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Design and Implementation of the Hardware Platform of Satellite Optical Switching Node

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Abstract

We design and implement a satellite optical switching hardware platform based on optical burst switching (OBS) technology. The hardware platform runs stably and realizes 20*20 channels of Microseconds level optical switching, which meets the requirements of quality of service (QoS) in the current optical network.

Introduction

- The current microwave communication has gradually failed to meet the requirements of spatial information exchange in terms of transmission bandwidth and delay. Compared with traditional microwave communication, laser communication has a faster transmission rate, larger bandwidth, and strong anti-electromagnetic interference capability.
- In order to improve the exchange capability of optical networks, we design an OBS switching scheme based on wavelength conversion, which is realized by the method of tunable laser, Mach-Zehnder (MZ) modulator, and arrayed waveguide grating router (AWGR).The maximum optical switching channels are 20*20. The transmission rate of each optical path is 10 Gbps. The minimum optical burst interval is 11.9 us. We also realize wavelength switching at the Microseconds level.

Design

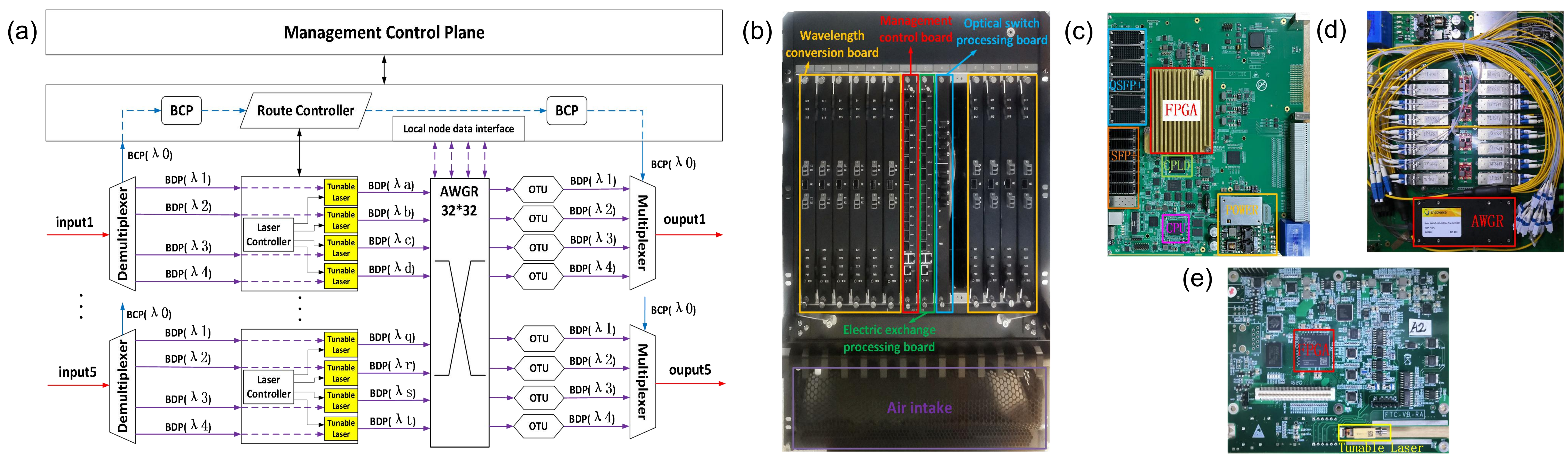

Fig. 1. (a) Functional structure diagram. (b) ATCA Chassis. (c) Management control board. (d) Optical processing board. (e)Wavelength conversion board.

- The functional structure of the hardware platform is shown in Fig. 1(a). The optical switching platform receives 5 dense wavelength division multiplexing (DWDM) laser signals for exchanging at the same time. Every DWDM laser signal is divided into 1 burst control packet (BCP) signal and 4 burst data packet (BDP) signals through a demultiplexer. Optical signals achieve wavelength conversion through tunable lasers. AWGR implements optical route exchange. Finally, BDP are coupled with the regenerated BCP to a laser signal through the wavelength division multiplexer.
- The chassis of the optical switching platform is shown in Fig. 1(b).The boards are divided into four types: management control board, electrical switching processing board, optical switching processing board, and wavelength conversion board. Electrical switching processing board adopts the same hardware architecture platform as the management control board. The boards are shown in Fig. 1(c)(d)(e).

