ETSI TS 129 569 V19.1.0 (2026-02)

TECHNICAL SPECIFICATION

5G;
5G System;
Ambient IoT Function (AIOTF) Services;
Stage 3
(3GPP TS 29.569 version 19.1.0 Release 19)

Reference
RTS/TSGC-0329569vj10

Keywords
5G

ETSI

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Contents

Foreword

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

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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 Naiotf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the AIOTF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.369 [14], 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

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 9113: "HTTP/2".

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

[13] IETF RFC 9457: "Problem Details for HTTP APIs".

[14] 3GPP TS 23.369: "Architecture support for Ambient power-enabled Internet of Things; Stage 2".

[15] 3GPP TS 29.522: "5G System; Network Exposure Function Northbound APIs; Stage 3".

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

[17] 3GPP TS 29.122: "T8 reference point for Northbound Application Programming Interfaces (APIs)".

[18] 3GPP TS 29.572: "5G System; Location Management Services; Stage 3".

[19] 3GPP TS 24.369: "Ambient IoT Non-Access-Stratum (AIoT NAS) protocol for 5G System (5GS); Stage 3".

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].

For the purpose of the present document, the terms and definitions given in clause 3 of 3GPP TS 23.369 [14] also apply, including the ones referencing other specifications.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1], 3GPP TS 23.369 [14] 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] or 3GPP TS 23.369 [14].

4 Overview

In the frame of AIoT Services, the AIoT Function (AIOTF) provides services to NF service consumers (e.g., NEF, AF) via the Naiotf service-based interface. The AIOTF supports for this purpose the functionalities defined in 3GPP TS 23.369 [14] to enable the management of AIoT services and their exposure to AIoT applications.

Figures°4-1 and 4.2 depict the AIoT related reference architecture of the AIOTF respectively in SBI representation and reference point representation.

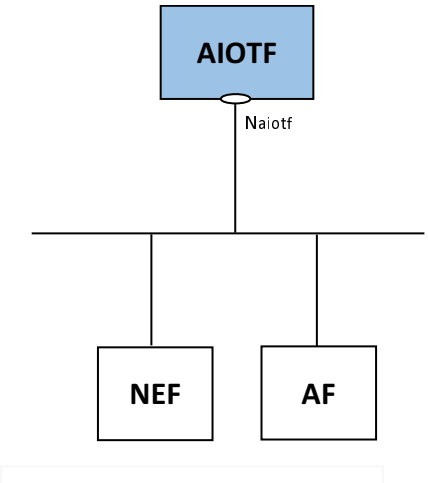

Figure 4-1: Reference model for the AIOTF Services – SBI representation

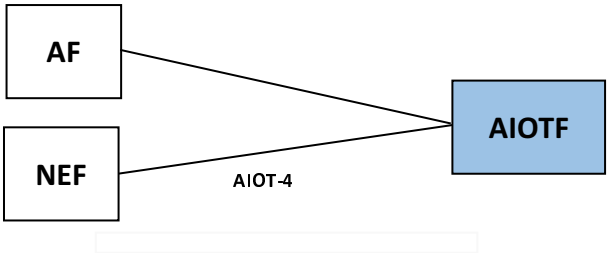

Figure 4-2: Reference Model for the AIOTF Services – Reference point representation

5 Services offered by the AIOTF

5.1 Introduction

The AIOTF provides the following services:

- Naiotf_AIoT

Table 5.1-1 summarizes the corresponding APIs defined in this specification.

Table 5.1-1: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Naiotf_AIoT	6.1	AIoT Service	TS29569_Naiotf_AIoT.yaml	naiotf-aiot	A.2

5.2 Naiotf_AIoT Service

5.2.1 Service Description

The Naiotf_AIoT service exposed by the AIOTF enables an NF service consumer to:

- request to perform AIoT Inventory operations;
- request to perform AIoT Command operations; and
- receive AIoT operations related event(s) reporting.

5.2.2 Service Operations

5.2.2.1 Introduction

The service operations defined for the Naiotf_AIoT service are shown in table 5.2.2.1-1.

Table 5.2.2.1-1: Naiotf_AIoT Service Operations

Service Operation Name	Description	Initiated by
Naiotf_AIoT_Inventory	This service operation enables the NF service consumer to request to perform an AIoT Inventory operation.	e.g., NEF, AF
Naiotf_AIoT_Command	This service operation enables the NF service consumer to request to perform an AIoT Command operation.	e.g., NEF, AF
Naiotf_AIoT_Notify	This service operation enables the NF service consumer to receive AIoT operations related event(s) reporting.	AIOTF

5.2.2.2 Naiotf_AIoT_Inventory

5.2.2.2.1 General

This service operation is used by an NF service consumer to request to perform an AIoT Inventory operation at the AIOTF.

The following procedures are supported by the "Naiotf_AIoT_Inventory" service operation:

- AIoT Inventory Request.

5.2.2.2.2 AIoT Inventory Request

Figure 5.2.2.2.2-1 depicts a scenario where an NF service consumer requests to perform an AIoT Inventory operation to the AIOTF (see also clause 6.2.2 of 3GPP TS 23.369 [14]).

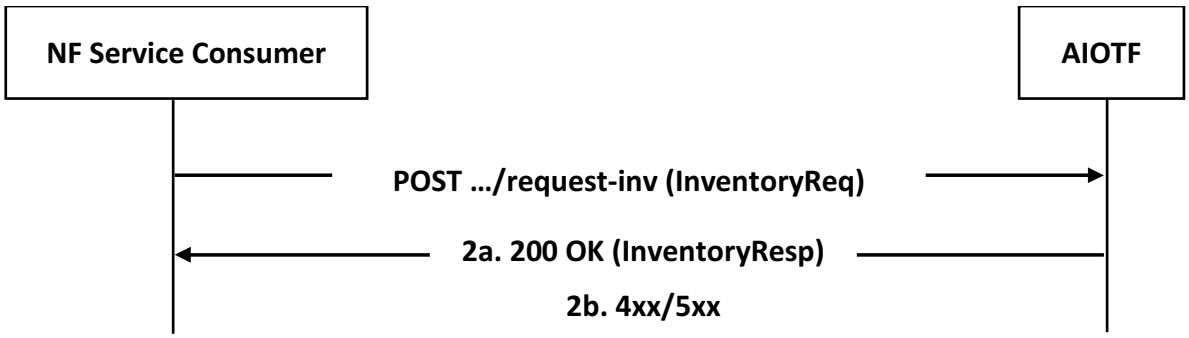

Figure 5.2.2.2.2-1: AIoT Inventory Request

1. In order to request to perform an AIoT Inventory operation, the NF service consumer shall send an HTTP POST request message to the AIOTF targeting the URI of the corresponding custom operation (i.e., "InventoryRequest"), with the request body containing the InventoryReq data structure.

