event of a fall, the device instantly sends an alert to the control center with precise location coordinates, and also notifies nearby workers wearing GuardHat; the safety control center then establishes audio and video contact with the injured worker and immediately sends help.

Because the system collects information from each GuardHat multiple times each second, it generates vast amounts of data: a site with 400 workers produces more than 200 GB of data per eight-hour shift. The challenge for the safety control center is to process and respond to this torrent of incoming data in near real time. Because GuardHat is a safety technology, service level agreements typically require that the system responds to incidents in less than two seconds. "The volume of data that's coming in is humongous," says Anupam Sengupta, GuardHat's Chief Technical Officer. "And it all has to be churned, processed, and analyzed in real time."

SOLUTION:

Rapid development was essential. "In a startup, agility is the most critical factor; time to market is crucial to success," Sengupta says. GuardHat evaluated several well-known big data platforms, but soon determined that it was spending too much time building its software framework and integrating components rather than focusing on development of its own solution.

That's when the company discovered HPCC Systems. HPCC Systems is a high-performance platform designed for big data analytical solutions, proven in the field through 10 years of development and operational use at parent LexisNexis Risk Solutions before being placed in the public domain as an Apache licensed open source project. It's an integrated, highly scalable end-to-end solution that enables fast development. Running on clusters of commodity hardware, HPCC Systems provides a single architecture with a unified data-centric programming language (ECL) and two high-performance platforms: Thor, a batch-oriented workflow processing and analytics system; and ROXIE, a front-end real-time data delivery system.

GuardHat quickly realized that HPCC Systems could simplify and speed development. It's an integrated solution, making it easier to learn and use, and GuardHat doesn't need to spend time bolting together components from multiple sources. "I call it 'batteries included'" Sengupta says. "Everything that you need is right there. We actually got up and running with HPCC literally over a weekend." Another key advantage was HPCC Systems' ECL language: "ECL is a system language across the whole HPCC Systems solution, which obviously plays in as a positive for overall implementation," Sengupta adds. "We don't have to learn multiple languages."

HPCC Systems also meets GuardHat's other key requirements. The HPCC Systems unique architecture, combining the ROXIE and Thor platforms, fulfills GuardHat's needs for real-time complex event processing together with big data analytics, Sengupta says. In addition, the solution can scale easily and allows flexible deployment models, with a mix of cloud-based and on-premises systems. Finally, HPCC Systems is a proven open source solution, with great support and a vibrant community, Sengupta says.

To solve the big-data challenge at the safety control center, GuardHat looked for a software platform that would:

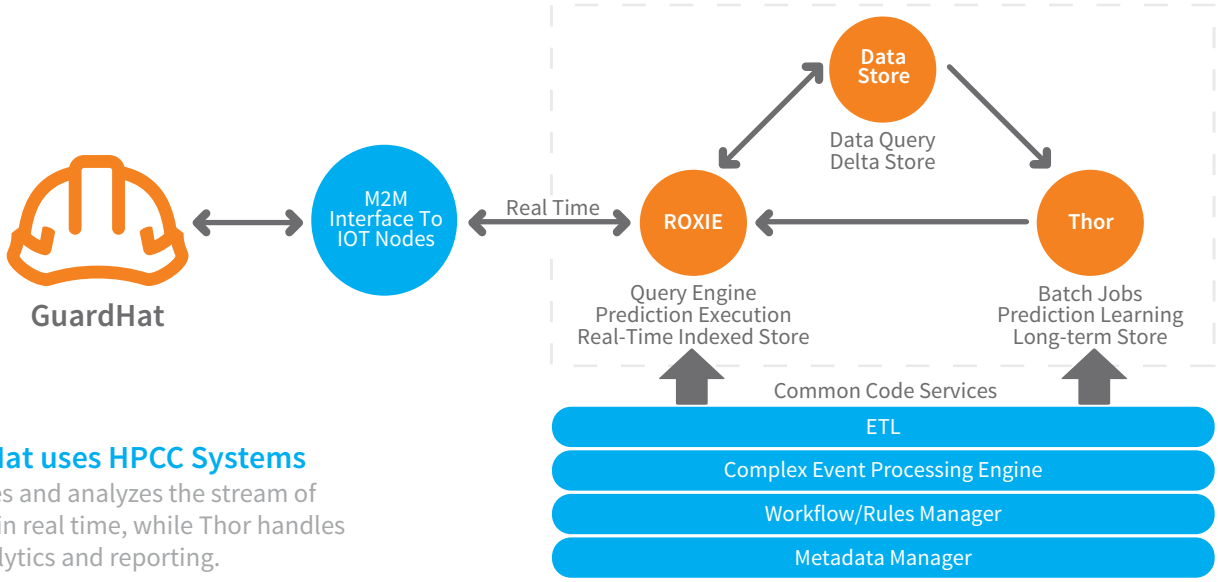
- Allow real-time complex event processing of vast amounts of streaming data.
- Enable horizontal scaling on commodity hardware, with the flexibility to deploy both on premises and in the cloud.
- Support big data analytics including the ability to analyze, identify, and predict trends.
- Enable rapid green-field development.

