
**Workshop**

Moving from optical components in RAN to optical components for RAN

Sunday, 18th September 2022

*Organiser*: Fabio Cavaliere, Ericsson, Italy

# Unlocking Open RAN Opportunities with Optical Networks

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**Orange Innovation Networks – Fixed Access Networks**

5GComplete

MARSAL

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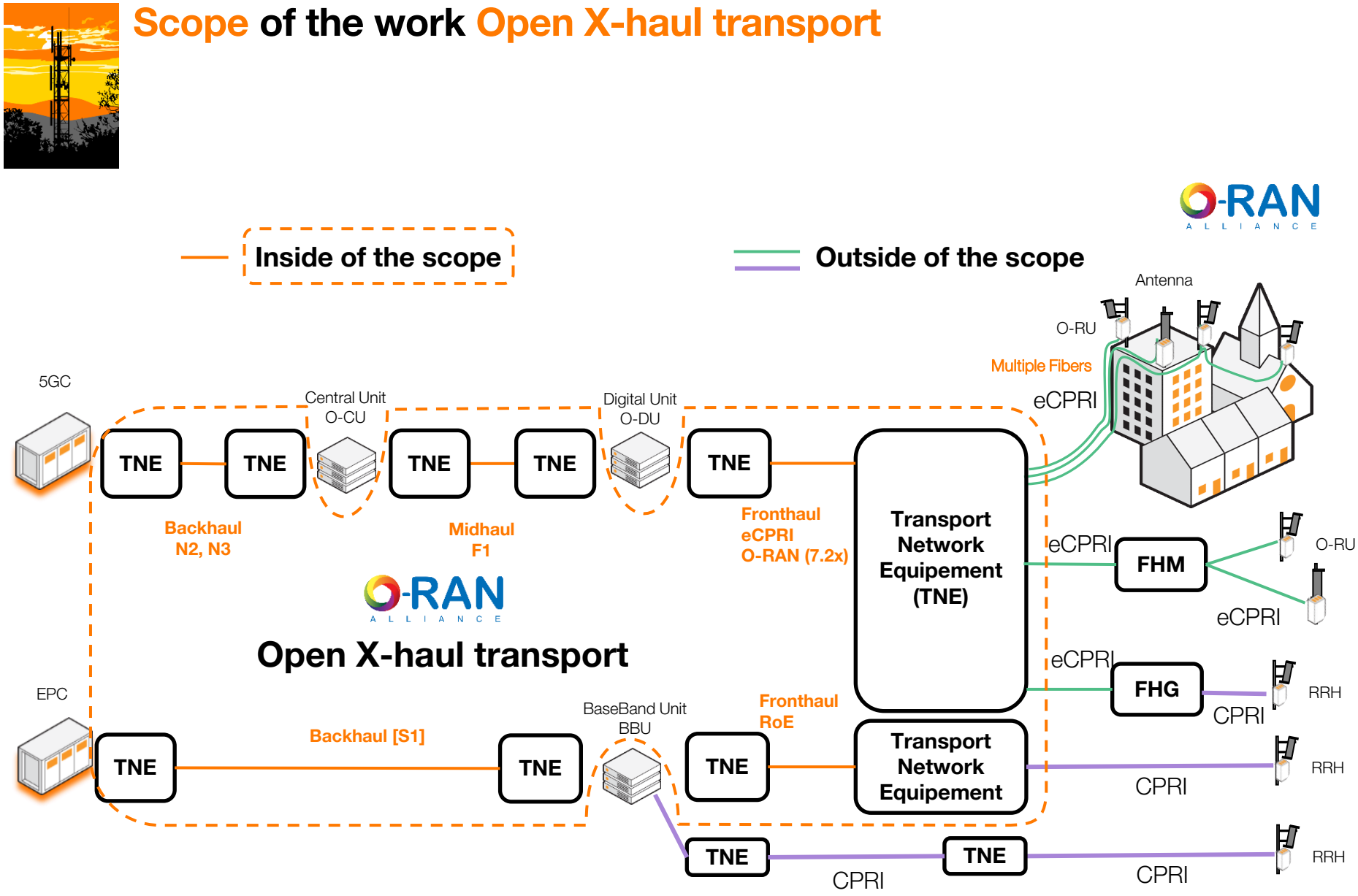
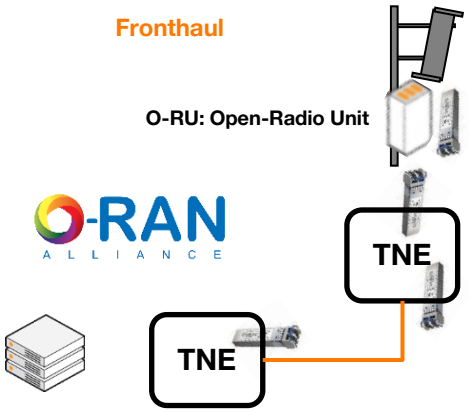
# Scope of the work Open X-haul transport



