Joint ITU/IEEE Workshop on Ethernet - Emerging Applications and Technologies

G.fast for FTTdp

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Overview

- What is FTTdp?
- FTTdp/G.fast "raison d' être"
- Applications
- Service provider requirements
- G.fast key features
- Standards time-line
- Standards body coöperation
- Backup material

What is FTTdp ?

- A broadband access solution taking fibre to a distribution point (FTTdp) very close to the customers premises, with total wire length to the customers' transceiver up to 250m.

  - It is expected that the bulk of the loop lengths may be in the order 30 to 50m. On 30 m loops, aggregate data rates up to at least 500 Mb/s should be supported on a single pair.

FTTdp/G.fast "raison d'être"

- To provide the best aspects of 'Fibre to the home' and 'ADSL':
  - Fibre to the home bit-rates
  - customer self-installation like ADSL

Applications

- Next-generation IPTV service at well over 100 Mb/s
- Access to small and medium business sites at well over 100 Mb/s
- Backhaul for very small wireless cell sites, including HetNet
- Backhaul for WiFi hot spots

Service provider requirements (1/6)

- Low Power/Cost/Complexity
- Reverse power feed for the remote device from the customers' residential gateway
- Mandatory customer self install
  - triple-play services with home network bridge taps, on loops up to 200m

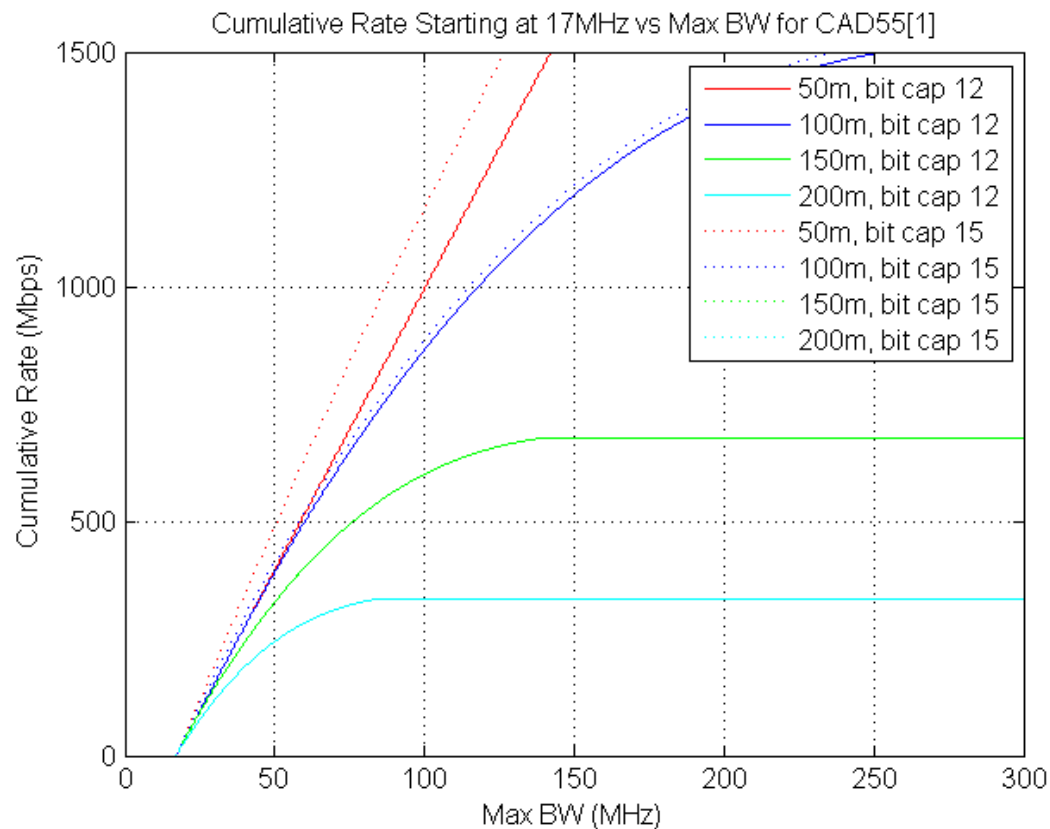# Service provider requirements (2/6)

- ## Zero Touch OAM
  - To provide for remote management of user connections – for connecting of new users or switching users to or from legacy exchange or cabinet hosted services)

