

Industrial Communications Professional Services

Delivering High-Performing Communication
Network Systems for Industrial Applications

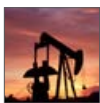
GE's Industrial Communications Professional Services offers a range of services and project management capabilities that can be tailored to provide a fully engineered, deployed, and supported system to meet application specific needs.

The services and project management offerings are a result of years of experience building multi-vendor and multi-technology communication networks worldwide. From network planning and systems design to project and program management, GE has a proven track record implementing communication networks for diverse applications.

Key Benefits

- Access to technical expertise that utilizes state-of-the-art tools and highly experienced system designs
- Minimizes overall costs and reduces risks through the provision of a guaranteed working design
- Proven processes identify and reduce risks and failure modes prior to implementation
- Single point of contact helps ensure timely implementation within scope and on budget
- GE engineering engagement allows tailoring of products to meet customer's specific needs

Applications



Oil & Gas

- SCADA systems to monitor and control processes
- Mobile hotspots for workforce automation



Energy

- Advanced metering systems and infrastructure
- Substation automation communications



Water/Wastewater

- Treatment and distribution SCADA
- Monitoring of pump status, tank levels and flow control



Rail

- Signaling and Positive Train Control (PTC) with ATCS, ACSES, and I-ETMS
- Remote Control Locomotive (RCL) and Yard Automation



Mining

- Voice and data communications infrastructure
- SCADA remote monitoring and control



Industrial Expertise

- Extensive experience in industrial environments, such as oil and gas, energy, and transportation
- Deep domain expertise in networking and communications systems
- Systems integration with third-party devices
- Large coalition of partners in a range of network communication specialty areas

Global Presence

- Technical expertise implementing projects on every continent
- Local presence, resources and experience to operationalize projects
- Worldwide technical expertise for project implementation

Quality Processes

- Utilize best-in-class processes and standards, such as Six Sigma, and ISO
- Project design and implementation based on real-world experience
- Processes and metrics that quickly identify and resolve issues

Project Scalability

- Ability to quickly adjust resources to support project deployments of all sizes
- Access to GE subject matter expertise in various domains ranging from products to security to applications
- Comprehensive project implementation from design through deployment to ongoing support



Today's Environment

Regardless of the operating environment, there are a common set of challenges occurring across all industries that affect the way customers approach network design and implementation. These challenges include:

Network and Technology Complexity

Networks, and the devices that operate in those networks, have become more sophisticated. Today's technology has a level of complexity that did not exist in previous generations, primarily because of the transition to IP communication networks, an increasing focus on security, spectrum scarcity and the evolution of Radio Frequency (RF) technologies.

IP enabled devices, and their enriched feature sets, allow customers increased flexibility and satisfy more stringent system requirements, however, they also present a host of new challenges. Customers must give considerably more effort and thought in the planning process prior to deploying devices.

Additionally, deploying a large number of RF devices in the network requires thorough system planning due to the large amounts of data moving through the network. More devices require increasing data speeds with complex modulation techniques. Increased interference is created by large RF networks. This combination makes careful system planning essential.

Finally, enhanced and changing security requirements command resources with a high-level of specialized skills in order to set up, provision and manage a secure network.

Application Complexity

In addition to network and technical complexity, application requirements have also evolved. In the past, most networks were designed to support a single application.

For example, a company could implement a network with the primary goal of supporting a SCADA system. Today, this is no longer the case.

Now networks need to be designed with multi-use in mind. Businesses need to maximize their available bandwidth to support multiple applications, such as video surveillance, workforce mobility and SCADA, as well as plan for evolving requirements. Because of ever changing automation needs, network designs need to keep pace with operational requirements to successfully manage new applications.

Resource Constraints

Managing resources at any company is always a challenge. Resources are scarce, regardless of the industry. Staffing and allocating resources for large, capital intensive projects, which occur periodically, often presents obstacles in running day-to-day operations.

Another challenge is finding the appropriate expertise to support all facets of the project life-cycle. This includes not only the initial network assessment and design, but an integrated approach to project management, procurement, commissioning, knowledge transfer and training.

Deploying large projects requires significant capital investments and is a critical decision for most companies. Due to the challenges facing companies today, the planning required to successfully deploy a project requires a substantial and more thorough engineering effort up-front. It is essential to have experienced professionals who understand the latest technologies and how those technologies work together within the diverse applications found in today's industrial environments.



