The Standards Based Integration Company

Systems Integration Specialists Company, Inc.

NASPInet and migration towards the use of IEC standards

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Introduction

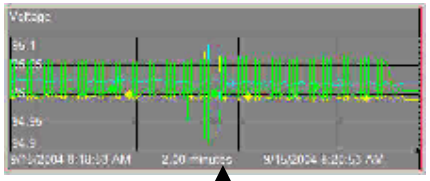
- The IEC TC 57 is producing standards that will be useful for the construction of NASPInet
  - WG 10: IEC 61850
  - WG 13: Common Information Model and related standards
- WECC and NYISO (among others) have to deliver a demonstration NASPInet in a little over two years.
- What is the process for migration to NASPInet in the future?
  - What do the harmonization the C37.118 / 61850 and the IEC Common Information Model standards do for synchrophasors and NASPInet

Develop strategy for NASPInet implementation

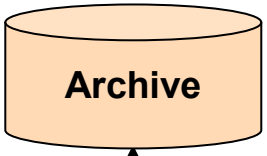
- If you had to build a working NASPInet by 2012, what is available off the shelf now that can be used?
- What do we need to do now to minimize migration efforts to include the IEC standards later?
- Plan for incorporation of C37.118/61850 harmonization and the CIM standards by 1st quarter 2014

Current Reference Architecture

Real-time

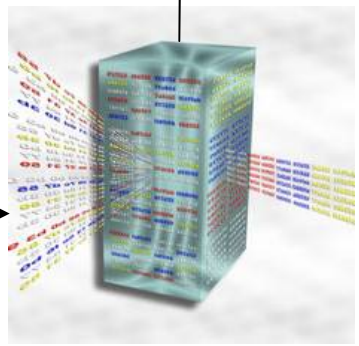


Analysis

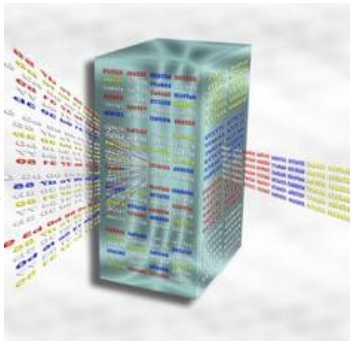


Some implementations act as C37.118 consumers without any intervening API

One Size Fits All: Data exchanged using C37.118



PDC



PDC (different location)

PMU(s)

Issues with C37.118 in a Substation

- Not readily integrated with substation automation and protection
  - Single purpose data semantics and wire protocol. Existing substation automation protection equipment cannot receive C37.118.
  - Only specifies the use of TCP or UDP.
    - Can't control QoS. Consequently, phasor data transmitted using C37.118 cannot be used for reliable system protection.
  - Only supports data streaming and not report by exception
    - This means that protection related data can be delayed by up to the C37.118 transmission period (at least 16 ms typically)

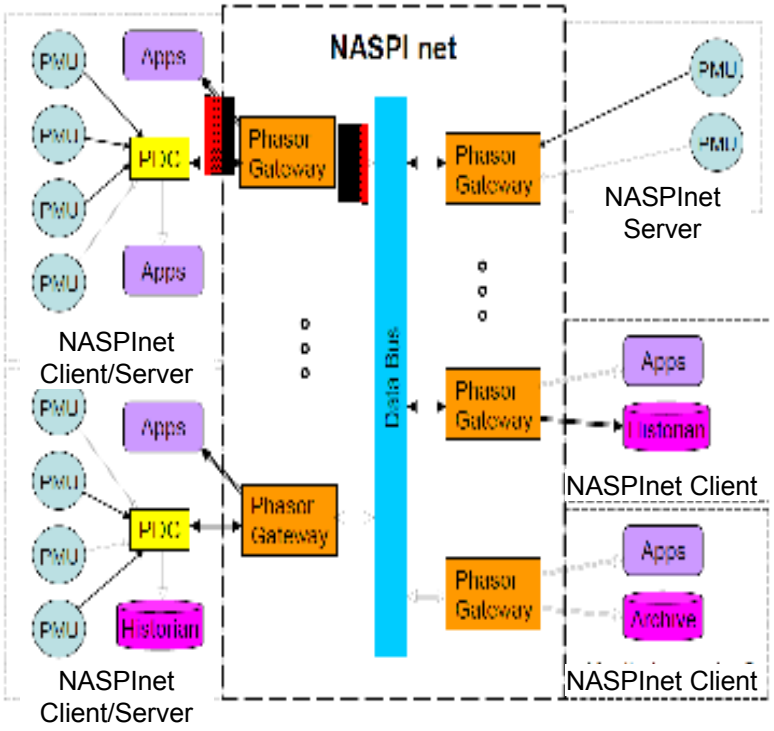
Issues with C37.118

- No standard way to describe a PMU in IEC 61850 Substation Configuration Language (SCL). Consequently no way to configure a system off line in a substation engineering tool.
- Miscellaneous protocol issues
  - There are numerous error handling issues that need to be resolved. Consequently, C37.118 cannot be described as a highly reliable protocol.
  - Quality and Timestamp loose meaning when C37.118 streams are aggregated and then split up
- No means of reliable delivery
- Security – C37.118 does not have security built in
  - Fine grained RBAC required down to the individual measurement
- Filtering – one cannot receive only selected items of interest using C37.118
  - Topic based subscriptions are needed
  - Should be able to filter on where in the network the PMU data is from

Issues with Current Reference Architecture

- Types of data –NASPInet will eventually need to support exchange of other data including but limited to:
  - Historical phasor data
  - COMTRADE files
  - Alarm/events data
  - Network model configuration data
- No context to data – Phasor data without the context of network/device data has limited value
  - NASPInet should be integrated using a common device/network models such as IEC 61850 and/or IEC 61970 Common Information Model (CIM)

