



What participants of the IEC 61850 Hands-on Training can find on the CD ROM and how to use the software for Demos and Real Applications

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GmbH
Information & Communication Systems

Content

- General remarks
- CD ROM Content
- Overview of Hands-On packages
- Evaluation Kit using the DLL
- Useful Information on Hands-On Training found on CD ROM
- How to use the software
- SCL to drive the Server and Client



General remarks (1)

- This presentation is intended to help you to run the various demo and evaluation software packages on the CD ROM provided for attendees of the hands-on training courses run by NettedAutomation GmbH.
- The Hands-On folder (2010-11) contains various packages:
 - IEC 61850 Servers and Clients
 - DLLs from SystemCorp (Perth, Western Australia) – this software runs also on the BECK IPC Chip (Development Kit DK61 with the Chip is used during the hands-on training) – the key is that the kit provides also source code of the server and the client application.
 - Infotech (Poland)
 - Browser and test tool
 - IED Scout from Omicron (Austria)
 - SCL Editor
 - ICD Designer from SystemCorp
 - Network Analyzers
 - Wireshark and Ethereal
 - KEMA UNICA



General remarks (2)

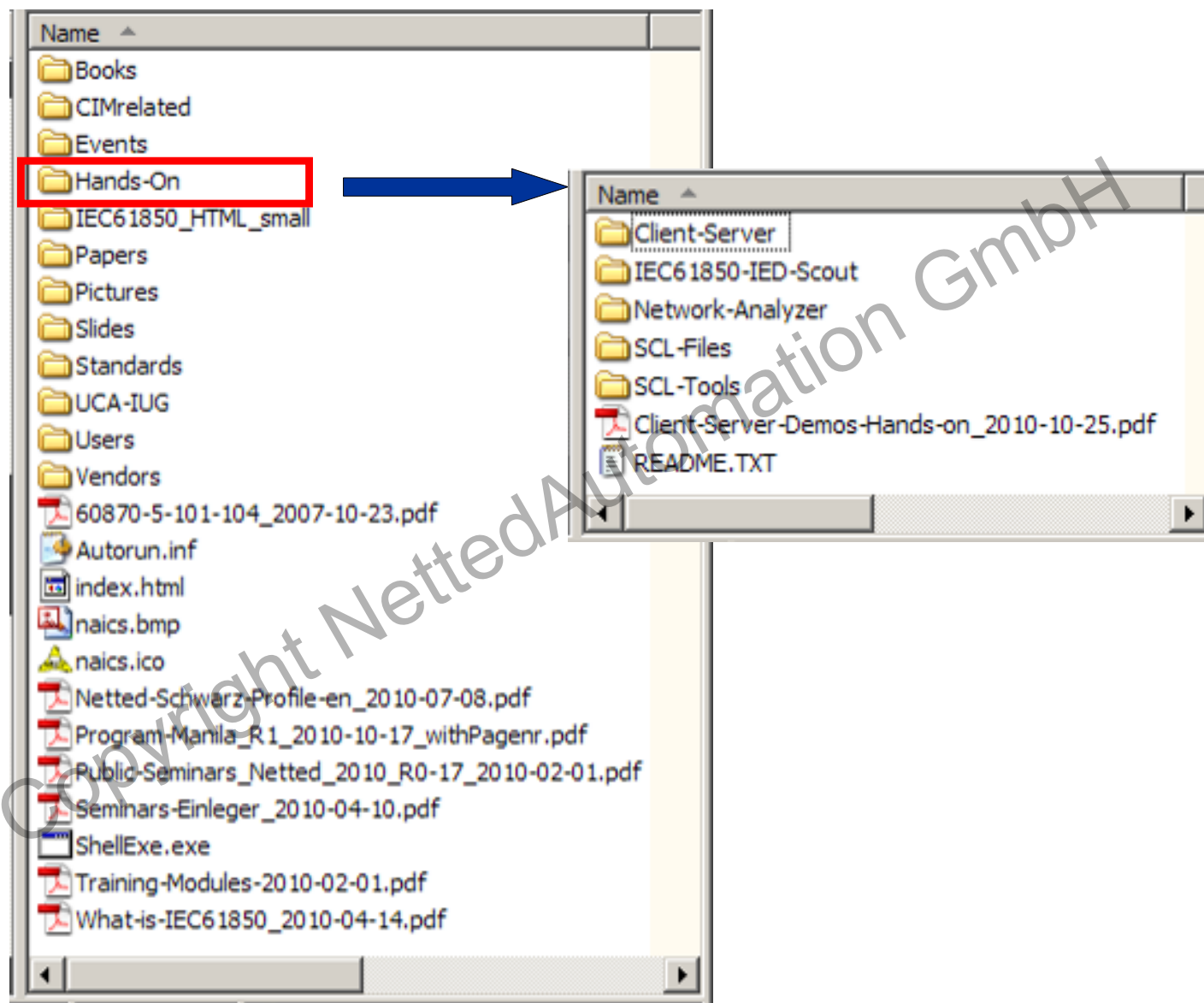
- Please note the following crucial requirements to successfully run the evaluation software:
 - READ all corresponding readme.txt documents!!
 - Install <<WinPcap_4_1_2.exe>> (check at CD ROM or www.winpcap.com)
 - Make sure that only ONE network adapter is active (disable any other – including wireless)
 - Check that IP/MAC addresses in the ICD Files (for server and client) are consistent with your setup (either client and server on one PC, or on two PCs).
 - Switch off DHCP; use fixed (or alternate) IP Address – as in SCL File
- **Please do NOT use any of the software packets as reference for conformance with the standards!!**
- Good Luck!
- Enjoy!

Recommended Software to be installed

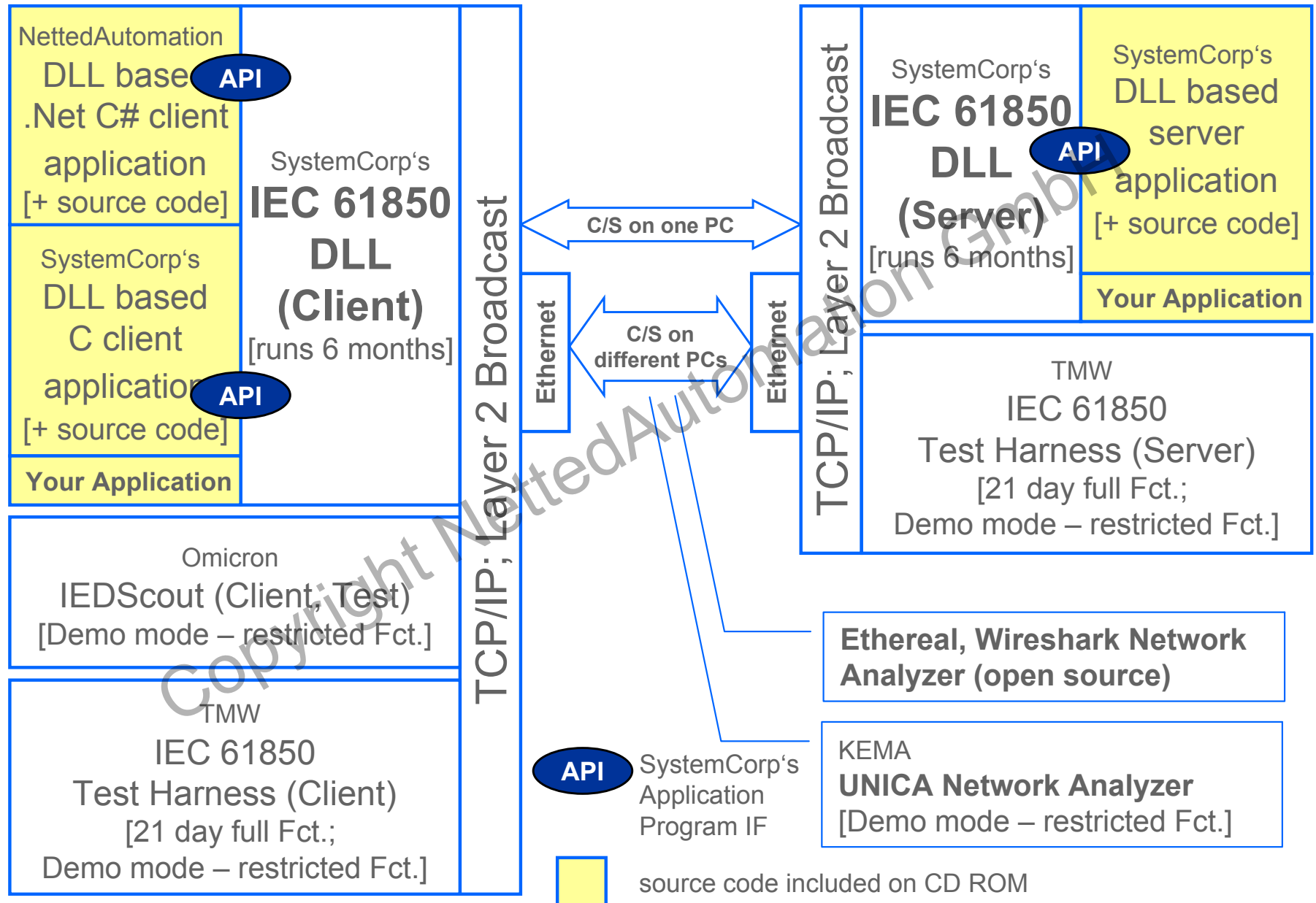
- The following software packages may be installed prior to the workshop:
 - Wireshark (on CD ROM) <<wireshark-win32-1.2.1.exe>>
 - Ethereal (CD) <<mms_ethereal_install_v116.exe>>
 - Omicron IEDScout (CD) <<IEDScout V2.11 Setup 32Bit.exe>>
 - SystemCorp: IEC 61850 DLL Demo (1 Server, 2 Clients) (CD)
<<SET IEC61850 DLL Demo Installation.exe>> - 1 server, 1 client
<<IEC61850Client.exe>> - .Net client runs without installing
 - UNICA analyzer (CD) <<UniCA 61850 Analyser v4.20.01.zip>>



