

I2ICF Use Case - Cooperative Intelligent Transportation Systems (C-ITS) with Agentic AI

(draft-ahn-opsawg-i2icf-cits-00, draft-an-nmrg-i2icf-cits-00)

*November 6, 2025
Montreal in Canada*

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Motivation of This Draft

❖ draft-ahn-opsawg-i2icf-cits-00

- This draft defines the use case of **In-Network Computing Functions (I2ICF)** for cooperative intelligent transportation systems with **Agentic AI**.
 - doc link : <https://datatracker.ietf.org/doc/draft-ahn-opsawg-i2icf-cits/>
- This draft specifies a structured **framework for orchestrating, managing, and monitoring** ICFs in **C-ITS with Agentic AI**
 - For example, in the context of Vehicle-to-Everything (V2X) communications, efficient management of Vehicle-to-Vehicle (V2V) communications and **their integration with C-ITS can greatly benefit from Agentic AI-driven in-network computing**.
 - By leveraging ICFs augmented with **Agentic AI capabilities**, it becomes possible to **dynamically optimize real-time communication**, proactively adapt traffic management strategies, and enhance data processing and security services at the network edge.

❖ Main contents of this draft

- **Intent-Based Management System in C-ITS with Agentic AI**
- Framework components, Interfaces in the I2ICF
- Use cases
- Security consideration

Google's Agent to Agent

❖ Google A2A Protocol Announcement (2025 April)

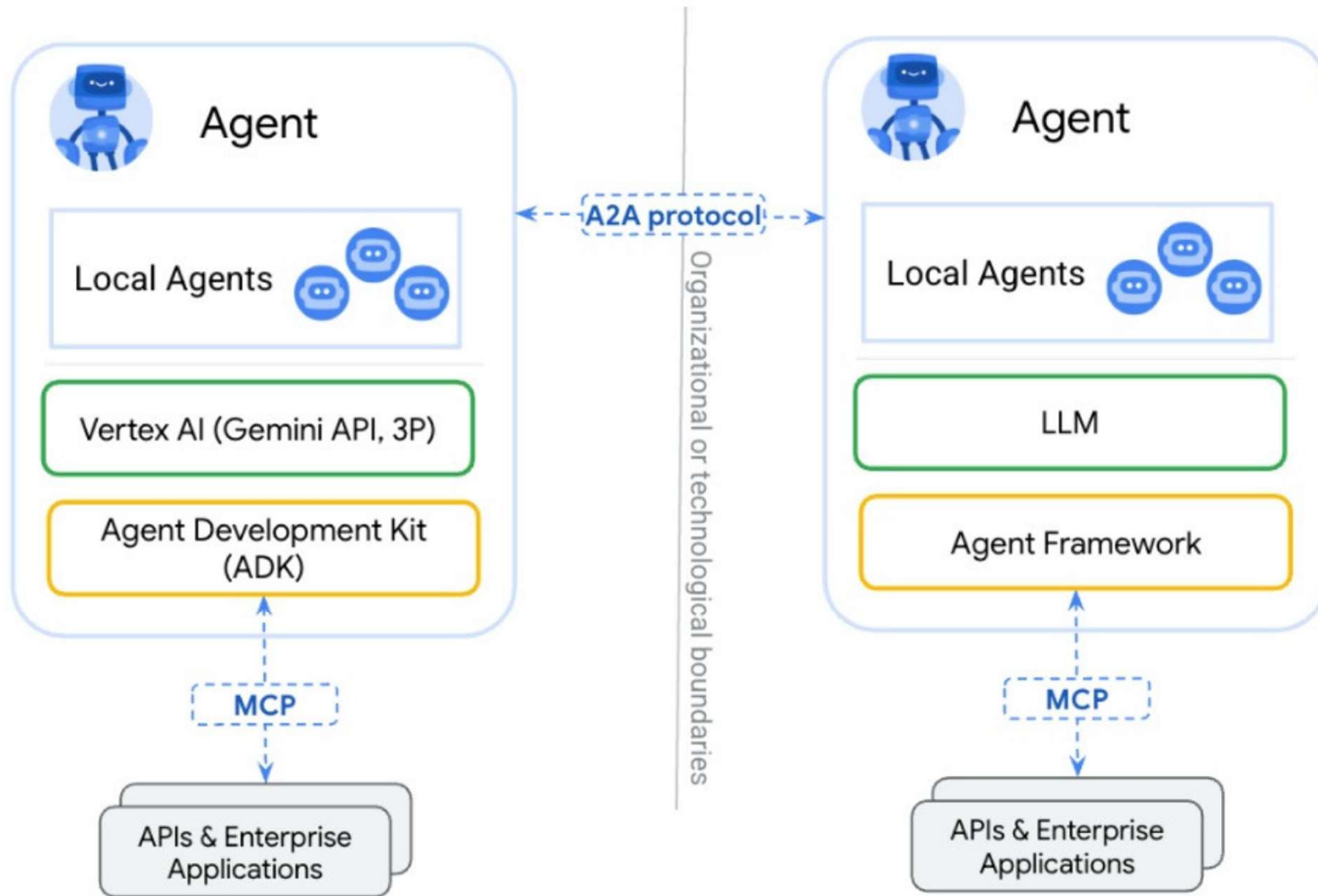
- <https://developers.googleblog.com/ko/a2a-a-new-era-of-agent-interoperability/>



❖ A2A Protocol

- A2A is an open protocol that enables interoperability between autonomous agents.
- It complements Anthropic's MCP by providing the tools and context necessary for agents
 - MCP (Model Context Protocol)
 - MCP defines how AI models access and use contextual information.
 - It provides agents with relevant data, tools, and memory for context-aware decision-making.

