



Optical Research drivers for 2030 and beyond

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Date: 28th November 2019



<http://metro-haul.eu>

METRO-HAUL: METRO High bandwidth, 5G Application-aware optical network, with edge storage, compute and low Latency

H2020-ICT-2016-2 Metro-Haul Grant No. 76172

Optical Networks Research Scope

19th / 20th Century saw massive world-wide infrastructure projects

Railways, electricity grids, water supplies, telephone networks based on copper

21st Century is also seeing massive world-wide build

High bandwidth wireless access

Optical Fibre to billions of homes and small cells

The fibre already installed is a small fraction of what is to come

World-wide project will take decades

Cost \$100s bns

Will have to endure for ~100 years or more

Optical technology underpins the future

Essential for all future 5G++ networks

Essential for all consumer internet

Essential for all future smart cities, IoT

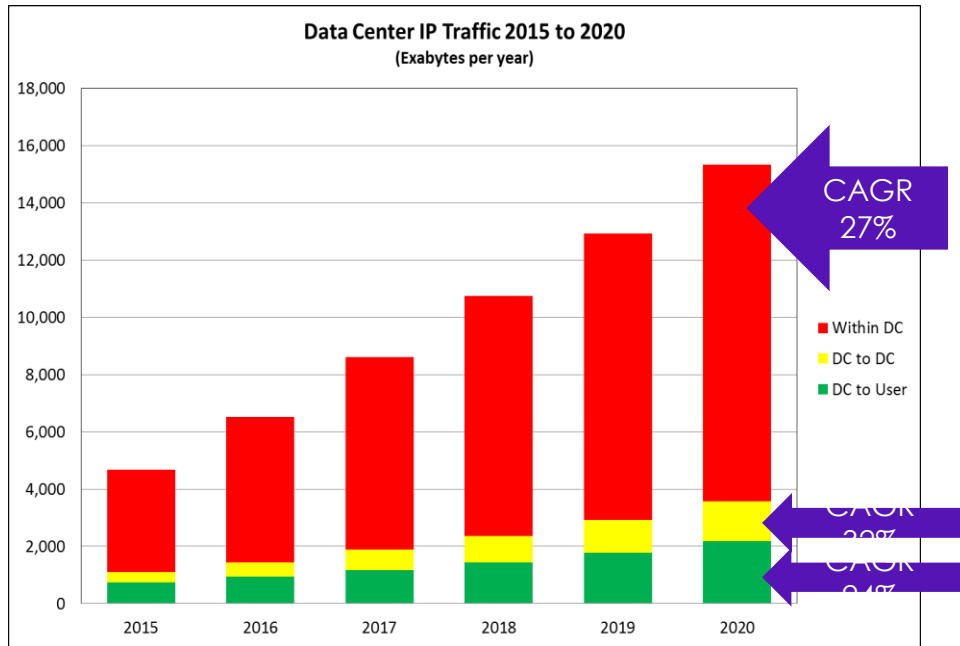
Essential to maintain EU leadership

Fibre to homes / 5G cells is a century-scale investment with century-scale impact



