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Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Network Functions Virtualisation (NFV).

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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1   Scope

The present document specifies a RESTful protocol and data model specification fulfilling the requirements specified in ETSI GS NFV-IFA 047 [1] for Telco-cloud data analytics service (Telco-cloud DAS).

2   References

2.1   Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are necessary for the application of the present document.

[1]   ETSI GS NFV-IFA 047: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Management data analytics Service Interface and Information Model Specification".

[2]   ETSI GS NFV-SOL 013: "Network Functions Virtualisation (NFV) Release 5; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs".

[3]   ISO 3166 (all parts): "Codes for the representation of names of countries and their subdivisions".

[4]   IETF RFC 4776: "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information".

[5]   IETF RFC 7946: "The GeoJSON Format".

[6]   ETSI GS NFV-IFA 045: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Faults and alarms modelling specification".

[7]   IETF RFC 7396: "JSON Merge Patch".

[8]   ETSI GS NFV-IFA 027: "Network Functions Virtualisation (NFV) Release 5; Management and Orchestration; Performance Measurements Specification".

2.2   Informative references

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1]   ETSI GR NFV 003: "Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV".

3   Definition of terms, symbols and abbreviations

3.1   Terms

For the purposes of the present document, the terms given in ETSI GR NFV 003 [i.1] apply.

3.2   Symbols

Void.

3.3   Abbreviations

For the purposes of the present document, the abbreviations given in ETSI GR NFV 003 [i.1] apply.

4   Overview of Telco-cloud data analytics service

4.1   Introduction

The present document defines the protocol and data model for the following interfaces produced by Telco-cloud DAF, in the form of RESTful Application Programming Interface (API) specifications:

- Telco-cloud data analytics service interface.

The design of the protocol and data model for the Telco-cloud data analytics service interface is based on the information model and requirements defined in ETSI GS NFV-IFA 047 [1].

In clause 4, general aspects are specified that apply to the Telco-cloud data analytics service interface. In addition, the provisions in clauses 4, 5, 6, 8 and 9 of ETSI GS NFV-SOL 013 [2] define common aspects of RESTful NFV-MANO APIs, and shall apply for all APIs defined in the present document.

In clause 5, the protocol and data model for the Telco-cloud data analytics service interface is specified. The resource structure with associated HTTP methods is defined and applicable flows are provided. Further, the resources and the data model are specified in detail.

4.2   Common data types

The structured data types and simple data types defined in clause 7 of ETSI GS NFV-SOL 013 [2] shall apply in the present document.

5   Telco-cloud data analytics service interface

5.1   Description

This interface allows the API consumer to invoke Telco-cloud data analytics service operations towards Telco-cloud DAF, to subscribe to notifications regarding data analytics changes and to retrieve API version information.

The operations provided through this interface are:

- DataAnalyticsRequest.

- QueryDataAnalyticsOutputRequest.

- Subscribe.

- Query Subscription Information.

- Terminate Subscription.

- Notify.

5.2   API version

For the Telco-cloud data analytics service interface version as specified in the present document, the MAJOR version field shall be 1, the MINOR version field shall be 0 and the PATCH version field shall be 0 (see clause 9.1 of ETSI GS NFV-SOL 013 [2] for a definition of the version fields). Consequently, the {apiMajorVersion} URI variable shall be set to "v1".

5.3   Resource structure and method

All resource URIs of the API shall use the base URI specification defined in clause 4.1 of ETSI GS NFV-SOL 013 [2]. The string "nfvtcdas" shall be used to represent {apiName}. All resource URIs in the sub-clauses below are defined relative to the above base URI.

Figure 5.3-1 shows the overall resource URI structure defined for the Telco-cloud data analytics service interface.
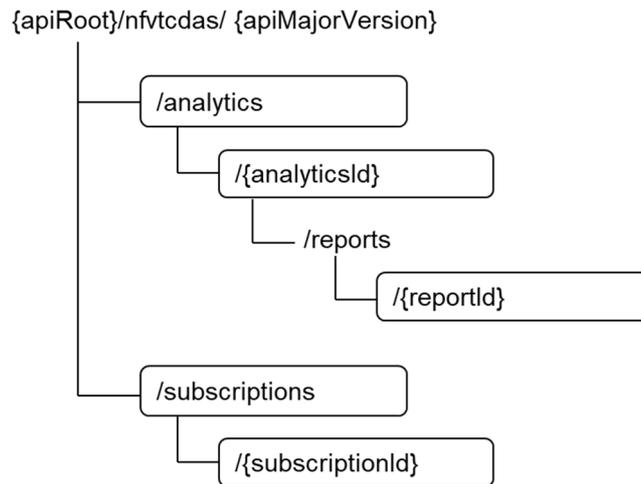
Figure 5.3-1: Resource URI structure of the Telco-cloud data analytics service interface

Table 5.3-1 lists the individual resources defined, and the applicable HTTP methods.

The API producer shall support responding to requests for all HTTP methods on the resources in table 5.3-1 that are marked as "M" (mandatory) in the "Cat" column. The API producer shall also support the "API versions" resources as specified in clause 9.3.2 of ETSI GS NFV-SOL 013 [2].

Table 5.3-1: Resources and methods overview of the Telco-cloud data analytics service interface

Resource name	Resource URI	HTTP Method	Cat	Meaning
Telco-cloud data analytics	/analytics	POST	M	Create a Telco-cloud data analytics.
		GET	M	Query a Telco-cloud data analytics.
Individual Telco-cloud data analytics	/analytics/{analyticsId}	GET	M	Read a single Telco-cloud data analytics.
		PATCH	M	Update the analytics information.
		DELETE	M	Delete a Telco-cloud data analytics.
Individual Telco-cloud data analytics report	/analytics/{analyticsId}/reports/{reportId}	GET	M	Read an individual analytics report.
Subscriptions	/subscriptions	POST	M	Subscribe to notifications of data analytics changes.
		GET	M	Query multiple subscriptions.
Individual subscription	/subscriptions/{subscriptionId}	GET	M	Read an individual subscription resource.
		DELETE	M	Terminate a subscription.
Notification endpoint	(client-provided)	POST	See note	Notify about analytics changes. See note.
		GET	See note	Test the notification endpoint. See note.
NOTE: The API producer shall support invoking the HTTP methods defined for the "Notification endpoint" resource exposed by the API consumer. If the API consumer supports invoking the POST method on the "Subscriptions" resource towards the API producer, it shall also support responding to the HTTP requests defined for the "Notification endpoint" resource.				

5.4   Sequence diagrams (informative)

5.4.1   Flow of creating a data analytics request

This clause describes a sequence for creating a data analytics request.
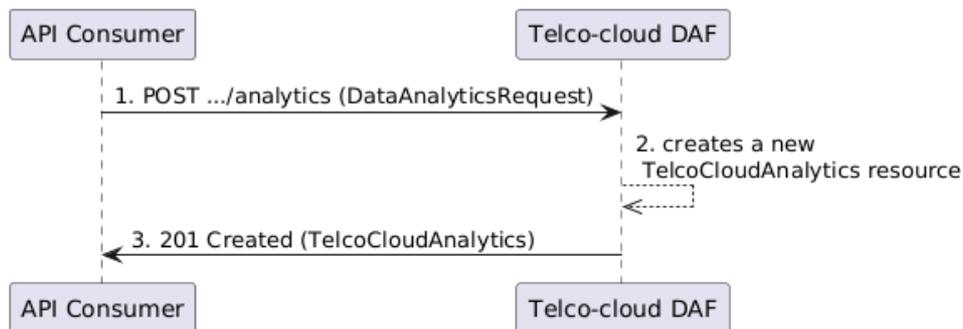
Figure 5.4.1-1: Flow of Data analytics creation

Data analytics creation, as illustrated in figure 5.4.1-1, consists of the following steps:

1)   If the API Consumer intends to create a data analytics request, it sends a POST request to the "analytics" resource, including one data structure of type "DataAnalyticsRequest" in the payload body.

2)   The Telco-cloud DAF creates a new TelcoCloudAnalytics instance.

3)   The Telco-cloud DAF returns a "201 Created" response to the API Consumer and includes in the payload body a representation of the TelcoCloudAnalytics instance just created.

Error handling: In case of failure, appropriate error information is provided in the response.

