Mind the gap:

void-creating algorithms for optical switching

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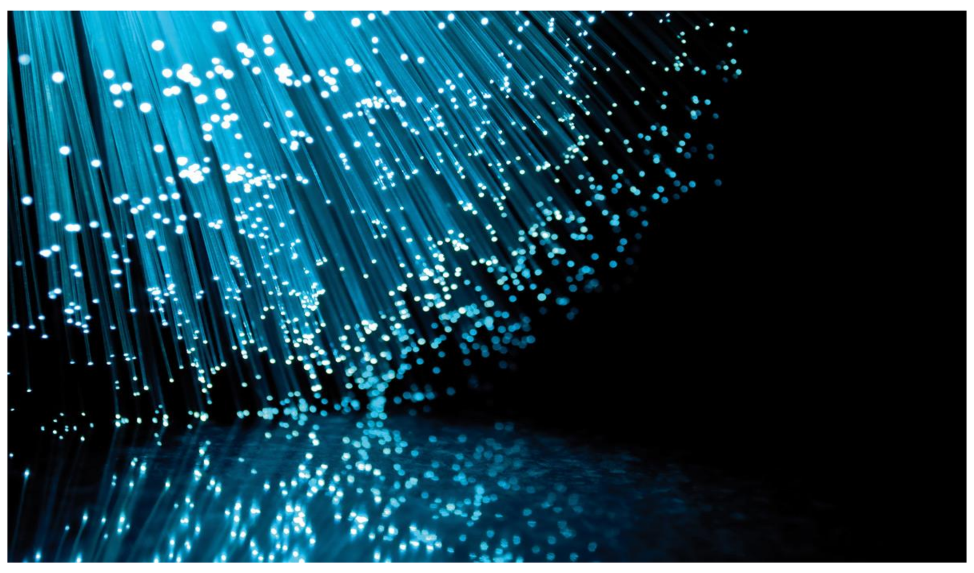
The connected world causes a bottleneck in the backbone

Cloud computing and (high definition) media services push bandwidth demands to unseen heights.

Nowadays optical fiber capacity is gigantic, but is used ineffectively, due to inflexible circuit switching.

Optical packet/burst switching is done at packet level, vastly improving the effective use of the fiber capacity.



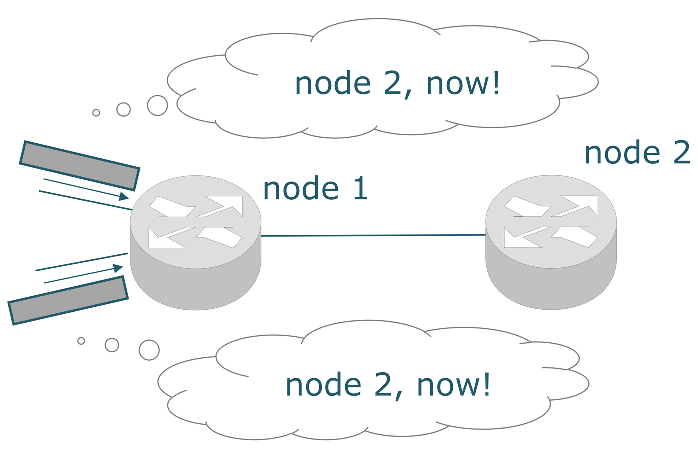
How to resolve contention

As network links are shared in optical packet/burst switching contention causes packet loss.

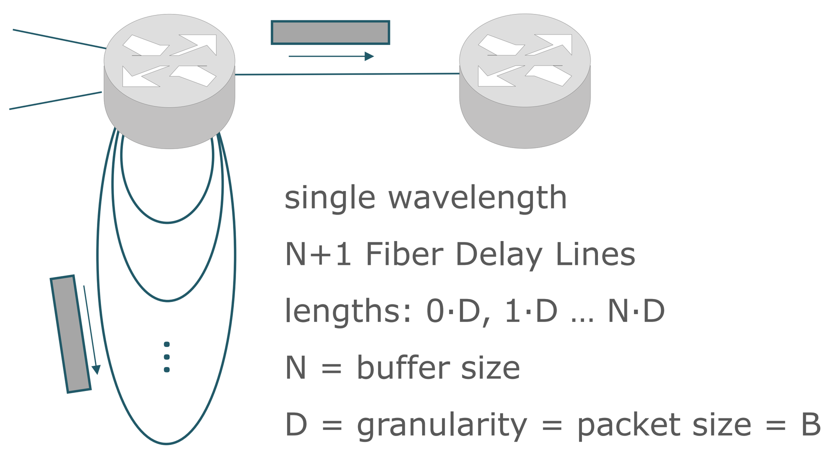
A method to buffer a contending packet is needed. Electronic buffering (RAM) is too slow for the optical speeds.

