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Contents

Foreword

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

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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where:

x the first digit:

1 presented to TSG for information;

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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.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

Should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

Can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

Will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Neasdf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the EASDF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2], 3GPP TS 23.502 [3] and 3GPP TS 23.548 [14].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

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 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[5] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[6] OpenAPI: "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0.

[7] 3GPP TR 21.900: "Technical Specification Group working methods".

[8] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[9] IETF RFC 6749: "The Oauth 2.0 Authorization Framework".

[10] 3GPP TS 29.510: "5G System; Network Function Repository Services; Stage 3".

[11] IETF RFC 7540: "Hypertext Transfer Protocol Version 2 (HTTP/2)".

[12] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[13] IETF RFC 7807: "Problem Details for HTTP APIs".

[14] 3GPP TS 23.548: "5G System Enhancements for Edge Computing; Stage 2".

[15] IETF RFC 6902: "JavaScript Object Notation (JSON) Patch".

[16] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[17] Void.

[18] IETF RFC 7871: "Client Subnet in DNS Queries".

[19] 3GPP TS 23.003: "Numbering, addressing and identification".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] 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].

One-Time DNS Rule: A DNS Rule that applies only once to a specific DNS message earlier buffered in the EASDF and reported to the SMF (see clause 5.2.3.2.4).

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] 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].

BD AIT	Baseline DNS Action Information Template
BD MDT	Baseline DNS Message Detection Template
EASDF	Edge Application Server Discovery Function
ECS	EDNS Client Subnet
EDNS	Extension mechanisms for DNS
MDT	(DNS Query or DNS Response) Message Detection Template

4 Overview

4.1 Introduction

Within the 5GC, the EASDF offers services to the SMF via the Neasdf service based interface (see 3GPP TS 23.548 [14], 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3]).

Figure 4.1-1 provides the reference model (in service based interface representation and in reference point representation), with focus on the EASDF and the scope of the present specification.

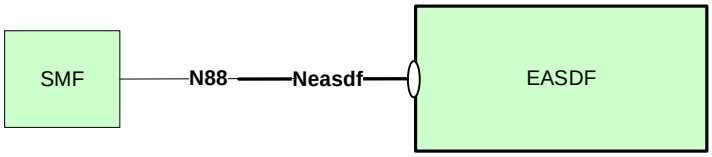

Figure 4.1-1: Reference model – EASDF

The functionalities supported by the EASDF are listed in clause 5.1.1 of 3GPP TS 23.548 [14].

5 Services offered by the EASDF

5.1 Introduction

The EASDF offers to other NFs the following service:

Table 5.1-1: NF Service provided by EASDF

Service Name	Description	Example Consumer
Neasdf_DNSContext	This service enables the consumer to create, update and delete DNS context in EASDF, or subscribe to DNS message reporting from EASDF.	SMF
Neasdf_BaselineDNSPattern	This service enables the consumer to create, update and delete Baseline DNS pattern in EASDF.	SMF

The Neasdf_DNSContext service and Neasdf_BaselineDNSPattern service are specified in 3GPP TS 23.548 [14].

Table 5.1-2 summarizes the corresponding APIs defined for this specification.

Table 5.1-2: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Neasdf_DNSContext	6.1	EASDF DNSContext Service	TS29556_Neasdf_DNSContext.yaml	neasdf-dnscontext	A.2
Neasdf_BaselineDNSPattern	6.2	EASDF BaselineDNSPattern Service	TS29556_Neasdf_BaselineDNSPattern.yaml	neasdf-baselinednspattern	A.3

5.2 Neasdf_DNSContext Service

5.2.1 Service Description

The Neasdf_DNSContext service operates on the DNS contexts. The EASDF is acting as NF Service Producer, while the SMF is the NF Service Consumer.

Following functionalities are provided by the Neasdf_DNSContext service:

- Create a DNS context in EASDF;
- Update a DNS context in EASDF;
- Delete a DNS context in EASDF;
- Enable the EASDF to report DNS signalling related information to the NF service consumer when receiving DNS Query or DNS Response.