Proposed TC 57 Based Approach



- Use IEC 61850 to carry phasor data over a wide area using a multicast profile that supports QoS. Event driven exchange also supported.
- Use proposed model driven IEC 61970 OPC UA Web Services to expose phasor data within CIM Views and for NASPInet system configuration and monitoring

Benefits Of Using IEC 61850 for PMU data

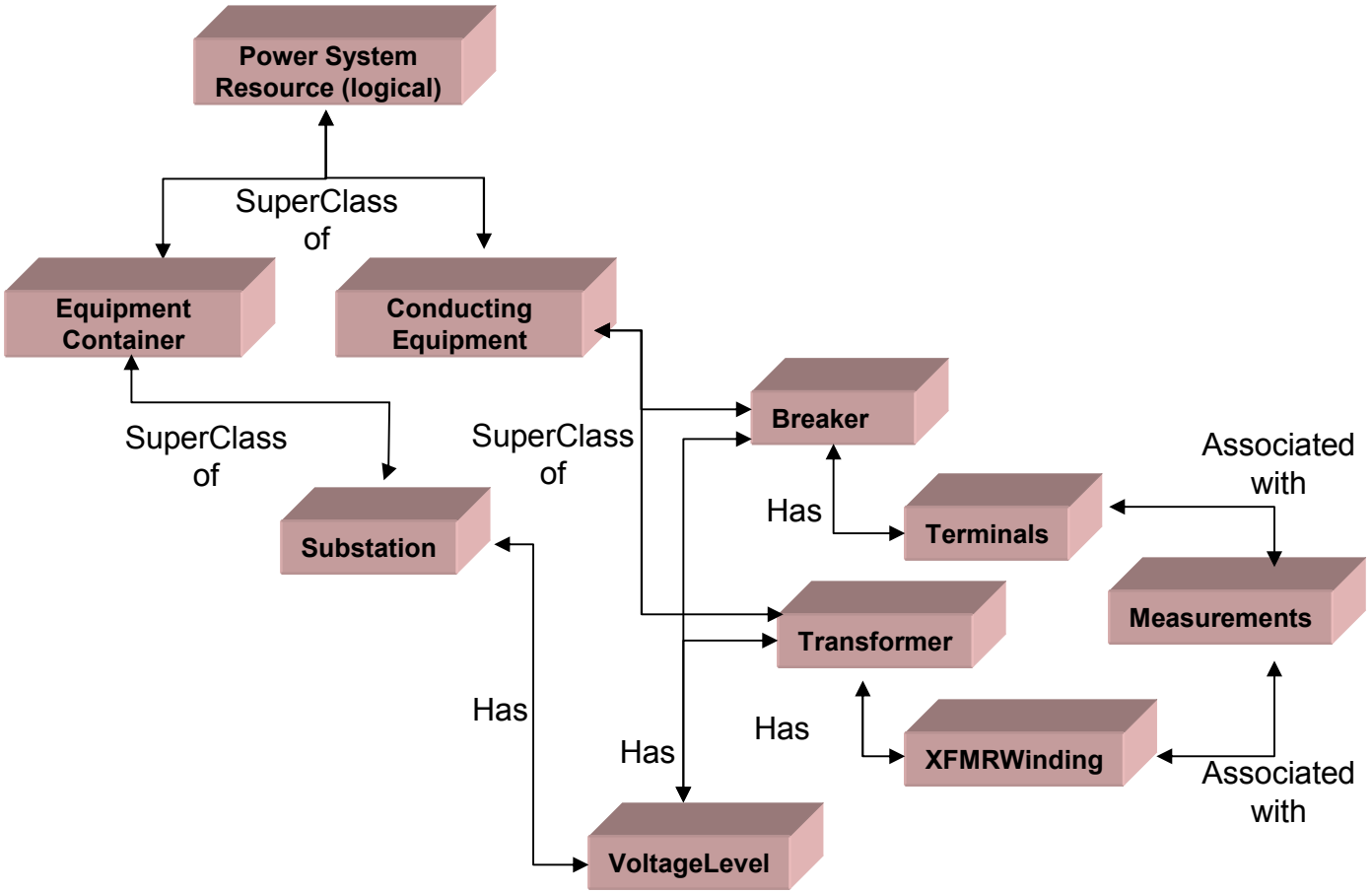
- More easily integrated with other substation and SCADA equipment
  - Common names and protocol
  - Common configuration files (Substation Configuration Language XML)
- Built in security.
- Enables standard mechanisms for handling reliable transfer and QoS
- Standardized names for device data based on device functional modeling
- Can use Event Driven Architecture if desired.
- IOP demos and testing

Using IEC 61970 To Exchange Non Phasor Data

IEC 61970 consists of:

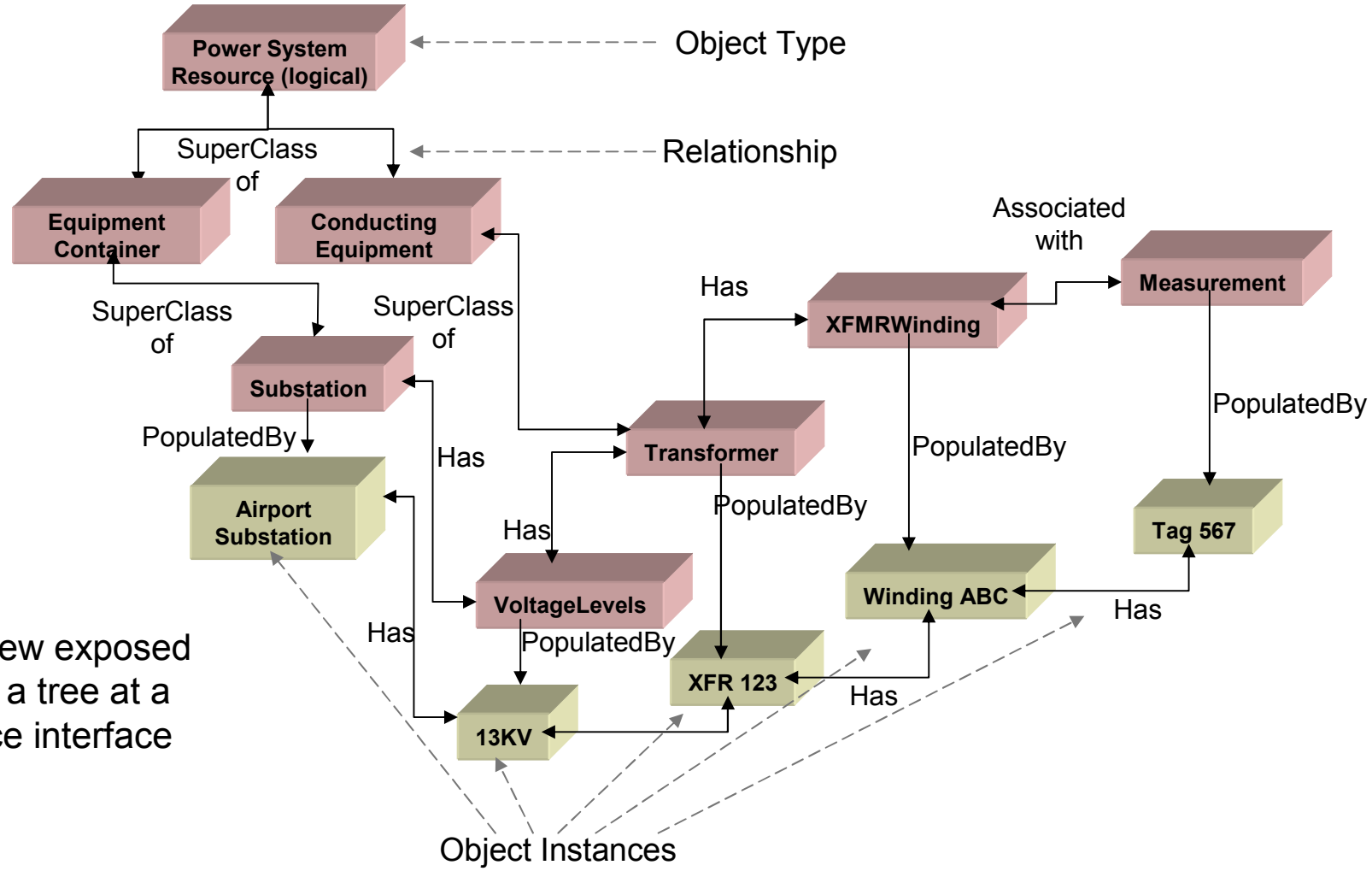
- Common Information Model (CIM): A standard way to model power system networks.
  - Use of the CIM allows utilities to share how PMUs connect to the power system
  - CIM model exchange has been IOP tested 12 times. Vendors included GE, Siemens, ABB, Areva, SISCO, and others
- A set of services for exchanging CIM
  - Use of the proposed IEC 61970 OPC UA Web Services provides a common mechanism for sharing CIM data
  - These services are not recommended for exchange of current PMU data
  - The IEC 61970 services are generic and can be used to exchange registry, **historical phasor data**, alarms, and hierarchical views of a power system model. Can be also used to exchange NASPInet configuration and network monitoring data

What is the IEC 61970 Part 3 CIM?



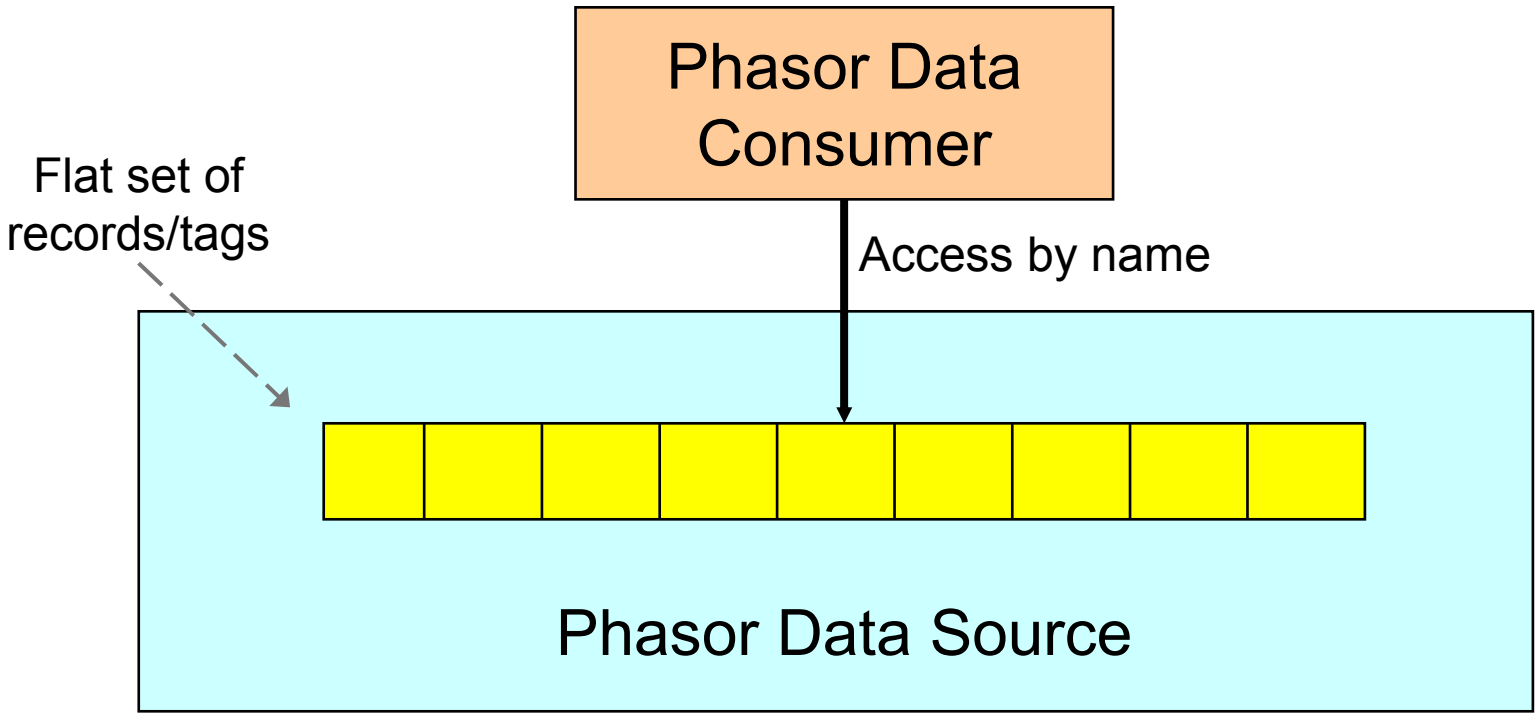
The IEC 61970 CIM describes power systems and can provide context for PMU Data