Fiber Delay Lines (FDLs) delay the contending packets, resolving the contention in the optical domain.

contention

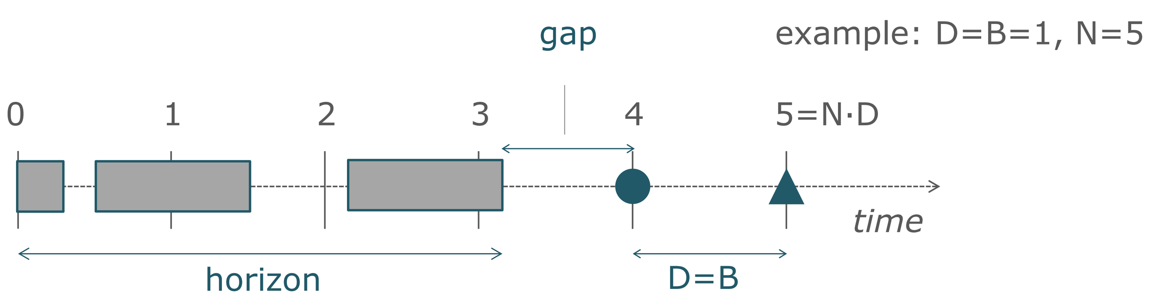


FDLs



Prevent voids by creating them

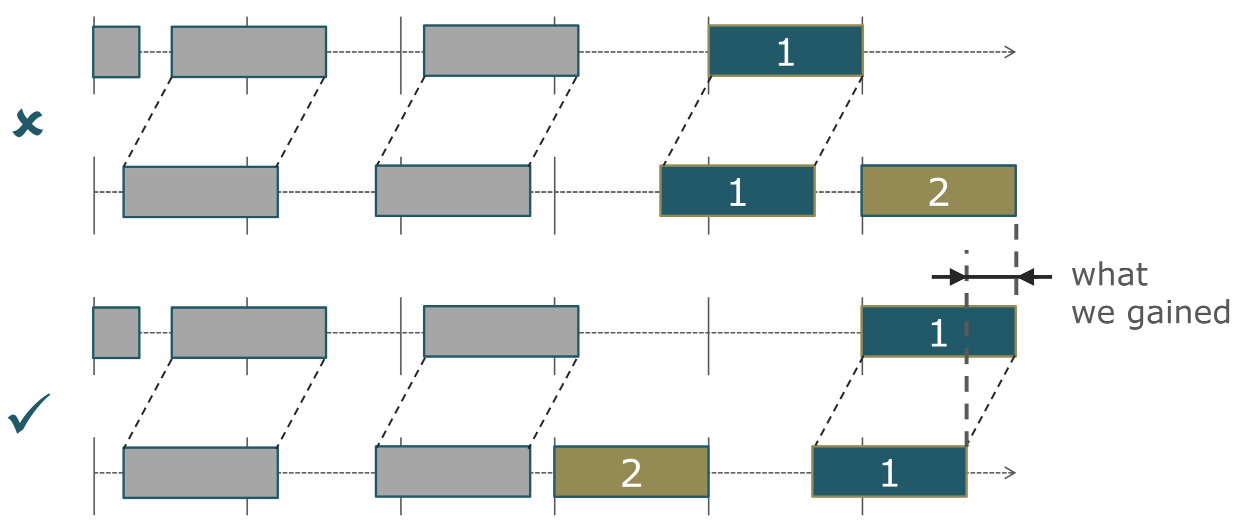
Consider **fixed-sized packets**.
A **provisional schedule** shows the already scheduled packets and the FDLs at every arrival.



✗ Existing algorithms always schedule on ●. For fixed-sized packets, only unfillable voids are created (<B).

