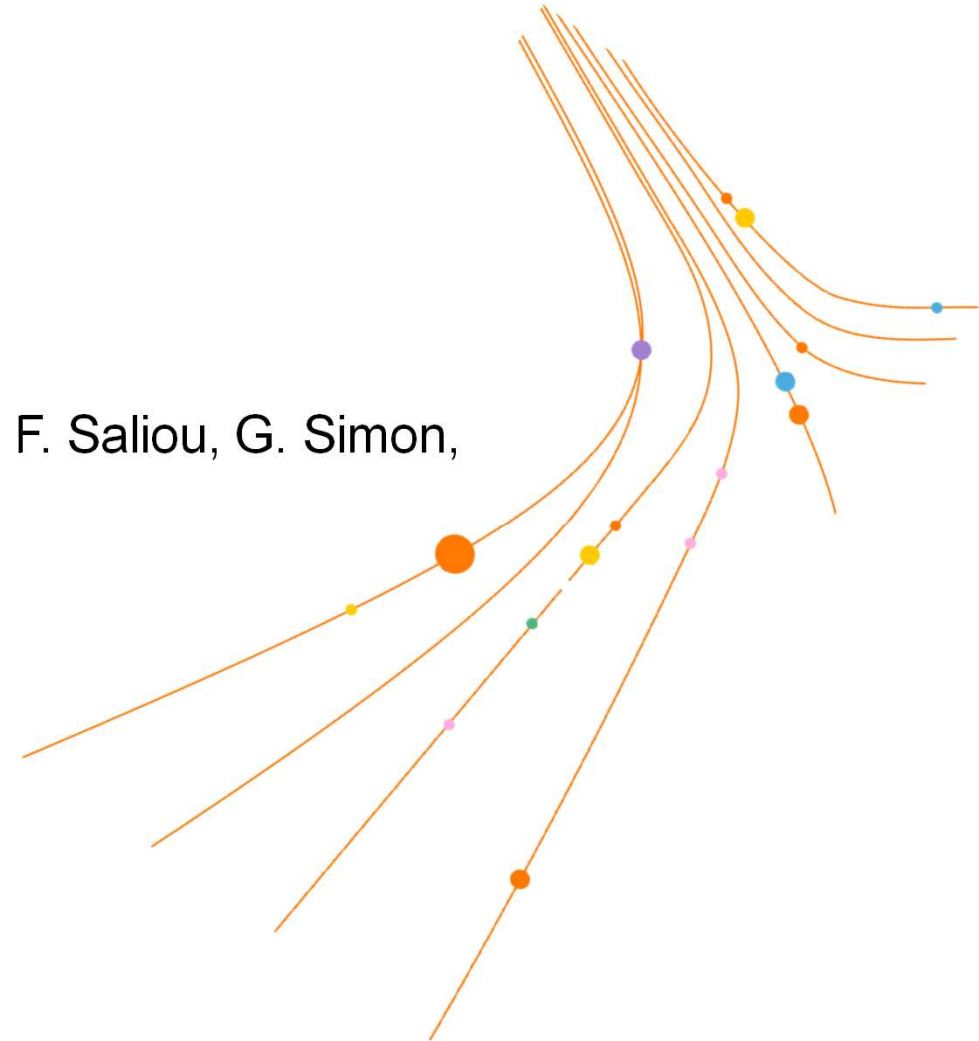


Orange's perspectives on AI and their interrelationship with broadband

P. Chanclou, C. Marais, S. Brunessaux, J. Le Corre, J. L'Escop, J. Potet, F. Saliou, G. Simon,
Workshop - ITU-T ION 2030: Enabling the intelligent optical network era
16th September 2026

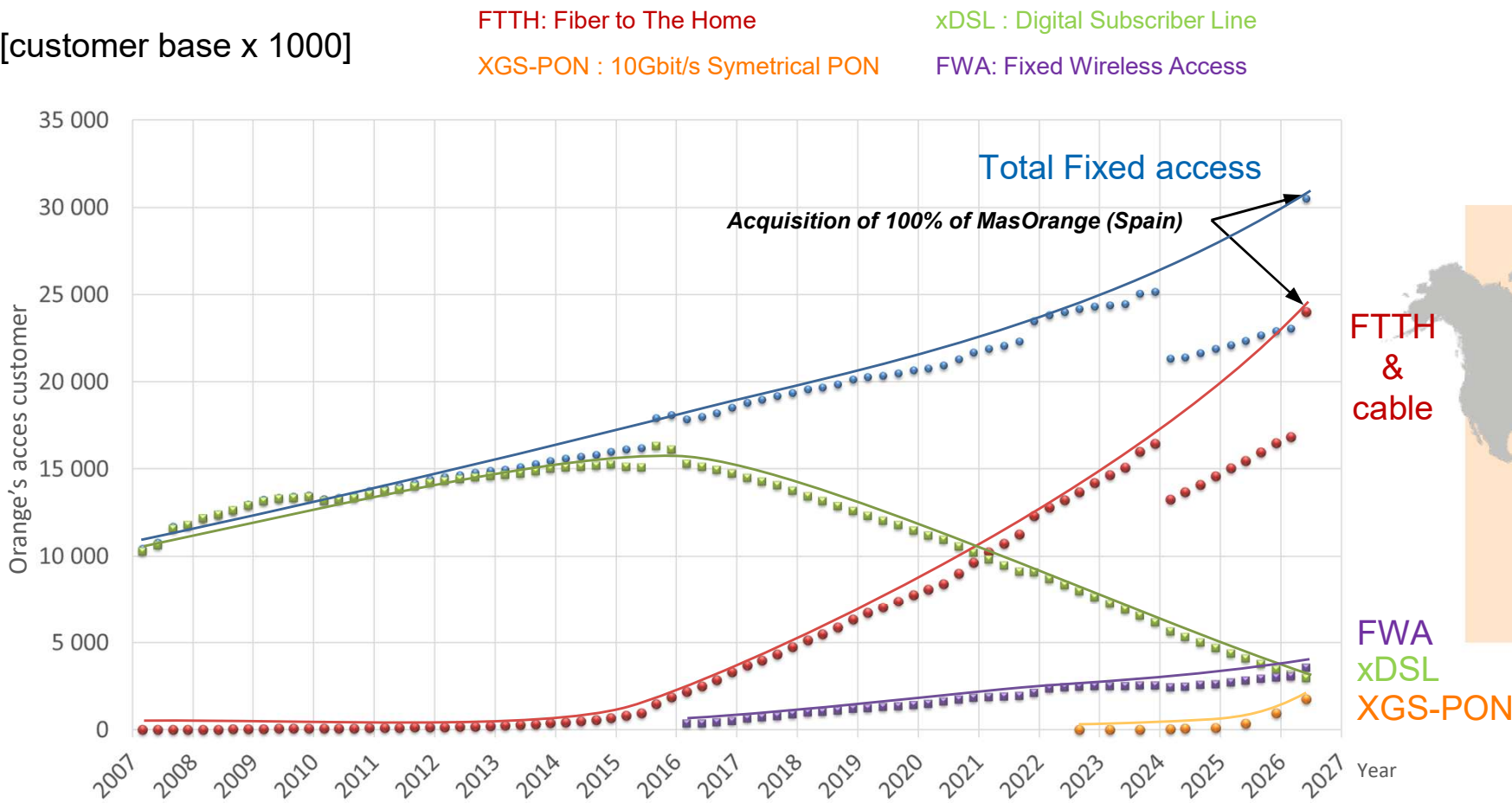


FSAN
Full Service
Access Network





Orange's Fixed accesses customers



Orange Fixed operations around the world



~ 31M

Fixed Broadband internet customers

~100M

FTTH Home Passed

~24M

FTTH & cable customers

19

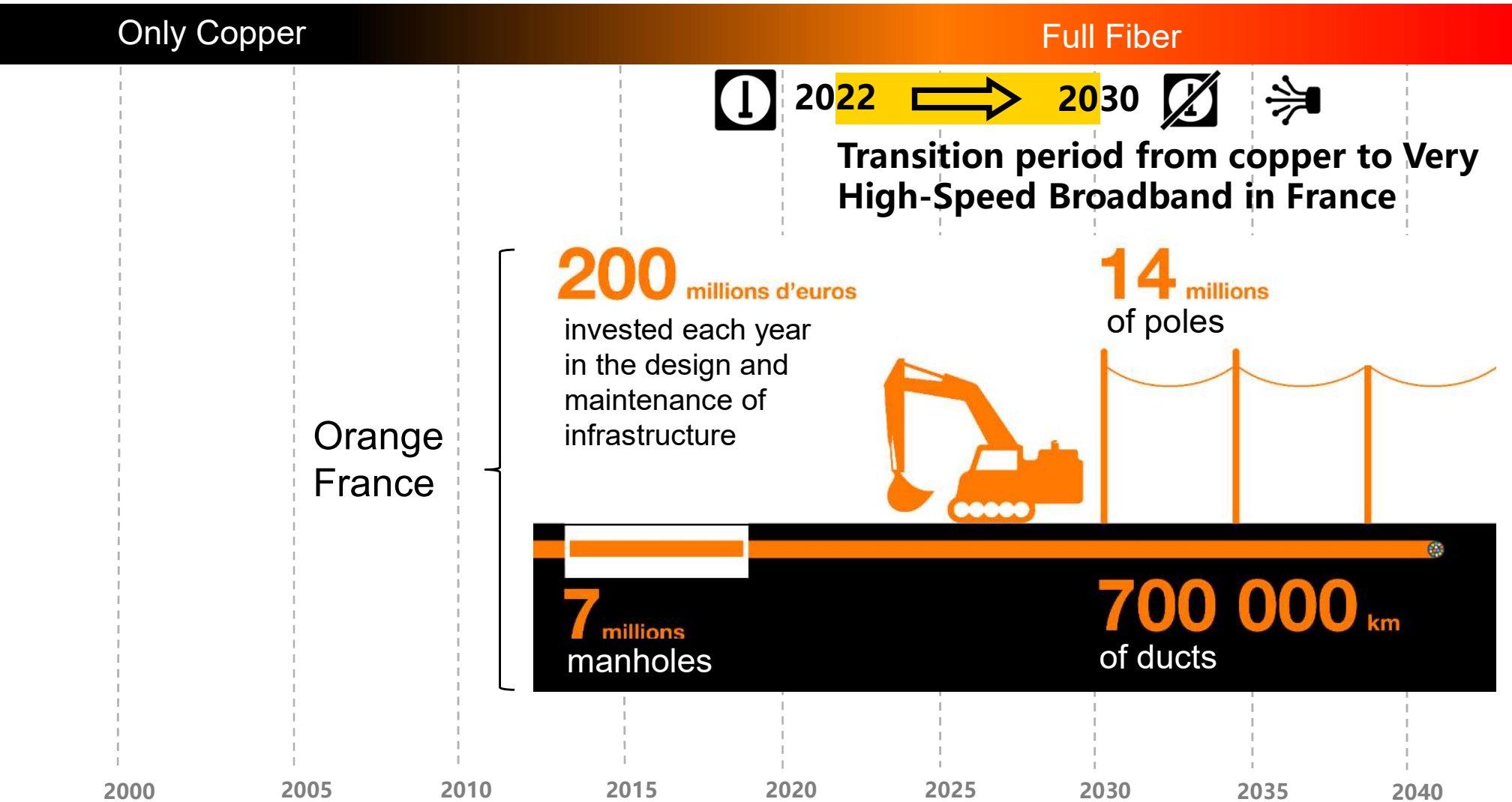
FTTH networks in Europe (8) and MEA (11)





