Convergence of DA & AMI

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AMI and DA Convergence

Smart Grid Challenge

A utility's distribution system is controlled by switchgear which includes reclosers, sectionalizers, capacitor bank controllers and voltage regulators

- Installed in Substations and along the Distribution Feeder

➢ The Distribution Feeder is the "challenge"

- Many switchgear elements are controlled by intelligent electronic devices (IEDs)
- Automatic control of the distribution network elements is typically done using a dedicated SCADA system
- Today monitoring & control of remote IEDs requires:
  - Site visits by a technician
  - Installation of a private or public network

Most solutions today are expensive and insecure

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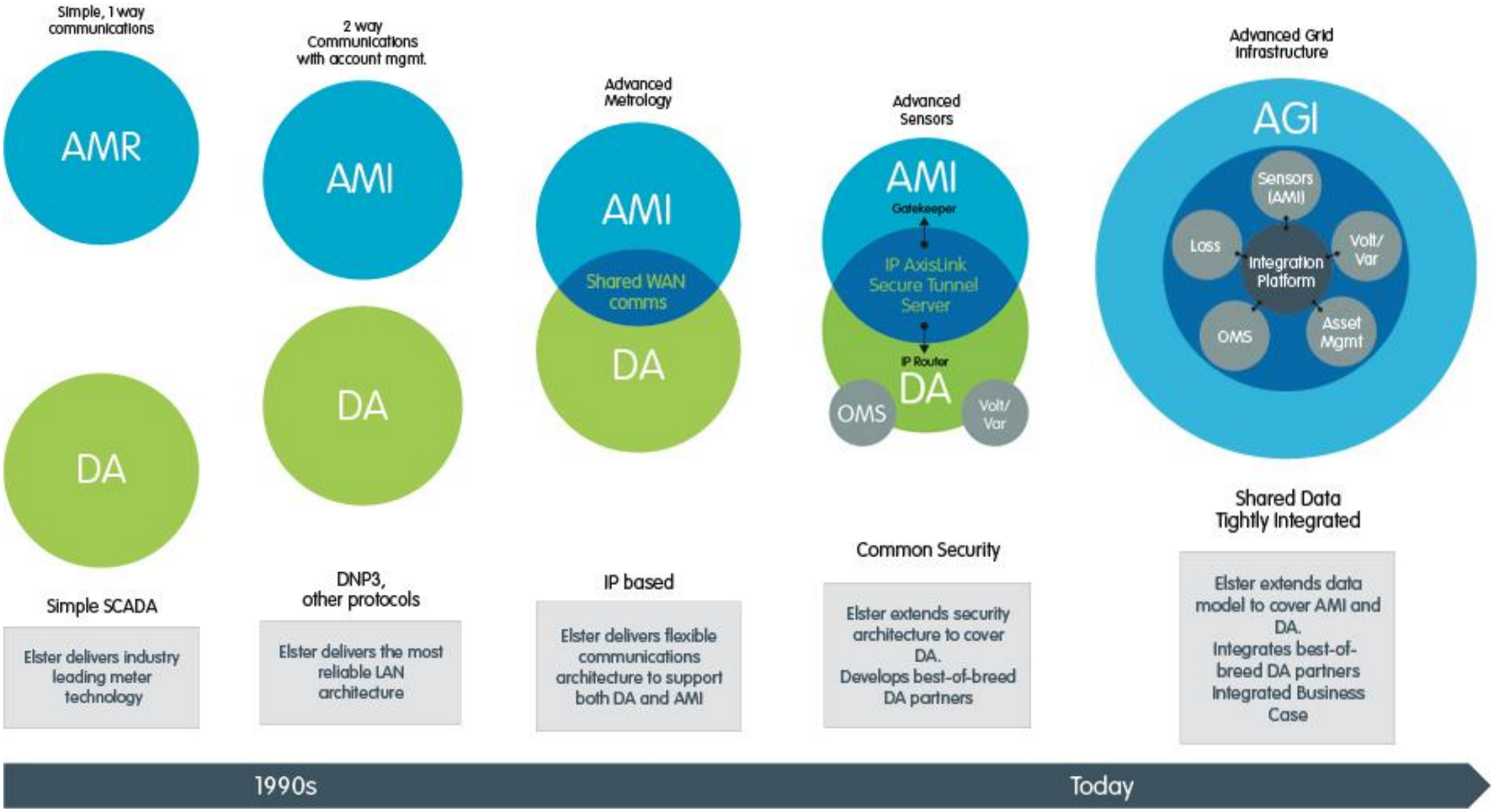
Evolution

