Suggestion for
the Layering Architecture

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On the Baseline Proposals for Layering..
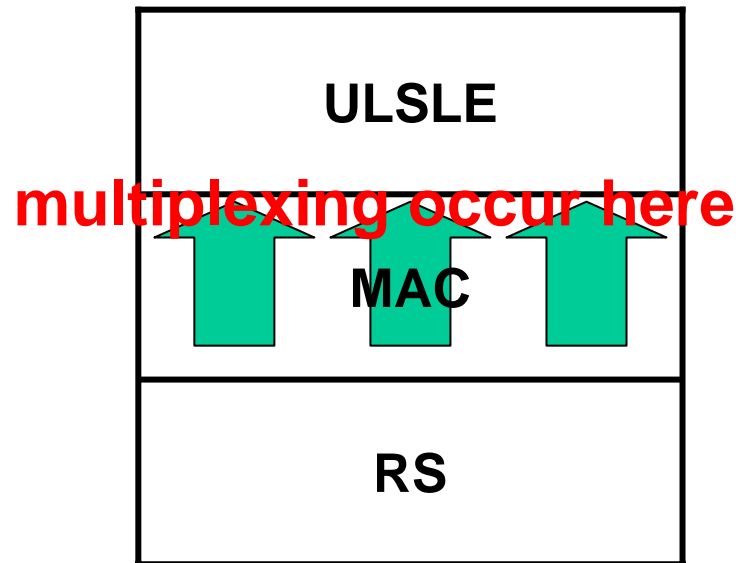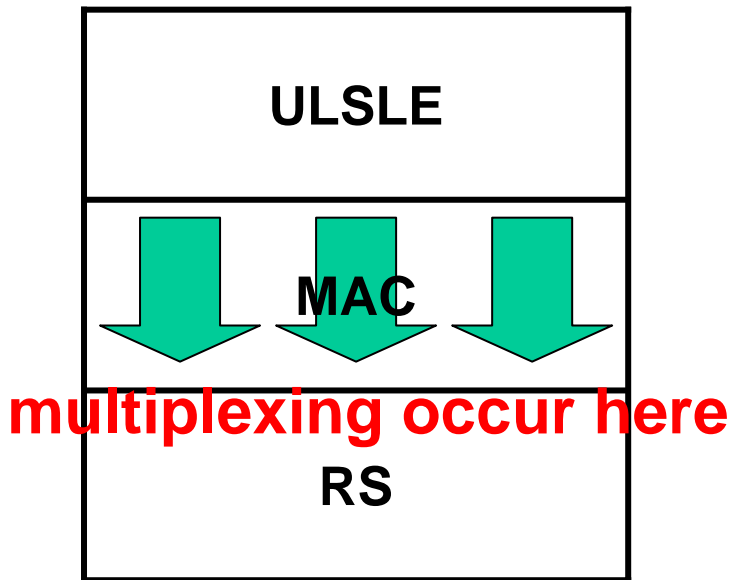
❑ **Vertical Things** in a Layer Architecture => always caused much confusion if it is not defined without an accurate definition of terms.

❑ Virtual MAC, Multi-MAC?
- ✓ Does each of Virtual MAC have its own MAC ADDRESS?
- ✓ Is it a physical MAC (means it has its address)?
- ✓ Answer)   NO! it use a single MAC (address).

❑ Then, How about calling it a **Virtual LLID Link**?

  or a **Virtual Port** of ULSLE?

❑ **Virtual LLID Link**: LLID Link virtually extended up from RS layer to a ULSLE port.

❑ **Virtual Port of ULSLE**: A port of ULSLE bridge virtually extended down from ULSLE to RS layer.

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Discussion Continued…(2/3)

People could misunderstand that

Virtual Port or Virtual MAC has

Only Virtual LLID Link has

ULSLE
MAC
RS

multiplexing occur here

ULSLE
multiplexing occur here
MAC
RS

Discussion Continued…(3/3)