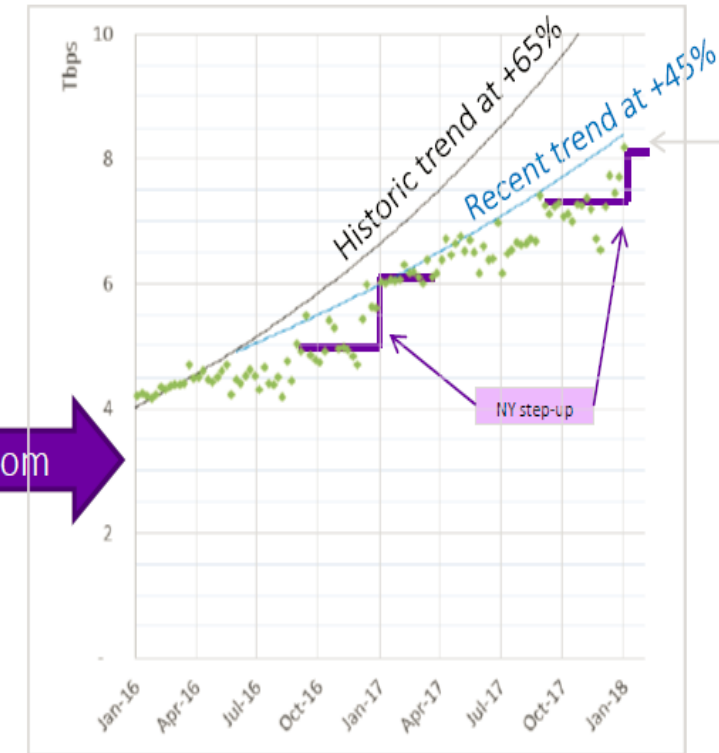
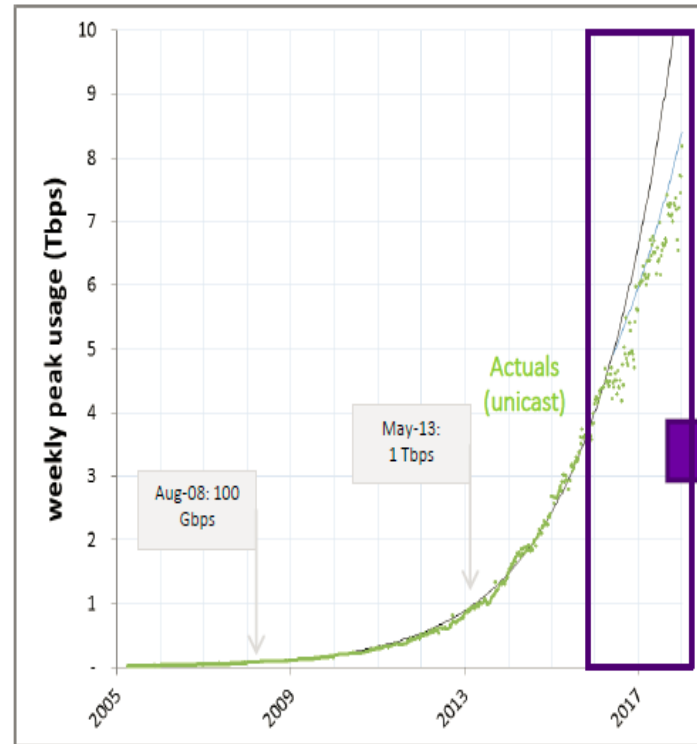
Network traffic growth

Global averages



Source: Cisco CGI, 2015-2020

A BT central core router



Strong, exponential traffic growth for many years – continual requirement for new optical technology

