Intent Classification
draft-li-nmrg-intent-classification-01

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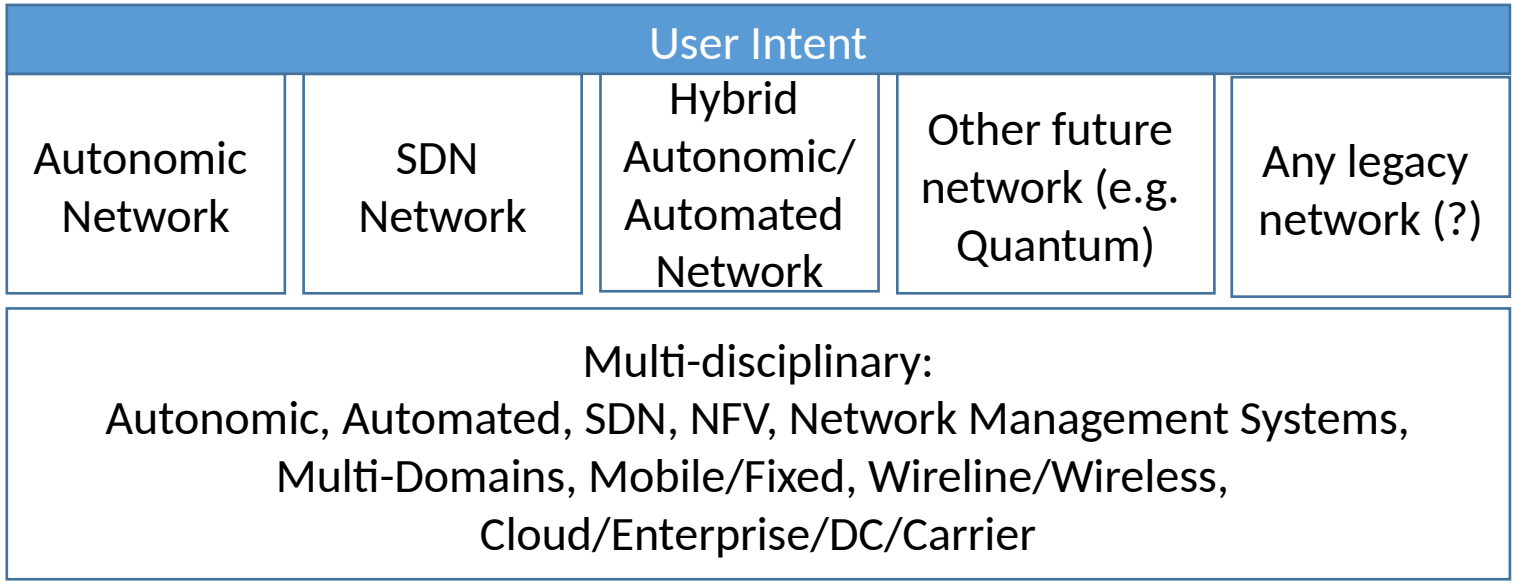
Brief Intro

- Goal: achieve agreed “Intent” related terminology and classification for NMRG, as well as guide how the term is used by other groups in IRTF/IETF, even other SDOs.

