

O-RAN Working Group 6

O2ims Interface Specification

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1 Introduction

1.1 Scope

This Technical Specification has been produced by the O-RAN.org.

The contents of the present document are subject to continuing work within O-RAN WG6 and may change following formal O-RAN approval. Should the O-RAN.org modify the contents of the present document, it will be re-released by O-RAN Alliance with an identifying change of release date and an increase in version number as follows:

Release x.y.z

where:

- x the first digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc. (the initial approved document will have x=01).
- y the second digit is incremented when editorial only changes have been incorporated in the document.
- z the third digit included only in working versions of the document indicating incremental changes during the editing process.

This document defines O-RAN O-Cloud IMS interface functions and protocols for the O-RAN O2 interface. The document studies the functions conveyed over the interface, including management functions, procedures, operations and corresponding solutions, and identifies existing standards and industry work that can serve as a basis for O-RAN work.

1.2 References

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 3GPP Release 18.

- [1] 3GPP TR 21.905: "3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications"
- [2] O-RAN Whitepaper
- [3] ORAN-WG4.MP.0-v01.00: O-RAN Alliance Working Group 4 Management Plane Specification
- [4] O-RAN WG1 Architecture Description
- [5] O-RAN WG1 OAM Architecture
- [6] O-RAN WG1 O1 Interface Specification
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- [8] RFC 6241, "Network Configuration Protocol (NETCONF)", IETF, June 2011
- [9] RFC 7950, "The YANG 1.1 Data Modeling Language", IETF, August 2016
- [10] RFC 2119, "Key words for use in RFCs to Indicate Requirement Levels", IETF, March 1997
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- [26] ISO/IEC 9646-7: "Information technology - Open Systems Interconnection - Conformance testing methodology and framework - Part 7: Implementation Conformance Statements".
- [27] ITU-T Recommendation X.733 (02/92): "Information technology - Open Systems Interconnection - Systems Management: Alarm reporting function".
- [28] ITU-T Recommendation X.736, "Information Technology - Open Systems Interconnection - System Management: Security Alarm Reporting Function", 1992"
- [29] IETF RFC 7396: "JSON Merge Patch"
- [30] IETF RFC 7230: "Hypertext Transfer Protocol (HTTP/1.1)"
- [31] IETF RFC 793: "Transmission Control Protocol"
- [32] IETF RFC 2818: "HTTP Over TLS"
- [33] IETF RFC 5246: "The TLS Protocol Version 1.2"
- [34] IETF RFC 3986: "Uniform Resource Identifier (URI)"
- [35] ETSI TS 133 310: "Universal Mobile Telecommunications System (UMTS); LTE; Network Domain Security (NDS); Authentication Framework (AF)"
- [36] O-RAN WG6 "O-Cloud Information Model"
- [37] O-RAN WG10 "O-RAN Work Group 10 (OAM for O-RAN); O-RAN Information Model and Data Models Specification".
- [38] ETSI GS NFV-IFA 045 (V5.2.1 2024-11): "Network Functions Virtualisation (NFV) Release 4; Management and Orchestration; Faults and alarms modelling specification".
- [39] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)"
- [40] 3GPP TS 32.404: "Technical Specification Group Services and System Aspects; Telecommunication management; Performance Management (PM); Performance measurements"
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- [42] 3GPP TS 28.111: "Technical Specification Group Services and System Aspects; Management and orchestration; Fault Management (FM)"
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1.3 Definitions and Abbreviations

1.3.1 Definitions

FFS.

1.3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 0 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 0.

DMS	O-Cloud Deployment Management Services
FCAPS	Fault, Configuration, Accounting, Performance, Security
HATEOAS	Hypermedia as the Engine of Application State
IMS	O-Cloud Infrastructure Management Services
MANO	Management and Orchestration
MnS	Management Service
MOC	Managed Object Class
MOI	Managed Object Instance
MVP	Minimum Viable Product
O-RAN	Open Radio Access Network
ONAP	Open Network Automation Platform
OSM	Open Source Mano
RAN	Radio Access Network
TLS	Transport Layer Security
TR	Technical Report
TS	Technical Specification
SMO	Service Management and Orchestration

2 Service Definitions

2.1 O2ims Services

2.1.1 General

Table 2.1.1-1 O2ims Services to API mapping summarizes the corresponding O2ims service APIs defined.

Table 2.1.1-1 O2ims Services to API mapping

Service Name	Clause	Description	apiName
O2ims_InfrastructureInventory Services	3.2	Service for querying the O-Cloud resources and management services.	O2ims_infrastructureInventory
O2ims_InfrastructureMonitoring Services	3.3	Services related to O-Cloud infrastructure fault management.	O2ims_infrastructureMonitoring
O2ims_InfrastructureProvisioning Services	3.4	Service for configuring the O-Cloud node cluster and infrastructure resources.	O2ims_infrastructureProvisioning
O2ims_InfrastructureSoftware Management Services	3.5	Services for software inventory and updating the software used for O-Cloud infrastructure resources and management services.	Not specified in the present document version
O2ims_InfrastructureLifecycle Management Services	3.6	Services related to O-Cloud infrastructure lifecycle management and events.	O2ims_infrastructureLifeCycleManagement
O2ims_InfrastructurePerformance Services	3.7	Services related to O-Cloud infrastructure performance management	O2ims_infrastructurePerformance
O2ims_InfrastructureLogging Services	3.8	Services related to O-Cloud infrastructure logging management	Not specified in the present document version

The information elements for the O2ims services are contained in the O-Cloud Information Model Specification, see O-RAN WG6.O-CLOUD-IM [36].

2.1.1.1 Void

2.1.1.2 Void

2.1.1.3 Void

2.1.1.4 Void

2.1.2 O2ims_InfrastructureInventory Services

Any object in the O-Cloud which can generate a fault, a performance metric, or is exposed to the SMO for configuration needs to have a type, which depicts the class of object. Generally, an O-Cloud is a composition of provisioned resources serving different roles, such as compute, storage, or networking.

2.1.2.1 Service description

O-Clouds contain physical, software and logical resources. The O-Cloud is the source of information for these assets but is required to provide a mechanism for asset management to account for them. The O2ims_InfrastructureInventory services provides the read-only interface to its inventory such that accounting can be achieved.

The O-Cloud SHALL expose its capabilities and supported resource types to the SMO.

The O2ims_InfrastructureInventory services SHALL be available only after the O-Cloud has registered its IMS endpoint with the SMO.

The O2ims_InfrastructureInventory services SHALL provide the list of resource type(s) supported by the O-Cloud across all resource pools defined in its distributed deployment.

2.1.2.2 Service operations

2.1.2.2.1 O-Cloud Information Query

The O2ims_InfrastructureInventory service shall enable an authorized consumer to query and retrieve various information related to the O-Cloud infrastructure and its resources.

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to retrieve the O-Cloud information.

Table 2.1.2.2.1-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.2.2-1: O2ims_InfrastructureInventory Query operation

Message	Direction
QueryOcloudInfoRequest	SMO → O-Cloud
QueryOcloudInfoResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support means to:

- Filter to select which information is queried about the supported Inventory Infrastructure Service Objects which can be any subclass of the InfrastructureInventoryObject as depicted in the Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.3.2.1. Filtering the Service Objects by their names, identifiers, metadata information and status information shall be supported. When the filter results in no matching Service Objects, the operation shall return an empty list.
- Select the list of attributes of information of the supported Inventory Infrastructure Service Objects to be returned matching the filter. An absence of attribute selection shall return the complete information of the Service Objects matching the filter the authorized consumer is allowed to query.

The Query operation shall support returning information about one or a set of service objects (i.e., list/array of service objects). The Query Service Operation shall support the ability to handle a large amount of data in return sets as described in ETSI GS NFV-SOL 013 [22], clause 5.4.2.1.

As a result of this operation, the producer (O-Cloud) shall indicate to the consumer whether the query was processed successfully. If the operation is not successful, the O-Cloud shall return to the consumer appropriate error information. An example of an error case is where the query filter is malformed, or attributes are not able to be processed.

The Alarm Dictionary Discovery and Performance Dictionary Discovery are pertinent use cases for this Service Operation. Those relate to this operation because the dictionary data for those use cases are contained within the Inventory Objects associated with this Service. See O-RAN WG6.ORCH-USE-CASES [23], clause 3.7.9, and 3.8.11 respectively for more details.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-53].

2.1.2.2.2 O-Cloud Inventory Event Notifications

The O2ims_InfrastructureInventory service shall provide a consumer who has established a valid subscription to be notified when an event which matches the subscription filter selection criteria to be sent to the consumer (SMO).

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to subscribe to the notification service, and to allow the notification service to invoke the specified callback procedure.

Table 2.1.2.2.2-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.2.2.2-1: O2ims Inventory Subscribe/Notify operation

Message	Direction
SubscribeInfrastructureInventoryRequest	SMO → O-Cloud
SubscribeInfrastructureInventoryResponse	O-Cloud → SMO
InfrastructureInventoryEventNotification	O-Cloud → SMO

The information representing one subscription shall follow the provisions indicated in table 2.1.2.2.2-2.

Table 2.1.2.2.2-2: Attributes of the InfrastructureInventoryEvent

Attribute	Qualifier	Description
consumerSubscriptionId	M	The consumer may provide its identifier for tracking, routing, or identifying the subscription used to report the event.
notificationEventType	M	The type (CREATE, MODIFY, DELETE) of event being reported
objectRef	M	The resultant reference to the object on which the action occurred
priorObjectState	M	If the Event type is 'MODIFY' or 'DELETE' this field will be populated with a copy of the object prior to the event.
postObjectState	M	If the Event type is 'CREATE' or 'MODIFY' this field will be populated with a copy of the object after the event.

The Alarm Dictionary Discovery and Performance Dictionary Discovery are pertinent use cases for this Service Operation. Dictionary data is sent via an O-Cloud Inventory Event Notification. See O-RAN WG6.ORCH-USE-CASES [23], clause 3.7.9, and 3.8.11 respectively for more details.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-GEN13], [REQ-ORC-O2-8].

2.1.3 O2ims_InfrastructureMonitoring Services

2.1.3.1 Alarm Services

Any object in the Infrastructure Inventory can generate faults. Also, a consumer such as the SMO may want to monitor the reachability of the IMS and therefore request a heartbeat message to be periodically sent. The O2ims_InfrastructureMonitoring services provide these. IMS Heartbeat is not specified in the present document version.

It is important to understand the differences between faults and alarms. All faults are logged, only some faults may be worthy of being an alarm. Policies within the IMS determine if a fault or set of faults warrant an alarm to be created. All Alarms are also logged. The following services are associated with alarms.

2.1.3.1.1 Service description

The O-Cloud has a historical table of past and active alarms. The SMO or any other consumer with permissions can query this table for trending analysis, correlation, or synchronization. Additionally, the service provides the ability to subscribe to alarm events which are evaluated whenever a change occurs to an AlarmEventRecord.

For a complete list of requirements see the O-Cloud Alarm related use cases in O-RAN WG6.ORCH-USE-CASES [23].

2.1.3.1.2 Service operations

2.1.3.1.2.1 Query Alarm Information

The O2ims_InfrastructureMonitoring service shall enable an authorized consumer to query and retrieve AlarmEventRecord information related to the O-Cloud infrastructure and its resources.

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to retrieve the O-Cloud information.

The information elements of an AlarmEventRecord are specified in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.10.

Table 2.1.3.1.2.1-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.3.1.2.1-1: Query O2ims_InfrastructureAlarmInformation operation

Message	Direction
QueryOcloudAlarmRequest	SMO → O-Cloud
QueryOcloudAlarmResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support means to:

- Filter to select which information is queried about the supported service objects specified in clause 2.1.3.1.2. Filtering by names, identifiers, metadata information and status information shall be supported.
- Select the list of attributes of information of the supported service objects to be returned matching the filter. An absence of attribute selection shall return the complete information of the service objects matching the filter the authorized consumer is allowed to query.

The query operation shall support returning information about one or a set of service objects (i.e., list/array of service objects).

As a result of this operation, the producer (O-Cloud) shall indicate to the consumer whether the query was processed successfully. If the operation is not successful, the O-Cloud shall return to the consumer appropriate error information.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23]. The following identifiers uniquely identify the requirements applicable to this operation: [REQ-ORC-O2-17], [REQ-ORC-O2-18], [REQ-ORC-O2-21], [REQ-ORC-O2-22], [REQ-ORC-O2-25].

2.1.3.1.2.2 Infrastructure Alarm Acknowledge

The O2ims_InfrastructureMonitoring service shall enable an authorized consumer to acknowledge an AlarmEventRecord recorded in the IMS.

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to acknowledge an alarm.

Table 2.1.3.1.2.2-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.3.1.2.2-1: O2ims_InfrastructureAlarmAcknowledge operation

Message	Direction
AcknowledgeInfrastructureAlarmRequest	SMO → O-Cloud
AcknowledgeInfrastructureAlarmResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to:

- identify the specific AlarmEventRecord to be acknowledged.

As a result of this operation, the producer (O-Cloud) shall indicate to the consumer whether the AlarmEventRecord was acknowledged successfully. If the operation is not successful, the O-Cloud shall return to the consumer appropriate error information.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23]. The following identifiers uniquely identify the requirements applicable to this operation: [REQ-ORC-O2-27], [REQ-ORC-O2-29]

2.1.3.1.2.3 Infrastructure Alarm Clear

The O2ims_InfrastructureMonitoring service shall enable an authorized consumer to clear an AlarmEventRecord recorded in the IMS which requires manual clearing by its definition in the alarm dictionary.

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to clear an alarm.

Table 2.1.3.1.2.3-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.3.1.2.3-1: O2ims_InfrastructureAlarmClear operation

Message	Direction
ClearInfrastructureAlarmRequest	SMO → O-Cloud
ClearInfrastructureAlarmResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to:

- identify the specific AlarmEventRecord to be cleared.

NOTE: If the identified entry is defined with a clearing type of AUTOMATIC then it is up to the cloud vendor implementation on how this will affect the AlarmEventRecord and the ClearInfrastructureAlarmResponse. One example implementation may allow manual clear of an automatic alarm and if the O-Cloud re-detects the fault a new alarm is issued. Another implementation example may reject the request and leave the AlarmEventRecord unchanged.

As a result of this operation, the producer (O-Cloud) shall indicate to the consumer whether the AlarmEventRecord was cleared successfully. If the operation is not successful, the O-Cloud shall return to the consumer appropriate error information.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23]. The following identifiers uniquely identify the requirements applicable to this operation: [REQ-ORC-O2-28], [REQ-ORC-O2-30].

2.1.3.1.2.4 Infrastructure Alarm Event Notifications

The O2ims `InfrastructureMonitoring` service shall provide a consumer who has established a valid subscription to alarms to be notified when an event which matches the subscription filter criteria to be sent to the consumer (SMO).

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to subscribe to the notification service, and to allow the notification service to invoke the specified callback procedure.

Table 2.1.3.1.2.4-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.3.1.2.4-1: O2ims Alarm Subscribe/Notify operation

Message	Direction
SubscribeInfrastructureAlarmRequest	SMO → O-Cloud
SubscribeInfrastructureAlarmResponse	O-Cloud → SMO
InfrastructureAlarmEventNotification	O-Cloud → SMO

The information sent in an `InfrastructureAlarmEventNotification` shall contain the information specified in the `AlarmEvent` as specified in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.11. As a result of this operation, the producer (O-Cloud) shall indicate to the consumer whether the subscription was processed successfully. If the operation is not successful, the O-Cloud shall return to the consumer appropriate error information.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23]. The following identifiers uniquely identify the requirements applicable to this operation: [REQ-ORC-O2-14], [REQ-ORC-O2-15], [REQ-ORC-O2-23], [REQ-ORC-O2-24]

2.1.3.1.2.5 Infrastructure Alarm Purge

Normally alarms are removed from the `AlarmList` when they age past the `retentionPeriod`. The Infrastructure Alarm Purge operation deletes inactive and acknowledged alarms based on parameters in the `InfrastructureAlarmPurgeRequest` from the alarm list irrespective of the `retentionPeriod`.

The Alarm Purge operation is requested by the service consumer (SMO). To see a complete description of this operation, refer to O-RAN.WG6.ORCH-USE-CASES [23], clause 3.7.13.

Table 2.1.3.1.2.5-1 lists the information flow exchanged between the SMO and the O-Cloud in a request/response pattern.

Table 2.1.3.1.2.5-1: O2ims_InfrastructureAlarmPurge operation

Message	Direction
InfrastructureAlarmPurgeRequest	SMO → O-Cloud
InfrastructureAlarmPurgeResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to:

- identify the specific `AlarmEventRecord(s)` to be purged based on attributes of the `AlarmEventRecord` described in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.10.

When this operation is successful, it will result in `AlarmEventRecords` contained in the `AlarmList` to be removed irrespective of the `retentionPeriod`.

The full requirements definitions can be found in O-RAN.WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to this operation: [REQ-ORC-O2-98].

2.1.3.1.2.6 Alarm List Configure

The Alarm List Configure enables the SMO to view/set attributes which configure the behavior of Alarm List Management at the IMS. The request for Alarm List Configure is sent from the FOCOM towards the IMS. The request

has parameters which describe the attributes associated with an Alarm List to be configured. To see a complete description of the Alarm List Configure operation, refer to O-RAN.WG6.ORCH-USE-CASES [23], clause 3.7.11.

The IMS keeps all the current alarms in an Alarm List. The Retention Period of alarms can be changed by the Alarm List Configure operation. After the Retention Period expires, alarms in the Alarm List will be purged or archived based on alarm policy. For example, the Alarm List Configure request could have an attribute to specify to Retention Period by the IMS of Compute Node alarms (resource types) for 72 hours. When the current value of the `retentionPeriod` is reduced then the Alarm Purge Use Case is triggered, found in O-RAN.WG6.ORCH-USE-CASES [23], clause 3.7.13.

Another Alarm List Configure operation could adjust the value(s) in the Extension attribute list of the Alarm List. Additional extensions attributes in the Alarm List Management request could change other aspects of Alarm List Management behavior. This would allow for implementation specific behavior. For example, an extension attribute might cause alarms to be purged or archived based on triggers. Extensions might define overflow behavior, or Alarm List composition handling.

Table 2.1.3.1.2.6-1 lists the information flow exchanged between the SMO and the O-Cloud in a request/response pattern over O2 IMS.

Table 2.1.3.1.2.6-1: O2ims_AlarmListConfigure operation

Message	Direction
AlarmListConfigureRequest	SMO → O-Cloud
AlarmListConfigureResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to modify the attributes of the `AlarmList` as specified in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.13:

- Provide updated values of the Retention Period applicable to the alarms in the Alarm List, and
- Provide values for the extension attribute list applicable to the Alarm List.

When this operation is successful, it will result in a change of the Alarm List management behavior.

The full requirements definitions can be found in O-RAN.WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to this operation: [REQ-ORC-O2-74].

2.1.3.2 Void

2.1.3.3 Void

2.1.4 O2ims_InfrastructureProvisioning Services

2.1.4.1 O-Cloud Node Cluster and Infrastructure Declarative Service

2.1.4.1.1 Service description

The O-Cloud Node Cluster and Infrastructure Declarative Service provides services for allocating, deallocating, and configuring O-Cloud Resources based on a declarative target request, referred as `ProvisioningRequest`. By means of the `ProvisioningRequest`, the consumer (SMO) can request to provision an O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s).

Additionally, the O-Cloud Node Cluster and Infrastructure Declarative Service offers the capability to a consumer of listing and reading existing `ProvisioningRequests`. This includes reading the status of ongoing creation, update, and deletion operations related to the declarative target execution of the `ProvisioningRequests`.

2.1.4.1.2 Service operations

2.1.4.1.2.1 ProvisioningRequest Management Operations

According to the O-RAN WG6.O-CLOUD-IM [36], the `ProvisioningRequest` represents a request for item(s), such as an O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s), to be provisioned within the O-Cloud. The `ProvisioningRequest` is a declarative target request issued by the SMO to the O-Cloud via the O-Cloud Node Cluster and Infrastructure Declarative service over the O2ims interface. O-Cloud Node Cluster and Infrastructure Declarative service operations follow a request-response pattern. Table 2.1.4.1.2.1-1 lists the service operations requested from the SMO to the O-Cloud to manage `ProvisioningRequest`.

Table 2.1.4.1.2-1 List of Service operations to manage ProvisioningRequest

Message	Direction
<code>ProvisioningRequestCreateRequest</code>	SMO → O-Cloud
<code>ProvisioningRequestCreateResponse</code>	O-Cloud → SMO
<code>ProvisioningRequestReadRequest</code>	SMO → O-Cloud
<code>ProvisioningRequestReadResponse</code>	O-Cloud → SMO
<code>ProvisioningRequestUpdateRequest</code>	SMO → O-Cloud
<code>ProvisioningRequestUpdateResponse</code>	O-Cloud → SMO
<code>ProvisioningRequestDeleteRequest</code>	SMO → O-Cloud
<code>ProvisioningRequestDeleteResponse</code>	O-Cloud → SMO

Figure 2.1.4.1.2.1-1 depicts in a single diagram all the different Service operations on a `ProvisioningRequest`.

NOTE: For simplicity and readability reasons, the response from the O-Cloud to SMO for each Service operations are not depicted in the Figure 2.1.4.1.2.1-1.

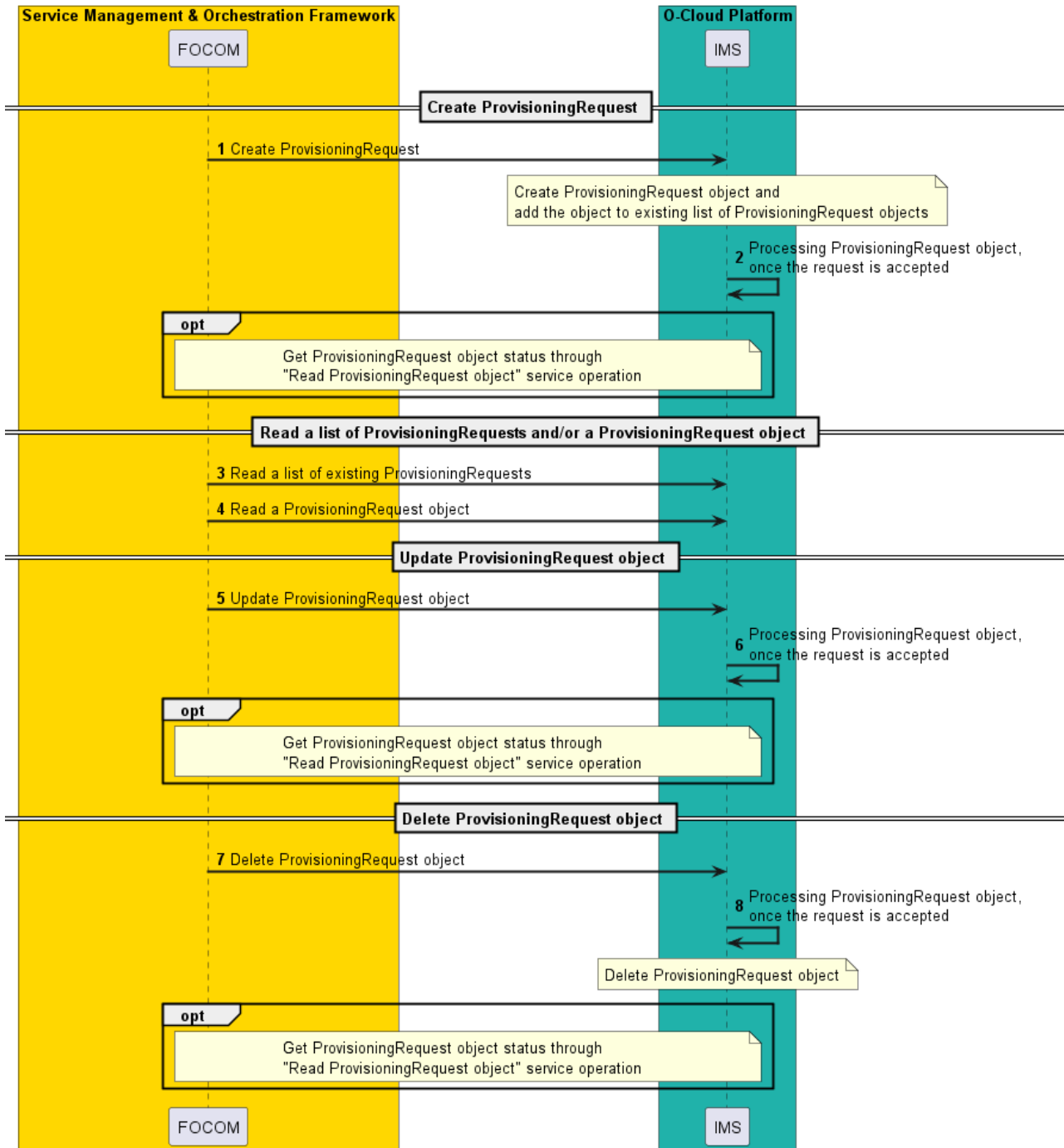


Figure 2.1.4.1.2.1-1 Service operations on a ProvisioningRequest

The information sent in a `ProvisioningRequest` shall include the information specified in the `ProvisioningRequest` as outlined in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.4.4.1. In response to this operation, the producer (O-Cloud) shall indicate to the consumer (SMO) whether the request has been accepted for processing. If the request is not accepted, the O-Cloud shall return appropriate error information to the consumer.

The processing of the `ProvisioningRequest` is an asynchronous operation, where requested fulfilment of the given declarative target of the `ProvisioningRequest` can or cannot be fulfilled, as processing can fail during its execution. If or when the `ProvisioningRequest` is eventually fulfilled or fails, the producer (O-Cloud) shall update the `ProvisioningRequest` status by updating the `provisioningPhase`. For more details, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.4.4.2.

The consumer (SMO) can send a read request for the `ProvisioningRequest`, for instance, while it is under processing and receive the current status of the `ProvisioningRequest`. The response to the read `ProvisioningRequest` will indicate the provisioning phase by means of the "provisioningPhase" attribute information.

The create and update O-Cloud Node Cluster using O-Cloud Template are applicable use cases for this service operations. See O-RAN WG6.ORCH-USE-CASES [23], clause 3.11.2.3 and 3.11.4.3 for more details.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-49], [REQ-ORC-O2-92], [REQ-ORC-O2-93], [REQ-ORC-O2-108] and the requirement applicable to the consumer (SMO) for this operation: [REQ-ORC-O2-91], [REQ-ORC-O2-107].

2.1.5 O2ims_InfrastructureSoftwareManagement Services

2.1.5.1 Service description

The `O2ims_InfrastructureSoftware` Management services support procedures that enable SMO/FOCOM to initiate the software update process for the O-Cloud Infrastructure Management software, the Deployment Management software, Server OS Software, updates, and patches, and firmware updates for accelerators. For initial release the O-Cloud software can be manually updated. Therefore, the orchestrated Software Update procedure is deferred FFS.

2.1.6 O2ims_InfrastructureLifecycleManagement Services

2.1.6.1 Service description

Although O-Clouds are usually built for future capacity, they are not static. Physical resources can become defective or obsolete. Also, the O-Cloud may grow beyond its initial deployed capacity. These activities represent life cycle events to the O-Cloud. Automation is expected to offload manual processes due to the high numbers expected of O-Cloud instances. `O2ims_InfrastructureLifecycleManagement` Services support procedures for the automation of O-Clouds lifecycle events.

2.1.6.2 Service operations

Primary Use cases for O-Cloud Genesis and O-Cloud Scaling are FFS. However, for this release the Notification to a callback specified at the onset of O-Cloud Genesis is defined.

2.1.6.2.1 O-Cloud Available Event Notification

The `O2ims_InfrastructureLifecycle` service shall provide a consumer who was established at the onset of O-Cloud Genesis. Data expected to be included with the callback URI in the genesis data is the `globalCloudId`, each `globalLocationID`, and each `AssetID` for infrastructure at those locations. Once enough of the O-Cloud is discovered, provisioned and is available for additional provisioning or workload deployments, the O-Cloud shall send the `O-CloudAvailableEvent` to the consumer (SMO), thus registering its `InfrastructureManagementServiceEndPoint` with the SMO. After receiving the notification, the SMO will interrogate the `InfrastructureInventory` APIs to account for corporate assets and discover the DMS service endpoints to allow workloads to be deployed.

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the notification service to invoke the specified callback procedure.

Table 2.1.6.2.1-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.6.2.1-1: O2ims Lifecycle Notification operation

Message	Direction
<code>OCloudAvailableNotification</code>	O-Cloud → SMO

The information representing O-Cloud Available Notification shall follow the provisions indicated in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.9.

2.1.7 O2ims_InfrastructurePerformance Services

2.1.7.1 Service description

The Service Operations described in the following clauses relate to Performance Management functions. These operations fall into four basic categories: Performance Measurement Job, Performance Management Reporting, Performance Management Subscription handling, and Performance Management configuration. Each of these service operations relates to the four areas in the Information Model related to Performance Management: Performance Measurement Store, Performance Measurement Report, Performance Subscription and Performance Measurement Jobs. See the O-RAN WG6.O-CLOUD-IM [36] for more details. The functions described in the following service operations collectively provide fundamental operations which enable a management system, such as the SMO, to setup Performance Measurement Jobs, to establish Performance Management Subscriptions (to receive reports), to configure Performance Management behaviour, and to interact with a Performance Measurement Store.

