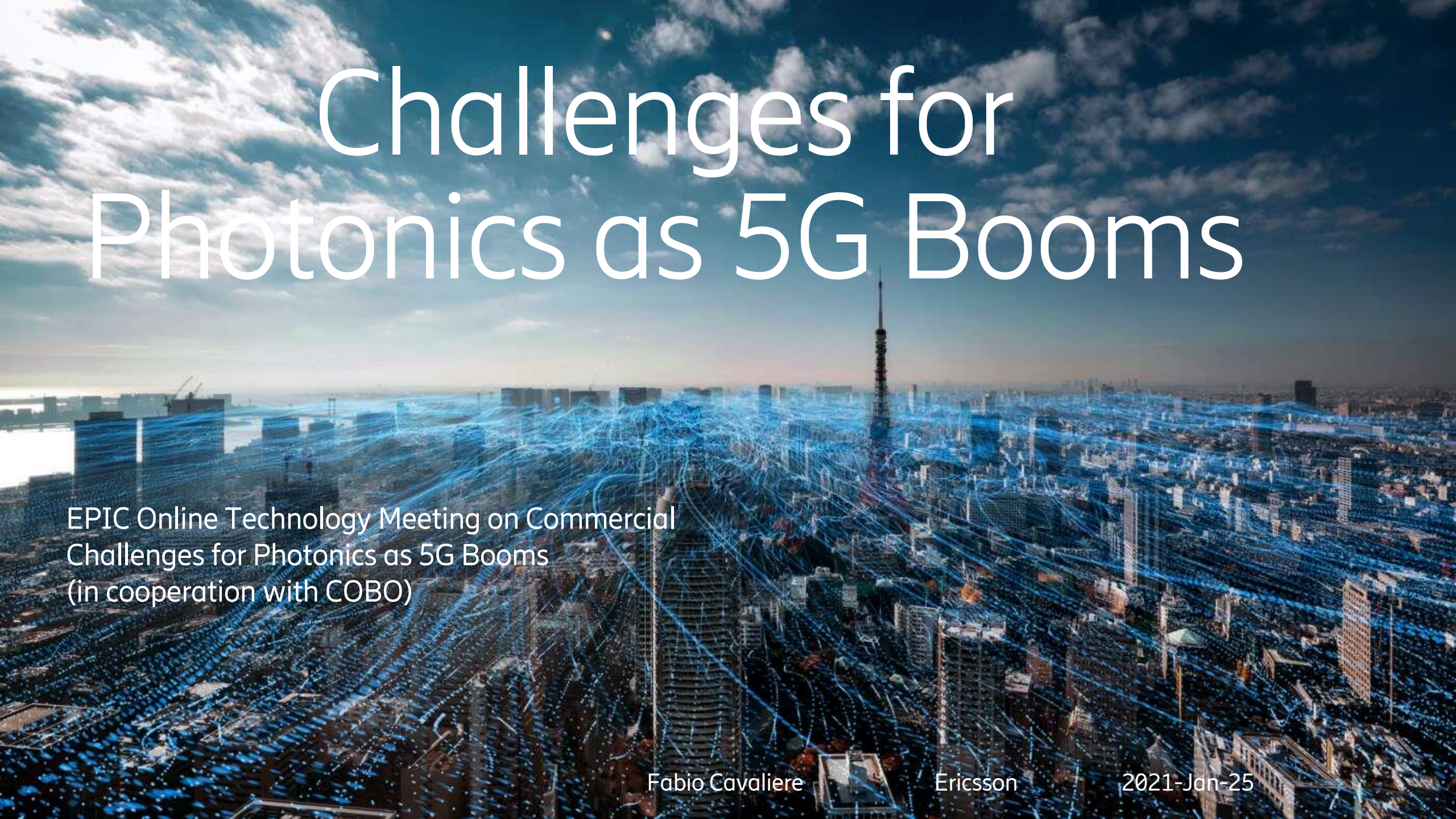
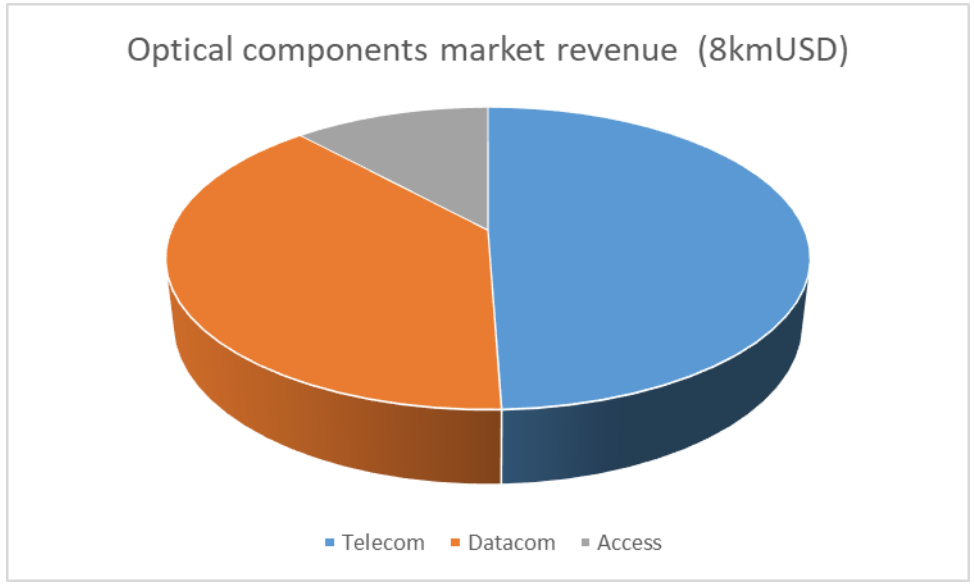


