

This course material is mainly intended to be used in **hands-on training courses** conducted by Karlheinz Schwarz. The material is of maximum use when You attend such a hands-on training! You are welcome!



IEC 61850

(Communication networks and systems for power utility automation)

Course Material for IEC 61850 Evaluation, Demonstration, and Hands-on Training (EvaDeHon) Package)



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Prior to the **hands-on training course** you may read slides 1 - 14!
Try to run the bat files to check if your computer "likes" the demo.
Do not spent too much time on trying ... I will help you at the beginning of the training to get the software up and running.

Version 06

IEC 61850 EvaDeHon
Package, V06

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Page 1


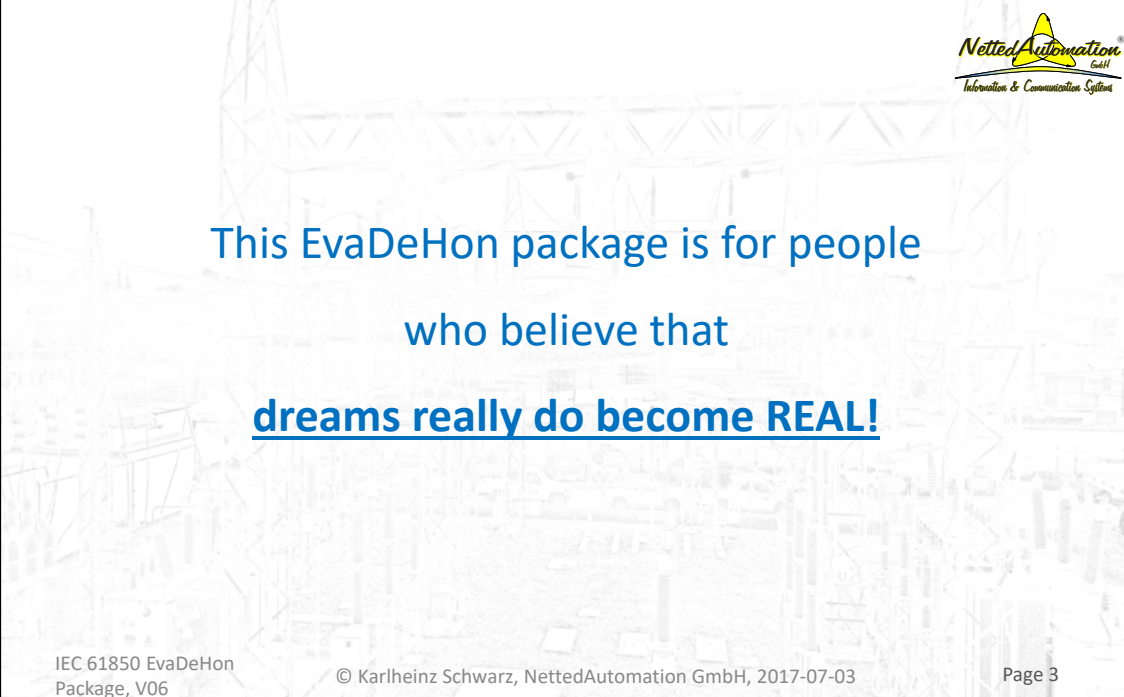


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Page 2


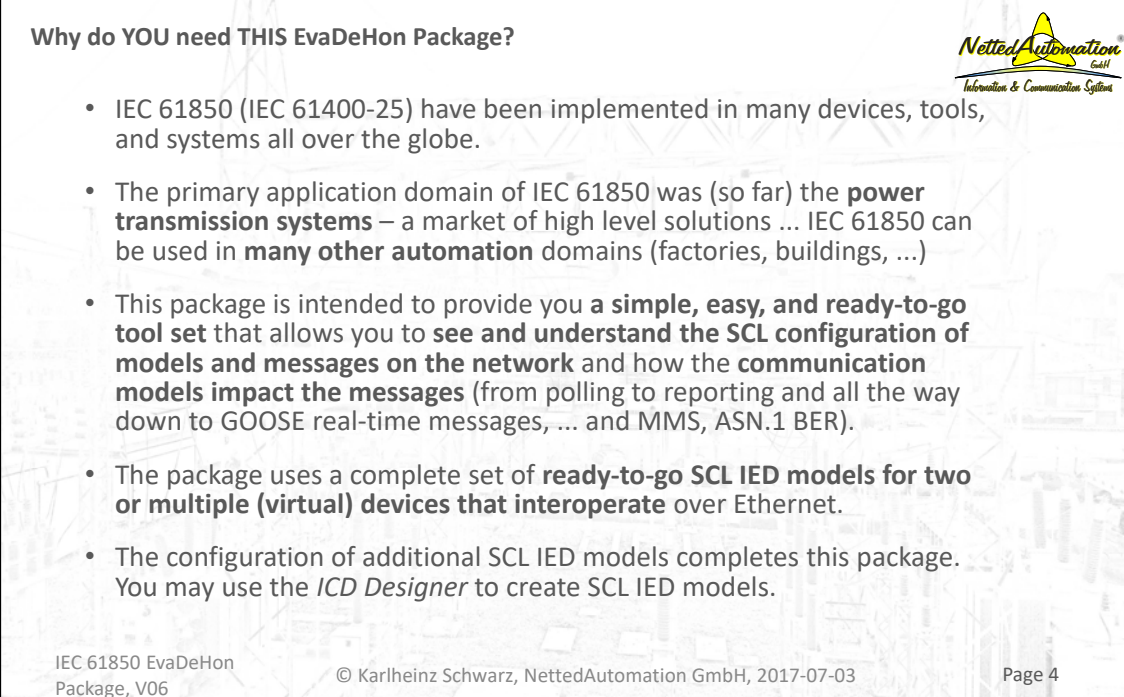


This EvaDeHon package is for people
who believe that
dreams really do become REAL!

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Page 3



Why do YOU need THIS EvaDeHon Package?

- IEC 61850 (IEC 61400-25) have been implemented in many devices, tools, and systems all over the globe.
- The primary application domain of IEC 61850 was (so far) the **power transmission systems** – a market of high level solutions ... IEC 61850 can be used in **many other automation** domains (factories, buildings, ...)
- This package is intended to provide you a **simple, easy, and ready-to-go tool set** that allows you to **see and understand the SCL configuration of models and messages on the network** and how the **communication models impact the messages** (from polling to reporting and all the way down to GOOSE real-time messages, ... and MMS, ASN.1 BER).
- The package uses a complete set of **ready-to-go SCL IED models for two or multiple (virtual) devices that interoperate** over Ethernet.
- The configuration of additional SCL IED models completes this package. You may use the *ICD Designer* to create SCL IED models.

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Page 4

Communication services



- **In the first part** we will use a given model (as provided with the package) and have a closer look at the communication services: DataSets, Reporting, Polling, Control, GOOSE, ...
- The Client in this package uses the model of the Server given by the SCL IED model of the device (XML File) that plays the role of the Server and Publisher.
The Client does intentionally not retrieve the Selfdescription from the Server by communication services. Browsers may retrieve the models.
- **In the second part** we will demonstrate and practice other models, e.g., developed with the ICDDesigner and decorated with the *IEC61850ModelDecorator* that can be downloaded from the **Microsoft App Store**.



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Page 5

License Agreements



- **The core API/Stack software of the EvaDeHon Package is provided by SystemCorp:**
SystemCORP Embedded Technology Pty Ltd
Address 15/50 William St
Beckenham WA 6107 / Australia
info@systemcorp.com.au
www.systemcorp.com.au
- **By using this EvaDeHon Package you accept the attached license agreements:**
<<SW License Agreement.pdf>>
<<[End-User-Software-License-Agreement-Embedded-Products.pdf](#)>>
- **Please read these documents before you use any software!**
- **The source application software** (written in C#) and **integration support for the API/Stack into your application** can be provided by NettedAutomation, please contact us at karlheinz.schwarz@nettedautomation.com

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Page 6

Objective of the EvaDeHon Package is to let IEDs communicate with other IEDs



The original purpose was to provide a **free of charge simple and easy to use IEC 61850 Client/Subscriber Tool** (running on Windows PCs) that can be used to **communicate with a Server/Publisher** implemented on the following platforms:

- [Beck IPC DK151 Development Kit for SC145 \(DK61\)](#)
- [Beck IPC com.tom / IXAT SG-gateways \(WEB-PLC\)](#)
- [SystemCorp Smart Grid Controllers](#)
- **Windows PC (for general hands-on training)**
- ...



The demonstration uses a **single generic SCL model** (and a derived JSON file [JavaScript Object Notation]) that can (beyond the main purpose) be used on the above WEB-PLC platforms to automatically configure (tree structured graphical applications for) Clients, Server/Publisher, and Client/Subscriber roles as shown on the next slides.

The decoration of additional models (.icd and .json) could be accomplished by a new tool that is downloadable as a Windows APP (*IEC61850ModelDecorator*).

Useful Links



The EvaDeHon Package can be downloaded from:

<http://www.nettedautomation.com/solutions/demo/dll>

Information about the underlying API/Stack software (plus another demo) can be found here:

<https://www.systemcorp.com.au/products/smart-grid-software/iec-61850/>

Usefull information about IEC 61850 can be accessed through the IEC 61850 blog:

<http://blog.iec61850.com/>

VHPready demo package:

<http://www.nettedautomation.com/iec61850li/dll/index.html>

GridEx Test Tool:

<http://fmtppower.com/>

Useful Links

Seminars and training for protection, control, SCADA, ... ask the experts:
<http://www.nettedautomation.com/seminars/uca/sem.html>

4,300+ Experts
from 1,000+ Companies
trained in 240+ courses
(2017-06)

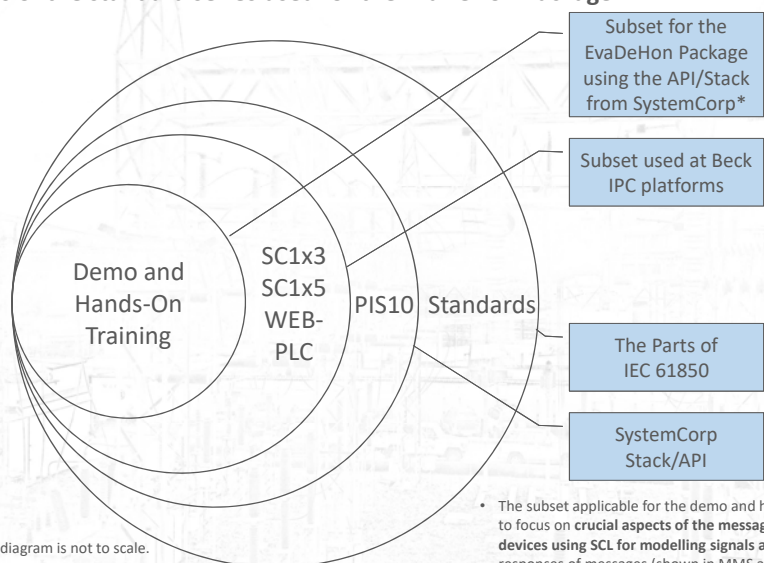
2016				
223.	public	Karlsruhe	Germany	
224.	in-house	Taipeh	Taiwan	
225.	in-house	Halmstad	Sweden	
226.	in-house	Mannheim	Germany	
227.	in-house	Ulm	Germany	
228.	public	Stockholm	Sweden	
229.	in-house	Zug	Switzerland	
230.	public	Montreal	Canada	
231.	in-house	Karlsruhe	Germany	
232.	in-house	Macau	Macau	
233.	in-house	Karlsruhe	Germany	
234.	in-house	Karlsruhe	Germany	
235.	in-house	Karlsruhe	Germany	
236.	in-house	Berlin	Germany	
237.	public	Stockholm	Sweden	
238.	public	Karlsruhe	Germany	
239.	public	Karlsruhe	Germany	
2017				
240.	in-house	Stuttgart	Germany	
241.	in-house	Ravensburg	Germany	
242.	public	Stockholm	Sweden	
243.	in-house	Glasgow	Schottland	
244.	in-house	Schio	Italy	
245.	in-house	Ettingen	Germany	
246.	public	Karlsruhe	Germany	
247.	in-house	Detmold	Germany	
248.	in-house	Glasgow	Schottland	

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Page 9

Subsets of the standard series used for the EvaDeHon Package



The diagram consists of three overlapping circles. The leftmost circle is labeled "Demo and Hands-On Training". The middle circle is labeled "SC1x3 SC1x5 WEB-PLC". The rightmost circle is labeled "PIS10 Standards". The intersection of the left and middle circles is labeled "Demo and Hands-On Training". The intersection of the middle and right circles is labeled "PIS10 Standards". The intersection of the left and right circles is labeled "SC1x3 SC1x5 WEB-PLC". The intersection of all three circles is labeled "SC1x3 SC1x5 WEB-PLC PIS10 Standards".

This diagram is not to scale.

- Subset for the EvaDeHon Package using the API/Stack from SystemCorp*
- Subset used at Beck IPC platforms
- The Parts of IEC 61850
- SystemCorp Stack/API

• The subset applicable for the demo and hands-on training is intended to focus on crucial aspects of the message exchange between two devices using SCL for modelling signals and communication. Negative responses of messages (shown in MMS at Wireshark level) are intentionally shown to a minimum at application level. The API has a lot more calls and call-backs than used in the package.

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Page 10

What the EvaDeHon Package provides?



1. One Client communicating with one Server on one PC (**local host**)
2. One Client on one PC communicating with one **Server on a second PC** (or other IEDs, e.g., Gateways)
3. One Server/Publisher sending GOOSE messages
4. One Client/Subscriber receiving GOOSE messages
5. **One or many Clients** on one PC communicating with **multiple Servers and multiple Publisher** on a (single!) second PC
6. All IEC 61850 Models for all roles listed above are configured by .cid Files
7. All **Applications** for Clients, Server, Publisher, and Subscriber are **auto-generated from the .cid Files** using the Microsoft APP *IEC61850ModelDecorator* located at the Microsoft Store in conjunction with the Application software.
8. The package uses a **commercially available API/Stack** from SystemCorp
9. Note that **security measures** for IEC 61850 are defined in IEC 62351
10. Note that this EvaDeHon Package **requires basic knowledge in IEC 61850**.



