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CONSEIL INTERNATIONAL DES GRANDS RÉSEAUX ÉLECTRIQUES
INTERNATIONAL COUNCIL ON LARGE ELECTRIC SYSTEMS

STUDY COMMITTEE D2

INFORMATION SYSTEMS AND TELECOMMUNICATION

SC D2 Colloquium - October 2011

Buenos Aires - Argentina

Special Report for Study Committee D2

SC D2 Chairman: Carlos Samitier

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Preferential Subject Special Reporter

1 Carlos Di Palma (AR)

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1 Introduction

Cigré Study Committee D2 (SC D2) covers all the aspects related with the use of the Information, Telecommunication and Telecontrol systems in the Electric Power Industry (EPI), both for operational and business activities. SC D2 mission is:

- to facilitate and promote the progress of engineering and the international exchange of information and knowledge in the field of information systems and telecommunications for power systems;
- to add value to this information and knowledge by means of synthesizing state-of-the-art practices and drawing recommendations.

For the 2011 SC D2 Colloquium hosted by Argentina, SC D2 has selected the following three Preferential Subjects as being current issues for the Electric power Industry:

1.1 Communication Technologies and Solutions for Core Networks in Electric Power Utilities.


The technologies and solutions for core networks are evolving and the utilities are seeing an increasing number of new alternatives. Some of them will not result interesting for EPU and some others are currently being incorporated gradually and will be widely used in the future. The papers for this preferential subject shall focus in the following areas:

- Applications;
- Reliability and availability;
- Experience.

1.2 Access solutions to be implemented by Electric Power Utilities

The increasing demand of new services, together with the evolution of the core networks, results in the implementation of access solutions that make use of a wide diversity of technologies, making network planners face new challenges. Specifically, the following areas can be mentioned:

- Substation and Protection access
- Wireless access

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- Cyber-Security

1.3 Information Systems to support data interchange between market participants

Deregulated markets have proven to be strongly information demanding. The transactions, among players in this marketplace, require the interchange of a lot of real time information among information systems based on different technologies. The technologies to support these services, along with the challenges in the implementation, have been initially selected and proposed as the main topics of this preferential subject, classified in:

- Requirements and architecture for data interchange applications
- Networking solutions for local and cross-border market participants

A total of 31 synopses have been received and will be discussed during the 2011 SC D2 Colloquium:

- 14 on the Preferential Subject n°1;
- 14 on the Preferential Subject n°2;
- 3 on the Preferential Subject n°3



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2 Preferential Subject no.1

Fourteen synopses were received for the Preferential Subject n°1. However, after a review, it was decided to retain only twelve papers for Preferential Subject n°1 and to move the two other papers to the Preferential Subject n°3. One paper, D2-01 A01 “Nordbalt HVDC system with optical cable between Sweden and Lithuania”, was not submitted and thus will not be discussed.

Hereafter the list of the papers related to Preferential Subject n°1 is to be found:

2.1 Overview of Submitted Papers

Number	Title	Country	Content
D2-01 A02	Communication systems for long haul links on 500kV HVAC systems	Argentina	Minimization of isolated repeater stations in long haul links for high Availability figures, as well as with big capacity for transmitting the whole information of the 500kV HVAC System.
D2-01 A03	Reliable and cost effective approach for transmission of long haul mission critical services in aerial optical links	Spain	Reliable implementation of long-haul mission-critical applications in protection and control networks, as well as with optimal use of the bandwidth.
D2-01 A04	Telecommunication systems over fiber optics–NOA-NEA	Argentina	Description of the implementation of duplicated SDH Communication System based on links of 300km without repeater stations. Main redundant SDH system with radio-link backup system.
D2-01 A05	Migrating from a TDM to a Next-generation Telecommunications Network in an Electrical Utility	South Africa	Migration from legacy TDM network to a next-generation networks like NGN-SDH for backbone networks, mixed TDM and IP MultiService Access Platforms and Internet Protocol/ /Level Switching technologies.
D2-01 A06	Optical infrastructure for security telecommunication network	France	Development of a private and dedicated communication infrastructure for upper level security telecommunication network, based on SDH Transport fiber optics technology, rather than a packet-based technologies.
D2-01 A07	Optical Cables Management System for the 500kV HVAC Networks	Argentina	The remote monitoring and management system of the whole optical cable networks in order to improve the Reliability figures of the 500kV HVAC Systems.



