
NOKIA
Nokia Network
Services Platform
for power utilities

The Nokia Network Services Platform (NSP) revolutionizes communication network management for power utilities, extending well beyond conventional boundaries. It enables unified, secure, end-to-end management of IP/MPLS and Ethernet networking alongside packet optical and microwave transport. NSP manages and automates network services that connect transmission and distribution grid assets to operational technology (OT) application software in substations, central operations centers and data centers.

These comprehensive management capabilities span the field area network (FAN), substation LANs, wide area network (WAN) and data center fabric, making NSP an indispensable tool for utilities.

Offering capabilities such as intent-based service fulfilment, AI-based proactive assurance and root cause analysis, NSP empowers utilities with the adaptability they need to navigate their mission-critical network infrastructure through the energy transition journey.

Utility communication network challenges

The transition towards green energy requires utilities to embrace exponential change. To thrive in the rapidly evolving energy landscape and its operating environments, utilities are accelerating their digitalization efforts. Many are adopting IEC 61850-based utility automation systems and cloud virtualization technology to make the power grid smarter and more adaptive. At the core of this adaptive smart grid lies a managed mission-critical communication network infrastructure that comprises IP/MPLS and Ethernet switching with packet optical and microwave transport.

This infrastructure spans several network domains:

- Field area network (FAN)
- Substation process bus and station bus
- Wide area network (WAN)
- Data center fabric

It provides mission-critical interconnectivity between assets across the grid and OT application software hosted in the substation edge compute, known as the substation cloud, or the central compute resources, known as the OT cloud.

Traditional element and network management solutions often falter in managing network services in this type of multi-domain, multilayer infrastructure. Manual processes that use a command line interface (CLI) are too slow and error prone. Reactive problem detection leads to longer outages that affect grid reliability and safety. Insufficient information on how the network is used and uncertainty about how planned changes will affect the network and users make network planning very challenging and sometimes incomplete.

From provisioning to service assurance and analytics to troubleshooting, utilities need a management platform that offers a new approach.

The importance of network management and automation

Utilities worldwide are implementing smart grid technologies to:

- Enhance grid resilience against climate impacts and cyber threats
- Integrate distributed energy resources to support the net-zero emissions goal
- Improve grid operational efficiency and monitoring through IEC 61850-enabled automation
- Meet new and evolving regulations and government mandates.

Accordingly, utilities are adopting a converged IP/MPLS communications infrastructure to support existing and new grid applications.

A converged network reduces overall effort and cost by reducing the number and types of network elements. But it also increases the requirements for flexibility and visibility. Without superior element, network and service management tools, it can be immensely challenging to realize the full benefits of convergence.

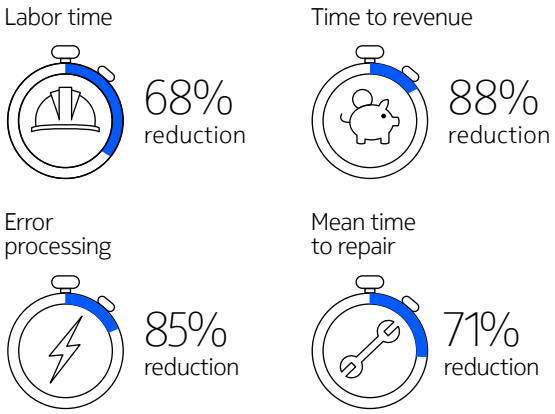
The smart grid also has many elements beyond the network infrastructure that need to be managed. Utilities need an overall network view, information about the network and its services, and the ability to control them.

Nokia NSP addresses these needs with one platform and a single pane of glass for provisioning, assurance and optimization across the entire network. Nokia conducted a survey with Analysys Mason based on real NSP deployments and the results prove the quantified benefits of network automation.

