MPCP Extension for EPoC

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802.3av-2009 MPCP Message set

1) GATE/REPORT: for DBA BW allocation
   a) request BW from OLT (REPORT)
   b) assign BW to ONUs (GATE)

2) REGISTER_REQ/REGISTER/REGISTER_ACK:
   a) ONU auto-discovery
   b) LLID assignment

3) All MPCP messages are time stamped
   a) RTT measurement
   b) ONU time reference

MPCP Message Structure and Limitation

1) Unique Opcode for message type
2) Maximal 64 bytes length
3) 40 bytes of message content

Fields	Octets
DA	6
SA	6
Length/Type	2
Opcode	2
Timestamp	4
Opcode-specific field/pad	40
FCS	4

Rationale to define new subset of messages for EPoC (instead of modifying existing subset for EPON

a) Message content limitation may not be adequate for certain EPoC scenario (GATE to support concurrent upstream transmission from multiple CNUs)

b) Backward compatibility

c) New message may be needed

Areas for Possible EPoC Extensions

- ✓ MAC Control opcodes
- ✓ New set of MPCP messages defined for EPoC
- ✓ Downstream GATE for TDD mode
- ✓ LLID assignment

Types of Possible EPoC Extensions

Types of MPCP extensions	Mechanism	Potential impact
New messages for EPOC	Use new OPCODE	Possibly done by existing EPON chips
Adding new field(s) to existing EPON MPCP messages	Use padding region in the message content body	Possibly done by existing chips
Modify existing field(s) to the existing EPON MPCP messages	Change the field length and/or sequence	Not feasible due to backward compatibility with EPON standards and equipments
Assign different semantics to existing field(s) of the EPON MPCP messages	Different interpretation of same field for EPON and EPOC	Possibly done by existing EPON chips

MAC Control OPCODES

Table 31A–1—MAC Control opcodes

Opcode (hexadecimal)	MAC Control function	Specified in	Value/Comment	Timestamp[a]
00-00	Reserved			
00-01	PAUSE	Annex 31B	Requests that the recipient stop transmitting non-control frames for a period of time indicated by the parameters of this function.	No
00-02	GATE	Clause 64 Clause 77	Request that the recipient allow transmission of frames at a time, and for a period of time indicated by the parameters of this function.	Yes
00-03	REPORT	Clause 64 Clause 77	Notify the recipient of pending transmission requests as indicated by the parameters of this function.	Yes
00-04	REGISTER_REQ	Clause 64 Clause 77	Request that the station be recognized by the protocol as participating in a gated transmission procedure as indicated by the parameters of this function.	Yes
00-05	REGISTER	Clause 64 Clause 77	Notify the recipient that the station is recognized by the protocol as participating in a gated transmission procedure as indicated by the parameters of this function.	Yes
00-06	REGISTER_ACK	Clause 64 Clause 77	Notify the recipient that the station acknowledges participation in a gated transmission procedure.	Yes
00-07 through FF-FFD	Reserved			

- ✓ Propose to use 01-02 to 01-06 for 5 equivalent EPoC MPCP messages
- ✓ Use 01-07 for a new EPoC MPCP message – “UPDATE”

Discovery GATE

(b)

