

All_1 – TIM FTTH deployment Service Models for external ONTs and internal ONTs in optical CPEs

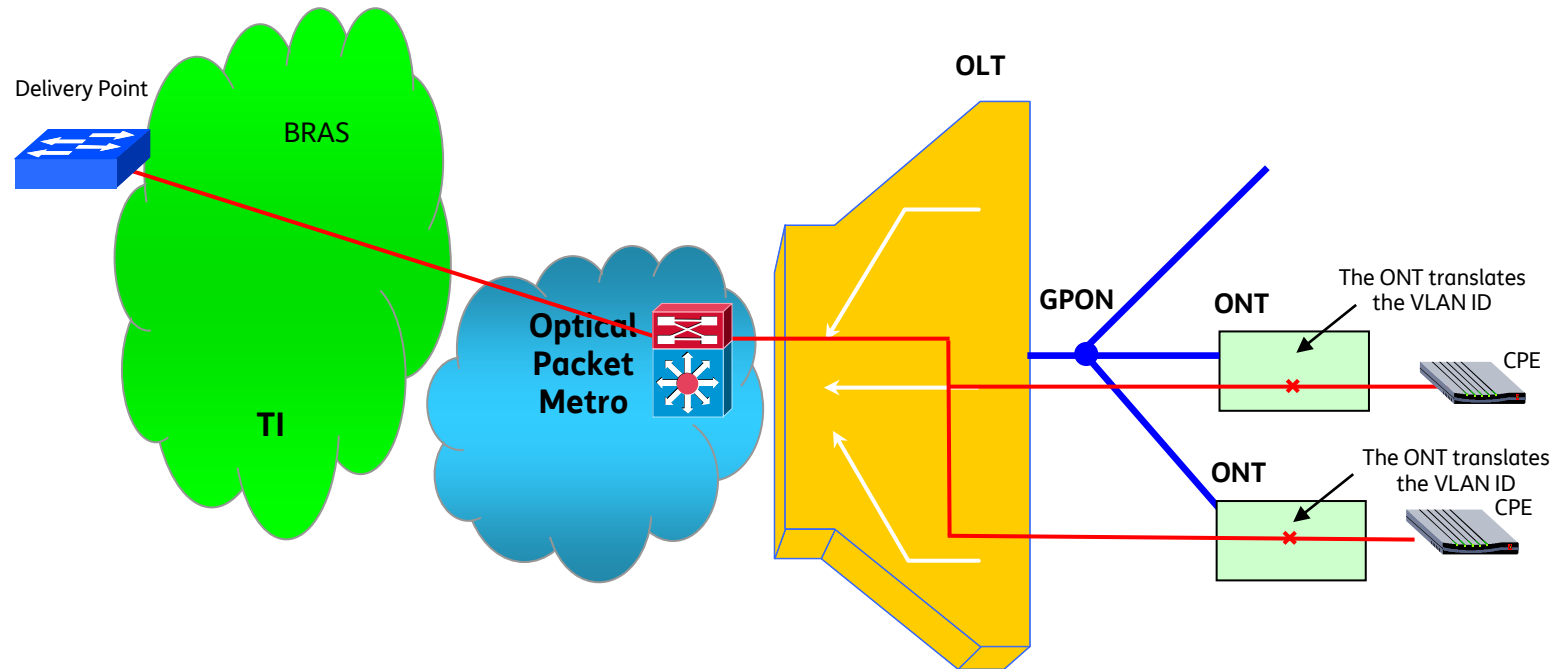
26 luglio 2022



Wholesale Service Model for FTTH Architecture

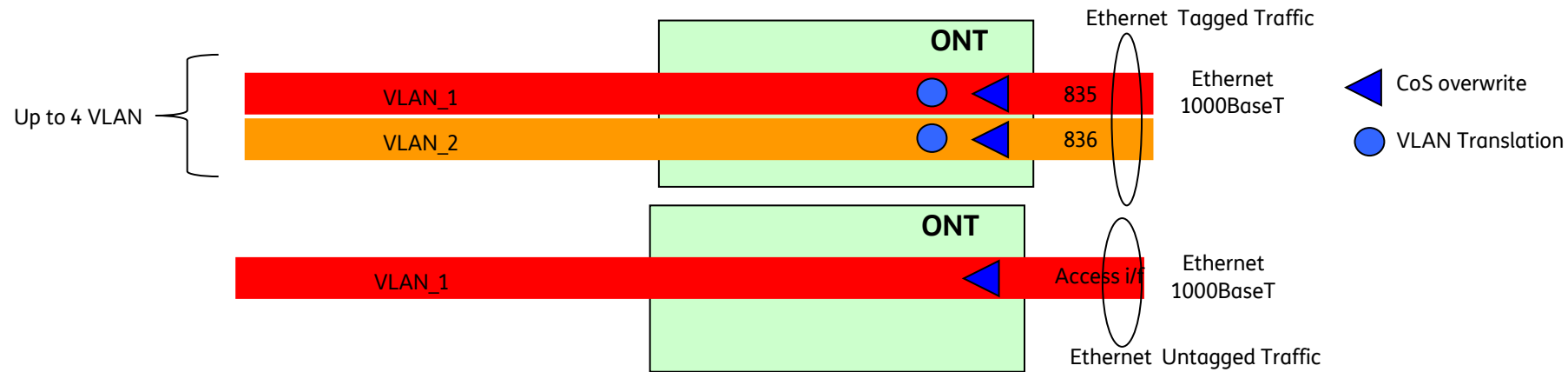
- Shared Bandwidth and Shared VLAN MonoCoS (no QinQ)
- Shared Bandwidth and Shared VLAN MultiCoS (no QinQ)

