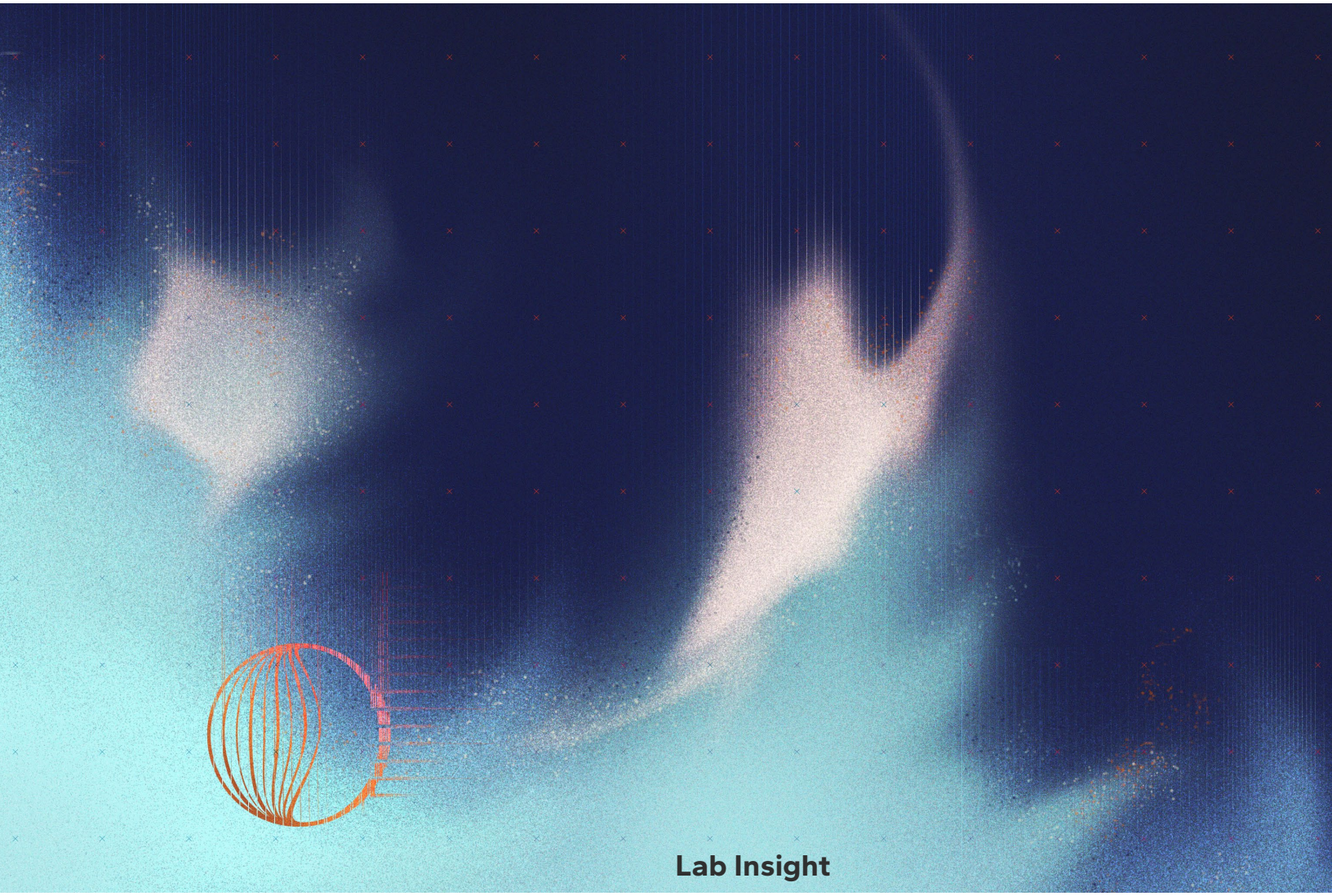
signal65



Lab Insight

Dell Enables an Industrial Digital Twin Proof of Concept with Artificial Intelligence Technology - Executive Summary

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AI for Manufacturing

Globally, there are millions of factories running 24/7, often with highly complex processes. By leveraging AI technology, organizations can further optimize and monitor these processes, resulting in safer factory environments, less downtime, and greater quality control.

