

Computing Path Blocking Probabilities for Traffic Splitting in Optical Hybrid Switching Networks

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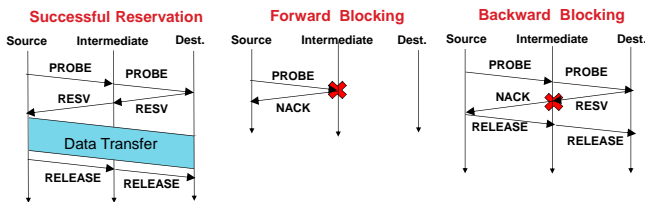
Objective

- **Analytical calculation of blocking probability in optical path (circuit) switched networks as a performance metric for optimization of hybrid switching networks.**

Advantages

- **Estimation of the optimum ratio of path and packet-switching wavelengths in a path-packet integrated architecture for**
 - Decreasing the file transfer delay and increasing the efficiency.
 - Decreasing the node cost.
 - Decreasing the power requirements (ECO).

Path (Circuit) Reservation

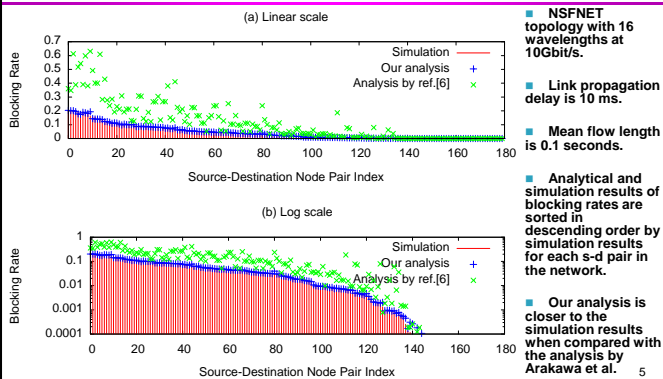


- In case there is no idle wavelength left in the list of the PROBE packet, node sends a NACK packet to the source. This is called **forward blocking**.
- If the destination selects an idle wavelength, it sends a RESV packet to the source node in order to reserve it along the path. However, a previously idle wavelength may have been reserved by another connection when the reservation packet arrives. This is called **backward blocking**.

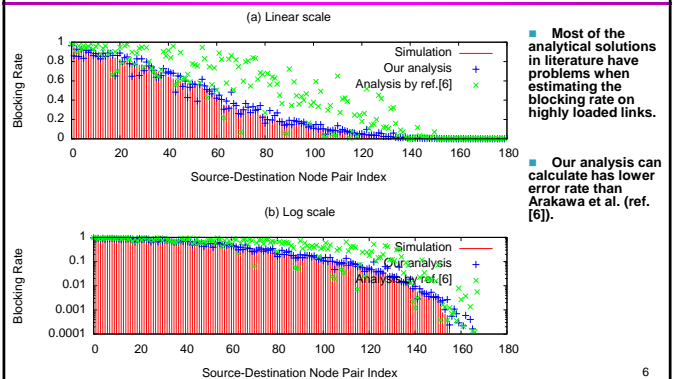
Analytical Solution

- **Applied the Reduced Load Approximation (RLA), which calculates the blocking rates in an iterative manner.**
- **The forward reservation blocking rate calculation is based on an analysis proposed by A. Birman.**
 - It is used by many analytical models in the literature.
 - Applies the Erlang-B formula for calculating the blocking probability.
 - Satisfies the wavelength continuity constraint.
- **Backward blocking rate is calculated by incorporating the wavelength reservation duration and propagation delays in the analysis to estimate the blocking due to outdated information.**
 - First proposed in a paper in year 1999 by S. Arakawa et al.
 - We further improved and extended Arakawa's backward blocking analysis for more precise results and adapted it for use with Birman's forward blocking analysis for an iterative calculation.

Low Traffic (400 requests/s)



High Traffic (2000 requests/s)



Conclusions

- Simulation results on mesh network show that the proposed analytical model can calculate the blocking rates with low error rate at both high and low loads.
- The precision of the analytical method is higher when the link load is low.

Future Work

- Increase the accuracy of the forward blocking calculation.
- Extend the analytical model to incorporate the retrial of blocked connections.
- Calculate the average flow transfer time as a performance metric.

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