5.4.2 Flow of querying/reading Telco-cloud data analytics

This clause describes a sequence for querying/reading Telco-cloud data analytics.
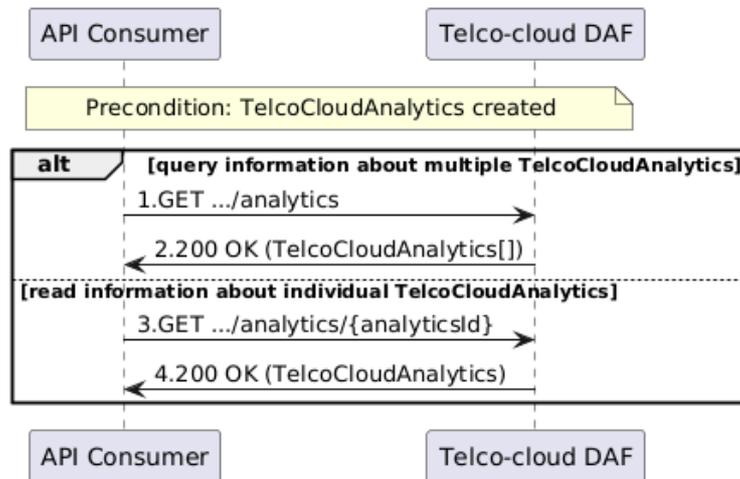
Figure 5.4.2-1: Flow of Telco-cloud Data analytics query/read

Telco-cloud data analytics query/read, as illustrated in figure 5.4.2-1, consists of the following steps:

1) If the API Consumer intends to query all Telco-cloud analytics, it sends a GET request to the "analytics" resource.

2) The Telco-cloud DAF returns a "200 OK" response to the API Consumer and includes zero or more data structures of type "TelcoCloudAnalytics" in the payload body.

3) If the API Consumer intends to read information about a particular data analytics, it sends a GET request to the "Individual Telco-cloud data analytics" resource, addressed by the appropriate data analytics identifier in its resource URI.

4) The Telco-cloud DAF returns a "200 OK" response to the API Consumer and includes one data structure of type "TelcoCloudAnalytics" in the payload body.

Error handling: In case of failure, appropriate error information is provided in the response.

5.4.3 Flow of deleting a Telco-cloud data analytics

This clause describes a sequence for deleting a Telco-cloud data analytics.
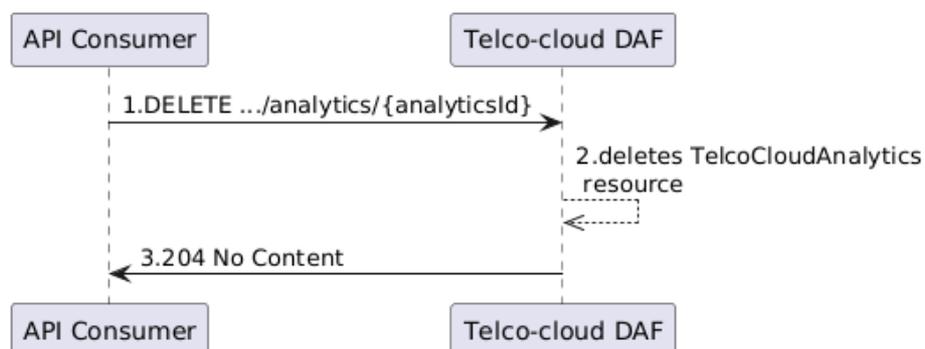
Figure 5.4.3-1: Flow of Telco-cloud Data analytics deletion

Telco-cloud data analytics deletion, as illustrated in figure 5.4.3-1, consists of the following steps:

1) If the API Consumer intends to delete a data analytics, it sends a DELETE request to the "Individual Telco-cloud data analytics" resource, addressed by the appropriate data analytics identifier in its resource URI.

2) The Telco-cloud DAF deletes the "Individual Telco-cloud data analytics" resource.

3) The Telco-cloud DAF returns a response with a "204 No Content" response code and an empty payload body to the API Consumer.

Error handling: In case of failure, appropriate error information is provided in the response.

5.4.4 Flow of obtaining Telco-cloud data analytics reports

This clause describes a sequence for obtaining Telco-cloud data analytics reports.
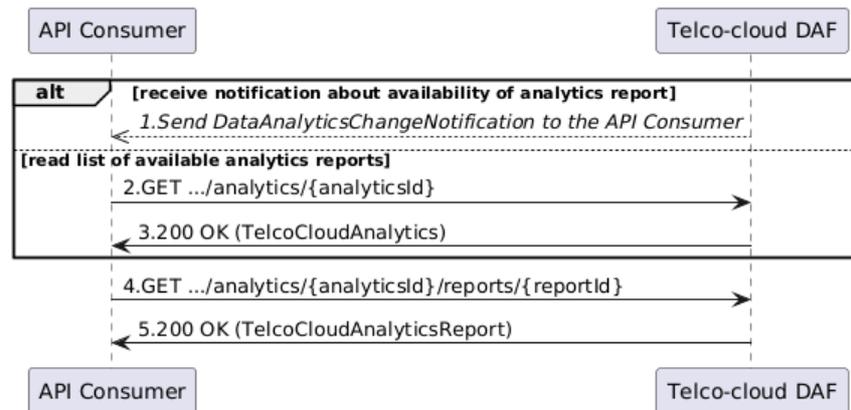
Figure 5.4.4-1: Flow of obtaining Telco-cloud data analytics reports

Obtaining Telco-cloud data analytics reports, as illustrated in figure 5.4.4-1, consists of the following steps:

1) The Telco-cloud DAF sends to the API Consumer a DataAnalyticsChangeNotification (see clause 5.4.6) that indicates the availability of a new Telco-cloud data analytics report, including a link from which the report can be obtained.

2) Alternatively, the API Consumer sends a GET request to the "Individual Telco-cloud data analytics" resource, to obtain a representation of the resource including information about analytics reports that are available for this data analytics, including their URIs.

3) In that case, the Telco-cloud DAF returns a "200 OK" response to the API Consumer and includes a data structure of type "TelcoCloudAnalytics" in the message content.

4) The API Consumer sends to the Telco-cloud DAF a GET request to the URI obtained either in step 1) or step 3), in order to read an "Individual Telco-cloud analytics report" resource.

5) The Telco-cloud DAF returns a "200 OK" response to the API Consumer and includes a data structure of type "TelcoCloudAnalyticsReport" in the message content.

Error handling: In case of failure, appropriate error information is provided in the response.

5.4.5 Flow of managing subscriptions

This clause describes a sequence for managing subscriptions.
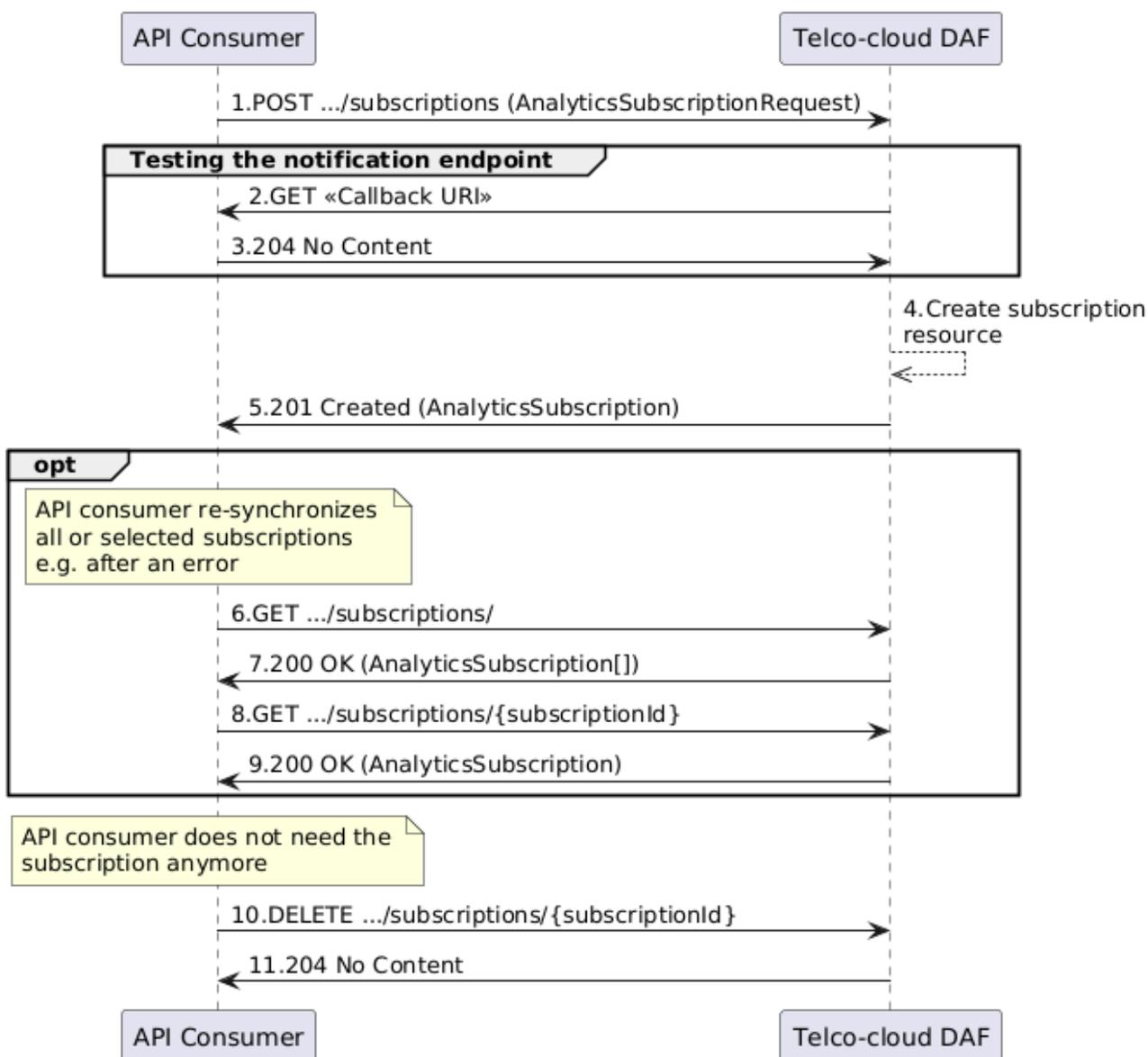
Figure 5.4.5-1: Flow of managing subscriptions

The procedure consists of the following steps as illustrated in figure 5.4.5-1:

1) The API Consumer sends a POST request to the "Subscriptions" resource including in the message content a data structure of type "AnalyticsSubscriptionRequest". That data structure contains filtering criteria and a callback URI to which the Telco-cloud DAF will subsequently send notifications about events that match the filter.

