**3GPP TSG SA WG4 Meeting #125 S4-231243**

**Goteborg, SE, 21 - 25 Aug 2023 *revision of S4aI230116***

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **26.512** | **CR** | **0038** | **rev** |  | **Current version:** | **17.5.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** |  | | | | | | | | |
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| ***Source to WG:*** | Tencent | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | |
|  |  | | | | | | | | |
| ***Work item code:*** | 5GMS\_Pro\_Ph2 | | | | |  | ***Date:*** | | 2023-08-14 |
|  |  | | | |  | |  | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | Rel-18 |
|  |  | | | | | | | | |
| ***Reason for change:*** | | Complete the uplink streaming with the following features:  1. The content publishing provisioning  2. The egest protocols | | | | | | | |
|  | |  | | | | | | | |
| ***Summary of change:*** | | 1. Adding the content publishing configuration API and resource 2. Adding the egest protocols | | | | | | | |
|  | |  | | | | | | | |
| ***Consequences if not approved:*** | | Lack of provisioning and protocols for using 5GMS uplink streaming. | | | | | | | |
| ***Q*** | |  | | | | | | | |
| ***Clauses affected:*** | | 4.3.12 (new), 4.3.12.1 (new), 4.3.12.2 (new), 4.3.12.3 (new), 4.3.12.4 (new), 4.3.12.5 (new), 4.3.12.6 (new), 4.4A (new), 7.12 (new), 8.1, 8.4 (new), 8.5 (new), C.3.5A (new) | | | | | | | |
|  | |  | | | | | | | |
|  | | **Y** | **N** |  | | | |  | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | |
| ***affected:*** | |  | **X** | Test specifications | | | |  | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | |
|  | |  | | | | | | | |
| ***Other comments:*** | |  | | | | | | | |
|  | |  | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | |

FIRST CHANGE

## 4.3.12 Content Publishing Provisioning procedures

#### 4.3.12.1 General

These procedures are used by the 5GMSu Application Provider and the 5GMSu AF at reference point M1u to provision the content publishing feature for uplink media streaming.

#### 4.3.12.2 Create Content Publishing Configuration

This procedure is used by the 5GMSu Application Provider to create a new Content Publishing Configuration. The 5GMSu Application Provider shall use the HTTP POST method for this purpose and the request message body shall include a ContentPublishingConfiguration resource, as specified in clause 7.12.3.1.

- If the Content Publishing Configuration uses the Push-based content ingest method, i.e. the pull attribute is set to False, then the publishingConfiguration.baseURL property shall be nominated by the 5GMSu Application Provider in the request message body. The 5GMSu AF shall not change the value of publishingConfiguration.baseURL property in its response.

- If the Content Hosting Configuration uses the Pull-based content ingest method, i.e. the pull attribute is set to True, then the publishingConfiguration.baseURL property shall be nominated by the 5GMSu AF and returned in the response message body. It shall not be set by the 5GMSu Application Provider in the request message body.

If the procedure is successful, the 5GMSu AF shall generate a resource identifier representing the new Content Publishing Configuration. In this case, the 5GMSu AF shall respond with a 201 (Created) HTTP response message and shall provide the URL to the newly created resource in the Location header field. The response message body may include a ContentPublishingConfiguration resource (see clause 7.12.3.1) that represents the current state of the Content Publishing Configuration, including any fields set by the 5GMSu AF.

If the procedure is not successful, the 5GMSu AF shall provide a response code as defined in clause 6.3.

#### 4.3.12.3 Retrieve Content Publishing Configuration

This procedure is used by the 5GMSu Application Provider to obtain the properties of an existing Content Publishing Configuration resource from the 5GMSu AF. The HTTP GET method shall be used for this purpose.

If the procedure is successful, the 5GMSu AF shall respond with a 200 (OK) response message that includes the ContentPublishingConfiguration resource in the response message body.

If the procedure is not successful, the 5GMSu AF shall provide a response code as defined in clause 6.3.

