

PI System at CAISO Since Year 2000

Presented by **Tim Willenberg – California ISO**
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Where we started...

- PI System was brought into CAISO around 2000 as an engineering planning tool
- 10-15 users
- Developed a way to connect CAISO EMS SCADA data to the PI System
- PI System replaced the Historian for ABB Spider EMS “archived” data.

Where we started...



PI is used at CAISO...

- Real Time Operations and Engineering
- Planning
- Compliance/Market
- Forecasting
- Training/Simulation
- Web Services

Where we started...

- A new EMS brings new opportunities
 - Multiple real-time data streams to multiple PI Servers
 - PI System becomes useful for real-time visualization
 - Engineering groups become more engaged
 - CAISO Real-time Operations sees the benefits

New Control Room



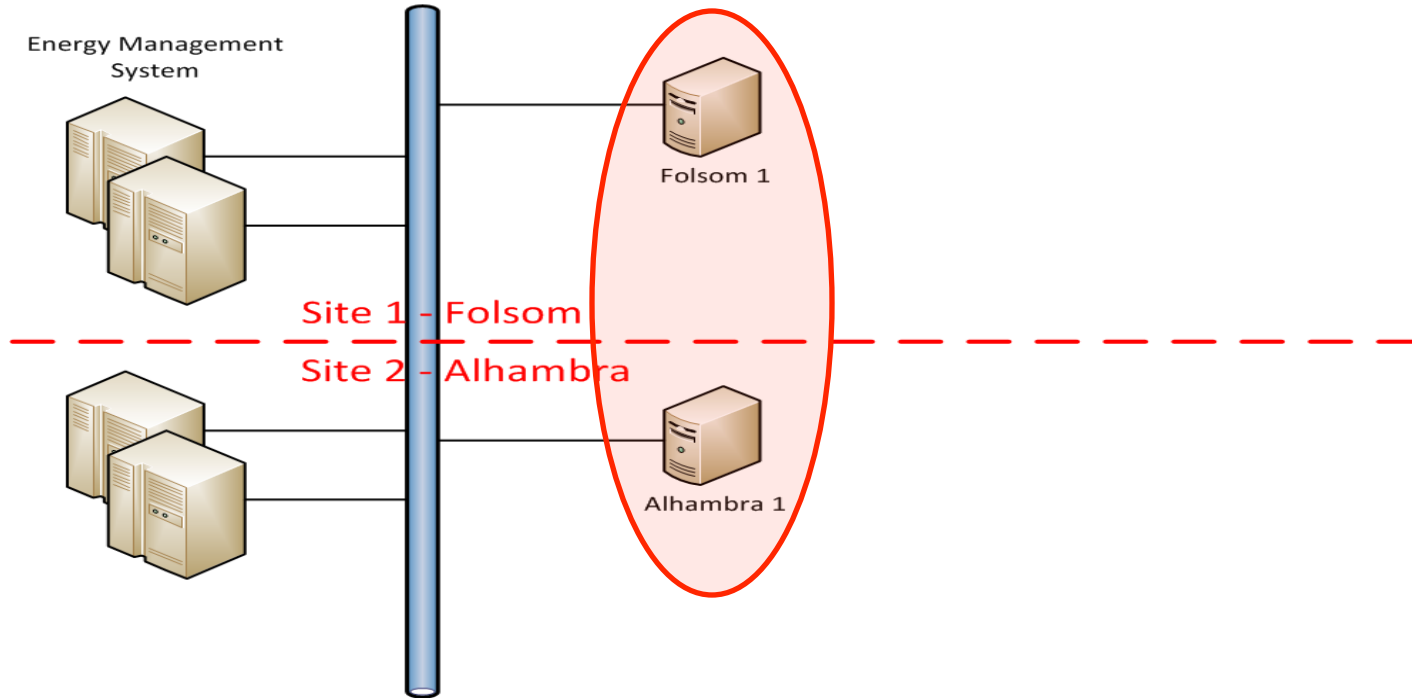
PI grows quickly at the CAISO...