GE's Industrial Communications professional services team has a long history and extensive experience in supporting organizations of all sizes in implementing reliable and scalable communication networks. GE's team will tailor their services and project management solutions to meet a broad range of customer requirements and communication networking applications that can easily scale where required.

Service Offerings

GE provides a broad range of services to support projects in a variety of industrial environments including:

Application Networking Services - GE can provide the following as part of their application networking services:

- New or modified network design, including IP addressing / subnetting and router configuration.
- Seamlessly integrate GE and non-GE equipment into a communications network.
- Manage and install security certificates or an entire security infrastructure.
- Set up and install cell-enabled radios to comply with existing contract requirements. Will arrive on-site ready to activate to a customer's cellular network and servers.

Propagation Analysis - For any network design, whether it consists of a thousand remotes that need to be monitored or a single point-to-point link, there must be a guarantee that stations can communicate within the service level requirements customers expect.

Based on site details including the latitude, longitude, antenna mounting height, a software modeling tool is utilized to predict the wireless coverage for the equipment needed to meet your application requirements. GE has extensive field-proven experience in modelling the predicted coverage and propagation analysis reporting.

Traffic Modeling - GE analysts work closely with customers to understand their unique application characteristics and traffic patterns. The information is utilized to tailor a model to predict the data traffic flow in the system and provide an optimal network design which utilizes every Hz of bandwidth to the fullest efficiency.

RF Survey - Before investing in property, permits or towers, GE can conduct a Radio Frequency (RF) survey that can provide the following:

- Temporary links using lifts to verify the radio path that could be implemented.
- Drive surveys that can establish mobile coverage with accompanying maps of the results.

Requisition Engineering - Detailed bills of materials, drawings and instructions will be provided for customers during a project implementation resulting in decreased implementation time and enabling ease of system deployment.

Customized Packaged Models - GE's services team has extensive experience designing, building, installing and commissioning customized packaged models. Model components can include GE and/or third party radios, power supplies, batteries, RTUs and sensors. Customized enclosures are available on request.

Onsite System Optimization - GE's team of expert analysts can conduct studies on existing system sites, examine current setups, and make recommendations for improving network performance. These studies include, but are not limited to, examining the following components: antenna and feedline systems, signal levels and interference, radio configurations, and firmware versions.



GE's Professional Services Process

Based on years of experience and multiple deployments across multiple applications and industries, GE has developed a professional services process allowing a close partnership with customers to ensure successful system implementations.

GE's comprehensive process is designed to be application specific but built on a common set of building blocks that is tailored to support each customer's unique systems requirements and business objectives.

GE 's Global Capabilities

GE provides engineering excellence to design and deliver complete communications system projects tailored to each customer's requirements and needs.

GE has an excellent track record in planning, executing and delivering a broad range of projects. GE's systems subject matter experts work in state-of-the-art facilities that include design, research and development, manufacturing and testing capabilities. Customer are supported with 24/7 field and application support.

Elements of a Successful Project

GE's number one priority is helping customers successfully implement projects that meet their operational and economic goals. Based on our experience, we have identified a number of factors that are critical to the success of a well-implemented project:

Dedicated Project Management

GE assigns a project manager at the beginning of each project to lead the team throughout the project lifecycle. The project manager acts as an extension of the customer's team to coordinate and drive all aspects of the project to a successful outcome.

Open Communication and Team Work

The most effective way to drive project performance is proactive communication with our customers. This is a priority for our projects team. A strong and collaborative relationship between the customer and GE increases the chances of a successful project.

A Well-Defined Execution Framework

Project success depends on up-front planning as well as a mutually agreed upon execution framework that includes clearly defined deliverables.

GE's Professional Services Process and Key Activities



Projects

Regardless of the size or scope of a project, GE assigns a project manager to oversee all of the activities and associated details to ensure a successful implementation. The details below outline GE's common project management process.

Phase 1: Defining the Scope of Work

The first phase of a network communications project is to gather information about the customer's requirements. The following activities will take place during the definition phase of a project:

- Capture the strategic objectives of the project.
- Meet with key stakeholders to collect system requirements which can range from latency and throughput, protocols, coverage areas, and security.
- Provide customers with a requirements document and initial system concept design.



