

## GÉANT network service evolutions R

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### **GÉANT Network Traffic**

#### Network Traffic (Q4 2017)

Average volumes 2017: 3.13PB per day for the IP/MPLS network, average daily rate of 289Gbps

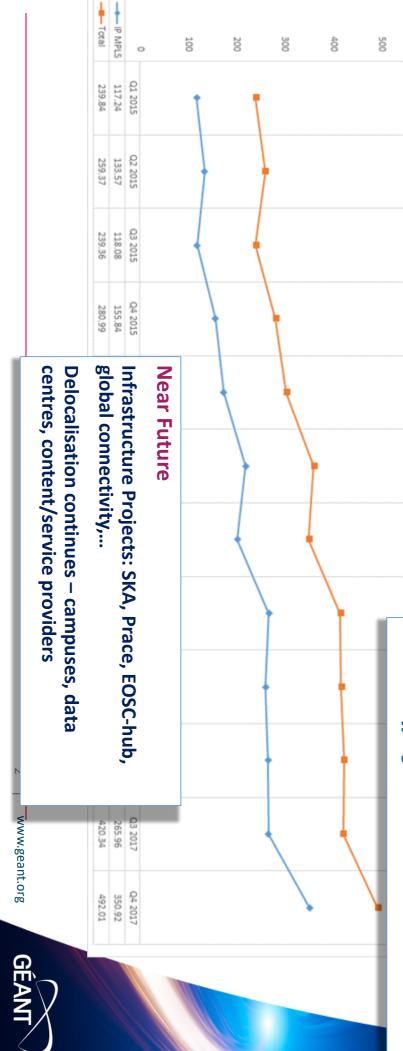
Average volumes including Lambdas 4.79PB day or average data rate of 444Gbps

Science traffic growth: 43%

**GÉANT TRAFFIC** 

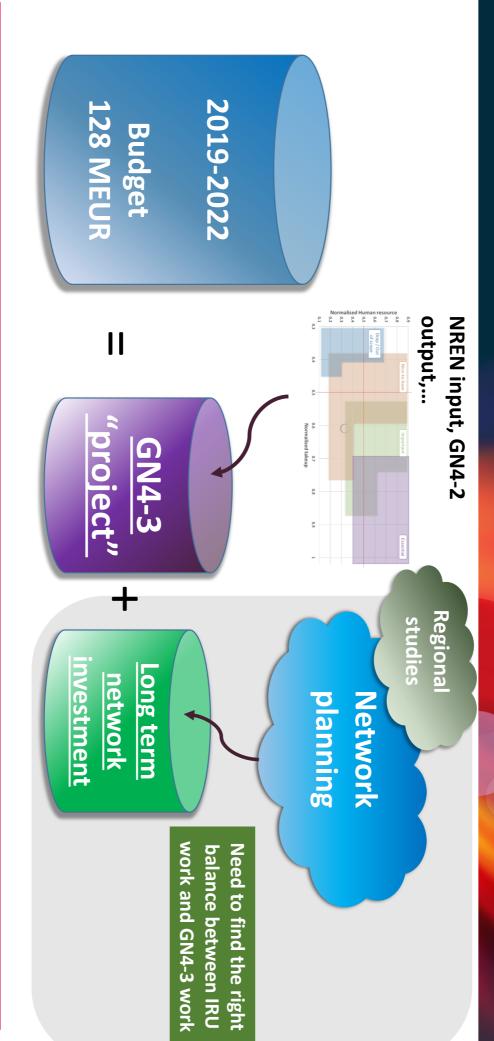
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Internet traffic growth: 26%



# GN4-3 project – Project and Network Investment





### GN4-3 Work Package Structure (2019-2022)



#### Supporting work packages

WP1: Project Management (PMO, Finance, IT, PLM, training, procurement)

WP2: Marketing, communications, events

WP3: User/stakeholder engagement, GÉANT community programme, exploitation

WP4: Online application and catalogue services development

WP5: Trust & Identity services development

WP6: Network technology & services development

WP7: Network core infrastructure and core service evolution and operations

WP8: Security evolution and development

Services/products devops cycle work packages

WP9:
Operations
support: OC,
Software,
Federated
service
operation,
Security
operation