There are Service Operations to Create, Query, Delete, Update, Suspend and Resume Performance Measurement Jobs. There are also Service Operations for Performance Management Subscription Query, Performance Management Subscription Update and Performance Management Subscription Delete. Once running, an entity, such as the SMO, can establish Performance Management Subscriptions to receive the collected Performance Measurements.

Service Operations relate to functioning of both kinds of Performance Measurement Jobs. Within the O-Cloud, there are Performance Measurement Jobs and preinstalled Performance Measurement Jobs. These have the function of collecting Performance Measurements from O-Cloud Resources and storing them into a Performance Measurement Store.

The behaviour of Performance Management reporting can be controlled by Performance Management Service Operations. There are three ways that an entity could receive Performance Measurement reports: through file reporting, notification reporting or streaming. Service Operations can also alter the Performance Management behaviour through the Performance Management Configure Service Operation, the Performance Measurement Job Update Service Operation, and Performance Management Subscription Update Service Operation.

2.1.7.2 Service operations

2.1.7.2.1 Performance Measurement Job Query

Performance Measurement (PM) Jobs collect performance data on O-Cloud infrastructure resources. The O2ims_InfrastructureMonitoring service shall enable an authorized consumer to query and retrieve PerformanceMeasurementJob information and its attributes for PM Jobs that reside in the O-Cloud.

The PM Job Query Service enables a consumer to:

- Query for all PM Jobs in the Active State including default PM Jobs (based on Owner).
- Query for PM Jobs in the Suspended State.
- Query for PM Jobs in the Deprecated State because of delete operations that have not yet been purged.
- Query for certain PM Jobs by indicating specific PM Job IDs in the query filter.

NOTE 1: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to retrieve the Performance Measurement Job information.

Table 2.1.7.2.1-1 lists the information flow exchanged between the SMO and the O-Cloud using the request-response pattern.

Table 2.1.7.2.1-1: O2ims_PerformanceMeasurementJobQuery operation

Message	Direction
PerformanceMeasurementJobQueryRequest	SMO → O-Cloud
PerformanceMeasurementJobQueryResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to:

- Specify a filter that defines the selection of PM Jobs to be included in the results. The attributes for filtering of the PerformanceMeasurementJob Information Object Class are specified in O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.16. Thus, the filter supports the requests based on PM Job IDs, PM Job status, PM Job owner, and PM Job states.
- Specify the list of associated attributes for the filtered PM Jobs to be returned in the results. An absence of attribute specification shall return the complete information of filtered PM Jobs back to the requestor.

NOTE 2: There is only one filter and only one list of associated attributes. Thus, for all filtered PM Jobs the request returns the same set of associated attributes.

The PM Job query operation shall support returning information about one or a set of filtered PM Jobs. The service operation shall support the ability to handle a large amount of data in return sets as described in ETSI GS NFV-SOL 013 [22], clause 5.4.2.1.

As a result of this operation, the producer (O-Cloud) shall indicate to the consumer whether the query was processed successfully. If the operation is not successful, the O-Cloud shall return to the consumer appropriate error information.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-57].

2.1.7.2.2 Performance Management Configure

The Performance Management Configure Service operation enables a requesting entity, such as the SMO, to configure the behavior of the Performance Management system.

This Service Operation complements the Performance Measurement Job Creation Service Operation, Performance Measurement Job Update Service Operation, Performance Management Subscription Service Operation and, Performance Management Subscription Update Service Operation which are other Service Operations that can alter the behavior of Performance Management functionality.

The Performance Management Configure Service Operation enables a requesting entity, such as the SMO, to modify the Retention Period attribute or the Extension attribute list in the PerformanceMeasureStore.

The Performance Management Configure Service Operation can be used to adjust the value(s) in the Extension attribute list of the PerformanceMeasurementStore. Updates to the Extensions attribute list from the Performance Management Configure request can change other aspects of Performance Management behavior, hence enabling for implementation specific behavior.

The Retention Period is described in the O-RAN.WG6.O2-GA&P [24], clause 3.9.11 and in the O-Cloud Information Model, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.14.2.

Table 2.1.7.2.2-1 lists the information flow exchanged between the SMO and the O-Cloud in a request/response pattern over the O2ims interface.

Table 2.1.7.2.2-1: O2ims_PerformanceManagementConfigure operation

Message	Direction
PerformanceManagementConfigure Request	SMO → O-Cloud
PerformanceManagementConfigure Response	O-Cloud → SMO

The input parameters sent when invoking this Service Operation shall support the means to:

- Identify the objects with the attributes to configure. For updating the Retention Period or Extension attributes, this relates to the Performance Measurement Store object.
- Provide updated value of the Retention Period for the requested object to be configured.
- Provide updated value(s) for the Extension attribute list of the requested object(s) to be configured.

When this Service Operation is successful, it will result in modification of the Performance Management behavior.

A description of the Performance Management Configuration Use Case which is relevant to this Service Operation can be found in O-RAN.WG6.ORCH-USE-CASES [23], clause 3.8.15.

The full requirements definitions can be found in O-RAN.WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to this operation: [REQ-ORC-O2-100].

2.1.7.2.3 Performance Measurement Job Create

Performance Measurement Jobs collect performance measurements and metrics on O-Cloud infrastructure resources. The O2ims_InfrastructureMonitoring service shall enable an authorized consumer to create a Performance Measurement Job in the O-Cloud over the O2 interface. The requested Performance Measurement Job would be in addition to the Preinstalled Performance Measurement Jobs that would already be running in the O-Cloud. For further information on Performance Measurement Jobs, see O-RAN WG6 O2 GA&P [24], Clause 3.9.5. For further information on the Performance Measurement Job Creation Use Case, see O-RAN WG6 ORCH-USE-CASES [23], Clause 3.8.1.

To create a Performance Measurement Job, a requestor would provide the following upon invoking the service operation:

- Consumer Performance Job Id – This is an identifier provided by the consumer for purposes of managing PM Jobs. This value could be the same across multiple instances of a PM Job.
- Collection Interval - This is provided by the requestor at time of Performance Measurement Job creation to define the interval at which performance measurements will be collected and stored.
- Resource Scope Criteria – The Resource Scope Criteria determines the value set for the Qualified Resource Types. It allows for the requestor of the Service Operation to indicate the list of Resources of interest from which measurements are to be collected. This criterion determines, the value set for the Qualified Resource Types (See Note).
- Measurement Selection Criteria – This is provided by the requestor at time of Performance Measurement Job creation to describe the measurements and/or resources that the PM Job is responsible for collecting and calculating. If a Resource Type is specified in the order, then the Performance Measurement Job operations applies to all resources of that Resource Type. From the Resource Scope Criteria, the Resource Types of interest can be calculated and from that the relevant PM Dictionaries. The Measurement Selection Criteria can then use these PM Dictionaries to identify the measurements of interest.
- Extensions - These are unspecified properties (key/value) which extend the information provided about the Performance Measurement Job

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to retrieve the Performance Measurement Job information.

Table 2.1.7.2.3-1 lists the information flow exchanged between the SMO and the O-Cloud using the request-response pattern.

Table 2.1.7.2.3-1: O2ims_PerformanceMeasurementJobCreate operation

Message	Direction
PerformanceMeasurementJobCreateRequest	SMO → O-Cloud
PerformanceMeasurementJobCreateResponse	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to:

- Specify an order that defines the Resource Scope Criteria, Measured Resources and Resources Type which indicates the pertinent resources for the Performance Measurement Job. From these the relevant PM Dictionaries can be identified.
- Specify an order that defines the Measurement Selection Criteria that the Performance Measurement Job would be responsible for. The relevant attributes given in an order to create a

PerformanceMeasurementJob Information Object Class are specified in O-Cloud Information Model in O-RAN WG6.O-CLOUD-IM [36], see clause 4.2.1.4.16.2.

As a result of the PM Job Create service operation, the producer (O-Cloud) shall indicate to the consumer whether the PM Job Create service operation was processed successfully. As a result, this operation will return the status of the newly created PM jobs running in the IMS. If the operation is not successful, the O-Cloud shall return to the consumer the appropriate error information.

The producer determines the Measured Resources as a list of Resources relevant to the PM Job; it is a read-only attribute derived from the Measurement Selection Criteria. Furthermore, the Collected Measurements are derived from the Resource Scope Criteria and Measurement Selection Criteria; this gives the measurements to be collected by the PM Job.

The Qualified Resource Types are computed from the evaluation of the Measurement Selection Criteria, thus is derived during the PM Job Create Service Operation. It is also part of the Information Model. These are byproducts of the operation inputs. The computation from the Resource Scope Criteria results in a unique set of Resource Types relevant to the PM Job create service operation. From those resources, Resource Types of interest can be calculated. From those, the associated PM Dictionaries can be deduced. From the Measurement Selection Criteria, the Qualified Measurements that the PM Job is responsible for are calculated. The Qualified Resource Type allows an operator to check these interim results.

After the service operation is complete, the IMS puts the PM Job into the Active State; and it immediately starts collecting measurements based on its collection interval.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-32].

2.1.7.2.4 Performance Management Subscription Create

The purpose of the Performance Subscription Create Service Operation is to create Subscriptions related to Performance Management. The Performance Management Subscription Create operation is vital because Subscriptions first need to be created before Performance Measurements Reports can be created by the producer.

Each subscription is associated with one subscriber. Each subscriber can have many subscriptions. Each Subscriber (consumer) has a consumer subscription identifier. However, the value could be the same across multiple instances of IMS subscription instances. A subscription only supports one reporting mechanism.

During the Query Information service operation, read-only attributes will provide an entity or the SMO with a capabilities assessment which indicate the protocol(s) supported for reporting, mechanism(s), and format(s) supported by the O-Cloud. Then, an entity or the SMO can subscribe to the mechanism(s) and format(s) by indicating them within the subscription filter. In the capabilities exchange, the IMS would report the Performance Measurement Jobs and their associated collection intervals.

During the Performance Management Subscription Create Service Operation, the creation request will indicate an endpoint for where the Performance Measurement Report(s) will be sent to. The subscription filter qualifies what data from the Performance Measurement Jobs will be sent. The Performance Management Subscription Create Service Operation will indicate the Subscription reporting interval. Performance Measurements in an O-Cloud might be sent through event notification reporting, stream-based reporting, or file-based reporting to a subscriber.

To create a Performance Management Subscription the following list explains the usage of the parameters that can be provided in service operation:

- **Consumer Performance Subscription ID** – This identifier can be optionally provided to indicate a consumer performance subscription which may be used to manage performance data. This value could be the same across multiple instances of IMS subscription instances.
- **Resource and Resource Types** – The Resources and Resource Types of interest can be provided by the requestor of the Service Operation.
- **Measurement Selection Criteria** – This is provided by the requestor at time of Performance Management Subscription creation to describe the measurement(s) of interest.

- **Report Format** – The Report format indicates whether the subscription is expected to be fulfilled through Event Notifications, File-based reporting or through a Stream. For Event Notifications, performance data is sent at the specified intervals. For File-based reporting, a file is generated, which can then be retrieved by the consumer. For Stream-based reporting, a session will remain open and continue to send the data in a streaming format, e.g., Google Protocol Buffers (GPB), at the specified intervals until the session or subscription is terminated. Reporting use cases can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 3.8.3, 3.8.4 and 3.8.5.
- **Callback** – The Performance Subscription Creation operation can (optionally) provide an end point for where Performance subscription reporting notifications are sent. For File-based reporting, the Callback is an endpoint where a file ready notification is sent. For Event-based reporting, the Callback is an endpoint where to send performance data to. The field is not required if the report format is Stream because the Callback is not used.
- **Measurement Reporting Frequency** – This is used to establish Performance monitoring processes. This indicates the periodicity that specified performance data shall be sent. Each process definition can have a Subscription Mode, Report Interval, Suppress Redundant Flag, and Heartbeat Interval. The Subscription Mode can be *Target Defined*, *On Change*, or *Sampled*. If Target Defined it is left up to the Producer when to send data. If On Change, data is sent whenever the value changes. If it is Sampled, it is sent regularly with a periodicity of the Report Interval. If the Suppress Redundant Flag is set to true, the process shall not send data at the Sample Report Interval if the value has not changed unless the Heartbeat Interval is set to a non-zero value. If the Heartbeat Interval is set it will always send data samples regularly.
- **Remote File Location** – This provides a destination for the consumer to push Performance Files to.

Performance Files produced in the O-Cloud can be retrieved by the consumer as in a pull paradigm. If a consumer wants to retrieve Performance Files, the callback is given in the Performance Subscription Create operation. When the Performance Files are ready, the callback is used as a notification endpoint for the O-Cloud to inform the consumer that the Performance Files are ready to be pulled.

Performance Files can also be delivered by the producer as in a push paradigm. In this case, the consumer will provide a *Remote File Location* (as an attribute in the operation) that the producer (O-Cloud) can upload the Performance Files to. Here, the callback is the endpoint where the Performance Files Ready notification is sent. This informs the consumer that the Performance Files have been uploaded. In the push paradigm, what happens to the files after the producer sends the Performance files to the remote file location is implementation specific.

The Performance Subscription can establish multiple monitoring processes. Each of those can have different Reporting Frequencies. Each of those processes could have different Subscription Modes, with Target Defined (producer determined), On Change or reported at every Reporting Interval. It is also possible to have a process report data periodically as defined by a heartbeat interval regardless of change when the suppress redundancy is set to true. For example, one process within the Performance Subscription could report data only when a target changes value, another process within that same Performance Subscription may report data every 8 minutes (on the heartbeat interval).

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to do a Performance Management Subscription create operation.

Table 2.1.7.2.4-1 lists the information flow exchanged between the SMO and the O-Cloud using the request, response, and notification patterns.

Table 2.1.7.2.4-1: O2ims_PerformanceManagementSubscriptionCreate operation

Message	Direction
PerformanceManagementSubscriptionCreateRequest	SMO → O-Cloud
PerformanceManagementSubscriptionCreateResponse	O-Cloud → SMO
FileReadyNotification	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to:

- **Consumer Performance Subscription ID** – This optional input parameter is a string without requirements on the format that can be provided by the requestor. This value could be the same across multiple instances of IMS subscription instances.
- **Resources** – This would be provided in the Global Subscription Criteria. The Resources are key-value pairs that indicate the Resource(s) of interest for the subscription.

- **Resource Types** – This is provided in a Global Subscription Criteria. The Resource Types are key-value pairs that indicate the Resource Type(s) of interest for the subscription.
- **Measurement Selection Criteria** – This is provided in the Performance Management Subscription to describe the measurement(s) of interest.
- **Report Format** – The report format is provided indicating whether the Performance subscription is fulfilled via Event Notifications, File-based reporting, or Stream reporting.
- **Callback** – A Callback can be provided in the Performance Subscription as an endpoint to send Performance-related notifications to.
- **Measurement Reporting Frequency** – This is an array of definitions which is used to establish Performance monitoring processes. Each process definition can have a Subscription Mode, Report Interval, Suppress Redundant Flag, and Heartbeat Interval.
- **Remote File Location** – This provides a destination for the consumer to push Performance Files to.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-38]. Requirements related to the endpoint for where the Performance Measurement Reports will be sent to are described [REQ-ORC-O2-39], [REQ-ORC-O2-40], [REQ-ORC-O2-42].

2.1.7.2.5 Performance Measurement Job Delete

Performance Measurement Jobs collect performance measurements and metrics on O-Cloud infrastructure resources. The O2ims_InfrastructurePerformance service shall enable an authorized consumer to delete a Performance Measurement Job(s) in the O-Cloud over the O2 interface. An authorized consumer needs to first suspend a Performance Measurement Job before it can be deleted. The Preinstalled Performance Measurement Jobs cannot be deleted. For further information on Performance Measurement Jobs, see O-RAN WG6 O2 GA&P [24], Clause 3.9.5. For further information on the Performance Measurement Job Delete Use Case, see O-RAN WG6 ORCH-USE-CASES [23], Clause 3.8.7.

To delete one or more Performance Measurement Job(s), a requestor would provide the following upon invoking the service operation:

- **Performance Measurement Job Id(s)** – This is a list of one or more identifiers provided by the consumer that identifies Performance Measurement Job(s) to be deleted.

Table 2.1.7.2.5-1 lists the information flow exchanged between the SMO and the O-Cloud using the request-response pattern.

Table 2.1.7.2.5-1: O2ims_PerformanceMeasurementJobDelete operation

Message	Direction
PerformanceMeasurementJobDeleteRequest	SMO → O-Cloud
PerformanceMeasurementJobDeleteResponse	O-Cloud → SMO
PerformanceMeasurementJobStateChangeNotification	O-Cloud → SMO

Prior to the deletion, the consumer should have suspended the Performance Measurement Job(s) which it wants to delete.

As a result of the Performance Measurement Job Delete service operation, the producer (O-Cloud) shall indicate to the consumer whether the Performance Measurement Job Delete service operation was processed successfully. As a result, this operation will return the status of the deleted Performance Measurement Job(s). If the operation is not successful, the O-Cloud shall return to the consumer the appropriate error information.

When a Performance Measurement Job is successfully deleted and changes its status to “*DEPRECATED*”, a notification of that change is sent to all of consumer(s) that have been subscribing to the data collected by the deleted Performance Measurement Job. The deletion of a Performance Measurement Job(s) shall also result in the deletion of any associated embedded PM subscription.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-59], [REQ-ORC-O2-60], [REQ-ORC-O2-84].

2.1.7.2.6 Performance Measurement Event Notification Reporting

In the context of O-RAN Cloud managed systems, performance measurements can be transmitted by any of the following mechanisms: performance measurement event notification(s), performance measurement streaming based reporting, or performance measurement file-based reporting. The performance management subscription create service operation subscription filter defines the service connection end point where the event notifications shall be sent to. Event based notification are expected to be utilized for non-real time performance measurements and for situations that have a low frequency and low volume of reporting since a session is re-established with the sending of each performance measurement event notification. At higher data volumes a streaming session would be more efficient. See O-RAN WG6.ORCH-USE-CASES, clause 3.8.3 [23] for more details.

This service model describes performance measurement event notification reporting to send performance data. An entity that subscribes to these performance event notifications will get a notification for each reporting message on the indicated notification callback endpoint. Notification reports are based on a performance management subscription. The performance subscription filters are described in the Performance Management Subscription Create Service Model. See Clause 2.1.3.2.2.4 for more information. Other service models in the present specification will describe the streaming based reporting and file-based reporting.

The O2ims_InfrastructurePerformance services shall provide a consumer who has established a valid subscription to be notified when an event which matches the subscription filter selection criteria to be sent to the consumer (SMO).

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to subscribe to the notification service, and to allow the notification service to invoke the specified callback procedure.

Table 2.1.7.2.6-1 lists the information flow exchanged between the SMO and the O-Cloud for this service operation. The Performance Measurement Event Notification is used for reporting.

Table 2.1.7.2.6-1: O2ims_PerformanceMeasurementEventNotification Reporting operation

Message	Direction
PerformanceMeasurementEventNotification	O-Cloud → SMO

There are three basic exception cases for this service operation:

- **CONNECTION LOST** – If connectivity between the subscriber and the publisher (IMS) is lost, a connection would not be able to be opened. There are implementation considerations such as: how long data is held for, recovery of the connection, backing up data, preventing data storms upon recovery, and management after recovery.
- **DATA UNAVAILABLE** – This exception occurs when the performance measurement data is not available in the O-Cloud at the IMS when it should be reported. This results in a missed timing window when data was expected, but it was not available. In the O2 interface, it would be expected that the notification would indicate data was unavailable. There are implementation considerations such as: O-Cloud failures, IMS failures, data recovery, and data synchronization.
- **PM JOB FAILURES & ISSUES** – If the PM Job is unable to perform its function. If there are failures or issues with the PM Job(s) which might result in data being unavailable it is expected that there would alarms that would be raised by the IMS. This results in performance data being unavailable when it is needed to be reported.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-39].

2.1.7.2.7 Performance Measurement Job Update

Performance Measurement Jobs collect performance measurements and metrics on O-Cloud Resources. The O2ims_InfrastructurePerformance service enables an authorized consumer to update a Performance Measurement Job in the O-Cloud over the O2 interface. The Preinstalled Performance Measurement Jobs cannot be updated. Performance Measurement Job Update can occur for one of two reasons as described below:

- **RESOURCE CHANGES** – O-Cloud Resource changes can cause a Performance Measurement Job to update. When O-Cloud Resources are updated, added, or deleted that a Performance Measurement Job depends on, the Performance Measurement Job update use case may be invoked. O-Cloud Resources changes can impact on the Performance Measurement Job measurement selection criteria, which triggers evaluation of the measured resources and collected measurements, and/or the resource scope criteria, which triggers evaluation of the qualified resource types and collected measurements. It is possible that the result of the O-Cloud Resource change may not alter the Performance Measurement Job.
- **UPDATE BY REQUEST** – A consumer may also request for an update to a Performance Measurement Job through a request operation. A consumer may request data collection updates (i.e. measurement selection criteria, resource scope criteria) and/or other updates (e.g. collection interval, extensions) for a Performance Measurement Job. This may occur autonomously from a consumer, for example through a policy trigger. Only a consumer with the proper permissions that owns the Performance Measurement Job can update the Performance Measurement Job.

To update a Performance Measurement Job the following list explains the usage of the parameters that can be provided in the service operation:

- **Consumer Performance Job ID** – This is an identifier optionally provided by the consumer for its purpose of managing Performance Measurement Job(s).
- **Resource Scope Criteria** – Key value pairs of resource attributes which are used to select the resources from which measurements are to be collected.
- **Measurement Selection Criteria** – Key value pairs that identify the distinct set of measurements within the scope of a Performance Measurement Job.
- **Collection Interval** – The interval at which performance measurements will be collected and stored.
- **Extensions** - These are key/value pairs which extend the information about the Performance Measurement Job.

All consumer(s) who are subscribed to a Performance Measurement Job are notified via the PerformanceMeasurementJobChangeNotification when the Performance Measurement Job is updated.

For further information on Performance Measurement Jobs, see O-RAN WG6 O2 GA&P [24], Clause 3.9.5. For further information on the Performance Measurement Job Update Use Case, see O-RAN.WG6. ORCH-USE-CASES [23], clause 3.8.8.

Table 2.1.7.2.7-1 lists the information flow exchanged between the SMO and the O-Cloud using the request-response pattern.

Table 2.1.7.2.7-1: O2ims_PerformanceMeasurementJobUpdate operation

Message	Direction
PerformanceMeasurementJobUpdateRequest	SMO → O-Cloud
PerformanceMeasurementJobUpdateResponse	O-Cloud → SMO
PerformanceMeasurementJobChangeNotification	O-Cloud → SMO

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-67], [REQ-ORC-O2-68].

2.1.7.2.8 Performance Management Subscription Query

Performance Management Subscription encompasses a subscription mechanism dedicated to getting reports for Performance Measurements. The query of a Performance Management Subscription is the ability of an authorized entity to get the details of a Performance Management Subscription including its performance subscription filter. The other Performance Management Subscription related service operations include the ability to create, update, and delete a subscription. The Performance Management Subscription Query operation can be performed on a set of subscriptions or a single subscription.

The Performance Management Subscription filter (applied to a list) in the service model defines the following for collecting and reporting Performance Measurements over O2ims. This operation can also be applied to a single subscription if a Subscription Identifier is provided.

- **Performance Measurement Data** – The subscription filter qualifies what data from the Performance Measurement jobs shall be sent.
- **Timing Interval** – The subscription filter indicates the reporting timing interval.
- **Reporting Mechanisms** – The subscription filter specifies the reporting mechanisms (file-based reporting, stream-based reporting, event notification reporting).
- **Report Formats** – The subscription filter dictates the report formats.
- **Consumer Performance Subscription Identifiers** – The query filter can include the *Consumer Performance Subscription Identifier(s)*.

The SMO can act as the consumer entity performing the query; however, it can also be another authorized user, technician, or machine (e.g. software, script, etc.). A typical use case for using the subscription query is to cross-check the Performance Management Subscription of the consumer. Though, it can also be utilized for other management purposes as well.

It is expected that the Performance Management Subscription Create operation will have been performed prior to a query operation. However, if a Performance Management Subscription Query has a mixture of valid and non-existing subscriptions, the operation will only return information about the content that does exist (this is not an exception case). Table 2.1.7.2.8-1 lists the information flow exchanged between the SMO and the O-Cloud for this service operation. The Performance Measurement Event Notification is used for reporting.

Table 2.1.7.2.8-1: O2ims_PerformanceManagementSubscriptionQuery operation

Message	Direction
PerformanceManagementSubscriptionQueryRequest	SMO → O-Cloud
PerformanceManagementSubscriptionQueryResponse	O-Cloud → SMO

Aside from unexpected condition exception, the only other exception case for this service operation is:

- **QUERY OF NON-EXISTING PERFORMANCE SUBSCRIPTION** – If the query operation results in no Performance Management Subscription that matches the query filter, then a “Performance Management Subscription not found” is issued back to the requestor.

Details about the Performance Management Subscription Query filter (applies to a subscription list) are as follows. This operation can also be applied to a single subscription if a Subscription Identifier is provided.

- **Performance Measurement Data** - The subscription query filter qualifies the data of interest that is collected by Performance Management Subscription(s). A Subscription Query service operation returns Subscriptions that are providing that data of interest. The filter can specify a set of collected Measurements, see O-RAN WG6.O-Cloud-IM [36], clause 4.2.1.4.18 for more details.
- **Timing Interval** – This relates to the reporting timing interval for how often data is reported. In the Subscription Query service operation, the filter indicates the reporting timing of interest. This will cause the service operation to return subscription(s) that have the timing cadence specified in the filter.

- **Reporting Mechanisms** – This will cause the Subscription Query service operation to return subscription(s) that match the reporting mechanisms specified in the filter. The reporting mechanisms indicate the type of reporting that is of interest whether file-based reporting, stream-based reporting, or event notification reporting.
- **Report Formats** – The filter can indicate the report formats of interest. The format is either File-based, Streaming or Notification based reporting.
- **Consumer Performance Subscription Identifiers** – The query filter can include the *Consumer Performance Subscription Identifier(s)*. The service operation will return those subscription(s) that match the *Consumer Performance Subscription Identifier(s)* if available. This value can be the same across multiple instances of IMS subscription instances.

The full requirements related to the present service operation are specified in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-86].

2.1.8 O2ims_InfrastructureLogging Services

2.1.8.1 Service description

Logging Services have service operations that are related to the operation and management of Logging functions within the O-Cloud. Logs can be kept at different entities within an O-Cloud. They can be kept within O-Cloud resources, Clusters, and IMS. Each of those entities can generate different kinds of logs including Alarm, Fault, Debug, Trace, Security, and Informational logs.

2.1.8.2 Service operations

2.1.8.2.1 Logging Configuration Service Operation

The Logging Configuration is related to how the IMS administrates, provisions, and configures logging management for logs that are generated in the O-Cloud. There are many kinds of logs that may exist in the O-Cloud such as Alarm Logs, Fault Logs, Debug Logs, and other logs. See O-RAN WG6.O2-GA&P [24], clause 3.8.19 for more details. This service operation will configure the logging behaviour of those logs. Further logging management configuration for specific types of logs are implementation specific.

Examples of elements that can be configured through the Logging Configuration Service Operation are the retention period, the activation of logging, logging behaviour (e.g., rotation of older logs (FIFO)), and log levels. Not all logs will have each of these kinds of configurable attributes.

See O-RAN WG6.ORCH-USE-CASES [23], clause 3.7.10 Logging Management Use Case for more information.

The Logging Configuration Service Operation is related to the Log Capability Query (IMS) Service Operation (see NOTE 1) because Logging Configuration sets the behaviour how IMS handles the management of logging.

NOTE 1: The Log Capability Query Service Operation is not defined in the present document.

NOTE 2: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to retrieve the O-Cloud information.

Table 2.1.8.2.1-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.8.2.1-1: O2ims_InfrastructureLoggingConfiguration operation

Message	Direction
InfrastructureLogging Configuration Request	SMO → O-Cloud
InfrastructureLogging Configuration Response	O-Cloud → SMO

The input parameters sent when invoking the operation shall support the means to specify configuration of different aspects of the management of Logs of interest for the IMS and for O-Cloud Resources:

- **Log Type** – Specify types of Log(s) supported for the IMS and O-Cloud Resources. These might include, but are not limited to Alarm Logs, Fault Logs, Debug Logs. Other logs could be described in the input parameter as well.
- **Retention Period** – Specify the Retention Period for the different types of Log(s). This attribute indicates the period of time for which a particular type of Log would be retained for.
- **Logging State** – This is an attribute to indicate the activate state for a particular type of Log. Each Log Type might have an active or inactive state to indicate whether that Log Type is used or not.
- **Expiry method** – Configure logging expiry method for a type of Log which describes what happens if the age of a Log exceeds the Retention Period. The expiry methods could include behaviours such as LIFO, FIFO, and FILO.
- **Logging Level** – Configure the Logging Level(s) for the Logs of interest. See O-RAN WG6.O2-GA&P [24], clause 3.8.20 for more details.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-55].

