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What limits us, inspires us

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See how the Nokia Photonic Service Engine 3 is taking optical performance to the limit of what's possible

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Taking light to the limit

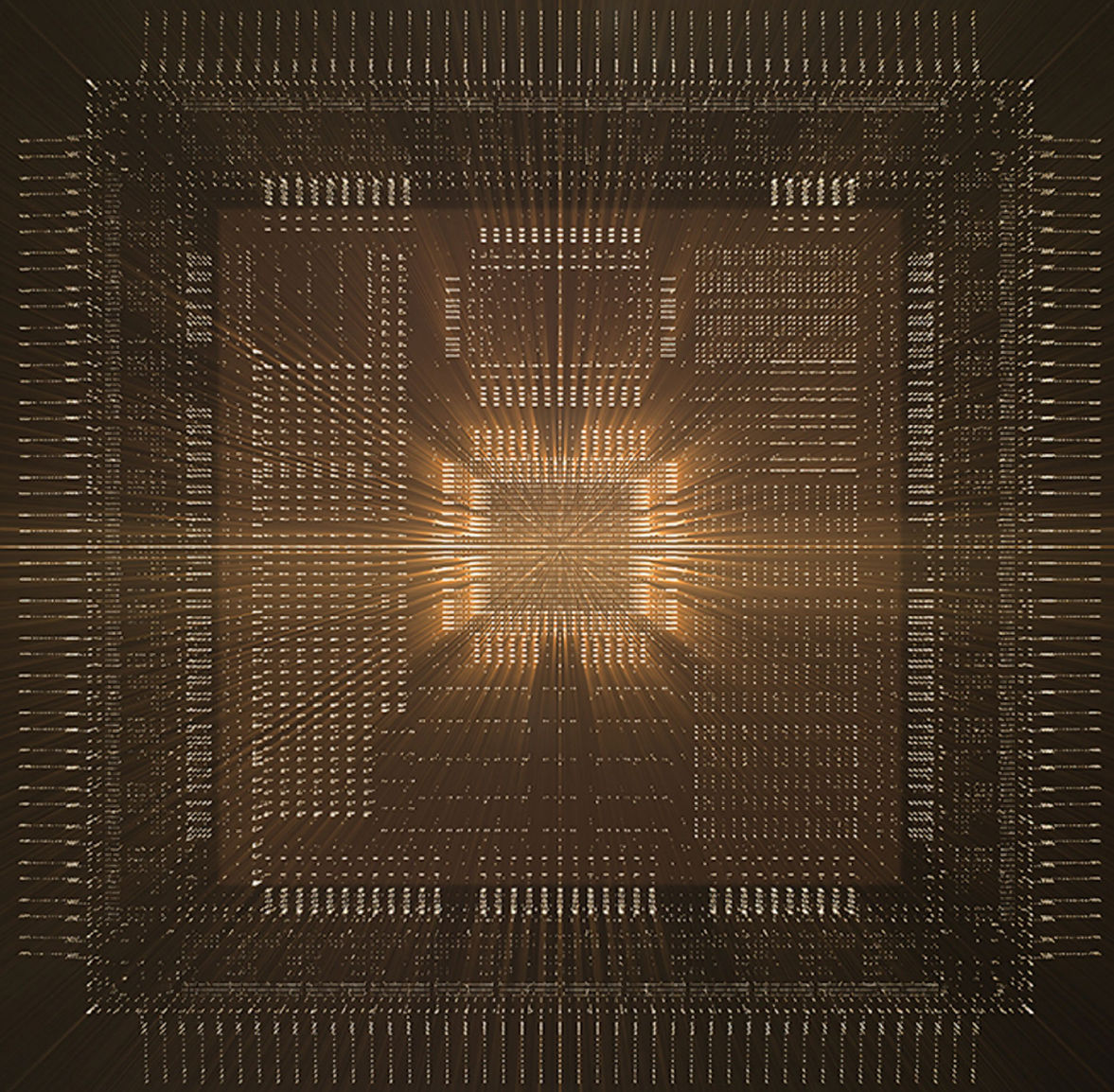
Customer demand for mobile broadband, cloud services and video streaming is growing exponentially, creating a massive requirement for increased bandwidth capacity on optical networks. Communication Service Providers (CSPs) and Internet Content Providers (ICPs) alike are struggling to keep up.

