A data transfer system for MAGIC based on gLite FTS and multiVAC

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PIC
port d'informació
científica

MAGIC
Major Atmospheric
Gamma Imaging
Cerenkov Telescopes

summary

- Introduction: The MAGIC data center (storage)
- Current data transfer + storage + access
- A new data transfer system
  - gLite FTS
  - multiVAC
- Conclusions

MAGIC telescopes

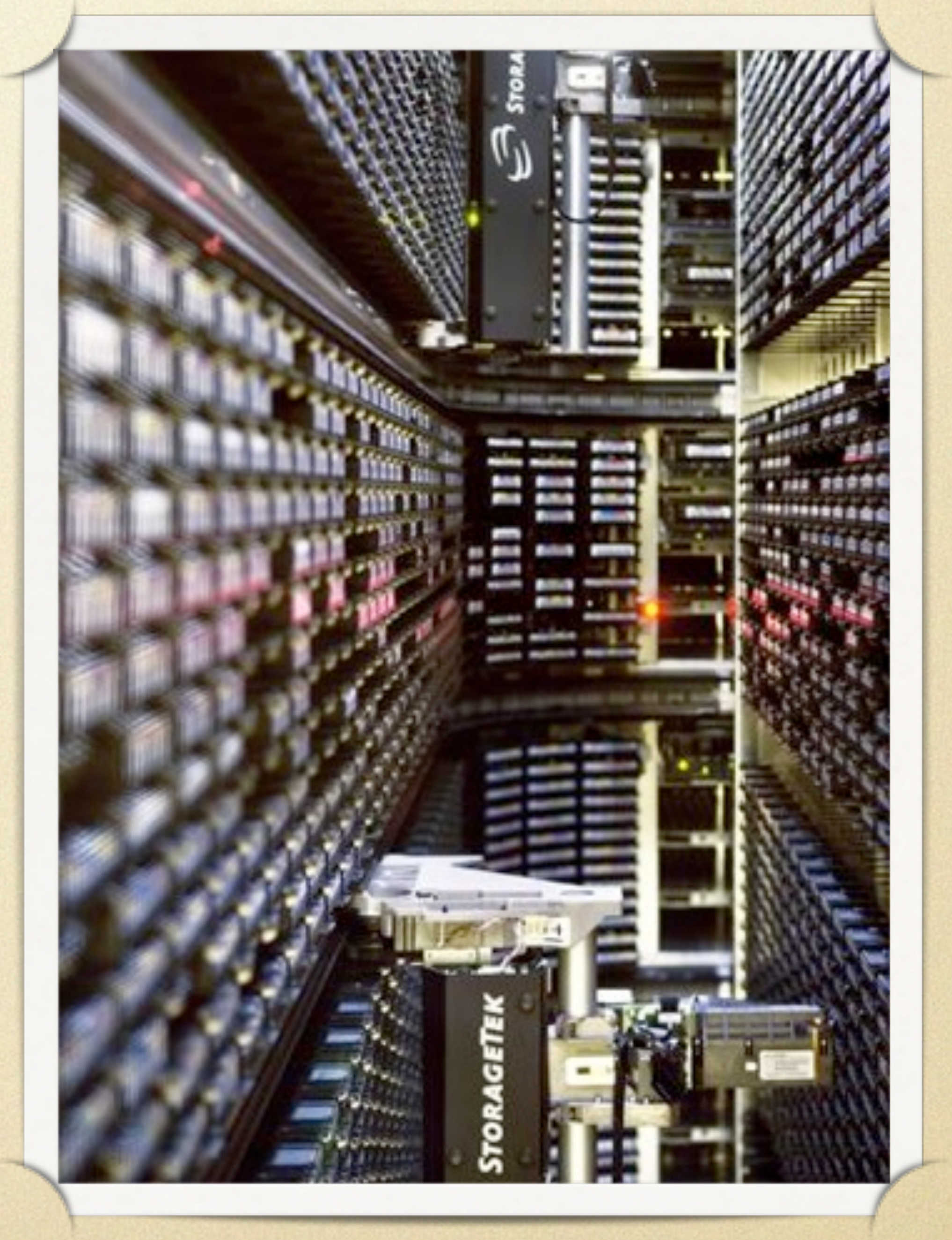
- Cherenkov telescopes ~30GeV to 10TeV γ-ray
- Observatory in La Palma: Canary Islands
- Observing since 2004, second telescope on 2009

data production @LP

- Data volume as of 2011
  - raw data: ~125 TB per year
  - OnSite Analysis: + ~16 TB per year
- ~30 different kinds of data (data + logs) to be transferred to the data center @PIC

