

GPA User's Forum 2011 – Atlanta, Georgia

Time-series Framework Tutorial

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The Multiple Open Source Projects

- **The TVA Code Library**
 - <http://tvacodelibrary.codeplex.com/>
- **The Time-series Framework**
 - <http://timeseriesframework.codeplex.com/>
- **The Open Source Phasor Data Concentrator (openPDC)**
 - <http://openpdc.codeplex.com/>
- **The PMU Connection Tester**
 - <http://pmuconnectiontester.codeplex.com/>
- **The Open Source Phasor Gateway (openPG)**
 - <http://openpg.codeplex.com/>

Benefits of CodePlex Hosting

- **Team Foundation Server project source control**
 - This directly integrates with Visual Studio
- **Project contributor forks or patches**
 - This allows contributors to suggest formal code updates
- **Project release downloads**
 - This allows us to control major releases and track downloads
- **Discussion forums & mailing lists**
 - This allows users to help users and request community help
- **Wiki and documentation pages**
 - This allows up-to-date online documentation
- **Bug and feature request tracker**
 - This allows users to post issues for resolution

Accessing Online Documentation

- All online documentation is continually updated by both GPA and contributors.
- Typically you need only go the project's CodePlex site in question and click the "Documentation" tab to get started with system documentation.
- Here is the [openPDC Documentation Link](#) - on this page you can navigate to:
 - Getting Started
 - Frequently Asked Questions
 - Major Component Overviews
 - How-to Guides, etc.
- Also included are links to compiled formal library documentation.

Setting up and using the openPDC

- Go to web site: <http://www.openpdc.com/>
- Click on “Downloads” tab
- Select desired release build
- Click on the “Recommended Download” link
- Save zip file onto your computer (Desktop is handy)
- Unzip the entire contents into their own folder
- Run “Setup.exe” in the root folder
- Select 32-bit or 64-bit installation
- If you have no database installed locally, you can use “SQLite” or “Access”. Note that Access only works for a 32-bit install.

Contextual Help System

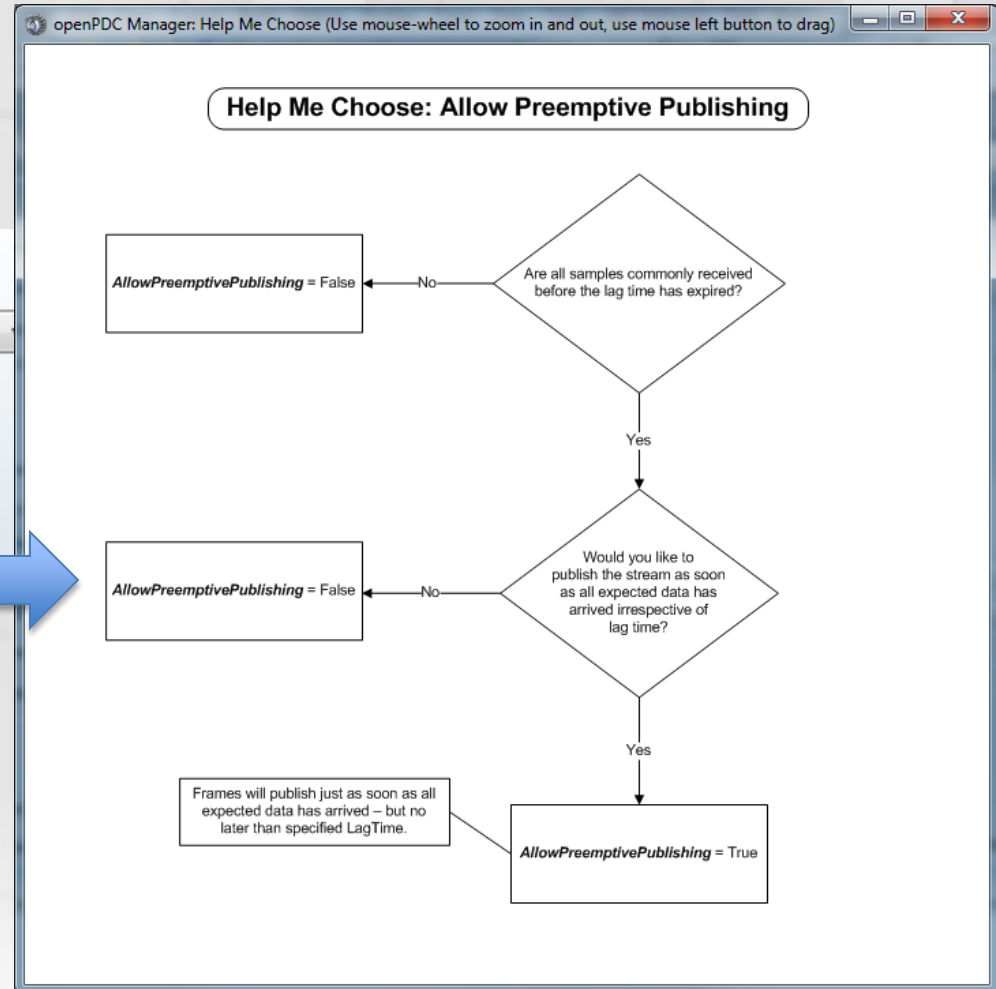
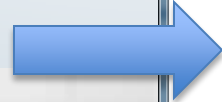
Time Resolution ? * 10000