FTTH Architecture



- 1 Wholesale VLAN per OLT (per each OLO) shared by all ONT belonging to the OLT. It can transport XoE protocol

L2 Functionalities on ONT



Ethernet Tagged Traffic

•Upstream:

- ONT overwrites the CoS value to a pre-defined value (e.g. 0, 1, 3 or 5) for MonoCoS Services and doesn't overwrite the CoS value for MultiCoS Services
- ONT Translates the VLAN ID from access ID (eg. 835, 836,..) to the Network VLAN ID

•Downstream

- ONT Translates the VLAN ID from the Network VLAN ID to access ID (eg. 835, 836,..)

Ethernet Untagged Traffic

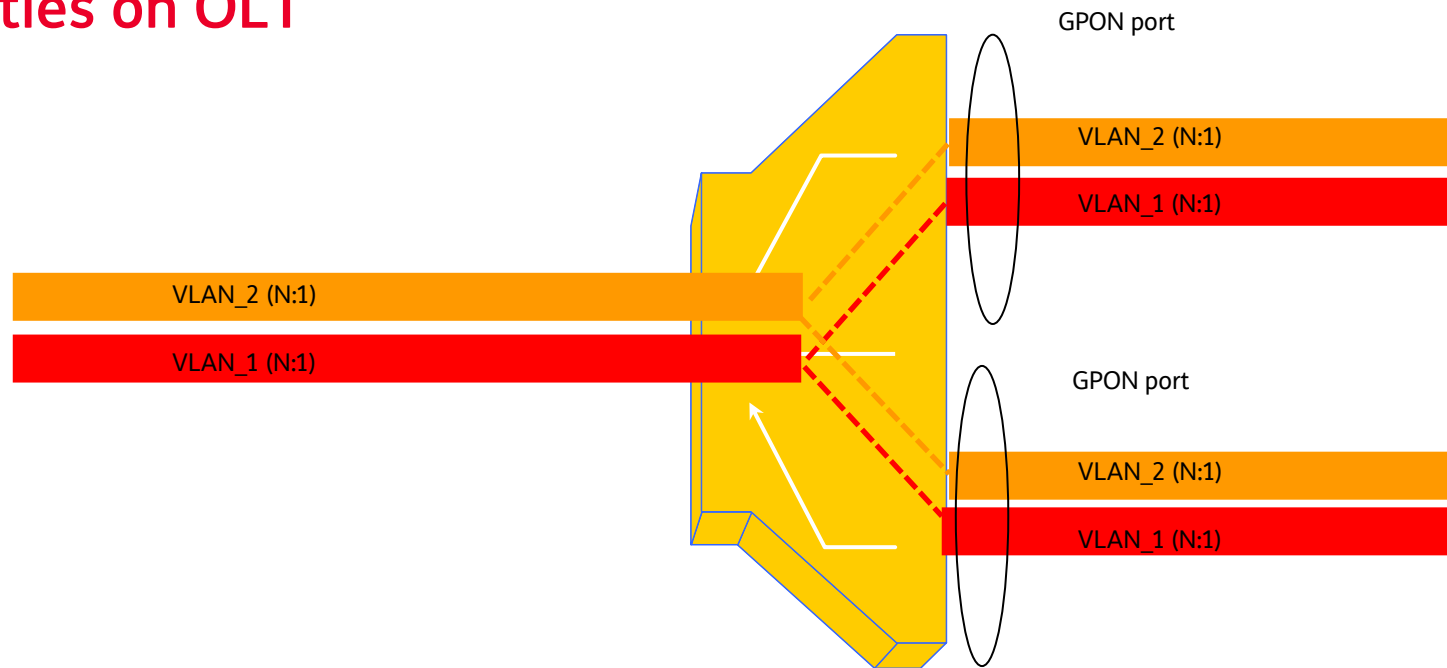
•Upstream:

- ONT adds the Network VLAN ID
- ONT overwrites the CoS value to a pre-defined value (CoS=1)

