

IEC 61850

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Substation Automation, Protection & Control

27 & 28 May 2009
PWTC, Kuala Lumpur, Malaysia

DISTINGUISHED GUEST OF HONOR:

Ir. Ahmad Fauzi Hasan
COO of Energy Commission (ST) Malaysia

Featuring Presentations from The IEC 61850 Experts:

- **IEC 61850 - The Information Exchange Standard for Energy Supply Systems**
- **IEC 61850 and IEC 61400-25 - General Monitoring and Condition Monitoring in Power Systems**
- **One day Pre-event Workshop on IEC 61850, IEC 6087-5, DNP3, CIM, Security, Decentralized Energy, Smart Grids... @ 26 May 2009**

*By Mr. Karlheiz Schwarz, Managing Director, NettedAutomation GmbH, Germany
Editor of IEC 61850 and IEC 61400-25*

Member of IEC TC 57 WG10, WG 17 (DER) and WG 18 (Hydro power plants)

Member of IEC TC 88 PT 25 (IEC 61400-25)

Convenor of IEC TC 88 project IEC 61400-25-6 (Information models for Condition Monitoring Systems)

- **More, Faster, Less, Less - The Business Drivers for IEC 61850**
- **Engineering Process for IEC 61850**

By Mr. Rodney Hughes, Technical Director, Maunsell AECOM, Australia

Convenor of the CIGRE Australia B5 Panel and contributor to Technical Brochure 326 on IEC 61850 implementation

Invited member on Grid Australia's Working Group on Implementation of IEC 61850

Advisory Board of PACWorld - Protection, Automation and Control Magazine

- **Evaluation of Substation Automation with IEC 61850**

By Mr. Knathip Spuntupong, Chief of Protective Relays and Control System Design Section,

MEA, Thailand & Mr. Niwat Sriklam, Senior Relay Engineer, Relay System and

Telemeter Division, Power System Maintenance Department, MEA, Thailand

- **Reliability and Availability Calculation for Substation Automation in IEC 61850**

By Dr. Bahisham bt Yunus, Director and Associate Professor, Uniten

- **The Single, Global and Future Proof Automation Standard - IEC 61850**

By Mr. P. Krishnan, Project Director, Incontrol Tech Sdn Bhd

- **IEC 61850, A New Engineering Perspective in Malaysia**

By Ir. Aminuddin Musa, Principal Technical Expert (System Design and

New Technology), TNB Transmission; Adjunct Associate Professor, Uniten

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What is IEC 61850?

IEC 61850 is an imperative and new international standard for electrical substation automation that will significantly impact on how electrical power systems are designed and constructed in the future.

IEC61850 is a part of the International Electrotechnical Commission's (IEC) Technical Committee 57 (TC57) reference architecture for electric power systems. The model-driven approach of the TC57 standards, including IEC61850, is an innovative approach that requires a new way of thinking about substation automation that will result in very significant improvements in both costs and performance of electric power systems. IEC 61850 provides a comprehensive model for how power system devices should organize data in a manner that is consistent across all types and brands of devices.

Multiple protocols exist for substation automation, which include many proprietary protocols with custom communication links. Interoperation of devices from different vendors would be an advantage to users of substation automation devices. An IEC project group of about 60 members from different countries worked in three IEC working groups from 1995. They responded to all the concerns and objectives and created IEC 61850. The objectives set for the standard were:

1. A single protocol for complete substation considering modeling of different data required for substation.
2. Definition of basic services required to transfer data so that the entire mapping to communication protocol can be made future proof.
3. Promotion of high interoperability between systems from different vendors.
4. A common method/format for storing complete data.
5. Define complete testing required for the equipments which confirms to the standard.

Extracted from Wikipedia – The Free Encyclopedia.

Who Should Attend?