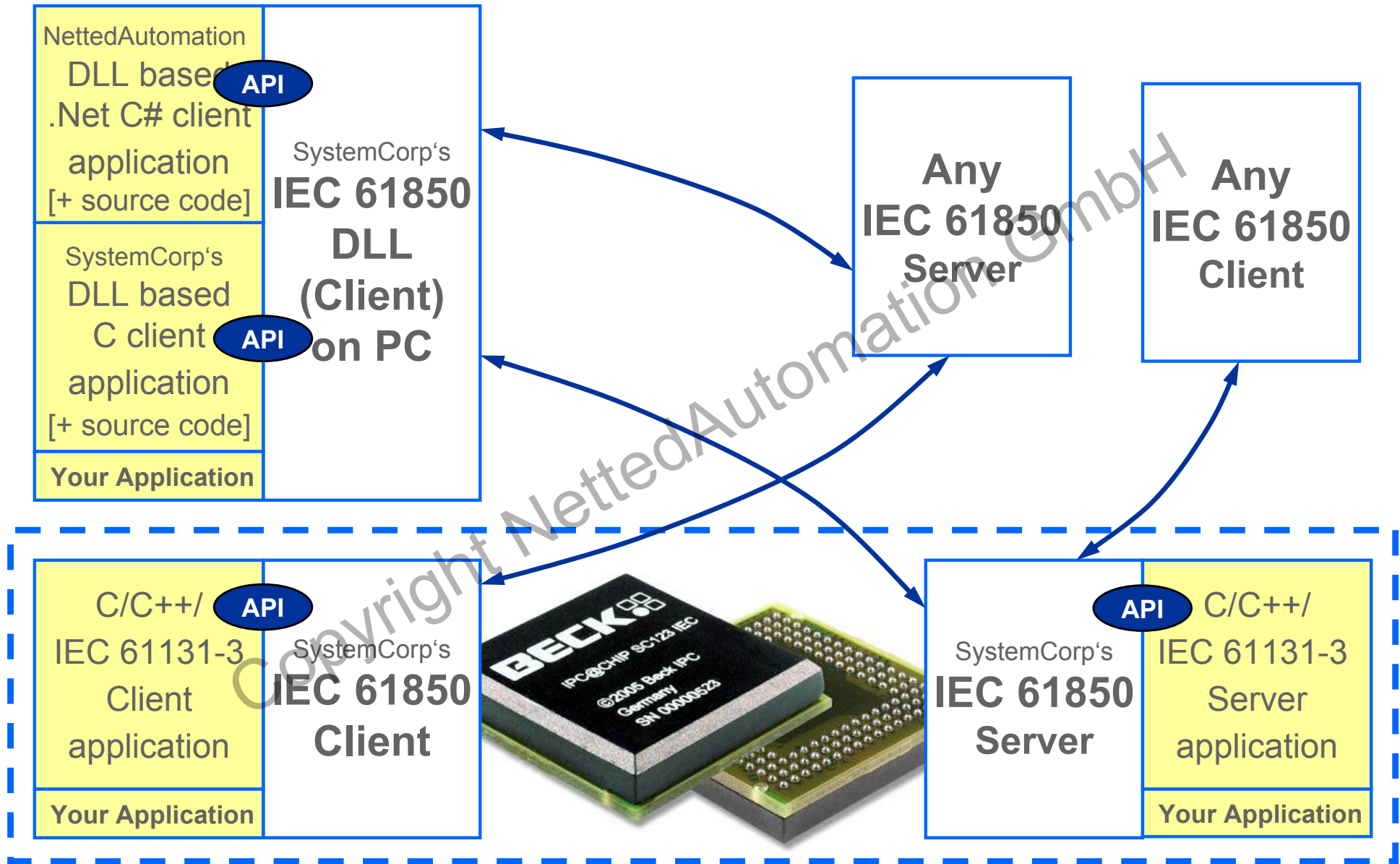
Seminar/Training CD ROM – Hands-On



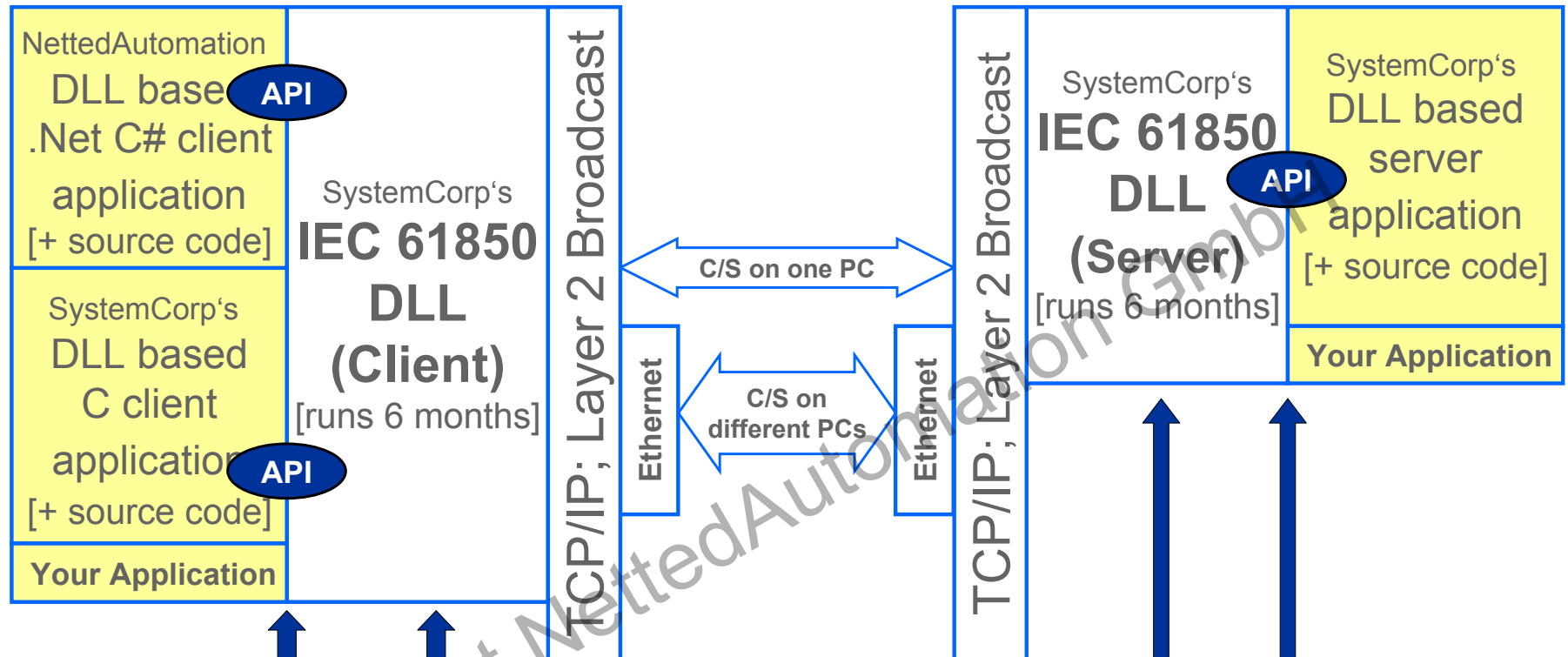
Overview of Hands-On packages (1)



