eSTAR

Implementing an Observational Grid

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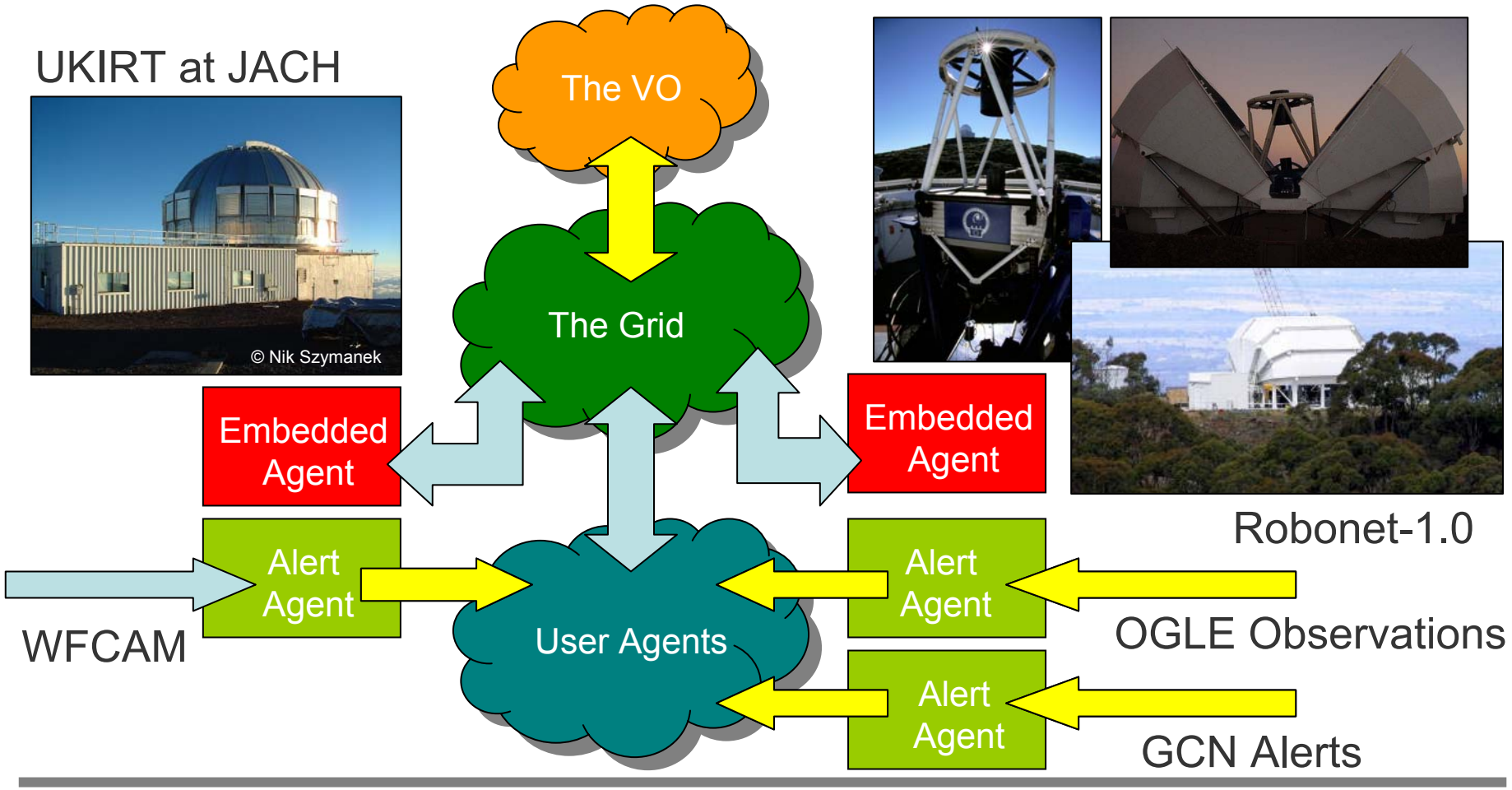
Aims

- Create an autonomous, intelligent robotic telescope network
- Allow new, previously impossible science, and scope for significant optimisations in observing / scheduling
  - Continuous tracking
  - Lightcurve analysis
  - Telescope time is expensive!

Architecture

- An ‘observational grid’
- Agent paradigm
- Decentralised, flat topology (peer to peer)
- Telescopes as real-time databases of the sky

The eSTAR network



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What are ‘agents’?

