NettedAutomation GmbH

Information & Communication Systems

IEC 61850, IEC 61400-25, IEC 60870-5-104, DNP3, IEC 62351 (Security), …

Generation, Transmission, Distribution, … –
Design, Specification, Engineering, Configuration, Automation, SCADA, Measuring, Condition Monitoring;
Information Modeling, Exchange and Management, Stack Integration, Embedded Systems, Application Programming, …

2013 (400 attendees):

175.	in-house	Quebec City
176.	in-house	Erlangen
177.	in-house	Aachen
178.	in-house	Kassel
179.	in-house	Karlsruhe
180.	in-house	München
181.	in-house	Backnang
182.	public	Filderstadt
183.	in-house	Toronto
184.	public	Frankfurt
185.	in-house	Backnang
186.	in-house	Stafford
187.	in-house	Kassel
188.	in-house	Jakarta
189.	in-house	Petten
190.	in-house	San Jose
191.	public	Frankfurt
192.	in-house	Hong Kong
193.	in-house	Hong Kong
194.	in-house	Hong Kong
195.	in-house	Bad Vilbel

Seminars & Training,
Support for Stacks, API Integration and Gateways, Consultancy,
Support for Conformance Testing, …

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http://blog.iec61850.com

4,000+ Experts from 900+ Companies from 90+ Countries trained (2016-05)

IEC 1906 AWARD

VHP READY Virtual Heat & Power

UCA International Users Group

USE61400-25 IEC 61400-25 user group

Dipl.-Ing. Karlheinz Schwarz
Editor of IEC 61850 and IEC 61400-25 (Wind Power Plants)
Member of IEC TC 57 WG 10, WG 17 (DER), WG 18 (Hydro Power Plants)
Member of IEC TC 88 PT 25 (IEC 61400-25, Wind Power Plants)
Convenor of IEC TC 88 IEC 61400-25-6 (Condition Monitoring)

You get comprehensive, first-hand, and neutral knowledge and experience

IEC 61850 & IEC 61400-25 SCC

NettedAutomation GmbH
Information & Communication Systems

Motivation: sustainable interoperability

The standards IEC 61850 „Communication networks and systems for power utility automation“ and IEC 61400-25 „Communications for monitoring and control of wind power plants“ provide support for **sustainable interoperability: Information Models, Information Exchange Methods, Protocol Mappings, and System Configuration Language (SCL)** for Power Systems (Generation, Transmission, and Distribution for HV, MV, and LV, ...).

Data Models

Logical Nodes (LN) represent real-world **Inputs, Outputs, Ratings, and Settings of functions** or **equipment**. A LN provides a list of named data objects (DO). The LN “XCBR” represents a real “circuit breaker” with the data object (DO) “Pos” (Position)**.** IEC 61850-7-2 defines **Information Exchange Methods**, e.g., for the position (with Client/Server services, GOOSE, SMV). **Data flow** is specified by a **SCL** file (IEC 61850-6).

IEC 61850-7-4xx

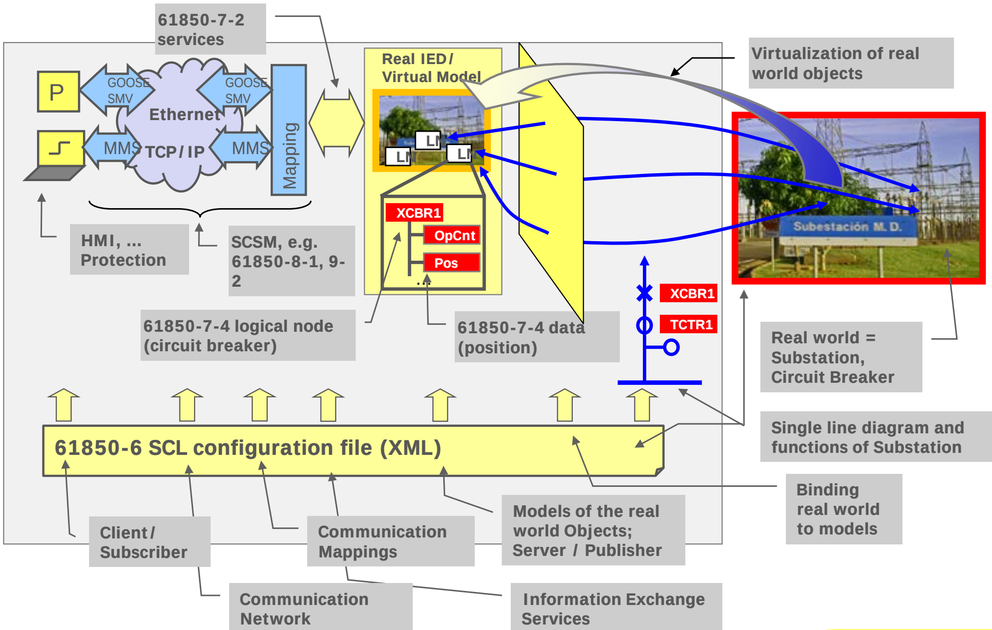
Substations (7-4)
160 LN
900 DO

Hydro Power (410)
63 LN
350 DO

Decentralized Energy Res. (420)
50 LN
450 DO

IEC 61400-25-2

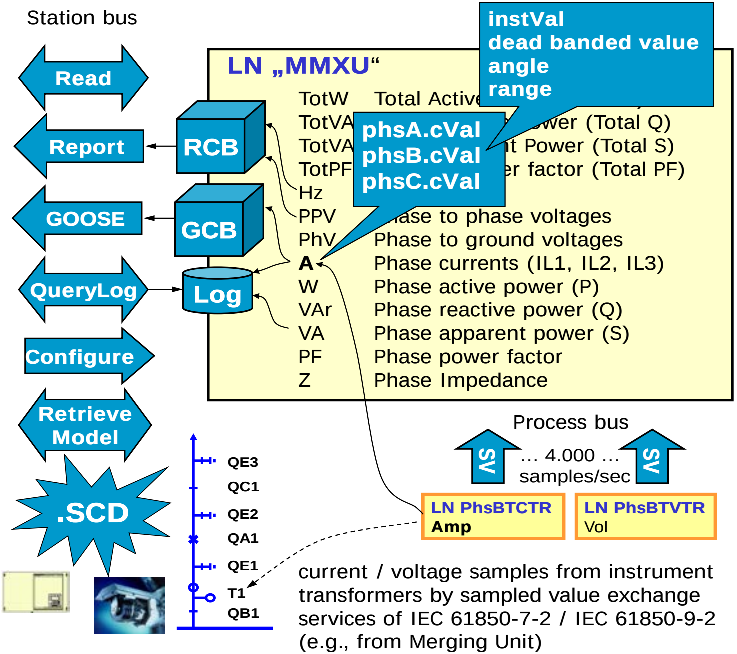
Wind Power
16 LN
250 DO



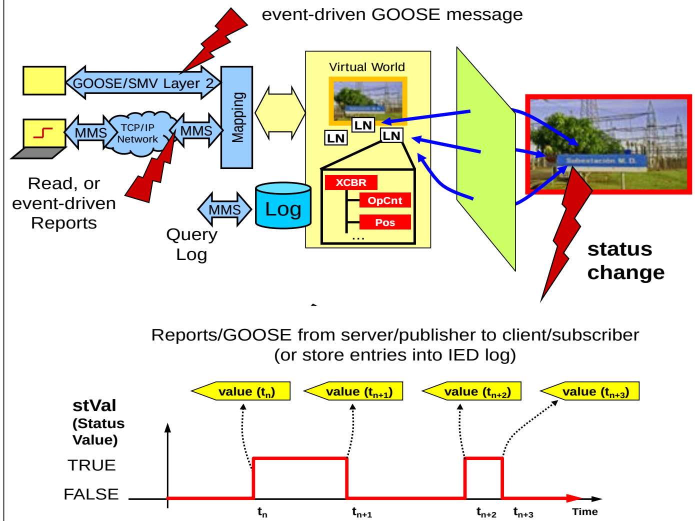
Example see reverse side

Example: Measurement LN “MMXU” represents power, voltages, currents, impedances, … in a three-phase electrical system. The values can be communicated by various services. The LN “MMXU” comprises values for measurements, monitoring, configuration, settings, description, and substitution. These values can be communicated by various services like read (polling), reporting, GOOSE, logging and log query. Recording and logging are build upon monitored value changes. The SCL configuration file .SCD (System Configuration Description) specifies the single line diagram of the substation, the information model, the parameters of the control blocks for reporting and logging, GOOSE, SV, the binding to the process and the data flow.

LN and data objects



Information flow (example)



NettedAutomation GmbH

Information & Communication Systems

25+ Years of Excellence

International Standards for Power Systems

Generation, Transmission, Distribution, ..., Smart Grids; Design, Specification, Bidding, Engineering, Configuration, Automation, SCADA, Condition Monitoring, Information Management ...

We bring standards, smart people, intelligent devices, tools, and systems together to build Smarter Grids!

IEC 1906 AWARD

Supplier information, capabilities, and experience profile

Supplier information

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URL http://www.nettedautomation.com
http://blog.iec61850

Foundation 2000

Our knowledge and experience are asked all over – more and more!

4,000+ Experts from 900+ Companies from 90+ Countries trained (2016-05)

Ownership Privately held by **Dipl.-Ing. Karlheinz Schwarz**

Registered Amtsgericht Karlsruhe HRB 8866

General Manager Ingeruth Schwarz

Major Customers

More than 30 training sessions in 2011

Users:	AXPO, Bayernwerk, Badenwerk, Con Edison NYC, ENERGI E2, E.ON, Endessa, EdF, EdP, Energex, ETRANS, EVS, EWE, GdF, HEW, Manitoba Hydro, Hydro Quebec, Itaipu Binacional Hydro Power Plant Brazil, KEPCO, Mercedes Benz, PowerLink Australia, RWE, Stattkraft, TNB Malaysia, Terna, Transba, Transpower NZ, Vector, VEW, Vattenfall, ...
Vendors:	AEG, Beck, Beckhoff, ABB, Alstom, AREVA, Bosch, BTC, Doble, E+H, IDS, Eberle, GE, Hirschmann, Kloeckner & Möller, LG, OMICRON, Pepperl & Fuchs, Phoenix Contact, PSI, Repas AEG, Schweitzer Engineering Labs, Siemens, TNB, VATECH SAT, SMA, VESTAS Wind, Voith Hydro, ...
Consultants:	KEPRI, SKM, Teshmont, ...

Vendor independent, up-to-date, neutral, and experienced!

The primary service of NettedAutomation is to provide **consulting** services to all enterprises for feasibility studies, information modeling, system specification, implementation and use of devices and systems; **education and hands-on training** for users, system integrators and vendors in all aspects of Standards used for Power Systems; **support** for marketing, information dissemination, procurement for distributed systems, specifying procurement requirements; and **evaluation** of bidder proposals for devices, systems, tools, and open communications. The application domains cover generation, transmission, and distribution, Smart Grids, RTUs, SCADA and EMS systems, protection, automation and condition monitoring systems.

NettedAutomation has long-time experience in IEC 61850, IEC 61400-25, IEC 60870-5-10x, IEC 60870-6 TASE.2, IEC 62351, DNP3, IEC 61970 CIM, IEC 61968, IEC 61158, IEC 61499, IEEE 802.3, and ISO 9506 MMS to name just a few.

To keep abreast of the latest technical development, NettedAutomation is actively involved in workshops, seminars, hands-on training, task forces, and committees of various professional organizations such as ISO, IEC, IEEE, CEN, CENELEC, DKE, VDI, ZVEI, NIST SGIP, UCA IUG, and USE-IEC61400-25.