#### 4.3.12.4 Update Content Publishing Configuration

The update operation is invoked by the 5GMSu Application Provider to modify the properties of an existing ContentPublishingConfiguration resource. All writeable properties may be updated. The HTTP PATCH or HTTP PUT methods shall be used for the update operation.

If the procedure is successful, the 5GMSu AF shall respond with 200 (OK) and provide the content of the resource in the response, confirming the successful update operation.

If the procedure is not successful, the 5GMSu AF shall provide a response code as defined in clause 6.3.

#### 4.3.12.5 Destroy Content Publishing Configuration

This operation is used by the 5GMSu Application Provider to destroy a Content Publishing Configuration resource and to terminate the related egest of content. The HTTP DELETE method shall be used for this purpose. As a result, the 5GMSu AF will release any associated network resources, purge any cached content, and delete any corresponding configurations.

If the procedure is successful, the 5GMSu AF shall respond with a 200 (OK) response message.

#### 4.3.12.6 Purge Content Publishing cache

This operation is used by the 5GMSu Application Provider to purge content from the 5GMSu AS Content Publishing cache. The HTTP POST method shall be used for this purpose with a regular expression describing the media resource URLs to be purged provided in the body of the request. As a result, as specified in clause 7.12.4.3, the 5GMSu AF purges any cached content whose URL matches the specified regular expression.

If the procedure is successful, the 5GMSu AF shall respond with a 200 (OK) response message.

If the procedure is not successful, the 5GMSu AF shall provide a response code as defined in clauses 6.3 and 7.12.4.3.

NEXT CHANGE

## 5.2 APIs relevant to Uplink Media Streaming

Table 5.2‑1 summarises the APIs used to provision and use the various uplink media streaming features specified in TS 26.501 [2].

Table 5.2‑1: Summary of APIs relevant to uplink media streaming features

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 5GMSu feature | Abstract | Relevant APIs | | |
| Interface | API name | Clause |
| Content protocols discovery | Used by the 5GMSu Application Provider to query which content egest protocols are supported by 5GMSu AS(s). | M1u | Content Protocols Discovery API | 7.5 |
| Content preparation | Supports manipulation by the 5GMSu AS of streaming media content uploaded by 5GMSu Client over M4u, prior to egest of the manipulated content over M2u. | M1u | Content Preparation Templates Provisioning API | 7.4 |
| Content publishing | Content is contributed to the 5GMSu AS and published to 5GMSu Application Providers according to a Content Publishing Configuration associated with a Provisioning Session. | M1u | Content Publishing Provisioning API | 7.12 |
| Metrics reporting | The 5GMSu Client uploads metrics reports to the 5GMSu AF according to a provisioned Metrics Reporting Configuration it obtains from the Service Access Information for its Provisioning Session. | M1u | Provisioning Sessions API | 7.2 |
| Metrics Reporting Provisioning API | 7.8 |
| M5u | Service Access Information API | 11.2 |
| Metrics Reporting API | 11.4 |
| Dynamic Policy invocation | The 5GMSu Client activates different traffic treatment policies selected from a set of Policy Templates configured in its Provisioning Session. | M1u | Provisioning Sessions API | 7.2 |
| Policy Templates Provisioning API | 7.9 |
| M5u | Service Access Information API | 11.2 |
| Dynamic Policies API | 11.5 |
| Network Assistance | The 5GMSu Client requests bit rate recommendations and delivery boosts from the 5GMSu AF. | M5u | Service Access Information API | 11.2 |
| Network Assistance API | 11.6 |
| Edge content processing | Edge resources are provisioned for processing content in 5GMS uplink media streaming sessions. | M1u | Provisioning Sessions API | 7.2 |
| Edge Resources Provisioning API | 7.10 |
| M5u | Service Access Information API | 11.2 |
| UE data collection, reporting and exposure | UE data related to uplink 5G Media Streaming is reported to the Data Collection AF instantiated in the 5GMSu AF for exposure to Event consumers. | M1u | Event Data processing Provisioning API | 7.11 |
| R4 | Ndcaf\_DataReporting service | 17 |
| R5, R6 | Naf\_EventExposure service | 18 |

NEXT CHANGE

## 7.12 Content Publishing Provisioning API

### 7.12.1 Overview

This clause specifies the API that a 5GMSu Application Provider uses at reference point M1u to provision and manage 5GMSu AS Content Publishing Configurations by interacting with a 5GMSu AF. Each such configuration is represented by a ContentPublishingConfiguration, the data model for which is specified in clause 7.12.3 below. The RESTful resources for managing Content Publishing Configurations are specified in clause 7.12.2 and the operations on these resources are further elaborated in clause 7.12.4.