The right infrastructure to maintain high quality fixed access network (FTTx)

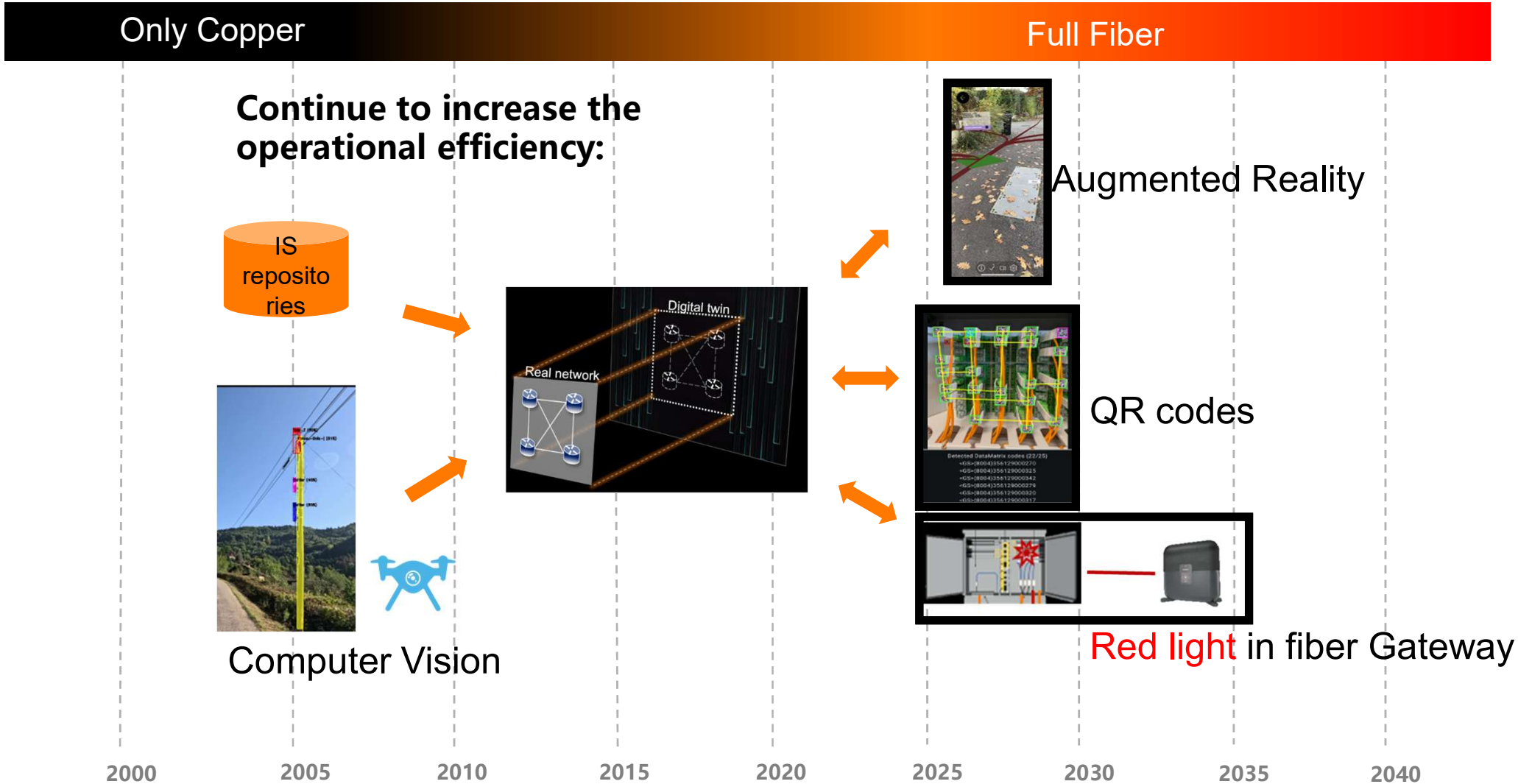
Access infrastructure medium





The right infrastructure to maintain high quality fixed access network (FTTx)

Access infrastructure medium





Telco passive infrastructures – some stakes...

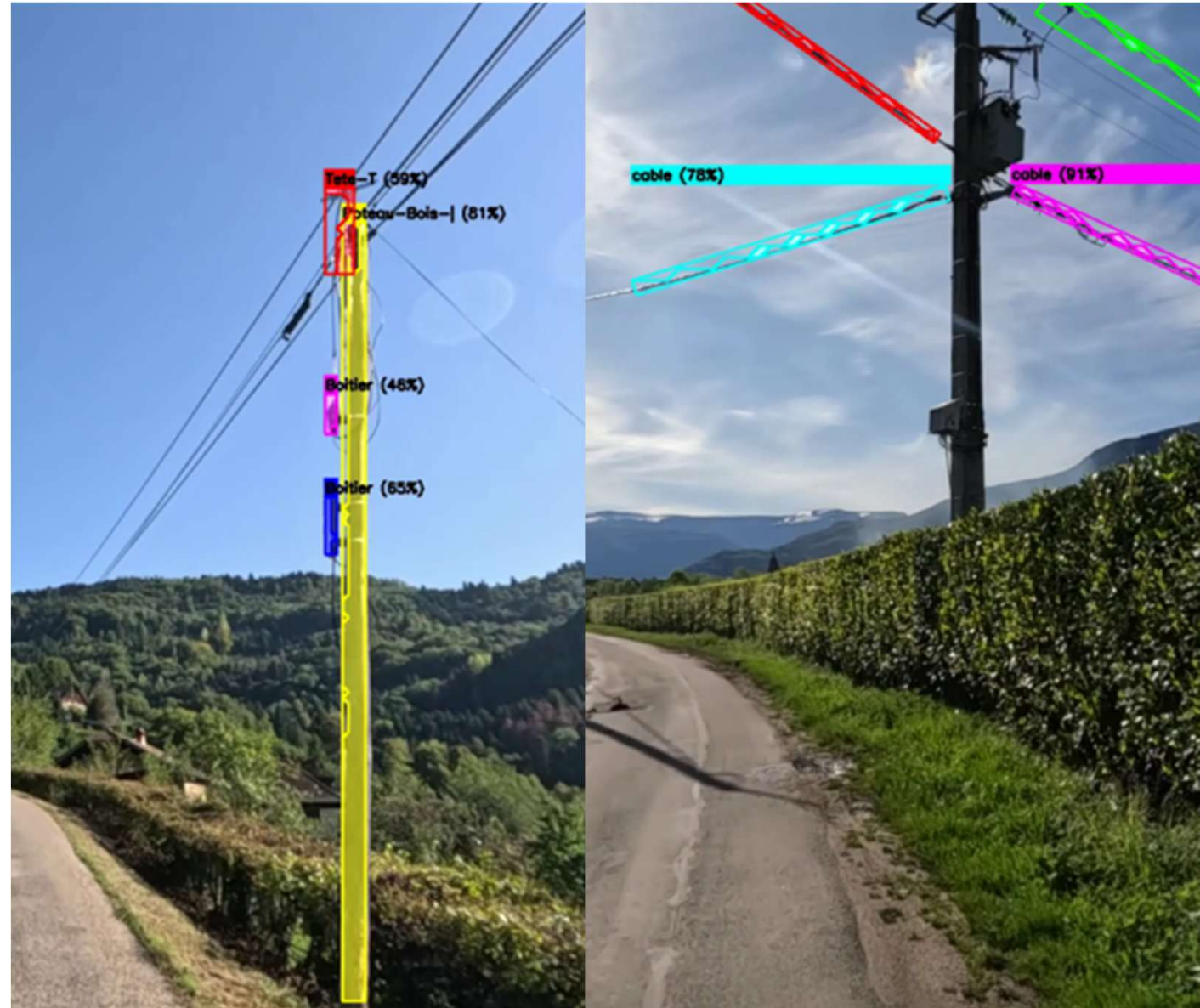
Infrastructures

- Poles
 - Labels
 - Boxes
 - Head
- Aerial lines
- Street Cabinets
- Traps

Analysis of type & defects: **material, pole verticality & buckling issues, ...**

For which purpose

- Quality of service for client
- Public and Technician security
- Civil engineering valorisation
- But also...





