Smart Grid Communications

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Empowering Smart Grid Communications
About Amperion

• Provider of Smart Grid Network Communications Solutions for electric utilities

• Developed world class BPL technology and holder of its foundational patents
  – IP Portfolio with worldwide coverage
  – Deep knowledge of powerline communications

• Innovator of hybrid broadband networks and HVBPL® substation communications required for T&D smart grid applications
  – Hybrid and HVBPL products are operational
  – Commercial deployments expected in 2010
  – Large market potential over the next 20 years

Amperion
360 Merrimack St.
Lawrence, MA
The Smart Grid requires an advanced communications network

Amperion is a provider of T&D network solutions and services

Amperion’s smart grid communications addressable market is >$1B

Source: NIST Sep. 2009
Smart Grid Network Architecture

Multi-Tiered Network Architecture
1. Substation backhaul (WAN)
2. Substation to substation communications
3. Substation to grid devices
Smart Grid Utility Network Specifications

• High availability – has redundancy and backup options
• Supports real time low latency applications – required for protection and control
• Broadband – has bandwidth capacity for future growth
• Private network – utility has full control of its operation
• Cost effective – one time investment vs recurring operational expense of leased lines or cellular service
• Standards based platform – IP v6 is a preferred choice
• Multi tier cyber security – integrated at all layers
• QoS – to support multiple applications
• Centralized management application
• Flexibility to interoperate with legacy protocols
• Future ready – investment protection for 15-20 years
Hybrid Utility Network Enables SG Applications

A hybrid network uses **on the wire and off the wire** communications.
Amperion Distribution Grid Communications

- **Griffin MV1000**
  - Utility grade Smart Grid Hybrid Gateway; pole top mounted
  - Mix of 4 radios, 2 BPL modems
  - 2 Ethernet ports, 2 Serial ports
  - Serial to IP conversion software
  - Redundancy via unique Switcher™ algorithm
  - Ruggedized + lightning protection

- **Eagle WR1000**
  - Smart Grid Wireless Gateway
  - Mix of 4 radios
  - 2 Ethernet ports, 2 serial ports
  - Serial to IP conversion software
  - Switcher algorithm
  - Ruggedized + Battery Back Up options

- **Amperion NMS**
  - Outage management
  - Fault management
  - Performance Data, Statistics, Historical reports
  - Configuration management
  - Alerts, alarms

- **w/Google Earth**
  - Visual Map
  - GPS Accuracy
  - Real Time Updates
Substation to Substation Communications

Reducing cost of communications and enabling faster deployment of smart grid applications

Station A
Throughput: 10-15 Mbps
Latency: 5-7 milliseconds

Safe, cost effective, fast and simple to deploy

Station B

Station C

Throughput: 10-15 Mbps
Latency: 5-7 milliseconds
Station Communications over HVBPL

Five Mile 69kV Network at AEP
Operational in Newark, Ohio Since 2008

Granville Station  ➤  West Granville Station

Performance
– Throughput 15-20 Mbps
– Latency 4-6ms
– High availability and redundancy
– Monitoring and automatic alerts

Applications
– Line protection
– Station Surveillance
– SCADA
– Synchrophasor data
Phoenix™ SG-5000
- Utility grade multi-protocol gateway for substation-to-substation and backhaul communications
- Rack mounted inside station
- QoS enabling traffic priority
- Multi Tier Cyber Security
- HVBPL modems, Fiber ports
- Ethernet and Serial ports
- Serial to IP conversion software
- Patent protected HVBPL technology
- Certified

AmperionNMS
- Outage management
- Fault management
- Performance Data, Statistics, Historical Reports
- Configuration management
- Alerts, alarms

w/Google Earth
- Visual Map
- GPS Accuracy
- Real Time Updates
Amperion HVBPL System Components

Phoenix SG-5000
Two 200Mbps HVBPL modems
Intelligent switch:
- 6 10/100 FE ports
- 2 1000 GE ports (Fiber)
CPU with Amperion embedded SW
DC powered from station battery

Monitors HVBPL modems and links - device and link health
Performance graphs: system up time, throughput, latency
Historical reports: daily, weekly, monthly, yearly
Configuration management: DHCP, TFTP, SW upgrade
Diagnostics features: Ping, Netperf, Syslog, SNMP get/walk
Automatic alerts by email are optional
Integration with other management systems is optional

Coax cable assembly
In the switchyard

HVBPL Coupler

Amperion NMS

Confidential Overview
Amperion Powerline Coupling Products

- **Safe and Reliable**
  - Uses standard utility arresters

- **Efficient**
  - Simple and quick to install
  - No special training required

- **Scalable**
  - From LV 110V to HV 138kV

- **Cost Effective**
  - Lightning protection
  - Low maintenance costs

- **Certified**
  - Tested by AEP

- **Patent Protected**
Communications Enable Smart Grid Applications

➢ **Transmission Application Examples**
  - Real-Time Protective Relaying
  - SCADA Data Collection
  - Station Surveillance
  - Real Time Synchrophasor Data Streaming
  - Substation Automation
  - Data backhaul

➢ **Distribution Application Examples**
  - Sensing & Monitoring
  - Grid Reliability
  - Distribution Automation
  - Asset Protection
  - Integration and control of Distributed and Renewable Generation
  - Demand Response
  - Smart Metering
  - Demand Dispatch