

OpenROADM-controlled Silicon Photonics Integrated Reconfigurable Switch Matrix

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A fully packaged photonic integrated switch matrix including 1398 circuit elements interconnected in a 3-D stack is controlled through OpenROADM NETCONF/YANG Agent and experimentally validated in an ONOS-based SDN testbed encompassing OpenConfig-driven 100G pol-mux transponders.

Keywords: White box, silicon photonics

1. Introduction

Optical network disaggregation has emerged as a promising candidate solution to provide potential CAPEX savings while avoiding vendor lock-in [1]. OpenROADM represents the most suitable approach to control disaggregated optical switching elements as white boxes [2]. In parallel with such control plane evolution, at the data plane level, relevant technological advancements have been achieved in the design and implementation of silicon photonics miniaturized optical switching devices (e.g., [3]). One of the most remarkable solution for silicon photonics miniaturized optical switching device was recently developed within the European IRIS project, where a wavelength selective switch matrix, called IRIS, was designed, fabricated and preliminarily validated [4]. So far, only few complex photonic integrated switching devices have been enhanced with meaningful control plane solutions (e.g. [5]). However, they relied on OpenFlow extensions for optical transmission, which have been now substantially abandoned by the optical community in favour of NETCONF/YANG solutions, such as OpenROADM.

2. OpenROADM IRIS White-box

The IRIS silicon photonics integrated reconfigurable switch matrix supports up to 12 C-band WDM signals per network port, 200 GHz spaced. It includes 824 thermal switch elements implemented as double micro-ring resonators (MRRs) for the drop of the signal and linear heaters for interleavers. 84 photodiodes enable continuous monitoring of the switch matrix configuration and the signal [4].

In this work, two packaged IRIS modules are placed in parallel using polarization beam splitters. The two modules are controlled through a specifically designed NETCONF agent supporting the OpenROADM YANG model. The agent has been developed extending the ConfD framework. Two sockets enable the communication with the device driver module for configuration and monitoring purposes.

The OpenROADM white box is used to interconnect a pair of commercial transponders operating at 100G PM-QPSK. They encompass a custom-made NETCONF agent adopting the OpenConfig YANG model, introduced in [2]. The testbed also includes a pair of EDFAs to compensate for the experienced

insertion loss of the switch (around 22dB). An ONOS SDN Controller dynamically configures the white box cross-connections and the two transponders (e.g., central frequency) [6]. Results show an extremely good pre-FEC BER of $2 \cdot 10^{-8}$ is achieved crossing the proposed OpenROADM-controlled white box encompassing silicon photonics integrated switch.

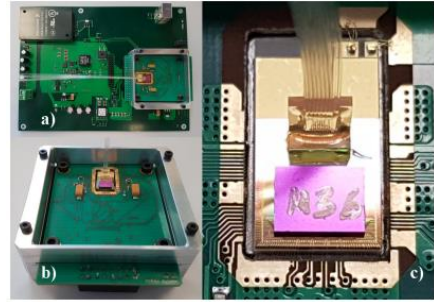


Fig. 1: Details of the packaged modules.

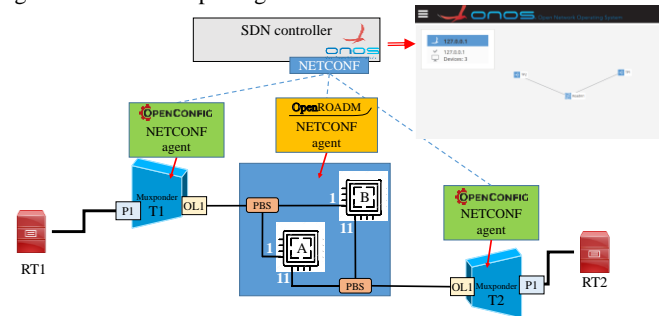


Fig. 2: ONOS-controlled IRIS white box and testbed setup

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