2a. Upon reception of the Inventory request from the NF service consumer:

- the AIOTF may perform the AF authorization for AIoT Services procedure as defined in clauses 5.6 and 6.2.2 of 3GPP TS 23.369 [14]; and
- if the AF authorization for AIoT Services procedure is successful and upon successful processing of the request, the AIOTF shall respond to the NF service consumer with an HTTP "200 OK" status code to indicate that the AIoT Inventory request is successfully received and processed, with the response body containing AIoT Inventory related information within the InventoryResp data structure.

2b. On failure, the AIOTF shall take proper error handling actions, as specified in clause 6.1.7, and respond to the NF service consumer with an appropriate error status code. In particular:

- if AF authorization for AIoT Services procedure is not successful, the AIOTF shall reject the request with an HTTP "403 Forbidden" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "AF_NOT_AUTHORIZED" application error;
- if the target(s) of the AIoT Inventory request (e.g., target AIoT Device(s), filtering information) is/are not supported and/or not allowed, the AIOTF shall reject the request with an HTTP "403 Forbidden" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "AIOT_TARGETS_ERROR" application error;
- if the provided time interval for results aggregation is invalid (e.g., the provided time interval is shorter than a locally configured minimum interval at the AIOTF as defined in clause 5.9 of 3GPP TS 23.369 [14]), the AIOTF shall reject the request with an HTTP "403 Forbidden" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "INVALID_AGGR_TIME_INVERTAVAL" application error; and
- if the AIOTF fails to process the AIoT Inventory request (e.g., failure to select the NG-RAN(s) or RAN Reader(s) to handle the request), the AIOTF shall reject the request with an HTTP "500 Internal Server Error" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "UNSPECIFIED_FAILURE" application error.

5.2.2.3 Naiotf_AIoT_Command

5.2.2.3.1 General

This service operation is used by an NF service consumer to request to perform an AIoT Command operation at the AIOTF.

The following procedures are supported by the "Naiotf_AIoT_Command" service operation:

- AIoT Command Request.

5.2.2.3.2 AIoT Command Request

Figure 5.2.2.3.2-1 depicts a scenario where an NF service consumer requests to perform an AIoT Command operation to the AIOTF (see also clause 6.2.3 of 3GPP TS 23.369 [14]).

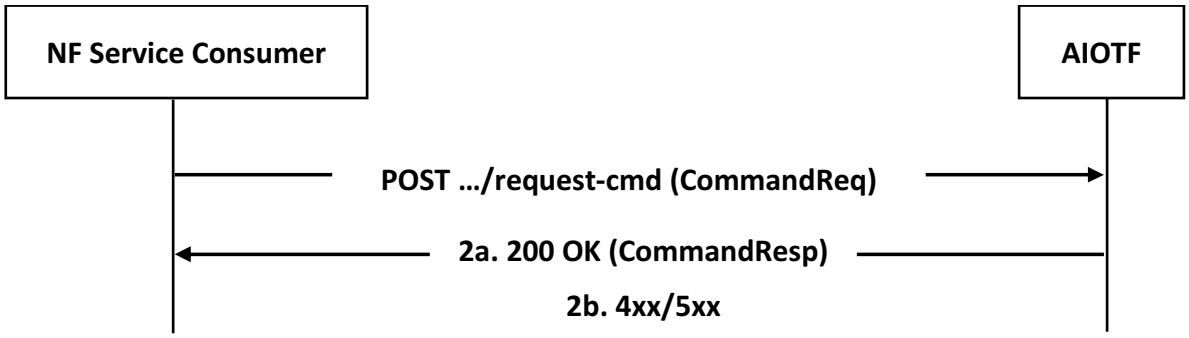

Figure 5.2.2.3.2-1: AIoT Command Request

1. In order to request to perform an AIoT Command operation, the NF service consumer shall send an HTTP POST request message to the AIOTF targeting the URI of the corresponding custom operation (i.e., "CommandRequest"), with the request body containing the CommandReq data structure.

2a. Upon reception of the Command request from the NF service consumer:

- the AIOTF may perform the AF authorization for AIoT Services procedure as defined in clauses 5.6 and 6.2.3 of 3GPP TS 23.369 [14]; and
- if the AF authorization for AIoT Services procedure is successful and upon successful processing of the request, the AIOTF shall respond to the NF service consumer with an HTTP "200 OK" status code to indicate that the AIoT Command request is successfully received and processed, with the response body containing AIoT Command related information within the CommandResp data structure.

2b. On failure, the AIOTF shall take proper error handling actions, as specified in clause 6.1.7, and respond to the NF service consumer with an appropriate error status code. In particular:

- if AF authorization for AIoT Services procedure is not successful, the AIOTF shall reject the request with an HTTP "403 Forbidden" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "AF_NOT_AUTHORIZED" application error;
- if the target(s) of the AIoT Command request (e.g., target AIoT Device(s), filtering information) is/are not supported and/or not allowed, the AIOTF shall reject the request with an HTTP "403 Forbidden" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "AIOT_TARGETS_ERROR" application error;
- if the provided length of application data is too long (e.g., above the allowed maximum value), the AIOTF shall reject the request with an HTTP "403 Forbidden" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "APP_DATA_TOO_LONG" application error; and
- if the AIOTF fails to process the AIoT Command request (e.g., failure to select the NG-RAN(s) or RAN Reader(s) to handle the request), the AIOTF shall reject the request with an HTTP "500 Internal Server Error" status code with the response body including the ProblemDetails data structure containing the "cause" attribute set to the "UNSPECIFIED_FAILURE" application error.

5.2.2.4 Naiotf_AIoT_Notify

5.2.2.4.1 General

This service operation is used by the AIOTF to notify a previously subscribed service consumer on:

- AIoT operations related event(s).

