



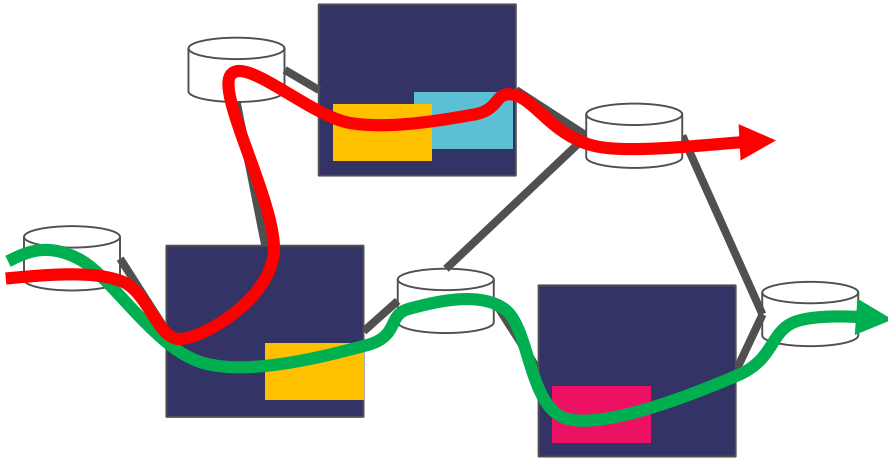
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TELECOM
ParisTech

Using Service Function Chaining for In-Network Computation

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Service Function Chaining for In-Network Computation



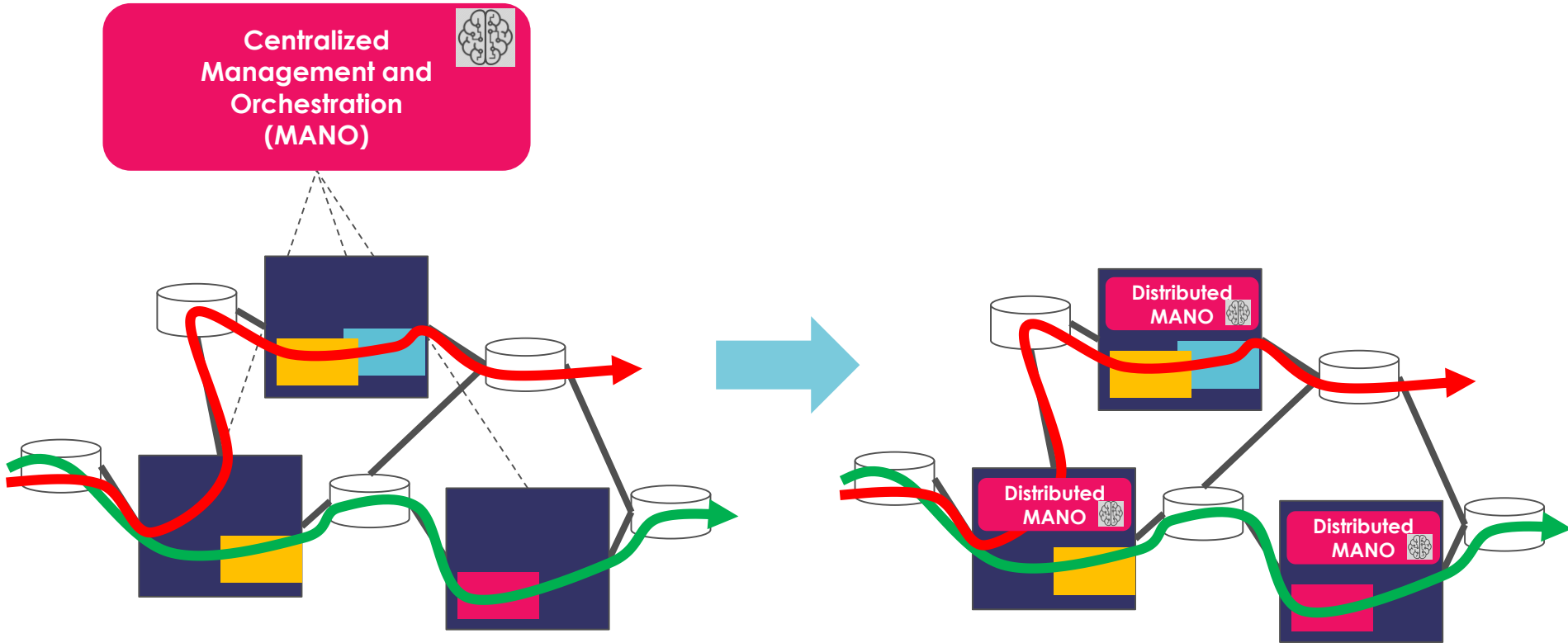
Current practices: Centralized control infrastructure