2) To test the notification endpoint that has been registered by the API Consumer as part of the subscription, the Telco-cloud DAF sends a GET request to the notification endpoint URI.

3) The API Consumer returns a "204 No Content" response to indicate success.

4) The Telco-cloud DAF creates a new subscription to notifications related to analytics changes, and an "Individual subscription" resource that represents this subscription.

5) The Telco-cloud DAF returns a 201 Created response containing a data structure of type "AnalyticsSubscription" representing the "Individual subscription" resource just created by the Telco-cloud DAF and provides the URI of the newly-created resource in the "Location" HTTP header.

6) If desired, e.g. to recover from an error situation, the API Consumer can query information about its subscriptions by sending a GET request to the resource representing the subscriptions.

7) In that case, the Telco-cloud DAF returns a "200 OK" response that contains zero or more representations of all existing subscriptions that were created by the API Consumer.

8) If desired, e.g. to recover from an error situation, the API Consumer can read information about a particular subscription by sending a GET request to the resource representing that individual subscription.

9) In that case, the Telco-cloud DAF returns a "200 OK" response that contains a representation of that individual subscription.

10) If the API Consumer does not need the subscription anymore, it terminates the subscription by sending a DELETE request to the resource that represents the individual subscription to remove.

11) The Telco-cloud DAF acknowledges the successful termination of the subscription by returning a "204 No Content" response.

Error handling: The Telco-cloud DAF rejects a subscription if the subscription information is not valid: endpoint cannot be reached, subscription information is malformed, etc.

5.4.6   Flow of sending notifications

This clause describes a sequence for sending notifications.
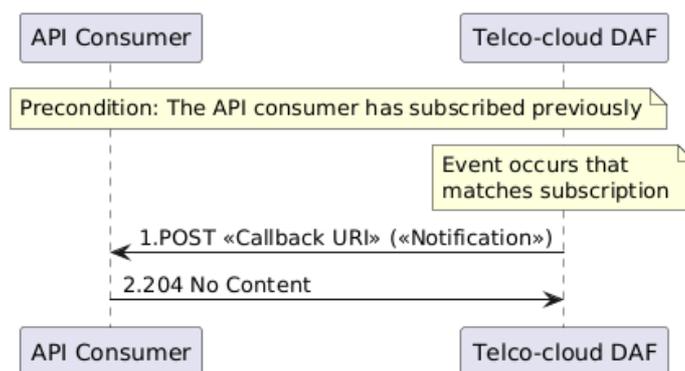
Figure 5.4.6-1: Flow of sending notifications

Precondition: The API Consumer has subscribed previously to notifications related to data analytics changes.

The procedure consists of the following steps as illustrated in figure 5.4.6-1:

1) If an event occurs that indicates data analytics changes, the Telco-cloud DAF generates a notification that includes information about the event and sends it in the body of a POST request to the URI which the API Consumer has registered as part of the subscription request. The variable <<Notification>> in the flow is a placeholder for the different types of notifications that can be sent by this API.

2) The API Consumer acknowledges the successful delivery of the notification by returning a "204 No Content" response.

Error handling: If the Telco-cloud DAF does not receive the "204 No Content" response from the API Consumer, it can retry sending the notification.

5.5   Resources

5.5.1   Introduction

This clause defines all the resources and methods provided by the Telco-cloud data analytics service interface.

5.5.2   Resource: API versions

The "API versions" resources as defined in clause 9.3.3 of ETSI GS NFV-SOL 013 [2] are part of the Telco-cloud data analytics service interface.

5.5.3   Resource: Analytics

5.5.3.1   Description

This resource represents Analytics. The API consumer can use this resource to create and query Analytics.

5.5.3.2   Resource definition

The resource URI is:

{apiRoot}/nfvtcdas/{apiMajorVersion}/analytics

This resource shall support the resource URI variables defined in table 5.5.3.2-1.

Table 5.5.3.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [2].
apiMajorVersion	See clause 5.2.

5.5.3.3   Resource methods

5.5.3.3.1   POST

The POST method creates a data analytics.

This method shall follow the provisions specified in the tables 5.5.3.3.1-1 and 5.5.3.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual Telco-cloud data analytics" resource as defined in clause 5.5.4 shall have been created.

Table 5.5.3.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.3.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality		Description
	DataAnalyticsRequest	1		Telco-cloud Data analytics creation request
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	TelcoCloudAnalytics	1	201 Created	Shall be returned when the Telco-cloud data analytics resource has been created successfully. The response body shall contain a representation of the created "Individual Telco-cloud data analytics" resource, as defined in clause 5.5.4. The HTTP response shall include a "Location" HTTP header that points to the created "Individual Telco-cloud data analytics" resource.
	ProblemDetails	1	422 Unprocessable Entity	Shall be returned upon the following error: The content type of the payload body is supported and the payload body of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [2], including rules for the presence of the response body. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.

5.5.3.3.2 GET

The API consumer can use this method to retrieve information about Analytics.

This method shall follow the provisions specified in the tables 5.5.5.3.2-1 and 5.5.3.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [2]. The Telco-cloud DAF shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the TelcoCloudAnalytics and in data types referenced from it shall be supported by the Telco-cloud DAF in the filter expression.
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [2] for details. The Telco-cloud DAF shall support this parameter.
fields	0..1	Complex attributes to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [2] for details. The Telco-cloud DAF should support this parameter.
exclude_fields	0..1	Complex attributes to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [2] for details. The Telco-cloud DAF should support this parameter.

Name	Cardinality	Description
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [2] for details. The Telco-cloud DAF shall support this parameter. The following attributes shall be excluded from the TelcoCloudAnalytics structure in the response body if this parameter is provided, or none of the parameters "all_fields," "fields", "exclude_fields", "exclude_default" are provided: - reports
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the Telco-cloud DAF if the Telco-cloud DAF supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource.

Table 5.5.3.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality		Description
	n/a			
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**
	TelcoCloudAnalytics	0..N	200 OK	Shall be returned when information about zero or more analytics has been queried successfully. The response body shall contain in an array the representations of zero or more TelcoCloudAnalytics, as defined in clause x. If the "filter" URI parameter or one of the "all_fields", "fields" (if supported), "exclude_fields" (if supported) or "exclude_default" URI parameters was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clauses 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [2], respectively. If the Telco-cloud DAF supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [2].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute selector. In the returned ProblemDetails structure, the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the Telco-cloud DAF supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [2].
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.

5.5.3.3.3   PUT

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.3.3.4   PATCH

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.3.3.5   DELETE

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.4   Resource: Individual Telco-Cloud data Analytics

5.5.4.1   Description

This resource represents an individual analytics. The API consumer can use this resource to delete and read the underlying Analytics.

5.5.4.2   Resource definition

The resource URI is:

{apiRoot}/nfvtcdas/{apiMajorVersion}/analytics/{analyticsId}

This resource shall support the resource URI variables defined in table 5.5.4.2-1.

Table 5.5.4.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [2].
apiMajorVersion	See clause 5.2.

5.5.4.3   Resource methods

5.5.4.3.1   POST

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.4.3.2   GET

The API consumer can use this method for reading an individual Telco-cloud data Analytics.

This method shall follow the provisions specified in the tables 5.5.4.3.2-1 and 5.5.4.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.4.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.4.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality		Description	
	n/a				
Response body	Data type	Cardinality	Response Codes	Description	
	TelcoCloudAnalytics	1	200 OK	Shall be returned when information about an individual Telco-cloud data Analytics has been read successfully. The response body shall contain a representation of the "Individual Telco-Cloud data Analytics" resource, as defined in clause 5.6.2.3.	
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.	

5.5.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.4.3.4 PATCH

This method allows to modify an "individual Telco-cloud data Analytics" resource.

