

# ACCELERATE GRID MODERNIZATION WITH ASSURED RELIABILITY AND CYBERSECURITY

*Juniper brings 99.999% network uptime for critical applications, strong security, and automated operations for utility networks.*

## Challenge

The business case for modernizing the grid is compelling, as utilities can converge operational technology (OT) and information technology (IT) networks to streamline operations and reduce costs.

## Solution

Juniper's portfolio of routing, switching, security, and network automation can enable power utilities to transform their networks, achieving 99.999% uptime for core and critical applications, reducing operational expenditures, and enabling next-generation edge applications.

## Benefits

- Support the most demanding control and protection applications like teleprotection
- Deliver applications and services where and when needed
- Keep pace with today's threat landscape
- Deploy resilient, repeatable automation of common network tasks
- Adopt next-generation asset management and indoor location services

*Threats to critical infrastructure and the impact of climate change are putting new pressures on power utilities. New technologies, such as rooftop solar panels, energy storage, electric vehicles, and advanced metering infrastructure, promise a more efficient, reliable, and resilient energy future.*

*Yet much of the nation's network of electricity generation, transmission, and distribution resources is aging. The business case for modernizing communications networks is compelling, as utilities can converge operational technology (OT) and information technology (IT) networks, re-imagine the grid edge, streamline network operations, and reduce costs.*

*As utilities consider the best path forward to modernize their communications infrastructure to support a smart and active grid, Juniper's portfolio of resilient networking, connected security, and network automation ensures that safety and reliability are never compromised.*

## The Challenge

A changing energy mix, unprecedented cyberattacks, and climate change are creating greater challenges for power utilities.

Distributed energy resources (DERs), smart grid initiatives, and the delivery of new services have a profound impact on how utility provider networks operate. These power grid dynamics require a modern, service-provider quality interconnection between energy producers, distribution, and transport grids, consumers, and independent system operators (ISOs) to enable utilities to reduce costs, increase cybersecurity, and improve agility.

Unprecedented cyberattacks are threatening the operations of critical infrastructure, and the risk of financial, environmental, and infrastructure damage is growing as industrial control systems allow remote access and connect to business networks. The federal government has specifically identified the grid's destruction systems as vulnerable, calling for immediate action. Cybersecurity cannot be an afterthought. Utilities need threat-aware networks that mitigate cybersecurity risks.

Utilities are especially impacted by climate change. The frequency of extreme weather events is increasing service outages and driving up financial risk. Utilities are proactively strengthening their network and operations, creating a smart and active grid, to maintain power during severe weather and quickly restore service after failures.

Broadband services offer an opportunity for utilities to diversify their service portfolio and deliver more services to customers. Rural electric cooperatives have been offering Internet services to consumers and businesses for many years, and electric utilities of all types can leverage their existing infrastructure investments to generate additional revenue.

A network modernization strategy can allow utilities to efficiently deliver a critical service and expand revenue opportunities while minimizing the risks of a changing energy mix, cyberattacks, and climate change. Utilities can employ multiple energy sources and improve the intelligence of transmission systems to maximize efficiency and avoid delivery failures. Modernization brings increased flexibility while reducing operational costs.

## The Juniper Networks Power Utilities Network Solution

Juniper partners with power utilities to modernize and transform their networks to meet today's challenges and future requirements by addressing common management goals, such as:

- Achieve 99.999% uptime for core and critical applications
- Reduce operational expenditures and simplify governance
- Enable the transition, deployment, and automation of next-generation edge applications

With a reliable, scalable, service-provider quality network infrastructure from Juniper, utilities have a strong foundation for automated meter infrastructure (AMI), demand response, distributed control systems, analytics, industrial IoT, AI and advanced analytics, and high-performance computing.

With Juniper, utilities can take advantage of a flexible building-block approach for core, data center, network operations center, campus, branch, and field area networks. With an open, programmable Juniper network, utilities can choose best-in-class solutions and avoid vendor lock-in. And utilities can migrate at their own pace, without rip-and-replace.

