A Light for Science



European Synchrotron Radiation Facility





TANGO collaboration and kernel status

- Brief introduction
- What's new since Icalepcs 2009
- New projects
- Re-thinking the Tango event system







What is Tango ?

- An object oriented control system based on CORBA
- Each piece of hardware or software to be controlled (from the simplest to the most sophisticated) is a device
- A device is an instance of a Tango class which is hardware/software specific
- Device supports commands (actions) and attributes (data)





What is Tango ?

 Tango class(es) are merged in operating system process called Device Server

 Device configuration parameters and network address stored in a database

3 types of communication
Synchronous, Asynchronous and Event driven

3 languages: C++, Python and Java

Collaboration between several institutes

European Synchrotron Radiation Facility





What's new since 2009 ?

- 3 kernel libraries releases
 - Tango 7.1.1 (11/2009)
 - Minor changes and bug fixes
 - Tango 7.2 (10/2010)
 - Thread safety on client part
 - Much faster algorithm used during device server process shutdown
 - Applications are able to subscribe to the same events several times
 - Minor changes and bug fixes
 - Tango 7.2.6 (03/2011)
 - Minor changes and bug fixes





What's new since 2009 ?

Packaging

- Linux binary distribution available
 - Based on Debian packaging system
 - 2 source packages



- 19 binary packages (including documentation and debug packages)
- Packages available from a Launchpad Tango-controls Personal Package Archive (PPA)
- Starting with Ubuntu 11.10, packages available from Ubuntu Software Center









What's new since 2009 ?

Graphical User Interfaces

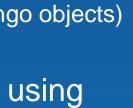
- Python GUI for Tango: Taurus
 - Based on PyQt 4
 - Talk WEAAUST 01 (Wednesday)



- The C++ GUI (QTango) is now in its release 4 (also based on Qt 4)
 - Poster WEPKS 022 (Wednesday)
- New widgets added to the ESRF Java GUI (ATK)
- A newcomer: Comète
 - Java GUI supporting several data sources (not only Tango objects)
 - Poster / Mini oral WEMAU 012 (Wednesday)

 Code generator (Pogo) release 7 based on DSL using Xtext is now routinely used to generate C++ Tango class









What's new since 2009

Collaboration Management

- A new Memorandum Of Understanding (MoU)
- 3 types of collaborators institutes
 - User (Not signing the MoU)
 - Contributors
 - Committers
- Executive Committee (EC)
 - 1 member for each institute which has signed the MoU
 - Decision made by voting
 - Weight of 1 for each committee member plus 1 extra for each committers institute

Executive committee meeting organized at each Tango meeting







On-Going projects

Java Tango classes and device server

 Soleil has started an ambitious project of re-factoring and updating this part of the Tango kernel



Software quality

- Continuous Integration with Jenkins
 - 20 libraries flavor, 10 device server, 5 test suite
- Improve the test suite
 - CxxTest selected as testing framework to unify the different test suite we have today
 - Increase test coverage to 75 %





The today's event system

- Based on the CORBA Notification service
 - omniNotify implementation
- Advantages
 - Simple on the event publisher side (no care about number of subscribers)
- Drawbacks
 - Require one extra process per host
 - Unicast network transfer
 - Use of CORBA Any objects
 - In some cases, large memory consumption
 - omniNotify is a dead project !





- Based on 0MQ
 - http://www.zeromq.org
- What is 0MQ?



- OMQ looks like an embeddable networking library but acts like a concurrency framework. It gives you sockets that carry whole messages across various transports like in-process, inter-process, TCP and multicast. You can connect sockets N-to-N with patterns like fanout, pub-sub, task distribution and request-reply. Its asynchronous I/O model gives you scalable multicore applications, built as asynchronous message-processing task.
- Runs on most operating systems
- LGPL





- OMQ does not provides data encoding / decoding
- For synchronous communications, Tango uses CORBA Common Data Representation (CDR)
- ORB's compiler generates methods to encode / decode data to / from CDR
- Most of the event data are encoded using CORBA CDR and transported using 0MQ.



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• Transferred data between event publisher and subscriber:

- String describing the event:
 - Fully qualified Tango attribute name plus the event type
- A single byte encoding the event sender endianess
- Some call related data (Coded using CDR)
 - Receiving event receiver object identifier
 - Method name to be called
- Event data themselves (Coded using CDR)

OMQ multipart messages used to transport these data





OMQ includes OpenPGM for multicast transport

http://code.google.com/p/openpgm



Spreading the events into multicast group (address)

- Find a way to automatically distribute the event on the available multicast group
- Unicast is still the default

Multicast supported for some specific events defined by the system administrator





- We are using the 0MQ publisher subscriber pattern (pubsub)
 - The device server process is the publisher
 - The applications listening for events are the subscribers

OMQ subscription is used to filter out unwanted events

- Subscription are length-specific blobs
- Subscriber receives only messages beginning with specified subscription buffer
- The first string sent in event messages is used as subscription buffer





Implementation

- We are using 0MQ 3
 - Subscription forwarded to the publisher (Unicast only)
 - Less network bandwidth
 - Less CPU consumption on client side
- 0MQ is written in C / C++ but it's API is C
 - We are using a provided C++ binding
 - 0MQ also provides a Java binding based on JNI
 - Not ready yet for 0MQ 3
- Compatibility old system new system
 - A new kind of synchronous request exchanged between event subscriber and publisher during Tango event subscription





Conclusion

Tango Event system

- Only client and server processes
- Better performances than previous system
- Multicasting requires more attention

Tango

- It's still an evolving project
- Problem is not the lack of ideas but rather a lack of resources
- We now have a clear way to take decision