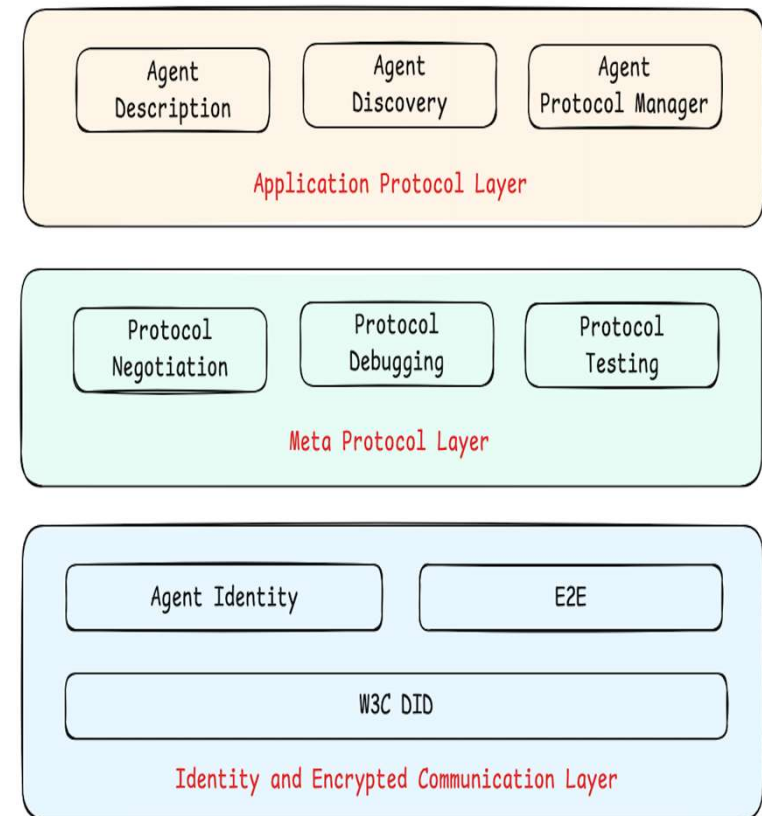
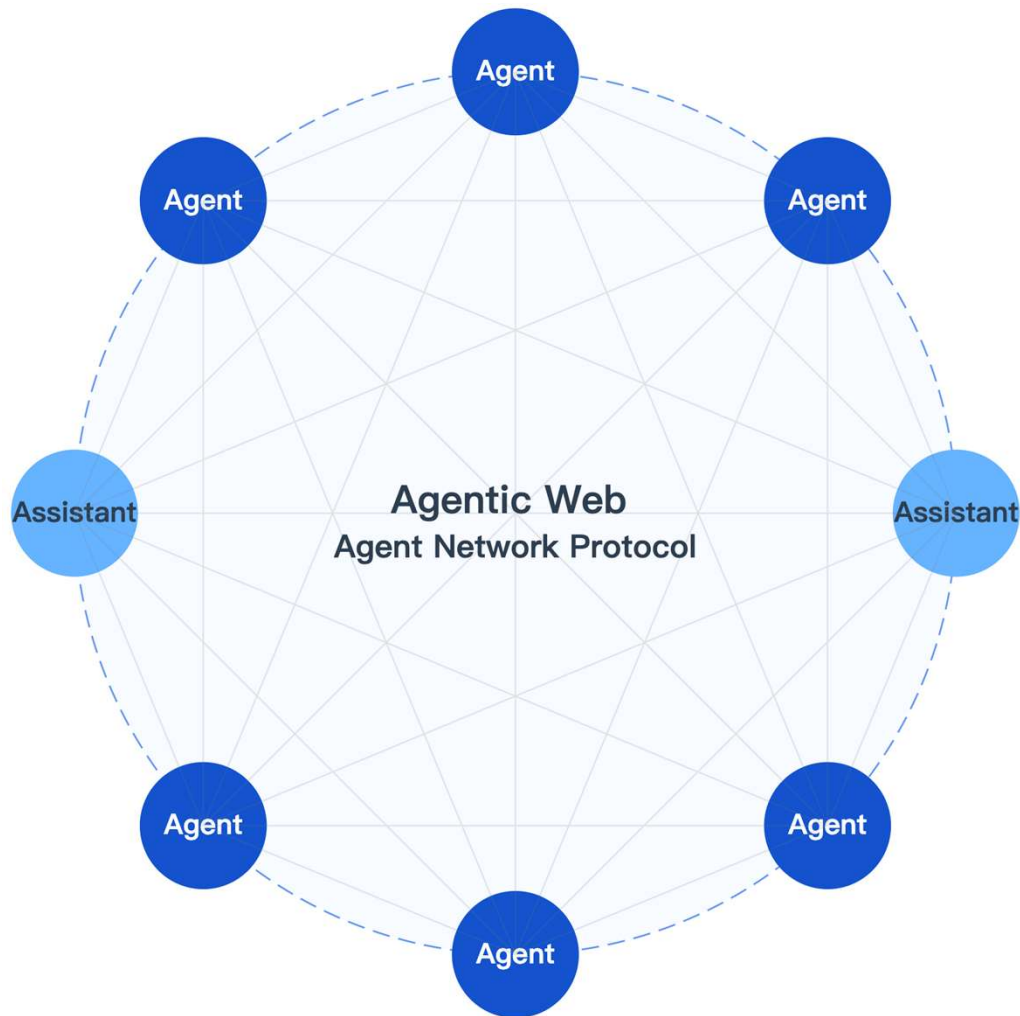
Relationship between A2A and MCP



