



Building a Real-Time Event-Driven Enterprise Infrastructure

Ann Moore – Business Development Executive

Agenda

- **PI for Enterprise Infrastructure**
- **Utility Industry Use Cases**
 - **Operational Data**
 - **Non-Operational Data**
 - **Asset/Model and Analytics**
 - **Critical Infrastructure Monitoring**
- **Summary and Q&A**

PI Centric Infrastructure

EMS-2 sec DMS-2 sec DCS-2 sec

Substation IED - 2 sec

Phasor – 1 ms Fault Recorder-1 ms

Meter – 5 min Power Market – 5 min

Planning-5 years

Infrastructure data

Asset/Model data

PI Platform/Infrastructure

Proven Utility Industry Use Cases

- **Operational:** EMS/DMS/DCS/SCADA data monitoring, archiving, event reporting and analysis
- **Non-operational:** substation field device non-SCADA data monitoring and archiving
- **Asset/Model:** metadata management and analytics
- **Security/Infrastructure:** Critical Infrastructure Protection (CIP) and monitoring
- **Enterprise:** integration, correlation and repository

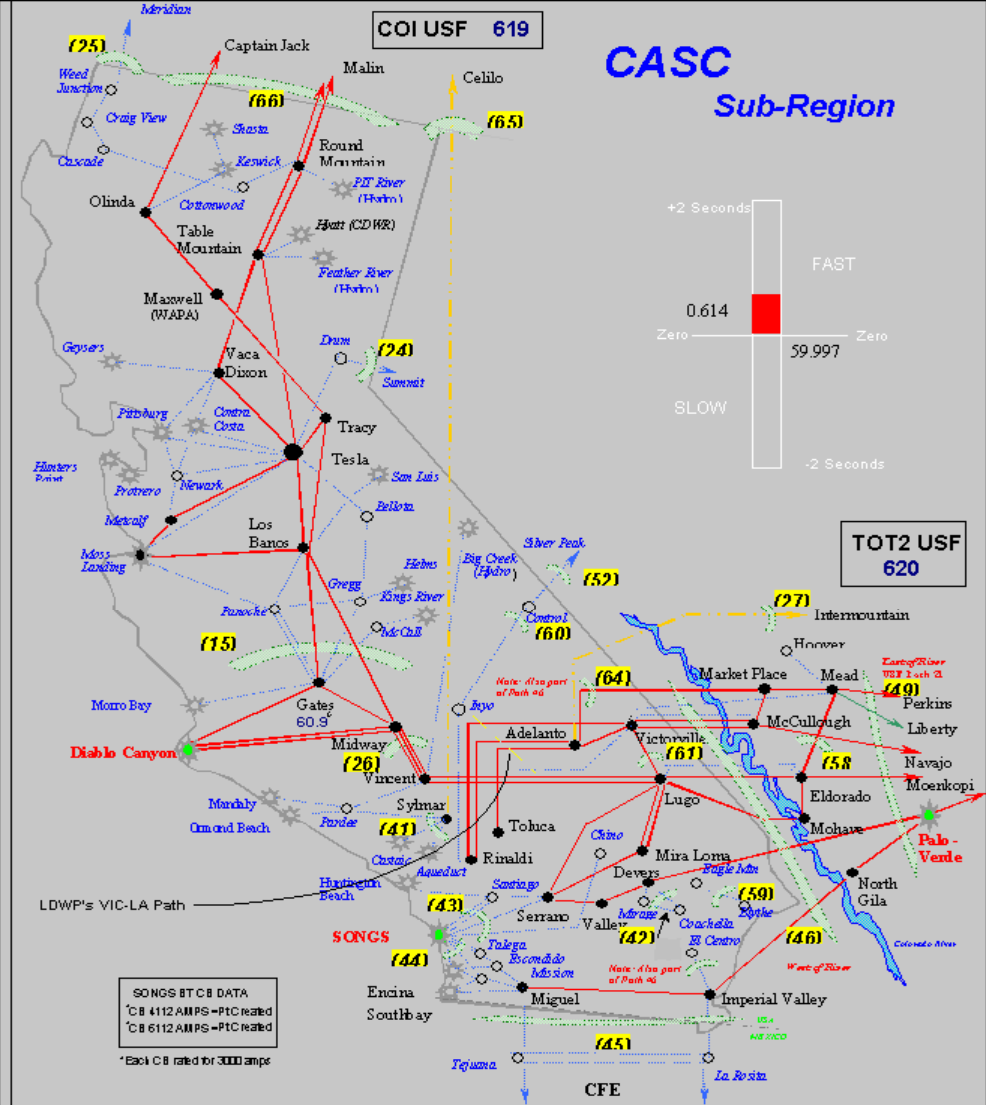
Utility Use Cases

PI for Operational Data

Enhancing and Complementing

- Real-time data analysis
- Real-time decision making
- Real-time visualization
- Long-term data archiving/retrieval
- Interfacing multiple external data sources
- Centralized data repository and user interface
- What-if case studies
- Easy of use and accessibility for everyone
- Off load from real-time control and operations





PATH	RATING	CHART
Path 15	1275 MW S 3449 MW N	
Path 24	120 MW E/W	
Path 25	110 MW N/S	
Path 26	30 MW S/N	
Path 27	1920 MW NE/SW	
Path 41	1200 MW	
Path 42	600 MW E/W	
SDG&E & CFE	3050 MW Total Imports	
Path 43	2440 MW S/N	
Path 44	2200 MW N/S	
Path 45	40B MW Bi-directional (CFE)	
Path 46	10,118 MW E/W	
Path 49	7550 MW E/W (EOR)	
Path 52	17 MW (Silver Peak)	
Path 58	1460 MW Bi-directional	
Path 59	72 MW (Blythe)	
Path 60	56 MW Bi-directional	
Path 61	1950 MW N/S (Lugo/Vic)	
Path 62	2958 MW E/W (McCullough)	
Path 64	1200 MW (McP/Ad)	
Path 65	2871 MW N/S	
Path 66	2858 MW S/N	
COI	3675 MW S/N	
SCII	12700 MW	
VIC - (DAV)		

3004

15 WSCC AGC DATA

89

12 WSCC PATH TRENDS

987

-1302

41

42 TIME ERROR

-297

42 CISO AGC DATA

1228

43 CISO GENERATION

584

44

541

45 CAL/NEV GEN

-7

5326

-3854

1 SE GENERATION

146

-46

11 NW GENERATION

-933

471

624

-116

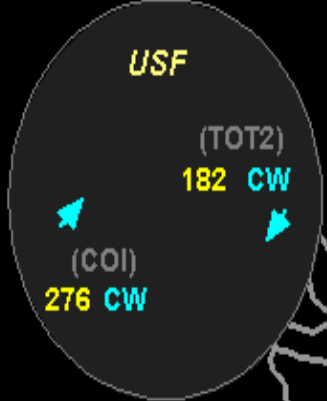
-665

-6316

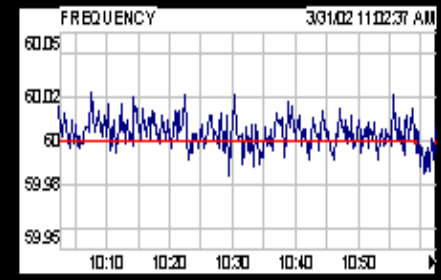
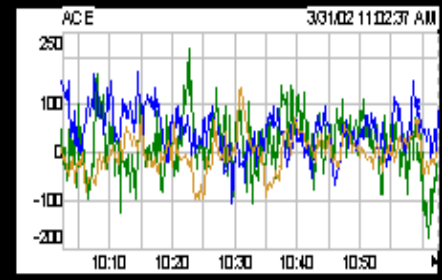
NERC

