

WHITEPAPER

BRIDGING THE GAP BETWEEN OPERATIONAL TECHNOLOGY AND INFORMATION TECHNOLOGY

EXECUTIVE SUMMARY

The Internet of Things (IoT) is ushering in a new era of networked computing where advanced applications intelligently monitor and control remote sensors, mobile devices, and smart machines. The IoT blurs the line between traditional operational technology (OT) systems and information technology (IT) systems.

The IoT brings the ability to connect devices, systems, and applications to create a flexible, interoperable environment that includes components from the smallest devices to the largest datacenters. Legacy machine-to-machine (M2M) systems—traditionally used for a single purpose and consisting of a single type of device or sensor and a single, pre-determined connectivity method—can now be re-invented or replaced by more powerful, continually evolving IoT solutions. Proprietary operational control systems are giving way to new, open solutions based on standard IT platforms and protocols.

By unifying OT and IT systems and practices in a converged system architecture, businesses can eliminate inefficiencies and barriers to interoperability, improve automation, and accelerate innovation.

In this whitepaper, learn the business advantages of a converged OT/IT intelligent systems architecture, including:

- Reduced risk by using proven technology and protocols.
- Reduced costs associated with distributed device infrastructures.
- Faster time to implementation by reducing the complexity of IoT initiatives.

This paper delivers:

- Guidelines for implementing a highly scalable, reliable, and secure IoT framework.
- Recommendations for strategically aligning OT and IT assets.
- Suggestions for achieving successful IoT initiatives.



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IIoT TRANSFORMS OPERATIONAL TECHNOLOGY

The Internet of Things (IIoT) has the potential to transform just about every industry, from manufacturing, utilities, and transportation to healthcare, defense, aerospace, and security. Intelligent systems applications can be found in a variety of operations, such as:

- Automated lighting, temperature, energy, and industrial control systems.
- Optimized inventory, logistics, and supply chain management solutions.
- Intelligent manufacturing systems.
- Fleet tracking and delivery optimization solutions.
- Smart transportation, security, environmental, and utility systems.
- Intelligent patient monitoring and healthcare management solutions.

The IIoT is made up of connected sensors, meters, and actuators monitor and manage the health and actions of people, resources, and machines. Unlike legacy operational control systems, modern IIoT solutions use standards-based IT infrastructure and communications protocols to cost-effectively achieve greater flexibility, and scalability.

By adopting standards-based OT solutions and converging disparate OT and IT environments, enterprises can reduce infrastructure cost and complexity and improve performance.

EXISTING INFORMATION AND OPERATIONAL TECHNOLOGY IS DISTINCT, SEPARATED

Most businesses treat IT and OT as isolated technologies and engineer, maintain, and use each for different purposes:

- **IT systems** are managed by the CIO and support general business applications, such as enterprise resource planning (ERP), customer relationship management (CRM), or business intelligence (BI) solutions.
- **OT systems** fall under the COO or line-of-business manager and support industrial control processes or other specialized applications, such as manufacturing execution systems (MES), energy management systems (EMS), or supervisory control and data acquisition (SCADA) systems.

IT and OT implementations evolved independently over time to solve different problems and employ different system architectures and communications protocols. IT systems were designed to connect applications and share data and, as a result, tend to be open and standards-based. Operational control systems were designed as standalone entities and were not originally intended to be connected or even accessed remotely. As a result, OT systems tend to be closed and proprietary. Table 1 summarizes the distinguishing characteristics of the two disciplines.

	INFORMATION TECHNOLOGY (IT)	OPERATIONAL TECHNOLOGY (OT)
OWNER	CIO	COO or line-of-business manager
FUNCTION	Supports enterprise applications and office workers	Supports industrial and environmental monitoring and control
EXAMPLES	ERP, CRM, BI	MES, EMS, SCADA
SCOPE	General	Specialized
SYSTEM APPROACH	Interconnected applications	Standalone applications
ARCHITECTURAL MODEL	Open, standards-based	Closed, proprietary

Table 1. Information technology and operational technology comparison

ISOLATED TECHNOLOGY INHIBITS INNOVATION

Segregated OT and IT environments are inherently inefficient and costly. Innovation can be stalled by the resulting technological and financial limitations.

TECHNOLOGICAL CONSTRAINTS

- Lack of communication between IT and OT systems prevents enterprises from using control data in business intelligence applications.
- OT organizations cannot take advantage of rapid advances in IT, such as continuous IT feature, function, and performance improvements.
- OT organizations cannot easily adopt new technologies, such as mobile communications or cloud-based services.

FINANCIAL/BUSINESS CONSTRAINTS

- Designing, implementing, and supporting parallel technology is fundamentally inefficient at a corporate level.
- Business units are locked into specific OT vendors and their product development plans and release cycles.
- OT organizations cannot take advantage of the cost savings of standards-based solutions.

