Standards and protocols for transient reporting

Petr Kubánek
IPL, Universidad de Valencia
IAA CSC Granada

The Universe is changing..

- Most of the survey work is done
  - You cannot except high scientific return for repeating static night sky surveys, unless you use really big (= expansive) equipment

- Time domain still sometimes lack coverage
  - Although number of installations operated with some kind of rapid follow up mode has increased significantly during last few years, you can still get some unique observations

Timescales for reporting

- seconds – GRBs, solar system bodies occultations, lunar meteorites, meteorites

- hours – planetary transits

- days – Novas, Supernovas

- months – AGNs, know high energy sources

So what you need..

- Source of messages with triggers

    - Hi, there was this interesting event

- Some logic to make decision what to observe

    - Provided by humans in the loop or by software

- Observatories

- Software and know-how for data processing

- Templates for papers (where to report observations)

Know sources

- GCN
- IBAS
- VOEvent
- Astronomers telegraphs
- MPC circulars
- uLensing & microFUN
- *And many more..*

GCN

- Gamma Ray Burst Coordinates Network

- Dinosaurus - started in 1990's

- Binary TCP/IP protocol + Emails

  - Plus dozen of excotic, depreciated transports (modem,..)

- You are the server, GCN (capella.gsfc.nasa.gov) is connecting to your computer

  - Nice solution to keep system safe from deny-of-service attacks

  - Nightmare for dealing with network administrators

Nice features of GCN

- Stability

  - GRBs are rare, and you don't want to miss it

  - Exchanges every 60 seconds "I am alive" messages, so you know that system is up and running

- Simple format

  - Positions are reported either in J2000, or in current

  - There is ussually RA, DEC and error radius

    - → you know where to look

GCN I

- System respons time

    - You get beep seconds after it is received from the sattelite, and network transport time is neglectible

- Simple code

- Sends tests messages

    - So you can test system response

GCN II

- Packet Format
  - 40 long integers
  - High endians (network order)
  - Message type, coordinates (RA, DEC * 10000), flags
- Email list
  - So you can send immediately your observations, and also know results of other observations

GCN - messages

- Swift GRBs

- INTEGRAL GRBs (proxy)

- AGILE GRBs (proxy)

- FERMI (GLAST) GRBs

- Suzuki & IPN GRBs (email only)

- Messages from participating ground-based observatories

  - ROTSE without human in the loop

  - http://gcn.gsfc.nasa.gov/gcn/submit_counterpart.html

GCN

- More on
  - http://gcn.gsfc.nasa.gov

IBAS

- Integral Burst Alert System

- Reports GRBs (and other events) observed by INTEGRAL satellite

- An attempt to produce advanced, "European GCN"

- UDP binary protocol

- IBAS is server (computer sitting in ISDC, Geneva), you need to register (by sending email) before asking server for data

IBAS

- J2000 position

- Library for receiving, parsing and sending messages

  - Part of OSA, and really dificult to install

- The question is "do I really need this"..

  - ..if I can get GRBs through GCN

- http://isdc.unige.ch/index.cgi?Soft+ibas

VOEvent

- Ambitious attempt to replace all transient sources with a network distributing it

