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Dealing with a new normal

The Covid-19 pandemic caused profound changes in the way that both enterprises and consumers use IT. Enterprises quickly adopted remote working and cloud communication and collaboration services, while consumer demand for online entertainment, video streaming and cloud gaming increased massively, especially during peak times.

Cloud providers experienced up to 600% growth in application usage, while network providers carried 40% more traffic in a week[1]. Cloud providers and data center operators responded well to the sudden and massive demand for the applications and services they provide, rapidly increasing capacity where needed.
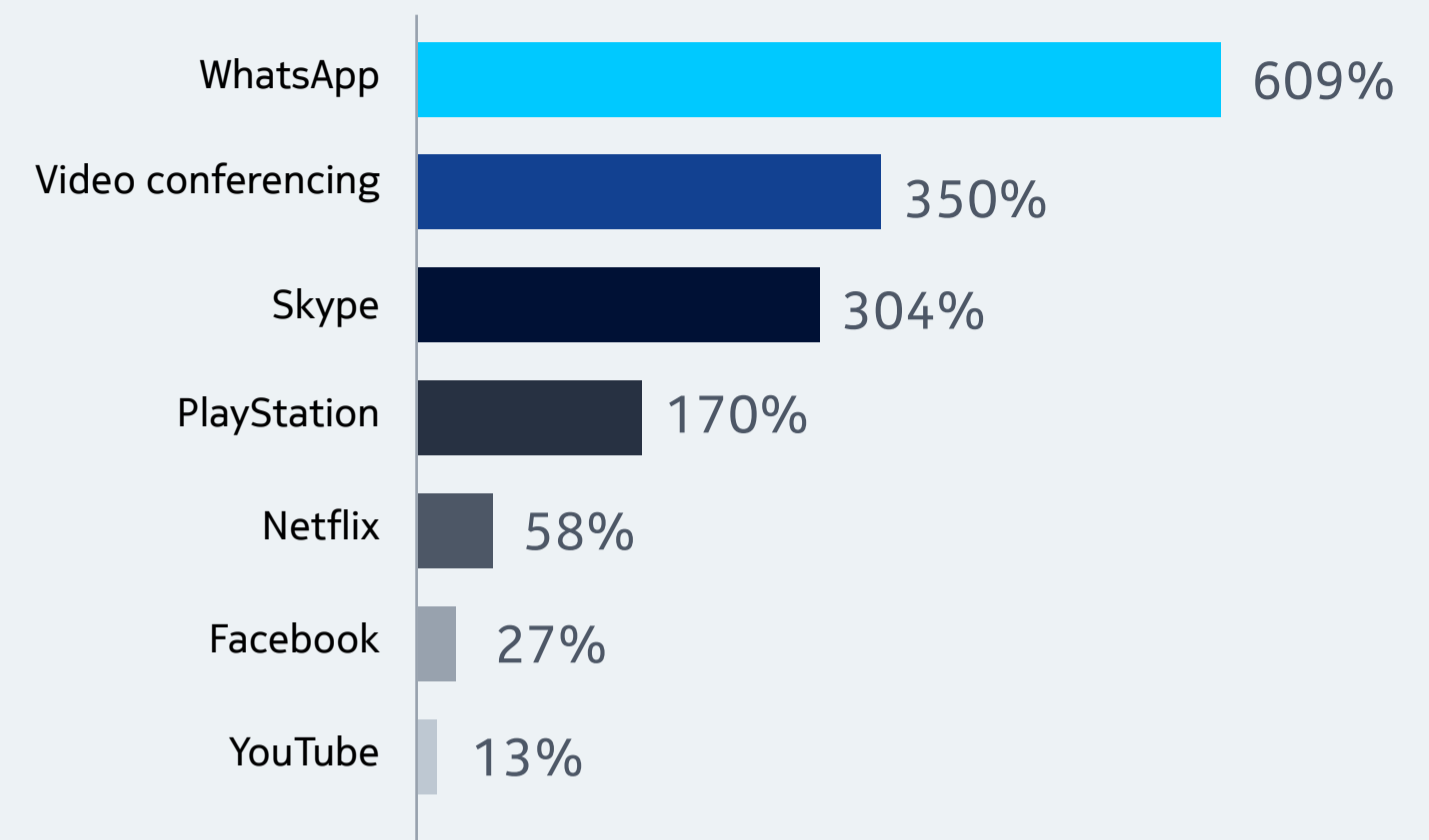
This new normal is likely to persist as enterprises change the way they operate and do business and consumers change their buying behaviours and attitudes to content consumption.

Increasing demand for new services and applications such as 5G, IoT, AI, Industry 4.0 will also drive the demand for edge   computing and greater interconnection.
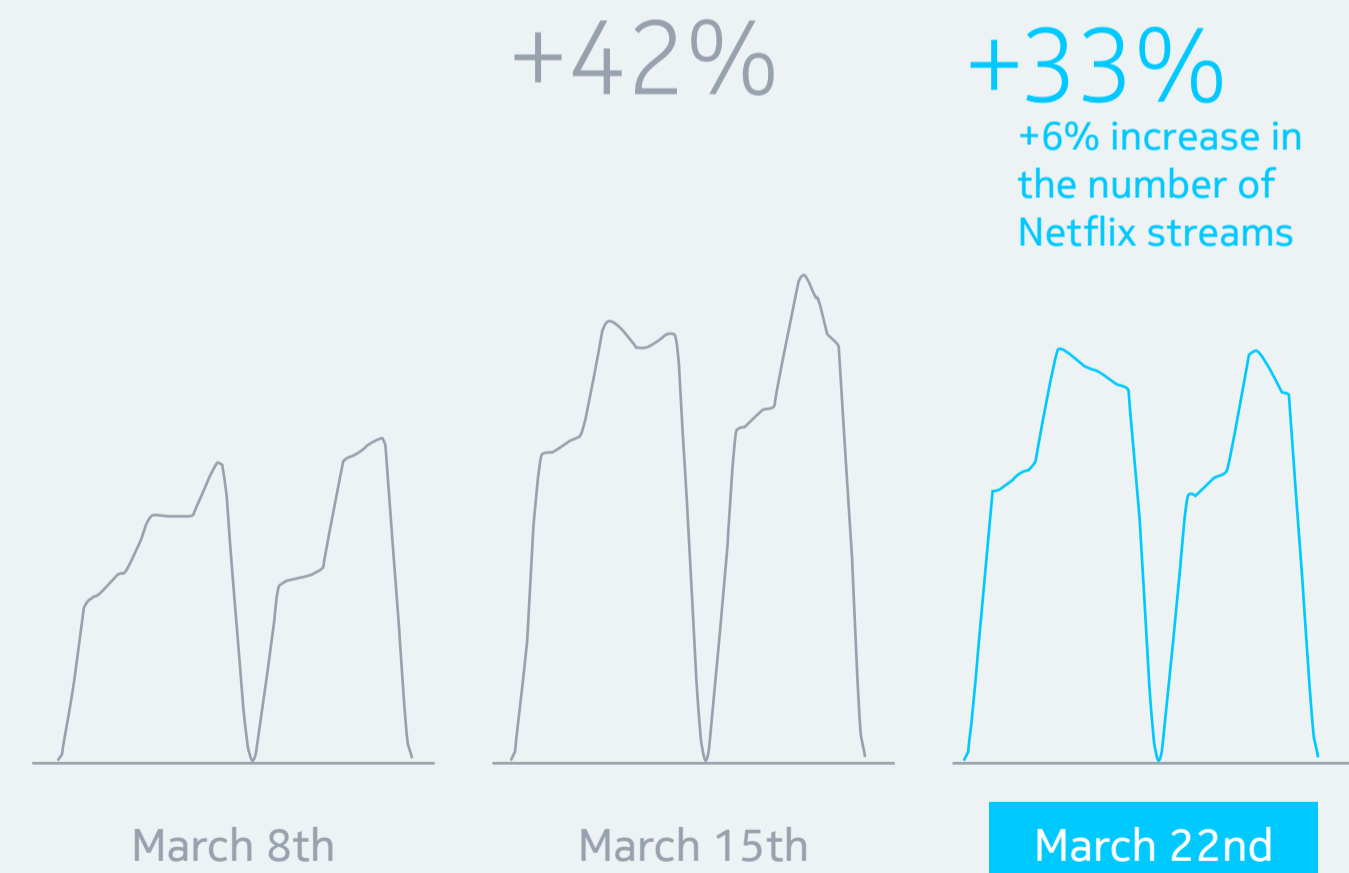
For your cloud provider and data center operator teams at the heart of cloud service delivery and the cloud experience, this translates to an increasing demand for data centers that scale easily and flexibly but are much more resilient and efficient.