Curriculum vitae of Karlheinz Schwarz

Dipl.-Ing. **Karlheinz Schwarz** (63) received his diploma degree in Information and Automation Technology at the University of Siegen (Germany) in 1982. He is married and has four children and seven grandchildren.

As a manager with Siemens Automation & Drives (communication systems) he represented the positions of Siemens and the German national committee in the international standardization of MAP, MMS, MMS companion standards, Fieldbus, and other standardization projects from 1984 until 1997.

He is president of SCC (Schwarz Consulting Company), Karlsruhe (Germany) specializing in distributed automation systems. He is an independent consultant in the area of information modeling, systems and information integration, system and device engineering and configuration, open information exchange, and open communications since 1992. Mr. Schwarz has immense experience in the migration from proprietary or other solutions to standard compliant solutions.

He is involved in many standardization activities within IEC (TC 57, TC 65, and TC 88), ISO (TC 184), CENELEC (TC 65 CX), IEEE (SCC 36 "UCA", 802), and DIN since 1985. He is engaged in representing main industry branches in the global standardization and providing consulting services to users and vendors. Mr. Schwarz is a well-known authority in the application of mainstream information and communication technologies. He provides guidance in the migration from proprietary solutions to advanced seamless and standard-based solutions applicable in substations, and power generation units, and between these and with local, regional, and central SCADA systems. Specifically, his contributions to the publication of many standards are considered to be outstanding.

He has been awarded with the IEC 1906 Award in 2007 ***"For his strong involvement in the edition of the IEC 61850 series, its promotion inside and outside IEC, and specifically its adaptation for wind turbine plant control."***

http://www.nettedautomation.com/download/IEC1906-Award.pdf

Publications:

http://www.nettedautomation.com/marketing/scc_publications/index.html

NettedAutomation's Capabilities and Experience Profile

Learn firsthand what you need to know about these standards and products!

We assist companies in examining open communications and distributed systems technologies in substation automation, Smart Grids, and many other application areas outside the utility industry (for which IEC 61850 was originally designed). We support the design and implementation of IEDs compliant with IEC 61850 and other standards. Support for procurement requirements and evaluation of bidder proposals for IEC 61850 related devices, systems and tools can be provided. We have long term experience in implementing and organizing IEC 61850 and IEC 61850 based pilot projects.

Mr. Schwarz is the principal teacher and trainer of the seminars and training services offered and organized by NettedAutomation GmbH. We have given lectures all over

http://www.nettedautomation.com/seminars

We offers consulting services outlined above for a wide range of information and device modeling as well as standards-based configuration, communication systems and technical applications oriented to the automation of discrete and continuous automation related to:

- International Fieldbus standard, IEC 61158 (IEC TC 65)
- European Fieldbus, EN 50170 (CENELEC TC 65 CX)
- National Fieldbus standards like PROFIBUS, FIP, P-Net
- Actuator Sensor Interface (ASI) or IEEE 802 LAN/WAN
- Utility Comm. Architecture (UCA™), IEEE SCC 36
- Communication networks and systems for power utiliy automation, IEC 61850 (IEC TC 57)
- Telecontrol equipment and system, IEC 60870-5-10x
- Communications for monitoring & control of wind power plants, IEC 61400-25 (IEC TC 88) and IEC 61400-25-6 on Information models for condition monitoring systems (IEC TC 88)
- Communications Systems for Distributed Energy Resources (DER), IEC 62350 (IEC TC 57)
- Hydroelectric power plants – Communication for monitoring and control, IEC 62344 (IEC TC 57)
- Intercontrol Center Communications Protocol (ICCP), IEC 60870-6 TASE.2 (IEC TC 57)
- Common information models (CIM), IEC 61970 (IEC TC 57)
- Accreditation, Testing and Certification of IT products (DIN Test Lab Auditor), Quality Management
- Standard for the Exchange of Product Model Data (STEP)
- Application and Function block modeling IEC 61499 (IEC TC 65)
- Process Control Functionblocks and Device Description Language, IEC 61804 (IEC TC 65)
- Open Systems Application Frameworks, ISO 15745 (ISO TC 184 SC5)
- Manufacturing Automation Protocol (MAP), MiniMAP/FAIS
- Manufacturing Message Specification, MMS, ISO 9506 (ISO TC 184)

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Appendix: Personal education and qualifications of Karlheinz Schwarz

1. Education

1958 – 1962	Elementary School
1962 – 1965	Secondary School
1965 – 1967	Secondary School (Gymnasium)
1967 – 1969	Technical School
1969 – 1972	Apprenticeship as electrical mechanic and electronics (Siemens)
1973 – 1974	Service technician responsible for alarm systems (Siemens: fire alarm systems, burglar alarm systems, ...)
1975 – 1977	Academic high school (Hessenkolleg)
1977 – 1982	Study of electrical engineering and IT at University Siegen (degree: Dipl.-Ing.)
1981 – 1997	Employee at Siemens Automation (responsible for standardization of comms)
1992 – present	Consultant and trainer for communication and automation (see above and below)

2. Training experience since 2002

Mr. Schwarz has trained more than 4,000 experts all over. Most seminars have been conducted as in-house courses. Attendees from more than 900 companies have attended. Attendees from small, medium and big utilities and big vendors have attended. An excerpt is shown in the following table:

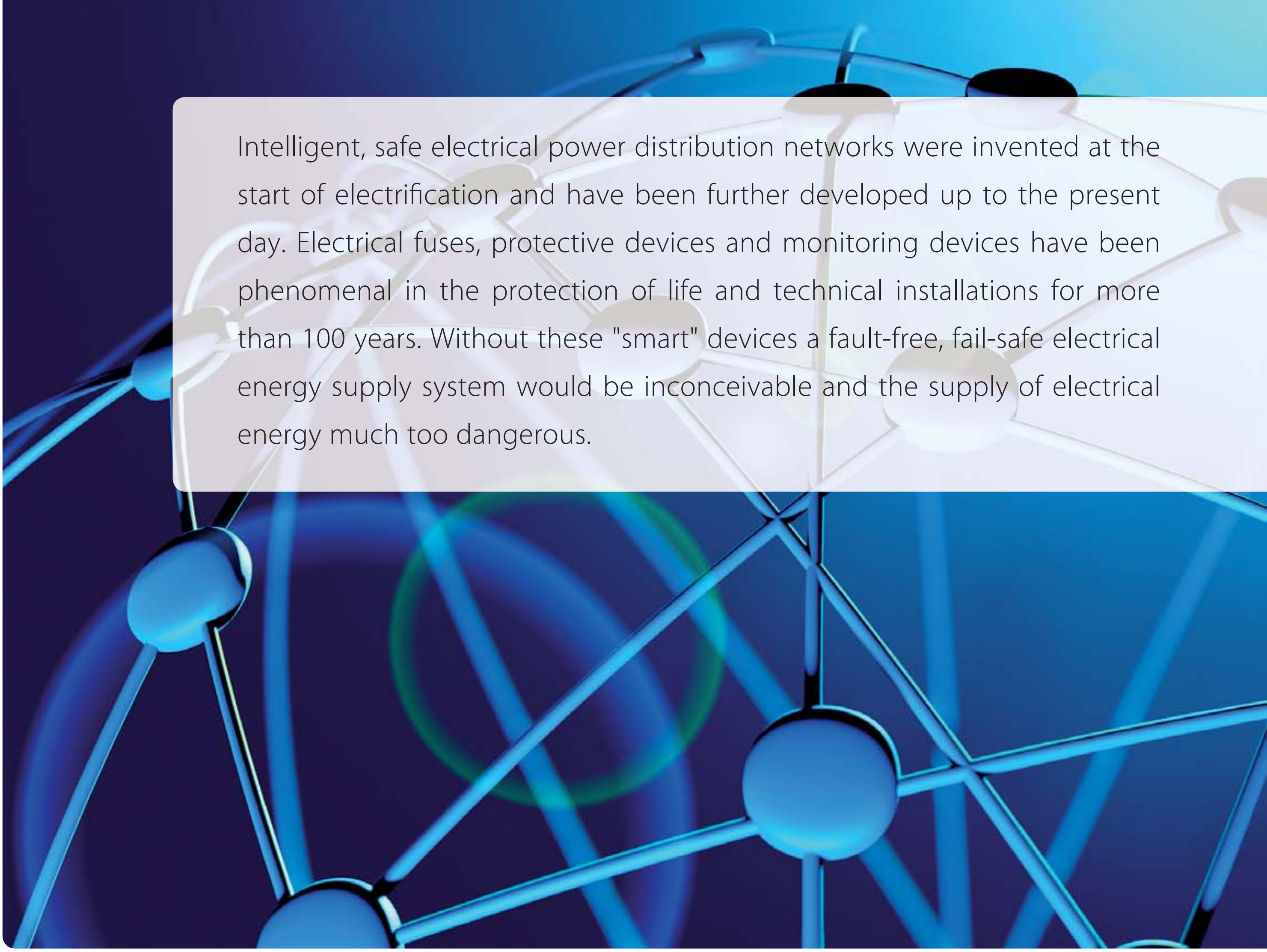
Year	Training in Countries	Courses	Attend.
2002	China	2	30
2003	Denmark, Spain	2	22
2004	Spain, Germany, France, USA, China, South Africa, Malaysia	8	199
2005	South Korea, Mexico, Denmark, Canada, Switzerland, Germany, South Africa, Australia, Israel	12	325
2006	Germany, Italy, Spain, India, Canada, UK, Portugal, France, Austria, USA	18	545
2007	Russia, Germany, Portugal, USA, France, Canada, South Korea, Australia, New Zealand	11	252
2008	Germany, Slovenia, Canada, USA, France, Malaysia, South Korea, Australia, New Zealand, Sweden	20	379
2009	Mexico, Russia, Italy, Germany, Malaysia, USA, Australia	15	220
2010	Iceland, Spain, Ireland, Argentina, Brazil, Germany, Japan, Denmark, USA, Philippines, Sweden, Australia, France	20	276
2011	France, UK, Germany, Australia, South Korea, Switzerland, Zimbabwe, Canada, Belgium, USA, China, Austria, Brazil	33	542
2012	Germany, India, Belgium, Israel, Italy, Sweden, USA, South Korea, China, Taiwan, Australia	18	456
2013	Germany, Canada UK, Indonesia, Netherlands, Costa Rica, Hong Kong	21	405
2014	Germany, USA, Switzerland, UK, Denmark, Czech Republic	14	139
2015	Germany, UK, USA, Switzerland, Slovakia, Sweden, Belgium, Hungary, Czech Rep., Bolivia, Saudi Arabia	13	157
2016	Germany, Taiwan, Sweden, Switzerland, Canada, ...	9	141
	Status 2016-05-12	***216***	***4.088***

3. Standardization experience

Mr. Schwarz is (was) a principal contributor in the following standardization projects (either project member or as the technical lead), representing many German industries (users and vendors):

