Dell Technologies Manufacturing Edge Reference Architecture with PTC

An introduction to a reference architecture using PTC ThingWorx with VMware

Abstract

This document introduces a reference architecture using PTC ThingWorx with VMware to enable smart manufacturing with scalable end-to-end enterprise and automation applications, asset monitoring, predictive maintenance and real-time performance monitoring.

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Executive summary

To remain competitive, manufacturers need a scalable, repeatable foundation for smart factory installations and Industry 4.0 solutions that can be reliably deployed at the edge. These solutions also need to aid the convergence of information technology (IT) and operational technology (OT) functions to ease digital transformation from the core to the edge.

Dell Technologies has collaborated with PTC—a world leader for industrial Internet of Things (IIoT) software applications—to create a high-availability, multi-cloud capability edge manufacturing solution that leverages VMware virtualization to enable scaling from a single factory floor to global production environments.

This document provides software and hardware guidance to help you design and implement an instance of Dell Technologies Manufacturing Edge Solutions with PTC, customized for your environment and use cases.

Business challenges

IIoT and smart factory applications are predicted to drive substantial productivity improvements, energy savings and gains in labor efficiency for manufacturers over the next few years. Due to the distributed nature of manufacturing operations, success with these applications will require comprehensive infrastructure solutions at the edge.

However, digital transformation for manufacturers involves more than just identifying and deploying IT solutions. True digital transformation requires a convergence of information technology (IT, i.e., people who select, source, and support technology) and operations technology (OT, i.e., people who use the technology at the edge to support operations).

The power of partnership

Dell Technologies, in partnership with VMware, has created a validated reference architecture for the Dell Technologies Manufacturing Edge Solutions. This solution bridges the gap between OT and IT so that manufacturers can thrive at the edge. Modernizing hardware and placing intelligent solutions at the edge helps IT better support OT by enabling:

- End-to-end enterprise operational intelligence
- Intelligent asset optimization
- Predictive maintenance
- Enterprise-grade capabilities and scale for factory applications

By helping to bring OT and IT together, the joint solution helps reduce costs and downtime while improving asset efficiency and revenue.

PTC ThingWorx offers the IIoT capabilities needed to quickly build and scale manufacturing solutions on Dell EMC VxRail. VMware vSphere® software, built into VxRail, enables operations teams to virtualize applications. The result is a scalable collaborative solution for manufacturers to modernize their industrial operations with a digital IIoT foundation from the edge to the cloud.

APEX Private Cloud

Dell Technologies is extending its APEX Private Cloud offering to the edge with the Dell Technology Manufacturing Edge Solutions. By collaborating with key partners such as PTC, the leader in software for the global manufacturing industry, manufacturing enterprises can now deliver tracking and performance analytics across all their production-line environments. By optimizing performance and managing resources more efficiently, they reduce costs and increase the overall reliability of their production lines, while at the same time consolidating critical applications and minimizing hardware sprawl.
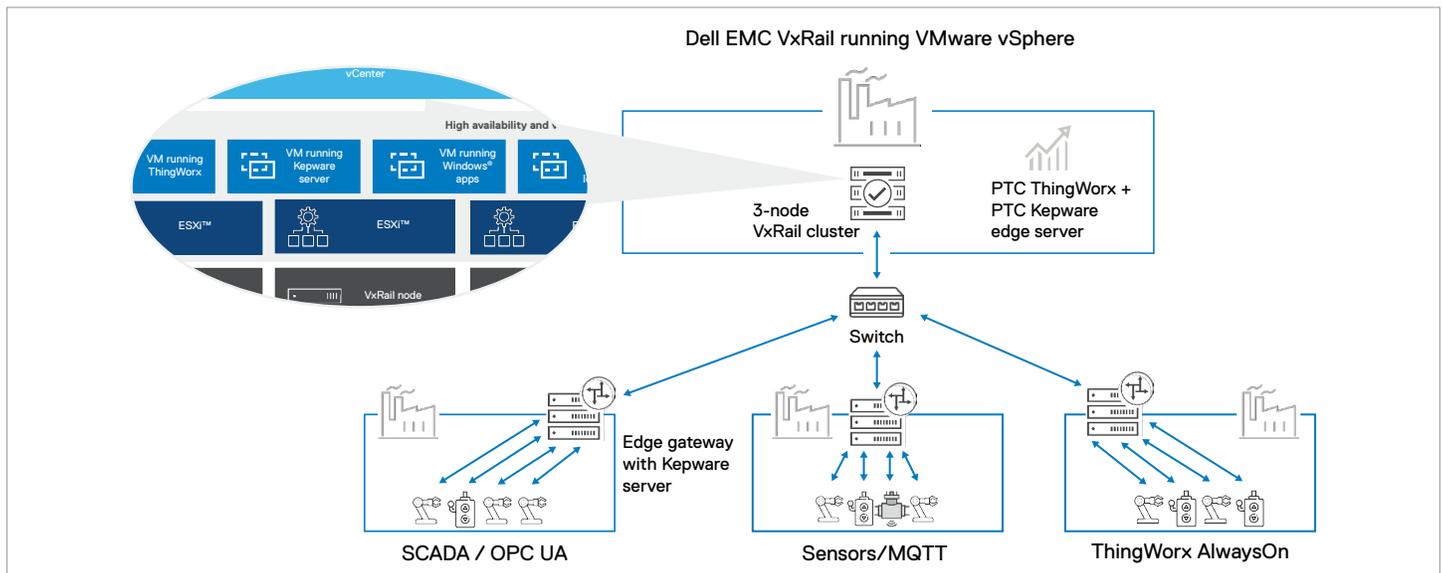
Reference architecture