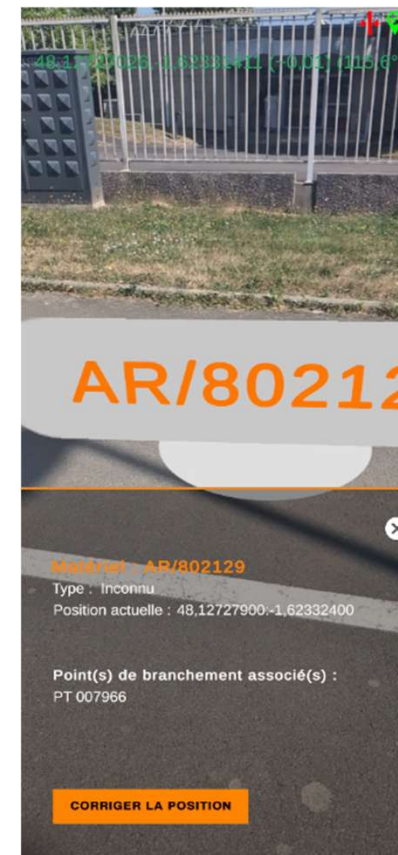
How does it help technicians ?

- **The Digital Twin and the AR mobile app help the network technician to:**

Locate network infrastructures



Correct inaccurate network location data



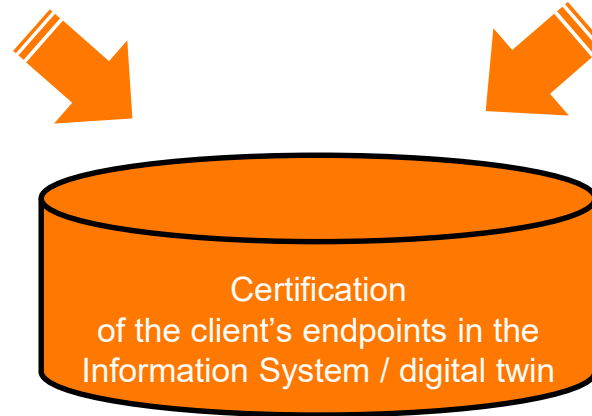


Optical Route Digitization and Associated Workflows

- The mobile app in AR allows through :

Datamatrix at the Shared Point:

to certify the positions occupied before and after each intervention



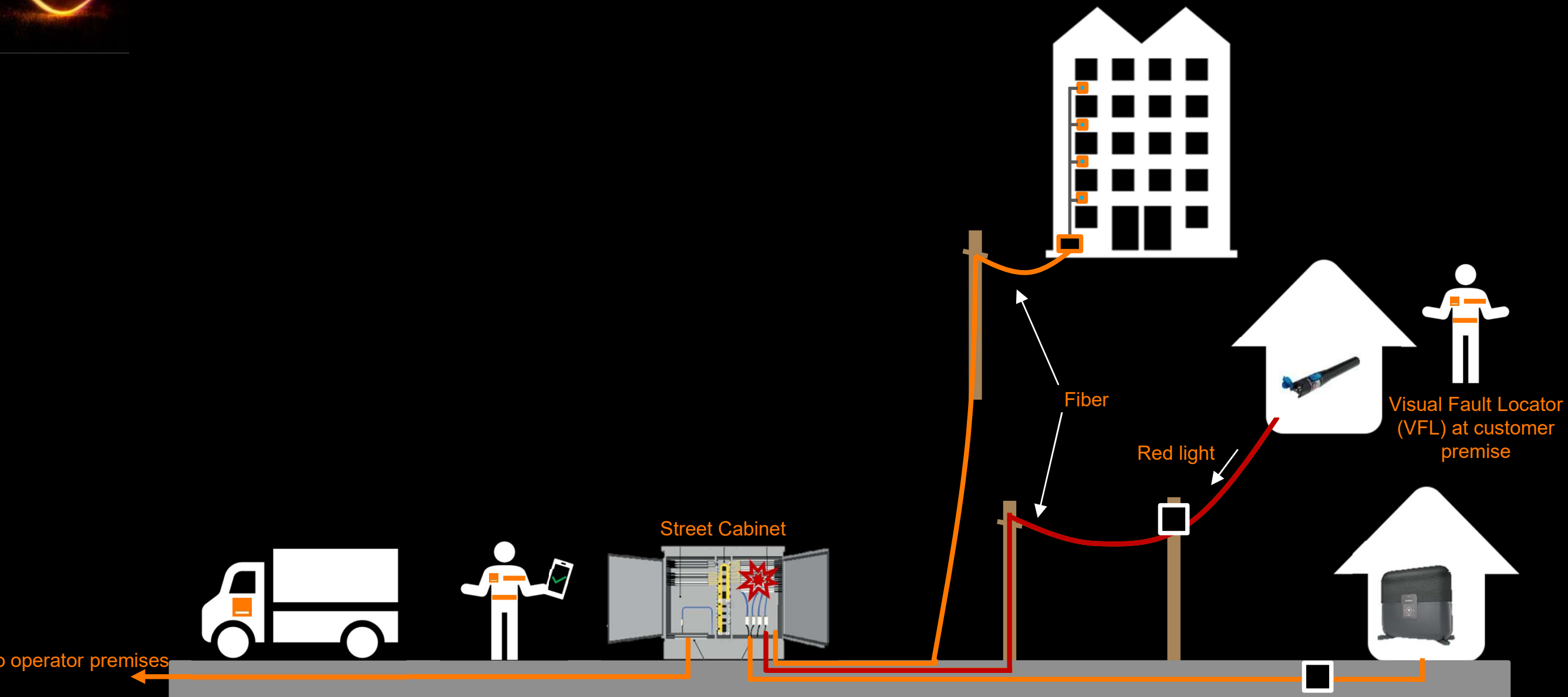
QR Code at the subscriber connection point

to uniquely identify the optical terminal outlet in the customer premises and the Information System.





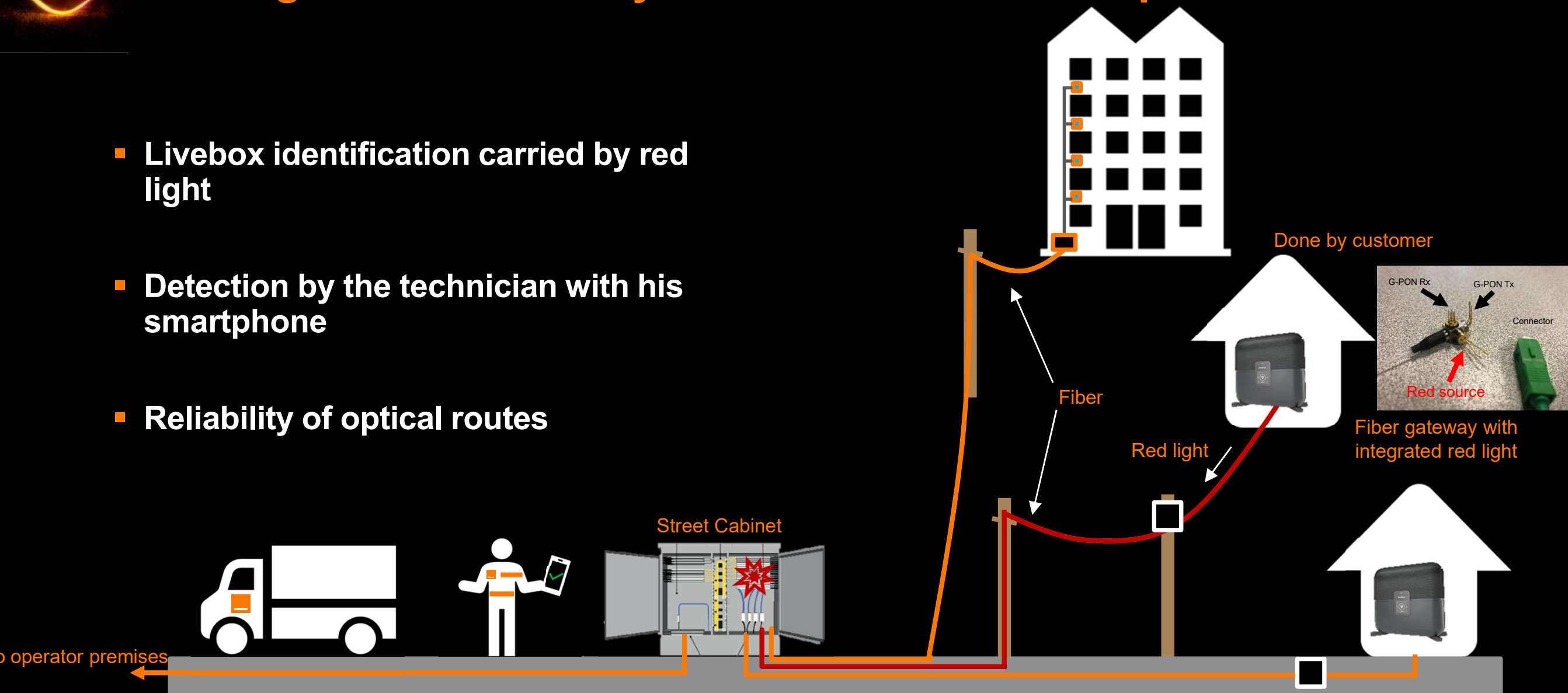
Red light: Fiber gateway identification made simple





Red light: Fiber Gateway identification made simple

- Livebox identification carried by red light
- Detection by the technician with his smartphone
- Reliability of optical routes



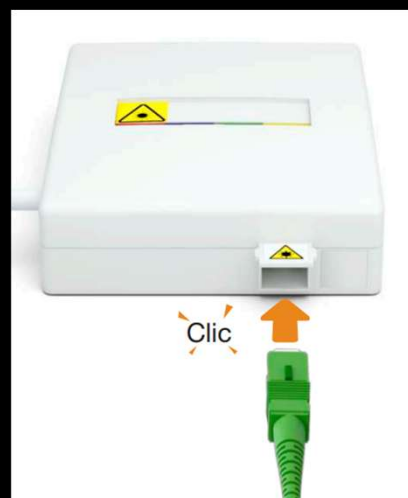


ONU identification during installation

Turning on the
fiber gateway at
home



Connection to the
optical
termination point



Red light visible
at the outdoor
cabinet



ONU identified using
smartphone camera!

