

IETF 102 - SFC WG

# Multi-domain Service Function Chaining with ALTO - 00

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# Document in a nutshell

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- ❖ This document focuses on how the **Application Layer Traffic Optimization (ALTO)** protocol can be used to **advertise and discover abstract topology, resource and service information from different domains**, and then compute inter-domain service function paths.
- ❖ Another important concern of this draft document is to initiate a discussion (ALTO, SFC as well as other WGs) regarding **if, how, and under what conditions ALTO can be useful** to improve the multi-domain SFC process.

# Multi-domain Approach

Building a complete end-to-end network service requires stitching services offered by **multiple administrations or multi-domain single administrations**.

- **Market Fragmentation:** Multiple Administrations
  - Having a **multitude of telecommunication networks and cloud operators** each with a footprint focused to a specific region.
- **Technology Fragmentation:** Multi-domain Single Administrations
  - Having different networks and different parts of a network built as different domains using **separate technologies**, such as optical or packet switched (with different packet switching paradigms included).
  - There are other reasons for having multiple domains within an operator, such as, **different geographies, different performance characteristics, scalability, policy** or simply historic (e.g., result of a merge or an acquisition)

# Multi-domain SFC

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- ❖ The delivery of end-to-end services often requires **various Service Functions (SFs)**.
- ❖ Service Function Chaining (SFC) is constructed as an **abstract sequence of SFs**.
- ❖ Multi-domain SFC refers to the ability to **deploy SFC across multiple domains** (geo-location, technology, administration, etc.).
- ❖ To do so, an inter-domain communication process between different domains is necessary in order to:
  - Exchange **topology, resource and service** information,
  - And then **compute inter-domain service function paths**.

# Multi-domain SFC - Related Work (1/2)

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## ❖ IETF - SFC WG

- [\[hSFC\]](#) defines an architecture to deploy SFC in large networks. This draft proposes to **decompose the network into smaller domains** (domains under the control of a single organization).
- [\[DRAFT-HH-MDSFC\]](#) describes **SFC crossing different domains** owned by different organizations (e.g., ISPs) or by a single organization with administration partitions. It proposes the use of a **SFC eXchange Platform (SXP)** to collect and exchange information (topology, service states, policies, etc.) between different organizations.

## ❖ IRTF - NFVRG

- The draft [\[DRAFT-MD-VIRT\]](#) envisions a complete **end-to-end logical network as stitching services offered by multiple domains from multiple providers**. It also points to the need for creating solutions that enable the exchange of relevant information (resources and topologies) across different providers.

## ❖ 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 SFC - Related Work (2/2)

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- ❖ 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 project **[5G-TRANSFORMER]** is defining flexible slicing and federation of transport networking and computing resources across multiple domains.

# ALTO for Multi-domain SFC

- ❖ The ALTO protocol [\[RFC7285\]](#) provides abstract network information in the form of map services that can be consumed by applications in order to become network-aware and to take optimized decisions regarding traffic flows.
- ❖ WHY ALTO?
  - The WG is discussing the use of ALTO as an information model for representing network, resource, and services in multi-domain scenarios.
    - The Broker-assisted architecture for multi-domain orchestration in 5G networks [\[draft-alto-brokermdo-01\]](#)
    - The Unicorn architecture for multi-domain, collaborative data sciences [\[draft-alto-multidomain-analytics-01\]](#)
- ❖ Some advantages:
  - Use the ALTO **Property Map service to get a clear global view** (resource and service information) of other potential candidates domains.
  - Use the ALTO **Cost Map service (and extensions) to compute inter-domain service function paths.**

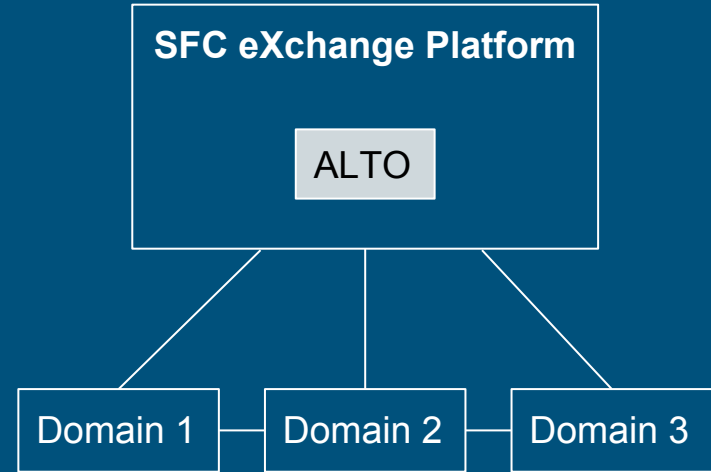
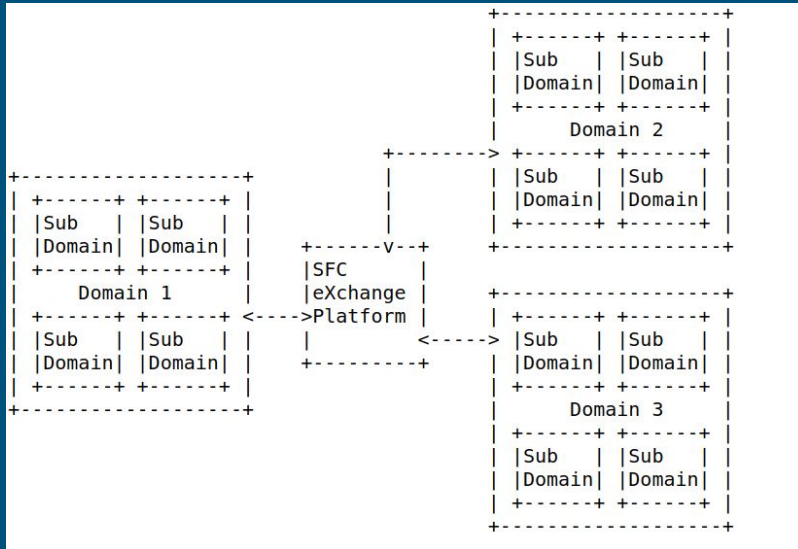
# Motivating Use Case (1/3)

