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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

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y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document defines the Stage 2 architecture enhancements for 5G System (5GS) to support network data analytics services in 5G Core network.

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; Stage 2".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 23.503: "Policy and Charging Control Framework for the 5G System; Stage 2".

[5] Void.

[6] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[7] 3GPP TS 28.550: "Management and orchestration; Performance Assurance".

[8] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[9] 3GPP TS 28.545: "Management and orchestration; Fault Supervision (FS)".

[10] 3GPP TS 28.554: "Management and orchestration; 5G end to end Key Performance Indicators (KPI)".

[11] ITU-T Recommendation P.1203.3: "Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport - Quality integration module".

[12] 3GPP TS 38.215: "NR; Physical layer measurements".

[13] Void.

[14] 3GPP TS 38.331: "NR; Radio Resource Control (RRC) protocol specification".

[15] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[16] 3GPP TS 38.413: "NG-RAN; NG Application Protocol (NGAP)".

[17] 3GPP TS 29.244: "Interface between the Control Plane and the User Plane Nodes".

[18] 3GPP TS 29.510: "5G System; Network function repository services; Stage 3".

[19] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

[20] 3GPP TS 37.320: "Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; stage 2".

[21] 3GPP TS 28.201: "Charging management; Network slice performance and analytics charging in the 5G System (5GS); stage 2".

[22] 3GPP TS 28.541: "Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3".

[23] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[24] 3GPP TS 28.310: "Management and orchestration; Energy efficiency of 5G".

[25] 3GPP TS 29.518: "5G System; Access and Mobility Management Services; Stage 3".

[26] 3GPP TS 29.503: "Unified Data Management Services; Stage 3".

[27] 3GPP TS 26.114: "IP Multimedia Subsystem (IMS); Multimedia Telephony; Media handling and interaction".

[28] 3GPP TS 26.247: "Transparent end-to-end Packet-switched Streaming Service (PSS); Progressive Download and Dynamic Adaptive Streaming over HTTP (3GP-DASH)".

[29] 3GPP TS 26.118: "Virtual Reality (VR) profiles for streaming applications".

[30] 3GPP TS 26.346: "Multimedia Broadcast/Multicast Service (MBMS); Protocols and codecs".

[31] 3GPP TS 26.512: "5G Media Streaming (5GMS); Protocols".

[32] 3GPP TS 26.531: "Data Collection and Reporting; General Description and Architecture".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1], TS 23.501 [2] and TS 23.503 [4]. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1], TS 23.501 [2] and TS 23.503 [4] apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

4 Reference Architecture for Data Analytics

4.1 General

The NWDAF (Network Data Analytics Function) is part of the architecture specified in TS 23.501 [2] and uses the mechanisms and interfaces specified for 5GC in TS 23.501 [2] and OAM services (see clause 6.2.3.1).

The NWDAF interacts with different entities for different purposes:

- Data collection based on subscription to events provided by AMF, SMF, PCF, UDM, AF (directly or via NEF), and OAM;
- [Optionally] Analytics and Data collection using the DCCF (Data Collection Coordination Function);
- Retrieval of information from data repositories (e.g. UDR via UDM for subscriber-related information);

- [Optionally] Storage and retrieval of information from ADRF (Analytics Data Repository Function);
- [Optionally] Analytics and Data collection from MFAF (Messaging Framework Adaptor Function);
- Retrieval of information about NFs (e.g. from NRF for NF-related information);
- On demand provision of analytics to consumers, as specified in clause 6.
- Provision of bulked data to consumers, as specified in clause 6.

A single instance or multiple instances of NWDAF may be deployed in a PLMN. If multiple NWDAF instances are deployed, the architecture supports deploying the NWDAF as a central NF, as a collection of distributed NFs, or as a combination of both. If multiple NWDAF instances are deployed, an NWDAF can act as an aggregate point (i.e. Aggregator NWDAF) and collect analytics information from other NWDAFs, which may have different Serving Areas, to produce the aggregated analytics (per Analytics ID), possibly with Analytics generated by itself.

NOTE 1: When multiple NWDAFs exist, not all of them need to be able to provide the same type of analytics results, i.e. some of them can be specialized in providing certain types of analytics. An Analytics ID information element is used to identify the type of supported analytics that NWDAF can generate.

NOTE 2: NWDAF instance(s) can be collocated with a 5GS NF.

4.2 Non-roaming architecture

4.2.0 General

As depicted in Figure 4.2.0-1, the 5G System architecture allows NWDAF to collect data from any 5GC NF. The NWDAF belongs to the same PLMN as the 5GC NF that provides the data.

Figure 4.2.0-1: Data Collection architecture from any 5GC NF

The Nnf interface is defined for the NWDAF to request subscription to data delivery for a particular context, to cancel subscription to data delivery and to request a specific report of data for a particular context.

The 5G System architecture allows NWDAF to retrieve the management data from OAM by invoking OAM services.

