



# IETF-122 Hackathon



## Interface to In-Network Computing Functions (I2ICF) Project

March 15-21, 2025, Bangkok

Champion: Jaehoon (Paul) Jeong

Members: [Xudong Wang](#), Yoseop Ahn, Byoungman Robert An

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Champion: Jaehoon (Paul) Jeong (SKKU)



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### Professors:

- Jaehoon (Paul) Jeong (SKKU)
- Yiwen (Chris) Shen (AJU)

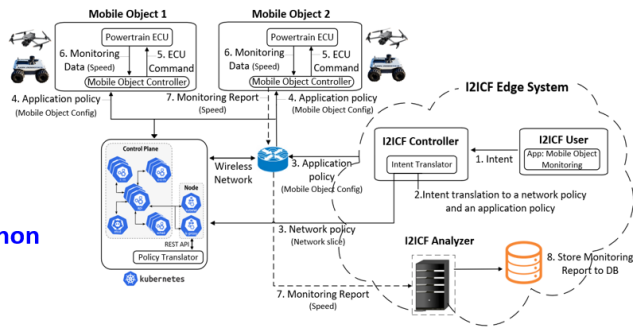
### Researchers:

- Jung-Soo Park (ETRI)
- Yunchul Choi (ETRI)
- Byoungman Robert An (KETI)

### Students:

- Yoseop Ahn (SKKU)
- Xudong Wang (SKKU)
- Bien Aime Mugabarigira (SKKU)
- Mose Gu (SKKU)
- Juwon Hong (SKKU)
- Jiwon Suh (SKKU)

### Architecture



### What to pull down to set up an environment:

- OS: Ubuntu 18.04 & 20.04
- Kubernetes: Microk8s v1.32.2
- ROS version: Melodic
- GitHub Repository:  
<https://github.com/jaehoonpauljeong/I2ICF/tree/main/IE TF-122>

### Workflow of the I2ICF Testbed on Kubernetes

- I2ICF User sends an intent to the I2ICF Controller.
- The I2ICF Controller's Intent Translator converts the intent into Network and Application Policies.
- The translated Network Policy is forwarded to the wireless network components.
- The translated Application Policy for Mobile Object configuration is sent to each Mobile Object Controller.
- Each Mobile Object Controller enforces the received application policy on the Powertrain ECU, adjusting the operational parameters as needed.
- The Mobile Objects continuously monitor operational data (e.g., speed and direction) and transmit it to their Mobile Object Controllers.
- The Mobile Object Controllers set this data into Monitoring Report and forward them to the I2ICF Analyzer.
- The I2ICF Analyzer processes the monitoring report to assess the performance of the applied policies and stores the results in a database for further analysis.

### Objectives

- To demonstrate Interface to In-Network Computing Functions (I2ICF).
- To build a comprehensive framework for intent-based management of networks, security, and applications in Mobile Objects (e.g., SDV and Drone) within the Kubernetes environment.

### Future Work

- We plan to use In-Context Learning and Prompt Tuning to design and implement the intent translator.
- The development of data analytics models, including Machine Learning and Deep Learning, for real-time diagnosis of Service Functions (SFs) in Mobile Objects to enhance safety and security.

