mirage

MultI-coRe, multi-level, WDM-enAbled embedded optical enGine for TErabit board-to-board and rack-to-rack parallel optics

At a Glance: ICT MIRAGE

Project website:

www.ict-mirage.eu

Project coordinator:

prof. H. Avramopoulos

Project partners:

- ICCS/NTUA
- AMS AG
- Optoscribe Ltd
- Technische Universität München
- Interuniversitair Micro-Elektronica Centrum
- AUTH
- AMO GmbH
- Mellanox Technologies Ltd

Duration:

Oct 2012 – Sep 2015

**EC financial contribution:**

2,099,975 €

The Challenge

The Internet is changing: it is rapidly reshaping into a content-centric network, where billions of users demand instant access to vast amounts of data. Currently online content makes up an enormous capacity of more than 500 billion gigabytes, all of which resides in datacenters. Datacenters are massive facilities consisting of hundreds or even thousands of servers interconnected with each other. Being the repositories of online content, datacenters are now becoming the "hot spots" of the internet and content providers face up to the challenge of increasing the interconnection speed to improve data delivery to the end user.

Mission Statement

MIRAGE aims to implement cost-optimized components for terabit optical interconnects introducing new multiplexing concepts through the development of a flexible, future-proof 3D "optical engine".
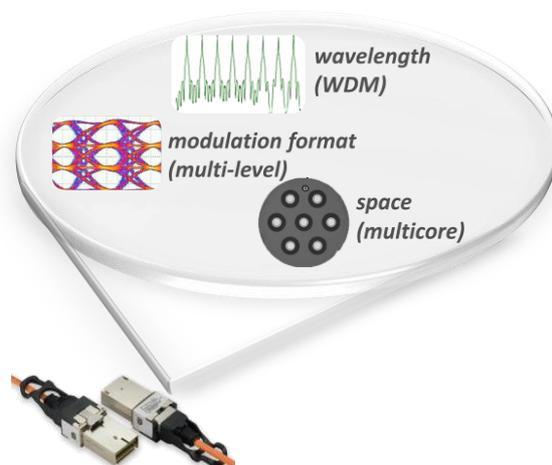
Project Objectives

MIRAGE aims to raise the bar of optical-interconnect technology currently used in data centers and bring it to the terabit scale. To achieve its challenging mission, the project has defined multidisciplinary objectives spanning from material research to cutting edge integration techniques and circuit design, streamlined towards suitability for commercial uptake.

The project core technological objectives are:

- develop 3D photonic-electronic Si platform
- fabricate monolithic CWDM long-wavelength VCSEL arrays for 40 Gb/s modulation
- develop advanced methodology for industry-compatible 3D assembly & packaging
- develop low cost techniques for multicore-fiber coupling
- fabricate application-specific components using the developed 3D optical engine
- evaluate components in application scenarios

System concept

Modern datacentres perform rack-to-rack interconnection primarily through Active Optical Cables (AOCs), used to carry hundreds of gigabits through hundreds of meters. Current AOC products rely on simple on-off keying modulation to transmit parallel "lanes" of data in arrays of multi-mode fiber. Although simple an approach, its scalability is reaching its limits and cannot keep up with the soaring demand for capacity.

MIRAGE aims to disrupt current development efforts by introducing new degrees of parallelization in optical interconnects. The project leverages effectively a manifold of recent developments and paradigms to unleash the scalability of AOCs, such as:

- data transmission in multi-core single-mode fiber and development of the necessary chip-to-fiber interfaces

- introduction of multi-level modulation schemes for capacity upgrade
- introduction of wavelength multiplexing in Active Optical Cables
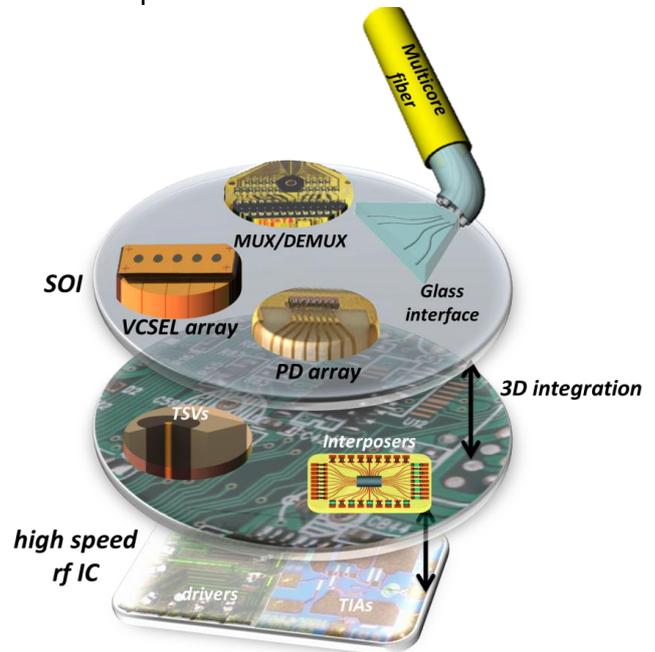
Photonic Integration

MIRAGE reassesses the existing technological baseline to develop a flexible and upgradeable "optical engine" capable of terabit-capacity optical interconnects. To achieve this in a cost-effective and commercially viable way, MIRAGE will blend the most prominent AOC technologies (VCSELs, silicon photonics) with concepts new to the datacom sector (multi-core fiber, wavelength multiplexing) using state-of-the-art 3D integration.

MIRAGE brings the following innovations to photonic integration:

- monolithic WDM VCSEL arrays at 1550 nm compatible for flip-chip assembly
- optical interfaces for easy assembly of multi-core fiber to silicon photonic chips
- high-speed linear electronic components
- a 3D integration platform combining silicon photonics and electronics