ISO	ISO TC 184/SC5	Architecture, Communications, Integration Frameworks	Member	1985-2012
	ISO TC 184/SC5/WG 5	Open Systems Application Frameworks	Member	1985-2005
	ISO TC 184/SC5/WG 2	Communications and interconnection (MMS, ...)	Mem-ber/Chairman	1985-2005/1998-2005
IEC	IEC TC 57	Power Systems Control and Associated Communications	Member	1992-2012
	IEC TC 57 SPAG	Strategic Policy Advisory Group	Invited Guest	
	IEC TC 57 WG 07	Protocols compatible with ISO/OSI and ITU	Member	1992-2000
	IEC TC 57 WG 10	Power system IED communication and associated data models / Communication and systems within Substations (IEC 61850)	Member/editor of 61850	1995-2012
	IEC TC 57 WG 17	Communications Systems for Distributed Energy Resources (DER) – based on IEC 61850	Member	2004-2012
	IEC TC 57 WG 18	Hydroelectric power plants – Communication for monitoring and control – based on IEC 61850	Member	2004-2012
	IEC TC 57 WG 19	Interoperability within TC 57 in the long term	Member	2005-2012
	IEC TC 65 WG 6	Functionblocks (IEC 61499)	Member	1990-2002
	IEC TC 65 PJWG	Device Profiles	Member	1998-2002
	IEC TC 65C WG 1	Message data format for information transferred on process and control data highways, Profiles	Member	1983-2006
	IEC TC 65C WG 6	Fieldbus (IEC 61158)	Member	1997-2000
	IEC TC 65C WG 7	Functionblocks and Data Descriptive Language (IEC 61804)	Member	1996-1999
	IEC TC 88 PT 25	Communications for monitoring and control of wind power plants (IEC 61400-25-1/-2/-3/-4/-5) – based on IEC 61850	Member/editor of 61400-25	2001-2012
	IEC TC 88 PT 25 / IEC 61400-6	Communications for monitoring and control of wind power plants (IEC 61400-25-6) – Logical node classes and data clas-ses for condition monitoring	Convenor	2006-2011
IEEE	IEEE 802.3 /.15	LAN, WAN	Member	1998-2001
	IEEE SCC 36	Utility Communication Architecture	Member	1996-2000
CENELEC	CENELEC TC 65 CX	Fieldbus Communication	Member	1992-2000
CEN	CEN TC 310/TG ICOM	Task Group on industrial communications	Member	1994-1996
MMS Forum	EPRI, Electric Power Research Institute	Communications and application modelling in the area of power utilities (UCA, ICCP)	Member	1992-1998
NAM	DKE/NAM/NI 96.5	Architektur und Kommunikation	Member	1985-1998
	DKE/NAM/NI GA 96.5.2	Kommunikation und Datenaustausch (MMS, ...)	Chairman	1985-2002
DKE	DKE FB 9 AK AP	FB 9 Arbeitskreis Arbeitsplanung	Member	1989-2003
	KG-ILT	Koordinierungsgruppe Industrielle Leittechnik	Member	1989-2003
	K 261	Mirror of IEC TC 8: System aspects of electrical energy supply	Member	2003-2008
	DKE K 950	Kommunikation und Informationslogistik	Member	1998-2001
	DKE AK 956.0.2	Kommunikationsdienste, Process Control	Member	1992-1997
	DKE K 956	Feldbus	Member	1986-2012
	DKE AK 956.3.1	Functionblocks and Data Descriptive Language	Chairman	1995-206
	DKE K 952	Netzleittechnik	Vice Chair-man/member	1992-2012
	DKE AK 952.0.7	Protocols compatible with ISO/OSI and ITU	Member	1992-2005
	DKE AK 952.0.10	Stationsleittechnik	Member	1995-2012
	DKE AK 952.0.17	Kommunikation für verteilte Energieversorgung (TC 57 WG 17)	Member	2005-2012
	DKE K 383.0.1	Kommunikation für Windenergieanlagen	Chairman	2001-2012
GMA	GMA AK 4.2	Kommunikation in verteilten Systemen	Member	1996-1998
VDMA	Fachverband InCom	Industrial Communications	Member	1990-1996
ZVEI	ZVEI GA IK	Gemeinschaftsausschuss Industrielle Kommunikation	Member	1986-2012

Smart Grids



Intelligent, safe electrical power distribution networks were invented at the start of electrification and have been further developed up to the present day. Electrical fuses, protective devices and monitoring devices have been phenomenal in the protection of life and technical installations for more than 100 years. Without these "smart" devices a fault-free, fail-safe electrical energy supply system would be inconceivable and the supply of electrical energy much too dangerous.

RELIABLE ENERGY DELIVERY

– A 19th century invention

Since the 19th century engineers have developed, tested, used on a large-scale and continuously improved suitable solutions for the safe and reliable operation of the rapidly growing supply of ever more applications with electrical energy. During the sustained further development of the supply systems, it is necessary to handle the available resources (energy sources, technical installations and individuals with experience) as well as the laws of physics both responsibly and in a "smart" manner.

Smart grids help to make it possible to use physics safely and reliably for the benefit of man – in the past, today and in the future

Smart energy supply

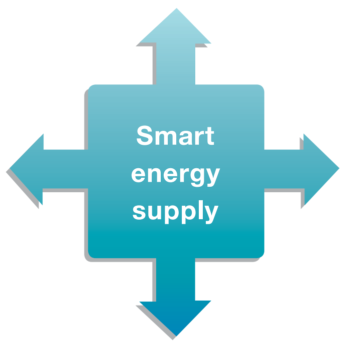
The system for the supply of electrical energy has been in construction for more than 130 years. Along with the high-availability provision of electrical energy, the protection of lives and technical installations has had a significant impact on the development of the supply system. Special concepts, processes and devices were "smart" from the start – the intelligent, selective shut down of a faulty electrical circuit or an intelligently planned redundant system topology result in minimal interruption in supply in the event of a malfunction.

ENERGY COMMUNICATION AT THE FORUM "LIFE NEEDS POWER" AT THE HANNOVER MESSE

Electrical distribution network operator:
"We cannot change Ohm's or Kirchhoff's laws."

Lawyer:
"Objection! Every law can be changed.
Even the constitution with a 2/3 majority."

Such a smart energy supply system that strictly follows the laws of physics is increasing viewed by politics, commerce, science and the public in relation to the conservation of natural resources and the protection of the environment, as well as in relation to the aim of generating profits. Smart grids are viewed as an effective instrument to achieve these goals.



The energy revolution and the increasing interest in renewable energy sources and storage options (for instance pumped storage, gas or heat storage systems) are increasingly frequently viewed in conjunction with new technological capabilities for the quick and safe exchange of information – a core topic of smart grids.

The term "smart grid" as an intelligent energy supply system involves, according to the DKE and IEC smart grid road maps, "the networking, monitoring, control and regulation of intelligent energy producers, storage systems, power consumers and network equipment in energy transmission and distribution networks with the aid of information and communication technology (ICT). The objective is, based on transparent energy-efficient, cost-efficient, safe and reliable system operation, to achieve the sustainable and environmentally acceptable assurance of the supply of energy."

These days a differentiation is made between **smart markets** (in which the market participants who offer or require energy organise themselves) and **smart grids** (the technical installations and processes to be further developed that are needed for high availability, efficient and safe supply based on the laws of physics). Even though both are closely linked, they do provide some orientation in the maze of discussions.

Smart markets with the high volatility of renewable energy sources place comprehensive requirements on smart grids; meeting these requirements requires above all that the solutions are in harmony with the laws of physics for the electrical system. Controlling the volatility of the availability of water and sunlight in the supply of foodstuffs by means of storage, transport and distribution can be taken as an example for the smart supply of energy of the future. The volatile availability of solar and wind energy could contribute to a secure, high-availability, efficient supply by means of increasing storage.

How secure is our supply of energy?

The current raw materials for energy (gas, oil, coal, uranium, ...) and also the volatile sources of energy such as the sun, water and wind are only secure to a limited extent. This uncertainty preoccupies above all the future smart market – it is of lesser importance during the consideration of smart grids.

Smart measures to make the supply of electrical energy secure (in the context of high availability) have been developed and continuously improved since the 1880s. During network planning for the higher voltage networks, the so-called (n-1) and (n-2) criteria have been used for some time – these criteria state that in the event of one (or two) failures due to malfunctions in any item of equipment (generator, transformer, cable, ...) the network as a whole must safeguard the supply within the stipulated limits. Higher costs for their implementation are justified because, for instance, interruptions in the supply to large areas can be prevented by redundant cable routing or power stations.

The European transmission systems are coupled together into an integrated European network and some are also integrated into a grid control network so that, on the failure of a component in a system, or in case of an imbalance in the generation and consumption of power in a sub-system, help can be obtained from a neighbouring system. These transmission systems can quite rightly be termed high-voltage smart grids.

In distribution networks (medium voltage, low voltage) on the other hand the risk of an interruption in the supply for minutes or hours is accepted in the majority of cases. Here the distribution network is often not constructed based on the (n-1) criterion. Accordingly few or even no technical features are provided that could automatically compensate for the failure of a component or an imbalance between generation and consumption.

In the area of energy supply systems a large number of system-related limits and parameters (trigger current for circuit breakers, frequency, voltage, insulation on a cable, ...), secondary devices (measuring systems, controllers, regulators, ...) and primary devices (transformers, circuit breakers, inverters, ...) as well as in future many components at the integration levels (above all the communication infrastructure such as Ethernet switches, routers, backup power supplies) must be constantly monitored, and that mostly in real-time. In the case of developing malfunctions it may be necessary to intervene with control measures within milliseconds. If action is not taken until a component fails, then an entire system may easily collapse with unpredictable consequences for people and the environment if a fail-safe supply is imperative.

Since the start of electrification, particularly high value has been placed on the protection of individuals against physical contact with the electrical system. Worldwide it is state-of-the-art to protect people against the hazards of electrical power. A series of IEC standards and other standards define suitable measures that have made possible a high safety standard.

In relation to electromagnetic compatibility (EMC), electronic devices in the area of the supply of electrical energy must meet particularly high requirements that go way beyond the requirements in the office or industrial environment. The "IEC Smart Grid Standardization Roadmap" from 2010 clearly refers to these requirements. In the second version of the familiar American "NIST Framework and Roadmap for Smart Grid Interoperability Standards" (2012) these requirement were recently placed alongside the requirements for communication security. The availability of an automation or communication component must be much higher in an energy supply system than in the office or residential sector.

Furthermore physically extensive integration levels require high security in relation to the availability and vulnerability of the infrastructure and the supply systems, in the past the topic of security has been largely ignored during the implementation. In the future energy supply, this topic must be taken significantly more into account in the implementation and the solutions must be much more rigorously applied.

Smart solutions for a secure energy supply are required for generation, transport, distribution and the power consumers – in public distribution networks just as in public buildings and offices, as well as in other items of infrastructure such as transport systems or the Internet.

What will be new in the future?

The reliable and secure operation of the future electrical supply system places new challenges on engineers, businessmen and politicians, and has done so particularly since the turn of the century. Necessary changes are to be expected due to:

- → The rapidly growing number decentral feed points, the transition from central to more decentral electricity generation,
- → The development of renewable energy generation,
- → The development of the integration level and
- → The ageing distribution network infrastructure.

These changes must be made "open heart" (that is while providing supply) against the background of the following issues:

- → An increasingly ageing and therefore reducing technical expertise,
- → The demand for more energy efficiency,
- → The short time for implementation and
- → The high expectations on profitable investments in increasingly networked supply systems for electrical energy, gas, heat and transport.

The broad and intense discussion to be observed in recent times and the publication of comprehensive studies and opinions from politics, research institutes, associations, federations and industry is unprecedented in the construction of the electrical supply system. What is so interesting about the supply of electrical energy in the future? For many manufacturers who traditionally operate in the area of industrial automation, or in the area of network technology, the Internet or cloud computing, the increasingly necessary equipment for the integration infrastructure in distribution networks appears to be a massive new market.

Can Internet technologies and general automation solutions help?

„**Energy-on-demand** is considered by many to be solution for the efficient usage of energy."

