



Adopt a platform approach to OT system orchestration



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Adopt a platform approach to OT system orchestration

System orchestration is critical for today's cloud-native enterprise applications. It will also become critical for future open industrial automation systems, which will have to manage many of the same concerns.¹

Operational technology (OT) system orchestration in manufacturing

Operational technology systems have long been the backbone of industrial processes. These systems, often built on specialized, proprietary hardware and software, are typically purpose-built to meet the industry's rigorous demands for reliability, performance, and safety. But as manufacturing and industrial environments become more connected and complex, the traditional approach to OT management is showing its limitations.

An overview of OT systems

OT systems in the manufacturing sector include a broad range of components, each with its own role and function in the production process.

- ▶ **Network devices** such as switches and firewalls, among other network components, are essential for security-focused, reliable communication between OT systems, managing data flow and protecting assets from external and internal threats.
- ▶ **Field devices**, including sensors and flow meters, gather critical data on variables like temperature, pressure, and flow rate.
- ▶ **Controllers** use this information to make real-time adjustments to keep processes running smoothly, often with custom-built logic tailored for specific applications.
- ▶ **Human machine interfaces (HMIs)** provide operators with a visual representation of plant operations, allowing them to monitor and respond to shifts in production.
- ▶ **Servers** aggregate data across these devices and support applications like analytics and storage, creating a foundation for insights and long-term data retention.

¹ Forbes, Harry. "[System Orchestration for Open Industrial Automation](#)." ARC, Aug. 2024