Data Format * FloatingPoint

Current Scaling Value * 2423

Analog Scaling Value * 1373291

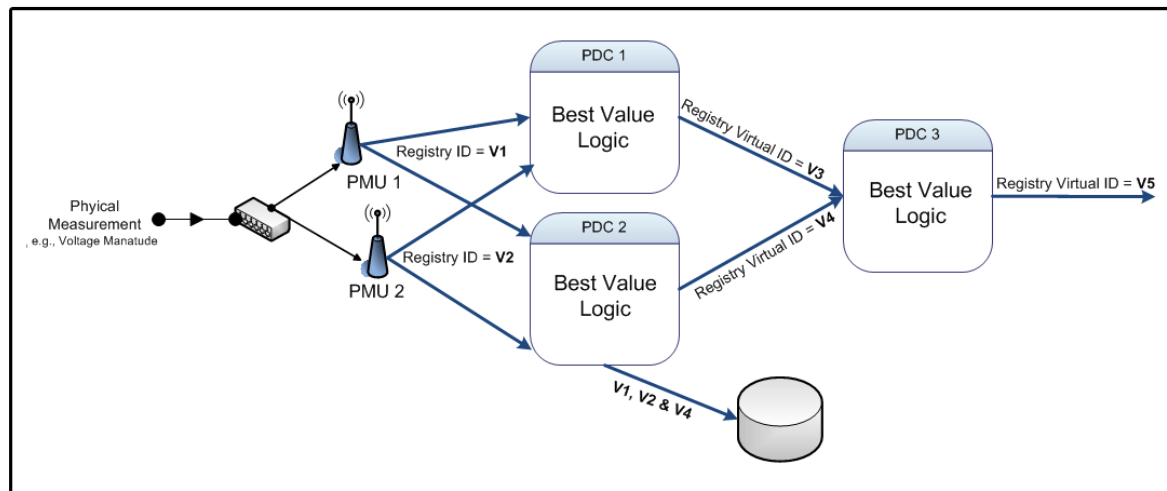
- Auto Start Data Channel ?
- Allow Sorts By Arrival ?
- Allow Preemptive Publishing ?



Flow chart styled help dialogs guide users through selection of more advanced options...

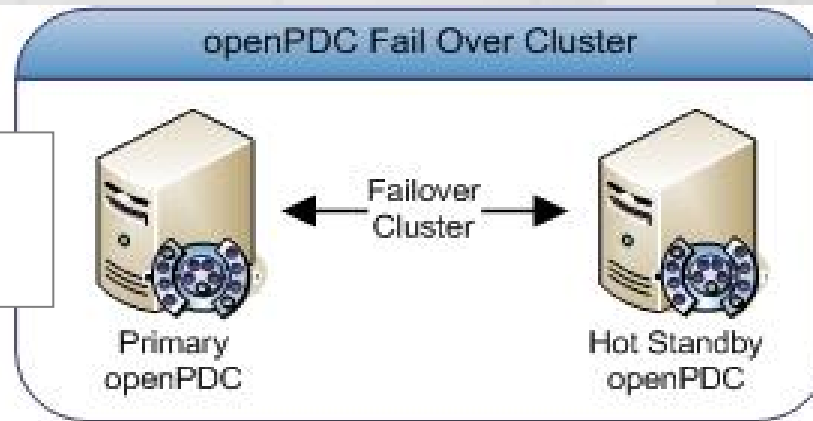
Multi-source Single-destination Configurations

- The “magic A/B” switch has recently been added to the openPDC to select the “best value” in phasor data systems that incorporate source device redundancy

