

Supporting SCE's Smart Grid Initiative

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SCE Smart Grid Vision

SCE's vision of a smart grid is to develop and deploy a more reliable, secure, economic, efficient, safe and environmentally-friendly electric system covering all facets of electricity from production through transmission, distribution, and its smart use in homes, businesses and vehicles.



SCE Wide-Area Situation Awareness System

Phase 1 from 2010 – 2015

- ▶ Up to 80 SCE PMU/DFR and 80 PMUs from neighbor utilities with data rate up to 120 samples/second using C37.118 or IEC 61850 protocol
- ▶ Post-event analysis and fault location calculations immediately after a fault or event occurrence
- ▶ Include the following real-time and near real-time situation awareness applications
 - Voltage phase angle difference monitoring
 - Voltage stability monitoring
 - Low frequency oscillation monitoring
 - Fault location
- ▶ Support synchrophasor data exchange with various WECC entities

SCE Wide-Area Situation Awareness System (WASAS)

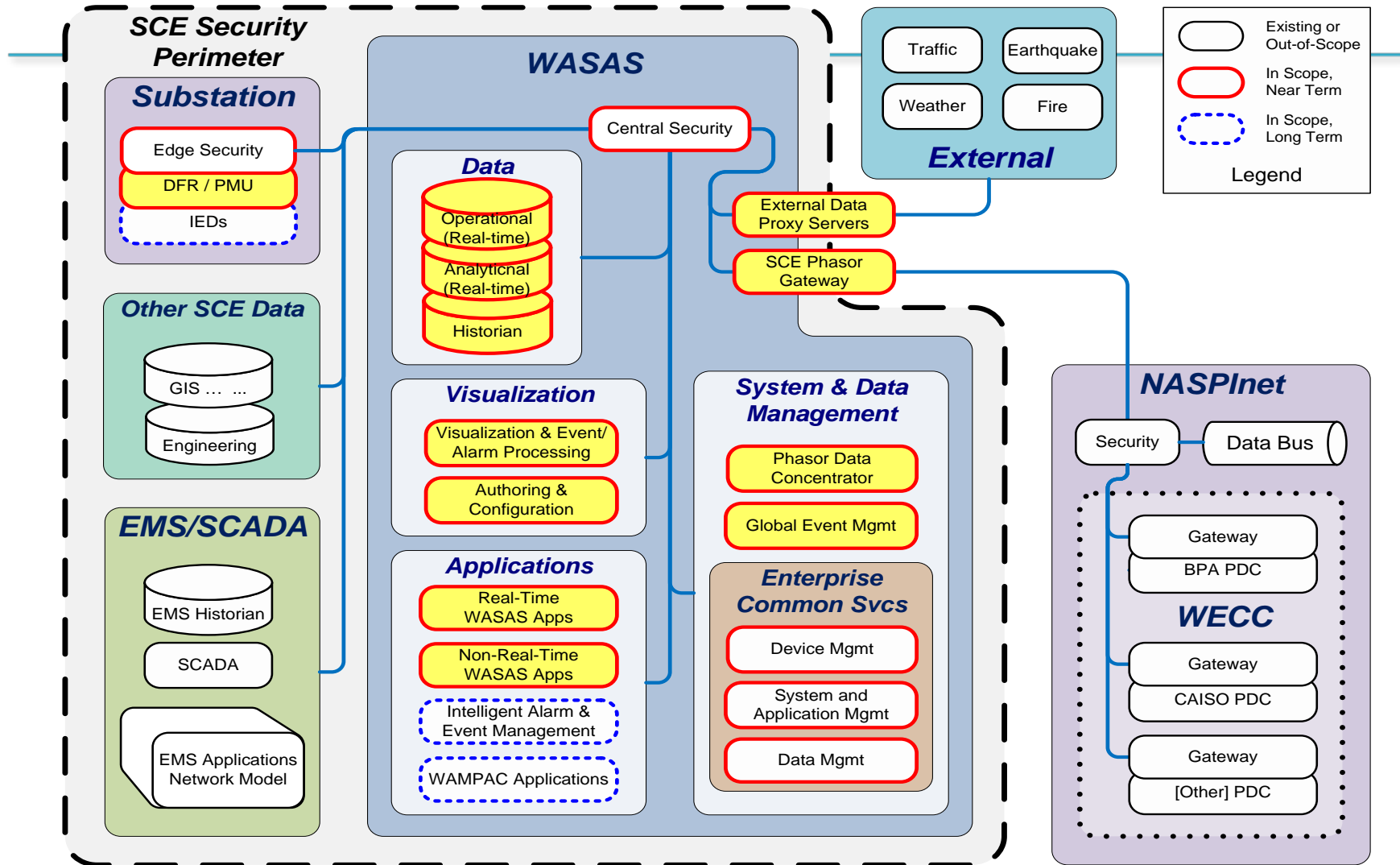
Phase 2 from 2015 to 2019

- ▶ Up to 500 SCE PMU/DFR
- ▶ Interface to WECCNet/NASPINet for data exchange
- ▶ WASAS evolves to become Wide Area Monitoring, Protection and Control System (WAMPAC)