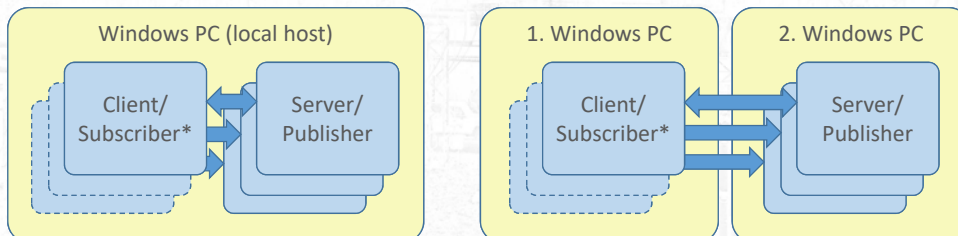
Application use-cases of the EvaDeHon Package



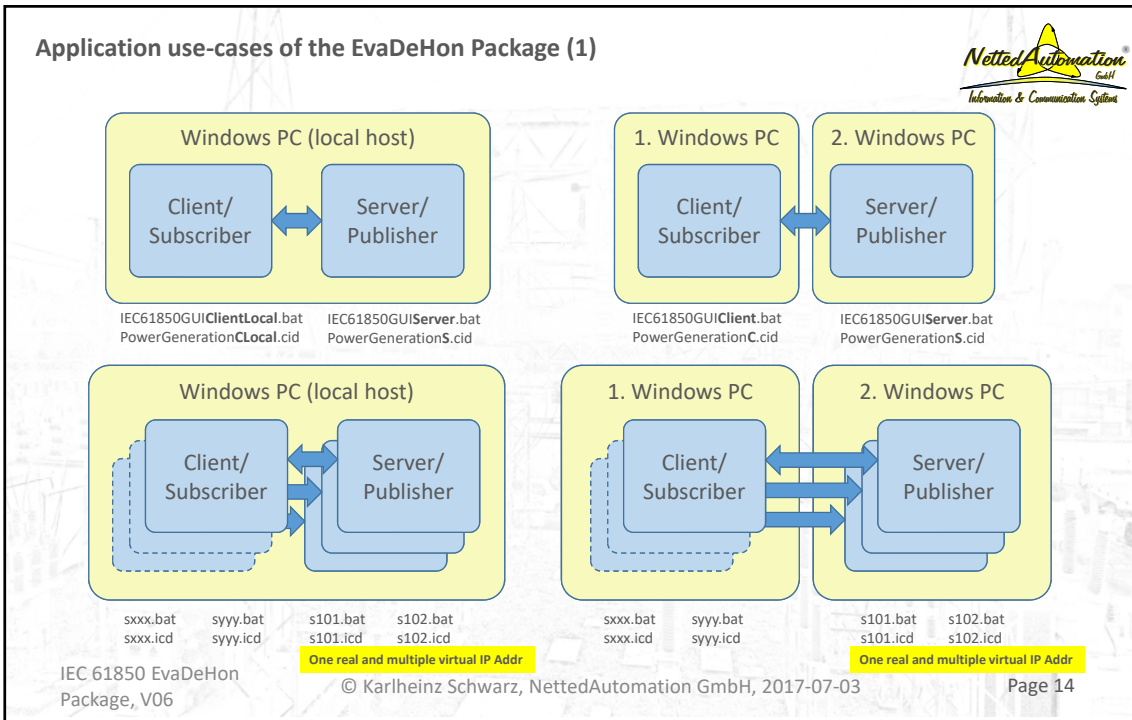
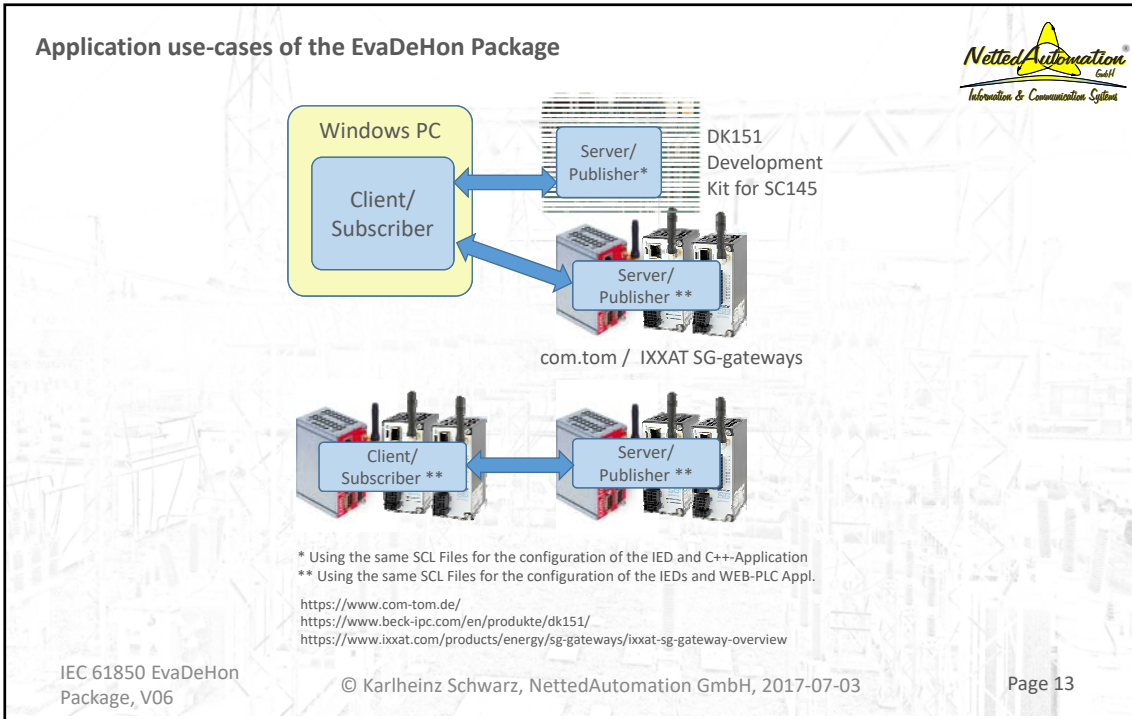
Single instance

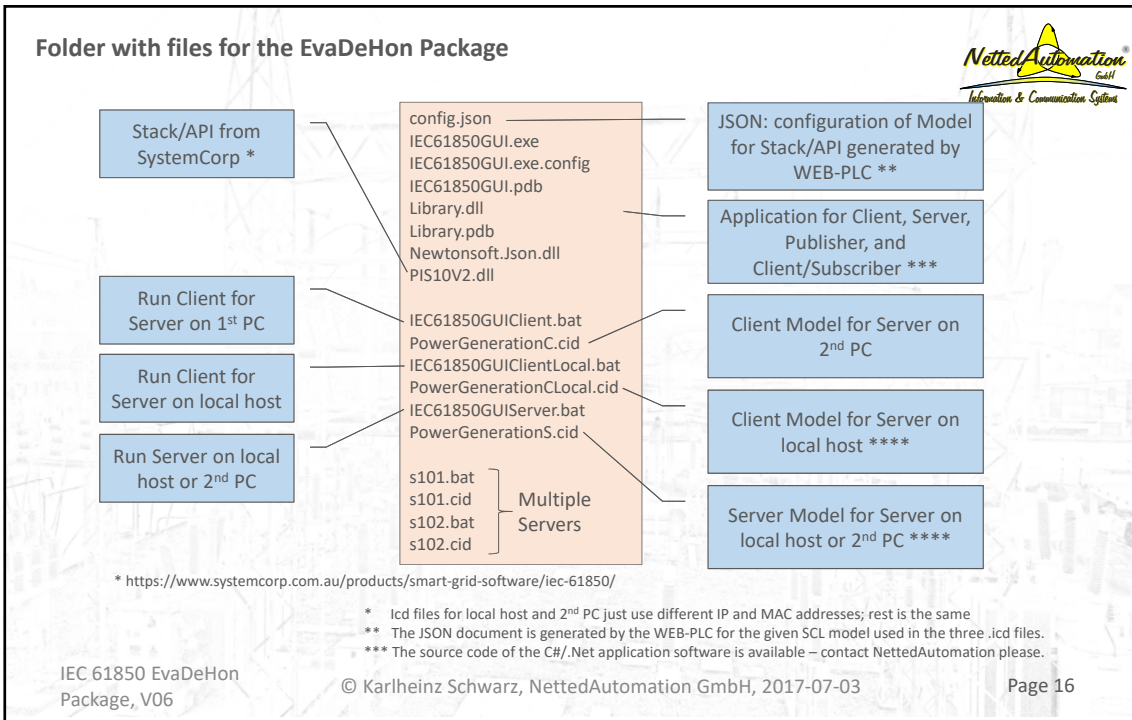
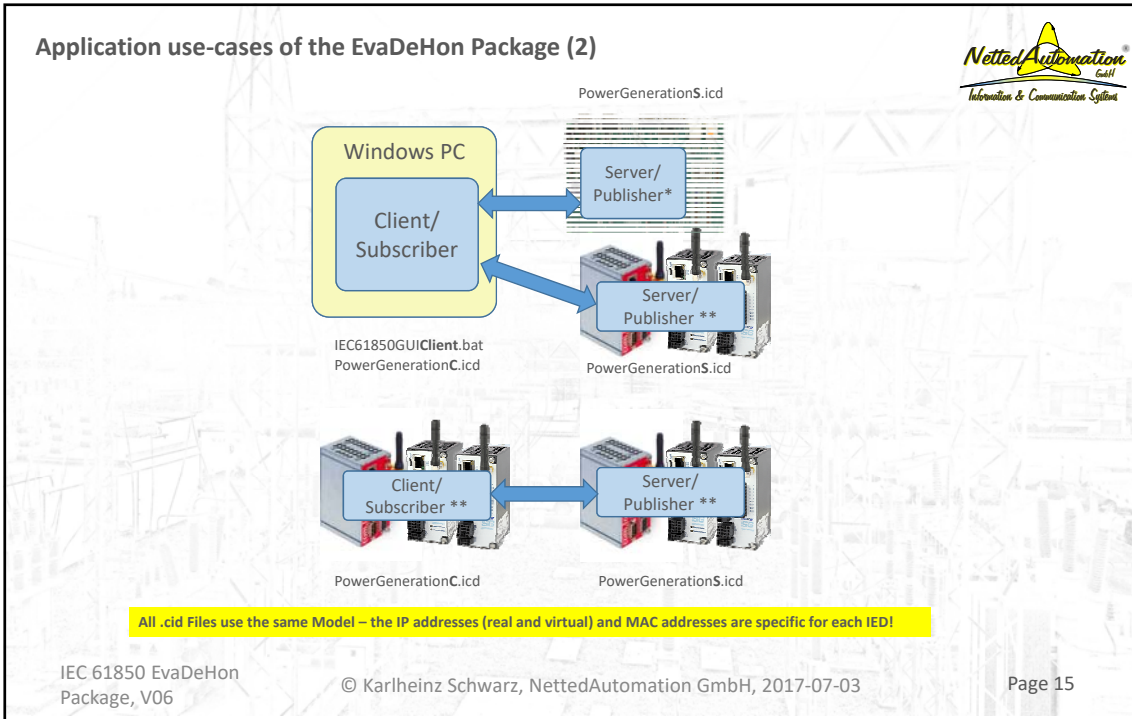


Multiple instances



* Single or multiple Clients/Subscriber. A single Client/Subscriber could communicate to multiple Server/Publisher





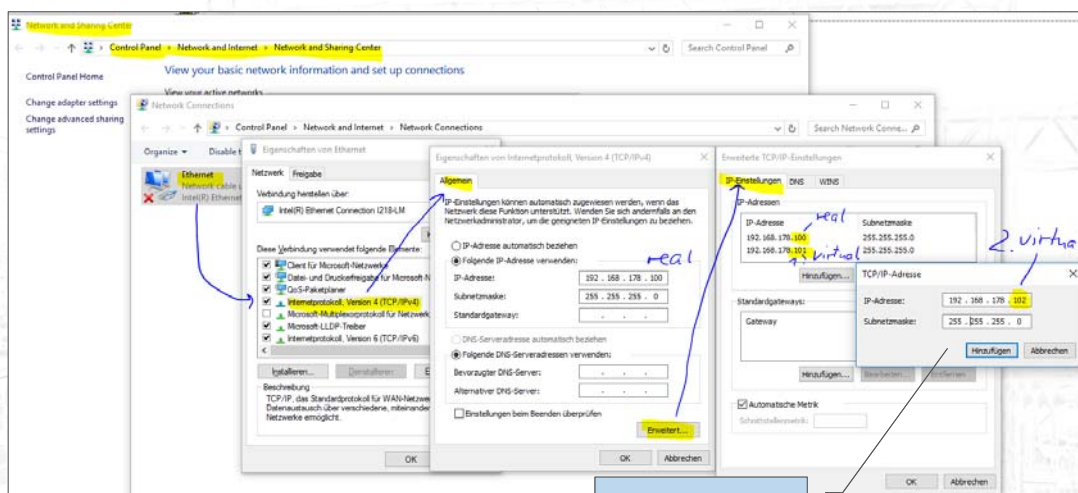
Prerequisites to run the software (important!!)



1. Modify **in the SCL files** the IP and MAC Addresses for the server/publisher and client/subscriber **to match with the PCs used**. For the "local host" you need to modify the MAC Addresses in both .icd files; use the MAC Address of the Ethernet Adapter where the Server/Publisher is running. **It is highly recommended to configure fix IPv4 addresses for Ethernet Adapters** (e.g., 192.168.172.100 for Client and 192.168.172.105 for Server). **Double check always that the addresses are correct!!!**
2. **In case the server and client (using the .bat files) do not run:**
 - a. Try to start the program as Admin ... if you are allowed to do so
 - b. Switch-off the Windows Firewall for the machine where the server is running or open port 102.
 - c. Check if the .Net-Framework is installed (one of the latest versions, e.g., 4.6.2) – try 32 or 64 bit version.
 - d. WinPcap needs to be installed (will be installed with Wireshark) – try 32 or 64 bit version.
 - e. Demo needs "Visual C++ Redistributable Packages install run-time components that are required to run C++ applications built using Visual Studio 2015":
<https://www.microsoft.com/en-us/download/details.aspx?id=48145> – try 32 or 64 bit version.
 - f. In some cases you have to deactivate the WLAN adapter.
 - g. In a few cases you have to connect an Ethernet cable to another PC or an Ethernet Switch. Check if the LED at the Ethernet port is flashing.
 - h. Very seldom it helps just to reboot your computer.
 - i. In some cases Windows restricts the Read and Write services in the use-case "local host".
 - j. **Double check always that the addresses are correct!!!**



Prerequisites to run Server/Publisher on multiple IP Addresses (important!!)



How to configure virtual IP Addresses

Prerequisites to run Server/Publisher on multiple IP Addresses **(important!!)**

2. Windows PC

- 192.168.178.100 Port 102
- 192.168.178.101 Port 102
- 192.168.178.102 Port 102
- ...

```

IEC61850GUIServer.bat
PowerGenerationS.cid*
s101.bat
s101.cid*
s102.bat
s102.cid*

```

```

13 <connectedAP IedName="PowerGen" apName="SubstationRing1">
14   <IAddress>
15     <AP-Title>1,1,9999,1</P>
16     <AP-Qualifier>12</P>
17     <PSEL>00000001</P>
18     <SSEL>0001</P>
19     <TSEL>0001</P>
20     <IP>192.168.178.100</P>
21     <!-- Enter the correct IP address of the PC acting
22     <P type="IP-SUBNET">255.255.255.0</P>
23     <P type="IP-GATEWAY">192.168.178.1</P>
24     <P type="MAC-Address">34-B6-D7-16-C7-AB</P>

```

* The IED name and LD name is the same in all .cid Files ... to simplify the EvaDeHon Package.

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Configuration of Client/Server (Subscriber/Publisher) with SCL Files

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Application of Client and Server (Subscriber and Publisher)

```
<SCL ...
<Communication ...
<IED name=„A“ ...
<IED name=„B“ ...
```

```
<SCL ...
<Communication ...
<IED name=„B“ ...
```

Both applications are automatically generated from the decorated .cid* file and JSON* File

Client IED (PIS10 V2.07.22 Apr 26 2017 17:35:33)

- IED
 - PowerGen_MONITOR
 - SPOS1
 - DRCC1
 - MMET1
 - MMTR1
 - MMXU1
 - TotW
 - mag

PowerGen_MONITOR.MMXU1.TotW.mag.f

Value: 2345

Quality: GOOD

Time stamp: 07/01/17 00:00:00

MM/dd/yy HH:mm:ss

Read Write Operate

Connected to IP 127.0.0.1.