- ## Node sizes typically 1 to 16 ports

- ## Support for exchange and derived POTS

Service provider requirements (3/6)

- Service rate performance targets
  - 500-1000 Mb/s for FTTB deployments @<100m, straight loops
  - 500 Mb/s at 100m
  - 200 Mb/s at 200m
  - 150 Mb/s at 250m
  - Aggregate service rates ≥500 Mb/s with start frequency of 23 MHz and VHF and DAB bands notches

Service provider requirements (4/6)

- Capacity vs. Max Bandwidth in AWGN=-140 dBm/Hz (100% crosstalk cance

Cumulative Rate Starting at 17MHz vs Max BW for CAD55[1]

Legend:
- 50m, bit cap 12
- 100m, bit cap 12
- 150m, bit cap 12
- 200m, bit cap 12
- 50m, bit cap 15
- 100m, bit cap 15
- 150m, bit cap 15
- 200m, bit cap 15

Y-axis: Cumulative Rate (Mbps)
X-axis: Max BW (MHz)

Service provider requirements (5/6)

- **Control of downstream/upstream asymmetry ratio**
  - Mandatory: 90/10 to 50/50
  - Optional: from 50/50 to 10/90
- **Interoperability with VDSL2**
- **Coexistence with xDSL**
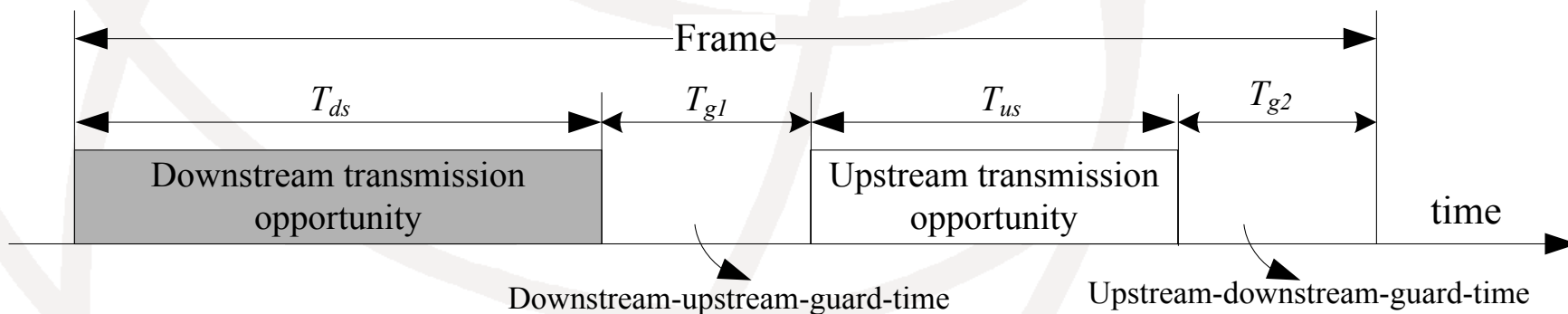 - Start frequency: 2.2, 8.5, 17.664, and 30 MHz

Service provider requirements (6/6)

