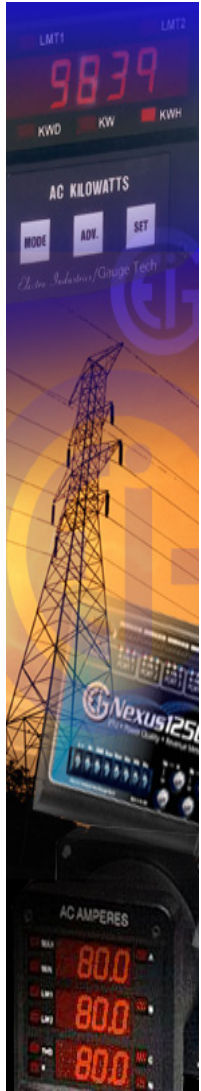


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WMEA

November 14, 2002

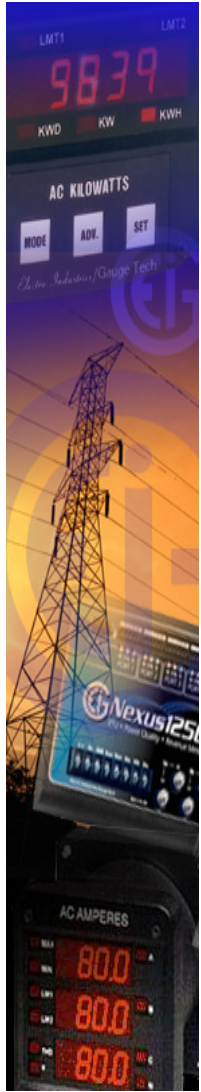
Power Management

By

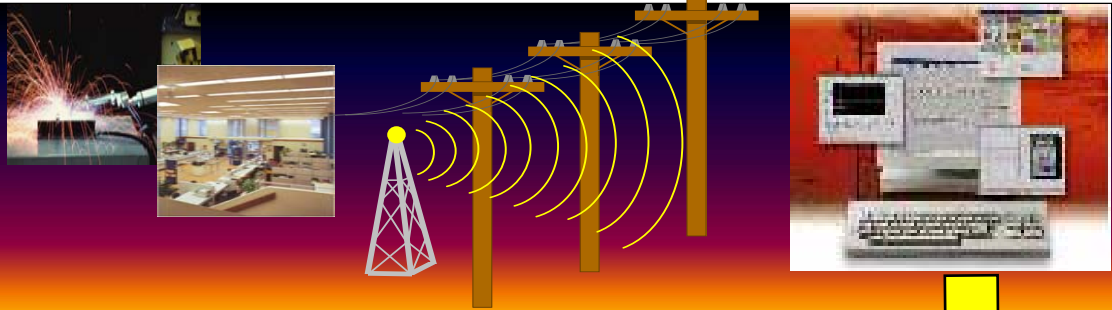
Marilyn Self



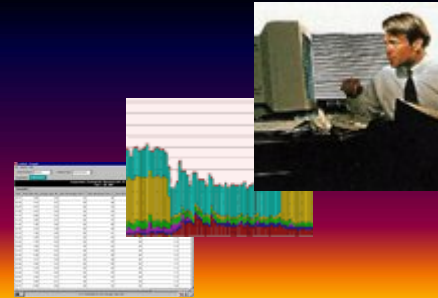
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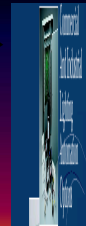
Gathering Information



Data Analysis



Improvement Solutions



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Demand and Supply Side Management



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Power Management Solutions - Data Gathering

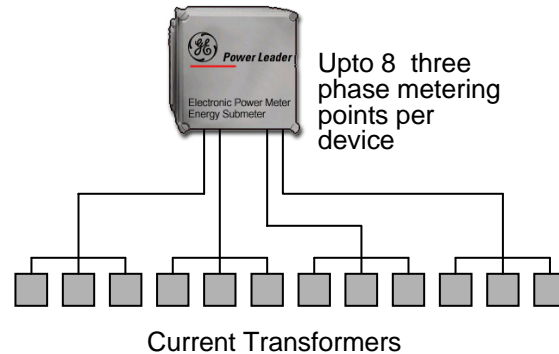
Three areas that are changing

1. Meters
2. Communications – Networks
 - Wireless – mesh networks
3. Software
 - OPC
 - “Cube”
 - Energy Aggregator
 - PQ Analyst – AI Based



Meters – gathering data at the point of origin

- Sub-metering with Power Factor
 - EPM4900 – up to 8 (3-phase) metering points per device



- Price per point < \$350
- Low cost single meters < \$ 500



PMCS Energy Management Solution



Basic & Sub Meters

\$300 to \$550

High

Cost ↑

Low

Low

Revenue Accurate

\$750 to \$1,500

- Revenue accurate
- Limited PQ (THD, V, I)

Datalogging and Power Quality

• \$1,500-\$3,000

- Revenue accurate
- PQ (Harmonic analysis, WF capture)
- Data & event logging & Control applications

