

POWER SYSTEM SOLUTIONS
MADE IN GERMANY

1 Functions

PowerFactory offers a wide range of functions to support companies with shared environments for various user groups. In the following sections the main features are introduced.

User Management and Groups

The user management within *PowerFactory* offers a wide range of options to support various organisational structures and policies. Thus, data can be protected to avoid unauthorised access and collaboration can be managed more efficiently. The number of users is not limited and is independent of the number of concurrent users defined in the licence. Each user has their own area for running studies and is able to configure it individually. Groups can be used to define roles and associated rights. Access to data and the permission to change data can be limited to groups. It is possible to assign *PowerFactory* licences to specific groups to organise the licence usage cost-efficiently. To avoid blocking of licences by inactive users, it's possible to set an idle session timeout.

Security

Authentication can use either *PowerFactory* user names and passwords or Microsoft Active Directory. The password policy offers parameters such as time of validity, password quality with length and characters, limiting of login attempts and reuse of previous passwords. The parameters can be selected and configured individually.

Versioning

By means of versions a specific snapshot of the network model can be stored. Versions for various points in time can be created to track the development of a network model. To recover a former state of a model, it is possible to roll back to a particular version.

Base and Derived Models

Users can work on the same network model to analyse different situations, run different calculation functions and for modelling purposes. In

PowerFactory a base model can be published representing the base of the model at a specific version. Typically the base model is owned by a model administrator, ensuring that the model is valid and correct and contains approved changes by users. Each user can create a derived model from a version of the base model and do individual operations in the model such as expansion planning or analysis of scenarios. Each derived model is independent from other derived models, and changes made to it do not affect the base model or models of other users. The derived model has a link to the base model. By means of the reference the following tasks can be addressed:

- Merge approved changes in a derived model back to the base model.
- Update a derived model with changes from the base model.

Derived models store only changes relative to the base model. This approach reduces the storage size for the individual model compared with copying full models.

Updates and Notifications

The person or team responsible for the base network model provides updates of the model by creating a new version. Once a user activates a model that is derived from the base model, the user gets a notification of the available update. The changes in the base model can be merged into the derived model using the *Compare & Merge* tool. It's also possible for the user to ignore the changes if they are not needed.

Sharing

Network models can be shared between users within the *PowerFactory* environment. Users are able to grant access to their network models to other users groups, either read-only, read-write or full access. Functional accounts like publishing users are supported to provide base models to other users. Access to this accounts can be granted to named users using their own cre-

dentials. The use of the common database also means that libraries can be maintained centrally. This is not only efficient, but ensures that all users in the organisation are able to use the same templates and type data such as transformer and line types.

Compare and Merge

To check the differences between models, a comprehensive *Compare & Merge* tool is available. Both two-way and three-way comparisons are available, the latter being used when updating a derived model to a later version of the base. The comparison can be realised using ID such as foreign key, CIM rdf:ID or based on the hierarchy within the network model. After the comparison, data can be merged into a target model. Assignments and solving of conflicts can be done in a separate dialog developed for the *Compare*

& *Merge* tool as can be seen in Figure 1.

Offline Mode

Sometimes it is necessary to work without connection to the multi-user database. For example in situations without connection to the server (e.g. when travelling) this might occur. *PowerFactory* supports an offline mode to be able to work temporarily independent from the database. In addition, a so-called *floating licence* can be obtained to work with a local *PowerFactory* installation and no connection to the licence server. During the offline session, a local database is used, comparable to the single-user environment. The user can define which network models shall be available offline by subscribing the models. Before starting and after terminating an offline session, the models are synchronised.

