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Foreword

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

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

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

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

shall indicates a mandatory requirement to do something

shall not indicates an interdiction (prohibition) to do something

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

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

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

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

can indicates that something is possible

cannot indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

1 Scope

The present document specifies the stage 3 protocol and data model for the AIML enabling SEAL services. It provides stage 3 protocol definitions and message flows and specifies the API for each service offered by the AIMLE server.

The stage 2 architecture and procedures are specified in 3GPP TS 23.482 [4].

The common protocol and interface aspects for API definition are specified in clause 5.2 of 3GPP TS 29.122 [5].

The present document is applicable to the user equipment (UE) supporting AIML enabling SEAL services functionalities as described in 3GPP TS 23.482 [4], to the application server supporting AIML enabling SEAL services functionalities as described in 3GPP TS 23.482 [4], and to the application server supporting the vertical application server (VAL server) functionality as defined in specific vertical application service (VAL service) specification.

NOTE: The specification of the VAL server for a specific VAL service is out of the scope of the present document.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.900: "Technical Specification Group working methods".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TS 23.222: "Common API Framework for 3GPP Northbound APIs; Stage 2".

[4] 3GPP TS 23.482: "Functional architecture and information flows for AIML Enablement Service".

[5] 3GPP TS 29.122: "T8 reference point for Northbound Application Programming Interfaces (APIs)".

[6] 3GPP TS 29.222: "Common API Framework for 3GPP Northbound APIs; Stage 3".

[7] 3GPP TS 29.482: "Service Enabler Architecture Layer for Verticals (SEAL); Artificial Intelligence Machine Learning Enablement (AIMLE) Services; Stage 3".

[8] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[9] 3GPP TS 29.549:" Service Enabler Architecture Layer for Verticals (SEAL); Application Programming Interface (API) specification".

[10] 3GPP TS 29.558: "Enabling Edge Applications; Application Programming Interface (API) specification; Stage 3".

[11] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[12] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs".

[13] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

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

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [2] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [2].

AIMLE client: an AIML enablement layer entity (see 3GPP TS 23.482 [4] clause 5) which is an AIML endpoint, and performs client-side operations.

AIML intermediate model: An AIML intermediate model defined in 3GPP TS 23.482 [4].

AIML operation: An AIML operation defined in 3GPP TS 23.482 [4].

AIMLE server: an AIML enablement layer entity (see 3GPP TS 23.482 [4] clause 5) which is an AIML endpoint, and performs server-side operations.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.434 [3] apply:

SEAL service
VAL client
VAL server
VAL service
Vertical
Vertical application

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.482 [4] apply:

AIMLE service
FL member
FL client
FL server

3.2 Symbols

For the purposes of the present document, the following symbols apply:

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [2] 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 [2].

ADAE	Application Data Analytics Enablement
AIML	Artificial Intelligence Machine Learning
AIMLE	AIML Enablement
API	Application Programming Interface
AS	Application Server
CAPIF	Common API Framework
FL	Federated Learning
HFL	Horizontal Federated Learning
ML	Machine Learning
SCEF	Service Capability Exposure Function
SCS	Services Capability Server
SEAL	Service Enabler Architecture Layer for verticals
TL	Transfer Learning
VAL	Vertical Application Layer
VFL	Vertical Federated Learning

4 General

4.1 Overview

Artificial intelligence machine learning enablement (AIMLE) SEAL services enable the AIMLE server to communicate with the AIMLE client over the AIML-UU reference points. The detailed specification of AIMLE is provided in 3GPP TS 23.482 [4].

The present document specifies the APIs in detail, needed to support the AIMLE services offered by the AIMLE client and the AIMLE services offered by the AIMLE server.

5 Artificial intelligence machine learning services

5.1 Introduction

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

Table 5.1-1: API descriptions

Service Name	Clause	Description	OpenAPI specification File	API name	Annex
Aimlec_AIMLEClientParticipation	5.2	AIMLE client participation service	TS24560_Aimlec_AIMLEClientParticipation.yaml	aimlec-cp	A.2
Aimlec_HFLTraining	5.3	AIMLE client HFL training service	TS24560_Aimlec_HFLTraining.yaml	aimlec-hfl-trng	A.3
Aimles_AIMLEClientRegistration	5.4	AIMLE client registration service	TS24560_Aimles_AIMLEClientRegistration.yaml	aimles-client-reg	A.4
Aimles_SplitOpEvent	5.5	AIMLE server split operation event	TS29482_Aimles_SplitOpEvent.yaml	aimles-splitopevent	NOTE
Aimles_SplitOpPipeline	5.6	AIMLE server split operation pipeline	TS24560_Aimles_SplitOpPipeline.yaml	aimles-sopl	A.5
Aimlec_FLGroupIndication	5.7	AIMLE client FL group indication service	TS24560_Aimlec_FLGroupIndication.yaml	aimlec-flgi	A.6
Aimlec_ClientDataProcessing	5.8	AIMLE client data processing service	TS24560_Aimlec_ClientDataProcessing.yaml	aimlec-data-proc	A.7
Aimlec_MLModTngCapEva	5.9	ML model training capability evaluation service	TS24560_Aimlec_MLModTngCapEva.yaml	aimlec-ml-mtce	A.8
Aimles_UeTLModelSelectionAssistance	5.10	TL enablement service	TS24560_Aimles_UeTLModelSelectionAssistance.yaml	aimles-ue-tl-msa	A.9
Aimlec_AIMLEClientServiceOperations	5.11	AIMLE client service operations service	TS24560_Aimlec_AIMLEClientServiceOperations.yaml	aimlec-serv-ops	A.10
Aimlec_AimlTaskTransfer	5.12	AIMLE client AIML task transfer service	TS24560_Aimlec_AimlTaskTransfer.yaml	aimlec-task-transfer	A.11
Aimles_AimlTaskTransfer	5.13	AIMLE server AIML task transfer service	TS24560_Aimles_AimlTaskTransfer.yaml	aimles-task-transfer	A.12
Aimles_MLModelRetrieval	5.14	AIMLE server ML model retrieval	TS29482_Aimles_MLModelRetrieval.yaml	aimles-mlmr	NOTE
Aimles_MLModelUpdate	5.15	AIMLE client ML model update	TS29482_Aimles_MLModelUpdate.yaml	TBD	NOTE
NOTE: The API and OpenAPI are defined in 3GPP TS 29.482 [7].					

NOTE: When 3GPP TS 29.122 [5] is referenced for the common protocol and interface aspects for API definition in the clauses under clause 5, the AIMLE service producer (AIMLE server or AIMLE client) takes the role of the SCEF and the AIMLE service consumer (AIMLE client or AIMLE server) takes the role of the SCS/AS.

5.2 AIMLE client participation service

5.2.1 Service description

The AIMLE client participation service enables the AIMLE server to verify and manage the participation of AIMLE clients in AIML operations as defined in 3GPP TS 23.482 [4].

5.2.2 Service operations

5.2.2.1 Introduction

The service operation defined for Aimlec_AIMLEClientParticipation API is shown in the table 5.2.2.1-1.

Table 5.2.2.1-1: Operations of AIMLE client participation service

Service operation name	Description	Initiated by
Aimlec_AIMLEClientParticipation_ Request	This service operation is used by the AIMLE server to request for participation of the AIMLE client for the AIML operations.	AIMLE server

5.2.2.2 Aimlec_AIMLEClientParticipation_Request

5.2.2.2.1 General

The Aimlec_AIMLEClientParticipation_Request service operation is used by AIMLE server to verify and manage the participation of AIMLE clients in AIML operations.

5.3.2.2.2 AIMLE client participation service operation

To manage the AIMLE client for AIML operations, the AIMLE server shall send an HTTP POST request (custom operation: "Participation for AIML operations") with a Request-URI set to "{apiRoot}/aimlec-cp/<apiVersion>/participation" and the request body including the AimlecParticipationReq data structure as specified in clause 6.1.6.2.2.

Upon receipt of the HTTP POST request:

a) the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized to request the AIMLE client to participate to the AIML operations; and

b) if the AIMLE server:

   1) is not authorized, the AIMLE client shall respond to the AIMLE server with an appropriate error status code; or

   2) is authorized, the AIMLE client shall respond to the AIMLE server with:

      i) if the HTTP POST request is handled successfully, an HTTP "200 OK" status code with the response body including the AimlecParticipationResp data structure as specified in clause 6.1.6.2.3; or

      ii) if the HTTP POST request is not handled successfully, an appropriate error response as specified in clause 6.1.7.

The AIMLE client may respond to the AIMLE server with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.3 HFL training service

5.3.1 Service description

The Horizontal Federated Learning (HFL) training service enables the AIMLE server to configure training schedule for one or more AIMLE clients and subscribe to HFL training as defined in 3GPP TS 23.482 [4].

5.3.2 Service operations

5.3.2.1 Introduction

The service operation defined for Aimlec_HFLTraining API is shown in the table 5.3.2.1-1.

Table 5.3.2.1-1: Operations of HFL training service

Service operation name	Description	Initiated by
Aimlec_HFLTraining_Subscribe	This service operation allows a service consumer to create an HFL training subscription.	e.g., AIMLE server
Aimlec_HFLTraining_Retrieve	This service operation allows a service consumer to retrieve an existing individual HFL training subscription.	e.g., AIMLE server
Aimlec_HFLTraining_Update	This service operation allows a service consumer to update an existing individual HFL training subscription.	e.g., AIMLE server
Aimlec_HFLTraining_Unsubscribe	This service operation allows a service consumer to delete an existing individual HFL training subscription.	e.g., AIMLE server
Aimlec_HFLTraining_Notify	This service operation allows a service consumer to receive HFL training notifications.	AIMLE client

5.3.2.2 Aimlec_HFLTraining_Subscribe

5.3.2.2.1 General

This service operation is used by a service consumer e.g., the AIMLE server to subscribe with the AIMLE client for HFL training event.

5.3.2.2.2 AIML operation for HFL training subscription

To subscribe to the HFL training event with the AIMLE client, the AIMLE server shall send to the AIMLE the HTTP POST request containing the HflTrngSub data type as specified in clause 6.2.6.2.2.

Upon receipt of the HTTP POST request from the AIMLE server, the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized for the request. If the AIMLE server:

a) is not authorized to subscribe to the HFL training event, the AIMLE client shall respond to the AIMLE server with an appropriate error status code as specified in clause 6.2.7; or

b) is authorized to subscribe to the HFL training event, the AIMLE client shall:

   1) create the HFL training event subscription and store the subscription information; and

   2) respond the AIMLE server by including in the response:

      i) an HTTP "Location" header containing the URI of the newly created resource; and

      ii) the HflTrngSub data type as specified in clause 6.2.6.2.2.

5.3.2.3 Aimlec_HFLTraining_Retrieve

5.3.2.3.1 General

This service operation is used by a service consumer e.g., the AIMLE server to retrieve an existing individual HFL training event subscription with the AIMLE client.

5.3.2.3.2 AIML operation for HFL training subscription retrieval

To retrieve an individual HFL training event subscription with the AIMLE client, the AIMLE server shall send the HTTP GET request to the AIMLE client.

Upon receipt of the HTTP GET request from the AIMLE server, the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized for the request. If the AIMLE server:

a) is not authorized to retrieve the existing individual HFL training event subscription, the AIMLE client shall respond to the AIMLE server with an appropriate error status code as specified in clause 6.2.7; or

b) is authorized to retrieve the existing individual HFL training event subscription, the AIMLE client shall include the HflTrngSub data type as specified in clause 6.2.6.2.2 in the response.

The AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.3.2.4 Aimlec_HFLTraining_Update

5.3.2.4.1 General

This service operation is used by a service consumer e.g., the AIMLE server to update an existing individual HFL training event subscription with the AIMLE client.

5.3.2.4.2 AIML operation for HFL training subscription update

To update an existing individual HFL training event subscription with the AIMLE client, the AIMLE server shall send to the AIMLE client:

- the HTTP PATCH request (for partial update) containing the HflTrngSubPatch data type as specified in clause 6.2.6.2.3; or

- the HTTP PUT request (for full replacement) containing the HflTrngSub data type as specified in clause 6.2.6.2.2.

Upon receipt of the HTTP PATCH request or HTTP PUT request from the AIMLE server, the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized for the request. If the AIMLE server:

a) is not authorized to update the existing individual HFL training event subscription, the AIMLE client shall respond to the AIMLE server with an appropriate error status code as specified in clause 6.2.7; or

b) is authorized to update the existing individual HFL training event subscription, the AIMLE client:

   1) shall update the existing individual HFL training event subscription with the updated subscription information; and

   2) may include the HflTrngSub data type as specified in clause 6.2.6.2.2 in the response.

The AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.3.2.5 Aimlec_HFLTraining_Unsubscribe

5.3.2.5.1 General

This service operation is used by a service consumer e.g., the AIMLE server to unsubscribe an existing individual HFL training event subscription with the AIMLE client.

5.3.2.5.2 AIML operation for HFL training unsubscription

To unsubscribe an existing individual HFL training event subscription with the AIMLE client, the AIMLE server shall send an HTTP DELETE request to the AIMLE client.

Upon receipt of the HTTP DELETE request from AIMLE server, the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized for the request. If the AIMLE server:

a) is not authorized to unsubscribe for the existing individual HFL training event subscription, the AIMLE client shall respond to the AIMLE server with an appropriate error status code as specified in clause 6.2.7; or

b) is authorized to update the existing individual HFL training event subscription, the AIMLE client shall:

   1) unsubscribe the existing individual HFL training event subscription; and

   2) respond to the AIMLE server with an HTTP "204 No Content" status code.

The AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.3.2.6 Aimlec_HFLTraining_Notify

5.3.2.6.1 General

This service operation is used by the AIMLE client to notify a service consumer e.g., the AIMLE server, information about the HFL training event.

5.3.2.6.2 AIML operation for HFL training notification

To notify about the HFL training event to the AIMLE server, the AIMLE client shall send to the AIMLE server an HTTP POST request containing the HflTrngNotify data type as specified in clause 6.2.6.2.4.

Upon receipt of the HTTP POST request from the AIMLE client, the AIMLE server shall verify the identity of the AIMLE client to determine that the AIMLE client is authorized for the request. Upon verification of the AIMLE client, the AIMLE server shall respond to the AIMLE client with:

a) if the HTTP POST request is handled successfully, an HTTP "204 No Content" status code; or

b) if the HTTP POST request is not handled successfully, an appropriate error response as specified in clause 6.2.7.

The AIMLE server may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE server towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.4 AIMLE client registration service

5.4.1 Service description

The AIMLE client registration service enables the communication between the AIMLE client and the AIMLE server for AIMLE client registration operations as defined in 3GPP TS 23.482 [4]. The AIMLE client registration service is provided by the AIMLE server.

5.4.2 Service operations

5.4.2.1 Introduction

The service operations defined for the Aimles_AIMLEClientRegistration API are shown in the table 5.4.2.1-1.

Table 5.4.2.1-1: Operations for AIMLE client registration service

Service operation name	Description	Initiated by
Aimles_AIMLEClientRegistration_Request	This service operation is used to request the AIMLE server to register the AIMLE client.	AIMLE client
Aimles_AIMLEClientRegistration_Update	This service operation is used to request the AIMLE server to update the AIMLE client registration information.	AIMLE client
Aimles_AIMLEClientRegistration_Delete	This service operation is used to request the AIMLE server to deregister the AIMLE client.	AIMLE client

5.4.2.2 Aimles_AIMLEClientRegistration_Request service operation

5.4.2.2.1 General

The Aimles_AIMLEClientRegistration_Request service operation is used by the AIMLE client to register to the AIMLE server. The AIMLE server stores the AIMLE client information for future interactions e.g. to discover and select suitable AIMLE clients for requested AIML operations.

5.4.2.2.2 AIMLE client registration request

To register itself at the AIMLE server, the AIMLE client shall send an HTTP POST request to the AIMLE server targeting the "AIMLE client registrations" collection resource, with the request body including the AimleClientRegInfo data structure as specified in clause 6.3.6.2.3.

Upon reception of the HTTP POST registration request, the AIMLE server shall perform an authentication and authorization check to determine if the AIMLE client is permitted to register to the AIMLE server and participate in AIML operations. If the AIMLE client:

1) is authorized to register at the AIMLE server, the AIMLE server shall:

   a) create a new "Individual AIMLE client registration" resource with the received registration information; and

   b) respond with an HTTP "201 Created" status code with the response body including the AimleRegistration data structure and an HTTP "Location" header field containing the URI of the created resource, as specified in clause 6.3.3.2.3.1; or

2) is not authorized to register at the AIMLE server, the AIMLE server shall take proper error handling actions, as specified in clause 6.3.7, and respond with an appropriate error status code.

If an "expTime" attribute indicating the expiration time for the AIMLE client registration was included in the AimleRegistration data structure as part of the created resource representation in step 1b above, then a periodic registration is required and to maintain the registration at the AIMLE server, the AIMLE client shall send a registration update request (as defined in clause 5.4.2.3) before the expiration of the current registration. If the AIMLE server did not receive the registration update request before the expiration of the current registration, then the AIMLE server shall delete the corresponding "Individual AIMLE client registration" resource.

NOTE: Upon successful authorization, the AIMLE server saves the context of the AIMLE client registration in the ML repository.

5.4.2.3 Aimles_AIMLEClientRegistration_Update service operation

5.4.2.3.1 General

The Aimles_AIMLEClientRegistration_Update service operation is used by the AIMLE client to update its registration information at the AIMLE server.

5.4.2.3.2 AIMLE client registration update

To update its registration information or invoke a reregistration at the AIMLE server, the AIMLE client shall send an HTTP PUT request to the AIMLE server targeting the "Individual AIMLE client registration" resource, as specified in clause 6.3.3.3.3.1, with the request body including the AimleRegistration data structure as specified in clause 6.3.6.2.2. The AIMLE client may update any data contained in the "suppProfiles" attribute and shall not update:

1) the expiration time for the AIMLE client registration contained in the "expTime" attribute;

2) the AIMLE client identifier contained in the "aimleClientId" attribute; and

3) a list of supported features contained in the "suppFeat" attribute.

Upon reception of the HTTP PUT request registration update request, the AIMLE server shall perform an authentication and authorization check to determine if the AIMLE client is permitted to update the targeted registration. If the AIMLE client:

1) is authorized update the targeted registration at the AIMLE server, the AIMLE server shall:

   a) accordingly update the targeted "Individual AIMLE client registration" resource; and

   b) respond with either:

      - an HTTP "204 No Content" status code if a periodic registration is not required; or

      - an HTTP "200 OK" status code with the response body including a representation of the updated resource within the AimleRegistration data structure; or

2) is not authorized update the targeted registration at the AIMLE server, the AIMLE server shall take proper error handling actions, as specified in clause 6.3.7, and respond with an appropriate error status code.

If the AIMLE server determined the received HTTP PUT request needs to be redirected, the AIMLE server may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE server towards which the HTTP PUT request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

If a periodic registration is required i.e. the "expTime" attribute indicating the expiration time for the AIMLE client registration was included in the AimleRegistration data structure in step 1b above, then to maintain the registration at the AIMLE server, the AIMLE client shall send the HTTP PUT registration update request (as described above) to update the registration prior to the expiration of the registration. If the AIMLE server did not receive the registration update request before the expiration of the registration, then the AIMLE server shall delete the corresponding "Individual AIMLE client registration" resource.

NOTE: Upon successful authorization, the AIMLE server saves the updated context of the AIMLE client registration in the ML repository.

5.4.2.4 Aimles_AIMLEClientRegistration_Delete service operation

5.4.2.4.1 General

The Aimles_AIMLEClientRegistration_Delete service operation is used by the AIMLE client to deregister itself from the AIMLE server.

5.4.2.4.2 AIMLE client deregistration

To deregister itself at the AIMLE server, the AIMLE client shall send an HTTP DELETE request to the AIMLE server targeting the "Individual AIMLE client registration" resource, as specified in clause 6.3.3.3.3.2.

Upon reception of the HTTP DELETE request, the AIMLE server shall perform an authentication and authorization check to determine if the AIMLE client is permitted to deregister at the AIMLE server. If the AIMLE client:

1) is authorized to deregister at the AIMLE server, the AIMLE server shall:

   a) delete the corresponding "Individual AIMLE client registration" resource; and

   b) respond with an HTTP "204 Not Content" status code; or

2) is not authorized to deregister at the AIMLE server, the AIMLE server shall take proper error handling actions, as specified in clause 6.3.7, and respond with an appropriate error status code.

If the AIMLE server determined the received HTTP DELETE request needs to be redirected, the AIMLE server may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE server towards which the HTTP DELETE request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.5 Split operation event subscription service

5.5.1 Service description

The split operation event subscription service enables an AIMLE client to subscribe, unsubscribe, and to update an existing subscription with the AIMLE server for events notification related to split AIML operation.

5.5.2 Service operations

5.5.2.1 Introduction

The service operation defined for Aimles_SplitOpEvent API is shown in the table 5.5.2.1-1.

Table 5.5.2.1-1: Operations of split operation event subscription

Service operation name	Description	Initiated by
Aimles_SplitOpEvent_Subscribe	This service operation is used by the AIMLE client to subscribe with the AIMLE server to be notified of events related to split AIML operation.	AIMLE client
Aimles_SplitOpEvent_Notify	This service operation is used by the AIMLE client to receive split operation notification from AIMLE server.	AIMLE server
Aimles_SplitOpEvent_UpdateSubscription	This service operation is used by the AIMLE client to update a subscription with the AIMLE server.	AIMLE client
Aimles_SplitOpEvent_Unsubscribe	This service operation is used by the AIMLE client to delete a subscription with the AIMLE server.	AIMLE client

5.5.2.2 Aimles_SplitOpEvent_Subscribe

5.5.2.2.1 General

This service operation is used by AIMLE client to subscribe with the AIMLE server to be notified of events related to split AIML operation.

5.5.2.2.2 AIMLE operation for split operation subscription

To subscribe with the AIMLE server for split operation event notification, the AIMLE client shall send an HTTP POST request to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.12.3.2. The body of the POST message shall include the SplitOpEventSub data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.12.6.2.2.

Upon receipt of the HTTP POST request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized for split operation subscription, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized to request ML split operation then the AIMLE server may create the subscription and store the subscription information. If the required AIMLE server:

      i) has created the subscription, then in the response the AIMLE server shall include an indication of success, the subscription identity and may include an expiration time to maintain the subscription; or

      ii) has not created the subscription, then in the response the AIMLE server shall include an indication of failure that the subscription is not created and shall include an appropriate error response as specified in 3GPP TS 29.482 [7] in clause 6.1.12.7.

If the AIMLE client determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.5.2.3 Aimles_SplitOpEvent_Notify

5.5.2.3.1 General

This service operation is used by AIMLE server to inform the AIMLE client about the split operation event.

5.5.2.3.2 AIMLE operation for split operation notification

To indicate a split operation event to a subscriber, i.e, AIMLE client, the AIMLE server shall send an HTTP POST request to AIMLE client as specified in 3GPP TS 29.482 [7] in clause 6.1.12.5. The body of the POST message shall include the SplitOpEventNotif data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.12.6.2.4.

Upon receipt of the HTTP POST request:

a) the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized to notify the AIMLE client about the split operation event; and

b) if the AIMLE server:

   1) is not authorized, the AIMLE client shall respond to the AIMLE server with an appropriate error status code; or

   2) is authorized, the AIMLE client shall respond to the AIMLE server with:

      i) if the HTTP POST request is handled successfully, an HTTP "204 No Content" status code; and

      ii) if the HTTP POST request is not handled successfully, an appropriate error response as specified in 3GPP TS 29.482 [7] in clause 6.1.12.7.

5.5.2.4 Aimles_SplitOpEvent_UpdateSubscription

5.5.2.4.1 General

This service operation is used by AIMLE client to update subscription with the AIMLE server for split operation event notification.

5.5.2.4.2 AIMLE operation for split operation subscription update

To update subscription with the AIMLE server for split operation, the AIMLE client shall send an HTTP PATCH request (for partial update) to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.12.3.3.3.3 or HTTP PUT request (for full replacement) to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.12.3.3.3.2. The body of the PATCH message shall include the SplitOpEventSubPatch data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.12.6.2.3 or the body of the PUT message shall include the SplitOpEventSub data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.12.6.2.2.

Upon receipt of the HTTP PATCH request or HTTP PUT request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized for split operation subscription update, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized to request split operation then the AIMLE server may update the subscription information. If the AIMLE server:

      i) has updated the subscription, then in the response the AIMLE server shall include an indication of success, and may include an expiration time; or

      ii) has not updated the subscription, then in the response the AIMLE server shall include an indication of failure and may include an appropriate error response as specified in 3GPP TS 29.482 [7] in clause 6.1.12.7.

If the AIMLE server determined the received HTTP PATCH request or HTTP PUT request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP PATCH request or HTTP PUT request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.5.2.5 Aimles_SplitOpEvent_Unsubscribe

5.5.2.5.1 General

This service operation is used by AIMLE client to unsubscribe with the AIMLE server for ML split operation.

5.5.2.5.2 AIMLE operation to unsubscribe for split operation

To unsubscribe with the AIMLE server for split operation, the AIMLE client shall send an HTTP DELETE request to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.12.3.3.3.4.

Upon receipt of the HTTP DELETE request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized to unsubscribe for split operation, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

2) is authorized to request split operation then the AIMLE server may cancel the subscription. If the AIMLE server:

   i) has cancelled the subscription, then in the response the AIMLE server shall include an indication of success; or

   ii) has not cancelled the subscription, then in the response the AIMLE server shall include an indication of failure and may include an appropriate error response as specified in 3GPP TS 29.482 [7] in clause 6.1.12.7.

If the AIMLE server determined the received HTTP DELETE request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP DELETE request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.6 Split AIML operation pipeline service

5.6.1 Service description

The split AIML operation pipeline service enables an AIMLE client to obtain information about available instances of split operation pipeline or processing the nodes of interest.

5.6.2 Service operations

5.6.2.1 Introduction

The service operation defined for Aimles_SplitOpPipeline API is shown in the table 5.6.2.1-1.

Table 5.6.2.1-1: Operations of split AIML operation pipeline service

Service operation name	Description	Initiated by
Aimles_SplitOpPipeline_Discover	This service operation is used by the AIMLE client or VAL server to communicate with the AIMLE server for split AIML operation pipeline discovery.	AIMLE client
Aimles_SplitOpPipeline_Create	This service operation is used by the AIMLE client to create an instance of a split operation pipeline at the AIMLE server.	AIMLE client
Aimles_SplitOpPipeline_Update	This service operation is used by the AIMLE client to update an instance of a split operation pipeline at the AIMLE server.	AIMLE client
Aimles_SplitOpPipeline_Delete	This service operation is used by the AIMLE client to delete an instance of a split operation pipeline at the AIMLE server.	AIMLE client

5.6.2.2 Aimles_SplitOpPipeline_Discover

5.6.2.2.1 General

This service operation is used by AIMLE client to discover instance(s) of split AIML operation pipeline or processing nodes from the AIMLE server.

5.6.2.2.2 AIML operation for pipeline discovery

To discover instance(s) of split AIML operation pipeline or processing nodes, the AIMLE client shall send an HTTP POST request to AIMLE server as specified in clause 6.5.4.2. The body of the POST message shall include the SplitOpPipelineDiscoverReq data structure as specified in clause 6.5.6.2.5.

Upon receipt of the HTTP POST request from the AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request; and

b) if the AIMLE client:

1) is not authorized to request split operation pipeline discovery, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

2) is authorized to request split operation pipeline discovery;

i) the AIMLE server may determine existing instance(s) of a split operation pipeline satisfy the request parameters; and

ii) if no instance of a split operation pipeline satisfies the request parameters, the AIMLE server shall determine whether an instance of a split operation pipeline can be created and creates a split operation profile as defined in clause 5.6.2.3.

5.6.2.3 Aimles_SplitOpPipeline_Create

5.6.2.3.1 General

This service operation is used by AIMLE client to create an instance of split AIML operation pipeline at the AIMLE server.

5.6.2.3.2 AIML operation for pipeline creation

To create an instance of split AIML operation pipeline, the AIMLE client shall send an HTTP POST request to AIMLE server as specified in clause 6.5.3.2. The body of the POST message shall include the SplitOpPipelineCreateReq data structure as specified in clause 6.5.6.2.2.