Overview of Hands-On packages (1)



Configuration of Server and Client (1)



Demo.icd - Editor

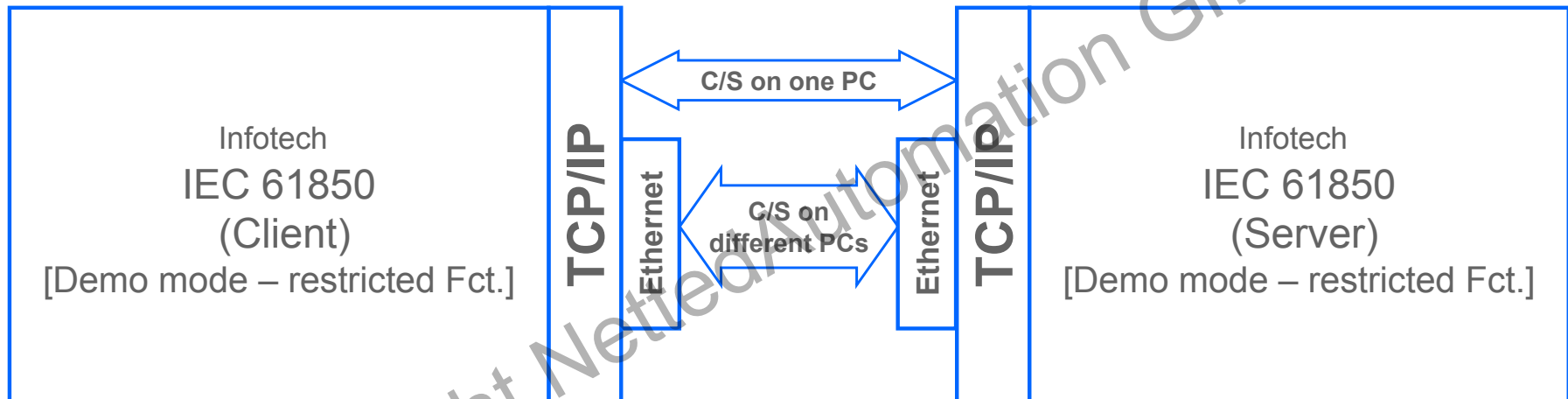
```
<?xml version="1.0" encoding="UTF-8"?>
<SCL xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns="http://www.w3.org/2001/XMLSchema" version="3"/>
  <Header id="" version="3"/>
  <Communication>
    <SubNetwork name="SubNetworkName">
      <ConnectedAP iedName="MyClient" apName="SubstationR">
        <Address>
          <P type="IP">127.0.0.1</P>
          <P type="IP-SUBNET">255.255.255.0</P>
          <P type="IP-GATEWAY">127.0.0.1</P>
          <P type="OSI-TSEL">00000001</P>
          <P type="OSI-PSEL">01</P>
          <P type="OSI-SSEL">01</P>
        </Address>
      </ConnectedAP>
    </Communication>
  </SCL>
```

SystemCorp's
**IEC 61850
ICDDesigner**
[SCL File size
< 100 KB]

ServerDemo61850.ICD - Editor

```
<?xml version="1.0" encoding="UTF-8"?>
<SCL xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns="http://www.w3.org/2001/XMLSchema" version="3"/>
  <Header id="" version="3"/>
  <Communication>
    <SubNetwork name="SubNetworkName">
      <ConnectedAP iedName="DK61" apName="SubstationR">
        <Address>
          <P type="OSI-AP-Title">1,1,9999,1</P>
          <P type="OSI-AE-Qualifier">12</P>
          <P type="OSI-PSEL">00000001</P>
          <P type="OSI-SSEL">0001</P>
          <P type="OSI-TSEL">0001</P>
          <P type="IP">127.0.0.1</P>
          <P type="IP-SUBNET">255.255.255.0</P>
          <P type="IP-GATEWAY">127.0.0.1</P>
        </Address>
      </ConnectedAP>
    </Communication>
  </SCL>
```

Overview of Hands-On packages (2)

