Motivation for Management of Network Slicing and IETF COMS work from Operator's View Point

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Multi-domain problem / COMS use case

- Vertical customers can request **services** that lay **outside the footprint** of their **primary provider**
  - How to resolve this?
- **Dynamic and automated** interaction with other providers are needed but …
  - How we can **charge** and bill for that service?
  - How we can **ensure SLAs** among providers?
  - How we can **know about the capabilities** of other providers for a comprehensive e2e service provision?
- **Current** wholesale and interconnection **services and mechanisms** are **not enough** in the era of virtualization and programmability
- In the case of Telefónica multi-domain refers to either interconnections with other providers as well as interconnections among affiliates (up to 15 Networks in Telefónica group!)
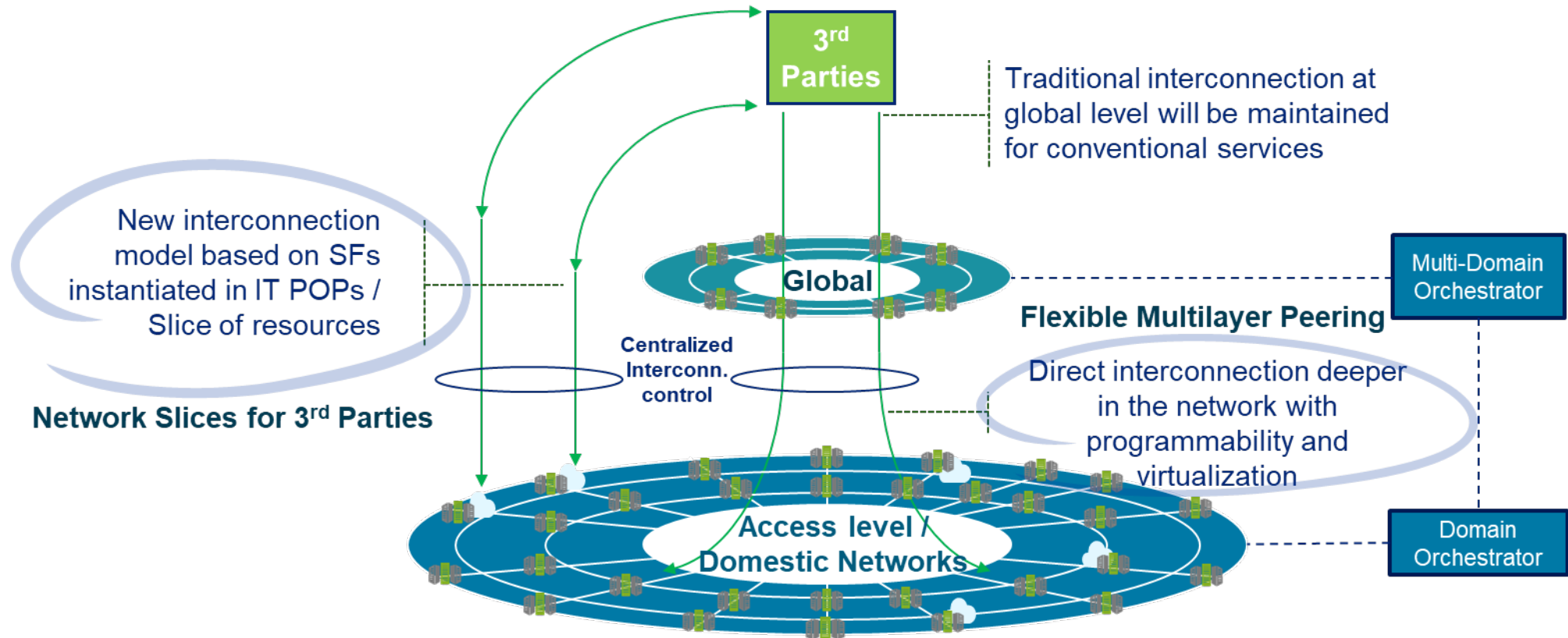
Interconnection models in place