The 5G System architecture allows NWDAF to collect data from any 5GC NF or OAM using a DCCF with associated Ndccf services as specified in clause 8.2.

The 5G System architecture allows NWDAF and DCCF to collect data from an NWDAF with associated Nnwdaf_DataManagement services as specified in clause 7.4. The 5G system architecture allows MFAF to fetch data from an NWDAF with associated Nnwdaf_DataManagement service as specified in clause 7.4.

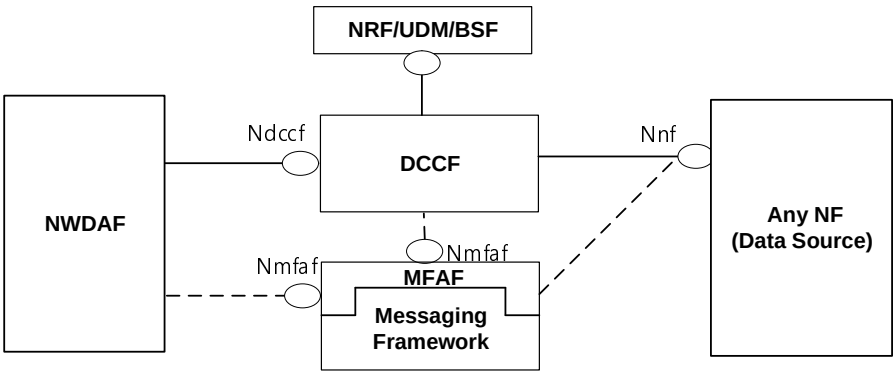

Figure 4.2.0-1a: Data Collection architecture using Data Collection Coordination

As depicted in Figure 4.2.0-1a, the Ndccf interface is defined for the NWDAF to support subscription request(s) for data delivery from a DCCF, to cancel subscription to data delivery, and to request a specific report of data. If the data is not already being collected, the DCCF requests the data from the Data Source using Nnf services. The DCCF may collect the data and deliver it to the NWDAF or the DCCF may rely on a messaging framework to collect data from the NF and deliver it to the NWDAF.

As depicted in Figure 4.2.0-2, the 5G System architecture allows any 5GC NF to request network analytics information from NWDAF containing Analytics logical function (AnLF). The NWDAF belongs to the same PLMN as the 5GC NF that consumes the analytics information.

Figure 4.2.0-2: Network Data Analytics Exposure architecture

The Nnwdaf interface is defined for 5GC NFs, to request subscription to network analytics delivery for a particular context, to cancel subscription to network analytics delivery and to request a specific report of network analytics for a particular context.

NOTE 1: The 5G System architecture also allows other consumers such as OAM and CEF (Charging Enablement Function) to request network analytics information from NWDAF.

The 5G System architecture allows any NF to obtain Analytics from an NWDAF using a DCCF function with associated Ndccf services, as specified in clause 8.2.

The 5G System architecture allows NWDAF and DCCF to request historical analytics from an NWDAF with associated Nnwdaf_DataManagement services as specified in clause 7.4. The 5G system architecture allows MFAF to fetch historical analytics from an NWDAF with associated Nnwdaf_DataManagement service as specified in clause 7.4.

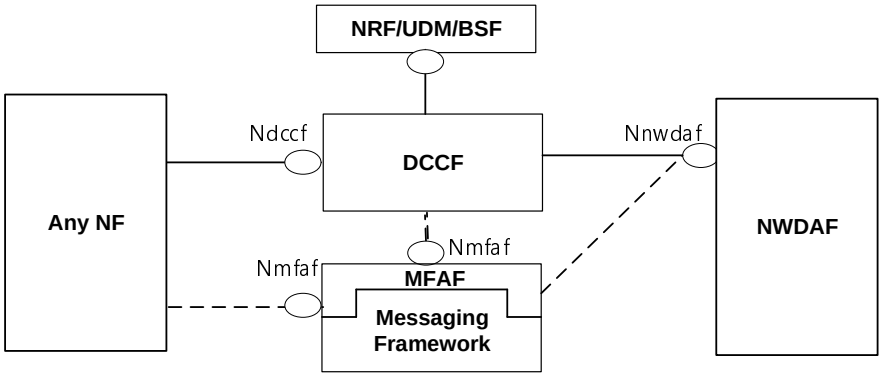

Figure 4.2.0-2a: Network Data Analytics Exposure architecture using Data Collection Coordination

As depicted in Figure 4.2.0-2a, the Ndccf interface is defined for any NF to support subscription request(s) to network analytics, to cancel subscription for network analytics, and to request a specific report of network analytics. If the analytics is not already being collected, the DCCF requests the analytics from the NWDAF using Nnwdaf services. The DCCF may collect the analytics and deliver it to the NF, or the DCCF may rely on a messaging framework to collect analytics and deliver it to the NF.

As depicted in Figure 4.2.0-3, the 5G System architecture allows NWDAF containing Analytics logical function (AnLF) to use trained ML model provisioning services from another NWDAF containing Model Training logical function (MTLF).