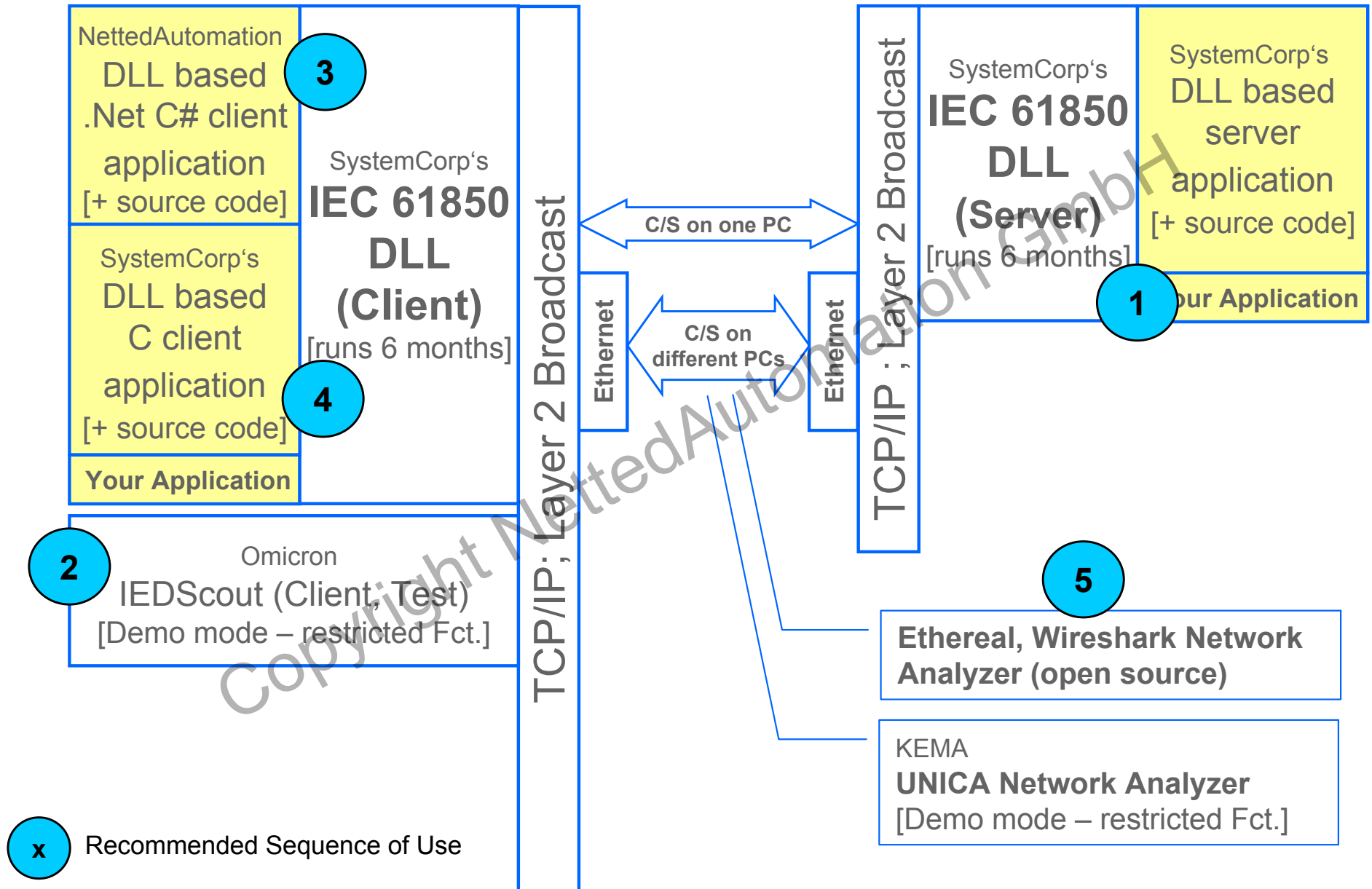


Evaluation Kit using the DLL

- Implementation of your own client and server application
- Using DLL from SystemCorp (Perth, Western Australia)



Overview of Hands-On packages (1)



Demos and Hands-On Training on CD ROM

1. Please read this first

2. Start with this demo

3. Read <<Readme.txt>>

4. Read these

Demos and Hands-On Training on CD ROM

Subset of IEC 61850 implemented

Understand Stack API

Understand application

5. Read this

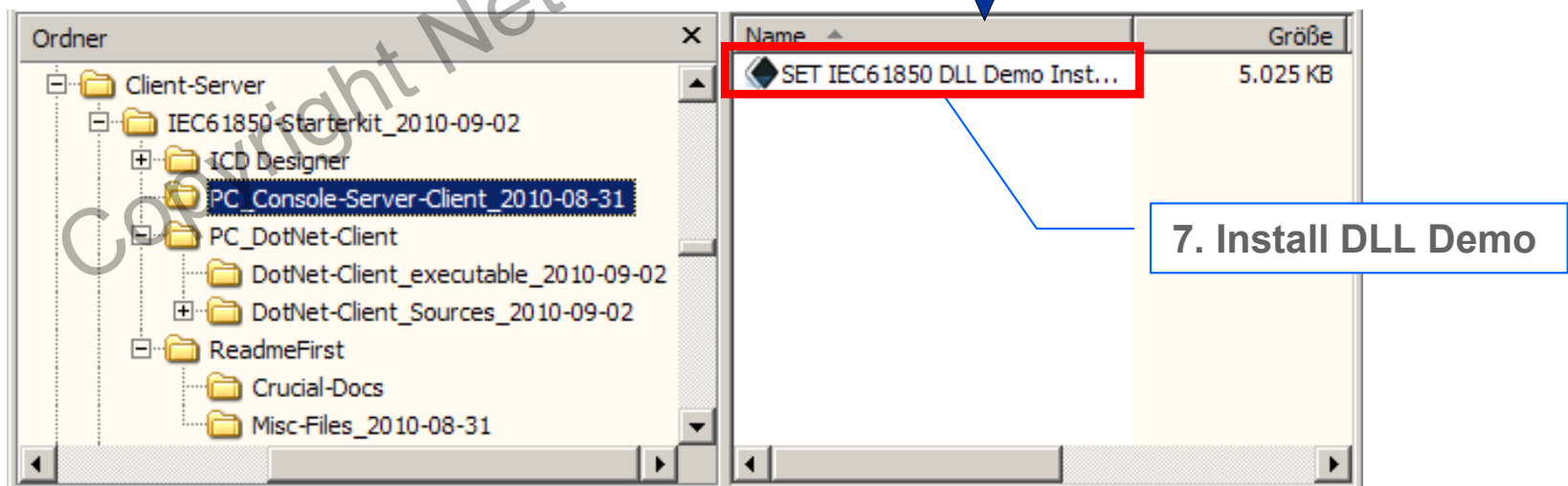
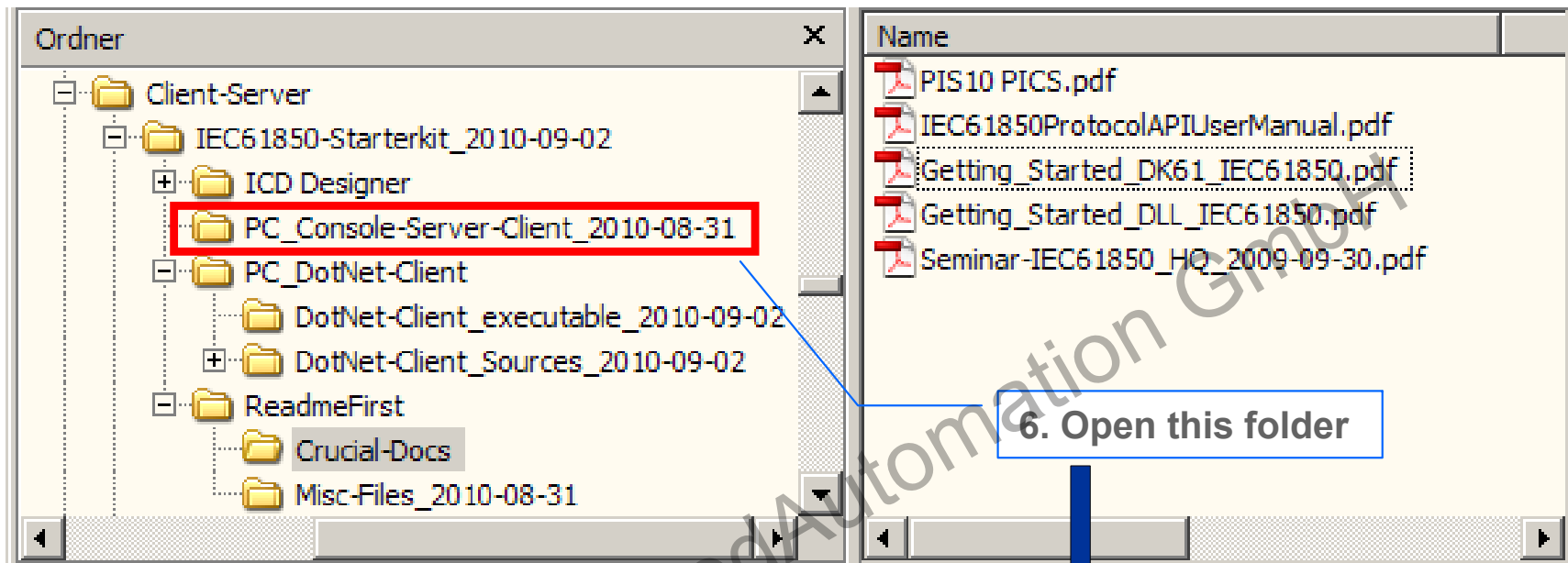
Background

Ordner

- Client-Server
 - IEC61850-Starterkit_2010-09-02
 - ICD Designer
 - PC_Console-Server-Client_2010-08-31
 - PC_DotNet-Client
 - DotNet-Client_executable_2010-09-02
 - DotNet-Client_Sources_2010-09-02
 - ReadmeFirst
 - Crucial-Docs**
 - Misc-Files_2010-08-31

Name

- PIS10 PICS.pdf
- IEC61850ProtocolAPIUserManual.pdf
- Getting Started DK61 IEC61850.pdf
- Getting Started DLL IEC61850.pdf**
- Seminar-IEC61850_HQ_2009-09-30.pdf



