IETF 104 - ALTO WG

Supporting Multi-domain Use Cases with ALTO:

Multi-domain E2E Network Services

Danny Alex Lachos Perez
Christian Esteve Rothenberg
(University of Campinas, Brazil)

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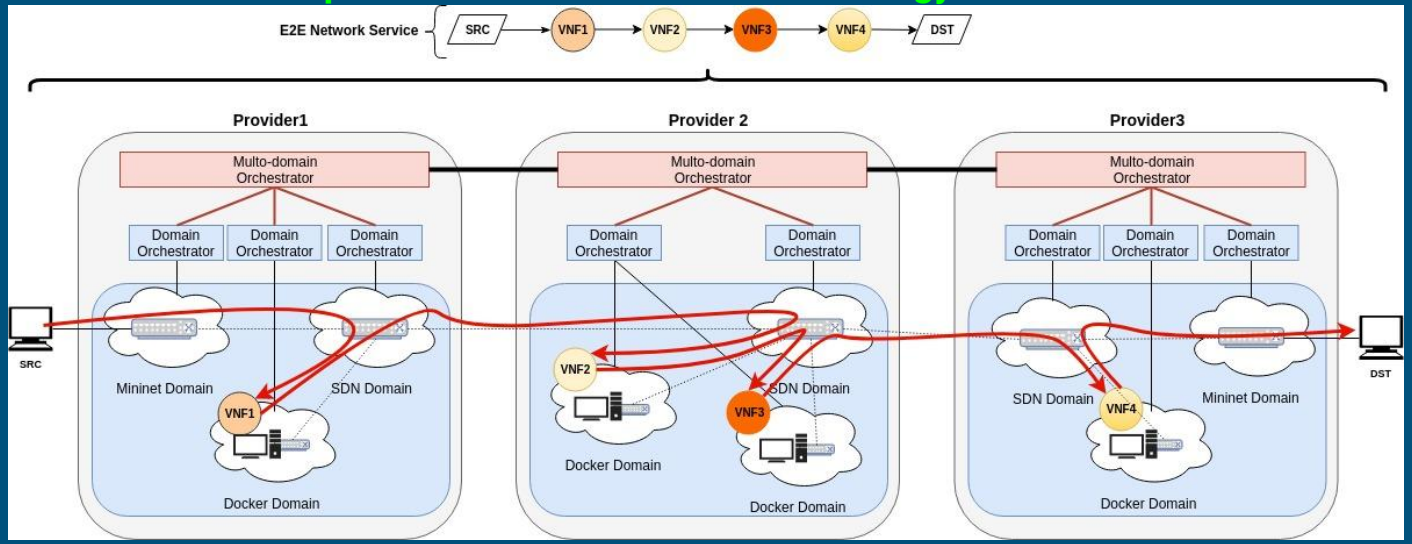
Document in a nutshell

- This document offers an **overview of standardization activities and research projects, including the problem statement**, behind building E2E services traversing different domains.
- From a layered network model, it is proposed a **potential ALTO extension related to E2E Network Service requirements representation** based on the ETSI NFV MANO data model.
- Another important objective of this document is to **arouse discussions into the ALTO WG/industrial players concerning potential new items/use cases** that motivate a re-charter.

Context / Motivation

Motivation

- E2E network services often require **VNFs and their specific order** [RFC7665].
  - Network services with specific requirements in **terms of resources** (e.g., cpu, memory, hard-disk) and **performance objectives** (e.g., bandwidth, latency).
  - Such demands are usually composed by distributed resources which are expected to be available **across multiple domains** with different **technology and/or administration**.



Multi-domain E2E Network Services (1/2)

- IETF - ALTO WG
  - [30] proposes an **ALTO-based Broker-assisted architecture** where a broker plane works as a coordinator between a set of top-level control planes for multi-domain orchestration in 5G networks.
  - The document [47] presents Unicorn, **a resource orchestration framework** for multi-domain, geo-distributed data analytics.
  - [50] introduces **several multi-domain applications** and how they can benefit from ALTO.
- IETF - SFC WG
  - [31] focuses on how the **ALTO protocol can be used to advertise and discover abstract network information from different domains,** and then compute inter-domain service function paths.
  - [hSFC] defines an architecture to deploy SFC in large networks.
  - [DRAFT-HH-MDSFC] describes **SFC crossing different domains** (technological and administrative).
- ETSI - NFV ISG
  - The document [ETSI-NFV-IFA028] reports different NFV MANO architectural approaches with use cases related to **network services provided using multiple administrative domains**.

