



Hollow Core Fiber for Mobile

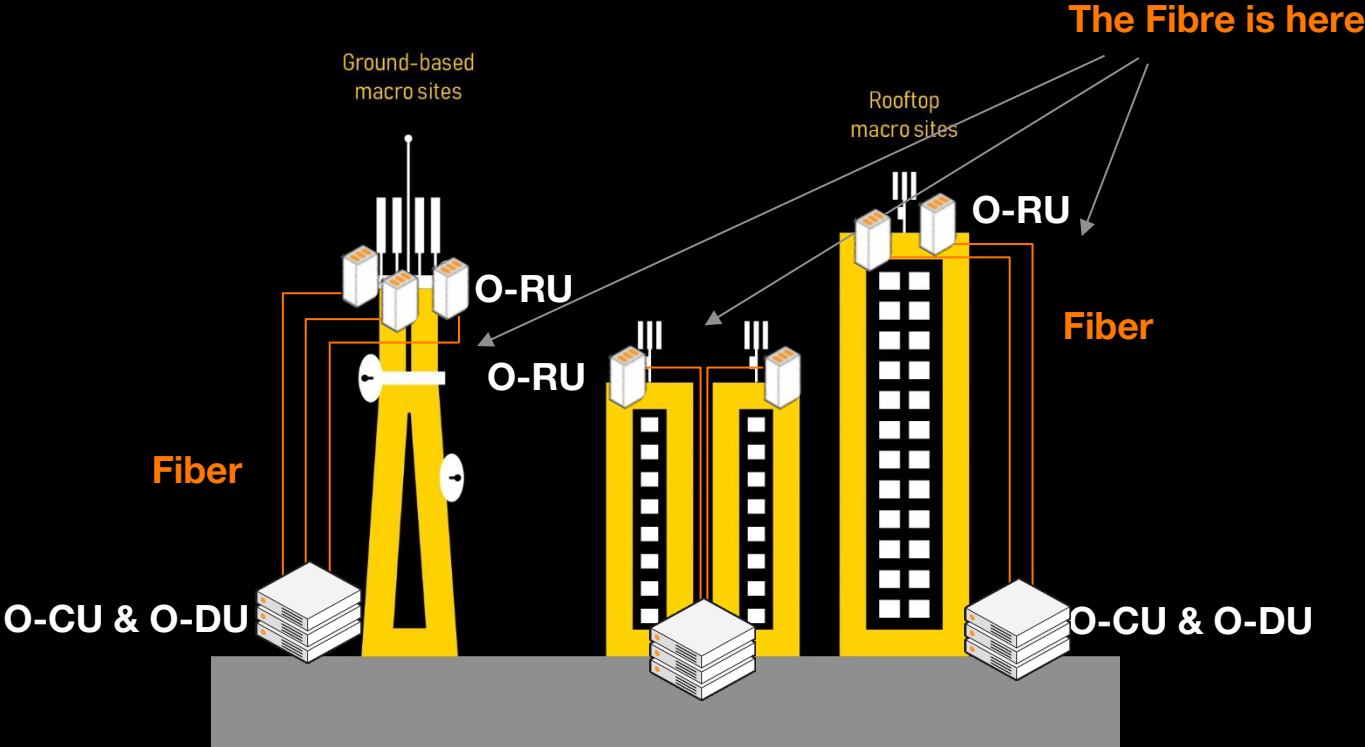
The fiber journey for Mobile

28th September 2025

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Orange Innovation/Networks/WNI/FUN, Lannion, France



