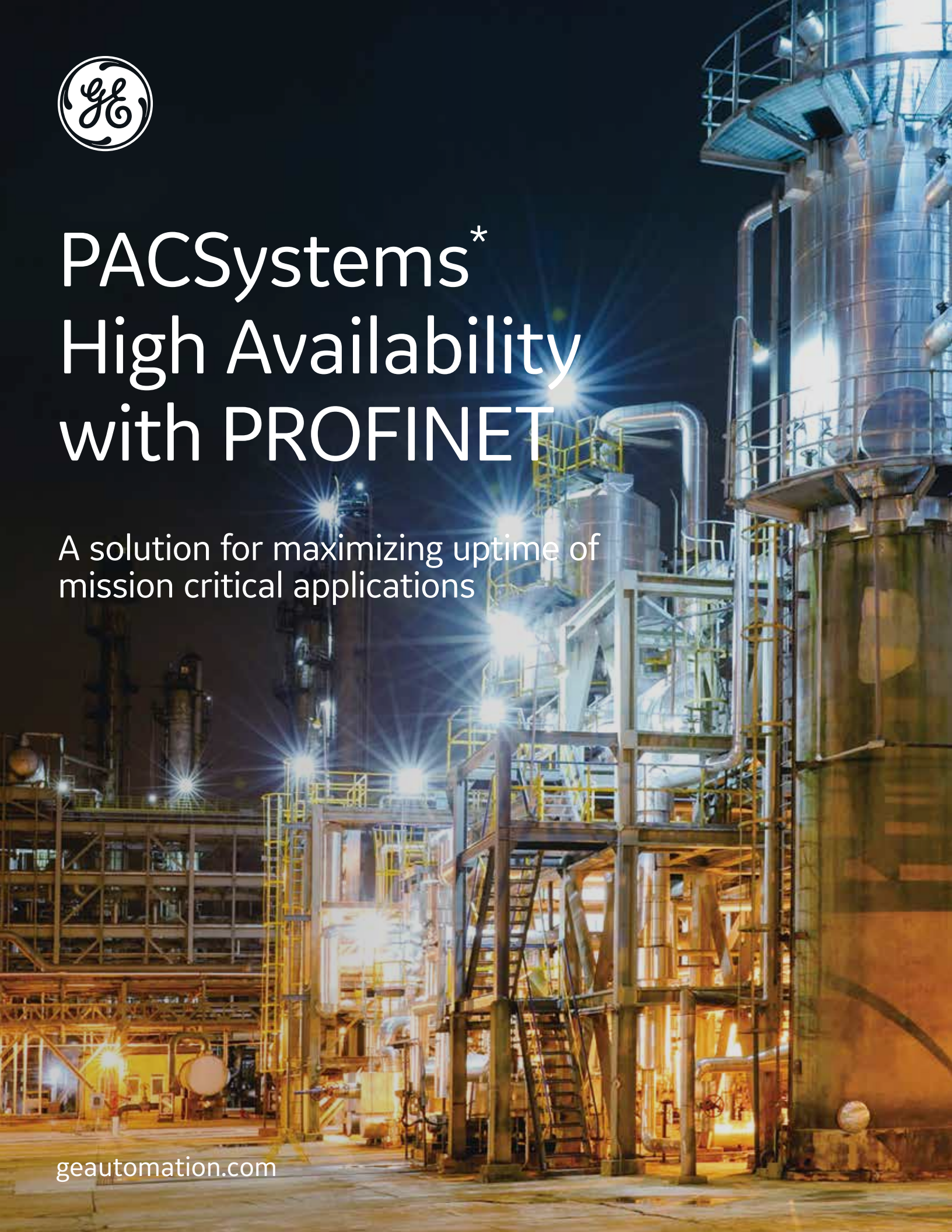

PACSystems* High Availability with PROFINET

A solution for maximizing uptime of mission critical applications

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Billions of dollars are lost annually to unscheduled downtime in global process industries. Time is money. In today's competitive markets, you need a high-availability system that maximizes uptime of your mission critical applications and provides concurrent maintainability, letting you change, troubleshoot and fix your process without stopping it.

At GE, we're committed to making the promise of the Industrial Internet real for the machines you build, the operations you run, or the process you control. High-availability systems from GE connect brilliant machines, people, and data to help ensure your mission critical applications achieve your maximum uptime requirements.