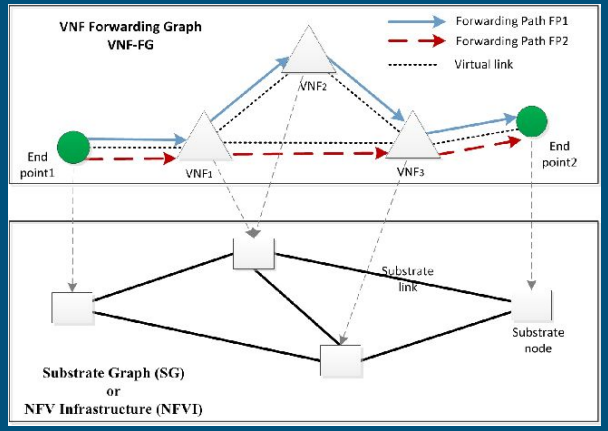
Multi-domain E2E Network Services (2/2)

- Several projects include an **architectural model integrating NFV management with SDN control capabilities** to address the challenges towards **flexible, dynamic, and on-demand** service chaining.
  - **[VITAL][T-NOVA]** follow a centralized approach where each domain advertises its capabilities to a federation layer which will act as a broker.
  - **[5GEx]** aims to integrate multiple administrations and technologies through the collaboration between operators in the context of emerging 5G networking.
  - The 5G-Transformer (5G-T) project **[5G-TRANSFORMER]** is defining flexible slicing and federation of transport networking and computing resources across multiple administrative domains.

Problem Statement

Research Problem

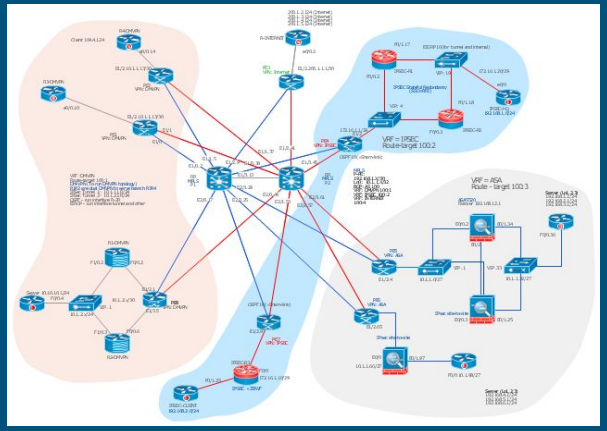
Placement Decisions



An E2E service request specifies **virtual nodes** and **virtual links**:

- Limited resources.
- Located on different domains
- Discover **“best” candidate resources**
- Discover **“best” feasible paths**

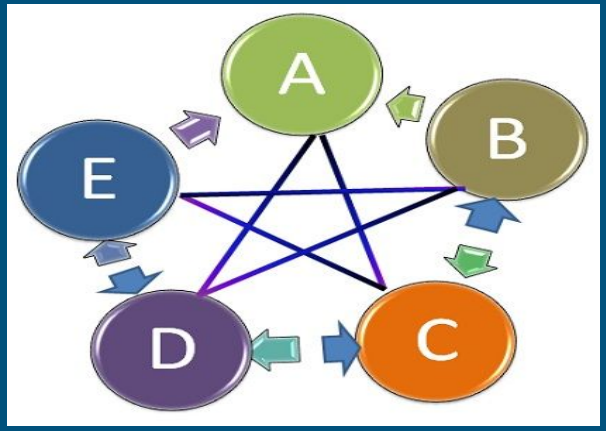
Network Inventory



The size of a **network inventory can be very large** in scenarios such as distributed cloud and edge computing:

- Scalability problems processing large amounts of data.
- Aggregation mechanisms to reduce time for discovery of resources.

