DISCUSSION MEETING

SUMMARY

Study Committee D2

Information Systems & Telecommunications

31st August 2022

Chairman: **Olga Sinenko (RU)**

Secretary: **Joël Nouard (FR)**

Special Reporters:

PS1: Alexandra Khalyasmaa (RU), Rodrigo Leal de Siqueira (BR), Antti Viro (FI)

PS2: Chen Ching Liu (US), Zwelandile Mbebe (ZA),

PS3: Jan Piotrowski (PL), Victor Tan (AU)

1. INTRODUCTION

The 2022 discussion meeting of Study Committee D2 was held on 31st August in room Havane at the Palais des Congrès in a morning and afternoon session.
The three Preferential Subjects were:

1. PS1: The opportunities and challenges brought by emerging Information and Communication technologies to electric power utilities in their path to digital transformation
2. PS2: Cybersecurity techniques, technologies and applications for securing critical utility assets
3. PS3: Meeting the demands of the modern utility and DER with an agile and resilient telecommunication network

General statistics
Over 100 participants at the peak (during the morning session), averaged more than 80. All subjects stimulated very active discussions.
There were a total of 49 papers with 26 questions and 49 contributions.

Young Engineer Presentation
A paper from Brazil was presented extensively in PS1.

PS1
23 papers, 8 questions, 20 contributions
PS2
16 papers, 12 questions, 15 contributions
PS3
10 papers, 6 questions, 14 contributions

2. RUNNING OF THE MEETING

The Discussion Group Meeting was chaired by the Study Committee Chairperson, Dr Olga Sinenko (RU), with Rodrigo Leal de Siqueira (BR), Antti Viro (FI), Chen Ching Liu (US), Zwelandile Mbebe (ZA), Victor Tan (AU) as Special Reporters and Joël Nouard (FR) as SC D2 Secretary. Marcelo Araujo (BR) and Louise Watts (AU) served has interactivity managers.

The incoming Study Committee Chairman Name 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.

3. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 1

The theme for Preferential Subject 1 (PS1) "**The opportunities and challenges brought by emerging Information and Communication technologies to electric power utilities in their path to digital transformation"** which includes:

- IoT technologies and architectures in physical asset management
- Artificial intelligence, Big Data and analytics tools to improve asset management in electric power utilities
- Augmented and virtual reality technologies in electric power utilities and power plants

The conclusions from the presentation and discussions may be briefly summarized as follows.

Users have to define and simulate incidents that ML can't recognize. Principal Component Analysis (PCA) technique can be used to find the relation between variables in a more compact way, which leads to a smaller matrixes. Machine learned models shall be tested by experts before they can be taken in the use. Data anomaly detection relies on the assumption that anomalies are rare events and they differ considerably from normal behavior. Machine learning algorithms accelerate the process and improve accuracy over a period through iterative learning

No laws or regulations to restrict black box machine learning, everything is based on voluntary operational safety. When applying machine learning based software for critical infrastructures, a checking mechanism is necessary. More complex models might increase the accuracy but they are usually a black-box. This makes it difficult to build trust to the users. The new European Union AI regulation proposes an easy-to-understand approach for various ML models. ML is often used in decision-making like in use-cases of power outages and professionals are hesitant to deploy such models because model error may induce a very large impact. Experts in machine learning need to know where the model is failing or it needs to be tuned, for that, they need to understand the black-box-based model structure.

Three main applications for AI can be identified: Load forecasting, Management of flexibility assets and Automated electricity market activities.

Four legged robot can be used for following tasks : Preventive inspection, post incident inspection, switching assistant and asset documentation.

Augmented Reality (AR) is expected to be used mainly for training purposes for young people. It is expected to be used to assist field engineers at remote areas. AR Accelerated process of plant maintenance. Effective remote support. Faster training for skilled workers. The most promising application of AR technology is to increase the accuracy and safety of maintenance tasks

Using asset condition, Markov chains and a smart optimizer the algorithm finds optimized key performance indicators. Multiple KPIs are optimized by means of a Pareto Optimal Curve. Scaling AI in Production of the Energy Transmission are divided to three segments. People expertise, tool support and process orchestration. Customized reliability and asset management dashboards based on client's reliability and asset management policies. Analytical and reporting requirements to achieve business goals

4. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 2

The theme for Preferential Subject 2 (PS2) is "**Cybersecurity techniques, technologies and applications for securing critical utility assets"** which includes:

- Cybersecurity directives, supporting standards and certification schemes – experiences from electric power utilities worldwide
- Cyber incident management and experiences in the implementation of security operation centres for electric power utilities
- Impact assessment and mitigation strategies for cyber-attacks to power system operations. Studies and experiences in the integration of information and communication technology (ICT) network and cybersecurity simulators with existing power system analysis tools

The conclusions from the presentation and discussions may be briefly summarized as follows.

