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**Preferential Subject N° - PS3 Highly Reliable ICT systems Infrastructure for Traditional and New Applications in EPI**

**Substation Network Optimisation Principles: IT features within an OT environment**

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10 years ago, one would have been hard-pressed to find any computer network in or even close to a Power Utility substation. Nowadays, however, with the ever increasing number of IEC61850 and other network based protocol implementations across the globe, the need for traditionally Information Technology (IT) type services is more likely to be found than not. The use of Ethernet based networks within substations, which is historically an Operational Technology (OT) environment, has seen the rate of convergence of IT and OT worlds increase at an alarming rate.

This exponential growth brings an interesting set of dynamics to Utilities and Eskom Holdings SOC Ltd (RSA) in particular. These dynamics challenge the traditional operating models for both parties (i.e. IT and OT) and also has an effect on technology selection within the business' long-term strategic plans. From an IT perspective, the OT environment is uncharted territory, where latency and redundancy is king. From an OT perspective, the IT environment is also somewhat unfamiliar, where the aspects of design and support are seen as services and the criticality and purpose of the overarching OT network is often overlooked. It's clear from these two examples that a set of rules or guidelines is necessary in order to achieve symbiosis between the previously distinct environments.

This paper, written from the perspective of an Automation Engineer, aims to discuss a number of technical elements which need to be considered when designing, engineering and implementing an Ethernet network (IT) within a Utility-based secondary plant (i.e. Transmission, Distribution and Reticulation) environment. The paper aims to specify the minimum set of IT network features and services, which is suffice to optimize the network to meet the unique set of criteria (i.e. high availability, low latency) specified by Utilities across the world. The paper also discusses the use of redundancy (e.g. RSTP, MSTP, and PTP) within these networks and the degree to which they need to be implemented to reap maximum benefit. Practical considerations are also given to Cybersecurity and the prevention of attacks from parties with malicious intentions, by implementing anti-malware software and design techniques.

Finally, the paper aims to answer the question: "Are IT based networking features implemented in an OT environment good enough or do new features need to be developed to meet the Utility's needs?", by considering the design of a typical HV substation (400kV+) Ethernet network.