Building on GE's market leadership and decades of expertise in mission critical backup power and critical cooling solutions, PACSystems High Availability with PROFINET is a flexible and intelligent high-availability control system that ensures maximum uptime while reducing total cost of ownership (TCO) through easier configuration, operation and maintenance.

Tailor the system to meet the needs of your mission critical applications to:

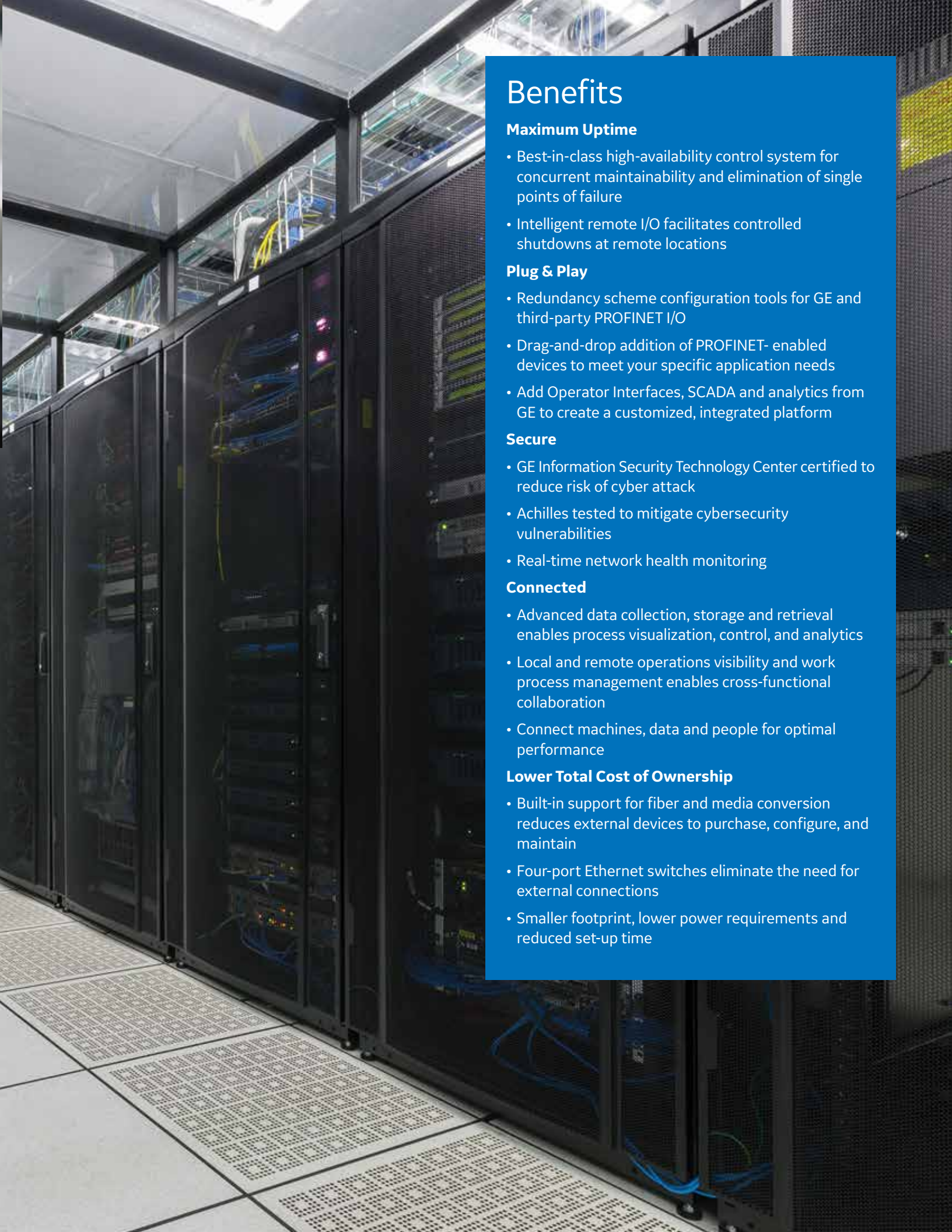
- Maintain production
- Protect against equipment or product losses
- Reduce unplanned interruptions or potential hazards

Maximize Uptime with PACSystems High Availability with PROFINET

Failure of mission critical systems can damage your company's bottom line, its reputation, and present health or environmental hazards. A single minute of downtime can cost hundreds, or thousands, of dollars. And depending on the location of your application or the nature of downtime, minutes can stretch to hours and even days.

