Modernize at the industrial edge

How Red Hat's advanced compute platform supports the path forward

The modern industrial edge

The industrial landscape is rapidly evolving, with technology powering improvements in efficiency, cost reduction, and productivity.

IT frameworks now extend beyond traditional datacenters into operational technology (OT) environments, prompting a transformation at the industrial edge. Regulatory compliance and vendor-led software requirements are accelerating the adoption of modern, scalable, and software-defined architectures capable of real-time data processing and simplified management.

Modernizing industrial edge environments delivers clear business value, including increased operational efficiency, reduced downtime, improved security, and better data use. Traditional OT infrastructures are stable but fragmented, relying heavily on manual oversight, leading to inefficiencies and elevated risks. Adopting a comprehensive platform approach allows organizations to streamline workload management, integrate with enterprise IT, automate processes, and address complex compliance demands without extensive cloud expertise.

A successful modern industrial edge platform provides robust interoperability, IT automation, orchestration, and standardized security practices.

- **Interoperability** bridges traditional OT systems with cloud-native applications, creating efficiencies for data sharing and use.
- **IT automation** reduces manual intervention for updates and maintenance, facilitating consistent performance across locations.
- **Integrated security frameworks** promote compliance with stringent regulations, protecting critical infrastructure from cyber threats.
- **Platform standardization** helps organizations avoid vendor lock-in, supporting both traditional and emerging technologies.

An open platform approach to OT orchestration

As industrial organizations modernize their edge environments, the need for platforms that simplify orchestration and management becomes critical.

Traditional OT systems typically use a mix of proprietary and traditional architectures, resulting in partial interoperability that relies heavily on temporary fixes and manual interventions. While these approaches work, they create complexity and inefficiency, and often require learning new skills—something operational teams rarely have time for.

Adopting a modern industrial edge platform provides standardized orchestration capabilities, automates deployments and updates, improves data integration, and offers a clearer path to modernization, even if the initial transition involves investment.

The value of a structured and supported open approach

An open platform approach means industrial organizations can integrate traditional OT systems with modern IT frameworks, adopt IT automation and orchestration, and prepare environments to adapt to evolving business and regulatory requirements.

A closed, vendor-specific approach to OT infrastructure creates long-term inefficiencies and limitations. Proprietary systems restrict how organizations can scale their operations, and limit the use of critical data, often leading to high costs, vendor lock-in, and limited compatibility with new technologies.

However, an open approach needs to have enterprise-level support to be appropriate in OT environments. This means 24x7 support, the framework for a security focus, and a large ecosystem of third-party partners. This is what Red Hat offers.

Red Hat's advanced compute platform (ACP) provides this flexibility by integrating containerized workloads, virtual machines (VMs), and IT automation tools into a single, hyperconverged platform. Built on open source technologies, Red Hat's ACP helps organizations scale their infrastructure without being restricted by proprietary software limitations.

Additionally, an open approach fosters innovation and adaptability by allowing organizations to incorporate new technologies, partners, and security measures into their existing environments. With Red Hat's ecosystem of open source solutions, organizations can develop tailored solutions that align with their specific operational needs while maintaining control over their modernization journey.

Open source initiatives that support compatibility for transformation efforts

Open source technologies address common operational challenges at the industrial edge by providing community-led solutions without proprietary limitations. These initiatives promote reliable, automated software deployments, streamlined data management across distributed locations, and reduced manual intervention, significantly increasing resilience and operational consistency.

Additionally, when upstream projects are hardened and packaged as enterprise-grade software with a security focus, compliance, and data storage for industrial environments, organizations can effectively integrate traditional IT operations, easing operational workloads while moving toward simpler, scalable, and automated edge operations.

How Red Hat collaborates with partners and through open source initiatives

Red Hat's commitment to open source collaboration extends beyond software—it includes strong partnerships with industry leaders to develop solutions that address real-world challenges in industrial environments.

Through collaborations with hardware, software, and system integrator partners, Red Hat provides tested and validated solutions that enhance reliability, security practices, and scalability at the industrial edge.

Increasing data use enhances business capability

A significant benefit of modernizing industrial edge environments is the ability to extract and use data more effectively. Historically, industrial data has been locked in air-gapped systems, limiting its potential for real-time insights, predictive analytics, and process optimization.