- Nowadays, **interconnection** is conceived as **pure IP traffic interchange**, which limits the capability of taking advantage of new advances like network virtualization

- The current interconnection model is **not aware of peer's** network **resources** (i.e., load conditions, etc)
  - Not feasible to implement an optimal delivery of traffic (/service) among peers

- All these **environments are static**, requiring long interactions for setting up any inter-provider connection

- **Manual operation** of current interconnections prevents any flexibility
  - **Automation** for both the **interconnection** sessions and the **service deployment** on top of that is needed to reach the goal of flexibility

Challenges of multi-domain service provision

- Strict **SLAs**, associated to penalties

  → guaranteed service is a must (latency, bandwidth, availability)

- High **customization** in provisioning

  → automation as the way for simplifying the provisioning and

  → programmability to reduce time to market (≈ time to revenue)

- Need for **segregation**

  o Physical separation (e.g., dedicated backbones) → not cost efficient

  o Overlay, in the form of VPN as overlay solution → not flexible nor agile

  o Slicing, through network resource (including SF) allocation → dedicated resources per customer/service to ensure isolation on top of the same infrastructure

- Need for standardized Slice – aware Customer / Tenant Service Interface and Service Delivery Interface in a single and multiple domain

- Need for interoperable slicing protocols and enablers

- Other network segments / slices become an integral part (E.g., Radio for IoT)

  → Need for a truly convergent network

New interconnection model

3rd Parties

Traditional interconnection at global level will be maintained for conventional services

New interconnection model based on SFs instantiated in IT POPs / Slice of resources

Network Slices for 3rd Parties

Global

Centralized Interconn. control

Flexible Multilayer Peering

Multi-Domain Orchestrator

Direct interconnection deeper in the network with programmability and virtualization

Access level / Domestic Networks

Domain Orchestrator

From dedicated **physical networks with dedicated control and dedicated services and resources** for different applications to a "network factory" where **resources and network functions are traded and provisioned**

- New business and partnership ecosystem enabled through APIs

- New potential revenue sources

- New potential revenue sources

- Deployment of SFs working cleanly in IT PoPs

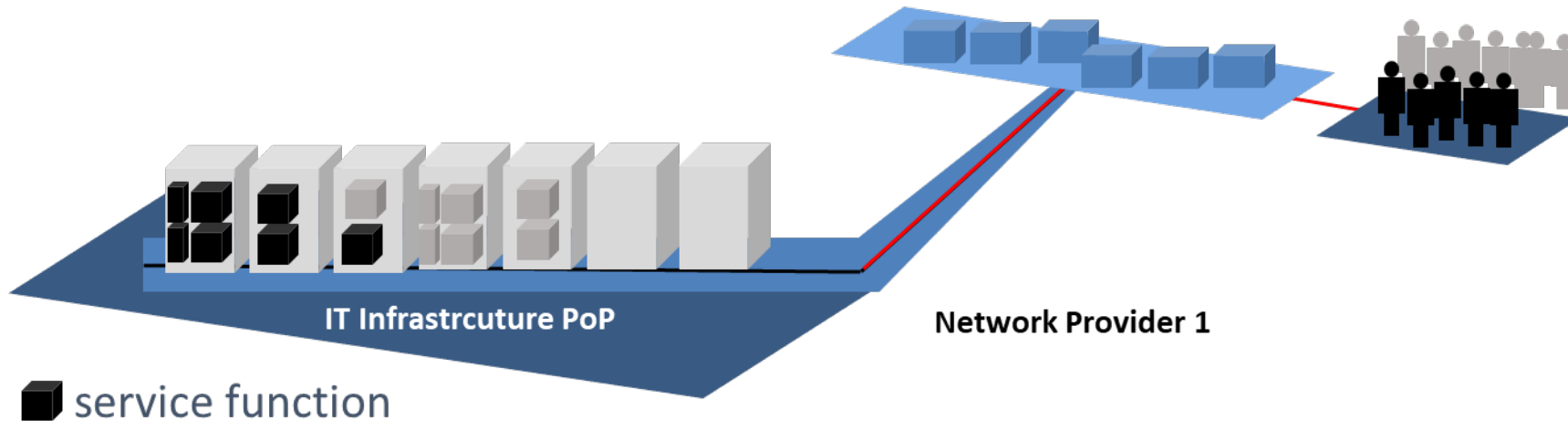- Capability for trading slices of resources

