ALTO
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ALTO extensions for handling Service Functions
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Abstract

This document proposes the usage of ALTO (and its extensions) to provide information about service functions to clients (e.g., external systems) that could consume such information for decisions requiring network information (service composition, traffic steering to service chains, etc).

Status of This Memo

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1. Introduction

Network services are commonly formed by means of the concatenation of several atomic service functions (SF), resulting in a connected graph of functions. Those functions can be topologically spread across the network. In addition to that, there will be typically more than one instance of any particular atomic service function in the network for different purposes such as load balancing, redundancy, traffic optimization, etc.

During the definition phase of a network service there will be a process for defining the type of service functions needed for implementing a given network service, as well as the way in which they should be connected to steer the traffic flows through them. The type of a SF can be for instance a User Plane Function (UPF) of the mobile packet core, a cache of a Content Delivery Network (CDN), etc. Thus when having multiple instances of a function (i.e., multiple UPFs or multiple caches as in the example before), a decision process should be in place to determine the particular instances for each type of service function (i.e., what instance of UPF and CDN cache) to be part of the realization of the network service.

At this point of network service realization, having timely information of the characteristics of the interconnection paths among SFs can be crucial. Aspects such as number of hops, associated performance metrics, etc., can enrich (or even determine) the decision of which instances of the service function consider as final election.

This document proposes the usage of ALTO [RFC7285] and its extensions to provide information about service functions or their interconnection paths to clients (e.g., external systems) that could consume such information for decisions requiring network information.

2. Service Function information

Several initiatives in IETF deal with the interconnection of service functions.

[RFC7665] defines the Service Function Chain (SFC) architecture. There, the traffic is steered through SFC domains with the objective of making the flow passing through a number of service functions to run a service. When entering the domain, the traffic is classified and assigned to an SFC Path. Specific information is added to the packet flows within the domain, being this SFC encapsulation containing metadata and contextual information useful for the processing of the flows by the service functions and other components in the architecture.
In all this process, there is no explicit identification of the service function to direct the traffic to, as it is implicit in the definition of a specific SFC Path.

Similarly, in [RFC8986] the Segment Identifiers of SRv6 structures the 128 bits of the IPv6 address in the form LOC:FUNCT:ARG. LOC is the locator used to route a packet to the endpoint and encoded in the L most significant bits of the Segment Identifier (SID) .FUNCT represents a Function ID and uses F bits. ARG represents optional parameters to be interpreted by the function, and uses A bits. Furthermore, [I-D.ietf-spring-sr-service-programming] defines data plane functionalities required to implement service segments, in a similar way as [RFC7665] for SFC.

Finally, [I-D.ietf-teas-sf-aware-topo-model] proposes a YANG data model able to integrate both network topology and service location on the same traffic engineering topology. In this model, the service functions are represented by service-function-id and sf-connection-point-id.

In all these previous cases, the information relative to the service functions is quite limited, if present. Richer information could be needed for an integration between the control systems responsible for the service operation and the control systems responsible for the network actions that could optimize the delivery of services relying on network information (that is, acting in an integrated fashion).

For instance, taking as example OpenStack [OpenStack], a network service relies on descriptors providing information about Virtual

Deployment Units (VDUs), Connection Points (CPs) and Virtual Links (VLs).

A VDU describes the properties of the virtual construct that hosts the service function. Important information is the function identifier and its type. The CPs contain the IP and MAC addresses for such function, showing the binding as well between a VDU and a VL. Finally, the VL identifies the connectivity between VDUs.

The level of information is not the same in all the solutions overviewed, however a solution like ALTO could help to reconcile all these different approaches by mapping and matching information on the service and the network planes.

3. Usage of ALTO for retrieving information relative to service functions

ALTO can expose combined information of the service overlay together with the underlying network characteristics. This section details the potential usage of ALTO in this respect.

3.1. Information of interest

There can be several kinds of ALTO information requests to take into consideration. Some examples are listed below:

- Path characteristics, from a PID, to any instance of a service function type.

- Path characteristics, from a PID, to a specific instance of a service function type.

- Path characteristics among any instance of a service function type X to any other instance of a service function type Y.

- Path characteristics among a specific instance of a service function type X to any other instance of a service function type Y.

- Path characteristics, from a PID, to a chain of service functions.

- Path characteristics, from a PID, to a chain of specific instances of service functions.

Other type of requests could be further identified.

An ALTO server could be able to provide information for a limited set of requests. Thus, some indication of the possible requests to be served should be in place when interacting with the client.

3.2. ALTO mechanisms to support the requests about service functions

ALTO can determine the path characteristics between two endpoints as determined by [RFC7285]. ALTO also can provide the view of chain of functions by leveraging on the path vector concept developed in [I-D.ietf-alto-path-vector], where the endpoints considered represent service functions.

[I-D.ietf-alto-path-vector] introduces the concept of Abstract Network Element (ANE) to specify a component or an aggregation of components sharing some characteristics in a network. Furthermore, [I-D.ietf-alto-unified-props-new] generalizes the concept of endpoint properties to entity properties, where entities may be defined in semantic domains such as as IPv4 or IPv6, or PIDs or ANEs.

This draft makes use of these capabilities to support the retrieval of information relative to service functions.

4. ALTO architecture for service function information retrieval

The following logical architecture defines the usage of ALTO for the retrieval of information about service functions or interconnection of service functions.

```
                        +--------+   Topological   +---------+
                        |        |   Information   |  e.g.,  |
                        |        |<--------------->|  BGP,   |
              ALTO      |        |                 | BGP-LS  |
+--------+  protocol    |        |                 |         |
| Client |<----------->|  ALTO  |                 +---------+
+--------+              | Server |
                        |        | Service Function+---------+
                        |        |   Information   |  e.g.,  |
                        |        |<--------------->| Service |
                        |        |                 | Function|
                        |        |                 |Orchestr.|
                        +--------+                 +---------+
```

The network topological information will be complemented with information relative to the service functions as provided by the orchestration system managing and controlling that part.

The ALTO server will integrate the information of the service functions based on some parameters, such as the IP address of the service functions.

5. Proposed ALTO extensions

As proposed extension to existing ALTO specifications, the following aspects are considered:

- o Extension to ALTO protocol to allow ALTO clients to express detailed requests in line with the information of interest described in Section 3.1.

- o Extensions to ALTO in order to collect and combine both service and network information, in line with the architecture depicted in Section 3.3. These extensions can involve particularizations of both [I-D.ietf-alto-path-vector] and [I-D.ietf-alto-unified-props-new].

Further extensions could be required.

Next iterations of this draft will further analyze the gap between existing ALTO features and requirements to support the provisioning of infrastructure information needed to perform efficient SF management.

6. Security Considerations

To be provided.

7. Informative References

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