Internet for energy

The BDI (Bundesverband der Deutschen Industrie e.V.) stated the following on the topic of the smart grid: "Information and communication technology will have a key role during the development of a supply of energy suitable for the future. It is the basis for the realisation of a future **energy internet**, that is the intelligent electronic networking **of all components in the energy system.** ... The biggest challenge here is to create an **integration level between business applications and the physical network** that makes possible the communication between complex IT components distributed across heterogeneous networks and organisational boundaries."

Is such an integration level primarily of service to the smart market or the smart grid at the distribution level, or both? The components installed today at the higher voltage levels are already effectively networked (CIM for grid control centre internal communication, telecontrol for communication with grid control centres and power generation systems as well as IEC 61850 for substations and power generation systems). With the need to integrate thousands of times more components in the lower voltage levels than in the higher voltage levels, it is still largely unclear which tasks they will have and how these can help also in the long-term to maintain the stability of the supply of electrical power at its current level.

Energy-on-demand is considered by many to be solution for the efficient usage of energy. In the context of social networks power consumers could suddenly develop volatile consumption behaviour and synchronously increase or reduce their consumption either in a limited area or over a large area, an event that could have unexpected effects on the systems and in some cases could result in the collapse of the system.

A key question for the realisation of future systems is knowledge of possible and probable failure scenarios. How many feed points

„**Development** must bee understood as continous "further" development of the existing systems with all their complex aspects."

and loads in the distribution networks can be controlled at which points using communication, and which regulation mechanisms could compensate for these effects adequately and quickly enough such that the distribution networks can be operated stably at all levels at all times?

Even under the assumption that all effects are known and corresponding mechanisms for stable system operation have been developed and tested, key questions remain unanswered: who is to finance this automation infrastructure and the related Internet-based integration levels foreseen and, above all, who is to implement, install, integrate, utilise and further develop it? ■

Dipl.-Ing Karlheinz Schwarz
NettedAutomation GmbH

CONCLUSION

The construction of automation infrastructures and integration levels for the supply of energy requires resources that go way beyond current notions and the resources that are available in the short-term. Financial aid for smart energy supply systems must not be primarily an "economic stimulus package" for the integration levels. The aspects such as the electrical safety, the high availability of the supply of energy, the ageing electrical and information technology infrastructure and above all the ageing personnel for the further development and operation of the electrical system must have a significantly higher priority.

The future supply of energy must be understood as a whole. Development must be understood as continuous "further" development of the existing systems with all their complex aspects. Only then can the familiar security of supply of the past also be ensured in the future. The scope and also the required short implementation period will overshadow all the experience of the past 130 years.

The energy revolution currently in planning and the concomitant development of a step-by-step structural change and a closer meshing of the energy networks for electricity, gas, heat and electric mobility, as well as the related necessary infrastructure will be more of a marathon than a sprint. Inter-disciplinary collaboration above all among the electrical engineers and power engineers must be significantly expanded. IEC standards and other standards can, above all against the background of limited development resources, make an important contribution to the simplification of solutions at the integration levels.

The smart grids that will result from the energy revolution will combine the inventions of several hundred years.

Training modules for public and in-house training courses

IEC 61850, IEC 61400-25, IEC 60870-5/-6, IEC 61968/70 CIM, DNP3, ...

The following list contains the most asked modules of our training services with regard to standards related to power system automation. Depending on the needs of our customers we select the modules to provide the most crucial information for the experts of the customers. Other topics can be added as needed. The modules are used for public training courses as well as for in-house training sessions.

[S-00] – General		
00	Welcome and opening	Welcome, opening, roll call of attendees, expectations of attendees, Title and scope of IEC 61850 (IEC TC 57), Power Delivery System, What does IEC 61850 provide?, Motivation for the new standards, IEC 61850 in brief, Re-use of IEC 61850, Tools and System Integration, Standardization and projects, General observations.
01	Summary	Summary and next steps
[S-01] – Management and automation of the power system (basics)		
00	Power system automation basics	Basics of power system information integration and automation covering control centers, substations, power generation; Elements of the power system: Substations, Power Generation, Transmission, Distribution, System architecture, Functions, Communications, System engineering, and device configuration
01	Standardization	IEC activities related to power system standardization, IEC TC 57 and TC 88, International organizations for the power industry, IEC organization and standardization work, IEC activities related to the power industry, CIGRE, IEEE, UCA Users Group, IEC 61400 User Group, activities related to the power industry; international fieldbus
02	System design and specification	Introduction Substation automation system specification, Product requirements for communication equipment from IEC 61850-4, product requirements from IEC 61850-3, substation automation system design
03	System migration aspects and role of system integrator	Stepwise migration from existing systems to solutions compliant to standards, project and migration planning, ...; roles of users, vendors and system integrators
04	Security	Secure communication (data on travel and data stored) (IEC 62351), IED security (IEEE 1686), IEC/TS 62443-1, NERC CIP (critical infrastructure protection), VDE Guideline, NIST SGIP
05	System management	Revision control and asset management with IEC 61850
06	Testing devices and systems	Test coverage and steps towards system testing and simulation (from devices to systems)
07	Power Delivery System Basics	Brief Introduction to Power Delivery System and relations to standards from IEC TC 57 and TC 88; mainly intended to give an overview of the power delivery system and power system automation for non-utility experts.
[S-02] – IEC 61850 (and IEC 61400-25) basics		
00	IEC 61850 series – overview	Communication networks and systems for power system automation: general introduction on whole series. Design objectives and scope IEC 61850, Content and structure of IEC 61850, Features of IEC 61850, Application modeling, Information exchange and communication services, the 20+ parts of the standard
01	IEC 61850 Application modeling principles	Modeling protection, substation automation, other applications (Logical nodes, data and data attributes, function modeling, extension of the models, monitoring). The elements of the data model, Acquisition of measured information, Controlling of switchgear equipment, Protection functions, Edition 2 updates, Example of a model.
02	IEC 61850-6 engineering process	Engineering process using the configuration language: from IEDs and single line diagram to configured substation automation system Systems specification (Single line diagram and functions), IED specification (IED

		capability description), System engineering, IED engineering and configuration, Use of SCL (summary), Edition 2.
03	Communication services of IEC 61850	Information exchange with the ACSI according to IEC 61850-7-2 Basics, Information flow through IEDs, ACSI in detail (IEC 61850-7-2), Server, Logical Device, Logical Node, Data, DataSet, Control Blocks (Reporting, Logging, GOOSE, SV), Control, Conformance statement, Recording (IEC 61850-7-4).
04	Implementation of IEC 61850 conformant devices and tools	Device models, design of advanced IEDs, software and hardware architectures, OEM software
05	Device conformance testing	Conformance testing of devices according to IEC 61850-10
06	Extension rules IEC 61850	The extension rules for Logical Nodes, Data, and Common Data Classes, the name space concept. Scope, Instantiation of existing information model classes, New information models, Name space concept.
07	Substation configuration language (SCL)	System configuration language: basics and details; Engineering process and SCL, SCL object model, SCL syntax (IEC 61850-6 (SCL)), SCL edition 2. The object model and content of the SCL files, Examples, Binding models to real world, inputs, and to outputs, the data flow engineering; File extensions: SSD, SCD, ICD, CID, IID, … including examples; configuring servers and clients.
08	Common Data Classes (Ed2)	What is new in part IEC 61850-7-3 Edition 2? New possibilities for information modelers.
50	Mapping of Common Data Classes (CDC) to IEC 60870-5-101/104 according to IEC 61850-80-1	Introduction and details of IEC 61850-80-1. The Technical Specification IEC 61850-80-1 gives a guideline on how to exchange information from a CDC based data model (IEC 61850) using IEC 60870-5-101 or IEC 60870-5-104 protocols between substation(s) and control center(s).
[S-03] – Substation automation and protection		
00	IEC 61850 modeling details	Modeling of protection, switchgear, metering and power quality equipment and other substation automation applications. Basic principles, Protection functions, Protection related functions, Control, Example
01	Applying IEC 61850 for power system automation – use cases	Use cases from power system automation like measuring of current and voltage, protection, operating a switch, creation of a sequence of events, SCADA. Use case 1 – measuring current and voltage Use case 2 – operate switchgear
02	Product specifications for substation equipment	Implementation guideline IEC 61850-9-2 "LE", Product standard for switchgear with integrated IEC 61850 interface (IEC 62271-003)
03	Substation automation system architecture	Communication architecture and topology, device architecture, impact of new technologies; redundancy concepts for switched Ethernet network. Communication architecture, Device modeling, Availability considerations
04	Substation to substation communication for protection and control with IEC 61850	What does the standard IEC 61850-90-1 (Use of IEC 61850 for the communication between substations) provide? Introduction and current status of work. Interlocking between substations, Distance line protection, Current differential line protection, Out-of-step detection, etc.
[S-04] – Power generation		
00	Wind power plants	Overview and introduction of the standard for Communications for monitoring and control of wind power plants – IEC 61400-25
01	Hydro power plants	Overview and introduction of the standard for Communications for monitoring and control of hydro power plants – IEC 61850-7-410
02	Distributed Energy Resources	Overview and introduction of the standard for Communications for monitoring and control of Distributed Energy Resources (DER) – IEC 61850-7-420
03	Application modeling for hydro power plants	Overview and introduction of the standard for IEC 61850-7-410 modeling details; New common data classes for hydro power plants
[S-05] – Communication between field devices and system level and at system level		
00	Telecontrol protocols IEC 60870-5-101/-104 and DNP3	Fundamentals of Telecontrol standards IEC 60870-5-101, IEC 60870-5-104, and DNP3. What is the market relevance in the future (comprehensive set of slides available if information is needed for the attendees; several slides are added for the attendees convenience – to take home). Is IEC 61850 competing with Telecontrol Protocols? What are the use cases for Telecontrol Protocols and IEC 61850?
01	Telecontrol protocols details	Fundamentals of DNP3; comparison with IEC 60870-5-101/104
02	Substation to control center communication with IEC 61850	What will the standard IEC 61850-90-2 (Using IEC 61850 for the communication between substations and control centres) provide? Introduction and current status of work.