Phase 2: Analyzing the Environment

The analysis phase of the communications project allows engineers to validate the initial concept design and verify that it meets the customer's expectations. During this phase, GE can provide:

- Traffic modelling analysis to support the network throughput and latency needs.
- Network and security analysis to identify the most appropriate network topology and possible security risks coupled with preventative solutions.
- Predictive reports, such as propagation coverage, spectrum interference and mitigation plans, to assist in identifying potential system failures.



Phase 3: Developing the Final Network Design

During the design phase, the network design is finalized and ready to be implemented to meet the customer's scope of work and requirements. GE can provide the following during this stage:

- On-site audits to validate design assumptions and RF site surveys to verify coverage models.
- Channel planning to meet spectrum requirements.
- The creation of a bill of materials and drafting plans to document subsystem components.
- Detailed system, network management and application design plans based on survey results to create the desired network topology.



Phase 4: Project Implementation

During project implementation, the following activities take place:

- File regulatory agency required spectrum documentation and procure all necessary equipment.
- Assemble the network communications devices, conduct factory assessment testing, oversee commissioning of the equipment, and complete network audits to ensure system performance.
- Prepare knowledge transfer and training materials on system operations and maintenance.
- Provide on-site training for a smooth transition of the project.



Phase 5: Ongoing Support

GE can continue support of the implemented system and provide the following services:

- Access to an authorized local partner close to the customer's location for troubleshooting and product replacement.
- A call center with access to technical services for assistance in troubleshooting system issues, general product questions or on-site support if required.
- A hosted or on-site network operations center for systems monitoring and diagnosis.



Energy Case Study

GE provided and managed the Smart Grid network communications deployment for one of North America's largest power utilities. The network was designed to carry Intelligent Grid (IG) and advanced meter systems data over a 5,000 square mile service territory supporting approximately two million customers.

The system required the implementation of wireless high-speed radios to communicate to 500 distribution IG devices that would backhaul meter data from over 5,000 collectors.

GE's Industrial Communications Professional Services team provided the following services:

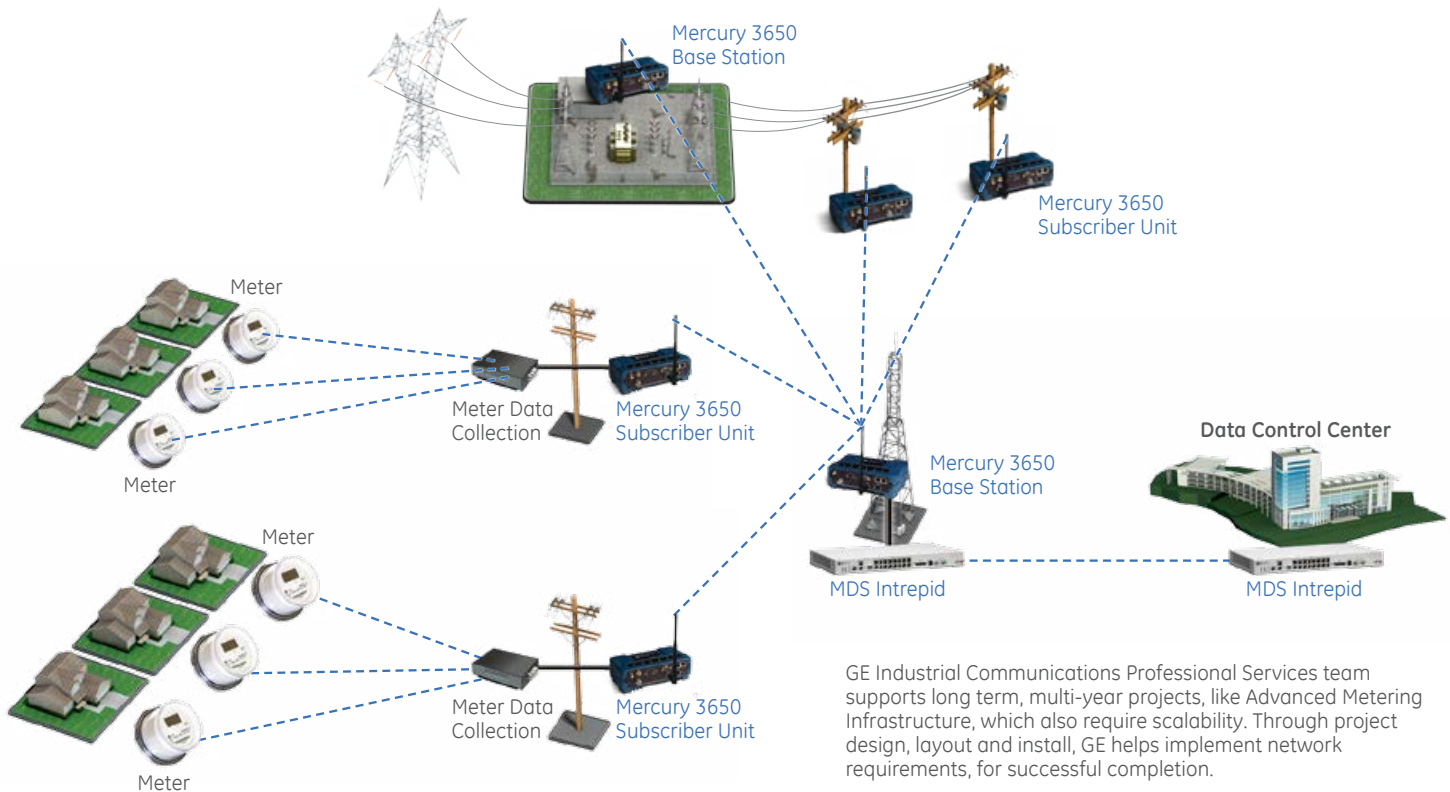
- Analyzed existing infrastructure, network and security mechanisms
- Developed a system concept and design for wireless system implementation, including GE and third-party devices
- Designed the system to maximize utilization of existing infrastructure and to minimize overall project costs
- Conducted RF feasibility studies and in-field RF testing to optimize propagation models to develop a near perfect simulation
- Commissioned all the field equipment to ensure individual site performance met or exceeded design criteria
- Performed system-wide optimization testing that enhanced the network performance
- Developed a Knowledge Transfer Program for an effective handover upon project conclusion to ensure full self-reliance of the customer



