



COSIGN in a Nutshell

The vision of the COSIGN project is to move away from the present restrictions of hierarchical, vendor specific, manually controlled data centre solutions and operations towards flat, scalable, automatic and optimised data centre infrastructures.

COSIGN is in its final year where focus will be on integration and testing of the planned demonstrators, based on the adopted architecture design and the progress made in novel fibre and switching technologies.

Three demonstrators are in the making:

The short-term proof-of-concept demonstrator will confirm the performance of the Ethernet switch developed at the Technical University of Eindhoven (TU/e) and act as reference for the other demonstrators by implementing a legacy-type Ethernet network based on the compact high radix TU/e Ethernet switch.

The medium-term demonstrator, to be shown at the ECOC conference in Dusseldorf in September 2016, will introduce optical switching in the Data Centre Network (DCN) as an optical overlay to a more conventional Ethernet-based network provided by a large port-count switch from Polatis. This demonstrator will be integrated with the COSIGN control plane and orchestration mechanisms to allow demonstrations of several different use cases, and it will furthermore be validated in an industrial environment at the Interoute data centre facility in Milan.

The long-term demonstrator will focus on the implementation of an all-optical DCN using multiple advanced optical technologies. It will be carried out pursuing two different approaches to demonstrate different achievable benefits by the large-scale introduction of optical technologies in DCNs. This demonstrator will be hosted at the University of Bristol and the Technical University of Denmark (DTU).

The primary test environment is located at DTU where the individual components can be installed remotely by the involved partners, and updated as dictated by the outcomes of the development work and test results.

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Partners

Danmarks Tekniske Universitet (DK)
Nextworks (IT)
Fundacio Privada i2CAT (ES)
Polatis Ltd (UK)
University of Bristol (UK)
Venture Photonics Ltd (UK)
Universitat Politecnica de Catalunya (ES)
University of Southampton (UK)
Technische Universiteit Eindhoven (NL)
Photonx Networks BV (NL)
IBM Israel - Science and Technology Ltd (IL)
OFS (DK)
Interoute S.p.A. (IT)

Project Coordinator

Lars Dittman
Danmarks Tekniske Universitet
Phone: +45 45253851
Email: ladit@fotonik.dtu.dk
Web: <http://www.fp7-cosign.eu/>

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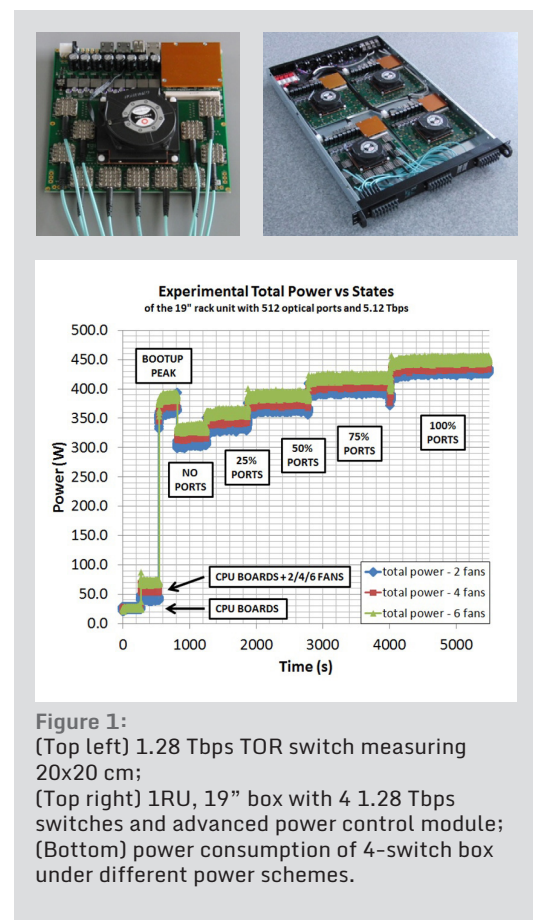
<http://www.fp7-cosign.eu/>

COSIGN Data plane

The COSIGN data plane implementation aims to combine novel electronic and optical switching devices to create a hybrid network. The main motivation for creating the hybrid network is to enable the handling of flows of different size and duration through either an electronic packet switch or an optical circuit switch. By implementing a clever off-loading strategy of the packet network, system throughput can be improved. In the long-term strategy we also aim to add time division multiplexing granularity between servers and switches. For this purpose we will connect some of the Top of Racks also with a fast integrated InP (indium phosphide) switch from Venture.

