



14 September 2021: new ECMWF data centre opens in Bologna, Italy



ECMWF data centre opens in Bologna, Italy

ECMWF's new data centre in Bologna, Italy, is formally opening on 14 September 2021, housing the Centre's new Atos supercomputer system scheduled to begin running operationally mid-2022.

This opening not only marks a new phase in ECMWF life, but also stands as the perfect illustration of the strong collaboration between ECMWF as a collective of nations and each individual Member State.



Overview

The decision to develop a new data centre followed the acknowledgement by the ECMWF Council that the existing facility in Reading, UK, could not accommodate ECMWF's next generation of supercomputers.

In June 2017, following an international tender amongst ECMWF Member States, representatives of all the Member States approved the proposal by the Italian Government and the Emilia-Romagna Region to host ECMWF's new data centre in Bologna. Construction work began in December 2018.

The past two and a half years have seen considerable progress to complete the building works and the tender process for the new supercomputer, during challenging times including the global COVID-19 pandemic.

The new Atos high-performance computers, installed in summer 2021, are now undergoing a series of user acceptance,

operational and reliability tests to complete the acceptance process. The system is currently running in parallel with the existing Cray high performance computing facility (HPCF) until 1 May 2022, when it will take over the provision of the operational service for a period of four years, supporting both operational and research activities.

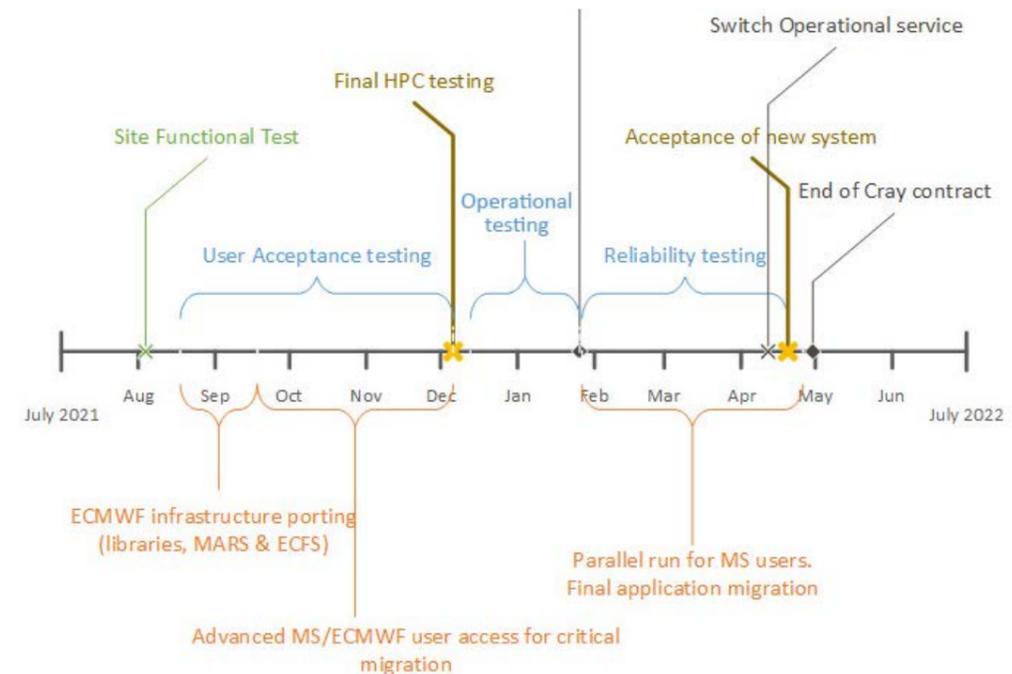
The Data Handling System (DHS), including more than 50,000 tape cartridges, will move from Reading to Bologna with all aspects of the migration planned to be finalised by early 2022.

The improved computing power will enable advances such as:

- a major upgrade of the ensemble forecast horizontal resolution from a grid spacing of 18 km to about 10 km, which is expected to significantly improve forecasts of near-surface temperatures and winds.
- introducing a multi-layer snow scheme allowing better description of near-surface temperature in snow-covered areas.

▲ Bologna data centre

The new facility is planned to become operational in 2022.