Power Analyzers

• \$3,000-\$6000

- Power Analyzers

Functionality →

High

Low



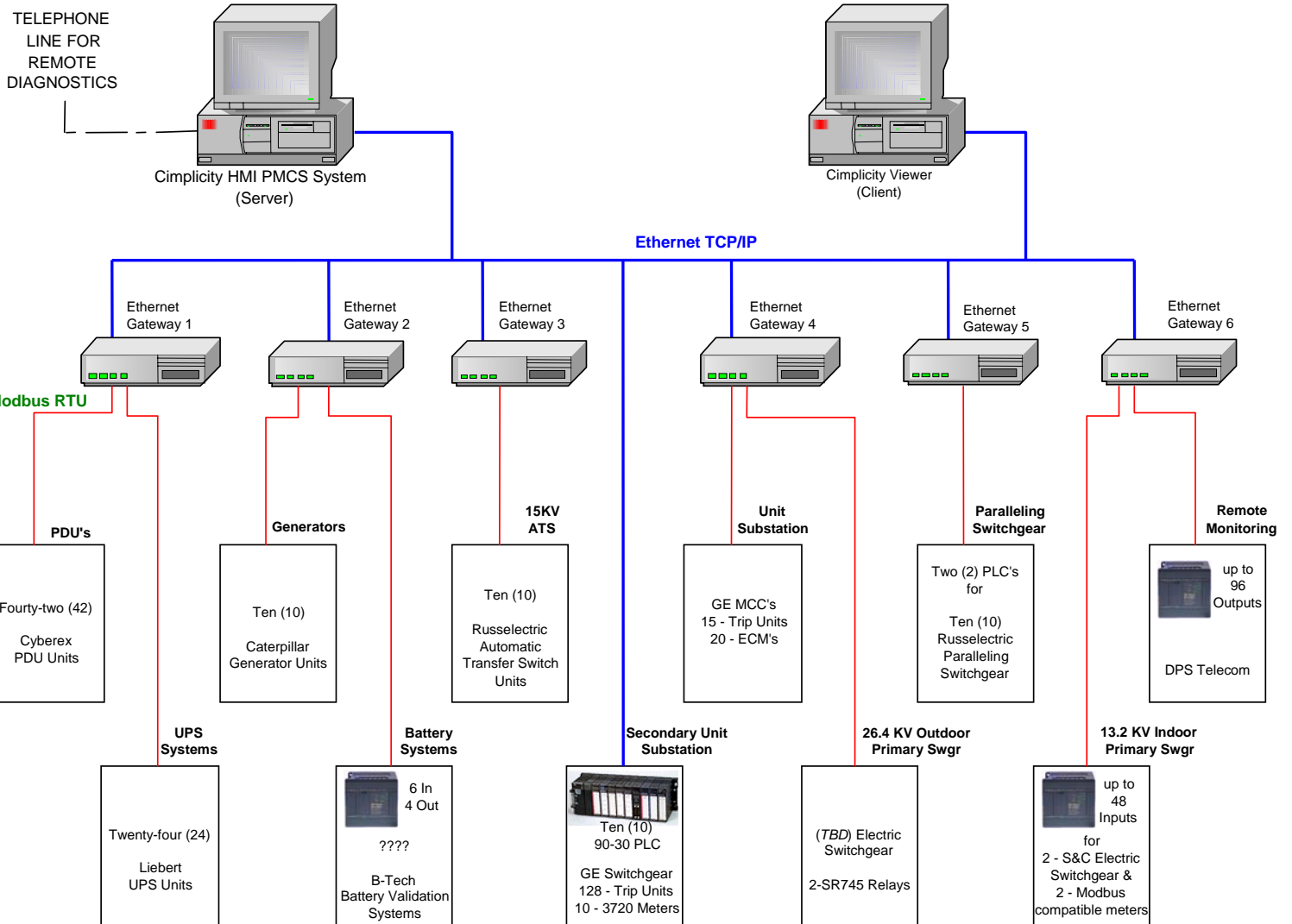
Communications - Network Connections, New Solutions – Mesh Networks

- Wireless – Reliable, adaptable and scalable
 - Reliability – crucial!
 - Multiple “repeater nodes”
 - Redundant
 - Adaptability – adapt to existing environment
 - Self-Configuring
 - Self-Healing
 - Scalability – not dependant on a central control point



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PMCS Energy Management Solution