•Downstream

- ONT removes the network VLAN ID

L2 functionalities on OLT



FTTH Architecture (GPON port)

Upstream:

- OLT limits the rate of the ingress traffic for each userVLAN (TCONT based)
- OLT adds Option 82 for DHCP traffic and Intermediate Agent for PPPoE discovery session

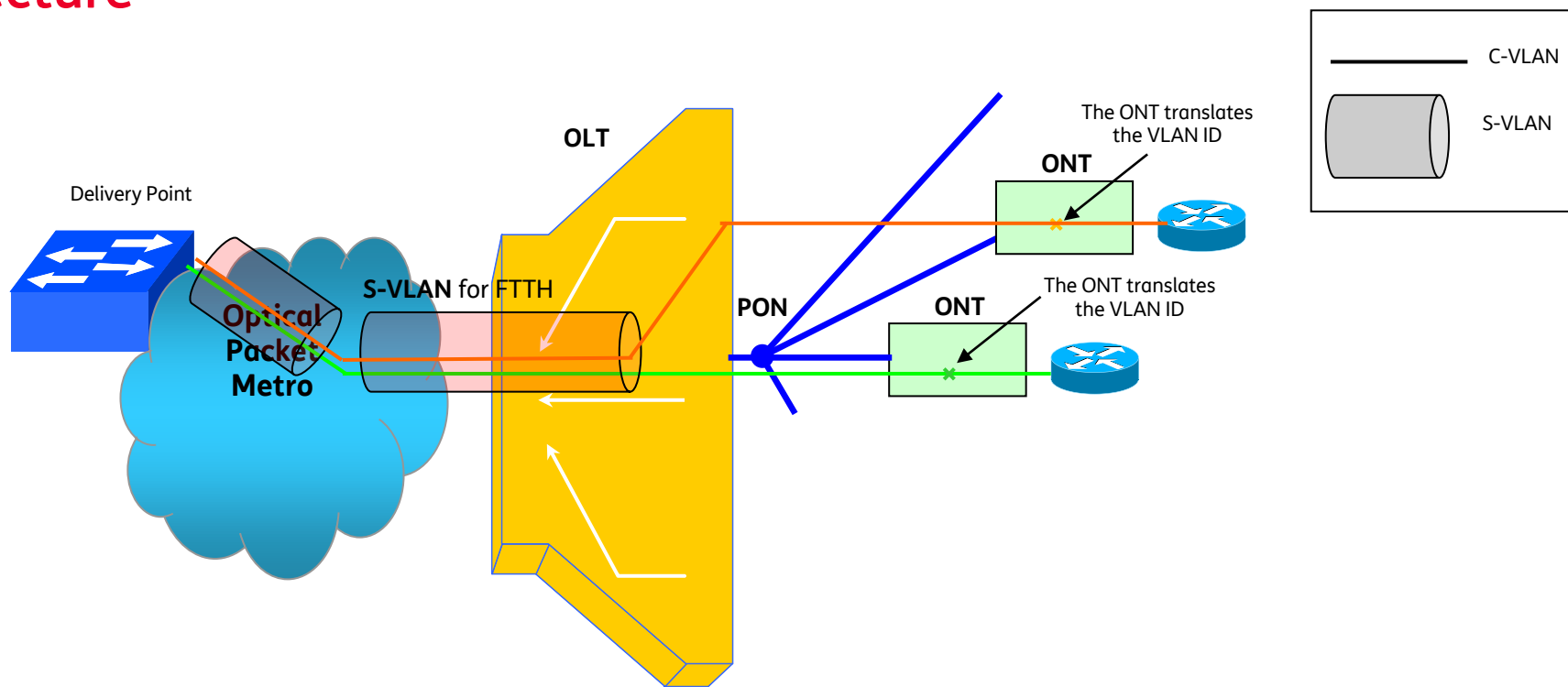
Downstream

- OLT limits the rate of the egress traffic for each userVLAN

Wholesale Service Model for FTTH Architecture

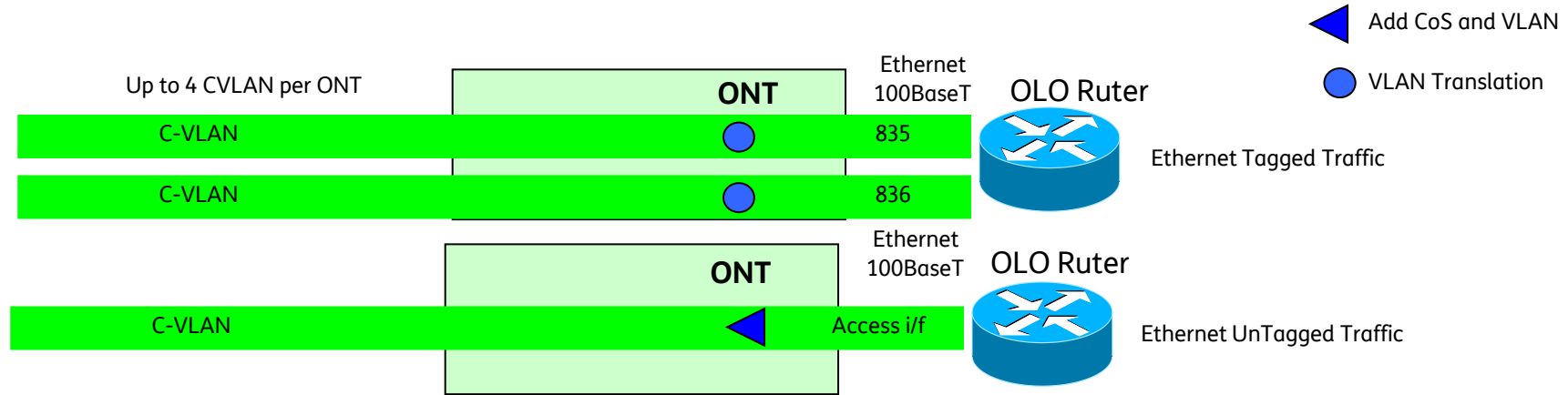
- Shared Bandwidth and Dedicated VLAN MonoCoS (QinQ)
- Shared Bandwidth and Dedicated VLAN MultiCoS (QinQ)
- Dedicated Bandwidth and Dedicated VLAN MonoCoS (QinQ)
- Dedicated Bandwidth and Dedicated VLAN MultiCoS (QinQ)

FTTH Architecture



- 1 S-VLAN per OLT shared by all ONT belonging to the same OLT (S-VLAN dedicated for FTTH): The S-VLAN is added by OLT for FTTH
