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Charting a Course to Energy Independence

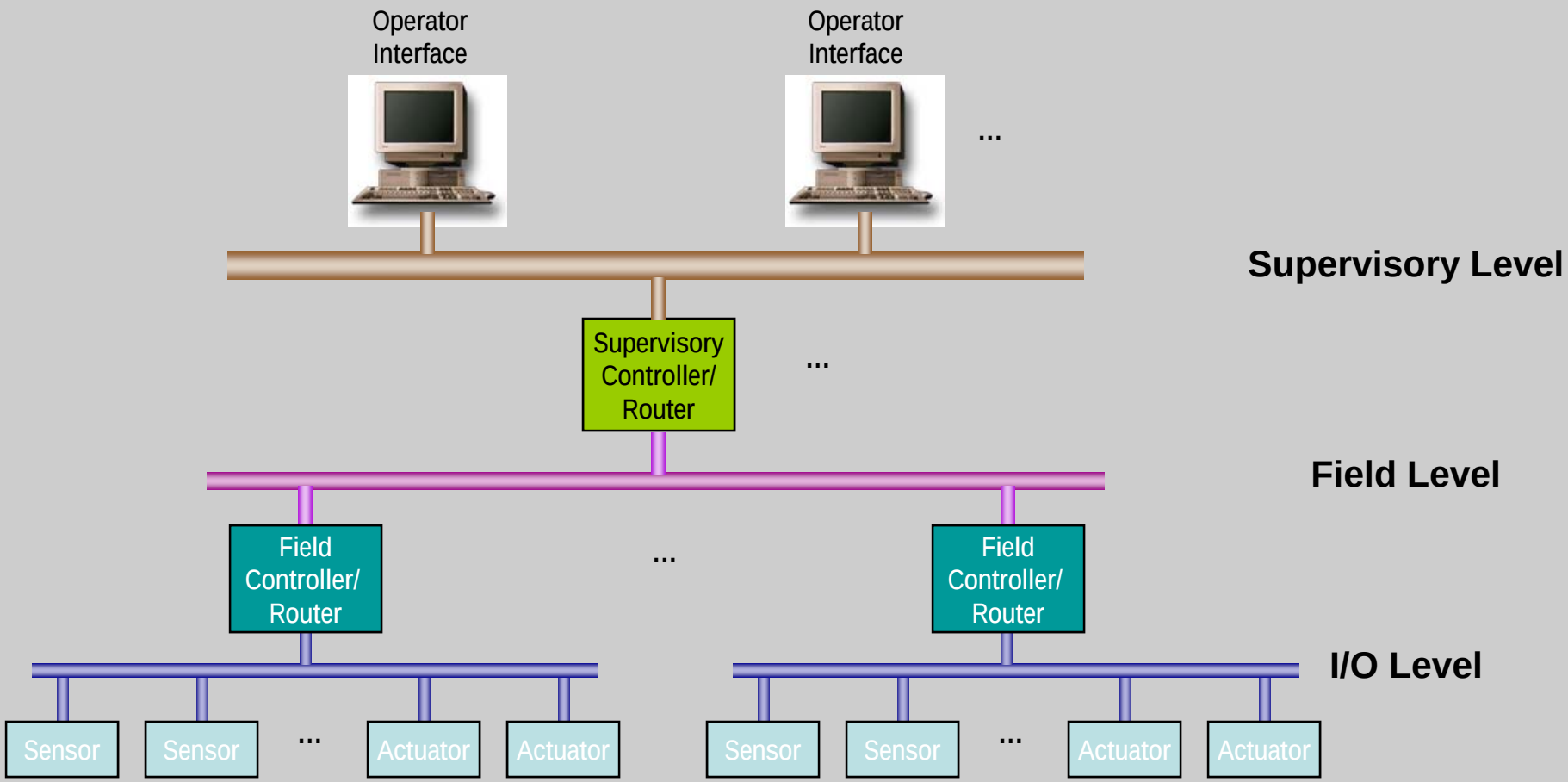
Providence, RI
August 9-12, 2009

Smart Grid Innovation

Session Overview – Part II

- LonWorks – Open Systems
- Energy Aware Devices
- Smart Grid Connectivity
- Next Gen LW's Hardware (LonWorks 2.0)
- Success Stories and Getting Started

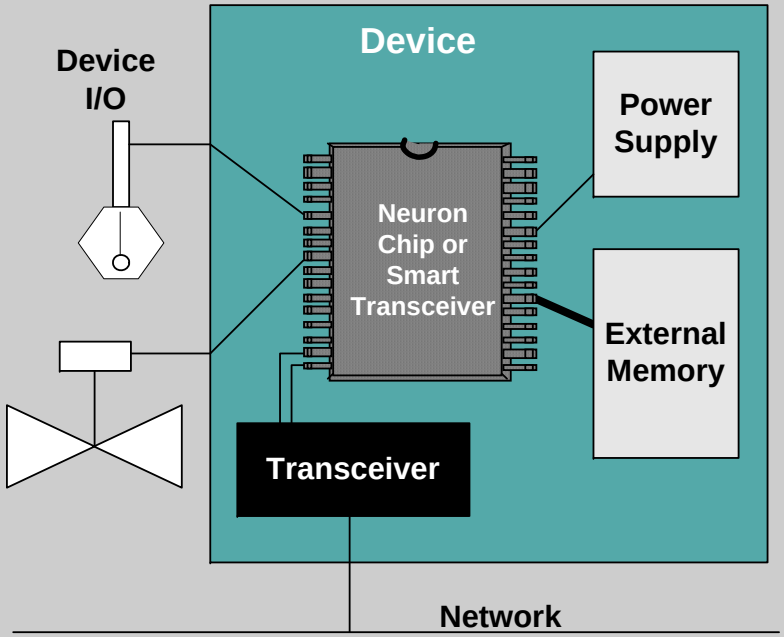
A LonWorks Control Network



Intelligent devices communicating using a common protocol over one or more media

A LONWORKS Intelligent Device

- Devices may include actuator, sensor, controller, or combination functionality
- Devices typically contain a Neuron chip and a transceiver
- Devices include a logical interface
  - Functional blocks
  - Network variables
  - Configuration properties



LONWORKS Platform Applications

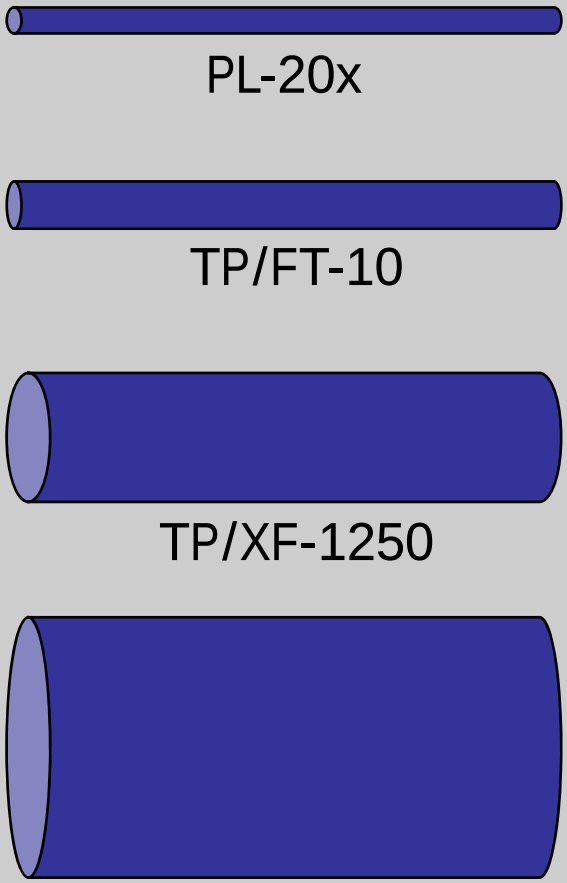
- Building automation
- Energy management
- Street lighting
- Home energy monitoring and control
- LED lighting
- Quick Service Restaurants
- Retail stores
- Renewable energy
- Sub metering
- Demand Response (DR)
- Industrial automation
- Transportation
- Machine-to-machine

