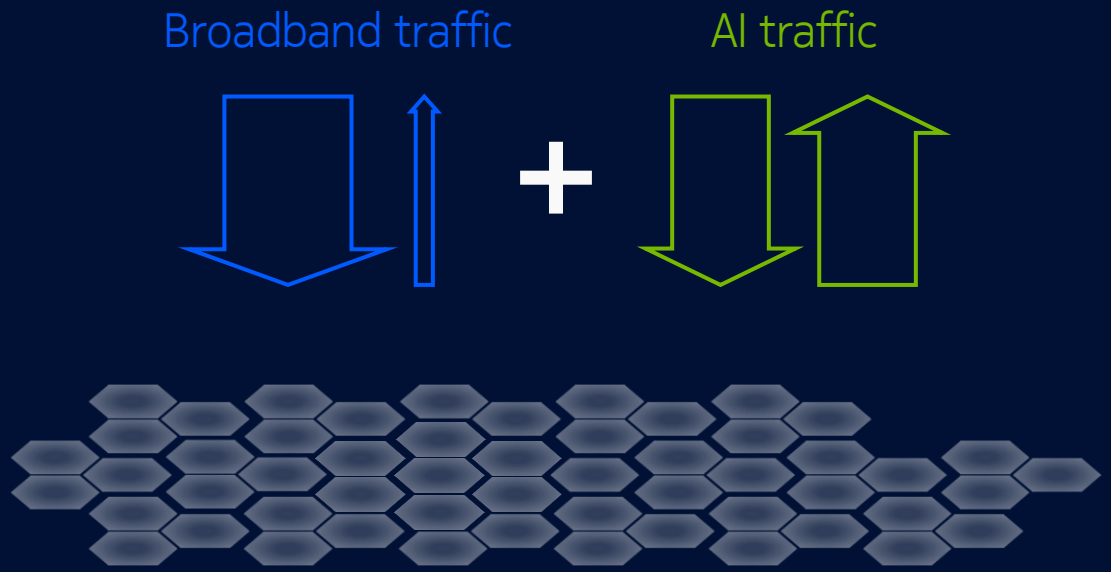
Optical Technology and Standards for Modern Mobile Networks

Capitalizing on Optics in 5G, 6G and Cloud RAN – OFC 2026

Andrew Bender

CTO Fixed Networks

Future wireless networks



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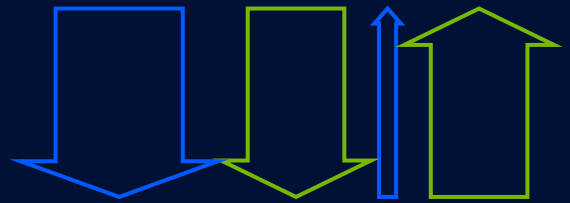
Future wireless networks



... must be AI-native

INNOVATION

PERFORMANCE

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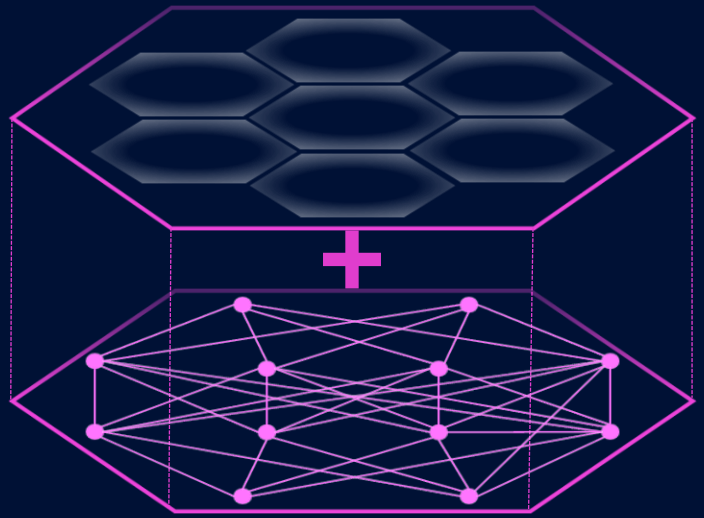
Connecting and processing with AI-RAN

AI ON RAN

AI FOR RAN

AI AND RAN



AI-RAN

Connectivity

Compute

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The monetization imperative will grow with Advanced 5G and 6G

