European Network of
Transmission System Operators
for Electricity

ASSESSED ELEMENT PROFILE SPECIFICATION

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ICTC APPROVED
VERSION 2.3.1

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NOTE CONCERNING WORDING USED IN THIS DOCUMENT

The force of the following words is modified by the requirement level of the document in which they are used.

- SHALL: This word, or the terms “REQUIRED” or “MUST”, means that the definition is an absolute requirement of the specification.
- SHALL NOT: This phrase, or the phrase “MUST NOT”, means that the definition is an absolute prohibition of the specification.
- SHOULD: This word, or the adjective “RECOMMENDED”, means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course.
- SHOULD NOT: This phrase, or the phrase “NOT RECOMMENDED”, means that there may exist valid reasons in particular circumstances when the particular behaviour is acceptable or even useful, but the full implications should be understood and the case carefully weighed before implementing any behaviour described with this label.
- MAY: This word, or the adjective “OPTIONAL”, means that an item is truly optional.

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Revision History

Version	Date	Paragraph	Comments
1.0.0	2021-03-22		Document for SOC approval.
2.0.0	2021-10-12		For CIM EG review. Additional associations added to Region, OverlapingZone and PowerSystemCorridor.
2.0.0	2022-02-16		Additional associations added to Region, OverlapingZone and PowerSystemCorridor. SOC approved.
2.1.0	2022-09-21		SOC approved.
2.2.0	2023-03-24		For review.
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2.3.0-gamma	2024-04-09		For StG Strategy review.
2.3.1-alpha	2024-09-07		For CIM WG review.

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1 Introduction

The assessed element profile is a profile to exchange a list of assessed elements.

An assessed element is a network element for which the electrical state is evaluated in a regional or cross-regional process and which value is expected to fulfil regional rules function of the operational security limits.[1]

The assessed elements are input data describing the elements that shall be assessed during the security analysis.

These are the elements on which limit violations are potentially detected (scanned assessed elements) and resolved (secured assessed elements) by applying defined and agreed remedial actions. Assessed elements can be a conducting equipment e.g. a line, transformer, breaker, etc or just a terminal i.e. the end of the equipment. In cases where an assessed element is associated with a conducting equipment the whole equipment is scanned meaning limits defined at all sides of the equipment are scanned. In cases where an assessed element is associated with a terminal only the limits defined for this terminal are scanned. In addition, it shall be noted that only elements from an IGM that are designated as assessed elements are scanned. This means that the party performing the analysis will normally not report, optimise or resolve any limit violations for elements that are not designated as assessed elements. This is designed in this way in order to provide more flexibility to the remedial action optimisation engines eventually helping to minimise computational effort and increase performance.

2 Application profile specification

2.1 Version information

The content is generated from UML model file CIM17-2_CGMES31v01_PROF-20v02_NC23v66_MS10v01_DES10v01.eap.

This edition is based on the IEC 61970 UML version ‘IEC61970CIM17v40’, dated ‘2020-08-24’.

- Title: Assessed Element Vocabulary
- Keyword: AE
- Description: This vocabulary is describing the aseessed element profile.
- Version IRI: https://ap-voc.cim4.eu/AssessedElement/2.3
- Version info: 2.3.1
- Prior version: http://entsoe.eu/ns/CIM/AssessedElement-EU/2.2
- Conforms to: urn:iso:std:iec:61970-600-2:ed-1|urn:iso:std:iec:61970-301:ed-7:amd1|file://iec61970cim17v40_iec61968cim13v13a_iec62325cim03v17a.eap|urn:iso:std:iec:61970-401:draft:ed-1|urn:iso:std:iec:61970-501:draft:ed-2|file://CIM100_CGMES31v01_501-20v02_NC23v62_MM10v01.eap
- Identifier: urn:uuid:a2de1738-214d-4552-b894-5b33cbc34218

2.2 Constraints naming convention

The naming of the rules shall not be used for machine processing. The rule names are just a string. The naming convention of the constraints is as follows.

“{rule.Type}:{rule.Standard}:{rule.Profile}:{rule.Property}:{rule.Name}”

[1] [SOURCE: 2019 Inter-RSC report, BRS CAS consistency function, 4.1]

where

rule.Type: C – for constraint; R – for requirement

rule.Standard: the number of the standard e.g. 301 for 61970-301, 456 for 61970-456, 13 for 61968-13. 61970-600 specific constraints refer to 600 although they are related to one or combination of the 61970-450 series profiles. For NC profiles, NC is used.

rule.Profile: the abbreviation of the profile, e.g. TP for Topology profile. If set to “ALL” the constraint is applicable to all IEC 61970-600 profiles.

rule.Property: for UML classes, the name of the class, for attributes and associations, the name of the class and attribute or association end, e.g. EnergyConsumer, IdentifiedObject.name, etc. If set to “NA” the property is not applicable to a specific UML element.

rule.Name: the name of the rule. It is unique for the same property.

