

OBS-over-GMPLS

a Control Plane architecture for Grid services support in wide-area multi-domain optical networks

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Current trends in OBS + GMPLS

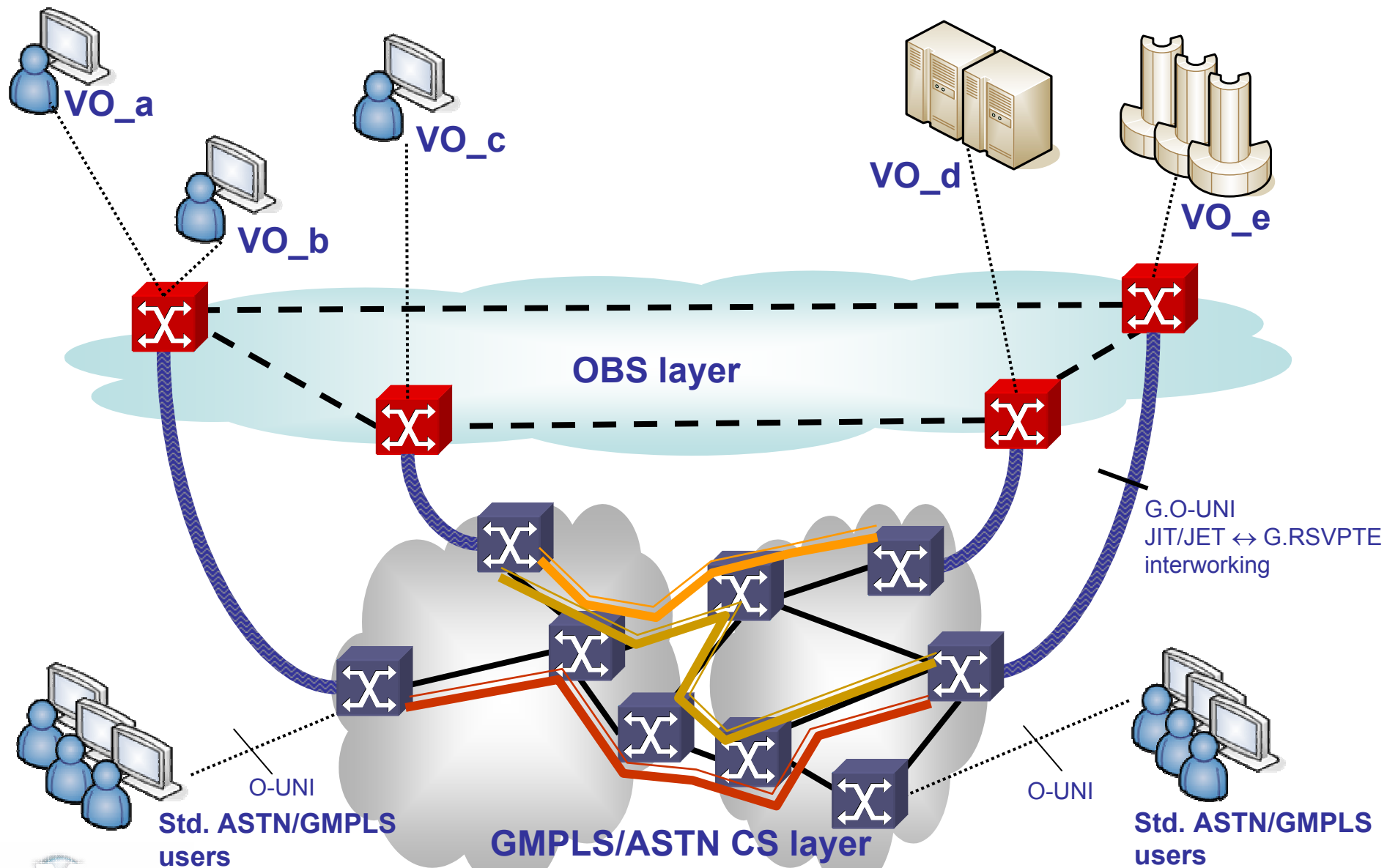
- **“OBS-native” approach**: to improve the OBS through the adoption of centralized routing intelligence and *light protocols* on fast hw
 - improvements to OBS: light protocols add the logic for dynamic management of OBS NE routing tables or to support inter-domain transactions
- **LOBS approach**: to enrich the OBS Control Plane by applying MPLS (+ extensions for all-optical networks) to the OBS SCN
 - improvements to OBS: traffic engineering, QoS (set-up/holding priority), recovery procedures
- ***These approaches are competing if we want a single peer-to-peer network model among the OBS Network Elements***