AI technology poses significant value in detecting anomalous or hazardous conditions within factory settings, such as fires, spills, or broken machinery. Detecting such events improves worker safety and prevents downtime, however, building such an application poses unique challenges for AI practitioners. To detect such conditions, AI models can leverage video and machine sensor data, however, creating training data and testing the solution can prove challenging. Specifically, training and testing AI solutions to detect anomalous or hazardous events in a live factory environment is impractical and unsafe.

This challenge introduces an ideal use case for combining AI with Metaverse technology. By leveraging digital twin factory environments, organizations can quickly create training data and test solutions involving hazardous events, while maintaining accuracy to their specific environments. Successfully tested solutions can then be deployed in physical factory settings.

The following PoC solution demonstrates one such strategy for a readily deployable AI-powered manufacturing solution developed using a digital twin Metaverse.

Solution Overview

To demonstrate an AI-powered application focused on manufacturing, Scalers AI™, in partnership with Dell™, Broadcom™, and Signal65 implemented a proof-of-concept for detecting hazards in a factory setting as well as providing predictive maintenance for factory equipment. This PoC solution specifically targets detection of hazardous chemical spills on a factory floor and detection of bearing faults in industrial compressors.

An overview of the PoC solution is as follows:

- A factory floor digital twin is created with NVIDIA™ Omniverse. Chemical spills are placed throughout the simulated factory floor.
- Simulated Autonomous Mobile Robots (AMRs) are deployed throughout the factory floor, streaming video data to an AI image detection pipeline trained to detect chemical spills.
- Sensor data from simulated compressors deployed in the Metaverse is collected at regular intervals and published over OPC Unified Architecture (OPC UA). A machine learning powered analytics module analyzes the data to detect bearing faults.
- A visualization dashboard provides monitoring and alerting of both chemical spill detection and compressor failure. The dashboard includes direct views from AMR cameras, a map of the factory floor with live AMR locations, chemical spill incident logs, and a time series graph of compressor failures. Alerts of hazards are displayed on the dashboard and can additionally be sent as mobile notifications

A high-level overview of the PoC solution can be found in Figure 3.

