**3GPP TSG-SA WG6 Meeting #50-e S6-22xxxx**

**e-meeting, 22nd – 31st August 2022 (revision of S6-221871, 221520)**

**Source: InterDigital**

**Title: New Solution: Support for DAA**

**Spec: 3GPP TR 23.700-55**

**Agenda Item: 9.9**

**Document for: Approval**

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**1. Introduction**

It is proposed to add a new solution for the support of DAA in 3GPP TR 23.700-55 v 0.6.0.

\* \* \* \* Start of changes \* \* \* \*

## 7.5 Solution #3: Support for DAA

### 7.5.1 Architecture enhancements

None.

### 7.5.2 Solution description

#### 7.5.2.1 General

This solution aims to address the gaps identified in Key Issue #4 "Support of detect and avoid services and applications".

The solution covers registration of the UAE clients and the UAE servers DAA capabilities to the USS, provision of the DAA capabilities and DAA policies of the UAS application specific server (USS) to the UAE client and the UAE server, and assistance by the UAE layer for DAA services and applications.

The functions of the USS are out of scope of the solution.

#### 7.5.2.2 Registration of DAA capabilities

Pre-conditions:

- The UAE client has discovered the UAE server and is aware of the address of the UAE server (e.g., FDQN).

NOTE: How the UAE client is provisioned with the UAE server information is outside the scope of the current document.

- The UAV has already been assigned with the UAV ID.



Figure 7.5.2.2-1: Registration of DAA capabilities of UAE client and UAE server

1. The UAE client sends a registration request to the UAE server. The UAE client includes an indication of its DAA capabilities.

NOTE: The details for definition of the UAE client DAA capabilities and DAA policies will be specified during the normative work.

2. The UAE server performs authentication and authorization check (e.g., based on pre-provisioned security information or by interacting with UAS application specific server (e.g., USS/UTM)).

3. The UAE server sends a registration response to the UAE client indicating success or failure of the registration for DAA support.

#### 7.5.2.3 Provision of DAA capabilities

##### 7.5.2.3.1 DAA management

Figure 7.5.2.3.1-1 illustrates the DAA management procedure where the UAE server receives an application request for managing the DAA configuration parameters from the UAS application specific server.

Pre-condition:

- The UAV has received its UAS ID from the UAS application specific server.

- The UAV has performed the UAS UE registration procedure.



Figure 7.5.2.3.1-1: DAA management procedure

1. The UAS application specific server sends to the UAE server a DAA management request with the DAA configuration parameters. The request includes the UAV (UAE client) identification information and the DAA configuration parameters. The UAE server stores the DAA configuration parameters in the UAE client context. The configuration includes a DAA deconflicting policy that provides parameters/rules on how the UAE layer provides assistance with respect to detect and avoid situations. For example, the policy can include rules for UAV communication with the UASS (e.g., DAA Alert) and/or other UAVs or other actions (e.g., change path or altitude) in a DAA situation. The DAA policy rules can also apply considering whether the UAV is in-coverage and out-of-coverage of the network.

NOTE: The complete list of parameters for the deconflicting policy will be specified during the normative work.

Editor’s Note: Whether the DAA management request includes event registration for the DAA Alert from the UAE server to the UASS (USS/UTM) is FFS.

2. The UAE server sends to the UAS application specific server a DAA management response with a positive or negative acknowledgement of the request.

3. UAE server executes the DAA configuration according to clause 7.5.2.3.2.

4. After successful execution of DAA configuration, the UAE server notifies the UAS application specific server with DAA management complete based on the configured capabilities of the UAE client and the UAE server.

##### 7.5.2.3.2 DAA configuration

Figure 7.5.2.3.2-1 illustrates the DAA configuration procedure. This procedure enables the UAE server to configure the UAE client with DAA configuration parameters, based on a request from UAS application specific server (which can be the USS/UTM).

Pre-conditions:

1. The UAS UEs are connected to 5GS and authenticated and authorized by UAS application specific server as specified in clause 5.2 of 3GPP TS 23.256 [4].

2. UAE server has established a UAE session with the respective UAE clients as the UAE clients are successfully registered to the UAE server.

3. UAE server has performed the initiation of DAA management capabilities as in clause 7.5.2.2.2.



Figure 7.5.2.3.2-1: DAA configuration

1. The UAE server sends a DAA configuration request to the UAE client. The UAE client receives a DAA configuration request from the UAE server that includes the DAA configuration parameters.