Upon receipt of the HTTP POST request from the AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request; and

b) if the AIMLE client:

1) is not authorized to request split operation pipeline creation, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

2) is authorized to request split operation pipeline creation then the AIMLE server shall determine if an instance of a split operation pipeline can be created or not. If the requested instance of split operation pipeline:

i) can be created, the AIMLE server shall create a split operation profile and in the response the AIMLE server shall include an indication that split operation pipeline was successful and the corresponding split operation profile; or

ii) cannot be created, the AIMLE server in the response shall include an indication that the split operation pipeline was unsuccessful with an appropriate error status code.

If the AIMLE client determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.6.2.4 Aimles_SplitOpPipeline_Update

5.6.2.4.1 General

This service operation is used by AIMLE client to update instance(s) of split AIML operation pipeline or processing nodes from the AIMLE server.

5.6.2.4.2 AIML operation for pipeline update

To update instance(s) of split AIML operation pipeline or processing nodes, the AIMLE client shall send an HTTP PATCH request (for partial update) or HTTP PUT request (for full replacement) to AIMLE server as specified in clause 6.5.3.3.3. The body of the HTTP PATCH request message or HTTP PUT request message shall include the SplitOpPipelinePatch data structure as specified in clause 6.5.6.2.4 or HTTP PUT request message shall include the SplitOpPipelineCreateReq data structure as specified in clause 6.5.6.2.2.

Upon receipt of the HTTP PATCH request or HTTP PUT request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request; and

b) if the AIMLE client:

   1) is not authorized to request split operation pipeline update, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized to request split operation pipeline update;

      i) has updated the instance, then in the response the AIMLE server shall include an indication of success, and may include an expiration time; or

      ii) has not updated the instance, then in the response the AIMLE server shall include an indication of failure and may include an appropriate error response as specified in clause 6.5.7.

If the AIMLE server determined the received HTTP PATCH request or the received HTTP PUT request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP PATCH request or the HTTP PUT request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.6.2.5 Aimles_SplitOpPipeline_Delete

5.6.2.5.1 General

This service operation is used by AIMLE client to delete an instance of split AIML operation pipeline at the AIMLE server.

5.6.2.5.2 AIML operation for pipeline deletion

To delete an instance of split AIML operation pipeline, the AIMLE client shall send an HTTP DELETE request to AIMLE server as specified in clause 6.5.3.3.3.

Upon receipt of the HTTP DELETE request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized to delete instance(s) of split AIML operation pipeline, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized to delete instance(s) of split AIML operation pipeline, the AIMLE server may delete the instance(s). If the AIMLE server:

      i) has deleted an instance of split AIML operation pipeline, then in the response the AIMLE server shall include an indication of success; or

      ii) has not deleted an instance of split AIML operation pipeline, then in the response the AIMLE server shall include an indication of failure and may include an appropriate error response as specified in clause 6.5.7.

If the AIMLE server determined the received HTTP DELETE request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP DELETE request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.7 FL group indication service

5.7.1 Service description

The FL group indication service enables the communication between the AIMLE server and the AIMLE client (i.e. the candidate FL member) for indicating the FL grouping procedure as defined in 3GPP TS 23.482 [4]. The FL group indication service is provided by the AIMLE client.

5.7.2 Service operations

5.7.2.1 Introduction

The service operation defined for the Aimlec_FLGroupIndication API is shown in the table 5.7.2.1-1.

Table 5.7.2.1-1: Operations for FL group indication service

Service operation name	Description	Initiated by
Aimlec_FLGroupIndication_Request	This service operation is used by AIMLE server to indicate AIMLE client (i.e. the candidate FL member) information about the FL members and the group.	AIMLE server

5.7.2.2 Indicate_FL_Member_Group

5.7.2.2.1 General

The Aimlec_FLGroupIndication_Request service operation is used by AIMLE server to indicate to the AIMLE client the FL group information.

5.7.2.2.2 Indicating FL group information

To update the AIMLE client (i.e. candidate FL member) about FL group, the AIMLE server shall send an HTTP POST request (custom operation: "Indicate FL group") with a Request-URI set to "{apiRoot}/aimlec-flgi/<apiVersion>/indicate" and with a body containing data type IndFlMember as defined in clause 6.6.6.2.2.

Upon receipt of the HTTP POST request:

a) the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized to indicate the information on FL member groups; and

b) if the AIMLE server:

   1) is not authorized, the AIMLE client shall respond to the AIMLE server with an appropriate error status code; or

   2) is authorized, the AIMLE client shall respond to the AIMLE server with:

      i) if the HTTP POST request is handled successfully, an HTTP "204 No Content" status code; and

      ii) if the HTTP POST request is not handled successfully, an appropriate error response as specified in clause 6.6.7.

5.8 Client data processing service

5.8.1 Service description

Client data processing service enables the communication between the AIMLE server and the AIMLE client for triggering the client data processing as defined in clause 8.15 in 3GPP TS 23.482 [4]. The client data processing is provided by the AIMLE client.

5.8.2 Service operations

5.8.2.1 Introduction

The service operation defined for the Aimlec_ClientDataProcessing API is shown in the table 5.8.2.1-1.

Table 5.8.2.1-1: Operations for Aimlec_ClientDataProcessing service

Service operation name	Description	Initiated by
Aimlec_ClientDataProcessing_Request	This service operation is used by the AIMLE server to trigger the AIMLE client to request the client data processing.	AIMLE server

5.8.2.2 Aimlec_ClientDataProcessing_Request

5.8.2.2.1 General

The Aimlec_ClientDataProcessing_Request service operation is used by AIMLE server to trigger the AIMLE client to request the client data processing procedure which includes the data preparation or the data analysis.

5.8.2.2.2 Triggering client data processing procedure

To trigger the AIMLE client to request the client data processing, the AIMLE server shall send an HTTP POST request (custom operation: "Trigger client data processing") with a Request-URI set to "{apiRoot}/aimlec-data-proc/<apiVersion>/trigger" and with a body containing CltDataProcReq structure data type as specified in clause 6.7.6.2.2.

Upon receipt of the HTTP POST request:

a) the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized to request the AIMLE client for the request; and

b) if the AIMLE server:

   1) is not authorized, the AIMLE client shall respond to the AIMLE server with an appropriate error status code; or

   2) is authorized, the AIMLE client shall respond to the AIMLE server with:

      i) if the HTTP POST request is handled successfully, an HTTP "200 OK" status code with the response body including the CltDataProcResp data structure as specified in clause 6.7.6.2.3; or

      ii) if the HTTP POST request is not handled successfully, an appropriate error response as specified in clause 6.7.7.

The AIMLE client may respond to the AIMLE server with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.9 ML model training capability evaluation service

5.9.1 Service description

The ML model training capability evaluation service enables the AIMLE server to request the AIMLE client to perform ML model training capability evaluation to support FL training (e.g. HFL, VFL) as defined in 3GPP TS 23.482 [4]. The AIMLE client service operations service is provided by the AIMLE client.

5.9.2 Service operations

5.9.2.1 Introduction

The service operations defined for the Aimlec_MLModTngCapEva API are shown in the table 5.9.2.1-1.

Table 5.9.2.1-1: Operations for ML model training capability evaluation service

Service operation name	Description	Initiated by
Aimlec_MLModTngCapEva_Request	This service operation is used by AIMLE server to requests for the ML model training capability evaluation.	AIMLE server

5.9.2.2 Aimlec_MLModTngCapEva_Request

5.9.2.2.1 General

The Aimlec_MLModTngCapEva_Request service operation is used by the AIMLE server to request the AIMLE client to perform the ML model training capability evaluation.

5.9.2.2.2 Perform ML model training capability evaluation

To request the AIMLE client to perform the ML model training capability evaluation, the AIMLE server shall send an HTTP POST request (custom operation: "ML model training capability evaluation request") to the AIMLE client, with the request URI set to "{apiRoot}/aimlec-ml-mtce/<apiVersion>/request", as specified in clause 6.8.4.2 and include in a body of the HTTP POST request a MlModTngCapEvalReq data structure defined in clause 6.8.6.2.2.

Upon reception of the HTTP POST request, the AIMLE client:

1) if the "availTime" attribute is received, shall evaluate availability for the requested time to support FL operation;
2) if the "testTask" attribute is received, shall run the task for test ML model training capability;
3) if "modelInfo" attribute is received, shall evaluate own capability for the indicated AIML model information and model parameters for use in the FL training process;
4) if the "dataSetReq" attribute is received, shall determine a data alignment between the datasets of the different domains;
5) based on the performed actions in steps 1 – 4, shall evaluate own capability and availability to join the FL training process; and
6) shall respond to the AIMLE server with an HTTP "200 OK" status code and include in the response body a MlModTngCapEvalResp data structure which:
   a) shall contain the outcome of the ML model training capability evaluation in the "capEvalOut" attribute; and
   b) if the "capEvalOut" attribute indicates:
      i) the ability to join the FL training process, shall contain the test result of the ML model training capability evaluation in the "testResult" attribute (e.g. successfully completed test task, available for the requested time to support FL operation, requirement on dataset successfully executed); or

ii) the inability to join the FL training process, shall contain the "evalFailInd" attribute which specifies the reason for not joining the FL training process (e.g. test task not completed, unavailable for the requested time to support FL operation, requirement on dataset cannot be executed, indicated model parameter for use in the FL training process not supported).

On failure, the AIMLE client shall take proper error handling actions, as specified in clause 6.8.7, and respond with an appropriate error status code.

If the AIMLE client determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

The ML model training capability result can be used by the AIMLE server to select FL members for FL training process (e.g. HFL, VFL).

5.10 TL enablement service

5.10.1 Service description

The Transfer Learning (TL) enablement service enables the communication between the AIMLE client (i.e., the VAL UE) and the AIMLE server for TL enablement service as defined in 3GPP TS 23.482 [4]. The TL enablement service is provided by the AIMLE server.

5.10.2 Service operations

5.10.2.1 Introduction

The service operation defined for the Aimles_UeTLModelSelectionAssistance API is shown in the table 5.10.2.1-1.

Table 5.10.2.1-1: Operations for TL enablement service

Service operation name	Description	Initiated by
Aimles_UeTLModelSelectionAssistance_Request	This service operation is used by AIMLE client to perform ML model selection by using a pre-trained model.	AIMLE client

5.10.2.2 Aimles_UeTLModelSelectionAssistance_Request

5.10.2.2.1 General

The Aimles_UeTLModelSelectionAssistance_Request service operation is used by AIMLE client for the TL enablement service to perform ML model selection for the target ML task by evaluating one or more pre-trained models, provided by the AIMLE server. Upon completion of the evaluation, the AIMLE client shall retrieve the selected ML model as described in 3GPP TS 29.482 [7].

5.10.2.2.2 AIML operation for TL model selection assistance request

To request the AIMLE server to provide one or more pre-trained ML models for the TL enablement service, the AIMLE client shall send an HTTP POST request (custom operation: "TL model selection assistance") with a Request-URI set to "{apiRoot}/aimles-ue-tl-msa/<apiVersion>/assist-tlms" and with a body containing data type TlModelSelectAssistReq as defined in clause 6.10.6.2.2.

Upon receipt of the HTTP POST request:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized to request one or more pre-trained ML models for the TL enablement service; and

b) if the AIMLE client:

1) is not authorized, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

2) is authorized, the AIMLE sever:

i) shall request ML repository one or more pre-trained ML models for the TL enablement service as described in 3GPP TS 29.482 [7]; and

ii) shall respond to the AIMLE server with:

A) if the HTTP POST request is handled successfully, an HTTP "200 OK" response code with the response body containing data type TlModelSelectAssistResp as defined in clause 6.9.6.2.3 which includes one or more pre-trained ML models for the TL enablement service; and

B) if the HTTP POST request is not handled successfully, an appropriate error response as specified in clause 6.9.7.

The AIMLE client may respond to the AIMLE server with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.11 AIMLE client service operations service

5.11.1 Service description

The AIMLE client service operations service enables the communication between the AIMLE client (e.g., AIML capable UE) and the AIMLE server for AIMLE client service operations as defined in 3GPP TS 23.482 [4]. The AIMLE client service operations service is provided by the AIMLE client.

5.11.2 Service operations

5.11.2.1 Introduction

The service operations defined for the Aimlec_AIMLEClientServiceOperations API are shown in the table 5.11.2.1-1.

Table 5.11.2.1-1: Operations for AIMLE client service operations service

Service operation name	Description	Initiated by
Aimlec_AIMLEClientServiceOperations_Request	This service operation is used by AIMLE server to request the AIMLE client service operation.	AIMLE server

5.11.2.2 Aimlec_AIMLEClientServiceOperations_Request

5.11.2.2.1 General

The Aimlec_AIMLEClientServiceOperations_Request service operation is used by AIMLE server to request the AIMLE client to perform the AIMLE client service operation.

5.11.2.2.2 Perform AIMLE client service operation

To request the AIMLE client to perform the AIMLE client service operation, the AIMLE server shall send an HTTP POST request (custom operation: "AIMLE service operation request") to the AIMLE client, with the request URI set to "{apiRoot}/aimlec-serv-ops/<apiVersion>/perform" and the request body including the AimleClientServOpReq data structure, as specified in clause 6.10.4.2.

Upon reception of the HTTP POST request, the AIMLE client:

1) shall perform the service operation mode received in the "servOpMode" attribute for the requested AIML service operation received in the "servOpId" attribute;

2) if the "servOpModeCfg" attribute is received, shall configure and monitor the AIML service operation in accordance with the received AIML service operation mode configuration requirements;

3) if the "servOpModeStatRptg" attribute is received, shall determine whether a periodic or event-based reporting of the AIML service operation mode status shall be applied towards the AIMLE server; and

4) shall respond to the AIMLE server with an HTTP "200 OK" status code and indicate the current service operation mode status within the "servOpModeStatus" attribute contained in the response body AimleClientServOpResp data structure.

On failure, the AIMLE client shall take proper error handling actions, as specified in clause 6.10.7, and respond with an appropriate error status code.

If the AIMLE client determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.12 AIMLE client AIML task transfer service

5.12.1 Service description

The AIMLE client AIML task transfer service enables the communication between the AIMLE client (e.g., AIML capable UE) and the AIMLE server for AIML task transfer operations as defined in 3GPP TS 23.482 [4]. The AIMLE client AIML task transfer service is provided by the AIMLE client.

5.12.2 Service operations

5.12.2.1 Introduction

The service operations defined for Aimlec_AimlTaskTransfer API are shown in the table 5.12.2.1-1.

Table 5.12.2.1-1: Operations for AIMLE client AIML task transfer service

Service operation name	Description	Initiated by
Aimlec_AIMLTaskTransfer_Request	This service operation is used by the AIMLE server to request AIML task transfer.	AIMLE server
Aimlec_DirectAIMLTaskTransfer_Request	This service operation is used by the source AIMLE client to request direct AIML task transfer.	AIMLE client

5.12.2.2 Aimlec_AIMLTaskTransfer_Request

5.12.2.2.1 General

The Aimlec_AIMLTaskTransfer_Request service operation is used by the AIMLE server to request the AIMLE client to perform the AIML task transfer operation.

5.12.2.2.2 Requesting AIML task transfer

To request the AIMLE client to perform the AIML task transfer operation, the AIMLE server shall send an HTTP POST request (custom operation: "AIML task transfer") to the AIMLE client, with the request URI set to "{apiRoot}/aimlec-task-transfer/<apiVersion>/request" and the request body including the AimleClientTaskTransferReq data structure, as specified in clause 6.11.6.2.2, which:

1) shall contain an identity of the AIMLE client from which the AIML task is to be transferred within the "sourceAimlId" attribute;

2) shall contain type of the AIML operation to be transferred within the "aimlTaskType" attribute;

3) shall contain type of the AIML information in the AIML task to be transferred within the "aimlInfoType" attribute; and

4 may contain the requested time for the AIML task transfer within the "aimlTaskTransferTime" attribute.

Upon reception of the HTTP POST request, the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized to request AIML task transfer. If the AIMLE server:

1) is not authorized or a failure occurs during HTTP request processing, the AIMLE client shall take proper error handling actions, as specified in clause 6.11.7, and respond with an appropriate error status code; or

2) is authorized, the AIMLE client shall respond to the AIMLE server with:

   a) an HTTP "200 OK" status code and indicate the time for the AIML task transfer within the "aimlTaskTransferTime" attribute contained in the response body AimleClientTaskTransferRes; or

   b) an HTTP "204 No Content" status code if the AIMLE client does not provide the AIML task transfer information in the response.

If the AIMLE client determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.12.2.3 Aimlec_DirectAIMLTaskTransfer_Request

5.12.2.3.1 General

The Aimlec_DirectAIMLTaskTransfer_Request service operation is used by the source AIMLE client to request the AIMLE client to perform the direct AIML task transfer operation.

5.12.2.3.2 Requesting direct AIML task transfer

To request the AIMLE client to perform the AIML task transfer operation, the source AIMLE client shall send an HTTP POST request (custom operation: "Direct AIML task transfer") to the AIMLE client, with the request URI set to "{apiRoot}/aimlec-task-transfer/<apiVersion>/request-direct" and the request body including the AimleClientDirectTransferReq data structure, as specified in clause 6.11.6.2.4, which:

1) shall contain type of the AIML operation to be transferred within the "aimlTaskType" attribute;

2) shall contain type of the AIML information in the AIML task to be transferred within the "aimlInfoType" attribute; and

3 may contain the requested time for the AIML task transfer within the "aimlTaskTransferTime" attribute.

Upon receipt of the HTTP POST request, the AIMLE client shall perform an authentication and authorization check to determine whether the source AIMLE client is permitted to request the AIML task transfer operation. If the source AIMLE client:

1) is not authorized or a failure occurs during HTTP request processing, the AIMLE client shall take proper error handling actions, as specified in clause 6.11.7, and respond with an appropriate error status code; or

2) is authorized, the AIMLE client shall respond with an HTTP "204 No Content" status code.

If the AIMLE client determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE

client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.13 AIMLE server AIML task transfer service

5.13.1 Service description

The AIMLE server AIML task transfer service enables the communication between the AIMLE client (e.g., AIML capable UE) and the AIMLE server for the AIML task transfer operations as defined in 3GPP TS 23.482 [4]. The AIMLE server AIML task transfer service is provided by the AIMLE server.

5.13.2 Service operations

5.13.2.1 Introduction

The service operations defined for the Aimles_AimlTaskTransfer API are shown in the table 5.13.2.1-1.

Table 5.13.2.1-1: Operations for AIMLE server AIML task transfer service

Service operation name	Description	Initiated by
Aimles_AIMLTaskTransferAssist_Request	This service operation is used by the AIMLE client to request the AIMLE server to assist in an AIML task transfer.	AIMLE client
Aimles_AIMLESControlledAIMLTaskTransfer_Request	This service operation is used by the AIMLE client to request the AIMLE server to perform the AIMLE server controlled AIML task transfer.	AIMLE client

5.13.2.2 Aimles_AIMLTaskTransferAssist_Request

5.13.2.2.1 General

The Aimles_AIMLTaskTransferAssist_Request service operation is used by the AIMLE client to request the AIMLE server to assist in AIML task transfer operation.

5.13.2.2.2 Requesting AIML task transfer assist

To get assistance from the AIMLE server, the AIMLE client shall send an HTTP POST request (custom operation: "AIML task transfer assist") to the AIMLE server, with the request URI set to "{apiRoot}/aimles-task-transfer/<apiVersion>/assist-tt" and the request body including the AimlesTaskTransferAssistReq data structure as specified in clause 6.12.6.2.2.

Upon reception of the HTTP POST request, the AIMLE server, based on the content of the received AimlesTaskTransferAssistReq data structure, shall discover other AIMLE clients, select one or more target AIMLE clients and determine which the transfer mode shall be applied. The AIMLE server shall send a "200 OK" response to the HTTP POST request. The AIMLE server shall include in the response body the AimlesTaskTransferAssistResp data structure, as specified in clause 6.12.6.2.3, which:

- shall contain a time window for assistance in the AIML task transfer in the "assistanceTime" attribute;
- shall contain the list of selected AIMLE clients in the "targetAimlIds" attribute; and
- may contain the transfer mode to be applied in the "transferMode" attribute.

On failure, the AIMLE server shall take proper error handling actions, as specified in clause 6.12.7, and respond with an appropriate error status code.

If the AIMLE server determined the received HTTP DELETE request needs to be redirected, the AIMLE server may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE

server towards which the HTTP DELETE request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.13.2.3 Aimles_AIMLESControlledAIMLTaskTransfer_Request

5.13.2.3.1 General

The Aimles_AIMLESControlledAIMLTaskTransfer_Request service operation is used by the AIMLE client to communicate with the AIMLE server to request AIMLE server-controlled AIML task transfer from the AIMLE client.

5.13.2.3.2 Requesting AIMLE server controlled AIML task transfer

To request the AIMLE server to perform the AIMLE server controlled AIML task transfer, the AIMLE client shall send an HTTP POST request (custom operation: "Controlled AIML task transfer") to the AIMLE server, with the request URI set to "{apiRoot}/aimles-task-transfer/<apiVersion>/request-ctld " and the request body including the AimlesControlledTaskTransferReq data structure as specified in clause 6.12.6.2.4.

Upon receipt of the HTTP POST request, the AIMLE server shall perform an authentication and authorization check to determine whether the AIMLE client is permitted to communicate with the AIMLE server. If the AIMLE client:

1) is authorized to communicate with the AIMLE server, the AIMLE server shall check the availability of the target AIMLE client. If the target AIMLE client is available, the AIMLE server shall send a "200 OK" response to the HTTP POST request. The AIMLE server shall include in the response body the AimlesControlledTaskTransferResp data structure, as specified in clause 6.12.6.2.5, which shall contain a time window for assistance in the AIML task transfer in the "assistanceTime" attribute; or

2) is not authorized or the target AIMLE client is not available, the AIMLE server shall take proper error handling actions, as specified in clause 6.12.7, and respond with an appropriate error status code.

If the AIMLE server determined the received HTTP DELETE request needs to be redirected, the AIMLE server may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE server towards which the HTTP DELETE request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.14 ML model retrieval service

5.14.1 Service description

The ML model retrieval service enables an AIMLE client to subscribe, unsubscribe, update the subscription to the event for the ML model retrieval.

5.14.2 Service operations

5.14.2.1 Introduction

The service operation defined for Aimles_MLModelRetrieval API is shown in the table 5.13.2.1-1.

Table 5.14.2.1-1: Operations of ML model retrieval service

Service operation name	Description	Initiated by
Aimles_MLModelRetrieval_Request	This service operation is used by the AIMLE client to request for one-time ML model retrieval.	AIMLE client
Aimles_MLModelRetrieval_Subscribe	This service operation is used by the AIMLE client to request to subscribe to for ML model retrieval.	AIMLE client
Aimles_MLModelRetrieval_Notify	This service operation is used by the AIMLE server to notify a previously subscribed AIMLE client with ML model retrieval.	AIMLE server
Aimles_MLModelRetrieval_UpdateSubscription	This service operation is used by the AIMLE client to update an existing subscription for ML model retrieval.	AIMLE client
Aimles_MLModelRetrieval_Unsubscribe	This service operation is used by the AIMLE client to cancel or delete an existing subscription for ML model retrieval.	AIMLE client

5.14.2.2 Aimles_MLModelRetrieval_Request

5.14.2.2.1 General

This service operation is used by AIMLE client to request for one-time ML model retrieval from the AIMLE server.

5.14.2.2.2 AIMLE operation for model retrieval

To request one-time ML model retrieval, the AIMLE client shall send an HTTP POST request to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.13.4. The body of the POST message shall include the MLMdlRetReq data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.13.6.2.5.

Upon receipt of the HTTP POST request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized to request ML model retrieval, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized to request ML model retrieval then the AIMLE server shall determine if the required ML models are available or not. For the registered AIMLE clients the AIMLE server uses the registered information and for the AIMLE clients that are not registered, the AIMLE server uses the ML model retrieval filters. If the required ML models are:

      i) available, then in the response the AIMLE server includes an indication that the retrieval was successful and includes the ML models; and

      ii) not available, then in the response the AIMLE server includes an indication that the retrieval failed and includes appropriate error code. The AIMLE server may also perform the ML model information discovery procedure with the ML using clause 6.1.13.7 of 3GPP TS 29.482 [7].

5.14.2.3 Aimles_MLModelRetrieval_Subscribe

5.14.2.3.1 General

This service operation is used by AIMLE client to subscribe to notifications from the AIMLE server about ML models retrieval.

5.14.2.3.2 AIMLE operation for model retrieval subscription

To subscribe with the AIMLE server to be notified of ML model retrieval, the AIMLE client shall send an HTTP POST request to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.13.3.2. The body of the POST message shall include the MLMdlRetSub data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.13.6.2.2.

Upon receipt of the HTTP POST request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

1) is not authorized for ML model retrieval subscription, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

2) is authorized to request ML model retrieval then the AIMLE server may create the subscription and store the subscription information. If the required AIMLE server:

i) has created the subscription, then in the response the AIMLE server shall include an HTTP "201 Created" status code with the response body including an indication of success, the subscription identity and may include an expiration time to maintain the subscription; or

ii) has not created the subscription, then in the response the AIMLE server shall include an indication of failure that the subscription is not created and shall include an appropriate error response as specified in clause 6.1.13.7 of 3GPP TS 29.482 [7].

If the AIMLE server determined the received HTTP POST request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP POST request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.14.2.4 Aimles_MLModelRetrieval_Notify

5.14.2.4.1 General

This service operation is used by AIMLE server to inform the AIMLE client about the availability of ML model.

5.14.2.4.2 AIMLE operation for model retrieval notification

To indicate availability of ML models to a subscriber, i.e, AIMLE client, the AIMLE server shall send an HTTP POST request to AIMLE client as specified in 3GPP TS 29.482 [7] in clause 6.1.13.5.2. The body of the POST message shall include the MLMdlRetNotif data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.13.6.2.4.

Upon receipt of the HTTP POST request:

a) the AIMLE client shall verify the identity of the AIMLE server and determine if the AIMLE server is authorized to indicate the newly available ML models; and

b) if the AIMLE server:

1) is not authorized, the AIMLE client shall respond to the AIMLE server with an appropriate error status code; or

2) is authorized, the AIMLE client shall respond to the AIMLE server with:

i) if the HTTP POST request is handled successfully, an HTTP "204 No Content" status code; and

ii) if the HTTP POST request is not handled successfully, an appropriate error response as specified in clause 6.1.13.7 of 3GPP TS 29.482 [7].

5.14.2.5 Aimles_MLModelRetrieval_UpdateSubscription

5.14.2.5.1 General

This service operation is used by AIMLE client to update subscription with the AIMLE server for ML model retrieval.

5.14.2.5.2 AIMLE operation for model retrieval subscription update

To update subscription with the AIMLE server for ML model retrieval, the AIMLE client shall send to the AIMLE server an HTTP PATCH request (for partial update) as specified in 3GPP TS 29.482 [7] in clause 6.1.13.3.3.3.3 or HTTP PUT request (for full replacement) as specified in 3GPP TS 29.482 [7] in clause 6.1.13.3.3.3.3. The body of the HTTP PATCH request message shall include the MLMdlRetSubPatch data structure as specified in in 3GPP TS 29.482 [7] clause 6.1.13.6.2.3 or the HTTP PUT request message shall include the MLMdlRetSub data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.13.6.2.2.

Upon receipt of the HTTP PATCH request or the HTTP PUT request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized for ML model retrieval subscription update, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized to request ML model retrieval then the AIMLE server may update the subscription information. If the AIMLE server:

      i) has updated the subscription, then in the response the AIMLE server shall include an indication of success, and may include an expiration time;

      ii) response may include either:

         - the HTTP "204 No Content" status code; or

         - the HTTP "200 OK" status code with the response body including a representation of the updated resource within the MLMdlRetSub data structure as specified in 3GPP TS 29.482 [7] in clause 6.1.13.6.2.2; or

      iii) has not updated the subscription, then in the response the AIMLE server shall include an indication of failure and may include an appropriate error response as specified in clause 6.1.13.7 of 3GPP TS 29.482 [7].

If the AIMLE server determined the received HTTP PATCH request or the received HTTP PUT request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP PATCH request or the HTTP PUT request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.14.2.6 Aimles_MLModelRetrieval_Unsubscribe

5.14.2.6.1 General

This service operation is used by AIMLE client to unsubscribe with the AIMLE server for ML model retrieval.