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Number	Title	Country	Content
D2-01 A08	Current Status of Migration of Electric Power Systems to IP Networks at Electric Power Companies in Japan	Japan	New telecommunication networks for electric power systems based on IP networks utilizing low-cost general purpose IP-related technologies capable of ensuring reliability and security equivalent to those of previous networks.
D2-01 A09	Convergence Technological for Modernization of Telecommunications Network – Case CHESF	Brazil	Greater capacity of bandwidth and better signal processing makes to design the expansion and transformation to a new telecommunication platform, arriving to the considered Telecommunication Business Plan with horizon 2018.
D2-01 A10	Reliable operational telephony communications in a wide area high power grid	Spain	To deploy a substation mobile communication network, in order to provide a high reliability telephony in its own facilities, with digital enhanced cordless telecommunications with an IP transport.
D2-01 A11	Life-cycle Considerations Regarding the Scope of Telecommunication Inventory OSS in the EPU	Slovenia	Electric Power Utilities utilize information technology support in telecommunications despite the element and network management levels, and the Inventory Operation Support System is the main support. Importance of the inventory system, as well as inventory project evaluation, lifecycle, improvements and direction for further deployment cycles, are given.
D2-01 A12	Evaluation of the use of stationary lithium-ion batteries in Telecommunications in the Brazilian Electricity Sector	Brazil	Presentation and results of batteries of lithium-ion technology like an alternative for stationary batteries, in order to improve the reliability and durability of telecom systems used by the companies of the electric sector.

2.2 Questions to the Authors/Presenters

The questions **Q1.1-n** given below are specific questions related to the presented paper, and the author of the paper should reply to them.

Some questions to which more participants from the audience may respond are numbered as **Q1.2-n** and are to be found at the end of this question list.



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Paper D2-01 A02

- Q1.1-1.** Please, try to detail what real/effective results were obtained in the installations that were done. Further explain if the projects have taken into account future data transmission according to new IEC61850 standard applied to teleprotection transmission between SSEE. Further explain if the projects have taken into account future data transmission according to the new IEC 61850 standard applied to SCADA transmission between SSEE and Control Centre.
- Q1.1-2.** Detail the longest link that was implemented by the Utility Company, as well as the BER figures that were obtained in the longest link (end-to-end).
- Q1.1-3.** Do you consider the possibility of using semiconductor optical amplifier (SOA) devices as an alternative to EDFA devices? Could you mention pros and cons of such alternative? Please, give the opinion about the possibility of using optical amplifier with remote Laser pump (long haul links).

Paper D2-01 A03

- Q1.1-4.** Could you explain how the external phenomenon (wind, lighting, temperature changes, etc) over an OPGW optical cable can affect the transmission performance, taking into account that the cable manufacturer must be taken into account those conditions in order to avoid eventual degradations?
- Q1.1-5.** Can you give an explanation about how short time interruptions of the optical digital communication service can have severe effects in the Utility networks? Is it possible to avoid them in case of using (n+1) communication redundancy schemes?
- Q1.1-6.** Do you consider the possibility of using semiconductor optical amplifier (SOA) as an alternative to EDFA devices? Could you detail pros and cons of such alternative? Could you give the opinion about the possibility of using optical amplifier with remote Laser pump (long haul links)? Could you give some details about the implemented 330km communication link? Is it using CDWM technology with 20nm wide channels (ITU-T channels)?

Paper D2-01 A04

- Q1.1-7.** Are the partial subsystems based on terminal-protection schemes? Are the redundant systems fully independent between them? Are each SDH system using a separate and independent pair of fibres in order to maintain the full redundancy scheme?
- Q1.1-8.** Please, can you talk about how the management system of this SDH systems are integrated with the rest of existing communication systems? Are the existing management systems including equipment of different kind of technologies, such as SDH links, radiolinks, etc., or it is necessary to use several NMS systems?
- Q1.1-9.** Please, give details about the simultaneously functioning of the SDH and PDH systems. Can you explain is the path-protection scheme between main system and backup system was implemented?
- Q1.1-10.** Please, can you give more details about the Availability figures of the double SDH system as well as the total Availability figures for the whole main and backup systems architecture (SDH and PDH)?
- Q1.1-11.** Can you give further details about the 301km link without repeaters? Can you give a brief explanation about the 400km link without the use of repeaters to be implemented in the future?



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Paper D2-01 A05

- Q1.1-12.** Please, detail about the particular IP/MPLS packed-based networks that have implemented by Eskom, as well as the date of put into service of them. Main topics can be: link lengths, transmitted data capacity, functions to be transmitted, etc.
- Q1.1-13.** Please, give details about the significant growth in the volume of data traffic carried by Utility communication networks. Try to describe the current data volume and the new requirements that will be necessary to be satisfied.
- Q1.1-14.** Can you give some comments about the considered latencies (between 5 to 10 msec) in relation with the teleprotection services?
- Q1.1-15.** Is the migrated telecontrol over IP according to concepts of new IEC 61850 standard applied to data transmission between SSEE and Control Centre?
- Q1.1-16.** Could you explain how do you plan to migrate from PDH, SDH, DWDM current systems to IP/MPLS new technology? Try to mention about criteria like: the condition of in-service installations; the cost taken into account; steps to be done; etc. Do you have a wide enough optical mesh in order to make an easy migration to IP/MPLS technology?
- Q1.1-17.** Please, try to explain the manner that the network security options were considered (item 3, page 7/10).
- Q1.1-18.** Please, further explain the compatibility of the mentioned microwave and wireless technologies with the transmission of teleprotection functions.