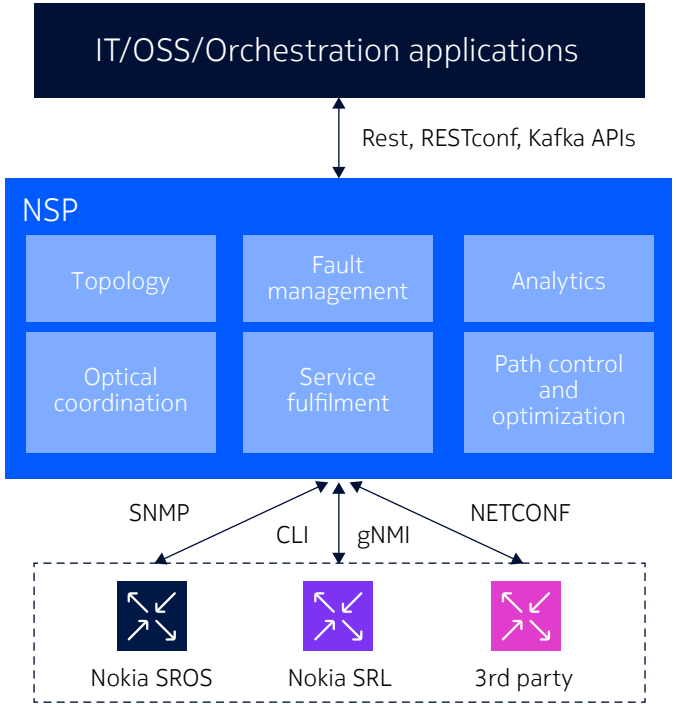
NSP's simple REST/ RESTCONF application programming interfaces (APIs) support seamless and rapid integration into an umbrella IT and operations support system (OSS), resulting in optimal network management and operational efficiency.

NSP's intuitive graphical user interface and customizable network health summary dashboards support easy navigation, inventory and deep-dive troubleshooting.

Quantified benefits from real NSP deployments based on a survey done by Analysys Mason



NSP provides one platform and a single pane of glass for the entire network



Accelerate the provisioning process with service automation

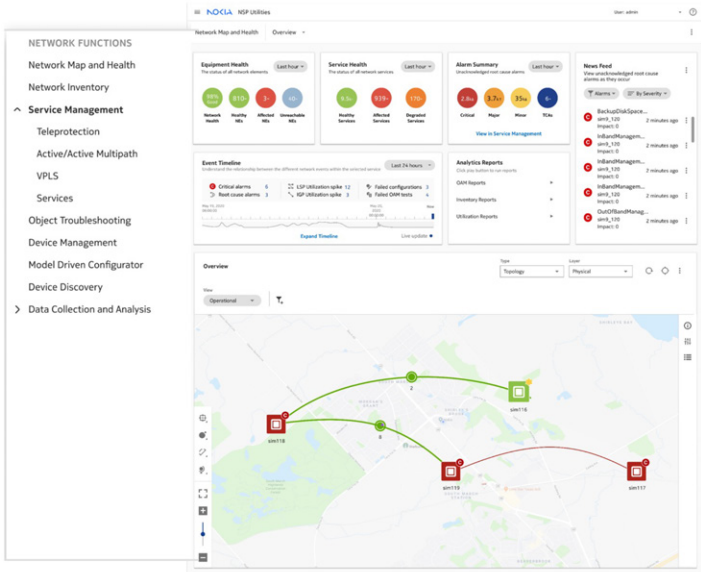
Agility is essential for maintaining a dynamic, yet reliable, communications network. Utilities must be able to quickly and easily configure and change network elements, routing infrastructure and services.

Using an element management tool such as CLI for configuration is cumbersome and error-prone and requires extensive technical expertise. Introducing new equipment and services can be unnecessarily slow, which impedes the deployment of smart grid applications and makes it tougher to achieve business objectives.

NSP helps utilities accelerate the configuration process and minimize the risk of misconfigurations through its comprehensive suite of capabilities, including:

- A user-centric web interface with tailored dashboards for utilities
- Intent-based physical and logical network configuration to simplify network and service provisioning, enabled by an extensive library of software artifacts
- Real-time auditing that detects misalignment between the intended configuration and the actual deployment
- Workflow-based deployment automation for network zero-touch provisioning, performance validation, upgrades and regular backups of device configurations for rollback scenarios
- A workflow manager that provides a high level of flexibility to automate service operations and customize specific network or service requirements. This customization also allows non-expert resources to handle more complex tasks and eliminates repetitive and error-prone activities.

