
An Efficient System Solution for EPON Compliance

Bob Gaglianelo Erwan Nedellec
Ajay Gummalla Carlos Ribeiro
Yannick Le Goff Gaurav Rishi
John Limb Dolores Sala

Motivation

- **Current baseline defines a SCB port that cannot be attached to a standard bridge or router without modifications due to the unidirectional nature of PON**
- **A particular solution is presented here**
 - The solution is described assuming that the OLT operates as a bridge. However, a similar approach can be applied to a router.
- **OLT implementation can be chosen based on application without ONU modifications**
 - P2P-LAN service for data only applications
 - SCB for support of digital video broadcast
 - Shared-LAN service for campus environments
 - Combination of shared-LAN and P2P service to support residences and businesses with private bridging domains in the same network

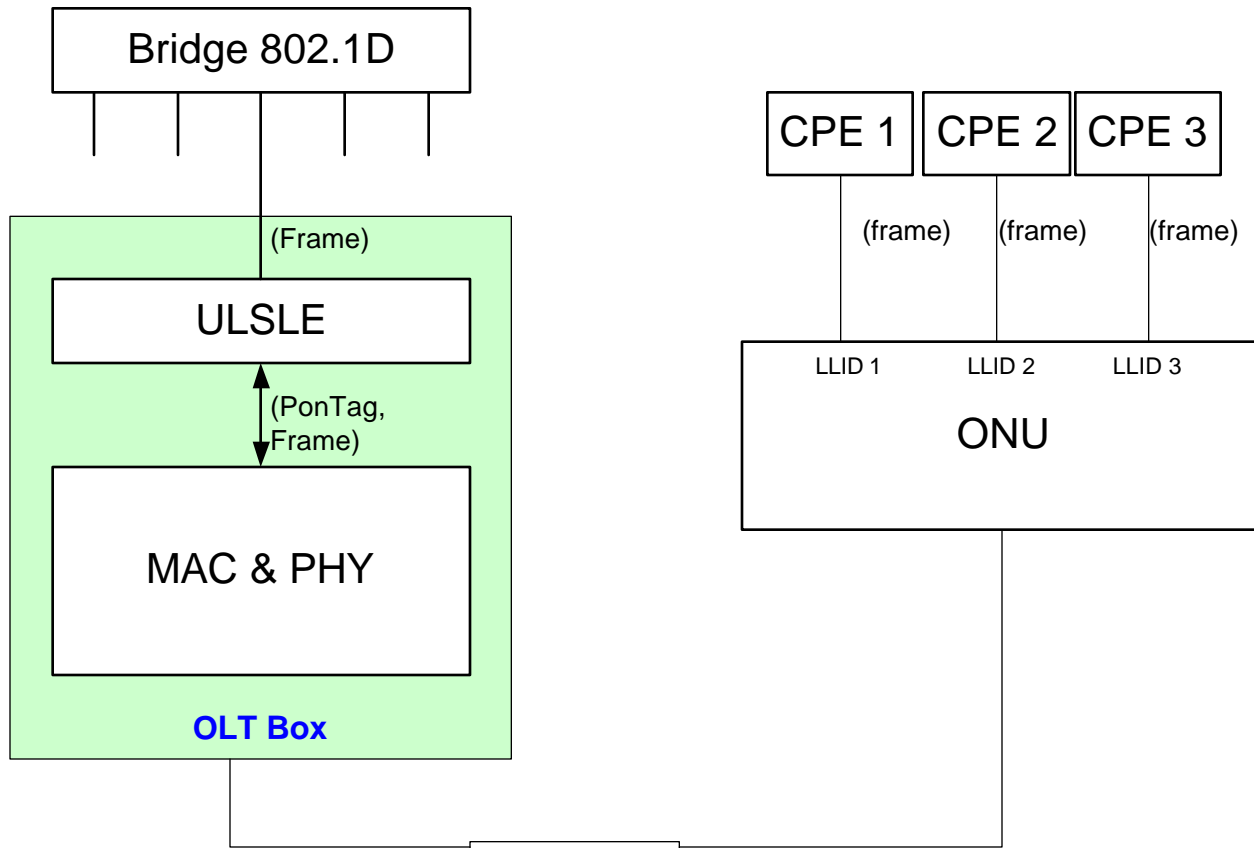
System Solution

- **Solution defines EPON as a shared-LAN with P2P service capabilities and administrative control**
 - It combines 802.3ah PON-tagging and 802.1 bridging
- **Functionality is confined in a middle block named Upper Layer Shared Layer Emulation (ULSLE)**
- **ULSLE is designed to take maximum advantage of SCB service of the shared-LAN but still offering P2P service**
 - An optimal set of rules is presented
- **A simple way to describe the ULSLE functionality is as a modified bridge**
 - The modifications required are small and effect 802.3 interface
- **A simple way to implement it is by passing the tag to/from ULSLE layer**

System Definition