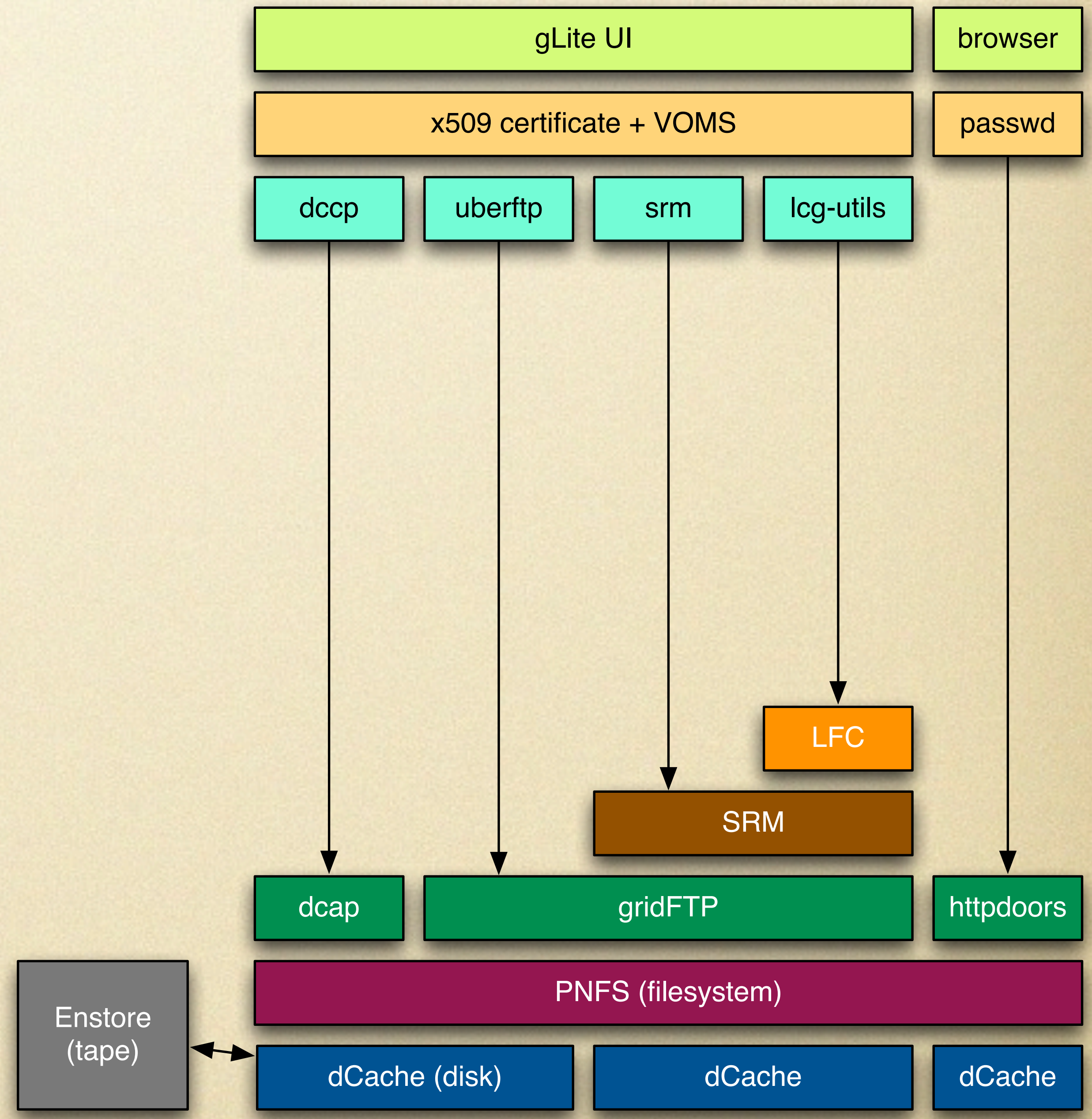
data center @PIC

- Hosted in PIC, Barcelona since 2007
- Storage (150 + 350 TB)
- Data access
- Data transfer from LP
- Computing: official + users' analysis