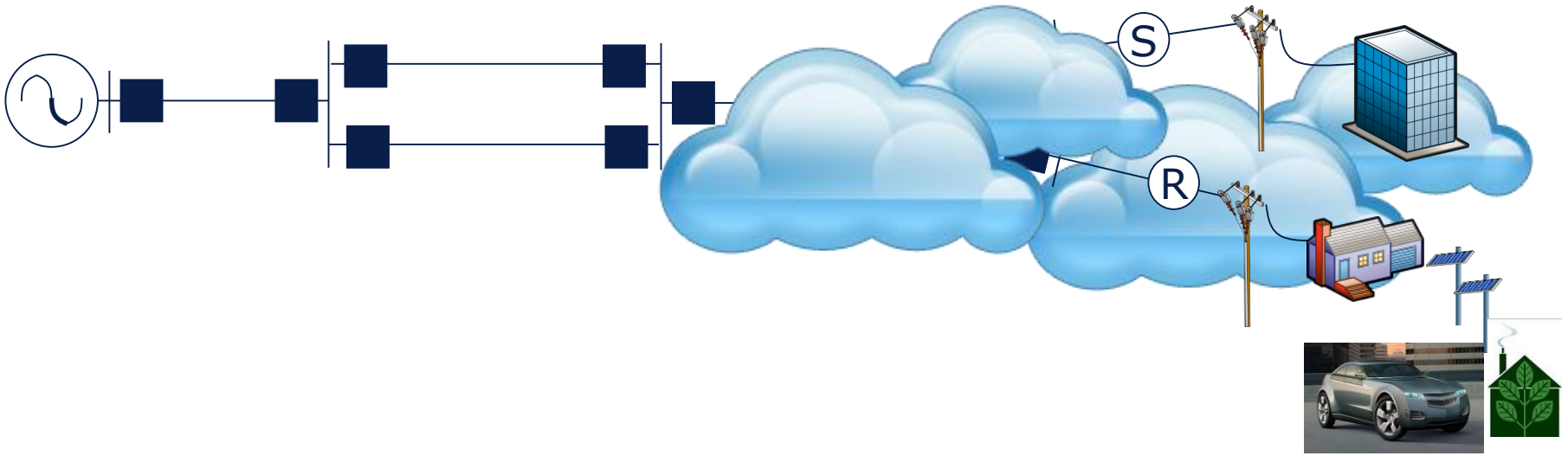


Converging AMI with DA Drivers

Extending Visibility and Control

System Visibility	Utility has little or poor visibility beyond the distribution substation

Generation Transmission Distribution Customer Premise



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Smart Grid Evolution

- Remote visibility and control of a distribution feeder system is a key component of an integrated Smart Grid
- Key Smart Grid challenges include:
  - Integrating stranded remote distribution components on the feeder into the existing SCADA systems
  - IED interoperability based on industry protocol standards
  - Integrated security

Converging AMI with DA Drivers

Distribution Automation Benefits

Benefits:

- Reduced operation and maintenance costs
- Improved reliability
- Power quality
- Improved information and control
- Increased network visibility

Better service!

AMI and DA Convergence
Advanced Grid Router Roles

IP Router functional requirements include:

- Leverage one WAN/FAN for both AMI and DA communications
- Provide a secure, encrypted, and authenticated communications
- Standards based interfaces to field network DA and AMI devices

Plus…

- Support for AMI & DA protocol routing (i.e., DNP 3.0, C12 protocols)
- Legacy DA device support including Discrete Input/Output control for existing and new equipment (RS232, Ethernet)
- Hardened form factor for outdoor feeder and 3rd party DA enclosure installations with battery backup

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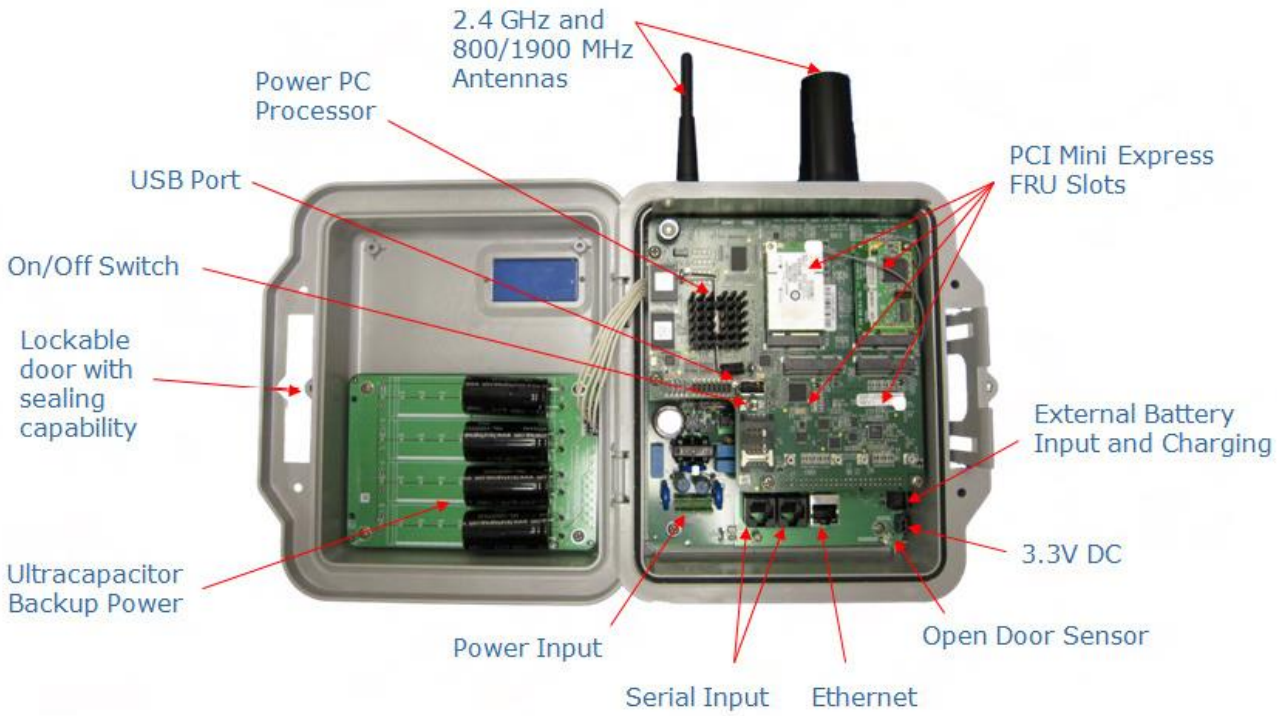
Advanced Grid Router Examples

Itron

- GridRouter – Includes Linux-based O/S Software Developers Kit
- Supports IPv6, ZigBee & WiFI interfaces, Open O/S



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Advanced Grid Router Examples

