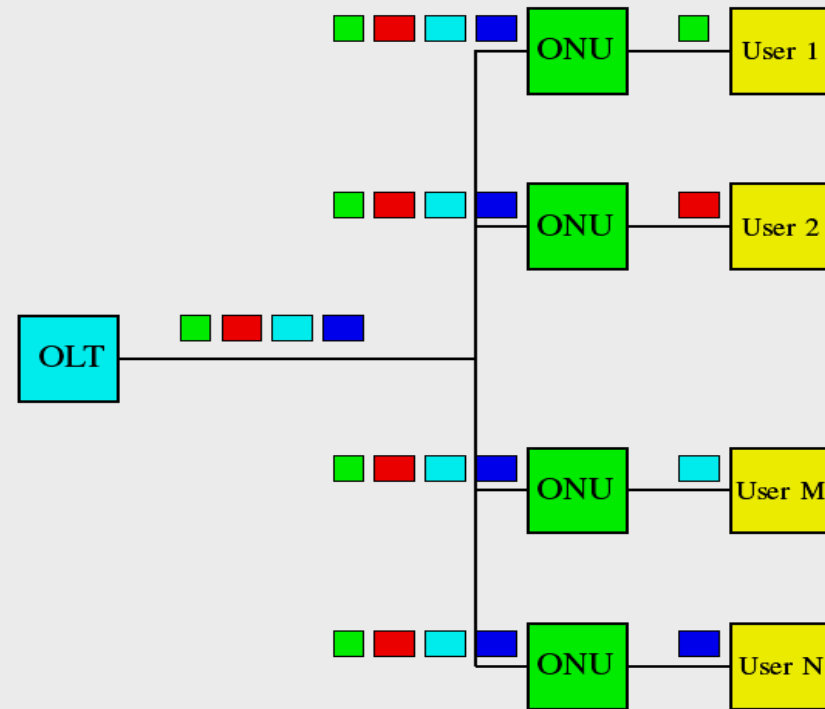
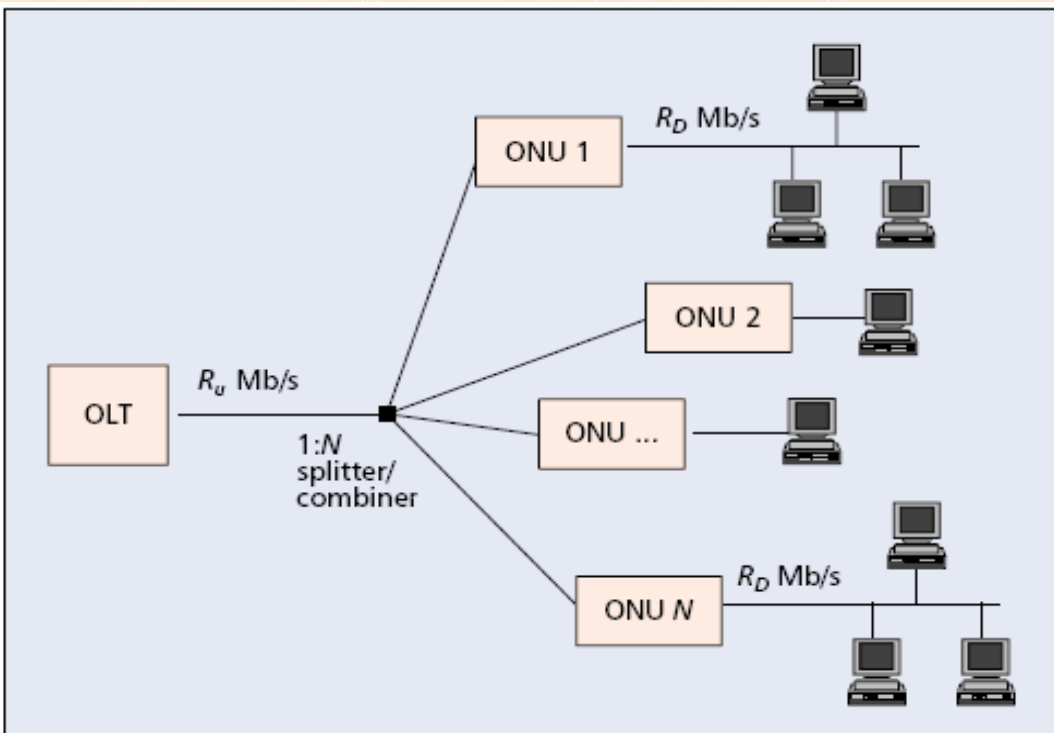


# EPON System ( Access Network )



# Intro to PON - What is PON?

- PON (Passive Optical Network):**  
**A point-to-multi-point (P2MP) optical network with no active elements in the path from source to destination**



# ***PON Components***

All transmissions in a PON are performed between an optical line terminal (OLT) and optical network units (ONUs).