Problems:

- Single Point of Failure
- Scalability
- Legacy Interoperability
- No Incremental Deployment
- Under exploitation of in-network resources

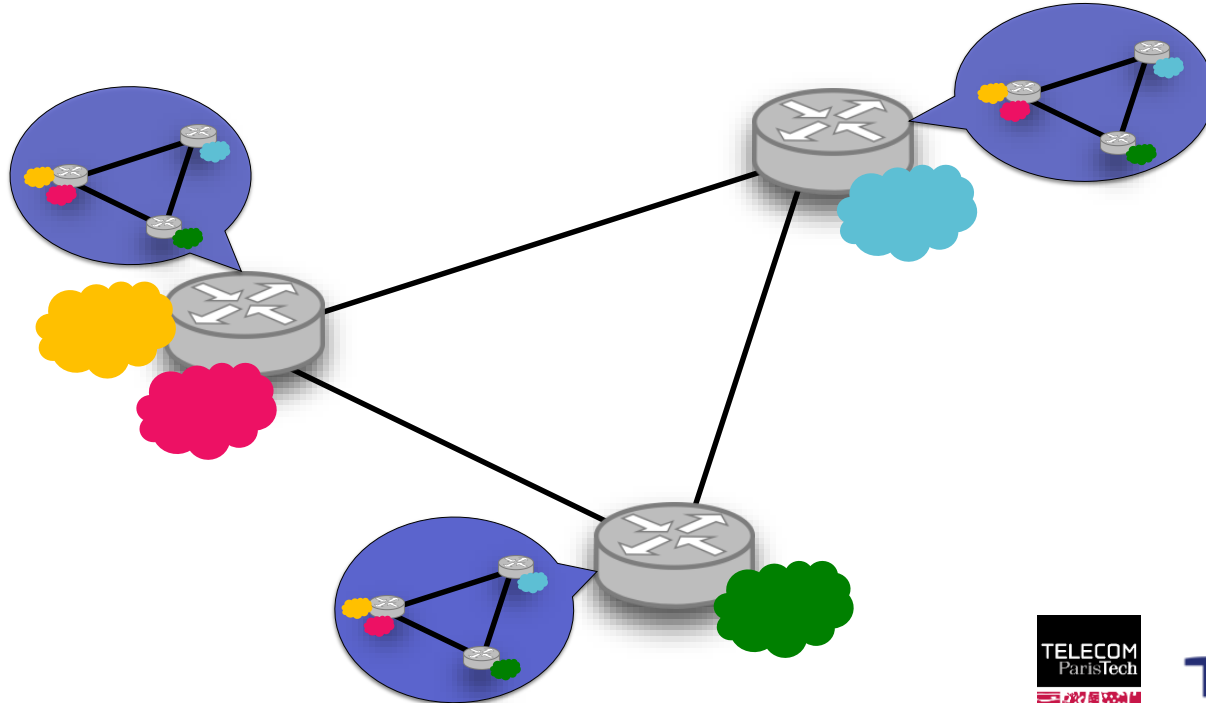
Proposal: Augment the IGP and make it function aware