- **A Logical Link is established between OLT and ONU. A link is identified with a Logical Link ID (LLID)**
- **A Pon-Tag is passed between MAC-control and ULSLE. The tag contains a Mode Bit (P2P or SCB) and a LLID field**
- **A Universal-LLID is specified for ONU registration and broadcast operation in general**
- **Each individual logical link supports both SCB and P2P services**

Architecture View



ULSLE: Upper Layer Shared Layer Emulation (Norm's document)

LLID : Logical Link ID

PonTag: (Mode Bit, LLID)

ONU Operation

- **Upstream**

- Send frame with a Pon-Tag with the corresponding LLID and mode-bit not used on the upstream

- **Downstream**

- If mode-bit in Pon-Tag is P2P and LLID is in ONU
 - Accept frame
- If mode-bit in Pon-Tag is SCB and LLID is not in ONU
 - Accept frame
- All other frames are discarded
- Accepted frames are forwarded to the corresponding LLID port

ULSLE Definition

- **ULSLE combines bridging function and tag management. It is defined as:**
 - A bridge function (standard learning, aging, ...)
 - ULSLE also learns LLID (adds an additional entry in learning table)
 - A frame is forwarded back to the PON if ULSLE-bridge-table says a destination is in PON.
 - The returned Pon-tag is built according to the following rules:
 - External Broadcast frame: (SCB, Universal-LLID)
 - External Unicast frame to LLIDn: (P2P, LLIDn)
 - External Unknown frame: (SCB, Universal-LLID)*
 - Internal Unicast frame from LLIDn to LLIDm: (P2P, LLIDm)*
 - Internal Broadcast frame from LLIDn: (SCB, LLIDn)*
 - Internal Unknown frame from LLIDn: (SCB, LLIDn)*