A high-availability system helps you maintain production, protect against equipment or production losses, and guard against unplanned interruptions or potential hazards – making your investment easy to justify.

GE expands its high-availability solutions portfolio with PACSystems High Availability with PROFINET. This best-in-class, high-performance architecture integrates PROFINET communications to dramatically lower total cost of ownership and simplify the configuration, maintenance, and operation of high-availability control for your functions that must run 24x7x365.



Benefits

Maximum Uptime

- Best-in-class high-availability control system for concurrent maintainability and elimination of single points of failure
- Intelligent remote I/O facilitates controlled shutdowns at remote locations

Plug & Play

- Redundancy scheme configuration tools for GE and third-party PROFINET I/O
- Drag-and-drop addition of PROFINET- enabled devices to meet your specific application needs
- Add Operator Interfaces, SCADA and analytics from GE to create a customized, integrated platform

Secure

- GE Information Security Technology Center certified to reduce risk of cyber attack
- Achilles tested to mitigate cybersecurity vulnerabilities
- Real-time network health monitoring

Connected

- Advanced data collection, storage and retrieval enables process visualization, control, and analytics
- Local and remote operations visibility and work process management enables cross-functional collaboration
- Connect machines, data and people for optimal performance

Lower Total Cost of Ownership

- Built-in support for fiber and media conversion reduces external devices to purchase, configure, and maintain
- Four-port Ethernet switches eliminate the need for external connections
- Smaller footprint, lower power requirements and reduced set-up time

Minimize Frequency and Impact of System Failures

Media redundancy protocol (MRP) in a ring topology minimizes the likelihood and impact of network failures. High-speed failover means that your system is running on the latest system inputs, resulting in better production quality. The system can be changed or updated without downtime.

PACSystems High Availability with PROFINET keeps you up and running through:

- Fail and recovery of either CPU
- Fail and recovery of I/O nodes
- Cable break and recovery of ring
- Cable break and recovery while an I/O node is in maintenance mode
- Cable break and recovery in either or both CPU redundancy links
- Starting the system with a stand-alone CPU in “run” mode
- Changing the hardware configuration or logic

System Performance Meets Application-Specific Needs

PACSystems High Availability with PROFINET offers two options to meet application-specific needs:

a) Extremely quick single CPU scan switchover performance (20 msec) and high-speed CPU synchronization over a robust, 2.12 Gbaud, reflective memory (RMX) network, capable of handling large amounts of data with CPUs located up to 300 meters apart or up to 10 km with the SMF RMX.

b) 300 msec switchover performance and CPU synchronization over a redundant 1Gbps Ethernet network, capable of handling large amounts of data with CPUs located up to 100 meters apart with CPE400.

The Gigabit I/O network processes data over a wider, faster pipeline. Built-in four-port Ethernet switches eliminate the need for external network connections, reducing the space required, power consumed, cost and setup time.

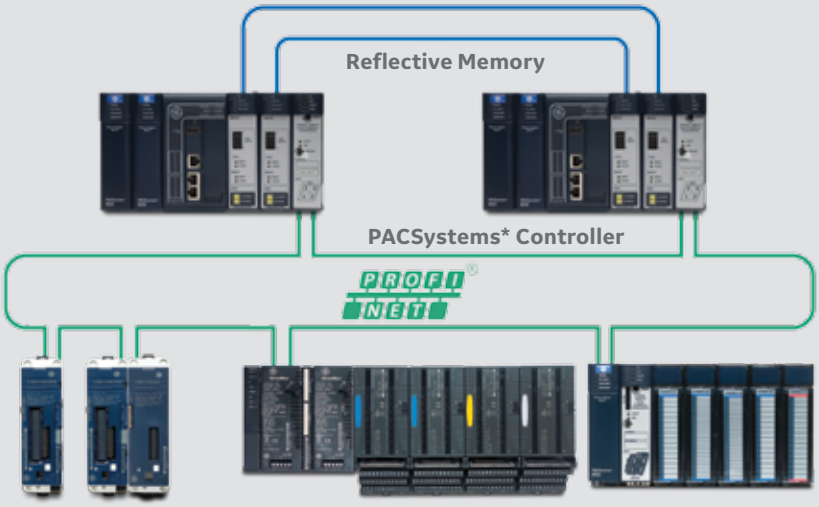
Tailor Your System

PACSystems High Availability with PROFINET gives you scalability without complexity. Configure a flexible, easy-to-use system to accommodate the unique uptime requirements of your operation. Its open architecture allows for a mix of redundant I/O to meet application requirements for footprint, performance, environment, node distances, and price point. Connect to local devices like operator interfaces using other Ethernet protocols without adding extra hardware and without impacting the determinism and integrity of your control network. This is accomplished through the guaranteed prioritization of PROFINET traffic on a mixed-protocol I/O network.