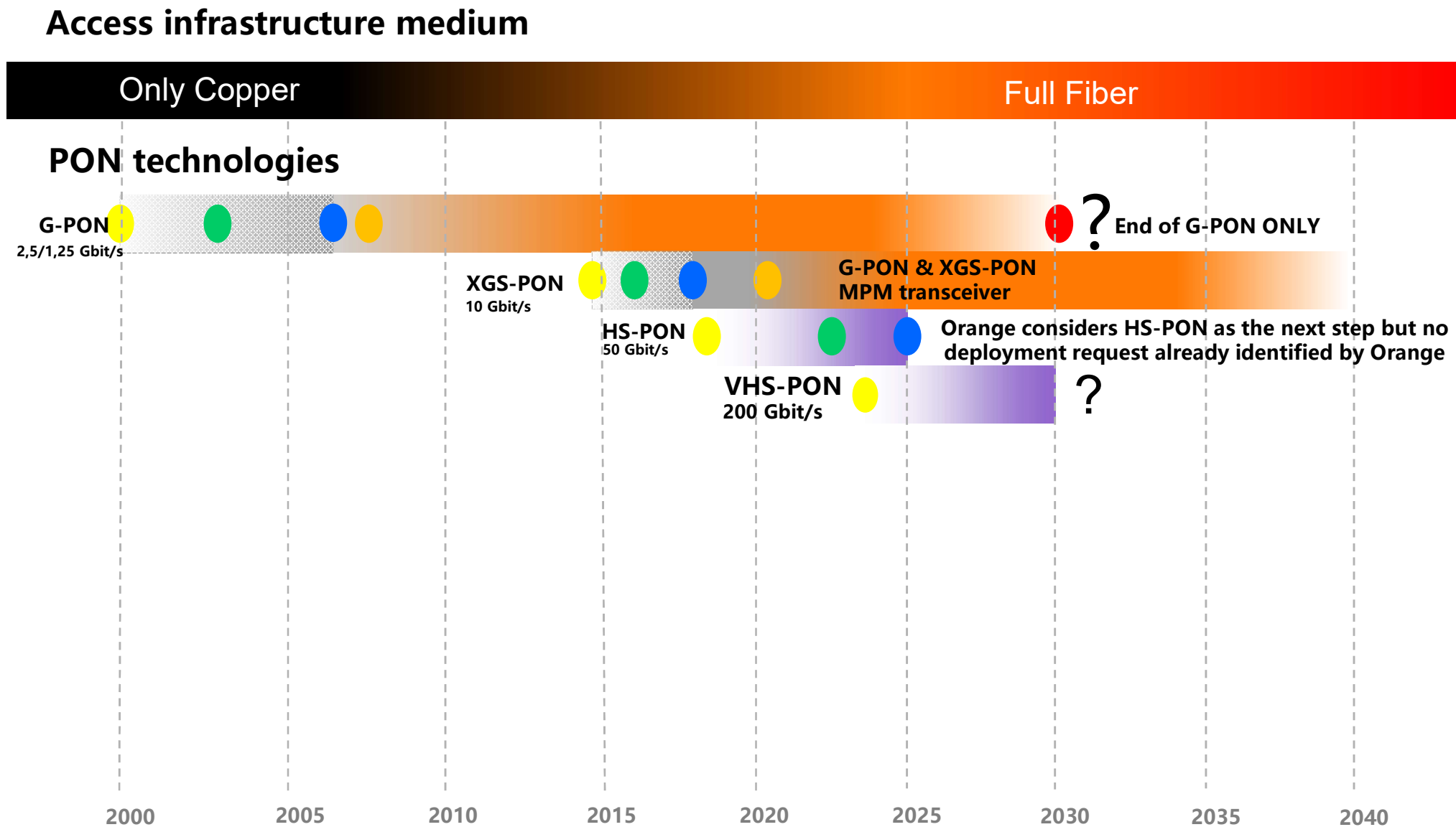


~3 seconds



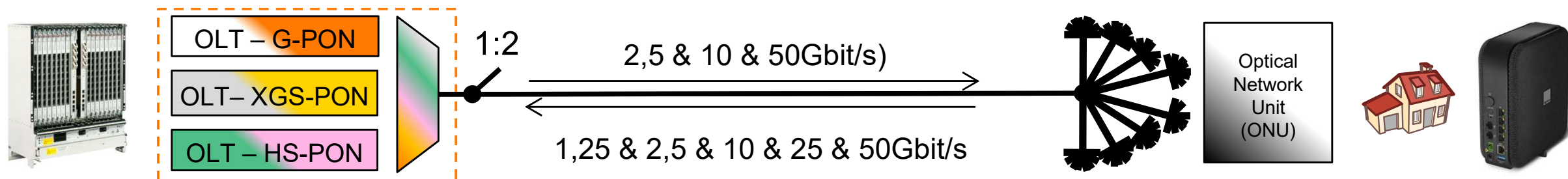


The right infrastructure and hardware to maintain high quality fixed access network (FTTx)





The right technology to maintain high quality fixed access



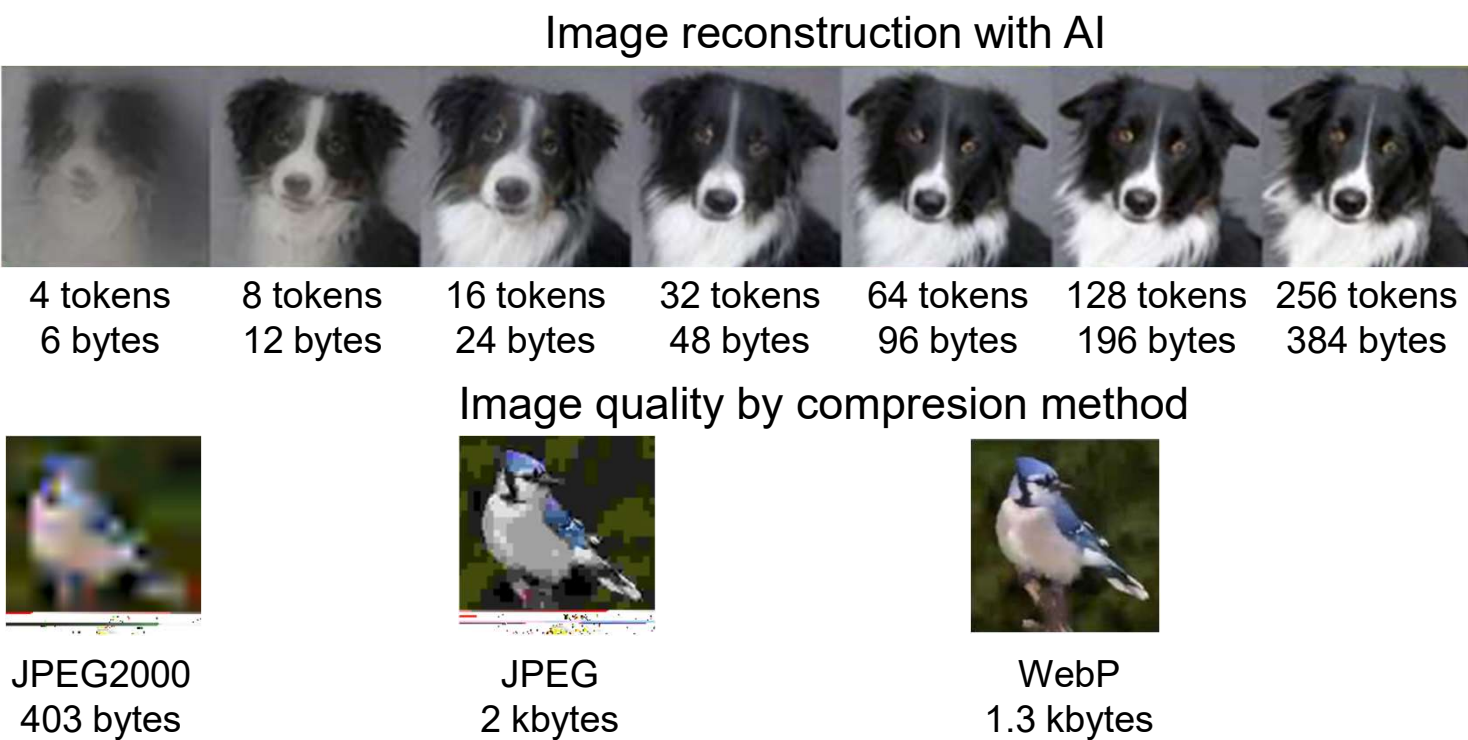
An experiment conducted by Orange on its FTTH fiber network in February 2024 demonstrates that it is possible for multiple technologies to coexist on the same operational fiber with a variety of line bitrates up to 50 Gbps.

