6G progress on Multi-Agent collaboration

Dependency on Standardization Work in IETF

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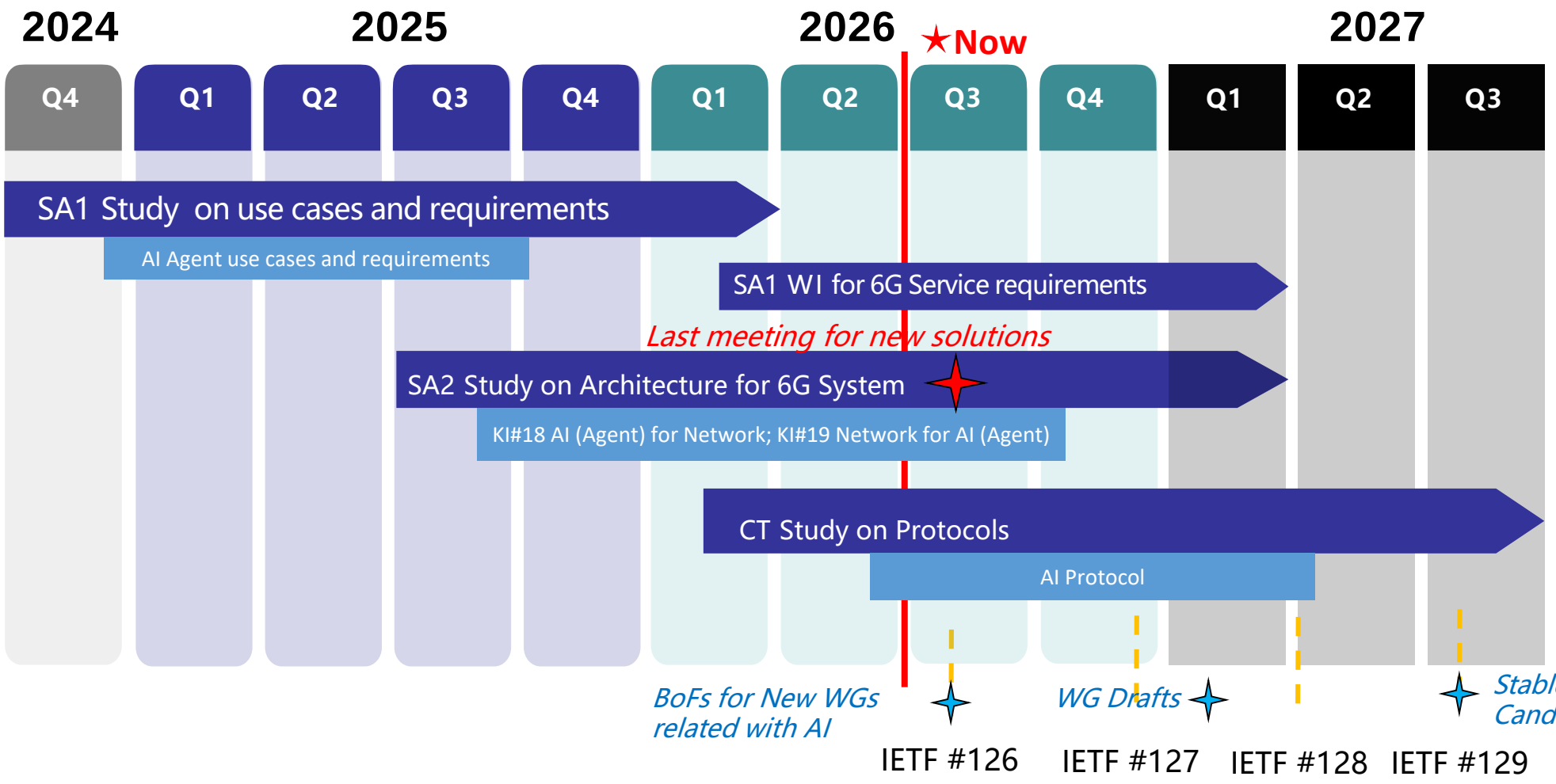
https://datatracker.ietf.org/doc/draft-yu-dmsc-ai-agent-use-cases-in-6g/

https://datatracker.ietf.org/doc/draft-ly-multi-agent-in6g/

Overview of 6G study timeline



- **Conclusion of whether to reference IETF Agent Protocols will be made in 2027Q1**
- **How to reference or enhance IETF Agent Protocols will be finalized in 2027Q3**

