Executive Summary

Utilities have invested a significant amount in technology, but in perhaps too many cases the investment has not delivered the value promised. Nonetheless, the dramatic changes taking place in the utility business environment tasks utilities to continue the evaluation of, and investment in, key technologies to improve the efficiency, quality, reliability and cost of supplying services. The key utility system automation initiatives—Automatic Meter Reading (AMR)/Advanced Metering Infrastructure (AMI), Supply Automation, Supply Control and Optimization—will ultimately enable utilities to control costs, improve customer service and power reliability, maximize asset use, help address climate change issues, and help mitigate the effects of an aging utility workforce.

The communications network functions as the blood vessels of the next-generation utility. Next-generation utility communications networks must supply critical voice and data communications between people, hardware, and software whenever, and wherever, needed. Utilities can use various communications technologies that satisfy different needs for system automation: while wireless radio is effective for voice communications, for instance, fiber optic networks may be deployed for ultra-fast critical transmissions, and LANs may be used for communications within a limited area. The options offer various strengths and weaknesses, and most utilities are likely to adopt a hybrid system that combines the technologies.

Advanced utility applications are driving the need for increased bandwidth that is more flexible and efficient. While core utility operational networks can be based on a number of technologies—Synchronous Optical Net (SONET)/ Time Division Multiplex (TDM), Asynchronous Transfer Mode (ATM)—increasingly these services will be delivered over an Internet Protocol/ Multi-Protocol Label

Executive Summary

Switching (IP/MPLS)-architecture; IP/MPLS WAN is an IP-based, Wide Area Network that uses MPLS to enable the delivery of multiple IP-based applications and services over a highly reliable, converged network. Individual services can be assigned and guaranteed QoS over an IP/MPLS WAN. Similarly, IP can be wedded to Virtual Private Networks (IP-VPN/VPLS) for use in both mission-critical operations as well as corporate applications.

This report discusses the primary advanced automation utility applications – AMR/AMI, Supply Automation, and Supply Control and Optimization – and their related sub-applications, as described below:

AMR/AMI	Asset Management and Usage Forecasting Dynamic Pricing Tampering, Theft and Outage Management
Supply Automation	Demand Response Load Profiling and Balancing Distribution Network Diagnosis Remote Surveillance and Control
Supply Control and Optimization	Supply Monitoring, Analysis and Quality Control Demand-Side Management Automated Load Leveling, Shedding and Shifting Automatic Capacitor Bank Analysis and Control

Executive Summary

The decision for a utility to automate depends on a number of factors, including the need to meet regulatory, market, competitive or cost-cutting requirements. Automation can also be driven by a utility's need to solve a particular operational challenge, or simply by the desire to gain, or maintain, competitive advantage.

The question facing most of today's water, gas, and electric utilities is not whether, but rather how they should implement an automation system. Utilities must determine how much and what type of automation is required, and they must choose a communications network capable of meeting operational goals. There are a variety of technology and network/system architecture options, and there is no one easy, "one-size-fits-all" framework. Each utility will have to choose from a diverse range of product, technology and service vendors (listed comprehensively in Appendix I).

The ultimate vision for the utility industry is to develop an advanced, inter-connected network referred to as a "smart," "intelligent," or "modern" grid. The intelligent grid links together the full set of automated applications, linking electricity with communications and computers to create a highly automated, responsive and resilient power delivery system. Communication networks operate in combination with a great many advanced control "intelligent" sensors, controlled relays, and other information technology components to monitor the electrical characteristics of the power grid. This intelligent, self-healing grid will continuously send, receive and process data on system condition and components' health, and pass information among intelligent electronic devices, generators, system operators, and even marketers and consumers.