Multi-domain problem

Conventional Carrier Networks does not have the tools to cope with customized multi-domain service creation and delivery with very short lead times

IT Infrastrcuture PoP

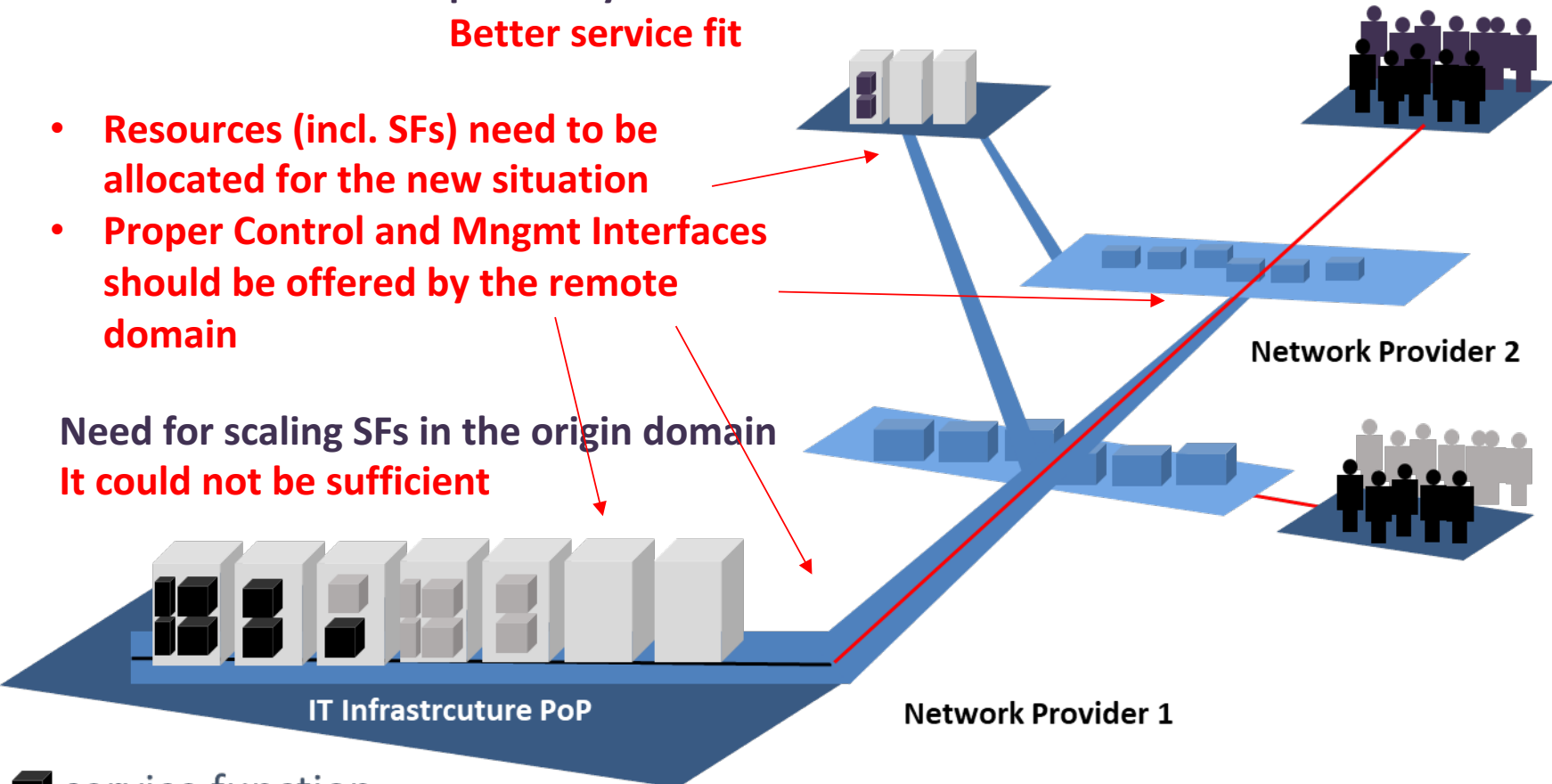**Network Provider 1**

🔲 service function

Multi-domain problem

