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Private Wireless sales playbook for Nokia partners

Digital Automation Cloud (DAC)

Modular Private Wireless (MPW)

August 2022

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Get to know Nokia

Here's our two-minute story

Who we are

We create technology that helps the world act together. Through technology leadership and trusted partnerships, we deliver critical networks to help address global issues. We have the power to bring together people, machines, and devices, sensing and acting in real-time at a massive scale.

Our critical networks go beyond connectivity to enable self-optimizing, intelligent systems both locally and globally. We deliver solutions that drive more efficient use and re-use of resources and restore productivity growth by digitalizing physical industries and providing more inclusive access globally.

What we do

We build mission-critical networks that accelerate digital transformation for enterprises to solve their most enduring business and operational pain points. Our private wireless solutions bring Industry 4.0 to realization resulting in increased productivity, agility, and sustainability for our customers worldwide.

We are unlocking operational productivity and have worked with over 2,200 enterprises in all geographies and industries. Leveraging our industrial ecosystem and deep industry knowledge, we have implemented mission-critical private wireless infrastructure for enterprises worldwide.

How we do it

We provide a leading portfolio of industrial-grade private wireless networking solutions that enable continuous operations, security, and safety for enterprise customers across industries. Our high-performance private wireless networks deliver secure connectivity at scale, ultra-high capacity, and ultra-low latency for mission- and business-critical reliability.

Our connectivity enhances efficiencies by enabling process automation, increased agility to meet changing requirements, and improves worker safety and productivity. Our focus on execution excellence, performance, quality, security, and reliability help enterprises effectively meet their industry 4.0 goals.

Welcome to the Nokia Private Wireless Partner Playbook

For you to make the most of the Industry 4.0 private wireless opportunity, we have created this sales messaging playbook. We'll share messaging, solution capabilities, ideal customer segments and audiences, market dynamics, buyer challenges, and how to conduct a conversation to generate interest and help you gain access to the right decision makers.

Private wireless supports essential industry applications in thousands of enterprises across a broad range of sectors. It provides the pervasive and predictable connectivity to automate business operations, ensure safety and security, and push new quality, efficiency, and productivity levels.

More information can be found at:

- Nokia Private Wireless
- Industry 4.0
- Nokia Digital Automation Cloud

About Nokia and private wireless

Nokia, a proven leader in digital transformation, has spent decades building some of the world's most extensive and advanced mission-critical IP, optical and wireless networks.

Nokia has implemented industrial-grade private wireless networks at more than 485 leading enterprises worldwide, such as manufacturers, utilities, railways, ports, smart cities, mining operations, public sector, and healthcare systems. Nokia has prioritized developing our industry knowledge which is essential to penetrate private wireless high-growth sector opportunities.

At Nokia we believe technology is central to the solution and partnerships are crucial to making the solution widely available to more communities around the world.

It's our aim to be your trusted partner for critical networks for years to come, delivering technology leadership in each of our business areas to help you capture the value shift to cloud and new business models, creating value with long-term research and intellectual property.

485+ private wireless customers

Uncontested market leader in private wireless*

Private wireless – the opportunity

Enterprise customers

The fourth industrial revolution is here

The digitalization of industries is unfolding. With 5G quickly becoming a real-world presence and virtualization/cloud, AI/ML (artificial intelligence/machine learning), and IoT (Internet of Things) picking up speed, we're quickly moving into the Fourth Industrial Revolution. It's disrupting how businesses work, think, and serve their customers, driving fundamental change in what networks need to deliver. We are now seeing unprecedented levels of demand for business and operational process automation, convenient usage of digital applications/services, as well as secure and highly reliable connectivity – all of which represent a perfect opportunity for a new generation of private wireless communications.

Private Wireless Networks - A key enabler of Industry 4.0

Private wireless networks are 4.9G/LTE and 5G cellular networks dedicated to a specific enterprise, venue, or geographic area. Private wireless leverages flexible spectrum access technologies to operate on unlicensed, shared, or licensed spectrum, to enable users and customers to integrate diverse sensors, machines, people, vehicles, and more across a wide range of applications and usage scenarios. It treats user concerns from reliability and service quality, to security and compliance as challenges that can be addressed by a single, scalable wireless networking solution.

Private wireless

A fast-growing market opportunity that you can be a part of

Private wireless from Nokia is a key component in the foundations of your customers' digital transformation strategies and a lucrative business opportunity for you to take advantage of and drive revenue from, today.

The private wireless market will grow from $588m to $64bn over the next decade*, and with the Nokia solution, you can expand your sales opportunities by upselling high-margin subscriptions and services that further help position you as a knowledgeable, trusted expert in enterprise solutions.

*Monetizing 5G Edge Networks, ABI Research, July 2021

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5 compelling reasons for you to partner with Nokia

Solve your customers' digital transformation challenges whilst growing your business

Complimentary technology to your existing portfolio

- Nokia's private wireless is complimentary to your existing enterprise Wi-Fi & wireless networking business.
- Private wireless is a profitable business for your company through customer sales expansion opportunities, subscription revenues and selling your services.

Large addressable market opportunity

- The total addressable market opportunity for private networks will grow from $588m in 2020 to more than $64bn in 2030.

Online training for partners

- Access to free online training courses and Nokia certifications.

Support on customer engagements

- Nokia is here to actively support you on customer engagement through joint marketing, pre-sales support and co-selling efforts.
- Our distributors are able to provide you with support as you build up your services capabilities so you can work on opportunities from day one.

Selling a proven technology

- Sell a proven technology from Nokia that has been used for nearly a decade in mobile networks and is now available and affordable for private networks.
- 485+ private wireless customers (July 2022) with public customer reference stories.

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The analyst view on Nokia as a market leader

Nokia is the clear market leader with over 485+ private networks installed.

Don't just take our word for it! Here's what leading analysts are saying:

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Macro trends and pressures impacting your customers

Macro trends and pressures

Fourth industrial revolution

- We are on the cusp of the 4th industrial revolution (industry 4.0), connecting digital to the physical world and infusing it with intelligence.
- Industry 4.0 will profoundly affect how businesses and industry sectors across economies will work in the future.
- It brings unprecedented levels of demand for business and operational process automation, convenient usage of digital applications/services, and secure and highly reliable connectivity – a perfect opportunity for service providers and their resellers/partners.

Confluence of key technologies and increase in mobility

- Increases in the use of cloud services, artificial intelligence, big data, inexpensive and ubiquitous sensors, computer vision, virtual reality, robotics, and a new generation of private 4.9/5G wireless technologies are transforming traditional physical industries.[1]
- 5G is set to connect 100x more devices, offer up to 100x faster speeds, and be 5x more responsive than 4G.[2]
- Growth in IoT is expected to connect over 43 billion devices by 2023.[2]

Releasing spectrum for businesses

- Governments are increasingly releasing spectrum for businesses in their support for Industry 4.0.
- Private wireless networks are emerging. They can operate on both the licensed and unlicensed spectrum and businesses will choose based on their locations, requirements, and budget.

Implications

Automation and continuous operations

- Industry 4.0 will deliver massive increases in productivity and economic value creation including: enhanced efficiency with process automation.
- Increased agility to meet fast changing requirements.
- Better decision making via intelligent insights.
- Increased worker safety and productivity.
- Sustainability through efficiency lowering environmental impacts.

Transform network capabilities

- Nextgen network technology will transform businesses and the consumer experience and drive more data use.
- Current networks cannot support future growth in areas such as IoT and digital transformation. Current enterprise wireless network technologies—such as Wi-Fi—simply can't deliver the secure, persistent connectivity needed by organizations with large indoor or outdoor campuses or bases. Private wireless is needed to eliminate coverage gaps and lost connectivity, inconsistent service quality, and fractured security.

Increase control and reduce cost

- High IT costs and slow response time to both issues and opportunities.
- Governments are allocating more licensed spectrum for operators for industrial use and the emergence of unlicensed spectrum (such as CBRS in the US and MulteFire) so enterprises can leverage it to automate and increase control of their operations while reducing costs.

1 The Coming Productivity Boom, The digital industries, which account for around 25% of U.S. private-sector employment and 30% of private-sector GDP, make 70% of all private-sector investments in information technology. The physical industries, which are 75% of private-sector employment and 70% of private-sector GDP, make just 30% of the investments in information technology.
2 CTIA 5G and Internet of Things

Let's take a deeper look at private wireless

A private wireless network is a standalone network based on cellular technology such as 4.9G/LTE and 5G, focused on operational assets and users. A private wireless network provides broadband connectivity like a public wireless network but is owned and controlled by the organization that built or purchased it. Placing micro towers, small cells, edge routers, and other infrastructure on-site allows enterprises to mimic a standard public cellular network, but with less congestion and more cost-effectiveness — even in areas where public LTE infrastructure does not exist.

Private wireless offers a much better experience for today's high-bandwidth and industrial applications such as robotics and video surveillance streaming. The network and its infrastructure control all connections, and priority and pre-emption can be assigned to specific SIMs and devices, providing better Quality-of-Service. Security is another important advantage of private wireless. Keeping traffic local between IoT devices and on-site servers is essential. It needs all the similar elements as a public network, including spectrum.

Private wireless networks enable enterprises to drive automation, increase business efficiency, safety, and agility, and shrink their environmental footprint by fusing physical with digital processes. To digitally transform processes and systems, enterprises need to connect sensors, machines, and workers in their operations in the most flexible way available. Tethering to wired network infrastructure is expensive and will limit Industry 4.0 transformation. **Private wireless is the best way to cost-effectively implement the broadest range of Industry 4.0 applications while providing the reliability and security typical of ethernet cables.**

Benefits

- Ubiquitous connectivity across large campus sites, indoors and outdoors
- High multi-user capacity
- Ability to meet growing demands with a single wireless network for operational technology needs
- Delivery of predictable high data rates and low latency, and support critical voice and low power sensors
- Support for advanced applications on mobile assets and transparent handovers to public networks
- Mission-critical reliability to keep systems up and running
- Intrinsic security with built-in encryption and authentication capabilities

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Wi-Fi and private wireless (1 of 2)

Where Wi-Fi makes sense and where a cellular solution, such as 4.9G/LTE or 5G, is the winner.

Wi-Fi is a good technology for IT and business applications but challenging when meeting the requirement of industrial operational technology (OT) environments. Wi-Fi 6 delivers enhancements over Wi-Fi 5 but is still very limited to what it can and cannot do to meet critical connectivity requirements.