ACCELERATE BUSINESS TRANSFORMATION WITH RED HAT AND EUROTECH

The integrated IoT architecture from Red Hat and Eurotech unites OT and IT. Combining these technologies prevents sending masses of data to the cloud for real-time processing by enabling essential data aggregation, data transformation, integration, and routing to occur close to devices, triggering business rules that automate machine processes.

Collecting and processing real-time control data at the network edge ensures optimal intelligent system performance, scalability, and cost. And transforming raw machine data into meaningful business information helps enterprises improve decision making and increase automation for better business results.

UNITING OT AND IT

Business leaders and technology planners view the IoT as a catalyst for change. Many are implementing standards-based operational control systems as part of IoT initiatives and replacing isolated meters, sensors, and actuators with smart, IP-enabled devices.

As a result, IoT initiatives present a perfect opportunity to unite isolated, parallel technology disciplines. By unifying OT and IT solutions around common protocols and building blocks, enterprises can connect disparate systems and practices to eliminate redundancies and improve business results.

By converging OT and IT implementations, enterprises can:

- **Improve decision making** by merging OT data into business intelligence solutions.
- **Optimize industrial control processes and business flows** by integrating OT systems with IT systems to improve automation.
- **Lower operating expenses (OpEx)** by minimizing organizational and technological overhead.
- **Accelerate business results** by streamlining development projects.
- **Reduce risks** by improving overall system reliability, availability, and security.

MEETING THE REQUIREMENTS OF INTELLIGENT SYSTEMS

The sheer magnitude and open nature of the IoT poses a variety of design challenges for system architects. New, converged OT/IT systems must satisfy unprecedented functional requirements, including:

- **Scalability.** Intelligent systems gather and analyze massive amounts of data from a vast number of endpoints, presenting unparalleled data processing, storage, and communications needs.
- **Availability.** Many intelligent systems will be used for applications where system downtime can result in diminished productivity, dissatisfied customers, or lost revenue at best. For critical applications –such as medical applications, surveillance solutions, and smart grid implementations–downtime could lead to loss of life or property or significant environmental or health hazards.
- **Security.** Intelligent systems may rely on public Internet for connectivity or use cloud-based compute or storage resources. New security systems and practices must be established to protect against data loss, service theft, and denial-of-service attacks.

ENSURING HIGH SCALABILITY AND RELIABILITY

Red Hat and Eurotech recommend a hierarchical intelligent systems architecture for ultimate scalability and resiliency. Figure 1 depicts as simplified reference architecture for a converged OT/IT implementation.

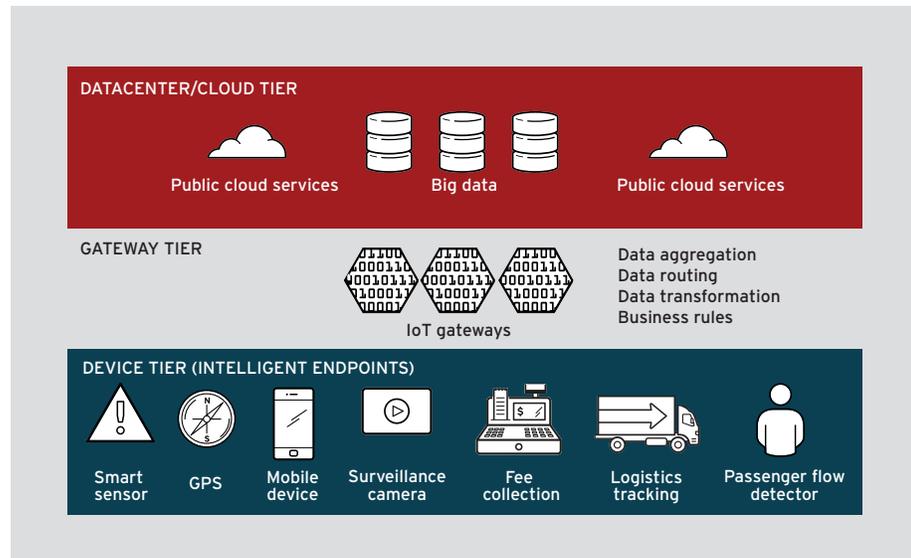


Figure 1. Intelligent systems simplified reference architecture

This layered architecture is composed of distinct device, gateway, and datacenter or cloud tiers. The device tier includes intelligent endpoints, such as IP-enabled meters, sensors, displays, and actuators. The datacenter or cloud tier includes smart applications and services that manage and automate industrial control processes and workflows. The gateway tier acts as an intermediary between the device and datacenter or cloud tiers.

A tiered architecture addresses stringent IoT scalability, availability, and security requirements by providing high modularity and autonomy for components. As a result, businesses gain improvements in:

- **Scalability.** Gateways can be added incrementally to cost-effectively accommodate growth.
- **Availability.** Redundant architectural components can be deployed in each tier to avoid single points of failure and ensure continuous service availability if equipment or networks fail.
- **Security.** Distinct security measures can be employed across tiers for an in-depth defense approach that protects against the widest range of threats and vulnerabilities.