❑ **Terms are not important if what it implies is well understood.**

ULSLE
MAC Control Sublayer
MAC Sublayer
RS

Exchange of Data Set (LLID, Frame either in a primitive form or in a frame format)
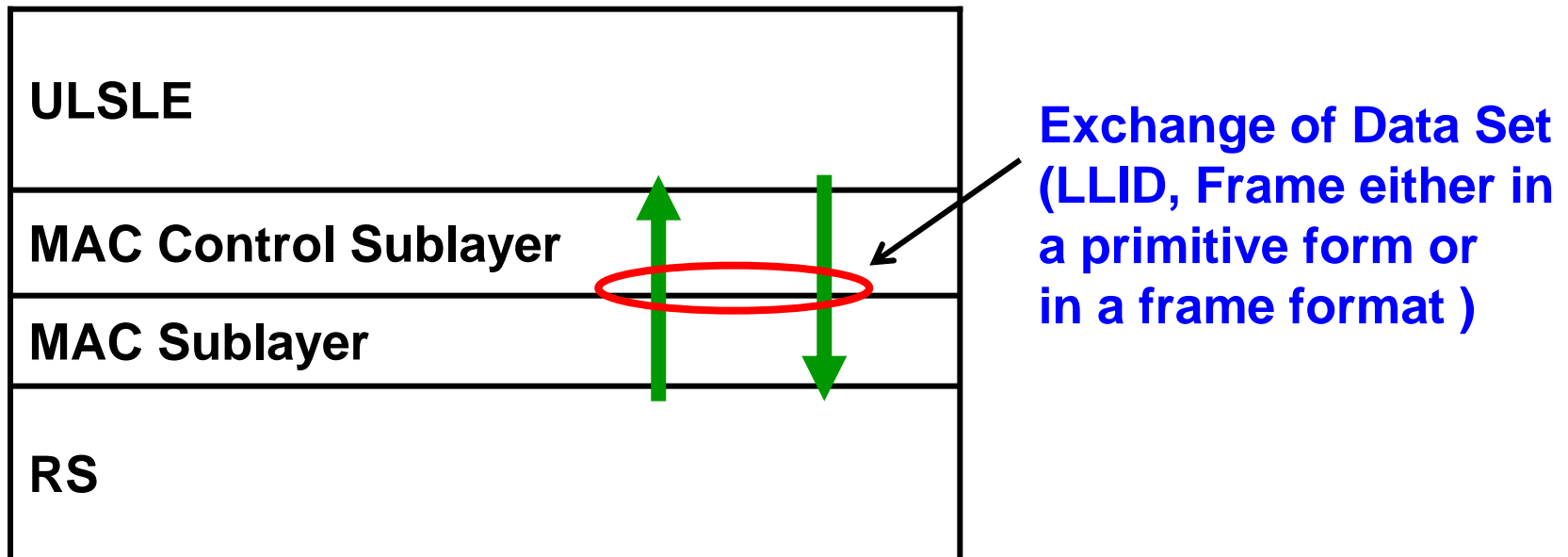
❑ **More detailed** description on Virtual things is desirable on the 802.3ah standard
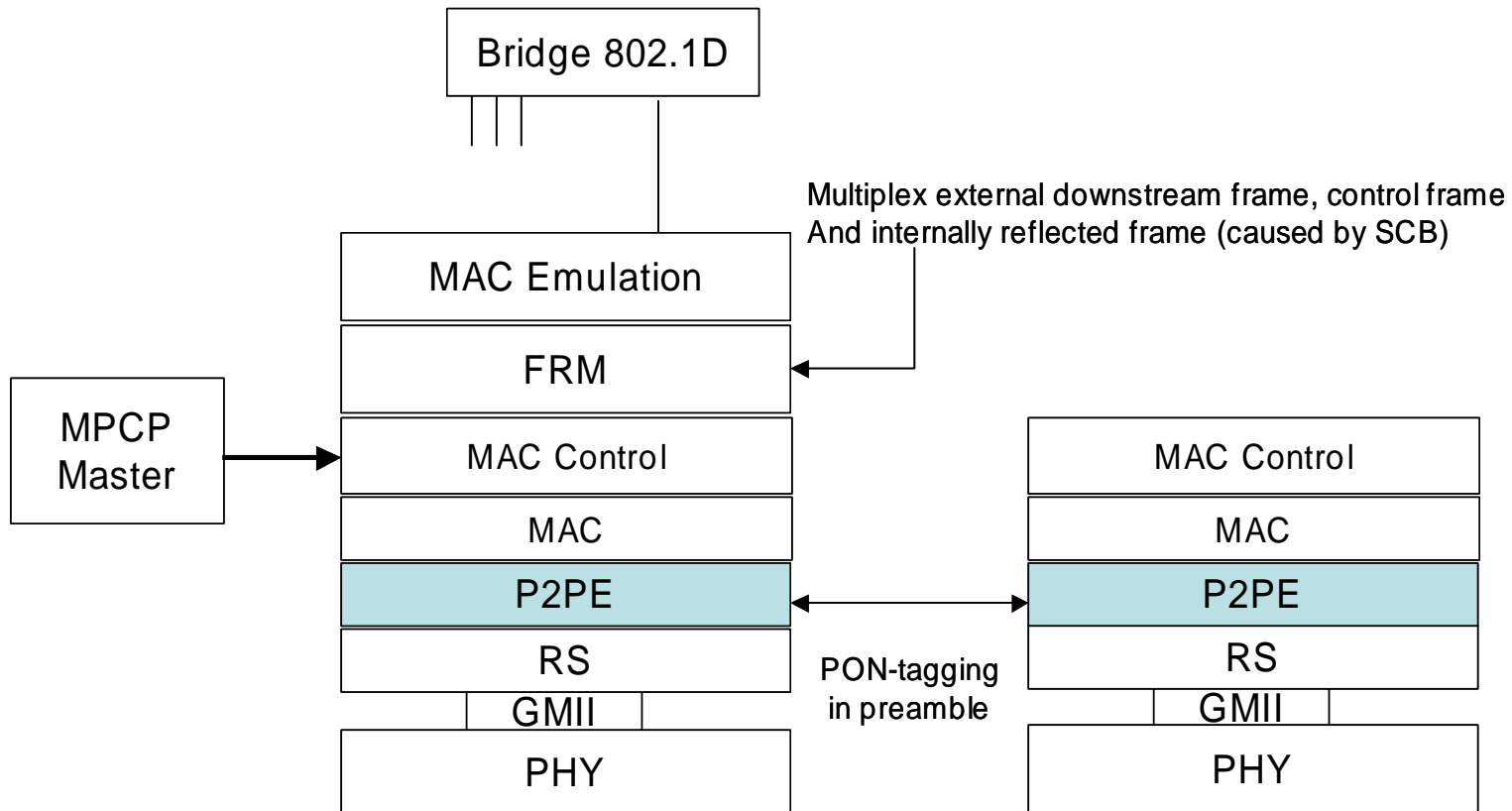
Purposes