Until now, the optical networking industry has delivered this increased capacity by inventing ever-more sophisticated digital signal processors (DSPs). These have advanced wavelengths from 100G to 200G and beyond.

But it’s still not enough.

Even with these innovations and capacity gains, performance and flexibility are lagging behind what the market needs. With 5G on the horizon, the demand for capacity is only going to grow.

Nokia believes that a bold new approach is now needed. One that will deliver a seamless evolution path for CSPs and ICPs that want to grow beyond the limited flexibility of the 100G/200G networks prevalent today, to a highly scalable and automation-ready network.



The new Photonic Service Engine 3 is our answer.

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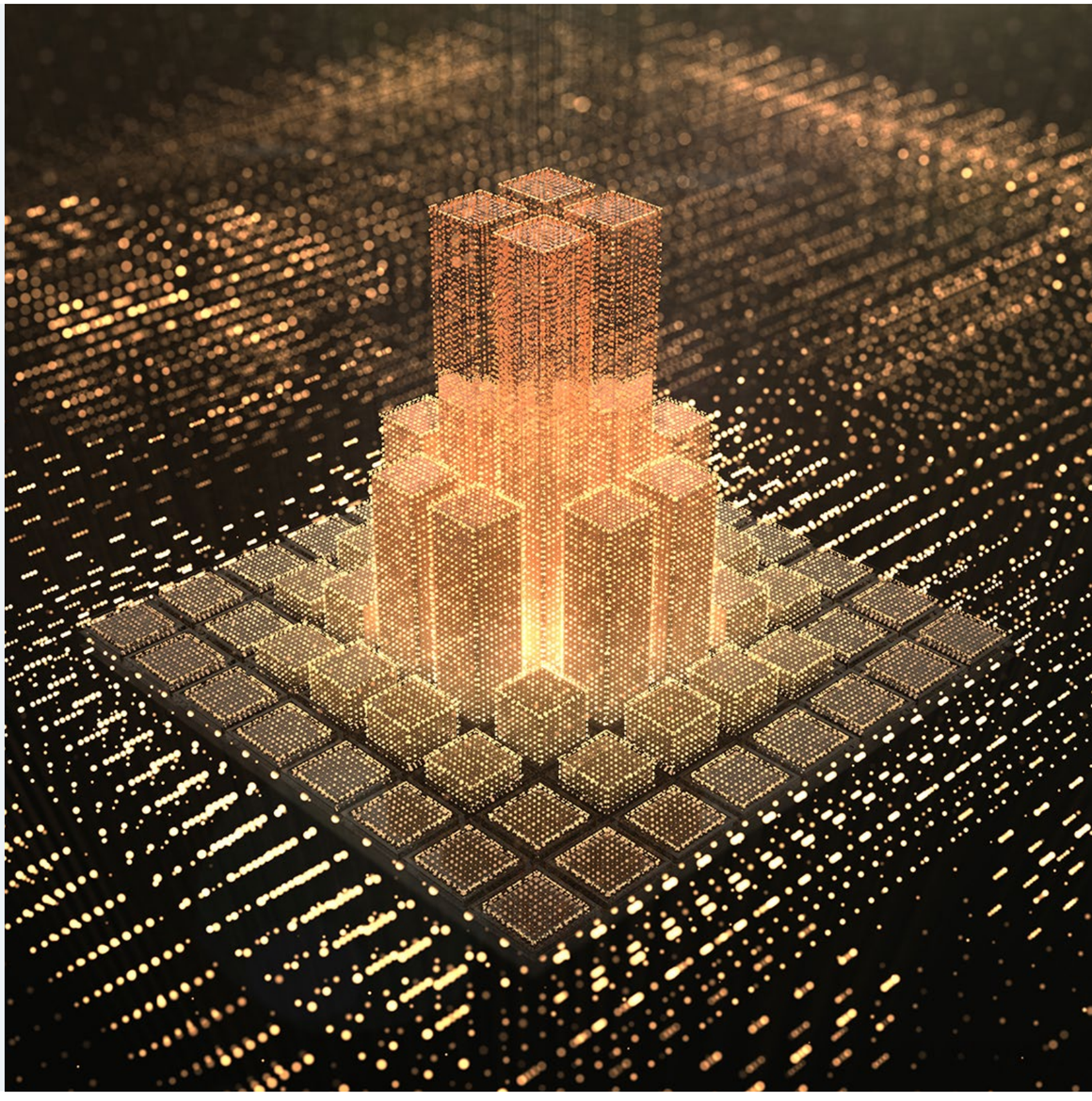
Taking light to the limit

Trail-blazing innovation. Limitless possibilities.