The following procedures are supported by the "Naiotf_AIoT_Notify" service operation:

- AIoT Operations Notification.

5.2.2.4.2 AIoT Operations Notification

Figure 5.2.2.4.2-1 depicts a scenario where the AIOTF sends a request to notify a previously subscribed NF service consumer on AIoT operations related event(s) (see also clauses 6.2.2 and 6.2.3 of 3GPP TS 23.369 [14]).

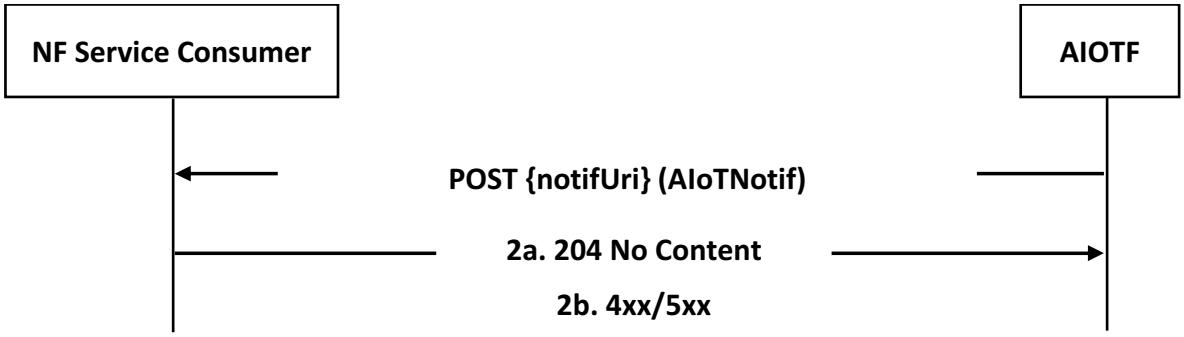

Figure 5.2.2.4.2-1: AIoT Operations Notification

1. In order to notify a previously subscribed service consumer on AIoT operations related event(s), the AIOTF shall send an HTTP POST request message to the NF service consumer with the request URI set to "{notifUri}", where the "notifUri" variable is set to the value received from the NF service consumer as part of the request used to trigger the corresponding AIoT service operation (e.g., Inventory, Command), as defined in clause 5.2.2.2 or clause 5.2.2.3, and the request body including the AIoTNotif data structure.

2a. Upon success, the NF service consumer shall respond to the AIOTF with an HTTP "204 No Content" status code.

2b. On failure, the NF service consumer shall take proper error handling actions, as specified in clause 6.1.7, and respond to the AIOTF with an appropriate error status code.

6 API Definitions

6.1 Naiotf_AIoT Service API

6.1.1 Introduction

The Naiotf_AIoT shall use the Naiotf_AIoT API.

The API URI of the Naiotf_AIoT API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "naiotf-aiot".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clauses 6.1.3 and 6.1.4.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, IETF RFC 9113 [11], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

The OpenAPI [6] specification of HTTP messages and content bodies for the Naiotf_AIoT API is contained in Annex A.

6.1.2.2 HTTP standard headers

6.1.2.2.1 General

See clause 5.2.2 of 3GPP TS 29.500 [4] for the usage of HTTP standard headers.

6.1.2.2.2 Content type

JSON, IETF RFC 8259 [12], shall be used as content type of the HTTP bodies specified in the present specification as specified in clause 5.4 of 3GPP TS 29.500 [4]. The use of the JSON format shall be signalled by the content type "application/json".

"Problem Details" JSON object shall be used to indicate additional details of the error in a HTTP response body and shall be signalled by the content type "application/problem+json", as defined in IETF RFC 9457 [13].

6.1.2.3 HTTP custom headers

The mandatory HTTP custom header fields specified in clause 5.2.3.2 of 3GPP TS 29.500 [4] shall be supported, and the optional HTTP custom header fields specified in clause 5.2.3.3 of 3GPP TS 29.500 [4] may be supported.

In this Release of the specification, no specific HTTP custom headers are defined for the Naiotf_AIoT API.

6.1.3 Resources

There are no resources defined for this API in this release of the specification.

6.1.4 Custom Operations without associated resources

6.1.4.1 Overview

The URI structure for Custom Operations without associated resources is shown in Figure 6.1.4.1-1.

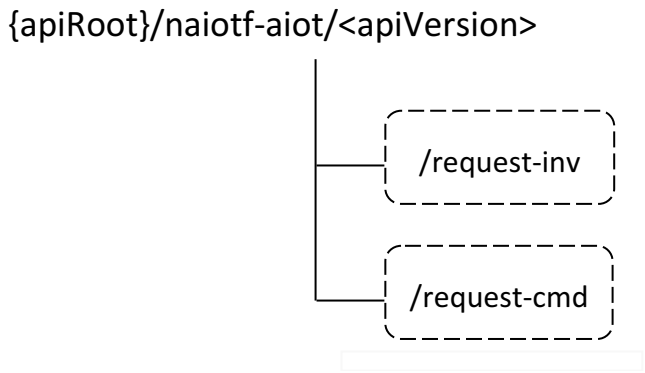

Figure 6.1.4.1-1: Custom operation URI structure of the Naiotf_AIoT API

Table 6.1.4.1-1 provides an overview of the custom operations and applicable HTTP methods defined for the Naiotf_AIoT API.

Table 6.1.4.1-1: Custom operations without associated resources

Custom operation name	Custom operation URI	Mapped HTTP method	Description
InventoryRequest	/request-inv	POST	Enables to request to perform an AIoT Inventory operation.
CommandRequest	/request-cmd	POST	Enables to request to perform an AIoT command operation.

The custom operations shall support the URI variables defined in table 6.1.4.1-2.

Table 6.1.4.1-2: URI variables for this custom operation

Name	Data type	Definition
apiRoot	string	See clause 6.1.1.

6.1.4.2 Operation: InventoryRequest

6.1.4.2.1 Description

The custom operation enables to request to perform an AIoT Inventory operation at the AIOTF.

6.1.4.2.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.2.2-1 and 6.1.4.2.2-2.

Table 6.1.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
InventoryReq	M	1	Contains the parameters to request to perform an AIoT Inventory operation.