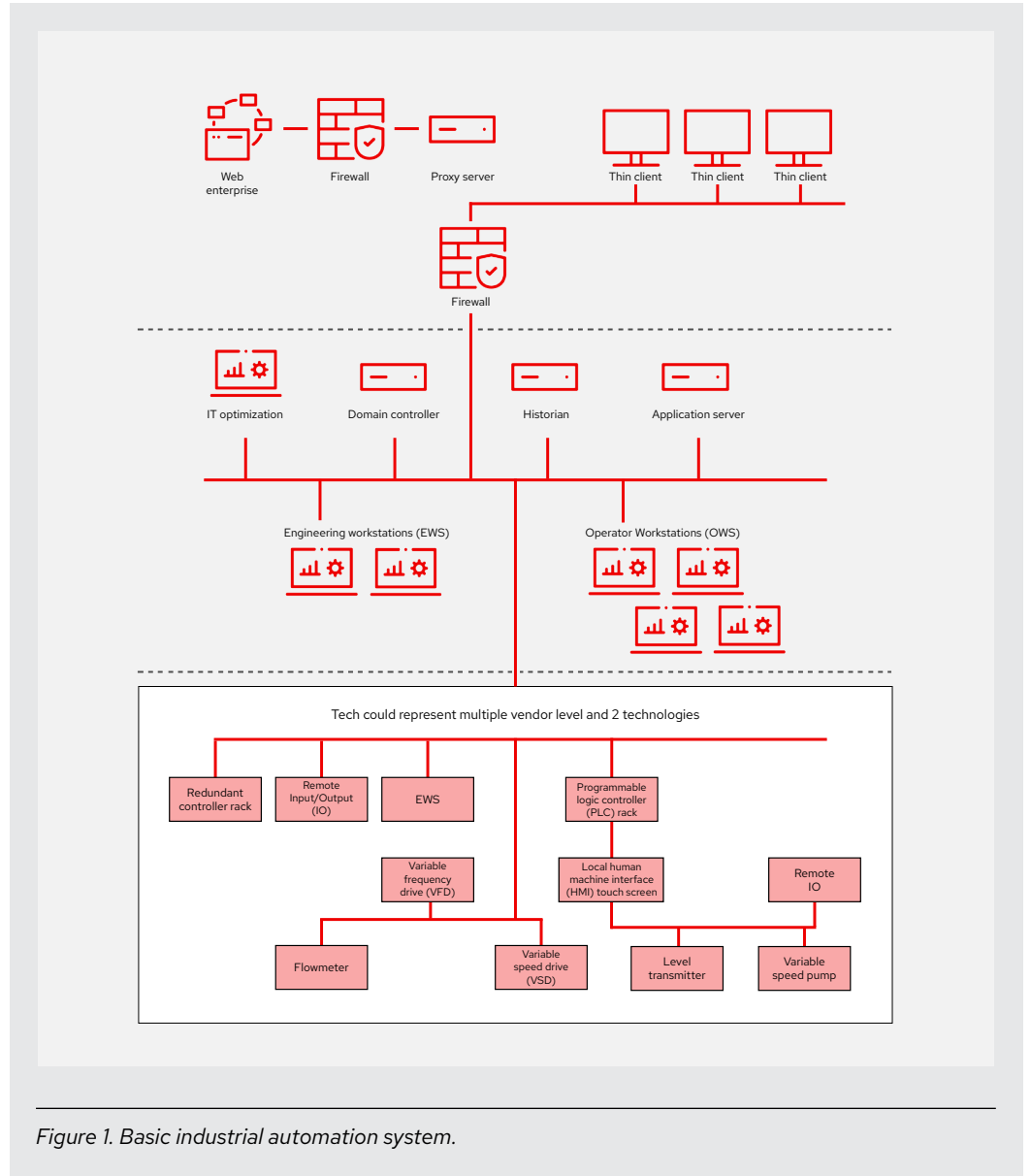


Figure 1. Basic industrial automation system.

For years, these systems were able to work in isolation, each managed by proprietary applications specific to their manufacturer. This approach brought stability, but at the cost of agility and integration.

Today, manufacturers are facing a wave of new technologies and market demands that challenge this status quo. The rise of internet of things (IoT) devices, artificial intelligence (AI), and machine learning (ML) is creating opportunities for deeper insights, predictive maintenance, and enhanced operational efficiency. However, to gain these benefits, industrial operations need a way to bridge the gap between traditional OT environments and modern IT practices. OT system orchestration can serve as that bridge.

OT systems are evolving

The industrial landscape is shifting as manufacturers adopt advanced technologies such as AI, containerization, virtualization, and Linux®-based operating systems (OSes). Alongside these innovations comes a growing need to manage frequent software and security updates, ensure patch compliance, and integrate the latest workloads into aging OT environments.

While these advancements promise greater efficiency, insight, and scalability, they also introduce complexity that traditional OT management approaches cannot handle. To navigate this evolving landscape, take advantage of the latest technologies, and maintain reliability, manufacturers need a unified strategy.

An introduction to OT system orchestration

Orchestration in the OT context refers to a centralized framework for deploying, updating, safeguarding, and managing the various applications and devices that make up an industrial environment. It presents a transformative shift in how OT systems are managed, maintained, and evolved.

Instead of handling each component individually, orchestration allows for a unified approach, helping manufacturers to:

- ▶ Deploy new applications.
- ▶ Update existing systems.
- ▶ Enforce security policies across an entire facility or across multiple sites.
- ▶ Do all of the above from a single platform.

For example, consider the complexity of maintaining an industrial facility's operational technology without orchestration. When a specific device or application requires updating, that update must be applied manually, often at significant risk of downtime or production disruption. Security patches, which are critical to protect against cyber threats, may not be applied consistently across all systems.

With orchestration, however, these tasks can be automated and scheduled in a way that minimizes operational interruptions, making sure that vital updates are applied uniformly and efficiently.