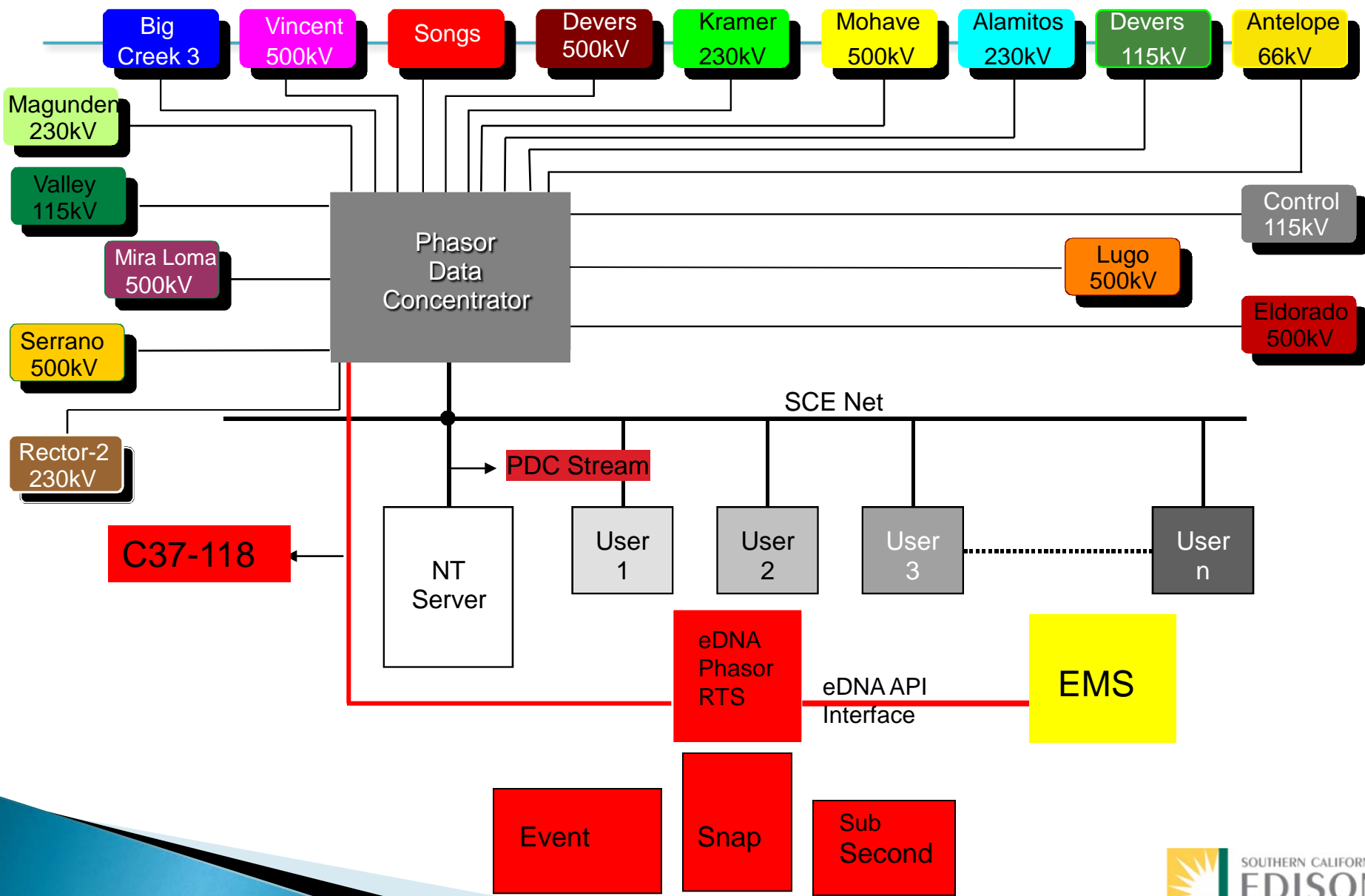
Application support:

- ▶ Small-Signal Stability Monitoring (optional)
- ▶ Real time thermal line rating monitoring
- ▶ Island identification and island condition monitoring
- ▶ Distributed generation / Independent power producer (DG / IPP) Applications

