July 2025

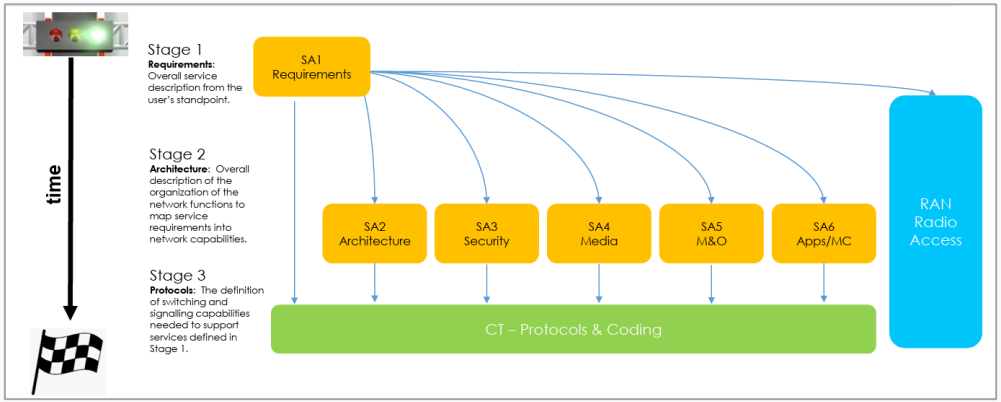
AI Agent protocols for 6G systems
draft-stephan-ai-agent-6g-00

IETF

3GPP

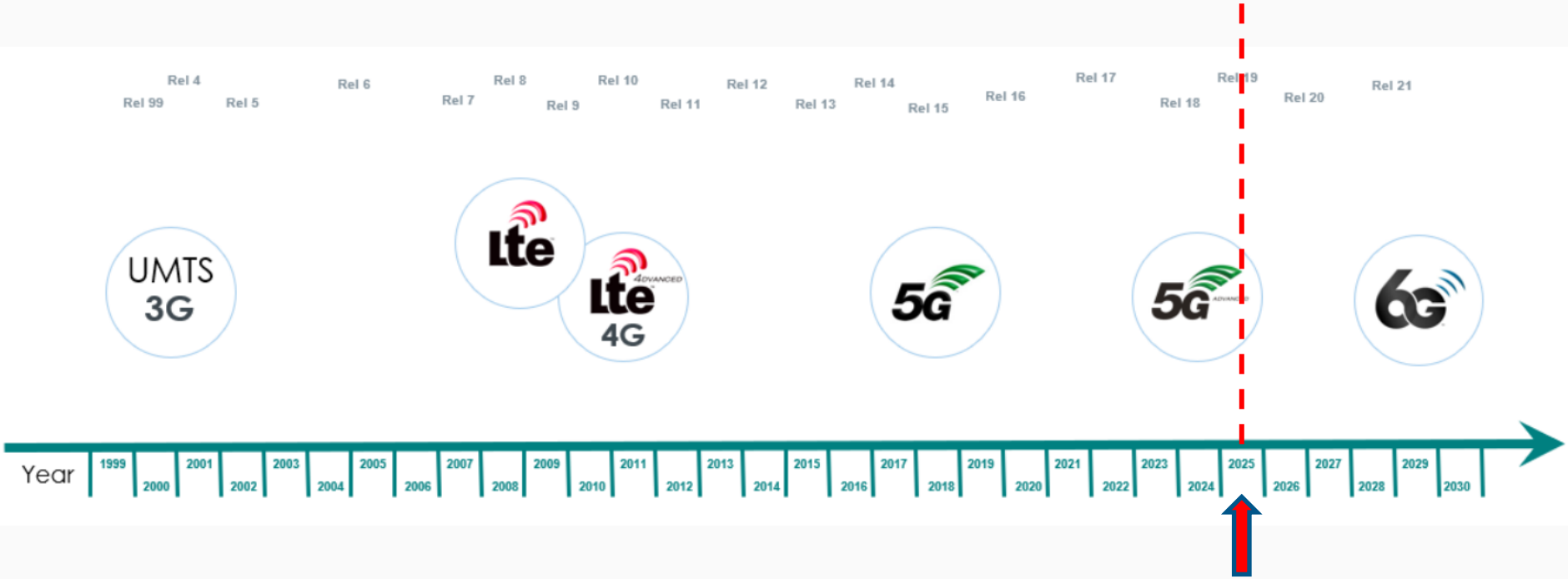
- 3GPP specifications cover cellular telecommunications technologies, including radio access, core network and service capabilities, which provide a complete system description for mobile telecommunications.
- 3GPP produces Technical Specifications, to be transposed by seven Standardization Bodies (ARIB, ATIS, CCSA, ETSI, TDSI, TTA, TTC) into their appropriate deliverables (e.g., standards).