## Features and Benefits

Utilities put their trust in Juniper networking, security, and network automation to modernize their networks.

### Support the Industry's Most Demanding Control and Protection Applications like Teleprotection

With Juniper, utilities can build a private, on-premises multivendor network that delivers the highest levels of reliability and resiliency, supports next-generation services, and drives operational efficiency. Gaining centralized control over distributed assets improves agility when responding to supply and demand fluctuations and enables the deployment of new processes. Operational and business traffic can securely share the same physical network, driving further efficiencies and simplifying network operations.

Utilities can rely on Juniper to support SCADA, teleprotection, engineering access, legacy protection schemes, and circuit-to-packet communications. Juniper's networks support the class-of-service, timing, and synchronization requirements necessary for the most demanding deterministic applications requiring millisecond resolution.

By extending the IP/MPLS network from the core to the substation and field-area networks, utilities can simplify delivery of the next generation of applications. Each SCADA device transmit or receive signal can be copied to many different locations and alarms, and control information can be sent to multiple sites. Video surveillance can also be directed to multiple sites, preserving bandwidth.

With a Juniper network, utilities can also efficiently deliver smart metering services, high-speed Internet, voice and video to residential customers, as well as enterprise-grade network services to businesses.

### Deliver Applications and Services Where and When Needed

Smart meters, demand response, distributed control systems, and other smart grid applications require fast, intelligent networks. With a Juniper IP fabric as the foundation of the data center, utilities can increase deployment flexibility and deliver applications and services where and when they are needed.

A data center fabric effectively flattens the network architecture, resulting in greater efficiency, lower latency, and increased scalability. A Juniper data center fabric provides a solid layer of connectivity in the physical network, enabling network virtualization, stretched Ethernet segments, and virtual machine workload mobility across multiple data center sites and network operations centers (NOCs).

## Keep Pace with Today's Threat Landscape

With Juniper's approach to zero-trust security, utilities can enhance situational awareness and mitigate business risk.

Juniper Connected Security safeguards utilities against rising cyber risk by unifying all network elements into a threat-aware network. Juniper's built-in defenses automatically protect users, devices, applications, and data across systems. Security policies are dynamically enforced at every point of connection.

With Juniper, critical applications operate safely, while even fast-moving attacks are detected and blocked. With clear visibility into threats and centralized, automated control over access and enforcement, utilities are protected from end to end and from top to bottom.

## Deploy Resilient, Repeatable Automation of Common Network Tasks

With a fully converged network from Juniper, utilities can simplify the deployment, management, and changing of core, data center, office, and field-area networks.

Juniper's network automation tools enable IT to drive intent-based operations across the network and services life cycle, reducing the time to perform common operating tasks and

minimizing process-related errors. Automation can speed repetitive processes, connecting the user intent such as creating a SCADA circuit, with the necessary configuration steps. The setup of an advanced data center fabric, including an Ethernet VPN-Virtual Extensible LAN (EVPN-VXLAN) architecture for workload mobility and scalability, can be automated, and the service continuously assured.

Network automation empowers the IT team to do more with the resources they have while engaging in more satisfying work.

## Adopt Next-Generation Asset Management and Indoor Location Services

From offices to the field, workers expect their mobile devices to connect quickly, easily, and securely. With Juniper's AI-driven enterprise network solution, utilities can deliver a superior network user experience and streamline IT operations.

For utilities that want to keep tabs on high-value assets like parts, tools, or supplies, there's no need to deploy an overlay network for real-time location services. With Juniper, utilities can leverage a single wireless infrastructure for both Wi-Fi connectivity and asset tracking, which simplifies deployment and lowers cost.