* Subject to control if wanted

OLT Operation

- **External traffic**

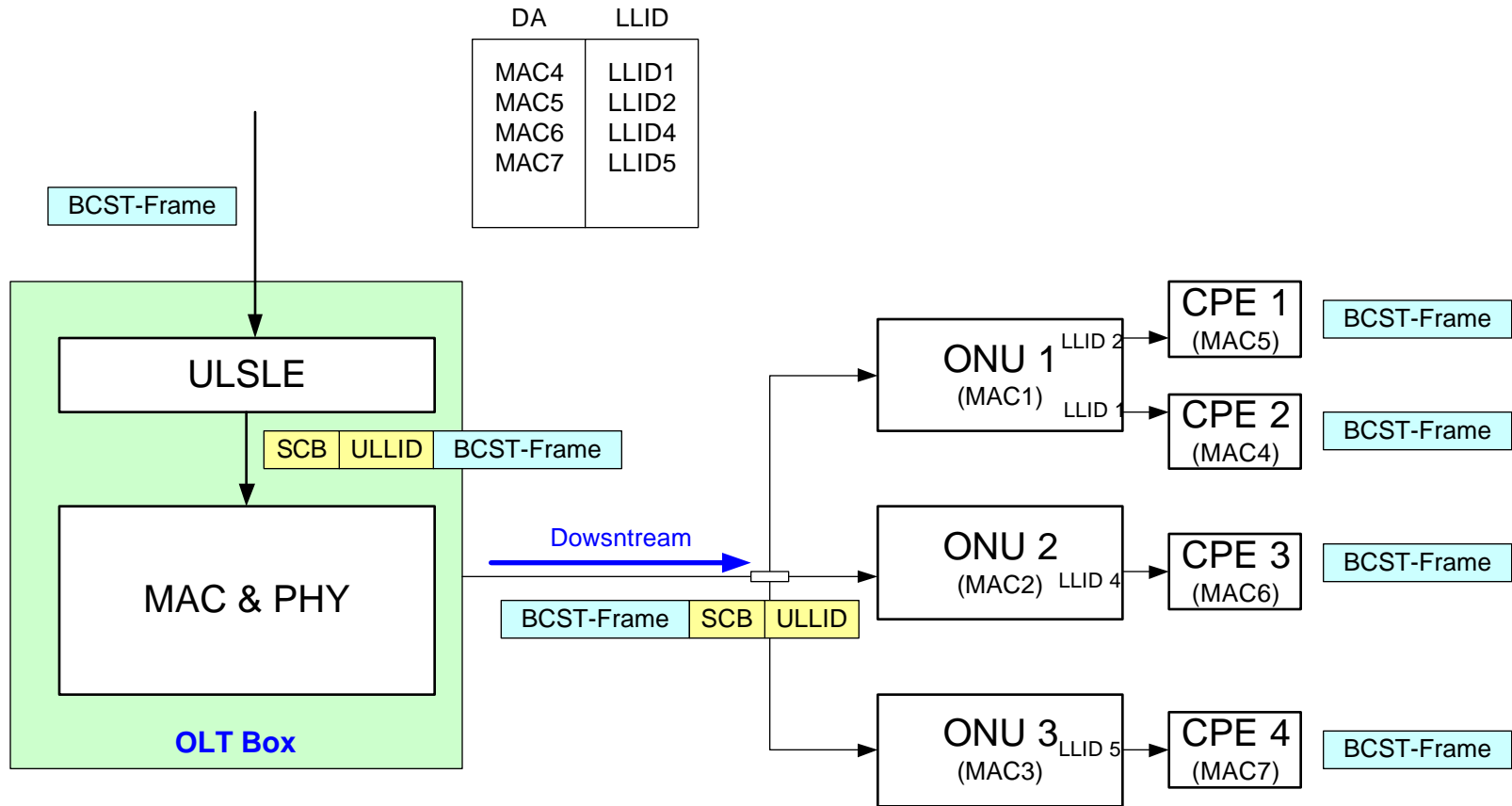
- The ULSLE attaches a Pon-Tag an incoming frame from the external interface and delivers it to MAC-control for transmission on downstream

- **Internal Traffic**

- A frame on the upstream comes with a Pon-Tag. Frame and tag are delivered to ULSLE
- The ULSLE decides the destination of the frame and forwards the frame to the appropriate location:
 - Forwards the frame to external interface if at least one destination is outside PON
 - Forwards the frame and a modified tag to PON interface if one destination is within the PON

