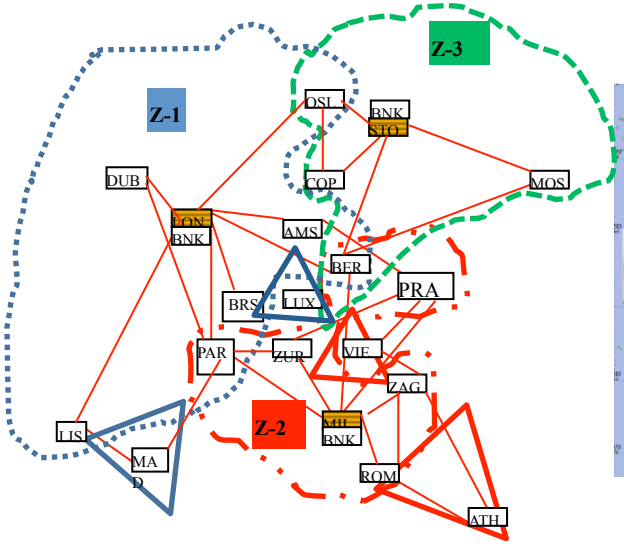
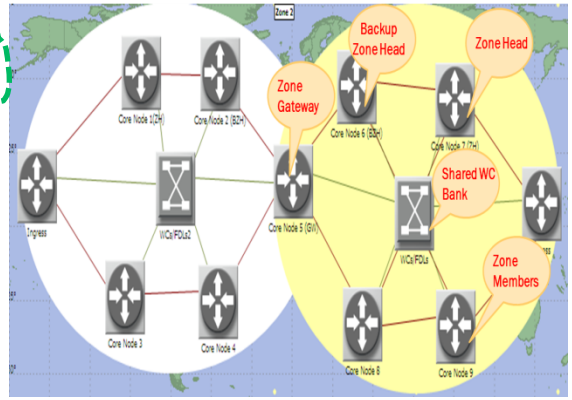
Resource Contention Avoidance Strategy for OBS Networks

Ihsan Ul Haq
Supervisors: Prof. Henrique M. Salgado
Dr. Jorge C.S. Castro

- **Resource contention is a major concern in Optical Burst Switching networks that leads to relatively high burst loss probability.**
- **To Minimize/Avoid Resource Contention:**
  - **Optical Network is divided into small manageable overlapping clusters/zones and there are Gateway nodes in the network that cooperate with ingress nodes for successful resource reservation in the adjacent zone. Thus the strategy tries to reduce the burst blocking probability.**
  - **A proposed novel strategy for contention avoidance that utilizes inferred knowledge about wavelength availability at the intermediate core nodes, for wavelength assignment at the ingress nodes.**
  - **Zone head stores a fixed alternate routing table for route selection and a route is selected from the pre-computed alternate routes where resources are available within the zone to avoid wavelength contention.**



C2OBS Architecture for EON Topology



Clustered Cooperative Architecture for OBS Networks (C2OBS)

Conclusions:

- A divide and conquer approach has been applied to Optical networks by splitting the whole network into more manageable C2OBS network architecture.
- A resource reservation strategy for C2OBS network architecture with the focus on gathering the advantages of both the centralized and the distributed reservation mechanism has been presented.
- Wavelength selection at the ingress node has a critical effect on the performance of the OBS network in terms of burst drop probability, we have proposed Intelligent Wavelength Assignment that assigns poles apart wavelengths to the bursts origination from nearby ingress nodes within the zone to proactively avoid contention at the intermediate nodes. Furthermore, Resource Aware Routing has been proposed that uses fixed alternate routing and resource awareness to proactively avoid contention at the intermediate nodes.

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Author:

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Supervisors:

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Dr. Jorge Castro

Overview:

Resource contention is a major concern in Optical Burst Switching networks that leads to relatively high burst loss probability. This work presents a clustered cooperative architecture for OBS networks, called Cooperative Clustered Optical Burst Switching (C2OBS) network architecture [1]. This work also presents the procedure to covert an Optical Network to C2OBS network architecture [2]. In this architecture, the network is divided in overlapping zones/clusters with a zone/cluster head having the knowledge of available resources within the zone called Zone Information Base (ZIB) and maintains a short resource usage history called Short History Base (SHB). For illustration purpose, the proposed architecture has been applied to the 20-nodes EON topology, 24-nodes NSF network topology, and 11-nodes COST-239 network topology.

A resource reservation strategy for the proposed Cooperative Clustered OBS network architecture (C2OBS-RR) is also presented which is centralized within the zone and distributed in the overall network, by combining the benefits of both the centralized and the distributed resource reservation schemes [3]. This novel approach uses the local state of the resource availability within the zone (ZIB) so that the bursts originating at the ingress nodes in the same part of network having been assigned the same wavelength, can be assigned different time offsets. This will proactively reduce the probability of contention at the intermediate nodes within a zone and is expected to significantly reduce the overall network burst loss probability.

This work also suggests a novel strategy for contention avoidance that utilizes inferred knowledge about wavelength availability at the intermediate core nodes, for wavelength assignment at the ingress nodes. The scheme also employs fixed alternate routing enhanced with traffic engineering and knowledge of resource availability hereby called resource aware routing for Cooperative Clustered OBS network (C2OBS). The zone head in C2OBS architecture stores a fixed alternate routing table for route selection and a route is selected from the pre-computed alternate routes where resources are available within the zone. The proposed approach exploits the zonal knowledge (ZIB & SHB) for proactively reducing both the contention probability and the overall burst drop probability, by optimizing routing and wavelength assignment at the ingress node, or at the zone gateway node(s) in case of inter-zonal traffic.

References:

[1] Ihsan Ul Haq, Henrique M. Salgado, Jorge C.S. Castro, “Clustered Cooperative Architecture for OBS Networks”, IX International Symposium on Enabling Optical Networks and Sensors, Aveiro Portugal, 1st July 2011.

[2] Ihsan Ul Haq, Henrique M. Salgado and Jorge C.S. Castro, “Optical Burst Switching Cooperative Clustered Architecture”, Conference on Electronics, Telecommunications and Computers, November 24-25, 2011, Lisbon Portugal.

[3] Ihsan Ul Haq, Henrique M. Salgado and Jorge C.S. Castro, “Cooperative Clustered Architecture and Resource Reservation for OBS Networks”, 6th International Conference on Systems and Networks Communications, Barcelona, Spain, Page(s) 213-219, 23-29 October-2011.