### 7.12.2 Resource structure

The Content Publishing Provisioning API is accessible through this URL base path:

{apiRoot}/3gpp-m1*/*{apiVersion}*/*provisioning-sessions/{provisioningSessionId}/

Table 7.12.2-1 below specifies the operations and the corresponding HTTP methods that are supported by this API. In each case, the Provisioning Session identifier shall be substituted into {provisioningSessionId} in the above URL template and the sub-resource path specified in the second column shall be appended to the URL base path.

Table 7.12.2‑1: Operations supported by the Content Publishing Provisioning API

|  |  |  |  |
| --- | --- | --- | --- |
| Operation | Sub‑resource path | Allowed HTTP method(s) | Description |
| Create Content Publishing Configuration | content-publishing-configuration | POST | Used to create a Content Publishing Configuration resource. |
| Retrieve Content Publishing Configuration | GET | Used to retrieve an existing Content Publishing Configuration. |
| Update Content Publishing Configuration | PUT,  PATCH | Used to modify an existing Content Publishing Configuration. |
| Delete Content Publishing Configuration | DELETE | Used to delete an existing Content Publishing Configuration. |
| Purge Content Publishing Configuration cache | content-publishing-configuration/purge | POST | This operation is used to invalidate some or all cached media resources associated with this Content Publishing Configuration.  After this operation, the purged content is no longer available to be pulled by the 5GMSu Application Provider at reference point M2u. |

### 7.12.3 Data model

#### 7.12.3.1 ContentPublishingConfiguration resource

The data model for the ContentPublishingConfiguration resource is specified in table 7.12.3.1-1 below:

Table 7.12.3.1-1: Definition of ContentPublishingConfiguration resource

| Property name | Data type | Cardinality | Description |
| --- | --- | --- | --- |
| name | string | 1..1 | A name for this Content Publishing Configuration. |
| contribution‌Configurations | Array(object) | 1..N | Each contribution configuration specifies a Media Entry Point and any content preparation required for the egested content. |
| entryPoint | M1‌Media‌Entry‌Point | 1..1 | A Media Entry Point generated by the 5GMS System, and used by the Media Streamer to initiate a media streaming session at reference point M4u contributing content to the 5GMSu AS.  The semantics of the entry point are dependent on the value of the contentType property. |
| relativePath | Relative‌URL | 1..1 | A relative path (i.e., without a scheme or any leading forward slash characters) to the resource for the Media Entry Point. |
| contentType | string | 1..1 | The MIME content type of this Media Entry Point.  Used by the 5GMSu Client to select a contribution configuration. |
| profiles | Array(Uri) | 0..1 | An optional list of conformance profile identifiers associated with this Media Entry Point, each one expressed as a URI. A profile URI may indicate an interoperability point, for example.  Used by the 5GMSu Client to select a contribution configuration.  If present, the array shall contain at least one item. |
| content‌Preparation‌TemplateId | ResourceId | 0..1 | Indicates that content preparation prior to egest is requested by the 5GMSu Application Provider to transform contributed content into the required egest format. This property identifies the Content Preparation Template (clause 7.4) that shall be used for this transformation. |
| canonical‌Domain‌Name | string | 1..1 | The Fully Qualified Domain Name of the 5GMSu AS assigned by the 5GMSu AF through which resources are contributed by default. |
| domainNameAlias | string |  | The 5GMSu Application Provider may assign another Fully-Qualified Domain Name through which media resources may additionally be contributed at reference point M4u.  This domain name is used by the 5GMSu AS to select an appropriate Server Certificate to present at M4u, and to set appropriate CORS HTTP response headers at M4u.  If this property is present, the 5GMSu Application Provider is responsible for providing in the DNS a CNAME record that resolves domainNameAliasto canonicalDomainName. |
| certificateId | string | 0..1 | When content is contributed using TLS [16], the X.509 certificate to be presented by the 5GMSu AS in the TLS handshake at M4u is shared with the 5GMSd AF. This property indicates the identifier of the certificate to use. |
| baseURL | AbsoluteUrl | 0..1 | A base URL (i.e. one that includes a scheme, authority and, optionally, path segments) to which content is contributed by 5GMSu Clients at reference point M4u for this contribution configuration.  The value is chosen by the 5GMSd AF when the Content Hosting Configuration is provisioned. It is an error for the 5GMSu Application Provider to set this. |
| egestConfiguration | object | 1..1 | Describes the 5GMSu Application Provider's origin server to which media resources will be published via reference point M2u or the endpoint at which they will be made available to the 5GMSu Application Provider at reference point M2u. |
| pull | boolean | 1..1 | Indicates whether pull- or push- based egest is to be used by the 5GMSu AS for making content available to the 5GMSu Application Provider. |
| protocol | Uri | 1..1 | A fully-qualified term identifier allocated in the name space urn:3gpp:5gms:content-protocol that identifies the content egest protocol.  The set of supported egest protocols is specified in table 8.1‑1. |
| baseURL | Absolute‌URL | 1..1 | A base URL (i.e., one that includes a scheme, authority and, optionally, path segments) to which content is published at reference point M2d for this publishing configuration.  In the case of pull-based content egest (*pull* flag is set to *True*), this property is populated by the 5GMSd AF to indicate the location on the 5GMSu AS from which content is to be pulled for this Content Publishing Configuration. An uplink media streaming request received at reference point M4u is mapped by the 5GMSu AS to a URL at reference point M2u whose base is the value of this property.  In the case of push-based content egest (*pull* flag is set to False), this property is nominated by the 5GMSu Application Provider and indicates the base URL to which content for this Content Hosting Configuration is to be published. |
| cachingConfigurations | array(object) | 0..1 | Defines a configuration of the 5GMSu AS cache for a matching subset of media resources intended for egest at reference point M2u in relation to this Content Publishing Configuration. |
| urlPatternFilter | string | 1..1 | A pattern that will be used to match media resource URLs to determine whether a given media resource is eligible for caching by the 5GMSu AS. The format of the pattern shall be a regular expression as specified in [5]. |
| cachingDirectives | object | 1..1 | If a urlPatternFilter applies to a resource, then the provided cachingDirectives shall be applied by the 5GMSu AS at reference point M2u. Any caching directives received at M4u shall take precedence over these. |
| statusCodeFilters | array(integer) | 0..1 | The set of HTTP origin response status codes to which these cachingDirectives apply. The filter shall be provided as a regular expression as specified in [5].  If the list is empty, the CachingDirectives shall apply to all HTTP origin response status codes at M4u. |
| noCache | boolean | 1..1 | If set to True, this indicates that the media resources matching the filters shall not be cached by the 5GMSu AS and shall be marked as not to be cached when served by the 5GMSu AS at reference point M2u. |
| maxAge | integer | 0..1 | The caching time-to-live period that shall be set on media resources matching the filters. This determines the minimum period for which the 5GMSu AS shall cache matching media resources as well as the time-to-live period signalled by the 5GMSu AS at interface M2u when it serves such media resources.  The time-to-live for a given media resource shall be calculated relative to the time it was contributed. |

### 7.12.4 Operations

#### 7.12.4.1 Overview

This clause defines the behaviour that is expected from the 5GMSu AS when the Content Publishing Configuration has been successfully provisioned.

The 5GMSu Client chooses one uplink streaming protocol based on provided information in one or more Content Publishing Configurations. The corresponding Content Publishing Configuration also provides if the 5GMSu AS is required to perform content preparation process, the caching requirements, and the egest protocol for the uplinked content to be delivered to the 5GMSu Application Provider.