Nokia is proud to launch our industry-leading new super coherent optical chipset - the Photonic Service Engine 3, or ‘PSE-3’. This leverages a recent innovation from Nokia Bell Labs called Probabilistic Constellation Shaping, which approaches the maximum information transfer rate physically possible. As such, it is fundamentally redefining industry benchmarks for network capacity and distance.

With this innovation, optical fiber transmission capacity is pushed to very near the Shannon Limit. This is the maximum theoretical capacity of a communications channel as defined by Claude Shannon in 1948, while he was a researcher at Bell Labs.



A track record of industry firsts

In 2010, Nokia introduced the industry's first single-carrier 100G wavelength and we subsequently also pioneered high-order modulation, soft-decision FEC, and increasing baud rates.

In 2016, we launched the Photonic Service Engine 2, a new generation multi-modulation, multi-baud rate, coherent DSP that significantly improved wavelength flexibility and capacity. For the first time, wavelengths were programmable, matching capacity to each optical route.

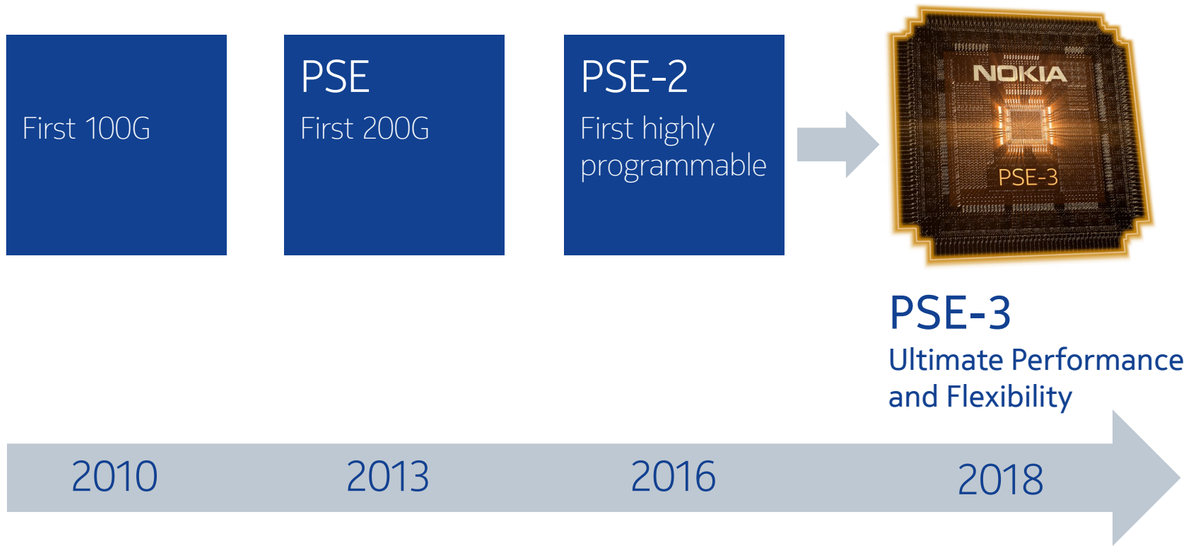
With the launch of the new Nokia PSE-3, we're now taking light to the limit - the Shannon Limit. Engineered with the only algorithm proven to approach the theoretical capacity limit of optical fiber, it combines the latest in electronics and algorithms to offer performance never before seen in a DSP.

Ready for the future

The Nokia PSE-3 drives these further improvements in optical performance, flexibility, and programmability by achieving a finer granularity across a larger range of wavelength speeds. Infinitely variable capacity means that spectral efficiency is also optimized for each specific route, along with enhanced performance, reaching the near physical limits of optical communication systems.