- SA1 has completed the study on AI Agent-related use cases and requirements and started standardization work in Feb. 2026.
- SA2 is discussing the overall 6G architecture, including 6G network support for communication of UE AI Agents and network-native Agents to improve network operational efficiency.
- CT has approved 6G protocol-related study, including study of AI protocol.

Definition for AI Agent in 3GPP

❑ Definition of AI Agent in 3GPP spec

- An automated intelligent entity that achieves a specific goal (autonomously or not) on behalf of another entity, by e.g. interacting with its environment, acquiring contextual information, reasoning, self-learning, decision-making, executing tasks (independently or in collaboration with other AI Agents)

❑ Agent Diversity

- Agent residing on cars understand drivers' intentions by considering various situational contexts and make inferences and take actions autonomously
- Robots can inspect and report anomalies in extremely dangerous condition for human technicians.
- VR/AR glasses helps us to access multi-modal communication services, e.g. meeting and game.
- Collaborative agents for digital twinning.

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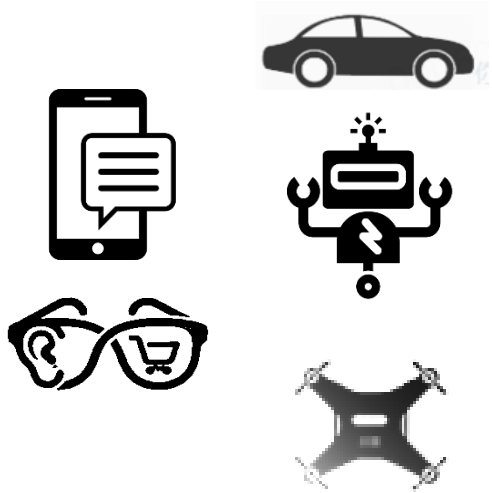
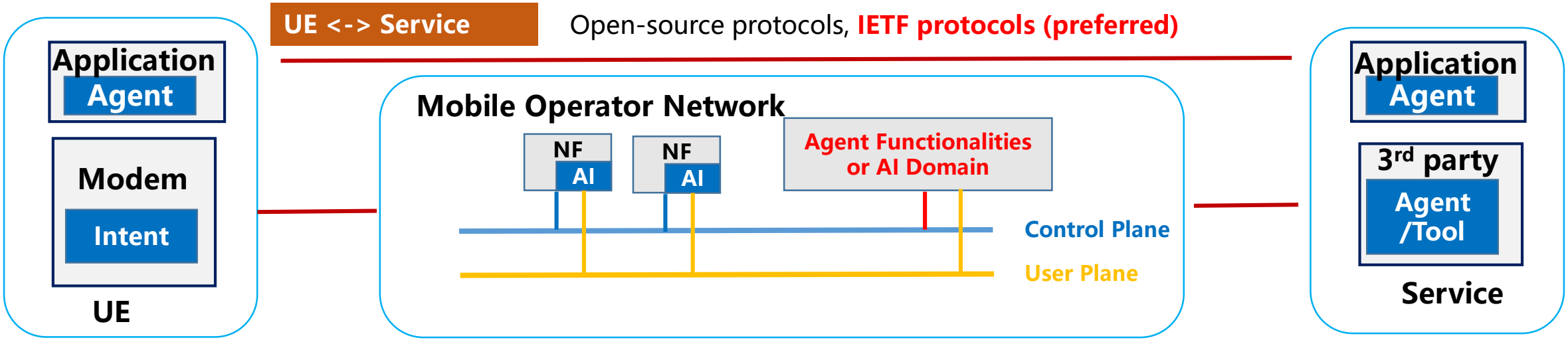