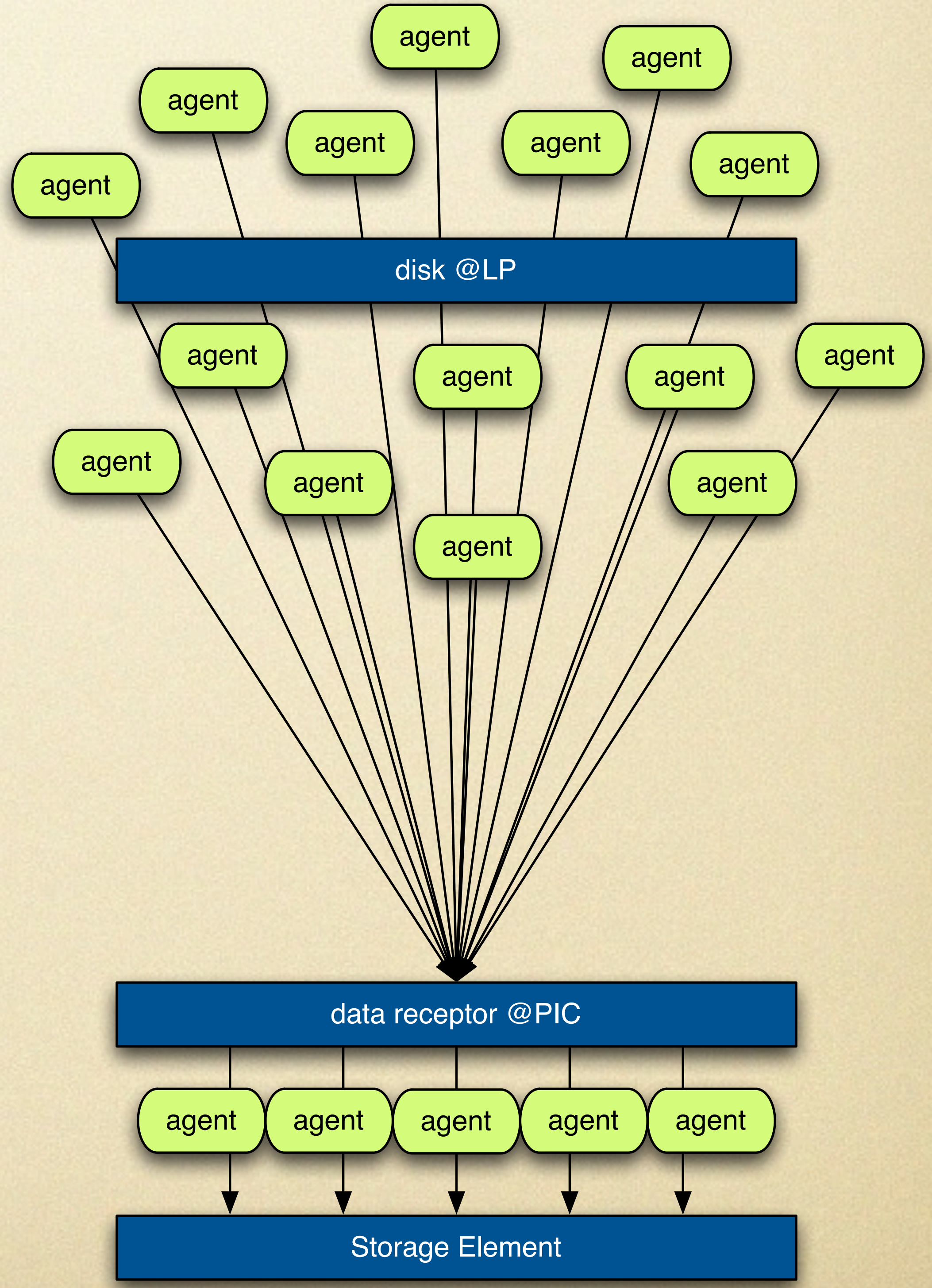
storage & data access

- Multiple protocol and authentication options
- Many disk pools, but single filesystem
- Transparent access to tape library
- POSIX*



current data transfer

- 1 agent per data type
- Temporal NFS disk @PIC to collect data, later moved to Storage
- Bottlenecks, multiple error points, poor monitoring & admin
- Raw data by air mail



need for a change

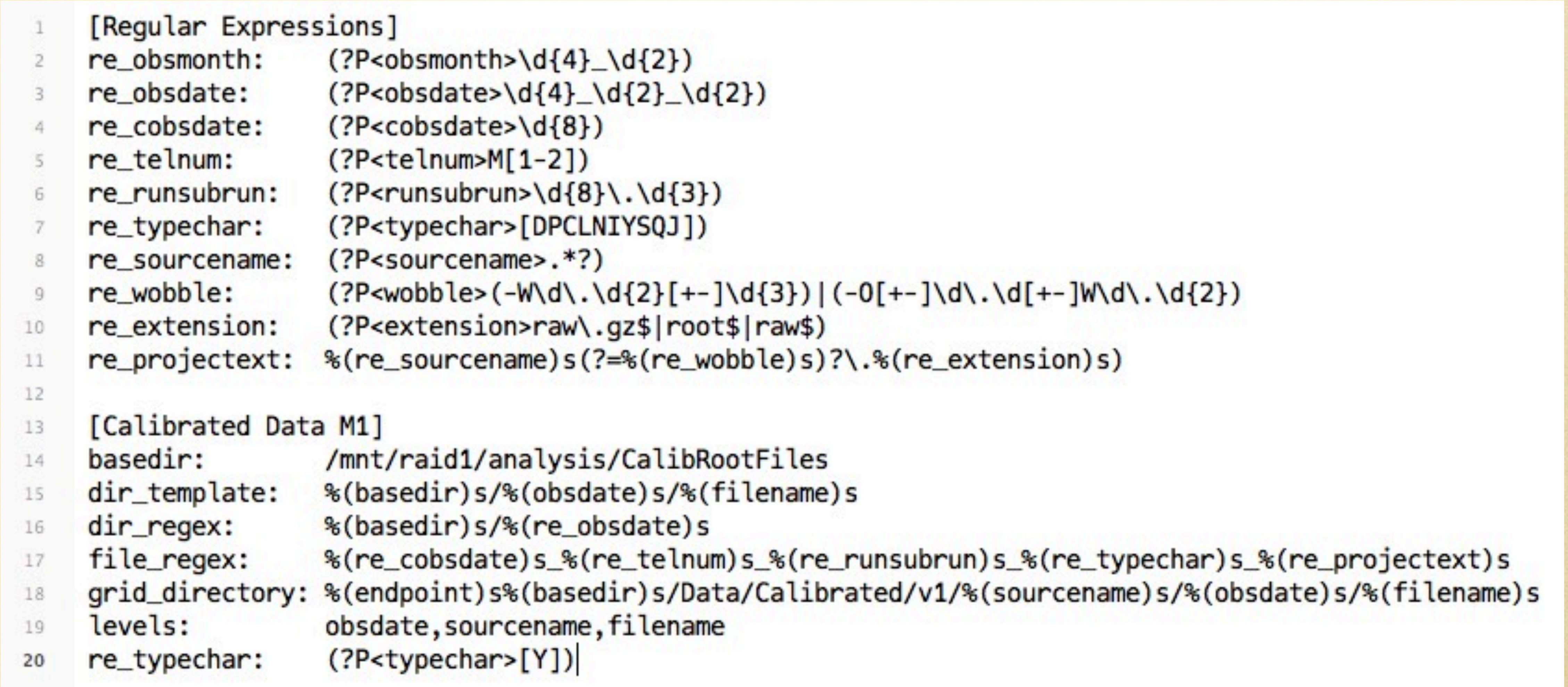
- This system is a legacy from the ‘early days’
- Many changes since 2004:
  - Data center completely renewed
  - 2nd telescope in operation: #agents x2!
  - 5 years of experience
- It’s time to review it!

