DbOBS: Dual Buffered Switch for Variable Optical Bursts in Future Datacenters

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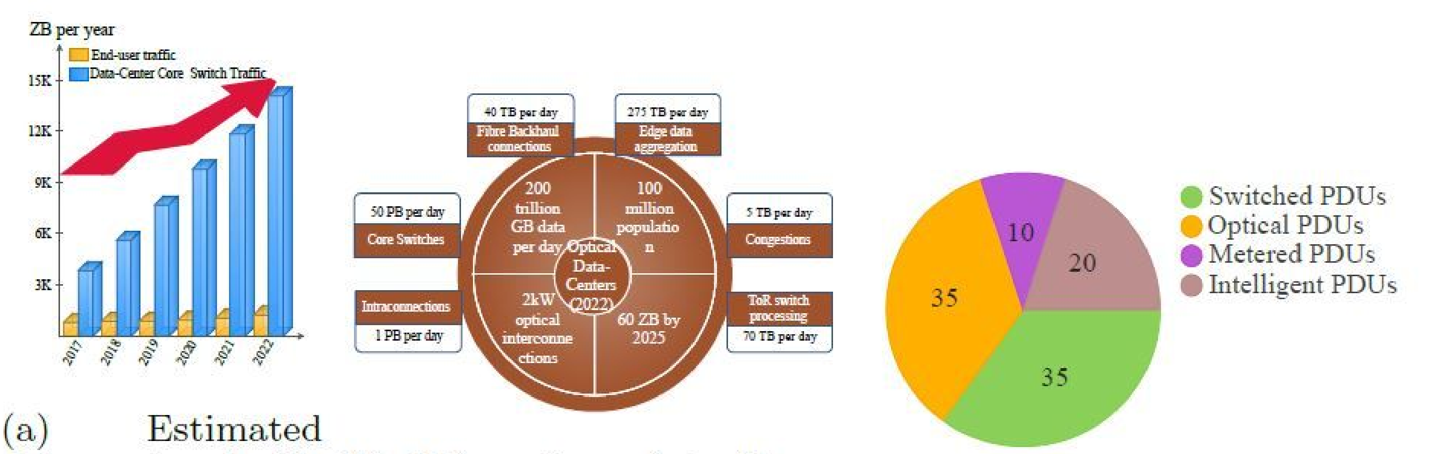
Abstract

Modern data-driven applications pose stringent requirements of high bandwidth, ultra-low-latency, low-powered, and scalable interconnections among switches and routers in data-centers. To address these demands, electronic switching is not a viable choice due to bandwidth and computing bottlenecks. Thus, researchers explored effective optical switch design principles for next-generation data-centers. In optical switches, data aggregates in the form of optical bursts (OB) at ultra-high speeds. In the case of OB contention, solutions are proposed by researchers to store OB as recirculating patterns in fiber delay lines (FDL) with induced optical delay. However, due to variable burst length, it is not possible to measure slot delay length, thus storage of contending bursts is not possible at intermediate core switches. Motivated from the aforementioned discussions, in this paper, we propose a switch design DbOBS, that is capable to store variable OB during contention slots. DbOBS estimates mean burst length, and possible deviation from mean length to minimize burst loss. The considered switch design is validated through parameters like-burst length estimation, over-reservation, and waiting time. For network-layer simulations, poison arrivals of data bursts are considered as packetized units. The packets are sent through Monte-Carlo arrivals and burst loss probability (BLP) is estimated at various input load conditions and buffer sizes. DbOBS achieves a BLP in order of 10-4 at load ≈ 0.8, and buffer-size of 50, and burst length of L = 5, that outperforms the traditional switch designs.

Full-text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed. However, the manuscript can be downloaded and accessed as a PDF.

Figures



(a) Estimated data-center traffic requirements 2022 [20]

(b) Bifurcation of traffic estimate in optical data-centers [18]

(c) Impact of optical PDUs in scalable computations [19]