# O-RAN enable a more competitive and interoperable supplier ecosystem

Fronthaul

O-RU: Open-Radio Unit



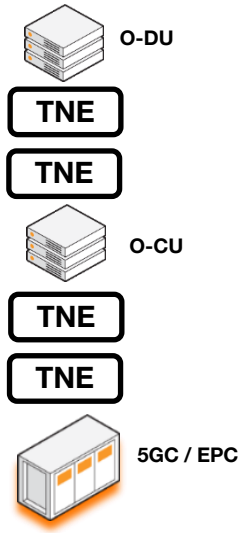

O-DU: Open-Digital Unit

Open purchasing based on interoperability

Vendor O-RU
Vendor transceiver
Vendor transceiver
Vendor O-TNE
Vendor transceiver
Vendor transceiver
Vendor O-TNE
Vendor transceiver
Vendor transceiver
Vendor O-DU

Vendor O-DU
Vendor transceiver
Vendor transceiver
Vendor O-TNE
Vendor transceiver
Vendor transceiver
Vendor O-CU
Vendor transceiver
Vendor transceiver
Vendor O-TNE
Vendor 5GC / EPC

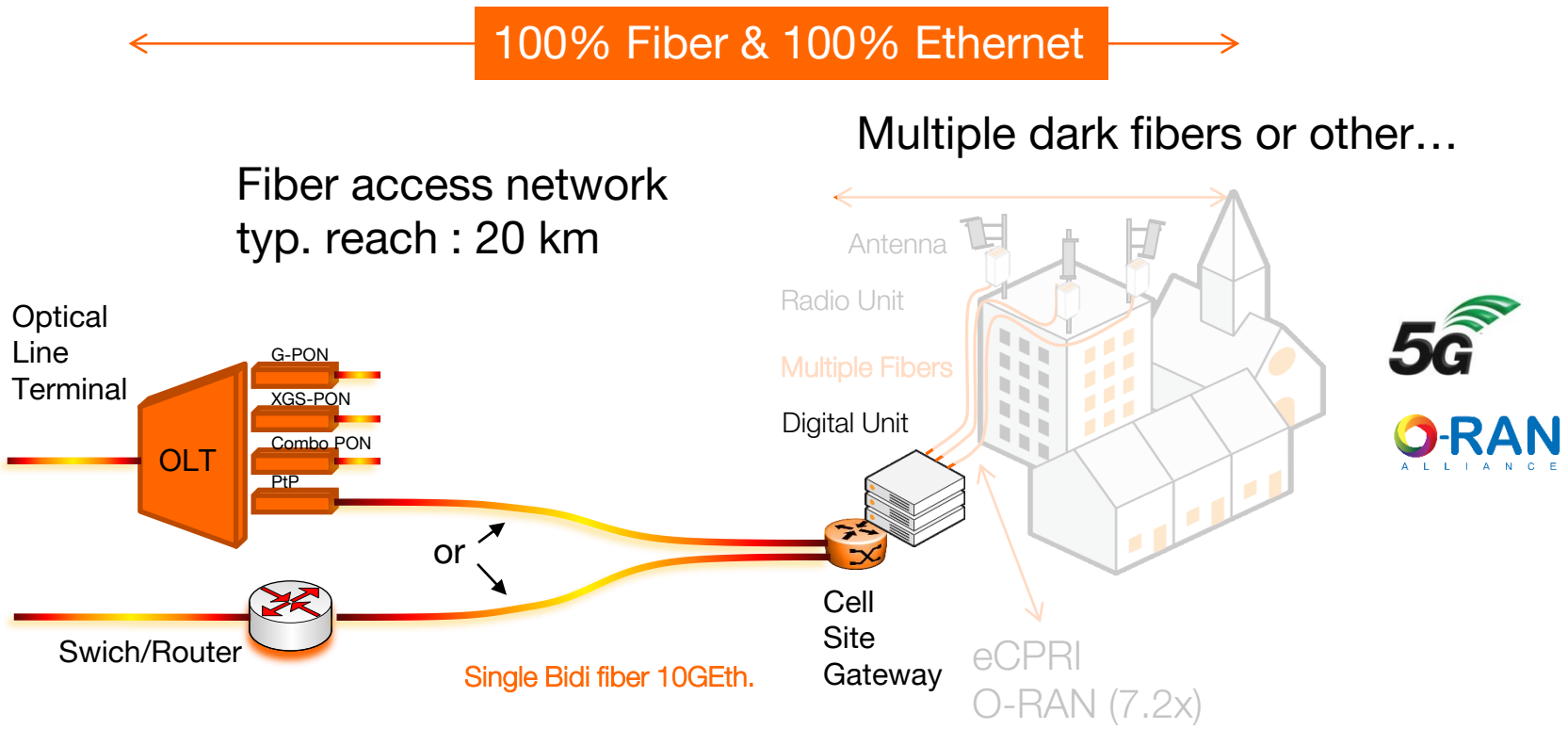
Mid-&back-haul




**Transceiver and transport equipment operations must allow to be able to be carried out by diverse and several network actors:**
**- interoperability & certification is a must**
**- common technical specification required for limited combination of transceivers & equipment : ex. MOPA initiative for transceiver**

