Consortium GARR | THE ITALIAN EDUCATION & RESEARCH NETWORK

Evoluzione rete ottica: Open Optical Networking in GARR

PAOLO BOLLETTA

Roma, 30/05/2018

Workshop GARR 2018

Net Makers

Outline

- GARR optical network and ELISA project
- Open Optical & Disaggregation
- Use Case
- GARR optical automation laboratory
- Next steps & Roadmap

GARR: fibre footprint & optical Network

IRU fiber footprint **15000 km**

- **~9.000 Km** of backbone
- **~6.000 Km** of access links

About 1000 user sites interconnected

- **> 1 Tbps** aggregated access capacity
- **> 2 Tbps** Backbone Capacity

DWDM/OTN/ROADM Network

- (2011) Huawei 1/10 G
- (2015) Infinera 10/40/100 G
- (2017) Alien Waves 100G between Core PoPs

Core IP/MPLS network

- Juniper MX960/480/80

Metro/Aggregation

- Cisco ME3600/3400
- CPE Cisco 2900 series

Elisa – Optical Networks and Technologies

- Scouting Tecnologico
- Casi d'uso
- Lab e Prototipi
- Definizione Requisiti

Disaggregazione - Programmabilità - Automazione

Piano Fotonico	Piano Elettrico (datagramma)	Scalabilità Architettura

• Flessibilita’
• Gestione Granulare
• Open:
  • Gestione AW
  • Interoperabilita’
• Monitoraggio
	• Integrazione PKT
	• Funzionalità Forwarding Layer2
	• Integrazione con Control Plane upper layer
	• Possibile disaccoppiamento da piano Fotonico
		• Capacità oltre 1Tbps
		• Semplificazione nodi:
		  • A/D più capillare su footprint FO
		• Raccolta/Aggregazione:
		  • Integrazione con LongHaul
		  • Integrazione con CPE

Opportunità nuovi paradigmi

- Flessibilità & Programmabilità
- Maggiore efficienza

- User self-provisioniong and monitoring
- Interazione tra control plane rete geografica di trasporto e quelli DC e Applicazioni
- Integrazione Metro+Long Haul

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Open Optical & Disaggregation

Scouting Tecnologico

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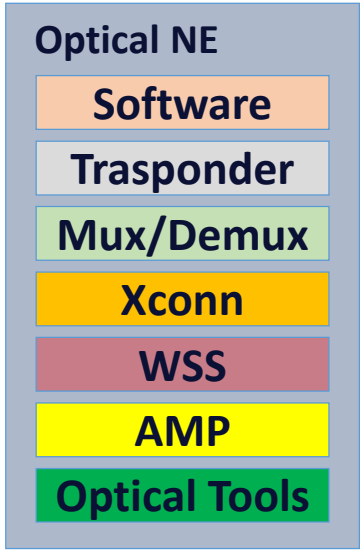
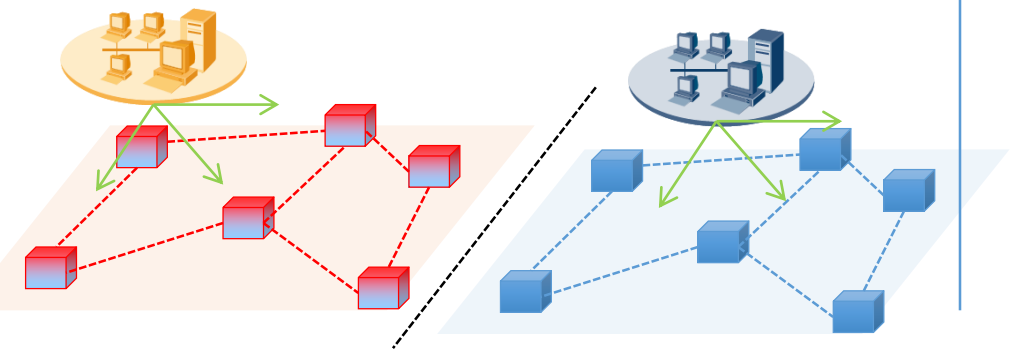
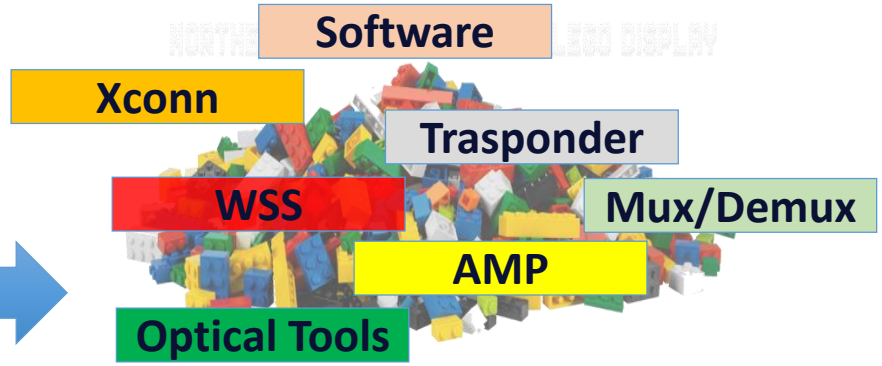
Innovation in Optical Network architecture