All this, while minimizing complexity and simplifying network operations, means that the new PSE-3 is set to play an instrumental role in the evolution of networks to meet the evergrowing demands for video, cloud and 5G.

A decade of DSP leadership



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Shaping a future without compromise

The PSE-3 is the first coherent DSP to implement Probabilistic Constellation Shaping, also known as PCS. This is an innovative DSP technique pioneered by the team at Nokia Bell Labs. By intelligently shaping the optical signal, PCS generates wavelengths that are more resilient to noise and other impairments, resulting in 25 percent greater capacity and reach.

PCS not only maximizes performance, but it does so at any possible distance within an optical network on any fiber – from metro to subsea: no compromise.

Unlike existing techniques, it is able to infinitely adjust the unavoidable tradeoff between capacity and reach. This allows network operators to operate every network connection at close to the Shannon Limit, regardless of distance, dramatically minimizing cost per bit per kilometer.

Ultimate performance, unconstrained flexibility, optimized spectral efficiency and extreme programmability are finally possible.

65%
Increase in capacity over currently deployed 100G networks

25%
Increase in capacity over the latest technologies

60%
Reduction in power per bit

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Dramatically cut network costs

The new Nokia PSE-3 chip powers a single modulation scheme. This drastically simplifies network operations while providing extreme levels of flexibility, making it ideal for ICPs and CSPs seeking to push operational limits and increase ROI on expensive leased fibers.

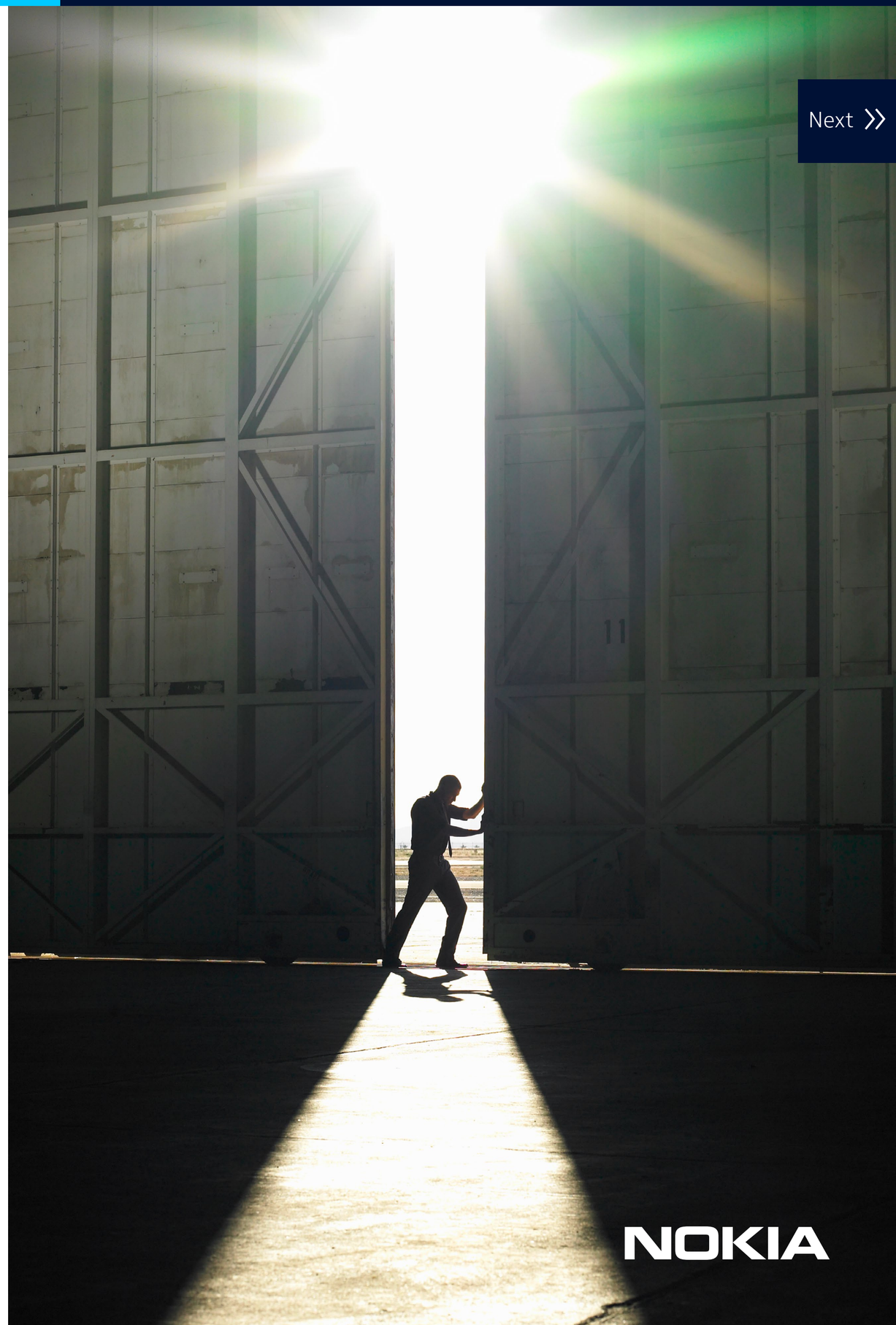
Significant network savings are achieved by:

- Enabling finer capacities over a wider range of wavelengths from 100G – 600G.
- Letting carriers transport additional capacity over their networks with fewer optical interfaces, providing better spectral efficiency and lower costs per gigabit.

More capacity. Fewer interfaces. Proven results.

A recent network study of a 75-node US backbone network compared the total capacity and interface requirements using PSE-3 probabilistically shaped wavelengths to a model that used 100G wavelengths, and a network built with newer 100G – 250G multi-modulation capable interfaces.

The results were clear: in both environments, the PSE-3 powered wavelengths delivered significantly more network capacity with fewer required interfaces.



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Radical simplicity, breakthrough programmability

The new PSE-3 chip enables optical networks to flexibly, simply and intelligently meet the surging and dynamic data traffic demands that will characterize the 5G era.

Day-to-day network operations and planning are radically simplified and optical networks are truly prepared for the benefits of network automation. Network operators are also able to create and deploy innovative customer services at lower costs, delivering real competitive advantage.

- Reverse the tide of ever-increasing complexity in Wavelength-division Multiplexing (WDM) systems, and provide infinitely adjustable wavelength capacity from 100G to 600G with a single WDM channel size.
- Achieve uniform channel sizing to eliminate spectral fragmentation and facilitate restoration and dynamic wavelength provisioning.

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Easy network insight and optimization

PSE-3 powered optical interfaces give CSPs and ICPs the ideal foundation for creating the kind of dynamic and flexible network infrastructure that has never before been possible. Working in conjunction with optical network performance management and optimization applications, they deliver truly ground-breaking results.

The PSE-3 can automatically adjust and optimize wavelength capacity, dynamically, based on streaming optical layer telemetry data. This means that network operators can recoup any capacity laying unused due to conservative design rules.

Network managers can also respond in real-time as network conditions evolve, maximizing capacity as changes occur due to restoration, or slow-moving fiber events such as the accumulation of ageing and splicing losses.

With capacity automatically optimized in line with real-time network monitoring across each and every optical route, operators can rest assured their networks are running at peak performance and capacity.

Turning innovation to commercial advantage

Right now, CSPs are under tremendous pressure to rapidly evolve their services to meet the needs of new IoT, 5G, cloud applications. At the same time, ICPs are seeking to stay agile and disruptive as the technologies and markets around them evolve.

Both need a trusted, strategic partner that can help them build future-ready optical networks, fit for what's next.

Nokia is the ideal partner. Our trail-blazing PSE-3 chip innovation leverages the work of Nokia Bell Labs to deliver yet another incredible industry first and real commercial advantage for our customers.