The expectation of industrial connectivity is about deep and wide penetration. When you are trying to cover a large area, especially a yard where many objects are stored and moved, things get tricky. This difficulty is because Wi-Fi coverage is relatively limited, and Wi-Fi is not great at managing radio interference. Just trying to figure out how to place the access points in a complex radio environment to ensure reliable coverage is a significant and expensive undertaking.

In contrast, LTE/4.9 and 5G have vastly increased penetration, consistent coverage, and ability to deliver reliable high performance in interference-prone environments. Private wireless is better suited to business- and mission-critical environments. Current enterprise network technologies such as Wi-Fi can't provide the secure, persistent connectivity needed by organizations with large indoor or outdoor campuses or bases.

Wi-Fi and private wireless (2 of 2)

Cellular technology for predictable performance of operational applications

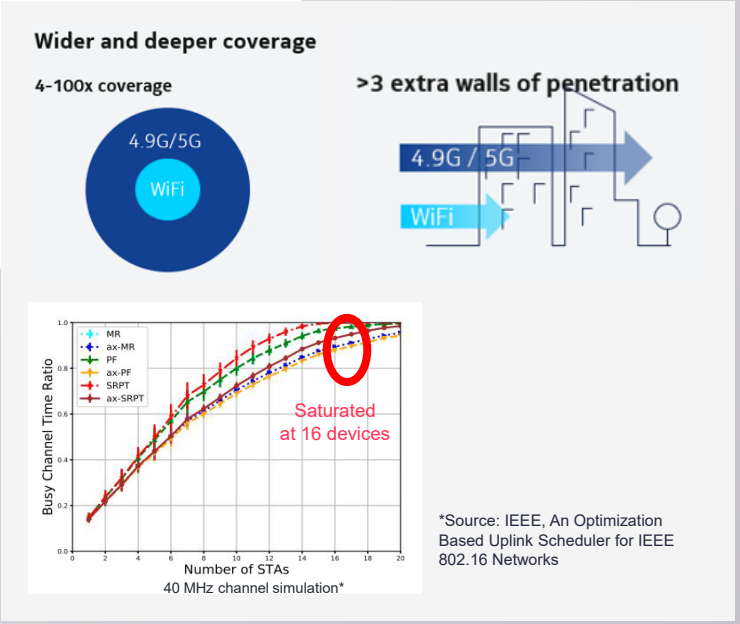
Predictable performance is a critical requirement for OT applications. You need to know you can have credible performance both in terms of capacity and latency. Wi-Fi, including Wi-Fi 6, provides good performance with a few users connected to the access point, but as soon as loading or interferences increase, the latency increases, and performance drops. This performance is documented by IEEE and based on their testing, which indicates some saturation once the Wi-Fi access point has more than 16 devices connected.

In comparison, an LTE/4.9G small cell can handle enough stable latency and multi-user capacity of up to 840 active connected devices. Also, LTE/4.9G provides significant security improvements with end-to-end security and SIM card encryption. LTE/4.9G in the same network provides low-power wide-area IoT capability with LT in the narrowband IoT. This capability means that you can add battery-powered sensors deep inside machines and have a full 10 years of battery life using the same network.

A common misperception that Wi-Fi is cheaper than private wireless

Most industrial sites have very complex radio environments needing extensive and pervasive coverage across indoor and outdoor areas. Where Wi-Fi can require several hundred access points to ensure indoor and outdoor coverage, Nokia's private wireless solutions can cover the same area with a few tens of Micro-BTS outdoors and a few Indoor-Pico BTS. These capabilities result in a lower price for the customer, up to 20% lower than Wi-Fi 6.

LTE/4.9 and 5G provides higher coverage, multi-user capacity, lower latency, more security, greater mobility



*Source: IEEE, An Optimization Based Uplink Scheduler for IEEE 802.16 Networks

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Nokia Digital Automation Cloud (NDAC) solution overview (1 of 5)

What is it?

Nokia Digital Automation Cloud (NDAC) is an end-to-end application platform for industrial-grade private wireless connectivity and edge computing capabilities. It is a compact, easy-to-deploy plug-and-play solution comprising network and user equipment, a cloud-based operation monitoring system, and industrial connectors that ease standard and industry-specific protocol connectivity.

Why it matters

- Enterprise transformation and digitalization has been severely limited with the more IT-centric Wi-Fi and other proprietary solutions. To support the next generation of industrial applications, enterprises will require ubiquitous connectivity with more bandwidth, low latency, and mission critical performance for continuous operations.

How it works

- Digital Automation Cloud is a secure plug-and-play, cloud-based, dedicated 4.9G and/or 5G wireless broadband solution. It offers a flexible pay-as-you-grow subscription model (OPEX), from a single ultra-local small deployment to multiple globally-distributed local networks. DAC is typically provided to enterprise customers in a combination of CAPEX / upfront investment and subscription.

What it does

- DAC delivers reliable high-bandwidth, low-latency private networking, local edge computing capabilities, voice and video services, and a catalog of applications. Data can be processed and stored locally on-premise with an ultra-scalable edge computing solution or can be transferred to a customer network through a local breakout function. Through the catalog in the DAC manager, portal customers can click and deploy digital automation applications like asset/object tracking, video processing, analytics, industrial connectors, and open APIs for 3rd party integration.

Service elements

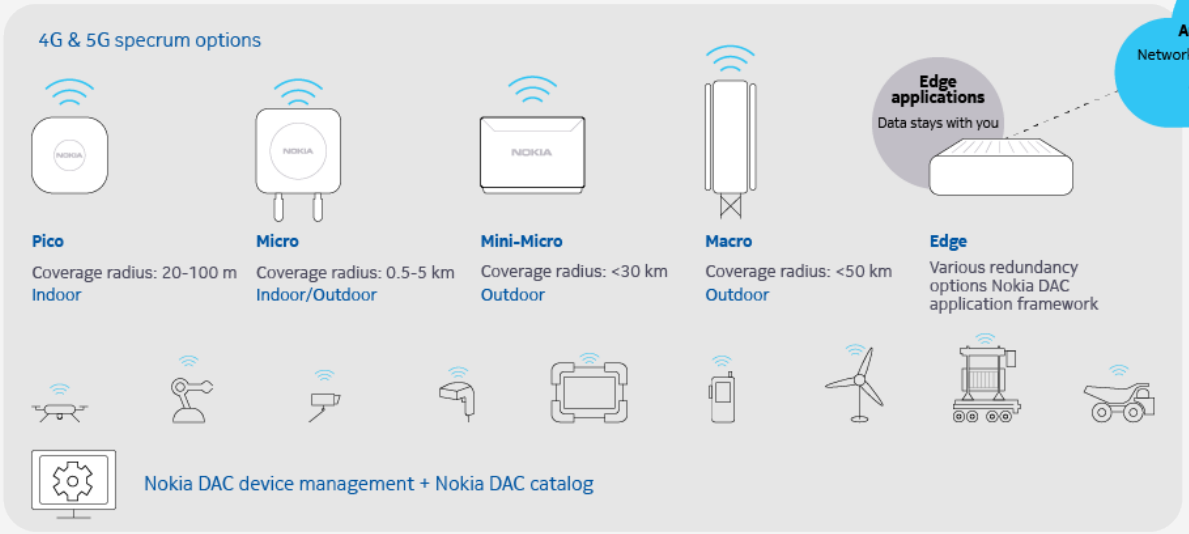
A secure plug-and-play, cloud-based, dedicated 4.9G and/or 5G wireless broadband solution including:

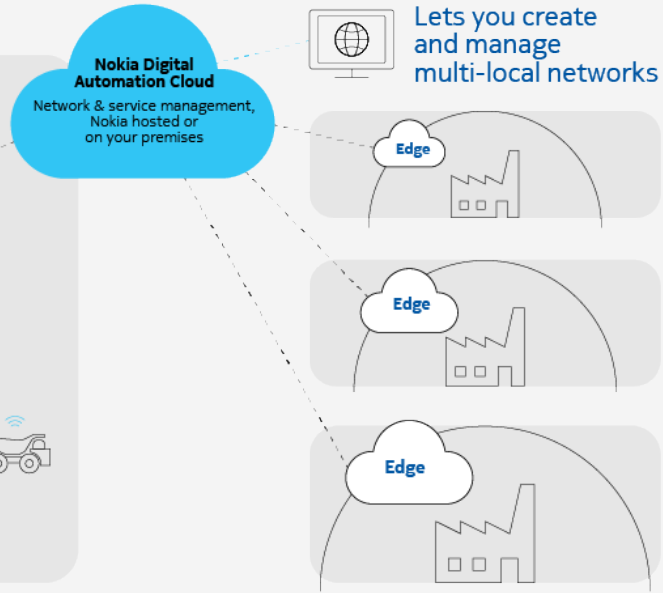
- Spectrum
- Edge computing
- Access points
- Applications
- User equipment.

Nokia DAC (2 of 5)

An end-to-end platform that makes private wireless 4.9G & 5G networking and automation easy

Comes with spectrum, edge computing, access points, applications and user equipment





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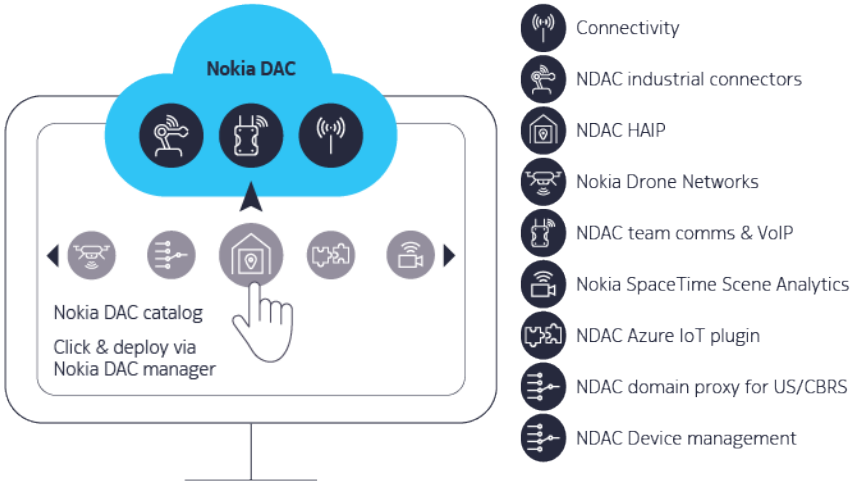
Nokia Digital Automation Cloud (NDAC) (3 of 5)

Applications



Enhancing DAC's industry-leading private 4.9G/LTE and 5G connectivity, the application catalog offers a portfolio of apps as well as a growing ecosystem of IoT modules and industry connectors essential to Industry 4.0 implementation.

