

## ABSTRACT

Reliability and security in power supply is a measure of how well an electrical load meets the needs of a consumer at a given point in time. Achieving high levels of reliability requires large capital expenditure. A power system is therefore required to operate at optimal capacity in order to create a return on capital investment. In order to attain a high level of reliability in these operating conditions, there is a need to implement protection processes in power systems to reduce the number and severity of failures to protect components connected to the grid. In South Africa, the power grid has aged and traditional infrastructure that has historically supported consumers is unable to support future requirements. To ensure the continued growth and refresh of grid technologies, industry bodies and committees have established standards and guidelines that challenge the traditional approach to substation systems architecture. Reference process architectures, substation communication and information exchange standards have gained support from utilities and technology vendors over the last decade. A growth in the number of implementations of these standards is proving that the demand for systems integration and interoperability is high and will continue to grow in the future. This demand and its applicability to emerging systems architecture approaches, like service-oriented architecture, are considered in this dissertation. This dissertation uses standards, design patterns and emerging frameworks to deliver a service based fault detection application design. In order to deliver the fault detection process accurately, a subset of UML artefacts represents the fault detection requirements. UML is a basis for model driven design in software engineering. The dissertation proposes the design of a series of software components that are flexible, extensible and manage fault detection information needed to support reliability processes in substations. A deployment model implements the final application design to indicate the placement of specific components in a reference architecture used in this dissertation.

The aim of the dissertation is to prove that an application for fault detection in substations can be modular, reusable and flexible in design by using existing software engineering methods and architecture design principles.

**Keywords:** TM Forum NGOSS, IEC 61850, COMTRADE, Service Oriented Architecture, Fault Detection.