



Celebrating
25 YEARS OF INNOVATION

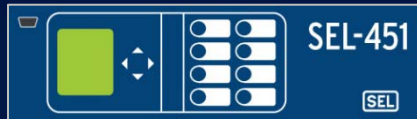
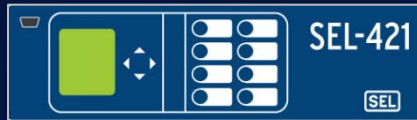
SEL Synchrophasor Solutions NASPI February 23rd, 24th 2011



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SEL Synchrophasor Building Blocks

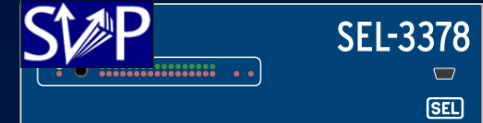
Integrated PMUs



Data Concentration



Distributed Control



Radios and Optical Networks



Visualization



Secure Communications



Satellite Clocks



System Architecture

ISO

System PDC
SEL-5073

Utility Control Center

System PDC
SEL-5073

Neighbor Utility Control Center

Station PDC

Visualization SEL-5078

Security Gateway
SEL-3620

Station PDC
SEL-3373

Other Substations

SEL-421
PMU

SEL-421
PMU

GPS Clock
SEL-2407

SEL Satellite Clocks: SEL-2401 & 2407

- Substation Rugged
- Accuracy: ± 100 ns
- Holdover: 18 secs
- -40° to $+80^{\circ}\text{C}$ temp range