Devices

Use the integrated ruggedized Nokia user equipment for mobile communication and applications to increase safety and operational efficiency.

Modular Private Wireless (MPW) solution overview (4 of 5)

What is it?

Modular Private Wireless (MPW) builds private 4.9G/5G-ready LTE networks for industrial sites and field area networks. It is a customizable end-to-end solution that includes indoor and outdoor solutions that meet the connectivity and application demands of Industry 4.0 strategies. Mobile operators can use MPW to offer secure MVNO services nationwide.

Why it matters

- MPW lets you design wireless networks that meet the unique demands of your customers' business and industry. It provides secure, reliable, and predictable connectivity that is essential for industrial applications. MPW provides control over the way the private wireless network is built and operated.

What it does

- MPW delivers an industrial-grade private wireless network with the capacity and scalability needed to connect machines, sensors, and workers securely. MPW ensures that every application and user gets the proper networks access, priority and performance, and enables control of proprietary data while keeping it on-premise.

How it works

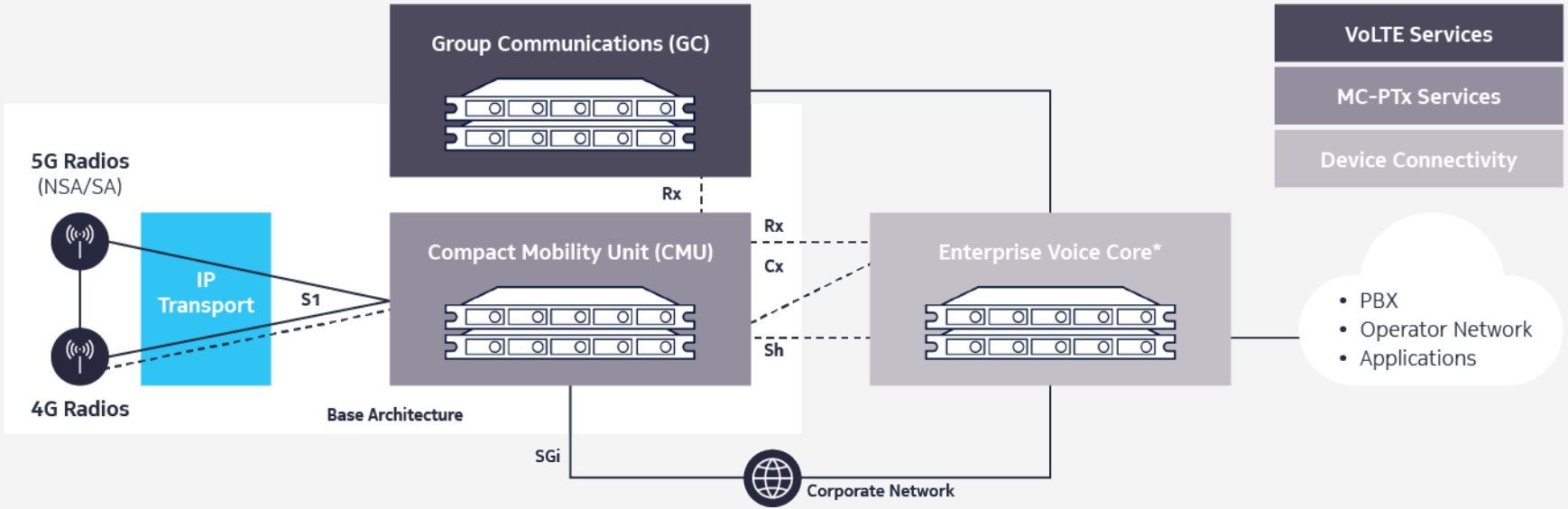
- The MPW solution provides a flexible platform that can be configured to your customers' exact requirements. It also gives you the flexibility to support centralized or distributed network architectures and various deployment scenarios.

Service elements

MPW provides you with everything you need for completely reliable, secure, and high-performance wireless connectivity. And is customizable depending on the customer's needs, including:

- **Flexi-zone** all-in-one indoor and outdoor small cells
- **AirScale** 4.9G and 5G-ready radio platforms for coverage of more extensive areas
- **Compact Mobility Unit** core network, ideally suited for enterprise private wireless networks to manage mobility between cells, security, and traffic engineering
- **Group communications** offering push-to-talk and push-to-video for secure, mission-critical radio communications and Enterprise Voice Core for IMS-based voice and video services
- **Network Services Platform (NSP),** a comprehensive end-to-end management system for managing all aspects of the wireless network, as well as IP backhaul and transport
- **IP Transport,** a service-aware converged IP-MPLS network that can be used to consolidate all cabled and wireless networks.

Network Services Platform (NSP) (5 of 5)



Spectrum overview

Licensed (vertical or service provider leasing)

More and more countries' regulatory bodies are releasing enterprise licenses for specific frequency bands. Over 40 countries have now issued spectrum bands (2.6GHz TD-LTE, 3.7GHz, etc.) for private wireless.

Nokia also has several service provider partners, with an agreement to use some of their spectrum for private wireless deployments. Also, spectrum can be requested from a service provider on an ad-hoc basis or as part of the service provider's private wireless offering.

Industrial site private wireless bands tend to be higher frequencies providing the right mix of capacity and coverage. Wide area private networks tend to favor lower spectrum for segments such as public safety, utility, or railways (410-900Mhz).

Shared

US Citizen Band Radio Service (CBRS) uses 3.5Ghz and has Incumbent, Priority Access License (PAL), and General Authorized Access (GAA) options available for shared use.

GAA spectrum is open to anyone using an online application, tends to be more applicable for site-specific coverage, while PAL, which requires bidding for, also allows for broader deployments.

The US is leading this spectrum offering; however, many countries are looking at similar spectrum usage for the future opening of shared spectrum bands.

Unlicensed

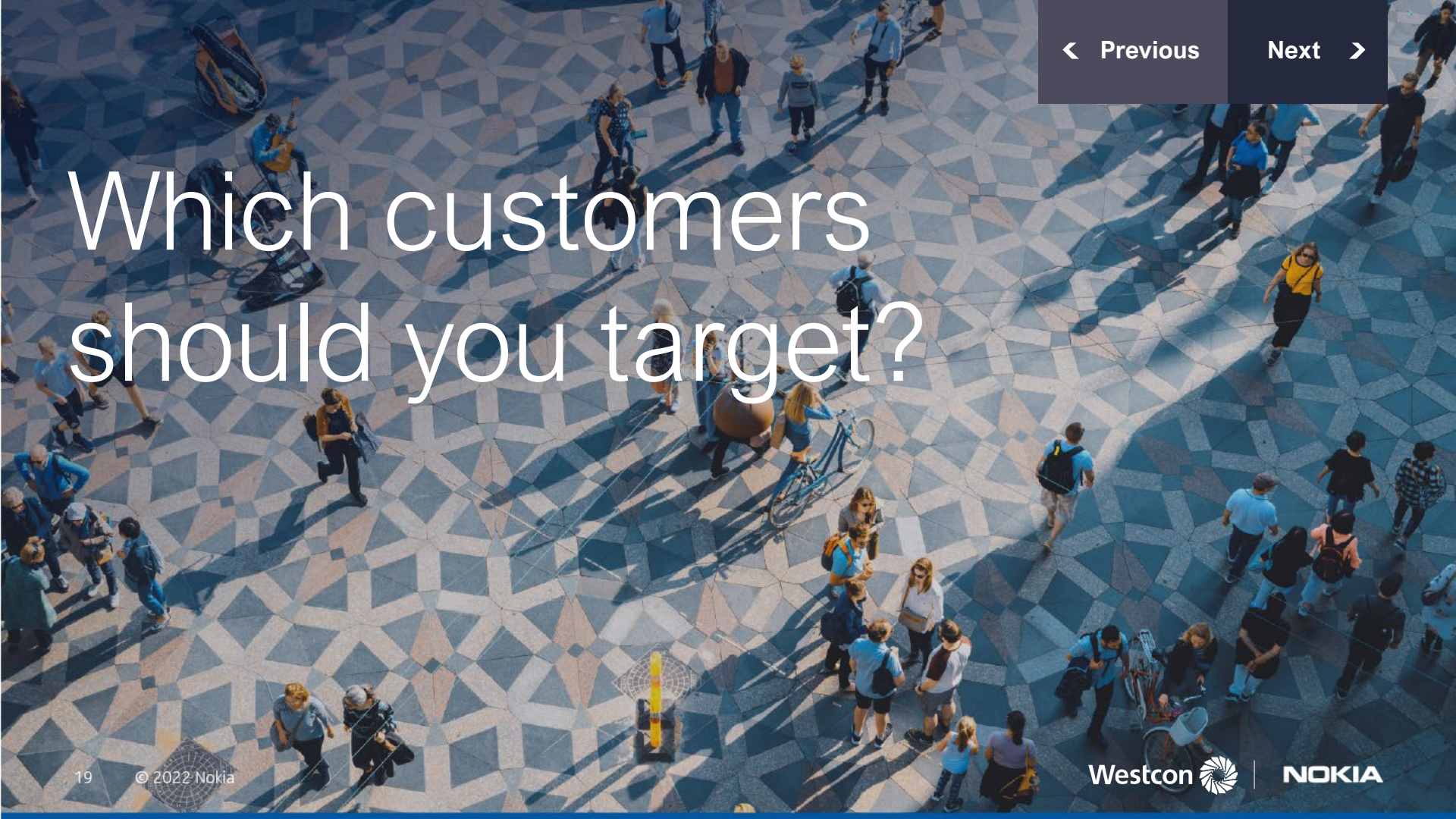
5G, 6G, and 60hz are opening new options for industries and the public sector to deliver private wireless services.

MulteFire Alliance (MFA) is an international consortium of companies driving unlicensed specifications on top of the 3GPP releases to provide network performance enhancements. Using MulteFire R1.0 allows for LTE/4G deployment into the unlicensed Wi-Fi 5.x GHz spectrum band.

Unlicensed spectrum opens many possibilities for private wireless:

- Ease access and further lower cost of private wireless is helping drive SME markets uptake as acquiring spectrum or rights to spectrum is no longer needed
- Allow deployment of private wireless in any markets where spectrum is hard to get, or service providers are not allowed to sub-lease their spectrum
- MulteFire can help complement existing private wireless networks, for example, to add capacity for video applications
- The unlicensed nature of spectrum makes it particularly suitable for new nomadic use cases critical in some segments (events, construction, broadcasting, etc.)

