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Interconnection Intents
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Abstract

This memo introduces the use case of the usage of intents for expressing advance interconnection features, further than traditional IP peering.

Status of This Memo

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1. Introduction

The success of Internet-based services has been built on top of the global reachability of content accessed by the end-users, which is facilitated by the interconnection of individual networks owned by distinct service providers constituting independent administrative domains.

Such interconnection services have been initially based simply on delivery of IP traffic between the interconnected parties leveraging on BGP. This peer model enables full connectivity. However, the traditional interconnection model shows some limitations when additional information to that related to routing is needed.

New network capabilities based on programmability and virtualization are producing service situations where a connectivity-only approach is not sufficient. The increasing availability of computing capabilities internal to the networks, or attached to them, enable new scenarios where those capabilities can be consumed through the advertisement or exposure of these execution environments (i.e., in terms of compute, storage and associated networking resources). Such information from an interconnected provider can be obtained from e.g. [I-D.llc-teas-dc-aware-topo-model].

In addition or complementary to that, even services or network functions could be advertised in order to make them available for interconnection. For example, as service we could consider the advertisement of CDN capabilities as in CDNi approach [RFC7336], while as network function we could consider functions like firewall, CGNAT, etc, present in the network [I-D.ietf-teas-sf-aware-topo-model].

All these scenarios present clear evolutions of the interconnection model which can not be simply expressed through existing mechanisms, or at least, cannot be expressed in a simple (and comprehensive) way with such existing mechanisms. Here is where an advanced interconnection intent can assist on declaring the goal of the interconnection transcending pure IP traffic exchange and including more advance capabilities as the ones mentioned before.

2. Evolution of Network interconnection

It becomes clear the trend to increasingly rely on multi-domain scenarios for the provision of services. For instance, the access today to an on-demand OTT video on Internet implies the interaction of more than one single administrative domain. Thus, end-to-end service delivery over multiple providers or domains is becoming the norm.

Complex network services leveraging on virtualization solutions and different infrastructure environments pertaining to distinct administrative domains (i.e., operated and managed by distinct providers) can be easily foreseen.

It is then necessary to explore mechanisms for interconnecting that multiple domain environments in a common, portable way independently of the owner of such infrastructure.

2.1. Potential interconnection intent types

The interconnection intent should provide enough abstractions to express a variety of interconnection options.

The purpose of the interconnection intent can be multiple:

* To enable multi-domain network service programming, by soliciting interconnection of service / network functions in different domains

* To enable multi-domain deployment of virtualized network functions, by advertising the availability of compute and storage resources in different domains

* To facilitate multi-domain network function or service charging, by advertising (cumulative) costs in the different domains

* To enable traffic interchange, ie. IP as in traditional peering or optical

* To put in place the right collection of policies to implement and operate the interconnection

* To facilitate whatever combination of all of them

2.2. Interconnection intent lifecycle

[RFC9315] defines an intent lifecycle composed of two phases, namely fulfillment and assurance. Figure 1 captures the intent procedure for the fulfillment phase.

```
          User Space   :       Translation / IBS       :  Network Ops
                       :             Space             :     Space
                       :                               :
         +----------+  :  +----------+   +-----------+ : +-----------+
 Fulfill |recognize/|---> |translate/|-->|  learn/   |-->| configure/|
         |generate  |     |          |   |  plan/    |   | provision |
         |intent    |<--- |  refine  |   |  render   | : |           |
         +----------+  :  +----------+   +-----------+ : +-----------+
                       :                               :
 ..........................................................................

       Provider A      :                 Provider B
       ----------      :                 ----------
                       :
   - Select interconn. : - Mapping of intent types to  : - Establishment of
     intent type       :   protocols / APIs for        :   protocol sessions
   - Specify targeted  :   coveying targeted resources :   or API requests
     resources (i.e.,  : - Parametrization of that     :   for configure or
     routes, compute   :   protocols / APIs, e.g.      :   provisioning
     quotes, service   :   leveraging on data models   :   targeted resources
     functions, etc.)  :                               :
                       :                               :
```

Figure 1: Fulfillment phase of the Interconnection Intent

Similarly, Figure 2 sketches the intent procedure for the assurance phase.

```
                         :                  +--------+   :
                         :                  |validate|   :  +----------+
                         :                  +----^---+ <----| monitor/ |
   Assure   +-------+    :  +---------+    +-----+---+   :  | observe/ |
            |report | <---- |abstract |<---| analyze | <----|          |
            +-------+    :  +---------+    |aggregate|   :  +----------+
                         :                 +---------+   :
   .....................................................................

         Provider A      :                   Provider B
         ----------      :                   ----------
                         :
    - Analysis of the    : - Checking of monitored data  : - Collection of
      reported metrics   :   for internal closed loops   :   telemetry info
      against the intent :   to ensure commited SLOs     :   related to allocated
      request            :   (inner closed loop)         :   resources (i.e.,
    - Trigger of actions : - Aggregation of data         :   routes, compute
      if needed, e.g.,   :   producing an abstracted view:   quotes, service
      new intent (outer  :   fitted to the intent request:   functions, etc.)
      closed loop)       :                               :
```

Figure 2: Assurance phase of the Interconnection Intent

Both Fulfillment and Assurance phases are integral part of the interconnection intent.