TSG RAN Radio Access Network	TSG SA Service & System Aspects	TSG CT Core Network & Terminals
RAN WG1 Radio Layer 1 (Physical layer)	SA WG1 Services	CT WG1 User Equipment to Core Network protocols
RAN WG2 Radio layer 2 and Radio layer 3 Radio Resource Control	SA WG2 System Architecture and Services	CT WG3 Interworking with External Networks & Policy and Charging Control
RAN WG3 UTRAN/E-UTRAN/NG-RAN architecture and related network interfaces	SA WG3 Security and Privacy	CT WG4 Core Network Protocols
RAN WG4 Radio Performance and Protocol Aspects	SA WG4 Multimedia Codecs, Systems and Services	CT WG6 Smart Card Application Aspects
RAN WG5 Mobile terminal conformance testing	SA WG5 Management, Orchestration and Charging	
RAN AH1 ITU-R Ad Hoc	SA WG6 Application Enablement and Critical Communication Applications	



https://www.3gpp.org/about-us/introducing-3gpp

3GPP Releases and Generations



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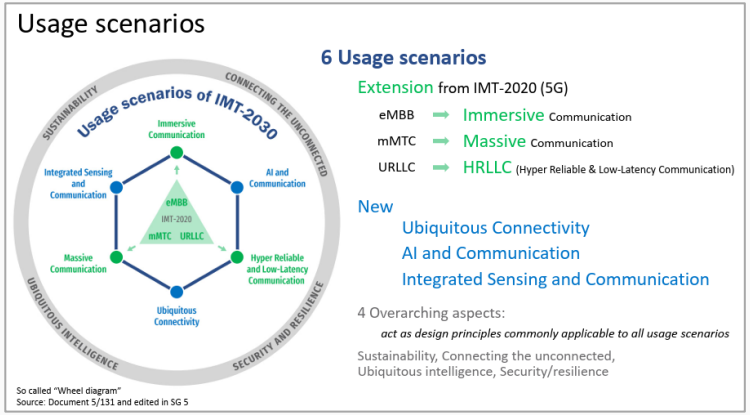
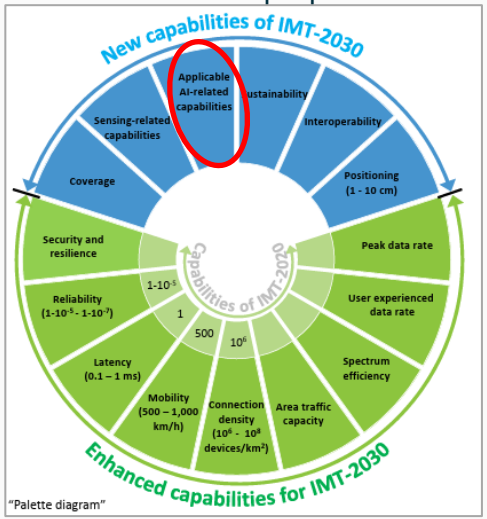
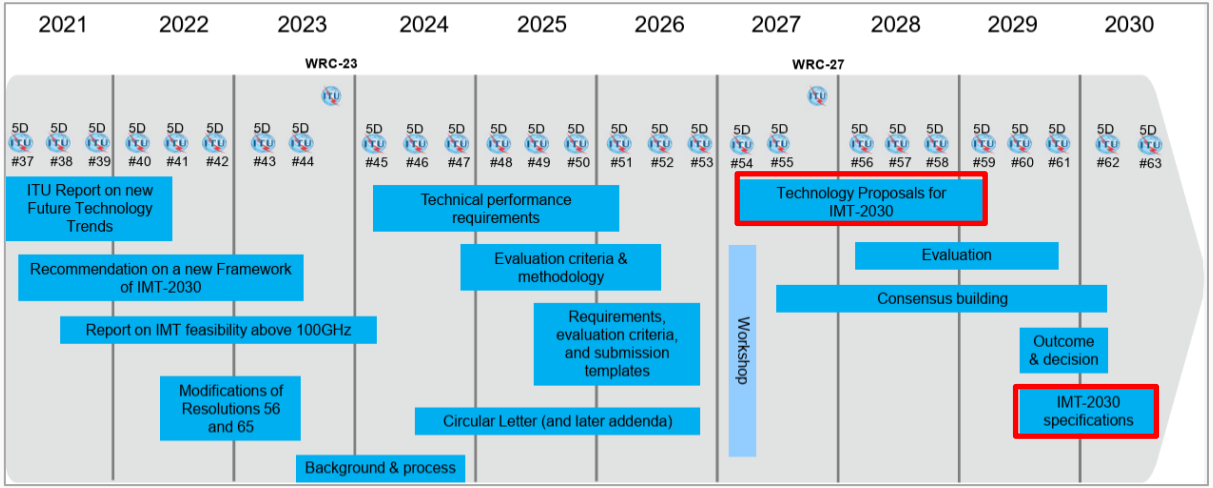
6G Roadmap: ITU-R IMT 2030

