Experience and perspective from a Virgo Tier 1: CNAF

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Virgo@CNAF

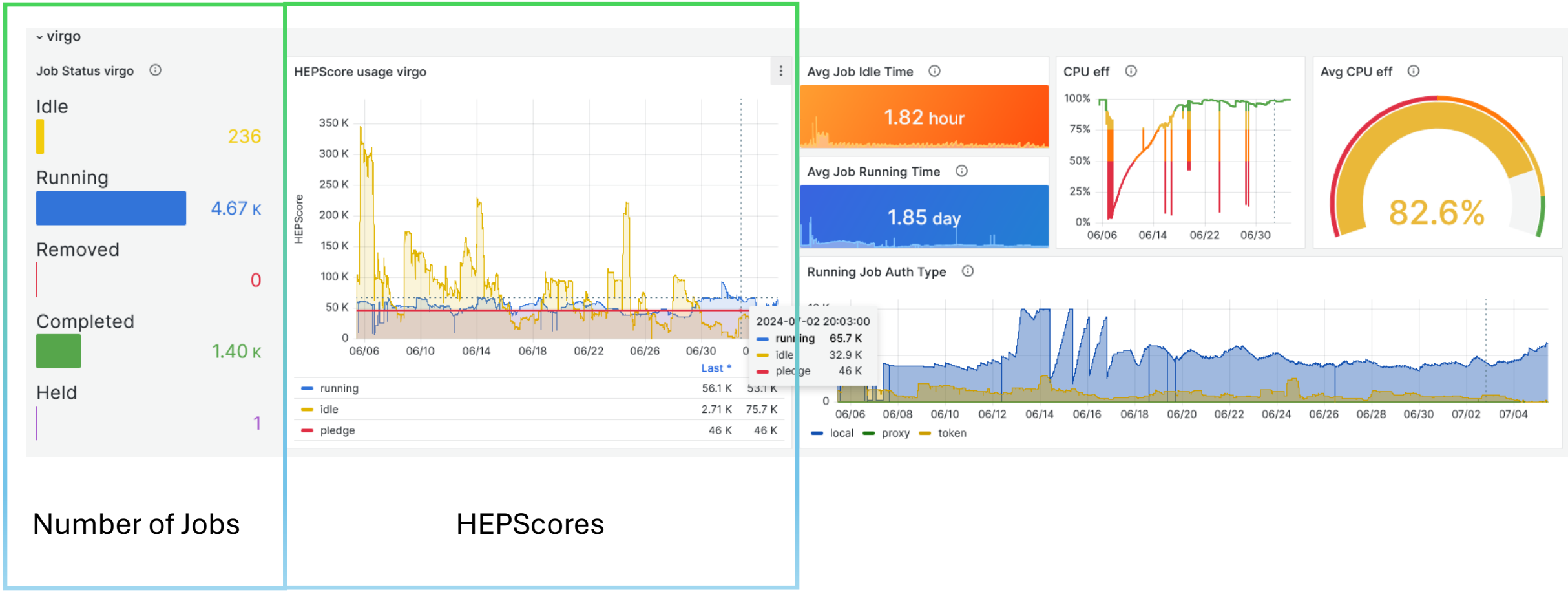
- decades-old support of Virgo (and LIGO) at CNAF
- many **ad-hoc services** alongside with the “typical” ones
  - HTCondor batch system with **dedicated access point (aka submit node) and LIGO sub-share**
  - **stashcache over CVMFS**
  - Dedicated Spectrum Scale (aka GPFS) filesystem
  - **IaaS Cloud access including GPUs**
  - **CephFS on Cloud**
  - **Dedicated K8s tenant for LL**
  - Dedicated servers for interactive access
  - Legacy VOMS server
  - **Dedicated INDIGO-IAM instance**

Virgo in the INFN-Tier1 Batch System

- Dedicated user interfaces
  - 2 x (4 Core, 8GB RAM)
  - ui01-virgo.cr.cnaf.infn.it ui02-virgo.cr.cnaf.infn.it
- HTCondor share
  - 46’000 HEPSpecs
  - 73% (33’580 HS) in the Virgo sub-share
  - 27% (12’420 HS) in the LIGO sub-share