Proposed approach: Divide & Conquer



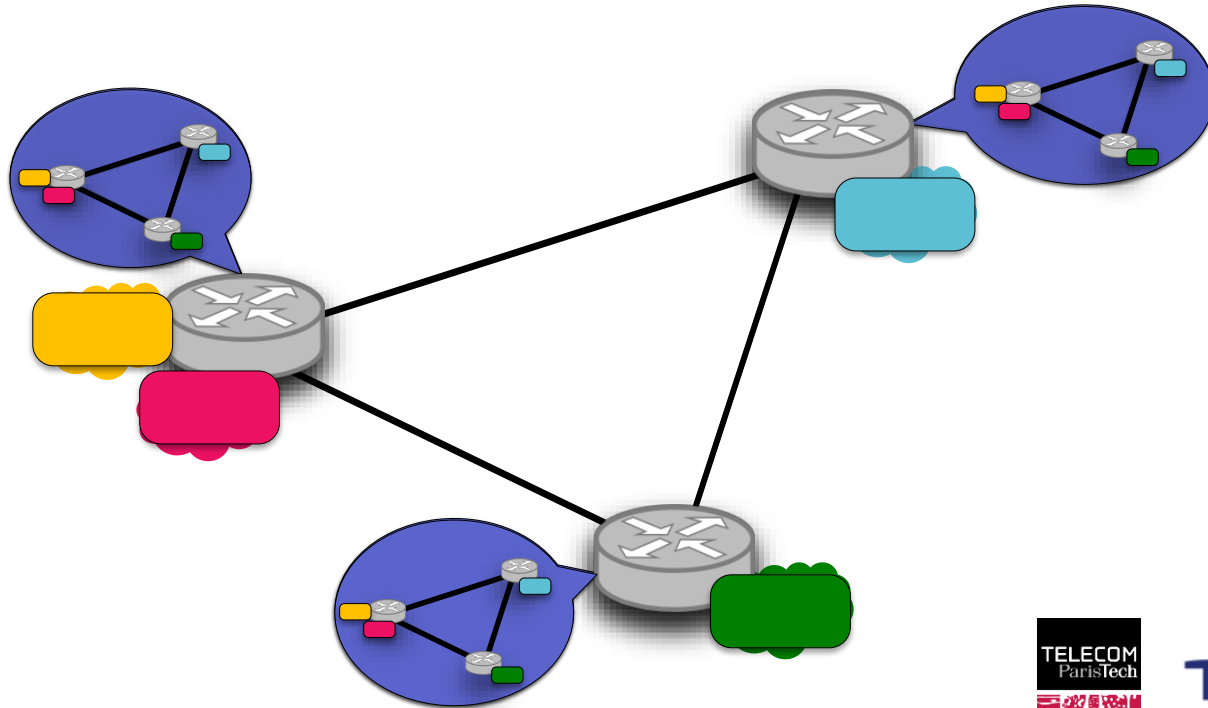
Exploiting the existing in-network resources

If you have a large network you have an IGP (Interior Gateway Protocol)