CAISO

California Independent System Operator



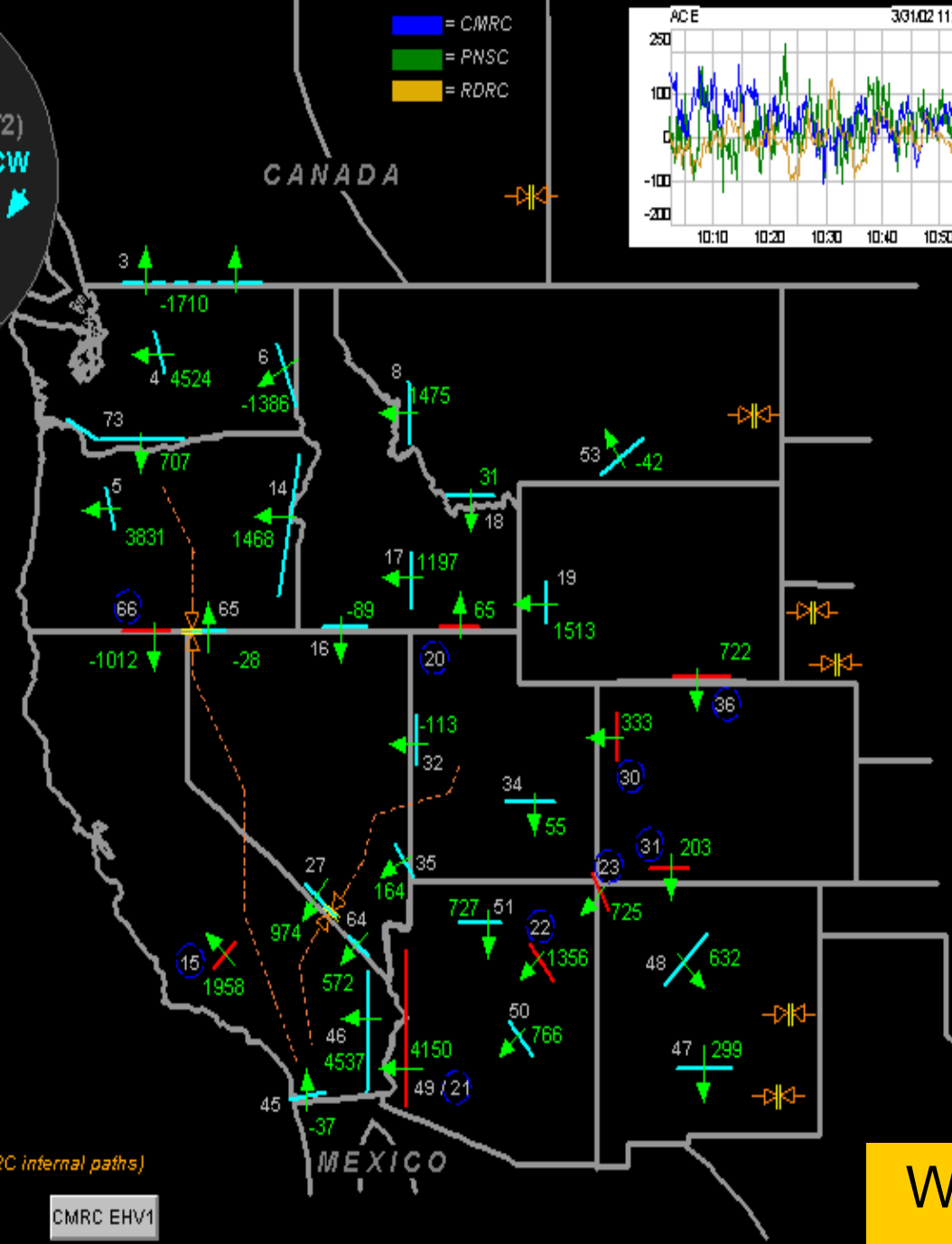
█ = CMRC
█ = PNSC
█ = RORC



- Generation**
- NorthWest
 - NorthEast
 - SouthWest
 - SouthEast
- WSSC PATH MONITOR
- WSSC PATH TRENDS

W.S.C.C. TRANSFER PATHS
 (Refer to CMRC EHV 1 for CMRC internal paths)

CMRC EHV1



INTERACTION

TIME ERROR



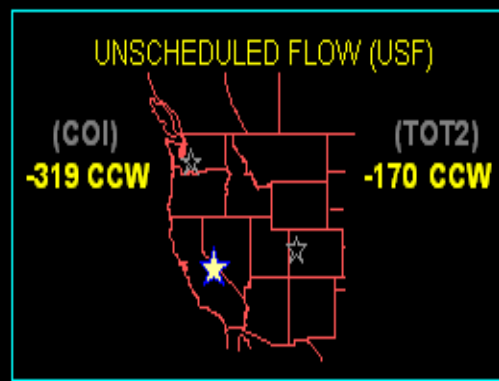
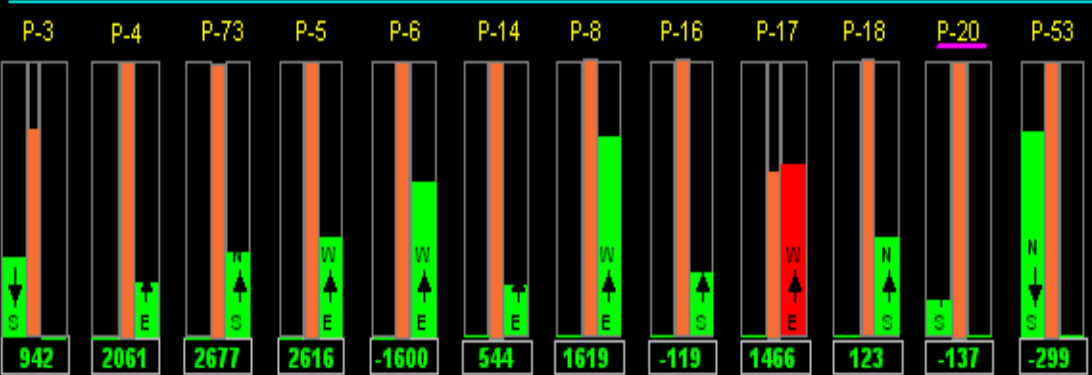
= DESIGNATED PATH

Western States Path Flow Monitoring

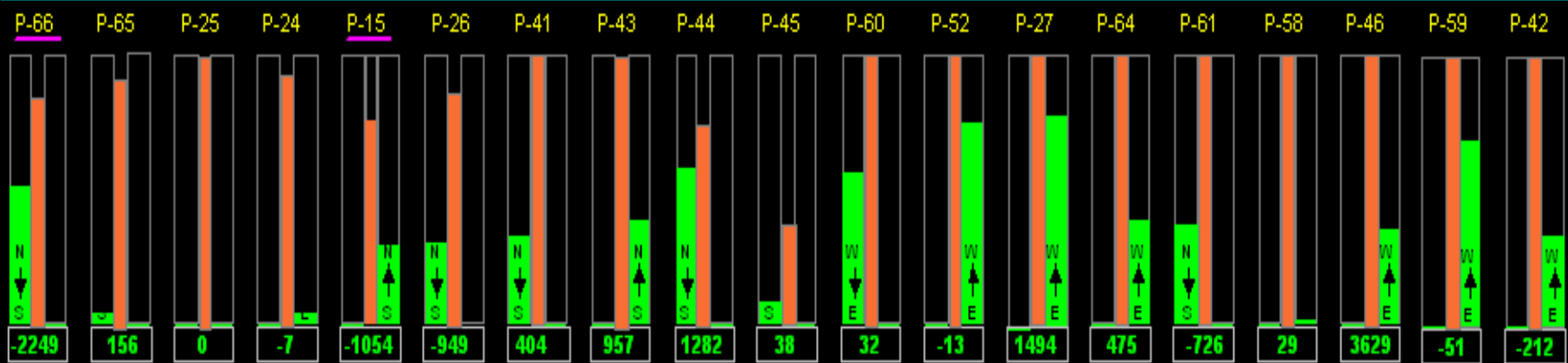
WSCC TRANSFER PATHS

USF

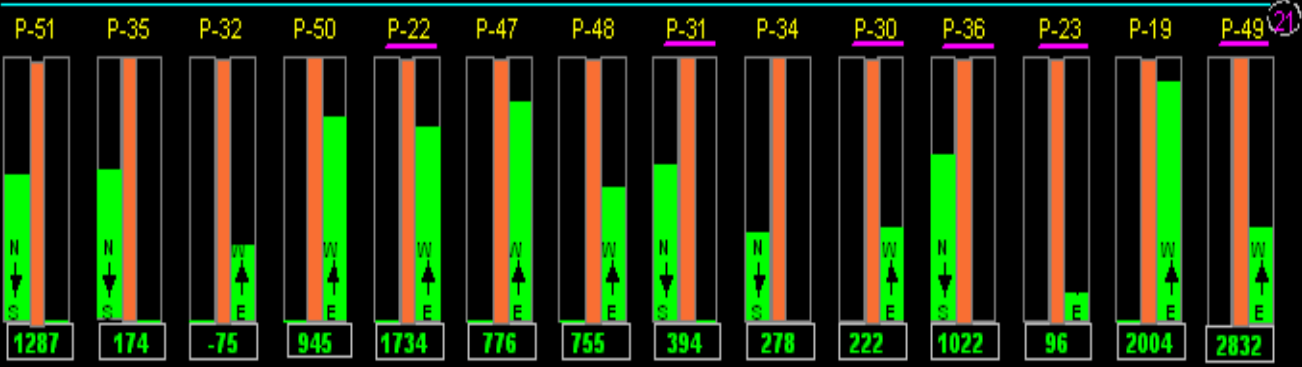
Northwest (PNSC)



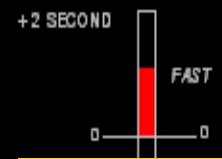
California / Mexico (CASC)



Desert Southwest (RDSC)



