



OSIsoft.

INDUSTRY SEMINAR 2012

E M E A

The **Power** of **Data**



The key strengths of the PI System for the T&D space: connectivity / performance / normalization / security

Presented by **Ann Moore - OSIsoft**

T&D Industry Challenges



- Electric grid operations and reliability
- Data and event correlation and analysis
- Enterprise synergy
- Aging infrastructure and mature workforce
- Asset utilization and performance
- O&M and capital cost reduction
- Safety and customer service
- Regulation and compliance
- Cyber Security

OSIsoft PI System Advantages



- Collect and extract mission critical systems data without being intrusive
- Integrate and normalize “Islands of Information”
- Real time collaboration platform
- Data repository and out-of-the-box tools for value-added applications
- Standardized information platform across Enterprise
- Integration with Line of Business Systems
- “Single version of the truth” for environmental tracking and compliance
- Support IT monitoring and infrastructure cyber security protection

How Does T&D Industry Use PI? (1 of 2)



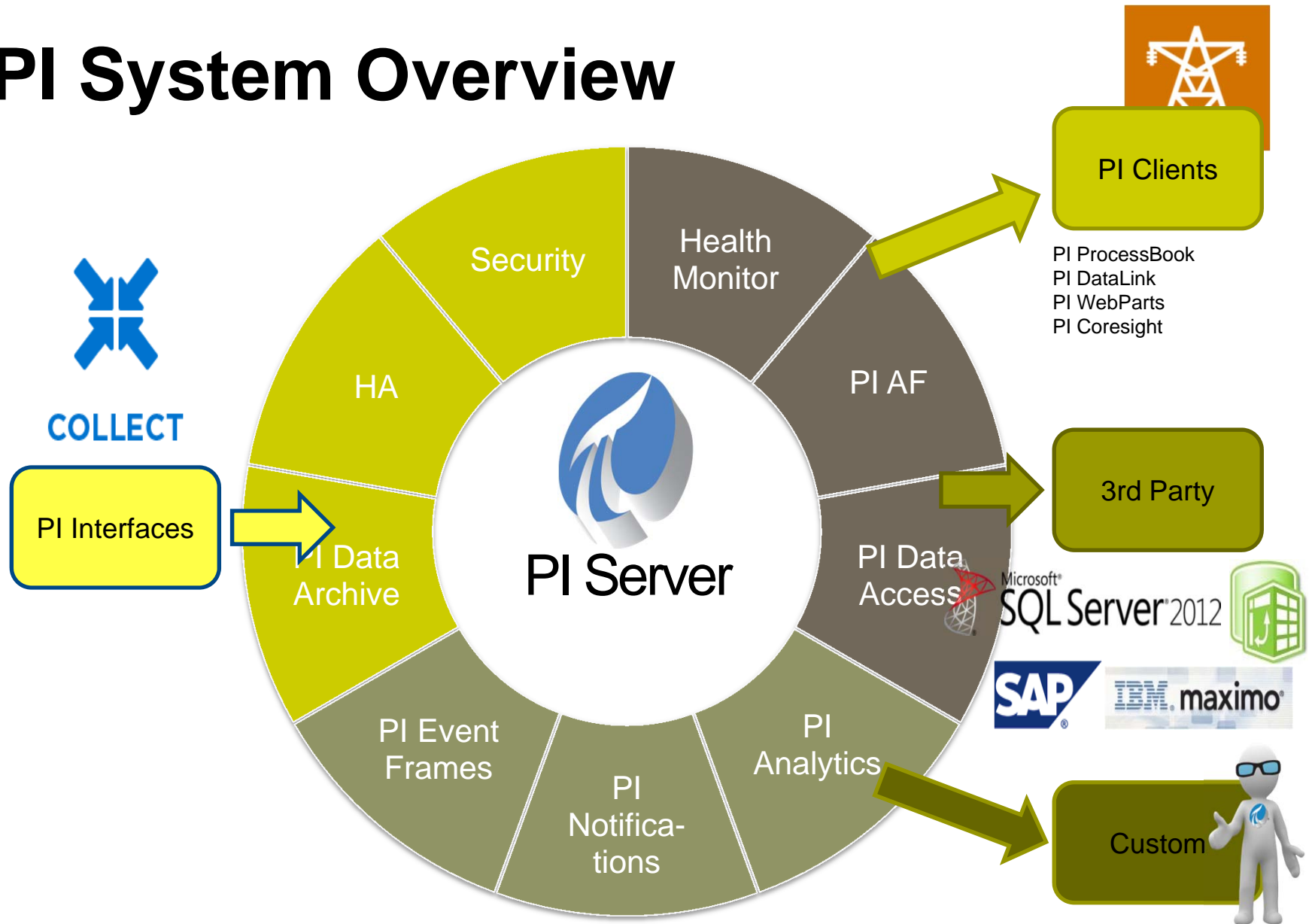
- To operate the T&D system
 - Provide flexible system overviews for operational situations
 - Monitor substation and distribution field devices
 - Distribute operational information to corporate users
 - Archive data for later event reporting and analysis
 - Reconstruct system conditions for post-mortem analysis
- To plan the T&D system
 - Integrate trending and analysis into engineering studies
 - View load patterns, create forecasts, measure system utilization
 - Provide load reports for regulatory cost-of-service studies

How Does T&D Industry Use PI? (2 of 2)

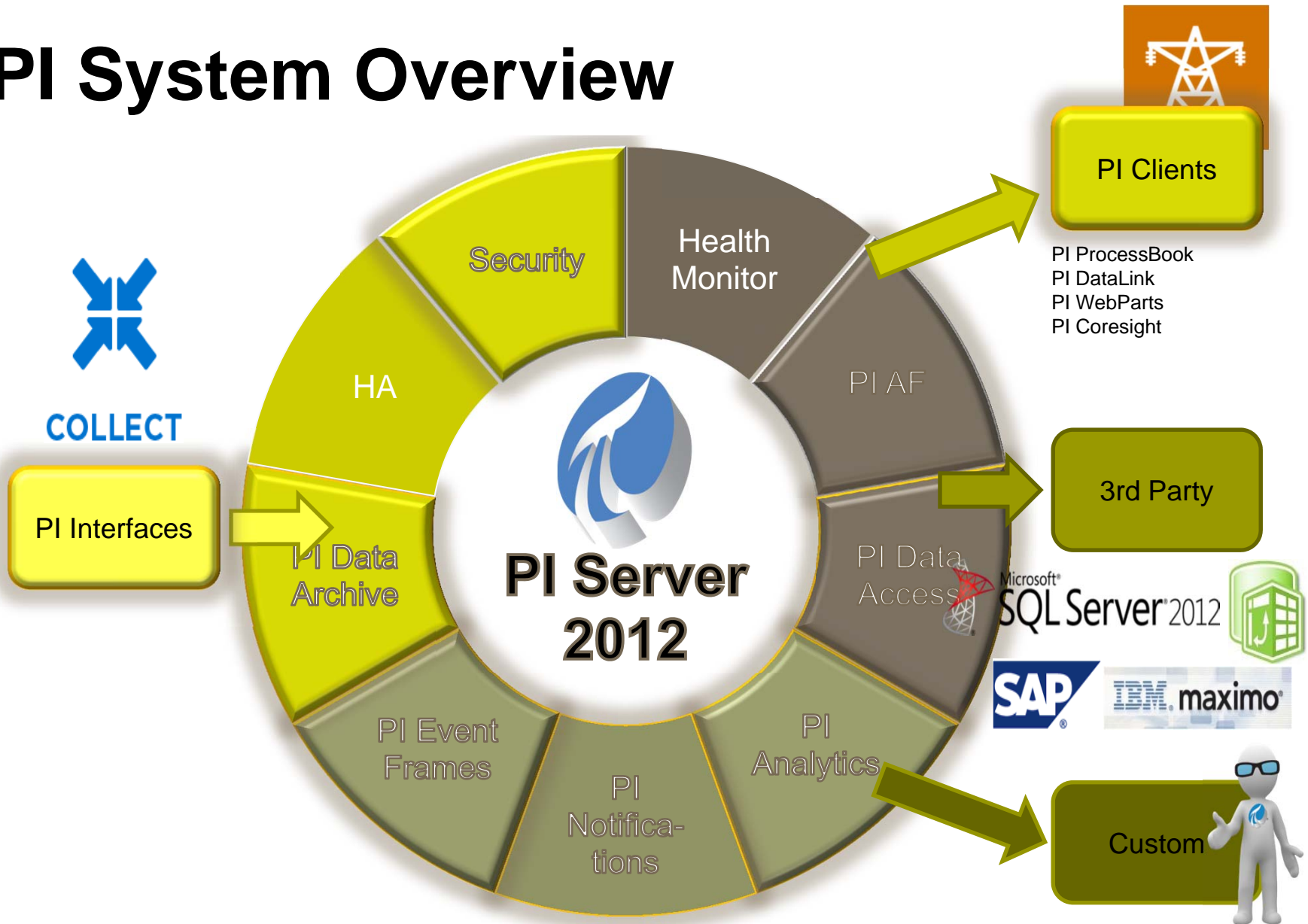


- To construct and maintain the T&D system
 - Monitor equipment performance and prioritize maintenance
 - Diagnose equipment operation problems
 - Archive critical equipment and event information from SCADA, substation IEDs, and field devices for later analysis
 - Identify best periods for new system construction
 - Avoid unnecessary or untimely capital expenditures
- To protect critical infrastructure
 - Monitor IT infrastructure supporting T&D assets
 - Integrate and correlate time-sensitive information across enterprise

