

DBA (Dynamic Bandwidth Allocation) Overview

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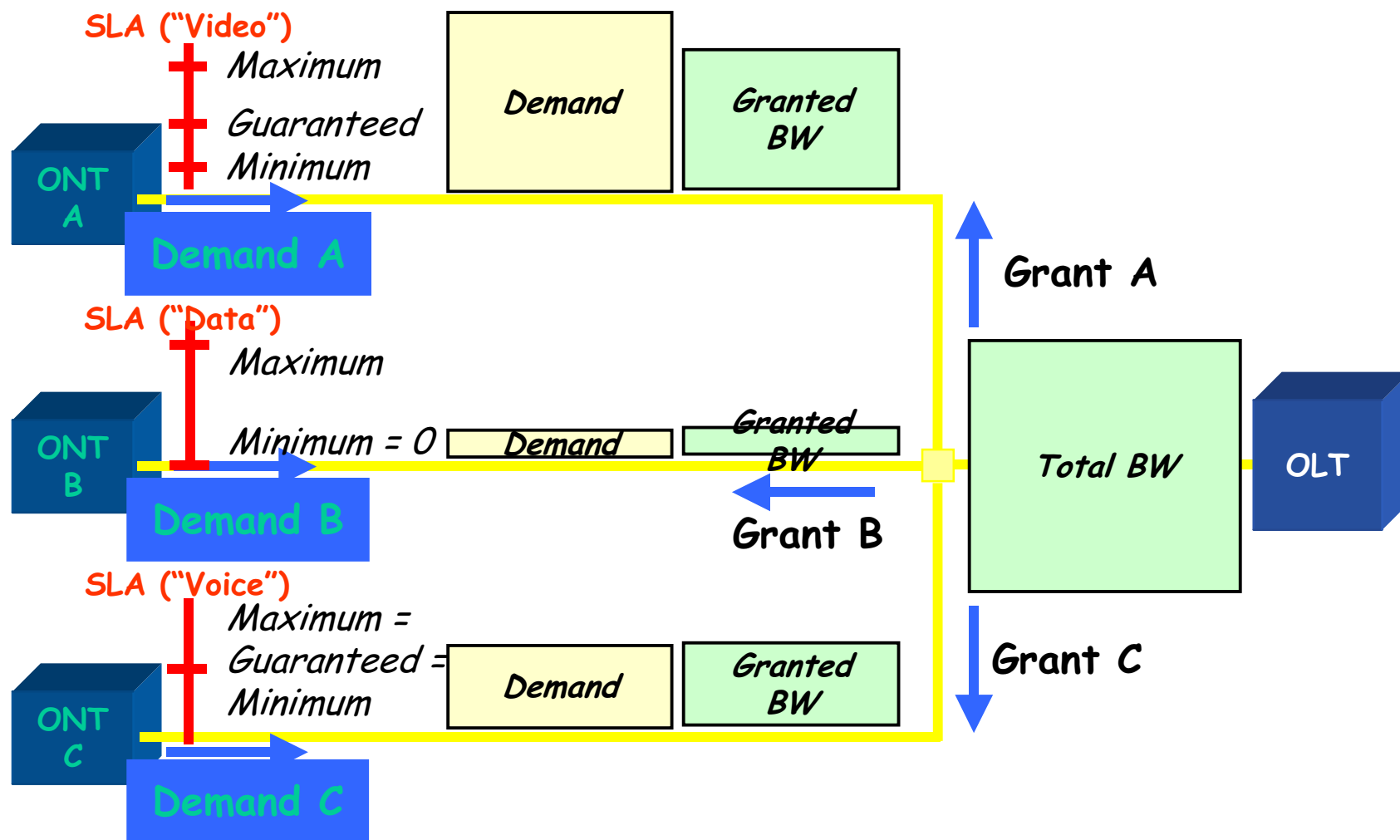
Outline

- What is DBA?
- Benefit of DBA
- DBA Service Requirements
- DBA Performance Requirements
- DBA Signaling Requirements

What is DBA

- What is DBA?
 - Mechanisms in place to dynamically change upstream BW on a millisecond/microsecond timescale
- Why we need DBA?
 - Improves the efficiency of the PON upstream bandwidth by dynamically adjusting the bandwidth among the ONUs in response to ONU burst traffic requirement
 - Network operators can add more end subscribers for a given PON due to the more efficient utilization
 - DBA allows more flexible SLAs for PONs with large (i.e. 32) splits
 - The end subscribers can enjoy enhanced services, such as those bandwidth peaks beyond the traditional fixed