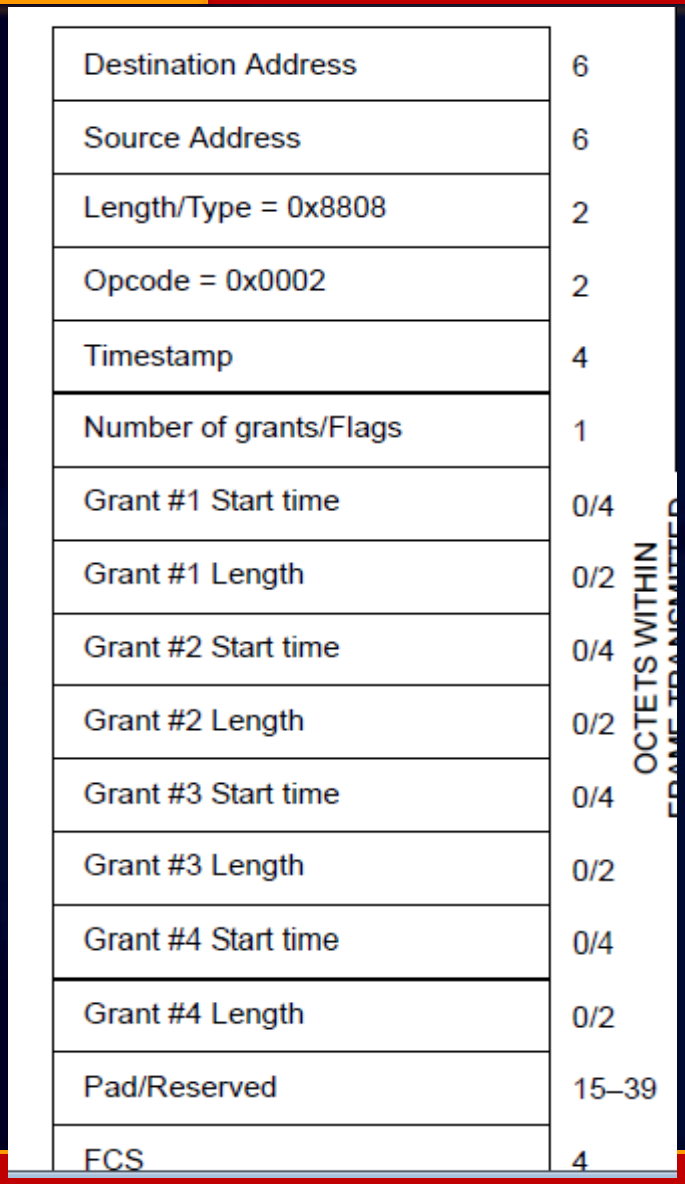
Destination Address	6
Source Address	6
Length/Type = 0x8808	2
Opcode = 0x0002	2
Timestamp	4
Number of grants/Flags	1
Grant #1 Start time	4
Grant #1 Length	2
Sync Time	2
Discovery Information	2
Pad/Reserved	29
FCS	4

Table 77–3—GATE MPCPDU discovery information fields

Bit	Flag field	Values
0	OLT is 1G upstream capable	0 – OLT does not support 1 Gb/s reception 1 – OLT supports 1 Gb/s reception
1	OLT is 10G upstream capable	0 – OLT does not support 10 Gb/s reception 1 – OLT supports 10 Gb/s reception
2–3	Reserved	Ignored on reception
4	OLT is opening 1G discovery window	0 – OLT cannot receive 1 Gb/s data in this window 1 – OLT can receive 1 Gb/s data in this window
5	OLT is opening 10G discovery window	0 – OLT cannot receive 10 Gb/s data in this window 1 – OLT can receive 10 Gb/s data in this window
6–15	Reserved	Ignored on reception

2: OLT is EPoC capable
3: Reserved
6-7: Reserved
8-11: define 16 rate profiles for EPoC (similar to xDSL)

Normal GATE – for EPoC upstream



Destination Address	6
Source Address	6
Length/Type = 0x8808	2
Opcode = 0x0002	2
Timestamp	4
Number of grants/Flags	1
Grant #1 Start time	0/4
Grant #1 Length	0/2
Grant #2 Start time	0/4
Grant #2 Length	0/2
Grant #3 Start time	0/4
Grant #3 Length	0/2
Grant #4 Start time	0/4
Grant #4 Length	0/2
Pad/Reserved	15–39
FCS	4

OCTETS WITHIN

Multiple CNUs per GATE:

✓ With 4 outstanding grants per GATES, 24 bytes are used per CNU

✓ Maximal 2 CNUs per GATE

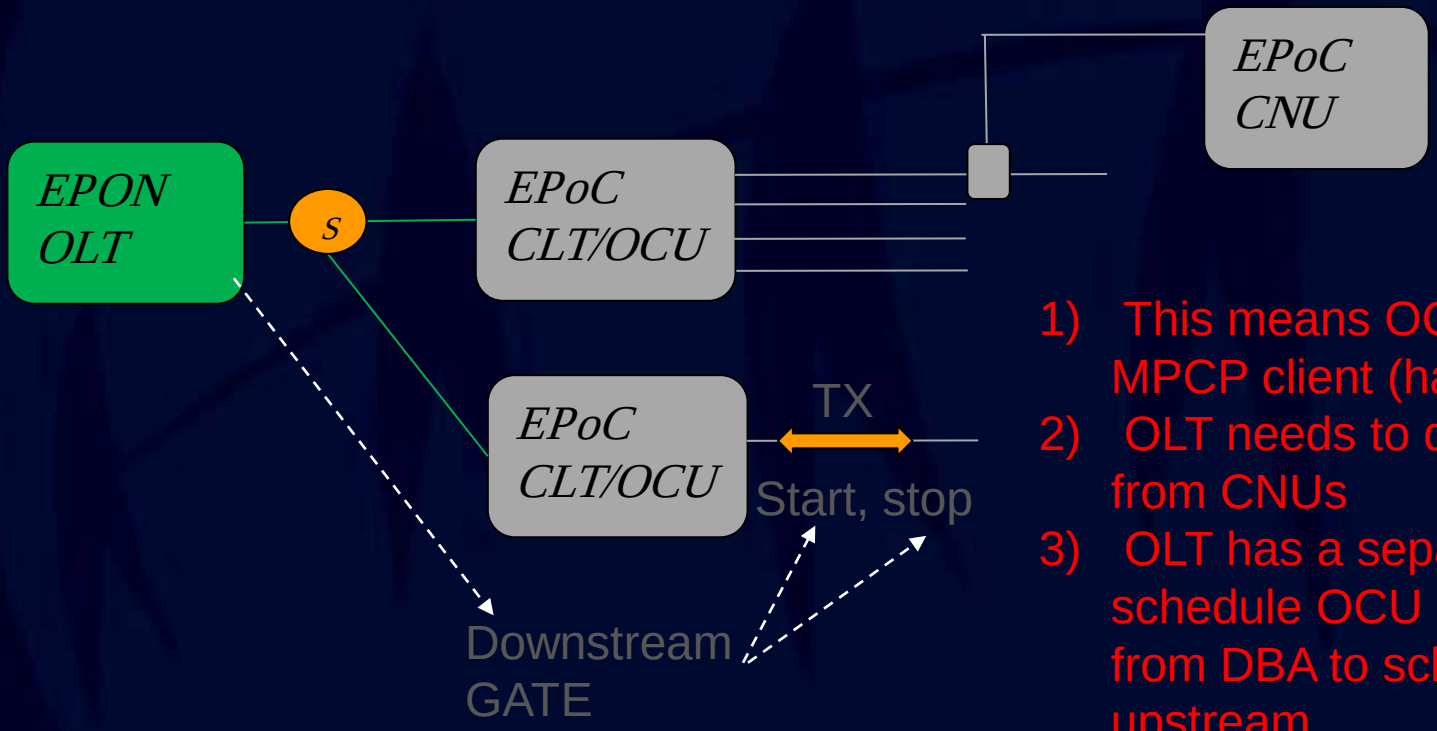
✓ Introduce multicast GATE message (for each coax segment)

Single CNU per GATE:

✓ Drawback is high MPCP overhead due to frequent GATE messages to hundreds of CNUs

Downstream GATE message for TDD

1) OCU needs to know when the TDD downstream phase starts and stop in each TDD cycle
2) When a change of TDD downstream/upstream split happens, OLT and/or OCU needs to know
3) If adaptive rate on coax segment is supported, OLT and/or OCU needs to know



1) This means OCU needs to be a MPCP client (has a MAC)
2) OLT needs to differentiate OCU from CNUs
3) OLT has a separate DBA to schedule OCU downstream TX from DBA to schedule CNU upstream