Typical LonWorks Channel Capacities

	PL-20N (3.6/5.4 kb/s)	TP/FT-10 (78 kb/s)	TP/XF-1250 and FO-20 (1.25 Mb/s)	IP-852 (10/100 Mb/s)
100% No Collisions	~14 pps	~227 pps	~850 pps	
84% Maximum Throughput	~12 pps	~192 pps	~720 pps	15,000 pps or greater
67% Sustained Throughput	~9 pps	~153 pps	~576 pps	
50% Design Guideline	~7 pps	~115 pps	~425 pps	

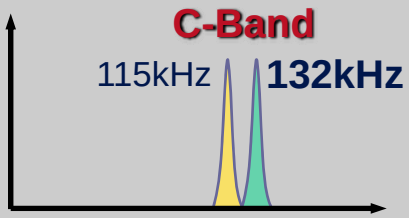
pps: packets per second (average packet = 15 bytes)

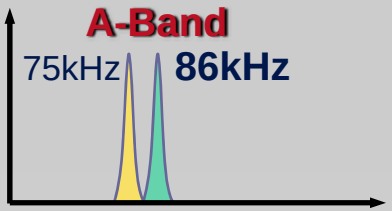
IP-852 estimate based on 46 byte minimum payload



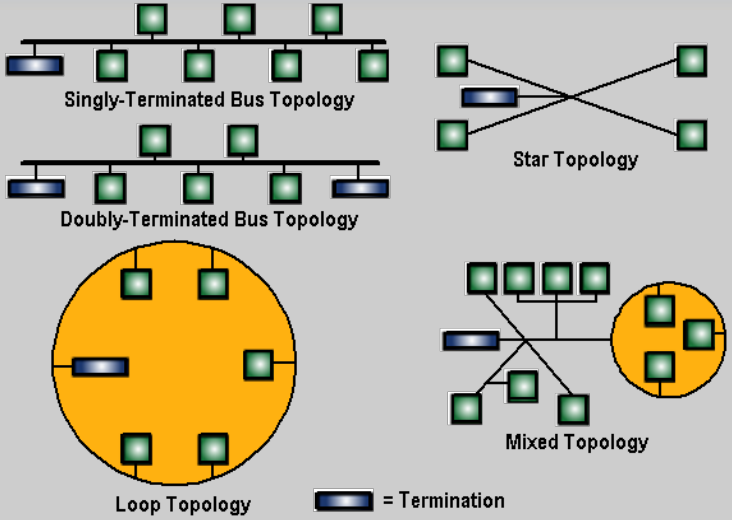
Power Line—PL-20

- Advanced technology for reliable communication
  - Dual carrier-frequency operation
  - Digital signal processing
- Worldwide operation
  - Meets FCC, Industry Canada, Japan MPT, and European CENELEC EN50065-1 regulations
  - ISO/IEC 14908-2 compliant
- European utility support
  - Dual frequency DSP performance in the A-Band for AMR/DSM applications
- Available in cost-effective device-on-a-chip
  - Transceiver, application processor, memory
- Proven technology
  - Millions of devices installed worldwide