7. Install DLL Demo

8. After Installation

9. Start Server

10. Start Client later

App Source Code

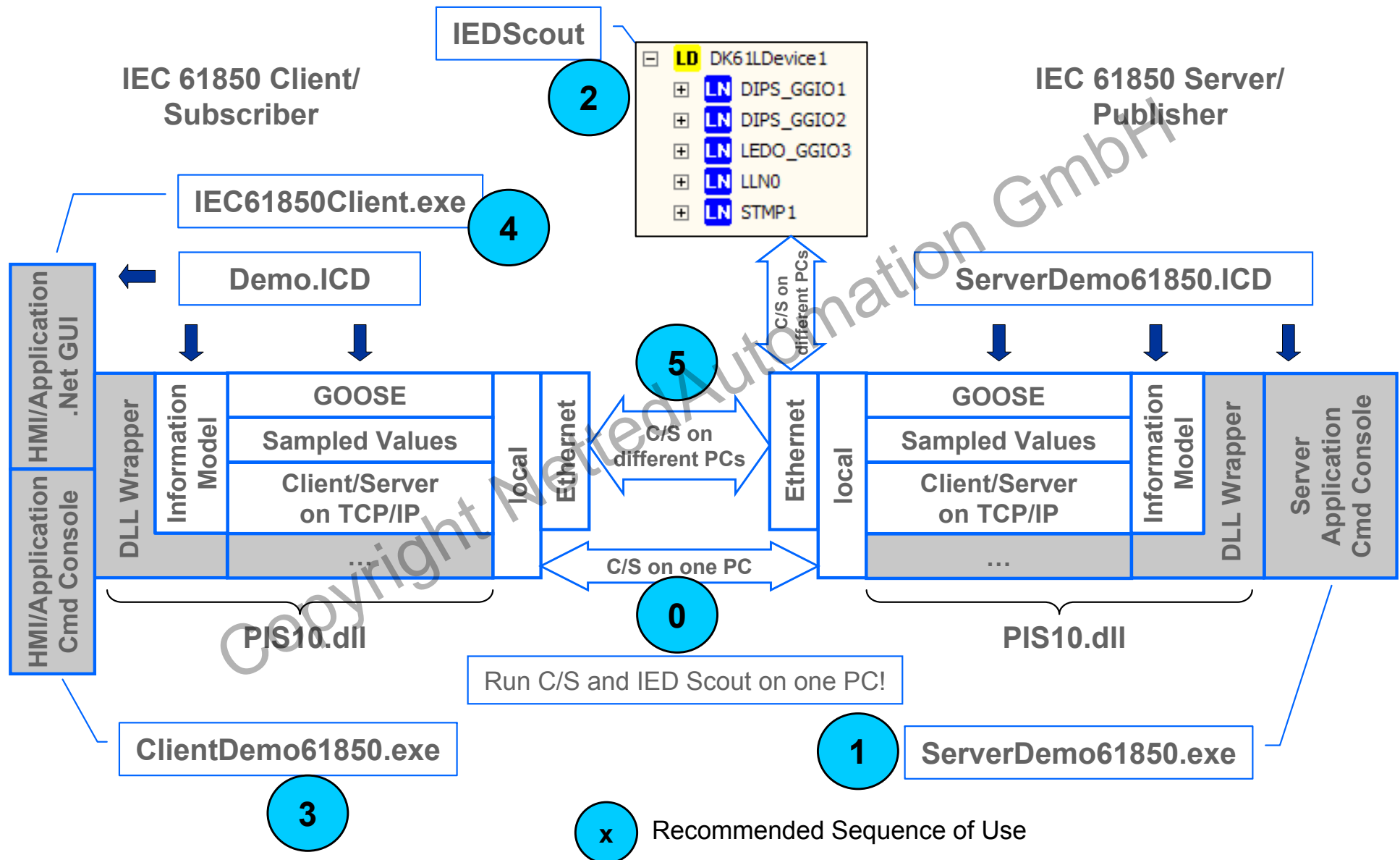
App Source Code

- After installation of the <<SET IEC 61850 DLL ...>> note that the client and server will automatically start.
- Of course, you have to install the <<SET IEC ...>> only once. It will operate fully functional for 6 months.
- Close the client and server before you continue.
- This gives you a „clean“ start condition for the next steps shown on the following slides.

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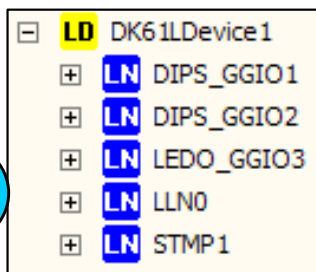
Demos and Hands-On Training on CD ROM



Demos and Hands-On Training on CD ROM

IEDScout

2



ServerDemo61850.exe

1



MMS Messages

<<SV61850_C-Source-with-STMP_2010-07-09.pdf>>
is a helpful explanation of
the server application using
the API !! On CD ROM.

```

C:\Dokumente und Einstellungen\khs\Desktop\IEC-61850-Demo-Applications\IEC-61850-Demo-Appli...
-----
IEC61850 Server DLL Demo from SystemCORP Pty Ltd
Suite 4/12 Brodie Hall Drive, Bentley, Technology Park, Western Australia, 6102
email: info@systemcorp.com.au Telephone: +61 (0) 8 9472 8500
http://www.systemcorp.com.au
-----

Report Control Blocks
LN:DIPS_GGIO1
OFF OFF OFF OFF OFF
DO:Ind1 DO:Ind2 DO:Ind3 DO:Ind4 DO:Alm5

GOOSE Control Blocks
LN:DIPS_GGIO2
OFF OFF OFF
DO:Alm6 DO:Alm7 DO:Alm8

Temperature is set to 25.

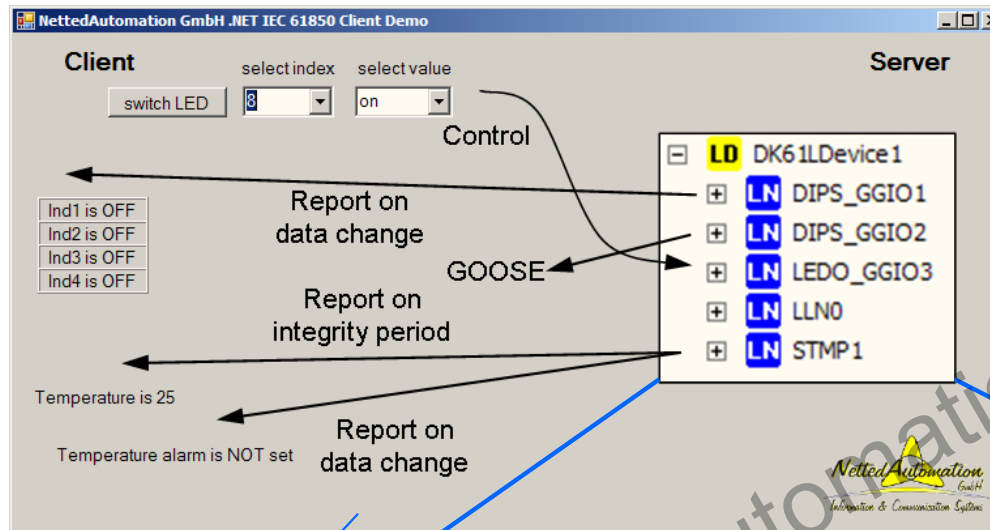
Single point control outputs
LN:LEDO_GGIO3
OFF OFF OFF OFF OFF OFF OFF ON
DO:SPCS01 DO:SPCS02 DO:SPCS03 DO:SPCS04 DO:SPCS05 DO:SPCS06 DO:SPCS07 DO:SPCS08
Enter t20 to set the temperature to 20, alarm temperature is 27
t25er al 1 to turn on Alarm1, i1 0 to turn off indication 1(x to exit):
  
```

- After using the IED Scout and before using the .Net Client it is recommended that you stop the IED Scout and the server.
- Start the server again.
- This is not really required ... better safe than sorry.

