NASPI North American SynchroPhasor Initiative

NASPInet Demo

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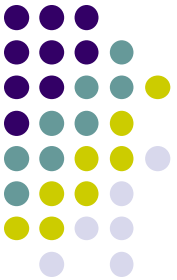
Co-Chair

Data & Networking Task Team



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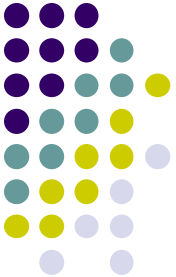
NASPInet Demo Participants



Agenda

- Demo goals
- Approach & Benefits
- Demo diagram
- Demo

Demo Goals

- Demonstrate interoperable IEC 61850 90-5 based phasor data exchange over a Wide Area Network (WAN).
- Demonstrate IP Multicast routing of phasor data across the WAN
- Demonstrate common API support for C37.118 & IEC 61850-90-5
- Demonstrate CIM-based PMU Registry data exchange using secure web services over a wide area.

Actual Geography Involved

Verizon provided the communications links between the sites.

Lenox & Charlotte PMUs signals sent to Knoxville.

Knoxville simulating corporate center and sending data to Fort Worth.

Local PMU at Fort Worth also integrated into demo.

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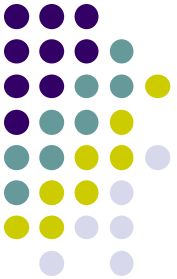
Approach - IEC 61850-90-5

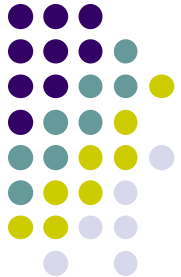
Demonstrate interoperable phasor data exchange over a WAN



- Integration of PMU data with protection and control systems
- Facilitate GOOSE packets over WAN
- Integration of PMUs into Substation engineering environments (PMU logical node)
- Enables Subscription to specific PMU data streams
- 90-5 standard version 2 stable

Benefits - IEC 61850-90-5

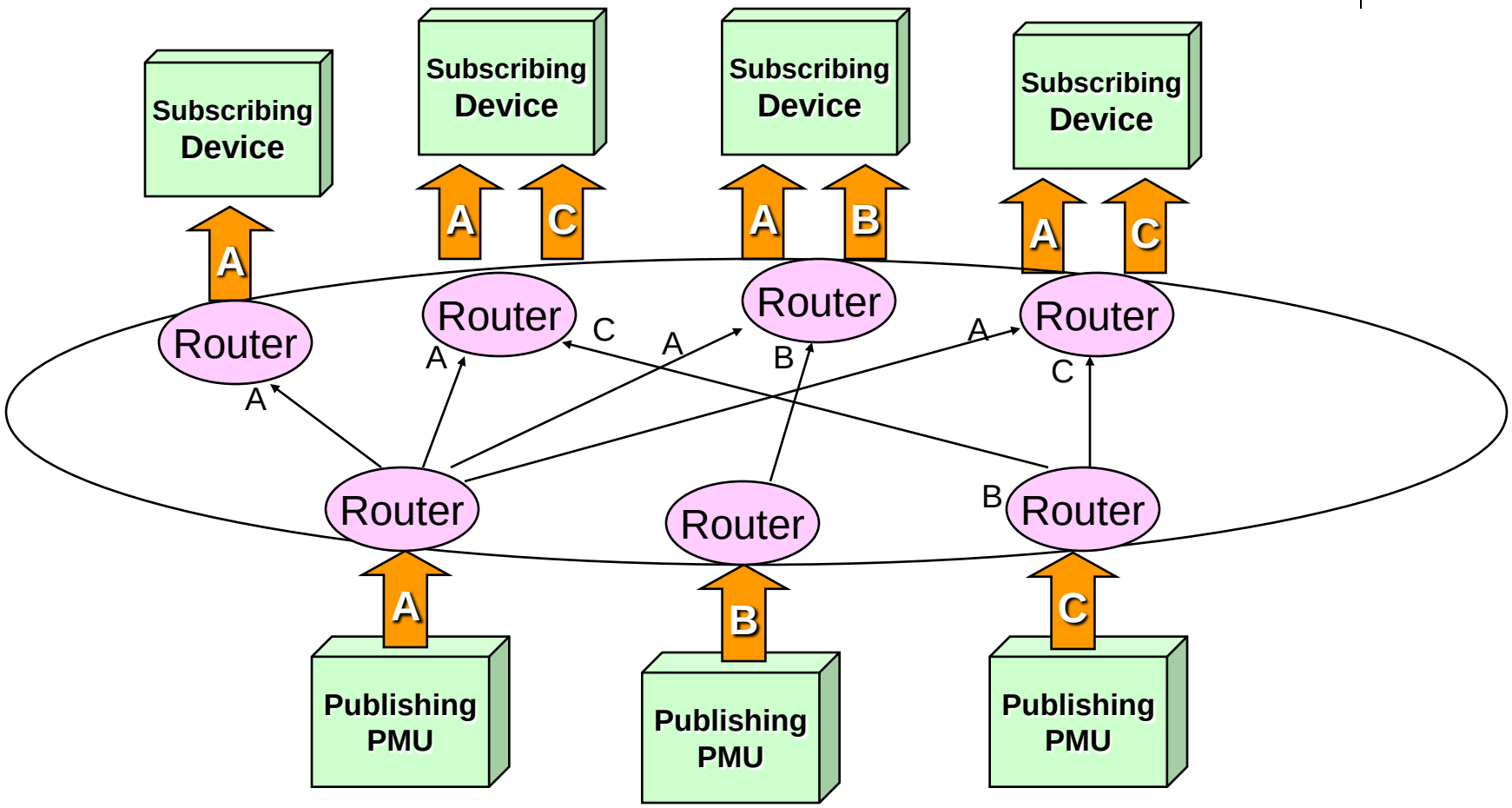
Demonstrate interoperable phasor data exchange over WAN



