



MISSISSIPPI STATE
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i-PCGRID Workshop 2014

Trends, Lessons and Benchmarks Worldwide

Dr. Alexander Apostolov

OMICRON electronics



Achievement



ACHIEVEMENT

YOU CAN DO ANYTHING YOU SET YOUR MIND TO WHEN YOU HAVE VISION,
DETERMINATION, AND AN ENDLESS SUPPLY OF EXPENDABLE LABOR.

Trends, Lessons and Benchmarks



protection automation and control magazine

pac world

57.15

The Guru: Prof. Dr. Andrzej Wizniewski

18


**Deploying
Advanced Technology -**
Key Success Factors and Applications

www.pacworld.org

The magazine cover features a red and black header with the text 'protection automation and control magazine'. The main title 'pac world' is prominently displayed in large, bold, red and black letters. Below the title, the price '57.15' is indicated. A small portrait of Prof. Dr. Andrzej Wizniewski is shown in the top right corner, with the caption 'The Guru: Prof. Dr. Andrzej Wizniewski'. The central image is a computer monitor displaying four technical graphs, likely related to power system analysis. The number '18' is printed in large black font below the monitor. Below the number, the article title 'Deploying Advanced Technology - Key Success Factors and Applications' is written in red and black. The website 'www.pacworld.org' is printed in the bottom right corner. A vertical yellow bar on the left side of the cover contains various technical terms and a small logo.

Trends, Lessons and Benchmarks

protection automation and control magazine




The Cure:
Prof. Dr. James Thorp

pac
world

\$7 US
march 2014

THE NEW YORK TIMES BESTSELLING AUTHOR OF THE CURE
BY ABBAS KHAN, SENIOR MEMBER OF PARLIAMENT
FUNCTIONAL TECHNOLOGIES
BY SPINTECH, COLUMBIA UNIVERSITY POWER SYSTEMS
SPECIAL ADVERTISING SECTION



18
Design of
System Integrity Protection Schemes

www.pacmag.org

Smart Grid

- The European Technology Platform for SmartGrids - Vision and Strategy for Europe's Electricity Networks of the Future was published in 2006.
- It defines a bold program for research, development and implementation of a strategy for modernization of the European grid that will meet Europe's needs in the future. According to this vision Europe's electric power grid must be:
- Flexible: fulfilling customers' needs whilst responding to the changes and challenges ahead

Smart Grid

- Accessible: granting connection access to all network users, particularly for renewable power sources and high efficiency local generation with zero or low carbon emissions
- Reliable: assuring and improving security and quality of supply, consistent with the demands of the digital age with resilience to hazards and uncertainties
- Economic: providing best value through innovation, **efficient** energy management and 'level playing field' competition and regulation

Smart Grid Definition

- Energy Independence and Security Act (2007):
- *It is the policy of the United States to support the modernization of the Nation's electricity transmission and distribution system to maintain a reliable and secure electricity infrastructure that can meet future demand growth and to achieve each of the following, which together characterize a Smart Grid:*

Smart Grid Definition

- Increased use of digital information and controls technology to improve reliability, security, and **efficiency** of the electric grid.
- Dynamic optimization of grid operations and resources, with full cyber-security.
- Deployment and integration of distributed resources and generation, including renewable resources.

Engineering requirements

- Improvements in efficiency
- Improvements of quality
- Standard object model of substation automation systems components
- Standard names of measurements, breakers and switches status
- Reporting and control services