- ❑ No Vitual Link/LLID,MAC across MAC layer
- ❑ Single MAC in OLT
- ❑ LLID in preamble
- ❑ Multiplexing in MAC control layer
- ❑ Link management per ONU link
- ❑ Simplified ULSLE
- ❑ Single LLID per ONU
- ❑ Easy implementation

If the address learning is allowed in the layer just below MAC !!!

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Method 1

- ❑ **PON tag is terminated in RS layer**
- ❑ **OLT interface through only one port to bridge**
  - ✓ **FRM (Frame Reflection Multiplex) which is a simplified ULSLE.**

Bridge 802.1D

Multiplex external downstream frame, control frame
And internally reflected frame (caused by SCB)

MAC Emulation

FRM

MPCP Master

MAC Control

MAC

P2PE

RS

GMII

PHY

MAC Control

MAC

P2PE

RS

GMII

PHY

PON-tagging in preamble

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Function of ULSLE for Method 1

802.1D Bridge

MAC Emulation

external broadcasting,
external P2P

internal
ONU to ONU traffic
(reflection)

Broadcasting

FRM

external upstream
(forward to bridge)

MUX

MPCP

MAC Control
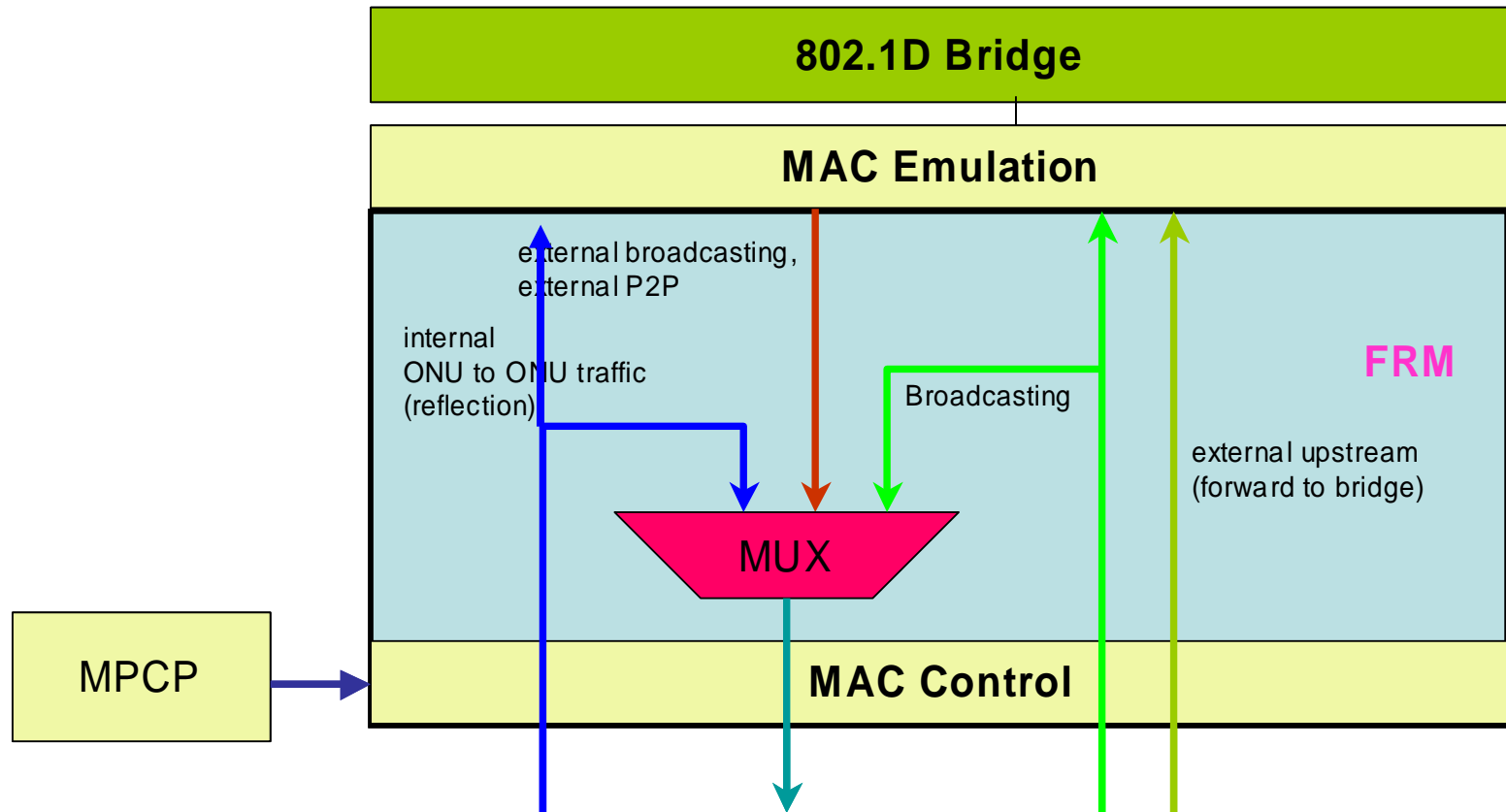
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Function of FRM