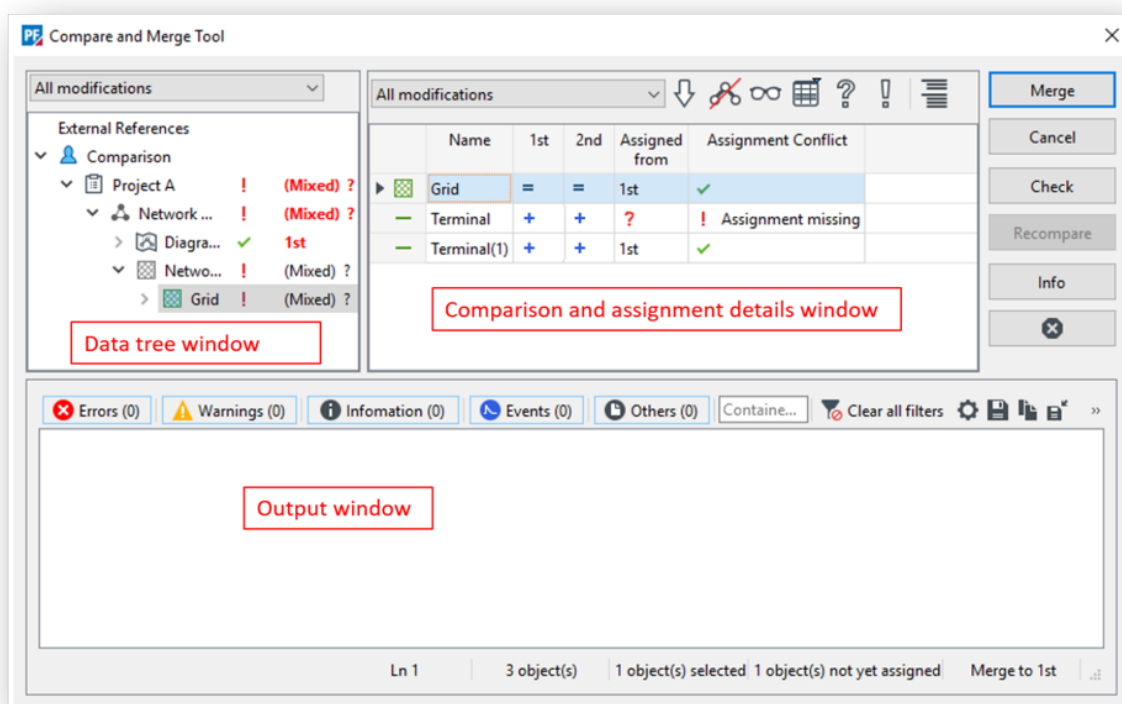


Figure 1: Compare & Merge tool

Profiles

Because every group may have its own scope of using *PowerFactory* it's possible to adapt the

user-interface by means of profiles to provide only the functions and models needed by the group. Depending on the functions required by the com-

pany or the user group buttons and menu entries can be added or reduced. By means of this customisation, working with *PowerFactory* becomes more efficient. It is possible to easily switch between profiles to get only the essential functions needed for the specific environment. By means of profiles, user-defined functions based on scripts can be provided to all users of the multi-user database.

2 Example Work Flow

In Figure 2 a possible work flow is illustrated. On top, the base model is located which is published by the model administrator. Below, two users are working on derived models based on the base model in their user account. The complete work flow is organised within one multi-user database.