- Substation Engineers
- Protection and Control Engineers
- Telecommunications and Network Specialists
- Design Engineers
- SCADA System Specialists
- Researchers
- Academicians
- Substation Operation Personnel
- Substation Maintenance Personnel
- Project Managers
- Senior Engineers
- Equipment Suppliers
- Managers
- Head of Department
- CEO/Chairman/Presidents
- General Managers/Managing Directors
- Operation Directors
- Technical Directors

Why You Should Attend?

- Provide a national and regional platform for exposures and practical case studies on successful implementation of IEC 61850 around the globe.
- Explore new opportunities along the development of IEC 61850 and challenges for organizations.
- Gain in-depth insights and updates in the latest trends of IEC 61850.
- Expose to an innovative approach of IEC 61850 that will result in significant improvement for both costs and performance of electric power systems.
- Grasp the history of protocol with its advantages and disadvantages.
- Learn the new engineering processes and challenges encountered during actual implementation.
- Integrate new international IEC 61850 standard series.
- Exchange information and ideas with regional IEC 61850 experts
- Network and expand your professional networks in the industry

Pre-event Workshop (26-May 2009)

Tuesday, 26-May 2009

One day Pre-event workshop on IEC 61850, IEC 6087-5, DNP3, CIM, Security, Decentralized Energy, Smart Grids... by Mr. Karlheinz Schwarz, Managing Director, NettedAutomation GmbH, Germany

9:00am - 10:30am	Welcome and Opening Introduction of attendees Expectations IEC 61850 in brief
10:30am - 10:45am	Coffee Break
10:45am - 12:00pm	Series IEC 61850 and IEC 61400-25 Communication networks and systems in substations: general introduction on series and current status
12:00pm - 12:30pm	Practical Experience IEC 61850 devices, tools, projects Use of IEC 61850 (61400-25) in the market
12:30pm - 2:00pm	Lunch Break
2:00pm - 2:20pm	IEC 60870-5 and DNP3 IEC 60870-5-10x and DNP3 basics Market relevance in the future
2:20pm - 2:50pm	Security Issues Security solutions provided by IEC 62351 and IEEE 1686, and required by NERC CIP
2:50pm - 3:30pm	Common Information Model (CIM) Overview of IEC 61968 and IEC 61970 and harmonization with IEC 61850
3:30pm - 3:45pm	Coffee Break
3:45pm - 4:15pm	Decentralized Energy, Smart Grids Standardization for decentralized Energy Resources, Smart Grids,... What's going on?
4:15pm - 5:00pm	Q&A session End of Workshop

Event at a Glance

DAY 1 - 27-May 2009

Welcoming Address by Our Distinguished Guest of Honor, Ir. Ahmad Fauzi Hasan, COO of Energy Commission (Suruhanjaya Tenaga) Malaysia.

IEC 61850 Beyond Substation - The Information Exchange Standard for Energy Supply Systems by Mr. Karlheiz Schwarz, Managing Director, NettedAutomation GmbH, Germany

Overview about the common aspects of the new international standard series IEC 61850 and how it is applied and extended to meet the requirements for almost the whole electrical energy supply chain.

- IEC 61850 extensions for Power Quality Monitoring
- IEC 61850 common extensions for monitoring, statistical and historical information
- IEC 61850 extensions for wind power plants including the new communication service mapping to web services (IEC 61400-25-x),
- IEC 61850 extensions for distributed energy resources (DER) (IEC 61850-7-420),
- IEC 61850 extensions for hydroelectric power plants (IEC 61850-7-410),
- IEC 61850 profile and extensions for high voltage switchgears (IEC 62271-3).

The IEC TC 57 has decided to publish all extensions of IEC 61850 under the single number "IEC 61850" with the following single new and extended title: "Communication networks and systems for power utility automation" to reflect the harmonized efforts of having one single harmonized standard for the whole electrical energy supply chain.