2.1.8.2.2 Logging Query Service Operation

The Log Query Service Operation allows a user, application, or entity (e.g., SMO) to query logs based on query filter. Logs could be queried by the SMO to the IMS via O2. This Service Operation concerns the retrieval and reading of logs within the O-Cloud that are present and managed by the IMS. A user, application, or entity can query for logs that are available in the Cloud: both exposed O-Cloud and Cloud Infrastructure logs. Any log kept in the Cloud infrastructure might be queried through an implementation specific user interface client or file transfer client such as CLI, SSH2, SFTP. The associated Log Query Use Case describes the concept and flow of this operation. See O-RAN WG6.ORCH-USE-CASES [23], clause 3.7.8 Log Query Use Case for more information.

There are three basic kinds of logs that might be kept within the Cloud (both exposed O-Cloud and Cloud infrastructure): Alarm Logs, Fault Log, and Debug Logs. Additionally, there may be many other kinds of Logs that might available as well, such as Trace Logs, Security Logs, Informational Logs, and Maintenance Logs among others. See O-RAN WG6.O2-GA&P [24], clause 3.8.19 for more details.

The Service Operation is filter driven which allows a requestor to retrieve Log data of interest. Log events are time and date stamped and Log events have a severity and source. Thus, these serve as a basis for Log querying and the filter in the Service Operation. For example, using a filter, an entity invoking the service operation could request for all the alarm logs in the O-Cloud within a certain date range or a log level.

Logs can be used for a variety of purposes. The Log Query Service Operation facilitates system probing, troubleshooting assistance, network optimization, and network investigation (forensics). Logs can be used for system probing to deduce an operational view of the system. For example, an entity could query for logged faults and alarms that have not been cleared.

Logs of interest produced in the O-Cloud can be retrieved by the consumer as in a pull paradigm. If a consumer wants to retrieve logs, the callback is given in the Log Query operation. When the Logs are ready, the callback is used as a notification endpoint for the O-Cloud to inform the consumer that the Logs are ready to be pulled. In a large distribute cloud native system, it can take a long time to write or move Logs, hence the callback is used as a notification mechanism to a consumer.

Logs of interest can also be delivered by the producer as in a push paradigm. In this case, the consumer will provide a *Remote File Location* (as an attribute in the operation) that the producer (O-Cloud) can upload the logs of interest to. Here, the callback is the endpoint where the Log File Ready notification is sent. This informs the consumer that the log files have been uploaded. In the push paradigm, what happens to the files after the producer sends the log files to the remote file location is implementation specific.

The Logging Capability Query use case permits an entity to query for the types of Logs that are supported by the O-Cloud.

NOTE: It is up to the protocol and data model specification to determine the one or various protocol operations enabling the authorized consumer to retrieve the O-Cloud information.

The Log Query Service Operation follows a request, response, and notification service pattern. Table 2.1.8.2.2-1 lists the information flow exchanged between the SMO and the O-Cloud.

Table 2.1.8.2.2-1: O2ims_InfrastructureLoggingQuery operation

Message	Direction
InfrastructureLoggingQueryRequest	SMO → O-Cloud
InfrastructureLoggingQueryResponse	O-Cloud → SMO
FileReadyNotification	O-Cloud → SMO

The Log Query Service Operation request has input parameters that are sent when invoking the operation. These shall support the means to specify different aspects of the Querying Logs of interest for to the requestor:

- **Log Type** – This allows a consumer to specify the types of Log(s) to retrieve. These might include, but are not limited to Alarm Logs, Fault Logs, Debug Logs. Other logs could be described in this input parameter as well. See O-RAN WG6.O2-GA&P [24], clause 3.8.19 for Log type concepts.
- **Date Ranges** – This parameter specifies a range of dates for entries in the Log type(s) of interest.
- **Types of Events** – The Event Type(s) can be specified as an input. Log(s) containing entries with certain types of events of interest to the requestor can be specified as an input.
- **Resources** – The Resources and Resource Types can be specified as an input. Log(s) containing entries from certain types of Resources or Resource Types of interest to the requestor can be specified.
- **Log Level (Severity)** – The Logging Level(s) can be specified as an input parameter. This would result in a Query for Logs with entries matching certain Logging Level(s) in the requested Log Type(s) of interest. See O-RAN WG6.O2-GA&P [24], clause 3.8.20 for the Log Level concept.
- **Callback** – This provides an endpoint to send “log ready” notifications to. It is given by a requesting entity so that the O-Cloud can send Log Query related notifications to.
- **Remote File Location (Optional)** – The consumer can provide a URI location where the logs of interest can be uploaded to in a push paradigm. If a Remote File Location is provided, the files of interest to the consumer will be uploaded to that location and a file list would be returned in the response with a file available notification using the Callback provided.

For example, the Log Query filters in the request may include input parameters specifying the date (ranges), types of logs, types of events, log level (severity), resource(s), or resource type(s) of interest to the consumer.

The Log Query service operation can experience three exceptions as follows:

- **Non-Existing Logs** – This exception occurs when the Log Query service operation results in a query for non-existent log(s). In this case, an object not found is returned for the operation.
- **No Content** – The Log Query service operation may have a Log Query filter that returns an empty set. This would return a failure from the operation.
- **Unable to Parse** – This exception happens when the records are unavailable for parsing or retrieval by the producer. This might occur because the Log File is corrupt, has been moved, or deleted.

The full requirements definitions can be found in O-RAN WG6.ORCH-USE-CASES [23], clause 4.3. The following identifiers uniquely specify the requirements applicable to the producer (O-Cloud) for this operation: [REQ-ORC-O2-36].

3 API definitions

3.1 General aspects

3.1.1 Introduction

The present document defines the protocol and data model for the following O2ims service interfaces in the form of RESTful Application Programming Interface (API) specifications:

- O2ims_InfrastructureInventory Service API (as produced by the O-Cloud towards the SMO)
- O2ims_InfrastructureMonitoring Service API (as produced by the O-Cloud towards the SMO)
- O2ims_InfrastructureProvisioning Service API (as produced by the O-Cloud towards the SMO)
- O2ims_InfrastructureSoftwareManagement Service API (as produced by the O-Cloud towards the SMO)
- O2ims_InfrastructureLifecycleManagement Service API (as produced by the O-Cloud towards the SMO)
- O2ims_InfrastructurePerformance Service API (as produced by the O-Cloud towards the SMO)
- O2ims_InfrastructureLogging Service API (as produced by the O-Cloud towards the SMO)

Table 3.1.1-1 lists the versions of the APIs defined in the present document.

Table 3.1.1-1: Versions of the APIs specified in the present document

Service API	API version
O2ims_InfrastructureInventory Service API	2.0.0
O2ims_InfrastructureMonitoring Service API	2.0.0
O2ims_InfrastructureProvisioning Service API	1.1.0
O2ims_InfrastructureSoftwareManagement Service API	TBD
O2ims_InfrastructureLifecycleManagement Service API	1.0.0
O2ims_InfrastructurePerformance Service API	2.0.0
O2ims_InfrastructureLogging Service API	TBD

The design of the protocol and data model for the above interfaces is based on the information model and requirements defined in [36]. In clause 3, general aspects are specified that apply to multiple APIs for O2ims services. In addition, the provisions in clauses 3.1.2, 3.1.3, 3.1.4, 3.1.5, 3.1.6, 3.1.7, and 3.1.8 define common aspects of RESTful APIs, and shall apply for all APIs defined in the present document.

In the subsequent clauses, the protocol and data model for the individual interfaces are specified. Per interface, 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.

Even though the different interfaces defined in the present document are related, implementations shall not assume a particular order of messages that arrive via different interfaces.

3.1.2 URI structure and supported content formats

This clause specifies the URI prefix and the supported formats applicable to the O2ims RESTful APIs.

All resource URIs of the APIs shall have the following prefix, except the "API versions" resource which shall follow the rules specified in clause 9.3 of ETSI GS NFV-SOL 013 [22]:

{apiRoot}/{apiName}/<apiMajorVersion>/

The request URIs used in HTTP requests from the API service consumer towards the API service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [11], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 4.4.1 of 3GPP TS 29.501 [11].
- The <apiName> indicates the API name of the service interface in an abbreviated form. The {apiName} of each interface is defined in the clause specifying the corresponding O2ims RESTful API.
- The <apiMajorVersion> indicates the current major version of the API and is defined in the clause specifying the corresponding O2ims RESTful API.
- The <apiSpecificResourceUriPart> indicates a resource URI of the API, and shall be set as described in the corresponding O2ims RESTful API for each one of the defined resources.

Either HTTP/2, as defined in IETF RFC 7540 [19], or HTTP/1.1, as defined in IETF RFC 7230 [30] shall be used.

The Transmission Control Protocol (TCP) as specified in IETF RFC 793 [31] shall be used as transport protocol for HTTP/2 and HTTP/1.1.

For HTTP requests and responses that have a body, the content format JSON (see IETF RFC 8259 [20]) shall be supported. The JSON format shall be signalled by the content type "application/json".

All APIs shall support and use HTTP over TLS (also known as HTTPS) (see IETF RFC 2818 [32]). At least support TLS version 1.2 but recommended to support TLS version 1.3 as defined by IETF RFC 5246 [33] shall be supported.

NOTE 1: The HTTP protocol elements mentioned in the O2ims RESTful APIs originate from the HTTP specification; HTTPS runs the HTTP protocol on top of a TLS layer. For simplicity, the O2ims RESTful APIs specifications therefore use the statement above to mention "HTTP request", "HTTP header", etc., without explicitly calling out HTTPS.

NOTE 2: There are a number of best practices and guidelines how to configure and implement TLS 1.2 in a secure manner, as security threats evolve. A detailed specification of those is beyond the scope of the present document; the reader is referred to external documentation such as annex E of ETSI TS 133 310 [35].

All resource URIs of the API shall comply with the URI syntax as defined in IETF RFC 3986 [34]. An implementation that dynamically generates resource URI parts (individual path segments, sequences of path segments that are separated by "/", query parameter values) shall ensure that these parts only use the character set that is allowed by IETF RFC 3986 [34] for these parts.

NOTE 3: This means that characters not part of this allowed set are escaped using percent-encoding as defined by IETF RFC 3986 [34].

Unless otherwise specified explicitly, all request URI parameters that are part of the path of the resource URI shall be individual path segments, i.e., shall not contain the "/" character.

NOTE 4: A request URI parameter is denoted by a string in curly brackets, e.g. {fooId}.

3.1.3 Usage of HTTP header fields

3.1.3.1 General

HTTP headers are components of the header section of the HTTP request and response messages. They contain the information about the server/client and metadata of the transaction. The use of HTTP header fields shall comply with the provisions defined for those header fields in the specifications referenced from tables 3.1.3.2-1 and 3.1.3.3-1. The following clauses describe more details related to selected HTTP header fields.

3.1.3.2 Request header fields

This clause describes the usage of selected HTTP header fields of the request messages in the O2ims RESTful APIs. The HTTP header fields used in the request messages that shall be supported are specified in table 3.1.3.2-1.

Table 3.1.3.2-1: Header fields supported in the request message

Header field name	Reference	Example	Descriptions
Accept	IETF RFC 7231 [ref-rfc7231]	application/json	Content-Types that are acceptable for the response. This header field shall be present if the response is expected to have a non-empty message body.
Content-Type	IETF RFC 7231 [ref-rfc7231]	application/json	The MIME type of the body of the request. This header field shall be present if the request has a non-empty message body.
Authorization	IETF RFC 7235 [ref-rfc7235]	Bearer mF_9.B5f-4.1JqM	The authorization token for the request.
Range	IETF RFC 7233 [ref-rfc7233]	1 000-2 000	Requested range of bytes from a file.
Version	IETF RFC 4229 [ref-rfc4229]	1.2.0 or 1.2.0-impl:example.com:myProduct:4	Version of the API requested to use when responding to this request.

3.1.3.3 Response header fields

This clause describes the usage of selected HTTP header fields of the response messages in the O2ims RESTful APIs. The HTTP header fields used in the response messages are specified in table 3.1.3.3-1.

Table 3.1.3.3-1: Header fields supported in the response message

Header field name	Reference	Example	Descriptions
Content-Type	IETF RFC 7231 [ref-rfc7231]	application/json	The MIME type of the body of the response. This header field shall be present if the response has a non-empty message body.
Location	IETF RFC 7231 [ref-rfc7231]	http://www.example.com/apiname/v1/objects/123	Used in redirection, or when a new resource has been created. This header field shall be present if the response status code is 201 or 3xx. In the O2ims RESTful APIs this header field is also used if the response status code is 202 and a new resource was created.
WWW-Authenticate	IETF RFC 7235 [ref-rfc7235]	Bearer realm="example"	Challenge if the corresponding HTTP request has not provided authorization, or error details if the corresponding HTTP request has provided an invalid authorization token.
Accept-Ranges	IETF RFC 7233 [ref-rfc7233]	bytes	Used by the server to signal whether or not it supports ranges for certain resources.
Content-Range	IETF RFC 7233 [ref-rfc7233]	bytes 21 010 - 47 021/47 022	Signals the byte range that is contained in the response, and the total length of the file.

Header field name	Reference	Example	Descriptions
Retry-After	IETF RFC 7231 [ref-rfc7231]	Fri, 31 Dec 1999 23:59:59 GMT or 120	Used to indicate how long the user agent ought to wait before making a follow-up request. It can be used with 503 responses. The value of this field can be an HTTP-date or a number of seconds to delay after the response is received.
Link	IETF RFC 8288 [ref-rfc8288]	<http://example.com/resources?nextpage_opaque_marker=abc123>; rel="next"	Reference to other resources. Used for paging in the present document, see clause 3.1.4.
Version	IETF RFC 4229 [ref-rfc4229]	1.2.0 or 1.2.0-impl:example.com:myProduct:4	Version of the API requested to use when responding to this request.

3.1.4 Result set control

3.1.4.1 Introduction

This clause specifies procedures that allow to control the size of the result set of GET requests w.r.t. the number of entries in a response list (using attribute-based filtering) or w.r.t. the number of attributes returned in a response (using attribute selection).

3.1.4.2 Attribute-based filtering and selector

The use of attribute-based filtering shall be supported by O2ims RESTful APIs as specified in clause 5.2.2 and 5.3.2 of ETSI GS NFV-SOL 013 [22].

NOTE: ETSI GS NFV-SOL 013 [22] refers to "RESTful NFV-MANO API" specification; and wherever such reference is provided "O2ims RESTful API" is to be considered instead for the purpose of the present document.

3.1.4.3 Handling of large query results

The handling of large query results shall be supported by O2ims RESTful APIs as specified in clause 5.4.2 of ETSI GS NFV-SOL 013 [22].

3.1.5 Error reporting

In RESTful interfaces, application errors are mapped to HTTP errors. Since HTTP error information is generally not enough to discover the root cause of the error, additional application specific error information is typically delivered.

The error reporting shall be supported by O2ims RESTful APIs as specified in clause 6 of ETSI GS NFV-SOL 013 [22].

NOTE: ETSI GS NFV-SOL 013 [22] refers to "RESTful NFV-MANO API" specification; and wherever such reference is provided "O2ims RESTful API" is to be considered instead for the purpose of the present document.

3.1.6 Common data types

3.1.6.1 Structured data types

3.1.6.1.1 Introduction

This clause defines data structures that are referenced from data structures in multiple O2ims RESTful APIs.

3.1.6.1.2 Type: Object

An object contains structured data and shall comply with the provisions of clause 4 of IETF RFC 8259 [20].

3.1.6.1.3 Type: Link

This type represents a link to a resource using an absolute URI. It shall comply with the provisions defined in table 7.1.3-1.

Table 3.1.6.1.3-1: Definition of the Link data type

Attribute name	Data type	Cardinality	Description
href	Uri	1	URI of another resource referenced from a resource. Shall be an absolute URI (i.e. a URI that contains {apiRoot}).

3.1.6.1.4 Type: NotificationLink

This type represents a link to a resource in a notification, using an absolute or relative URI. It shall comply with the provisions defined in table 3.1.6.1.4-1.

Table 3.1.6.1.4-1: Definition of the NotificationLink data type

Attribute name	Data type	Cardinality	Description
href	Uri	1	URI of a resource referenced from a notification. Should be an absolute URI (i.e. a URI that contains {apiRoot}), however, may be a relative URI (i.e. a URI where the {apiRoot} part is omitted) if the {apiRoot} information is not available.

3.1.6.1.5 Type: KeyValuePairs

This type represents a list of key-value pairs. The order of the pairs in the list is not significant. In JSON, a set of key-value pairs is represented as an object. It shall comply with the provisions defined in clause 4 of IETF RFC 8259 [20]. In the following example, a list of key-value pairs with four keys ("aString", "aNumber", "anArray" and "anObject") is provided to illustrate that the values associated with different keys can be of different type.

EXAMPLE:

```
{
  "aString" : "O2ims service",
  "aNumber" : 0.03,
  "anArray" : [1,2,3],
  "anObject" : {"organization" : "O-RAN", workingGroup" : "WG6"}
}
```

3.1.6.1.6 Type: ApiVersionInformation

This type represents API version information. It shall comply with the provisions defined in table 3.1.6.1.6-1.

Table 3.1.6.1.6-1: ApiVersionInformation data type

Attribute name	Data type	Cardinality	Description
uriPrefix	String	1	Specifies the URI prefix for the API, in the following form {apiRoot}/{apiName}/{apiMajorVersion}/.
apiVersions	Structure (inlined)	1..N	Version(s) supported for the API signaled by the uriPrefix attribute.
>version	String	1	Identifies a supported version. The value of the version attribute shall be a version identifier as specified in clause 3.1.6.2.
>isDeprecated	Boolean	0..1	If such information is available, this attribute indicates whether use of the version signaled by the version attribute is deprecated (true) or not (false). See note.
>retirementDate	DateTime	0..1	The date and time after which the API version will no longer be supported. This attribute may be included if the value of the isDeprecated attribute is set to true and shall be absent otherwise.
NOTE: A deprecated version is still supported by the API producer but is recommended not to be used any longer. When a version is no longer supported, it does not appear in the response body.			

3.1.6.2 Simple data types and enumerations

3.1.6.2.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in multiple interfaces.

3.1.6.2.2 Simple data types

Table 3.1.6.2.2-1 lists the simple data types that are referenced from multiple interfaces.

Table 3.1.6.2.2-1: Simple data types

Type name	Description
Identifier	An identifier with the intention of being globally unique. Representation: string of variable length. See note 1.
DateTime	A date-time stamp. Representation: String formatted as defined by the date-time production in IETF RFC 3339 [43].
Uri	A string formatted according to IETF RFC 3986 [34].
Boolean	A data type having two values (true and false).
IpAddress	An IPV4 or IPV6 address. Representation: In case of an IPV4 address, string that consists of four decimal integers separated by dots, each integer ranging from 0 to 255. In case of an IPV6 address, string that consists of groups of zero to four hexadecimal digits, separated by colons.
Version	A version. Representation: string of variable length.
String	A string as defined in IETF RFC 8259 [20].
Number	A number as defined in IETF RFC 8259 [20].
Integer	An integer, i.e. a number that cannot have a fractional component. See note 2.
UnsignedInt	An unsigned integer, i.e. an integer that can't assume negative values. See note 2.
Point	A geometry object as defined in IETF RFC 7946 [44].
NOTE 1: Individual API specifications are assumed to define types for additional identifiers with dedicated scope (e.g. identifiers scoped by some O-Cloud).	
NOTE 2: In the JSON instance data model, only the concept of a "number" is used to represent numerical data. Numbers in JSON can be integral, i.e. have no fractional part, or can include a fractional part. The additional numeric types defined in the present document represent constraints on the general "number" type present in JSON instances which can be enforced e.g. during parsing when processing the JSON instance or expressed as constraints in modelling languages such as JSON Schema [ref-json-schema] or OpenAPI [ref-openapi].	

3.1.7 Security

3.1.7.1 Introduction

The current version of the present document mandates compliance with the authorization mechanisms outlined in the O-RAN.WG11.TS.SecProtSpec [46] for handling API requests and notifications specified herein, to ensure alignment with the following best practices and guidelines:

- O-RAN.WG11.TS.SecProtSpec [46] clause 4.10 for HTTP over TLS (HTTPS),
- O-RAN.WG11.TS.SecProtSpec [46] clause 4.7 for OAuth 2.0 framework and token usage.

3.1.8 Version management

3.1.8.1 Version identifiers and parameters

API version identifiers and rules for incrementing version identifier fields shall be supported by O2ims RESTful APIs as specified in clause 9.1 and 9.2 of ETSI GS NFV-SOL 013 [22].

NOTE: ETSI GS NFV-SOL 013 [22] refers to "RESTful NFV-MANO API" specification and OpenAPI specification that ETSI publishes; and wherever such reference is provided "O2ims RESTful API" and OpenAPI that O-RAN publishes is to be considered instead for the purpose of the present document.

Clause 9.2.2 of ETSI GS NFV-SOL 013 [22] provides examples of backward and non-backward compatible changes.

3.1.8.2 Version information retrieval and signaling

The API producer shall support the dedicated URIs to enable API consumers to retrieve information about API versions supported by an API producer as specified in clause 9.3 of ETSI GS NFV-SOL 013 [22], and the API consumer shall include the "Version" HTTP header in each HTTP request as specified in clause 9.4 of ETSI GS NFV-SOL 013 [22].

NOTE: ETSI GS NFV-SOL 013 [22] refers to "RESTful NFV-MANO API" specification; and wherever such reference is provided "O2ims RESTful API" is to be considered instead for the purpose of the present document.

3.2 O2ims_InfrastructureInventory Service API

3.2.1 Description

This API allows the SMO to invoke O2ims_InfrastructureInventory Services towards the O-Cloud.

The operations defined for O2ims_InfrastructureInventory Services through this API are:

- Query information about one or multiple Resource Type
- Query information about one or multiple Resource Pool
- Query information about one or multiple Resource
- Query information about one or multiple Deployment Manager
- Query information about one or multiple Subscriptions
- Query information about one or multiple Alarm Dictionary
- Query information about one or multiple Performance Dictionary
- Query information about one or multiple Location
- Query information about one or multiple O-Cloud Site

- Notify consumer identified by an established subscription which is not filtered by the filter criteria of the occurrence of a change to the infrastructure inventory objects

3.2.2 API version

For the O2ims_InfrastructureInventory Service API version as specified in the present document, the MAJOR version field shall be 2, the MINOR version field shall be 0, and the PATCH version field shall be 0.

Table 3.2.2-1 lists the history of API versions of the O2ims_InfrastructureInventory Service and the main capabilities added/removed across versions.

Table 3.2.2-1: History of API versions of the O2ims_InfrastructureInventory Service.

Version	Description
1.0.0	Initial API Supporting: O-Cloud Description Resource Type List Resource Type Description Resource Pool List Resource Pool Description Resource List Resource Description Deployment Manager List Deployment Manager Description Inventory Subscription List Inventory Subscription Description
1.1.0	Modified method: Inventory Subscription Description New resources: Performance Dictionary Alarm Dictionary Alarm Dictionary List Performance Dictionary List
1.2.0	Modified Data Type: ResourceTypeInfo
2.0.0	New resources: Location List Location Description O-Cloud Site List O-Cloud Site Description Modified Data Types: ResourcePoolInfo CloudInfo InventorySubscriptionInfo

3.2.3 REST resources structure and methods

All resource URIs of the API shall use the base URI specification defined in clause 3.1.2. The string "O2ims_infrastructureInventory" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the formed base URI (i.e., {apiRoot}/O2ims_infrastructureInventory/{apiVersion}).

When ambiguity is possible, the term REST resource is used to make the distinction between the term resource as understood within the context of REST API from the term resource as understood within the context of O-RAN.

Figure 3.2.3-1 shows the overall resource URI structure defined for the O2ims_InfrastructureInventory Service API.

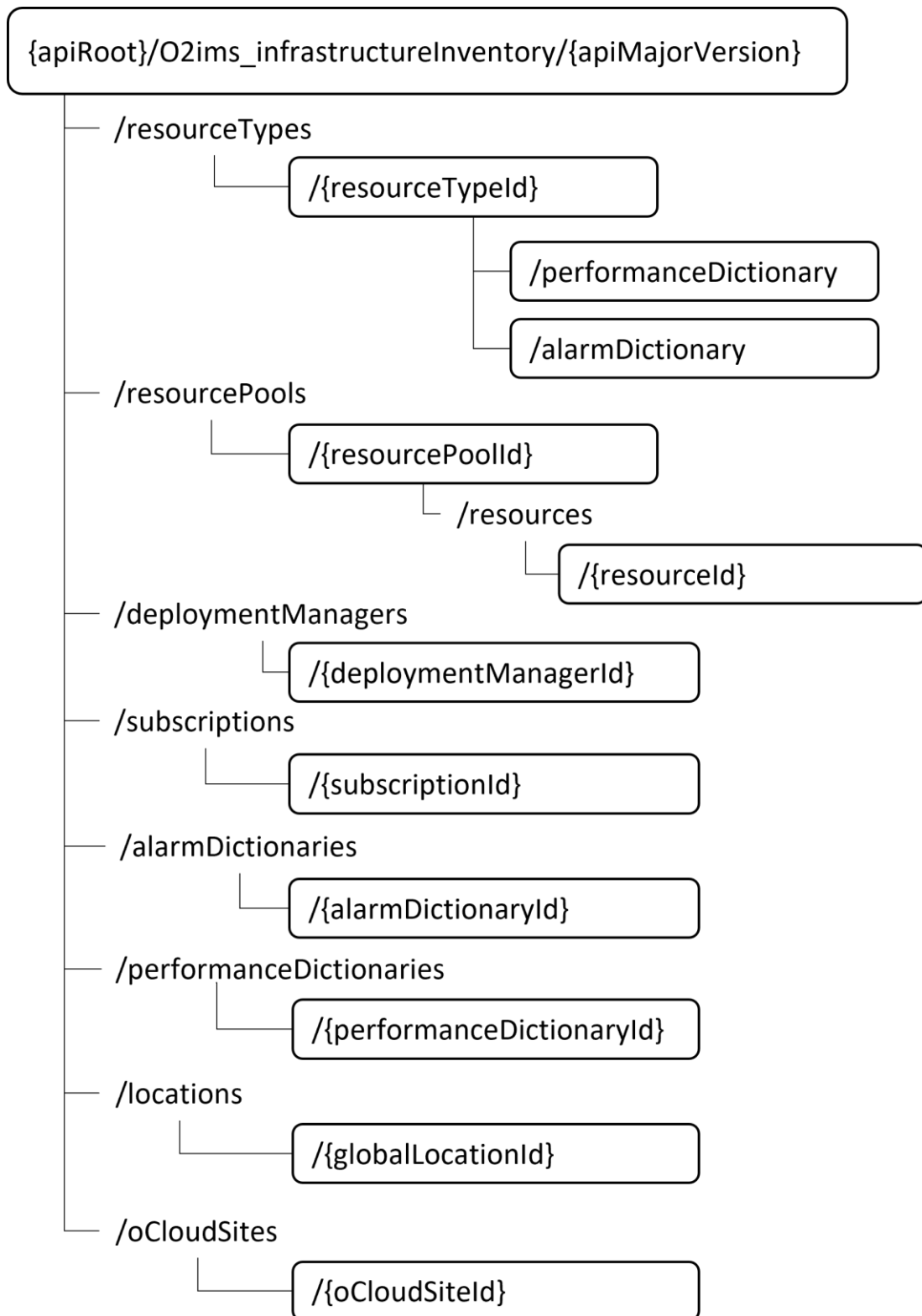


Figure 3.2.3-1 Resource URI structure of the O2ims_infrastructureInventory API

Table 3.2.3-1 provides an overview of the resources and applicable HTTP methods.

The O-Cloud shall support responding to requests for all HTTP methods on the resources in Table 3.2.3-1 that are marked as "M" (mandatory) in the "Cat" column. The O-Cloud shall also support the "API versions" resources as specified in clause 3.1.8.

Table 3.2.3-1 Resources and methods overview

Resource name	Resource URI	HTTP method	Cat	Description
O-Cloud Description	/	GET	M	To get the attributes of the O-Cloud instance
Resource Type List	/resourceTypes	GET	M	To get a list of resource types
Resource Type Description	/resourceTypes/{resourceTypeId}	GET	M	To get an individual resource type description
Performance Dictionary	/resourceTypes/{resourceTypeId}/performanceDictionary /performanceDictionaries/{performanceDictionaryId}	GET	M	To get the Performance Dictionary
Alarm Dictionary	/resourceTypes/{resourceTypeId}/alarmDictionary /alarmDictionaries/{alarmDictionaryId}	GET	M	To get the Alarm Dictionary
Resource Pool List	/resourcePools	GET	M	To get a list of resource pools
Resource Pool Description	/resourcePools/{resourcePoolId}	GET	M	To get an individual resource pool description
Resource List	/resourcePools/{resourcePoolId}/resources	GET	M	To get a list of resources in the resource pool
Resource Description	/resourcePools/{resourcePoolId}/resources/{resourceId}	GET	M	To get an individual resource description
Deployment Manager List	/deploymentManagers	GET	M	To get a list of deployment managers
Deployment Manager Description	/deploymentManagers/{deploymentManagerId}	GET	M	To get an individual deployment manager description
Inventory Subscription List	/subscriptions	GET	M	To get a list of subscriptions
Inventory Subscription List	/subscriptions	POST	M	To create an individual subscription
Inventory Subscription Description	/subscriptions/{subscriptionId}	GET	M	To get an individual subscription description
Inventory Subscription Description	/subscriptions/{subscriptionId}	DELETE	M	To delete an individual subscription
Alarm Dictionary List	/alarmDictionaries	GET	M	To get the list of individual Dictionaries that qualify
Performance Dictionary List	/performanceDictionaries	GET	M	To get the list of individual Performance Dictionaries that qualify
Location List	/locations	GET	M	To get a list of locations
Location Description	/locations/{globalLocationId}	GET	M	To get an individual location description
O-Cloud Site List	/oCloudSites	GET	M	To get a list of O-Cloud sites
O-Cloud Site Description	/oCloudSites/{oCloudSiteId}	GET	M	To get an individual O-Cloud site description

3.2.4 REST resources

3.2.4.1 Introduction

There are no preconditions or postconditions for a successful execution of each of the O2ims_InfrastructureInventory Service API triggered by an operation.