Paper D2-01 A06

- Q1.1-19.** Could you explain the considerations taken into account for using SDH Transport fibre optics network technology rather than packed-based technologies (IP-based technologies like GB Ethernet with MPLS switching)? It is interesting for D2-Colloquium to know about the pros and cons that were considered by you.
- Q1.1-20.** Please, further explain the criteria that have guided to the previous decision of using public telecommunication operator for the upper level network. How do you arrive to the decision of developing and operating your own private and dedicated communication infrastructure (from 2004 to nowadays)?
- Q1.1-21.** For the upper level, please talk about the equipment, monitoring systems, management systems, etc.
- Q1.1-22.** Please, further explain the criterion for using WDM technique only when few fibres are available in the optical cable.
- Q1.1-23.** Please, give more explanation about the national SDH backbone at 2,5 Gbps as well as the regional SDH rings at 600Mbps. It could be interesting to detail about the features of the functions to be carried by each of them (detailing the list of page 5/9). Try to detail the type and link lengths involved in the security network (ROSE).
- Q1.1-24.** Does the NOC's mission include the monitoring of fibre optic of each optical cable? Do you plan this function additionally to the centralized and redundant manager of the SDH/WDM core network?
- Q1.1-25.** Please, details about the characteristic and type of each link that has been listed in table of item 4.1 (page 7/9).



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Paper D2-01 A07

- Q1.1-26.** Please, further explain how you are doing at present, the method of revision and checking of the performance of your 5300km optical cable network. Please, try to compare the time that is currently needed for detecting a failure in your whole optical cable network, with the expected lower time that you estimate could be obtained with an on-line monitoring of the optical cables.
- Q1.1-27.** Would the Utility Company accept doing the monitoring of one fiber optic per cable, instead of doing the monitoring of all fibres?
- Q1.1-28.** Do you have an estimation of the reduction of maintenance cost, as well as the improvement of System Availability that the on-line optical cable monitoring can obtain? Could you tell us if the Utility Company has saved a detailed, recorded information of each optical cable (in spite of its date of put in-service) in order to use it for the future monitoring system of these cables (comparison of performance by overlapping of graphs)?

Paper D2-01 A08

- Q1.1-29.** Please, further explain how can be preserved the secure operation of each individual electric power system when the integration in a whole IP network will be done.
- Q1.1-30.** Please, try to explain the MPLS systems operating at present in Electric Power Systems in the world that were considered by you as a reference. Additionally, what are the HV levels of the Electric Systems that nowadays are using MPLS systems?
- Q1.1-31.** Please, try to describe the technology to be used both, for the core network and the local network (150H-MUX multiplexer T1/E1 for IP network; Ethernet 10/100Mbps to STM-1 for transmission over optical cables). Please, further explain the H-MUX as an useful tool for being used in the integration period (IP new technology and TDM existing one).
- Q1.1-32.** Please, detail the capacity and other features of the Side-A (fully IP based) network, as well as the Side-B (co-existing legacy information and IP information) network.
- Q1.1-33.** How do you consider the transmission of teleprotection orders, automation data, etc, could be done with 2 sec switching time between Side-A and Side-B?
- Q1.1-34.** You have developed an IP converter for legacy interfaces (GW) in order to accommodate information on Side-A and Side-B. Is it a customized solution for you, or is it a solution that has been offered by the manufacturers? Could you elaborate?

Paper D2-01 A09

- Q1.1-35.** Please, further explain the new administrative and operational applications that CHESF nowadays has, as well as the capacity of bandwidth and better signal processing that have been considered. Please, try to give details about the technical and commercial factors that have been considered for the definition of CAPEX and OPEX of the telecommunication.
- Q1.1-36.** Please, give an explanation about the four probable scenarios that were studied, as well as the selected scenario that was chosen. We ask that you talk about the factors impacting on the telecommunication systems that are mentioned in item 1.2.
- Q1.1-37.** Please, can you talk about the predicted traffic matrix among CHESF localities that were studied and taken into account? It is interesting to relate the studies with the



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OTN adopted backbone at 10 Gbps, as well as how distances and high speed are supported by it.