It discusses the reduction of total life cycle cost of power utility automation systems using standard compliant devices, communication and tools. The presentation will show how the various information models can be easily mapped to state-of-the-art communication protocols like MMS (ISO 9506 – Manufacturing Message Specification according to IEC 61850-8-1), web services, IEC 60870-5-101/104 and DNP3 (according to IEC 61400-25-4)

IEC 61850 And IEC 61400-25 - General Monitoring and Condition Monitoring in Power Systems by Mr. Karlheiz Schwarz, Managing Director, NettedAutomation GmbH, Germany

The focus of the globally well accepted and used Standard series IEC 61850 is the provision of interoperability of intelligent electronic devices (IED) and tools for the automation, control, protection, and configuration of substations. Application domains like wind and hydro power plants and other decentralized energy resources (e.g., combined heat and power) have extended the standard information models and communication mappings provided by IEC 61850. First standard of the series IEC 61400-25 (IEC 61850 for wind turbines) have already been published. Other standards are under way.

Most of these definitions are related to the operation of the power system. During the recent years people have realized that the standard IEC 61850 provides also a useful basis for the (condition) monitoring of the primary power system equipment – the crucial assets that need best care and attention. Maintenance and asset management can use the new standardized information such as critical vibration, temperature, oil level, gas density et cetera. Such extensions cover the monitoring of equipment in substations (e.g., switchgear, transformers, onload tap changers, automatic voltage regulation devices, gas compartments, and lines) and on generation sites (e.g., generators, gearboxes, transmission systems, and towers in wind turbines). Comprehensive input for the extension of the existing standard series IEC 61850 has been provided recently. IEC TC 88 (wind turbines) standardizes IEC 61850 compliant information models for condition monitoring of wind turbines (IEC 61400-25-6) to cover the crucial areas of wind turbines.

An IEC 61850 compliant system for monitoring a high voltage transformer (380/110 kV) has been successfully installed at a substation at RWE (the second biggest German utility) by end of 2007. The monitoring system uses existing and new information models, client-server communication, GOOSE messaging and sampled value information exchange from conventional current and voltage transformers. The objective of the project is to demonstrate the feasibility of the IEC 61850 process bus for protection, control, and equipment monitoring under real high voltage conditions.

The new extensions seem to be a pivotal point for the future electric power system. This presentation discusses the various efforts related to the international standardization. A solution of a comprehensive monitoring system based on IEC 61850 and IEC 61400-25-6 using off the shelf components will be presented. And the benefits and challenges of condition monitoring using standards will be discussed.

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Event at a Glance

DAY 1 - 27-May 2009

IEC 61850, A New Engineering Perspective in Malaysia by *Ir. Aminuddin Musa, Principal Technical Expert (System Design and New Technology), TNB Transmission; Adjunct Associate Professor, Uniten*

IEC 61850 suite of standard is the world's first standard on communication networks and systems in power system substation environment. The standards define a consistent methodology for interconnecting Intelligent Electronic Devices (IEDs) using predefined data models and communication services mapped over main stream communications technologies such as Ethernet based Local Area Network. The key goals of the standards are to ensure interoperability of IEDs or products from different vendors, easy integration into any utility philosophies and practices (free configuration & function allocations), and long term technology stability. In TNB, IEC 61850 has been identified as the key enabler and driving force for achieving full substation automation by 2015 and intelligent transmission power delivery system by 2020 as part of TNB Electricity Technology Roadmap. Although IEC 61850 has offered potential benefits to utility, TNB has decided to implement the standards in stages with emphasis on applied research and development (R&D), and pilot project implementation.

IEC 61850 promises a comprehensive engineering approach throughout the life cycle of the substation protection, automation and control (PAC) systems. The engineering activities include technical requirements and specifications development, engineering design, system and device configurations, documentation generation, system and device testing, and configurations management. In Malaysia, especially for power utility, there will definitely be a paradigm shift in terms of engineering approach, methodology and practices. Implementation of IEC 61850 will also introduce other kind engineering challenges which need to be understood before they can be tackled systematically.

This presentation will provide Malaysian utility engineers, design engineers and engineering professional awareness about potential IEC 61850 engineering approach, issues and challenges. Possible problems and limitations associated with IEC 61850 implementation in typical power system substations will also be highlighted.