This method shall follow the provisions specified in the tables 5.5.4.3.4-1 and 5.5.4.3.4-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.4.3.4-1: URI query parameters supported by the PATCH method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.4.3.4-2: Details of the PATCH request/response on this resource

Request body	Data type	Cardinality		Description	
	TelcoCloudAnalyticsModifications	1		Parameters for the Telco-cloud analytics modification. The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [7].	
Response body	Data type	Cardinality	Response Codes	Description	
	TelcoCloudAnalyticsModifications	1	200 OK	Shall be returned when the request has been processed successfully. The response body shall contain a data structure of type "TelcoCloudAnalyticsModifications".	
	ProblemDetails	0..1	412 Precondition failed	Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled. Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.	

	Data type	Cardinality	Response Codes	Description
Response body	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [2], including rules for the presence of the response body.
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.

5.5.4.3.5   DELETE

This method terminates an individual Telco-cloud data Analytics.

This method shall follow the provisions specified in the tables 5.5.4.3.5-1 and 5.5.4.3.5-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, the "Individual Telco-cloud data Analytics" resource shall not exist any longer.

Table 5.5.4.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.4.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description		
	n/a				
	Data type	**Cardinality**	**Response Codes**	**Description**	
Response body	n/a		204 No Content	Shall be returned when the Telco-cloud data Analytics has been deleted successfully. The response body shall be empty.	
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.	

5.5.5   Resource: Individual Telco-cloud data Analytics report

5.5.5.1   Description

This resource represents an individual Telco-cloud data analytics report that has been collected by a Telco-cloud data analytics. The API consumer can use this resource to read the Telco-cloud data analytics report. The URI of the Telco-cloud data analytics report can be obtained from a DataAnalyticsChangeNotification (see clause 5.6.2.4) or from the representation of the "Individual Telco-cloud data Analytics" resource.

It is determined by means outside the scope of the present document and the internal implementation, how long an individual Telco-cloud data analytics report is available.

5.5.5.2   Resource definition

The resource URI is:

{apiRoot}/nfvtcdas/{apiMajorVersion}/analytics/{analyticsId}/reports/{reportId}

This resource shall support the resource URI variables defined in table 5.5.5.2-1.

Table 5.5.5.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [2].
apiMajorVersion	See clause 5.2.
analyticsId	Identifier of the Telco-cloud data analytics.
reportId	Identifier of the Telco-cloud data analytics report.

5.5.5.3   Resource methods

5.5.5.3.1   POST

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.5.3.2   GET

The API consumer can use this method for reading an individual Telco-cloud data analytics report.

This method shall follow the provisions specified in the tables 5.5.5.3.2-1 and 5.5.5.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.5.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.5.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality		Description	
	n/a				
Response body	Data type	Cardinality	Response Codes	Description	
	TelcoCloudAnalyticsReport	1	200 OK	Shall be returned when information of an individual Telco-cloud data analytics report has been read successfully. The response body shall contain a representation of the "Individual Telco-cloud data Analytics report" resource, as defined in clause 5.6.2.5.	
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.	

5.5.5.3.3   PUT

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.5.3.4   PATCH

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.5.3.5   DELETE

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.6   Resource: Subscriptions

5.5.6.1   Description

This resource represents subscriptions. The API consumer can use this resource to subscribe to notifications related to Telco-cloud data analytics, and to query its subscriptions.

5.5.6.2   Resource definition

The resource URI is:

{apiRoot}/nfvtcdas/{apiMajorVersion}/subscriptions

This resource shall support the resource URI variables defined in table 5.5.6.2-1.

Table 5.5.6.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [2].
apiMajorVersion	See clause 5.2.

5.5.6.3   Resource methods

5.5.6.3.1   POST

The POST method creates a new subscription.

This method shall follow the provisions specified in the tables 5.5.6.3.1-1 and 5.5.6.3.1-2 for URI query parameters, request and response data structures, and response codes.

As the result of successfully executing this method, a new "Individual subscription" resource as defined in clause x shall have been created. This method shall not trigger any notification.

Creation of two subscription resources with the same callback URI and the same filter can result in performance degradation and will provide duplicates of notifications to the API consumer, and might make sense only in very rare use cases. Consequently, the Telco-cloud DAF may either allow creating a subscription resource if another subscription resource with the same filter and callback URI already exists (in which case it shall return the "201 Created" response code), or may decide to not create a duplicate subscription resource (in which case it shall return a "303 See Other" response code referencing the existing subscription resource with the same filter and callback URI).

Table 5.5.6.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Remarks
none supported		

Table 5.5.6.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality	Remarks	
Request body	AnalyticsSubscriptionRequest	1	Details of the subscription to be created, as defined in clause 5.6.2.6.	
	Data type	**Cardinality**	**Response Codes**	**Remarks**
Response body	AnalyticsSubscription	1	201 Created	Shall be returned when the subscription has been created successfully. The response body shall contain a representation of the created "Individual subscription" resource. The HTTP response shall include a "Location:" HTTP header that points to the created "Individual subscription" resource.
	n/a		303 See Other	Shall be returned if a subscription with the same callback URI and the same filter already exits and the policy of the Telco-cloud DAF is to not create redundant subscriptions. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the existing "Individual subscription" resource. The response body shall be empty.
	ProblemDetails	1	422 Unprocessable Content	Shall be returned upon the following error: The content type of the message content is supported and the message content of a request contains syntactically correct data but the data cannot be processed. The general cause for this error and its handling is specified in clause 6.4 of ETSI GS NFV-SOL 013 [2], including rules for the presence of the response body. Specifically in case of this resource, the response code 422 shall also be returned if the Telco-cloud DAF has tested the Notification endpoint as described in clause 5.4.5 and the test has failed. In this case, the "detail" attribute in the "ProblemDetails" structure shall convey more information about the error.
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.

5.5.6.3.2   GET

The GET method queries the list of active subscriptions of the functional block that invokes the method. It can be used e.g. for resynchronization after error situations.

This method shall follow the provisions specified in tables 5.5.6.3.2-1 and 5.5.6.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.6.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Remarks
filter	0..1	Attribute-based filtering expression according to clause 5.2 of ETSI GS NFV-SOL 013 [2]. The Telco-cloud DAF shall support receiving this parameter as part of the URI query string. The API consumer may supply this parameter. All attribute names that appear in the AnalyticsSubscription and in data types referenced from it shall be supported by the Telco-cloud DAF in the filter expression.
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the Telco-cloud DAF if the Telco-cloud DAF supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource.

Table 5.5.6.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality		Remarks
	n/a			
Response body	Data type	Cardinality	Response Codes	Remarks
	AnalyticsSubscription	0..N	200 OK	Shall be returned when the list of subscriptions has been queried successfully. The response body shall contain in an array the representations of all active subscriptions of the functional block that invokes the method, i.e. zero or more representations of lifecycle change notification subscriptions as defined in clause 5.6.2.7. If the "filter" URI parameter was supplied in the request, the data in the response body shall have been transformed according to the rules specified in clause 5.2.2 of ETSI GS NFV-SOL 013 [2]. If the Telco-cloud DAF supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource, inclusion of the Link HTTP header in this response shall follow the provisions in clause 5.4.2.3 of ETSI GS NFV-SOL 013 [2].
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Invalid attribute-based filtering expression. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	400 Bad Request	Shall be returned upon the following error: Response too big. If the Telco-cloud DAF supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [2].
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.

5.5.6.3.3 PUT

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.6.3.4 PATCH

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.6.3.5 DELETE

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.7 Resource: Individual subscription

5.5.7.1 Description

This resource represents an individual subscription. It can be used by the API consumer to read and to terminate a subscription to notifications related to Telco-cloud data analytics management.

5.5.7.2 Resource definition

The resource URI is:

{apiRoot}/nfvtcdas/{apiMajorVersion}/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in table 5.5.7.2-1.

Table 5.5.7.2-1: Resource URI variables for this resource

Name	Definition
apiRoot	See clause 4.1 of ETSI GS NFV-SOL 013 [2].
apiMajorVersion	See clause 5.2.
subscriptionId	Identifier of this subscription. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new subscription resource. It can also be retrieved from the "id" attribute in the message content of that response.	

5.5.7.3 Resource methods

5.5.7.3.1 POST

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.7.3.2 GET

The GET method retrieves information about a subscription by reading an individual subscription resource.

This method shall support the URI query parameters, request and response data structures, and response codes, as specified in tables 5.5.7.3.2-1 and 5.5.7.3.2-2.

Table 5.5.7.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Remarks
none supported		

Table 5.5.7.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality		Remarks	
	n/a				
	Data type	**Cardinality**	**Response Codes**	**Remarks**	
Response body	AnalyticsSubscription	1	200 OK	Shall be returned when information about an individual subscription has been read successfully. The response body shall contain a representation of the subscription resource.	
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.	

5.5.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.7.3.4 PATCH

This method is not supported. When this method is requested on this resource, the Telco-cloud DAF shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.7.3.5 DELETE

The DELETE method terminates an individual subscription.