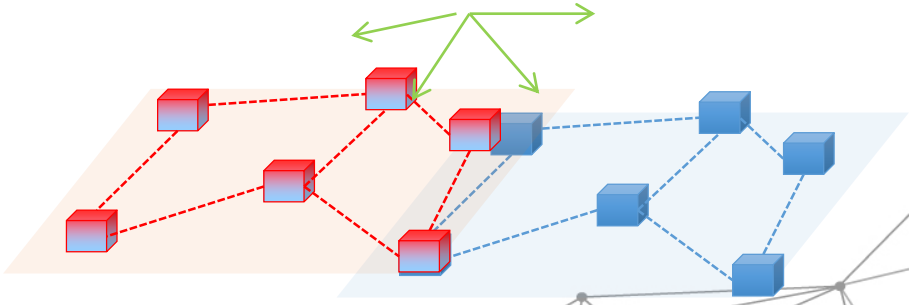
Integrated – closed





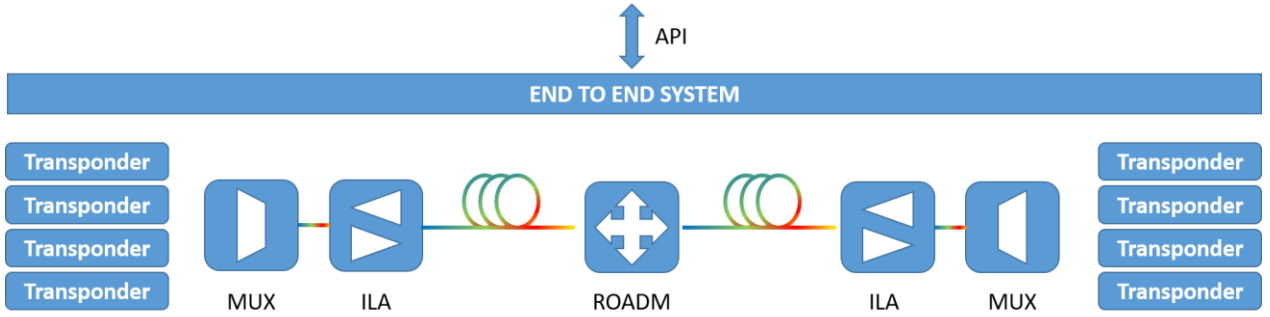
Disaggregated – open



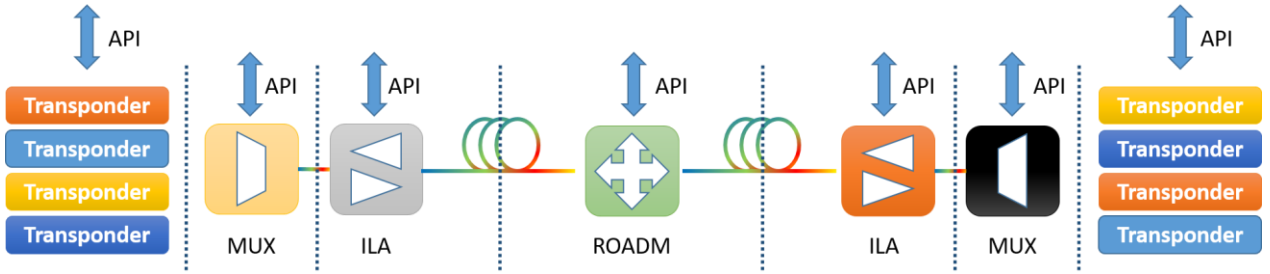


Aggregated and disaggregated networks

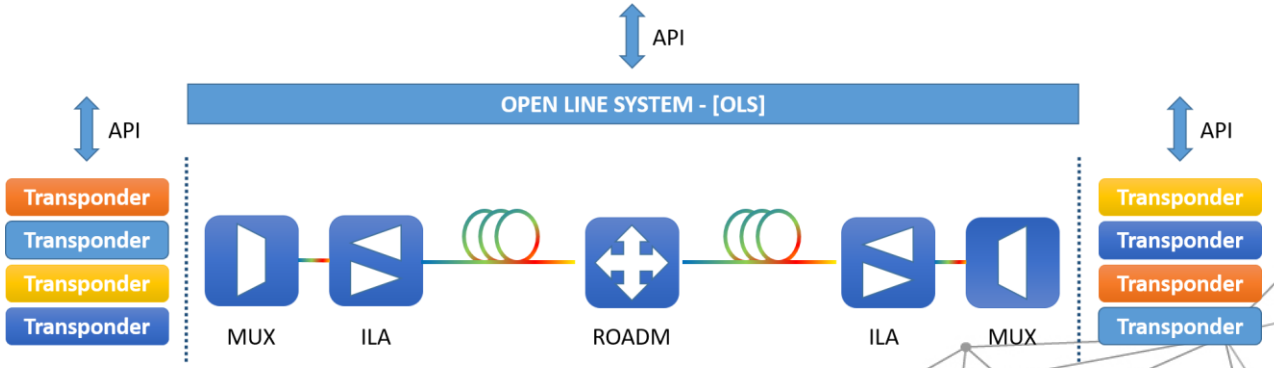
Integrated:
Intera piattaforma agiste come un unico sistema end-to-end



