**3GPP TSG-S4 Meeting #115-e *S4-211036***

**Online, , 18th–27th August 2021** revision of S4aI211220

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| *CR-Form-v12.0* | | | | | | | | |
| **PSEUDO CHANGE REQUEST** | | | | | | | | |
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|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | |  | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Documentation of reference architecture. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | * Logical architecture diagram (reference point notation). * Description of logical functions. * Description of reference points. * Logical architecture (service-based architecture notation). * Description of service-based interfaces. * High-level design of information. | | | | | | | | |
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| ***Consequences if not approved:*** | |  | | | | | | | | |
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| ***Clauses affected:*** | | 4 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
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| ***Other comments:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | | S4-210723 -> S4aI211210 -> S4aI211214->S4aI211220 | | | | | | | | |

FIRST 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 23.501: "System architecture for the 5G System (5GS)".

[3] 3GPP TS 23.502: "Procedures for the 5G System (5GS)".

[4] 3GPP TS 23.288: "Architecture enhancements for 5G System (5GS) to support network data analytics services".

[5] 3GPP TS 29.517: "5G System; Application Function Event Exposure Service; Stage 3".

[6] 3GPP TS 29.510: "Network function repository services; Stage 3".

[7] 3GPP TS 29.532: "Data Collection and Reporting; Protocols and Formats".

NEXT CHANGE

## 3.1 Terms

For the purposes of the present document, the terms given in 3GPP TR 21.905 [1], TS 23.501 [2], TS 23.502 [3], TS 23.288 [4], TS 29.517 [5] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

**direct reporting:** method of sending a data report from the Direct Data Collection Client to the Data Collection AF

**indirect reporting:** method of sending a data report from a UE Application to the Data Collection AF via an Indirect Data Reporting Client function of an Application Service Provider

NEXT CHANGE

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] , TS 23.501 [2], TS 23.502 [3], TS 29.517[4] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

AF Application Function

AS Application Server

DCAF Data Collection AF

DN Data Network

NEF Network Exposure Function

NF Network Function

NWDAF Network Data Analytics Function

UE User Equipment

NEXT CHANGE

# 4 Reference architecture for data collection and reporting

## 4.1 General

Clause 6.2.8 of TS 23.288 [4] envisages a set of high-level procedures by which data is collected by a Network Data Analytics Function (NWDAF) from UE Application(s) via an intermediary Application Function. This clause defines a generic reference architecture for data collection and reporting that satisfies those procedures, including the logical functions involved and the logical reference points between them. The intermediary Application Function envisaged in [4] is here named the *Data Collection AF*. It is intended that this reference architecture be instantiated in domain-specific ways to suit the needs of different features of the 5G System. The reference architecture may be instantiated separately in different slices of a network.

## 4.2 Functional entities for data collection and reporting

Figure 4.2‑1 below shows the reference architecture for data collection and reporting using reference point notation.



NOTE: The Application Service Provider and/or the AS and/or the Data Collection AF may be deployed outside the trusted domain, in which case the services they expose to API invokers are mediated by the NEF. The logical relationships denoted by the reference points are unaffected by such deployment choices.

Figure 4.2‑1: Reference architecture for data collection and reporting in reference point notation

The functional entities illustrated in the figure are described as follows:

1. Data collection and reporting functionality is provisioned at reference point R1 by a *Provisioning AF* inside the *Application Service Provider* that may be deployed either inside or outside the trusted domain. Alternatively, the data collection and reporting functionality is set up and configured by other means than using a Provisioning AF and R1.

2. The *Data Collection AF* may be deployed inside or outside the trusted domain. It is responsible for managing the provisioning state for data collection and reporting. When its provisioning state changes, the Data Collection AF updates the set of available NF profile(s) in the NRF by invoking the Nnrf\_NFManagement service defined in clause 5.2.7.2 of TS 23.502 [3] according to the usage defined in clause 6.2.8.2.2 of TS 23.288 [4] and specified in clause 6.1 of TS 29.510 [6].

NOTE 1: If the Data Collection AF is deployed outside the trusted domain, this registration occurs via the NEF, as described in clause 6.2.2.3 of TS 23.288 [4].

The Data Collection AF provides a data collection and reporting configuration to the *Direct Data Collection Client* at reference point R2, to the *Indirect Data Collection Client* at reference point R3 and Application Server (*AS*) instances at reference point R4, and receives data reports from them respectively at those same reference points. The data collection and reporting configuration provided by the Data Collection AF in turn depends on what data the subscribers for data from the Data Collection AF have subscribed to.