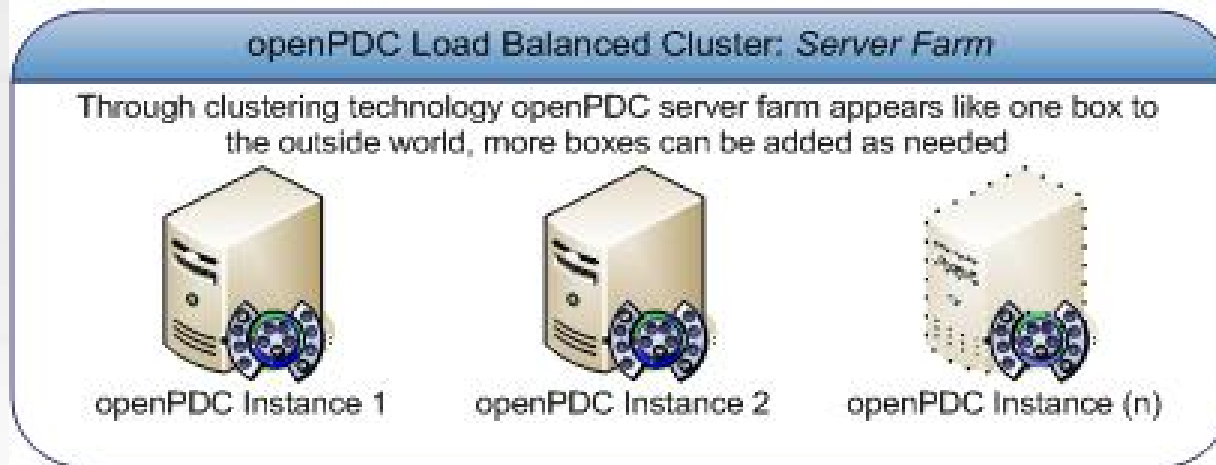


Clustered Deployments

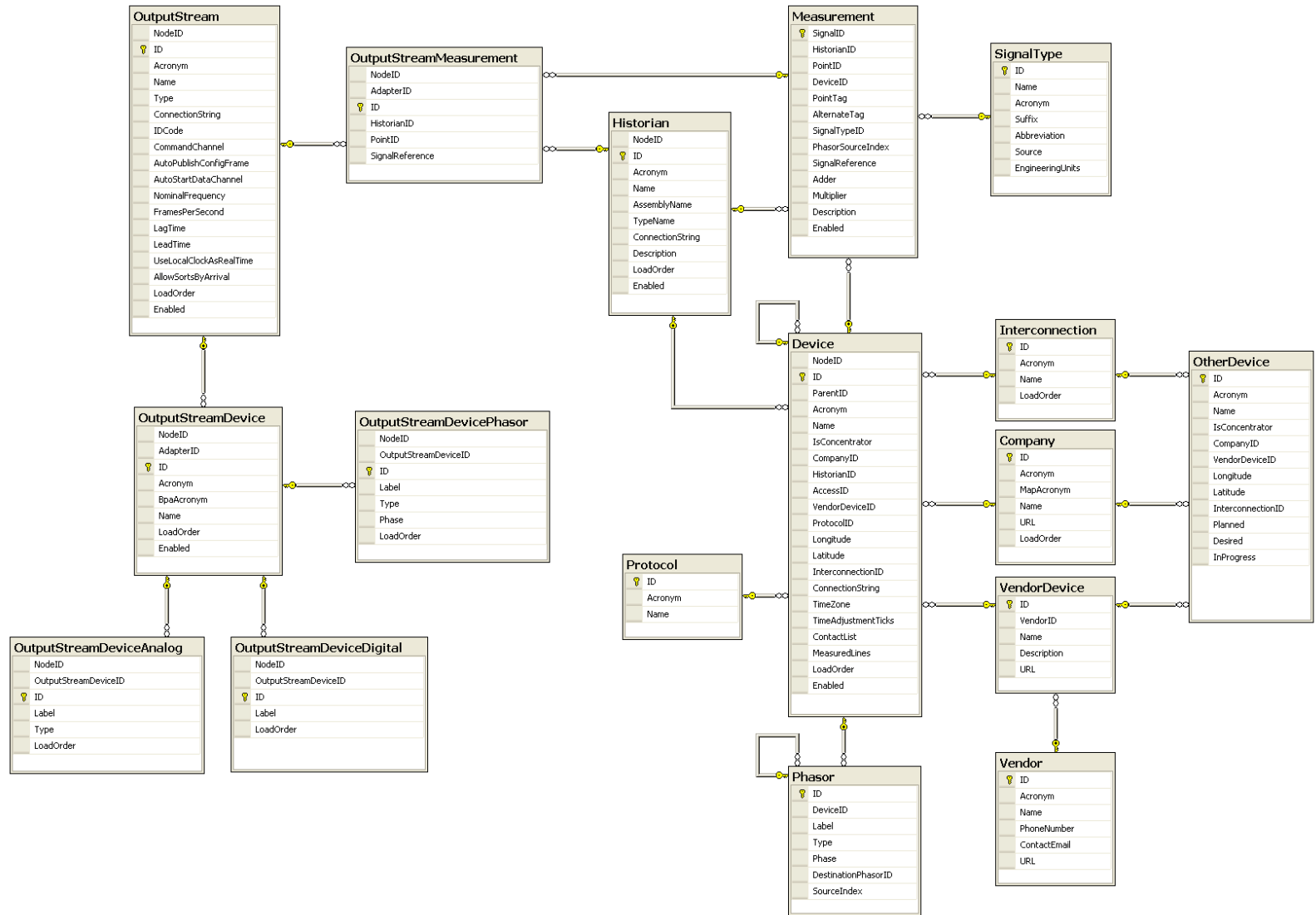
Fail Over Cluster



Load Balanced Cluster



The Configuration Data Structure



Understanding “Nodes”

- In its most simple form a “Node” is an instance of an openPDC (or other Time-series Framework app)