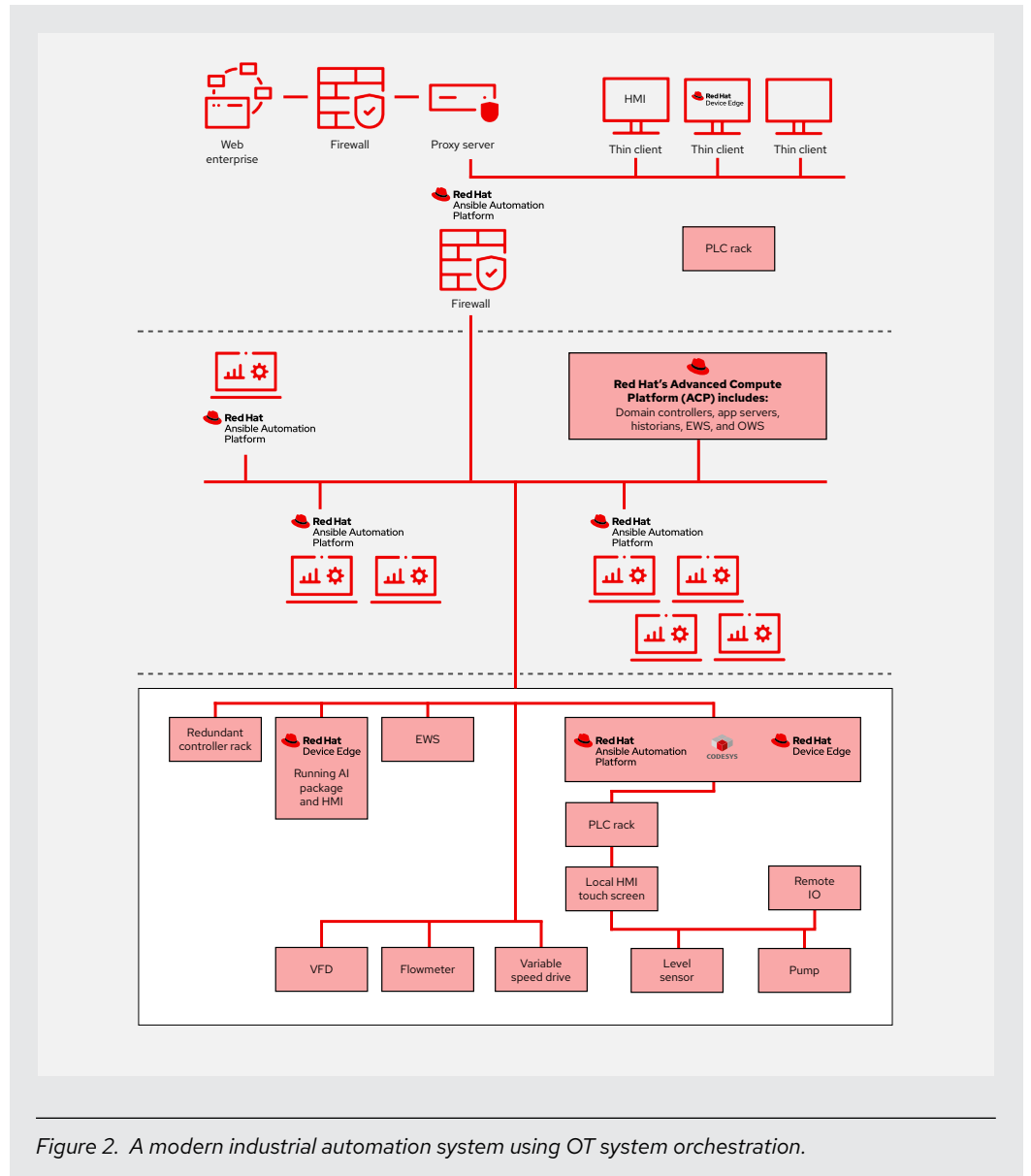


Figure 2. A modern industrial automation system using OT system orchestration.

Uniformity with flexibility

Orchestration also introduces repeatable actions, which provides much-needed flexibility in an industrial setting. Not only does this help organizations as they expand their use of connected devices, predictive analytics, and AI-powered insights, it also helps them manage current IT infrastructures and architectures.