The Neasdf_DNSContext service supports the following service operations.

Table 5.2.1-1: Service operations supported by the Neasdf_DNSContext service

Service Operations	Description	Operation Semantics	Example Consumer(s)
Create	Create a DNS context in EASDF.	Request/Response	SMF
Update	Update a DNS context in EASDF.	Request/Response	SMF
Delete	Delete a DNS context in EASDF.	Request/Response	SMF
Notify	EASDF reports DNS signalling related information to the NF service consumer when receiving DNS Query or DNS Response.	Subscribe/Notify	SMF

5.2.2 Service Operations

5.2.2.1 Introduction

See Table 5.2.1-1 for an overview of the service operations supported by the Neasdf_DNSContext service.

5.2.2.2 Create

5.2.2.2.1 General

The Create service operation shall be used to create an individual DNS context for a given PDU Session in the EASDF.

It is used in the following procedures:

- EAS Discovery Procedure with EASDF (see clause 6.2.3.2.2 of 3GPP TS 23.548 [14]).

There shall be only one individual DNS context created in an EASDF per PDU session.

The NF Service Consumer (e.g. SMF) shall create a DNS context by using the HTTP POST method as shown in Figure 5.2.2.2.1-1.

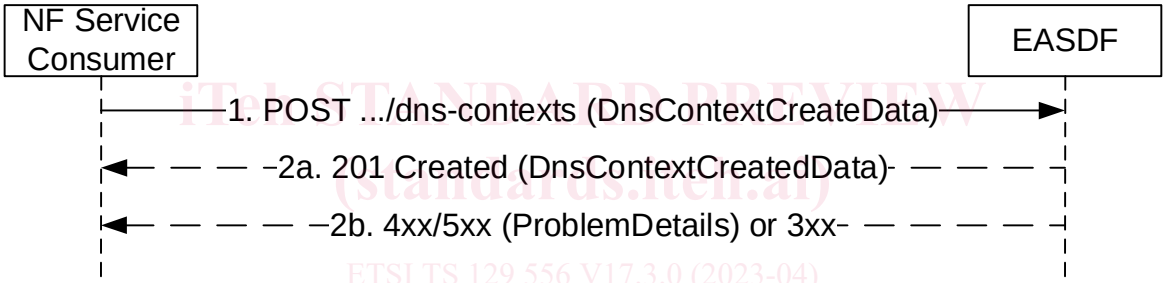

Figure 5.2.2.2.1-1: DNS context creation

1. The NF Service Consumer shall send a POST request to the resource representing the DNS contexts collection resource of the EASDF. The payload body of the POST request shall contain:
   - the UE IP address, S-NSSAI and the DNN of the related PDU session;
   - a notification URI for receiving DNS context related event notifications, if notifications are requested;
   - one or more DNS rules.

2a. On success, a "201 Created" response shall be returned with the "Location" header containing the URI of the created resource.

The POST response body shall include:

- the IP address of the EASDF (to be sent by the SMF to the UE).

2b. On failure, or redirection, one of the HTTP status code listed in Table 6.1.3.2.3.1-3 shall be returned.

5.2.2.3 Update

5.2.2.3.1 General

The Update service operation shall be used to update an individual DNS context previously created in the EASDF. The update operation may apply to the whole DNS context (complete replacement of the data of the existing DNS context by new data), or it may apply to modify a subset of the parameters of the DNS context.

It is used in the following procedures:

- EAS Discovery Procedure with EASDF (see clause 6.2.3.2.2 of 3GPP TS 23.548 [14]).

To perform a partial update of the DNS context of a given DNS context Id, the NF Service Consumer shall issue an HTTP PATCH request, as shown in Figure 5.2.2.3.1-1. This partial update shall be used to add, delete and/or replace individual parameters of the DNS context.