Publishing Information

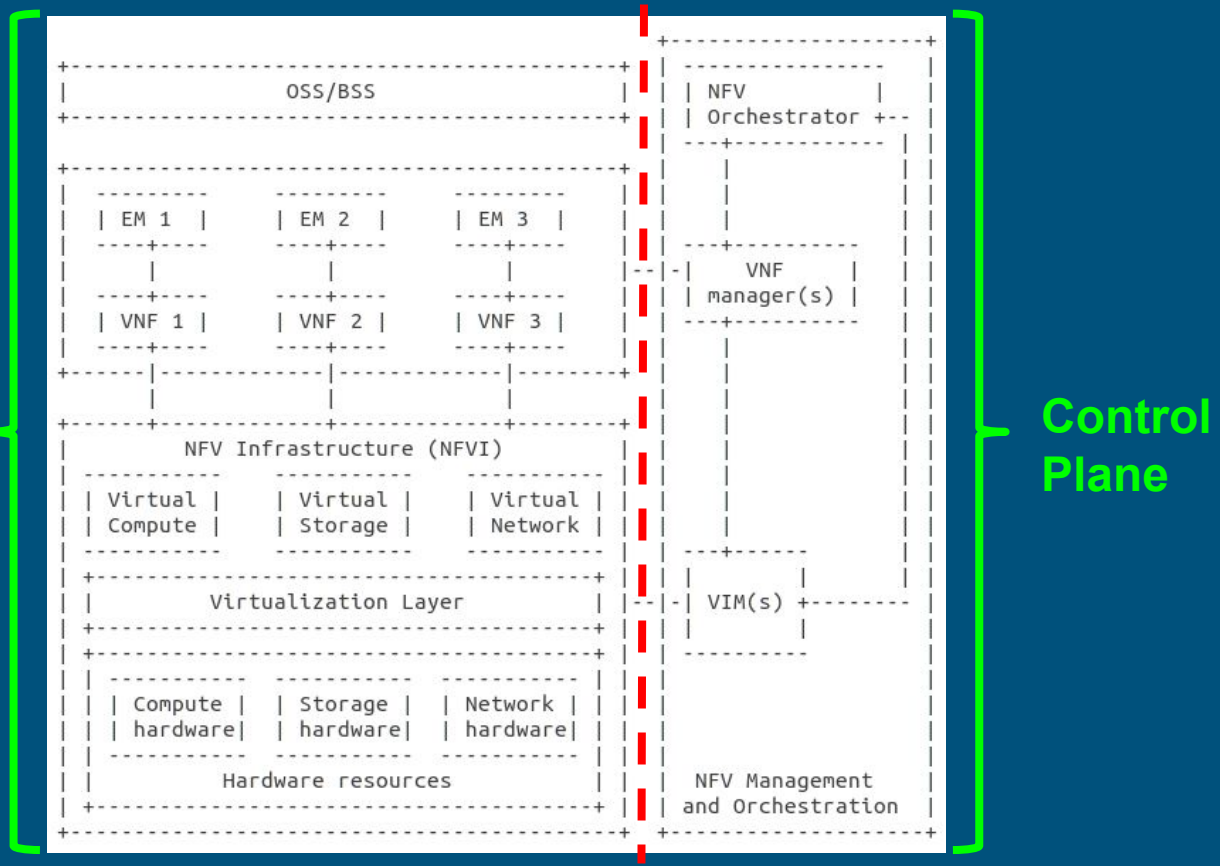


Network inventory can provide a **simplified, yet enough network information view** to network apps.