a new system

- Must deal with 4 key points:
  - **Which** data must be transferred to PIC and **where** this data is and will be copied
  - **How much** data is there
  - **When** this data is ready/safe to transfer
  - **How** to transfer the data to PIC (and mark it as transfered afterwards)

which and where?

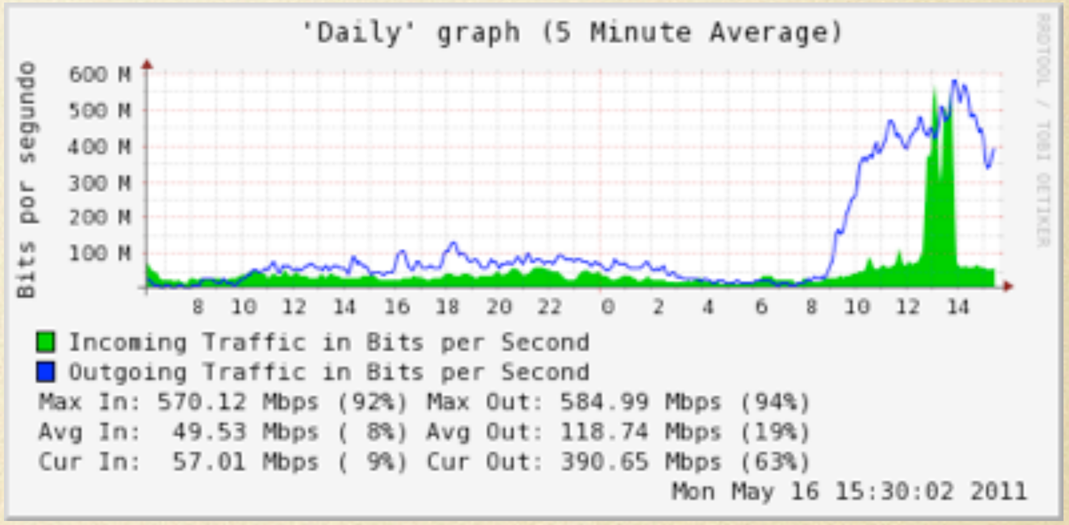
- Common configuration file: simple and intuitive



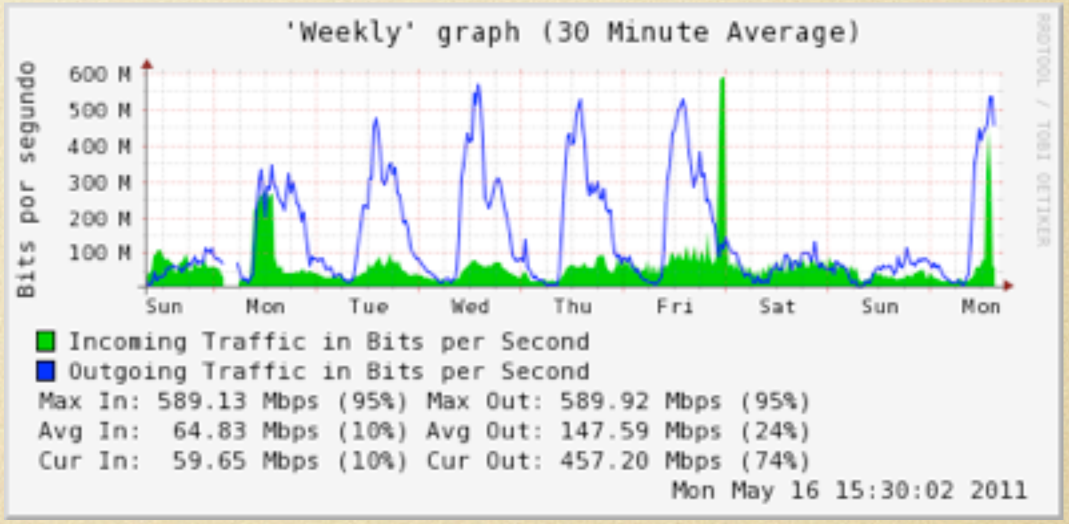
```
[Regular Expressions]
re_obsmonth:    (?P<obsmonth>\d{4}_\d{2})
re_obsdate:     (?P<obsdate>\d{4}_\d{2}_\d{2})
re_cobsdate:    (?P<cobsdate>\d{8})
re_telnum:      (?P<telnum>M[1-2])
re_runsubrun:   (?P<runsubrun>\d{8}\.\d{3})
re_typechar:    (?P<typechar>[DPCLNIYSQJ])
re_sourcename:  (?P<sourcename>.*?)
re_wobble:      (?P<wobble>(-W\d\.\d{2}[+-]\d{3})|(-O[+-]\d\.\d[+-]W\d\.\d{2})
re_extension:   (?P<extension>raw\.gz$|root$|raw$)
re_projectext:  %(re_sourcename)s(?=%(re_wobble)s)?\.%(re_extension)s)

[Calibrated Data M1]
basedir:        /mnt/raid1/analysis/CalibRootFiles
dir_template:   %(basedir)s/%(obsdate)s/%(filename)s
dir_regex:      %(basedir)s/%(re_obsdate)s
file_regex:     %(re_cobsdate)s_%(re_telnum)s_%(re_runsubrun)s_%(re_typechar)s_%(re_projectext)s
grid_directory: %(endpoint)s%(basedir)s/Data/Calibrated/v1/%(sourcename)s/%(obsdate)s/%(filename)s
levels:         obsdate,sourcename,filename
re_typechar:    (?P<typechar>[Y])
```

how much?