LEARN MORE ABOUT THE INTERNET OF THINGS

“An intelligent systems solution for the Internet of Things” technology detail

redhat.com/en/resources/intelligent-systems-solution-internet-things

“Simplify IoT implementation with Eurotech and Red Hat” technology overview

redhat.com/en/resources/simplify-iot-implementation-eurotech-and-red-hat

BRIDGING IT AND OT WITH IoT GATEWAYS

IoT gateways are the cornerstone of the converged OT/IT architecture. Specifically designed to close the gap between devices in the field and centralized business and industrial applications, IoT gateways optimize intelligent system performance by gathering and processing real-time operational control data at the network edge. IoT gateways work to:

- **Ensure high scalability for smart systems** by offloading data collection and processing from the datacenter or cloud tier and pushing intelligence to the network edge.
- **Enable simpler, lower-cost devices** by reducing endpoint processor, memory, and storage requirements.
- **Streamline project development** by providing an abstraction layer between devices and higher-level applications.
- **Accelerate time-to-market** for new endpoints by segregating devices and applications.
- **Reduce telecommunications expenses** by minimizing machine-to machine (M2M) wide area network (WAN) traffic.
- **Mitigate risk** by isolating devices and securing upstream communications.
- **Optimize performance** by decoupling producers and consumers of data and minimizing M2M latency.
- **Protect and extend previous investments** by interoperating with legacy devices and protocols.

STRATEGIC RECOMMENDATIONS

Enterprises can improve business results by converging OT and IT environments, but aligning disparate organizations, disciplines, and business practices requires careful analysis and planning. In most businesses, OT and IT functions are handled by separate organizations, with distinct goals, budgets, and strategies, as well as different backgrounds and skills:

- **OT organizations** implement and support highly specialized control systems for nonstop availability for critical applications—many control systems cannot even be taken down for maintenance.
- **IT organizations** implement and support large-scale, complex, and open systems. They rely on standards-based networking and computing, and many have deployed virtualized applications and cloud-based services.

To achieve a successful converged OT/IT environment, these groups must learn to coordinate programs, align plans, and share resources. By collaborating, they will be able to take advantage of their combined proficiency and knowledge to successfully deliver a unified IoT architecture.

Red Hat and Eurotech recommend business executives consider the following guidelines for converging OT and IT systems:

- **Set strategic direction at the executive level.** CEOs and business leaders should make OT/IT convergence a strategic priority and encourage IT organizations and business units to seek common ground and pursue common outcomes.
- **Use IoT as a catalyst for convergence.** Many OT organizations are adopting standards-based control systems as part of IoT initiatives. Use this opportunity to converge OT and IT architectures to build a powerful, efficient IoT environment.
- **Create cross-functional teams.** IT teams and OT teams each provide unique skills, perspectives, and experiences. Sharing knowledge and aligning business practices can help enterprises achieve both the reliability and availability of OT systems and the scalability of IT systems.
- **Start with a pilot program.** Begin with a small-scale test project to evaluate the feasibility and business impact of a converged OT/IT implementation. A pilot program can help identify hidden costs and risks and can be used to formulate budgets, implementation plans, and timelines for full-scale deployments.

CONCLUSION

The Internet of Things is transforming OT with new IP-based operational control systems that can help businesses improve costs and increase automation.

By aligning and unifying OT and IT infrastructure, systems, and practices, enterprises can optimize business processes and greatly reduce operating expenses.

Integrating these environments, however, requires businesses to address both technological and organizational requirements. Implementing a tiered intelligent system architecture ensures high scalability, availability, and security, while IoT gateways efficiently bridge OT and IT. In addition, effective converged architectures require organizations to establish cross-functional teams that share knowledge and unify business practices, following strategic direction that is set at the executive level.

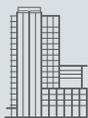
By aligning OT and IT, enterprises can transform raw data into meaningful, actionable information that increases productivity, simplifies decision making, and improves business results.

ABOUT EUROTECH

Eurotech is a global company that designs, creates and delivers full Internet of Things solutions, including hardware, software and services, to leading systems integrators and enterprises large and small. With Eurotech solutions in place, clients have access to the latest open source and standardized software stacks, flexible and rugged multi-service gateways and sophisticated sensors to bring actionable data from the field into business operations. Working with worldclass ecosystem partners, Eurotech delivers on the promise of the Internet of Things either from end to end, or with best in class building blocks, including device and data management, connectivity and communication platform, intelligent edge devices and smart objects following business models that fit today's business world. Learn more about Eurotech at www.eurotech.com

ABOUT RED HAT

Red Hat is the world's leading provider of open source software solutions, using a community-powered approach to reliable and highperforming cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers awardwinning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.



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