



Nokia cloud

For fully digitized
businesses

NOKIA

Digitalization is everyone's business

Digital evolution is actually more like a revolution, and it's happening right now. Today, every business is on the way to becoming a digital business. And going digital means not only enhancing traditional business models but creating entirely new innovations with digital data and connected devices.

For newer businesses and enterprises, digitalization is more natural. For those who have operated on more traditional models, the evolution to digital means changing how they've done just about everything. The benefits of digital evolution are clear, including better efficiency and use of data, deeper insights, improved reach and more profitability.

Today, both new and more traditional players are under pressure to innovate faster, more flexibly and with fewer resources. And as the digitalization of virtually everything marches on, consumer needs and behavior are also

changing fast. People want new and innovative services with a great user experience. And they want them to be available at any time – on any device.

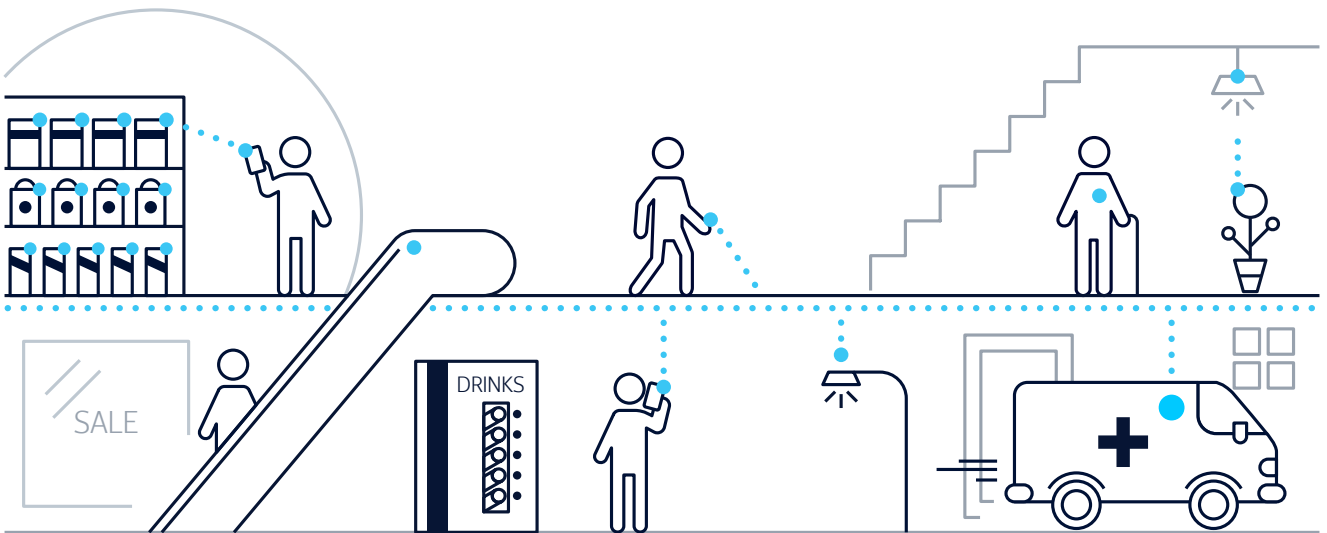
Right now there's a new generation of disruptive and digitally-driven businesses out there showing the world how it's done. Many companies are agile and adaptable because they're reinventing existing services with meta-data, without the need to own actual physical assets. And their success is fueled not only by software and technology but by the fact that they do first, fail fast and learn fast.

These digitally native companies are going horizontal in industries that have traditionally been vertical. And as they go about their business, they're changing everyone's business.

For Nokia, at its core this digital evolution is about expanding the human possibilities of technology.



Is your business
ready for the
digital transformation?



The Cloud with a silver lining

Businesses, enterprises and governments have always communicated - with people, each other and the world around them - but the channels they use have changed over time. First came the internet. Then the mobile revolution. Both were big. But to say that they're paving the way for "the next big thing" isn't thinking big enough.

Digitalization, the Internet of Things and soon 5G are enabling a whole world of new services. The possibilities are endless, but they require new ways of thinking and doing.

The successful transition to digital business requires not only new ways of thinking but new kinds of platforms and applications, cloud-based platforms and applications. Cloud allows businesses to focus on their core business faster and with lower up-front investments. Practically speaking, cloud enables all-over and on-demand access to a shared pool of configurable computing resources. For those who want to take advantage of everything the digitalizing world has to offer, the choice is clear: Nokia cloud solutions.