3.2.4.2 REST resource: Resource Type List

3.2.4.2.1 Description

This resource represents the list of resource types that the O-Cloud is designed to support. The Resource Type List contains Resource Type Descriptions.

3.2.4.2.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourceTypes

This resource shall support the resource URI variables defined in Table 3.2.4.2.2-1.

Table 3.2.4.2.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 3.1.2
apiMajorVersion	string	See clause 3.1.2

3.2.4.2.3 Resource methods

3.2.4.2.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.2.3.2 GET

The GET operation is used to retrieve the list of resource type.

This method shall support the URI query parameters specified in Table 3.2.4.2.3.2-1.

Table 3.2.4.2.3.2-1 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 [22]. The O-Cloud 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 ResourceTypeInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of ResourceTypeInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.2.3.2-2.

Table 3.2.4.2.3.2-2: 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
	ResourceTypeInfo	0..N	200 OK	<p>Shall be returned when information about zero or more ResourceTypeInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more ResourceTypeInfo instances, as defined in clause 3.2.6.2.2.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.2.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.2.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.2.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.3 REST resource: Resource Type Description

3.2.4.3.1 Description

This resource represents the description of a resource type. The Resource Type Description is a record of the attributes. The record contains mandatory fields and allows for non-standard attributes to also be inventoried.

3.2.4.3.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourceTypes/{resourceTypeId}

This resource shall support the resource URI variables defined in Table 3.2.4.3.2-1.

Table 3.2.4.3.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
resourceTypeId	Identifier	The identifier of the Resource Type Description resource. See note.
NOTE: This identifier can be retrieved from the resourceTypeId attribute in the payload body of the response to a GET request getting the list of "ResourceType" resources.		

3.2.4.3.3 Resource methods

3.2.4.3.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.3.3.2 GET

The GET operation is used to retrieve the resource type description of a single resource type.

This method shall support the URI query parameters specified in Table 3.2.4.3.3.2-1.

Table 3.2.4.3.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.3.3.2-2.

Table 3.2.4.3.3.2-2: 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
	ResourceTypeInfo	1	200 OK	Shall be returned when information about a ResourceTypeInfo instance has been queried successfully. The response body shall contain a representation of the ResourceTypeInfo instance, as defined in clause 3.2.6.2.2.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.4 REST resource: Resource Pool List

3.2.4.4.1 Description

This resource represents the list of Resource Pools that the O-Cloud has resource deployed to. The Resource Pool List contains Resource Pool Descriptions.

3.2.4.4.2 Resource definition

Resource URI: **{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourcePools**

This resource shall support the resource URI variables defined in Table 3.2.4.4.2-1.

Table 3.2.4.4.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.4.3 Resource methods

3.2.4.4.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.4.3.2 GET

The GET operation is used to retrieve the list of resource pools.

This method shall support the URI query parameters specified in Table 3.2.4.4.3.2-1.

Table 3.2.4.4.3.2-1 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 [22]. The O-Cloud 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 ResourcePoolInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of ResourcePoolInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.4.3.2-2.

Table 3.2.4.4.3.2-2: 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
	ResourcePoolInfo	0..N	200 OK	<p>Shall be returned when information about zero or more ResourcePoolInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more ResourcePoolInfo instances, as defined in clause 3.2.6.2.3.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.5 REST resource: Resource Pool Description

3.2.4.5.1 Description

The Resource Pool Description represents the description of a resource pool. This includes some mandatory attributes and allows for extended attributes as well.

3.2.4.5.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourcePools/{resourcePoolId}

This resource shall support the resource URI variables defined in Table 3.2.4.5.2-1.

Table 3.2.4.5.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
resourcePoolId	Identifier	The identifier of the Resource Pool Description resource. See note.
NOTE: This identifier can be retrieved from the resourcePoolId attribute in the payload body of the response to a GET request getting the list of "ResourcePool" resources.		

3.2.4.5.3 Resource methods

3.2.4.5.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.5.3.2 GET

The GET operation is used to retrieve the resource pool description of a single resource pool.

This method shall support the URI query parameters specified in Table 3.2.4.5.3.2-1.

Table 3.2.4.5.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.5.3.2-2.

Table 3.2.4.5.3.2-2: 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
	ResourcePoolInfo	1	200 OK	Shall be returned when information about a ResourcePoolInfo instance has been queried successfully. The response body shall contain a representation of the ResourcePoolInfo instance, as defined in clause 3.2.6.3.2.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.5.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.6 REST resource: Resource List

3.2.4.6.1 Description

This resource represents the list of resources in a specific Resource Pool. The Resource List contains Resource Descriptions.

3.2.4.6.2 Resource definition

Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourcePools/{resourcePoolId}/resources

This resource shall support the resource URI variables defined in Table 3.2.4.6.2-1.

Table 3.2.4.6.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
resourcePoolId	Identifier	The identifier of the Resource Pool Description resource. See note.
NOTE: This identifier can be retrieved from the resourcePoolId attribute in the payload body of the response to a GET request getting the list of "ResourcePool" resources.		

3.2.4.6.3 Resource methods

3.2.4.6.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.6.3.2 GET

The GET operation is used to retrieve the list of resource descriptions in the specific Resource Pool.

This method shall support the URI query parameters specified in Table 3.2.4.6.3.2-1.

Table 3.2.4.6.3.2-1 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 [22] . The O-Cloud 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 ResourceInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of ResourceInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.6.3.2-2.

Table 3.2.4.6.3.2-2: 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
	ResourceInfo	0..N	200 OK	<p>Shall be returned when information about zero or more ResourceInfo instances has been queried successfully. The response body shall contain in an array the representations of zero or more ResourceInfo instances, as defined in clause 3.2.6.2.4.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>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.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.6.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.6.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.6.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.7 REST resource: Resource Description

3.2.4.7.1 Description

The Resource Description represents the description of an individual resource instance in a resource pool. This includes some mandatory attributes including a reference to the Resource Type that defines it and allows for extended attributes as well.

3.2.4.7.2 Resource definition

Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourcePools/{resourcePoolId}/resources/{resourceId}

This resource shall support the resource URI variables defined in Table 3.2.4.7.2-1.

Table 3.2.4.7.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 4.1.1
apiMajorVersion	String	See clause 3.1.2
resourcePoolId	Identifier	The identifier of the Resource Pool Description resource. See note1.
resourceId	Identifier	The identifier of the Resource in the Resource Pool. See note2.
NOTE 1: This identifier can be retrieved from the resourcePoolId attribute in the payload body of the response to a GET request getting the list of "ResourcePool" resources.		
NOTE 2: This identifier can be retrieved from the resourceId attribute in the payload body of the response to a GET request getting the list of "ResourcePoolDescription" resources.		

3.2.4.7.3 Resource methods

3.2.4.7.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.7.3.2 GET

The GET operation is used to retrieve the resource description of an individual resource instance in a resource pool.

This method shall support the URI query parameters specified in Table 3.2.4.7.3.2-1.

Table 3.2.4.7.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.7.3.2-2.

Table 3.2.4.7.3.2-2: 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
	ResourceInfo	1	200 OK	Shall be returned when information about a ResourceInfo instance has been queried successfully. The response body shall contain a representation of the ResourceInfo instance, as defined in clause 3.2.6.2.4.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.7.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.7.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.8 REST resource: Deployment Manager List

3.2.4.8.1 Description

This resource represents the set of Deployment Managers in the O-Cloud the SMO can use for managing Deployments. The Deployment Manager List contains Deployment Manager Descriptions.

3.2.4.8.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/deploymentManagers

This resource shall support the resource URI variables defined in Table 3.2.4.8.2-1.

Table 3.2.4.8.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.8.3 Resource methods

3.2.4.8.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.8.3.2 GET

The GET operation is used to retrieve the list of deployment manager.

This method shall support the URI query parameters specified in Table 3.2.4.8.3.2-1.

Table 3.2.4.8.3.2-1 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 [22] . The O-Cloud 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 DeploymentManagerInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of DeploymentManagerInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.8.3.2-2.

Table 3.2.4.4.3.2-2: 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
	DeploymentManagerInfo	0..N	200 OK	<p>Shall be returned when information about zero or more DeploymentManagerInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more DeploymentManagerInfo instances, as defined in clause 3.2.6.2.5.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.8.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.8.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.8.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.9 REST resource: Deployment Manager Description

3.2.4.9.1 Description

The Deployment Manager Description represents the description of a Deployment Manager instance in the O-Cloud. This includes some mandatory attributes including a reference to the capabilities that defines it and allows for extended attributes as well.

3.2.4.9.2 Resource definition

Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/deploymentManagers/{deploymentManagerId}

This resource shall support the resource URI variables defined in Table 3.2.4.9.2-1.

Table 3.2.4.9.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
deploymentManagerId	Identifier	The identifier of the Deployment Manager Description resource.
NOTE: This identifier can be retrieved from the deploymentManagerId attribute in the payload body of the response to a GET request getting the list of "DeploymentManagerInfo" resources.		

3.2.4.9.3 Resource methods

3.2.4.9.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.9.3.2 GET

The GET operation is used to retrieve the deployment manager description of a single deployment manager.

This method shall support the URI query parameters specified in Table 3.2.4.9.3.2-1.

Table 3.2.4.9.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.9.3.2-2.

Table 3.2.4.9.3.2-2: 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
	DeploymentManagerInfo	1	200 OK	Shall be returned when information about a DeploymentManagerInfo instance has been queried successfully. The response body shall contain a representation of the DeploymentManagerInfo instance, as defined in clause 3.2.6.2.2.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.9.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.9.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.9.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.10 REST resource: Cloud Description

3.2.4.10.1 Description

This resource represents the attributes of the O-Cloud instance and provides the Cloud Description.

3.2.4.10.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/

This resource shall support the resource URI variables defined in Table 3.2.4.10.2-1.

Table 3.2.1.10.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 3.1.2
apiMajorVersion	string	See clause 3.1.2

3.2.4.10.3 Resource methods

3.2.4.10.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.10.3.2 GET

The GET operation is used to retrieve the O-Cloud description.

This method shall support the URI query parameters specified in Table 3.2.4.10.3.2-1.

Table 3.2.4.10.3.2-1 URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
all_fields	0..1	Include all complex attributes in the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of ResourceTypeInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.10.3.2-2.

Table 3.2.4.10.3.2-2: 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
	OCloudInfo	1	200 OK	Shall be returned when information for the OCloudInfo has been queried successfully. The response body shall contain a representation of the OCloudInfo instance, as defined in clause 3.2.6.2.6.
	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. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.10.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.10.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.10.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.11 REST resource: Inventory Subscription List

3.2.4.11.1 Description

This resource represents the set of Inventory Subscriptions in the O-Cloud the SMO can use for being notified when certain changes in the inventory object occur. The Inventory Subscription List contains Inventory Subscription Descriptions.

3.2.4.11.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/subscriptions

This resource shall support the resource URI variables defined in Table 3.2.4.11.2-1.

Table 3.2.4.11.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.11.3 Resource methods

3.2.4.11.3.1 POST

The POST operation is used to create an inventory subscription.

This method shall support the URI query parameters specified in Table 3.2.4.11.3.1-1.

Table 3.2.4.11.3.1-1 URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.11.3.1-2.

Table 3.2.4.11.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description		
	InventorySubscriptionInfo	1	The InventorySubscriptionInfo instance to be created as defined in clause 3.2.6.2.7. Note: The supplied SubscriptionId is ignored and assigned by the O-Cloud.		
Response body	Data type	Cardinality	Response Codes	Description	
	InventorySubscriptionInfo	1	201 Created	Shall be returned when information about a InventorySubscriptionInfo instance has been created successfully. The response body shall contain a representation of the InventorySubscriptionInfo instance, as defined in clause 3.2.6.2.7.	
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.	

3.2.4.11.3.2 GET

The GET operation is used to retrieve the list of inventory subscriptions.

This method shall support the URI query parameters specified in Table 3.2.4.11.3.2-1.

Table 3.2.4.11.3.2-1 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 [22] . The O-Cloud 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 InventorySubscriptionInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of InventorySubscriptionInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.11.3.2-2.

Table 3.2.4.11.3.2-2: 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
	InventorySubscriptionInfo	0..N	200 OK	<p>Shall be returned when information about zero or more InventorySubscriptionInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more InventorySubscriptionInfo instances, as defined in clause 3.2.6.2.7.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.11.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.11.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.11.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.12 REST resource: Inventory Subscription Description

3.2.4.12.1 Description

The Inventory Subscription Description represents the description of a subscription to inventory change events in the O-Cloud.

3.2.4.12.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/subscriptions/{subscriptionId}

This resource shall support the resource URI variables defined in Table 3.2.4.12.2-1.

Table 3.2.4.12.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
subscriptionId	Identifier	The identifier of the Inventory Subscription Description resource.
NOTE: This identifier can be retrieved from the subscriptionId attribute in the payload body of the response to a GET request getting the list of "InventorySubscriptionInfo" resources.		

3.2.4.12.3 Resource methods

3.2.4.12.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.12.3.2 GET

The GET operation is used to retrieve the inventory subscription description of a single inventory subscription.

This method shall support the URI query parameters specified in Table 3.2.4.12.3.2-1.

Table 3.2.4.12.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.12.3.2-2.

Table 3.2.4.12.3.2-2: 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
	InventorySubscriptionInfo	1	200 OK	Shall be returned when information about a InventorySubscriptionInfo instance has been queried successfully. The response body shall contain a representation of the InventorySubscriptionInfo instance, as defined in clause 3.2.6.2.7.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.12.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.12.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.2.4.12.3.5 DELETE

The DELETE operation is used to delete the inventory subscription description of a single inventory subscription.

This method shall support the URI query parameters specified in Table 3.2.4.12.3.5-1.

Table 3.2.4.12.3.5-1 URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.12.3.5-2.

Table 3.2.4.12.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	Data type	Cardinality	Response Codes	Description
	n/a	1	204	No content.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.13 REST resource: Alarm Dictionary

3.2.4.13.1 Description

The Alarm Dictionary REST resource dedicated to the Alarm Dictionary which describes alarms that are collected. The Alarm Dictionaries are integrated by the IMS in the O-Cloud and provided to the SMO for consumption.

3.2.4.13.2 Resource definition

3.2.4.13.2.1 Resource URI for Alarm Dictionaries

Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/alarmDictionaries/{alarmDictionaryId}

This resource shall support the resource URI variables defined in Table 3.2.4.13.2.1-1.

Table 3.2.4.13.2.1-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
alarmDictionaryId	Identifier	The alarmDictionaryId is a unique identifier that singles out an individual Alarm Dictionary of interest.
NOTE: This identifier can be retrieved from the alarmDictionaryId attribute in the payload body of the response to a GET request getting a "ResourceType" resource. It can also be retrieved from the payload body of the response to a GET request getting "AlarmDictionaries"		

3.2.4.13.2.2 Resource URI for Resource Type Alarm Dictionary

Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourceTypes/{resourceTypeId}/alarmDictionary

This resource shall support the resource URI variables defined in Table 3.2.4.13.2.2-1.

Table 3.2.4.13.2.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
resourceTypeId	Identifier	The identifier of the Resource Type Description resource. See Note.
NOTE: This identifier can be retrieved from the resourceTypeId attribute in the payload body of the response to a GET request getting the list of "ResourceType" resources.		

3.2.4.13.3 Resource methods

3.2.4.13.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.13.3.2 GET

The GET operation is used to retrieve a single dictionary.

This method shall support the URI query parameters specified in Table 3.2.4.13.3.2-1.

Table 3.2.4.13.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.13.3.2-2.

Table 3.2.4.13.3.2-2: 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
	AlarmDictionary	1	200 OK	Shall be returned when information about an AlarmDictionary instance has been queried successfully. The response body shall contain a representation of the AlarmDictionary instance, as defined in clause 3.2.6.2.8.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.13.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.13.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.13.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.14 REST resource: Alarm Dictionary List

3.2.4.14.1 Description

The Alarm Dictionary List resource represents the collection of Alarm Dictionaries. The API consumer can use this resource to query multiple Alarm Dictionaries.

3.2.4.14.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/alarmDictionaries

This resource shall support the resource URI variables defined in Table 3.2.4.14.2-1.

Table 3.2.4.14.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.14.3 Resource methods

3.2.4.14.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.14.3.2 GET

The GET operation is used to retrieve a list of Alarm dictionaries.

This method shall support the URI query parameters specified in Table 3.2.4.14.3.2-1.

Table 3.2.4.14.3.2-1 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 [22]. The O-Cloud 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 AlarmDictionary shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of AlarmDictionary in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - alarmDefinition
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.14.3.2-2.

Table 3.2.4.14.3.2-2: 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
	AlarmDictionary	0..N	200 OK	<p>Shall be returned when information about zero or more AlarmDictionary instances has been queried successfully. The response body shall contain in an array the representations of zero or more AlarmDictionary instance(s), as defined in clause 3.2.6.2.8.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.14.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.14.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.14.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.15 REST resource: Performance Dictionary

3.2.4.15.1 Description

The Performance Dictionary REST resource dedicated to the Performance Dictionary which describes performance measurements that can be collected. The Performance Dictionaries are integrated by the IMS in the O-Cloud and provided to the SMO for consumption.

3.2.4.15.2 Resource definition

3.2.4.15.2.1 Resource URI for Performance Dictionaries

Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/performanceDictionaries/{performanceDictionaryId}

This resource shall support the resource URI variables defined in Table 3.2.4.15.2.1-1.

Table 3.2.4.15.2.1-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
performanceDictionaryId	Identifier	The performanceDictionaryId is a unique identifier that singles out an individual performance dictionary of interest.
NOTE: This identifier can be retrieved from the performanceDictionaryId attribute in the payload body of the response to a GET request getting a "ResourceType" resource. It can also be retrieved from the payload body of the response to a GET request getting "PerformanceDictionaries"		

3.2.4.15.2.2 Resource URI for Resource Type Performance Dictionary

Resource URI: Resource URI:

{apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/resourceTypes/{resourceTypeId}/performanceDictionary

This resource shall support the resource URI variables defined in Table 3.2.4.15.2.2-1.

Table 3.2.4.15.2.2-2 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
resourceTypeId	Identifier	The identifier of the Resource Type Description resource. See Note.
NOTE: This identifier can be retrieved from the resourceTypeId attribute in the payload body of the response to a GET request getting the list of "ResourceType" resources.		

3.2.4.15.3 Resource methods

3.2.4.15.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.15.3.2 GET

The GET operation is used to retrieve a single dictionary.

This method shall support the URI query parameters specified in Table 3.2.4.15.3.2-1.

Table 3.2.4.15.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.15.3.2-2.

Table 3.2.4.15.3.2-2: 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
	PerformanceDictionary	1	200 OK	Shall be returned when information about an PerformanceDictionary instance has been queried successfully. The response body shall contain a representation of the PerformanceDictionary instance, as defined in clause 3.2.6.2.11.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.15.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.15.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.15.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.16 REST resource: Performance Dictionary List

3.2.4.16.1 Description

The Performance Dictionary List resource represents the collection of Performance Dictionaries. The API consumer can use this resource to query multiple Performance Dictionaries.

3.2.4.16.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/performanceDictionaries

This resource shall support the resource URI variables defined in Table 3.2.4.16.2-1.

Table 3.2.4.16.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.16.3 Resource methods

3.2.4.16.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.16.3.2 GET

The GET operation is used to retrieve a list of Performance dictionaries.

This method shall support the URI query parameters specified in Table 3.2.4.16.3.2-1.

Table 3.2.4.16.3.2-1 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 [22]. The O-Cloud 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 PerformanceDictionary shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of PerformanceDictionary in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - PerformanceMeasureDefinition
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.16.3.2-2.

Table 3.2.4.16.3.2-2: 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
	PerformanceDictionary	0..N	200 OK	<p>Shall be returned when information about zero or more PerformanceDictionary instances has been queried successfully. The response body shall contain in an array the representations of zero or more PerformanceDictionary instance(s), as defined in clause 3.2.6.2.12.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.16.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.16.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.16.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.17 REST resource: Location List

3.2.4.17.1 Description

This resource represents the list of Locations where O-Cloud Sites can be available. The Location List contains Location Descriptions.

3.2.4.17.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/locations

This resource shall support the resource URI variables defined in Table 3.2.4.17.2-1.

Table 3.2.4.17.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.17.3 Resource methods

3.2.4.17.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.17.3.2 GET

The GET operation is used to retrieve the list of locations.

This method shall support the URI query parameters specified in Table 3.2.4.17.3.2-1.

Table 3.2.4.17.3.2-1 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 [22]. The O-Cloud 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 LocationInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of LocationInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.17.3.2-2.

Table 3.2.4.17.3.2-2: 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
	LocationInfo	0..N	200 OK	<p>Shall be returned when information about zero or more LocationInfo instances has been queried successfully. The response body shall contain in an array the representations of zero or more LocationInfo instances, as defined in clause 3.2.6.2.16.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.17.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.17.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.17.3.5 DELETE

3.2.4.18 This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].**REST resource: Location Description**

3.2.4.18.1 Description

This resource represents the description of a Location and provides information about its characteristics and other data.

3.2.4.18.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/locations/{globalLocationId}

This resource shall support the resource URI variables defined in Table 3.2.4.18.2-1.

Table 3.2.4.18.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
globalLocationId	Identifier	The identifier of the Location Description resource. See note.
NOTE: This identifier can be retrieved from the globalLocationId attribute in the payload body of the response to a GET request getting the list of "Location" resources.		

3.2.4.18.3 Resource methods

3.2.4.18.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.18.3.2 GET

The GET operation is used to retrieve the resource type description of a single location.

This method shall support the URI query parameters specified in Table 3.2.4.18.3.2-1.

Table 3.2.4.18.3.2-1 URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.18.3.2-2.

Table 3.2.4.18.3.2-2: 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
	LocationInfo	1	200 OK	Shall be returned when information about a LocationInfo instance has been queried successfully. The response body shall contain a representation of the LocationInfo instance, as defined in clause 3.2.6.2.16.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.18.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.18.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.18.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.19 REST resource: O-Cloud Site List

3.2.4.19.1 Description

This resource represents the list of O-Cloud Sites. The O-Cloud Site List contains O-Cloud Site Descriptions.

3.2.4.19.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/oCloudSites

This resource shall support the resource URI variables defined in Table 3.2.4.19.2.-1.

Table 3.2.4.19.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.2.4.19.3 Resource methods

3.2.4.19.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.19.3.2 GET

The GET operation is used to retrieve the list of O-Cloud Sites.

This method shall support the URI query parameters specified in Table 3.2.4.19.3.2-1.

Table 3.2.4.19.3.2-1 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 [22]. The O-Cloud 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 OCloudSiteInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of OCloudSiteInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.19.3.2-2.

Table 3.2.4.19.3.2-2: 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
	OCloudSiteInfo	0..N	200 OK	<p>Shall be returned when information about zero or more OCloudSiteInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more OCloudSiteInfo instances, as defined in clause 3.2.6.2.17.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.2.4.19.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.19.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.19.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.20 REST resource: O-Cloud Site Description

3.2.4.20.1 Description

This resource represents the description of an O-Cloud Site. The O-Cloud Site Description is a record of the attributes.

3.2.4.20.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureInventory/{apiMajorVersion}/oCloudSites/{oCloudSiteId}

This resource shall support the resource URI variables defined in Table 3.2.4.20.2-1.

Table 3.2.4.20.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
oCloudSiteId	Identifier	The identifier of the O-Cloud Site Description resource. See note.
NOTE: This identifier can be retrieved from the oCloudSiteId attribute in the payload body of the response to a GET request getting the list of "OCloudSite" resources.		

3.2.4.20.3 Resource methods

3.2.4.20.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.20.3.2 GET

The GET operation is used to retrieve the resource type description of a single O-Cloud site.

This method shall support the URI query parameters specified in Table 3.2.4.20.3.2-1.

Table 3.2.4.20.3.2-1 URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.2.4.20.3.2-2.

Table 3.2.4.20.3.2-2: 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
	OCloudSiteInfo	1	200 OK	Shall be returned when information about an OCloudSiteInfo instance has been queried successfully. The response body shall contain a representation of the OCloudSiteInfo instance, as defined in clause 3.2.6.2.17.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.2.4.20.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.20.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.4.20.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.2.5 Notifications

3.2.5.1 General

Notifications shall comply to the Subscribe/Notify pattern described in clause 5.9 of ETSI GS NFV-SOL 015 [25].

Table 3.2.5.1-1 Notifications overview

Notification	Callback URI	HTTP method	Description
Inventory Change Notification	Inventory Subscription.callback	POST	Notify subscribers when objects in the O2ims inventory have changed.

3.2.5.1.1 Inventory Change Notification Description

The Inventory Change Notification is used by the O-Cloud Infrastructure Management Service to report changes to the O2ims Inventory to a O2ims consumer that has subscribed to such notifications.

3.2.5.1.2 Target URI

The Inventory Subscription.Callback URI “{InventoryEventNotification}” shall be used with the callback URI variables define in table 3.2.5.1.2-1.

Table 3.2.5.1.2-1 Inventory Subscription.Callback URI Variables

Attribute name	Data type	P	Cardinality	Description
consumerSubscriptionId	Identifier	O	0..1	The value provided by the consumer in the subscription.
notificationEventType	Integer	M	1	One of the following values: <ul style="list-style-type: none"> • 0 for "CREATE" • 1 for "MODIFY" • 2 for "DELETE"
objectRef	String	CO	0..1	The URL to the object. This is not required if the notificationEventType is 2 (DELETE). It will point to one of the following data types defined in clause 3.2.6 and the reference will match the type of objects supplied in priorObjectState and/or postObjectState: <ul style="list-style-type: none"> • ResourceInfo • ResourceTypeInfo • ResourcePoolInfo • DeploymentManagerInfo • CloudInfo • LocationInfo • OCloudSiteInfo
priorObjectState	String	CM	0..1	This is required if the notificationEventType is 1 (MODIFY) or 2 (DELETE) and is one of the following data types defined in clause 3.2.6 and will match the type of object in postObjectState and/or the type referred to in objectRef: <ul style="list-style-type: none"> • ResourceInfo • ResourceTypeInfo • ResourcePoolInfo • DeploymentManagerInfo • CloudInfo • LocationInfo • OCloudSiteInfo
postObjectState	String	CM	0..1	This is required if the notificationEventType is 0 (CREATE) or 1 (MODIFY) and is one of the following data types defined in clause 3.2.6 and will match the type of object in priorObjectState and/or the type referred to in objectRef: <ul style="list-style-type: none"> • ResourceInfo • ResourceTypeInfo • ResourcePoolInfo • DeploymentManagerInfo • CloudInfo • LocationInfo • OCloudSiteInfo

3.2.6 Data model

3.2.6.1 REST resource data types

This clause specifies the data types to be used in resource representations and notifications supported by the present API.

Table 3.2.6.1-1 specifies the data types defined for the O2ims_InfrastructureInventory service API.

Table 3.2.6.1-1: O2ims_InfrastructureInventory resource data types

Data type	Clause defined	Description	Applicability
ResourceTypeInfo	3.2.6.2.2	This data type represents the type of a resource deployed in the O-Cloud Infrastructure.	
ResourcePoolInfo	3.2.6.2.3	This data type represents a logical Resource Pool for the collection of O-Cloud Resources at a location.	
ResourceInfo	3.2.6.2.4	This data type represents a resource instance of the O-Cloud Infrastructure	
DeploymentManagerInfo	3.2.6.2.5	This data type represents a Deployment Manager for managing Deployments into the O-Cloud.	
CloudInfo	3.2.6.2.6	This data type represents an O-Cloud instance.	
InventorySubscriptionInfo	3.2.6.2.7	This data type represents an instance of a subscription to O2ims Inventory change events.	
AlarmDictionary	3.2.6.2.8	This data type represents an Alarm Dictionary for alarms that can be reported by a given ResourceType within the O-Cloud.	
PerformanceDictionary	3.2.6.2.12	This data type represents a Performance Dictionary of performance measurement definitions that can be reported for a given ResourceType within the O-Cloud.	
LocationInfo	3.2.6.2.16	This data type represents a location instance where O-Cloud Sites can be available.	
OCloudSiteInfo	3.2.6.2.17	This data type represents an O-Cloud Site instance.	

3.2.6.2 Structured data types

3.2.6.2.1 Introduction

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

3.2.6.2.2 Type: ResourceTypeInfo

This type represents information about a type of a resource deployed in the O-Cloud Infrastructure. It shall comply with the provisions defined in table 3.2.6.2-1.