PI System Overview



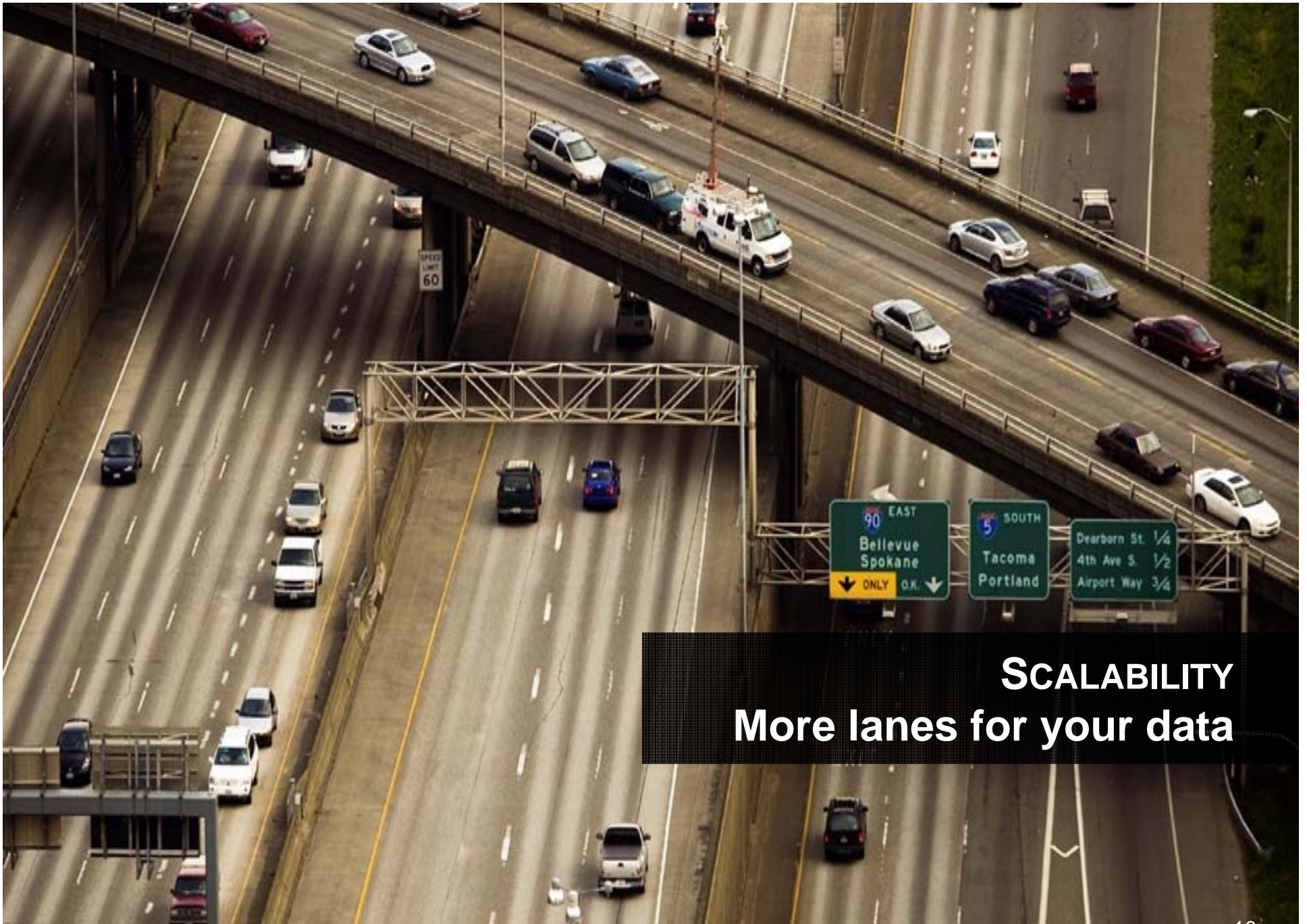
PI System Overview





INFRASTRUCTURE
Highway for your data





SCALABILITY More lanes for your data



PERFORMANCE
Move your data faster



RELIABILITY
Most stable system for your data



MANAGEABILITY
Bring all your data online

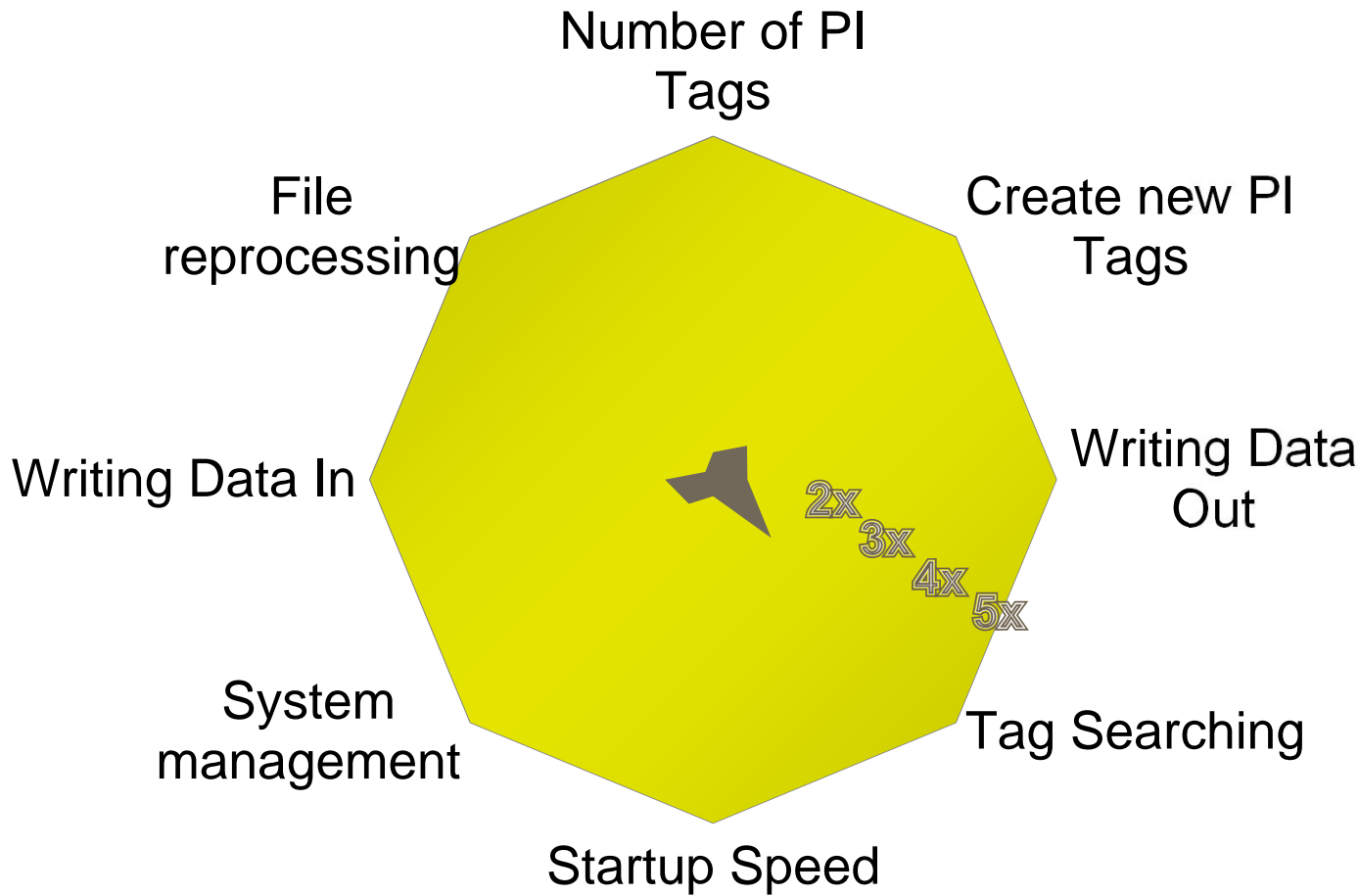


SECURITY
Better protection for your data

Metrics



5x



■ PI Server 2012

■ PI Server 2010



Common PI T&D Specific Interfaces



- EMS/DMS/SCADA
 - Native Interface – PI API
 - OSIsoft OPC with SISCO AX-S4 ICCP Inter Control-Center Communication Protocol
 - OSIsoft OPC DA and OPC HDA
- Substation
 - PI DNP 3.0, Modbus, Modbus Plus
 - PI IEEE C37.118 (for PMU-Phasor Measurement Unit or PDC-Phasor Data Concentrator)
 - IEC 61850
 - COMTRADE-Common Format for Transient Data Exchange and PQDIF (by SISCO)
 - Substation gateway vendors
- CIM (Common Information Model)-IEC 61970/61968: PI Adapter (by SISCO)

Coming in PI Interfaces



- Performance and Scalability
 - More points
 - Faster buffering
- Support for Metadata
 - Assets
 - Events
 - Auto-create point
- Easier to manage



T&D Utility Examples

CAISO

Changes in the Electric Industry affecting us



- Renewable Generation – Setting new peaks on a weekly base
 - Wind unpredictable output (3300 MW peak)
 - Solar unpredictable output for telemetry generation (1100 MW peak)
 - Photo Voltaic (PV) on roof tops without telemetry (1500 MW Estimate)
- Higher expectation of reliability
- Higher expectation of security
- SmartGrid
- Immediate answers
- Situational awareness through Visualization