50G-PON: Orange paves the way for the fiber of the future



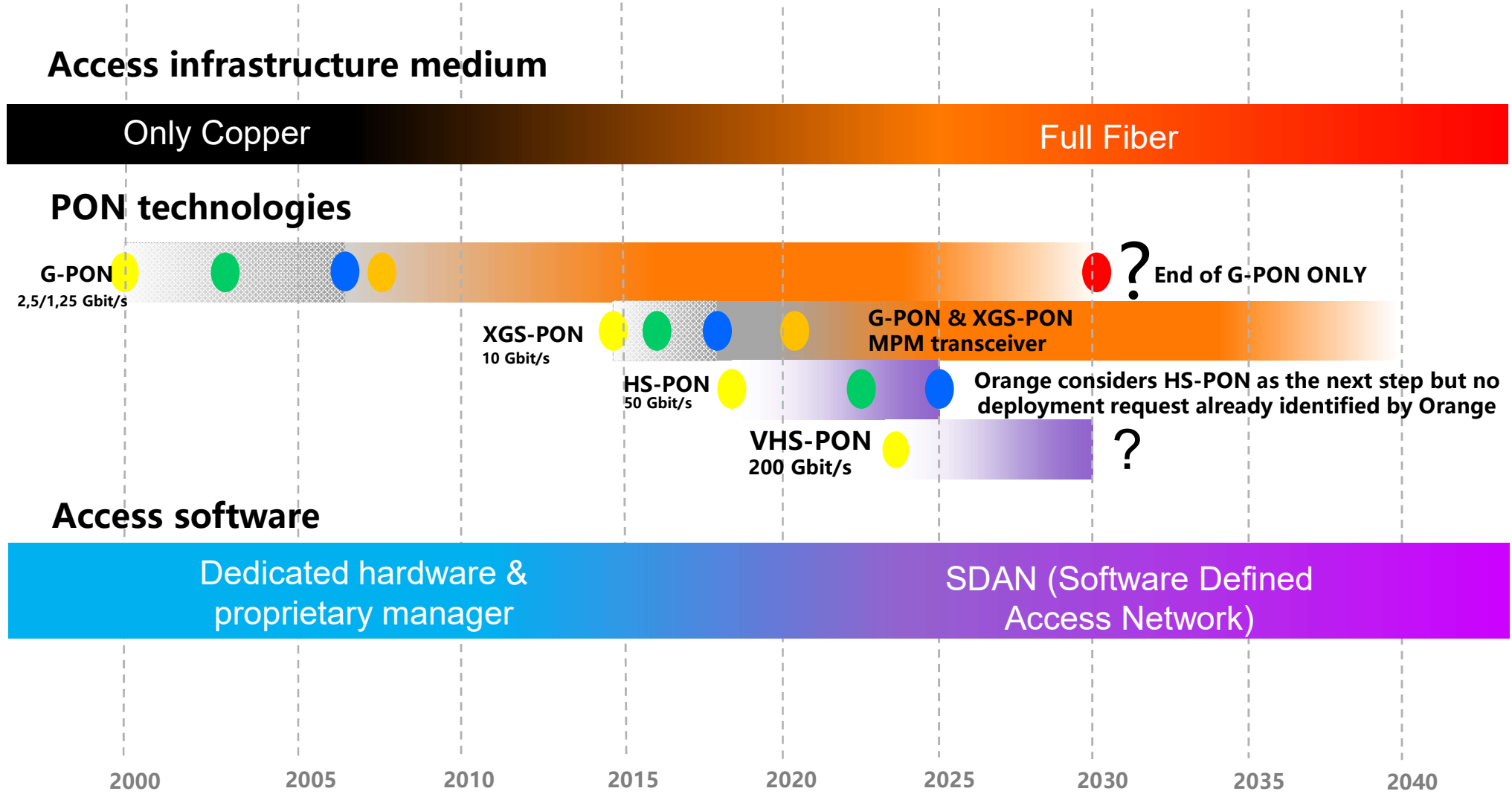
Impact of IA in traffic & tokenization

- ✓ “Token-based communication” is specific to AI apps
 - ✓ Raw data (text, image, video) is converted into tokens which bear “meaning” rather than plain information
 - ✓ This is a form of “compression”, each app / LLM may have their own formats – some are standardized
 - ✓ Network-awareness of tokens useful for
 - ✓ Token integrity check to guarantee reception of tokens
 - ✓ Token prioritization (some tokens are more critical than others)
- ✓ Illustration: Token vs. JPEG*



* Source: “One-D-Piece: Image Tokenizer Meets Quality-Controllable Compression”, Keita Miwa Kento Sasaki Hidehisa Arai Tsubasa Takahashi Yu Yamaguchi

The right infrastructure, hardware and software to maintain high quality fixed access network (FTTx)

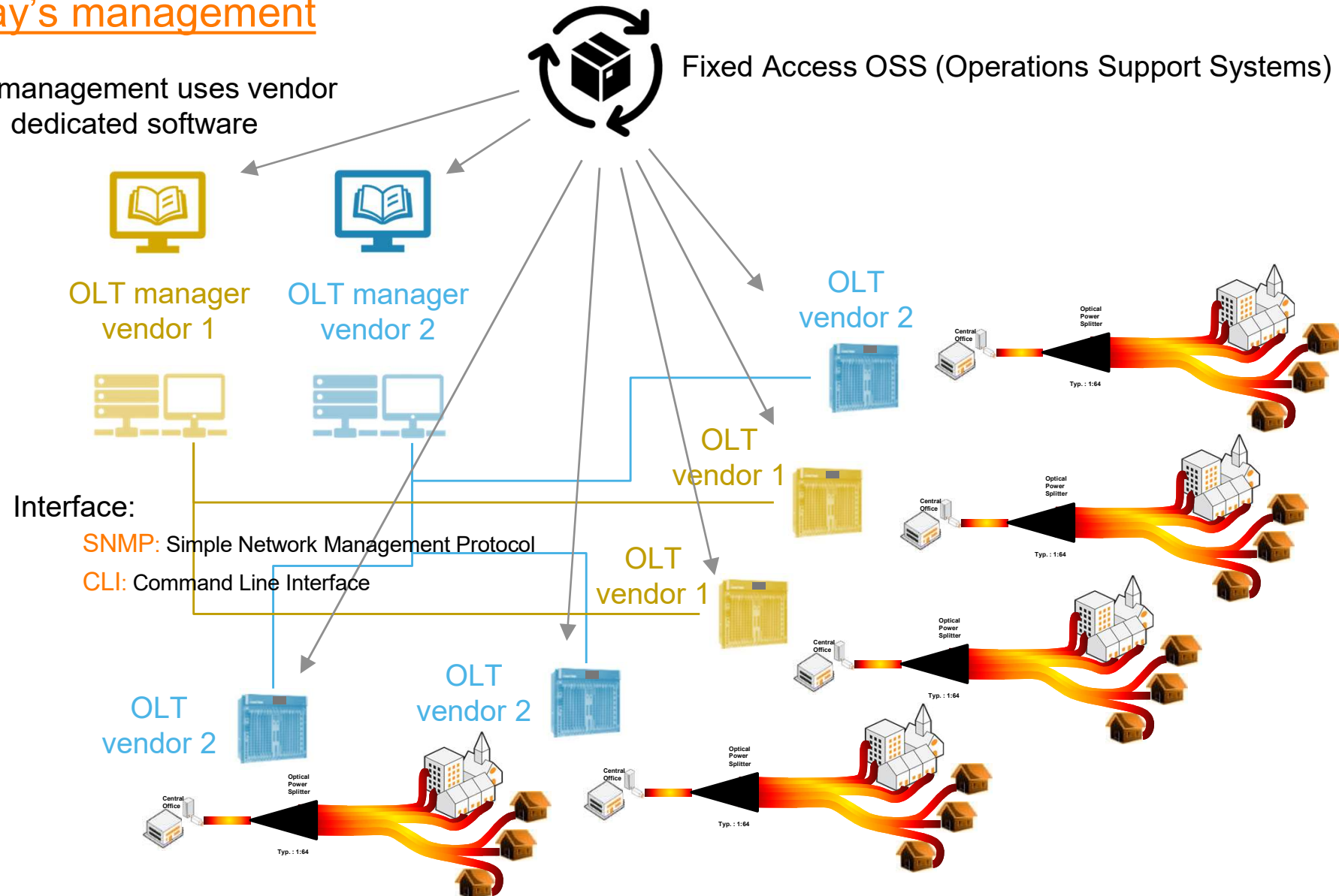




The right “software” to maintain high quality fixed access

Today's management

OLT management uses vendor dedicated software





Open Broadband – Broadband Access Abstraction

Tomorrow's potential implementation:

OLT controller with the “promise” to be vendor agnostic



Fixed Access OSS (Operations Support Systems)