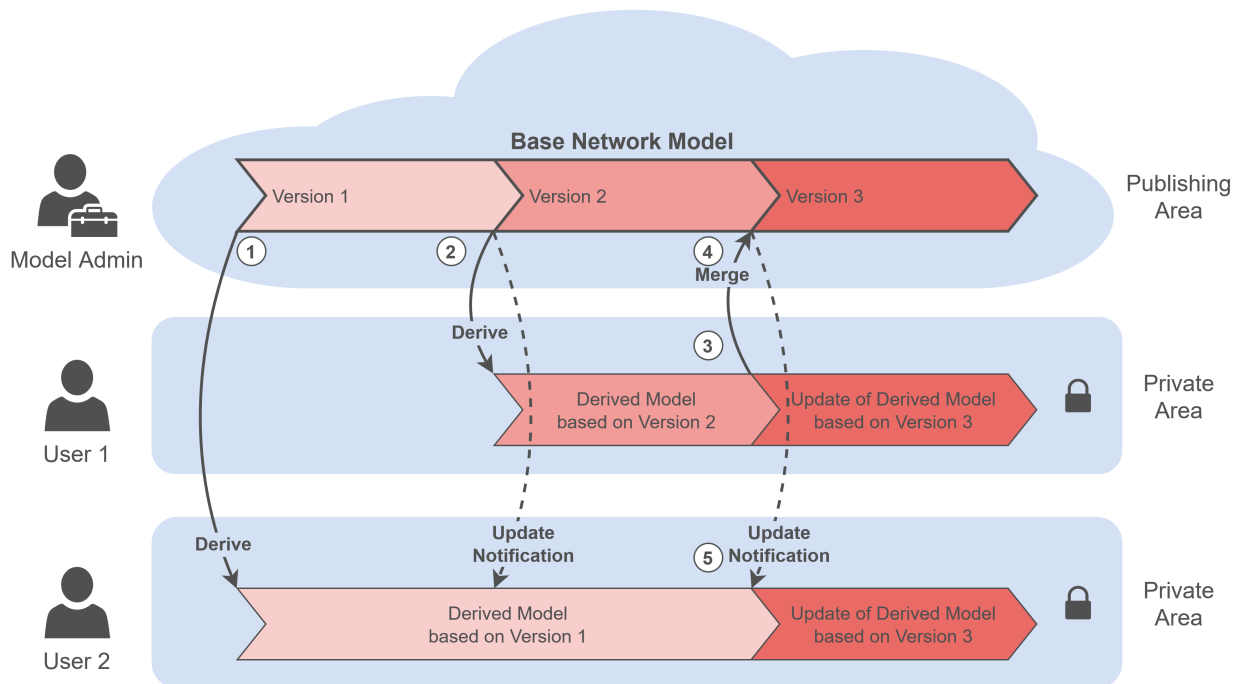


Figure 2: Example work flow

- 1 The model administrator publishes an initial version of the network model. User 2 creates a derived model based on version 1.
- 2 A new version of the base model has been published by the model administrator. Users working on models based on the base model are notified when activating the model the next time. In this case, User 2 rejects the update. User 1 picks the model based on version 2 for the first time.
- 3 User 1 made changes or extensions on his derived model and wants to provide the update to other users. He makes the model available to the model administrator and informs him.
- 4 After validating the changes, the model admin merges the changes into the base model using the *Compare & Merge* tool.
- 5 After the successful merge another version has been defined and provided to all users. User 2 updates his model with this version to have the changes made by User 1.

3 Architecture

To use *PowerFactory* as central application for network model management and calculations in a team, the system components shown below are recommended. The components should be connected to each other with a high bandwidth and a low latency.

Application Components

- ✓ Database Server
- ✓ Licence Server
- ✓ Application Server

Database Server

PowerFactory requires a database. In a single-user installation this can be a local database file which is automatically created by the application in the workspace directory. Working in a team involves a centralised database everyone has access to. The database management systems (DBMS) shown below are supported. To avoid the increase of the database storage with superfluous information various housekeeping functions such as archiving, purging or automated deletion are available. For companies planning a migration to another DBMS, *DlG SILENT* offers a database transfer tool to support a seamless migration of the *PowerFactory* database.

Database Management Systems

- ✓ Oracle
- ✓ MS SQL
- ✓ PostgreSQL

Licence Server

The licence server is the central component providing users access to *PowerFactory* and keeping the connection to the licence management of *DlG SILENT*. The number of users being able to work in parallel with *PowerFactory* is limited to the number of concurrent users defined in the licence. The number of users in general is not limited. The licence server can run on a physical machine with a softkey or on a virtual machine with connection to USB dongle providing the licence. In addition, a cloud-based softkey is available if the complete *PowerFactory* environment is virtualised, e.g. in a cloud system.