Operations

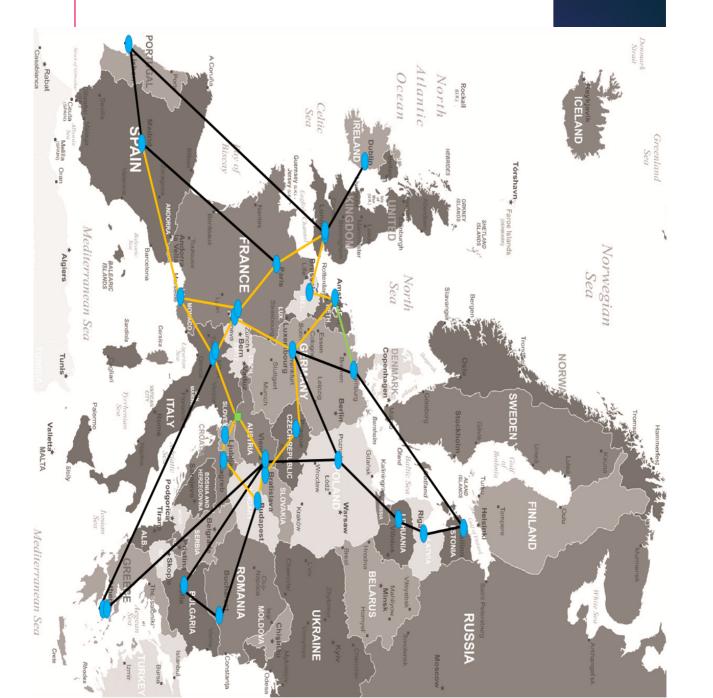
### Fibre IRU – the Project

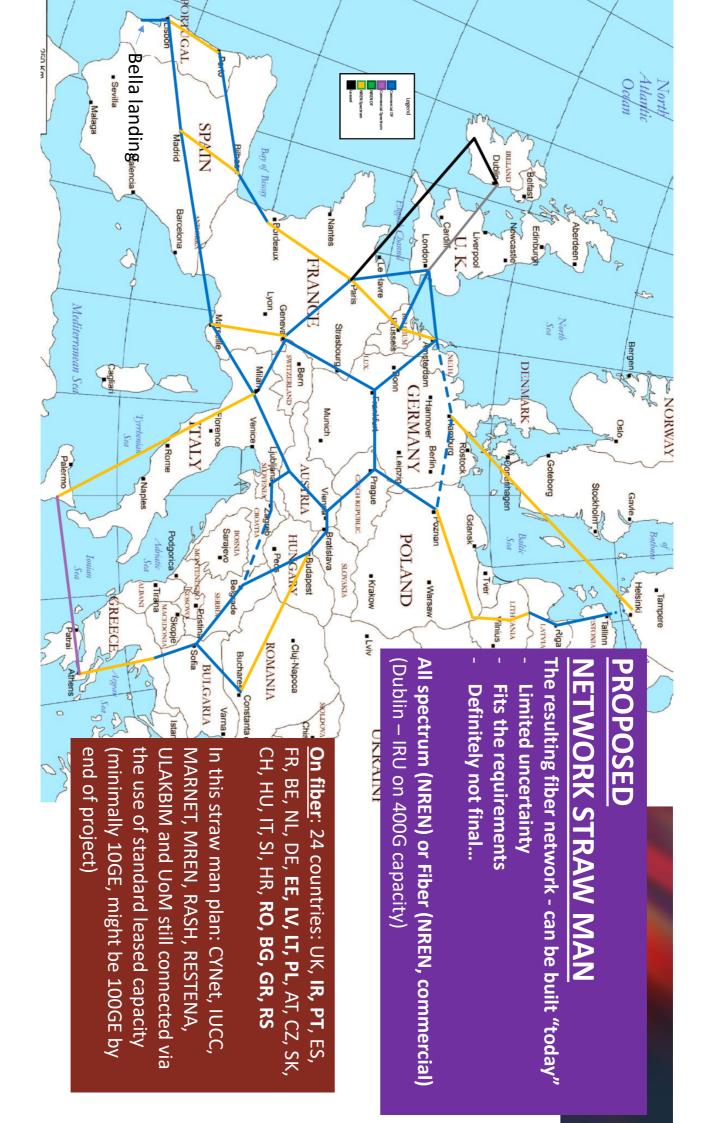
- Horizon 2020 SGA(a/b)
- Go beyond the state-of-the-art by restructuring the backbone network decreasing the digital divide and reducing costs associated equipment to increase the footprint, stimulating the through exploration and procurement of long-term IRUs and market in cross-border communications infrastructure **whilst**
- Improve the minimum service level of the smaller European Gbps (where technically and economically feasible) NRENs and their users by ensuring connectivity speeds of 100
- Minimally 16M€ spent on network investments