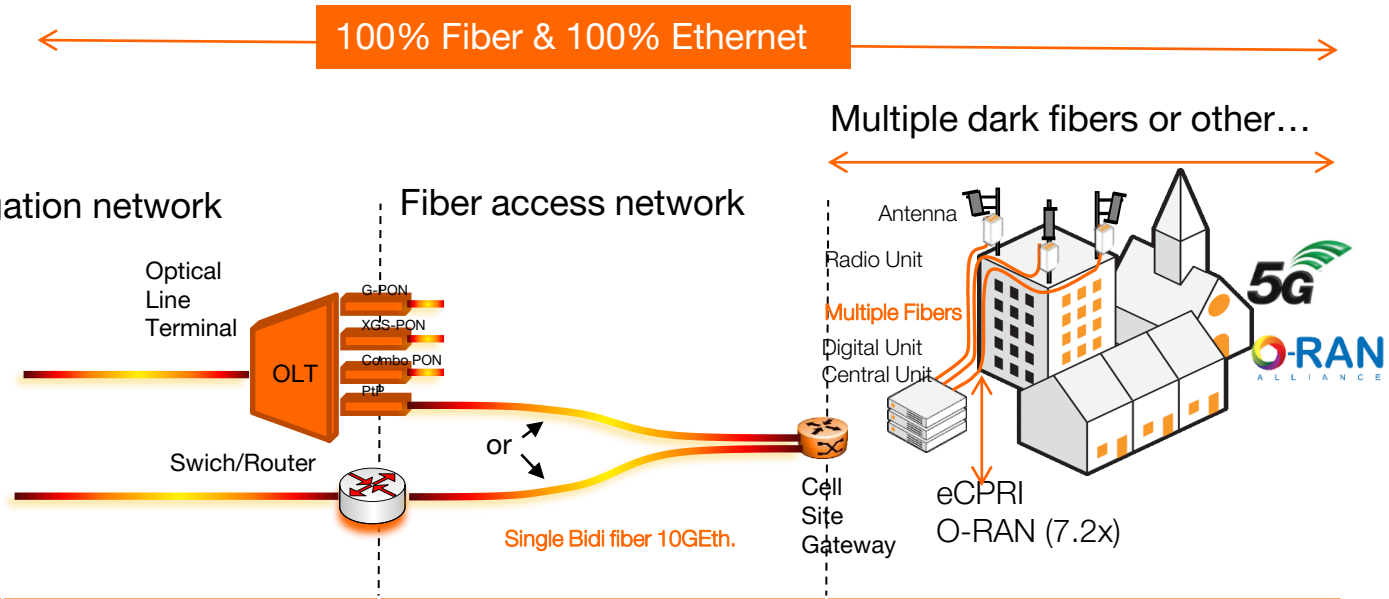
*O-TNE : Open Transport Network Equipment*

# Fiber goes further and further with 5G : back- & mid-haul




Legacy backhaul is based on PtP Ethernet 10GEth with PtPv2 synchronization feature, in future 25GEth.
Cell site gateway is connected with either Switch/Router, or PtP OLT port.