Which customers should you target?



Customer targeting

Ideal customer profile

Business characteristics

- Companies with high process complexity – i.e., sophisticated chemical, refinery, steel, raw materials processing, etc.
- Businesses with high revenue top 50 to 100 in an industry with high numbers of locations.
- Large operations site area – the higher the better with outdoor space for massive TC gains vs. Wi-Fi.
- Embracing IoT possibilities (i.e., M2M, connected everything).
- High executive focus on industrial automation/digitization with large budgets assigned.
- The need for private wireless is very high when manual labor is high (white goods, heavy goods, custom goods, etc).

Technology characteristics

- Experiencing quality of service issues with Wi-Fi & public networks.
- Do not target Wi-Fi replacement only. Look for use cases with mobility requirements - handovers between Wi-Fi APs are not working well.
- High bandwidth low latency requirements - video stream, data shower.
- Large number of devices or coverage topics (LTE more pervasive).
- Limited coverage, range and responsiveness for IoT devices and machines.
- Need for aerial drone inspection with live video stream.

Operations characteristics

- Major focus on automation, digital workflows and flexible production.
- Mobility use cases – sites involving moving vehicles, cranes, trucks, forklifts, etc.
- Need for workers safety and site security is high leading to need for automation.
- Strained by Wi-Fi limitations (mobility, reliability, capacity).
- Insufficient data/low visibility into processes.
- Inability of wired networks to adapt to evolving business needs.
- Ongoing need to reconfigure operations to be agile.
- Innovation/transformation unit exists.

Compelling events

- Spectrum is available.
- Current network approach is being reviewed e.g. - due to reliability, speed, security, etc.
- Public 4G and 5G not available in key locations.
- Realization of the need to reconfigure operations e.g. production lines.
- Need to increase automation, increase productivity and reduce operational costs.
- Need for situational awareness & real-time monitoring.

Target personas

Technology leader

- Chief Information Officer
- Chief Technology Officer
- Chief Technology Innovation Officer
- Chief Information Technology Officer
- VP, Director, Manager of: Networks, Wireless Networks

Key challenges

- Compiling, analyzing and recommending technologies that drive business outcomes e.g. improving speed to market, greater agility
- Gain greater visibility and insights into operations through improved data collection and analytics
- Executing technology strategy ensuring risk management and targeted outcomes are met
- Implementing cyber-security plan, policies and compliance to mitigate threats
- Vendor technology management by ensuring a continuous audit of vendor capabilities aligned to business need
- Managing on-going services and changes within budget

Performance measures

- Achievement of internal SLAs: reliability, speed of service and response - Efficiency improvements
- Success rate in identifying cyber threats and repelling cyber attacks
- Automation projects meet requirements and delivered on budget
- Data safety

Operations leader

- Chief Operations or Operating Officer
- Chief Customer Experience Officer
- VP, Director, Manager of: Operational Technology Business Operations, Business Transformation, Digital Operations, Automation, Production Director, Plant Leader

Key challenges

- Improving productivity and efficiency (uptime, quality, waste etc); meet operational cost constraints
- Creating flexibility and adaptability to meet changing needs of the business & end customer
- Aligning OT needs with IT automation plans to achieve desired outcomes and increasing production capacity
- Modernizing plant, processes and technology while meeting ROI project objectives
- Meet quality and workplace safety regulations
- Ensuring mobile and cloud-based digitalization strategies do not create security or IP threats

Performance measures

- Efficiency e.g. operations uptime/downtime, energy consumption, cost management, production, yield, waste
- Customer satisfaction for quality, performance and value
- Compliance with regulations and standards
- Safety and accidents

Transformation leader

- Chief Transformation Officer
- Chief Digital Officer
- Chief Digital Transformation Officer
- Chief Innovation Officer
- VP of Business Transformation

Key challenges

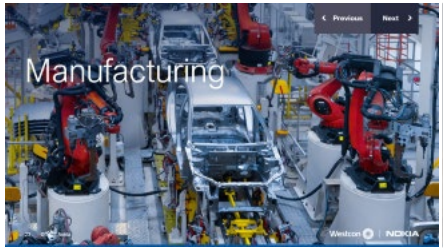
- Need to upend their market by deploying new technologies to exceed the intended business outcomes of Industry 4.0
- Need to take a more holistic approach to decision-making, which includes having clearer processes, being more data-driven and drawing insights from diverse sets of stakeholders
- Must be able to overcome what has made investing in technology such a challenge: a focus on short-term results, a lack of understanding of Industry 4.0 technologies, and a lack of leadership vision

Performance measures

- Increased productivity and cost reduction
- The realization of a digital enterprise that is not only interconnected, but also capable of more holistic, informed decision making

Target personas

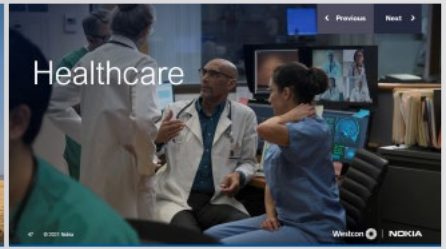
Manufacturing



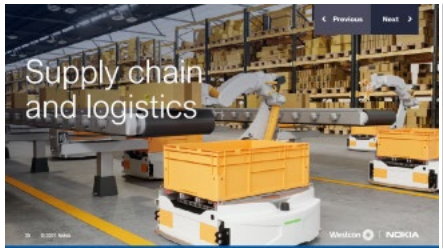
Energy (Mining)

Energy (Utilities)

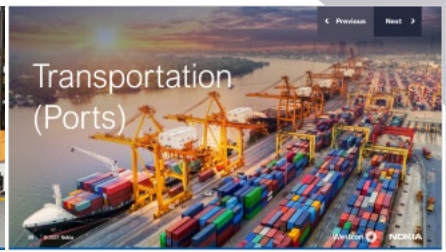
Healthcare



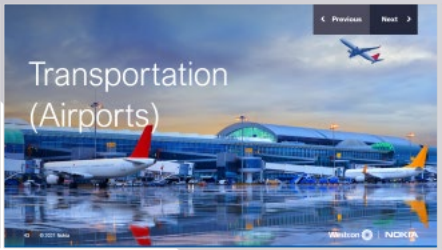
Supply chain and logistics



Transportation (Ports)



Transportation (Airports)



Education

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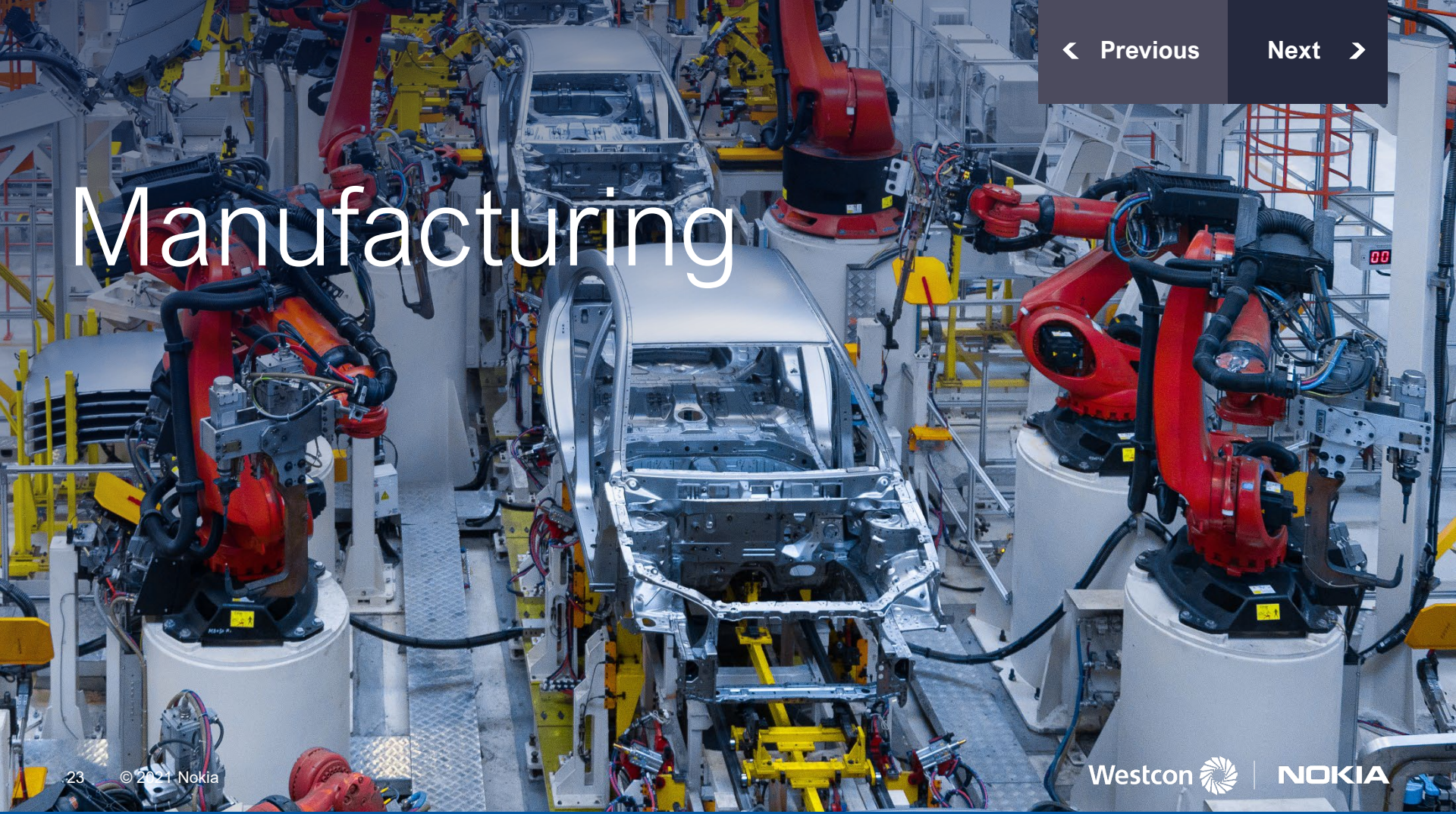
Manufacturing



Vertical markets

Manufacturing overview (1 of 3)

Opportunity

- Manufacturers are digitalizing and automating production operations to accelerate their Industry 4.0 initiatives. There are over 10.7M manufacturing facilities worldwide.
- This requires a high-performance, reliable and secure network for their mission-critical industrial control and communications.
- Physical industries make up 70% of the world's GDP but have only 30% of total ICT spend (The Technology CEO Council).
- New spectrum is increasingly made available for private networks (e.g., C-band) and unlicensed spectrum (e.g., MulteFire).
- Wi-Fi and 4G and 5G private wireless will co-exist in manufacturing operations, but 4G and 5G are better suited for mission-critical communications due to the reliability, security, coverage, and performance.