Results

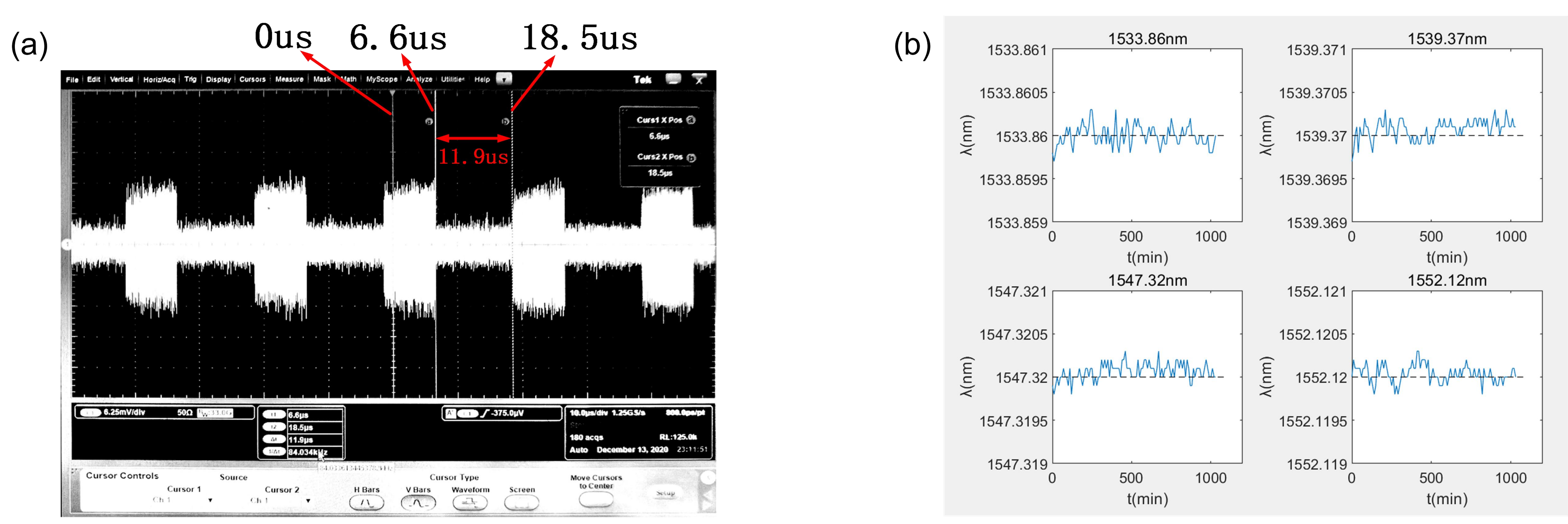

Fig. 2. (a) Optical burst interval (b) Wavelength stability test

- Based on the JET protocol, we test the physical performance of the optical burst switching on the hardware platform. The minimum optical burst interval is 11.9 us, as shown in Fig.2(a). This interval includes the processing time of the BCP signaling, the transmission time from the control board to the wavelength conversion board, and the laser wavelength switching time.
- Fig.2(b) shows that the jitter of the output wavelength of the tunable laser. The maximum wavelength jitter does not exceed 0.01 nm. For AWGR with a wavelength interval of 0.8 nm, the wavelength jitter will not affect its output. So the wavelength stability of the platform meets normal use.

Conclusion

In this article, we introduce and test the spatial optical switching hardware platform. We design and realize the maximum 20*20 channels optical switching, each 10 Gbps optical switching, the minimum optical burst switching interval is 11.9 us. The platform works stably and sustainably for a long time.

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