IETF-121 Hackathon

Interface to In-Network Functions (I2INF) Project

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Champion: Jaehoon (Paul) Jeong

Members: **Yoseop Ahn**, Bien Aime Mugabarigira, Mose Gu, Jiwon Suh, and Juwon Hong

Department of Computer Science and Engineering at SKKU

Email: {pauljeong, ahnjs124, bienaime, rna0415, sjw6136, hongju2024}@skku.edu

Why is This Work important?

- **Advancement of Network Technologies and Emergence of Various Network Technologies**
  - **Increasing complexity and cost of network management**

- **According to Cisco 2024 Global Networking Trends Report**
  - **75% of network administrators feel limitations of manual network management.**
  - **Over 60% of IT leaders plans to introduce network automation solution with Artificial Intelligence (AI).**

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Professors:

- Jaehoon (Paul) Jeong (SKKU)
- Younghan Kim (SSU)
- Yong-Geun Hong (DJU)
- Joosang Youn (DEU)
- Yiwen (Chris) Shen (AJU)

Researchers:

- Jung-Soo Park (ETRI)
- Yunchul Choi (ETRI)
- Jun Ho Ko (TTA)

Students:

- Yoseop Ahn (SKKU)
- Bien Aime Mugabarigira (SKKU)
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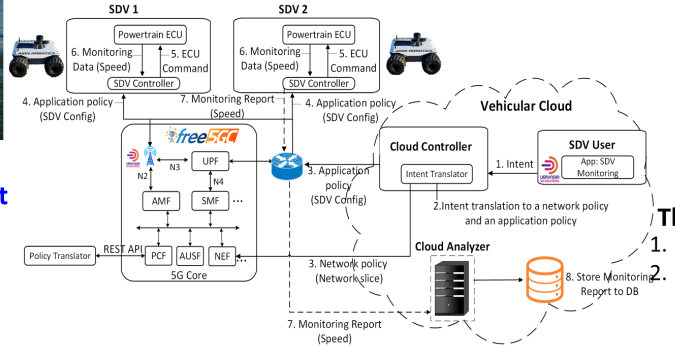
- Juwon Hong (SKKU)
- Jiwon Suh (SKKU)
- Nobuo Aoki (SOKENDAI)

Architecture



Objectives

- To demonstrate Interface to In-Network Functions (I2INF).
- To set up a comprehensive framework for intent-based management of networks, security, and applications in Software-Defined Vehicles (SDVs) within 5G networks.

Future Work

- The designd and implementation of an intent translator is required for correct and efficient intent translation.
- The construction of data analytics models (e.g., Machine Learning and Deep Learning models) for on-line diagnosis of SFs in SDVs for safety and security.

What to pull down to set up an environment:

- OS: Ubuntu 18.04
- Free5GC VM: version 3.4.1
- UERANSIM VM (UE & RAN): version 3.2.6
- ROS version: Melodic
- GitHub Repository: https://github.com/jaehoonpauljeong/I2INF