Challenges

- The 4th industrial revolution – rapidly improving speed to market, flexibility, and agility to adapt to demand changes at the moment, optimizing efficiency based on real-time predictive measures, zero safety issues – can't be achieved with current approaches to connectivity
- Manufacturers need to connect the entire production process in real-time
- However, they often can't for reasons such as aged equipment lacking IoT capabilities and fixed infrastructure restricted by legacy cabling

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Vertical markets

Manufacturing overview (2 of 3)

How private wireless helps manufacturing operations

- Private wireless gives manufacturers a compact 4G or 5G private network that provides the connectivity they need to digitally transform their operations.
- Private wireless mobilizes manufacturing operations to maximize output and business results, supporting a large eco-system of end-devices, applications, and cloud system partners.

Trends or stats

- 74% of manufacturing decision-makers surveyed by ABI Research plan to upgrade comms and control networks in the next two years to advance digital transformation and Industry 4.0.
- More than 90% are investigating the use of 4G and 5G in their operations.
- 84% that are considering 4G and 5G will deploy their own local private wireless network in their manufacturing operations.
- LogisticsIQ Research forecasts the warehouse automation market will grow at a ~14% CAGR over the next six years, from $14.8bn in 2019 to almost double at $29.8bn in 2026.

Vertical markets

Manufacturing overview (3 of 3)

Departments & job titles to target

- OT (Operational Technology)
- Operations
- Business Operations
- Digital Supply Chain
- Plant Manufacturing
- Plant Operations
- Supply Chain & Logistics
- Plant Information Technology
- Business Transformation
- Digital Operations
- Automation
- IT (Information Technology)
- Networks (fixed, wireless)

Questions to ask

- Do you have any current or planned automation or modernization projects that require greater mobility of your machines, equipment, or people?
- Are you adding Industrial IoT to your operations and/or facilities? How are they being connected to your network?
- Have you deployed autonomous mobile robots? (Or are you considering doing so?)
- Have you implemented predictive maintenance technologies? How are they working?
- Have you considered how AI and Computer Vision could monitor for quality and compliance?
- Are you using VR/AR technologies for training or industrial use?
- How has Covid-19 impacted your facility operations?

Primary use cases

- Legacy asset digitalization with Industrial IoT for condition-based monitoring and predictive maintenance
- Fix Wi-Fi imposed low speed & reliability issues with automated guided vehicles (AGVs) in complex manufacturing areas for categories such as campus, worker, shop floor, and moving assets
- Worker connected tools and safety
- Remote maintenance / technical support with AR
- Advanced remote industrial robotics
- HD/4K video for quality control/inspection. Remotely controlling factory operations and operating with less energy consumption
- Creating real-time “digital twins” that allow plant management to identify capacity, track production, and optimize operations
- Creating flexibility in production including, “IoT-size one” manufacturing

Energy (Mining)

Vertical markets

Energy (Mining) overview (1 of 3)

Opportunity

- Automating critical processes is vital to increase operational efficiency and mine productivity while improving worker safety, reliability, and quality.
- Advances in technologies like industrial IoT, AI, and AR/VR will enable mining companies to optimize decision making, automate processes and eventually replace all manual operations with fully autonomous systems.
- Enhances ability to see and effectively track people and assets throughout the production chain.

Challenges

- The choice of network technology can make or break digital transformation.
- Mining companies need pervasive, predictable wireless connectivity – above and underground – to enable automated operations.
- Unfortunately, many mines still rely on legacy networks, like Wi-Fi, WiMAX, TETRA and P25, that weren't created to cater to the demands of ultra-broadband and mission-critical use cases.
- Especially underground mining environments with continuously changing networks of tunnels set particular challenges compared to open-pit outdoor mining sites.

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Vertical markets

Energy (Mining) overview (2 of 3)

How private wireless helps mining operations

- We provide an end-to-end solution for mine digitalization, combining an easily deployable private wireless network with the real-time applications needed for mission-critical communication and industrial IoT use cases.
- The high-performance and secure connectivity provides indoor and outdoor coverage for surface, open pits, and underground mines.

Trends or stats

- Private wireless provides up to 800 connections on a single (4.9G) small-cell; tens of thousands on a macro antenna – compared to 30-100 active connections per Wi-Fi AP. Coverage radius from 100 meters up to 30km, and 5-10 times fewer antennas needed.
- Transitioning from Wi-Fi to LTE reduced communications errors per truck operating hour by 84.62%, resulting in a production increase of 255,000 metric tons/year (Komatsu).
- 90% fewer AHS (autonomous haulage system) stop events, almost 1.5% better fleet utilization, and a productivity increase of 75 hours per truck per year[1].

1 Source: Nokia Australian mining customer.

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Vertical markets

Energy (Mining) overview (3 of 3)

Departments & job titles to target

- VP, Director, Manager of:
- Geological & Mining Engineer
- Mining Operations
- Site Operations
- Surface mines
- Underground mines
- Mine (site) manager, GM
- IT (Information Technology)
- Networks (fixed, wireless)

Questions to ask

- Is your mine network reliable and predictable enough to support mine automation?
- How many safety incidents did you have the past year due to communication hiccups?
- How many Cell on Wheels (CoW) do you need to cover your mine site?
- Have you implemented autonomous drilling/haulage? (Or are you considering doing so?)
- Have you implemented predictive maintenance technologies? How are they working?
- Have you implemented video monitors and/or drones to monitor your site/conveyors/stockpiles/etc?
- How has Covid-19 impacted safety, productivity, efficiency?

Primary use cases

- Autonomous (or tele-remote operated) drilling and haulage
- Mission-critical push-to-talk and/or push-to-video
- Group communications between workers and with the operations center
- Environmental monitoring with IoT sensors
- Real-time data collection for analysis and simulation
- Worker safety with digital PPE
- Geo-tracking and geo-fencing of people, vehicles, and assets
- Surveillance cameras and drone monitoring
- Integrated Remote Operations Center (IROC)

Energy (Utilities)

Vertical markets

Energy (Utilities) overview (1 of 3)

Opportunity

- Utilities need to extend communications towards the distribution grid edge (Field Area Network (FAN)) to enable digitalization, automation, integration of distributed renewable generation, and realization of the benefits of Industry 4.0.
- Existing application-specific networks (AMI, LMR backhaul, SCADA, etc.) typically do not have the reliability, bandwidth, security, and/or capacity to support new operational applications.

Challenges

- Growing intermittent, distributed renewable generation, battery storage, and energy conservation means utilities face lower demand, sharper demand peaks, and flatter revenues. Options for addressing these challenges:
- Remain a distribution system operator and automate, improve operational efficiency and optimize asset lifecycles.
- Expand portfolio with new services that leverage assets.
- Aging infrastructure that is typically not up to the challenges of today's consumer expectations.

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Vertical markets

Energy (Utilities) overview (2 of 3)

How private wireless helps utility operations

- Provides the private wireless connectivity, applications, and device ecosystem required to automate and integrate distributed renewable generation into the grid and empower mobile workers - with a smooth path to 5G when needed.
- Offers a complete UAV solution integrated with Private LTE - Nokia Drone Networks solution for safer and more cost-effective inspection of feeders, poles, and grid facilities.
- Services can be added that meet the critical communication needs of the utility mobile workforce and effectively replace legacy land mobile radio (LMR) systems - push-to-talk (PTT), push-to-video (PTV), and group communications (emergency broadcast calls, priority, and pre-emption).

Trends or stats

- The declining cost of solar and battery storage and its increasing distributed presence require more monitoring and control for grid reliability and power quality.
- Flattening or declining revenue growth in many markets and potential new market entrants increase utility to focus on efficiency and business model transformation.
- Greater customer market participation and choice.

Vertical markets

Energy (Utilities) overview (3 of 3)

Departments & job titles to target

- VP, Director, Manager of:
- Network Communications
- Telecom Engineering
- Telecom Services
- IT & Communications
- Company owns an electrical grid - distribution power utility; no companies that are retailers or competitive energy providers