By providing a standardized platform for deployment, organizations can rapidly adopt new technologies without overhauling their entire infrastructure. In a sense, orchestration acts as a bridge between existing, proprietary systems and new technology, allowing manufacturers to innovate without sacrificing reliability.

“As the industrial automation space rapidly accelerates its modernization, there is an urgent need to enhance edge interoperability across the ecosystem. The Margo Initiative aligns with Red Hat’s commitment to unlocking barriers to innovation and simplifying the deployment, scalability, and operation of industrial solutions for our customers.”²

Kelly Switt

Senior Director,
Intelligent Edge Global
Business Development
at Red Hat

Orchestration adoption challenges

Transitioning to an orchestrated OT environment is not without its challenges. For many organizations, this shift represents a fundamental change in how they manage current technology and adopt new technology, requiring careful consideration of several factors, including:

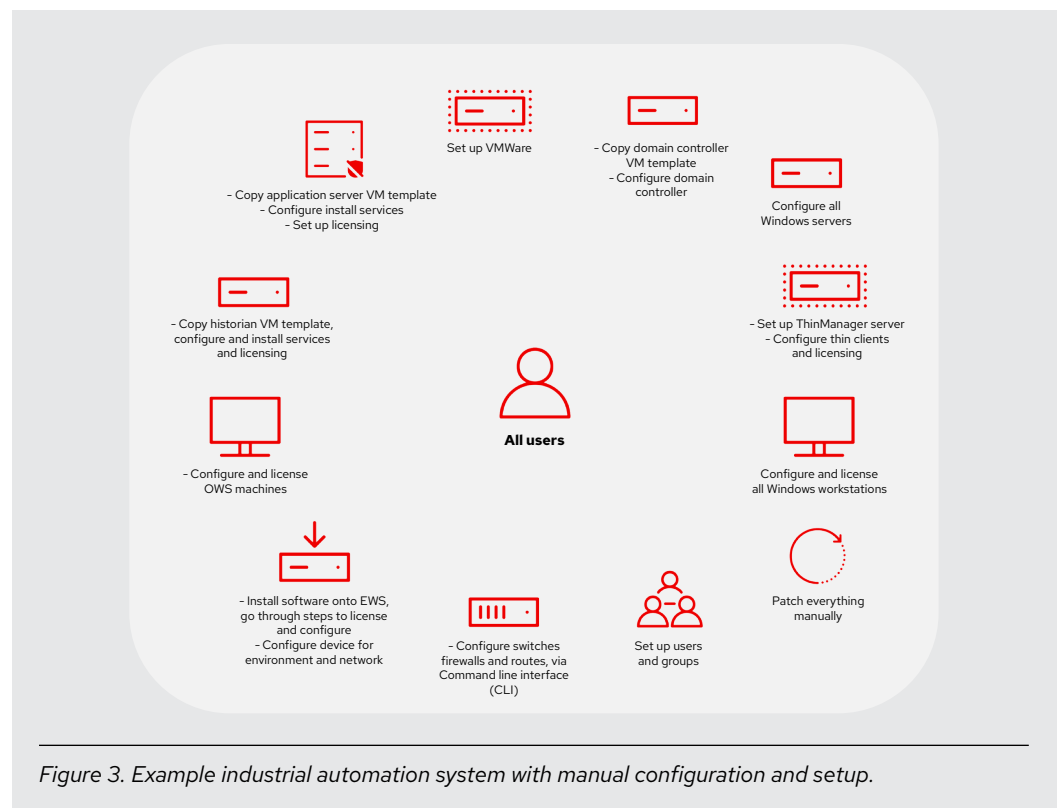
- 1. IT complexity.** As technology continues to improve production, efficiency, and safety, these advancements come with new layers of IT complexity. Manufacturing facilities now face the challenge of integrating advanced technologies such as IoT and AI with their existing infrastructure.
- 2. Planning for future technology systems.** Many manufacturing facilities have relied on technology solutions that have been in place for years, even decades, simply because they work. Many of these technologies are at their end of life and lack easy replacements, putting organizations at risk of being out of date. Open technology and orchestration help organizations integrate new technologies that are ready for the demands of the future.
- 3. Uptime and managing updates.** Uptime is critical in industrial environments. In the past, software and equipment updates often required restarts, disrupting production and risking downtime. In the 24/7 industrial sector, this has led to delays in applying necessary updates.
- 4. Consistency and standardization.** A standardized environment is essential for managing a wide range of systems and applications. Achieving a level of standardization, however, can be challenging given the growing IT complexity and the inconsistencies created by incorporating new and aging systems.