# Fiber goes further and further with 5G : back- & mid-haul



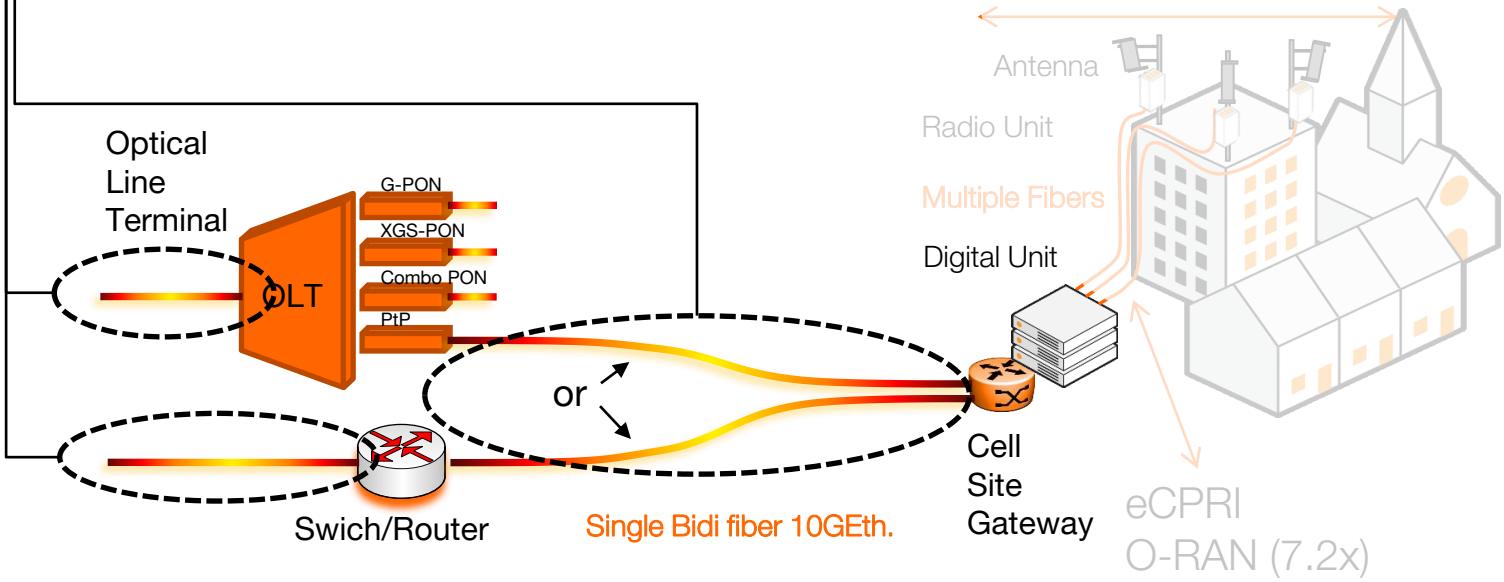

| | Backhaul aggregation (mesh) | Backhaul access (typ. 10 km) (PtP, option: dual adduction) | Fronthaul (local < 2km) (N x PtP links] |
|---|---|---|---|
| Now | 100Gbit/s [bidirectional recently available] | Bidirectional 10Gbit/s | N = number of RU interfaces<br>N x 10 or 25 Gbit/s ≈ 100 Gbit/s |
| Future | 200, 400, 800Gbit/s [bidi. not available] | 25Gbit/s and 100Gbit/s | RU interface = 100 Gbit/s |

# Fiber goes further and further with 5G : back- & mid-haul


What is coming and missing?

Transceiver for single fiber operation:

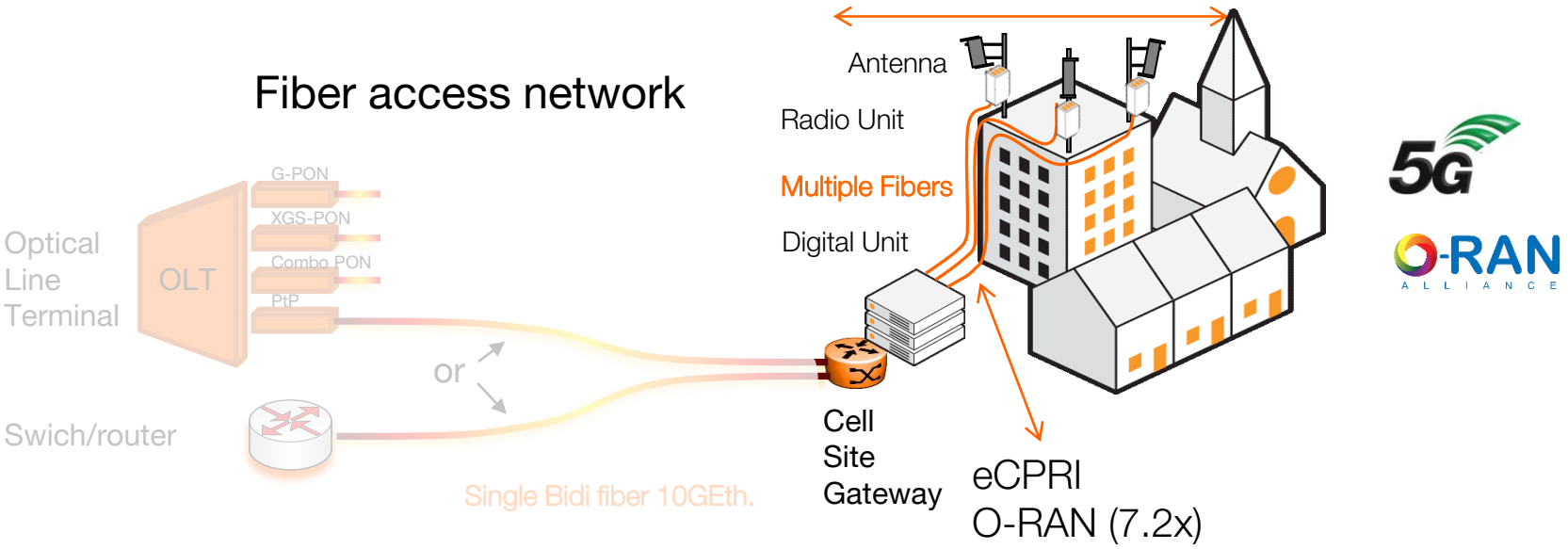
- For uplink (aggregation link) :
  - For now: 100Gbit/s bidirectional (single fiber) transceiver (20 km and 40 km) Not available, but first “samples” based on100Gbase LR1 (10km) and ER1 (40km) bidirectional. Waiting the maturity of ITU-T G.9806Am3 for Class S (0-15dB/10km) and B (10-23 or 25dB/40km) operations
  - For future: 200, 400, 800 Gbit/s : not available
- For last miles (access segment)
  - For now: 10Gbit/s and 25Gbit/s bidirectional (single fiber), Available (G.9806)
  - For Future: 100 Gbit/s, not available for industrial temperature