GUARDHAT ARCHITECTURE

GuardHat determined that ROXIE's real-time, low-latency performance was ideally suited to provide the required complex event processing. "ROXIE churns all the data, processes the events, and generates notifications" Sengupta says. The system also uses the incoming data to update a real-time dashboard that shows exactly what's happening in the field. "You actually can see who is moving around on a real-life map in high accuracy, both indoors and outdoors," he adds.

Batches of data are then periodically sent to Thor, which analyzes the historical information to identify trends that can be used to predict problems in the future. Thor also acts as a long-term data store that supports reporting and provides forensic data used to analyze the cause of incidents.

To accurately detect and respond to potentially dangerous situations, the system must aggregate and correlate the stream of incoming data points. A simple but critical example is the detection of increasing levels of noxious carbon monoxide gas at a site. Based on aggregated data from the sensors in multiple hardhats, ROXIE performs immediate analysis of the short-term trend—if necessary pulling in historical data from Thor, such as the previous month's gas levels. If the hazardous gas concentration (such as CO or H2S) trends towards a dangerous level, ROXIE creates an alarm. The alarm is communicated to GuardHat's control application, which displays the problem on the dashboard and notifies others, including emergency services.



How GuardHat uses HPCC Systems

ROXIE processes and analyzes the stream of incoming data in real time, while Thor handles batch data analytics and reporting.

RESULTS

With HPCC Systems, GuardHat's technology has the potential to make life safer for workers in a range of industries. The technology could also save employers money by preventing incidents, and provide analysis that helps insurance companies develop better models. Sengupta points out that the system has many other potential applications, including on-the-job training and maintenance—all of which rely on the ability to process vast and ever-growing volumes of data. "We need a tool that can grow with the data," Sengupta says. "We believe HPCC Systems is the right choice."

ABOUT HPCC SYSTEMS

HPCC Systems incorporates a software architecture implemented on commodity shared-nothing computing clusters to provide high-performance, data-parallel processing and delivery for applications utilizing Big Data. The HPCC Systems platform includes system configurations to support both parallel batch data processing (Thor) and high-performance data delivery applications using indexed data files (ROXIE). It also includes a high level and implicitly parallel data-centric declarative programming language for parallel data processing, called Enterprise Control Language (ECL).

The HPCC Systems technology was designed by data scientists. The programming language, ECL, is a declarative, collaborative and extensible, high-level language that allows the programmer to describe the desired outcome instead of programming tedious and ambiguous scripting.

Benefits of HPCC Systems

End-to-End Configuration: All components are included in a homogeneous platform. No additional third party tools are required which simplifies and eliminates complexities from heterogeneous platforms.

Real-time Analytics: Ability to handle massively diverse amounts of real-time data combined with built-in analytics libraries for Machine Learning help to quickly extract useful insights from data.

Scalability and Rapid Development: Massively scalable data platform supports rapid development from a growing set of real time data sources.

Ease of Use: ECL is highly efficient and accomplishes big data tasks with far less code, yet is flexible enough to be used for both complex data processing on a Thor cluster and for a query and report processing on a ROXIE cluster.

Integrates Multiple Data Types: Supports multiple data types out-of-the box, including fixed and variable length delimited records and XML. Data model is open for data analyst to define based on business needs without the constraints imposed by strict-key-value store models.

For more information, call 866.528.0780 or visit hpccsystems.com

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