Modern industrial edge platforms, such as those using Red Hat's ACP, provide a framework to collect, process, and analyze data at the edge before transmitting it to centralized systems. This capability enhances:

- **Real-time decision-making.** Organizations can act on data insights immediately, optimizing production workflows and reducing downtime.
- **Predictive maintenance.** AI-powered analytics can detect potential failures before they occur, reducing costly outages and maintenance delays.
- **Operational efficiency.** Automating data collection and processing minimizes manual intervention, allowing resources to be used more effectively.

The importance of data in industrial environments cannot be overstated. Organizations that successfully modernize their edge computing infrastructure can turn raw data into actionable intelligence, promoting innovation and gaining a competitive advantage in an increasingly data-first industry.

The journey ahead of IT/OT convergence

The convergence of IT and OT is no longer a distant goal—it is a necessity for industrial organizations striving to modernize their operations. Historically, IT and OT operated in separate domains: IT focused on enterprise applications, data management, and information security, while OT was responsible for physical processes, industrial control systems, physical security, and production environments. However, as businesses demand greater efficiency, IT automation, and real-time insights, the boundaries between IT and OT are rapidly dissolving.

While IT teams bring expertise in IT automation, information security, and cloud-native applications, OT teams often rely on traditional, monolithic systems that prioritize stability over flexibility. The key to success lies in adopting IT best practices that enhance OT environments without disrupting critical industrial processes.

A modern industrial edge platform, such as Red Hat's ACP, provides the interoperability, IT automation, and security focus required to bring IT efficiencies into OT environments. By standardizing deployment processes, enabling real-time data use, and providing tools to boost system-wide consistency, Red Hat's ACP facilitates a gradual, nondisruptive transition toward full IT/OT convergence.

Find success with leading IT practices in OT environments

A path to success in industrial organizations is to not treat IT and OT as separate domains. Instead, they focus on integrating IT capabilities into OT environments through standardized platforms, IT automation, and modern data management strategies. Several key practices contribute to a successful convergence strategy:

- **Adopting a platform-centric approach.** Industrial operations benefit most when virtualization, containerization, and IT automation are integrated into a single, unified platform. Red Hat's ACP supports both traditional OT applications (such as Windows-based control systems) and modern, containerized workloads, facilitating uninterrupted operation across IT and OT environments.
- **Using IT automation to reduce complexity.** A major challenge in industrial modernization is the manual effort required for software updates, security patches, and system management. Red Hat Ansible® Automation Platform allows for automated configuration, patching, and event-driven responses, reducing the need for manual intervention and improving system reliability.
- **Enhancing a security focus without increasing operational overhead.** Industrial organizations face strict regulatory requirements and growing cybersecurity risks. By integrating security best practices from IT—such as access controls, automated compliance enforcement, and container security policies—organizations can strengthen OT security while minimizing disruptions.

- **Modernizing data use.** Extracting and analyzing industrial data has historically been challenging due to air-gapped systems and traditional infrastructure. A modern edge platform supports real-time data processing, allowing organizations to optimize production, reduce downtime, and implement predictive maintenance strategies.

Implementation scenarios

Modernizing industrial edge environments requires a platform that can support both legacy and modern workloads, fostering reliability, scalability, and IT automation across industrial operations. Red Hat's ACP, built on Red Hat® OpenShift®, provides a standardized, highly available architecture that simplifies orchestration, IT automation, and workload management at the edge.

A foundation for orchestration at the edge with Red Hat OpenShift

Red Hat OpenShift serves as the foundation for Red Hat's ACP, providing container orchestration, workload automation, and application lifecycle management at the industrial edge. Many organizations struggle with managing multiple workloads across distributed sites, often relying on manual processes for deployment, updates, and maintenance. As part of Red Hat's ACP, Red Hat OpenShift helps to solve this challenge by offering:

- **Consistent workload management.** Organizations can run both containerized and virtualized applications on a single platform, reducing infrastructure complexity.
- **Automated deployments and updates.** Through GitOps workflows with ArgoCD, Red Hat OpenShift supports declarative state management, making sure applications remain consistent and recover automatically from failures.
- **Integrated security and compliance.** Red Hat OpenShift provides built-in security policies, including role-based access control (RBAC), image scanning, and supply chain security, helping organizations meet regulatory requirements.
- **Scalability and portability.** Red Hat OpenShift allows workloads to be deployed, migrated, and managed across multiple sites, facilitating high availability and operational resilience.

Standardized highly available computing platform architecture

A key requirement for industrial edge environments is high availability—facilitating workloads to remain operational even when hardware failures or network disruptions occur. Red Hat's ACP provides a flexible architecture that supports single or multinote node configurations, allowing organizations to balance redundancy with hardware constraints.