# Fiber goes further and further with 5G : fronthaul

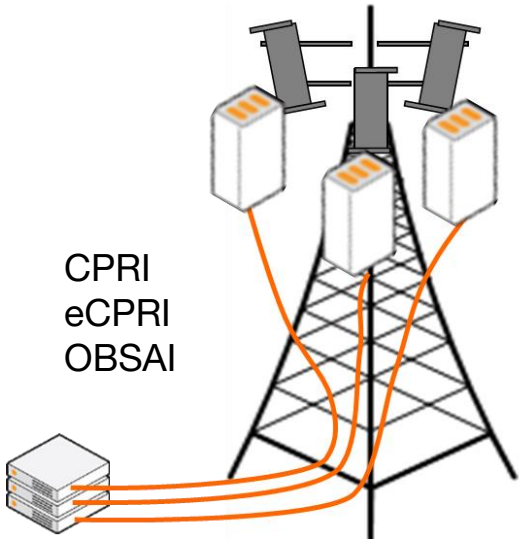
100% Fiber & 100% Ethernet

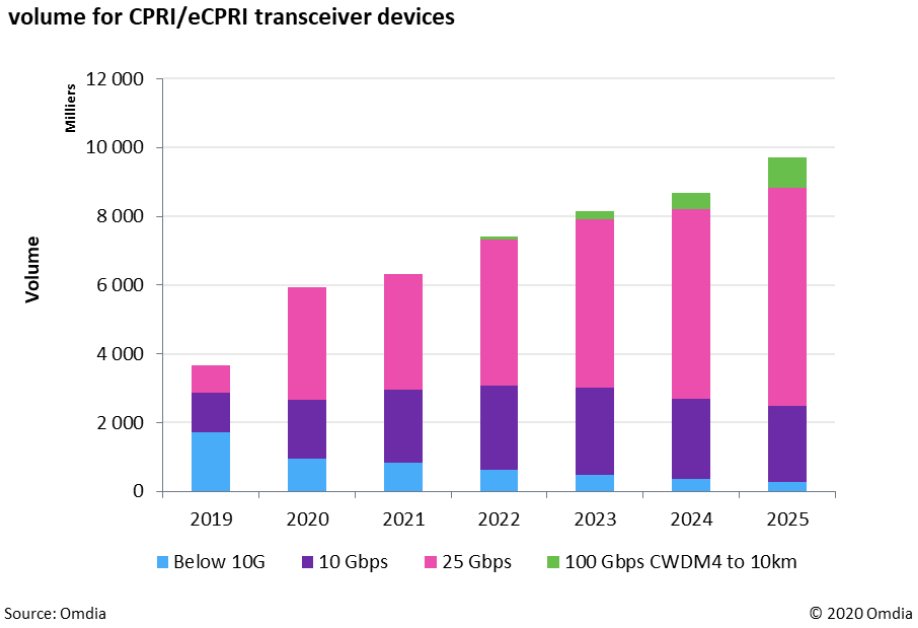
Multiple dark fibers or other…



# Fiber goes further and further with 5G : fronthaul

## Existing transceivers in fronthaul 5G markets

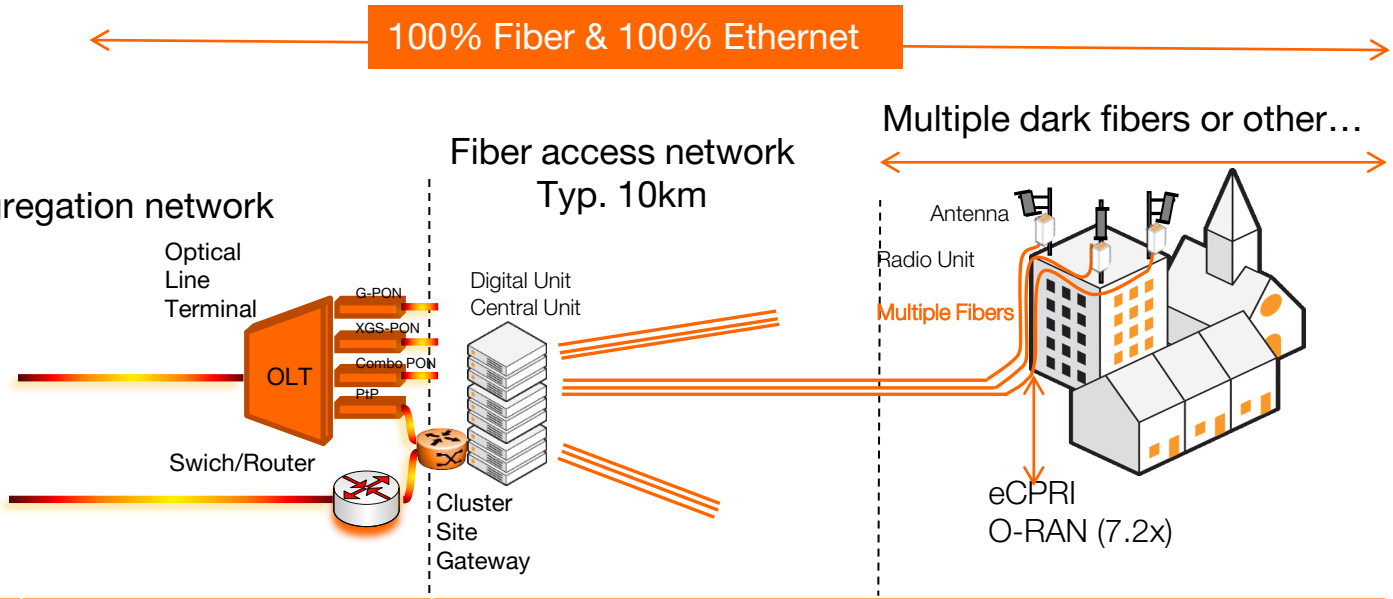



Observation :

- 25G is dominant in coming years
- we have to consider 10, 25G and 100G transceivers in our fronthaul footprint