The Nokia cloud portfolio builds platforms that connect people, businesses and a world of new devices. From mobile and any type of fixed network to the service platforms, it's the only cloud portfolio to truly deliver end-to-end solutions. And it's helping businesses, enterprises and governments change how they operate with agile services made possible by cloud technology.

End-to-end is only the beginning

Today's networks were designed to handle personal communication and content like voice, video, and web browsing on computers and handheld devices. The Internet of Things is already here, and both the opportunities and challenges it brings will continue to grow with the introduction of 5G and the massive traffic volumes it will bring.

For service providers, success depends on their ability to react quickly and flexibly to the changing needs of the people they serve. That means not only the ability to adjust network capabilities but also services and solutions.

Industries like energy, transportation and the public sector have similar scalability needs and they, too, need to adapt their own operational models to provide their customers with unique, adaptable and scalable cloud-based solutions.

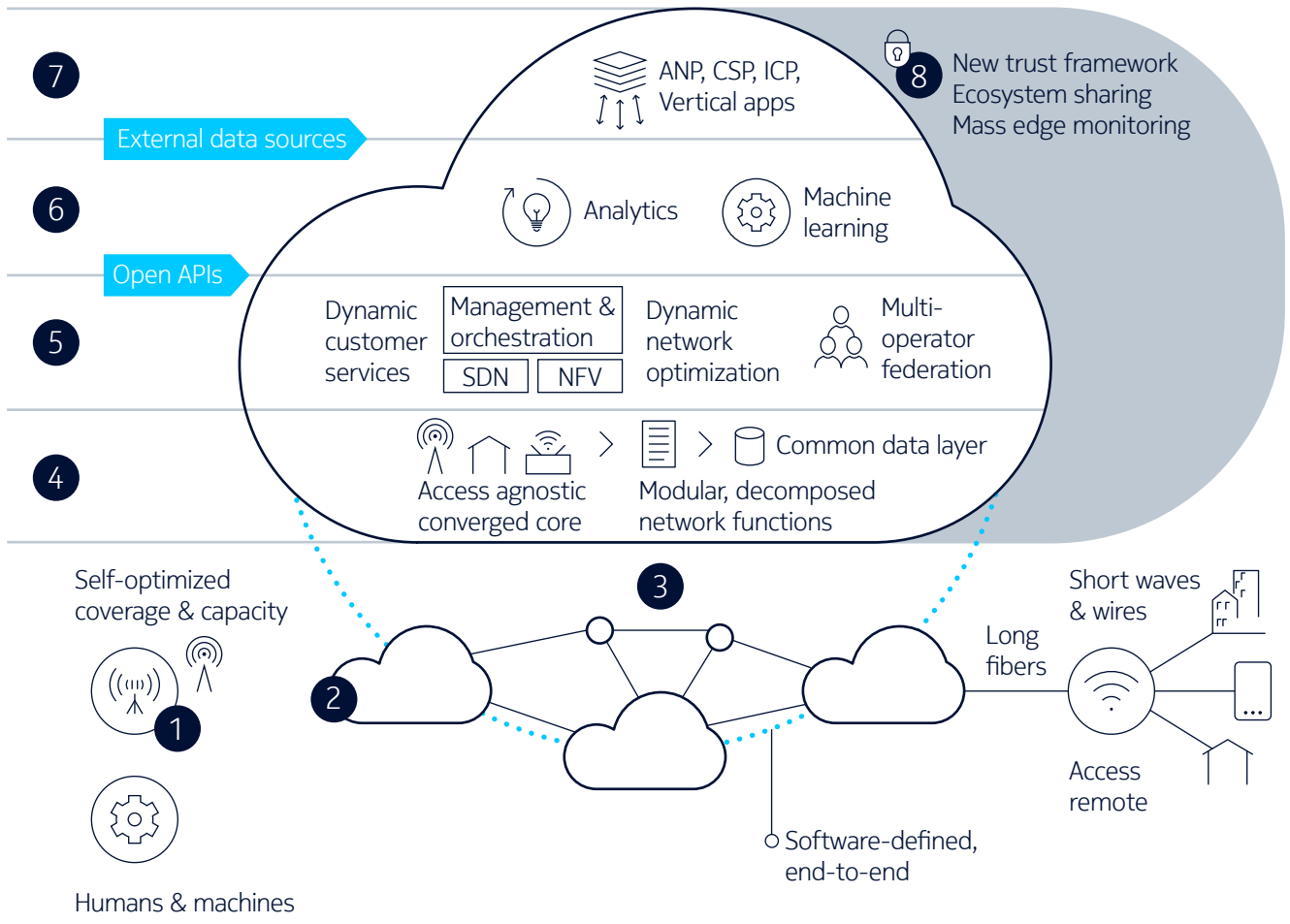
For over a generation Nokia has been leading the industry as the prime provider of secure, high-quality and scalable carrier-grade networks. And now, this experience and expertise is carrying over into Nokia's real-time, high-throughput and reliable cloud portfolio. From connected devices through access networks all the way to the core of