❑ **LLID mapping table for PON I/F is managed by RS layer**

❑ **Mirrored table is referenced by FRM for frame reflection**

❑ **FRM includes address learning process for internal frame reflection**
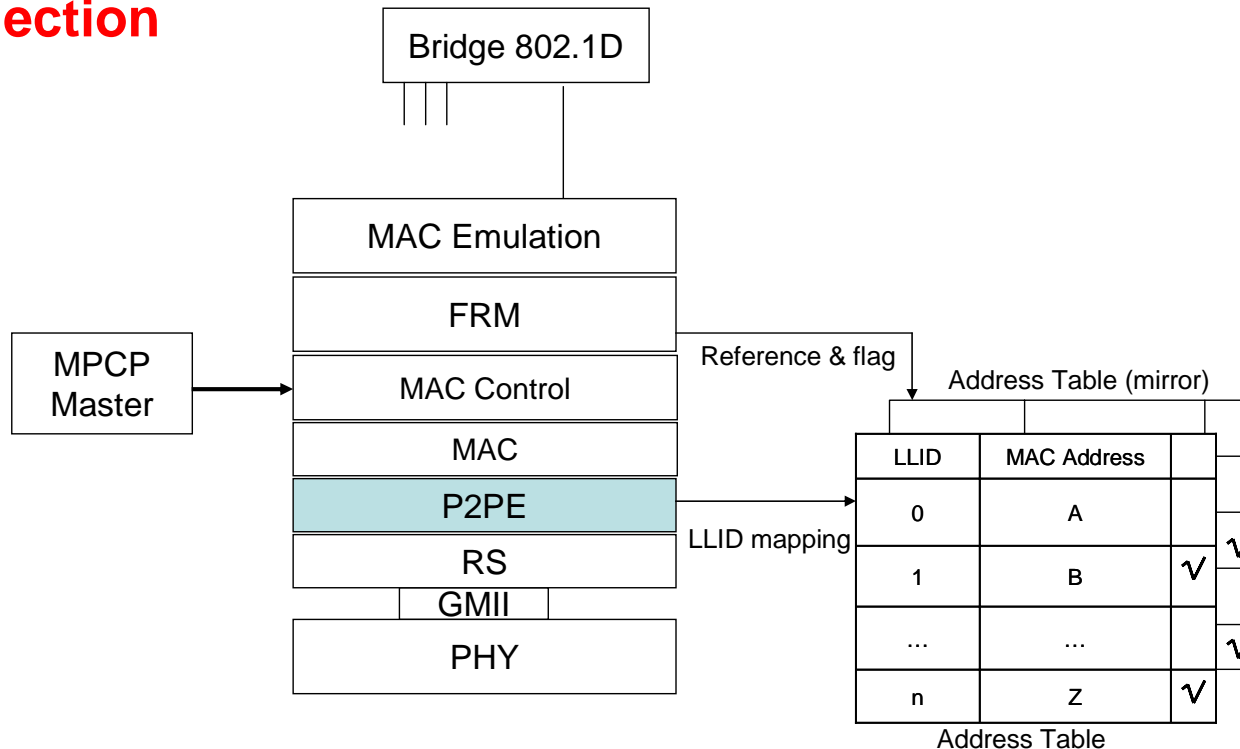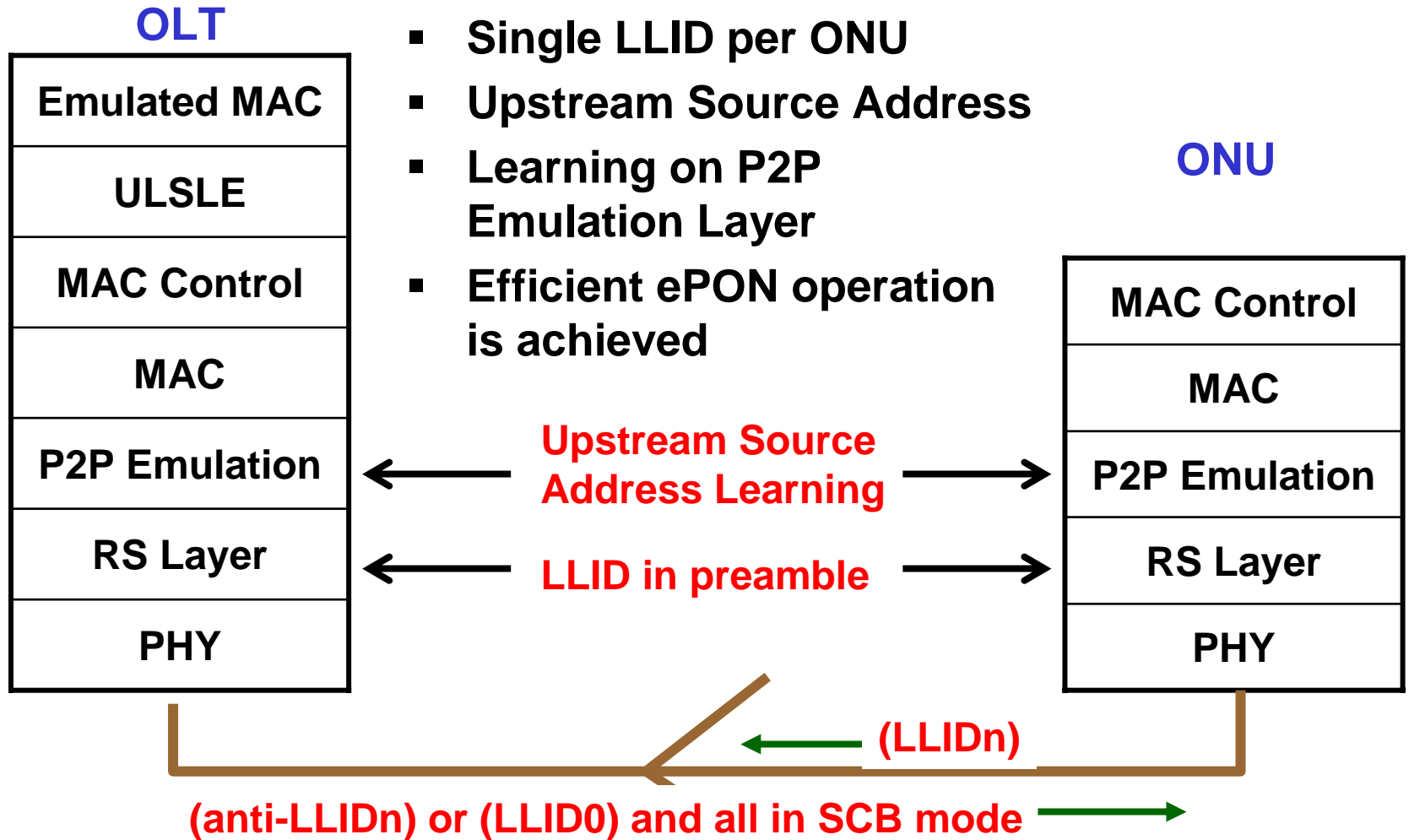
Functions of OLT layers