The Workflow of the 5G-Based I2INF Testbed

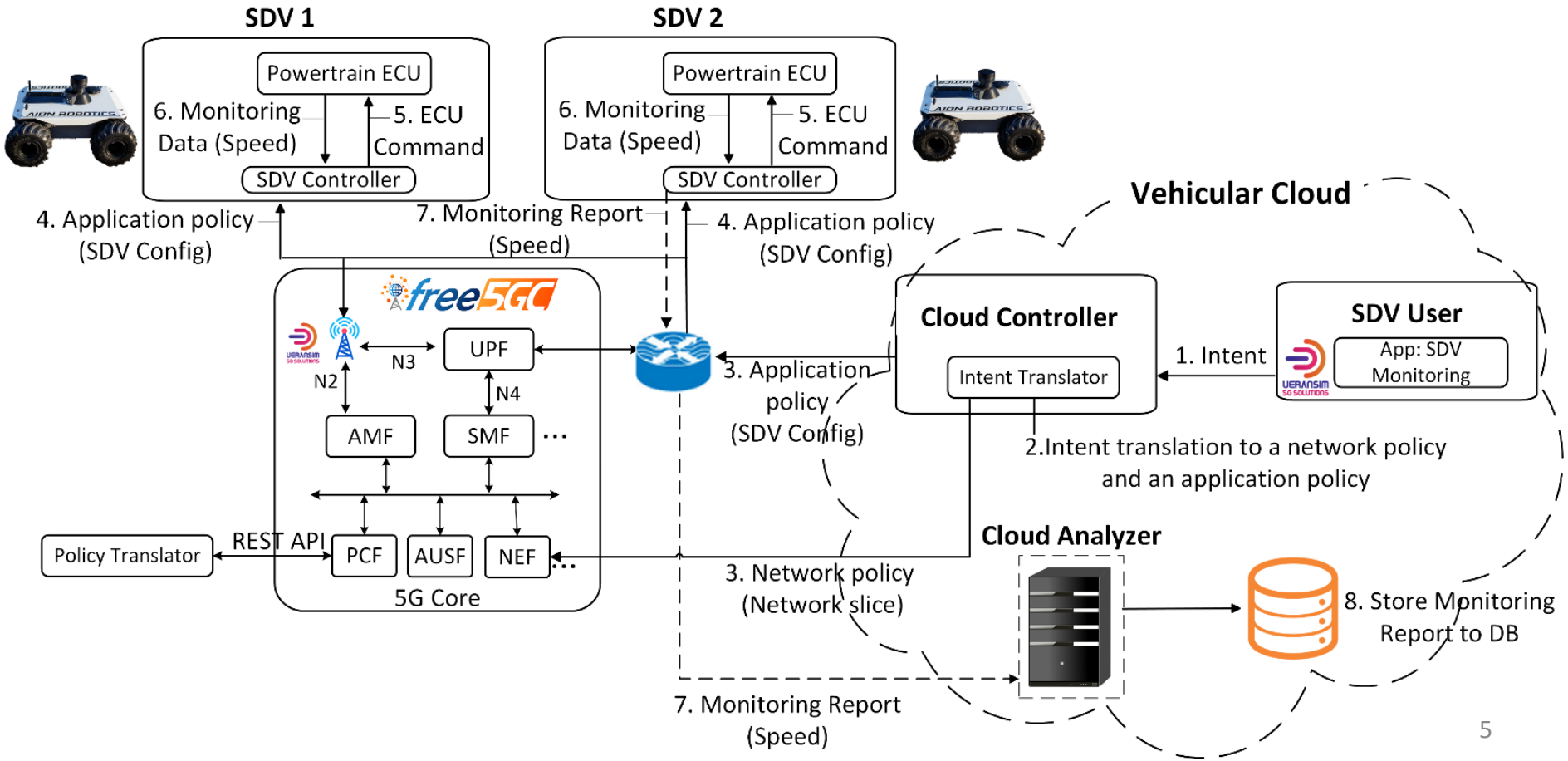
1. SDV User sends an intent to the Cloud Controller.
2. The intent is translated into Network and Application Policies by Intent Translator within the Cloud Controller.
3. The translated Network Policy is delivered to the 5G core network components.
4. The translated Application Policy for SDV configuration is delivered to the target SDV Controllers.
5. Each SDV Controller applies the received application policy to the Powertrain ECU, adjusting the vehicle's operational parameters accordingly.
6. The SDVs monitor operational data (e.g., speed and direction), and send this data to their SDV Controllers.
7. The SDV Controllers compile this data into monitoring reports, which are then sent to the Cloud Analyzer.
8. The Cloud Analyzer processes the monitoring reports to evaluate the functionality and performance of the applied policies and store it in the database for analysis.