- Volume: ~140 TB/year
- Mean: ~50 Mbps for all year data (80%uptime)
- Peaks: ~300 Mbps for winter nights (in 24h)
- Line: 600 Mbps, ~10 Gbps before 2012



```
Max In: 570.12 Mbps (92%) Max Out: 584.99 Mbps (94%)
Avg In:  49.53 Mbps ( 8%) Avg Out: 118.74 Mbps (19%)
Cur In:  57.01 Mbps ( 9%) Cur Out: 390.65 Mbps (63%)
                              Mon May 16 15:30:02 2011
```



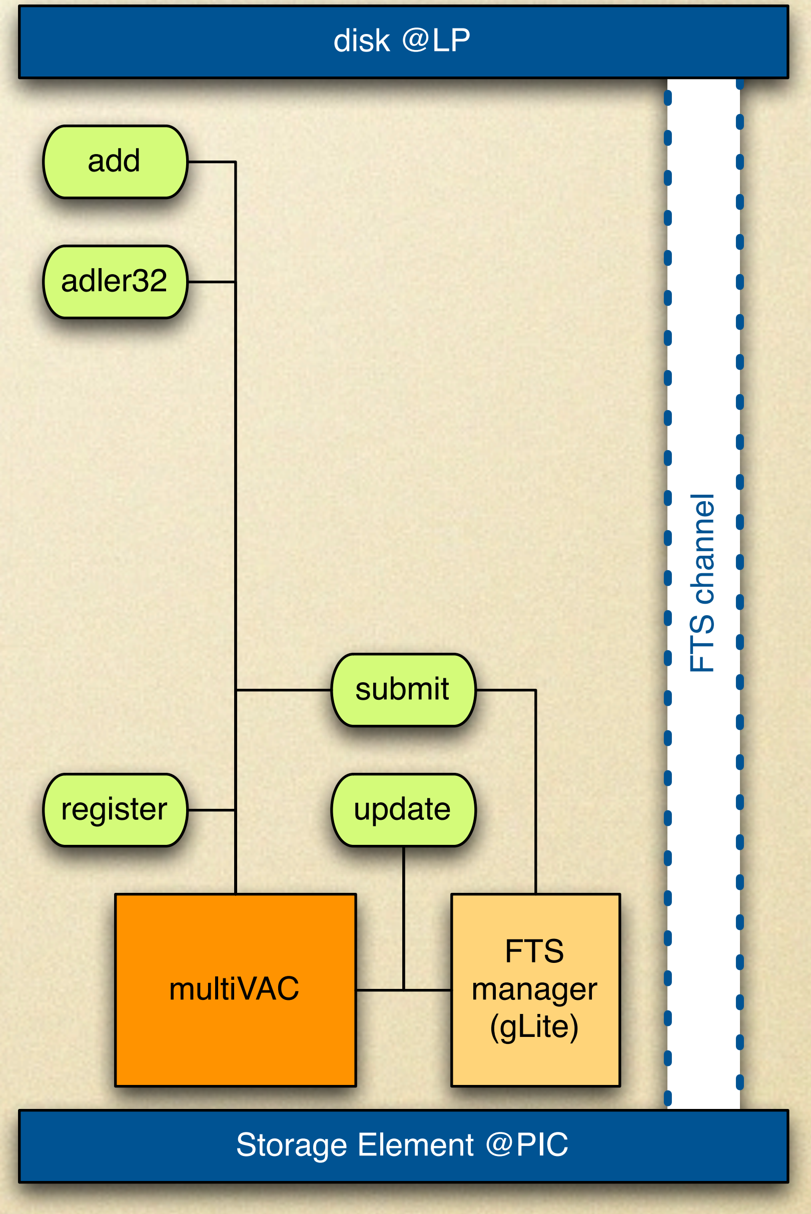
```
Max In: 589.13 Mbps (95%) Max Out: 589.92 Mbps (95%)
Avg In:  64.83 Mbps (10%) Avg Out: 147.59 Mbps (24%)
Cur In:  59.65 Mbps (10%) Cur Out: 457.20 Mbps (74%)
                              Mon May 16 15:30:02 2011
```

when?

- Data ready conditions depend on data type:
  - Raw & subsystem data: observation is over
  - Analysis: ask to OSA manager, webservice
  - ...

how?