The high availability architecture of Red Hat's ACP offers many key benefits, including:

- **Fault tolerance and failover protection.** In multinode deployments, workloads can automatically failover in case of hardware or network failures, maintaining continuous operations.
- **Consistent infrastructure management.** The self-healing capabilities and automated monitoring of Red Hat OpenShift make sure that applications remain in their desired state, reducing manual intervention.
- **Elasticity.** Red Hat's ACP architecture allows organizations to dynamically scale workloads based on demand, making sure resources adjust quickly to changing operational needs without compromising availability or performance.

Key capabilities of Red Hat's ACP

Red Hat's ACP integrates multiple technologies to support scalable, resilient, and automated operations at the industrial edge. This section highlights key capabilities that allow efficient workload deployment, management, and IT automation in OT environments.

- **Advanced software release lifecycles.** Red Hat's ACP supports modern deployment strategies, including canary deployments and blue-green releases, to minimize disruptions during software updates. Organizations can automate installations and upgrades, reducing downtime and manual intervention. Red Hat OpenShift facilitates progressive rollouts with the ability to revert to a previous state if issues arise, maintaining reliability and operational continuity.
- **Virtual machine management.** Many industrial applications still rely on monolithic, Windows-based workloads that run on VMs. Red Hat's ACP consolidates VM and containerized workloads on a single platform, simplifying management and reducing infrastructure sprawl. The integrated virtualization capabilities within Red Hat OpenShift allow organizations to deploy, monitor, and automate VM operations while maintaining high availability and a security focus.
- **Container orchestration.** As industrial organizations adopt containerized applications, Red Hat's ACP provides scalable, automated orchestration through the Kubernetes-based Red Hat OpenShift platform. This helps promote consistent workload deployment across distributed edge sites, reducing manual management and improving efficiency. Automated resource allocation and self-healing capabilities help maintain system reliability, even in unpredictable edge environments.
- **Constant reconciliation of desired state.** Red Hat's ACP facilitates application consistency through declarative state management with ArgoCD and GitOps workflows. If an application or service fails, Red Hat's ACP automatically restores it to its defined state, reducing the need for manual troubleshooting. This approach provides predictability, resilience, and repeatability for industrial workloads, improving long-term system stability.
- **Monitoring, logging, and security functionality.** Red Hat's ACP integrates centralized logging, performance monitoring, and security policies, allowing organizations to detect and mitigate threats in real time. Built-in RBAC, image scanning, and compliance automation maintain regulatory adherence.
- **High availability and recoverability.** Red Hat's ACP supports flexible high availability configurations (multinode setups) to prevent downtime and allow uninterrupted failover and disaster recovery. Workloads can be automatically migrated or restarted in case of failure.
- **Support.** With Red Hat's ACP, you get access to Red Hat teams that collaborate with you to make sure you accomplish your goals. With 24x7 support-engineer coverage available, Red Hat provides you with the tools and resources you need to find success.

Implementation goals

To successfully modernize industrial edge environments, organizations should focus on key implementation goals that maintain efficiency, scalability, and data-based decision-making. Red Hat's ACP provides a framework for achieving these objectives through IT automation, orchestration, and a security focus.

Organizations should:

- Increase efficiency of deployed hardware
  - Consolidate virtualized and containerized workloads on a single platform to reduce hardware sprawl and resource waste.
  - Use IT automation and orchestration to optimize resource use and minimize idle capacity.
  - Implement high availability configurations to ensure maximum uptime and workload resilience.
- Ready software-defined architectures for the future
  - Adopt a standardized, open source platform to avoid vendor lock-in and support long-term scalability.
  - Simplify application updates, security patches, and deployments with automated software lifecycle management.
  - Make sure the platform supports hybrid IT/OT environments, allowing for flexibility in future technology adoption.
- Modernize data use for analytics
  - Deploy real-time data processing at the edge to support predictive maintenance and operational intelligence.
  - Implement secure and scalable storage solutions, ensuring data persistence and availability.
  - Use machine learning and analytics from AI to gain actionable insights and optimize industrial processes.

Learn more

Discover how Red Hat's open source innovation, robust partner ecosystem, and industry-leading technologies can help your industrial enterprise confidently navigate the challenges of today while preparing for the innovations of tomorrow.

Visit redhat.com/industrial to learn more or to connect with a Red Hatter for more information.

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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