- 1 or more C-VLAN (up to 4) per each Wholesale Customer.

L2 Functionalities on ONT



Ethernet Tagged Traffic

•Upstream:

- ONT overwrites the CoS value to a pre-defined value (e.g. 0, 1, 3 or 5) for MonoCoS Services and doesn't overwrite the CoS value for MultiCoS Services
- ONT Translates the VLAN ID from access ID (eg. 835, 836,..) to the C-VLAN ID
- ONT must be transparent for every kind of traffic (e.g. Broadcast, Multicast, Unicast Unknown, IGMP, ARP, DHCP, etc..)

•Downstream

- ONT Translates the VLAN ID from the C-VLAN ID to access ID (eg. 835, 836,..)
- ONT must be transparent for every kind of traffic (e.g. Broadcast, Multicast, Unicast Unknown, IGMP, ARP, DHCP, etc..)

Ethernet UnTagged Traffic

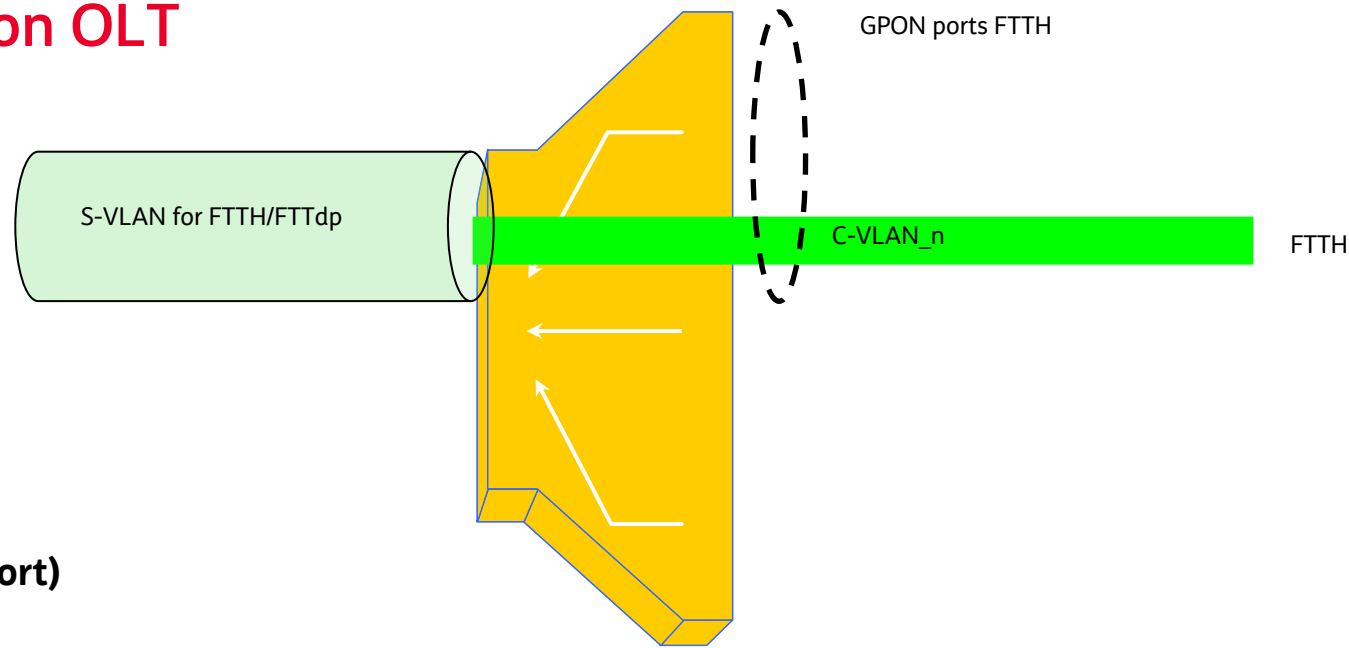
•Upstream:

- ONT adds the C-VLAN ID
- ONT overwrites the CoS value to a pre-defined value (CoS=1)
- ONT must be transparent for every kind of traffic (e.g. Broadcast, Multicast, Unicast Unknown, IGMP, ARP, DHCP, etc..)

•Downstream

- ONT removes the C-VLAN field
- ONT must be transparent for every kind of traffic (e.g. Broadcast, Multicast, Unicast Unknown, IGMP, ARP, DHCP, etc..)

L2 Functionalities on OLT



FTTH Architecture (GPON port)

Upstream:

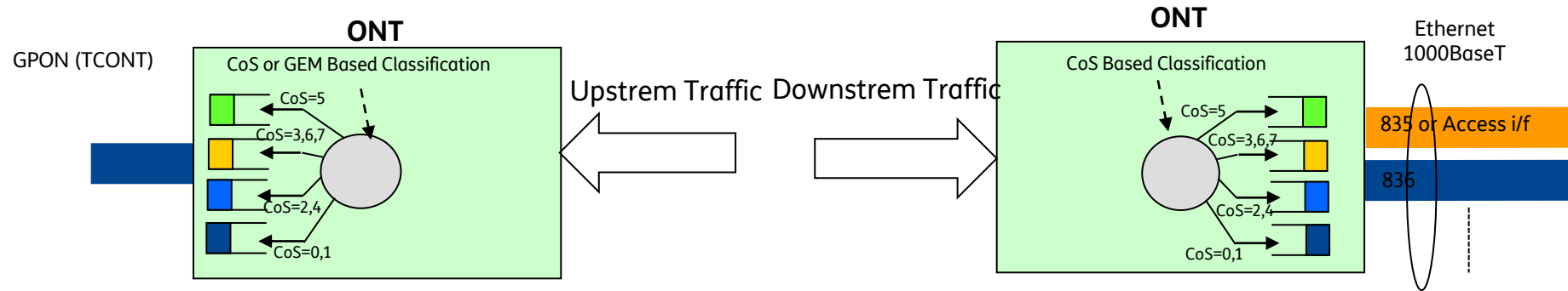
- OLT limits the rate of the ingress traffic for each user VLAN (TCONT based)
- OLT add the S-VLAN TAG
- OLT copies 802.1p bits of the C-VLAN in the 802.1p bits of the S-VLAN
- OLT must be transparent for every kind of traffic (e.g. . Broadcast, Multicast, Unicast Unknown, IGMP, ARP, DHCP, etc..)

Downstream

- OLT limits the rate of the egress traffic for each user VLAN
- OLT removes the S-VLAN TAG
- OLT must be transparent for every kind of traffic (e.g. Broadcast, Multicast, Unicast Unknown, IGMP, ARP, DHCP, etc..)