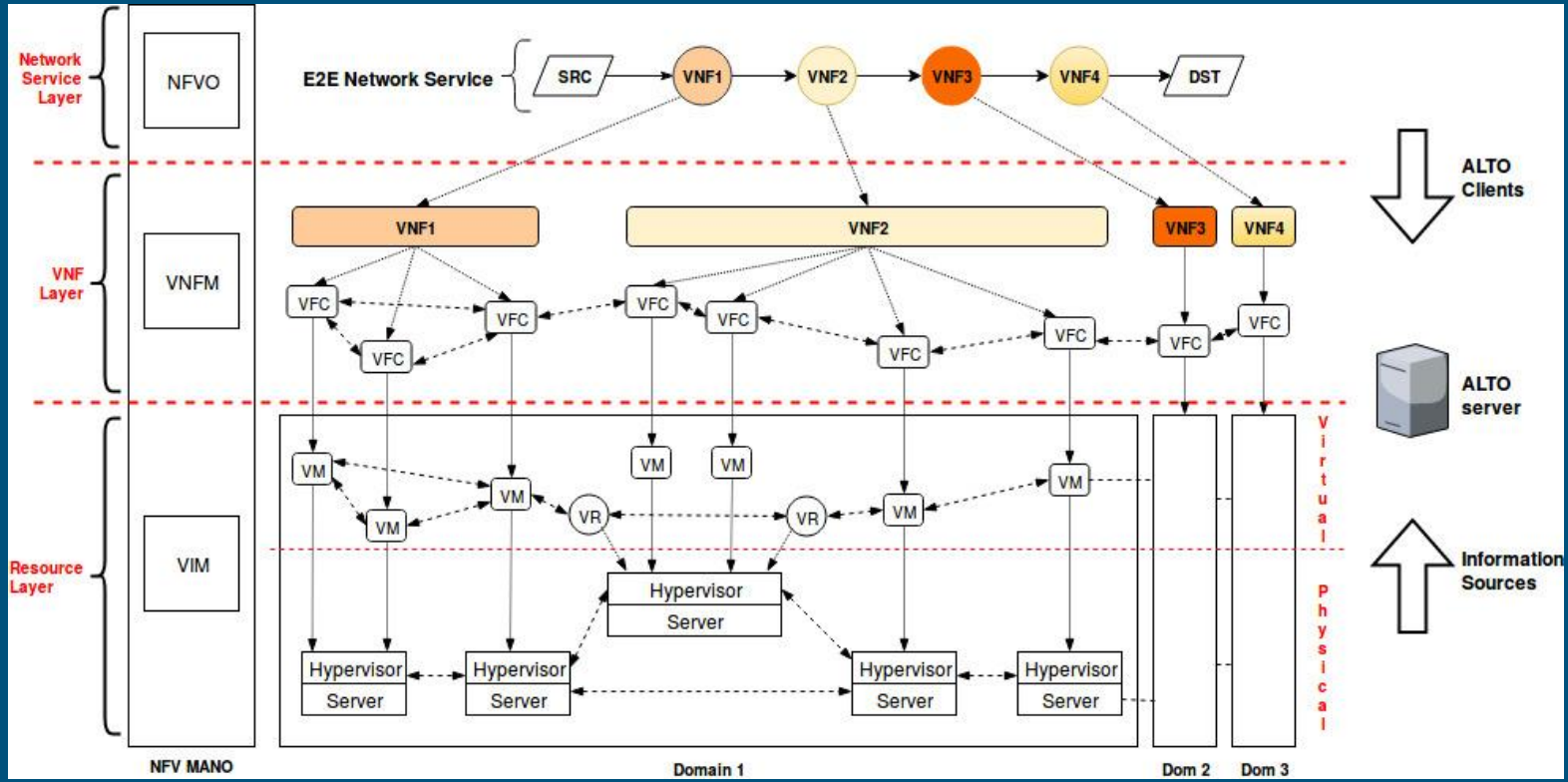
- Network info **needs to be advertised** to the network apps.
- Network apps need to **describe their requirements**.

NFV Architectures & Infrastructures

ETSI NFV Reference Architecture



Layered Network Model



ALTO Extension

E2E Network Service Requirements Representation

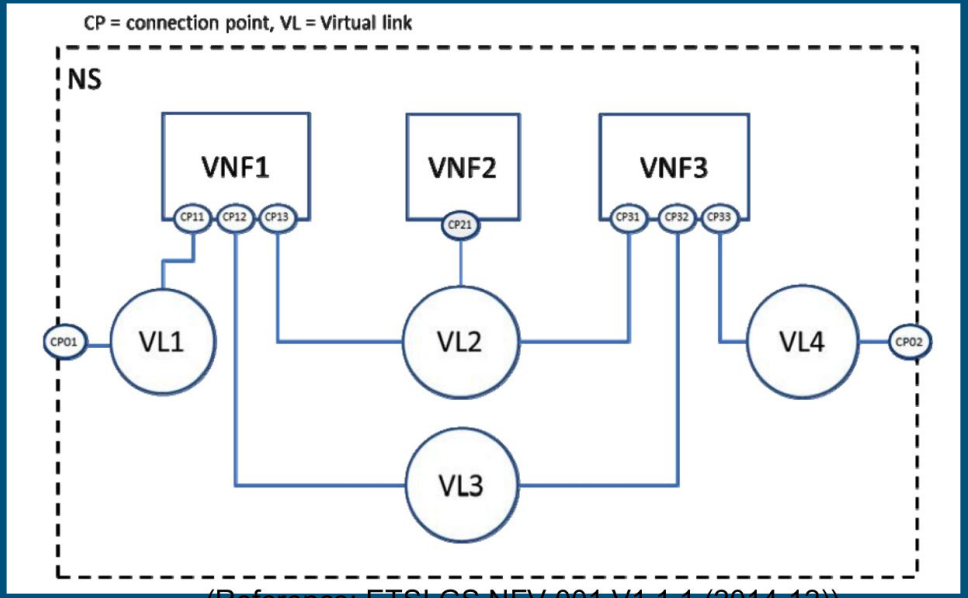
- Related document:
  - ALTO-based Broker-assisted MdO draft[1]
- Basic Idea:
  - Network applications (e.g., DOs, MdOs), working as ALTO clients, need to specify a set of E2E service requirements to an ALTO server to obtain candidate resources (domains) and candidate paths.
- Data Model: ETSI NFV MANO[2]
  - ETSI NFV defines the network service as a composition of Network Functions including functional and behavioural specifications.
  - Such specifications are captured in templates called NSD and VNFD.

```
object {
  [NFFG sg;]
} ReqFilteredCostMap;

object {
  JSONString nfs<1..*>;
  JSONString saps<1..*>;
  NextHops sg_links<1..*>;
  REQs reqs<1..*>;
} NFFG;

object {
  JSONNumber id;
  JSONString src-node;
  JSONString dst-node;
} NextHops;

object {
  JSONString id;
  JSONString src-node;
  JSONString dst-node;
  JSONNumber sg-path<1..*>;
} REQs;
```

