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Network AI Agent Use Cases and Requirements in 6G
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Abstract

This draft introduces use cases related to network AI agents in 6G, with a focus on the interaction workflows of network AI agents in two distinct scenarios: connectivity services and third-party application services. These use cases primarily draw upon 6G-related scenarios outlined in the 3GPP technical report [TR22.870]. Furthermore, the document elaborates on the integration of network AI agents within the 6G framework and discusses corresponding network requirements.

Status of This Memo

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1. Introduction

In the era of 6G network, the emergence of new services such as AI, computing, and sensing poses unprecedented challenges to network processing capabilities. As autonomous decision-making entities, AI agents are poised to become a core driving force for innovation in network architecture. Through capabilities such as intent understanding, environmental modeling, and cross-domain collaboration, they can dynamically adapt to user demands and network operating conditions, facilitating an intelligent leap toward "proactive optimization" in network. Within the 3GPP R20 6G standardization research, AI agents have already been taken into consideration. At the recent SA1#111 meeting, a total of 41 proposals related to AI agents were submitted, including 18 new use cases, of which 6 were ultimately approved. This paper primarily focuses on how network intelligence can enhance internal quality while simultaneously enabling external empowerment. Specifically, AI agents play a dual role in 6G network: on the user and operator sides, they provide low-latency, high-reliability communication services based on real-time behavior prediction and resource scheduling, thereby improving network quality and user experience; for personalized requests from third-party applications, they expose network capabilities externally through AI agents, enabling external empowerment and fostering innovative scenarios such as smart healthcare IoT and immersive metaverse applications. Section 2 summarizes two categories of relevant cases, Section 3 describes the network framework and requirements, and Section 4 concludes this draft.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

2. Use Cases

In scenarios involving connectivity services, users or network administrators submit intent-based requests to the 6G network. The network agent can perform accurate intent parsing, conduct task classification and planning, and delegate further strategy formulation and execution to hierarchical service agents, thereby completing network design in accordance with the service intent. For new service scenarios such as AI, the network agent can provide AI capabilities from the network side based on the given intent.

2.1. Generative Network for Connectivity Services

Based on service requirements or network status, users or network administrators can submit networking intents to the network. These intents are then fulfilled by agents within the network, which perform cross-domain collaborative optimization and configuration of resources to achieve efficient generative networking.

2.1.1. Process Flow

1. David, a network administrator from a certain operator, submits the following request to the network: "A concert will be held at the downtown stadium tomorrow from 19:00 to 22:00. Please design the network to smoothly handle the traffic surge while ensuring the fluency of key user services."

2. The 6G core network Task Orchestration Agent parses the networking intent requirement, performs an initial task breakdown, splits the task, and identifies the agents required for execution. For example, the task is decomposed into multiple

subtasks, including intelligent access, resource configuration, service identification, and service policy optimization, involving the Connectivity Agent and the QoS Assurance Agent.

3. The Task Orchestration Agent acquires the data necessary for task execution to support decision-making by the service agents. For instance, it can invoke external tools to obtain historical data and predict the service scale for this networking task through intelligent forecasting and digital twin functionalities. The subtask information is then distributed to the corresponding agents. This information includes task descriptions, task identifiers, task requirements, and task data, supporting the delivery of structured data, intents, control commands, and other types of information to fully convey task instructions.

4. Upon receiving the intelligent access and resource configuration subtasks, the Connectivity Agent addresses user access requests within the area by employing intelligent access algorithms to schedule corresponding 6G network elements for efficient user access. Based on the distribution of user types and services in the area, it utilizes a reinforcement-based generative policy model to allocate and optimize network resources. During the decision-making process, in addition to using the data provided in the task information, the agent also interacts with network elements to obtain real-time data and performs enhanced data analysis.

5. The QoS Assurance Agent receives the subtasks for service identification and service policy optimization. During the networking optimization task, the QoS agent activates the service identification function, providing a service basis for generating networking strategies through service recognition and quality degradation analysis. According to the real-time status of services, it dynamically generates core network optimization strategies. Meanwhile, leveraging its cross-domain coordination capability, it shares strategies with the RAN side to achieve refined resource allocation and optimize service quality.

Based on the task agents’ demand analysis and task planning, the Connectivity Agent and the QoS Assurance Agent, through intelligent access, dynamic resource configuration, precise service identification, quality degradation analysis, and leveraging policy generation capabilities, achieve efficient generative networking, thereby ensuring the highly effective execution of the task.

2.1.2. Analysis of AI Agent Roles

This case involves two types of agents. The first type is the central agent, which is responsible for receiving requests from users or network administrators, performing intent recognition, extracting detailed information, and decomposing tasks. The second type of agent is oriented toward specific services and is responsible for task decomposition, policy generation, and execution.

In this specific case:The role of the central agent is undertaken by the Task Orchestration Agent, which performs intent recognition on the network administrator’s request, divides it into multiple subtasks, and extracts key task information to distribute to the corresponding second-type agents.

The second-type agents are service agents, responsible for policy planning and execution of specific subtasks. In this scenario, two service agents are involved: the QoS Assurance Agent and the Connectivity Agent. Each agent, based on the subtask it receives, leverages its corresponding capabilities to collaboratively accomplish the networking task.