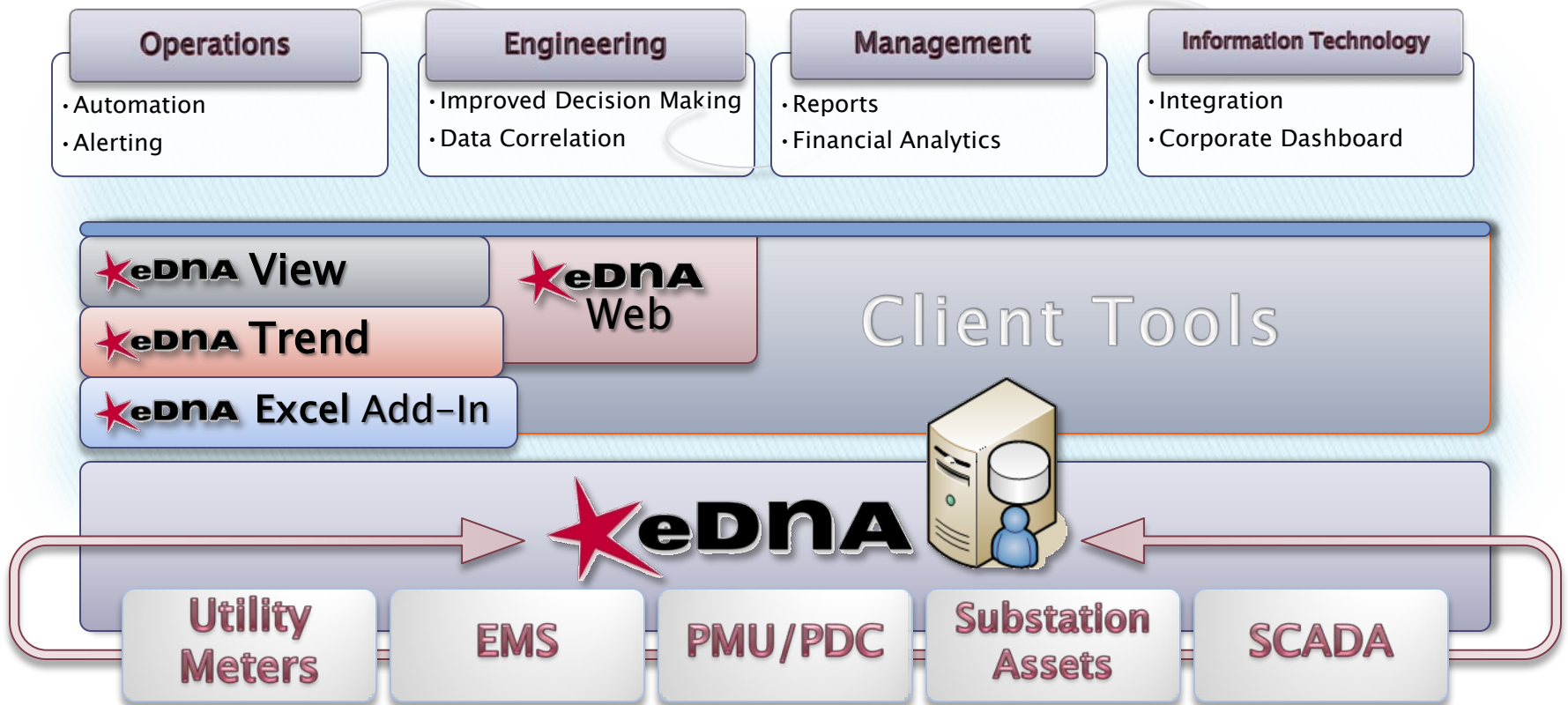
WASAS Design Views – logical



Current SCE Phasor Measurement System Network



Infrastructure



eDNA Synchronphasor Data Management

- ▶ Stores all collected data online for configurable number of days in its original collected resolution (Rolling Archive)
- ▶ Snapshot archive of the data that can be efficiently stored online for many years
- ▶ Event archive management
- ▶ All data is stored in an archive such that the integrity and resolution of the measurement values are fully maintained (lossless compression)
- ▶ Rapid retrieval of data regardless of archive sizing

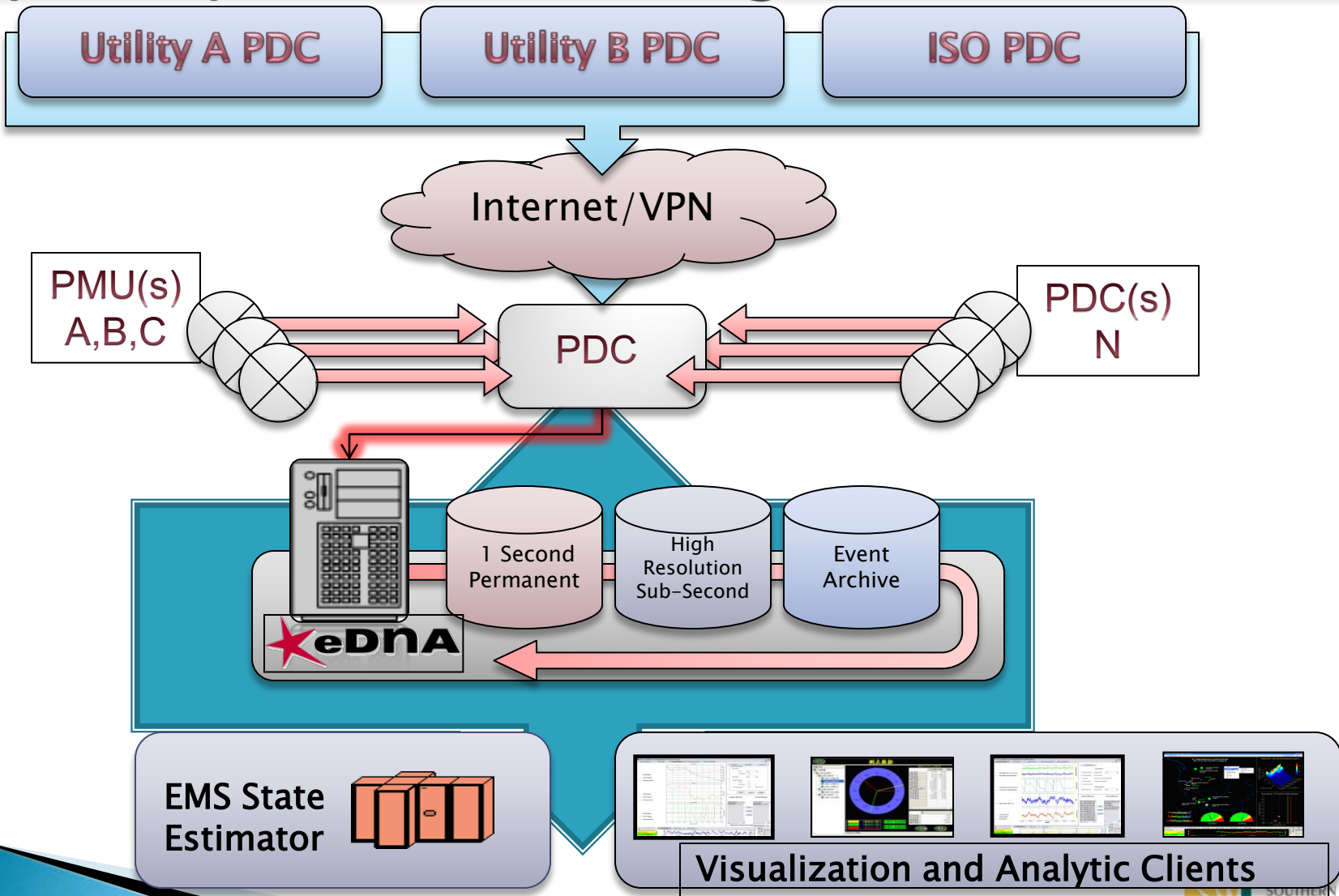
Data Management

- ▶ Integration of phasor data with other applications (OPC, ODBC Web Services and API's for integration with other systems)
- ▶ Ability to easily retrieve time synchronized snapshots of the Phasor information
- ▶ Output data via Excel, Binary Files (DST), Comtrade
- ▶ Any number of users and applications can access the real-time and historical data simultaneously without delay
- ▶ Data Management/Organization using a meta data model