◀ Timeline to Atos system acceptance

- issuing extended-range forecasts daily rather than twice-weekly, whilst increasing the number of members from 51 to 100. This will allow a better description of extreme events in the monthly time-range.

The increased capability will also enable the Centre to continue investigative work in the field of machine learning in numerical weather prediction.

Longer-term strategic goals include developing the operational prediction system to run on heterogeneous GPU/CPU HPC architectures and using advanced high-performance computing, big data and AI methodologies to create a digital twin of the Earth with a breakthrough in realism.

Staffing

Some ECMWF staff are already working in the new data centre, and whilst the COVID-19 pandemic has impacted some moves, more colleagues will join later in 2021 and 2022. ECMWF staff in Bologna are being joined by experts from our vendors. All are working to support the data centre and the equipment it houses. The roles range from electrical and mechanical engineers to support the infrastructure, 24/7 operations staff monitoring the performance of the building, systems, applications and services, big data experts, and hardware and software analysts to support not only the supercomputers and meteorological applications, but all of the supporting systems and the Data Handling System.

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The Bologna data centre

The new facility provides the flexibility to accommodate the latest technologies in supercomputing and allow ECMWF to continue on its path towards its long-term strategic goals. It offers flexibility for future expansion requirements and modern infrastructure that supports ECMWF's network and telecommunications requirements.

The data centre is on the site of the Tecnopolo di Bologna campus that is redeveloping the unused buildings and grounds of a former tobacco factory. The campus extends over 13 hectares and consists of newly built and refurbished buildings for public and private research facilities.

The Emilia-Romagna Region maintains the site and general services that are shared with other users of the development (cleaning, site security etc.). It retains ownership of the premises and of any other land, buildings and infrastructure in the area of the Tecnopolo di Bologna and will provide them to ECMWF free of charge during the contract period.

Atos BullSequana XH2000

In December 2019, ECMWF agreed a four-year contract worth over 80 million euros with Atos for the supply of its BullSequana XH2000 supercomputer, to replace the current Cray XC40 supercomputers.

The Atos system will deliver an increase in sustained performance by a factor of about five compared to the current HPCF.

The main system is made up of four self-sufficient Atos BullSequana XH2000 clusters, also called 'complexes'. Each cluster is connected to all the high-performance storage.

There are two types of nodes that run user workloads: 'compute nodes' for parallel jobs, and 'GPIL nodes' for general purpose and interactive workloads. Other nodes have special functions, such as managing the system, running the scheduler and connecting to the storage.

More details about the system configuration are available in an [ECMWF Newsletter article about the new high-performance computing facility](#).



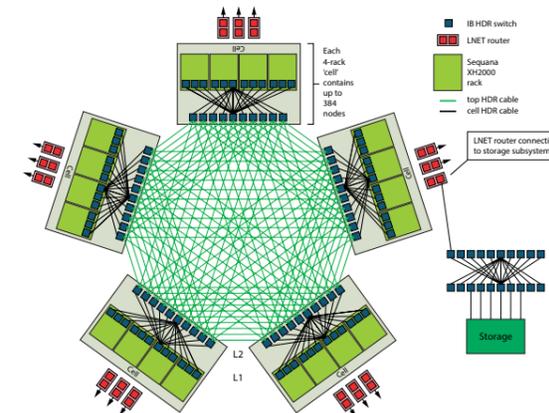
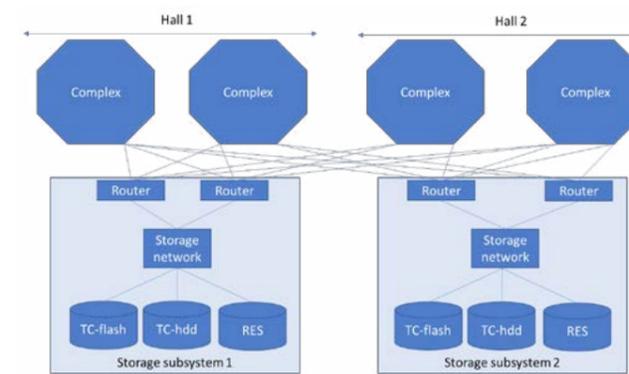
▲ Data hall

The new 1,000m2 data hall houses the Atos BullSequana XH2000 supercomputer.