Energy Applications Supported

- Advanced metering systems / automated metering infrastructure
- Home area networks
- Intelligent Grid
- Distribution automation
- Substation automation communications
- Advanced distribution management systems

Application: Advanced Metering Infrastructure - Multi-Year



GE Industrial Communications Professional Services team supports long term, multi-year projects, like Advanced Metering Infrastructure, which also require scalability. Through project design, layout and install, GE helps implement network requirements, for successful completion.

Water/Wastewater Case Study

GE worked with a municipal wastewater company to implement a wireless SCADA infrastructure to drive resource and operational efficiencies. This wastewater treatment facility provides services for approximately thirty thousand residents with an extensive collection system that includes 65 lift stations, and 60 miles of piping and treatment capacity of four million gallons a day.

To support their new wastewater treatment facility, this customer needed to implement a SCADA network for data acquisition and monitoring. The project was managed by a systems integrator and GE worked concurrently to provide a wireless infrastructure to monitor data from over 50 lift stations.

GE's Industrial Communications Professional Services team provided the following services:

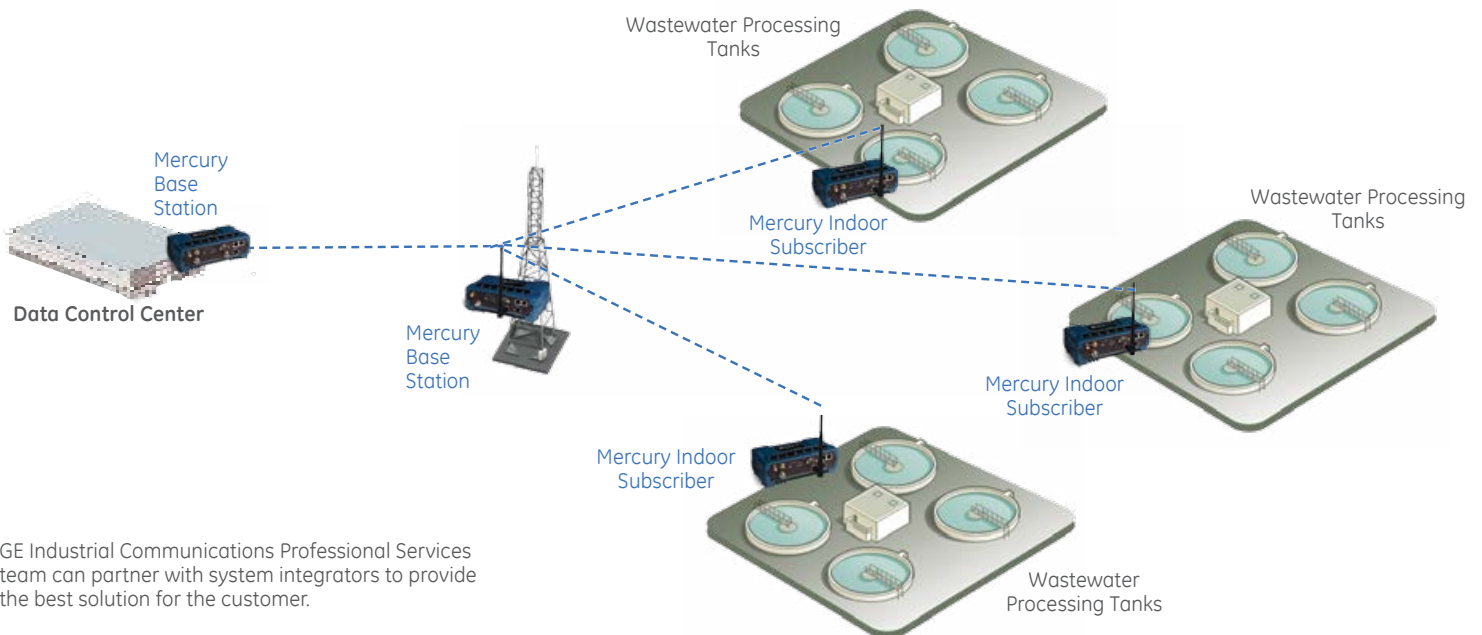
- System design, including propagation studies
- Site surveys at all of the lift stations to validate propagation studies
- Implementation of a network management system
- System commissioning, including connectivity back to the treatment plant
- On-site training of personnel on network management and wireless radios



Water/Wastewater Applications Supported

- Treatment and distribution SCADA