Fully disaggregated:
Ogni componente è un elemento di rete separato

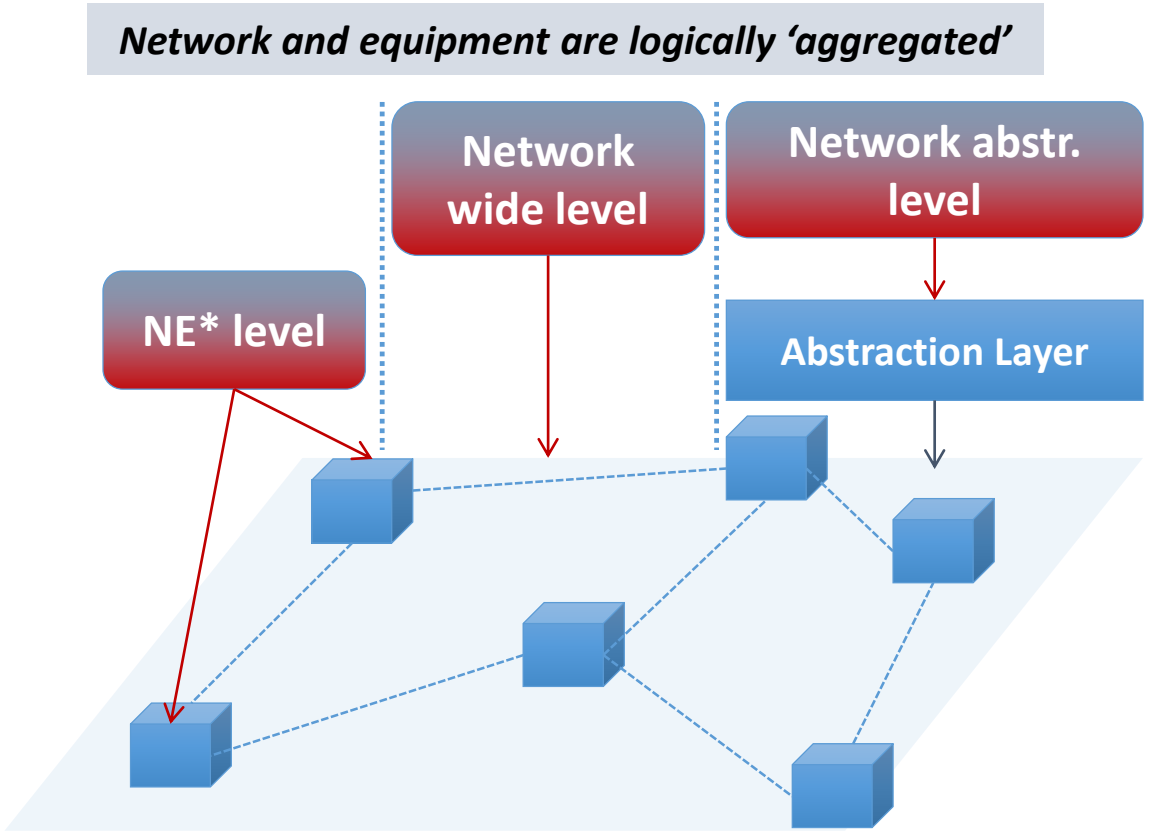


Partially disaggregated Open Line System:
disaccoppiamento elementi fotonici e transponder



Open approach to API/NBI

APIs and NBIs are mandatory for integration and net operations in a multivendor environment



APIs:

- REST
- NETCONF
- RESTCONF

Data Model (YANG) equipment:

- ONF Core model
- OPEN ROADM
- OpenConfig

Data Model (YANG) network :

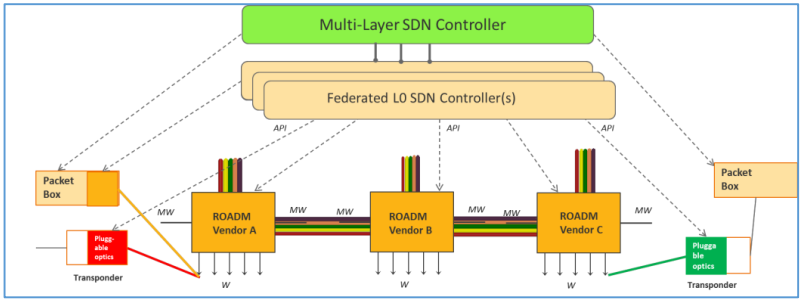
- ONF Transport API
- IETF TEAS TE Topology

Scope and target of these data models are not overlapped and span between different applications

