|  |  |
| --- | --- |
| 3GPP TS 24.560 V0.3.0 (2025-03) | |
| Technical Specification | |
| 3rd Generation Partnership Project;  Technical Specification Group Core Network and Terminals;  Artificial Intelligence Machine Learning (AIML) Services - Service Enabler Architecture Layer for Verticals (SEAL);  Protocol Specification;  Stage 3;  (Release 19) | |
|  | |
|  |  |
|  | |
| The present document has been developed within the 3rd Generation Partnership Project (3GPP TM) and may be further elaborated for the purposes of 3GPP. The present document has not been subject to any approval process by the 3GPPOrganizational Partners and shall not be implemented. This Specification is provided for future development work within 3GPPonly. The Organizational Partners accept no liability for any use of this Specification. Specifications and Reports for implementation of the 3GPP TM system should be obtained via the 3GPP Organizational Partners' Publications Offices. | |

|  |
| --- |
|  |
| ***3GPP***  Postal address  3GPP support office address  650 Route des Lucioles - Sophia Antipolis  Valbonne - FRANCE  Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16  Internet  http://www.3gpp.org |
| ***Copyright Notification***  No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.  © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).  All rights reserved.  UMTS™ is a Trade Mark of ETSI registered for the benefit of its members  3GPP™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners LTE™ is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners  GSM® and the GSM logo are registered and owned by the GSM Association |

