The LCOGT network scheduler
Multi-telescope observing

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Who’s Eric Saunders anyway?

- 2007+: Solving LCOGT’s scheduling problem (with much help from many others!)
What is LCOGT?

- A non-profit organisation
- A network of longitudinally-spaced optical telescopes
- A global instrument for the time domain
- A new frontier in telescope scheduling
Keeping you in the dark
Maui: Faulkes Telescope North
Siding Spring: Faulkes South + 2 x 1m
Cerro Telolo: 3 x 1m
Sutherland: 3 x 1m
McDonald Observatory: 1 x 1m
The problem we solve

- Accept requests from many users, at any time, interactively or programmatically
- Support many different kinds of science
- Be highly responsive to new input
- Utilise the full potential of a telescope network
- Be a killer follow-up observing engine
Unique network capabilities

- Simultaneous observing
- Cadences
- Cross-site observing
- Globally optimal placement
- Automatic weather rescheduling
- Smart retrying of incomplete requests
Requests: the unit of scheduling

*Requests* are powerful, generalised observing descriptions

- The building blocks for all observing
- Provide a way to ask for data from the network as a whole
- Abstract until scheduled as *Blocks*
Request windows

- User temporal constraint
- Bigger is generally better
- No need for explicit rise/set calculations
- Overheads automatically added
- Darkness handled for you
- Airmass handled for you
Moon distance, airmass or other *a priori* constraints would be applied in the same way.
Adaptive network scheduling

- Full cross-telescope scheduling
- All telescopes scheduled together
- Automatic site selection
- Automatic hard constraint enforcement
- Real-time dynamic rescheduling for weather, telescope availability
- Priority-based global optimisation
- Modular architecture - improve and extend!
Lifecycle of a Request
Choosing what to do

- Solve a very large integer programming problem, with thousands of constraints
- Maximise summed priority
- Calculate over all Requests, available time, telescopes, within the scheduling horizon
- This is an optimal solution, not “best effort”
- Recalculate whenever necessary
Dynamic recomputation

- Triggered by a change in the scheduler environment
  - New requests
  - Failed requests
  - Network resource changes
- Fast
  - 2 minute full computation goal (very challenging)
- Stable
  - running observations not pre-empted
  - 3 days of schedule cached at site
Current status

- Stable and running 9 x 1m, 24/7, but not yet feature-complete
- Active beta testing with 20+ external users, and heavy collaborative use (microlensing, supernovae follow-up, transits)
- Aiming to be fully operational April 1st 2014
Further reading


● Brown et al., *Las Cumbres Observatory Global Telescope Network*, PASP, 125, 931

● Visit us: [www.lcogt.net](http://www.lcogt.net)