Phasor Measurement Overview

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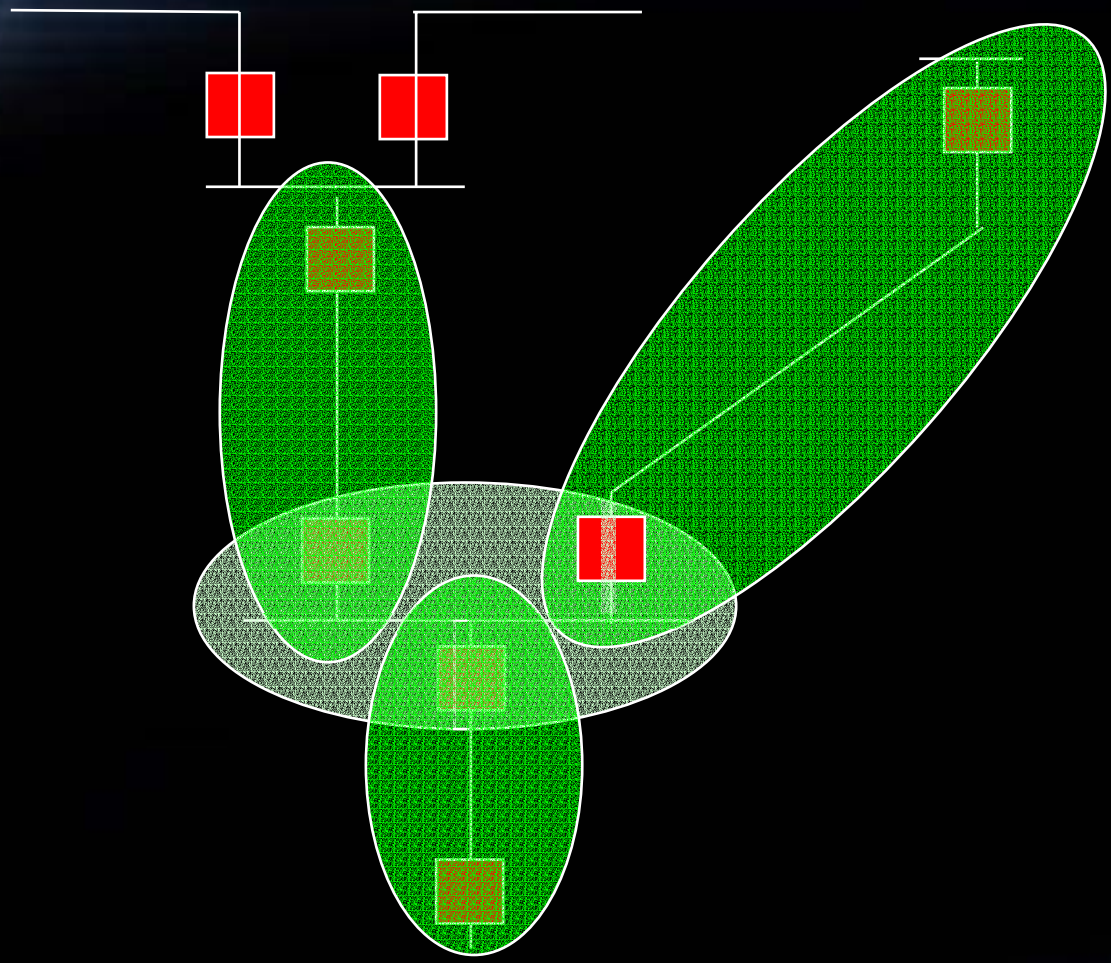