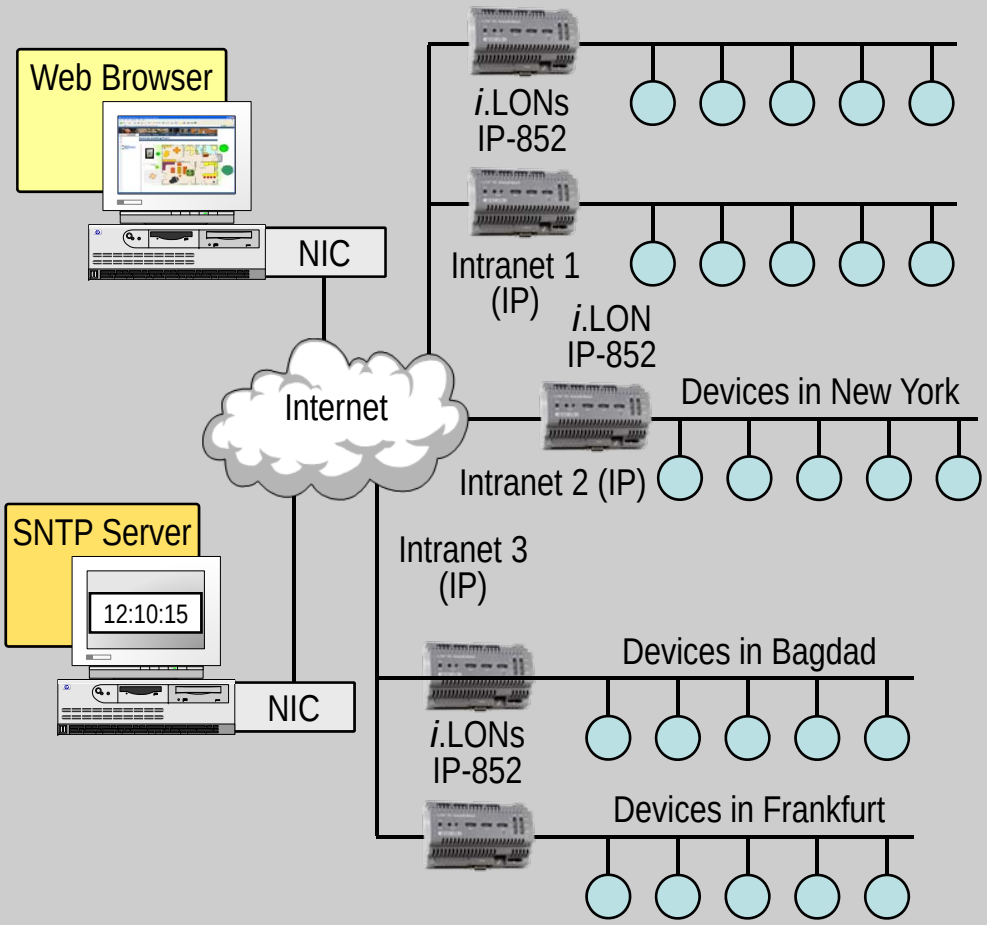
Free Topology Twisted Pair—TP/FT-10



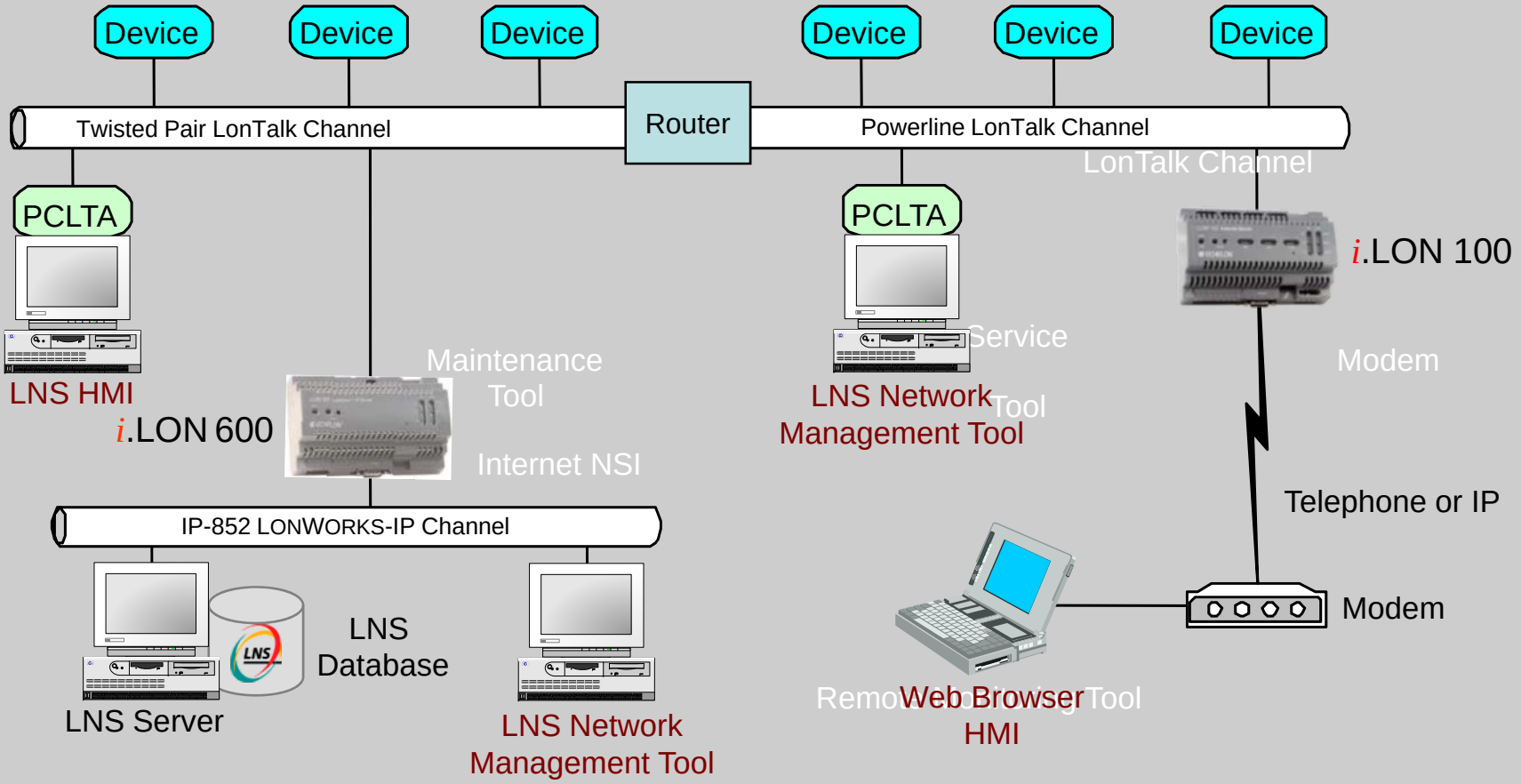
- Defined by *ANSI/CEA-709.3-A Free-Topology Twisted Pair Channel Specification*
- Media is free topology twisted pair with optional link power
  - Supports commonly available unshielded and shielded 0.50mm (24AWG) to 1.3mm (16AWG) twisted pair wires
  - Polarity insensitive wiring with optional link power
  - Reduces installation and maintenance costs
- Up to 64 devices on a single network segment
  - Or 128 devices along with a link power source
- Available in cost-effective device-on-a-chip
  - With all-in-one transceiver, application processor, and memory

IP-852 / Wired and Wireless Ethernet

- Internet to LONWORKS (*i*.LON devices) can be used to create one network by connecting remote locations over ANSI/CEA IP-852 channels
- Up to 256 LONWORKS IP-852 devices per channel
- Devices can receive data from any other
- Monitor 1000s NVs per second