Server IED (PIS10 V2.07.22 Apr 26 2017 17:35:33)

- IED
 - PowerGen_MONITOR
 - SPOS1
 - DRCC1
 - MMET1
 - MMTR1
 - MMXU1
 - TotW
 - mag

PowerGen_MONITOR.MMXU1.TotW.mag.f

Value: 2345

Quality: GOOD

Time stamp: 07/01/17 00:00:00

MM/dd/yy HH:mm:ss

Update

Update timestamp success.

* Defines the mapping of signals to application; for SystemCorp Stack/API;
IEC61850ModelDecorator Windows App generates the decoration and generation of the JSON File

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Page 21

Topology of Demo (on one Windows machine) – local host

Second run Client for Server on local host

First run Server on local host

Client IED (PIS10 V2.07.22 Apr 26 2017 17:35:33)

- IED
 - PowerGen_MONITOR
 - SPOS1
 - DRCC1
 - MMET1
 - MMTR1
 - MMXU1
 - TotW
 - mag

PowerGen_MONITOR.MMXU1.TotW.mag.f

Value: 2345

Quality: GOOD

Time stamp: 07/01/17 00:00:00

MM/dd/yy HH:mm:ss

Read Write Operate

Connected to IP 127.0.0.1.

Server IED (PIS10 V2.07.22 Apr 26 2017 17:35:33)

- IED
 - PowerGen_MONITOR
 - SPOS1
 - DRCC1
 - MMET1
 - MMTR1
 - MMXU1
 - TotW
 - mag

PowerGen_MONITOR.MMXU1.TotW.mag.f

Value: 2345

Quality: GOOD

Time stamp: 07/01/17 00:00:00

MM/dd/yy HH:mm:ss

Update

Update timestamp success.

<P type="IP">127.0.0.1</P> PC internal communication <P type="IP">127.0.0.1</P>

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Page 22

Topology of Demo (on two Windows machines)

2. Run Client for Server on 1st PC

1. Run Server on 2nd PC

Client IED (PIS10 V2.07.22 Apr 26 2017 17:35:33)

Server IED (PIS10 V2.07.22 Apr 26 2017 17:35:33)

<P type="IP">192.168.178.100</P>

<P type="IP">192.168.178.105</P>

MMS, TCP/IP, GOOSE, Ethernet/Ethertype, ...visible with Wireshark

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Page 23

Services used

The services driven by the .icd file are:

1. Client connects automatically to the Server (it's an embedded client!).
2. Client enables automatically the Report Control Block (if it is not reserved, Client checks if reserved or not).
3. Measurements are sent by the RCB every 10 seconds.
4. Events are sent by the configured GOOSE message.
5. Read and Write could be used for corresponding attributes.
6. Operate could be used for controlling the LN DRCC (manually change stVal to allow another Operate).
7. Quality may be changed manually (not recommended)
8. Time stamp may be set manually to another time.
9. When Client and Server run on two machines, you can trace the traffic with Wireshark.
10. DataSets with members from the existing models (LD/LN.DO.DA ...), Report Control Blocks, and GOOSE Control Blocks may be added, modified or removed. They do not have an impact on the JSON file used for building out the tree for the Device Model.
Note that any change in any icd file has to be made in ALL other icd files (client and server)!!
11. GOOSE messages may be "manipulated" by managed Ethernet Switches. Some may remove the VLAN-Header for example or may duplicate the GOOSE messages (one with and one without VLAN Header).

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Page 24

Excerpt of icd file of Sever Model

```
PowerGenerationS.icd
40 <IED type="Monitoring-Device" name="PowerDev" manufacturer="NettedAutomation GmbH" configVersion="1.0">
41 <Services>
42 <AccessPoint name="SubstationRing1">
43 <Server timeout="30">
44 <Authentication />
45 <keyView desc="Desc of models and services on DK151" instat="MONITOR">
46 <LNO instat=" InClass="LNO" InType="LNO_0">
47 <FCDA inClass="STATUS" desc="Status information for GOOSE">
48 <FCDA inClass="SPOS" InInstat="1" doName="Aln" fc="ST" ldnat="MONITOR" />
49 <FCDA inClass="DNOC" InInstat="1" doName="DENStz" fc="ST" ldnat="MONITOR" />
50 </DataSet>
51 <DataSet name="Measurements" desc="Measurements for reporting">
52 <FCDA inClass="SPOS" InInstat="1" doName="DiffInsel" fc="MG" ldnat="MONITOR" />
53 <FCDA inClass="MSTFR" InInstat="1" doName="TotHM" fc="ST" ldnat="MONITOR" />
54 <FCDA inClass="MSTFR" InInstat="1" doName="TotHM" fc="ST" ldnat="MONITOR" />
55 </DataSet>
56 <ReportControl name="Status Report" rptID="Status Values" intgPd="0" dataSet="Status" confRev="1" buffered="false">
57 <RptOps subOp="true" qOp="false" sOp="false" period="true" />
58 <OptFields eqOp="true" timeStamp="true" reasonCode="true" dataSet="true" />
59 <RptEnabled max="2">
60 <ClientLN ldnat="MyClient" InClass="IMM" prefix="" InInstat="1" ldnat="none" />
61 </RptEnabled>
62 </ReportControl>
63 <ReportControl name="Measurement Report" rptID="Measured and counted Values" intgPd="5000" dataSet="Measurements" confRev="1" buffered="false">
64 <RptOps subOp="false" qOp="false" sOp="false" period="true" />
65 <OptFields eqOp="true" timeStamp="true" reasonCode="true" dataSet="true" />
66 <RptEnabled max="2">
67 <ClientLN ldnat="MyClient" InClass="IMM" prefix="" InInstat="1" ldnat="none" />
68 </RptEnabled>
69 </ReportControl>
70 <DOI name="ManPit">
71 <DAI name="wender" valKind="Set">
72 <Val>Beck IPC / NettedAutomation GmbH</Val>
73 </DAI>
74 <DAI name="swRev" valKind="Set">
75 <Val>2.07.18</Val>
76 </DAI>
77 </Services>
78 </AccessPoint>
79 </Server>
80 </IED>
81 </Monitoring-Device>
82 </ICDTemplate>
```

Server/Publisher

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Excerpt of icd file of Client Model

```
PowerGenerationC.icd
10 </Reader>
11 <Communication>
12 <SubNetwork type="B-IEEE" name="SubNetworkName">
13 <ConnectAsIP InClass="MyClient" sName="SubstationRing1">
14 <Address>
15 <IP type="IP">192.168.178.100</IP>
16 <MAC type="MAC-Address">34-B6-D7-16-C7-AB</MAC>
17 <IP type="IP-SUBNET">255.255.255.0</IP>
18 <IP type="IP-GATEWAY">192.168.178.1</IP>
19 <IP type="OSI-SSEL">00000001</IP>
20 <IP type="OSI-SSEL">01</IP>
21 <IP type="OSI-SSEL">01</IP>
22 </Address>
23 </ConnectAsIP>
24 <ConnectAsIP InClass="PowerDev" sName="SubstationRing1">
25 <Address>
26 <IP type="OSI-AP-Title">1,1,9999,1</IP>
27 <IP type="OSI-AP-Qualifier">12</IP>
28 <IP type="OSI-SSEL">00000001</IP>
29 <IP type="OSI-SSEL">0001</IP>
30 <IP type="OSI-TSEL">0001</IP>
31 <IP type="IP">192.168.178.151</IP>
32 <!-- Enter the correct IP address of the DR151 acting as 41850 server here: 0.0.0.0 means DR151 will use the configured IP of the device -->
33 <IP type="IP-SUBNET">255.255.255.0</IP>
34 <!-- IP type="IP-GATEWAY">192.168.178.1</IP>
35 <!-- IP type="MAC-Address">34-B6-D7-16-C7-AB</MAC> -->
36 <IP type="MAC-Address">300-30-56-50-01-4D</IP>
37 <!-- Enter the MAC address of the DR151 acting as 41850 server here: needed for GOOSE -->
38 </Address>
39 <IEC inClass="STATUS_CB_GOOSE" ldnat="MONITOR">
40 <Address>
41 <IP type="MAC-Address">01-0C-CD-01-00-36</IP>
42 <IP type="VLAN-PRIORITY">4</IP>
43 <IP type="VLAN-ID">0000</IP>
44 <IP type="APPID">0000</IP>
45 </Address>
46 <MinTime unit="s" multiplier="1">200</MinTime>
47 <MaxTime unit="s" multiplier="1">1000</MaxTime>
48 </IEC>
49 </ConnectAsIP>
50 </SubNetwork>
51 <Communication>
52 <IED name="MyClient">
53 <AccessPoint name="SubstationRing1">
54 <IEC inClass="IMM" instat="1" InType="IMM1">
55 </AccessPoint>
56 </IED>
57 </Communication>
58 </ICDTemplate>
```

IED: Client/Subscriber

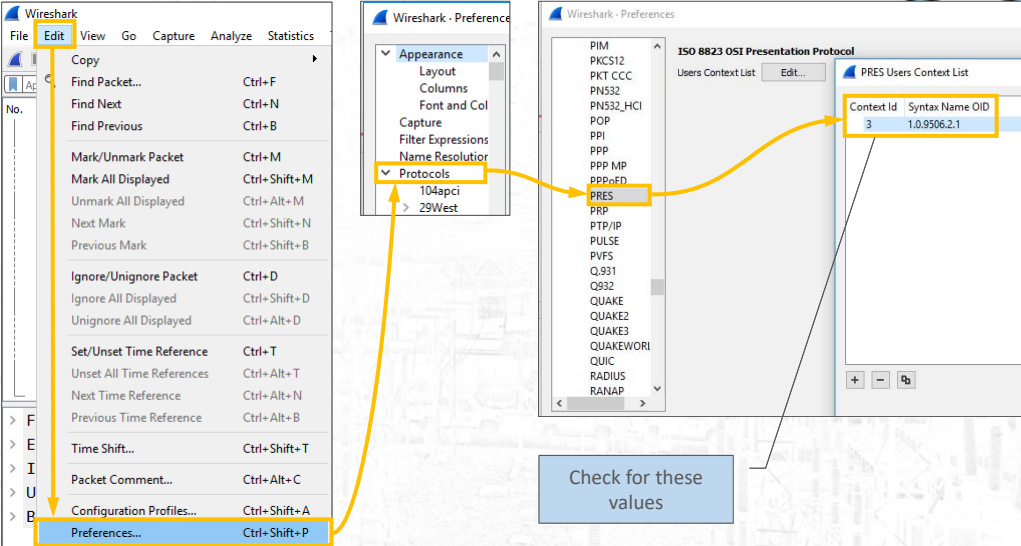
IED: Shadow Server/Publisher

IED: Client/Subscriber

IED: Shadow Server/Publisher

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Wireshark settings for MMS (ISO 9506) message analysis (1)



The screenshot shows the Wireshark interface with the following steps highlighted:

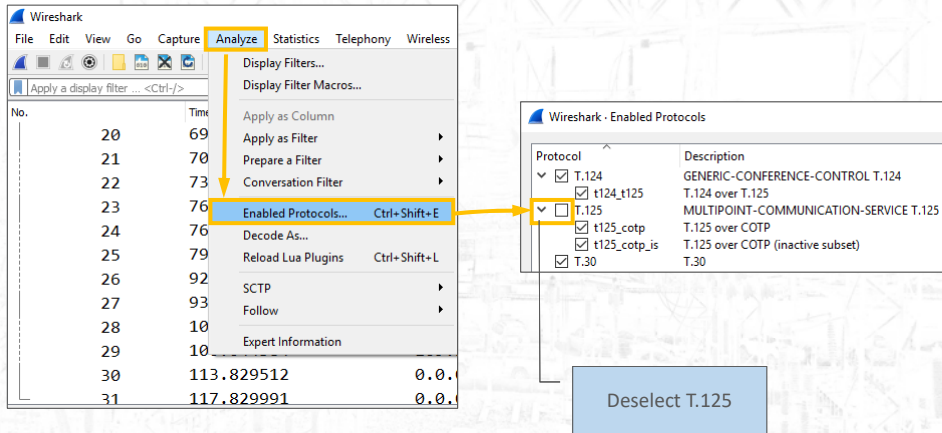
- Menu Path:** Edit > Preferences... (Ctrl+Shift+P)
- Appearance > Protocols:** The Protocols folder is expanded, showing sub-folders like 104apci and 29West.
- ISO 8823 OSI Presentation Protocol:** The protocol list is expanded to show 'PRES'.
- PRES Users Context List:** The 'PRES Users Context List' dialog is open, showing a table with the following data:

Context Id	Syntax Name	OID
3	1.0.9506.2.1	

A blue box with the text "Check for these values" points to the table above.

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Wireshark settings for MMS (ISO 9506) message analysis (2)



The screenshot shows the Wireshark interface with the following steps highlighted:

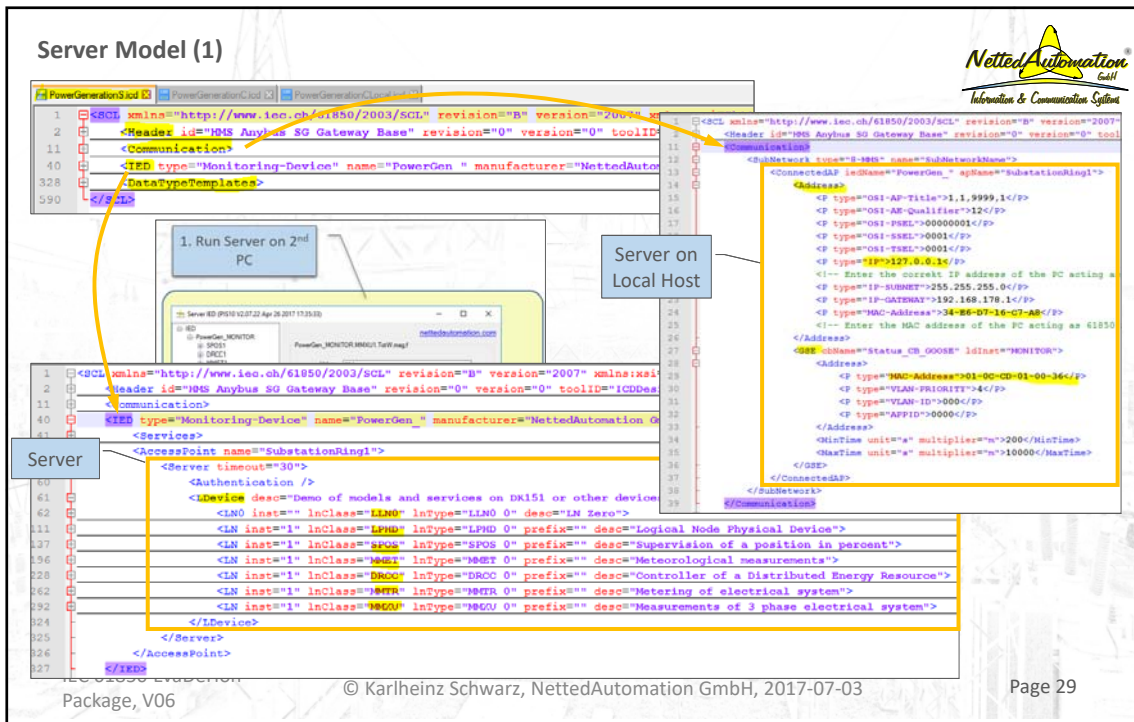
- Menu Path:** Analyze > Enabled Protocols... (Ctrl+Shift+E)
- Enabled Protocols Dialog:** The 'Enabled Protocols' dialog is open, showing a list of protocols with checkboxes. The 'T.125' checkbox is unchecked.