# Goal of Hackathon Project

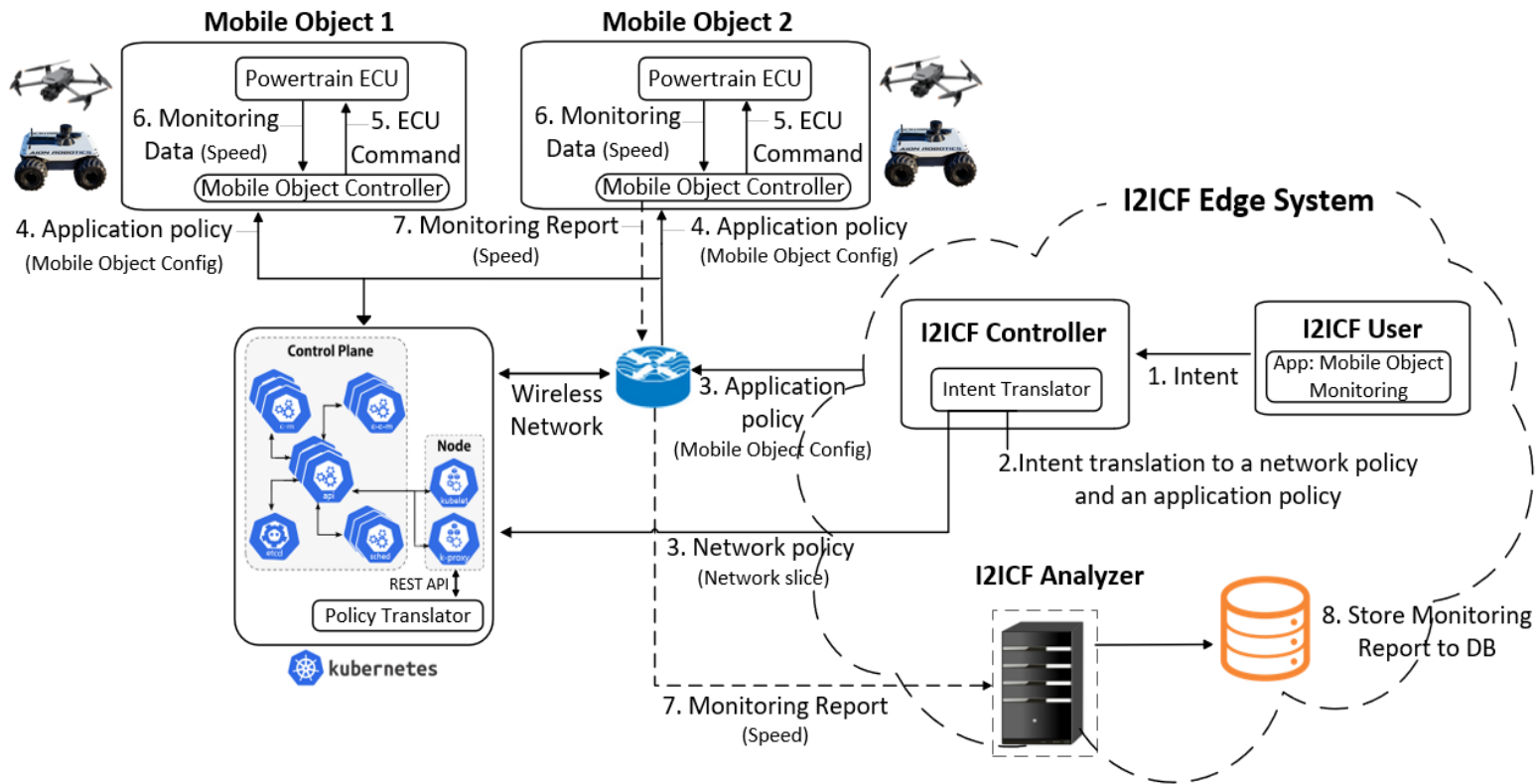
- The goal is to showcase Feasibility of Intent Translation in Interfaces to In-Network Computing Functions (I2ICF) and its Framework.
  - **Intent Translation** and **Policy Provisioning**
    - Creation of a YAML Intent based on 3GPP 28.312 and its Deliverance to Mobile Objects.
- Internet Drafts for the I2ICF Project
  - <https://datatracker.ietf.org/doc/draft-ahn-opsawg-i2icf-cits/>
  - <https://datatracker.ietf.org/doc/draft-ywj-opsawg-i2icf-data-center-networking/>
  - <https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-framework/>
  - <https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-problem-statement/>