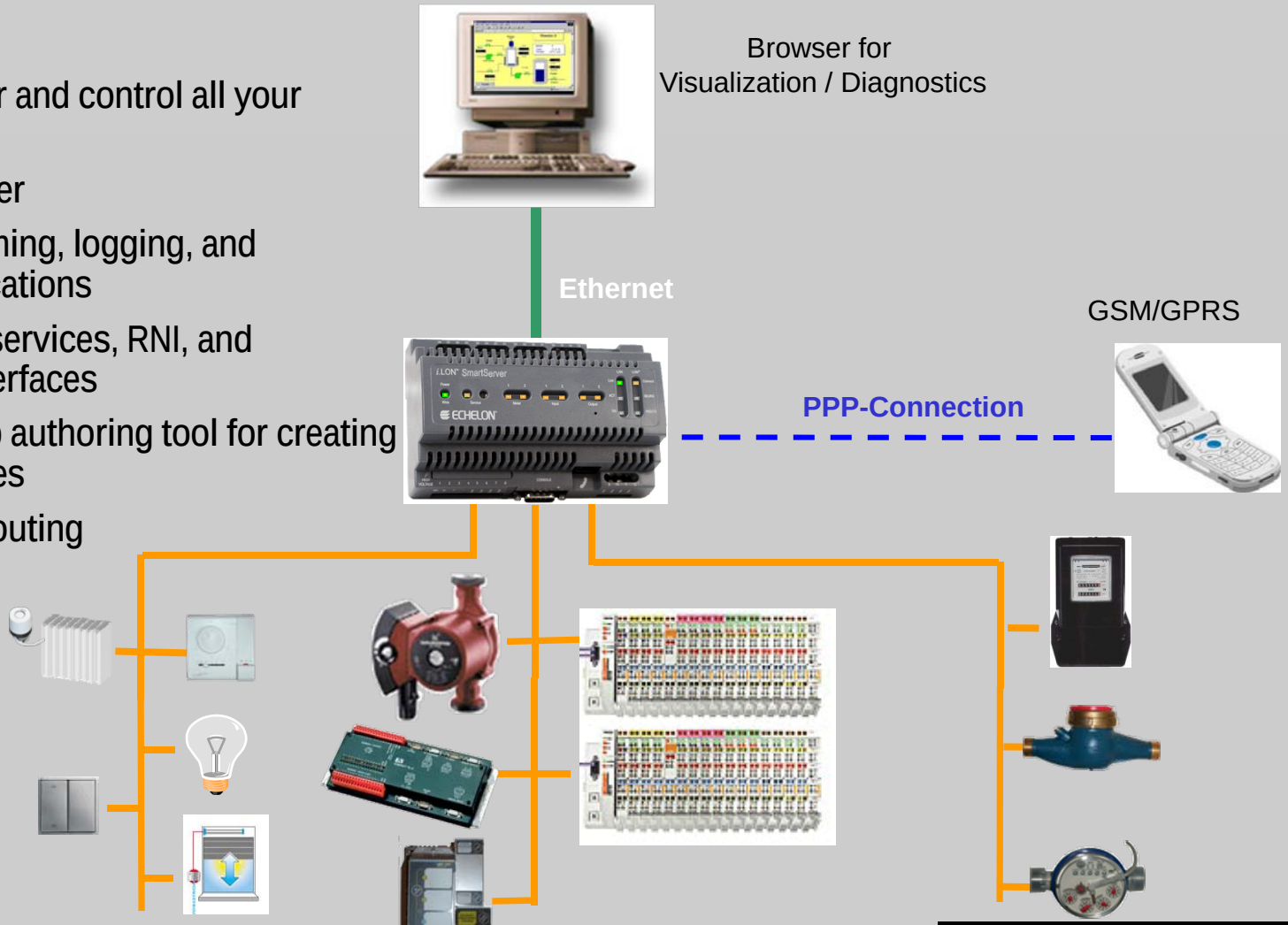


LONWORKS Network Architecture

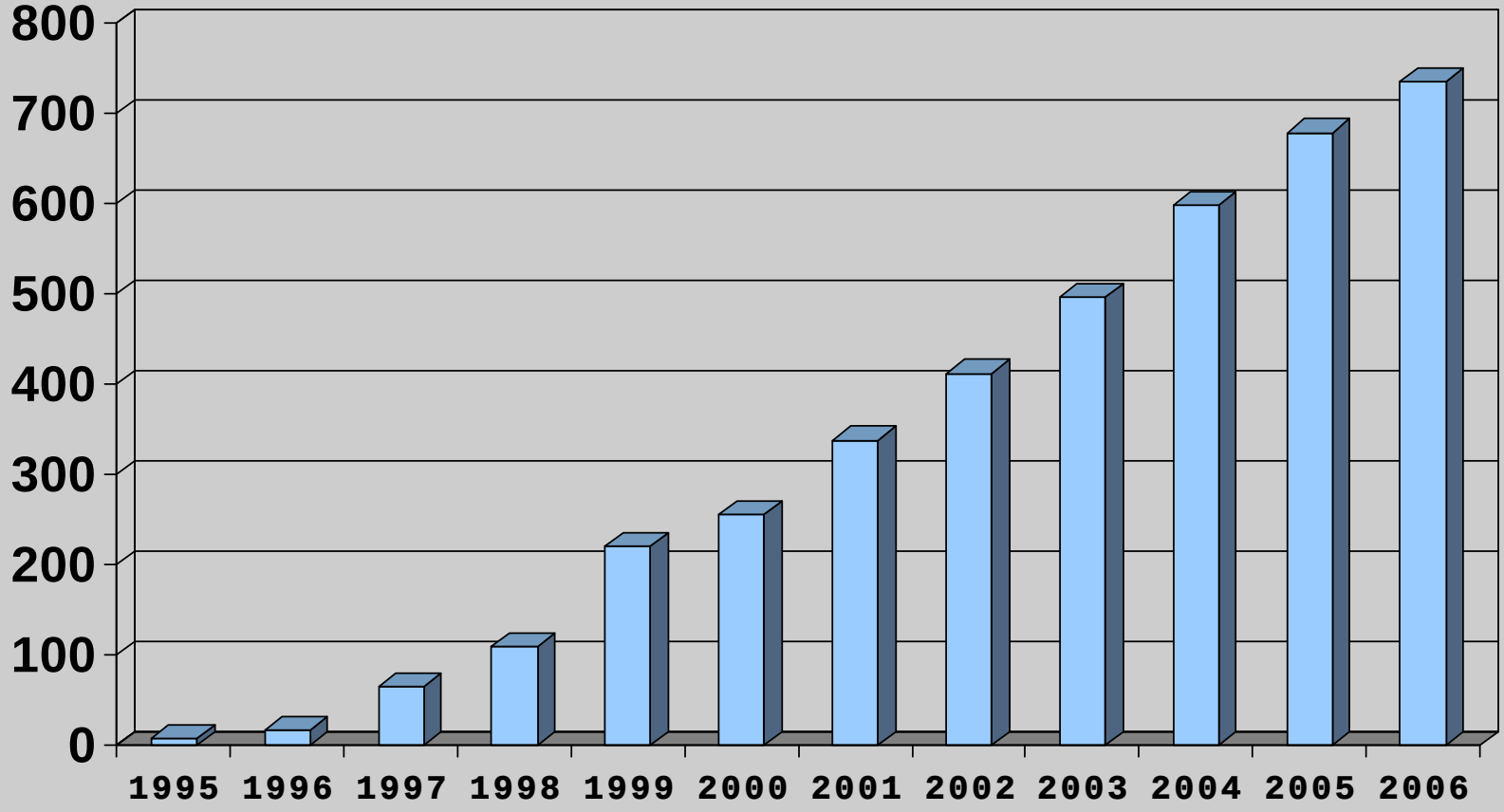


i.LON SmartServer Integrates Diverse Networks

- Remotely monitor and control all your devices
- Built-in Web server
- Scheduling, alarming, logging, and integration applications
- SOAP/XML Web services, RNI, and LonScanner™ interfaces
- *i*.LON Vision Web authoring tool for creating custom Web pages
- Optional IP-852 routing



LonMark Certified Products



*includes certifications in process

HVAC Products

PRODUCT	DESCRIPTION
ST-31-F/-31-P	Thermostat
EC-STAT	Thermostat
Model 1150-1250	Network temperature transmitters
PentaSens	Multifunction detector for room control
S-ADR112-F	2 UI's, 2 AI, 2 AO, 2 DIO, 3 relays
S-EC230-F	5AI, 4 AO, 7 DI, 7 DO
Model 200	Temperature/Relative humidity probe
FCX	LonWorks fan coil controller
AM24LON	18Nm Damper Actuator
GM24LON	36Nm Damper Actuator
AF24LON	15Nm Damper Actuator
NV24LON	1000N/800N Valve Actuator
NVF24LON	800N Retracting Valve Actuator
NVF24LON-E	800N Extending Valve Actuator
AV24LON	2000N Valve Actuator
NVS24LON	1200N Valve Actuator
AVS24LON	2000N Valve Actuator
UK24LON	Belimo MP-Bus to LON
Xenta 101/102-ES/103/104	Zone Controllers
Xenta 101-VF	3-Speen Fan Coil Controller
Xenta 102-AX VAV	Controller with Actuator and Airflow Transducer
Xenta 110-D	Dual Zone Controller
L-Combo	Temp and Humidity Sensor
100-07P	Thermostat
EC-FCU-L	Fan Coil Controller
EC-RTU-L	Roof Top Controller
EC-HPU-L	Heat Pump Controller
UHC-320	VAV Controller Single Duct
SCC-200-UVC	Unit Ventilator Controller
EC-VAV-L	VAV Controller

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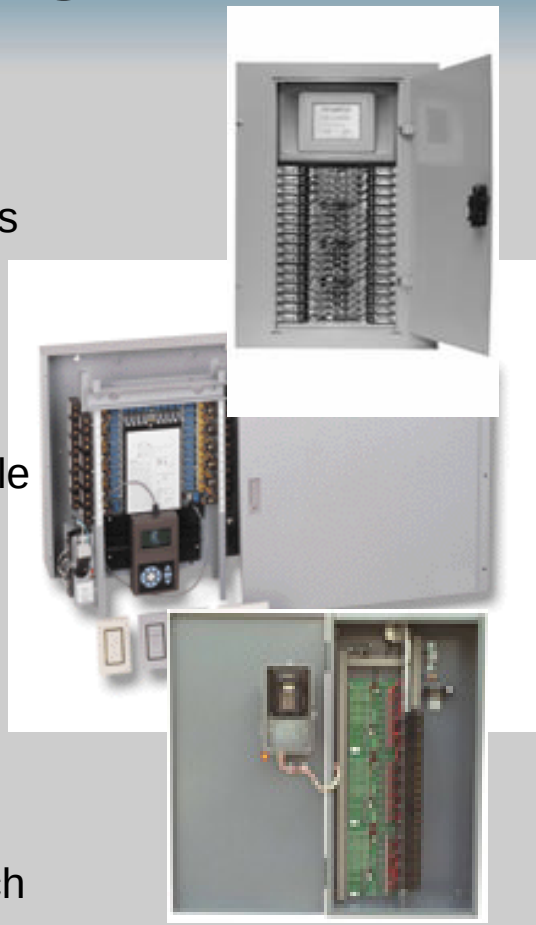
Mike Gibson – Echelon

Source: Engenuity Systems Inc.

Lighting Controls

PRODUCT	DESCRIPTION
WNX-2624	8-72 relay lighting control panels
Lightpoint	Lighting system
SL-ARP-F	2 relay lighting controller
SL-ACPxx-xxxF	8-48 relay lighting control panel
PentaSens	Multifunction detector
LC2	2-Channel light controller module
DaliLon system	LON infrared remote control
HIWS4-2	4 Button Wall Switch
4404L	4 Channel Digital Dimmer
SIMLXTB Interface	Touch Tablet Panel User
Simplicity LX	LonWorks Lighting Panel
LX Switch	Programmable LonWorks Switch



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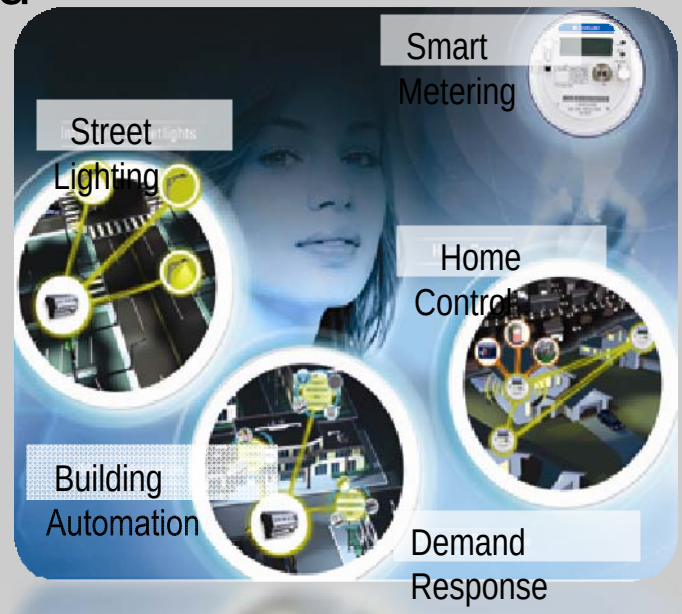
Source: Engenuity Systems Inc.