Example: C:600:ALL:IdentifiedObject.name:stringLength

2.3 Profile constraints

This clause defines requirements and constraints that shall be fulfilled by applications that conform to this document.

This document is the master for rules and constraints tagged "NC". For the sake of self-containment, the list below also includes a copy of the relevant rules from IEC 61970-452, tagged "452".

- C:452:ALL:NA:datatypes

  According to 61970-501, datatypes are not exchanged in the instance data. The UnitMultiplier is 1 in cases none value is specified in the profile.

- R:452:ALL:NA:exchange

  Optional and required attributes and associations must be imported and exported if they are in the model file prior to import.

- R:452:ALL:NA:exchange1

  If an optional attribute does not exist in the imported file, it does not have to be exported in case exactly the same data set is exported, i.e. the tool is not obliged to automatically provide this attribute. If the export is resulting from an action by the user performed after the import, e.g. data processing or model update the export can contain optional attributes.

- R:452:ALL:NA:exchange2

  In most of the profiles the selection of optional and required attributes is made so as to ensure a minimum set of required attributes without which the exchange does not fulfil its basic purpose. Business processes governing different exchanges can require mandatory exchange of certain optional attributes or associations. Optional and required attributes and associations shall therefore be supported by applications which claim conformance with certain functionalities of the IEC 61970-452. This provides flexibility for the business processes to adapt to different business requirements and base the exchanges on IEC 61970-452 compliant applications.

- R:452:ALL:NA:exchange3

An exporter may, at his or her discretion, produce a serialization containing additional class data described by the CIM Schema but not required by this document provided these data adhere to the conventions established in Clause 5.

- R:452:ALL:NA:exchange4

From the standpoint of the model import used by a data recipient, the document describes a subset of the CIM that importing software shall be able to interpret in order to import exported models. Data providers are free to exceed the minimum requirements described herein as long as their resulting data files are compliant with the CIM Schema and the conventions established in Clause 5. The document, therefore, describes additional classes and class data that, although not required, exporters will, in all likelihood, choose to include in their data files. The additional classes and data are labelled as required (cardinality 1..1) or as optional (cardinality 0..1) to distinguish them from their required counterparts. Please note, however, that data importers could potentially receive data containing instances of any and all classes described by the CIM Schema.

- R:452:ALL:NA:cardinality

The cardinality defined in the CIM model shall be followed, unless a more restrictive cardinality is explicitly defined in this document. For instance, the cardinality on the association between VoltageLevel and BaseVoltage indicates that a VoltageLevel shall be associated with one and only one BaseVoltage, but a BaseVoltage can be associated with zero to many VoltageLevels.

- R:452:ALL:NA:associations

Associations between classes referenced in this document and classes not referenced here are not required regardless of cardinality.

- R:452:ALL:IdentifiedObject.name:rule

The attribute “name” inherited by many classes from the abstract class IdentifiedObject is not required to be unique. It must be a human readable identifier without additional embedded information that would need to be parsed. The attribute is used for purposes such as User Interface and data exchange debugging. The MRID defined in the data exchange format is the only unique and persistent identifier used for this data exchange. The attribute IdentifiedObject.name is, however, always required for CoreEquipment profile and Short Circuit profile.

- R:452:ALL:IdentifiedObject.description:rule

The attribute “description” inherited by many classes from the abstract class IdentifiedObject must contain human readable text without additional embedded information that would need to be parsed.

- R:452:ALL:NA:uniqueIdentifier

All IdentifiedObject-s shall have a persistent and globally unique identifier (Master Resource Identifier - mRID).

- R:452:ALL:NA:unitMultiplier

For exchange of attributes defined using CIM Data Types (ActivePower, Susceptance, etc.) a unit multiplier of 1 is used if the UnitMultiplier specified in this document is “none”.

- C:452:ALL:IdentifiedObject.name:stringLength

The string IdentifiedObject.name has a maximum of 128 characters.

- C:452:ALL:IdentifiedObject.description:stringLength

The string IdentifiedObject.description is maximum 256 characters.

- C:452:ALL:NA:float

An attribute that is defined as float (e.g. has a type Float or a type which is a Datatype with .value attribute of type Float) shall support ISO/IEC 60559:2020 for floating-point arithmetic using single precision floating point. A single precision float supports 7 significant digits where the significant digits are described as an integer, or a decimal number with 6 decimal digits. Two float values are equal when the significant with 7 digits are identical, e.g. 1234567 is equal 1.234567E6 and so are 1.2345678 and 1.234567E0.

- R:NC:ALL:Region:reference

The reference to the Region is normally a reference to the capacity calculation region, which is identified by “Y” EIC code of the capacity calculation region.

- R:NC:ALL:SystemOperator:reference

The reference to the System Operator is normally identified by “X” EIC code of TSO.