- PI System becomes a Critical Cyber Asset at the CAISO
 - 6 identical Production servers in 3 HA Collectives
 - Staging Systems (tied to EMS Staging System)
 - Test Systems (tied to EMS Development System)
 - 5 Training Simulation and Market Test Systems

CAISO HA Architecture

PI Production Environment

Collective 1

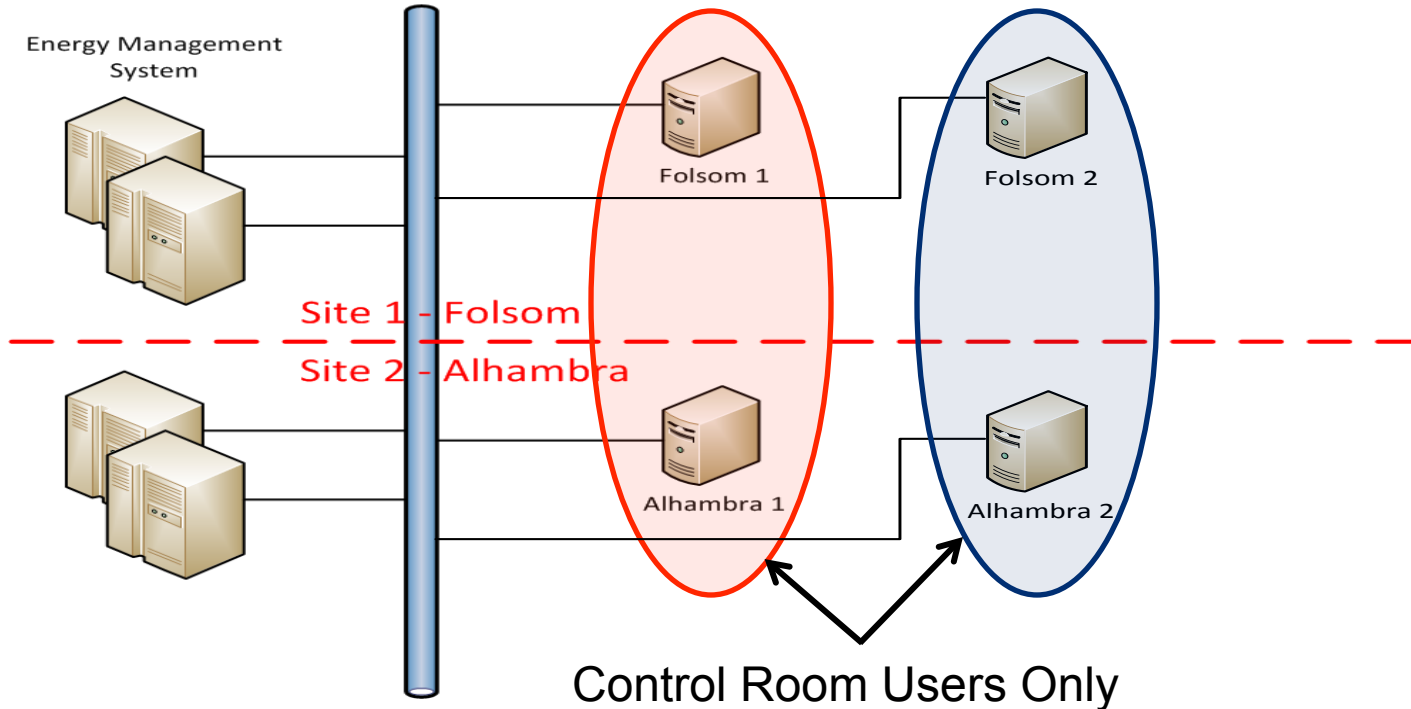


CAISO HA Architecture

PI Production Environment

Collective 1

Collective 2



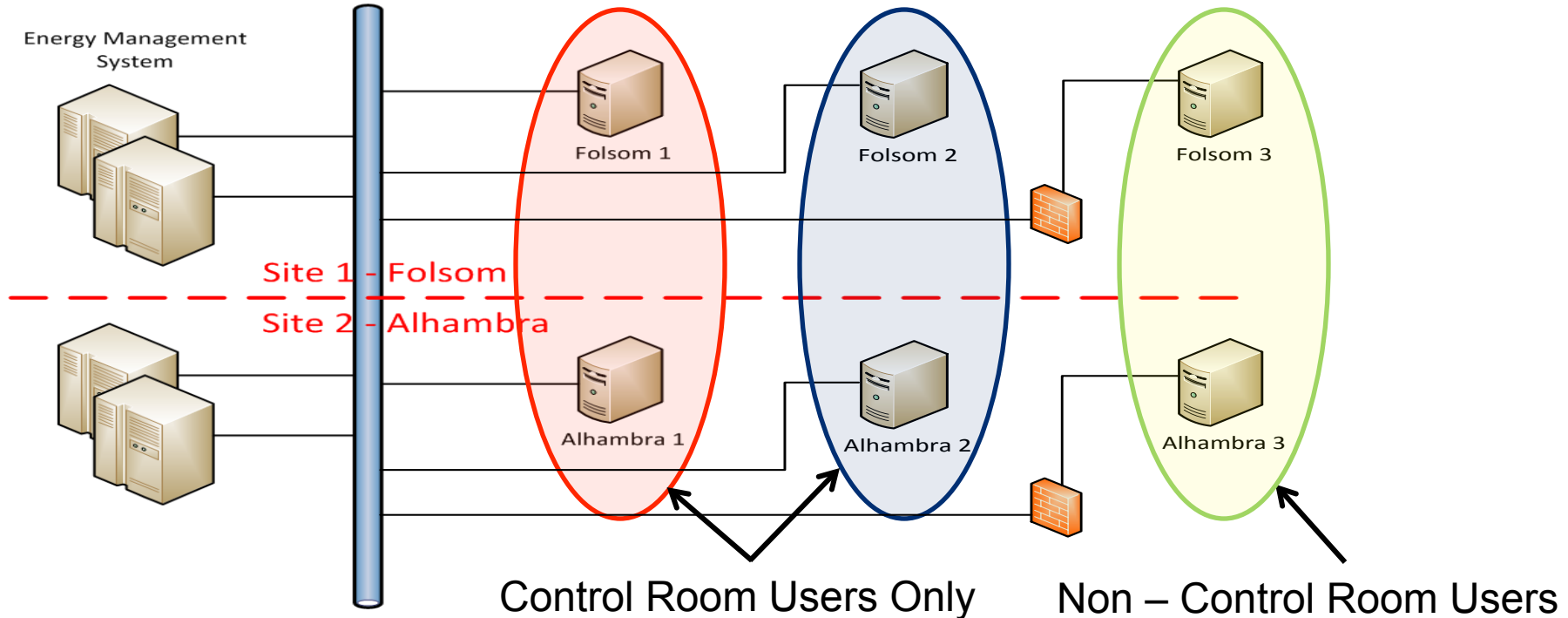
CAISO HA Architecture

PI Production Environment

Collective 1

Collective 2

Collective 3



PI Content Management

- New PI opportunities = **lots** more users
 - Currently we have over 400
- The “Wild Wild West”
 - CAISO leverages the flexibility of PI
 - Balance flexibility with “loss of control”
 - PI becomes a critical system – we need reliability
 - Managing operator and engineering displays is crucial

PI Content Management

- E2T Tracking Tool
