

#### Past, Present and Future of EPICS in ASKAP

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ASTRONOMY AND SPACE SCIENCE www.csiro.au



2007



2007

#### CONRAD

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CONvergent Radio Astronomy Demonstrator





CONRAD



2007 CONRA CONRA



#### A "short" history of everything - 2008

- New "Telescope Operating System" (TOS) for ASKAP
- Bottom-up Approach
- Process
  - Search for candidates: "reuse" principle
  - Short-evaluation and down-select (one preferable) for prototyping
  - ~ 1 month
  - Prototyping + Architecture
- Outcome draft 0.1 of Evaluation document in Feb 2008
- Shortlisted: EPICS Version 3.x





#### A "short" history of everything - 2008

- Why EPICS?
  - It is free, open source and with a very active community
  - Both clients and servers can run in many platforms; not only VxWorks!
  - Proven technology
  - Proven scalability
  - All the client needs to know is the PV name. No messing around with fixed addresses
  - Simple client API: get, put, monitor and for C++, Python and Java
  - Lots of software tools available on the web: GUI toolkit, Alarm Handler, Archiver, Configuration database
  - Real-time database design appeals also to non-programmers
  - Presents a unified interface to high-level control (easier integration)
  - Common software for hardware subsystems developers



#### A "short" history of everything - 2008

- Weakness at the time
  - Close loop control up to 20 Hz 🖌
  - Channel Access does not support structured data "natively", but arrays are supported -> important for PAF-related M&C variables -
  - No support for bulk-data transfer 🖌
  - No "native" request/reply (RPC) ?
  - Has not been used recently in astronomical projects- ✓



#### **PROTOTYPING!** Let's Code!



#### A "short" history of everything - 2008

- Prototyping
  - ~ 6 month
  - Real telescope: Parkes 12m + PAF Prototype
  - Reused internal component: MoniCA
  - Reused/expanded software development environment and infrastructure
  - "Ad-hoc" ICDs
  - Serve to refine TOS Architecture
- No showstoppers found
- Final decision: Use EPICS for ASKAP TOS in Dec 2018



## **The Implementation Phase**





# **The Implementation Phase**

- Evolutionary Architecture
- Replaced GUI toolkit from EDM (Motif) to Control System Studio

DSP

DSP 4

• Replaced ALH (Motif) to Control System Studio BEAST

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## What we've learnt from EPICS

- It works and it scales!
- Channel Access is great for handling arrays
- Preference for narrow interfaces PV concept is neat!
- Great and active community, with experience in Australia and worldwide
- Use in lots of astronomical and high-energy physics, including major new projects such as ITER, ESS, NSLS-II
- It is old but there is a new generation and roadmap EPICS v4
- Major industrial fieldbus and protocols supported: modbus, OPC-UA, SNMP, etc.
- Allowed us to re-use our own (legacy but well loved) tools



## What we've learnt from EPICS

- Documentation is not great
- Writing "custom" servers outside of IOC software is hard
  - asynDriver but only in C++
- Complex control logic via IOC record linking is hard to do and maintain
  - asynDriver but only in C++
- Request/reply in IOC v3 is not the best but no showstopper
  - Looking into version 4
- Control System Studio
  - Great and easy tool to use
  - Eclipse RCP is a bit complex but lots of documentation
  - Headless build and managing plugin dependencies is hard



## **The Future**

- Continue developing some components needed for Early Science
- ADE System integration, verification and commissioning
- Looking into EPICS Version 4
  - Next generation of EPICS
  - Aim to be used in high-level applications or "services"
  - Expand EPICS PV data (structured data, request/reply)
  - Backward compatible with EPICS v3.14 for now
  - Already available supporting tools: CSS, elog, channel finder, archiver, etc.
  - Potential to replace ICE middleware
  - Active development, in production in NSLS-II
  - Other high-energy physics looking into put it in production for some beamlines: SNS, PSI, ESS
  - SKA should strongly consider use of EPICS v4 + v3.14



## **Lessons Learned: Summary**

- EPICS, Tango and ACS are all technically capable but not perfect
- Decision will be more likely be based on non-technical aspects
- Don't spend too much time evaluating < 1 2 months
- After selecting one, prototype to refine/define Architecture
- Use of common framework saves development cost and maintenance costs
- EPICS has been an excellent choice for ASKAP
- ASKAP TOS components could potentially be re-used and expanded for SKA prototypes and/or telescopes – report pending



# Thank you

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