SEL Integrated PMUs

- Full IEEE C37.118 compliance
- Up to 60 messages per second



Stand-alone PMUs Are Available



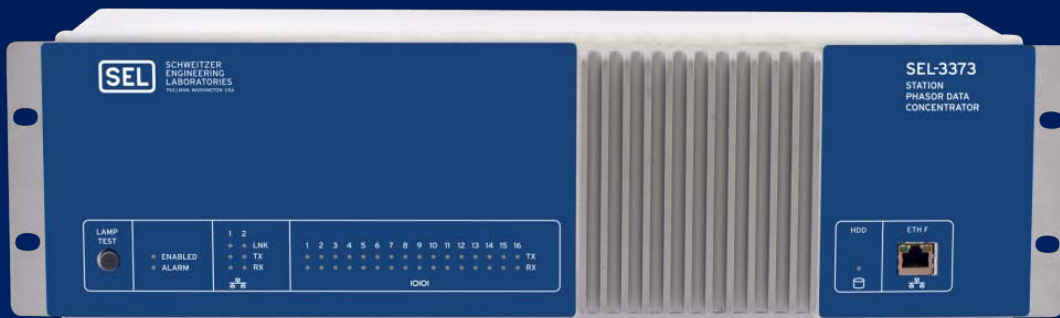
- SEL-487E Station PMU
- SEL-351A PMU



SEL-3373 Station PDC

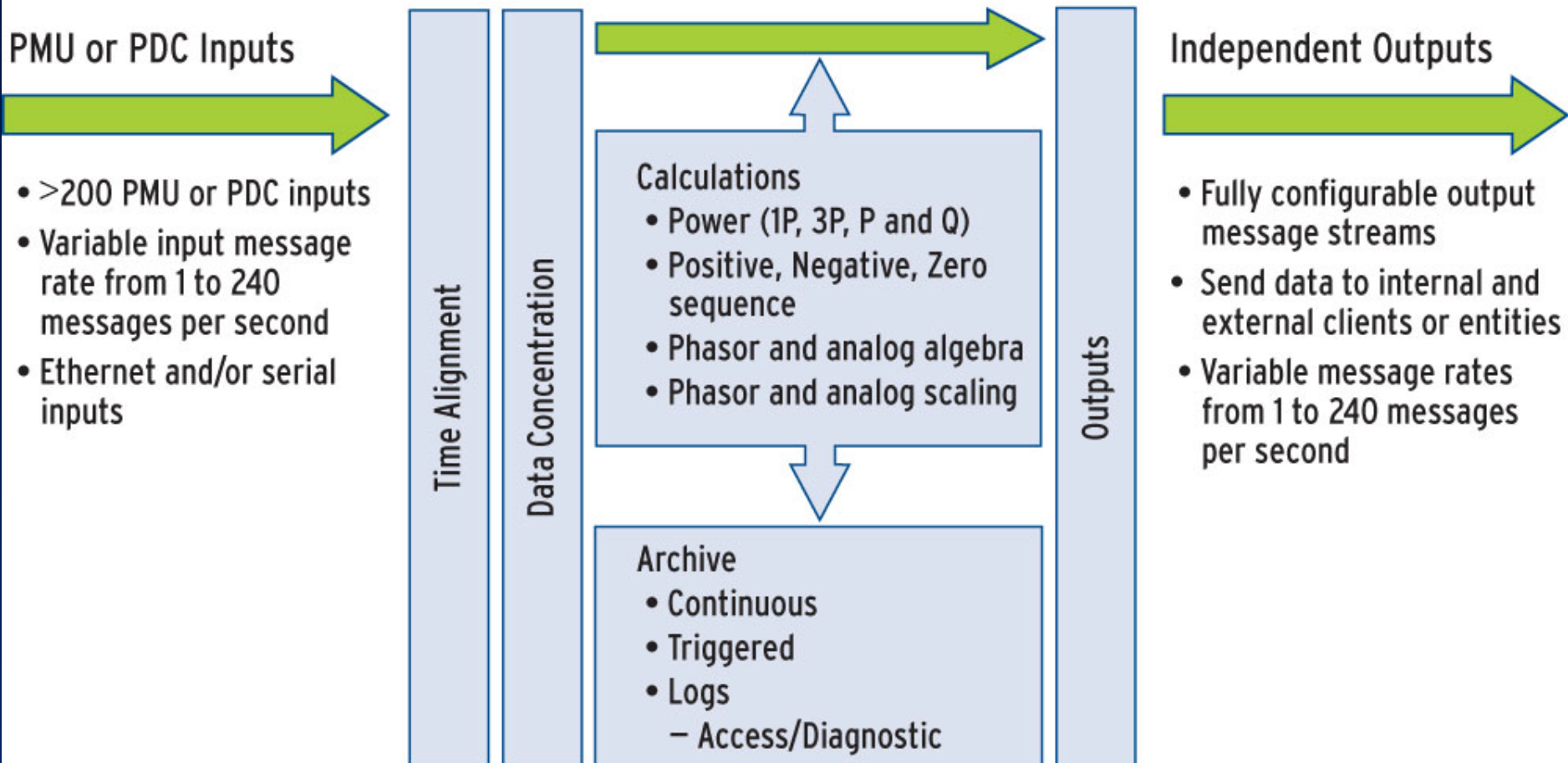
SEL-5073 Synchrowave PDC

- High performance
- Simple configuration
- Security features
- Substation Rugged
- Database archiving
- Status and logs
- Windows® OS



5073/3373 PDC Architecture

SEL-5073 SYNCHROWAVE PDC Functional Block Diagram

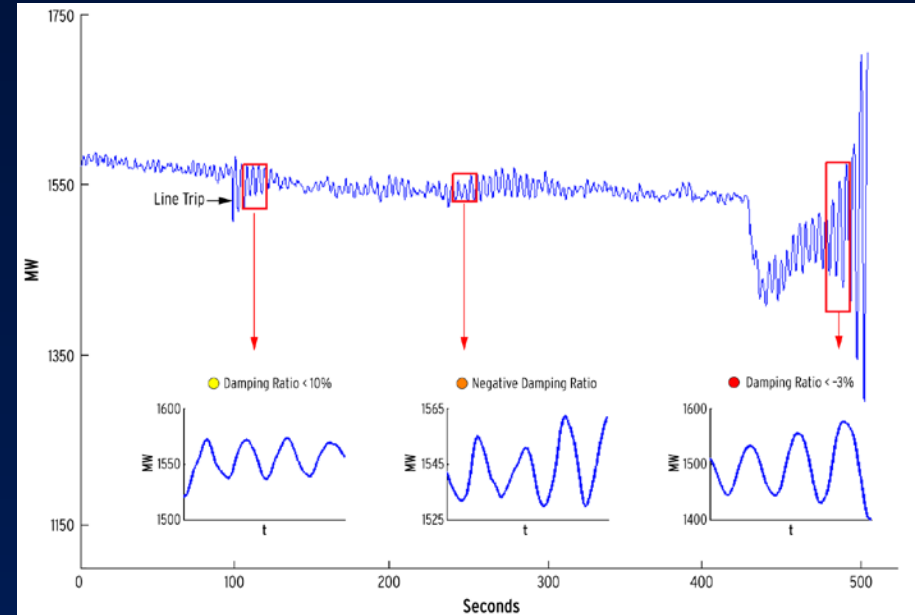


PDC Security

- User- and role-based accounts
- Strong passwords
- *Port control (3373)*
- UDP_S protocol
- Access and queried logs