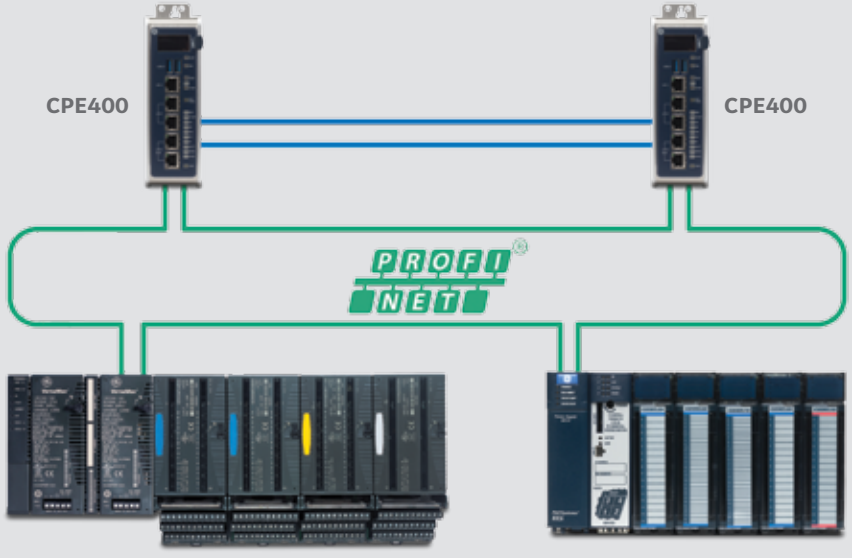
Get Started Quickly and Easily

Integration and implementation is fast and easy. The system provides a common control platform across your critical facility infrastructure. Single-point, name-based configuration is done with a simple set of tools, reducing setup time.

PACSystems High Availability with PROFINET and RX3i



PACSystems High Availability with PROFINET and CPE400



Gain Insight into Critical Systems

The system boosts reliability by delivering critical data that can then be used to analyze system performance and downtime events. It enables centralized visualization of system status, providing the ability to remotely diagnose problems and quickly and efficiently share data with operations and maintenance personnel.

Reduce Cost with Reduced Complexity

With built-in Ethernet switches and media conversion, the system provides external point-to-point plug-in connectivity and seamless support for mixed network media types.

This means fewer devices to purchase, fewer external devices to configure and fewer spare parts to maintain. By installing the PACSystems High Availability with PROFINET solution, you can eliminate up to 30% of a high-availability control system's cost throughout its lifespan.

The PROFINET Advantage

PROFINET is the leading industrial Ethernet protocol, offering quick, easy, cost-effective connection of all levels of industrial systems This high-speed, open standard makes it easy to mix and match any form of I/O, retrofit as needed with minimal downtime, and incorporate third-party products.

Up to 60% of the cost of an automation project involves pulling, landing, and validating I/O wiring. Utilizing Ethernet communications can significantly reduce the setup cost for your high-availability system by allowing for shorter wire runs to remote I/O and local connection validation with a simple Ethernet cable back to the main controller.

PROFINET gives you:

- Broad coverage for discrete and process applications
- Multiple levels of real-time control with high performance for heavy traffic
- An open standard with a fast-growing ecosystem of vendors and PROFINET-enabled devices

By using PROFINET as its communications protocol, this GE high-availability system offers:

- Single point of configuration and name-based configuration
- Simple point-to-point network connection
- High-speed execution and integrated switchover
- Built-in switches and fiber capability to reduce installation and maintenance costs

Maximize Uptime in Critical Applications

High-availability systems for LNG transportation applications go from simplex to redundant with simplicity