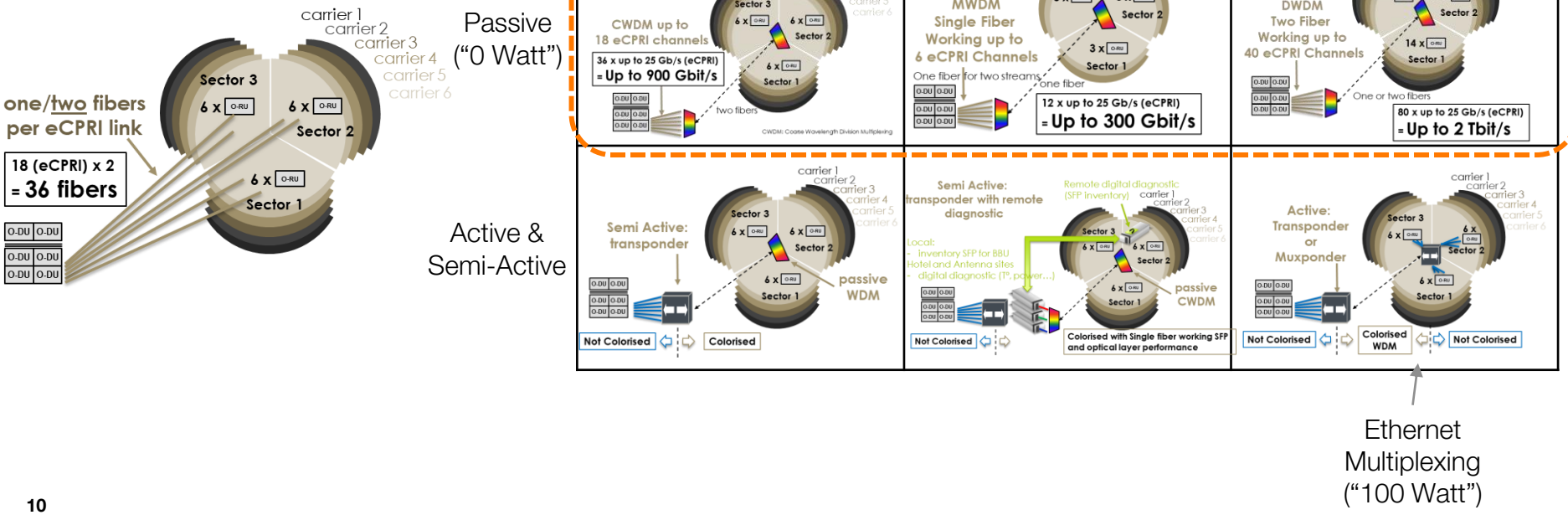
# Fiber goes further and further with 5G centralized (fronthaul extended)




| | Backhaul aggregation (mesh) | Fronthaul access and local (typ. 10 km) (PtP, WDM) |
|---|---|---|
| Now | Multiple 100Gbit/s | N = number of RU interfaces; P = number of Antenna site<br>N x P x 10 or 25 Gbit/s ≈ 1 Tbit/s |
| Future | 200, 400, 800Gbit/s [bidi. not available] | RU interface = 100 Gbit/s |