- A Node is identified by a uniquely generated Guid (a 128-bit randomly generated integer that is statistically going to be unique in the world)
- One configuration database is designed to hold any number of Nodes.
- The magic of “Nodes” allows a single openPDC Manager to manage any number of openPDC and TSF application instances.

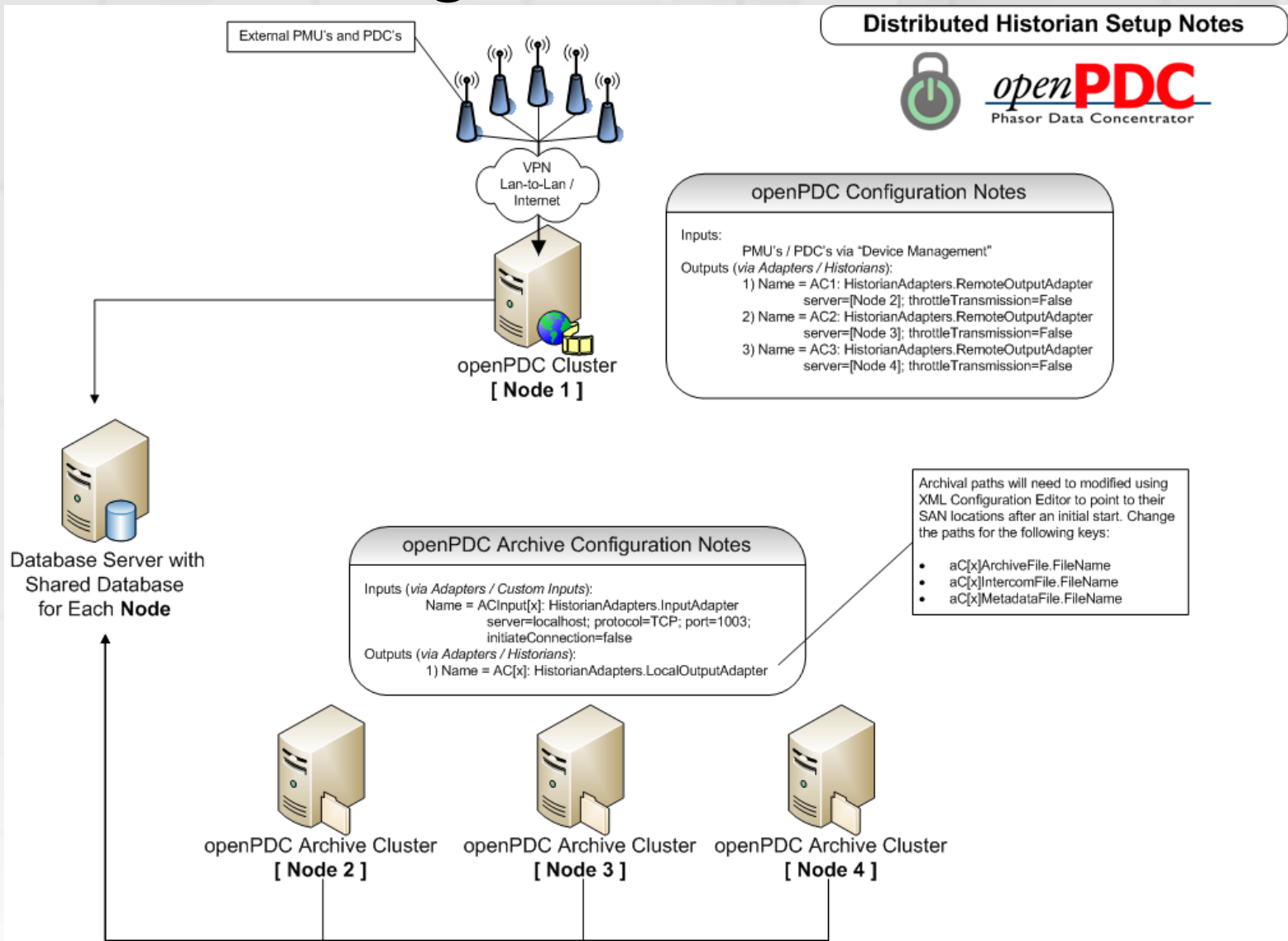
Understanding “Measurements”