- Coexistence with xDSL: VDSL2 to G.fast migration
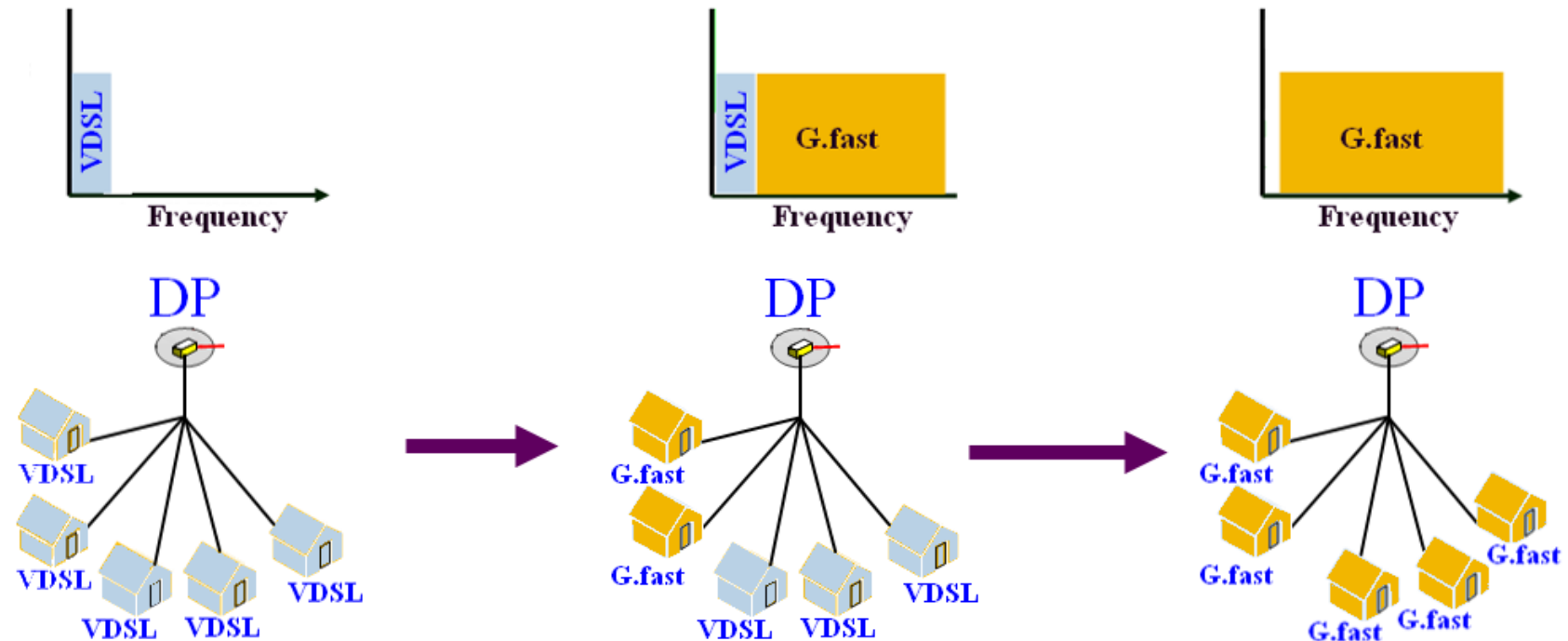
G.fast key features (1/4)

- Duplexing method: TDD
  - Can easily vary DS/US asymmetry ratio
  - Easily supports low-power states
  - Discontinuous mode allows trade-off of throughput vs. power consumption
  - Point-to-point distribution (no TDMA)

G.fast key features (2/4)

- Bandwidth: ≈ 100 MHz

- Modulation: DMT, 2048 sub-carriers, sub-carrier spacing 51.75 kHz, ≤12 bits/sub-carrier

- PHY layer retransmission
  - improved robustness against impulsive noise while maintaining low latency

- Mandatory support for vectoring
  - Far-end crosstalk (FEXT) cancellation

G.fast key features (3/4)

- FEC: Trellis code + Reed Solomon of VDSL2 (G.993.2) with the retransmission block (DTU) interleaving defined in G.998.4

- Will provide transport of network timing (8 kHz NTR) and Time of Day (ToD)

G.fast key features (4/4)

- Intended to operate over loops up to approximately 250 m of 24 AWG (0.5 mm) wire pair
  - VDSL2 is approximately 2500 metres of 26 AWG (0.4 mm)
- Support for both TR-156 and TR-167 Broadband Forum architectures

Standards time-line

- September 2010: Broadband Forum (BBF) Service Provider Action Council (SPAC) agreed to develop a white paper capturing network operators' potential requirements.

- January 2011: At request of BBF, ITU-T Q4/15 agreed to study the transceiver aspects of FTTdp, and issued a call for papers.

- February 2011: Q4/15 opened G.fast project and assigned an Associate Rapporteur/Editor