TIME ERROR



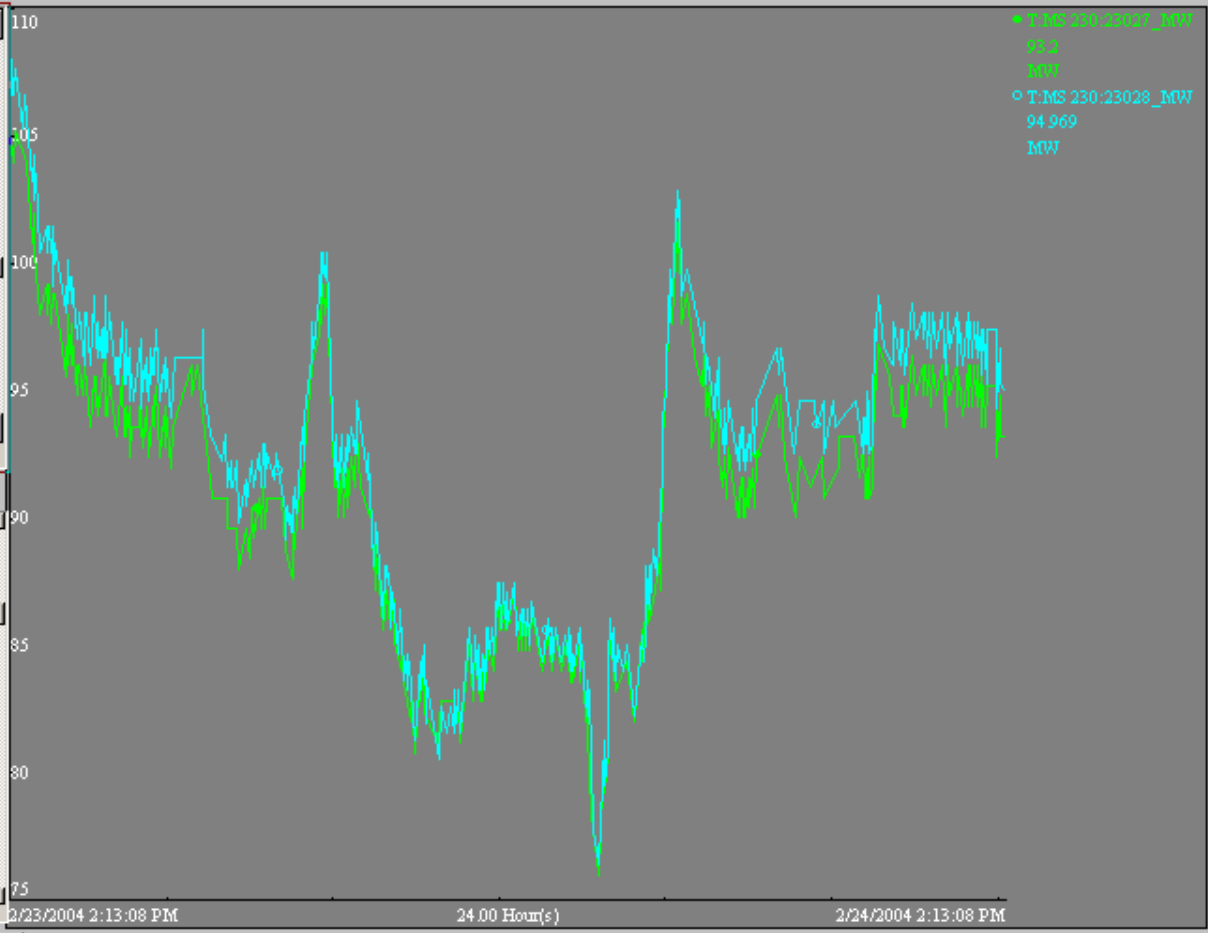
Western States
Transfer Paths

File Edit View Insert Tools Draw Arrange Window Help

70%

T & D Substation Search

- ALARM-MISC
- ANALOG
 - KV
 - MISC
 - MVAC
 - MVAR
 - MW
 - Aliases
 - 23001 = T:MS 230:23001
 - 23004 = T:MS 230:23004
 - 23022 = T:MS 230:23022
 - 23027 = T:MS 230:23027
 - 23028 = T:MS 230:23028



Search Dlg T:MS* Enter

- I:MS138:EK32 LCOOL
- I:MS138:EK40 MVAC
- I:MS138:EK40 MVAR
- I:MS138:EK40 MW
- I:MS138:EK41 MVAC
- I:MS138:EK41 MVAR
- I:MS138:EK41 MW
- I:MS138:ELEC REL IEL
- I:MS138:MS 138 EK30
- I:MS138:N BUS KV
- I:MS138:S BUS KV
- I:MS 230:1N 23028 D8
- I:MS 230:1N B D8
- I:MS 230:1S B D8
- I:MS 230:1S EK40 D8
- I:MS 230:1I 23028 D8
- I:MS 230:1I EK40 D8
- I:MS 230:23001 MVAC
- I:MS 230:23001 MVAR
- I:MS 230:23001 MW
- I:MS 230:23004 MVAC
- I:MS 230:23004 MVAR
- I:MS 230:23004 MW

<< >> 1 Min. 5 Min. ClearTrend

1 Hour 4 Hour 8 Hour 1 Day 7 Day

Curr. Time

TAG NAME	MIN	MAX	AVERAGE
23027_MW	76.00	105.20	91.12
23028_MW	76.46	108.00	92.55

Substation Hierarchical Point-n-Click Trending

MW

Aliases

- LD = T:Gdc Ge
- LD = T:Gdc Ge
- E_LD = T:Gdc (
- LD = T:Gdc Ge
- NET_TIE = T:G
- OPER_RES = T:
- SPIN_RES = T:(
- TIE_T2 = T:Gdc
- SPIN_RES = T:
- OPER_RES = T
- SPIN_RES = T:(

Search Dlg * Enter

T:GdcGenerator: allLoad

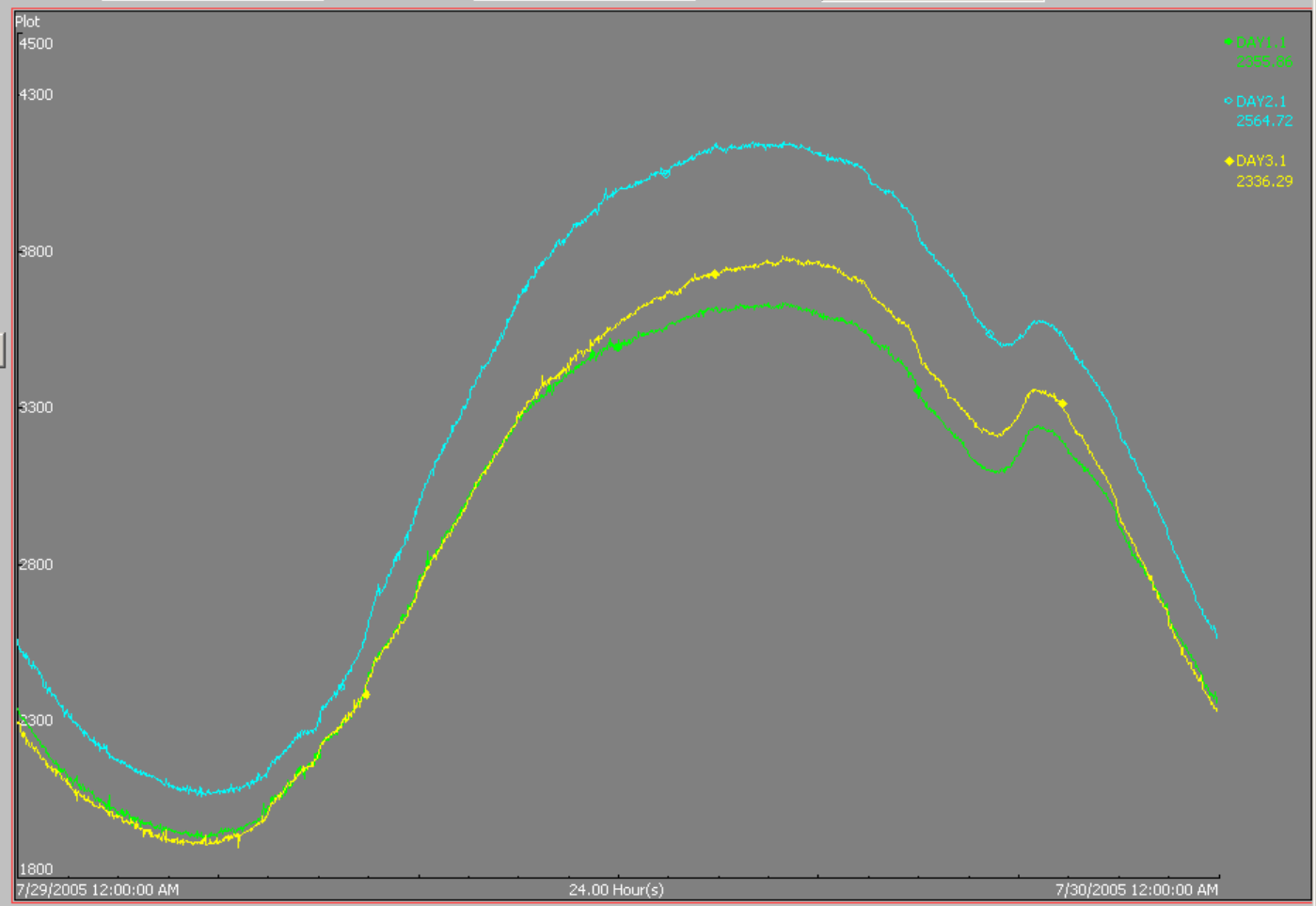
<< >> 1 Min. 5 Min.

1 Hour 4 Hour 8 Hour 1 Day

7 Day Curr. Time ClearTrend

T&D Load Comparison Trending

Plot 1 7 /29/2005 Plot 2 7 /22/2005 Plot 3 7 /15/2005



Load Comparison Trending

Watch List

6/2/2006 12:13:16 PM

Select a Substation
 Circuit
 Bank
 All

- Circuit
- D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH
 - D:\CIR_...-MW_3PH

- Bank
- D:\XFMR_BK30-MW_3PH
 - D:\XFMR_BK31-MW_3PH
 - D:\XFMR_BK32-MW_3PH
 - D:\XFMR_BK33-MW_3PH


	CIR/BK	MW	A Phase (Amps)	B Phase (Amps)	C Phase (Amps)	Rating (Amps/MW)	Forecast (Amps/MW)	% of Rating Max(A,B,C) Or MW
ADD		5.84	285.00	289.20	287.40	660	413	44
CLR								
ADD		5.05	235.20	245.40	240.00	614	391	40
CLR								
ADD		10.06				29	22	35
CLR								
ADD		3.16	162.00	160.80	157.80	600	352	27
CLR								
ADD		6.40	315.00	322.80	295.20	770	491	42
CLR								
ADD		2.84	136.80	169.20	151.20	600	266	28
CLR								
ADD								
CLR								
ADD								
CLR								
ADD		6.08	284.10	289.80	293.70	520	448	55
CLR								


Circuit/Transformer Top-10 Watch List

MSNBC Weather


Tucker

Current conditions **Tomorrow**

75°  Wind: 7VAR
Baro: 29.81"
Humidity: 31%

 **75°/43°**

All temps shown in F° | Change to C°

 For extended forecasts, go to MSNBC.com

Web Links

New | Organize

- ♦ <http://schedmem.gasoc.com>
- ♦ http://ecs_team2/tms

Microsoft Outlook Messages - Inbox

New | Delete

From	Subject	Received
Sarracini, Loreto	FW: Dat...	Wed 10/22/...
Taganajan, Tito	Owner ...	Wed 10/22/...
McCafferty, ...	Comput...	Wed 10/22/...
Taganajan, Tito	Question	Tue 10/21/2...
Devnet SL	OSI Dev...	Mon 10/20/2...
Denning, Helen	RE: Req...	Fri 10/17/20...
Paschall, Sara	Benefits...	Mon 10/13/2...