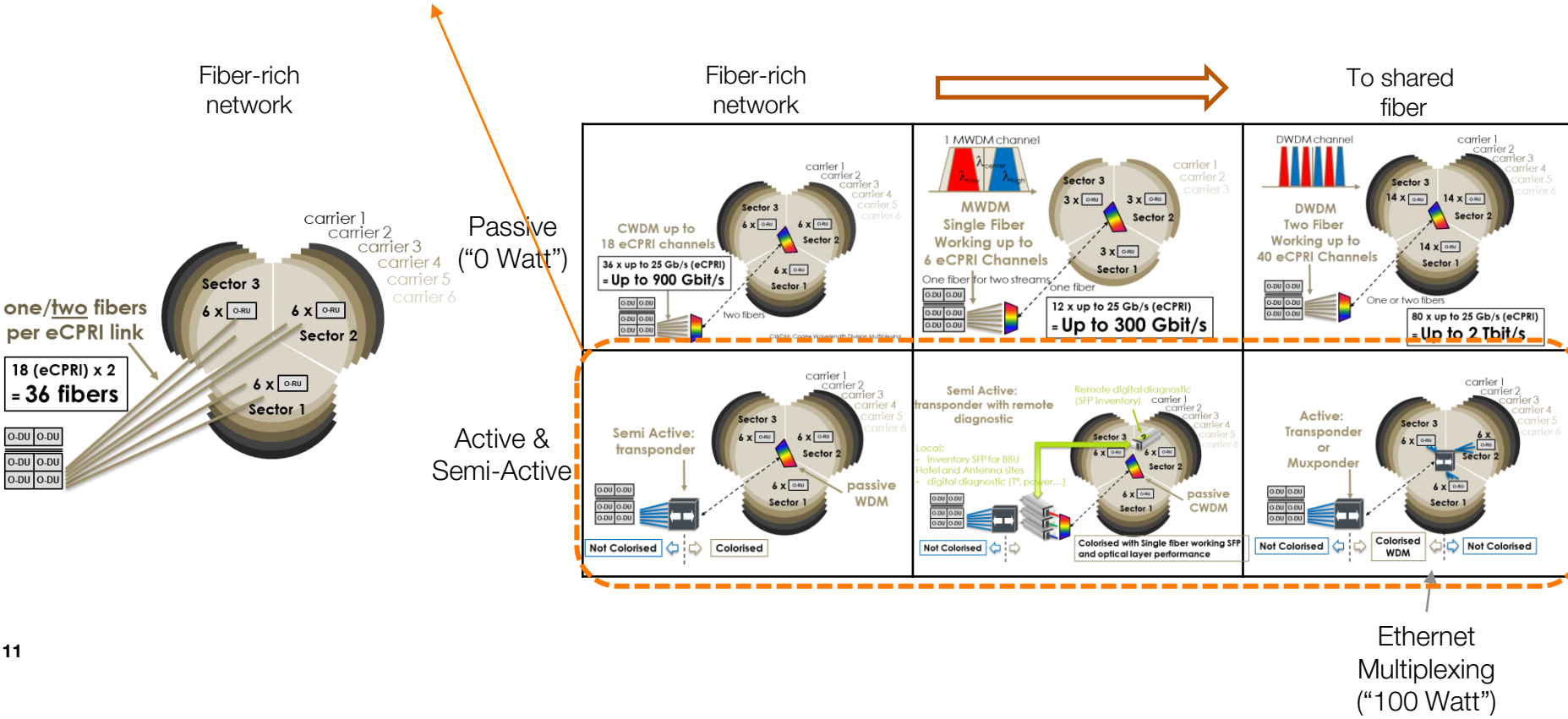
# Existing passive optical transport solution for outdoor Mobile fronthaul

- **“0 Watt” solution (passive) is used to save fiber between cell sites and central office node**
- **Fiber and wavelength allocation are not line rate dependent**
- **Potential complex colorized transceiver operation**
- **No dedicated transport management (passive demarcation point)**
- **Required dark fiber offers (by wholesale or other)**

