Smart Grid and Interoperability Standards

IEC 61850 Lite Implementation –
Low cost microcontroller chip with
IEC 61850 (IEC 61400-25) and IEC 61131-3

Dipl.-Ing. Karlheinz Schwarz (owner of NettedAutomation GmbH; Karlsruhe, Germany) specializing in distributed automation systems. He is involved in many standardization projects (IEC 61850 – utility automation, DER, hydro power, IEC 61400-25 – wind power, IEC 61158 - Fieldbus, ISO 9506 – MMS, ...). He is engaged in representing main industry branches in the international standardization of real-time information modeling, configuration, and exchange systems. He provides consulting services and training to utilities, system integrators, consultants, and vendors. He has trained more than 2,000 experts from more than 400 companies and more than 50 countries. The training courses are considered to be outstanding. Mr. Schwarz is a well-known authority on the application of mainstream information and communication technologies in the utility industry.
Contents

• What is IEC 61850 about?
• Motivation for IEC 61850 Lite implementation
• IEC 61850 Lite implementation (general)
• Chip Architecture (IEC61850@Chip (Beck IPC))
• Chip Development Kit (Beck IPC)
• Free DLL Evaluation/Starter Kit (SystemCorp)
• Useful links
What is IEC 61850 all about?

1. ITC
2. ITC
3. ITC
4. Teamwork
5. See number 1.
What is IEC 61850 all about?

German speaking

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Karlheinz Schwarz, NettedAutomation; 2010-10-11
What is IEC 61850 all about?

Standard Logical Node
Class MMXU

A  Phase currents
PhV  Phase to ground voltage
PhV.PhsA
PhV.PhsB
...
PPV  Phase to phase voltage
W  Phase active power
VAR  Phase reactive power
VA  Phase apparent power
TotW  Total active power
TotVAR  Total reactive power
TotVA  Total apparent power
Hz  Frequency

What's the difference?
... don't touch the line to figure it out!!
What is IEC 61850 all about?

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Motivation for IEC 61850 Lite implementation

- First Implementations of IEC 61850 for **High Voltage Substations** (quite expensive, too complex, too ...)
- Mainly **two vendors** of Stack Software
- Need **simple API** (Appl. Progr. IF) for small devices
- **Reduce cost for devices** in Power Generation, Distribution, Smart Grids, ...
- **Hide details** of MMS and IEC 61850
- Get a **fast start with low cost and low risk**
- **Easy to configure** devices with SCL (System Configuration Language)
IEC 61850 Lite implementation (general)

- SystemCorp (Perth, Western Australia) developed a complete IEC 61850 Stack from Scratch since 2007
- Main Objectives:
  - Provide **very simple API** to Application
  - Port stack to **micro-controller**
    (first: Beck IEC61850@Chip)
  - Run software on **many platforms**
  - **Configure Stack with SCL**
  - Provide **free software** for **getting started and evaluation**
## API: Client/Server and Object Management

<table>
<thead>
<tr>
<th>No</th>
<th>API</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IEC61850_Create</td>
<td>API to create a client or server object with call-backs for reading, writing and updating data objects</td>
</tr>
<tr>
<td>2</td>
<td>IEC61850_LoadSCLFile</td>
<td>API to read the SCD XML data to get the configuration of server or client</td>
</tr>
<tr>
<td>3</td>
<td>IEC61850_Start</td>
<td>API to start the server or client</td>
</tr>
<tr>
<td>4</td>
<td>IEC61850_Stop</td>
<td>API to stop the server or client</td>
</tr>
<tr>
<td>5</td>
<td>IEC61850_Free</td>
<td>API to delete a client or server object created</td>
</tr>
</tbody>
</table>

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<tr>
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<tbody>
<tr>
<td>1</td>
<td>IEC61850_Read</td>
<td>Read the value of a specified data attribute</td>
</tr>
<tr>
<td>2</td>
<td>IEC61850_Write</td>
<td>Write the value to a specified data attribute</td>
</tr>
<tr>
<td>3</td>
<td>IEC61850_Update</td>
<td>Update the value of a specified data attribute</td>
</tr>
</tbody>
</table>
IEC61850@Chip (Beck IPC)

IEC 61850
Application in C/C++, IEC 61131-3

IPC@CHIP® RTOS architecture

API: RTOS, TCP/IP, Hardware, DOS (Int. 21h), Webserver CGI,
Serial (Fossil), Ethernet, PC, SPI, CAN, USB, ...

(T)FTP
DHCP
HTTP(S)
Telnet
SSH
DNS
UDP
Server
Client
Web Server
Server
Server
Client
Config Server

SSL (Secure Socket Layer)

Sockets Application interface

TCP/IP v4/v6 dual stack
ARP, ICMP, ICMPv6, TCP, UDP,
IP Multicast, Auto IP, IPv6

Ethernet
PPP
PPP
PPPoE
Driver
Client
Server
Client

Real Time Operation System – IPC@CHIP-RTOS

FAT16/32 Filesystem

Flash Translation Layer

IPC@CHIP Hardware

AVB Bus
Serial ports
Ethernet
USB
CAN
PC
SPI
PIO
Interrupts
Timers
DMA
IEC61850@Chip (Beck IPC)

IEL 61850 Application in C/C++, IEC 61131-3

Wireless LAN
Bluetooth
GSM/GPRS
Graphic
IEC 61131-3 CoDeSys
EtherCAT
M2M Communication
Fieldbus

Drivers for DNP3, 101/104, Modbus, ... are available from SystemCorp

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Karlheinz Schwarz,
NettedAutomation; 2010-10-11
Chip Development Kit DK61 (Beck IPC)

- Hardware
- C/C++ Compiler
- CoDeSys (IEC 61131-3)
- IEC 61850 Stack (SystemCorp):
  - Client/Server
  - Publisher/Subscriber
- Application examples
- 2 x Ethernet
- Serial
- CAN bus
- ...
Free DLL Evaluation/Starter Kit (SystemCorp)

- IEC 61850 Stack (SystemCorp):
  - Client/Server/Pub/Sub (in DLL)
  - Same API as on Beck-IPC-Chip
- Application examples in C/C++ and C# (incl. Source Code)
Useful links

• General
  – www.systemcorp.com.au
  – www.beck-ipc.com
  – blog.iec61850.com
  – www.nettedautomation.com/seminars

• Free IEC 61850 DLL Evaluation/Starter Kit Download
  – www.nettedautomation.com/iec61850li/dll
Questions?

Karlheinz Schwarz
Schwarz Consulting Company (SCC)
schwarz@scc-online.de
blog.iec61850.com
Karlsruhe (Germany)