Advanced Grid Operations



- Renewable wind and solar integration
 - Managing the intermittent power
 - Advanced forecasting
- WAMS (Wide Area Measurement System) PMU (Phasor Measurement Unit) synchrophasor data
- Intelligent Decision Support
- Wide Area Voltage/VAR Management
- Dynamic Security Assessment (DSA/VSA-Voltage Security)
- Dynamic Line/Transformer Rating
- Meteorological-based Load/Gen Forecasts
- Situational Awareness (Advanced Visualization, Analytics and Notifications)
- Demand Response, Load Curtailment and Storage
- Cyber security (NERC CIP-North American Electric Reliability Corporation Critical Infrastructure Protection)

PacifiCorp SCHOOL

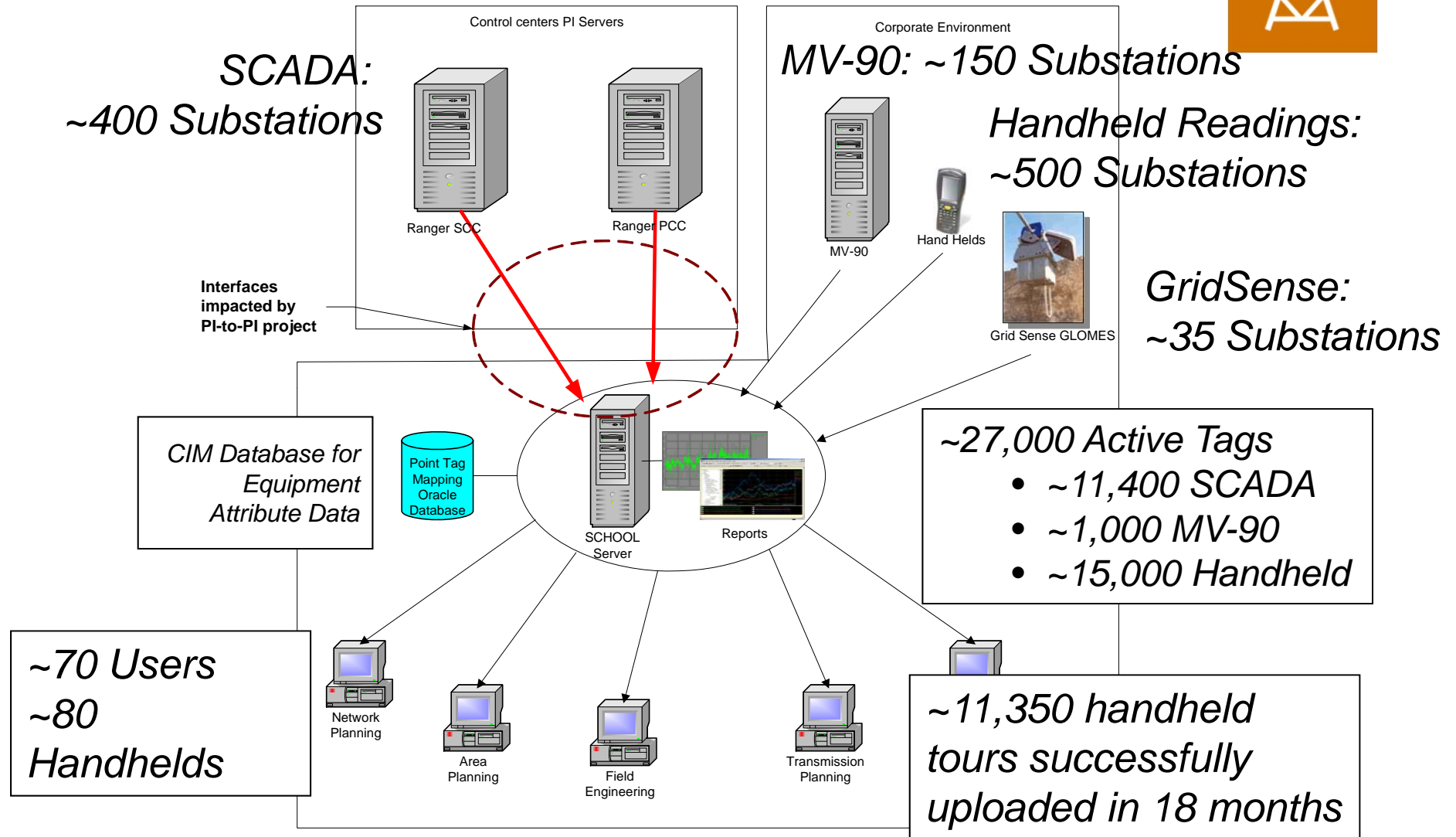
(Substation Circuit History of Operational Loading)



- Business needs:
 - Utility needs better tools to manage critically loaded assets
- Quality load data are critical because:
 - 30% (over \$100M per year) of power delivery CAPEX (California Power Exchange) budget is driven by load growth
 - Utility Is currently CAPEX-constrained
 - Substation capacity projects come in \$2M-\$5M “chunks”
 - Measuring and forecasting peak demand drives the timing of these expenditures
- Lack of quality load data = Asset overloads and outages



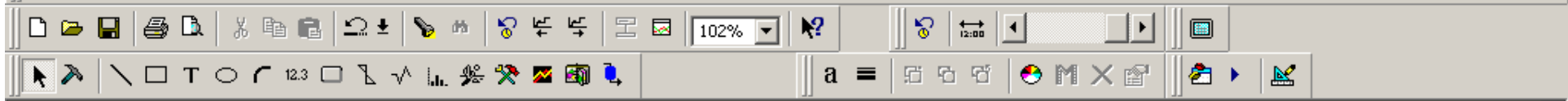
The SCHOOL System at a Glance



SCHOOL Data Integration



- SCADA (~ 400 substations)
 - RTUs polled by the SCADA system every 1-10 Seconds
- Commercial and Industrial MV-90 meters (~150 substations)
 - Modem-equipped substation meters
 - MV-STAR data
- Handheld data (~ 500 substations)
 - Non-SCADA and non-MV90 subs have peak recording analog and digital meters
 - Read periodically by substation technicians
 - Manual Logger data
- Critically loaded substations
 - For non-SCADA, non-MV90 substations needing load profile data: Cost-effective sensors

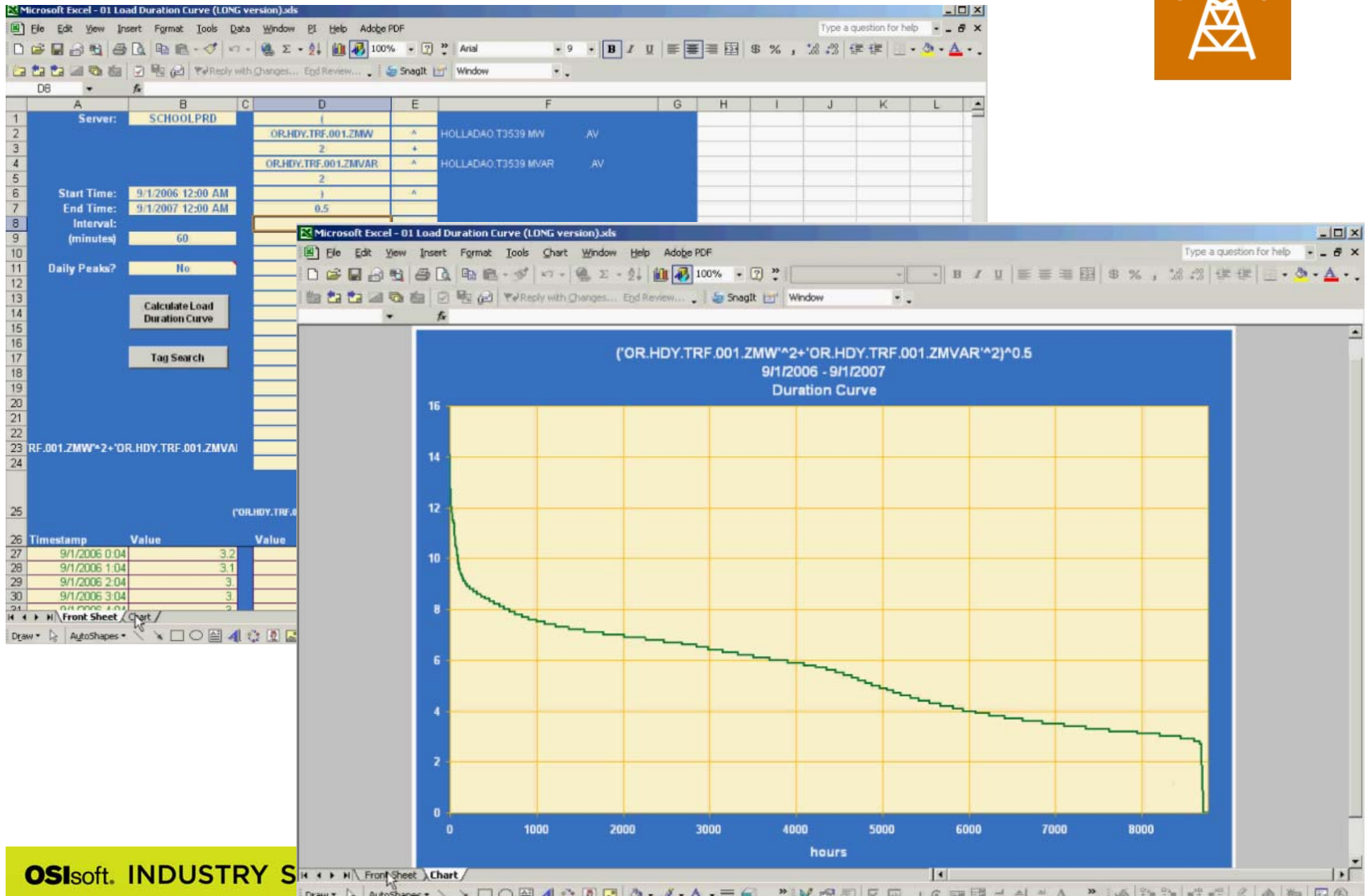


- Corporate
 - California
 - Idaho
 - Oregon
 - ALBANY
 - ASTORIA
 - BEND
 - COOS BAY
 - ALDER STREET
 - ANDERSON STREET
 - COOS RIVER
 - EMPIRE NEW
 - FAIRVIEW (BPA)
 - ISTHMUS
 - JORDAN POINT
 - LOCKHART STREET
 - NORTH BEND PLANT
 - SOUTH DUNES
 - Transformer, Power
 - 1
 - 2
 - (A) MVAR
 - (A) MW
 - STATE STREET
 - COQUILLE
 - CORVALLIS
 - COTTAGE GROVE
 - DALLAS