- Q1.1-38.** Please, further explain the NG-SDH techniques that were used for transporting IP charge through Carrier Ethernet services. Please, can you talk about MS-SPRing and ODU-SPRing protocols, as well as their implementation over four fibres?
- Q1.1-39.** Could you talk about the limitation of available fibres in OPGW cables, as well as the use of DWDM techniques that were decided? Could it possible to explain about the reasons why the current optic fibre system is used up in its totality?
- Q1.1-40.** Please, further explain the Metro/Carrier Ethernet technology that was decided to use. Can you give more details about the alternatives that were considered before the decision that was taken? We ask that you talk about the integration that was considered between video-monitoring system (electro-energetic system controlling necessities) and the electric system's operation (SAGE).
- Q1.1-41.** Please, can you talk about the replacement of GPS synchronization system by the new clocks distributors in each locality, according to IEEE 1558 PTP standard and IEC 61850 standard?
- Q1.1-42.** Can you explain about the information security policy that was developed with the Telecom Director Plan (listed in item 2.10)?

Paper D2-01 A10

- Q1.1-43.** Is the DECT (dedicated network) an independent communication system of REE, or is it offered by a telecomm public provider? Additionally, could you explain if the substation mobile communication network is possible to be used in any wide or local area of the whole 400 and 220kV networks? Does it have any restrictions for using it?
- Q1.1-44.** Please, further explain if the three layers (wireless access, IP transport, switch core) were a new ones or they were existing previously.
- Q1.1-45.** Please, explain the steps that were necessary to do in order to arrive to the final decision.
- Q1.1-46.** In case of total or partial blackouts the optical network probably remains in-service. Consequently, it would not possible to use the REE's own communication networks for electric grid operations. Please, discuss further those possibilities.
- Q1.1-47.** Please, further explain why the decision that was made about deploying an enterprise private telephony networks was not made at the beginning of REE operation (like other Utilities companies have typically done). Which were the new considerations taken into account?
- Q1.1-48.** Please, can you talk about the two different physical optical links for IP network (to every station)? Has the IP network been used only for new telephone network? Considering that voice service was assigned to a specific VLAN, it would be interesting to explain how the rest of services were considered (teleprotection, SCADA, protection and local control, etc.).
- Q1.1-49.** We ask that you explain the technologies that are used by REE for long distance Ethernet links (Ethernet over SDH, Ethernet over optical fibres). Could you talk about the design concepts that were considered by REE in order to implement the N-1 Criterion?



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Q1.1-50. Please, further explain the additional long distance E1 links (auxiliary TDM switching backbone) to be used. It would be interesting to say more about the features of the TDM backbone (limited number of hops, minimum latency and process time, etc). Are the TDM links (like second option priority) independent of the IP backbone connection? Is the level of redundancy fully obtained?

Paper D2-01 A11

Q1.1-51. Please, can you give further details about the OSS development lifecycle?

Q1.1-52. Do you consider that it is a common style that Telecom services for the public market are provided via a daughter company of EPU?

Q1.1-53. Please, further explain the telecommunication inventory system cost versus telecommunication resource capitalization

Q1.1-54. Please, give more details about why the technology-specific inventory is not a good practice in case of being done by EPU. Can you detail pros and cons of the solution developed by vendors in comparison with the solution developed by the EPUs?

Paper D2-01 A12

Q1.1-55. Please, detail the increase of insecurity of lead-acid batteries that were observed by FURNAS in the last years (reliability, durability, etc). Can you explain why FURNAS+CPqD have decided to investigate Lithium-ion batteries (among other options)? Please, can you talk about Communication and Control Systems that are nowadays assisted by Lithium-ion batteries in Power Utility Companies (in the world)?


Q1.1-56. Additionally, it would be interesting to know the amount of manufacturers that can provide such type of batteries, as well as the life-period, cost, etc., that FURNAS has analyzed. Please, try to make a relation with the samples that were submitted by French and American manufacturers. Can you talk about the specific IEC, IEEE, etc, standards that are focused on Lithium-ion batteries (additionally to Telcordia GR-3150-CORE)?

Q1.1-57. Please, try to give further details related to the Lithium-ion batteries' less safe function. The paper speaks about the necessary refined electronic control (battery management system-BMS) that was developed by the manufacturer, in order to reduce the disadvantage of the material's less stable composition. What is the Availability of the whole arrangement (battery + BMS)?

Q1.1-58. Please, further explain about the primary and secondary systems that are used by the BMS system. Does it have a very reliable protection system in order to avoid battery collapse and explosion (in case of failure of the BMS device), in spite of the protection system against short-circuit condition?

Q1.1-59. Are the Lithium-ion batteries a commercially standardized product or they are a customized development? Due to the typical capacity of the 48Vcc Auxiliary System for SSEE are greater than 100Ah; how will you consider that situation?

Q1.1-60. Please, can you talk about the battery-charger that is used for the Lithium-ion battery? Is it possible to use the existing 48Vcc chargers (with an adaptation), or it is necessary to replace them? Did you evaluate the cost of such replacement? Can you talk about the eventual coexistence of existing lead-acid batteries with new Lithium-ion batteries (in case of existing SSEE that must be expanded)?