PI Graphic - emc_id_sum_v1.0.svg

EMC Load Summary

ECS/PI Link
Receiving

EMC	Load (MW)	CurHr (MWh)	EMC	Load (MW)	CurHr (MWh)	EMC	Load (MW)	CurHr (MWh)
Altamaha	93.66	76.68	Irwin	21.52	17.23	Slash Pine	19.85	15.94
Amicalola	51.61	41.44	Jackson	459.67	376.79	Snapping Shoals	150.74	122.94
Canoochee	42.00	34.09	Jefferson	58.22	47.24	Sumter	38.77	30.91
Carroll	93.28	75.25	Lamar	29.74	24.14	Three Notch	25.51	20.40
C. Georgia	89.64	72.27	L. Ocmulgee	20.73	17.15	Tri-County	32.71	26.66
Coastal	35.10	28.84	Middle GA.	15.74	12.68	Troup	50.16	40.45
Cobb	377.40	308.72	Mitchell	53.46	43.26	Upton	13.52	11.01
Colquitt	135.39	109.82	Ocmulgee	19.11	15.18	Walton	220.58	179.62
Coweta-Fayette	138.08	112.05	Oconee	25.11	19.69	Washington	43.38	35.49
Excelsior	39.80	32.22	Okefenoke	61.82	49.32	Sterling Pulp	11.58	
Flint	168.51	137.42	Pataula	10.67	8.64	Total System Load	3658.70	
Grady	38.97	31.63	Planters	23.58	18.51	System Frequency	60.00 Hz	
Greystone	202.94	165.88	Rayle	25.81	20.48	Temperature	76.88 F	
Habersham	43.19	35.03	Satilla	119.89	96.48			
Hart	54.30	44.16	Sawnee	270.98	221.06			

**Web Portal Enterprise
Data Repository**

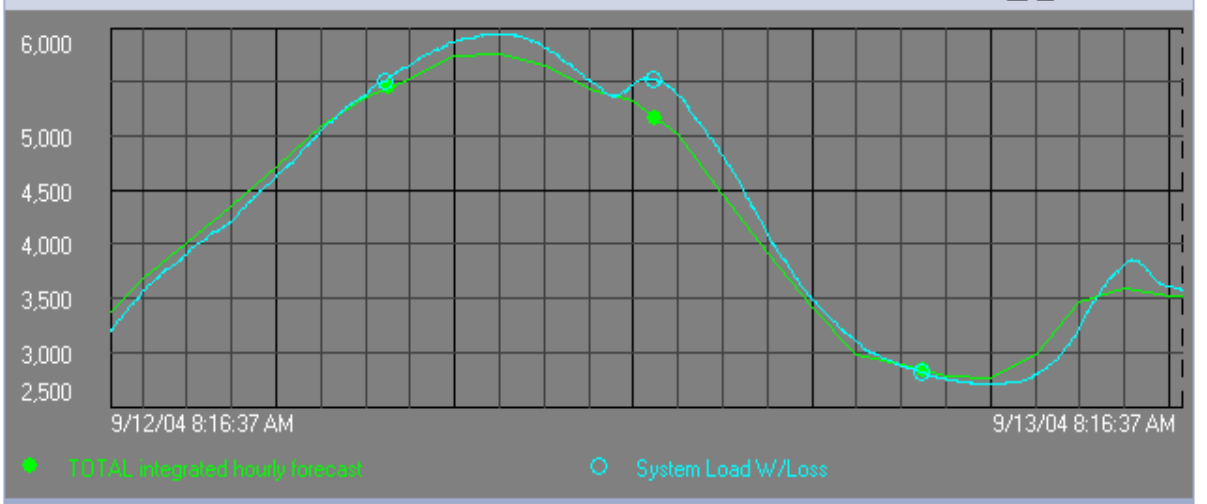


Day Ahead Load Forecast

Date	Hour	Load(MWh)	Current State
9/13/2004 1:00:00 AM	1	2973	
9/13/2004 1:00:00 AM	2	2886	
9/13/2004 1:00:00 AM	3	2780	
9/13/2004 1:00:00 AM	4	2770	
9/13/2004 1:00:00 AM	5	2978	
9/13/2004 1:00:00 AM	6	3467	

Showing 1 to 6 of 48

Load-Forecast vs Actual



Day Ahead Temperature Forecast

Date	Hour	Temp(F)	Current State
9/13/2004 1:00:00 AM	1	68	
9/13/2004 1:00:00 AM	2	68	
9/13/2004 1:00:00 AM	3	67	
9/13/2004 1:00:00 AM	4	67	
9/13/2004 1:00:00 AM	5	67	
9/13/2004 1:00:00 AM	6	67	

Showing 1 to 6 of 48

Temperature-Forecast vs Actual



Dashboard
Forecast vs. Actual

PI for Non-Operational Data

PI T&D Trends

- Distributed Generation
- Power Quality/Transient/Disturbance Data
- Fast Sampling PMU Phasor data
- Condition Based Maintenance/Monitoring
- Asset Management
- AMR
- Substation/Distribution Automation
- Smart Grid/Intelligent Grid

PI T&D Substation Interfaces

PI Standard Real-time Interfaces



PI Modbus

PI DNP3

PI C37.118
and
PI FFT

PI
Arbiter1133a

PI
CybectecSMP

PI DNP3 Circuit Relay Status

PI ProcessBook - [12kV Relay Status]

File Edit View Insert Tools Draw Arrange Window Help

100%

Substations Harrisburg

Harrisburg Retail 351 Relay Status

Relay ID	EN	TRIP	INST	COMM	SOTF	50	51	81	RS	CY	LO	A	B	C	G	N
L12-01 351S	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L12-02 351S	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L12-03 351S	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
L12-04 351S	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

EN: Emergency Stop (Green)

TRIP: Trip Status (Black)

INST: Instantaneous Trip (Black)

COMM: Communication (Black)

SOTF: Short Out of Trip Function (Black)

50: Overcurrent (Black)

51: Undercurrent (Black)

81: Overcurrent (Black)

RS: Reclosing State (Black)

CY: Closing (Black)

LO: Lockout (Black)

FAULT TYPE: A, B, C, G, N (Black)

Line Capacitor Status

PI ProcessBook - [AUGUSTA RD (BK1) SUMMARY.PDI]

File Edit View Insert Tools Draw Arrange Window Help

93% a

Augusta Rd Retail (BK1) Capacitors

L12-01

KVar (XYZ): -170 -140 -170

Capacitor # 22994854
 Location (S Pleasantburg @ Legrand Blvd)
 Capacitor Position **CLOSED**
 Temperature 74 F
 Adjusted KVar 513
 Total Cycles 529
 Cap Bank Size 900

600 Fixed
 (332 S Pleasantburg Dr)

Capacitor # 23177280
 Location (708 S Pleasantburg Dr @ Skyview Rd)
 Capacitor Position **CLOSED**
 Temperature 73 F
 Adjusted KVar -716
 Total Cycles 287
 Cap Bank Size 900

L12-03

KVar (XYZ): 30 140 50

Capacitor # 23002306
 Location (410 McAlister Rd, Greenville, SC)
 Capacitor Position **TRIPPED**
 Temperature 72 F
 Adjusted KVar 158
 Total Cycles 362
 Cap Bank Size 450

Capacitor # 23002981
 Location (Greenacre Dr @ McAlister Rd)
 Capacitor Position **TRIPPED**
 Temperature 74 F
 Adjusted KVar -151
 Total Cycles 103
 Cap Bank Size 450

L12-02

KVar (XYZ): -10 90 20

Capacitor # 22998406
 Location (410 S Pleasantburg Dr @ Honey Baked Ham Store)
 Capacitor Position **Switched FP**
 Cap Bank Size 600

300 Fixed
 (S Pleasantburg @ Antrim Dr)

450 Fixed
 (Keith Dr)

Capacitor # 22998288
 Location (Laurens Rd @ Bledkley Ave)
 Capacitor Position **TRIPPED**
 Temperature 72 F
 Adjusted KVar 174
 Total Cycles 157
 Cap Bank Size 600

450 Fixed
 (2003 Laurens Rd)

L12-04

KVar (XYZ): 20 70 100

900 Fixed
 (Rockcreek Dr)

Capacitor # 23041827
 Location (Faris Rd west of Cleveland St)
 Capacitor Position **TRIPPED**
 Temperature 71 F
 Adjusted KVar -18
 Total Cycles 16
 Cap Bank Size 900

Capacitor # 23004214
 Location (219 W Antrim Rd)
 Capacitor Position **TRIPPED**
 Temperature 72 F
 Adjusted KVar -412
 Total Cycles 47
 Cap Bank Size 600