◀ Atos HPC – Compute

| Atos BullSequana XH2000 System | |
|--------------------------------|--|
| Clusters | 4 |
| Each cluster has | |
| Compute nodes | 1,872 |
| General purpose nodes | 112 |
| Racks | 20 water-cooled, 2 air-cooled |
| Weight (kg) | 42,000 |
| Each node has | |
| Processor type | AMD Epyc Rome |
| Cores | 64 cores/socket, 128 cores/node |
| Memory/node (GiB) | 256 (compute nodes) / 512 (general purpose) |
| Total | |
| Memory (PiB) | 2.05 |
| Nodes | 7,488 compute, 488 general purpose |
| Cores | 1,015,808 |

| Type | Filesystems | Usable capacity (PB) per filesystem | Bandwidth (GB/s) per filesystem |
|---|-------------|-------------------------------------|---------------------------------|
| Storage for time critical operations | | | |
| Flash | 2 | 0.7 | 307 |
| Hard Disk | 2 | 5.4 | 112 |
| Storage for research | | | |
| Hard Disk | 6 | 13 | 260 |



| | Cray | Atos |
|-----------------------------|-----------------|---------------------------------------|
| Performance factor | 1 | 4.67 |
| Clusters | 2 | 4 |
| Compute nodes | 7,020 | 7,488 |
| General purpose nodes | 208 | 448 |
| Processor type | Intel Broadwell | AMD Epyc Rome |
| Cores per node | 36 | 128 |
| Memory per node (GiB) | 128 | 256 (compute) / 512 (general purpose) |
| Total cores | 260,208 | 1,015,808 |
| Total memory (PiB) | 0.88 | 2.05 |
| Parallel storage type | HDD Lustre | HDD & SSD Lustre |
| Total parallel storage (PB) | 22 | 90 |
| Total storage bandwidth | 355 GB/s | 2,408 GB/s |

◀ Atos HPC – Storage

◀ Comparison between current and new systems

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Oggi è una giornata davvero molto importante, per Bologna e per tutta l'Emilia-Romagna, ma soprattutto per il Paese. Dopo due anni di lavori, che non si sono mai fermati nonostante le difficoltà dovute alla pandemia, al Tecnopolo di Bologna si avvia l'attività del nuovo Data center del Centro meteo europeo.

Sempre di più prende forma quella cittadella della scienza in cui come Regione, insieme allo Stato e all'Unione Europea, abbiamo fortemente creduto. Una infrastruttura che rende la nostra regione hub internazionale dei Big Data, del digitale e delle nuove tecnologie, dove si concentrerà l'80% della capacità di supercalcolo nazionale e il 20% di quella europea, tale da porre l'Europa alla pari dei colossi Usa e Cina.

Oltre al cuore tecnologico del Centro meteo europeo, il Tecnopolo sarà la casa del supercomputer europeo Leonardo e vi troveranno sede le più importanti istituzioni scientifiche nazionali, fra cui Agenzia Italia Meteo e Istituto nazionale di astrofisica, oltre a Centri di ricerca, distaccamenti universitari, aree comuni per incubatori, attività all'avanguardia nel campo della ricerca e sviluppo. Insieme alla Fondazione Big Data and Artificial Intelligence for Human Development – IFAB, che abbiamo voluto direttamente come Regione.

Negli oltre 120mila i metri quadri di superficie dell'ex Manifattura Tabacchi, riconsegnati alla città attraverso un'opera di riqualificazione urbana condivisa con amministratori e comunità locale, troveranno impiego 1.500 persone tra ricercatori, tecnici, addetti.

Saperi e tecnologie che porteranno a soluzioni concrete in tutti i settori: tutela dell'ambiente e lotta ai cambiamenti climatici, salute e scienze della vita, riorganizzazione dei tempi delle città e logistica, processi produttivi e agricoltura. Una capacità di leggere il futuro che mettiamo a disposizione del Paese, per ripartire nel segno della sostenibilità, dell'innovazione del lavoro di qualità. Per costruire da subito un presente diverso.



Stefano Bonaccini

Presidente Regione Emilia-Romagna

Today is a very important day, for Bologna and for the whole of Emilia-Romagna, but above all for the country. After two years of work, which has never stopped despite the difficulties due to the pandemic, the new Data Center of the European Weather Center starts up at the Bologna Technopole.