the network, Nokia cloud solutions keep service providers, industry verticals and the public covered end-to-end.

For us, end-to-end includes our AirFrame data center solution, networking with our SDN and transport portfolios, a comprehensive portfolio of application software, lean operations and management through our OSS and CloudBand MANO solutions, and a comprehensive suite of cloud services.

But an end-to-end cloud portfolio really is just the beginning.

Following the Bell Labs Future X Network vision of the connection of everything and everyone with the goal of automating a large proportion of life, the Nokia cloud portfolio and services are constantly evolving towards a cloud-native future, delivering the seamless connectivity that end customers demand and building the virtualized, software-defined programmable networks needed in the digitalizing world. And by re-architecting applications to be infrastructure-independent and programmable, Nokia is paving the way toward a cloud-native future that makes it easier than ever to integrate and operate networks.



- 1 Massive-scale access
- 2 Converged edge cloud
- 3 Smart network fabric
- 4 Universal adaptive core
- 5 Programmable network OS
- 6 Augmented cognition systems
- 7 Digital value platforms
- 8 Dynamic data security

Bell Labs Future X Network vision of the connection of everything and everyone.

Increased operational excellence

Technology is evolving at breakneck speed. But what's even more important is that so, too, are the ways in which services and networks are built and operated.

Infrastructure has traditionally been operated by groups of experts dedicated to specific parts of it. Thanks to hardware and software consolidation and new related management tools, operational silos can be broken. The shift from the traditional vertical operations to a horizontal model is already well underway.

Cloud, NFV and SDN take operability to a whole new level with common platforms, programmability and automation. Applications and services will be continuously delivered without long planning and development cycles. And cloud also allows for real-time responsiveness to feedback and changing needs. Operations and development can be linked more closely in order to follow DevOps principles, enabling the much faster adaptability of services to customer needs.

Scalable, agile and flexible, the Nokia cloud allows operators to automate and simplify

labor-intensive tasks that today need to be done manually. We provide standards-based solutions that can be integrated and launched quickly. When capacity needs to grow unexpectedly, the Nokia cloud adapts right away. And it also provides a platform that helps operators to roll out new services and sources of revenue - fast. With the Nokia cloud portfolio, customers can upgrade and grow existing solutions and deploy new revenue-generating services in days, not months, as it is with traditional systems.

The automation and elasticity provided, for example, by our AirFrame data center solution, CloudBand and Nuage SDN portfolios enable networks to respond faster, deliver more consumer value and become more competitive compared to today's systems.

The goal of simplifying networks and operations is simple. But the vision, experience and innovation that's driving this technological transformation is anything but. Nokia is a trusted partner that can provide the end-to-end services and support needed to plan, build, secure and operate the clouds.

An aerial, high-angle photograph of a city square or plaza. The pavement is made of large, light-colored rectangular tiles. Several people are walking across the square, their shadows cast long and dark on the ground. The scene is captured in a cool, blue-toned light, suggesting dusk or dawn. The text "Technology is evolving at breakneck speed" is overlaid in the center in a clean, white, sans-serif font.

Technology is evolving
at breakneck speed

Building the future together

The way in which applications, networks and services will be built in the future is changing rapidly.

One of the biggest changes is the move from purpose-built hardware to more software-centric solutions. Open source communities and other open ecosystems are fueling the development of the software defined future by allowing everyone involved to work together to innovate.

