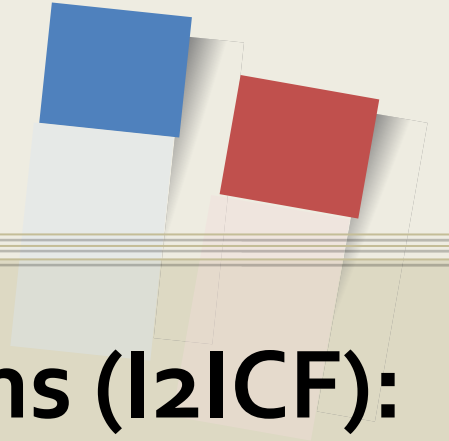# IETF-123 I2ICF Side Meeting

# Interface to In-Network Computing Functions (I2ICF): Problem Statement
## ([draft-jeong-opsawg-i2icf-problem-statement-00](draft-jeong-opsawg-i2icf-problem-statement-00))

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Madrid in Spain

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# Introduction to I2ICF

❑ **Interface to In-Network Computing Functions (I2ICF)**

  ❑ I2ICF aims at making **a Framework** and **Interfaces** for <u>configuring and monitoring</u> **Moving Objects** (e.g., [Robotic AI Agents](#)) by a user in Cloud.

    ❑ **In-Network Computing Functions (ICF) within Moving Objects**

      ■ **Perception Functions, Reasoning Functions, Action Functions, and Autonomy Functions**

    ❑ [draft-jeong-opsawg-i2icf-problem-statement-00](#)

  ❑ I2ICF will work on the standardization of **Interface YANG Data Models**:

    ❑ Capability of an In-Network Computing Function (ICF) as Service Function

    ❑ Registration Interface, Consumer-Facing Interface, Service Function-Facing Interface, and Monitoring Interface

# Service Functions of Moving Objects



**Robot Car**



**Drone**

❑ **Perception Functions:** Sensing by Sensors (e.g., Camera)

❑ **Reasoning Functions:** AI Inference

❑ **Action Functions:** Message Delivery (e.g., Camera Video Data), Moving Robot, and Transaction (e.g., Logging and Monitoring Data Delivery)

❑ **Autonomy Functions:** Autonomous Navigation and Actuation

# Goal of I2ICF Group

- ❑ **Goal:** Standardization of **I2ICF for Computing in the Network**
  - ▪ **I2ICF Problem Statement**
    - ▪ [https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-problem-statement/](https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-problem-statement/)
  - ▪ **I2ICF Framework**
    - ▪ [https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-framework/](https://datatracker.ietf.org/doc/draft-jeong-opsawg-i2icf-framework/)
  - ▪ **I2ICF Use Case**: Intelligent Transportation Systems
    - ▪ [https://datatracker.ietf.org/doc/draft-ahn-opsawg-i2icf-cits/](https://datatracker.ietf.org/doc/draft-ahn-opsawg-i2icf-cits/)
  - ▪ **I2ICF Intent Translator**
    - ▪ [https://datatracker.ietf.org/doc/draft-gu-nmrg-intent-translator/](https://datatracker.ietf.org/doc/draft-gu-nmrg-intent-translator/)

# Motivation of this Draft

❑ **Motivation of I2ICF Problem Statement**

- This draft <u>defines</u> the In-Network Computing Functions (ICFs) and Problems for Interface to In-Network Computing Functions (I2ICF).

- This draft <u>investigates</u> the need for <u>a standard framework with the interfaces for ICFs within a Moving Object</u>, in terms of applications with the need to run AI services by multi-vendor ICFs.

  - AI can enable the creation of dynamic, adaptable network/security/AI policies for Moving Objects.

  - AI can learn from telemetry data collected from those Moving Objects and react to the those monitoring data for the requested services with them.