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- ❖ To enable a highly customized multi-domains SFC, [\[DRAFT-HH-MDSFC\]](#) proposes a **SFC eXchange Platform to realize inter-domain communication** between top-level control planes.
  - The SXP is a **logical entity deployed in future Software-defined IXP** (as a trusted third-party platform) or built by a single owner between different networks.
- ❖ On a high level, the scope of the SXP contains two main tasks:
  - Provide **end-to-end visibility through the collection of topology information, service states, and policies** from different domains.
  - **Compute inter-domain service function path** to select the service function location from multiple candidate domains.
- ❖ In this context, the SXP can take advantage of **multi-domain ALTO services to obtain important inter-domain information** to "guide" the resource/service provider selection process.
  - So that the "best" domain or candidate domains (according to policies/metrics) can be selected.

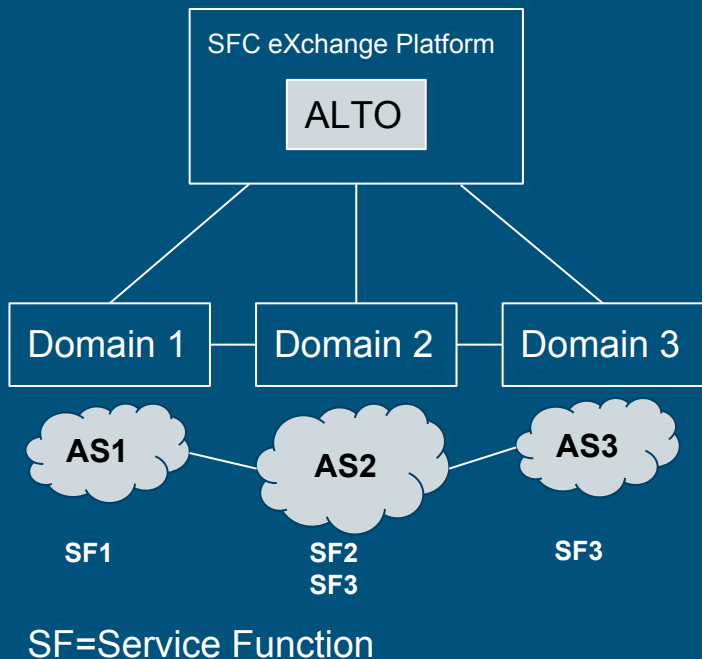


# Motivating Use Case (2/3)



Multiple SFC domains connected by a SFC eXchange Platform

# Motivating Use Case (3/3)



AS-level topology:

**AS1<->AS2<->AS3**

Property Map

	SFs	...
AS1	{SF1}	...
AS2	{SF2, SF3}	...
AS3	{NF3}	...

Cost Map

SFC	Multi-domain Service Function Paths(SFPs)
SF1->SF2->SF3	1:{AS1:SF1->AS2:SF2->AS2:SF3} 2:{AS1:SF1->AS2:SF2->AS3:SF3}

# Open Questions

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- ❖ The SFC WG is currently scoped to **one single administrative domain**.
  - In the hierarchical SFC draft [\[hSFC\]](#), the assumption is that sub-domains are **managed by the same administrative** entity.
- ❖ Before going into protocol details regarding how to realize inter-domain service chains:
  - Describe **concrete uses cases** which require **SFs from distinct administrative domains**. Related projects include **large, collaborative science experiments** (e.g., Large Hadron Collider).
  - Justify why **topology visibility** is required
- ❖ Security/Privacy Considerations
  - Using ALTO **extensions** (e.g., Multi-Cost, Cost-Calendar, Unified Property, Path Vector) to **provide fine-grained network information** may raise new security / privacy concerns. A systematic study is required.

# Next Steps

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- ❖ Gather **feedback** from the WG
  - Comments, questions, suggestions are greatly appreciated, especially on open questions.
  - -00 version reviewed by Mohamed Boucadair:
    - Comments addressed in -01

# Thanks!

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