Proposal for modification of EPON DBA scheme

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Need for DBA

- Traditionally "potential bandwidth efficiency is traded for simplicity" => in EPON, it's different
  - Efficient use of upstream bandwidth is needed to provide quality of service for mixture of upstream traffic
  - In EPON, ONU cannot send upstream data if not granted by the OLT
- Through DBA,
  - Network operators can add more customers due to increased efficiency
  - Customers can enjoy enhanced services requiring bandwidth peaks beyond traditional fixed bandwidth
- Quality of service is related to delay and loss, and for upstream traffic, it is determined by the grant allocation

Need to specify DBA ?

- Is DBA a target for standardization?
  - Yes for the framework
  - No for the allocation algorithm
- The "hook" for DBA should be designed to accommodate a wide range of DBA algorithms
- The current baselines limits the possibility of efficient DBA algorithms

Current problems regarding DBA

- reports and gates don’t match
  - report is for maximum 8 priority queues
  - but gate is “aggregate” for 8 such queues
  - gate usage for queues service is up to ONU
  - Is this enough?
- report is not always initiated by the OLT but also can be initiated by ONUs
  - Some algorithms may use systematic, managed report gathering and not want ONU-initiated reports.
  - There should be a way to prevent these ONU-initiated reports.(ex: set during auto-discovery)

Problem in EPON DBA

- in ONU, at the reporting time or gate application time

  queue level = last reported bytes + newly arrived bytes – serviced bytes after the previous report

  (for each priority queue)

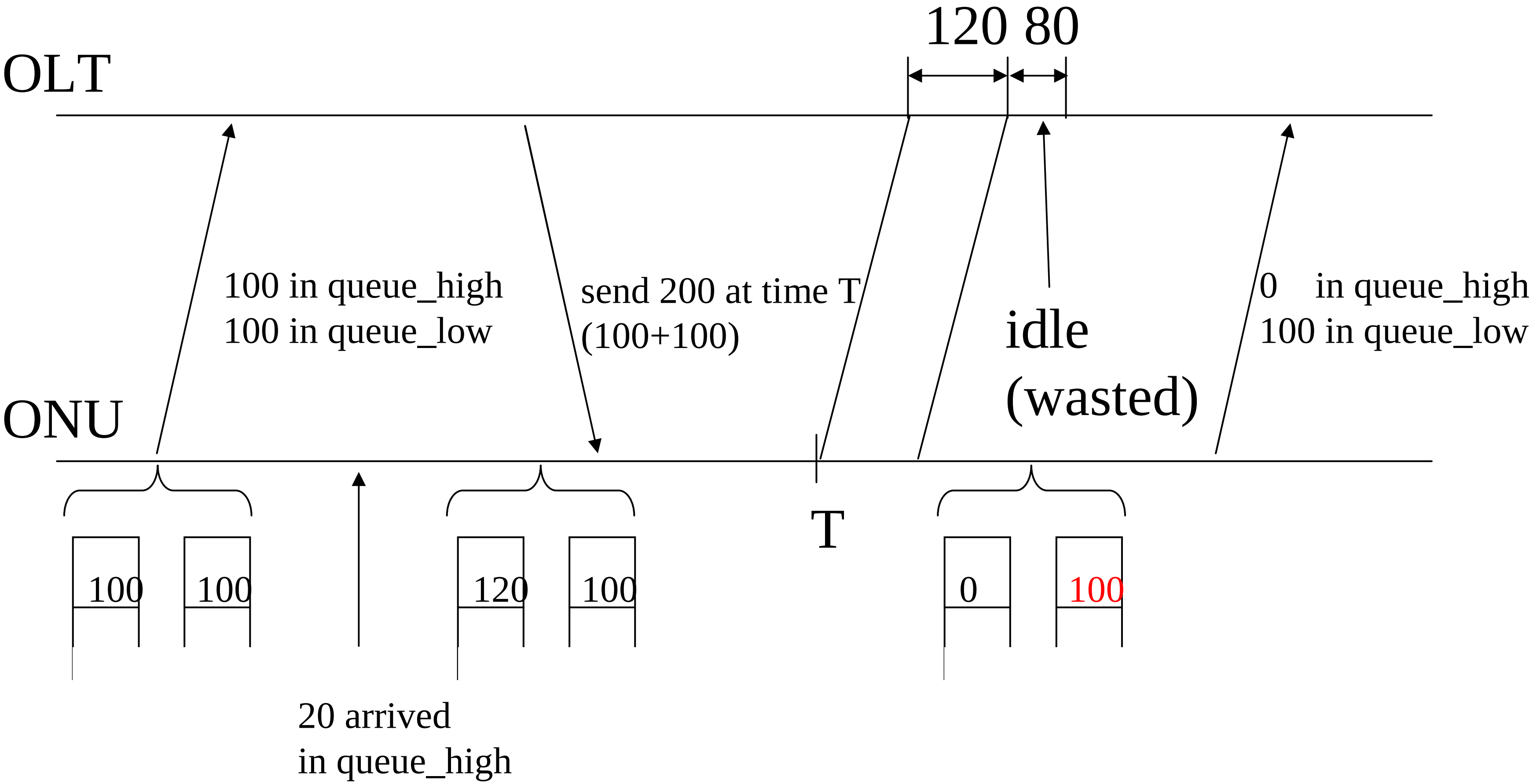
=> The OLT should know the serviced bytes of each priority queue to extract the new arrivals from the report

=> But the ONU does not know OLT’s algorithm and uses the received gates in its best discretion

=> This in turn, makes the OLT not know how much were serviced for each priority queue at the ONU between reports(even though OLT knows ONU’s algorithm)

=> false assignment between priority => a vicious cycle!

Problem example



Excluding unreported data from service?

