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ALTO extensions for handling Service Functions
draft-lcsr-alto-service-functions-00

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).

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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:

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

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

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

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

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

o 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.

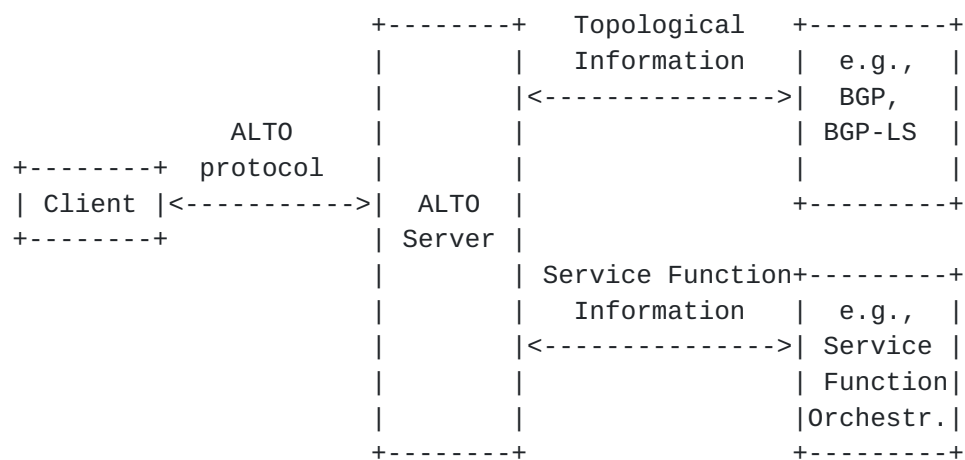## 3.2. ALTO mechanisms to support the requests about service functions

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.

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