Metering

Distribution Automation

Home Area Network

LAN
802.15.4
Ethernet
RS232/485
Wi-Fi

WAN
HSPA
EVDO
iDEN

GridRouter™

Utility Back Office

SmartSynch

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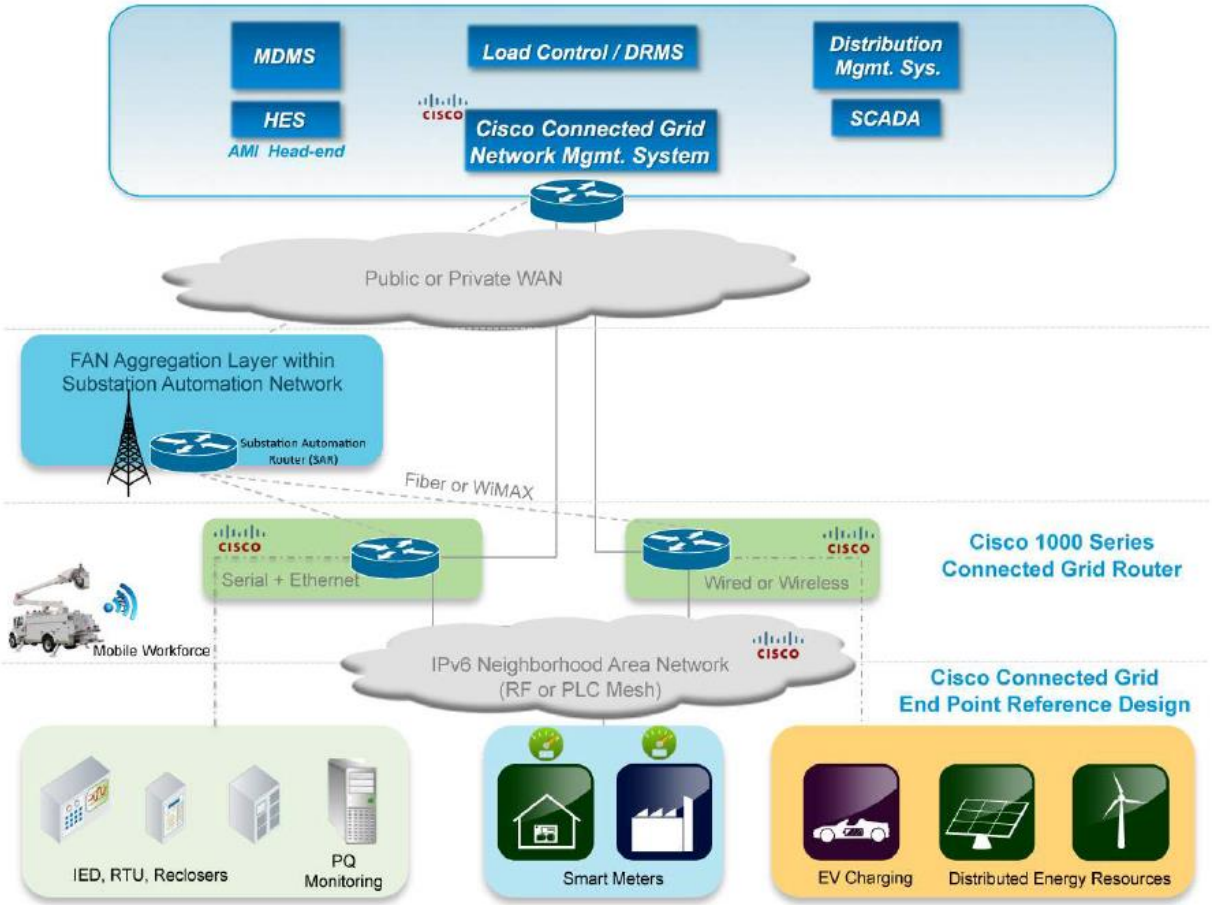
Advanced Grid Router Examples

Cisco 1000 series grid router network



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Advanced Grid Router Examples

ABB - Tropos wireless mesh WiFi grid router

FEATURES AND BENEFITS

- 802.11b/g/n wireless mesh routers and bridges
- IPSec VPN and firewall in every device
- Ethernet or serial device connectivity
- DNP3, Modbus, SEL Mirrored Bits and IEC 61850 support
- Stand-alone and embedded versions
- Tropos Control network management

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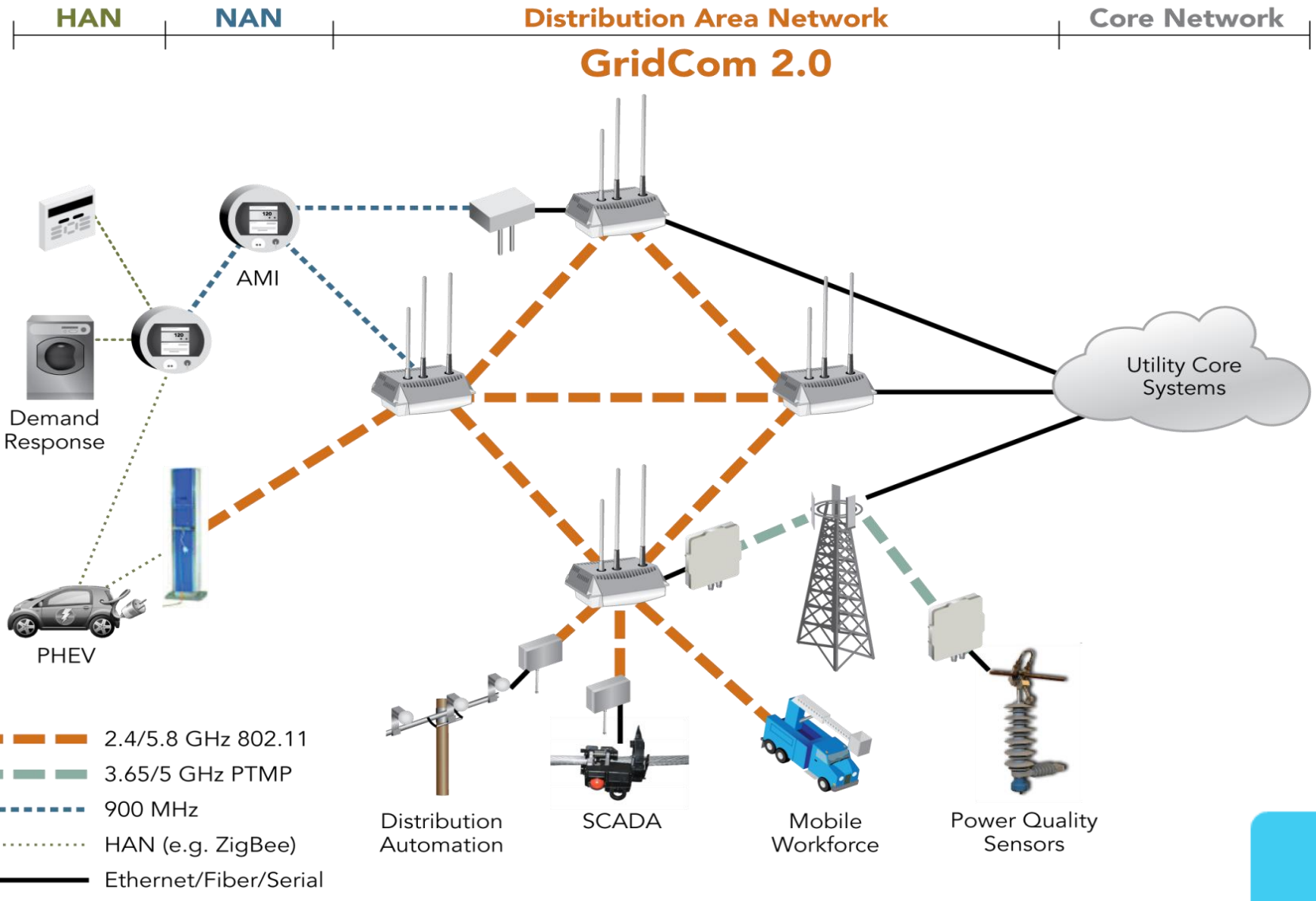
Advanced Grid Router Examples