- R:NC:AE:AssessedElement:usage

All elements that need to be scanned for a base case or contingencies shall be explicitly defined. If not specified otherwise in another document, an application that performs contingency analysis will only report violations that occur on an assessed element and will not report any other violations on elements that have operational limits defined, but the object in the equipment is not designated as an AssessedElement. Therefore, the choice which equipment is scanned shall be made considering multiple factors among which the probability of missing potential violations and the performance of the contingency analysis.

- C:NC:AE:AssessedElement:associations

An AssessedElement shall have at least one of the following association ends instantiated: AssessedElement.ConductingEquipment, AssessedElement.OperationalLimit, AssessedElement.DCTieCorridor, AssessedElement.AssessedPowerTransferCorridor, AssessedElement.Line.

- R:NC:AE: AssessedElement:danglingAssociations

Due to the nature of the exchange and requirements it is allowed that the associations AssessedElement.ConductingEquipment, AssessedElement.OperationalLimit, AssessedElement.DCTieCorridor, AssessedElement.AssessedPowerTransferCorridor, AssessedElement.Line provide a dangling reference. This occurs when the referenced element is in another MAS. Validation of these associations is only performed when all dangling references are completed.

- R:NC:ALL:NA:serialization

The profiles are defined in the EnterpriseArchitect application and have multiple artifacts that describe them. The main artifacts are:

1) the EAP file (EnterpriseArchitect project file),
2) the profiles’ specification document and

3) the application profiles (RDFS and SHACL).

Due to the complexity of the profiles, there are various cross profile associations that, from profiling and profile maintenance point of view, it is not practical to include the complete inheritance structure in all profiles. If this is done the documentation provided for all profiles would also include duplicated information on the description of classes defined in other profiles. The following cases are often observed in profiles:

- Case 1: An association end refers to an abstract class
- Case 2: An abstract class (stereotyped with “Description”) has an association (direction to another class)
- Case 3: An abstract class (not stereotyped with “Description”) has an association (direction to another class)
- Case 4: An abstract class has attributes and subclasses are not in the profile

In all cases, the datasets shall only include the subtypes of the abstract classes with the related properties (i.e. association or attributes) defined in the profile. The information is taken from either canonical model or the profiles where complete (expected) inheritance structure for the related abstract class is described. SHACL based constraints include constraints only for the concrete classes that are subtypes of the abstract class in the profile, and this can be used to inform which are the concrete classes expected in a dataset that conforms to this profile.

It should be taken into account that this approach deviates from MVAL5 (IEC 61970-600-1:2021), which creates multiple inheritance at serialization. For instance, with this more explicit exchange the serialization of the association between abstract class Equipment and abstract class Circuit for a PowerTransformer will be serialized as follows:

- for association

```
<cim:PowerTransformer rdf:about="_c328f787-bc17-47ad-a59f-6ba7133340d0">
  <nc:Equipment.Circut rdf:resource="#_9ced16ac-d076-4ef9-a241-a998a579e77b"/>
</cim:PowerTransformer>
```

- for attribute

```
<cim:ACLineSegment rdf:about="_04f681aa-6999-4fb3-9775-acaa5eb7ceff">
  <cim:Equipment.inService>true</cim:Equipment.inService>
</cim:ACLineSegment>
```

The usage of rdf:ID or rdf:about depends on the stereotype of the class. rdf:about is used if the class has the stereotype “Description”.

An example of not allowed serialization, as the Equipment is an abstract class

```
<cim:Equipment rdf:about="_c328f787-bc17-47ad-a59f-6ba7133340d0">
  <nc:Equipment.Circut rdf:resource="#_9ced16ac-d076-4ef9-a241-a998a579e77b"/>
</cim:Equipment>
```

- C:NC:AE:AssessedElementWithContingency.combinationConstraintKind:allowedValues

ElementCombinationConstraintKind.considered is not allowed value for the attribute AssessedElementWithContingency.combinationConstraintKind.

2.4 Metadata

ENTSO-E agreed to extend the header and metadata definitions by IEC 61970-552 Ed2. This new header definitions rely on W3C recommendations which are used worldwide and are positively recognised by the European Commission. The new definitions of the header mainly use Provenance ontology (PROV-O), Time Ontology and Data Catalog Vocabulary (DCAT). The global new header applicable for this profile is included in the metadata and document header specification document.

The header vocabulary contains all attributes defined in IEC 61970-552. This is done only for the purpose of having one vocabulary for header and to ensure transition for data exchanges that are using IEC 61970-552:2016 header. This profile does not use IEC 61970-552:2016 header attributes and relies only on the extended attributes.

2.4.1 Constraints

The identification of the constraints related to the metadata follows the same convention for naming of the constraints as for profile constraints.

- R:NC:ALL:wasAttributedTo:usage

  The prov:wasAttributedTo should normally be the “X” EIC code of the actor or their URI (prov:Agent).