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The following are questions to participants of the audience that may respond and consequently are marked as “Questions to the Audience”.

- Q1.2-1.** Is your Utility Company considering to migrate to new Communication Systems shortly? In such case, which technology is being taken into account?
- Q1.2-2.** Is your Utility Company satisfied with the bandwidth, speed and rest of performance of the existing communication systems? In such of not, is it possible to obtain better results without changing the existing communication systems?
- Q1.2-3.** Does your Utility Company monitor and manage the whole optical cable networks? In such of not, how the is the degradation/failure of fibre optic detected?
- Q1.2-4.** Is your Utility Company foreseeing a transmission of teleprotection functions under IEC 61850-90-1?
- Q1.2-5.** Which are the standards of fibre optic that have been selected for your optical cables (G.652, G.652D, etc.)?



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3 Preferential Subject no.2

3.1 Overview of Submitted Papers

There were fourteen abstracts received. Two main categories have been defined inside this Preferential Subject:

- Access
- Security

Two papers were not submitted, D2-02 B01 “Enhancement of Switching Gear Maintenance using Unified Communication” and D2-02 B07 “An Analysis of Communications and Networking Technologies for the Smart Grid”, and thus they will not be discussed.

Hereafter the list of the papers related to Preferential Subject n°2:

Number	Title	Country	Content
PS 2.1: Access			
D2-02 B02	Construction of Unified Access Infrastructure for In-house Business Systems in Teleworking and Mobile Environments	Japan	They are looking how to facilitate a high-security system connection environment to safely access data stored in in-house business systems from anywhere and at any time in order to maintain a stable power supply. They have introduced communication encryption devices (SSL-VPN) via a unified point of entry in order to access all in-house business systems via the Internet from outside. There are two primary access infrastructures, teleworking method and web access method, allowing for standardized system structure and operations.
D2-02 B03	Telecommunications network for differential protection on long distance serial compensated power lines	Sweden	Describes a renewing of protection system from distance protection to differential protection, initially using PDH 64 kb/s transmission. This was upgraded to 2 Mbit/s transmission but there are still some problems with the redundant routes which have longer transmission lines. Now are using a DWDM network at 10 Gbit/s line speed with SDH and Gbit Ethernet channels. Trial has been made on the old 622 Mbit/s network and the new Gbit/s built in parallel in a 1000km ring.



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Number	Title	Country	Content
D2-02 B04	Communication Architecture for IP-based Substation Applications	Denmark	<p>WG D2.28 analyzes the definition of single coordinated communication architecture for IP applications and porting legacy applications onto IP. They produces a brochure about:</p> <ul style="list-style-type: none"> • Description of the user's needs: they asked 120 participants, and 56 have responded. • A possible network migration process step-by-step. • Choosing the network architecture, in line with the IEC TC57 (61850-90-4) • Studies from real-world implementations at Statnett, Tennet, EDP, REN and Energinet.
D2-02 B05	Upgrade of Mexico City's downtown Distribution Network	Mexico	<p>CFE took operation of the electric network of Mexico City and surrounding which was operated by LFC. The installations have old equipment, saturated network, constant faults and sabotage attacks. The modernization process has taken as a guide the Smart Grid model, and consists in the refurbishment of 261 state switchgears designed according to ANSI C37.74 and C37.60. One IED will be doing the functions of control, protection and metering. The telecommunications network will support the integration of other intelligent elements, IP cameras, legacy services based on a serial interface, DNP over TCP/IP, integrating real-time critical services with other Ethernet-based. Due to the variety of data and protocols in the network, the solution uses IEC61850-3 standard and CWD Mmultiplexer.</p>



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Number	Title	Country	Content
D2-02 B06	Communication technologies applied to smart metering and energy loss detection system	Mexico	A smart metering system can help electric utilities to minimize energy losses by detecting frauds and meter tampering and by carrying out energy balances. These networks are able to read advanced meters many times per day to obtain metering data and to send information such as power outage and tamper alarms in near real time from the meters to the utility data center. These are hierarchical or peer-to-peer communications networks over different media and technologies. The Electrical Research Institute developed the Meter Data Management System.
D2-02 B14	Enabling smart grid communications over MV lines	Spain	For many existing distribution grid facilities, most of the facilities are not connected. Communications resources must be added, able of delivering the required data rate and latency requirements: GPRS/3G, Satellite links or ADSL, with operational costs and the control outside the utility. Traditional technologies cannot be used in most urban environments. May be used the MV lines, a very noisy and lossy medium, so deep analysis and test are required. This paper describes a network device over MV lines, using different modulations such as OFDM and Spread Spectrum.
PS 2.2: Security			
D2-02 B08	Information Security applied to the network access: a methodological approach	Uruguay	To protect access to the configuration of the devices of the network we need antivirus, password access, firewalls, WPA, VPN. To reach them in an orderly way we follow family of standards ISO / IEC 27000, a set of rules, procedures and systems planned for the Operational IP Network of the Electric Power Utility. Describes a possible implementation and provides some examples of applications, considered as a particular case.