Ongoing working freameworks

HW

Open ROADM



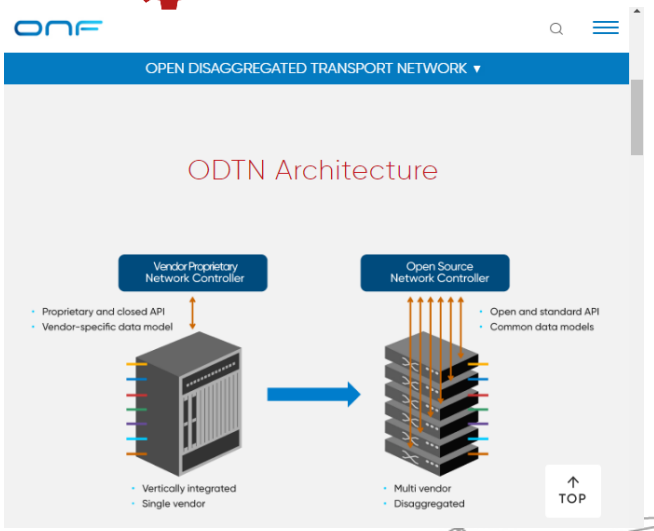
TELECOM INFRA PROJECT

SW

NETCONF/YANG

OPEN NETWORKING FOUNDATION

OPENCONFIG



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Use Cases

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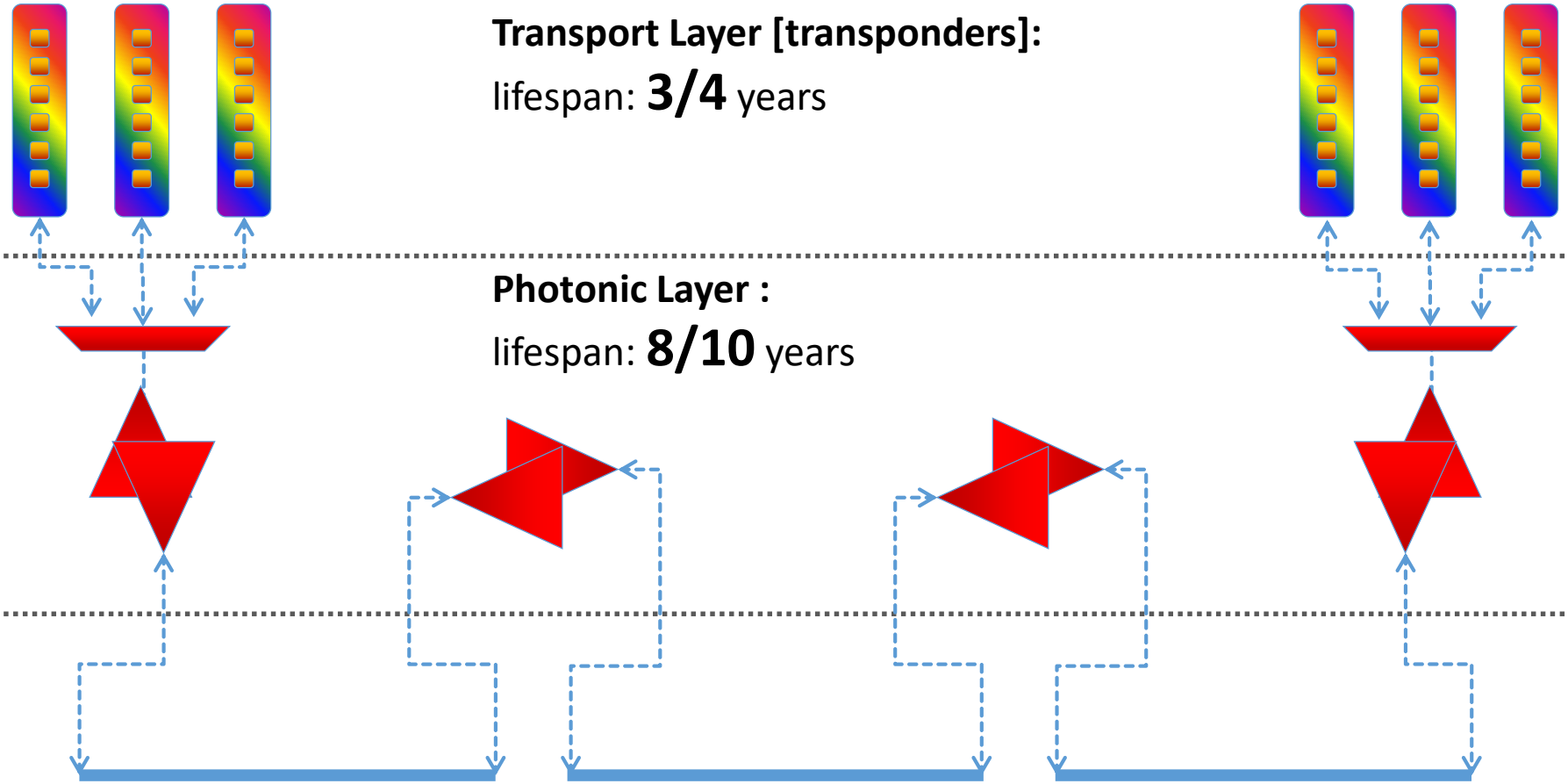
[USE CASE] Decoupling transport service from optical infrastructure