The fiber journey for Mobile : Fronthaul



The fiber journey for Mobile : Fronthaul

Fronthaul in distributed RAN

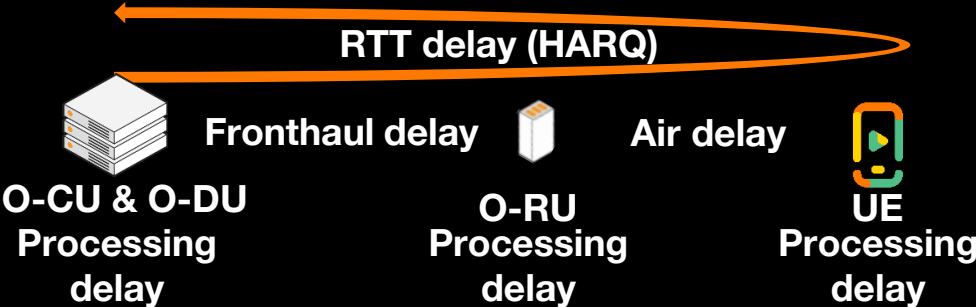
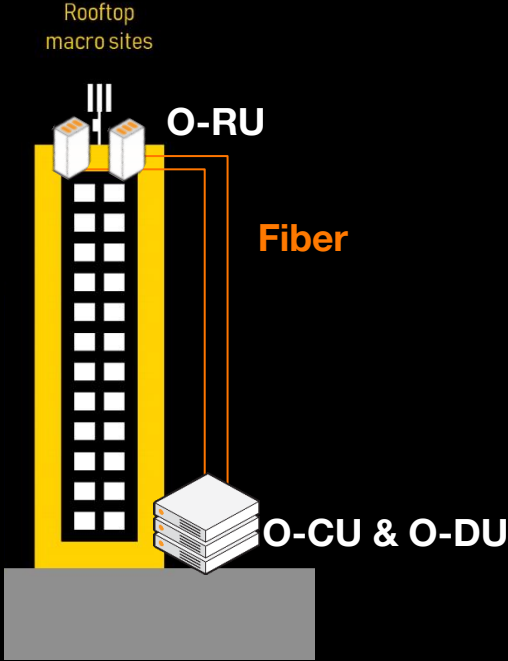
Fiber path < 1km

Hollow core fiber for what?

To decrease latency to 5 μs at 3,3 μs : 1,7 μs gain

It is relevant for :

- more time for O-DU and/or O-CU processing
⇒ time for local adaptive IA?
- more coverage for RF signal between UE and O-RU
⇒ 1,7 μs = 500 m more air delay : Radio coverage



The fiber journey for Mobile : fronthaul

Fiber in Distributed Antenna System

Fiber path 20 km or more

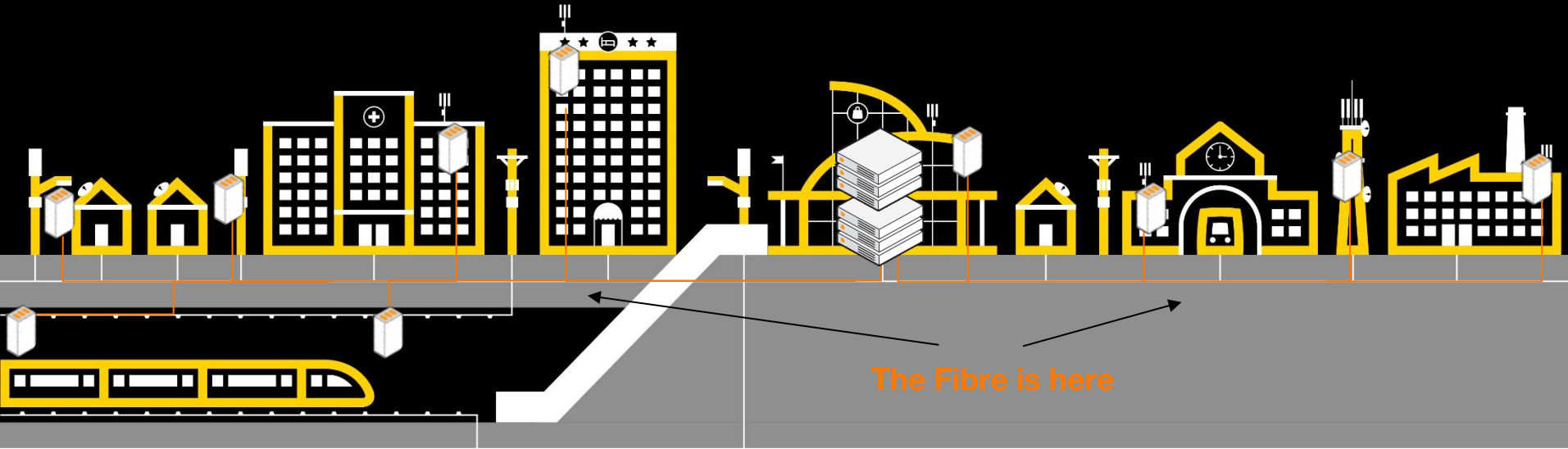
Ex. RAN sharing in tube lines, airport, stadium...

Hollow core fiber for what?