 - What is E2T?
 - New or Modified display? Check it in!!
 - What does E2T do?
 - Looks for common errors
 - Updates to current tag names
 - Distributes across all systems
 - Puts display in the right place

Request and Tracking Management Tool – E²T



E²T
Event Enhancement Tracker

[Submit Comments](#)
Login: James Hiebert

Request ID Lookup

- View My Requests
- DCR - Current EMs
- DCR - Old EMs
- Data Request
- Data Quality
- DB Edits
- Net Apps
- System Ops Apps
- PI

View Open Requests
All PI Requests
New
Approved
Being Researched
Rejected
Ready for Verification
Verification Passed
Verification Failed
Failed Spawn
Completed

Search by Requestor
Search by Assignee
Search by Type
Search by Display Owner
Search Display Name
Non-Display Requests

Display Ownership
Expired Displays
PI-Admin Pages
Display FAQ & Logs

[Submit New Request](#)

[Admin Tool](#)

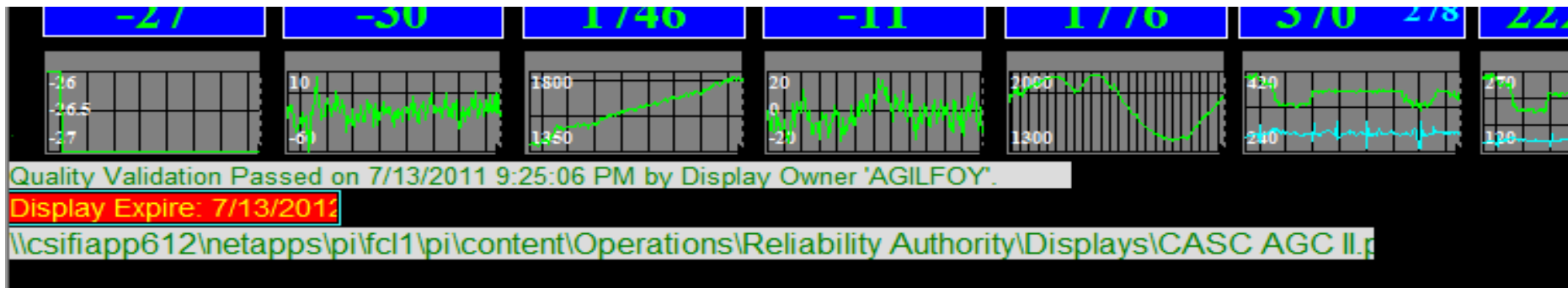
Records 1 - 4000 [Print](#)