DA – AMI Network Convergence

Advanced Grid Router Examples

Robust, centralized wireless network management

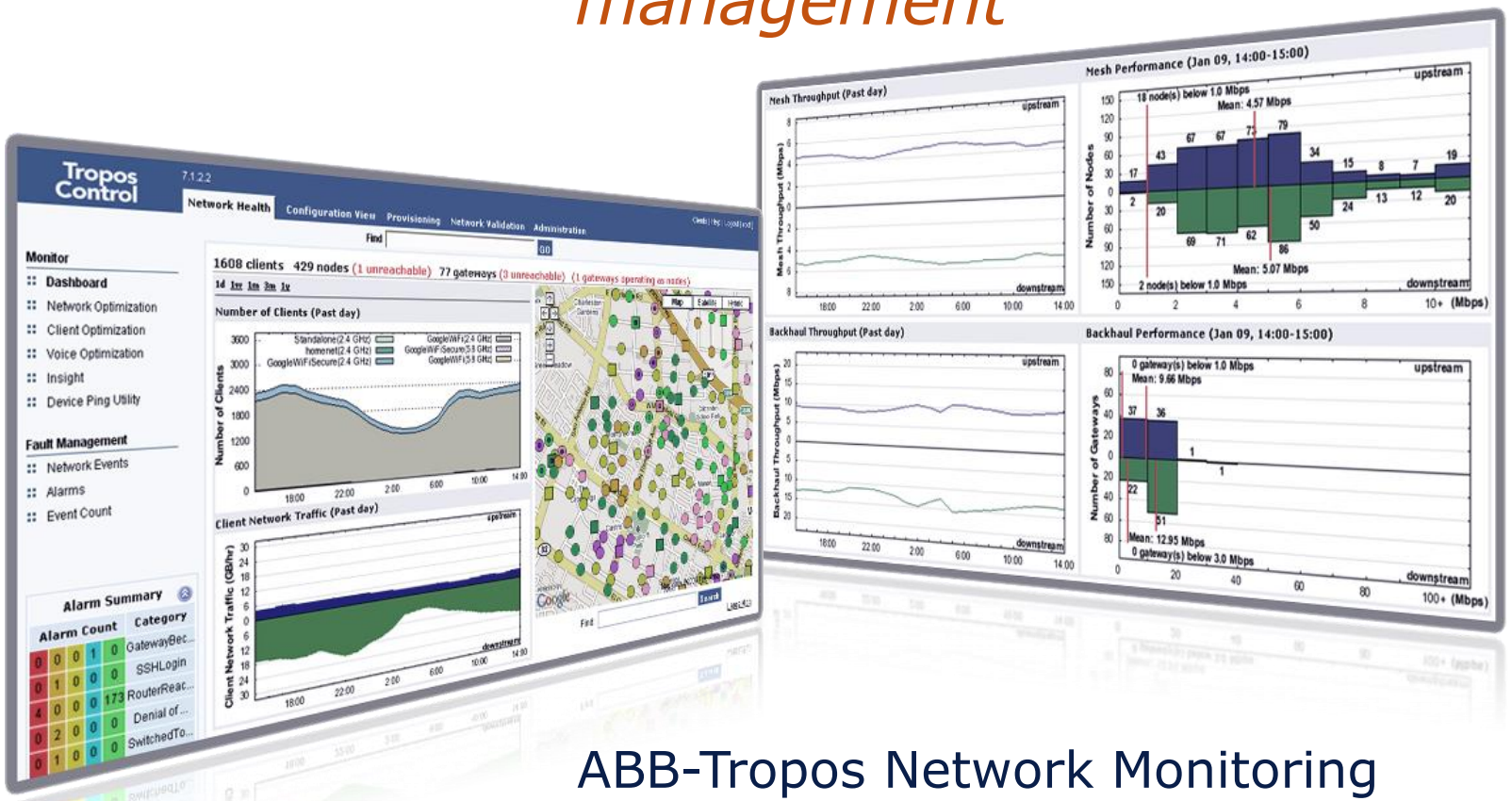


ABB-Tropos Network Monitoring

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Advanced Grid Router Examples

Silver Spring Networks

- Supports device-to-device routing using a WAN Access Point coupled with DA bridges

Features

- Two-way 902-928 MHz FHSS communications
- One-watt transmitter
- Dynamic IP-based network discovery
- Time synchronization and management
- Continuous neighbor monitoring and route calculation
- Supports device-to-back office and device-to-device routing
- Over-the-air firmware upgrades
- Power outage and restoration notification and products