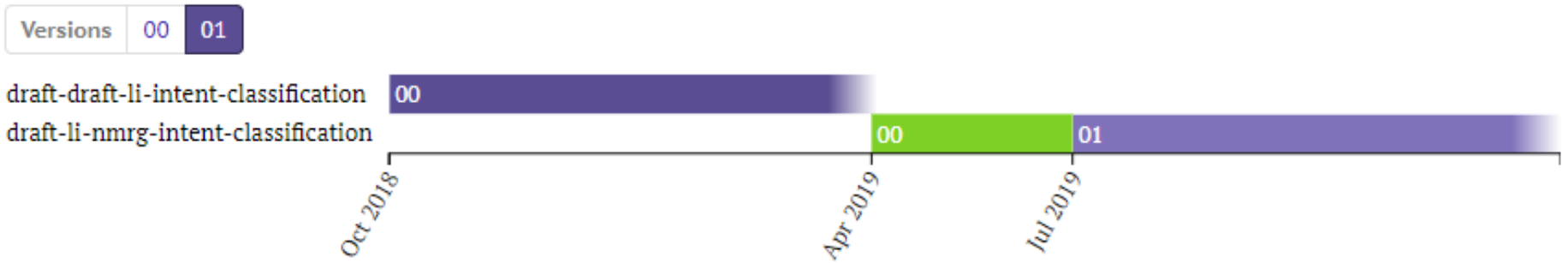
- Focus: user intents, intents definition and classification
- Scope:
  - relevant for any system or node that expects interaction with human user in the intent driven network
  - Intent driven approach is applicable to both autonomic and traditional networking, including controllers, network management systems, autonomic systems and autonomic nodes.
- Proposed classification based on:
  - Solutions, Users and their Purpose
  - When to Activate
  - Lifecycle Management Requirements
  - Granularity
- Examples were listed for each class above

Intent Classification

Intents need to be technology independent & easily transferrable; a robust system of classification will make it easier to transfer Intents, as well as easier to catalogue, search & retrieve suitable Intents



History & Update



-01 version updates:

- Addressed Brian's comments about "Management personnel, such as network Administrators, have complete knowledge of the underlying network."
- Added a table in section 3.2 with more details about solutions and intent users that intent driven networking needs to support.
- Added section 4.3 to explain the road map of network management evolution with intent.
- Added section 6 Involvement of intents in the application of AI to NM provided by Pedro.
- Moved the section of Policy Continuum after the section Functional Characteristics and Behavior.
- Updated references, contributor list, acknowledgement.
- Fixed document format and typos.

There are still some comments not addressed:

- Adding solid use cases. - Brian
- Provide a framework for further intent evolution. - Diego

➢ A new draft about intent architecture is going to address these two comments. draft-sun-nmrg-intent-framework-00

-01 version ToC

Table of Contents

Main Updates

Main Updates (1)

- Added a table in section 3.2 with more details about solutions and intent users that intent driven networking needs to support.
- Therefore, intent can be classified by users as carrier network intent, DC network intent and Enterprise network intent.

Solutions	Intent Users
Carrier Networks	Network Operator
	Service Designers
	Service Operators
	Customers/Subscribers
DC Networks	Cloud Administrator
	Underlay Network Administrator
	App Developers
	End Users
Enterprise Networks	Enterprise Administrator
	App Developers
	End Users

Main Updates (2)

Added Section 4.3 Hierarchy to explain the road map of network management evolution with intent.

In different phases of the autonomous driving network*, the intents are different. A typical example of autonomous driving network Level 0 ~ 5 (just for discussion) are listed as below.

- Level 0 - Traditional manual network: O&M personnel manually control the network and obtain network alarms and logs. – **No intent**
- Level 1 - Partially automated network: Automated scripts are used to automate service provisioning, network deployment, and maintenance. Shallow perception of network status and decision making suggestions of machine; - **No intent**
- Level 2 - Automated network: Automation of most service provisioning, network deployment, and maintenance comprehensive perception of network status and local machine decision making; **- Simple intent on service provisioning**
- Level 3 - Self-optimization network: Deep awareness of network status and automatic network control, meeting users' network intentions. – **Intent based on network status cognition**
- Level 4 - Partial autonomous network: In a limited environment, people do not need to participate in decision-making and adjust themselves. **– Intent based on limited AI**
- Level 5 - Autonomous network: In different network environments and network conditions, the network can automatically adapt to and adjust to meet people's intentions. **– Intent based on AI**

* https://www.tmforum.org/wp-content/uploads/2019/05/22553-Autonomous-Networks-whitepaper.pdf

Main Updates (3)

Added section 6 Involvement of intents in the application of AI to NM, provided by Pedro.