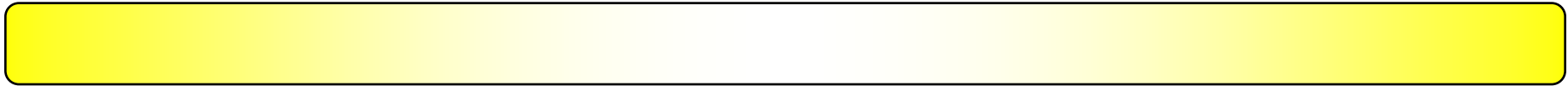
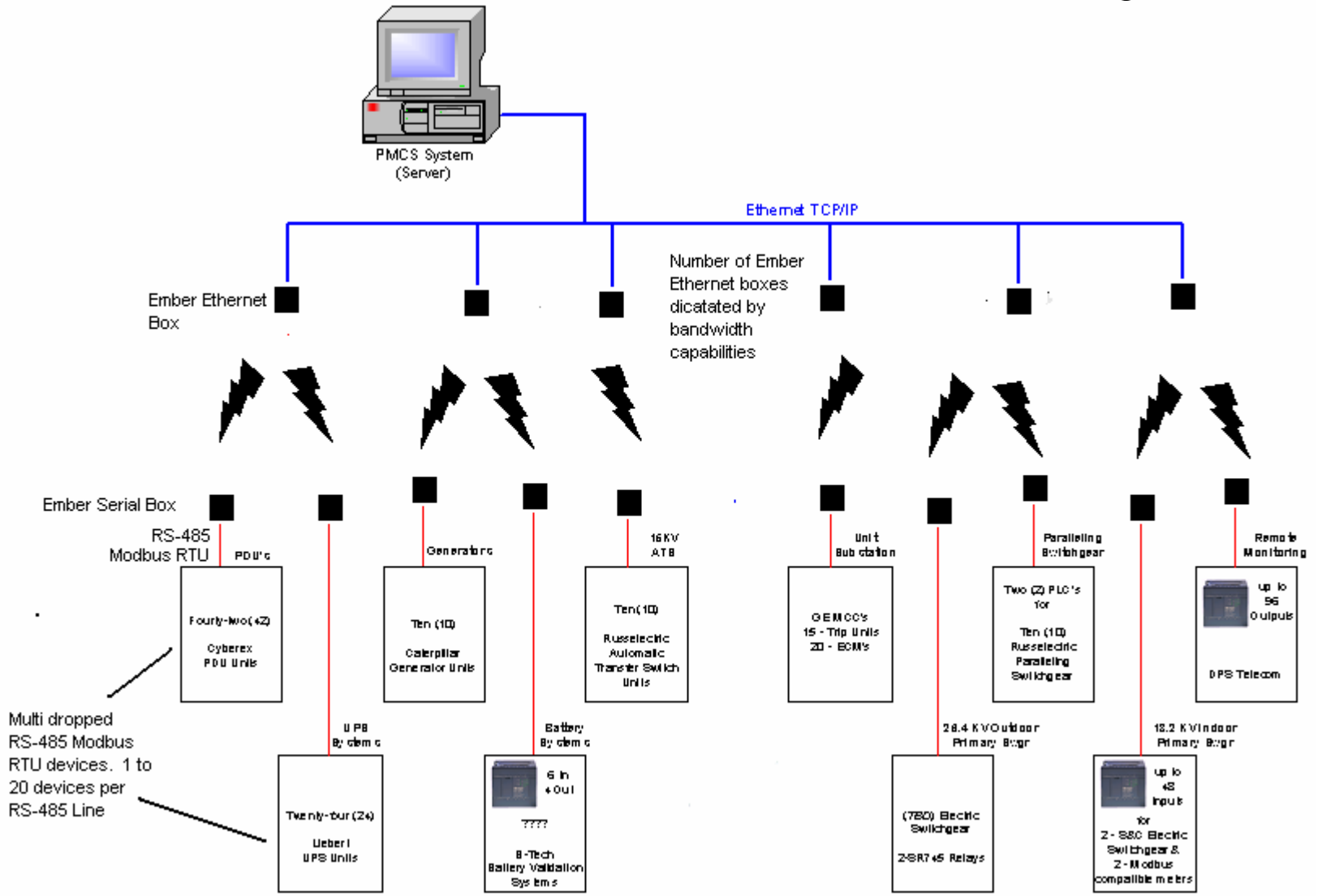
GE Integrated Power Monitoring System Architecture Diagram

Architecture of a current system

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PMCS Energy Management Solution

Eliminates use of Ethernet Serial Port servers and wiring





Software - OPC

What is a OPC Server?

Translators between process control hardware's language and the application that needs the data

- DDE server to OPC Server / OPC Client
 - Increase reliability
 - Interface to other OPC applications such as PI

The OPC goal is “ to provide an open, flexible, **plug-and play** software standard for software interoperability in the automation industry.”

Software – “Cube”

PMCS ...What's next

- Allow “plug and play” operation with third party systems and protocols
- Allow easy scalability