900 Fixed
 (Ackley Rd)

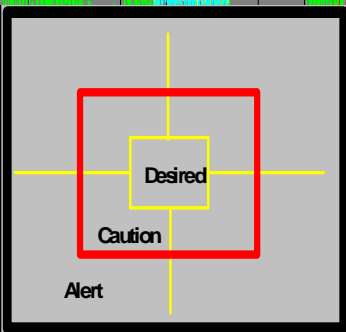
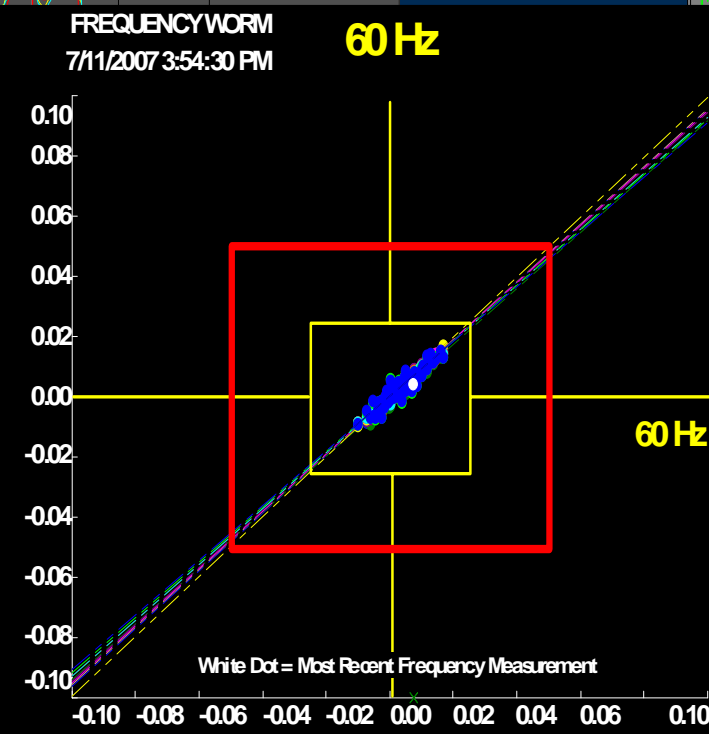
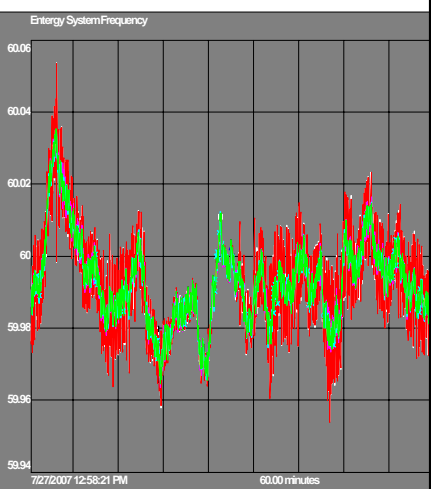
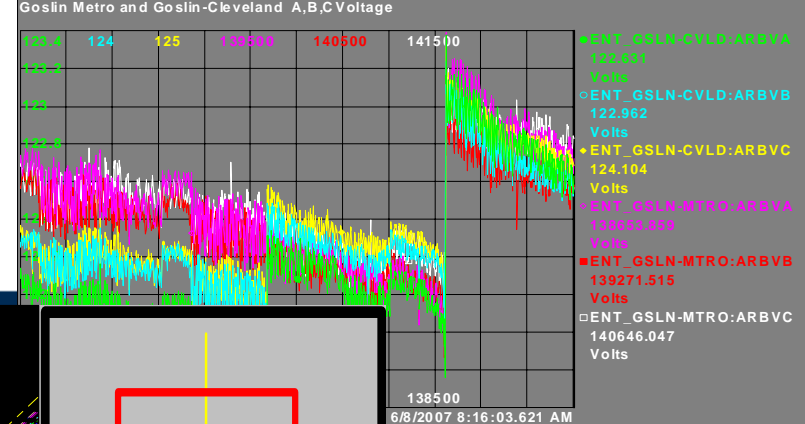
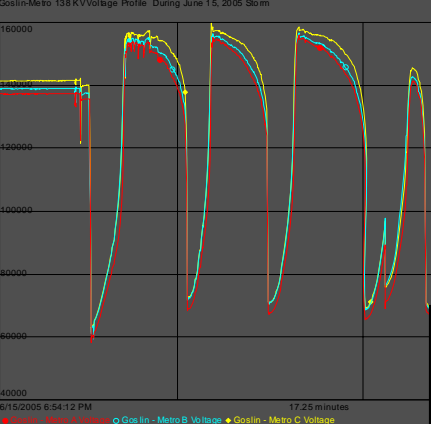
Protocol Standard IEC61850

- IEC61850 is an object oriented substation automation standard that defines:
 - Standardized naming convention and object models
 - Standardized meaning of data
 - Standardized abstract services
 - Standardized device behavior models
 - Standardized protocols for:
 - *Control*
 - *Protection*
 - *SCADA*
 - *Transducers*
 - Self-describing devices
 - Common configuration language

PI-based WAMS

Wide Area Measurement Systems

- Streaming Server
 - Very fast synchronized sampling with standard PI IEEE C37.118 Interface
- Real-time Analytics
 - Fast and synchronized real-time calculations (phase angle difference, FFT, etc.)
- Visualization/Alerts
 - Enhance operations and early warning to prevent grid instability and cascade collapse

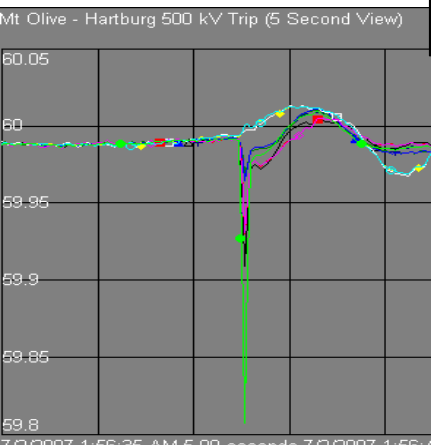
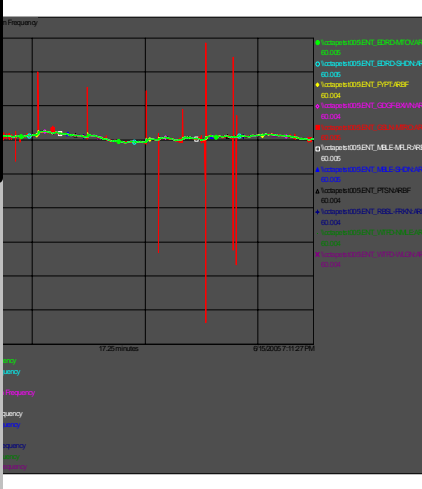


This chart represents your operating frequency domain. Frequency here is represented as a difference from 60 Hz.

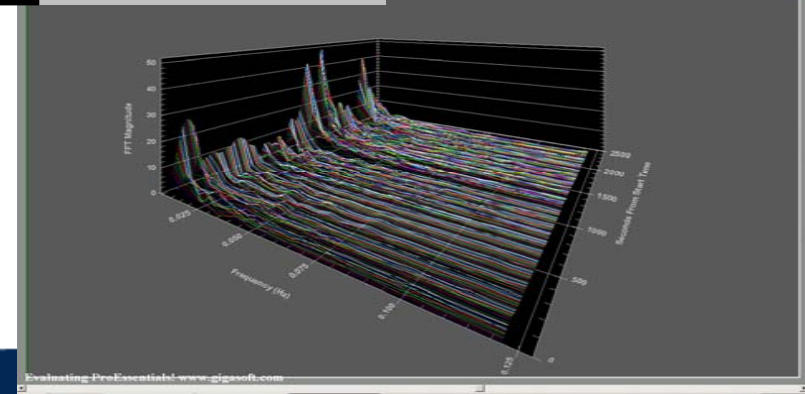
The system should be operated within the desired range (the yellow dashed box). Caution should be noted when frequencies begin to migrate outside of the yellow dashed box.

Frequencies falling in the alert region (outside of the red box) should be closely monitored.

If the frequency worm begins to scatter, this represents potential islanding.

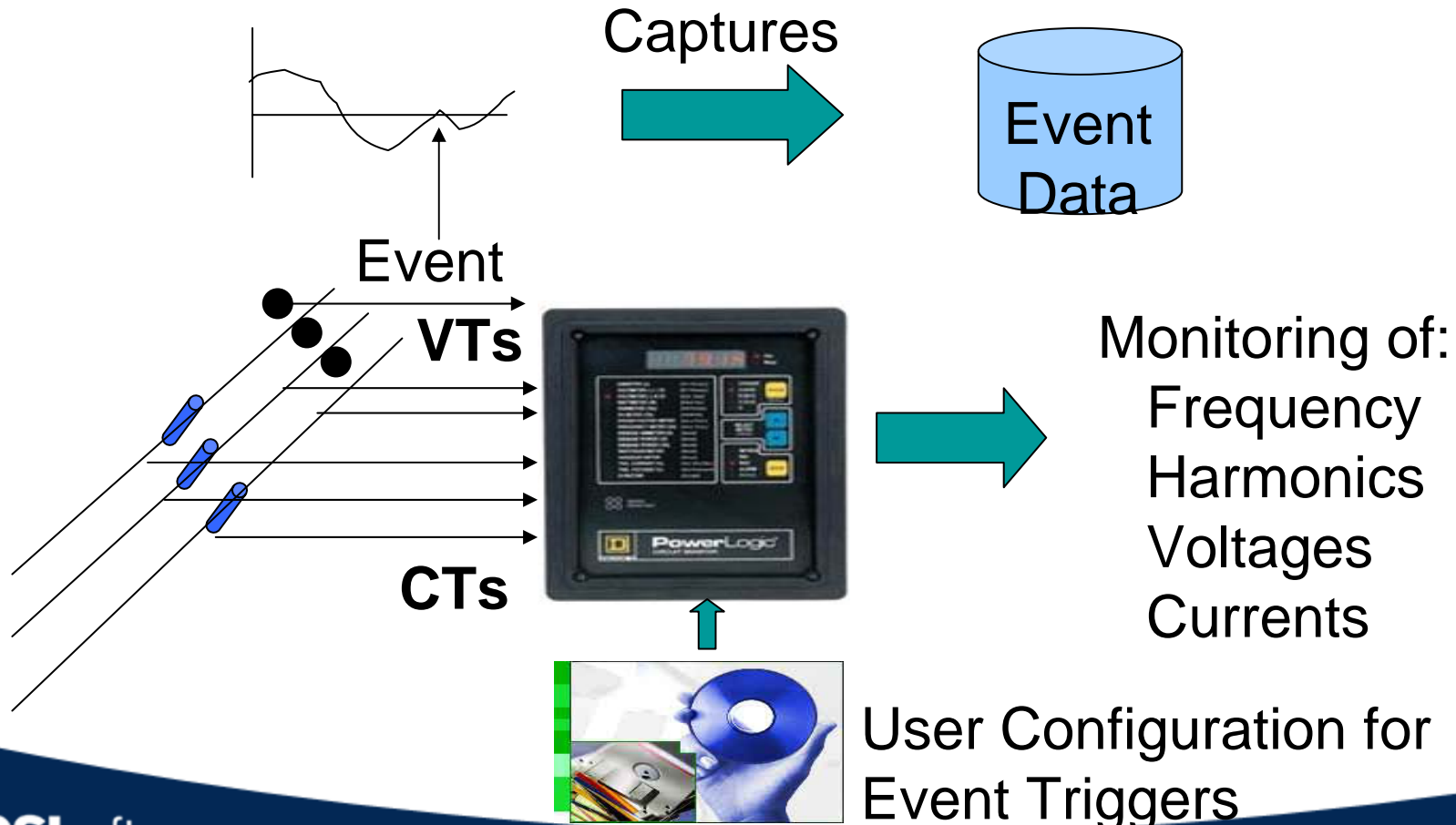


- ENT_IDRD-CH-ARBF: FREQUENCY 59.984
- ENT_WTFD-NMLE: FREQUENCY 59.995
- ◆ ENT_WTFD-WLGN: FREQUENCY 59.995
- ENT_MBLE-MFLR: FREQUENCY 59.983
- ENT_MBLE-SHDN: FREQUENCY 59.983
- ENT_NMLE-WTFD: FREQUENCY 59.995
- ▲ ENT_RBSL-FRKN: FREQUENCY 59.989
- △ ENT_RMML-ACLA: FREQUENCY 59.985
- + ENT_EDRD-SHDN: FREQUENCY 59.984
- ENT_RXBN-MAMI: FREQUENCY 59.995

