

A NEW DESIGN FOR A FLEXIBLE INTEGRATED PHASOR
SYSTEM

By

Andrew H. Armenia

A Thesis Submitted to the Graduate
Faculty of Rensselaer Polytechnic Institute
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE

Major Subject: COMPUTER AND SYSTEMS ENGINEERING

Rensselaer Polytechnic Institute
Troy, New York

May 2010
(For Graduation May 2010)

ABSTRACT

In power systems, data collection is an important function to ensure reliable operation of the system. Throughout the evolution of power systems, the accuracy, precision and rate of data collection have been the subjects of improvement. Recently, synchrophasor measurement has proven to be an important step in that evolution. Synchrophasor measurement uses GPS signals to provide accurate measurement of phase angles in a power system spanning a wide area. This data is typically collected at a very high sample rate, such as 30 or 60 samples per second. Transmitting this data to various locations for processing and analysis entails a number of network and communication issues. Furthermore, storage of the large volume of data arising from synchrophasor measurements is an area which has not received significant attention. A new synchrophasor system design, called FIPS (Flexible Integrated Phasor System) has been proposed to address these issues.

It is important to address the limitations of existing communication protocols in transmitting synchrophasors. Many protocols exhibit significant overheads which can result in additional bandwidth costs or delays. Minimizing these overheads is an important part of a synchrophasor system. Also, distributed communication and processing can provide significant improvements to a wide area measurement system. By distributing the data collection and storage, the communication network between systems needs only to transmit the data that is desired by the data consumers, reducing communication costs. By making appropriate use of cryptographic algorithms and techniques, it is shown that data integrity and confidentiality can be guaranteed, even in a distributed peer-to-peer phasor system.

Furthermore, synchrophasor data presents a new set of demands on a data storage system. It is shown that assumptions about the nature of data arrival can be used to construct a database with improved performance characteristics. Additionally, an extensible interface for users and applications to access phasor data stored in a phasor data system has been developed.