² Red Hat press release. [“Red Hat Joins the Linux Foundation’s Margo to Deliver Edge Interoperability for Industrial Automation Ecosystems,”](#) 12 Nov. 2024.

Shift toward software-centric operations

As industrial organizations look to the future, the need for a more integrated, flexible, and resilient approach to OT management becomes clear. Orchestration allows manufacturers to move beyond the limitations of proprietary systems, embracing an open and scalable model that can adapt to new demands, technologies, and industry challenges.

In this new era of industrial automation, orchestration is not just a convenience; it is a necessity. By embracing an orchestrated OT environment, manufacturing leaders are setting the foundation for a future where their operations can thrive amidst change, adapt to new technologies, and achieve greater efficiency and insight.



Red Hat can help manufacturing organizations take advantage of an open ecosystem that is constantly evolving by offering solutions tailored to the industrial sector's unique requirements.

An open platform approach to OT orchestration

As manufacturing environments embrace new technologies, the need for a streamlined and scalable approach to managing OT systems has never been greater.

Red Hat offers a proven, open platform approach that combines innovation, flexibility, and reliability. This means providing a platform that is vendor-neutral, flexible, and scalable, to help manufacturers to manage diverse and evolving workloads with consistency and efficiency.

To make sure our solutions are aligned with industry standards and address the unique challenges of industrial environments, Red Hat cultivates strategic partnerships with leading manufacturing vendors and is a member of organizations such as the Open Process Automation Forum (OPAF) and the Linux Foundation's [Margo Initiative](#) to enhance interoperability in industrial automation environments and advance [OT system orchestration](#) strategies across the industry.

The value of an open approach

Red Hat's commitment to openness extends beyond software solutions. Fostering an open source community means that Red Hat's platforms are continuously improving, backed by the collective expertise of thousands of developers and contributors worldwide.

In the OT space, Red Hat's commitment to open source means shorter time to innovation and problem solving. By using platforms like Red Hat® Ansible® Automation Platform, manufacturers can orchestrate and manage complex OT environments with greater agility and efficiency. Open source initiatives empower teams to adopt new technologies, respond to industry demands, and solve operational challenges collaboratively.

This approach accelerates advancements by drawing on community-led innovations while streamlining integration of traditional OT systems with modern IT infrastructures. With Red Hat's open source solutions, manufacturers can reduce complexity, enhance scalability, and stay ahead in an ever-evolving industrial landscape.

Red Hat's dedication to open source solutions empowers businesses to bridge the gap between traditional OT systems and modern IT infrastructures, facilitating smooth integration and improved operational efficiency.

For manufacturers and industrial organizations, this means access to a platform that is proven, reliable, and constantly evolving, so they can meet their challenges today while setting the foundation to adapt as the industry changes.

Gain the expertise of a robust partner ecosystem

No provider can do it alone, even Red Hat. Our open approach includes an extensive network of partners. Collaborations with vendors make sure that Red Hat's platforms are optimized for the unique performance requirements of OT environments.

For example, Red Hat and Intel collaborated on a new industrial edge platform that provides a modern approach to building and operating industrial controls. Red Hat's partnership with Intel provides real-time operating system capabilities that are critical for OT environments that prioritize deterministic performance.