Figure 1

Statistics of optical switch deployments in Future data centers

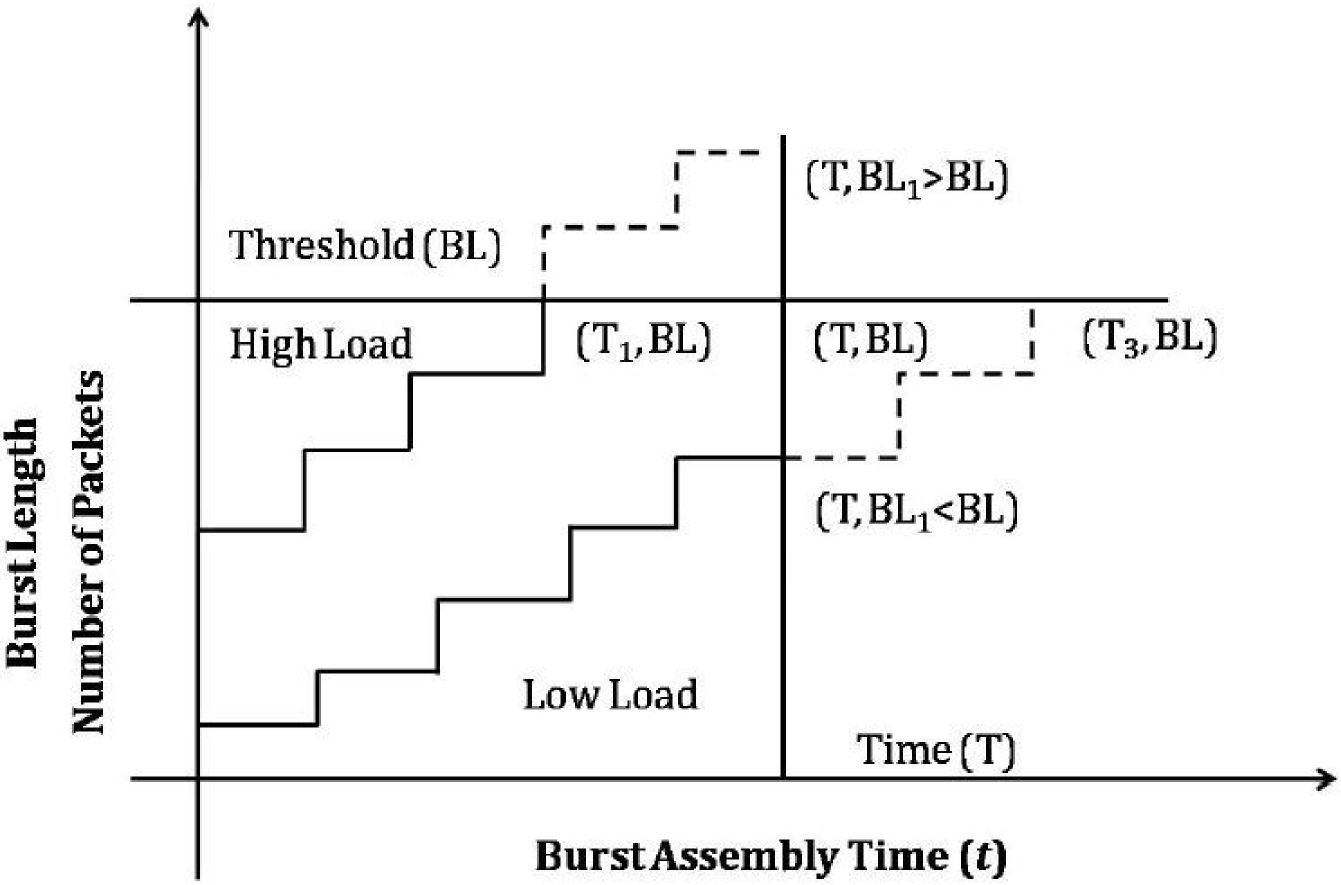


Figure 3

Burst Length vs. Assembly time

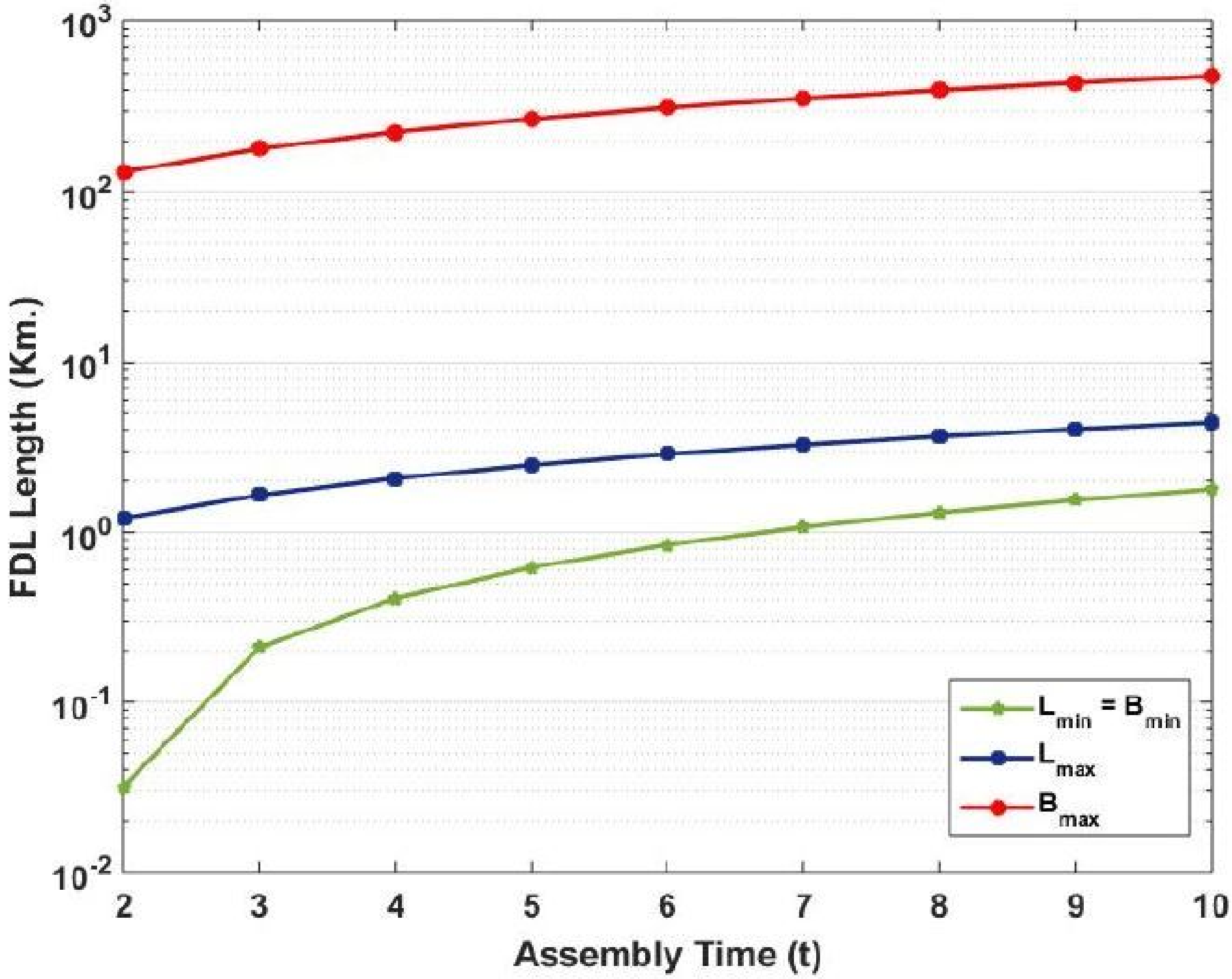
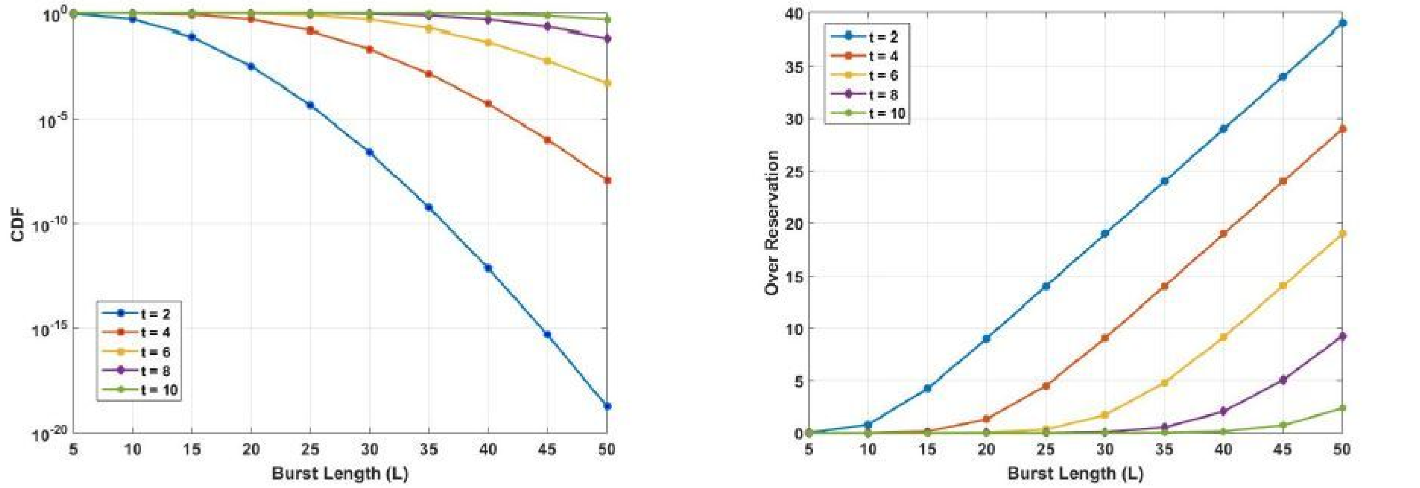


Figure 7

FDL Length vs. Assembly Time



(a) CDF vs. Burst Length (L)   (b) Over reservation vs. Burst Length (L)

Figure 8

Analysis of burst length probability and over-reservation for varying burst assembly times