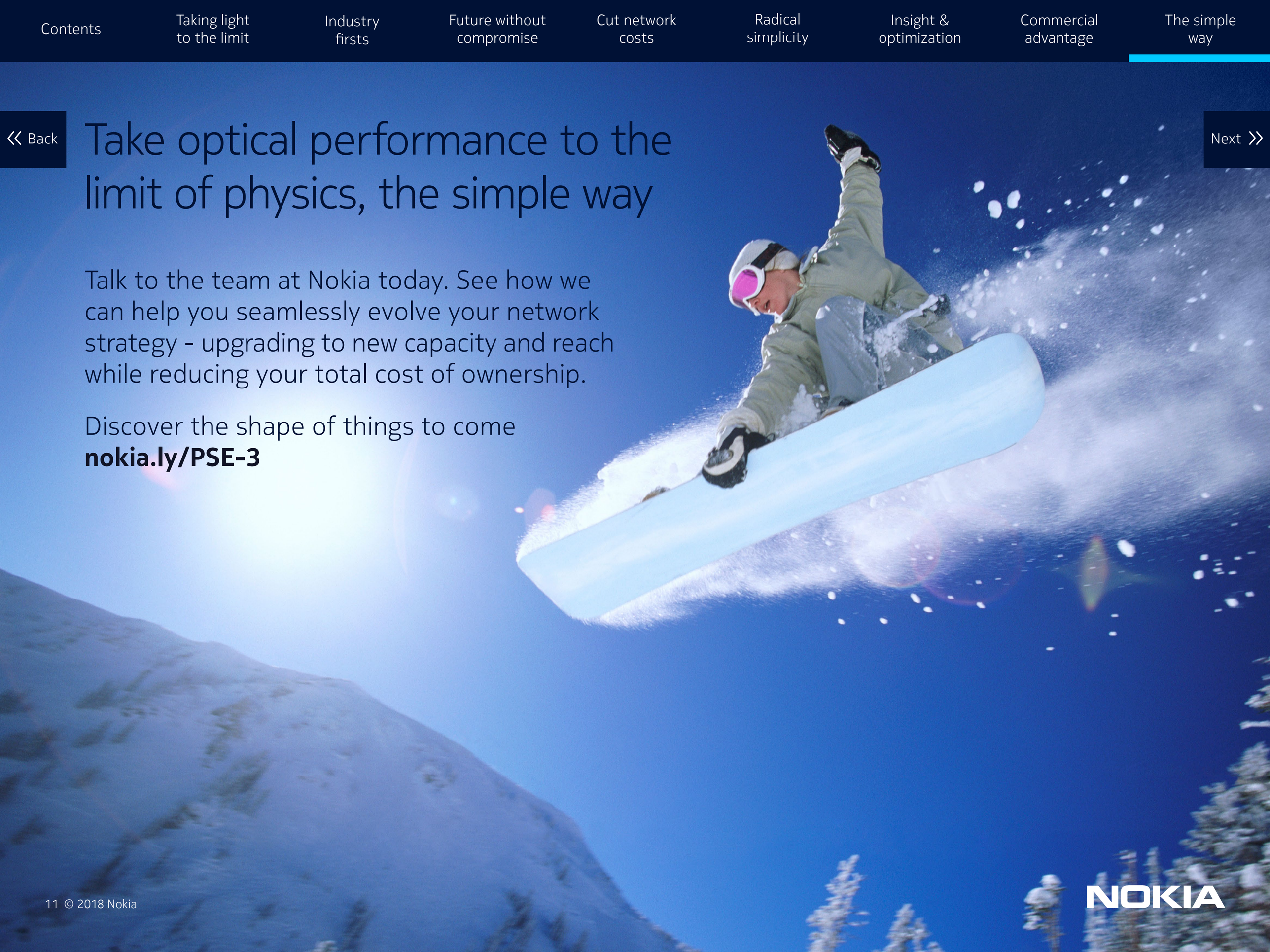
PSE-3 is transforming what our network customers can do

- Power awesome video, mobile and cloud experiences whether they're 100 or 10,000 kilometers away
- Dynamically maximize every wavelength in the network
- Simplify planning and operations
- Drop per-gigabit costs
- Achieve real-time network visibility and analysis
- Offer competitive and affordable new customer services
- Increase revenue generation and ROI

Take optical performance to the limit of physics, the simple way

Talk to the team at Nokia today. See how we can help you seamlessly evolve your network strategy - upgrading to new capacity and reach while reducing your total cost of ownership.

Discover the shape of things to come
nokia.ly/PSE-3



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