Table 6.1.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
InventoryResp	M	1	200 OK	Successful case. The AIoT Inventory request is successfully received and processed, and AIoT Inventory related information is returned in the response body.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 3)
NOTE 1: The mandatory HTTP error status codes for the HTTP POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.1.7.				

Table 6.1.4.2.2-3: Headers supported by the 307 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIOTF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target AIOTF (service) instance towards which the request is redirected.

Table 6.1.4.2.2-4: Headers supported by the 308 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIOTF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target AIOTF (service) instance towards which the request is redirected.

6.1.4.3 Operation: CommandRequest

6.1.4.3.1 Description

The custom operation enables to request to perform an AIoT command operation.

6.1.4.3.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.3.2-1 and 6.1.4.3.2-2.

Table 6.1.4.3.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
CommandReq	M	1	Contains the parameters to request to perform an AIoT command operation.

Table 6.1.4.3.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
CommandResp	M	1	200 OK	Successful case. The AIoT command request is successfully received and processed, and the requested AIoT command related information is returned in the response body.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	(NOTE 3)
ProblemDetails	O	0..1	500 Internal Server Error	(NOTE 3)
NOTE 1: The manadatory HTTP error status codes for the HTTP POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]). NOTE 3: Failure cases are described in clause 6.1.7.				

Table 6.1.4.3.2-3: Headers supported by the 307 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIOTF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target AIOTF (service) instance towards which the request is redirected.

Table 6.1.4.3.2-4: Headers supported by the 308 Response Code on this custom operation

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIOTF (service) instance towards which the request is redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target AIOTF (service) instance towards which the request is redirected.

6.1.5 Notifications

6.1.5.1 General

Notifications shall comply to clause 6.2 of 3GPP TS 29.500 [4] and clause 4.6.2.3 of 3GPP TS 29.501 [5].

Table 6.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
AIoT Operations Notification	{notifUri}	POST	Enables the AIOTF to notify a previously subscribed NF service consumer on AIoT operations related event(s).

6.1.5.2 AIoT Operations Notification

6.1.5.2.1 Description

The AIoT Operations Notification is used by the AIOTF to report AIoT operations related event(s) to a previously subscribed NF service consumer.

6.1.5.2.2 Target URI

The Callback URI **"{notifUri}"** shall be used with the callback URI variables defined in table 6.1.5.2.2-1.

Table 6.1.5.2.2-1: Callback URI variables

Name	Definition
notifUri	Represents the callback URI encoded as a string formatted as a URI.

6.1.5.2.3 Standard Methods

6.1.5.2.3.1 POST

This method shall support the request data structures specified in table 6.1.5.2.3.1-1 and the response data structures and response codes specified in table 6.1.5.2.3.2-1.

Table 6.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
AIoTNotif	M	1	Represents the AIoT Operations Notification.

Table 6.1.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The AIoT Operations Notification is successfully received and acknowledged.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
NOTE 1: The mandatory HTTP error status codes for the HTTP POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] shall also apply. NOTE 2: The RedirectResponse data structure may be provided by an SCP (cf. clause 6.10.9.1 of 3GPP TS 29.500 [4]).				

Table 6.1.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF service consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target NF service consumer (service) instance towards which the notification request is redirected.

Table 6.1.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative URI representing the end point of an alternative NF service consumer (service) instance towards which the notification should be redirected. For the case where the request is redirected to the same target via a different SCP, refer to clause 6.10.9.1 of 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Contains the identifier of the target NF service consumer (service) instance towards which the notification request is redirected.

6.1.6 Data Model

6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Naiotf_AIoT service-based interface protocol.

Table 6.1.6.1-1: Naiotf_AIoT specific Data Types

Data type	Clause defined	Description	Applicability
AIoTDevFailCause	6.1.6.3.3	Represents the per-AIoT Device failure cause of an AIoT service operation.	
AIoTDeviceLoc	6.1.6.2.9	Represents the AIoT Device's location information.	
AIoTDevices	6.1.6.2.7	Represents the AIoT Device(s) related information.	
AIoTNotif	6.1.6.2.6	Represents the AIoT Operations Notification.	
CommandReq	6.1.6.2.4	Represents the AIoT Command request.	
CommandResp	6.1.6.2.5	Represents the AIoT Command response.	
DevicesRepInfo	6.1.6.2.8	Represents the AIoT Device(s) related reporting information.	
FailureCause	6.1.6.3.4	Represents the AIoT service operation failure cause.	
InventoryReq	6.1.6.2.2	Represents the AIoT Inventory request.	
InventoryResp	6.1.6.2.3	Represents the AIoT Inventory response.	

Table 6.1.6.1-2 specifies data types re-used by the Naiotf_AIoT service-based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Naiotf_AIoT service-based interface.

Table 6.1.6.1-2: Naiotf_AIoT re-used Data Types

Data type	Reference	Comments	Applicability
AiotArea	3GPP TS 29.571 [16]	Represents the Target Area for AIoT.	
AiotDevPermId	3GPP TS 29.571 [16]	Represents the permanent identifier of the AIoT Device.	
AiotFilteringInformation	3GPP TS 29.571 [16]	Represents the the filtering information used for identifying the target AIoT Device(s).	
Bytes	3GPP TS 29.571 [16]	Represents a sequence of bytes.	
CivicAddress	3GPP TS 29.572 [18]	Represents a civic address.	
CommandType	3GPP TS 29.522 [15]	Represents the type of AIoT Command.	
DurationSec	3GPP TS 29.571 [16]	Represents a time duration in units of seconds.	
GeographicArea	3GPP TS 29.572 [18]	Represents a geographical area.	
ProblemDetails	3GPP TS 29.571 [16]	Represents error related information.	
RedirectResponse	3GPP TS 29.571 [16]	Contains redirection related information.	
SupportedFeatures	3GPP TS 29.571 [16]	Represents the list of supported feature(s) and is used to negotiate the applicability of optional features.	
Uinteger	3GPP TS 29.571 [16]	Represents an unsigned integer.	
Uri	3GPP TS 29.571 [16]	Represents a URI.	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.1.6.2.2 Type: InventoryReq