### **Current GÉANT topology**

- 2018 design has been in place since 2012.... With very little change
- Fibre 'core' in yellow
- Leased capacity in **black**
- Spectrum in green
- PoPs blue circle





## Capabilities: Data Centre Interconnects



- Next gen of commodity pluggable optics has excellent performance
- Data centre style 1 RU stackable form factor.
- Up to 6 times reduction in cost over traditional telecoms equipment

architectures

- Significant increase in density and reduction in power consumption
- Modular easy to scale up
- Easy **upgrade path** to new technology



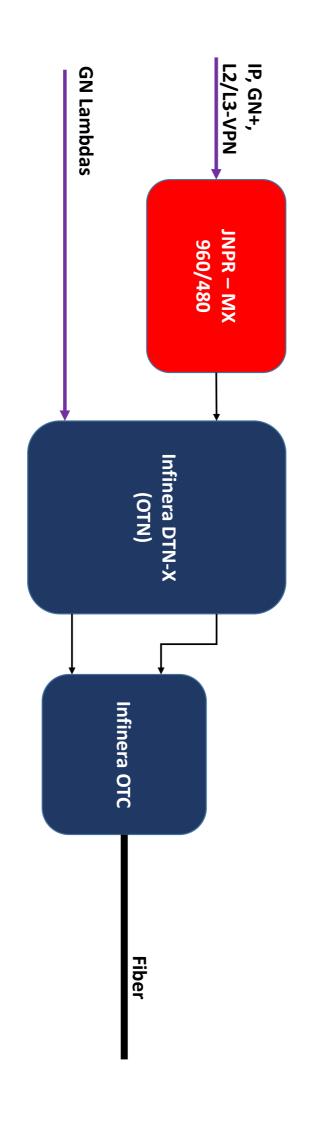
Loss of equipment integrity – not designed to be highly available as per ETSI etc.

- No internal hardware redundancy
- No in-service upgrades
- Restricted temperature operation



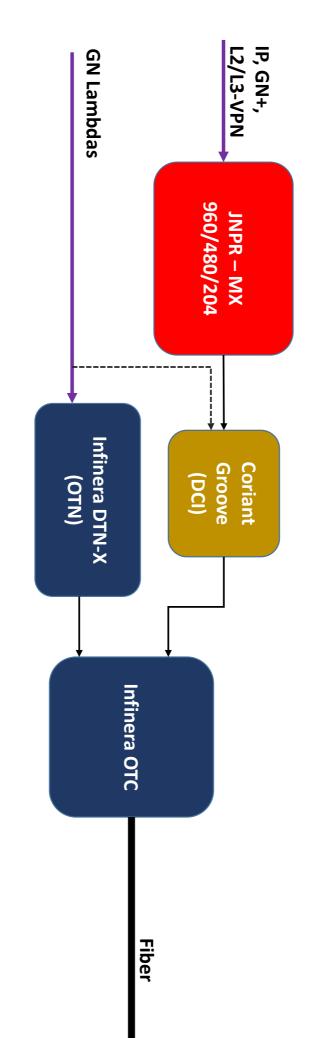
# Current Network and Services Setup (very much simplified)





## Adding the DCI capability now – Low Cost Transmission





- DCI provides a low cost transmission alternative to OTN boxes
- Adding MX204 fits well in small PoPs (100G line side)

# Building for the Long Term: Open Line System

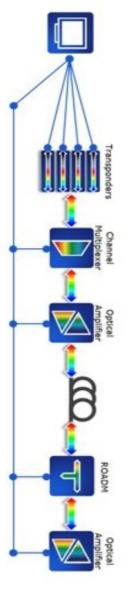
No Disaggregation: Entire transport network acts as one element





Current closed interop model

Fully Disaggregated: Everything is a separate network element



Partially: Transponding is one element, OOLS is second.