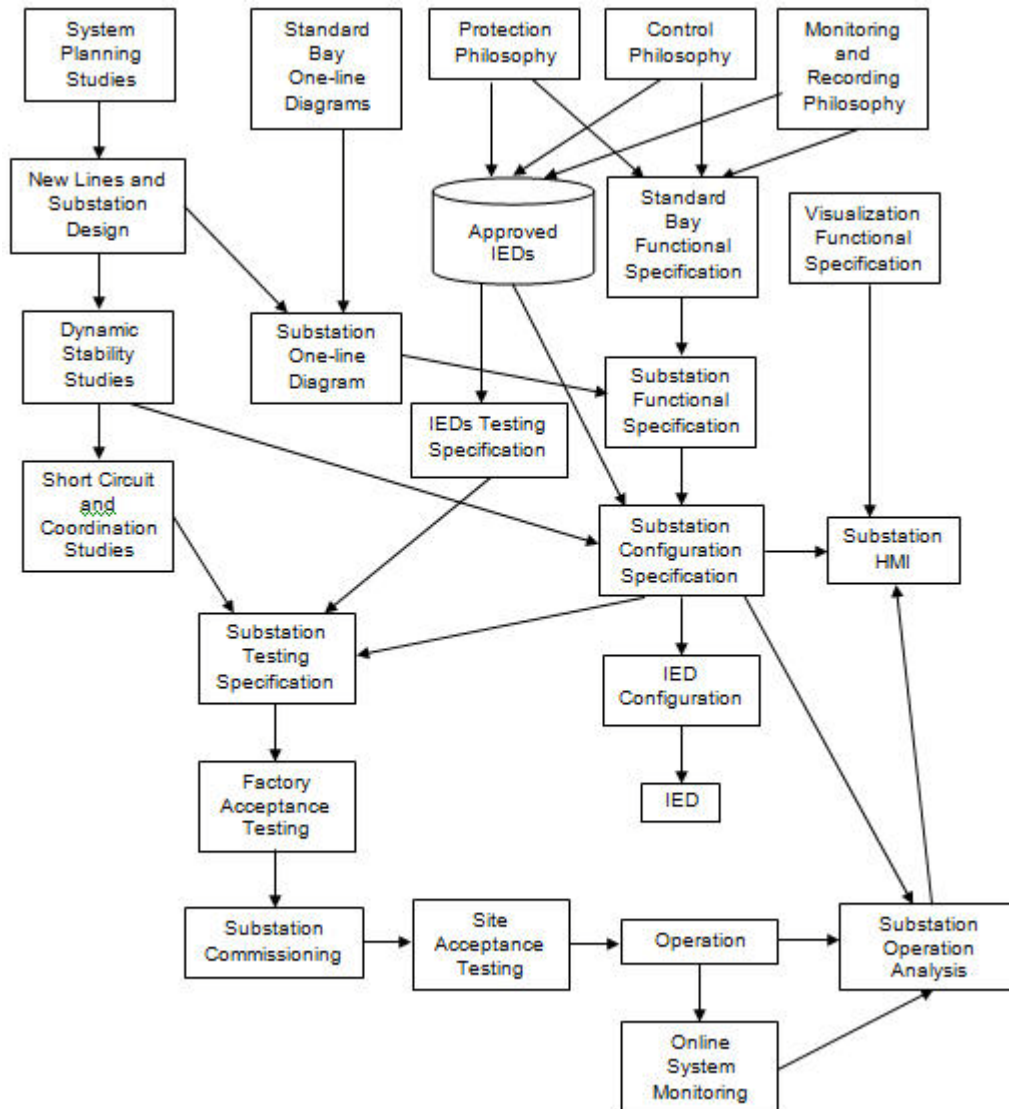
Efficiency

- Effectiveness – the degree to which objectives are achieved, without consideration of the resources being used.
- Efficiency – the extent to which a resource is used in order to effectively achieve an objective.