LonWorks Applications

Products for Energy Network Applications

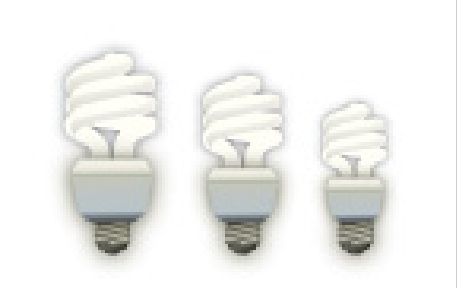
- Leader in technology for control and energy awareness
  - An ISO global standard for control
  - Over 80 million devices installed
  - Utilized in buildings, homes, factories, utilities, and cities



- The smart grid foundation
  - Smart metering technology for over 30 million homes
  - Energy aggregator for DSM

Energy Aware (Smart) Devices

Advantages of Smart Devices:



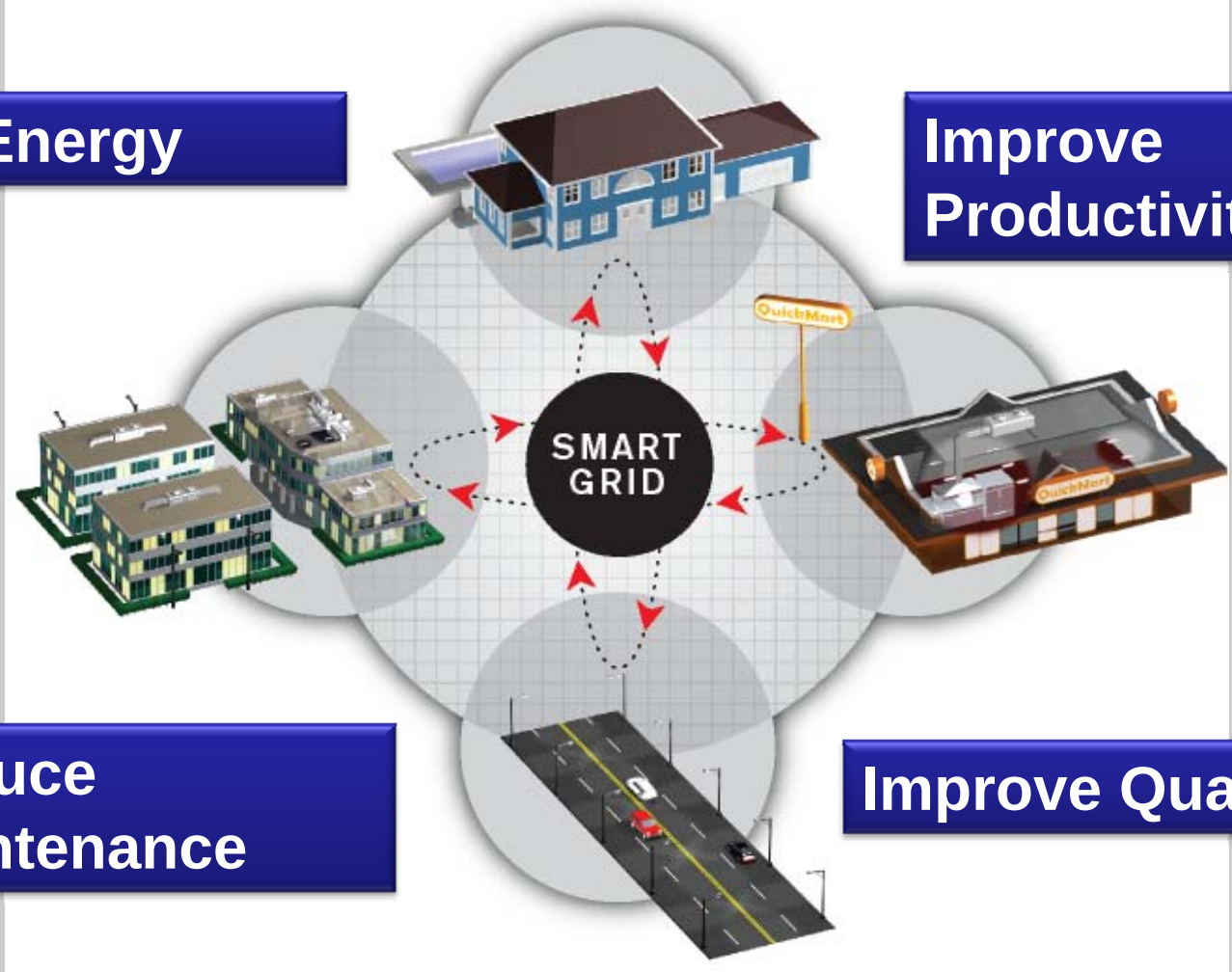
- Runtime reporting
- Maintanence/Replacement
- Energy savings
  - Energy use based on both scheduled usage and real-time activity.

LonWorks Smart Grid Vision

When Everything Is Energy Aware

Save Energy

Improve Productivity



Reduce Maintenance

Improve Quality

NES Metering System

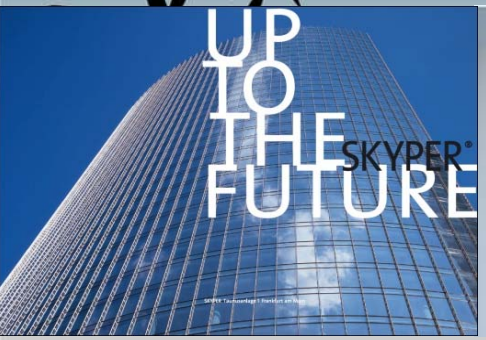
Smart Grid System based on LonWorks Power Line Technology

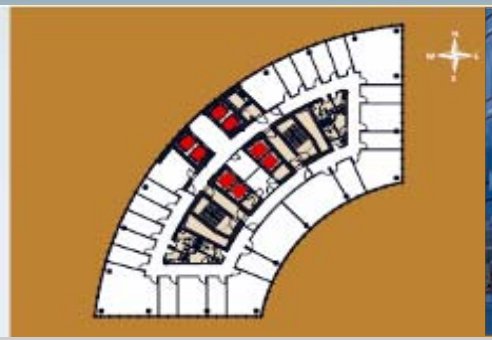
- A metering infrastructure that delivers core services such as:
  - Automated meter reading
  - Outage detection
  - Theft and tampering detection
  - Very accurate data collection
  - The industry's highest level of reliability
  - Extensibility from 10,000s to millions of customers

Over 30 million PL meters installed!

Selected by Duke Energy as Smart Grid solution.