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Number	Title	Country	Content
D2-02 B09	Graded approach to cyber security for EPU: Clarifying the security levels and zones concepts	The Netherlands	Cyber security applies “defense in depth” methodologies and the “graded defense approach” to protect Industrial Automation and Control Systems and critical IT infrastructure. Exist today no aligned understanding, taxonomy or obvious compatibility of “Zoning principles”, “Level protection structure” or “domain protection structure”. Today different standards, best practices and architecture blue prints are lacking consistent classifications methods and models to classify and map systems to different zones, levels, or domains. The paper gives a general overview about standards, and architectures, about “Defense in Depth” and “Graded defense approach”. Includes the application in “Smart Grids” and in the protection of critical IT infrastructure against upcoming threats.



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INFORMATION SYSTEMS AND TELECOMMUNICATION

SC D2 Colloquium - October 2011

Buenos Aires - Argentina

Number	Title	Country	Content
D2-02 B10	Modeling of cyber attacks for assessing smart grid security	Italy	<p>Cyber-security will constitute an important success criterion for an efficient and reliable operation of smart grids. Several aspects of vulnerabilities include their topological complexity, the vast number of heterogeneous participants, interfaces, communication channels, operational modes and policies. Cyber security requirements have to be derived from risk assessments and general architectural decisions. This paper addresses the characterization, categorization and modelling of malicious cyber threats, one of the priority topics identified by the WG D2.31. Presents the meaning and the links between the key concepts of cyber risks, provides insights and results related to the four step process agreed among the members:</p> <ul style="list-style-type: none"> • choose a graphical attack modelling approach • a reference architecture for smart grid applications including the deployment of appropriate security countermeasures. • attack processes applied to the reference architecture, demonstrating the consequences of good/bad access solutions • the connection between attack modelling and a comprehensive risk analysis framework



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Number	Title	Country	Content
D2-02 B11	Cyber Security requirements and related standards for Substation Automation Systems	Switzerland	Systems have become more interconnected and provide end users with much more information to allow for higher reliability, interoperability between different vendor products and systems based on open standards and by Ethernet technology. This change in technology has also exposed utilities to cyber security threats, even with stringent requirements for instance regarding timing, availability and environmental conditions. Several standards covers different areas and parts leaving many gaps in between, and also they in different phases. This paper will look at the broad field of cyber security requirements for Substation Automation systems and discuss how security should be addressed in a meaning full manner, including new security features and usage of specialized security equipments.
D2-02 B12	Privileged User Management System Development	Japan	Describes a framework to manage privileged users in an integrated manner, using the experience on data access control. Different system development sections have specified privileged users for each business system, and then managed their access authorities and data access records. Now developed a unique privileged user management system, a general section responsible for system operation and management handles all privileged users in an integrated manner, with preliminary authentication to allow to access their server using the privileged user ID to login. Major functions are described: Privileged user/ID management, Access control, ID authentication, Operation log management.

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Number	Title	Country	Content
D2-02 B13	Approaches to Smart Grid Communications Networks at Electric Power Companies in Japan	Japan	New distributed generation requires a communication networks for high-speed, advanced monitoring and control of power systems and sensor networks for the advancement of facility management with secure communications. Describes access solutions for Automatic Meter Reading System using Wireless Mesh Communications, WiMAX Solutions, and Power Line Communication Solutions.

3.2 Questions to the Authors/Presenters

The questions are given below, where paper numbers are mentioned in relation to specific questions, and the author/presenter of the paper should reply to them.

Some of the questions to which more participants from the audience may respond are marked as “All”.

Access

- Q2.1-1.** About the survey: Would you please to open the universe of survey participants? How many of them are transmission or distribution utilities? How many are covering a region or a city? **Paper D2-02 B04**
- Q2.1-2.** About the study case: It is possible to know the brand and model of equipment used? Are they thinking to move the existing IP/SDH network to a pure IP one? **Paper D2-02 B04**
- Q2.1-3.** Which were the documents about the Smart Grid concept used as reference to design the new network? Was the design of the network developed by the utility or the provider? Are they response time a goal to be fitted at the services level? **Paper D2-02 B05**
- Q2.1-4.** Do you know some practical implementation of WiMax+WiFi equipment? In the case of PON networks, are the dark fibers an available service in your country? **Paper D2-02 B13**
- Q2.1-5.** Would you please to describe the state of the art for these systems? How many systems are operating? Which are the top ranked equipment in the market? **Paper D2-02 B14**
- Q2.1-6.** Which are the limitations to implement the Smart Grid model founded in your environment caused by the existing electrical market regulation? **All**

