European Network of
Transmission System Operators
for Electricity

Test Use Cases

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Conformity Assessment Process on the CGMES

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1. Introduction

The document is describing test use cases applicable for the ENTSO-E Common Grid Model Exchange Standard (CGMES) Conformity Assessment Framework hereafter referred as "the Framework". These test use cases can also be used for other tests outside the Framework.
The test use cases are used in the processes to issue a Declaration of Conformity of an Application or in the processes to assess an Application for the purpose of issuing an Attestation of Conformity.

2. Test Use Cases (TUC)

The test use cases defined in the document do not necessarily reflect how the business processes are using data exchange functionalities defined in the CGMES. For the purpose of documentation the test use cases are grouped in three main categories:

- Import category (TUC 1 to TUC 12)
- Export category (TUC 13 to TUC 24)
- Functional category (TUC 25 to TUC 46)

For each TUC a sequence of actions to be executed in order to cover a TUC is defined. The details of the individual test steps (TS) are described in detail in the Test Definitions and Results Report spreadsheet.

2.1. TUC 1: Import of Boundary Set instance data

A. Description

The exchange of a Boundary Set is necessary to prepare an exchange of an internal TSO model and assemble a common grid model. The import of a Boundary Set is used by:

- ENTSO-E systems that are managing the boundary information for TSO exchanges and providing TSOs with the Boundary Set;
- TSOs when importing an assembled model;
- TSOs when interfacing with DSOs and need to import a Boundary Set.

Specific CGMES references: CGMES-C4.5.7, C4.5.8, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import an EQ_BD and a TP_BD instance files.

2.2. TUC 2: Import of Equipment profile instance data

A. Description

The use case is used when it is necessary to import an EQ instance file for the purpose of an exchange. An EQ instance file could be exchanged separately or as a part of an assembled model. The correct import of an Equipment Profile instance data file is necessary to prepare a common grid model or for proper modelling of different parties' networks.
This test use case covers that cases in which the equipment instance file contains equipment operation and/or equipment short circuit parts of the equipment profile.
Specific CGMES references: CGMES-C4.5.3, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import an EQ instance file.

2.3. TUC 3: Import of Topology profile instance data

A. Description

This use case is used during partial exchange, i.e. exchange only of TP instance file. The TP instance files can also be exchanged as a part of assembled model.
The correct import of a Topology Profile instance data file is necessary to prepare a grid model or for proper modelling of different parties' networks.

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Specific CGMES references: CGMES-C4.5.4, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import a TP instance file.

2.4. TUC 4: Import of Steady State Hypothesis profile instance data

A. Description

The import of the steady state hypothesis (SSH) is used to complete the model by providing necessary parameters (load, generation, reference voltages, tap positions, etc.) – input for load flow calculation. The import of the SSH is used when:

- it is necessary exchange data for performing load flow calculation;
- it is necessary to define different SSH on an equipment model;
- assembled model is imported.

Specific CGMES references: CGMES-C4.5.5, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import a SSH instance file.

2.5. TUC 5: Import of State Variables profile instance data

A. Description

The import of state variables (SV) use case is used when parties are exchanging information resulting from a load flow calculation. The SV could be exchanged separately and as a part of an assembled model.

The import of the SV is used to complete the model by providing load flow solution (voltage values, tap positions, reactive power values, etc.). It is used when:

- importing a solved model for an individual MAS or an assembled model;
- it is necessary to compare (without performing a load flow calculation) load flow solutions produced by different tools.

Specific CGMES references: CGMES-C4.5.6, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import the SV instance file.

2.6. TUC 6: Import of Dynamics profile instance data

A. Description

The import of the dynamics instance file (DY) is used to supply parameters necessary for dynamics simulations. The import of the DY is used when importing a dynamics model for an individual MAS or an assembled model.

Specific CGMES references: CGMES-C4.5.9, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import a DY instance file.

2.7. TUC 7: Import of Diagram Layout profile instance data

A. Description

The import of the diagram layout instance file (DL) is used to supply diagram related information enabling tools to construct a diagram on a network model. The import of the DL is used when it is necessary to import and construct a diagram for an individual MAS or an assembled model.

Specific CGMES references: CGMES-C4.5.10, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import a DL instance file.