2.4.2 Reference metadata

The header defined for this profile requires availability of a set of reference metadata. For instance, the attribute prov:wasGeneratedBy requires a reference to an activity which produced the model or the related process. The activities are defined as reference metadata and their identifiers are referenced from the header to enable the receiving entity to retrieve the “static” (reference) information that it is not modified frequently. This approach imposes a requirement that both the sending entity and the receiving entity have access to a unique version of the reference metadata. Therefore, each business process shall define which reference metadata is used and where it is located.

3 Detailed Profile Specification

3.1 General

This package contains assessed element profile.

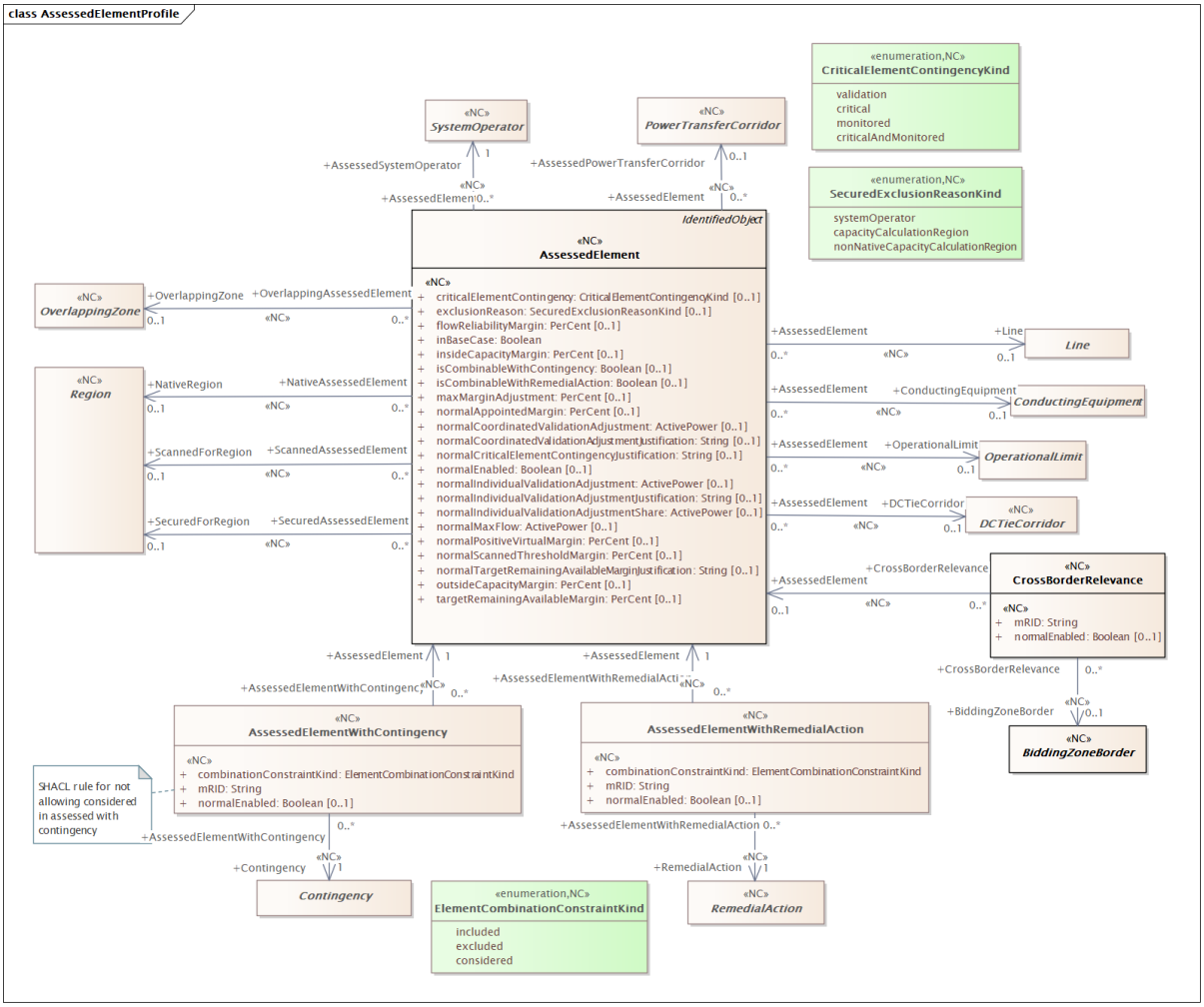

Figure 1 – Class diagram AssessedElementProfile::AssessedElementProfile

Figure 1: The diagram contains the main classes used in the profile.

3.2 (abstract) Line root class

Contains equipment beyond a substation belonging to a power transmission line.

3.3 (abstract,NC) BiddingZoneBorder root class

Defines the aggregated connection capacity between two Bidding Zones.