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IT Infrastrcuture PoP

Network Provider 1

■ service function

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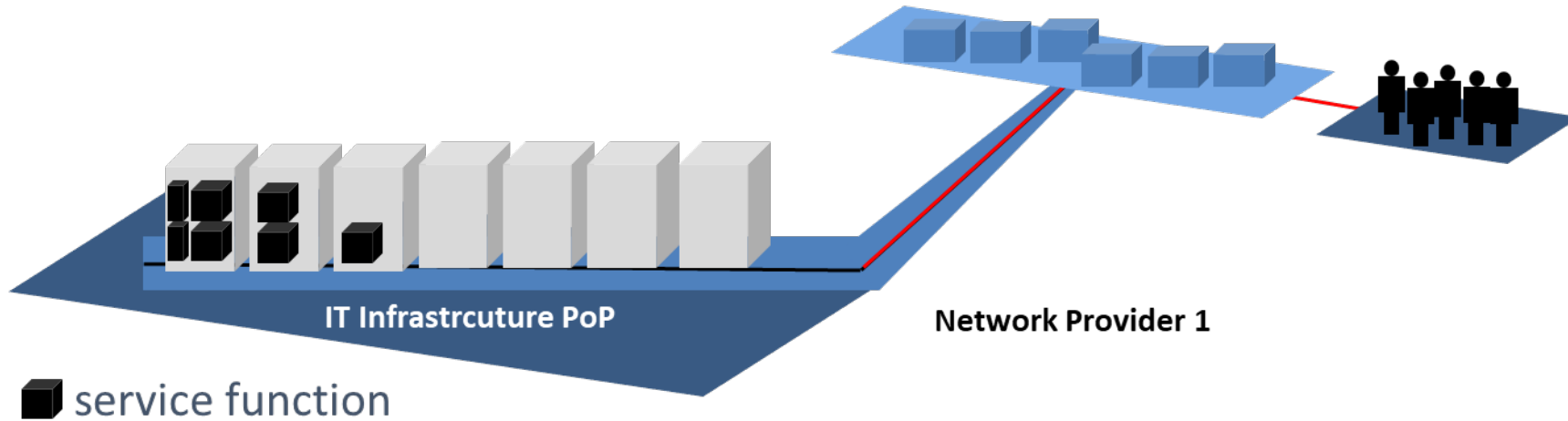
Multi-domain problem

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Opportunity for instantiating SFs in proximity
Better service fit