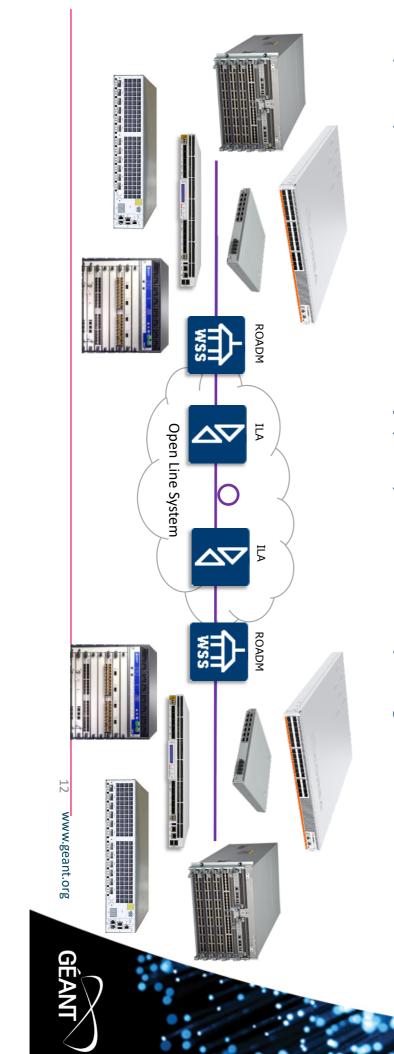
Long-term vision. But open standards and management under development

Medium term solution. Open access, single management plane for OLS



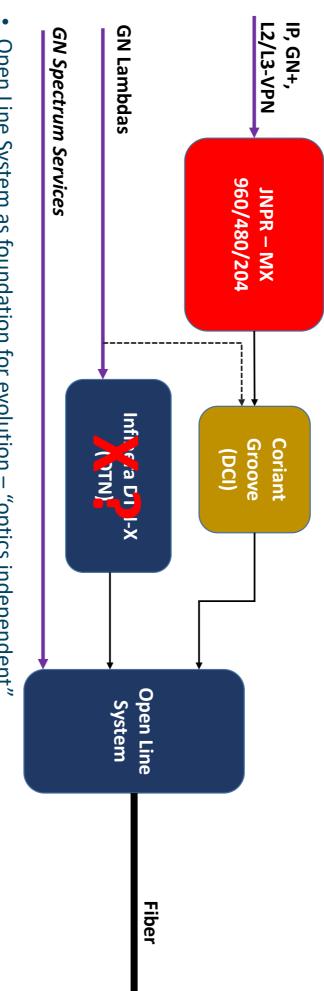
#### **OLS** gives flexibility

- Allows for fast technology cycles in layers above the amplifiers and WSS.
- Alien waves allow transponders from multiple vendors to operate on a single line system.
- Still benefit from a single vendor providing end-to-end optical management: Channel & span equalization, DCN connectivity (OSC), ALS, Alarm reporting ect.



### Implementing the Open Line System





- Open Line System as foundation for evolution "optics independent"
- Infinera DTN-X not easily compatible
- Spectrum services!
- Reciprocal: we will also use spectrum/alien waves on others' systems

### **GÉANT Packet Layer Evolution**

- Three tracks for investigation:
- Deploy high-density line cards in existing platform to support the traffic growth
- from same vendor. existing platform with another vendor equipment or platform Find an alternative and cost-effective solution to replace
- <u>ယ</u> Disaggregated solution - White box and third party NOS

#### Why Disaggregate?

Do we really need 12 million lines of codes to move packets between NRENs/Campuses?