- June 2011: Q4/15 agreed to develop a new Recommendation

- July 2012: agreed to a goal to Consent the G.fast standard in July, 2013

- Expect an approve standard March, 2014

Standards body coöperation

- Close coöperation between standards groups is needed:
  - ITU-T Q4/15 for G.fast transceiver aspects
  - ITU-T Q2/15 for PON related aspects
  - Broadband Forum (FAN and E2E Architecture WGs) for architectural aspects, and
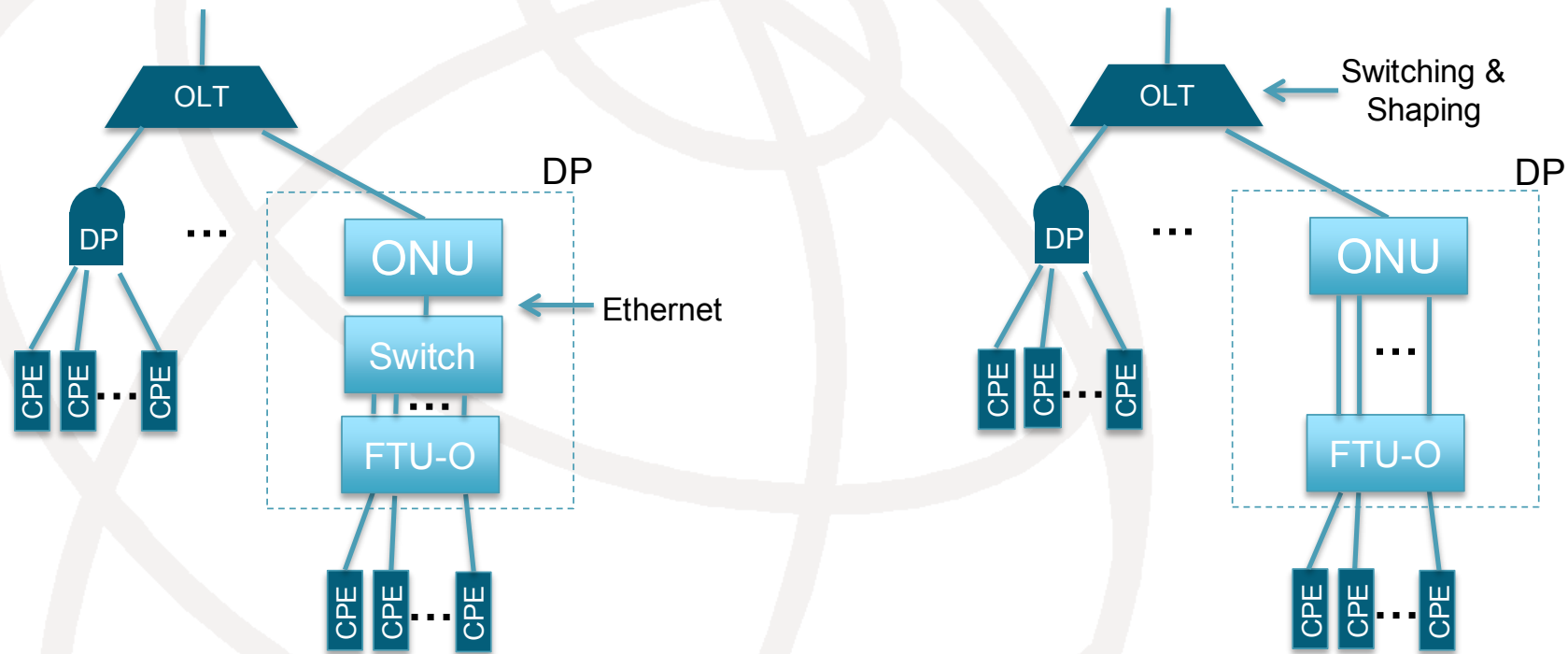 - ETSI TM6 for reverse power feeding aspects
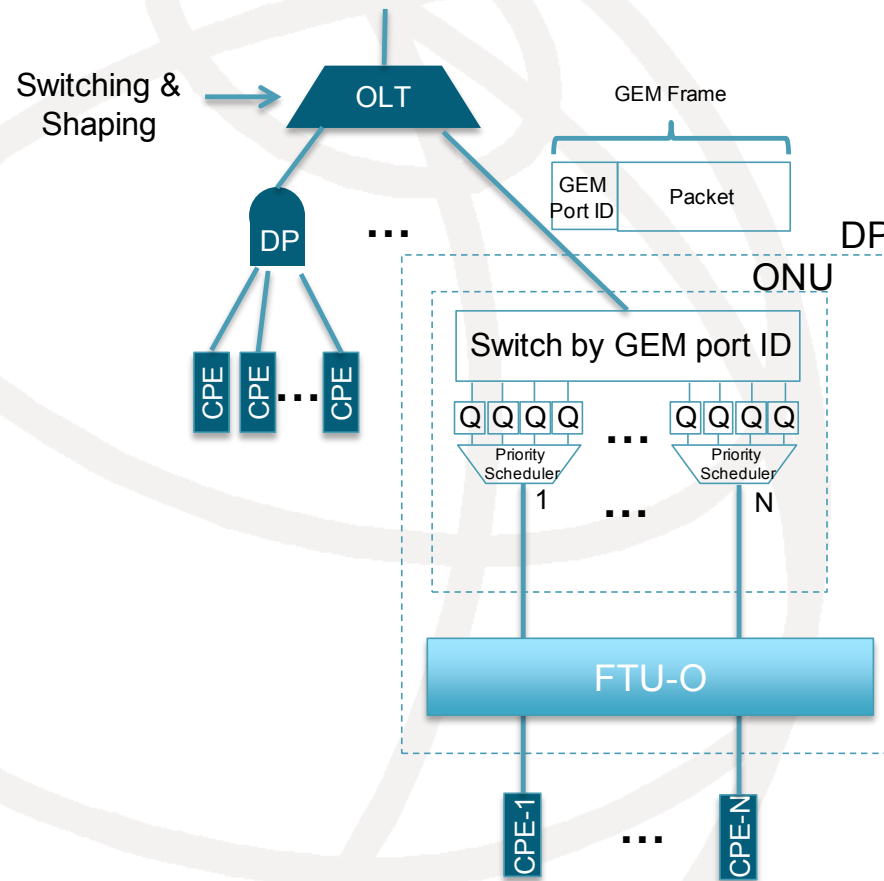
The end
Thank you
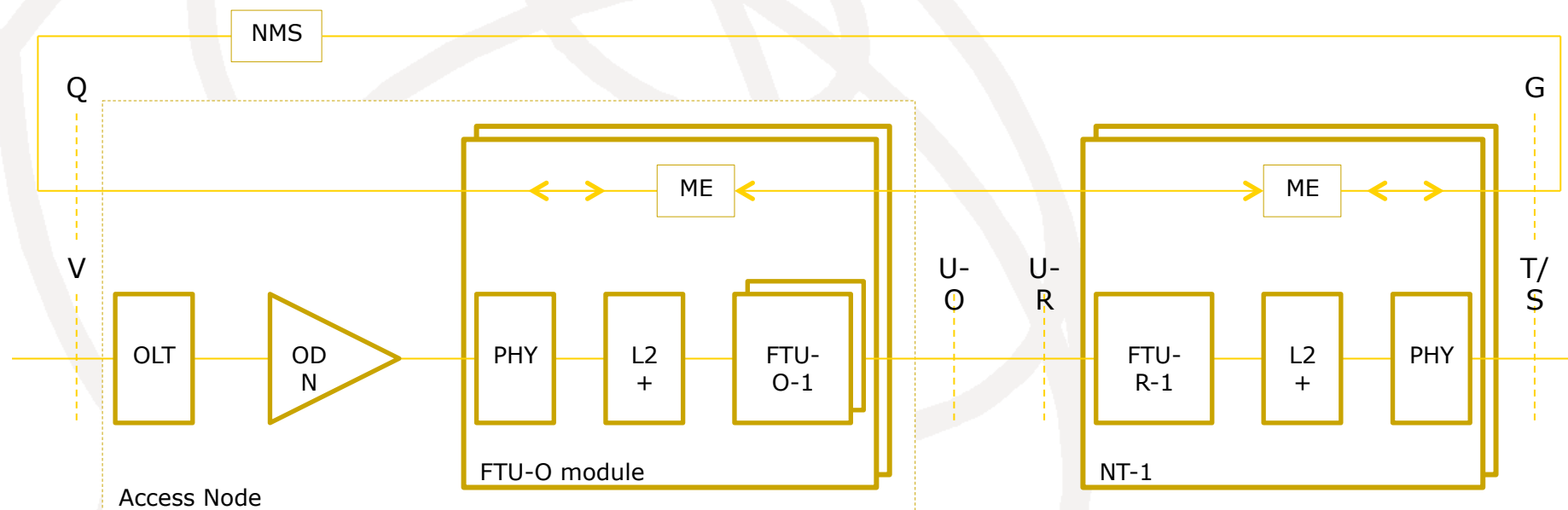
Backup material