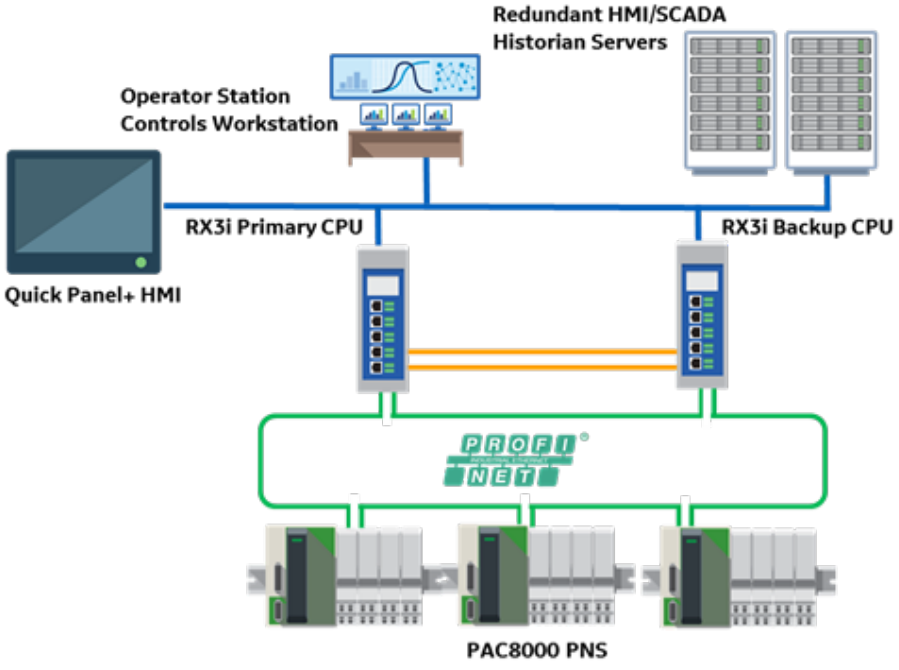
Challenge

Increasing concerns about climate impact are changing traditional consumption patterns of fossil fuels. Coal and oil are being supplanted by liquefied natural gas (LNG) as a source of reliable heat and electricity. Unfortunately, the sources for natural gas aren't always near primary demand centers. This requires transporting the volatile fuel in a safe and economical method.

State-of-the art LNG transport ships and fuel loading and unloading terminals must provide highly reliable and efficient methods for controlling gas transfer and storage operations, while minimizing gas lost to venting. Operating in environments that can include explosive fuel vapors, harsh salt mist and other corrosive chemicals, and widely varying ambient temperatures, control solutions for these applications must be tough as well as reliable.

Solution

PACSystems High Availability with PROFINET utilizing the RX3i CPE400 Standalone Controller with rugged PAC8000 I/O meets the challenge. The high performance CPE400 provides ample processing power and connectivity to keep the LNG cargo well under control throughout loading, transport, and unloading operations. The PROFINET-based high-availability system speeds up implementation, lowering installation costs and providing maintenance savings through its ease of configuration and built-in switches and media converters. This reduces the amount of extra hardware needed, reducing the power consumption and upfront costs of the system. Conformal-coated components, a -40° to +70°C temperature range, and intrinsically safe I/O make this solution tough enough to survive in this harsh environment for many years, reducing maintenance costs, improving productivity, and eliminating downtime.



Mass Transit and Transportation Applications

PACSystems High Availability with PROFINET gets you to your high availability destination