- DataTransfer app
- Common workflow for all data types
- 1 agent per step
- Direct channel
- Proper monitoring and management



DataTransfer app

- Extension of multiVAC classes with methods to deal with data transfer using FTS
- Includes the central db and the agents:
  - watch & add files, compute adler32, submit FTS jobs, update status from FTS, register file
- Deals with all data types with simple cfg file
- Developed at PIC

FTS

- FTS = gLite File Transfer Service (by EGEE)
- Between SRM endpoints: BeStMan server in LP
- Queue of files defined by origin, destination & checksum
- Limited protection against errors (n retries)
- Provides information on individual files

multiVAC

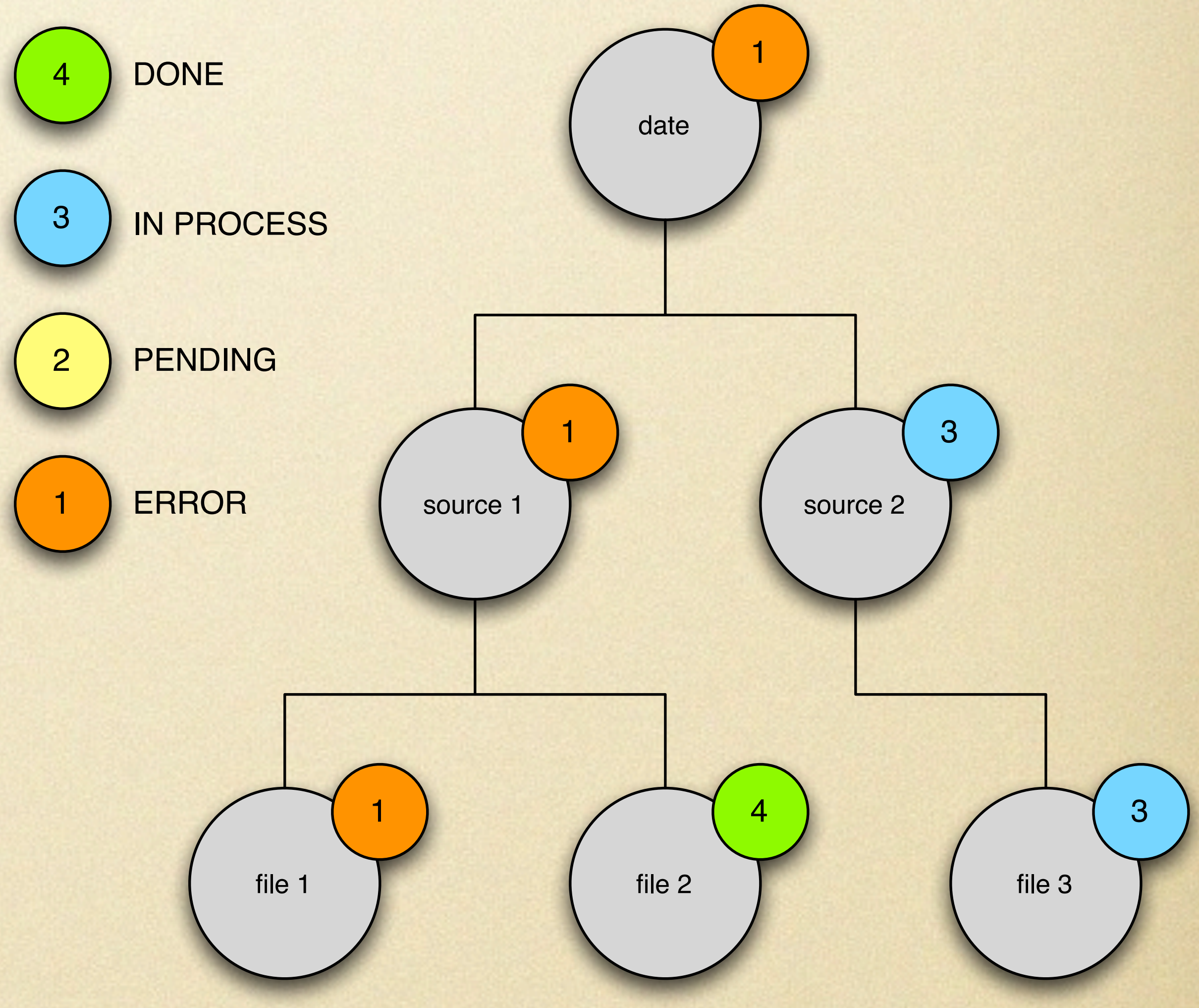
- multiVAC (Versatile Application Core)
- Coded in Python 2.4 (req. by gLite)
- PostgreSQL database
- Db access using sqlalchemy
- Developed at PIC

multiVAC

- Hierarchical collection of elements, with a defined state and arbitrary tags (metadata)
- Workflow: finite-state machine with priorities
- Calculated states based on children & priority
- Versatile: interesting for applications besides data transfer, like computing, monitoring, ...

multiVAC element tree

- Hierarchical structure
- Status changes propagate upwards, following priorities
- Easy to track problems
- Can fix element status to avoid propagation