Protocol	Description
<input checked="" type="checkbox"/> T.124	GENERIC-CONFERENCE-CONTROL T.124
<input checked="" type="checkbox"/> t124_t125	T.124 over T.125
<input type="checkbox"/> T.125	MULTIPOINT-COMMUNICATION-SERVICE T.125
<input checked="" type="checkbox"/> t125_cotp	T.125 over COTP
<input checked="" type="checkbox"/> t125_cotp_is	T.125 over COTP (inactive subset)
<input checked="" type="checkbox"/> T.30	T.30

A blue box with the text "Deselect T.125" points to the unchecked checkbox for T.125.

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Server Model (1)



```

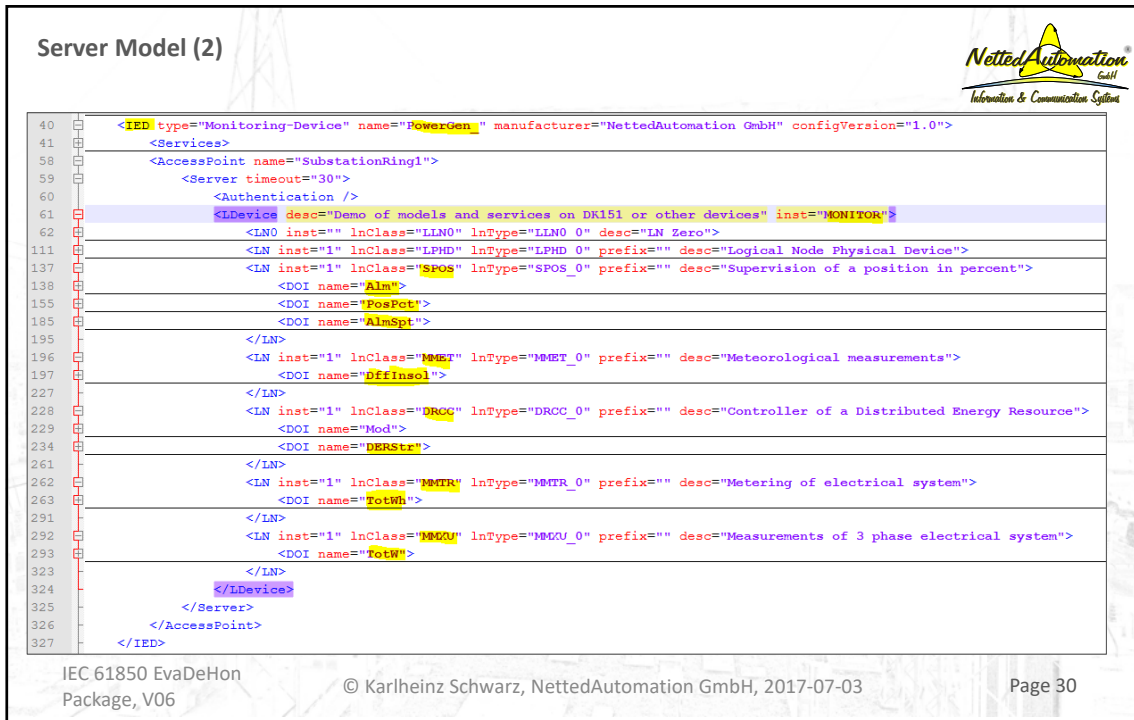
1 <SCL xmlns="http://www.iec.ch/61850/2003/SCL" revision="B" version="2007"
2 <Header id="IBMS Anybus SG Gateway Base" revision="0" version="0" toolID="
11 <Communication>
40 <IED type="Monitoring-Device" name="PowerGen" manufacturer="NettedAut
328 </SCL>
590
    
```

```

1 <SCL xmlns="http://www.iec.ch/61850/2003/SCL" revision="B" version="2007" xmlns:ks1
2 <Header id="IBMS Anybus SG Gateway Base" revision="0" version="0" toolID="ICDDea
11 <Communication>
40 <SIB type="Monitoring-Device" name="PowerGen" manufacturer="NettedAutomation G
<Services>
<AccessPoint name="SubstationRing1">
<Server timeout="30">
<Authentication />
<LDevice desc="Demo of models and services on DK151 or other device
61 <LN0 inst="" inClass="LLNO" lnType="LLNO_0" desc="LN Zero">
62 <LN inst="1" inClass="LPHD" lnType="LPHD_0" prefix="" desc="Logical Node Physical Device">
111 <LN inst="1" inClass="SPOS" lnType="SPOS_0" prefix="" desc="Supervision of a position in percent">
137 <LN inst="1" inClass="MMET" lnType="MMET_0" prefix="" desc="Meteorological measurements">
156 <LN inst="1" inClass="DRCC" lnType="DRCC_0" prefix="" desc="Controller of a Distributed Energy Resource">
162 <LN inst="1" inClass="MMTR" lnType="MMTR_0" prefix="" desc="Metering of electrical system">
192 <LN inst="1" inClass="MVGU" lnType="MVGU_0" prefix="" desc="Measurements of 3 phase electrical system">
324 </LDevice>
325 </Server>
326 </AccessPoint>
327 </IED>
    
```

Package, V06 © Karlheinz Schwarz, NettedAutomation GmbH, 2017-07-03 Page 29

Server Model (2)

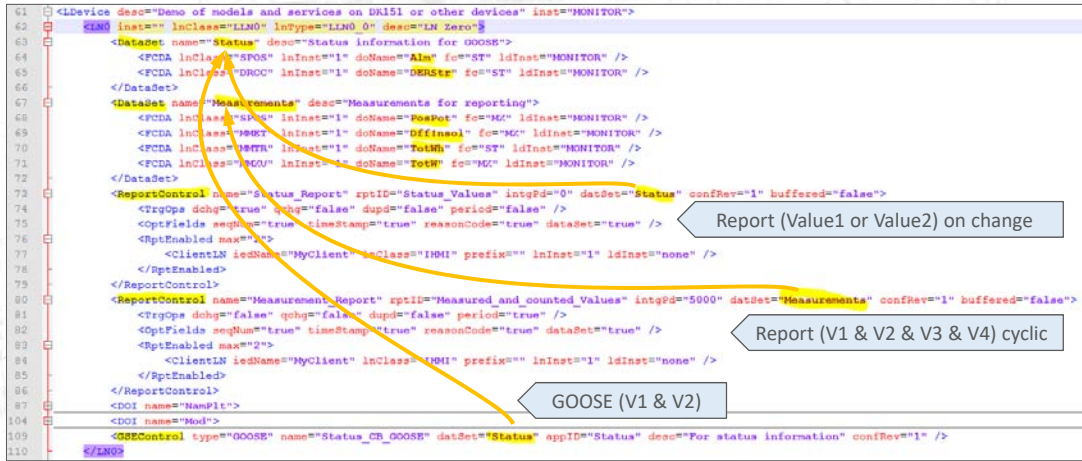


```

40 <IED type="Monitoring-Device" name="PowerGen" manufacturer="NettedAutomation GmbH" configVersion="1.0">
41 <Services>
58 <AccessPoint name="SubstationRing1">
59 <Server timeout="30">
60 <Authentication />
61 <LDevice desc="Demo of models and services on DK151 or other devices" inst="MONITOR">
62 <LN0 inst="" inClass="LLNO" lnType="LLNO_0" desc="LN Zero">
111 <LN inst="1" inClass="LPHD" lnType="LPHD_0" prefix="" desc="Logical Node Physical Device">
137 <LN inst="1" inClass="SPOS" lnType="SPOS_0" prefix="" desc="Supervision of a position in percent">
138 <DOI name="Alm">
155 <DOI name="PosPct">
185 <DOI name="AlmSpt">
195 </LN>
196 <LN inst="1" inClass="MMET" lnType="MMET_0" prefix="" desc="Meteorological measurements">
197 <DOI name="OffInsol">
227 </LN>
228 <LN inst="1" inClass="DRCC" lnType="DRCC_0" prefix="" desc="Controller of a Distributed Energy Resource">
229 <DOI name="Mod">
234 <DOI name="DERstr">
261 </LN>
262 <LN inst="1" inClass="MMTR" lnType="MMTR_0" prefix="" desc="Metering of electrical system">
263 <DOI name="TotWh">
291 </LN>
292 <LN inst="1" inClass="MVGU" lnType="MVGU_0" prefix="" desc="Measurements of 3 phase electrical system">
293 <DOI name="TotWh">
323 </LN>
324 </LDevice>
325 </Server>
326 </AccessPoint>
327 </IED>
    
```

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Server Model (3)

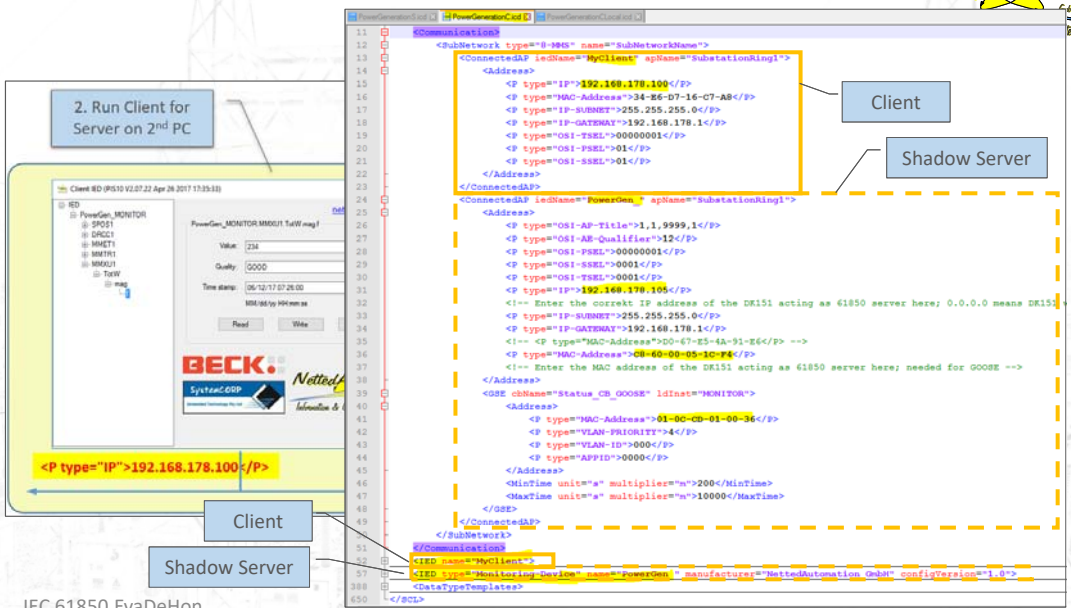


The screenshot shows XML code for a server model. Annotations include:

- Report (Value1 or Value2) on change**: Points to the `<ReportControl name="Status_Report" rptID="Status_Values" intgPd="0" dataSet="Status" confRev="1" buffered="false">` block.
- Report (V1 & V2 & V3 & V4) cyclic**: Points to the `<ReportControl name="Measurement_Report" rptID="Measured_and_counted_Values" intgPd="5000" dataSet="Measurements" confRev="1" buffered="false">` block.
- GOOSE (V1 & V2)**: Points to the `<GOOSEControl type="GOOSE" name="Status_CB_GOOSE" dataSet="Status" appID="Status" desc="For status information" confRev="1" />` block.

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Client Model (1)




The screenshot shows XML code for a client model and a client configuration window. Annotations include:

- Client**: Points to the `<SubNetwork type="B-9905" name="SubNetworkName">` block.
- Shadow Server**: Points to the `<ConnectedAP IedName="MyClient" apName="SubstationRing1">` block.
- 2. Run Client for Server on 2nd PC**: Points to the client configuration window.
- Client**: Points to the `<P type="IP">192.168.178.100</P>` line in the XML code.
- Shadow Server**: Points to the `<GOSE cbName="Status_CB_GOOSE" lIdInst="MONITOR">` block in the XML code.

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Client Model (2)



```


52 <IED name="MyClient">
53   <AccessPoint name="SubstationRing1">
54     <LN lnClass="IHMI" inst="1" lnType="IHMIa"/>
55   </AccessPoint>
56 </IED>
57 <IED type="Monitoring-Device" name="PowerGen" manufacturer="NettedAutomation GmbH" configVersion="1.0">
58   <Services>
75     <AccessPoint name="SubstationRing1">
76       <Server timeout="30">
77         <Authentication />
78         <LDevice desc="Demo of models and services on DK151 or other devices" inst="MONITOR">
79           <LN0 inst="" lnClass="LLNO" lnType="LLNO 0" desc="LN Zero">
28             <LN inst="1" lnClass="LPHD" lnType="LPHD 0" prefix="" desc="Logical Node Physical Device">
54             <LN inst="1" lnClass="SPOS" lnType="SPOS 0" prefix="" desc="Supervision of a position in percent">
27             <LN inst="1" lnClass="MMET" lnType="MMET 0" prefix="" desc="Meteorological measurements">
66             <LN inst="1" lnClass="DRCC" lnType="DRCC 0" prefix="" desc="Controller of a Distributed Energy Resource">
09             <LN inst="1" lnClass="MMTR" lnType="MMTR 0" prefix="" desc="Metering of electrical system">
45             <LN inst="1" lnClass="MMGU" lnType="MMGU 0" prefix="" desc="Measurements of 3 phase electrical system">
84           </LDevice>
85         </Server>
86       </AccessPoint>
87 </IED>

```

The model of the Shadow Server is exactly the same as the model of the real Server.

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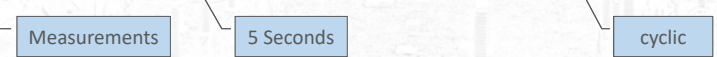
Report Control (1)



```

<ReportControl name="Status Report" rptID="Status_Values" intgPd="0" dataSet="Status"
  confRev="1" buffered="false">
  <TrgOps dchg="true" qchg="false" dupd="false" period="false" />
  <OptFields seqNum="true" timeStamp="true" reasonCode="true" dataSet="true" />
  <RptEnabled max="2">
    <ClientLN iedName="MyClient" lnClass="IHMI" prefix="" lnInst="1" ldInst="none" />
  </RptEnabled>
</ReportControl>
<ReportControl name="Measurement Report" rptID="Measured and counted Values"
  intgPd="5000" dataSet="Measurements" confRev="1" buffered="false">
  <TrgOps dchg="false" qchg="false" dupd="false" period="true" />
  <OptFields seqNum="true" timeStamp="true" reasonCode="true" dataSet="true" />
  <RptEnabled max="2">
    <ClientLN iedName="MyClient" lnClass="IHMI" prefix="" lnInst="1" ldInst="none" />
  </RptEnabled>
</ReportControl>

```



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Report Control (2) – Chance configuration

```

<ReportControl name="Status_Report" rptID="Status_Values" intgPd="0" dataSet="Status"
  confRev="1" buffered="false">
  <TrgOps dchg="true" qchg="false" dupd="false" period="false" />
  <OptFields seqNum="true" timeStamp="true" reasonCode="true" dataSet="true" />
  <RptEnabled max="2">
    <ClientLN iedName="MyClient" lnClass="IHMI" prefix="" lnInst="1" ldInst="none" />
  </RptEnabled>
</ReportControl>
<ReportControl name="Measurement_Report" rptID="Measured and counted Values"
  intgPd="5000" dataSet="Measurements" confRev="1" buffered="false">
  <TrgOps dchg="false" qchg="false" dupd="false" period="true" />
  <OptFields seqNum="true" timeStamp="true" reasonCode="true" dataSet="true" />
  <RptEnabled max="2">
    <ClientLN iedName="MyClient" lnClass="IHMI" prefix="" lnInst="1" ldInst="none" />
  </RptEnabled>
</ReportControl>
  
```

on change

set to true

set to 15000
(15 sec)

5 Seconds

set to 20 ms

cyclic

Report Control (3)

1. Make sure that you keep a copy of the original models!
2. After making a change in the server's control blocks you have to restart the server.
3. Check message flow after modifying the **status report control block** to intgPd="15000" and periodic="true".
Change value of Alarm manually.
4. Check message flow after modifying the **measurement report control block** to intgPd="20"
5. Change other attributes – be careful! Think twice before you change any value!
6. It is recommended to use ONE (1) control block at the beginning! Just not to get confused watching many messages ... You can comment out control blocks in the SCL file to "stop" them working: **<!-- commented out control block -->** see next slide
7. You may modify the DataSets as well ... be aware that you have to make the same changes in both files (in the model of server **AND** of the client).