03	Inter control center communication (ICCP)	Fundamentals of the use of IEC 60870-6-TASE.2 (ICCP); a comprehensive stand-alone seminar is available as well, ask for details.
04	Webservices	Fundamentals of the definition of Webservices for IEC 61400-25-3 (and IEC 61850-7-2) as specified in IEC 61400-25-4.
05	Comparison of protocols	Detailed comparison of the protocol suites IEC 60870-5, DNP3, ICCP (TASE.2), IEC 61850
[S-06] – Power system level applications		
00	IEC 61970 / 61968 series	Energy management system application program interface (EMS-API) / System interfaces for distribution management – introduction
01	IEC 61970-301 CIM	Energy management system application program interface (EMS-API); focus on Part 301: Common Information Model (CIM) and harmonization with IEC 61850
02	Dynamic and static use of the CIM Model	Component Interfaces for information exchange, use cases for the CIM: GID, EAI, Network models
03	Tooling for the Common Information Model CIM	Available tools, platforms, experiences with power delivery systems Overview of existing OS tools: CIMTool, Xpetal, CIMVT, CIMValidate, CIMSpy; Available commercial tools; Flaws and future tools
04	UML Modeling basics	Introduction of the modeling basics required for CIM
05	UML demonstration of the CIM	Using the free viewer of the Spax Enterprise Architect Modeling and Design Tool to visualize the current CIM (IEC 61970-301 Edition 2009). Free viewer will be provided for all attendees.
06	CIM Users Group	Activities of the CIM Users Group
07	Application examples and projects	Presentation of implemented and planned applications; projects
08	Harmonization CIM – IEC 61850	Present the current status and potential issues of the harmonization of the two models
[S-07] – Communication and SCADA aspects and protocol implementations		
00	Extracting data from field devices	General SCADA services – configuration of control blocks (IEC 61850-7-2). Overview, Reporting, Logging, GOOSE, Sampled values
01	Monitoring for SCADA applications	Fundamentals of special SCADA services (IEC 61850-7-2): model basics for monitoring, event reporting, event logging. IEC 61850 aspects of monitoring, SCADA services, Alarm handling
02	Communication technologies	Fundamentals of Industrial Ethernet used for substations and beyond Industrial Ethernet features, Ethernet Requirements for IEC 61850, Shared Ethernet, Switched Ethernet, Ethernet frames, Ethertypes used in IEC 61850, Priority tagging, 802.1Q / 802.1p
03	Information presentation and encoding	Fundamentals of UML, XML, ASN.1, ... Presentation of IEC 61850 Domain in UML Notation (Status of WG 10Task Force: 2010-09; Enterprise Architect)
04	Protocol details	Fundamentals of ISO 9506 (MMS), Webservices, IEC 60870-5, DNP3, ICCP
05	Protocol implementations and Mappings for IEC 61850-7-2	Details on how to implement protocols and information models? MMS, ASN.1 BER, Web services, ..., simple MMS clients; IEC 60870-5, ICCP, DNP3
06	Demonstration of compliant software	Demonstration of IEC 61850 compliant client and server software. Server (software-only, hardware version), API between existing data and „standard world", Existing data, DER model, and mapping of existing data to the DER model, Clients (MS Internet Explorer, Tamarack test client, Tamarack Client), Demonstrate information exchange
07	MMS client and server implementation – the basis for IEC 61850	Comprehensive training on the implementation of MMS clients and servers for all basic services required by TC 57 standards: Association, NamedVariable, NamedVariableList, Read, Write, Information Report, ... This module usually requires a 2 day course
08	ICCP (IEC 60870-6 TASE.2 Protocol)	Use of MMS for realizing the TASE.2 services
09	Network Engineering Guidelines (IEC 61850-11)	Recovery protocols (RSTP, PRP, etc); different approaches to network topology, redundancy, time synchronization, etc.; status of standardization
[S-08] – Products and projects		
00	Practical experience	IEC 61850 devices, tools, and projects in reality; penetration of IEC 61850 (61400-25) in the global market. Equipment, IEDs, Tools, Substations, Industrial applications
01	Tool support	Tools for IEC 61850, SCL, IEC 61400-25, Ethernet, TCP/IP, MMS, ASN.1 MS Internet Explorer, XML, SCL browser from ABB, Use of SCL for automatic building IED data bases of servers, Validation of models of a server IEDs, Network analyzers (Ethereal, KEMA UNICA, …)

02	User support	UCA international users group, quality measures and TISSUE process, why to join the users group?
03	Current and future standardization	Introduction of current and future application domains using and extending IEC 61850; Update on ongoing and planned standardization activities, Coordination and harmonization of information models, Maintenance of IEC 61850 base documents, Data and communication security, Power quality monitoring, Statistical and historical statistical data, Wind power plants, Hydro power plants, Decentralized energy resources, Substation to control center communication, Substation to substation communication, Product standards: switch gear and merging units, Monitoring, asset management, and maintenance (various groups), Condition monitoring.
04	SCL demo with compliant software	Use of SCL files for building data model in an IED, extension of model (new data); including live demonstration.
05	Products offered by major vendors	What is the situation on the market? What products are offered by the major vendors (ABB, Areva, GE, Siemens, … Doble, Omicron, … Beckhoff, Phoenix Contact, … RuggedCom, Hirschmann, …)
06	Multivendor projects and turn key projects of single vendor	Experiences after two years substation automation and protection with IEC 61850; turn key projects, ... User's view and requirements. Are the users' expectations met?
07	IEC 61850 Network Analyzer and SCL	Presentation and demonstration of the use of SCL files for the interpretation of messages: Connect IED Scout to QNE Measurement IED, Generate SCL for QNE with IED Scout, KEMA UNICA trace without SCL, KEMA UNICA trace with SCL, Ethereal Trace and interpretation of ASN.1 BER
10	Tools for the engineering of IEC 61850 conformant systems	The engineering process of IEC 61850 requires several tools for the various aspects of engineering: system design, IED design, system engineering, IED configuration, testing, ... The presentation introduces the typical engineering process using tools. More details can be found in the hands-on training [H-0104]
11	Second edition of IEC 61850 and other extensions	The first edition of IEC 61850 had 14 parts and was published between 2002 to 2005. In the meantime many extensions have been defined and published as standards or draft standards. This presentations presents the many new definitions in information models, services, configuration, mappings, and applications.
50	Quality process and user group	The UCA international users group represents all major vendors, many utilities, system integrators and consultants to support the various standards. The crucial objective is the support of the quality assurance process for testing, certification and lab accreditations.
[S-09] – Real-time information exchange with GOOSE and Sampled Values		
00	Network Infrastructure for Real-time information exchange	Required Ethernet communication infrastructure (Ethertype, Multicasting, Multicast filtering, … Redundancy). Non Ethernet communication solutions. Basics on PRP, HSR, and IEEE 1588. Draft IEC 61850-90-4
01	GOOSE (Generic Object Oriented System Event)	GOOSE Control Blocks and dynamic behavior of GOOSE message exchange. Required Ethernet communication infrastructure (Ethertype, Multicasting, Multicast filtering, …) . GOSSE message syntax (flexible and fixed encoding). Configuration of GOOSE control using SCL. GOOSE application examples. Demonstration of GOOSE messaging and network traffic analysis.
02	Sampled Measured Values	SMV Control Blocks and dynamic behavior of SMV message exchange. Required Ethernet communication infrastructure (Ethertype, Multicasting, Multicast filtering, …). SMV message syntax. Configuration of SMV control using SCL. SMV application examples.
[S-10] – Functional Testing		
00	Basics of functional testing. NEW	The functional elements in system testing. Status of standardization work in IEC TC 57 and CIGRÉ
02	Details of functional testing. NEW	How to use services and Model contents (various data objects) and IEDs like Merging Units for functional testing. Testing of servers, clients and system aspects.
[S-11] – Edition 1, Edition 2, Edition 3, …		
00	Basics of the various Editions in the series IEC 61850 and IEC 61400-25. NEW	The standard series IEC 61850 and IEC 61400-25 comprise more than 25 different parts. Each part has its own designation: "Edition 1", "Edition 2", … To reduce the confusion and to learn the right terminology of Editions the basic structures will be explained.
01	Basic comparisons of the Edition 1 and Edition 2 of the core documents. NEW	The crucial differences between Edition 1 and Edition 2 of the following documents will be explained: IEC 61850-5, IEC 61850-6, IEC 61850-7-1, IEC 61850-7-2, IEC 61850-7-3, IEC 61850-7-4, IEC 61850-8-1, IEC 61850-7-410
02	Detailed comparisons of the Edition 1 and Edition 2 of the core documents. NEW	The many differences between Edition 1 and Edition 2 of the following documents will be explained: IEC 61850-5, IEC 61850-6, IEC 61850-7-1, IEC 61850-7-2, IEC 61850-7-3, IEC 61850-7-4, IEC 61850-8-1, IEC 61850-7-410

Special hands-on Training opportunities for IEC 61850

[H-00] – General IEC 61850 hands-on training for in-house courses

00	Extended modeling of non-standardized information	Build your own extended model. The use of the extension rules of IEC 61850 to model application information outside standards
01	Design and engineering of a substation	Engineering of substations, IEDs and other systems using SCL tools
02	Real models	Analysis of existing real models; design of the model for your application
03	IED communication	Hands-on training of the use of communication services (ACSI) using an IED Simulator and common IED Browsers. The communication comprises all ACSI services except Sampled Values; communication with real IEDs (if IEDs are available and accessible); Network infrastructure and PCs are required; one PC per two attendees; training software will be provided in advance
04	Analyzing the communication	Analyzing the communication according to IEC 61850: client-server, GOOSE, SV; communication testing
05	H-0005-Client-Server-Demos-Hands-on_reviced-2010-10-25.ppt	

[H-01] – IEC 61850 IED and Engineering tools hands-on training in cooperation with STRI, Ludvika/Sweden

This hands-on training is offered as public or in-house events. The duration is usually 4 days. Contact NettedAutomation for details, dates and locations.

00	Module 1	Gives an introduction to the IEC 61850 standard together with a summary with real applications and the demonstration of STRI facilities for multivendor interoperability testing. Introduction to IEC 61850, the basics of the standard series, updates and other extensions. Presentation of the STRI multivendor application with ABB, Areva and Siemens IEDs for a typical substation. Demonstration of compliant IEC 61850 software, devices and test procedures in STRI's Independent IEC 61850 laboratory.
01	Module 2	Gives an independent and more detailed update on the IEC 61850 standard for substation and device modeling as well as communication principles with real examples. IEC 61850 substation and device modeling and communication principles (GOOSE, Sample Values, Client/Server applications). What you need to know for specification, evaluation, verification and maintenance of IEC 61850 systems (whole substations and IEDs).
02	Module 3	Presents possible functional allocation and architecture of a typical substation with state of the art IEDs from different manufacturers (ABB, Areva, Siemens) as well as available test sets (Omicron, Doble, Programma) with group sessions on how to optimize the solution. Review of available functions and possible architectures for substation automation. Optimized application of IEC 61850 in power utilities with examples based on the STRI multivendor application with ABB, Areva and Siemens IEDs for a typical substation. Morning session with theory and afternoon with group workshop to design and specify typical substation functions.
03	Module 4A IED interoperability workshop	IEC 61850 hands-on workshop demonstrating inter-operability of protection and control devices from ABB, Areva and Siemens. The intention is to create a small system demonstrating interoperability of protection and control devices from ABB, Areva and Siemens. The participants will be divided in three subgroups with the task of browsing the IED model of each device (using self-description, validation of model and SCL file) and creating outgoing GOOSE messages from their relay. After lunch the network traffic is jointly analyzed and the reception of GOOSE messages will be configured in smaller groups. Finally the system is tested through e.g. simple multi-protection tripping schemes and the use of IEC 61850 compatible test devices. Participant gets hands-on experience of at least two vendors IEC 61850 implementation in IEDs and tools. Experience in system debugging and network traffic analysis using third party and open source tools is gained.
04	Module 4B Substation Configuration Language	Substation Configuration Language (SCL) hands-on workshop. Learn what you need to know for specification, evaluation, verification, and maintenance of IEC 61850

	(SCL) workshop	substations and IEDs. The workshop focuses on the design of typical substation functions and the engineering of the substation and IEDs according to the engineering process described in edition 2 of IEC 61850-6 (SCL). The participants will use third-party functional specification, design and engineering tools to design ICD files, substation sections, communication sections, IED sections and DataTypeTemplates. The participants will create a SCD file that is used to generate a fully functional IED (IEC 61850) server simulator. The SCD file is also used as import file for an IED configuration tool to configure a real IED (data model, server and GOOSE message). During the last hour of the workshop the two groups join for the IED configuration by use of the SCD file created by the SCL group. This workshop 4B requires participants to bring their own notebooks (at least one for two attendees). The demo tools (from third parties) required will be provided by NettedAutomation prior to the beginning of the event.