The LONWORKS Platform in BMS

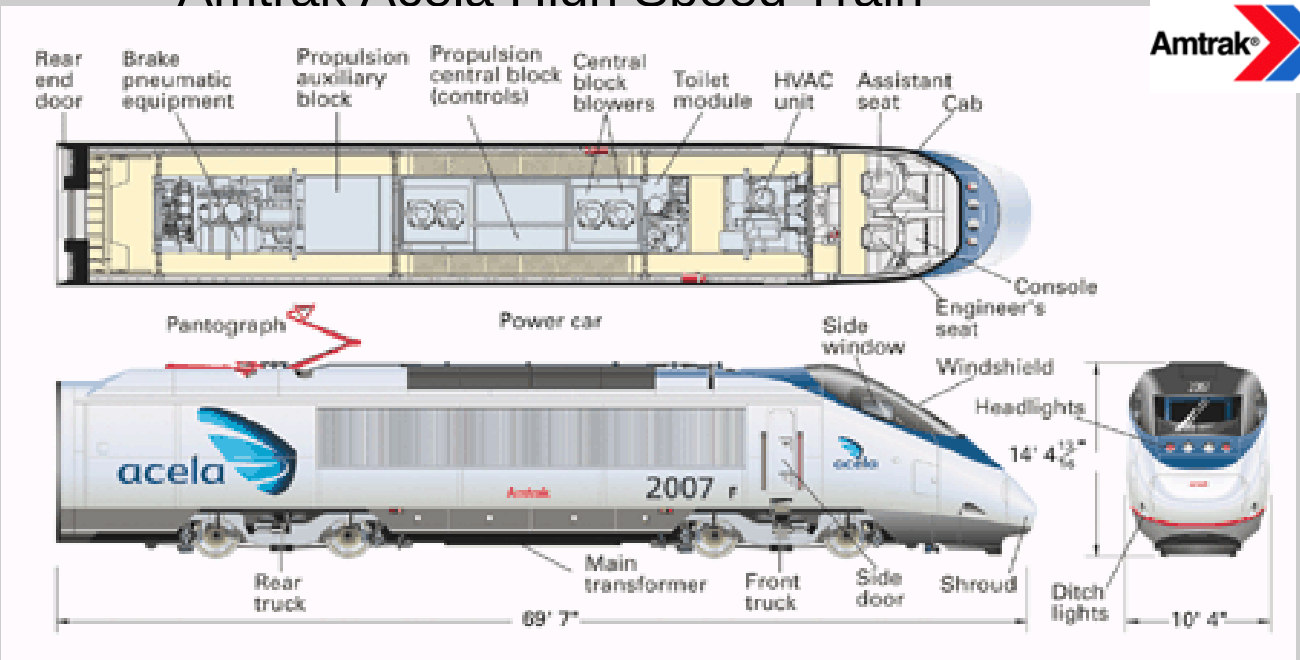




- Adopted by thousands of companies
  - Honeywell, Kieback & Peter, MERTEN, Siemens, SPEGA, TAC, etc.
    - HVAC and room lighting control
    - Access control and security etc.
    - Elevators
  - Lower maintenance cost
  - Asset Management
  - Remote monitoring
  - Optimized energy efficiency
- Ideal for energy management applications
  - Monitor and Control consumption
  - Devices, Buildings, Homes, Municipalities etc.

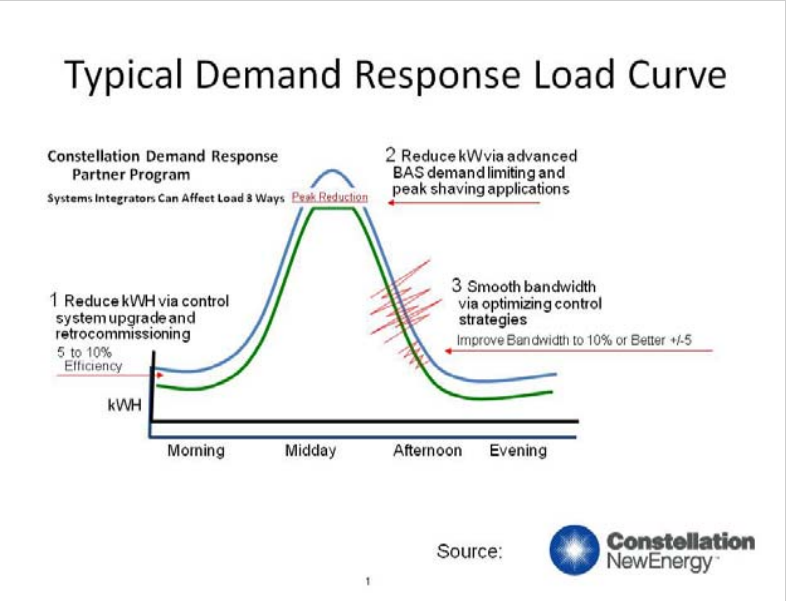
Transportation

Amtrak Acela High Speed Train



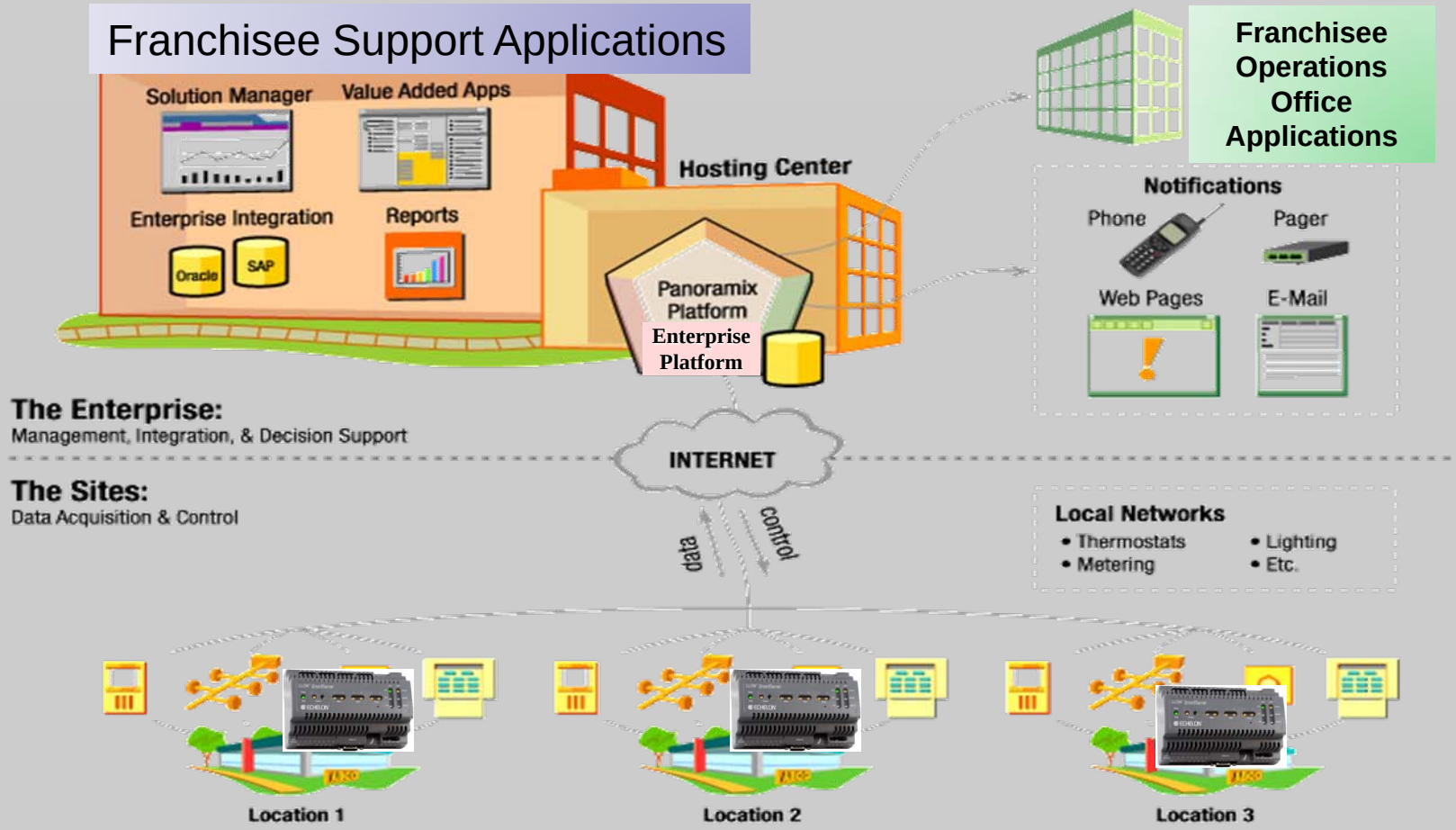
- High speed tilting train service between Boston, New York, and Washington, D.C.
- Built by Bombardier, uses FT-10 free topology twisted pair channel to monitor and control propulsion, power inverters, braking, fire protection systems, ride stability, safety, and comfort.