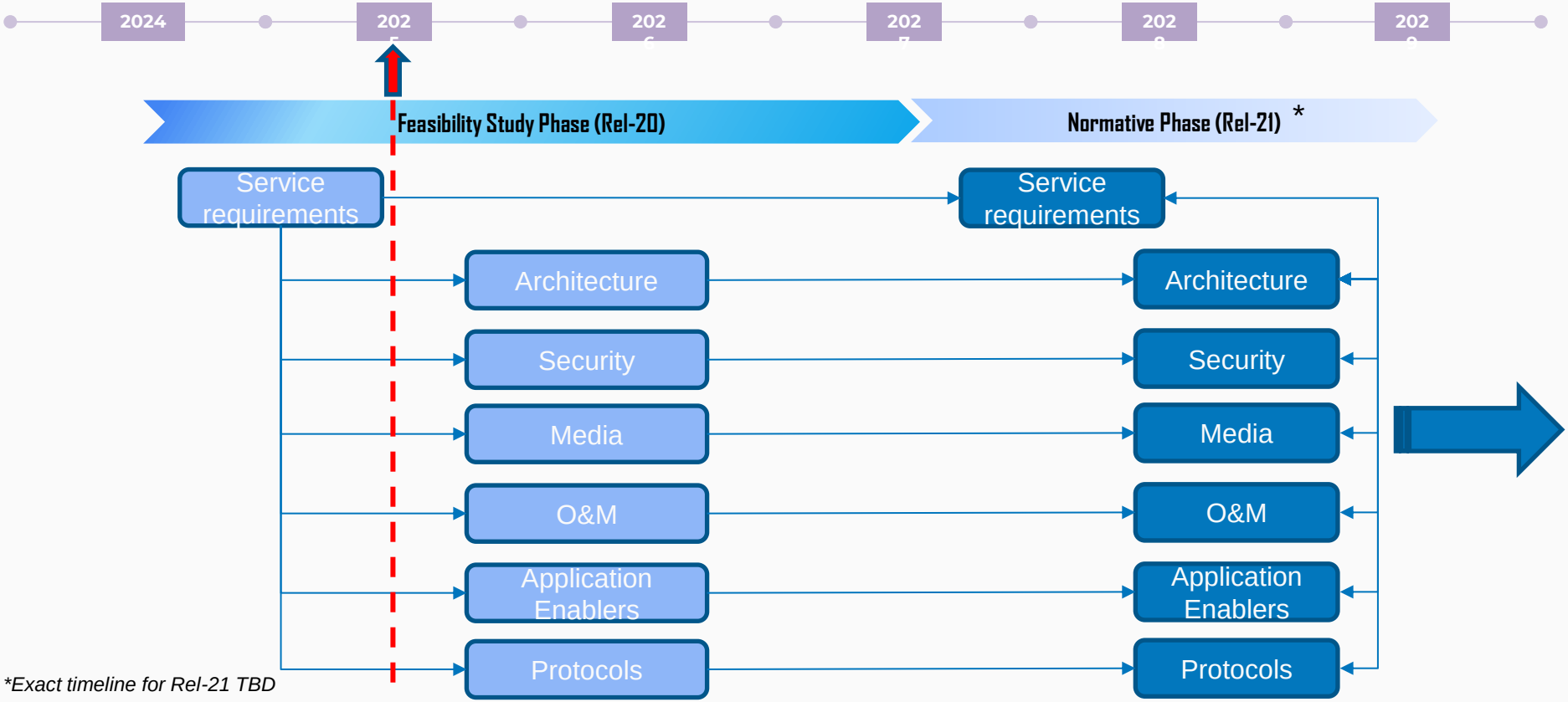
- ITU-R has commenced the process of developing ITU-R Recommendations for the terrestrial components of the IMT-2030 radio interface(s), i.e., 6G.
- 6G is expected to provide enhanced capabilities compared to those described for IMT-2020 (aka 5G), as well as new capabilities to support the expanded usage scenarios of IMT-2030.
- 3GPP will submit a proposal for a 6G system (Radio+Core)