2.8. TUC 8: Import of Geographical Location profile instance data

A. Description

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The import of the geographical location instance file (GL) is used to supply GIS related information enabling tools to construct a diagram on a network model linked with a geographical map. The import of the GL is used when it is necessary to import and construct a diagram (geographical map) for an individual MAS or an assembled model.
Specific CGMES references: CGMES-C4.5.11, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import a GL instance file.

2.9. TUC 9: Import of multiple profiles instance data

A. Description

The import of multiple profiles instance data is necessary to allow any data exchange of a new model or an update of a model which is part of different profiles. It is used when:

- ENTSO-E systems are receiving an unsolved or solved model for a MAS or for an assembled model;
- TSOs are importing their individual models or an assembled model.

Specific CGMES references: CGMES-C4.6, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved MAS.
2) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent unsolved MAS (e.g. SV instance file not included in the import).

2.10. TUC 10: Import of difference instance data of a profile

A. Description

The use case is applied during the exchange of difference instance files. This is necessary when updating an individual MAS and assembled model.
Specific CGMES references: CGMES-[R.4.6.7]

B. Sequence 1

1) TS 1 (Import of instance data belonging to a profile) is used to import an instance data to be used as a baseline for the import of a difference instance data.
2) TS 1 (Import of instance data belonging to a profile) is used to import a difference instance data.

2.11. TUC 11: Import of a set of difference instance data belonging to multiple profiles

A. Description

The use case is applied during the exchange of difference instance files. This is necessary when updating an individual MAS and assembled model.
Specific CGMES references: CGMES-[R.4.6.7]

B. Sequence 1

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved MAS.
2) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains difference instance data of more than one profile.

2.12. TUC 12: Import of an assembled model

A. Description

The use case is used to support studies between multiple parties, i.e. between different Applications. The content of the model could be different depending on the purpose of the analyses.

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Specific CGMES references: CGMES-C4.8, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an assembled model.

2.13. TUC 13: Export of Boundary Set instance data

A. Description

The exchange of a Boundary Set is necessary to prepare an exchange of an internal TSO model and assemble a common grid model. The export of a Boundary Set is used by:

- ENTSO-E systems that are managing the boundary information for TSO exchanges and providing TSOs with the Boundary Set;
- TSOs when exporting an assembled model;
- TSOs when interfacing with DSOs and need to exchange a Boundary Set.

Specific CGMES references: CGMES-C4.5.7, 4.5.8, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import an EQ_BD and a TP_BD instance files. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export an EQ_BD and a TP_BD instance files.

2.14. TUC 14: Export of Equipment profile instance data

A. Description

The use case is used when it is necessary to export an EQ instance file for the purpose of an exchange. An EQ instance file could be exchanged separately or as a part of an assembled model. The correct export of an Equipment Profile instance data file is necessary to prepare a common grid model or for proper modelling of different parties' networks.

Specific CGMES references: CGMES-C4.5.3, C4.5.1.

B. Sequence

1) TS 1 (Import of instance data belonging to a profile) is used to import an EQ instance file. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export an EQ instance file.

2.15. TUC 15: Export of Topology profile instance data

A. Description

This use case is used during partial exchange, i.e. exchange only of TP instance file. The TP instance files can also be exchanged as a part of assembled model.

The correct export of a Topology Profile instance data file is necessary to prepare a grid model or for proper modelling of different parties' networks.

Specific CGMES references: CGMES-C4.5.4, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent unsolved (e.g. SV instance file not included in the import) or solved MAS. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export a TP instance file.

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2.16. TUC 16: Export of Steady State Hypothesis profile instance data

A. Description

The export of the steady state hypothesis (SSH) is used to complete the model by providing necessary parameters (load, generation, reference voltages, tap positions, etc.) – input for load flow calculation. The export of the SSH is used when:

- it is necessary exchange data for performing load flow calculation;
- it is necessary to define different SSH on an equipment model;
- assembled model is exported.

Specific CGMES references: CGMES-C4.5.5, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent unsolved (e.g. SV instance file not included in the import) or solved MAS. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export a SSH instance file.

2.17. TUC 17: Export of State Variables profile instance data

A. Description

The export of state variables (SV) use case is used when parties are exchanging information resulting from a load flow calculation. The SV could be exchanged separately and as a part of an assembled model.

The export of the SV is used to complete the model by providing load flow solution (voltage values, tap positions, reactive power values, etc.). It is used when:

- exporting a solved model for an individual MAS or an assembled model;
- it is necessary to compare (without performing a load flow calculation) load flow solutions produced by different tools.