187	7/2/2010 22:14:39.684	Information Settings	Historian	Created new process "Triggered"
186	7/2/2010 22:14:39.324	Information Settings	Historian	Created new process "Archive"
185	7/2/2010 22:14:15.169	Information Web Service		User 'administrator' authenticated with web service.
184	7/2/2010 22:13:39.545	Information database		administrator@127.0.0.1: New settings uploaded by user: administrator comments:

SEL-3378 Synchrophasor Vector Processor



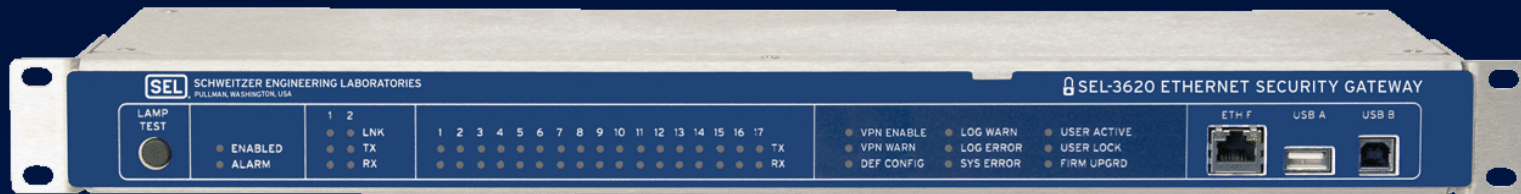
Phasor Data Concentration

Integrated Protection and Control

Built-in Functions like Modal Analysis, etc



SEL-3620 Substation Firewall


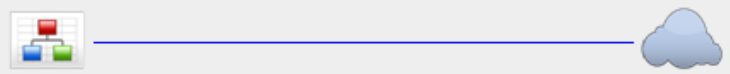


- Stateful Firewall using “deny-by-default” settings
- Encryption of data using IPsec VPN

FIREWALL

[Add Firewall Rule](#) [General Rule Settings](#)

Global Rules

Global Order	Alias	Status	Source Port	Description	Protocol	Rule	Destination Port	Options
1	Telnet	Disabled	0.0.0.0/0 23-23	Drop Telnet	TCP	DROP	0.0.0.0/0 23-23	Update Enable Delete
								
2	Address	Enabled	192.168.24.0/24 1-65535	Accept address	TCP	ACCEPT	0.0.0.0/0 1-65535	Update Disable Delete
								

Interface Rules

Global Order	Alias	Status	Source Port	Description	Protocol	Rule	Destination Port	Options
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General Rule Settings

Firewall Rule Successfully Enabled

[Move From Above To](#)

[Move From to End](#)