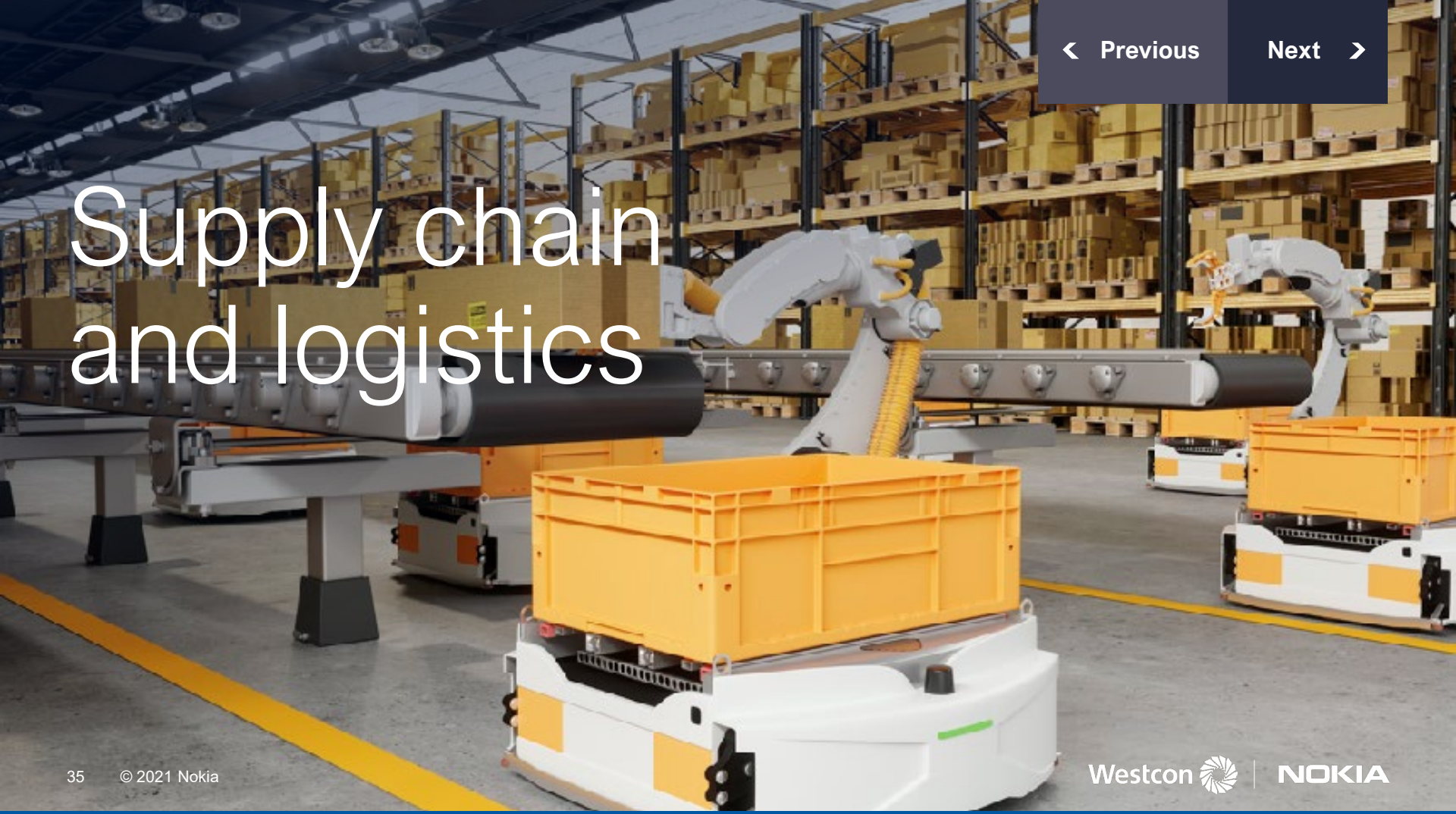
Questions to ask

- What are the critical drivers for your digitalization and automation plans for the distribution grid?
- How much distributed renewable generation and storage have you integrated into the grid?
- What are your plans to enable the mobile workforce to realize the benefits of Industry 4.0?
- Do you plan to refresh or extend your land mobile radio/Tetra network?
- Are you considering new service offerings for business model transformation?
- How has the COVID pandemic impacted your operation and the grid remote monitoring and control requirements?

Primary use cases

- Field force enablement - Enabling remote workers, enhance worker safety, enable remote assistance & augmented reality
- Remote asset inspection - Remote inspection of assets such as overhead power lines, transformers, wind turbines/blades, solar panels without the need for human presence/truck rolls
- Distribution automation - Provide connectivity to MV/LV utility assets such as transformers, capacitor banks, circuit breakers/reclosers to enable more granular control over the power distribution grid
- AMI backhaul - Provide connectivity to smart meters to backhaul the meter data to the utility operations center

Supply chain and logistics



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Vertical markets

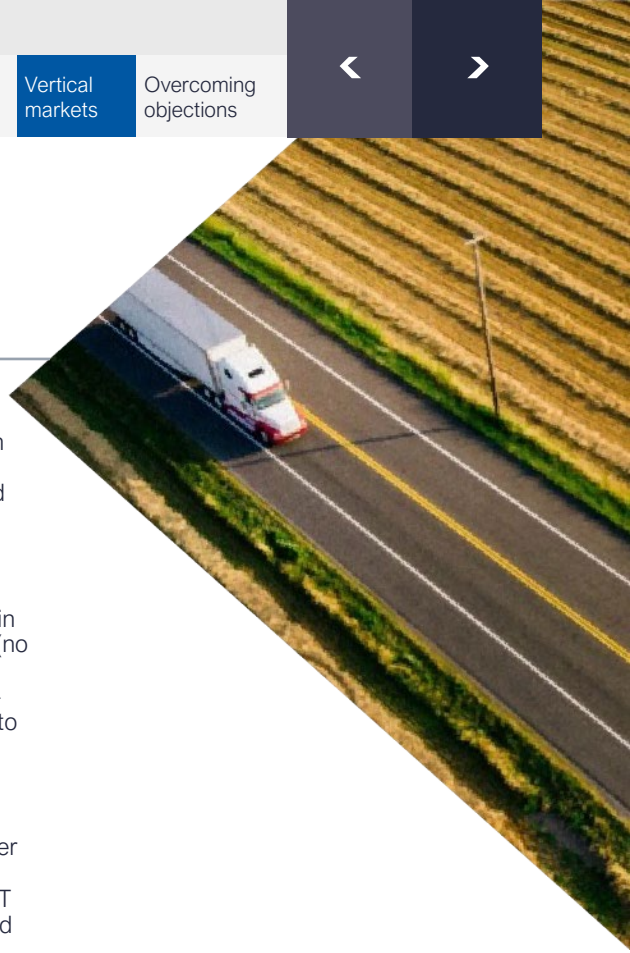
Supply chain and logistics overview (1 of 3)

Opportunity

- Supply Chain and Logistics are digitalizing and automating production operations to accelerate their Industry 4.0 initiatives. There are over 13.3m warehouses worldwide.
- The massive increase in e-commerce with same day/next day delivery is driving demand for warehousing and distribution centers closer to the end-customer.
- New spectrum is increasingly made available for private networks (e.g., C-band) and unlicensed spectrum (e.g., MulteFire).
- Wi-Fi and 4G and 5G private wireless will co-exist in logistics operations, but 4G and 5G is better suited for mission-critical communications due to reliability, security, coverage, and performance.

Challenges

- Covid-19 has placed immense pressures on the supply chain to provide greater visibility and real-time information in the tracking and delivery of materials and shipments.
- Private wireless enables route optimization within the warehouse and yard, assets (vehicles, lifting equipment, people) always in the right place, and everything fully utilized (no idle time). Visibility & tracking of assets wherever they are in the distribution chain – can't be achieved with current approaches to connectivity.
- Logistics enterprises require end-to-end visibility of their operations in real-time to increase efficiency and improve the customer experience. However, they often can't for reasons such as aged equipment lacking IoT capabilities and fixed infrastructure restricted by legacy cabling.



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Vertical markets

Supply chain and logistics overview (2 of 3)

How private wireless helps utility operations

- Digital Automation Cloud gives logistics enterprises a compact, plug-and-play 4G or 5G private wireless solution that provides the connectivity they need to digitally transform their operations. Supported with a large eco-system of end-devices, applications, and cloud system partners, NDAC mobilizes logistics operations to maximize throughput, efficiency, and business results.

Trends or stats

- 2020 Honeywell Intelligrated Automation Investment Study reveals that these industries are most willing to invest more in automation: e-commerce (66%); grocery, food, and beverage (59%); and logistics (55%).
- LogisticsIQ Research forecasts an 87% increase in the warehouse automation market to $26.3bn by 2025 from 2020 levels, with Covid-19 impact factored.

Vertical markets

Supply chain and logistics overview (3 of 3)

Departments & job titles to target

- VP, Director, Manager of:
- Warehouse Operations
- Regional Operations
- Business Operations
- Digital Supply Chain
- Business Transformation
- Digital Operations
- Automation
- IT (Information Technology)
- Networks (fixed, wireless)

Questions to ask

- How do you see 4G and 5G technologies fitting in with your digitalization/automation plans? Are there technical limitations with existing Wi-Fi or flex cable access in meeting your digitalization objectives?
- What difficulties exist in keeping track of your workforce, equipment, and shipping assets?
- Are your rates of operational efficiency and equipment utilization as high as possible?
- Will you be adding more industrial IoT sensors and cameras to monitor movements, minimize damage and improve safety? What is your network upgrade plan to support this increase in connectivity?
- Are you considering the addition of Autonomous Mobile Robots (AMRs) in your facility operations? How do you envision supporting the bandwidth, coverage, and real-time capabilities of these more advanced systems?
- Are your customers and partners looking for more information about their shipments and assets?

Primary use cases

- High accuracy indoor positioning of assets for warehouses
- Slotting optimization: Optimize storage locations by analyzing order distribution & routes of picking activities
- Rapid reconfiguration of facilities: Reduce idle time/improve efficiencies of operations in equipment & workforce through improved data collection & analytics into Warehouse Management Systems (WMS)
- Condition-based monitoring
- Security systems: Obtain real-time visibility of facilities & visitor location to reduce risks
- Material Handling Equipment (MHE) utilization: Track the non-active time of MHE & improve utilization rates
- Safety improvement: Avoiding accidents/collision by understanding & reducing the number of times AMRs get within a specific distance of the associates (risky interactions)
- Autonomous trucks, forklifts, cranes, mobile communications. Vision-guided robotic vehicles
- Workforce group mobile communications (PTT/PTV) upgrades from legacy TETRA/iDEN systems

Transportation (Ports)

Vertical markets

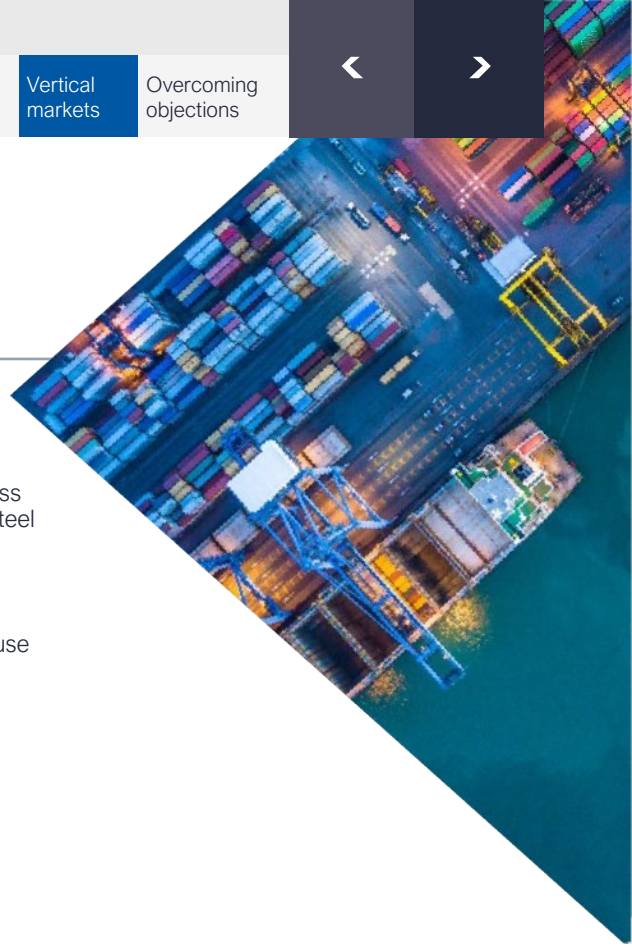
Transportation (Ports) overview (1 of 3)

Opportunity

- Smart Ports or Smart Port Terminals refers to applying digital technologies and advanced wireless communications technologies to the port ecosystem. This push for digital transformation is driving innovation and automation to increase operational efficiency.
- Communications technologies, particularly wireless, play a vital role in the digital transformation of terminal operations. LTE/5G private wireless network is key to unlocking new productivity gains for the future all-digital terminals.