Overview of Agents Use Cases

- **Use cases:** 62 AI use cases, including 25+ AI Agent related use cases. More than 80% of AI Agent related use cases involve cross-domain agent communication (UE, edge, core, application, 3rd party…), which can be divided into:
  - UE-Network Agent Collaboration
  - Network-Application Agent Collaboration
  - Collaborative Network-Native AI Agents
- **Requirements:**
  - 6G network shall provide intent-based services to users via AI technologies (e.g., AI agents)
  - 6G network shall support management, registration and discovery for UE AI agents
  - 6G network shall authenticate and authorize a subscriber/user/3rd party to send Intent to the 6G network.
  - 6G network shall support exposure of network AI (Agent) capabilities
  - 6G network shall support invocation of external AI Agents
  - 6G network shall adapt QoS for AI traffic intelligently and dynamically.

Overview of Functionalities Involving Agents



UE <-> Operator Network

- ID allocation/mapping, Authentication/Authorization, Registration/Discovery, 1-1/1-N Communication
- Intent-based signalling exchange.
- Potential dependency on IETF protocol or 3GPP defined protocols

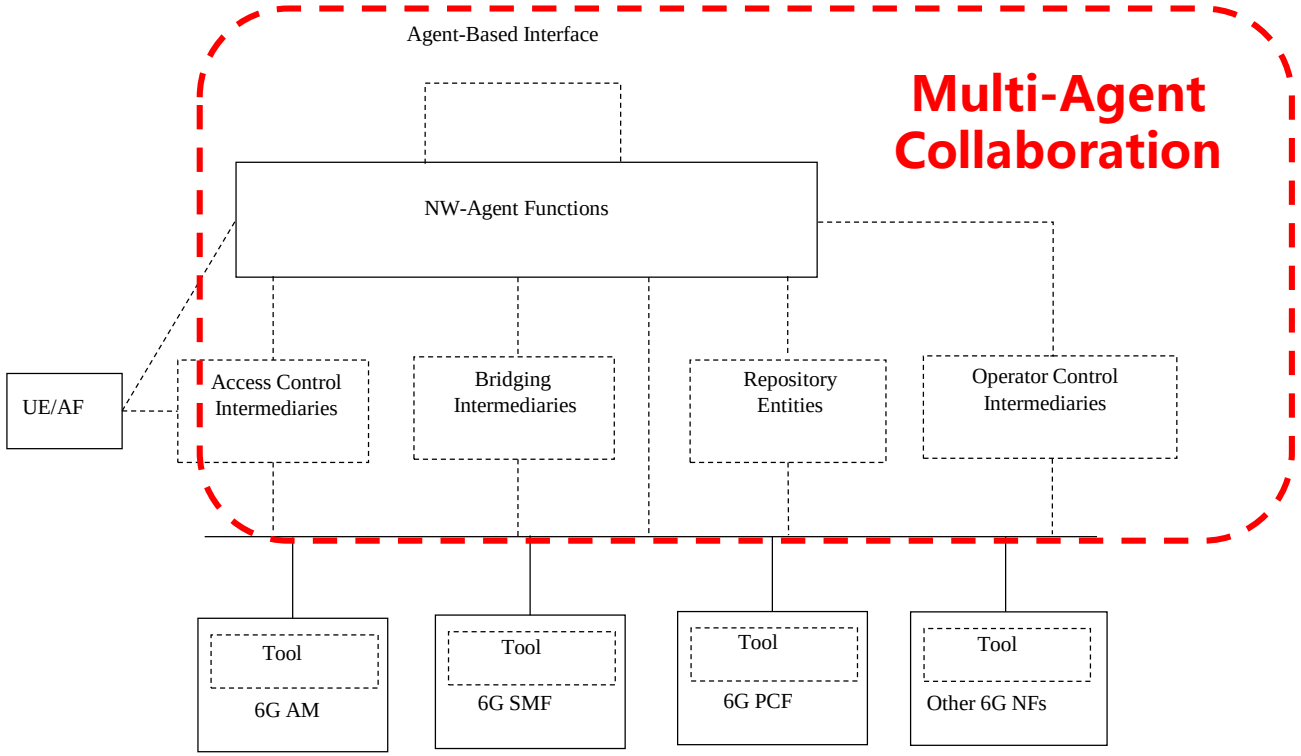
Intra-Operator Network

- One or more agents collaboration
- Registration/Discovery
- Collaboration between Agent and NF with/without agentic capabilities
- Two variants of architectures are under discussion.
- Collaboration between Agents, between Agents and NFs depends on IETF protocols

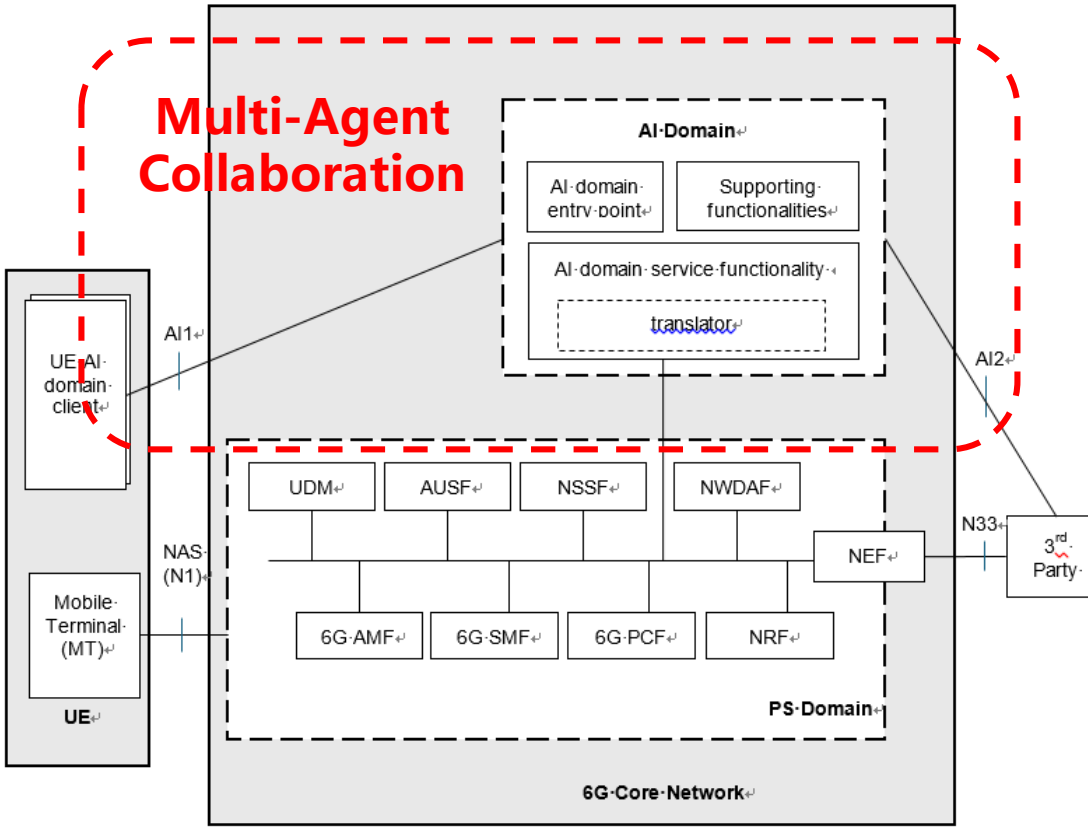
Operator Network <-> Service

- Authentication/authorization
- Invocation of AI agents/tools on the service side
- Exposure of network AI (Agent) capabilities to AI Agents
- Invocation and exposure are based on IETF protocols.