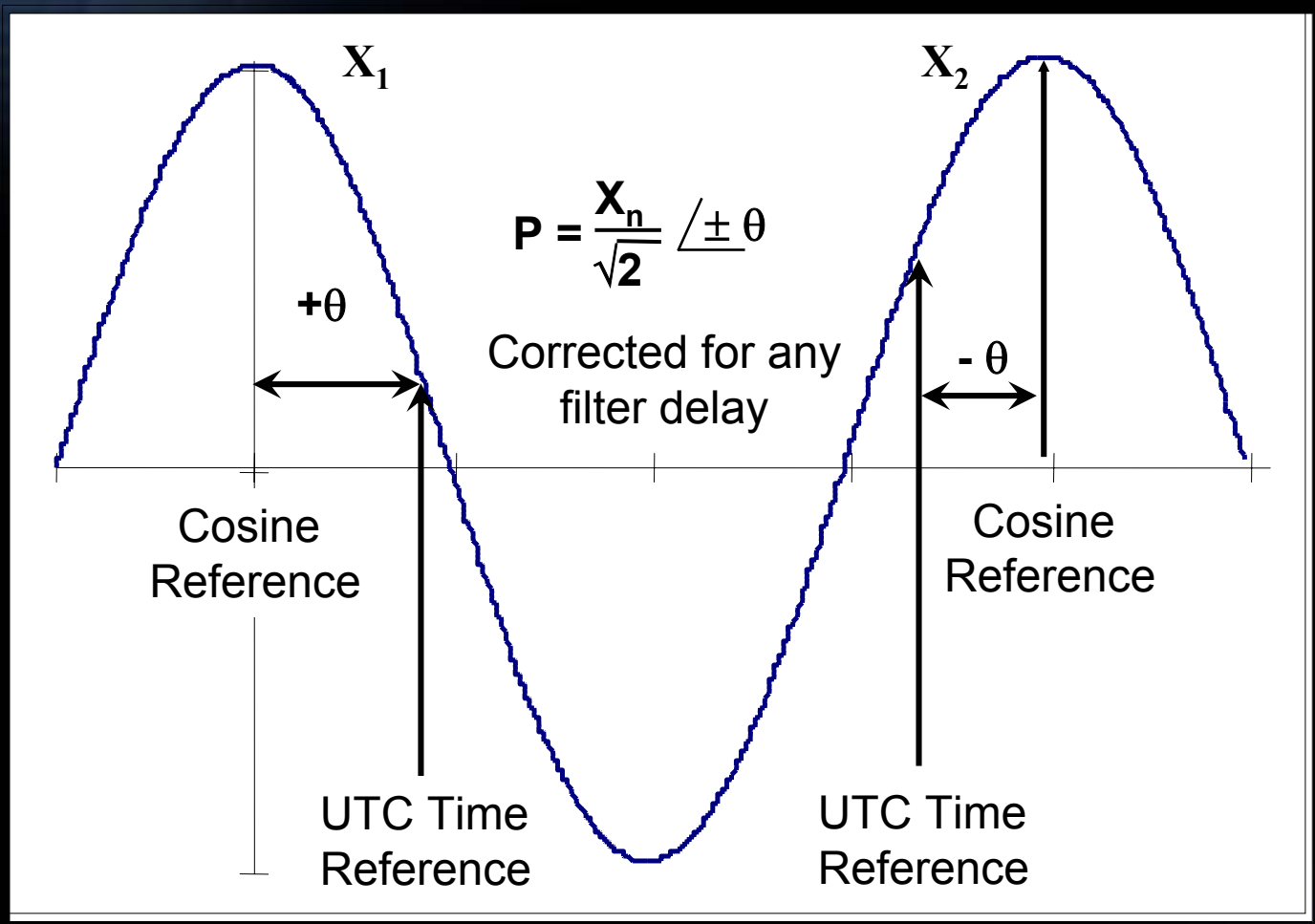
Traditional Relay Region of Protection