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PI Requests - Completed								
ID	Requestor	Date	PI Request Type	PI Process Type	Display/Item Name	Assignee	Display Owner	Status
915	Timothy Willenberg	3/14/2006 8:48:16 AM	Performance Equation	ADD	SCE Coastal No Pump Load Averages - 5min and 30min	Willenberg		Completed 0
916	Timothy Willenberg	3/14/2006 9:58:41 AM	Performance Equation	ADD	SCE Inland No Pump Load Averages - 5min and 30min	Willenberg		Completed 0
922	Timothy Willenberg	3/15/2006 4:17:43 PM	Performance Equation	ADD	Vernon No Pump Load Averages - 5min and 30min	Willenberg		Completed 0
932	Nick Messner	3/16/2006 3:48:21 PM	PI Display	UPDATE	WEST OF DEVERS.PDI	Willenberg		Completed 0
937	Timothy Willenberg	3/16/2006 4:49:45 PM	PI Display	UPDATE	CAISO SE STATUS.PDI	Willenberg		Completed 0
942	Timothy Willenberg	3/17/2006 9:06:06 AM	PI Display	UPDATE	CAISO SE STATUS.PDI	Willenberg		Completed 0
951	Nick Messner	3/20/2006 10:38:21 AM	Word	UPDATE	West of Devers FL1 MITIGATION.docWest of Devers FL2 MITIGATION.docWest of Devers FL3 MITIGATION.doc	Willenberg		Completed 0
956	Nick Messner	3/20/2006 1:23:44 PM	Performance Equation	UPDATE	WOOD: N-0 SB-Etiwanda FLCVWOOD: N-1 (Dev-Valley) SB-Etiwanda FLCV	Willenberg		Completed 0
957	Jenny Lynch	3/20/2006 1:33:10 PM	Performance Equation	ADD	New Performance Equations.xls	Willenberg		Completed 0
962	Timothy Willenberg	3/21/2006 8:56:00 AM	Maintenance	UPDATE	n/a	Willenberg		Completed 0
963	Jenny Lynch	3/21/2006 9:26:25 AM	Performance Equation	UPDATE	Edit Performance Equations.xls	Willenberg		Completed 0
967	Nick Messner	3/21/2006 1:32:27 PM	Maintenance	UPDATE	server change	Willenberg		Completed 0
969	Timothy Willenberg	3/22/2006 9:02:46 AM	Maintenance	UPDATE	PI Procbok INI files and possibly others	Willenberg		Completed 0
970	Timothy Willenberg	3/22/2006 9:05:36 AM	Maintenance	UPDATE	many display, XL and Procbok files	Willenberg		Completed 0
972	Timothy Willenberg	3/22/2006 10:51:07 AM	Performance Equation	UPDATE	SCE.COASTAL.NOPUMP_B.CV	Willenberg		Completed 0
975	Nick Messner	3/23/2006 9:37:23 AM	Performance Equation	UPDATE	New performance equations	Willenberg		Completed 0
987	Timothy Willenberg	3/24/2006 2:40:23 PM	Performance Equation	UPDATE	Oakland CX_DL Flow Limit Alarm.ALH	Willenberg		Completed 0
988	Ben Stephenson	3/24/2006 3:13:40 PM	Excel	ADD	T-129 Schindler-Stroud Nomogram	Willenberg		Completed 0
992	Nick Messner	3/24/2006 4:33:25 PM	PI Display	UPDATE	WEST OF DEVERS.PDI	Willenberg		Completed 0
1005	Nick Messner	3/28/2006 11:57:16 AM	Word	UPDATE	WOOD ETIWANDA-SB TEST FL1 MITIGATION.docWOOD ETIWANDA-SB TEST FL2 MITIGATION.doc	Willenberg		Completed 0
1006	Chue Thor	3/28/2006 1:02:28 PM	Performance Equation	UPDATE	Performance Equations for T-133 BAY AREA OPERATIONS.PDI	Willenberg		Completed 0
1014	Chue Thor	3/29/2006 9:40:23 AM	Performance Equation	UPDATE	Performance Equations for T-133 Bay Area Operations PI display	Willenberg		Completed 0
1019	Nick Messner	3/29/2006 3:06:03 PM	Performance Equation	ADD	WOOD: N-0 SB-Vista (de-loop) FLCV0.27* DEVERS - DEVERS-VALLEY_LIN_MWS .AV + SBERDO -SBERDO-VISTA_LIN_MW2 .AV	Soto		Completed 0
1022	Ben Stephenson	3/30/2006 9:56:09 AM	Maintenance	UPDATE	PI Alarmview	Willenberg		Completed 0
1024	Nick Messner	3/30/2006 10:48:17 AM	Word	UPDATE	West of Devers FL3 MITIGATION.doc	Willenberg		Completed 0
1030	Joseph Meier	3/30/2006 12:52:46 PM	PI-ProcessBook	UPDATE	T-138 HUMBOLDT NORMAL OPS.PDI-T-138 HUMBOLDT EMERGENCY OPS.PDI	Willenberg		Completed 0
1038	Jenny Lynch	3/31/2006 11:34:08 AM	PI Display	ADD	T-129 FRESNO AREA OPERATIONS.PDI	Willenberg		Completed 0
1040	Patrick Truong	3/31/2006 12:51:49 PM	Excel	UPDATE	SCIT nomogram	Willenberg		Completed 0
1045	Lynn Hurd	4/3/2006 8:51:40 AM	Maintenance	UPDATE	various	Willenberg		Completed 0
1047	Jenny Lynch	4/3/2006 12:33:36 PM	Maintenance	ADD	PI Alarm.XLS	Willenberg		Completed 0
1050	Ben Stephenson	4/3/2006 4:16:50 PM	PI Display	UPDATE	10AM TO 7PM EXCEPTION LINE OVERVIEW-SUMMER 2006.PDI	Willenberg		Completed 0
1053	Patrick Truong	4/4/2006 8:12:09 AM	Excel	UPDATE	SCIT Nomograms	Willenberg		Completed 0