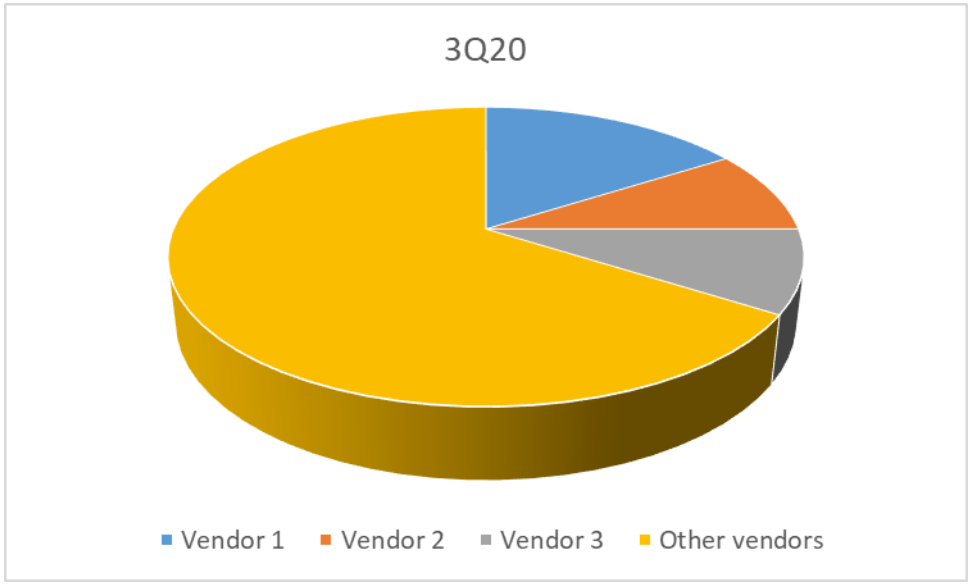
Challenges for Photonics as 5G Booms

EPIC Online Technology Meeting on Commercial Challenges for Photonics as 5G Booms
(in cooperation with COBO)

Fabio Cavaliere Ericsson 2021-Jan-25

The optical components market





Telecom= wide area networks (WAN), including amplifiers and ROADM
Datacom= components for data centers, enterprise, and LANs
Access= FTTx and CATV

- The optical components market is a healthy but fragmented market, where competition fosters innovation but also poses profitability challenges
- It is dominated by telecom (moderate volumes, higher cost) and datacom (higher volumes, lower cost) products: where does 5G fit?

The mobile transport network

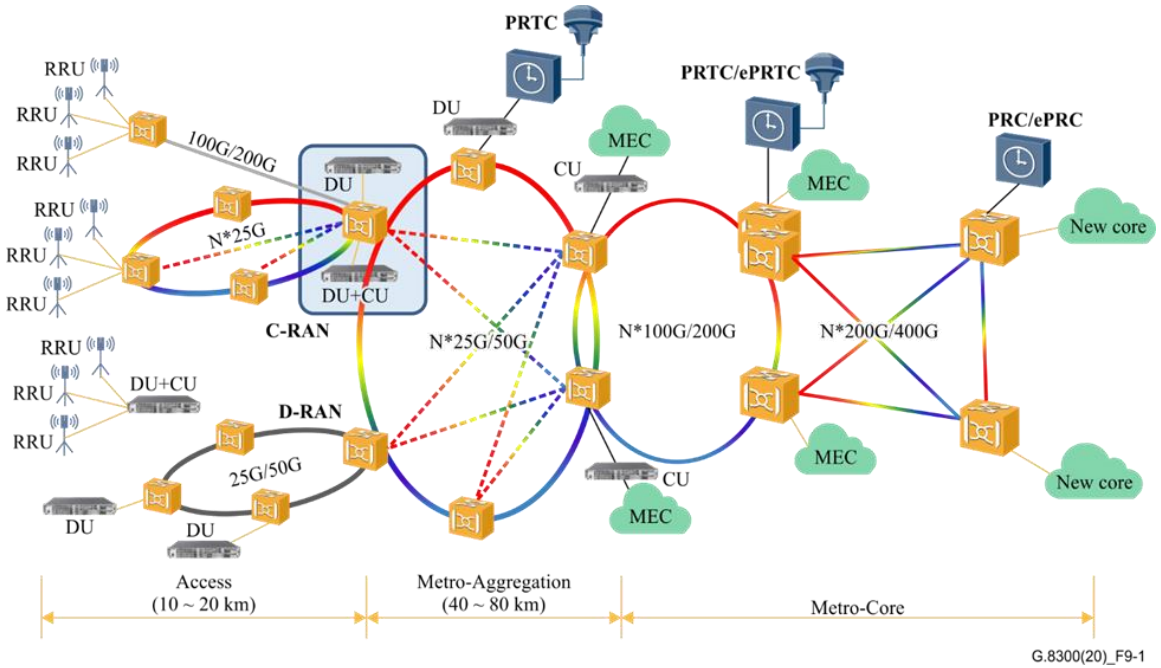
5G led to the introduction of a new "mobile transport network" segment, with its own peculiarities