GOOSE Control Block commented out



```

</DOI>
<!--
<GOOSEControl type="GOOSE" name="Status_CB_GOOSE" dataSet="Status" appID="Status" desc="For status information" confRev="1" />
-->
</LN0>
    
```

1. This GOOSE control block will not run after restart of the server.
2. The manipulation of the SCL File could be done with any text editor (I like Notepad++) or with a special IEC 61850 IED configuration tools (ICT).
3. The use of a text editor could cause severe damages of the SCL file ... It may not conform anymore to the correct SCL schema or IEC 61850 models.
4. Tools that check correctness of the SCL files are available ... e.g., ICDDesigner from SystemCorp, IED Scout from Omicron, UNICA SCL Checker from DNV/KEMA, ...

GOOSE message configuration



```

<GSE cbName="Status_CB_GOOSE" ldInst="MONITOR">
  <Address>
    <P type="MAC-Address">01-0C-CD-01-00-36</P>
    <P type="VLAN-PRIORITY">4</P>
    <P type="VLAN-ID">000</P>
    <P type="APPID">0000</P>
  </Address>
  <MinTime unit="s" multiplier="m">200</MinTime>
  <MaxTime unit="s" multiplier="m">10000</MaxTime>
</GSE>

<DataSet name="Status" desc="Status information for GOOSE">
  <FCDA lnClass="SPOS" lnInst="1" doName="Alm" fc="ST" ldInst="MONITOR" />
  <FCDA lnClass="DRGC" lnInst="1" doName="DRRStg" fc="ST" ldInst="MONITOR" />
</DataSet>

<DataSet name="Measurements" desc="Measurements for reporting">
  <FCDA lnClass="SPOS" lnInst="1" doName="PosPot" fc="MC" ldInst="MONITOR" />
  <FCDA lnClass="MRET" lnInst="1" doName="Definso1" fc="MC" ldInst="MONITOR" />
  <FCDA lnClass="MRET" lnInst="1" doName="TotW" fc="ST" ldInst="MONITOR" />
  <FCDA lnClass="MRCU" lnInst="1" doName="TotW" fc="MC" ldInst="MONITOR" />
</DataSet>

</DOI>
<GOOSEControl type="GOOSE" name="Status_CB_GOOSE" dataSet="Status" appID="Status" desc="For status information" confRev="1" />
</LN0>
    
```

set to 10

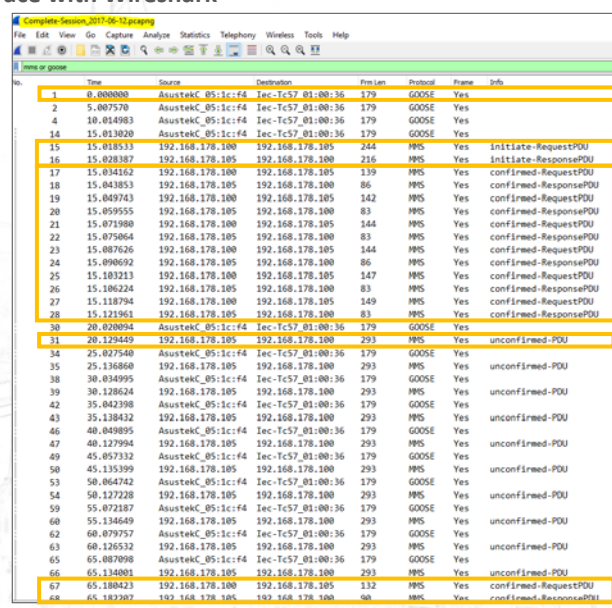
after change

Steady state (actual every 5 sec)

stVal, q, t

stVal, q, t

Session Trace with Wireshark



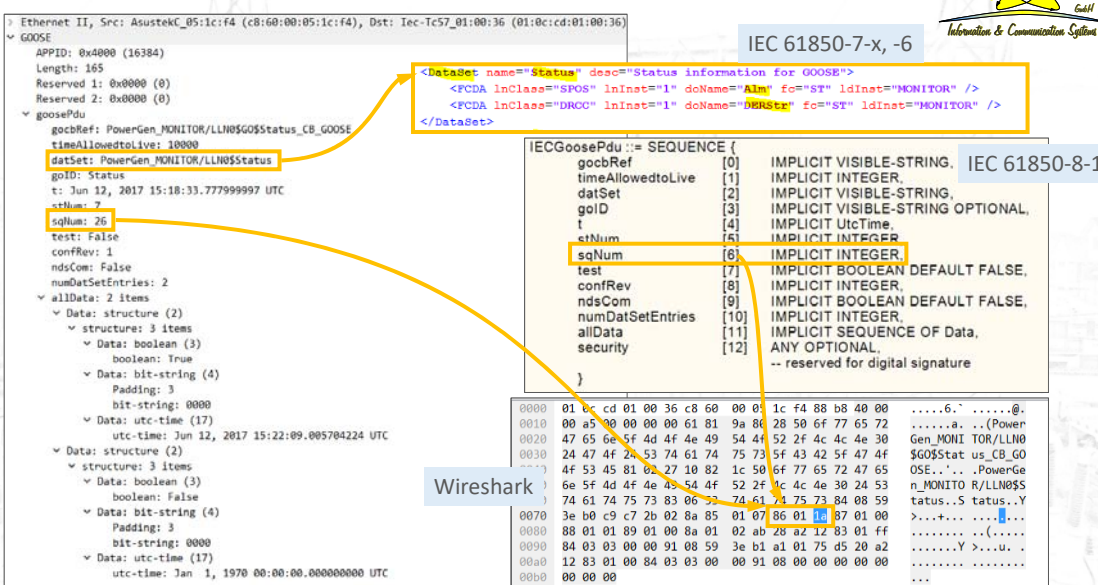
Complete-Session_2017-06-12.pcapng

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Page 39

GOOSE Message



IEC 61850-7-x, -6

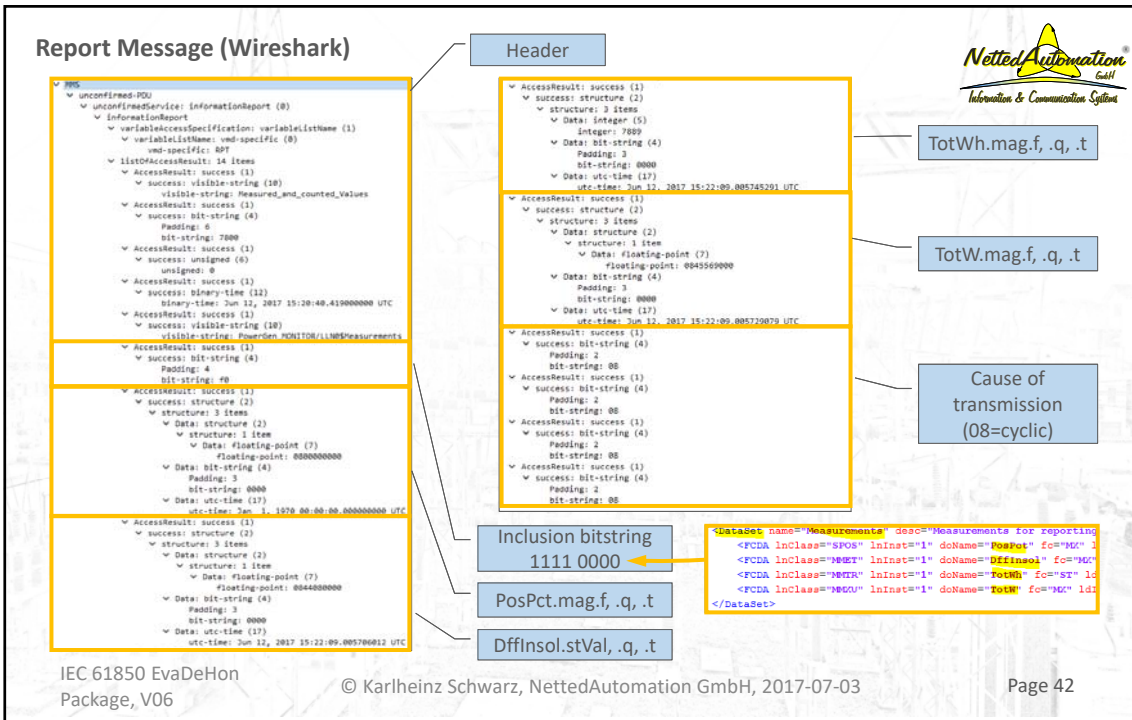
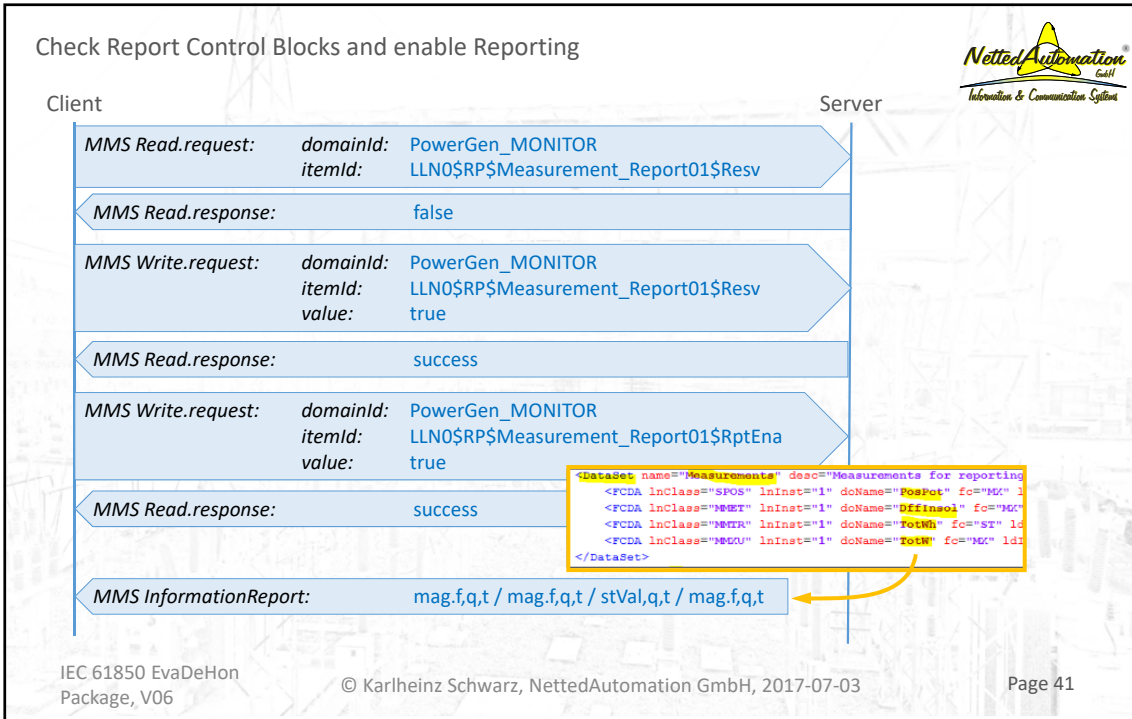
IEC 61850-8-1

Wireshark


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Page 40




Report Message (Wireshark ASN.1 BER encoding)



0000	34 e6 d7 16 c7 a8 c8 60 00 05 1c f4 08 00 45 00	4.....`.....E.
0010	01 17 03 92 40 00 80 06 10 30 c0 a8 b2 69 c0 a8	...@... .0...i..
0020	b2 64 00 66 d9 41 74 b2 e0 d1 ba 79 3a 02 50 18	.d.f.At. ...y:P.
0030	00 fd 7f 93 00 00 03 00 00 ef 02 f0 80 01 00 01
0040	00 61 81 e1 30 81 de 02 01 03 a0 81 d8 a3 81 d5	.a.0.....
0050	a0 81 d2 a1 05 80 03 52 50 54 a0 81 c8 8a 1b 4dR PT.....P
0060	65 61 73 75 72 65 64 5f 61 6e 64 5f 63 6f 75 6e	asured_ and coun
0070	74 65 64 5f 56 61 6c 75 65 73 84 03 06 78 00 86	ted_Valu es...x..
0080	01 00 8c 06 03 4a e6 e3 2f b8 8a 22 50 6f 77 65J.. /.. "Powe
0090	72 47 65 6e 5f 4d 4f 4e 49 54 4f 52 2f 4c 4c 4e	rGen_MON ITOR/LLN
00a0	30 24 4d 65 61 73 75 72 65 6d 65 6e 74 73 84 02	0\$Measur ements..
00b0	04 f0 a2 18 a2 07 87 05 08 00 00 00 84 03 03
00c0	00 00 91 08 00 00 00 00 00 00 00 00 a2 18 a2 07
00d0	87 05 08 44 08 00 00 84 03 03 00 00 91 08 59 3e	...D.....Y>
00e0	b1 a1 01 75 f3 50 a2 13 85 02 1e d1 84 03 03 00	...u.P.....
00f0	00 91 08 59 3e b1 a1 01 78 86 e0 a2 18 a2 07 87	...Y>... x.....
0100	05 08 45 56 90 00 84 03 03 00 00 91 08 59 3e b1	..EV.....Y>.
0110	a1 01 77 76 44 84 02 02 08 84 02 02 08 84 02 02	..wvD.....
0120	08 84 02 02 08

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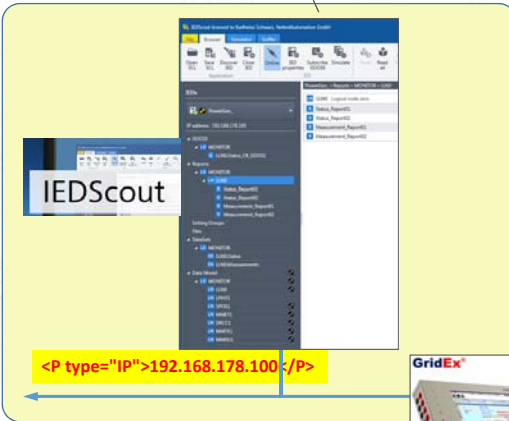
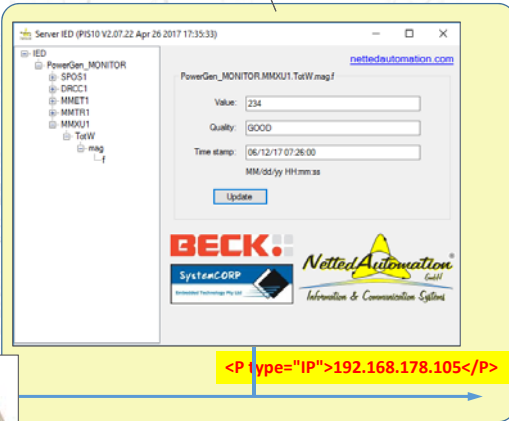
Many other exercises during Hands-On Training will be done (if time permits)



1. Issue GetData and SetData services
2. Issue Operate service
3. Add DataSets
4. Add Control Blocks
5. Configure new device model with *ICDDesigner* (SystemCorp)
<https://www.systemcorp.com.au/products/tools/icd-designer/>
6. Decorate the Server ICD File with the *IEC61850ModelDecorator* (get Client.icd, Server.icd, and .json File), and use with the demo.
7. Use GridEx (FMTP)
<http://fmpower.com/>
8. Use Browser-Client, e.g., *IEDScout 4.2* (Omicron)
<https://www.omicronenergy.com/en/products/all/secondary-testing-calibration/iedscout/noc/1/#Description>
9. ...