Table 6.1.6.2.2-1: Definition of type InventoryReq

Attribute name	Data type	P	Cardinality	Description	Applicability
afId	string	M	1	Contains the identifier of the AF that triggered the request.	
targetArea	AiotArea	C	0..1	Contains the Target Area within which the requested Inventory operation shall apply. (NOTE)	
targetDevices	AIoTDevices	C	0..1	Contains the target AIoT Device(s) related information. (NOTE)	
numDevices	Uinteger	O	0..1	Contains the approximative number of the targeted AIoT Device(s).	
timeInterval	DurationSec	O	0..1	Contains the time interval to be used for results aggregation.	
devLocReqInd	boolean	O	0..1	Indicates that the location information of the target AIoT Device(s) is requested. - "true" indicates that the location information of the target AIoT Device(s) is requested. When present, this attribute shall be set to "true". The presence of this attribute set to the value "false" is forbidden.	
notifUri	Uri	M	1	Contains the URI via which the AIoT Inventory operation related notifications shall be delivered.	
suppFeat	SupportedFeatures	C	0..1	Contains the list of supported features among the ones defined in clause 6.1.8. This attribute shall be present only when feature negotiation is required.	
NOTE: At least one of these attributes shall be present.					

6.1.6.2.3 Type: InventoryResp

Table 6.1.6.2.3-1: Definition of type InventoryResp

Attribute name	Data type	P	Cardinality	Description	Applicability
transId	string	M	1	Contains the identifier of the transaction that is created for the inventory request.	
suppFeat	SupportedFeatures	C	0..1	Contains the list of supported features among the ones defined in clause 6.1.8. This attribute shall be present only when feature negotiation is required.	

6.1.6.2.4 Type: CommandReq

Table 6.1.6.2.4-1: Definition of type CommandReq

Attribute name	Data type	P	Cardinality	Description	Applicability
afId	string	M	1	Contains the identifier of the AF that triggered the request.	
commandType	CommandType	M	1	Contains the type of the requested command.	
targetArea	AiotArea	C	0..1	Contains the Target Area within which the requested Command operation shall apply. (NOTE 1)	
targetDevices	AIoTDevices	C	0..1	Contains the target AIoT Device(s) related information. (NOTE 1)	
numDevices	Uinteger	O	0..1	Contains the approximative number of the targeted AIoT Device(s).	
msgSize	Uinteger	O	0..1	Contains the approximative message size in units of Bytes. This attribute may be present only if the "commandType" attribute is set to "READ".	
offset	Uinteger	C	0..1	Contains the offset, expressed in units of bytes. This attribute shall be present only if the "commandType" attribute is set to "READ" or "WRITE": - If the "commandType" attribute is set to "READ", this attribute contains the offset from which to read the application data. - If the "commandType" attribute is set to "WRITE", this attribute contains the offset from which to write the application data.	
length	Uinteger	C	0..1	Contains the length of application data, expressed in units of bytes (i.e., byte length). This attribute shall be present only if the "commandType" attribute is set to "READ" or "WRITE": - If the "commandType" attribute is set to "READ", this attribute contains the length of application data to read. - If the "commandType" attribute is set to "WRITE", this attribute contains the length of application data to write. (NOTE 2)	
data	Bytes	C	0..1	Contains the application data to write. This attribute shall be present only if the "commandType" attribute is set to "WRITE".	

devLocReqInd	boolean	O	0..1	Indicates that the location information of the target AIoT Device(s) is requested. - "true" indicates that the location information of the target AIoT Device(s) is requested. When present, this attribute shall be set to "true". The presence of this attribute set to the value "false" is forbidden.	
notifUri	Uri	M	1	Contains the URI via which the AIoT Command operation related notifications shall be delivered.	
suppFeat	SupportedFeatures	C	0..1	Contains the list of supported features among the ones defined in clause 6.1.8. This attribute shall be present only when feature negotiation is required.	
NOTE 1: At least one of these attributes shall be present. NOTE 2: The maximum value of this attribute shall be as specified in clause 7.2.4 of 3GPP TS 24.369 [19].					

6.1.6.2.5 Type: CommandResp

Table 6.1.6.2.5-1: Definition of type CommandResp

Attribute name	Data type	P	Cardinality	Description	Applicability
transId	string	M	1	Contains the identifier of the transaction that is created for the command request.	
suppFeat	SupportedFeatures	C	0..1	Contains the list of supported features among the ones defined in clause 6.1.8. This attribute shall be present only when feature negotiation is required.	

6.1.6.2.6 Type: AIoTNotif

Table 6.1.6.2.6-1: Definition of type AIoTNotif

Attribute name	Data type	P	Cardinality	Description	Applicability
transId	string	M	1	Contains the identifier of the AIoT transaction to which the notification is related.	
devicesRepData	array(DevicesRepInfo)	C	1..N	Contains the AIoT Device(s) related reporting information. (NOTE 1, NOTE 2)	
lastRepInd	boolean	C	0..1	Indicates that this is the last reporting from the AIOTF for the AIoT service operation identified by the "transId" attribute. - "true" indicates that this is the last report. This attribute shall be present only when this is the last reporting from the NF service consumer for the AIoT service operation identified by the "transId" attribute. When present, this attribute shall be set to "true". The presence of this attribute set to the value "false" is forbidden. (NOTE 1)	
failCause	FailureCause	C	0..1	Contains the AIoT service operation failure cause. (NOTE 1, NOTE 2)	
NOTE 1: At least one of these attributes shall be present. NOTE 2: These attributes are mutually exclusive.					

6.1.6.2.7 Type: AIoTDevices

Table 6.1.6.2.7-1: Definition of type AIoTDevices

Attribute name	Data type	P	Cardinality	Description	Applicability
devices	array(AiotDevPermId)	C	1..N	Contains the list of the permanent identifier(s) of the target AIoT Device(s). (NOTE)	
filteringInfo	AiotFilteringInformation	C	0..1	Contains the filtering information used for identifying the target AIoT Device(s). (NOTE)	
NOTE: These attributes are mutually exclusive and only one of them shall be present.					