Goal of Hackathon Project

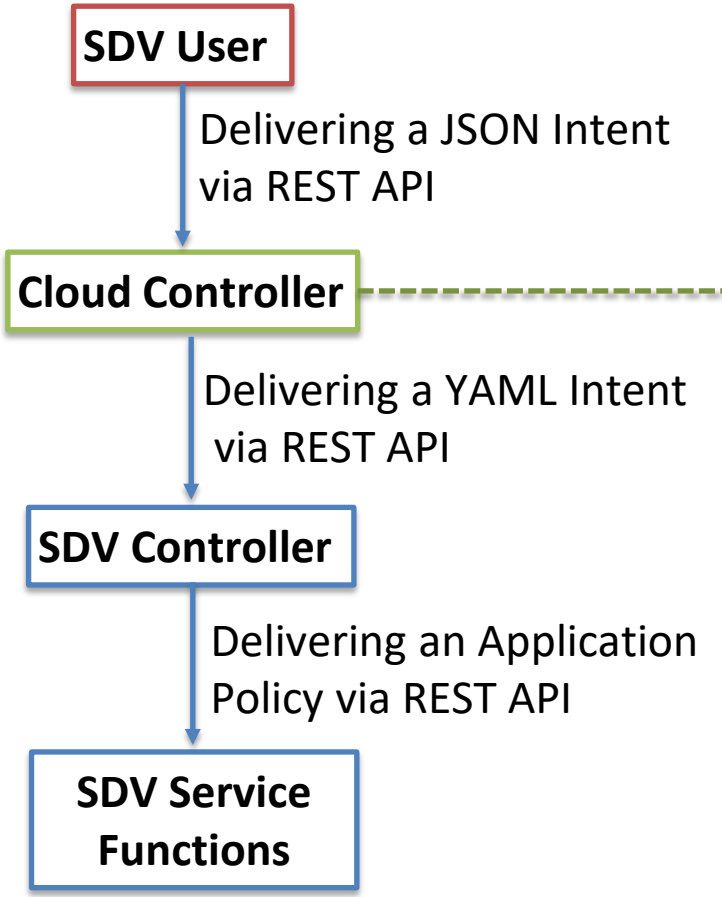
- The goal is to demonstrate the Feasibility of Intent Translation in Interfaces to In-Network Functions (I2INF) and its Framework.
  - **Intent Translation** and **Policy Provisioning**
    - Creation of a YAML Intent based on 3GPP 28.312 and its Deliverance to Software-Defined Vehicles (SDVs).

- Internet Drafts for the I2INF Project
  - https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2inf-problem-statement/
  - https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2inf-framework/
  - https://datatracker.ietf.org/doc/draft-jeong-opsawg-intent-based-sdv-framework/