❑ **FRM (frame reflection and multiplexing)**
- ✓ **Frame reflection to ONU, forwarding to 802.1D bridge**
- ✓ **Downstream frame multiplexing**

❑ **MAC-control layer convergence**
- ✓ **Convergence of control frames and downstream data frames**

❑ **RS layer**
- ✓ **PON-tagging in preamble to downstream frames**
  - • **DA is broadcast MAC – mapping to ULLID**
  - • **both DA and SA is in address table – LLID of SA with SCB mode bit**
  - • **DA is in address table, but SA is not in – LLID of DA with P2P mode bit**
  - • **DA is not in address table, but SA is not in – LLID of SA with SCB mode bit**
  - • **both DA and SA is not in address table – mapping to ULLID**
- ✓ **LLID mapping**
- ✓ **No multiplexing function because OLT has only one MAC**

Functions of ONU layers

❑ **P2PE in RS layer**

  ✓ **Insert PON-tag in preamble to upstream frames**

  ✓ **Strip the PON-tag of preamble from downstream frame**

  ✓ **Filtering the downstream frame by PON-tag**

Method 2

OLT

Emulated MAC
ULSLE
MAC Control
MAC
P2P Emulation
RS Layer
PHY

- **Single LLID per ONU**
- **Upstream Source Address**
- **Learning on P2P Emulation Layer**
- **Efficient ePON operation is achieved**

ONU

MAC Control
MAC
P2P Emulation
RS Layer
PHY

← **Upstream Source Address Learning** →

← **LLID in preamble** →

← **(LLIDn)**

(anti-LLIDn) or (LLID0) and all in SCB mode →

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ULSLE function (simplified, so call it FRM)