Layer 2 QoS for all Service Models

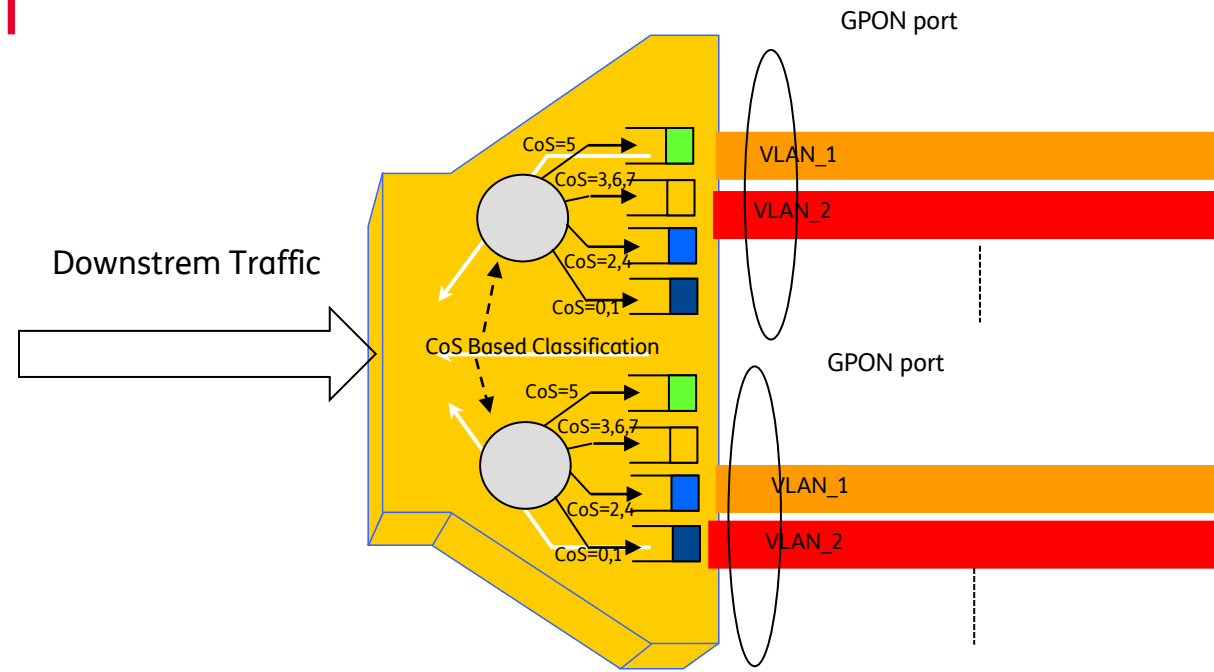
QoS Functionalities on ONT



QoS on Ethernet Interface

- The downstream traffic that gets out from ethernet interface must be classified by CoS.
- It is necessary to have at least four queues
- The mapping between CoS and queues must be configurable (e.g. CoS=0,1 in the lowest priority queue, CoS=2,4 in the medium priority queue, etc..)
- It is necessary to have at least 2 queues in Strict Priority mode (e.g. for voice and video)
- Same behaviour must be considered also in US direction:
 - For each TCONT in case of ONT (Classification based on GEM)

QoS Functionalities on OLT



QoS on GPON port

- The downstream traffic that gets out from GPON ports must be classified by CoS of the outer VLAN
- It is necessary to have at least four queues for each GPON port
- The mapping between CoS and queues must be configurable (e.g. CoS=0,1 in the lowest priority queue, CoS=2,4 in the medium priority queue, etc..)
- It is necessary to have at least 2 queues in Strict Priority mode (e.g. for voice and video) and two queues in WRR mode
- It is necessary to implement **WRED** mechanism on the two lower priority queues:
 - CoS 1 higher priority than CoS=0 in lowest priority queue
 - CoS=2 higher priority than CoS=4 in medium priority queue

QoS on 10GbE port (uplnk)

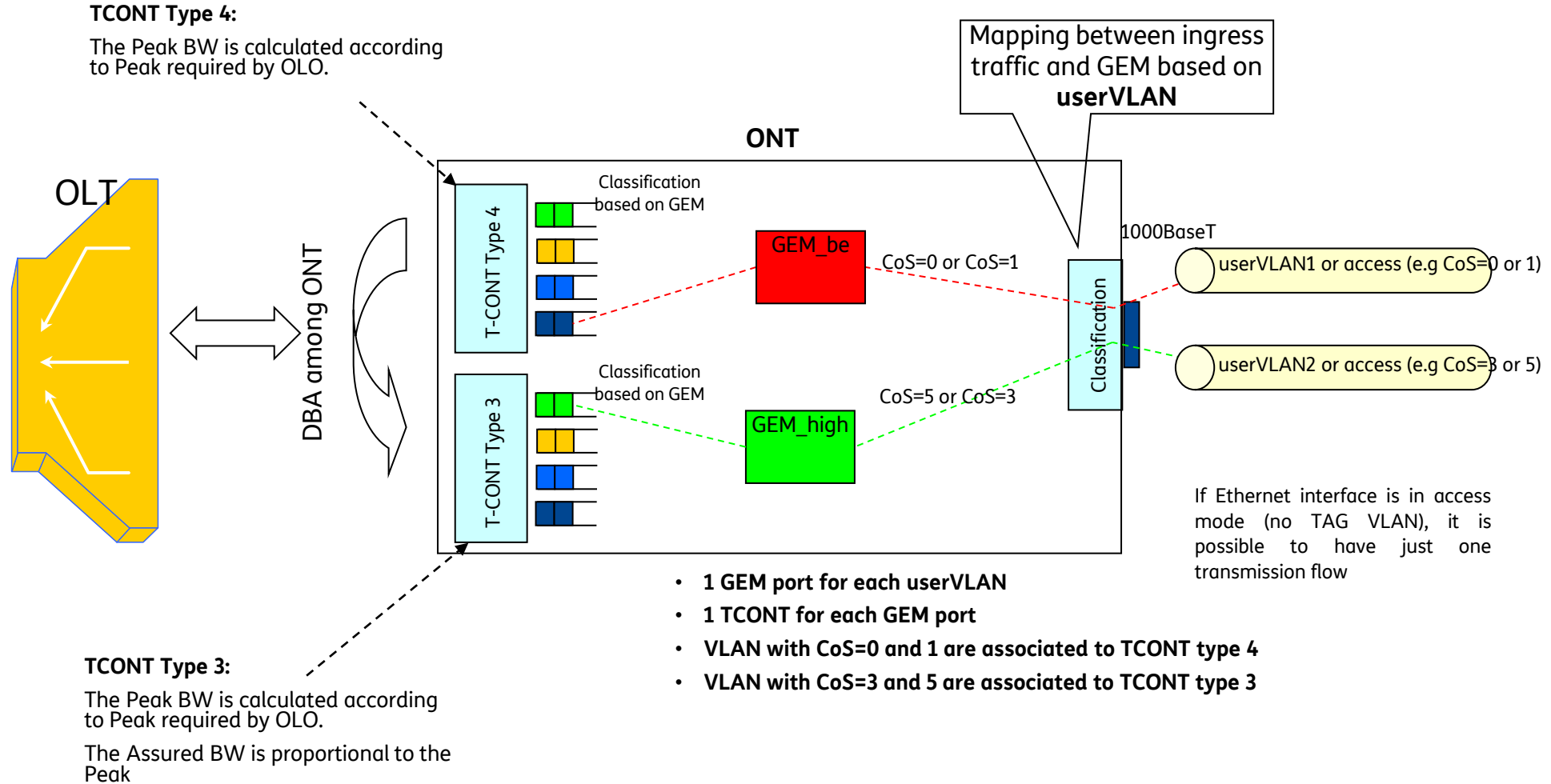
- Similar behaviour to GbE port, must be considered also in US direction on 10GbE port. In this case WRED is not mandatory