Introducing OBS-over-GMPLS

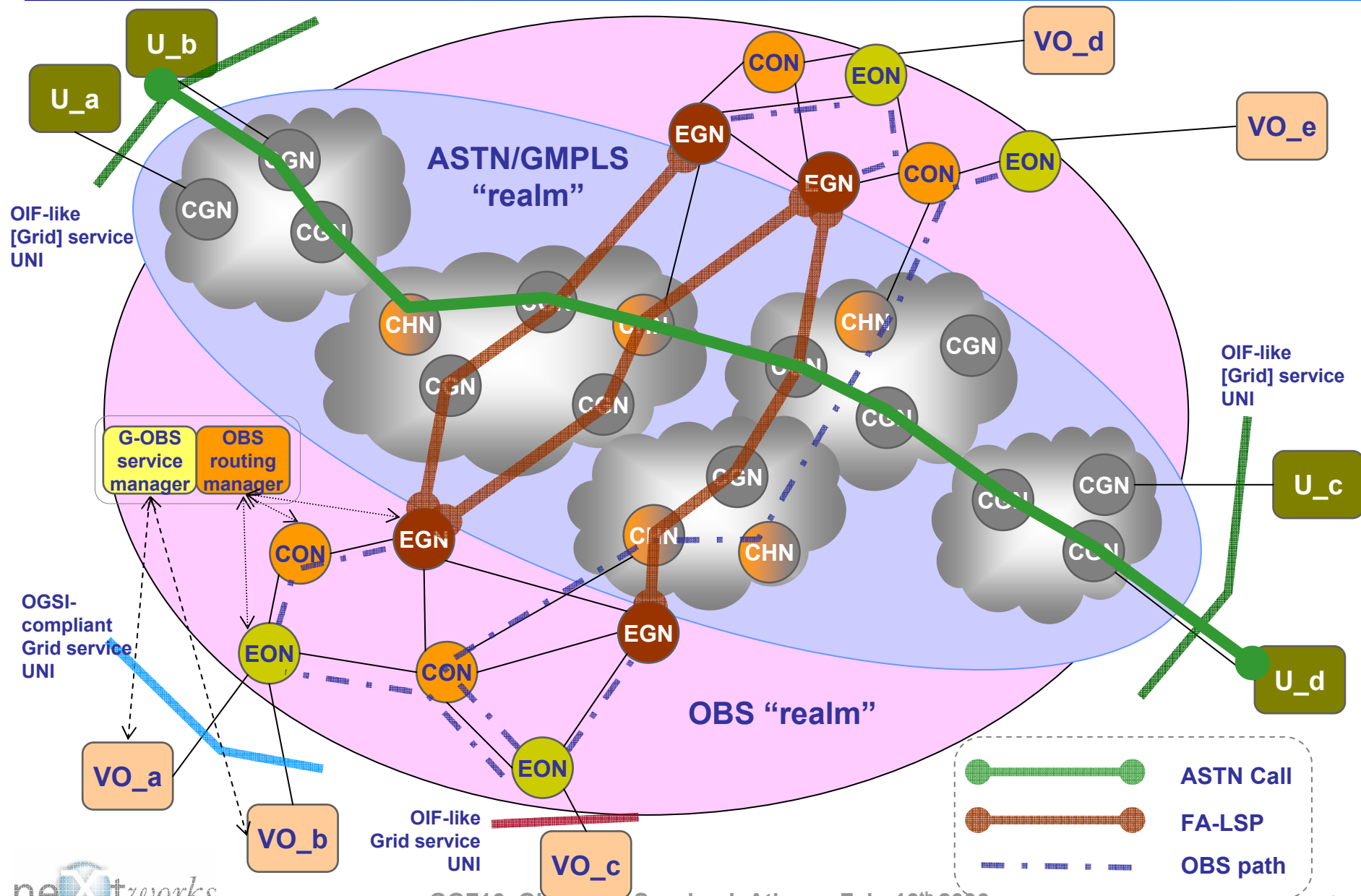
- ASTN/GMPLS and OBS-native Control Planes
 - have different purposes and fulfil different requirements
 - do different jobs
 - in different timescales
 - can help each other...
- The edge network
 - should be free to evolve rapidly
 - need to implement some “statistical multiplexing” into core trunks
 - ⇒ OBS can fulfil the user requirements of efficient bw utilization
- The core network
 - should run more slowly
 - can support only deterministic multiplexing if proper trunking is performed at the edge
 - ! *if efficient muxing is performed by an aggregation network, deterministic muxing (i.e. circuit) is not that bad*
 - ⇒ it can be managed by an “intelligent” ASTN/GMPLS control plane