# A Service Scenario for Robotic AI Agents:
## IETF-123 I2ICF Hackathon Project
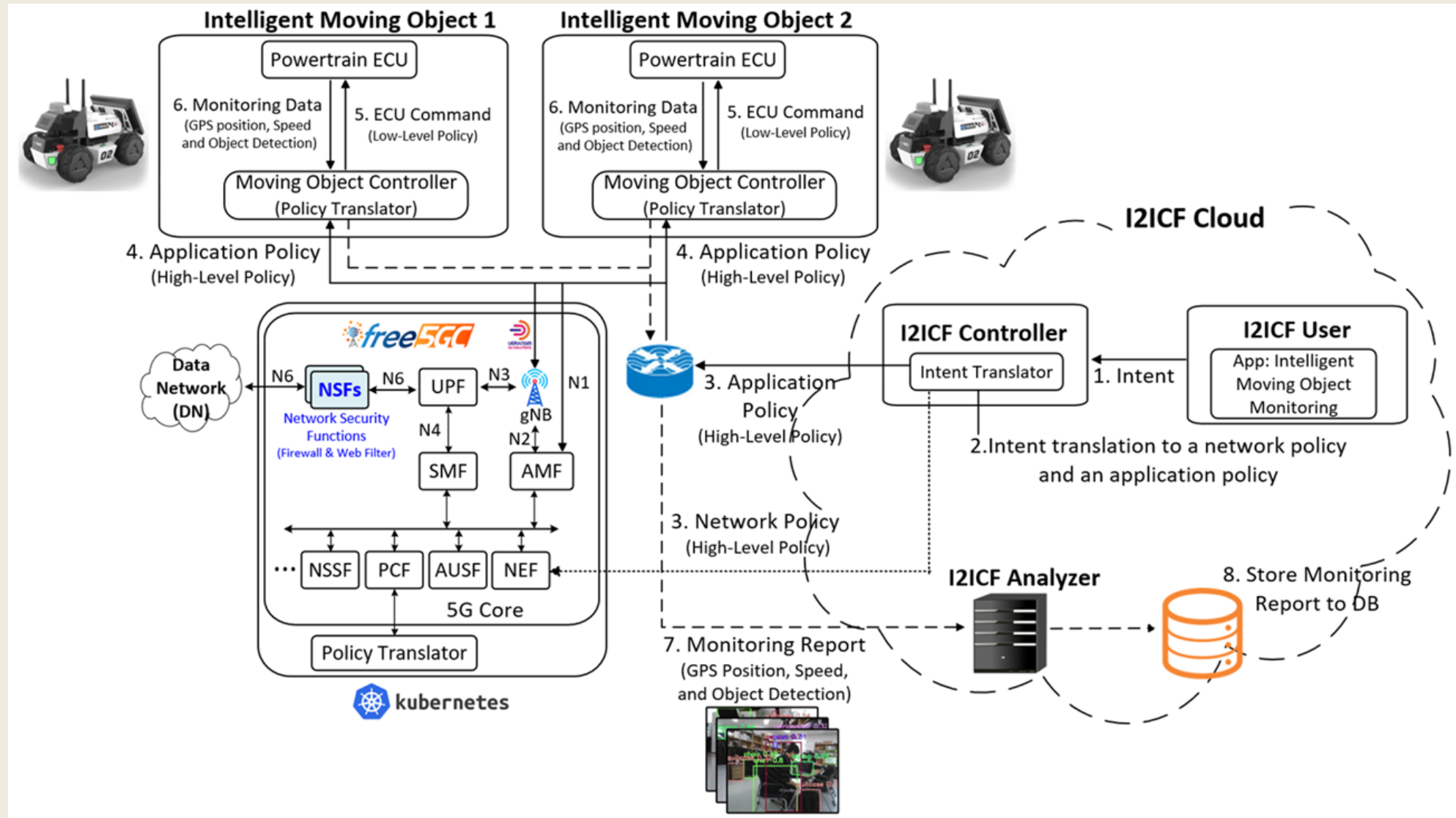
# Scope of this Draft

❑ **Scope of I2ICF Problem Statement**

- ◘ **ICF Capability Registration** and **Intent-Based Service Provisioning**
  - ◻ The capability of each ICF is registered with an I2ICF Controller.
  - ◻ For a given intent, an **Intent Translator** in the I2ICF framework can translate it into policies executable in ICFs in a target Moving Object.
  - ◻ For intent assurance, a **Closed-Loop Intent Control** can make sure that the I2ICF framework operates correctly according to the user's intent.

- ◘ ICFs to be considered in I2ICF
  - ◻ **ICFs within Moving Objects** such as Robotic AI Agents (e.g., Robots, Drones, and Software-Defined Vehicles).

