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Title of PhD Thesis: Integration, Evaluation and Security Analysis of Smart Metering Infrastructure

This thesis is organized into seven chapters to provide appropriate emphasis on the topics related to the work done. The chapters of thesis are organized as follows.

Chapter I discusses various operational features and evolution of metering system in the Smart Grid. Different metering protocols, communication technologies, and issues involved in AMI networking are also described in this chapter.

Chapter II provides the review of the available research work in the areas of research done in this thesis.

Chapter III discusses various traditional schemes used for fetching data from power meters. A novel architecture is provided that provides interoperability among the applications for extracting meter data from a metering infrastructure. An AMI application is also developed and discussed that automatically extracts various energy parameter addresses for configuring the tags.

Chapter IV discusses integration of smart devices like IEC 61850 based IEDs with the metering infrastructure as discussed in chapter III. A brief section is dedicated to usage of functionalities of Manufacturing Message Specification (MMS) in IEC 61850 based IEDs. To validate interoperability, without the use of protocol converters, a non IEC 61850 based industrial SCADA is discussed for fetching data from IEC 61850 based IEDs and other smart meters.

Chapter V discusses various types of threats, security attributes, and actors involved in AMI networks that can impact the operational features of AMI. A new scheme is developed and discussed that enables exchanging of secret keys among the AMI applications.

Chapter VI discusses a mathematical model for evaluating the performance of a shared communication channel used by the metering infrastructure.

Conclusions and the suggestions for future work are discussed in Chapter VII.