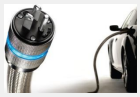
3rd Southern African DIgSILENT User Conference

PowerFactory API

and

Smart Grid Applications

Interfacing with Google Earth and other systems



13/14 March 2013

DIgSILENT Ibérica S.L.

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INTRODUCTION

PowerFactory offers many standard functions for **smart grids** planning and operation, **electric vehicles**, **renewable energies** and **distributed generation** integration studies:

- Load flow with many optimization functions
- OPF
- Distribution network optimization
- Open tie point placement
- Time sweep
- State estimation
- …

INTRODUCTION

But it also offers:

- OPC communication
- Expandable DPL instruction set
- Expandable DSL instruction set
- API

This presentation will show how these nice features can be used in **smart grid** applications.

INTRODUCTION

Cases:

1. **Virtual Control Commissioning**: Connection to **SCADA** system via **OPC** protocol
2. **Direct Connection to MODBUS TCP Devices**
3. **Exporting/Importing grids to/from Google Earth using the API**
4. **Integrating Smart Meters Data in Network Planning thanks to the API**

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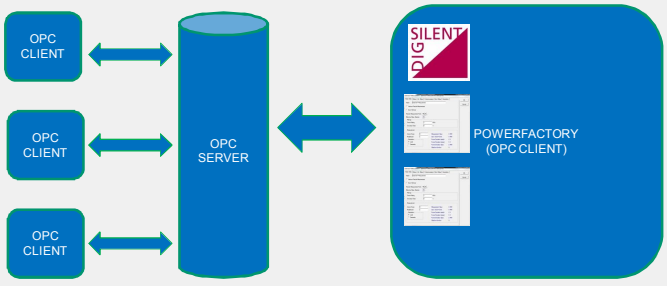
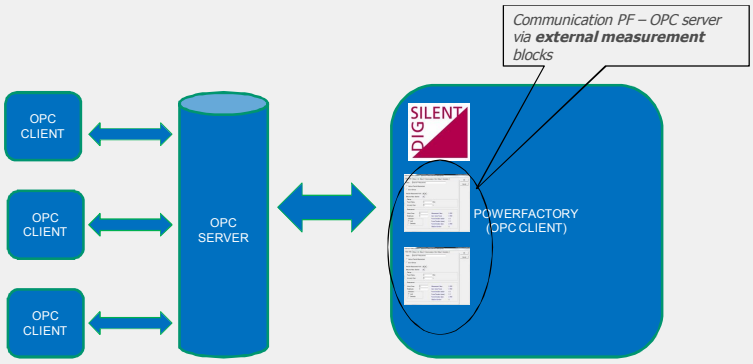
OPC – VIRTUAL COMMISSIONING



Virtual commissioning = real application or final implementation tested in real-time and full scale with simulated signals

OPC – VIRTUAL COMMISSIONING



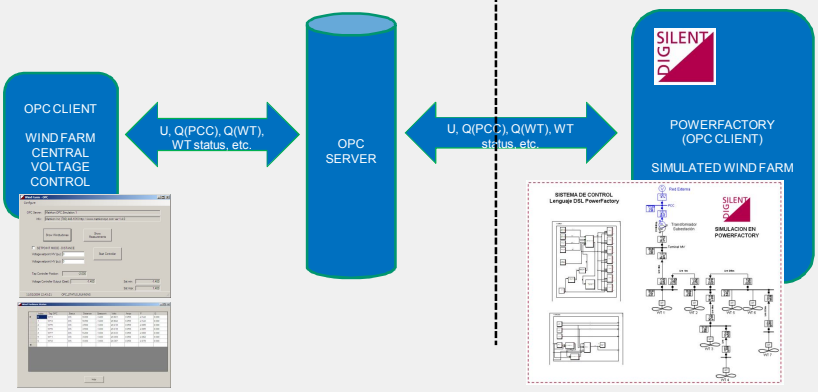
Virtual commissioning = real application or final implementation tested in real-time and full scale but with simulated signals

OPC – VIRTUAL COMMISSIONING

Example: Wind farm central voltage controller

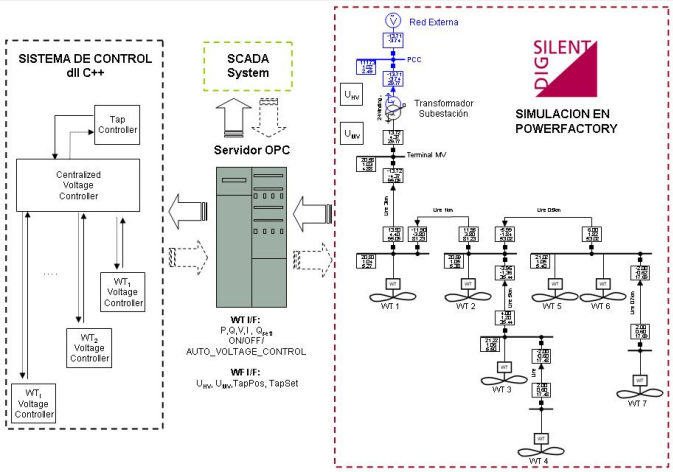
Real/Implemented solution to be tested

Simulation



OPC – VIRTUAL COMMISSIONING

Example: Wind farm central voltage controller - implementation



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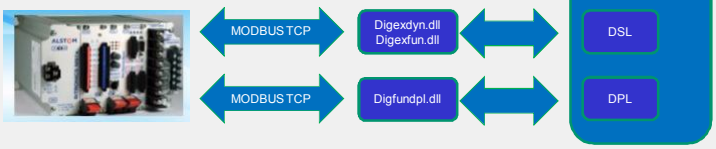
MODBUS TCP