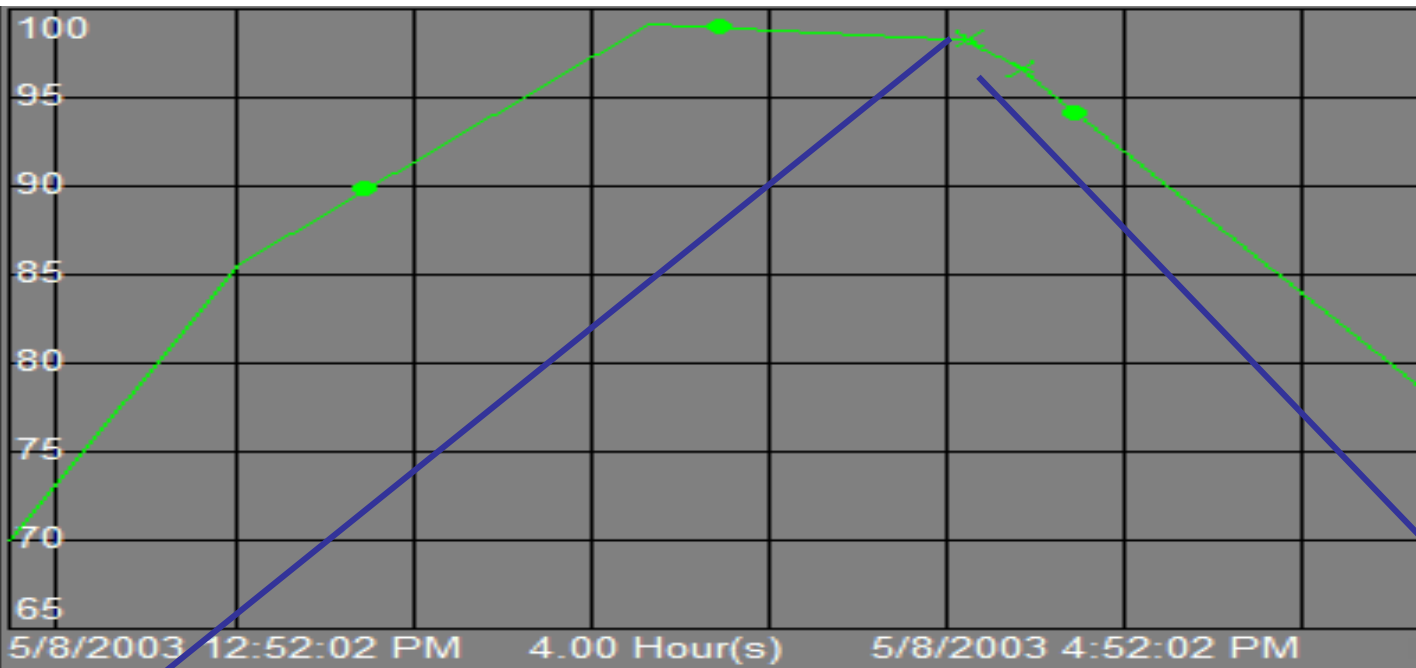


Transient Data in PI

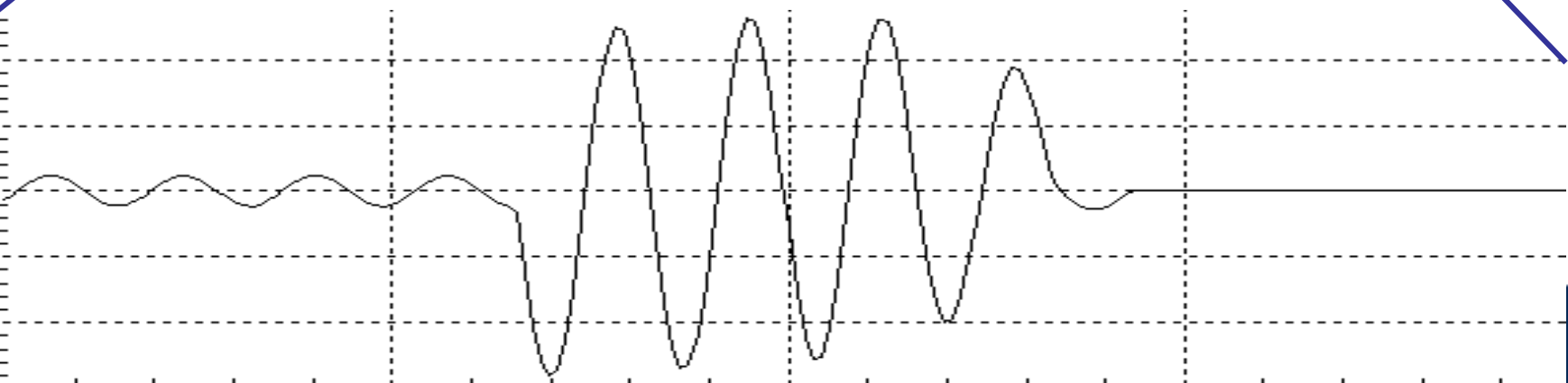
IEEE C37.111-1997 COMTRADE



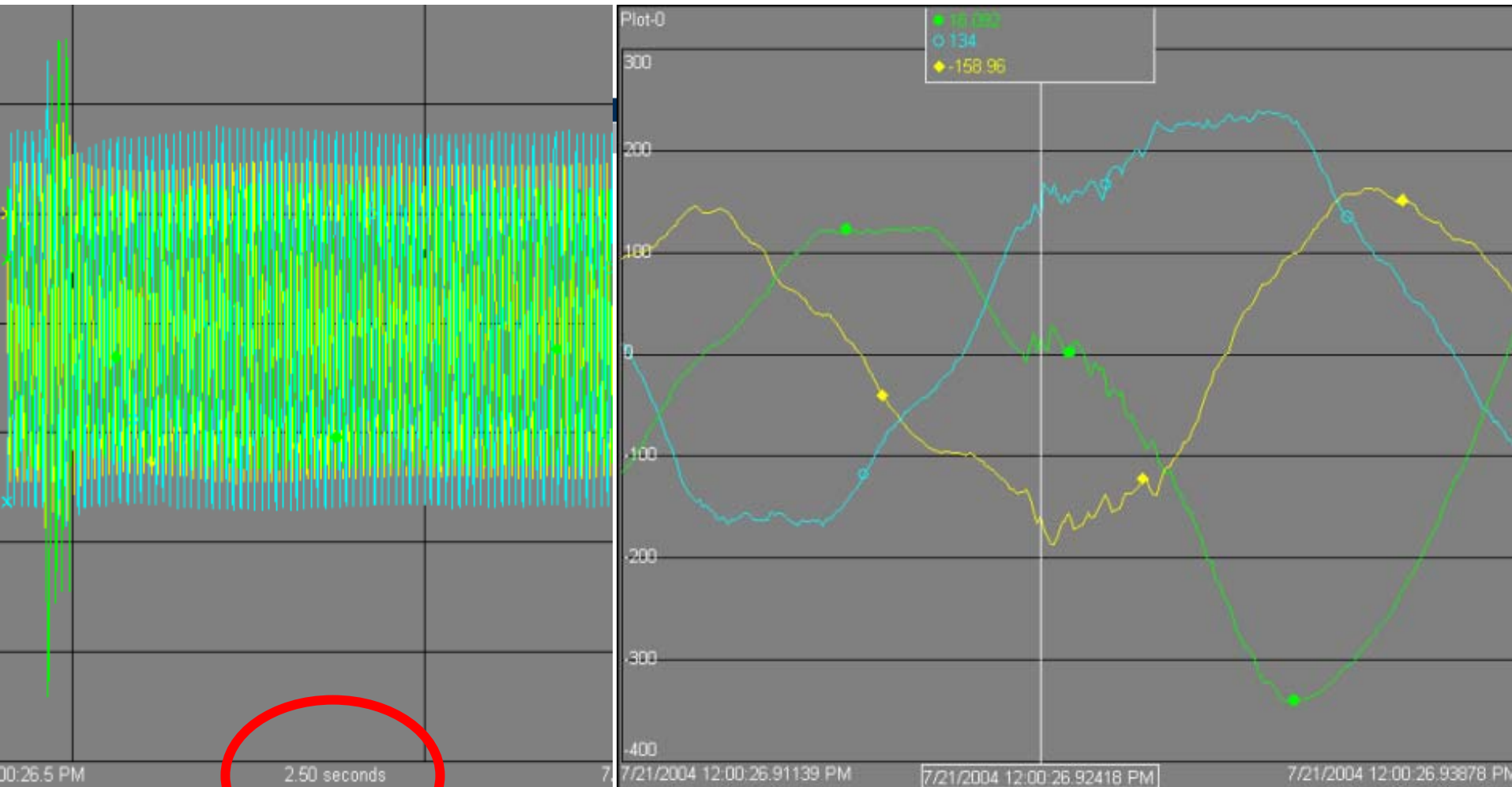
Process Information Integration



What
really
happened?



