# DISCUSSION MEETING SUMMARY

## Study Committee D2

## Information systems telecommunications and cybersecurity

## *30th August 2024*

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**Chair: Victor Tan**

**Secretary: Marcelo Araujo**

**Special Reporters:**

**PS1: Joyce Meireles and Rachel Berryman**

**PS2: Herwig Klima and Gerard Mbouyap**

**PS3: Amadou Louh and Hiroki Doi**

### 1. INTRODUCTION

The 2024 discussion meeting of Study Committee D2 was held on 30th August in room Havane at the Palais des Congrès in a morning and afternoon session.
The three Preferential Subjects were:

> **PS1:** IT/OT solutions to improve the efficiency and resilience of electric power systems
> **PS2:** Cybersecurity in emerging application domains and technologies for securing energy organisations
> **PS3:** Meeting the challenges of energy transition with reliable, scalable, and efficient telecommunications networks

**General statistics**
Over 120 participants at the peak (during the morning session), averaged more than 100. All subjects stimulated very active discussions.
There were a total of 76 papers with 41 questions and 50 contributions.

**Young Engineer Presentation**
A presentation was made on the purpose of NGN and how to obtain more information for anyone who is interested.

**PS1**
40 papers, 8 questions, 18 contributions
**PS2**
13 papers, 23 questions, 6 contributions
**PS3**

23 papers, 10 questions, 26 contributions

## 2. RUNNING OF THE MEETING

The Discussion Group Meeting was chaired by the Study Committee Chairperson, Victor Tan (AU), with Joyce Meireles (BR), Rachel Berryman (DE), Herwig Klima (AT), Amadou Louh (NL) and Hiroki Doi (JP) as Special Reporters and Marcelo Araujo (BR) as SC D2 Secretary. Louise Watts (AU) and Vitor Meneguim (FR) served as interactivity managers.

Joel Nouard, the former SC D2 Secretary and responsible for the SC D2 GDM organization was also presented.

The morning session started with a brief summary by the chairperson of the scope of the work of SC D2. The chairperson also provided a quick summary of the procedure for running the DGM. The chairperson then introduced the special reporters and the preferential subjects, and indicated that the special reporters would provide a brief discussion of each preferential subject after the contributors' presentations with the assistance of Slido.

## 3. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 1

PS1 – IT/OT SOLUTIONS TO IMPROVE THE EFFICIENCY AND RESILIENCE OF ELECTRIC POWER SYSTEMS

Promoting openness and open-source development in the electric power industry can enhance collaboration, innovation, and cost-efficiency, despite challenges like legacy systems and cyber-security, with strategies including education, standardization and virtualization.

The electric power industry is evolving with digital technologies and renewable energy, where Generative AI (GenAI) enhances grid management and forecasting. However, challenges like data quality, system interoperability, cybersecurity, and human oversight must be addressed to optimize operations and maximize GenAI's benefits.

By analyzing electricity consumption data, the selected forecasting model optimizes biogas generator operation, reducing peak demand. The generator is efficiently controlled to conserve gas for critical periods.

Integrating generative AI into Japanese power industry can address workforce challenges and enhance knowledge transfer but must be managed with a human-centered governance framework to mitigate risks like AI hallucinations.

Generative AI can significantly enhance the electric power industry by improving predictive maintenance, renewable energy forecasting, and operational efficiency, and digital model and twin development. However, it poses challenges like data privacy concerns, cybersecurity risks, and the need for human oversight to ensure reliable decision-making. Balancing AI's benefits with these risks is crucial for its successful implementation.

The digitalization process is fundamental not only to improve power systems technology and reliability, but also to strengthen the service level quality. Beyond just upgrading assets and analytics, successful integration relies on collaboration across condition monitoring, control systems, predictive analytics, and data interpretation. Digitally-enabled services and effective partnerships are essential for meeting sustainability goals and improving power system operations.

Integrating IT and OT systems in power grids presents challenges like system complexity, cybersecurity risks, and outdated OT systems. Organizations can address these by standardizing integration, enhancing cybersecurity, using advanced analytics, investing in training, and adopting effective change management practices.

To improve grid resilience and efficiency, organizations should adopt standardized, agnostic solutions like SGAM for interoperability and use EPC and PPA models to manage risks and flexibility. Implementing advanced cybersecurity measures and technologies is crucial for protecting IT-OT interfaces. Embracing continuous technological advancements, such as edge computing and virtualization, ensures adaptation to evolving network conditions and compliance with the latest standards.