NSP provides tailored dashboards and operations menu for utilities



Enable proactive service assurance for consistently high grid application performance

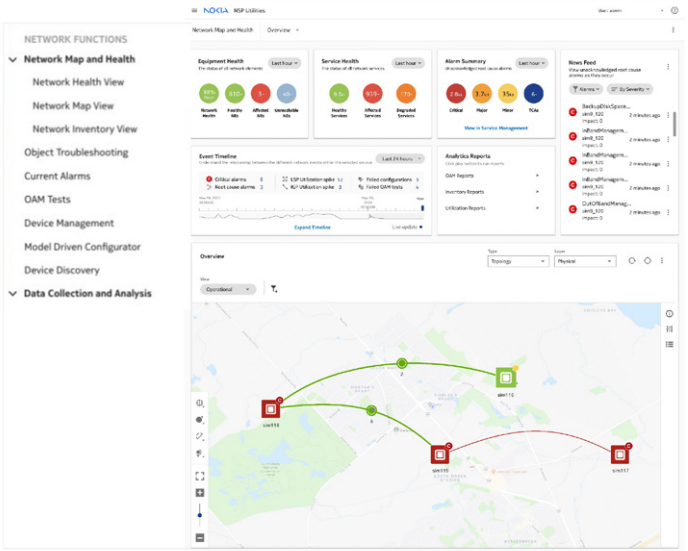
Grid applications need consistent network quality of service (QoS). Any degradation or intermittent outage in a utility's mission-critical WAN can impact application performance. For example, a false trip in a line differential protection system can directly affect power reliability and quality, which can cause revenue loss or compromise worker and public safety. Utilities must continually assure that network services are up and running. But network and application environments are becoming increasingly complex, so implementing service assurance with traditional element- and network-centric tools and CLIs is inefficient and resource-intensive.

With NSP, utilities can proactively identify and resolve potential problems in the network before they impact the network services that support grid applications. NSP's operations, administration and maintenance (OAM) test capabilities provide detailed information on network performance and assurance thresholds for any applications where increased latency, jitter or packet loss will diminish QoS and affect application performance.

Alarm notifications based on simple or complex user-defined service-related key performance indicators (KPIs), such as threshold-crossing alerts and escalating test-failure alerts, will further automate fault management and ensure adherence to QoS objectives or service level agreements (SLAs).

When a problem does occur, NSP offers a comprehensive set of tools that let utilities quickly find and resolve the issue. Integrated and purpose-built views of the physical and logical topology depict all paths traversed by a service, including the actual routes across the network. And enhanced alarm correlation reduces the number of alerts by providing a single entry that identifies the root cause of the problem.

NSP provides OAM test capabilities and simplifies performance monitoring and troubleshooting



Enhance network planning and data analytics

Network administrators often lack visibility of how the network is used and how planned changes and unforeseen outages will affect the network, utility operations and users.

NSP provides detailed visualizations and real-time analysis of the network—from hardware inventory to services—by collecting, warehousing and aggregating event, performance and volumetric data. Historical and real-time statistics graphing help administrators better understand performance issues before they cause a problem.

Analytics and reporting

NSP provides prepackaged analytics reports and dashboards that deliver real-time analysis. These include insightful ad hoc reports and dashboards for self-service reporting using web-based tools that can be further customized or extended.

NSP leverages machine learning (ML) algorithms to automatically learn and adapt to changing patterns in key network resources. It uses these capabilities to detect and react to network anomalies faster than traditional methods. NSP proactively identifies and prevents potential service-affecting problems before they impact end users and applications.

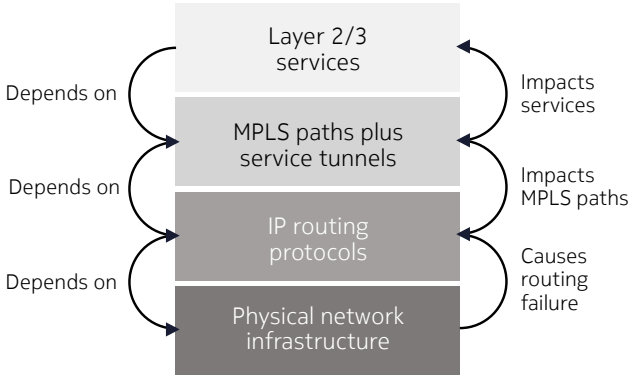
Using NSP, utilities can better understand how their network is being used and can make informed decisions during network re-optimization and expansion.