To decrease latency to 50 μ s at 33 μ s : 17 μ s gain

It is relevant for :

- more fiber coverage
- \Rightarrow 17 μ s = 5 km more fiber delay



The fiber journey for Mobile : Backhaul (Midhaul)

Fiber in optical access backhaul

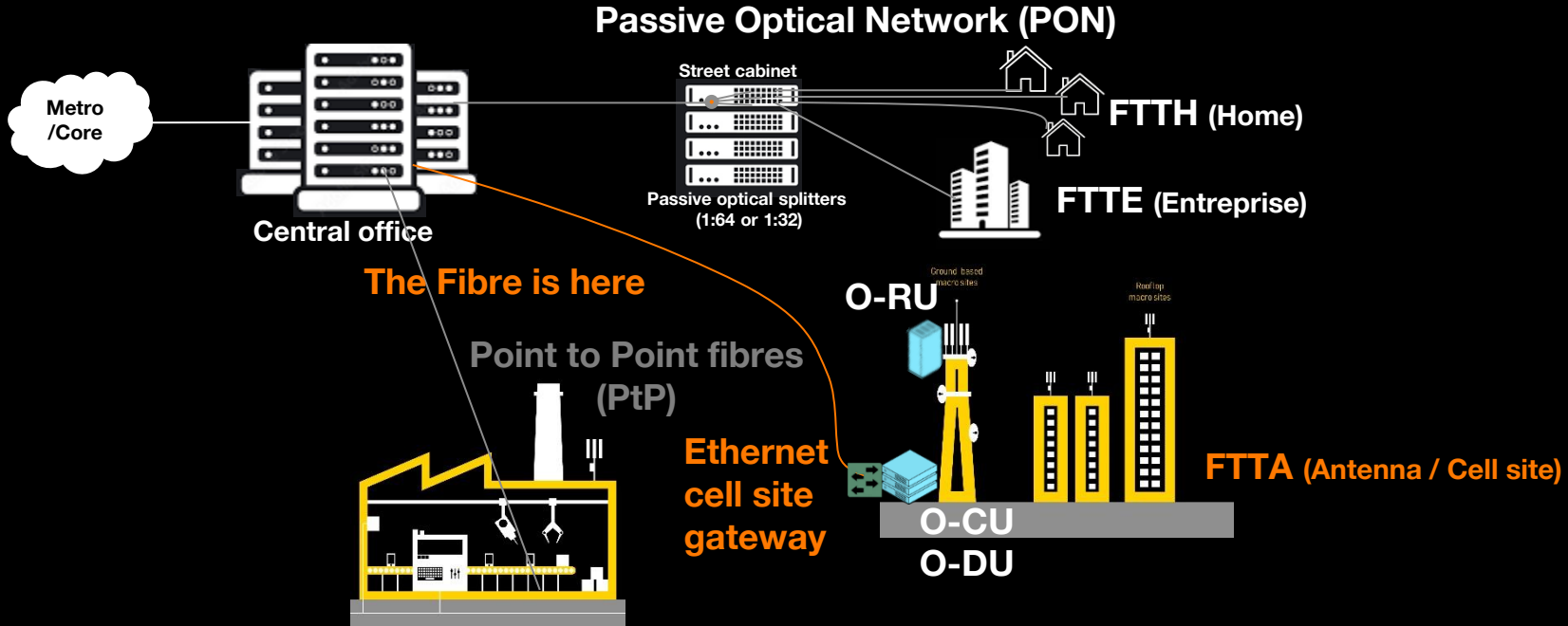
Fiber path typ. 20 km

Ex. PtP bidirectional link at 10Gbit/s

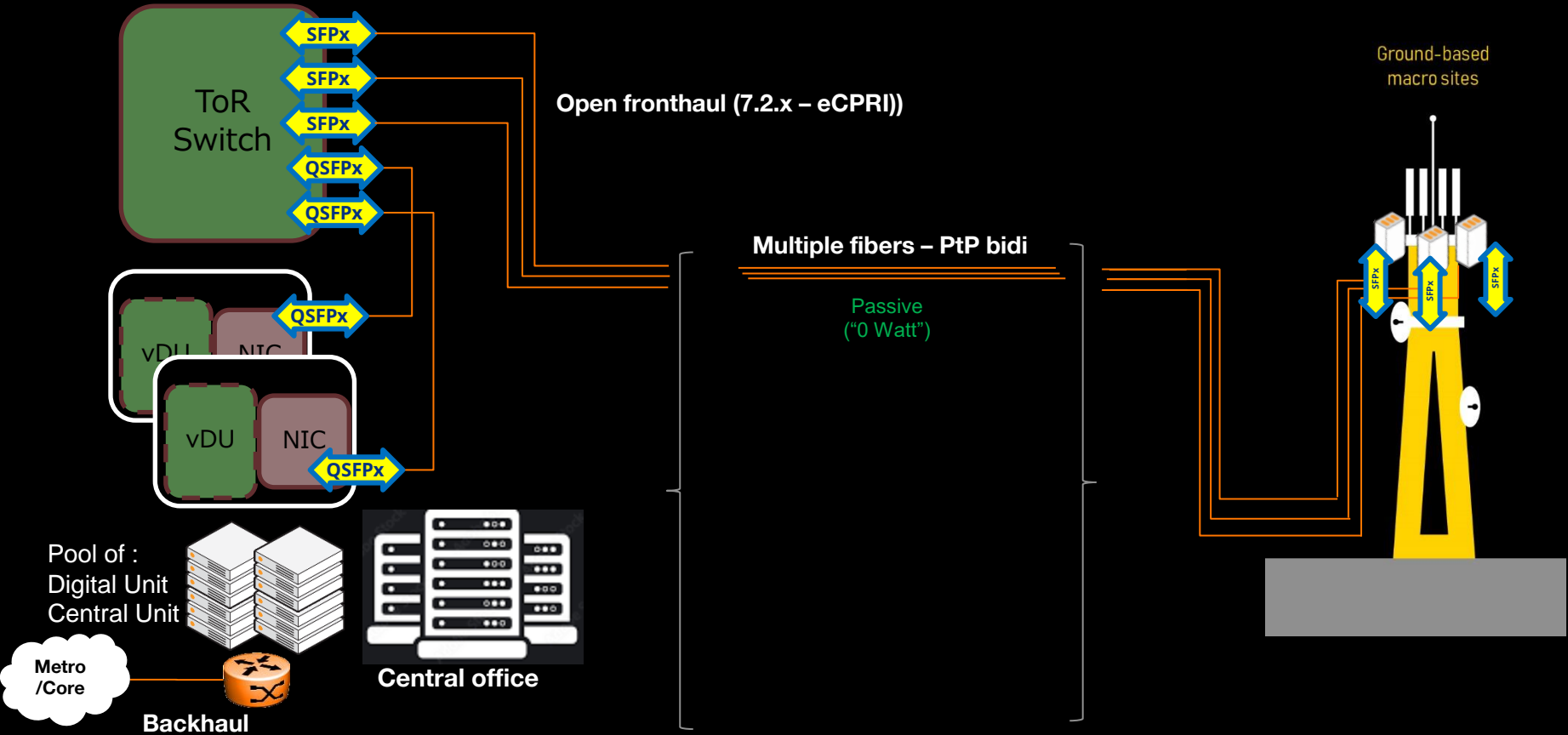
Hollow core fiber for what?