The industrial edge platform provides a holistic solution that spans from real-time shop floor control and AI/ML to full IT manageability—delivering greater customer choice for data gravity or edge-to-cloud style architectures and improved overall equipment efficiency (OEE).³

Red Hat’s partnership network also includes system integrators, whose feedback helps Red Hat tailor solutions to meet the needs of those implementing and managing industrial systems. System integrators are the connection point between vendors and end users, making sure implementations are successful and allowing for constant improvement.

Implementation scenarios

For years, manufacturers have grappled with the challenge of deploying and managing large OT systems across their diverse and complex environments.

These systems, often spread across multiple facilities, production lines, and geographic regions, require meticulous setup, configuration, and ongoing maintenance. Manual deployment processes not only consume time and resources, but also introduce variability that can lead to inefficiencies, errors, and vulnerabilities.

Red Hat Ansible Automation Platform transforms this process by automating deployment across OT environments with many prebuilt components for Ansible Automation Platform, helping manufacturers manage servers, controllers, and AI workloads, such as vision systems, without having to build from scratch, boosting efficiency and consistency.

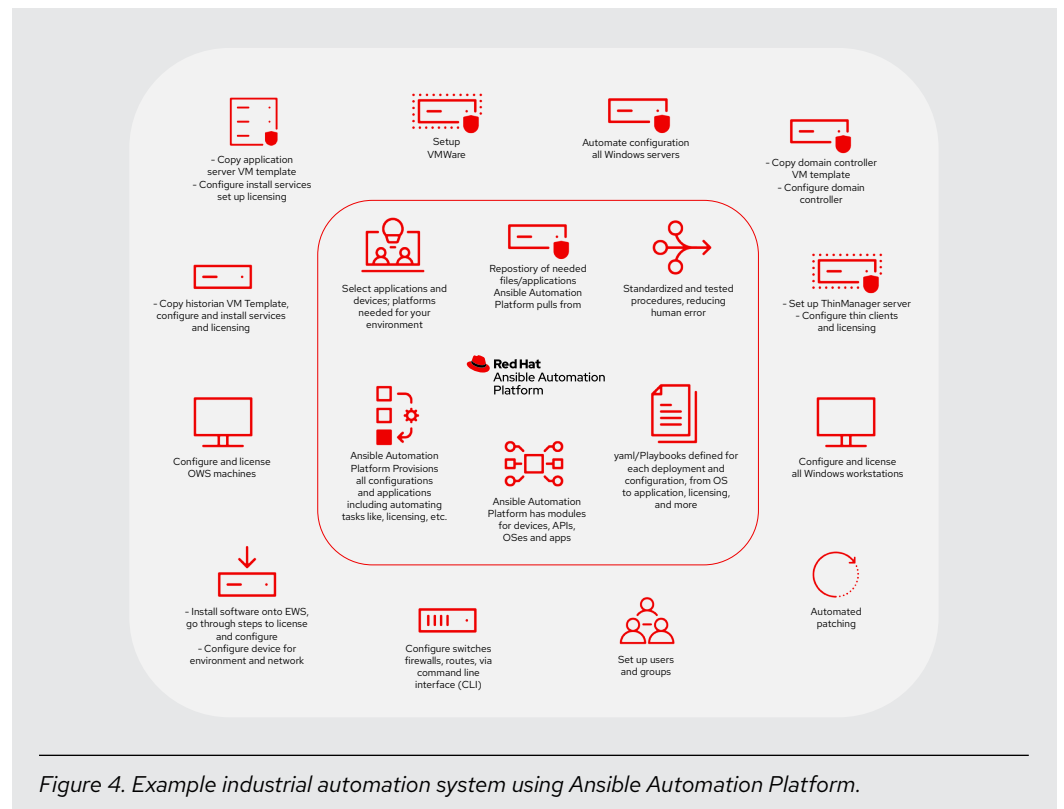


Figure 4. Example industrial automation system using Ansible Automation Platform.

³ Red Hat press release. “[Red Hat Collaborates with Intel to Deliver Open Source Industrial Automation to the Manufacturing Shop Floor](#),” 19 Sept. 2023.