Announced address are actually VNF

Idea(s): Binding a prefix to a specific function

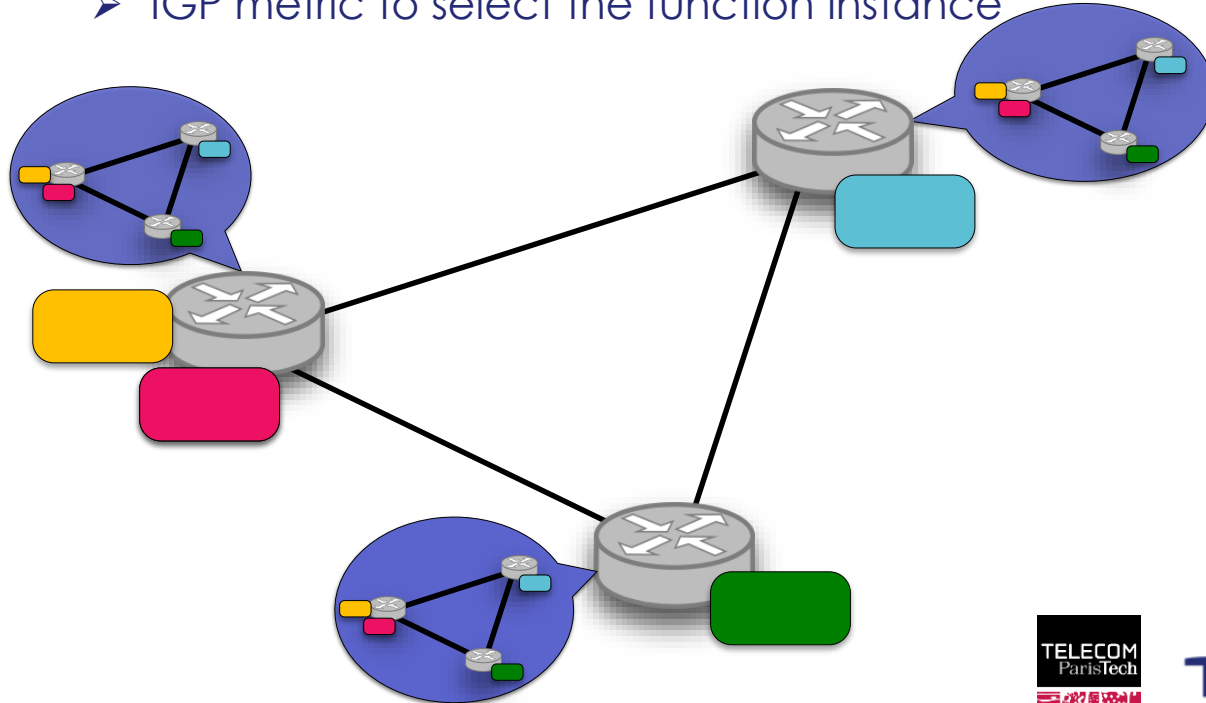


Leveraging on anycast addressing

Idea(s): Binding a prefix to a specific function + Anycast Addressing

Advantages

- Prefix to select the function
- IGP metric to select the function instance

