Consideration and proposal of laser on/off time for 10G EPON

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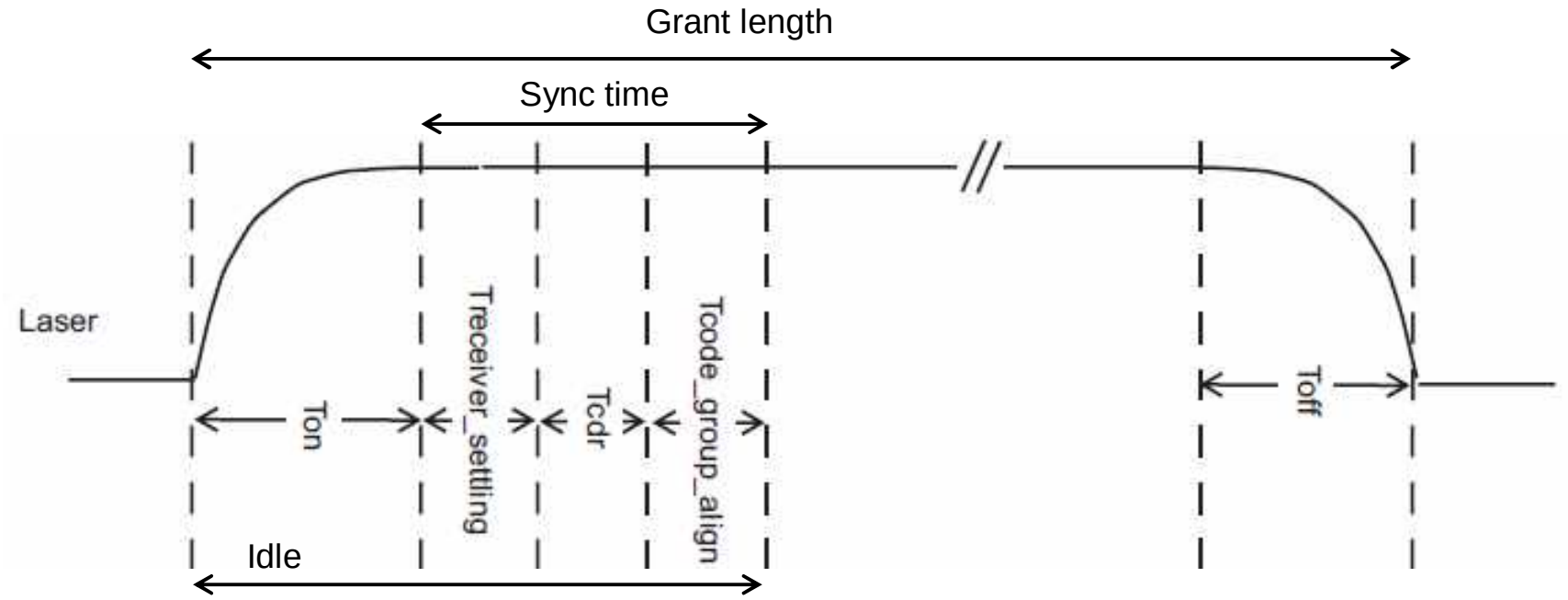
Background

- We should consider remaining issues including upstream overhead length for 10G EPON.
- In 1G EPON, the burst overhead consists of a constant length of 1024 ns (T_{on}+T_{off}) and a variable length less than 832 ns (Sync time = $T_{receiver\_setting}$ + T_{cdr} + $T_{code\_group\_align}$).



Upstream burst signal and timing parameters

Observation

- In 2001-2002, IEEE 802.3ah had no experience with burst mode optics and has selected conservative values for T_{on} and T_{off} which would allow continuous-mode optics be used in burst-mode operation.
- Since 2003, the optics continuously became faster and faster. **No transceivers deployed today require 512 ns on/off time.**
- Because laser turns on very fast, many commercially-deployed systems set SyncTime=0, because OLT receiver can synchronize during the 512 ns allocated for T_{on}.
- Allocating constant 512 ns for T_{on} and 512 ns for T_{off} wastes significant amount of bandwidth.

Proposal

- We propose definitions of T_{on} and T_{off} be variables while their default values remain 512 ns in Section 64.4.5.1 of IEEE std. 802.3-2005.
- Currently, OLT maintains ONU-specific parameter (RTT) used in calculating grant start time.
- Currently, OLT does not preclude SyncTime to be ONU-specific.
- Adding ONU-specific T_{on} and T_{off} is not a burden on the OLT.