Transport Layer [transponders]:

lifespan: **3/4** years

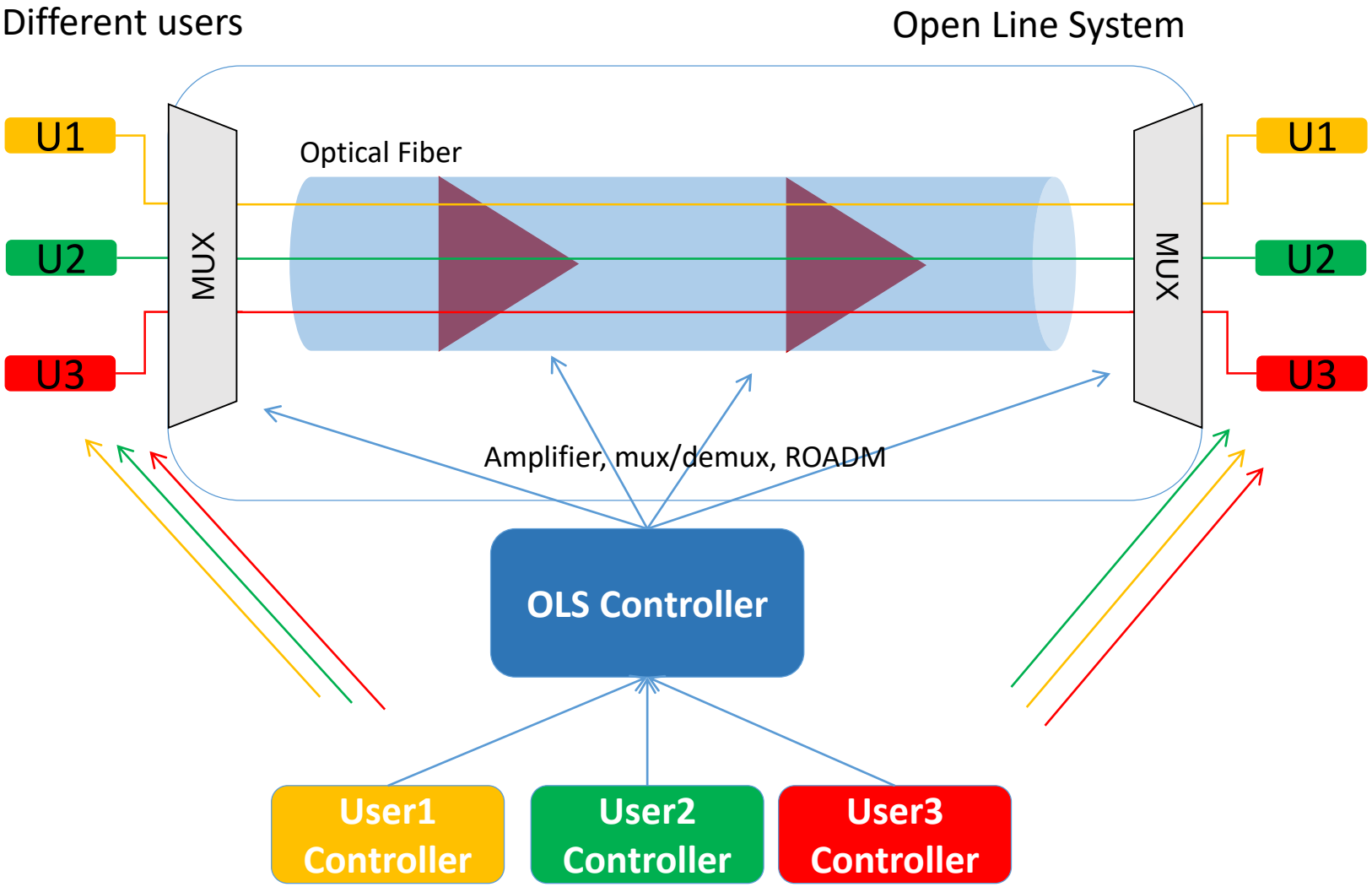
Photonic Layer :