Specific CGMES references: CGMES-C4.5.6, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved MAS. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export a SV instance file.

2.18. TUC 18: Export of Dynamics profile instance data

A. Description

The export of the dynamics instance file (DY) is used to supply parameters necessary for dynamics simulations. The export of the DY is used when exporting a dynamics model for an individual MAS or an assembled model.

Specific CGMES references: CGMES-C4.5.9, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved MAS which includes DY data. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export a DY instance file.

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2.19. TUC 19: Export of Diagram Layout profile instance data

A. Description

The export of the diagram layout instance file (DL) is used to supply diagram related information enabling tools to construct a diagram on a network model. The export of the DL is used when it is necessary to export and construct a diagram for an individual MAS or an assembled model.
Specific CGMES references: CGMES-C4.5.10, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved or unsolved (e.g. SV instance file not included in the import) MAS which includes DL data. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export a DL instance file.

2.20. TUC 20: Export of Geographical Location profile instance data

A. Description

The export of the geographical location instance file (GL) is used to supply GIS related information enabling tools to construct a diagram on a network model linked with a geographical map. The export of the GL is used when it is necessary to export a diagram (geographical map) for an individual MAS or an assembled model.
Specific CGMES references: CGMES-C4.5.11, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved or unsolved (e.g. SV instance file not included in the import) MAS which includes GL data. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 3 (Export of instance data belonging to a profile) is used to export a GL instance file.

2.21. TUC 21: Export of multiple profiles instance data

A. Description

The export of multiple profiles instance data is necessary to allow any data exchange of a new model or an update of a model which is part of different profiles. It is used when:

- ENTSO-E systems are packaging an unsolved or solved model for a MAS or for an assembled model;
- TSOs are exporting their individual models or sharing an assembled model that they constructed.

Specific CGMES references: CGMES-C4.6, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved MAS. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 4 (Export of multiple profiles instance data) is used to export a zip file which shall contain instance data of more than one profile. The instance data shall represent unsolved (e.g. SV instance file not included in the export) MAS.
3) TS 4 (Export of multiple profiles instance data) is used to export a zip file which shall contain instance data of more than one profile. The instance data shall represent solved MAS.

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2.22. TUC 22: Export of difference instance file of a profile

A. Description

The use case is applied during the exchange of difference instance files. This is necessary when updating an individual MAS and assembled model.
Specific CGMES references: CGMES-[R.4.6.7].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved or unsolved (e.g. SV instance file not included in the import) MAS. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 5 (Apply a change or set of changes to a model) is used to apply changes to the instance data belonging to one of the profiles.
3) TS 3 (Export of instance data belonging to a profile) is used to export a difference instance data of a profile.

2.23. TUC 23: Export of difference instance files of a set of multiple profiles instance data

A. Description

The use case is applied during the exchange of difference instance files. This is necessary when updating an individual MAS and assembled model.
Specific CGMES references: CGMES-[R.4.6.7].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains instance data of more than one profile. The instance data shall represent solved or unsolved (e.g. SV instance file not included in the import) MAS. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 5 (Apply a change or set of changes to a model) is used to apply changes to the instance data belonging to at least two of the profiles.
3) TS 4 (Export of multiple profiles instance data) is used to export a set of difference instance data of a profile.

2.24. TUC 24: Export of an assembled model

A. Description

The use case is used to support studies between multiple parties, i.e. between different Applications. The content of the model could be different depending on the purpose of the analyses.
Specific CGMES references: CGMES-C4.8, C4.5.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved assembled model. In case the Application is not designed to support import function, this step is skipped and replaced by manual insertion of the data from available test configurations in order to be able to validate the correctness of the export.
2) TS 4 (Export of multiple profiles instance data) is used to export a zip file which shall contain instance data of more than one profile and more than one MAS. The instance data shall represent unsolved assembled model (e.g. SV instance file not included in the export).
3) TS 4 (Export of multiple profiles instance data) is used to export a zip file which shall contain instance data of more than one profile and more than one MAS. The instance data shall represent solved assembled model.

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2.25. TUC 25: Manage boundary set

A. Description

The exchange of a Boundary Set is necessary to prepare an exchange of an internal TSO model and assemble a common grid model. The import of a Boundary Set is used by:

- ENTSO-E systems that are managing the boundary information for TSO exchanges and providing TSOs with the Boundary Set;
- TSOs when importing an assembled model;
- TSOs when interfacing with DSOs and need to import a Boundary Set.