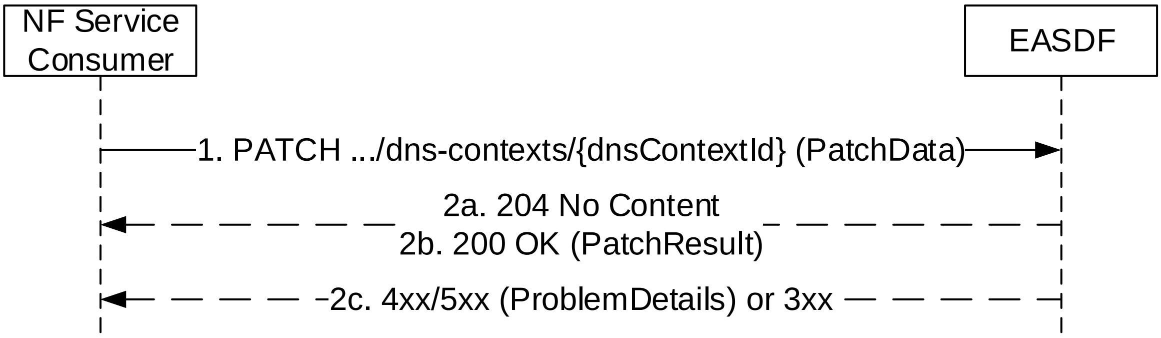

Figure 5.2.2.3.1-1: DNS context Partial Update

1. The NF Service Consumer (e.g. SMF) shall send a PATCH request to the resource URI representing the individual DNS context, identified by the {dnsContextId}. The payload body of the PATCH request shall contain the list of operations (add/delete/replace) to be applied to parameters in the individual DNS context.

2a. On success, if all the modification instructions in the PATCH request have been implemented, "204 No Content" shall be returned.

2b. If some of the modification instructions for unknown attribute(s) in the PATCH request have been ignored, the EASDF shall respond with "200 OK" with the response body containing PatchResult, as specified in clause 5.2.7.2 of 3GPP TS 29.500 [4].

2c. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.3.3.2-3 shall be returned.

To perform a complete replacement of the data of the DNS context of a given DNS context Id, the NF Service Consumer shall issue an HTTP PUT request, as shown in Figure 5.2.2.3.1-2:

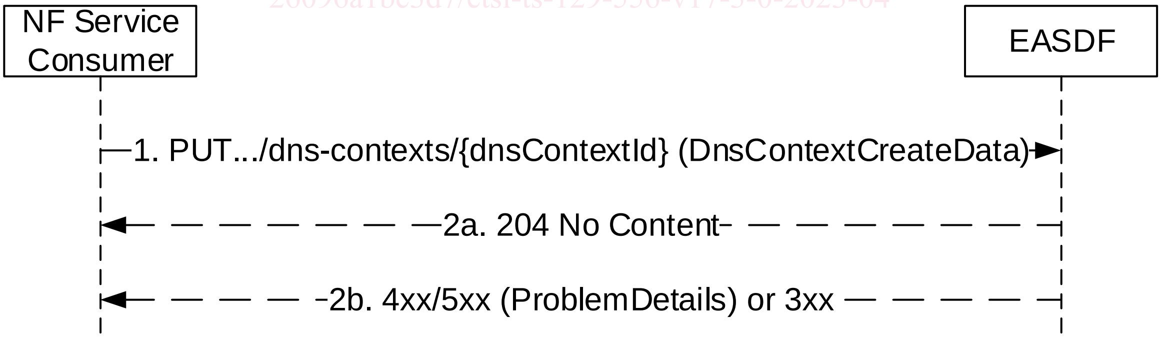

Figure 5.2.2.3.1-2: DNS context Complete Replacement

1. The NF service consumer (e.g. SMF) shall send a PUT request to the resource URI representing the individual DNS context, identified by the {dnsContextId}. The payload body of the PUT request shall contain a representation of the individual DNS context to be completely replaced in the EASDF.