- An agent is just software, not magic!
- Many definitions
- I shall use:
  - An entity which encompasses its own flow of control
- The real ‘intelligence’ comes from relaxing the hardcoding
- Useful behaviour emerges through agent-agent interactions

Implementation

- eSTAR written entirely in Perl
- Node agents at telescope implemented as web services
- Communication via RTML and WSDL
- SOAP for the transport protocol

- Interoperability is important to us!

Encapsulating Expertise

- Lightcurve analysis:
  - Stars have spots
  - Stars rotate
  - Luminosity varies

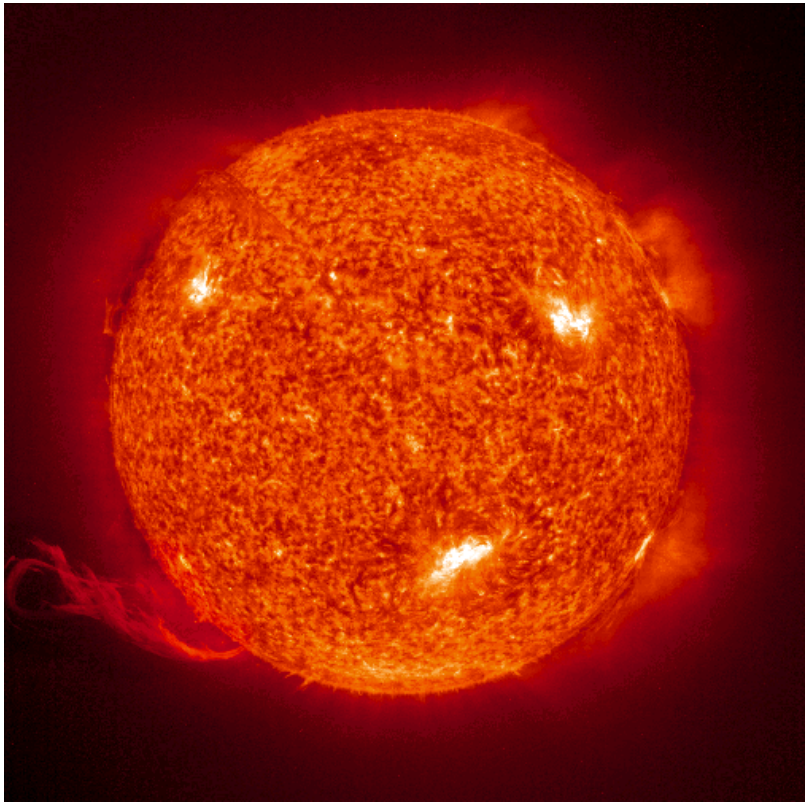
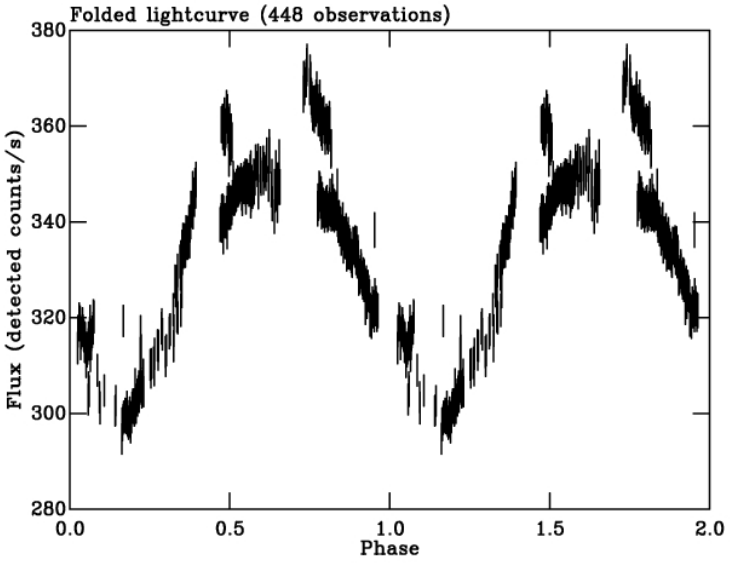
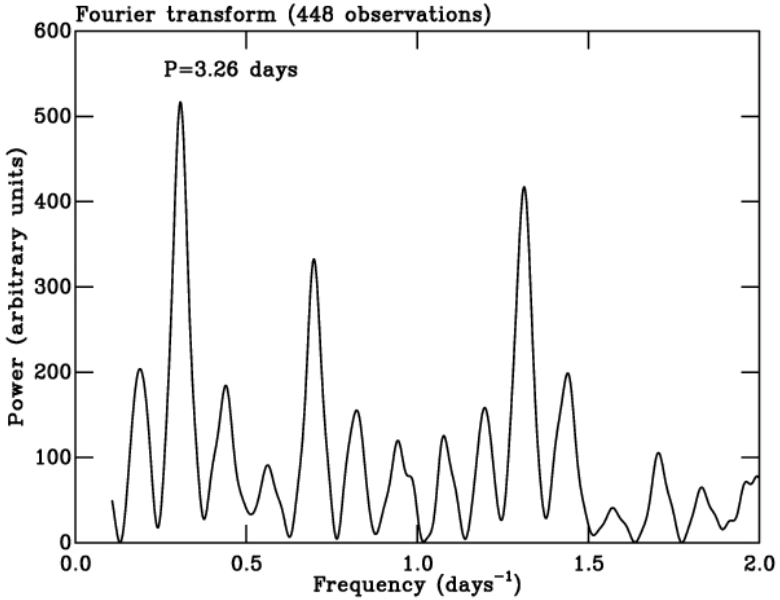