# I2ICF Technical Architecture

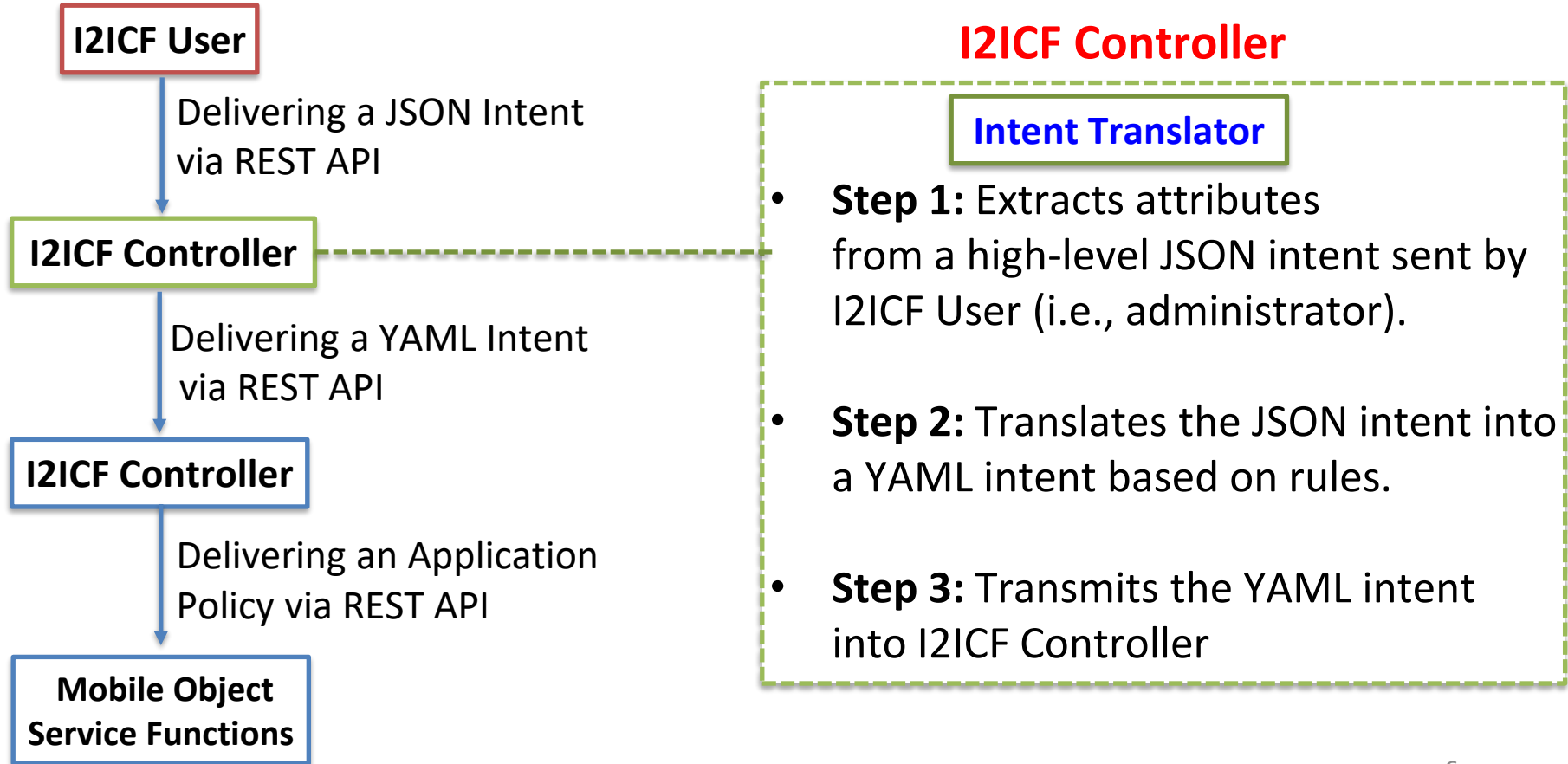
- Intent Translator processes high-level intents and converts them into YAML format.
- I2ICF Controller manages intent-based networking configurations.
- REST API facilitates communication between components.
- Kubernetes orchestrates I2ICF services for scalability and reliability.



# Interface to In-Network Computing Functions (I2ICF) for Mobile Objects



# Flow Diagram of Intent Translator



# What we learned

- We implemented **an Intent Translator for I2ICF Framework for Mobile Objects** in Wireless Networks.
- We demonstrated **Intent-Based Networking (IBN)** for the configuration and monitoring of **Mobile Objects** through the I2ICF Framework.

The figure displays two screenshots of the Kubernetes Dashboard interface.