MPCP GATE/REPORT parameters

a) MPCP GATE and REPORT work in “TQ”

b) Actual ONU queues are in in “BYTES”

c) ONU needs to assume a given link speed to translate “BYTES” into “TQ” for MPCP REPORT generation

d) With adaptive rate on coax link or TDD upstream/downstream split change, the REPORT value OLT receives may no longer be ‘fresh’

e) A mechanism is needed to
   - ✓ keep the link rate in lock-step on OLT and CNU or
   - ✓ CNU needs to make readjustment up on link rate change on the GATE grant start and grant length

EPoC REGISTER-REQ Message

Table 77–6—REGISTER_REQ MPCPDU Discovery Information Fields

Bit	Flag field	Values
0	ONU is 1G upstream capable	0 – ONU transmitter is not capable of 1 Gb/s 1 – ONU transmitter is capable of 1 Gb/s
1	ONU is 10G upstream capable	0 – ONU transmitter is not capable of 10 Gb/s 1 – ONU transmitter is capable of 10 Gb/s
2–3	Reserved	Ignored on reception
4	1G registration attempt	0 – 1 Gb/s registration is not attempted 1 – 1 Gb/s registration is attempted
5	10G registration attempt	0 – 10 Gb/s registration is not attempted 1 – 10 Gb/s registration is attempted
6–15	Reserved	Ignored on reception

2: OLT is EPoC capable
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8-11: define 16 rate profiles for EPoC (similar to xDSL)

Profile include: frequency plan, TDD/FDD mode support, rates supported, etc

EPoC UPDATE message

This would be a newly introduced MPCP message for EPoC

Function: for CNUs to asynchronously or periodically update non-bandwidth related information

Field	Description
A blacklist of subcarriers with bad reception	List of subcarriers to be excluded in subsequent transmission
Launch power	CNU Tx power

Classful LLID Assignment

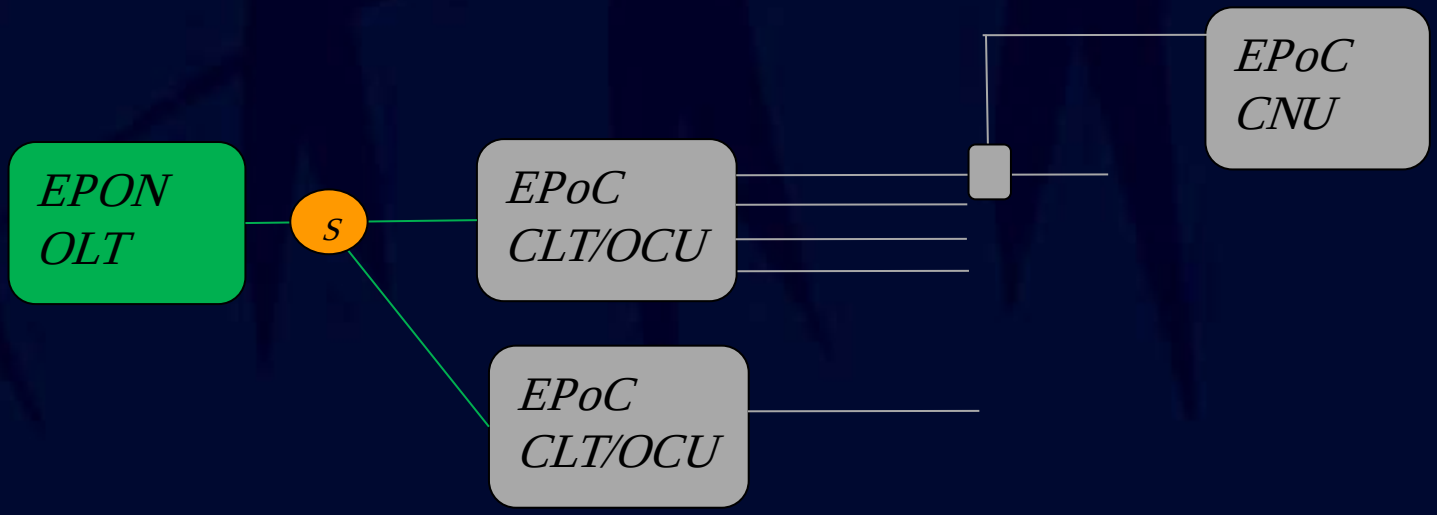
Network hierarchy is introduced in EPoC

a) To uniquely identify the fact that CNUs are on different coax segments

This is to allow EPON OLT DBA to schedule concurrent upstream transmission from the CNUs to their corresponding OCU

