NEXT-GENERATION OIL AND GAS NETWORKS ACCELERATE DIGITAL TRANSFORMATION WITH AI-DRIVEN SD-WAN

Overview

Oil and gas companies are under intense pressure to improve operational efficiencies, cut costs, and increase investment returns in today's hypercompetitive business climate. Extreme market volatility, eroding profit margins, and an evolving geopolitical landscape are forcing energy businesses to modernize exploration and production (E&P) systems and rethink business practices. Innovative oil and gas producers are turning to a new generation of digital solutions and connected systems to optimize operations, improve business performance, and reduce risk.

Forward-looking energy companies are digitizing assets and using data analytics, machine learning (ML), and artificial intelligence (AI) to automate processes, avoid hazards and waste, and eliminate expenses. Smart IoT sensors, gauges, and valves monitor tank levels and flow rates, detect leaks and structural damage, sense temperature and vibration changes, and measure valuable real-time extraction performance data.

By transforming this wealth of data into actionable insights—monitoring gas and oil well assets, analyzing measurements, and automating control processes—energy companies can boost efficiencies, reduce lease operating expenses, and improve regulatory compliance, uptime, and safety.

Digital Energy Applications

- **Digital oil fields**—automate E&P processes to improve performance, safety, and uptime
- **Smart pipelines**—improve security and resiliency with end-to-end pipeline management
- **Connected refineries**—automate control processes to improve performance, economics, and safety
- **OT/IT integration**—converge operational and information technology to eliminate redundancies and accelerate innovation
- **Smart supply chain**—automate inventory and procurement to streamline operations and improve business agility

The Challenge: Ensuring Fast, Reliable, and Secure Connectivity

By embracing digital transformation, oil and gas producers can accelerate business agility, improve decision-making, and gain a competitive edge in today's challenging energy markets. But digital transformation poses a variety of performance, security, and reliability challenges for energy network planners.

Use Case

Performance

Vast numbers of smart sensors, actuators, and gauges will generate massive amounts of diverse application data and machine-to-machine (M2M) traffic. Each data flow has unique characteristics and quality-of-service (QoS) requirements. Some data like real-time control data is latency-sensitive; other data like historical machine data for predictive maintenance is not. Network planners must prioritize and shape traffic to provide the right service-level agreement (SLA) for the right application. To make matters even more challenging, oil and gas well assets are often deployed in remote locations like offshore platforms, mountainous areas, and desert regions that are reachable only via low-speed satellite links or weak cellular data connections. Planners must ensure adequate service quality for delay-sensitive applications even over latency-prone or lossy connections.

Security

Many smart systems will rely on public Internet connectivity. Bad actors can exploit public data networks to steal confidential information or disrupt critical infrastructure. Planners must introduce strong security solutions to protect data privacy and to defend cloud and data center resources against cyber-attacks.

Availability

Next-generation oil and gas networks will support a variety of mission-critical and safety-critical applications. Network disruptions can hinder workforce productivity, impair business performance, and cause environmental hazards, injury, or loss of life. Planners must implement resilient networks that can withstand link failures or ISP outages to ensure business continuity and worker safety.

The Solution: Juniper AI-Driven SD-WAN

The Juniper AI-driven SD-WAN solution, powered by the Juniper Session Smart™ Router, is an advanced, service-centric networking solution that takes the software-defined WAN to a whole new level. Providing fast, secure, and reliable connectivity for next-generation oil and gas networks, AI-Driven SD-WAN eliminates the inherent inefficiencies and constraints of traditional routing protocols and legacy SD-WAN solutions, delivering a tunnel-free network architecture that meets stringent industrial IoT performance, security, and availability per conversation requirements to provide unmatched economics, scalability, and visibility. Additionally, Juniper Mist WAN Assurance delivers AI-based insights and automates troubleshooting for improved uptime and performance enhancements.

Performance

AI-Driven SD-WAN supports a variety of session optimization and intelligent routing features to ensure high performance and service quality for diverse data flows. Fine-grained QoS controls let network administrators efficiently shape and prioritize traffic to provide different service assurances for different data streams. Innovative application-aware routing intelligently steers traffic based on real-time network conditions, automatically selecting the right network path for the right application at the right time. A unique lossless application delivery capability optimizes WAN bandwidth utilization and improves performance over low bandwidth connections like satellite links, eliminating the need for dedicated WAN optimization appliances.

Security

The AI-Driven SD-WAN solution protects against data breaches and malicious attacks. Inherent security capabilities include deny-all (zero trust) routing, L3/L4 firewall, payload encryption, Intrusion Detection System/Intrusion Prevention System (IDS/IPS), URL filtering, and Network Address Translation (NAT) and VPN functionality. AI-Driven SD-WAN's pioneering Secure Vector Routing (SVR) provides strong data security over public Internet connections, without the overhead of traditional encryption protocols like IPsec. (Secure Vector Routing reduces protocol overhead by over 30% when compared to IPsec.)

Visibility

Unlike alternative solutions that encapsulate all data flows into a single overlay tunnel, Juniper's tunnel-free, AI-driven SD-WAN solution gives network administrators full visibility into individual data flows, so they can efficiently monitor end-to-end sessions, track key performance indicators (KPIs), and troubleshoot problems. Further, with Juniper Mist WAN Assurance, powered by Mist AI™, administrators get unparalleled insights into user experiences, anomalies, and root cause issues. These AI-driven insights simplify operations and drastically reduce mean time to repair.

Availability

AI-Driven SD-WAN is designed to provide continuous connectivity without requiring expensive hot-standby tunnels like conventional routing or traditional SD-WAN solutions. In the event of a link failure, network outage, or poor SLA link detection, the solution seamlessly redirects traffic over an alternative path without disrupting sessions or impairing application performance.