1 https://tools.ietf.org/html/draft-lachosrothenberg-alto-brokermdo-02
2 https://www.etsi.org/deliver/etsi_gs/NFV-MAN/001_099/001/01.01.01_60/gs_nfv-man001v010101p.pdf

ETSI: Network Service Descriptor (NSD)

- The NSD contains (relatively) static information used in the process of on-boarding network services.
- The NSD connects VNFs using the Virtual Links (VLs)
- The VNFs attach to the VLs using the Connection Points (CPs)

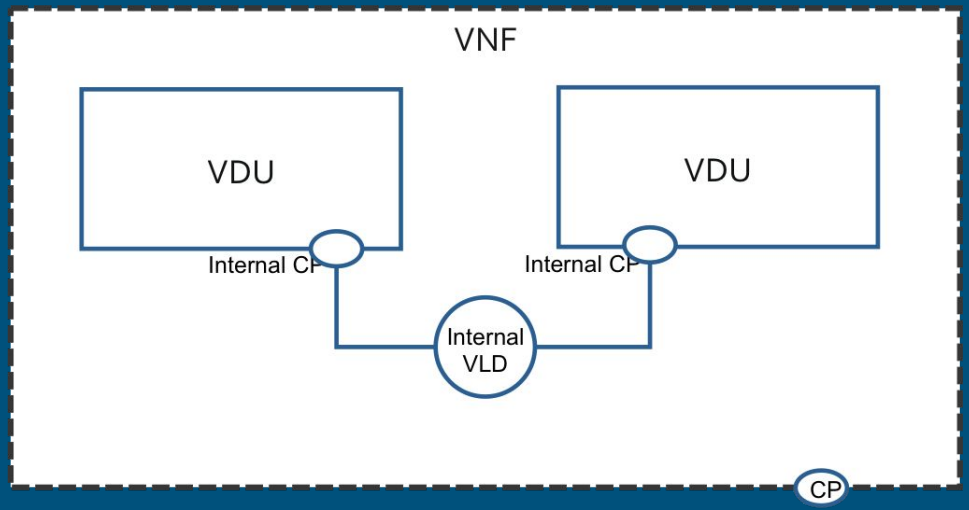


(Reference: ETSI GS NFV 001 V1.1.1 (2014-12))

https://www.etsi.org/deliver/etsi_gs/NFV-MAN/001_099/001/01.01.01_60/gs_nfv-man001v010101p.pdf
https://osm.etsi.org/wikipub/index.php/Release_0_Data_Model_Details

ETSI: Virtual Network Function Descriptor (VNFD)

- VNFD contains (relatively) static information used in the process of on-boarding VNFs.
- VNFD connects Virtual Deployment Units (VDUs) using the internal Virtual Links (VLs).
  - Each VDU represents a VM/Container.
- The VDUs attach to the internal VLs using the internal Connection Points (CPs).



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https://osm.etsi.org/wikipub/index.php/Release_0_Data_Model_Details

Next Steps

Next Steps

- Gather **feedback** from the WG
  - Comments, questions, suggestions are greatly appreciated.
- Further **engagement** with Industrial Players:
  - Identify new use cases that justify the re-charter and possible new extensions.
  - Interested industrial players:
    - Ericsson
    - Telefonica

Thanks!

(More) Questions?