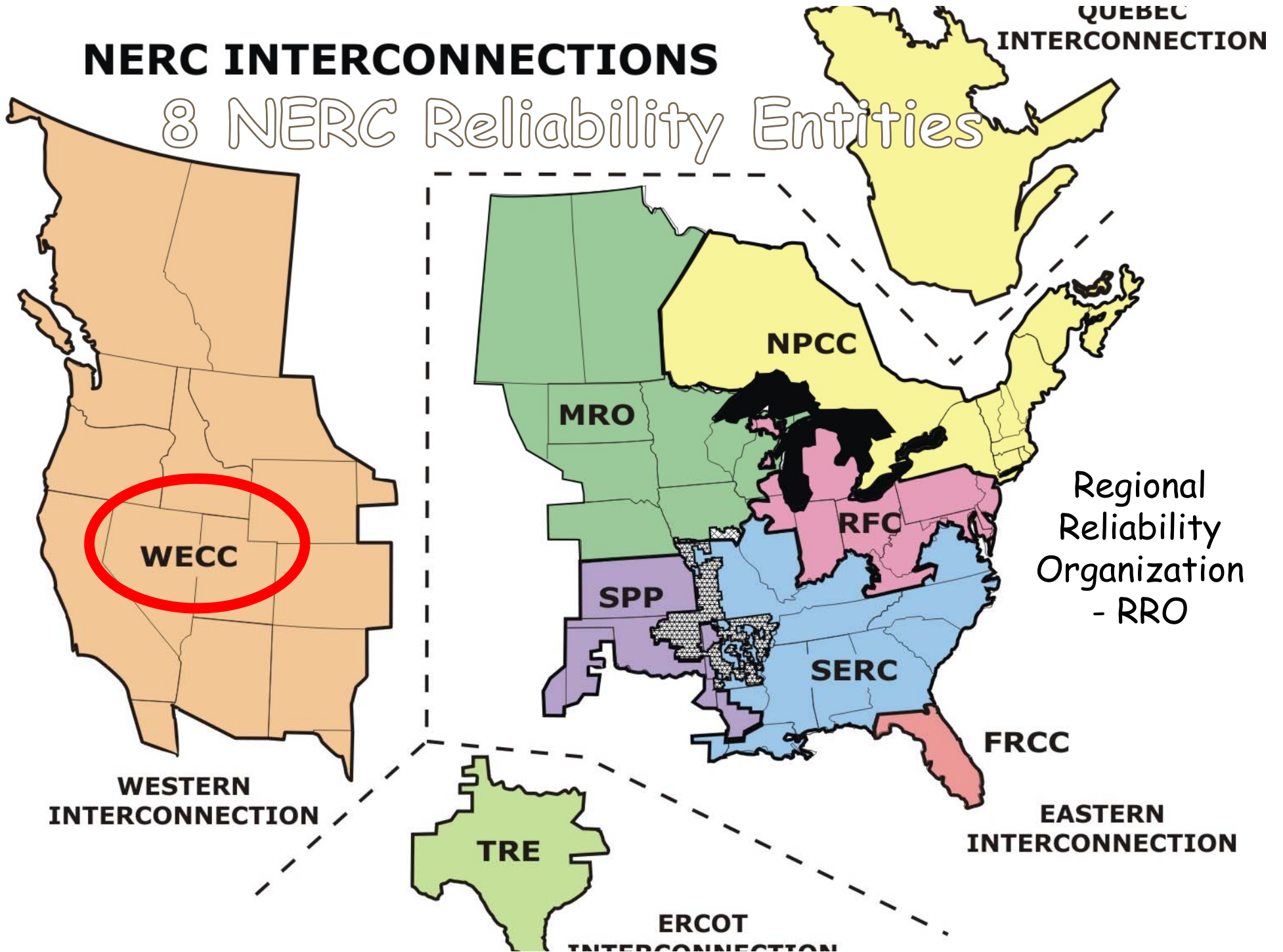
- | | |
|--|--|
| <input type="checkbox"/> Oregon\COOS BAY\ALDER STREET\Transformer, Power\1\MW | <input type="checkbox"/> Oregon\COOS BAY\COOS RIVER\Transformer, Power\1\MW |
| <input type="checkbox"/> Oregon\COOS BAY\ALDER STREET\Transformer, Power\2\MW | <input type="checkbox"/> Oregon\COOS BAY\COOS RIVER\Transformer, Power\2\MW |
| <input type="checkbox"/> Oregon\COOS BAY\ANDERSON STREET\Transformer, Power\1\MW | <input type="checkbox"/> Oregon\COOS BAY\SOUTH DUNES\Transformer, Power\1\MW |
| <input type="checkbox"/> Oregon\COOS BAY\ANDERSON STREET\Transformer, Power\2\MW | <input type="checkbox"/> Oregon\COOS BAY\SOUTH DUNES\Transformer, Power\2\MW |

Load Duration Curve Application



NERC INTERCONNECTIONS

8 NERC Reliability Entities



"WECC"

Largest of the 8 NERC Regions
(1.8 million square miles)

- 14 Western states,
- 2 Canadian provinces,
- 1 Mexican state (*Portion*)

- 243 entity systems
- 37 Balancing Areas
- 71+ million people

• Peak Demand (2007/8)

(S) 158,178 MW

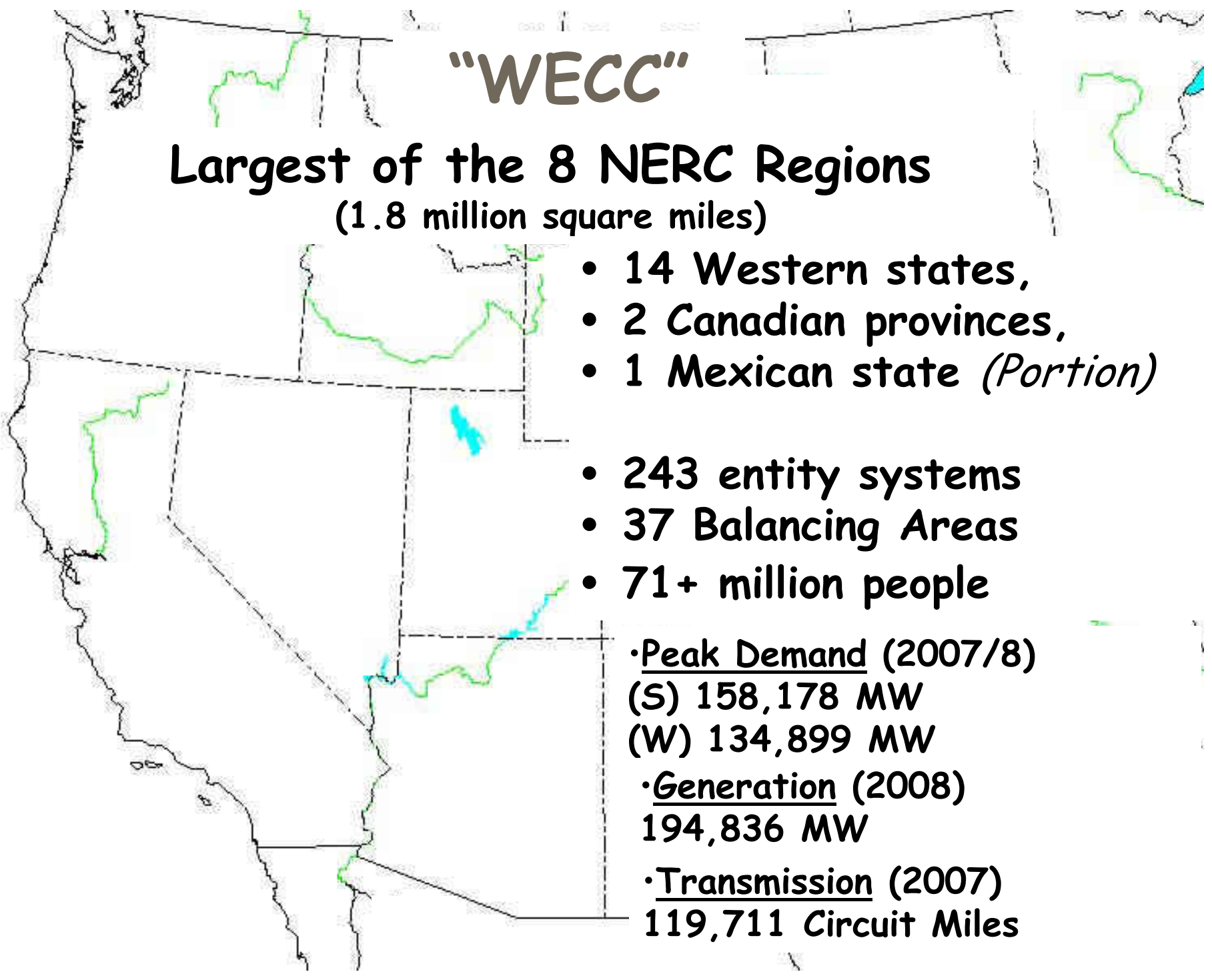
(W) 134,899 MW

• Generation (2008)