1. "Network traffic insights in the time of COVID", Nokia Deepfield March 2020

Increase in application use one week after lockdown

Application	Increase
WhatsApp	609%
Video conferencing	350%
Skype	304%
PlayStation	170%
Netflix	58%
Facebook	27%
YouTube	13%

Weekend traffic peaks

+42%

+33%

+6% increase in the number of Netflix streams

March 8th   March 15th   March 22nd

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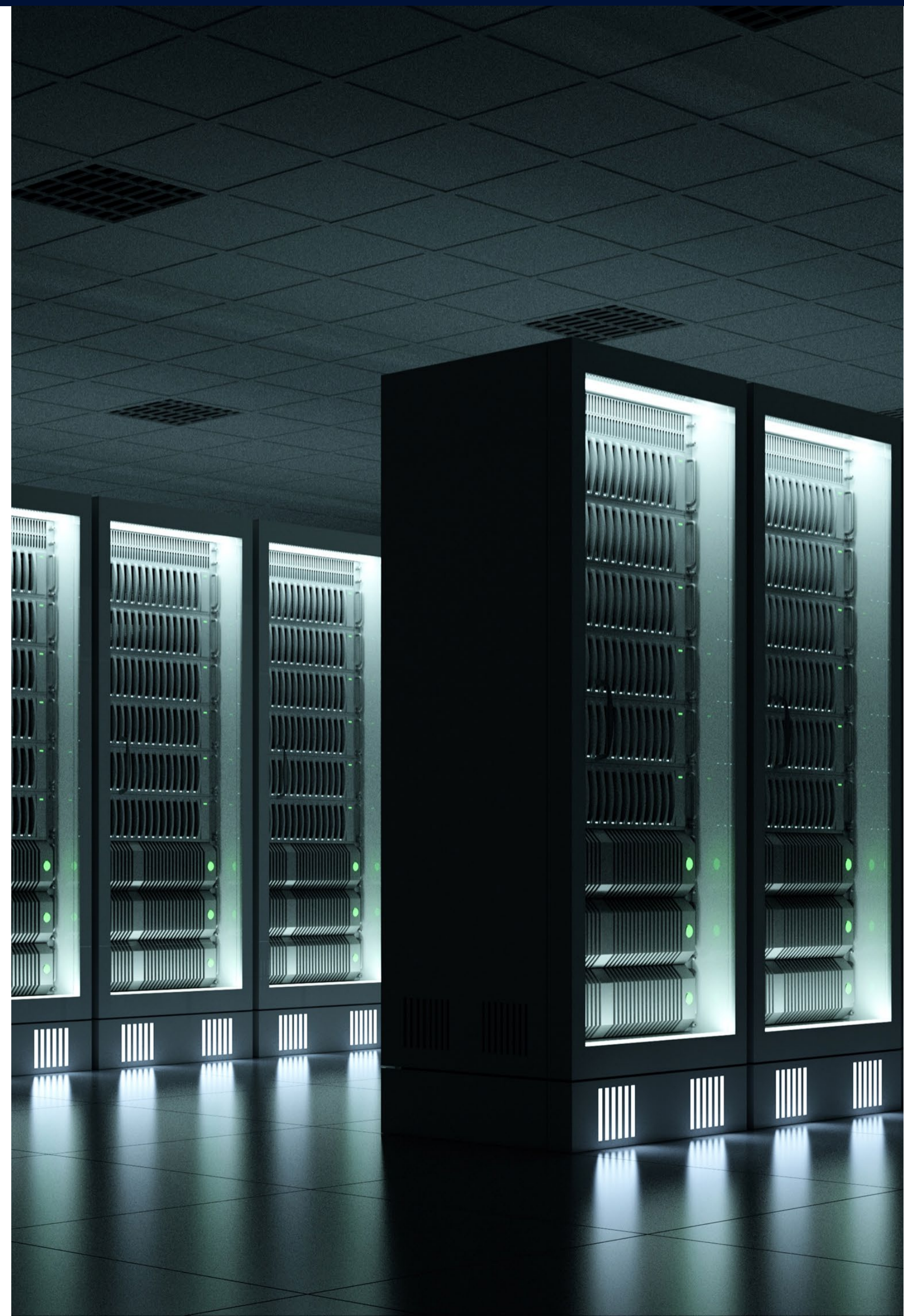This is just the beginning – keep exploring
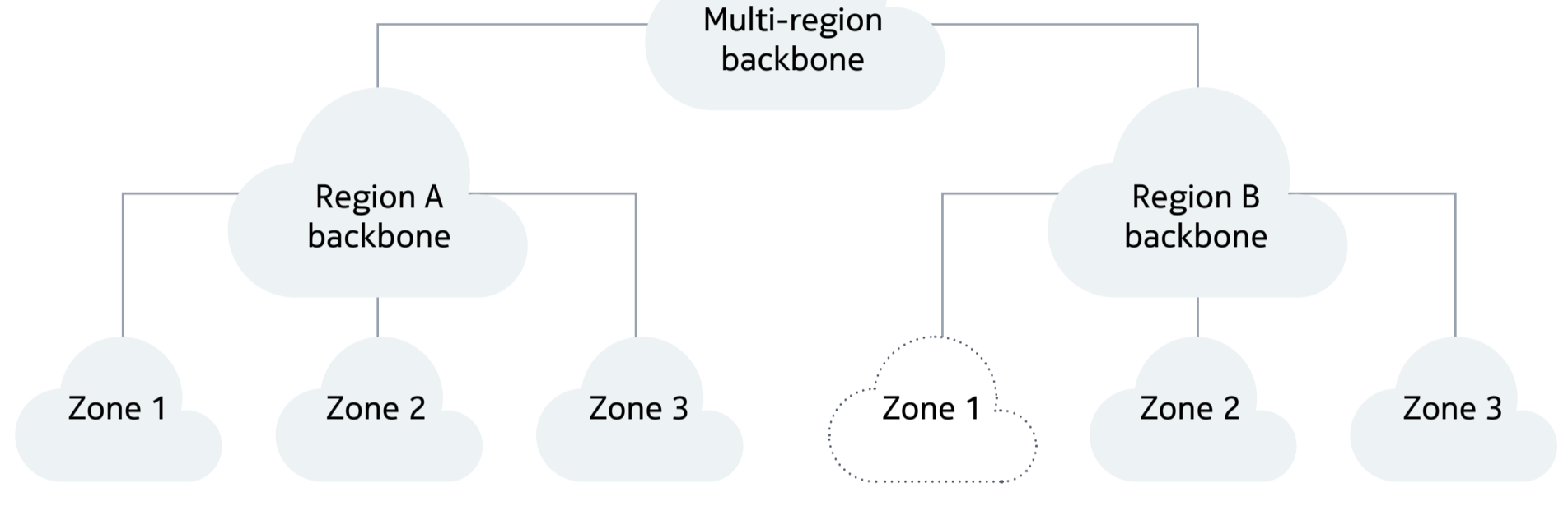
Change comes with new requirements