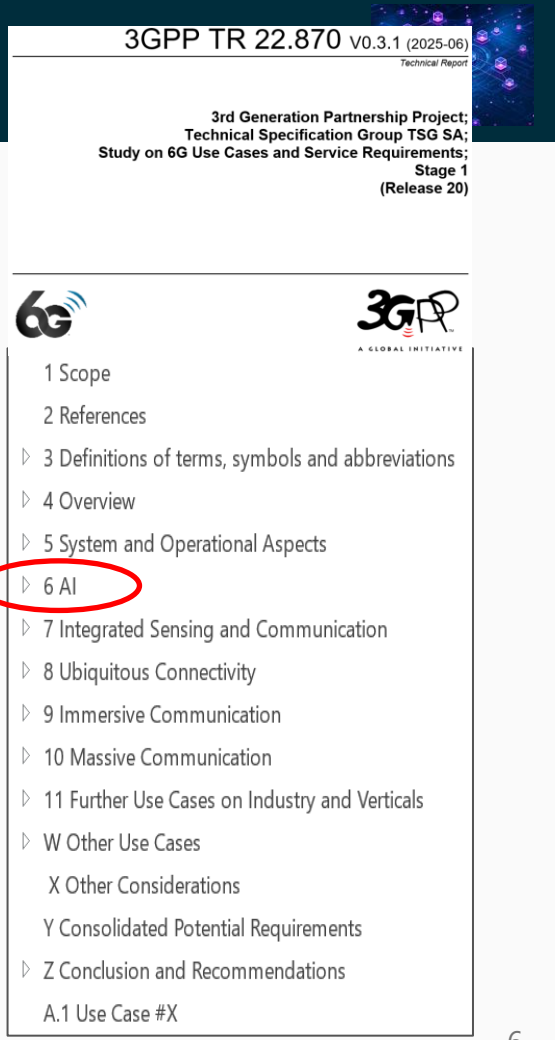
3GPP 6G workplan



*Exact timeline for Rel-21 TBD

Study on 6G Use Cases and Service Requirements

- 6G Use Cases and Service Requirements captured in 3GPP TR 22.870 (https://www.3gpp.org/dynareport/22870.htm)
  - Initiated 2024/12 for completion expected by 2026/03
- Objectives:
  - Identify high level principles and use cases
    - based on, but not limited to, IMT-2030 usage scenarios
  - Define potential requirements for 6G system to support new/enhanced services
- Status: at an early stage and study being still a work in progress
- Anyway, useful insights on the potential foundation pillars of the new 6G system.
- AI and AI agents are clearly hot topics



3GPP TR 22.870 V0.3.1 (2025-06)
Technical Report

3rd Generation Partnership Project;
Technical Specification Group TSG SA;
Study on 6G Use Cases and Service Requirements;
Stage 1
(Release 20)