Current grant calculation

GrantStartTime[n] = RxTime – RTT[n]
GrantLength[n] = **T_{on}** + SyncTime[n?] + DataSize + **T_{off}**

Proposed grant calculation

GrantStartTime[n] = RxTime – RTT[n]
GrantLength[n] = **T_{on}[n]** + SyncTime[n?] + DataSize + **T_{off}[n]**

Options

- There are two options to make T_{on} and T_{off} adjustable
- **Method 1: MPCP Handshake**
  - Add additional fields to REGISTER_REQ and REGISTER messages
  - ONU informs OLT about its actual T_{on} and T_{off} in REGISTER_REQ message.
  - OLT echoes T_{on} and T_{off} that it will assume in the REGISTER message.
  - Same method as ONU uses to announce Pending Grants value to the OLT.
- **Method 2: OAM Query**
  - Add ***aLaserOnTime*** and ***aLaserOffTime*** MIB variables.
  - OLT starts with allocating 512 ns for T_{on} and T_{off}.
  - OLT uses OAM messages to get the actual T_{on} and T_{off} from the ONU.
  - After receiving the actual T_{on} and T_{off} values, the OLT starts allocating ONU-specific T_{on} and T_{off} in the grant length.
- **With both methods, ONU always allocates its actual on/off times and does not need to have logic to adjust times based on its state.**

Proposal for REGISTER_REQ T_{on} and T_{off} field

- We propose to add 2-byte field to REGISTER_REQ
- The field carries the actual T_{on} and T_{off} values used by the actual laser in the given ONU.
- The OLT confirms (echoes) these values in a REGISTER message.
  - This is the same handshake as used for delivering Pending Grants value from ONU to OLT
- After sending REGISTER, OLT starts allocating ONU-specific T_{on} and T_{off} in grant length.

Existing REGISTER_REQ

Destination Address	6
Source Address	6
Length/Type = 88-08	2
Opcode = 00-04	2
Timestamp	4
Flags	1
Pending grants	1
Discovery Information	1
Pad/Reserved	37
FCS	4

Proposed REGISTER_REQ

Destination Address	6
Source Address	6
Length/Type = 88-08	2
Opcode = 00-04	2
Timestamp	4
Flags	1
Pending grants	1
Discovery Information	1
Laser Turn On Time	1
Laser Turn Off Time	1
Pad/Reserved	35
FCS	4

Proposal for REGISTER T_{on} and T_{off} field

- We propose we add 2-byte field to REGISTER message.
- The field echoes T_{on} and T_{off} values received from the ONU.

Existing REGISTER

Destination Address	6
Source Address	6
Length/Type = 88-08	2
Opcode = 00-05	2
Timestamp	4
Assigned port	1
Flags	1
Sync Time	2
Echoed pending grants	1
Pad/Reserved	34
FCS	4

Proposed REGISTER

Destination Address	6
Source Address	6
Length/Type = 88-08	2
Opcode = 00-05	2
Timestamp	4
Assigned port	1
Flags	1
Sync Time	2
Echoed pending grants	1
Echoed Laser On Time	1
Echoed Laser Off Time	1
Pad/Reserved	32
FCS	4

Pros and Cons

	Pros	Cons
Method 1: MPCP handshake	Efficient from the start - all grants are allocated by the OLT with the actual T_{on} and T_{off}	Changes to MPCP messages (changes to state machines in Clause 64).
Method 2: OAM Query	No modifications to state machines in Clause 64.	OLT will issue a number of grants with default T_{on} and T_{off} (512 ns) until it queries the ONU's MIB. ONUs with faster lasers may be getting extra bandwidth for a while

Straw Poll #5

- I support Adjustable (ONU-specific) Laser On and Laser Off times for only 10G EPON (PR and PRX).
- Yes: _____33
- No: _____0
- No opinion: _____4

Straw Poll #6

- Adjustable (ONU-specific) Laser On and Laser Off times should use:
  - A) Modified REGISTER_REQ and REGISTER messages _____28
  - B) OAM messages _____0
  - No opinion _____9

Motion #10

- Accept as a baseline proposal for MPCP handshake-based adjustable Laser On and Laser Off times for 10G EPON using modified REGISTER_REQ and REGISTER messages shown in pages 6 and 7 of 3av_0711_suzuki_1.pdf.
- Moved by: Ken-Ichi Suzuki
- Seconded by: Bidyut Parruck
  - Yes: 33
  - No: 0
  - Abstain: 3
  - Number in the room: 37
  - Technical, required ≥75%
  - Motion passed