

Net-Tech Future Coordination Meeting

Plenary session

CaON

Brussels, 23th October 2014

Sergi Figuerola (sergi.figuerola@i2cat.net)

Dimitra Simeonidou (dimitra.simeonidou@bristol.ac.uk)

Motivation (inputs from 5G Optical Stakeholders group towards 5G PPP Research and innovations priorities)

- Moving to a **Cloud-centric world; Ample, flexible and low latency connectivity** to the user, inside data centers and between distributed sites is becoming the bottleneck which undisputedly **only optical networks** can resolve
- **Availability**, and **performance of network infrastructure** is also crucial
- Evolution of the **cloud infrastructure and services** will have to **rely on optical infrastructures**
- Key figures:
 - 7 of the top 20 network operators main HQ are in Europe
 - 6 of the 20 largest optical equipment manufacturers have their main R&D centers in Europe
 - 3 of the top 5 optical component manufacturers have operations in Europe.

Consolidated targets

- ***A research priority:***
 - *focus on **Petabit/s energy efficient optical core and metro networks** leveraging advances in photonics devices, new fibers and multiplexing schemes, digital signal processing and system design including new **advances in transport SDN and NFV.***
- ***An innovation priority***
 - *focus on delivering **next generation network technologies for optical access and aggregation** targeting **optimized convergence between fixed and mobile** as well as programmable orchestration of network and IT resources*

RTD challenges

- ***Programmable optical backbone networks supporting petabit throughput***
- ***Disruptive approaches for increasing network capacity***
- ***Trans-layer coordination for elastic optical networks***
- ***Optical network virtualisation, transport SDN and network functions virtualisation***
- ***Unified control of optical access, metro and core network segments and wireless technologies***
- ***Data Center networks and architectures and its impact of how cloud services are considered, provided and deployed.***
- ***Inter and intra data centers optical architectures***
- ***Fibre networks for petabytes capacity.***

Innovation challenges

- **New approaches for converged optical access networks**
 - Cover cloud-centric network architectures along with adapted optical access systems capable of consolidating broadband access, business access, backhaul and fronthaul with a single platform.
- **Optical network technologies for ubiquitous 5G access**
 - Leveraging novel integrated photonic devices and subsystems, actions should cover new optical transmission and switching techniques as well as new network concepts and control architectures.

Comments and suggestions

- Optical network technologies need to evolve together with Photonics21 and RAS/FI
- It is important to strength cross-cluster / cross-project collaborations (i.e. What is the status of extension of Openflow to leverage full capabilities of the radio devices? in terms of virtualisation Wireless networks are also analogue networks)
- 5G (needs to strength transport SDN with its capabilities and services)
- ONF has very deep discussions in transport SDN, and how we make our network technologies agnostic.
- We need to deal with converged scenarios (i.e. 4G outside and fibre inside home, we can not decouple it) and its impact on energy efficiency too
- It is need to strength the importance of improving resiliency, performance at the infrastructure level (microwaves are less stable).
- We are evolving to a service society and we will depend on infrastructure reliability and stability (i.e. large roll out of e-health system will require much higher reliability of the infrastructure)
- With regards to the cluster/EC:
 - Does it make sense to have a common repository for open source SW?
 - We need a way to easily populate internal outcomes across the community

New projects

- **ACINO** - Application centric IP/Optical network orchestration
 - Optical networks become more elastic and may allow finer granularity optical service in a cost effective manner (i.e. sliceable transponders). It will deliver an open source IP/optical orchestrate suite
- **SAFARI** (EU-Japan) Reconfigurable infrastructure control
- **Orchestra** - Optical performance monitoring enabling dynamic networks using holistic cross-layer self-configurable truly flexible approach
- **ROAM** - Revolutionising optical fibre transmissions and networking using the orbital angular momentum of light
 - New device to support orbital angular momentum. Increase connectivity in DC more than 100 times
- **Nephele** - E2E scalable and dynamically reconfigurable optical architecture for applications aware SDN cloud
 - Develop a fully functional control plane overly comprising an SDN controller
- **iCrrus** - Intelligent converged network consolidating radio and optical access around user equipment

Current projects

COSIGN

- Implement a flat, scalable DCN architecture empowered by optical technologies and SDN based network
- Goal 1: change the TOR (Top of Rack) switch to support more upload connections, full mesh, enable mixture of technology,..
- Goal 2: optical switching in the DCN to scale above # of uplink connection in ToR switch. Multiple topologies under investigation for handling different type of traffic and services
- Goal 3: integrate the new components and the architecture into a common resource control framework

STRAUSS:

- A general controller dealing with GMPLS and OF. Optical Network Virtualisation (with QoS and SLA specific requirements)
- Multidomain transport networks
- Phase 1: Adaptation (Single SDN controller)
- Phase 2: Peer Coordination (Multiple SDN controllers)
- Phase 3: Hierarchical orchestration (Single SDN controller)

INSPACE:

- Spatial spectral flexible optical networking. Enabling solutions for a simplified and efficient SDM
- Define an additional switching level. Design multi-dimensional resource allocation algorithms and study required control extensions, and study its benefits.
- 3 degrees of flexibility Modes/core, Wavelengths, Data rate.