Data centers are at the heart of the cloud delivery model and experience. This growing demand for distributed cloud services and applications translates into an increasing need for your teams to build data centers that scale easily and flexibly within buildings, across campuses and regions, but are also more resilient and efficient.

Technical innovations let you achieve much greater server density and processing capacity than ever before alongside higher storage density, energy efficiency and much more. New software methods such as containers, microservices and DevOps processes are also speeding up how you develop and deliver applications.

But rapid growth and the need to massively scale data centers means that your cloud builder networking teams are now required to manage more network devices and workloads, more locations and more capacity across multiple clouds, as well as an increase in "east-west" or "machine to machine" data center traffic, and "north-south" or client-server traffic.

Data center design using leaf-spine fabrics

Multi-region backbone

Region A backbone

Region B backbone

Zone 1   Zone 2   Zone 3   Zone 1   Zone 2   Zone 3

Data Center, Region B, Zone 1

Edge Switches

Spine Switches

Fabric 1   Fabric 2   Fabric 3   Fabric 4
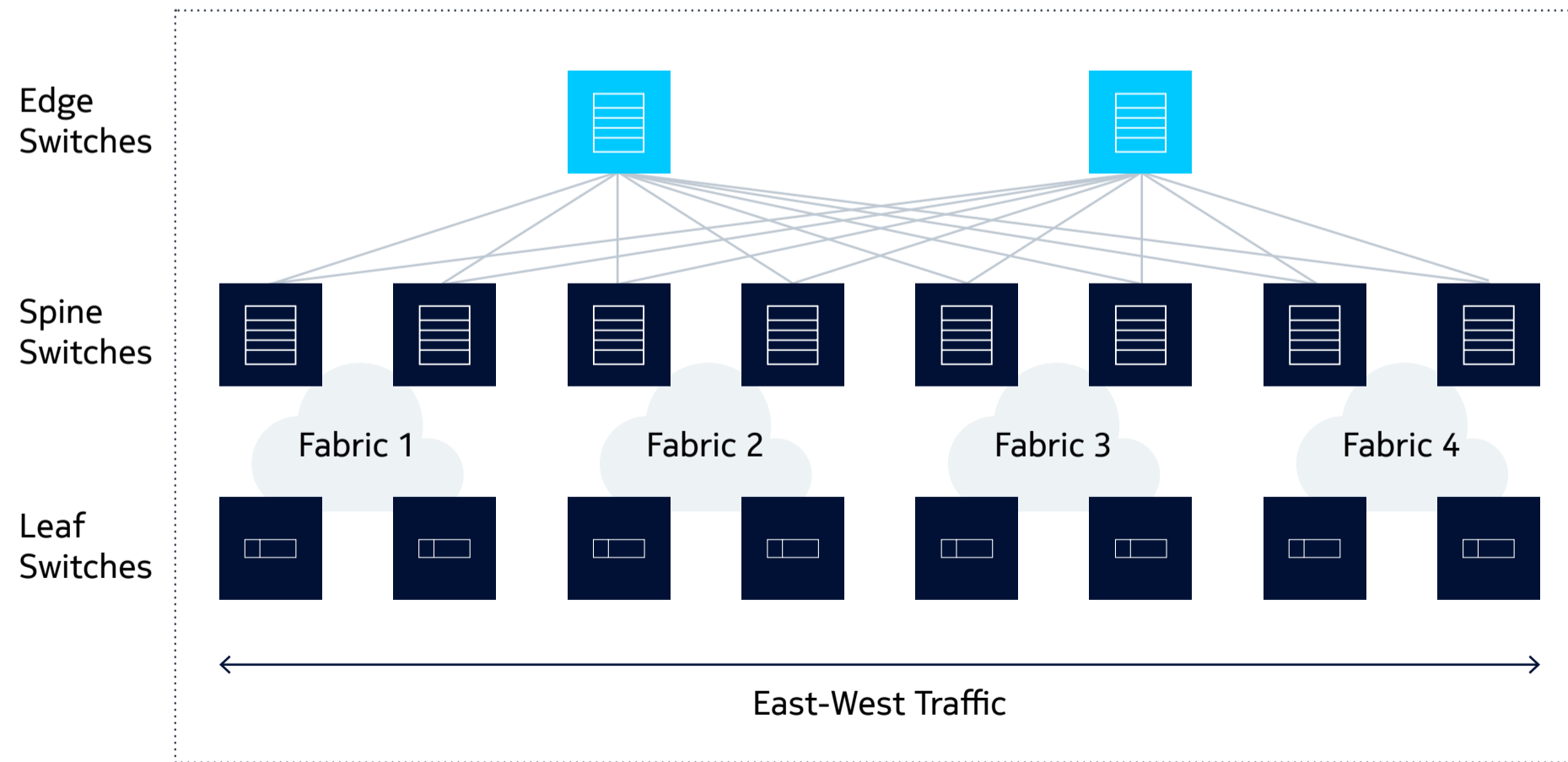
Leaf Switches

East-West Traffic

A greater number of network devices that require configuration and management is driving a change in how data center networks are designed in order to provide greater bandwidth within and between data centers.