Specific CGMES references: CGMES-C4.5.7, C4.5.8, C4.7.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zipped dataset which includes the boundary profiles (EQ_BD and a TP_BD).
2) TS 1 (Import of instance data belonging to a profile) is used to import a difference file which updates one or more elements in the EQ_BD.
3) TS 5 (Apply a change or set of changes to a model) is used to apply changes to the instance data belonging to TP_BD.
4) TS 4 (Export of multiple profiles instance data) is used to export a zip file which shall contain instance data of an EQ_BD and a TP_BD instance files.
5) TS 4 (Export of multiple profiles instance data) is used to export a zip file which shall contain difference instance data of an EQ_BD and a TP_BD instance files.

2.26. TUC 26: Manage node-breaker level of model representation

A. Description

The use case serves models handling of a node-breaker model used mainly for operational data exchanges where a detail substation configuration is necessary to be shared between parties. It includes the ability to have (or display) such representation in an Application. The Application shall be able to change/modify the information contained in the node-breaker model (considering the dependencies between different profiles - equipment, topology, etc.). The Application shall retain the information of the node-breaker model for further processing.

Specific CGMES references: CGMES-[R.4.1.9], [R.3.2].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved assembled model (e.g. SV instance file not included in the import) which has node-breaker model representation.
2) TS 5 (Apply a change or set of changes to a model) is used to modify information contained in the node-breaker model (considering the dependencies between different profiles - equipment, topology, steady state hypothesis, etc.). Applied changes shall be related to the equipment and topology.
3) TS 4 (Export of multiple profiles instance data) is used to export original instance data of the imported model.
4) TS 4 (Export of multiple profiles instance data) is used to export complete instance data of the imported model including committed modifications.
5) TS 4 (Export of multiple profiles instance data) is used to export all changes by profile in a difference instance data form.

2.27. TUC 27: Manage bus-branch level of model representation

A. Description

The use case serves models handling of a bus-branch model which is mainly used but not limited to long term data exchanges where a detail substation configuration is not necessary to be shared between parties. It

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demonstrates the ability to have (or display) such representation in an Application. The Application shall be able to change/modify the information contained in the bus-branch model (considering the dependencies between different profiles - equipment, topology, etc.). The Application shall retain the information of the bus-branch model.
Specific CGMES references: CGMES-[R.4.1.9], [R.3.3].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved assembled model which has bus-branch model representation.
2) TS 5 (Apply a change or set of changes to a model) is used to modify information contained in the bus-branch model (considering the dependencies between different profiles - equipment, topology, steady state hypothesis, state variables, etc.). Applied changes shall be related to all profiles belonging to the imported instance data.
3) TS 4 (Export of multiple profiles instance data) is used to export original instance data of the imported model.
4) TS 4 (Export of multiple profiles instance data) is used to export complete instance data of the imported model including committed modifications.
5) TS 4 (Export of multiple profiles instance data) is used to export all changes by profile in a difference instance data form.

2.28. TUC 28: Manage node-breaker model to bus-branch model exchange

A. Description

The use case is applicable when it is necessary to exchange node-breakers models and use these as a basis for operational or long term planning analyses based on bus-branch models. The use case also involves topology processing functions.
Specific CGMES references: CGMES-[R.4.1.9], [R.3.2], [R.3.3].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved assembled model (e.g. SV instance file not included in the import) which has node-breaker model representation.
2) TS 6 (Perform topology processing) is used to perform topology processing of the model and prepare for an export of a bus-branch model.
3) TS 7 (Perform load flow) is used to solve the model.
4) TS 4 (Export of multiple profiles instance data) is used to export a bus-branch model.

2.29. TUC 29: Perform load flow calculation

A. Description

The proper execution of a power flow calculation is required to support the following calculations/analyses:

- Outage planning coordination;
- Capacity calculations;
- Operational security assessment;
- Assessment of the impact of remedial actions;
- Long term planning;
- Dynamic Stability Assessment.

It is also used to check the quality of the exchanged data for a Common Grid Model.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved (e.g. SV instance file not included in the import) model of a MAS.
2) If an unsolved node-breaker model is imported: TS 6 (Perform topology processing to a node-breaker model) is used to perform topology processing of the model and prepare for an export of a bus-branch model.

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3) TS 7 (Perform load flow) is used to solve the model.
4) TS 4 (Export of multiple profiles instance data) is used to export the load flow solution.