## Solution Components

Solution Domain	Summary	Description
<b>Converged Core Network</b>		
<b>Juniper Networks® MX Series Universal Routing Platforms</b>	Build a service-provider grade network to converge OT and IT operations.	Utilities can leverage MX Series routers to build a private IP/MPLS network that supports both operational technology and business systems. MX Series routers provide industry-leading system capacity, density, security, and performance with unparalleled longevity. MX Series routers simplify connectivity from the core network to the edge. The Juniper Networks vMX Virtual Router brings the same feature set and operations as the physical MX Series routers to a virtualized solution.
<b>Juniper® Session Smart™ Router</b>	Deliver agility, security, and resilient connectivity that optimizes the network user experience in offices and field locations.	The Session Smart Router takes software-defined routing and SD-WAN to the next level. It creates a flexible, application-aware network fabric that meets stringent enterprise, performance, security, and availability requirements. A tunnel-less architecture enables up to 75% reduction in headend infrastructure costs and 30% to 50% reduction in bandwidth costs. The software-based Session Smart Router can be deployed on white-box CPE, data center servers, and in the cloud.
<b>Connected Substations</b>		
<b>Juniper Networks ACX Series Universal Metro Routers</b>	Provide fast, secure network aggregation and access for substations and field locations.	Substation-compliant ACX Series platforms simplify network architectures and dramatically reduce costs by eliminating network overviews. ACX Series routers can enable Ethernet or IP/MPLS infrastructure and are optimized to deliver high precision synchronization, industry-leading security, and high availability features ideal for utilities. Environmental- or temperature-hardened designs and low power consumption enable deployment in extreme situations such as outside cabinets or remote points of presence.
<b>Joint SEL-Juniper solution</b>	Automate critical utility applications and enable secure and seamless IT-OT convergence.	The substation-hardened and reliable SEL-2740S Software Defined Switch, SEL-5056 Software-Defined Network Flow Controller, and SEL ICON Integrated Communications Optimal Network integrate with MX Series routers to support circuit orchestration and network monitoring.

Solution Domain	Summary	Description
<b>Data Center</b>		
<b>Juniper Networks QFX Series Switches and EX Series Ethernet Switches</b>	Optimize applications and services with cloud-grade, high-density Ethernet switching.	Juniper switches provide the high-performance, high-density platforms required to build data center fabrics to support next-generation grid applications. QFX Series switches deliver industry-leading throughput and scalability, the best routing stack, the open programmability of the Junos® operating system, and the broadest set of EVPN-VXLAN and IP fabric capabilities. QFX Series switches are ideal for data center spine-and-leaf switches, campus distribution, and core network. EX Series Ethernet Switches are ideal for AI-driven access switching that delivers superior user and device experiences while simplifying operations with zero-touch provisioning and AI-driven insights and automation.
<b>Grid Cybersecurity</b>		
<b>Juniper Next-Generation Firewall</b>	Protect the network edge, data center, and cloud applications with next-generation physical, virtual, and containerized firewalls.	Juniper Networks SRX Series Services Gateways reduce the risk of attack and provide granular control of applications, users, and devices through identity-based policies, microsegmentation, VPN connectivity, and validated threat prevention. The Juniper Networks vSRX Virtual Firewall provides flexibility, effectiveness, and performance for cloud environments. The highly agile Juniper Networks cSRX Container Firewall offers advanced security services to improve the visibility and secure applications running containers and microservices.
<b>Juniper Advanced Threat Prevention</b>	Find and block both known and unknown cyberthreats.	Juniper Advanced Threat Prevention is a threat intelligence hub for the network, with built-in services that use AI to detect attacks and optimize enforcements. The Juniper ATP Cloud service finds and blocks commodity and zero-day cyberthreats within files, IP traffic, and Domain Name System (DNS) requests. The service assesses risk from encrypted and decrypted network traffic and connected devices, including IoT. It also distributes intelligence throughout the network to stop attacks and drastically reduce the attack surface before a breach occurs.
<b>Automation and Network Management</b>		
<b>Juniper Apstra</b>	Bring continuous automation and assurance to data center operations.	Apstra enables you to automate the data center network life cycle in a single system. Apstra is a revolutionary approach. Start by specifying the outcomes you want, and the software will set up the network, ensure it runs as intended, alert you when brownouts or deviations occur, and manage changes and maintenance. The Apstra toolset automates the design, deployment, and management of EVPN-VXLAN and IP fabrics. This reduces the time from design to deployment from months or weeks to days or even hours.
<b>Juniper Paragon™ Automation Portfolio</b>	Use closed-loop automation to translate business intent into service performance.	Juniper Paragon Planner (formerly NorthStar Controller) is a network planning and simulation tool used to optimize network usage without impacting network performance. Juniper Paragon Pathfinder simplifies and automates provisioning, management, and monitoring of IP/MPLS networks and segment routing
<b>Wireless Access and Asset Tracking</b>		
<b>Juniper AI-Driven Enterprise portfolio</b>	Deliver optimized network user experiences and simplify network operations for offices and field locations.	Juniper's microservices cloud architecture natively integrates AI and data science tools to create a scalable, agile, and reliable wireless solution for corporate headquarters, offices, and field locations. Juniper delivers exceptional user, device, and IoT experiences with customizable service-level expectations (SLEs) based on streaming telemetry data from the Juniper Series of High-Performance Access Points. An integrated AI engine with self-driving capabilities proactively resolves issues before users even notice they have occurred.
<b>Juniper Mist™ Asset Visibility</b>	Locate assets and support proximity tracing with ease and accuracy.	Juniper Mist Asset Visibility cloud service makes it easy to find high-value assets and people with detailed location analytics.
<b>Services</b>		
<b>Juniper Global Services</b>	Choose from advisory, implementation, migration, optimization, and support services.	Juniper Global Services is here to help you achieve success in your network modernization strategy and reach your business goals.