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Many other exercises during Hands-On Training (time permitted)





Second run Client for Server on 1st PC

First run Server on 2nd PC

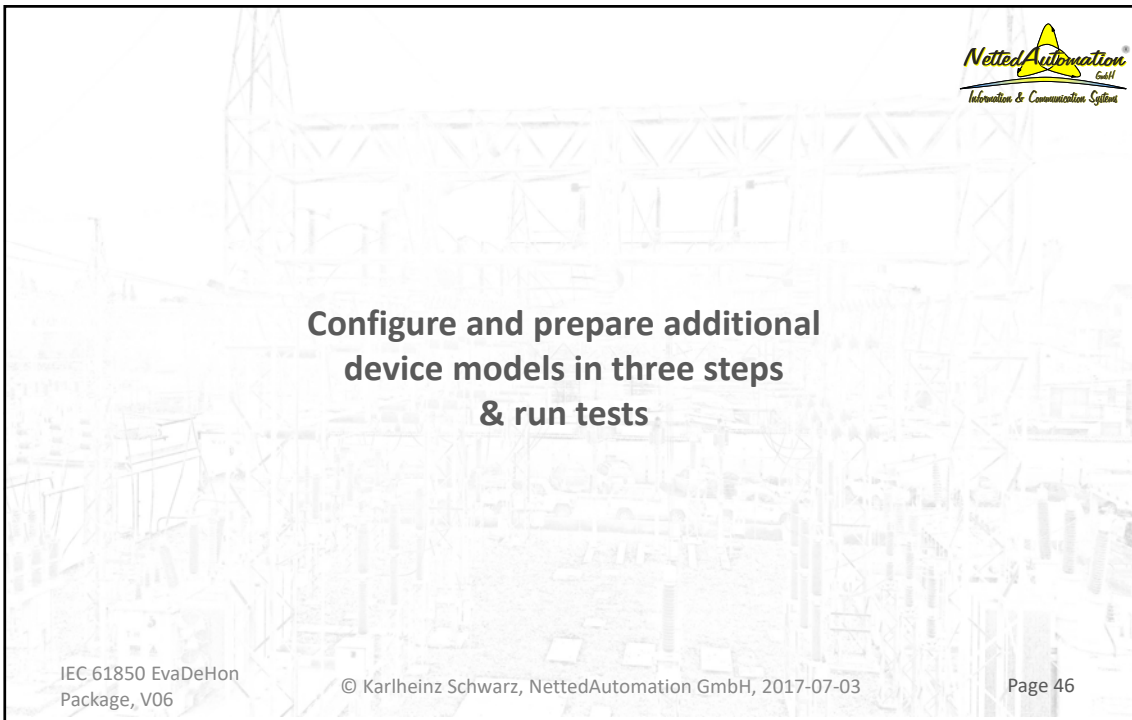
`<P type="IP">192.168.178.100 /P>`

`<P type="IP">192.168.178.105 /P>`

MMS, TCP/IP, GOOSE,  Ethernet/Ethertype, ...visible with Wireshark

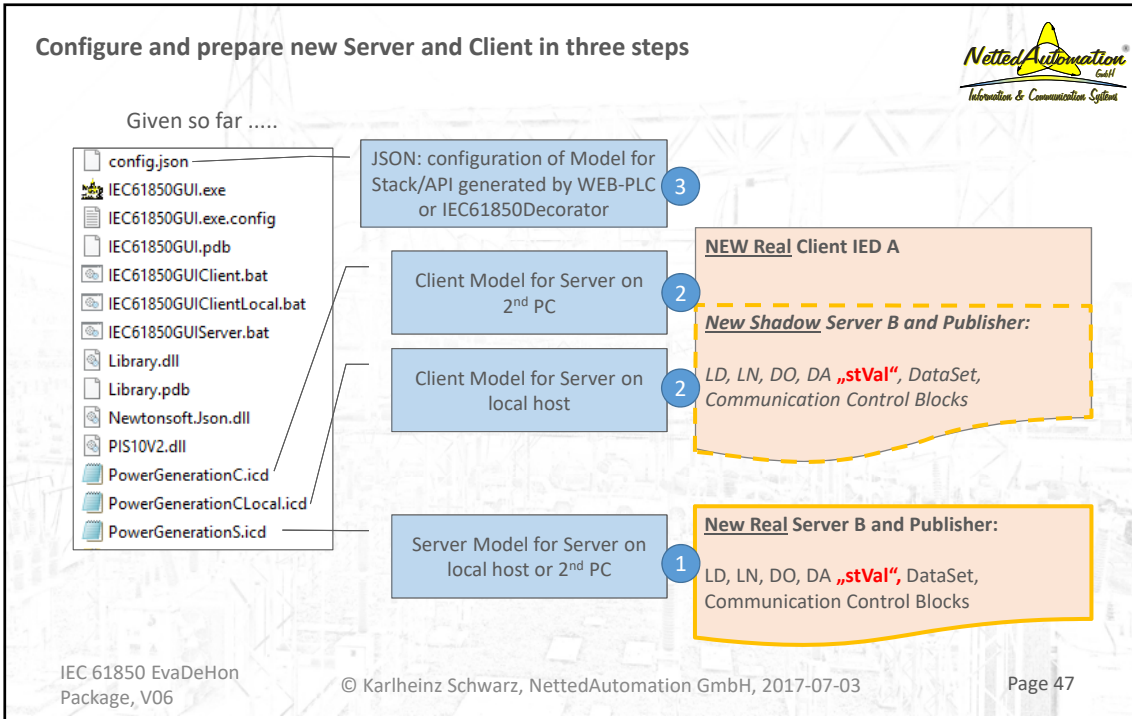
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Configure and prepare additional device models in three steps & run tests



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Configure and prepare new Server and Client in three steps



Given so far

- config.json
- IEC61850GUI.exe
- IEC61850GUI.exe.config
- IEC61850GUI.pdb
- IEC61850GUIClient.bat
- IEC61850GUIClientLocal.bat
- IEC61850GUIServer.bat
- Library.dll
- Library.pdb
- Newtonsoft.Json.dll
- PIS10V2.dll
- PowerGenerationC.icd
- PowerGenerationCLocal.icd
- PowerGenerationS.icd

1 Server Model for Server on local host or 2nd PC

2 Client Model for Server on 2nd PC

2 Client Model for Server on local host

3 JSON: configuration of Model for Stack/API generated by WEB-PLC or IEC61850Decorator

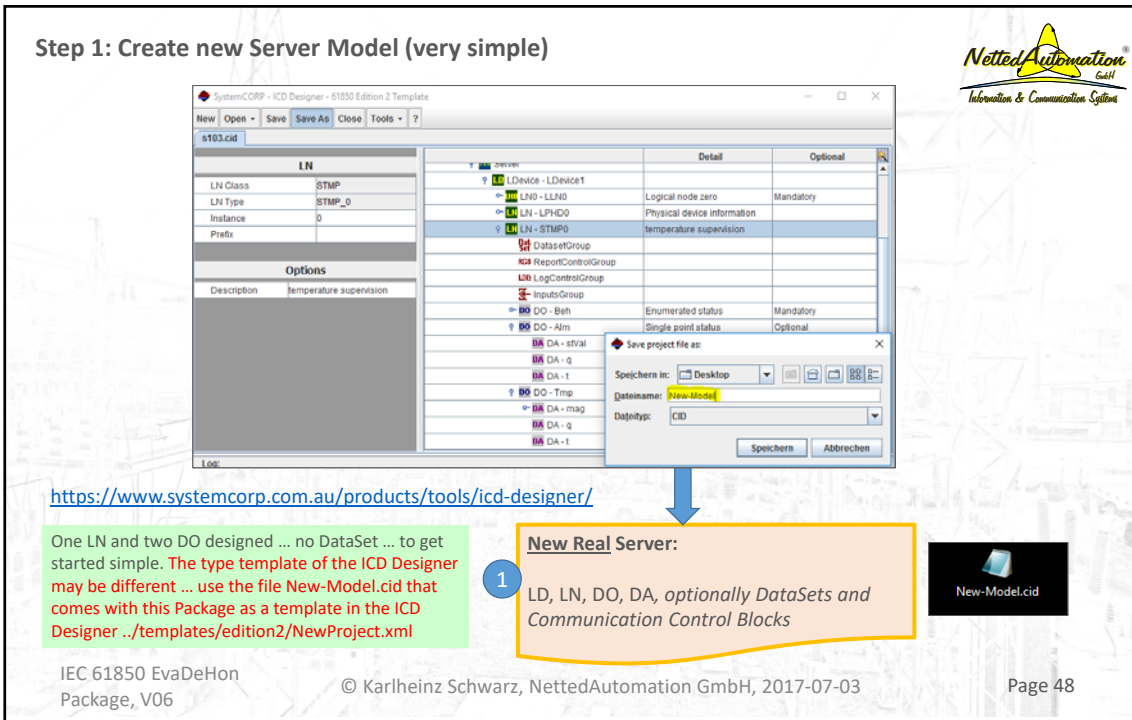
NEW Real Client IED A

New Shadow Server B and Publisher:
LD, LN, DO, DA „stVal“, DataSet, Communication Control Blocks

New Real Server B and Publisher:
LD, LN, DO, DA „stVal“, DataSet, Communication Control Blocks

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Step 1: Create new Server Model (very simple)



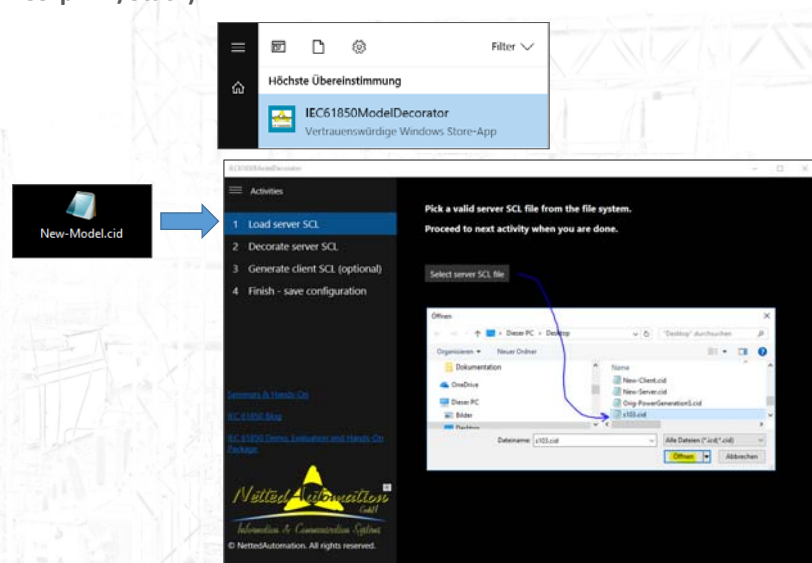
<https://www.systemcorp.com.au/products/tools/icd-designer/>

One LN and two DO designed ... no DataSet ... to get started simple. The type template of the ICD Designer may be different ... use the file New-Model.cid that comes with this Package as a template in the ICD Designer ../templates/edition2/NewProject.xml

1 New Real Server:
LD, LN, DO, DA, optionally DataSets and Communication Control Blocks

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Step 2: Decorate Server Model (adds Private Elements to signals for SystemCorp API/Stack)

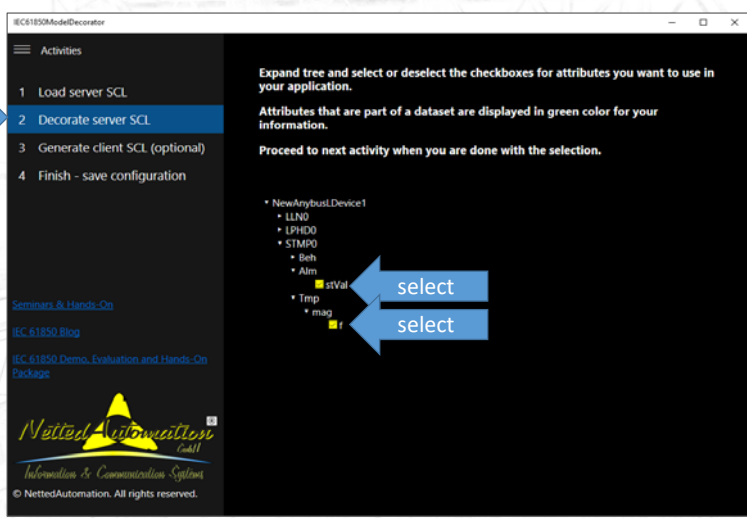


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Page 49

Step 2: Decorate Server Model (adds Private Elements to signals for SystemCorp API/Stack)

