Supporting Multi-domain Use Cases with ALTO:
Multi-domain E2E Network Services

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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**.
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

Network Inventory

Publishing Information

An E2E service request specifies virtual nodes and virtual links:
- Limited resources.
- Located on different domains
- Discover "best" candidate resources
- Discover "best" feasible paths

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.

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.

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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))
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).

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
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?