Autonomic Network Intent and Format
draft-du-anima-an-intent-02

Abstract

   This document describes the concept and consideration of the
   Autonomic Network Intent, and proposes a uniform format for the
   Autonomic Network Intent.

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1. Introduction

This document describes the concept and consideration of the
Autonomic Network Intent, which is used to operate the Autonomic
Nodes within Autonomic Networks. The background to Autonomic Network
(AN) is described in [RFC7575] and [RFC7576]. A generic autonomic
signaling protocol (GRASP) is proposed by [I-D.ietf-anima-grasp],
which would be used in the propagation of the Autonomic Network
Intent.

The Autonomic Network Intent should be able to be unscrambled by all
Autonomic Nodes, although certain parts of contents may not be
relevant to a specific Autonomic Node. The Autonomic Network Intent
gives operational guidance for every Autonomic Node.

This document also proposes a generic format for Autonomic Network
Intent.

The interface to receive or configure the Autonomic Network Intent is
out of scope. The distribution mechanism of the Autonomic Network
Intent is introduced in [I-D.liu-anima-intent-distribution].

Note in draft: This version is preliminary. In particular, many
design details may be subject to change until the anima
specifications become agreed.

2. Requirements Language and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in
[RFC2119] when they appear in ALL CAPS. When these words are not in
ALL CAPS (such as "should" or "Should"), they have their usual
English meanings, and are not to be interpreted as [RFC2119] key
words.

Autonomic Function: A feature or function which requires no
   configuration, and can derive all required information either
   through self-knowledge, discovery or through Intent.

Autonomic Node: A node which employs exclusively Autonomic
   Functions.

Legacy Node: A non-autonomic node, i.e., a node which employs some
   non-autonomic functions.

Autonomic Network: A network containing exclusively Autonomic Nodes.
   It may contain one or several Autonomic Domains.

Autonomic Service Agent: An agent implemented on an Autonomic Node
   which implements an Autonomic Function.

Intent: An abstract, high-level policy used to operate the network,
   quoted from [RFC7575].

Autonomic Network Intent: Intent that is used to intervene the
   running status of the Autonomic Network.

Administrative Intent: Intent that is used to manage the network
   infrastructure.

Service Intent: Intent that is used to intervene the network
   services running over the network infrastructure.

3. Intervention of the Network Running by Autonomic Network Intent

The Autonomic Network is supposed to work with minimum intervention
from human operators. However, it is still needed to receive some
form of guidance/information/orders in order to meet specific
requirements.

Upon receiving the Autonomic Network Intent, the Autonomic Node
should be able to unscramble the meaning of the intent with no
ambiguity, and act accordingly.

Using this intent approach, the operator can manage the network as a
whole, and does not need to configure specific node(s) in the network
like what happens in the traditional NMS system. In other words, the
operator communicates with the Autonomic Network using an abstract or
high lever intent, and the configurations of the nodes take place
automatically. By replacing most of the NMS jobs, intent-based
management makes the network management work much easier than before.

On the other sides, the intent-based and NMS-based management may co-
exist for a long time, because autonomic behavior will be defined
function by function. Similarly, at the beginning of defining the
Autonomic Network Intents, the intent-based method cannot be assumed
to cover every aspect of network management.

3.1. Concept of Autonomic Network Intent

The definition of Intent can be found in
[I-D.behringer-anima-reference-model], which is described as an
abstract, declarative, high-level policy used to operate an autonomic
domain, such as an enterprise network. Based on this definition,
this section further discusses the concept of Autonomic Network
Intent.

Autonomic Network Intent consists of different parts, and should not
be considered as a monolithic block. Different parts of Intent will
be "interpreted" by different entities in autonomic networks, and the
"level" of understanding of the intent will impact how the intent
will be presented to this entity. So there should be "intermediate"
mechanisms/functions that cater for the intent translation continuum
across the heterogeneity (in policy capabilities) of the network
entities. Also, intents will possibly overlap and this overlapping
should be managed (e.g., avoid conflicts, resolve applicable policies
in context).

The description of "abstract" in the definition is relative.
Different users (e.g., the network administrator, end-users) of the
network see different levels of network details, so they are in
different abstraction levels. Meanwhile, different intents or
different parts of intent may require different levels of
abstraction.

The more abstract an intent is, the more intelligent the devices are
required. In an extreme example, the network operator just needs to
have only one intent for the network: "the network should work well

for everything". However, this assumption is not likely to be
realized in recent years, and this intent requires no or little
standardization jobs. Besides, if an intent is too abstract,
different solutions can emerge from different vendors, and it is hard
to co-exist for the devices from different vendors.