- **Resources (incl. SFs) need to be allocated for the new situation**
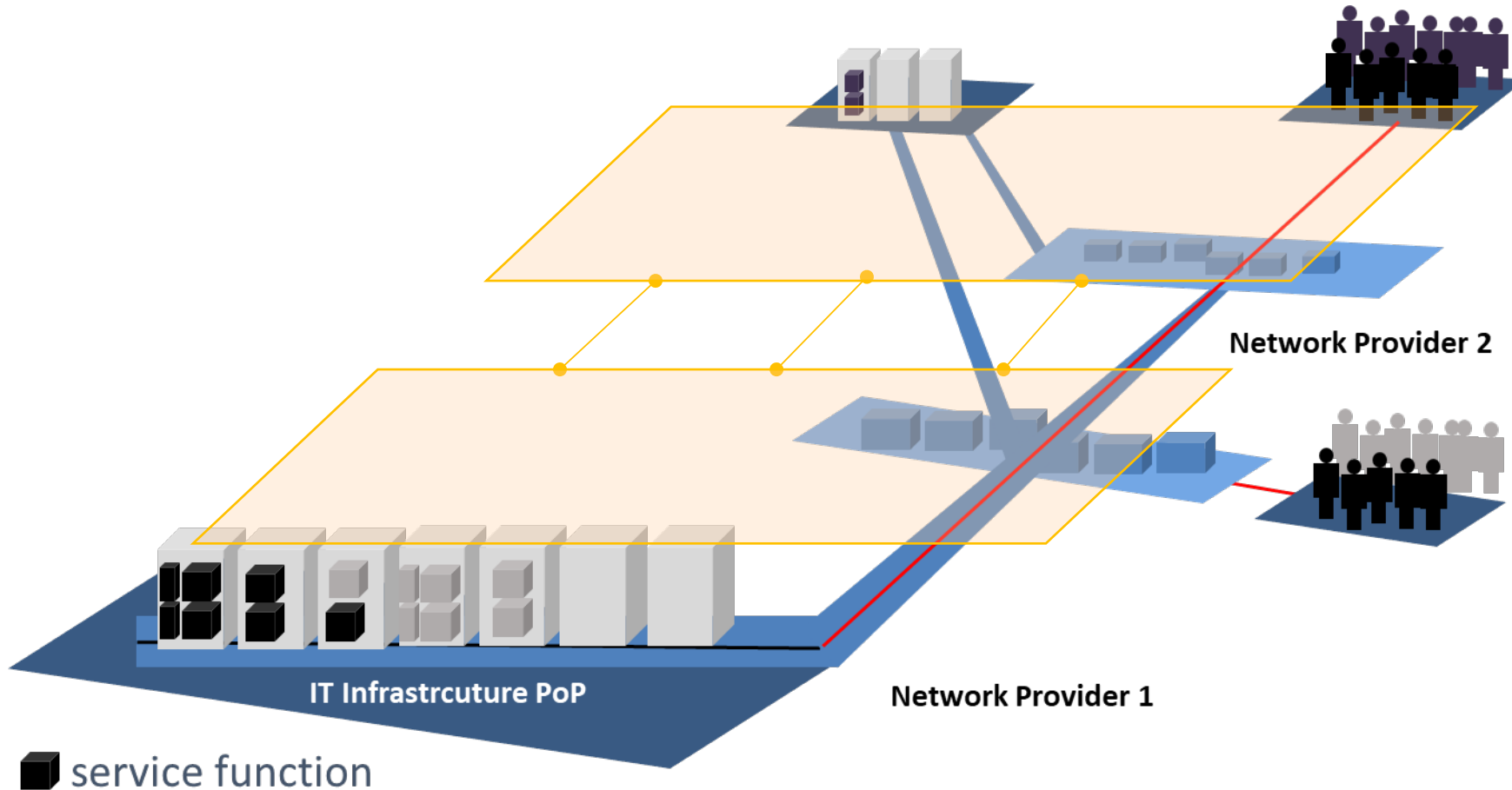- **Proper Control and Mngmt Interfaces should be offered by the remote domain**

Need for scaling SFs in the origin domain
It could not be sufficient

Network Provider 2

IT Infrastrcuture PoP

Network Provider 1

🔲 service function

Multi-domain problem

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Network Provider 2

Network Provider 1

IT Infrastrcuture PoP

■ service function

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Multi-domain requires standard mechanisms

- Multi-domain implies integration of distinct administrative domains
- Standard procedures are required to minimize integration costs
  - Flexibility, agility, etc
  - E.g., BGP
- Different functional behavior to be considered
  - Control of resources and SFs
  - Topology of resources and SFs
  - Lifecycle management of the slice
  - Monitoring
  - etc

Concluding remarks

- Expecting realization of Multi-domain network slices - Standard protocols and service interfaces are required to minimize integration costs and maximize interoperability