MODBUS = Communication protocol

Read/write registers/coils

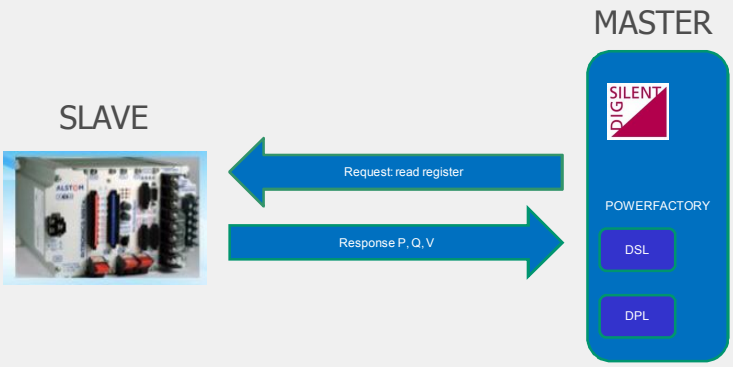
Implementation: C++ dll - digexdyn, digexfun, digfundpl



MASTER/SLAVE

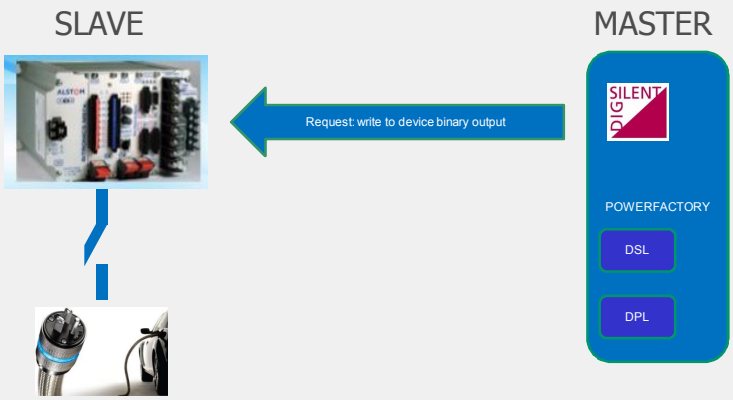
MODBUS TCP

Application: read measurements P, Q, V and inject into simulation (load-flow and RMS)



MODBUS TCP

Simulation output: shut down monitored device if necessary via Slave binary outputs



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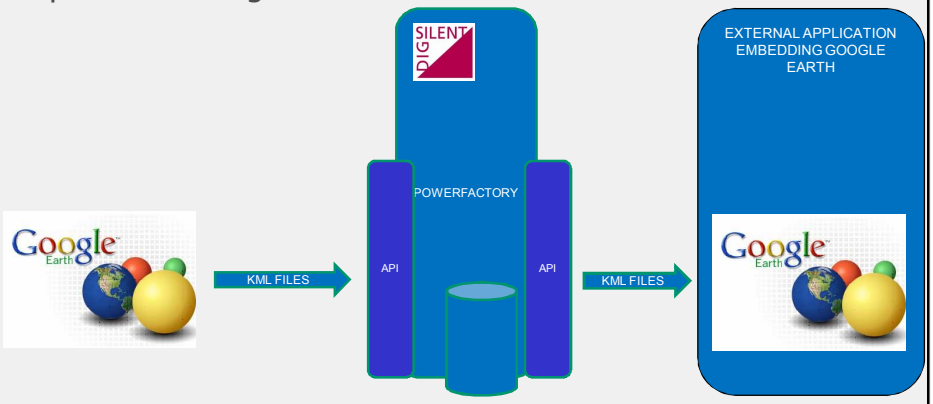
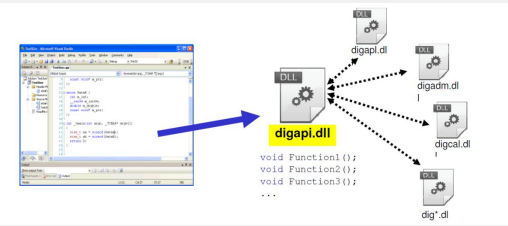
GOOGLE EARTH

Export to Google Earth
Import from Google Earth

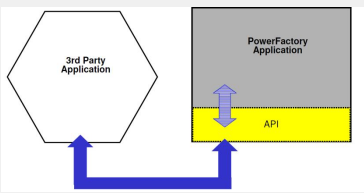


GOOGLE EARTH

PowerFactory API

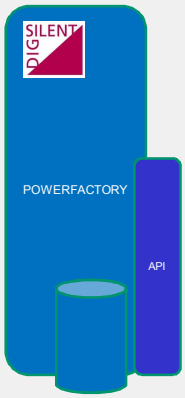


- Available with version 15.0
- Necessary .lib in installation folder
- C++ programming
- Possibility .NET programming via wrapper
- !Compilation: 64bits or 32bits