Control plane assurance management

Power utilities can take advantage of control plane assurance management (CPAM), a multivendor route analytics capability provided by NSP, which delivers unprecedented real-time visualization, surveillance and troubleshooting for dynamic IP/MPLS networks and services. CPAM helps utilities quickly identify IP routing and MPLS path misconfigurations, malfunctions and undetected updates. This simplifies troubleshooting and accelerates problem resolution times.

Power utilities can use this function to simulate planned control plane configuration changes and operational maintenance, such as node upgrades, and to carry out what-if scenario analysis. With graphical analysis of the simulated topology, they can pre-validate the impact of the changes before implementing them in the live network. This pre-validation reduces the risk of service degradations and interruptions.

Control plane assurance management is key to understand and correlate control plane failure with services



"CPAM has proven an invaluable tool for troubleshooting complex BGP configurations. It allowed us to graphically visualize the AS path topology, enabling us to quickly diagnose BGP issues that occured after an upgrade scenario. We look forward to continue to leverage the significant value the CPAM has added to our overall network assurance capabilities as we introduce new services and our network grows."

Jeff Fry, Manager,
Telecommunications Engineering Transmission and Technology
Ausgrid

Security

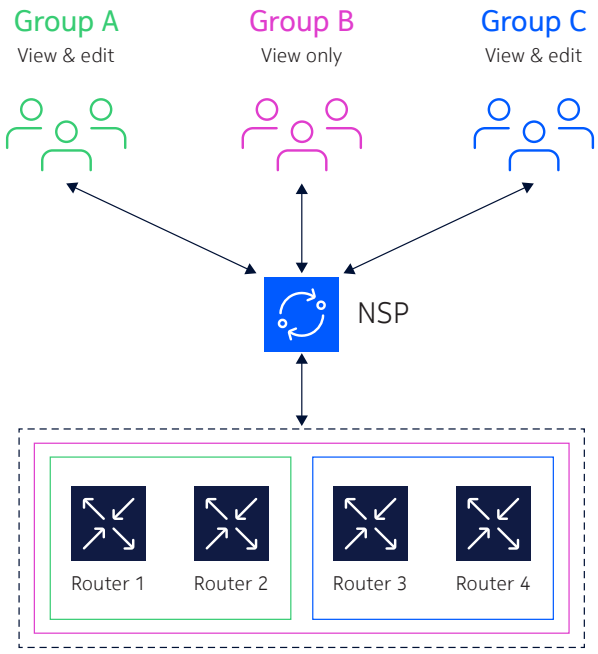
Security is a top concern for utilities, and NSP is designed with security in mind. It follows the Nokia design for security processes, which defines a framework for delivering products that support a defence-in-depth approach and utilizing industry-recognized security standards and best practices. Requirements defined by the framework cover various areas from the platform to users.

Each NSP release undergoes security testing using prevalent industry methodologies and a variety of scanning test applications specialized for different areas and purposes such as ports, web applications, code, images, vulnerability and fuzzing for software reliability. These tests ensure that NSP is a secure and reliable platform.

NSP strengthens user security with role-based access control (RBAC). RBAC grants permissions and privileges based on roles, ensuring that users have only the access rights necessary for their responsibilities. It is configured by defining groups of users and assigning roles to them. Each role consists of a permitted set of actions and/or resources. All users within the user group will be authorized to perform actions on a specific set of resources, as permitted for their group's role. All user activities are logged for troubleshooting and security auditing.

NSP user security provides local user account management and supports identity brokering through multiple remote sources. This ensures continuous system access and offers the ability to enable multi-factor authentication. User security settings such as password and session policies for brute-force attack prevention can be configured through the web user interface (UI) for either UI or OSS users.

