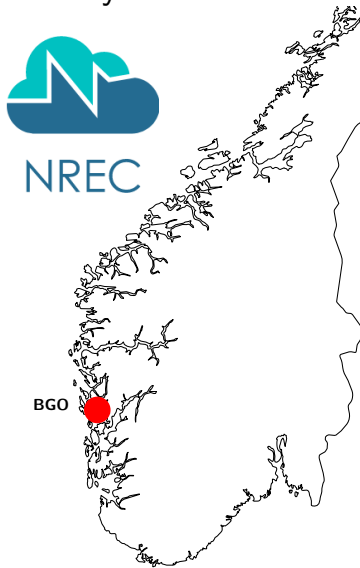
Infrastructure of the ALICE Grid computing setup in Norway

- Tier-1 hardware is hosted within the Norwegian Research and Education Cloud (NREC)
- All nodes are provisioned and managed as Infrastructure as Code (IaC)

GitLab HashiCorp Terraform ANSIBLE

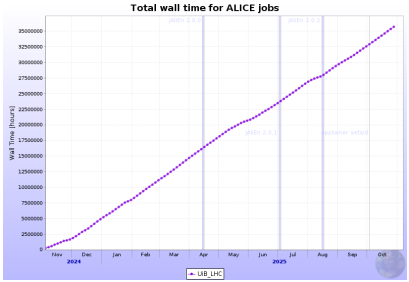
Current resources:

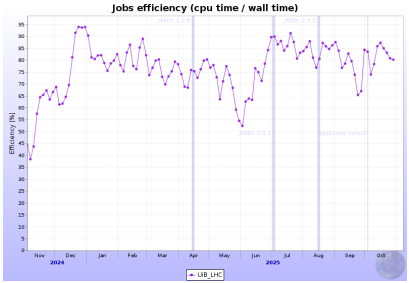
- 44 compute servers, hosting compute workers and dCache pool intances
- 320 worker instances with 16 CPUs providing 45 MCPUh/a, $\sim$ 60 kHS06
- 50 Dell disk servers, 7.8 PiB raw, 5.6 PB usable space
- 10 PB tape storage



Compute resources

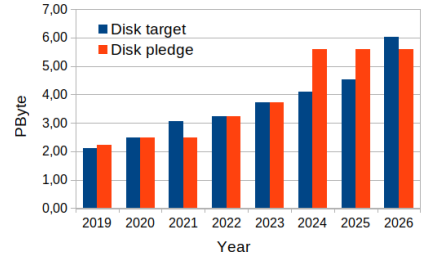
- operating 325 virtual nodes with 16 cores
  $\rightarrow$ 5200 cores
- 45*10^6 CPUh per year
- pledged: 55 kHS23 (target 51.48 kHS23 in 2026)
- operating opportunistic resources - hardware from 2019 with end-of-life in 2024 - allows UiB to pledge more than expected, reacting on a request by ALICE experiment
- Small investment with the rest of NorLHC-II infrastructure project in 2027; applying for funding for investments in 2028 and 2030 (NorLHC III)
- Using JAliEn middleware

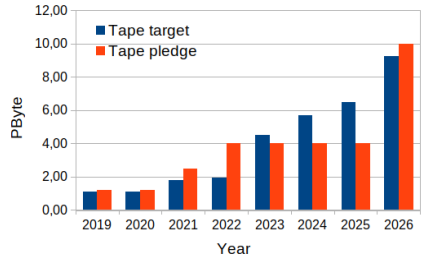




Storage resources

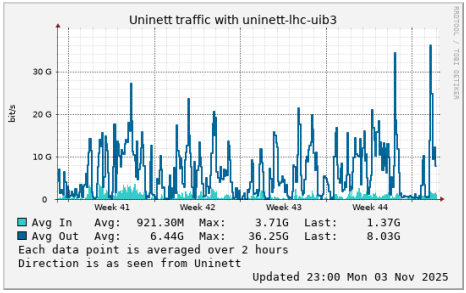
- 5.6 PB Disk storage as Ceph cluster
  scalable, distributed storage solution
- expected disk upgrade in 2026: $\sim$ 2.5 PB
- Ceph operation is challenging if the cluster is nearly filled
  $\rightarrow$ occasionally observing instabilities
- tape upgrade 2025 finished: new drives, new server, extended frame, same robot
- 4 PB (2019) plus 6 PB (2025) tape storage

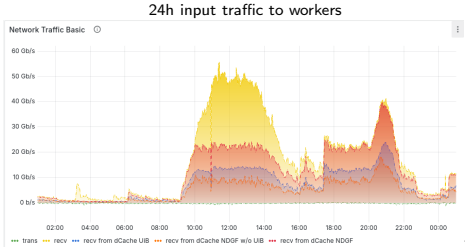




Network

- got 100 Gb links operational in March 2025
- peak traffic up to 50 Gb, but at the moment almost no data migration to disk or tape
- network traffic comes almost entirely from Grid jobs
- data locality can not be fully exploited because of distributed Tier-1





Status and Plans

- All in all stable operation, very high availability
- Tape upgrade accomplished
- We can fulfill pledges until 2027 with some smaller investments in 2026 and 2027
- Infrastructure application NorLHC III including Norwegian Grid resources close to be finished
- Second application to cover NT1 funding in Norway, deadline Nov 12
- Preparing to order storage servers in December 2025, planned delivery in January