- **A “measurement” as it is understood in the Time-series Framework has many aliases:**
 - Signal
 - Point
 - Tag
 - Time-series Value
- **The primary components of the measurement are:**
 - Timestamp
 - Value
 - Identification

Measurement Identification

- **Guid:**
 - 128-bit randomly generated integer that is statistically going to be unique in the world, examples:
 - 7ACDEE91-661B-42A0-82C1-081090D0CA38
 - 532863E4-8C3A-4F84-8366-0C8A4711EA6F
 - 4E3548FD-470E-45DF-8C44-138936805BB6
- **Measurement “Key”:**
 - Two part identifier represented by a “Source” string and a numeric “ID”, examples:
 - PPA:2
 - STAT:42
 - SHELBY:39
- **The best flattened representation of all measurements defined in the system can be found in the “ActiveMeasurements” view.**

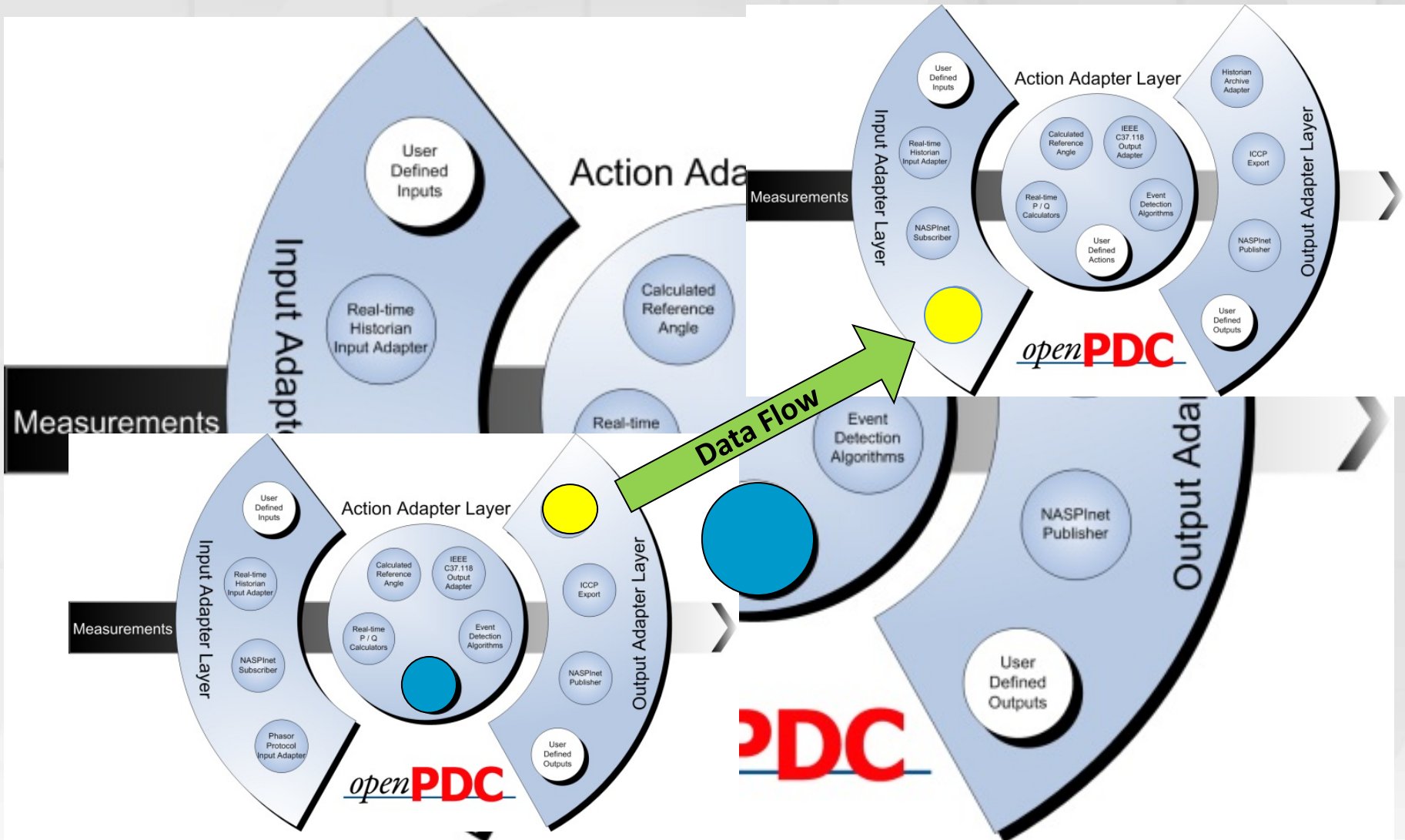
Establishing a Distributed Archive



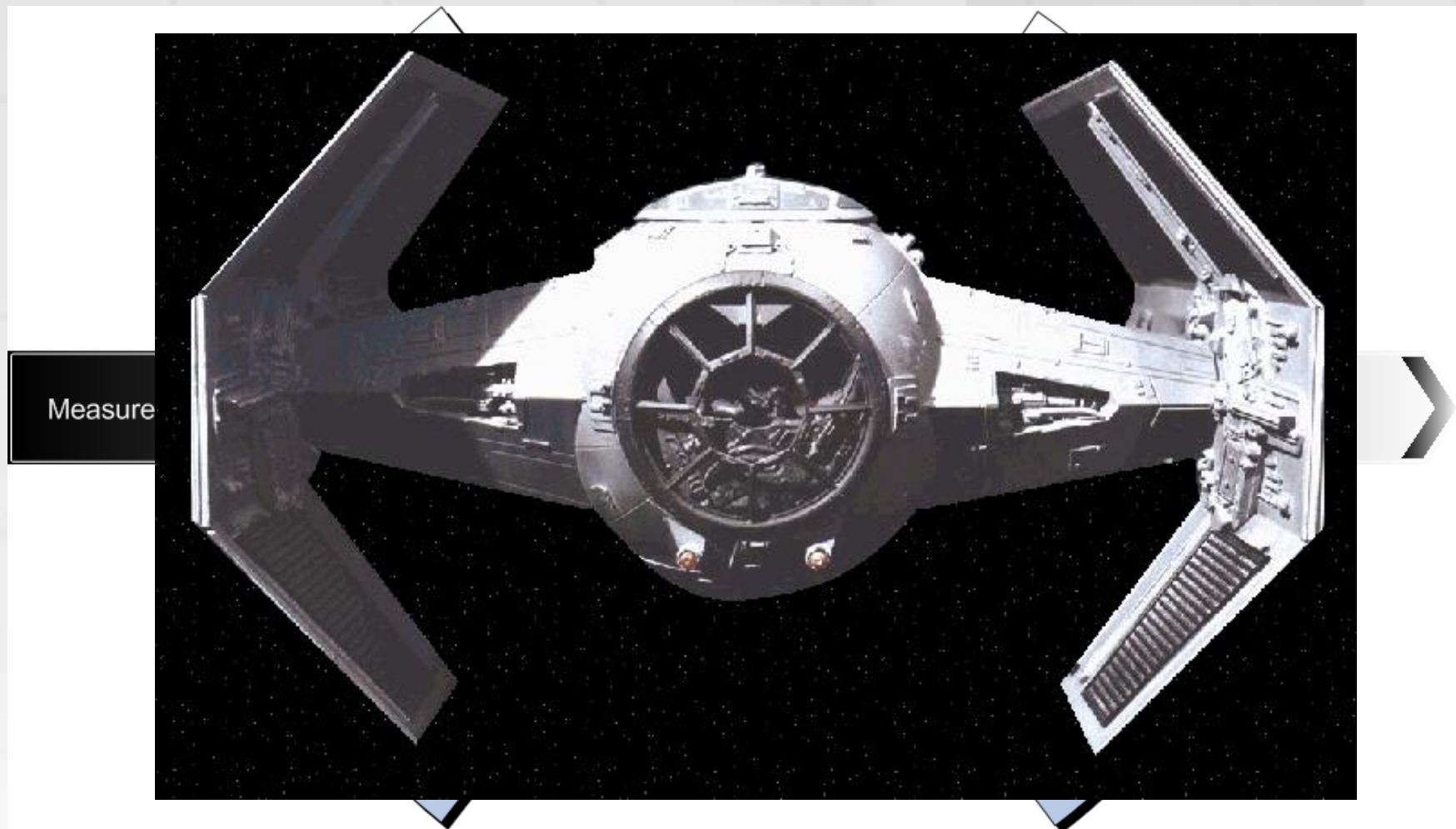
Deploying Custom Calculations and Action Adapters

- **Run openPDC Manager**
- **Navigate to “Adapters / Calculated Measurements”**
- **Populate required fields. Pay special attention to:**
 - Assembly Name (the DLL)
 - Type Name
 - Connection String
- **Set an appropriate Lag Time / Lead Time**
- **Set appropriate “Use Local Clock as Real-time”**
- **Check “enabled”**
- **Save new record**