#### 7.12.4.2 Content processing

The 5GMSd AS can perform various content processing tasks (such as repackaging, encryption, ABR transcoding) on media resources prior to publishing or making them available at reference point M2u. These processing tasks shall be specified in a Content Preparation Template resource referenced from the Content Publishing Configuration resource.

#### 7.12.4.2 Content caching

A Content Publishing Configuration may specify caching rules to be applied to media resources contributed to the 5GMSu AS over reference point M4u and after any content preparation processing. In the case where a contributed media object has a caching directive, that caching directive overrides any other directive and is carried to the corresponding content preparation output(s). Otherwise, the M4u contribution URL shall be tested agains the provisioned set of urlPatternFilters in the CachingConfiguration to determine which caching directives apply. In case a media resource's URL matches the pattern filter of more than one CachingConfiguration, the first match shall apply. In the case where no match is found and no caching directive is provided at M4u, then default caching directives based on the media resource type shall be applied.

A caching directive shall either indicate that a matching media resource is not to be cached by the 5GMSu AS (noCache set to True), or that the 5GMSu AS is to cache it for maxAge seconds. The maxAge value applies relative to the time when a media resource was completely received by the 5GMSu AS at reference point M4u, t\_uplink. For simple HTTP-based uplink streaming with no chunked transfer coding, this corresponds to the Date header field in the HTTP request/response that carries the media resource at M4u. At the time t\_uplink + maxAge, the object and its corresponding content preparation output objects are considered stale and should not be served at M2u from the 5GMSu AS cache. The 5GMSu AS shall compensate for any synchronization skew between the client and its own clock. This can be for instance done by including the max-stale HTTP cache directive in its M2u responses.

The maxAge value may be signalled at M2u by the 5GMSu AS using the Expires HTTP response header or the HTTP Cache-Control directives max‑age or s‑maxage.

When distributing a media resource using HTTP, a no-cache request may be translated into a no-cache and no-store HTTP Cache-Control directive and/or a max-age=0 HTTP Cache-Control directive for exposure at reference point M2u.

By default, all origin HTTP header fields from the client shall be assumed as not forwarded by the 5GMSu AS, unless specified otherwise by setting the flag originCacheHeaders to True.

#### 7.12.4.3 Cache purging

The 5GMSu Application Provider may perform a purge operation to invalidate some or all cached media resources associated with a particular Content Publishing Configuration. A regular expression describing the set of media resource URLs to be purged from the 5GMSu AS cache for the Content Publishing Configuration in question shall be supplied in the body of the request. The body shall be encoded using the application/x-www-form-urlencoded MIME content type as a key–value pair, with the key being the string pattern and the value being the regular expression.

On receiving a purge request, the 5GMSu AF shall immediately invalidate all media resources in the 5GMSu AS cache matching the regular expression by declaring them as stale. In case of a Pull-based egest, any request at reference point M2u for a purged media resource shall be responded to with a 404 (Not Found) HTTP response. In the case of Push-based egest, any purged media object shall not be pushed until a new version of that object becomes available.

If the procedure is successful, the 5GMSu AF shall respond with one of the following response messages:

- 204 (No Content) if no cache entries were purged, for example because no current cache entries matched the regular expression supplied in the original request.

- 200 (OK) if some cache entries were purged. The body of the response message shall indicate the total number of cache entries purged in all 5GMSu AS instances distributing the Provisioning Session in question.

If the procedure is not successful, the 5GMSu AF shall provide a response code as defined in clause 6.3. In addition, the HTTP response 422 (Unprocessable Entity) shall be returned in the case where the request message body – or the regular expression contained in it – are found by the 5GMSd AF to be syntactically malformed.