The predominant approach is to use Clos principles and leaf-spine fabrics which are more scalable, comprising a group of switches managed as a logical unit. Multiple fabrics are replicated within data centers and across data centers, zones and regions.

But data center operators – including webscale companies, service providers and large enterprises – now need data center fabrics that are even more scalable without being too complex or costly to build and operate.

Your key challenge is to balance the need to constantly scale data center fabrics against the increasing costs of designing, building and operating them.

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Today's cloud building solution challenges

Although data center networks and operations have become more open and scalable, today's solutions are not always as open as cloud builders and data center operators want.
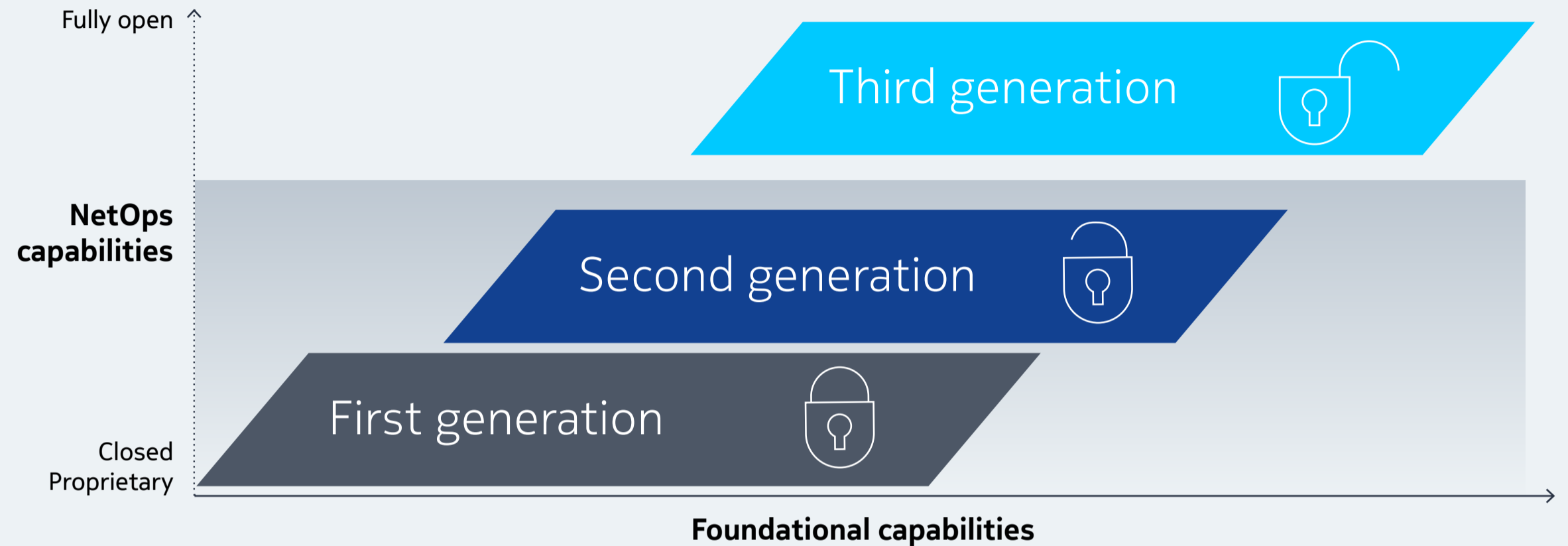
Today's large and growing community of cloud builders often find themselves faced with poor choices. You probably know the options well: you either have to choose solutions with closed, proprietary data center network operating systems (NOS) that give you limited visibility and control, making it difficult to customize, integrate and automate; or you go for open systems that are cumbersome to operationalize and offer unproven scale and performance.

The first generation closed proprietary solutions limit deployments within a data center. While they give you some level of openness and scale, you only have access to limited toolkits for operations and automation. That often creates extra work for you and delays for the business, for example requiring you to write your own applications in the language of the system and then recompile them with each release of the NOS.
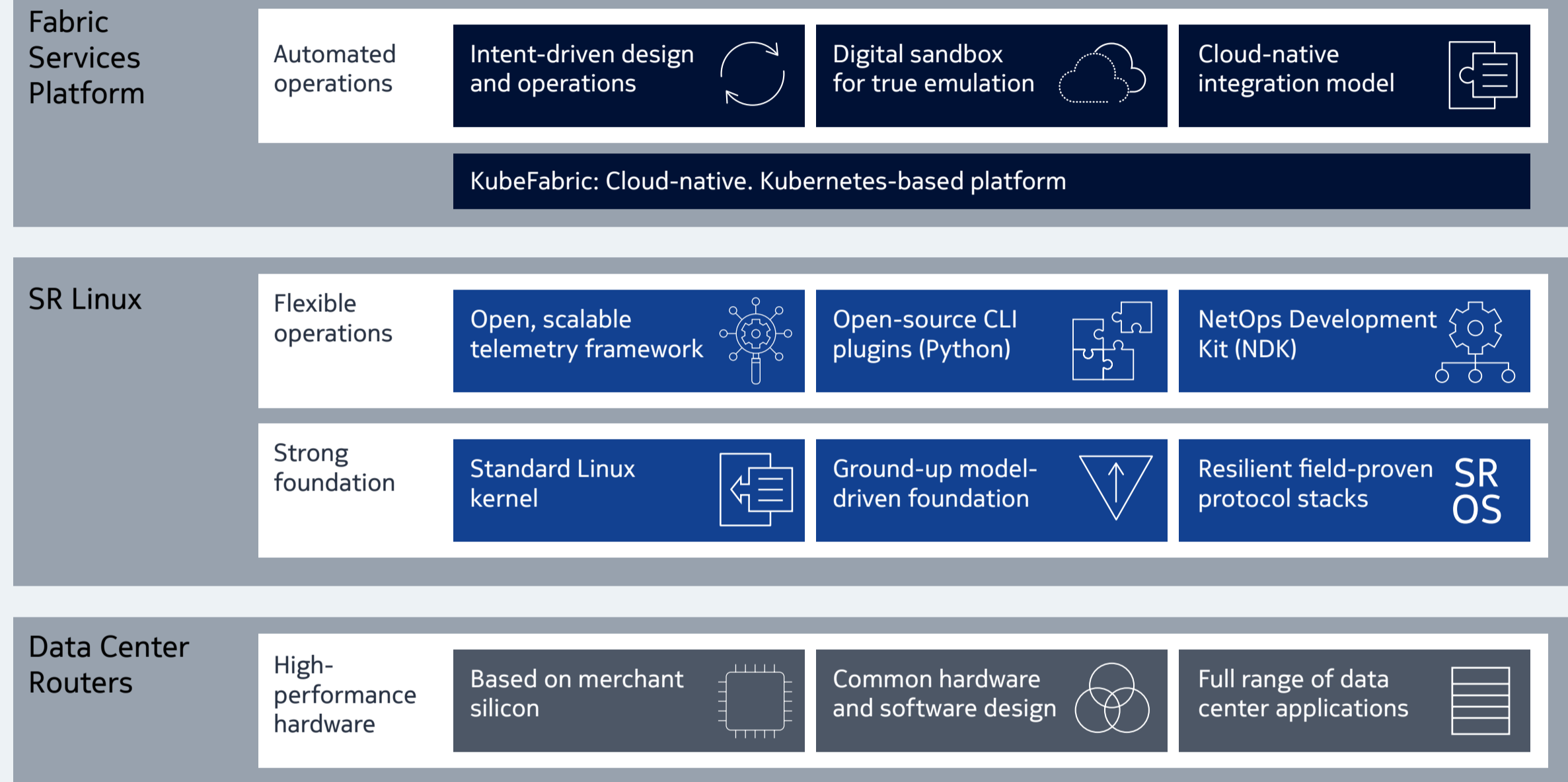
The current generation of solutions are more open and scalable, often with a Linux®-based NOS but one that is restrictive and difficult to customize,