1 Scope
2 References
3 Definitions of terms, symbols and abbreviations
4 Overview
5 System and Operational Aspects
6 AI
7 Integrated Sensing and Communication
8 Ubiquitous Connectivity
9 Immersive Communication
10 Massive Communication
11 Further Use Cases on Industry and Verticals
W Other Use Cases
X Other Considerations
Y Consolidated Potential Requirements
Z Conclusion and Recommendations
A.1 Use Case #X

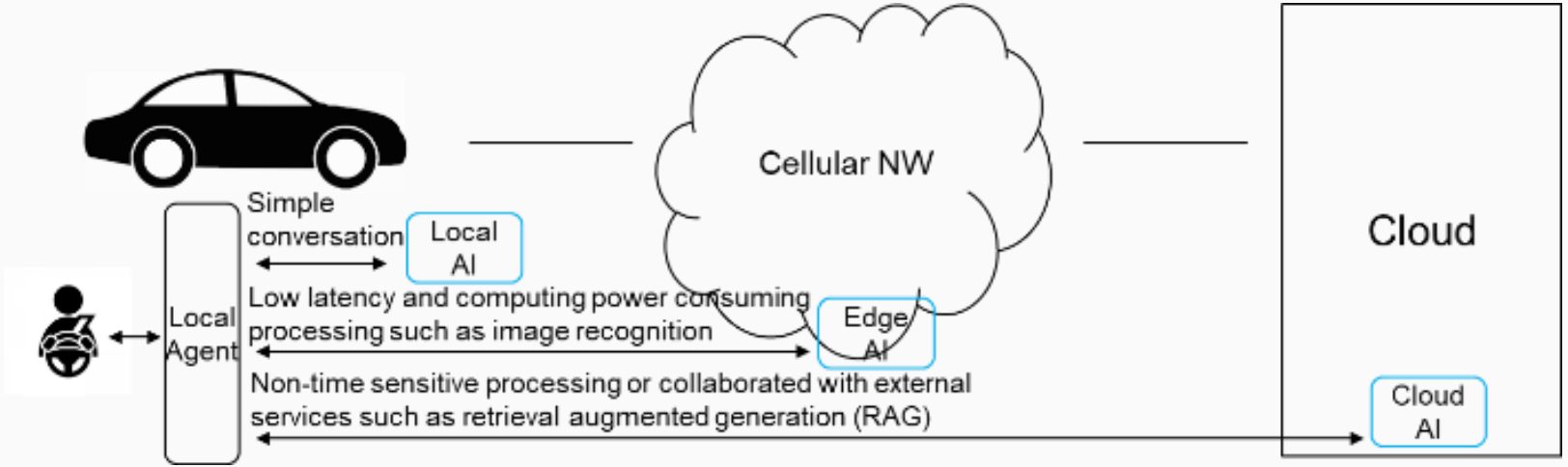
"AI Agent" as defined in the TR 22.870

AI Agent: an automated intelligent entity capable of e.g interacting with its environment, acquiring contextual information, reasoning, self-learning, decision-making, executing tasks (autonomously or in collaboration with other AI Agents) to achieve a specific goal.

Editor's Note: This definition could be updated as the study goes on to align with the potential new understand of AI agent.