Economics

AI-Driven SD-WAN is fully software-based for ultimate flexibility and economics. The software runs on Juniper hardware or certified white box hardware, including ruggedized platforms for harsh environments. The solution reduces cost and complexity by eliminating the middlebox and virtualized network function (VNF) sprawl that plague legacy WAN and SD-WAN solutions.

Table 1: AI-Driven SD-WAN Delivers Superior Performance, Security, and Availability

Requirement	Traditional WAN and Legacy SD-WAN	Juniper Session Smart SD-WAN
Improve performance of suboptimal WAN links	High overhead tunneling protocols squander bandwidth and impair the performance of delay-sensitive applications.	Secure Vector Routing minimizes protocol overhead. Lossless application delivery optimizes bandwidth utilization and boosts application performance.
Enforce application-specific SLAs	Tunnel overlays inhibit traffic management and prevent application-specific SLAs.	Fine-grained traffic management and application-aware routing provide policy-based SLAs.
Ensure continuous connectivity	Idle hot-standby tunnels are costly and inefficient.	Multipath session migration provides cost-effective protection against link failures and ISP outages.
Deliver easy setup and remote management	Special-purpose middleboxes or dedicated VNFs add cost and complexity.	AI-Driven SD-WAN consolidates network functionality, speeds deployments with ZTP, and simplifies management with AI-based insights and an agile cloud-based controller.
Protect data privacy	Tunnel overlays safeguard data privacy, but limit visibility and control.	Secure Vector Routing protects data privacy, while enabling granular traffic management and visibility.

Scalability

AI-Driven SD-WAN can rapidly scale to over 10,000 sites. The tunnel-free solution eliminates the scaling limitation of tunnel-based solutions and enables fast and simple rollouts with automated configuration templates and zero touch provisioning (ZTP) claim codes. The Juniper Mist cloud, a microservices cloud-based controller, also enhances agility and scalability.

Energy Services Provider Uses AI-Driven SD-WAN to Power Its Digital Oilfield Networks

A multibillion dollar energy services company is rolling out data analytics and AI-driven automation to improve the performance and safety of its oilfield and gas well operations. By analyzing and intelligently acting upon remote sensor and measurement data, this services provider can help its customers improve production rates, avoid hazards and downtime, and reduce operations expenses. But the company's oilfield assets are often deployed in remote areas served only by spotty satellite and mobile data services. To make the most of its investments, the company needed to find a way to efficiently transport a wide variety of application data over suboptimal WAN connections.

"AI-Driven SD-WAN lets us boost our networking capacity up to 900%. The solution gives us the bandwidth we need to remotely monitor and control our assets, which helps us dramatically improve oilfield operations."

- Manager of Field Operations

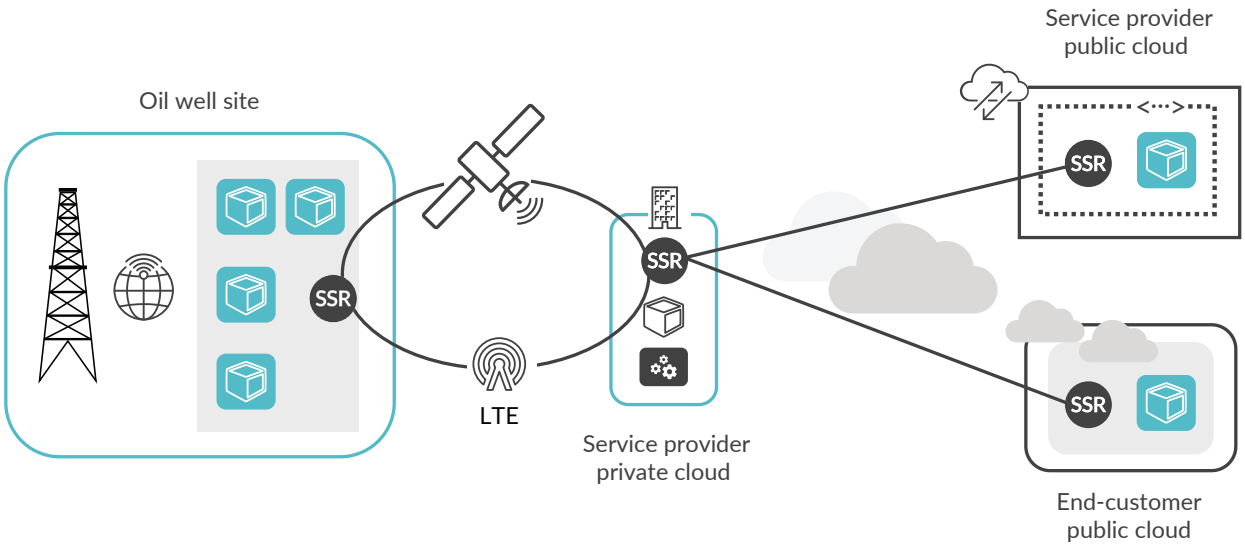

Figure 1: Next-Generation digital oil field with AI-Driven SD-WAN

After a thorough investigation and pilot program, the company selected AI-Driven SD-WAN as the foundation for its next-generation digital oilfield networks. Ideal for bandwidth-constrained networks, the solution provides fast, secure, and reliable connectivity, even over lower speed, higher latency links. The solution also increases available WAN capacity by up to 900% and increases TCP transmission rates by up to 100%, paving the way for a new wave of digital oilfield applications.

For More Information

To find out more about how Juniper AI-Driven SD-WAN can benefit your business, contact your Juniper representative and visit www.juniper.net.

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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