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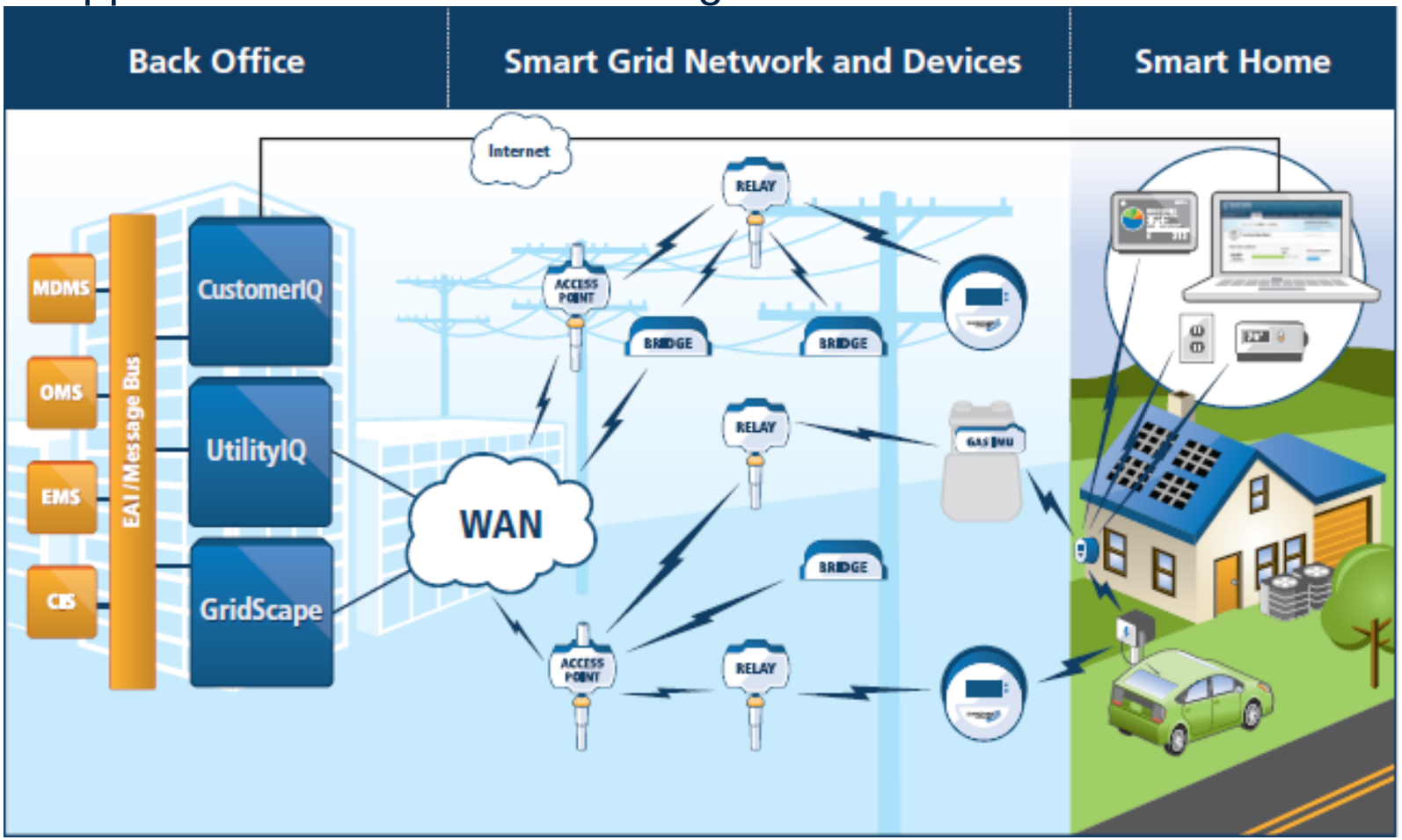
Advanced Grid Router Examples

Silver Spring Network & application management

- Supports device-to-device routing



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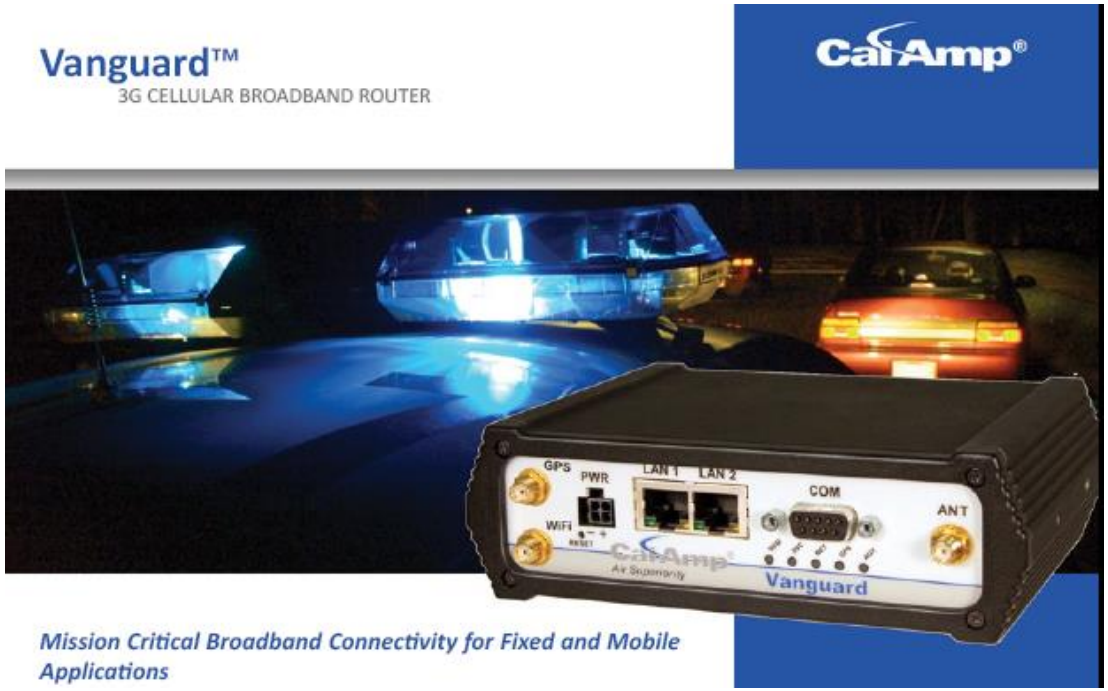
Advanced Grid Router Examples

elster
Vital Connections

CalAmp

- Open Linux O/S
- Hardened communication platform
- Device-to-device routing
- Integrated Discrete Inputs/Outputs