There is sometime a lack of consolidated approach by utilities in addressing cyber security. Utility networks are interconnected, a siloed approach is not a solution. The involved players must work together (EPUs, manufacturers, regulators) to come up with technically backed standards which are not subject to interpretation.

Standards should be detailed to a level that eliminates the potential for conflicting interpretations. There is a need for detailed guidance on implementation of the standards, to configuration level for critical parameters.

Utilities have experience on some standards and regulations including IEC 62351, NERC CIP, IEEE P1711, ISO/IEC 27000, NIST 800-53, NISTIR 7628, ISA/IEC 62443… Some of these standards were adopted to support legacy EPU networks to packet networks migration initiatives. Some countries have existing regulations, but a concern is these are not necessarily tailored for EPUs. Reasonable level of prescription by regulators seems to be more welcome by EPUs and has better positive impact compared to highly prescriptive regulations. Highly prescriptive regulations can have negative financial impact to the EPUs and their customers, there must be reasonable balance.

Steps that must be undertaken to do impact analysis and mitigation of cyber security attacks were presented. Such steps must take into consideration infrastructure, analysis of potential cyber attacks, and establishment of SOCs which comply with the standards. SOCs Should comply to standards including NISTIR 7628, NERC critical infrastructure protection (CIP), ISA99, IEEE 1402. The Emergency Response Teams setup by the governments seem to recognize that utilities are critical, with some taking responsibility to work with utilities.

Centralized attribute-based access control (ABAC) can be used to mitigate complexities associated with integration of cyber security systems with the traditional power systems. This solved a challenged posed by proprietary interfaces on traditional power systems.

Collection of data from multiple devices require diverse experience. Access to data is required by the business but must not compromise the systems. Automated data retrieval mechanisms must be supported to avoid repetitive data access tasks. Management systems which understands the SAS protocols eliminate the limitations posed by OT equipment which does not support the known IT management protocols

There is a fear that in short to medium term quantum computing can be used to break the current cryptographic methods and utilities should consider looking at post quantum cryptographic technologies.

Cyber security solutions must be tested like any other OT applications. This is necessary because OT equipment interfaces vary between OEMs, with some interfaces proprietary. Standardization can assist in reducing the tests which must be done by utilities. OT environments have emergency applications which can be seen as attacks by AI based automated systems and for this reason, AI based systems should be limited to advisory functions.

5. CONTRIBUTIONS TO PREFERENTIAL SUBJECT 3

The theme for Preferential Subject 1 (PS1) is "**Meeting the demands of the modern utility and DER with an agile and resilient telecommunication network"** which includes:

- Supporting operation technology (OT) services and applications using current and next generation cellular (4G/5G) and IoT-based wireless technologies
- Increasing efficiency and cyber security with the use of cloud-based techniques and intelligent networks including modern network management systems, network automation and service orchestration, network function virtualization (NFV) and software defined wide area network (SD-WAN)
- Improving and maintaining reliability and resiliency of critical services including protection services using modern telecommunication techniques and technologies

The conclusions from the presentation and discussions may be briefly summarized as follows

5G has potential in improving the operations of power utilities.

Utilities need a plan and strategy in selecting the right wireless technologies, including 5G, balancing the communication requirements, such as latency, range of coverage, bandwidth, inherent security features within the individual wireless technologies, power requirements, and current market considerations such as maturity of technology, spectrum cost and availability, and product costs and availability.

Within those considerations, utilities also need to assess whether to implement a private cellular network (e.g. private LTE/5G by acquiring spectrum) or using the carrier's public services.

It seems likely that utilities will continue to use a combination of wireless technologies to meet the requirements of the many different types of services in power utilities.

In areas such as SDN and SD-WAN, cybersecurity challenges should be considered, in particular proper securing of the control plane, management, and the data plane.

Advantages of SDN solutions are ease of deployment, scalability and flexibility that it provides.

Migration to packet switched networks remain to be in focus to most utilities. It is important to carefully plan for the migration of the services, and then carefully take a phased approach in migration to reduce the operational interruption risks to critical services.

Along with migration to packet switched networks, time synchronisation is one aspect which is impacted, as new ways to distributed timing information across a packet network needs to be carefully considered.

As we have observed from today's exchanges, teleprotection over packet-based networks continue to be a topic of interest as utilities continue to migrate towards packet based networks.

6. CONCLUSION

The chairperson gave a brief summary of the session, thanked all the special reporters and the contributors and participants. The Discussion Group Meeting (DGM) of Study Committee D2 closed at 5:50 pm.

A total of 49 contributions, including spontaneous contributions and suggestions, provided many interesting ideas and stimulated useful discussions. The session was of interest to all participants from a technical viewpoint. The number of participants was over 100 during the morning session and averaged at more than 80 throughout the day.

Sparkup facilities brought some interactivity in the discussion, including with remote attendees.