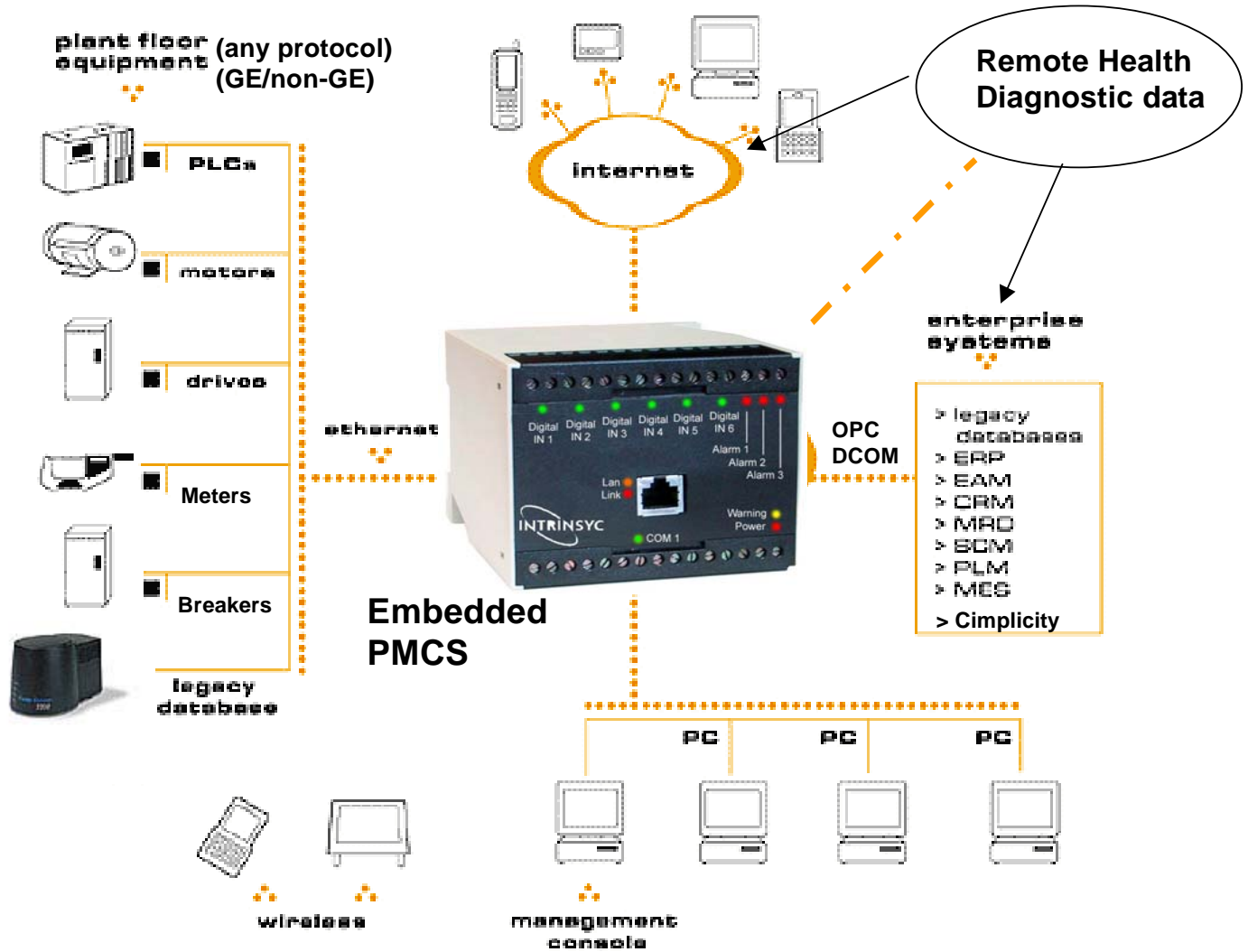
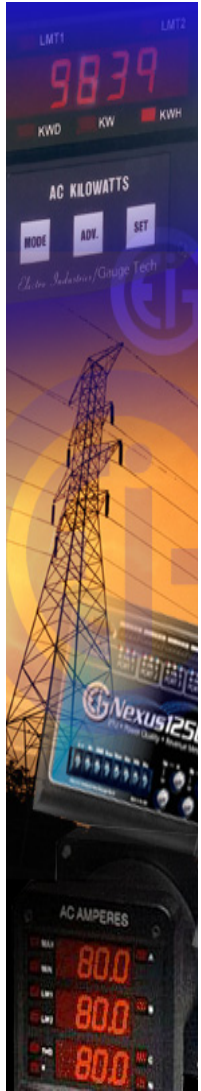
Approach...

- Provide Remote Health Monitoring / diagnostics
- Install Power Management as a solid state networkable device
- Use open framework
- Use embedded device architecture