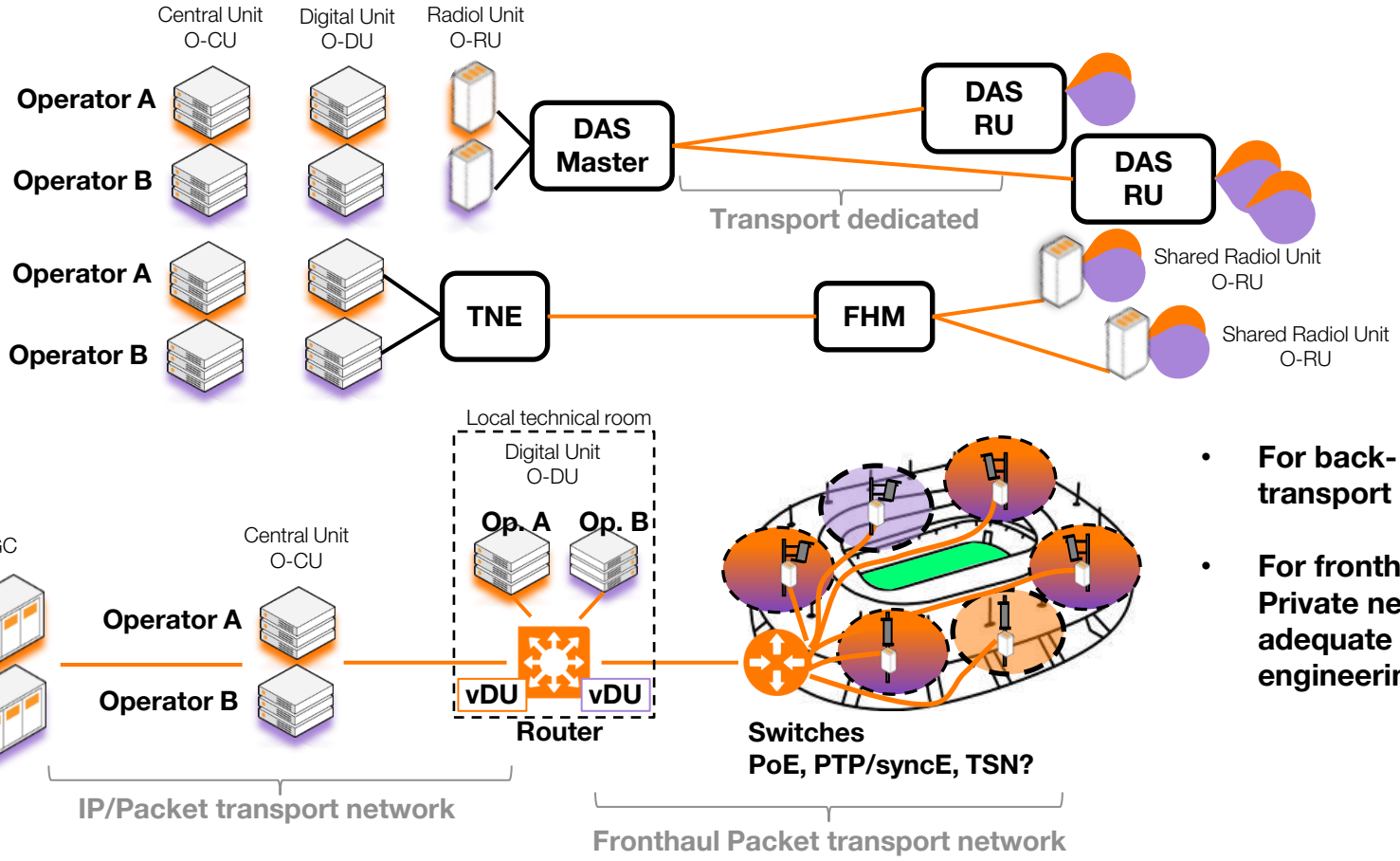


# Existing active optical transport solution for outdoor Mobile fronthaul

- Active solution (about 100 watt) is used to save fiber between cell sites and central office node
- Grey optical transceivers operations (low cost vs. colorized transceivers)
- Ports, card & shelf are line rate and protocol dependents (renewal of transport equipment to be planned cyclically)
- Interoperability between providers
- Potential special features required: time sensitive, slice management,…
- Transport management allowing to provide demarcation points with KPI



# Overview of a transport solution for indoor Mobile




- **For back- & mid-haul transport : no challenges**
- **For fronthaul transport: Private network with the adequate dimensioning and engineering rule.**

# Conclusion

## key points for X-haul transport

1. Control the transceivers combinations

2. Bidirectional (single fiber) 100Gb/s is a must.

3. Extended Fronthaul transport:
   - country wholesale or fiber operation dependent
   - Active and passive solutions

4. For indoor RAN, traditional transport equipment could be reused (private network)

# Thank You

*Acknowledgments European projects:*
*5G-COMPLETE and MARSAL*