Architecture Variants – Multi-Agent Collaboration



Agents are considered as new 6G CN NFs



Separated AI Domain

Summary

- **Following functionalities discussed in 6G network may reside in Agent Gateway:**
  - **Intent Handling and Fulfilment:** Interprets the request with intent, routes the request to other functions based on interpretation and monitors the execution of the plan based on plan/task ID.
  - **Access Control:** Handles agent authentication and authorization to ensure secure and compliant network access constraints, i.e. operator policy and subscription.
  - **Bridging:** Bridges and translates the message from agents (NW-agents, UE AI agents, 3rd party agents) to the service-based NFs.
  - **Registration & Profile Retrieval:** Serves as repository function of authorized agents, tools and available network capabilities, supporting agent registration and capability discovery.
  - **Exposure and Invocation:** Exposes the capabilities of 6G network functions and invocate the external agents.
  - **Identifier Management:** allocates a permanent ID or mapping the permanent ID with application ID.
- **Functionalities provided by Agent Gateway may be distributed across different network functions in 6G network.**

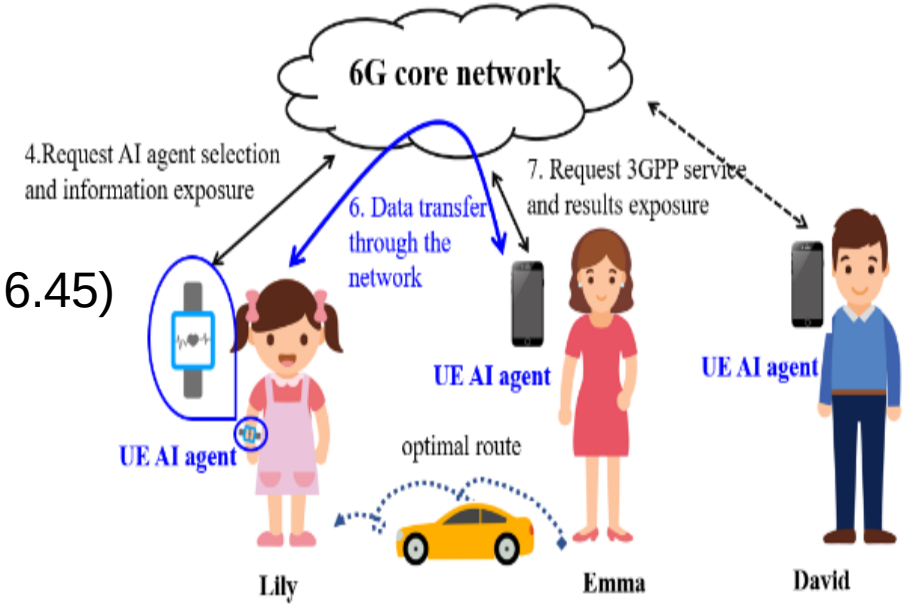
Thank You

Backup Slides for Reference Go on

Use Cases for UE-Network Agent Collaboration

- **UE-Network Agent Collaboration**:

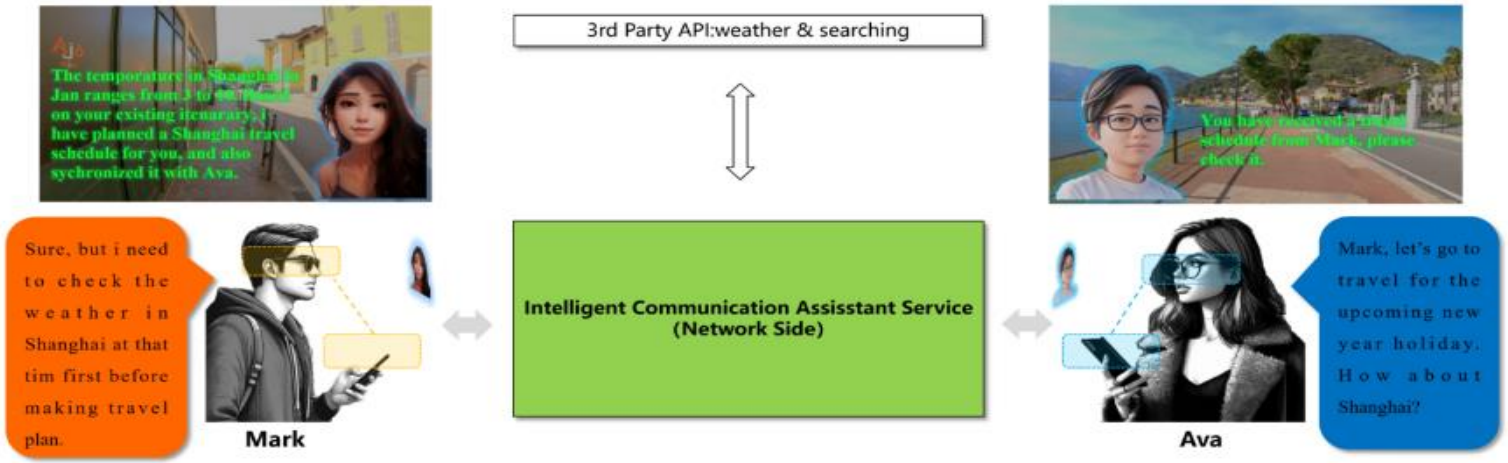
- Due to device limitations (computational resources, battery capacity, etc.) The device cannot fully execute complex tasks locally and may offload partial tasks to the network, collaborating with 6G network to execute complex tasks.
- Agent Communication: Agents communication between on-device AI Agents, and between on-device Agents and network AI Agents
- Use Cases:
  - End-to-end AI for connected cars (Clause 6.3)
  - AI Agents communication (Clause 6.7)
  - 6G System Assisted AI Agent Service (Clause 6.8)
  - Smart Housekeeping (Clause 6.20)
  - Child Health Management Assistant (Clause 6.23)
  - Flexible UE-Network coordination through AI Agent(s) (Clause 6.45)
  - …



Use Cases for Network-Application Agent Collaboration

❑ **Network-Application Agent Collaboration**:

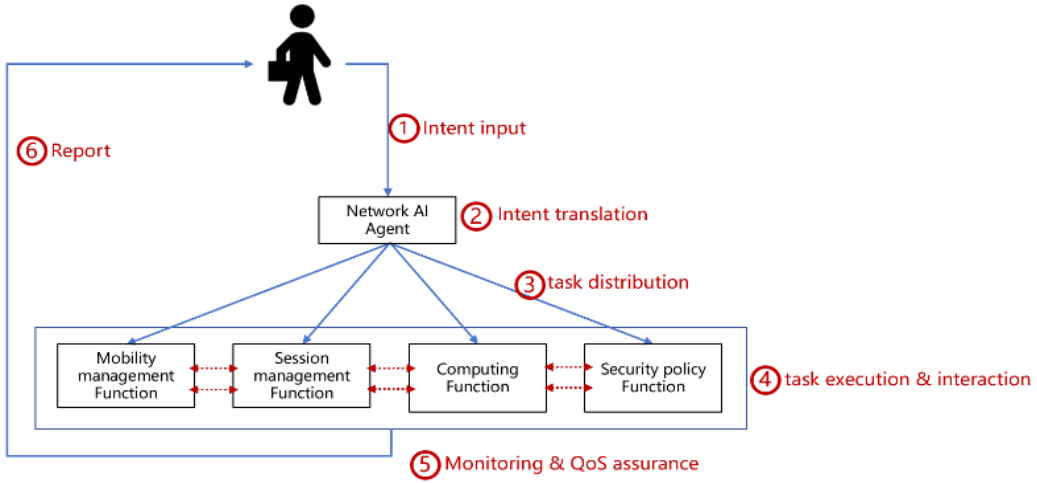
- The network AI Agents can invoke appropriate application AI Agents, and can share network data and domain expertise with application AI Agents, providing crucial data support for application AI Agents.
- Agent Communication: Agents communication between network AI Agents and Application AI Agents
- Use Cases:
  - 6G AI Agent Collaboration With Third-party AI Using LLM (Clause 6.6)
  - Collaborative AI Agents (Clause 6.9)
  - Network knowledge as part of Retrieval Augmented Generation for Generative AI (Clause 6.13)
  - Network-based intelligent assistance by a network-native AI Agent (Clause 6.51)
  - Smart support for data collection and fusion in multi-agent scenarios (Clause 6.52)
  - …