Contents

Foreword 10

1 Scope 12

2 References 13

3 Definitions, symbols and abbreviations 14

3.1 Definitions 14

3.2 Symbols 14

3.3 Abbreviations 14

5 Artificial intelligence machine learning services 15

5.1 Introduction 15

5.2 Member participation configurations provisioning and management service 15

5.2.1 Service description 15

5.2.2 Service operations 16

5.2.2.1 Introduction 16

5.3 Enablement client selection service 17

5.3.1 Service description 17

5.3.2 Service dperations 17

5.3.2.1 Introduction 17

5.4 AIMLE client registration service 18

5.4.1 Service description 18

5.4.2 Service operations 18

5.4.2.1 Introduction 18

5.4.2.2 Aimles\_AIMLEClientRegistration\_Request service operation 18

5.4.2.2.1 General 18

5.4.2.2.2 AIMLE client registration request 18

5.4.2.3 Aimles\_AIMLEClientRegistration\_Update service operation 19

5.4.2.3.1 General 19

5.4.2.3.2 AIMLE client registration update 19

5.4.2.4 Aimles\_AIMLEClientRegistration\_Delete service operation 19

5.4.2.4.1 General 19

5.4.2.4.2 AIMLE client deregistration 20

5.5 Lifecycle management service 21

5.5.1 Service description 21

5.5.2 Service operations 21

5.5.2.1 Introduction 21

5.6 Split AIML operation pipeline service 22

5.6.1 Service description 22

5.6.2 Service operations 22

5.6.2.1 Introduction 22

5.6.2.2 Aimles\_SplitOpPipeline\_Discover 22

5.6.2.2.1 General 22

5.6.2.2.2 AIML operation for pipeline discovery 22

5.7 Federated learning service 24

5.7.1 Service description 24

5.7.2 Service operations 24

5.7.2.1 Introduction 24

5.7.2.2 Indicate\_FL\_Member\_Group 24

5.7.2.2.1 General 24

5.7.2.2.2 Indicating FL members information on FL member group using indicate\_FL\_Member\_Group service operation 24

5.8 Data management service 25

5.8.1 Service description 25

5.8.2 Service operations 25

5.8.2.1 Introduction 25

5.9 Edge service 26

5.9.1 Service description 26

5.9.2 Service operations 26

5.9.2.1 Introduction 26

5.10 Model distribution service 27

5.10.1 Service description 27

5.10.2 Service operations 27

5.10.2.1 Introduction 27

5.11 AIMLE client service operations service 28

5.11.1 Service description 28

5.11.2 Service operations 28

5.11.2.1 Introduction 28

5.11.2.2 Aimlec\_AIMLEClientServiceOperations\_Request 28

5.11.2.2.1 General 28

5.11.2.2.2 Perform AIMLE client service operation 28

5.12 AIMLE client AIML task transfer service 29

5.12.1 Service description 29

5.12.2 Service operations 29

5.12.2.1 Introduction 29

5.12.2.2 Aimlec\_AIMLTaskTransfer\_Request 29

5.12.2.2.1 General 29

5.12.2.2.2 Requesting AIML task transfer 29

5.12.2.3 Aimlec\_DirectAIMLTaskTransfer\_Request 30

5.12.2.3.1 General 30

5.12.2.3.2 Requesting direct AIML task transfer 30

5.13 AIMLE server AIML task transfer service 31

5.13.1 Service description 31

5.13.2 Service operations 31

5.13.2.1 Introduction 31

5.13.2.2 Aimles\_AIMLTaskTransferAssist\_Request 31

5.13.2.2.1 General 31

5.13.2.2.2 Requesting AIML task transfer assist 31

5.13.2.3 Aimles\_AIMLESControlledAIMLTaskTransfer\_Request 32

5.13.2.3.1 General 32

5.13.2.3.2 Requesting AIMLE server controlled AIML task transfer 32

5.14 ML model retrieval service 33

5.14.1 Service Description 33

5.14.2 Service Operations 33

5.14.2.1 Introduction 33

5.14.2.2 Aimles\_MLModelRetrieval\_Request 33

5.14.2.2.1 General 33

5.14.2.2.2 AIML operation for model retrieval 33

6 API definitions 35

6.3 Aimles\_AIMLEClientRegistration API 35

6.3.1 Introduction 35

6.3.2 Usage of HTTP and common API related aspects 35

6.3.3 Resources 35

6.3.3.1 Overview 35

6.3.3.2 Resource: AIMLE client registrations (Collection) 36

6.3.3.2.1 Description 36

6.3.3.2.2 Resource Definition 36

6.3.3.2.3 Resource Standard Methods 36

6.3.3.2.4 Resource Custom Operations 37

6.3.3.3 Resource: Individual AIMLE client registration (Document) 37

6.3.3.3.1 Description 37

6.3.3.3.2 Resource Definition 37

6.3.3.3.3 Resource Standard Methods 37

6.3.3.3.4 Resource Custom Operations 39

6.3.4 Custom Operations without associated resources 39

6.3.5 Notifications 39

6.3.6 Data Model 39

6.3.6.1 General 39

6.3.6.2 Structured data types 40

6.3.6.2.1 Introduction 40

6.3.6.2.2 Type: AimleRegistration 41

6.3.6.2.3 Type: AimleClientRegInfo 41

6.3.6.2.4 Type: ServiceProfile 41

6.3.6.2.5 Type: ValServiceData 41

6.3.6.2.6 Type: AimleClientProfile 42

6.3.6.2.7 Type: ClientCapability 43

6.3.6.2.8 Type: DataSetAvailability 43

6.3.6.2.9 Type: LocationConfig 43

6.3.6.3 Simple data types and enumerations 43

6.3.6.3.1 Introduction 43

6.3.6.3.2 Simple data types 43

6.3.6.3.3 Enumeration: ServicePermissionLevel 43

6.3.6.3.4 Enumeration: AimlModelType 44