***What is Optical Line Terminal (OLT) ?***

**OLT**

An OLT resides in the local exchange (central office), connecting the optical access network to the metro back-bone.

***What are Optical Network Units (ONUs) ?***

**ONU**

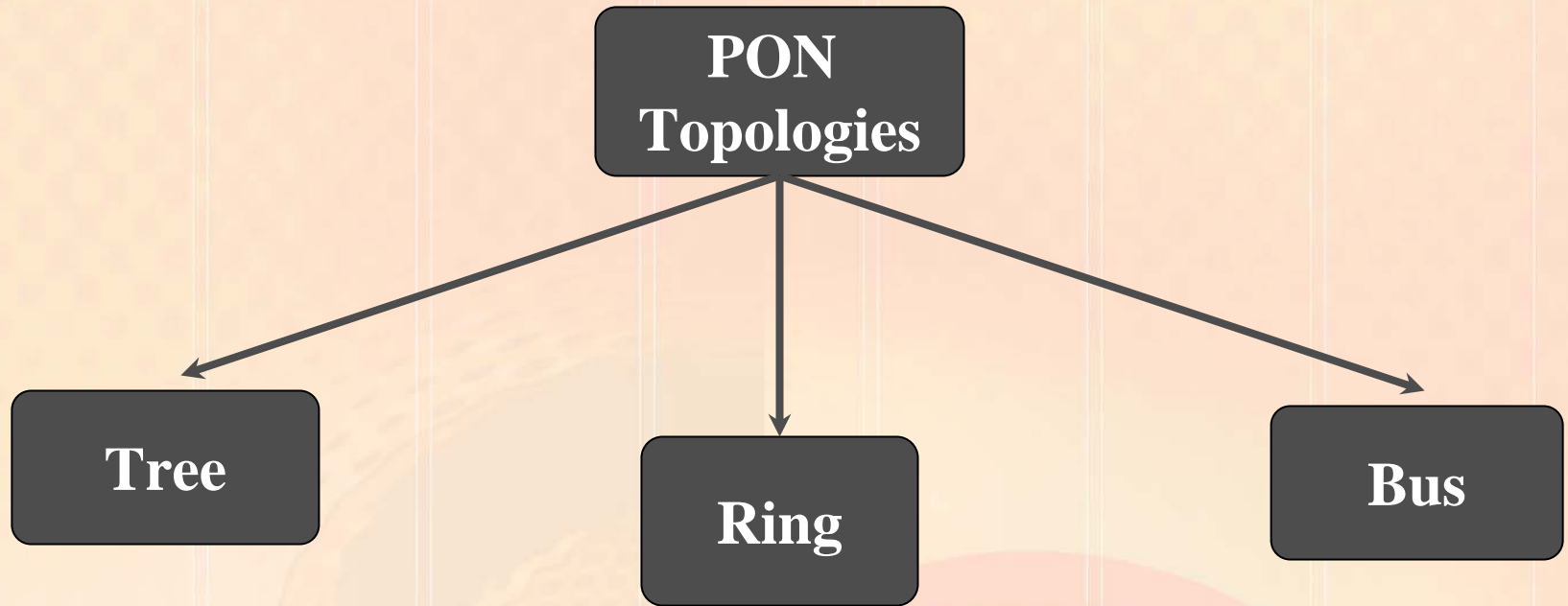
The ONU provides the interface between the customer's data, video, and telephony networks and the PON. Its function is to receive traffic in an optical format and convert it into the customer's desired format (Ethernet, IP multicast, T1, etc.)