Challenges

- A modern terminal operating system (TOS) requires seamless data links to TOS mobile applications. Interferences with other wireless systems and reflections of highly dynamic steel environments impact network quality.
- Current wireless infrastructures are not designed to meet the requirements of next-generation business-critical industrial use cases or modern terminal operations.



Vertical markets

Transportation (Ports) overview (2 of 3)

How private wireless helps utility operations

- Delivers a highly available and reliable terminal yard wireless infrastructure to enable complete control of all human-crewed and remote operations across the (semi-) automated port, including low latency requirements and support of Profinet / Profisafe protocol for remote control.
- Improves TOS efficiency, control, and productivity of the container yard. Terminal operators can continuously stay in touch with remote cargo conditions in reefer containers, with instant alarms from IoT sensors monitoring temperature, airflow, humidity, and light. Uses real-time insights from multiple CCTV and drone video feeds to make better-informed decisions.
- Enhances operational control, connecting personnel through reliable, secure voice applications on a single converged network, keeping them protected with remote safety monitoring from wearable sensors and connected personal protective equipment (PPE).
- High uplink requirements for video streaming: 6-18 cameras.

Trends or stats

- Contain`er traffic by sea traffic expected to double by 2050.

Vertical markets

Transportation (Ports) overview (3 of 3)

Departments & job titles to target

Chief Harbor Master

Chief Information Officer

VP, Director, Manager of:

- Port/Rail/Yard/Vessel Operations
- Automation
- Digitalization
- Innovation
- IT (Information Technology)
- Networks (fixed, wireless)

Questions to ask

- Are you planning to introduce automation and remote control of container handling equipment?
- Are you facing issues with your wireless network including, Wi-Fi for operational needs such as TOS connectivity?
- Would you like to optimize the cost for wireless voice communications?
- Would you like to support push-to-talk, push-to-video, and terminal-wide connectivity for user devices?

Primary use cases

- Wireless data for manned operations
- Wireless remote control for automated and semi-automated operations
- Remote reefer monitoring
- Voice communication

Transportation (Airports)

Vertical markets

Transportation (Airports) overview (1 of 3)

Opportunity

- With Industry 4.0 digital strategies and enabling technologies upon us, airports have a significant opportunity to gain efficiencies by moving from paper-based to more cost-efficient digital processes. The digitization of airport processes calls for a reliable wireless connection.
- A good digital transformation strategy, based on enabling sound Airport Collaborative Decision Making, defines a digital airport by connecting processes, people, and assets. LTE/5G private wireless will be a key enabler in this transformation.

Challenges

- Airports need to connect all their operations spanning employees, mobile assets, and the passengers, in real-time to achieve efficiency and raise the customer experience. However, they often can't for reasons such as aged equipment lacking IoT capabilities and fixed infrastructure restricted by legacy cabling.
- Wi-Fi and public mobile services are not able to provide the reliable pervasive connectivity needed for operational use.

Vertical markets

Transportation (Airports) overview (2 of 3)

How private wireless helps utility operations

- Private LTE/5G wireless technology offers ultra-reliable, high bandwidth, low latency connectivity throughout the airport.
- This wireless network will become a strategic asset to the airport, enabling it to enhance operational efficiencies, increase situational and operational awareness, and improve the passenger experience.
- By enabling cost-effective connectivity at both the airside and terminal side, new opportunities for operational efficiency gains present themselves as well as ensuring business continuity is maintained.

Trends or stats

- Covid-19 severely impacted the entire aviation industry.
- Airports need to accelerate touchless services, improve efficiency, and manage costs.

Vertical markets

Transportation (Airports) overview (3 of 3)

Departments & job titles to target

- Chief Information Officer
- VP, Director, Manager of:
- Airport Network Infrastructure
- Airport Operations
- Airport Networks (fixed, wireless)
- Emergency Management and Communications
- IT (Information Technology)

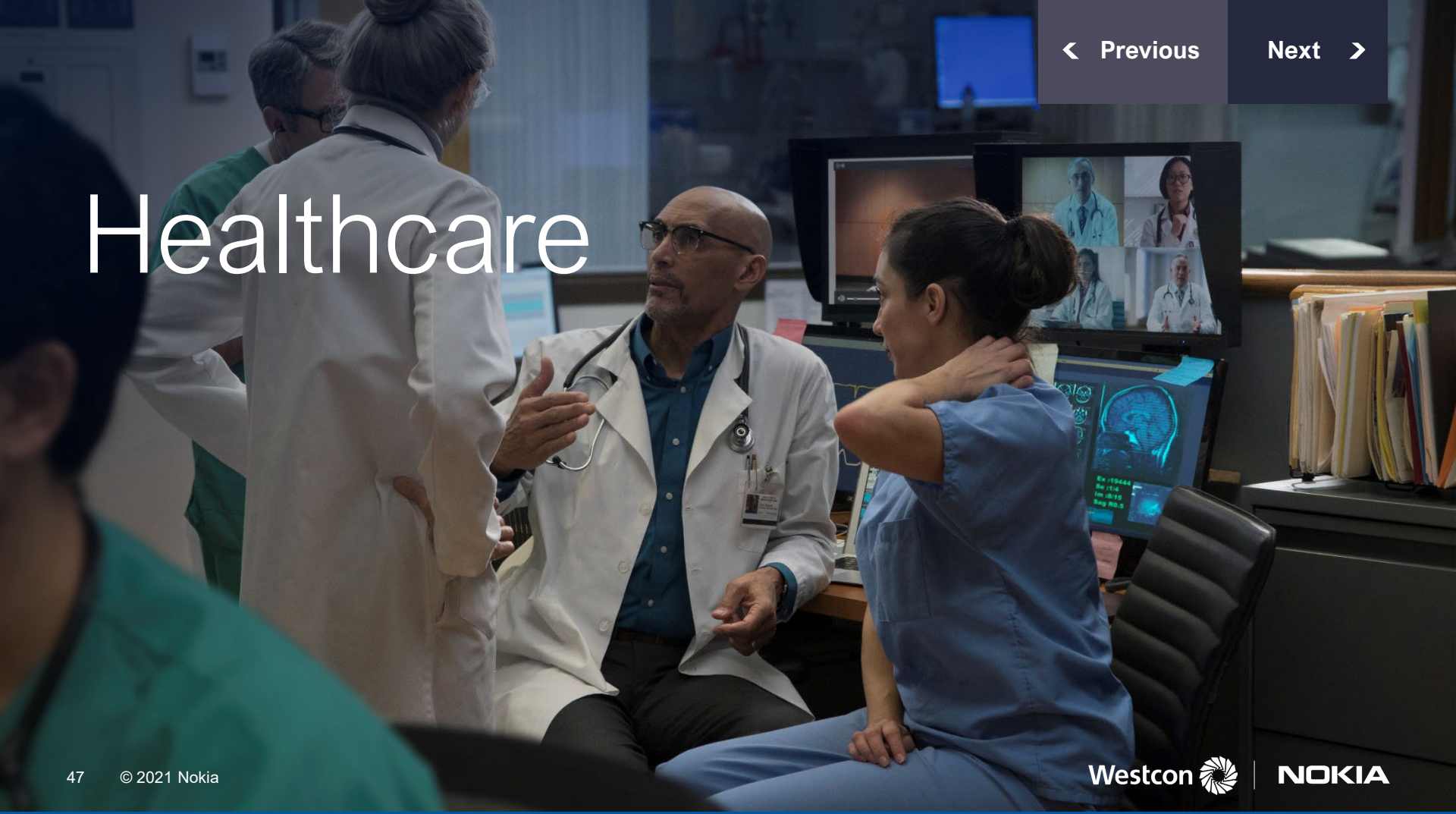
Questions to ask

- What is your vision for an evolved passenger experience?
- What is your vision for improving aircraft turnaround processes?
- What are your digital strategy plans?
- Do you experience wireless coverage issues below the wing and in the airfield?
- Are you looking for non-aeronautical revenue potential?
- How are you improving operational awareness (visuals beyond CCTV perimeter) on vehicles with zoom cameras?
- How will you need to manage issues with Wi-Fi and public wireless for airport operational use? (QoS, Security, Coverage)

Primary use cases

- Follow me car: with in-vehicle real-time visibility of runway activity and upcoming flights.
- Enhanced situational awareness: Vehicles (common use or first responder) are equipped with a wireless connected pan-tilt-zoom (PTZ) camera for APOC to gain enhanced situational awareness anywhere at the airport.
- Asset connectivity: Airport assets can be connected wirelessly, increasing flexibility and avoiding the need for expensive CATx installation e.g., kiosks, biometric scanners, CCTV, etc.
- Critical communications: Critical comms such as push-to-talk or push-to-video enabled through the private wireless network.
- PAX connectivity: Offloading operational communications from public wireless and Wi-Fi freeing capacity for PAX.
- Non-aeronautical revenue potential: Airport operators are enabled to offer wireless services to airport tenants.

Healthcare



Vertical markets

Healthcare overview (1 of 3)

Opportunity

- Technology advancements and Covid-19 have ushered in Healthcare 4.0 as healthcare systems and providers have been forced to accelerate their digital transformation journeys to empower healthcare professional and support remote patients.
- Telehealth and AI have emerged as priorities for health leaders to advance the digitalization of the healthcare system.
- Resource strained health providers must find new ways to treat increasing numbers of patients and provide a better patient experience in more cost-effective ways.

Challenges

- Covid-19 has exposed new challenges for health care organizations, including:
- Supply chain visibility (for masks, personal protective equipment, cleaning supplies, etc).
- Managing utilization of beds, resources, and patient flow.
- Increased staffing needs in specific areas (e.g., managing Covid-19 protocols and treatment).
- Critical and medical functions need greater bandwidth and security than health systems Wi-Fi network can handle and must be separated from patient communication and entertainment on the Wi-Fi network.
- Need for remote work options.