This method shall support the URI query parameters, request and response data structures, and response codes, as specified in tables 5.5.7.3.5-1 and 5.5.7.3.5-2.

Table 5.5.7.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Remarks
none supported		

Table 5.5.7.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality		Remarks	
	n/a				
	Data type	**Cardinality**	**Response Codes**	**Remarks**	
Response body	n/a		204 No Content	Shall be returned when the "Individual subscription" resource has been deleted successfully. The response body shall be empty.	
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.	

5.5.8 Resource: Notification endpoint

5.5.8.1 Description

This resource represents a notification endpoint for Telco-cloud data analytics management.

The Telco-cloud DAF can use this resource to send notifications related to Telco-cloud data analytics management events to an API consumer, which has provided the URI of this resource during the subscription process.

5.5.8.2 Resource definition

The resource URI is provided by the API consumer when creating the subscription.

This resource shall support the resource URI variables defined in table 5.5.8.2-1.

Table 5.5.8.2-1: Resource URI variables for this resource

Name	Definition
none supported	

5.5.8.3 Resource methods

5.5.8.3.1 POST

The POST method delivers a notification from the Telco-cloud DAF to an API consumer. The API consumer shall have previously created an "Individual subscription" resource with a matching filter.

This method shall follow the provisions specified in the tables 5.5.8.3.1-1 and 5.5.8.3.1-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.8.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Remarks
none supported		

Each notification request body shall include exactly one of the alternatives defined in table 5.5.8.3.1-2.

Table 5.5.8.3.1-2: Details of the POST request/response on this resource

	Data type	Cardinality		Remarks
Request body	DataAnalyticsChangeNotification	1		A notification to inform the receiver of changes on the Telco-cloud data analytics processing caused by the Telco-cloud data analytics request.
	Data type	Cardinality	Response Codes	Remarks
Response body	n/a		204 No Content	Shall be returned when the notification has been delivered successfully.
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.

5.5.8.3.2 GET

The GET method allows the Telco-cloud DAF to test the notification endpoint that is provided by the API consumer, e.g. during subscription.

This method shall follow the provisions specified in the tables 5.5.8.3.2-1 and 5.5.8.3.2-2 for URI query parameters, request and response data structures, and response codes.

Table 5.5.8.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

Table 5.5.8.3.2-2: Details of the GET request/response on this resource

Request body	Data type	Cardinality		Description	
	n/a				
Response body	**Data type**	**Cardinality**	**Response Codes**	**Description**	
	n/a		204 No Content	Shall be returned to indicate that the notification endpoint has been tested successfully. The response body shall be empty.	
	ProblemDetails	See clause 6.4 of [2]	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2] may be returned.	

5.5.8.3.3   PUT

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.8.3.4   PATCH

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.5.8.3.5   DELETE

This method is not supported. When this method is requested on this resource, the API consumer shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [2].

5.6   Data model

5.6.1   Introduction

This clause defines the request and response data structures of the Telco-cloud data analytics service interface. If a request or response contains attributes not defined in the present document, a receiving functional block that does not understand these attributes shall not treat their presence as an error, and may choose to ignore them.

5.6.2   Resource and notification data types

5.6.2.1   Introduction

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

5.6.2.2   Type: DataAnalyticsRequest

This type represents a request to create a Telco-cloud data analytics request. It shall comply with the provisions defined in table 5.6.2.2-1.

Table 5.6.2.2-1: Definition of the DataAnalyticsRequest data type

Attribute name	Data type	Cardinality	Description
tcdaType	TcdaType	1	The type of a Telco-cloud data analytics.
controlAttributes	ControlAttributes	1	Control attributes associated to a Telco-cloud data analytics request, to guide the report of the analytics process.

5.6.2.3 Type: TelcoCloudAnalytics

This type represents a Telco-cloud data analytics. It shall comply with the provisions defined in table 5.6.2.3-1.

Table 5.6.2.3-1: Definition of the TelcoCloudAnalytics data type

Attribute name	Data type	Cardinality	Description
analyticsId	Identifier	1	The identifier generated by the Telco-cloud DAF used to identify the Telco-cloud data analytics process. This identifier is later used in the associated notification informing about the data analytics process.
tcdaType	TcdaType	1	The type of a Telco-cloud data analytics.
analyticsCollectionInterval	AnalyticsCollectionInterval	1	The time interval of the Telco-cloud data analytics will be processed.
locationAreaInfo	LocationAreaInfo	0..N	The location areas from which available management data is to be involved in the data analytics process.
objectInstanceId	Identifier	0..N	Identifies the NFV-MANO managed object instances (e.g. NS instances, VNF instances) to be involved in the data analytics process.
reports	Structure (inlined)	0..N	Information about available reports generated by this Telco-cloud data analytics.
>href	Uri	1	The URI where the report can be obtained.
>readyTime	DateTime	1	The time when the report was made available.
>expiryTime	DateTime	0..1	The time when the report will expire.
>fileSize	UnsigendInt	0..1	The size of the report file in bytes, if known.
_links	Structure (inlined)	1	Links for this resource.
>self	Link	1	URI of this resource.

5.6.2.4 Type: DataAnalyticsChangeNotification

This notification informs the receiver of events related to Telco-cloud data analytics processing. It shall comply with the provisions defined in table 5.6.2.4-1.

This notification is produced by the Telco-cloud DAF when there is an event caused by the Telco-cloud data analytics process, e.g. the result of the Telco-cloud data analytics (i.e. availability of a corresponding Telco-cloud data analytics report).

If this is a notification about the start of a Telco-cloud data analytics process, the notification shall be sent before any action (including sending the input information collection requests for Telco-cloud data analytics purpose) is taken, however, after acknowledging the Telco-cloud data analytics request to the Telco-cloud DAF Consumer.

If this is a notification about the result of a Telco-cloud data analytics process, the notification shall be sent after all other actions of the Telco-cloud data analytics have been executed. This notification can also be raised in case of an unsuccessful Telco-cloud data analytics process to provide appropriate error information.

Table 5.6.2.4-1: Definition of the DataAnalyticsChangeNotification data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this notification. If a notification is sent multiple times due to multiple subscriptions, the "id" attribute of all these notifications shall have the same value.
notificationType	String	1	Discriminator for the different notification types. Shall be set to "DataAnalyticsChangeNotification" for this notification type.
timeStamp	DateTime	1	Date and time of the generation of the notification.
analyticsId	Identifier	1	Identifier of the Telco-cloud data analytics for which analytics report is available.
notificationStatus	Enum(inlined)	1	Indicates whether this notification reports about the start or the result of a data analytics process. Permitted values: - START: Informs about the start of the data analytics - RESULT: Informs about the result of the data analytics

Attribute name	Data type	Cardinality	Description
analysisStatus	Enum(inlined)	1	Indicates the analysis status. Permitted values: - PROCESSING: The Telco-cloud data analytics process is currently in execution. - COMPLETED: The Telco-cloud data analytics process has been completed successfully. - FAILED: The Telco-cloud data analytics process is failed and determined that it will not succeed.
failureReason	String	0..1	Indicates the failure reason for a Telco-cloud data analytics process, e.g. lack of resources. Shall be present in case the "analysisStatus" is set to "FAILED".
_links	Structure (inlined)	1	Links to resources related to this notification.
>analytics	NotificationLink	1	Link to the resource that represents the Telco-cloud data analytics for which analytics report is available.
>analyticsReport	NotificationLink	0..1	Link from which the available Telco-cloud data analytics report of data type "TelcoCloudAnalyticsReport" (see clause 5.6.2.5) can be obtained. This link should point to an "Individual Telco-cloud data analytics report" resource as defined in clause 5.5.5. Shall be present in case the "analysisStatus" is set to "COMPLETED".

5.6.2.5 Type: TelcoCloudAnalyticsReport

This type represents a Telco-cloud data analytics report. It shall comply with the provisions defined in table 5.6.2.5-1.

Table 5.6.2.5-1: Definition of the TelcoCloudAnalyticsReport data type

Attribute name	Data type	Cardinality	Description
tcdaType	TcdaType	1	The type of a Telco-cloud data analytics.
reportGenerationTime	DateTime	0..1	The time when the Telco-cloud data analytics report is generated. See note.
outputPerTcdaType	OutputPerType	0..1	The output information specific to the type of Telco-cloud data analytics. See note.
NOTE: This attribute shall be present if the data analytics output represents the results of a successful data analytics process.				

5.6.2.6 Type: AnalyticsSubscriptionRequest

This type represents a subscription request related to notifications about Telco-cloud data analytics change. It shall comply with the provisions defined in table 5.6.2.6-1.

Table 5.6.2.6-1: Definition of the AnalyticsSubscriptionRequest data type

Attribute name	Data type	Cardinality	Description
filter	DataAnalyticsChangeNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
authentication	SubscriptionAuthentication	0..1	Authentication parameters to configure the use of Authorization when sending notifications corresponding to this subscription, as defined in clause 8.3.4 of ETSI GS NFV-SOL 013 [2]. This attribute shall only be present if the subscriber requires authorization of notifications.