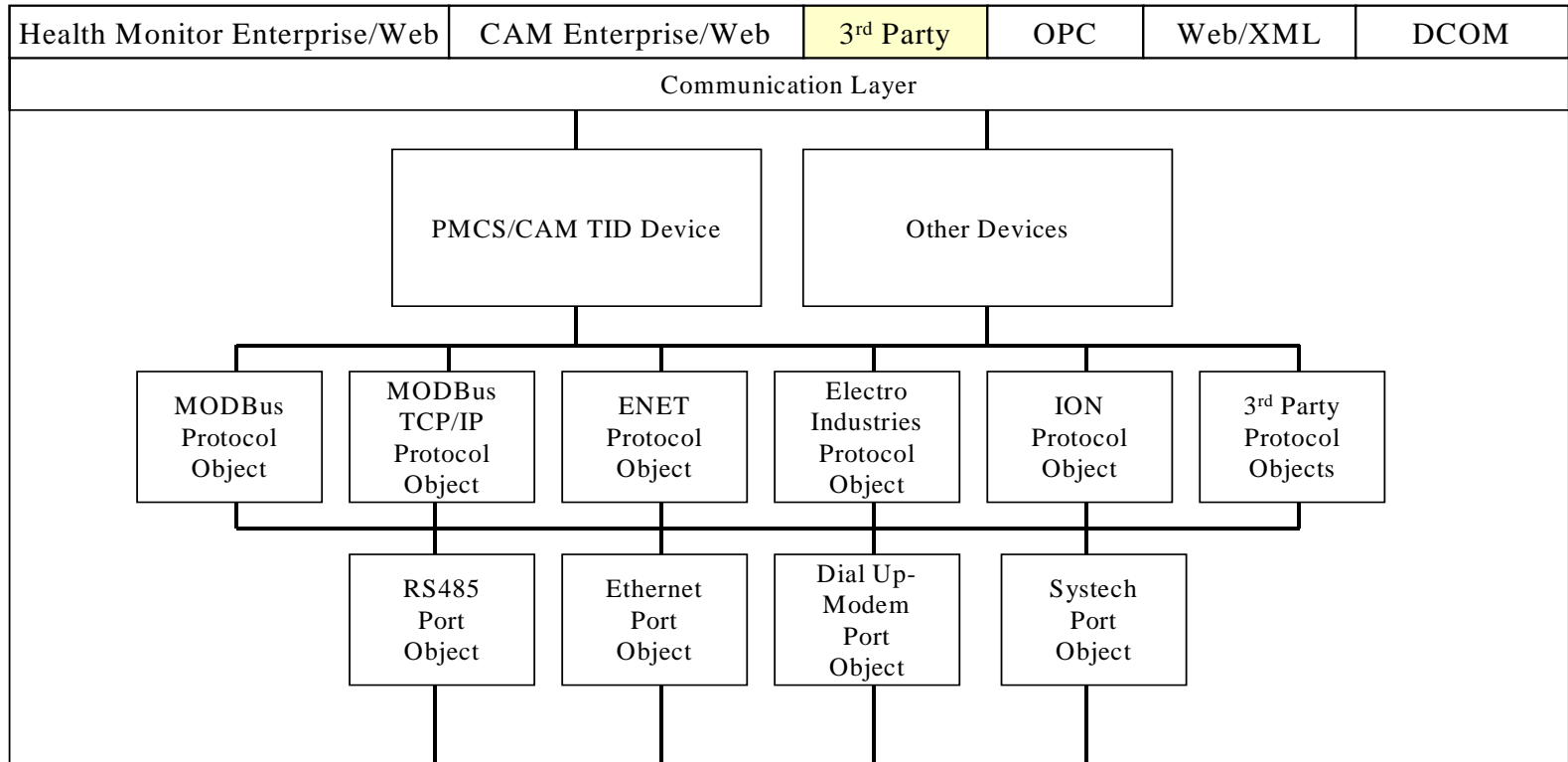


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PMCS Energy Management Solution

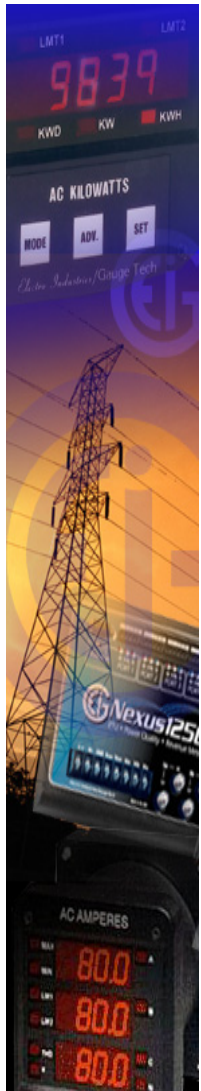
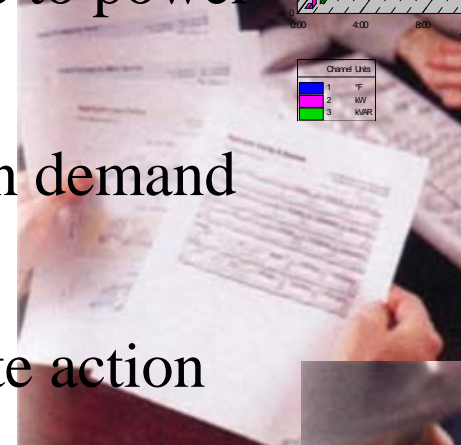
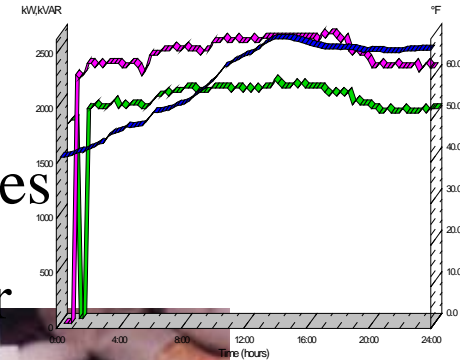


Embedded PMCS/CAM Architecture

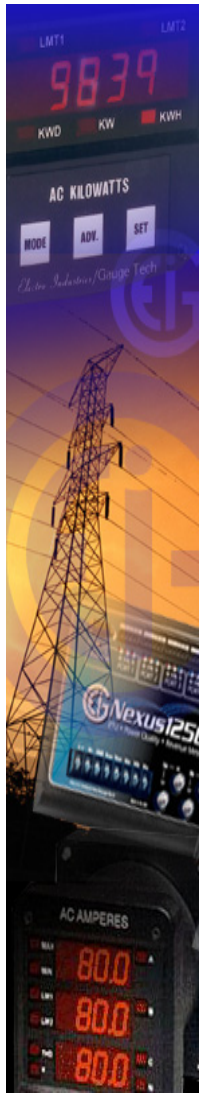


Software – Energy Aggregator

- Provide cost and productivity opportunities
- Isolate and eliminate effects due to power quality problems
- Ability to establish and maintain demand profiles
- Alarm notification for immediate action
- Peak shaving/load shifting
- Characterize power usage load profiles across the business
- Added benefit - Verify utility billing

