Acreo and Future Internet Research

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September 15, 2014

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Acreo? What's that?

- ❖ Independent non-profit research institute in the ICT area
- ❖ Roughly 120 employees
- ❖ Part of the Swedish ICT group of research institutes
    - ❖ Together with Interactive Institute ($\approx$50), SICS($\approx$120), Viktoria($\approx$30)
- ❖ Our departments focus on:
    - ❖ **Broadband Technology** - NetLab, this is us!
    - ❖ Fiber Optics
    - ❖ Nanoelectronics
    - ❖ Printed Electronics
    - ❖ Sensor Systems

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Network control

- ❖ Background in Optical networking
- ❖ GMPLS, PCE, for WSON, MPLS, and multi-layer Ethernet
- ❖ Last years more towards SDN and NFV topics
- ❖ Mainly on the lower layers, control- and data-plane
- ❖ Focus on: routing/switching, monitoring, network virtualization, control plane abstractions, ...
- ❖ From architecture and system design, to protocols and prototyping, ending up with testbeds

- ❖ Examples from past and ongoing projects, "test-tube guy"
- ❖ ICT Alpha - (2008 - 2010) - www.ict-alpha.eu
- ❖ FP7 SPARC - (2010 - 2012) - www.fp7-sparc.eu
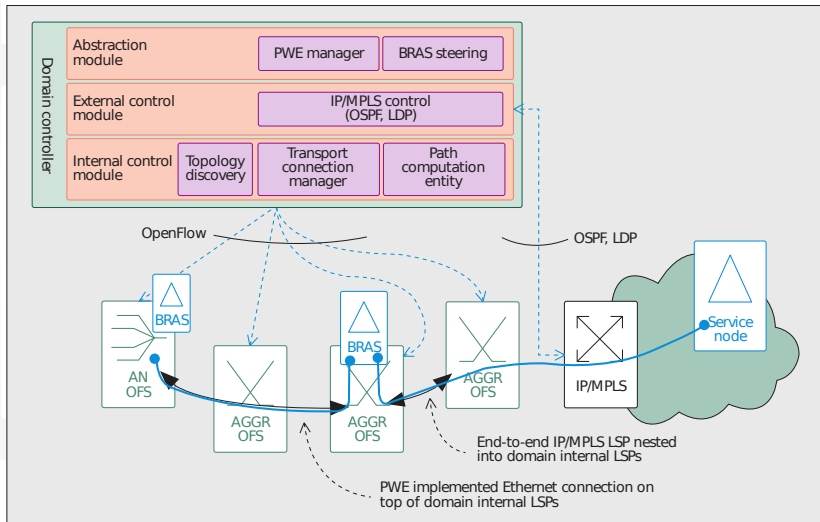- ❖ FP7 UNIFY - (2013 - 2016) - www.fp7-sparc.eu

ALPHA - 2008-2010

❖ Architectures for flexible photonic home and access networks

❖ Research in Access network technologies like PON, Radio-over-Fibre, Fibre-in-the-Home, Transmission technologies, and Control and management of these networks (e.g. GMPLS & UPnP)

❖ Our focus was design and implementation of a GMPLS controlled multi-layer Ethernet network

❖ GMPLS extended to support a heterogenous mix of various Ethernet standards, 802.1Q VLANs, Q-in-Q, PB bridging, PBB bridging

❖ Control and data plane implementations of GMPLS protocol stack, software switches,..

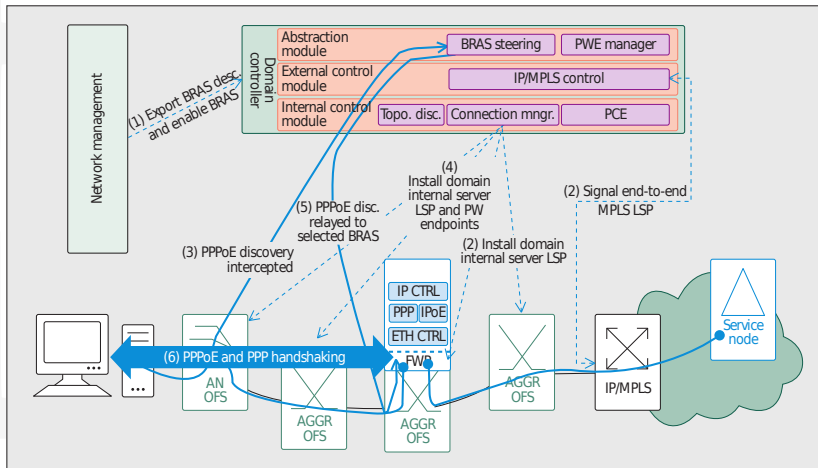❖ Discovered OpenFlow as a neat interface to hardware

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SPARC - 2010-2012

❖ Small focused project on applying OpenFlow/SDN concepts in carrier grade large-scale networks with millions of customers, high automation and high reliability.