Vertical markets

Healthcare overview (2 of 3)

How private wireless helps utility operations

- As more functions become untethered in the health system and more medical IoT devices are placed into use, private wireless can separate essential health care functions from patient/guest Wi-Fi use. Mission-critical hospital processes and procedures function reliably on a private wireless network that can differentiate and prioritize traffic.
- Private wireless 4.9/5G can provide the speed, bandwidth, and connectivity needed to continuously collect data from devices such as ingestible camera pills for diagnostic imaging, VR for pain reduction, mobile patient monitoring, and more. These devices can provide aggregate data to improve diagnosis, treatments, and care.
- Private wireless enables and improves the logistics of medical equipment and supplies. A private wireless network used with Automated Guided Vehicles (AGVs) & High Accuracy Indoor Positioning (HAIP) will help staff locate and track beds, food, wheelchairs, medication, and Covid-19 staff movements in real-time.

Trends or stats

- COVID-19 has forced healthcare providers to accelerate adoption of telemedicine, eHealth, and other remote solutions to secure patient safety, leading to accelerated adoption of IoT solutions more broadly.

Vertical markets

Healthcare overview (3 of 3)

Departments & job titles to target

- CIO/Head of Networking (Decision Maker)
- VP, Director, Manager, Architect of Networks/Wireless Networks (Influencer)
- Chief Medical Officer /Chief Medical Information Officer (Influencer)
- CSO/CISO (Influencer)

Questions to ask

- How do you separate access, availability, and security of public (patient, staff, etc.) and private (hospital, operations, testing, patient) data?
- Can you allocate the necessary QoS and bandwidth to your mission-critical apps across your wireless network in real-time?
- What are your plans for Wi-Fi and private wireless covering best practices for use-case delineation per technology? Is your wireless network enterprise-grade or carrier-grade?
- Does your network meet the performance needed for wireless digital procedures and processes today? And also in the next couple of years as, Internet of Medical Things (IoMT) expands?

Primary use cases

- Outdoor connectivity for overflow field hospitals, testing facilities, and emergency staff.
- Logistics for medical equipment, supplies, and medications.
- Mobile patient monitoring and elder care.
- Mobile UV robots such UVD Robots and LightStrike Robots deployed to assist with room disinfection.
- Critical patient and hospital workflows.
- Connecting Internet of Medical Things (IoMT) including ingestible sensors, thermometers, artificial eyes, blood pressure monitors, cardio scales, continuous glucose monitoring, insulin delivery, patient wrist bands, coagulation monitoring, asthma monitors, connected ambulances, and more.
- Mobile AR/VR training of medical students.

Education

Vertical markets

Education overview (1 of 3)

Opportunity

- The Covid-19 pandemic has exposed an enormous gap in internet access for students attending classes from home. Some 826 million students have been kept out of the classroom by the pandemic with no internet access. While digital-based distance learning is relied upon to ensure educational continuity in most countries, this lack of connectivity has weakened our students' education.
- In the U.S., the CARES Act has earmarked $30.7bn for education in Federal funding and encourages schools to invest in technology advancements. The U.S. Department of Education encourages States, LEAs, and IHEs to invest GEER funds in technology infrastructure to improve capacity to provide high quality, accessible, distance education, or remote learning.

Challenges

- The COVID-19 situation has exposed our digital divide. Millions of students without internet access at home have faced difficulties attending classes and completing assignments online.
- Students are given laptops and tablets to take home, but the content is only accessible on the cloud or through the internet, requiring students to have broadband connectivity at home.
- Many households, especially in more impoverished neighborhoods and remote areas, don't have the wireline or reliable cellular connection necessary. We hear stories of families driving miles and spending hours in restaurant parking lots or near Wi-Fi hotspots to give their children a chance to participate in distance learning.
- Education IT staff need a simple, easy-to-use broadband connectivity solution that provides automated O&M and management.

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Vertical markets

Education overview (2 of 3)

Globally, at least 1.5 billion students and 63 million primary and secondary teachers were affected by the unprecedented disruption caused by the COVID-19 pandemic.

How private wireless helps education

- Private wireless for educational entities ensures student access to online learning and school resources from the comfort and safety of their homes.
- Ensures educators can teach a consistent curriculum to all remote students.
- Will ensure business continuity for administration, parents, and the community when operating remotely due to public health precautions.
- The pandemic has shown it is critical to find sustainable solutions for the homework gap. The digital divide challenges that underprivileged students and residents face; private wireless will help remove these barriers so that educators can deliver consistent student education opportunities for all students.

Vertical markets

Education overview (3 of 3)

Departments & job titles to target

- Director of Operational Technology
- Director of Technology
- Head of IT
- Chief Information Officer
- School District Superintendent
- School Board Members

Questions to ask

- How many students and teachers do you need to provide with broadband?
- How many students and teachers lack internet access?
- Can you leverage your existing fiber and IT network and use PLTE to extend your IP network?
- Are your students located within 3-mile radius of schools or community fiber assets?

Primary use cases

- Campus wide high-speed Internet including content services
- Reliable wireless connectivity for automated vehicles
- Fixed wireless broadband
- Facilities management - building automation and control system (BACS), HVAC control, water & environmental and power control sensors
- Indoor and outdoor positioning – location-based asset tracking
- Voice connectivity for entrance access automation, analytics and monitoring - including roaming video robots/drones, fever detection
- PoS – mobile e-commerce
- Interactive smart boards, podium
- Campus autonomous and/or drone delivery
- Remote learning through VR/AR classroom setting
- Broadband content for student housing/hospitality
- Emergency booth (Blue phones)

Overcoming objections

Overcoming customer objections (1 of 2)

Objection	Response
I need to see Wi-Fi vs 4G and 5G cost comparisons.	All things considered, private wireless frequently has a lower total cost of ownership (TCO) than Wi-Fi and Wi-Fi 6. Generally, for any indoor sites larger than 20,000m² or complex radio environments such as high ceilings, private wireless is less costly. When there are outdoor elements to cover, private wireless is the most cost-effective solution. Private wireless goes far beyond Wi-Fi capability; it enables business transformation where Wi-Fi can't. It's not about Wi-Fi vs. 4G and 5G – there is a role for both.
We don't need 'business critical data' to be kept within our premises.	Data security is a top concern for many enterprises. Still, even if not, on-premises data is critical to lower latency, higher reliability, and prioritization/QoS of business-critical operational data for fast decision-making and preventive maintenance towards equipment efficiency and staff safety.
Our mobile operator will offer such use cases on its commercial network.	The mobile network operators can allocate a single slice-off of their public networks by using their public radio networks, but this will only come with 5G SA networks post R17 (not available or possible today). Deploying equipment at the same location as the application gives coverage, performance, security, and control advantages that a private network slice (or VPN service) on a macro network cannot match.

Overcoming customer objections (2 of 2)

Objection	Response
I want to wait for 5G, including devices and ecosystem availability.	The technology choice is a matter of use cases. For most private wireless customers, the latest generation LTE/4.9G is still the right answer for now and for the longer term with its much more mature ecosystem of devices. According to Nokia Bell Labs, 4.9G/LTE is good enough for more than 85% of today's applications. Currently, we have many validated industrial use cases in operation on LTE/4.9G providing tangible business benefits in all segments that make them more competitive (with a head start on digitalization), resilient, sustainable, and agile. Our solutions are 5G-ready. When the ecosystem is ripe, or you are introducing new use cases that need 5G — the upgrade will be seamless.
I don't think you know my specific business processes enough to help me.	We are bringing 10 years' experience running private wireless networks with various use cases requirements. We have dedicated teams looking at specific industry segments and developed deep expertise and ecosystem partnerships. We have segment blueprint solutions and the capability to customize them as needed.
The business case of the private wireless network does not pay back fast enough. The private network is still too expensive.	Many industries have already embraced private wireless to digitize their industrial assets, making them more competitive, efficient, and agile. For them, the private wireless network brings tangible business benefits. Based on our experience with our existing customers, we can help you build your TCO model. From experience, private wireless is not only the best solution for wireless connectivity for OT use cases but often the lowest TCO.

Glossary of key acronyms

3GPP = 3rd generation partnership project (defining 5G standards)
AGV = Automated guided vehicle
AI = Artificial intelligence
AMR = Autonomous mobile robots
AR/VR/MR = Augmented reality/virtual reality/mixed reality
CBRS = Citizen broadband radio service
IoT = Internet of Things
LTE = Long term evolution
ML = Machine learning
MLF = MuLTEFire
MPW = Modular private wireless
NDAC = Nokia Digital Automation Cloud
PLTE = Private LTE
PTT = Push to talk

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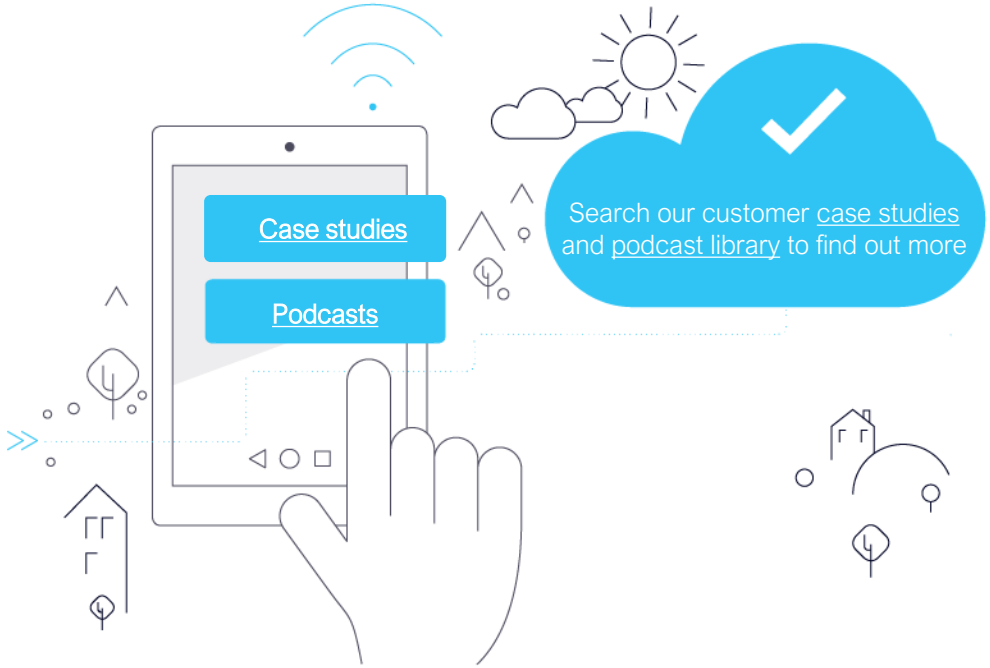

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