2.2. Network Capability Exposure to Third-Party Services

The concert organizer initiates a high-value user recommendation request to the network via its official "AR Smart Interaction" app. The network then performs statistical analysis based on user contract data and service profiles, delivers the corresponding capability, and assists the third party in formulating a targeted push notification strategy for the app.

2.2.1. Process Flow

1. During the concert, the organizer provides an immersive interactive service through the official "AR Smart Interaction" app. This third-party app platform sends an intent request to the Capability Exposure Agent to acquire user information for delivering customized services. For example, a request may state: "Please provide me with relevant information for the users on the list, including user profiles, network quality, and service resource allocation, to facilitate customized services." Additionally, the Capability Exposure Agent also supports receiving specified data requests from the third-party app platform via standardized APIs.

2. The 6G core network Capability Exposure Agent parses the intent conveyed by the third-party app platform and decomposes it into tasks directed at the Service Customization Agent. These tasks

may include obtaining target user preferences, identifying high-demand users within the target group, and acquiring the network quality of target users. The Capability Exposure Agent then dispatches these tasks to the Service Customization Agent.

3. Upon acquiring task information, the Service Customization Agent invokes data functions to retrieve the required analysis results. This retrieval is performed either from its internal data storage or by obtaining results from other agents and network elements.

4. If existing data cannot fully meet the application requirements, the Service Customization Agent can also retrieve raw data and utilize its built-in functions, such as user profiling and network quality assessment, to generate up-to-date analysis results. For instance, it may interact with the Connectivity Agent to obtain network quality data for relevant users, which is then processed by its network quality assessment function to produce the required results.

5. After gathering all necessary information for the task, the Service Customization Agent reports the results back to the Capability Exposure Agent.

6. The Capability Exposure Agent then provides the requested information to the "Concert AR Smart Interaction" app platform via standardized APIs.

7. With the received data, the "Concert AR Smart Interaction" app platform can deliver customized services based on its own business logic. Examples include selecting preferred interaction methods according to user profiles, recommending services likely to interest the user, and suggesting higher-quality service packages to high-value users.

2.2.2. Analysis of AI Agent Roles

This case involves two categories of agents. The first category is the central agent, responsible for receiving requests for third-party personalized services, performing intent recognition, extracting detailed information, and conducting task decomposition. The second category comprises service agents, which are oriented toward specific services and handle task decomposition, policy generation, and execution.

In this specific case:The role of the central agent is fulfilled by the Capability Exposure Agent, which performs intent recognition on requests from third-party applications and distributes subtasks to the Service Customization Agent.The Service Customization Agent is responsible for the analysis, execution, and feedback of the specific subtasks.

3. Architecture and Potential Requirements of AI Agent-Integrated 6G Network

3.1. AI Agent-Integrated 6G Network Framework

The 6G network framework incorporating network AI agents is primarily structured into three layers:

1. The first layer is the Central Intelligence Layer, composed of the Task Orchestration Agent and the Capability Exposure Agent. The Task Orchestration Agent is responsible for receiving requests from the user side and the network management side. The Capability Exposure Agent handles capability exposure requests from external applications.

2. The second layer is the Service Agent Layer, which consists of multiple service agents, including but not limited to the QoS Assurance Agent, Connectivity Agent, and Service Customization Agent. Each service agent is responsible for the analysis, decision-making, and execution of its corresponding tasks. During operation, service agents need to communicate with network elements and external tools to collaboratively complete their assigned tasks.

   * The functionalities of the QoS Assurance Agent may include service identification, quality degradation analysis, and dynamic parameter adjustment.

   * The functionalities of the Connectivity Agent may include intelligent access, mobility management optimization, and resource configuration.

   * The functionalities of the Service Customization Agent may include user profiling, network quality assessment, and service orchestration.

   By leveraging their respective capabilities, the service agents work in coordination to accomplish specific tasks.

3. The third layer is the Atomic Capability Layer, which comprises network elements and tools. This layer provides the fundamental capabilities required for the service agents to execute their various tasks.

3.2. Potential Network Requirements

Based on the above case studies and framework, the network side must possess the following capabilities:

1. The network must support the reception of intent-based requests, such as user-side intents, network management intents, and third-party requests for capability exposure. The central-layer agents must be capable of identifying and parsing these intents.

2. The network must support communication protocols between AI agents, enabling direct interaction among network AI agents to collaboratively complete tasks.

3. The network must support communication protocols between AI agents and external tools or network elements. During task execution, service agents need to invoke network elements or specific tools to fulfill their responsibilities.

4. The network must possess identity management capabilities for network AI agents. For instance, the Task Orchestration Agent should manage the identities and capabilities of other agents to assign specific subtasks to the appropriate agents. Similarly, the Connectivity Agent should be able to manage the identities of external AI agents, ensuring their secure access and supporting on-demand networking, among other requirements.

5. The network must enable the exposure of network AI agent capabilities to external parties, thereby supporting innovative third-party services.

4. Conclusion

In 6G network, AI agents can function both as communication entities and as tools for empowering the network. This chapter analyzes the potential benefits of introducing AI agents into 6G through two types of case studies. It also examines how network AI agents can be integrated into the 6G architecture and identifies the corresponding network requirements.

5. IANA Considerations

This memo includes no request to IANA.

6. Security Considerations

This document should not affect the security of the Internet.

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/rfc/rfc2119>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/rfc/rfc8174>.

7.2. Informative References

[TR22.870] 3GPP TR 22.870, "Study on 6G Use Cases and Service Requirements", 2025.

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