

Summary
Intelligent Power Routers for Distributed Coordination in Electric Energy Processing Networks
Proposal No: 0224743

We propose to develop a model for the next generation power network using a distributed concept based on scalable coordination by an *Intelligent Power Router* (IPR). Our goal is to show that by distributing network intelligence and control functions using the IPR, we will be capable of achieving improved survivability, security, reliability, and re-configurability. Our approach builds on our knowledge from power engineering, systems, control, distributed computing, and computer networks.

Each IPR has embedded intelligence into them allowing the IPR to switch power lines, shed load and receive/broadcast local state variable information to and from other routers. The information exchange capability of the routers provides coordination among **themselves** to reconfigure the network, even when the designated principal control center of the system has collapsed due to a natural or man-made disaster. The IPRs may achieve their task using direct monitoring, area-limited on-line security assessment and adaptive controls to establish a coordinated and local set of control actions to either apply preventive countermeasures against high risk operating conditions prior to a potential disturbance or corrective countermeasures following a disturbance.

Our proposed approach borrows from computer networks, where data is moved over geographically distant nodes via *data routers*. In the event of a component or system failure, the IPRs will make local decisions and coordinate with other routers to bring the system, or part of it, back into an operational state. Each IPR will operate on a **Peer-to-Peer** system (P2P) or a **mesh** hierarchy making irrelevant whether its inputs come from power producers or other IPRs,

Research and education will be integrated through undergraduate research (UR) and adapting research results for class examples, seminars and demonstrations. The structure of UR will be improved by using the affinity research group model [31], a model that integrates the knowledge and skills required for research to those required for cooperative work.