2.3. Protocol aspects

Ultimately the ideas and notions elaborated in this document will need to find room in a framework made of one or multiple protocols (ie. BGP, LISP, ALTO, etc.) and/or API definitions. While the exact definition of such framework is left as future work, in this document we intend to perform some seminal work in this sense (ie. identify existing protocols that could fit, determine gaps of such protocols, etc.).

3. Interconnection intent structure

In order to address the different interconnection intent types described in section 2.1, the structure of the intent should be sufficiently flexible to allow the expression of different targets. Thus, the intent structure could include:

* Information of the type of data traffic being subject of the interconnection intent (e.g., IP prefixes involved) among providers.

* Service functions expected to be supported by the peer provider. These could be expressed in terms of type of service function and number of instances required. Furthermore, it can be necessary to consider how the service functions are expected to be connected in terms of topology (i.e., service function graph).

* Resources expected to be offered by the peer provider. These could be expressed in terms of raw values of number of CPUs, memory and storage size, or bandwidth capacity, or alternatively, in terms of quotas grouping resources in a predefined manner.

* Constraints that could apply to whatever of the elements included in the interconnection intent, including traffic steering ones. Aspects such as committed rates, burst size, cumulative traffic, service function affinity, redundancy, traffic engineering (e.g., latency), etc., could be part of such constraints.

* Further information that could be necessary for delivering an end-to-end service by means of the intent.

3.1. Structure of the Intents

Different Standardization Development Organizations (SDOs) are working on the area of intents. This is the case of ETSI ZSM [ZSM011], ETSI NFV [IFA050], or 3GPP [TS 28312].

The structure of the declarative intent model along those SDOs follows a common design, considering a number of classes (i.e., objects that can be instantiated) and data types (i.e., assigned values) as described next:

* Expectation: it refers to the expectation(s) of an intent including the requirements, goals, constraints and context that apply to it.

* Target: it refers to the behavioral outcomes resulting from the configurations derived from the intent expectation. A given intent expectation may include various targets.

* Condition: it applies to the value of the target.

* Context: It describes constraints or conditions applicable to the intent expectation.

The same model will be followed in this document for exemplifying possible interconnection intents.

Note: Further alignment is yet needed with the referenced models in other SDOs.

3.2. Examples

Section 2.1 presented potential interconnection intent types. This section proposes examples of declarative intents for those interconnection cases.

Note: further versions will refine and complete the examples.

3.2.1. Example 1. Conventional IP peering

Conventional IP peering leverages on BGP for performing interdomain interconnection between two Autonomous Systems (AS). The conventional IP peering intent could consider the following details:

* Peer AS number (ASN) and IP address

* Peering authentication (e.g., MD5)

* Traffic levels (e.g., PIR, CIR, etc)

The following intent can serve for the purposes of requesting peering in a declarative manner from peer A (with ASN N and IP address ipA) to peer B (with ASN M and IP address ipB)

* IntentExpectation: IP_peering

* - IntentTarget: AutonomousSystem

  - o IntentTargetValue: M

    o IntentContext: ASorigin = N

* - IntentTarget: IP_address

  - o IntentTargetValue: ipB

    o IntentContext: IPorigin = ipA

* - IntentTarget: CIR

  - o IntentTargetValue: 1 Gbps

* - IntentTarget: Authentication

  - o IntentTargetValue: MD5

3.2.2. Example 2. interconnection of service functions in different domains

Service functions could be deployed in different administrative domains, being of interest to interconnect them for creating a service chain. An interconnection of this kind could consider as relevant information:

* Service function in peer domain

* Preferred location (i.e., geographical area)

* Connection Service Level Objectives (e.g., bandwidth, latency, etc)

* Preferred peering point (in terms of existing peering session identified by peer Ip address)

The following intent can serve for the purposes of requesting interconnection with a service function SF2 of peer B from service function SF1 from peer A, with the expectation of connecting both service functions observing a bandwidth capacity of up to 1 Gbps during 90% of the time, and a latency lower than 10 ms.

* IntentExpectation: SF_interconnect

* - IntentTarget: ServiceFunction

  - o IntentTargetValue: SF2

    o IntentContext: SForigin = SF1

* - IntentTarget: Location

  - o IntentTargetValue: Zone_X

* - IntentTarget: SLO_Bandwidth

  - o IntentTargetValue: 1 Gbps

    o IntentTargetContext: 90%

* IntentTarget: SLO_Latency

* - IntentTargetValue: 10 ms

  - IntentTargetCondition: lower than

4. Security Considerations

To be done.

5. IANA Considerations

This draft does not include any IANA considerations

6. References

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