By providing industry-leading expertise, support and services, Nokia can handle and guarantee the service of complex systems built on a combination of open source, commercial software and 3rd party products. Programmability through open application programming interfaces (APIs) and active participation in open source communities means we can share innovation and enable DevOps with our customers.

One good example is the open compute project (OCP), from which Nokia is leveraging open hardware specifications and driving

webscale efficiency, operability and scale in data centers into telecom and enterprise business verticals. In return, Nokia also contributes to OCP designs with telecom features and solutions designed to meet requirements related, for example, to high availability.

The acceleration of telco and IT convergence and the need to support a diverse range of demanding applications requires innovative solutions that simplify operations and create value for data centers. Right now, Nokia is delivering real-time solutions that bring low latency, high throughput and high availability functionality to cloud infrastructures.

As another example, Nokia has taken substantial steps to make OpenStack, a popular cloud stack for telco and IT, carrier grade. This includes both the software-defined networking capabilities for datacenter automation and the root-cause analysis capabilities and easier failure detection for improved service quality.

Open ecosystem for the programmable world Nokia's open approach for tomorrow's networks

CSP, IT, enterprise and industry verticals

Open system interfaces and APIs

Standardization



Open reference architectures

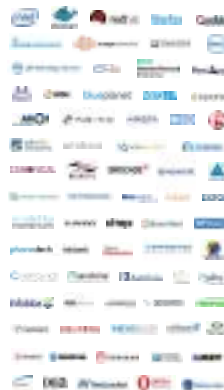


Multi-access Edge Computing (MEC)

Open source software



Nokia ecosystem



NOKIA

Products
Solutions
Services
Security
Analytics
Automation



The (r)evolution into digital business

Technology and lean, flexible and scalable operations are a big part of successful business and operational digitalization. But the cloud is also about creating new revenue streams. The cloud makes it easy to grow revenue by creating new models for old services and allowing new services to be launched in just days and scaled on demand.

Not all service providers are alike. Some are focused on being efficient connectivity providers, using cloud and automation to boost efficiency. Others are focused more on service agility and becoming platform providers, just as public cloud providers have done for computing. With a complete end-to-end cloud portfolio, Nokia supports both approaches and more. And we're expanding our portfolio with more software-only solutions or XaaS delivery options.

New solutions like software-defined wide area networks (SD-WAN) are showing us how new technologies can re-invent services in highly automated and cost-effective ways. Plus, the agility, scalability and flexibility of the Nokia cloud portfolio makes it easy for

service providers to experiment and trial new services, and to learn fast. Beyond existing services, the open interfaces and programmability of the Nokia cloud portfolio make it possible to create open platforms for 3rd parties to innovate just as they can in public clouds.

Nokia's end-to-end cloud portfolio and services are ready for production right now. And right now Nokia is helping customers in all sectors to grow revenue by creating new models for old services, enabling new revenue generating applications and by literally changing how they do business.

Nokia is the partner for the digital transformation. It's the partner for moving business to the cloud. And together with its partners, clients and end users, Nokia is building the foundation for 5G and beyond.



The cloud in practice

Government cloud: Burkina Faso's government uses cloud technology to connect the government, education infrastructure, cities and industries. Nokia is providing the government of Burkina Faso with the CloudBand cloud platform and networking infrastructure that will enable it to develop new digital public services like E-government, E-learning and E-health.

CSP: Nokia and the mobile operator Three UK are set to deploy a cloud core network that will remove capacity limitations and enable massive scalability to allow Three to rapidly respond to changing customer habits while preparing for the future delivery of IoT and 5G. This project highlights the breadth of Nokia's technology and services capabilities.

Enterprises: The online gambling service Betfair uses Nuage Networks' SDN solution with its OpenStack cloud for DevOps and continuous delivery of its 200 applications to production. Betfair's exchange does 120 million transactions per day, 2.7 billion API transactions and has 1.7 million active users, all of which will be hosted on OpenStack.

Abbreviations

ANP	Access network provider
API	Application programming interface
CSP	Communications service provider
DevOps	Development and operations
E2E	end-to-end
ICP	Internet content provider
IoT	Internet of things
MANO	Management and orchestration
MEC	Multi-access edge computing
NFV	Network functions virtualization
OCP	Open compute project
OSS	Operations support systems
SDN	Software-defined networking
SD-WAN	Software-defined wide area network
XaaS	Everything as a service

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