xPON configuration for FTTH architecture Wholesale Services

xPON FTTH Wholesale Services (OLT Type 1 & 2)

1/2

- Shared Bandwidth and Shared VLAN MonoCoS (no QinQ)
- Shared Bandwidth and Dedicated VLAN MonoCoS (QinQ)
- Dedicated Bandwidth and Dedicated VLAN MonoCoS(QinQ)



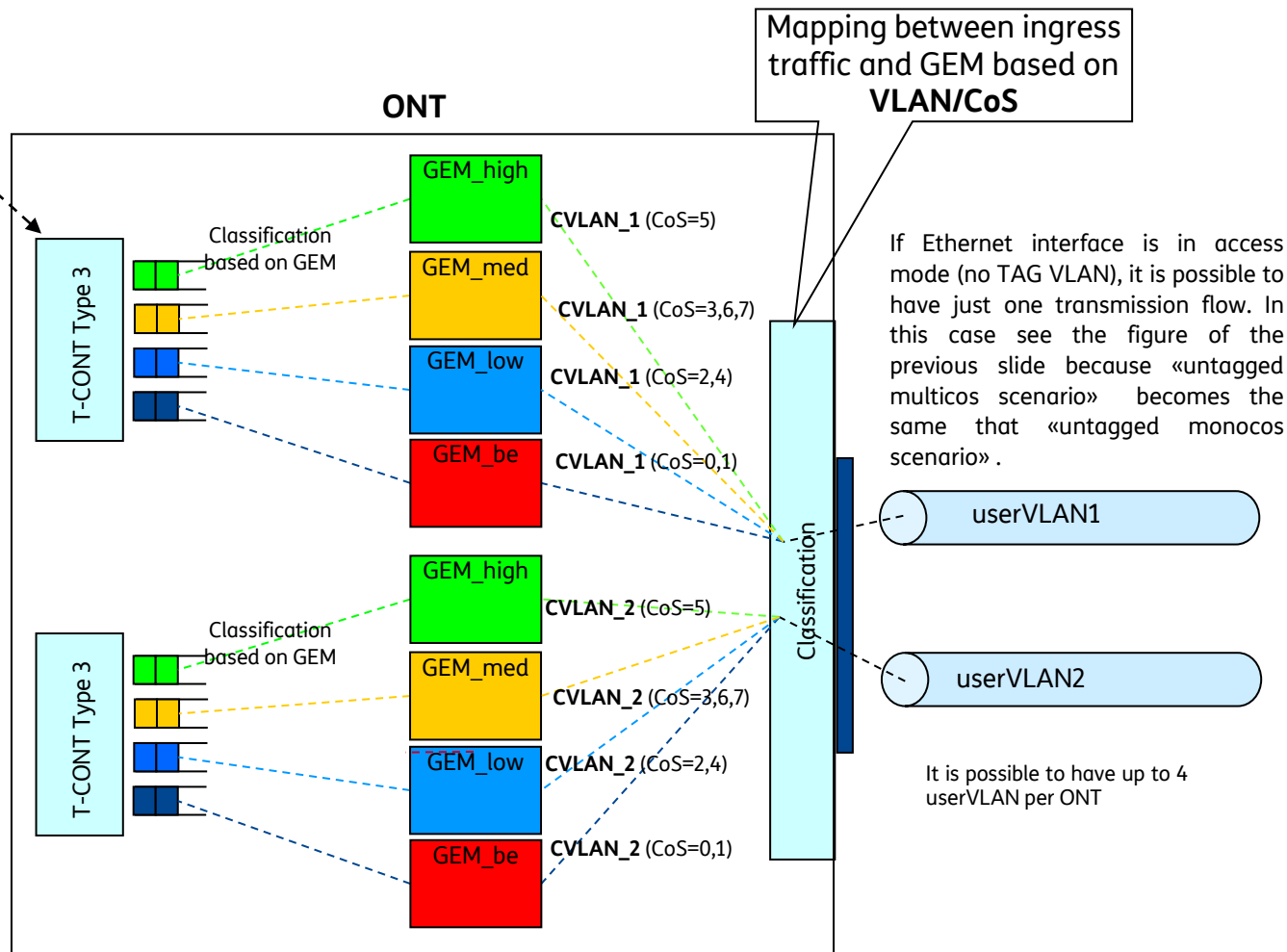
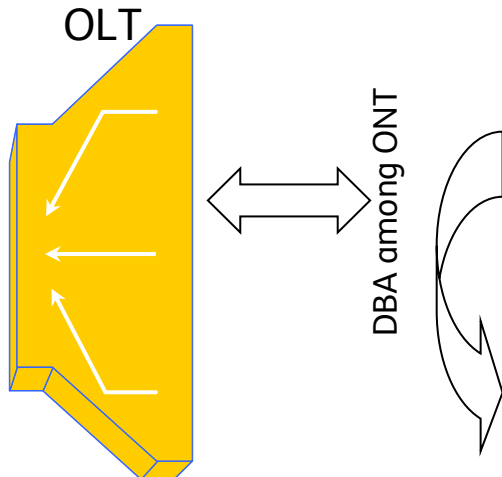
- Shared Bandwidth and Shared VLAN MultiCoS (no QinQ)
- Shared Bandwidth and Dedicated VLAN MultiCoS (QinQ)
- Dedicated Bandwidth and Dedicated VLAN MultiCoS (QinQ)