GOOGLE EARTH

Export to Google Earth



KML format not meant for electrical data →

- Use additional property fields
- Define a format/properties to be exported

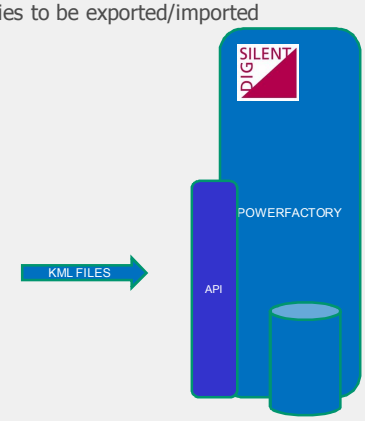
From Version 15.0, Fields for GPS data of bus and lines are available

GOOGLE EARTH

Import from Google Earth

KML format not meant for electrical data →

- Use additional property fields
- Define a format/properties to be exported/imported



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NETWORK PLANNING

- GIS
- SCADA – History
- SCADA – Real time operation
- Temperatures
- Load/generation models
- Smart meters
- …

Large quantity of data available → How to give them an **additional value**?

NETWORK PLANNING

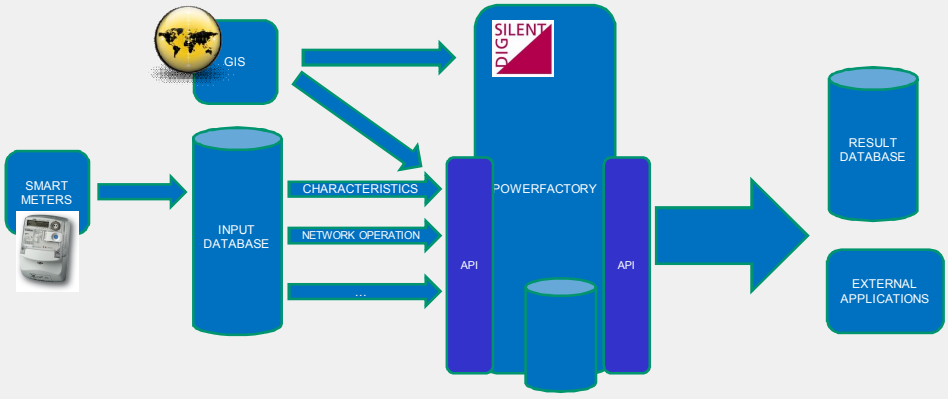
- GIS
- SCADA – History
- SCADA – Real time operation
- Temperatures
- Load/generation models
- Smart meters
- …

Large quantity of data available → How to give them an **additional value**?

- Identification of weak spots
- Badly supplied customers
- Post-event analysis (replay)
- Control design
- Studies (→ future): integration of electric vehicle, distributed generation, etc.
- Investments: techno-economical studies
- …

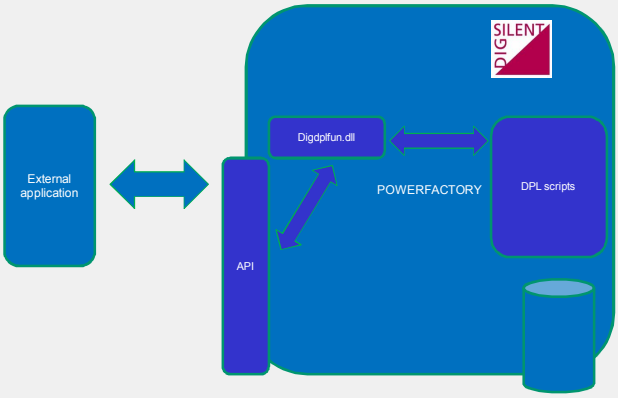
NETWORK PLANNING

PowerFactory can interact with many systems and adds real value to **smart grid** data, not only in operation but also in network planning



NETWORK PLANNING

API + digdplfun.dll → new DPL instructions to read/write **PowerFactory** objects from/to external applications



NETWORK PLANNING

New DPL instructions to import measured load characteristics, generation pattern, maneuvers, etc. from external data source

Having all this information in **PowerFactory**, it is possible to:

- Generate operation scenarios
- Write DPL scripts to spot problems
- Write DPL scripts to study investments

... as far as your imagination drives you!

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CONCLUSIONS

PowerFactory capabilities can be extended way beyond the normal use of the software:

- **OPC** allows connecting to your SCADA systems and using **PowerFactory** to generate signals for the full scale system and/or import measurements into your simulations.
- **DLL** (digexdyn, digexfun, digdplfun) allows building DSL and DPL functions to directly communicate with devices using different protocols (Modbus, DNP3, Ethercat, etc.).
- **API** allows modifying **PowerFactory** objects from your external applications and sending data to external data repositories.

Smart Grids planning and event analysis are typical applications where you can exploit the full potential of **PowerFactory** connectivity.