To decrease latency to 100 μ s at 66 μ s : 34 μ s gain

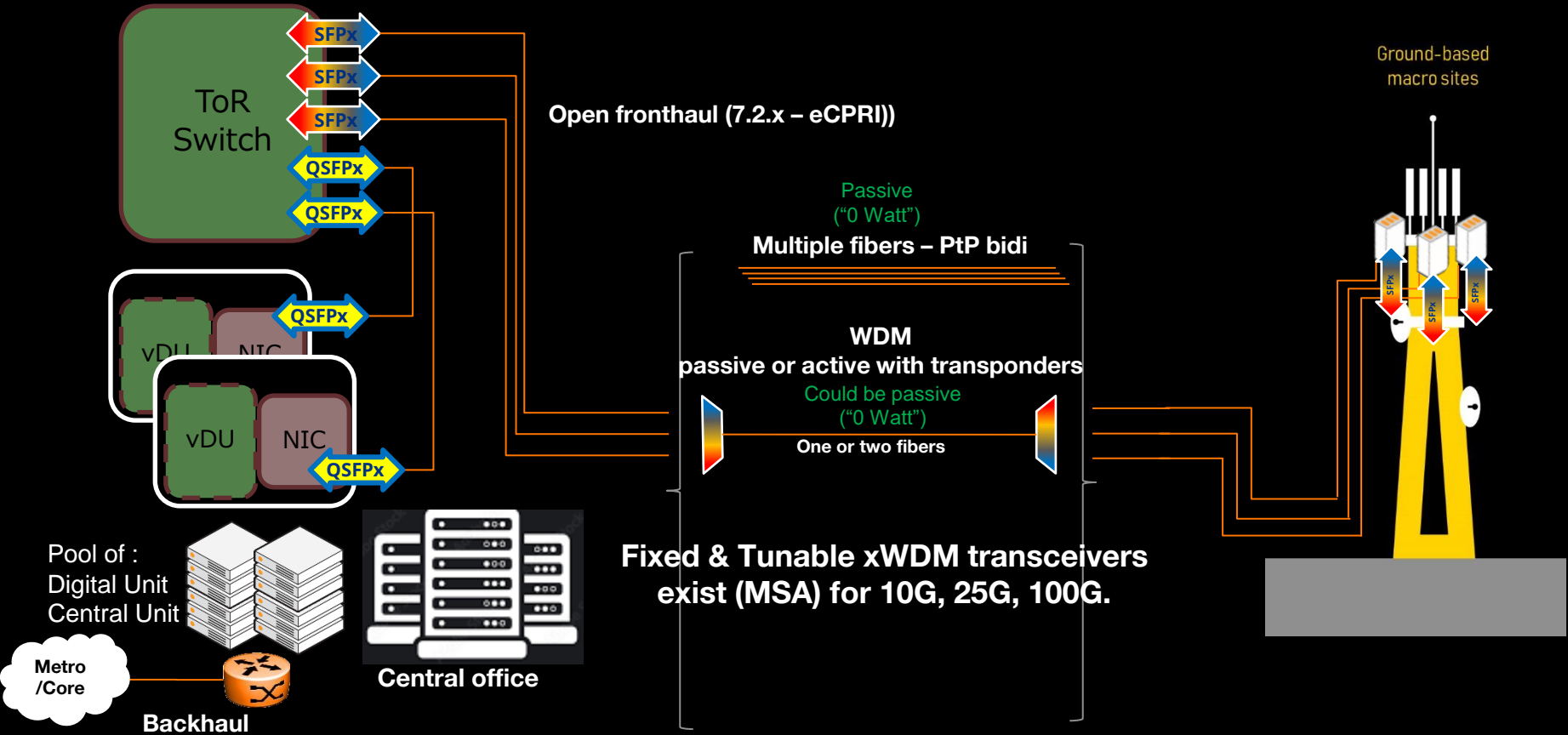
It is not relevant for backhaul (E2E