Tango for Experiment Control

- What is Tango
- Scanning and Sequencing
- Diffractometers
- 2D Detectors
- Data Analysis Workbench
What is Tango
What is Tango

- A software bus for distributed objects

Linux, Windows, Solaris

Java, C++, Python

TANGO Software Bus

Dev

Linux, Windows, Solaris
Java, C++, Python

EPICS

Dev

GUI

Scan Service

Archiving Service

GUI ATK (Java)

GUI Qtango (C++)

GUI Taurus (Python)
What is Tango

- GUI frameworks for C++, Python and Java
- Synoptic editor
What is Tango

A simple Tango device

Power supply:

**Commands**: On(), Off(), …

**Attributes**: Current, Voltage, …

**State**: On, Off, Moving, Alarm, Fault

Round robin buffer, polling thread, event triggering…

*Hardware control code*

Interface

Code generator

To be written by the programmer

**PCaPAC2012 - Tango for Experiment Control**
What is Tango

- Graphical interface and state machine design
- Code generation: C++, Java and Python
- Editing and code re-generation
- Fast development cycle
What is Tango

- Administration and survey system
- Graphical system configuration
What is Tango?

- An object oriented software bus
  - Communication types: Synchronous, asynchronous, grouped asynchronous and event driven
- Servers and clients can be written in C++, Python and Java
- The Tango tool chain: Software from the hardware interface to the GUI

<table>
<thead>
<tr>
<th>Module</th>
<th>Description</th>
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<tbody>
<tr>
<td>Core Libraries</td>
<td>Client/Server communication libraries for C++, Python and Java</td>
</tr>
<tr>
<td>Device Classes</td>
<td>About 300 hardware interface classes are available to download</td>
</tr>
<tr>
<td>GUI Frameworks</td>
<td>Available for C++ and Python using QT, for Java using Swing and a web interface written in PHP</td>
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<tr>
<td>Client Bindings</td>
<td>LabView, Matlab and IgorPro</td>
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<tr>
<td>Tools</td>
<td>Pogo – Code generator for device classes in C++, Python and Java</td>
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<td></td>
<td>Jive – Configuration and testing tool</td>
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<tr>
<td></td>
<td>Astor – Administration and survey of the Control system</td>
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<tr>
<td>Archiving</td>
<td>Archiving and snapshot system with GUIs and web interface. Usable with Oracle and MySQL</td>
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<tr>
<td>Sardana</td>
<td>Framework for experiment control : Interface standardization, configuration, sequencing, command line interface</td>
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</tbody>
</table>
Sequencing and Scanning

- Tango Scan Server + GUI
  - Different types of scans available
  - Plug-in architecture for hardware integration
  - Developed at SOLEIL
Sequencing and Scanning

- Workflow editor Passerelle:
  - [http://code.google.com/a/eclipselabs.org/p/passerelle](http://code.google.com/a/eclipselabs.org/p/passerelle)
  - Customized for experiment sequencing at SOLEIL
  - Library of standard actuators
  - Allows non programmers to write experimental sequences
Sequencing and Scanning

• Sardana
  • Integrated user environment
devolved at ALBA
  • Interface standardization
  • Scanning framework
  • Python procedures + IDE
  • Command line interface
    • SPEC like syntax
  • Configuration GUI
  • GUI builder
    • based on PyQt widgets
Sequencing and Scanning

- Sardana configuration GUI
Sequencing and Scanning

- Sardana procedure IDE and the command line interface
Diffractometers

- SOLEIL developed a C-library for reciprocal space transformations.
- The purpose of the library is to factorise single crystal diffraction angles computation for different kinds of diffractometer geometries.
- [http://people.debian.org/picca/hkl](http://people.debian.org/picca/hkl)
Diffractometers