Virgo in the INFN-Tier1 Batch System: the last 6 months

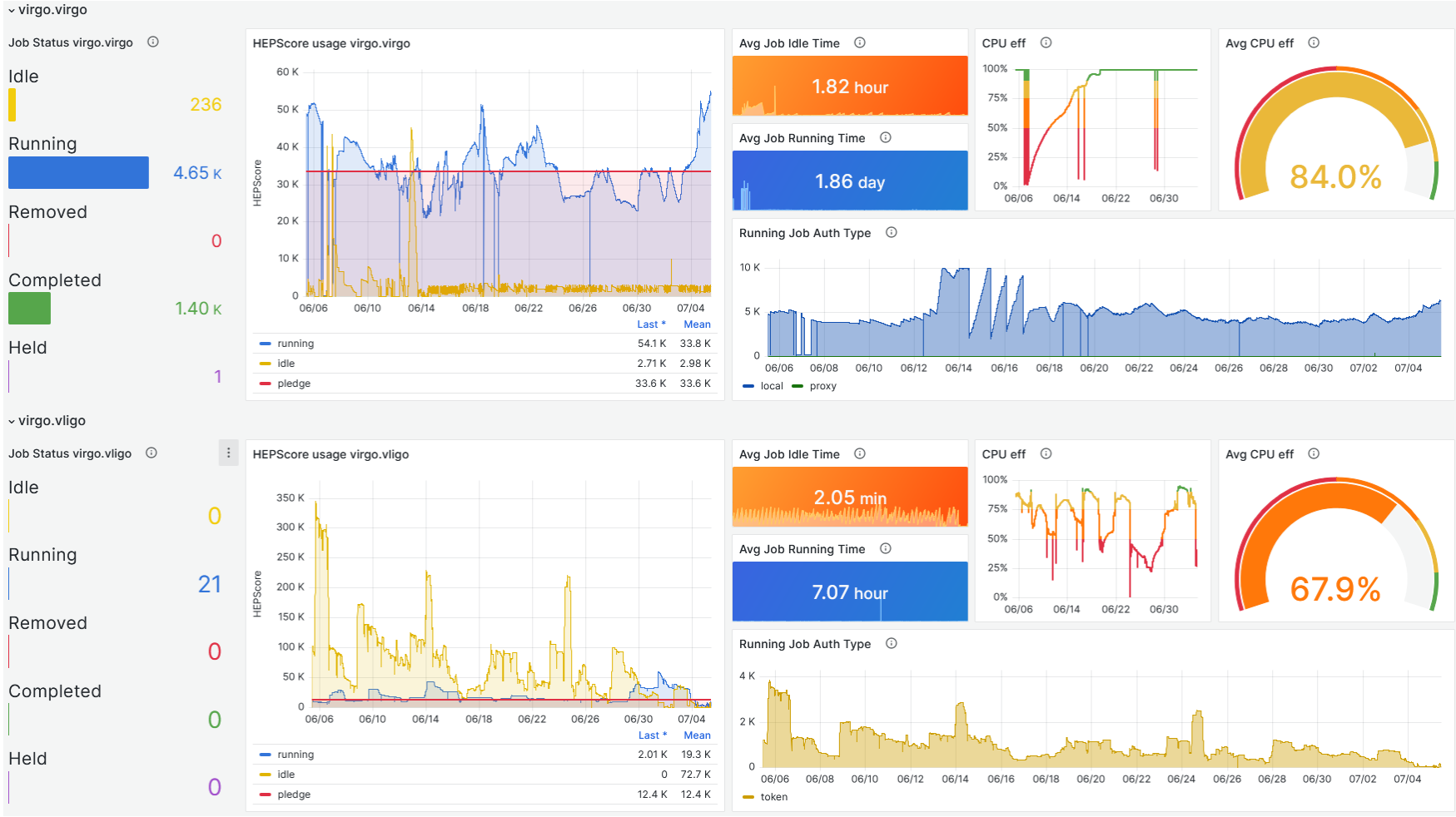
Virgo in the INFN-Tier1 Batch System: the global share