- Lift station SCADA
- Pump station SCADA
- Elevated tank automation
- Monitoring of pump status, tank levels, flow control, water pressure, system faults and alarms
- Video surveillance

Application: Water & Wastewater Facilities - Systems



GE Industrial Communications Professional Services team can partner with system integrators to provide the best solution for the customer.

Rail Case Study

GE worked with a major freight railroad to develop an application-specific network for Remote Control Locomotives (RCL) in switching yards. This required the design and implementation of a new wireless product and participation in the development of a new rail standard. The radio product, network, and standard were designed to meet the unique requirements of the RCL application.

GE also developed an application-specific network and product for new PTC requirements to increase overall safety for high speed rail. This product family is now used worldwide and operates in passenger, mining, and freight applications. GE has also designed and implemented backhaul networks for the PTC application.

GE's Industrial Communications Professional Services team provided the following services:

- Analysis and design to meet media access control requirements
- GPS and site-to-site wireless backhaul solutions for coordinated infrastructure
- Repeater racks for RCL yard infrastructure coverage
- Ongoing technical support for installed network
- On-site radio network training for the company's personnel



Rail Applications Supported

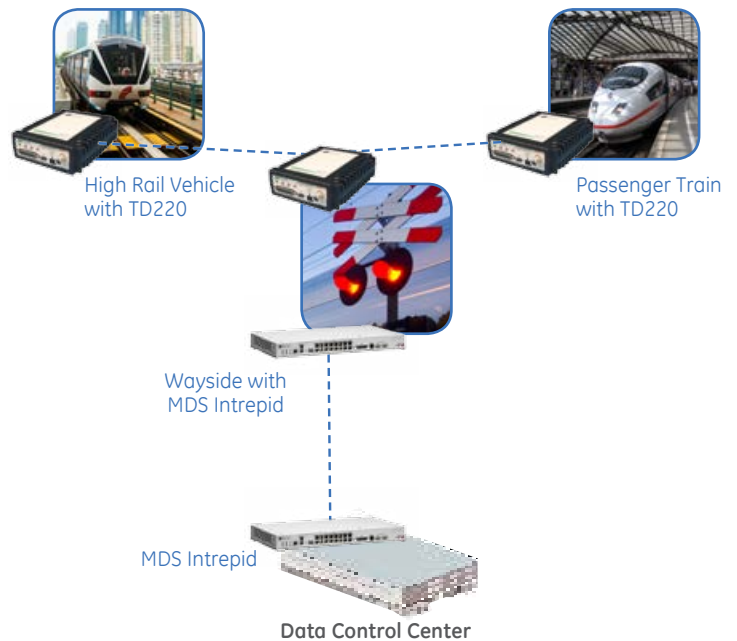
- Microwave and fiber backhaul
- Code and pole line replacement
- Remote control locomotives, hydraswitch yards and yard automation/intermodal
- PTC, ATCS, ACSES, ETMS
- Proximity detection and hot box detectors
- Distributed power and end of train

