Adapting ATLAS@Home to trusted and semi-trusted resources

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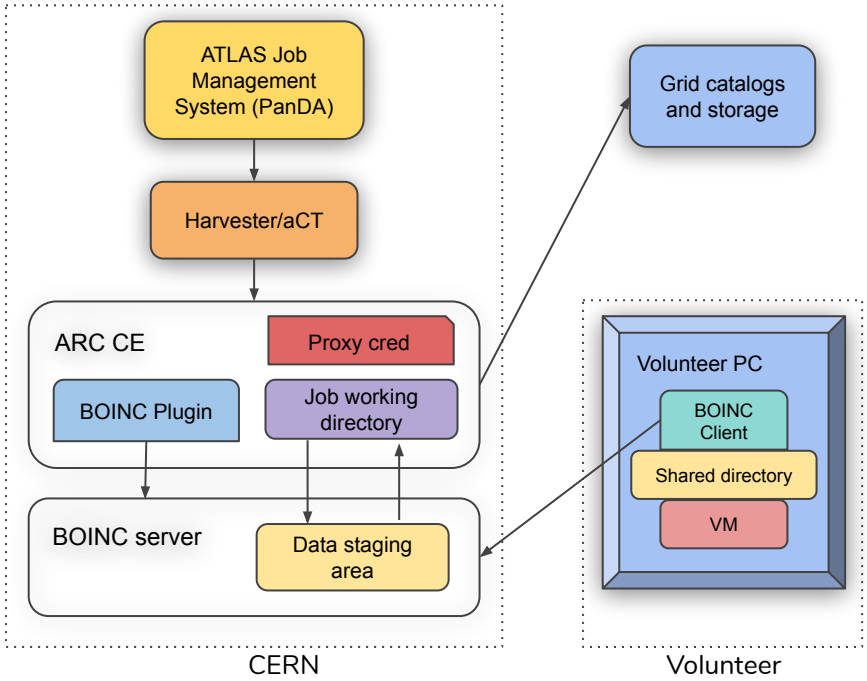
ATLAS@Home: Volunteer computing for ATLAS

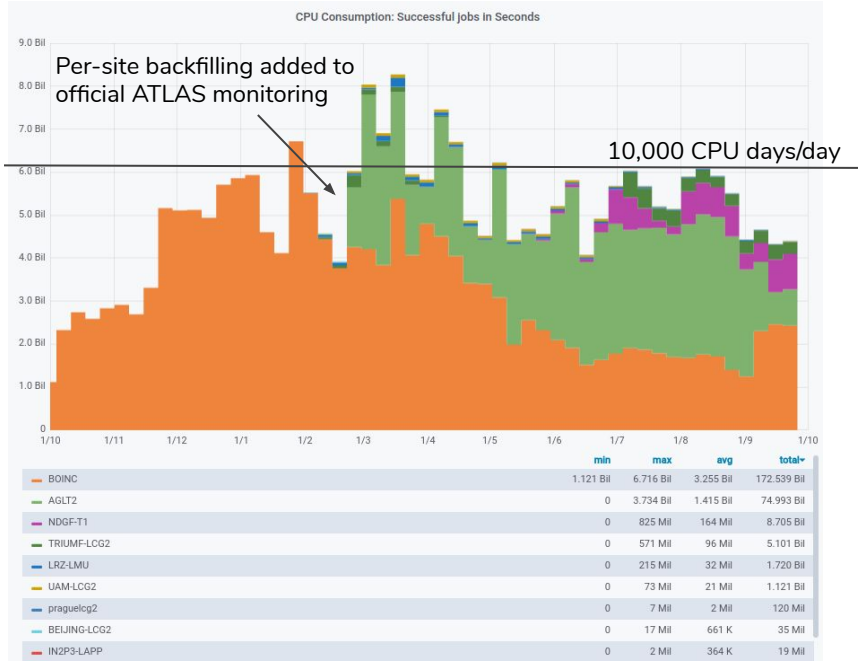
- “Free” but untrusted computing resources
- Architecture was designed to give a clear separation between volunteers and the rest of the ATLAS grid
  - Isolated payload
  - Data staging sandbox
  - Result validation



Expansion beyond traditional volunteers

- ATLAS@Home is now also used as a backfilling platform on Grid sites
  - Native Linux version running in Singularity container instead of VirtualBox
  - Independent from batch system and grid jobs
  - Not affected by grid services downtime
  - By design BOINC does backfilling
- Up to 50% of work performed by Grid backfilling
- Can be installed on a worker node in one line:

```
curl http://atlasathome.cern.ch/Atlas-test/scripts/install_atlasathome.sh
| bash -s -- --uid <boinc_authenticator> --ProDir /home/boinc
```