- Of course, there are ways to prevent unreported data from being serviced
  - By remembering “up to where each queue was reported”
- The problem isn’t solved because ONU doesn’t know OLT’s algorithm state and OLT doesn’t know ONU’s algorithm state either
  - OLT doesn’t know how the grant was used,
  - ONU doesn’t know how the grant should be assignd to each queue

Intermediate queues for DBA?

- In IEEE802.1D, we have
  - user priority (best effort, excellent effort, background, voice, controlled load, video, network control)
  - Mapping user priority to limited number of supporting queues
- Priority queue does not represent the real traffic characteristics, because the mapping is different for different number of queues implemented
- So we may need an logical queue for DBA purposes which better represents the actual traffic contained in it
- But this also assumes user priority is known at ONU(using VLAN tag)
- This intermediate queue is for further study (we don’t know the traffic characteristic because it’s connectionless!)

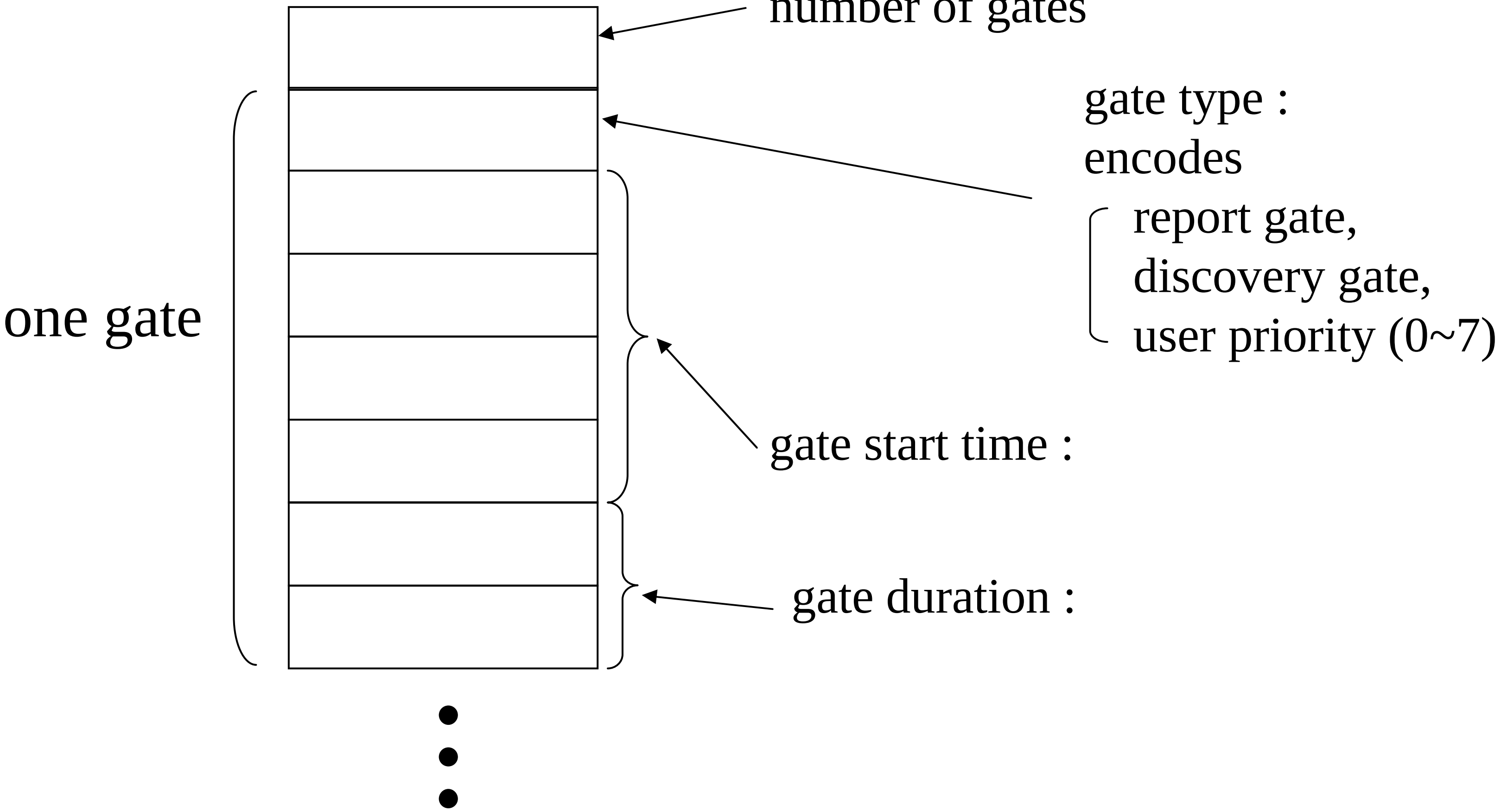
Need for report mode setting

- Current baselines allows ONU-initiated reports
- Some algorithms may want controlled reports only
    - This would be very conviniant for OLT's scheduling.(for most algorithms I think)
- Another suggestion : put the allowed report mode in the OLT capability in the gate (for discovery) message

What is proposed here

- modify the gate message to have explicit user priority like in the report message
- report method should be negotiated during auto-discovery (to block ONU-initiated report for some cases)

Proposed Gate Format change



number of gates

gate type :
encodes
report gate,
discovery gate,
user priority (0~7)

one gate

gate start time :

gate duration :

Conclusion

- It is impossible to avoid algorithm failure with current baseline proposals
- Modifying the gate to have explicit user priority will prevent the algorithm failure
- Still, ONU can use the grant on its own
- It should be possible to disable the ONU-initiated reports during auto-discovery using OLT's capability field
- This suggestion is not a bandwidth allocation algorithm but a "better hook" for EPON DBA.