The Data Collection AF processes received data reports according to recipes in its provisioning state. The processing activities include, but are not limited to, reporting format conversion, data normalisation, domain-specific anonymisation of data and (dis)aggregation of data into reports to be exposed as events.

Finally, the Data Collection AF is responsible for exposing processed UE data to event notification subscribers both inside the trusted domain (such as the NWDAF) and outside it (such as the *Event Consumer AF* in the Application Service Provider). In this role, the Data Collection AF realises the Event Exposure Service as defined in clause 6.2.2.1 of TS 23.288 [4] and as specified in TS 29.517 [5]. Subscribers fulfil the role of NF consumers of this service in the service-based architecture [2, 3]. The Data Collection AF is responsible for ensuring that access to UE data is controlled according to the rules indicated in its provisioning state.

NOTE 2: When the Data Collection AF is deployed outside the trusted domain, the NWDAF uses the procedure defined in clause 5.2.6.2 of TS 26.502 [3] and further elaborated by clause 6.2.2.3 of TS 23.288 [4] to collect data from the externally deployed Data Collection AF via the NEF.

NOTE 3: The Data Collection AF is intended to be instantiated inside another Application Function in order to satisfy the domain-specific data collection and reporting requirements corresponding to particular features in the 5G System. As such, there may be several domain-specific Data Collection AF instances operating simultaneously in a particular 5G System, each one performing a different role. The definitions of these instantiations are beyond the scope of the present document.

3. The *Direct Data Collection Client* is responsible for collecting relevant data in the UE and for sending data reports to the Data Collection AF via reference point R2 using the Ndcaf\_DataReporting service according to a data collection and reporting configuration that it has previously obtained from the Data Collection AF.

NOTE 1: This method of reporting corresponds to the direct data collection procedure defined in clause 6.2.8 of TS 23.288 [4].

NOTE 2: In the case where the Data Collection AF is deployed in a different trust domain than the UE, the Direct Data Collection Client instead invokes the equivalent Nnef\_DataReporting API via the NEF.

NOTE 3: The Direct Data Collection Client function is intended to be instantiated inside other UE functions in order to satisfy the domain-specific data collection and reporting requirements corresponding to particular features of the 5G System. As such, there may be several domain-specific Data Collection Client instances operating simultaneously on a given UE, each one performing a different role. Another option is to provide the Direct Data Collection Client as an integral part of the UE Application. The definitions of these instantiations are beyond the scope of the present document. The realisation of these logical functions is implementation-dependent.

4. It is the responsibility of the Application Service Provider to make sure that the relevant data is shared by the *UE Application* to the Direct Data Collection Client. This responsibility extends to data shared by Direct Data Collection Client function to the Data Collection AF for cases when the Direct Data Collection Client is an integral part of the UE Application. This likely done as a combination of design and configuration (via R8) of the UE Application.

5. An Application Service Provider may also collect data from UE Applications (via reference point R8) and employ an *Indirect Data Collection Client* subfunction to then send data reports to the Data Collection AF via reference point R3 by invoking the Ndcaf\_DataReporting service according to a data collection and reporting configuration that it has previously obtained from the Data Collection AF via reference point R3.

NOTE 1: This method of reporting corresponds to the indirect data collection procedure defined in clause 6.2.8 of TS 23.288 [4].

NOTE 2: In the case where the Application Service Provider server is deployed in a different trust domain than the Data Collection AF, the Indirect Data Collection Client instead invokes the equivalent Nnef\_DataReporting API via the NEF at reference point R3.

6. Application Server instances (labelled *AS*) inside or outside the trusted domain may also collect data and report it to the Data Collection AF via reference point R6 by invoking the Ndcaf\_DataReporting service, according to a data collection and reporting configuration previously obtained from the Data Collection AF via reference point R6.

NOTE 1: In the case where the Application Server is deployed in a different trust domain than the Data Collection AF, the AS instead invokes the equivalent Nnef\_DataReporting service via the NEF.

NOTE 2: The data collection and reporting requirements for such Application Servers are domain-specific and therefore beyond the scope of the present document.

7. The NWDAF is the primary consumer of processed UE data. This is exposed to the NWDAF by the Data Collection AF in the form of data reporting event notifications via reference point R5 using the Naf\_EventExposure service (as specified in TS 29.517 [5]) after any processing by the Data Collection AF has been performed according to its provisioned recipes.

NOTE: If the Data Collection AF is deployed outside the trusted domain, this interaction occurs instead by invoking the Nnef\_EventExposure service via the NEF, as defined in clause 5.2.6.2 of TS 26.502 [3] and as further elaborated by clause 6.2.2.3 of TS 23.288 [4].