5.14.2.6.2 AIMLE operation to unsubscribe for model retrieval

To unsubscribe with the AIMLE server for ML model retrieval, the AIMLE client shall send an HTTP DELETE request to AIMLE server as specified in 3GPP TS 29.482 [7] in clause 6.1.13.3.3.3.4.

Upon receipt of the HTTP DELETE request from AIMLE client:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized for the request;

b) if the AIMLE client:

   1) is not authorized to unsubscribe for ML model retrieval, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

2) is authorized to request ML model retrieval then the AIMLE server may cancel the subscription. If the AIMLE server:

   i) has cancelled the subscription, then in the response the AIMLE server shall include an indication of success; or

   ii) has not cancelled the subscription, then in the response the AIMLE server shall include an indication of failure and may include an appropriate error response as specified in clause 6.1.13.7 of 3GPP TS 29.482 [7].

If the AIMLE client determined the received HTTP DELETE request needs to be redirected, the AIMLE client may respond with an HTTP "307 Temporary Redirect" status code or an HTTP "308 Permanent Redirect" status code including an HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the HTTP DELETE request should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

5.15 ML model update service

5.15.1 Service description

The ML Model update service operations service enables AIMLE client to request ML model update at the AIMLE server as defined in 3GPP TS 23.482 [4].

5.15.2 Service operations

5.15.2.1 Introduction

The service operations defined for the Aimles_MLModelUpdate API are shown in the table 5.15.2.1-1.

Table 5.15.2.1-1: Operations for ML Model Update service

Service operation name	Description	Initiated by
Aimles_MLModelUpdate_Request	This service operation is used by AIMLE client to request the ML model update from the AIMLE server.	AIMLE client

5.15.2.2 Aimles_MLModelUpdate_Request

5.15.2.2.1 General

The Aimles_MLModelUpdate_Request service operation is used by AIMLE client to request the ML model update from the AIMLE server.

5.15.2.2.2 ML model update service request

To request the AIMLE server to provide ML model updates, the AIMLE client shall send an HTTP POST request with a body containing data type MLMdlUpdateReq as defined in 3GPP TS 29.482 [7] in clause 6.1.15.6.2.2.

Upon receipt of the HTTP POST request:

a) the AIMLE server shall verify the identity of the AIMLE client and determine if the AIMLE client is authorized to request ML model update service; and

b) if the AIMLE client:

   1) is not authorized, the AIMLE server shall respond to the AIMLE client with an appropriate error status code; or

   2) is authorized, the AIMLE sever:

i) shall request ML repository for one or more pre-trained ML models that can be used for ML model update service as described in 3GPP TS 29.482 [7]; and

ii) shall respond to the AIMLE client with:

A) if the HTTP POST request is handled successfully, the HTTP "200 OK" response code with the response body containing data type MLMdlUpdateRsp as defined in 3GPP TS 29.482 [7] in clause 6.1.15.6.2.3 which includes ML model update response; and

B) if the HTTP POST request is not handled successfully, an appropriate error response as specified in3GPP TS 29.482 [7] in clause 6.1.15.7.

The AIMLE server may respond to the AIMLE client with the HTTP "307 Temporary Redirect" status code or the HTTP "308 Permanent Redirect" status code including the HTTP "Location" header containing an alternative URI representing the end point of an alternative AIMLE client towards which the request shall be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].

6 API definitions

6.1 Aimlec_AIMLEClientParticipation API

6.1.1 Introduction

The AIMLE client participation service shall use the Aimlec_AIMLEClientParticipation API.

The API URI of the Aimlec_AIMLEClientParticipation API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-cp".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_AIMLEClientParticipation API.

6.1.3 Resources

There are neither resources nor methods used for the service.

6.1.4 Custom operations without associated resources

6.1.4.1 Overview

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

Table 6.1.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
Participation for AIML operations	/participation	POST	Used by the AIMLE server to request the AIMLE client for participation of the AIML operations.

6.1.4.2 Operation: Participation for AIML operations

6.1.4.2.1 Description

The custom operation enables the AIMLE server to request the AIMLE client to join or depart one or more AIML operations.

6.1.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.2.2-1, 6.1.4.2.2-2, 6.1.4.2.2-3 and 6.1.4.2.2-4.

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

Data type	P	Cardinality	Description
AimlecParticipationReq	M	1	Request for participation the AIML operations.

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

Data type	P	Cardinality	Response codes	Description
AimlecParticipation Resp	M	1	200 OK	Successful case. The requested "participation the AIML operation" shall be responded.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

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

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

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

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.1.5 Notifications

6.1.5.1 General

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

6.1.6 Data model

6.1.6.1 General

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

Table 6.1.6.1-1 specifies the data types defined for the Aimlec_AIMLEClientParticipation API.

Table 6.1.6.1-1: Aimlec_AIMLEClientParticipation API specific data types

Data type	Clause defined	Description	Applicability
AimlecParticipationReq	6.1.6.2.2	Represents the participation request for the AIML operations.	
AimlecParticipationResp	6.1.6.2.3	Represents the participation response for the AIML operations.	
ClienSetPart	6.1.6.3.3	Represents the participation request for the AIMLE client set.	
SchedAimlOperation	6.1.6.2.4	Represents the scheduled AIML participation type.	

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

Table 6.1.6.1-2: Aimlec_AIMLEClientParticipation API re-used data types

Data type	Reference	Comments	Applicability
AimlOperation	6.3.6.3.5	Represents the type of the AIML operation.	
DatasetRequirement	3GPP TS 29.482 [7]	Represents the dataset requirements.	
ScheduledCommunicationTime	3GPP TS 29.122 [5]	Represents an offered scheduled communication time.	
ServiceRequirement	3GPP TS 29.482 [7]	Represents the service requirements.	

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

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

6.1.6.2.2 Type: AimlecParticipationReq

Table 6.1.6.2.2-1: Definition of type AimlecParticipationReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requesterId	string	M	1	Contains the identifier of the service consumer. For the AIMLE client, e.g. unique client identifier. For the AIMLE server, e.g., FQDN, URI.	
clientSetId	string	M	1	Identifies the identity of the AIMLE client set.	
clientSetPart	ClientSetPart	M	1	Identifies the participation request for the AIMLE client set.	
mlModelId	string	M	1	Identifies the identity of the ML model for AIML operation.	
schedAimlOperations	array(SchedAimlOperation)	M	1..N	Identifies the list of AIML operations which are required to be performed.	
dataSetReq	DatasetRequirement	M	1	Identifies the dataset requirements.	
serviceReq	ServiceRequirement	M	1	Identifies the service requirements.	

6.1.6.2.3 Type: AimlecParticipationResp

Table 6.1.6.2.3-1: Definition of type AimlecParticipationResp

Attribute name	Data type	P	Cardinality	Description	Applicability
clientStatus	boolean	M	1	A "true" value indicates the willingness of the AIMLE client to be added to or to be removed from the AIMLE client list to perform AIML operations. A "false" value indicates the denial of the AIMLE client to be added to or to be removed from the AIMLE client list to perform AIML operations.	

6.1.6.2.4 Type: SchedAimlOperation

Table 6.1.6.2.4-1: Definition of type SchedAimlOperation

Attribute name	Data type	P	Cardinality	Description	Applicability
aimlOperation	AimlOperation	M	1	Identifies the type of the AIML operation.	
aimlOperSched	ScheduledCommunicationTime	O	0..1	Identifies the schedule for the AIML operation.	

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

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

6.1.6.3.2 Simple data types

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

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.1.6.3.3 Enumeration: ClientSetPart

The enumeration ClientSetPart represents the participation request for the AIMLE client set. It shall comply with the provisions defined in table 6.1.6.3.3-1.

Table 6.1.6.3.3-1: Enumeration ClienSetPart

Enumeration value	Description	Applicability
JOIN	Identifies to join the AIMLE client set.	
DEPART	Identifies to depart the AIMLE client set.	

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

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

6.1.6.5 Binary data

6.1.6.5.1 Binary data types

Table 6.1.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.1.7 Error handling

6.1.7.1 General

For the Aimlec_AIMLEClientParticipation API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.1.7.2 Protocol errors

No specific procedures for the Aimlec_AIMLEClientParticipation API are specified.

6.1.7.3 Application errors

The application errors defined for the Aimlec_AIMLEClientParticipation API are listed in table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description

6.1.8 Feature negotiation

The optional features in table 6.1.8-1 are defined for the Aimlec_AIMLEClientParticipation API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.1.8-1: Supported features

Feature number	Feature Name	Description

6.1.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_AIMLEClientParticipation API.

6.2 Aimlec_HFLTraining API

6.2.1 Introduction

The Horizontal Federated Learning (HFL) training service shall use the Aimlec_HFLTraining API.

The API URI of the Aimlec_HFLTraining API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-hfl-trng".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.2.3.

6.2.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_HFLTraining API.

6.2.3 Resources

6.2.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.2.3.1-1 depicts the resource URIs structure for the Aimlec_HFLTraining API.

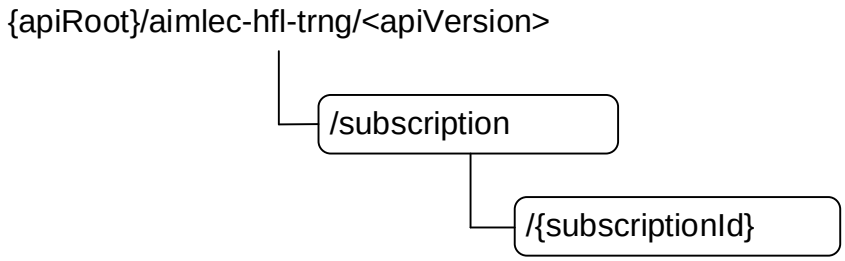

Figure 6.2.3.1-1: Resource URI structure of the Aimlec_HFLTraining API

Table 6.2.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.2.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
HFL training subscription	/subscriptions	POST	Request the creation of the HFL training subscription resources.
Individual HFL training subscription	/subscriptions/{subscriptionId}	GET	Retrieve an existing "Individual HFL training subscription" resource.
		PUT	Request the full replacement of an existing "Individual HFL training subscription" resource.
		PATCH	Request the partial replacement of an existing "Individual HFL training subscription" resource.
		DELETE	Request the deletion of an existing "Individual HFL training subscription" resource.

6.2.3.2 Resource: HFL training subscription

6.2.3.2.1 Description

This resource represents the AIMLE server subscription request to the HFL training event with the AIMLE client.

6.2.3.2.2 Resource definition

Resource URI: **{apiRoot}/aimlec-hfl-trng/<apiVersion>/subscriptions**

This resource shall support the resource URI variables defined in table 6.2.3.2.2-1.

Table 6.2.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1

6.2.3.2.3 Resource standard methods

6.2.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.2.3.2.3.1-1.

Table 6.2.3.2.3.1-1: 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 specified in table 6.2.3.2.3.1-2 and the response data structures and response codes specified in table 6.2.3.2.3.1-3.

Table 6.2.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
HflTrngSub	M	1	Represents the " HFL training subscription" resource.

Table 6.2.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
HflTrngSub	M	1	201 Created	Successful case. The creation of an Individual HFL training subscription resource is confirmed, and a representation of that resource is returned. An HTTP "Location" header that contains the URI of the created resource shall also be included.
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.2.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/aimlec-hfl-trng/<apiVersion>/subscriptions{subscriptionId}

6.2.3.2.4 Resource custom operations

There are no resource custom operations defined for this resource in this release of the specification.

6.2.3.3 Resource: Individual HFL training subscription

6.2.3.3.1 Description

This resource represents an individual HFL training subscription resource at a given AIMLE client.

6.2.3.3.2 Resource definition

Resource URI: **{apiRoot}/aimles-hfl-trng/<apiVersion>/subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.2.3.3.2-1.

Table 6.2.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.2.1
subscriptioinId	string	Represents the identifier of an "Individual HFL training subscription" resource.

6.2.3.3.3 Resource standard methods

6.2.3.3.3.1 GET

This method shall support the URI query parameters specified in table 6.2.3.3.3.1-1.

Table 6.2.3.3.3.1-1: 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 specified in table 6.2.3.3.3.1-2 and the response data structures and response codes specified in table 6.2.3.3.3.1-3.

Table 6.2.3.3.3.1-2: Data structures supported by the GET Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.3.3.3.1-3: Data structures supported by the GET Response Body on this resource

Data type	P	Cardinality	Response codes	Description
HflTrngSub	M	1	200 OK	Successful case. The requested "Individual HFL training subscription" resource is successfully retrieved and a representation of the updated resource shall be returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP GET method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.2.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.2.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.2.3.3.3.2 PUT

This method shall support the URI query parameters specified in table 6.2.3.3.3.2-1.

Table 6.2.3.3.3.2-1: 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 specified in table 6.2.3.3.3.2-2 and the response data structures and response codes specified in table 6.2.3.3.3.2-3.

Table 6.2.3.3.3.2-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
HflTrngSub	M	1	Represents the complete update of the representation of the existing "Individual HFL training subscription" resource.

Table 6.2.3.3.3.2-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
HflTrngSub	M	1	200 OK	Successful case. The requested "Individual HFL training subscription" resource is successfully updated and a representation of the updated resource shall be returned in the response body.
n/a			204 No Content	Successful case. The "Individual HFL training subscription" resource is successfully updated and no content is returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP PUT method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.2.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.2.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.2.3.3.3.3 PATCH

This method shall support the URI query parameters specified in table 6.2.3.3.3.3-1.

Table 6.2.3.3.3.3-1: 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 specified in table 6.2.3.3.3.3-2 and the response data structures and response codes specified in table 6.2.3.3.3.3-3.

Table 6.2.3.3.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
HflTrngSubPatch	M	1	Represents the parameters to request the modification of the "Individual HFL training subscription" resource.

Table 6.2.3.3.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
HflTrngSub	M	1	200 OK	Successful case. The "Individual HFL training subscription" resource is successfully modified and a representation of the updated resource shall be returned in the response body.
n/a			204 No Content	Successful case. The "Individual HFL training subscription" resource is successfully modified and no content is returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP PATCH method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.2.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.2.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.2.3.3.3.4 DELETE

This method shall support the URI query parameters specified in table 6.2.3.3.3.4-1.

Table 6.2.3.3.3.4-1: 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 specified in table 6.2.3.3.3.4-2 and the response data structures and response codes specified in table 6.2.3.3.3.4-3.

Table 6.2.3.3.3.4-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.2.3.3.3.4-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The "Individual HFL training subscription" resource is successfully deleted.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP DELETE method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.2.3.3.3.4-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.2.3.3.3.4-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.3.3.3.4 Resource custom operations

There are no resource custom operations defined for this resource in this release of the specification.

6.2.4 Custom operations without associated resources

6.2.4.1 Overview

There are no custom operations without associated resources defined for this resource in this release of the specification.

6.2.5 Notifications

6.2.5.1 General

Notifications shall comply to clause 5.2.5 of 3GPP TS 29.122 [5].

Table 6.2.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
HFL training event notification	{notifUri}	POST	This service operation enables the AIMLE client to notify the AIMLE server on HFL training event.

6.2.5.2 HFL training event notification

6.2.5.2.1 Description

The HFL training event notification is used by the AIMLE client to report HFL training event to AIMLE server that has subscribed to such an event notification.

6.2.5.2.2 Target URI

The Callback URI **"{notifUri}"** shall be used with the callback URI variables defined in table 6.2.5.2.2-1.

Table 6.2.5.2.2-1: Callback URI variables

Name	Definition
notifUri	The notification URI is assigned within the Individual HFL training subscription and described by the HflTrngSub structure data as specified in clause 6.2.6.2.2.

6.2.5.2.3 Standard methods

6.2.5.2.3.1 POST

This method shall support the request data structures specified in table 6.2.5.2.3.1-1 and the response data structures and response codes specified in table 6.2.5.2.3.1-1.

Table 6.2.5.2.3.1-2: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
HflTrngNotify	M	1	Represents the HFL training event notification.

Table 6.2.5.2.3.1-3: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The HFL training event notification is successfully received and acknowledged.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI representing the end point of an alternative AIMLE service consumer where the notification should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI representing the end point of an alternative AIMLE service consumer where the notification should be sent. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

6.2.6 Data model

6.2.6.1 General

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

Table 6.2.6.1-1 specifies the data types defined for the Aimlec_HFLTraining API.

Table 6.2.6.1-1: Aimlec_HFLTraining API specific data types

Data type	Clause defined	Description	Applicability
HflTrngNotify	6.2.6.2.4	Represent the information from an HFL training event notification.	
HflTrngSub	6.2.6.2.2	Represents the information for: - creation of the HFL training subscription resource; or - partial update or complete update of the existing HFL training subscription resource.	
HflTrngSubPatch	6.2.6.2.3	Represents the information for partial update of the existing HFL training subscription resource.	

Table 6.2.6.1-2 specifies data types re-used by the Aimlec_HFLTraining API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimlec_HFLTraining API.

Table 6.2.6.1-2: Aimlec_HFLTraining API re-used data types

Data type	Reference	Comments	Applicability
DateTime	3GPP TS 29.122 [5]	Used to represent the date and time.	
MLModelInfo	3GPP TS 29.482 [7]	Represents the ML model information.	
PerfParams	3GPP TS 29.482 [7]	Represents the output of training, e.g., ML model performance parameters for the training.	
ReportingRequirements	3GPP TS 29.549 [8]	Identifies the requirements for reporting.	
ScheduledCommunicationTime	3GPP TS 29.122 [5]	Represents an offered scheduled communication time.	
SupportedFeatures	3GPP TS 29.571 [9]	Used to negotiate the supported optional features of the API.	
TrainingErr	3GPP TS 29.482 [7]	Represents the error encountered during training.	
Uri	3GPP TS 29.122 [5]	Represents a URI.	

6.2.6.2 Structured data types

6.2.6.2.1 Introduction

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

6.2.6.2.2 Type: HflTrngSub

Table 6.2.6.2.2-1: Definition of type HflTrngSub

Attribute name	Data type	P	Cardinality	Description	Applicability
requesterId	string	M	1	Contains the identifier of the service consumer. For the AIMLE client, e.g. unique client identifier. For the AIMLE server, e.g., FQDN, URI.	
notifUri	Uri	M	1	Identifies the URI towards which the notification should be delivered.	
aimlMdlInfo	MlModelInfo	M	1	Identifies the information about the AIML model and the model parameters which are to be used for the HFL training. This attribute shall be provided in the HTTP request.	
dataId	string	M	1	Identifies the dataset which is to be used for the HFL training. This attribute shall be provided in the HTTP request.	
noDataSamp	integer	M	1	Identifies the required number of samples for a round of the HFL training. This attribute shall be provided in the HTTP request.	
operSched	ScheduledCommunicationTime	O	0..1	Identifies the schedule for when the HFL training is to occur.	
notifReqs	ReportingRequirements	O	0..1	Identifies the requirements for the notifications.	
suppFeat	SupportedFeatures	C	0..1	Used to negotiate the applicability of optional features. This attribute shall be present only if feature negotiation in clause 6.2.8 needs to take place. This attribute shall be provided in the HTTP request and in the HTTP response of successful resource creation.	
vaSrvId	string	M	1	Identifies the VAL service for the AIMLE HFL training operation. This parameter shall be supplied by the AMILE client in the HTTP response.	
subID	string	O	0..1	Identifies the subscription.	

6.2.6.2.3 Type: HflTrngSubPatch

Table 6.2.6.2.3-1: Definition of type HflTrngSubPatch

Attribute name	Data type	P	Cardinality	Description	Applicability
notifUri	Uri	O	0..1	Identifies the URI towards which the notification should be delivered.	
aimlMdlInfo	MlModelInfo	O	0..1	Identifies the information about the AIML model and the model parameters which are to be used for the HFL training.	
dataId	string	O	0..1	Identifies the dataset which is to be used for the HFL training.	
noDataSamp	integer	O	0..1	Identifies the required number of samples for a round of the HFL training.	
operSched	ScheduledCommunicationTime	O	0..1	Identifies the schedule for when the HFL training is to occur.	
notifReqs	ReportingRequirements	O	0..1	Identifies the requirements for the notifications.	

6.2.6.2.4 Type: HflTrngNotify

Table 6.2.6.2.4-1: Definition of type HflTrngNotify

Attribute name	Data type	P	Cardinality	Description	Applicability
vaSrvId	string	M	1	Identifies the VAL service for the AIMLE HFL training operation.	
hflTrngOut	PerfParams	M	1	Identifies the ML model parameters from the HFL training.	
hflTrngErr	TrainingErr	C	0..1	Identifies the encountered error list from the HFL training. This attribute shall be included if there is an encountered error list.	
timestamp	DateTime	O	0..1	Identifies timestamp for the notification.	

6.2.6.3 Simple data types and enumerations

6.2.6.3.1 Introduction

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

6.2.6.3.2 Simple data types

The simple data types defined in table 6.2.6.3.2-1 shall be supported.

Table 6.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

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

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

6.2.6.5 Binary data

6.2.6.5.1 Binary data types

Table 6.2.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.2.7 Error handling

6.2.7.1 General

For the Aimlec_HFLTraining API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.2.7.2 Protocol errors

No specific procedures for the Aimlec_HFLTraining API are specified.

6.2.7.3 Application errors

The application errors defined for the Aimlec_HFLTraining API are listed in Table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description

6.2.8 Feature negotiation

The optional features in table 6.2.8-1 are defined for the Aimlec_HFLTraining API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.2.8-1: Supported features

Feature number	Feature Name	Description

6.2.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_HFLTraining API.

6.3 Aimles_AIMLEClientRegistration API

6.3.1 Introduction

The AIMLE client registration service shall use the Aimles_AIMLEClientRegistration API.

The API URI of the Aimles_AIMLEClientRegistration API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimles-client-reg".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.3.3.

6.3.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimles_AIMLEClientRegistration API.

6.3.3 Resources

6.3.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.3.3.1-1 depicts the resource URIs structure for the Aimles_AIMLEClientRegistration API.

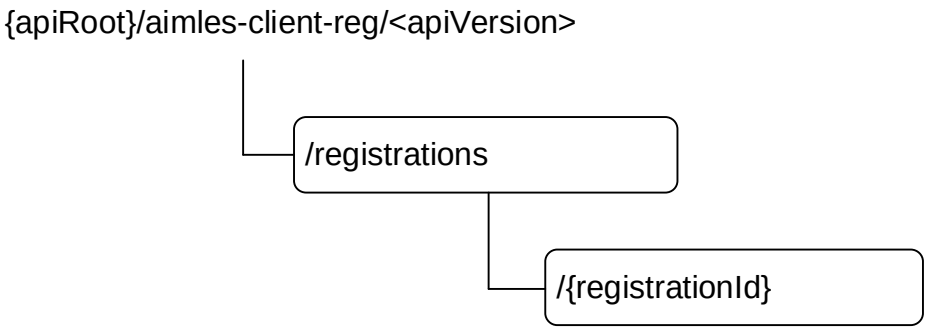

Figure 6.3.3.1-1: Resource URI structure of the Aimles_AIMLEClientRegistration API

Table 6.3.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.3.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
AIMLE client registrations	/registrations	POST	Registers the AIMLE client at the AIMLE server i.e. creates a new individual AIMLE client registration resource.
Individual AIMLE client registration	/registrations/{registrationId}	PUT	Fully replace an individual AIMLE client registration resource.
		DELETE	Deregisters the AIMLE client i.e. removes an individual AIMLE client registration resource.

6.3.3.2 Resource: AIMLE client registrations (Collection)

6.3.3.2.1 Description

This resource represents all AIMLE clients that are registered at a given AIMLE server.

6.3.3.2.2 Resource definition

Resource URI: **{apiRoot}/aimles-client-reg/<apiVersion>/registrations**

This resource shall support the resource URI variables defined in table 6.3.3.2.2-1.

Table 6.3.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.3.1

6.3.3.2.3 Resource standard methods

6.3.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.3.3.2.3.1-1.

Table 6.3.3.2.3.1-1: 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 specified in table 6.3.3.2.3.1-2 and the response data structures and response codes specified in table 6.3.3.2.3.1-3.

Table 6.3.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AimleClientRegInfo	M	1	Contains information for the creation of a new individual AIMLE client registration resource.

Table 6.3.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AimleRegistration	M	1	201 Created	Successful case. An individual AIMLE client registration resource is created, and a representation of that resource is returned.
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.3.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/aimles-client-reg/<apiVersion>/registrations/{registrationId}

6.3.3.2.4 Resource custom operations

None.

6.3.3.3 Resource: Individual AIMLE client registration (Document)

6.3.3.3.1 Description

This resource represents an individual AIMLE client registered at a given AIMLE server.

6.3.3.3.2 Resource definition

Resource URI: **{apiRoot}/aimles-client-reg/<apiVersion>/registrations/{registrationId}**

This resource shall support the resource URI variables defined in table 6.3.3.3.2-1.

Table 6.3.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.3.1
registrationId	string	The AIMLE client registration identifier.

6.3.3.3.3 Resource standard methods

6.3.3.3.3.1 PUT

This method shall support the URI query parameters specified in table 6.3.3.3.3.1-1.

Table 6.3.3.3.3.1-1: 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 specified in table 6.3.3.3.3.1-2 and the response data structures and response codes specified in table 6.3.3.3.3.1-3.

Table 6.3.3.3.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
AimleRegistration	M	1	Contains information for the update of individual AIMLE client registration resource.

Table 6.3.3.3.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AimleRegistration	M	1	200 OK	Successful case. An individual AIMLE client registration resource is updated, and a representation of that resource is returned.
n/a			204 No Content	Successful case. An individual AIMLE client registration resource is updated.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP PUT method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.3.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.3.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.3.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 6.3.3.3.3.2-1.

Table 6.3.3.3.3.2-1: 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 specified in table 6.3.3.3.3.2-2 and the response data structures and response codes specified in table 6.3.3.3.3.2-3.

Table 6.3.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.3.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. An individual AIMLE client registration resource is removed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP DELETE method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.3.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.3.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.3.3.3.4 Resource custom operations

None.

6.3.4 Custom operations without associated resources

There are no custom operations without associated resources defined for this API in this release of the specification.

6.3.5 Notifications

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

6.3.6 Data model

6.3.6.1 General

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

Table 6.3.6.1-1 specifies the data types defined for the Aimles_AIMLEClientRegistration API.

Table 6.3.6.1-1: Aimles_AIMLEClientRegistration API specific Data Types

Data type	Clause defined	Description	Applicability
AimleClientProfile	6.3.6.2.6	Contains the AIMLE client capability information e.g. supported AIML model types, AIML service operation type.	
AimleClientRegInfo	6.3.6.2.3	Contains the AIMLE client registration information.	
AimleRegistration	6.3.6.2.2	Represents an individual AIMLE client registration resource.	
AimlModelType	6.3.6.3.4	Represents the AIML model type.	
AimlOperation	6.3.6.3.5	Represents the AIML service operation type.	
ClientCapability	6.3.6.2.7	Contains the AIMLE client capability information.	
DataCapability	6.3.6.3.8	Contains a list of data capabilities.	
DataSetAvailability	6.3.6.2.8	Represents a dataset availability.	
LocationConfig	6.3.6.2.9	To be checked if needed.	
MlApplicationType	6.3.6.3.6	Represents the ML application type.	
ResourceUsageLevel	6.3.6.3.7	Represents the resource usage level.	
ServiceData	6.3.6.2.5	Contains VAL service identifier with the corresponding service permission.	
ServicePermissionLevel	6.3.6.3.3	Represents the service permission level.	
SupportedProfile	6.3.6.2.4	Contains AIMLE client profiles and supported service information.	
TaskCapability	6.3.6.3.9	Contains the AIML task performing capabilities.	

Table 6.3.6.1-2 specifies data types re-used by the Aimles_AIMLEClientRegistration API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimles_AIMLEClientRegistration API.

Table 6.3.6.1-2: Aimles_AIMLEClientRegistration API re-used Data Types

Data type	Reference	Comments	Applicability
DateTime	3GPP TS 29.122 [5]	Used to indicate an expiration time of the AIMLE client registration.	
LocationArea5G	3GPP TS 29.122 [5]	Used to indicate a location area represented as list of geographic areas, civic addresses and network area.	
ScheduledCommunicationTime	3GPP TS 29.571 [11]	Used to indicate the availability schedule of the AIMLE client for the AIML service.	
SupportedFeatures	3GPP TS 29.571 [11]	Used to negotiate the applicability of the optional features defined in table 6.3.8-1.	
Uri	3GPP TS 29.122 [5]	Used to indicate a URI.	
ValSvcAreaId	3GPP TS 29.549 [9]	Used to indicate the VAL Service Area identifier.	
ValTargetUe	3GPP TS 29.549 [9]	Unique identifier of a VAL user or a VAL UE.	