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Demos and Hands-On Training on CD ROM



.Net Application

3

IEC61850Client.exe



MMS Messages

ServerDemo61850.exe

```

C:\Dokumente und Einstellungen\khs\Desktop\IEC-61850-Demo-Applications\IEC-61850-Demo-Appli...
-----
IEC61850 Server DLL Demo from SystemCORP Pty Ltd
Suite 4/12 Brodie Hall Drive, Bentley, Technology Park, Western Australia, 6102
email: info@systemcorp.com.au Telephone: +61 (0) 8 9472 8500
http://www.systemcorp.com.au
-----

Report Control Blocks
LN:DIPS_GGIO1
OFF OFF OFF OFF
DO:Ind1 DO:Ind2 DO:Ind3 DO:Ind4

GOOSE Control Blocks
LN:DIPS_GGIO2
OFF OFF OFF OFF
DO:Alm5 DO:Alm6 DO:Alm7 DO:Alm8

Temperature is set to 25.

Single point control outputs
LN:LEDO_GGIO3
OFF OFF OFF OFF OFF OFF OFF ON
DO:SPCS01 DO:SPCS02 DO:SPCS03 DO:SPCS04 DO:SPCS05 DO:SPCS06 DO:SPCS07 DO:SPCS08
Enter t20 to set the temperature to 20, alarm temperature is 27
t25er al 1 to turn on Alarm1, il 0 to turn off indication 1(x to exit):
    
```

Demos and Hands-On Training on CD ROM

IEC61850Client.exe

4

The client does not browse the server – like the IEDScout. The client knows the server's model by interpreting the ICD file (in same folder as client exe).

```

C:\Dokumente und Einstellungen\khs\Eigene Dateien\Hersteller\SytemCorp_Perth\Client-Server-DLL...
-----
IEC61850 Client DLL Demo from SystemCORP Pty Ltd
Suite 4/12 Brodie Hall Drive, Bentley, Technology Park, Western Australia, 6102
email: info@systemcorp.com.au Telephone: +61 (0) 8 9472 8500
http://www.systemcorp.com.au
-----

Report Control Blocks
LN:DIPS_GGIO1
OFF OFF OFF OFF
DO:Ind1 DO:Ind2 DO:Ind3 DO:Ind4

GOOSE Control Blocks
LN:DIPS_GGIO2
DO:Alm5 DO:Alm6 DO:Alm7 DO:Alm8

Temperature is 25

Single point control outputs
LN:LEDO_GGIO3
DO:SPCS01 DO:SPCS02 DO:SPCS03 DO:SPCS04 DO:SPCS05 DO:SPCS06 DO:SPCS07 DO:SPCS08
Enter m27 to set the alarm max temperature to 27.
Enter (1 to 8) to control the LEDs (x to exit):
  
```



MMS Messages

ServerDemo61850.exe

```

C:\Dokumente und Einstellungen\khs\Desktop\IEC-61850-Demo-Applications\IEC-61850-Demo-Appli...
-----
IEC61850 Server DLL Demo from SystemCORP Pty Ltd
Suite 4/12 Brodie Hall Drive, Bentley, Technology Park, Western Australia, 6102
email: info@systemcorp.com.au Telephone: +61 (0) 8 9472 8500
http://www.systemcorp.com.au
-----

Report Control Blocks
LN:DIPS_GGIO1
OFF OFF OFF OFF
DO:Ind1 DO:Ind2 DO:Ind3 DO:Ind4

GOOSE Control Blocks
LN:DIPS_GGIO2
OFF OFF OFF OFF
DO:Alm5 DO:Alm6 DO:Alm7 DO:Alm8

Temperature is set to 25.

Single point control outputs
LN:LEDO_GGIO3
OFF OFF OFF OFF OFF OFF OFF ON
DO:SPCS01 DO:SPCS02 DO:SPCS03 DO:SPCS04 DO:SPCS05 DO:SPCS06 DO:SPCS07 DO:SPCS08
Enter t20 to set the temperature to 20, alarm temperature is 27
t25er al 1 to turn on Alarm1, il 0 to turn off indication 1(x to exit):
  
```

5

MMS Messages

In order to trace messages with any of the three network analyzers, it is required to run the server and the client on different PC connected by Ethernet (end-to-end or through an Ethernet Switch).

Ethereal-DK61_Full-Sequence_2010-03-05 - Ethereal

File Edit View Go Capture Analyze Statistics Help

Filter: Add Expression... Clear Apply

No.	Time	Source	Destination	Protocol	Info
45	0.852840	169.254.145.195	169.254.145.200	MMS	Read
46	0.853041	169.254.145.200	169.254.145.195	MMS	Read
47	0.855833	169.254.145.195	169.254.145.200	MMS	Read
48	0.856036	169.254.145.200	169.254.145.195	MMS	Read

Frame 46 (125 bytes on wire, 125 bytes captured)

- Ethernet II, Src: 00:1c:23:3a:65:75 (00:1c:23:3a:65:75), Dst: 00:30:56:a1:26:
- Internet Protocol, Src: 169.254.145.200 (169.254.145.200), Dst: 169.254.145.1
- Transmission Control Protocol, Src Port: 3542 (3542), Dst Port: iso-tsap (102
- TPKT, Version: 3, Length: 71
- ISO 8073 COTP Connection-Oriented Transport Protocol
- ISO 8327-1 OSI Session Protocol
- ISO 8327-1 OSI Session Protocol
- ISO 8823 OSI Presentation Protocol
- ISO/IEC 9506 MMS
 - Conf Request (0)
 - Read (4)
 - InvokeID: InvokeID: 16
 - Read
 - List of Variable
 - VariableSpecification
 - Object Name
 - Domain Specific
 - DomainName:
 - DomainName: DK61LDevice1
 - ItemName:
 - ItemName: DIPS_GGIO1\$ST\$Ind3

```

0000  00 30 56 a1 26 85 00 1c 23 3a 65 75 08 00 45 00  .OV.&... #:eu..E.
0010  00 6f a6 98 40 00 80 06 dc 67 a9 fe 91 c8 a9 fe  .o..@... .g.....
0020  91 c3 0d d6 00 66 14 79 3e c5 2b 00 3d f9 50 18  ....f.y >.+.=.P.
0030  fc 2d 77 ea 00 00 03 00 00 47 02 f0 80 01 00 01  .-w..... .G.....
0040  00 61 3a 30 38 02 01 03 a0 33 a0 31 02 01 10 a4  .a:08... .3.1....
0050  2c a1 2a a0 28 30 26 a0 24 a1 22 1a 0c 44 4b 36  ,.*(0&. $.".DK6
0060  31 4c 44 65 76 69 63 65 31 1a 12 44 49 50 53 5f  1LDevice 1..DIPS_
0070  47 47 49 4f 31 24 53 54 24 49 6e 64 33          GGIO1$ST $Ind3
    
```

ItemName (mms.itemname), 18 bytes

P: 133 D: 133 M: 0

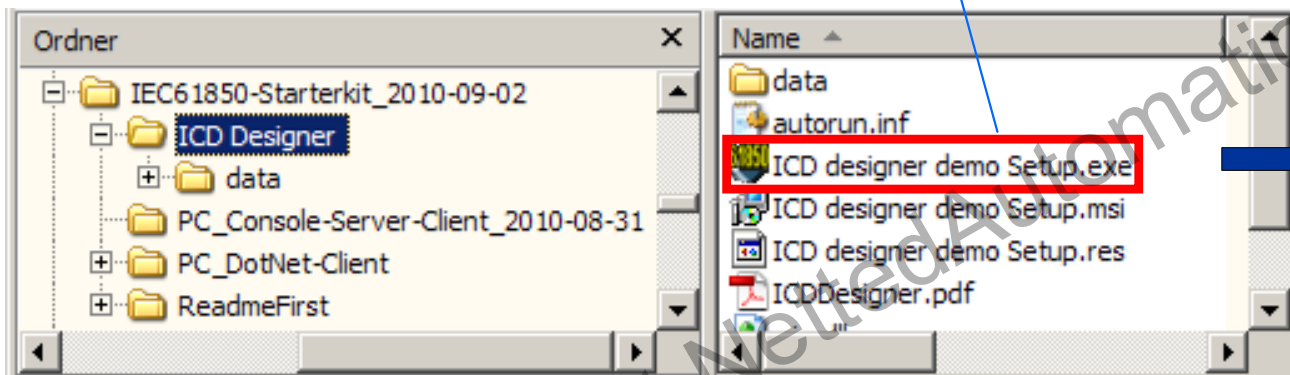
Evaluation Kit using the DLL

- ICD Designer (Installation)
- ICD Designer
- SCL to drive the Server and Client