2.30. TUC 30: Perform short-circuit calculation (symmetrical)

A. Description

The use case is applied in case of need to perform short-circuit calculation (symmetrical) using the data included in the EQ, TP, SSH and SV profiles instance files. These calculations can be performed using methods described in IEC 60909. This use case is used in both studies using individual TSO MAS models and assembled models. The studies performed by different parties should produce results within engineering tolerance and allow shared studies between parties on the basis of a dataset.
Note: In case the short-circuit calculations are performed using different methods than those described in IEC 60909 the use case number is TUC 30.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model. The model shall contain short circuit data.
2) TS 8 (Perform short-circuit calculation) is used to perform short-circuit calculation (symmetrical) according to IEC 60909 or other standard.

2.31. TUC 31: Perform short-circuit calculation (asymmetrical)

A. Description

The use case is applied in case of need to perform short-circuit calculation (asymmetrical) using the data included in the EQ, TP, SSH and SV profiles instance files. These calculations can be performed using methods described in IEC 60909. This use case is used in both studies using individual TSO MAS models and assembled models. The studies performed in different Applications should produce results within engineering tolerance and allow shared studies between parties on the basis of a common dataset.
Note: In case the short-circuit calculations are performed using different methods than those described in IEC 60909 the use case number is TUC 31.1.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model. The model shall contain short circuit data including sequence data for elements in the model.
2) TS 8 (Perform short-circuit calculation) is used to perform short-circuit calculation (asymmetrical) according to IEC 60909 or other standard.

2.32. TUC 32: Perform dynamics simulation

A. Description

The use case is applied in case of need to perform dynamics simulations using the data included in the EQ, TP, SSH, SV and DY profiles instance files. This use case is used in both studies using individual TSO MAS models and assembled models. The studies performed in different Applications should produce results within engineering tolerance and allow shared studies between parties on the basis of a common dataset.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model. The model shall contain instance data for DY profile.
2) TS 9 (Perform dynamics simulation) is used to perform dynamics simulation.

2.33. TUC 33: Manage model assembling (simplified bus-branch)

A. Description

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The assembly of models is necessary to create the Common Grid Model from individual grid models. This simplified model assembling test use case is designed for loaf flow applications which do not support DL, GL or DY profiles.
Specific CGMES references: CGMES-C4.8

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes boundary set.
2) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved bus-branch single MAS model (MAS A). The model shall contain EQ, SSH, TP and SV profiles.
3) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved bus-branch single MAS model (MAS B). The model shall contain EQ, SSH, TP and SV profiles.
4) TS 10 (Perform assemble a model) is used to perform model assembling of MAS A and MAS B. The resulted model is AM A.
5) TS 4 (Export of multiple profiles instance data) is used to export an unsolved assembled model (e.g. SV instance file not included in the export).
6) TS 7 (Perform load flow) is used to perform load flow.
7) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains a set of difference instance files which modify MAS of the AM A.
8) TS 5 (Apply a change or set of changes to a model) is used to apply changes on MAS A or MAS B of the AM A. The changes shall be different from the set of changes applied in the previous step. The changes shall be in the EQ, TP and SSH profiles.
9) TS 7 (Perform load flow) is used to perform load flow.
10) TS 4 (Export of multiple profiles instance data) is used to export a complete solved assembled model. The resulted model is AM B.
11) TS 3 (Export of instance data belonging to a profile) is used to export SV instance data representing the load flow solution for the assembled model obtained in sequence 9.
12) TS 4 (Export of multiple profiles instance data) is used to export a solved assembled model which contains difference files for changed MAS from AM A and a SV instance file.

2.34. TUC 34: Manage model assembling (simplified node-breaker)

A. Description

The assembly of models is necessary to create the Common Grid Model from individual grid models. This simplified model assembling test use case is designed for loaf flow applications which do not support DL, GL or DY profiles.
Specific CGMES references: CGMES-C4.8

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes boundary set.
2) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved (e.g. SV instance file not included in the import) node-breaker single MAS model (MAS A). The model shall contain EQ and SSH profiles.
3) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved node-breaker single MAS model (MAS B). The model shall contain EQ and SSH profiles.
4) TS 10 (Perform assemble a model) is used to perform model assembling of MAS A and MAS B. The resulted model is AM A.
5) TS 4 (Export of multiple profiles instance data) is used to export an unsolved assembled model.
6) TS 6 (Perform topology processing) is used to perform topology processing on the assembled model AM A.