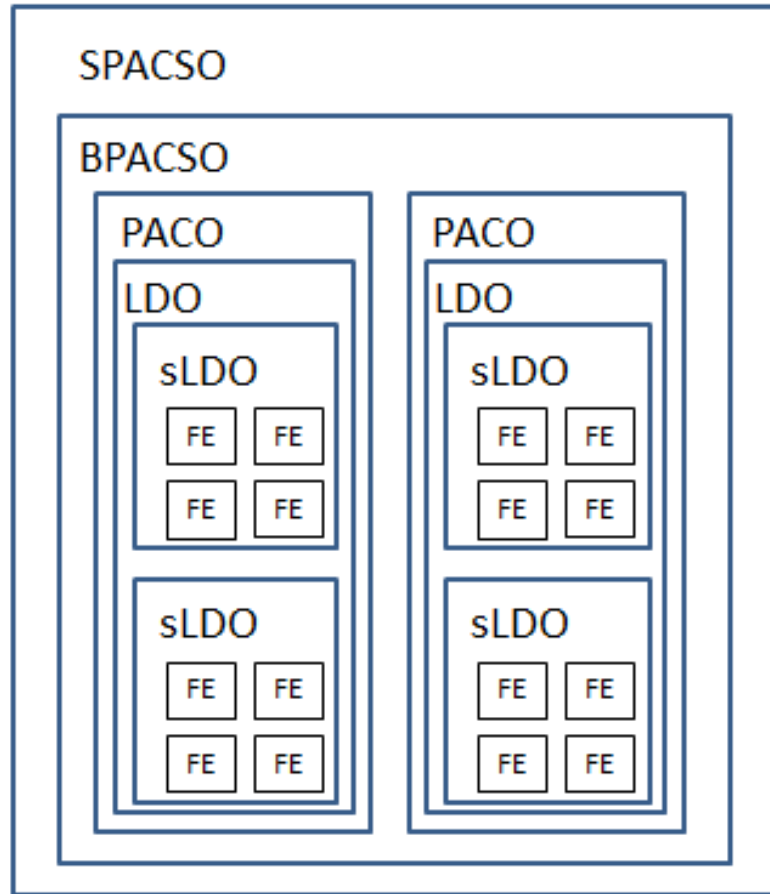
Engineering Objectives

- Improved efficiency
- Completeness
- Flexibility
- Adaptability
- Ease of use
- Support of different migration strategies
- Future-proof

Engineering Process



Object-Oriented design



Standardization Process

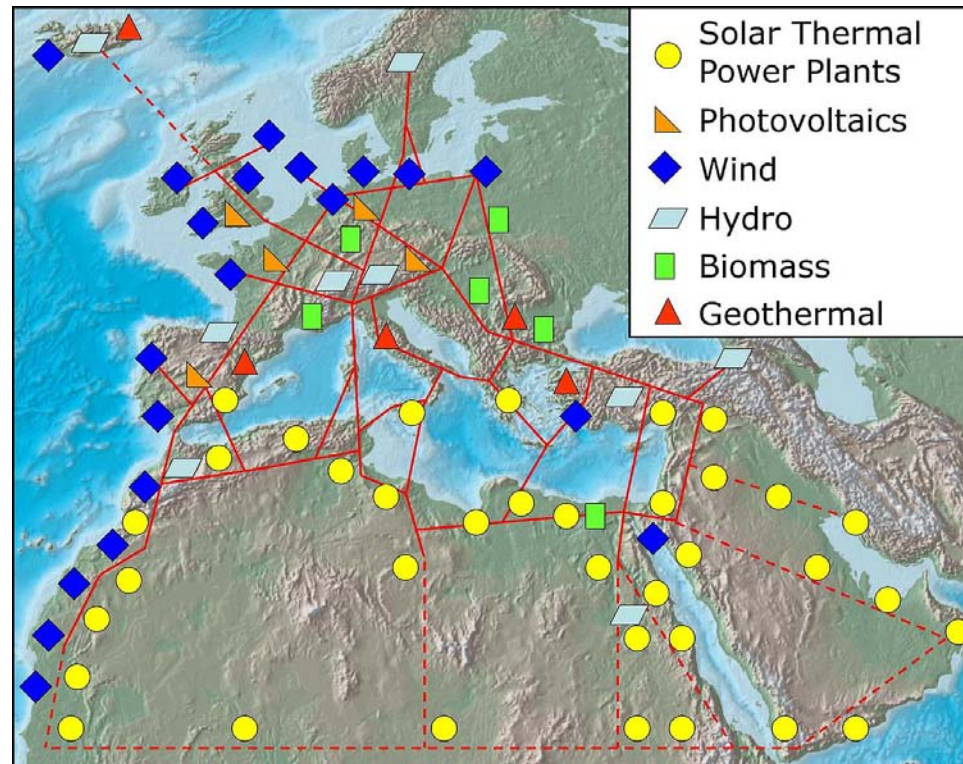
	Phase	Bay	PAC Devices	Plant Application / Substation	What it means
A	Standard scheme – template	G	G	G	Totally generic SSD, ISD
B	Standard scheme – defined	S	G	G	All HW interfaces fixed SSD
C	Standard scheme – applied	S	S	G	IEDs fixed ICD, IID
D 1 2	Standard scheme: Instantiated Instantiated with small variations	S	S	S	Everything fixed, also settings (= standard scheme applied in reality) SCD, CID