Experience
The Advantage

- Internal web configuration, diagnostics and OTA updates
- Auto redial (always-on connection)
- ODP partitioned flash for custom applications
- GRE and IPsec tunneling, local IP, VPN client and WAN gateways
- Internal serial port for embedded devices
- Optional local and remote GPS for AVL and local mapping
- Wi-Fi option with tethered connectivity

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Advanced Grid Router Examples

Siemens – RuggedCom grid routers & IEEE802.16 WiMAX radios

- Hardened communication platform
- Internal web configuration
- Device-to-device routing

Ruggedcom RX1400
Intelligent Node

RuggedMAX™ WiN7200 is a long range, secure, IEEE 802.16e-2005 mobile WiMAX broadband wireless platform

RUGGEDCOM
RX1400 is a compact Layer 3 integrated switch and router – ideal for large scale, hierarchical networks, capable of transporting data from both modern Ethernet-based IEDs and from legacy or low cost serial IEDs.

EnergyAxis IP AxisLink Platform

IP AxisLink Router/Gatekeeper/Gateway

Install at DA control devices such as reclosers, load tap changers and capacitor bank controllers

Benefits:

- **Interoperable:** routes/tunnels industry standard IP-based & DA protocol messages
  - TCP/IP, UDP/IP,DNP-IP, Modbus-IP, IEC 61850
- **Adaptable:** supports legacy equipment with serial and discrete I/O control via DNP
- **Integrated security**
- **Connectivity:**
  - Ethernet, wireless
  - 3rd party radios

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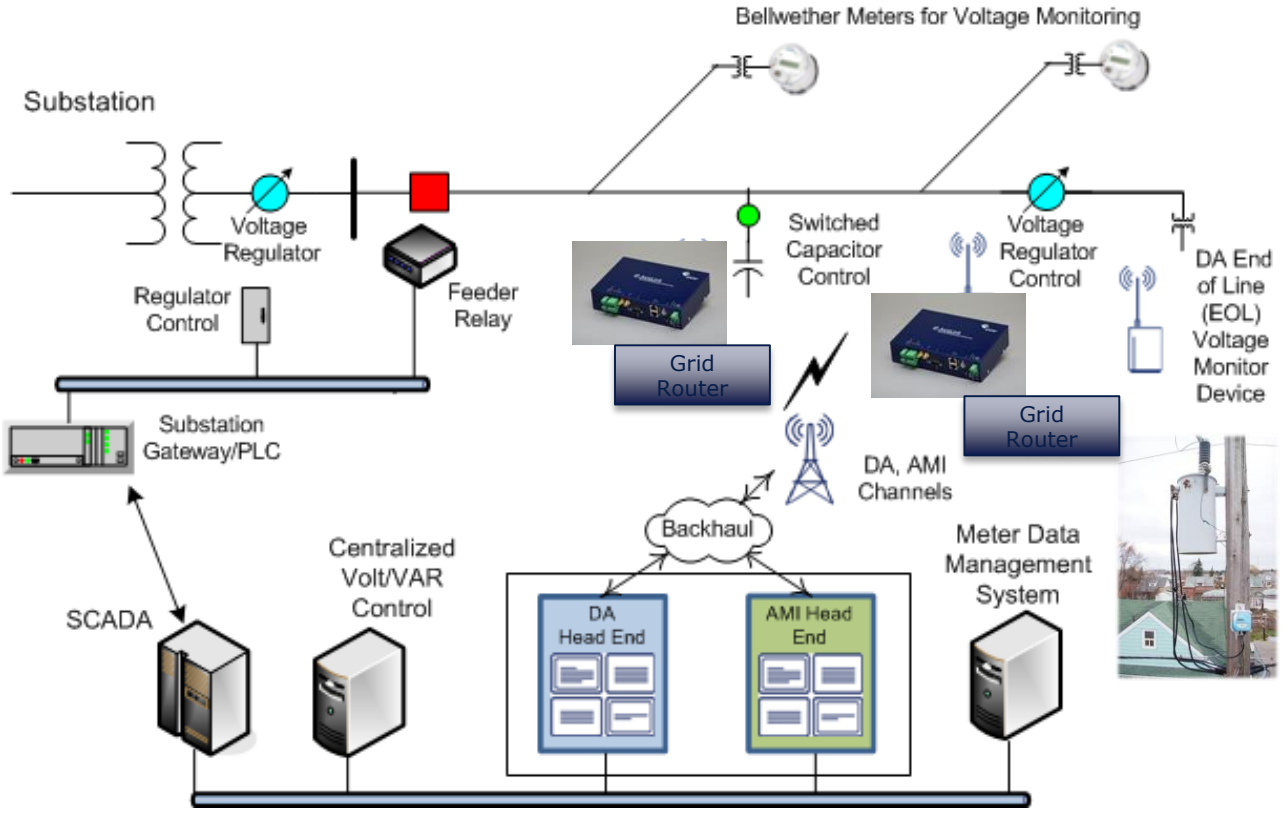
Scenario Examples



Volt/VAR with Bellwether Metering

- Bellwether meters provide voltage data to AMI head end via AMI network
- AMI head end receives voltage data from bellwether meters and EOL transformer monitors forwards this data to the target Distribution Management System application(s).
- Secure Capacitor and Voltage Regulator Control communications provided by AMI grid routers via a shared DA-AMI WAN backhaul