## Summary—A Reliable, Secure Foundation for Efficient Service Delivery and Next-Gen Grid Applications

As pressure mounts on budgets and business cases for modernizing the grid edge, power utilities can rely on Juniper's comprehensive portfolio of resilient routing, switching, security, and network automation to ensure that safety and reliability are never compromised.

With Juniper, utilities can build a modern foundation for teleprotection as well as emerging smart grid applications. A Juniper network is threat-aware, following a zero-trust security approach, and it provides active response to fast-moving threats. Juniper enables power utilities to transform their networks, achieving 99.999% uptime for core and critical applications, accelerating grid modernization, reducing operational expenditures, and enabling next-generation edge applications.

### Next Steps

For more information, please visit [Juniper's Utilities Solutions](#) or contact your Juniper Networks representative.

## About Juniper Networks

At Juniper Networks, we are dedicated to dramatically simplifying network operations and driving superior experiences for end users. Our solutions deliver industry-leading insight, automation, security and AI to drive real business results. We believe that powering connections will bring us closer together while empowering us all to solve the world's greatest challenges of well-being, sustainability and equality.

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# Converged Industrial Edge Solution Architecture



The Converged Industrial Edge was developed in response to the ever-growing demand for cybersecurity and converged connectivity for critical infrastructure. It solves for overly complex network architectures that limit visibility, increase operational costs, and expose cyberattack surfaces.

Utilities and other critical infrastructure providers can reduce time-to-value by automating the engineering, deployment, testing, and surveillance of critical infrastructure communications.