194,836 MW

• Transmission (2007)

119,711 Circuit Miles

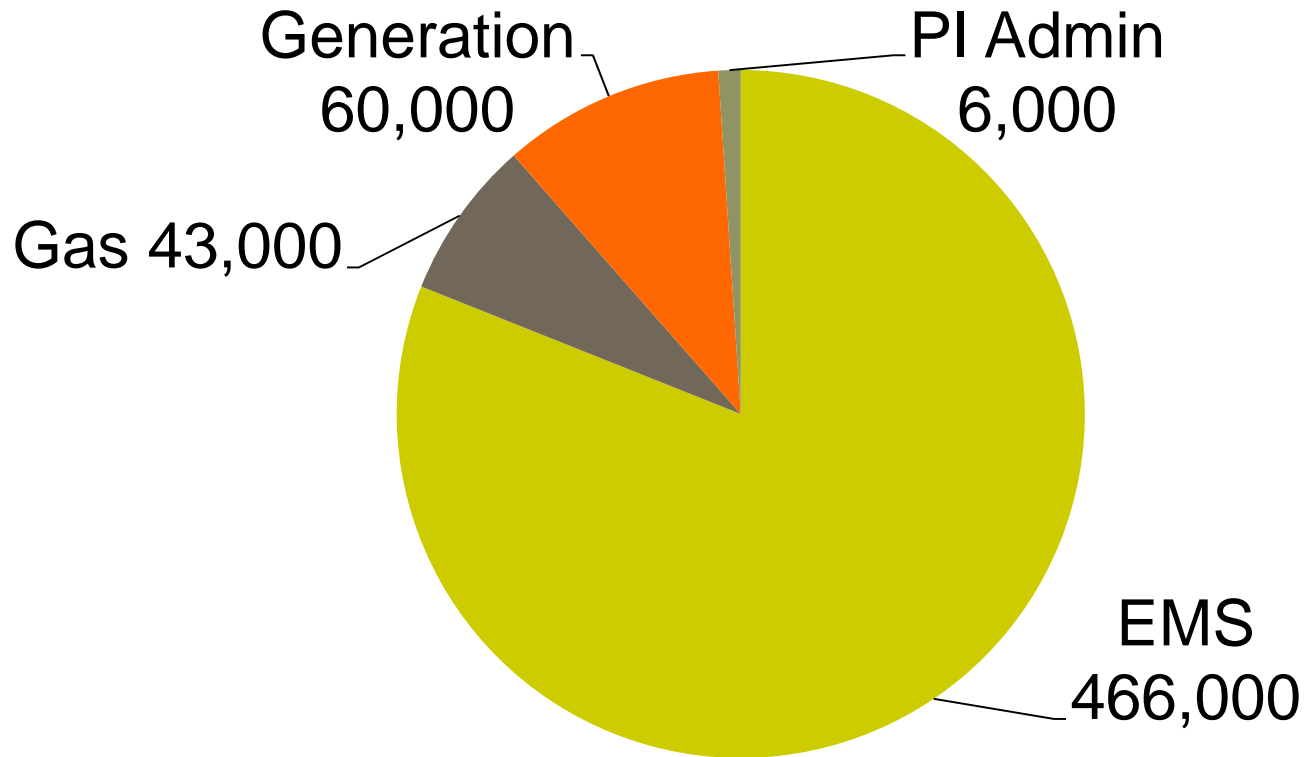


PG&E's PI System – Scale



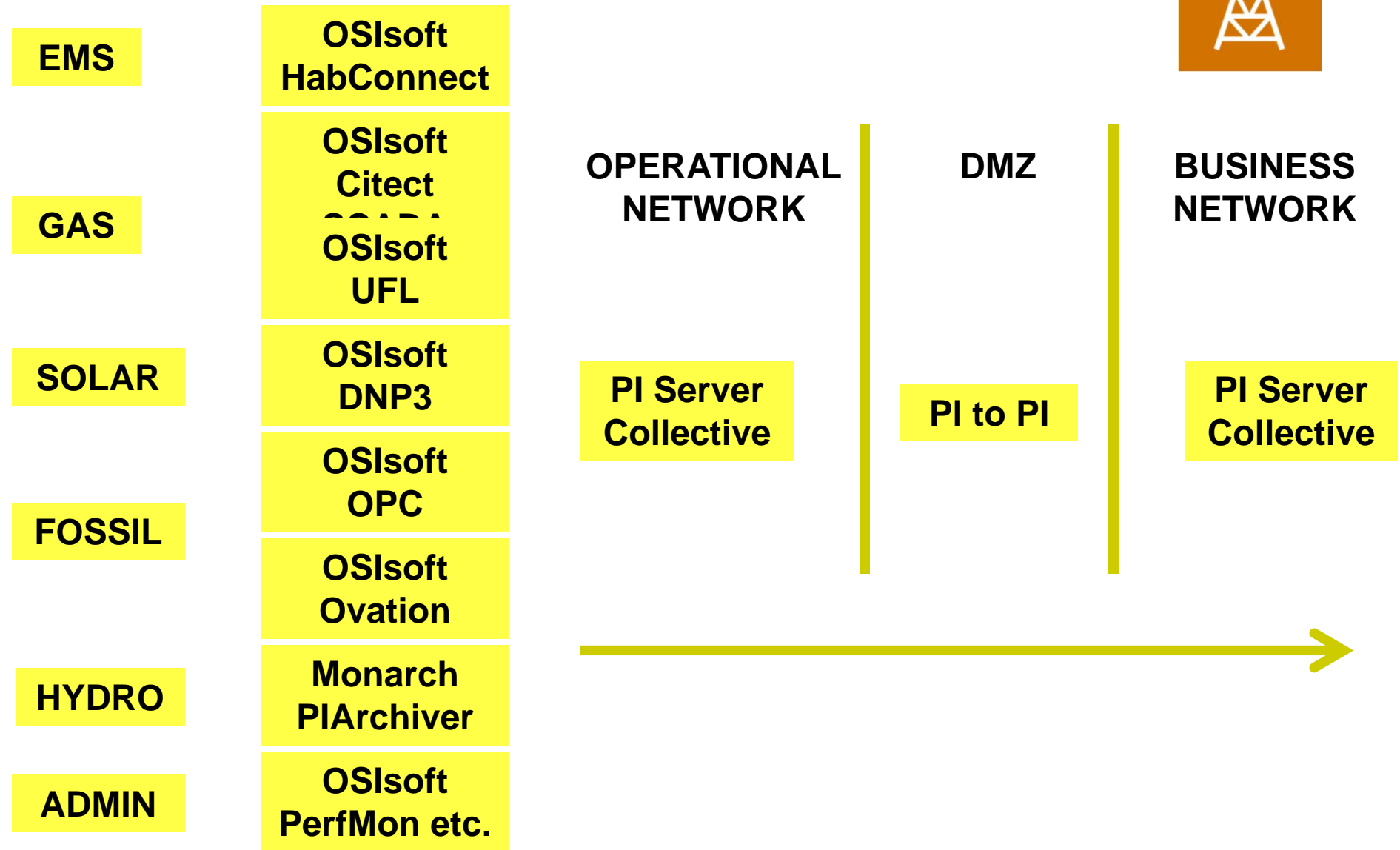
Version	PI Server 2010 R2
Point Count	575,000
Snapshots per second	4,000
Archive Storage	820 GB
Archive Files	175

