SOUTHERN AFRICAN LARGE TELESCOPE

SALT Guidance System Upgrade Project

Supporting ‘unsupported’ devices on a cRIO using custom C/C++ drivers running on Linux

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25 February 2016
Outline

• SALT and its prime focus guidance system
• Our cRIO control architecture
• Integrating third party hardware and libraries
Southern African Large Telescope
Largest single optical telescope in the Southern Hemisphere
10m segmented primary mirror
Located in Sutherland (400km NE of Cape Town)
Prime Focus

- Prime Focus Imaging Spectrograph

Telescope layout

Field of view
Prime Focus

- Guidance system

Positioning system

Optical probe
Guidance System Control

- cRIO 9035
  - 4x 9503 Stepper Drives
  - 2x 9411 6-Ch DI
  - 1x 9361 8-Ch Counter
  - 1x 9485 8-Ch SSR

- Third Party Components

Starlight Xpress
Lodestar CCD

Faulhaber Stepper Controller

Data Distribution Service
Third Party Components

We have successfully integrated these components with our cRIO:

• **Lodestar CCD Camera API**
  – Low-light astronomy CCD detector (0.4 MP)
  – Ported Windows SDK to Linux and then to cRIO RT Linux
  – Generalises Windows USB driver via ‘libusb’

• **Faulhaber Micro-Stepper Controller**
  – Virtual COM port based (ttyACM supported by the kernel)
  – Linux configuration change to set tty permissions for use by NI-MAX

• **Data Distribution Service (DDS)**
  – Software-only library compiled from source
To build custom code on the cRIO:

- Use built-in OPKG Package Manager

**Update opkg database**
```
opkg update
```

**Install build essentials**
```
opkg install binutils
  binutils-symlinks
  g++
  g++-symlinks
  gcc
  gcc-symlinks
  libc6-dev
  libgcc-s-dev
  libstdc++-dev
make
```

**Install source control**
```
opkg install git
git subversion
```

[https://decibel.ni.com/content/docs/DOC-36980](https://decibel.ni.com/content/docs/DOC-36980)
Building Custom Software

To build custom code on the development machine:

• Use the “C/C++ Development Tools for NI Linux Real-Time, Eclipse Edition” to cross-compile libraries for use on cRIO
• …and to link against cRIO-compiled libraries

http://decibel.ni.com/content/thread/23094
Questions?