lifespan: **8/10** years

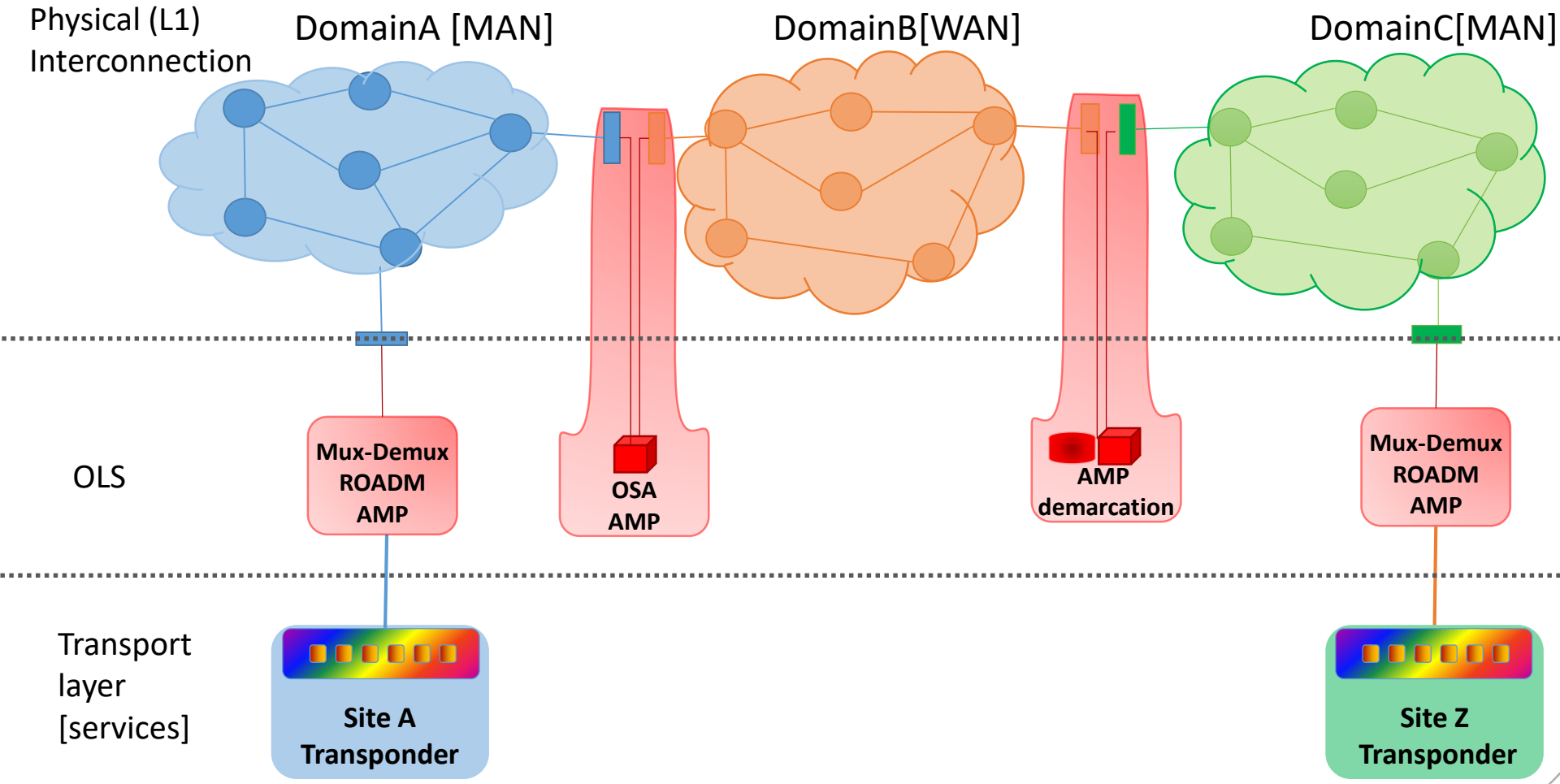
Fiber Layer:

lifespan: **15/20** years

[USE CASE] Sharing spectrum and infrastructure



[USECASE] InterDomain Optical Neworking



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LAB e Sperimentazioni

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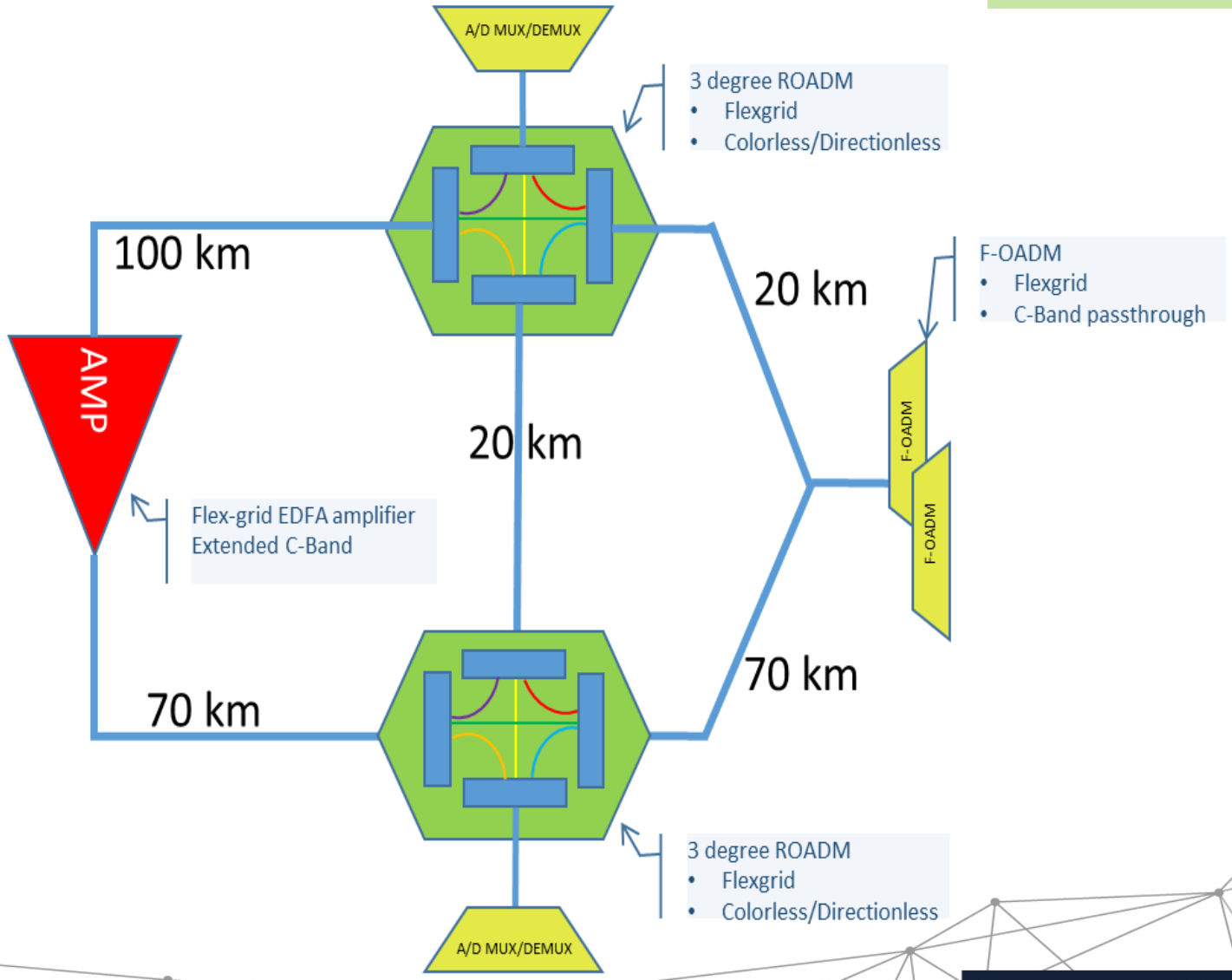
GOAL - Photonic Layer