BBF controller NBI eagerly awaited

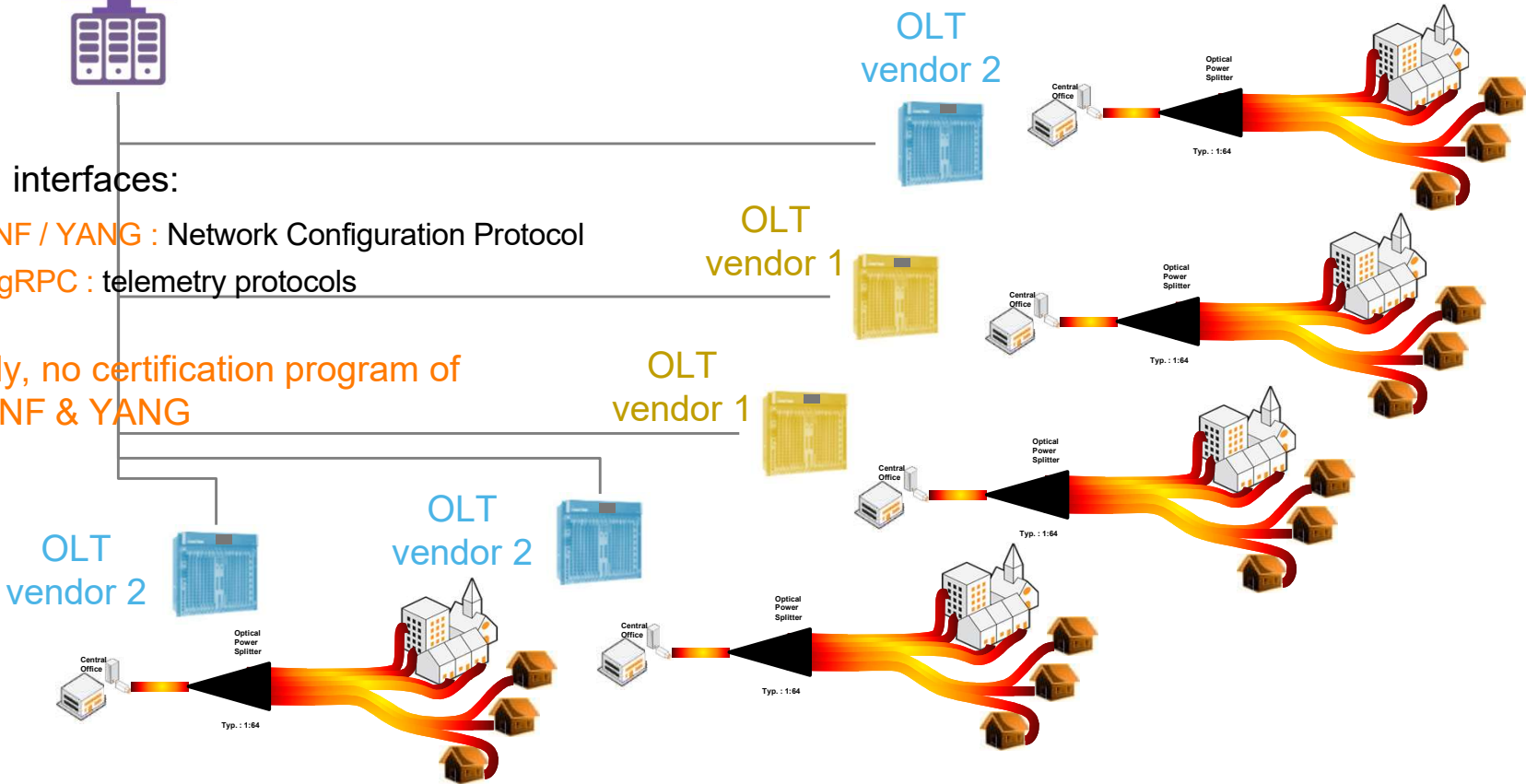


Modern interfaces:

NETCONF / YANG : Network Configuration Protocol

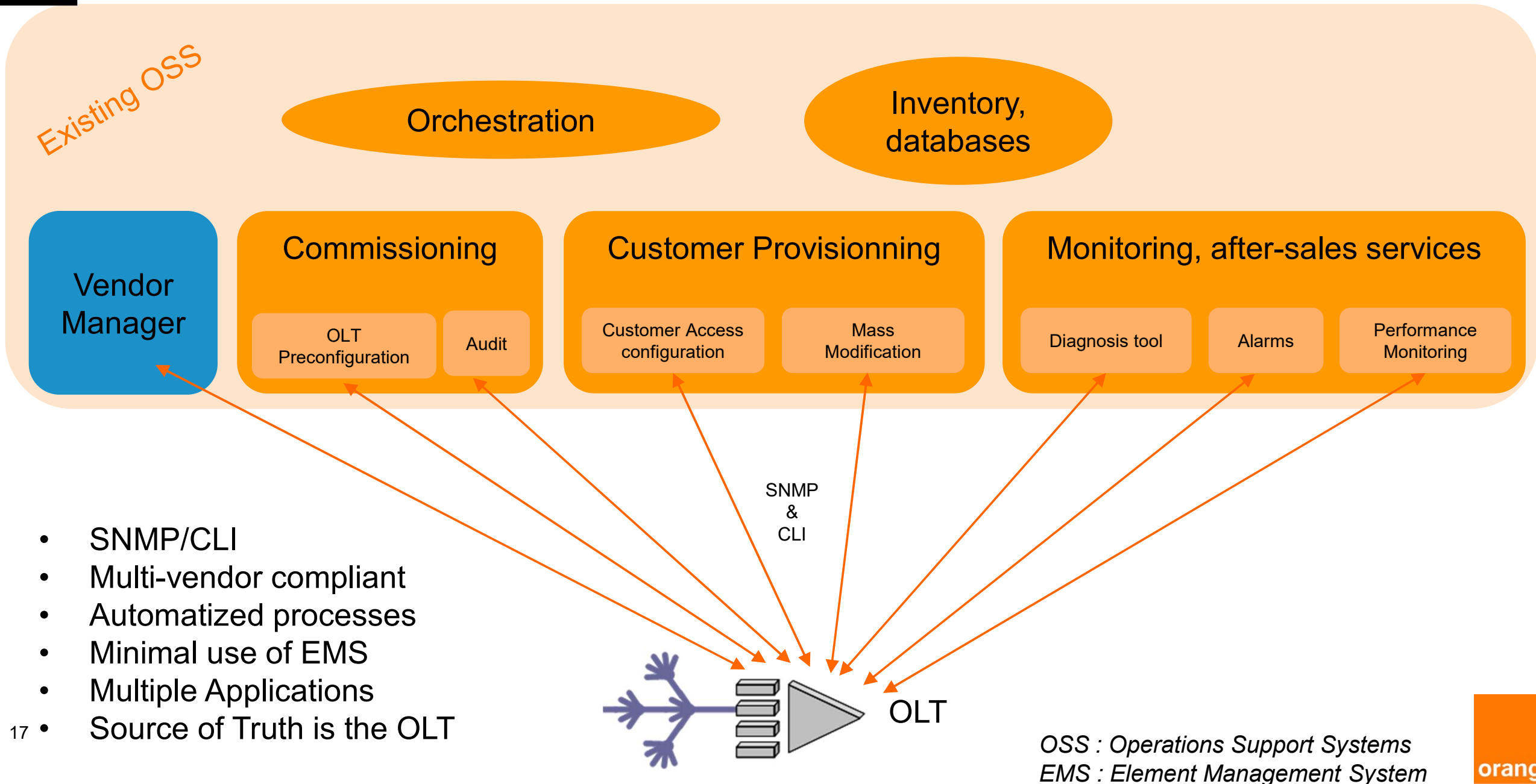
IPFIX & gRPC : telemetry protocols

Presently, no certification program of NETCONF & YANG





Simplified representation of an OSS today

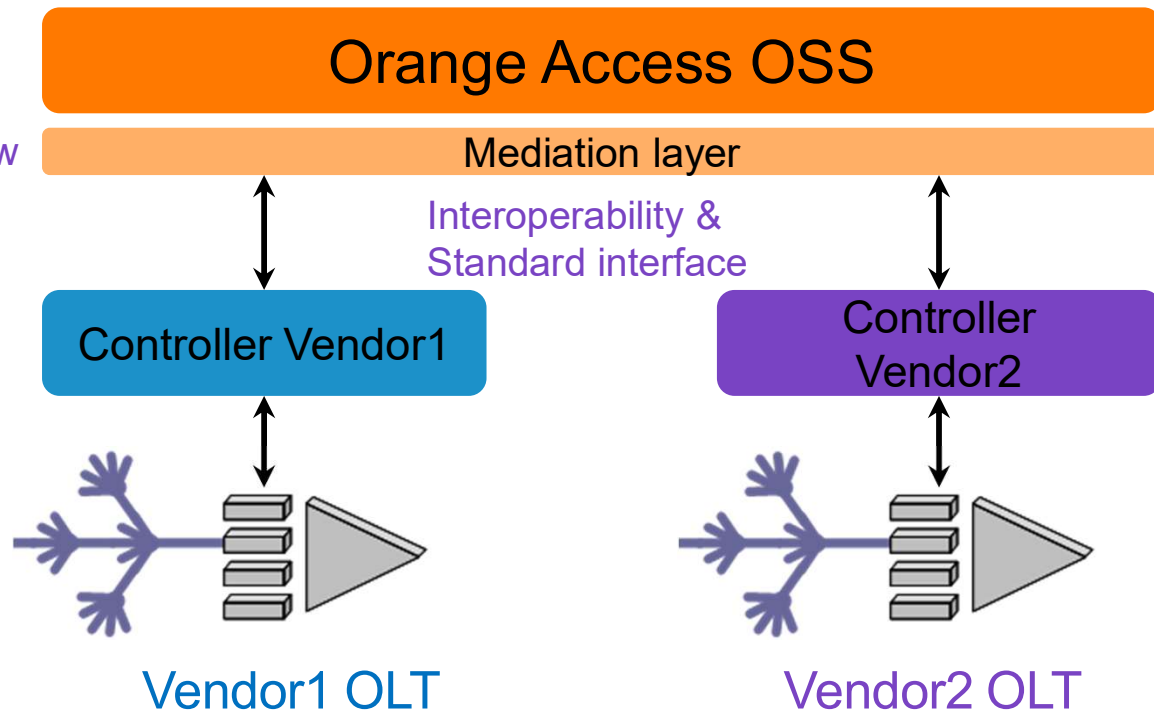




SDAN introduction – macro scenarios with Controller

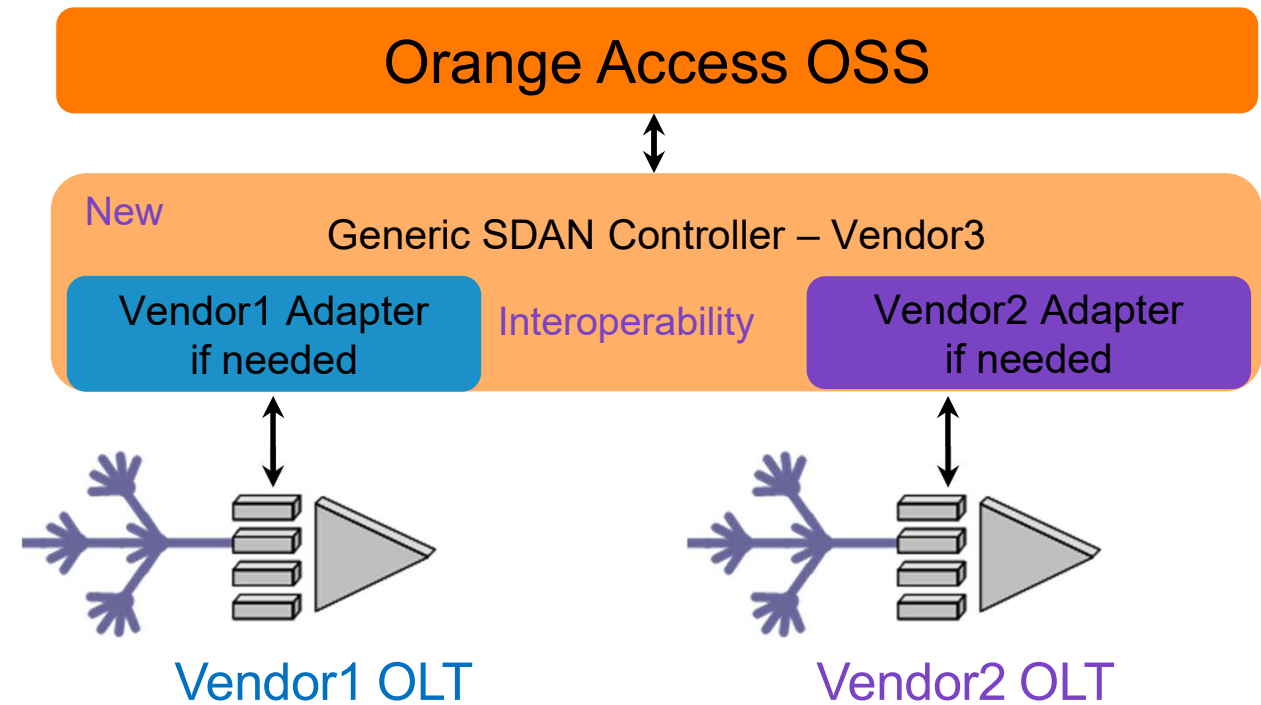
Silo scenario

- One controller per OLT vendor
- Requires an intermediate level of abstraction “Mediation Layer”
- Ideally requires the controller’s NBIs to be standard



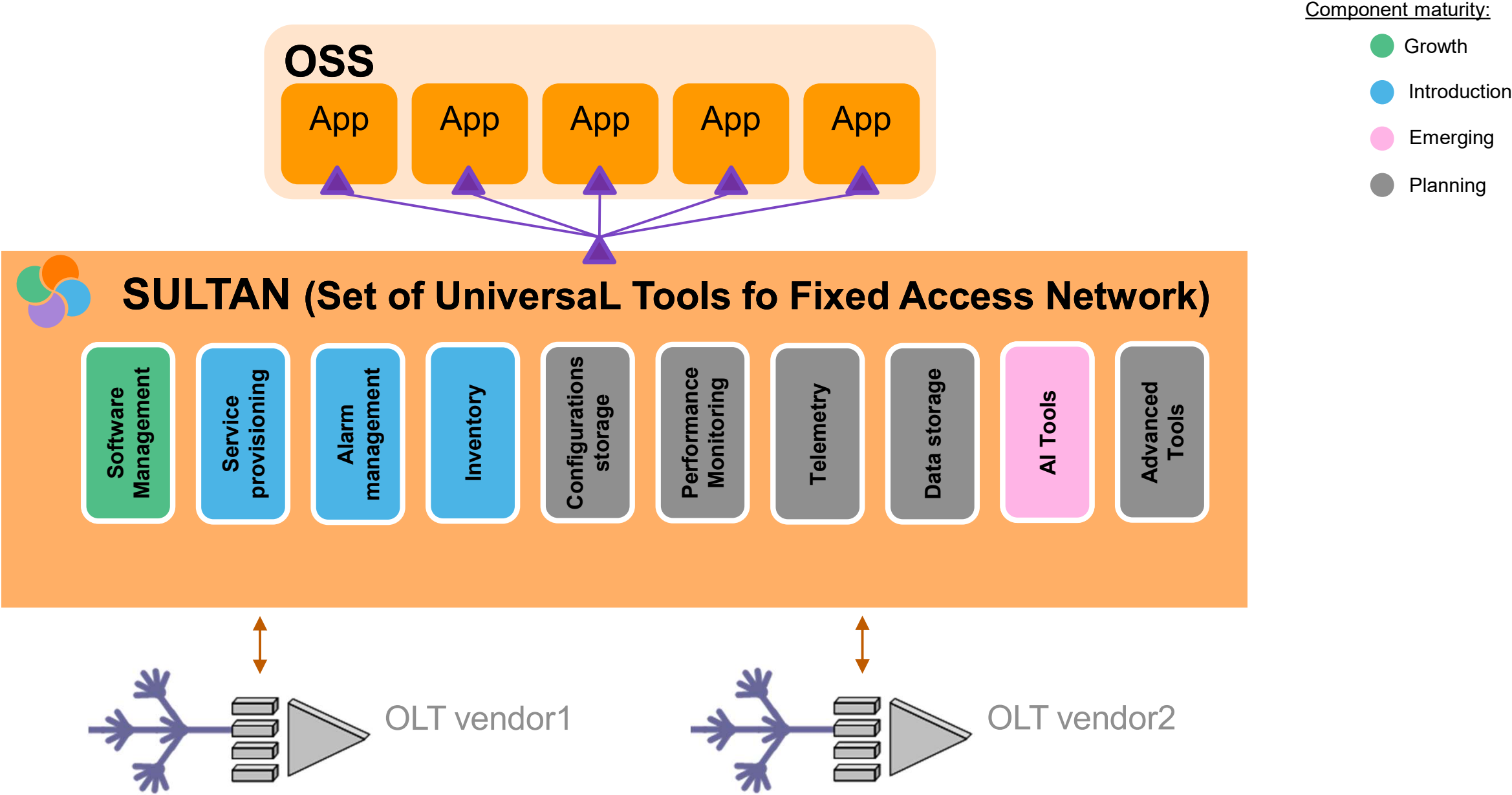
One Controller scenario

- Only one controller for the whole fixed access network with adaptors for each vendor (BBF model)
- May require an intermediate level of abstraction “Mediation Layer”
- Ideally requires the OLT to follow BBF YANG standards



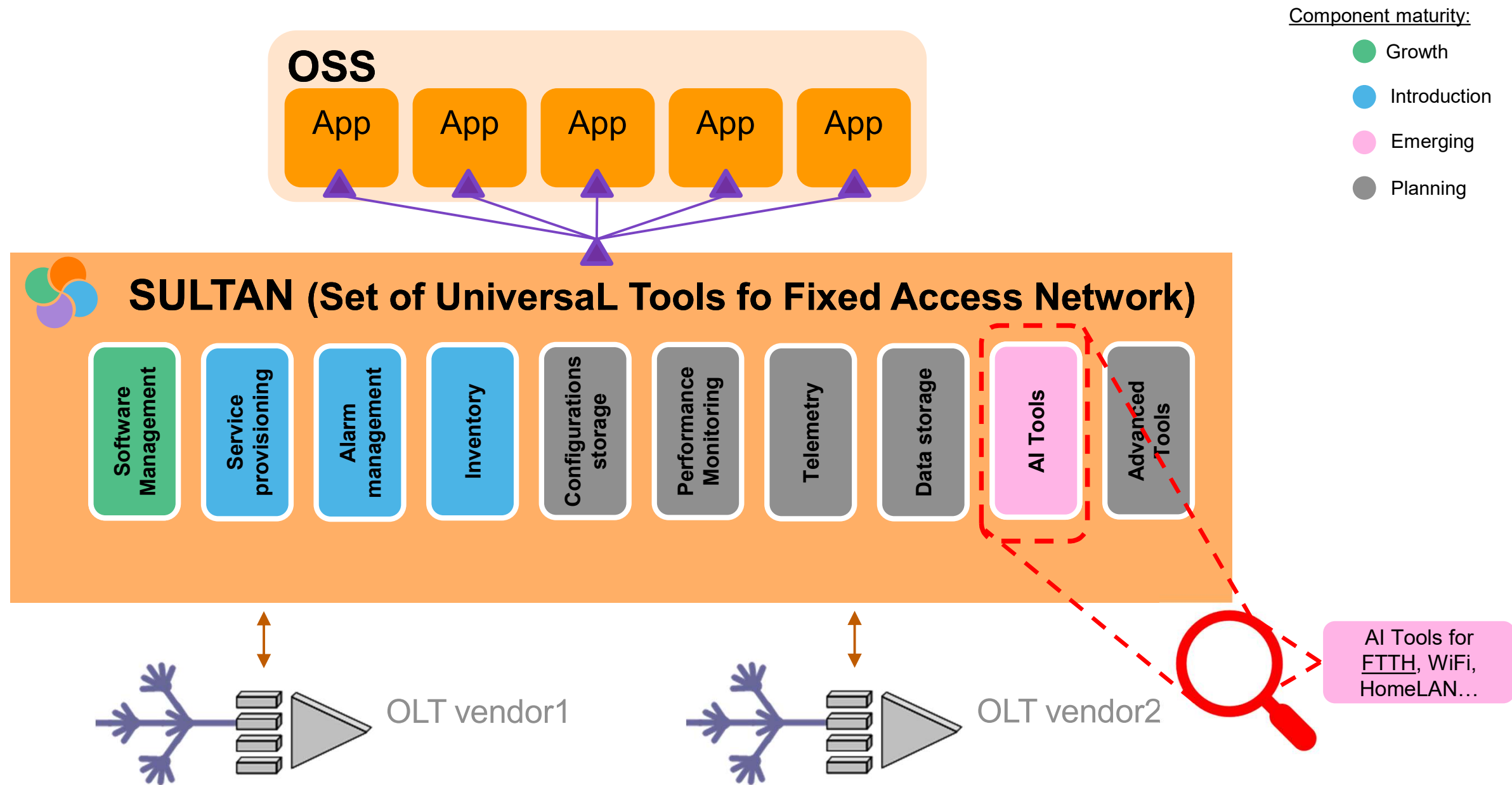


Under the hood: **SULTAN** product is the home-made solution based on components for modularity