Interface to In-Network Functions (I2INF) for SDVs



Flow Diagram of Intent Translator



Cloud Controller

Intent Translator

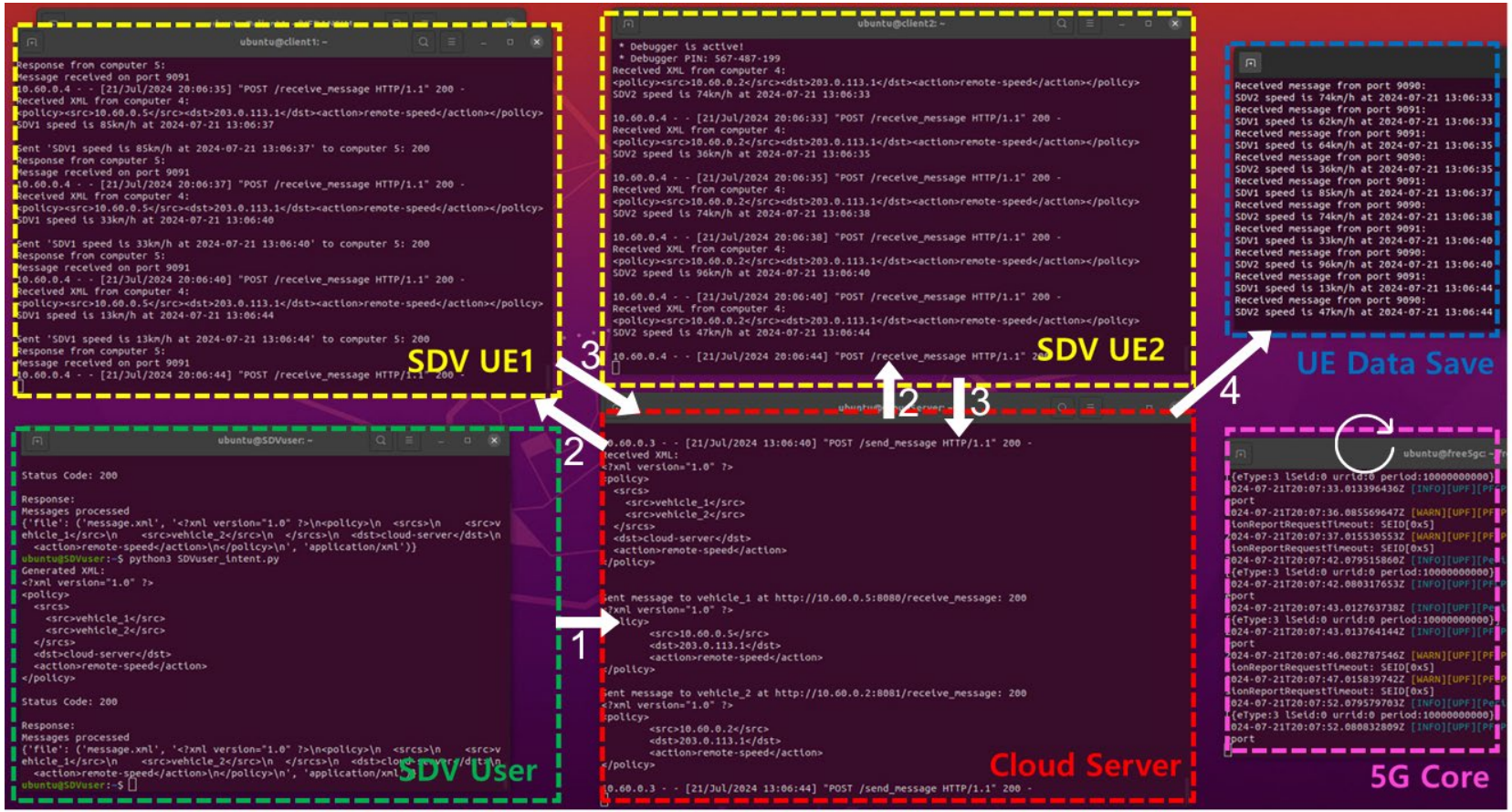
- **Step 1:** extracts attributes from a high-level JSON intent sent by SDV User (i.e., administrator).
- **Step 2:** translates the JSON intent into a YAML intent based on rules.
- **Step 3:** transmits the YAML intent into SDV Controller

What we learned

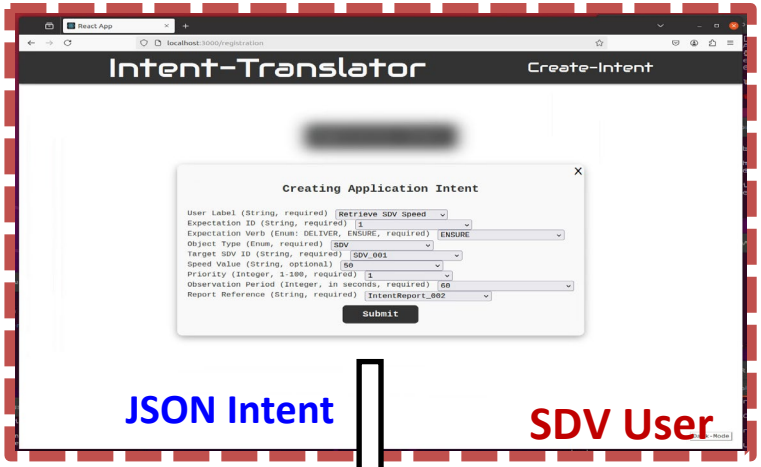
- We implemented an Intent Translator for I2INF Framework for Software-Defined Vehicles (SDV) in Wireless Networks.