Tu/E Top of Rack switch

The 2nd generation top of rack (ToR) switch solution for the TU/e switch has been designed to accomplish the most compact solution. This has been achieved by using on-board optical modules integrated close together with the switching ASIC. Figure 1 shows the newly developed 2nd generation TOR switch on the left and the newly developed 4-switch box with an extra centralized power controller in the middle. The new switch design and the 4-switch box offer a breakthrough in size and packaging of switches for data centres and demonstrate the potential of using on-board optics for facilitating further scaling of switches for large scale data centres of the future. The work on the switch has been a collaboration between the TU/e and PhotonX networks B.V. which is a TU/e spin-off and a partner in the COSIGN project. PhotonX networks is involved in the development of the required agents and software APIs to allow the switch to run under the OpenDayLight controller operating system to be used in the COSIGN project demonstrators.



Venture Switch

Venture Photonics Ltd is the partner in COSIGN Project that is developing a 4x4 fast polarisation independent optical switch. This will be integrated with Field-Programmable Gate Array, electrical drivers and OpenFlow software control, developed with partners University of Bristol, DTU and TU/e.

Carrier injection induces an index change in the optical wave guide. Total internal reflection then steers the light onto a second route. In addition to the 16 switches needed on each chip for 4x4 operations there are semiconductor optical amplifiers and optical monitors integrated into the chip.

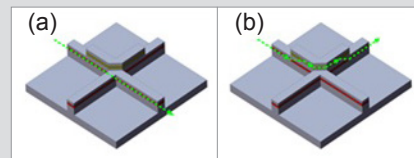
The chip is packaged into an industry standard CFP2 module. This will have a MTP (Multi-fibre termination Push-on) low loss single-mode optical fibre ribbon connector bulkhead for easy interfacing with the rest of the rack.

The OXS is based on Indium Phosphide (InP) chip technology and works at 1550 nm. This will deliver

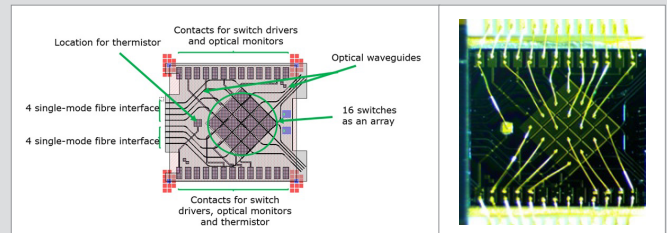
- Polarisation independent performance better than 1 dB polarisation dependent loss
- Fast switching at 5 ns
- Crosstalk of <-50 dB
- Off state leakage of <-50 dB

The switch will be capable of multicasting. An additional part of the COSIGN project activity is to study scaling the OXS switch to 16x16 ports, useful as part of the planned commercial progression of the product by Venture Photonics toward high volume manufacture in the future.

Samples of the OXS 4x4 CFP2 modules are expected to be available for partner characterisation in the autumn of 2016.



The principle behind the Optical Crosspoint switch (OXS)
(a) Off state, light path is straight
(b) On state, light path at right angles



OXS chip graphic and a wire bonded example



CFP2 module with MTP ribbon fibre optical interface

Meet COSIGN



IEEE Electronic Components and Technology Conference

ECTC 2016 (Las Vegas, May 2016)

<https://www.ectc.net>

Tu/E presented a Paper entitled “Wet Etched Silicon Interposer for the 2.5D stacking of CMOS and Optoelectronic Dies”.



Sigmetrics 2016 (Antibes Juan-les-Pins - June 2016)

<http://www.sigmetrics.org/sigmetrics2016>

IBM presented a paper entitled “Integrated Optical Circuitry for Data Centre Network”.



NetSoft 2016 (Seoul, June 2016)

<http://sites.ieee.org/netsoft/>

DTU presented a paper entitled “Dynamic aggregation of traffic flows in SDN” during Technical session 4.



ECOC 2016 (Dusseldorf, September 2016)

<http://conference.vde.com/ecoc-2016/Pages/ECOC2016.aspx>

COSIGN will present the medium-term Demonstrator, with the COSIGN data plane and control plane components that will showcase the COSIGN use cases.