Special hands-on Training opportunities for IEC 61850

[H-02] – General CIM (IEC 61968) hands-on training for in-house courses		
00	Hands-on training with available CIM tool demonstration software	The attendees will be guided through several sample tools. The students will learn how to use CIM compliant tools for sample applications.

Date and locations for public events: http://www.nettedautomation.com/seminars/uca/sem.html#standardpublic
In-house courses: http://www.nettedautomation.com/seminars/uca/sem.html#inhouse
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IEC 61850 Blog: http://blog.iec61850.com

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2013 Public Seminars and Training Courses

11.-13. March 2013 Atlanta (GA USA)
06.-08. May 2013 Frankfurt (Germany)
16.-18. October 2013 Frankfurt (Germany)

Most asked help is for in-house courses and hands-on training

Details and Registration:
http://www.nettedautomation.com/seminars/uca/sem.html

Other subjects, locations and dates for public and in-house training courses need be negotiated according to your requirements. Please contact us.

Feedback from attendees and pictures of IEC 61850/61400-25, IEC 60870-5-104 and DNP3 Seminars and Training Workshops

NettedAutomation GmbH

http://nettedautomation.com

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Version 2015-12-17

Summary of courses (seminars and training courses)

	Event	*Days*	*Att.*	*Type*
1.	Shanghai (China) 2002-10		13	
2.	Xian (China) 2002-10		17	
3.	Rødkærsbro (Denmark) 2003-03		8	
4.	Barcelona (Spain) 2003-04		14	
5.	Madrid (Spain) 2004-03		22	
6.	Frankfurt (Germany)2004-05		40	
7.	Paris (France) 2004-08		25	
8.	Chicago (USA) 2004-10		12	
9.	Beijing (China) 2004-11		32	
10.	Johannesburg (South Africa) 2004-11		23	
11.	Kuala Lumpur (Malaysia) 2004-11		27	
12.	Frankfurt (Germany) 2004-12		18	
13.	Daejeon (South Korea) 2005-02		30	
14.	Torréon (Mexico) 2005-04		22	
15.	Copenhagen (Denmark) 2005-05		18	
16.	Berlin (Germany) 2006-06		15	
17.	Frankfurt (Germany) 2006-06		15	
18.	Toronto (Canada) 2005-09		16	
19.	Ottawa (Canada) 2005-09		15	
20.	Baden (Switzerland) 2005-09		21	
21.	Berlin (Germany) 2005-10		20	
22.	Cape Town (South Africa) 2005-10		35	
23.	Zurich (Switzerland) 2005-10		22	
24.	Melbourne (Australia) 2005-11		22	
25.	Brisbane (Australia) 2005-11		43	
26.	Haifa (Israel) 2005-12		31	
27.	ABB (Italien) 2006-01		16	
28.	RWE Dortmund (Germany)2006-02		15	
29.	Hirschmann Neckart. (Germany) 2006-02		10	
30.	Suzlon Rostock (Germany) 2006-03		6	
31.	Frankfurt (Germany) 2006-03		7	
32.	Madrid (Spain) 2006-03		11	
33.	Bangalore (India) 2006-04	3	350	
34.	Siemens Berlin (Germany) 2006-05	3	22	
35.	Calgary (Canada)	3	17	
36.	London (UK) 2006-07	2	15	
37.	EdP Lisboa (Portugal), 2006-07	3	8	
38.	Paris (France) 2006-08	3	7	
39.	Bachmann Klaus (Austria) 2006-08	3	7	
40.	ABB Allentown (USA) 2006-11	4	10	
41.	Ecotecnia Barcelona (Spain) 2006-11	3	8	
42.	Frankfurt (Germany) 2006-12	3	6	
43.	Cheboksary (Russia) 2007-04	4	16	
44.	Schneider Electric Grenoble (France) 2007-04	2	70	
45.	BTC Oldenburg (Germany) 2007-04	3	14	

	Event	Days	Att.	Type
46.	Phoenix Contact Blomberg (Germany) 2007-05	2	10	
47.	Itaipu (Brazil) 2007-05		15	
48.	Doha (Qatar) 2007-05		15	
49.	Frankfurt (Germany) 2007-07		5	
50.	EdP Lissabon (Portugal) 2007-07		10	
51.	PSI Aschaffenburg (Germany) 2007-08		10	
52.	Triangle MW Raleigh (NC, USA) 2007-08		5	
53.	Frankfurt (Germany) 2007-09		5	
54.	Alstom Power Paris (France) 2007-09		18	
55.	SASK Power Regina (Canada) 2007-10		6	
56.	AnyGate Corp Seoul (Rep. Korea) 2007-10		9	
57.	Melbourne (Australia) 2007-11		15	
58.	Sydney (Australia) 2007-11		9	
59.	Transpower Wellington (New Zealand) 2007-11		20	
60.	Elster Dortmund (Germany) 2008-01		11	
61.	Frankfurt (Germany) 2008-01		11	
62.	SMA Niestetal (Germany) 2008-02		29	
63.	BTC Oldenburg (Germany) 2008-03		10	
64.	Iskra Ljublijana (Slovenia) 2008-03		28	
65.	Frankfurt (Germany) 2008-04		15	
66.	Manitoba Hydro Winnipeg (Canada)		25	
67.	Atlanta (USA) 2008-07		12	
68.	Paris (France) 2008-08		10	
69.	InControl Kuala Lumpur (Malaysia) 2008-09		16	
70.	Seoul (Rep. Korea) 2008-10		20	
71.	ABB Minden (Germany) 2008-10	2	5	
72.	ConEd New York City (USA) 2008-10	3	55	
73.	Energex Brisbane (Australia) 2008-10	3	23	
74.	Transpower Auckland (New Zealand) 2008-11	2	15	
75.	Transpower Hamilton (New Zealand) 2008-11	3	10	
76.	Electronet Christchurch (New Zealand) 2008-11	3	30	
77.	STRI Ludvika (Sweden) 2008-11	4	35	
78.	Younicos, Berlin (Germany) 2008-12	2	7	
79.	Weidmueller, Detmold (Germany)	2	12	
	2008-12			
80.	Mexico City (Mexico) 2009-01	1	21	
81.	Frankfurt (Germany) 2009-03	4	23	
82.	Moscow (Russia) 2009-03	3	22	
83.	Terna (TSO Italy) 2009-03/05/07 11 days	11	12	
84.	Gai NetConsult, Berlin (Germany) 2009-04	2	7	
85.	Kuala Lumpur (Malaysia) 2009-05	1	22	
86.	Ifak, Magdeburg (Germany) 2009-06	2	6	
87.	Moscow (Russia) 2009-09	3	10	
88.	Siemens, Fürth (Germany) 2009-10	4	14	
89.	Frankfurt (Germany) 2009-10	4	19	
90.	San Antonio (TX, USA) 2009-10	2	16	
91.	Nürnberg (Germany) 2009-11	1	10	
92.	Brisbane (Australia) 2009-11	3	21	
93.	Sydney (Australia) 2009-12	3	17	
94.	Reykjavik (Iceland) 2010-01	3	29	
95.	AREVA, Madrid (Spain) 2010-01	5	23	
96.	CG Power, Dublin (Ireland) 2010-01	4	8	
97.	Buenos Aires (Argentina) 2010-04	3	26	
98.	Sao Paulo (Brazil) 2010-04	3	10	
99.	Frankfurt (Germany) 2010-05	3	9	
100.	KBK Tokyo (Japan) 2010-05	4	7	
101.	Siemens Wind DK 2010-06	4	32	
102.	ABB Bethlehem (USA) 2010-07	4	24	
103.	National Instruments 2010-07	3	1	
104.	Frankfurt (Germany) 2010-09	3	7	
105.	Schneider Electric Seligenstadt (Germany) 2010-10	1	7	
106.	Remote Dallas (TX) 2010-10	2	7	
107.	NGCP Manila (Phil) 2010-10	4	25	
108.	STRI Stockholm (Sweden) 2010-11	4	19	
109.	Beck Pohlheim (Germany) 2010-11-10	2	16	
110.	Hirschmann Neckartenzlingen (Germany) 2010-11-19	1	8	
111.	SKM Sydney (Australia) 2010-12-06	5	15	
112.	EdF Paris (France) 2010-12-14	1	3	
113.	Bender Grünberg (Germany) 2010-12-21	1	7	
114.	Schneider-Electric Lattes (France) 2011-01-06	2	9	

	Event	Days	Att.	Type
115.	RTK Instruments Knaresborough (UK) 2011-01-10	3	6	
116.	Siemens Fürth Karlsruhe Crashkurs 2011-02-17	1	2	
117.	5 Guru Sydney (Australia) 2011-03-07	3	49	
118.	Myong Ji University Yongin (Korea) 2011-03-13	1	45	
119.	Tennet Bayreuth (Germany) 2011-03-14	1	6	
120.	Alstom Baden (Schweiz) 2011-04-26	2	6	
121.	SAPP Power Pool ICCP Harare (Zimbabwe) 2011-04-04	3	22	
122.	Siemens Ashby (UK) 2011-04-18	3	5	
123.	Frankfurt (Germany) 2011-05-04	3	6	
124.	Siemens Karlsruhe (Germany) 2011-05-12	1	7	
125.	BCIT Vancouver (Canada) 2011-05-16	3	46	
126.	TQ Seefeld (Germany) 2011-06-01	1	7	
127.	TÜV SÜD München (Germany) 2011-06-03	1	6	
128.	Hirschmann Neckartenzlingen (Germany) 2011-06-17	1	5	
129.	TÜV SÜD München (Germany) 2011-06-27	2	6	
130.	Siemens SE Fürth (Germany) 2011-06-29	3	15	
131.	Beck IPC Pohlheim (Germany) 2011-07-05	1	13	
132.	Siemens HGÜ Fürth (Germany) 2011-07-13	1	6	
133.	3S Kempten (Germany) 2011-07-14	1	6	
134.	SSV Hannover (Germany) 2011-07-21	1	2	
135.	Macq Brussels (Belgium) 2011-08-22	3	9	
136.	Bard Emden (Germany) 2011-08-30	3	6	
137.	Shanghai (China) 2011-09-05	1	110	
138.	AutomationX Graz (Austria) 2011-09-12	2	6	
139.	Remote Nashville (TN, USA) 2011-09-20	2	11	
140.	Fronius Linz (Austria) 2011-09-27	3	14	
141.	Frankfurt (Germany) 2011-10-05	3	7	
142.	Schneider Electric Lattes (France) 2011-10-17	6	19	
143.	Schneider Electric Lattes (France) 2011-11-02	6	20	
144.	Sao Paulo (Brazil) 2011-11-21	3	23	