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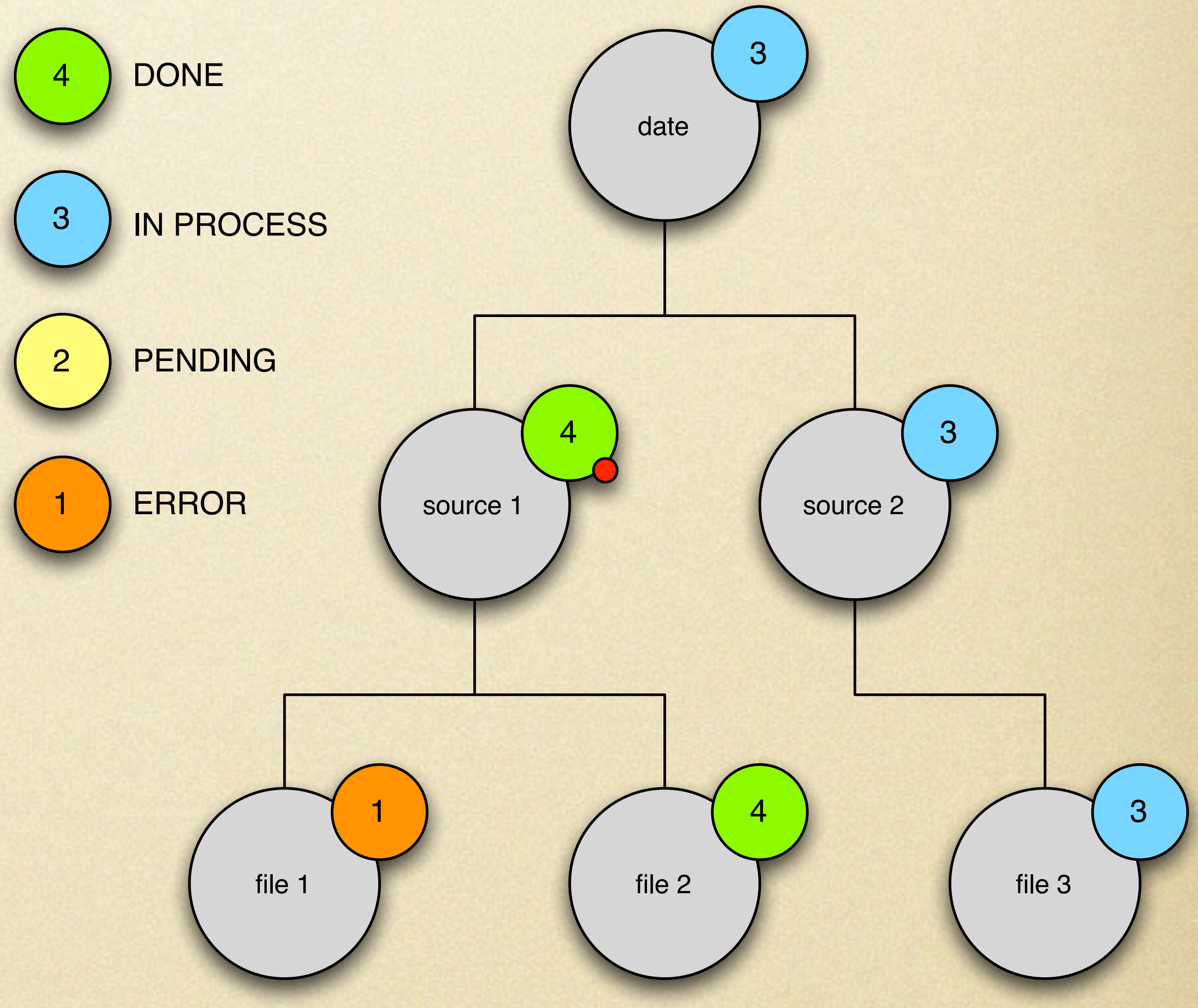
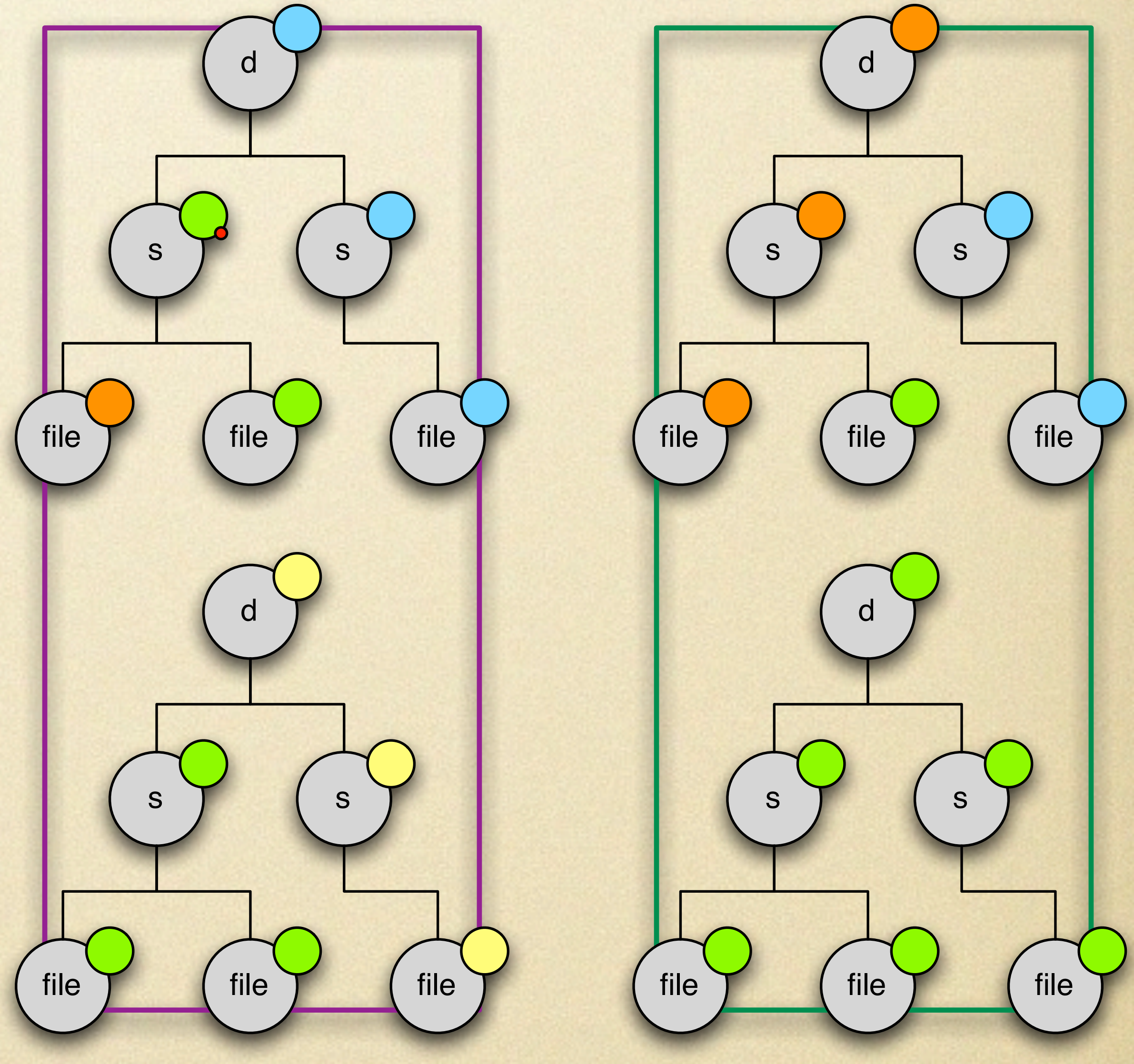
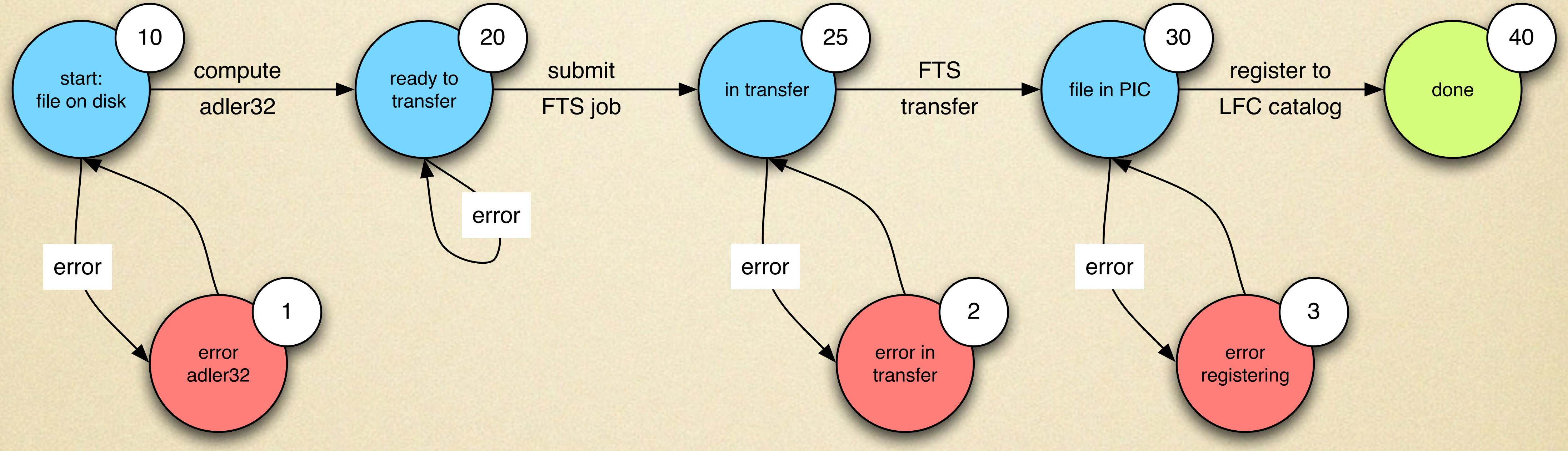


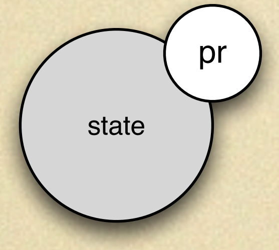
bring it together

- DataTransfer app
- 1 data type = N trees
- agents act on trees looking for specific status, elements, ...
- states defined w.r.t. application workflow

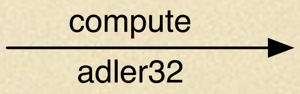


workflow





State with its assigned priority



Process (agent)

DataTransfer status

- Currently testing, in production very soon
- Missing:
  - interaction with OSA: this week
  - automation: next week
  - optimization: always!
- Test results show good performance: OK!

outreach

- Already some projects showed interest in multiVAC and the DataTransfer app in particular
- It may be also interesting for you!

Conclusions

- The DataTransfer application has been developed to deal with the data transfers of a multi-TB/year experiment
- It is based on multiVAC, a PIC development which can be the base of many applications
- It uses gLite FTS as the file transfer method
- Interesting for projects with similar needs