3.4 (NC) CrossBorderRelevance root class

Combination of an assessed element and a bidding zone border.
Table 1 shows all attributes of CrossBorderRelevance.

Table 1 – Attributes of AssessedElementProfile::CrossBorderRelevance

name	mult	type	description
mRID	1..1	String	(NC) Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID

name	mult	type	description
			or rdf:about attributes that identify CIM object elements.
normalEnabled	0..1	Boolean	(NC) If true, the cross border relevance shall be considered under normal operating conditions.

Table 2 shows all association ends of CrossBorderRelevance with other classes.

Table 2 – Association ends of AssessedElementProfile::CrossBorderRelevance with other classes

mult from	name	mult to	type	description
0..*	BiddingZoneBorder	0..1	BiddingZoneBorder	(NC) Bidding zone border relevant for this combination.
0..*	AssessedElement	0..1	AssessedElement	(NC) Assessed element which is cross border relevant.

3.5 (NC) AssessedElement

Inheritance path = IdentifiedObject

Assessed element is a network element for which the electrical state is evaluated in the regional or cross-regional process and which value is expected to fulfil regional rules function of the operational security limits.

The measurements and limits are as defined in the steady state hypothesis.

Table 3 shows all attributes of AssessedElement.

Table 3 – Attributes of AssessedElementProfile::AssessedElement

name	mult	type	description
inBaseCase	1..1	Boolean	(NC) Indicates if the assessed element is scanned in the base case. In case of a base case overload, the assessed element is considered as a limiting element for the optimization process. True means that the assessed element is scanned in the base case. False means it is not scanned in the base case.
insideCapacityMargin	0..1	PerCent	(NC) Percentage of the maximum flow (margin) from coordinated capacity calculation, i.e. capacity available for cross-zonal trade within the considered coordination area. The allowed value range is [0,100].
outsideCapacityMargin	0..1	PerCent	(NC) Percentage of the maximum flow (margin) capacity calculation, i.e. the capacity available for cross-zonal trade outside the considered coordination area. The allowed value range is [0,100].
criticalElementContingency	0..1	CriticalElementContingencyKind	(NC) Indicates the type of the critical element contingency.
maxMarginAdjustment	0..1	PerCent	(NC) Maximum adjustment, relative to maximum flow allowed for exceeding the maximum flow of this assessed element. The allowed value range is [0,100].
flowReliabilityMargin	0..1	PerCent	(NC) Percentage of the maximum flow (margin) reserved to anticipate forecasting errors. The allowed value range is [0,100].

name	mult	type	description
targetRemainingAvailableMargin	0..1	PerCent	(NC) Target for the remaining available margin as a percentage of maximum flow. The allowed value range is [0,100].
normalEnabled	0..1	Boolean	(NC) If true, the assessed element shall be considered under normal operating conditions.
normalMaxFlow	0..1	ActivePower	(NC) Maximum flow on a conducting equipment or a collection of conducting equipment forming a power transfer corridor under normal operating conditions. For assessed elements that become critical due to contingency, this value represents the maximum flow with remedial action taken into consideration.
normalAppointedMargin	0..1	PerCent	(NC) The normal percentage (appointed to a region) of the remaining margin obtained in the grid model to reach its current limit under normal operating conditions. The maximum percentage shall by default be 10% of the remaining margin. It is only used when an assessed element is considered conservative for a region. The allowed value range is [0,100].
normalPositiveVirtualMargin	0..1	PerCent	(NC) A positive margin that defines the overload allowed in a solution for the assessed element for a normal situation. The margin represents influences that can be solved by the System Operators using available remedial action which is not cross-border relevant remedial action. All relevant operational limits (e.g. PATL, TATL, etc) are modified by this margin value. The attribute represents the increase. The allowed value range is [0,100].
exclusionReason	0..1	SecuredExclusionReasonKind	(NC) Reason for not associating this assessed element with a secured region.
isCombinableWithRemedialAction	0..1	Boolean	(NC) Defines if the AssessedElement is available to be combined with RemedialAction. If true, this AssessedElement can be included in various combinations not defined in the data exchange in an explicit way. If false, this assessed element is not to be considered in any combination with remedial actions and contingencies except for the exclusive combination.
isCombinableWithContingency	0..1	Boolean	(NC) Defines if the AssessedElement is available to be combined with Contingency. If true, this AssessedElement can be included in various combinations not defined in the data exchange in an explicit way. If false, this assessed element is not to be considered in any combination with remedial actions and contingencies except for the exclusive combination.
normalScannedThresholdMargin	0..1	PerCent	(NC) Normal threshold percentage that a scanned element can be overloaded, on a given element, on top of any overload prior to optimisation (default= 5%). e.g. Initial loading of the element is 110%, with a 5% scanned threshold margin, the new maximum is 115% of the limit (e.g. PATL, TATL, etc). The allowed value range is [0,100].
normalIndividualValidationAdjustment	0..1	ActivePower	(NC) Normal positive value calculated and provided by System Operators from their individual validation process for the reduction of Remaining Available Margin (RAM) in order to ensure grid security.