6.3.6.3.5 Enumeration: AimlOperation 44

6.3.6.3.6 Enumeration: MlApplicationType 44

6.3.6.3.7 Enumeration: ResourceUsageLevel 44

6.3.6.3.8 Enumeration: DataCapability 45

6.3.6.3.9 Enumeration: TaskCapability 45

6.3.6.4 Data types describing alternative data types or combinations of data types 45

6.3.6.5 Binary data 45

6.3.6.5.1 Binary Data Types 45

6.3.7 Error Handling 46

6.3.7.1 General 46

6.3.7.2 Protocol Errors 46

6.3.7.3 Application Errors 46

6.3.8 Feature negotiation 46

6.3.9 Security 46

6.6 AIML\_FederatedLearning API 47

6.6.1 Introduction 47

6.6.2 Usage of HTTP and common API related aspects 47

6.6.3 Resources 47

6.6.3.1 Overview 47

6.6.4 Custom operations without associated resources 47

6.6.4.1 Overview 47

6.6.4.2 Operation: Indicate 48

6.6.4.2.1 Description 48

6.6.4.2.2 Operation Definition 48

6.6.5 Notifications 49

6.6.5.1 General 49

6.6.6 Data Model 49

6.6.6.1 General 49

6.6.6.2 Structured data types 49

6.6.6.2.1 Introduction 49

6.6.6.2.2 Type: IndFMember 50

6.6.6.2.3 Type: FlGroupInfo 50

6.6.6.2.4 Type: FlMemberData 50

6.6.6.2.5 Type: FlMemberInfo 50

6.6.6.3 Simple data types and enumerations 50

6.6.6.3.1 Introduction 50

6.6.6.3.2 Simple data types 51

6.6.6.3.3 Enumeration: FlMemberAvailability 51

6.6.6.3.4 Enumeration: FlMemberConstraint 51

6.6.6.3.5 Enumeration: FlMemberRole 51

6.6.6.4 Data types describing alternative data types or combinations of data types 52

6.6.6.5 Binary data 52

6.6.6.5.1 Binary Data Types 52

6.6.7 Error Handling 52

6.6.7.1 General 52

6.6.7.2 Protocol Errors 52

6.6.7.3 Application Errors 52

6.6.8 Feature negotiation 52

6.6.9 Security 52

6.10 Aimlec\_AIMLEClientServiceOperations API 53

6.10.1 Introduction 53

6.10.2 Usage of HTTP and common API related aspects 53

6.10.3 Resources 53

6.10.4 Custom Operations without associated resources 53

6.10.4.1 Overview 53

6.10.4.2 Operation: AIMLE service operation request 53

6.10.4.2.1 Description 53

6.10.4.2.2 Operation Definition 53

6.10.5 Notifications 54

6.10.6 Data Model 54

6.10.6.1 General 54

6.10.6.2 Structured data types 55

6.10.6.2.1 Introduction 55

6.10.6.2.2 Type: AimleClientServOpReq 55

6.10.6.2.3 Type: AimleClientServOpResp 56

6.n1.6.2.4 Type: ServiceOperationInfo 56

6.n1.6.2.5 Type: ServiceOpModeConfiguration 56

6.10.6.3 Simple data types and enumerations 56

6.10.6.3.1 Introduction 56

6.10.6.3.2 Simple data types 56

6.10.6.3.3 Enumeration: ServiceOperationMode 57

6.10.6.4 Data types describing alternative data types or combinations of data types 57

6.10.6.5 Binary data 57

6.10.6.5.1 Binary Data Types 57

6.10.7 Error Handling 57

6.10.7.1 General 57

6.10.7.2 Protocol Errors 57

6.10.7.3 Application Errors 57

6.10.8 Feature negotiation 58

6.10.9 Security 58

6.11 Aimlec\_AimlTaskTransfer API 59

6.11.1 Introduction 59

6.11.2 Usage of HTTP and common API related aspects 59

6.11.3 Resources 59

6.11.4 Custom Operations without associated resources 59

6.11.4.1 Overview 59

6.11.4.2 Operation: AIML task transfer 59

6.11.4.2.1 Description 59

6.11.4.2.2 Operation Definition 59

6.11.4.3 Operation: Direct AIML task transfer 60

6.11.4.3.1 Description 60

6.11.4.3.2 Operation Definition 60

6.11.5 Notifications 61

6.11.6 Data Model 61

6.11.6.1 General 61

6.11.6.2 Structured data types 62

6.11.6.2.1 Introduction 62

6.11.6.2.2 Type: AimleClientTaskTransferReq 62

6.11.6.2.3 Type: AimleClientTaskTransferRes 62

6.11.6.2.4 Type: AimleClientDirectTransferReq 62

6.11.6.3 Simple data types and enumerations 63

6.11.6.3.1 Introduction 63

6.11.6.3.2 Simple data types 63

6.11.6.3.3 Enumeration: AimlInfoType 63

6.11.6.4 Data types describing alternative data types or combinations of data types 63

6.11.6.5 Binary data 63

6.11.6.5.1 Binary Data Types 63

6.11.7 Error Handling 63

6.11.7.1 General 63

6.11.7.2 Protocol Errors 64

6.11.7.3 Application Errors 64

6.11.8 Feature negotiation 64

6.11.9 Security 64

6.12 Aimles\_AIMLTaskTransfer API 65

6.12.1 Introduction 65

6.12.2 Usage of HTTP and common API related aspects 65

6.12.3 Resources 65

6.12.4 Custom Operations without associated resources 65

6.12.4.1 Overview 65

6.12.4.2 Operation: AIML task transfer assist 65

6.12.4.2.1 Description 65

6.12.4.2.2 Operation Definition 65

6.12.4.3 Operation: Controlled AIML task transfer 66

6.12.4.3.1 Description 66

6.12.4.3.2 Operation Definition 66

6.12.5 Notifications 67

6.12.6 Data Model 67

6.12.6.1 General 67

6.12.6.2 Structured data types 68

6.12.6.2.1 Introduction 68

6.12.6.2.2 Type: AimlesTaskTransferAssistReq 68

6.12.6.2.3 Type: AimlesTaskTransferAssistResp 68

6.12.6.2.4 Type: AimlesControlledTaskTransferReq 69