Integrating IT and OT in power grids enhances real-time visibility, security and operational efficiency, with Eskom's standards ensuring secure remote access and effective collaboration, though not all divisions have fully integrated yet.

To rapidly test new technologies in the electric power industry, organizations should use cloud, fog, and edge computing, along with platforms like FLUIDOS. Collaborative efforts with research institutions, manufacturers, and standardization bodies, plus initiatives like European Open Calls, can speed up technology adoption and integration.

Organizations in the electric power industry can rapidly test and validate new technologies by participating in European R&D initiatives that focus on secure and interoperable data sharing. Engaging in such projects facilitates the development of standards and frameworks for data interoperability and semantic models. By leveraging pilot implementations and collaborating with industry experts, utilities can effectively integrate new solutions and stay at the forefront of innovation.

Virtualization at the substation level enables utilities to modernize gradually, integrating new functionalities while maintaining legacy systems. By separating hardware and software concerns, this approach allows for flexible updates, rapid deployment of security patches, and independent testing of new functions. This modular strategy enhances overall agility and efficiency in power system operations.

The IIoT solutions enhance power grid management with real-time monitoring, intelligent services, and efficient maintenance. They can improve efficiency through precise line loss analysis, better fault detection, and optimized energy resource management.

Energy systems face significant data management challenges, including handling large volumes and diverse types of data, integrating scattered sources, ensuring efficient storage and retrieval, and avoiding data loss; data historians are recommended to address these issues by offering time-series data storage, real-time analysis, integrating capabilities, and enhanced security monitoring.

The growing complexity of power systems and the increase in renewable energy sources require new control approaches. The rise in synchrophasor measurements and WAMS has highlighted the need for data-driven techniques for real-time monitoring, because efficient data processing and context-aware analysis are crucial for managing the vast amount of measurement data generated.

Digital technologies can reduce Europe’s fossil fuel reliance, improve efficiency, and cut costs. Standardized ontologies like the Common Information Model (CIM) and methods like Building Information Modeling (BIM) can enhance data interoperability and asset management, addressing challenges from proprietary software and data schemas.

Considering power consumption as a new parameter in the application of Beyond 5G and all-photonic network technology to electric power telecommunication networks is important to guarantee the needed performance of this technology in the power system applications.

## 4. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 2

PS2 - CYBERSECURITY IN EMERGING APPLICATION DOMAINS AND TECHNOLOGIES FOR SECURING ENERGY ORGANISATIONS

To protect/defend the cyber-physical system from multiple types of cyber threats, zero trust, security by design, end-to-end security, insiders’ threats, network & protocol security, digital certificate management, Public Key Infrastructures, Security monitoring, Threat detection and Security Operation Infrastructure are needed.

To enhance cybersecurity in energy communities, best practices include network segmentation, deploying intrusion detection systems, enforcing network access control, integrating SIEM and SOC for centralized management, continuous monitoring adopting a defense-in-depth strategy, ensuring compliance through regular audits, and fostering collaboration and training between IT and OT teams.

An effective advanced remote engineering platform should enable Secure SSO centralized user access and management to all their digital OT devices.

Regulatory frameworks and industry standards play a critical role in guiding cybersecurity practices for DER, microgrid, and energy community control infrastructures.

Implementing a Protection Management System in the Cloud needs strict cyber security standards and rules.

The shared responsibility model in cloud services for power utilities defines security and operational roles between cloud providers and utilities with emphases on infrastructure security, data management and compliance.

## 5. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 3

PS3 - MEETING THE CHALLENGES OF ENERGY TRANSITION WITH RELIABLE, SCALABLE, AND EFFICIENT TELECOMMUNICATIONS NETWORKS

The inherent characteristic of SDN like reliability, security and speed of the network could make SDN as a choice of communication in IEC-61850 in case of faulty power system.

MPLS-TP is inherently suitable to be combined with SDN. Both, the SDN architecture and MPLS-TP framework are based on the separation of the data plane and the control plane. In MPLS-TP the NMS takes care of the management and control plane and with built-in automation in the NMS controller one can facilitate and automate manual tasks that are prone to human errors.

