P2P Emulation with vLink tagged frame

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Compatibility Problem

PHY ID in preamble requires HW changes of RS layer and MAC.

If a solution is PHY-dependent, it will loose compatibility with existing PHYs

- **–Specialized parts means higher cost and longer developing time.**
- **–Higher unit cost means less market penetration and less profitability in the beginning.**

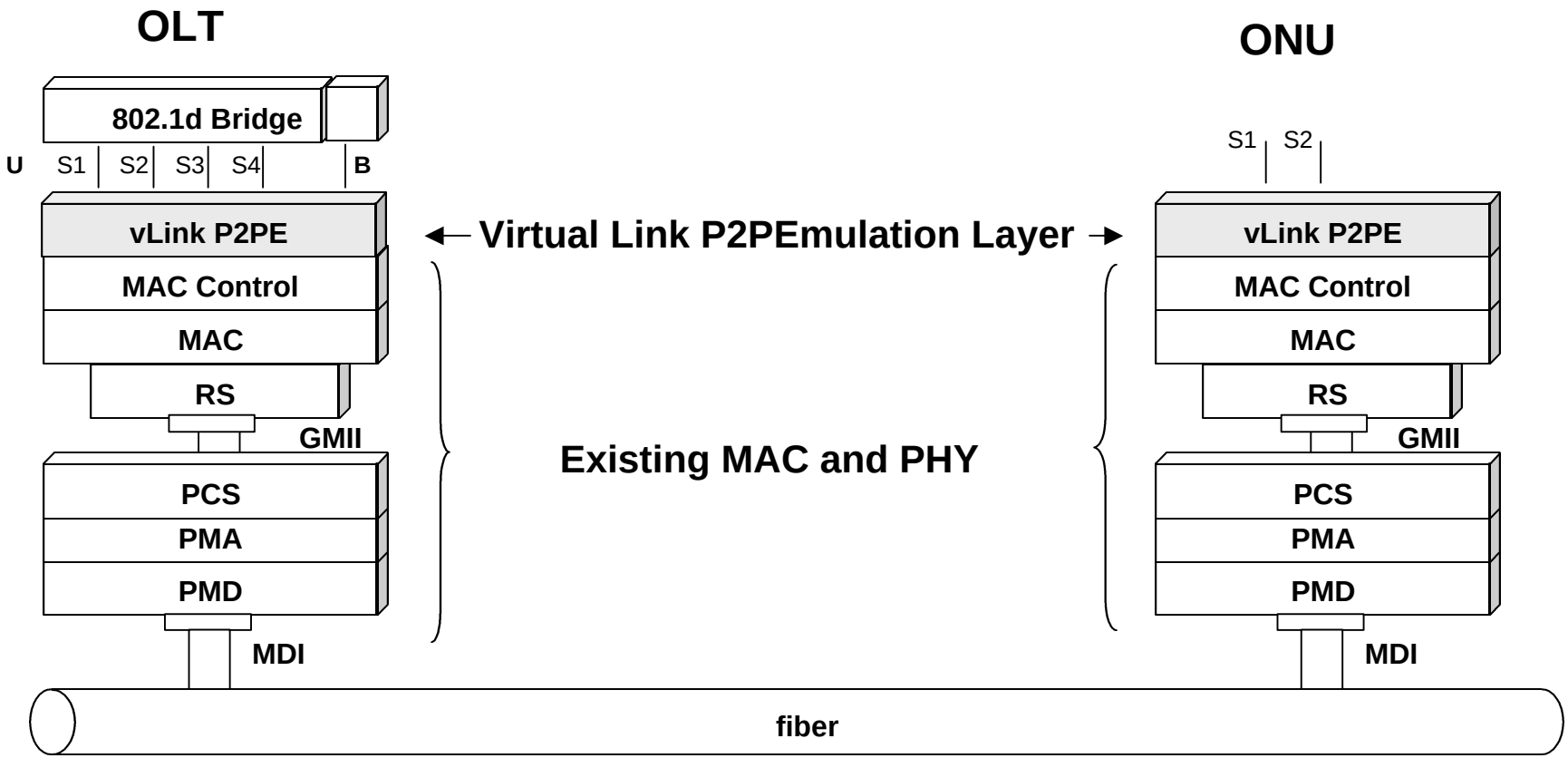
EFM should not be limited to the dedicated solution for EPON. Instead, the Ethernet solution with EPON support.

Compatible with existing Ethernet system and realizable with legacy Ethernet MAC chip.

How?