Realizing IIoT data through a validated reference architecture

Despite an environment of well- and long-established industrial automation control systems, a significant gap exists in how to extract previously unrealized meaningful data from industrial automation machines and the controllers themselves. This data can potentially provide deeper visibility into a machine's behavior, performance and overall efficiency.

There were a limited number of systems that could go beyond the gathering of basic machine data. Historian systems, which are critical to tracking industrial automation performance, cannot dive deeper into the data provided by controllers, sensors and control systems.

Through industry-defined use cases, Dell Technologies Manufacturing Edge Reference Architecture with PTC dives deeper into industrial automation machine data, simplifying how to design and implement a validated architecture. This architecture enables the gathering, normalization and visualization of machine and sensor data through the integration of the PTC ThingWorx, PTC Kepware Server, PTC Kepware Edge software platforms, and Dell EMC VxRail HCI.

Solution components in the reference architecture

PTC ThingWorx

One of the key solutions in the reference architecture is the PTC ThingWorx Application Enablement Platform (AEP). ThingWorx enables digital transformation through aggregation, analytics and visualization of data from industrial operating environments. The ThingWorx platform provides implementation flexibility, extending from an on-premises solution to hybrid cloud and local enterprise edge architectures, all the way to fully public cloud solutions.

Because building IIoT solutions are often cited as a pain point, ThingWorx is designed to remove barriers to adoption by delivering IIoT applications that are specific to industrial use cases. The platform delivers an end-to-end capability to allow you to achieve your transformational goals and objectives.

There are five key areas addressed by ThingWorx:

Task	Solution
Connect	Establish a standardized connectivity layer across edge industrial devices, applications and enterprise systems, centralizing a pipeline of valuable industrial data.
Build	Fast-track digital transformation with powerful tools that simplify creating connected applications across IIoT deployments.
Analyze	Transform high-volume IoT data into actionable insights. Operationalize models, predictions and recommendations across enterprise functions to enhance decision-making with powerful ThingWorx analytics capabilities.
Manage	Centrally administer, manage and maintain physical and digital assets to keep them running at peak performance.
Experience	Access valuable insights in IIoT data. Use ThingWorx dashboards, applications and tools to empower employees with the right data at the right time.

The reference architecture includes the following underlying components of the ThingWorx platform.

- ThingWorx Foundation
- InfluxDB®
- PostgreSQL
- ThingWorx Kepware® Edge
- ThingWorx Kepware Server

Dell EMC VxRail

Dell Technologies Manufacturing Edge Solutions, based on Dell EMC VxRail, help you simplify your edge. You can remove complexity and sprawl from your edge to generate more value by optimizing production and increasing overall operational efficiencies.

VxRail, powered by Dell EMC PowerEdge server platforms and VxRail HCI System Software, is the only fully integrated, preconfigured, and tested hyperconverged infrastructure (HCI) system optimized for VMware vSAN. VxRail provides a simple, cost-effective HCI solution for a wide range of operational and environmental challenges. It supports almost any use case, including tier-one applications, cloud-native and mixed workloads. VxRail invests in the complete lifecycle, including advanced automation, making it easier for you from day one forward, allowing you to further simplify IT infrastructure and operations.

The Dell EMC PowerEdge servers maximize performance and optimize flexibility at any scale. Focused on accelerated performance, enhanced automation and simplified management, PowerEdge servers are also optimized for industrial automation computing. This portfolio of rack servers is designed to ensure a stable environment with intuitive IT-supported tools that simplify and automate throughout the entire server and PTC application lifecycle through:

- **Adaptive compute**—Maximize application performance across highly scalable architectures and flexible internal storage.
- **Autonomous compute infrastructure**—Automate the entire server and application platform lifecycle from deployment to retirement with embedded intelligence that dramatically increases productivity. Reduce server and edge infrastructure configuration time up to 99% with zero-touch administrative tools.
- **Proactive resilience**—Protect customer, business, and proprietary production data with a deep layer of defense built into the hardware and firmware of every server.

The VxRail family is ideal as a platform for hosting the industrial automation platforms in the industrial space. As a turnkey platform, these appliances simplify IT support in the OT space and can be managed by existing Dell EMC management tools. The VxRail servers also have ruggedized versions that are designed to withstand extreme conditions, such as intense heat and cold, shock, vibration, dust, humidity and electromagnetic interference.