	Event	Days	Att.	Type
145.	Schneider Electric Shanghai (China) 2011-11-28	10	26	
146.	TQ Systems Seefeld (Germany) 2011-12-14	1	16	
147.	Garderos München 2012-01-26	1	6	
148.	PD Aachen (Germany) 2012-02-15	1	6	
149.	SMA Niestetal (Germany) 2012-02-22	1	29	
150.	Softing München 2012-03-16	1	5	
151.	Schneider Electric New Delhi 2012-03-19/21	3	28	
152.	HAW Hamburg 2012-03-28	2	55	
153.	Laborelec Brüssel 2012-03-11/13	3	8	
154.	Motorola Tel Aviv (Israel) 2012-04-30	4	15	
155.	Uni Peninsula Capetown 2012-05-02	3	2	
156.	Frankfurt 2012-05-09	3	2	
157.	Hirschmann (Germany) 2012-05-14	1	45	
158.	Solar Log Geislingen-Binsdorf (Germany) 2012-05-15	1	7	
159.	Selta Italien 2012-05-29	3	15	
160.	KTH Stockholm 2012-06-11	1	16	
161.	Hilscher Hattersheim (Germany) 2012-06-19	2	6	
162.	Beck IPC Pohlheim (Germany) 2012-07-03	1	9	
163.	Doble Watertown (MA), 2012-07-16/19	3	4	
164.	TÜV SÜD München (Germany). 2012-07-23	1	4	
165.	TÜV-SÜD Seoul, 2012-09-04	1	60	
166.	TÜV-SÜD Beijing,2012-09-06	1	30	
167.	TÜV-SÜD Taipei, 2012-09-11	1	45	
168.	Frankfurt 2012-10-17	3	15	
169.	Remote, Denver (CO), 2012-09-18	1	5	
170.	SystemCorp, Beltley (WA, Australia), 2012-10-25	7	2	
171.	SCE Los Angeles (CA), 2012-10-05	2	13	
172.	Monfox Cumming (GA), 2012-10-06	3	2	
173.	EICT Berlin, 2012-12-11	1	15	
174.	TÜV SÜD, 2012-12-13	1	7	
175.	Cooper, Quebec City, Canada; 2013-01-07/11	5	15	i
176.	Siemens HGÜ, Erlangen, 2013-01.21/23	3	33	i
177.	RWTH Aachen EON RC, Aachen, 2013-02-06	0,2	25	p

	Event	Days	Att.	Type
178.	IWES, Kassel, 201302-07	0,2	6	i
179.	EnBW Kraftwerke AG, Karlsruhe, 2013.02-13	1	15	i
180.	Fraunhofer ESK, München, 2013-02-05	1	7	i
181.	EES Backnang, 2013-03-06	1	6	i
182.	TÜV SÜD, Filderstadt, 2013-04-02	2	4	p
183.	Prolucid, Toronto (Canada), 2013-04-22	5	6	i
184.	Frankfurt, 2013-05-06	3	6	p
185.	EES, Backnang, 2013-06-13	0,5	12	i
186.	Alstom, Stafford, 2013-06-18	3	20	i
187.	IWES, Kassel, 2013-06-27	0,2	4	i
188.	IDS, Jakarta, Indonesia, 2013-07-01	3	20	i
189.	JRC EC, Petten, Netherlands, 2013-07-08	2	8	i
190.	ICE, San Jose, Costa Rica, 2013-09-23/27	5	20	i
191.	Frankfurt, 2013-10-16	3	8	p
192.	CLP, Hong Kong, 2013-10-28	1	120	i
193.	CLP, Hong Kong, 2013-10-29/30	2	50	i
194.	CLP, Hong Kong, 2013-10-31/11-01	2	15	i
195.	TÜV SÜD, Essen, 2014-02-20/21	2	5	p
196.	Beck-IPC, Wetzlar, 2014-01-30	0,5	9	i
197.	Beck-IPC, Wetzlar, Germany, 2014-03-12	0,5	10	i
198.	Beck-IPC, Wetzlar, Germany, 2014-03-13	0,5	6	i
199.	NettedAutomation, Karlsruhe, Germany, 2014-03-18/19	2	1	i
200.	TÜV SÜD, Filderstadt, Germany, 2014-04-03/04	4	2	p
201.	SchneiderAutomation, La Vergne (TN), USA, 2014-04-28/05-01	4	25	i
202.	NH Hotel, Frankfurt, Germany, 2014-05-07/09	3	6	p
203.	Leicom , Winterthur, Schweiz 2014-08-12/13	2	10	i
204.	Brush, Loughboro, UK, 2014-09-	4	13	i

	Event	Days	Att.	Type
	29/10-02			
205.	NH Hotel, Frankfurt, Germany, 2014-10-15/17	3	14	p
206.	Deif, Skieve, Denmark, 2014-11-18/21	4	23	i
207.	eduGlobal, Karlsruhe, Germany, 2014-11-24/26	3	9	p
208.	Holiday Inn, Prague, Czech Republic, 2014-12-8/10	3	6	p
209.	eduGlobal, Karlsruhe, Germany, 2015-01-12/14	3	6	p
210.	Lucy Switchgear, Bunbary, UK, 2015-02-02/06	5	25	i
211.	Honeywell, Fort Washington, USA, 2015-02-24/27	4	15	i
212.	eduGlobal, Karlsruhe, Germany, 2015-03-23/25	3	13	i
213.	Landis & Gyr, Zug, Schweiz, 2015-04-21/23	3	14	i
214.	Holiday Inn, Bratislava, Slovakia, 2015-05-18/20	3	3	i
215.	AF Consult, Stockholm, Sweden, 2015-06-02/04	3	27	i
216.	Holiday Inn, Brussels, Belgium, 2015-06-08/10	3	6	p
217.	Protecta, Budapest, Hungary, 2015-06-23/24	2	7	i
218.	ELVAC, Ostravia, Czech Republic, 2015-06-29/07-01	3	14	i
219.	Elfec, Cochabamba, Bolivia, 2015-07-06/09	4	5	i
220.	eduGlobal, Karlsruhe, Germany 2015-10-13/16	4	5	p
221.	Novotel, Dammam, Saudi Arabia 2015-10-18/21	4	17	p
222.				
223.				
224.				
225.				
226.				
	***Total** (by 2015-07-24)*	***380***	***3.897***	

Experts from almost 80 countries have attended (2015-07-24):

1. Argentina 2. Australia 3. Austria 4. Belgium 5. Bolivia 6. Botswana 7. Brazil 8. Canada 9. Czech Re-public 10. China 11. Chile 12. Colombia 13. Costa Rica 14. Democratic Repulic Of Congo 15. Croatia 16. Cyprus 17. Denmark 18. Finland 19. France 20. Ghana 21. Germany 22. Greece 23. Hong Kong 24. Hungary 25. India 26. Indonesia 27. Iceland 28. Ireland	29. Israel 30. Italy 31. Japan 32. Kingdom of Bahrain 33. Kosovo 34. Lesotho 35. Lithuania 36. Macao 37. Malaysia 38. Malawi 39. Mexico 40. Mozambique 41. Namibia 42. Netherlands 43. New Zealand 44. Norway 45. Paraquay 46. Peru 47. Poland 48. Portugal 49. Philippines 50. Romania 51. Qatar 52. Russia	53. Saudi Arabia 54. Schweiz 55. Schwitzerland 56. Singapore 57. Slovakia 58. Slovenia 59. South Africa 60. South Korea 61. Spain 62. Sweden 63. Switzerland 64. Taiwan 65. Tanzania 66. Thailand 67. The Nether-lands 68. Turkey 69. UK 70. United Arab Emirates 71. United King-dom 72. Uruguay 73. USA 74. Venezuela 75. Vietnam 76. Waziland 77. Zambia 78. Zimbabwe

Companies that have sent people to the seminars (2006-04-01):

1. A. Zilinskio ir ko UAB
2. ABB AG
3. ABB Australia Ply Limited
4. ABB Automation GmbH
5. ABB Automation Ltd.
6. ABB Corporate Research
7. ABB Elk. San. A.S.
8. ABB Forschungszentrum
9. ABB High Voltage Products
10. ABB HVDC
11. ABB Malaysia Sdn Bhd
12. ABB Power Technologies
13. ABB Substation Automation
14. ABB Taiwan
15. Abu Dhabi Water & Electricity Authority-ADWEA
16. AEW
17. Agency for Technology and Standards
18. Alcatel-Lucent
19. Alcom Matomo
20. Alstom Power Paris
21. Alstom Power Sweden AB
22. Alstom Transport
23. AMA-SYSTEMS GmbH
24. AnyGate Corp.
25. AREVA Energietechnik GmbH
26. Areva T&D
27. AREVA T&D Canada Inc
28. Areva T&D Malaysia SDN BHD
29. AREVA T&D P&C
30. AREVA-TD
31. Atien Industries Sdn. Bhd
32. ATS
33. Avacon AG
34. B.R. Sp.Pracy M.S.A.Mikronika
35. Beca
36. Behagian Penghantaran
37. BeiJing Sifang Automation
38. BEL Engineering
39. BEL Engineering S.A.
40. Bernecker + Rainer Industrie-Elektronik GmbH
41. BFH TI Burgdorf
42. Breton, Beanville & Associates
43. C.F.E.
44. C.F.E. CENACE
45. C.F.E. CPTT
46. C.F.E. GRTN
47. C.F.E. GRTOR
48. Camille Bauer AG
49. Cape Town City Council
50. Cape Town Electricity
51. Chilectra S.A.
52. City of Cape Town
53. City of Capetown
54. CKW
55. Connected Energy Corp.
56. CROC Incorporated, JSC
57. Current Group
58. Cybectec Inc.
59. Doble Engineering Co.
60. Doble Engineering Company
61. Dong Energy
62. DongDaZHongdianke
63. Dravske elektrarne Maribor, d.o.o.
64. E.ON Finland Oyj
65. EDF
66. EDF Cite
67. EDF R & D
68. EDF R&D
69. EDF Research and Development
70. EKS
71. EKT
72. EKZ
73. El & Industriteknik Svenska AB
74. Electranet
75. Electric Power Development Co., Ltd
76. Electrificación del Caroní, C.A
77. Elektro Celje, d.d.
78. Elektro Gorenjska, d.d.
79. Elektro Ljubljana, d.d.
80. Elektro Primorska, d.d.
81. Elektro Slovenija, d.o.o.
82. Elster GmbH
83. Eltra amba
84. Empower
85. Empresas Públicas de Medellín
86. ENDESA
87. Eneco netbeheen B.V.

88. ENERGEX
89. Energex Pty Ltd
90. Energi E2
91. Energy & Control Services Pty Ltd
92. EnergyAustralia
93. E-ON
94. EON Solutions
95. ESCOM
96. Eskom
97. ESKOM - Warmbad
98. Eskom Distribution
99. Eskom Holdings Ltd
100. Essent Network
101. ethekwini electricity
102. ETRANS Ltd
103. EURISCO Aps
104. Fingrid
105. Fingrid Oyj
106. Fortum Service Oy
107. GE Energy Services
108. General Electric Canada Inc.
109. GuoDian Nari Technology Co.
110. Helinks
111. Hirschmann Electronics GmbH & Co. KG
112. Hitachi Power Systems
113. HSE, d.o.o.
114. HV Power
115. Hydro One Networks
116. Hydro-Quebec
117. Hydro-Québec
118. Hydro-Québec TransÉnergie
119. Hyosung
120. Hyundai
121. IDS GmbH
122. IEC
123. IKERLAN
124. INDAP S.A.
125. Infokom GmbH
126. INFOTEAM SA
127. Institut de Recherche d'Hydro-Québec
128. Institute of Power Engineering
129. IPCOMM GmbH
130. Iskra Sistemi, d.d.
131. Kayser Threde GmbH
132. KDN
133. KEPCO
134. KEPRI
135. KERI
136. Kinkei System Corporation
137. Končar - Electrical engineering institute
138. KONCAR - Power Plant and Electric Traction Engineering Inc.
139. Kraftwerke Hinterrhein AG
140. Labein
141. Latihan & Pembangunan
142. LEM BE
143. LG Industiral Systems
144. LG Industrial Systems Co., Ltd.
145. logicaCMG
146. MAESSA - Sistemas de Telecontrol
147. Mälarenergi
148. Manitoba Hydro
149. Maschinenfabrik Reinhausen GmbH
150. Maunsell
151. Microsol
152. Ministery of Electricity & Water department
153. Myonggji University
154. NanJing Relay Electrical Co.
155. National Power Line Company (OVIT)
156. NOK
157. Norconsult AS
158. North China Power Electric University
159. Northwest Territories Power Corp
160. Nulec Africa
161. NU-LEC industries
162. Nuon
163. Oersted-DTU (University)
164. OFFIS
165. Pacific Hydro
166. PB Power South Africa
167. Pengurus
168. Pestech SDN BHD
169. Phoenix Contact GmbH & Co. KG
170. Power & Industrial Division"
171. Power Corporation of Kosova
172. Power Systems Consultants
173. PowerCorp
174. Powerlink
175. Prolan Co.
176. PSC
177. Pulsar Technologies, INC.
178. Quanta Technology
179. Remsdaq Limited
180. Rittmeyer
181. Royal Haskoning
182. Royal Haskoning
183. RTDS Technologies Inc.
184. RTE