→ **vLink tagged frame**

Compliance Layering Model



vLink P2P Emulation Layer

Basic Function of vLink Control Layer

- **Reading and writing PHY ID to/from MAC frame**
- **Tagging and de-tagging PHY ID**
- **Link multiplexing based on PHY ID**
- **Revalidation FCS**

vLink Control Layer Implementation Method

- **Firmware Implementation above existing MAC**
  - **Introductory solution**
- **One chip solution**
  - **Mass market solution**

Message format

DA : 6byte
SA : 6byte
virtual Link (vLink) tag header
- Tag type : 2byte (TBD)
- vLink ID : 2byte
Mode (Unicast/Broadcast)
LLID identifier

Length/Type : 2byte
PDU
FCS : 4byte

vLink tagged frame (I)

Overhead by using vLink tagged frame

Assuming IFG is 30 bytes,

BW utility U_{lower}**= 0.588(w/o tag) => 0.55(w/ tag)**

U_{upper}**=0.973(w/o tag) => 0.970 (w/ tag)**

(lower : Min. PDU Size, upper : Max. PDU Size)

- **BW utilization degradation is not that critical.**
- **Ethernet is a packet-based, and waste is a given.**
- **ONU MAC has enough resources to perform DS filtering.**

vLink tagged frame (II)

Ethernet MaxFrameSize

In Clause 4, CSMA/CD layer support tagged MAC frames

maxTaggedFrameSize = (maxUntaggedFrameSize + qTagPrefixSize)
→ (example, vLAN)

Implementation with legacy Ethernet MAC chip

MAX Data size is configurable by the Receive_Max_Frame_Length register setting.

Vender has a choice of

Easy, rapid, and low cost implementation
vs.
High cost and very little BW utilization improvement implementation

Comparing with PHY-ID in preamble

PHY-ID in preamble

No overhead, of course.

Filtering downstream frames at RS layer in ONU.

Changes of Interface add complexity.

In case of RS layer multiplexing, frame can suffer variable delay across MAC and below. (Sala_2_0302.pdf)

In case of MAC control layer multiplexing, augmentation of service interface is necessary to pass the tag to/from RS.

Need CRC check in RS layer.

Cons of vLink tagged frame

PHY independent.

- **Can be implemented with existing HW → Cost down.**
- **Can work with new PHY**

No changes on service interface and Low complexity.

Realizable by giving a little bit of touch with existing MAC chips.

- **(Existing MAC chip + Firmware implementation of vLink P2PE layer) can perform EPON functionality.**
- **Easy implementation and fast marketable product.**

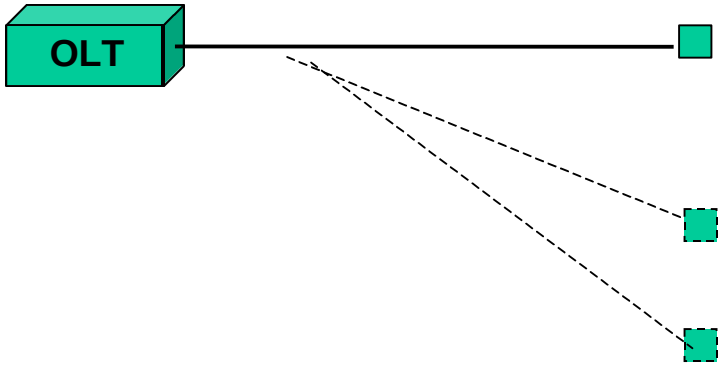
Compatibility

Protocol/implementation commonality

4 bytes overhead? It is worth it!

Considering

- **System compatibility**
- **Flexibility**
- **Topology change**



Suppose P2P network becomes P2MP, the Ethernet solution with EPON support can operate seamlessly on both network.

What we have to achieve is an “Ethernet MAC chip which can also support E-PONs”, not a “dedicated EPON MAC chip” which can not be applied to other Ethernet applications.

Another option to support Multiple PHYID per ONU

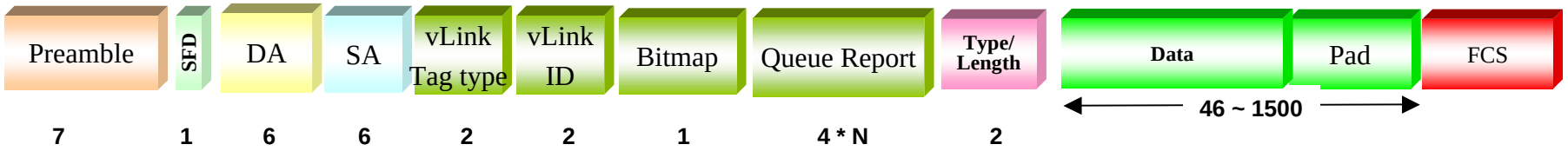
Tag control information: 2byte

- **Priority 3bits**
- **Mode (Unicast/Broadcast) 1bit**
- **PHY-ID**

To support CoS/QoS of multiservice and SLA of subscribers in PON system not supporting VLAN.

The vendor can support QoS or CoS with existing VLAN technology or priority bits in vLink control.

Possible solution to overcome 4B overhead loss



In stead of using separate control frame to report ONU queue information to OLT, M_SDU can include ONU queue reports by using special vLink tag type or an identification bit in the vLink ID.

Since the overhead for one control message is bigger than 28 bytes, this routine can increase the system bandwidth utilization and overcome the 4 bytes overhead loss due to vLink tag header.

Summary

Discussed about EPON supporting solution vs. dedicated EPON solution.

The vLink tagged frame has compatible with legacy network.

The compatible solution will make vendors in favor of an EPON.