***Passive elements such as splitters/couplers and combiners***

**Passive  
Elements**



# ***Different types of PON topologies***

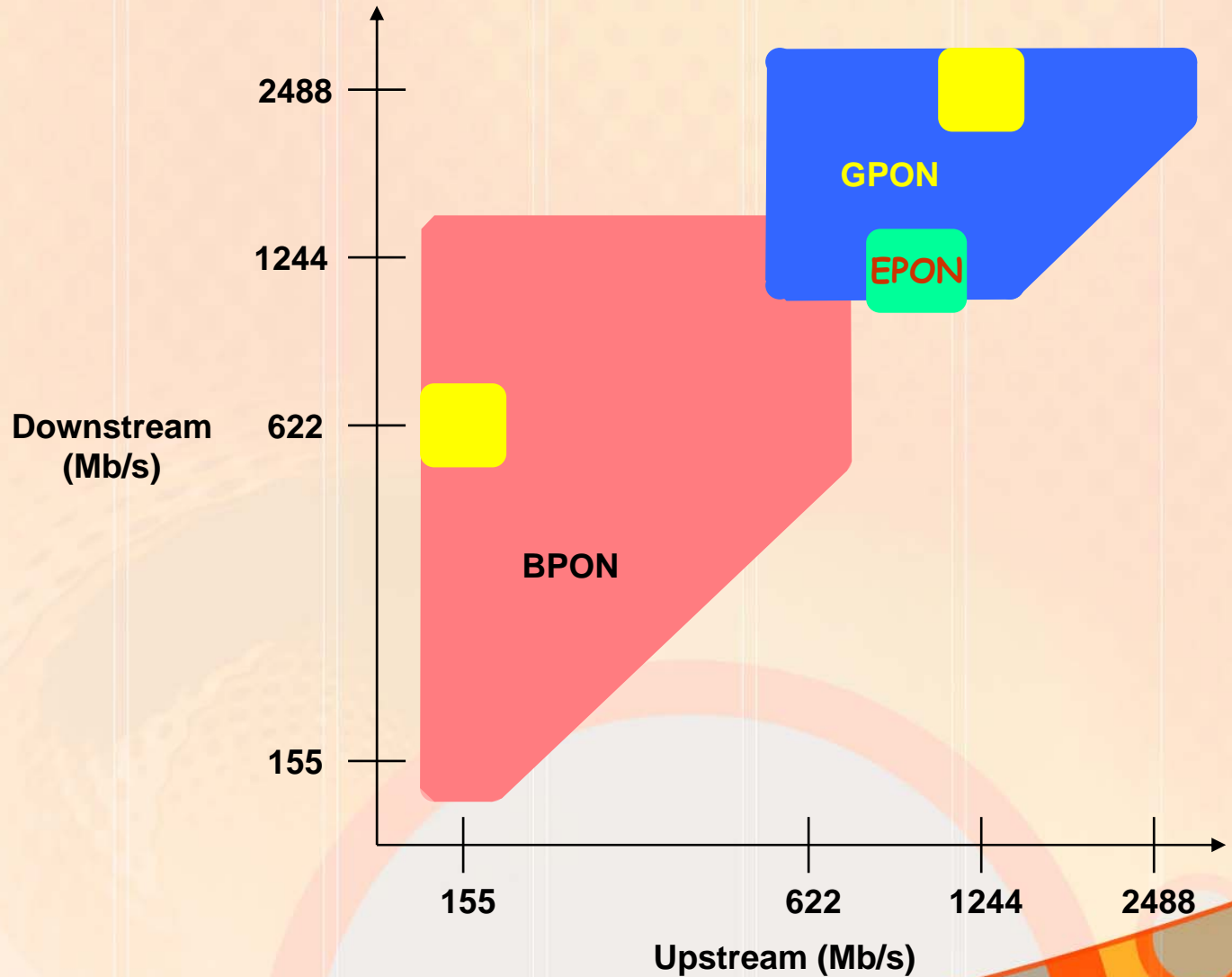






# ***PON standards***

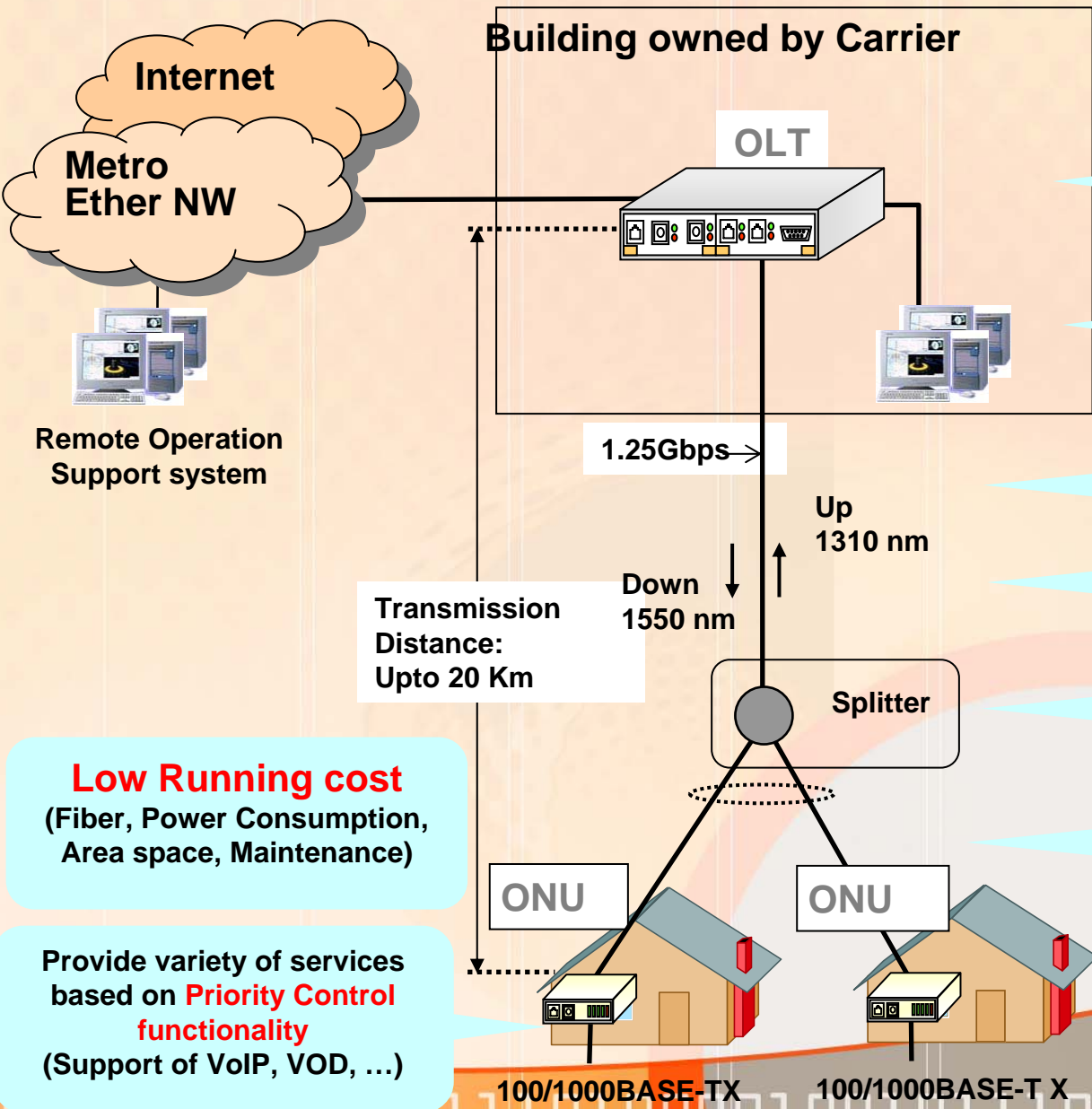
- APON
- BPON
- EPON
- GPON