❏ **No LMAC, No Virtual MAC required**
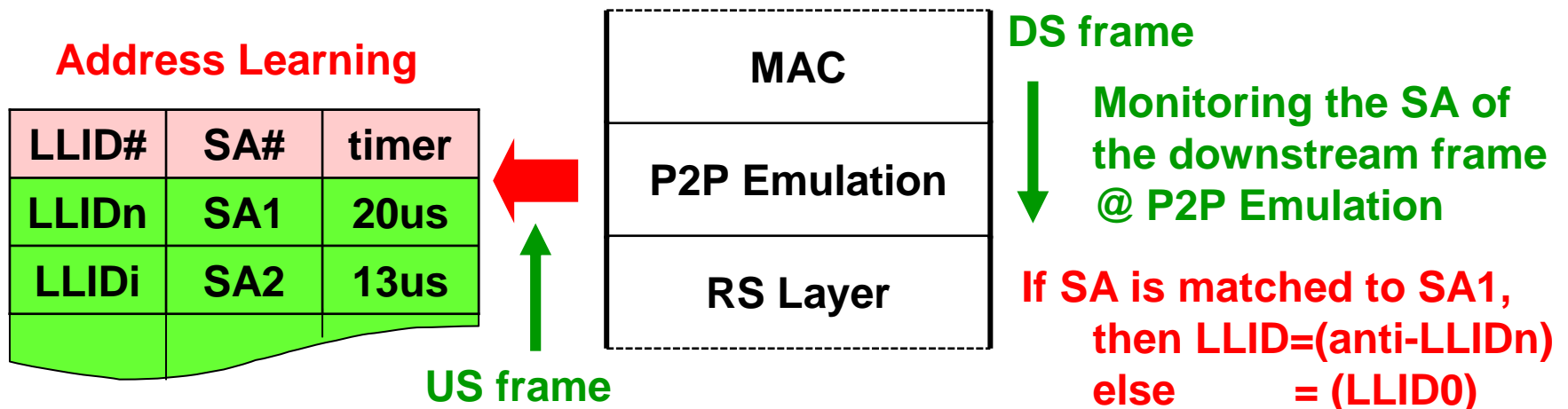
❏ **Two ports ULSLE**
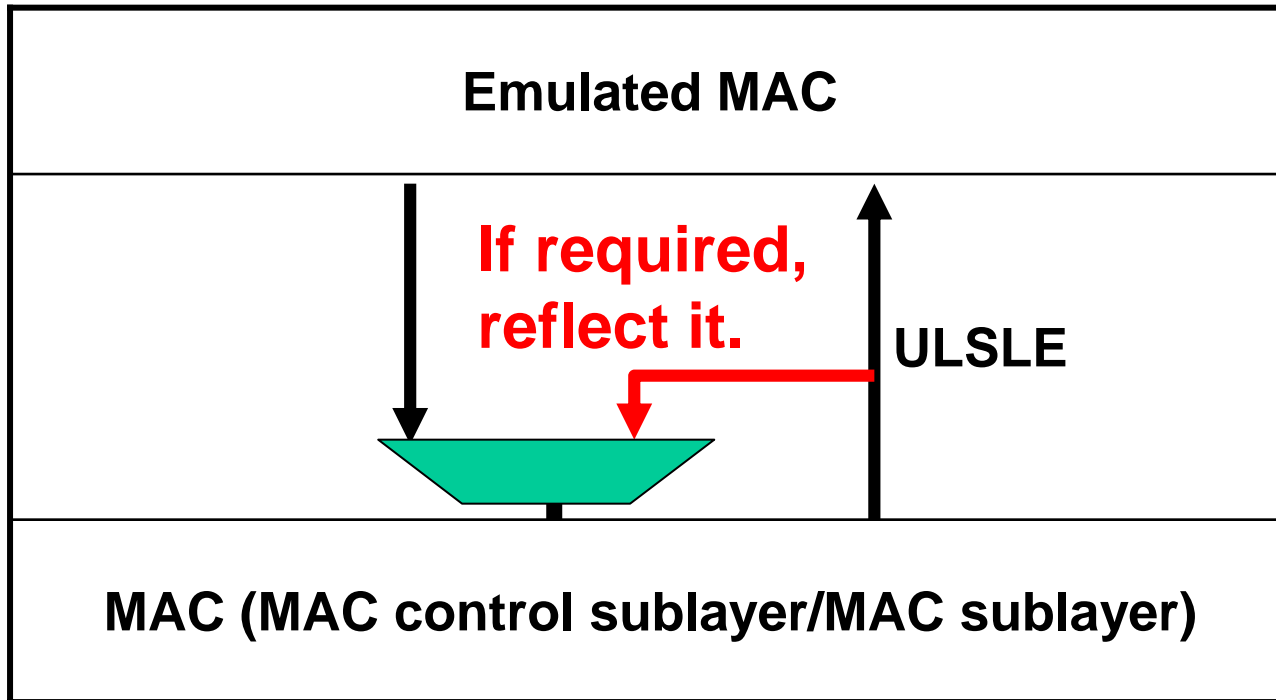
P2P Emulation Function in OLT

❑ **Temporary hold the SA and LLIDn of the upstream frame:**

holding time ~ returning time of the reflected frame from ULSLE.