- Group of solutions are needed (e.g. COMS solutions)

- IETF is an appropriate and unique SDO place for creating it.
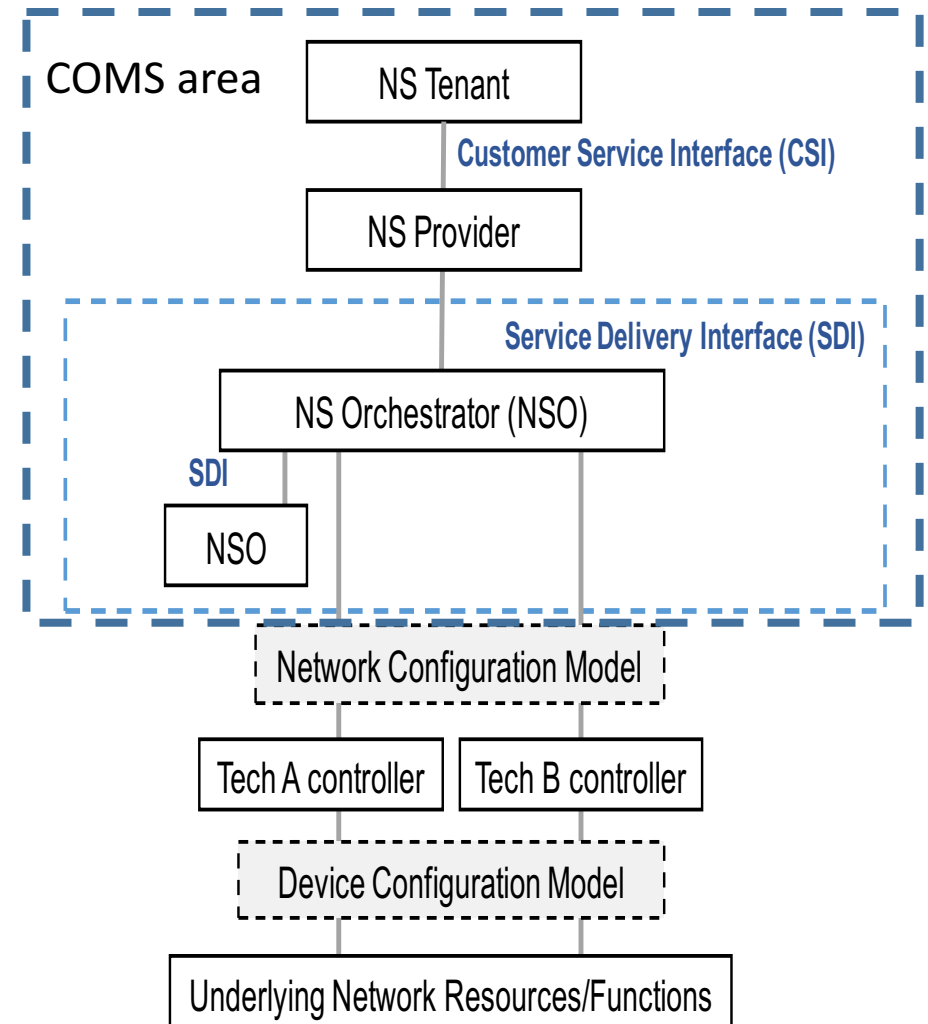
Backup

Evolution of wholesale services

- **Operators** start deploying its **own computing capabilities**
  - o UNICA environment in the case of Telefónica
- Operators can leverage on these capabilities for creating **service offerings** to external (vertical / wholesale) customers
  - o E.g., by deploying (or requesting) specific service functions and service graphs
  - o It is necessary to find proper mechanisms for **trading** these capabilities (at resource and service function level)
  - o It is necessary as well to implement **protocols / APIs** that could allow this to happen in an **automated** way
  - o And it is also necessary to properly **configure and manage** them either from the provider or the customer perspective!!
- **Adaptation** to **variable demands** and **changing service end-points** require more dynamic and responsive mechanisms for service delivery