This document will talk about the intents which need to be
communicated among devices, and have more detailed requirements.
Some intents may have a higher abstraction level (e.g. some high-
level policies), and some may have a lower abstraction level (e.g.
some network-level parameters). Meanwhile, due to the target of
reducing human Interventions for the Autonomic Network, detailed
configurations should be avoided as much as possible.

{Editor notes: the most important questions here are as follows. Are
there any configuration parameters of an anima network outside
intents? Are there different kinds of intents? Need we define a
"hierarchy" for intents?}

3.2. Administrative Intent and Service Intent

The Autonomic Networks are supposed to be self-managed. It includes
managing the network infrastructure, and also the network services
that are running over the network infrastructure. However, the
network services have different features against network
administration, as listed below. Hence, it may be better to organize
them into separated Administrative Intent and Service Intent.

o A Service Intent may have a smaller scope than the Administrative
   Intent because only the nodes related to the service need to know
   this intent. Although it may only affect a few nodes, the Service
   Intent may also be propagated domain wide.

o A Service Intent may have a limited lifetime, while the
   Administrative Intents are normally permanent although the content
   of the Administrative Intent may be updated from time to time.

o There maybe are many Service Intents in the autonomic domain,
   while only one Administrative Intent for a giving Autonomic
   Service Agent.

{Editor notes: one possibility is to treat the Service Intent as a
normal Intent for a certain Autonomic Service Agent, such as a
Autonomic Service Provision Agent.}

3.3. **Use Cases for Autonomic Network Intent**

   An example of the intent can be found in
   [I-D.jiang-anima-prefix-management]. Other examples include what
   kind of IGP (such as OSPF) or what kind of transport layer technology
   (such as MPLS) should be used for the autonomic domain.

   After these configurations in the network level, detailed
   configurations in every node are not needed; whereas, policy-based
   method will need detailed configurations for every specific node.

   An Intent should contains some common information that are needed by
   every intent and some specific information that influence the
   configuration of the nodes, and the detailed content and format of
   the specific part should be defined under its specific application
   environment by other documents, such as the prefix management intent
   defined in [I-D.jiang-anima-prefix-management].

   {Editor Notes: as autonomic functions are defined one by one, the
   intent should be developed at a per need basis.}

   {Editor Notes: the intents introduced here look like not that
   abstract, however, it does help to make the network more autonomic,
   and reduce the configuration jobs. Maybe in future, when the
   autonomic node becomes more intelligent, some of the intents defined
   will disappear or be replaced.}

3.3.1. **High-Level Policy Intent**

   For clarifying the concept of the intent in Autonomic Network, this
   section introduces some autonomic intent examples about the high-
   level polices. Multiple Autonomic Function Agents may be involved in
   the implementation of these intents.

   These abstract policies need to be interpreted by a policy continuum
   to low level commands that the device can understand. The detailed
   realization of the tranlation for these high-level polices is out of
   scope of this document.

   Usecase one:

   Autonomic Network of Operator A is composed of Autonomic Function
   Agents such as load balancing (LB_AFA) and energy saving (ES_AFA).
   Operator A wants to limit the proportion of links loaded over a
   certain threshold and thus defines an Intent to activate load
   balancing if the load is superior to 0.6 on more than 30% of the
   links.

Meanwhile, operator A wants different load balancing policies per
(technology, administrative, topology) domain. Let's consider a
metropolitan network domain and a core network domain, or different
LB policy for border routers than interior routers. For the
metropolitan network domain, Operator A defines an Intent to minimize
the link load variance. For the core network domain, Operator A
applies the previously defined intent (activate load balancing if the
load is superior to 0.6 on more than 30% of the links).

The intents will be distributed to the right network domain, and take
effect after being interpreted and coordinated, and it is easy to
change them without the need to configure every device manually.

Usecase two:

This example is about "arranging VM guest distribution". The
autonomic network is supposed to be able to monitor the CPU/power
utilization on each host machine, and control the status of each host
machine (e.g. turn on/off). The operator may have an intent "there
should be enough hosts to keep CPU utilization less than 70%", and
also another one "there are few enough hosts powered so that
electricity isn't wasted".