  - Using single format for distributions

- Part of the Virtual Observatory movement

- XML based

- Currently in transition stage between design and implemenation

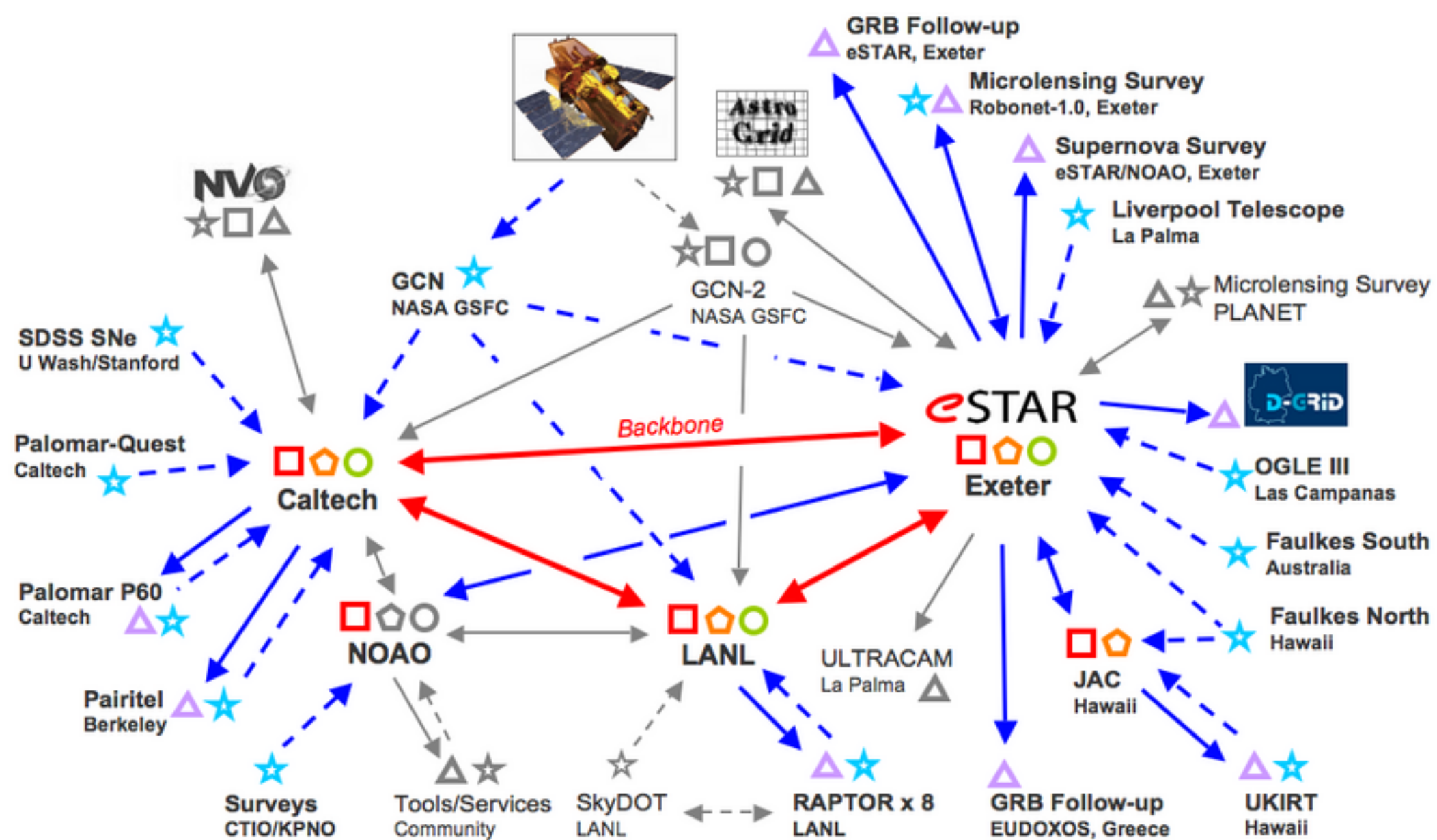 - which do show some minor problems with the design

VOEvent

- http://www.voevent.org (http://www.ivoa.net)

- Author / Publisher / Repository / Subscriber / Broker or Relay (Filter)

- "Vanilla TCP" or Jabber XMMP extension

VOEvent fields

- Fields

  - \<Who\>   Author Identification

  - \<What\>   Event Characterization

  - \<WhereWhen\>   Space-Time Coordinates

  - \<How\>   Instrument Configuration

  - \<Why\>   Initial Scientific Assessment

  - \<Citations\>   Follow-up Observations

  - \<Description\>   Human Oriented Content

  - \<Reference\>   External Content

VOEvent protocols

- Draft from 2006 specify "vanilla TCP"

