

ZTE中兴

Adjustable Timer Value for Power Saving



Stronger
Together

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GATE and REPORT timeouts

- From Figure 77-25, we can see that a registered ONU will transmit a REPORT MPCPDU to the OLT, when:
 - it was requested by the OLT, or
 - the timer *report_period_time* is done.
 - *report_timeout* = 50ms
- A OLT will send a GATE MPCP to a registered ONU when:
 - an upstream transmission slot is allocated to deliver queued subscriber frames to OLT, or
 - the timer *gate_period_time* is done.
 - *gate_timeout* = 50ms
- Figure 77-24 shows that, if a registered ONU doesn't receive any GATE MPCPDU from OLT in *mcp_timeout*, it will switch to WATCHDOG TIMEOUT state and reregister.
 - *mcp_timeout* = 1s



Possible power saving feature

- When no data flows are exchanged between an ONU and the OLT, this ONU will still transmit empty REPORT MPCPDUs to the OLT every 50 ms (*report_timeout*)
- Similarly, OLT will transmit empty, keep-alive GATE MPCPDUs to this ONU every 50 ms (*gate_timeout*)
- When no useful data is exchanged between an ONU and the OLT, ONU can go into power saving mode and be awakened with lower frequency than currently defined in the standard
- It would be also useful, if timeout frequencies could be altered by the OLT using the MPCP protocol



Relation between parameters

- Values of *report_timeout* and *gate_timeout* should be same
- Set the default value of both timeout timers to 50 ms.
- Relation between timeout and bandwidth use is presented below:

$$\frac{\text{Bandwidth}}{\text{FrameLength} \times 8} \times \text{Ratio} = \frac{1[\text{s}]}{\text{Timeout}}$$

- FrameLength – packet length [B]
 - Bandwidth – current available bandwidth [b/s]
 - Timeout – interval between subsequent keep-alive GATE / REPORT MPCPDUs, equal to *report_timeout* and *gate_timeout*
 - Ratio – ratio of empty reports or gates to the whole bandwidth
- The system can have two modes:
 - *Normal*: timeout set at 50ms
 - *Optimized*: timeout set according to current observed network load



Formula to calculate *timeout*

- Values of *report_timeout* and *gate_timeout* should be same
- Set the default value of both timeout timers to 50 ms.

$$\text{Timeout} = \frac{\text{FrameLength} \times 8}{\text{Bandwidth} \times \text{Ratio}}$$

- FrameLength – packet length [B]
 - Bandwidth – current available bandwidth [b/s]
 - Timeout – interval between subsequent keep-alive GATE / REPORT MPCPDUs, equal to *report_timeout* and *gate_timeout*
 - Ratio – ratio of empty reports or gates to the whole bandwidth
- How to calculate *Ratio (R)* value:
- Typically, there are up to 128 ONUs per OLT port
 - Bandwidth = 10Gb/s / 128 = 78.125Mb/s \approx 100Mb/s
 - FrameLength for MPCPDUs = 64 B
 - Timeout = 50 ms
- $$R = \frac{64 \times 8}{50\text{ms} \times B} \approx 10^{-4}$$



Examples of *timeout* values

- Values of *report_timeout* and *gate_timeout* calculated for various levels of bandwidth use (variable & configurable)

Bandwidth [b/s]	report_timeout	gate_timeout	mpcp_timeout
100Mb/s ~ 10Gb/s	50ms	50ms	1s
50Mb/s	100ms	100ms	1s
20Mb/s	250ms	250ms	1s
10Mb/s	500ms	500ms	1s
5Mb/s	1s	1s	1s

- Along with the decrease in bandwidth use, frequency of keep-alive mechanism diminishes, minimizing the time the laser is on and reducing power consumption on the ONU side;
- MPCP protocol can be used to exchange information on the current **timeout value between ONUs and OLT**