2a. On success, "204 No Content" shall be returned.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.3.3.3-3 shall be returned.

5.2.2.4 Delete

5.2.2.4.1 General

The Delete Service operation shall be used by the NF service consumer (e.g. SMF) to delete the individual DNS context in the EASDF.

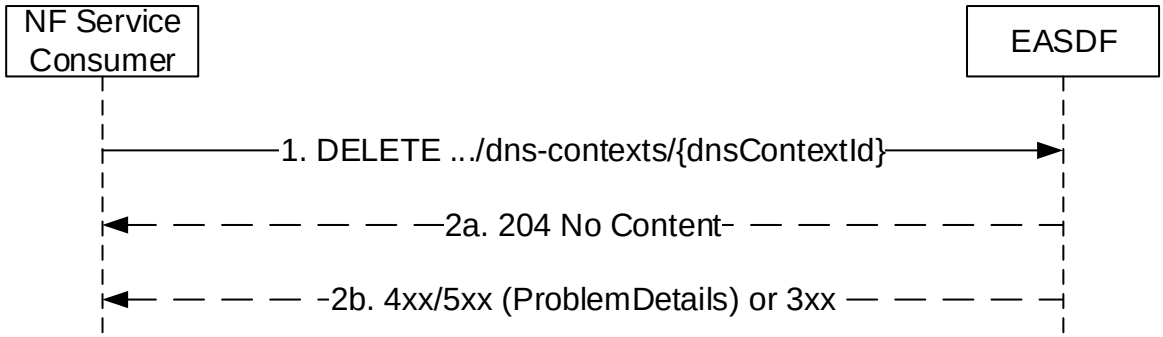

Figure 5.2.2.4.1-1: DNS context deletion

1. The NF Service Consumer (e.g. SMF) shall send a DELETE request to delete the individual DNS context represented by the {dnsContextId}. The request body shall be empty.

2a. On success, "204 No Content" shall be returned. The response body shall be empty.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.3.3.3.1-3 shall be returned.

5.2.2.5 Notify

5.2.2.5.1 General

The Notify service operation shall be used to notify the NF Service Consumer (e.g. SMF) about a DNS context related event, e.g. if a received DNS Query message or DNS response message matches a DNS detection template of an DNS rule and the associated action requires to report the message to the NF service producer.

It is used in the following procedures:

- EAS Discovery Procedure with EASDF (see clause 6.2.3.2.2 of 3GPP TS 23.548 [14]).

The EASDF shall send an HTTP POST request targeting the DNS context notification URI provided by the NF Service Consumer in the Create or Update service operation (see clause 5.2.2.2.1). See also Figure 5.2.2.5.1-1.

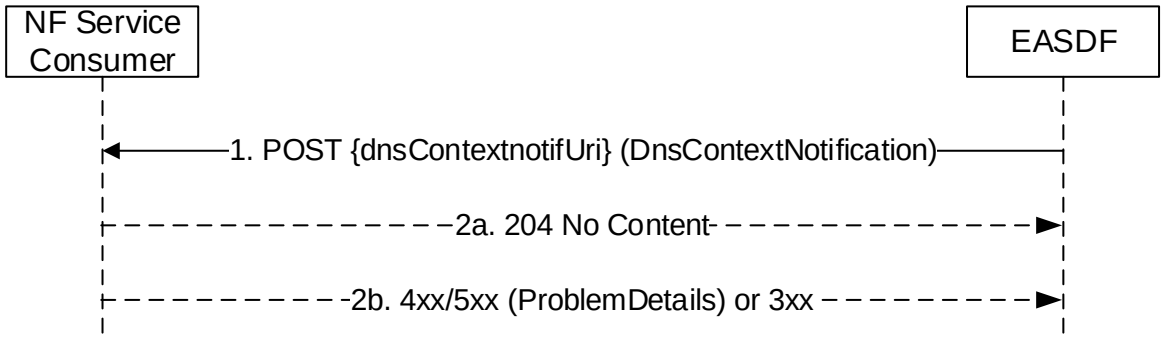

Figure 5.2.2.5.1-1: DNS Context Notify

1. The EASDF shall send a HTTP POST request to the DNS context notification URI, and the payload body of the POST request shall contain a DnsContextNotification data structure, with the DNS message report that was subscribed by the NF Service Consumer.