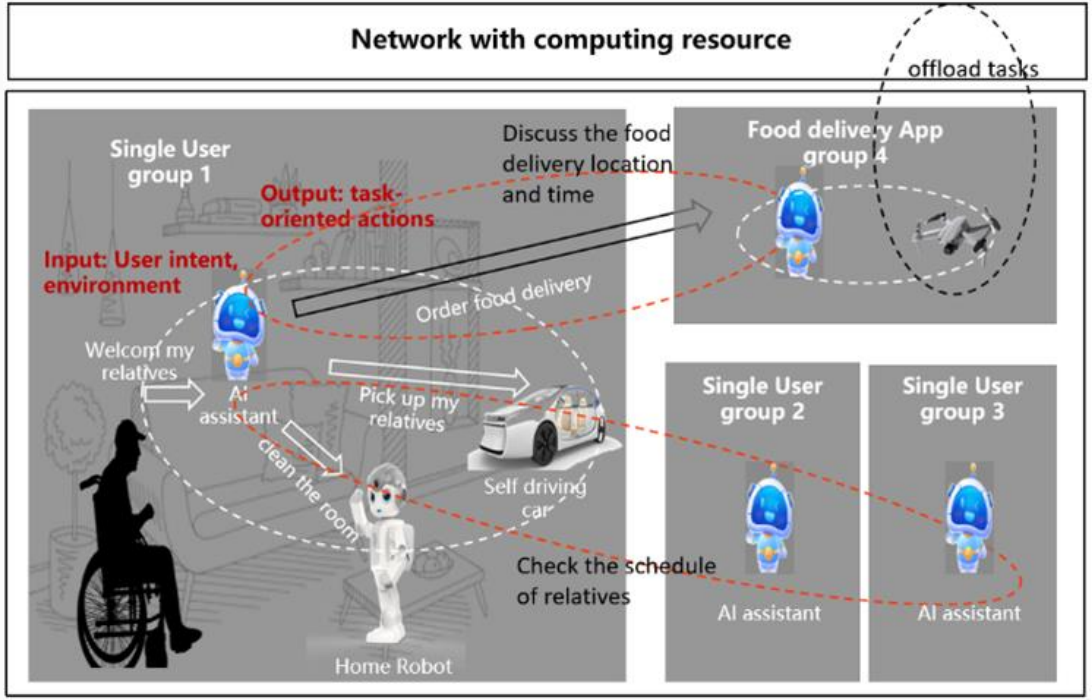
Example 1 (for illustration): end-to-end AI for connected cars

- In-vehicle local agent collaborating with Edge AI and cloud agents to provide services to the end-users



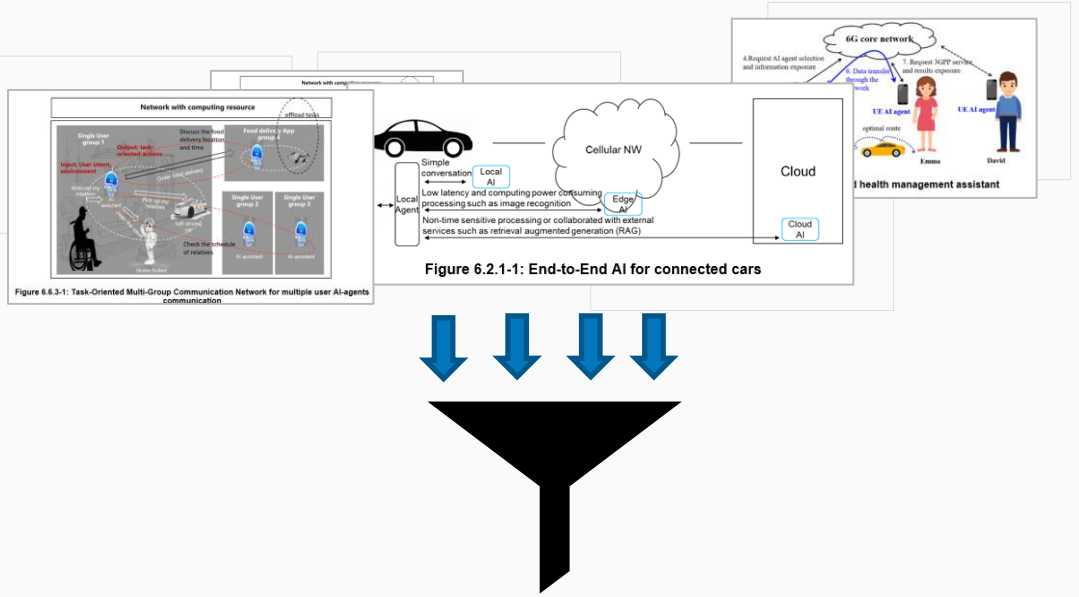
Example 2 (for illustration): AI-agents group communication

- AI agents from distinct groups collaborating inside temporary communication domain to complete with each other for a specific task during a specific time.