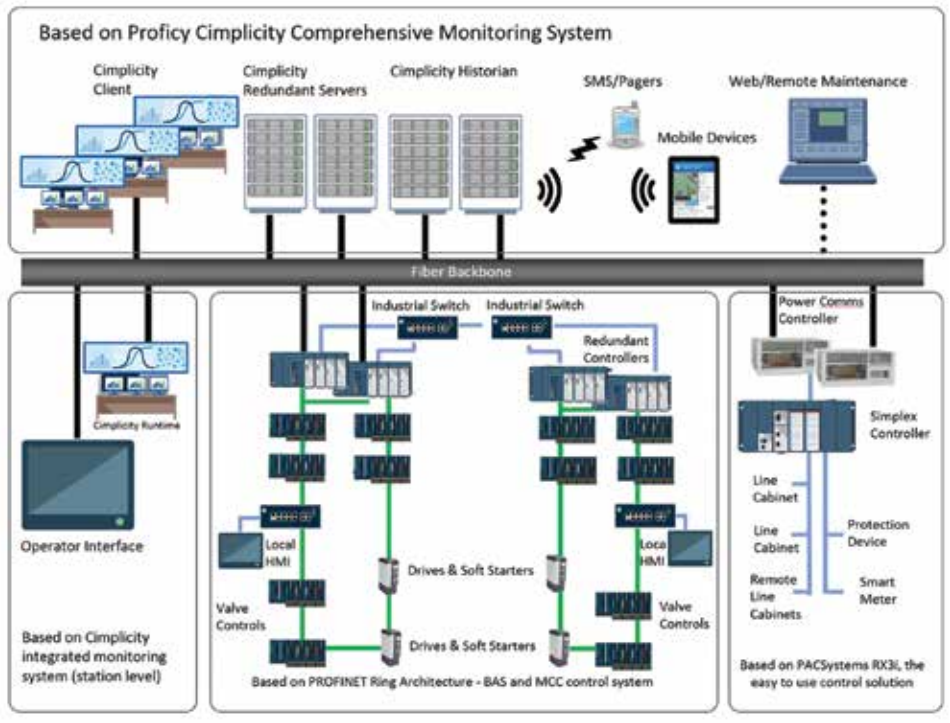
Challenge

In today's global cities, mass transit systems swallow and disgorge millions of passengers a minute–an economic circulatory system that must function 24x7x365. High-availability systems play a critical role in numerous applications throughout the transportation system and in its heavily trafficked stations or hubs:

- Environmental control or ventilation systems in the stations and tunnels
- Escalator and elevator controls
- Water drainage systems
- Electrical supply to stations
- Central control monitoring facilities

Solution

With PACSystems High Availability with PROFINET, the CPUs can be up to 10 km apart from each other, while remote I/O nodes can be up to 70 km from the controller. The high speed data synchronization provides the fastest data transfer on the market and lets you transfer large amounts of data. Whether it's a brand-new metro system or an older one ready for modernization or expansion, PACSystems High Availability with PROFINET ensures maximum uptime of critical functions and can be integrated or extended with a suite of proven GE software products for mass transit systems.



Ordering Information

Redundant CPU Components	Quantity	Part Number	Notes
RX3i Power Supplies	2	IC695PSA040	Single 120/240 VAC Power Supply
	4	IC695PSA140	Redundant 120/240 VAC Power Supply
	2	IC695PSD040	Single 24 VDC Power Supply
	4	IC695PSD140	Redundant 24 VDC Power Supply
RX3i Backplanes	2	IC695CHS007	7-slot RX3i Backplane
	2	IC695CHS012	12-slot RX3i Backplane
	2	IC695CHS016	16-slot RX3i Backplane
RX3i Redundant CPU	2	IC695CPE330	PACSystems RX3i CPU w/ 64MB User Memory + 3 1000/100/10 Mbps Network Interfaces
RMX Synchronization Link	4	IC695RMX128	Synchronization Link Up to 300m Between CPUs
	4	IC695RMX228	Synchronization Link Up to 10km Between CPUs
PROFINET Controller Module	2	IC695PNC001	Up to 64 PROFINET IO Devices per PNC
Ethernet Communications Module	2	IC695ETM001	Supports SRTP, Modbus/TCP, EGD communications
Rx3i CPE400 Energy Pack	2	IC695ACC403	Energy Pack for Rx3i CPE400 Only
RX3i CPE400	2	IC695CPE400	PACSystems RX3i Standalone CPU, 6 Ethernet ports, PREDIX enabled, mounting plates included

Redundant Remote IO Interfaces	Quantity	Part Number	Notes
RX3i I/O			
1 Slot Backplane	1	IC695CEP001	RX3i Carrier with Embedded PROFINET
2 Slot Backplane	1+1	IC695CEP001 + IC694CEE001	RX3i Carrier with Embedded PROFINET+ Expansion
7, 12, 16, Slot RX3i Backplane	1	IC695PNS001	RX3i PROFINET Scanner Module, 2 Built-in RJ-45 1000/100/10 Mbps and 2 SFP Network Interfaces
VersaMax I/O	1	IC200PNS001	2-RJ45 Copper 100 Mbps Network Interfaces
	1	IC200PNS002	2-SC Multimode Fiber 100 Mbps Network Interfaces
PAC8000 I/O	1	8515-BI-PN	2-RJ45 Copper 100 Mbps Network Interfaces
	1	8516-BI-PN	2-SC Multimode Fiber 100 Mbps Network
	1	8752-CA-NS	PAC8000 Node Services Carrier

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