< Source : Google >

ANP (Agent Network Protocol)

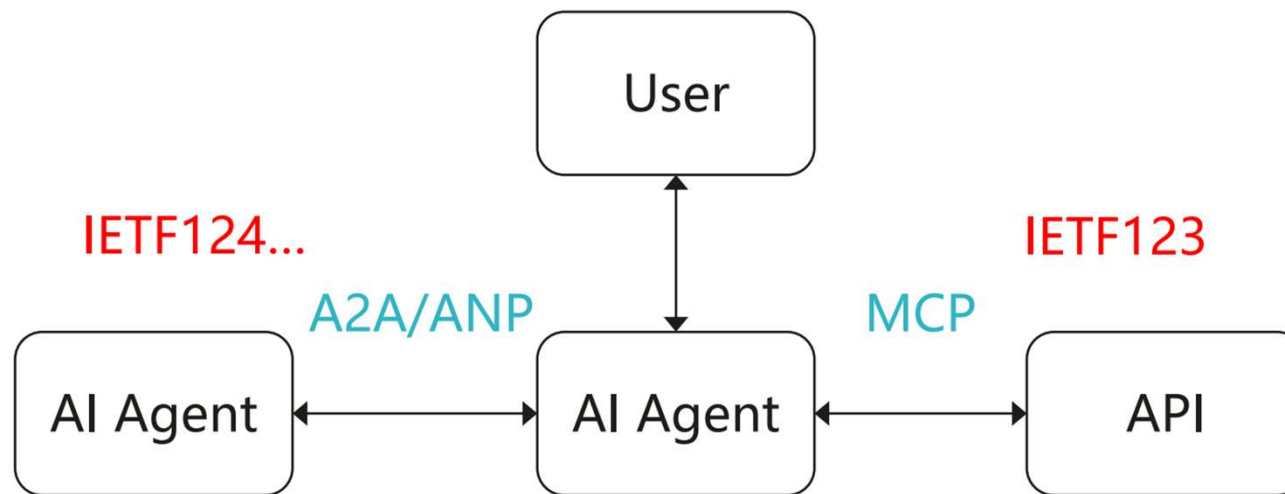
❖ <https://github.com/agent-network-protocol/AgentNetworkProtocol>