CIM Views



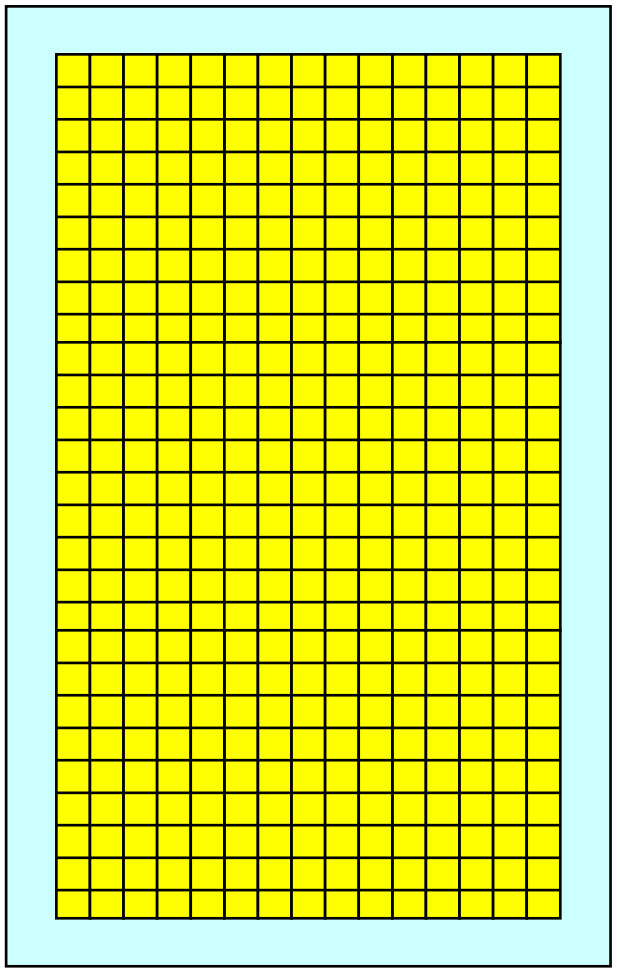
CIM View exposed using a tree at a service interface

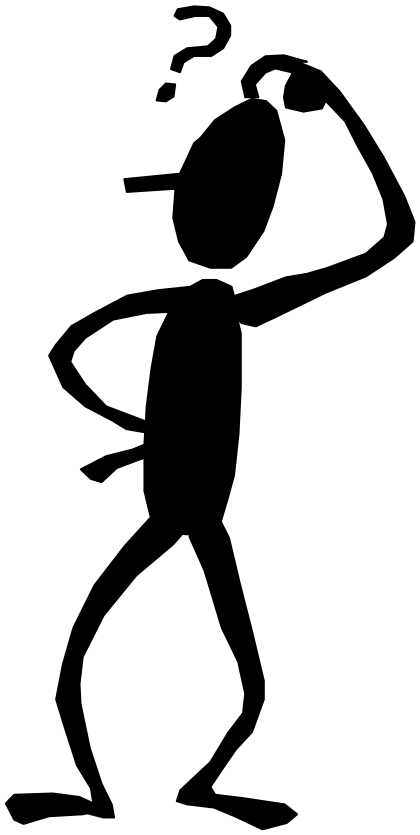
C37.118 Flat View of Phasor Data



A typical web service interface also only exposes the names but does not show how data is related to a power system