name	mult	type	description
normalCoordinatedValidationAdjustment	0..1	ActivePower	(NC) Normal positive value calculated and provided by the Coordinated Capacity Calculator (CCC) for the reduction of Remaining Available Margin (RAM) in order to ensure grid security.
normalIndividualValidationAdjustmentShare	0..1	ActivePower	(NC) Normal positive value expressed calculated by the Coordinated Capacity Calculator (CCC) based on the provided Individual Validation Adjustment (IVA) by System Operators in order to show the actual reduction of Remaining Available Margin (RAM). Individual Validation Adjustment Share is a positive non-zero value. It is equal or less than the Individual Validation Adjustment value.
normalIndividualValidationAdjustmentJustification	0..1	String	(NC) Normal free text description provided by System Operators for justifying the reduction of Remaining Available Margin (RAM) by means of Individual Validation Adjustment (IVA). This justification is not intended for any application processing purpose, it should only be used for reporting.
normalCoordinatedValidationAdjustmentJustification	0..1	String	(NC) Normal free text description provided by the coordinated capacity calculator (CCC) for justifying the reduction of Remaining Available Margin (RAM) by means of Coordinated Validation Adjustment (CVA). This justification is not intended for any application processing purpose, it should only be used for reporting.
normalCriticalElementContingencyJustification	0..1	String	(NC) Normal free text describing the justification of critical element contingency categorization (e.g. the use of the kind). This justification is not intended for any application processing purpose, it should only be used for reporting.
normalTargetRemainingAvailableMarginJustification	0..1	String	(NC) Normal free text describing the justification for the target Remaining Available Margin (RAM). This justification is not intended for any application processing purpose, it should only be used for reporting.
description	0..1	String	inherited from: IdentifiedObject
mRID	1..1	String	inherited from: IdentifiedObject
name	0..1	String	inherited from: IdentifiedObject

Table 4 shows all association ends of AssessedElement with other classes.

Table 4 – Association ends of AssessedElementProfile::AssessedElement with other classes

mult from	name	mult to	type	description
0..*	NativeRegion	0..1	Region	(NC) The native region for an assessed element.
0..*	AssessedSystemOperator	1..1	SystemOperator	(NC) A system operator that assesses the element.
0..*	ScannedForRegion	0..1	Region	(NC) This is the region in which this assessed element is scanned.
0..*	ConductingEquipment	0..1	ConductingEquipment	(NC) The conducting equipment that is designated as an assessed element, i.e. the equipment that is assessed.
0..*	SecuredForRegion	0..1	Region	(NC) This is the region where the element is secured.

mult from	name	mult to	type	description
0..*	Line	0..1	Line	(NC) The line that is designated as an assessed element, i.e. the equipment that is assessed.
0..*	AssessedPowerTransferCorridor	0..1	PowerTransferCorridor	(NC) The power transfer corridor that is designated as an assessed element.
0..*	OverlappingZone	0..1	OverlappingZone	(NC) The overlapping zone grouping the overlapping assessed elements.
0..*	DCTieCorridor	0..1	DCTieCorridor	(NC) The DC tie corridor that is assessed.
0..*	OperationalLimit	0..1	OperationalLimit	(NC) The terminal limit that is being assessed against.

3.6 (NC) AssessedElementWithContingency root class

Combination of an assessed element and a contingency.

Table 5 shows all attributes of AssessedElementWithContingency.

Table 5 – Attributes of AssessedElementProfile::AssessedElementWithContingency

name	mult	type	description
mRID	1..1	String	(NC) Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.
combinationConstraintKind	1..1	ElementCombinationConstraintKind	(NC) Defines the combination constraint of the AssessedElement and Contingency. If included, this assessed element is only assessed for this contingency. Else if excluded, this assessed element should not be assessed for this contingency. Considered shall not be used for this combination.
normalEnabled	0..1	Boolean	(NC) If true, the assessed element with contingency is enabled, otherwise it is disabled under normal operating conditions.

Table 6 shows all association ends of AssessedElementWithContingency with other classes.

Table 6 – Association ends of AssessedElementProfile::AssessedElementWithContingency with other classes

mult from	name	mult to	type	description
0..*	AssessedElement	1..1	AssessedElement	(NC) The assessed element defined for this contingency and assessed element combination.
0..*	Contingency	1..1	Contingency	(NC) The contingency defined for this contingency and assessed element combination.

3.7 (NC) AssessedElementWithRemedialAction root class

Combination of an assessed element and a remedial action

Table 7 shows all attributes of AssessedElementWithRemedialAction.

