Advances in ATLAS@Home towards a major ATLAS computing resource

David Cameron, University of Oslo
Wenjing Wu, IHEP & CAS
Alexander Bogdanchikov, Budker Institute of Nuclear Physics
Riccardo Maria Bianchi, University of Pittsburgh
On behalf of the ATLAS collaboration
Why volunteer computing for ATLAS?

- “Free” computing resources
- Outreach, letting people contribute and feel part of HEP experiments
- ATLAS@Home started in 2013, in 2017 joined forces with LHC@Home
- More info on LHC@Home and BOINC in [LHC@Home talk](#)
Expanding beyond traditional volunteers

- Traditional volunteer resource of home PCs is static or declining
- Entry barrier to ATLAS@Home for non-experts is rather high compared to other projects
- At the same time ATLAS does not exploit fully Grid CPUs
  - Software has inefficiencies
  - Initialisation and finalisation steps in multi-core jobs
  - Draining and ramping up around downtimes
  - Scheduling inefficiencies (draining a node to run a multi-core job)
- This led to investigating using ATLAS@Home as a backfilling platform
  - Independent from batch system and grid jobs
  - Not affected by grid services downtime
  - By design BOINC does backfilling
Removing the need for VirtualBox

- ATLAS@Home was built around using VirtualBox to provide a uniform execution environment (75% of volunteers use Windows)
- Not necessary for Linux machines
  - Admins not keen on installing VirtualBox on worker nodes
  - Not easily possible to run VM inside another VM (on cloud infrastructures)
- -> Creation of native Linux version
  - Runs natively on SLC6/Centos7
  - Uses a singularity container on other Linux OS
    - Image is standard SLC6 image used on many ATLAS sites
- Install BOINC client on worker nodes and configure to run in background
  - E.g. with high nice value
  - Doesn’t affect batch system scheduling since it doesn’t know about BOINC processes
Usage of different apps and versions

- ATLAS and sixtrack are roughly equivalent in terms of CPU time consumed
- The majority of CPU for ATLAS@Home now comes from the native app

Note: these plots do not include ~3k CPU days/day for ATLAS from LHC@Home development server
Current volunteers

Top 5 (~85%) are ATLAS/CERN-related resources:

1. **Agile Boincers**: Machines being commissioned/decommissioned in CERN computing centre
2. **TRIUMF**: Canadian T1 site ~5k cores in backfill
3. **BEIJING**: Chinese T2 site ~500 cores in backfill
4. **LRZ-LMU**: German T2 site ~200 cores in backfill
5. **WLCG Performance Cluster**: used for ATLAS software performance testing, ATLAS@Home in background

More information on how Grid sites are used in “Backfilling the Grid with Containerized BOINC in the ATLAS computing”, Wed 11:45, Track 7
Impact of ATLAS@Home

Events processed per week by ATLAS@Home June 2017 - May 2018

CPU consumption per day of ATLAS@Home jobs in April/May 2018 - equivalent of 10,000 continuous running cores
Impact of ATLAS@Home

ATLAS simulation events processed in May 2018

ATLAS@Home (4.5%): second largest simulation site

Average efficiency of ATLAS@Home jobs in May 2018

Average efficiency of ATLAS@Home jobs is 73% compared to 84% for all ATLAS simulation
Ongoing research and development

Dynamic data staging with event-level granularity using the ATLAS event service

ATLAS Qualification task E. Rye (UiO): “Enhanced graphical interface and workloads for ATLAS@Home”

Extending the graphical interface to show events in real time
Exploring new workloads outside MC simulation
Local University of Oslo project ATLAS@Work: implement private analysis cluster at UiO using ATLAS@Home on office desktops

Masters thesis of D. Sidiropoulos Kontos (Lund University): validation of ATLAS@Home as a platform for event generation
Conclusions

- ATLAS@Home has expanded far beyond its traditional “@home” base
- However it is still a useful tool to connect and involve the general public in HEP
- The move towards backfilling Grid sites provides ATLAS extra resources at no extra cost

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  - 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