TCONT Type 3:

The Peak BW is calculated according to Peak required by OLO.

The Assured BW is:

- proportional to the Peak for Shared Bandwidth services
- equal to «B» (BMG) for Dedicated Bandwidth services



The adoption of Multicast assumes the use of an additional TCONT (for IGMP) + GEM Port (for IGMP + Mcast) + UserVLAN

- Below there is Wholesale MultiCoS and MonoCoS Services configuration. Some considerations:
- VLAN translation has been neglected but it is assumed it is executed by ONT on the Ethernet Port.
 - They are necessary: 4 Queues, 4 GEMs and 1 TCONT per each userVLAN
 - This GPON service model suits for both single-TAG and Double-TAG Wholesale Service model. The eventual second TAG is added by OLT.
 - This GPON service model suits for Tagged or Untagged access traffic. If the traffic is untagged the ONT instead of execute VLAN translation should add a TAG

The figure of the Service Model is depicted in the next slide.

The tables below describes the configuration depicted in figure of next slide; but in the figure only two VLAN groups (or userVLAN) are shown

Bandwidth Profile	CIR	AIR	EIR	Type (automatic)
BW_pr1	0	ww	tt	3
BW_pr2	0	yy	zz	3

Queue	Bandwidth Profile	Weight	Priority	Shaper Sharing
Q0	BW_pr1	1	1	single VLAN based
Q1	BW_pr1	2	1	single VLAN based
Q2	BW_pr1	0	2	single VLAN based
Q3	BW_pr1	0	3	single VLAN based
Q0	BW_pr2	1	1	single VLAN based
Q1	BW_pr2	2	1	single VLAN based
Q2	BW_pr2	0	2	single VLAN based
Q3	BW_pr2	0	3	single VLAN based
Q0	BW_pr1	1	1	single VLAN based
Q1	BW_pr1	2	1	single VLAN based
Q2	BW_pr1	0	2	single VLAN based
Q3	BW_pr1	0	3	single VLAN based
Q0	BW_pr2	1	1	single VLAN based
Q1	BW_pr2	2	1	single VLAN based
Q2	BW_pr2	0	2	single VLAN based
Q3	BW_pr2	0	3	single VLAN based

VAN group_1
(userVLAN 835)

VAN group_2
(userVLAN 836)

VAN group_3
(userVLAN 837)

VAN group_4
(userVLAN 838)