Table 7 – Attributes of AssessedElementProfile::AssessedElementWithRemedialAction

name	mult	type	description
mRID	1..1	String	(NC) Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.
combinationConstraintKind	1..1	ElementCombinationConstraintKind	(NC) Defines the combination constraint of the AssessedElement and Remedial Action. If included, this remedial action is only assessed for this assessed element. Else if excluded, this remedial action should not be used for this assessed element. Else if considered, this remedial action can be considered for this assessed element.
normalEnabled	0..1	Boolean	(NC) If true, the assessed element with remedial action is enabled, otherwise it is disabled under normal operating conditions.

Table 8 shows all association ends of AssessedElementWithRemedialAction with other classes.

Table 8 – Association ends of AssessedElementProfile::AssessedElementWithRemedialAction with other classes

mult from	name	mult to	type	description
0..*	AssessedElement	1..1	AssessedElement	(NC) The assessed element defined for this assessed element and remedial action combination.
0..*	RemedialAction	1..1	RemedialAction	(NC) The remedial action defined for this assessed element and remedial action combination.

3.8 (abstract) ConductingEquipment root class

The parts of the AC power system that are designed to carry current or that are conductively connected through terminals.

3.9 (abstract) Contingency root class

An event threatening system reliability, consisting of one or more contingency elements.

3.10 (abstract,NC) DCTieCorridor root class

A collection of one or more direct current poles that connect two different control areas.

3.11 (abstract) IdentifiedObject root class

This is a root class to provide common identification for all classes needing identification and naming attributes.
Table 9 shows all attributes of IdentifiedObject.

398 **Table 9 – Attributes of AssessedElementProfile::IdentifiedObject**

name	mult	type	description
description	0..1	String	The description is a free human readable text describing or naming the object. It may be non unique and may not correlate to a naming hierarchy.
mRID	1..1	String	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.
name	0..1	String	The name is any free human readable and possibly non unique text naming the object.

399

400 ### 3.12 (abstract) OperationalLimit root class

401 A value and normal value associated with a specific kind of limit.
402 The sub class value and normalValue attributes vary inversely to the associated
403 OperationalLimitType.acceptableDuration (acceptableDuration for short).
404 If a particular piece of equipment has multiple operational limits of the same kind (apparent
405 power, current, etc.), the limit with the greatest acceptableDuration shall have the smallest limit
406 value and the limit with the smallest acceptableDuration shall have the largest limit value. Note:
407 A large current can only be allowed to flow through a piece of equipment for a short duration
408 without causing damage, but a lesser current can be allowed to flow for a longer duration.

409 ### 3.13 (abstract,NC) OverlappingZone root class

410 A collection of all the overlapping cross border assessed elements which have the same sets
411 of impacted and impacting regions.

412 ### 3.14 (abstract,NC) PowerTransferCorridor root class

413 A power transfer corridor is defined as a set of circuits (transmission lines or transformers)
414 separating two portions of the power system, or a subset of circuits exposed to a substantial
415 portion of the transmission exchange between two parts of the system.

416 ### 3.15 (abstract,NC) Region root class

417 A region where the system operator belongs to.

418 ### 3.16 (abstract,NC) RemedialAction root class

419 Remedial action describes one or more actions that can be performed on a given power system
420 model situation to eliminate one or more identified breaches of constraints. The remedial action
421 can be costly, and have a cost characteristic, or non costly.

422 ### 3.17 (abstract,NC) SystemOperator root class

423 System operator.

424 ### 3.18 (NC) SecuredExclusionReasonKind enumeration

425 The kind of secured exclusion reason.
426 Table 10 shows all literals of SecuredExclusionReasonKind.

Table 10 – Literals of AssessedElementProfile::SecuredExclusionReasonKind

literal	value	description
systemOperator		The network element that is going to be assessed is excluded for being secured by the system operator.
capacityCalculationRegion		The network element that is going to be assessed is excluded for being secured by the capacity calculation region.
nonNativeCapacityCalculationRegion		The network element that is going to be assessed is excluded for being secured for the native capacity calculation region since it would be secured for a non native capacity calculation region.

3.19 (NC) ElementCombinationConstraintKind enumeration

Kind of constraint for an element combination.
Table 11 shows all literals of ElementCombinationConstraintKind.

Table 11 – Literals of AssessedElementProfile::ElementCombinationConstraintKind

literal	value	description
included		Element combination is included.
excluded		Element combination is excluded.
considered		Element combination can be considered.

3.20 (NC) CriticalElementContingencyKind enumeration

The kind of critical element contingency.
Table 12 shows all literals of CriticalElementContingencyKind.

Table 12 – Literals of AssessedElementProfile::CriticalElementContingencyKind

literal	value	description
validation		Network element should be assessed according to the methodology.
critical		Network element is considered to be critical according to the methodology.
monitored		Network element is considered to be monitored under contingency.
criticalAndMonitored		Network element is considered to be Critical Network Element monitored under Contingency (CNEC).