Global learnings
from 5G deployments & monetization

Subscription conversion
5G conversion, 5G data rates

FWA as a service for home & enterprise, service bundle with slicing

5G customer experience
event based services, data speed

New monetization opportunities

Computing offload
Edge compute and AI-RAN

Gaming experience
Service bundle with slicing

Critical Comms
Utility, defence and enterprise

Immersive experience
XR, digital twin, metaverse

AI RAN
AI monetization, OPEX saving, network as Code

5G IoT with eRedCap
Low power, low cost IoT use cases

Network sensing
Positioning, localization, asset tracking

Space comms
NTN, UAV

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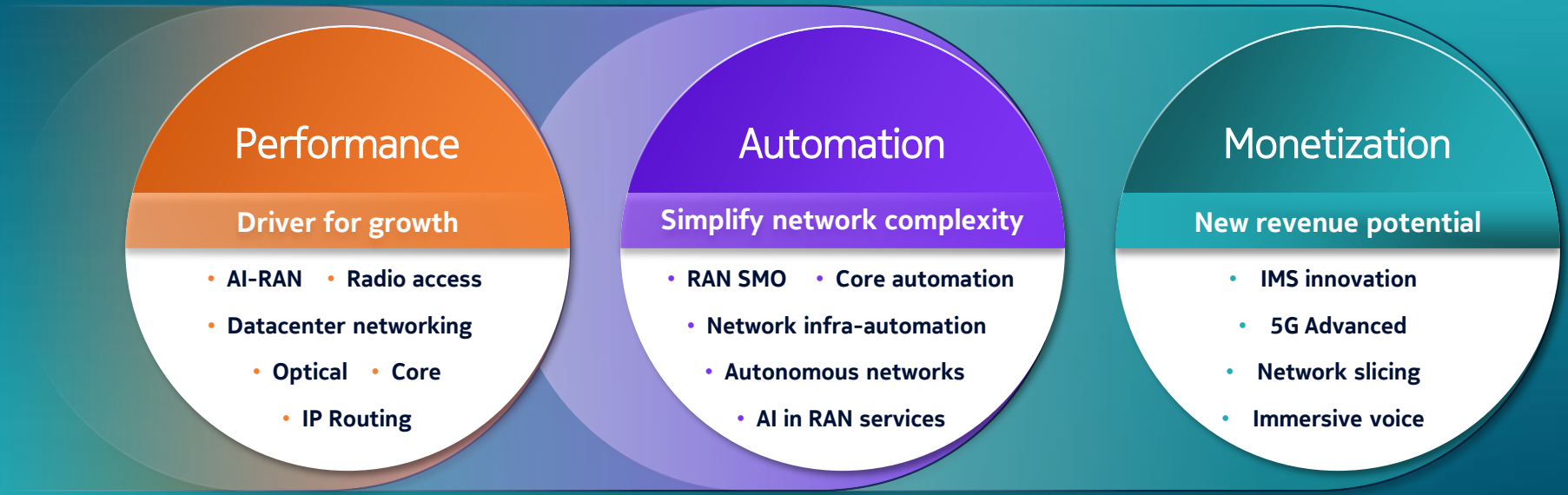
Staying ahead in the AI supercycle

Advancing connectivity ready for the demands and opportunities of the AI era



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6G standardization objectives

Extreme efficiency
on both existing and new spectrum
for improved cost per GB

Efficient 5G-6G MRSS
for optimized spectrum sharing

Single stand-alone
streamlined and lean architecture

Enhanced cyber-security assurance
user privacy, reliability and resilience

6G native IoT technology
in the first release

Scalable 6G RAT
supporting diverse device types
from IoT to higher capability.

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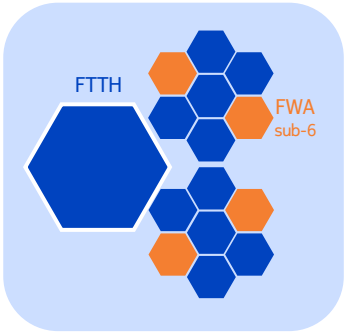
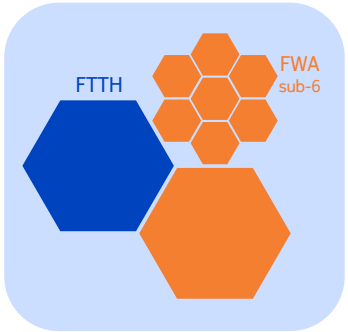
Fixed wireless access as a complement to FTTH



Fiber complement

Use 5G FWA where the fiber cost or TTM is prohibitive



Fast time-to-market

Instant coverage with 5G, build fiber later

Broadband competition

Mobile challenger, fast TTM, and low start-up cost

mmWave overlay

Increase network capacity where you need it

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MOPA work products

Supporting the evolution

- **Market Outlook [MOPA-MO]:** The market outlook for optical technologies in the context of mobile applications.
- **Requirements & Blueprints [MOPA-RBP]:** General functional requirements, and mobile optical blueprints for C-RAN, D-RAN and VRAN, based on available technologies.
- **New Technologies [MOPA-NT]:** Relevant emerging and future technologies that could be included in the blueprints.