## Overcoming Challenges, Both New and Old

### Growing Cybersecurity Risk



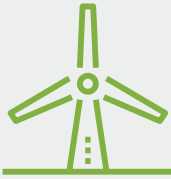
Utilities rose to the **#3 most-attacked** industry in 2020 after financial services and manufacturing<sup>1</sup>

### Improved Resilience Is a Priority



**\$1 billion**  
5X increase in losses due to extreme weather over the last decade<sup>3</sup>

### A Focus on Delivering Clean and Reliable Power



**45%**  
of utility executives say renewables, sustainability, or the environment are their top issues<sup>2</sup>

### Aging Infrastructure



**40%**  
of utility executives consider aging assets or technology to be a major challenge<sup>4</sup>

## 5 Reasons to Build a Converged Industrial Edge

**1** Create an ultra-resilient, secure network from control centers to substations

Easily engineer communication circuits to meet precise OT requirements

**2**

**3** Automate network service creation to reduce human error and truck rolls

Actively detect and prevent cyber threats protect against service disruptions

**4**

**5** Simplify audit reporting and reduce risk of noncompliance

## Modernize and Simplify IT and OT Infrastructure at the Edge

Industry leaders Juniper, SEL Inc., and Dragos have engineered the Converged Industrial Edge solution architecture to automate the orchestration of IT-OT communications and simplify information exchange to achieve business outcomes for critical infrastructure and industrial IoT without compromise.

### Programmable Forwarding Plane



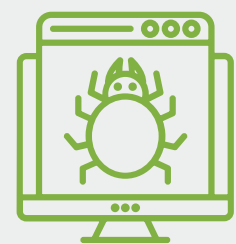
Build a resilient, deny-by-default, Zero Trust network fabric from control centers to the industrial edge (such as substations)

### Automation Plane



Automate network service creation, deployment, testing, monitoring and assurance

### Cybersecurity Plane



Create a threat aware network, end-to-end. Actively detect and mitigate malicious threats within the OT industrial controls systems environment

## Build Your Converged Industrial Edge Faster and with Less Risk



To learn more about the Converged Industrial Edge solution architecture from Juniper, SEL, and Dragos, contact your Juniper account representative at [Converged-Industrial-Edge-Juniper-Info@juniper.net](mailto:Converged-Industrial-Edge-Juniper-Info@juniper.net) or visit [www.juniper.net/convergedindustrialedge](http://www.juniper.net/convergedindustrialedge).

**JUNIPER**  
NETWORKS

1. "X-Force Threat Intelligence Index," IBM, 2021  
2. "State of the Electric Utility," Utility Dive, 2021  
3. "Billion-Dollar Weather Events and Climate Disasters: Overview," NOAA, 2021. There were five times more \$1 billion weather events from 2018 to 2020 than during the 2000s.  
4. "State of the Electric Utility," Utility Dive, 2021