backhaul about few ms).



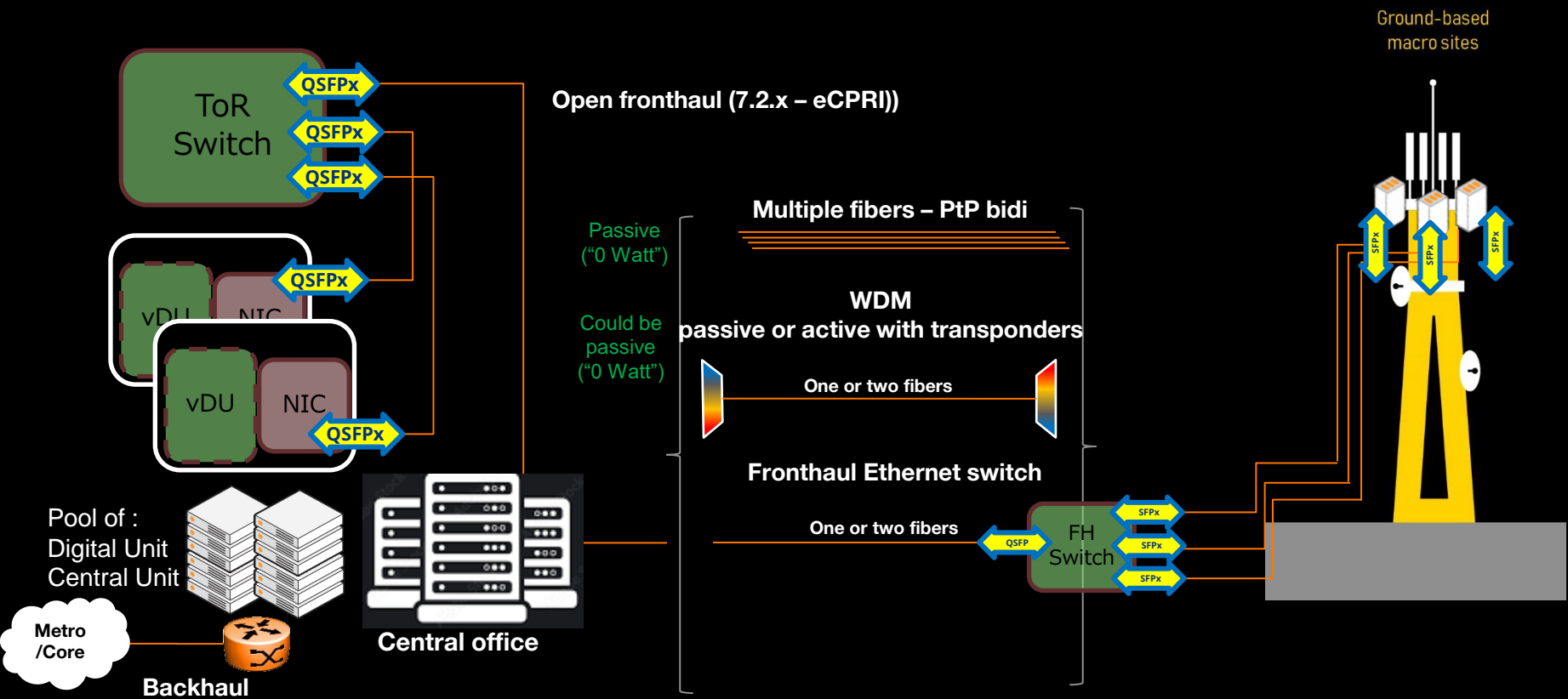
The fiber journey for Mobile : Centralized RAN (fronthaul)