Table 3.2.6.2.2-1 Definition of type ResourceTypeInfo

Attribute name	Data type	P	Cardinality	Description
resourceTypeId	Identifier	M	1	Identifier for the Resource Type. This identifier is allocated by the O-Cloud.
name	String	M	1	Human readable name of the resource type.
description	String	M	1	Human readable description of the resource type.
vendor	String	M	1	Provider of the Resource.
model	String	M	1	Information about the model of the resource as defined by its provider.
version	String	M	1	Version or generation of the resource as defined by its provider.
alarmDictionary	AlarmDictionary	M	0..1	Dictionary of alarms for this resource type. See Note 1.
alarmDictionaryId	Identifier	M	0..1	Identifier of the Alarm Dictionary for this resource type. See Note 2.
performanceDictionaryId	Identifier	M	0..1	Identifier of the Performance Dictionary for this resource type. See Note 2.
resourceKind	Enum (inlined)	M	1	Value describing "physicality" of the resource type Permitted values: <ul style="list-style-type: none"> • UNDEFINED • PHYSICAL • LOGICAL
resourceClass	Enum (inlined)	M	1	Functional role of the resource type within the cloud. Permitted values: <ul style="list-style-type: none"> • UNDEFINED • COMPUTE • NETWORKING • STORAGE
extensions	KeyValuePairs	M	0..1	List of metadata key-value pairs used to associate meaningful metadata to the related resource type.

NOTE 1: alarmDictionary attribute is deprecated and it may be removed in future releases.
NOTE 2: The IMS shall ensure that the identifier points to the same dictionary available under the URI path of the resource type (refer to Table 3.1.6.2.2.3-1).

3.2.6.2.3 Type: ResourcePoolInfo

This type represents information about a logical Resource Pool which comprises O-Cloud Resources at a location. It shall comply with the provisions defined in table 3.2.6.2.3-1.

Table 3.2.6.2.3-1 Definition of type ResourcePoolInfo

Attribute name	Data type	P	Cardinality	Description
resourcePoolId	Identifier	M	1	Identifier for the resource pool in the O-Cloud instance. This identifier is allocated by the O-Cloud.
oCloudId	Identifier	M	1	Identifier for the containing O-Cloud. (NOTE 1)
globalLocationId	Identifier	M	1	This identifier is copied from the O-Cloud Id assigned by the SMO during the O-Cloud deployment. (NOTE 2)
name	String	M	1	Human readable name of the resource pool.
oCloudSiteId	Identifier	M	1	Identifier of the O-Cloud site the resource pool is a part of.
description	String	M	1	Human readable description of the resource pool.
location	String	O	0..1	Information about the geographical location of the resource pool as detected by the O-Cloud. (NOTE 3)
extensions	KeyValuePairs	O	0..1	List of metadata key-value pairs used to associate meaningful metadata to the related resource pool.

NOTE 1: oCloudId attribute is deprecated and may be removed in future releases.
NOTE 2: globalLocationId attribute is deprecated and may be removed in future releases.
NOTE 3: location attribute is deprecated and may be removed in future releases.

3.2.6.2.4 Type: ResourceInfo

This type represents a resource instance of the O-Cloud Infrastructure. It shall comply with the provisions defined in table 3.2.6.2.4-1.

Table 3.2.6.2.4-1 Definition of type ResourceInfo

Attribute name	Data type	P	Cardinality	Description
resourceId	Identifier	M	1	Identifier for the Resource. This identifier is allocated by the O-Cloud.
resourcePoolId	Identifier	M	1	Identifier of the Resource Pool containing this resource (refer to type "ResourcePoolInfo").
resourceTypeId	Identifier	M	1	Identifier for the Resource Type of this resource (refer to type "ResourceTypeInfo").
globalAssetId	String	CM	0..1	Identifier or serial number of the resource, if available. It is required only if the resource has been identified during its addition to the cloud as a reportable asset in the SMO inventory.
description	String	M	1	Human readable description of the resource
elements	ResourceInfo	M	0..N	The resource might be composed of smaller resources or other resource instances of a different type
tags	String	M	0..N	Keywords describing or classifying the resource instance.
groups	String	M	0..N	Keywords denoting groups a resource belongs to.
extensions	KeyValuePairs	M	0..1	List of metadata key-value pairs used to associate meaningful metadata to the related resource.

3.2.6.2.5 Type: DeploymentManagerInfo

This type represents information about a Deployment Manager for managing Deployments into the O-Cloud. It shall comply with the provisions defined in table 3.2.6.2.5-1.

Table 3.2.6.2.5-1 Definition of type DeploymentManagerInfo

Attribute name	Data type	P	Cardinality	Description
deploymentManagerId	Identifier	M	1	Identifier for the Deployment Manager. This identifier is allocated by the O-Cloud.
name	String	M	1	Human readable name of the deployment manager.
description	String	M	1	Human readable description of the deployment manager.
oCloudId	Identifier	M	1	Identifier for the containing O-Cloud.
serviceUri	Uri	M	1	The fully qualified URI to a Deployment Management server for O2dms services. Since the O2dms provides multiple services, this entry is for the {apiRoot} only.
supportedLocations	String	M	1..N	List of globalLocationIDs that were assigned to the O-Cloud Site(s) which this Deployment Manager supports.
capabilities	KeyValuePairs	M	0..N	Information about the capabilities supported by the Deployment Manager and its set of deployment management services based on the resources allocated to the Deployment Manager.
capacity	KeyValuePairs	M	0..N	Information about the available, allocated and reserved capacity of O-Cloud Resources allocated to the Deployment Manager.
extensions	KeyValuePairs	O	0..N	List of metadata key-value pairs used to associate meaningful metadata to the related Deployment Manager.

3.2.6.2.6 Type: CloudInfo

This type represents information about an O-Cloud instance. It shall comply with the provisions defined in table 3.2.6.2.6-1.

Table 3.2.6.2.6-1 Definition of type CloudInfo

Attribute name	Data type	P	Cardinality	Description
oCloudId	Identifier	M	1	Identifier of the O-Cloud instance. Internally generated within an O-Cloud instance.
globalCloudId	Identifier	M	1	Identifier of the O-Cloud instance. Globally unique across O-Cloud instances. This value was provided by the SMO with the callback URI at the beginning of O-Cloud genesis and used in registration at the end of genesis.
name	String	M	1	Human readable name of the O-Cloud.
description	String	M	1	Human readable description of the O-Cloud.
serviceUri	Uri	M	1	The fully qualified URI root to all services provided by the O2ims interface, Inventory only being one of them. Since the O2ims provides multiple services this entry is for the {apiRoot} only.
extensions	KeyValuePairs	M	0..1	These are unspecified (not standardized) properties (keys) which are tailored by the vendor to extend the information provided about the O-Cloud.

3.2.6.2.7 Type: InventorySubscriptionInfo

This type represents information about an instance of a subscription to O2ims Inventory change events. It shall comply with the provisions defined in table 3.2.6.2.7-1.

Table 3.2.6.2.7-1 Definition of type InventorySubscriptionInfo

Attribute name	Data type	P	Cardinality	Description
subscriptionId	Identifier	M	1	Identifier for the Subscription. This identifier is allocated by the O-Cloud.
consumerSubscriptionId	String	O	0..1	Identifier for the consumer of events sent due to the Subscription.
filter	String	O	0..1	Criteria for events which do not need to be reported or will be filtered by the subscription notification service. Therefore, if a filter is not provided then all events are reported.
callback	Uri	M	1	The fully qualified URI to a consumer procedure which can process a Post of the InventoryEventNotification.

3.2.6.2.8 Type: AlarmDictionary

This type represents information about alarms that can be reported by a given ResourceType within the O-Cloud. The Alarm Dictionary object is defined not only for O-Clouds but for Network Functions as well. Therefore, its structure may overlap with other O-Cloud structures and contain redundant information that is used by the SMO. It shall comply with the provisions defined in table 3.2.6.2.8-1.

Table 3.2.6.2.8-1 Definition of type AlarmDictionary

Attribute name	Data type	P	Cardinality	Description
alarmDictionaryId	Identifier	M	1	The Identifier of the Alarm Dictionary. The Identifier is unique within an O-Cloud.
alarmDictionaryVersion	String	M	1	Version of the Alarm Dictionary. Version is vendor defined such that the version of the dictionary can be associated with a specific version of the software delivery of this product.
alarmDictionarySchema Version	String Constant (See Note 1)	M	1	Version of the Alarm Dictionary Schema to which this alarm dictionary conforms. (See Note 2)
entityType	String	M	1	O-RAN entity type emitting the alarm: This shall be unique per vendor ResourceType.model and ResourceType.version
vendor	String	M	1	Vendor of the Entity Type to whom this Alarm Dictionary applies. This should be the same value as in the ResourceType.vendor attribute.
managementInterfaceId	ENUM -O1 -O2DMS -O2IMS -OpenFH (See Note 3)	M	1..N	List of management interface over which alarms are transmitted for this Entity Type. RESTRICTION: For the O-Cloud IMS Services this value is limited to O2IMS.
pkNotificationField	String Constant "alarmDefinition Id"	M	1..N	Identifies which field or list of fields in the alarm notification contains the primary key (PK) into the Alarm Dictionary for this interface; i.e. which field contains the Alarm Definition ID.
alarmDefinition	AlarmDefinition	M	1..N	Contains the list of alarms that can be detected against this ResourceType.
probableCauses	ProbableCause	M	1..N	Contains the list of Probable Causes that indicate the root cause of the Alarm events.
NOTE 1: String value is not yet defined but would match a specific Schema Version. NOTE 2: The specific value for this should be defined in the IM/DM specification for the Alarm Dictionary Model Schema when it is published at a future date. NOTE 3: Italicized and grayed text is only provided for informative purposes. These values are used by other dictionary providers, but not the O2 IMS.				

3.2.6.2.9 Type: AlarmDefinition

This type represents information about an alarm that can be reported by a given ResourceType within the O-Cloud. It shall comply with the provisions defined in table 3.2.6.2.9-1.

Table 3.2.6.2.9-1 Definition of type AlarmDefinition

Attribute name	Data type	P	Cardinality	Description
alarmDefinitionId	UUID	M	1	Provides a unique identifier of the alarm being raised. This is the Primary Key into the Alarm Dictionary.
alarmName	String	M	1	Provides short name for the alarm.
alarmLastChange	String	M	1	Indicates the Alarm Dictionary Version in which this alarm last changed.
alarmChangeType	ENUM: -added -deleted -modified	M	1	Indicates the type of change that occurred during the alarm last change; added, deleted, modified.
alarmDescription	String	M	1	Provides a longer descriptive meaning of the alarm condition and a description of the consequences of the alarm condition. This is intended to be read by an operator to give an idea of what happened and a sense of the effects, consequences, and other impacted areas of the system.
proposedRepairActions	String	M	1	Provides guidance for proposed repair actions.
clearingType	ENUM: -automatic -manual	M	1	Identifies whether alarm is cleared automatically or manually.
managementInterfaceId	ENUM -O1 -O2DMS -O2IMS -OpenFH (See Note 1)	M	0..N	List of management interface over which alarms are transmitted for this Entity Type. RESTRICTION: For the O-Cloud IMS Services this value is limited to O2IMS.
pkNotificationField	String Constant "alarmDefinitionId"	M	0..N	Identifies which field or list of fields in the alarm notification contains the primary key (PK) into the Alarm Dictionary for this interface; i.e. which field contains the Alarm Definition ID.
alarmAdditionalFields	KeyValuePairs	M	0..N	List of metadata key-value pairs used to associate meaningful metadata to the related resource type.
NOTE 1: Italicized and grayed text is only provided for informative purposes. These values are used by other dictionary providers, but not the O2 IMS.				

3.2.6.2.10 Type: ProbableCause

This type represents information about the ProbableCause which provides an indication of the root cause of an alarm event. ProbableCause is intended to help operators determine the root cause of an alarm event. It shall comply with the provisions defined in table 3.2.6.2.10-1.

There are industry suggested lists of probable causes that could be used. When used the ProbableCause definition should allow for an indication of such a source. See O-RAN WG10 Information Model and Data Models [37], clause 5.2.1.4.13.

Alarm Definitions may provide one or more ProbableCause(s) as part of their extended fields. However, each alarm event should have a ProbableCause that is specific to that alarm instance. The ProbableCause(s) used by the product vendor for alarm events shall be listed independently in the alarm dictionary.

Table 3.2.6.2.10-1 Definition of type ProbableCause

Attribute name	Data type	P	Cardinality	Description
probableCauseCode	String	M	1	This identifies a specific probableCause instance in the AlarmDictionary. This is the Primary Key into the probableCauses.
probableCauseDescription	String	M	1	This provides any additional information beyond the probableCauseCode to describe the probable cause
standardReference	StandardReference	M	0..1	This gives a reference to the standard body when the Probable Cause definition has been provided by another Standards body.

3.2.6.2.11 Type: StandardReference

When definition has been provided by another Standards body this dataType provides a reference to the standard body that is author of particular definition, as well as to where the definition can be found. It shall comply with the provisions defined in table 3.2.6.2.11-1.

Table 3.2.6.2.11-1 Definition of type StandardReference

Attribute name	Data type	P	Cardinality	Description
standardDefinitionOrganization	String	M	1	Provides the Organization that provided the Definition
standardSpecification	String	M	1	Gives the Specification of the Standards Organization
versionOrRelease	String	M	1	Gives the version of the Specification of interest
NOTE: With reference to the baseline modeling in the O-RAN.WG10.Information Model and Data Models [37], the "clause" attribute in the type "StandardReference" is not specified in the present document version.				

3.2.6.2.12 Type: PerformanceDictionary

This type represents information about performance measurements for a performance dictionary that can be reported by a given ResourceType within the O-Cloud. It shall comply with the provisions defined in table 3.2.6.2.12-1. These are also described in O-RAN.WG10.Information Model and Data Models [37], clause 5.2.1.

Table 3.2.6.2.12-1 Definition of type PerformanceDictionary

Attribute name	Data type	P	Cardinality	Description
performanceDictionaryId	Identifier	M	1	The Identifier of the Alarm Dictionary. The Identifier is unique within an O-Cloud.
performanceDictionaryVersion	String	M	1	Version of the Performance Dictionary
performanceDictionarySchemaVersion	String	M	1	Schema Version of the Performance Dictionary
vendorSoftwareProduct	String	M	1	Vendor Software Product
supportedInterfaces	ENUM -O1 -O2DMS -O2IMS -OpenFH (See Note 1)	M	1	This gives the supported interfaces for the Performance Dictionary
supportedMeasurements	PerformanceMeasurementDefinition	M	1..N	This lists the supported Performance Measurements
NOTE 1: Italicized and grayed text is only provided for informative purposes. These values are used by other dictionary providers, but not the O2 IMS.				

3.2.6.2.13 Type: PerformanceMeasurementDefinition

This type represents a performance measurement definition. The PerformanceMeasurementDefinition inherits attributes from Top IOC (defined in 3GPP TS 28.622 [39], clause 4.3.29). It shall comply with the provisions defined in table 3.2.6.2.13-1.

Table 3.2.6.2.13-1 Definition of type PerformanceMeasurementDefinition

Attribute name	Data type	P	Cardinality	Description
performanceMeasurementDefinitionId	UUID	M	1	Provides a unique identifier of the performance Measurement. This is the Primary Key into the Performance Dictionary.
performanceMeasurementId	String	M	1	This gives the Performance Measurement Id
standardReference	String	M	1	Gives the Standards Reference from which this Performance Measurement comes from
supportedInterfaces	String	M	0..1	Supported Interfaces
extensions	KeyValuePairs	M	0..1	This gives Extension
measurementDefinition	3GPPPerformanceMeasurementDefinition	M	0 if ETSI, 1 if 3GPP. (See Note)	If it is a 3GPP measurement, this would use the 3GPP Performance Measurement Definition (concrete class). See Note
measurementDefinition	ETSIPerformanceMeasurementDefinition	M	0 if 3GPP, 1 if ETSI. (See Note)	If it is a ETSI measurement, this would use the ETSI Performance Measurement Definition (concrete class). See Note
NOTE: The measurementDefinition would be either 3GPPPerformanceMeasurementDefinition or ETSIPerformanceMeasurementDefinition. The "P" is "M" because this needs to be supported on the interface.				

3.2.6.2.14 Type: 3GPPPerformanceMeasurementDefinition

The 3GPPPerformanceMeasurementDefinition is a concrete class of the PerformanceMeasurementDefinition_ class from which it inherits attributes from. It extends the class with attribute fields defined in 3GPP TS 32.404 [40] clause 3.3.

3.2.6.2.15 Type: ETSIPerformanceMeasurementDefinition

The ETSIPerformanceMeasurementDefinition is a concrete class of the PerformanceMeasurementDefinition_ class from which it inherits attributes from. It extends the class with attribute fields defined in ETSI GS NFV-IFA 027 [41] clause 5.

3.2.6.2.16 Type: LocationInfo

This type represents information about a location, where O-Cloud Site may be available. It shall comply with the provisions defined in table 3.2.6.2.16-1.

Table 3.2.6.2.16-1 Definition of type LocationInfo

Attribute name	Data type	P	Cardinality	Description
globalLocationId	String	M	1	Identifier of the location as defined by the SMO.
name	String	M	1	Human readable name of the location as defined by the SMO.
description	String	M	1	Human readable description of the location.
oCloudSiteIds	Identifier	M	0.. N	List of O-Cloud Site identifiers referencing the O-Cloud Sites available at the location.
coordinate	Point (see [43])	M	0.. N	The coordinates (including latitude and longitude) of the location. The content of this attribute shall follow the provisions for the "Point" geometry object as defined IETF RFC 7946 [43], for which the "type" member shall be set to the value "Point". See note.

civicAddress	Structure (inlined)	M	0..N	Civic address of the location. It includes zero or more elements comprising the civic address. See note.
>caType	Integer	M	1	Describes the content type of caValue. The value of caType shall comply with IETF RFC 4776 [45].
>caValue	String	M	1	Content of civic address element corresponding to the caType. The format caValue shall comply with section 3.4 of IETF RFC 4776 [45].
address	String	M	0.. 1	Human readable format of address of the location. See note.
extensions	KeyValuePairs	M	0..1	List of metadata key-value pairs used to associate meaningful metadata to the related location.
NOTE: At least one of the "coordinate" or "civicAddress" or "address" shall be provided.				

3.2.6.2.17 Type: OCloudSiteInfo

This type represents information about O-Cloud site instance. It shall comply with the provisions defined in table 3.2.6.2.17-1.

Table 3.2.6.2.17-1 Definition of type OCloudSiteInfo

Attribute name	Data type	P	Cardinality	Description
oCloudSiteId	Identifier	M	1	Identifier of the O-Cloud site. Locally unique within the scope of an O-Cloud instance.
globalLocationId	String	M	1	Identifier of location where the O-Cloud site is deployed at.
name	String	M	1	Human readable name of the O-Cloud site as identified by the cloud provider.
description	String	M	1	Human readable description of the O-Cloud site as provided by the cloud provider.
resourcePools	Identifier	M	1.. N	List of resource pools that are part of the O-Cloud site.
extensions	KeyValuePairs	M	0..1	List of metadata key-value pairs used to associate meaningful metadata to the related O-Cloud site.

3.2.6.3 Simple data types and enumerations

3.2.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses. The simple data types defined in a request body, response body, or a structured type are defined in ETSI GS NFV-SOL 013 [22] or this clause of the specification.

3.2.6.3.2 Simple data types

The simple data types defined in table 3.2.6.3.2-1 shall be supported.

Table 3.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description
n/a		

3.2.7 Error handling

3.2.7.1 General

For the O2ims_InfrastructureInventory Service API, HTTP error responses shall be supported as specified in clause 3.1.5.

In addition, the requirements in the following clauses are applicable for the O2ims_InfrastructureInventory Service API.

3.2.7.2 Protocol errors

No specific protocol errors for the O2ims_InfrastructureInventory Service API are specified.

3.2.7.3 Application errors

No specific application errors for the O2ims_InfrastructureInventory Service API are specified

3.2.8 Security

No specific security procedures for the O2ims_InfrastructureInventory Service API are specified beyond those in clause 3.1.7.

3.3 O2ims_InfrastructureMonitoring Service API

3.3.1 Description

This API allows the SMO to invoke O2ims_InfrastructureMonitoring Services towards the O-Cloud.

The operations defined for O2ims_InfrastructureMonitoring Services through this API are:

- Query information about one or multiple Alarms;
- Create a subscription to Alarms of interest;
- Notify consumer identified by an established subscription which is not filtered by the filter criteria of the occurrence of a change to the alarm objects;
- Acknowledge an Alarm;
- Clear an Alarm;
- Ability to query and modify the configurable values which govern the behaviour of the Alarm Service; and
- Purge Alarms

Services for IMS Heartbeat are not specified in the present document version.

3.3.2 API version

For the O2ims_InfrastructureMonitoring Service API version as specified in the present document, the MAJOR version field shall be 2, the MINOR version field shall be 0, and the PATCH version field shall be 0.

Table 3.3.2-1 lists the history of API versions of the O2ims_InfrastructureMonitoring Service and the main capabilities added/removed across versions.

Table 3.3.2-1: History of API versions of the O2ims_InfrastructureMonitoring Service.

Version	Description
1.0.0	Initial API Supporting: Alarm Query Alarm Subscription Alarm Notification
1.1.0	New methods: Acknowledge Alarm Clear Alarm Alarm Service Configure
1.2.0	Updated methods: Alarm Subscription New resources: Purge Alarms Task Task Operation List Task Operation Occurrence
2.0.0	Updated Notification: Alarm Change Notification Updated Data Type: AlarmSubscriptionInfo AlarmEventRecord Alarm Change Notification

3.3.3 REST resources structure and methods

All resource URIs of the API shall use the base URI specification defined in clause 3.1.2. The string "O2ims_infrastructureMonitoring" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the formed base URI (i.e., {apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}).

When ambiguity is possible, the term REST resource is used to make the distinction between the term resource as understood within the context of REST API from the term resource as understood within the context of O-RAN.

Figure 3.3.3-1 shows the overall resource URI structure defined for the O2ims_InfrastructureMonitoring Service API.

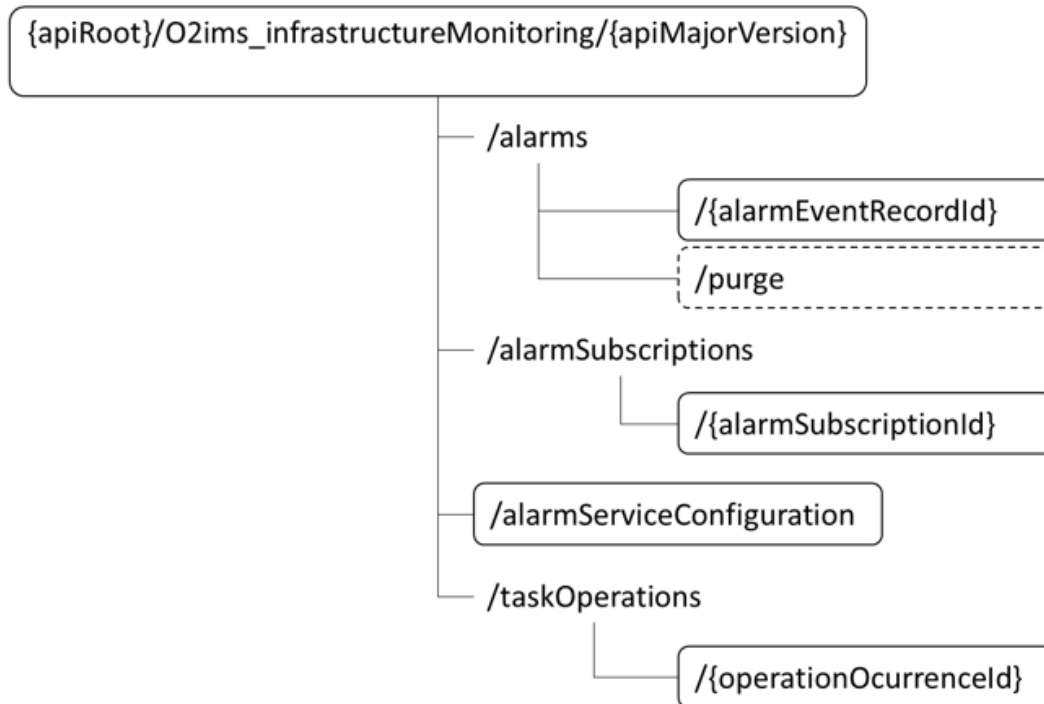


Figure 3.3.3-1 Resource URI structure of the O2ims_infrastructureMonitoring API

Table 3.3.3-1 provides an overview of the resources and applicable HTTP methods.

The O-Cloud shall support responding to requests for all HTTP methods on the resources in table 3.3.3-1 that are marked as “M” (mandatory) in the “Cat” column. The O-Cloud shall also support the “API versions” resources as specified in clause 3.1.8.

Table 3.3.3-1 Resources and methods overview

Resource name	Resource URI	HTTP method	Cat	Description
Alarm List	/alarms	GET	M	To get a list of alarms
Alarm Record	/alarms/{alarmEventRecordId}	GET	M	To get an individual alarm record
		PATCH	M	To modify (acknowledge, clear) an individual alarm record
Purge Alarms Task	/alarms/purge	POST	M	To purge alarms from the list.
Alarm Subscription List	/alarmSubscriptions	POST	M	To create an individual alarm subscription
		GET	M	To get a list of alarm subscriptions
Alarm Subscription Description	/alarmSubscriptions/{alarmSubscriptionId}	GET	M	To get an individual alarm subscription description
		DELETE	M	To delete an individual alarm subscription
Alarm Service Configuration	/alarmServiceConfiguration	GET	M	To get the current configuration of the alarm service.
		PUT	M	To set a whole new configuration of the alarm service.
		PATCH	M	Partially update the configuration of the alarm service.
Task Operation List	/taskOperations	GET	M	To query information about multiple task operation occurrences related to alarm management.
Task Operation Occurrence	/taskOperations/{operationOccurrenceId}	GET	M	To query information about a specific task operation occurrence related to alarm management.

3.3.4 REST resources

3.3.4.1 Introduction

There are no preconditions or postconditions for a successful execution of each of the O2ims_InfrastructureMonitoring Service API triggered by a corresponding operation.

3.3.4.2 REST resource: Alarm List

3.3.4.2.1 Description

This resource represents the list of alarms that the O-Cloud has seen during its alarm retention period. The Alarm List can contain Alarm Records.

3.3.4.2.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/alarms

This resource shall support the resource URI variables defined in Table 3.3.4.2.2 1.

Table 3.3.4.2.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 3.1.2
apiMajorVersion	string	See clause 3.1.2

3.3.4.2.3 Resource methods

3.3.4.2.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.2.3.2 GET

The GET operation is used to retrieve the list of alarms.

This method shall support the URI query parameters specified in Table 3.3.4.2.3.2 1.

Table 3.3.4.2.3.2-1 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 [22] . The O-Cloud 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 AlarmEventRecord and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of AlarmEventRecord in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.2.3.2-2.

Table 3.3.4.2.3.2-2: 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
	AlarmEventRecord	0..N	200 OK	<p>Shall be returned when information about zero or more AlarmEventRecord instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more AlarmEventRecord instances, as defined in clause 3.3.6.2.2.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.3.4.2.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.2.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.2.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.3 REST resource: Alarm Record

3.3.4.3.1 Description

This resource represents the details of an Alarm Record in the Alarm List. The Alarm Record is a record of the details of an Alarm since its creation.

3.3.4.3.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/alarms/{alarmEventRecordId}

This resource shall support the resource URI variables defined in Table 3.3.4.3.2 1.

Table 3.3.4.3.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
alarmEventRecordId	Identifier	The identifier of the Alarm Record resource. See note.
NOTE: This identifier can be retrieved from the alarmEventRecordId attribute in the payload body of the response to a GET request getting the list of "Alarm Record" resources.		

3.3.4.3.3 Resource methods

3.3.4.3.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.3.3.2 GET

The GET operation is used to retrieve the details of a single Alarm Event Record.

This method shall support the URI query parameters specified in Table 3.3.4.3.3.2 1.

Table 3.3.4.3.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.3.3.2-2.

Table 3.3.4.3.3.2-2: 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
	AlarmEventRecord	1	200 OK	Shall be returned when information about a AlarmEventRecord instance has been queried successfully. The response body shall contain a representation of the AlarmEventRecord instance, as defined in clause 3.3.6.2.2.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.3.4.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.3.3.4 PATCH

The PATCH method is used to modify an individual alarm record. Supported modifications of an individual alarm record include:

- Acknowledging an alarm, and
- Clearing an alarm.

A PATCH request shall only target a single type of modification from the list above. Upon processing the request, the IMS shall update the requested attributes from the "AlarmEventRecord" (see clause 3.3.6.2.2) representing the individual alarm record, as well as other related attributes concerning the requested modifications. For instance, if the alarm record is requested to be acknowledged, the "alarmAcknowledgeTime" attribute in the "AlarmEventRecord" is expected to be also updated accordingly.

This method shall support the URI query parameters specified in Table 3.3.4.3.3.4-1.

Table 3.3.4.3.3.4-1 URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.3.3.4-2.