5.6.2.7   Type: AnalyticsSubscription

This type represents a subscription related to notifications about Telco-cloud data analytics change. It shall comply with the provisions defined in table 5.6.2.7-1.

Table 5.6.2.7-1: Definition of the AnalyticsSubscription data type

Attribute name	Data type	Cardinality	Description
id	Identifier	1	Identifier of this subscription resource.
filter	DataAnalyticsChangeNotificationsFilter	0..1	Filter settings for this subscription, to define the subset of all notifications this subscription relates to. A particular notification is sent to the subscriber if the filter matches, or if there is no filter.
callbackUri	Uri	1	The URI of the endpoint to send the notification to.
_links	Structure (inlined)	1	Links to resources related to this resource.
>self	Link	1	URI of this resource.

5.6.2.8   Type: TelcoCloudAnalyticsModifications

This type represents modifications to a Telco-cloud data analytics. It shall comply with the provisions defined in table 5.6.2.8-1.

Table 5.6.2.8-1: Definition of the TelcoCloudAnalyticsModifications data type

Attribute name	Data type	Cardinality	Description
analyticsCollectionInterval	AnalyticsCollectionInterval	0..1	New value of the "analyticsCollectionInterval" attribute. See note.
locationAreaInfo	LocationAreaInfo	0..N	New values of the "locationAreaInfo" attribute. See note.
NOTE: At least one of the attributes defined in this type shall be present in request bodies.			

5.6.3   Referenced structured data types

5.6.3.1   Introduction

This clause defines data structures that can be referenced from data structures defined in the previous clauses, but can neither be resource representations nor bound to any subscribe/notify mechanism.

5.6.3.2   Type: ControlAttributes

This type represents control information for the Telco-cloud data analytics request. It shall comply with the provisions defined in table 5.6.3.2-1.

Table 5.6.3.2-1: Definition of the ControlAttributes data type

Attribute name	Data type	Cardinality	Description
analyticsCollectionInterval	AnalyticsCollectionInterval	1	Specifies the time interval of Telco-cloud data to be used in the Telco-cloud data analytics process. For instance, it enables the consumer to indicate that the processing of the Telco-cloud data analytics output is requested to consider analytics data generated in a given interval of time.
locationAreaInfo	LocationAreaInfo	0..N	Indicates location areas from which available management data is to be involved in the data analytics process. See note.

Attribute name	Data type	Cardinality	Description
objectInstanceId	Identifier	0..N	Identifies the NFV-MANO managed object instances (e.g. NS instances, VNF instances) to be involved in the data analytics process. See note.
objectType	Enum(inlined)	0..1	Indicates the type of the NFV-MANO managed object to be involved in the data analytics process. Permitted values: - VNF: The type of managed object involved is VNF. - NS: The type of managed object involved is NS. See note.
NOTE: At least one of the following attributes shall be present: locationAreaInfo or objectInstanceId or objectType. If objectInstanceId is present, neither locationAreaInfo nor objectType shall be present.			

5.6.3.3   Type: DataAnalyticsChangeNotificationsFilter

This type represents a subscription filter related to notifications about Telco-cloud data analytics change. It shall comply with the provisions defined in table 5.6.3.3-1.

At a particular nesting level in the filter structure, the following applies: All attributes shall match in order for the filter to match (logical "and" between different filter attributes). If an attribute is an array, the attribute shall match if at least one of the values in the array matches (logical "or" between the values of one filter attribute).

Table 5.6.3.3-1: Definition of the DataAnalyticsChangeNotificationsFilter data type

Attribute name	Data type	Cardinality	Description
objectInstanceSubscription Filter	ObjectInstanceSubs criptionFilter	0..1	Filter criteria to select object instances about which to notify.
tcdaTypes	TcdaType	0..N	Match Telco-cloud data analytics with Telco-cloud data analytics type listed in this attribute.
locationAreaFilters	LocationAreaFilter	0..N	Match Telco-cloud data analytics with location criteria listed in this attribute.

5.6.3.4   Type: AnalyticsCollectionInterval

This type represents the time interval of Telco-cloud data to be used in the Telco-cloud data analytics process. It shall comply with the provisions defined in table 5.6.3.4-1.

Table 5.6.3.4-1: Definition of the AnalyticsCollectionInterval data type

Attribute name	Data type	Cardinality	Description
startTime	DateTime	1	First date and time of the interval. See note.
endTime	DateTime	0..1	Second date and time of the interval. Shall be present when a time interval is provided, and absent otherwise. When provided, the endTime shall be greater than startTime. See note.
NOTE: When only the startTime is present, there is no time interval being defined, and therefore the provided timing information refers to a specific point in time to start the analytics.			

5.6.3.5   Type: LocationAreaInfo

This type represents the location information from which available management data is to be involved in a Telco-cloud data analytics process. It shall comply with the provisions defined in table 5.6.3.5-1.

Table 5.6.3.5-1: Definition of the LocationAreaInfo data type

Attribute name	Data type	Cardinality	Description
countryCode	String	0..1	The two-letter ISO 3166 [3] country code in capital letters. Shall be present in case the "area" attribute is absent. May be absent if the "area" attribute is present (see note).
civicAddressElements	Structure (inlined)	0..N	Zero or more elements comprising the civic address. Shall be absent if the "area" attribute is present.
>caType	Integer	1	Describe the content type of caValue. The value of caType shall comply with section 3.4 of IETF RFC 4776 [4].
>caValue	String	1	Content of civic address element corresponding to the caType. The format caValue shall comply with section 3.4 of IETF RFC 4776 [4].
area	Polygon (see IETF RFC 7946 [5])	0..1	Geographic area. Shall be absent if the "civicAddressElement" attribute is present. The content of this attribute shall follow the provisions for the "Polygon" geometry object as defined in IETF RFC 7946 [5], for which the "type" member shall be set to the value "Polygon". See note.
resourceZoneIds	Identifier	0..N	Identifies the resource zone(s) is to be involved in a Telco-cloud data analytics process.
cisClusterIds	Identifier	0..N	Identifies the CIS cluster(s) is to be involved in a Telco-cloud data analytics process.
containerNamespaces	String	0..N	Identifies the container namespace(s) is to be involved in a Telco-cloud data analytics process.
NOTE:	If both "countryCode" and "area" are present, no conflicts should exist between the values of these two attributes. In case of conflicts, the API producer (i.e. Telco-cloud DAF) shall disregard parts of the geographic area signalled by "area" that are outside the boundaries of the country signalled by "countryCode". If "countryCode" is absent, it is solely the "area" attribute that defines the location constraint.		

5.6.3.6   Type: ObjectInstanceSubscriptionFilter

This type represents subscription filter criteria to match Object Instance. It shall comply with the provisions defined in table 5.6.3.6-1.

Table 5.6.3.6-1: Definition of the ObjectInstanceSubscriptionFilter data type

Attribute name	Data type	Cardinality	Description
vnfInstanceSubscriptionFilter	VnfInstanceSubscriptionFilter	0..1	Filter criteria to match VNF instances.
nsInstanceSubscriptionFilter	NsInstanceSubscriptionFilter	0..1	Filter criteria to match NS instances.

5.6.3.7   Type: VnfInstanceSubscriptionFilter

This type represents subscription filter criteria to match VNF instances. It shall comply with the provisions defined in table 5.6.3.7-1.

Table 5.6.3.7-1: Definition of the VnfInstanceSubscriptionFilter data type

Attribute name	Data type	Cardinality	Description
vnfdIds	Identifier	0..N	If present, match VNF instances that were created based on a VNFD identified by one of the vnfdId values listed in this attribute. See note 1.
vnfProductsFromProviders	Structure (inlined)	0..N	If present, match VNF instances that belong to VNF products from certain providers. See note 1.
>vnfProvider	String	1	Name of the VNF provider to match.
>vnfProducts	Structure (inlined)	0..N	If present, match VNF instances that belong to VNF products with certain product names, from one particular provider.
>>vnfProductName	String	1	Name of the VNF product to match.

Attribute name	Data type	Cardinality	Description
>>versions	Structure (inlined)	0..N	If present, match VNF instances that belong to VNF products with certain versions and a certain product name, from one particular provider.
>>>vnfSoftwareVersion	Version	1	Software version to match.
>>>vnfdVersions	Version	0..N	If present, match VNF instances that belong to VNF products with certain VNFD versions, a certain software version and a certain product name, from one particular provider.
vnfInstanceIds	Identifier	0..N	If present, match VNF instances with an instance identifier listed in this attribute. See note 2.
vnfInstanceNames	String	0..N	If present, match VNF instances with a VNF Instance Name listed in this attribute. See note 2.
NOTE 1: The attributes "vnfdIds" and "vnfProductsFromProviders" are alternatives to reference to VNF instances that are based on certain VNFDs in a filter. They should not be used both in the same filter instance, but one alternative should be chosen.			
NOTE 2: The attributes "vnfInstanceIds" and "vnfInstanceNames" are alternatives to reference to particular VNF instances in a filter. They should not be used both in the same filter instance, but one alternative should be chosen.			