6.3.6.2 Structured data types

6.3.6.2.1 Introduction

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

6.3.6.2.2 Type: AimleRegistration

Table 6.3.6.2.2-1: Definition of type AimleRegistration

Attribute name	Data type	P	Cardinality	Description	Applicability
regData	AimleClientRegInfo	M	1	Contains the AIMLE client registration information.	
expTime	DateTime	O	0..1	Identifies the expiration time for the AIMLE client registration. (NOTE)	
NOTE: If the AIMLE server did not include the expTime attribute in HTTP 200 and 201 responses, the registration of AIMLE client never expires.					

6.3.6.2.3 Type: AimleClientRegInfo

Table 6.3.6.2.3-1: Definition of type AimleClientRegInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
aimleClientId	ValTargetUe	M	1	The AIMLE client identifier.	
suppProfiles	array(SupportedProfile)	M	1..N	Contains a list of supported service information and AIMLE client profiles.	
suppFeat	SupportedFeatures	C	0..1	Represents a list of supported features used as described in clause 6.3.8. This attribute shall be provided in the HTTP 201 response if it was provided in the POST request.	

6.3.6.2.4 Type: SupportedProfile

Table 6.3.6.2.4-1: Definition of type SupportedProfile

Attribute name	Data type	P	Cardinality	Description	Applicability
clientProfile	AimleClientProfile	C	0..1	Contains the AIMLE client capability information e.g. supported AIML model types, AIML service operation type. (NOTE)	
suppServices	array(ServiceData)	C	1..N	Contains the list of VAL services identifiers with corresponding service permissions. (NOTE)	
NOTE: This attribute shall be included in the HTTP POST request for the AIMLE client registration.					

6.3.6.2.5 Type: ServiceData

Table 6.3.6.2.5-1: Definition of type ServiceData

Attribute name	Data type	P	Cardinality	Description	Applicability
valServiceId	string	M	1	Represents the VAL service identifier.	
servPermLevel	ServicePermissionLevel	O	0..1	Represents the service permission level (e.g., allowed resource usage).	

6.3.6.2.6 Type: AimleClientProfile

Table 6.3.6.2.6-1: Definition of type AimleClientProfile

Attribute name	Data type	P	Cardinality	Description	Applicability
aimleClientUri	Uri	M	1	URI information of the AIMLE client.	
aimlModelTypes	array(AimlModelType)	O	1..N	Contains AIML model types supported by the AIMLE client (e.g., decision tree, linear regression, neural network).	
aimlOperations	array(AimlOperation)	M	1..N	Contains AIML operations supported by the AIMLE client (e.g., training, model transfer, model inference, model offload, model split, continue performing intermediate AIML operation).	
clientCap	ClientCapability	M	1	Contains the AIMLE client capability information (e.g. ML application type, allowed resource usage level).	
availTimeSchedCfgs	array(ScheduledCommunicationTime)	O	1..N	Contains the availability schedule of the AIMLE client for the AIML service, e.g., the AIMLE client is available to participate in the AIML operations in the given time slot(s) and/or day(s) of the week.	
unavblTimeSchedCfgs	array(ScheduledCommunicationTime)	O	1..N	Contains the unavailability schedule of the AIMLE client for the AIML service, e.g., the AIMLE client is not available to participate in the AIML operations in the given time slot(s) and/or day(s) of the week.	
availLocCfgs	array(LocationConfig)	O	1..N	Contains the available location-based configurations of the AIMLE client for the AIML service, e.g., the AIML member is available to participate in the AIML operations in the given locations represented by coordinates, civic addresses, network areas, or VAL service area ID.	
unavblLocCfgs	array(LocationConfig)	O	1..N	Contains the unavailable location-based configurations of the AIMLE client for the AIML service, e.g., the AIML member is not available to participate in the AIML operations in the given locations represented by coordinates, civic addresses, network areas, or VAL service area ID.	
dataSetAvail	DataSetAvailability	O	0..1	Contains a dataset availability such as dataset size, age, list of dataset features, and dataset identifiers.	
dataCap	array(DataCapability)	O	1..N	Contains a list of data capabilities such as the type of data that can be collected (e.g. raw data), supported data processing capabilities (e.g. processed data), and supported exploratory data analysis (EAD) functions.	
taskCaps	array(TaskCapability)	O	1..N	Contains the AIML task performing capabilities i.e. compute capabilities (e.g., high, low), task performance preference capabilities (e.g., low costs).	

6.3.6.2.7 Type: ClientCapability

Table 6.3.6.2.7-1: Definition of type ClientCapability

Attribute name	Data type	P	Cardinality	Description	Applicability
mlAppType	MlApplicationType	M	1	Contains the ML application type like FL (federated learning), TL (transfer learning), SL (split learning).	
rsrcUsageLvl	ResourceUsageLevel	M	1	Indicates allowed resource usage level.	

6.3.6.2.8 Type: DataSetAvailability

Table 6.3.6.2.8-1: Definition of type DataSetAvailability

Attribute name	Data type	P	Cardinality	Description	Applicability
dataSetIds	array(string)	M	1..N	Contains a list of dataset identifiers.	
size	integer	O	0..1	Represents the dataset size e.g., number of entries in dataset.	
age	integer	O	0..1	Represents the dataset age e.g. data set usage in number of days.	
features	array(string)	O	1..N	Contains a list of dataset features.	

6.3.6.2.9 Type: LocationConfig

Table 6.3.6.2.9-1: Definition of type LocationConfig

Attribute name	Data type	P	Cardinality	Description	Applicability
clientLoc	LocationArea5G	O	0..1	Contains the location-based configurations of the AIMLE client for the AIML service, e.g., locations represented by coordinates, civic addresses, and network area information.	
valSvcAreaId	ValSvcAreaId	O	0..1	Contains the VAL service area identifier.	

6.3.6.3 Simple data types and enumerations

6.3.6.3.1 Introduction

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

6.3.6.3.2 Simple data types

The simple data types defined in table 6.3.6.3.2-1 shall be supported.

Table 6.3.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.3.6.3.3 Enumeration: ServicePermissionLevel

The enumeration ServicePermissionLevel represents a service permission level. It shall comply with the provisions defined in table 6.3.6.3.3-1.

Table 6.3.6.3.3-1: Enumeration ServicePermissionLevel

Enumeration value	Description	Applicability
PREMIUM_RESOURCE_USAGE		
STANDARD_RESOURCE_USAGE		
LIMITED_RESOURCE_USAGE		
OTHER_SERVICE_PERMISSION_LEVEL		

6.3.6.3.4 Enumeration: AimlModelType

The enumeration AimlModelType represents AIML model types. It shall comply with the provisions defined in table 6.3.6.3.4-1.

Table 6.3.6.3.4-1: Enumeration AimlModelType

Enumeration value	Description	Applicability
DECISION_TREE	Indicates the decision tree type of the AIML model.	
LINEAR_REGRESSION	Indicates the linear regression type of the AIML model.	
NEURAL_NETWORK	Indicates the neural network type of the AIML model.	
OTHER_MODEL_TYPE	Indicates the other type of the AIML model.	

6.3.6.3.5 Enumeration: AimlOperation

The enumeration AimlOperation represents the type of the AIML operation. It shall comply with the provisions defined in table 6.3.6.3.5-1.

Table 6.3.6.3.5-1: Enumeration AimlOperation

Enumeration value	Description	Applicability
MODEL_INFERENCE	Indicates the model inference type of the AIML operation.	
MODEL_OFFLOAD	Indicates the model offload type of the AIML operation.	
MODEL_SPLIT	Indicates the model split type of the AIML operation.	
MODEL_TRANSFER	Indicates the model transfer type of the AIML operation.	
MODEL_TRAINING	Indicates the model training type of the AIML operation.	
CONTINUE_PERFORM_INTERMEDIATE	Indicates the ability to continue performing of the intermediate AIML operation.	

6.3.6.3.6 Enumeration: MlApplicationType

The enumeration MlApplicationType represents ML application types. It shall comply with the provisions defined in table 6.3.6.3.6-1.

Table 6.3.6.3.6-1: Enumeration MlApplicationType

Enumeration value	Description	Applicability
FEDERATED_LEARNING	Indicates federated learning ML application type.	
TRANSFER_LEARNING	Indicates transfer learning ML application type.	
SPLIT_LEARNING	Indicates split learning ML application type.	
OTHER_ML_APPLICATION_TYPE	Indicates other ML application type.	

6.3.6.3.7 Enumeration: ResourceUsageLevel

The enumeration ResourceUsageLevel represents the resource usage level. It shall comply with the provisions defined in table 6.3.6.3.4-1.

Table 6.3.6.3.4-1: Enumeration ResourceUsageLevel

Enumeration value	Description	Applicability
PREMIUM_RESOURCE_USAGE		
STANDARD_RESOURCE_USAGE		
LIMITED_RESOURCE_USAGE		

6.3.6.3.8 Enumeration: DataCapability

The enumeration DataCapability represents data capabilities such as the type of data that can be collected (e.g. raw data), supported data processing capabilities (e.g. processed data), and supported exploratory data analysis functions. It shall comply with the provisions defined in table 6.3.6.3.8-1.

Table 6.3.6.3.8-1: Enumeration DataCapability

Enumeration value	Description	Applicability
RAW_DATA		
STRUCURED_DATA		
SEMI_STRUCTURED_DATA		
UNSTRUCTURED_DATA		
PROCESSED_DATA		
EXPLOATORY_DATA_ANALYSIS		

6.3.6.3.9 Enumeration: TaskCapability

The enumeration TaskCapability represents AIML task performing capabilities. It includes compute capabilities (e.g., high, low), task performance preference capabilities. It shall comply with the provisions defined in table 6.3.6.3.9-1.

Table 6.3.6.3.9-1: Enumeration TaskCapability

Enumeration value	Description	Applicability
HIGH_COMPUTE_CAPABILITY		
LOW_COMPUTE_CAPABILITY		
LOW_COSTS_PERFORMANCE		
GREEN_TASK_PERFORMANCE (NOTE)		
ENERGY_EFFICIENT_PERFORMANCE (NOTE)		
NOTE: The client shall not include GREEN_TASK_PERFORMANCE and ENERGY_EFFICIENT_PERFORMANCE.		

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

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

6.3.6.5 Binary data

6.3.6.5.1 Binary data types

The binary data types defined in table 6.3.6.5.1-1 shall be supported.

Table 6.3.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.3.7 Error handling

6.3.7.1 General

For the Aimles_AIMLEClientRegistration API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.3.7.2 Protocol Errors

No specific procedures for the Aimles_AIMLEClientRegistration API are specified.

6.3.7.3 Application errors

The application errors defined for the Aimles_AIMLEClientRegistration API are listed in table 6.3.7.3-1.

Table 6.3.7.3-1: Application errors

Application Error	HTTP status code	Description

6.3.8 Feature negotiation

The optional features in table 6.3.8-1 are defined for the Aimles_AIMLEClientRegistration API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.3.8-1: Supported Features

Feature number	Feature Name	Description

6.3.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimles_AIMLEClientRegistration API.

6.4 Aimles_SplitOpEvent API

See 3GPP TS 29.482 [7].

6.5 Aimles_SplitOpPipeline API

6.5.1 Introduction

The AIML split operation pipeline shall use the Aimles_SplitOpPipeline API.

The API URI of the Aimles_SplitOpPipeline API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimles-sopl".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.5.3.

6.5.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimles_SplitOpPipeline API.

6.5.3 Resources

6.5.3.1 Overview

This clause describes the structure for the Resource URIs and the resources and methods used for the service.

Figure 6.5.3.1-1 depicts the resource URIs structure for the Aimles_SplitOpPipeline API.

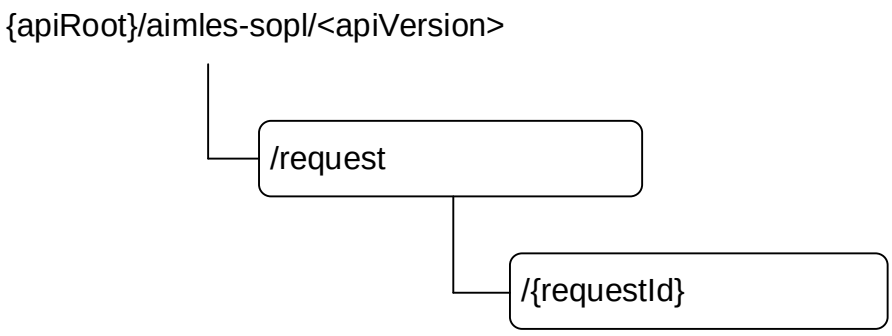

Figure 6.5.3.1-1: Resource URI structure of the Aimles_SplitOpPipeline API

Table 6.5.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.5.3.1-1: Resources and methods overview

Operation name	Custom operation URI	Mapped HTTP method	Description
AIML split operation pipeline creation	/request	POST	Used by the AIMLE client to create an instance of a split operation pipeline at the AIMLE server.
Individual AIML split operation pipeline creation	/request/{requestId}	PUT	Used by the AIMLE client to fully update an instance of a split operation pipeline at the AIMLE server
		DELETE	Used by the AIMLE client to delete an instance of a split operation pipeline at the AIMLE server
		PATCH	Used by the AIMLE client to partially fully update an instance of a split operation pipeline at the AIMLE server.

6.5.3.2 Resource: AIMLE split operation pipeline creation

6.5.3.2.1 Description

This resource represents the AIMLE client split operation pipeline creation request resource at a given AIMLE server.

6.5.3.2.2 Resource definition

Resource URI: **{apiRoot}/aimles-sopl/<apiVersion>/request**

This resource shall support the resource URI variables defined in table 6.5.3.2.2-1.

Table 6.5.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.5.1

6.5.3.2.3 Resource standard methods

6.5.3.2.3.1 POST

This method shall support the URI query parameters specified in table 6.5.3.2.3.1-1.

Table 6.5.3.2.3.1-1: 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 specified in table 6.5.3.2.3.1-2 and the response data structure and response codes specified in table 6.5.3.2.3.1-3.

Table 6.5.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
SplitOpPipelineCreateReq	M	1	An individual AIMLE split operation pipeline creation resource to be created.

Table 6.5.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
SplitOpPipelineCreateResp	M	1	201 Created	Successful case. An individual split operation pipeline creation resource is created successfully. The URI of the created resource shall be returned in the location HTTP header.
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.5.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/aimles-splitopplcreat/<apiVersion>/request

6.5.3.2.4 Resource custom operations

None.

6.5.3.3 Resource: Individual AIMLE split operation pipeline creation

6.5.3.3.1 Description

This resource represents an individual AIMLE client split operation pipeline creation request resource at a given AIMLE server.

6.5.3.3.2 Resource definition

Resource URI: **{apiRoot}/aimles-sopl/<apiVersion>/request/{requestId}**

This resource shall support the resource URI variables defined in table 6.5.3.3.2-1.

Table 6.5.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.5.1
requestId	string	An individual AIMLE split operation pipeline creation request identifier.

6.5.3.3.3 Resource standard methods

6.5.3.3.3.1 PUT

This method shall support the URI query parameters specified in table 6.5.3.3.3.1-1.

Table 6.5.3.3.3.1-1: 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 specified in table 6.5.3.3.3.1-2 and the response data structures and response codes specified in table 6.5.3.3.3.1-3.

Table 6.5.3.3.3.1-2: Data structures supported by the PUT Request Body on this resource

Data type	P	Cardinality	Description
SplitOpPipelineCreateReq	M	1	An individual instance of AIMLE split operation pipeline resource to be updated.

Table 6.5.3.3.3.1-3: Data structures supported by the PUT Response Body on this resource

Data type	P	Cardinality	Response codes	Description
SplitOpPipelineCreateResp	M	1	200 OK	Successful case. An individual AIMLE split operation pipeline resource is updated, and a representation of that resource is returned.
n/a			204 No Content	Successful case. An individual AIMLE split operation pipeline resource is updated.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP PUT method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.5.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.5.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.5.3.3.3.2 DELETE

This method shall support the URI query parameters specified in table 6.5.3.3.3.2-1.

Table 6.5.3.3.3.2-1: 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 specified in table 6.5.3.3.3.2-2 and the response data structures and response codes specified in table 6.5.3.3.3.2-3.

Table 6.5.3.3.3.2-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.5.3.3.3.2-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. An individual AIMLE split operation pipeline resource is removed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP DELETE method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.5.3.3.3.2-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.5.3.3.3.2-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.5.3.3.3.3 PATCH

This method shall support the URI query parameters specified in table 6.5.3.3.3.3-1.

Table 6.5.3.3.3.3-1: 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 specified in table 6.5.3.3.3.3-2 and the response data structures and response codes specified in table 6.5.3.3.3.3-3.

Table 6.5.3.3.3.3-2: Data structures supported by the PATCH Request Body on this resource

Data type	P	Cardinality	Description
SplitOpPipelinePatch	M	1	An individual instance of AIMLE split operation pipeline resource to be updated.

Table 6.5.3.3.3.3-3: Data structures supported by the PATCH Response Body on this resource

Data type	P	Cardinality	Response codes	Description
SplitOpPipelineCreate Resp	M	1	200 OK	Successful case. An individual AIMLE split operation pipeline resource is updated, and a representation of that resource is returned.
n/a			204 No Content	Successful case. An individual AIMLE split operation pipeline resource is updated.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP PUT method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.5.3.3.3.3-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.5.3.3.3.3-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.5.3.3.4 Resource custom operations

None.

6.5.4 Custom operations without associated resources

6.5.4.1 Overview

Table 6.5.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
AIML split operation discovery	/discovery	POST	Used by the AIMLE client or VAL server to communicate with the AIMLE server for split AIML operation pipeline discovery.

6.5.4.2 Operation: AIML split operation discovery

6.5.4.2.1 Description

The custom operation enables the AIMLE client to request the AIMLE server to perform the AIML split operation discovery.

6.5.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.5.4.2.2-1 and 6.5.4.2.2-2.

Table 6.5.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
SplitOpPipelineDiscReq	M	1	Contains the AIMLE split operation pipeline discovery request information.

Table 6.5.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
SplitOpPipelineDiscResp	M	1	200 OK	Successful case. The AIMLE split operation pipeline discovery is performed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.5.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.5.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.5.5 Notifications

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

6.5.6 Data Model

6.5.6.1 General

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

Table 6.5.6.1-1 specifies the data types defined for the Aimles_SplitOpPipeline API.

Table 6.5.6.1-1: Aimles_SplitOpPipeline API specific Data Types

Data type	Section defined	Description	Applicability
SplitOpPipelineCreateReq	6.5.6.2.2	Represents the AIMLE Split Operation Pipeline Create request.	
SplitOpPipelineCreateResp	6.5.6.2.3	Represents the AIMLE Split Operation Pipeline Create response	
SplitOpPipelinePatch	6.5.6.2.4	Represents the AIMLE Split Operation Pipeline Patch request.	
SplitOpPipelineDiscReq	6.5.6.2.5	Represents the AIMLE Split Operation Pipeline Discovery request.	
SplitOpPipelineDiscResp	6.5.6.2.6	Represents the AIMLE Split Operation Pipeline Discovery response.	
SplitOpRequirements	6.5.6.2.7	Represents the AIMLE Split Operation Pipeline requirements	

Table 6.5.6.1-2 specifies data types re-used by the Aimles_SplitOpPipeline API service.

Table 6.5.6.1-2: Aimles_SplitOpPipeline API re-used Data Types

Data type	Reference	Comments	Applicability
Uri	3GPP TS 29.122 [5]	Used to indicate the notification URI.	
UsageInformation	3GPP TS 29.482 [7]	Represents the usage information for the split AIML model.	
DiscFilters	3GPP TS 29.482 [7]	Represents the discovery filters to determine matching split operation profile or nodes.	
SplitOpPipelineInfo	3GPP TS 29.482 [7]	Represents split operation pipeline information.	
SplitOpProfile	3GPP TS 29.482 [7]	Represents the split operation profile that VAL server participates to.	
StageInfo	3GPP TS 29.482 [7]	Represents the information related to each stage in split operation pipeline.	
Endpoint	3GPP TS 29.558 [10]	Represent the endpoint information of a node.	

6.5.6.2 Structured data types

6.5.6.2.1 Introduction

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

6.5.6.2.2 Type: SplitOpPipelineCreateReq

Table 6.5.6.2.2-1: Definition of type SplitOpPipelineCreateReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	string	M	1	Contains the identifier of the service consumer. For the AIMLE client, e.g. unique client identifier. For the AIMLE server, e.g., FQDN, URI.	
notifUri	Uri	M	1	Identifies the URI, towards which the notification should be delivered.	
splitOpRequirements	SplitOpRequirements	M	1	Contains the set of characteristics to determine matching split operation profiles or nodes.	

6.5.6.2.3 Type: SplitOpPipelineCreateResp

Table 6.5.6.2.3-1: Definition of type SplitOpPipelineCreateResp

Attribute name	Data type	P	Cardinality	Description	Applicability
splitOpProfile	SplitOpProfile	O	0..1	Contains the split operation profiles.	

6.5.6.2.4 Type: SplitOpPipelinePatch

Table 6.5.6.2.4-1: Definition of type SplitOpPipelinePatch

Attribute name	Data type	P	Cardinality	Description	Applicability
notifUri	Uri	M	1	Identifies the URI, towards which the notification should be delivered.	
splitOpPipelineId	string	M	1	Contains the identifier for split operation pipeline.	
splitOpPipelineInfo	SplitOpPipelineInfo	M	1	Contains split operation pipeline information.	

6.5.6.2.5 Type: SplitOpPipelineDiscReq

Table 6.5.6.2.5-1: Definition of type SplitOpPipelineDiscReq

Attribute name	Data type	P	Cardinality	Description	Applicability
notifUri	Uri	M	1	Identifies the URI, towards which the notification should be delivered.	
discFilters	DiscFilters	M	1	Contains the set of characteristics to determine matching split operation profiles or nodes.	

6.5.6.2.6 Type: SplitOpPipelineDiscResp

Table 6.5.6.2.6-1: Definition of type SplitOpPipelineDiscResp

Attribute name	Data type	P	Cardinality	Description	Applicability
discoveredNodes	array(string)	C	1..N	Contains the list of discovered nodes. (NOTE)	
splitOpProfiles	array(SplitOpProfile)	C	1..N	Contains the list of split operation profiles. (NOTE)	
NOTE: At least one of these attributes shall be present.					

6.5.6.2.7 Type: SplitOpRequirements

Table 6.5.6.2.7-1: Definition of type SplitOpRequirements

Attribute name	Data type	P	Cardinality	Description	Applicability
stageInfo	array(StageInfo)	M	1..N	Contains information about split operation stages.	
usageInfo	UsageInformation	O	0..1	Contains information about planned usage of the split operation.	
notificationTarget	Endpoint	O	0..1	Contains information about the Endpoint where the result of the split operation is sent by the tail node.	

6.5.6.3 Simple data types and enumerations

6.5.6.3.1 Introduction

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

6.5.6.3.2 Simple data types

The simple data types defined in table 6.5.6.3.2-1 shall be supported.

Table 6.5.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

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

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

6.5.6.5 Binary data

6.5.6.5.1 Binary Data Types

Table 6.5.6.5.1-1: Binary Data Types

Name	Clause defined	Content type

6.5.7 Error Handling

6.5.7.1 General

For the Aimles_SplitOpPipeline API, HTTP error responses shall be supported as specified in clause 5.2.1.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.1.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.1.6-1 of 3GPP TS 29.122 [5].

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

6.5.7.2 Protocol Errors

No specific protocol errors for the Aimles_SplitOpPipeline API are specified.

6.5.7.3 Application Errors

The application errors defined for Aimles_SplitOpPipeline API are listed in table 6.5.7.3-1.

Table 6.5.7.3-1: Application errors

Application Error	HTTP status code	Description	Applicability

6.5.8 Feature negotiation

The optional features in table 6.5.8-1 are defined for the Aimles_SplitOpPipeline API. They shall be negotiated using the extensibility mechanism defined clause 5.2.1.7 of 3GPP TS 29.122 [5].

Table 6.5.8-1: Supported Features

Feature number	Feature Name	Description

6.5.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimles_SplitOpPipeline API.

6.6 Aimlec_FLGroupIndication API

6.6.1 Introduction

The FL group indication service shall use the Aimlec_FLGroupIndication API.

The API URI of the AIML_FederatedLearning API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-flgi".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.6.4.

6.6.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_FLGroupIndication API.

6.6.3 Resources

6.6.3.1 Overview

There are neither resources nor methods used for the service.

6.6.4 Custom operations without associated resources

6.6.4.1 Overview

Table 6.6.4.1-1 provides an overview of the custom operations and applicable HTTP methods defined for the Aimlec_FLGroupIndication API.

Table 6.6.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
Indicate FL group	/indicate	POST	Used by the AIMLE server to indicate FL group information to the AIMLE client.

6.6.4.2 Operation: Indicate FL group

6.6.4.2.1 Description

The custom operation enables the AIMLE server to indicate the AIMLE client as the candidate FL member the information on the FL group.

6.6.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.6.4.2.2-1, 6.6.4.2.2-2, 6.6.4.2.2-3, and 6.6.4.2.2-4.

Table 6.6.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
IndFlMember	M	1	Information which shall be indicated to the FL members.

Table 6.6.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Success. The indicated information on FL member group is successfully received, processed, and provisioned.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.6.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.6.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.6.5 Notifications

6.6.5.1 General

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

6.6.6 Data model

6.6.6.1 General

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

Table 6.6.6.1-1 specifies the data types defined for the Aimlec_FLGroupIndication API.

Table 6.6.6.1-1: Aimlec_FLGroupIndication API specific Data Types

Data type	Clause defined	Description	Applicability
FlGroupDelCause	6.6.6.3.6	Represents the deletion cause for the FL group.	
FlGroupDeletionInfo	6.6.6.2.6	Represents the FL group deletion information.	
FlGroupInfo	6.6.6.2.3	Represents the FL group information.	
FlMemberAvailability	6.6.6.3.3	Indicates the FL member availability.	
FlMemberConstraint	6.6.6.3.4	Indicates the FL member constraint.	
FlMemberData	6.6.6.2.4	Represents the FL group member data e.g. FL member identifier, address.	
FlMemberInfo	6.6.6.2.5	Represents the FL member information e.g. availability, constraint, FL role.	
FlMemberRole	6.6.6.3.5	Indicates the FL member role.	
IndFlMember	6.6.6.2.2	Indicates the FL member the information on FL member group	

Table 6.6.6.1-2 specifies data types re-used by the Aimlec_FLGroupIndication API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimlec_FLGroupIndication API.

Table 6.6.6.1-2: Aimlec_FLGroupIndication API re-used Data Types

Data type	Reference	Comments	Applicability
TimeWindow	3GPP TS 29.122 [5]	Represents a time window.	
ValUeAddrInfo	3GPP TS 29.549 [9]	Represents VAL UE address information.	

6.6.6.2 Structured data types

6.6.6.2.1 Introduction

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

6.6.6.2.2 Type: IndFMember

Table 6.6.6.2.2-1: Definition of type IndFlMember

Attribute name	Data type	P	Cardinality	Description	Applicability
serverId	string	M	1	Identifier of the indicating AIMLE server	
valServiceId	string	O	0..1	Identifier of the VAL service for which the grouping indication is applied. (NOTE)	
mlModelId	string	O	0..1	Identifier of the ML model for which the indication is applied. (NOTE)	
analyticsIds	string	O	0..1	Identifier of the UE-to-UE session analytics, the FL grouping is based on, if the FL process is used for that of the UE-to-UE session analytics. (NOTE)	
flGroupIds	array(FlGroupInfo)	M	1..N	Identifiers of one or more AIMLE created or modified FL group for the FL process	
flGroupDelInfo	FlGroupDeletionInfo	C	0..1	Indicates the FL group is going to be deleted. (NOTE 2)	
NOTE 1: One of the attributes valServiceId, mlModelId, or analyticsId shall be present if the FL group indication is related to FL group creation or change. NOTE 2: The flGroupDelInfo attribute shall be present if the indication is related to an FL group deletion.					