LONWORKS Enables Energy Aware Solutions



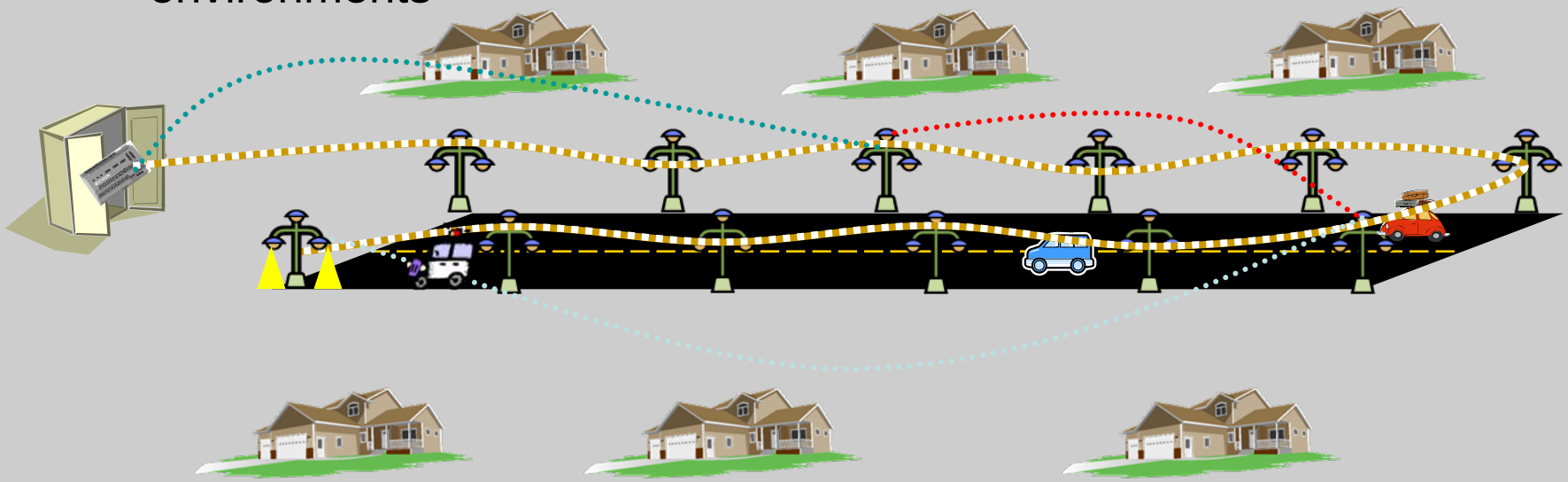
- Buildings react automatically to changes in energy demand
- Street lights deliver more energy efficiency, greater safety and lower maintenance cost
- Utilities benefit from real-time access to energy demand, outages, tampering and theft
- Consumer products react automatically to changes in energy prices
- Demand Response and virtual power plants
  - Utility programs and services to decrease energy use in real-time

LonWorks Solutions Scale



The *i*.LON SmartServer Improves Performance

- Any electrical environment is now suitable for controls
  - Powerline repeating seeks out and utilizes the best communications path
  - Reliability in extremely noisy environments on par with quiet environments



Managed Street Lighting

- Up to 70% reduction of energy use
- Lower operating and maintenance costs
- Improved security
  - Individual control of light output und to meet traffic and weather conditions (on/off and dim)
  - Brighter lights at crosswalks, accidents or other danger spots
- Predictive maintenance and replacement of light bulbs
  - Failing bulbs use approximately 3x more electricity
  - Improved security
  - Lower maintenance costs
- Improved city aesthetics

Smart Kitchen Equipment McDonalds

- Smart Kitchen
- 30.000 restaurants in 120 countries
- Goal:
  - Meet requirements of the food-safety regulations in an efficient way - HACCP (Hazard Analysis & Critical Control Point)
  - Optimize business processes – lower operational costs
  - Increase revenue
  - Lower energy consumption

McDonald's *LonWorks Connected Kitchen*

In-Store Applications

- Food Production Management
- Product Quality Monitoring
- Equipment Configuration
- Crew Management
- Customer Interface

Enterprise Applications

- Operations Management
- Inventory Management
- Product Development
- Equipment Performance
- Remote Diagnostics & Repair

Firewall / VPN / Router

Store Ethernet / IP LAN

i.LON SmartServer

FT-10

FT-10 / PL-20 Router

Embedded Production Supervisor

- Production Alarm Management
- Operations Scheduler
- Data Logging

PL-20

HVAC

Lighting

Refrigeration

Signage

Drive-thru Control

Kitchen Equipment

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Mike Gibson – Echelon

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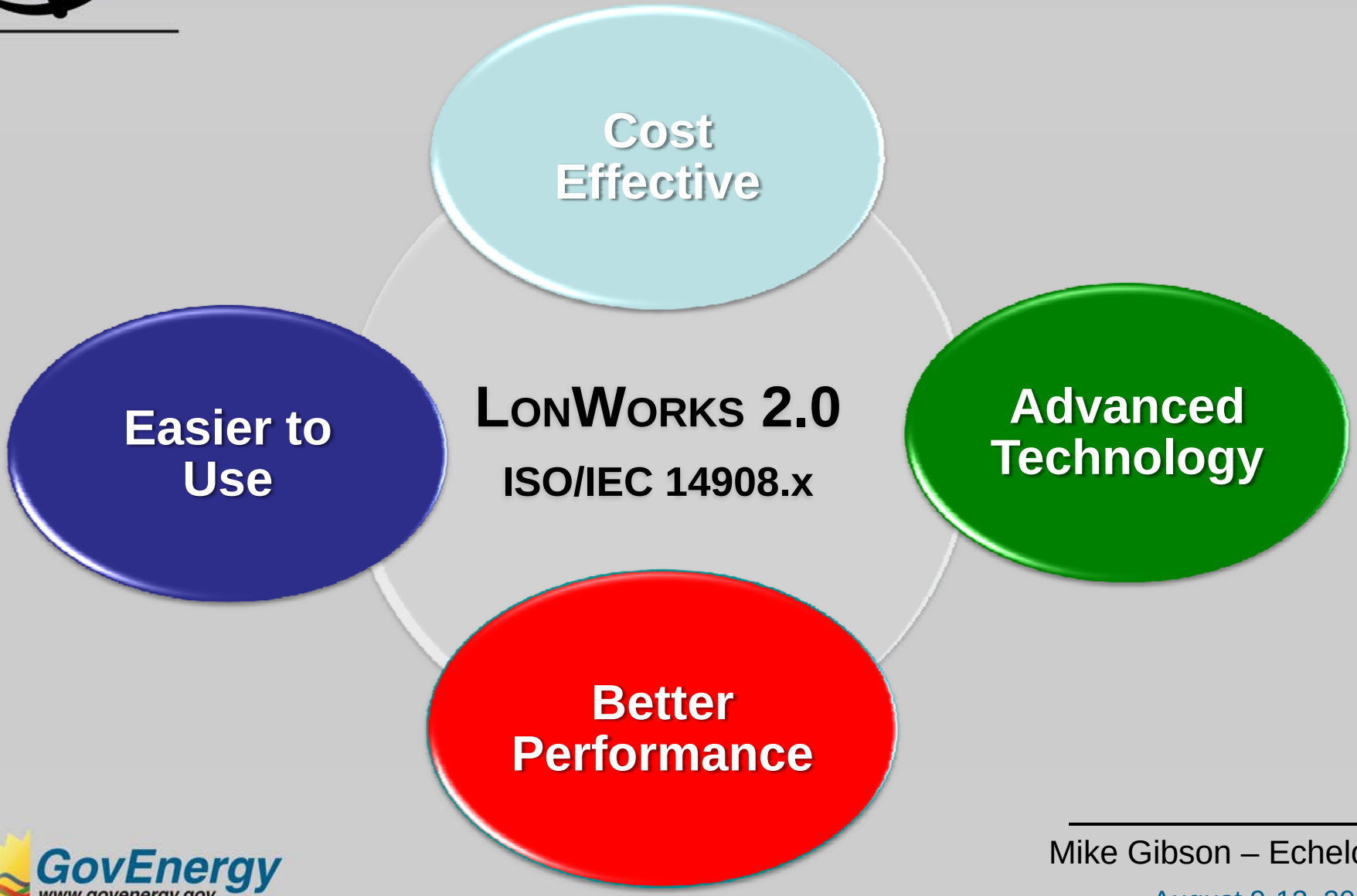
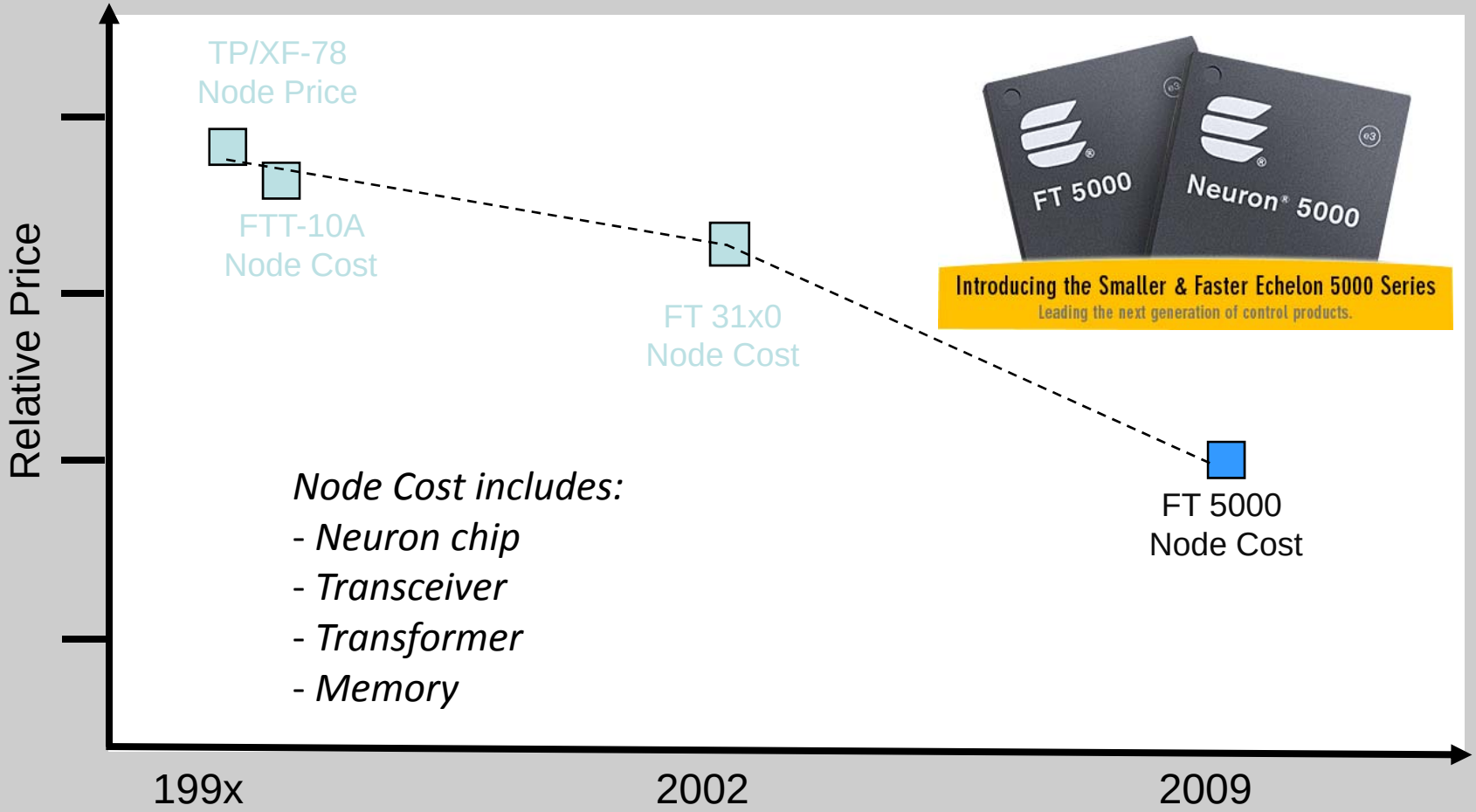
The LONWORKS 2.0 Platform