☐ Drop Ping

☐ Drop Traceroute

☐ Must Be Encrypted

☐ Allow All Encrypted

☐ Text-only View

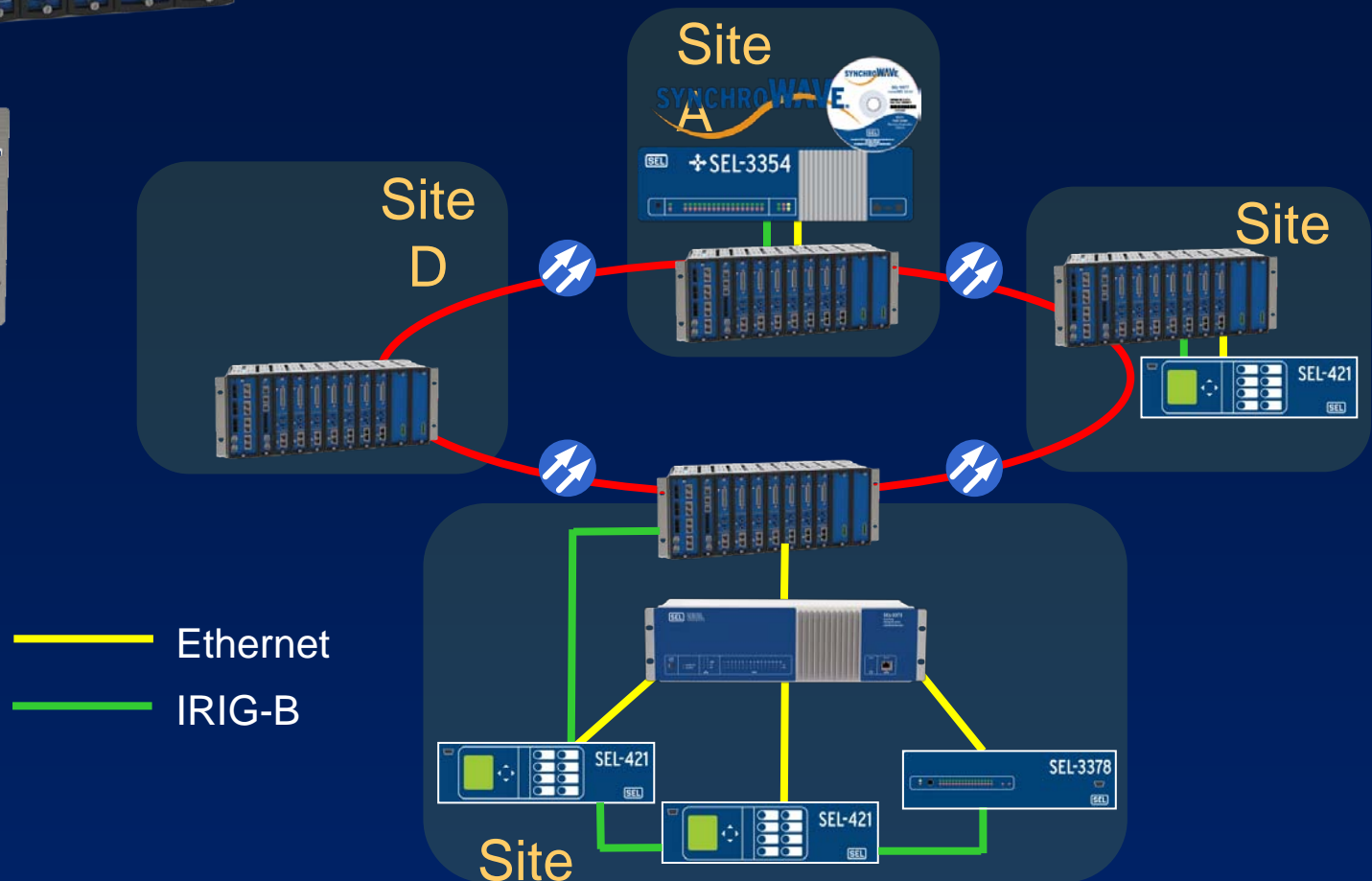
☐ Integrated View

[Save](#)

Integrated Communications Network



icon
INTEGRATED COMMUNICATIONS OPTICAL NETWORK

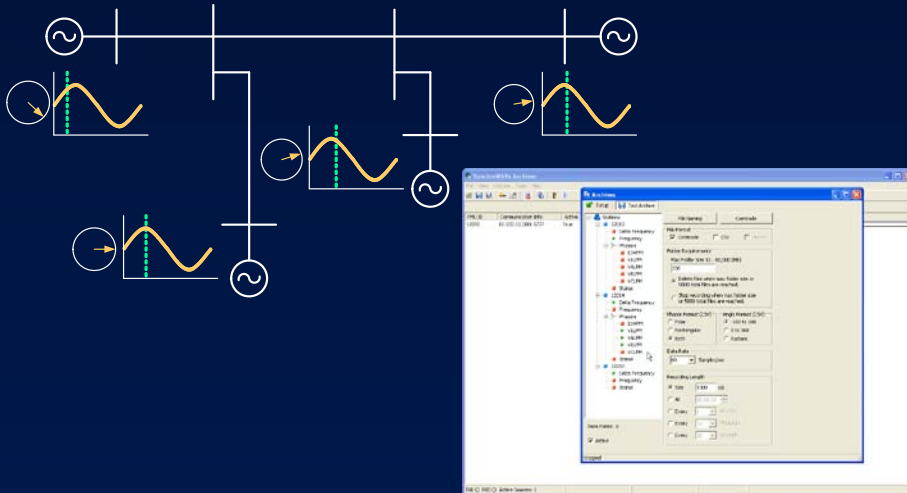




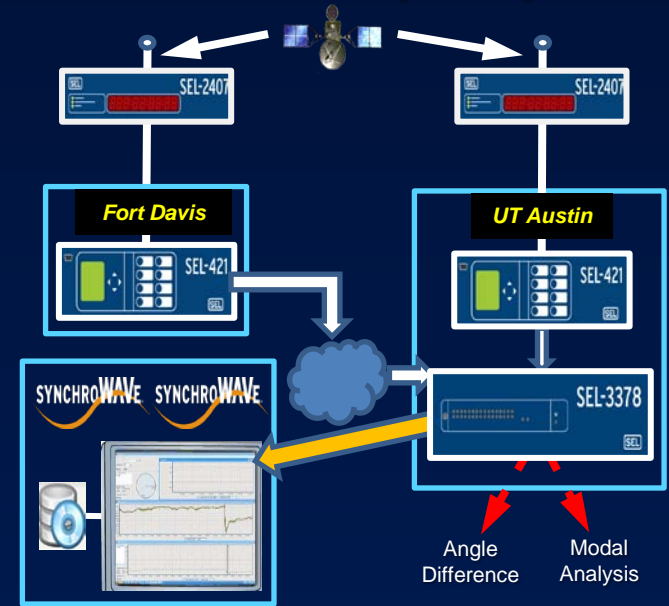
- OC-48 SONET multiplexer with 256 bit AES encryption
- SONET/Ethernet multiplexer
- Time Distribution with $<1\mu\text{s}$ accuracy maintained with loss of GPS clock
- Measures and reports communication latency