- Increase visibility and reliability of the Power System
- Enable wide area protection and control
- Simplifies substation design engineering
- Reduced telecommunication cost
- Supports secure protocol for Phasor data
  - 90-5 key exchange protocol under review in IEC

Network based Publish/Subscribe

No network flooding, simple configuration



A, B, and C are PMU streams

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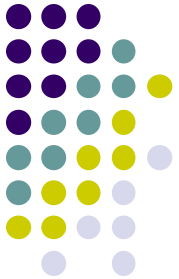
Approach - IP Multicast

Routing of phasor data across the Wide Area Network as opposed to Unicast

- Network based publish and subscribe paradigm for distributing PMU data
- Source subscription PMU Data via Multicast
- Network Centric approach for PMU data distribution
- Utilizes network protocols for data distribution
- One packet traverses the network (picture)

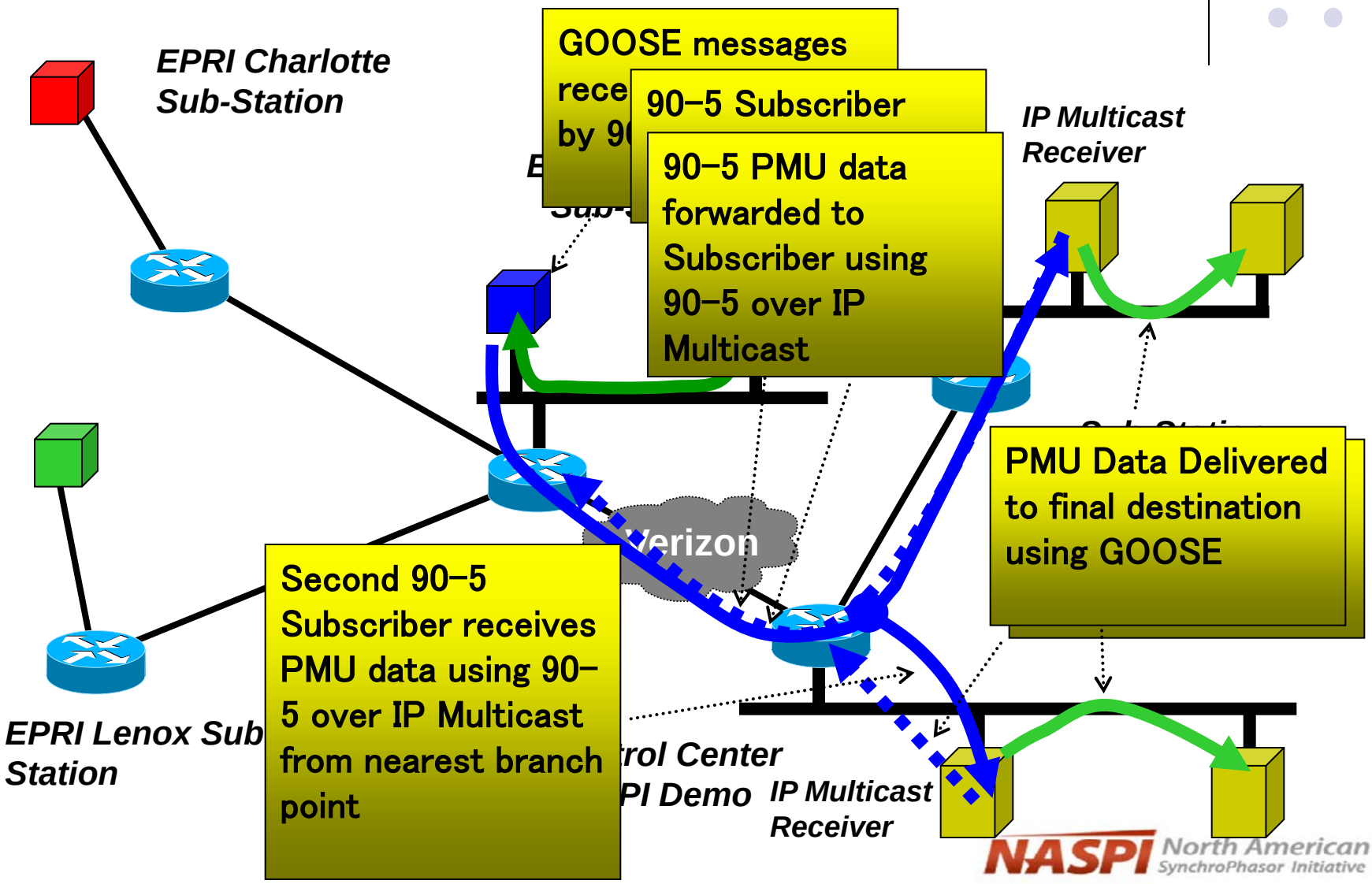
Benefits - IP Multicast

Demonstrate routing of Phasor data across the WAN

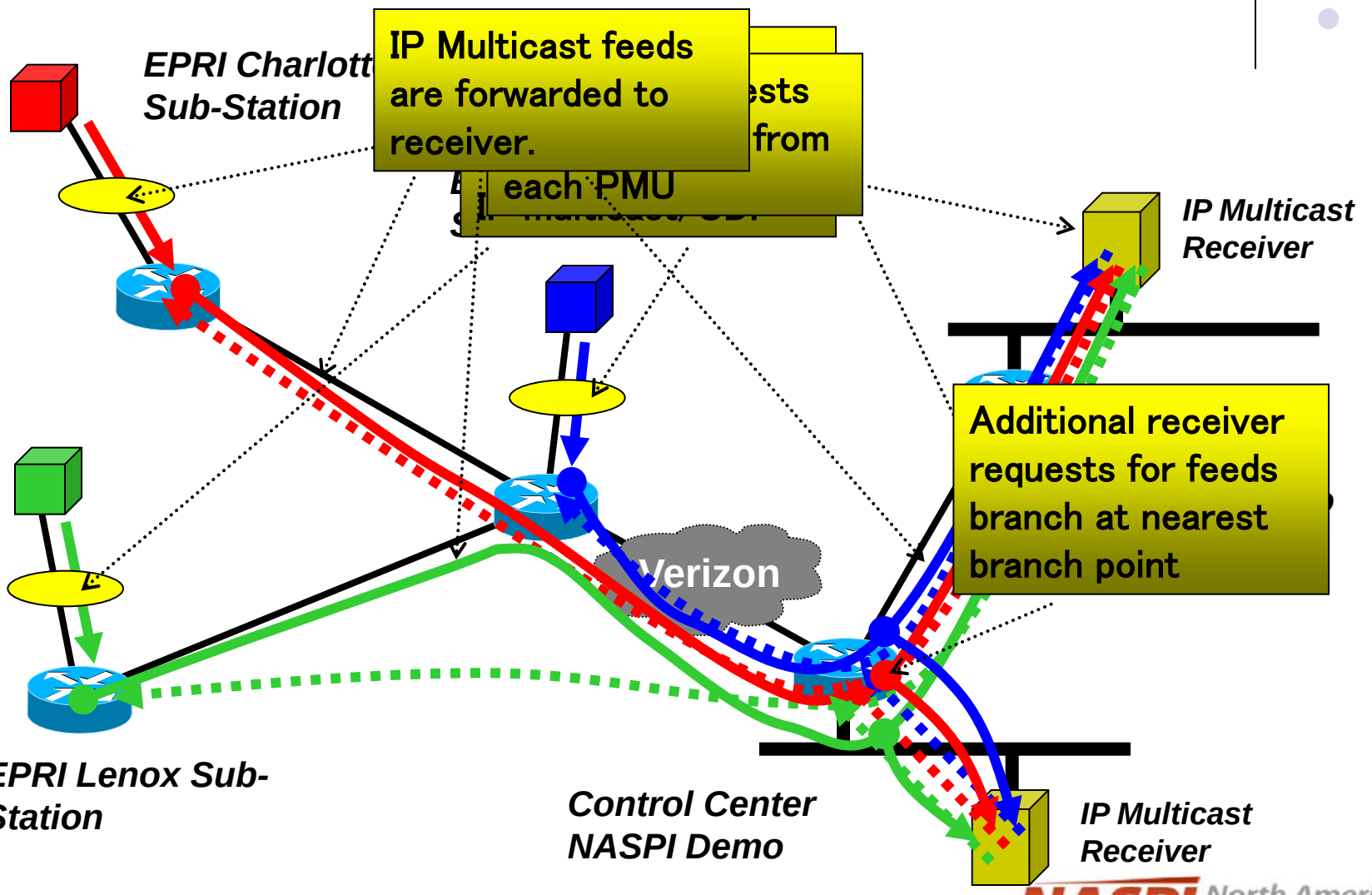


- Reduces PMU network complexity
- Can avoid PDC stacking – Enable low latency
- Reduce PMU processing – single source stream
- Unlimited number of receivers for one PMU source
- Reliable data receipt modes available
- Support C37.118 and 61850-90-5 traffic
- Extensive security measures available

