

Virtual Computer Hall tour

Online Training course: Advanced HPC training

15-18 Jun 2026

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ECMWF - User Services - Computing and Software Support team



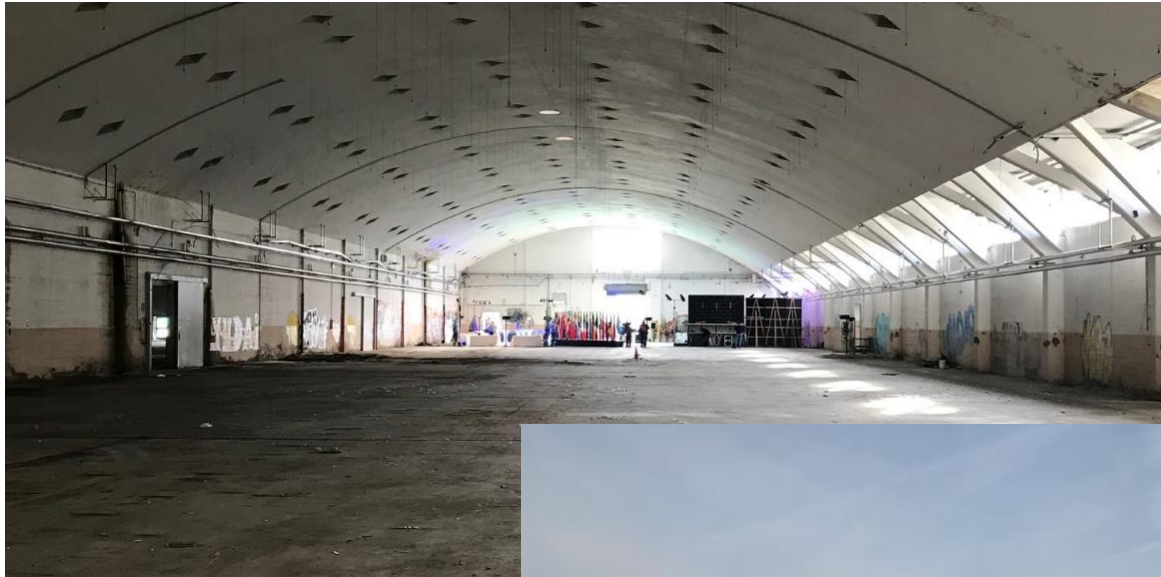
The ECMWF Data Centre in Bologna (Italy)



Located in the Tecnopolo di Bologna

- a former tobacco factory
- designed by Pier Luigi Nervi
- built in 1949 and closed in 1998

