Synchro-Phasor Vision for New England

David Bertagnolli – ISO-NE
Andrew Armenia - RPI
Prof. Joe Chow – RPI
Harish Mehta – Mehta Tech

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New England Synchro-phasor system

- 5 PMUs in-service
  - All functioning as Dynamic Disturbance Recorder (DDRs)
    - Event detection & recording at high rate (720 per second)
    - Continuous recording of synchro-phasor at slow rate (60 per second)
  - 2 of 5 streaming synchro-phasor to TVA SPDC (30 per second)
New England Synchro-phasor system

• No direct access to synchro-phasors
  – Historical data available from TVA
  – ISO-NE & Transmission Owners (TOs) cannot deploy applications
  – ISO-NE & TOs need access to synchro-phasors from neighbors
New England Synchro-phasor system

- Flexible Integrated synchro-Phasor System (FIPS)
  - Provides some functions of NASPInet
  - Two year development & deployment timeframe
  - ISO-NE & TOs will gain knowledge & experience
Initial Configuration

New England PMUs
Step 1
Step 2

TVA
SPDC

NYISO
PDC

PJM
PDC

ISO-NE
FIPS

T.O.

T.O.

New England PMUs
Step 3

New England PMUs
Integration with NASPInet

TVA
SPDC

NYISO
PDC

PJMPDC

T.O.
FIPS

ISO-NE
FIPS

T.O.
FIPS

New England PMUs
FIPS PDC Issues

• Data Storage in Databases
  – Data is fundamentally “2-D” : (time, channel) vs. (value)
  – Most existing databases don’t work well with this model
  – Simplifying assumption: ranges of consecutive data points
FIPS PDC Issues (continued)

• Dedicated Time-Series Storage
  – The data lends itself to a very simple data structure
    • Fixed length records in flat files
    • Use one flat file per channel (or split & index if file system limits arise)
    • Use binary search algorithm to find data
FIPS PDC Issues (continued)

• Data Interchange
  – Need to exchange channel IDs
  – Need a means to request streams or archived data from PMU
  – NASPIInet may address these issues
    • Can it be done before NASPIInet?
FIPS PDC Issues (continued)

• User Interface
  – Uses a “Model-View-Controller” framework
    • Provides a degree of extensibility
  – Add metadata to database: channel names, disturbance events, ...
    • Supports data export in many formats
FIPS PDC Issues (continued)

• “Quality of Service” can mean many things...
  – We really need 2 types of service
    • “Archival” - reliability
    • “Realtime” - timeliness
  – TCP vs. UDP vs. Custom “selective repeat” protocol
PDC Architecture for QoS

Inbound Data Streams → Protocol Conversion → Time Alignment → Protocol Conversion

QoS Parameter (max. lateness)

Realtime Data Stream
Some data is discarded. Data is delay-bounded.

Reordering Buffer

Archival Data Stream
All data is retained. Data may be untimely (but always properly timestamped!)

Database