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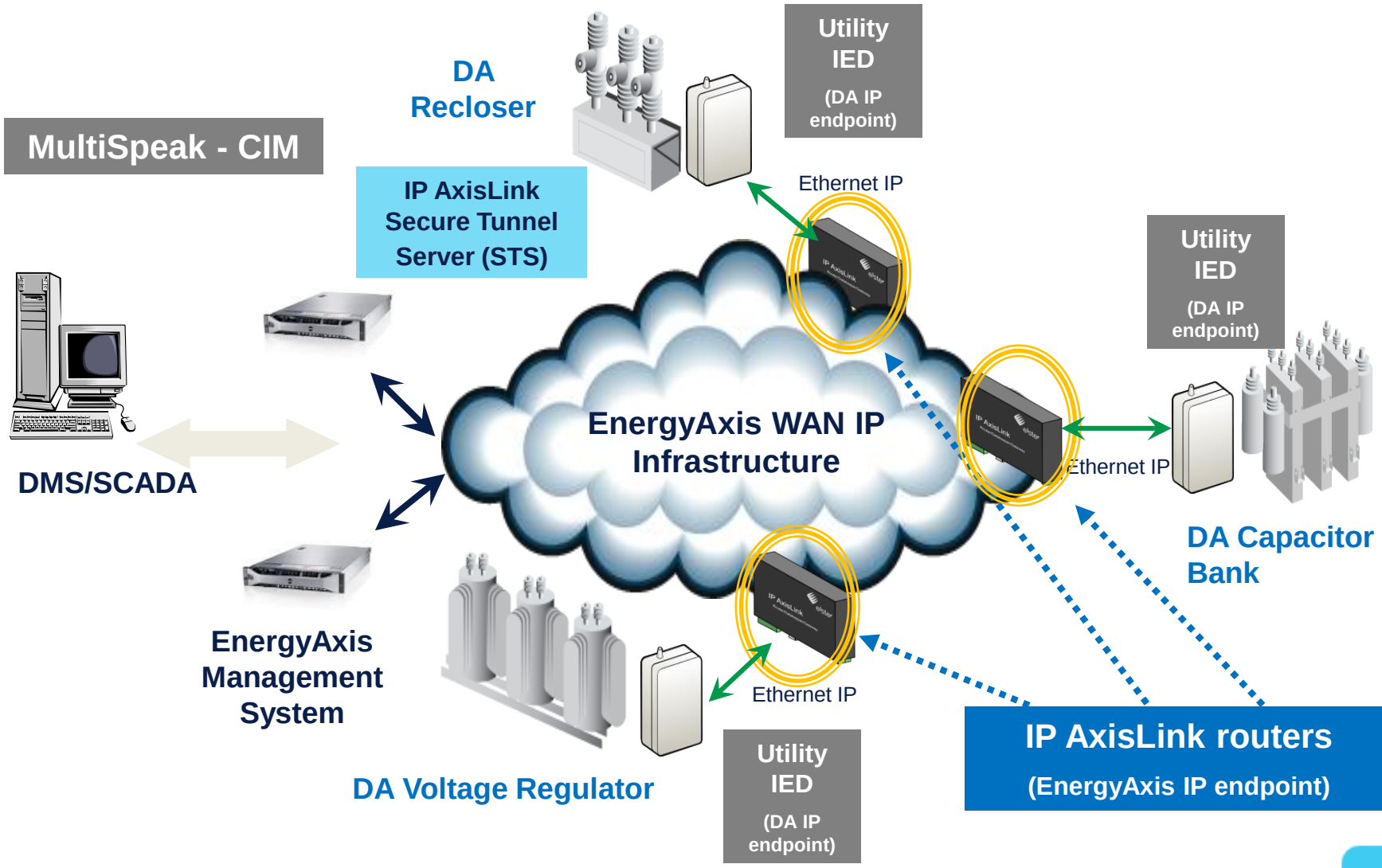
EnergyAxis IP AxisLink



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Transformer Life Analysis

Issue: Utilities have little visibility down to transformers.
Problem: An emergency replacement of a transformer can cost up to $10,000, while a scheduled maintenance replacement is only $1,000.
Solution: Meters can be used as sensors. Meters on homes can be summed to get virtual transformer loading. Meter on the transformer can get actual loading (Rogowski coil sensors)
Transformer monitoring can:

- Be used to calculate shortened transformer life due to overloading
- Can be used to rebalance transformer loading

Note: The same transformer sensing capability can be used for theft detection.

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Transformer Asset Management

LV AGI Node

Distribution Transformer Monitoring

- Monitors distribution transformers
- Monitor voltage, transformer loading, outage

AMI and DA Convergence

Transformer Asset Management

LV AGI Node

A3 Multiplatform Package

Features

- Integrated with Alpha metering platform
- Standard product supports EA AMI LAN
- Fully integrated voltage and current metering
- Continuous current measurement range – Up to 1000A
- Safely and accurately measures 240 V distribution transformer secondary
- Adaptable current sensor assembly with integrated voltage attachment
- Flexible mounting options

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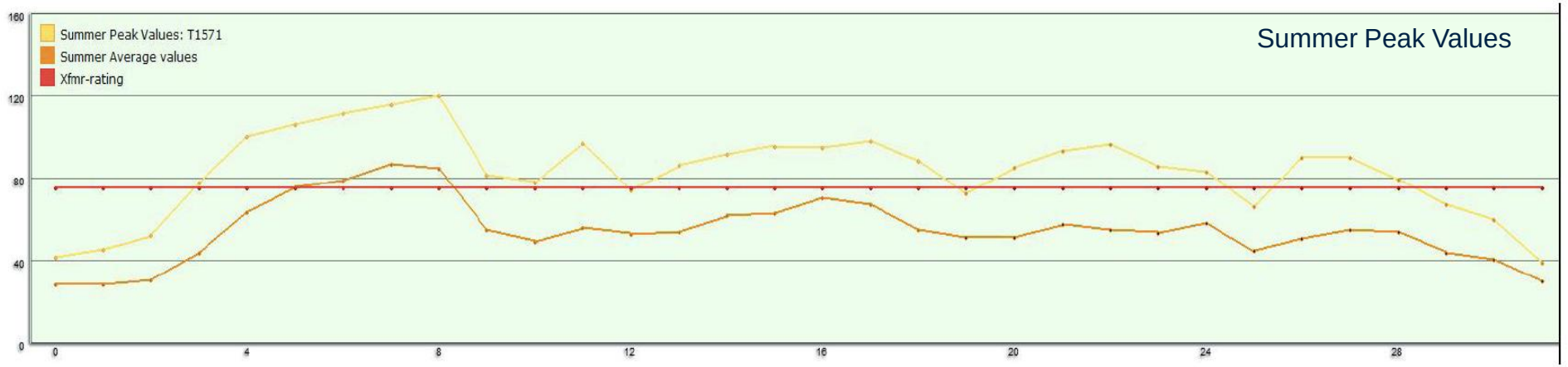
Transformer Life Analysis