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MOPA roadmap for optical mobile transport

In current and future mobile networks

Mobile Transport Evolution Roadmap

Network Phase	Strategic Service Category	Line Rate Evolution
5G	eMBB / mMTC	10G → 25G
5G-Advanced	URLLC / Advanced eMBB	25G → 50G
6G (2030 Launch)	AI-Native / Integrated Sensing	50G → 100G

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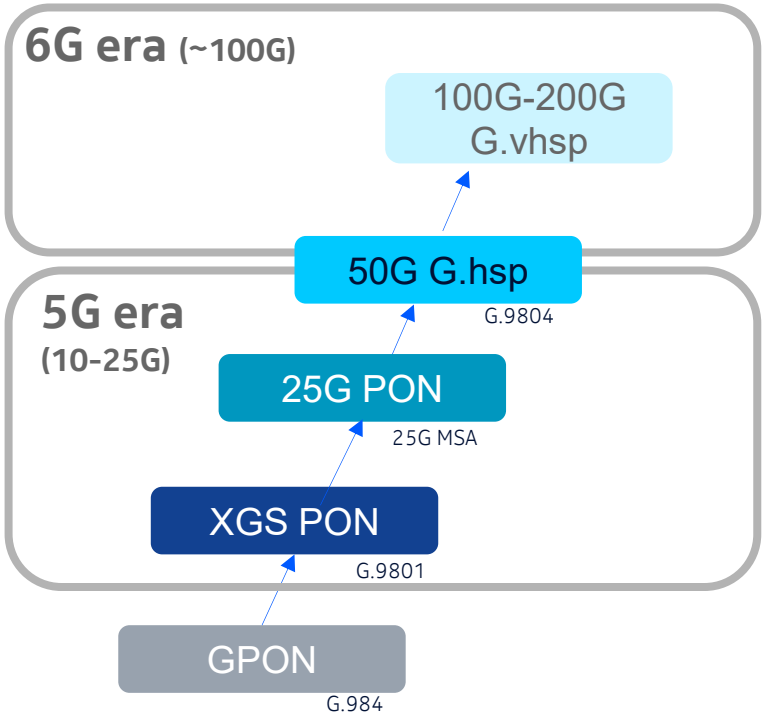
PON technology standards progression for 5G and 6G

ITU-T G-series Recommendations



Anyhaul using PON

- G.Sup66 (2020)
  5G wireless fronthaul requirements in PON
- G.Sup.LLSoTDM (on-going)
  Low Layer Split over T(W)DM PON

Low Latency for Fronthaul

- G.Sup71 (2023)
  OLT Capabilities for Cooperative DBA

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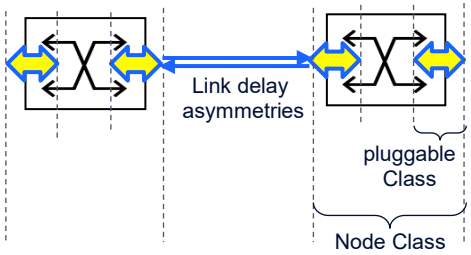
MOPA brings tight sync parameters to standards

Pluggables participate to end-end lcTEI:



Keeping Tight Sync parameters per pluggable specifies:

1) Internal average Tx and Rx latencies, per lane
   => allows for PTP correction of their asymmetries

2) Classification of remaining (uncorrectable) variations
   => part of total Node cTE (Node level: ITU-T G.8273.2)

	Class A.10	Class A.20	Class B.10	Class B.20	Class C.2	Class C.10
Max constant time error budget allocated to one pluggable	+/- 5ns	+/-10ns	+/- 2ns	+/- 4ns	+/- 0.2ns	+/- 1ns
	ΔTmax=+/-5ns	ΔTmax=+/-10ns	ΔTmax=+/-2ns	ΔTmax=+/-5ns	ΔTmax=+/-0.2ns	ΔTmax=+/-1ns
	Δmax=+/-5ns	Δmax=+/-10ns	Δmax=+/-2ns	Δmax=+/-5ns	Δmax=+/-0.2ns	Δmax=+/-1ns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Implementation considerations about FEC and MII extenders for "tight sync"

September 22nd, 2024

Authors (in alphabetical order)

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Included in **SNIA SFF 8472**

ongoing in **SNIA SFF 8636** and **OIF CMIS**

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