RTS2 – Remote Telescope System

Petr Kubánek

IPL, Universitat de Válencia

IAA CSIC Granada

RTS2

- Robotic Telescope System, 2nd Version
- Open source
- Wide hardware support
  - Easy to add new devices
- Plug and pray
  - You add device, run its driver – and it should work
- http://rts2.org
- http://rts2.org/wiki

Features I

- Integrated database with housekeeping

  - Target entries, planning, observing log, searchable images (using WCS coordinates)

- XML-RPC interface for outside consumers

  - GUI, Web,..

- Runs on Linux 32 and 64 bits, Solaris, and partly on MS Windows

- Own TCP/IP communication

  - telCorba if you like

- Integrated SOAP/Simbad name resolving

Features II

- Make everything what is possible interruptible
  - Nice for GRBs and other TOO observations
- Different executive components for different tasks
  - Xfocusc for quick look, executor and selector for telescopes, scriptor for all-sky cameras
- PHP library for easy creation of status real-time web pages
- Python XML-RPC extension, Python GUI
  - Should work everywhere

Features III

- Simple to use object extensions for various interfaces
  - Serial, TCP/IP, EPICS, …
  - Speed-up writing of a new device drivers
- Integrated telescope modelling
  - Using modelling file produced from TPoint
  - Can produce TPoint input from list of observations
- Integrated "easy" scripting
  - for 3 { E 10 filter+=1 } E 20 focpos-=10 for 10 { E 5 }

Supported devices (A-Z)

Aerotech A3200 arm, Andor CCDs, APC UPS, Apogee CCDs, Brondebrot rain sensors, CAHA CCDs, CAHA EPICS (telescope, dome, focuser), Cryocoon controller, Davis weather stations, Dummy for almost everything, FLI CCDs & filter wheels & focusers, Ford serial boards, Gemini mount controller, IA filter wheel (EPICS, CAHA), Keythley picoAmps, LSST testing boards, LX200 mounts, MGE UPS, MS257 monochromator, Newport light source, NI I/O boards, OpenTPL mounts & focusers & domes, Optec filter wheels, focusers & photometers, Paramount mount, Phytron drives, SBIG CCDs, System monitor (disk space), Startlight Xpress CCDs, **Z**elio logic PLCs

History

- 2000 – RTS1, BART
- 2003 – RTS2, BOOTES 1 & 2
- 2005 – FRAM
- 2006 – BOOTES IR, Watcher
- 2007 – LSST testing lab
- 2008 – D50
- 2009 – BOOTES 3, CAHA 1.23m, Watcher upgrade, Polish spectrometer?, two India telescopes?, Reunion Island?, two Slovak telescopes?, ...

Structure

- C++
- Subversion CMS (migrated from CVS)
- Some object design
- Various classes for various stuff
  - Own TCP/IP transport library
- Based around central *select* call
  - Avoid multi-threading
  - Has different processes for different tasks

Weather voting

- Each RTS2 component can vote for bad/good weather

- Centrald hold list of components **required** for switching to good weather – if some of them is missing or isn't responding to commands, system will switch to bad weather state

- Dome driver is ultimately responsible for opening/closing

    - Single point of failure

    - Best done with PLC, which closes on its own if computer is not responding..

State blocking

- Generic solution for "do not expose when telescope is moving"

  - Telescope raise flag "do not expose"

  - Camera ask central server "can I expose"

    - Yes, you can

    - No, you cannot

  - If the answer is NO, camera wait for moment when the answer is YES

- Same with filters, focusers, ..

Multiple centrald connections

- For crazy setup as can be found on BOOTES 1
  - 2 telescopes, one all sky camera
  - each have dome connection to vote for weather
    - so all sky does not take images at bad weather
- Easy and nice way how to bring important informations to important screens
  - running centrald everywhere, so you can rts2-mon to get the values

Scheduling

- GA (Genetic Algorithm) scheduler

- Generates observing plans for a full night

- Show some promising results

  - Quite flexible approach to scheduling, enable easy addition of new constrains and merit functions

  - Fast and robust

- Some UI to display resulting schedule

  - Uses XML-RPC interface

- More hopefully at 12:00 talk by Francisco Forster

Path expansion

- Character string for file names etc..

- Things like %y%m%d/%H%M%S.fits

    - .. easy translate to 20090327/061154.fits

- RTS2 keeps care of creating directories, if they do not exists

- Support in rts2-image and rts2-marchive

    - For shifting images around directory structure

Results

- GRBs – tens of detections, hundreds of follow-ups

  - Notably 050904, 060117, 090423

- Few minor solar system bodies occultations, one with positive detection

- Terra Bytes of data

Life demo..

Conclusion

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