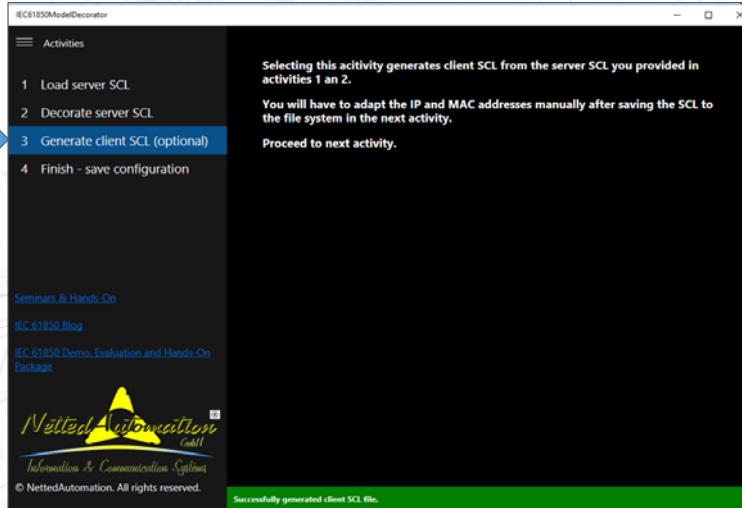


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Page 50

Step 2: Generate Client Model based on decorated Server Model

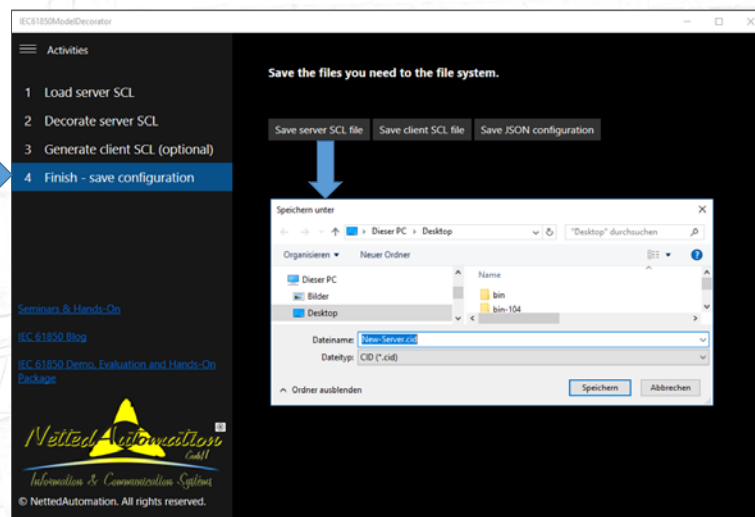


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Page 51

Step 2: Generate Client Model based on decorated Server Model

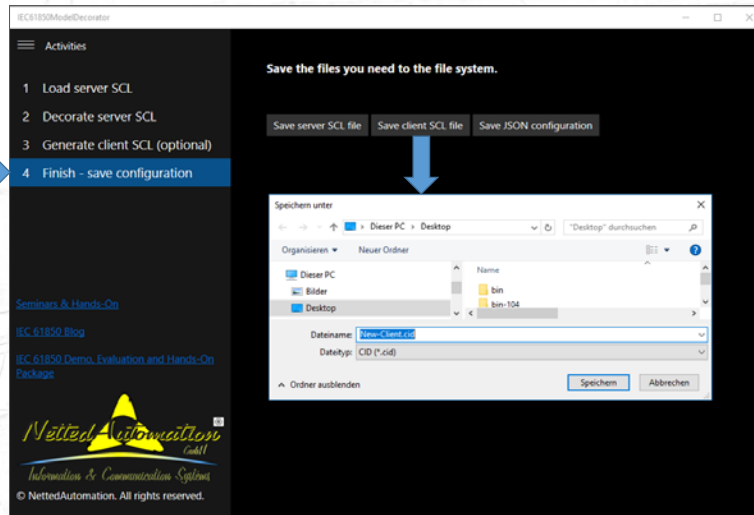


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Package, V06

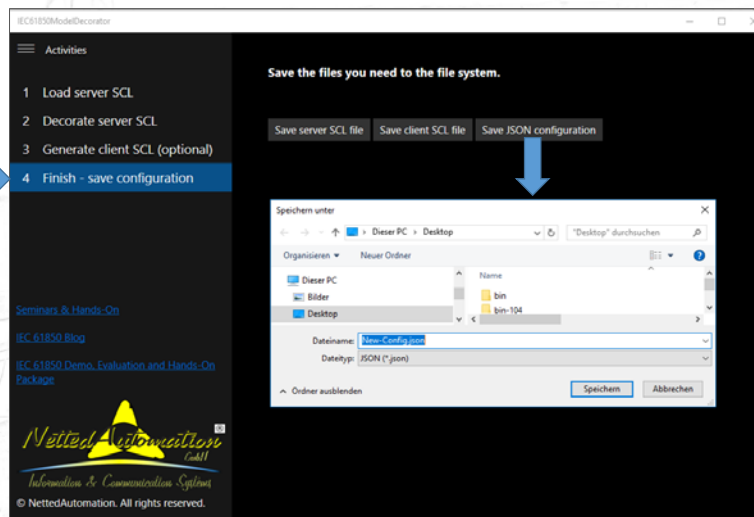
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Page 52

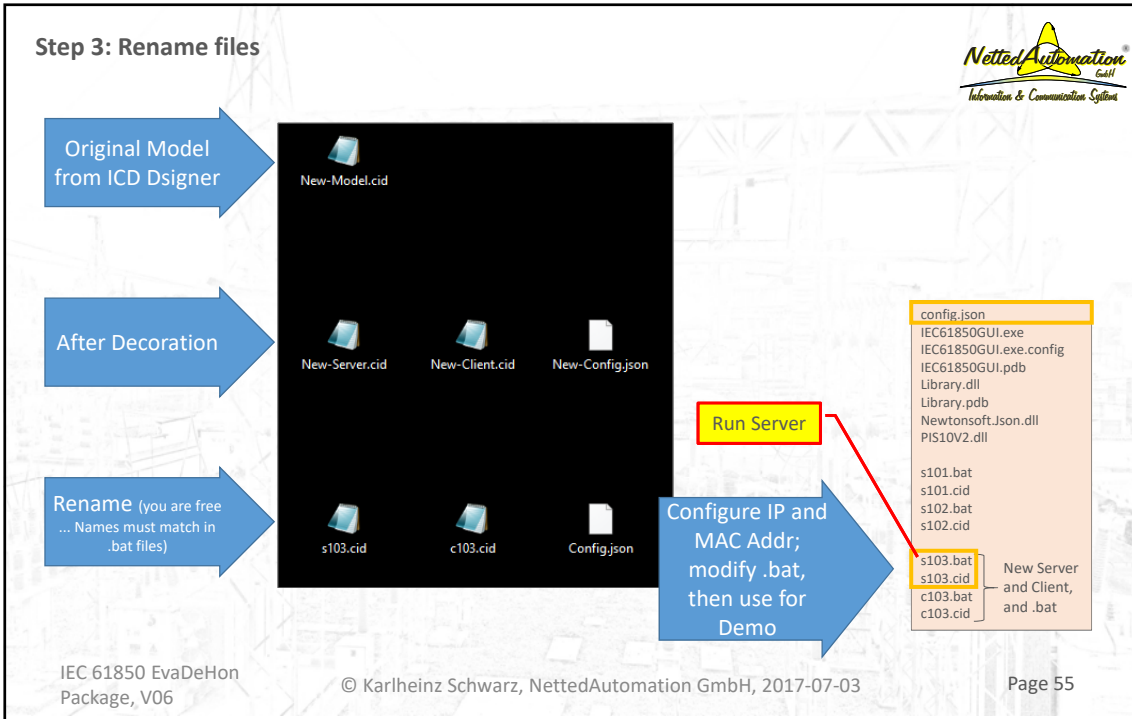
Step 2: Generate Client Model based on decorated Server Model



Step 3: Save Json file (used by demo)



Step 3: Rename files



The diagram illustrates the file renaming process in three stages:

- Original Model from ICD Designer:** A folder containing 'New-Model.cid'.
- After Decoration:** The folder now contains 'New-Server.cid', 'New-Client.cid', and 'New-Config.json'.
- Rename (you are free ... Names must match in .bat files):** The files are renamed to 's103.cid', 'c103.cid', and 'Config.json'.

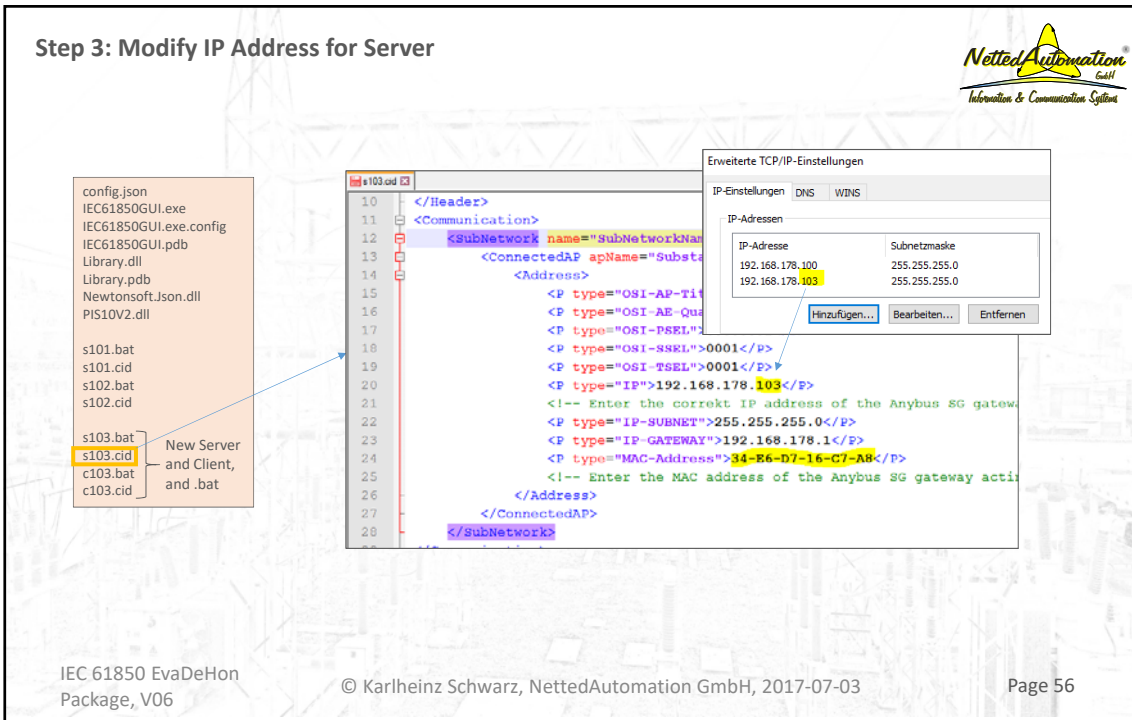
Additional files shown include:

- config.json
- IEC61850GUI.exe
- IEC61850GUI.exe.config
- IEC61850GUI.pdb
- Library.dll
- Library.pdb
- Newtonsoft.Json.dll
- PIS10V2.dll
- s101.bat
- s101.cid
- s102.bat
- s102.cid
- s103.bat
- s103.cid
- c103.bat
- c103.cid

Instructions: **Run Server** and **Configure IP and MAC Addr; modify .bat, then use for Demo**.

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Step 3: Modify IP Address for Server



The screenshot shows the XML configuration for a sub-network and a dialog for extended TCP/IP settings.

XML Configuration (s103.cid):

```

10 </Header>
11 <Communication>
12 <SubNetwork name="SubNetworkName">
13 <ConnectedAP apName="Substation">
14 <Address>
15 <P type="OSI-AP-TITLE"></P>
16 <P type="OSI-AB-QUALIFIER"></P>
17 <P type="OSI-PSEUDONYM"></P>
18 <P type="OSI-SNREL">0001</P>
19 <P type="OSI-TSEL">0001</P>
20 <P type="IP">192.168.178.103</P>
21 <!-- Enter the korrekt IP address of the Anybus SG gateway. -->
22 <P type="IP-SUBNET">255.255.255.0</P>
23 <P type="IP-GATEWAY">192.168.178.1</P>
24 <P type="MAC-Address">34-B6-D7-16-C7-AB</P>
25 <!-- Enter the MAC address of the Anybus SG gateway activation. -->
26 </Address>
27 </ConnectedAP>
28 </SubNetwork>

```

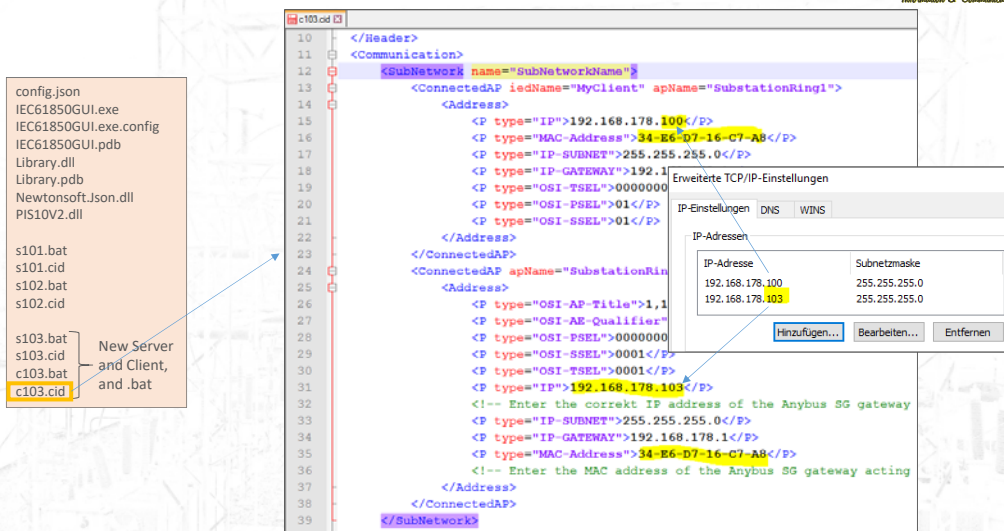
Erweiterte TCP/IP-Einstellungen Dialog:

IP-Adresse	Subnetzmaske
192.168.178.100	255.255.255.0
192.168.178.103	255.255.255.0

Buttons: Hinzufügen..., Bearbeiten..., Entfernen

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Step 3: Modify IP Address for Client



The screenshot shows an XML configuration file for a subnetwork. The IP address for the client is being changed from 192.168.178.100 to 192.168.178.103. A dialog box titled "Erweiterte TCP/IP-Einstellungen" (Advanced TCP/IP Settings) is open, showing the IP address and subnet mask settings.

```

10 </Header>
11 </Communication>
12 <SubNetwork name="SubNetworkName">
13   <ConnectedAP IedName="MyClient" apName="SubstationRing1">
14     <Address>
15       <P type="IP">192.168.178.103</P>
16       <P type="MAC-Address">34-E6-D7-16-C7-AB</P>
17       <P type="IP-SUBNET">255.255.255.0</P>
18       <P type="IP-GATEWAY">192.168.178.1</P>
19       <P type="OSI-TSEL">0000000</P>
20       <P type="OSI-PSEL">01</P>
21       <P type="OSI-SSEL">01</P>
22     </Address>
23   </ConnectedAP>
24 </SubNetwork>

```

Erweiterte TCP/IP-Einstellungen

IP-Adresse	Subnetzmaske
192.168.178.100	255.255.255.0
192.168.178.103	255.255.255.0

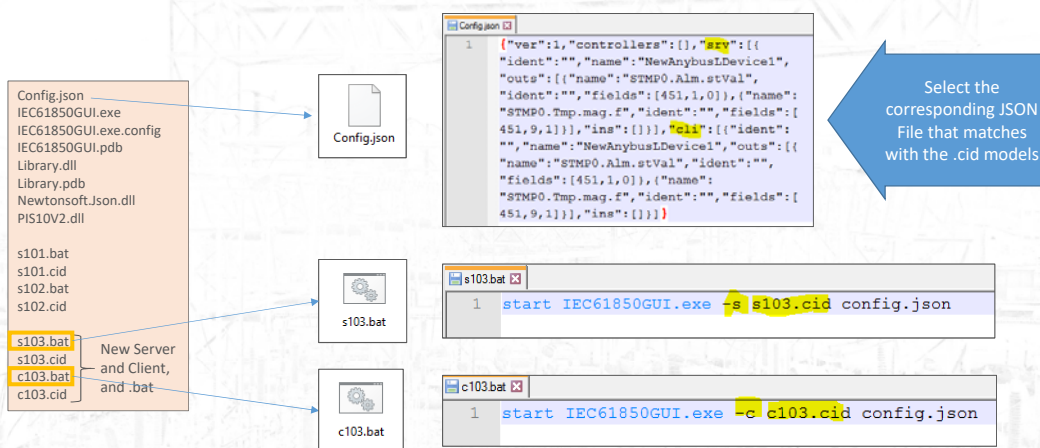
Buttons: Hinzufügen..., Bearbeiten..., Entfernen

