Intent-Based Network Management Automation in 5G Networks
(draft-jeong-nmrg-ibn-network-management-automation-03)

November 10, 2023
Prague

Jaehoon (Paul) Jeong
Department of Computer Science and Engineering, SKKU
Email: pauljeong@skku.edu
• The goal of this draft [1] is to make a use case of IBN for 5G network management.
  • The common part of the definitions of Intent from IETF NMRG and 3GPP [2-6] is used for IBN.

• The following work items will be investigated:
  • A framework for 5G intent-based network management,
  • A data model mapper between an intent data model and a policy data model,
  • An intent translator from an intent to a policy,
  • A closed-loop control for intent assurance, and
  • A network audit system for secure intent provisioning.
Suggestion for NMRG Use Cases

• NMRG can work for guidelines for an intent translator and closed-loop control mechanism for demands from other SDOs (3GPP, ETSI, ITU-T) such as
  • 5G core network management (e.g., network slicing, SRv6 routing, and fault recovery),
  • Internet of Things (IoT) device management, and
  • V2X vehicular network management (for terrestrial vehicles, Urban Air Mobility (UAM), and drones).

• NMRG can use the Security Policy Translator (SPT) of I2NSF WG as a reference:
• Intent [2] can be used for management and control of closed-loop automation.

• Intent User provides an intent to the Controller, which will be translated to configure the 5G Networks.

• Then the NWDAF can monitor and collect data from the 5G Networks to analyze the performance.

• Feedback will be given to adjust the 5G Networks to ensure the performance is up to the intent of the user.
• Intent Translation

1. Extract: Verify an intent [1,2] given by IBN User and extract data.

2. Convert: Transform the extracted intent data to the corresponding policy data and select the proper Network Functions to apply the policy.

3. Generate: Producing a policy in a JSON format to be delivered to the selected Network Function (e.g., NEF).
SKKU, SSU, and ETRI are working for an Intent-Based Network Management Automation for 5G Networks.

- Intent-Based Network Management Automation in 5G Networks [1]
- They have an experience of having developed a Security Policy Translator (SPT) in the I2NSF WG:
  - [Open Source] https://github.com/jaehoonpaul/i2nsf-framework

The above draft [1] specifies the following:

- The Framework of Intent-Based Network Management in 5G networks.
- A Network Intent Translator (NIT) (with data model mapper) from an intent to a policy.
- A Network Audit System for remote attestation of network functions
- A Use Case of IoT device data aggregation in 5G networks
Intent-Based Network Management Automation (3/7)

- 5G Intent-Based Network Management Framework
• Automatic Mapping of Intent and Policy Data Models

Intent Data Module  Policy Data Module

Data Model Mapper

Mapping Model (Data Model Mapping Table)

NSF Database
• Network Intent Translator (NIT)
  • Translates Network Intent into Network Policy.
Intent-Based Network Management Automation (6/7)

- Network Audit System for Activity Auditing
# IoT Device Data Aggregation Policy Enforcement and Reporting

**Case 1: NSFs available: Go to Policy Generation**

**Case 2: NSFs unavailable (START)**

**Case 2: NSFs unavailable (END)**

**Translation: Data Extraction & Data Conversion**

<table>
<thead>
<tr>
<th>IBN User</th>
<th>IBN Controller</th>
<th>Vendor’s Mgmt System</th>
<th>Cloud (or Edge Server)</th>
<th>NSF1 (IoT Device)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Network Intent Request
- NSF Query Request
- NSF Initiation Request
- NSF Initiation Response
- NSF Query Response
- NSF Configuration

**Network Policy Request**

**Network Policy Response**

<table>
<thead>
<tr>
<th>IBN User</th>
<th>IBN Controller</th>
<th>IBN Analyzer</th>
<th>NSF1 (IoT Device)</th>
<th>NSF2 (IoT Device)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Sensing Data
- Sensing Data Aggregation
- Sensing Report
- Policy Update (or Generation)
- Updated (New) Network Policy Request
- Updated (New) Network Policy Response
- NSF (Re)Configuration
Intent Types

• Intent Types
  • **Network Intent**: e.g., throughput and E2E delay
  • **Application Intent**: e.g., configuration for applications

• Examples of Intents
  • **Network Intent**: Two IoT devices at SKKU IoT Lab in Suwon get 1Mbps and 50ms delay for environmental monitoring.
  • **Application Intent**: SKKU IoT Lab’s IoT devices measure light & temperature, and report them to an IoT server every 5 min.
Intent: Two IoT Devices at SKKU IoTLab in Suwon get 1Mbps and 50ms delay for environment monitoring.

SKKU 5G Testbed (2/2)

[Image of Core Network diagram with Intent User and Intent Controller]

5G Core Network and gNodeB

Core Network with Intent User and Intent Controller

[Image of User Equipment (UE) as IoT Devices]

User Equipment (UE) as IoT Devices

[Link to IETF-118 NMRG Hackathon Project]
Next Steps

• Is this draft valuable to work on it in NMRG?

• If so, may this draft be adopted as an RG item now? Or is it needed to develop this draft more?

• In this IETF-118 NMRG hackathon project, we showed the feasibility of 5G Testbed.
  • We will work on 5G Testbed to support Intent-Based Network Management Automation at IETF 119.

• We welcome your comments and feedback 😊
References