- Short distances, as in access networks
- High capacity and multiple topologies, as in WANs
- New advanced features, such as self-configurable components and low latency transmission and switching.

What does it imply for optical components?

- Potential product volumes are high, as in datacom
- Target cost is low, as in access
- Required features are demanding, as in WAN

Example of mobile transport network topology, from ITU-T Recommendation G.8300



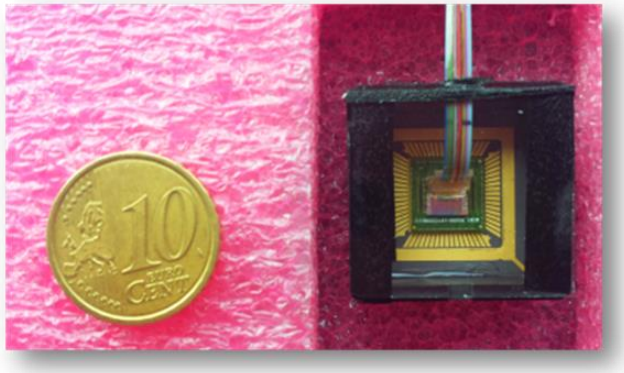
5G requires new optical components: the high volumes make the business opportunity appealing but initial investments and risks are big too

- Standardization, multi-source agreements, pilot lines for prototypes, public co-funding are possible tools to mitigate the risk and accelerate the introduction of such new technologies

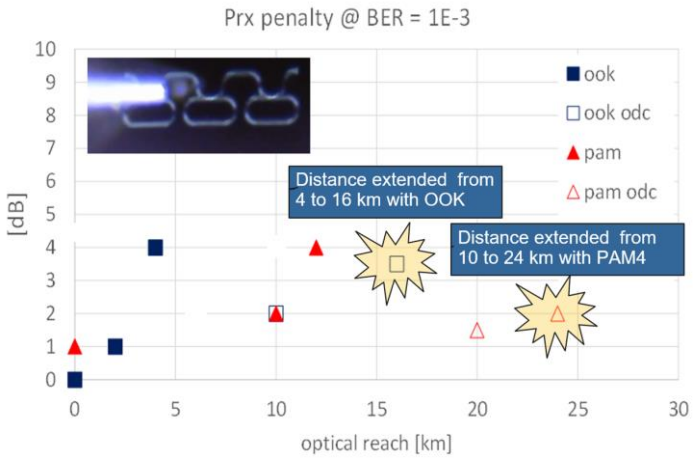
Examples of new enabling optical technologies for 5G transport

- Self-tunable, multi-vendor interoperable, bidirectional DWDM SFP28 (e.g., based on ITU-T G.698.4)
- Ultra cost-effective bidirectional "grey" SFP28 for very short distances (<2km)
- Cost-effective 100G (400G later) coherent optical interfaces targeting short distances (~20 km)
- High speed (50-200G) direct detection optical interfaces, enabled by:
  - New modulation formats
  - Tunable chromatic dispersion compensators in integrated photonics
  - Advanced receiver architectures
- Small form factor, cost effective ROADMs based on silicon photonics
- Integrated photonics, tunable optical filters, e.g., for WDM overlay over PON

Packaged mini-ROADM



50G reach with a 3 micro-rings dispersion compensator



Integrated photonics ecosystem challenges

- Integrated photonics, especially silicon photonics, is a key enabling technology for all those new developments, but …
  - Multi-project wafers are ideal for proof-of-concept demos but not for products or engineered prototypes
  - No widely accepted standards and design libraries exist for PICs, as for electrical ICs
  - Silicon fabs are reluctant to divert resources on products with much lower volumes than the consumer market, which is their cash cow
  - Skills such us co-packaging with high-speed electrical ICs and III-V/Si integration are not so common yet
  - Different business models exist (see picture) and choosing one is not obvious
- In Europe there is a unique knowhow that could lead to significant industrial impact but more coordination and resource sharing among the various initiatives is needed.

TRL	Short description	Delta cost
1	Basic principles observed and Technology concept formulated	-
2	Simulations and feasibility (including first design)	$
3	Experimental proof of concept	$
4	Technology validated in a research lab	$
5	Technology validated in industrially relevant environment	$$
6	Technology demonstrated in industrially relevant environment	$$$
7	System prototype demonstration in operational environment	$$$
8	System complete and qualified , ready for product release	$$$$
9	Actual system proven in operational environment, ready for product ramp up	$$$$