6.6.6.2.3 Type: FlGroupInfo

Table 6.6.6.2.3-1: Definition of type FlGroupInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
flGroupId	string	M	1	Contains the FL group identifier.	
flMembers	array(FlMemberData)	O	1..N	Contains FL member data e.g. FL member identifier, address.	

6.6.6.2.4 Type: FlMemberData

Table 6.6.6.2.4-1: Definition of type FlMemberData

Attribute name	Data type	P	Cardinality	Description	Applicability
flMemberId	string	O	0..1	Identifier of FL member (NOTE)	
flMemberAddr	ValUeAddrInfo	O	0..1	Address information of FL member (NOTE)	
flMemberInfo	FlMemberInfo	O	0..1	Information on FL members	
NOTE: At least one of the attributes flMemberID and flMemberAddr shall be present.					

6.6.6.2.5 Type: FlMemberInfo

Table 6.6.6.2.5-1: Definition of type FlMemberInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
availability	FlMemberAvailability	O	0..1	Represents the FL group member availability.	
constraints	array(FlMemberConstraint)	O	1..N	Represents the FL group member constraints.	
role	FlMemberRole	O	0..1	Represents the FL group member role/type.	

6.6.6.2.6 Type: FlGroupDeletionInfo

Table 6.6.6.2.6-1: Definition of type FlGroupDeletionInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
cause	FlGroupDelCause	O	0..1	Represents the cause for the FL group deletion.	
expTime	TimeWindow	O	0..1	Represents the expiration time of the FL members group deletion (e.g., due to AIML service termination or group UE mobility to different service area). If the expTime attribute is not included, the deletion of the group is instant.	

6.6.6.3 Simple data types and enumerations

6.6.6.3.1 Introduction

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

6.6.6.3.2 Simple data types

The simple data types defined in table 6.6.6.3.2-1 shall be supported.

Table 6.6.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.6.6.3.3 Enumeration: FlMemberAvailability

The enumeration FlMemberAvailabilityrepresents information regarding FL member availability of the VAL UE. It shall comply with the provisions defined in table 6.6.6.3.3-1.

Table 6.6.6.3.3-1: Enumeration FlMemberAvailability

Enumeration value	Description	Applicability
AVAILABLE	The FL member is available.	
NOT_AVAILABLE	The FL member is not available.	

6.6.6.3.4 Enumeration: FlMemberConstraint

The enumeration FlMemberConstraint represents an FL member constraint information of the VAL UE. It shall comply with the provisions defined in table 6.6.6.3.4-1.

Table 6.6.6.3.4-1: Enumeration FlMemberConstraint

Enumeration value	Description	Applicability
LIMITED_MEMORY	Indicates a limited memory load.	
LIMITED_PROCCESSING	Indicates a limited processing power.	
LIMITED_ACCESS	Indicates a limited access to only the local data.	

6.6.6.3.5 Enumeration: FlMemberRole

The enumeration FlMemberRole represents an FL member role of the VAL UE. It shall comply with the provisions defined in table 6.6.6.3.5-1.

Table 6.6.6.3.5-1: Enumeration FlMemberRole

Enumeration value	Description	Applicability
FL_CLIENT	Indicates an FL client role.	
FL_SERVER	Indicates an FL server role.	
FL_AGGREGATOR	Indicates an FL aggregator role.	

6.6.6.3.6 Enumeration: FlGroupDelCause

The enumeration FlGroupDelCause represents the deletion cause for the FL group. It shall comply with the provisions defined in table 6.6.6.3.6-1.

Table 6.6.6.3.6-1: Enumeration FlGroupDelCause

Enumeration value	Description	Applicability
SRV_TERMINATION	Indicates the AIML service termination.	
OUT_OF_SRV_AREA	Indicates the UE has moved out of the service area.	

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

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

6.6.6.5 Binary data

6.6.6.5.1 Binary data types

The binary data types defined in table 6.6.6.5.1-1 shall be supported.

Table 6.6.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.6.7 Error handling

6.6.7.1 General

For the Aimlec_FLGroupIndication API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.6.7.2 Protocol errors

No specific procedures for the Aimlec_FLGroupIndication API are specified in this release of the specification.

6.6.7.3 Application errors

The application errors defined for the Aimlec_FLGroupIndication API are listed in Table 6.6.7.3-1.

Table 6.6.7.3-1: Application errors

Application Error	HTTP status code	Description

6.6.8 Feature negotiation

The optional features in table 6.6.8-1 are defined for the Aimlec_FLGroupIndication API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.6.8-1: Supported Features

Feature number	Feature Name	Description

6.6.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_FLGroupIndication API.

6.7 Aimlec_ClientDataProcessing API

6.7.1 Introduction

The client data processing service shall use the Aimlec_ClientDataProcessing API.

The API URI of the Aimlec_ClientDataProcessing API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-data-proc".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.7.4.

6.7.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_ClientDataProcessing API.

6.7.3 Resources

6.7.3.1 Overview

There are neither resources nor methods used for the service.

6.7.4 Custom operations without associated resources

6.7.4.1 Overview

Table 6.7.4.1-1 provides an overview of the custom operations and applicable HTTP methods defined for the Aimlec_ClientDataProcessing API.

Table 6.7.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
Trigger client data processing	/trigger	POST	Used by the AIMLE server to trigger the AIMLE client for the client data processing.

6.7.4.2 Operation: Trigger client data processing

6.7.4.2.1 Description

The custom operation enables the AIMLE server to trigger the AIMLE client for the client data processing which includes the data preparation or the data analysis.

6.7.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.7.4.2.2-1 and 6.7.4.2.2-2, 6.7.4.2.2-3, and 6.7.4.2.2-4.

Table 6.7.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
CltDataProcReq	M	1	Information which shall be used to trigger the client data processing.

Table 6.7.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
CltDataProcResp			200 OK	Successful case. The requested client data processing is successfully received and processed, and the processed data and optionally a timestamp shall be returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.7.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.7.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.7.5 Notifications

6.7.5.1 General

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

6.7.6 Data model

6.7.6.1 General

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

Table 6.7.6.1-1 specifies the data types defined for the Aimlec_ClientDataProcessing API.

Table 6.7.6.1-1: Aimlec_ClientDataProcessing API specific Data Types

Data type	Clause defined	Description	Applicability
CltDataProcReq	6.7.6.2.2	Represents triggering information for client data processing.	
CltDataProcResp	6.7.6.2.3	Represents the outcome of the successful client data processing.	

Table 6.7.6.1-2 specifies data types re-used by the Aimlec_ClientDataProcessing API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimlec_ClientDataProcessing API.

Table 6.7.6.1-2: Aimlec_ClientDataProcessing API re-used Data Types

Data type	Reference	Comments	Applicability
AggregatedDataAnaOutputs	3GPP TS 29.482 [7]	Represents the AIMLE Aggregated Data Analysis Output.	
AggregatedDataPrepOutputs	3GPP TS 29.482 [7]	Represents the AIMLE Aggregated Data Preparation Output.	
DataMgmtOp	3GPP TS 29.482 [7]	Represents the type of the client data processing.	
DataProcessReqs	3GPP TS 29.482 [7]	Represents the data preparation requirement.	
DateTime	3GPP TS 29.122 [5]	Used to represent the date and time.	
ScheduledCommunicationTime	3GPP TS 29.122 [5]	Used to define the schedules for traffic pattern configurations.	

6.7.6.2 Structured data types

6.7.6.2.1 Introduction

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

6.7.6.2.2 Type: CltDataProcReq

Table 6.7.6.2.2-1: Definition of type CltDataProcReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requesterId	string	M	1	Contains the identifier of the service consumer. For the AIMLE client, e.g. unique client identifier. For the AIMLE server, e.g., FQDN, URI.	
dataProc	DataMgmtOp	M	1	Identifies the type of the client data processing i.e., the data preparation or the data analysis.	
dataPrepReqs	DataProcessReqs	O	0..1	Identifies the data preparation requirements for the client data processing. (NOTE)	
dataAnalysisReqs	DataProcessReqs	O	0..1	Identifies the data analysis requirements for the client data processing. (NOTE)	
dataProcSched	ScheduledCommunicationTime	O	0..1	Identifies the schedule for the client data processing.	
NOTE: At least one of the attributes dataPrepReqs or dataAnalysisReqs shall be present.					

6.7.6.2.3 Type: CltDataProcResp

Table 6.7.6.2.3-1: Definition of type CltDataProcResp

Attribute name	Data type	P	Cardinality	Description	Applicability
dataPrepOutputs	AggregatedDataPrepOutputs	C	1..N	Identifies one or more outputs for the client data processing, where each output is w.r.t. a data preparation requirement. (NOTE)	
dataAnalysisOutputs	AggregatedDataAnaOutputs	C	1..N	Identifies one or more outputs for the client data processing, where each output is w.r.t. a data analysis requirement. (NOTE)	
timeStamp	DateTime	O	0..1	Identifies the timestamp for the client data processing.	
NOTE: At least one of the attributes dataPrepOutputs or dataAnalysisOutput shall be present.					

6.7.6.3 Simple data types and enumerations

6.7.6.3.1 Introduction

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

6.7.6.3.2 Simple data types

The simple data types defined in table 6.7.6.3.2-1 shall be supported.

Table 6.7.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

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

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

6.7.6.5 Binary data

6.7.6.5.1 Binary data types

The binary data types defined in table 6.7.6.5.1-1 shall be supported.

Table 6.7.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.7.7 Error handling

6.7.7.1 General

For the Aimlec_ClientDataProcessing API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.7.7.2 Protocol errors

No specific procedures for the Aimlec_ClientDataProcessing API are specified in this release of the specification.

6.7.7.3 Application errors

The application errors defined for the Aimlec_ClientDataProcessing API are listed in Table 6.7.7.3-1.

Table 6.7.7.3-1: Application errors

Application Error	HTTP status code	Description

6.7.8 Feature negotiation

The optional features in table 6.7.8-1 are defined for the Aimlec_ClientDataProcessing API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.7.8-1: Supported Features

Feature number	Feature Name	Description

6.7.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_ClientDataProcessing API.

6.8 Aimlec_MLModTngCapEva API

6.8.1 Introduction

The ML model training capability evaluation service shall use the Aimlec_MLModTngCapEva API.

The API URI of the Aimlec_MLModTngCapEva API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-ml-mtce".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.8.4.

6.8.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_MLModTngCapEva API.

6.8.3 Resources

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

6.8.4 Custom operations without associated resources

6.8.4.1 Overview

Table 6.8.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
ML model training capability evaluation request	/request	POST	Enables the AIMLE server to request the AIMLE client to perform ML model training capability evaluation service operation.

6.8.4.2 Operation: ML model training capability evaluation request

6.8.4.2.1 Description

The custom operation enables the AIMLE server to request the AIMLE client to perform the ML model training capability evaluation service operation.

6.8.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.8.4.2.2-1 and 6.8.4.2.2-2.

Table 6.8.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
MlModTngCapEvalReq	M	1	Contains the ML model training capability evaluation request information.

Table 6.8.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
MlModTngCapEvalResp	M	0..1	200 OK	Contains the ML model training capability evaluation response information.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.8.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.8.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.8.5 Notifications

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

6.8.6 Data model

6.8.6.1 General

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

Table 6.8.6.1-1 specifies the data types defined for the Aimlec_MLModTngCapEva API.

Table 6.8.6.1-1: Aimlec_MLModTngCapEva API specific Data Types

Data type	Clause defined	Description	Applicability
AimlModelData	6.8.6.2.4	Contains the AIML model information and model parameters for use in FL training.	
CapEvalOutcome	6.8.6.3.3	Indicates the outcome of the ML model training capability evaluation.	
DataSetRequirements	6.8.6.2.5	Contains requirements on data set for FL training.	
DomainFeatures	6.8.6.2.6	Contains a list of features for each data domain(s) of the datasets at the UE.	
MlModTngCapEvalReq	6.8.6.2.2	Contains the ML model training capability evaluation request information.	
MlModTngCapEvalResp	6.8.6.2.3	Contains the ML model training capability evaluation response information.	

Table 6.8.6.1-2 specifies data types re-used by the Aimlec_MLModTngCapEva API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimlec_MLModTngCapEva API.

Table 6.8.6.1-2: Aimlec_MLModTngCapEva API re-used Data Types

Data type	Reference	Comments	Applicability
AimlModelType	6.3.6.3.4	Used to indicate a type of the AIML model.	
MLModelProfile	3GPP TS 29.482 [7]	Used to indicate an ML model profile.	
TimeWindow	3GPP TS 29.122 [5]	Used to indicate a time window.	

6.8.6.2 Structured data types

6.8.6.2.1 Introduction

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

6.8.6.2.2 Type: MlModTngCapEvalReq

Table 6.8.6.2.2-1: Definition of type MlModTngCapEvalReq

Attribute name	Data type	P	Cardinality	Description	Applicability
aimleServerId	string	M	1	The AIMLE server identifier.	
availTime	TimeWindow	O	0..1	Indicates the requested available time to support FL operation.	
testTask	string	O	0..1	Represents the task for test ML model training capability. (NOTE)	
modelInfo	AimlModelData	O	0..1	Contains the AIML model information and model parameters for use in the FL training process.	
dataSetReq	DataSetRequirements	O	0..1	Contains requirements on data set for FL training.	
NOTE: The detail content of the "testTask" attribute is implementation dependent.					

6.8.6.2.3 Type: MlModTngCapEvalResp

Table 6.8.6.2.3-1: Definition of type MlModTngCapEvalResp

Attribute name	Data type	P	Cardinality	Description	Applicability
capEvalOut	CapEvalOutcome	M	1	Indicates the outcome of the ML model training capability evaluation.	
testResult	string	C	0..1	Contains the test result of the ML model training capability evaluation. If the "capEvalOut" indicates the ability to join the FL training process the "testResult" attribute shall be included. (NOTE)	
evalFailInd	string	C	0..1	Contains the reason for inability to join the FL training process. If the "capEvalOut" indicates the inability to join the FL training process the "evalFailInd" attribute shall be included. (NOTE)	
NOTE: The detail content of this attribute is implementation dependent and depends on the information provided in the MlModTngCapEvalReq data type.					

6.8.6.2.4 Type: AimlModelData

Table 6.8.6.2.4-1: Definition of type AimlModelData

Attribute name	Data type	P	Cardinality	Description	Applicability
aimlModels	array(AimlModelInfo)	O	1..N	Contains information about the AIML model. (NOTE 1)	
mlModelParams	array(string)	O	1..N	Contains model parameters for use in FL training. (NOTE 2)	
NOTE 1: For the HFL only one AIML model shall be present. For the VFL more than one AIML model may be present. NOTE 2: The detail content of the "mlModelParams" attribute is implementation dependent.					

6.8.6.2.5 Type: DataSetRequirements

Table 6.8.6.2.5-1: Definition of type DataSetRequirements

Attribute name	Data type	P	Cardinality	Description	Applicability
commonFtIds	array(string)	O	1..N	Contains a list of the features identifiers of the required features common to the dataset of the different data domains. (NOTE 1)	
domainFts	array(DomainFeatures)	O	1..N	Contains a list of features for each data domain(s) of the datasets at the UE. (NOTE 1)	
dataSource	string	O	0..1	Contains the identifier of a data source for the FL training (e.g. SEAL server, SEAL client, other NF entity, etc.). (NOTE 2)	
NOTE 1: For the VFL at least one of the "commonFtIds" and "domainFts" attributes shall be present. NOTE 2: The "dataSource" attribute shall be present for the HFL and may be present for the VFL.					

6.8.6.2.6 Type: DomainFeatures

Table 6.8.6.2.6-1: Definition of type DomainFeatures

Attribute name	Data type	P	Cardinality	Description	Applicability
domain	string	M	1	Represents a data domain i.e. a specific category of data or logical groupings of data that all relate together (e.g. customer data, product data, etc.).	
featureIds	array(string)	M	1..N	Represents a list of the features identifiers for the data domain of the datasets at the UE.	

6.8.6.2.7 Type: AimlModelInfo

Table 6.8.6.2.7-1: Definition of type AimlModelInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
aimlModelType	AimlModelType	O	0..1	Contains AIML model type (e.g., decision tree, linear regression, neural network).	
mlModelProf	MLModelProfile	O	0..1	Contains ML model profile data e.g. ML model profile identifier, ML model address, ML model information, AIMLE server identifier, ML repository identifier.	

6.8.6.3 Simple data types and enumerations

6.8.6.3.1 Introduction

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

6.8.6.3.2 Simple data types

The simple data types defined in table 6.8.6.3.2-1 shall be supported.

Table 6.8.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.8.6.3.3 Enumeration: CapEvalOutcome

The enumeration CapEvalOutcome represents the outcome of the ML model training capability evaluation. It shall comply with the provisions defined in table 6.8.6.3.3-1.

Table 6.8.6.3.3-1: Enumeration CapEvalOutcome

Enumeration value	Description	Applicability
ABILITY_TO_JOIN	Indicates ability to join the training process.	
INABILITY_TO_JOIN	Indicates inability to join the training process.	

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

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

6.8.6.5 Binary data

6.8.6.5.1 Binary data types

The binary data types defined in table 6.8.6.5.1-1 shall be supported.

Table 6.8.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.8.7 Error handling

6.8.7.1 General

For the Aimlec_MLModTngCapEva API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.8.7.2 Protocol errors

No specific procedures for the Aimlec_MLModTngCapEva API are specified.

6.8.7.3 Application errors

The application errors defined for the Aimlec_MLModTngCapEva API are listed in table 6.8.7.3-1.

Table 6.8.7.3-1: Application errors

Application Error	HTTP status code	Description

6.8.8 Feature negotiation

The optional features in table 6.8.8-1 are defined for the Aimlec_MLModTngCapEva API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.8.8-1: Supported Features

Feature number	Feature Name	Description

6.8.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_MLModTngCapEva API.

6.9 Aimles_UeTLModelSelectionAssistance API

6.9.1 Introduction

The TL enablement service shall use the Aimles_UeTLModelSelectionAssistance API.

The API URI of the Aimles_UeTLModelSelectionAssistance API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimles-ue-tl-msa".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.9.4.

6.9.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimles_UeTLModelSelectionAssistance API.

6.9.3 Resources

6.9.3.1 Overview

There are neither resources nor methods used for the service.

6.9.4 Custom operations without associated resources

6.9.4.1 Overview

Table 6.9.4.1-1 provides an overview of the custom operations and applicable HTTP methods defined for the Aimles_UeTLModelSelectionAssistance API.

Table 6.9.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
TL model selection assistance	/assist-tlms	POST	Used by the AIMLE client to request the AIMLE server to perform TL enablement service.

6.9.4.2 Operation: TL model selection assistance

6.9.4.2.1 Description

The custom operation enables the AIMLE client to request the AIMLE server to provide one or more pre-trained ML models for the TL enablement service.

6.9.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.9.4.2.2-1, 6.9.4.2.2-2, 6.9.4.2.2-3, and 6.9.4.2.2-4.

Table 6.9.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
TlModelSelectAssistReq	M	1	Contains information to trigger TL enablement service.

Table 6.9.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
TlModelSelectAssistResp			200 OK	Successful case. The TL enablement service is performed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status code for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.9.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.9.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.9.5 Notifications

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

6.9.6 Data model

6.9.6.1 General

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

Table 6.9.6.1-1 specifies the data types defined for the Aimles_UeTLModelSelectionAssistance API.

Table 6.9.6.1-1: Aimles_UeTLModelSelectionAssistance API specific Data Types

Data type	Clause defined	Description	Applicability
AccessType	6.9.6.2.6	Contains permission and restriction to access the pre-trained model.	
EnvironmentType	6.9.6.3.4	Contains the environment for the target ML task.	
MLModel	6.9.6.2.5	Contains the pre-trained ML models for the TL enablement service.	
TlCriteria	6.9.6.2.4	Contains the criteria for transfer learning.	
TlModelSelectAssistReq	6.9.6.2.2	Contains information to trigger TL enablement service.	
TlModelSelectAssistResp	6.9.6.2.3	Contains one or more pre-trained ML model for the TL enablement service.	
TlType	6.9.6.3.3	Contains the type of the transfer learning.	

Table 6.9.6.1-2 specifies data types re-used by the Aimles_UeTLModelSelectionAssistance API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimles_UeTLModelSelectionAssistance API.

Table 6.9.6.1-2: Aimles_UeTLModelSelectionAssistance API re-used Data Types

Data type	Reference	Comments	Applicability
MLModelProfile	3GPP TS 29.482 [7]	Used to indicate an ML model profile.	
Uint32	3GPP TS 29.571 [11]	Integer where the allowed values correspond to the value range of an unsigned 32-bit integer.	
ValTargetUe	3GPP TS 29.549 [9]	Unique identifier of a VAL user or a VAL UE.	

6.9.6.2 Structured data types

6.9.6.2.1 Introduction

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

6.9.6.2.2 Type: TlModelSelectAssistReq

Table 6.9.6.2.2-1: Definition of type TlModelSelectAssistReq

Attribute name	Data type	P	Cardinality	Description	Applicability
serverId	string	M	1	Identifies the AIMLE server	
valSrvId	string	M	1	Identifying the VAL service, for which the TL enablement service is requested.	
tlCriteria	TlCriteria	M	1	Identifying the criteria for transfer learning, for which the TL enablement service is requested.	
mlTaskId	string	O	0..1	Identifying the ML task, for which the TL enablement service is requested. (NOTE)	
adaeAnalyticsId	string	O	0..1	Identifying the ADAE analytics, for which the TL enablement service is requested. (NOTE)	
mlModelProfile	MlModelProfile	O	0..1	Identifying the ML model profile, for which the TL enablement service is requested. (NOTE)	
mlModelReq	array(string)	O	0..N	Identifying the requirements for the ML model, for which the TL enablement service is requested.	
valUeIds	array(ValTargetUe)	O	0..N	Identifying a list of one or more VAL UEs associated with the target ML task, for which one or more pre-trained models are requested.	
mlModelRateReq	array(string)	O	0..N	Identifying the requirements for the rating of the ML model, for which the TL enablement service is requested.	
NOTE: At least one of these attributes shall be included.					

6.9.6.2.3 Type: TlModelSelectAssistResp

Table 6.9.6.2.3-1: Definition of type TlModelSelectAssistResp

Attribute name	Data type	P	Cardinality	Description	Applicability
mlModelList	array(MlModel)	M	1..N	Identifying the selected one or more pre-trained ML models, for which the TL enablement service is requested.	

6.9.6.2.4 Type: TlCriteria

Table 6.9.6.2.4-1: Definition of type TlCriteria

Attribute name	Data type	P	Cardinality	Description	Applicability
reqFeatures	array(string)	O	0..N	Identifies the required features for a pre-trained model.	
dataReq	array(string)	O	0..N	Identifies the training data requirements.	
tlType	TlType	O	0..1	Identifies the type of transfer learning.	
environment	EnvironmentType	O	0..1	Identifies the environment which is associated with the target ML task.	
access	array(AccessType)	O	0..N	Permissions and restrictions to access the pre-trained model.	

6.9.6.2.5 Type: MLModel

Table 6.9.6.2.5-1: Definition of type MLModel

Attribute name	Data type	P	Cardinality	Description	Applicability
mlRepositoryId	string	M	1	Identifies the unique repository identity of the ML model.	
mlModelInfo	AimlModelInfo	M	1	Identifies the information on the ML model.	
mlModelRating	Uint32	O	0..1	Identifies the rating of the ML model.	

6.9.6.2.6 Type: AccessType

Table 6.9.6.2.6-1: Definition of type AccessType

Attribute name	Data type	P	Cardinality	Description	Applicability
modelLicense	string	O	0..1	Identifies the license of the pre-trained ML model.	
dataTrainLicense	string	O	0..1	Identifies the license of the dataset, used to train the pre-trained ML model.	
codeTrainLicense	string	O	0..1	Identifies the license of the code, used to train the pre-trained ML model.	

6.9.6.3 Simple data types and enumerations

6.9.6.3.1 Introduction

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

6.9.6.3.2 Simple data types

The simple data types defined in table 6.9.6.3.2-1 shall be supported.

Table 6.9.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.9.6.3.3 Enumeration: TlType

The enumeration TlType represents the AIMLE service operation modes. It shall comply with the provisions defined in table 6.9.6.3.3-1.

Table 6.9.6.3.3-1: Enumeration TlType

Enumeration value	Description	Applicability
INDUCTIVE	Identifies that the pre-trained ML models are for different task than the target ML task, but the target ML task has labelled data.	
TRANSDUCTIVE	Identifies that the pre-trained ML models and the trained ML model for the target ML task have different data distributions (labelled and unlabelled), however share similarities for the task.	
UNSUPERVISED	Identifies that the pre-trained ML models and the trained ML model for the target ML task have both unlabelled data, however share similarities for the task.	

6.9.6.3.4 Enumeration: EnvironmentType

The enumeration EnvironmentType represents the AIMLE service operation modes. It shall comply with the provisions defined in table 6.9.6.3.4-1.

Table 6.9.6.3.4-1: Enumeration EnvironmentType

Enumeration value	Description	Applicability
DOMAIN_SHIFT	Identifies that the data distribution suited for the pre-trained ML models differs from the data distribution suited for the trained ML model for the target ML task.	
SIMULATED_REAL	Identifies that the pre-trained ML models are suited for the simulated data while the target ML task has the real-world data.	
DYNAMIC	Identifies that the suited data distribution for the pre-trained ML models changes over time.	
HETEROGENEOUS	Identifies that the data distribution suited for the pre-trained ML models differs significantly from the data distribution suited for the trained ML model for the target ML task.	
ROBOTICS	Identifies that the pre-trained ML models are suited for the target ML task for robotic platforms.	
SMART	Identifies that the pre-trained ML models are suited for the target ML task for smart platforms.	

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

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

6.9.6.5 Binary data

6.9.6.5.1 Binary data types

The binary data types defined in table 6.9.6.5.1-1 shall be supported.

Table 6.9.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.9.7 Error handling

6.9.7.1 General

For the Aimles_UeTLModelSelectionAssistance API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.9.7.2 Protocol errors

No specific procedures for the Aimles_UeTLModelSelectionAssistance API are specified.

6.9.7.3 Application errors

The application errors defined for the Aimles_UeTLModelSelectionAssistance API are listed in table 6.9.7.3-1.

Table 6.9.7.3-1: Application errors

Application Error	HTTP status code	Description

6.9.8 Feature negotiation

The optional features in table 6.9.8-1 are defined for the Aimles_UeTLModelSelectionAssistance API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.9.8-1: Supported Features

Feature number	Feature Name	Description

6.9.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimles_UeTLModelSelectionAssistance API.

6.10 Aimlec_AIMLEClientServiceOperations API

6.10.1 Introduction

The AIMLE client service operations service shall use the Aimlec_AIMLEClientServiceOperations API.

The API URI of the Aimlec_AIMLEClientServiceOperations API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-serv-ops".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.10.4.

6.10.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_AIMLEClientServiceOperations API.

6.10.3 Resources

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

6.10.4 Custom operations without associated resources

6.10.4.1 Overview

Table 6.10.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
AIMLE service operation request	/perform	POST	Used by the AIMLE server to request the AIMLE client to perform AIMLE service operation.

6.10.4.2 Operation: AIMLE service operation request

6.10.4.2.1 Description

The custom operation enables the AIMLE server to request the AIMLE client to perform the AIMLE client service operation.

6.10.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.10.4.2.2-1 and 6.10.4.2.2-2.

Table 6.10.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AimleClientServOpReq	M	1	Contains the AIMLE client service operation request information.

Table 6.10.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AimleClientServOpResp	M	1	200 OK	Successful case. The AIMLE client service operation is performed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.10.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.10.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.10.5 Notifications

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

6.10.6 Data model

6.10.6.1 General

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

Table 6.10.6.1-1 specifies the data types defined for the Aimlec_AIMLEClientServiceOperations API.

Table 6.10.6.1-1: Aimlec_AIMLEClientServiceOperations API specific Data Types

Data type	Clause defined	Description	Applicability
AimleClientServOpReq	6.10.6.2.2	Contains the AIMLE client service operation request information.	
AimleClientServOpResp	6.10.6.2.3	Contains the AIMLE client service operation response information.	
ServiceOperationInfo	6.10.6.2.4	Contains the AIML service operation information.	
ServiceOperationMode	6.10.6.3.3	Represents service operation modes.	
ServiceOpModeConfiguration	6.10.6.2.5	Contains the AIML service operation mode configuration.	