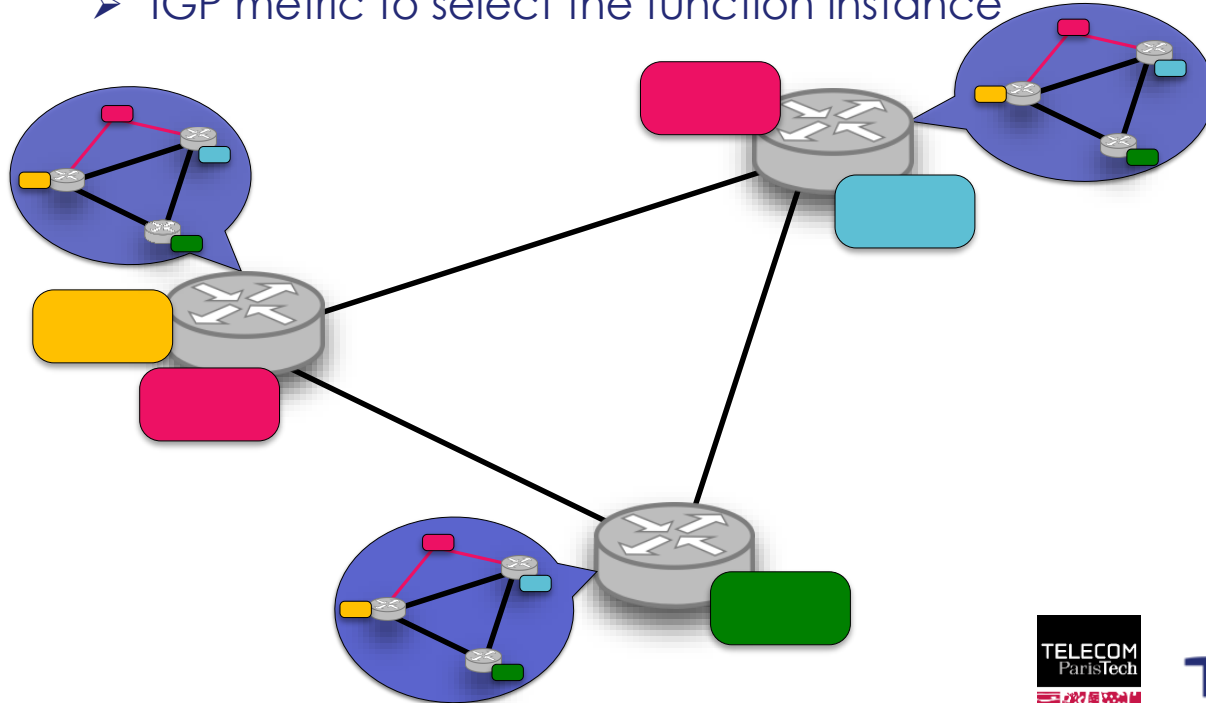


Leveraging on anycast addressing

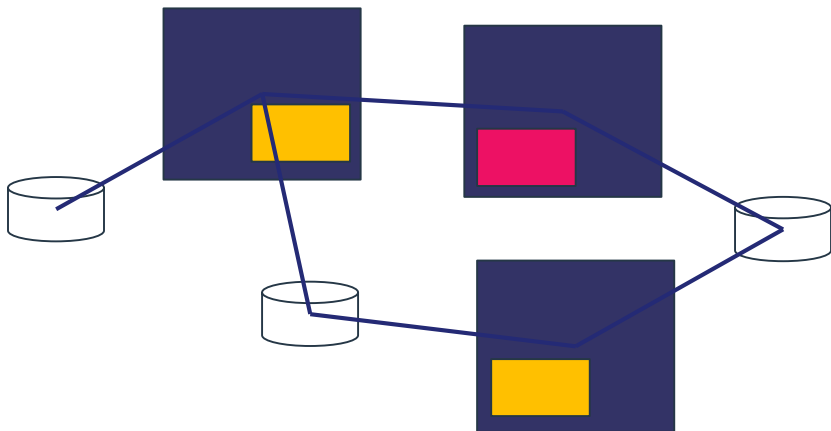
Idea(s): Binding a prefix to a specific function + Anycast Addressing

Advantages

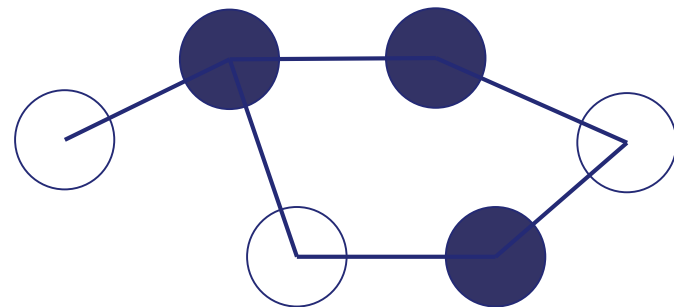
- Prefix to select the function
- IGP metric to select the function instance