Under the hood: **SULTAN** product is the home-made solution based on components for modularity





SULTAN AI tools for FTTH



SULTAN AI tools : FTTH section
Combine **data science** and **FTTH expertise**



Data lake

Analysis on **customers data**

- Statistics to provide some insights to the FTTH experts
- Data science **analysis** to improve FTTH diagnosis (identify **patterns**)
- SULTAN AI : Adapt Machine Learning tools to access network



Data preprocessing and visualisation

Analysis on **customers data**

- Provide efficient **analysis** or **preprocessing** on the data
- Adapt **diagnosis** from lab data to customer data
- Provide **visualisation** solutions to the FTTH experts : dashboard (e.g: OTDR* correlation data)



Data lab

- **Generate/Collect** data in our lab
- Analyze data **behavior** for a better understanding
 - FTTH Instability
- Strong expertise on FTTH thanks to experts contributors

Key points

1

The optical fiber infrastructure : continue to increase operation efficiency

2

Hardware : The use of multi-PON cards, ports, transceiver and fiber gateways (ensure OLT / ONU interoperability with certification program & qualification tests)

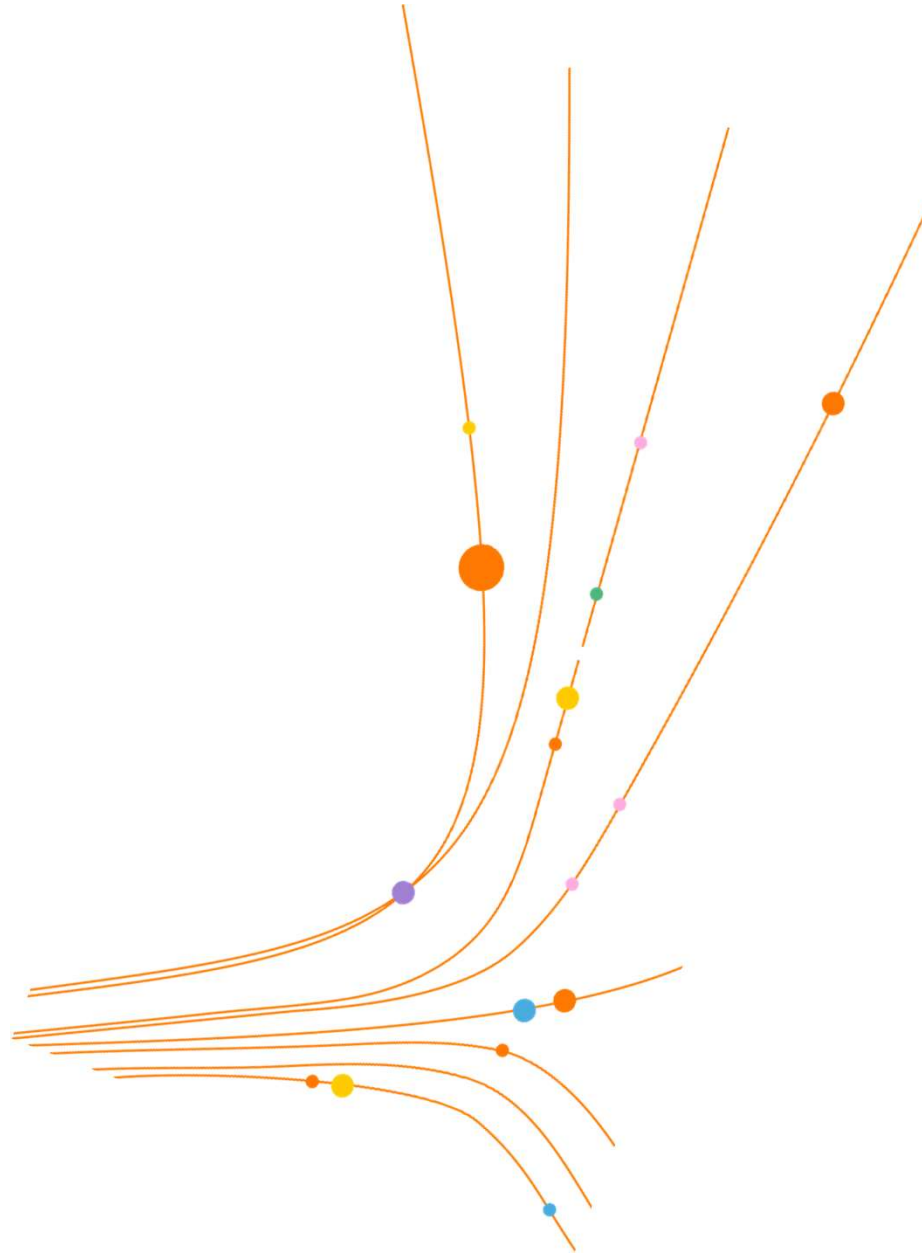
3

Software : Modernization of OLT management by the introduction of controller and Apps related to OSS services including AI tools



Thanks

FSAN
Full Service
Access Network





Fixed access availability: optical fiber access (PON)

PON systems propose a variety of resilience mechanisms:

Path protection

Performance monitoring to anticipate ageing / gradual degradation

Accurate plant fault detection to shorten the time to repair

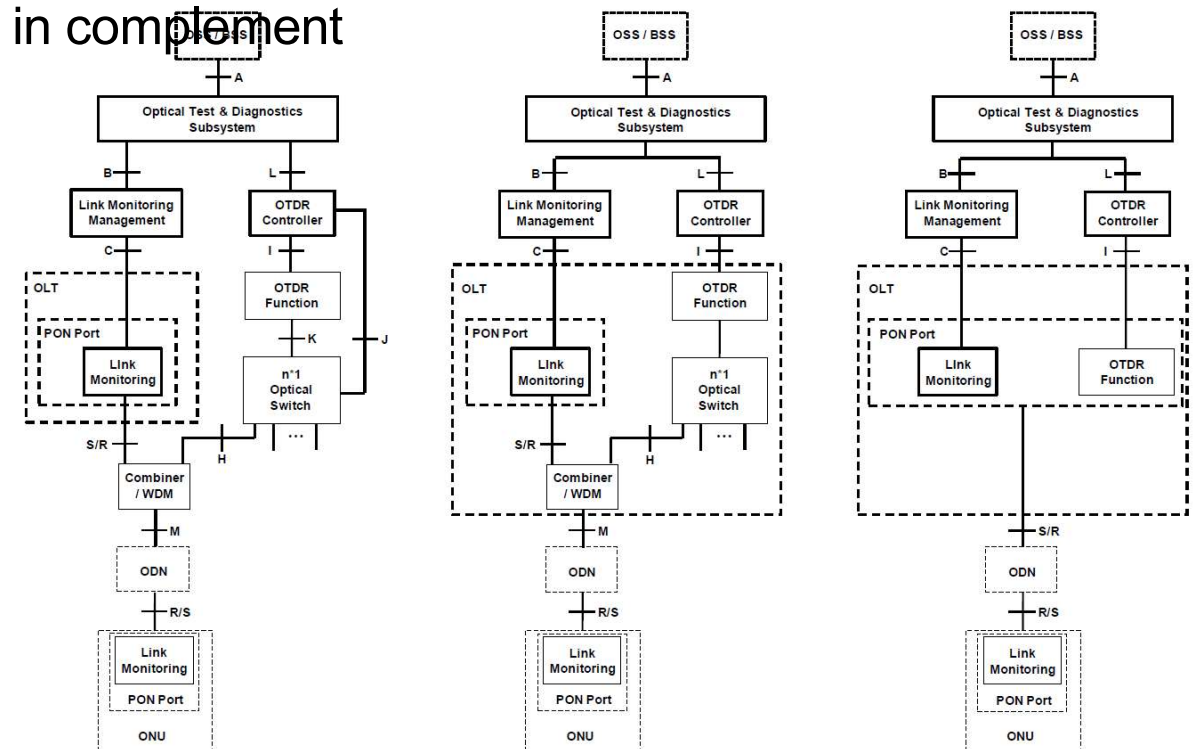
Service level trouble reporting (related to fault management and SLA)

Accurate plant fault detection to shorten the time to repair

Internal & external OTDR is proposed in complement

BBF TR-287 – issue 2 / 2017

PON Optical-Layer Management:





Orange's access networks technologies

Access network segment :

- for Residential based on PON technologies
- for Mobile backhauling & business on PtP

