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PhD Dissertation Announcement

Packetized Dense Wavelength Division Multiplexing (DWDM) Optical Networks

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Internet today is dominated by emerging multimedia applications such as HD videos, VoIP services and online gaming. All of those applications have driven the bandwidth demand. Dense Wavelength Division Multiplexing (DWDM) enables hundreds of wavelengths to be transmitted in one physical fiber with rates at 100Gbps per channel. This is the most promising solution for next generation networks. However, all-optical DWDM network is not practical right now due to the limitations on optical technologies. On the other hand, new services such as cloud computing produces heterogeneous data traffic, which has different Quality-of-Service (QoS) requirements for different types of applications. We proposed a reconfigurable multimode switching router as a service platform to support the next generation networks. The reconfigurable multimode switching router can perform electronic packet switching, optical circuit switching and optical burst switching concurrently with dynamic reconfiguration capability.

In this work, we first present a mathematical model to analysis the blocking probability of the multimode router with full and partial wavelength conversion. The model provides an efficient way to evaluate performance of the multimode under various traffic scenarios, and gives insights in traffic sharing and queuing in the multimode router. In order to enable packet level traffic managements in optical networks, we propose a packetized DWDM network architecture. A dynamic resource allocation scheme is proposed to assign bandwidth to different flows with absolute end-to-end delay guarantee. Results show the efficiency of the proposed QoS provisioning method to assign appropriate amount of bandwidth to the traffic to meet its QoS requirements. We design an Open Channel multimode switching network to improve the QoS support via establishing multi-hop lightpath to reduce the midpoint delay and traffic loss. A dynamic online routing scheme is applied to create the open channel hop by hop using the traffic information at each hop. Numerical results demonstrate the efficiency of the open channel approach. We evaluate the-state-of-the-art research and commercial network architectures and position the proposed reconfigurable multimode switching router as a promising service platform to support new network paradigms and services.

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