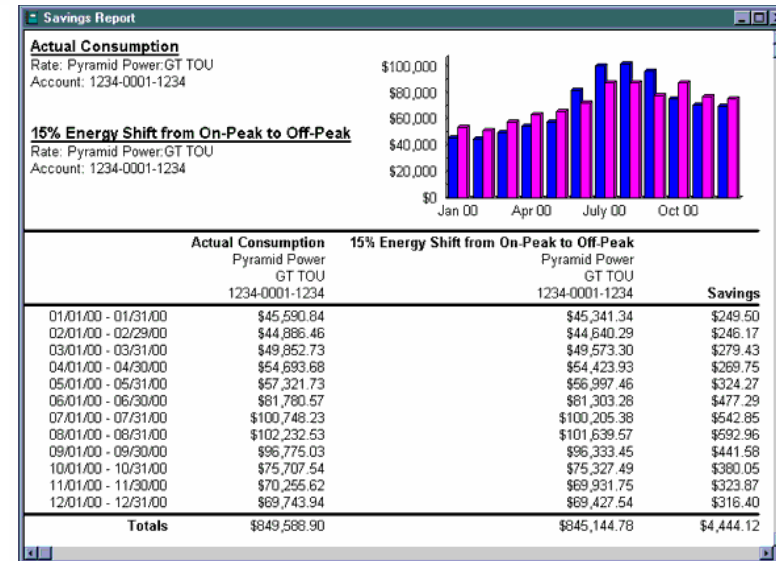
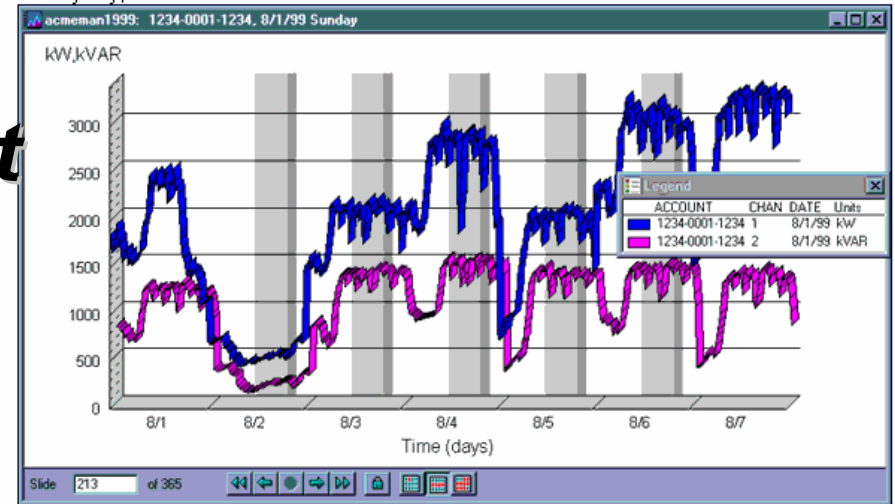


Cost Allocation & Load Management



- Determine Load Profiles,
- Aggregate Usage,
- Analyze Rate Structures,
- Allocate Costs

With Energy Profiler, you can view multiple channels of data on one graph, display multiple on-peak periods data by day, week or month.