6.12.6.2.5 Type: AimlesControlledTaskTransferResp 69

6.12.6.2.6 Type: AimlRmngTrainingReq 69

6.12.6.2.7 Type: AimlIntermediateInfo 69

6.12.6.3 Simple data types and enumerations 69

6.12.6.3.1 Introduction 69

6.12.6.3.2 Simple data types 69

6.12.6.3.3 Enumeration: TransferMode 70

6.12.6.4 Data types describing alternative data types or combinations of data types 70

6.12.6.5 Binary data 70

6.12.6.5.1 Binary Data Types 70

6.12.7 Error Handling 70

6.12.7.1 General 70

6.12.7.2 Protocol Errors 70

6.12.7.3 Application Errors 70

6.12.8 Feature negotiation 71

6.12.9 Security 71

7 Using common API framework 72

7.1 General 72

7.2 Security 72

Annex A (normative): OpenAPI specification 73

A.1 General 73

A.2 AIML\_FederatedLearning API 73

Annex B (informative): Change history 76

# 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 AIML 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 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[8] 3GPP TS 29.549:" Service Enabler Architecture Layer for Verticals (SEAL); Application Programming Interface (API) specification".

[9] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[10] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs".

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

[12] 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.

**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:

<symbol> <Explanation>

## 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

ML Machine Learning

SCEF Service Capability Exposure Function

SCS Services Capability Server

SEAL Service Enabler Architecture Layer for verticals

VAL Vertical Application Layer

4 Overview

# 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 |
| Member participation configurations provisioning and management | 5.2 | <short description as included in the OpenAPI file> | <file name> | <apiName in the URI> | <ref Annex> |
| Enablement client selection | 5.3 |  |  |  |  |
| Aimles\_AIMLEClientRegistration | 5.4 | AIMLE client registration service | TS24560\_Aimles\_AIMLEClientRegistration.yaml | aimles-client-reg |  |
| Lifecycle management service | 5.5 |  |  |  |  |
| Operational splitting and provisioning management | 5.6 |  |  |  |  |
| Federated learning | 5.7 |  |  |  |  |
| Data management | 5.8 |  |  |  |  |
| Edge | 5.9 |  |  |  |  |
| Model distribution | 5.10 |  |  |  |  |
| Aimlec\_AIMLEClientServiceOperations | 5.11 | AIMLE client service operations service | TS24560\_Aimlec\_AIMLEClientServiceOperations.yaml | aimlec-serv-ops |  |
| Aimlec\_AimlTaskTransfer | 5.12 | AIMLE client AIML task transfer service | TS24560\_Aimlec\_AimlTaskTransfer.yaml | aimlec-task-transfer |  |
| Aimles\_AimlTaskTransfer | 5.13 | AIMLE server AIML task transfer service | TS24560\_Aimles\_AimlTaskTransfer.yaml | aimles-task-transfer |  |

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 Member participation configurations provisioning and management service

### 5.2.1 Service description

### 5.2.2 Service operations

#### 5.2.2.1 Introduction

## 5.3 Enablement client selection service

### 5.3.1 Service description

### 5.3.2 Service dperations

#### 5.3.2.1 Introduction

## 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 for 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 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) to update the registration prior to the expiration time. If the AIMLE server did not receive the registration update request before the expiration time, 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 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 "serviceProfiles" 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; 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 an "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 time. If the AIMLE server did not receive the registration update request before the expiration time, 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 Lifecycle management service

### 5.5.1 Service description

### 5.5.2 Service operations

#### 5.5.2.1 Introduction

## 5.6 Split AIML operation pipeline service

### 5.6.1 Service description

The Aimles\_SplitOpPipeline API, as defined in 3GPP TS 23.482 [4], allows 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 the Aimles\_SplitOpPipeline API

|  |  |  |
| --- | --- | --- |
| 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 AI/ML 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 AI/ML 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.x.x.x.x. The body of the POST message shall include the SplitOpPipelineDiscoverReq data structure as specified in clause 6.y.y.y.y.