LonWork 2.0
Drives Down Smart Device Cost



US Military Building Automation

US Army Corps of Engineers (USACE)

- The LONWORKS specification is the only building control guide specification that is recognized by the Army, Navy and Air Force for all of their facilities worldwide.
- Corps District designers will use them for all building controls, although it is not mandatory
  - UFGS 15951: Direct Digital Control for HVAC and Other Local Building Systems (‘ Building level’ spec)
  - UFGS 13801: Utility Monitoring and Control System (campus- wide/ base- wide spec)

NYC Schools

- Scope
  - 1200 buildings
  - Upgrades to existing pneumatic systems
- The Spec
  - Has two components
    - Building level
    - Enterprise connectivity
  - Bidders on the buildings cannot bid on the enterprise and vise versa
- Specs released in January 2004
  - Multiple buildings bid and won by multiple controls contractors
  - Master Systems Integrator (MSI) contract awarded

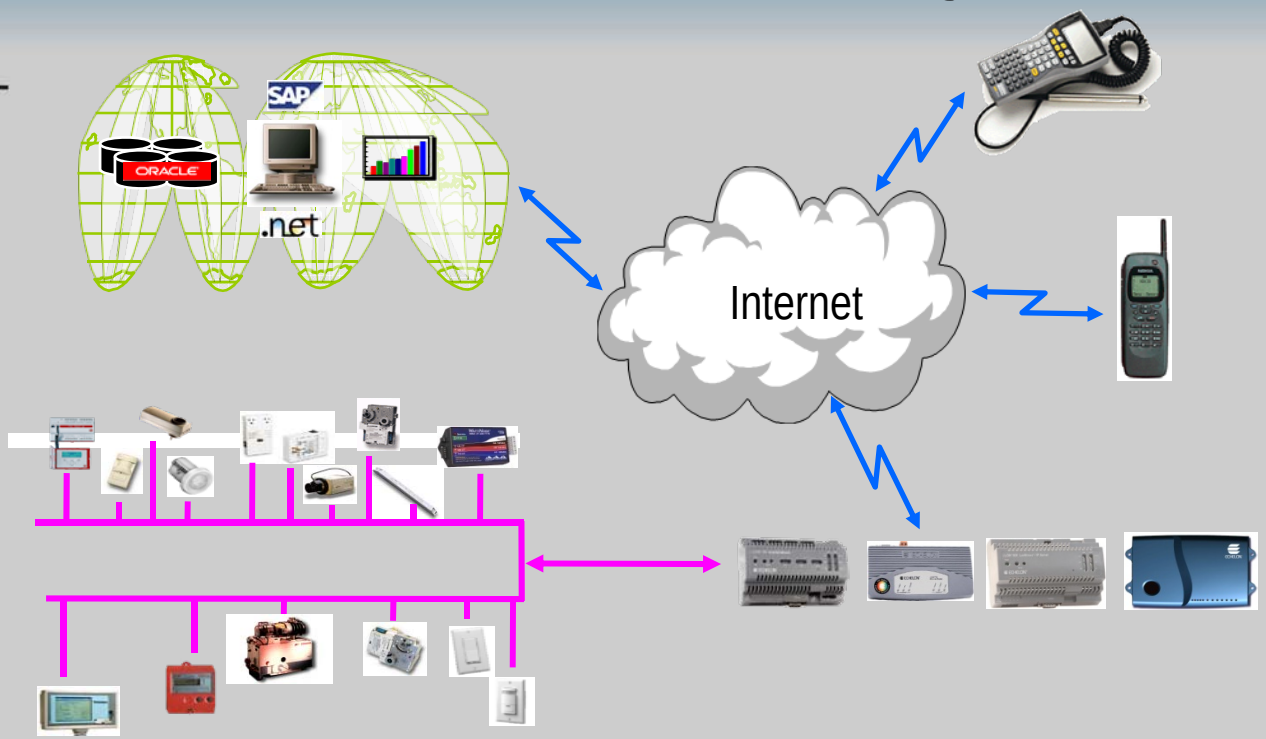
State of Louisiana

- Scope
  - Open Systems with LONWORKS for all State buildings – Police, City, Universities, etc.
  - Open to competition
  - 100s of buildings
- Status
  - Multiple buildings already bid, won and installed
  - Many more in the works
- Issues
  - Original spec developed 3-4 years ago
  - Finger pointing on Enterprise Integration “not part of original scope of work”
  - Contract specifics required to define scope of integration work – looking at a two tier spec – Building and Integration
  - Importance of a good specification

NASA

- Scope
  - Kennedy Space Center - Florida
  - Upgrades to existing control systems – built in the 70s
  - Multi-year, multi-phase project
  - Need open system bidding process
- The Spec
  - Calls for LNS, LONMARK, and IT connectivity into existing SCADA front end
- Status
  - Several projects underway using spec
  - Multiple bidders winning jobs

Summary



When we achieve a truly interconnected Smart Grid we will enjoy the benefits!