Objectives of the draft

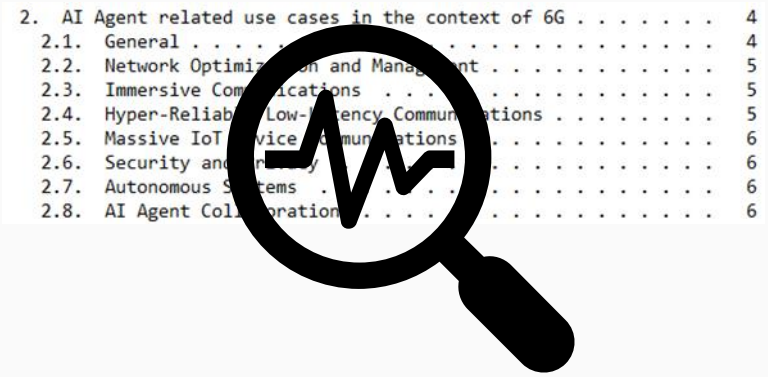
From use cases described in the TR 22.870

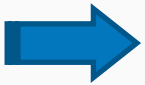


Highlight AI Agent communication scenarios

Objectives of the draft

- Potential key requirements derived from the illustrative use cases





Potential Key Requirements 1/3

Prospect

- Interoperability

  - Standardized Protocols: Ensuring seamless interaction across platforms.
  - Multimodal Data Formats: Supporting text, files, audio, and video.
  - Agent Identity Management: Secure identification and verification.
- Discovery Mechanisms

  - Dynamic identification and location of AI agents and tools.
  - Combining multiple discovery mechanisms for efficiency.
- Task Management

  - Task decomposition, assignment, scheduling, and coordination.
  - Importance of seamless collaboration among agents.

Potential Key Requirements 2/3

Prospect

- Context Awareness

  - Contextual Understanding: Awareness of operational context.
  - Adaptive Communication: Adapting communication based on context.
- Autonomy

  - Decision Making: Autonomous and collaborative decisions.
  - Self-Management: Self-configuration, optimization, and healing.
- Security

  - Authentication and Authorization: Identity verification and access control.
  - Data Protection: Encryption for privacy and confidentiality.
  - User Consent: Mechanisms for secure data exchange.

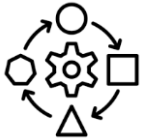
Potential Key Requirements 3/3

Prospect

- Low Latency Communication

  - Importance of minimal delay in data transmission.
  - Critical for real-time applications.
- Reliability

  - Fault Tolerance: Detecting, mitigating, and recovering from anomalies.
  - Load Balancing: Distributing tasks to prevent bottlenecks.
  - Redundancy: Ensuring high reliability and service continuity.
- Flexibility



  - Scalability: Accommodating increasing network sizes and data volumes.
  - Adaptability: Adjusting to various contexts and transmission methods.
  - Extensibility: Evolving with new technologies.
- Energy Efficiency

  - Optimized Communication: Reducing energy consumption.
  - Power Management: Extending operational life of devices.

Conclusions

- Ongoing study demonstrates the potential of AI agent communication in the scope of 6G.
- Early stage: 3GPP is still discussing the AI agent related use cases. Functional and protocol related aspects will be studied in the upcoming months
- If a multi-AI agent-based system is formally adopted by 3GPP in the scope of 6G, standard solutions will be required to support secure and reliable communication between agents and between agents and external tools.
- Standard solutions for intra-network but also for interaction with 3rd-party platforms.
- Authors consider that IETF could be the right place for such standard effort.
- Close coordination between IETF and 3GPP is expected

Next: Study on Architecture for 6G System

- Study on use cases and service requirements in SA1 WG will be concluded in March 2026.
- In parallel, the study on Architecture and functional aspects for 6G system has just been launched in SA2 WG (SP-250890), to be completed by end of 2026/beginning of 2027:

This study aims to define a system architecture for 6G mobile networks for improvement of existing services and support of new services, to meet the 6G system requirements as defined by 3GPP SA1 and TSG RAN.

The study includes the following high level work tasks, and the conclusion will consolidate the 6G architecture among all work tasks:

- *WT#1: Define the overall 6G architecture as collection of capabilities and high level functionalities considering the*
- *WT#2: Study migration and interworking*
- *WT#3: Study how to support and enable use of AI in 6G (e.g. AI agent, framework).*
- *WT#4: Study the integration of Sensing and Communication over 3GPP access, considering the sensing modes to be supported and other sources of sensing data.*
- *WT#5: Study data framework for all aspects related to efficient and scalable data handling*
- *WT#6: Study aspects on support of computing for UE, core network and application server in 6G*
- *WT#7: Study how to support 6G RAT for NTN, based on RAN decision, and support service continuity aspects.*
- *WT#8: Study whether and how to support cellular IoT enablers in 6G, based on RAN decision for 6G IoT.*

The conclusions of this study will form the basis for the normative work and/or for any further study.