{Editor Notes: Besides these ones, we are quite open for other use
cases here.}

3.3.2. Network-Level Parameter Intent

Due to the system limitations and complexity reasons, some intents
may just be network-level parameters configured by the network
operator for a specific autonomic function. These configuration
parameters can be distributed in the autonomic domain to influence
the detail configurations on each autonomic node.

Most of these parameters are for establishing network infrastructure.
They are likely only needed to be configured once, and rarely
changed. Meanwhile, these parameters do not need coordination with
others parameters most of the times. Some examples are as follows.

Usecase three:

When bootstrapping, the new device needs to know some basic
parameters about the autonomic domain to complete the process. To
reduce the complexity of bootstrapping, they are perhaps not need to
be encrypted. They can be treated as "bootstrapping intent" as a
special kind of intent.

Usecase four:

Assuming we need an autonomic network to run and connect to Internet, an IP prefix is needed for the whole autonomic domain in the data plane. In this case, we need devices in the autonomic domain can configure themselves after the human operator has notified the IP prefix for this autonomic network. (Configuring every device's IP address manually is not considered a good way in autonomic network, and is not recommended here.)

Usecase five:

Configuring the routing protocol in the autonomic network directly by the operator, assuming it can be ISIS or OSPF.

Usecase six:

In the prefix management draft [I-D.jiang-anima-prefix-management], it is suggested that the prefix lengths for the CSG, ASG, RSG (different roles in IPRAN) should be assigned as an "intent".

{Editor Notes: Besides these ones, we are quite open for other use cases here.}

3.4. Distribution of Autonomic Network Intent

TBD.

{Editor Notes: talk about the questions as follows. Who are the sources and recipients of the intent? }

3.5. Interpretation of Autonomic Network Intent

TBD.

{Editor Notes: talk about the questions as follows. How the AFAs receive, understand and react to an intent? }

3.6. Management of Autonomic Network Intent

TBD.

{Editor Notes: talk about the questions as follows. When/on which triggers are intents generated, updated? How the domain(s) are defined and recognized (if I am an AFA, how do I know i am part of domain x, y or z...?). }

[4](#). **Uniform Format of the Autonomic Network Intent**

   {Editor Notes: It is still remaining an open issue for the way that
   intent may be organized. Should the intent be a single one in a
   given AN domain with a hierarchical version, or multiple intents,
   each of which targets different Autonomic Service Agent? For now,
   the below text takes the later approach.}

   This section proposes a uniform intent format. It uses the tag-based
   format.

   Autonomic intent: The root tag for the Autonomic Network Intent.

   Intent type: It indicates the intent type, which is associated with
      a specific Autonomic Service Agent.

   Autonomic domain: It indicates the domain of the Autonomic Network.
      It is also the scope of the Autonomic Network Intent.

   Intent version: It indicates the version of the Autonomic Network
      Intent. This is an important feature for synchronization.

   Model version: The version of the model used to define the intent.

   Name: The name of the intent which describes the intent for human
      operators.

   Signature: The signature is used as a security mechanism to provide
      authentication, integrity, and non-repudiation.

   Timestamp: The timestamp of the creation of the intent using the
      format supported by the IETF [TBC].

   Lifetime: The lifetime in which the intent may be observed. A
      special case of the lifetime is the definition of permanent
      intents.

   Content: It contains the main information of the intent. It may
      include objects, policies, goals and configuration data. The
      detailed contents and formats should be defined under their
      specific situations by documents that specifies the Autonomic
      Service Agent. Within the content, there may be sub_intents.

   {Editor Notes: JSON is one of the term candidates for the Autonomic
   Network Intent format.}

5. Security Considerations

   Relevant security issues are discussed in [I-D.ietf-anima-grasp].
   The Autonomic Network Intent requires strong security environment
   from the start, because it would be great risk if the Autonomic
   Network Intent had been maliciously tampered. The Autonomic Intent
   should employ a signature scheme to provide authentication,
   integrity, and non-repudiation.

6. IANA Considerations

   This document defines one new format. The IANA is requested to
   establish a new assigned list for it.

7. Acknowledgements

   Valuable comments were received from Bing Liu and Brian Carpenter.
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   This document was produced using the xml2rfc tool [RFC2629].

8. Change log [RFC Editor: Please remove]

   draft-du-anima-an-intent-00: original version, 2015-06-11.

   draft-du-anima-an-intent-01: add intent use case section, add some
   elements for the format section, and coauthor Jeferson Campos Nobre
   and Laurent Ciavaglia, 2015-07-06.

   draft-du-anima-an-intent-02: add the intent concept section, and some
   other sections, 2015-10-14.

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