absence) of signal in the header channels affects the gain of the payload channels. This cross-talk is greatly mitigated in B, in which different packets have more uniform power levels. Fig. 5 shows the payload eye diagrams emerging from the SOA node A (top 2 traces) and from the LOA node B (bottom 2 traces). It is evident that channel cross-talk noise in the SOA node A severely degrades the high signal level in the eye diagram.

5. Conclusion

We have demonstrated successful routing of 10Gb/sec optical packets through two complete nodes in the Data Vortex switch using bit-parallel WDM headers. This was facilitated by the use of LOA switching gates, which were shown to significantly reduce cross-talk among the WDM payload data channels. Control signaling between the two nodes was experimentally shown to properly route 10-packet sequences. The unique control mechanism effectively eliminates the need for packet contention resolution within the switch fabric, greatly simplifying the optical implementation of the system.

References:
P2, and P3 with labels L1, L2, and L3 respectively ingress into the optical label switching network. The experiment incorporated the OLS router with an all-optical label swapping module with 2R regeneration for the data payload. According to the forwarding table content, at each hop, L1, L2, and L3 contents trigger the packets P1, P2, and P3 to be forwarded to relevant directions or destinations. At each hop, an all-optical label swapping takes place with the new label content on each packet generated by the OLSR controller. This controller, as mentioned in section 2 also conducts contention resolution in wavelength, time, and space domains with a switching speed of approximately 1 nsec. Based on the forwarding decision, the switch controller sends a control signal to the tunable wavelength converter to switch to the designated wavelength within the switching fabric, which in turn triggers switching in the wavelength, time, and space domain switching based on the optical switching fabric architecture. Packet by packet bit-error-rate measurements took place on the P3 at each hop. Fig. 3 (a) shows the packet patterns at the ingress (top trace), at the first hop (middle trace), and at the second hop (bottom trace), which clearly demonstrates the desired optical-label based packet dropping. Fig. 3(b) shows packet BER measured on P3. A negative power penalty after 2 hop OLSR is mainly due to the 2R regeneration and the decrease of received average power after two packet droppings. The eye diagrams of the switched payload are shown as insets in Fig. 3 showing clear openings.

4. Network Evolution

The viability of optical-packet switching, the current prevalence of circuit switching, the popularity of MPLS and MPLambdaS will all necessitate the flexible interoperability of optical-label switching networks. The edge router will not only provide important packet aggregation points for improved end-to-end performance, but it will also function as an interface to generate labels or to set up label switched paths. Via the proper edge router functions, we envision that the current IP overlay on ATM architecture will evolve to IP overlay on MPLS, and MPLambdaS, and eventually IP over Optical-Label Switching/WDM. The current optical-label switching can directly interoperate with MPLS, IP, and MPLambdaS through the GMPLS, however, a new GMPLS extension can support unique optical-label switching capability to achieve packet switching directly in the optical layer.

5. Summary

The optical-packet switching and optical-label switching will play key roles in the future optical Internet. The seamless integration of data and optical networking with full interoperability can be achieved by optical-label switching. Recent progress achieved by a number of research groups including demonstration of cascaded OLS routers, edge routers, and the field network trial show promising future for this technology.

6. References


FS6 12:00 PM

Optical Time-to-Live Decrementing and Subsequent Dropping of an Optical Packet

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An optical time-to-live (TTL) decrementing module for optical packet-switched networks is demonstrated. Our module acts on an NRZ-modulated binary TTL field and decrements it, drops a packet if its TTL is zero, and is independent of the TTL length.

1. Introduction

All-optical packet switching remains a laudable goal for efficient and high-speed networking. One problem in many packet-switched networks is “routing loops”, where misdirected or mislabeled packets are routed in circles, never reaching their destination and leading to severe