Piano Fotonico

- Flessibile
- Gestione Granulare
- Open:
  - Gestione AW
  - Interoperabile
- Monitoraggio

Committed

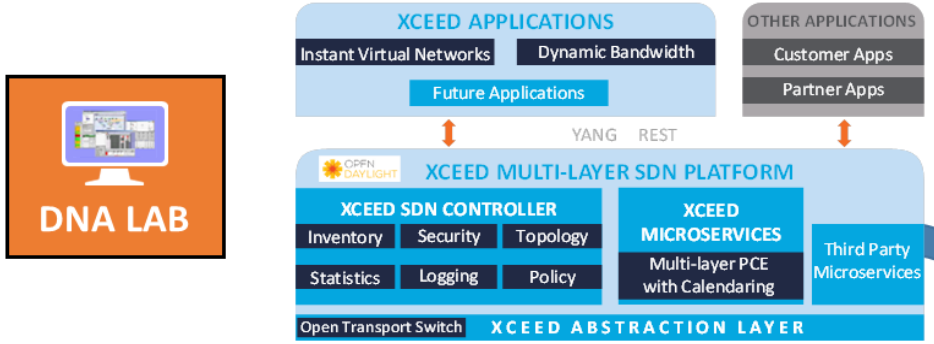


GOAL – Transport + Pkt Layer / crtl + mgmt

Piano Elettrico
(datagramma)

- Integrazione PKT
- Funzionalità Forwarding Layer2
- Integrazione con Control Plane upper layer
- Possibile disaccoppiamento da piano Fotonico