Image credit: SOHO (ESA & NASA)

Finding stellar periods





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Automating period discovery

- Difficult – many-variable problem.
- Not well understood, even by astronomers!
- Ideal problem for robotic, unmanned observation
- The sampling problem is a schedule optimisation problem – ideal for agents
- My work: Building the engine at the heart of the eSTAR period discovery agent

Design goals

- We call the eSTAR environment an ‘observational grid’. Why?
  - Uniformity – resources present the same interface
  - Dynamism – resources appear and disappear
  - Scalabilty – arbitrary resources can be added
  - Heterogenous – platform / language-independent
  - Distributed control – Many providers and users
  - Workflow – service chaining to solve problems

eSTAR and Robonet-1.0

- Searching for extra-Solar planets
- Real time observation follow-up using the same agent software as UKIRT
- A testbed for our adaptive dataset planning work

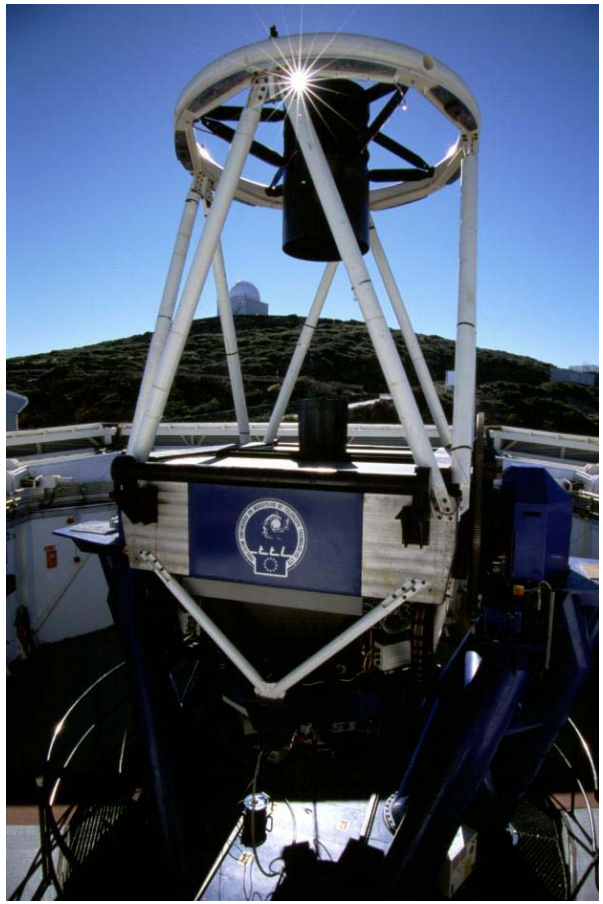