PI Display “Water Marks”

- “Water Mark” indications at the bottom of every display show:
 - Display Owner
 - Quality Validation Date
 - Display Expiration Date
 - Content Location
 - Warnings



Two types of CAISO PI Displays

- Persistent Displays
 - Stable Displays – infrequent changes
 - Validated/Tested by both the PI Admin and Operations Engineers before moving to production
 - Highly optimized
- Outage Displays
 - Submitted through E2T tracking tool but processed automatically to production for validation
 - Accessed by automatically generated Table of Contents
 - Temporary displays correspond to the Planned Outage
 - Expire (disappear) when Grid maintenance is complete

Planned Grid Outage Maintenance

+ Auto Pushed Displays - Date Sort

+ Today, 9/19/2012

- SLIC 1987349 KESWICK-CASCADE LINE [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1961221 SOBRANTE-MORAGA [7/3 [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1965281 & 1965380 - Palermo-Nicolaus & Palermo-Bogue 115kV lines**
- SLIC 1965263 & 1965379 - Palermo-Nicolaus & Palerr [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1961713 & 1965373 - Palermo-Nicolaus & Palerr [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1986852 Vierra_Kasson_Tracy_0705 [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1986135_Vierra_Kasson_Tracy_0703 [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- Cottonwood-Olinda overload [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1961711 & 1965372 - Palermo-Nicolaus [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1983401 BC3-Springville_230 Line [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1987242 Lugo-Vincent_2_out [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep

+ Tomorrow, 9/20/2012

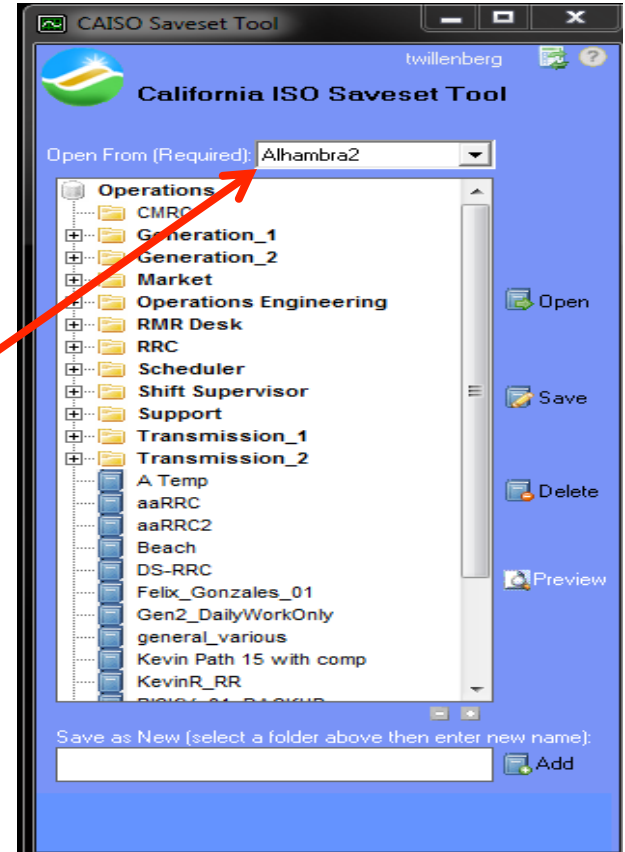
- Cottonwood-Olinda overload
- SLIC 1961711 & 1965372 - Palermo-Nicolaus & Palermo-Bogue 115kV lines
- SLIC 1983401 BC3-Springville_230 Line
- SLIC 1987242 Lugo-Vincent_2_out
- P26vsTehachapi
- 1986127-GEYSERS#3-CLOVERDALE
- SLIC 1983889 MIDWAY BANK 1
- SLIC-1925824-MENDOCINO-REDBUD
- SLIC 1979766 VACA DIXON BNK 2-2A
- SLIC 1794561 ANTELOPE-VINCENT #2
- IID Actual vs Scheduled flow
- SLIC-1940075-CORTINA-MENDOCINO
- SLIC 1900622 Lugo 1AA Bank outage
- SLIC 1839622 LLAGAS