Applications: Railroad Network - Custom Product Design

Freight Train/Rail Yard Application



Passenger Train/Rail Maintenance Application



GE Industrial Communications Professional Services team will build customized products, like the RCL220 and TD220, to fill customer needs.

Industrial Communications Solutions

With over **2MM DEVICES INSTALLED** in applications around the world, our products allow customers to collect, manage and analyze data enabling insights that maximize productivity and minimize failures and downtime.



INDUSTRIAL WIRELESS SOLUTIONS

- Licensed, Unlicensed, Cellular, Wi-Fi
- Enclosures & Accessories
- Network Management Solutions



HARDENED OPTICAL NETWORKS

- Packaged Switched Solutions – MPLS-TP
- Optical Multiplexers – SONET / SDH
- Network Management Solutions



GLOBAL PROFESSIONAL SERVICES

- Radio System Design & Engineering Services
- RF Site Surveys & Path Studies, Spectrum Planning, Propagation Coverage Models
- FAT Testing, Commissioning, Network Audit



BROADBAND POWERLINE SOLUTIONS

- Broadband on Existing Power Cables
- Easy and Fast Installation
- Integrated Network Manager



Industrial Wireless Solution

MDS is a world leading single-source, end-to-end wireless solution provider. From wellhead monitoring to utility substation automation, our wireless devices are packaged for industrial environments and have been rated and tested to harsh industrial specifications.



Licensed Solutions

Licensed solutions covering a broad range of frequencies from 100MHz to 38GHz and supporting data rates up to 350Mbps of throughput.

Unlicensed Solutions

Private 900MHz and 2.4GHz radios with speeds up to 1.25Mbps. WIMAX and Backhaul



Cellular Solutions

Cellular routers and gateways with 2G/3G/4G LTE worldwide carrier coverage.

Accessories & Enclosures

Antennas, cables, customized and standard enclosures and other accessories for radio TV products.



Hardened Optical Networks

Lentronics multiplexers and switches are rugged telecommunications solutions for industrial applications, providing T1, SONET, SDH and MPLS –TP standards based solutions for both short and long range applications over optical fiber and other media.



Multiplexers

Multiplexers providing T1, SONET and SDH standards based solutions for both short and long range applications over optical fiber and other media.



Packet Switched Solutions

Switch based on MPLS-TP technology, that maintains deterministic performance through packet based communications.

Network Management Solutions

GE provides network management solutions for the industrial wireless and hardened optical network solutions. The PulseNET is purpose-built for industrial wireless communications providing sophisticated pre-built workflows along with intuitive graphical representations of the network. The VistaNET is a complete suite of software tools to manage multiplexes and can be provisioned as a stand-alone tool or a client-server solution, permitting centralized or distributed network management.

Broadband Power Line Solutions

e-terrapower.com is designed for communication on medium voltage power lines, using the most advanced broadband PLC technology to build reliable and cost-effective networks using existing cables.



PulseNET Network Management

Software for network and device management of MDS radios.



VistaNET Network Management

Software for network and device management of Lentronics Multiplexers



Broadband Power Line

Broadband power line communications providing 200Mbps of bandwidth and low latency.



For more information about
GE's Industrial Communications products visit
GEGridSolutions.com/Communications



Grid Solutions
2018 Powers Ferry Road
Atlanta, GA 30339
Tel: 1-877-605-6777 (toll free in North America)
678-844-6777 (direct number)

GridSolutions.com

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