**Left Screenshot: Services Page**

- Navigation:** Service > Services
- Workloads:** Cron Jobs, Daemon Sets, Deployments, Jobs, Pods, Replica Sets, Replication Controllers, Stateful Sets
- Services List:**

Name	Service
analyzer	analyzer
sdv	sdv
controller	controller
user	user
kubernetes	kubernetes

**Right Screenshot: Pods Page**

- Navigation:** Workloads > Pods
- CPU Usage Graph:** A line graph showing CPU usage (cores) over time (20:59 to 21:10). The usage is relatively stable, fluctuating between approximately 0.5 and 1.0 cores.
- Pods Table:**

Name	Images	Labels
analyzer-b796c65c5-j5mtx	analyzer-service	app: analyzer pod-template-hash: b796c65c5
user-7b7bd97866-8dcj	user-service	app: user pod-template-hash: 7b7bd97866
sdv-7d74f468cd-d9vvh	sdv-service	app: sdv pod-template-hash: 7d74f468cd
controller-74b8ffc55c-	controller-service	app: controller pod-template-hash: 74b8ffc55c

```

Logs from user-service in user-7b7bd978...

Status Code: 200

Resp
Mess
Gene
Logs from controller-servi... in controller-74b8...

{"us =====Intent from User=====

Stat Recei
Resp {'con
Mess
Gene
Logs from analyzer-service in analyzer-b796c...

{"us 'exp <pre class="line before"><span class="ws"> </span>
Stat 'exp <pre
Resp 'obj <pre
Mess 'obs <pre
Gene 'pri <pre
{"us 'rep <pre
Stat 'tar <pre

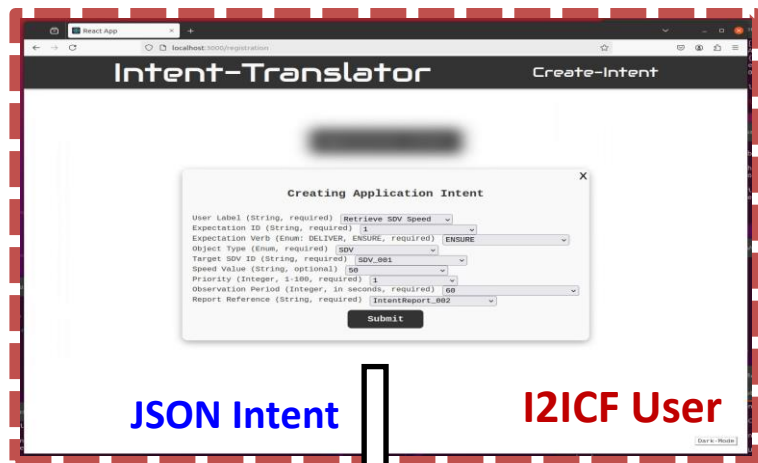
=====new message start=====
<pre Received XML from SDVUser:
<pre <?xml version="1.0" ?>
<pre <policy>
'use <pre <src>10.152.183.240</src>
<pre </div><dst>203.50.23.1</dst>
<pre </ul><action>remote-speech</action>
<pre </policy>
SDV1 speed is 70km/h and location is at 2025-03-16 13:19:49
=====new message start=====

```

8



# Demonstration of an Intent Translator



The screenshot shows a web browser window titled "Intent-Translator" with a "Create-Intent" tab. A modal window titled "Creating Application Intent" is open, displaying a form with the following fields:

- User Label (String, required): Retrieve SDV Speed
- Expectation ID (String, required): 1
- Expectation Verb (Enum, required): ENSURE
- Object Type (Enum, required): SDV
- Target SDV ID (String, required): SDV\_001
- Speed Value (String, optional): 50
- Priority (Integer, 1-100, required): 1
- Observation Period (Integer, in seconds, required): 60
- Report Reference (String, required): IntentReport\_002

A "Submit" button is at the bottom of the form.

