# Power Savings

Ryan Hirth

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Introduction

- Methods exist with current standard to implement a power savings mode with little or no changes to the draft.

- Sleep mode request and response messages can be conveyed implicitly through existing Report and Gate messages.

- Control of the sleep mode can be controlled through the MAC Control Client

Reduced Polling Rate Sleep Mode
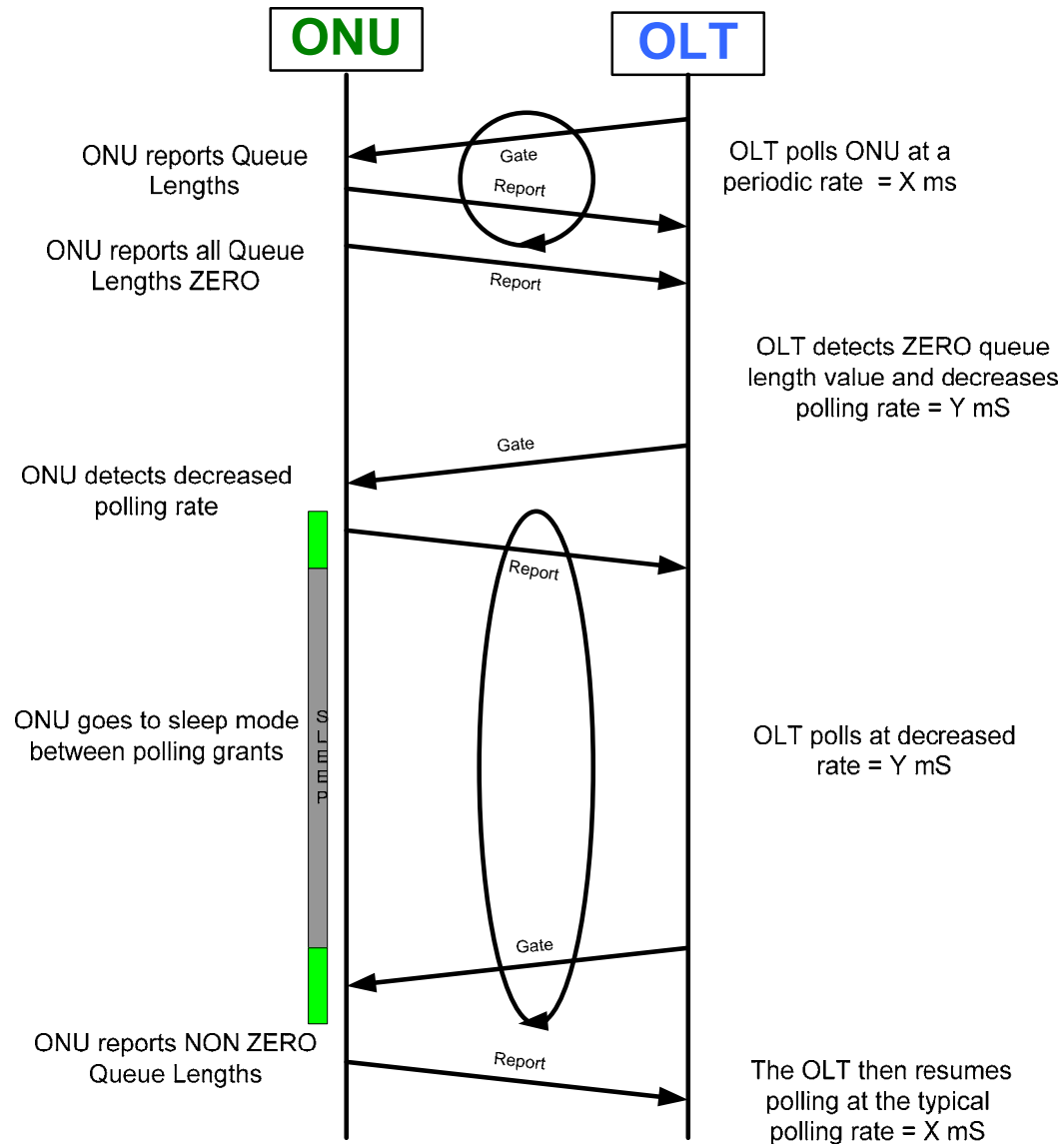
OAM is used to configure power down settings

- OAM message request (ONU->OLT)
  - Sleep time (min, max)
- OAM message response (OLT-> ONU)
  - Typical Poll Rate (min, max)
  - Sleep Poll Rate (min,max)

Power cycle limits

- Minimum power up time is required for ONU to leave the Sleep state.
  - Transceivers take time to power on
    - Power supply stability
    - Optical/electrical sensitivity needs to stabilize
    - Clock recovery and equalization
    - Transmit calibration and initialization
- Maximum sleep time is limited by mpcp_timeout (1 second)