Scaling-out with Custom Adapters



Overview of the Iaon Adapter Layer



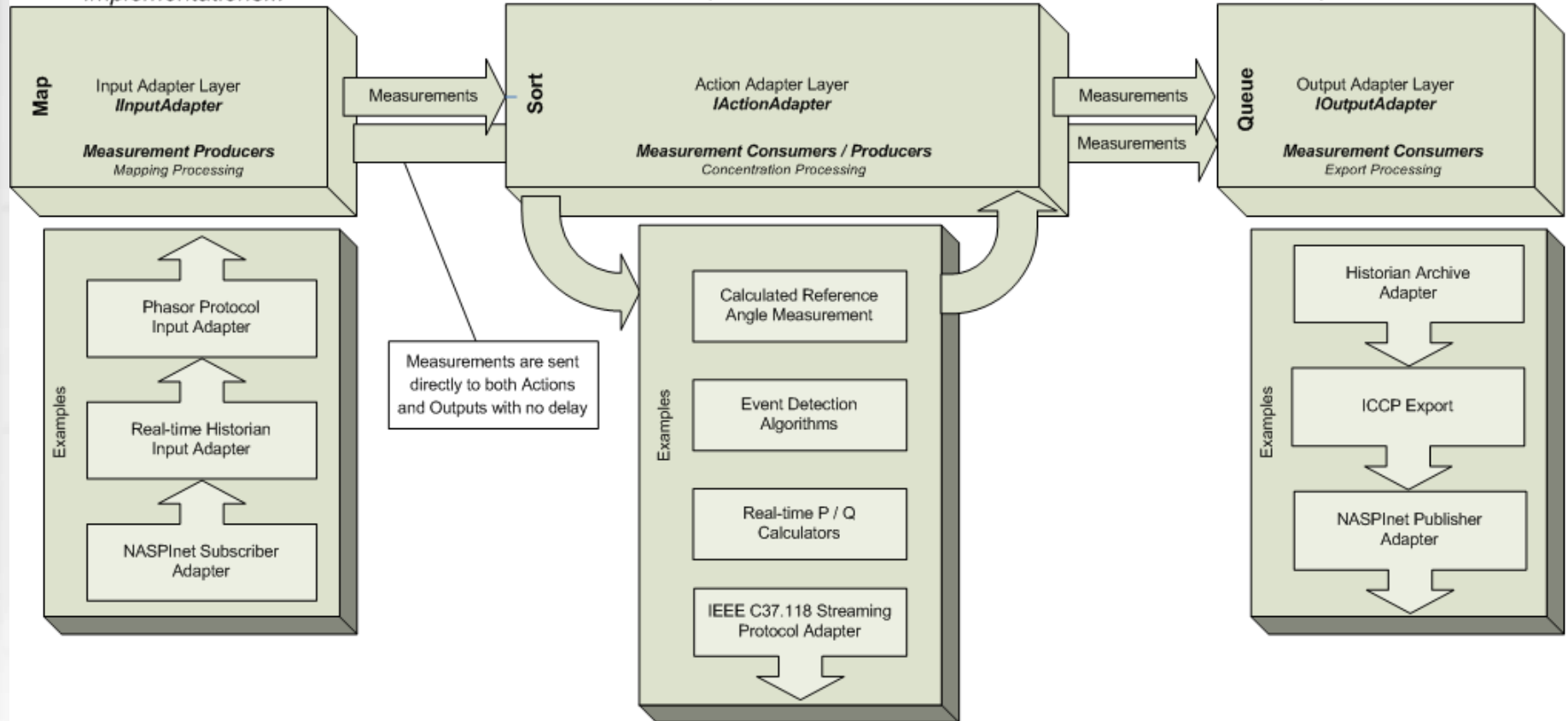
Input/Action/Output Interface Adapter Layer