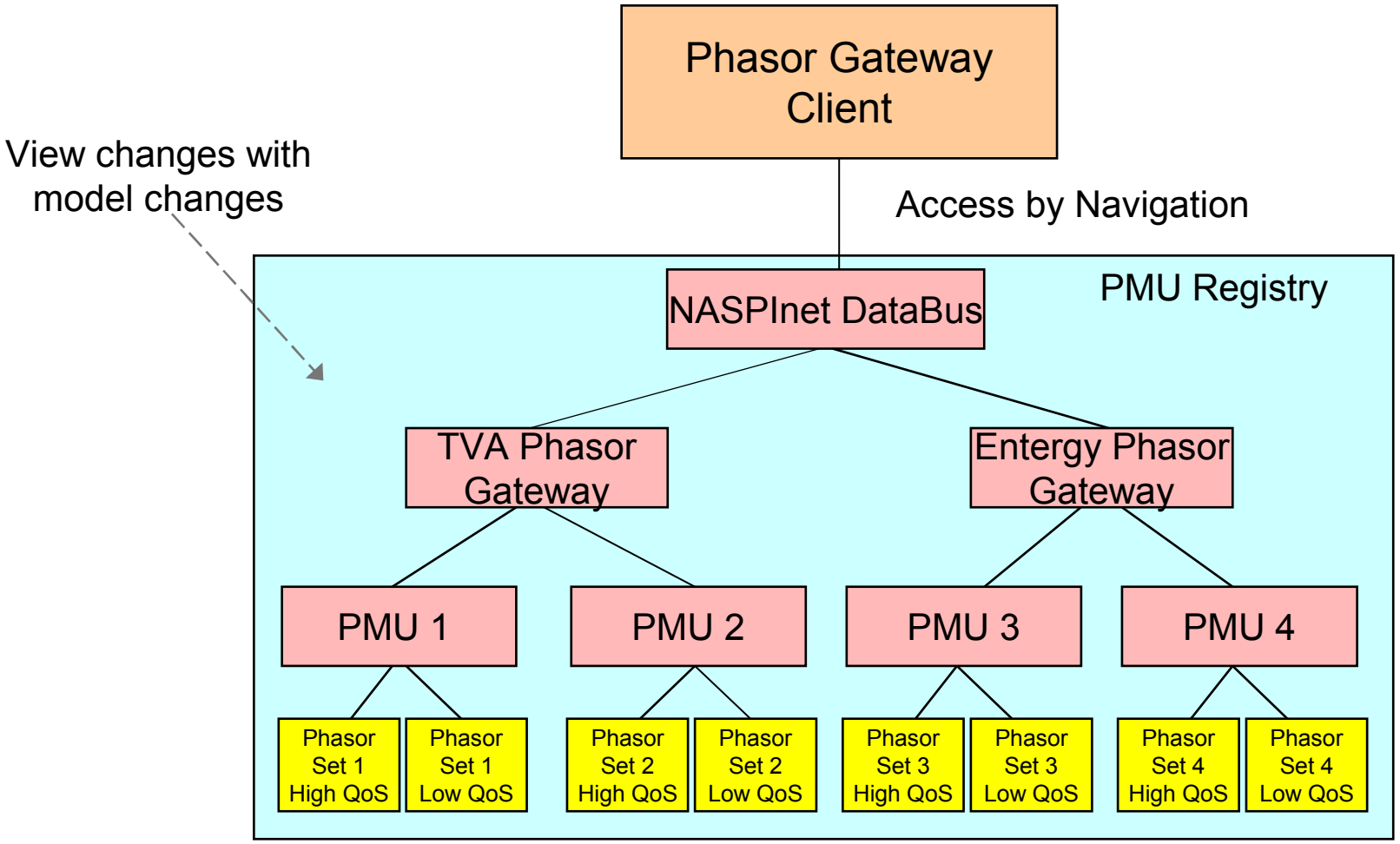
Accessing by Name





I need the voltage phasor for the Reynard substation 500kV bus

PUM Data Within The Context Of A CIM View

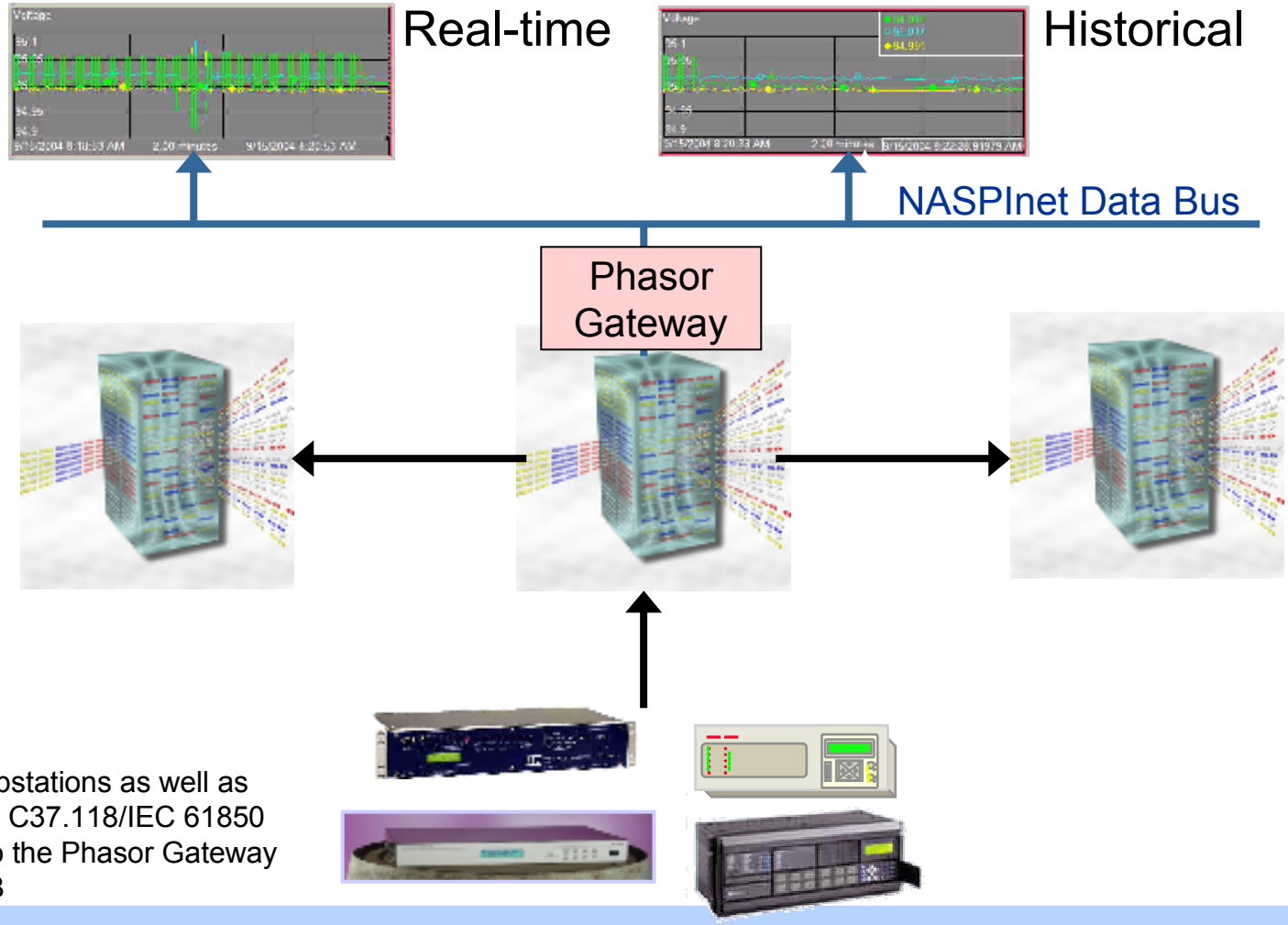


Benefits of Model Driven Access of PMU and Data Bus Configuration Data

- CIM Views give context to **instance** data improving understanding and productivity.
- The information contained in a CIM View enables automated **discovery** of available information e.g. automation of setup and maintenance tasks
- CIM Views used as:
  - Topic Tree for alarms and events
  - Phasor data integrated with PMU Registry/Data Bus configuration data