Traditional Protection – Local View

Phasor Definition



Report Format

Second of Century (SOC) – 4 bytes
Fraction of Second (usec, sample count, LCM)
Phasor 1 (mag and angle)
Phasor 2 (mag and angle)

Proposed Synchronous Reporting Rates

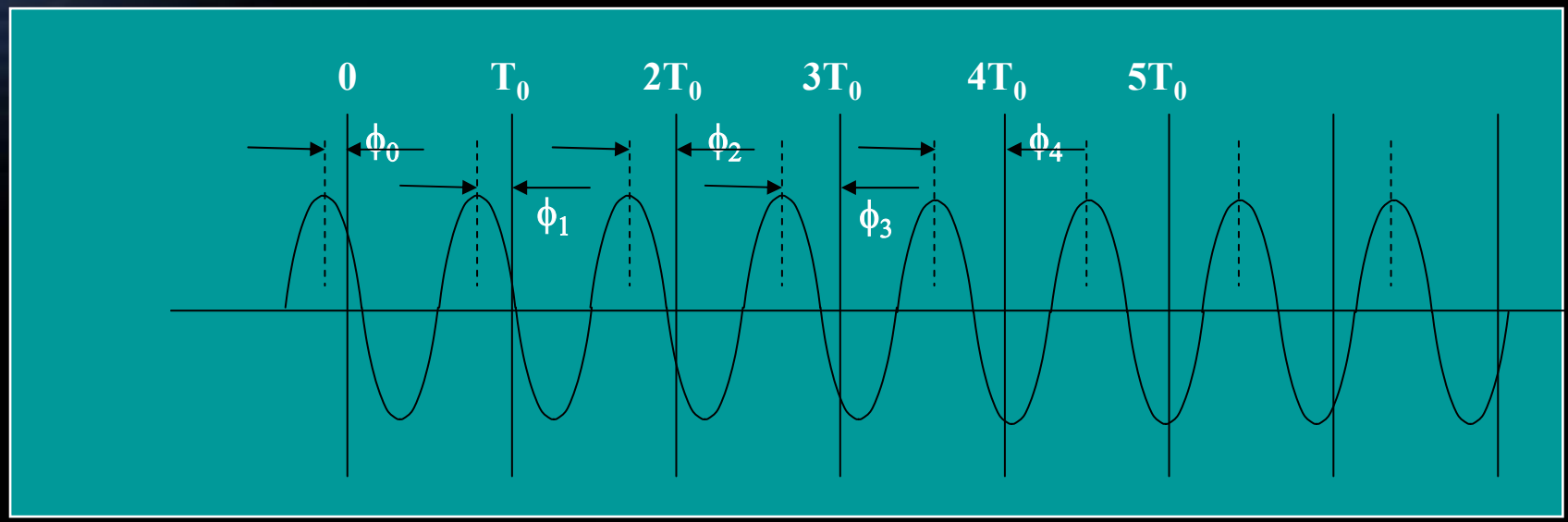
System Frequency	50 Hz		60 Hz				
Report rates (phasors/sec)	10	25	10	12	15	20	30

Optional Phasor Reporting Rates:

50 phasors/sec on 50 Hz systems

60 phasors/sec on 60 Hz systems

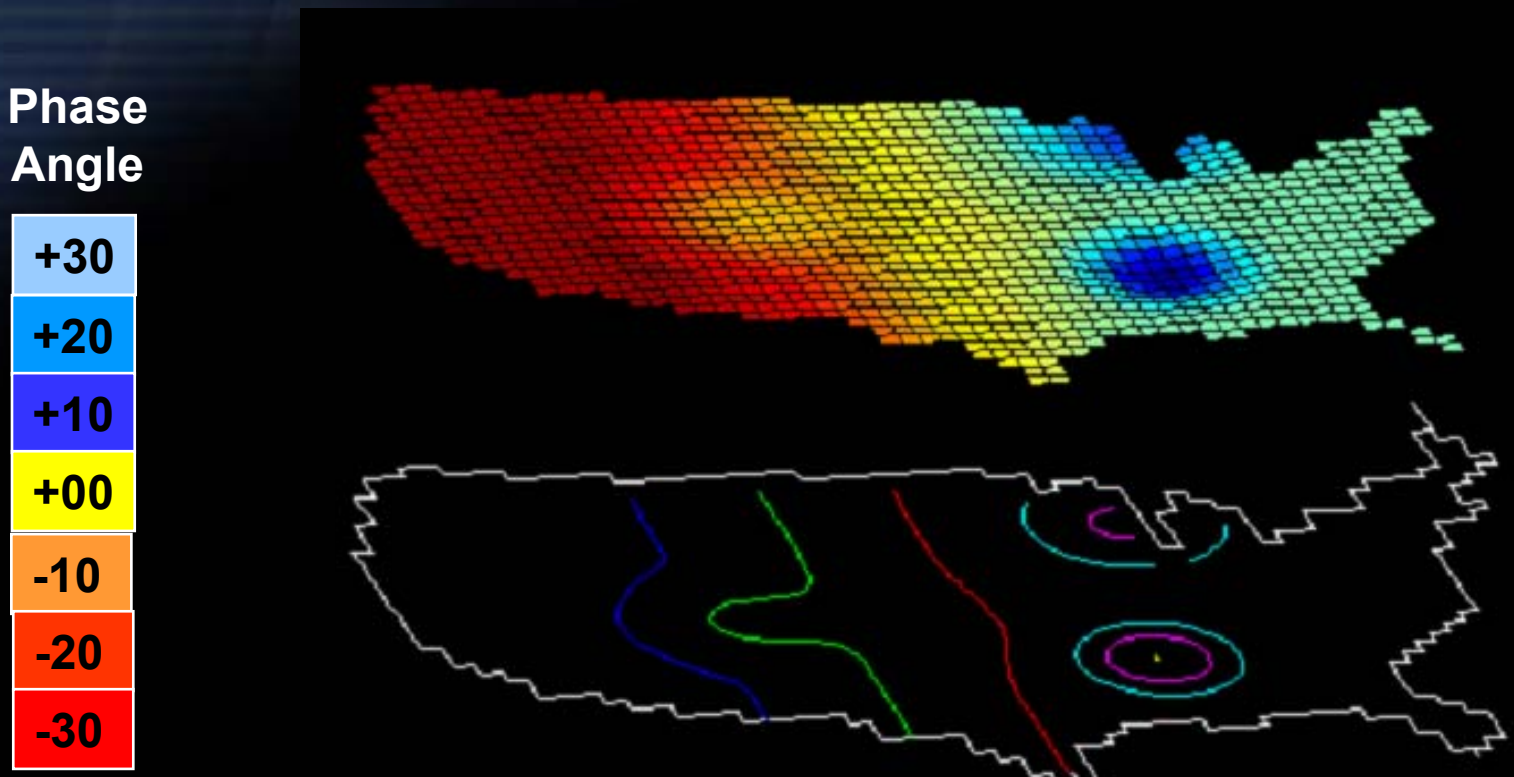
UTC Based Synchronized Reporting



Where: 0 = Top of Second

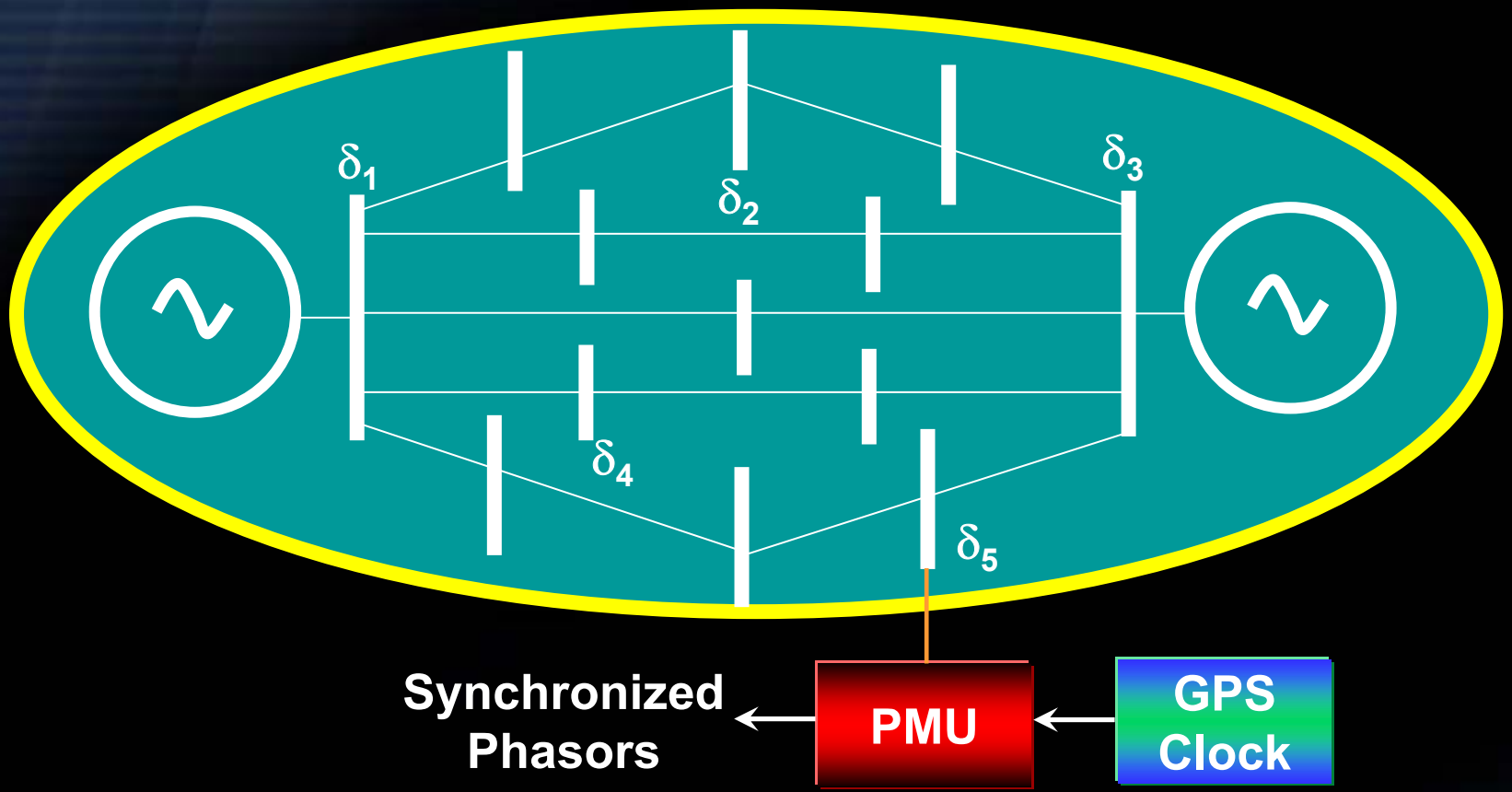
$T_n = 0 + n*(1/Fs)$ from top of second

Wide Area System View

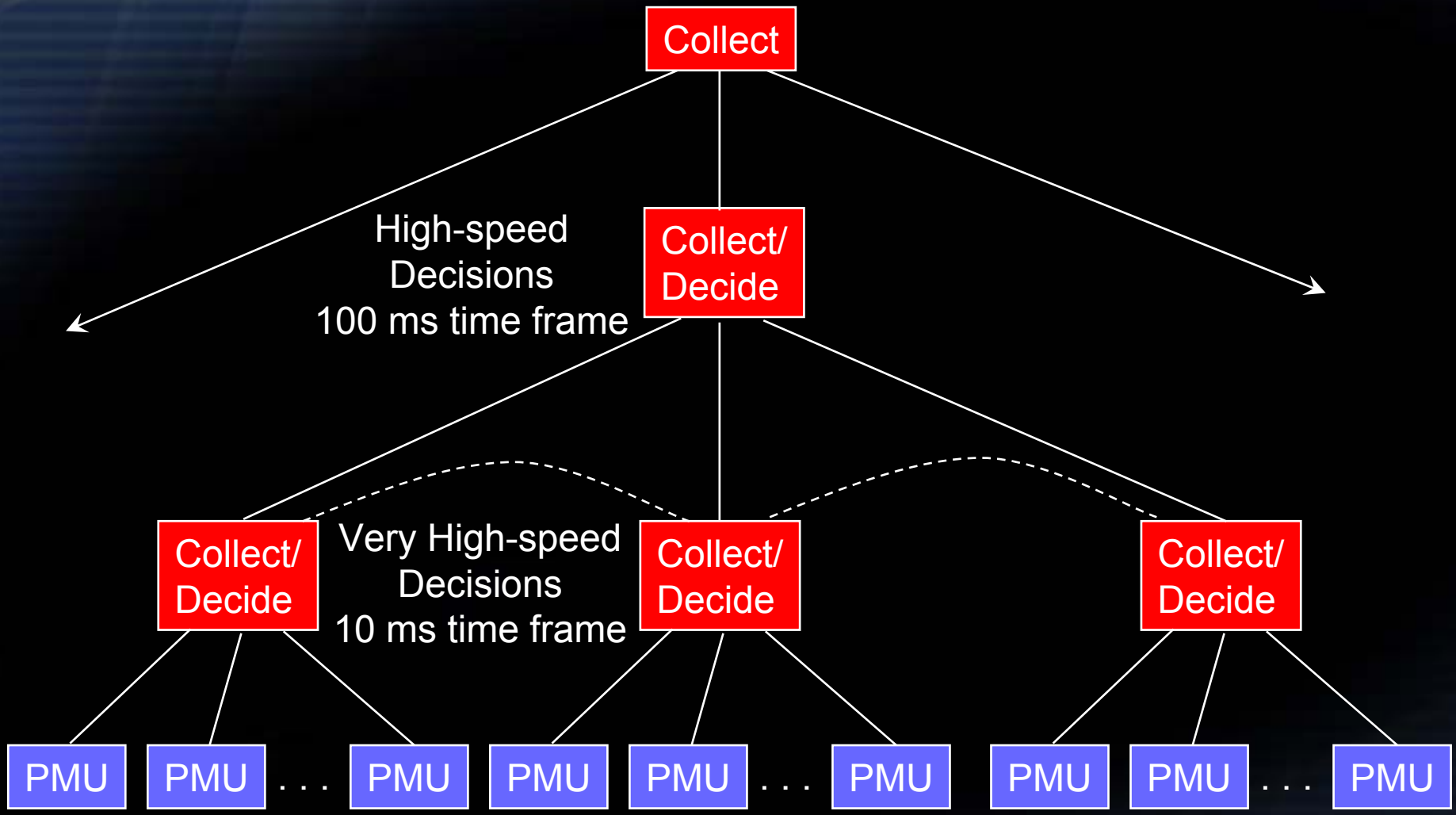


New Challenge: Wide Area Protection

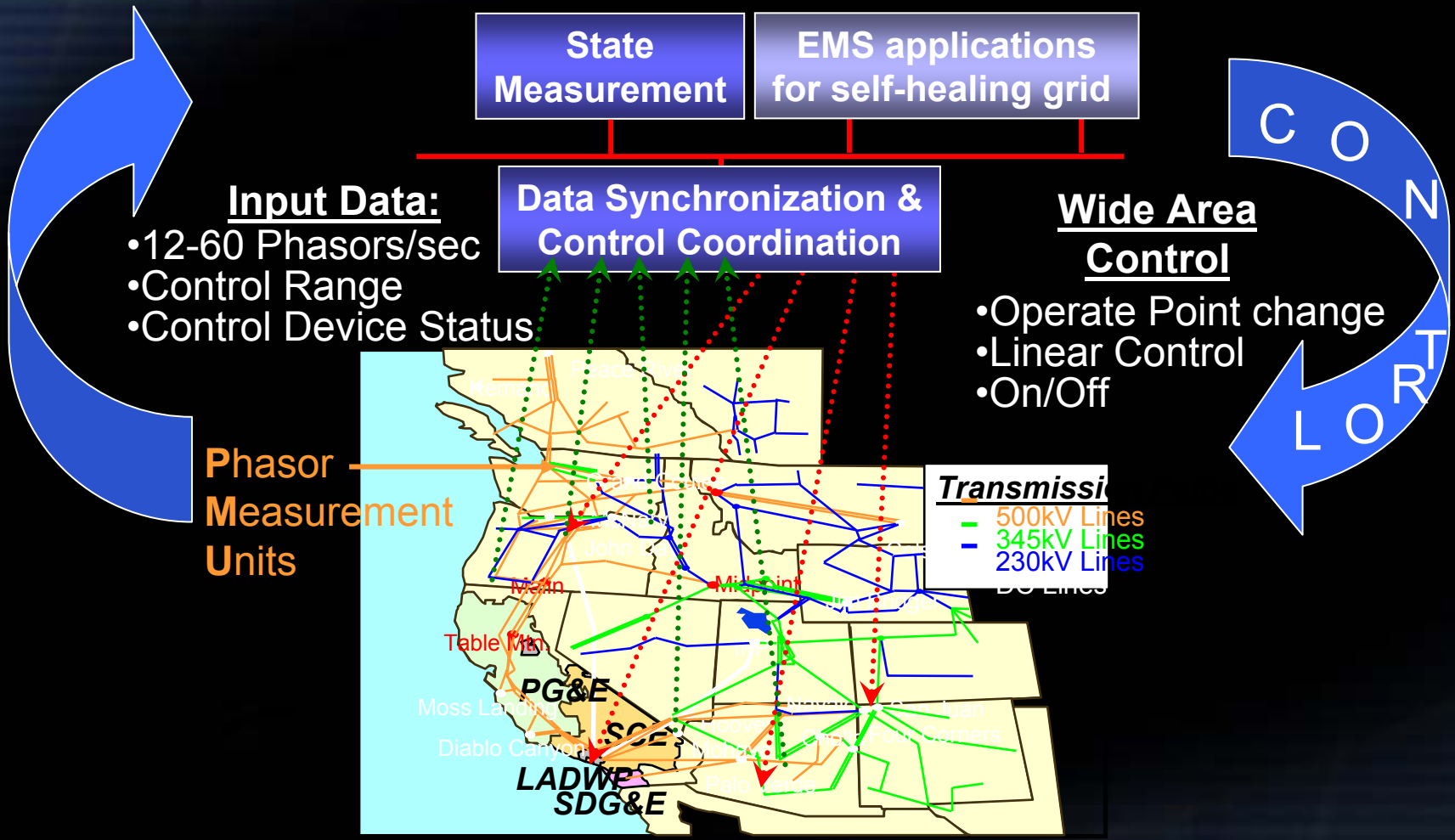
Phasor Measurement Technology