integrate and automate. For example, today's leading systems give you limited functions for customization and often require tedious and time-consuming integration as well as specialist expertise to write applications and automate operations. This 'do-it-yourself' approach may suit some cloud builders by offering basic levels of control; however, others find being left to put the pieces together themselves difficult and daunting, meaning that they can't respond to the demands of their business with confidence and speed.

A bold new approach is needed. A next generation data center networking solution that is truly open, built on a Linux-based foundation but with a flexible consumable framework that supports operations and automation at scale – and provides the right tools. An approach that finally frees your cloud builder networking teams to build, operate, automate and troubleshoot data center fabrics at scale and speed, and in the way that suits them best with full control and confidence.

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The new Nokia Data Center Fabric solution is the answer

Welcome to network operations on your terms. Rapidly design and deploy, easily adapt and integrate, and confidently operate and automate data center network fabrics at scale.

Fabric Services Platform

Automated operations

| Intent-driven design and operations | Digital sandbox for true emulation | Cloud-native integration model |

KubeFabric: Cloud-native. Kubernetes-based platform

SR Linux

Flexible operations

| Open, scalable telemetry framework | Open-source CLI plugins (Python) | NetOps Development Kit (NDK) |

Strong foundation

| Standard Linux kernel | Ground-up model-driven foundation | Resilient field-proven protocol stacks | SR OS |

Data Center Routers

High-performance hardware

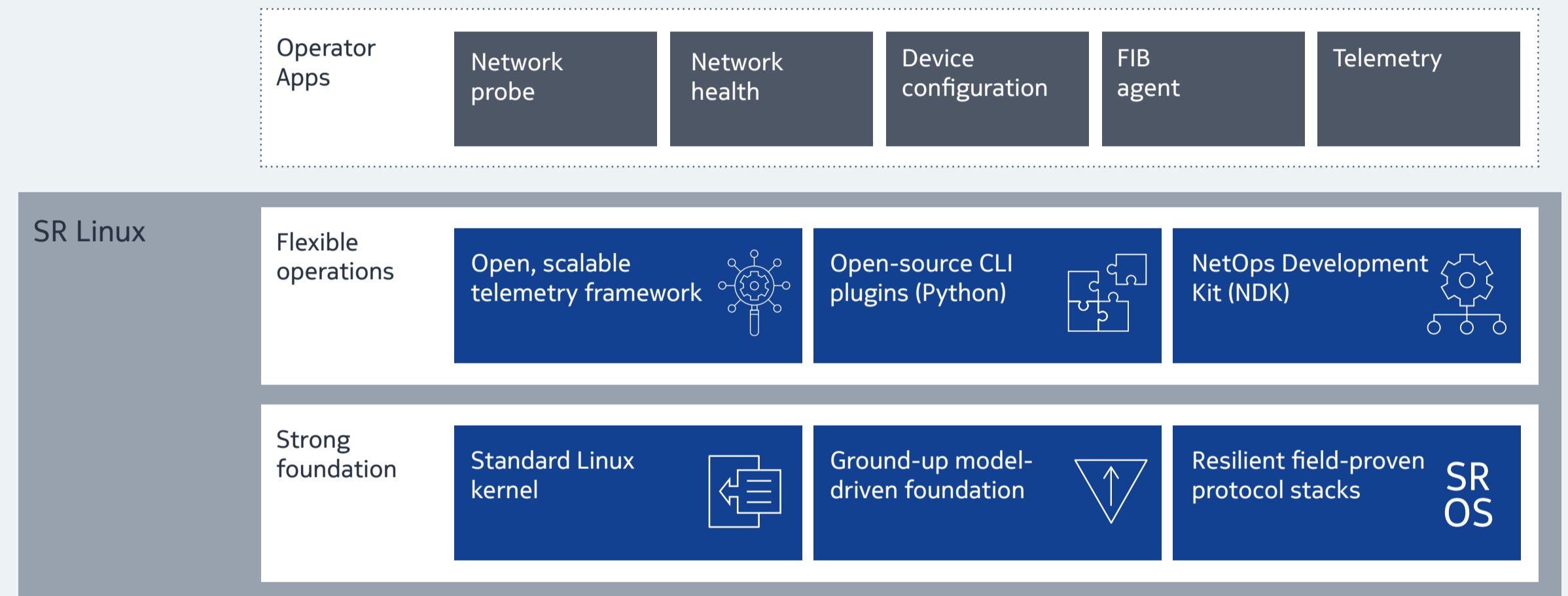| Based on merchant silicon | Common hardware and software design | Full range of data center applications |

The next-generation Nokia Data Center Fabric solution has been designed from the ground up to free your cloud builder networking teams to rapidly design and deploy, easily adapt and integrate and confidently operate and automate data center network fabrics: at scale. Nokia brings together the following products in one new era-redefining solution:

- **Nokia Service Router Linux (SR Linux):** An open, extensible and resilient network operating system (NOS) based on standard Linux® that enables scalability, flexibility and efficiency in data center and cloud environments.

- **Nokia Fabric Services Platform:** A declarative, intent-based automation and operations toolkit that delivers agile and scalable network operations for data center and cloud environments.

- **Nokia Data Center Routers:** A portfolio of routers that deliver massive scalability, openness, aggregation and interconnection for data center and cloud environments.