That citadel of science is taking shape more and more in which, as a Region, together with the State and the European Union, we have strongly believed. An infrastructure that makes our region an international hub for Big Data, digital and new technologies, where 80% of the national supercomputing capacity and 20% of the European one will be concentrated, such as to put Europe on a par with the giants USA and China.

In addition to the technological heart of the European Weather Center, the Technopole will be the home of the European supercomputer Leonardo and will house the most important national scientific institutions, including the Italian Weather Agency and the National Institute of Astrophysics, as well as research centers, university branches, municipal areas for incubators, cutting-edge activities in the field of research and development. Together with the Big Data and Artificial Intelligence for Human Development Foundation - IFAB, which we directly wanted as a Region.

In the more than 120 thousand square meters of the former Tobacco Factory, returned to the city through an urban redevelopment project shared with administrators and the local community, 1,500 people will be employed, including researchers, technicians and employees.

Knowledge and technologies that will lead to concrete solutions in all sectors: protection of the environment and the fight against climate change, health and life sciences, reorganization of cities and logistics, production processes and agriculture. An ability to read the future that we make available to the country, to restart in the name of sustainability, of innovation in quality work. To immediately build a different present.



It is an important moment in the life of ECMWF as we formally become a multi-site organisation, with our head offices in the UK, our new data centre in Bologna, Italy, and our new offices in Bonn.

As we formally open the ECMWF new data centre in Bologna, it is difficult to find words to express not just how grateful, but also how impressed we are in the face of what has been achieved here. Our links with Italy have always been strong, and Italy has always been and is a key player in our Council of Member States. Now the collaboration which unites ECMWF and Italy is only growing stronger with new partnerships being developed at national, regional and local levels. This collaboration at the heart of the city of big data will I am sure support our Member States as we endeavour to tackle the critical impact of severe weather and climate change.



È un momento importante nella vita di ECMWF poiché diventiamo formalmente un'organizzazione multi-sito, con le nostre sedi centrali nel Regno Unito, il nostro nuovo data center a Bologna, in Italia, e i nostri nuovi uffici a Bonn.

Mentre apriamo formalmente il nuovo data center ECMWF a Bologna, è difficile trovare le parole per esprimere non solo quanto siamo grati, ma anche quanto siamo impressionati di fronte a ciò che è stato raggiunto qui. I nostri legami con l'Italia sono sempre stati forti e l'Italia è sempre stata ed è un attore chiave nel nostro Consiglio degli Stati membri. Ora la collaborazione che unisce l'ECMWF e l'Italia non fa che rafforzarsi con lo sviluppo di nuove partnership a livello nazionale, regionale e locale. Sono sicuro che questa collaborazione nel cuore della città dei big data sosterrà i nostri Stati membri mentre ci sforziamo di affrontare l'impatto critico delle condizioni meteorologiche avverse e dei cambiamenti climatici.

Florence Rabier

Director-General ECMWF

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About ECMWF

ECMWF is the European Centre for Medium-Range Weather Forecasts.

Headquartered in Reading in the UK, and with offices in Bonn, Germany, and its data centre in Bologna, Italy, ECMWF is an independent intergovernmental organisation supported by 34 Member and Co-operating States, mostly in Europe. ECMWF is both a research institute and a 24/7 operational service, producing global numerical weather predictions at medium and long ranges for its Member and Co-operating States and the broader community. The Centre also holds one of the largest archives of numerical weather prediction data in the world.

Over the years, ECMWF has developed a strong partnership with the EU and is an entrusted entity for the implementation and operation of the Climate Change and Atmosphere Monitoring Services of the ground-breaking EU Copernicus Programme.

www.ecmwf.int

Contact

For more information, interviews, B-roll, or queries, please contact pressoffice@ecmwf.int.

Further reading and images

- <https://www.ecmwf.int/en/about/media-centre/news/2017/ecmwfs-new-data-centre-be-located-bologna-italy-2019>
- <https://www.ecmwf.int/en/about/media-centre/news/2020/ecmwf-signs-contract-atos-%20new-supercomputer>
- <https://www.ecmwf.int/en/about/media-centre/press-kit-bologna-host-ecmwfs-new-data-centre>
- <https://www.flickr.com/photos/ecmwf/albums>

▲ ECMWF

Three ECMWF sites in the UK, Germany and Italy.

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