***proposed solution:
an OBS + ASTN/GMPLS overlay network (O₂G)***

O₂G Control Plane: a framework picture



O₂G overview

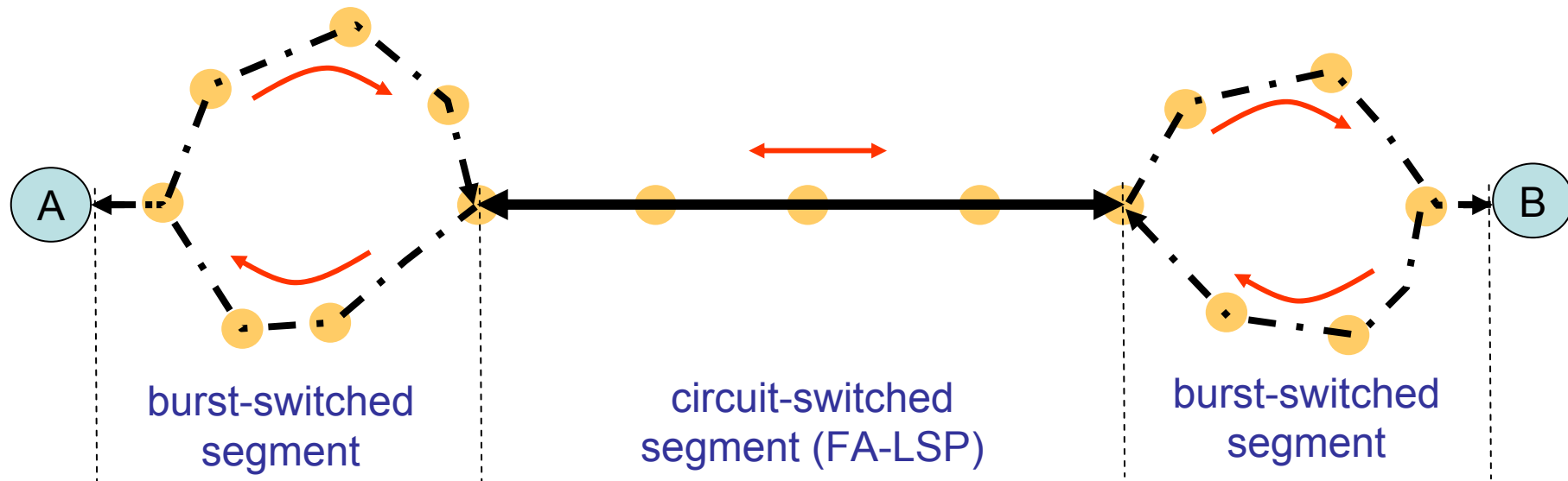


O₂G Control Plane network elements

- Plain OBS nodes:
 - Edge OBS Node (EON)
 - Core OBS Node (CON)
- Plain GMPLS nodes:
 - Core GMPLS Node (CGN)
- Hybrid O₂G nodes:
 - Edge GMPLS Node (EGN)
 - Core Hybrid OBS/GMPLS Node (CHN)

The end-to-end “session”

- “Session” = end-to-end transport connection between the end-users
 - long-lived data transfer relationship (*long* w.r.t. the bursts timescale)
 - Implemented by stitched segments, applying different switching paradigms
 - It is bidirectional...
 - ...but the component segments might be either unidirectional (OBS) or bidirectional (ASTN/GMPLS)



GMPLS extensions for O₂G

- Purposes:

- ⇒ Improve LSP routing with additional information
- ⇒ Export to OBS a detailed “description” of FA-LSP virtual-links

- Possible extensions:

- free/allocated λ on a fiber
- λ converters location, optical transmission impairments (e.g. PMD) and OSNR
- LMP optical link monitoring and bundling [RFC 4209] + runtime estimates for BER, LOS, optical impairments, jitter
- Signalling extensions to control EGNs behaviour
- Signalling extensions for speedy FA-LSP set-up
- QoS extensions for the GridDiffServ model
- ...

Pros & Cons

■ Pros:

- Efficient usage of core circuit resources thanks to the edge OBS multiplexing
- Manageable core thanks to ASTN/GMPLS (+ slower core dynamics)
- Core with ASTN/GMPLS resiliency
- Capability to create trunks through administrative boundaries (applicability of SLA procedures)
- Smaller number of burst multiplexing points ⇒
 - practical applicability of JET
 - similar blocking probability performance of different OBS signalling paradigms (w/wo DR and void filling)?

■ Cons:

- loss of lambda switching flexibility (meshing degree) in the core
 - ...but still available for recovery procedures in ASTN/GMPLS!
- It's an overlay architecture: duplication of Control Plane functions (e.g. signalling)

■ Challenges:

- Need to define a unified Network Management System when edge + core under a single operator

Further issues about O₂G

- FA-LSPs lifecycle management
- SCN continuity between OBS edges through the ASTN/GMPLS core
- Addressing
- Administrative ownership
- Inter-domain procedures
- Applicability of LOBS or Active OBS for intelligent aggregation control
- Support for P2MP trees in the GMPLS core
- Support for anycast posting of jobs

Questions ?

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