PMU 61850-90-5 over WAN-based IP Multicast



PMU C37.118 over WAN-based IP Multicast



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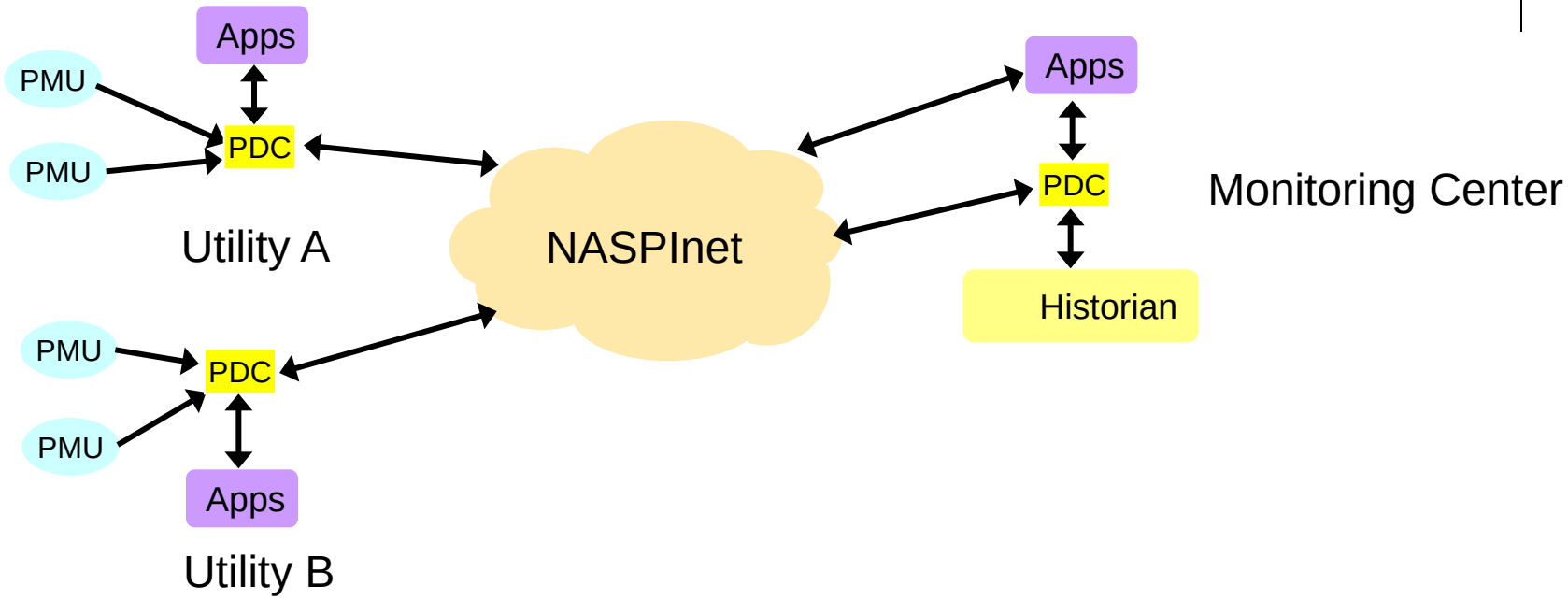
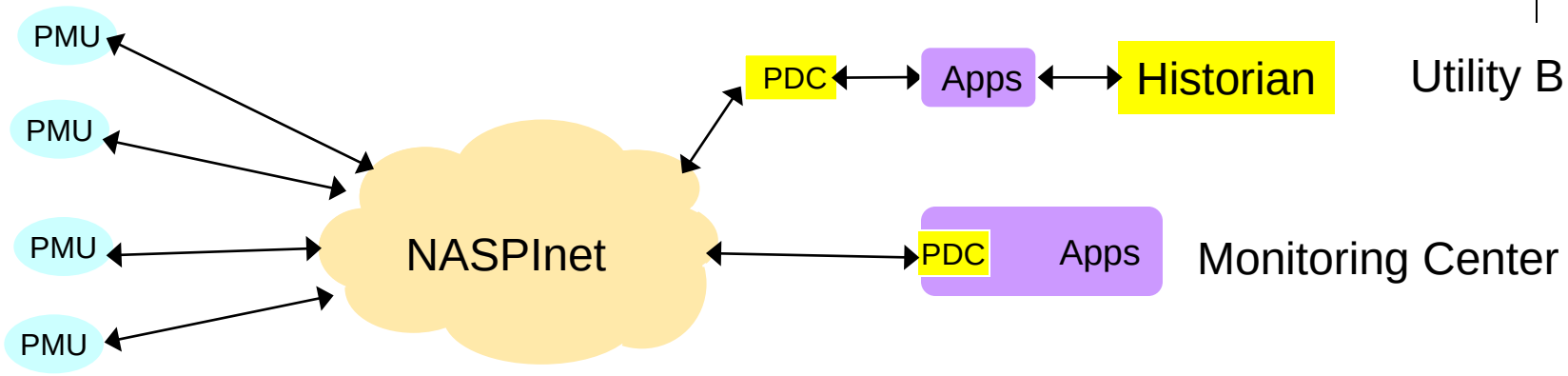
NASPInet with PDC Stacking



- Conventional architecture utilizes PDC stacking
- Some architectures may have 2 to 6 PDC's in series
- PDC stacking causes application latency and limits throughput