Number of Jobs

HEPScores

Virgo in the INFN-Tier1 Batch System: Virgo and LIGO sub-shares



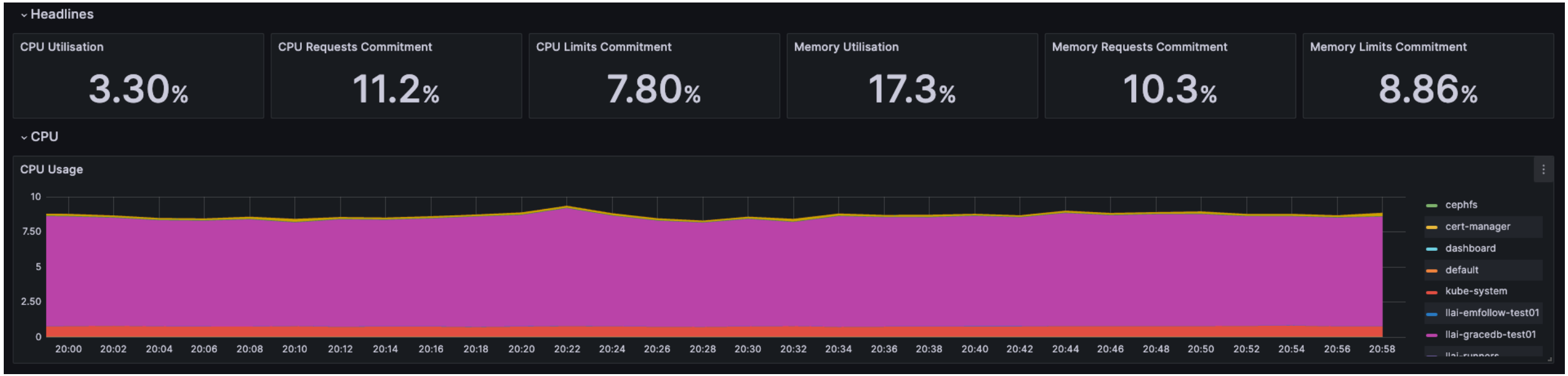
VIRGO jobs require 1 core

LIGO jobs require 8 cores

Virgo in the CNAF Cloud System: the K8s clusters for low-latency analysis

- Kubernetes cluster composed of 19 nodes (3 HA master nodes), **300 vCores**, **600 GB vRAM**, **2 TB** on CephFS as Persistent Volume Claim (PVC)

- CNAF-managed cluster, Virgo people are unprivileged users



Virgo in the CNAF Cloud System: IaaS and GPUs

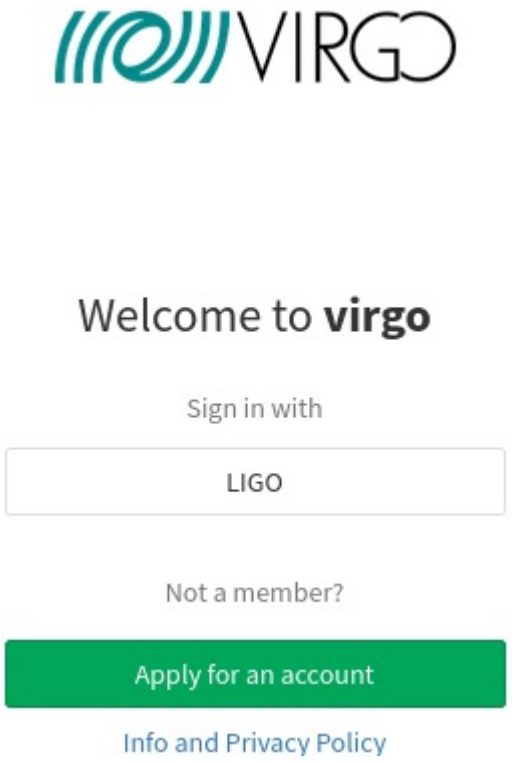
- 1 Web service for publishing LIGO accounting metrics
- 1 dedicated **nVidia A100 80GB GPU**, for testing and tuning del porting of Hough analysis
- Virgo Access Point
  - direct job submission from IGWN
  - currently based on HTCondor 10.4 / CentOS7
  - soon based on HTCondor 23 / AlmaLinux9.
  - Authentication and CVMFS support via SCITOKENS (htgettoken)
- The services above: **19 vCores, 38 GB vRAM, 6 TB Ceph Volumes**

Storage services for VIRGO

- Dedicated **760 TB** filesystem (gpfs_virgo, disk) and dedicated **123 TB** filesystem (gpfs_virgo4, disk buffer for tape)
  - SRM + HTTPS / HTTPS access via StoRM backend and StoRM WebDAV endpoints shared with other experiments
- **3.48 PB** archived on tape
- Dedicated **stashcache** service supported with a dedicated **15 TB** filesystem (gpfs_xcache)

AuthN/Z services for Virgo

- Legacy VOMS server with 51 registered users
  - https://voms.cnaf.infn.it:8443/voms/virgo/
- Dedicated INDIGO-IAM instance with XX registered users
  - https://iam-virgo.cloud.cnaf.infn.it
  - User Authentication through the LIGO IdP
  - Future use to access CNAF storage via Grid



Communication and local support

- Tier 1 “Comitato di Gestione” (CdG) every 3rd Friday of the month
- Tier 1 user support group (user-support@lists.cnaf.infn.it)
- Stefano Dal Pra is the local dedicated contact point for Virgo

Open issues

- It’s hard to obtain fixed computing requirements
- K8S Cluster:
  - the usage of the cluster is not very mature
    - large under-usage of the cluster
    - gitlab pipelines depend on highly-unsecure cluster configuration, need work by the Collaboration with the support of the CNAF team
- CVMFS stashcache:
  - problematic and inefficient technology
  - used to distribute experiment data via CVMFS (which is designed for software distribution)
  - needs “manual periodic refresh” to avoid wasting computing time on the computing farm waiting for data from the US
- Ad-hoc services increase the effort requested to the Centre in terms of support