Migrating to MPLS networks using hybrid equipment providing SDH and MPLS technologies enables a smooth and risk-mitigated approach for the complex migration of OT-network. Also, efficient migration from TDM to packet should take a phased approach that considers human resources, planning, testing, parallel operation, stakeholder engagement, technology change, robust redundancy and phased cutover plan.

With 1+1 protection in MPLS-TP combined with a buffer mechanism on each end of the network there will be zero packet loss and no delay jump. Defining the buffer depth can be done with the following rule of thumb: calculate the maximum path delay difference between the shortest and longest path which is 5 µs per node and 5 µs/km for the fiber.

There are different components that contributes to the E2E delay. Delay jump can be compensated using different jitter buffer sizes for different paths. Using 1+1 protection jitter buffer has to be defined very precisely.

The enhanced delay control concept which is based on 6 features provides the operator the ability to be 100% in control of the E2E delay including the asymmetrical delay on a MPLS-TP networks. For an IP-network and Layer 2 network there is always a risk on asymmetrical delay. This is covered in the RFC 5654 standard.

Critical applications demand phase aligned data exchange which cannot be delivered by standardized circuit emulation function. Application specific solutions are able to solve this and are available.

TSN (Time Sensitive Network) guarantees low latency of transmission in layer 2 network.

SNMP plays very important role in troubleshooting of network elements like up and down status of equipment, disk/CPU/memory utilization, interfaces status and bandwidth utilisation.

A Mediation Layer is used to communicate with the Network Elements (NEs) and Network Management systems (NMS) deployed in Power System Communication network. For systems where a North bound interface (NBI) is present, UNMS system directly interfaces with OEM’s (original equipment manufacturer) for communicating with NEs. But for systems where no NMS is present, UNMS is Directly Communicating with NEs.

Mitigating instability in 5G delays is a complex problem and EPUs need to make partnerships with mobile operators and manufacturers to solve this.

Power utilities need to use different wireless transport technologies, like Wi-Fi, 5G/6G/Li-Fi and satellite communications to support business applications and OT latency dependent services. It is necessary to compare the requirements and costs with the features of each technology and to show/discuss the needs with the service providers.

It is possible to proceed with the migration from the legacy wireless microwave network to the packet-switched wireless microwave network by using the MPLS-TP equipment which accommodates the legacy interfaces.

Networks could be built with cost reduction by taking into account the probability that the latency would not meet the requirements.

Intent Based Networking (IBN) offers a solution for enhancing substation communication networks in compliance with IEC 61850 by enabling interoperability and reliability.

IEC 61850 MMS offers an effective solution for PACS monitoring in digital substations, addressing limitations in timestamping and data model found in SNMP, and ensuring better integration, reliability and compliance with IEC 61850 standards.

The network must have at least two paths available and should select transmission routes that are resilient to disasters.

A backup path can be used as the active path by both introducing LAG in the network within the site and setting the BGP priority parameters (LP value, Community value, and MED value) in the network between sites.

## 6. CONCLUSION

Digital solutions have become integrated into the core business of utilities, with many use cases, bringing value to stakeholders. In the polls, 80% of respondents said that generative AI is being used in their companies. In the conclusion of PS1, existing and new working groups were presented and the audience was stimulated to contribute.

Cybersecurity involves all areas in EPU (Electric Power Utilities) as an interdisciplinary demand in the world of information technology for critical infrastructure.Previously most of the IT/OT infrastructure and services were owned by the utilities, the increasing degree of cloud serves as well as the global supply chain increase the demand cybersecurity as well.

SONET/SDH/PDH is becoming obsolete. As a consequence, there is less spare/support/development; higher maintenance risks. This theme is still relevant to CIGRE and power utilities. Regarding the physical layer, the contributions demonstrated that they can be either wired or wireless for IP/MPLS. Traditionally, traffic has been segregated in the logical level, using for instance VLAN and VPNs. Optical technologies like OTN and PON make it possible to have physical segregation as well. Accurate time (PTP) and frequency (SyncE) synchronisation are essential for power utilities and telecommunication and control engineers should cooperate in design. At last, There is a great variety of communication technologies and CIGRE can help in mapping the criteria that are relevant to power utilities before they choose the ones that better fit their requirements. SDN, with its separation of control and data plane, provides more flexibility, efficiency, less errors, user-friendliness, i.r.t. scalability and network changes (SDN)