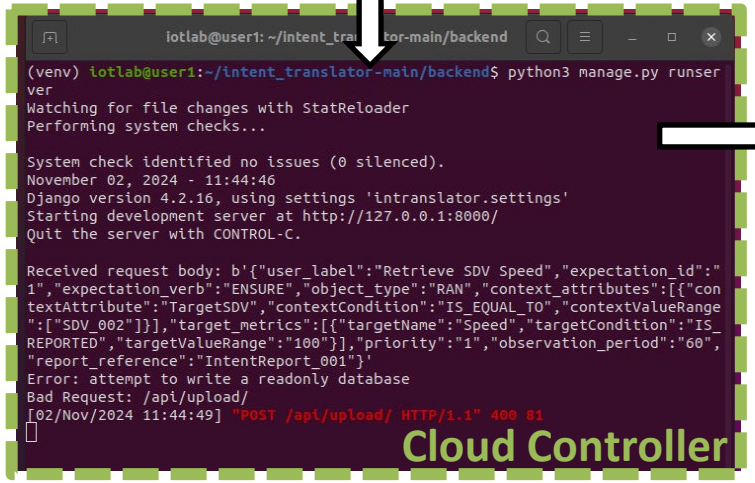
- We demonstrated Intent-Based Networking (IBN) for the configuration and monitoring of SDVs through the I2INF Framework.