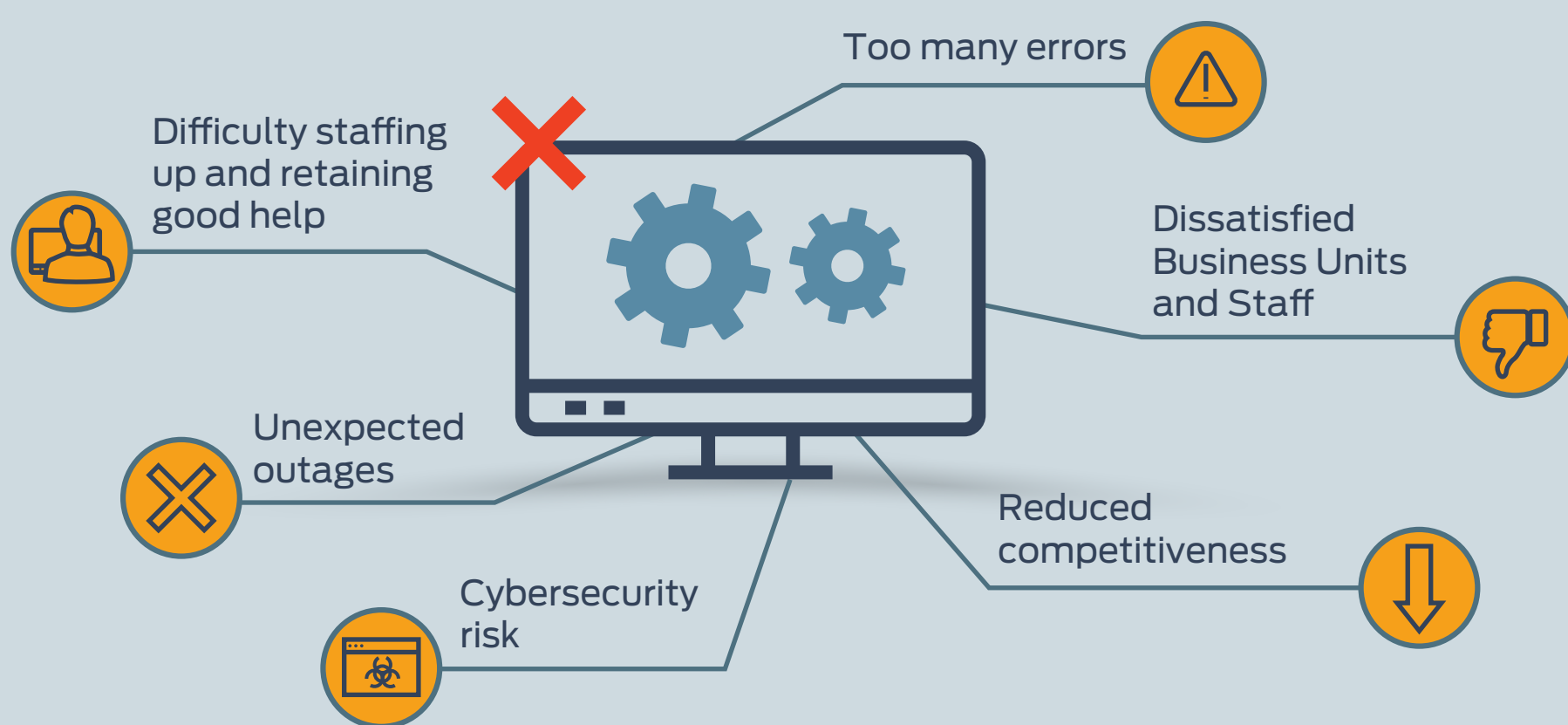
# 4 Reasons to Automate Your Network



Automation is the cornerstone strategy for energy companies looking to increase network agility, reliability, and mitigate cybersecurity risk.

Expectations to operate a network efficiently and effectively across multiple business units and technology domains never stops. But network operation teams still tend to rely on manual “error-prone” processes. The probability of errors only increases with number of teams, network scale and complexity. And the sophistication of cybersecurity threats never stops.

## WHAT ARE THE RISKS OF **NOT** AUTOMATING?



## WHY AUTOMATE NOW?

REASON

1

### Improve Resiliency

By reallocating human touches away from each network component and to automating network processes, network operations will become more strategic and the network will operate with more consistency and fewer errors. Even problem resolution and troubleshooting processes can be automated.

Non-automated networks experience **5 to 6 errors per month**, on average.<sup>1</sup>



REASON

2

### Lower Your Costs

Precisely because automation masks the complexities of the underlying infrastructure—dramatically fewer person-hours are required for network operations because the provisioning, managing, and orchestrating of network services have all been simplified—your operating expenses are immediately lower.