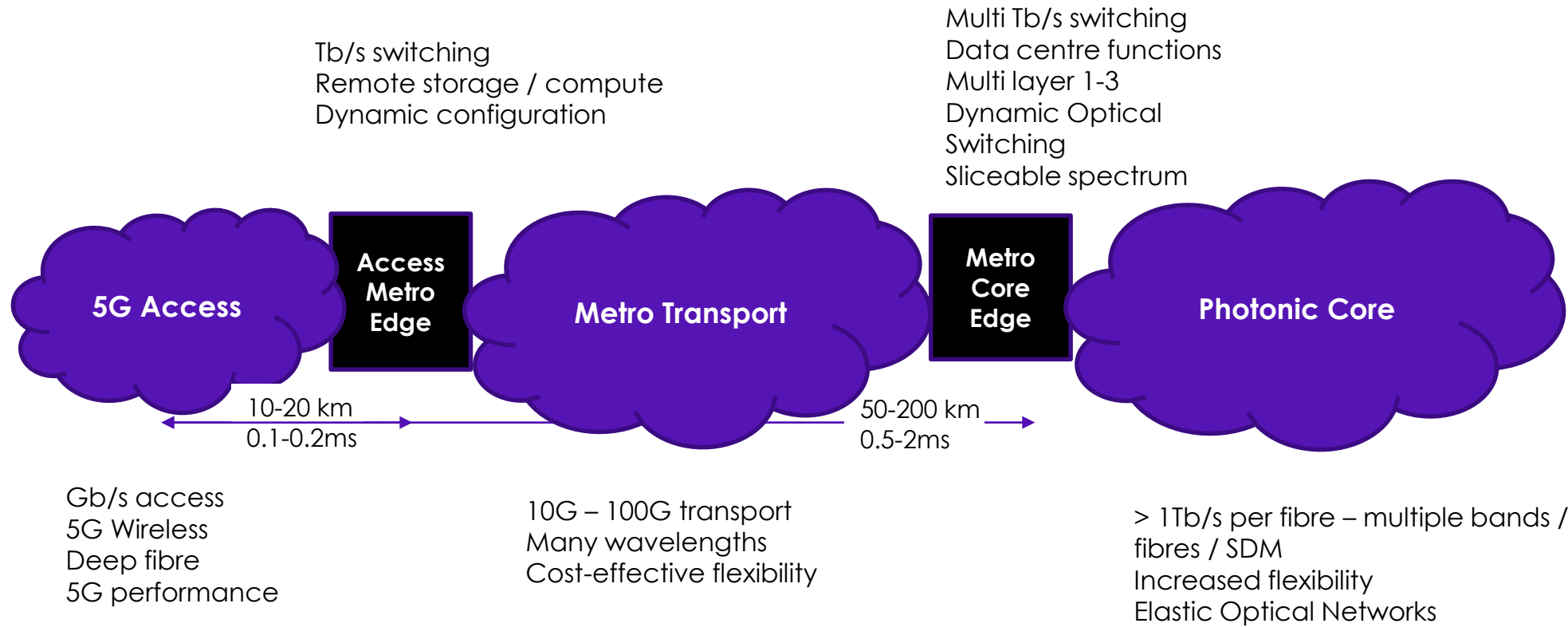
Overall view of a typical national-scale optical network

Millions of nodes

100s / 1000 nodes

Dozens of nodes

SDN-based Control / Orchestration, security, monitoring, resilience



Where are we?

Optical tech is expensive

Optical technology is fragile,
needs deep skills

Installation is expensive and slow

Very limited means of managing
vast fibre inventory

Limited integration with wireless
/ in-home networks

Ambition?

Consumer optics, buy from
local store

Robust, plug and play optical
networks

Automated fibre installation on demand

Automated real-time identification
of all network fibre

Full, end-to-end infrastructure and
service convergence

Research areas

Photonic + electronic integration,
packaging low cost coherent
optical transport

From component ruggedization to
resilient architectures, education
and training, monitoring

Robotics, infrastructure mapping
techniques, drilling...

Integrated OTDR, integration of ML
techniques, widespread monitoring

Genuine radio+optics
convergence, E2E management



Where are we?

Expensive 100G optics for small cell densification

Repairs are time-consuming

No convergence between transport and IT

Still stuck with the same fibre we started with!

Limited, costly, power-hungry Edge IT functions

Ambition?

Cost-effective, short range but HIGH bandwidth optical backhaul

Architectures will be hitlessly resilient

Full end-to-end distributed DC resources with dynamic slice / app support

Fibre infrastructure optimised for future access

Fully integrated, carbon-neutral, liquid-cooled mini edge DCs everywhere

Research areas

All optical transmission options – high speed / WDM PON to coherent, radio over fibre, Free space Optics, THz comms...

Cross-domain resiliency (wireless, fibre, satellite)

SDN-based control of multi-domain resources, integrated monitoring with AI/ML

New fibres and cables

High density storage, compute. New cooling.

.... And many more I haven't thought of.... ☺



Future comms will not happen without optical research

The assumptions that fibre is always there and will always have enough bandwidth are no longer valid

Even if optical technology is more than capable of meeting long-term access requirements – the cost points are currently far too high

You only build out a national fibre access infrastructure, costing \$10s bns....ONCE

Let's get it right