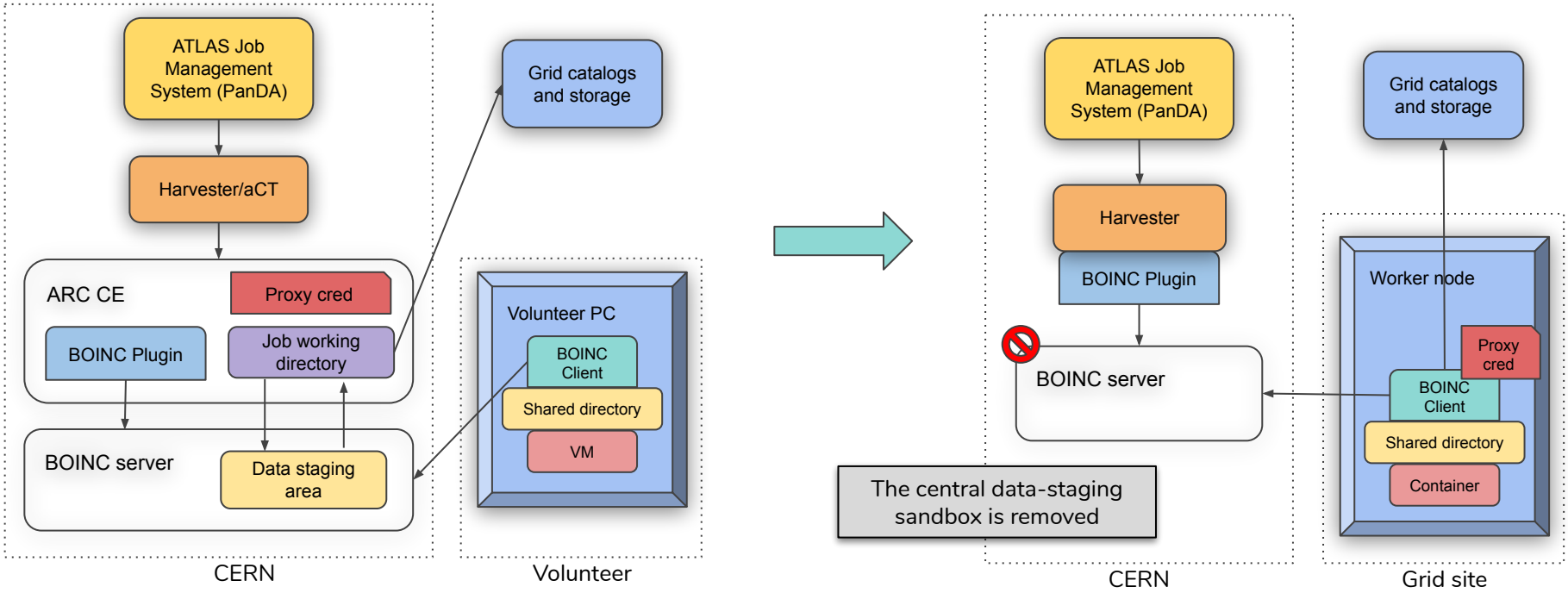


CPU consumption of ATLAS@Home jobs from Oct ‘18 to Oct ‘19. From March ‘19 jobs running on grid worker nodes are accounted under the corresponding site.

Backfilling trusted resources

- Backfilling resources (Grid worker nodes) are trustable
- In addition scaling up could cause a data transfer bottleneck in the sandbox
  - Current tasks are MC simulation
  - 200 events per job, 5-30 mins per event (depending on physics and CPU power)
  - 4000 - 20000 jobs per day
  - 300MB input, 200MB output
  - Up to 10TB traffic per day (100MB/s)
  - Probably not feasible for scaling up one order of magnitude

Backfilling trusted resources



How it works

- A BOINC plugin was written for Harvester
  - Uses BOINC RPC (python wrapper around XML) to communicate with BOINC server
  - Submits proxy and simple wrapper which downloads ATLAS pilot wrapper then runs it
  - Queries status of jobs
  - Copy logs (pilot stdout) of finished jobs to harvester web area
- Why not just run a “pilot launcher script”, vacuum model etc?
  - It would require:
    - A scheduling system to start processes on each worker node
    - A way to control how they run alongside the real jobs from the batch system
    - A secure means of getting the X.509 credential
    - A way for central operations to monitor these processes
  - i.e. implementing something that looks a lot like BOINC

Backfilling status

- A test set up exists with a private BOINC server and a PanDA queue BOINC_BACKFILL running event service jobs
- Future plans:
  - Setting up on a real grid site
  - Dynamically adapting to the site running the job (data transfer to/from local storage)
  - Possibly using other workflows than simulation (eg event generation)