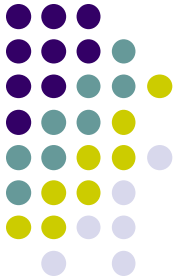
NASPInet w/o PDC Stacking



- Multicast can eliminate PDC Stacking
- PDC Function can be located close to application
- PDC functions can reside in:
  - dedicated Servers
  - Applications
  - Historians
  - Routers

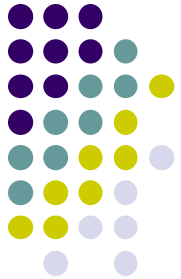
Approach - common API

Support for C37.118 & IEC 61850-90-5



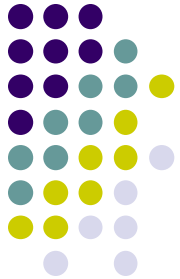
- Simplifies migration of legacy protocols & devices
- Enables integration of Phasor measurement data with CIM & PMU registry

Benefits - common API
Support for C37.118 & IEC 61850-90-5



- Reduced migration cost
- Simultaneous support of both protocols
- Eliminates forklift upgrade
- One environment for model driven application development

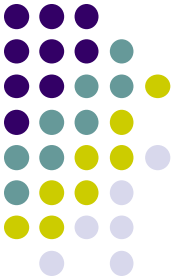
Approach - CIM-based PMU Registry
Data exchange using secure web services over a Wide Area Network



- CIM - Common Information Model
- Secure exchange of connected power system models with Phasor data
- Support available for historical data, alarms and events

Benefits - CIM-based PMU Registry

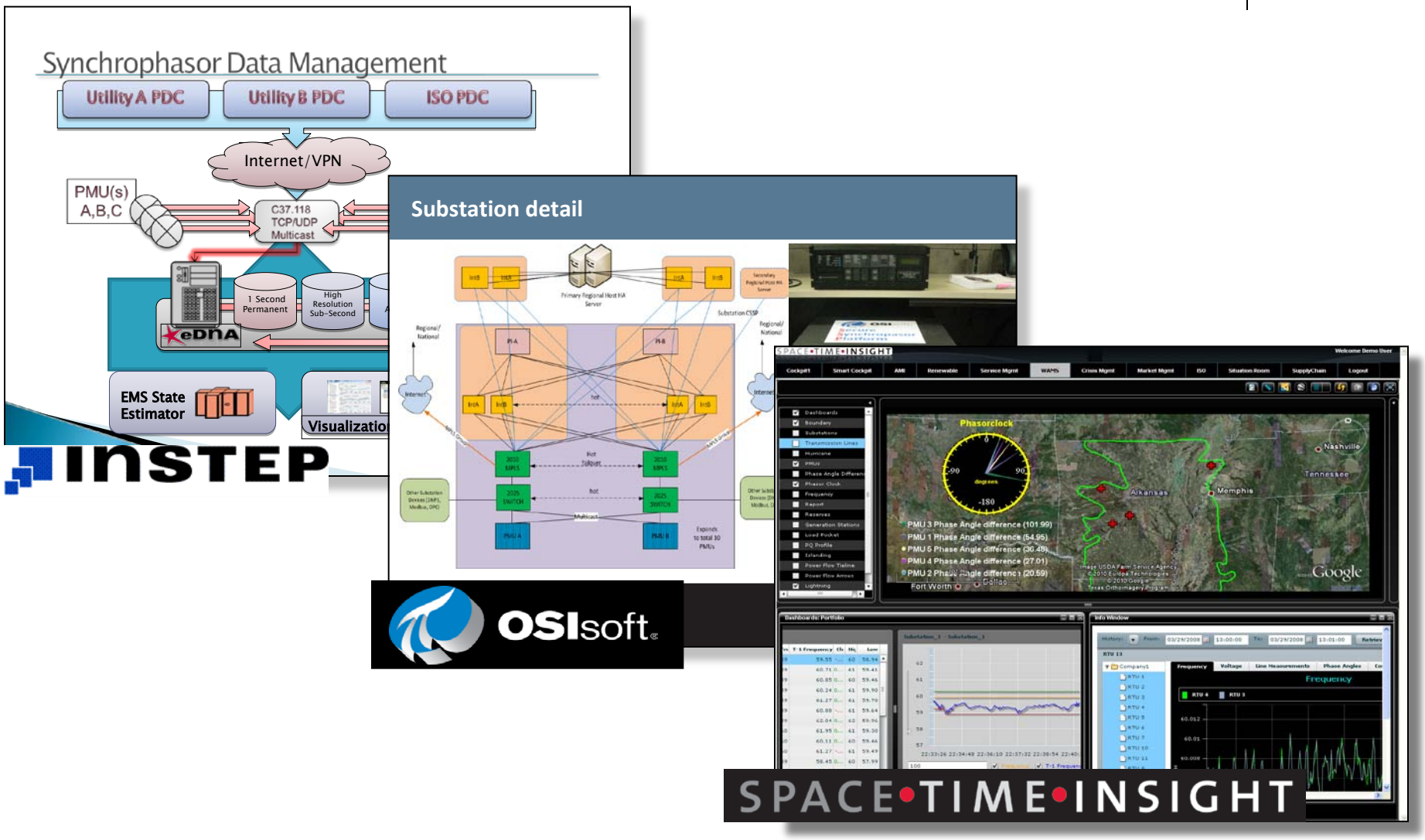
Data exchange using secure web services over a Wide Area