Waveforms in PI



2.5 seconds

12:00:26:91139

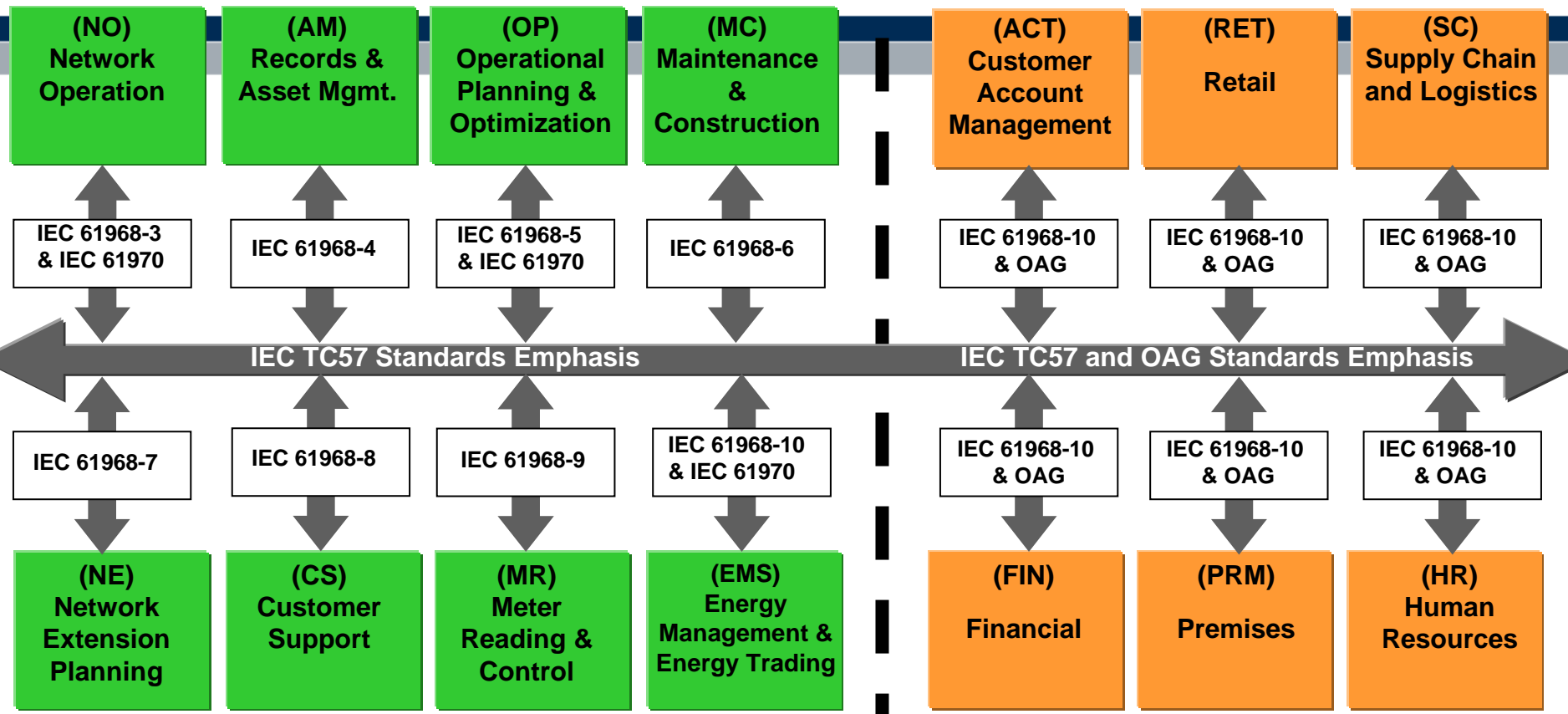
12:00:26:92418

12:00:26:93878

hundredth of second

PI for Asset Models and Analytics

Common Information Model (CIM)



Utility Electric Network Planning, Constructing, Maintaining, & Operating

Customer Care, Enterprise Resource Planning, Supply Chain, & General Corporate Services

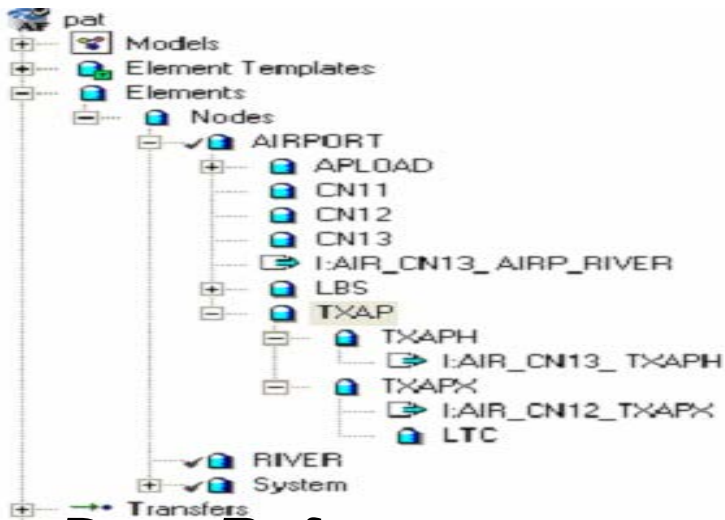
Why CIM Matters to PI Analysis Framework (AF)

- Both about modeling the business
 - PI brings history to the model
 - CIM brings deep definition to the model
- PI is moving from “tag-centric” to **“asset-centric”**
- The industry has moved along in parallel
 - T&D has always been a real-time, no-inventory business – measurements matter
 - A smart grid without standards is a dumb grid
 - AF + CIM makes sense
- AF is a **“Measurement Model Manager”**

CIM Model in Analysis Framework

- Models can be built manually, using the downloading, or programmatically
- Building the template for elements (i.e. line)
- Elements have attributes
 - Another measurements, line rating, power factor, graphic symbols
- Elements have connections
- Building analysis rules (calculations, schedules)
- Values back into any other sources

Data References ease Analysis



General Elements Attributes Ports				
TXAP in Model AIRPORT				
	Name	Value	Value Type	Data Reference
	BusinessUnit		String	<None>
	MX.TotVa	84657.4...	Double	PI Point
	MX.TotVar	213788...	Double	PI Point
	OperatedBy_Companies		String	<None>
✓	PF	74.1625...	Double	Formula
	aliasName	74.1625880940302 %	String	<None>
	bmagSat		String	<None>
	magBaseKV	0 kV	Double	<None>
	magSatFlux	0	Double	<None>
	name	TXAP	String	<None>
	pathName		String	<None>
	phases		String	<None>
	transfCoolingType		String	<None>
	transformerType		String	<None>

Data References are a lot like advanced calculations, but

A Data Reference can be:

- PI Points

- A calculation

- A reference to data in other systems

- XML Web Services

- Relational Databases (IEEE specs, line ratings, etc.)

- A reference to a CIM model

Other Possible Analysis

- Telemetry Analysis
- Peak Load
- Peak Circuit Load
- Dynamic Line Ratings
- Load Distribution
- Transformer Gas/Oil Analysis
- Harmonics
- VAR Calculations

PI for Control System and Critical Infrastructure

The Solution – IT Monitor

- No requirement for additional Agents to be installed
- A proactive and preventive way to monitor resource health to ensure system reliability and performance
- Monitoring all infrastructure attributes for disk, file, paging, CPU, swap and memory usage, ...etc.
- Monitoring the processes and applications
- Establishing performance baseline standards
- Helping avoid finger pointing during trouble shooting
- Root cause analysis and problem solving
- Automatic notification



Monitor and Protect Critical Systems

PI - ProcessBook - [EMS STATUS PAGE DISPLAY*]

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8/17/2004 10:14:28 AM

EMS Node Status Overview

MCC NODE	HOSTS				FEPS			ORACLE			WORKSTATIONS						CM		DTS						
	H01	H02	H03	H04	F06	F07	F08	O30	O31	O32	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S28	H19	H18	H28
LAN 'A'	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LAN 'B'	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
cpu idle %	85	90	95	97	75	90	77	91	90	91	91	92	92	94	96	97	96	88	96	91	76	67	88		
cpu sys usage %	1	1	2	0	10	10	30	2	4	7	6	8	7	5	6	2	4	5	4	4	7	7	3		
cpu user usage %	7	8	0	1	10	2	3	0	5	6	3	1	2	2	0	0	0	0	0	0	12	13	9		
Free Mem & Swap	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Free Phy Mem	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
/xahome Used %	37	62	68	66	18	23	Au01 11 %													50	40	20			
/xalocal Used %	70	68	67	59	73	73	Au02 19 %	●	●	●	●	●	●	●	●	●	●	●	●	66	80	73			
/var Used %	47	21	24	21	11	40	Au03 13 %	●	●	●	●	●	●	●	●	●	●	●	●	58	23	22			
xa21 goxall	■	■	■	■	■	■	Au04 26 %	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
							Au05 24 %																		
							Au06 36 %																		

BCC NODE	HOSTS				FEPS			ORACLE			WORKSTATIONS					
	H05	H06	H07	H08	F08	F09	F02	O20	O21	O21	S21	S22	S23	S24	S25	S26
LAN 'A'	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
LAN 'B'	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
cpu idle %	78	95	94	91	77	88	90	95	96	96	97	96	96	96		
cpu sys usage %	15	5	2	7	13	7	2	0	5	4	5	3	3	4		
cpu user usage %	14	1	0	1	8	4	1	0	0	0	0	0	0	0		
Free MemSwap	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Free Phy Mem	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
/xahome Used %	43	40	52	77	51	31	Au01 11 %									
/xalocal Used %	69	73	78	67	79	79	Au02 19 %	●	●	●	●	●	●	●		
/var Used %	24	21	21	68	67	36	Au03 14 %	●	●	●	●	●	●	●		
xa21 goxall	■	■	■	■	■	■	Au04 17 %	■	■	■	■	■	■	■		
							Au05 7 %									
							Au06 3 %									