How DBA works



The Value of DBA

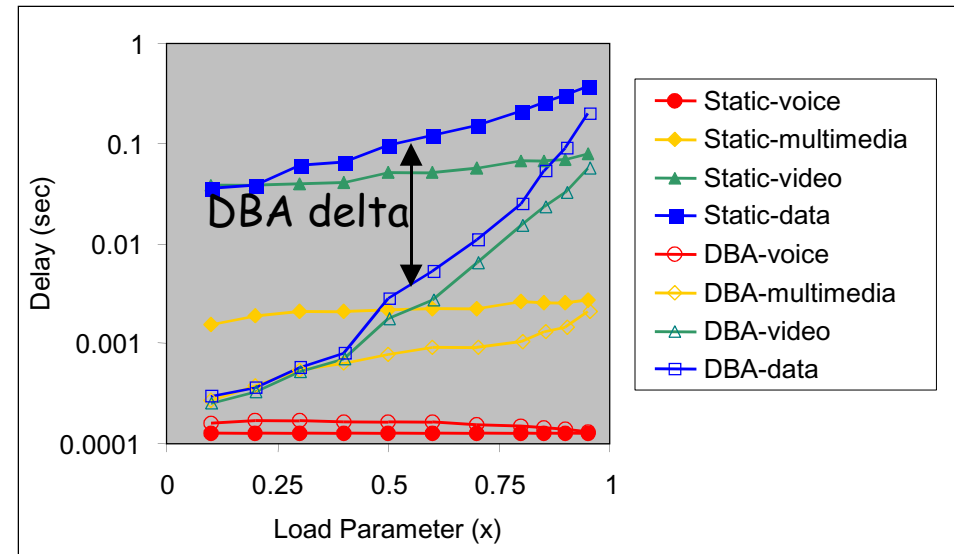
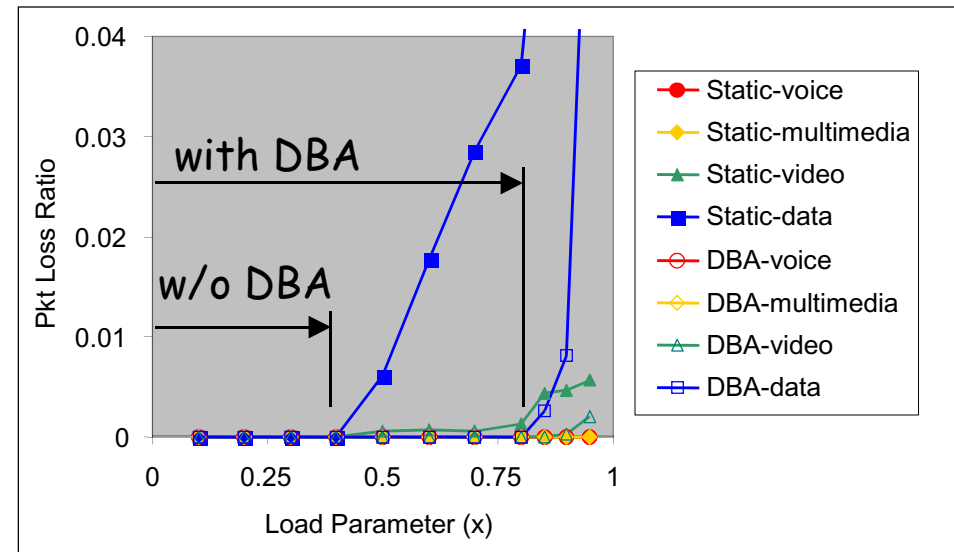
Utilization and Delay Impact

