**3GPP TSG-SA WG1 Meeting #108 S1-244536**

**Orlando, Florida, USA, 18-22 November 2024** *(revision of S1-244265)*

Title: Collaborative intelligent Agents

Agenda Item: 8.1.7. Other use cases

Source: KPN

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*Abstract: This pCR introduced a use case on Intelligent Agents in Other Use Cases.*

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## 11 Other Use Cases

## 11.1 Use case on Collaborative Intelligent Agents

### 11.1.1 Description

Intelligent agents are small software components in the network that can perform tasks for or represent e.g. devices, persons, drones, or cars. By offloading tasks to the network, devices can save on complexity and energy consumption. An example of this could be Augmented Reality Glasses that offload the task of stitching different media streams, when the combination of media and information streams becomes to compute intensive for light weight glasses. Offload can happen e.g. towards a local/edge network or a nearby other device with more processing capabilities.

Editor’s Note: Definition and terminology of Intelligent Agents is FFS.

Collaboration between intelligent agents and or other applications will reduce the amount of radio communication that otherwise would be needed for collaboration between the devices/persons/drones/cars directly. An important advantage of intelligent agents is that intelligent agents can represent a device/person/drone/car even when that device/person/drone/car itself is not reachable.

Intelligent agents can be used for many different purposes. In this use case we are including an example of an intelligent agent for a car, which is communicating with e.g. personal agents representing the owners of the car and applications for the energy grid.

Collaboration between intelligent agents requires interoperability between different intelligent agents. This interoperability between the intelligent agents even needs to be provided when the collaborating intelligent agents are implemented in different networks. Supporting interoperability across different networks is a case for standardisation. However, with a huge number of different intelligent agents, only the basic interoperability aspects can be standardised. E.g. how to identify an intelligent agent, how to authorise access to a different intelligent agent and how to establish and maintain secure association between intelligent agents.

Intelligent agents will follow the device/person/car/drone/etc they are associated with to nearby edge network locations. One reason is to reduce latency, another reason is to avoid large amounts of traffic travelling long distance through the network. Intelligent agents can collaborate with other intelligent agents relevant for where they are located.

**Key Value impact analysis**

**Material resources:** Intelligent agents will require compute resources. On the other hand, offloading device tasks to intelligent agents in the network can lead to less complexity in devices.

**Energy resources:** Processing intelligent agents will imply an increase in the use of energy resources. On the other hand, intelligent applications may be incur energy savings in other sectors.

**Inclusion & Equality:** Collaborating intelligent agents are expected to form an important part of the digital society, e.g. interactions with government, public transport, commerce. It is therefore of great importance that intelligent agents are accessible to all.

**Trustworthiness:** Privacy and trustworthiness are key for the public acceptance of intelligent agents.

### 11.1.2 Pre-conditions

Husband and wife John and Ann own an electric car. The electric car has a intelligent agent that can organise various things for the car. This includes that it can communicate with applications from the energy grid to optimise charging the car. There is a ‘spot-price’ for electricity that fluctuates with locally available electricity. The price can even be negative if there is more renewable energy is produced than can be used. The intelligent agent for the car is provided by the car company. The local networks the intelligent agent runs on are determined by contracts the car company has.

John has a personal intelligent agent that amongst others manages his calendar. John gets the subscription for the intelligent agent through his corporate employer.

Also Ann has a personal intelligent agent that manages her calendar. As Ann is a self employed consultant, she obtains a subscription for her personal intelligent agent from her telecommunications provider.

The car intelligent agent has been authorised by John and Ann to access their personal intelligent agents to obtain information about their calendars.

### 11.1.3 Service Flows

1. John is on a business trip abroad with his car. While he is asleep in a hotel, the car is connected to a charger. The intelligent agent for the car runs in an edge network near the car.

2. The car intelligent agent communicates with a local application for the local energy grid and notices that the price for electricity is particularly high that night in the area of the hotel. There is the possibility to make a profit if the car can actually provide energy from its battery back to the grid.

3. To determine whether it is a good idea to provide energy from the car battery back to the grid, the car intelligent agent needs to check whether . It needs to check whether the car needs to travel far next day. Rather than calling John and Ann, and waking them up, to get that information, the intelligent agent checks the intelligent agents from John and Ann to see if any large trips are planned. The intelligent agent for John has ported to an edge location at the hotel. The intelligent agent for Ann runs it her telecommunications network back at home.

4. The personal intelligent agent from John indicates that the next day John plans to travel back home, a 900 km journey. It is not a good idea to use the car battery to sell energy back to the grid.

5. In the morning John sees a message from a friend asking him to meet some friends in the pub. The friends (or their personal intelligent agents) are not authorised to access calendar information from his intelligent agent.

### 11.1.4 Post-conditions

Information was exchanged between the car intelligent agent and the personal intelligent agents from John and Ann, even though these intelligent agents at that time used computing resources from different providers in different countries. Information was protected against unauthorised access.

### 11.1.5 Existing features partly or fully covering the use case functionality

3GPP SA6 has specified an architecture for Edge Applications [2] where third party applications can be hosted at the edge. Application mobility into visited networks is also supported. What is not supported are agents for individual devices/persons/cars/drones where it is the device/person/car/drone that offloads compute for specific tasks to the network (or another device). Also there is no support for interoperability, with authorisation and security, between different applications.

### 11.1.6 Potential New Requirements needed to support the use case

**Requirements**

The 6G system shall support the hosting of large amounts of intelligent agents.

NOTE: It is expected that the number of intelligent agents will be in the same order of magnitude as the number of UEs.

The 6G system shall support secure interoperability between intelligent agents and between intelligent agents and applications; Secure interoperability shall include identification of the intelligent agent, authorisation of access to specific other intelligent agents and protection against eavesdropping of the communication between intelligent agents.

Editor’s Note: Additional requirements for collaboration between Intelligent agents FFS.

The 6G system shall support mobility of intelligent agents where the intelligent agent representing a device/person/drone/car can be hosted in an edge networks local to the device/person/drone/car or in a nearby other device.

The 6G system shall be able to charge for compute resources provided to intelligent agents.

---------- second change ----------

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.558: "Architecture for enabling Edge Applications"