IEC TC 57 Based Architecture

- Use IEC 61850 multicast current phasor data
- Use IEC 61970 OPC UA for non phasor data such as registry data, historical phasor data, alarms, and network model data as well as for NASPInet Data Bus Configuration.
- Use OPC API to abstract data suppliers and applications from the particulars of the NASPInet database protocols and services (except into archive)



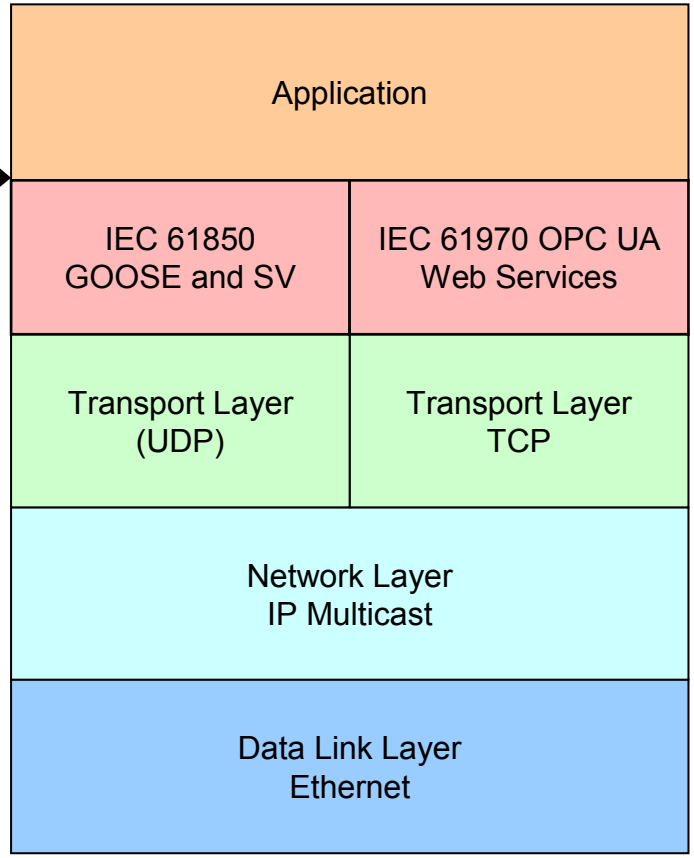
For traffic inside and between substations as well as substations to control centers, use C37.118/IEC 61850 between PMUs, PDCs as well as to the Phasor Gateway for Class A - B