NSP strengthens security with role-based access control



Use case: Unified converged WAN/FAN management

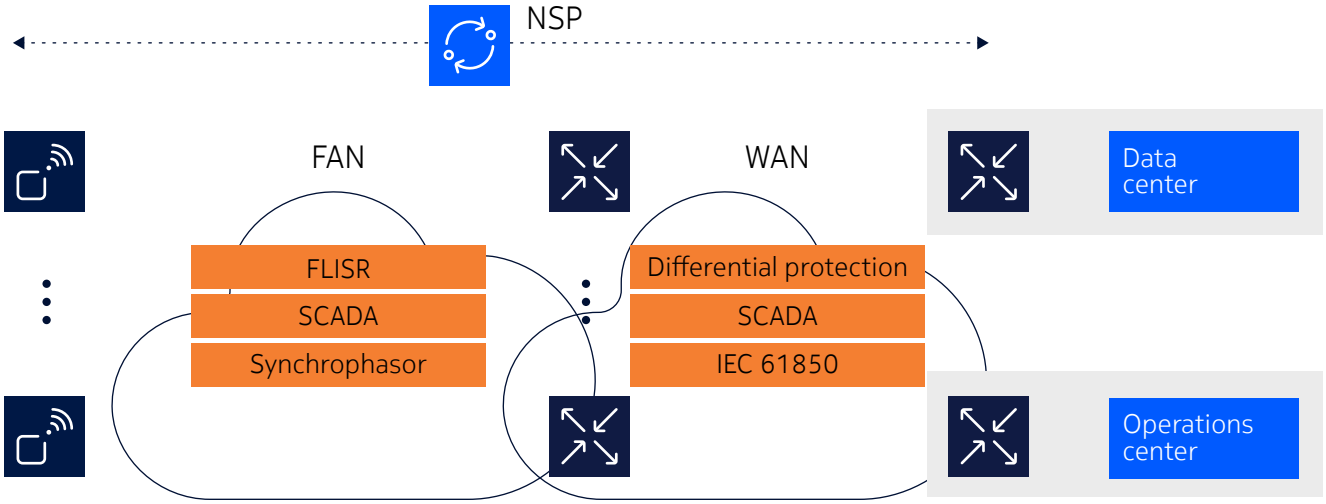
Utilities can use NSP to manage their mission-critical IP/MPLS WAN, connecting substations to data centers and operations centers to support automation use cases. With the increasing adoption of electric vehicles, heat pumps and DERs, utilities are deploying distribution automation applications beyond substations in the feeder circuit domain to support advanced grid capabilities, from self-healing to fire mitigation to real-time circuit monitoring.

Utilities need a converged FAN to realize this ambition. A converged FAN harnesses the multiservice capabilities of IP/MPLS and ubiquitous wireless access to enable the reliable communications required for distribution automation applications such as FLISR and synchrophasor.

NSP extends network services management from WAN to FAN as one domain. It manages the wireless field router, offering robust features such as:

- Zero touch provisioning for agile, large-scale development
- Service automation for operations efficiency
- Integrated OAM for proactive service assurance.