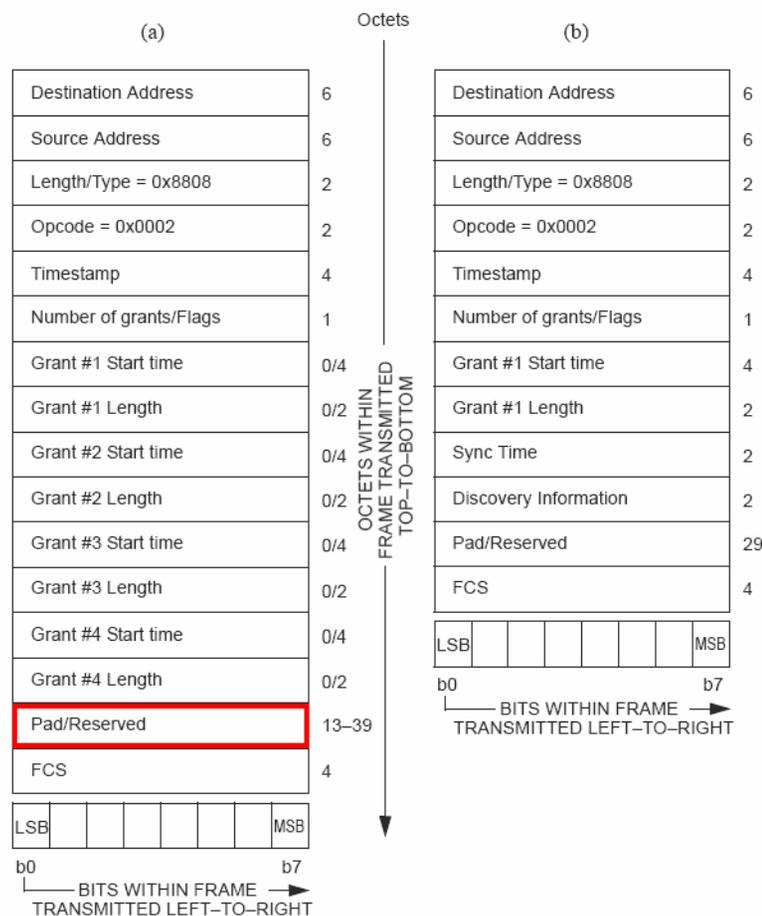
What is *Ratio*

- Coefficient *Ratio* defines the rate at which the system should slow down the generation of keep-alive messages on ONU and OLT side
- Relation between bandwidth usage per ONU and timeout is set as linear to facilitate calculations:
 - experimental verification of this power saving mode would be necessary
 - non-linear relations are also possible, if tested and proven better
- Current definition of the *Ratio* coefficient and its application in OLT and ONU with default values equal to existing standard prescribed values assures backward compatibility
 - ONUs with no support for such features would operate with 50ms timeouts
 - extended ONUs could do power-saving independently
 - power saving feature could be indicated by an ONU during discovery process by setting one of the bits in the Discovery Information field



Implementation in D2.0 [1]

- MPCP protocol can be used to notify the ONU on the current setting of the timeout parameter for report_timeout
- OLT operates in two modes:
 - In normal mode, bytes 38~39 in regular GATE MPCPDU are filled with zero; can be ignored at ONU.
 - In optimized mode, gate_timeout is calculated using formula on page 5 and then carried in bytes 38-39 (Vt), expressed in units of 50 ms
- Current measurement of the total bandwidth flow for the given ONU can be obtained from DBA client





Implementation in D2.0 [2]

There are some changes in the OLT:

- Bandwidth per ONU is observed by the DBA client and used to calculate timeout value for `gate_timeout`
- Next, `Vt` is calculated: $Vt = \text{gate_timeout} / 50 \text{ ms}$
- `Vt` value is encoded into bytes 38 – 39 of Pad / Reserved field in GATE MPCPDU and delivered to ONU

There are also some changes required in the ONU:

- In normal mode, an ONU ignores the value carried in byte 38~39 in the reserved field of a GATE MPCPDU,
- In optimized mode, an ONU obtains the value carried in bytes 38-39 (`Vt`) in the reserved field of a GATE MPCPDU and calculates `report_timeout` value:
 - $\text{report_timeout} = Vt \times 50 \text{ ms}$
 - $\text{mpcp_timeout} = 1 \text{ s}$

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Thank You for Your attention



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