Table 6.10.6.1-2 specifies data types re-used by the Aimlec_AIMLEClientServiceOperations API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimlec_AIMLEClientServiceOperations API.

Table 6.10.6.1-2: Aimlec_AIMLEClientServiceOperations API re-used Data Types

Data type	Reference	Comments	Applicability
DurationSec	3GPP TS 29.122 [5]	Used to indicate a time duration expressed in units of seconds.	
ReportingRequirements	3GPP TS 29.549 [9]	Used to indicate the reporting configuration of the AIML service operation status.	
Uint32	3GPP TS 29.571 [11]	Used to indicate the latency.	
Uri	3GPP TS 29.122 [5]	Used to indicate a URI.	

6.10.6.2 Structured data types

6.10.6.2.1 Introduction

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

6.10.6.2.2 Type: AimleClientServOpReq

Table 6.10.6.2.2-1: Definition of type AimleClientServOpReq

Attribute name	Data type	P	Cardinality	Description	Applicability
aimleServerId	string	M	1	The AIMLE server identifier.	
valServiceId	string	O	0..1	Represents the VAL service identifier.	
servOpId	string	M	1	Contains the AIML service operation identifier.	
servOpMode	ServiceOperationMode	M	1	Contains the service operation mode.	
servOpInfo	ServiceOperationInfo	O	0..1	Contains the AIML service operation information (e.g. AIML service model container, URI of the model to fetch the model from a repository, AIML service aggregator URI).	
servOpModeCfg	ServiceOpModeConfiguration	O	0..1	Contains the AIML service operation mode configuration (e.g. network utilization (like stop the AIML service when latency is worse than x milliseconds, time limit threshold (like stop the AIML service after 24 hours), model performance (like stop the AIML service when model accuracy is 99% achieved)).	
servOpModeStatRptg	ReportingRequirements	O	0..1	Indicates the reporting configuration of the AIML service operation status.	

6.10.6.2.3 Type: AimleClientServOpResp

Table 6.10.6.2.3-1: Definition of type AimleClientServOpResp

Attribute name	Data type	P	Cardinality	Description	Applicability
valServiceId	string	O	0..1	Represents the VAL service identifier.	
servOpId	string	M	1	Contains the AIML service operation identifier.	
servOpModeStatus	ServiceOperationMode	M	1	Indicates the service operation mode status.	

6.10.6.2.4 Type: ServiceOperationInfo

Table 6.10.6.2.4-1: Definition of type ServiceOperationInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
mlMdlContainer	string	O	0..1	Represents the AIML service model container.	
mlMdlUri	Uri	O	0..1	Represents the URI of the ML model to be retrieved from the model repository.	
mlMdAggregUri	Uri	O	0..1	Represents the ML model aggregator URI to send the model updates.	
maxConvgTime	DurationSec	O	0..1	Indicates the maximum convergence time used in the AIML service operation optimization assistance.	

6.10.6.2.5 Type: ServiceOpModeConfiguration

Table 6.10.6.2.5-1: Definition of type ServiceOpModeConfiguration

Attribute name	Data type	P	Cardinality	Description	Applicability
maxLatency	Uint32	O	0..1	Indicates the latency threshold value in milliseconds to stop the AIML service operation.	
maxDurHour	integer	O	0..1	Indicates the maximum duration time of the AIML service operation expressed in hours.	
modelAccuracy	integer	O	0..1	Indicates the threshold value of the model accuracy expressed as a percentage to stop the AIML service operation.	

6.10.6.3 Simple data types and enumerations

6.10.6.3.1 Introduction

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

6.10.6.3.2 Simple data types

The simple data types defined in table 6.10.6.3.2-1 shall be supported.

Table 6.10.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.10.6.3.3 Enumeration: ServiceOperationMode

The enumeration ServiceOperationMode represents the AIMLE service operation modes. It shall comply with the provisions defined in table 6.10.6.3.3-1.

Table 6.10.6.3.3-1: Enumeration ServiceOperationMode

Enumeration value	Description	Applicability
START	Indicates a request to start the AIMLE service operation or status of the AIMLE service operation.	
STOP	Indicates a request to stop the AIMLE service operation or status of the AIMLE service operation.	

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

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

6.10.6.5 Binary data

6.10.6.5.1 Binary data types

The binary data types defined in table 6.10.6.5.1-1 shall be supported.

Table 6.10.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.10.7 Error handling

6.10.7.1 General

For the Aimlec_AIMLEClientServiceOperations API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.10.7.2 Protocol errors

No specific procedures for the Aimlec_AIMLEClientServiceOperations API are specified.

6.10.7.3 Application errors

The application errors defined for the Aimlec_AIMLEClientServiceOperations API are listed in table 6.10.7.3-1.

Table 6.10.7.3-1: Application errors

Application Error	HTTP status code	Description

6.10.8 Feature negotiation

The optional features in table 6.10.8-1 are defined for the Aimlec_AIMLEClientServiceOperations API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.10.8-1: Supported Features

Feature number	Feature Name	Description

6.10.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_AIMLEClientServiceOperations API.

6.11 Aimlec_AimlTaskTransfer API

6.11.1 Introduction

The AIMLE client AIML task transfer shall use the Aimlec_AimlTaskTransfer API.

The API URI of the Aimlec_AimlTaskTransfer API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimlec-task-transfer".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.11.4.

6.11.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimlec_AimlTaskTransfer API.

6.11.3 Resources

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

6.11.4 Custom operations without associated resources

6.11.4.1 Overview

Table 6.11.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
AIML task transfer	/request	POST	Used by the AIMLE server to request the AIMLE client to perform AIML task transfer.
Direct AIML task transfer	/request-direct	POST	Used by the AIMLE client to request the target AIMLE client to perform AIML task transfer.

6.11.4.2 Operation: AIML task transfer

6.11.4.2.1 Description

The custom operation enables the AIMLE server to request the AIMLE client to perform the AIML task transfer operation.

6.11.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.11.4.2.2-1 and 6.11.4.2.2-2.

Table 6.11.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AimleClientTaskTransferReq	M	1	Contains the AIMLE client task transfer request information.

Table 6.11.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AimleClientTaskTransferRes	M	1	200 OK	Successful case. The AIMLE client AIML task transfer is performed.
n/a			204 No Content	Successful case. The AIMLE client AIML task transfer is performed and no content is returned in the response body.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.11.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.11.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.11.4.3 Operation: Direct AIML task transfer

6.11.4.3.1 Description

The custom operation enables the AIMLE client to request an AIMLE client to perform the direct AIML task transfer operation.

6.11.4.3.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.11.4.3.2-1 and 6.11.4.3.2-2.

Table 6.11.4.3.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AimleClientDirectTransferReq	M	1	Contains the AIMLE client direct task transfer request information.

Table 6.11.4.3.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	Successful case. The AIMLE client direct AIML task transfer is performed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE client. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.11.4.3.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

Table 6.11.4.3.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE client.

6.11.5 Notifications

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

6.11.6 Data model

6.11.6.1 General

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

Table 6.11.6.1-1 specifies the data types defined for the Aimlec_AimlTaskTransfer API.

Table 6.11.6.1-1: Aimlec_AimlTaskTransfer API specific Data Types

Data type	Clause defined	Description	Applicability
AimleClientDirectTransferReq	6.11.6.2.4	Contains the AIMLE client direct task transfer request information.	
AimleClientTaskTransferReq	6.11.6.2.2	Contains the AIMLE client task transfer request information.	
AimleClientTaskTransferRes	6.11.6.2.3	Contains the AIMLE client task transfer response information.	
AimlInfoType	6.11.6.3.3	Represents the AIML information type.	

Table 6.11.6.1-2 specifies data types re-used by the Aimlec_AimlTaskTransfer API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimlec_AimlTaskTransfer API.

Table 6.11.6.1-2: Aimlec_AimlTaskTransfer API re-used Data Types

Data type	Reference	Comments	Applicability
AimlOperation	6.3.6.3.5	Represents a type of the AIML operation (e.g., training, model transfer, model inference, model offload, model split, continue performing intermediate AIML operation).	
TimeWindow	3GPP TS 29.122 [5]	Represents a time window.	
ValTargetUe	3GPP TS 29.549 [9]	Unique identifier of a VAL user or a VAL UE.	

6.11.6.2 Structured data types

6.11.6.2.1 Introduction

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

6.11.6.2.2 Type: AimleClientTaskTransferReq

Table 6.11.6.2.2-1: Definition of type AimleClientTaskTransferReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	string	M	1	Contains the identifier of the service consumer. For the AIMLE client, e.g. unique client identifier. For the AIMLE server, e.g., FQDN, URI.	
sourceAimlId	ValTargetUe	M	1	The identifier of the VAL UE i.e. the source AIMLE client.	
aimlTaskType	AimlOperation	M	1	The type of the AIML operation (e.g. ML model training).	
aimlInfoType	AimlInfoType	M	1	The type of the AIML information in the AIML task need be transferred (e.g. intermediate AIML operation status, intermediate AIML operation results).	
aimlTaskTransferTime	TimeWindow	O	0..1	Information on the requested time or time window for the AIML task transfer.	
timeValidity	TimeWindow	O	0..1	The time validity of the AIML task transfer request.	

6.11.6.2.3 Type: AimleClientTaskTransferRes

Table 6.11.6.2.3-1: Definition of type AimleClientTaskTransferRes

Attribute name	Data type	P	Cardinality	Description	Applicability
aimlTaskTransferTime	TimeWindow	M	1	Information on the time or time window for the AIML task transfer.	

6.11.6.2.4 Type: AimleClientDirectTransferReq

Table 6.11.6.2.4-1: Definition of type AimleClientDirectTransferReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	ValTargetUe	M	1	The identifier of the VAL UE i.e. the source AIMLE client.	
aimlTaskType	AimlOperation	M	1	The type of the AIML operation (e.g. ML model training).	
aimlInfoType	AimlInfoType	M	1	The type of the AIML information in the AIML task need be transferred (e.g. intermediate AIML operation status, intermediate AIML operation results).	
aimlTaskTransferTime	TimeWindow	O	0..1	Information on time or time window for the AIML task transfer.	
timeValidity	TimeWindow	O	0..1	The time validity of the request.	

6.11.6.3 Simple data types and enumerations

6.11.6.3.1 Introduction

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

6.11.6.3.2 Simple data types

The simple data types defined in table 6.11.6.3.2-1 shall be supported.

Table 6.11.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.11.6.3.3 Enumeration: AimlInfoType

The enumeration AimlInfoType represents the type of the AIML Information. It shall comply with the provisions defined in table 6.11.6.3.3-1.

Table 6.11.6.3.3-1: Enumeration AimlInfoType

Enumeration value	Description	Applicability
INTERMEDIATE_AIML_OP_RESULTS	Indicates the intermediate AIML operation results type of the AIML information.	
INTERMEDIATE_AIML_OP_STATUS	Indicates the intermediate AIML operation status type of the AIML information.	
OTHER_AIML_INFO_TYPE	Indicates other types of the AIML information.	

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

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

6.11.6.5 Binary data

6.11.6.5.1 Binary data types

The binary data types defined in table 6.11.6.5.1-1 shall be supported.

Table 6.11.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.11.7 Error handling

6.11.7.1 General

For the Aimlec_AimlTaskTransfer API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.11.7.2 Protocol errors

No specific procedures for the Aimlec_AimlTaskTransfer API are specified.

6.11.7.3 Application errors

The application errors defined for the Aimlec_AimlTaskTransfer API are listed in table 6.11.7.3-1.

Table 6.11.7.3-1: Application errors

Application Error	HTTP status code	Description

6.11.8 Feature negotiation

The optional features in table 6.11.8-1 are defined for the Aimlec_AimlTaskTransfer API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.11.8-1: Supported Features

Feature number	Feature Name	Description

6.11.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimlec_AimlTaskTransfer API.

6.12 Aimles_AIMLTaskTransfer API

6.12.1 Introduction

The AIMLE server AIML Task Transfer shall use the Aimles_AIMLTaskTransfer API.

The API URI of the Aimles_AIMLTaskTransfer API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URIs used in HTTP requests shall have the Resource URI structure defined in clause 5.2.4 of 3GPP TS 29.122 [5], i.e.:

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

with the following components:

- The {apiRoot} shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].
- The <apiName> shall be "aimles-task-transfer".
- The <apiVersion> shall be "v1".
- The <apiSpecificSuffixes> shall be set as described in clause 6.12.4.

6.12.2 Usage of HTTP and common API related aspects

The provisions of clause 5.2 of 3GPP TS 29.122 [5] shall apply for the Aimles_AIMLTaskTransfer API.

6.12.3 Resources

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

6.12.4 Custom operations without associated resources

6.12.4.1 Overview

Table 6.12.4.1-1: Custom operations without associated resources

Operation name	Custom operation URI	Mapped HTTP method	Description
AIML task transfer assist	/assist-tt	POST	Used by the AIMLE client to request the AIMLE server to perform task transfer assist.
Controlled AIML task transfer	/request-ctld	POST	Used by the AIMLE client to request the AIMLE server to perform AIMLE server controlled task transfer.

6.12.4.2 Operation: AIML task transfer assist

6.12.4.2.1 Description

The custom operation enables the AIMLE client to request the AIMLE server to perform the AIML task transfer assist operation.

6.12.4.2.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.12.4.2.2-1 and 6.12.4.2.2-2.

Table 6.12.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AimlesTaskTransferAssistReq	M	1	Contains the AIMLE server task transfer assist request information.

Table 6.12.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AimlesTaskTransferAssist Resp	M	1	200 OK	Successful case. The AIMLE server AIML task transfer assist is performed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.12.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.12.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.12.4.3 Operation: Controlled AIML task transfer

6.12.4.3.1 Description

The custom operation enables the AIMLE client to request an AIMLE server to perform the AIMLE server controlled task transfer operation.

6.12.4.3.2 Operation definition

This operation shall support the response data structures and response codes specified in tables 6.12.4.3.2-1 and 6.12.4.3.2-2.

Table 6.12.4.3.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
AimlesControlledTaskTransfer Req	M	1	Contains the AIMLE server controlled task transfer request information.

Table 6.12.4.3.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
AimlesControlledTaskTransferResp	M	1	200 OK	Successful case. The AIMLE server controlled AIML task transfer is performed.
n/a			307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
n/a			308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing an alternative URI of the resource located in an alternative AIMLE server. Redirection handling is described in clause 5.2.10 of 3GPP TS 29.122 [5].
NOTE: The mandatory HTTP error status codes for the HTTP POST method listed in table 5.2.6-1 of 3GPP TS 29.122 [5] also apply.				

Table 6.12.4.3.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

Table 6.12.4.3.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains an alternative target URI located in an alternative AIMLE server.

6.12.5 Notifications

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

6.12.6 Data model

6.12.6.1 General

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

Table 6.12.6.1-1 specifies the data types defined for the Aimles_AIMLTaskTransfer API.

Table 6.12.6.1-1: Aimles_AIMLTaskTransfer API specific Data Types

Data type	Clause defined	Description	Applicability
AimlesControlledTaskTransferReq	6.12.6.2.4	Contains the AIMLE server controlled task transfer request information.	
AimlesControlledTaskTransferResp	6.12.6.2.5	Contains the AIMLE server controlled task transfer response information.	
AimlesTaskTransferAssistReq	6.12.6.2.2	Contains the AIMLE server task transfer assist request information.	
AimlesTaskTransferAssistResp	6.12.6.2.3	Contains the AIMLE server task transfer assist response information.	
AimlIntermediateInfo	6.12.6.2.7	Contains the AIML intermediate information for intermediate AIML operation.	
AimlRmngTrainingReq	6.12.6.2.6	Contains requirements for AIML model training.	
TransferMode	6.12.3.3.3	Represents the transfer mode.	

Table 6.12.6.1-2 specifies data types re-used by the Aimles_AIMLTaskTransfer API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the Aimles_AIMLTaskTransfer API.

Table 6.12.6.1-2: Aimles_AIMLTaskTransfer API re-used Data Types

Data type	Reference	Comments	Applicability
AimlInfoType	6.11.6.3.3	Represents the AIML information type.	
AimlOperation	6.3.6.3.5	Represents a type of the AIML operation (e.g., training, model transfer, model inference, model offload, model split, continue performing intermediate AIML operation).	
TimeWindow	3GPP TS 29.122 [5]	Represents a time window.	
ValTargetUe	3GPP TS 29.549 [9]	Unique identifier of a VAL user or a VAL UE.	

6.12.6.2 Structured data types

6.12.6.2.1 Introduction

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

6.12.6.2.2 Type: AimlesTaskTransferAssistReq

Table 6.12.6.2.2-1: Definition of type AimlesTaskTransferAssistReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	ValTargetUe	M	1	The identifier of source AIMLE client.	
valServiceId	string	O	0..1	The identifier of the VAL service for which the assistance information is requested.	
aimlTaskType	AimlOperation	M	1	The type of the AIML operation (e.g. ML model training).	
aimlInfoType	AimlInfoType	M	1	The type of the AIML information in the AIML task need be transferred (e.g. intermediate AIML operation status, intermediate AIML operation results).	
aimlRmngTrainReq	AimlRmngTrainingReq	C	0..1	Contains requirements for AIML model training including, required remaining training resource, required remaining training number of iterations. (NOTE)	
aimlImdInfo	AimlIntermediateInfo	C	0..1	Contains the AIML intermediate information for intermediate AIML operation, including AIML intermediate model, AIML intermediate model used training time, used training resource, used training number of iterations. (NOTE)	
timeValidity	TimeWindow	O	0..1	The time validity of the request.	
NOTE: This attribute may be present only if the aimlTaskType attribute is set to value "MODEL_TRAINING".					

6.12.6.2.3 Type: AimlesTaskTransferAssistResp

Table 6.12.6.2.3-1: Definition of type AimlesTaskTransferAssistResp

Attribute name	Data type	P	Cardinality	Description	Applicability
assistanceTime	TimeWindow	M	1	Indicates a time window for assistance in the AIML task transfer.	
targetAimlIds	array(ValTargetUe)	M	1..N	List of the target AIMLE clients.	
transferMode	TransferMode	O	0..1	Indication of the transfer mode (e.g., direct transfer).	

6.12.6.2.4 Type: AimlesControlledTaskTransferReq

Table 6.12.6.2.4-1: Definition of type AimlesControlledTaskTransferReq

Attribute name	Data type	P	Cardinality	Description	Applicability
requestorId	ValTargetUe	M	1	The identifier of the source AIMLE client.	
aimlTaskType	AimlOperation	M	1	The type of the AIML operation (e.g. ML model training).	
aimlInfoType	AimlInfoType	M	1	The type of the AIML information in the AIML task need be transferred (e.g. intermediate AIML operation status, intermediate AIML operation results).	
aimlTaskTransferTime	TimeWindow	M	1	Information on time or time window for the AIML task transfer.	
timeValidity	TimeWindow	O	0..1	The time validity of the request.	

6.12.6.2.5 Type: AimlesControlledTaskTransferResp

Table 6.12.6.2.5-1: Definition of type AimlesControlledTaskTransferResp

Attribute name	Data type	P	Cardinality	Description	Applicability
assistanceTime	TimeWindow	M	1	Indicates a time window for assistance in the AIML task transfer.	

6.12.6.2.6 Type: AimlRmngTrainingReq

Table 6.12.6.2.6-1: Definition of type AimlRmngTrainingReq

Attribute name	Data type	P	Cardinality	Description	Applicability
reqRmngTrainResorce	string	O	0..1	Indicates required remaining training resource.	
reqRmngTrainIterNum	integer	O	0..1	Indicates required remaining training number of iterations.	

6.12.6.2.7 Type: AimlIntermediateInfo

Table 6.12.6.2.7-1: Definition of type AimlIntermediateInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
aimlImdModel	AimlRmngTrainingReq	O	0..1	Indicates the AIML intermediate model.	
aimlUsedTrainTime	TimeWindow	O	0..1	Indicates the AIML intermediate model used training time.	
usedTrainResource	string	O	0..1	Indicates used training resource.	
usedTrainIterNum	integer	O	0..1	Indicates used training number of iterations.	

6.12.6.3 Simple data types and enumerations

6.12.6.3.1 Introduction

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

6.12.6.3.2 Simple data types

The simple data types defined in table 6.12.6.3.2-1 shall be supported.

Table 6.12.6.3.2-1: Simple data types

Type Name	Type Definition	Description	Applicability

6.12.6.3.3 Enumeration: TransferMode

The enumeration TransferMode represents the mode of transfer. It shall comply with the provisions defined in table 6.12.6.3.3-1.

Table 6.12.6.3.3-1: Enumeration TransferMode

Enumeration value	Description	Applicability
DIRECT	Directly from the source AIML member to the target AIML member.	
SERVER_CONTROLLED	Transfer with AIMLE server controlled.	

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

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

6.12.6.5 Binary data

6.12.6.5.1 Binary data types

The binary data types defined in table 6.12.6.5.1-1 shall be supported.

Table 6.12.6.5.1-1: Binary data types

Name	Clause defined	Content type

6.12.7 Error handling

6.12.7.1 General

For the Aimles_AIMLTaskTransfer API, HTTP error responses shall be supported as specified in clause 5.2.6 of 3GPP TS 29.122 [5]. Protocol errors and application errors specified in clause 5.2.6 of 3GPP TS 29.122 [5] shall be supported for the HTTP status codes specified in table 5.2.6-1 of 3GPP TS 29.122 [5].

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

6.12.7.2 Protocol errors

No specific procedures for the Aimles_AIMLTaskTransfer API are specified.

6.12.7.3 Application errors

The application errors defined for the Aimles_AIMLTaskTransfer API are listed in table 6.12.7.3-1.

Table 6.12.7.3-1: Application errors

Application Error	HTTP status code	Description

6.12.8 Feature negotiation

The optional features in table 6.12.8-1 are defined for the Aimles_AIMLTaskTransfer API. They shall be negotiated using the extensibility mechanism defined in clause 5.2.7 of 3GPP TS 29.122 [5].

Table 6.12.8-1: Supported Features

Feature number	Feature Name	Description

6.12.9 Security

The provisions of clause 6 of 3GPP TS 29.122 [5] shall apply for the Aimles_AIMLTaskTransfer API.

6.13 Aimles_MLModelRetrieval API

See 3GPP TS 29.482 [7].

6.14 Aimles_MLModelUpdate API

See 3GPP TS 29.482 [7].

7 Using common API framework

7.1 General

When CAPIF is used with a AIMLE server service, the AIMLE server shall support the following functionalities as defined in 3GPP TS 29.222 [6]:

- the API exposing function and the related APIs over CAPIF-2/2e and CAPIF-3/3e reference points;
- the API publishing function and the related APIs over CAPIF-4/4e reference point;
- the API management function and the related APIs over CAPIF-5/5e reference point; and
- at least one of the security methods for authentication and authorization, and the related security mechanisms.

In a centralized deployment as defined in 3GPP TS 23.222 [3], where the CAPIF core function and the API provider domain functions are co-located, the interactions between the CAPIF core function and the API provider domain functions may be independent of the CAPIF-3/3e, CAPIF-4/4e and CAPIF-5/5e reference points.

When CAPIF is used with a AIMLE server service, the AIMLE server shall register all the northbound APIs features in the CAPIF core function.

7.2 Security

When CAPIF is used for external exposure, before invoking an API exposed by the AIMLE server, the service API consumer (e.g. AIMLE client) acting as an API invoker shall negotiate the security method (PKI, TLS-PSK or OAuth 2.0) with the CAPIF core function and ensure that the AIMLE server has enough credentials to authenticate the service API consumer (e.g. AIMLE client), as defined in clauses 5.6.2.2 and 6.2.2.2 of 3GPP TS 29.222 [6].

If PKI or TLS-PSK is selected as the security method to be used between the service API consumer (e.g. AIMLE client) and the AIMLE server, upon API invocation, the AIMLE server shall retrieve the authorization information from the CAPIF core function as described in clause 5.6.2.4 of 3GPP TS 29.222 [6].

As indicated in 3GPP TS 33.122 [12], the access to the AIMLE server APIs may be authorized by means of the OAuth 2.0 protocol (see IETF RFC 6749 [13]), using the "Client Credentials" authorization grant, where the CAPIF core function (see 3GPP TS 29.222 [6]) plays the role of the authorization server.

NOTE 1: In this release, only "Client Credentials" authorization grant is supported.

If OAuth 2.0 is selected as the security method to be used between the service API consumer (e.g. AIMLE client) and the AIMLE server, the service API consumer (e.g. AIMLE client) shall, prior to consuming the services offered by the AIMLE server APIs, obtain a "token" from the authorization server, by invoking the Obtain_Authorization service operation as described in clause 5.6.2.3.2 of 3GPP TS 29.222 [6].

The AIMLE server APIs do not define any scopes for OAuth 2.0 authorization. It is the AIMLE server responsibility to check whether the service API consumer (e.g. AIMLE client) is authorized to use an API based on the provided "token". Once the AIMLE server verifies the "token", it shall check whether the AIMLE server identifier in the "token" matches its own published identifier, and whether the API name in the "token" matches its own published API name. If those checks are passed, the service API consumer (e.g. AIMLE client) has full authority to access any resource or operation provided by the invoked API.

NOTE 2: For the aforementioned security methods, the AIMLE server needs to apply admission control according to access control policies after performing the authorization checks.

Annex A (normative): OpenAPI specification

A.1 General

This annex specifies the formal definition of the API(s) defined in the present specification. It consists of OpenAPI specifications in YAML format, see OpenAPI [14].

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

NOTE 1: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository that uses the GitLab software version control system (see clause 5.3.1 of 3GPP TS 29.501 [8] and clause 5B of 3GPP TR 21.900 [1]).