NOTE: Details in case of e.g. removal of DAA configuration will be specified during the normative work in stage 2 and stage 3.

2. The UAE client stores or removes the DAA configuration parameters as per the information received in step 1.

3. The UAE client sends a DAA configuration response to the UAE server.

#### 7.5.2.4 UAE-layer assisted change of flight path due to DAA

The Figures 7.5.2.4-1, 7.5.2.4-2, and 7.5.2.4-3 illustrate the procedure with UAE-layer assisted change of flight path due to DAA. Figure 7.5.2.4-1 and Figure 7.5.2.4-2 shows how the UAE client or the UAS application specific server can initiate the procedure, and Figure 7.5.2.4-3 shows the UAE-layer assisted change flight path due to DAA.

Pre-conditions:

1. UAE client and UAE server have indicated DAA support.

2. UAS application specific server has provided DAA configuration to the UAE client.



Figure 7.5.2.4-1: UAE client-initiated change of flight path due to DAA

1. When UAV detects UAVs in proximity, the UAE client informs the application layer of the deconflicting policy based on DAA policy (e.g., local or server assisted deconflicting) and whether the UE is in or out of coverage. The UAE client may send to the UAE server a DAA alert indicating a detected or resolved flight path conflict (e.g., local deconflicting performed) with one or more UAVs in proximity. The message can include updated trajectory with a cause of DAA. The UAE server sends the DAA alert to the UAS application specific server.

In an emergency situation deemed necessary by the UAE client (e.g., while out of coverage), the UAE client can initiate the change of flight path according to received DAA configuration parameters.

Editor’s Note: It should be studied if and how the UAE server can use SEAL services for flight path monitoring and notification to fulfill support for DAA. Possible enhancements are; for flight path monitoring and notification, SEAL LM's SS\_LocationAreaMonitoring API to monitoring the UAVs in a given location and SS\_EventsMonitoring API to monitor the events related to UAVs.

2. The UAS application specific server acknowledge the alert to the UAE client via the UAE server.



Figure 7.5.2.4-2: UAS application specific server-initiated change of flight path due to DAA

1. The DAA alert can be initiated by the UAS application specific server and can include updated trajectory information. The alert is forwarded to the UAE client via the UAE server to process the updated trajectory information.

2. The UAE client acknowledge the alert to the UAS application specific server via the UAE server.



Figure 7.5.2.4-3: UAE-layer assisted change flight path due to DAA

1. The UAE server receives from the UAS application specific server a DAA flight path update request including UAV identification and new/corrected flight path information. The UAE server verifies that the request is authorized as described above before sending a request for change of flight path to the UAE client.

2. The UAE client receives a DAA flight path update request from the UAE server.

3. The UAE client handles change of flight path due to DAA based on request and/or DAA configuration. The UAE layer may inform the application.

4. The UAE client sends to the UAE server a DAA flight path update response to indicate a change of flight path. The UAE client can include relevant additional information about the reason for change of flight path and actual new flight path in the message.

5. The UAE server sends to the UASS a DAA flight path response to confirm a change of flight path/DAA conflict resolution. The UAE server can include relevant additional information about the reason for change of flight path and actual new flight path in the message.

### 7.5.3 Solution evaluation

This clause provides an evaluation of this solution.

\* \* \* \* Next change \* \* \* \*

### 9.2.1 General

All the key issues, solutions and architecture enhancements specified in this technical report are listed in Table 9.2.1-1.

Table 9.2.1-1 provides a mapping of the key issues to the related solutions. It also indicates whether the solution requires enhancement to the Release-17 architecture and lists the dependencies on other working groups.

Table 9.2.1-1 Key issue and solutions

| Key issues (evaluation clause reference) | Solution | Architectural enhancement  (clause reference) | Enhancements required | Dependency on other working groups |
| --- | --- | --- | --- | --- |
| KI #1 Direct communication between UAVs |  |  |  | SA2 |
| KI #2: Support for multi-USS deployments | Solution #1: Change of USS during flight NOTE | 7.3 | None | None |
| Solution #2: Support for USS re-mapping for a UAS | 7.4 | None | None |
| KI 3: Coordination between Uu and PC5 for direct UAV-to-UAV or UAV-to-UAV-C communication |  |  |  | SA2 |
| KI 4: Support of detect and avoid services and applications | Solution #3: Support for DAA | 7.5 | None | None |
| NOTE: Change of DN/EDN to avoid disruption while in flight due to change of USS is not covered by this solution. | | | | |

\* \* \* \* End of changes \* \* \* \*