PG&E's PI System - Points

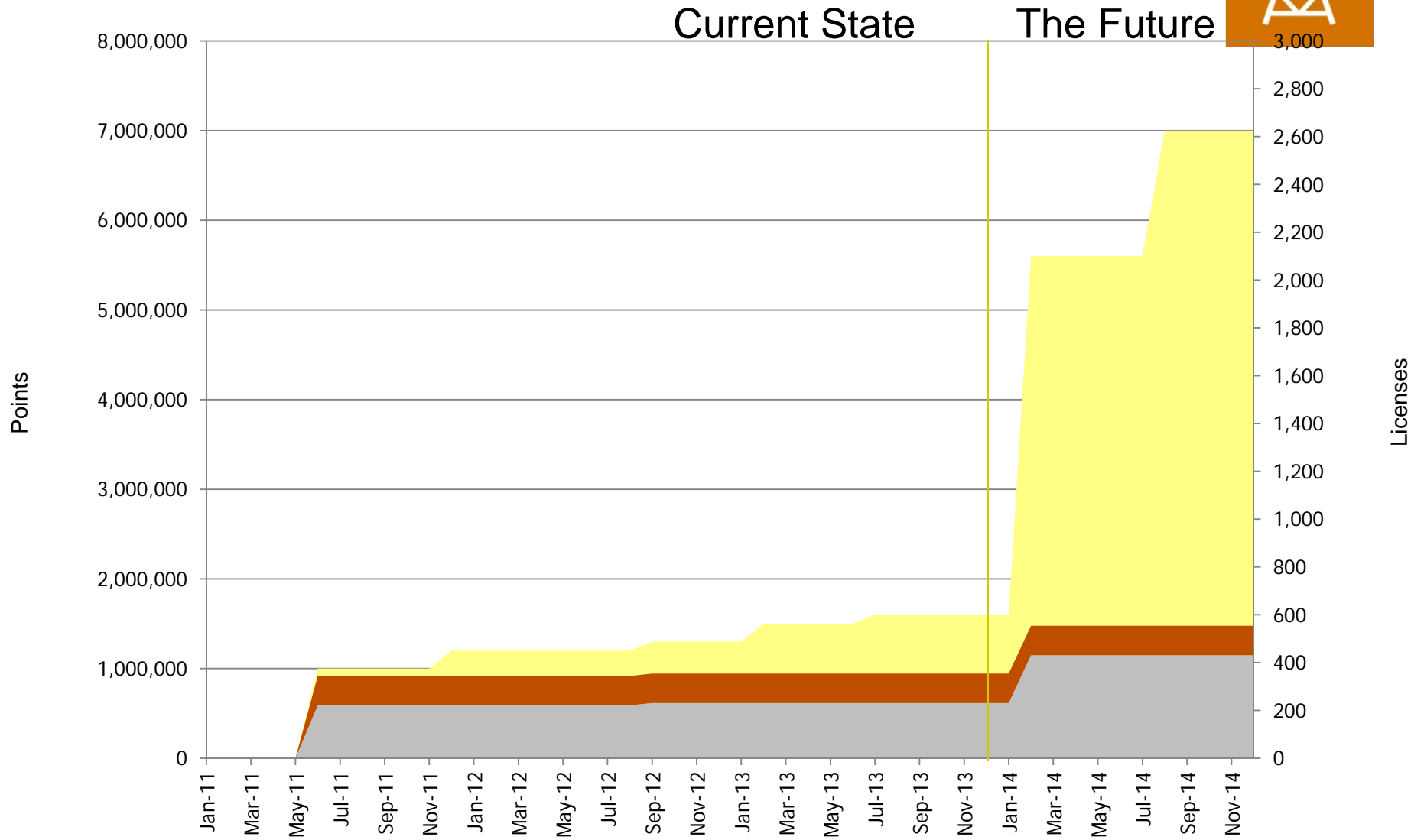
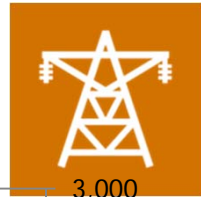