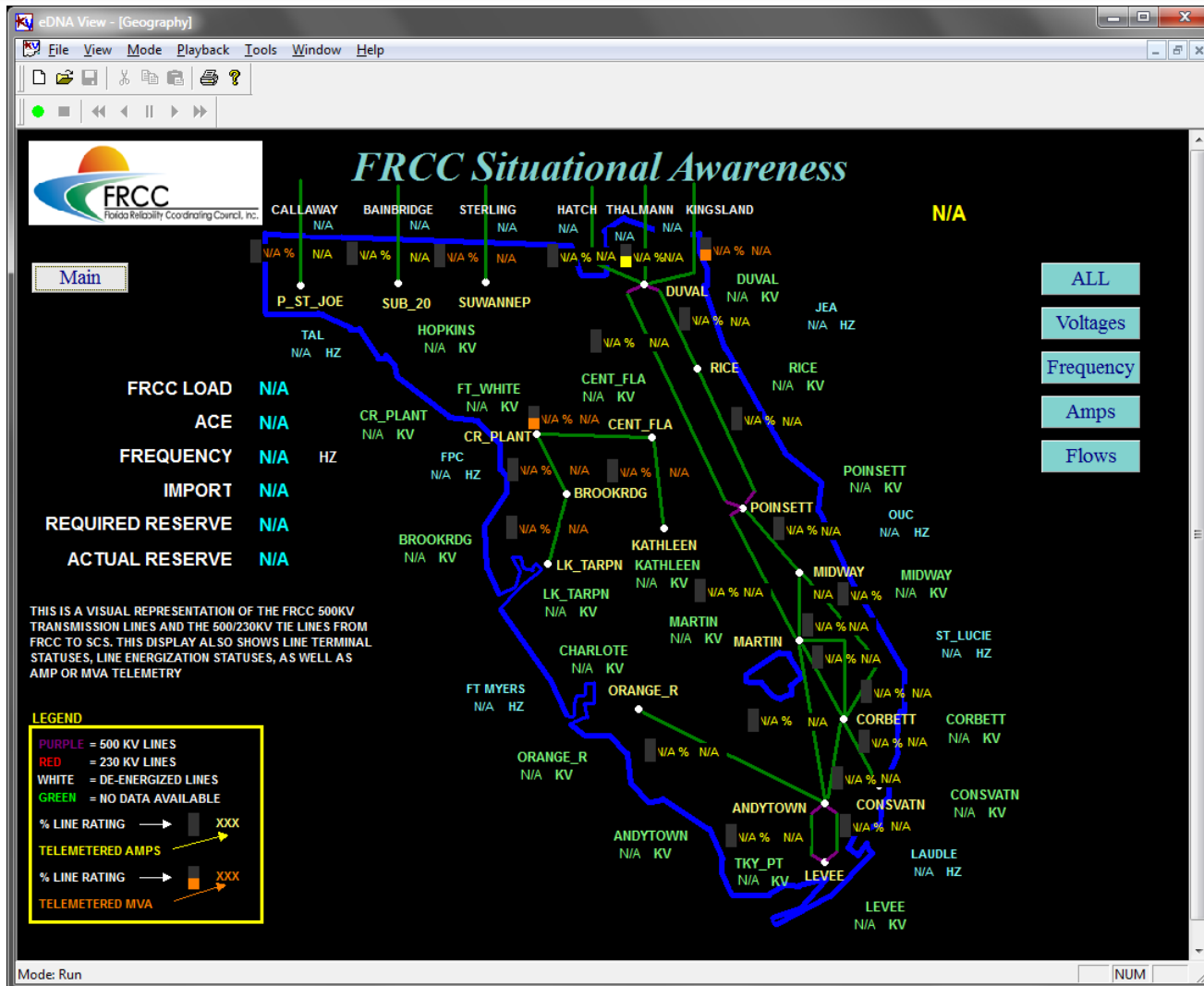
Event Detection/Management

- ▶ Configure and generate alarms based on high/low limit checking for each collected measurement value
- ▶ Configure and generate alarms based on rate of change
- ▶ Alarm filtering (in alarm state for x period of time, alarm threshold violation x times over x period of time, etc.)
- ▶ Automatic storage of the data for a configurable amount of time (so much pre event and post event) based on the alarms
- ▶ Manually defined events to be stored in the event archive

Synchrophasor Data Management PDC



Graphical View Displays



Event Configuration Interface

The screenshot displays the eDNA Event Configuration Interface. The main window title is "demo - Remote Desktop Connection". The interface features a navigation menu on the left and a main configuration area on the right.

Navigation Menu:

- View Events
 - Open Events Summary
 - Open Events By Instance
 - Events History
- Manage Event Definitions
 - Individual
 - By CHaD Class
 - Breaker
 - Enterprise
 - Network
 - Site
 - AIX Servers
 - Routers
 - Switches
 - Windows
 - Windows
 - Folder
 - Organization
 - Facility
 - Boiler
 - Meter
 - Pump
- Admin Tools

Main Configuration Area:

Manage CHaD Class: Meter

Event Definition | **Rule** | Notification | Schedule

Attribute: ...