Real Time Contingencies

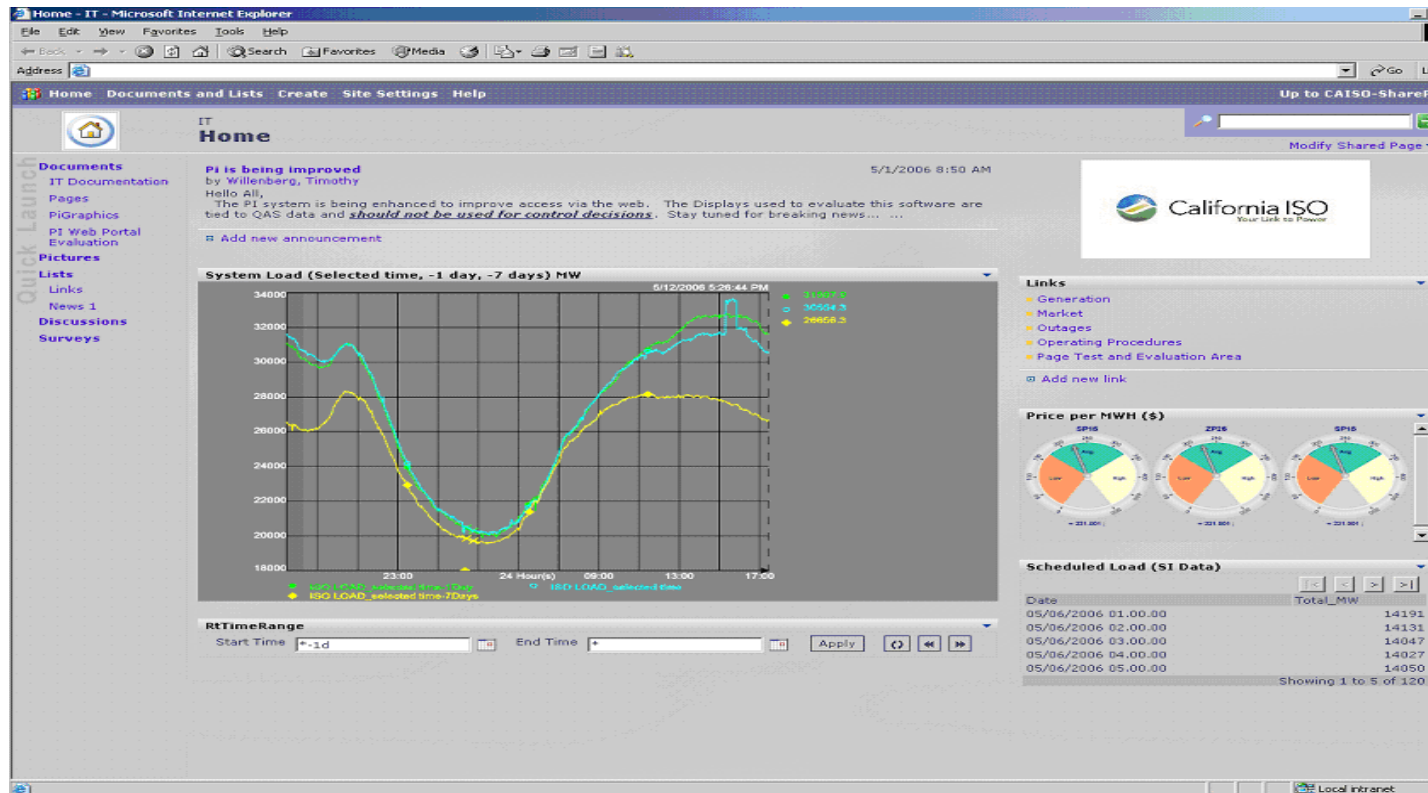


Save-Set Tool

- Dispatchers have the ability to organize PI displays on the screen and “save” them in the tool
- Each dispatcher can access PI content from any of the three collectives using the Save-set Tool