Augmenting network layer routing



Network view

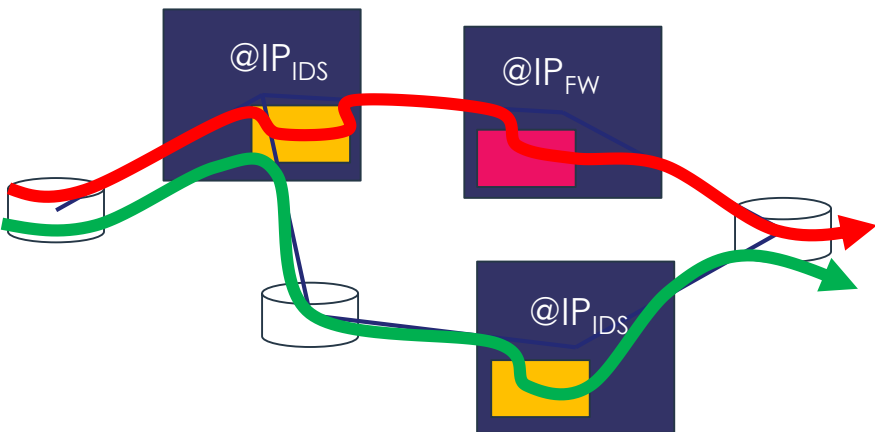


IGP View

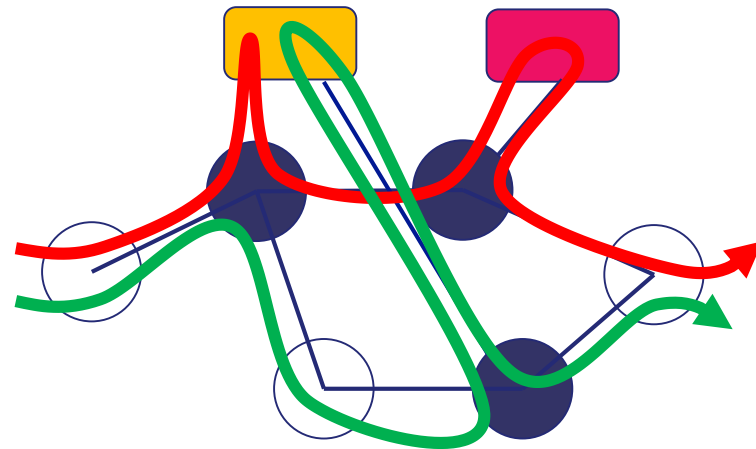
Augmented IGP topology:

- Service mapped to an anycast prefix
- Node advertise available service
- Routing decision taken with shared topology
- Routing decision is applied per flow

Augmenting network layer routing



Network view



IGP Augmented View

Augmented IGP topology:

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NFV Router Architecture & Implementation