Maximum Utilization

- Without DBA: 40%
- With DBA: 80%
- Double capacity
- 3dB more Revenue

Average Transfer Delay

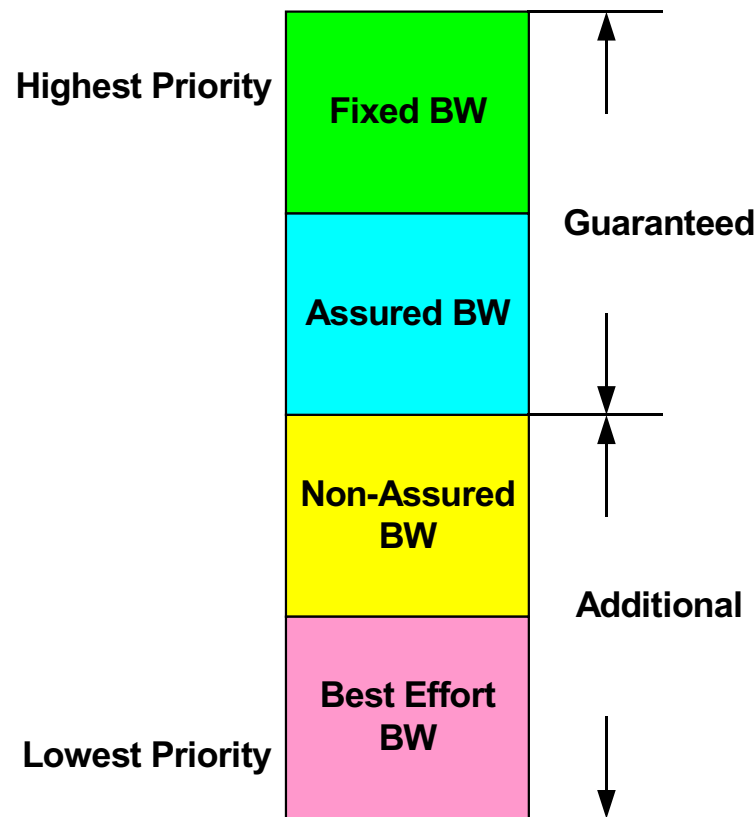
- Without DBA: 100 ms
- With DBA: <10 ms
- >10dB more speed



DBA Service Requirement - Introducing T-CONT

- **T-CONTs:** “Traffic Containers (T-CONTs)” carry traffic flows / connections and are used for the management of upstream bandwidth allocation in the PON section of the Transmission Convergence layer.
- **T-CONTs** are primarily used to improve the bandwidth utilization in PON section.

T-CONT BW Terminologies



- Fixed BW: reserved upstream BW, cyclically allocated regardless of demand.
- Assured BW- similar to fixed, but BW may not be given without demand.
- Non-Assured - bandwidth only given if BW is available but not guaranteed.
- Best Effort - demand only met if remaining upstream BW is available.
- Maximum BW - max BW that can be allocated to a T-CONT.

T-CONT Types and Relationships with BW terminologies

- Types: 1, 2, 3, 4, 5
- Relationships

BW Type	Delay Sensitive	Applicable T-CONT types				
		Type 1	Type 2	Type 3	Type 4	Type 5
Fixed	Yes	X				X
Assured	No		X	X		X
Non-Assured	No			X		X
Best Effort	No				X	X
Max.	No			X	X	X

DBA Performance Requirement

– Speed of response

- Waiting time for bandwidth allocation
 - Target at least millisecond ($\sim 1\text{ms}$)
- Transition time from ONU status change to steady state
 - Target several millisecond ($\sim 3\text{ms}$)

– Fairness

- Surplus bandwidth shall be FAIRLY allocated to all relevant T-CONTs, according to the T-CONT parameters

DBA Signaling Requirement

- Downstream bandwidth assignment
 - Supporting continuous change
 - Once every frame
 - Protect from error propagations
- Upstream status reporting
 - Implicit ONT status report
 - Idle slot detection: OLT looks for idle slot in transmissions
 - Explicit ONT status report
 - ONT transmits reports of buffer status for OLT

Upstream Signaling: Implicit ONT Status Reporting

- Idle slot detection (real time monitoring) provides
 - Per T-CONT indication of empty buffers
 - No additional function required at ONT
 - First level of DBA support

Upstream Signaling: Explicit ONT Status Report: PSS PCBu embedded Reporting

- Every ONT/T-CONT can report its buffer status in every upstream burst
- Buffer queue length report format (default): 4 Byte / T-CONT
- Buffer queue length coding (default): non-linear

Summary

- DBA improves the PON upstream bandwidth efficiency
- DBA service, performance and signaling requirements need to be satisfied

Thank You