❑ Computing-Aware Traffic Steering (CATS)

- ❑ **Goal**
  - ❑ CATS WG aims at handle how the network edge can steer traffic between clients of a service and sites offering the service.

- ❑ **Assumption**
  - ❑ The configuration and monitoring of edge server instances are done by other services, so they are out of scope.

- ❑ **I2ICF**
  - ❑ I2ICF aims the configuration and monitoring of ICFs in a Robotic AI Agent according to a user's intent.

# Comparison I2ICF with CATS and NeoTec (2/3)

❑ Network Telco-cloud Orchestration Interfaces (NeoTec)

  ❑ **Goal**

  ❑ **Central Cloud:** Elastic Scaling on Demand (Millisecond-Level Scaling)

  ❑ **Edge Cloud:** Deterministic Low Latency (<10ms End-to-End)

  ❑ **Global Efficiency:** Cross-Domain Resource Utilization Improved, and agile Domain Coordination

  ❑ **I2ICF**

  ❑ I2ICF focuses on the <u>configuration and monitoring of Robotic AI Agents</u> rather than <u>edge cloud and central cloud</u>.

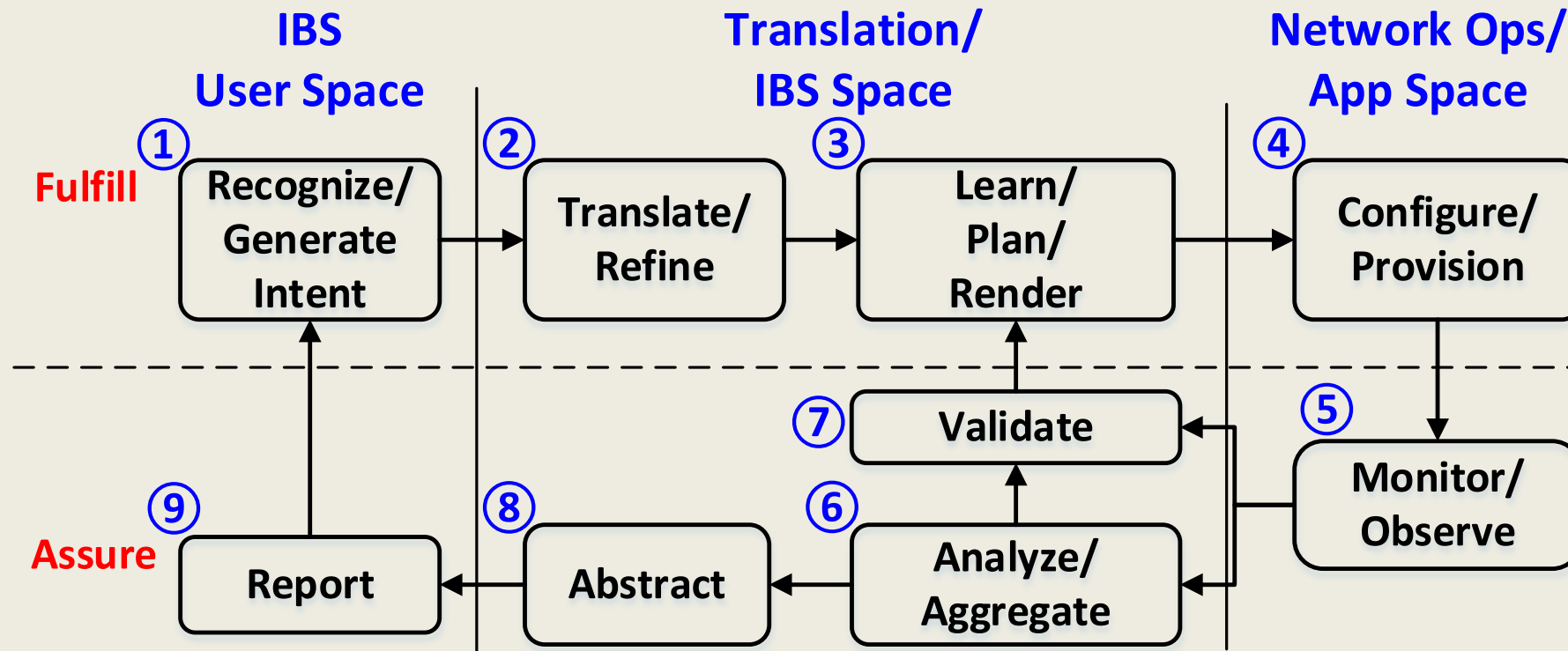# Comparison I2ICF with CATS and NeoTec (3/3)