Enter In Minutes: 1 Curr. Time

UNIX

ProcessBook - [WS_CPU]

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8/17/2004 5:00:38 PM

EMS Workstation CPU Idle%

Window Help

8/17/2004 11:00:58 AM

CPU	AP.1.P/AP.2.P	XA2		
PU idle time %	87 %	AB642	■	dbar
PU iowait time %	3 %	AEPR	■	dbax
PU kernel time %	3 %	AGCS	■	dbst
PU system usage %	2 %	AGCU	■	logr
PU user usage %	6 %	agdc0l	■	mcar
		daap	■	mcar
		dbassae	■	rtps
		dbasscf	■	rttm
		dcevt	■	sbhth
		DHL.S	■	scce
		LDCR	■	secs
		CData	■	time
		cots	■	tpsc
		rds cldb ss	■	xaloc
		rds cpbl ss	■	
		rds cpbl ss	■	
		dcol shdw	■	
		rtscnd	■	
		sbhth	■	
		T13802	■	
		TL658C	■	
		TL6401	■	
		TL6402	■	

Enter In Minutes: 1 Curr. Time

PING

PerfMon

SNMP

SNMP

Traps

Syslogs

AP-Servers (AP-03 & AP-04)

	AP-03 (MCC)	AP-04 (BCC)
Interface	UP	UP
Memory Available MB	77.00	272.00
Memory Committed Bytes	977.51	647.73
Memory Pages/sec	0.04	0.03
C Drive Free GB	9.73	11.79
D Drive Free GB	64.80	67.42
Processor(0) % Process Time	1.04	0.04
Processor(1) % Process Time	0.96	0.04
Processor Total % Process Time	0.98	0.15
Paging File % Usage	32.22	2.02
Processor(0) % User Time	0.24	0.03
Processor(1) % User Time	0.39	0.01
Processor Total % User Time	0.32	0.05
Server Bytes Received/sec	3.63	3.76
Server Bytes Transmitted/sec	157.57	143.29
Server Errors Logon	0.00	0.00
Server Errors System	0.00	0.00
WWW Bytes Received/sec	0.01	0.00
WWW Bytes Sent/sec	0.00	0.00
WWW Bytes Current Connections	0.00	0.00
WWW Get Requests/sec	0.00	0.00
WWW Not Found Errors/sec	0.00	0.00
WWW Post Requests/sec	0.00	0.00
WWW Put Requests/sec	0.00	0.00
WWW Service Uptime (Days)	7.49	1.52
WWW Total Get Requests	1467.00	196.00
WWW Total Not Found Errors	160.00	46.00
WWW Total Post Requests	160.00	2.00
WWW Total Put Requests	0.00	0.00

Enter In Minutes: 1 Curr. Time

Windows

Total free mem&swap	1400.79 MB
Total real mem	1024.06 MB
Total avail mem	3.71 MB
Total swap	1536.15 MB
Total avail swap	1397.08 MB

/xahome

/xahome total disk space	512.05 MB
/xahome used disk space	187.03 MB
/xahome disk % used	37 %
/xahome available disk space	325.02 MB

/xalocal

/xalocal total disk space	2000.19 MB
/xalocal used disk space	1404.58 MB
/xalocal disk % used	70 %
/xalocal available disk space	595.62 MB

Enter In Minutes: 1 Curr. Time

Monitor and Protect Networks

EMS CISCO 6509 Status

MISSION

	Switch	Router
CPU Usage	4 %	7 %
I/O Free Memory	85 %	85 %
I/O Pool Memory Free	6 MB	6 MB
I/O Pool Memory Used	1 MB	1 MB
I/O Total Memory	7 MB	7 MB
Processor Free Mem	86 %	92 %
Processor Mem Pool Free	34 MB	38 MB
Processor Mem Pool Used	5 MB	3 MB
Processor Total Mem	40 MB	41 MB

METRO

	Switch	Router
CPU Usage	3 %	7 %
I/O Free Memory	85 %	85 %
I/O Pool Memory Free	6 MB	6 MB
I/O Pool Memory Used	1 MB	1 MB
I/O Total Memory	7 MB	7 MB
Processor Free Mem	87 %	92 %
Processor Mem Pool Free	34 MB	38 MB
Processor Mem Pool Used	5 MB	3 MB
Processor Total Mem	40 MB	41 MB

EMS CISCO 3550/2950 Status

MISSION

	Inside R1	Inside R2	Inside R3	Inside R4	Inside R5
CPU Total Mem	0 %	0 %	0 %	0 %	0 %
I/O Free Memory	87 %	87 %	87 %	87 %	50 %
I/O Memory Used	0 MB	0 MB	0 MB	0 MB	0 MB
I/O Memory Free	1 MB	1 MB	1 MB	1 MB	0 MB
I/O Total Memory	1 MB	1 MB	1 MB	1 MB	0 MB
Processor Free Mem	91 %	91 %	87 %	87 %	94 %
Processor Mem Pool Free	5 MB	5 MB	5 MB	5 MB	10 MB
Processor Mem Pool Used	1 MB	0 MB	1 MB	1 MB	1 MB
Processor Total Mem	6 MB	6 MB	6 MB	6 MB	11 MB

Network Port Status

	Inside R1	Inside R2	Dev E1	Dev E2
CPU Total Mem	13 %	12 %	3 %	2 %
I/O Free Memory	45 %	45 %	75 %	71 %
I/O Memory Used	0 MB	0 MB	0 MB	0 MB
I/O Memory Free	0 MB	0 MB	0 MB	0 MB
I/O Total Memory	0 MB	0 MB	0 MB	0 MB
Processor Free Mem	29 %	29 %	62 %	40 %
Processor Mem Pool Free	0 MB	0 MB	0 MB	0 MB
Processor Mem Pool Used	0 MB	0 MB	0 MB	0 MB
Processor Total Mem	0 MB	0 MB	0 MB	0 MB

Cisco Devices

NetFlow
TCPResponse
SNMP

Monitor and Protect Facility Equipment

PI - ProcessBook - [MCC_BCC_FACILITY_ALARM.PDI]

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53% Layers... Assign Layers... Symbol Attach

12/13/2005 2:55:30 PM

Grid Operations Facility Equipment Status

1 Curr. Time

MCC

<p>NORM</p> <p>UTIL A ALARM 146</p> <p>NORM</p> <p>UTIL B ALARM 147</p>	<p>Generator</p> <p>NORM</p> <p>GEN RUNNING</p> <p>NORM</p> <p>GEN FAIL</p> <p>NORM</p> <p>OIL TANK LEAK</p>	<p>UPS</p> <p>NORM</p> <p>UPS A Alrm</p> <p>NORM</p> <p>UPS 24V LOSS</p> <p>NORM</p> <p>UPS B Alrm</p> <p>NORM</p> <p>COM BATT CHRG</p> <p>NORM</p> <p>UPS C Alrm</p>	<p>Microwave</p> <p>NORM</p> <p>MW SYSTEM AL</p> <p>NORM</p> <p>MUX FAIL</p> <p>NORM</p> <p>MW RF FAIL</p>	<p>Communications</p> <p>NORM</p> <p>PHONE UNIT</p> <p>NORM</p> <p>TELEM PWR</p> <p>NORM</p> <p>TELEM FUSE</p> <p>NORM</p> <p>RFLCARR</p> <p>NORM</p> <p>DAQ CARR</p> <p>NORM</p> <p>SNMPLCARR</p>
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BCC

PIPED

3.8

3.6

3.4

CIRCUIT 469 MW

NORM

FIRE ALARM

NORM

SECURITY ALARM

<p>Generator</p> <p>NORM</p> <p>GEN RUNNING</p> <p>NORM</p> <p>GEN LOW BATTY CHGR FAIL</p> <p>NORM</p> <p>GEN BATT REMOVED</p> <p>NORM</p> <p>GEN LOW FUEL</p>	<p>RTU UPS (LOSS OF AC)</p> <p>NORM</p> <p>COMPUTER RM HITEMP</p> <p>BULKPOWER RM HITEMP</p> <p>TELECOM RM HITEMP</p>	<p>Generator</p> <p>NORM</p> <p>GEN RM HITEMP</p> <p>NORM</p> <p>GEN MAIN CB OPEN</p> <p>NORM</p> <p>GEN MISC FAILURE</p> <p>NORM</p> <p>GEN LOW WATER TEMP</p>	<p>ATS</p> <p>NORM</p> <p>ATS EMER POWER AVL</p> <p>NORM</p> <p>ATSON EMER POSITION</p> <p>NORM</p> <p>ATS MISC FAILURE</p> <p>NORM</p> <p>ATS AUTO/MAN</p>	<p>UPS</p> <p>NORM</p> <p>UPS MISC TBL</p> <p>NORM</p> <p>UPS ON BYPASS</p> <p>NORM</p> <p>UPS OVERLOAD</p> <p>NORM</p> <p>UPS LOW BATT</p> <p>NORM</p> <p>UPS SOURCE FAILURE</p> <p>NORM</p> <p>UPS SMIN SHUTDOWN</p> <p>NORM</p> <p>UPS MAINT BYPASS</p> <p>NORM</p> <p>UPS TRF N/A</p> <p>NORM</p> <p>UPS BATT N/A</p> <p>NORM</p> <p>UPS ON INVERTER</p>	<p>Other</p> <p>DISARM</p> <p>AV LOAD DROP (CURTAILMENT)</p> <p>NORM</p> <p>ACOP (DAQ) PS ALARM</p> <p>NORM</p> <p>DAQ CARRIER FAILURE</p> <p>NORM</p> <p>RTU PS FAILURE</p>
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UPS, Emergency Generator, Air Conditioner, Humidifier

Summary

- Building a real-time event-driven infrastructure by utilizing **The PI System**
- Expanding the value from Operations, Engineering, Planning, Protection, Asset Management, Maintenance to **Enterprise**

THANK YOU!!