This presentation will include discussions on:

- Substation requirements and specifications
- Substation physical and logical architectures
- Standardisation of substation data models and services
- Substation communications, cyber security and networking technologies
- System design and performance
- IED interoperability and changeability issues
- New protection, automation and control applications
- System architect and integrator
- Substation Configurations Language (SCL) files, engineering & configuration tools, and configuration management
- Managing substation information
- Conformance, interoperability, system and device testing
- Impact on substation design and implementations
- Change in engineering processes and practices
- Engineering organisation change
- Change management and user acceptance

Evaluation of Substation Automation with IEC 61850 by *Mr. Knathip Spuntupong, Chief of Protective Relays and Control System Design Section, MEA, Thailand & Mr. Niwat Sriklam, Senior Relay Engineer, Relay System and Telemeter Division, Power System Maintenance Department, MEA, Thailand*

Modern substation automation using Intelligent Electronics Device (IED) such as numerical protection relay and/or Bay Control Unit (BCU) will integrate control, protection and many functions to reduce system complexity. Moreover, new international standard such as IEC61850 allows multi-vendor interoperability, hardwired reduction and ease of integration. However, it is still difficult for utility to evaluate system configuration, allocate function and accept the final system. This presentation will discuss Metropolitan Electricity Authority (MEA) concept design, experience and practical solution for system configuration, function allocation and system integration.

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Event at a Glance

DAY 2 - 28 May 2009

Reliability and Availability Study on Substation Automation System based on IEC 61850

by Dr. Bahisham bt Yunus, Director & Associate Professor, Universiti Tenaga Nasional.

The introduction of IEC61850 standards for substation automation requires the specification of the reliability and availability performance parameter. The general system requirements for the IEC 61850 Substation Automation System (SAS) include Reliability and Availability. The IEC 61850 standard does not specify any performance target or benchmarks to be met. However, verification and publication of actual performance measures is necessary to be conformant to the standard. Therefore it is up to the system integrators to predict the performance of the interconnected Intelligent Electronics Devices (IEDs) and, thus, the overall performance of the system. Presently, the methodology to calculate and verify the parameters is not readily available. This presentation will propose a methodology to calculate the parameters of the substation automation system at device level, bay level and substation level. The presentation will propose suitable monitoring and evaluation of those parameters for future improvement.

This presentation will include discussions on:

- The definitions of reliability and availability
- Reliability calculation methodology
- Substation Automation System Structure
- Communication System Reliability
- Protection System Reliability
- Control System Reliability
- Station HMI Reliability
- Overall System Reliability
- Monitoring and Evaluation of Reliability

More, Faster, Less, Less - The Business Drivers for IEC 61850 by Mr. Rodney Hughes, Technical Director of Maunsell AECOM, Australia

The increased demands on our engineering processes cannot be met in respect of cost, time and effort with our traditional engineering approach and solutions to the SAS. Organizations are clearly being driven by more diverse and compelling objectives than pure technical excellence, which was the driver for so many years in our past. Technical excellence is not shunned, but the corporate drivers are summed up in a phrase we have coined as "More, Faster, Less, Less". More projects delivered in faster time frames with less money and less resources. We could also add "Higher, Lower" to the phrase to include with higher reliability and with lower operational cost.

One avenue to achieve this outcome is through innovation in technical and project delivery strategies, undertaken in an environment where the market is generally considered to be resource constrained and there is strong competition for essential resources. One such technical option being considered is through the implementation of new technology defined under IEC 61850.

The development of IEC 61850 based substations will lead to exciting new opportunities and challenges for organizations as a whole and its staff in particular. This presentation describes the impact of IEC 61850 to deliver more projects in a shorter time using less resources and less money and provides a guideline for an approach.

Event at a Glance

DAY 2 - 28 May 2009

The Single, Global and Future Proof Automation Standard – IEC 61850 by Mr. P. Krishnan, Incontrol Tech Sdn Bhd

This presentation aims to give participants, a holistic picture and principles of the IEC 61850 standard, and problems experienced during actual implementation. The participants will be walked through the history of protocol and its advantages and disadvantages.