TVA.Measurements.Routing

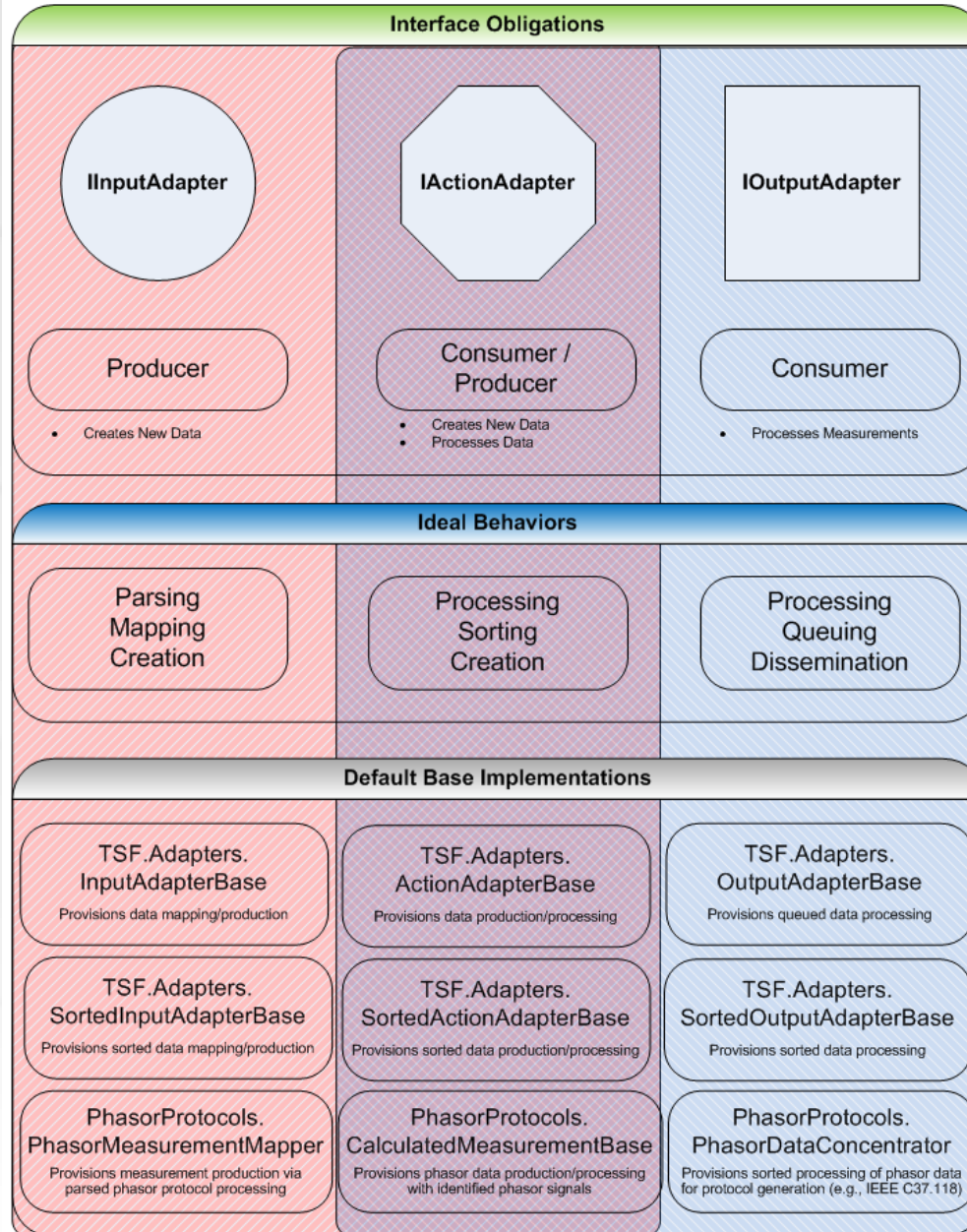
Measurements flow into the system via *IInputAdapter* implementations...

Measurements are sorted by time and acted upon by *IActionAdapter* implementations...

Measurements are queued for export by *IOutputAdapter* implementations...



Input / Action / Output Interface Overview



Developing New Adapters and Calculations

- **Difference between a “calculated measurement” and a basic “custom action adapter” are known “signal types” – this is specific to synchrophasors**
- **Always refer to Iaon Overview Diagram to decide which base class is most appropriate for my custom adapter**
- **Know when to use sorted and non-sorted base classes – “to concentrate or not to concentrate, that is the question” – no need to waste CPU sorting if it’s not needed**
- **Applying new attributes to enhance user experience for setting up new custom adapters**

Extended Code Level Overview of Time-series Framework

- **Code hierarchy and inheritance model**
 - Navigate through projects starting at openPDC.exe
- **The laon adapter framework**
 - Discuss connection string implementation and initialization, as well as relationship to class properties
- **The new extensible UI framework**
 - Discuss how the new UI framework can be used to create your own screens and deploy them by updating Menu.xml
- **The new “historical access mode” of the framework**
 - Discuss how the framework is being “extended” to support historical playback through the pub/sub API’s
- **The “phasor” specific code implementation**
 - Explore the synchrophasor specific code in openPDC

Formal Questions / Issues / Review

During this final free-form part of the day you are encouraged to discuss things that you still may be confused about, take time to ask questions about things you've wanted to know, discuss issues you may have encountered with any of the Time-series Framework related projects and simply review important issues from today's training.