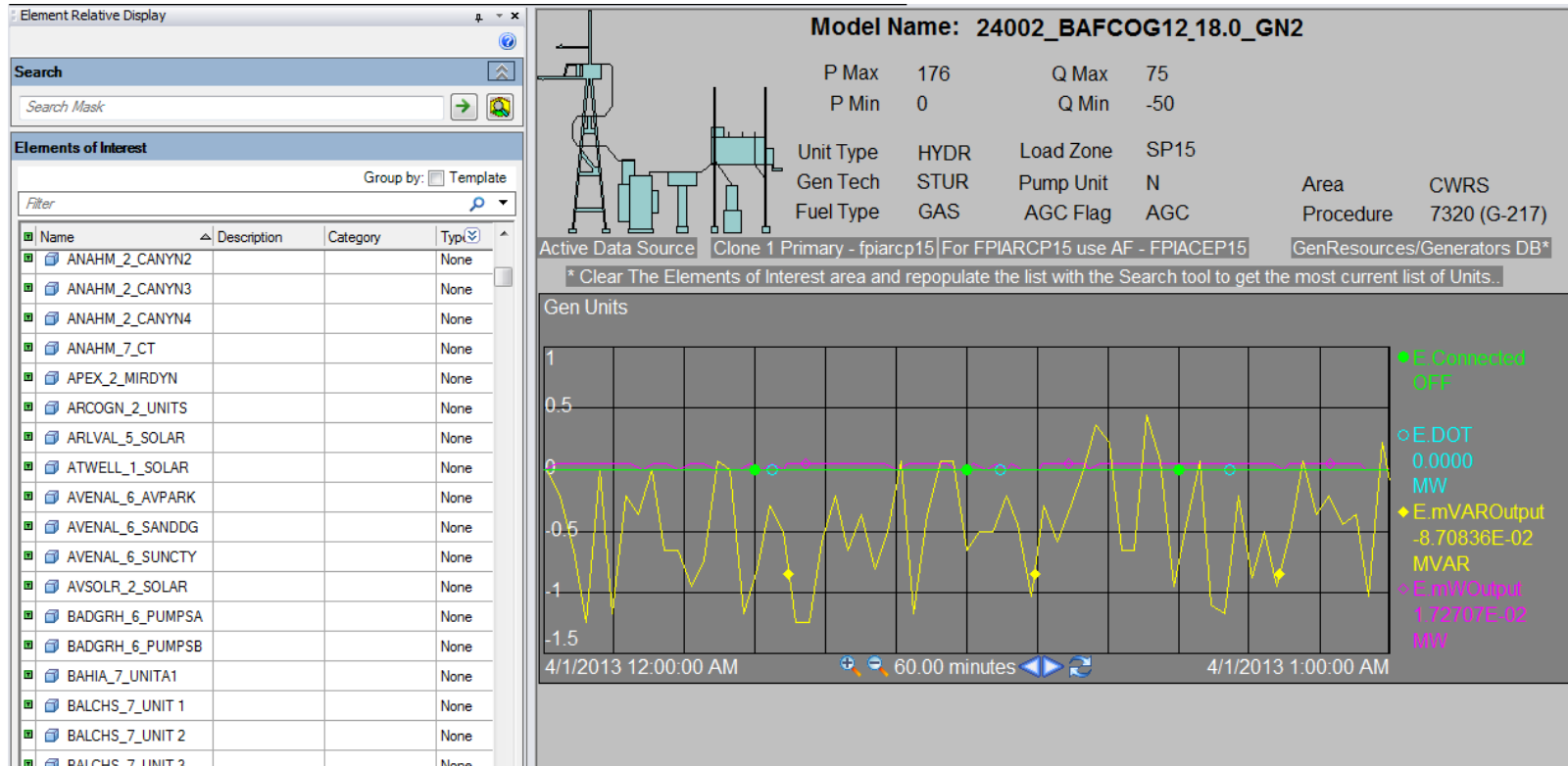
WebParts



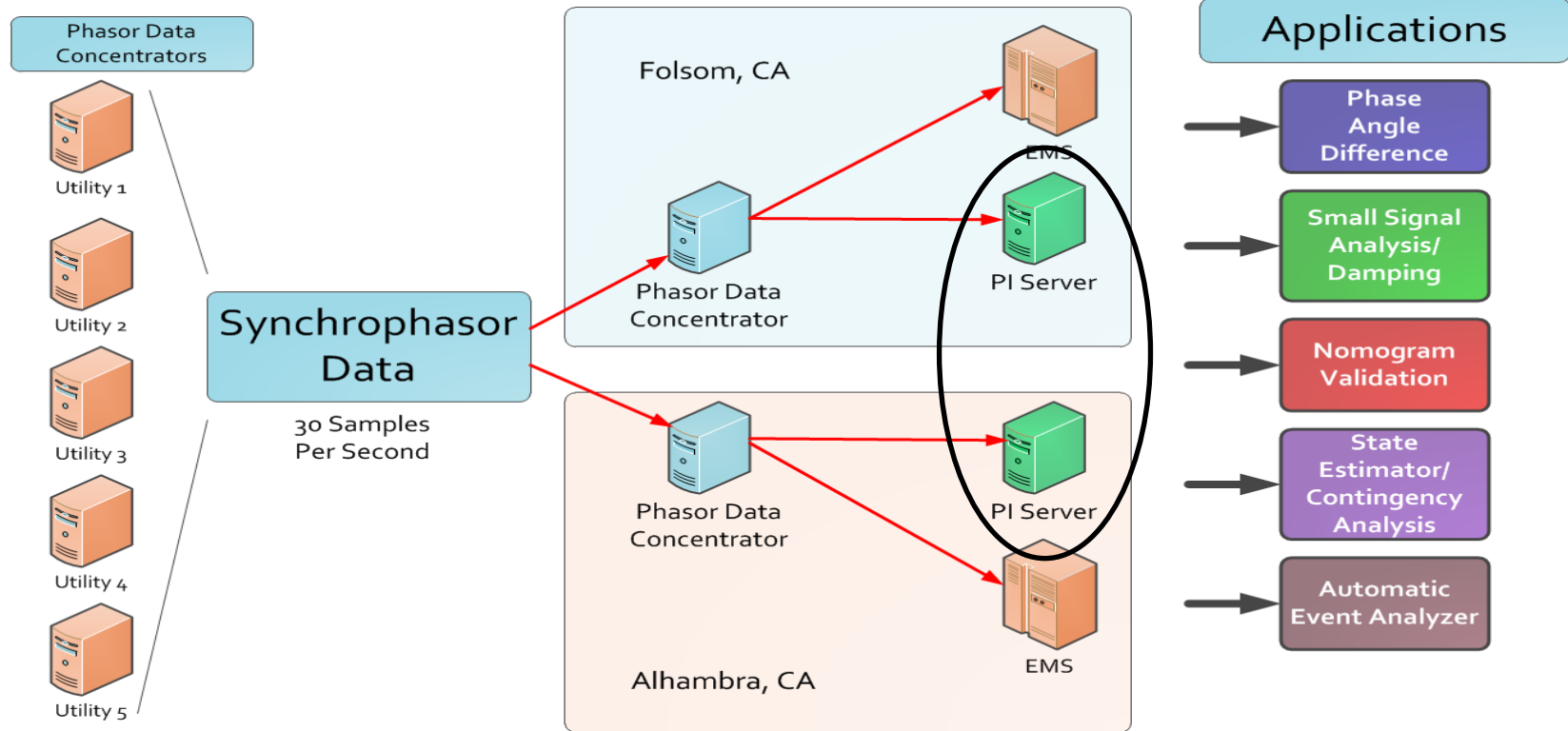
PI AF Implementation

- CAISO PI AF Implementation
 - Compliance focused on Generator modeling
 - Brings together equipment “nameplate” information along with active telemetry and performance trends
 - Programmed PI AF to display information for over 1000 Generators
 - Replaced 898 “conventional” displays with a single PI AF enabled display

PI AF Display



Synchrophasor Project



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