# Ethernet Passive Optical Network (EPON)



**High capacity**

**Easy operation/maintenance**  
User-friendly GUI for configuration, test, and fault maintenance

**Gives broad enough bandwidth in Access NW**  
**1.25Gbps**

**Only need one fiber**  
Accommodate up to 32 Users.

**Maintenance-free**  
Passive device

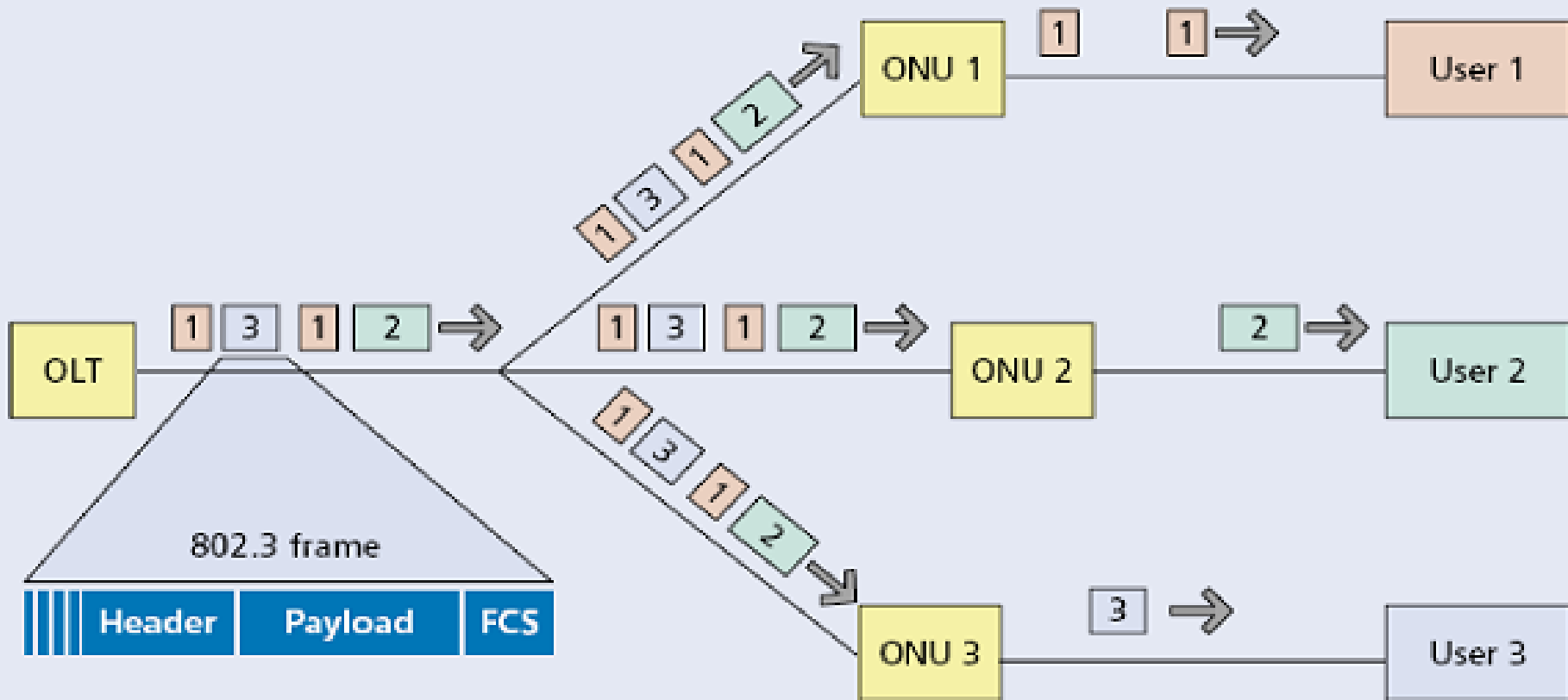
**Fairness on distance (Reach)**  
Purely optical

**Low Running cost**  
(Fiber, Power Consumption, Area space, Maintenance)

Provide variety of services based on **Priority Control functionality**  
(Support of VoIP, VOD, ...)