5.6.3.8   Type: NsInstanceSubscriptionFilter

This type represents subscription filter criteria to match NS instances. It shall comply with the provisions defined in table 5.6.3.8-1.

Table 5.6.3.8-1: Definition of the NsInstanceSubscriptionFilter data type

Attribute name	Data type	Cardinality	Description
nsdIds	Identifier	0..N	If present, match NS instances that were created based on an NSD identified by one of the nsdId values listed in this attribute. See note 1.
vnfdIds	Identifier	0..N	If present, match NS instances that contain VNF instances that were created based on a VNFD identified by one of the vnfdId values listed in this attribute. See note 1.
pnfdIds	Identifier	0..N	If present, match NS instances that contain PNFs that are represented by a PNFD identified by one of the pnfdId values listed in this attribute. See note 1.
nsInstanceIds	Identifier	0..N	If present, match NS instances with an instance identifier listed in this attribute. See note 2.
nsInstanceNames	String	0..N	If present, match NS instances with an NS Instance Name listed in this attribute. See note 2.
NOTE 1: The attributes "nsdIds", "vnfdIds" and "pnfdIds" are alternatives to reference to NS instances that are created based on certain NSDs, or contain VNF instances that are based on certain VNFDs, or contain PNFs that are based on certain PNFDs in a filter. They should not be used together in the same filter instance, but one alternative should be chosen.			
NOTE 2: The attributes "nsInstanceIds" and "nsInstanceNames" are alternatives to reference to particular NS Instances in a filter. They should not be used both in the same filter instance, but one alternative should be chosen.			

5.6.3.9   Type: LocationAreaFilter

This type represents subscription filter criteria to match location areas. It shall comply with the provisions defined in table 5.6.3.9-1.

Table 5.6.3.9-1: Definition of the LocationAreaFilter data type

Attribute name	Data type	Cardinality	Description
countryCode	String	0..1	If present, match location areas with a county code listed in this attribute.
civicAddressElements	Structure (inlined)	0..N	If present, match location areas with civic addresses listed in this attribute. See note.
>caType	Integer	1	Describe the content type of caValue. The value of caType shall comply with section 3.4 of IETF RFC 4776 [4].
>caValue	String	1	Content of civic address element corresponding to the caType. The format caValue shall comply with section 3.4 of IETF RFC 4776 [4].
area	Polygon (see IETF RFC 7946 [5])	0..1	If present, match location areas with a Geographic area listed in this attribute. See note.
resourceZoneIds	Identifier	0..N	If present, match location areas with resource zone identifiers listed in this attribute.
cisClusterIds	Identifier	0..N	If present, match location areas with CIS cluster identifiers listed in this attribute.
containerNamespaces	String	0..N	If present, match location areas with container namespaces listed in this attribute.
NOTE: The attributes "civicAddressElement" and "area" are alternatives to reference to particular location in a filter. They should not be used both in the same filter instance, but one alternative should be chosen.			

5.6.3.10   Type: OutputPerType

This type represents the output contained in a Telco-cloud data analytics report. It shall comply with the provisions defined in table 5.6.3.10-1.

Table 5.6.3.10-1: Definition of the OutputPerType data type

Attribute name	Data type	Cardinality	Description
outputForIncidentAnalysis	OutputForIncidentAnalysis	0..1	It shall be present when the value of "tcdaType" in TelcoCloudAnalytics is INCIDENT_ANALYSIS.
outputForHealthAnalysis	OutputForHealthAnalysis	0..1	It shall be present when the value of "tcdaType" in TelcoCloudAnalytics is HEALTH_ANALYSIS.
outputForResourceUtilizationAnalysis	OutputForResourceUtilizationAnalysis	0..1	It shall be present when the value of "tcdaType" in TelcoCloudAnalytics is RESOURCE_UTILIZATION_ANALYSIS.

5.6.3.11   Type: OutputForIncidentAnalysis

This type represents the specific output contained in a Telco-cloud data analytics report when the value of "tcdaType" in TelcoCloudAnalytics is INCIDENT_ANALYSIS. It shall comply with the provisions defined in table 5.6.3.11-1.

Table 5.6.3.11-1: Definition of the OutputForIncidentAnalysis data type

Attribute name	Data type	Cardinality	Description
incidentSourceObjects	Identifier	1..N	Indicates the identifier of the object instance(s) managed by NFV-MANO which are the root cause of the identified incident.
faultType	String	0..1	Indicates the type of source fault that has caused the incident. Valid values map to "Event type" values or "Alarm definition identifier" values of the Alarm as defined in ETSI GS NFV-IFA 045 [6].
eventTime	DateTime	1	Indicates the timestamp when the identified incident is reported.
issueId	String	1	Holds the identifier of the reported incident.

Attribute name	Data type	Cardinality	Description
perceivedSeverity	String	1	This field holds the value to indicate relative level of urgency for operator attention. Valid values map to "Perceived severity" values of the Alarm as defined in ETSI GS NFV-IFA 045 [6].

To enable Telco-cloud data analytics with type INCIDENT_ANALYSIS, the enabling data may be used by Telco-cloud DAF are provided in table A.2-1.

5.6.3.12 Type: OutputForHealthAnalysis

This type represents the specific output contained in a Telco-cloud data analytics report when the value of tcdaType in TelcoCloudAnalytics is HEALTH_ANALYSIS. It shall comply with the provisions defined in table 5.6.3.12-1.

Table 5.6.3.12-1: Definition of the OutputForHealthAnalysis data type

Attribute name	Data type	Cardinality	Description
healthStatus	Enum(inlined)	1	Indicates the health status of the analysed object instance. Permitted values: - HEALTHY: The analysed object instance is running in a healthy statues. - SUB_HEALTHY: The analysed object instance is running in a sub healthy statues, e.g. over loaded may cause failure. - NOT_HEALTHY: The analysed object instance is running in a not healthy statues, e.g. heavy loaded for long time, the probability of failure is high.
analyticsStatistics	string	0..N	Indicates the processed and computed statistics by Telco-cloud DAF, of certain performance data associated to this data analytics process in a time period, e.g. Percentage of times when incoming/outgoing bytes (or packages) of a SAP exceeds a certain threshold in the last 24 hours for the analysed object instance.
unhealthyObjectInfos	Structure (inlined)	0..N	Indicates the constituent objects which are in SUB_HEALTHY or NOT_HEALTHY status in case the analysed object is a NS instance.
>objectInstanceId	Identifier	1	Identifier of the unhealthy object instance.
>unhealthCause	string	0..1	Indicates the analysed cause(s) for respective unhealthy object, e.g. over loaded.
>recommendedAction	string	0..1	Indicates the recommended action to recover unhealthy object, e.g. to scale or heal constituent VNF instances of the NS instance.

To enable Telco-cloud data analytics with type HEALTH_ANALYSIS, the enabling data may be used by Telco-cloud DAF are provided in table A.3-1.

5.6.3.13 Type: OutputForResourceUtilizationAnalysis

This type represents the specific output contained in a Telco-cloud data analytics report when the value of tcdaType in TelcoCloudAnalytics is RESOURCE_UTILIZATION_ANALYSIS. It shall comply with the provisions defined in table 5.6.3.13-1.

Table 5.6.3.13-1: Definition of the OutputForResourceUtilizationAnalysis data type

Attribute name	Data type	Cardinality	Description
resourceUtilizationStatus	Enum(inlined)	1	Indicates the resource utilization status of the analysed object instance. Permitted values: - NORMAL: The resource been used is in a normal statues. - UNDER_UTILIZED: The resource been used is in an under-utilized statues. - OVER_UTILIZED: The resource been used is in an over-utilized statues.
resourceTypes	String	1..N	Indicates the resource type associated to resourceUtilizationStatus. Permitted values: - COMPUTE: The resource type is compute. - STORAGE: The resource type is storage. - NETWORK: The resource type is network.
analyticsStatistics	string	0..N	Indicates the processed and computed statistics by Telco-cloud DAF, of certain performance data associated to this data analytics process in a time period, e.g. Percentage of times when the CPU usage exceeds a certain threshold in the last 24 hours for the analysed object instance.
recommendedActions	string	0..1	Indicates the recommended actions to resolve the resource utilization issues, e.g. to scale the NS instance or update corresponding NFV-MANO policies impacted by NS instance resource utilization issues.

To enable Telco-cloud data analytics with type RESOURCE_UTILIZATION_ANALYSIS, the enabling data may be used by Telco-cloud DAF are provided in table A.4-1.

5.6.4 Referenced simple data types and enumerations

5.6.4.1 Introduction

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

5.6.4.2 Simple data types

No particular simple data types are defined for this interface, in addition to those defined in clause 7.2.2 of ETSI GS NFV-SOL 013 [2].

5.6.4.3 Enumeration: TcdaType

The enumeration TcdaType shall comply with the provisions defined in table 5.6.4.3-1.