Ansible Automation Platform can streamline the path to consistency and scalability across many implementation scenarios, and across thousands of nodes at a time. Example implementation scenarios include:

- ▶ **Server setup.** Consider a manufacturing facility that is deploying a new set of data servers for process control and analytics. Traditionally, this process involves manual installation of the operating system, configuration of parameters, installation of applications, and patching of updates. Using Ansible Automation Platform, manufacturers can create reusable playbooks—scripts that define the set-up process—to automate these tasks. As a result, deployment becomes consistent, repeatable, and scalable across multiple facilities.
- ▶ **Controller configuration.** Controllers are vital to industrial operations, yet their configuration is often proprietary and labor-intensive. Ansible Automation Platform allows manufacturers to automate these configurations, making sure that every controller is set up to the same specifications while minimizing the need for specialized expertise.
- ▶ **AI workloads for vision systems.** In advanced manufacturing setups, AI-powered vision systems are increasingly used for quality control, defect detection, and safety monitoring. Deploying these workloads typically requires careful calibration of both hardware and software. Ansible Automation Platform simplifies this by automating the deployment of vision system software, allowing for greater consistency in performance and reducing set-up time from hours to minutes.

By automating deployment, Red Hat not only helps manufacturers save time and reduce errors, but also frees teams to focus on higher-value tasks like optimizing production processes and exploring new technologies.

Simplify connectivity in industrial environments

The backbone of any manufacturing operation is its network, which connects field devices, controllers, servers, and edge systems. Managing this network is a complex task, involving the setup of subdomains, synchronization of time-sensitive operations, and enforcement of stringent security protocols. Errors can disrupt production, compromise data integrity, or expose vulnerabilities.

Ansible Automation Platform simplifies network management by providing manufacturers with tools to address these challenges while enhancing performance and prioritizing security.

- ▶ **Network subdomain segmentation for security posture and efficiency.** Industrial environments often house a mix of aging systems and modern devices, each with unique connectivity requirements. Segmenting the network into subdomains ensures that different parts of the operation, such as field devices, controllers, and HMIs, can communicate with a security focus without interfering with each other. Ansible Automation Platform can help implement best practice network strategies and expert partnerships with top OT vendors, to not only improve your network performance, but improve your security posture and industrial automation system performance.
- ▶ **Time synchronization for operational harmony.** Precision is critical in manufacturing, where even microsecond discrepancies can disrupt processes. Using Ansible Automation Platform can help automate some of the processes that contribute to maintaining uptime such as switch configuration.
- ▶ **Performance and security optimization.** Industrial networks require rigorous performance and security standards. Ansible Automation Platform can help organizations meet these high standards by providing automated configuration of network switches to enforce security policies, manage traffic loads, and optimize performance for critical applications. Whether it is ensuring that AI-powered analytics workloads receive the necessary bandwidth or implementing role-based access control for sensitive systems, Ansible Automation Platform handles it all with precision.

Edge-to-core integration using Red Hat Device Edge

The backbone of any manufacturing operation is its network, which connects field devices, controllers, servers, and edge systems. Managing this network is a complex task, involving the setup of subdomains, synchronization of time-sensitive operations, and enforcement of stringent security protocols. Errors can disrupt production, compromise data integrity, or expose vulnerabilities.

Having the same operating system across your plant would be ideal. However, each level and function has different requirements and different needs for compute power. In the case of devices, as well as devices that require less compute power, it would be beneficial to have a built-for-purpose OS with lower compute needs on the same OS. This is where Red Hat Device Edge can help.

Red Hat Device Edge provides essential capabilities to resource-constrained devices at the edge of the network. In industrial environments, these edge devices are often lightweight systems with limited computing power, such as sensors, HMIs, and controllers.