Finished job: https://bigpanda.cern.ch/job?pandaid=4500811827

PanDA Event Service job details for job **4500811827**

PandaID	Owner WG	TaskID	Mode	Cores	Status	Substate	Created
4500811827	mnegrini / AP_HIGG	19195544		1	finished	es_wait	2019-10-03 06:20:07

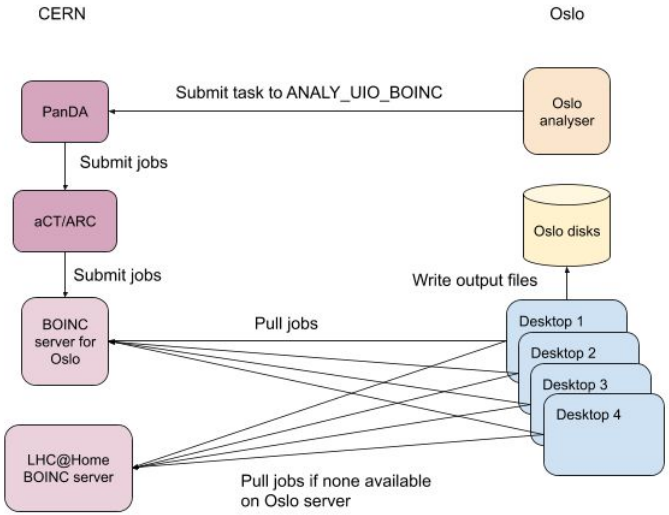
Job type: simul **Job transform:** Sim_tf.py **Dispatched event states:** merged(224)

Datasets: In: mc16_13TeV:mc16_13TeV.345337.PowhegPythia8EvtGen_NNPDF3_AZNLO_ZH125J_MINLO_llWWlvlv.merge.EVNT.e5810_e5984_tid19195541_00
Out: mc16_13TeV.345337.PowhegPythia8EvtGen_NNPDF3_AZNLO_ZH125J_MINLO_llWWlvlv.simul.HITS.e5810_e5984_s3126_tid19195544_00

Dispatched event states	merged(224)
TaskBuffer return code	115
TaskBuffer message	finished since an associated ES or merge job PandaID=4501641145 finished

ATLAS@Work

- "*ATLAS@Work: Boosting research by running ATLAS@Home on HEP desktops and other opportunistic computers*"
- A project at the University of Oslo to use idle office desktops to boost local user analysis
- Users submit regular PanDA tasks but specify running on a special queue
- Desktops are connected to a private BOINC server which distributes tasks
- Outputs are written directly to local Oslo grid disks



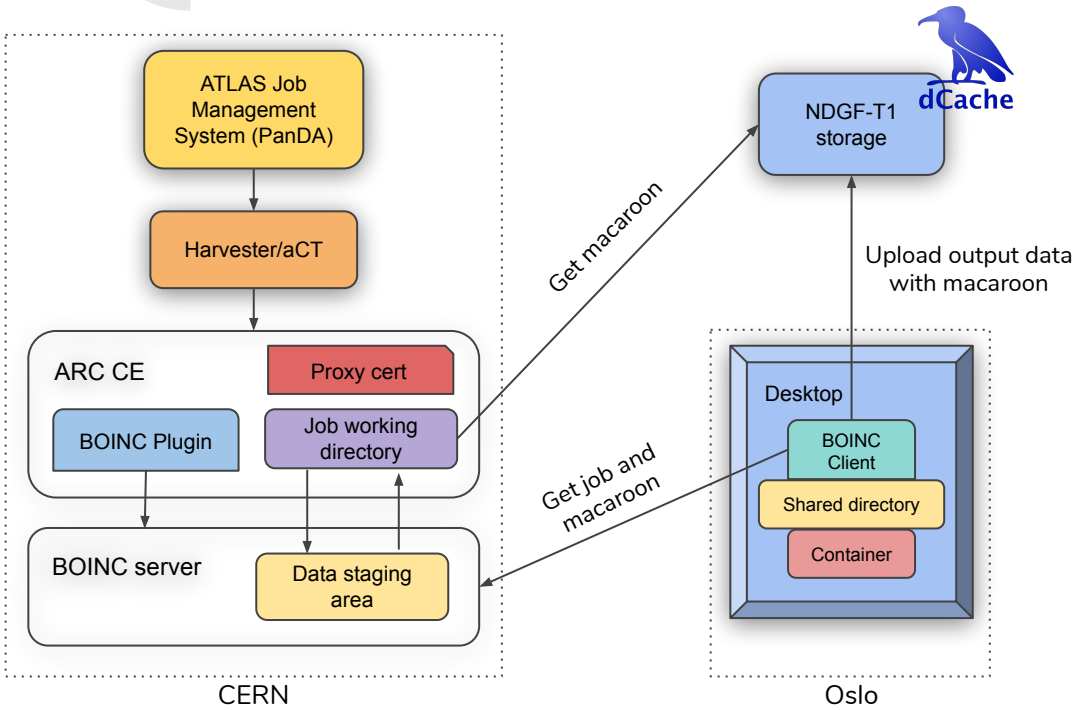
ATLAS@Work: Data management using Macaroons