Table 3.3.4.3.3.4-2: Details of the PATCH request/response on this resource

Request body	Data type	Cardinality	Description	
	AlarmEventRecordModifications	1	<p>The parameter for the alarm record modification, as defined in clause 3.3.6.2.4.</p> <p>The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [29].</p>	
Response body	Data type	Cardinality	Response Codes	Description
	AlarmEventRecordModifications	1	200 OK	<p>Shall be returned when the request has been accepted and completed.</p> <p>The response body shall contain attribute modifications for an individual alarm record resource (see clause 3.3.6.2.2).</p>
	ProblemDetails	1	409 Conflict	<p>Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the individual alarm record resource.</p> <p>Typically, this is due to the fact that the alarm is already in the state that is requested to be set (such as trying to acknowledge an already-acknowledged alarm, or clearing an already-cleared alarm).</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute shall convey more information about the error.</p>
	ProblemDetails	0..1	412 Precondition failed	<p>Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled.</p> <p>Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity.</p> <p>The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.3.4.3.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.4 REST resource: Alarm Subscription List

3.3.4.4.1 Description

This resource represents the set of Alarm Subscriptions in the O-Cloud the SMO can use for being notified when certain changes in the Alarm List occur. The Alarm Subscription List can contain Alarm Subscription Descriptions.

3.3.4.4.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/alarmSubscriptions

This resource shall support the resource URI variables defined in Table 3.3.4.4.2-1.

Table 3.3.4.4.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.3.4.4.3 Resource methods

3.3.4.4.3.1 POST

The POST operation is used to create an alarm subscription.

This method shall support the URI query parameters specified in Table 3.3.4.4.3.1-1.

Table 3.3.4.4.3.1-1 URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.4.3.1-2.

Table 3.3.4.4.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	AlarmSubscriptionInfo	1	The AlarmSubscriptionInfo instance to be created. Note: The supplied SubscriptionId is ignored and assigned by the O-Cloud.	
Response body	Data type	Cardinality	Response Codes	Description
	AlarmSubscriptionInfo	1	201 Created	Shall be returned when information about a AlarmSubscriptionInfo instance has been created successfully. The response body shall contain a representation of the AlarmSubscriptionInfo instance, as defined in clause 3.3.6.2.3.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.3.4.4.3.2 GET

The GET operation is used to retrieve the list of alarm subscriptions.

This method shall support the URI query parameters specified in Table 3.3.4.4.3.2-1.

Table 3.3.4.4.3.2-1 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 [22]. The O-Cloud 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 AlarmSubscriptionInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of AlarmSubscriptionInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.4.3.2-2.

Table 3.3.4.4.3.2-2: 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
	AlarmSubscriptionInfo	0..N	200 OK	<p>Shall be returned when information about zero or more AlarmSubscriptionInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more AlarmSubscriptionInfo instances, as defined in clause 3.3.6.2.3.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.3.4.4.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.4.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.5 REST resource: Alarm Subscription Description

3.3.4.5.1 Description

The Alarm Subscription Description represents the description of a subscription to alarm change events in the O-Cloud.

3.3.4.5.2 Resource definition

Resource URI:

{apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/alarmSubscriptions/{alarmSubscriptionId}

This resource shall support the resource URI variables defined in Table 3.3.4.5.2-1.

Table 3.3.4.5.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
alarmSubscriptionId	Identifier	The identifier of the Alarm Subscription Description resource. This identifier can be retrieved from the alarmSubscriptionId attribute in the payload body of the response to a GET request getting the list of "AlarmSubscriptionInfo" resources.

3.3.4.5.3 Resource methods

3.3.4.5.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.5.3.2 GET

The GET operation is used to retrieve the alarm subscription description of a single alarm subscription.

This method shall support the URI query parameters specified in Table 3.3.4.5.3.2-1.

Table 3.3.4.5.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.5.3.2-2.

Table 3.3.4.5.3.2-2: 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
	AlarmSubscriptionInfo	1	200 OK	Shall be returned when information about a AlarmSubscriptionInfo instance has been queried successfully. The response body shall contain a representation of the AlarmSubscriptionInfo instance, as defined in clause 3.3.6.2.3.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.3.4.5.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.5.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.5.3.5 DELETE

The DELETE operation is used to delete the alarm subscription description of a single alarm subscription.

This method shall support the URI query parameters specified in Table 3.3.4.5.3.5-1.

Table 3.3.4.5.3.5-1 URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.5.3.5-2.

Table 3.3.4.5.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	Data type	Cardinality	Response Codes	Description
	n/a	1	204 (no content)	Shall be returned when the individual instance of Alarm Subscription has been deleted successfully. The response body shall be empty.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.3.4.6 REST resource: Alarm Service Configuration

3.3.4.6.1 Description

The Alarm Service Configuration represents the ability to get and set the configurable values which govern the behaviour of the alarm service.

3.3.4.6.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/alarmServiceConfiguration

This resource shall support the resource URI variables defined in Table 3.3.4.6.2-1.

Table 3.3.4.6.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.3.4.6.3 Resource methods

3.3.4.6.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.3.4.6.3.2 GET

The GET operation is used to retrieve the current alarm service configuration.

This method shall support the URI query parameters specified in Table 3.3.4.6.3.2-1.

Table 3.3.4.6.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.6.3.2-2.

Table 3.3.4.6.3.2-2: 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
	AlarmServiceConfiguration	1	200 OK	Shall be returned when information about an AlarmServiceConfiguration instance has been queried successfully. The response body shall contain a representation of the AlarmServiceConfiguration instance, as defined in clause 3.3.6.2.5.
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.3.4.6.3.3 PUT

The PUT method is used to update all fields of the Alarm Service Configuration. It operates as a “replace” or “overwrite” semantic model.

A 200 OK response with the updated copy of the final object content after the update has been performed is the acceptable response for objects with minimal complexity.

This method shall support the URI query parameters specified in Table 3.3.4.6.3.3-1.

Table 3.3.4.6.3.3-1 URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.6.3.3-2.

Table 3.3.4.6.3.3-2: Details of the PUT request/response on this resource

Request body	Data type	Cardinality	Description	
	AlarmServiceConfiguration	1	The parameter for the Alarm Service Configuration, as defined in clause 3.3.6.2.5.	
Response body	Data type	Cardinality	Response Codes	Description
	AlarmServiceConfiguration	1	200 OK	Shall be returned when the request has been accepted and completed. The response body shall contain attribute modifications for the alarm service configuration (see clause 3.3.6.2.5).
	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 prior to this request. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.3.4.6.3.4 PATCH

The PATCH method is used to modify individual fields of the Alarm Service Configuration.

A PATCH request shall enable only those fields of the alarm service configuration that are contained in the request to be modified. Attributes not contained in the request will remain unmodified. This is sometimes referred to as a partial update.

This method shall support the URI query parameters specified in Table 3.3.4.6.3.4-1.

Table 3.3.4.6.3.4-1 URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.3.4.6.3.4-2.

Table 3.3.4.6.3.4-2: Details of the PATCH request/response on this resource

Request body	Data type	Cardinality	Description	
	AlarmServiceConfiguration	1	<p>The parameter for the Alarm Service Configuration, as defined in clause 3.3.6.2.5.</p> <p>The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [29].</p>	
Response body	Data type	Cardinality	Response Codes	Description
	AlarmServiceConfiguration	1	200 OK	<p>Shall be returned when the request has been accepted and completed.</p> <p>The response body shall contain attribute modifications for the alarm service configuration (see clause 3.3.6.2.5).</p>
	ProblemDetails	0..1	412 Precondition failed	<p>Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled.</p> <p>Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity.</p> <p>The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.3.4.6.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in ETSI GS NFV-SOL 013 [22], clause 6.4.

3.3.4.7 REST resource: Purge Alarms task

3.3.4.7.1 Description

This task resource represents the "Purge Alarms" operation. The API consumer can use this resource to request purging one or multiple Alarms Event Records in the Alarms List.

3.3.4.7.2 Resource definition

The resource URI is:

{apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/alarms/purge

This resource shall support the resource URI variables defined in table 3.3.4.7.2-1.

Table 3.3.4.7.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 3.1.2
apiMajorVersion	string	See clause 3.3.2

3.3.4.7.3 Resource Methods

3.3.4.7.3.1 POST

The POST operation is used to purge Alarm Event Record(s) contained in the alarm list. The request body input parameters can identify the specific Alarm Event Record(s) to be purged. For additional information about the purge service operation, refer to the service model in clause 2.1.3.1.2.5.

This method shall follow the provisions specified in table 3.3.4.7.3.1-1 for URI query parameters.

Table 3.3.4.7.3.1-1 URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in table 3.3.4.7.3.1-2.

Table 3.3.4.7.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	PurgeRequest	1	This identifies the specific AlarmEventRecord(s) to be purged based on attributes of the AlarmEventRecord	
Response body	Data type	Cardinality	Response Codes	Description
	n/a		202 Accepted	Shall be returned when the request has been accepted for processing. The response body shall be empty. The HTTP response shall include a "Location" HTTP header that contains the URI of the newly created "Task Operation Occurrence" resource corresponding to the purge operation.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: The operation cannot be executed currently, due to a conflict with the state of the resource. Typically, this is due to the fact that another task operation is ongoing on the affected resources. The response body shall contain a ProblemDetails structure, in which the "detail" attribute shall convey more information about the error.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.3.4.7.3.2 GET

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.7.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.7.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.7.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.8 REST resource: Task Operation List

3.3.4.8.1 Description

This resource represents the list of task operation occurrences triggered through the respective API. The API consumer can use this resource to query status information about multiple task operation occurrences.

3.3.4.8.2 Resource definition

The resource URI is:

{apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/taskOperations

This resource shall support the resource URI variables defined in table 3.3.4.8.2-1.

Table 3.3.4.8.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 3.1.2
apiMajorVersion	string	See clause 3.1.2

3.3.4.8.3 Resource methods

3.3.4.8.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.8.3.2 GET

The API consumer can use this method to query status information about multiple task operation occurrences.

This method shall follow the provisions specified in Table 3.3.4.8.3.2-1 for URI query parameters.

Table 3.3.4.8.3.2-2 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 [22]. The O-Cloud 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 TaskOperationInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of XYZ in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided. - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [2]] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in table 3.3.4.8.3.2-2.

Table 3.3.4.8.3.2-2: 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
	TaskOperationInfo	0..N	200 OK	<p>Shall be returned when information about zero or more task operation occurrences has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more TaskOperationInfo instances, as defined in clause 3.3.6.2.7.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.3.4.8.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.8.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.8.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.9 REST resource: Task Operation Occurrence

3.3.4.9.1 Description

This resource represents a task operation resource. The API can use this resource to read status information about an individual task operation occurrence.

The O-Cloud may remove an individual task operation occurrence resource some time after it has reached one of the terminal states (i.e., the "operationState" attribute of its representation is equal to one of the values "COMPLETED", "FAILED" or "ROLLED_BACK"). The minimum time how long the O-Cloud waits before deleting such a resource is not defined by the present document version.

3.3.4.9.2 Resource definition

The resource URI is:

{apiRoot}/O2ims_infrastructureMonitoring/{apiMajorVersion}/taskOperations/{operationOccurrenceId}

This resource shall support the resource URI variables defined in Table 3.3.4.9.2-1.

Table 3.3.4.9.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 3.1.2
apiMajorVersion	string	See clause 3.3.2
operationOccurrenceId	Identifier	Identifier of a task operation occurrence. See note.
NOTE: This identifier can be retrieved from the resource referenced by the "Location HTTP" header in the response to a POST request triggering a task operation.		

3.3.4.9.3 Resource methods

3.3.4.9.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.9.3.2 GET

The API consumer can use this method to retrieve status information about a task operation occurrence by reading a "Task Operation Occurrence" resource.

This method shall follow the provisions specified in table 3.3.4.9.3.2-1 for URI query parameters.

Table 3.3.4.9.3.2-1 URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
none supported		

This method shall support the request data structures, the response data structures, and response codes specified in table 3.3.4.9.3.2-2.

Table 3.3.4.9.3.2-2: 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
	TaskOperationInfo	1	200 OK	Shall be returned when information about an individual task operation occurrence has been read successfully. The response body shall contain status information about a task operation occurrence (see clause 3.3.6.2.7).
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.3.4.9.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.9.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.4.9.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.3.5 Notifications

3.3.5.1 General

Notifications shall comply to the Subscribe/Notify pattern described in clause 5.9 of ETSI GS NFV-SOL 015 [25].

Table 3.3.5.1-1 Notifications overview

Notification	Callback URI	HTTP method	Description
Alarm Change Notification	Alarm Subscription.callback	POST	Notify subscribers when objects in the O2ims Alarm List have changed.

3.3.5.1.1 Alarm Change Notification Description

The Alarm Change Notification is used by the O-Cloud Infrastructure Monitoring Service to report changes to the O2ims alarm List to an O2ims consumer that has subscribed to such notifications.

3.3.5.1.2 Target URI

The Alarm Subscription.Callback URI "{AlarmEventNotification}" shall be used with the callback URI variables define in table 3.3.5.1.2-1.

Table 3.3.5.1.2-1 Definition of Alarm Change Notification type

Attribute name	Data type	P	Cardinality	Description
globalCloudId	Identifier	M	1	The global cloud identifier assigned by the SMO.
consumerSubscriptionId	String	M	0..1	The value optionally provided by the consumer in the subscription.
notificationEventType	Integer	M	1	One of the following values: <ul style="list-style-type: none"> 0 for "NEW" 1 for "CHANGE" 2 for "CLEAR" 3 for "ACKNOWLEDGE"
objectRef	String	M	0..1	The URL to the AlarmEventRecord object.
alarmEventRecordId	Identifier	M	1	The identifier for the AlarmEventRecord Object.
objectTypeId	Identifier	M	1	A reference to the type of object which caused the alarm.
objectId	Identifier	M	1	A reference to the object instance which caused the alarm.
objectClass	String	M	1	The fully qualified name of the class of the object being referenced by the objectId attribute (e.g., "oran.o2ims.cluster.ClusterResource").
alarmDefinitionId	Identifier	M	1	A reference to the Alarm Definition record in the Alarm Dictionary associated with the referenced Object Type.
probableCauseId	Identifier	M	1	A reference to the ProbableCause of the Alarm.
alarmRaisedTime	DateTime	M	1	Date/Time stamp value when the AlarmEventRecord has been created.
alarmChangedTime	DateTime	M	1	Date/Time stamp value when any value of the AlarmEventRecord has been modified.
alarmAcknowledgeTime	DateTime	M	1	Date/Time stamp value when the alarm condition is acknowledged.
alarmAcknowledged	Boolean	M	1	Boolean value indicating of a management system has acknowledged the alarm.
perceivedSeverity	integer	M	1	One of the following values: <ul style="list-style-type: none"> 0 for "CRITICAL" 1 for "MAJOR" 2 for "MINOR" 3 for "WARNING" 4 for "INDETERMINATE" 5 for "CLEARED"
extensions	Key/Value	M	0..N	Unspecified (not standardized) properties (keys) which are tailored by the vendor or operator to extend the information provided about the O-Cloud Alarm.

3.3.6 Data model

3.3.6.1 REST resource data types

This clause specifies the data types to be used in resource representations and notifications supported by the present API.

Table 3.3.6.1-1 specifies the data types defined for the O2ims_InfrastructureMonitoring service API.

Table 3.3.6.1-1: O2ims_InfrastructureMonitoring resource data types

Data type	Clause defined	Description	Applicability
AlarmEventRecord	3.2.6.2.2	This data type represents an instance of an Alarm detected by the O-Cloud Infrastructure.	
AlarmSubscriptionInfo	3.2.6.2.3	This data type represents an instance of a subscription to O2ims Alarm change events.	
AlarmServiceConfiguration	3.3.6.2.5	This type represents information about the Alarm Service Configuration.	
TaskOperationInfo	3.3.6.2.7	This type represents a task operation occurrence.	

3.3.6.2 Structured data types

3.3.6.2.1 Introduction

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

3.3.6.2.2 Type: AlarmEventRecord

This type represents information about an Alarm in the O-Cloud Infrastructure. It shall comply with the provisions defined in table 3.3.6.2.2-1.

Table 3.3.6.2.2-1 Definition of type AlarmEventRecord

Attribute name	Data type	P	Cardinality	Description
alarmEventRecordId	Identifier	M	1	The identifier for the AlarmEventRecord Object.
objectTypeId	Identifier	M	1	A reference to the type of resource which caused the alarm.
objectId	Identifier	M	1	A reference to the resource instance which caused the alarm.
objectClass	String	M	1	The fully qualified name of the object being referenced by the objectId attribute (e.g., "oran.o2ims.cluster.ClusterResource").
alarmDefinitionId	Identifier	M	1	A reference to the Alarm Definition record in the Alarm Dictionary associated with the referenced Object Type.
probableCauseId	Identifier	M	1	A reference to the ProbableCause of the Alarm.
alarmRaisedTime	DateTime	M	1	Date/Time stamp value when the AlarmEventRecord has been created.
alarmChangedTime	DateTime	M	0..1	Date/Time stamp value when any value of the AlarmEventRecord has been modified. It shall be present if the alarm record has been modified.
alarmAcknowledgedTime	DateTime	M	0..1	Date/Time stamp value when the alarm condition is acknowledged. It shall be present if the alarm record has been acknowledged.
alarmAcknowledged	Boolean	M	1	Boolean value indicating of a management system has acknowledged the alarm. "True" if the alarm has been acknowledged, and "False" otherwise.
alarmClearedTime	DateTime	M	0..1	Date/Time stamp value indicating when the alarm was cleared. It shall be present if the alarm record has been cleared.
perceivedSeverity	integer	M	1	One of the following values: <ul style="list-style-type: none"> • 0 for "CRITICAL" • 1 for "MAJOR" • 2 for "MINOR" • 3 for "WARNING" • 4 for "INDETERMINATE" • 5 for "CLEARED"
extensions	KeyValue	M	0..N	Unspecified (not standardized) properties (keys) which are tailored by the vendor or operator to extend the information provided about the O-Cloud Alarm.

3.3.6.2.3 Type: AlarmSubscriptionInfo

This type represents information about a Subscription for Alarms in the O-Cloud. It shall comply with the provisions defined in table 3.3.6.2.3-1.

Table 3.3.6.2.3-1 Definition of type AlarmSubscriptionInfo

Attribute name	Data type	P	Cardinality	Description
alarmSubscriptionId	Identifier	M	1	Identifier for the Alarm Subscription. This identifier is allocated by the O-Cloud.
consumerSubscriptionId	String	O	0..1	Identifier for the consumer of events sent due to the Subscription.
filter	String	O	0..1	Criteria for events which do not need to be reported or will be filtered by the subscription notification service. Therefore, if a filter is not provided then all events are reported.
callback	Uri	M	1	The fully qualified URI to a consumer procedure which can process a Post of the AlarmEventNotification.

3.3.6.2.4 Type: AlarmEventRecordModifications

This type represents modifications for an individual alarm record, i.e., modification to a resource representation based on the "AlarmEventRecord" data type. The attributes of "AlarmEventRecord" that can be modified according to the provision in clause 3.3.6.2.2 are included in the "AlarmEventRecordModifications" data type.

The "AlarmEventRecordModifications" data type shall comply with the provisions defined in table 3.3.6.2.4-1.

Table 3.3.6.2.4-1: Definition of type AlarmEventRecordModifications

Attribute name	Data type	P	Cardinality	Description
alarmAcknowledged	Boolean	M	0..1	New value of the "alarmAcknowledged" attribute in "AlarmEventRecord". See note.
perceivedSeverity	Integer	M	0..1	New value for the "perceivedSeverity" attribute in "AlarmEventRecord" to indicate that the alarm record is requested to be cleared. Only the value "5" for "CLEARED" is permitted in a request message content. See note.
NOTE: Either "alarmAcknowledged" or "perceivedSeverity" shall be included in a request message content, but not both.				

3.3.6.2.5 Type: AlarmServiceConfiguration

This type represents request information about the Alarm Service Configuration which includes attributes to control the retention of Alarms in the O-Cloud Alarm List. It shall comply with the provisions defined in table 3.3.6.2.5-1.

Table 3.3.6.2.5-1 Definition of type AlarmServiceConfiguration

Attribute name	Data type	P	Cardinality	Description
retentionPeriod	Integer	M	1	Number of days for alarm history to be retained. See Note.
extensions	KeyValuePairs	M	0..N	List of metadata key-value pairs used to associate meaningful metadata to the related alarm service.
NOTE: this value has a minimum limit such that it can't be set to a value lower than the limit.				

3.3.6.2.6 Type: PurgeRequest

This data type is used in the Alarm Purge operation. The PurgeRequest data type is used to specify the Alarm Record IDs and a time window for alarms to be purged through the API. It shall comply with the provisions defined in table 3.3.6.2.6-1. See clause 3.3.4.7.3 for more details on the Alarm Purge Operation.

Table 3.3.6.2.6-1: Definition of type PurgeRequest

Attribute name	Data type	P	Cardinality	Description
alarmRecordId	String	M	0..N	A list of AlarmRecord ID (strings) if provided would be the alarm records that are to be purged. See note.
purgeConditions	Structure (inline)	M	0..1	Provides a time window (begin time, end time) for inactive and acknowledged alarms to be purged within. See note.
>startWindowTime	DateTime	M	0..1	Start time of the timing window of Alarms to be purged. Time refers to the "alarmClearedTime" in the AlarmEventRecord. If attribute is not provided, all cleared alarms older than the "endWindowTime" are considered for the purge request.
>endWindowTime	DateTime	M	1	End time of the timing windows of Alarms to be purged. Time refers to the "alarmClearedTime" in the AlarmEventRecord. If only this attribute is provided in the purgeConditions, all cleared alarms older than this time are considered for the purge request.
NOTE: At least either alarmRecordId or purgeCondition shall be provided in a request. If more than one attribute is provided, the API producer shall determine the intersection between the affected alarm event records and the purge conditions. For instance, if a list of alarm records is provided, as well as additional purge conditions, then those purge conditions are only to be applied to the list of alarm records provided.				

3.3.6.2.7 Type: TaskOperationInfo

This type represents a task operation occurrence. It shall comply with the provisions defined in table 3.2.6.2.7-1.

Table 3.3.6.2.7-1 Definition of type TaskOperationInfo

Attribute name	Data type	P	Cardinality	Description
Id	Identifier	M	1	Identifier of this task operation occurrence.
operationState	Enum (inlined)	M	1	The state of the alarm management operation. Permitted values: - PROCESSING: the operation is currently in execution. - COMPLETED: the operation has completed successfully. - FAILED: the operation has failed. - ROLLED_BACK: the operation has rolled back.
stateEnteredTime	DateTime	M	1	Date-time when the current state has been entered.
startTime	DateTime	M	1	Date-time of the start of the operation.
operation	Enum (inlined)	M	1	Type of the operation represented by this task operation occurrence. Permitted values: - PURGE: represents the "purge alarms" alarm management operation.
operationParams	Object	M	0..1	Input parameters of the triggered operation. This attribute shall be formatted according to the request data type of the related alarms management operation. The following mapping between operation attribute and the data type of this attribute shall apply: - PURGE: PurgeRequest This attribute shall be present if this data type is returned in a response to reading an individual resource and may be present according to the chosen attribute selector parameter if this data type is returned in a response to a query of a container resource.
error	ProblemDetails	M	0..1	If "operationState" is "FAILED", this attribute shall be present and contain error information, unless it has been requested to be excluded via an attribute selector.

3.3.6.3 Simple data types and enumerations

3.3.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses. The simple data types defined in a request body, response body, or a structured type are defined in ETSI GS NFV-SOL 013 [22] or this clause of the specification.

3.3.6.3.2 Simple data types

The simple data types defined in table 3.3.6.3.2-1 shall be supported.

Table 3.3.6.3.2-1: Simple data types

Type Name	Type Definition	Description
n/a		

3.3.7 Error handling

3.3.7.1 General

For the O2ims_InfrastructureMonitoring Service API, HTTP error responses shall be supported as specified in clause 3.1.5.

In addition, the requirements in the following clauses are applicable for the O2ims_InfrastructureMonitoring Service API.

3.3.7.2 Protocol errors

No specific protocol errors for the O2ims_InfrastructureMonitoring Service API are specified.

3.3.7.3 Application errors

No specific application errors for the O2ims_InfrastructureMonitoring Service API are specified

3.3.8 Security

No specific security procedures for the O2ims_InfrastructureMonitoring Service API are specified beyond those in clause 3.1.7.

3.4 O2ims_InfrastructureProvisioning Service API

3.4.1 Description

This API enables the SMO to invoke O2ims_InfrastructureProvisioning Service towards the O-Cloud.

The operations defined for O2ims_InfrastructureProvisioning Service through this API are- create, read, update, or delete. Elements provisioned through a ProvisioningRequest include but are not limited to the following:

- O-Cloud NodeCluster
- O-Cloud InfrastructureResource(s)

3.4.2 API Version

For the O2ims_InfrastructureProvisioning Service API version as specified in the present document, the MAJOR version field shall be 1, the MINOR version field shall be 1, and the PATCH version field shall be 0.

Table 3.4.2-1 lists the history of API versions of the O2ims_InfrastructureProvisioning Service and the main capabilities added/removed across versions.

Table 3.4.2-1: History of API versions of the O2ims_InfrastructureProvisioning Service.

Version	Description
1.0.0	Initial API Supporting: ProvisioningRequest List ProvisioningRequest Description
1.1.0	Modified data types: ProvisioningRequestInfo

3.4.3 REST resources structure and methods

All resource URIs of the API shall use the base URI specification defined in clause 3.1.2. The string "O2ims_infrastructureProvisioning" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the formed base URI (i.e., {apiRoot}/O2ims_infrastructureProvisioning/{apiVersion}).

When ambiguity is possible, the term REST resource is used to make the distinction between the term resource as understood within the context of REST API from the term resource as understood within the context of O-RAN.

Figure 3.4.3-1 shows the overall resource URI structure defined for the O2ims_infrastructureProvisioning API.

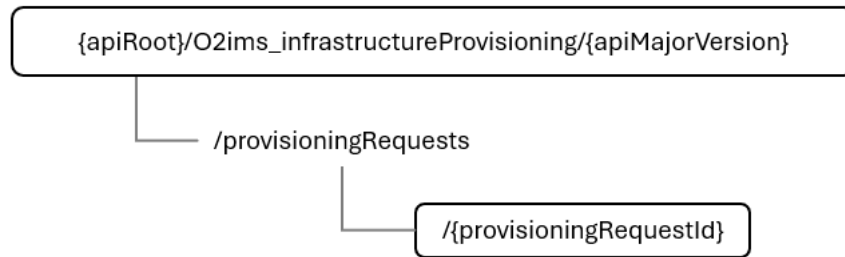


Figure 3.4.3-1 Resource URI structure of the O2ims_infrastructureProvisioning API

Table 3.4.3-1 provides an overview of the resources and applicable HTTP methods.

The O-Cloud shall support responding to requests for all HTTP methods on the resources in table 3.4.3-1 that are marked as "M" (mandatory) in the "Cat" column. The O-Cloud shall also support the "API versions" resources as specified in clause 3.1.8.

Table 3.4.3-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Cat	Description
ProvisioningRequest List	/provisioningRequests	GET	M	To get a list of ProvisioningRequests
		POST	M	To create an individual ProvisioningRequest
ProvisioningRequest Description	/provisioningRequests/{provisioningRequestId}	GET	M	To get the description of an individual ProvisioningRequest
		PUT	M	To replace/update an individual ProvisioningRequest
		DELETE	M	To delete an individual ProvisioningRequest

3.4.4 REST resources

3.4.4.1 Introduction

There are no preconditions or postconditions for a successful execution of each of the O2ims_infrastructureProvisioning Service API triggered by an operation.

3.4.4.2 REST resource: ProvisioningRequest List

3.4.4.2.1 Description

This resource represents the list of ProvisioningRequests that the O-Cloud has created based on request from the SMO as declarative target to provision O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s). The API consumer can use this resource to create a new ProvisioningRequest and to query the list of created ProvisioningRequests.

3.4.4.2.2 Resource definition

Resource URI: {apiRoot}O2ims_infrastructureProvisioning/{apiMajorVersion}/provisioningRequests

This resource shall support the resource URI variables defined in Table 3.4.4.2.2-1.

Table 3.4.4.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.4.4.2.3 Resource methods

3.4.4.2.3.1 POST

The POST operation is used to create an individual ProvisioningRequest. As a result of successfully executing this method, a new ProvisioningRequest instance resource as defined in clause 3.4.6.2.3 shall have been created, and the value of the "status" attribute in the representation of the ProvisioningRequest instance shall reflect the current phase in the provisioning request when the response is provided.

NOTE: The present document version does not specify the protocol and data model mechanisms to address the handling of ProvisioningRequests in a "multi-tenancy" scenario.

This method shall support the URI query parameters specified in Table 3.4.4.2.3.1-1.

Table 3.4.4.2.3.1-1: URI query parameters supported by the POST method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.4.4.2.3.1-2.

Table 3.4.4.2.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	ProvisioningRequestData	1	Parameters for the ProvisioningRequest instance to be created as defined in clause 3.4.6.2.2.	
Response body	Data type	Cardinality	Response Codes	Description
	ProvisioningRequestInfo	1	201 Created	Shall be returned when information about a ProvisioningRequest instance has been created successfully. The response body shall contain a representation of the created ProvisioningRequestInfo instance, as defined in clause 3.4.6.2.3. The HTTP response shall include a "Location" HTTP header that contains the resource URI of the newly-created ProvisioningRequest.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: the operation cannot be executed due to a conflict with the state of the resource. Typically, this is due to the fact that the consumer has requested to create a ProvisioningRequest instance with same "provisioningRequestId" as an already existing other ProvisioningRequest instance. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.4.4.2.3.2 GET

The GET method is used to retrieve the list of ProvisioningRequests.