Engineering Process for IEC 61850 by Mr. Rodney Hughes, Technical Director of Maunsell AECOM, Australia

The power industry is facing significant challenges in the years ahead driven by increases in the number of projects, the proverbial skills shortage and now exacerbated by the squeeze on available funding. IEC 61850 was released in 2004 which has already been deployed in thousands of locations with tens of thousands of devices in service already offering significant advantages. The early deployments of IEC 61850 have tended to be single vendor solutions proving that the basics of the technology work. Systems are now in service as multivendor installations in some cases consisting of over 200 devices in the substation. These projects have allowed the industry to learn much and refine the IEC 61850 devices but most importantly they have proven that the standard is robust and the fundamental principles of interoperability work. The next step is where to from here?

One of the intriguing capabilities that IEC 61850 provides is the freedom to design a substation independently and in advance of the vendor and device selection. In comparison previous design processes start with a vendor and device selection in order to start producing the wiring diagrams. Clearly IEC 61850 introduces a new methodology to the design process that is not fulfilled by specifications simply stating "shall comply with IEC 61850 and use GOOSE messaging". The essential process is, and should be, about making the specification phase more specific to the needs, making design process faster, make the commissioning processes far more robust and automated and most importantly, future enabling for the next augmentation, refurbishment or replacement of the substation automation system. This is predicated on the engineering process adopting the requirement to establish SSD and SCD files as the basis of specifying, developing and maintaining the "as designed" through to "as operating" documentation.

This presentation describes the new engineering processes and benefits of the IEC 61850 standard and associated XML files when used with an appropriate new engineering tool. Investing in a new engineering system is the basis to achieve significant time and cost reductions as well as a dramatic change in requirements for creating documentation, drawings and databases for I/O and settings.

Featuring Presentations from IEC 61850 Experts in the Region...

Mr. Karlheinz Schwarz, *Managing Director, SSC, Germany*

Dipl.-Ing. Karlheinz Schwarz received his diploma (master degree) in Information Technology at the University of Siegen (Germany) in 1982. 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 the 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.";

Mr. Rodney Hughes, *Technical Director - Power, Energy & Telecommunications, Maunsell AECOM, Australia*

Rodney Hughes has more than twenty five years in the international power industry with a wide range of expertise in the strategic direction of substation, power system and telecommunication design. He is graduated from Sydney University in 1980 and joined AREVA (then GEC) Protection & Control as a Protection Applications Engineer. In 1985 he was appointed as General Manager for the Protection & Control business in Australia through to 1998 during which time he was responsible for introducing several generations of AREVA's technology to the market changing from electromechanical to static to digital numeric and communicating system. Rodney moved to France as AREVA's (the ALSTOM) HV Protection Product Director in charge of the R&D, marketing and production for distance and bus bar protection for the world market. In 2001 he moved back to Australia as the Protection & Telecommunications Manager for ElectraNet, the 275kV and 132kV transmission utility in South Australia and was subsequently appointed as the Plant Strategy & Technology Manager in 2003. Rodney is now the Technical Director for Maunsell AECOM Power & Energy with responsibilities for developing IEC 61850 based expertise and applications. He has served on CIGRE Australia's Panel B5 since 1985 and was appointed as Convener in 2003. He has contributed as editor to the publication of Technical Brochure 326 on IEC 61850 implementation. He is also an invited member on Grid Australia's Working Group on Implementation of IEC 61850.

Mr. Knathip Spuntupong, *Chief of Protective Relays and Control System Design Section, MEA, Thailand*

Knathip Spuntupong received a B.Eng. in Electrical Engineering from Kasetsart University, Thailand and M.Sc. in Electric Power Engineering from Rensselaer Polytechnics Institute, USA. He has been working with MEA for 14 years, as a substation design engineer. Now he is a chief of protective relays and control system design section.