VMware

VMware vSphere is the virtualization platform for the solution. It transforms edge locations into aggregated computing infrastructures that include CPU, storage and networking resources. vSphere manages the infrastructure or distributed infrastructures as a unified operating environment. It provides the IT tools to administer each edge data center that supports the application needs of the production space of each plant.
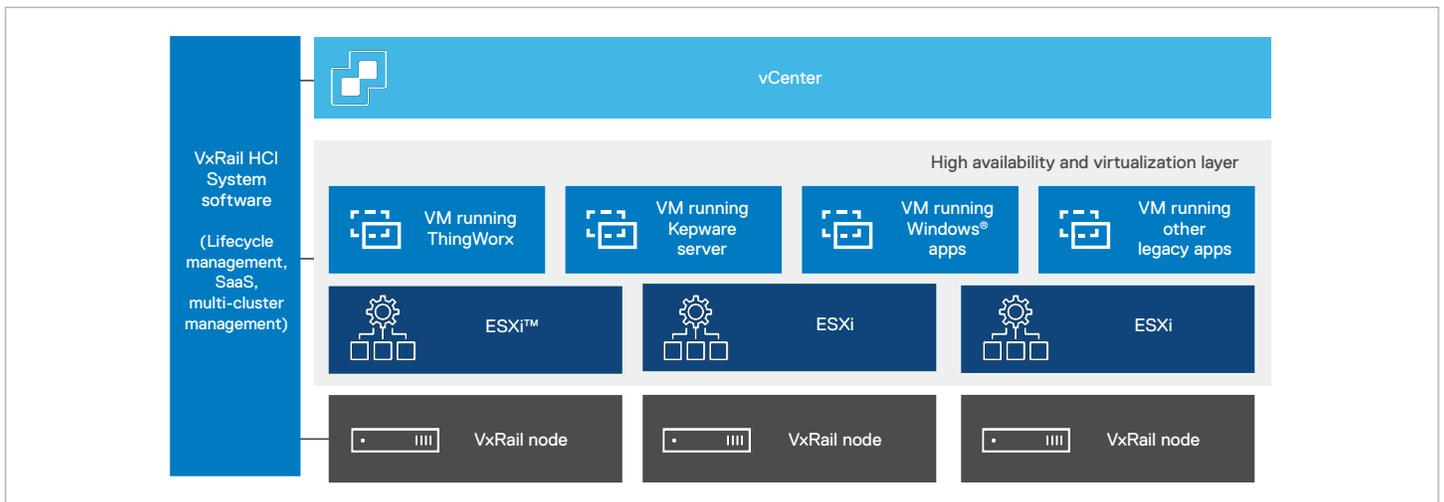
Use cases

The following use cases are a few of the many opportunities unlocked through this joint solution with PTC.

Enterprise operational intelligence	Intelligent asset optimization
Transform plant operations from silos of people, assets, and processes into a comprehensive data-driven, synchronized plan with predictable and measurable results. This joint solution with PTC gives OT unmatched visibility into actionable key performance indicators (KPIs), such as: • **Real-time product performance monitoring**—Gives operators insights that help increase throughput and quality while reducing unplanned downtime and manufacturing costs. • **Standardized plant benchmarking**—Enables comparison across machines and plants to identify top performers and best practices. Tracking and performance analytics across all lines of the production environment help reduce costs, waste and delays. It also helps with insights that prevent downtime, accelerate changeover and push performance optimization to the next level.	Increase asset utilization by monitoring asset health in real time to identify abnormal conditions and identify what caused them. Real-time analytics has the potential to bring new insights into plant operations and asset utilization, such as: • **Asset monitoring and utilization**—Real-time visibility and management of asset performance, status, and under- or overutilization. • **Predictive maintenance**—Intelligence applied to asset data can identify issues before they impact production. This proactive approach reduces unplanned downtime, increases asset lifespan, and optimizes maintenance costs. • **Optimized maintenance windows**—Data-driven maintenance decisions reduce disruptions to plant production. Monitoring, diagnostics, and prescriptive analytics services help reduce unplanned downtime while maximizing asset utilization via more efficient maintenance and identification of underutilized machines. In addition, by identifying and eliminating inefficiencies between each production cycle of each machine, the true value and revenue potential of the production environment can be realized.

Summary

The tested and validated reference architecture for PTC ThingWorx provides a high-performance platform that is ready to host the most demanding IIoT and smart factory applications. By leveraging a proven design documented by industry leaders, the path to value is accelerated and the risks are reduced. Whether an on-premises or a hybrid deployment, the jointly produced reference architecture exemplifies design principles that yield a scalable and repeatable foundation for Industry 4.0 initiatives across the globe.

As modern applications such as advanced analytics, digital twin/digital thread, predictive maintenance, and application consolidation drive manufacturing organizations to move more compute resources to the enterprise edge, the solution from Dell Technologies, PTC and VMware leverages the value of an enterprise-grade infrastructure to run industrial analytics platforms closer to where the data is being created and where results are most valuable.

These joint solutions between Dell Technologies, PTC and VMware deliver unprecedented stability, security, scalability and repeatability for every smart manufacturing initiative.

Learn more.

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