6.1.6.2.8 Type: DevicesRepInfo

Table 6.1.6.2.8-1: Definition of type DevicesRepInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
deviceId	AiotDevPermId	M	1	Contains the identifier of the AIoT Device to which the reporting information is related.	
readCmdRep	Bytes	O	0..1	Contains the Read command specific report information for the AIoT Device identified by the "deviceId" attribute. This attribute may be present only if the reporting information is related to a Read command operation, i.e., the "commandType" attribute is set to "READ" in the corresponding AIoT Command service operation.	
deviceLocInfo	AIoTDeviceLoc	O	0..1	Contains the location information of the AIoT Device identified by the "deviceId" attribute. This attribute may be present only if the "devLocReqInd" attribute within the corresponding AIoT Inventory or Command request was set to "true" and the AIoT Device location information is available. (NOTE)	
failCause	AIoTDevFailCause	O	0..1	Contains the AIoT service operation failure cause for the AIoT Device identified by the "deviceId" attribute.	
NOTE: In this release of the specification, the AIOTF determines whether to provide the AIoT Device location information to the AIoT AF based on operator policy.					

6.1.6.2.9 Type: AIoTDeviceLoc

Table 6.1.6.2.9-1: Definition of type AIoTDeviceLoc

Attribute name	Data type	P	Cardinality	Description	Applicability
customLocInfo	string	C	0..1	Contains the location information of the AIoT Device, expressed in a pre-configured customized format. (NOTE)	
geographicAreas	array(GeographicArea)	C	1..N	Contains the location information of the AIoT Device, expressed in the form of a set of geographical area(s). (NOTE)	
civicAddresses	array(CivicAddress)	C	1..N	Contains the location information of the AIoT Device, expressed in the form of a list of a set of civic address(es). (NOTE)	
NOTE: These attributes are mutually exclusive and only one of them shall be present.					

NOTE: The AIoT Device location format is defined based on the SLA between the operator and the AIoT AF, which is out of 3GPP scope.

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.1.6.3.3 Enumeration: AIoTDevFailCause

The enumeration AIoTDevFailCause represents the per-AIoT Device failure cause of an AIoT service operation. It shall comply with the provisions defined in table 6.1.6.3.3-1.

Table 6.1.6.3.3-1: Enumeration AIoTDevFailCause

Enumeration value	Description	Applicability
COMMAND_TYPE_SPECIFIC_PARAMETERS_INVALID	Indicates that the failure cause of the AIoT service operation is due to the command type specific parameters being invalid. (NOTE)	
ERROR_UNSPECIFIED	Indicates that the failure cause of the AIoT service operation is because the requested read or write command was not executed successfully for an unspecified reason. (NOTE)	
LOW_ENERGY	Indicates that the failure cause of the AIoT service operation is because the write command cannot be implemented because the energy will run out. (NOTE)	
INVALID_MANDATORY_INFORMATION	Indicates that the failure cause of the AIoT service operation is because the AIoT Device sending this cause has received a message with a non-semantical mandatory IE error. (NOTE)	
MESSAGE_TYPE_NON_EXISTENT_OR_NOT_IMPLEMENTED	Indicates that the failure cause of the AIoT service operation is because the AIoT Device received a message with a message type that it does not recognize either because this is a message that is not defined, or defined but not implemented by the equipment. (NOTE)	
NOTE: This value applies only to the AIoT Command service operation.		

6.1.6.3.4 Enumeration: FailureCause

The enumeration FailureCause represents the AIoT service operation failure cause. It shall comply with the provisions of table 6.1.6.3.4-1.

Table 6.1.6.3.4-1: Enumeration FailureCause

Enumeration value	Description	Applicability
NO_SUCC_INV_RESP	Indicates that the AIoT Inventory/Command request failed because none of the related Inventory response(s) received by the AIOTF was successful.	

6.1.6.4 Data types describing alternative data types or combinations of data types

There are no data types describing alternative data types or combinations of data types defined for this API in this release of the specification.

6.1.6.5 Binary data

6.1.6.5.1 Binary Data Types

Table 6.1.6.5.1-1: Binary Data Types

Name	Clause defined	Content type

6.1.7 Error Handling

6.1.7.1 General

For the Naiotf_AIoT API, HTTP error responses shall be supported as specified in clause 4.8 of 3GPP TS 29.501 [5]. Protocol errors and application errors specified in table 5.2.7.2-1 of 3GPP TS 29.500 [4] shall be supported for an HTTP method if the corresponding HTTP status codes are specified as mandatory for that HTTP method in table 5.2.7.1-1 of 3GPP TS 29.500 [4].

In addition, the requirements in the following clauses are applicable for the Naiotf_AIoT API.

6.1.7.2 Protocol Errors

No specific procedures for the Naiotf_AIoT service are specified.

6.1.7.3 Application Errors

The application errors defined for the Naiotf_AIoT service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability
AF_NOT_AUTHORIZED	403 Forbidden	The request for AIoT services is rejected because the AF is not authorized for the requested AIoT Services.	
AIOT_TARGETS_ERROR	403 Forbidden	The request for AIoT services is rejected because the target(s) of the AIoT request (e.g., target AIoT Device(s), filtering information) is/are not supported and/or not allowed.	
INVALID_AGGR_TIME_INVERTAVAL	403 Forbidden	The AIoT Inventory request is rejected because the provided aggregation time interval is invalid.	
APP_DATA_TOO_LONG	403 Forbidden	The AIoT Command request is rejected because the provided length of application data is too long (e.g., above the allowed maximum value).	
UNSPECIFIED_FAILURE	500 Internal Server Error	The request for AIoT services is rejected because the AIOTF failed to process it for an unspecified reason.	

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Naiotf_AIoT API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.8-1: Supported Features

Feature number	Feature Name	Description

6.1.9 Security

As indicated in 3GPP TS 33.501 [8] and 3GPP TS 29.500 [4], the access to the Naiotf_AIoT API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [9]), based on local configuration, using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [10]) plays the role of the authorization server.

If OAuth2 is used, an NF Service Consumer, prior to consuming services offered by the Naiotf_AIoT API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in clause 5.4.2.2 of 3GPP TS 29.510 [10].

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Naiotf_AIoT service.

Table 6.1.9-1 defines the OAuth2 scopes defined for the Naiotf_AIoT API.

Table 6.1.9-1: Oauth2 scopes defined in Naiotf_AIoT API

Scope	Description
"naiotf-aiot"	Enables to access all the resources and custom operations of the Naiotf_AIoT API.
"naiotf-aiot:inventory"	Enables to access only the "InventoryRequest" custom operation (Naiotf_AIoT_Inventory service operation) of the Naiotf_AIoT API.
"naiotf-aiot:command"	Enables to access only the "CommandRequest" custom operation (Naiotf_AIoT_Command service operation) of the Naiotf_AIoT API.