How it looked in 2018



How it looked in 2021



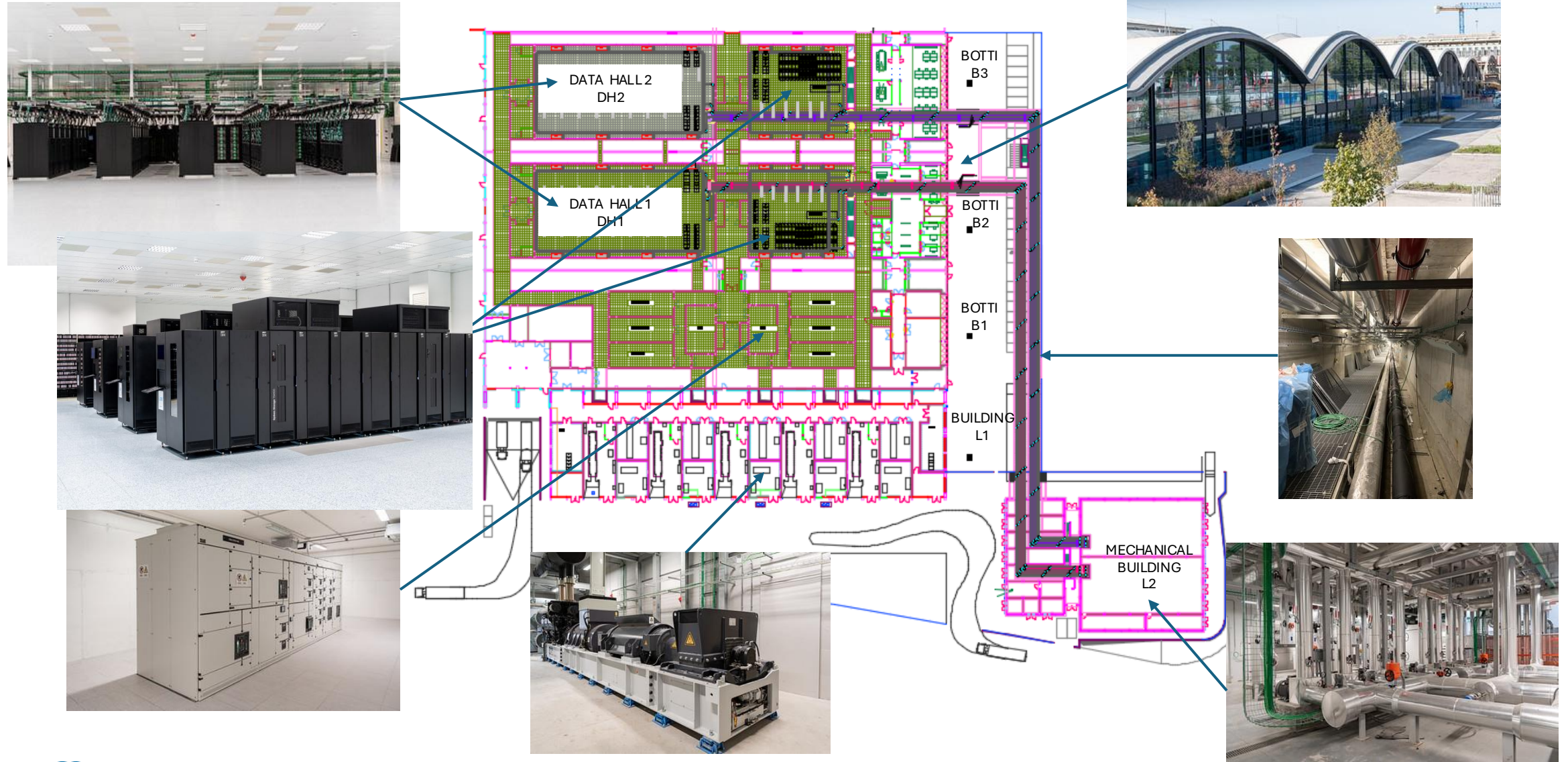
How it looks now



Seen from above

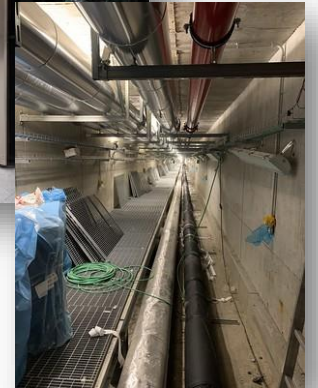


Bologna Data Centre layout



Cooling

- Data Centre cooling system relies on three sources in two thermal plants
 - 4 adiabatic dry coolers
 - 4 geothermal wells
 - 8 chillers + 1 reserve chiller
- These operate alternately and together depending on the season
 - Adiabatic dry coolers only in winter
 - Geothermal wells operate when external temperatures become too high
 - Chillers used in the hottest season
- Chilled water is pumped from the L2 building to the Data Halls