❑ Network Telco-cloud Orchestration Interfaces (NeoTec)
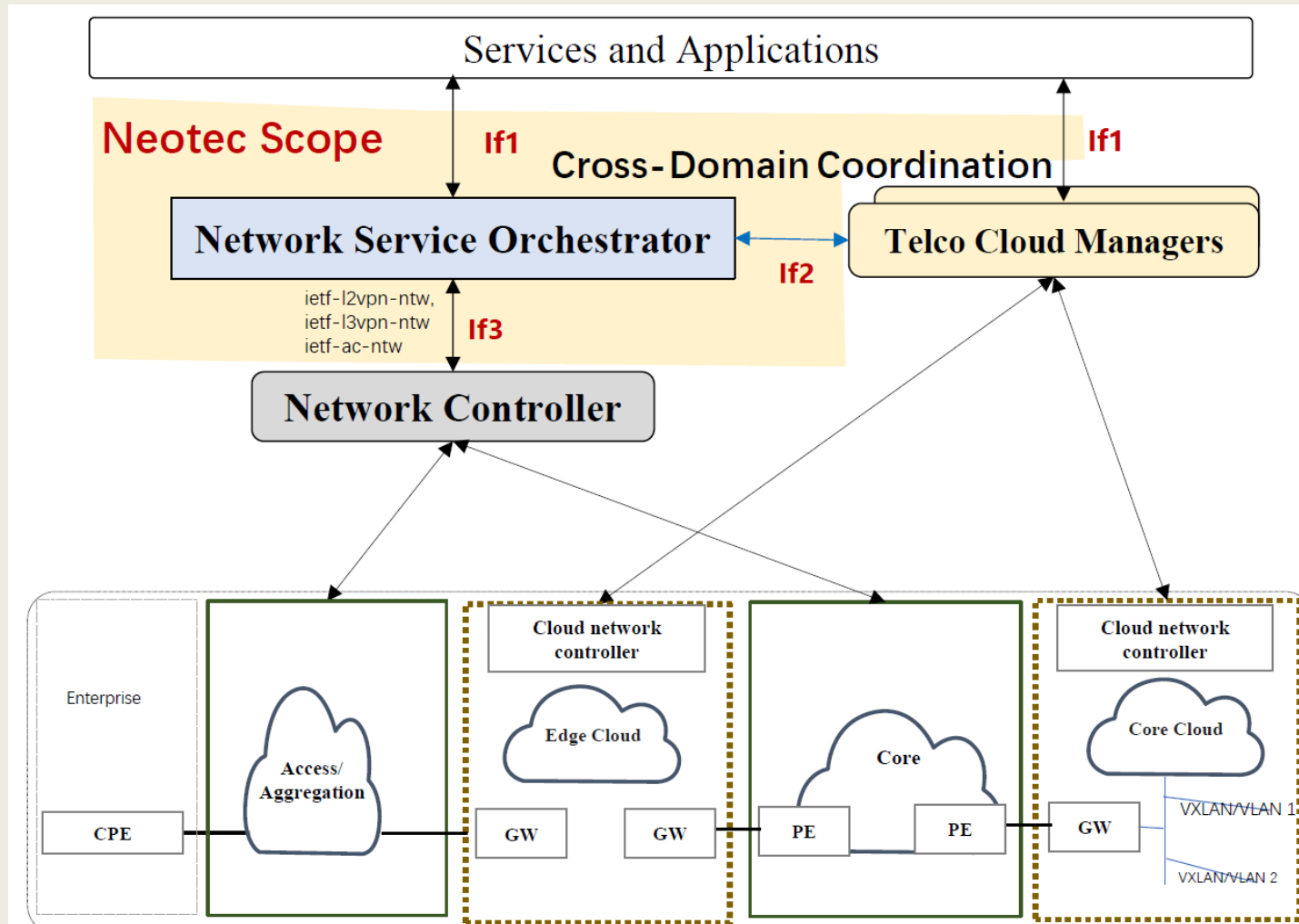
# Intent-Based Networking (IBN)

❑ **Intent-Based System (IBS)** can be based on **RFC 9315** (Intent-Based Networking - Concepts and Definitions).