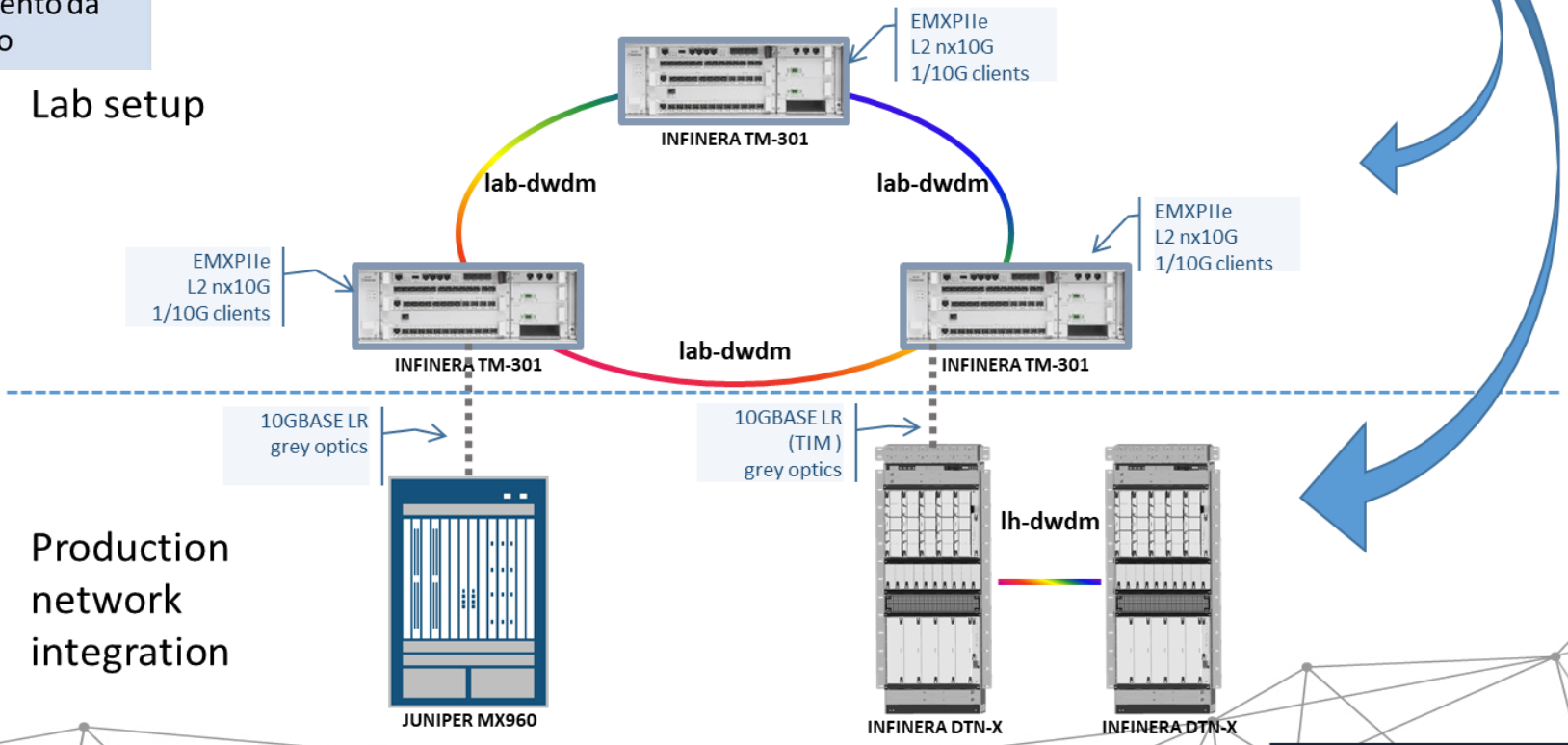
Committed



DNA LAB

Xceed 2.0

Lab setup



Production network integration

Juniper Packet-Optical Integration Beta

Ongoing

TCX1000 - ROADM

PRONX - NMS

Beta version

p2p

Open-API

TCX1200 – DCI + Transport

MultiDegree ROADM node (TCX stable ver.)

FlexGrid

TCX1200 Beta

Service Prototype

Network Pilot

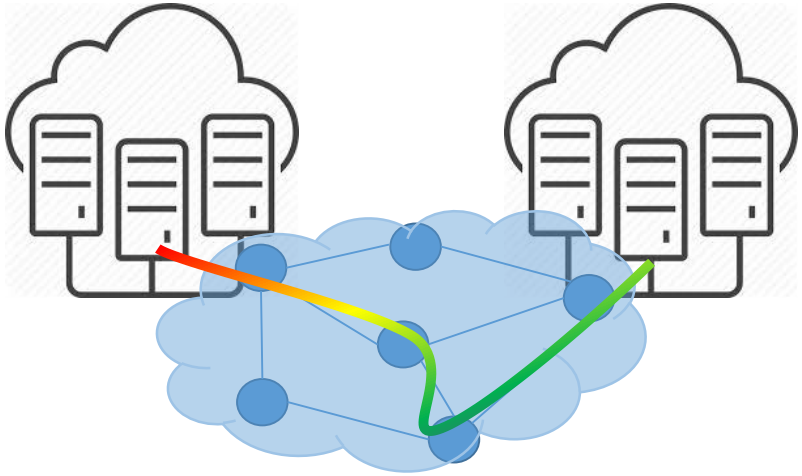
Production Environment

Integration with GARR DWDM network

GARR Service Beta

Pilot Servizi innovativi: DCI e Segnale Metrologico over WAN

planning

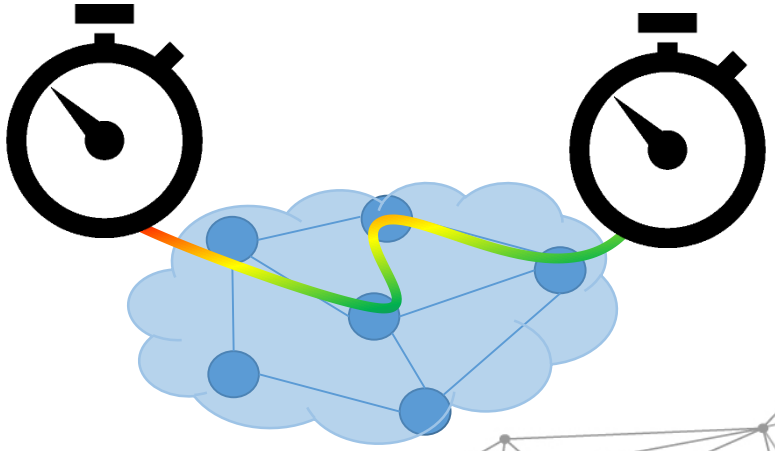


Data Center Interconnection over WAN

- Definizione dinamica e su richiesta di topologie
- Alta capacita' on demand
- Integrazione con elementi a pacchetto

Time distribution over WAN

- Condivisione infrastruttura distribuzione segnale di riferimento tempo e frequenza
- Distribuzione segnale accurato di riferimento di tempo



Next steps

Lab

- Beta
- Integration

Prototype

- Programmable DCI
- Bandwidth on Demand
- Metro Regional Integration
- Open Control Plane

RFI/RFP

- **Data Center Interconnect**
- **Photonic Layer**

What	How	Who
Photonic layer	• RFI/RFP • Field Trial	GARR MAN/RAN
DCI	• RFI/RFP • Field Trial	GARR DC + USERS
SD-WAN Control Plane	• Lab prototype • Field/User Beta	GARR DC + USERS
Packet Integration	• Lab prototype • Field Pilot	GARR USERS

Conclusioni

Open Line System elemento tecnologico abilitante

- Introduzione progressiva servizi evoluti
- Accesso diretto a infrastruttura ottica
- Integrazione a livello ottico
- Condivisione risorse

Dal Laboratorio a Pilot con la comunità

Definizione condivisa delle specifiche

Q&A