Diesel Rotary Uninterruptible Power Supply

- 5 x (flywheel + diesel generator)
 - 3 tons, 3000 rpm, 2MW

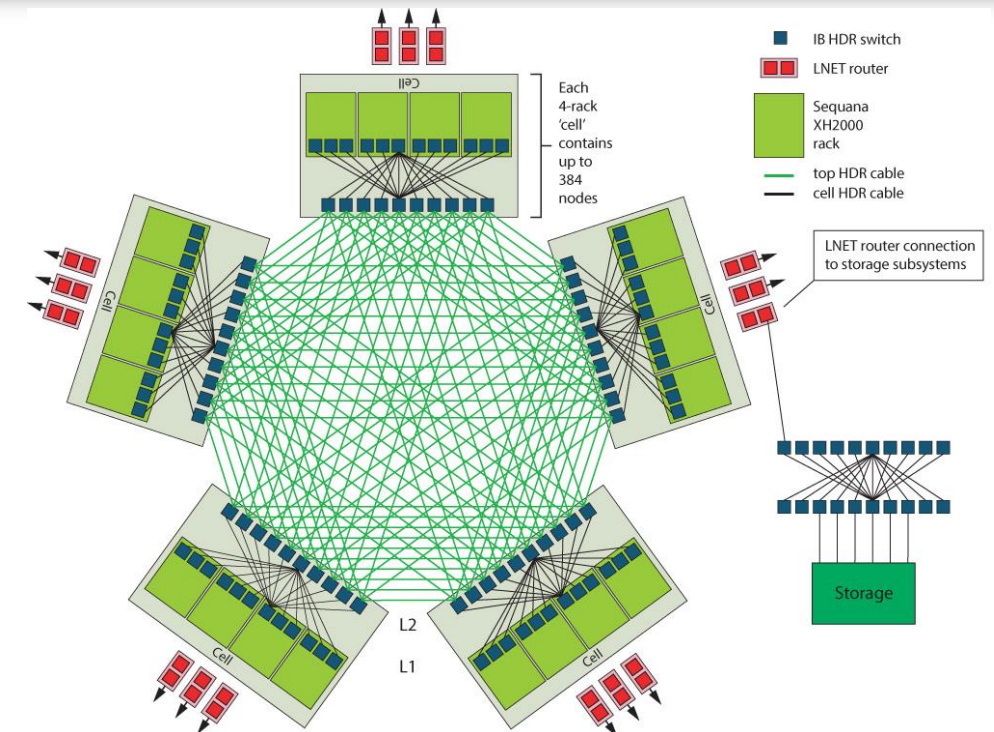
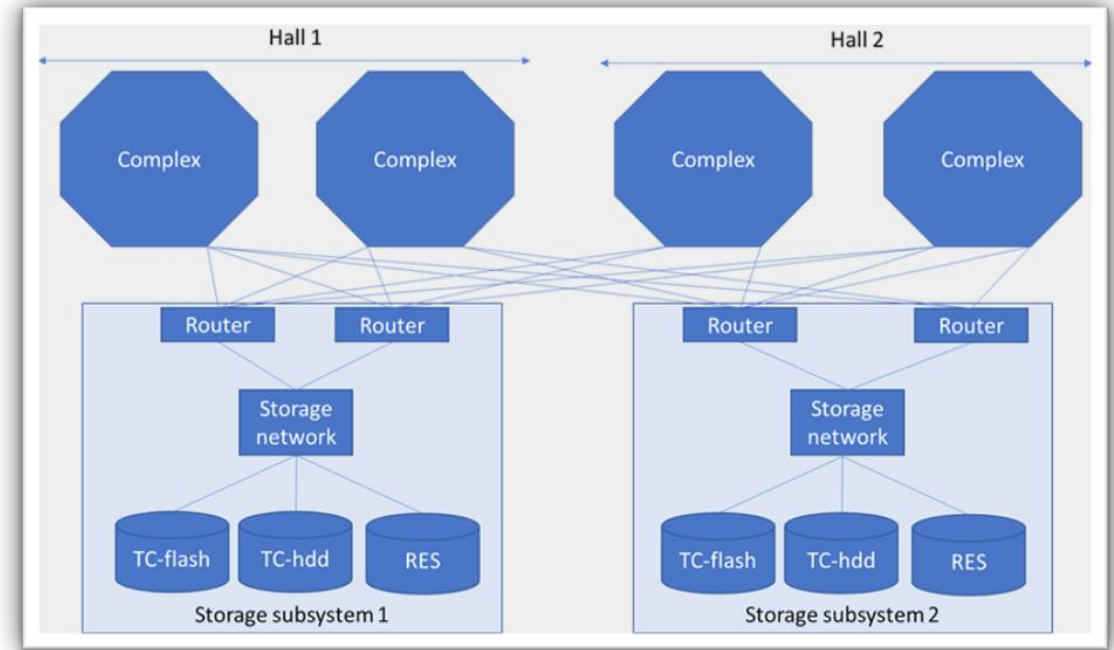


High Performance Computing Facility



Atos BullSequana XH2000

- 4 Complexes
 - Two in each hall
 - Each Complex consists of two partitions:
 - Parallel:
 - ATOS XH2000 Water cooled racks
 - Arranged in 5 “cells”, 4 racks per cell
 - IB HDR Fat Tree in each cell. Each cell connected to every other cell
 - 1920 nodes for parallel compute
 - AMD Rome 64 core processors
 - General Purpose (GPIL)
 - 112 nodes for general purpose use
 - More memory, local SSD
- One Slurm scheduler in each complex