Point Counts by Line of Business

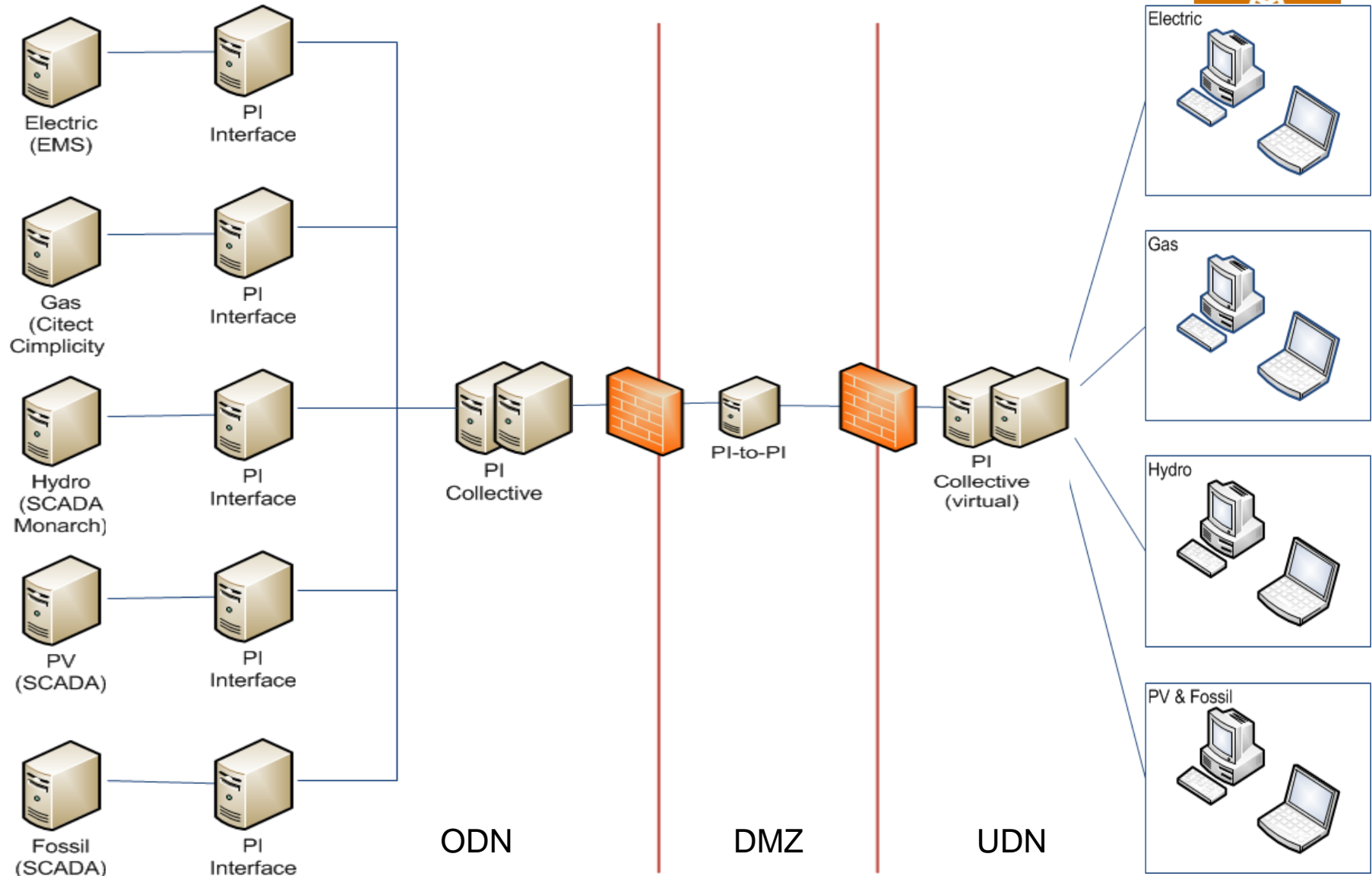
PG&E's PI System - Interfaces



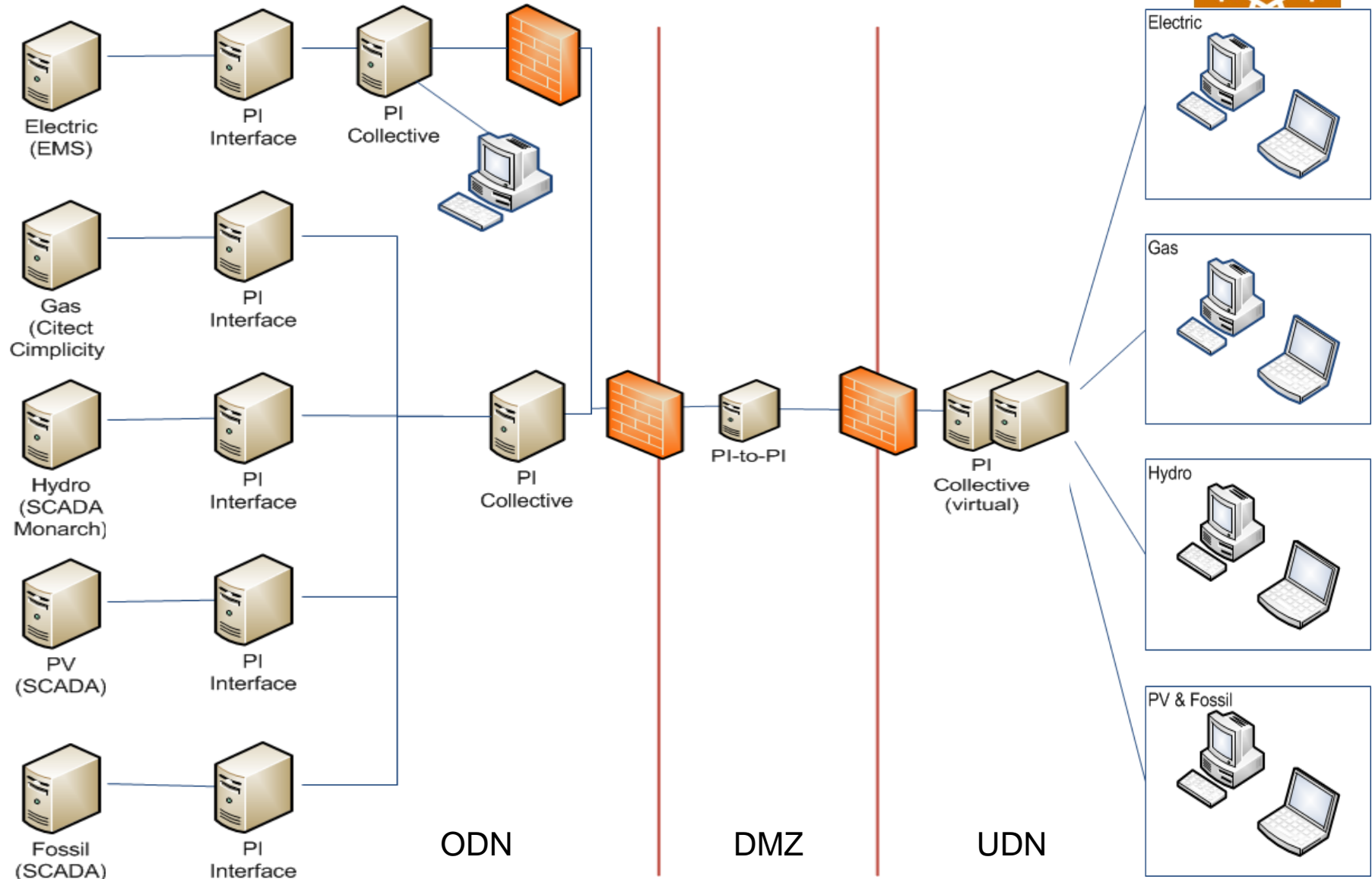
Roadmap



Architecture



Architecture



Powerlink - Queensland, Australia

How we use PI System - NED



- Network Element Downtime calculator
 - Automatically calculate network element availability
 - Business wanted a POC – quick/agile/low \$
 - Use RTDUET?
 - Develop in-house POC – saved \$80K
 - EMS Network Topology Processor results > PI
 - .net service automates Event framing – inputs from OMS & HMI on EMS
 - Now in Production

How we use PI System - NED



- WAS – wait for EOM report & impact on bonus \$
 - E.G. Outage of Cap bank early in mth – \$120K penalty
- NOW – impact on bonus \$ known same day – aids response to outages – planned & forced -
 - Drive car or use helicopter ?
 - Fix now or defer ?

How we use PI System - NED



Cost of Regulator report

- WAS - 2 x staff, 2 weeks per mth
- NOW –
 - 1 x staff for 1 day per mth
 - 1 x staff for 1/2 hour per day
- Saving = \$110K year, i.e. 0.8 FTE
- Satisfy Regulator quality audit
- Repeatable processes

How we use PI System – Alert Centre



- PI connectors – SNMP, mibs, traps > servers, switches, routers, wallboard/map-board screens
- Alert to SMS, email, FAX, Diary
- Non-SCADA connected plant
 - Data center BMS, PDU's, HVAC/CRAC
 - Data center Gensets, Fire, Security
- EMS 100% availability !
- RTCA 99.9875% availability
- Telecommunications MUX's
- Use ACE algorithm for generating alerts
- Auto logging ALERTS in Operator Diary

How we use PI System – Alert Centre



The screenshot shows the PI System Alert Centre interface. At the top, there is a navigation bar with tabs for Systems, EMS, Telecom, Applications, Tools, Reports, AMT, and BMS. Below this is a secondary bar with tabs for Activity Manager, Diary, Absences, Overtime Log, Support Roster, Calendar(Gantt), Documents, Syslog Viewer, Admin, and AlertCentre. The main content area is divided into several sections:

- Quick Links:** A list of various tools and reports such as '1 - QUICK CONTACT LISTS', '2 - Job Numbers 2012-2013', '3 - SubStn entry log', etc.
- IT Monitor Tree:** A tree view showing the hierarchy of assets, including categories like Auxiliary, EMS, Development, Disaster Recovery, Production, Simulator, Test, State Estimator, QData, QData_WC, Historian, Network, SNMP Traps, Syslog, and Telecom.
- Active Alerts:** A section showing a list of active alerts, including details like 'HUAWEI' and various user names.
- DIARY:** A section showing a list of diary entries with columns for Time, User, and Text. The text includes various system alerts and reminders.

Four callout boxes highlight specific features:

- Tree of assets Hierarchy:** Points to the IT Monitor Tree.
- Current ALERTS:** Points to the Active Alerts section.
- Team web portal Presents Alert info:** Points to the main alert list area.
- Diary of alerts + user notes:** Points to the DIARY section.

How we use PI System – Alert Centre



PI tag lookup
Equipment lookup
HUAWEI

Network
Auxiliary
Production
Simulation
Test
State Estimator
QData
QData_WC
Historian
Development
Disaster Recovery
Production

Detail of ALERT

ALERT
Unconfirmed: \\POVPITM1\Huawei_DWDM_Alarm_Count[Huawei] on Monday, 20 August 2012 13:52

Alert on 20/08/2012 1:52:13 PM for Tag \\POVPITM1\Huawei_DWDM_Alarm_Count on Equipment Huawei
DWDM - \\POVPITM1\Huawei_DWDM_Alarm_Count Critical exceeded.
Current value: 16 - Critical
Critical: 15

Notifications: SMS and Email on 20/08/12 13:52 to raguayo

Early Warning No Fault Found Loss Of Service

ALERT
Unconfirmed: \\POVPITM1\Huawei_DWDM_Alarm_Count[Huawei] on Tuesday, 21 August 2012 00:42

Alert on 21/08/2012 12:42:12 AM for Tag \\POVPITM1\Huawei_DWDM_Alarm_Count on Equipment Huawei
DWDM - \\POVPITM1\Huawei_DWDM_Alarm_Count Critical exceeded.
Current value: 15 - Critical
Critical: 15

Notifications: SMS and Email on 21/08/12 00:42 to raguayo

Early Warning No Fault Found Loss Of Service

User must confirm/resolve > auto escalate

How we use PI System – Loss of Load Alert



How we use PI System – Loss of Load Alert



- QANTAS A380 incident 2010 –
 - Share price falling 13 mins after incident
 - Before plane had even landed !
- Social media – fast – & accurate?
- Learning – tell business ASAP !!!!!!! **5 minutes**
- Loss of Load alert – using the outcomes of NED – in development

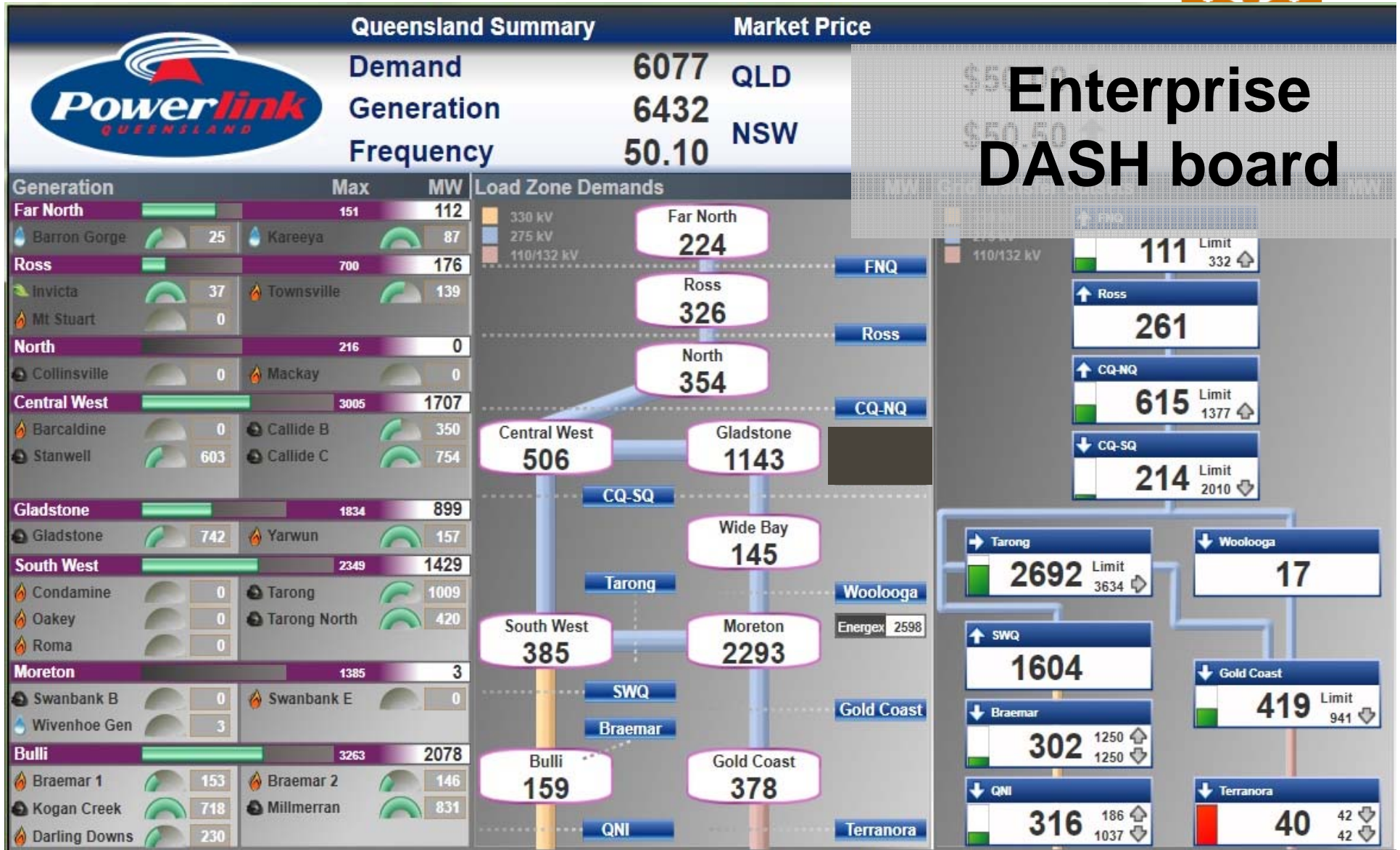
How we use PI System – Loss of Load Alert