A Few Example Applications

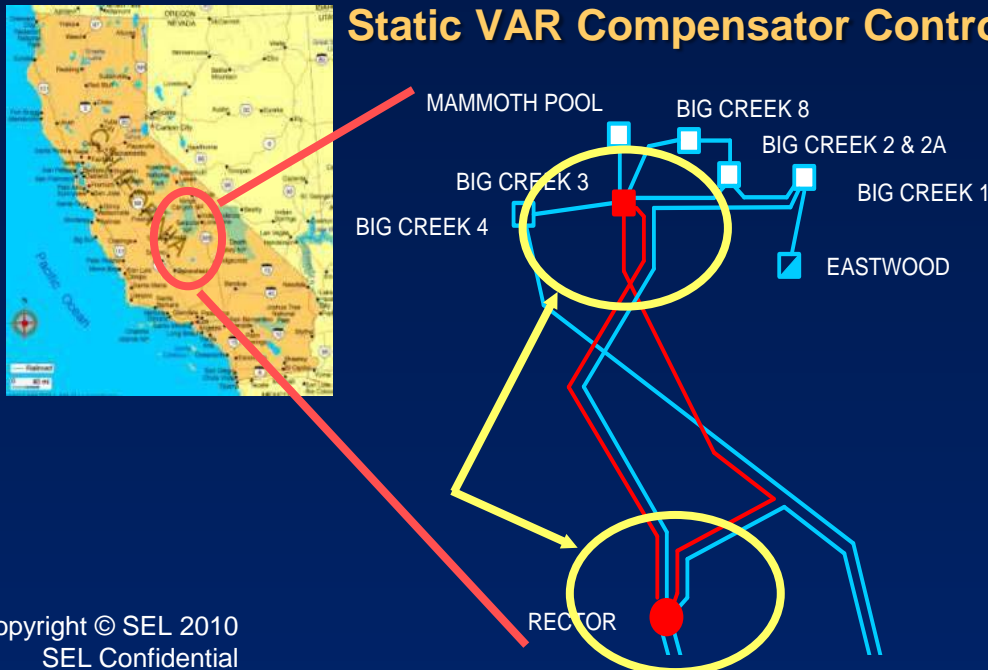
PRC-002-2 Archiving System



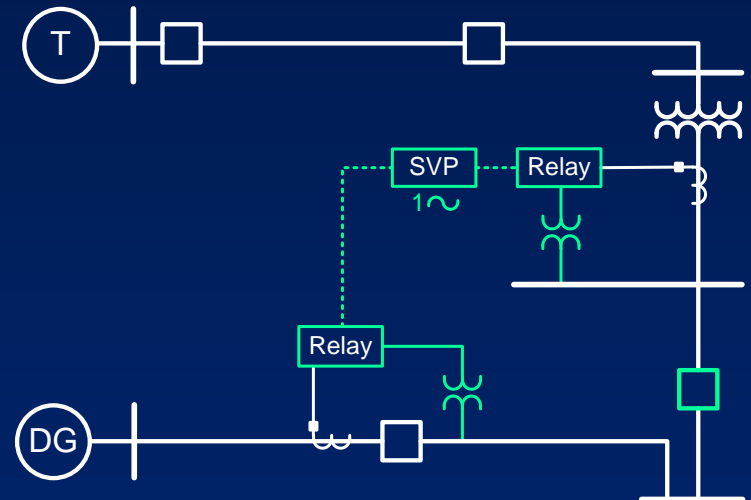
UT Austin Analysis System



Static VAR Compensator Control



Distributed Generation Anti-Islanding



Summary

- SEL offers a very complete set of solutions for synchrophasor systems
- SEL has a lot of experience helping customers implement systems
- SEL can help design, install and commission your system

PRC-002-2 Disturbance Recording System



Disturbance Recording System

- Sequence of Events Recording
- Fault Recording
- Dynamic Disturbance Recording

Questions?