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7) TS 7 (Perform load flow) is used to perform load flow.
8) TS 2 (Import of multiple profiles instance data) is used to import a zip file which contains a set of difference instance files which modify MAS of the AM A.
9) TS 5 (Apply a change or set of changes to a model) is used to apply changes on a MAS of the AM A. The changes shall be different from the set of changes applied in the previous step. The changes shall be in the EQ instance data for the two MAS.
10) TS 6 (Perform topology processing) is used to perform topology processing on the updated assembled model.
11) TS 7 (Perform load flow) is used to perform load flow.
12) TS 4 (Export of multiple profiles instance data) is used to export a complete solved assembled model. The resulted model is AM B.
13) TS 3 (Export of instance data belonging to a profile) is used to export SV instance data representing the load flow solution for the assembled model obtained in sequence 11.
14) TS 4 (Export of multiple profiles instance data) is used to export a solved assembled model which contains difference files for changed MAS from AM A, TP instance files and a SV instance file.

2.35. TUC 35: Manage model assembling (advanced-load flow)

A. Description

The assembly of models is necessary to create the Common Grid Model from individual grid models. This simplified model assembling test use case is designed for loaf flow applications which do not support DL, GL or DY profiles.

Specific CGMES references: CGMES-C4.8

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes boundary set.
2) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved (e.g. SV instance file not included in the import) node-breaker single MAS model (MAS A). The model shall contain EQ and SSH profiles.
3) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved bus-branch single MAS model (MAS B). The model shall contain EQ, SSH, TP and SV profiles.
4) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved mixed bus-branch and node-breaker single MAS model (MAS C). The model shall contain EQ, SSH, TP and SV profiles.
5) TS 10 (Perform assemble a model) is used to perform model assembling of MAS A and MAS C. The resulted model is AM A.
6) TS 10 (Perform assemble a model) is used to perform model assembling of already assembled model (AM A) in sequence 5 with MAS B. The resulted model is AM B.
7) TS 6 (Perform topology processing) is used to perform topology processing on the assembled model AM B.
8) TS 4 (Export of multiple profiles instance data) is used to export an unsolved assembled model – AM B (bus-branch) without retaining of node-breaker data.
9) TS 5 (Apply a change or set of changes to a model) is used to apply changes in all MAS of the AM B. The changes shall be in the EQ, TP and SSH instance data for all MAS.
10) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes difference instance data for different profiles to apply additional changes (the changes shall not replace changes applied in sequence 9) in the AM B.
11) TS 7 (Perform load flow) is used to perform load flow.
12) TS 3 (Export of instance data belonging to a profile) is used to export SV instance data representing the load flow solution for the assembled model obtained in sequence 11.
13) TS 4 (Export of multiple profiles instance data) is used to export a complete solved assembled model – AM B with retaining of node-breaker data.

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14) TS 4 (Export of multiple profiles instance data) is used to export a solved assembled model which contains difference files for changed MAS from AM B, TP instance files and a SV instance file.

2.36. TUC 36: Manage model assembling (advanced-all profiles)

A. Description

The assembly of models is necessary to create the Common Grid Model from individual grid models. The Common Grid Model requires a consistent set of files with which the following calculations/analyses can be performed:

- Outage planning coordination;
- Capacity calculations;
- Operational security assessment (power flow and contingency analysis);
- Assessment of the impact of remedial actions;
- Long term planning;
- Dynamic Stability Assessment.

The assembled model consists of not only individual grid model profiles per MAS, but also associated information that is used in different business processes, which could be:

- Lists of planned outages;
- Lists of contingencies;
- Lists of Predefined remedial actions;
- Special Protection Schemes;
- Generation Shift keys, Wind Shift keys, Solar Shift keys, Load shift keys;
- Lists of Critical Branches/Critical outages/Constraints;
- Schedules of net positions and HVDC flows.

Specific CGMES references: CGMES-C4.8

B. Sequence

Remark: if DY profile is not supported the sequence could be followed without DY profile.