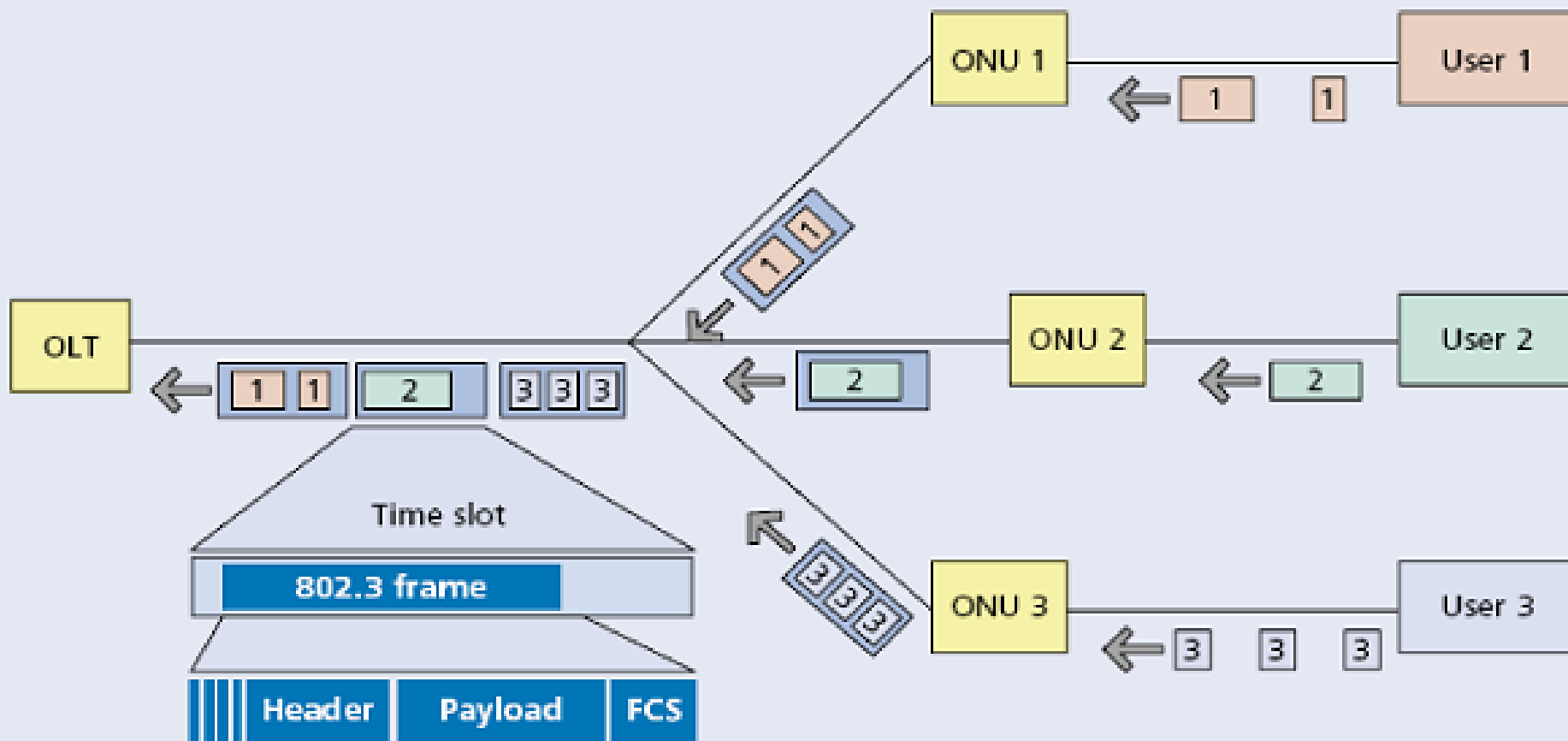
# Downstream traffic in EPON

Downstream traffic in EPON is broadcasted downstream from OLT to multiple ONUs. Each packet carries a header that uniquely identifies it as data intended for ONU-1, 2 or ONU-3. At the splitter the traffic is divided into three separate signals, each carrying all of the ONU specific packets. When the data reaches the ONU, it accepts the packets that are intended for it and discards the packets that are intended for other ONUs.



# Upstream traffic in EPON

The time slots are synchronized so that upstream packets from the ONUs do not interfere with each other once the data is coupled onto the common fiber.