High Alarm Limit: ...

High Warning Limit: ...

Low Warning Limit: ...

Low Alarm Limit: ...

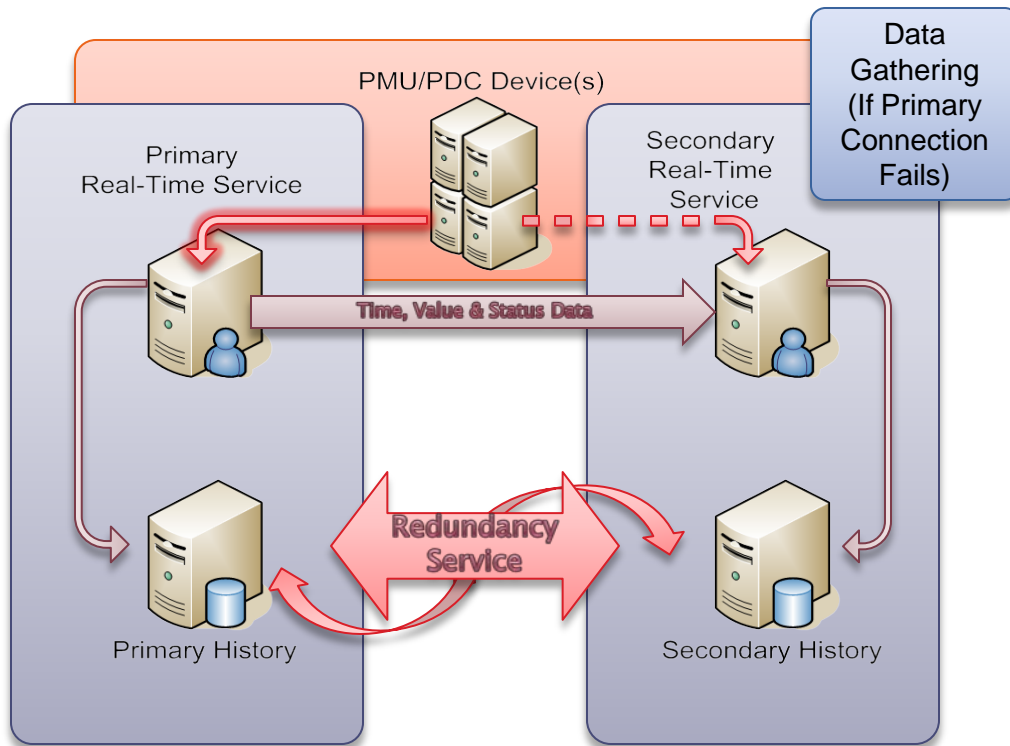
Dead Bands

Pre Trigger: Type: Value: of samples

Post Trigger: Type: Value:

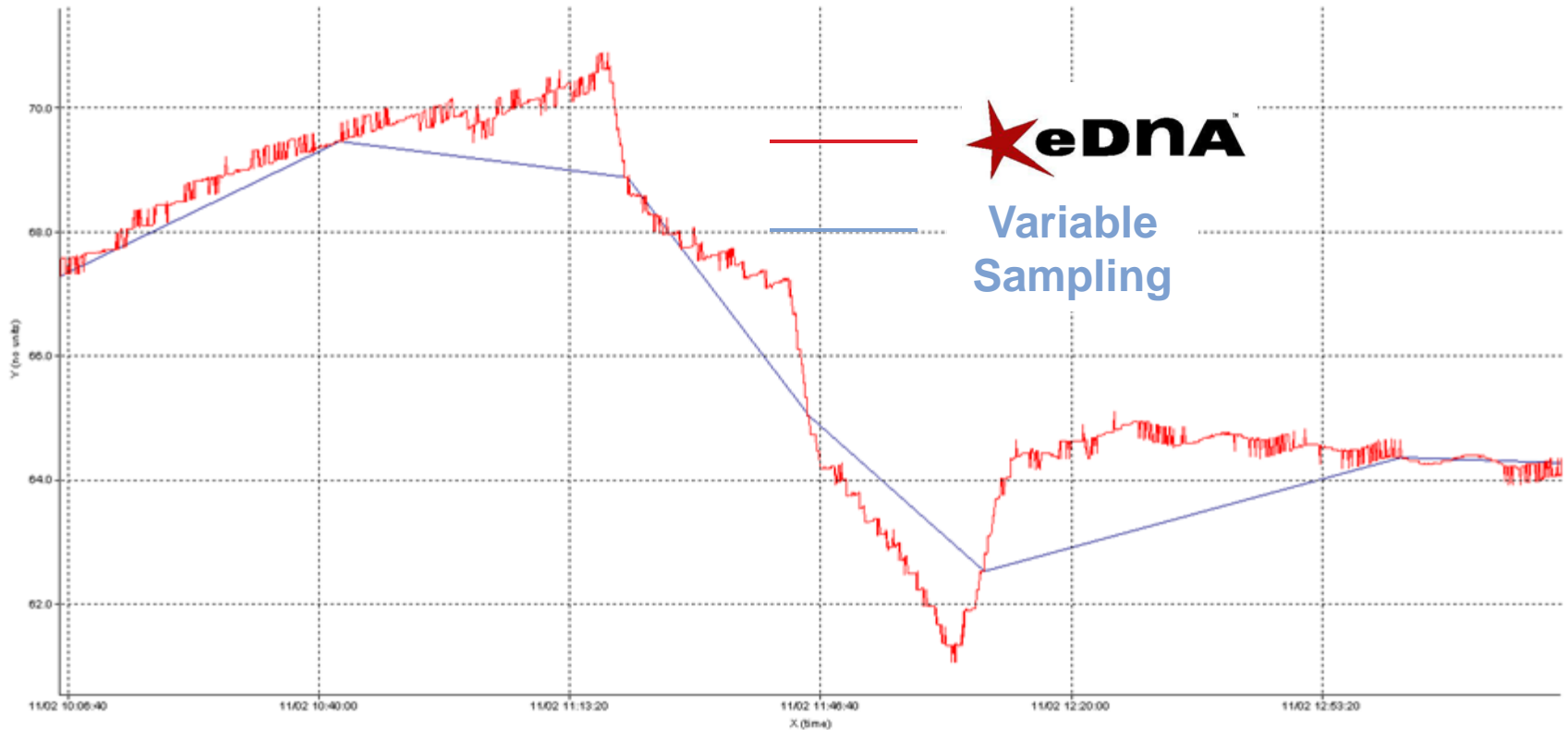
Buttons: Update | Delete | Cancel | Assign Instances