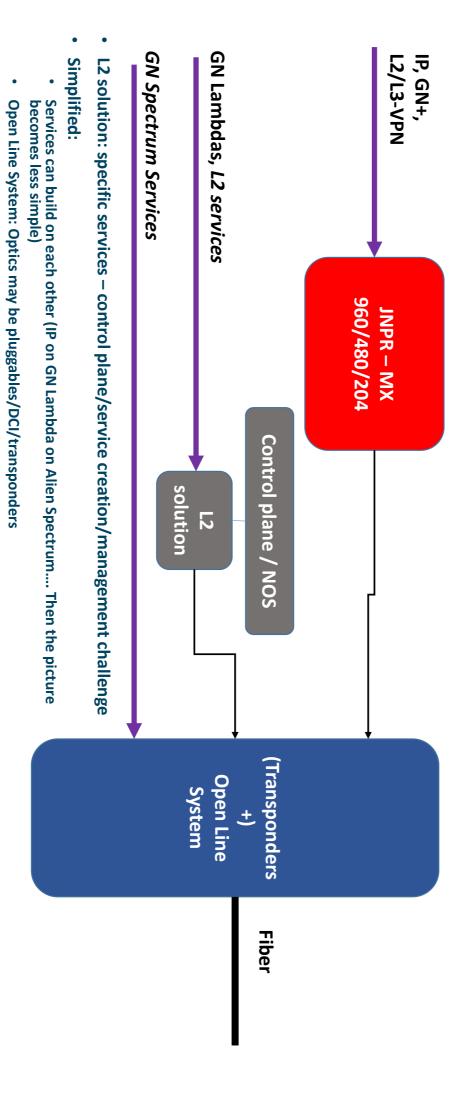
- Disaggregation of software means the control plane can be split, simplified, made modular
- We can choose to only develop / deploy what is necessary for the required function
- Simplify core and have feature rich edge
- Focus on most minimalistic, simple and modular approach
- Apply RFC1925 Truth 12 to the network and protocols

nothing left to add, but when there is nothing left Perfection has been reached not when there is to take away