# ***EPON-Why?***

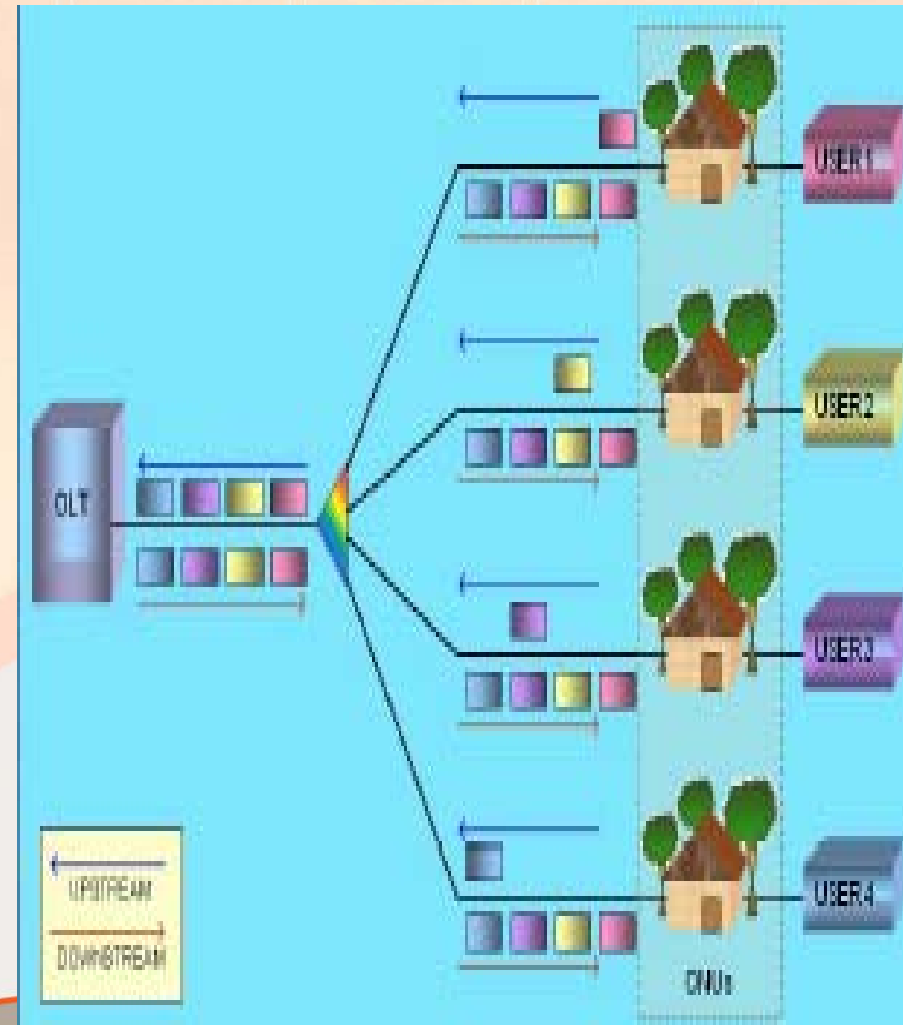
- ***More subscribers per PON***
- ***More bandwidth per subscriber***
- ***Higher split counts***
- ***Video capabilities***
- ***Better QoS***
- ***Ethernet PONs (EPONs) promise to offer the ubiquity and price efficiency.***
- ***EPONs are defined in the IEEE 802.3ah Ethernet in the First Mile specification***
- ***Capable to transport data/voice/video***
- ***It is being widely deployed***
- ***IP based so fragmentation/assembly not needed***

# ***PON Variants***

- *Time Division Multiplexing (TDM) PON*
- *Wavelength Division Multiplexing (WDM) PON*

# TDM PON

- *Time division*  
*Multiplexing (TDM) in PON is a method used in a point to multipoint topology*
- In the **downstream** direction the signal sent by the OLT passes through passive splitter and is broadcasted to the attached ONUs





# TDM PON

- *On the other hand the **upstream** signal, from ONU to OLT cannot be sent simultaneously by two or more ONUs as the superposition of all the signals would be reached at the OLT*
- *Hence the TDM approach is used between the ONUs to avoid interference of the signal from different ONUs*

# TDM PON

- **Therefore in a TDM PON, end users *share the bandwidth in time domain* i.e. the OLT assigns timeslots to the ONUs in a round robin fashion for upstream transmission**
- **While waiting for its opportunity, an *ONU buffers all incoming data*. The contents of the queues are transmitted in a single burst by utilizing full available bandwidth of the channel upon the start of an allocated transmission window**

# *Design challenges for PON technology:*

	<i>Advantage</i>	<i>Disadvantage</i>
<i>WDM</i>	<i>Provides high bandwidth.</i>	<i>Cost and scalability: the OLT has to have a transmitter array with one transmitter for each ONU. adding a new ONU could be a problem. Each ONU must have a wavelength-specific laser</i>
<i>TDM</i>	<i>Only one transmitter needed in the OLT, no matter how many ONUs are connected</i>	<i>More complicated than WDM. Require ONUs to be synchronized</i>