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Package, V06

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Page 57

Step 3: Modify .bat Files to match with .cid Files



The screenshot shows a list of files on the left, including config.json, IEC61850GUI.exe, and various .bat and .cid files. A blue arrow points from the list to a Config.json file. Another blue arrow points from the list to s103.bat and c103.bat files. The s103.bat file is shown with the command: `start IEC61850GUI.exe -s s103.cid config.json`. The c103.bat file is shown with the command: `start IEC61850GUI.exe -c c103.cid config.json`. A blue arrow points from the text "Select the corresponding JSON File that matches with the .cid models" to the Config.json file.

```

1 ["ver":1,"controllers":[],"any":[{"
2   "ident":"","name":"NewAnybusDDevice1",
3   "outs":[{"name":"STMP0.Alm.stVal",
4     "ident":"","fields":{"451,1,0}},{"name":
5     "STMP0.Tmp.mag.f","ident":"","fields":{"
6     451,9,1}},{"ins":[]}], "cid":{"ident":
7     "", "name":"NewAnybusDDevice1", "outs":{
8     "fields":{"451,1,0}},{"name":
9     "STMP0.Tmp.mag.f","ident":"","fields":{"
10    451,9,1}},{"ins":[]}]

```

```

s103.bat
1 start IEC61850GUI.exe -s s103.cid config.json

```

```

c103.bat
1 start IEC61850GUI.exe -c c103.cid config.json

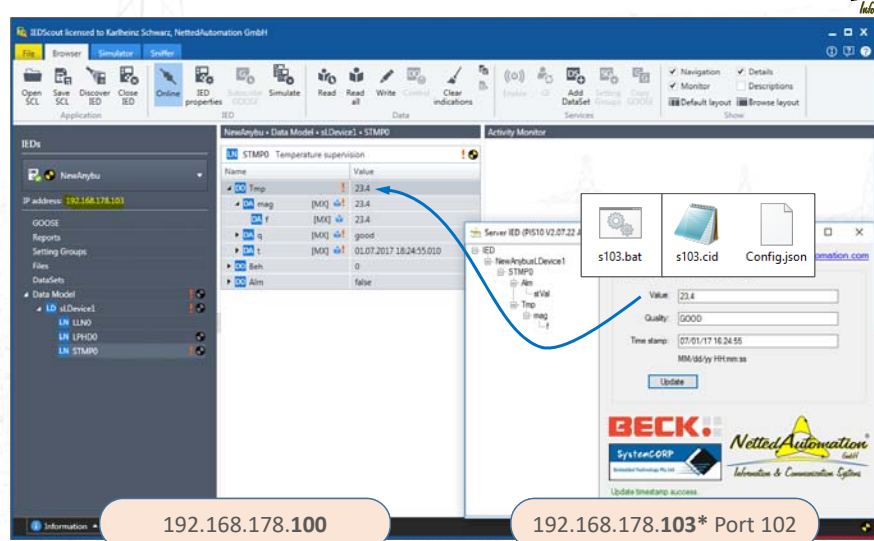
```

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Package, V06

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Page 58

Test Server with IEDScout



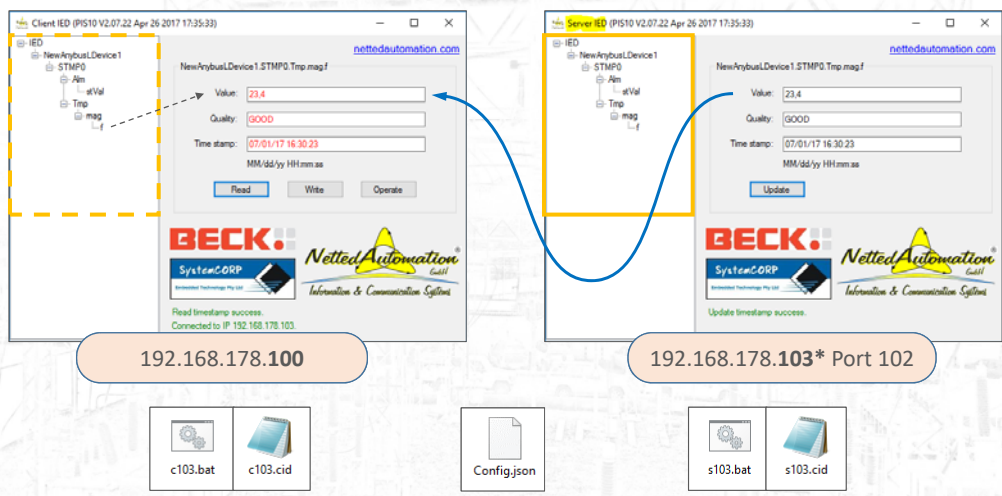
The screenshot shows the IEDScout software interface. On the left, a tree view shows the project structure under 'Data Model'. The main window displays a table for 'STMP0 Temperature supervision' with columns for Name, Value, and Quality. The 'Active Monitor' window on the right shows a form with fields for Value (23.4), Quality (GOOD), and Time stamp (07/01/17 16:24:55). Below the interface, two callouts indicate IP addresses: 192.168.178.100 and 192.168.178.103* Port 102. A blue arrow points from the 'mag' entry in the table to the 'mag' field in the active monitor.

192.168.178.100 192.168.178.103* Port 102

* Virtual IP Address at the same PC.

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Test Server with EvaDeHon Client (running on one PC)



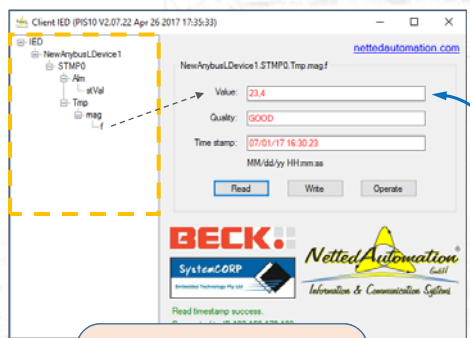
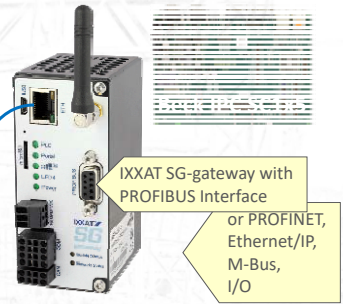
The diagram illustrates the connection between a Client IED and a Server IED. Both windows show the same data as the previous screenshot. A central 'Configjson' file icon is connected to both windows by blue lines. Below the windows, two sets of icons represent files: 'c103.bat' and 'c103.cid' on the left, and 's103.bat' and 's103.cid' on the right. Callouts at the bottom indicate IP addresses: 192.168.178.100 and 192.168.178.103* Port 102.

192.168.178.100 192.168.178.103* Port 102

* Virtual IP Address at the same PC. This IP may be used for a second PC instead ...

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Test Server on Gateway with EvaDeHon Client (running on a PC)

192.168.178.100

192.168.178.41 Port 102

c103.bat c103.cid Config.json




s103.cid

<https://www.ixxat.com/products/energy>

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Summary

- IEC 61850 is very flexible to be used in many application domains.
- The EvaDeHon Package is a one of its kind Package that can be used to evaluate the SystemCorp API/Stack (to some degree), learn IEC 61850 (models and services), configure SG IXXAT (HMS) Gateways, ... and to be used for hands-on training.
- Mr Karlheinz Schwarz (NettedAutomation GmbH) has been involved in modern information exchange systems since 1983 – when got involved into the GM led MAP project.
- Mr Schwarz has always been a supporter of IEC 61850 (IEC 61400-25) in theory and practice. His hands-on training courses are outstanding!

4,300+ Experts from 1,000+ Companies from 90+ Countries trained in 240+ courses (2017-06)

5. I guess YOU believe that dreams have become REAL with using this EvaDeHon Package!

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Summary



6. The SystemCorp API/Stack runs on many platforms:

- Embedded Linux (ARM, Coldfire, Power PC)
- Linux, Ubuntu, Debian(X86, X86-64)
- Beck @Chip SC1x3 RTOS, SC145 RTOS LNX
- Microsoft Windows XP, Vista, Windows 7, Windows 8, Windows 10
- The ready to go Windows DLL (used in the EvaDeHon Package) could be used right away for a short time-to-market

<https://www.systemcorp.com.au/products/smart-grid-software/iec-61850/>

7. [Need help – come to us! We can offer you any support in getting started or to continue in your projects.](#)



**Thank YOU for
YOUR interest in
our Services!**

Let us know how you liked the EvaDeHon Package. Thanks!



Any Question?

IEC 61850 EvaDeHon
Package, V06

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Page 65

IEC 61850 Model for Beck IPC DK151 and DLL Tree Demo and Hands-on Training

Karlheinz Schwarz, NettedAutomation GmbH

karlheinz.schwarz@nettedautomation.com

2017-06-15

Die folgenden Modelle enthalten nur instanziierte Logische Knoten, Daten Objekte und Daten Attribute. Referenzierte Typen werden nicht expandiert. Es werden die dekorierten Signale (mit Private-Elementen) dargestellt.

Die Modelle werden durch eine XSL-Transformation eines CID-Files erzeugt. (Die Endung des CID-Files muss in .xml geändert werden. Die Attribute des SCL-Elements müssen entfernt werden; <SCL attr ...> in Kommentare setzen und <SCL> einfügen.

Transformation:

Server_Report-Meas-Status_Operate_publish-GOOSE_Decorated_2017-06-15_Final(4).xsl

IED = PowerGen_

LD	MONITOR	Demo of models and services on DK151 or other devices
LN	LLNO	LN Zero
	Mod.stVal	on
	NamPlt.configRev	0.1
	NamPlt.d	Demonstration of IEC61850 using multiple Models and services with DK151.
	NamPlt.IdNs	IEC61850-7-4:2007B
	NamPlt.swRev	2.07.18
	NamPlt.vendor	Beck IPC / NettedAutomation GmbH
DataSet	Status	
	- MONITOR/SPOS1.ST.Alm.	
	- MONITOR/DRCC1.ST.DERStr.	
DataSet	Measurements	
	- MONITOR/SPOS1.MX.PosPct.	
	- MONITOR/MMET1.MX.DffInsol.	
	- MONITOR/MMTR1.ST.TotWh.	
	- MONITOR/MMXU1.MX.TotW.	
Report Control	RCB-Name = Status_Report	Beschr = , Zyklus = 0 ms, ReportID = Status_Values
	Datensatz = Status	DataChange = true, zyklisch = false, QualityChange = false, DataUpdate = false
Report Control	RCB-Name = Measurement_Report	Beschr = , Zyklus = 5000 ms, ReportID = Measured_and_counted_Values
	Datensatz = Measurements	DataChange = false, zyklisch = true, QualityChange = false, DataUpdate = false
GOOSE Control	GCBName = Status_CB_GOOSE	
	DataSet = Status	
	appID = Status	
LN	LPHD1	Logical Node Physical Device
	PhyHealth.stVal	0
	PhyNam.location	All over
	PhyNam.model	SC145
	PhyNam.serNum	76D4
	PhyNam.vendor	Beck IPC DK151
	Proxy.stVal	0
LN	SPOS1	Supervision of a position in percent
	Alm.q	
	Alm.stVal	
	Alm.t	

	AlmSpt.setMag.f	28
	PosPct.d	Position measurement, by proximity sensor on DK151
	PosPct.q	
	PosPct.t	
	PosPct.mag.f	
	PosPct.units.multiplier	0
	PosPct.units.SIUnit	2
LN	MMET1	Meteorological measurements
	DffInsol.d	Diffuse insolation by light sensor on DK151
	DffInsol.q	
	DffInsol.t	
	DffInsol.mag.f	
	DffInsol.units.multiplier	0
	DffInsol.units.SIUnit	55
LN	MMTR1	Metering of electrical system
	TotWh.actVal	
	TotWh.d	Counter of energy
	TotWh.q	
	TotWh.t	
	TotWh.units.multiplier	3
	TotWh.units.SIUnit	72
LN	MMXU1	Measurements of 3 phase electrical system
	TotW.d	Current power generated
	TotW.q	
	TotW.t	
	TotW.mag.f	
	TotW.units.multiplier	3
	TotW.units.SIUnit	38
LN	DRCC1	Controller of a Distributed Energy Resource
	DERStr.ctlModel	direct-with-normal-security
	DERStr.stVal	
	Mod.stVal	on
	Oper.ctlVal	

+++++

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expat - XML Parser Toolkit

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2017-04-24

Version 1.0

The wait for a FREE IEC 61850/61400-25 Evaluation/Starter Kit is over - here it is for immediate use.

Congratulation!

SystemCorp (Perth, Australia) and NettedAutomation offer an IEC 61850/61400-25 DLL (Dynamic Link Library) and four Application examples using the DLL (runs under Windows):

- C/C++ Server Application (simple Console)
- C/C++ Client Application (simple Console)
- .Net/C# Server Application (nice graphical interface)
- .Net/C# Client Application (nice graphical interface)

The packages contain executable software and the source code of the C and .Net/C# Applications (projects).

You can use these applications and modify them according to your needs.

NOTE 1: The Clients and the server run on ONE machine (localhost). If you want to run the server on one machine and the clients on another you have to configure both (client and server)! This is done by modifying the ICD files that are in the same folders where the client/server executables are located. Read the Documentation for details!

NOTE 2: To see information communicated by GOOSE messages at the client you have to install WinPcap driver (latest version is 4.1.3 or so / <http://www.winpcap.org>). And you have to have your Ethernet adapter active and running - any other adapter like WiFi MUST be off and disabled!!

NOTE 3: To trace the messages exchanged between Client/Server (Publisher/Subscriber) you have to run them on different machines. Then you can trace the traffic, e.g. with Wireshark.

Run first the simple console applications ... follow the instructions.

Before you start the server and client (launchapp.bat) it is recommended to read first the <<Getting_Started_DLL_IEC61850.pdf>> in the Documentation folder; this folder is generated through installation and is contained in the package.

For the console applications you have to change the IP and MAC Addresses first!!

For Client and Server running on one machine (local host) you have to set the IP Address in both icd files to 127.0.0.1 and you have to set the MAC Address to the MAC Address of your Ethernet adapter. This may cause problems when you use virtual machines.

NOTE 4: The server must run before the client is started.

NOTE 5: You may also use the IEDScout (Omicron, free demo version) and browse the server. This is quite convenient - but the Browser cannot be used to connect to a client application!

NOTE 6: This Evaluation/Starter Kit requires basic understanding of IEC 61850 Information Models, Information Exchange Services, and Configuration Language!!

NOTE 7: The server uses the same Information Model as the BECK IPC Development Kit DK151. The DK151 is a platform to run IEC 61850/61400-25 in real-time - for real-time applications! The PIS10 runs also on the DK61 (Beck Chip) or the IXXAT SG10, SG20 and SG40 with Profinet. All use the same simple Stack API.

We offer all services for the integration of the PIS10 stack (DLL, ...) into your application

We offer implementation support provided by our experienced application programmer: Andreas Pfefferle, Karlsruhe, Germany.
Andreas is familiar with Substation Automation, RTUs, IEC 60870-5-10x, protocol integration, ... SystemCorp PIS10-Stack API and many other domains.

Please contact us, in case you need comprehensive education and/or help for the integration and application development.

I am confident, that our experience and service would help to get started in short time! You would get first-hand, very comprehensive, vendor neutral and up-to-date knowledge, experience, and guidance; learn how to reach interoperability of devices;

You would get best advice and help - for the best price.

Please note also the copyright statements and other crucial information.

Best Regards,

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