NEXT CHANGE

# 8 Media Ingest and Publish (M2) protocols

## 8.1 General

The set of content protocols supported by the 5GMS AS is listed in table 8.1-1 below:

Table 8.1-1: Supported content protocols

| Description | Term identifier | Clause |
| --- | --- | --- |
| Content ingest protocols at interface M2d | | |
| HTTP pull-based content ingest protocol | urn:3gpp:5gms:content-protocol:http-pull-ingest | 8.2 |
| DASH-IF push-based content ingest protocol | urn:3gpp:5gms:content-protocol:dash-if-ingest | 8.3 |
| Content egest protocols at interface M2u | | |
| HTTP pull-based content egest protocol | urn:3gpp:5gms:content-protocol:http-pull-egest | 8.4 |
| DASH-IF push-based content egest protocol | urn:3gpp:5gms:content-protocol:dash-if-egest | 8.5 |

## 8.2 HTTP pull-based content ingest protocol

If IngestConfiguration.protocol is set to urn:3gpp:5gms:content-protocol:http-pull-ingest in the Content Hosting Configuration, media resources shall be ingested by the 5GMSd AS from the 5GMSd Application Provider using HTTP [24]. The IngestConfiguration.pull property shall be set to True, indicating that a Pull-based protocol is used. The IngestConfiguration.baseURL property shall point at the 5GMSd Application Provider's origin server, as specified in table 7.6.3.1‑1, and may indicate the use of HTTPS [16].

When the 5GMSd AS receives a request for a media resource at interface M4d that cannot be satisfied from its content cache, the request shall be transformed into a corresponding HTTP GET request directed to the 5GMSd Application Provider's origin server via interface M2d as follows:

1. The prefix of the request URL indicated in the Distribution‌Configuration.‌baseURL of the applicable Content Hosting Configuration is replaced with that of the corresponding Ingest‌Configuration‌.baseURL.

NOTE: It is the responsibility of the 5GMSd AF to assign unique M4d base URLs to each provisioned Content Hosting Configuration so as to ensure that this substitution is unambiguous.

2. The path rewrite rules (if provisioned in DistributionConfiguration.PathRewriteRules) are applied in strict order to the remainder of the request URL (i.e., the path segments following Distribution‌Configuration.‌baseURL). The requestPathPattern of the first matching path rewrite rule is replaced with the corresponding mappedPath.

## 8.3 DASH-IF push-based content ingest protocol

If IngestConfiguration.protocol is set to urn:3gpp:5gms:content-protocol:dash-if-ingest in the Content Hosting Configuration, media resources shall be published by the 5GMSd Application Provider to the 5GMSd AS as specified by the DASH‑IF Live Media Ingest specification [3]. The IngestConfiguration.pull property shall be set to False, indicating that a Push-based protocol is used. The IngestConfiguration.baseURL property shall be set by the 5GMSd AF to the base URL that is to be used by the 5GMSd Application Provider to upload the DASH segments and MPD(s) to the 5GMSd AS at reference point M2d.

## 8.4 HTTP pull-based content egest protocol

If EgestConfiguration.‌protocol is set to urn:3gpp:5gms:content-protocol:http-pull-egest in the Content Publishing Configuration, media resources shall be retrieved by the 5GMSu Application Provider from the 5GMSu AS using HTTP [25]. The EgestConfiguration.‌pull property shall be set to True, indicating that a Pull-based protocol is used. The EgestConfiguration.‌entryPoint property shall point at the 5GMSu AS, as specified in table 7.12.2-1, and may indicate the use of HTTPS [16].

## 8.5 DASH-IF push-based content egest protocol

If EgestConfiguration.‌protocol is set to urn:3gpp:5gms:content-protocol:dash-if-egest in the Content Publishing Configuration, media resources shall be published by the 5GMSu AS to the Application Service Provider as specified by the DASH‑IF Live Media Ingest specification [3]. The EgestConfiguration.‌pull property shall be set to False, indicating that a Push-based protocol is used. The EgestConfiguration.‌baseURL property shall be set by the 5GMSu Application Provider to the base URL that is to be used by the 5GMSu AS to upload the DASH segments and MPD(s) to the 5GMSU Application Provider at reference point M2u.

Next change

### C.3.5A M1\_ContentPublishingProvisioning API

Editor's Note: To be provided once resource structures are stable.

END OF CHANGES