  - Wrap XML message on TCP/IP port and see what happens

- And Jabber XMMP protocol

  - Use XMMP extension to transfer XML through Jabber messaging system

GRB Follow-up
eSTAR, Exeter

Microlensing Survey
Robonet-1.0, Exeter

Supernova Survey
eSTAR/NOAO, Exeter

Liverpool Telescope
La Palma

Microlensing Survey
PLANET

NVO

AstroGrid

GCN
NASA GSFC

GCN-2
NASA GSFC

SDSS SNe
U Wash/Stanford

Palomar-Quest
Caltech

Caltech

Backbone

eSTAR
Exeter

D-GRID

OGLE III
Las Campanas

Faulkes South
Australia

Faulkes North
Hawaii

Palomar P60
Caltech

NOAO

LANL

ULTRACAM
La Palma

JAC
Hawaii

Pairitel
Berkeley

Surveys
CTIO/KPNO

Tools/Services
Community

SkyDOT
LANL

RAPTOR x 8
LANL

GRB Follow-up
EUDOXOS, Greece

UKIRT
Hawaii

Key Roles

□ Publisher ⬠ Filter ○ Repository ☆ Author △ Subscriber

Document Type
VOEvent   Other

Implementation Status
Backbone   Operational   Planned

VOEvent - positives

- Attempt to create integrated, secure, stable platform for transient reporting and follow-ups
  - Which will be fully computer readable
- Able to handle all kinds of events
  - With cavets mentioned on next slide
- Able to cope well with high bandwidh sources
  - LSST expect thousands events per night

VOEvent - negatives

- Different groups, different interestes
  - Tries to serve too many masters
  - GRBs – seconds matter, exoplanets – we can wait..
- As whole VO, sometimes look like as when cat and dog cook the cake
  - STC – tries to describe impossible cases (observations done from Mars surface) for "just in case" cases
- Steep learn curve
  - And not so much SW available for testing and quick look

Astronomers Telegraphs

- Report various events, ussually somehow related to high-energy (X-Ray, Gamma) known sources

- All messages are text strings, distributed to email list

- http://www.astronomerstelegram.org/

- Usually high-energy sources activity is reported there

MPC

- http://www.cfa.harvard.edu/iau/mpc.html

- Free service

    - Catalogue of solar system bodies

- Paid services (~ 300 $ / year)

    - Access to circulars, messages, …

- Messages not computer readable

    - But you can search for some patterns..

uLensing and microFUN

- Microlensers for planetary transists

- Sources are two big (> 2m) telescopes, monitoring galactic bulge region for change in brightnes of some star

- OGLE (Polish, Las Cumbrillas Observatory, Chile) and MOA (Japan + New Zealand, Mont John, New Zealand)

- Requires access to southern sky (usually dec - 30..)

uLensing

- Web pages at https://it019909.massey.ac.nz/moa/alert/ (MOA) and http://ogle.astrouw.edu.pl/ogle3/ews/2008/ews.html

- Transfered and distributed by VOEvent

- Follow-up messages distributed by few "email lists"

- Provides some computer-readable interfaces

  - Request for some predefined documents produce XML file with all necessary informations

Issues?

- Data rights
  - I don't want to give off this particular source informations, as it might turn important for my work
- The problem is that I decided to get coverage only myself
  - I can loose lot of mayby important data ($\rightarrow$ science)
- And if I will get with the others..
  - I can be scare that the others will do better, and my research will become useless?

Issues?

- Data processing
  - We can trigger on any stream, but we need to know what to do with the data
  - We have enought problems dealing with GRBs (fill in your subject), so please don't disturb us with your problems
  - Shall we try to put some effort to develop the ultimate software for transient observations?
    - Scalable
    - Fully configurable

Issues?

- How big scalability?
  - Everything from 10cm to 30m class optical, and 1m to 150m radio dishes?
- How to coordinate efforts
  - So everybody feels that he is making something important
  - And nobody fears that the others are better?
- Capitalism vs. comunism shows that does not work
  - Competition keeps product inovations goiing on
  - Punk style? Anarchism? Keep it as it is?

Conclusions

- Presented were a few sources of information for transients

- Future looks brighter

  - There seems to be discussion about some serious VOEvent implementation