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 6.z.z.z.z.

Editor's Note: Definition of the remaining service operations of Aimles\_SplitOpPipeline API is FFS.

## 5.7 Federated learning service

### 5.7.1 Service description

Federated learning service allows AIMLE capability to enable creating, monitoring, and updating FL member groups consisting of AIMLE clients based on AIML service operations as defined in 3GPP TS 23.482 [4]. As the AIML service operations are applicable in given service areas, due to availability of the AIMLE clients, and other aspects, the AIMLE clients may enter or leave the FL member groups which results in AIMLE server indicating the AIMLE clients the updates for the FL member groups.

### 5.7.2 Service operations

#### 5.7.2.1 Introduction

The service operation defined for AIML\_FederatedLearning API for is shown in the table 5.7.2.1-1.

Table 5.7.2.1-1: Operations for federated learning service

|  |  |  |
| --- | --- | --- |
| Service operation name | Description | Initiated by |
| Indicate\_FL\_Member\_Group | This service operation is used by AIMLE server to indicate the candidate FL members information about the FL members and the group. | AIMLE server |

#### 5.7.2.2 Indicate\_FL\_Member\_Group

##### 5.7.2.2.1 General

This clause provides a general description of the service operation.

##### 5.7.2.2.2 Indicating FL members information on FL member group using indicate\_FL\_Member\_Group service operation

To update the FL members information on FL member groups, the AIMLE server shall send an HTTP POST request with a Request-URI according to the pattern "{apiRoot}/aiml-fl/<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 Data management service

### 5.8.1 Service description

### 5.8.2 Service operations

#### 5.8.2.1 Introduction

## 5.9 Edge service

### 5.9.1 Service description

### 5.9.2 Service operations

#### 5.9.2.1 Introduction

## 5.10 Model distribution service

### 5.10.1 Service description

### 5.10.2 Service operations

#### 5.10.2.1 Introduction

## 

## 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 for 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 operation defined for Aimlec\_AimlTaskTransfer API for is 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 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.

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>/direct-request" 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 AIML 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 AIML 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 for 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 AIML 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>/tt-assist" 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 AIML 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 AIML 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>/ctld-request" 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 Aimles\_MLModelRetrieval API, as defined in 3GPP TS 23.482 [4], allows an AIMLE client to obtain information about available instances of split operation pipeline or processing the nodes of interest.

### 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 the Aimles\_MLModelRetrieval API

|  |  |  |
| --- | --- | --- |
| 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. | 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 AIML 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 clause 6.x.x.x.x. The body of the POST message shall include the MlModelRetrievalReq data structure as specified in clause 6.y.y.y.y.

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 6.z.z.z.z.

Editor's Note: Definition of the remaining service operations of Aimles\_MLModelRetrieval API is FFS.

# 6 API definitions

## 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. |  |
| AimlModelType | 6.3.6.3.4 | Represents the AIML model type. |  |
| AimlOperation | 6.3.6.3.5 | Represents the AIML service operation type. |  |
| AimleRegistration | 6.3.6.2.2 | Represents an individual AIMLE client registration resource. |  |
| 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. |  |
| ServicePermissionLevel | 6.3.6.3.3 | Represents the service permission level. |  |
| ServiceProfile | 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. |  |
| ValServiceData | 6.3.6.2.5 | Contains VAL service ID and the corresponding service permission. |  |

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 [9] | Used to indicate the availability schedule of the AIMLE client for the AIML service. |  |
| SupportedFeatures | 3GPP TS 29.571 [9] | 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 [8] | Used to indicate the VAL Service Area identifier. |  |
| ValTargetUe | 3GPP TS 29.549 [8] | 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. |  |
| serviceProfiles | array(ServiceProfile) | M | 1 | Contains a list of supported service information and AIML 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: ServiceProfile

Table 6.3.6.2.4-1: Definition of type ServiceProfile

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attribute name | Data type | P | Cardinality | Description | Applicability |
| clientProfile | AimleClientProfile | M | 1 | Contains the AIMLE client capability information e.g. supported AIML model types, AIML service operation type. |  |
| valServices | array(ValServiceData) | O | 1..N | Contains the list of VAL services IDs with corresponding permissions. |  |

##### 6.3.6.2.5 Type: ValServiceData

Table 6.3.6.2.5-1: Definition of type ValServiceData

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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). |  |
| 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(DataSetId) | 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. |  |

##### 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 |  |  |
| ENERGY\_EFFICIENT\_PERFORMANCE |  |  |

Editor's Note: Whether the green and energy-efficient task performance are applicable to a UE is FFS.