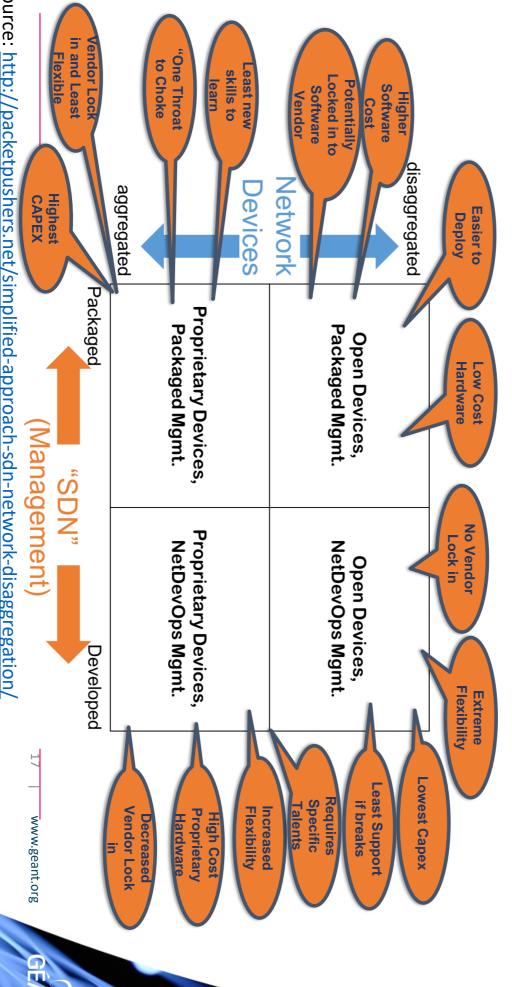


## Implementing the Open Line System – simplified picture



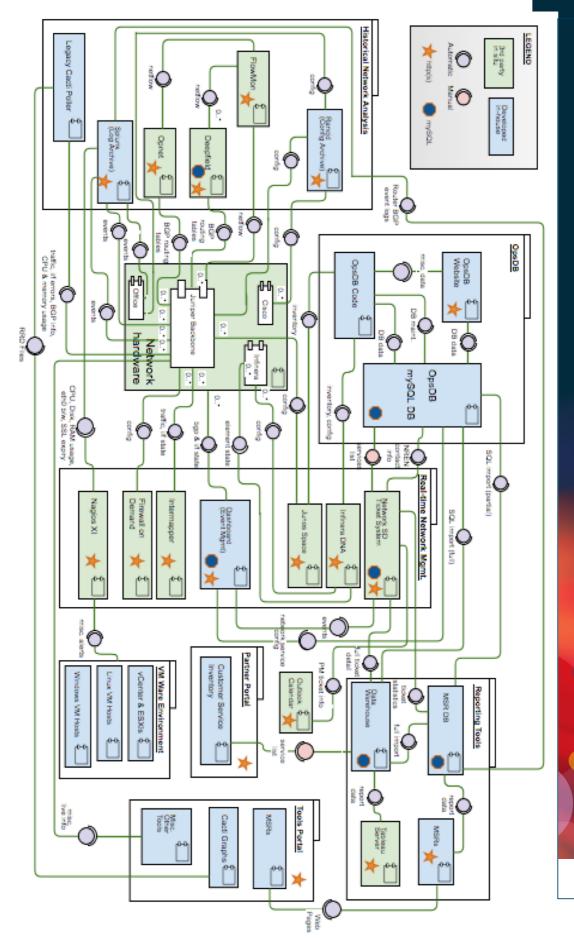


## Network Disaggregation and Software



Source: <a href="http://packetpushers.net/simplified-approach-sdn-network-disaggregation/">http://packetpushers.net/simplified-approach-sdn-network-disaggregation/</a>

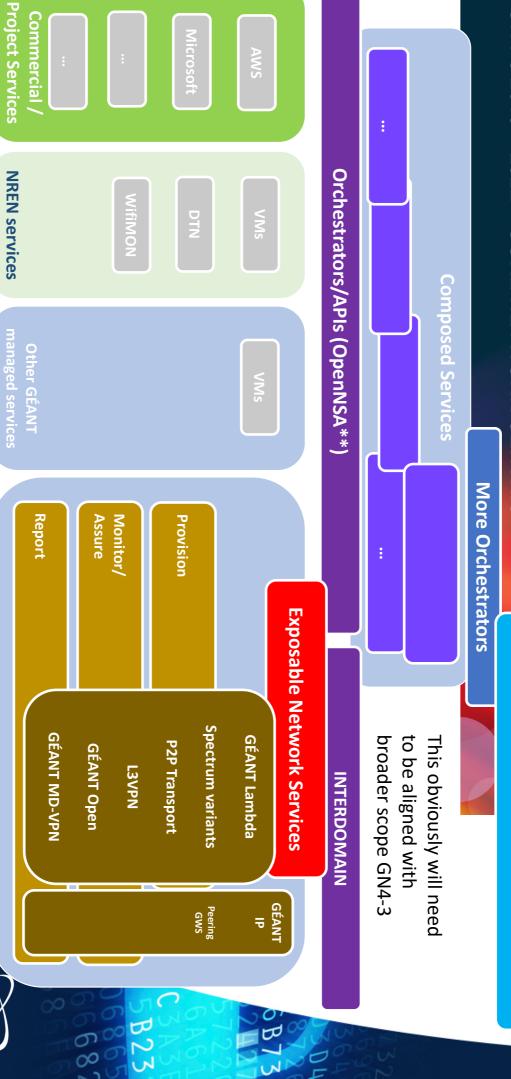
## Future Proofing the Network Software Setup - OSS?





### Network Services Helicopter View GN4-3 2019 – 2022 – CORE NETWORK CENTRIC

**SERVICE USERS: NRENS, Projects, Peers** 



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### RF 1925 – Networking Truths

- (5) It is always possible to agglutenate multiple interdependent solution. In most cases this is a bad separate problems into a single complex
- (6) It is easier to move a problem around (for the overall network architecture) than it is to solve example, by moving the problem to a different part of
- (6a) (corollary). It is always possible to add another level of indirection.





#### Summary



- Fiber investment will change reach and capabilities
- Network overhaul required
- Complexity increases, much more reliance on software capabilities
- Services will need to be developed with interdomain/customer in mind



#### Thank you Any Questions?

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