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Nokia SR Linux – an open foundation with tools for agile, flexible operations

A truly open, extensible and resilient network operating system (NOS) is the foundation of this next generation solution, enabling scalability, flexibility and efficiency across your data center and cloud environments.

Operator Apps

| Network probe | Network health | Device configuration | FIB agent | Telemetry |

SR Linux

Flexible operations

| Open, scalable telemetry framework | Open-source CLI plugins (Python) | NetOps Development Kit (NDK) |

Strong foundation

| Standard Linux kernel | Ground-up model-driven foundation | Resilient field-proven protocol stacks — SR OS |

Take a look at the components of SR Linux that, together, open up the future for your cloud builder networking team.

Standard Linux-based kernel

Nokia SR Linux achieves true openness by using an unmodified Linux-based kernel as the foundation on which to build a suite of network applications. This provides reliability, portability and ease of application development, and speeds the availability of non-Nokia applications, such as OpenSSH, and security patches for operating system components.

Ground-up, model-driven foundation delivering extensibility

It's designed from the ground up, with a management architecture that meets the demands of scalability, visibility and ease of operations. An extensible and open infrastructure allows applications to define and declare their own schemas, enabling them to set configurations and retrieve fine-grained system state. A scalable interface supports more granular data with push-based streaming.

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Modular, optimized, state-sharing architecture

The NOS uses an unmodified Linux kernel as the foundation on which applications share state via a publish/subscribe (pub/sub) architecture. The Nokia pub/sub architecture is implemented using generalized Remote Procedure Call (gRPC), protocol buffers (protobufs) and the Nokia Impart Database (IDB): a lightweight database that is optimized to handle high volumes of messages without slowing down the whole system.

Field-proven protocol stacks

It implements the field-proven protocol stacks from the Nokia Service Router Operating System (SR OS). Data centers are adopting leaf-spine fabrics using IP routing based on Multiprotocol-Border Gateway Protocol (MP-BGP), Ethernet VPN (EVPN) and Virtual Extensible LAN (VXLAN). By using SR Linux, your data center operators benefit from the resilience, stability, scalability and proven interoperability of Nokia SR OS.

Best-in-class streaming telemetry

SR Linux delivers an open and extensible infrastructure, which allows the retrieval of fine-grained system state, configuration setting, and a scalable interface to support more granular data with push-based streaming telemetry.

Open source CLI plugins

It includes an advanced, Python-based CLI and a JSON-RPC API for management. The CLI provides a flexible framework for accessing the system's underlying data models. Operators can leverage CLI plugins to completely customize the way the CLI operates, plugging in Linux commands, or pulling the state/configuration from various locations and combining them with system state/configuration. Existing CLI-based scripts can also be re-used with no changes.

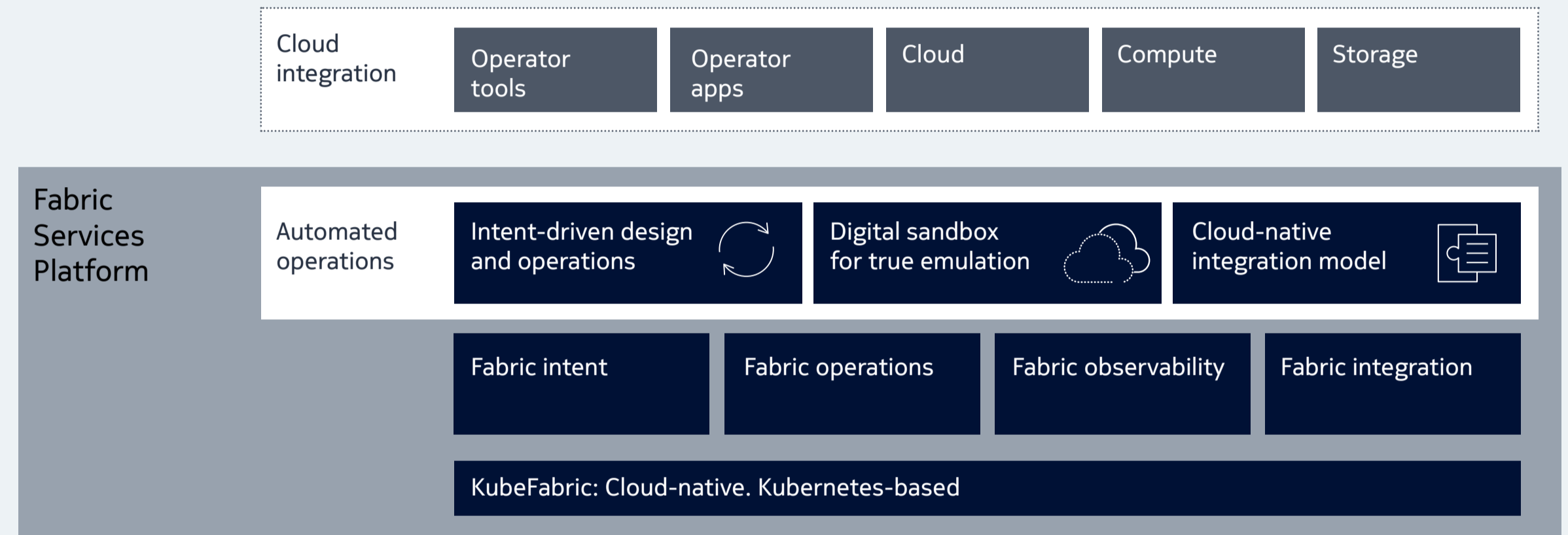## State of the art NetOps Development Kit (NDK)

The NDK enables operators to integrate their own and third-party applications into the system with all the same benefits as Nokia applications. This includes consistent configuration via YANG, telemetry support, lifecycle management and visibility of system resources. Application developers can leverage SR Linux's underlying model driven architecture, with simple, clean, decoupled integration and without worrying about the scalability or functionality of the underlying infrastructure and routing stack.

The NDK lets your operators easily integrate their own and third-party applications into the system with all the same benefits as Nokia applications.

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Nokia Fabric Services Platform – automation at scale with control and confidence

Discover a declarative, intent-based automation and operations toolkit that delivers agile and scalable network operations for your data center and cloud environments.

Cloud integration

| Operator tools | Operator apps | Cloud | Compute | Storage |

Fabric Services Platform

Automated operations

| Intent-driven design and operations | Digital sandbox for true emulation | Cloud-native integration model |

| Fabric intent | Fabric operations | Fabric observability | Fabric integration |

KubeFabric: Cloud-native. Kubernetes-based

Learn how the Fabric Services Platform gives your networking team agile operations and automation.

Scalable automation for all phases of data center fabric operations

The Nokia Fabric Services Platform is designed for the intent-based automation of all phases of data center fabric operations, including Day-0 design, Day-1 deploy and Day-2+ configuration, operation and troubleshooting of a data center fabric. It uses the open Kubernetes framework and all fabric services use a distributed microservices approach to deliver a true cloud-native automation and operations platform.