Security

- Q2.2-1.** Are the users comfortable with the security restrictions? Which are the limitations to operate the company systems from outside? Had you got security incidents after this implementation? **Paper D2-02 B02**
- Q2.2-2.** Was the methodological description of risk assessment applied inside your company? Which is the current status of security policies implementation on your network? **Paper D2-02 B08**



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- Q2.2-3.** Have the security specialists some influence in the early design of the new networks? Is there some recommendation about the default passwords used in the electronic equipment? **Paper D2-02 B09**
- Q2.2-4.** The security policies are mainly oriented to prevent and detect the incidents. Is there some kind of protocol to be carried out to manage a detected incident? Are the used trained to follow this? **Paper D2-02 B10**
- Q2.2-5.** Which is the relationship between a Security Operation Centre and a Network Operation Centre? **Paper D2-02 B10, All**
- Q2.2-6.** Is there a formal relationship between the WG on Security and IEC 61850? Did you know some practical application of the SDH Link Capacity Adjustment Scheme? **Paper D2-02 B11**
- Q2.2-7.** Would you please to discuss about the pros and cons of Layer 2 and Layer 3 security schemes in the control systems? **Paper D2-02 B11, All**
- Q2.2-8.** Is the management of privileged user described on the business servers the same for the operative servers? Which is the physical relationship between both networks, the Internet and the allocation of the validation server? **Paper D2-02 B12**
- Q2.2-9.** Which is the current status of electronic signature systems inside your company? **Paper D2-02 B12, All**
- Q2.2-10.** About the maintenance of network equipment: Is there a integrated policy about the authorized access for the technicians? **All**
- Q2.2-11.** Is there a centralized reservoir as a backup of the configuration files? **All**
- Q2.2-12.** Are these policies independent of the NOC existence? **All**
- Q2.2-13.** Are you able to overcome the suddenly lost of a system administrator? **All**

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4 Preferential Subject no.3

4.1 Overview of Submitted Papers

Only two abstracts have been initially received from Cigré D2 community. Later on, following a general analysis of all collected abstracts and papers, it was decided to transfer other three papers from PS1 and PS2 into PS3 group, due to a direct connection of these ones with the scope of PS3.

Finally, the following categories have been defined, based on these five papers received:

- Requirements and architecture for IT application interchange
- Interoperability / standardization
- Networking solutions

Hereafter the list of the papers related to Preferential Subject n°3 is to be found:

Number	Title	Country	Content
D2-03 C01	Undertaking to Realize Interconnection of Video Conference Systems between Various Companies	Japan	The paper presents the concern referred to the connection between the videoconference systems of electric power companies as an useful information exchange tool for main electricity actors in Japan. The list of requirements, as well as realizations of external connections via Internet, both with guidelines for companies planning future system replacements will create a good benefit base to realize conferences between electrical power companies nationwide.



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Number	Title	Country	Content
D2-03 C02	Energy Management Information System – A data interchange application for partially deregulated energy market	Mexico	The authors focus on the presentation of an information architecture for the deregulated power generation sector in Mexico, describing as example the Energy Variables Management Information System implemented to support all the information and the processes needed to monitor the commercial transactions between CFE and IPPs. The formulation of pricing models including energy variables calculation like combustible fuels, transport, water, economic factors and other variables related to energy market are automated processed. The result is a flexible, scalable and interoperable architecture to fulfill the complex requirements inherent to exchange information among participants in the energy markets.
D2-03 C03	The Web2Energy project. Bringing IEC 61850 and the Smart Grid closer together	The Netherlands	Web2Energy (W2E) aims to develop an open standardized communication system covering all 7 layers of the OSI/ISO reference model for communication protocols and demonstrate this in the field. As well, the project will develop, build, field-demonstrate, and operationally deploy an open ICT communication system. It opens the way for “plug and play” and interoperability capabilities, and minimizes engineering efforts for future exploitation of the developed solutions.



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Number	Title	Country	Content
D2-03 C04	Development of Power Transmission Line Fault Information Network System	Japan	The paper presents a solution of a “Power Transmission Line Fault Information Network System” that realizes sharing and visualization of information by integrating the functions of dedicated monitoring equipment installed at power system maintenance offices and using network technology to collect information from tower-mounted stations across the entire service area. The system notifies maintenance personnel of occurrences of faults and fault points by e-mail to enable speedy identification of fault points and reduction in the recovery time from faults.
D2-03 C05	Monitoring the quality of service in Metropolitan Area Network	Spain	The paper describes how new equipment used for Ethernet access services use advanced mechanisms for the characterization and supervision of the network features with Ethernet traffic generators and analyzers integrated in the access equipment. The solution adopts also the functionality required by the new OAM standards. Protocols have been established to carry out tests between nodes, allowing confirmation of the features offered by the Metro Ethernet networks.