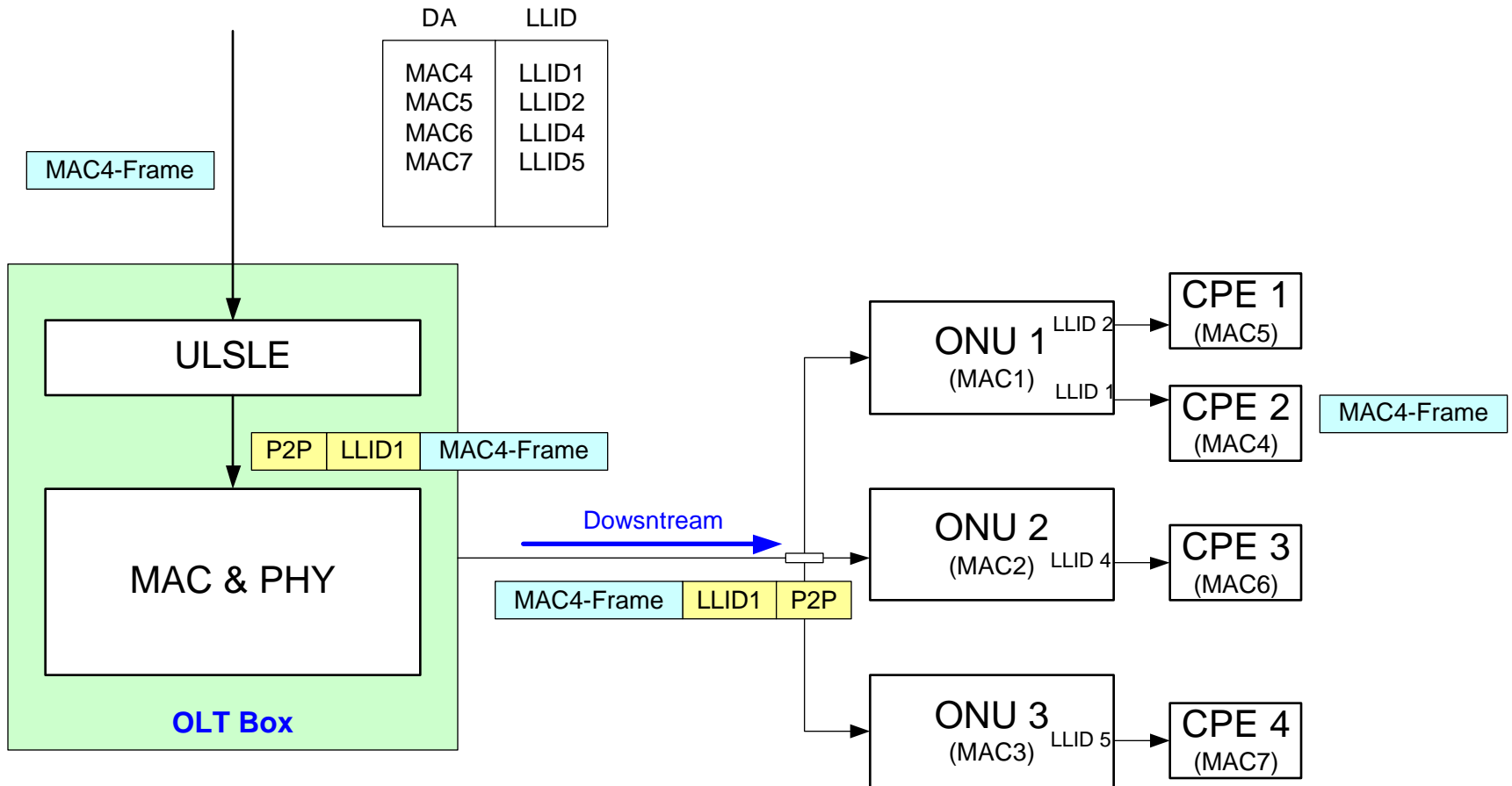
Examples

Example 1: Broadcast

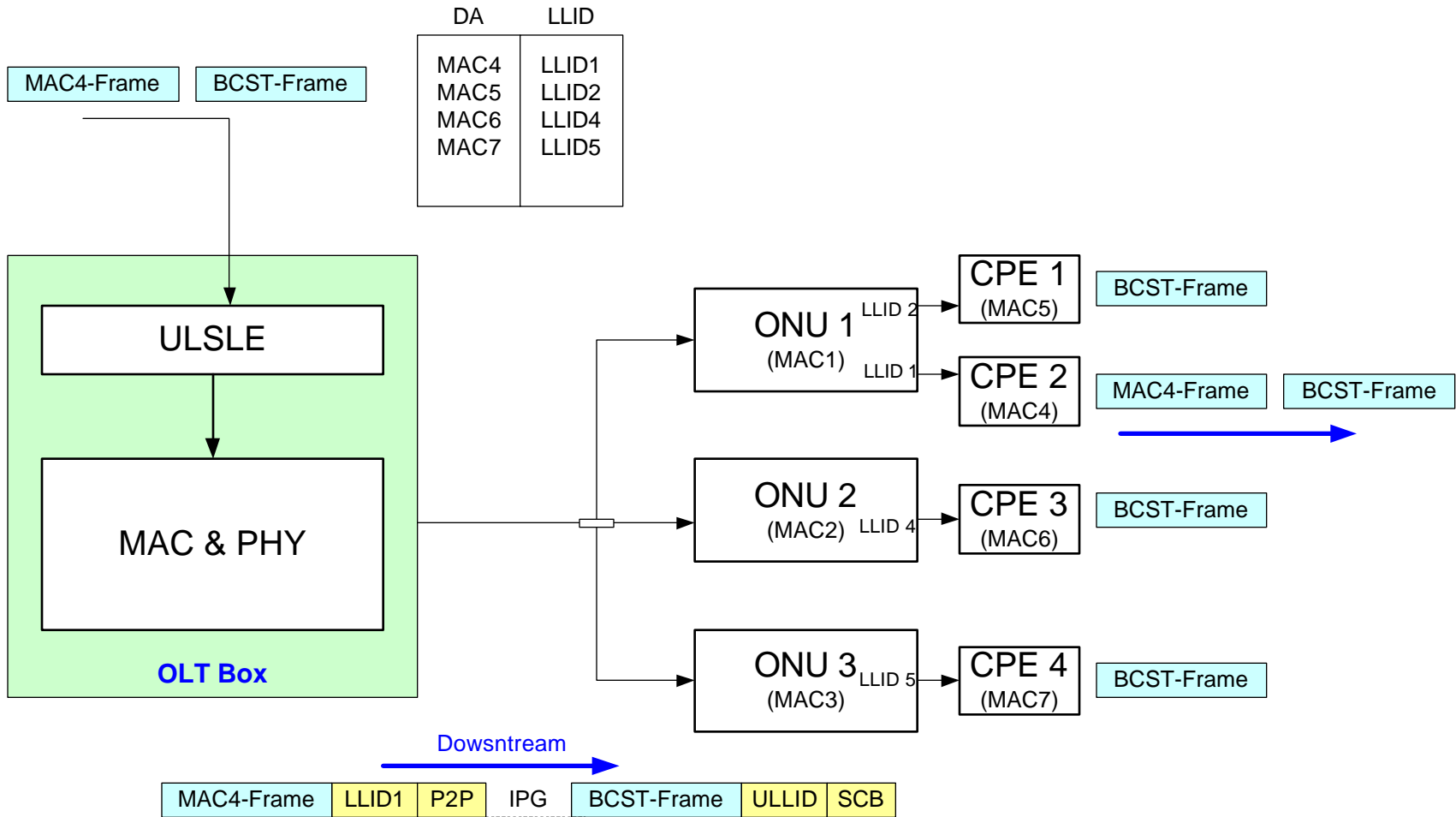


ULLID: Universal-LLID

Example 2: Unicast



Ex 3: Integrated SCB/Unicast LLID



Summary

- **A flexible architecture that supports several OLT implementations with a single ONU definition**
- **An efficient OLT solution has been presented**
 - It defines EPON as a shared-LAN with P2P service
 - Administrative control is achieved by configuring the bridge functionality at the ULSLE
- **Any multicast solution can be incorporated when decided**