< Source : ANP github >

IETF Standardization Activitie

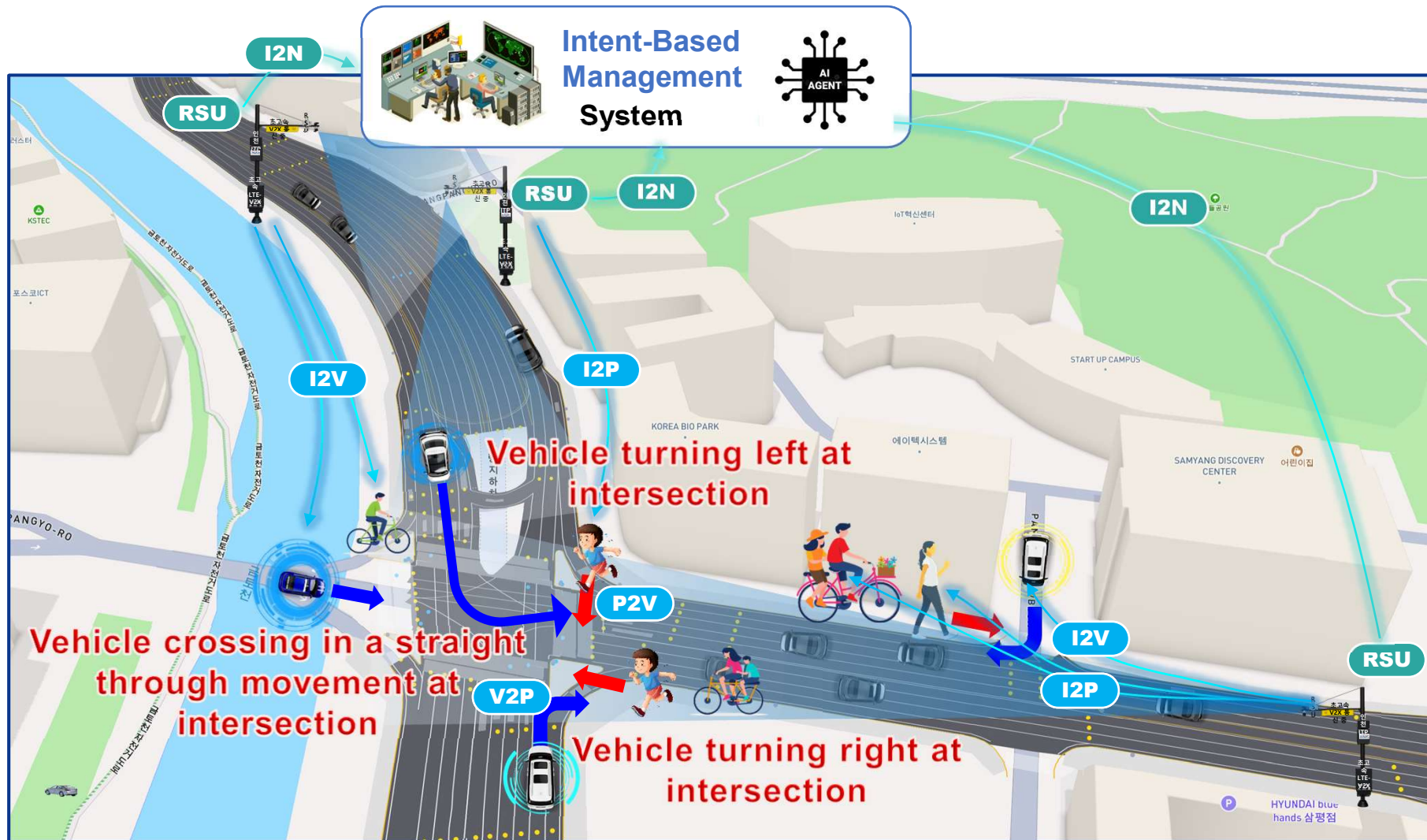
❖ IETF 123rd (25.07), IETF 124th (25.11)



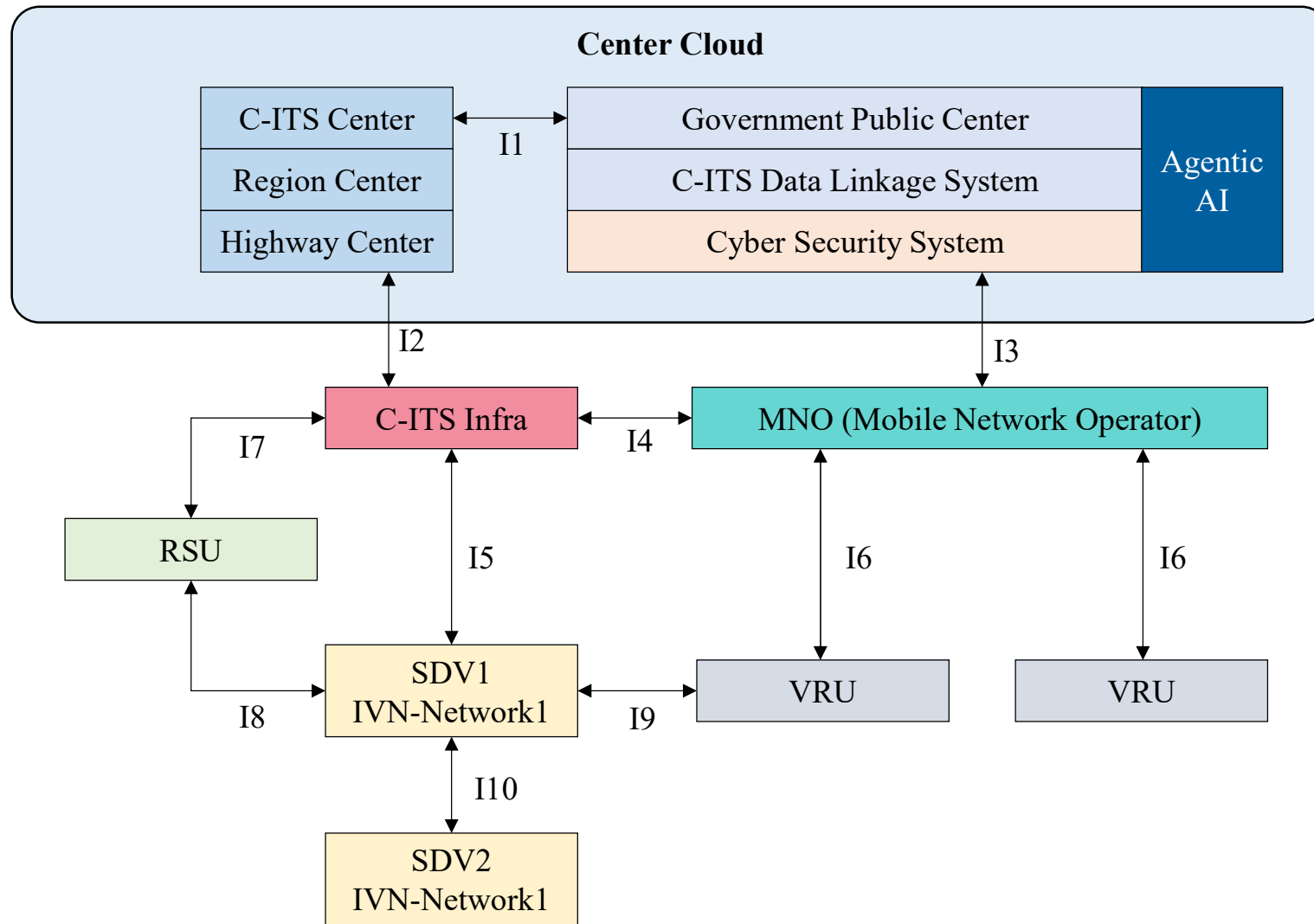
Security aspects includes:

- Identity
- Authentication
- Authorization
- Privacy

Intent-Based Management System in C-ITS



I2ICF Framework and Interfaces



I2ICF Framework and Interfaces

❖ Framework Components

Components	Description
Central Cloud	A system that comprehensively controls the entire C-ITS environment . It manages information from various C-ITS centers, including regional centers and highway centers, and facilitates and oversees the connection between C-ITS data from the Government Public Center and end users.
C-ITS Center	The C-ITS Center is a comprehensive term that encompasses both the Region Center and the Highway Center. It serves as the central hub for managing and coordinating intelligent transportation systems across various environments, including urban regions and highways.
Region Center	The Region Center refers to local centers established at key locations. These regional centers are connected to Road-Side Units (RSU) and function as one of the C-ITS Centers .
Highway Center	The Highway Center operates similarly to the Region Center but is managed separately due to the unique characteristics of highways, which span multiple regions rather than being confined to a single city .

I2ICF Framework and Interfaces

❖ Framework Components

Components	Description
Government Public Center	The Government Public Center is a C-ITS information provision system managed by the government . Due to the nature of road traffic infrastructure, it is challenging for private companies to manage this data effectively , and concerns over reliability make it difficult for users to utilize privately managed data.
C-ITS Data Linkage System	The C-ITS Data Linkage System is a platform designed to provide C-ITS data to external users . By offering data through methods such as Open APIs, this system connects C-ITS infrastructure information with users, enabling seamless access to real-time traffic and transportation data.
Cyber Security System	The Cyber Security System is responsible for managing the security of communications between Software-Defined Vehicles (SDV), Vulnerable Road Users (VRU), RSU, Mobile Network Operators (MNO), and C-ITS infrastructure.
C-ITS Infra	The C-ITS Infrastructure is a system designed to collect and provide various types of information , including traffic signal data, roadside environment information, VRU data, and RSU data.

I2ICF Framework and Interfaces

❖ Framework Components

Components	Description
RSU	The RSU is a device that connects the C-ITS Infrastructure with SDVs . Through the RSU, SDVs can transmit and receive data between vehicles via V2V and between vehicles and infrastructure via V2I.
SDV1, SDV2	An SDV (Software-Defined Vehicle) consists of two main communication interfaces (External Communication Interface : Enables communication with external systems such as RSUs (Roadside Units), other vehicles (V2V), and infrastructure (V2I/V2N), supporting seamless interaction within the C-ITS ecosystem, and Internal Vehicle Network (IVN) Interface)
IVN-Network1, 2	These networks are part of the In-Vehicle Network (IVN), which facilitates communication within the vehicle.
VRU	A VRU refers to users who can communicate either with an MNO or directly with SDVs.
MNO	An MNO is a service provider that owns and manages wireless communication infrastructure , including network towers, core networks, and data centers.

I2ICF Framework and Interfaces

I2ICF Interfaces

Interface 1

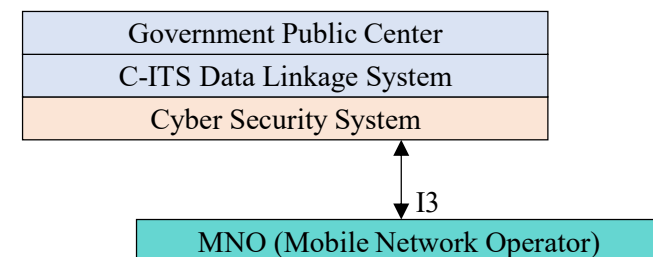
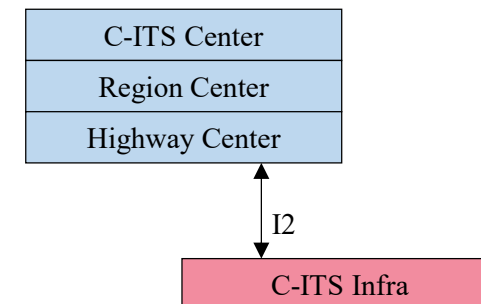
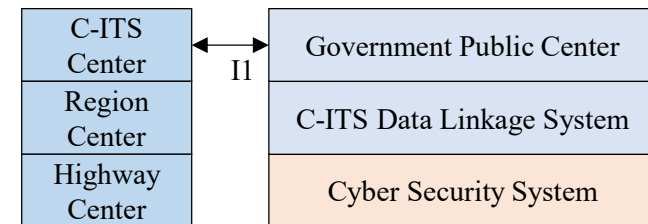
This is the registration interface between the ITS Center and the Government Public Center. It facilitates the **exchange of C-ITS infrastructure data**, such as traffic information and real-time road conditions, ensuring the Government Public Center can provide accurate and trustworthy data to external users.