Table 5.6.4.3-1: Enumeration TcdaType

Enumeration value	Description
INCIDENT_ANALYSIS	The type of a Telco-cloud data analytics is incident analysis.
HEALTH_ANALYSIS	The type of a Telco-cloud data analytics is health analysis.
RESOURCE_UTILIZATION_ANALYSIS	The type of a Telco-cloud data analytics is resource utilization analysis.

Annex A (informative):
Enabling data for Telco-cloud data analytics

A.1   Introduction

The clauses under Annex A describe enabling data may be used for Telco-cloud data analytics. Analytics are capability-specific, it is not restrictive or mandatory to use the analytics inputs exactly the same as the provided enabling data (including historical and current data) for implementation, and other (additional or different) data are also allowed in order to facilitate the production of analytics outputs.

A.2   Enabling data for INCIDENT_ANALYSIS

The enabling data applied for INCIDENT_ANALYSIS are provided in table A.2-1.

Table A.2-1: Enabling data for INCIDENT_ANALYSIS

Data category	Description	Data Source
Alarm notifications	Alarm information, e.g. the alarm notifications sent by NFV-MANO entities.	NFVO/VNFM/VIM/CCM
Performance measurements	The deteriorated or abnormal performance measurements based on certain performance monitoring threshold.	NFVO/VNFM/VIM

A.3   Enabling data for HEALTH_ANALYSIS

The enabling data applied for HEALTH_ANALYSIS are provided in table A.3-1.

Table A.3-1: Enabling data for HEALTH_ANALYSIS

Data category	Description	Data Source
State	State of the object instance to be analysed, e.g. INSTANTIATED, NOT_INSTANTIATED.	NFVO/VNFM
Performance measurements	Performance measurements associated to the object instance.	NFVO/VNFM/VIM (see performance measurements as specified in ETSI GS NFV-IFA 027 [8])
Alarm notifications	Alarm notifications associated to the NS instance.	NFVO/VNFM/VIM/CCM
Configurations	Configuration parameters of the analysed object instance and its constituent objects (e.g. VNF instances of the NS instance).	NFVO/VNFM/CISM/VIM/WIM/CCM
VNF indicators	VNF indicators associated to the analysed object instance.	VNFM

A.4   Enabling data for RESOURCE_UTILIZATION_ANALYSIS

The enabling data applied for RESOURCE_UTILIZATION_ANALYSIS are provided in table A.4-1.

Table A.4-1: Enabling data for network service resource utilization analysis

Data category	Description	Data Source
Performance measurements	Performance measurements associated to the object instance.	NFVO/VNFM/VIM (see performance measurements as specified in ETSI GS NFV-IFA 027 [8])
VNF indicators	VNF indicators associated to the analysed object instance.	VNFM

Annex B (normative):
Authorization scope values

B.1   Overview

This annex specifies authorization scope values for selected APIs defined in the present document as defined in clause 8.3.7 of ETSI GS NFV-SOL 013 [2]. Each authorization scope value is defined recursively as the union of a set of permitted resource URIs with associated permitted methods, and a set of permitted referenced authorization scope values, where one of these sets can be empty.

B.2   Telco-cloud data analytics service interface

This clause specifies authorization scope values to consume the Telco-cloud data analytics service interface specified in clause 5. If the Telco-cloud DAF supports authorization scope values, the Telco-cloud DAF shall support the authorization scope values specified in table B.2-1 and may support additional authorization scope values, when authorizing an API request from an API consumer as specified in clause 8.3.3 of ETSI GS NFV-SOL 013 [2].

The elements in the authorization scope value definition specified in clause 8.3.7 of ETSI GS NFV-SOL 013 [2] are defined as follows, resulting in the authorization scope values given in table B.2-1:

- {apiName} is set as defined in clause 5.3;

- <vn> shall be set to the value of {apiMajorVersion} as defined in clause 5.2;

- <permissionName> and <qualifier> are set as defined in table B.2-1.

Table B.2-1: Authorization scope values for Telco-cloud data analytics service interface

Authorization Scope value	Description
nfvtcdas:<vn>:analytics	Allows to read the "Analytics" resource, and to create, read, modify and delete its child resources. This permission allows to create a Telco-cloud data analytics as indicated in clause 5.4.1, query/read one or multiple Telco-cloud data analytics as indicated in clause 5.4.2, delete a Telco-cloud data analytics as indicated in clause 5.4.3 and obtain Telco-cloud data analytics reports as indicated in clause 5.4.4.
nfvtcdas:<vn>:subscriptions	Allows to read the "Subscriptions" resource and to create, read and delete its child resources. This permission allows managing subscriptions as indicated in clause 5.4.5.
nfvtcdas:<vn>:all	Allows analytics and subscriptions authorization scopes of the Telco-cloud data analytics service interface.

Table B.2-2 defines the authorization scope values that are applicable to the Telco-cloud data analytics service interface.

Table B.2-2: Resource and permission of authorization scope
for Telco-cloud data analytics service interface

Authorization scope value	Resources and scopes	Permitted methods
nfvtcdas:<vn>:analytics	/analytics	GET, POST
	/analytics/{analyticsId}	GET, PATCH, DELETE
	/analytics/{analyticsId}/reports/{reportId}	GET
nfvtcdas:<vn>:subscriptions	/subscriptions	GET, POST
	/subscriptions/{subscriptionId}	GET, DELETE
nfvtcdas:<vn>:all	nfvtcdas:<vn>:analytics	-
	nfvtcdas:<vn>:subscriptions	-

Annex C (informative):
Change history

Date	Version	Information about changes
July 2024	0.0.1	First version providing the document skeleton and scope.
September 2024	0.0.2	Implemented: NFVSOL(24)000233_SOL025_adding_interface_description, NFVSOL(24)000241_SOL025_adding_overview, NFVSOL(24)000272_SOL025_adding_API_version, NFVSOL(24)000274_SOL025_adding_resource_structure_and_method
September 2024	0.0.3	Implemented: NFVSOL(24)000282r1_SOL025_adding_sequence_diagram_create_DataAnalyticsRequest, NFVSOL(24)000283r1_SOL025_adding_sequence_diagram_querying_data_analytics, NFVSOL(24)000284r1_SOL025_adding_sequence_diagram_deleting_a_data_analytics, NFVSOL(24)000285r1_SOL025_adding_sequence_diagram_obtaining_analytics_report, NFVSOL(24)000286r1_SOL025_adding_sequence_diagram_managing_subscriptions, NFVSOL(24)000287r1_SOL025_adding_sequence_diagram_sending_notifications
October 2024	0.0.4	Implemented: NFVSOL(24)000306r1_SOL025_adding_analytics_resource_definition, NFVSOL(24)000317r1_SOL025_modification_on_analytics_resource_name, NFVSOL(24)000319_SOL025_adding_Individual_analytics_resource_definition, NFVSOL(24)000320r1_SOL025_adding_Individual_analytics_report_resource_definition, NFVSOL(24)000321_SOL025_adding_subscriptions_resource_definition, NFVSOL(24)000322_SOL025_adding_Individual_subscription_resource_definition, NFVSOL(24)000323_SOL025_adding_Notification_endpoint_resource_definition, NFVSOL(24)000330_SOL025_adding_Introduction_of_Data_model, NFVSOL(24)000331r1_SOL025_adding_DataAnalyticsRequest_Data_type_definition, NFVSOL(24)000332_SOL025_adding_TelcoCloudAnalytics_Data_type_definition, NFVSOL(24)000333_SOL025_adding_DataAnalyticsChangeNotification_Data_type_definition, NFVSOL(24)000334_SOL025_adding_AnalyticsReport_Data_type_definition, NFVSOL(24)000335r1_SOL025_adding_AnalyticsSubscription_Data_type_definition
November 2024	0.0.5	Implemented: NFVSOL(24)000405_SOL025_adding_PATCH_for_individual_analytics, NFVSOL(24)000406_SOL025_Update_Sequence_diagrams, NFVSOL(24)000407_SOL025_resolve_editor_note_in_Analytics_resource, NFVSOL(24)000408_SOL025_adding_TcdaType_definition, NFVSOL(24)000409_SOL025_adding_AnalyticsCollectionInterval_definition, NFVSOL(24)000410_SOL025_adding_analysisStatus_definition
December 2024	0.0.6	Implemented: NFVSOL(24)000450r1_SOL025_resolve_editor_note_for_ControlAttributes, NFVSOL(24)000451r1_SOL025_resolve_editor_note_for_DataAnalyticsChangeNotificationsFilter, NFVSOL(24)000452_SOL025_resolve_editor_note_for_report, NFVSOL(24)000453r1_SOL025_resolve_multiple_editor_notes, NFVSOL(24)000454r2_SOL025_adding_outputPerTcdaType_definition
January 2025	0.0.7	Implemented: NFVSOL(25)000008r1_SOL025_OAuth_scope_values_for_TCDAS

History

Document history		
V5.2.1	March 2025	Publication