❑ **If the SA of the downstream frame is matched to it, then generate (anti-LLIDn), otherwise (LLID0).**

Address Learning

LLID#	SA#	timer
LLIDn	SA1	20us
LLIDi	SA2	13us

DS frame

MAC
P2P Emulation
RS Layer

Monitoring the SA of the downstream frame @ P2P Emulation

If SA is matched to SA1, then LLID=(anti-LLIDn) else = (LLID0)

US frame

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P2P Emulation Function in ONU

❑ **Hold the SA of the upstream frame for a long enough time**

❑ **If the SA of the downstream frame with (anti-LLIDn) is not matched to any SA in the table, then discard the frame.**

US frame

Address Learning

**If there is no matched SA for (anti-LLIDn),
  then discard it,
  else pass it upwards.**

LLID#	SA#	timer
LLIDn	SA1	long
LLIDi	SA2	long

MAC

P2P Emulation

RS Layer

Monitoring the SA of the downstream frame @ P2P Emulation

DS frame

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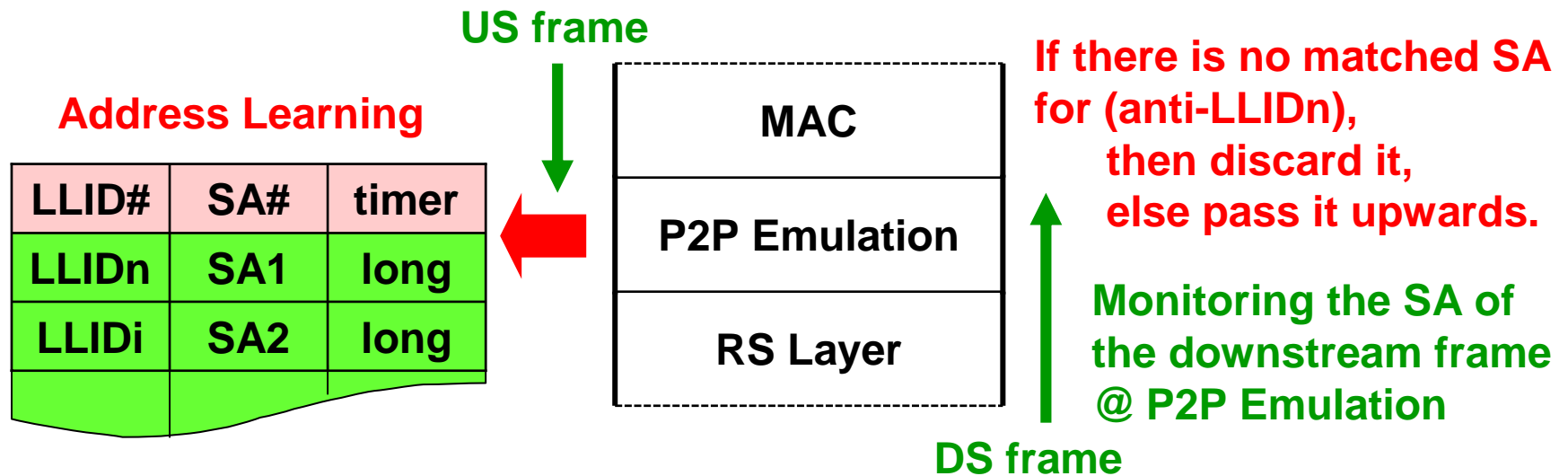
Link Management for both methods

❑ **Point-to-Point link is maintained in ONU**

❑ **OLT knows which ONU is sending the current upstream frames because OLT gives the time grant to the ONU.**

❑ **The errors in LLID don't interfere the collection of the correct information for link management.**

Multiplexing for both methods

❑ **Multiplexing in MAC control layer**

❑ **No time jitter below MAC by allocating a fixed time duration for table searching in P2P Emulation Layer**

- **a negligible time for OLT**

- **a reasonable small time for ONU**

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Summary

❑ **Two methods are presented using Address Learning Below MAC Layer.**

❑ **802.1D compatibility and an efficient ePON operation is achieved by allowing the address learning in P2P Emulation Layer located between MAC and RS.**

❑ **The ULSLE to be defined in 802.1D is supported in this proposal.**

❑ **# of port in ULSLE is reduced to two,**

$\qquad\qquad\qquad$ **=> so it is renamed FRF.**

❑ **Single LLID per ONU**

❑ **Link management per LLID, ie. per ONU.**

❑ **Multiplexing in MAC control**

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Need Support

❑ **Very simple implemention of Ethernet PON**

❑ **Not much different to the current draft except the much simplified P2P, SCB emulation**

❑ **Open to EFM for the further development of ideas.**

●
●
●

❑ **Think it in a simple way!**

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