#### 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.

## 6.6 AIML\_FederatedLearning API

### 6.6.1 Introduction

The AIML\_FederatedLearning shall use the AIML\_FederatedLearning 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 "aiml-fl".

- The <apiVersion> shall be "v1".

- The <apiSpecificSuffixes> shall be set as described in clause 5.2.4 of 3GPP TS 29.122 [5].

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 service producer (i.e. <NF or Entity, e.g. UAE Server>) takes the role of the SCEF and the service consumer (i.e. <provide examples of service consumers>) takes the role of the SCS/AS.

### 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 AIML\_FederatedLearning 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

The structure of the custom operation URIs of the AIML\_FederatedLearning API is shown in Figure 6.6.4.1-1.



Figure 6.6.4.1-1: Custom operation URI structure of the AIML\_FederatedLearning API

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

Table 6.6.4.1-1: Custom operations without associated resources

|  |  |  |
| --- | --- | --- |
| Custom operation URI | Mapped HTTP method | Description |
| /indicate | POST | Indicates FL member information on FL member group |

#### 6.6.4.2 Operation: Indicate

##### 6.6.4.2.1 Description

The custom operation is for the AIMLE server to indicate the AIMLE client as the FL member the information on the FL member group and shall support the custom operation URI "/indicate" as shown in table 6.6.4.1-1.

##### 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 manadatory 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 AIML\_FederatedLearning 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 API.

Table 6.6.6.1-1 specifies the data types defined for the AIML\_FederatedLearning API.

Table 6.6.6.1-1: AIML\_FederatedLearning API specific Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Clause defined | Description | Applicability |
| 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 AIML\_FederatedLearning API from other specifications, including a reference to their respective specifications, and when needed, a short description of their use within the AIML\_FederatedLearning API.

Table 6.6.6.1-2: AIML\_FederatedLearning API re-used Data Types

|  |  |  |  |
| --- | --- | --- | --- |
| Data type | Reference | Comments | Applicability |
| ValUeAddrInfo | 3GPP TS 29.549 [8] | 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 | C | 0..1 | Identifier of the VAL service for which the grouping indication is applied. (NOTE) |  |
| mlModelId | string | C | 0..1 | Identifier of the ML model for which the indication is applied. (NOTE) |  |
| analyticsId | string | C | 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) |  |
| flGroupId | array(FlGroupInfo) | M | 1..N | Identifier of the AIMLE created FL group for the FL process |  |
| NOTE: One of the attributes valServiceId, mlModelId, or analyticsId shall be present. | | | | | |

##### 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 | C | 0..1 | Identifier of FL member  (NOTE) |  |
| flMemberAddr | ValUeAddrInfo | C | 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 | arary(FlMemberConstraint) | O | 1..N | Represents the FL group member constraints. |  |
| role | FlMemberRole | O | 0..1 | Represents the FL group member role/type. |  |

#### 6.6.6.3 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 |
| LOW\_BATTERY\_LEVEL | Indicates a low battery level. |  |
| HIGH\_MEMORY\_LOAD | Indicates a high memory load. |  |

Editor's Note: Enumeration values for FlMemberConstraint are FFS.

##### 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. |  |

Editor's Note: Enumeration values for FlMemberRole related to the FL type are FFS.

#### 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 AIML\_FederatedLearning API in this release of the specification.

#### 6.6.6.5 Binary data

##### 6.6.6.5.1 Binary Data Types

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 AIML\_FederatedLearning 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 AIML\_FederatedLearning API.

#### 6.6.7.2 Protocol Errors

No specific procedures for the AIML\_FederatedLearning API are specified in this release of the specification.

#### 6.6.7.3 Application Errors

The application errors defined for the AIML\_FederatedLearning 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 AIML\_FederatedLearning 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 AIML\_FederatedLearning API.