Digital sandbox

It provides a digital sandbox that is a true emulation of the data center fabric, creating a virtual digital twin of the live production network. This operational tool emulates a data center fabric and application workloads, and can emulate Day 0 fabric design, Day 1 fabric deployment and Day 2+ operations such as fabric change management and troubleshooting.

Fabric intent (as code)

The platform is designed to represent 'fabric as code'. It represents all the intent and configuration state of the data center fabric in a declarative way in YAML format, laying a strong foundation for continuous integration and

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continuous deployment of network infrastructure and supporting the move towards 'infrastructure as code'.

Both fabric design intent and workload intent can be validated using the digital sandbox. This allows operators to confidently and rapidly manage the risk of any change. The digital sandbox allows the operator to first try out the changes on a virtual platform where detailed validations can be performed and then apply it to the real production network.

Fabric observability
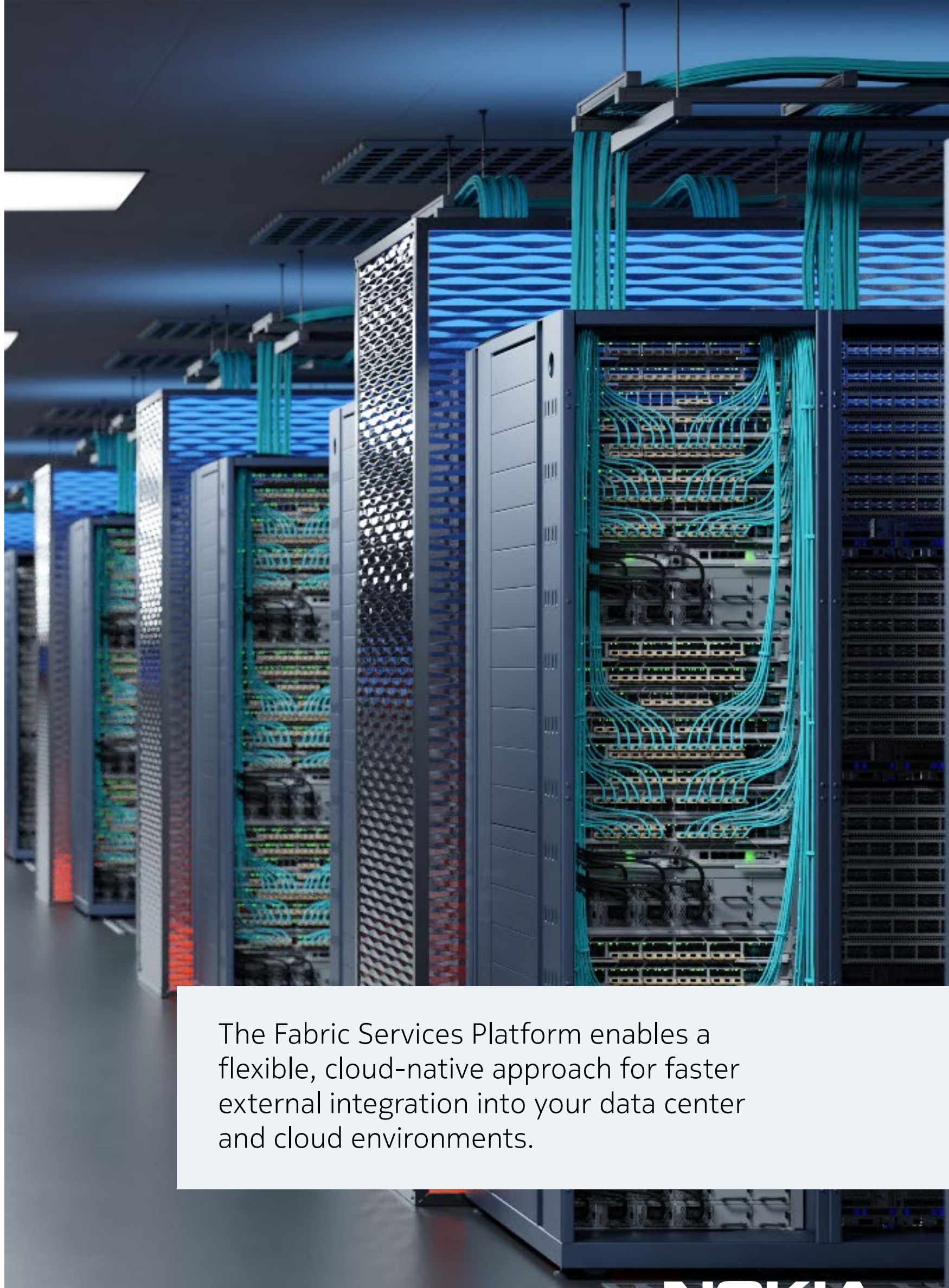
Fabric observability combines telemetry and data collected from the fabric to monitor and provide visibility into data center east-west and north-south traffic. The Fabric Services Platform enables a cloud-native, highly distributed collector architecture. It also offers a GUI to visualize key network utilization, availability and workload performance data, so that your operators can quickly understand the state of the fabric and the workloads running over it.

Fabric operations

The Fabric Services Platform combines design intent with all the telemetry data collected from the fabric and presents the data in a context relevant to the operational task. These contextual views, combined with the digital sandbox, enable your operations team to deliver agility with confidence.

Fabric integrations

It enables a flexible, cloud-native approach for faster external integration into your data center and cloud environments. The Fabric Services Platform integrates tightly with your compute or storage resources or in-house operational tools. It also integrates easily into your cloud environments in a loosely coupled way within a standard Kubernetes framework.
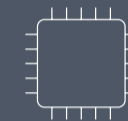
The Fabric Services Platform enables a flexible, cloud-native approach for faster external integration into your data center and cloud environments.

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Nokia Data Center Routers – hardware for scale and performance

Data Center Routers

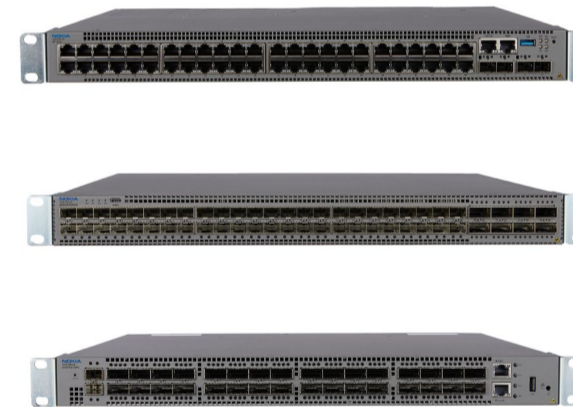| High-performance hardware | Based on merchant silicon | Common hardware and software design | Full range of data center applications |

The Nokia portfolio of Data Center Routers addresses the needs of modern data centers for massive scale and interconnectivity. The portfolio includes the Nokia 7250 Interconnect Router (IXR) and Nokia 7220 IXR, which offer a broad range of high-performance platforms for data center top of rack (TOR), leaf, spine and super-spine applications.