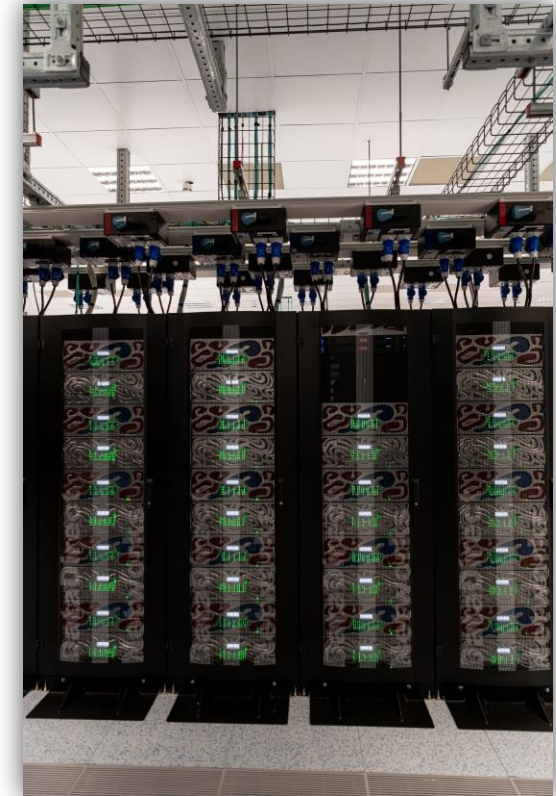
Atos BullSequana XH2000 – in numbers

Atos Sequana XH2000	
Clusters (AA, AB, AC, AD)	4
Total number of compute nodes / GPIL nodes	7,680 / 448
Processor type	AMD EPYC Rome
Cores	64 cores / socket ; 128 cores / node
Base frequency	2.25 GHz (compute) / 2.5 GHz (GPIL)
Memory/node	256 GiB (compute) / 512 GiB (GPIL)
Total memory	2.1 PiB
Total number of cores	1,040,384
Operational storage - SSD	1.3 PiB
Operational storage - HDD	12 PiB
Research storage	77 PiB
Total storage	~90 PiB

1 Cluster is equivalent to ~ 64,000 quad core laptops, 1,200 m stack (if the laptop is about 2cm thick)

Storage Subsystem

- Global Lustre parallel filesystems
 - Disk and Solid-State storage
 - Separate file systems for time critical operations and research
 - Time Critical Storage
 - 2 Lustre SSD 700TB file systems for production
 - 2 Lustre HDD 5PB file systems for short term storage
 - Research
 - 6 Lustre HDD 13PB file systems
 - Filesystems available to all clusters. 90 PB in total.
- NFS storage for libraries per complex
- HOME and PERM from NetApp and TrueNAS
- Long term storage in the MARS and ECFS archives



Atos HPC – GPU partition

- 30 GPU nodes integrated into one GPIL cluster, each with:
 - 2 x AMD Rome 7742
 - 512GB DDR4 3200
 - NVidia Redstone board with 4 x A100-40GB
 - 2 x HDR200 InfiniBand connections
- 120 GPUs in total



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 - 2 x AMD Rome 7742
 - 512GB DDR4 3200
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 - 2 x HDR200 InfiniBand connections
- 120 GPUs in total
- 30 nodes, each with:
 - 4 x NVidia Grace Hopper 200 Superchip
 - Grace CPU, with 128 GB LPDDR5
 - Hopper GPU, with 96 GB HBM3
 - NVIDIA NVLink
 - 4 x NDR 400 Infiniband connections
- 120 GPUs in total



NEW



TOP500 – the world's most powerful supercomputers

- List updated and published twice a year
- ECMWF's Atos HPC appears at 227, 228, 229, 230 – November 2025