Native System Redundancy

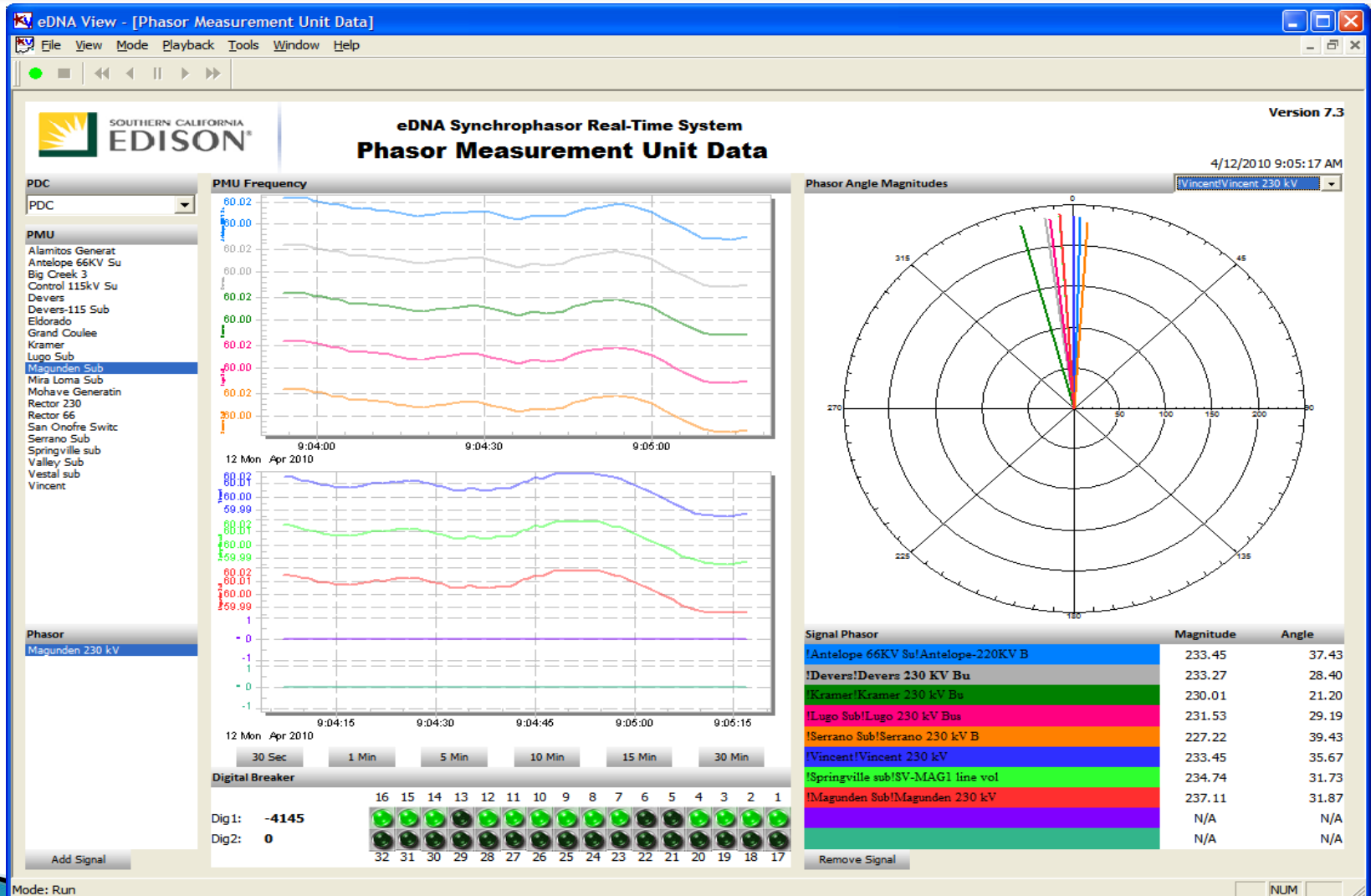


- ▶ Seamless Failover
- ▶ Operate Through System Failures and Maintenance
- ▶ 24x7 Fault Tolerance
- ▶ Built Into Core eDNA Architecture
- ▶ Eliminate Costly and Limited 3rd Party Solutions

Data Accuracy & Fidelity



Object Based Viewing of PMUs using CHaD



eDNA View – Example Situational Awareness

Main

5/20/2009 2:39:54 PM



eDNA Synchrophasor Real-Time System Phasor Measurement Unit Data

PDC: PDC
PMU: Rector 230
Phasor: BC1
Digital Break: Dchan1

PDC

PDC

PMU

- Alamitos Generat
- Antelope 66kV Su
- Big Creek 3
- Control 115kV Su
- Devers
- Devers-115 Sub
- Eldorado
- Grand Coulee
- Kramer
- Lugo Sub
- Magunden Sub
- Mira Loma Sub
- Mohave Generating
- Rector 230**
- Rector 66
- San Onofre Switc
- Serrano Sub
- Springville Sub
- Valley Sub