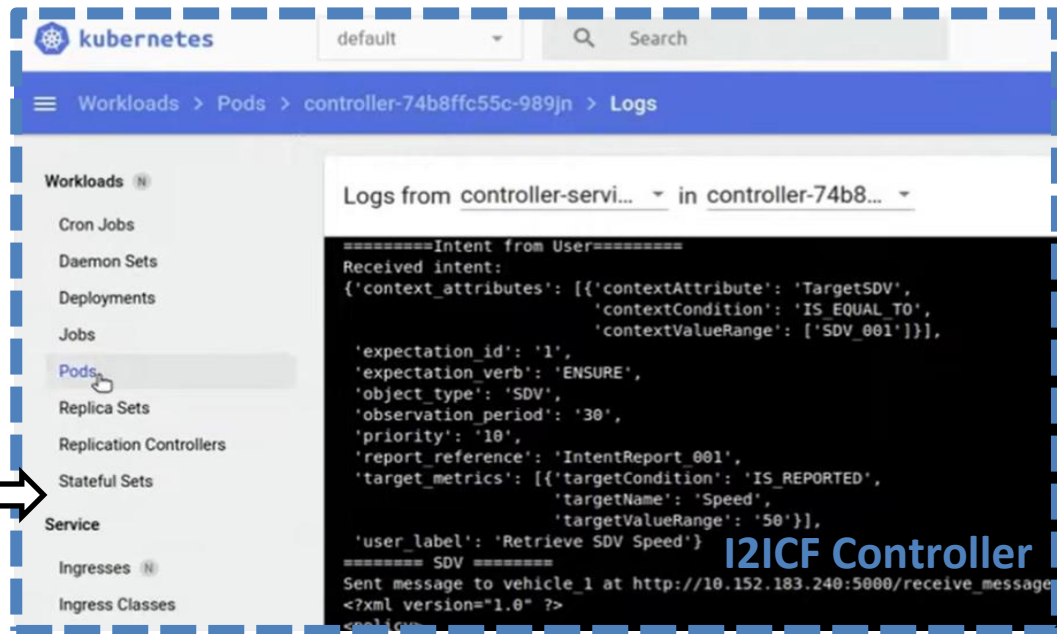
JSON Intent

I2ICF User



The screenshot shows the Kubernetes dashboard with the "Pods" tab selected. The logs for the pod "user-7b7bd9786-8dcj9" are displayed. The logs show a sequence of messages processed by the user-service, including "Generated Intent Data" and "Status Code: 200".

I2ICF Controller



The screenshot shows the Kubernetes dashboard with the "Pods" tab selected. The logs for the pod "controller-74b8fc55c-989jn" are displayed. The logs show a sequence of messages processed by the controller, including "Received intent:" and "Sent message to vehicle\_1 at http://10.152.183.240:5000/receive\_message".

I2ICF Controller

YAML Intent

# Open-Source Project for I2ICF

[URL] <https://github.com/jaehoonpauljeong/I2ICF/tree/main/IETF-122>

The screenshot shows the GitHub web interface for the repository `jaehoonpauljeong / I2ICF`. The page is viewed on the `main` branch, specifically the `IETF-122` directory. The left sidebar shows the file tree with `IETF-122` selected. The main content area displays a table of files and folders in the `IETF-122` directory, including `Analyzer`, `Controller`, `SDV`, `User`, `readme.txt`, and `Side-Meeting`. The `readme.txt` file is selected, showing its content: "This is the IETF-122 Hackathon Project for IETF-122 Hackathon."

github.com/jaehoonpauljeong/I2ICF/tree/main/IETF-122

Product Solutions Resources Open Source Enterprise Pricing

jaehoonpauljeong / I2ICF (Public)

Code Issues Pull requests Actions Projects Security Insights

Files

main

Go to file

- BoF
- IETF-120
- IETF-121
- IETF-122**
  - Analyzer
  - Controller
  - SDV
  - User
  - readme.txt
- Side-Meeting

README.md

Readme

I2ICF / IETF-122

ahnjs124 Add files via upload

Name	Last commit message
..	
Analyzer	Add files via upload
Controller	Add files via upload
SDV	Add files via upload
User	Add files via upload
readme.txt	Create readme.txt

readme.txt

This is the IETF-122 Hackathon Project for IETF-122 Hackathon.

[URL] <https://www.youtube.com/watch?v=hZgnWlQzXbE>

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# Next Steps

- We explored the implementation and design of **an Intent Translator** for the I2ICF Framework within **IBN-Based System** in wireless networks.
- In IETF 123, we will develop **an Intent Translator** that advances from a Rule-based scheme to an AI-based scheme (e.g., Large Language Model: LLM) on Kubernetes Container Orchestration System.
- Also, we will design **YANG Data Models for the Main I2ICF Interfaces**.
  - Refer to <https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-framework/>

# I2ICF Hackathon Team

- **Professors:**
  - Jaehoon (Paul) Jeong (SKKU)
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## Hackathon Team Photo