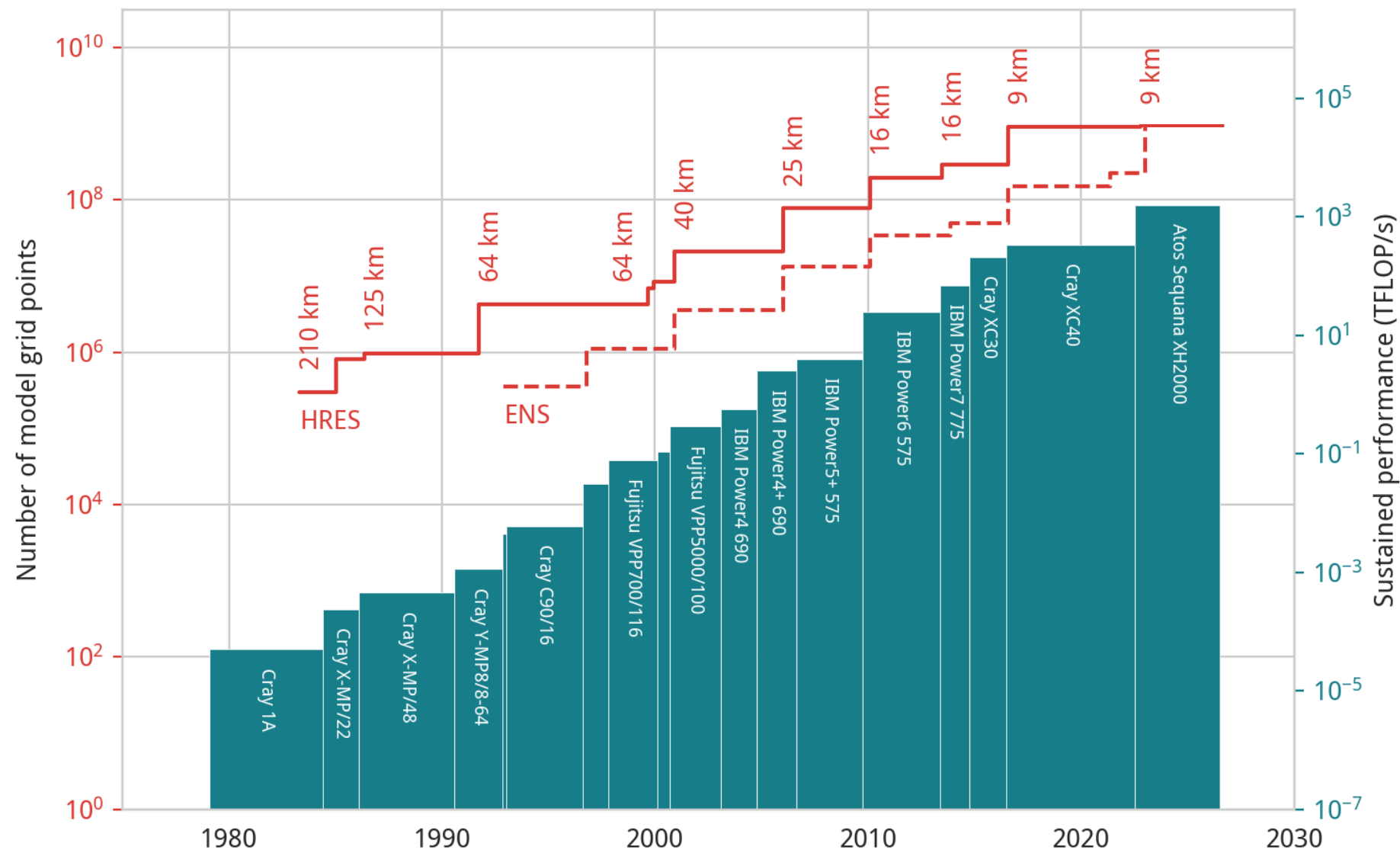
227	HPCF-AD - EVIDEN BullSequana XH2000, AMD EPYC 7742 64C 2.25GHz, Infiniband HDR200, EVIDEN ECMWF Italy	245,760	6.67	8.85	1,200
228	HPCF-AC - EVIDEN BullSequana XH2000, AMD EPYC 7742 64C 2.25GHz, Infiniband HDR200, EVIDEN ECMWF Italy	245,760	6.67	8.85	1,200
229	HPCF-AB - EVIDEN BullSequana XH2000, AMD EPYC 7742 64C 2.25GHz, Infiniband HDR200, EVIDEN ECMWF Italy	245,760	6.67	8.85	1,200
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November 2025