S = specific; G = generic; B and C can be one step.

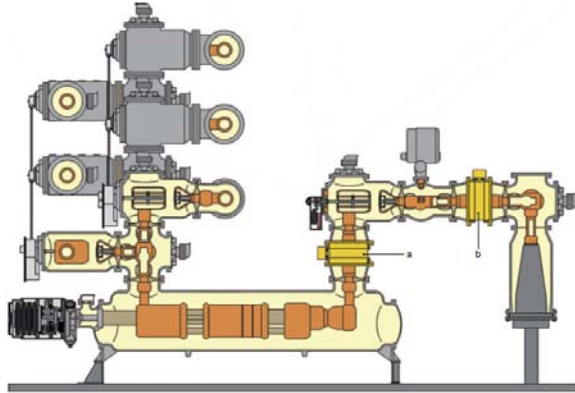
Super Grid

- A **super grid** is a wide area transmission network that makes it possible to trade high volumes of electricity across great distances.
- It is sometimes also referred to as a "mega grid".

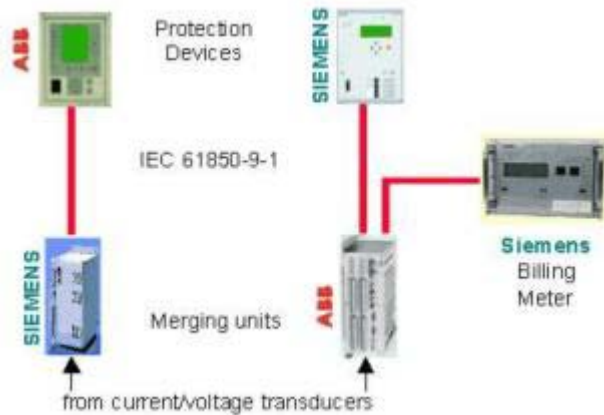
Super Grid



NCIT



IEC 61850 Sampled Values



IEC 61850 Development

No	Title	
8-2	Specific communication service mapping (SCSM) – Mappings to web-services	IS
10	Conformance testing	IS
80-3	Mapping to Web Services – Requirement Analysis and Technology Assessment	TR
90-2	Using IEC 61850 for the communication between substations and control centres	TR
90-3	Using IEC 61850 for condition monitoring	TR
90-4	Network engineering guidelines for substations	TR

IEC 61850 Development

No	Title	
90-6	Using IEC 61850 for Distribution Automation	TR
90-7	Object models for photovoltaic, storage and other inverter based applications	TR
90-8	Object models for electrical vehicles	TR
90-9	Object models for electrical energy storage	TR
90-10	Object models for schedules	TR


IEC 61850 Development

No	Title	
90-11	Methodologies for modelling of logics for IEC 61850 based applications	TR
90-12	Wide area network engineering guidelines Extension of IEC 61850 information models	TR
90-13	to also include logical nodes and data models for steam and gas turbines	TR
90-14	Using IEC 61850 for FACTS data modelling	TR
90-15	Hierarchical DER system model	TR

IEC 61850 Development

No	Title	
90-xx	Communication network structures in hydro power plants	TR
100-1	Functional testing of IEC 61850 based systems	TR
100-2	Interoperability tests for hydro equipment based on IEC 61850	TS

PAC World Americas




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Raleigh, North Carolina, USA

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PACWorld

In response to many requests we are bringing
PAC World to
North America.

The first PAC World
Americas Conference
will be held in
September 2014
in, Raleigh, North Carolina

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