Transformer Life Impact - Summary Stats

	Heat Wave Week in July 2010		Another Week in July 2010	
Transformer Rating:	75.0	KVA	75.0	KVA
Peak Demand:	133.2	KVA	100.27	KVA
Peak Demand:	119.88	KW	90.24	KW
Overload:	48	%	12	%
Load Factor Rating:	0.59		0.5	
Use Factor Rating:	1.78		1.34	
Outages:	0		0	
Total Outage Time:	0.0	Minutes	0.0	Minutes
Loss of Life:	6.45	%	0.0	%

**Based on IEEE C57.92-1981 as a starting point*



Summer Peak Values

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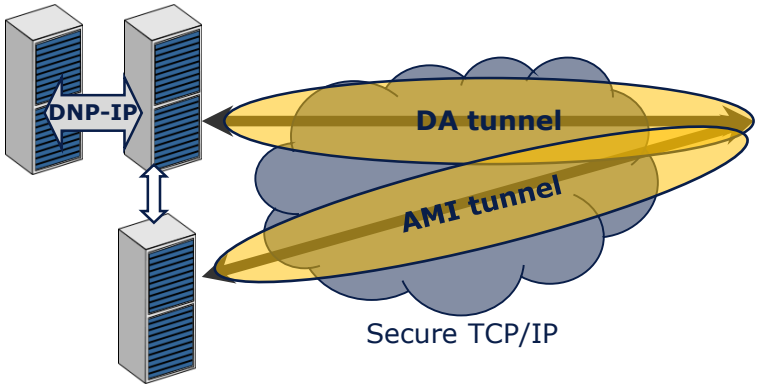
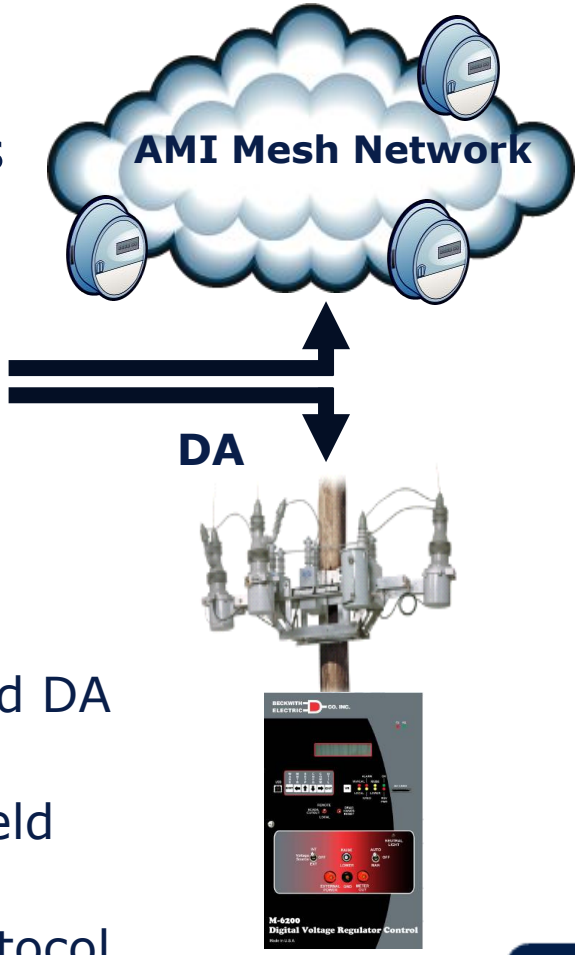
EnergyAxis IP AxisLink

Integrated SCADA and AMI IP-enabled routers





- Leverages one WAN solution for both AMI and DA communications
- Provides multiple secure IP connections to field network DA and AMI devices
- Provides support for combined AMI & DA protocol routing (i.e., DNP 3.0 and C12 protocols)

EnergyAxis IP AxisLink

Feeder Fault Detection

- Integrated within AMI communication infrastructure
- FCI fault information can be passed from AMI head-end to external OMS or DMS applications
- Improves reliability with fast, effective fault location and isolation
- Utilizes the IP AxisLink platform to monitor FCI status

Wireless Fault Circuit Indicator (FCI)

IP AxisLink field device

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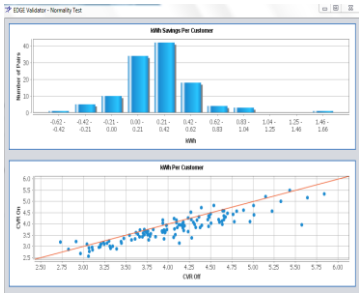
For conservation voltage optimization / reduction

To Billing and Customer Information Systems

MDM

Connexo NetSense

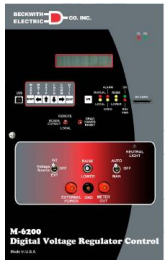
SCADA / DMS



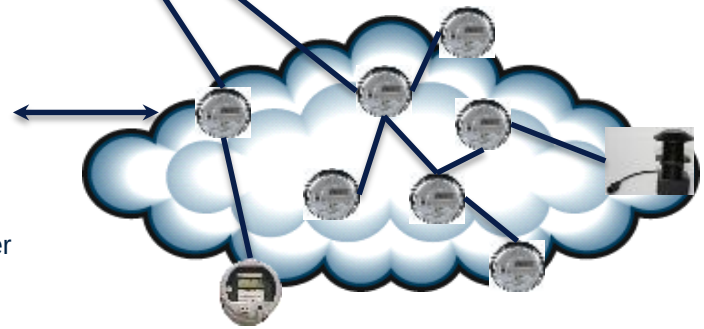
WAN

- Voltage management solution uses voltage data from key monitoring points along the feeder
- Elster network is used to communicate with IEDs in the field to control voltage.
- Energy savings result from lowering voltage where possible. (For 120 V systems, 1V reduction results in ~0.8% reduction in energy)

SCADA control system:
control load tap changers,
voltage regulators
capacitor banks



Edge Router



RF NAN

Thank you