Photo credit: Dr Robert Smith, Liverpool John Moores University

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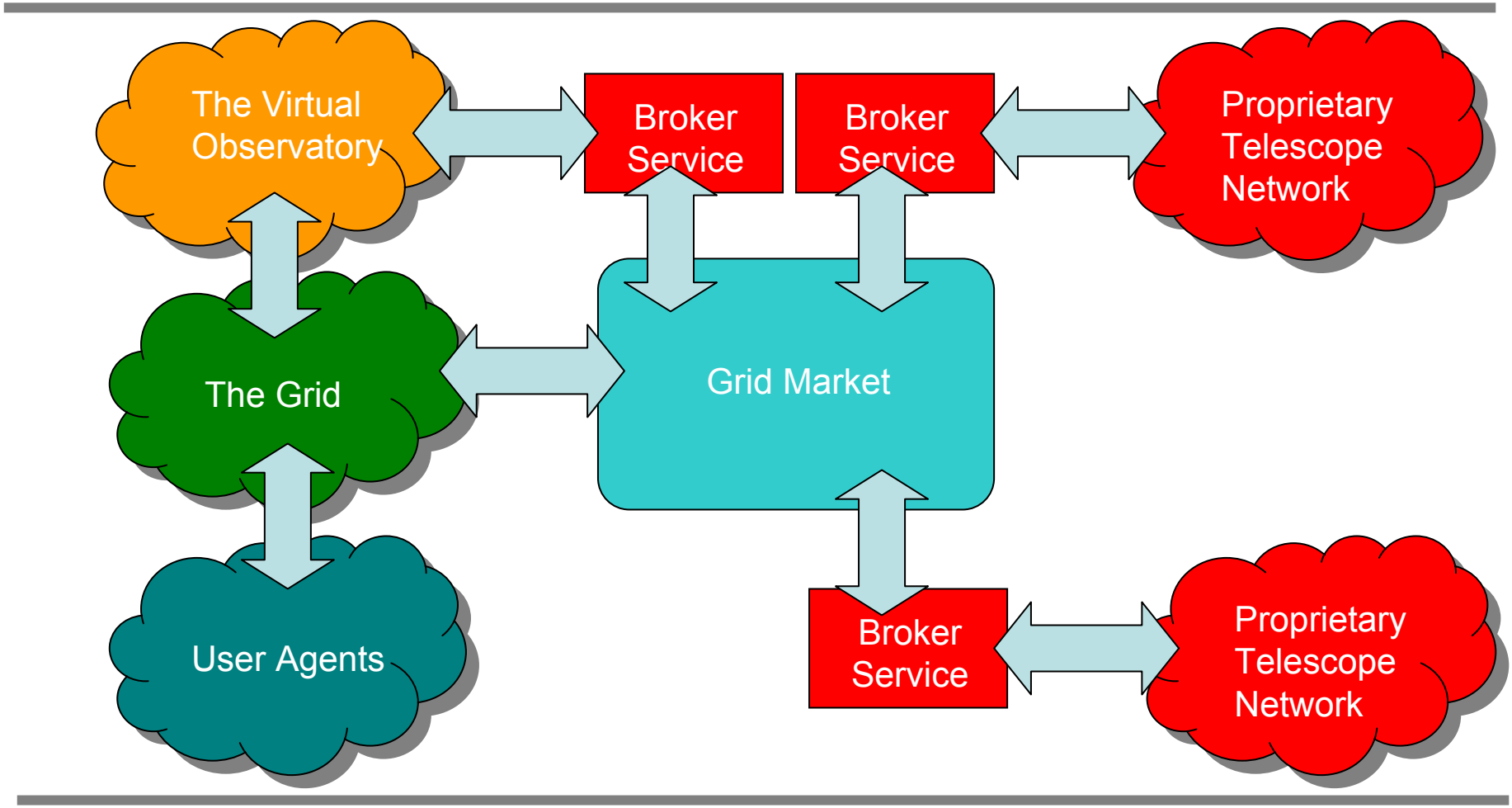
Future challenges

- Adding further telescopes would mean the network becomes truly heterogeneous. Can we handle that?
- Interoperability between existing networks is not yet a solved problem. Standards based, using RTML over SOAP (and VOEvent for notification?)
- How do we deal with the general case, of smart agents bartering for telescope time?

A Grid Market



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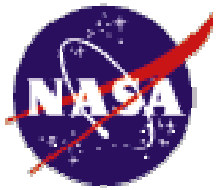
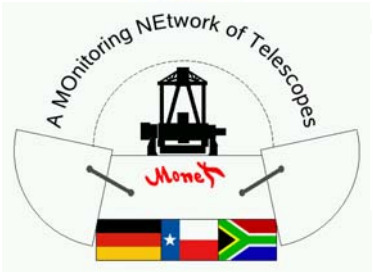
The HTN Workshop

July 18 -21 2005



eSTAR



Science Goal Monitor

Aims

- Establish the standards for interoperability between robotic telescope networks
- Work towards the establishment of an e-market for the exchange of telescope time
- Establish the standards for interoperability with the Virtual Observatory (VO) for event notification

See htn-workshop2005.ex.ac.uk

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