2a. On success, "204 No Content" shall be returned and the payload body of the POST response shall be empty.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.5.2.3.1-3 shall be returned.

5.2.3 DNS messages processing by EASDF

5.2.3.1 Introduction

This clause specifies how the EASDF shall process DNS messages according to the instructions received from the SMF.

5.2.3.2 DNS message processing model

5.2.3.2.1 DNS Context

The SMF shall control how the EASDF processes DNS messages received for a particular UE's PDU session by creating one single DNS context per PDU session including the following information:

- the UE IP address, S-NSSAI and DNN of the PDU session; and
- one or more DNS rules.

There shall be at most one DNS context created in the EASDF with the same UE IP address, S-NSSAI and DNN. If the EASDF receives a request to create a DNS context for which another DNS context already exists with the same UE IP address, S-NSSAI and DNN, the EASDF shall proceed with creating the DNS context and shall delete the earlier existing DNS context with the same UE IP address, S-NSSAI and DNN.

5.2.3.2.2 DNS Rule

A DNS rule shall apply either to DNS Query messages or DNS Response messages. A DNS rule shall contain:

- the DNS Rule ID uniquely identifying the DNS rule within the DNS context, for a DNS rule other than a One-Time DNS rule;
- precedence information, indicating the order in which the EASDF shall attempt to match DNS messages against all the DNS rules provisioned in the DNS context, for a DNS rule other than a One-Time DNS rule;
- for a DNS rule provisioned for DNS Query messages:
  - for a DNS rule other than a One-Time DNS rule:
    - at least one DNS Query Message Detection Template (MDT) or Baseline DNS Query Message Detection Template (BD MDT) ID referring to a BD MDT provisioned in a baseline DNS pattern; such a DNS rule may contain one or more DNS Query MDTs and/or BD MDT IDs referring to BD MDTs provisioned in one or more baseline DNS patterns; or
  - for a One-Time DNS rule:
    - the DNS message identifier uniquely identifying the DNS message buffered in the EASDF;
- for a DNS rule provisioned for DNS Response messages:
  - for a DNS rule other than a One-Time DNS rule:
    - at least one DNS Response MDT or Baseline DNS Response MDT ID referring to a BD MDT provisioned in a baseline DNS pattern; a DNS rule may contain one or more DNS Response MDTs and/or BD MDT IDs referring to BD MDTs provisioned in one or more baseline DNS patterns;
  - for a One-Time DNS rule:
    - the DNS message identifier uniquely identifying the DNS message buffered in the EASDF;
- a list of actions to apply to all DNS messages matching at least one DNS MDT of the DNS rule or one BD MDT referred by the DNS rule.

See clauses 5.2.3.5 and 5.2.3.2.4 for the description of baseline DNS patterns and One-Time DNS rules respectively.

Figure 5.2.3.2-1 provides an overview of DNS contexts, DNS rules (other than One-Time DNS rules) and baseline DNS patterns, depicting one DNS context created with N DNS rules, some of them referring to baseline DNS patterns.