A.2 Aimlec_AIMLEClientParticipation API

```
openapi: 3.0.0

info:
  title: Aimlec_AIMLEClientParticipation
  version: 1.0.1
  description: |
    API for Client Participation Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimlec-cp/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /participation:
    post:
      summary: >
        Used by AIMLE server to manage the participation of AIMLE clients in AIML operations.
      operationId: ClientParticipation
      tags:
        - AIMLE client for participation of the AIML operations request
      requestBody:
        description: Contains information of the AIMLE client participates the AIML operations.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimlecParticipationReq'
      responses:
        '200':
          description: Contains the outcome of the successful AIMLE client participation.
          content:
            application/json:
              schema:
```

```
                $ref: '#/components/schemas/AimlecParticipationResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    AimlecParticipationReq:
      description: Represents the participation request for the AIML operations.
      type: object
      required:
      - requesterId
      - clientSetId
      - clientSetPart
      - mlModelId
      - schedAimlOperations
      - dataSetReq
      - serviceReq
      properties:
        requesterId:
          description: Represents the requester identity.
          type: string
        clientSetId:
          description: Represents the AIMLE client set identity.
          type: string
        clientSetPart:
          $ref: '#/components/schemas/ClientSetPart'
        mlModelId:
          description: Identifies the identity of the ML model for AIML operation.
          type: string
        schedAimlOperations:
          type: array
          items:
            $ref: '#/components/schemas/SchedAimlOperation'
          minItems: 1
        dataSetReq:
          $ref: 'TS29482_AIMLES_AIMLEClientDiscovery.yaml#/components/schemas/DatasetRequirement'
        serviceReq:
          $ref: 'TS29482_AIMLES_AIMLEClientDiscovery.yaml#/components/schemas/ServiceRequirement'

    AimlecParticipationResp:
      description: Represents the participation response for the AIML operations.
      type: object
```

```
      required:
      - clientStatus
      properties:
        clientStatus:
          description: true indicates the willingness and false indicates the denial.
          type: boolean

    SchedAimlOperation:
      description: Represents the scheduled AIML participation type.
      type: object
      required:
      - aimlOperation
      properties:
        aimlOperation:
          $ref: 'TS24560_Aimles_AIMLEClientRegistration.yaml#/components/schemas/AimlOperation'
        aimlOperSched:
          $ref: 'TS29122_CpProvisioning.yaml#/components/schemas/ScheduledCommunicationTime'

# Enumerations

    ClientSetPart:
      anyOf:
      - type: string
        enum:
          - JOIN
          - DEPART
      - type: string
        description: >
          This string provides the participation request for the AIMLE client set.
      description: |
        Identifies the type of request for participating the AIMLE client set.
        Possible values are:
        - JOIN: Request to join the AIMLE client set.
        - DEPART: Request to depart from the AIMLE client set.
```

A.3 Aimlec_HFLTraining API

```
openapi: 3.0.0

info:
  title: Aimlec_HFLTraining
  version: 1.0.1
  description: |
    API for Horizontal Federated Learning (HFL) training Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimlec-hfl-trng/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /subscriptions:
    post:
      summary: >
        Used by AIMLE server to subscribe with the AIMLE client for HFL training event.
      operationId: HFLTraningSubs
      tags:
        - HFL training service API event subscriptions (Collection)
      requestBody:
        description: Contains information for HFL training subscription.
        required: true
        content:
```

```
        application/json:
          schema:
            $ref: '#/components/schemas/HflTrngSub'
    responses:
      '201':
        description: Created. Service API event subscription resource created successfully.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/HflTrngSub'
        headers:
          Location:
            description: Contains the URI of the newly created resource.
            required: true
            schema:
              type: string
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29122_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29122_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29122_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'
    callbacks:
      notifUri:
        '{$request.body#/notifUri}':
          post:
            requestBody:  # contents of the callback message
              required: true
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/HflTrngNotify'
            responses:
              '204':
                description: No Content (successful notification)
              '307':
                $ref: 'TS29122_CommonData.yaml#/components/responses/307'
              '308':
                $ref: 'TS29122_CommonData.yaml#/components/responses/308'
              '400':
                $ref: 'TS29122_CommonData.yaml#/components/responses/400'
              '411':
                $ref: 'TS29122_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29122_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29122_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29122_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29122_CommonData.yaml#/components/responses/500'
              '503':
                $ref: 'TS29122_CommonData.yaml#/components/responses/503'
              default:
                $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  /subscriptions/{subscriptionId}:
    parameters:
      - name: subscriptionId
        in: path
        description: Identifier of the individual Events Subscription.
        required: true
```

```
      schema:
        type: string
  get:
    description: Retrieve an existing "Individual HFL training subscription" resource.
    operationId: RetrieveHFLTraningSubs
    tags:
      - Individual HFL training Subscription (Document)
    responses:
      '200':
        description: The individual HFL training subscription.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/HflTrngSub'
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '406':
        $ref: 'TS29122_CommonData.yaml#/components/responses/406'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  put:
    description: >
      Update the "Individual HFL training subscription" resource.
    operationId: UpdateHFLTrainingSubs
    tags:
      - Individual HFL training subscription (Document)
    requestBody:
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/HflTrngSub'
    responses:
      '200':
        description: >
          OK. Individual HFL training subscription resource is successfully updated,
          and representation of updated resource is returned in the response body.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/HflTrngSub'
      '204':
        description: >
          No Content. Individual HFL training subscription resource is successfully updated,
          and no content is returned in the response body.
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29122_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29122_CommonData.yaml#/components/responses/413'
```

```
      '415':
        $ref: 'TS29122_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  patch:
    description: >
      Modify the "Individual HFL training subscription" resource.
    operationId: ModifyHFLTrainingSubs
    tags:
      - Individual HFL training subscription (Document)
    requestBody:
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/HflTrngSubPatch'
    responses:
      '200':
        description: >
          OK. The Individual HFL training subscription resource is successfully modified,
          and representation of the modified resource is returned in the response body.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/HflTrngSub'
      '204':
        description: >
          No Content. The Individual HFL training subscription resource is successfully modified,
          and no content is returned in the response body.
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29122_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29122_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29122_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  delete:
    description: Deletes an individual HFL training ubscription.
    operationId: DeleteHFLTraningSubs
    tags:
      - Individual HFL training Subscription (Document)
    responses:
      '204':
        description: >
          The individual HFL training Subscription matching the subscriptionId is deleted.
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
```

```
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

#
# STRUCTURED DATA TYPES
#

    HflTrngSub:
      description: Represents data type for HFL training subscription and its update.
      type: object
      required:
      - requesterId
      - notifUri
      - aimlMdlInfo
      - dataId
      - noDataSamp
      - vaSrvId
      properties:
        requesterId:
          description: Represents the requester identity.
          type: string
        notifUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        aimlMdlInfo:
          $ref: 'TS29482_AIMLES_MLModelTraining.yaml#/components/schemas/MlModelInfo'
        dataId:
          description: Identifies the dataset which is to be used for the HFL training.
          type: string
        noDataSamp:
          description: Identifies the required number of samples for a round of the HFL training.
          type: integer
        operSched:
          $ref: 'TS29122_CpProvisioning.yaml#/components/schemas/ScheduledCommunicationTime'
        notifReqs:
          $ref:
'TS29549_SS_NetworkResourceMonitoring.yaml#/components/schemas/ReportingRequirements'
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
        vaSrvId:
          description: Identifies the VAL service for the AIMLE HFL training operation.
          type: string
        subId:
          description: Identifies the subscription.
          type: string

    HflTrngSubPatch:
      description: Represents data type for partial update of the HFL training subscription.
      type: object
      properties:
        notifUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        aimlMdlInfo:
          $ref: 'TS29482_AIMLES_MLModelTraining.yaml#/components/schemas/MlModelInfo'
        dataId:
```

```
          description: Identifies the dataset which is to be used for the HFL training.
          type: string
        noDataSamp:
          description: Identifies the required number of samples for a round of the HFL training.
          type: integer
        operSched:
          $ref: 'TS29122_CpProvisioning.yaml#/components/schemas/ScheduledCommunicationTime'
        notifReqs:
          $ref:
'TS29549_SS_NetworkResourceMonitoring.yaml#/components/schemas/ReportingRequirements'

    HflTrngNotify:
      description: Represent the information from the HFL training event notification.
      type: object
      required:
      - hflTrngOut
      - vaSrvId
      properties:
        vaSrvId:
          description: Identifies the VAL service for the AIMLE HFL training operation.
          type: string
        hflTrngOut:
          $ref: 'TS29482_AIMLES_MLModelTraining.yaml#/components/schemas/PerfParams'
        hflTrngErr:
          $ref: 'TS29482_AIMLES_MLModelTraining.yaml#/components/schemas/TrainingErr'
        timestamp:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
```

A.4 Aimles_AIMLEClientRegistration API

```
openapi: 3.0.0

info:
  title: Aimles_AIMLEClientRegistration
  version: 1.0.1
  description: |
    API for AIMLE Client Registration Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimles-client-reg/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /registrations:
    post:
      summary: Registers the AIMLE client at the AIMLE server.
      operationId: RegAimleClient
      tags:
        - AIMLE client registrations
      requestBody:
        description: >
          Contains information for the creation of a new individual AIMLE client registration
          resource.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimleClientRegInfo'
      responses:
        '201':
          description: Represents an individual AIMLE client registration resource.
```

```
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimleRegistration'
        headers:
          Location:
            description: >
              Contains the URI of the newly created individual AIMLE client registration
              resource.
            required: true
            schema:
              type: string
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29122_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29122_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29122_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'

/registrations/{registrationId}:
  put:
    summary: Update an Individual AIMLE client registration resource.
    operationId: UpdateAimleClientReg
    tags:
      - Individual AIMLE client registration (Document)
    parameters:
    - name: registrationId
      description: >
        String identifying the individual AIMLE client registration resource at the AIMLE server.
      in: path
      required: true
      schema:
        type: string
    requestBody:
      description: >
        Contains information for the update of individual AIMLE client registration resource.
      required: true
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/AimleRegistration'
    responses:
      '200':
        description: >
          An individual AIMLE client registration resource is updated, and a representation of
          that resource is returned.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimleRegistration'
      '204':
        description: No Content. An individual AIMLE client registration resource is updated.
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
```

```
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

    delete:
      summary: Removes an Individual AIMLE client registration resource.
      operationId: DelAimleClientReg
      tags:
        - Individual AIMLE client registration (Document)
      parameters:
      - name: registrationId
        description: >
          String identifying the individual AIMLE client registration resource at the AIMLE server.
        in: path
        required: true
        schema:
          type: string
      responses:
        '204':
          description: An individual AIMLE client registration resource is removed.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    AimleRegistration:
      description: Represents an individual AIMLE client registration resource.
      type: object
      required:
      - regData
      properties:
        regData:
          $ref: '#/components/schemas/AimleClientRegInfo'
        expTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
```

```
    AimleClientRegInfo:
      description: Contains the AIMLE client registration information.
      type: object
      required:
      - aimleClientId
      - suppProfiles
      properties:
        aimleClientId:
          $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
        suppProfiles:
          description: Contains a list of supported service information and AIMLE client profiles.
          type: array
          items:
            $ref: '#/components/schemas/SupportedProfile'
          minItems: 1
        suppFeat:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

    SupportedProfile:
      description: Contains AIMLE client profiles and supported service information.
      type: object
      properties:
        clientProfile:
          $ref: '#/components/schemas/AimleClientProfile'
        suppServices:
          description: >
            Contains the list of VAL services identifiers with corresponding service permissions.
          type: array
          items:
            $ref: '#/components/schemas/ServiceData'
          minItems: 1

    ServiceData:
      description: Contains VAL service identifier with the corresponding service permission.
      type: object
      required:
      - valServiceId
      properties:
        valServiceId:
          description: Represents the VAL service identifier.
          type: string
        servPermLevel:
          $ref: '#/components/schemas/ServicePermissionLevel'

    AimleClientProfile:
      description: >
        Contains the AIMLE client capability information e.g. supported AIML model types,
        AIML service operation type.
      type: object
      required:
      - aimleClientUri
      - aimlOperations
      - clientCap
      properties:
        aimleClientUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        aimlModelTypes:
          description: Contains AIML model types supported by the AIMLE client.
          type: array
          items:
            $ref: '#/components/schemas/AimlModelType'
          minItems: 1
        aimlOperations:
          description: Contains AIML operations supported by the AIMLE client.
          type: array
          items:
            $ref: '#/components/schemas/AimlOperation'
          minItems: 1
        clientCap:
          $ref: '#/components/schemas/ClientCapability'
        availTimeSchedCfgs:
          description: >
            Contains the availability schedule of the AIMLE client for the AIML service.
          type: array
          items:
            $ref: 'TS29571_CommonData.yaml#/components/schemas/ScheduledCommunicationTime'
          minItems: 1
```

```
      unavblTimeSchedCfgs:
        description: >
          Contains the unavailability schedule of the AIMLE client for the AIML service.
        type: array
        items:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ScheduledCommunicationTime'
        minItems: 1
      availLocCfgs:
        description: >
          Contains the available location-based configurations of the AIMLE client for the
          AIML service.
        type: array
        items:
          $ref: '#/components/schemas/LocationConfig'
        minItems: 1
      unavblLocCfgs:
        description: >
          Contains the unavailable location-based configurations of the AIMLE client for the
          AIML service.
        type: array
        items:
          $ref: '#/components/schemas/LocationConfig'
        minItems: 1
      dataSetAvail:
        $ref: '#/components/schemas/DataSetAvailability'
      dataCap:
        description: >
          Contains a list of data capabilities such as the type of data that can be collected,
          supported data processing capabilities and supported exploratory data analysis (EAD)
          functions.
        type: array
        items:
          $ref: '#/components/schemas/DataCapability'
        minItems: 1
      taskCaps:
        description: Contains the AIML task performing capabilities.
        type: array
        items:
          $ref: '#/components/schemas/TaskCapability'
        minItems: 1

  ClientCapability:
    description: Contains the AIMLE client capability information.
    type: object
    required:
    - mlAppType
    - rsrcUsageLvl
    properties:
      mlAppType:
        $ref: '#/components/schemas/MlApplicationType'
      rsrcUsageLvl:
        $ref: '#/components/schemas/ResourceUsageLevel'

  DataSetAvailability:
    description: Represents a dataset availability.
    type: object
    required:
    - dataSetIds
    properties:
      dataSetIds:
        description: Contains a list of dataset identifiers.
        type: array
        items:
          type: string
        minItems: 1
      size:
        description: Represents the dataset size e.g., number of entries in dataset.
        type: integer
      age:
        description: Represents the dataset age e.g. data set usage in number of days.
        type: integer
      features:
        description: Contains a list of dataset features.
        type: array
        items:
          type: string
        minItems: 1
```

```
    LocationConfig:
      description: >
        Indicates the location-based configurations of the AIMLE client for the AIML service.
      type: object
      properties:
        clientLoc:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/LocationArea5G'
        valSvcAreaId:
          $ref: 'TS29549_SS_VALServiceAreaConfiguration.yaml#/components/schemas/ValSvcAreaId'

# Simple data types


# Enumerations

    ServicePermissionLevel:
      anyOf:
      - type: string
        enum:
          - PREMIUM_RESOURCE_USAGE
          - STANDARD_RESOURCE_USAGE
          - LIMITED_RESOURCE_USAGE
          - OTHER_SERVICE_PERMISSION_LEVEL
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents a service permission level.
        Possible values are:
        - PREMIUM_RESOURCE_USAGE: Indicates a premium resource usage level.
        - STANDARD_RESOURCE_USAGE: Indicates a standard resource usage level.
        - LIMITED_RESOURCE_USAGE: Indicates a limited resource usage level.
        - OTHER_SERVICE_PERMISSION_LEVEL: Indicates other service permission level.

    AimlModelType:
      anyOf:
      - type: string
        enum:
          - DECISION_TREE
          - LINEAR_REGRESSION
          - NEURAL_NETWORK
          - OTHER_MODEL_TYPE
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents the AIML model types.
        Possible values are:
        - DECISION_TREE: Indicates the decision tree type of the AIML model.
        - LINEAR_REGRESSION: Indicates the linear regression type of the AIML model.
        - NEURAL_NETWORK: Indicates the neural network type of the AIML model.
        - OTHER_MODEL_TYPE: Indicates the other types of the AIML model.

    AimlOperation:
      anyOf:
      - type: string
        enum:
          - MODEL_INFERENCE
          - MODEL_OFFLOAD
          - MODEL_SPLIT
          - MODEL_TRANSFER
          - MODEL_TRAINING
          - CONTINUE_PERFORM_INTERMEDIATE
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents the type of the AIML operation.
        Possible values are:
        - MODEL_INFERENCE: Indicates the model inference type of the AIML operation.
        - MODEL_OFFLOAD: Indicates the model offload type of the AIML operation.
        - MODEL_SPLIT: Indicates the model split type of the AIML operation.
        - MODEL_TRANSFER: Indicates the model transfer type of the AIML operation.
        - MODEL_TRAINING: Indicates the model training type of the AIML operation.
        - CONTINUE_PERFORM_INTERMEDIATE: Indicates the ability to continue performing of
```

```
      the intermediate AIML operation.

    MlApplicationType:
      anyOf:
      - type: string
        enum:
          - FEDERATED_LEARNING
          - TRANSFER_LEARNING
          - SPLIT_LEARNING
          - OTHER_ML_APPLICATION_TYPE
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents the ML application types.
        Possible values are:
        - FEDERATED_LEARNING: Indicates the federated learning ML application type.
        - TRANSFER_LEARNING: Indicates the transfer learning ML application type.
        - SPLIT_LEARNING: Indicates the split learning ML application type.
        - OTHER_ML_APPLICATION_TYPE: Indicates the other ML application types.

    ResourceUsageLevel:
      anyOf:
      - type: string
        enum:
          - PREMIUM_RESOURCE_USAGE
          - STANDARD_RESOURCE_USAGE
          - LIMITED_RESOURCE_USAGE
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents a resource usage level.
        Possible values are:
        - PREMIUM_RESOURCE_USAGE: Indicates a premium resource usage level.
        - STANDARD_RESOURCE_USAGE: Indicates a standard resource usage level.
        - LIMITED_RESOURCE_USAGE: Indicates a limited resource usage level.

    DataCapability:
      anyOf:
      - type: string
        enum:
          - RAW_DATA
          - STRUCURED_DATA
          - SEMI_STRUCTURED_DATA
          - UNSTRUCTURED_DATA
          - PROCESSED_DATA
          - EXPLOATORY_DATA_ANALYSIS
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents the data capabilities.
        Possible values are:
        - RAW_DATA: Indicates the raw data.
        - STRUCURED_DATA: Indicates the structured data.
        - SEMI_STRUCTURED_DATA: Indicates the semi-structured data.
        - UNSTRUCTURED_DATA: Indicates the unstructured data.
        - PROCESSED_DATA: Indicates the processed data.
        - EXPLOATORY_DATA_ANALYSIS: Indicates the exploratory data analysis function.
          match.

    TaskCapability:
      anyOf:
      - type: string
        enum:
          - HIGH_COMPUTE_CAPABILITY
          - LOW_COMPUTE_CAPABILITY
          - LOW_COSTS_PERFORMANCE
          - GREEN_TASK_PERFORMANCE
          - ENERGY_EFFICIENT_PERFORMANCE
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
```

```
      description: |
        Represents the AIML task performing capabilities.
        Possible values are:
        - HIGH_COMPUTE_CAPABILITY: Indicates a high compute capability.
        - LOW_COMPUTE_CAPABILITY: Indicates a low compute capability.
        - LOW_COSTS_PERFORMANCE: Indicates a low cost performance.
        - GREEN_TASK_PERFORMANCE: Indicates a green task performance.
        - ENERGY_EFFICIENT_PERFORMANCE: Indicates an energy efficient performance.
```

A.5 Aimles_SplitOpPipeline API

```
openapi: 3.0.0

info:
  title: Aimles_SplitOpPipeline
  version: 1.0.1
  description: |
    API for split AIML operation pipeline service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimles-sopl/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /request:
    post:
      summary: >
        Used by AIMLE client to create an instance of a split operation pipeline at the AIMLE serve.
      operationId: SplitOpPipeCreate
      tags:
        - Split operation pipeline creation API (Collection)
      requestBody:
        description: Contains information of the AIML split operation pipelie creation.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SplitOpPipelineCreateReq'
      responses:
        '201':
          description: Created. Split operation pipeline creation resource is created successfully.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/SplitOpPipelineCreateResp'
          headers:
            Location:
              description: Contains the URI of the newly created resource.
              required: true
              schema:
                type: string
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
```

```
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  /request/{requestId}:
    parameters:
      - name: requestId
        in: path
        description: Identifier of the individual AIML split operation pipeline.
        required: true
        schema:
          type: string

    put:
      description: >
        Update an individual split operation pipeline resource.
      operationId: SplitOpPipeUpdate
      tags:
        - Individual split operation pipeline (Document)
      requestBody:
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SplitOpPipelineCreateReq'
      responses:
        '200':
          description: >
            OK. Individual AIMLE split operation pipeline resource is successfully updated,
            and representation of updated resource is returned in the response body.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/SplitOpPipelineCreateResp'
        '204':
          description: >
            No Content. Individual AIMLE split operation pipeline resource is successfully updated,
            and no content is returned in the response body.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

    patch:
      description: >
        Modify the "Individual AIMLE split operation pipeline" resource.
      operationId: SplitOpPipeModify
```

```
    tags:
      - Individual AIMLE split operation pipeline (Document)
    requestBody:
      required: true
      content:
        application/merge-patch+json:
          schema:
            $ref: '#/components/schemas/SplitOpPipelinePatch'
    responses:
      '200':
        description: >
          OK. The Individual AIMLE split operation pipeline resource is successfully modified,
          and representation of the modified resource is returned in the response body.
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SplitOpPipelineCreateResp'
      '204':
        description: >
          No Content. The Individual AIMLE split operation pipeline resource is successfully
          modified, and no content is returned in the response body.
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29122_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29122_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29122_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  delete:
    description: Deletes an individual AIMLE split operation pipeline.
    operationId: SplitOpPipeDelete
    tags:
      - Individual AIMLE split operation pipeline (Document)
    responses:
      '204':
        description: >
          The individual AIMLE split operation pipeline matching the requestId is deleted.
      '307':
        $ref: 'TS29122_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29122_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29122_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29122_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29122_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29122_CommonData.yaml#/components/responses/404'
      '429':
        $ref: 'TS29122_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29122_CommonData.yaml#/components/responses/500'
      '503':
        $ref: 'TS29122_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29122_CommonData.yaml#/components/responses/default'
```

```
  /discovery:
    post:
      summary: >
        Used by consumer to request the AIMLE server for split AIML operation pipeline discovery
      operationId: SplitOpPipeDiscovery
      tags:
        - AIMLE split operation pipeline discovery
      requestBody:
        description: Contains information of the AIMLE split operation pipeline discovery.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/SplitOpPipelineDiscReq'
      responses:
        '200':
          description: Contains successful outcome of AIMLE split operation pipeline discovery.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/SplitOpPipelineDiscResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

#
# STRUCTURED DATA TYPES
#

    SplitOpPipelineCreateReq:
      description: Represents AIMLE split operation pipeline create and its update.
      type: object
      required:
      - requestorId
      - notifUri
      - splitOpRequirements
      properties:
        requestorId:
          description: Identifies the service consumer.
          type: string
        notifUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        splitOpRequirements:
```

```
        $ref: '#/components/schemas/SplitOpRequirements'

    SplitOpPipelineCreateResp:
      description: Represents response to AIMLE split operation pipeline create and its update.
      type: object
      properties:
        splitOpProfile:
          $ref: 'TS29482_AIMLES_SplitOpEvent.yaml#/components/schemas/SplitOpProfile'

    SplitOpPipelinePatch:
      description: Represents AIMLE split operation pipeline update.
      type: object
      required:
      - notifUri
      - splitOpPipelineId
      - splitOpPipelineInfo
      properties:
        notifUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        splitOpPipelineId:
          description: Identifies split operation pipeline.
          type: string
        splitOpPipelineInfo:
          $ref: 'TS29482_AIMLES_SplitOpEvent.yaml#/components/schemas/SplitOpPipelineInfo'

    SplitOpPipelineDiscReq:
      description: Represents the AIMLE Split Operation Pipeline Discovery request.
      type: object
      required:
      - notifUri
      - discFilters
      properties:
        notifUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        discFilters:
          $ref: 'TS29482_AIMLES_SplitOpEvent.yaml#/components/schemas/DiscFilters'

    SplitOpPipelineDiscResp:
      description: Represents the AIMLE Split Operation Pipeline Discovery response.
      type: object
      properties:
        discoveredNodes:
          type: array
          items:
            type: string
          minItems: 1
        splitOpProfiles:
          type: array
          items:
            $ref: 'TS29482_AIMLES_SplitOpEvent.yaml#/components/schemas/SplitOpProfile'
          minItems: 1
      anyOf:
        - required: [discoveredNodes]
        - required: [splitOpProfiles]

    SplitOpRequirements:
      description: Represents the AIMLE Split Operation Pipeline requirements.
      type: object
      required:
      - stageInfo
      properties:
        stageInfo:
          type: array
          items:
            $ref: 'TS29482_AIMLES_SplitOpEvent.yaml#/components/schemas/StageInfo'
          minItems: 1
        usageInfo:
          $ref: 'TS29482_AIMLES_SplitOpNodeRegistration.yaml#/components/schemas/UsageInformation'
        notificationTarget:
          $ref: 'TS29558_Eees_EASRegistration.yaml#/components/schemas/EndPoint'
```

A.6 Aimlec_FLGroupIndication API

```
openapi: 3.0.0

info:
```

```
  title: Aimlec_FLGroupIndication
  version: 1.0.1
  description: |
    API for AIMLE Client Federated Learning Group Indication Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services –
    Service enabler Architecture Layer for Verticals (SEAL) Protocol Specification; Stage 3.
  url: http://www.3gpp.org/ftp/Specs/archive/24_series/24.560/

servers:
  - url: '{apiRoot}/aimlec-flgi/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /indicate:
    post:
      summary: Indicates FL group information to FL group member
      operationId: IndicateFLMemberInfo
      tags:
        - Indicate FL group
      requestBody:
        description: Contains the FL group member information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/IndFlMember'
      responses:
        '204':
          description: No Content (Success)
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

# Structured data types

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
```

```
        scopes: {}

  schemas:

    IndFlMember:
      description: Indicates the FL member the information on FL member group.
      type: object
      properties:
        serverId:
          type: string
          description: Identifier of the indicating AIMLE server.
        valServiceId:
          type: string
          description: Identifier of the VAL service for which the grouping indication is applied.
        mlModelId:
          type: string
          description: Identifier of the ML model for which the grouping indication is applied.
        analyticsId:
          type: string
          description: >
            Identifier of the ADAE analytics service, the FL grouping is based on, if
            the FL process is used for that ADAE analytics service.
        flGroupIds:
          type: array
          items:
            $ref: '#/components/schemas/FlGroupInfo'
          minItems: 1
          description: >
            List of the AIMLE identifiers of that created or modified FL group for the FL process.
        flGroupDelInfo:
          $ref: '#/components/schemas/FlGroupDeletionInfo'
      required:
        - serverId
        - flGroupIds

    FlGroupInfo:
      description: Represents the FL group information.
      type: object
      required:
      - flGroupId
      properties:
        flGroupId:
          description: Contains the FL group identifier.
          type: string
        flMembers:
          type: array
          items:
            $ref: '#/components/schemas/FlMemberData'
          minItems: 1
          description: Contains FL member data.

    FlMemberData:
      description: Represents the FL group member data e.g. FL member identifier, address.
      type: object
      properties:
        flMemberId:
          type: string
          description: Identifier of the FL members
        flMemberAddr:
          $ref: 'TS29549_SS_NetworkResourceAdaptation.yaml#/components/schemas/ValUeAddrInfo'
        flMemberInfo:
          $ref: '#/components/schemas/FlMemberInfo'

    FlMemberInfo:
      description: Represents the FL member information e.g. availability, constraint, FL role.
      type: object
      properties:
        availability:
          $ref: '#/components/schemas/FlMemberAvailability'
        constraints:
          description: Represents the FL group member constraints.
          type: array
          items:
            $ref: '#/components/schemas/FlMemberConstraint'
          minItems: 1
        role:
          $ref: '#/components/schemas/FlMemberRole'
```

```
    FlGroupDeletionInfo:
      description: Indicates the FL group deletion information.
      type: object
      properties:
        cause:
          $ref: '#/components/schemas/FlGroupDelCause'
        expTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'


# Simple data types


# Enumerations


    FlMemberAvailability:
      anyOf:
      - type: string
        enum:
          - AVAILABLE
          - STOP
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          But is not used to encode content defined in the present version of this API.
      description: |
        Represents the information regarding FL member availability of the VAL UE.
        Possible values are:
        - AVAILABLE: The FL member is available.
        - NOT_AVAILABLE: The FL member is not available.

    FlMemberConstraint:
      anyOf:
      - type: string
        enum:
          - LIMITED_MEMORY
          - LIMITED_PROCCESSING
          - LIMITED_ACCESS
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          But is not used to encode content defined in the present version of this API.
      description: |
        Represents the FL member constraint information of the VAL UE.
        Possible values are:
        - LIMITED_MEMORY: Indicates a limited memory load.
        - LIMITED_PROCCESSING: Indicates a limited processing power.
        - LIMITED_ACCESS: Indicates a limited access to only the local data.

    FlMemberRole:
      anyOf:
      - type: string
        enum:
          - FL_CLIENT
          - FL_SERVER
          - FL_AGGREGATOR
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          But is not used to encode content defined in the present version of this API.
      description: |
        Represents the FL member role of the VAL UE.
        Possible values are:
        - FL_CLIENT: Indicates an FL client role.
        - FL_SERVER: Indicates an FL server role.
        - FL_AGGREGATOR: Indicates an FL aggregator role.

    FlGroupDelCause:
      anyOf:
      - type: string
        enum:
          - SRV_TERMINATION
          - OUT_OF_SRV_AREA
      - type: string
        description: >
          This string provides information on the FL group deletion cause.
      description: |
```

```
        Represents the information regarding FL group deletion cause as AIML service termination or
        UE has moved out of the service area.
        Possible values are:
        - SRV_TERMINATION: Indicates the AIML service termination.
        - OUT_OF_SRV_AREA: Indicates the UE has moved out of the service area.
```