8. By means of appropriate data collection and reporting provisioning, certain UE data may also be exposed in the form of data reporting events by the Data Collection AF to an *Event Consumer AF* residing in the Application Service Provider via reference point R6 using the Naf\_EventExposure service defined in clause 5.2.19 of TS 23.502 [4] and specified in TS 29.517 [5].

NOTE: In the case where the Application Service Provider server is deployed outside the trusted domain, the Nnef\_EventExposure service, as defined in clause 5.2.6.2 of TS 23.502 [3], is invoked instead.

## 4.3 Reference points for data collection and reporting

The purposes of the reference points in the functional architecture defined in clause 4.2 above are as follows:

- **R1** supports the following interactions between a Provisioning AF in the Application Service Provider and the Data Collection AF:

- Used by the Application Service Provider to provision data collection and reporting in a Data Collection AF instance by means of the Ndcaf\_DataReportingProvisioning service defined in clause 4.4 of the present document (or else the equivalent service exposed by the NEF if the two functions are deployed in different trust domains). The provisioning information specifies what data is to be collected by Data Collection Clients, how it is to be processed by the Data Collection AF and how it is to be exposed to event notification subscribers. A generic provisioning envelope for data collection and reporting is defined in clause 4.6 of the present document, but this is expected to be extended by individual reporting domains.

- **R2** supports the following interactions between the Direct Data Collection Client in the UE and the Data Collection AF:

- Used by a Direct Data Collection Client instance to obtain its data collection and reporting configuration from the corresponding Data Collection AF instance by means of the Ndcaf\_DataReporting service defined in clause 4.4 of the present document. A generic data collection and reporting configuration envelope is defined in clause 4.7 of the present document, but details of the configuration are specific to individual reporting domains and are specified elsewhere.

- Subsequently used by the Direct Data Collection Client to send reports to its Data Collection AF instance by means of the Ndcaf\_DataReporting service defined in clause 4.4 of the present document. A generic data reporting envelope is defined in clause 4.8 of the present document, but details of the reporting format are specific to individual reporting domains and are specified elsewhere.

NOTE 1: This method of reporting corresponds to the direct data collection procedure defined in clause 6.2.8 of TS 23.288 [4].

- **R3** supports the following interactions between the Indirect Data Collection Client in the Application Service Provider Server and the Data Collection AF.

- Used by an Indirect Data Collection Client instance to obtain its data collection and reporting configuration from the corresponding Data Collection AF instance by means of the Ndcaf\_DataReporting service defined in clause 4.4 of the present document (or else the equivalent service exposed by the NEF if the two functions are deployed in different trust domains). A generic data collection and reporting configuration envelope is defined in clause 4.7 of the present document, but details of the configuration are specific to individual reporting domains and are specified elsewhere.

- Subsequently used by the Indirect Data Collection Client in the Application Service Provider server to send data reports to its Data Collection AF instance by means of the Ndcaf\_DataReporting service defined in clause 4.4 of the present document (or else the equivalent service exposed by the NEF if the two functions are deployed in different trust domains). A generic data reporting envelope is defined in clause 4.8 of the present document, but details of the reporting format are specific to individual reporting domains and are specified elsewhere.

NOTE 2: This method of reporting corresponds to the indirect data collection procedure defined in clause 6.2.8 of TS 23.288 [4].

- **R4** supports the following interactions between the Application Server (AS) and the Data Collection AF:

- Used by an AS instance to obtain its data collection and reporting configuration from the corresponding Data Collection AF instance by means of the Ndcaf\_DataReporting service defined in clause 4.4 of the present document (or else the equivalent service exposed by the NEF if the two functions are deployed in different trust domains). A generic data collection and reporting configuration envelope is defined in clause 4.7 of the present document, but details of the configuration are specific to individual reporting domains and are specified elsewhere.

- Subsequently used by the AS instance to send data reports to its Data Collection AF instance by means of the Ndcaf\_DataReporting service defined in clause 4.4 of the present document (or else the equivalent service exposed by the NEF if the two functions are deployed in different trust domains).

NOTE 3: The AS plays the role of a Network Function when it invokes the Ndcaf\_DataReporting service at reference point R4.

- **R5** supports the following interactions between the NWDAF and the Data Collection AF:

Used by an NWDAF instance to subscribe to data reporting events exposed by a Data Collection AF instance, according to the Naf\_EventExposure\_Subscribe procedure defined in clause 5.2.19.2.2 of TS 23.502 [3], as further elaborated in step 3a of clause 6.2.8.2.3 in TS 23.288 [4] , and is specified in TS 29.517 [5] (or else the equivalent Nnef\_EventExposure\_Subscribe service exposed by the NEF if the two functions are deployed in different trust domains).