mpcp_timeout
   This constant represents the maximum allowed interval of time between two MPCPDU
   messages. Failure to receive at least one frame within this interval is considered a fatal fault
   and leads to deregistration.
   TYPE   32-bit unsigned
   VALUE   03-B9-AC-A0 (1 second)
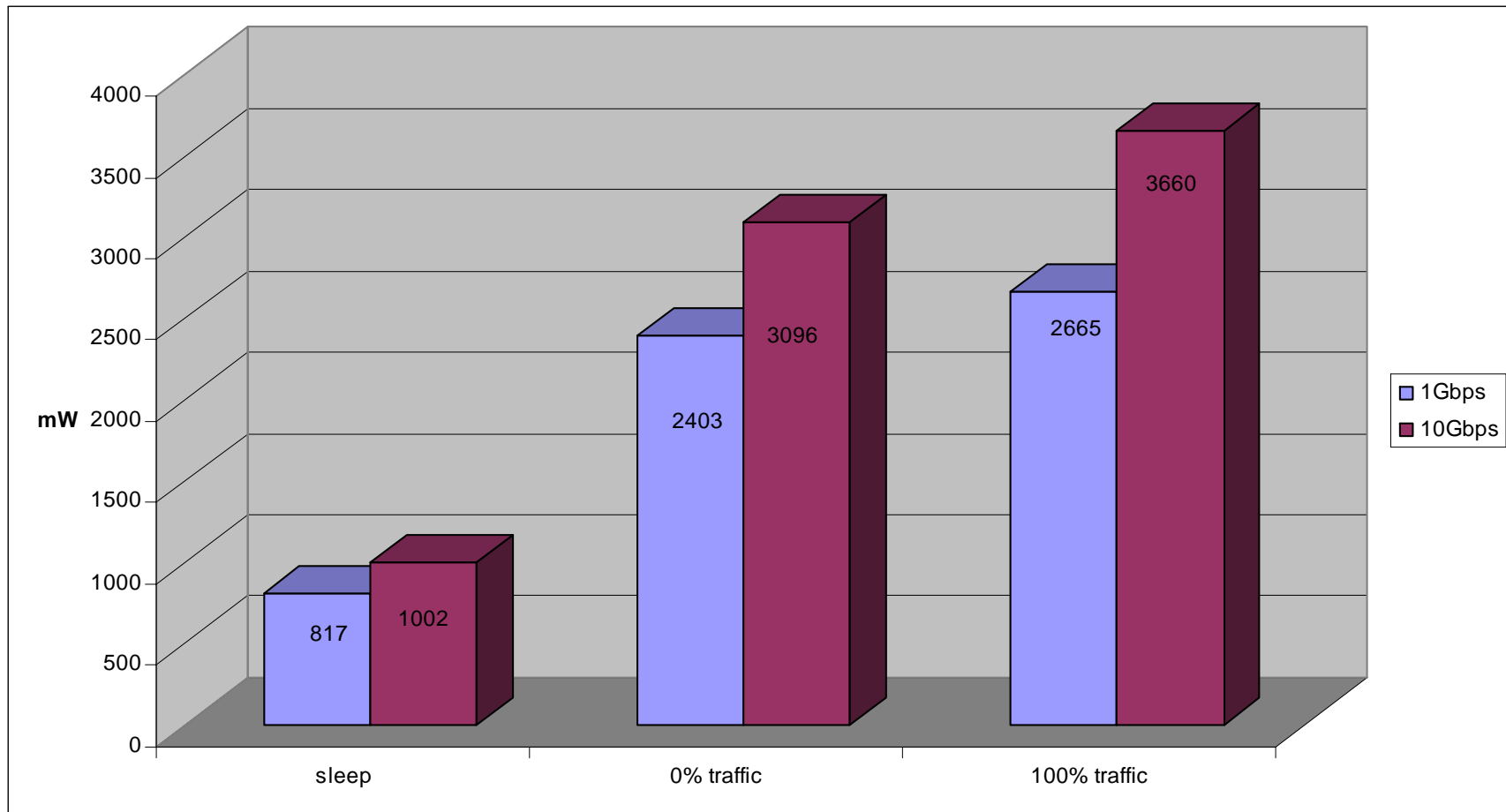report_timeout
   This constant represents the maximum allowed interval of time between two REPORT
   messages generated by the ONU.
   TYPE   32-bit unsigned
   VALUE   00-2F-AF-08 (50 milliseconds)

Typical ONU Power
(single GE port UNI)

mW

Legend:
- 1Gbps
- 10Gbps

	1Gbps	10Gbps
sleep	817	1002
0% traffic	2403	3096
100% traffic	2665	3660

RX power down

- Receiver power down is not recommended
- Broadcast packets will not be received by ONU
  - Network requires response from packets such as BPDUs to prevent MAC addresses from aging out.
  - ONU needs continued management control through OAM
- Potential RX power savings is 400mW
  - Less than 25% of the power reduction
- APD diodes require temperature stability
  - Transceiver stability is critical especially for PR-30

Performance Impact

- Increased latency for packet(s) upstream while in sleep state equal to a maximum of one polling interval
- Downstream performance not affected
- Minimal impact to any services

European Commission: "Code of Conduct on Energy Consumption of Broadband Equipment"

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- – "When the equipment is in the DSL-low-power-state … broadband services need to be offered to a user with almost the same quality and setup times as in on-state."
- – "… power management is not hampering the user experience of the targeted service … not in contradiction with the applicable standard"
- – "The CPE-low-power state for home gateways (including/excluding modem is based on putting the LAN side modules that are not needed or active into a low-power state"
- – "The transition time should be less than 1 second in order to not reduce the customer experience"

Impact to standard

- Too late to add new features to the draft
  - No changes are required for this proposal
  - Any modification will significant delay completion of the standard.
- Existing 1Gbps EPON standard and 10Gbps EPON draft already support Reduced Polling Rate Sleep Mode.

Comparison of proposals

- Signal a sleep request from ONU to OLT
  - New MPCP message

    or

  - Report message of ZERO length
- OLT responds with a sleep grant
  - New MPCP message

    or

  - Change Gate interval
- Sleep mode parameters are configured
  - New MPCP message

    or

  - Through OAM