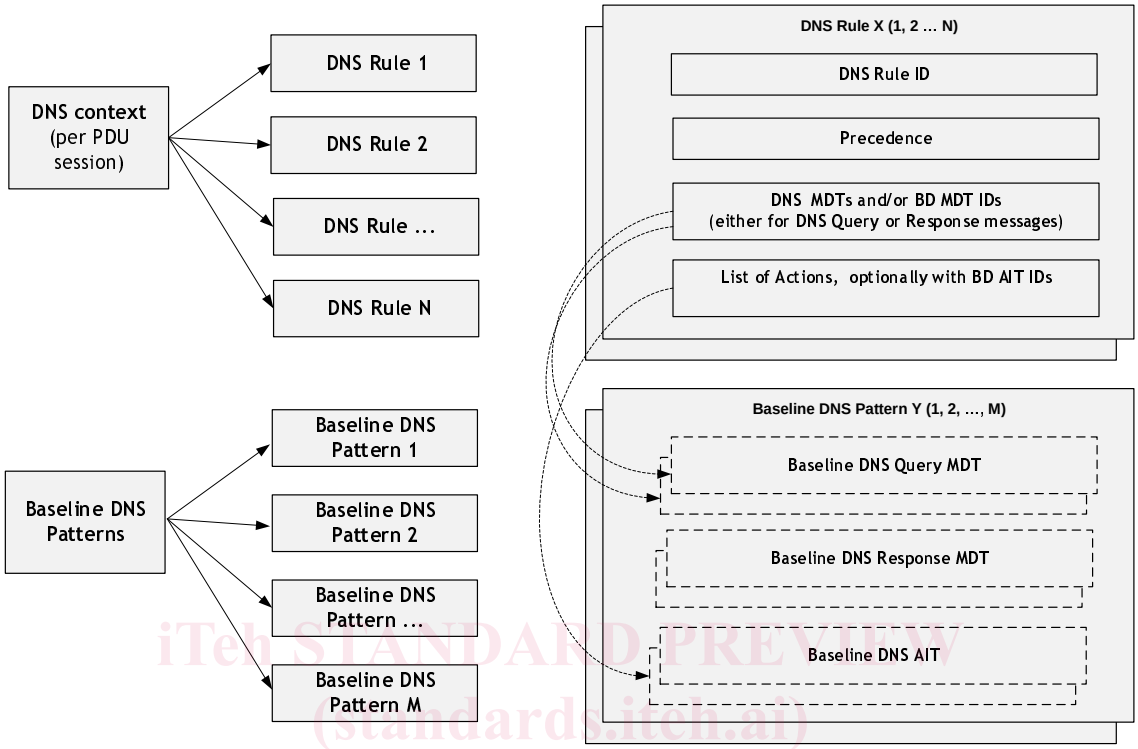

Figure 5.2.3.2-1: Overview of DNS contexts, DNS rules and Baseline DNS Patterns

5.2.3.2.3 Processing flow for incoming DNS messages

Upon receipt of a DNS message, the EASDF shall first identify the DNS context corresponding to the DNS message as follows:

- for DNS Query message: by using the source IP address of the DNS Query message and by matching it with the UE IP address provisioned in the DNS Query MDTs if any or with the UE IP address provisioned in the DNS context; and

- for a DNS Response message: by matching the DNS response with the DNS Query (either by the EASDF assigning a specific Transaction ID when forwarding the DNS Query message and by matching the Transaction ID in the DNS Query and DNS Response, or by the EASDF using a unique couple of source IP address and UDP port per DNS context when forwarding the DNS Query message and by matching the DNS Response message using the destination IP address and UDP port) and by retrieving the DNS context that is associated with the DNS query.

NOTE 1: The EASDF has direct user plane connectivity (i.e., without any NAT) with the PSA UPF over N6 for the transmission of DNS signalling exchanged with the UE. The deployment of a NAT between EASDF and PSA UPF is not supported.

If there is no DNS context matching a DNS Query or Response message, the EASDF should forward the DNS Query message towards a preconfigured DNS server and the DNS response towards the UE.

After finding the DNS context, the EASDF shall look up for a DNS rule matching the DNS message, among all DNS rules provisioned in the DNS Context, starting with the DNS rules with the highest precedence and continuing then with DNS rules with a lower precedence, in decreasing order of precedence. If there is no DNS rule matching the DNS message, the EASDF should forward the DNS Query message towards a preconfigured DNS server/resolver for resolution.