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes boundary set.
2) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an unsolved (e.g. SV instance file not included in the import) node-breaker single MAS model (MAS A). The model shall contain EQ and SSH profiles.
3) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved bus-branch single MAS model (MAS B). The model shall contain EQ, SSH, TP and SV profiles.
4) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved mixed bus-branch and node-breaker single MAS model (MAS C). The model shall contain EQ, SSH, TP, SV, DL, GY and DY profiles.
5) TS 10 (Perform assemble a model) is used to perform model assembling of MAS A and MAS C. The resulted model is AM A.
6) TS 10 (Perform assemble a model) is used to perform model assembling of MAS A, MAS B and MAS C. The resulted model is AM B.
7) TS 6 (Perform topology processing) is used to perform topology processing on the assembled model AM B.
8) TS 2 (Import of multiple profiles instance data) is used to import a zip file to complete instance data for (MAS A), i.e. to add DL, GY and DY profiles.
9) TS 2 (Import of multiple profiles instance data) is used to import a zip file to complete instance data for (MAS B), i.e. to add DL, GY and DY profiles.
10) TS 4 (Export of multiple profiles instance data) is used to export an unsolved assembled model – AM B (bus-branch) without retaining of node-breaker data.
11) TS 5 (Apply a change or set of changes to a model) is used to apply changes in all MAS of the AM B. The changes shall be in the EQ, TP, SSH and DY instance data for all MAS.

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12) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes difference instance data for different profiles to apply additional changes (the changes shall not replace changes applied in sequence 11) in the AM B.
13) TS 7 (Perform load flow) is used to perform load flow.
14) TS 3 (Export of instance data belonging to a profile) is used to export SV instance data representing the load flow solution for the assembled model obtained in sequence 13.
15) TS 4 (Export of multiple profiles instance data) is used to export a complete solved assembled model – AM B with retaining of node-breaker data.
16) TS 4 (Export of multiple profiles instance data) is used to export a solved assembled model which contains difference files for changed MAS in AM B in comparison with AM A and a SV instance file.

2.37. TUC 37: Handle power transformer, tap changers and phase shift transformers

A. Description

The use case is applicable for applications which can store and operate such kind of elements for the purpose of data management or analyses (load flow, dynamics, etc.). For instance, handling of the following elements is required:

- two-winding transformers;
- three-winding transformers (with or without Shunt connected to tertiary winding);
- Asymmetrical and symmetrical PST;
- Non-linear ratio tap changers;
- Tap changers with tabular impedance and angle dependence (phase angle difference and impedance varies with the tap step);
- Transformers with tap changers on different windings;
- two tap changers per winding (angle and phase);
- Different winding connection types;
- Related short circuit data of above elements – including grounding regime (PetersenCoil).

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model(s) which contain elements mentioned in the use case.
2) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the data/model by the Application.
3) TS 5 (Apply a change or set of changes to a model) is used to modify data.
4) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the data/model by the Application.
5) TS 4 (Export of multiple profiles instance data) is used to export a complete model.

2.38. TUC 38: Handle generation types

A. Description

The use case is applicable for applications which can store and operate different generation types for the purpose of data management or analyses (load flow, dynamics, etc.).
CGMES references: CGMES-[R.4.1.5.].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model. The model shall contain different generation types.
2) TS 5 (Apply a change or set of changes to a model) is used to modify generation types.
3) TS 4 (Export of multiple profiles instance data) is used to export an updated model.

2.39. TUC 39: Handle shunt compensators

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A. Description

The use case is applicable for applications which can store and operate linear and non-linear shunt compensators for the purpose of data management or analyses (load flow, dynamics, etc.).

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model. The model shall contain different types of shunt compensators.
2) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the data/model of shunt compensators by the Application.
3) TS 5 (Apply a change or set of changes to a model) is used to modify shunt compensators data.
4) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the data/model of shunt compensators by the Application.
5) TS 4 (Export of multiple profiles instance data) is used to export an updated model.

2.40. TUC 40: Maintain hierarchy of the model

A. Description

The use case is applicable for applications which can store and operate with various CGMES classes for the purpose of data management. The Application's ability to display and navigate considering the hierarchy of the models as defined in the CGMES is required. For instance the user should be able to see in the Application the hierarchy of the model GeographicalRegion, different SubGeographicalRegions, Substations, VoltageLevel, etc.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved model.
2) TS 11 (Data quality) is used to check the hierarchy of the model.

2.41. TUC 41: Handle HVDC modelling

A. Description

The use case is applicable for applications which can store and operate HVDC elements for the purpose of data management or analyses (load flow, dynamics, etc.). It is necessary to handle models that have VSC and CSC HVDC; models where HVDC is a tie-line (the different combinations supported by CGMES); models where HVDC is an internal link.