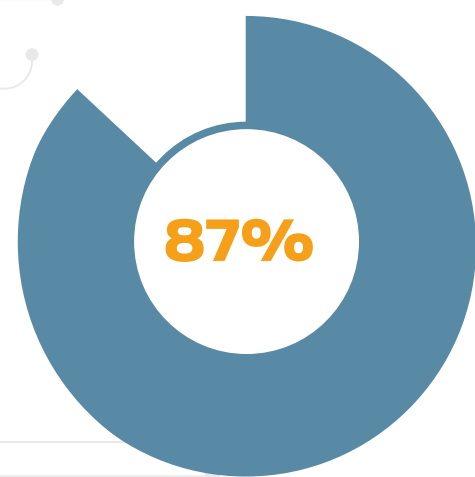
of daily network administrative tasks have been automated. **This leads to higher costs.**

REASON

3

### Free Your Staff For More Strategic Work

First and foremost, your staff is already overstretched. And the majority of their time and energy is spent on tactical tasks to keep the business running. By reducing the effort spent on repetitive and mundane, manual tasks, you free up resources to work on higher-order tasks, such as driving improvements in application delivery.



of IT leaders in the 2017 State of the CIO survey say their role is becoming more challenging. Many say they struggle to find the right balance between operations and innovation.<sup>2</sup>

REASON

4

### Enable Your Institution to Be More Agile and Competitive

Network automation helps make IT operations more responsive to change with the use of analytics. You understand network performance much more precisely. Network automation can add speed to network operations during mergers, acquisitions and divestitures.



of organizations experience **network errors caused by human mistakes** on a regular basis.

## CONCLUSION

User performance expectations, support for new advanced applications and cybersecurity threats will never stop. These are critical assets to IT. OT operations adopted automation many years ago to minimize error-prone processes to manage critical field assets that drive exploration, production, transportation and refining.

Automate your network to satisfy your critical assets.

**Engineering. Simplicity.**

For more information about the self-driving network, visit [juniper.net/us/en/solutions/energy/oil-gas/](http://juniper.net/us/en/solutions/energy/oil-gas/)

Data sources:  
<sup>1</sup>Juniper Networks: Four Reasons to Automate Your Network Right Now  
<sup>2</sup>2017 State of the CIO survey



# Industry 4.0 in Manufacturing

Here's 3 Ways to Prepare



## 1. Manage increasing volume with Mist™ and AI-Driven Wi-Fi

The Industrial Internet of Things (IIoT) has resulted in manufacturers managing billions of new connections, unpredictable data traffic, and multiple devices. Requiring a solution with rapid deployment and scale, Juniper Mist Cloud, AI wireless and wired solutions are the answer.

With Bluetooth low energy (BLE) and AIOps capabilities, Juniper's solutions provide easy deployment, agile operations, and higher scalability.

“

*Our staff must have secure, reliable access to the network, or they can't do anything. The whole business, especially the warehouse, runs on wireless, and we're dead in the water without it. Juniper gives us the ability to manage all the devices.*

—Warren Welch, IT Manager, Dicker Data

[Read their story](#)

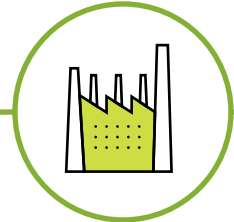
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## 2. Handle variety with Juniper's Paragon Suite

The diversity of devices, protocols, and requirements has led to manufacturers in management plants, warehouses, and distribution channels looking to deploy distributed architectures.

Guaranteeing complete control of the network, reliability, and meeting the demands for mission-critical operating environments, Juniper's Paragon Suite ensures connectivity without increasing complexity or resources..



## 3. Control velocity with Connected Security

Hardware and software innovation has accelerated malware and surface attacks. To safeguard their network, manufacturers need advanced threat protection, be able to manage increased connections, and see all the associated risks.

Juniper Connected Security inspects and enforces policies at all points. Protecting users, applications, and infrastructure, Juniper's security solutions extend across the entire network.

“

*We wanted to keep overhead at a minimum and reduce operational costs wherever possible. Juniper gave us exactly what we needed in our critical core and aggregation layers. Juniper was a one-stop shop.*

—Sean Teggart, Technology Director, Toob

[Read their story](#)

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## Connectivity drives Industry 4.0 integration

Want to know more and how to position your enterprise as an innovation-led future manufacturer?

Stay tuned to discover additional insights.



[Read on](#)

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