185. RuggedCom Inc. (Europe)
186. RWE
187. RYTU SKIRSTOMIEJI TINKLAI AB
188. SAE IT-systems GmbH & Co. KG
189. SAK
190. Sanion
191. Saudi Electricity Co.
192. Schneider Electric
193. Schneider Electric - E.P.S Ltd. (Saudi Arabia)
194. Schweitzer Engineering Laboratories
195. Schweitzer Engineering Laboratories b.v.
196. Schweitzer Engineering Laboratories PTY Ltd.
197. Schweitzer Engineering Laboratories, Inc.
198. SEL
199. SENSA
200. Services Ind.
201. SGS
202. Siemens A/S
203. Siemens AG
204. Siemens AG
205. Siemens AG PTD
206. Siemens Energy Management & Information Systems
207. Siemens Ltd, South Africa.
208. Siemens Ltd.
209. SMA Technologie AG
210. Smart Digital Optics
211. SNC-Lavalin Inc.
212. Solvay R&T
213. Soške elektrarne Nova Gorica, d.o.o.
214. Soške elektrarne Nova Gorica, d.o.o.
215. Souzlon
216. SPARQ Solutions
217. SPI PowerNet Pty Ltd
218. SPPower ystems
219. SSC
220. St. Gallisch-Appenzellische Kraftwerke AG
221. St. Gallisch-Appenzellische Kraftwerke AG
222. Statnett
223. Sumbor Manusia & Pentadbiran
224. Svenska Kraftnät
225. SystemCorp Pty Ltd
226. TEAM S.A.
227. TEAM, S.A
228. Teletrol
229. Telvent Energía y Medio Ambiente
230. Tenaga Nasional Berhad
231. Tenix Alliance
232. Teshmont Consultants LP
233. Tesla
234. TE-TOL, d.o.o.
235. TGE
236. Thronson Internacional de Venezuela (Tiven-ca)
237. Transba S.A.
238. Transgrid
239. Transpower
240. Transpower Limited - New Zealand
241. Transpower New Zealand Limited
242. Trench Austria GmbH
243. TruData
244. UNION FENOSA distribución
245. University Alverca
246. University of Ulsan
247. VA TECH SAT
248. VA TECH SAT GmbH
249. VA TECH SAT GmbH & Co
250. VA TECH SAT SDN BHD
251. Vamp
252. VATECH Reyrolle ACP Ltd
253. Vattenfall Distribution Norden
254. Vattenfall Eldistribution
255. Vattenfall Europe
256. Vattenfall Research & Development
257. Vattenfall Service
258. Vector
259. Vector Networks Ltd
260. Vestas Wind Systems A/S
261. Voith AG
262. WAGO Kontakttechnik GmbH
263. Warsaw University of Technology
264. Weidmüller Interface GmbH & Co. KG
265. Woodward-Seg
266. Xelpower
267. XuJi Software Technology Co.
268. Yantai Dongfang Electronics
269.

not up-to-date

References from satisfied attendees:

1. I just wanted to send you an e-mail to say how much I enjoyed the 3.5 day course I attended with you in last month. I really learnt a lot and enjoyed every second. You make it really fun to learn.

   2015-11-18

2. It should be a seminar for the CHP… partners with relation to IEC61850 in the project (about 20 people) and hosted at xx in xxx – hopefully some time before the end of the year when the project ends.

   We see you as the best candidate for providing this seminar and would therefore like to start a dialog on your conditions for this, like draft agenda, availability and price.

   I look forward to hear from you and see if we can get this going.

   2015-08-14

3. The ultimate goal is to have didactic tools for training people into using IEC61850 in hydro power plants. **Keep on the good work Karlheinz. I'm a big fan of yours.**

   2015-08-15

4. Again thank you for all wise words and information.

   My knowledge of 61850 is extremely improved. It is always nice to see how experts show their knowledge. Also the location (Frankfurt) was excellent

5. I would like to thank you very much for the CD you gave me in Paris at the Cigré exhibition.

   It is very interesting for us to be informed like this about all the improvements done for the IEC 61850 and to realise how much work you had for all the presentations you made during the workshop in Paris. Congratulation !

   I was very pleased to see you once more and I hope it will not last too long since we meat again.

6. Excellent course ….thought provoking. I think it will be a matter of seeing if demand from the user community is high enough to encourage vendors to adopt 61850. Or visa versa. Another chicken before the egg scenario. I intend to pursue corporate membership in the UCA User's group.

7. Hi Karlheinz,

   You and Mr. Brunner speak very good today. Thank you very much.

8. You've done very well. Thanks for your hard work!

9. Thanks for your evaluation and your help. I would admire your hard working greately. I would like to cooperate with you in the future.

10. Friends,

    We had an IEC61850 seminar in Kuala Lumpur last week for 3 days. Needless to say, it was a rewarding experience to listen to Karlheinz Schwarz (Nettedautomation, Germany) and Christoph Brunner (ABB, Switzerland). I was informed by Karlheinz that there is an intent to have a IEC61850 seminar in India early next year.

    The standard is in the early stages of pilot implementations (in Europe). All leading players like ABB, Siemens, VATECH SAT, Areva etc besides the utilities in Europe are supporting this standard strongly.

    I am sure this seminar will go a long way in your understanding of the new standard. Please make the best use of the opportunity.

11. One of my colleagues (Gary T.) has attended Netted Automation courses in the past and his feedback has been very positive.

12. The seminar on the implementation of IEC 61850 based solutions is some kind of unique. As far as I know, there have not been such events in Russian Federation before. The lecturer is highly qualified professional who is involved in the development of IEC 61850 series and other standards. The program of the seminar included as well as the overview of all parts of the standard as the questions of its practical application. That is why the seminar gave a chance to capture a great portion of information and to learn the experience of foreign companies who are already implementing the standard in their systems.

    It was very useful to talk to other participants of the seminar – those professionals who work on its implementation, those who work in the area of SAS development, development of microprocessor based relays, testing equipment and in the utilities.

    The only drawback of the seminar is the limits of time that we had – three days is not enough for such an event – there is a will to get into the aspects of the standard more deeply.

13. "The seminar has delivered all the goods that I expected and brought even more. It was once more confirmed that IEC 61850 standard is the main track for the development of automation systems in power engineering and other related areas. One of the most useful aspects of the seminar was revealing of the aspects of the second edition of the standard.

    If there is something to add I would only say that there is a need for organizing separate and more specialized seminars for programmers, engineers and top-managers of organizations."

14. "It was a very useful seminar. Karlheinz Schwarz is highly qualified professional in the field. I must say that we got the information from first hands and he was able to answer every question almost at once and if not - knew where to look for the answer. It is great that we had such an opportunity to attend such a seminar.

    If to compare this seminar with those provided by vendors I must state that vendors have a different approach – the approach that states that IEC 61850 standard is going to solve all the existing problems. And it is not like that at the moment. What is true here is that we need to have skills and a higher level of competence in the field – either way the standard is not going to bring benefits. It was mentioned by Karlheinz Schwarz during the seminar and it is right. It was very good to know about the existing problems. Nobody before mentioned about those things we should take care of to use the possibilities of IEC 61850 with the highest efficiency. And we can understand why the vendors do not talk about such things – because every need to acquire new knowledge and get the higher level of competence would require more investments from the utilities. It is important for the utilities to know about that."

15. Attendee of the Sydney course (02-04 December 2009):

    "Well organized and very well run. The presenters were well on top of the subject and could explain the subject matter. There was a huge amount of material to cover and they did it well. Being independent, the subject was presented objectively. Karlheinz was very strong on the background and the detail of the specification, including the interaction with related specifications. Andrea was excellent on the implementation and configuration. Had a very practical approach and committed to making it work in the real world. I certainly gained much more than I expected from the seminar. Excellent value."

Need any information? – contact:

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Email mailto:karlheinz.schwarz@nettedautomation.com
or visit: www.nettedautomation.com/seminars/uca

www.blog.iec61850.com

Shanghai (China), 2002-10

Xian (China), 2002-10

Frankfurt, 2004-05

Beijing, 2004-11


IEC61850 Seminar/Workshop (BeiJing)


61850 Seminar/Workshop


国家电网公司
STATE GRID
CORPORATION OF CHINA
江苏省电力公司人力资源管理赴欧洲考察团
用餐地点
行云流水
电梯厅
IEC61850研讨会
用餐地点
细雨润物
电梯厅


61850 Seminar/Workshop (BeiJin

Daejeon (South Korea), 2005-02

Torréon (Mexico), 2005-04

Bangalore (India), 2006-04

Terna, Turin (Italy), 2009-07

Successful IEC 61850 Hands-On Training Courses in Australia

NettedAutomation GmbH and STRI conducted two 3 day IEC 61850 Hands-On Training courses in Australia: in Brisbane on November 30 - December 02 and Sydney on December 02-04, 2009.

Brisbane course (attendees from 7 organizations)

Sydney course (attendees from 10 organizations)

Andrea Bonetti (STRI) in action
... actions speak louder than words!

The attendees reported that there are many concrete plans to apply IEC 61850 in Substations of Australian transmission and distribution utilities in 2010 and 2011. Also substations outside of utilities (e.g., in the mining industry) are being build with IEC 61850 compliant automation and protection systems.

The plans to implement a huge Smart Grid project in Australia are an additional opportunity for IEC 61850 being applied for distribution networks - to make the Grids smarter.

Feedback from an attendee of the Sydney course:
"Well organized and very well run. The presenters were well on top of the subject and could explain the subject matter. There was a huge amount of material to cover and they did it well. Being independent, the subject was presented objectively. Karlheinz was very strong on the background and the detail of the specification, including the interaction with related specifications. Andrea was excellent on the implementation and configuration. Had a very practical approach and committed to making it work in the real world. **I certainly gained much more than I expected from the seminar. Excellent value.**"

110 Young People attended the Shanghai IEC 61850 and IEC 61400-25 Workshop

The workshop on IEC 61850 and IEC 61400-25 organized by the State Energy Smart Grid R&D Center (Shanghai) hosted at Shanghai Jiao Tong University on Monday, 05 September 2011, was very successful.

The **110 young attendees** from 37 organizations came to the event to get up-to-date information about the standards, market acceptance, challenges with the new standards, experience, and implementation hints.

One of the students of the workshop and the teacher at the entrance:

The 110 attendees (mostly young people):

Professor Peichao Zhang and his colleague Professor Dong Liu organized the event:

According to a report given during the IEC TC 57 Plenary meeting in Shanghai (6.-7. September 2011), one substation per day and one wind power turbine per hour are installed in China. So, there is a huge demand for solutions according to IEC 61850 and IEC 61400-25.

The young people are eager to learn how to use the standards for the various products and applications. The workshop has helped them a lot to get the basics of the standard.