ICD Designer (Installation)

Install ICD Designer



SystemCorp's
IEC 61850
ICDDesigner
[Demo version
supports
File sizes < 50 KB]

ICD Designer

SystemCorp ICD Designer Demo 0.1.0.21

File Help

New Open... Save Save As... Close File Open WDX file Close WDX file

mag

fc	MX
Name	mag
bType	Struct

Options

Trigger Options

Data Change	☒ True
Data Update	☐ False
Quality Change	☐ False
Description	
Value Kind	Set

ServerDemo61850.ICD.xml

SCL

- Header
- Communication
- IED DK61
 - SubstationRing1
 - Server
 - LDevice1
 - LN0
 - DIPS_GGIO1
 - DIPS_GGIO2
 - LEDO_GGIO3
 - STMP1
 - Data Sets
 - Report Control Blocks
 - Log Control
 - Inputs
 - DO Mod
 - DO Beh
 - DO Health
 - DO NamPlt
 - DO Alm
 - DO Tmp
 - DA mag
 - DA q
 - DA t
 - DO TmpAlmSpt

Tree View

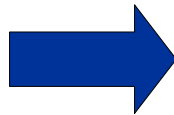
Log

ServerDemo61850.ICD

Allows definition of any extended model: LN class, DO, ...
see: <<61850DTT.xml>>

SCL for Server generated by ICD Designer

SystemCorp's
**IEC 61850
ICDDesigner**
[SCL File size
< 100 KB]

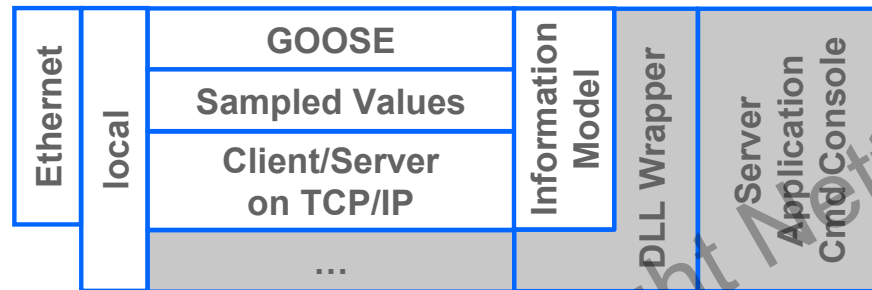


```
<?xml version="1.0" encoding="UTF-8" ?>
- <SCL xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.iec.ch/61850/2003/SCL">
  <Header id="" version="3" />
  + <Communication>
  - <IED type="RTUType" manufacturer="SystemCORP Pty Ltd" configVersion="1.0"
    name="DK61">
    <Services />
    - <AccessPoint name="SubstationRing1">
      - <Server timeout="30">
        <Authentication />
        - <LDevice inst="LDevice1" desc="">
          + <LN0 InClass="LLN0" inst="" InType="LLN0_0">
          + <LN InClass="GGIO" inst="1" prefix="DIPS_" InType="GGIO_0">
          + <LN InClass="GGIO" inst="2" prefix="DIPS_" InType="GGIO_10">
          + <LN InClass="GGIO" inst="3" prefix="LEDO_" InType="GGIO_17">
          - <LN InClass="STMP" inst="1" prefix="" InType="STMP_0">
            + <DOI name="Alm">
              - <DOI name="Tmp">
                - <SDI name="mag">
                  - <DAI name="i">
                    - <Private type="SystemCorp_Generic">
                      <SystemCorp_Generic:GenericPrivateObject Field1="2"
                        Field2="3" Field3="1" Field4="0" Field5="0"
                        xmlns:SystemCorp_Generic="http://www.systemcorp.com.au/61850/SCL/c
                      </Private>
                    </DAI>
                  </SDI>
                + <DAI name="q">
                + <DAI name="t">
                </DOI>
              + <DOI name="TmpAlmSpt">
            </LN>
          </LDevice>
        </Server>
      </AccessPoint>
    </IED>
```

SCL to build Server

IEC 61850 Server/
Publisher

ServerDemo61850.ICD



PIS10.dll

ServerDemo61850.exe

```
<?xml version="1.0" encoding="UTF-8" ?>
- <SCL xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="http://www.iec.ch/61850/2003/SCL">
  <Header id="" version="3" />
  + <Communication>
  - <IED type="RTUType" manufacturer="SystemCORP Pty Ltd" configVersion="1.0"
    name="DK61">
    <Services />
  - <AccessPoint name="SubstationRing1">
    - <Server timeout="30">
      <Authentication />
    - <LDevice inst="LDevice1" desc="">
      + <LN0 InClass="LLNO" inst="" InType="LLNO_0">
      + <LN InClass="GGIO" inst="1" prefix="DIPS_" InType="GGIO_0">
      + <LN InClass="GGIO" inst="2" prefix="DIPS_" InType="GGIO_10">
      + <LN InClass="GGIO" inst="3" prefix="LEDO_" InType="GGIO_17">
      - <LN InClass="STMP" inst="1" prefix="" InType="STMP_0">
      + <DOI name="Alm">
      - <DOI name="Tmp">
      - <SDI name="mag">
      - <DAI name="i">
      - <Private type="SystemCorp_Generic">
        <SystemCorp_Generic:GenericPrivateObject Field1="2"
          Field2="3" Field3="1" Field4="0" Field5="0"
          xmlns:SystemCorp_Generic="http://www.systemcorp.com.au/61850/SCL/c
        </Private>
      </DAI>
      </SDI>
      + <DAI name="q">
      + <DAI name="t">
      </DOI>
      + <DOI name="TmpAlmSpt">
      </LN>
      </LDevice>
      </Server>
      </AccessPoint>
    </IED>
```

Binding „Model to Application“ (see
DLL and DK61 Getting started)

Start application (.exe)

- DLL reads the <<ServerDemo61850.ICD>>
- DLL interprets the ICD file
- DLL builds the information model
- DLL builds the data sets and control blocks
- DLL configures the control blocks
- DLL binds the information model to the application
- Start Server



SCL to configure Data Sets and Reporting

ICD Designer

Control Blocks and Data Sets can be created and modified by simply modifying ICD file

...
start server again
... all changes are automatically made.

No vendor specific definition/tool required!!

The screenshot displays the ICD Designer application window. On the left, the 'Report Control Blocks' configuration panel is visible, with several fields highlighted by red boxes: 'Data Set' (DSTMPVal), 'Name' (URCB_STMP_Val), and 'Report ID' (TempVal). Below this, the 'Options' section contains various checkboxes for configuration. On the right, the 'Tree View' shows the project hierarchy. A red box highlights the 'Data Sets' folder, which contains several data sets, including 'DSTMPVal'. Another red box highlights the 'Report Control Blocks' folder, which contains 'UNBUFFERED_RCB', 'URCB_STMP_Alm', and 'URCB_STMP_Val'. A blue arrow points from the 'URCB_STMP_Val' entry in the 'Report Control Blocks' folder to the 'URCB_STMP_Val' field in the configuration panel.