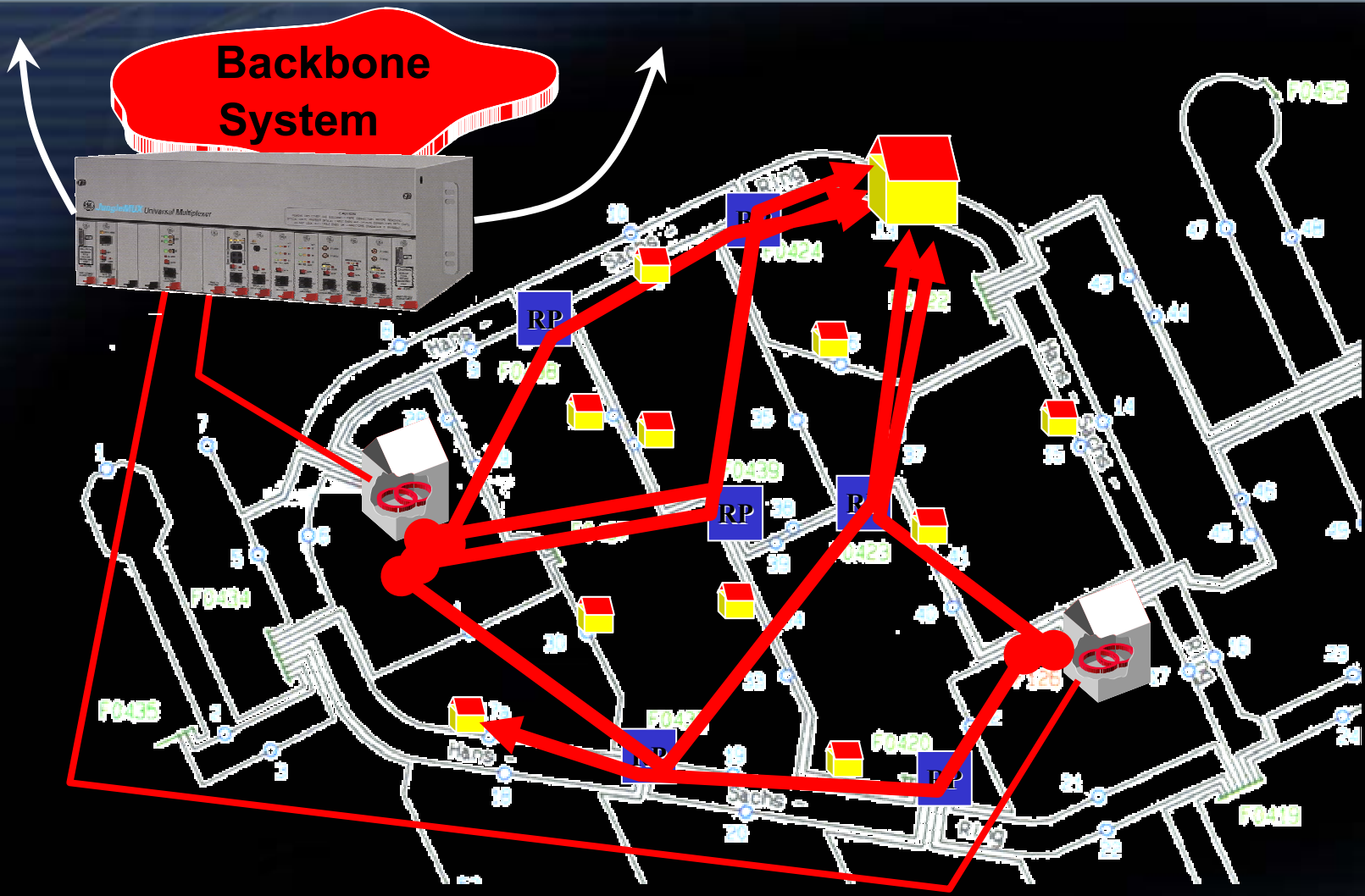
Reporting Hierarchy Options



Wide Area Protection and Control



Wide Area Fiber as Backbone for Consumer Load Control



Broadband Power Line Communications is coming…

Common Event Reporting Format

- New IEEE – PSRC working group
- Scope: Develop an XML based common format for the reporting of event data
- Format to include:
    - Date
    - Time
    - Serial number (module 2^{32})
    - Data source
    - Event number
    - Event Type (fault, system/substation alarm, IED alarm, etc.)
    - Payload (e.g. – fault payload)
        - Fault type
        - Fault Location
        - Fault Voltages / Currents
        - Clearing time
        - Reclosing success/failure
        - etc.

IEEE File Naming Convention

- Report exists at: www.pes-psrc.org and click on "published reports"

- Long file name contains Date, Time, Location and several other parameters incorporated in file name

- In process of obtaining an IEEE PAR to turn it into an IEEE Standard

Discussion Issues

- Time-stamp issues
  - Microsecond, Sample Count, Phasor Count
- Data models
  - Binary data (as presently defined in IEEE-1344)
  - Model based (UCA / IEC 61850)
- Data Integrity / Security
  - Error detection requirements
  - Data Security
- Data Reporting
  - Point to point (as presently defined)
  - Multi-connection (Client – Server: IP based)
  - Multicast (Publisher – Subscriber: IP based)

Future Needs of the Power System

- Wide Area Protection & Control
- Next Generation Energy Management
- Advanced Distribution Automation
- Distributed Energy Resources
- Self-Healing Grid
- Real Time Pricing
- Consumer Interface
- Asset Management

All Functions Will Need to Interoperate