Specific CGMES references: CGMES-[R.4.7.4], [R.4.7.5], [R.4.7.6].

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved assembled model. The model shall contain different types of HVDC.
2) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the HVDC by the Application.
3) TS 5 (Apply a change or set of changes to a model) is used to modify HVDC data.
4) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the HVDC by the Application.
5) TS 4 (Export of multiple profiles instance data) is used to export an updated model.

2.42. TUC 42: Manage dependencies between instance data from different profiles of the CGMES

A. Description

The use case is applicable at any exchange using CGMES. For instance, all profiles have dependencies with a boundary set. Dependencies are present between the profiles and also between different sets of exchanges.

Specific CGMES references: CGMES-[R.3.1.], C4.3.

B. Sequence

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1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved assembled model which contains MAS A and MAS B.
2) TS 5 (Apply a change or set of changes to a model) is used to modify EQ data of MAS A and SSH data of MAS B. The applied changes shall not impact other instance data belonging to other profiles.
3) TS 7 (Perform load flow) is used to perform load flow.
4) TS 4 (Export of multiple profiles instance data) is used to export updated EQ of MAS A, SSH of MAS B and SV of the assembled model.
5) TS 11 (Data quality) is used to check the references in the file headers of the exported EQ of MAS A, SSH of MAS B and SV of the assembled model.

2.43. TUC 43: Handle equivalent elements

A. Description

The use case is applicable for applications which can store and operate equivalent elements for the purpose of data management or analyses (load flow, dynamics, etc.). In a lot of cases equivalent elements are used to represent distribution network or part of transmission network which is not necessary for a given analysis.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved assembled model. The model shall contain equivalent elements.
2) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the equivalent elements by the Application.
3) TS 5 (Apply a change or set of changes to a model) is used to modify equivalent elements data.
4) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the equivalent elements by the Application.
5) TS 4 (Export of multiple profiles instance data) is used to export an updated model.

2.44. TUC 44: Handle regulating controls

A. Description

The use case is applicable for applications which can store and operate different regulating controls for the purpose of data management or analyses (load flow, dynamics, etc.). The Applications shall be able to handle models that have remote bus regulation; models with multiple regulating devices (parallel generators, transformers, shunts) controlling a node.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for a solved assembled model. The model shall contain remote bus regulation and a MAS with multiple regulating devices (parallel generators, transformers, shunts) controlling a node.
2) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the regulating controls by the Application.
3) TS 5 (Apply a change or set of changes to a model) is used to modify regulating controls data.
4) TS 7 (Perform load flow) is used to perform load flow to verify the handling of the regulating controls by the Application.
5) TS 4 (Export of multiple profiles instance data) is used to export an updated model.

2.45. TUC 45: Data handling in Applications (simplified)

A. Description

The use case includes the ability to report on the content of the model (statistics), data/models manipulation (access to instance data) and model visibility (e.g. display parameters of a generator, etc).

B. Sequence

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1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an assembled model.
2) TS 12 (Data manipulation, reporting and display schematic information) is used to allow a user of the Application to manipulate the data by having access to all classes and attributes belonging to CGMES profiles.
3) TS 12 (Data manipulation, reporting and display schematic information) is used to create a report on the content of the model.
4) TS 12 (Data manipulation, reporting and display schematic information) is used to display schematic information of the data/model available in the Application. The schematic information shall be exported by the Application in digital image file form. The sequence is not performed in case the Application does not have functionalities to visualise the data and show the topology of the imported test configuration.

2.46. TUC 46: Data handling in Applications (advanced)

A. Description

The use case includes the ability to report on the content of the model (statistics), data/models manipulation (access to instance data) and model visibility (e.g. display parameters of a generator, etc).
For diagram layout and geographical location profiles this use case includes ability of the Application to display the information in a schematic way.

B. Sequence

1) TS 2 (Import of multiple profiles instance data) is used to import a zip file which includes instance data for an assembled model. The model shall contain DL and/or GL data.
2) TS 12 (Data manipulation, reporting and display schematic information) is used to allow a user of the Application to manipulate the data by having access to all classes and attributes belonging to CGMES profiles.
3) TS 12 (Data manipulation, reporting and display schematic information) is used to create a report on the content of the model.
4) TS 12 (Data manipulation, reporting and display schematic information) is used to display schematic information by using the information from the DL and/or GL profiles. The schematic information shall be exported by the Application in digital image file form.

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