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Performance Analysis of Crosstalk-Aware Sparse Core-Switching Optical Networks

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How does an SDM-EON benefit from different core switching architectures? What are the efficient architectures for performing core switching? How does the sparse core switching allocation affect network performance?

Fig 1

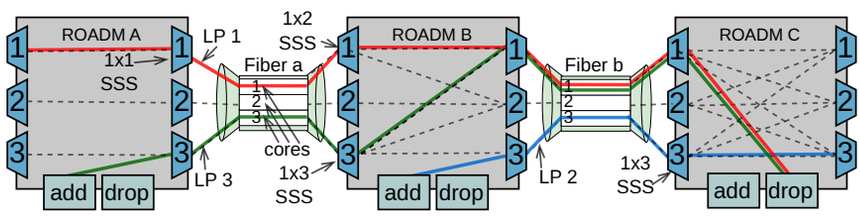
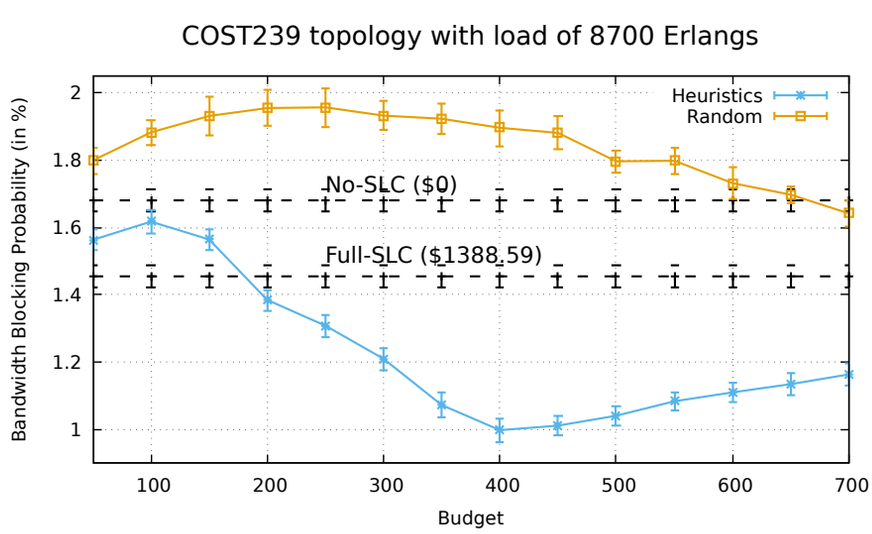


Figure 1 shows a small network with three Reconfigurable Optical Add-Drop Multiplexers (ROADM) representing the nodes A, B, and C, and two links (fiber a and b). The Spectrum Selective Switches (SSS) connect cores from different links. Each ROADM exemplifies one type of core switching architecture: core constrained (ROADM A), full switching capacity (ROADM C), and sparse core switching (ROADM B). LPs 1 and 2 do not go through any core switching, remaining on the same core during their whole route (cores 1 and 3 respectively). The LP 3 goes through a core switching on ROADM B.

Fig 2



KEY FINDINGS

In Figure 2, we compare the performance of core-constrained, full core-switching, and sparse core-switching architectures regarding bandwidth blocking rate, fragmentation, and number of accepted circuits. The comparison shows that efficient switching port distribution improves the network operation as it approaches the full core-switching performance. The performance evaluation considers the COST239 topology. We show that the sparse solution reaches the same bandwidth blocking rate performance as the full-switching architecture with only 14.4% of its budget. Furthermore, investments beyond the mentioned percentage can reduce even more the blocking rate, and the sparse solution overcomes the performance of the full core-switching architecture. In the best scenario found, the sparse core-switching architecture blocks 31.34% fewer circuits than the full core-switching. After this point, the amount of available switching ports grows and gets closer to the full core-switching, increasing the blocking rate. We associate this performance boost with the crosstalk impairment between cores, which intensifies when the spectrum shows more compactness of circuits. Thus, the sparse solution provides a beneficial level of fragmentation to reduce the crosstalk impact on the network performance.

Brasileiro, Ítalo ; Drummond, André ; Jukan, Admela . Performance Analysis of Crosstalk-Aware Sparse Core-Switching Optical Networks. In: IEEE Global Communications Conference (Globecom), 2023.

Brasileiro, Ítalo ; Drummond, André ; Jukan, Admela. Sparse Spatial Lane Change Increases SDM Network Efficiency. In: European Conference on Optical Communications (ECOC), 2023.