A.7 Aimlec_ClientDataProcessing API

```
openapi: 3.0.0

info:
  title: Aimlec_ClientDataProcessing
  version: 1.0.1
  description: |
    API for Transfer Learning (TL) Enablement Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimlec-data-proc/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /trigger:
    post:
      summary: >
        Used by AIMLE server to trigger AIMLE client to request client data processing procedure.
      operationId: ClientDataProcessing
      tags:
        - Client data processing procedure request
      requestBody:
        description: Contains information to trigger client data processing procedure.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/CltDataProcReq'
      responses:
        '200':
          description: Contains the outcome of the successful client data processing.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/CltDataProcResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
```

```
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    CltDataProcReq:
      description: Contains information to trigger client data processing procedure.
      type: object
      required:
      - requesterId
      - dataProc
      properties:
        requesterId:
          description: Represents the requester identity.
          type: string
        dataProc:
          $ref: 'TS29482_AIMLES_DataManagement.yaml#/components/schemas/DataMgmtOp'
        dataPrepReqs:
          $ref: 'TS29482_AIMLES_DataManagement.yaml#/components/schemas/DataProcessReqs'
        dataAnalysisReqs:
          $ref: 'TS29482_AIMLES_DataManagement.yaml#/components/schemas/DataProcessReqs'
        dataProcSched:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ScheduledCommunicationTime'

    CltDataProcResp:
      description: Contains the outcome of the successful client data processing.
      type: object
      properties:
        dataPrepOutputs:
          $ref: 'TS29482_AIMLES_DataManagement.yaml#/components/schemas/AggregatedDataPrepOutputs'
        dataAnalysisOutputs:
          $ref: 'TS29482_AIMLES_DataManagement.yaml#/components/schemas/AggregatedDataAnaOutputs'
        timestamp:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DateTime'
      anyOf:
        - required: [dataPrepOutputs]
        - required: [dataAnalysisOutputs]
```

A.8 Aimlec_MLModTngCapEva API

```
openapi: 3.0.0

info:
  title: Aimlec_MLModTngCapEva
  version: 1.0.1
  description: |
    API for ML Model Training Capability Evaluation Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimlec-ml-mtce/v1'
    variables:
```

```
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /request:
    post:
      summary: >
        Enables the AIMLE server to request the AIMLE client to perform ML model training
        capability evaluation service operation.
      operationId: MlModTrainCapEvaReq
      tags:
        - ML model training capability evaluation request
      requestBody:
        description: Contains the ML model training capability evaluation request information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/MlModTngCapEvalReq'
      responses:
        '200':
          description: Contains the ML model training capability evaluation response information.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/MlModTngCapEvalResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    MlModTngCapEvalReq:
      description: Contains the ML model training capability evaluation request information.
      type: object
      required:
      - aimleServerId
      properties:
```

```
      aimleServerId:
        description: Represents the AIMLE server identifier.
        type: string
      availTime:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      testTask:
        description: Represents the task for test ML model training capability.
        type: string
      modelInfo:
        $ref: '#/components/schemas/AimlModelData'
      dataSetReq:
        $ref: '#/components/schemas/DataSetRequirements'

  MlModTngCapEvalResp:
    description: Contains the ML model training capability evaluation response information.
    type: object
    required:
    - capEvalOut
    properties:
      capEvalOut:
        $ref: '#/components/schemas/CapEvalOutcome'
      testResult:
        description: Represents the test result of the ML model training capability evaluation.
        type: string
      evalFailInd:
        description: Represents the reason for inability to join the FL training process.
        type: string

  AimlModelData:
    description: Contains the AIML model information and model parameters for use in FL training.
    type: object
    properties:
      aimlModels:
        description: Contains information about the AIML model.
        type: array
        items:
          $ref: '#/components/schemas/AimlModelInfo'
        minItems: 1
      mlModelParams:
        description: Contains model parameters for use in FL training.
        type: array
        items:
          type: string
        minItems: 1

  DataSetRequirements:
    description: Contains requirements on data set for FL training.
    type: object
    properties:
      commonFtIds:
        description: >
          Contains a list of the features identifiers of the required features common to
          the dataset of the different data domains.
        type: array
        items:
          type: string
        minItems: 1
      domainFts:
        description: >
          Contains a list of features for each data domain(s) of the datasets at the UE.
        type: array
        items:
          $ref: '#/components/schemas/DomainFeatures'
        minItems: 1
      dataSource:
        description: >
          Represents the identifier of a data source for the FL training (e.g. SEAL server,
          SEAL client, other NF entity, etc.).
        type: string

  DomainFeatures:
    description: Contains a list of features for each data domain(s) of the datasets at the UE.
    type: object
    required:
    - domain
    - featureIds
    properties:
      domain:
```

```
          description: >
            Represents a data domain i.e. a specific category of data or logical groupings of
            data that all relate together (e.g. customer data, product data, etc.).
          type: string
        featureIds:
          description: >
            Represents a list of the features identifiers for the data domain of the datasets
            at the UE.
          type: array
          items:
            type: string
          minItems: 1

    AimlModelInfo:
      description: Contains information about the AIML model.
      type: object
      properties:
        aimlModelType:
          $ref: 'TS24560_Aimles_AIMLEClientRegistration.yaml#/components/schemas/AimlModelType'
        mlModelProf:
          $ref: 'TS29482_MLR_MLModelManagement.yaml#/components/schemas/MLModelProfile'

# Simple data types


# Enumerations

    CapEvalOutcome:
      anyOf:
      - type: string
        enum:
          - ABILITY_TO_JOIN
          - FIRST_MATCH
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents the outcome of the ML model training capability evaluation.
        Possible values are:
        - ABILITY_TO_JOIN: Indicates ability to join the training process.
        - INABILITY_TO_JOIN: Indicates inability to join the training process.
```

A.9 Aimles_UeTLModelSelectionAssistance API

```
openapi: 3.0.0

info:
  title: Aimles_UeTLModelSelectionAssistance
  version: 1.0.1
  description: |
    API for Transfer Learning (TL) Enablement Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimles-ue-tl-msa/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /assist-tlms:
    post:
      summary: >
```

```
        Used by the AIMLE client to request the AIMLE server to perform TL enablement service.
      operationId: UeTlModSelectAssistReq
      tags:
        - UE transfer learning model selection assistance request
      requestBody:
        description: Contains information to trigger TL enablement service.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/TlModelSelectAssistReq'
      responses:
        '200':
          description: Contains one or more pre-trained ML models for the TL enablement service.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/TlModelSelectAssistResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    TlModelSelectAssistReq:
      description: Contains information to trigger TL enablement service.
      type: object
      required:
      - serverId
      - valSrvId
      - tlCriteria
      properties:
        serverId:
          description: Represents the AIMLE server identity.
          type: string
        valSrvId:
          description: Represents the VAL service for the TL enablement service.
          type: string
        tlCriteria:
          $ref: '#/components/schemas/TlCriteria'
        mlTaskId:
          description: Represents the task for the TL enablement service.
          type: string
```

```
      adaeAnalyticsId:
        description: Represents the ADAE analytics for the TL enablement service.
        type: string
      mlModelProfile:
        $ref: 'TS29482_MLR_MLModelManagement.yaml#/components/schemas/MLModelProfile'
      mlModelReq:
        description: Represents the requirements for the ML model for the TL enablement service.
        type: array
        items:
          type: string
        minItems: 0
      valUeIds:
        description: Represents VAL UEs associated with the ML task for the TL enablement service.
        type: array
        items:
          $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
        minItems: 0
      mlModelRateReq:
        description: Represents requirements for rating the ML model for TL enablement service.
        type: array
        items:
          type: string
        minItems: 0

  TlModelSelectAssistResp:
    description: Contains the pre-trained ML models for the TL enablement service.
    type: object
    required:
    - mlModelList
    properties:
      mlModelList:
        description: Represents the selected pre-trained ML models for the TL enablement service.
        type: array
        items:
          $ref: '#/components/schemas/MlModel'
        minItems: 1

  TlCriteria:
    description: Contains the criteria for the TL enablement service.
    type: object
    properties:
      reqFeatures:
        description: Represents the required features for a pre-trained model.
        type: array
        items:
          type: string
        minItems: 0
      dataReq:
        description: Represents the training data requirements.
        type: array
        items:
          type: string
        minItems: 0
      tlType:
        $ref: '#/components/schemas/TlType'
      environment:
        $ref: '#/components/schemas/EnvironmentType'
      access:
        description: Permissions and restrictions to access the pre-trained model.
        type: array
        items:
          $ref: '#/components/schemas/AccessType'
        minItems: 0

  MlModel:
    description: Contains the pre-trained ML models for the TL enablement service.
    type: object
    required:
    - mlRepositoryId
    - mlModelInfo
    properties:
      mlRepositoryId:
        description: Represents the unique repository identity of an ML model.
        type: string
      mlModelInfo:
        $ref: 'TS24560_Aimlec_MLModTngCapEva.yaml#/components/schemas/AimlModelInfo'
      mlModelRating:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'
```

```
    AccessType:
      description: Contains permission and restriction to access the pre-trained model.
      type: object
      properties:
        modelLicense:
          description: Represents the license of the pre-trained ML model.
          type: string
        dataTrainLicense:
          description: Represents the license of the dataset for the pre-trained ML model.
          type: string
        codeTrainLicense:
          description: Represents the license of the code for the pre-trained ML model.
          type: string

# Enumerations

    TlType:
      anyOf:
      - type: string
        enum:
          - INDUCTIVE
          - TRANSDUCTIVE
          - UNSUPERVISED
      - type: string
        description: >
          This string provides the type of transfer learning.
      description: |
        Identifies how the pre-trained ML models can be related to the trained ML models for
        the target ML task.
        Possible values are:
        - INDUCTIVE: For different task than the target ML task
        - TRANSDUCTIVE: For similar task as target ML task but different data distributions
        - UNSUPERVISED: For similar tasks as target ML task but with unlabelled data

    EnvironmentType:
      anyOf:
      - type: string
        enum:
          - DOMAIN_SHIFT
          - SIMULATED_REAL
          - DYNAMIC
          - HETEROGENEOUS
          - ROBOTICS
          - SMART
      - type: string
        description: >
          This string provides the type of the environment.
      description: |
        Identifies how the environment and data distributions, suited for pre-trained ML models
        in relationship with the trained ML model for the target ML task.
        Possible values are:
        - DOMAIN_SHIFT: Different data distributions
        - SIMULATED_REAL: Simulated data vs. real data
        - DYNAMIC: Data distributions changes over time
        - HETEROGENEOUS: Significantly different data distributions
        - ROBOTICS: Suitable for the target ML task for robotic platforms
        - SMART: Suitable for the target ML task for smart platforms
```

A.10 Aimlec_AIMLEClientServiceOperations API

```
openapi: 3.0.0

info:
  title: Aimlec_AIMLEClientServiceOperations
  version: 1.0.1
  description: |
    API for AIMLE Client Service Operations Service.
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    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'
```

```
servers:
  - url: '{apiRoot}/aimlec-serv-ops/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /perform:
    post:
      summary: >
        Enables the AIMLE server to request the AIMLE client to perform the AIMLE client
        service operation.
      operationId: AimleServOperReq
      tags:
        - AIMLE service operation request
      requestBody:
        description: Contains the AIMLE client service operation request information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimleClientServOpReq'
      responses:
        '200':
          description: Contains the AIMLE client service operation response information.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/AimleClientServOpResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    AimleClientServOpReq:
      description: Contains the AIMLE client service operation request information.
```

```
      type: object
      required:
      - aimleServerId
      - servOpId
      - servOpMode
      properties:
        aimleServerId:
          description: Represents the AIMLE server identifier.
          type: string
        valServiceId:
          description: Represents the VAL service identifier.
          type: string
        servOpId:
          description: Represents the AIML service operation identifier.
          type: string
        servOpMode:
          $ref: '#/components/schemas/ServiceOperationMode'
        servOpInfo:
          $ref: '#/components/schemas/ServiceOperationInfo'
        servOpModeCfg:
          $ref: '#/components/schemas/ServiceOpModeConfiguration'
        servOpModeStatRptg:
          $ref:
'TS29549_SS_NetworkResourceMonitoring.yaml#/components/schemas/ReportingRequirements'

    AimleClientServOpResp:
      description: Contains the AIMLE client service operation response information.
      type: object
      required:
      - servOpId
      - servOpModeStatus
      properties:
        valServiceId:
          description: Represents the VAL service identifier.
          type: string
        servOpId:
          description: Represents the AIML service operation identifier.
          type: string
        servOpModeStatus:
          $ref: '#/components/schemas/ServiceOperationMode'

    ServiceOperationInfo:
      description: Contains the AIML service operation information.
      type: object
      properties:
        mlMdlContainer:
          description: Represents the AIML service model container.
          type: string
        mlMdlUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        mlMdAggregUri:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/Uri'
        maxConvgTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/DurationSec'

    ServiceOpModeConfiguration:
      description: Contains the AIML service operation mode configuration.
      type: object
      properties:
        maxLatency:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uint32'
        maxDurHour:
          description: >
            Indicates the maximum duration time of the AIML service operation expressed in hours.
          type: integer
        modelAccuracy:
          description: >
            Indicates the threshold value of the model accuracy expressed as a percentage to
            stop the AIML service operation.
          type: integer

# Simple data types


# Enumerations

    ServiceOperationMode:
      anyOf:
```

```
      - type: string
        enum:
          - START
          - STOP
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          But is not used to encode content defined in the present version of this API.
      description: |
        Represents the AIMLE service operation modes.
        Possible values are:
        - START: Indicates a request to start the AIMLE service operation or status of the AIMLE
          service operation.
        - STOP: Indicates a request to stop the AIMLE service operation or status of the AIMLE
          service operation.
```

A.11 Aimlec_AimlTaskTransfer API

```
openapi: 3.0.0

info:
  title: Aimlec_AimlTaskTransfer
  version: 1.0.1
  description: |
    API for AIMLE Client AIML Task Transfer Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimlec-task-transfer/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /request:
    post:
      summary: Enables the AIMLE server to request the AIMLE client to perform AIML task transfer.
      operationId: AimlTaskTransf
      tags:
        - AIML task transfer
      requestBody:
        description: Contains the AIMLE client task transfer request information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimleClientTaskTransferReq'
      responses:
        '200':
          description: Contains the AIMLE client task transfer response information.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/AimleClientTaskTransferRes'
        '204':
          description: No Content. The AIMLE client AIML task transfer is performed.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
```

```
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

  /request-direct:
    post:
      summary: >
        Enables the AIMLE client to request the target AIMLE client to perform AIML task transfer.
      operationId: DirAimlTaskTransf
      tags:
        - Direct AIML task transfer
      requestBody:
        description: Contains the AIMLE client direct task transfer request information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimleClientDirectTransferReq'
      responses:
        '204':
          description: No Content. The AIMLE client direct AIML task transfer is performed.
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    AimleClientTaskTransferReq:
```

```
      description: Contains the AIMLE client task transfer request information.
      type: object
      required:
      - requestorId
      - sourceAimlId
      - aimlTaskType
      - aimlInfoType
      properties:
        requestorId:
          description: Represents the identifier of the AIMLE server.
          type: string
        sourceAimlId:
          $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
        aimlTaskType:
          $ref: 'TS24560_Aimles_AIMLEClientRegistration.yaml#/components/schemas/AimlOperation'
        aimlInfoType:
          $ref: '#/components/schemas/AimlInfoType'
        aimlTaskTransferTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        timeValidity:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

    AimleClientTaskTransferRes:
      description: Contains the AIMLE client task transfer response information.
      type: object
      properties:
        aimlTaskTransferTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

    AimleClientDirectTransferReq:
      description: Contains the AIMLE client direct task transfer request information.
      type: object
      required:
      - requestorId
      - aimlTaskType
      - aimlInfoType
      properties:
        requestorId:
          $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
        aimlTaskType:
          $ref: 'TS24560_Aimles_AIMLEClientRegistration.yaml#/components/schemas/AimlOperation'
        aimlInfoType:
          $ref: '#/components/schemas/AimlInfoType'
        aimlTaskTransferTime:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
        timeValidity:
          $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'


# Simple data types


# Enumerations

    AimlInfoType:
      anyOf:
      - type: string
        enum:
          - INTERMEDIATE_AIML_OP_RESULTS
          - INTERMEDIATE_AIML_OP_STATUS
          - FIRST_MATCH
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          but is not used to encode content defined in the present version of this API.
      description: |
        Represents the type of the AIML Information.
        Possible values are:
        - INTERMEDIATE_AIML_OP_RESULTS: Indicates the intermediate AIML operation results type
          of the AIML information.
        - INTERMEDIATE_AIML_OP_STATUS: Indicates the intermediate AIML operation status type of
          the AIML information.
        - OTHER_AIML_INFO_TYPE: Indicates other types of the AIML information.
```

A.12 Aimles_AimlTaskTransfer API

```
openapi: 3.0.0

info:
  title: Aimles_AimlTaskTransfer
  version: 1.0.1
  description: |
    API for AIMLE Server AIML Task Transfer Service.
    © 2025, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: >
    3GPP TS 24.560 V19.0.0; Artificial Intelligence Machine Learning (AIML) Services – Service
    Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3.
  url: 'https://www.3gpp.org/ftp/Specs/archive/24_series/24.560/'

servers:
  - url: '{apiRoot}/aimles-task-transfer/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 5.2.4 of 3GPP TS 29.122.

security:
  - {}
  - oAuth2ClientCredentials: []

paths:
  /assist-tt:
    post:
      summary: >
        Enables the AIMLE client to request the AIMLE server to perform task transfer assist.
      operationId: AimlTtAssist
      tags:
        - AIML task transfer assist
      requestBody:
        description: Contains the AIMLE server task transfer assist request information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimlesTaskTransferAssistReq'
      responses:
        '200':
          description: Contains the AIMLE server task transfer assist response information.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/AimlesTaskTransferAssistResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'
```

```
  /request-ctld:
    post:
      summary: >
        Enables the AIMLE client to request the AIMLE server to perform AIMLE server controlled
        task transfer.
      operationId: CtldAimlTt
      tags:
        - Controlled AIML task transfer
      requestBody:
        description: Contains the AIMLE server controlled task transfer request information.
        required: true
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/AimlesControlledTaskTransferReq'
      responses:
        '200':
          description: Contains the AIMLE server controlled task transfer response information.
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/AimlesControlledTaskTransferResp'
        '307':
          $ref: 'TS29122_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29122_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29122_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29122_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29122_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29122_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29122_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29122_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29122_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29122_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29122_CommonData.yaml#/components/responses/500'
        '503':
          $ref: 'TS29122_CommonData.yaml#/components/responses/503'
        default:
          $ref: 'TS29122_CommonData.yaml#/components/responses/default'

components:

  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{tokenUrl}'
          scopes: {}

  schemas:

# Structured data types

    AimlesTaskTransferAssistReq:
      description: Contains the AIMLE server task transfer assist request information.
      type: object
      required:
      - requestorId
      - aimlTaskType
      - aimlInfoType
      properties:
        requestorId:
          $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
        valServiceId:
          description: >
            Represents identifier of the VAL service for which the assistance information
            is requested.
```

```
        type: string
      aimlTaskType:
        $ref: 'TS24560_Aimles_AIMLEClientRegistration.yaml#/components/schemas/AimlOperation'
      aimlInfoType:
        $ref: 'TS24560_Aimlec_AimlTaskTransfer.yaml#/components/schemas/AimlInfoType'
      aimlRmngTrainReq:
        $ref: '#/components/schemas/AimlRmngTrainingReq'
      aimlImdInfo:
        $ref: '#/components/schemas/AimlIntermediateInfo'
      timeValidity:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

  AimlesTaskTransferAssistResp:
    description: Contains the AIMLE server task transfer assist response information.
    type: object
    required:
    - assistanceTime
    - targetAimlIds
    properties:
      assistanceTime:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      targetAimlIds:
        description: List of the target AIMLE clients.
        type: array
        items:
          $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
        minItems: 1
      transferMode:
        $ref: '#/components/schemas/TransferMode'

  AimlesControlledTaskTransferReq:
    description: Contains the AIMLE server controlled task transfer request information.
    type: object
    required:
    - requestorId
    - aimlTaskType
    - aimlInfoType
    - aimlTaskTransferTime
    properties:
      requestorId:
        $ref: 'TS29549_SS_UserProfileRetrieval.yaml#/components/schemas/ValTargetUe'
      aimlTaskType:
        $ref: 'TS24560_Aimles_AIMLEClientRegistration.yaml#/components/schemas/AimlOperation'
      aimlInfoType:
        $ref: 'TS24560_Aimlec_AimlTaskTransfer.yaml#/components/schemas/AimlInfoType'
      aimlTaskTransferTime:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
      timeValidity:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

  AimlesControlledTaskTransferResp:
    description: Contains the AIMLE server controlled task transfer response information.
    type: object
    required:
    - assistanceTime
    properties:
      assistanceTime:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'

  AimlRmngTrainingReq:
    description: Contains requirements for AIML model training.
    type: object
    properties:
      reqRmngTrainResorce:
        description: Indicates required remaining training resource.
        type: string
      reqRmngTrainIterNum:
        description: Indicates required remaining training number of iterations.
        type: integer

  AimlIntermediateInfo:
    description: Contains the AIML intermediate information for intermediate AIML operation.
    type: object
    properties:
      aimlImdModel:
        $ref: '#/components/schemas/AimlRmngTrainingReq'
      aimlUsedTrainTime:
        $ref: 'TS29122_CommonData.yaml#/components/schemas/TimeWindow'
```

```
        usedTrainResource:
          description: Indicates used training resource.
          type: string
        usedTrainIterNum:
          description: Indicates used training number of iterations.
          type: integer


# Simple data types


# Enumerations

    TransferMode:
      anyOf:
      - type: string
        enum:
          - DIRECT
          - SERVER_CONTROLLED
      - type: string
        description: >
          This string provides forward-compatibility with future extensions to the enumeration
          But is not used to encode content defined in the present version of this API.
      description: |
        Represents the mode of transfer.
        Possible values are:
        - DIRECT: Directly from the source AIML member to the target AIML member.
        - SERVER_CONTROLLED: Transfer with AIMLE server controlled.
```

Annex B (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2024-10	CT1#151					TS skeleton for Artificial Intelligence Machine Learning (AIML) Services - Service Enabler Architecture Layer for Verticals (SEAL); Protocol Specification; Stage 3;	0.0.0
2024-10	CT1#151	C1-249006				Scope	0.1.0
2024-10	CT1#151	C1-249007				Security	0.1.0
2024-10	CT1#151	C1-245909				AIML Services Introduction	0.1.0
2024-10	CT1#151	C1-245910				Reference	0.1.0
2024-12	CT1#152	C1-246117				Correcting misadjustments	0.2.0
2024-12	CT1#152	C1-247040				Definitions and abbreviations	0.2.0
2024-12	CT1#152	C1-247080				Federated learning service	0.2.0
2024-12	CT1#152	C1-247081				Federated learning service API	0.2.0
2024-12	CT1#152	C1-247082				Federated learning service OpenAPI	0.2.0
2025-03	CT1#153	C1-251027				Pseudo CR on adding definitions related to AIML	0.3.0
2025-03	CT1#153	C1-251030				Split AIML operation pipeline service	0.3.0
2025-03	CT1#153	C1-251031				FL grouping indication data model	0.3.0
2025-03	CT1#153	C1-251032				Support of AIMLE client registration service	0.3.0
2025-03	CT1#153	C1-251033				Support of AIMLE Client Service Operations	0.3.0
2025-03	CT1#153	C1-251034				Support of AIMLE Client AI/ML Task Transfer API	0.3.0
2025-03	CT1#153	C1-251035				Support of AIMLE Server AI/ML Task Transfer API	0.3.0
2025-03	CT1#153	C1-251068				Correction to FL Service	0.3.0
2025-03	CT1#153	C1-251071				ML model retrieval service	0.3.0
2025-04	CT1#154	C1-252052				Support of ML model training capability evaluation	0.4.0
2025-04	CT1#154	C1-252054				Overview of AIMLE services	0.4.0
2025-04	CT1#154	C1-252055				Aimlec_FLGroupIndication API	0.4.0
2025-04	CT1#154	C1-252056				AIMLE server AIML task transfer service alignment	0.4.0
2025-04	CT1#154	C1-252057				AIMLE client AIML task transfer service alignment	0.4.0
2025-04	CT1#154	C1-252447				Split AIML operation pipeline service	0.4.0
2025-04	CT1#154	C1-252448				ML model retrieval service	0.4.0
2025-04	CT1#154	C1-252449				AIMLE client registration alignment	0.4.0
2024-05	CT1#155	C1-253385				Aimles_AIMLEClientRegistration API: DataSetAvailability definition	0.5.0
2024-05	CT1#155	C1-253386				OpenAPI file for Aimles_AIMLEClientRegistration API	0.5.0
2024-05	CT1#155	C1-253387				OpenAPI file for Aimlec_AIMLEClientServiceOperations API	0.5.0
2024-05	CT1#155	C1-253389				OpenAPI file for Aimlec_AimlTaskTransfer API	0.5.0
2024-05	CT1#155	C1-253390				OpenAPI file for Aimles_AimlTaskTransfer API	0.5.0
2024-05	CT1#155	C1-253391				OpenAPI file for Aimlec_MLModelTrainingCapabilityEva API	0.5.0
2024-05	CT1#155	C1-253392				AimlModelInfo data type not listed in data model introduction	0.5.0
2024-05	CT1#155	C1-253393				Update of OpenAPI file for Aimlec_FLGroupIndication API	0.5.0
2024-05	CT1#155	C1-253395				FL group deletion flag in Aimlec_FLGroupIndication API	0.5.0
2024-05	CT1#155	C1-254011				ML model retrieval service API	0.5.0
2024-05	CT1#155	C1-254012				Split AIML operation pipeline API	0.5.0
2024-05	CT1#155	C1-254013				Aimlec_AimlTaskTransfer API: support of 204 response	0.5.0
2025-06	CT#108	CP-251214				TS presented for information	1.0.0
2025-09	CT1#156	C1-254677				AIMLE client profile	1.1.0
2025-09	CT1#156	C1-255543				Update AIML client registration	1.1.0
2025-09	CT1#156	C1-255544				Client participation service	1.1.0
2025-09	CT1#156	C1-255545				Client participation service API	1.1.0
2025-09	CT1#156	C1-255546				Data management service	1.1.0
2025-09	CT1#156	C1-255547				Data management service API	1.1.0
2025-09	CT1#156	C1-255548				TL enablement service	1.1.0
2025-09	CT1#156	C1-255550				FL Group Indicator corrections	1.1.0
2025-09	CT1#156	C1-255690				TL enablement service API	1.1.0
2025-10	CT1#157	C1-256323				Aimlec_ClientDataProcessing API	1.2.0
2025-10	CT1#157	C1-256325				HFL training service	1.2.0
2025-10	CT1#157	C1-256326				HFL training service API	1.2.0
2025-10	CT1#157	C1-256811				Resolution of Editor's note for the Definition of MLModelProfile data type	1.2.0
2025-10	CT1#157	C1-256812				Resolving editor's note related to energy efficient performance	1.2.0
2025-10	CT1#157	C1-256813				Aimlec_AIMLEClientParticipation API	1.2.0
2025-10	CT1#157	C1-256814				Aimles_UeTLModelSelectionAssistance API	1.2.0
2025-10	CT1#157	C1-256815				Removal of edge and model distribution services	1.2.0
2025-10	CT1#157	C1-256816				Updating the ML model retrieval service	1.2.0
2025-10	CT1#157	C1-256817				Split operation event subscription service	1.2.0
2025-10	CT1#157	C1-256818				Defining update and delete operations for Split AIML operation pipeline service	1.2.0
2025-11	CT1#158	C1-257058				Changing API name for ML model training capability evaluation service	1.3.0
2025-11	CT1#158	C1-257061				Miscellaneous corrections	1.3.0
2025-11	CT1#158	C1-257240				To define the ML model update service operation	1.3.0
2025-11	CT1#158	C1-257241				To update the AIML split operation pipeline service operation	1.3.0

2025-11	CT1#158	C1-257312				Fixing Lint error in Aimlec_AIMLEClientParticipation API	1.3.0
2025-11	CT1#158	C1-257313				Fixing Lint error in Aimlec_ClientDataProcessing API	1.3.0
2025-11	CT1#158	C1-257314				Fixing Lint error in Aimles_UeTLModelSelectionAssistance API	1.3.0
2025-11	CT1#158	C1-257760				Complete CltDataProcResp	1.3.0
2025-11	CT1#158	C1-257761				HFL training OpenAPI	1.3.0
2025-11	CT1#158	C1-257762				Split AIML operation pipeline service OpenAPI	1.3.0
2025-11	CT1#158	C1-257800				AIML split operation pipeline service API	1.3.0
2025-12	CT#110	CP-253068				TS presentation to TSG CT for approval	2.0.0
2025-12	CT#110	CP-253068				Approved by TSG CT. Corrected name of the PerfParams data type and reference to the MLModelProfile data type, defined in TS 29.482.	19.0.0

History

Version	Date	Status
V19.0.0	February 2026	Publication