Interface 2

This interface connects the C-ITS Center with the C-ITS Infra. It is **responsible for distributing infrastructure data**, such as traffic signal information, road environment data, and RSU status, from the C-ITS Center to the C-ITS Infra for real-time processing and delivery to connected vehicles.

Interface 3

This is the data exchange interface between the Government Public Center and the MNO (Mobile Network Operator). It **enables the secure transmission of C-ITS data to MNOs**, allowing mobile networks to deliver critical traffic and safety information to VRUs and vehicles.

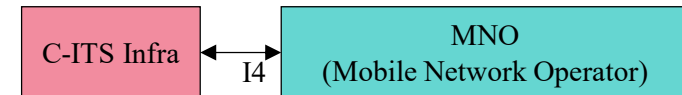


I2ICF Framework and Interfaces

I2ICF Interfaces

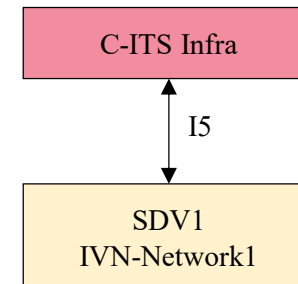
Interface 4

This interface connects the C-ITS Infra with the MNO. It **supports the sharing of network resources and real-time communication** between infrastructure components and mobile networks.



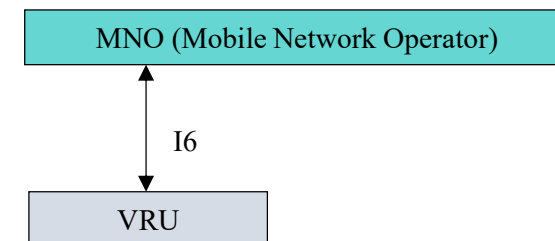
Interface 5

This is the communication interface between the C-ITS Infra and SDVs. It **enables bidirectional data exchange, allowing SDVs to receive real-time infrastructure information** (e.g., traffic signals, road hazards) and transmit vehicle status data back to the infrastructure.



Interface 6

This interface connects the MNO with both VRUs and SDVs. It is used to **deliver real-time safety messages**, navigation updates, and other critical data. It also allows VRUs and SDVs to send status or emergency signals back to the network.



I2ICF Framework and Interfaces

I2ICF Interfaces

Interface 7

This is the management interface between the RSU and the C-ITS Infra. It **facilitates the configuration, monitoring, and management of RSUs** to ensure stable communication between roadside infrastructure and vehicles.

Interface 8

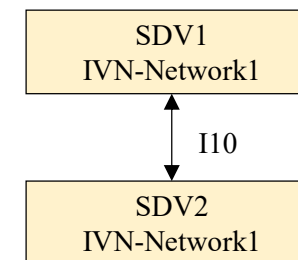
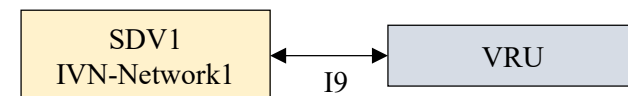
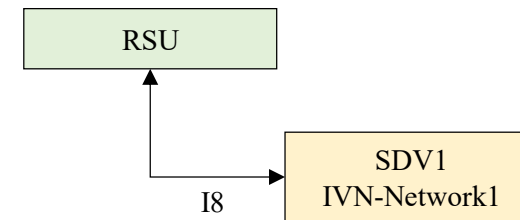
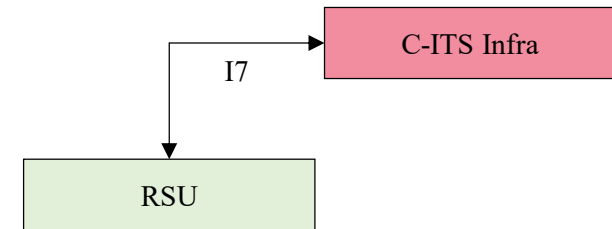
This interface supports V2I communication between SDVs through the RSU. It **allows SDVs to exchange critical information** such as speed, direction, and emergency signals, enabling collision avoidance and cooperative driving.

Interface 9

This is the communication interface between SDVs and VRUs. It **ensures that vulnerable road users receive immediate safety notifications** from nearby vehicles and infrastructure.