This method shall support the URI query parameters specified in Table 3.4.4.2.3.2-1.

Table 3.4.4.2.3.2-1: 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 [22] . The O-Cloud 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 ProvisioningRequestInfo and in data types referenced from it shall be supported by the O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud 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 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Indicates to exclude the following complex attributes from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of ProvisioningRequestInfo in the response body if this parameter is provided, or none of the parameters "all_fields", "fields", "exclude_fields", "exclude_default" are provided: - TBD
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.4.4.2.3.2-2.

Table 3.4.4.2.3.2-2: 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
	ProvisioningRequestInfo	0..N	200 OK	<p>Shall be returned when information about zero or more ProvisioningRequestInfo instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more ProvisioningRequestInfo instances, as defined in clause 3.4.6.2.3.</p> <p>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 [22] , respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22] .</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22] .</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.4.4.2.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.4.4.2.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.4.4.2.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.4.4.3 REST resource: ProvisioningRequest Description

3.4.4.3.1 Description

The ProvisioningRequest Description represents an individual ProvisioningRequest that exists in the O-Cloud.

3.4.4.3.2 Resource definition

Resource URI:

{apiRoot}O2ims_infrastructureProvisioning/{apiMajorVersion}/provisioningRequests/{provisioningRequestId}

This resource shall support the resource URI variables defined in Table 3.4.4.3.2-1.

Table 3.4.4.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
provisioningRequestId	Identifier	The identifier of the ProvisioningRequest resource.
NOTE: This identifier can be retrieved from the provisioningRequestId attribute in the payload body of the response to a GET request getting the list of "ProvisioningRequestInfo" resources. This identifier can be also retrieved from the resource referenced by the "Location" HTTP header in the response to a POST request creating a new ProvisioningRequest resource.		

3.4.4.3.3 Resource methods

3.4.4.3.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.4.4.3.3.2 GET

The GET method is used to retrieve the description of a single ProvisioningRequest.

This method shall support the URI query parameters specified in Table 3.4.4.3.3.2-1.

Table 3.4.4.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.4.4.3.3.2-2.

Table 3.4.4.3.3.2-2: 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
	ProvisioningRequestInfo	1	200 OK	Shall be returned when information about a ProvisioningRequestInfo instance has been queried successfully. The response body shall contain a representation of the ProvisioningRequestInfo instance, as defined in clause 3.4.6.2.3.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.4.4.3.3.3 PUT

The PUT method is used to update fields of the ProvisioningRequest object. It operates as a “replace” or “overwrite” semantic model. All fields that are input to the ProvisioningRequest, i.e., as indicated by the data type "provisioningRequestData", can be updated, with the exception of the "provisioningRequestId". In case a different value of "provisioningRequestId" is indicated in the request payload compared to the "provisioningRequestId" that identifies the created ProvisioningRequest, the API producer shall return an appropriate error response.

This method shall support the URI query parameters specified in Table 3.4.4.3.3.3-1.

Table 3.4.4.3.3.3-1: URI query parameters supported by the PUT method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.4.4.3.3.3-2.

Table 3.4.4.3.3.3-2: Details of the PUT request/response on this resource

Request body	Data type	Cardinality	Description	
	ProvisioningRequestData	1	The parameters for the ProvisioningRequest, as defined in clause 3.4.6.2.2.	
Response body	Data type	Cardinality	Response Codes	Description
	ProvisioningRequestInfo	1	200 OK	Shall be returned when the request has been accepted. The response body shall contain a representation of the ProvisioningRequestInfo instance, as defined in clause 3.4.6.2.3.
	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 the request contains syntactically correct data, but the data cannot be processed. In particular, this is due to the fact that the consumer has requested to modify values of the ProvisioningRequest instance that are not modifiable due to specific API producer logic such as trying to modify the value of the "provisioningRequestId". The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.4.4.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.4.4.3.3.5 DELETE

The DELETE method is used to perform delete operation on a single ProvisioningRequest. On receiving a DELETE request, the ProvisioningRequest instance transitions to 'DELETING' phase and in case resources had been provisioned, the O-Cloud starts performing the deprovision of corresponding O-Cloud NodeCluster and/or other Infrastructure Resources represented by the ProvisioningRequest instance being deleted. During this period the consumer can poll for the status of deletion using GET method on the ProvisioningRequest resource URI. Once there are no resources provisioned by the ProvisionedRequest, such as all corresponding resources are deleted successfully, the ProvisioningRequest resource instance is deleted. Further onwards a GET on this ProvisioningRequest URI shall return '404 Not Found' response.

This method shall support the URI query parameters specified in Table 3.4.4.3.3.5-1.

Table 3.4.4.3.3.5-1: URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.4.4.3.3.5-2.

Table 3.4.4.3.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	Data type	Cardinality	Response Codes	Description
	n/a	1	202 Accepted	Shall be returned when the request has been accepted. The HTTP response shall include a "Location" HTTP header containing the URI for the ProvisioningRequest instance being deleted. This URI can be used to poll for status of the delete request.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.4.5 Notifications

3.4.5.1 General

The ProvisioningRequest object is designed for on-demand status retrieval. The consumer (SMO) can send a read request for the ProvisioningRequest object to retrieve its status. For example, while the ProvisioningRequest is being processed, the consumer can request the current status. The response will indicate the ProvisioningRequest's status, including its current ProvisioningPhase.

Additionally, the set of provisioned resources that are provisioned once the ProvisioningRequest is fulfilled could include an O-Cloud NodeCluster and/or O-Cloud InfrastructureResource(s). These resources will be notified through the O-Cloud inventory change notification subscription.

NOTE: Change notifications for ProvisioningRequest object is not defined in the present version of the document.

3.4.6 Data model

3.4.6.1 REST resource data types

This clause specifies the data types to be used in resource representations supported by the present API.

Table 3.4.6.1-1 specifies the data types defined for the O2ims_infrastructureProvisioning API.

Table 3.4.6.1-1: O2ims_infrastructureProvisioning resource data types

Data type	Clause defined	Description	Applicability
ProvisioningRequestInfo	3.2.6.2.2	This data type represents the information about the ProvisioningRequest object to provision O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s) in an O-Cloud	

3.4.6.2 Structured data types

3.4.6.2.1 Introduction

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

3.4.6.2.2 Type: ProvisioningRequestData

This type represents information about the input parameters of a ProvisioningRequest object to provision O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s) in an O-Cloud. It shall comply with the provisions defined in table 3.4.6.2.2-1.

Table 3.4.6.2.2-1: Definition of type ProvisioningRequestData

Attribute name	Data type	P	Cardinality	Description
provisioningRequestId	Identifier	M	1	Identifier of the ProvisioningRequest instance assigned by the SMO.
name	String	M	1	Human readable name of the ProvisioningRequest instance as assigned by the SMO.
description	String	M	1	Human readable description of the ProvisioningRequest instance as assigned by the SMO.
templateName	String	M	1	Name of the template to be used as the basis for the declarative model for the ProvisioningRequest instance. When combined with the templateVersion it shall resolve to a templateId.
templateVersion	String	M	1	Version of the template used as the basis for the declarative model for the ProvisioningRequest instance. When combined with the templateName it shall resolve to a templateId.
templateParameters	KeyValuePairs	M	0..1	List of variables/value pairs used within the template to tailor the template to this ProvisioningRequest instance.

3.4.6.2.3 Type: ProvisioningRequestInfo

This type represents information about the ProvisioningRequest object to provision O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s) in an O-Cloud. It shall comply with the provisions defined in table 3.4.6.2.3-1.

Table 3.4.6.2.3-1: Definition of type ProvisioningRequestInfo

Attribute name	Data type	P	Cardinality	Description
provisioningRequestData	ProvisioningRequestData	M	1	It represents information about the input parameters of a ProvisioningRequest object to provision O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s) in an O-Cloud. It shall comply with the provisions defined in table 3.4.6.2.2-1.
provisioningRequestReference	Identifier	M	1	A unique reference of this ProvisioningRequest, assigned by the service producer (O-Cloud) at the time of request creation. This attribute can be used for, e.g., troubleshooting purposes.
status	ProvisioningStatus	M	1	The time of the last message and the current ProvisioningPhase of the ProvisioningRequest.
provisionedResourceSet	ProvisionedResourceSet	M	0..1	The resources that have been successfully provisioned as part of the ProvisioningRequest.

3.4.6.2.4 Type: ProvisioningStatus

This type represents information about the status of the ProvisioningRequest object to provision an O-Cloud Node Cluster and/or O-Cloud Infrastructure Resource(s) in an O-Cloud. It shall comply with the provisions defined in table 3.4.6.2.4-1.

Table 3.4.6.2.44-1: Definition of type ProvisioningStatus

Attribute name	Data type	P	Cardinality	Description
updateTime	DateTime	M	1	The last date and time that the provisioningPhase attribute was modified. This attribute will follow the date-time format.
message	String	M	1	Human readable text about the provisioningPhase at the last updateTime.
provisioningPhase	ProvisioningPhase	M	1	This is an enumerated set of values which reflects the current phase of the provisioning request.

3.4.6.2.5 Type: ProvisionedResourceSet

This type represents information about the resources that have been successfully provisioned as part of the ProvisioningRequest in the O-Cloud. It shall comply with the provisions defined in table 3.4.6.2.5-1.

Table 3.4.6.2.55-1: Definition of type ProvisionedResourceSet

Attribute name	Data type	P	Cardinality	Description
nodeClusterId	String	M	0..1	If the ProvisioningRequest is fulfilled by a NodeCluster this field will contain its Id. See note.
infrastructureResourceIds	String	M	0..N	If the ProvisioningRequest is fulfilled by InfrastructureResource(s) this list will contain the Id(s) of all resources used to fulfil it. See note.
NOTE: Either "nodeClusterId" or "infrastructureResourceIds" shall be present, but not both, to cover respectively and exclusively a ProvisioningRequest used for O-Cloud Node Cluster provisioning or Infrastructure Resources				

3.4.6.3 Simple data types and enumerations

3.4.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses. The simple data types defined in a request body, response body, or a structure type are defined in ETSI GS NFV-SOL -013 [22] or this clause of the present document.

3.4.6.3.2 Simple data types

The simple data types defined in table 3.4.6.3.2-1 shall be supported.

Table 3.4.6.3.2-1: Simple data types

Type Name	Type Definition	Description
n/a		

3.4.6.3.3 Enumerations

3.4.6.3.3.1 ProvisioningPhase

The enumeration ProvisioningPhase shall comply with the provisions defined in table 3.4.6.3.3.1-1.

Table 3.4.6.3.3.1-1: Enumeration ProvivisioningPhase

Enumeration value	Description
PENDING	The ProvisioningRequest is waiting to be processed by the O-Cloud (IMS).
PROGRESSING	The O-Cloud (IMS) is processing the ProvisioningRequest and executing the actions to fulfill it.
FULFILLED	The ProvisioningRequest has been successfully processed and completed by the O-Cloud (IMS).
FAILED	The ProvisioningRequest could not be fully processed by the O-Cloud (IMS).
DELETING	The ProvisioningRequest is in the process of being deleted by the O-Cloud (IMS).

3.4.7 Error handling

3.4.7.1 General

For the O2ims_InfrastructureProvisioning Service API, HTTP error responses shall be supported as specified in clause 3.1.5.

In addition, the requirements in the following clauses are applicable for the O2ims_InfrastructureProvisioning Service API.

3.4.7.2 Protocol errors

No specific protocol errors for the O2ims_InfrastructureProvisioning Service API are specified.

NOTE: Descriptions on how to perform error handling based on the ProvisioningRequest machinery are not provided in the present document version.

3.4.7.3 Application errors

No specific application errors for the O2ims_InfrastructureProvisioning Service API are specified.

NOTE: Descriptions on how to perform error handling based on the ProvisioningRequest machinery are not provided in the present document version.

3.4.8 Security

No specific security procedures for the O2ims_InfrastructureProvisioning Service API are specified beyond those in clause 3.1.7.

3.5 O2ims_InfrastructureSoftwareManagement Service API

Not specified in the present document version.

3.6 O2ims_InfrastructureLifecycleManagement Service API

3.6.1 Description

This API allows the SMO to invoke O2ims_InfrastructureLifecycleManagement Services towards the O-Cloud.

Operations against SMO Service objects are not defined.

At this time no operations are defined for O2ims_InfrastructureLifecycleManagement in the present document version.

3.6.2 API version

For the O2ims_InfrastructureLifecycleManagement Service API 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.

3.6.3 REST resources structure and methods

REST resource structure and methods for this API are not specified in the present document version.

3.6.4 REST resources

Not specified in the present document version.

3.6.5 Notifications

3.6.5.1 General

Notifications shall comply to the Subscribe/Notify pattern described in clause 5.9 of ETSI GS NFV-SOL 015 [25].

Table 3.6.5.1-1 Notifications overview

Notification	Callback URI	HTTP method	Description
OCloud Available Notification	callback	POST	Notify SMO when the O-Cloud has determined that it is complete enough to allow provisioning from the SMO and/or to begin to support workload deployments.

3.6.5.1.1 OCloud Available Notification Description

The OCloud Available Notification is used by the O-Cloud Infrastructure Management Service to register itself with the SMO. This occurs as part of the Genesis life cycle procedure when the O-Cloud has determined it can begin to support interactions with the SMO.

3.6.5.1.2 Target URI

OCloud Available Notification.Callback URI “{oCloudAvailableEventNotification}” shall be used with the callback URI variables defined in table 3.6.5.1.2-1.

Table 3.6.5.1.2-1 OCloud Available Notification.Callback URI Variables

Attribute name	Data type	P	Cardinality	Description
globalCloudId	Identifier	M	1	Identifier of the O-Cloud instance. Globally unique across O-Cloud instances. This value was provided by the SMO with the callback URI at the beginning of O-Cloud genesis and used in registration at the end of genesis.
oCloudId	Identifier	M	1	Identifier of the O-Cloud instance. Unique within an O-Cloud instance.
IMS_EP	String	M	1	The URI to the Infrastructure Services APIRoot.

3.6.6 Data Model

3.6.6.1 REST resource data types

This clause is not specified in the present document version.

3.6.6.2 Structured data types

This clause is not specified in the present document version.

3.6.6.3 Simple data types and enumerations

3.6.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses. The simple data types defined in a request body, response body, or a structured type are defined in ETSI GS NFV-SOL 013 [22] or this clause of the specification.

3.6.6.3.2 Simple data types

The simple data types defined in table 3.6.6.3.2-1 shall be supported.

Table 3.6.6.3.2-1: Simple data types

Type Name	Type Definition	Description
n/a		

3.6.7 Error handling

3.6.7.1 General

For the O2ims_InfrastructureLifecycleManagement Service API, HTTP error responses shall be supported as specified in clause 3.1.5.

In addition, the requirements in the following clauses are applicable for the O2ims_InfrastructureLifecycleManagement Service API.

3.6.7.2 Protocol errors

No specific protocol errors for the O2ims_InfrastructureLifecycleManagement Service API are specified.

3.6.7.3 Application errors

No specific application errors for the O2ims_InfrastructureLifecycleManagement Service API are specified

3.6.8 Security

No specific security procedures for the O2ims_InfrastructureLifecycleManagement Service API are specified beyond those in clause 3.1.7.

3.7 O2ims_InfrastructurePerformance Service API

3.7.1 Description

This API allows the SMO to invoke O2ims_InfrastructurePerformance Services towards the O-Cloud.

The operations defined for O2ims_InfrastructurePerformance Services through this API are:

- Query information about one or more Performance Measurement Jobs,
- Create an individual Performance Measurement Job,
- Delete an individual Performance Measurement Job, and
- Ability to query and modify the configurable values which govern the behaviour of the Performance Service.

3.7.2 API version

For the O2ims_InfrastructurePerformance Service API version as specified in the present document, the MAJOR version field shall be 2, the MINOR version field shall be 0, and the PATCH version field shall be 0.

Table 3.7.2-1 lists the history of API version of the O2ims_InfrastructurePerformance Service and the main capabilities added/removed across versions.

Table 3.7.2-1: History of API versions of the O2ims_InfrastructurePerformance Service.

Version	Description
1.0.0	Initial API Supporting: Measurement Job Query
1.1.0	New resources: Performance Measurement Job Create Performance Management Configuration
2.0.0	New method: Performance Measurement Job Delete Updated Data types: MeasurementJob MeasurementJobRequest

3.7.3 REST resources structure and methods

All resource URIs of the API shall use the base URI specification defined in clause 3.1.2. The string "O2ims_infrastructurePerformance" shall be used to represent {apiName}. All resource URIs in the clauses below are defined relative to the formed base URI (i.e., {apiRoot}/O2ims_infrastructurePerformance/{apiVersion}).

When ambiguity is possible, the term REST resource is used to make the distinction between the term resource as understood within the context of REST API from the term resource as understood within the context of O-RAN.

Figure 3.7.3-1 shows the overall resource URI structure defined for the O2ims_infrastructurePerformance Service API.

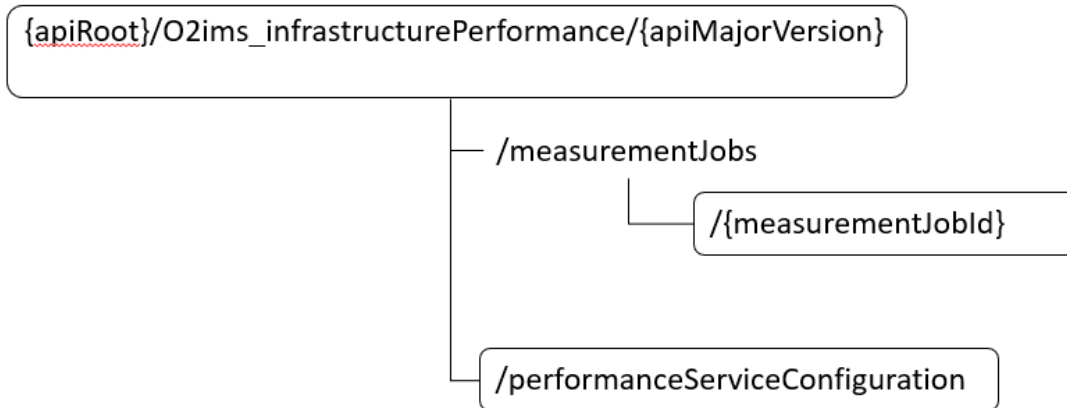


Figure 3.7.3-1: Resource URI structure of the O2ims_infrastructurePerformance API

Table 3.7.3-1 provides an overview of the resources and applicable HTTP methods.

The O-Cloud shall support responding to requests for all HTTP methods on the resources in table 3.7.3-1 that are marked as "M" (mandatory) in the "Cat" (category) column. The O-Cloud shall also support the "API versions" resources as specified in clause 3.1.8.

Table 3.7.3-1: Resources and methods overview

Resource name	Resource URI	HTTP method	Cat	Description
Measurement Job List	/measurementJobs	POST	M	To create an individual Performance Measurement Job.
		GET	M	To get a list of Performance Measurement Jobs
Measurement Job	/measurementJobs/{measurementJobId}	GET	M	To get an individual Performance Measurement Job
		DELETE	M	To delete an individual Performance Measurement Job
Performance Service Configuration	/performanceServiceConfiguration	GET	M	To get the current configuration of the performance service.
		PUT	M	To set a whole new configuration of the performance service.
		PATCH	M	Partially update the configuration of the performance service.

3.7.4 REST resources

3.7.4.1 Introduction

The O2ims Infrastructure Performance Service API described in the following clauses relate to Performance Management operations. These fall into four categories: Performance Measurement Job, Performance Management Reporting, Performance Management Subscription handling, and Performance Management configuration operations. Each of these REST operations relates to the four areas in the Information Model for Performance Management: Performance Measurement Store, Performance Measurement Report, Performance Subscription and Performance Measurement Jobs. See the O-RAN WG6.O-CLOUD-IM, clause 4.2.1.4.24, 4.2.1.4.21, 4.2.1.4.14 and 4.2.1.4.16 [36]

for more details. These APIs enable a management system, such as the SMO, to setup Performance Measurement Jobs, to establish Performance Management Subscriptions (to receive reports), to configure Performance Management behaviour, and to interact with a Performance Measurement Store. There are REST resources and supported methods to Create, Query, Delete, Update, Suspend and Resume Performance Measurement Jobs. There are also REST resources and supported methods for Performance Management Subscription Query, Performance Management Subscription Update and Performance Management Subscription Delete.

There are no preconditions or postconditions for a successful execution of each of the O2ims_InfrastructurePerformance Service API triggered by a corresponding operation.

3.7.4.2 REST resource: Measurement Job List

3.7.4.2.1 Description

This resource represents the list of Performance Measurement Jobs. The list can include Performance Measurement Jobs created either by the O-Cloud for internal monitoring or created by the SMO for additional measurement collection.

3.7.4.2.2 Resource definition

Resource URI: {apiRoot}/O2ims_infrastructurePerformance/{apiMajorVersion}/measurementJobs

This resource shall support the resource URI variables defined in Table 3.7.4.2.2 1.

Table 3.7.4.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.7.4.2.3 Resource methods

3.7.4.2.3.1 POST

The POST operation is used to create a Performance Measurement Job.

This method shall support the URI query parameters specified in Table 3.7.4.2.3.1-1.

Table 3.7.4.2.3.1-1 URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.7.4.2.3.1-2.

Table 3.7.4.2.3.1-2: Details of the POST request/response on this resource

Request body	Data type	Cardinality	Description	
	MeasurementJobRequest	1	Request for Performance Measurement Job instance to be created.	
Response body	Data type	Cardinality	Response Codes	Description
	MeasurementJob	1	201 Created	Shall be returned when a Performance Measurement Job instance has been created successfully. The response body shall contain a representation of the MeasurementJob instance, as defined in clause 3.7.6.2.2.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.7.4.2.3.2 GET

The GET operation is used to retrieve the list of Performance Measurement Jobs.

This method shall support the URI query parameters specified in Table 3.7.4.2.3.2-1.

In the provisions below, according to clause 5.3.2.1 of ETSI GS NFV-SOL 013 [22], *complex attributes* are assumed to be those attributes that are structured or that are arrays and are thus atomic in nature.

Table 3.7.4.2.3.2-2: URI query parameters supported by the GET method on this resource

Name	Cardinality	Description
filter	0..1	Attribute-based filtering expression according to ETSI GS NFV-SOL 013 [22], clause 5.2. The O-Cloud 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 MeasurementJob and in data types referenced from it shall be supported by the O-Cloud in the filter expression.
all_fields	0..1	Include all <i>complex attributes</i> in the response. See ETSI clause 5.3 of GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter.
fields	0..1	<i>Complex attributes</i> to be included into the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud should support this parameter.
exclude_fields	0..1	<i>Complex attributes</i> to be excluded from the response. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud should support this parameter.
exclude_default	0..1	Presence of this URI query parameter requests that a default set of <i>complex attributes</i> shall be excluded from the response. This parameter is a flag, i.e., it has no value. If none of the attribute selector parameters are specified, the " <i>exclude_default</i> " parameter shall be assumed as the default. See clause 5.3 of ETSI GS NFV-SOL 013 [22] for details. The O-Cloud shall support this parameter. The following attributes shall be excluded from the list of MeasurementJob if this parameter is provided: <ul style="list-style-type: none"> - measuredResources - collectedMeasurements
nextpage_opaque_marker	0..1	Marker to obtain the next page of a paged response. Shall be supported by the O-Cloud if the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource.

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.7.4.2.3.2-2.

Table 3.7.4.2.3.2-2: 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
	MeasurementJob	0..N	200 OK	<p>Shall be returned when information about zero or more MeasurementJob instances has been queried successfully.</p> <p>The response body shall contain in an array the representations of zero or more MeasurementJob instances, as defined in clause 3.7.6.2.2.</p> <p>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 [22], respectively.</p> <p>If the O-Cloud supports alternative 2 (paging) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] 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 [22].</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute-based filtering expression.</p> <p>The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Invalid attribute selector. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	1	400 Bad Request	<p>Shall be returned upon the following error: Response too big.</p> <p>If the O-Cloud supports alternative 1 (error) according to clause 5.4.2.1 of ETSI GS NFV-SOL 013 [22] for this resource, this error response shall follow the provisions in clause 5.4.2.2 of ETSI GS NFV-SOL 013 [22].</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	<p>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 [22] may be returned.</p>

3.7.4.2.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.7.4.2.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.7.4.2.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.7.4.3 REST resource: Measurement Job

3.7.4.3.1 Description

This resource represents the details of a Performance Measurement Job in the Measurement Job List. The Measurement Job also keeps a record of the details of the Measurement Job since its creation, such as the historical list of resources measured with the Performance Measurement Job.

3.7.4.3.2 Resource definition

Resource URI:

{apiRoot}/O2ims_infrastructurePerformance/{apiMajorVersion}/measurementJobs/{measurementJobId}

This resource shall support the resource URI variables defined in Table 3.7.4.3.2-1.

Table 3.7.4.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2
measurementJobId	Identifier	The identifier of the Measurement Job resource. See note.
NOTE: This identifier can be retrieved from the performanceMeasurementJobId attribute in the payload body of the response to a GET request getting the "Measurement Job List".		

3.7.4.3.3 Resource methods

3.7.4.3.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.7.4.3.3.2 GET

The GET operation is used to retrieve the details of an individual Measurement Job.

This method shall support the URI query parameters specified in Table 3.7.4.3.3.2-1.

Table 3.7.4.3.3.2-1: URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in 3.7.4.3.3.2-2.

Table 3.7.4.3.3.2-2: 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
	MeasurementJob	1	200 OK	Shall be returned when information about a MeasurementJob instance has been queried successfully. The response body shall contain a representation of the MeasurementJob instance, as defined in clause 3.7.6.2.2.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.7.4.3.3.3 PUT

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.7.4.3.3.4 PATCH

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22].

3.7.4.3.3.5 DELETE

The DELETE method is used to delete an individual Performance Measurement Job.

This method shall support the URI query parameters specified in Table 3.7.4.3.3.5-1.

Table 3.7.4.3.3.5-1 URI query parameters supported by the DELETE method on this resource

Name	Cardinality	Description
n/a		

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.7.4.3.3.5-2.

Table 3.7.4.3.3.5-2: Details of the DELETE request/response on this resource

Request body	Data type	Cardinality	Description	
	n/a			
Response body	Data type	Cardinality	Response Codes	Description
	n/a	1	204 (no content)	Shall be returned when the Performance Measurement Job has been deleted successfully. The response body shall be empty.
	ProblemDetails	1	409 Conflict	Shall be returned upon the following error: Deletion of non-suspended Performance Measurement Job. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	404 Not Found	Shall be returned upon the following error: Deletion of non-existent Performance Measurement Job. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	1	403 Forbidden	Shall be returned upon the following error: Deletion was requested on a Preinstalled Performance Measurement Job, which is not permitted. The response body shall contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 3.1.5	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 [22] may be returned.

3.7.4.4 REST resource: Performance Service Configuration

3.7.4.4.1 Description

The Performance Service Configuration represents the ability to get and set the configurable values which govern the behaviour of the performance service.

3.7.4.4.2 Resource definition

Resource URI:

{apiRoot}/O2ims_infrastructurePerformance/{apiMajorVersion}/performanceServiceConfiguration

This resource shall support the resource URI variables defined in Table 3.7.4.4.2-1.

Table 3.7.4.4.2-1 Resource URI variables for this resource

Name	Data type	Definition
apiRoot	String	See clause 3.1.2
apiMajorVersion	String	See clause 3.1.2

3.7.4.4.3 Resource methods

3.7.4.4.3.1 POST

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in clause 6.4 of ETSI GS NFV-SOL 013 [22] .

3.7.4.4.3.2 GET

The GET operation is used to retrieve the current performance service configuration.

This method shall support the URI query parameters specified in Table 3.7.4.4.3.2-1.

Table 3.7.4.4.3.2-1 URI query parameters supported by the GET method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.7.4.4.3.2-2.

Table 3.7.4.4.3.2-2: 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
	PerformanceServiceConfiguration	1	200 OK	Shall be returned when information about a PerformanceServiceConfiguration instance has been queried successfully. The response body shall contain a representation of the PerformanceServiceConfiguration instance, as defined in clause 3.7.6.2.4.
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.7.4.4.3.3 PUT

The PUT method is used to update all fields of the Performance Service Configuration. It operates as a replace or overwrite of the whole information representing the Performance Service Configuration

This method shall support the URI query parameters specified in Table 3.7.4.4.3.3-1.

Table 3.7.4.4.3.3-2 URI query parameters supported by the PUT method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.7.4.4.3.3-2.