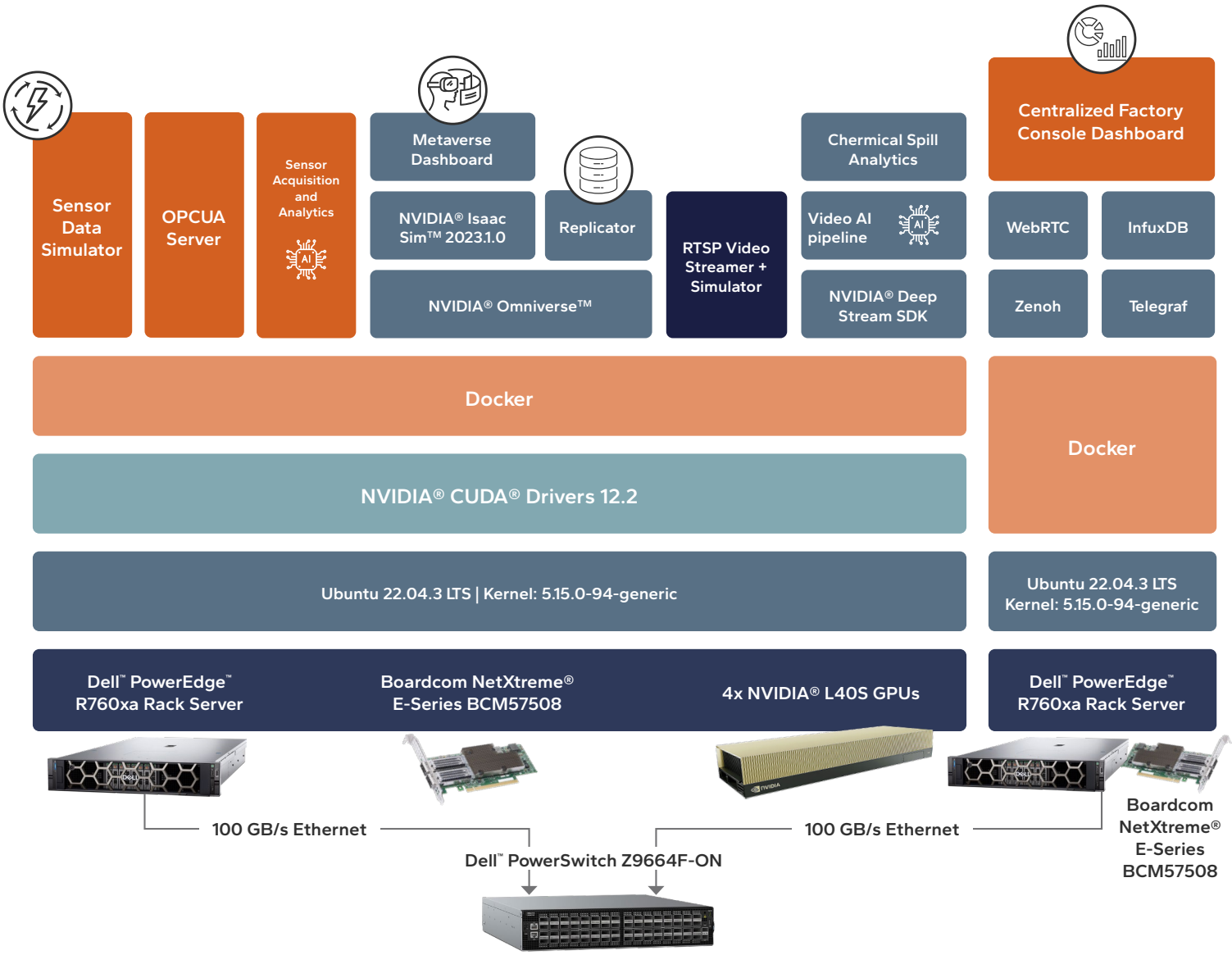
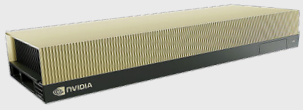


Figure 3: *Solution Overview (Source: Scalers AI)*

The key hardware components used in the solution included the following:

Dell PowerEdge XR7620 Server



NVIDIA® L40S GPUs

Broadcom NetXtreme E-Series BCM57508 Ethernet Controllers

Dell PowerSwitch Z9664F-ON

Solution Highlights

This PoC solution provides valuable insight for both AI practitioners and IT operations working in industrial and manufacturing environments. Notable highlights from the solution include:

- Demonstration of a practical AI solution for manufacturing environments enabled by leveraging NVIDIA Omniverse for creating training data and testing implementation. The Metaverse solution is transferable to a physical factory environment.
- AI powered equipment failure detection and predictive maintenance capabilities are enabled using machine sensor data and the OPC UA protocol commonly used in manufacturing environments.
- The PoC leverages GPU-dense Dell R760xa servers with NVIDIA L40S GPUs to support Metaverse simulation alongside video processing and AI inferencing.
- Modular architecture connects AI pipeline and visualization dashboard over high bandwidth Broadcom Ethernet for a highly scalable solution.

Conclusion

Use of AI technology in manufacturing environments presents significant opportunity to optimize processes, enhance safety, and reduce costly downtime. Despite the potential value, manufacturing organizations are met with many challenges in deploying new AI solutions, ranging from understanding the hardware requirements, integrating the solution with existing protocols, and feasibly developing and testing solutions without disrupting live factory environments. This PoC demonstrates how these challenges can be met by leveraging innovative Metaverse technology alongside powerful hardware from Dell, NVIDIA, and Broadcom.

Important Information About this Report

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