6.1.10 HTTP redirection

An HTTP request may be redirected to a different AIOTF service instance when using direct or indirect communications (see 3GPP TS 29.500 [4]).

An SCP that reselects a different AIOTF producer instance will return the NF Instance ID of the new AIOTF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an AIOTF redirects a service request to a different AIOTF using an HTTP 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new AIOTF towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the HTTP 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

Annex A (normative): OpenAPI specification

A.1 General

This Annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI specifications in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

NOTE: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see clause 5.3.1 of 3GPP TS 29.501 [5] and clause 5B of 3GPP TR 21.900 [7]).

A.2 Naiotf_AIoT API

```
openapi: 3.0.0

info:
  title: AIOTF Ambient IoT Service
  version: 1.0.0
  description: |
    API for the Naiotf_AIoT Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.569 V19.1.0; Ambient IoT Function (AIOTF) Services.
  url: http://www.3gpp.org/ftp/Specs/archive/29_series/29.569/

servers:
  - url: '{apiRoot}/naiotf-aiot/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501.

security:
  - {}
  - oAuth2ClientCredentials:
    - naiotf-aiot

paths:
  /request-inv:
    post:
      summary: Request to perform an AIoT Inventory operation.
      operationId: InventoryRequest
      tags:
        - AIoT Inventory Request (custom operation without associated resources)
      security:
        - {}
        - oAuth2ClientCredentials:
          - naiotf-aiot
        - oAuth2ClientCredentials:
          - naiotf-aiot
          - naiotf-aiot:inventory
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/InventoryReq'
      responses:
        '200':
          description: >
            OK. The AIoT Inventory request is successfully received and processed, and
            AIoT Inventory related information is returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/InventoryResp'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
```

```
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        AIoTOperationsNotif:
          '{$request.body#/notifUri}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/AIoTNotif'
              responses:
                '204':
                  description: >
                    No Content. The AIoT Operations Notification is successfully received and
                    acknowledged.
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                '429':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                '500':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                '502':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                '503':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /request-cmd:
    post:
      summary: Request to perform an AIoT Command operation.
      operationId: CommandRequest
      tags:
        - AIoT Command Request (custom operation without associated resources)
      security:
        - {}
        - oAuth2ClientCredentials:
          - naiotf-aiot
        - oAuth2ClientCredentials:
          - naiotf-aiot
          - naiotf-aiot:command
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/CommandReq'
      responses:
        '200':
          description: >
            OK. The AIoT Command request is successfully received and processed, and
            AIoT Command related information is returned in the response body.
          content:
            application/json:
```

```
            schema:
              $ref: '#/components/schemas/CommandResp'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        AIoTOperationsNotif:
          '{$request.body#/notifUri}':
            post:
              requestBody:
                required: true
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/AIoTNotif'
              responses:
                '204':
                  description: >
                    No Content. The AIoT Operations Notification is successfully received and
                    acknowledged.
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                '429':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                '500':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                '502':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                '503':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'


components:
  securitySchemes:
    oAuth2ClientCredentials:
```

```
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            naiotf-aiot: >
              Enables to access all the resources and custom operations of the Naiotf_AIoT API.
            naiotf-aiot:inventory: >
              Enables to access only the InventoryRequest custom operation (Naiotf_AIoT_Inventory
              service operation) of the Naiotf_AIoT API.
            naiotf-aiot:command: >
              Enables to access only the CommandRequest custom operation (Naiotf_AIoT_Command
              service operation) of the Naiotf_AIoT API.

  schemas:

#
# STRUCTURED DATA TYPES
#

    InventoryReq:
      description: Represents the AIoT Inventory request.
      type: object
      properties:
        afId:
          type: string
        targetArea:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AiotArea'
        targetDevices:
          $ref: '#/components/schemas/AIoTDevices'
        numDevices:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
        timeInterval:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
        devLocReqInd:
          type: boolean
          enum:
            - true
          description: >
            Indicates that the location information of the target AIoT Device(s) is requested.
            "true" indicates that the location information of the target AIoT Device(s) is
            requested.
            When present, this attribute shall be set to "true". The presence of this attribute set
            to the value "false" is forbidden.
        notifUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - afId
        - notifUri
      anyOf:
        - required: [targetArea]
        - required: [targetDevices]

    InventoryResp:
      description: Represents the AIoT Inventory response.
      type: object
      properties:
        transId:
          type: string
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      required:
        - transId

    CommandReq:
      description: Represents the AIoT Command request.
      type: object
      properties:
        afId:
          type: string
        commandType:
          $ref: 'TS29522_AIoT.yaml#/components/schemas/CommandType'
        targetArea:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AiotArea'
        targetDevices:
          $ref: '#/components/schemas/AIoTDevices'
```

```
      numDevices:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      msgSize:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      offset:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      length:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uinteger'
      data:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
      devLocReqInd:
        type: boolean
        enum:
          - true
        description: >
          Indicates that the location information of the target AIoT Device(s) is requested.
          "true" indicates that the location information of the target AIoT Device(s) is
          requested.
          When present, this attribute shall be set to "true". The presence of this attribute set
          to the value "false" is forbidden.
      notifUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      suppFeat:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - afId
      - commandType
      - notifUri
    anyOf:
      - required: [targetArea]
      - required: [targetDevices]

  CommandResp:
    description: Represents the AIoT Command response.
    type: object
    properties:
      transId:
        type: string
      suppFeat:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    required:
      - transId

  AIoTNotif:
    description: Represents the AIoT Operations Notification.
    type: object
    properties:
      transId:
        type: string
      devicesRepData:
        type: array
        items:
          $ref: '#/components/schemas/DevicesRepInfo'
        minItems: 1
      lastRepInd:
        type: boolean
        enum:
          - true
        description: >
          Indicates that this is the last reporting from the AIOTF for the AIoT service
          operation identified by the "transId" attribute.
          true indicates that this is the last report.
          This attribute shall be present only when this is the last reporting from the NF service
          consumer for the AIoT service operation identified by the transId attribute.
          When present, this attribute shall be set to true. The presence of this attribute set
          to the value false is forbidden.
      failCause:
        $ref: '#/components/schemas/FailureCause'
    required:
      - transId
    allOf:
      - anyOf:
        - required: [devicesRepData]
        - required: [lastRepInd]
        - required: [failCause]
      - not:
          required: [devicesRepData, failCause]
```

```
    AIoTDevices:
      description: Represents the AIoT Device(s) related information.
      type: object
      properties:
        devices:
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/AiotDevPermId'
          minItems: 1
        filteringInfo:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AiotFilteringInformation'
      oneOf:
        - required: [devices]
        - required: [filteringInfo]

    DevicesRepInfo:
      description: Represents the AIoT Device(s) related reporting information.
      type: object
      properties:
        deviceId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/AiotDevPermId'
        readCmdRep:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
        deviceLocInfo:
          $ref: '#/components/schemas/AIoTDeviceLoc'
        failCause:
          $ref: '#/components/schemas/AIoTDevFailCause'
      required:
        - deviceId

    AIoTDeviceLoc:
      description: Represents the AIoT Device's location information.
      type: object
      properties:
        customLocInfo:
          type: string
        geographicAreas:
          type: array
          items:
            $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/GeographicArea'
          minItems: 1
        civicAddresses:
          type: array
          items:
            $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/CivicAddress'
          minItems: 1
      oneOf:
        - required: [customLocInfo]
        - required: [geographicAreas]
        - required: [civicAddresses]


#
# SIMPLE DATA TYPES
#

#
# ENUMERATIONS
#

    AIoTDevFailCause:
      anyOf:
      - type: string
        enum:
          - COMMAND_TYPE_SPECIFIC_PARAMETERS_INVALID
          - ERROR_UNSPECIFIED
          - LOW_ENERGY
          - INVALID_MANDATORY_INFORMATION
          - MESSAGE_TYPE_NON_EXISTENT_OR_NOT_IMPLEMENTED
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration but
          is not used to encode content defined in the present version of this API.
      description: |
        Represents the per-AIoT Device failure cause of an AIoT service operation.
        It complies with the provisions defined in Table 6.1.6.3.3-1 of 3GPP TS 29.569.
        Possible values are:
          - COMMAND_TYPE_SPECIFIC_PARAMETERS_INVALID: Indicate that the failure cause of the AIoT
```

```
            service operation is due to the command type specific parameters being invalid.
          - ERROR_UNSPECIFIED: Indicate that the failure cause of the AIoT service operation is
            because the requested read or write command was not executed successfully for an
            unspecified reason.
          - LOW_ENERGY: Indicate that the failure cause of the AIoT service operation is because the
            write command cannot be implemented because the energy will run out.
          - INVALID_MANDATORY_INFORMATION: Indicate that the failure cause of the AIoT service
            operation is because the AIoT Device sending this cause has received a message with
            a non-semantical mandatory IE error.
          - MESSAGE_TYPE_NON_EXISTENT_OR_NOT_IMPLEMENTED: Indicates that the failure cause of the
            AIoT service operation is because the AIoT Device received a message with a message type
            that it does not recognize either because this is a message that is not defined, or
            defined but not implemented by the equipment.

    FailureCause:
      anyOf:
      - type: string
        enum:
          - NO_SUCC_INV_RESP
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration but
          is not used to encode content defined in the present version of this API.
      description: |
        Represents the AIoT service operation failure cause.
        It complies with the provisions defined in Table 6.1.6.3.4-1 of 3GPP TS 29.569.
        Possible values are:
        - NO_SUCC_INV_RESP: Indicates that the AIoT Inventory/Command request failed because none of
          the related Inventory response(s) received by the AIOTF were successful.


#
# Data types describing alternative data types or combinations of data types
#
```