NSP unifies mission-critical WAN and FAN management



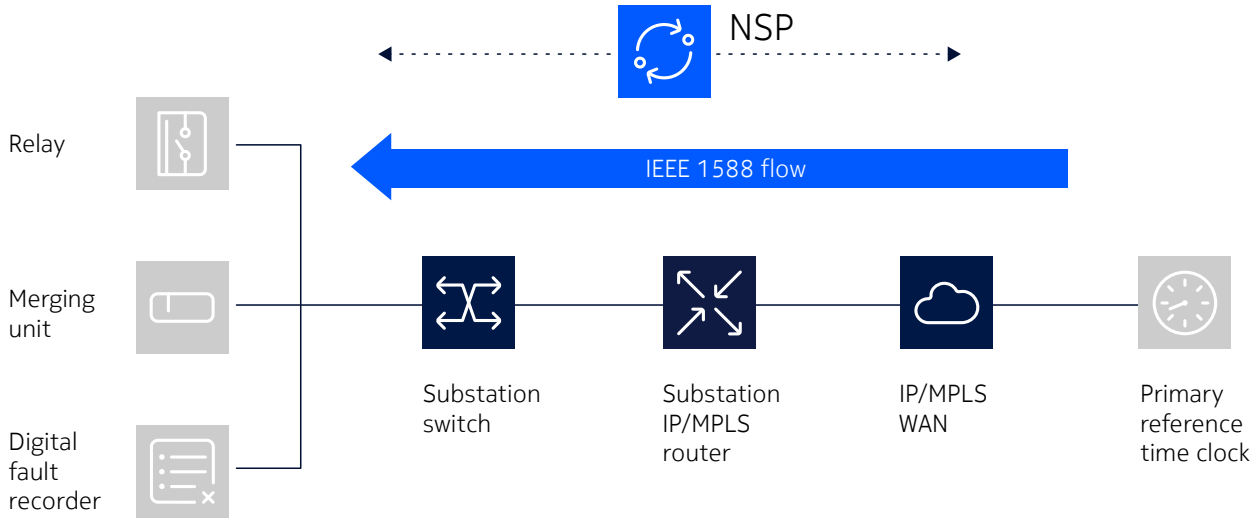
Use case: Synchronization management

Grid operations require accurate synchronization of assets across the electrical and communications domains. Utilities have long used synchronous line timing in the WAN to support frequency synchronization and ensure that digital data is transmitted and received properly. With the growing adoption of IEC 61850 technologies such as synchrophasor, GOOSE and digital fault recording, utility synchronization requirements have expanded to include time synchronization.

Utilities increasingly rely on IEEE 1588v2 to deliver time synchronization through the WAN and substation buses to assets across the grid. The network nodes in the WAN and substation LANs play the active role of boundary clock in the overall synchronization topology to deliver accurate time to grid assets.

The traditional way of managing synchronization is on a nodal basis. This approach cannot be scaled as the network grows and expands. NSP offers a novel network-based approach to synchronization management. With capabilities such as real-time monitoring of synchronization network topology status and master/slave relationships, it enables utilities to perform synchronization planning, what-if analysis and troubleshooting, significantly improving synchronization network reliability.

A novel network-based approach to synchronization management with NSP



Ready to embrace automation today

As power grids become intelligent and responsive, the networks that manage them must evolve and become more automated, dynamic and optimized so they can provide efficient and scalable support for smart grid applications.

The Nokia NSP can be expanded to include path control and optimization capabilities to help utilities meet the communications requirements of smart grid applications with:

- Increased abstraction and intelligence to optimize service provisioning for the demands of specific functions such as teleprotection, including latency, bandwidth and maximum number of hops
- Real-time network self-tuning in response to changing traffic demands and patterns
- Automated path optimization to get more from network assets without compromising reliability.