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The fiber journey for Mobile : Centralized RAN (fronthaul)

Fiber in optical access fronthaul for centralized RAN

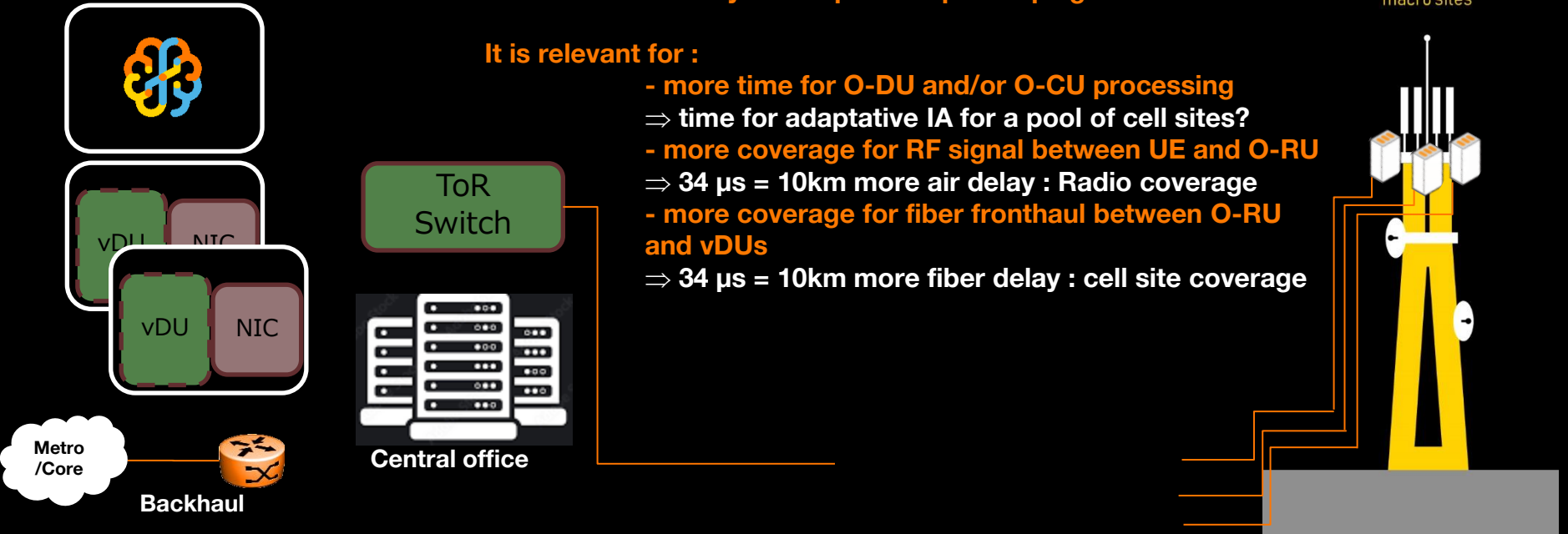
Fiber path typ. 20 km

Hollow core fiber for what?