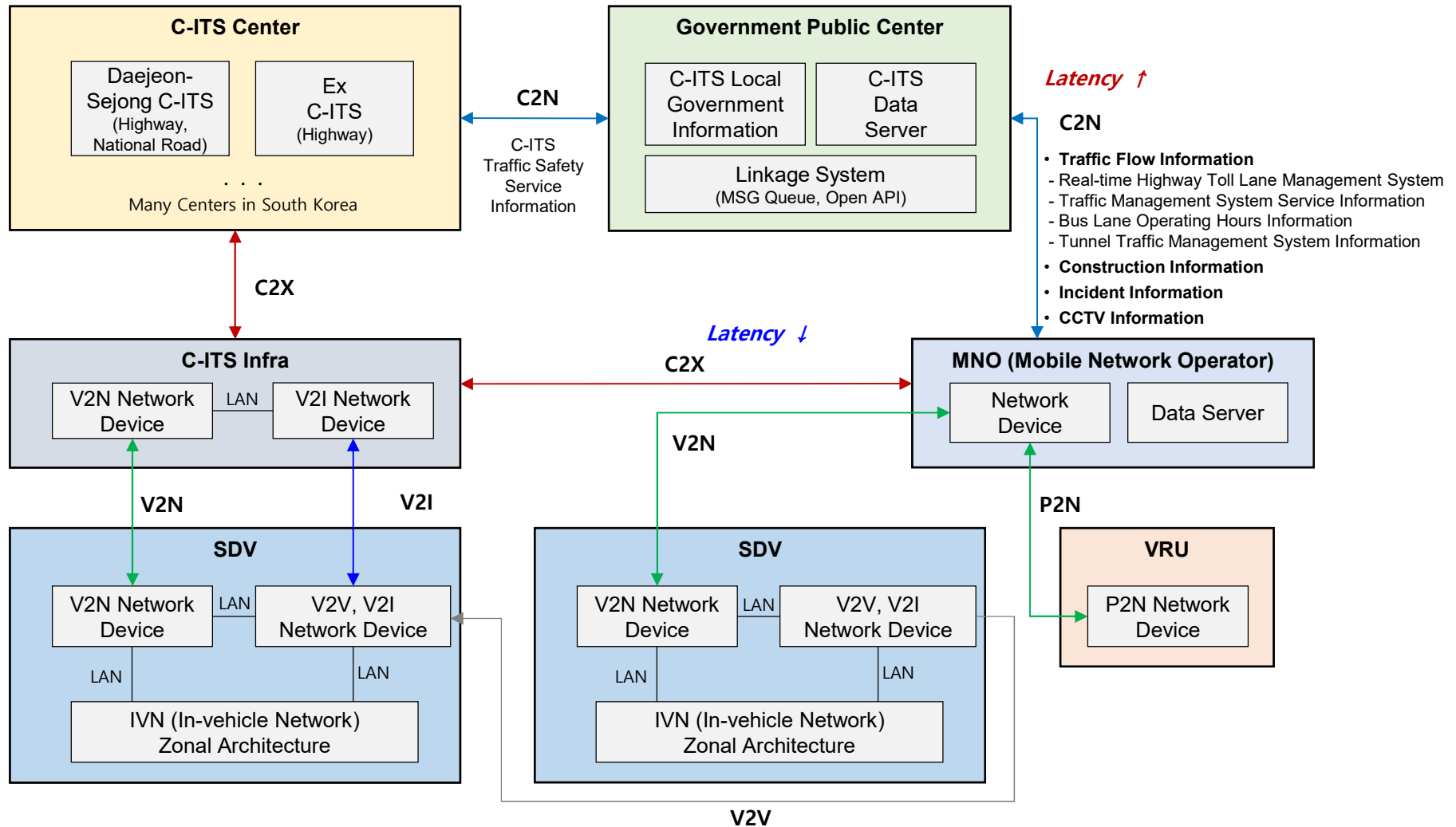
Interface 10

This is the external and internal communication interface between multiple SDVs. It **enables secure and efficient communication** within the vehicle's zonal architecture, facilitating seamless data exchange between various internal systems and supporting autonomous driving functions.