3.21 UnitMultiplier enumeration

The unit multipliers defined for the CIM. When applied to unit symbols, the unit symbol is treated as a derived unit. Regardless of the contents of the unit symbol text, the unit symbol shall be treated as if it were a single-character unit symbol. Unit symbols should not contain multipliers, and it should be left to the multiplier to define the multiple for an entire data type. For example, if a unit symbol is "m2Pers" and the multiplier is "k", then the value is k(m**2/s), and the multiplier applies to the entire final value, not to any individual part of the value. This can be conceptualized by substituting a derived unit symbol for the unit type. If one imagines that the symbol "Þ" represents the derived unit "m2Pers", then applying the multiplier "k" can be conceptualized simply as "kÞ".

For example, the SI unit for mass is "kg" and not "g". If the unit symbol is defined as "kg", then the multiplier is applied to "kg" as a whole and does not replace the "k" in front of the "g". In this case, the multiplier of "m" would be used with the unit symbol of "kg" to represent one gram. As a text string, this violates the instructions in IEC 80000-1. However, because the unit symbol in CIM is treated as a derived unit instead of as an SI unit, it makes more sense to conceptualize the "kg" as if it were replaced by one of the proposed replacements for the SI mass symbol. If one imagines that the "kg" were replaced by a symbol "Þ", then it is easier to conceptualize the multiplier "m" as creating the proper unit "mÞ", and not the forbidden unit "mkg".
Table 13 shows all literals of UnitMultiplier.

Table 13 – Literals of AssessedElementProfile::UnitMultiplier

literal	value	description
none	0	No multiplier or equivalently multiply by 1.
M	6	Mega 10**6.

3.22 UnitSymbol enumeration

The derived units defined for usage in the CIM. In some cases, the derived unit is equal to an SI unit. Whenever possible, the standard derived symbol is used instead of the formula for the derived unit. For example, the unit symbol Farad is defined as "F" instead of "CPerV". In cases where a standard symbol does not exist for a derived unit, the formula for the unit is used as the unit symbol. For example, density does not have a standard symbol and so it is represented as "kgPerm3". With the exception of the "kg", which is an SI unit, the unit symbols do not contain multipliers and therefore represent the base derived unit to which a multiplier can be applied as a whole.
Every unit symbol is treated as an unparseable text as if it were a single-letter symbol. The meaning of each unit symbol is defined by the accompanying descriptive text and not by the text contents of the unit symbol.
To allow the widest possible range of serializations without requiring special character handling, several substitutions are made which deviate from the format described in IEC 80000-1. The division symbol "/" is replaced by the letters "Per". Exponents are written in plain text after the unit as "m3" instead of being formatted as "m" with a superscript of 3 or introducing a symbol as in "m^3". The degree symbol "°" is replaced with the letters "deg". Any clarification of the meaning for a substitution is included in the description for the unit symbol.
Non-SI units are included in list of unit symbols to allow sources of data to be correctly labelled with their non-SI units (for example, a GPS sensor that is reporting numbers that represent feet instead of meters). This allows software to use the unit symbol information correctly convert and scale the raw data of those sources into SI-based units.
The integer values are used for harmonization with IEC 61850.
Table 14 shows all literals of UnitSymbol.

Table 14 – Literals of AssessedElementProfile::UnitSymbol

literal	value	description
none	0	Dimension less quantity, e.g. count, per unit, etc.
W	38	Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I^2R or VIcos(phi)), is expressed in Watts. See also apparent power and reactive power.

3.23 ActivePower datatype

Product of RMS value of the voltage and the RMS value of the in-phase component of the current.
Table 15 shows all attributes of ActivePower.

Table 15 – Attributes of AssessedElementProfile::ActivePower

name	mult	type	description
multiplier	0..1	UnitMultiplier	(const=M)
unit	0..1	UnitSymbol	(const=W)
value	0..1	Float	

3.24 PerCent datatype

Percentage on a defined base. For example, specify as 100 to indicate at the defined base. Table 16 shows all attributes of PerCent.

Table 16 – Attributes of AssessedElementProfile::PerCent

name	mult	type	description
value	0..1	Float	Normally 0 to 100 on a defined base.
unit	0..1	UnitSymbol	(const=none)
multiplier	0..1	UnitMultiplier	(const=none)

3.25 String primitive

A string consisting of a sequence of characters. The character encoding is UTF-8. The string length is unspecified and unlimited.

3.26 Boolean primitive

A type with the value space "true" and "false".

3.27 Float primitive

A floating point number. The range is unspecified and not limited.

Annex A (informative): Sample data

A.1 General

This Annex is designed to illustrate the profile by using fragments of sample data. It is not meant to be a complete set of examples covering all possibilities of using the profile. Defining a complete set of test data is considered a separate activity to be performed for the purpose of setting up interoperability testing and conformity related to this profile.

A.2 Sample instance data

Test data files are available in the CIM EG SharePoint.