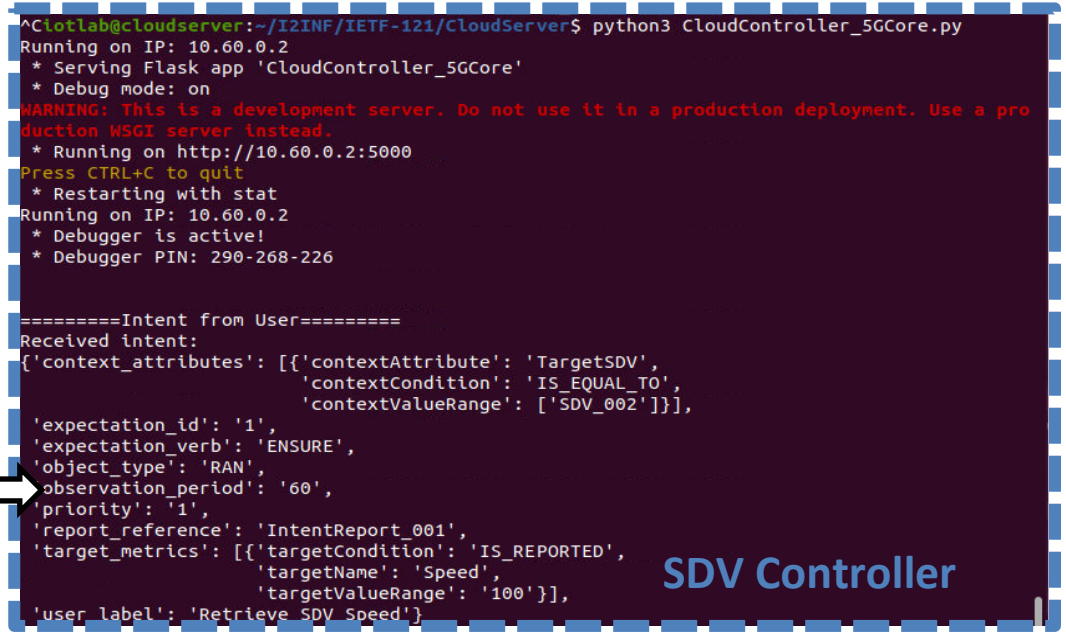
Demonstration of an I2INF Framework



Demonstration of an Intent Translator



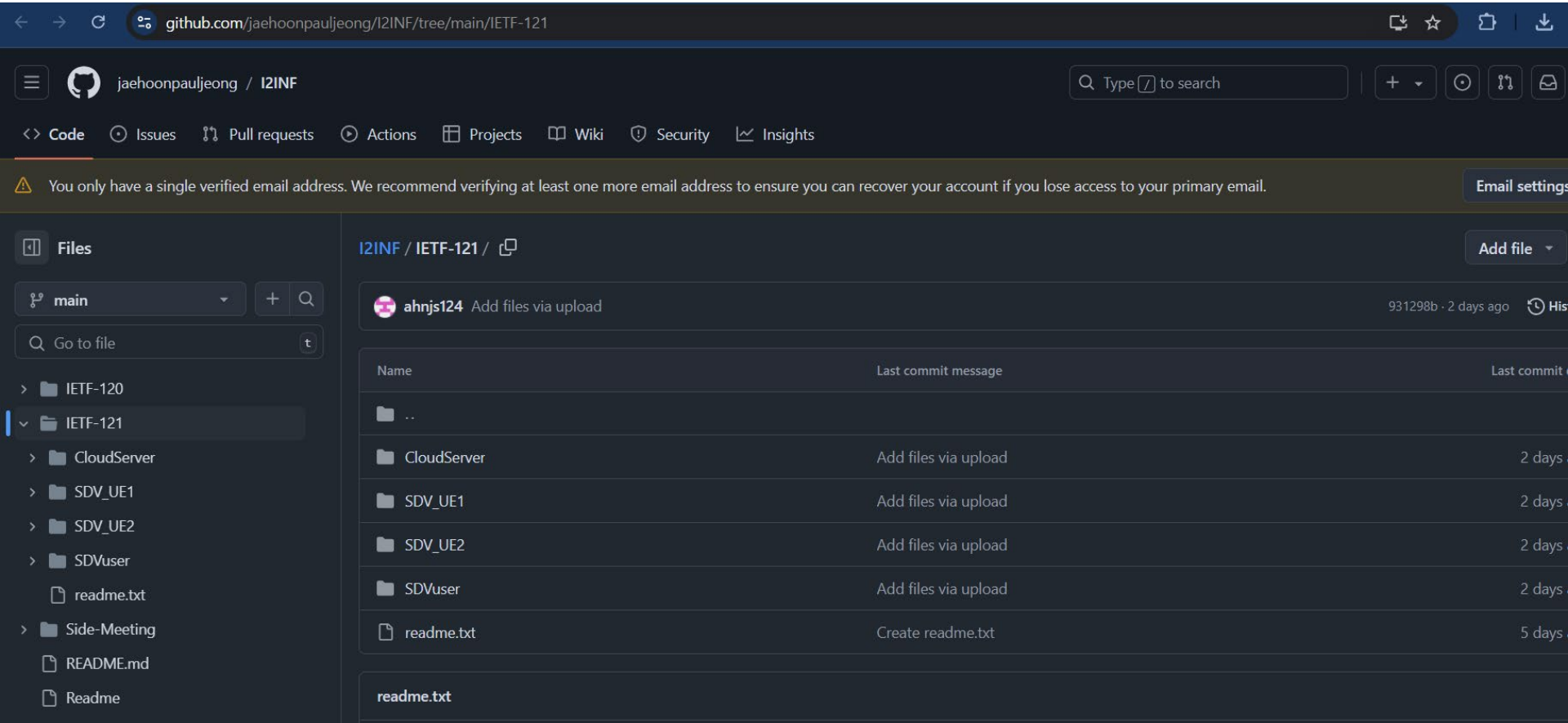




YAML Intent

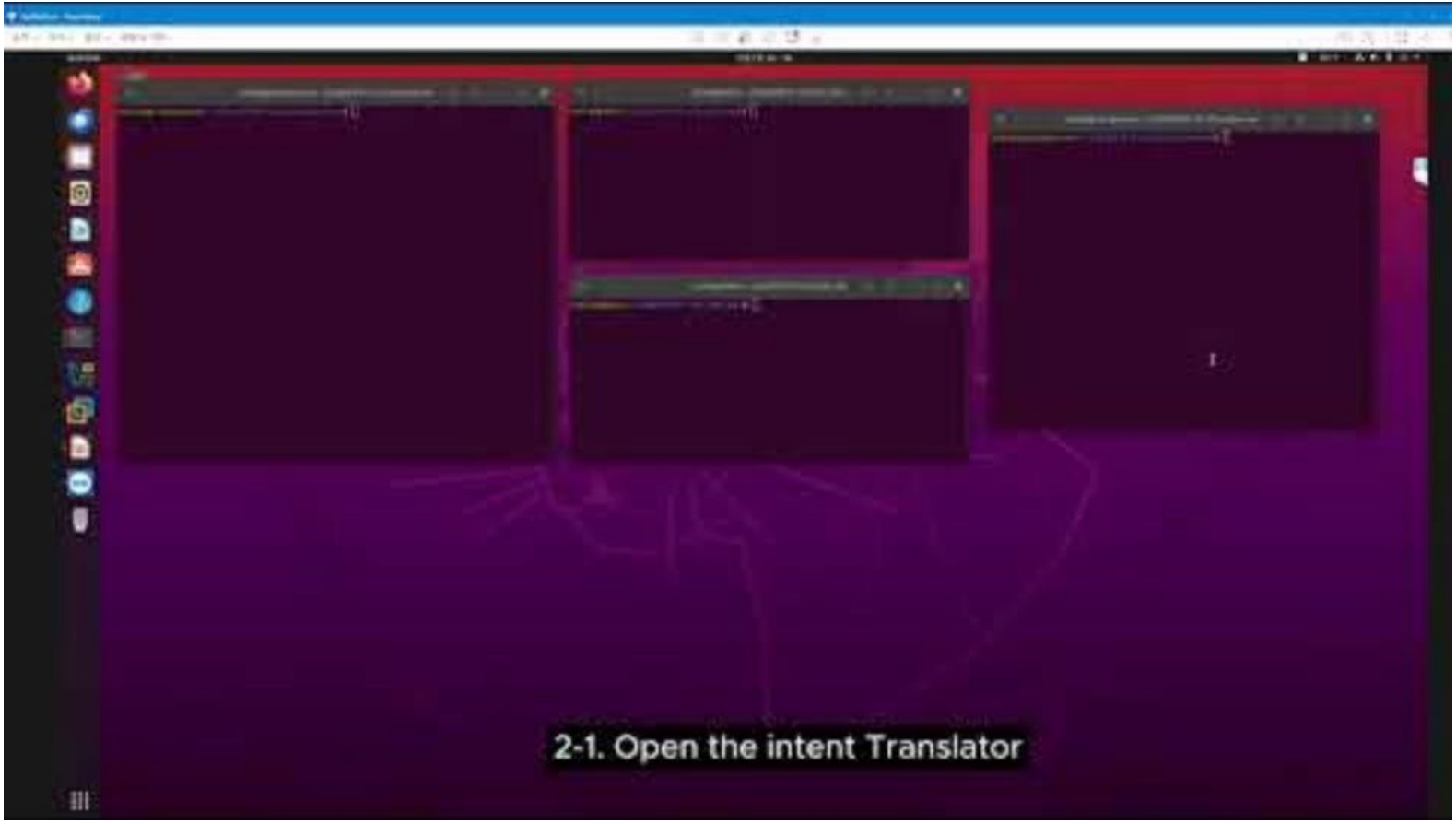
Open-Source Project for I2INF

[URL] https://github.com/jaehoonpauljeong/I2INF/tree/main/IETF-121



Demonstration Video Clip for I2INF

[URL] https://www.youtube.com/watch?v=AAGVGPl6E9s&ab_channel=Joseph



Next Steps

- We learned how to design and implement **an Intent Translator** for the I2INF Framework for **IBN-Based System** in wireless networks.

- In IETF 122, we will develop **an Intent Translator** that advances from a Rule-based scheme to an AI-based scheme (e.g., Large Language Model: LLM).

- Also, we will design **YANG Data Models for the Main I2INF Interfaces.**
  - Refer to https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2inf-framework/

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Hackathon Team Photo