Subsequently used by the Data Collection AF to expose data reporting events to the NWDAF, according to the Naf\_EventExposure\_Notify procedure defined in clause 5.2.19.2.2 of TS 23.502 [3], as further elaborated in step 5a of clause 6.2.8.2.3 in TS 23.288 [4] , and is specified in TS 29.517 [5] (or else the equivalent Nnef\_EventExposure\_Notify service exposed by the NEF if the two functions are deployed in different trust domains).

- **R6** supports the following interactions between the Event Consumer AF in the Application Service Provider and the Data Collection AF:

- Used by an Event Consumer AF instance to subscribe to data reporting events exposed by the Data Collection AF, according to the Naf\_EventExposure\_Subscribe procedure defined in clause 5.2.19.1 of TS 26.502 and specified in TS 29.517 [5] (or else the equivalent Nnef\_EventExposure\_Subscribe service exposed by the NEF if the two functions are deployed in different trust domains).

- Subsequently used by the Data Collection AF to expose data reporting events to the Event Consumer AF according to the Naf\_EventExposure\_Notify procedure defined in clause 5.2.19.1 of TS 26.502 and specified in TS 29.517 [5] (or else the equivalent Nnef\_EventExposure\_Notify service exposed by the NEF if the two functions are deployed in different trust domains).

Editor’s Note: Need to check with SA2/CT3 about the security aspects of event exposure to External AFs via the NEF. Exposure of events to external parties via NEF is not explicitly described in TS 23.288, although it is envisaged as a possibility in TS 26.502.

- **R7** is a client API offered by the Direct Data Collection Client to the UE Application.

NOTE 4: When the Direct Data Collection Client is embedded in the UE Application R7 is not visible.

- **R8** supports data collection and reporting interactions between the UE Application and the Application Service Provider server.

NOTE 5: Interactions at reference point R8 are beyond the scope of 3GPP standardisation.

## 4.4 Service-based architecture for data collection and reporting

Figure 4.4‑1 below shows the reference architecture for data collection and reporting in service-based architecture notation. It depicts the case where the Data Collection AF is deployed inside the trusted domain, while the Application Service Provider and the AS may be deployed independently either inside or outside the trusted domain.



NOTE 1: In its role as an event exposure service provider Application Function, the Data Collection AF provides the (un)subscription operations of the Naf\_EventExposure (or Nnef\_EventExposure) service for use by Network Function service consumers. As Network Function service consumers, the NWDAF and the Event Consumer AF provide the event notification operation of the Naf\_EventExposure (or Nnef\_EventExposure) service for use by the Data Collection AF.

NOTE 2: The UE-based Direct Data Collection Client interacts with the Data Collection AF in the user plane, and so the interaction at reference point R2 does not traverse the service bus.

Figure 4.4‑1: Reference architecture for data collection and reporting in service‑based architecture notation when the Data Collection AF is deployed in the trusted domain

The following service-based APIs are used in connection with data collection and reporting:

1. The Ndcaf\_DataReportingProvisioning service is provided by the Data Collection AF. It is defined by the present document and is specified in TS 26.532 [7].

a. Used by Provisioning AF instances in the Application Service Provider server to provision data collection and reporting in the Data Collection AF.

NOTE 1: Alternatively, provisioning of data collection and reporting in the Data Collection AF may done by other means.

2. The Nnrf\_NFManagement service is provided by the NRF. It is defined in clause 5.2.7.2 of TS 23.502 [3] and specified in clause 6.1 of TS 29.510 [6].

a. Used by the Data Collection AF to register an available NF profile with the NRF for each set of data collection and reporting provisioning information held by the former.

NOTE 2: As described in clause 6.2.8.2.2 of TS 23.288 [4] the NF profile in this case includes the External Application Identifier (used by clients when reporting data to the Data Collection AF), the Internal Application Identifier (used for event exposure to the NWDAF) and the Event ID. These NF profile parameters are in addition to those specified in clause 5.2.7.2 of TS 26.502 [3].

3. The Ndcaf\_DataReporting service is provided by the Data Collection AF. It is defined by the present document and is specified in TS 26.532 [7].

a. Used by the Direct Data Collection Client, by the Indirect Data Collection Client in the Application Service Provider server and by AS instances to obtain their data collection and reporting configuration from the Data Collection AF.

b. Subsequently used by the Direct Data Collection Client, by the Indirect Data Collection Client and by AS instances to send data reports to the Data Collection AF.