b) To uniquely identify the fact that CNUs are subtending off a particular OCU

This is to allow EPON OLT DBA to schedule concurrent upstream transmission from multiple CNUs on the same coax segment in a single DBA cycle



Classful LLID Assignment

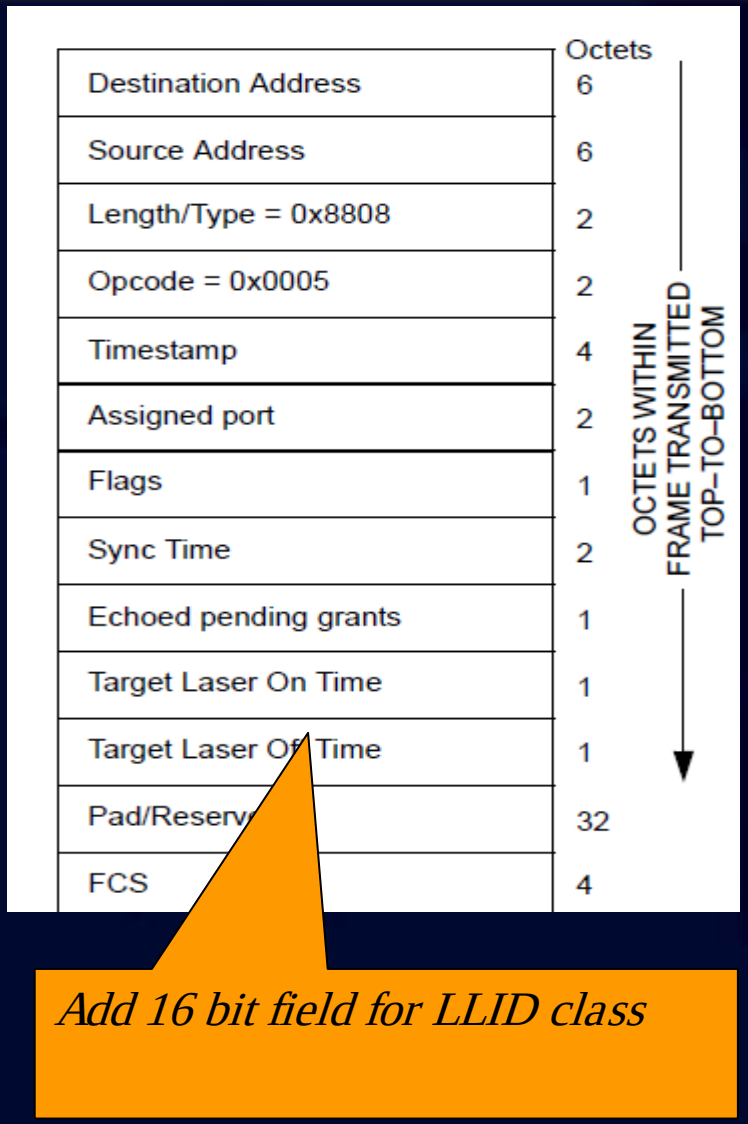
Class A: 5 bit coax ID; 9 bit CNU ID
Class B: 7 bit coax ID; 7 bit CNU ID
Class C: 8 bit coax ID; 6 bit CNU ID

Class A:
✓ 32 coax distribution networks per EPON port
512 CNUs per coax segment

Class B:
✓ 128 coax distribution networks per EPON port
✓ 128 CNUs per coax segment

Class C:
✓ 256 coax distribution networks per EPON port
✓ 64 CNUs per coax segment

Allow CNUs to do filtering based on its coax ID



Thank You