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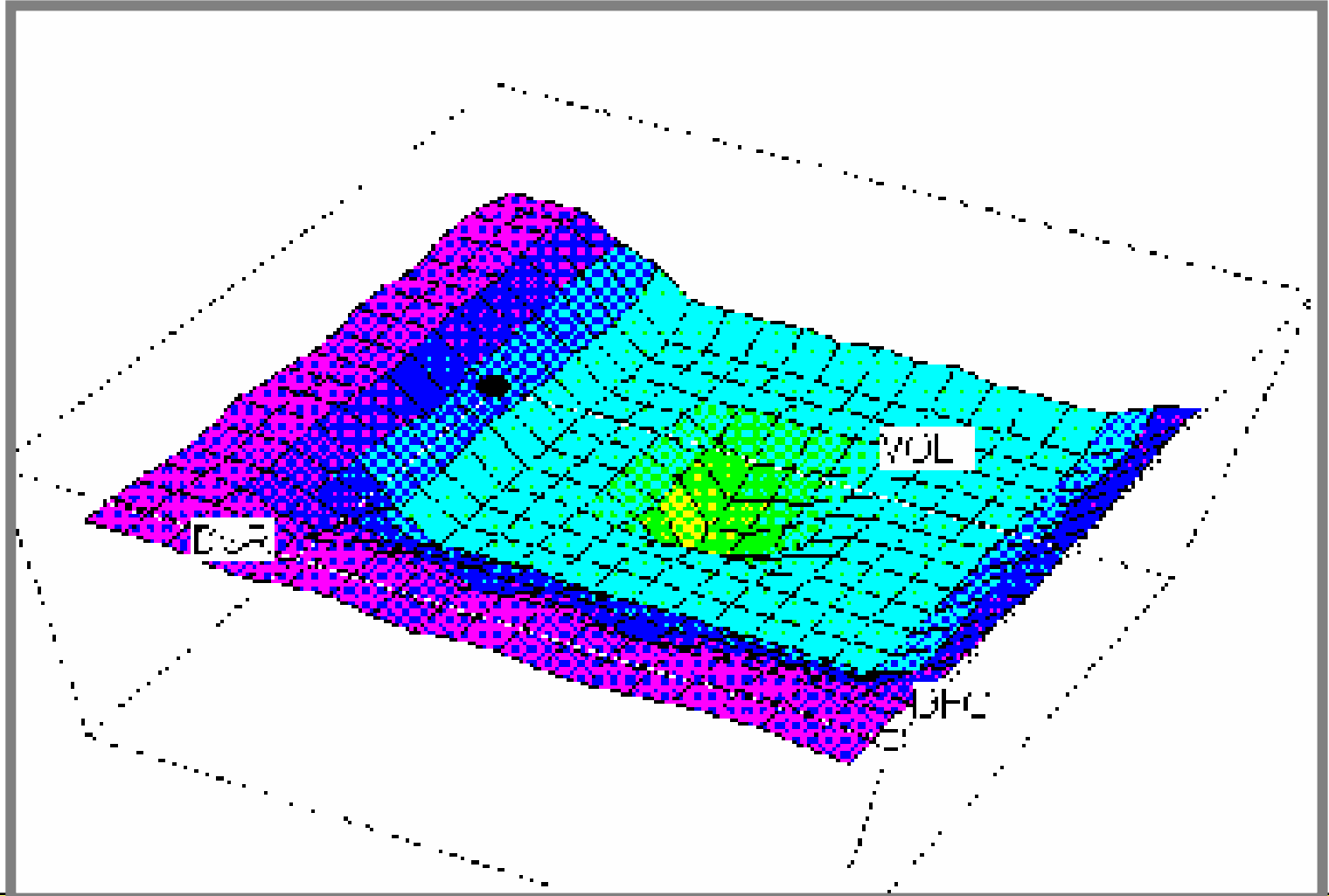
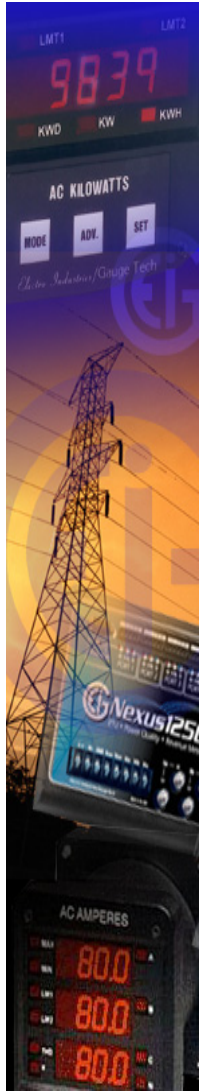
Software - PQ Analyst

- OPEN Architecture
 - Drivers for today's and future monitors
 - Open Database (for all measurement data)
 - Common data charting and graphing soft
- Totally Automated Operation
 - Data collection, data processing/reporting
- Intelligent Analysis Applications (**Power Quality**)
 - AI
 - Fuzzy Logic
- COM based
- Automated Alarm & Paging



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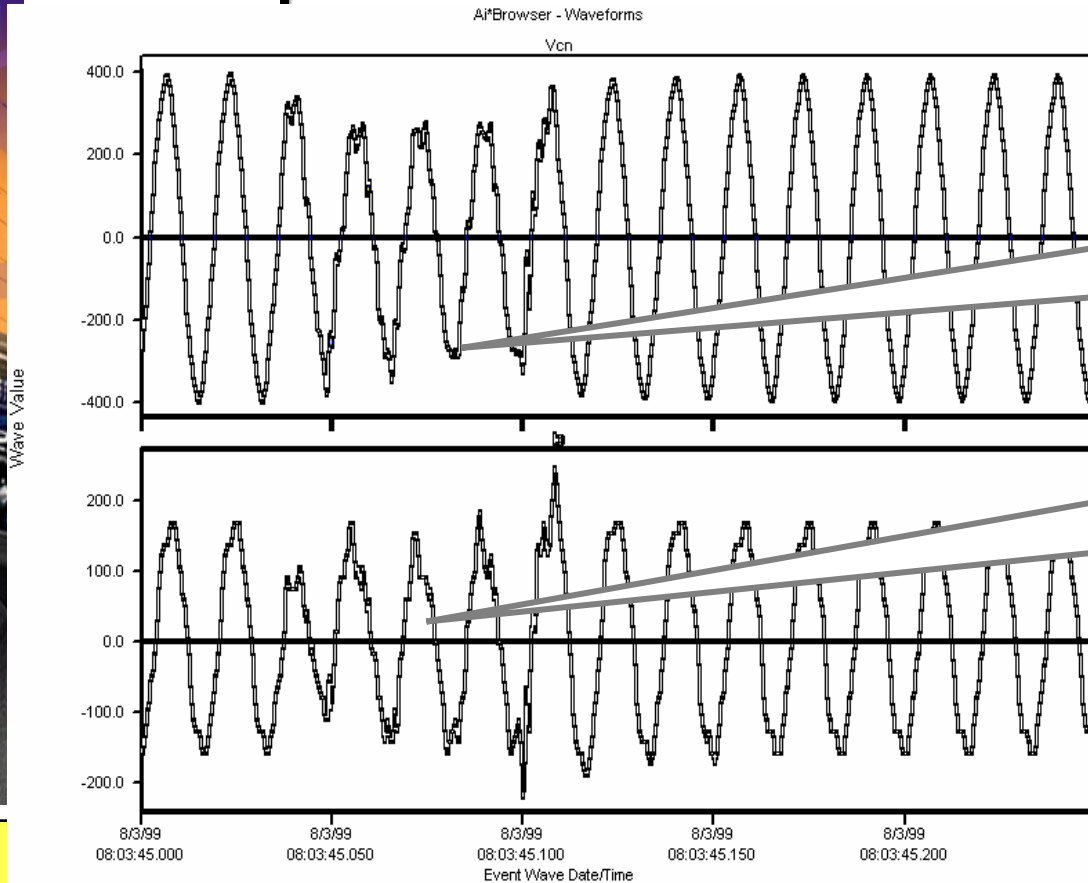
Fuzzy Logic Embeds Expert Reasoning