Mr. Niwat Sriklam, *Senior Relay Engineer, Relay System and Telemeter Division, Power System Maintenance Department, MEA, Thailand*

Mr. Niwat Sriklam holds a Bachelor Degree in Electrical Engineering from Rajamangala University of Technology, Thailand. Mr. Niwat joined MEA in 1991. He currently manages the installation, commissioning and maintenance of Computerized Substation Control System (CSCS) and Remote Terminal Unit (RTU)

Featuring Presentations from IEC 61850 Experts in the Region...

Ir. Aminuddin Musa, *Principal Technical Expert (System Design and New Technology), TNB Transmission; Adjunct Associate Professor, Uniten*

Ir. Aminuddin bin Musa, P.Eng., M.I.E.M., has more than 20 years experience in the area of transmission power system protection especially related to the protection system planning and design for transmission system projects. He received his Bachelor of Science degree from University of Nevada-Reno, USA in 1988 and his Masters degree in Electrical Engineering from University Teknologi Malaysia in 1995. He is a registered Professional Engineer with the Board of Engineers Malaysia (BEM). He is also a Corporate Member of The Institution of Engineers Malaysia (IEM) and a Member of *Conseil International des Grands Réseaux Électriques (CIGRE)*.

He started his career in TNB/LLN since 1988. He was stationed to various departments in TNB Transmission Division. Among them are Protection Department, System Maintenance Department, Transmission System Project Department, TNB Engineers Sdn. Bhd., and Engineering Department. He has prepared technical specifications and requirements for TNB transmission projects since 1994. Among the important projects are IPP Tanjung Bin 500kV substation, IPP Jimah 500kV substation, Gelang Patah 275/132kV substation, and "Central Area Reinforcement (CAR)" projects. He has prepared technical and standard design guidelines related to protection and control systems for TNB transmission system. The technical guidelines are being widely used as reference in TNB standard protection and control system technical drawings for new transmission system projects. Presently, he is the group leader of protection, automation and control system for implementation of new technology related to IEC 61850 standards in TNB transmission system.

Dr. Bahisham bt Yunus, *Director & Associate Professor, University Tenaga Nasional*

Bahisham Yunus graduated as an Electrical Engineer in 1987, at the George Washington University, Washington D.C. United States of America. On her return from the States, she was assigned to the power system communication department in TNB (previously LLN) the power utility in Malaysia. She completed her Master in Business Administration at Ohio University, Athens, Ohio while working as a manager in the department. She served the utility for 20 years as an engineer and manager in various engineering positions within the communication department. During the service, she was selected to participate in various performance improvement programs for the Transmission Division and TNB.

In 2002, she was awarded a scholarship by the TNB to pursue a PhD studies in Electrical Engineering, specializing on power system communication and IEC 61850 standards. Upon returning from her PhD studies at the University of Manchester, UK in 2007, she was assigned as a Associate Professor at the Universiti Tenaga Nasional (UNITEN) a subsidiary of the utility. Since November 2008 she was appointed as the Director of the Strategic and Corporate Planning Unit of the university. She is actively involved in consultancy projects and managing strategic and quality related projects in the university and appointed as a quality auditor for TNB.

Mr. P. Krishnan, *Project Director, Incontrol Tech Sdn. Bhd.*

Mr P. Krishnan has over 27 years of experience in the Power Industry. He began his career as a utility engineer with Tata Power before moving to become the Project Manager of one of the largest Distribution SCADA Systems executed worldwide in Southern India.

Presently, as Project Director at Incontrol Tech, he oversees all the SCADA, Substation Automation and Control and Relay Panel projects executed by the Company. Mr Krishnan is the key architect of inControl Tech Sdn Bhd's venture into 61850. He has the experience of having brought in this knowhow into the company and pioneered the execution of the first three substation automation project with 61850 in Malaysia.

IEC 61850 - Substation Automation, Protection & Control

Dates: 27 & 28 May 2009

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