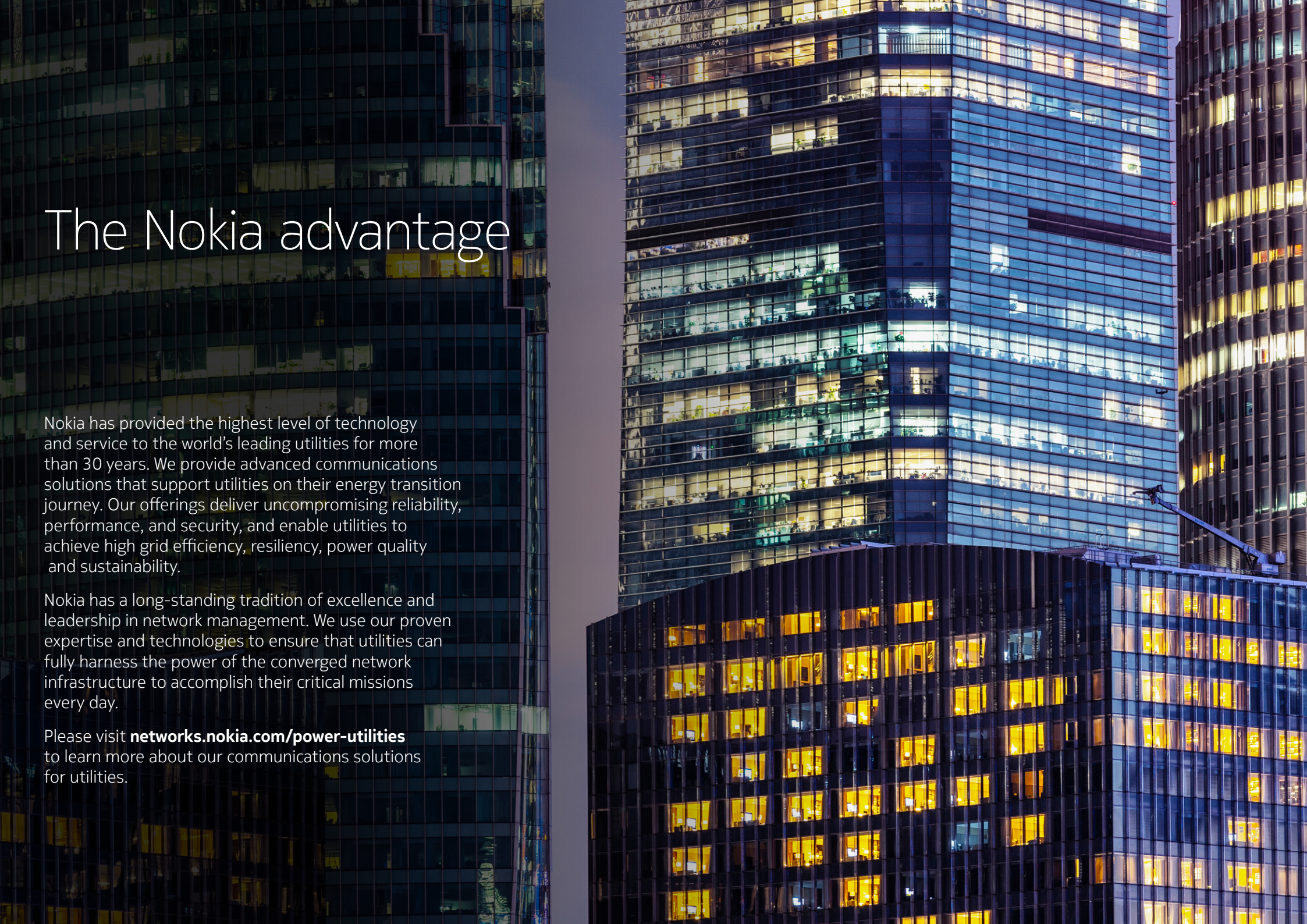
Continue evolving with Nokia

Nokia has a long tradition of excellence in network management and leadership in mission-critical WAN solutions. We also continue to enhance our network and service management solutions far beyond conventional systems. These enhancements allow utilities to implement the lean, scalable and flexible processes they need to deliver reliable, versatile networks that meet current and future grid application performance requirements.

Utilities can count on the Nokia NSP to:

- Streamline network migration from legacy TDM/SONET/SDH technologies to IP/MPLS
- Accelerate provisioning processes
- Continually monitor service and network performance
- Proactively prevent user-affecting problems
- Ensure fast and simple fault resolution
- Deliver unmatched network visibility and application usage.

Deployed in more than 1,000 network operator environments, including some of the world's largest and most advanced and demanding mission-critical networks, the Nokia NSP is a proven solution that sets the standard for each aspect of network operations. With an architecture that is modular, extensible and scalable, NSP helps utilities address today's challenges and build a foundation for navigating the energy transition journey.



The Nokia advantage

Nokia has provided the highest level of technology and service to the world's leading utilities for more than 30 years. We provide advanced communications solutions that support utilities on their energy transition journey. Our offerings deliver uncompromising reliability, performance, and security, and enable utilities to achieve high grid efficiency, resiliency, power quality and sustainability.

Nokia has a long-standing tradition of excellence and leadership in network management. We use our proven expertise and technologies to ensure that utilities can fully harness the power of the converged network infrastructure to accomplish their critical missions every day.

Please visit **networks.nokia.com/power-utilities** to learn more about our communications solutions for utilities.

Nokia OYJ
Karakaari 7
02610 Espoo
Finland

Tel. +358 (0) 10 44 88 000

CID: 214290 (October)

nokia.com

About Nokia

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

With truly open architectures that seamlessly integrate into any ecosystem, our high-performance networks create new opportunities for monetization and scale. Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.