New AI Technology

Example: Voltage Sag Rule

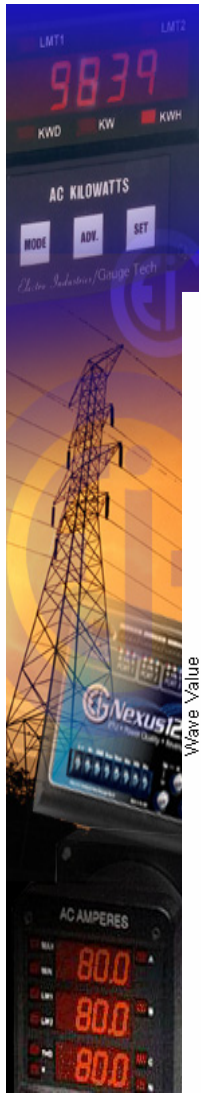
During a voltage Sag, if current does not significantly increase then the origin of the sag is upstream from the monitoring location.

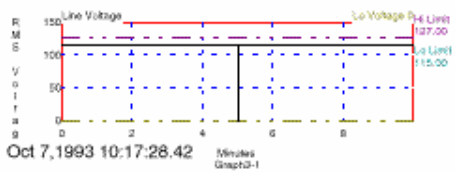


Voltage Sag

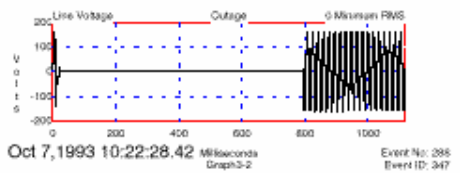
No current increase

Origin is Upstream!

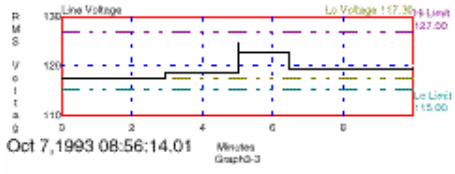




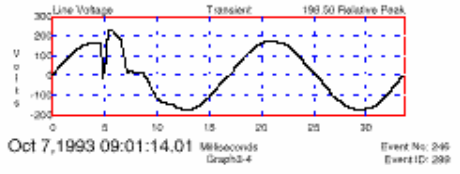
Oct 7, 1993 10:17:28.42
 Minutes Graph3-1
 Event severity factor: 100
 Possible cause: local fault clearing and reclosure operation .



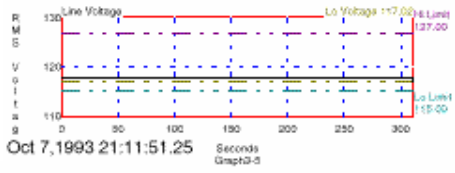
Oct 7, 1993 10:22:28.42
 Milliseconds Graph3-2
 Event No: 286
 Event ID: 247
 Equipment affected: Computers, motors, and electronic drives .
 Typical solution: UPS .



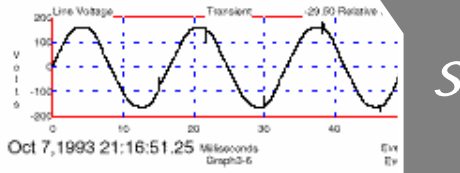
Oct 7, 1993 08:56:14.01
 Minutes Graph3-3
 Event severity factor: 36
 Possible cause: The closing of a utility power factor correction capacitor .



Oct 7, 1993 09:01:14.01
 Milliseconds Graph3-4
 Event No: 246
 Event ID: 289
 Equipment affected: Electronic drives, capacitors .
 Typical solution: Chokes, filters .



Oct 7, 1993 21:11:51.25
 Seconds Graph3-5
 Event severity factor: 35
 Possible cause: Operation of a phase controlled load .



Oct 7, 1993 21:16:51.25
 Milliseconds Graph3-6
 Event No: 245
 Event ID: 288
 Equipment affected: Computers and unfiltered electronic loads .
 Typical solution: Filter, move phase controlled load to another circuit .

Describes the most severe disturbances

Analysis includes the severity, origin, and possible solution

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Complete Data Charting