Table 3.7.4.4.3.3-2: Details of the PUT request/response on this resource

Request body	Data type	Cardinality	Description	
	PerformanceServiceConfiguration	1	The parameter for the Performance Service Configuration, as defined in clause 3.7.6.2.4.	
Response body	Data type	Cardinality	Response Codes	Description
	PerformanceServiceConfiguration	1	200 OK	Shall be returned when the request has been accepted and completed. The response body shall contain a representation of the PerformanceServiceConfiguration with the result of the update (see clause 3.7.6.2.4).
	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 prior to this request. The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.7.4.4.3.4 PATCH

The PATCH method is used to modify individual fields of the Performance Service Configuration, also referred to as a partial update

A PATCH request shall enable only those fields of the performance service configuration that are contained in the request to be modified. Attributes not contained in the request will remain unmodified.

NOTE: It is not specified in the present document version the handling of the modifications of the child attributes of the "extension" attribute in the representation of the performance service configuration.

This method shall support the URI query parameters specified in Table 3.7.4.4.3.4-1.

Table 3.7.4.4.3.4-1 URI query parameters supported by the PATCH method on this resource

Name	Data type	P	Cardinality	Description	Applicability
n/a					

This method shall support the request data structures, the response data structures, and response codes specified in Table 3.7.4.4.3.4-2.

Table 3.7.4.4.3.4-2: Details of the PATCH request/response on this resource

Request body	Data type	Cardinality	Description	
	PerformanceServiceConfiguration	1	<p>The parameter for the Performance Service Configuration, as defined in clause 3.7.6.2.4. Only parameters requested to be updated shall be included in the message content</p> <p>The Content-Type header shall be set to "application/merge-patch+json" according to IETF RFC 7396 [29].</p>	
Response body	Data type	Cardinality	Response Codes	Description
	PerformanceServiceConfiguration	1	200 OK	<p>Shall be returned when the request has been accepted and completed.</p> <p>The response body shall contain only the attributes that have been modified for the performance service configuration (see clause 3.7.6.2.4).</p>
	ProblemDetails	0..1	412 Precondition failed	<p>Shall be returned upon the following error: A precondition given in an HTTP request header is not fulfilled.</p> <p>Typically, this is due to an ETag mismatch, indicating that the resource was modified by another entity.</p> <p>The response body should contain a ProblemDetails structure, in which the "detail" attribute should convey more information about the error.</p>
	ProblemDetails	See clause 3.1.5	4xx/5xx	In addition to the response codes defined above, any common error response code as defined in ETSI GS NFV-SOL 013 [22], clause 6.4 may be returned.

3.7.4.4.3.5 DELETE

This method is not supported. When this method is requested on this resource, the O-Cloud shall return a "405 Method Not Allowed" response as defined in ETSI GS NFV-SOL 013 [22], clause 6.4.

3.7.5 Notifications

The O2ims_InfrastructurePerformance Service API does not specify any notifications.

3.7.6 Data Model

3.7.6.1 REST resource data types

Table 3.7.6.1-1 specifies the data types defined for the O2ims_InfrastructurePerformance service API.

Table 3.7.6.1-1: O2ims_InfrastructurePerformance resource data types

Data type	Clause defined	Description	Applicability
MeasurementJob	3.7.6.2.2	This data type represents an instance of a Performance Measurement Job created either by the O-Cloud for internal monitoring or created by the SMO for additional measurement collection.	
MeasurementJobRequest	3.7.6.2.3	This data type represents a request for creation of a Performance Measurement Job by the consumer for measurement collection.	
PerformanceServiceConfiguration	3.7.6.2.4	This data type represents the Performance Service Configuration information.	

3.7.6.2 Structured data types

3.7.6.2.1 Introduction

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

3.7.6.2.2 Type: MeasurementJob

This data type represents an instance of a Performance Measurement Job created either by the O-Cloud for internal monitor or created by the SMO for additional measurement collection. It shall comply with the provisions defined in table 3.7.6.2.2-1.

Table 3.7.6.2.2-1: Definition of type MeasurementJob

Attribute name	Data type	P	Cardinality	Description
performanceMeasurementJobId	Identifier	M	1	Identifier of this instance of Performance Measurement Job within the IMS. This value is assigned by the IMS when the job is created
consumerPerformanceJobId	String	M	0..1	Identifier provided by the consumer for its purpose of managing performance jobs. This value could be the same across multiple instances of IMS performance job instances.
state	MeasurementJobState	M	1	The current state of the Performance Measurement Job.
collectionInterval	Integer	M	1	The interval at which performance measurements will be collected and stored.
resourceScopeCriteria	KeyValuePairs	M	0..1	Key value pairs of resource attributes which are used to select resources from which measurements are to be collected. This criterion determines, the value set for the Qualified Resource Types.
measurementSelectionCriteria	KeyValuePairs	M	1	Key value pairs that identify the distinct set of measurements within the scope of a Performance Measurement Job.
status	MeasurementJobStatus	M	1	The current status within the state. See note 1.
preinstalledJob	Boolean	M	1	Boolean which is True if the PerformanceMeasurementJob was created by the O-Cloud and False for external consumer such as the SMO.
qualifiedResourceTypes	String	M	0..N	This list is computed from evaluation of the resourceScopeCriteria. The resulting qualifiedResourceTypes are the distinct set of ResourceTypes among those measuredResources. This list of resource type UUIDs is used to qualify collectedMeasurements defined in the PM Dictionary of the qualified resource types.
measuredResources	MeasuredResource	M	0..N	This is the historical list of resources measured by this job. Resources added and deleted are kept track of for the life of the job.
collectedMeasurements	CollectedMeasurement	M	0..N	The historical list of measurements that are or have been collected by this job based on its resourceScopeCriteria and measurementSelectionCriteria over the life of the job.
extensions	KeyValuePairs	M	0..1	These are unspecified properties (keys and values) which extend the information provided about the Performance Measurement Job. See note 2.
NOTE 1: The O-RAN WG6.O-CLOUD-IM [36], clauses 4.2.1.4.16.3 and 4.2.1.4.16.4 have more details for the valid status values per state.				
NOTE 2: The extensions are not specified in the present document. None of the referenced documents do currently specify such extensions.				

3.7.6.2.3 Type: MeasurementJobRequest

This data type represents a request for the creation of a Performance Measurement Job for measurement collection. It shall comply with the provisions defined in table 3.7.6.2.3-1.

Table 3.7.6.2.3-1: Definition of type MeasurementJobRequest

Attribute name	Data type	P	Cardinality	Description
consumerPerformanceJobId	String	M	0..1	Identifier provided by the consumer for purpose of managing the performance job.
collectionInterval	Integer	M	1	The interval at which performance measurements will be collected and stored. The unit shall be seconds.
resourceScopeCriteria	KeyValuePairs	M	0..1	Key value pairs of resource attributes which are used to select resources from which measurements are to be collected. This criterion determines the value set for the Qualified Resource Types.
measurementSelectionCriteria	KeyValuePairs	M	1	Key value pairs that identify the distinct set of measurements within the scope of a Performance Measurement Job.
extensions	KeyValuePairs	M	0..1	These are unspecified properties (keys and values) which extend the information provided about the Performance Measurement Job. See note.
NOTE: The extensions are not specified in the present document. None of the referenced documents do currently specify such extensions.				

3.7.6.2.4 Type: PerformanceServiceConfiguration

This type represents information about the Performance Service Configuration which includes attributes to control the retention of measurements, and the meaningful metadata related to the performance service in the PerformanceMeasureStore, see O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.14. It shall comply with the provisions defined in table 3.7.6.2.4-1.

Table 3.7.6.2.4-1 Definition of type PerformanceServiceConfiguration

Attribute name	Data type	P	Cardinality	Description
retentionPeriod	Integer	M	1	Number of days for measurements to be retained. See note 1.
extensions	KeyValuePairs	M	0..1	These are unspecified properties (keys and values) which can be tailored to control the behaviour of the Performance Service. See note 2.
NOTE 1: This value has a minimum limit such that it can't be set to a value lower than the limit. NOTE 2: The extensions are not specified in the present document. None of the referenced documents do currently specify such extensions				

3.7.6.3 Simple data types and enumerations

3.7.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses. The simple data types defined in a request body, response body, or a structured type are defined in ETSI GS NFV-SOL 013 [22] or this clause of the specification.

3.7.6.3.2 Simple data types

The simple data types defined in table 3.7.6.3.2-1 shall be supported.

Table 3.7.6.3.2-1 Simple data types

Type Name	Type Definition	Description
n/a		

3.7.6.3.3 Enumerations

3.7.6.3.3.1 MeasurementJobState

The MeasurementJobState contains the value for the current condition of the Performance Measurement Job which reflects operational actions that is part of a state machine for the Performance Measurement Job. See O-RAN WG6.O-CLOUD-IM [36], clause 4.3.1.4.16.3 for more details.

Table 3.7.6.3.3.1-1 Enumeration MeasurementJobState

Enumeration value	Description
ACTIVE	A Performance Measurement Job that has been created and is currently running is defined to be in the ACTIVE state.
SUSPENDED	Performance Measurement Job that has been created, and through a request to stop measurement collection is defined to be in the SUSPENDED state. See the Performance Measurement Job Suspend use case in the O-RAN WG6.ORCH-USE-CASES [23], clause 3.8.9 for more details.
DEPRECATED	Job has been deleted but there are still counters it collected in the Performance Measurement Store. As a result of a Performance Measurement job deletion request, the Performance Measurement job is defined to be in the DEPRECATED state. A Performance Measurement job will remain deprecated until the last performance measurement referring to it is deleted from the Performance Measurement Store. See the Performance Measurement Job Delete use case in the O-RAN WG6.ORCH-USE-CASES [23], clause 3.8.7 for more details.

3.7.6.3.3.2 MeasurementJobStatus

The MeasurementJobStatus is further information within a current MeasurementJobState of a Performance Measurement Job. The state and status together provide a more complete view of the operational condition of a Performance Measurement Job. See O-RAN WG6.O-CLOUD-IM [36], clause 4.2.1.4.16.3 for more details.

Table 3.7.6.3.3.2-1: Enumeration MeasurementJobStatus

Enumeration value	Description
RUNNING	Performance Measurement Job is ACTIVE and running without error.
FAILED	Performance Measurement Job is supposed to be collecting measures but has totally failed.
DEGRADED	Performance Measurement Job is having issues collecting some of the measures, but it is collecting some.
IDLE	Performance Measurement Job is SUSPENDED.
PENDING_DELETE	Performance Measurement Job is DEPRECATED.

3.7.7 Error handling

3.7.7.1 General

For the O2ims_InfrastructurePerformance Service API, HTTP error responses shall be supported as specified in clause 3.1.5.

In addition, the requirements in the following clauses are applicable for the O2ims_InfrastructurePerformance Service API.

3.7.7.2 Protocol errors

No specific protocol errors for the O2ims_InfrastructurePerformance Service API are specified.

3.7.7.3 Application errors

No specific application errors for the O2ims_InfrastructurePerformance Service API are specified.

3.7.8 Security

No specific security procedures for the O2ims_InfrastructurePerformance Service API are specified beyond those in clause 3.1.7.

3.8 O2ims_InfrastructureLogging Service API

Not specified in the present document version.

4 O-Cloud Alarms

4.1 General

Clause 4 specifies the list of common alarms for O-Cloud, so that SMO can interpret the alarms from O-Cloud and perform root cause analysis in a multi-vendor environment.

The template of alarms has been defined in clause 5.2.3.11.2 in O-RAN.WG10.Information Model and Data Models.0 [37]. This template consists of the attribute names for AlarmDictionary (such as alarmDefinitions and probableCauses). The specifications of O-Cloud alarms consist of possible values for such attributes, alarmDefinitionId and probableCauseId.

ETSI NFV has defined alarms related to virtualized, containerized and cluster resources in clause 7 of ETSI GS NFV-IFA 045 [38]. Alarm definitions in ETSI GS NFV-IFA 045 specify the identifiers/names of the alarms, probable causes, associated managed objects and fault details, where applicable.

Since the functional capabilities in NFV and O-Cloud environments are related, O-Cloud alarms can be based, but not limited to, on alarms specified in ETSI GS NFV-IFA 045 [38]. Therefore, here feasible, terminology of alarm definitions can be generalized to align and make reusable the alarm definitions between O-RAN and ETSI NFV frameworks. Table 4.1-1 provides a mapping between the O-RAN and ETSI NFV concepts and identified objects that are managed by respective frameworks.

NOTE 1: Table 4.1-1 identifies in the present document version mapping of objects related to O-Cloud Node Clusters. The list can be extended in future versions of the present document.

Table 4.1-1: Concepts mapping between O-RAN and ETSI NFV

O-RAN concept	ETSI NFV concept	Description	Reference
O-Cloud Node Cluster	CIS cluster	In ETSI NFV, CIS refers to Container Infrastructure Services, which when termed together with cluster it implies that is a cluster that provides capabilities for deployment of containerized workloads. In O-RAN, the O-Cloud Node Cluster concept is described in clause 3.4.3.5.8 of O-RAN.WG6.O2-GA&P [24].	Clause 7.6 of ETSI GS NFV-IFA 045 [38] specifies alarms associated to CIS cluster.
O-Cloud Node	CIS cluster node	A CIS cluster node is a compute resource that runs container infrastructure data plane services, or control plane services, or both. In O-RAN, the O-Cloud Node concept is described in clause 3.4.3.5.5 of O-RAN.WG6.O2-GA&P [24].	Clause 7.6 of ETSI GS NFV-IFA 045 [38] specifies alarms associated to CIS cluster node.
O-Cloud Node Cluster Site Network	CIS cluster network	A CIS cluster network is a network connecting part of or the whole set of CIS cluster nodes conforming the CIS cluster. In O-RAN, the O-Cloud Node Cluster Site Network concept is described in clause 3.4.3.5.6 of O-RAN.WG6.O2-GA&P [24].	Clause 7.6 of ETSI GS NFV-IFA 045 [38] specifies alarms associated to CIS cluster network.

In alarm definitions of ITU-T X.733 [27] and ETSI GS NFV-IFA 045 [38], five basic categories of alarm, which are named as “event type”, are specified as shown in Table 4.1-2 below. Additional five categories for security alarm causes are specified in ITU-T X.736 [28] and 3GPP TS 28.111 [42], and those are provided in Table 4.1-2.

In ETSI GS NFV-IFA 045 [38], as well as in 3GPP TS 28.111 [42], all the probable causes are associated to specific "event type". The "event type" categories the kind of Alarms hence providing information for analysis and further correlation.

Table 4.1-2: Event types

Event type	Description
COMMUNICATIONS_ALARM	An alarm of this type is associated with the procedure and/or process required for conveying information from one point to another. (as defined by Recommendation ITU-T X.733 [27]).
PROCESSING_ERROR_ALARM	An alarm of this type is associated with a software or processing fault. (as defined by Recommendation ITU-T X.733 [27]).
ENVIRONMENTAL_ALARM	An alarm of this type is associated with a condition related to an enclosure in which the equipment resides. (as defined by Recommendation ITU-T X.733 [27]).
QOS_ALARM	An alarm of this type is associated with degradation in the quality of service. (as defined by Recommendation ITU-T X.733 [27]).
EQUIPMENT_ALARM	An alarm of this type is associated with an equipment fault. Equipment can be either logical devices that are realized via some form of virtualisation or physical devices. (as defined by Recommendation ITU-T X.733 [27]).
INTEGRITY_VIOLATION	An indication that information may have been illegally modified, inserted or deleted. (as defined by Recommendation ITU-T X.736 [28]).
OPERATIONAL_VIOLATION	An indication that the provision of the requested service was not possible due to the unavailability, malfunction or incorrect invocation of the service. (as defined by Recommendation ITU-T X.736 [28]).
PHYSICAL_VIOLATION	An indication that a physical resource has been violated in a way that suggests a security attack. (as defined by Recommendation ITU-T X.736 [28]).
SECURITY_SERVICE_OR_MECHANISM_VIOLATION	An indication that a security attack has been detected by a security service or mechanism. (as defined by Recommendation ITU-T X.736 [28]).
TIME_DOMAIN_VIOLATION	An indication that an event has occurred at an unexpected or prohibited time. (as defined by Recommendation ITU-T X.736 [28]).

4.2 Alarm Definition Identifiers

This clause describes the list of O-RAN standardised values for alarmDefinitionId.

Table 4.2-1 lists the specified alarm definitions, based on ETSI GS NFV-IFA 045 [38] alarms definition scopes, with the alarm definition identifier and a description of the meaning (semantics) of the alarm in the O-Cloud context.

Table 4.2-1 List of alarmDefinitionIds

Associated object	Alarm definition Identifier	Description
O-Cloud Node Cluster	CLUSTER_WARNING	One or multiple of the underlying resources of the O-Cloud Node Cluster have potential impeding service impacts, but the O-Cloud Node Cluster is still operational.
	CLUSTER_MINOR	One or multiple of the underlying resources of the O-Cloud Node Cluster are experimenting non-service affecting fault conditions and the O-Cloud Node Cluster has nonservice affecting fault conditions.
	CLUSTER_MAJOR	One or multiple of the underlying resources of the O-Cloud Node Cluster have service affecting conditions, but the O-Cloud Node Cluster is still operational.
	CLUSTER_CRITICAL	One or multiple of the underlying resources of the O-Cloud Node Cluster has service affecting conditions and the O-Cloud Node Cluster is not fully operational.
O-Cloud Node	CLUSTERNODE_WARNING	One or multiple of the underlying resources or software of the O-Cloud Node have potential impeding service impacts, but the O-Cloud Node is still operational.
	CLUSTERNODE_MINOR	One or multiple of the underlying resources or software of the O-Cloud Node are experimenting non-service affecting fault conditions and the O-Cloud Node has non-service affecting fault conditions.
	CLUSTERNODE_MAJOR	One or multiple of the underlying resources or software of the O-Cloud Node have service affecting conditions, but the O-Cloud Node is still operational.
	CLUSTERNODE_CRITICAL	One or multiple of the underlying resources or software of the O-Cloud Node has service affecting conditions and the O-Cloud Node is not fully operational.
O-Cloud Node Cluster Site Network	CLUSTERNETWORK_WARNING	One or multiple of the underlying resources or software of the O-Cloud Node Cluster Site Network resource have potential impeding service impacts, but the O-Cloud Node Cluster Site Network resource is still operational.
	CLUSTERNETWORK_MINOR	One or multiple of the underlying resources or software of the O-Cloud Node Cluster Site Network resource are experimenting non-service affecting fault conditions and the O-Cloud Node Cluster Site Network resource has non-service affecting fault conditions.
	CLUSTERNETWORK_MAJOR	One or multiple of the underlying resources or software of the O-Cloud Node Cluster Site Network resource have service affecting conditions, but the O-Cloud Node Cluster Site Network resource is still operational.
	CLUSTERNETWORK_CRITICAL	One or multiple of the underlying resources or software of the O-Cloud Node Cluster Site Network resource has service affecting conditions and the O-Cloud Node Cluster Site Network resource is not fully operational.

4.3 Probable Cause Identifiers

This clause describes the list of O-RAN standardised values for probableCauseId. The probable causes are used to provide additional information when reporting an alarm involving those listed as "associated objects". The objects

shown in the following Table 4.3-1 does not imply that associated objects are individually managed, but rather lists a set of objects with probable cause information about the failures.

Table 4.3-1 lists the specified probable causes, based on ETSI GS NFV-IFA 045 [38] probable cause scopes, with the probable cause identifiers, event types, and the fault details in the O-Cloud context.

NOTE 1: The probable causes specified in ETSI GS NFV-IFA 045 [38] are in turn based on and cover the typical probable cause scopes as defined in ITU-T Recommendation X.733 [27], but considering the specific referenced objects listed in Table 4.3-1 and their resource-level realization, such as, for instance, when a compute related object (see O-Cloud Node in table 4.3-1) contains also network and storage elements.

NOTE 2: Table 4.3-1 provides a list of defined probable causes and associated event types. Implementations may define/use additional probable causes with tailored description and semantics to be mapped to a different event type, if necessary.

Table 4.3-1 List of probableCauselds

Associated object	Probable cause identifier	Description	Event type
O-Cloud Node Cluster	CLUSTER_COMMUNICATION	Event related to the communication within the O-Cloud Node Cluster between O-Cloud Nodes.	COMMUNICATIONS_ALARM
O-Cloud Node	CERTIFICATE_EXPIRATION	Event related to expiration of certificate(s) for the O-Cloud Node.	PROCESSING_ERROR_ALARM
	CPU_BUS	Event related to buses of a CPU resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	CPU_CONFIGURATION	Configuration related event or state change on a CPU resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	CPU_DOWN	CPU resource associated to the O-Cloud Node is down/not available.	EQUIPMENT_ALARM
	CPU_PROTOCOL	Event related to CPU protocol, e.g. initialization procedure, state transitions, etc., on a CPU resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	CPU_TEMPERATURE	Event related to the temperature on a CPU resource associated to the O-Cloud Node.	ENVIRONMENTAL_ALARM
	CPU_THROTTLING	Throttling related event or state change on a CPU resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	HOST_OS_ERROR	Event related to processing failure in the host OS of the O-Cloud Node.	PROCESSING_ERROR_ALARM
	MEMORY_BIT_ERROR	Event related to single/multiple bit errors of the memory resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	MEMORY_CONFIGURATION	Event related to configuration of the memory resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	MEMORY_ECC	Event related to changes in states or rates concerning Error Correction Code (ECC) of the memory resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	MEMORY_REDUNDANCY	Event related to redundancy configuration of the memory resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	MEMORY_STATE	Event related to change of state on the memory resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM

Associated object	Probable cause identifier	Description	Event type
	MEMORY_TEMPERATURE	Event related to the temperature of memory resource associated to the O-Cloud Node.	ENVIRONMENTAL_ALARM
	INFRA_COMPONENT_MAINTENANCE	Event related to maintenance of an infrastructure component associated to the O-Cloud Node.	EQUIPMENT_ALARM
	INFRA_COMPONENT_POWER_OUTAGE	Event related to power outage of an infrastructure component associated to the O-Cloud Node.	EQUIPMENT_ALARM
	NIC_CABLE	Event related to cabling/connection of the network interface associated to the O-Cloud Node.	EQUIPMENT_ALARM
	NIC_CONFIGURATION	Event related to a configuration of the network interface associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	NIC_DOWN	Event related to the NIC associated to the O-Cloud Node is down/not available.	EQUIPMENT_ALARM
	NIC_LINK_DOWN	Event related to a link down on the network interface associated to the O-Cloud Node.	COMMUNICATIONS_ALARM
	NIC_LINK_TUNING	Event related to link tuning of the network interface associated to the O-Cloud Node.	COMMUNICATIONS_ALARM
	NIC_PCI_ERROR	Event related to a component of a Peripheral Component Interconnect (PCI) device of the network interface associated to the O-Cloud Node.	EQUIPMENT_ALARM
	NIC_PCI_PARITY_ERROR	Event related to PCI parity errors of the network interface associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	NIC_PCIE_ERROR	Event related to a component of a PCI Express (PCIE) device of the network interface associated to the O-Cloud Node.	EQUIPMENT_ALARM
	NIC_RECEIVE_FAILURE	Event related to errors in the reception of packet/frames by the network interface associated to the O-Cloud Node.	EQUIPMENT_ALARM
	NIC_TRANSMIT_FAILURE	Event related to errors in the transmission of packet/frames by the network interface associated to the O-Cloud Node.	EQUIPMENT_ALARM
	NODE_DOWN	Event related to the virtual compute or bare-metal machine associated to the O-Cloud Node is down/not available.	EQUIPMENT_ALARM
	PROCESSOR_SENSOR	Sensor related event or state change on a processor resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_BIT_ERROR	Event related to single/multiple bit errors on the storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_BLOCK_ERROR	Event related to bad blocks on the storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_CACHE	Event related to the cache of the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_CAPACITY	Event related to capacity (such as shortage) of the storage resource associated to the O-Cloud Node.	QOS_ALARM

Associated object	Probable cause identifier	Description	Event type
	STORAGE_CHECK	Event related to consistency checks on a storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_COMMUNICATION	Event related to the communication to/from the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_CONFIGURATION	Event related to the configuration of the storage associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_CONTROLLER	Event related to the controller of the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_DOWN	Storage resource associated to the O-Cloud Node is down/not available.	PROCESSING_ERROR_ALARM
	STORAGE_DRIVE_ARRAY	Event related to storage's drive array associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_ECC	Event related to changes in states or rates concerning Error Correction Code (ECC) of the storage or memory resources associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_ENCLOSURE	Event related to the enclosure of the storage resource associated to the O-Cloud Node.	ENVIRONMENTAL_ALARM
	STORAGE_FAILURE_PREDICTION	Event related to a predictive failure confirmed on a storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_MEMORY	Event related memory resources of the storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_PHYSICAL_DISK_DEGRADED	Event related to the performance on a physical disk resource associated to the O-Cloud Node.	QOS_ALARM
	STORAGE_PHYSICAL_DISK_STATE	The state has changed on a physical disk resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_POWER	Event related to power supply and/or power status of the storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_REBUILD	Event related to the rebuild process of the storage resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	STORAGE_REDUNDANCY	Event related to redundancy configuration of the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_SCSI	Event related to the Small Computer System Interface (SCSI) of the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_SENSOR	Event or state change related to sensor of the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM
	STORAGE_SMART	Event related to the Self-Monitoring Analysis and Reporting Technology (SMART) feature of the storage resource associated to the O-Cloud Node.	EQUIPMENT_ALARM

Associated object	Probable cause identifier	Description	Event type
	STORAGE_TEMPERATURE	Event related to the temperature of the storage resource associated to the O-Cloud Node.	ENVIRONMENTAL_ALARM
	STORAGE_VIRTUAL_DISK_DEGRADED	Event related to the performance on a virtual disk resource associated to the O-Cloud Node.	QOS_ALARM
	STORAGE_VIRTUAL_DISK_STATE	The state has changed on a virtual disk resource associated to the O-Cloud Node.	PROCESSING_ERROR_ALARM
	SYSTEM_LICENSE_EXPIRATION	Event related to expiration of a license applicable to the O-Cloud Node.	PROCESSING_ERROR_ALARM
O-Cloud Node Cluster Site Network	NETWORK_CONFIGURATION	Event related to configuration issues with a network resource associated to the O-Cloud Node Cluster Site Network.	PROCESSING_ERROR_ALARM
	NETWORK_CONNECTIVITY_SIGNAL	Event related to loss or changes in the connectivity signal provided/supported by a network resource associated to the O-Cloud Node Cluster Site Network.	COMMUNICATIONS_ALARM
	NETWORK_CPU_OVERLOAD	Event related to overload in the CPU/compute subsystems of a network resource associated to the O-Cloud Node Cluster Site Network.	PROCESSING_ERROR_ALARM
	NETWORK_MEMORY_OVERLOAD	Event related to overload in the memory subsystems of a network resource associated to the O-Cloud Node Cluster Site Network.	PROCESSING_ERROR_ALARM
	NETWORK_OVERLOAD	Event related to overload network input/output on a network resource associated to the O-Cloud Node Cluster Site Network.	QOS_ALARM
	NETWORK_PACKET_LOSS	Event related to packet loss experienced on a network resource associated to the O-Cloud Node Cluster Site Network.	COMMUNICATIONS_ALARM
	NETWORK_QOS	Event related to degradation of QoS levels of a network resource associated to the O-Cloud Node Cluster Site Network.	QOS_ALARM

Annex (informative): Change History

Date	Revision	Description
2023.10.13	04.00.01	Implemented CRs ATT-021, NOK-0066, NOK-0077
2023.11.10	04.00.02	Implemented CRs ATT-0022, DCM-0001, NOK-0078, and editorial updates
2023.11.17	04.00.03	Editorial updates based on review comments
2023.11.28	05.00	Final version 05.00 with editorial updates
2024.03.19	05.00.01	Implemented CRs NOK-0095, NOK-0092, DTAG-0001, DTAG-0002, ATT-0023
2024.03.20	05.00.02	Editorial updates based on review comments
2024.03.22	05.00.03	Editorial updates based on review comments
2024.03.22	05.00.04	Editorial updates based on review comments
2024.04.01	06.00	Final version 06.00
2024.07.15	06.00.01	Implemented CRs ATT-024, ATT-0025, ATT-026, DELL-0007, NOK-0087, NOK-0114, NOK-0102
2024.07.19	06.00.02	Editorial updates based on review comments
2024.07.29	07.00	Final version 07.00
2024.11.14	07.00.01	Implemented CRs ATT-0027, DCM-002, DTAG-0005, DTAG-007, DTAG-004, NOK-0128, NOK-0132, NOK-0129, and editorial changes
2024.11.26	07.00.02	Editorial updates based on review comments
2024.12.02	07.00.03	Updates made based on review comments
2024.12.03	07.00.04	Updates made based on review comments
2024.12.03	07.00.05	Updates made based on review comments
2024.12.09	08.00	Final version 08.00
2025.03.14	08.00.01	Implemented CRs DCM-003, DELL-0011, DTAG-0008, ERI-0054, ERI-0058, NOK-0115, NOK-0145
2025.03.19	08.00.02	Updates made based on review comments
2025.03.20	08.00.03	Updates made based on review comments
2025.03.26	09.00	Final version 09.00
2025.07.11	09.00.01	Implemented CRs ATT-0028, DCM-0004, DELL-0013, DTAG-0011, DTAG-0014, DTAG-0010, ERI-0068, NOK-0149, RHT-0005, RHT-0006, RMI-0038
2025.07.17	09.00.02	Updates made based on review comments
2025.07.17	09.00.03	Updates made based on review comments
2025.07.18	10.00	Final version 10.00