4.2 Questions to the Authors/Presenters

The questions are given below, where paper numbers are mentioned in relation to specific questions, and the author/presenter of the paper should reply to them.

Some of the questions to which more participants from the audience may respond are marked as “All”.

Requirements and architecture for IT application interchange

- Q3.1-1.** Could the authors explain what management solutions they had in view to monitor the videoconference system interconnections and who has this responsibility? Are the IP networks used for this application belonging exclusively to EPU (Electric Power Utilities) or there are also mixed solutions – EPU and public networks and what supplementary security measures could be considered in the last case? Could the authors elaborate more about the potential benefits of this solution implementation at a large scale, besides video images and document sharing

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between EPU actors? **Paper D2-03 C01**


- Q3.1-2.** Have been registered some practical development and implementation of the videoconference interconnection solution from the time of studies elaboration so far? What other conclusions came from, specially related to technical requirements for EPU interconnection? It would be necessary to involve an IT system integrator or not? Till what extent could be this solution used as a real time tool to support the daily operation / maintenance of electrical grids? **Paper D2-03 C01**
- Q3.1-3.** May anyone from the audience present similar experiences in their countries of videoconference system interconnections and the related efficiency in terms of IT applications used, categories of users and eventually the influence in costs for daily activities? **Paper D2-03 C01, All**
- Q3.1-4.** The authors are invited to describe the interfaces of EVMIS application with specific IT systems of different entities participating in electricity generation market , i.e. external entities (e.g. IPPs) and internal departments of CFE (financial – accounting, National Control Centre, other). Are there direct interfaces with EMS, ERP or AMR systems of CFE? The ED (Economic Dispatch) function of EMS system used by National Control Center delivers some reference data for the validation function of EVMS? **Paper D2-03 C02**
- Q3.1-5.** Could the authors describe the hardware architecture running the EVMIS application, including communication solutions with user environment? **Paper D2-03 C02**
- Q3.1-6.** Which are the direct benefits of EVMIS implementation or of similar applications in other countries, in terms of time and costs saving, HR saving, etc? Are such of figures available to be presented **Paper D2-03 C02, All**

Interoperability / standardization

- Q3.2-1.** Based on the actual Web2E project stage at the time of CIGRE Colloquium, which are the effective achievements and related risks of a non alignment to the proposed IEC standards of all interested parts / stakeholders intended to be involved in this project? **Paper D2-03 C03**
- Q3.2-2.** Which are the expectations related to the achievement of the same level of security and availability of public communication infrastructures, as for private ones (belonging to EPU's)? Are there envisaged special requirements to be achieved by both Infranets (public and private communication infrastructures? **Paper D2-03 C03**
- Q3.2-3.** A new and very important type of Control Centre, with a very complex set of tasks is envisaged in the Web2E project, i.e. VPP CC. In the author' vision is there the responsibility of the VPP Control Centre to act in the name of its "customers" (residential, RES, etc) in the daily electricity market tenders organized by market operators, and/or in the balancing market organized by TSO's? **Paper D2-03 C03, All**

Networking solutions

- Q3.3-1.** How the acquisition equipment installed on each tower is power supplied and what about its reliability behaviour in connection with harsh electromagnetic and ambient temperature environment? What accuracy has the fault point determination if the

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equipment is not yet GPS synchronized? Paper D2-03 C04

- Q3.3-2.** The authors are invited to provide some relevant figures and comments related to cloud computing solution, to monitor an electrical grid with 1000 OHL towers, e.g.: monthly/yearly cost of cloud computing service, monthly/early cost of rented communication services (satellite, mobile), percentage of rented vs. owned communication services used for data acquisition, cost of acquisition equipment mounted on towers, etc. Paper D2-03 C04
- Q3.3-3.** How this solution for a transmission grid could be economically justified for top management, against of another one based on fault location by means of algorithms of "double-end fault location time algorithms" which is very accurate (error location less than 0.2%), while the necessary equipment is much lower than for proposed solution method. There are required PMU units (Phase Measurement Units) only, possibly synchronized by GPS, in the two ends of the line. The audience is also invited to comment or to share similar experiences. **Paper D2-03 C04, All**
- Q3.3-4.** The probe presented in the paper could be easily used for operation with other types of Media Convertors, besides those ones showed in the picture? Is there proprietary the protocol used for probes communication? Please add more details about. **Paper D2-03 C05**
- Q3.3-5.** Is there a standalone network management application for monitoring of nodes equipped with probes? What about its interoperability with other network management applications? **Paper D2-03 C05**
- Q3.3-6.** Which is the influence in cost of Media Convertors equipped to be integrated in a monitoring network with QoS management? **Paper D2-03 C05**