❖ Scalable and flexible controller design

❖ Integration with existing networks: Seamless MPLS, OSPF-TE, RSVP-TE, LDP, BGP, etc.

❖ Monitoring and fault detection tools in OpenFlow, sub-50ms failover

❖ "Carrier-grade" network virtualization for multi-tenancy

❖ (first?) NFV - Floating BRAS, with control/dataplane split
  ❖ Article in October IEEE Communications Magazine
  ❖ Seamless MPLS prototype demoed at GEC10, 2011
  ❖ Floating BRAS kicked off a SDN startup, BISDN
  ❖ Working closely with the OFELIA people

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Seamless MPLS demo

End-to-end IP/MPLS LSP nested into domain internal LSPs

PWE implemented Ethernet connection on top of domain internal LSPs

Floating BRAS demo

UNIFY - 2013-2016

- ❖ Combining SDN, NFV, SFC, and Cloud concepts
- ❖ Again large scale carrier-grade networks
- ❖ Scalable orchestration for "Service graphs", similar to SFC
- ❖ "BigNFV" automatic scaling NFVs, with control/data split
- ❖ Monitoring/verification tools to support NFV development, troubleshooting and orchestration
- ❖ DPDK COTS hardware support with software switching and lightweight virtualization for cheap mixed forwarding and processing
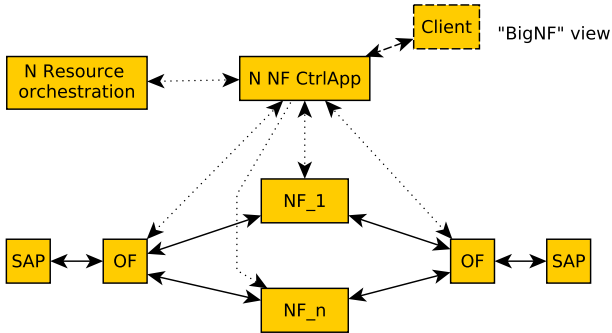
NFV/SFC orchestration
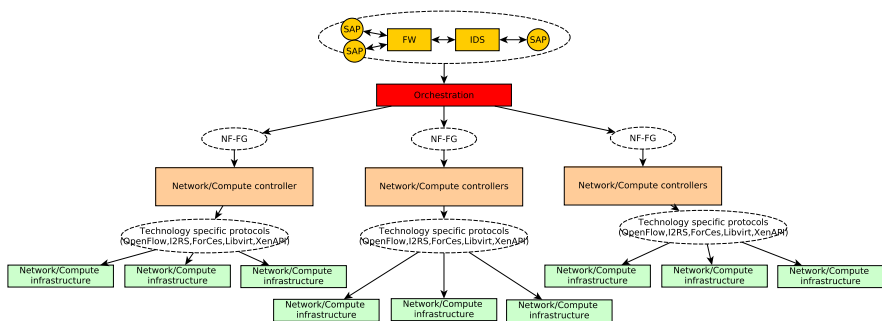
- ❖ From service spec to instantiation in city sized network?
- ❖ Parallelized/distributed and/or hierarchical orchestration?

NF Scaling
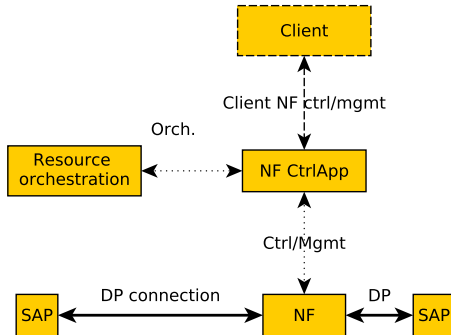
❖ Generic client NF interface to e.g. insert firewall rules, etc.

NF Scaling

❖ How to coordinate scale-out with orchestrator?

❖ How to move/copy state/flow from old instance to new?

Related projects?

- ❖ Acreo National Testbed,
  `www.acreo.se/groups/acreo-national-testbed`
- ❖ XIFI Nordic federated node (XIFI NFN), `www.acreo.se/`
  `projects/xifi-nordic-federated-node-xifi-nfn`
- ❖ FI-Star Expose - Cloud based solution for e-Health,
  `www.acreo.se/projects/`
  `fi-star-expose-cloud-based-solution-for-ehealth`

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