                        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.

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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.)   :                               :
                      :                               :
```
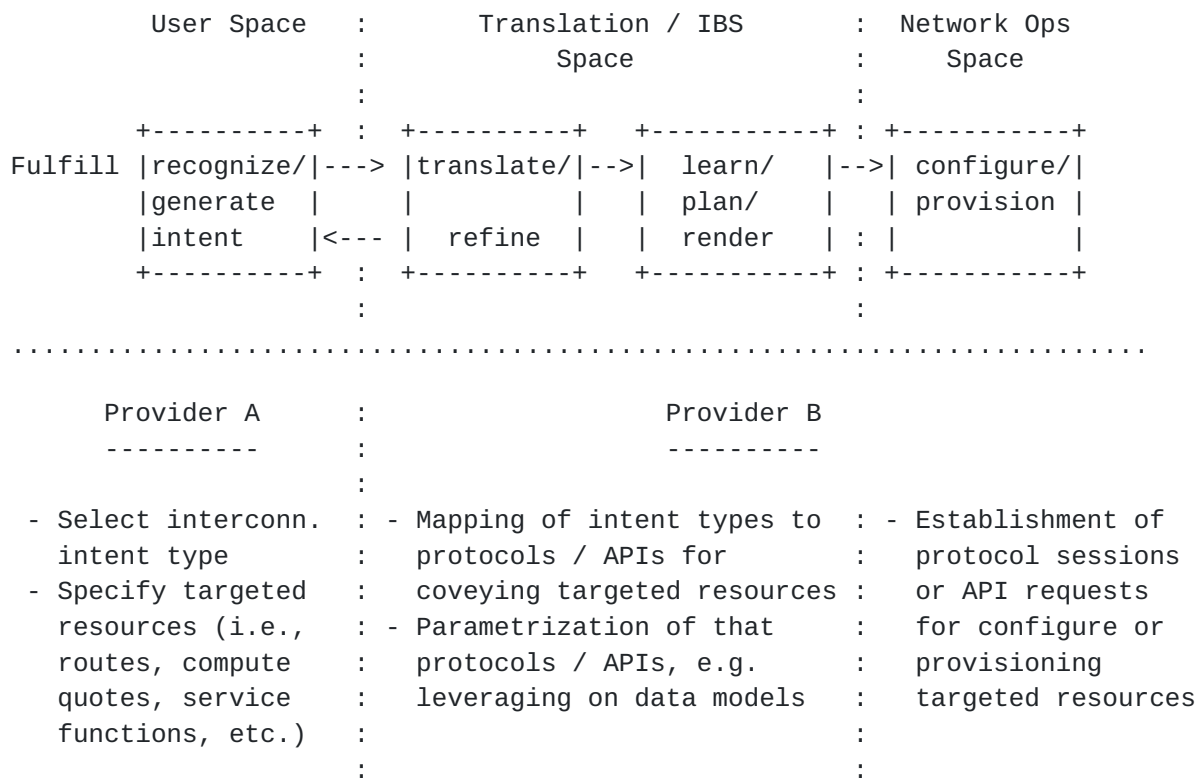
Figure 1: Fulfillment phase of the Interconnection Intent

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)      :                                 :
```
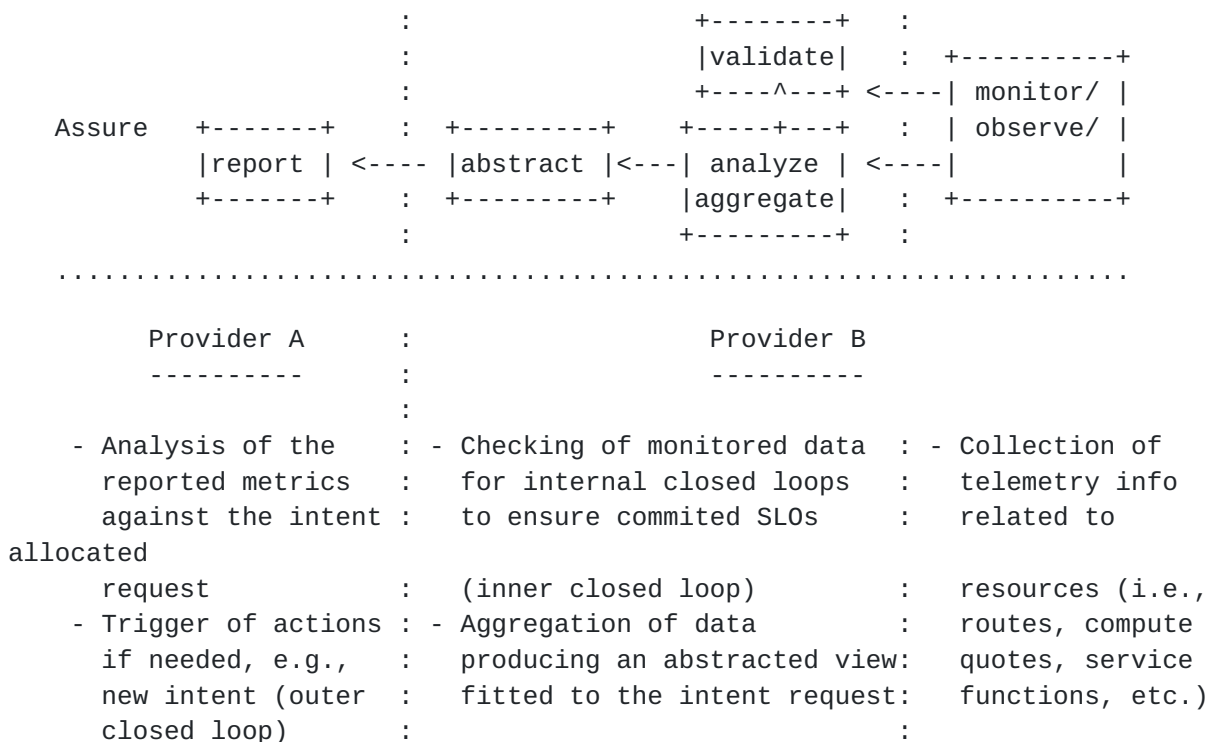
Figure 2: Assurance phase of the Interconnection Intent

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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Acknowledgments

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