Based on merchant silicon with a common hardware design, the products include both chassis-based platforms and fixed-form-factor platforms. This lets your data center network teams choose the appropriate hardware while running the same SR Linux NOS and enjoying all its benefits.

The products offer 400GE, 100GE, 50G, 40GE, 25GE, 10GE and 1GE interfaces and deliver a robust and comprehensive set of Layer 3 IP routing capabilities including MP-BGP, EVPN and VXLAN, Layer 2 switching, QoS, scalable telemetry, security and model-driven management.
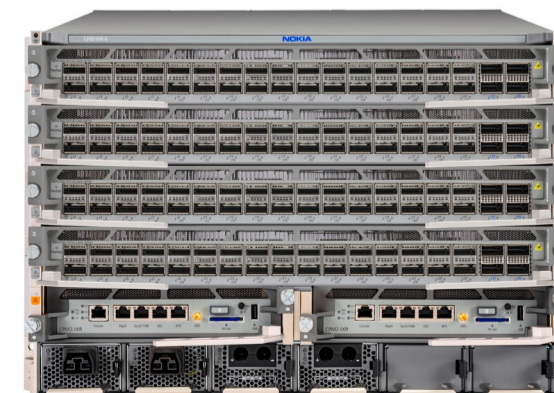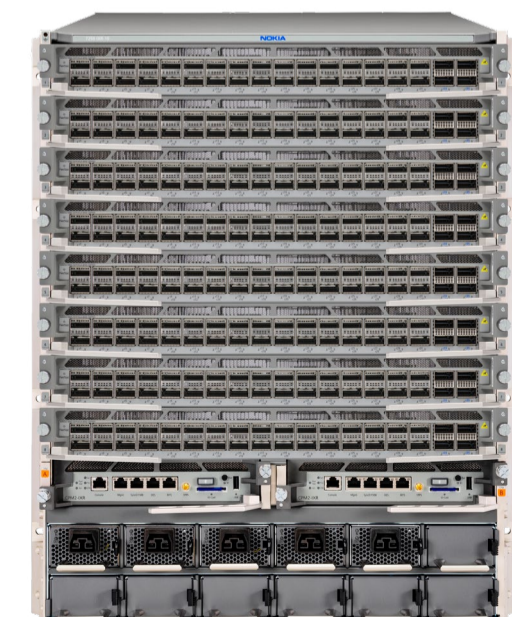
Nokia 7220 IXR-D Series

Nokia 7220 IXR-H Series

Nokia 7250 IXR-10

Nokia 7250 IXR-6

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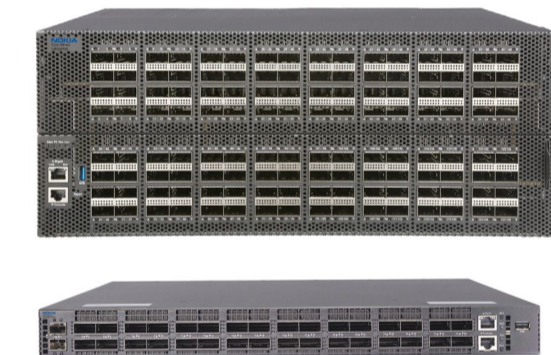
Summary of key features and benefits

Scale your data center fabrics on your terms to meet changing business requirements

- Scale your data center networks without losing flexibility with true open SR Linux providing a strong networking foundation

- Enhance and optimize your network operations with the Fabric Services Platform to enable automation at scale delivered using declarative intent

- Benefit from resilient and field proven IP routing protocol stacks including MP-BGP, EVPN and VXLAN

- Implement high-performance hardware platforms supporting massive scale and port speeds up to 400GE.

Take control of your operations with unmatched openness

- Simplify network programmability with SR Linux and its ground-up model-driven management and modern interfaces

- Deliver superior visibility and deep control via an open, scalable telemetry framework

- Write your own Python based CLI plugins to monitor and tune system information across different contexts

- Develop new applications with the NetOps Development Kit (NDK) that uses gRPC and protobufs to provide maximum flexibility

- Leverage supported languages and full backwards compatibility with existing applications and NOS versions.

Automate at scale to keep pace with operational practices and data center growth

- Enable agile and scalable Day 0 design, Day 1 deployment and Day 2+ change management and troubleshooting with the Fabric Services Platform

- Deliver automation at scale by representing intent and configuration state of the fabric (as code) in a declarative way in YAML format

- Manage risk with the Fabric Services Platform digital sandbox and provide true emulation of the data center fabric before making changes to the live network

- Support flexible cloud-native approaches for integration with compute or storage, in-house operational tools or cloud environments.

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How the market is responding to the new approach

"We regularly upgrade our data center equipment with technology to increase efficiency and reduce energy consumption. Using Nokia's new system will enable better networking and routing capabilities in our Viborg, Denmark facility."

Adam Bechtel, Vice President and Networking Lead at Apple

"We're pleased to see Nokia getting into the data center networking space and applying rigor to developing a next-generation open and easily extensible data center network operating system operating system, while leveraging its IP protocol stack."

Muhammad Durrani, Senior Director, Network Architecture, Equinix

"Nokia's new data center fabric solution promises to provide full programmability with deep telemetry, along with a modern operational toolkit to drive the extreme automation and scaling of our telco cloud, which is critical to drive future 5G services."

Neil McRae, BT Group Chief Architect

"Nokia's approach of bringing a new level of robustness and creativity to disaggregated data center networks is very much needed. We are pleased to see established vendors like Nokia stepping into the game in a big way."

Richard Petrie, CTO and Executive Director, LINX

"For our data center operations we need maximum agility with maximum confidence. Nokia's approach is well positioned, and we are pleased to partner with Nokia to drive ease of operations for rapid deployment, extreme adaptability, and absolute resiliency at scale."

Elif Yenihan, Core and Access Planning Director, TurkCell

"The network visibility and openness of Nokia's SR Linux platform would give us the automation we need to grow and scale our operations for many years to come. We look forward to trialling Nokia's new solution in our data centers."

Mark van Teunenbroek, Managing Director, team.blue/nl

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This is just the beginning — keep exploring

For more information about the Nokia Data Center Fabric solution, SR Linux and Fabric Services Platform, please see:

- Nokia Data Center Fabric Solution Overview

- Nokia SR Linux Product Description

- Nokia SR Linux product page

- Nokia Fabric Services Platform Product Description

- Nokia Fabric Services Platform product page

- Nokia 7220 Interconnect Router for data center fabrics product page

- Nokia 7250 Interconnect Router for data center fabrics product page

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