IEC TC 57 Based NASPInet Stack

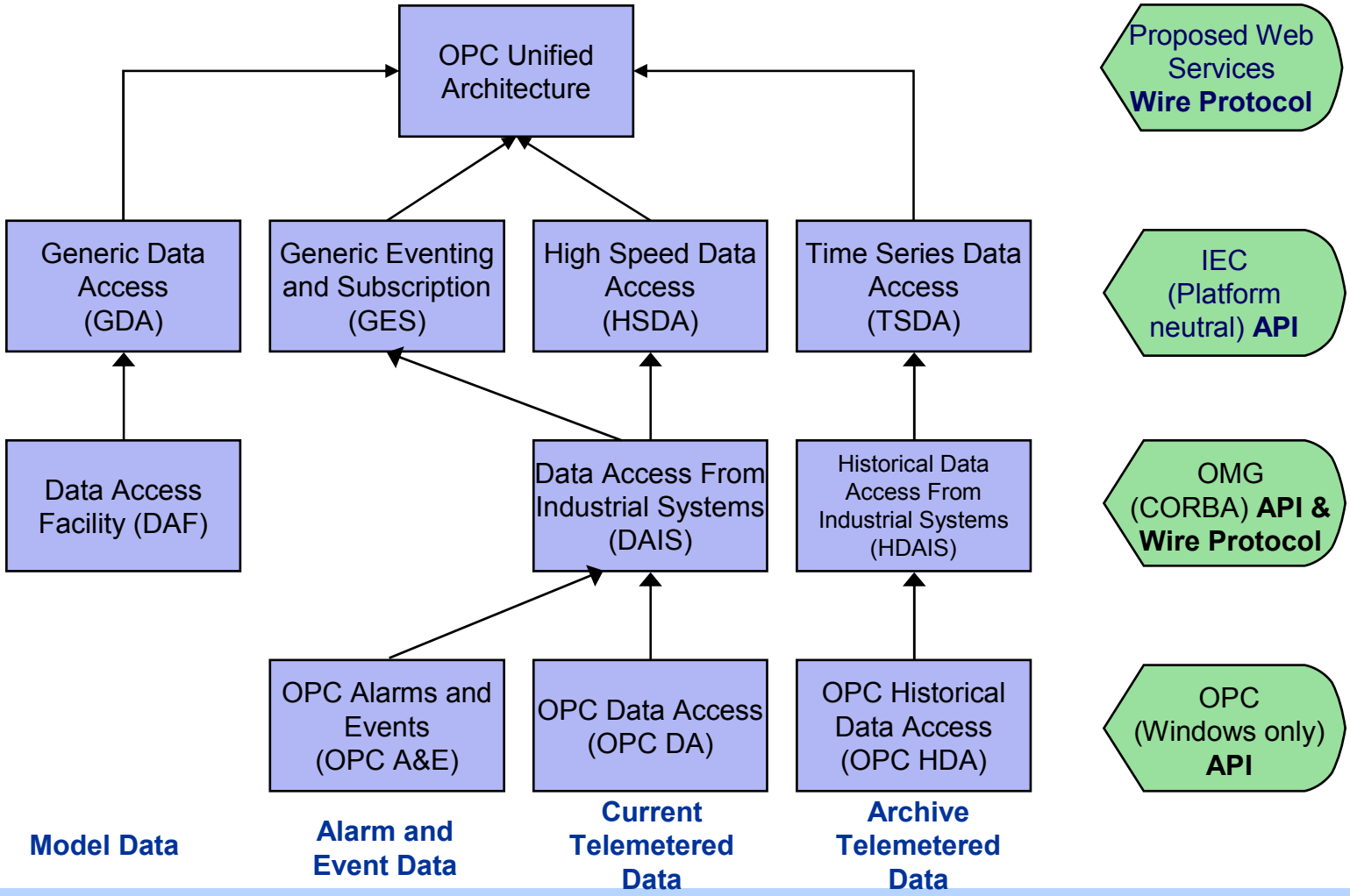
Application Programming Interface

IEC 61970 API (OPC) can support setting QoS parameters

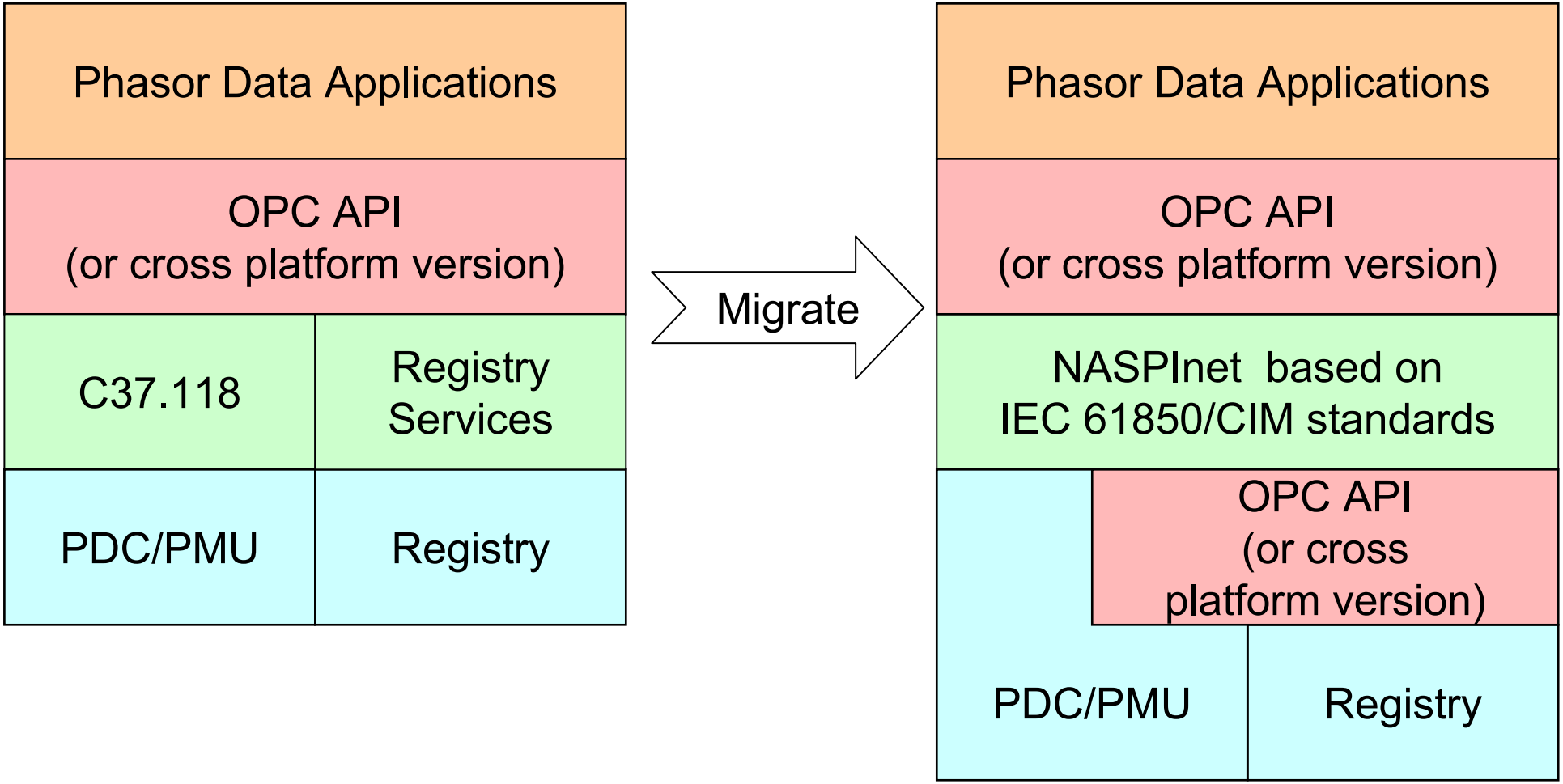
Archive may implement C37.118/IEC 61850 interface natively