## 

## 6.10 Aimlec\_AIMLEClientServiceOperations API

### 6.10.1 Introduction

The <Service 1> 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 [8] | Used to indicate the reporting configuration of the AIML service operation status. |  |
| Uint32 | 3GPP TS 29.571 [9] | 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.n1.6.2.4 Type: ServiceOperationInfo

Table 6.n1.6.2.4-1: 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.n1.6.2.5 Type: ServiceOpModeConfiguration

Table 6.n1.6.2.5-1: 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 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 | /direct-request | 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 |  |  | 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 | Contains AIML operations supported by the AIMLE client (e.g., training, model transfer, model inference, model offload, model split). |  |
| TimeWindow | 3GPP TS 29.122 [5] | Represents a time window. |  |
| ValTargetUe | 3GPP TS 29.549 [8] | 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 | The identifier of the AIMLE server. |  |
| 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 | O | 0..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 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 | /tt-assist | POST | Used by the AIMLE client to request the AIMLE server to perform task transfer assist. |
| Controlled AIML task transfer | /ctld-request | 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 |
| AimlesTaskTransferAssistResp | 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 |
| AimlesControlledTaskTransferReq | 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. |  |
| 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. |  |
| 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. |  |
| 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. |  |
| TimeWindow | 3GPP TS 29.122 [5] | Represents a time window. |  |
| ValTargetUe | 3GPP TS 29.549 [8] | 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.

# 7 Using common API framework

## 7.1 General

When CAPIF is used with a AIML server service, the AIML 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 AIML server service, the AIML 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 AIML 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 AIML 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 AIML server, upon API invocation, the AIML 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 [10], the access to the AIML server APIs may be authorized by means of the OAuth 2.0 protocol (see IETF RFC 6749 [11]), 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 AIML server, the service API consumer (e.g. AIMLE client) shall, prior to consuming the services offered by the AIML 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 AIML server APIs do not define any scopes for OAuth 2.0 authorization. It is the AIML 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 AIML server verifies the "token", it shall check whether the AIML 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 AIML 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 [12].

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 [7] and clause 5B of 3GPP TR 21.900 [1]).

## A.2 AIML\_FederatedLearning API

openapi: 3.0.0

info:

title: AIML\_FederatedLearning

version: 1.0.0

description: |

API for Federated Learning Service.

© <2024>, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).

All rights reserved.

externalDocs:

description: >

3GPP TS 24.560 V<0.3.0; 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}/aiml-fl/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 member information on FL member group

operationId: IndicateFLMemberInfo

tags:

- FL member information

requestBody:

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:

securitySchemes:

oAuth2ClientCredentials:

type: oauth2

flows:

clientCredentials:

tokenUrl: '{tokenUrl}'

scopes: {}

schemas:

IndFlMember:

description: Indicates the FL member the information on FL member.

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 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.

flGroupId:

type: array

items:

$ref: '#/components/schemas/FlMemberType'

minItems: 1

description: >

Identifier of the AIMLE created FL group for the FL process.

required:

- serverId

- flGroupId

oneOf:

- required: [valServiceId]

- required: [mlModelId]

- required: [analyticsId]

FlMemberType:

description: Identifier of FL group.

type: object

properties:

flMemberId:

type: string

description: Identifier of the FL members

flMemberAddr:

$ref: 'TS29549\_SS\_NetworkResourceAdaptation.yaml#/components/schemas/ValUeAddrInfo'

description: Address information of the FL members

flMemberInfo:

$ref: '#/components/schemas/ValUeInfo'

# Simple data types and Enumerations

ValUeInfo:

anyOf:

- type: string

enum:

- AVAILABILITY

- CONSTRAINT

- ROLE

- type: string

description: >

This string provides Information on the FL member.

description: |

Represents the information regarding availability, constraint, and role of the VAL UE.

Possible values are:

- AVAILABILITY: Indicates the availability of the VAL UE e.g., available or not available.

- CONSTRAINT: Indicates the capability of the VAL UE e.g., battery constraint and

computational load constraint.

- ROLE: Indicates the role and type of the VAL UE e.g., FL client, FL server, or

FL aggregator.

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 |  |  |  | Pseudo-CR on FL grouping indication data model | 0.3.0 |
| 2025-03 | CT1#153 | C1-251032 |  |  |  | Pseudo-CR on Support of AIMLE client registration service | 0.3.0 |
| 2025-03 | CT1#153 | C1-251033 |  |  |  | Pseudo-CR on Support of AIMLE Client Service Operations | 0.3.0 |
| 2025-03 | CT1#153 | C1-251034 |  |  |  | Pseudo-CR on Support of AIMLE Client AI/ML Task Transfer API | 0.3.0 |
| 2025-03 | CT1#153 | C1-251035 |  |  |  | Pseudo-CR on 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 |