Control Software for the LBT interferometer
LINC-NIRVANA

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Technical Seminar
DESY Zeuthen

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Outline

• Introduction to LINC-NIRVANA

• MPIA common software
  ◦ Development tools and frameworks
  ◦ Components and features

• Control Software for LINC-NIRVANA
LINC-NIRVANA

- LBT Interferometric Camera and Near-Infrared / Visible Adaptive Interferometer for Astronomy
  - Imaging beam combiner for the LBT
- Multi-conjugated Adaptive Optics: MCAO
  - High-layer and ground-layer sensing and correction using adaptive mirrors
  - Guidestars for wavefront measurement
- Several rotating fields

Large Binocular Telescope
Large Binocular Telescope

LINC-NIRVANA
LINC-NIRVANA

LINC-NIRVANA
What needs to be controlled?

- 4 Wavefront sensors → AO Loops
- 6 De-rotating elements
- Detector positioning and readout
- Many movable elements on motorized stages (ca. 120)
- Interaction with the telescope

- We will have multiple services running on 8 different computers
MPIA Common Software

- TwiceAsNice
  - Framework for developing service oriented architectures – SOA
  - Linux only
  - Based on Ice and Qt

1. Neubau
2. Nice
3. Basda
  - Mocca, Tempo, Vino, IO, Misda…

Third party software

- Internet Communications Engine (Ice) from ZeroC – www.zeroc.com
  - Distributed computing platform
  - Provides powerful network infrastructure
  - Supports many languages: C++, Java, Python, Ruby…

- Qt and Qwt – qt.nokia.com
  - Crossplatform application and UI framework
  - Widgets for technical applications

- Boost – www.boost.org
  - Widely useful C++ source libraries
Development Organization

- Version control using subversion – SVN
- Using TRAC on top of SVN
  - Web-based software project management
  - Issue tracking system – Tickets
  - Enhanced wiki system (documentation)
    - Allows linking of sources or tickets to wiki pages
  - Plugins and enhancements:
    - Blog, Discussion, Roadmap based on tickets, Source browser … extendable

- trac.edgewall.org
Development Organization

- Continuous integration testing using:
  - **Bitten**:
    - continuous integration plugin for Trac
    - Python-based framework for collecting various software metrics via continuous integration
  - **Jenkins**:
    - Extendable open source continuous integration server
    - Several plugins available

- bitten.edgewall.org
- jenkins-ci.org
Software Overview

- Perl script for creating auto tools based projects
- Helps to manage projects
  - Adding subdirectories
  - Keeping the subdir tree of configure.in and Makefile.am synchronized
  - Code template support, for creating pieces of code
- *Autoconf* macros for finding various software packages (boost, qt4, ice, ...)

Neubau

- [gnu.org/software/autoconf](http://gnu.org/software/autoconf)
Neubau

- *Automake* build rules for administration
  - Automatic subversion add
  - Building of rpm packages
  - Doxygen documentation …
- *Automake* build rules for compiling not supported meta languages and formats
  - Qt, ice, png, nice, …

- gnu.org/software/automake

Nice

![Diagram of Nice](image)
Nice Instrument Control Environment

Basic functionalities:

Logging
- Exceptions
- Configuration File Parser

Utilities
- File
- Directory
- Time
- Complex Datatypes

Basic functionalities:
- Integration of Qt/Qwt
- Ranger tool for engineering GUIs
- Service/Device architectures with dedicated property trees
- Code generation
- Python interface
Heart and Soul - Properties

- **Property:**
  - Weak typed data container attached to a Joint
  - All supported data types of our framework can be placed here
  - May contain a set of bridges to communicate with outside world
  - May contain a set of actors to trigger actions whenever the internal value is about to change

Service – Client Connections

1. Server & Client create a Joint root node
2. Client connects to publisher's Joint node
3. Server sub-tree is cloned at client side and an Ice bridge is attached to each property
4. Property value changes are distributed via attached Ice bridges to all subscribers
More Heart and Soul

Ranger – Engineering Interface
Basda

LN OPS

LOPSS

LOSS

LBCS

LICS

LAOS

LRCS

LEIFS

LN ICS

Basda

Devices

Services

Apps...

Nice

Util

Time

Map

Log

Property...

3rd Party

DevTools

Ice

Qt/Qwt

boost...

Basda - Overview

Applications

Ranger (aka DrGreenThumb)

Alarm

Services

Vino

Mocca

IO

Tempo

Mida

Muj

Moon

LocCon

Lakeshore

Agilent

AVT

Pizza

W&T

Pfeiffer

Laser

Fia

Val

Cryopump

RCU

Devices

Assemblies

Hardware

Quantum

BASDA!
Basda - Device

Basda - Service

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Basda – Interface Def. Language

- Asynchronous communication via bridge member functions
- What about synchronous stuff?
- General programming language independent interface
  - Similar to Corba or Sun RPC \( \rightarrow \) *.basda
- Basda2xx
  - Automatic generation of skeleton and stub code for the target programming language
  - Special property sub-tree CMD for synchronous invocations

LN Instrument Control Software