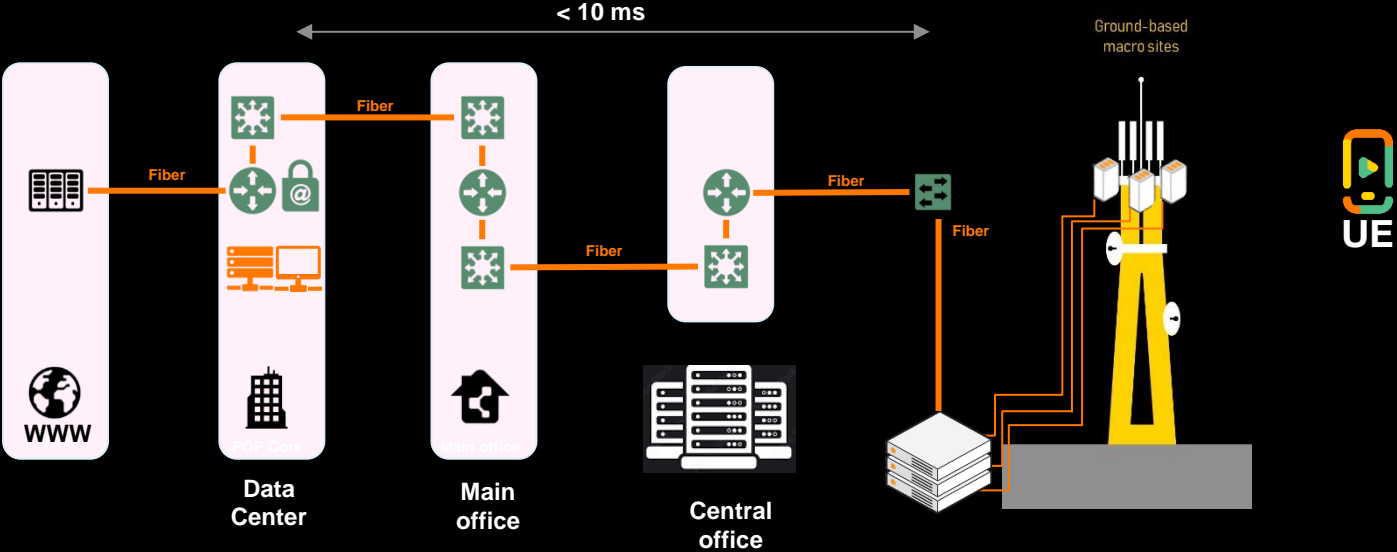
To decrease latency to 100 μ s at 66 μ s : 34 μ s gain

It is relevant for :

- more time for O-DU and/or O-CU processing
⇒ time for adaptative IA for a pool of cell sites?
- more coverage for RF signal between UE and O-RU
⇒ 34 μ s = 10km more air delay : Radio coverage
- more coverage for fiber fronthaul between O-RU and vDUs
⇒ 34 μ s = 10km more fiber delay : cell site coverage



The fiber journey for Mobile : End to End backhaul



Orange Data Centers in France

Our objectives in 2030

Close 17 legacy Data Centers

some functions moved in existing Central Offices
(edge servers & computing)

Keep only 3 new generation DCs

Val-de-Reuil 1 (2012)

Val-de-Reuil 2 (2022)

Amily (2022)

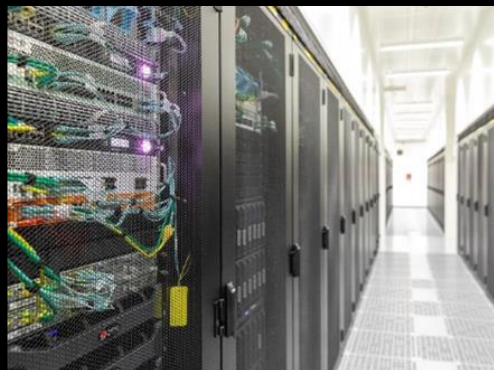


~10.5/12 months in free cooling
reduce by 30 % energy footprint

100% renewable energy with PPA

PUE : 1.3 WUE ~ 0 CUE 0,087

Objective: Net Zero Carbon in 2040



PPA: Purchase Plan Agreement ; PUE, WUE, CUE: Power, Water, Carbon Usage Effectiveness