**IBS User Space**  **Translation/ IBS Space**  **Network Ops/ App Space**

Fulfill

① Recognize/ Generate Intent → ② Translate/ Refine → ③ Learn/ Plan/ Render → ④ Configure/ Provision

⑦ Validate

⑤ Monitor/ Observe

Assure

⑨ Report ← ⑧ Abstract ← ⑥ Analyze/ Aggregate

**The Life Cycle of IBS for Intent Management**

# Problem Statement (1/5)

❑ **The goal of an Intent-Based System (IBS)**

  ❑ <u>To enforce the service corresponding to a user's intent</u> with an appropriate application in a target network in terms of functionality and quality.

❑ **Enforcement Procedure of an Intent**

  ❑ ① **Intent Translation**

    ❑ <u>An intent</u> needs to be translated into <u>an application policy</u> (and a network policy) by an intent translator.

# Problem Statement (2/5)

❑ **Enforcement Procedure of an Intent (Con't)**

- ■ ② **Delivery of Application Policy (and Network Policy)**
  - ◻ The application policy (and network policy) needs to be delivered to a target controller in a moving object (and another target controller in a network).

- ■ ③ **Application Policy Translation**
  - ◻ The application controller translates the application policy into the application rules for application entities (i.e., AFs).

- ■ ④ **Network Policy Translation**
  - ◻ The network controller translates the network policy into the network rules for network entities (i.e., NFs).

# Problem Statement (3/5)

❑ **Data Models for ICF Capability and Registration Interface (RI)**

- ❑ The **Capability Data Model for ICFs (i.e., NFs and AFs)** are required to describe the ICF capabilities for usage.

- ❑ A **Registration Interface** is required for a vendor to register the ICF Capability with an I2ICF Controller.

- ❑ **YANG Data Models for ICF Capabilities and Registration Interface** should be specified to make a registration message for the Vendor's Management System (VMS).

❑ **Data Model for Consumer-Facing Interface (CFI)**

- ⬜ An IBS user needs <u>an interface to deliver its intent to an IBS Controller</u> (e.g., MO Controller).

- ⬜ The IBS Controller translates the intent into an application policy (and a network policy) with an intent translator.

- ⬜ It dispatches the policies to appropriate destinations (e.g., AF Controller and NF Controller) with a dispatcher.

- ⬜ This interface is called a Customer-Facing Interface (CFI) for the IBS User.

- ⬜ **A YANG Data Model for the Customer-Facing Interface** should be specified.

# Problem Statement (5/5)

❑ **Data Model for Service Function-Facing Interface (SFI)**

◻ Both an AF Controller and an NF Controller need an **SF-Facing Interface** to deliver the application and network rules to the appropriate AFs and NFs, respectively.

❑ **Data Models for Monitoring Interface (MI) and Analytics Interface (AI)**

◻ **Monitoring Interface** collects monitoring data from either an NF or an AF to a Data Collector.

◻ **Analytics Interface** delivers analysis results to either an AF Controller or an NF Controller.

# Planning for WG Scope

- ❑ **WG Phase 1**
  - ◻ I2ICF Problem Statement and Use Cases
  - ◻ I2ICF Framework
  - ◻ A YANG Data Model for ICF Capability
  - ◻ A YANG Data Model for Registration Interface

- ❑ **WG Phase 2 (Re-charter)**
  - ◻ YANG Data Models of Consumer-Facing Interface, Controller-Facing Interface, SF-Facing Interface, Monitoring Interface, and Analytics Interface

# Next Steps

❑ This draft will include use cases for I2ICF as follows:

  ❑ A Use Case of I2ICF for Cooperative ITS

    ❑ https://datatracker.ietf.org/doc/draft-ahn-opsawg-i2icf-cits/

  ❑ An Intent Translation for IoT Devices including Moving Objects

    ❑ https://datatracker.ietf.org/doc/draft-gu-nmrg-intent-translator/

❑ I2ICF Group will prepare a WG-Forming BoF in the IETF 124 in Montreal in November in 2025.

❑ I2ICF Group will prepare IETF-124 Hackathon Project to clarify (i) the I2ICF Problem Statement & Use Cases and (ii) the I2ICF Framework.