Annex B (informative): Withdrawn API versions

B.1 General

This Annex lists withdrawn API versions of the APIs defined in the present specification. Clause 4.3.1.6 of 3GPP TS 29.501 [5] describes the withdrawal of API versions.

B.2 Naiotf_AIoT API

The API versions listed in table B.2-1 are withdrawn for the Naiotf_AIoT API.

Table B.2-1: Withdrawn API versions of the Naiotf_AIoT service

API version number	Remarks

Annex C (normative): ABNF grammar for 3GPP SBI HTTP custom headers

C.1 General

This Annex contains a self-contained set of ABNF rules, comprising the re-used rules from IETF RFCs, and the rules defined by the 3GPP custom headers defined in this specification (see clause 6.1.2.3).

This grammar may be used as input to existing tools to help implementations to parse 3GPP custom headers.

Annex D (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2025-04	CT3#140	C3-251057	-	-	-	The skeleton for the new AIOTF Services TS.	0.0.0
2025-04	CT3#140	C3-251623	-	-	-	Inclusion of C3-251577, C3-251578, C3-251579, C3-251634, C3-251635 and C3-251640.	0.1.0
2025-05	CT3#141	C3-252434	-	-	-	Inclusion of C3-252057, C3-252058, C3-252390, C3-252391, C3-252392, C3-252393, C3-252394 and C3-252398.	0.2.0
2025-06	CT#108	CP-251141				Presentation to TSG CT for information.	1.0.0
2025-08	CT3#142	C3-253655	-	-	-	Inclusion of C3-253140, C3-253310, C3-253473, C3-253500, C3-253663 and C3-253664.	1.1.0
2025-09	CT#109	CP-252067				Presentation to TSG CT for approval.	2.0.0
2025-09	CT#109	CP-252067				Approved by TSG CT.	19.0.0
2025-12	CT#110	CP-253034	0002	5	B	Introduce device cause report	19.1.0
2025-12	CT#110	CP-253034	0006	2	B	Various additional updates and corrections to the Naiotf_AIoT API	19.1.0
2025-12	CT#110	CP-253034	0007		F	Missing 500 Internal Server Error response code	19.1.0
2025-12	CT#110	CP-253034	0008	4	B	Support of failure report in AIOT notify	19.1.0
2025-12	CT#110	CP-253034	0010	1	B	Support Device Location in Ambient IoT	19.1.0
2025-12	CT#110	CP-253034	0011	2	B	Defining the AIoT message size related restrictions	19.1.0
2025-12	CT#110	CP-253065	0012		F	Update of info and externalDocs fields	19.1.0

History

Version	Date	Status
V19.0.0	January 2026	Publication
V19.1.0	February 2026	Publication