NOTE 2: Analytics logical function and Model Training logical function are described in clause 5.1.

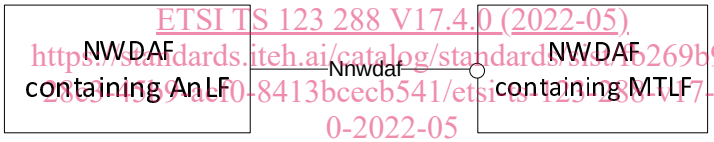

Figure 4.2.0-3: Trained ML Model Provisioning architecture

The Nnwdaf interface is used by an NWDAF containing AnLF to request and subscribe to trained ML model provisioning services.

NOTE 3: The NWDAF trained ML model provisioning services are described in clause 7.5 and clause 7.6.

NOTE 4: The NWDAF containing AnLF is the only consumer of trained ML model provisioning services in this release of the specification.

4.2.1 Analytics Data Repository Function

As depicted in Figure 4.2.1-1, the 5G System architecture allows ADRF to store and retrieve the collected data and analytics. The following options are supported:

- ADRF exposes the Nadrf service for storage and retrieval of data by other 5GC NFs (e.g. NWDAF) which access the data using Nadrf services.

- Based on the NF request or configuration on the DCCF, the DCCF may determine the ADRF and interact directly or indirectly with the ADRF to request or store data. The interaction can be:

- Direct: the DCCF requests to store data in the ADRF via an Nadrf service, or via an Ndccf_DataManagement_Notify (e.g. when ADRF requested data collection notification via DCCF). In addition, the DCCF retrieves data from the ADRF via an Nadrf service.

- Indirect: the DCCF requests that the Messaging Framework to store data in the ADRF i.e. via an Nadrf service or via an Nmfaf_3daDataManagement_Configure. The Messaging Framework may contain one or more Adaptors that translate between 3GPP defined protocols.

NOTE 1: The internal logic of Messaging Framework is outside the scope of 3GPP, only the MFAF and the interface between MFAF and other 3GPP defined NF is under 3GPP scope.

- A Consumer NF may specify in requests to a DCCF that data provided by a Data Source needs to be stored in the ADRF.

- The ADRF stores data received in an Nadrf_DataManagement_StorageRequest sent directly from an NF, or data received in an Ndccf_DataManagement_Notify / Nmfaf_3caDataManagement_Notify or Nnwdaf_DataManagement_Notify from the DCCF, MFAF or from the NWDAF.

- The ADRF checks if the Data Consumer is authorized to access ADRF services and provides the requested data using the procedures specified in TS 23.501 [2] clause 7.1.4.

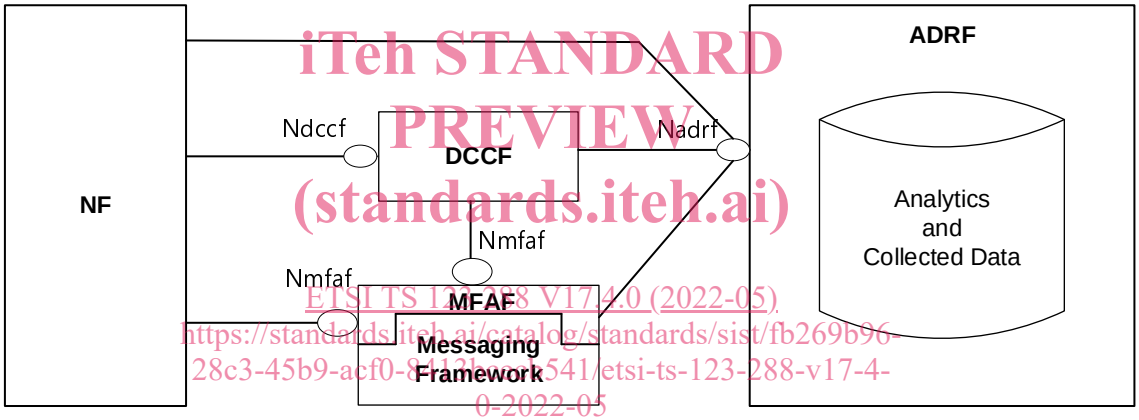

Figure 4.2.1-1: Data storage architecture for Analytics and Collected Data

4.3 Roaming architecture

The interactions between the NWDAF and the other 5GC NFs are only considered in the same PLMN case.

Roaming architecture does not apply in this release of the specification.

5 Network Data Analytics Functional Description

5.1 General

The NWDAF provides analytics to 5GC NFs, and OAM as defined in clause 7. An NWDAF may contain the following logical functions:

- **Analytics logical function (AnLF):** A logical function in NWDAF, which performs inference, derives analytics information (i.e. derives statistics and/or predictions based on Analytics Consumer request) and exposes analytics service i.e. Nnwdaf_AnalyticsSubscription or Nnwdaf_AnalyticsInfo.