PMU Data

PMU: Rector 230

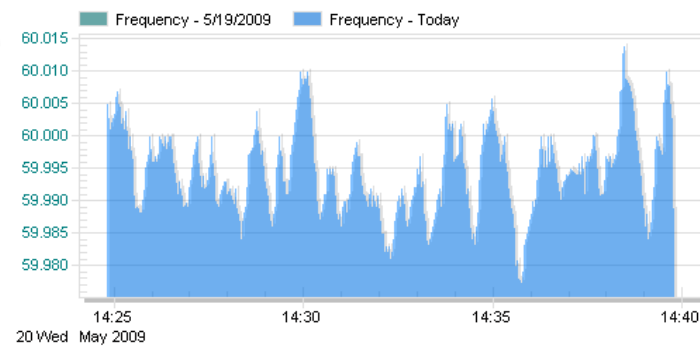
Freq: 60.0040
DFreq: -0.4600
Quality: 0.00

Trend Comparison Date:

5/19/2009

Trend Type:

Frequency



1 Min 5 Min 15 Min 30 Min 1 Hour 6 Hours 12 Hours 1 Day

Phasor

- BC1**
- BC3
- Rector 230 kV N
- Rector 230 kV S
- Vestal#1
- Vestal#2

Phasor

Phasor: BC1

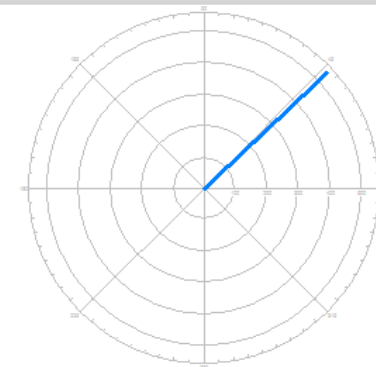
Magnitude: 528.1008
Angle: 43.0079
Unit: 64904.00

Digital Break: Dchan1

Dig1: 13056
Dig2: 65504

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17

Phase Angle/Magnitude



Digital Break

Dchan1

Data Organization

Address: <http://alhe02a/default.aspx>

eDNA Home Favorites Help Preferences Log Out Hide/Show Tree

eDNA View SCE Station Hierarchy Watch Lists Trending Query Reports Reference Incident Analysis Snapshots EventLog User: instep

Instances Search **!PDC!Alamitos Generat!Alamitos 230 KV!Voltage Data**

Instance Attributes Page Size: 20

Attribute	Value	Units	Status	Time	Plot
Voltage Angle	-65.60	DEG-CEL	OK	9:41:15 AM	
Voltage Imaginary	-9801		OK	9:41:15 AM	
Voltage Magnitude	225.7	Volts/kV	OK	9:41:15 AM	
Voltage Real	4445		OK	9:41:15 AM	