NOTE 3: AS instances play the role of a Network Function when invoking the Ndcaf\_DataReporting service (or equivalent) and are therefore depicted in figure 4.4‑1 as being directly attached to the service bus.

4. The Naf\_EventExposure service is provided by the Data Collection AF. It is defined in clause 5.2.19.2 of TS 23.502 [3] and TS 23.288 [4], and is specified in TS 29.517 [5].

a. Used by the NWDAF to subscribe to data reporting events exposed by the Data Collection AF and subsequently used by the Data Collection AF to notify these events to the NWDAF, as described in clause 6.2.2.2 or 6.2.2.3 (as appropriate) of TS 23.288 [4].

b. Used by an Event Consumer AF in the Application Service Provider server to subscribe to data reporting events exposed by the Data Collection AF and subsequently used by the Data Collection AF to notify these events to the Application Service Provider server, as described in clause 6.2.2.2 or clause 6.2.2.3 (as appropriate) of TS 23.288 [4].

## 4.5 Domain model

Editor’s Note: UML static entity model explaining the relationship between the data entities and their cardinalities.

## 4.6 Provisioning information for data collection and reporting

A separate set of provisioning information shall be provided to the Data Collection AF at reference point R1 (or by other means) for each Event ID it is to expose. This provisioning information embodies the Service Level Agreement between the network operator and the Application Service Provider envisaged in clause 6.2.8.1 of TS 26.288 [4]. The provisioning information shall include at least the parameters defined in table 4.5‑1 below:

Table 4.6‑1: Baseline provisioning information for data collection and reporting

|  |  |  |
| --- | --- | --- |
| Parameter | Cardinality | Description |
| External Application Identifier | 1..1 | The identifier used in reports sent to the Data Collection AF. (This needs to be mapped to the Internal Application Identifier when exposing events to the NWDAF.) |
| Internal Application Identifier | 1..1 | The identifier used by the NWDAF when subscribing to events in the Data Collection AF. |
| Event ID | 1..1 | The identifier of an AF event that will be exposed to event consumers as a result of the provisioning. |
| Valid targets | 1..1 | A parameter to control whether event consumers are permitted to filter events by External UE identifier or External Group Identifier when subscribing, instead of receiving events relating to all UEs. |
| Parameters to be collected | 1..\* | The subset of domain-specific parameters associated with the specified Event ID to be collected by the Data Collection AF (subject to user consent). |
| Data transformation recipe | 1..1 | A set of instructions that enable the Data Collection AF to transform received data reporting records into one or more exposed events. These transformations may involve aggregation/‌consolidation/‌summarisation of collected parameter values, as well as anonymisation of collected parameters. |

## 4.7 Configuration information for data collection and reporting clients

All clients of the Data Collection AF wishing to report data shall first obtain a data collection and reporting configuration from the Data Collection AF at reference point R2, R3 or R4 (as appropriate). The data collection and reporting configuration shall include at least the parameters defined in table 4.6‑1 below:

Table 4.7‑1: Baseline information for data collection and reporting configuration

|  |  |  |
| --- | --- | --- |
| Parameter | Cardinality | Description |
| External Application Identifier | 1..1 | Identifies the UE Application to which this data collection and reporting configuration pertains.  Quoted in reports sent to the Data Collection AF. |
| Parameters to be collected | 1..\* | The subset of domain-specific parameters associated with the specified Event ID to be collected by the Data Collection AF (subject to user consent). |

Editor’s Note: When *requesting configuration*, additional information needs to be passed across the R7 client API (then R2) to realise the "authentication information that enables the [Data Collection] AF to verify the auhtenticity of the UE's Application that provides data" as envisaged in clause 6.2.8.1 of TS 23.288 [4].

## 4.8 Information included in data reports to the Data Collection AF

Table 4.8‑1: Baseline information for data reporting

|  |  |  |
| --- | --- | --- |
| Parameter | Cardinality | Description |
| External Application Identifier | 1..1 | Identifies the UE Application to which this data report pertains. |
| Collected parameters | 1..\* | The subset of domain-specific parameters associated with the specified Event ID to be collected by the Data Collection AF (subject to user consent). |

Editor’s Note: When *reporting data*, additional information needs to be passed across the R7 client API (then R2) to realise the "authentication information that enables the [Data Collection] AF to verify the auhtenticity of the UE's Application that provides data" as envisaged in clause 6.2.8.1 of TS 23.288 [4].

END OF CHANGES