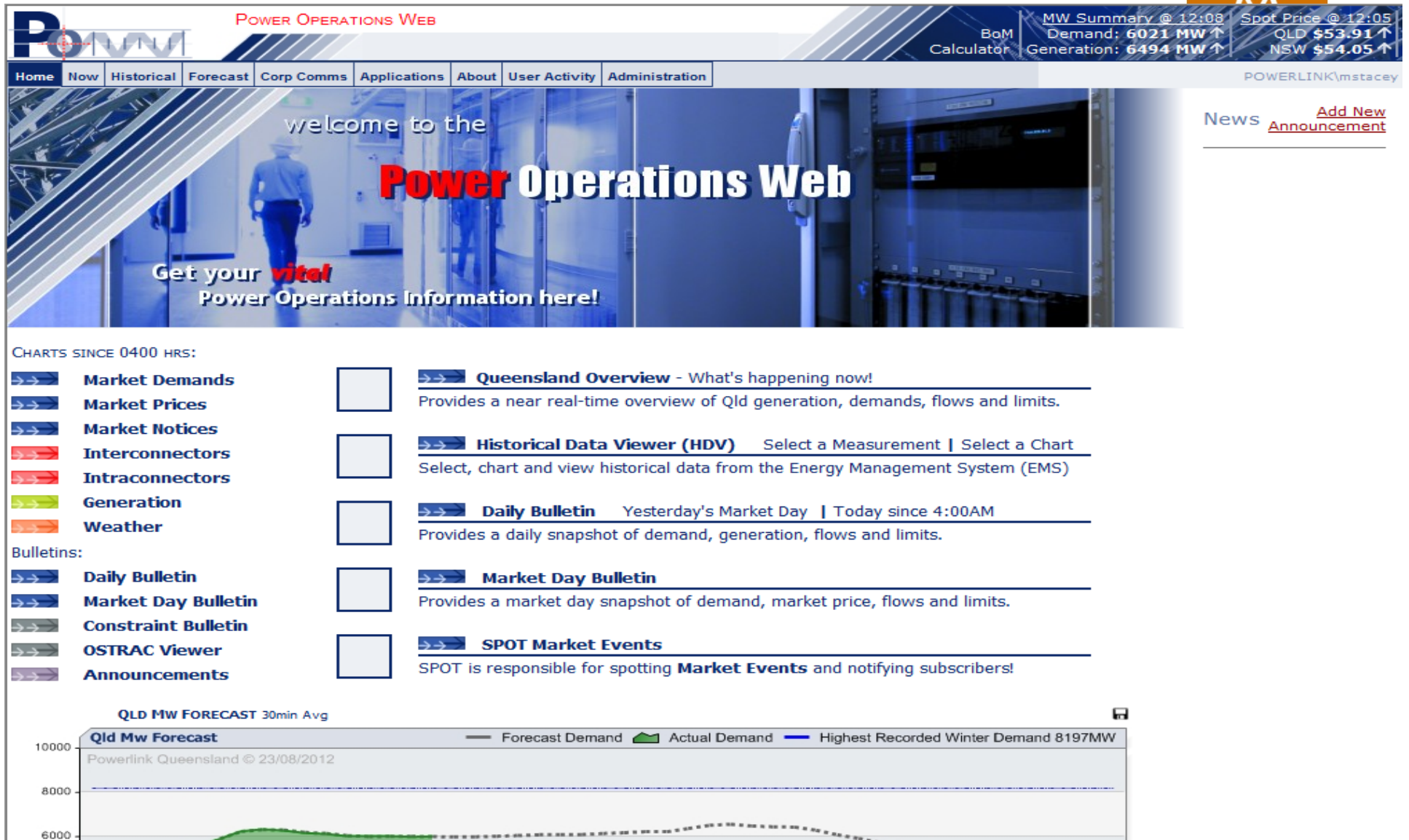
- Due Q1 2013
- Using NED Event framing engine (PI events)
- Use PI calc to detect loss of load - combo of event frame & ZERO load
- Generate SMS/email via Alert Centre
- Avoid false positives
- Alert - Emergency Manager, CEO, Corp Comms

5 minutes !!!!

How we use PI System – the Enterprise



How we use PI System – Enterprise use



How we use PI System – Enterprise use



EMS STATE ESTIMATOR PERFORMANCE BY POWERLINK\MSTACEY

EMS Real-time State Estimator appln performance

MY CHARTS

My Group

DEFINED CHARTS

- Bulk Supply Loads
- EMS performance
- Interconnectors
- Intraconnectors
- Load Zone Demands
- Qld North charts
- Qld South charts
- System charts
- Topical Charts

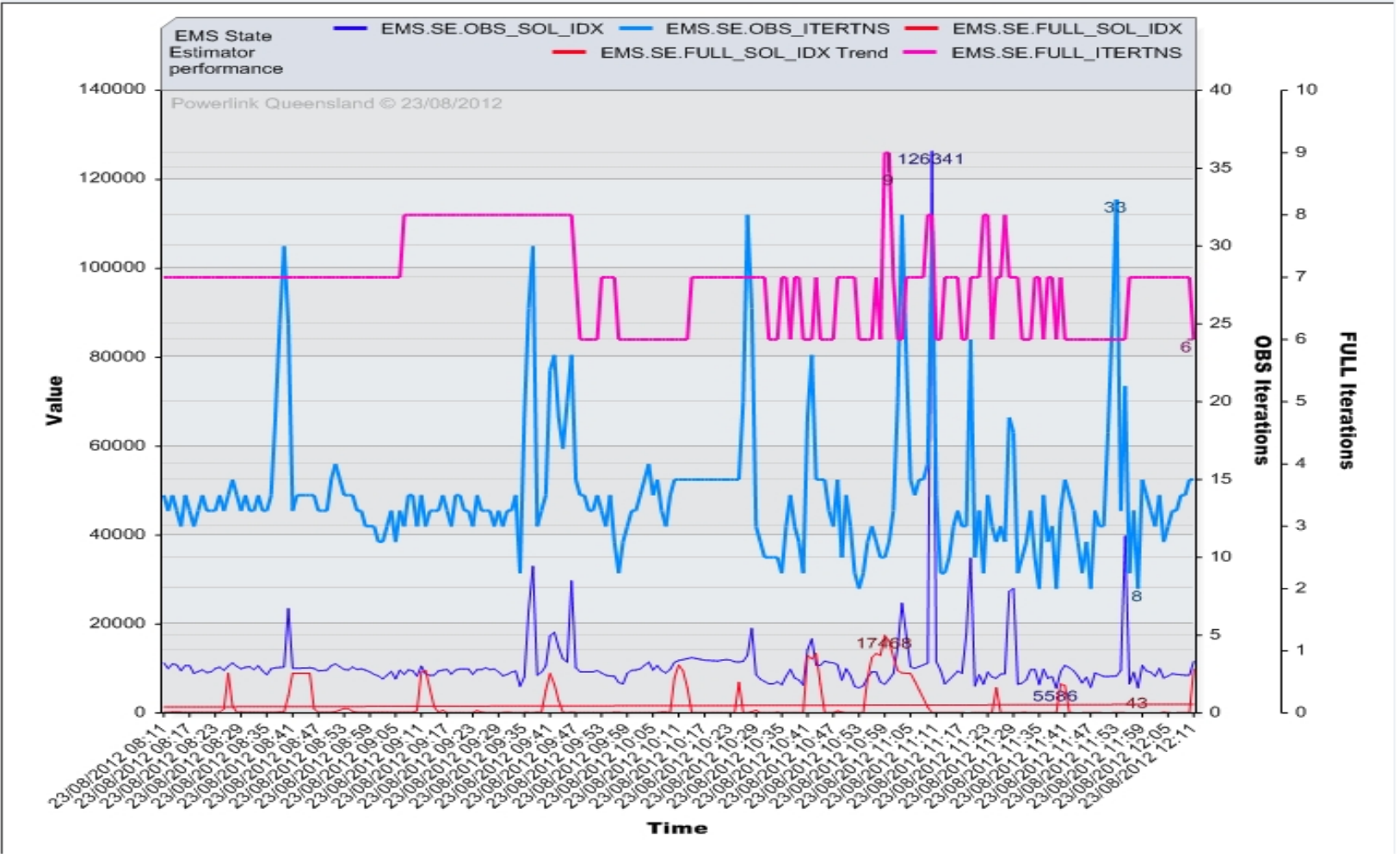
SHARED CHARTS

- Alex (POWERLINK\apogadae)
- Andrew (POWERLINK\abannist)
- Andrew (POWERLINK\atimms)
- Brian (POWERLINK\bday)
- Cameron (POWERLINK\cmclean)
- Chris (POWERLINK\cscott)
- David (POWERLINK\dparry)
- Dion (POWERLINK\dmikkels)
- Enrique (POWERLINK\emontiel)
- Gordon (POWERLINK\ggrayson)
- Ian (POWERLINK\iprescot)
- Kevin (POWERLINK\kpaice)
- Matt (POWERLINK\mkeune)
- Paul (POWERLINK\pkirn)
- ...

Options: Statistics Data Table Marker Alert level at 200 ■ ...

Refresh

THURSDAY, 23 AUGUST 2012 AT 08:11 TO THURSDAY, 23 AUGUST 2012 AT 12:11





THANK YOU

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