Report Control Blocks	
Buffer time(ms)	0
Buffered	☐ False
Config Revision	0
Data Set	DSTMPVal
Description	Integrity Report
Integrity Period	1000
Name	URCB_STMP_Val
Report ID	TempVal

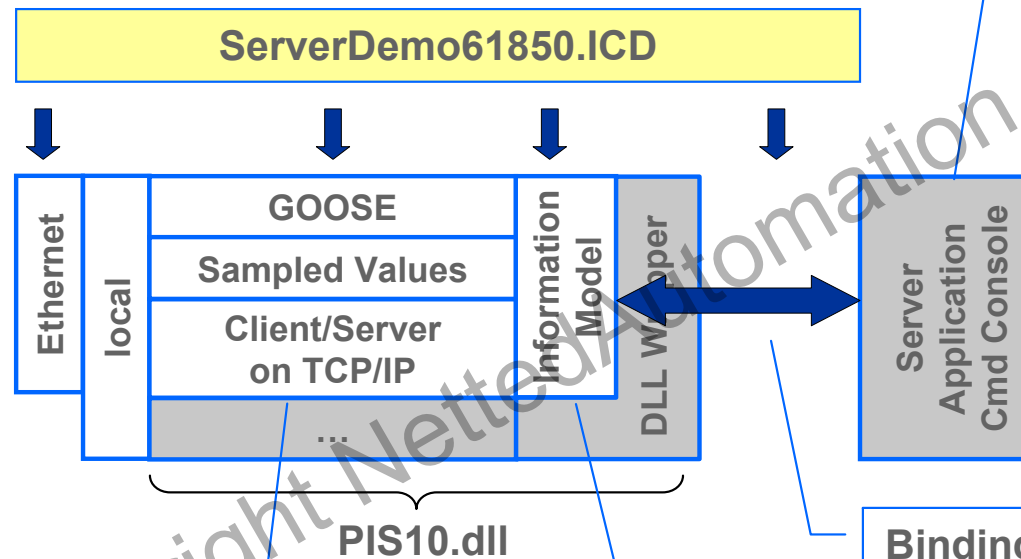
Options	
Options	
Configuration Re...	☐ False
Data Reference	☐ False
Data Set name	☒ True
Entry ID	☐ False
Reason for Includ...	☒ True
Sequence number	☐ False
Time Stamp	☒ True
Trigger Options	
Data Change	☐ False
Data Update	☐ False
Included in Integr...	☒ True
Quality Change	☐ False
Report Enabled	
Max	5

Tree View

- SCL
 - Header
 - Communication
 - DK61
 - SubstationRing1
 - Server
 - LDevice1
 - LLN0
 - Data Sets
 - Indicate_DataSet
 - Goose_Alarm_DataSet
 - DSTMPAlm
 - DSTMPVal
 - LDevice1/LDevice1STMP1\$MX\$Tm\$mag.i
 - LDevice1/LDevice1STMP1\$MX\$Tm\$pq
 - LDevice1/LDevice1STMP1\$MX\$Tm\$st
 - Report Control Blocks
 - UNBUFFERED_RCB
 - URCB_STMP_Alm
 - URCB_STMP_Val
 - Client Logical Node
 - GSE Control Blocks
 - Sampled Value Control
 - Log Control
 - DO Mod
 - DO Beh
 - DO Health

SCL to build Server

IEC 61850 Server/
Publisher

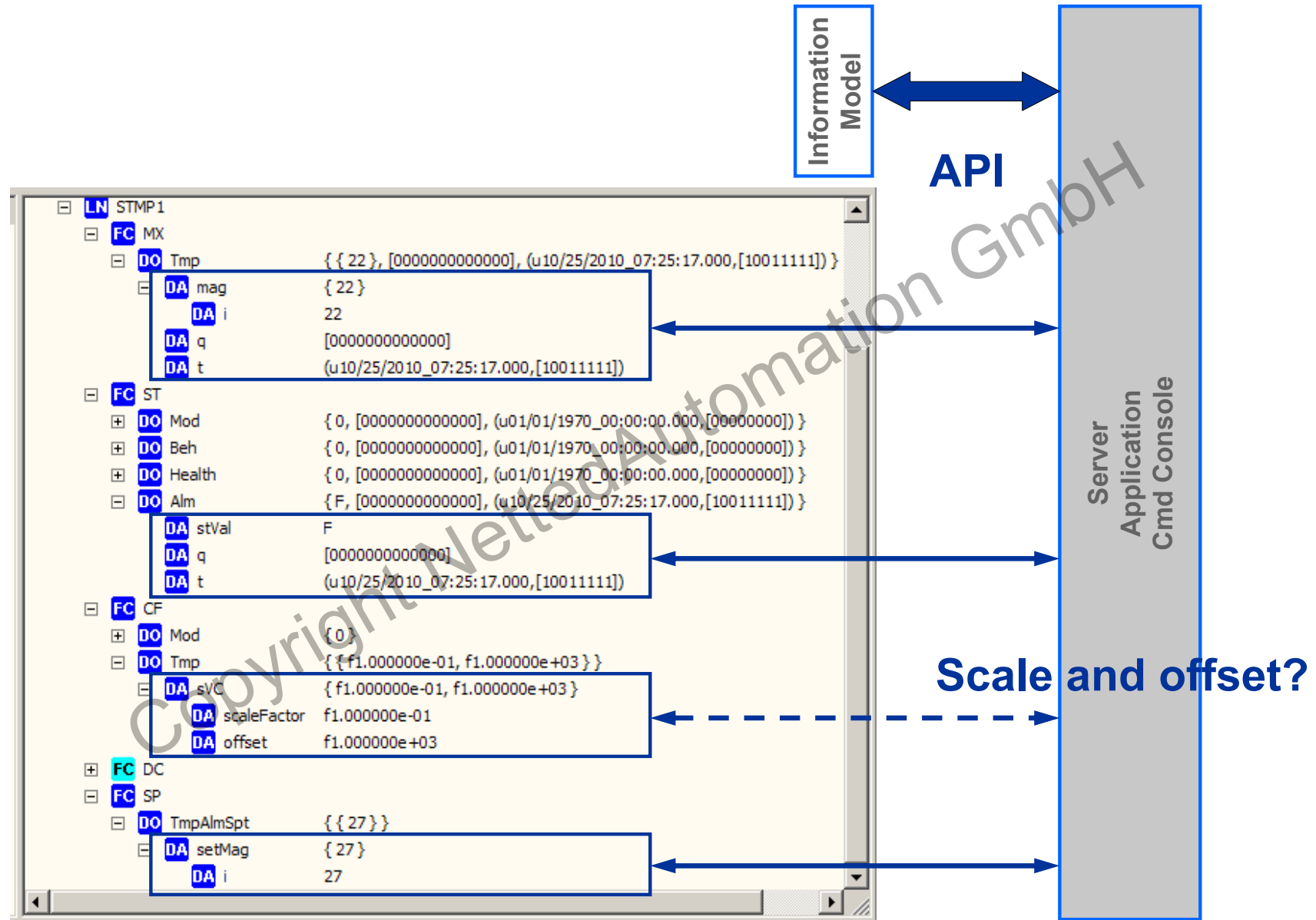


Application Data (e.g. Temperature) must fit to the Information Model (LN STMP.Tmp.mag.i)

Information Exchange Methods (e.g. Get, Set, Browse, DataSet, Control Blocks, ...)

Information Model (e.g. LN STMP.Tmp.mag.i) must fit to the Application (Temperature)

Model mapping to Application



- For further details see:
 - <<Getting_Started_DLL_IEC61850_2010-08-28.pdf>>
 - <<Seminar-IEC61850_HQ_2009-09-30.pdf>>
 - <<Getting_Started_DK61_IEC61850.pdf>>
 - <<IEC61850ProtocolAPIUserManual.pdf>>
 - and other documents found under the
 <Demos_Hands-On> folder
- Questions? Contact Karlheinz Schwarz at:
 - schwarz@scc-online.de

