CSIRO Astronomy and Space Science
Monitoring and Control System status update
Malte Marquarding | Team Lead Monitoring and Control Software
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CSIRO Astronomy and Space Science

Instruments and locations

ASKAP

ATCA

Mopra

Parkes

CDSCC

MRO

Geraldton

Perth

New South Wales

Narrabri

Coonabarabran

Parkes

Sydney

Tidbinbilla

Western Australia
The Wajarri Yamatji people are the traditional owners of the land.
Murchison Radio Observatory
ASKAP – the telescope

- 36 x 12m antennas
- 700-1800 MHz
- Phased-array feeds
- > 350km custom fibre to site
- Remote operation
- Faraday cage building
- Hybrid solar diesel power
- Off-site data processing
- Supercomputer @ Pawsey
ASKAP – the architecture

Combined data rate ~ 21 Tb/s

Single mode Fibre
188 feeds
700-1800MHz

~ 2.5 GB/s

Pawsey HPC Centre for SKA Science Perth

Dedicated optical fibre
40Gb/s
800km

Fine Filterbank
Beamformer/
Antennas

Correlator

MRO
Control Building

ADC
Filterbank

RFOF RX

12m 3-axis
Reflector

Phased
Array Feed

Antenna
Pedestal

LNAs/Receiver/
RFOF TX

x36

Combined data rate ~ 21 Tb/s
# ASKAP – some numbers

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number of IOCs types</td>
<td>18</td>
</tr>
<tr>
<td>Number of IOC instances</td>
<td>351</td>
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<tr>
<td>number of records</td>
<td>2,564,516</td>
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<tr>
<td>number of archived points</td>
<td>470,836</td>
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<tr>
<td>Typical update interval</td>
<td>5s</td>
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<tr>
<td>Number of Servers</td>
<td>10</td>
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ASKAP – the software

- Custom c++ libraries to interface with firmware
  - Autogenerated points/records from xml annotations
- EPICS
  - software input/output controllers
- ZeroC ICE
  - Middleware orchestration layer
- Python API
- DiaMoniCA (lightning talk)
  - Application stack of MoniCA, Influx, grafana
- Engineering UI
- Web UI
  - Operator/science control
  - Java, js, d3js
ASKAP software architecture
Parkes software architecture

Software Components
- Observation Management Portal
- Data Services
- Executive
- Monitoring Archiver
- Facility Configuration Manager
- Log Archiver
- Python API

EPICS Controllers
- Other (e.g. weather)
- Drivesmon
- UWB frontend
- Digital Receiver
- Antenna Composite
- Metadata

Hardware
- Other (e.g. weather)
- DESK/drives
- UWB frontend
- Digitiser
- CPU Processing
EPICS

• v7 readiness
  • Recently transitioned to 3.16.1+patches
  • 4.6 (pvaSrv)
• All base on support module – askapioc
  • Logging, templating, iocadmin (stats)
  • Asyn abstraction
  • Big asub
• Composite IOCs - aggregation and delegation
• Auto-generation of databases
• Various support modules
• Pyepics for commissioning and experiment control
• Cs-studio configuration/set up
Observation Management Portal (OMP)
Control System Studio (cs-studio)
ASKAP – alarms???

- All critical alarms handled in hardware
- Soft limits around those
- No critical safety alarms
- No consistent alarm handler
  - Mix of IM, email, UI colours
- BEAST has no acceptance
- All different requirements
- AUTOMATION

```csharp
var database string
var downsampled_database string
var measurement string

var data = stream
    | from()
    | .database(database)
    | .retentionPolicy('autogen')
    | .measurement(measurement)
    | .groupBy(*)
    | @deadband()
    | .change(2.0)
    | .influxDBOut()
    | .database(downsampled_database)
    | .retentionPolicy('autogen')
    | .measurement(measurement)
    | .precision('ms')
```
Future enhancements

• Machine Learning
  • Explore existing solutions to large parameter space anomaly detection
• Alarm handling
  • Tool and pre-processing
• Visualising visibilities
  • Quasi-realtime displays of high volume data correlations
https://github.com/webepics
Thank you

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