- Student desktops are a “semi-trusted” resource
  - Allowed to interact with grid storage to read input data and write output data
  - But not allowed production grid proxies with full powers
- Macaroons are a simple way of providing time- and resource-limited access to a storage resource through “caveats”
  - “With this macaroon you can upload to http://storage.org/data/file1 for the next 24 hours”
  - A macaroon can only be used for a specific operation on a specific file, making them more secure than grid proxies
- ATLAS@Work macaroons are requested like this:

```
auth="-E $userProxy --cacert $userProxy  --capath /etc/grid-security/certificates"
caveats_boinc={\"caveats\":[\"activity:UPLOAD\"],\"validity\":\"PT24H\"}
curl $auth -sH 'Content-Type:application/macaroon-request' -X POST -d '$caveats_boinc' $output_file
```

- “Give me a 24h token to upload to this filename”

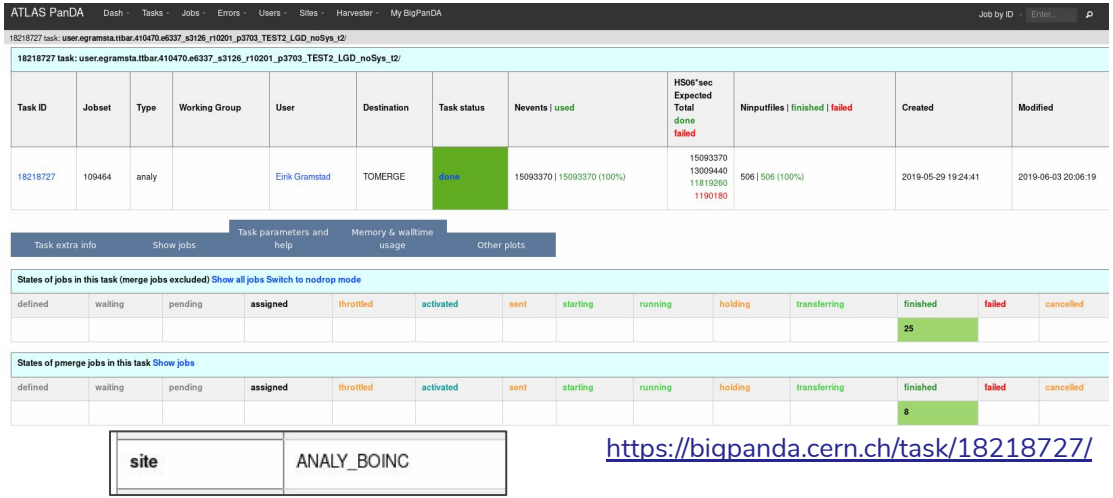
Macaroon Implementation in ATLAS@Work



- Macaroons are enabled on NDGF-T1 dCache WebDAV door
- ARC CE uses the proxy to request macaroons for the job output files
- It passes the macaroons to BOINC along with the job description
- The BOINC client downloads the job and macaroons
- At the end of the job it uploads the output files using the macaroons

ATLAS@Work status

- A queue in PanDA ANALY_BOINC sends jobs to the private BOINC server for Oslo users
- Some desktop machines in Oslo are connected to this server
- Real analysis tasks have been completed successfully
- Future plans:
  - Increase the pool of resources
  - Try the macaroon concept with real volunteers



https://bigpanda.cern.ch/task/18218727/

Conclusions

- The expansion of ATLAS@Home beyond its traditional “@home” base has driven some new developments and optimisations
- Running in a “Grid pilot-like” way on fully trusted resources like worker nodes relieves potential data management bottlenecks
- Macaroons provide a useful mechanism to allow restricted access to Grid storage, and could potentially be used by the real @home volunteers

Acknowledgements

- Thanks to
  - CERN IT for hosting the BOINC infrastructure and help integrating to LHC@Home
  - All our volunteers not just for resources provided over the years but for support in helping out others with problems
  - Grid site admins willing to risk running ATLAS@Home alongside their Grid jobs
  - Analysers at University of Oslo testing out ATLAS@Work

- Join us! http://lhcathome.web.cern.ch/projects/atlas