High Level Policies

Virtualization

Namespaces

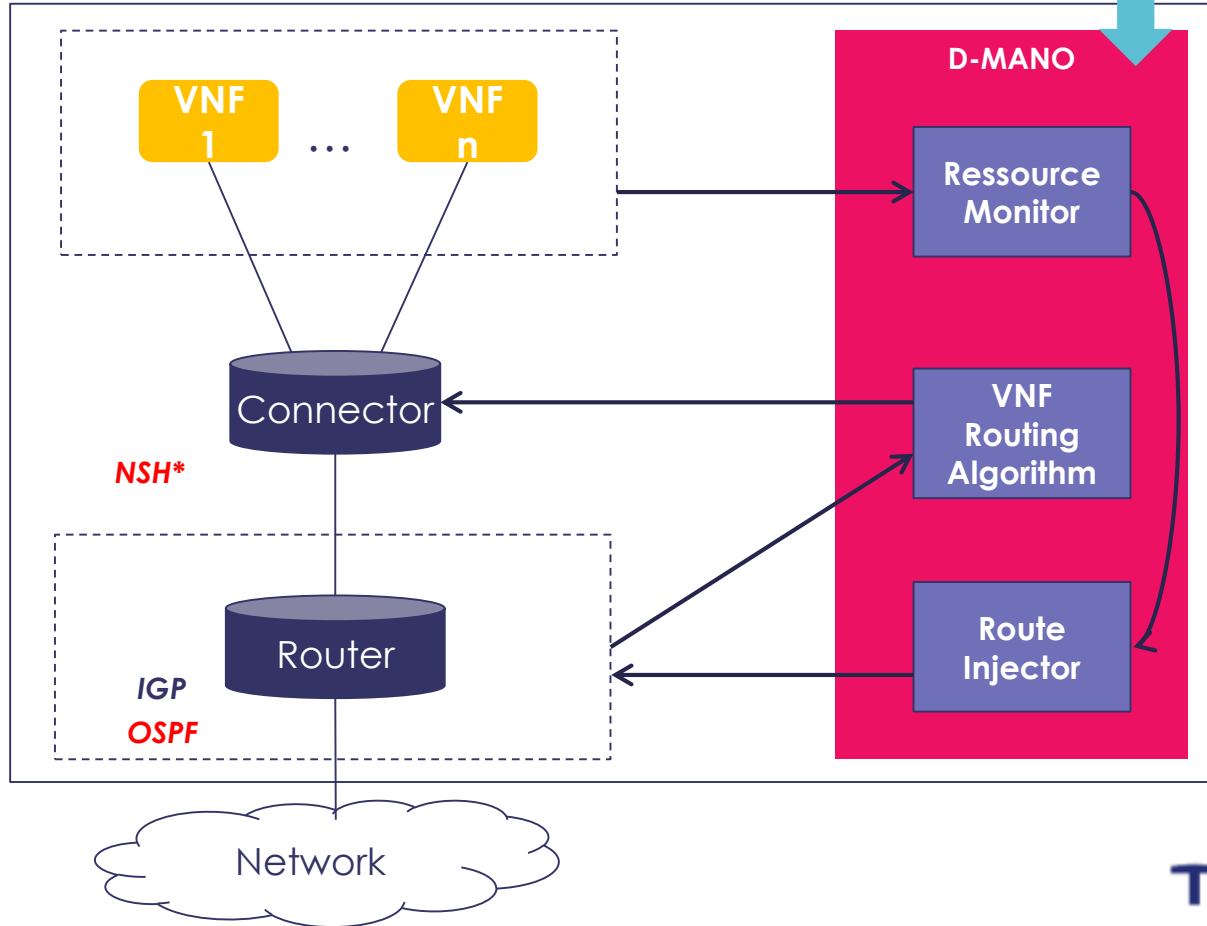
Encapsulation



Routing



FRROUTING



*Network Service Header (RFC 8300)

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Highlights on evaluation results

Source: <https://sites.uclouvain.be/defo/>

Topology	Nodes	Edges	Demands	Type
rf1755	87	372	7527	Rocketfuel
rf3967	79	294	6160	Rocketfuel
synth50	50	276	2449	Synthetic

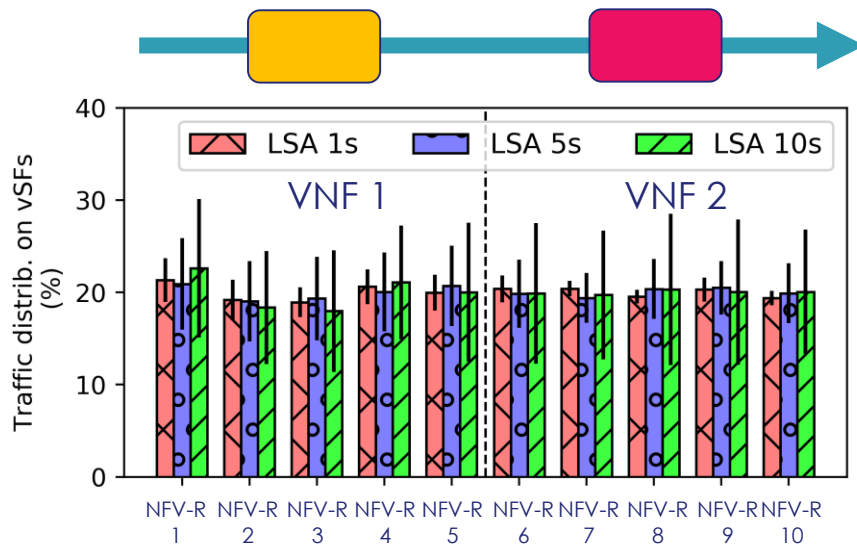
Network emulation:

- NFV Routers ⇒ LXC container
- Deployed on 48 nodes cluster
- 10 VNF (nodes with max betweenness centrality)

Routing policy:

- Shortest Path to next VNF
- Hop-by-hop routing

Load balancing on VNF



The higher LSA **update frequency**,
the higher the network traffic distribution **stability**

What did we achieve ?

Fully distributed framework to chain in-network function

- No need to rely on fast responses from a controller => Resilience, Scalability
- Load balancing between VNF instance
- Interoperability with legacy network => No need of SDN architecture, may rely on distributed routing protocol like OSPF
- No configuration needed for adding new VNF instances

Future Work

- Inter-Domain Service Provisioning
- VNF metrics
- Maintenance and Failure
- VNF Provisioning

References:

<https://hal.archives-ouvertes.fr/hal-01889856v1>

<https://hal.archives-ouvertes.fr/hal-02165785v1>



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Backup slides