Broadband Forum Architectures

TR-167 Model
(PON-fed Access Node)

TR-156 Model
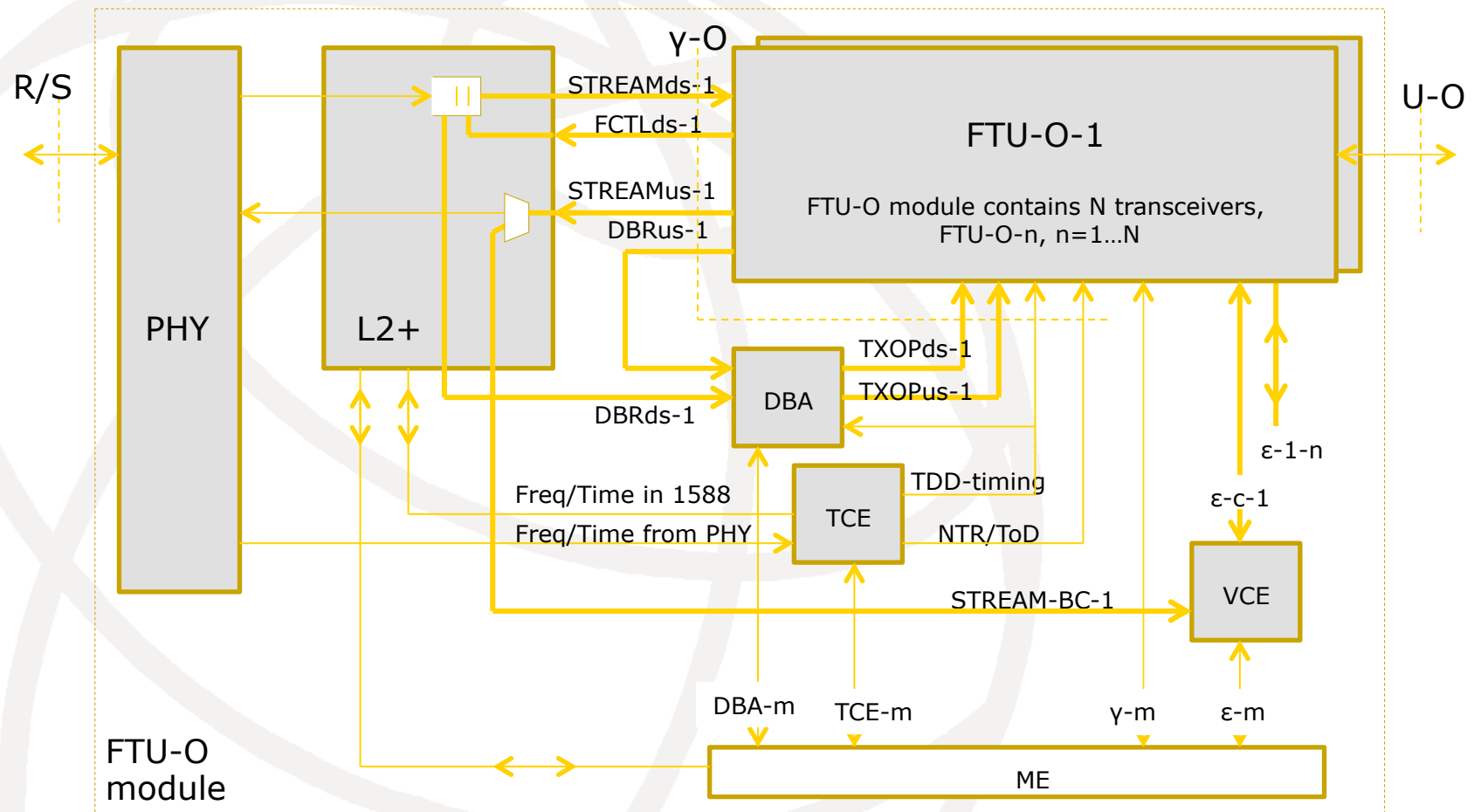(OLT+ONU=Access Node)

Detailed TR-156 Architecture (Downstream)

Reference model of FTTdp deployment

Reference model of an FTU-O module

VCE=vectoring control entity, TCE=timing control entity, DBA=dynamic bandwidth allocation

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23

Reference model of an FTU-R module