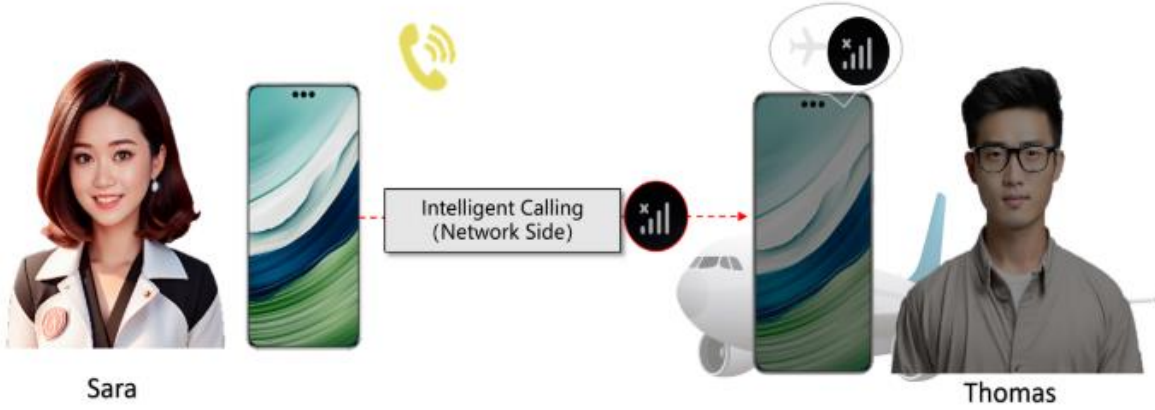


Use Cases for Collaborative Network-Native AI Agents

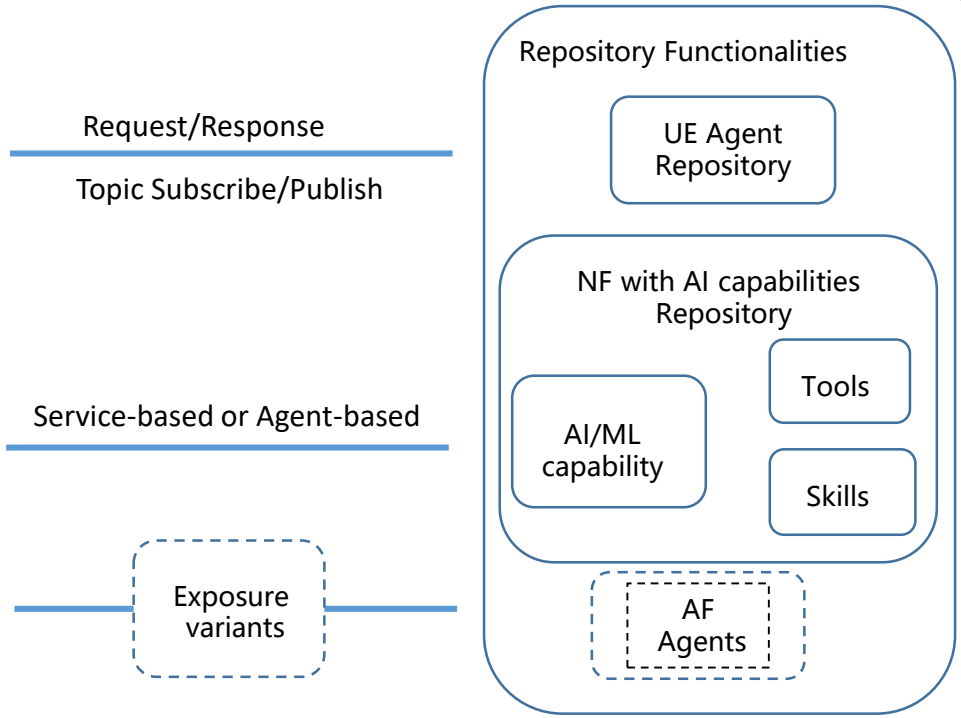
- Collaborative Network-Native AI Agents:

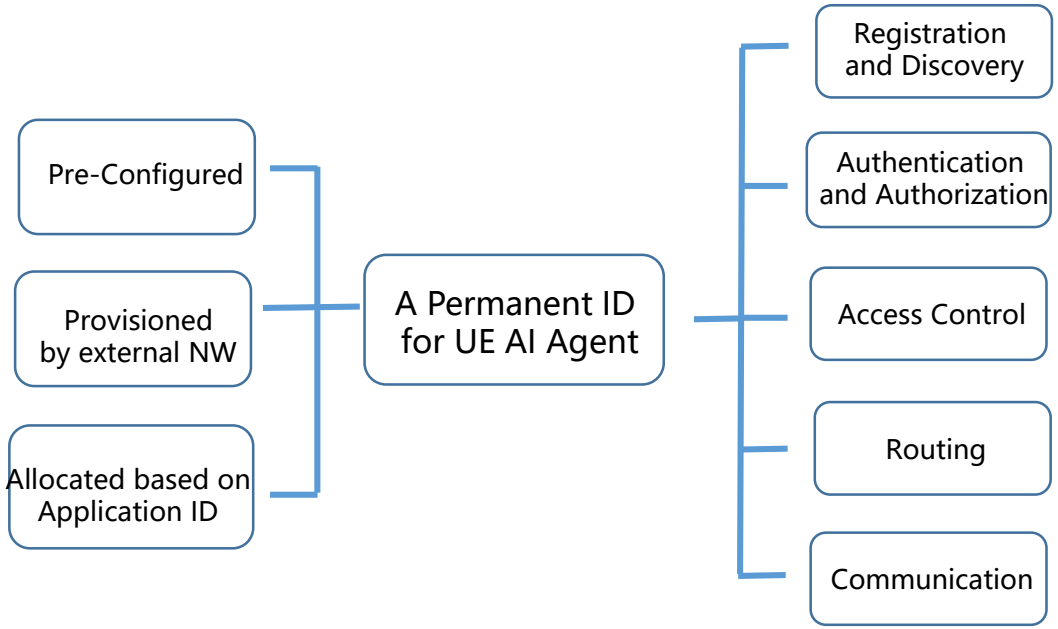
- By deploying AI Agents in 6G network, the 6G network can provide users with novel intelligent services requested by the user intent.
- Agent Communication: Agents communication between different network AI Agents
- Use Cases:
  - 6G Network Providing On-demand Networking with AI Agent (Clause 6.21)
  - Disaster Rescue Planning Enabled By Network AI Agents (Clause 6.32)
  - Customised service provisioning based on AI Agents (Clause 6.44)
  - Multi-MNO cooperative service continuity in disaster scenarios (Clause 6.57)
  - …





Functionalities for Multi-Agent Collaboration





Registration and Profile Retrieval

- Repository Functionalities may be a single function or distributed in several functions for UE Agent, NF and application Agent(optionally).
- A common Repository Function (e.g. NRF) or Separated Repository Functions for NF with/without AI capabilities
- NF may register its AI capabilities as services as traditional NFs.
- Application agents may be discovered in external network or in 6G network if it has registered in 6G network.

UE Agent ID

- The permanent ID remains valid throughout the lifecycle of the UE AI agent.
- The authentication may be collaborated with external server.
- The application identifier includes corresponding AF information and is used for discover the external application server.
- Format variants may consider: NAI defined in RFC 7542, DID, …..