IEC 61970 Service Names And Lineage



Using An API to Enable Migration

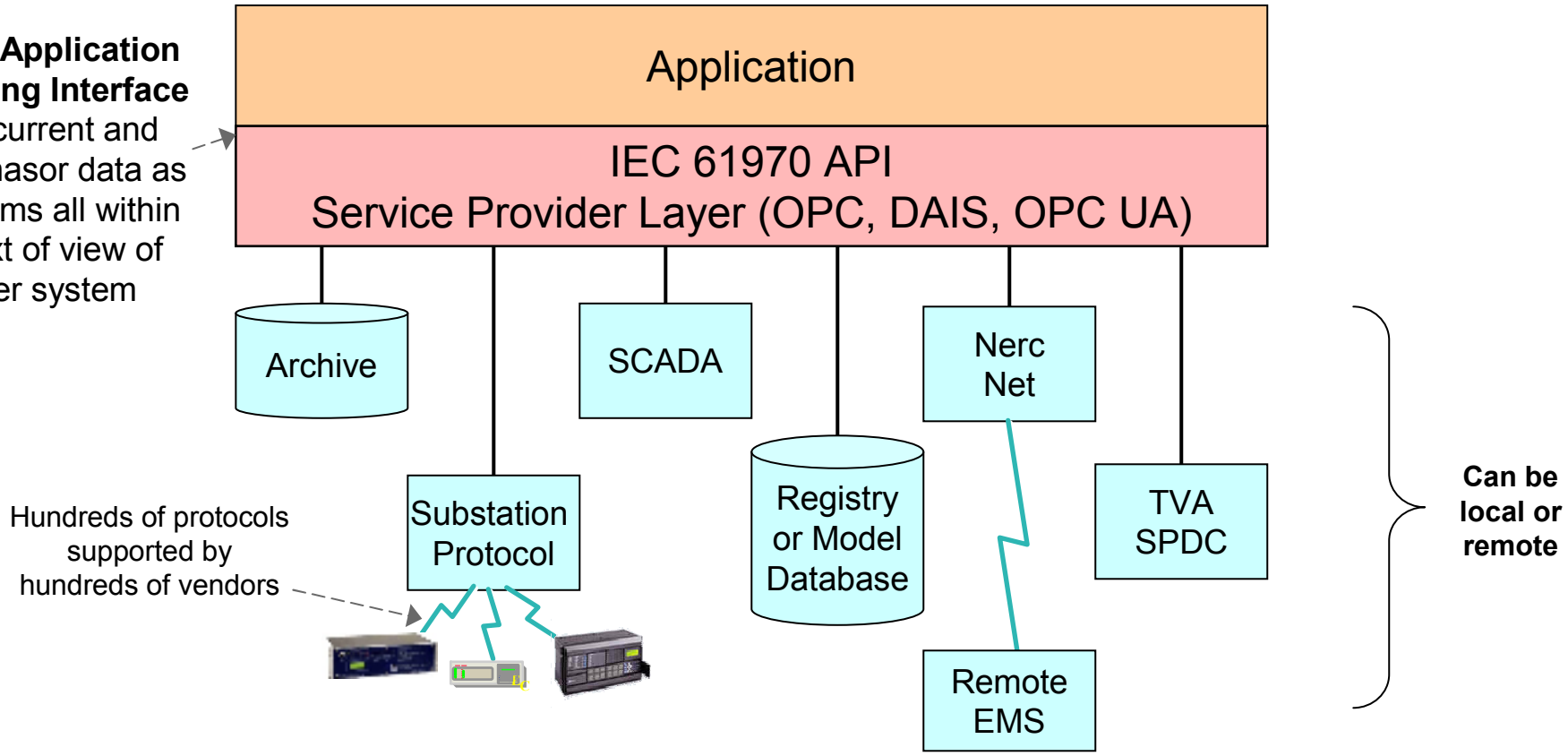


IEC 61970 API

- Implemented in many products (1,000s) by many companies (100s)
- Widely implemented in substation products
- Deployment neutral – same API used for local and remote communication
- Can be used to set up pub/sub of PMU data even though IEC 61850 and C37.118 can be used as the wire protocols for PMU data

Off the Shelf API Reuse

IEC 61970 **Application Programming Interface** supports current and historical phasor data as well as alarms all within the context of view of the power system



Approach

- SISCO believes that in the longer term, NASPInet must be fully integrated with EMS and Substation Automation
- For this to happen, reuse of standards such as IEC 61970 Common Information Model and IEC 61850 is critical
- Don’t hard code C37.118 or the existing Registry Services into phasor data applications
- Use OPC API as a way to enable migration to IEC 61850 protocol and CIM based registries.

Thank You!

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