<https://www.top500.org/>

Evolution of ECMWF Supercomputers v HRES and ENS resolution



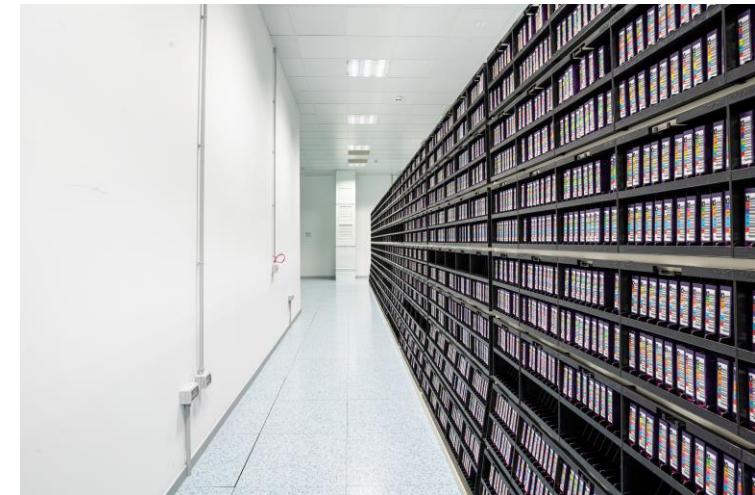
New computer coming soon!

- 2025 – Budget agreed with our member states
- December 2025 – Publication of the Invitation To Tender
- February 2026 – Deadline for submission
- Currently – Assessing the submission(s)
- End of 2026 – Final choice
- 2027 – Installation of the new HPC

Data Handling System

ECMWF hosts one of the largest HPSS archive of >1 Exabyte (EB)

- ❖ Meteorological Archival and Retrieval System (MARS)
- ❖ ECMWF File System (ECFS)
- Primary data: 1.01 EB
- 2nd copy data: 337 PB
- ~600 TB primary data added per day
- Number of tapes:
 - 37,000 primary
 - 29,000 secondary
- Number of tape libraries: 12
- Number of Linux servers: 300
- Total amount of usable disk space: 45 PiB



Common Cloud Infrastructure

- Two production clouds, named CCI1 and CCI2
- Supporting multiple services including:



European Weather Cloud



Copernicus Climate and Atmosphere Data Stores

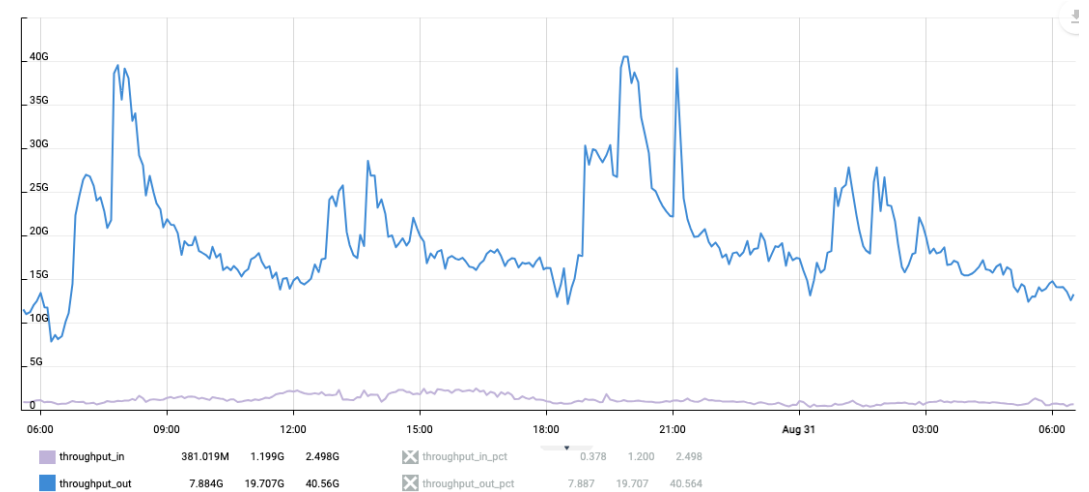
- Openstack as deployed cloud software platform
- Ceph is the backend storage solution



Compute Nodes	68
Compute node CPUs	2 x AMD 7713 2.0GHz,64C/128T
GPU Nodes	16 (each with 2 GPUs per node)
GPU node CPUs	2 x AMD 7543 2.8GHz,32C/64T
Total GPU cards	32 x NVIDIA Ampere A100 80GB
Total HT Cores	19456
Total Physical Memory	117 TiB
Total Storage	11 PiB

Networks

- Internet
 - Dual links to local networks at each of ECMWF's sites
 - Jisc in the UK, GARR in Italy, and DFN in Germany
 - high-speed connections to the rest of the Internet, e.g. GÉANT
 - Bologna: 60Gbit/s uplink to GARR
 - Two routers on our side, each of which has a single connection to a separate GARR router



- ECMWF is a participating organisation in the eduroam federation



The video!

- <https://www.youtube.com/watch?v=iXC5IWDYR9o>

Thank you for your attention!