- The main features are:
  - Mode computation
  - UB matrix computation
  - Crystal lattice refinement
  - Pseudo axes (psi, eulerians, q, ...)
- Today the HKL library can handle 5 different geometries:
  - 2 circles
  - Eulerian 4 circles
  - Eulerian 6 circles
  - Kappa 4 circles
  - Kappa 6 circles
- Modes hkl
  - bissecteur
  - constant omega, chi, phi
Diffractometers

- Generic diffractometer device server + GUI
- Example: Kappa 6 Circles diffractometer GUI
2D Detectors

- LIMA : Library for Image Acquisition
  - Lima is a C++ library for integrating 2D detectors developed at ESRF
  - Oriented to high-speed detectors
  - Separate hardware specific code from common software
  - Provide software alternatives to “missing” hardware capabilities
  - Plug-in architecture for detector integration
- Web site: [http://www.lima.blissgarden.org](http://www.lima.blissgarden.org)
- Contributors: SOLEIL, PETRA-III, FRM-II, ALBA, RAYONIX, ADSC
2D Detectors

- Geometric image transformations:
  - Reconstruction of discontinuous readout
  - Bin, Rot, Flip & Rotation
  - Stripe concatenation

- Basic image processing:
  - Multi-Roi Statistics
  - Centroid (Beam Position Monitoring)
  - Roi Spectrum
  - Background subtraction, Flat-field normalisation
  - Spatial distortion correction
  - Frame accumulation
  - Image Mask
2D Detectors

Available detector plug-ins:

<table>
<thead>
<tr>
<th>Detector</th>
<th>Interface</th>
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</thead>
<tbody>
<tr>
<td>Basler</td>
<td>GigE</td>
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<tr>
<td>Prosilica</td>
<td>GigE</td>
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<tr>
<td>Ueye (IDS)</td>
<td>GigE</td>
</tr>
<tr>
<td>Pilatus (Dectris)</td>
<td>300K, 1M, 2M, 6M, 6M-F</td>
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<tr>
<td>PCO Edge</td>
<td>Camera-Link</td>
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<tr>
<td>Pco Dimax</td>
<td>GigE + Camera-Link</td>
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<tr>
<td>PhotonicScience 4022</td>
<td>USB</td>
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<tr>
<td>RoperScientific</td>
<td>PVCAM SDK</td>
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<tr>
<td>Andor I-Kon</td>
<td>USB</td>
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<tr>
<td>PerkinElmer Flat-Panel</td>
<td>Proprietary board</td>
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<tr>
<td>ADSC 315r</td>
<td>Proprietary board</td>
</tr>
<tr>
<td>MarCcd 165</td>
<td>Proprietary board</td>
</tr>
<tr>
<td>Mythen (strip detector)</td>
<td>Proprietary board</td>
</tr>
<tr>
<td>XPAD</td>
<td>Proprietary board</td>
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<tr>
<td>Maxipix (ESRF)</td>
<td>Espia</td>
</tr>
<tr>
<td>Frelon 2K (ESRF)</td>
<td>Espia</td>
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</tbody>
</table>
Data Analysis Workbench

- Data analysis workbench with a workflow editor
  - Developed by DIAMOND and ESRF
  - Viewing scientific data: 1D, 2D and 3D datasets
  - Data exploring, data analysis and data saving
  - Importing and running other tools based on Eclipse RCP
  - Editing and running python scripts for data analysis
- Web site: [http://www.dawnsi.org](http://www.dawnsi.org)
TANG Data Analysis Workbench

Data Explorer Perspective

Python Perspective
Data Analysis Workbench

- Designing pipelines for data analysis
  - Workflow editor Passerelle
  - Customized with a library of data analysis actuators
How to try it?

• Binary Packages
  • Available for Ubuntu (Debian) Linux in the standard distribution
  • Available for Windows on the Tango web site

• The Tango Box
  • A virtual Linux machine with most of the Tango packages installed and configured for easy testing
  • Runs with VMware Player

• Common Tango web site: http://www.tango-controls.org

• A mailing list for all questions and propositions to the community