By running Red Hat Device Edge, manufacturers can:

- ▶ Deploy lightweight applications at the edge to allow for real-time analytics, monitoring, and control.
- ▶ Extend the benefits of orchestration to devices that were previously difficult to manage due to hardware limitations.
- ▶ Help even the smallest devices maintain a strong security posture, remain up-to-date, and maintain integration with the broader OT system.

Together, Ansible Automation Platform and Red Hat Device Edge provide a comprehensive solution for managing the full spectrum of industrial workloads—from lightweight edge devices to centralized servers—creating a consistent, scalable, and security-focused environment.

Industrial control system

Figure 1 is an architecture diagram that represents a high-level view of an industrial control system with components organized into layers and platforms for managing and orchestrating devices, applications, and data flows.

Red Hat solutions act as the core orchestration layer that ties together the entire architecture in the diagram. From edge devices to enterprise systems, Red Hat provides the tools and platforms manufacturers need to modernize their OT environments, overcome integration challenges, and unlock new efficiencies.

Whether managing diverse compute workloads, maintaining a strong network security posture, or accessing real-time analytics, Red Hat is transforming how industrial control systems operate.

Implementation goals

As organizations look to the future, Red Hat is helping make the shift toward a software-defined approach to industrial control.

Empowering soft controllers and virtualized environments

- ▶ **Soft controllers and virtualization.** While soft controllers are not new, the opportunity for large-scale usage is now possible with Red Hat Device Edge and Ansible Automation Platform. By virtualizing controllers and making it so they can run on standardized compute resources, manufacturers can dynamically allocate processing power based on operational needs. This is possible due to innovation and technologies such as containers and microservices, which allow Red Hat solutions to align specifically to requirements in ways that were not necessarily possible before.
- ▶ **APIs for proprietary hardware controllers.** When the need arises to make large-scale updates to hardware programmable logic controllers (PLCs), Ansible Automation Platform provides a trusted platform to update thousands of servers in datacenters and beyond.

These advancements pave the way for a fully orchestrated environment where workloads can be shifted dynamically based on performance, availability, or security needs.

Be ready for the future with Red Hat

Red Hat's orchestration strategy is designed to meet manufacturers where they are while preparing them for the future. Organizations can start small, automating basic deployments and updates, and gradually evolve toward a software-defined architecture capable of managing complex, multiworkload environments. This helps organizations develop:

- ▶ **Evergreen infrastructure.** Organizations can continuously improve their systems by adding new compute resources with better random-access memory (RAM), central processing units (CPUs), or storage—without disrupting existing operations.
- ▶ **Workload flexibility.** Whether deploying AI-powered analytics, IoT integrations, or predictive maintenance applications, manufacturers can rely on Red Hat's platform to help manage these workloads with greater efficiency.
- ▶ **Scalability across edge and enterprise.** From lightweight edge devices to cloud-based servers, Red Hat provides a consistent orchestration layer that ties the entire ecosystem together.

Transform the definition of control

The industrial sector is on the cusp of a major transformation, and orchestration is the key to unlocking its full potential.

By adopting Red Hat's open platform approach, manufacturers can overcome the challenges of IT complexity, aging systems, and maintaining uptime, while building a strong foundation for innovation and growth.

With Red Hat as a trusted partner, organizations gain access to a broad partner ecosystem, advanced automation tools, and a future-ready architecture. This transformation is about more than updating old systems; it is about redefining what is possible in industrial automation.

Learn more

To start your journey toward OT system orchestration, [contact a Red Hatter for a discovery session](#).



About Red Hat

Red Hat is the world's leading provider of enterprise open source software solutions, using a community-powered approach to deliver reliable and high-performing Linux, hybrid cloud, container, and Kubernetes technologies. Red Hat helps customers develop cloud-native applications, integrate existing and new IT applications, and automate and manage complex environments. [A trusted adviser to the Fortune 500](#), Red Hat provides [award-winning](#) support, training, and consulting services that bring the benefits of open innovation to any industry. Red Hat is a connective hub in a global network of enterprises, partners, and communities, helping organizations grow, transform, and prepare for the digital future.

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