✓ **Void-creating algorithms** dare to schedule on ▲ if advisable. This creates fillable voids (>B).

Filling a void results in an overall denser stacking, a lower packet loss and a lower packet delay.

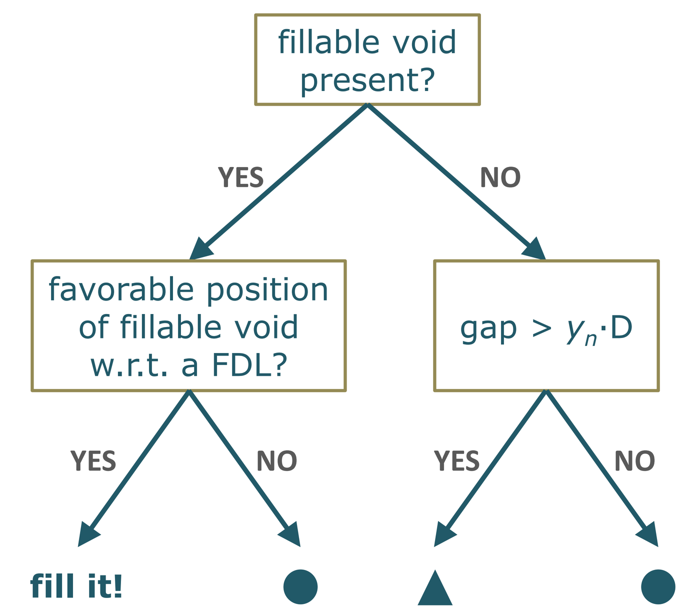


Optimizing the void-creating algorithm: mind the gap

Only fillable voids with a favorable position with respect to a FDL can be filled, which depends on the stochastic arrival process.

Chance of filling a void increases as both gap and horizon increase.

Use **gap thresholds y_n** (n=1 … N-1), one for each horizon index $=\left\lceil \frac{horizon}{D} \right\rceil$. Optimize each y_n ($0 \le y_n \le 1$).

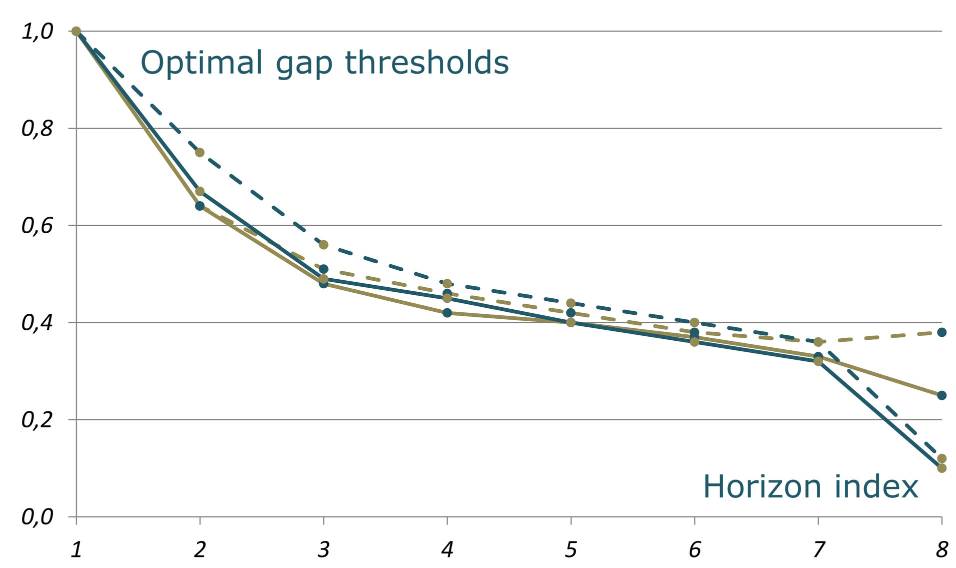


Packet loss and packet delay is reduced drastically by creating fillable voids:

load = 80 %:	packet loss: —•— : -32 %	delay: —•— : -14 %
load = 60 %:	packet loss: - -•- - : -51 %	delay: - -•- - : -18 %

Current and future work:

Consider variable-sized packets and multiple wavelengths.



Monte Carlo simulation: Poisson arrivals parameter λ, N = buffer size = 10, load = λ·B