To conclude on WT#3, 3GPP will need to know if standardized solutions are or will be available

Study on protocol aspects will be launched in upcoming months, using first outputs of the study.

Clear need for a standard for Agent communications…

AGNTCY Agent Connect Protocol

Search

OASF

Agent Directory Service

We propose a solution where all agents are able to communicate over the network using a standard protocol to interoperate. We call it the **Agent Connect Protocol** (**ACP**).

Agent Communication Protocol

Search... Ctrl K

Python SDK

TypeScript SDK

The **Agent Communication Protocol (ACP)** is an open protocol for agent interoperability that solves the growing challenge of connecting AI agents, applications, and humans. Modern AI agents are often built in isolation, across different frameworks, teams, and infrastructures. This fragmentation slows innovation and makes it harder for agents to work together effectively. ACP solves this by enabling agents to communicate through a standardized RESTful API that supports:

An open protocol enabling communication and interoperability between opaque agentic applications.

The Agent2Agent (A2A) protocol addresses a critical challenge in the AI landscape: enabling gen AI agents, built on diverse frameworks by different companies running on separate servers, to communicate and collaborate effectively - as agents, not just as tools. A2A aims to provide a common language for agents, fostering a more interconnected, powerful, and innovative AI ecosystem.

AgentNetworkProtocol / docs / anp-getting-started-guide.md ↑ Top

Preview Code Blame 356 lines (269 loc) · 17.8 KB Raw

What is ANP

ANP (Agent Network Protocol) is an open-source intelligent agent communication protocol, designed to be the HTTP protocol for the age of the agent internet. ANP enables agents to discover, connect, and interact with each other on the internet, establishing an open and secure network for agent collaboration.

Project NANDA

Project NANDA is building the foundational infrastructure for the **Open Agentic Web** - a system where trillions of AI agents can collaborate, communicate, and transact across organizational boundaries without bottlenecks or security vulnerabilities. NANDA addresses the core challenge: how can billions or even trillions of AI agents discover each other, verify capabilities, and coordinate tasks without creating bottlenecks or security vulnerabilities. The project develops both the technical infrastructure (index - interop links between all heterogenous agent registries, protocols, SDKs) and the governance frameworks needed for a responsible, **Open Agentic Web**.

Introduction

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Get started with the Model Context Protocol (MCP)

MCP is an open protocol that standardizes how applications provide context to LLMs. Think of MCP like a USB-C port for AI applications. Just as USB-C provides a standardized way to connect your devices to various peripherals and accessories, MCP provides a standardized way to connect AI models to different data sources and tools.

** MCP currently considered as de facto solution for agent-tool communication*

But at the end…

If you really want a STANDARD solution to ensure full interoperability between agents!

Next steps

- Help to build consensus on:
  - Existing need for a standard for agent communication
  - IETF is the right place to work on it

- Include 3GPP specific requirements (if any) in the scope of the discussion on a possible charter

- Provide updates on the progress of the work in 3GPP

- Promote close cooperation between IETF and 3GPP

Useful References

- ITU-R, "Recommendation ITU-R M.2160-0: Framework and overall objectives of the future development of IMT for 2030 and beyond",
  - https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2160-0-202311-I!!PDF-E.pdf .
- 3GPP TR 22.870: Study on 6G Use Cases and Service Requirements; Stage 1 (Release 20)"
  - https://www.3gpp.org/ftp/Specs/archive/22_series/22.870
- 3GPP SA2 Study Item on Architecture for 6G System
  - https://www.3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_108_Prague_2025-06/Docs/SP-250806.zip
- 3GPP Work Plan: Review at Plenary #108 (June 2025)
  - https://www.3gpp.org/ftp/tsg_sa/TSG_SA/TSGS_108_Prague_2025-06/Docs/SP-250890.zip