License Technologies

- ✓ USB dongle (Hardlock)
- ✓ Softkey
- ✓ Cloud-based Softkey

Application Server

In general, *PowerFactory* can run on any machine based on a Windows platform. This can be a desktop, laptop or server. Using a multi-user database it is important to ensure a connection to the database with a low latency. When working outside the offices at a distance from the database server, the use of an application server may be advantageous. In this case the users only need a thin client with a remote desktop connection or other terminal solutions to access *PowerFactory* (right side of Figure 3). The application server can also be used to provide the workspace for all users to store result and log files.

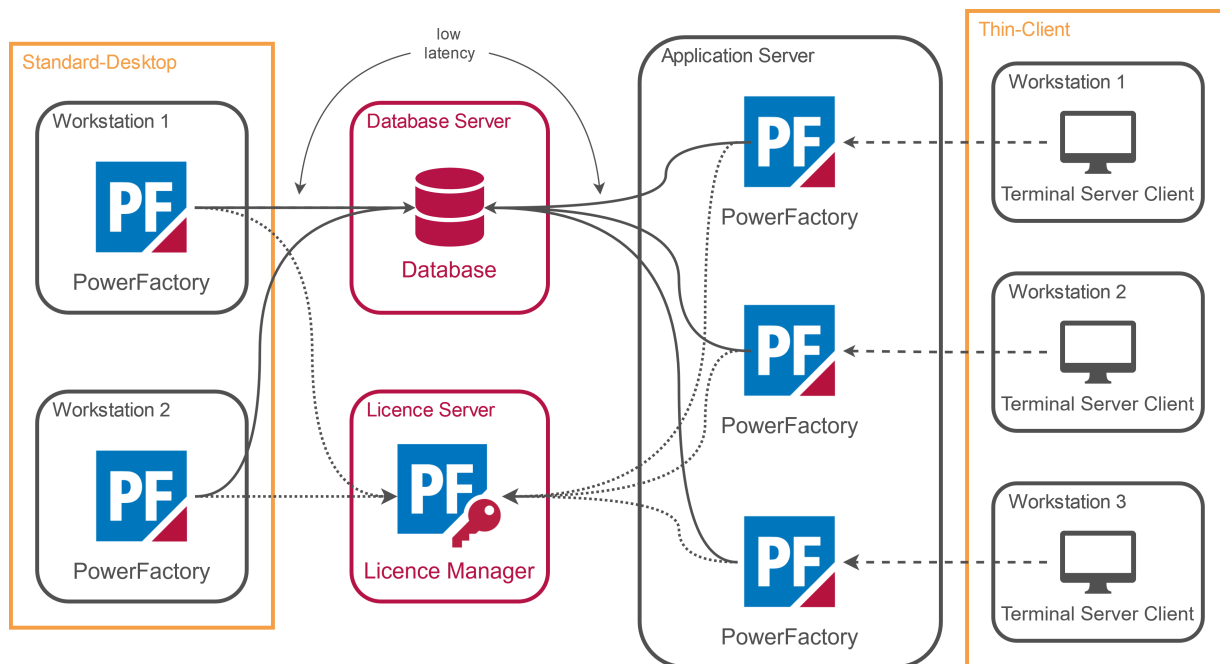


Figure 3: Architecture in a multi-user environment

4 Executive Summary

In this white paper, a solution is described that enables teams to work both independently and collaboratively, with the ability to use the same network model. Data can be easily shared within the one environment. This allows different user groups such as asset management and operational planning to work together efficiently in the same environment. It reduces the effort needed to model a network in a team and leads to fewer modelling errors and inconsistencies, as all users are working on the same base of the model.

5 Licence Configuration

Required

- ✓ Team Edition

Optional

- ✓ Floating Licence
- ✓ Database Transfer Tool



For more information, visit
www.digsilent.de



DIGSILENT GmbH
Heinrich-Hertz-Straße 9
72810 Gomaringen (Germany)
T: +49 7072 9168-0
mail@digsilent.de



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