Dark Fiber business is the most increasing market in DCI

IDC: Datacenter-to-Datacenter Connectivity Services in EMEA

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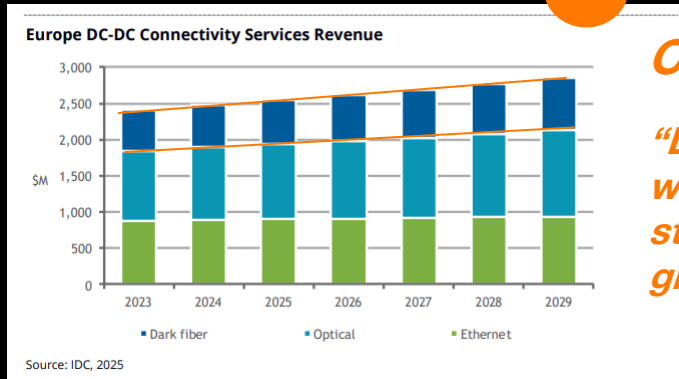
Key Takeaways

- Telcos, digital service providers, and enterprises will all experience growing demand for DC-DC connectivity on the back of higher data volumes, footprint densification, and resilience requirements. The pace is set to accelerate over time as the impact of AI intensifies.
- The choice of a specific type of DC-DC connectivity is typically route-specific and based on availability, cost, requirements for performance, privacy, and security, and in-house ICT capabilities and preferences.
- Revenue for DC-DC connectivity in Europe will grow modestly, as healthy circuit growth — driven by new customers, routes, and resiliency requirements — and even stronger growth in average bandwidth will be partially offset by strong price pressures.
- Network-as-a-service (NaaS) platforms are increasingly appearing in the DC-DC connectivity market. Such platforms typically provide on-demand Ethernet connectivity between their on-net datacenters.

Recommended Actions

- Providers should prepare for the upcoming traffic deluge by working closely with their customers and partners to predict future flows and geographic hotspots and develop investment plans accordingly.
- Service providers in this market should take a proactive approach to adopting NaaS models to drive automation and provide
- Demand for DC-DC connectivity services comes from a wide range of customers with vastly different requirements. Providers should ensure they understand the differences and tailor their offerings to the specific needs of each target segment.

Source: IDC, 2025



CAGR ~4%

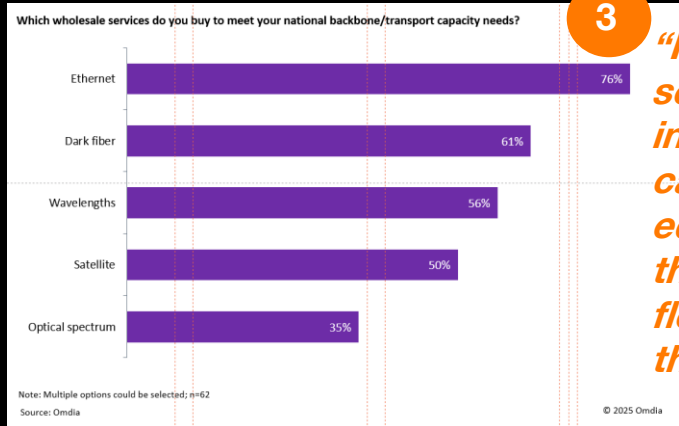
“Dark fiber will show the strongest growth” ...

2

...but “Strong growth will be partially offset by strong price pressure”

Omdia: Wholesale Customer Survey – 2025

3



“Procuring an unlit service like dark fiber incurs opex as well as capex (optical equipment) but gives the provider more flexibility in managing the service.”

The fiber journey for Mobile : CORE RAN – Data Centers

Fiber inside Data Center

Silica multimode Fiber is still common (transceiver short reach transceiver)

Fiber between Data Centers

Dark fiber is more and more required

Hollow core fiber for what?

To decrease latency between CPUs

- indoor cable and patch cord (<500 m)
- outdoor cable between hubs : 1km
- between data centers : 20 to 100 km and more

The AI computing processes that require the most inter-processor communication are generally those involving intensive data exchange to synchronize information and share gradients or parameters:

- ⇒ Deep Learning Model Training
- ⇒ Federated learning
- ⇒ Large Language Models (LLMs)
- ⇒ Distributed Simulation and Modeling



Conclusion



Hollow core fiber is welcome in Mobile applications:

- For local and extended fronthaul
- For Distributed Antenna Systems (RAN and fiber sharing for campus)
- For Data center (related to Mobile Core and IA functions)

Hollow core fiber is welcome with the property :

- Low delay : YES, YES, YES
- Low loss : not the main aspect
- Nonlinearity : not the main aspect
- Low dispersion : why not, but “O-band” is already often used with SMF
- Wavelength Bandwidth : For HCF, it is defined by “design”. The existing 1270 nm – 1675 nm is appreciated.

Merci

Thank you