Last Updated: Tuesday 11/9/2010 9:41:17 AM

Done Local intranet









Start E:\eDNA eDNA View - [Phasor Me... eDNA Web - Microsoft... 9:41 AM

Viewing Event Archive

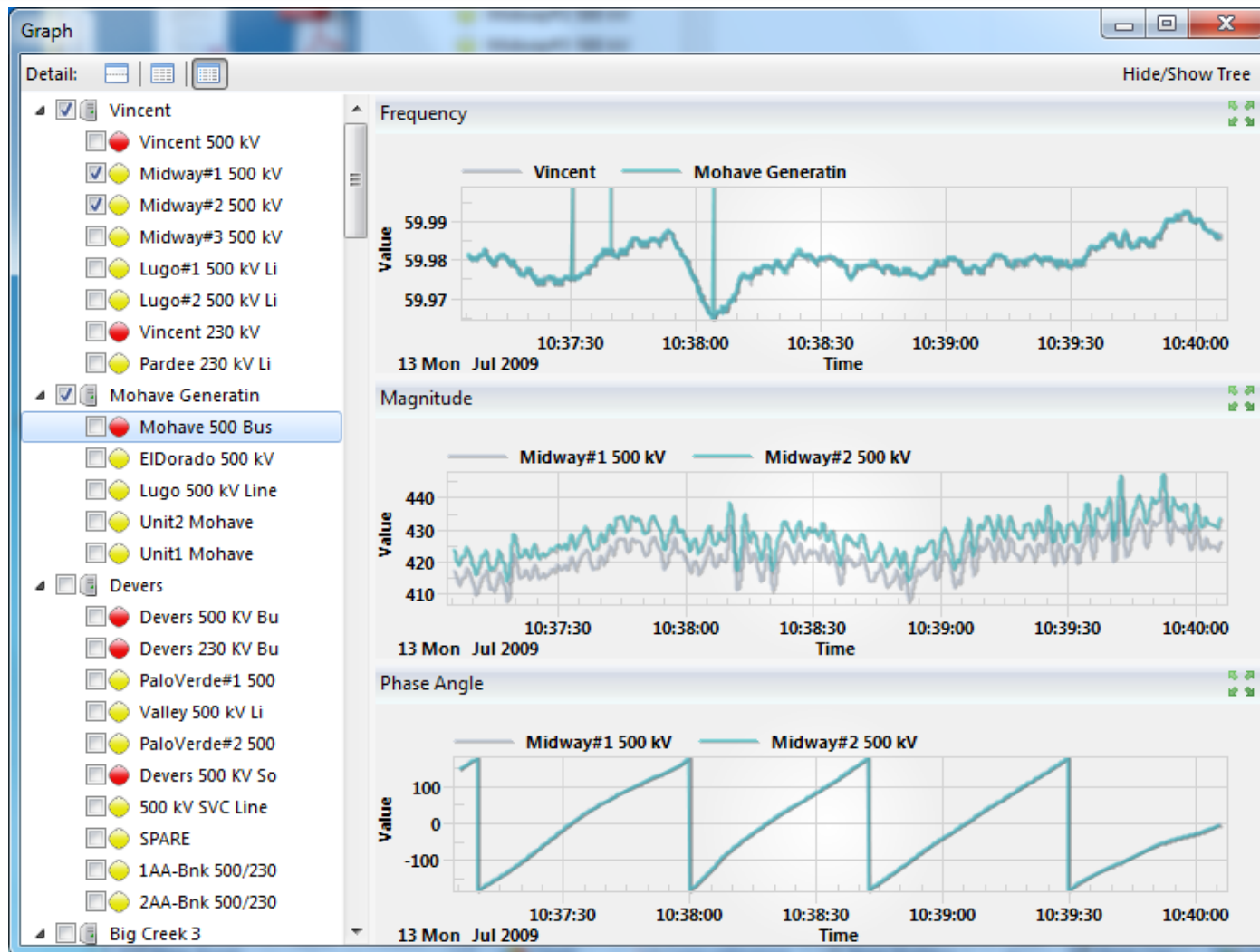
New DST

Search events:

To create a new DST, select an event below:

DST File	RTS	Start Time	End Time	Start Sa...	No. of ...	Trigger ...	Trigger ...	Trigger ...	Trigger ...	Index
 SCE1_0...	LGUIA...	03/23/09 19:29:19	03/23/09 19:32:19	18	5400	123785...	18	18	1	0
 SCE1_0...	LGUIA...	04/13/09 10:46:33	04/13/09 10:49:32	0	5400	123963...	0	10	1	1
 SCE1_0...	LGUIA...	04/13/09 10:54:00	04/13/09 10:56:59	0	5400	123963...	0	13	8	2
 SCE1_0...	LGUIA...	04/13/09 10:54:00	04/13/09 10:56:59	0	5400	123963...	0	5	8	3
 SCE1_0...	LGUIA...	07/13/09 10:37:05	07/13/09 10:40:05	17	5400	124749...	17	15	5	4
 SCE1_1...	LGUIA...	04/06/10 21:57:44	04/06/10 22:00:44	23	5400	127060...	23	16	5	5
 SCE1_1...	LGUIA...	04/07/10 09:16:15	04/07/10 09:19:15	25	5400	127064...	25	14	5	6
 SCE1_1...	LGUIA...	04/07/10 09:16:15	04/07/10 09:19:14	25	5400	127064...	25	14	5	7

Trending Analysis



DST File Created

The screenshot displays the SyncConvert application window. The interface includes a menu bar (File, Edit, View, DST, Data, Help) and a toolbar with icons for New, Open, Save, View Data, Trend, Write to History, and Event Transfer. The main workspace is divided into several panels:

- PDC Hierarchy:** A tree view showing the project structure. The root is 'SCE1_0904131546.dst', which contains sub-entries for 'Vincent', 'Mohave Generatin', and 'Devers'. Each sub-entry lists various power system components like '500 kV', '230 kV', and '500 Bus'.
- Information:** A table showing properties of the selected file.
- DST Header Data:** A table showing metadata for the DST file.
- Offset Data:** A table listing PMU offsets.
- Active DST Files:** A list of currently active DST files, with 'SCE1_0904131546.dst' highlighted.

The status bar at the bottom left indicates 'Ready'.

Property	Value
File	SCE1_0904131546.dst
Number of PMUs	21

Property	Value
Start of Header	170 204
File Type	Event
File Version	0
Include Dbuf Flag	True
File Source ID	SCE1
Header Long	0
Start Time	04/13/09 10:46:33
End Time (calculated)	04/13/09 10:49:33

PMU	Flag	Offset
VN01	0	1
MOGS	0	13
DV01	0	21
BC01	0	35
ALGS	0	43
SN01	0	51
KRMR	0	64
DV02	0	72

Transfer from Streaming to Event Archive

Event Transfer

History Information

Susbecond History: **LGUAMAT.HISTORY** Synchrophasor RTS: **LGUAMAT.SYNCPHZR**

Event History: **LGUAMAT.HIST2**

Snapshot History: **LGUAMAT.HIST1**

Event Information

Start Time: **Monday , April 13, 2009** Records(default = 5400): **5400**

10:50:00 AM

Select a PMU:

VN01 Vincent	MOGS Mohave Generatin	DV01 Devers	BC01 Big Creek 3	ALGS Alamitos Generat
SN01 San Onofre Switc	KRMR Kramer	DV02 Devers-115 Sub	ANTP Antelope 66KV Su	VALY Valley Sub
MAGN Magunden Sub	ELDO Eldorado	LUGO Lugo Sub	CNTL Control 115kV Su	MRLM Mira Loma Sub
SRNO Serrano Sub	RCT1 Rector 230	RCT2 Rector 66	SPVL Springville sub	VEST Vestal sub
BPA1 Grand Coulee				

Event Trigger: **8**

Event File Prefix: **SCE**

Preview **Transfer Data** **Close**

Summary

- ▶ Need to Plan for the Data Management Infrastructure Now
- ▶ More than just a database of time series data
- ▶ Need to Organization Layer
- ▶ Need Event Archive
- ▶ Need Import / Export / Replay

More Information

- ▶ Reception Tonight – InStep Booth
- ▶ Multiple Vendor Interoperability Demonstration – Tomorrow 8 AM

Questions or Comments

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