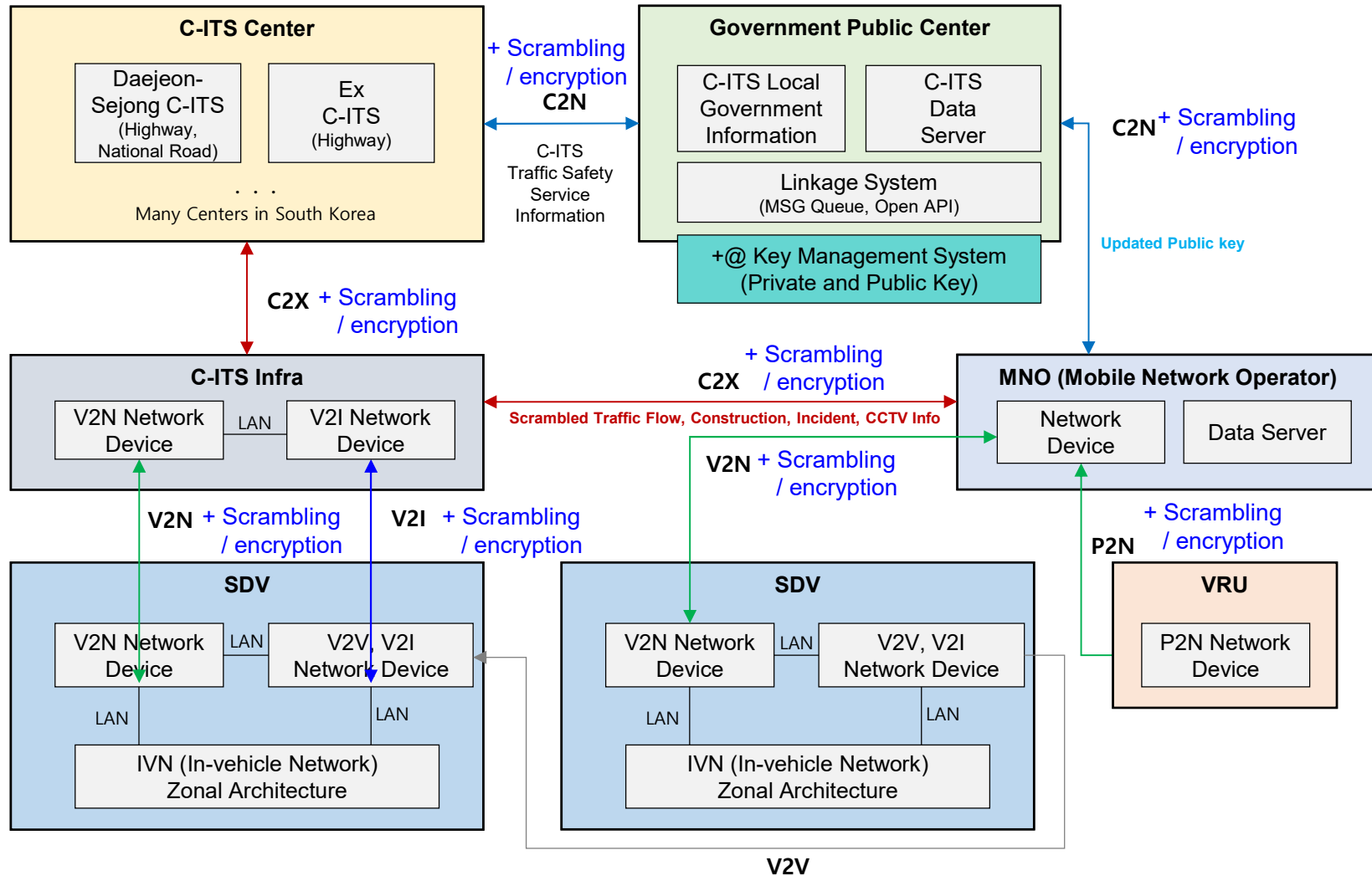
Use Cases of I2ICF for C-ITS

Data Processing, Streamline Traffic Management









Use Cases of I2ICF for **Security** C-ITS

Cybersecurity Consideration



Implementation of Multi-Vehicle and RSU Prototype


KETI HERMES 2025년 10월 29일 수요일 15시 45분 18초 192.168.2.97 연결됨  

**OBU Devices (16)**
**My Vehicle (1)**



- 28777
패킷 429개
방금 전


Connected Vehicle (15)

- 24060009
패킷 1735개
방금 전
- 24060015
패킷 1750개
방금 전
- 24060006
패킷 1730개
방금 전
- 24060057
패킷 2991개
방금 전
- 24060010
패킷 1718개
방금 전
- 25040006
패킷 4144개
방금 전
- 24060007
패킷 1732개
방금 전

RSU Devices (1)
Active (1)

- 25020001
패킷 3504개
방금 전



Summary and Next Steps

❖ Summary

- This document introduces **a structured framework** for their registration, configuration, management, and monitoring.
- It evaluates extended **use cases**, including V2X communication, wherein ICFs facilitate the efficient orchestration of V2V networks, **seamless integration with C-ITS, and interoperability with MNOs with agentic AI.**
- This document underscores the pivotal role of ICFs in **strengthening cybersecurity** measures for both private and public data within such interconnected ecosystems.
- This document includes the **Intent-Based Management System in C-ITS with agentic AI.**

❖ Next Steps

- This draft will be enhanced to accommodate use cases for I2ICF as follows:
 - A Use Case of C-ITS Networking with agentic AI
 - A Use Case of Real-Time Data Processing for SDV with agentic AI
 - A Use Case of E2E Communication for Cooperative Driving with agentic AI
 - A Use Case of Enhanced Cybersecurity for C-ITS and MNO Integration



Unframed Perspective

"틀에서 벗어난 시각으로 미래를 이끌어 간다"



This work was supported by Institute of Information & Communications Technology Planning & Evaluation (IITP) grant funded by the Korea Ministry of Science and ICT (MSIT) (No. 2022-0-00199, 5G-NR-V2X performance verification for connected Autonomous Driving).

This work was in part supported by Institute of Information & Communications Technology Planning & Evaluation (IITP) grant funded by the Korea Ministry of Science and ICT (MSIT) (No. RS-2024-00398199 and RS-2022-II221015).