- Simplifies registration and subscription of outside Utilities data
- Enables secure power system model synchronization between utilities
- Enables coordinated alarm handling across a wide area
- Support for wide area system analysis for event response

Vendor Applications

Ready to go today!!!

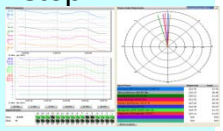


Demo Network

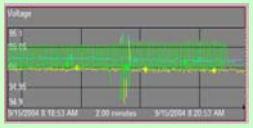
OSIsoft CSSP Rack

SISCO Netbook

Instep



PI



IEC 61850 L3-IP GOOSE Converter

SISCO/OSIsoft UAP with High Speed Phasor Analytics And Registry Consumer

GE UR+

C37.118 IP Multicast

GOOSE L3 Multicast

C37.118 IP Multicast

GOOSE IP Multicast

GOOSE L3 Multicast

OPC UA Web Services

GOOSE L3 Multicast

GOOSE L3 Multicast

Control Center LAN

IEC 61850 L3-IP GOOSE Converter

GOOSE IP Multicast

Substation WAN

These WAN routing functions actually supplied by a singe router

GOOSE L3 Multicast

C37.118 IP Multicast

GE N60

Cisco PMOD IP Multicaster

Substation LAN

C37.118 IP Multicast

GOOSE IP Multicast

GOOSE L3 Multicast

OPC UA Web Services

GOOSE L3 Multicast

GOOSE L3 Multicast

Instep

IEC 61850 L3-IP GOOSE Converter

SISCO/OSIsoft UAP Phasor Gateway with CIM Based Registry

GE N60

Voltage and currents

C37.118.1 Unicast from SEL 487s

SISCO Laptop

Simulated C37.118

Voltage and currents

EPRI Knoxville and Lenox Labs

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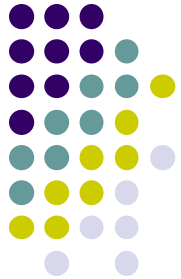
Demo includes

- Interoperable IEC 61850 90-5 based phasor data exchange over a wide area.
- IP Multicast routing of phasor data across the WAN
- Common API support for C37.118 & IEC 61850-90-5
- CIM-based PMU Registry data exchange using secure web services over a wide area.

NASPI Demo Table Layout



OSIsoft

CISCO

GE Digital Energy

Table 1		Table 2		Table 3		Table 4	Table 5

SPACE•TIME•INSIGHT

SISCO

INSTEP

INSTEP

verizon

EPRI ELECTRIC POWER RESEARCH INSTITUTE

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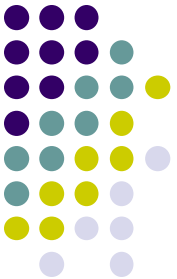
Demo Time



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