- One additional dimension for classification:
  - Degree of formality is an important dimension to classify intents so that users, which here are AI-based agents, can be able to choose the proper solution to consume them.
  - Have a format that avoids misconceptions as much as possible: be closer to machine language structures than natural (human) language structures.

Conclusion and Next Steps

- The current version discusses what intent means to different stakeholders, describes different ways to classify intent, and an associated taxonomy of this classification. This is a foundation for future discussion on intent related topics.

- Next steps:
  - Provide specifications for the proposed solutions - e.g. more formal definitions of categories, some prioritization, or discussion of overlap, multiple classifications.
  - Add a section briefly describing Intent work status in other SDOs, such as 3GPP, ETSI, MEF…
  - Update according to comments from mailing list and offline discussion.

- Ask for volunteers to review and contribute.
- (Ask for adoption as an RG draft if the group think it’s ready?)

Thank You

Intent Classification based on Solutions, Users and their Purpose

Intents may be classified based on solutions and users:

- Different Intent ***Solution Types*** e.g. Enterprise, Data Center
- ***Intent Users*** e.g. administrator/operator/end-user/customer/app developer/etc.

Intents may be classified based on its purpose:

- Customer network service intents *'I want to stream 4K Video to Sites A & B'*
- Network resource management intents *'Ensure Hosts in Eng don't exceed 40% avgCPU'*
- Cloud & cloud resource management intents *'I want a Safe-DNS & Firewall service with up-to-date white/blacklists'*
- Network Policy intents *'Use MPLS for Video and Internet for e-mail'*
- Task based intents *'Create new repo & give access to all leads'*
- System policies intents *'Use Host A for video & Host B for gaming'*
- etc.

Intent Classification based on When to Activate

Intent can be used to operate:

- ***Immediately*** on the target
  - E.g. *'Add firewall protection around RnD-Net'*
- ***Whenever required***
  - When some event happens: *'If an intrusion is detected, isolate all systems'*
  - Specific time in the future: *'Migrate hosts during maintenance window'*
  - Periodically at specific time: *'Scale back all servers over the weekends'*
  - When some condition occurs: *'If video quality degrades, switch to MPLS'*

Intent Classification based on Lifecycle Management Requirements

Intents can be classified into transient/persistent intents.

- If intent is ***transient***, it has no lifecycle management. As soon as the specified operation is successfully carried out, the intent is finished, and can no longer affect the target object.
  - E.g. *'Decommission host A and relocate its services'*
- If the intent is ***persistent***, it has lifecycle management (activate, monitor, correct, optimize). Once the intent is successfully activated and deployed, the system will keep all relevant intents active until they are deactivated or removed.
  - E.g. *'Don't allow hosts in Eng-NET to talk to those in Finance-NET'*

Intent Classification based on Granularity

Intents can have different granularities: high granularity, low granularity and anything in between.

- ***High granularity intents*** are more complex to design but are the most valuable. Intent translation, intent conflict resolution and intent verification are very complex and require advanced algorithms. Examples: e2e network service, like customer network service over physical & virtual network, over access, metro, dc and wan with all related QoS, security and application policies.
  - E.g. *'ensure the service quality for 720p video transmission to user A'*
- ***Low granularity intents***, like some path checks (can A talk to B) or individual network service/network/application/user policies, are the least complex. Their intent translation, intent conflict resolution and intent verification are much simpler than for high granularity intents.
  - E.g. *'ensure packet loss rate between device B to C is no higher than x%'*

Policy Continuum, Abstracted Intent Operation, Policy Targets and Policy Scope

- Policy Continuum for defining different types of Actors and their characteristics
- Intent Context / Capabilities / Constraints:
  - Context selects policies based on applicability
  - Capabilities describe the functionality provided by the policy
  - Constraints restrict the capabilities offered and/or the behaviour of the policy
- Policy Target is a set of managed objects which may be affected in the policy enforcement.
- Policy Scope (solutions, users)