Novos meios de computação e dados da INCD

RNCA — REDE NACIONAL DE COMPUTAÇÃO AVANÇADA

INCD

FUJITSU

LIP participation in R&D projects focused on grid computing.

INGRID — Iniciativa Nacional GRID
IBERGRID

Portuguese main node for grid computing, joining LIP, LNEC and FCCN. Collaboration with U.Porto, U.Minho, U.Aveiro etc

egi

Portugal joins EGI. IBERGRID activities are boosted. PT LHC Tier-2 starts.

2006

2000

2008

2010

2013

The national grid initiative is established by the ministry. IBERGRID joins PT and ES centres. WLCG MoU is signed.

Construction of a datacenter for the main node for grid computing at LNEC. Portuguese WLCG Tier-2 for ATLAS and CMS is established.

Creation of INCD is proposed to the national roadmap of research infrastructures (RNIE).

PORTUGUESE ROADMAP OF RESEARCH INFRA-STRUCTURES 2014-2020

The proposal for the creation of INCD passes the scientific evaluation.

The 1st project to fund INCD is submitted under the infrastructures roadmap.

INCD

First INCD collaborators are contracted. First international public tender for compute and storage.

RNCA — REDE NACIONAL DE COMPUTAÇÃO AVANÇADA

2015

2017

2021

2022

2014

2016

2018

The legal entity "Associação INCD" is established.

The project to establish INCD starts. Establishing the administrative and organizational basis for INCD.

Infrastructure project is extended until October 2022.

fct — Fundação para a Ciência e a Tecnologia

POAT 2020 — Programa Operacional Assistência Técnica

PORTUGAL 2020

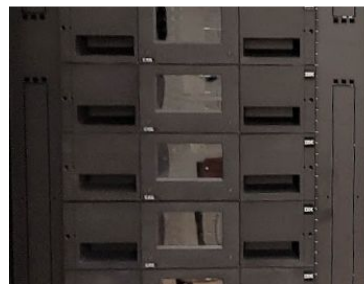UNIÃO EUROPEIA — Fundo Europeu de Desenvolvimento Regional

FCCN

Lisbon Region I
(UPGRADE OF WORKER NODES)
HPC / HTC / Cloud / Federation
Stratus-A (cloud)
Cirrus-A (farm)
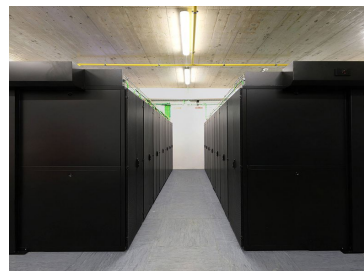WAN 100GbE

North Region I
HTC / HPC
Cirrus-B (farm)

Center Region
(NEW TAPE STORAGE IN PLACE)
Tape storage expansion
WAN 10GbE

Lisbon Region II
Tape storage
WAN 10GbE

North Region II
(EXPECTED TO BE DEPLOYED)
HPC / HTC / Cloud / Federation
Stratus-D (farm)
Cirrus-D (farm)
WAN 10GbE

CPUs	RAM	Network	COREs	Place
AMD Epyc 96 CORE	**512GB & 1TB**	**IB200 + 10GbE**	**4992**	**North**
AMD Epyc 96 CORE (1)	**512GB**	**10GbE + IB56**	**2304**	**Lisbon**
AMD Epyc 64 CORE (2)	256GB & 512GB	10GbE + IB56	2112	Lisbon
INTEL Xeon 24 CORE	64GB	1GbE	2088	Lisbon
INTEL Xeon 16 CORE	32GB	IB56 + 1GbE	2560	North
Total	62912GB		14056	

(1)   Nvidia A100
(2)   Nvidia V100 and Nvidia T4

Storage Type	Capacity (RAW)	Place
Lustre	4.6 PB	Lisbon
Lustre	2.0 PB	North
Lustre	0.8 PB	North
Ceph (block + object)	1.3 PB	Lisbon
Ceph (block + object)	2.8 PB	North
CVMFS	1.0 TB	*
Tape LTO9	20 PB	Center
Total	~ 32 PB	

- **HPC**
  - Slurm batch system
  - Infiniband network
  - Lustre
  - CVMFS
  - Access to GPUs A100/V100/T4
  - Containers

- **HTC**
  - Slurm batch system
  - Ethernet network
  - Lustre
  - CVMFS
  - NFS
  - Access to GPUs A100/V100/T4
  - Containers

- **Cloud**
  - Openstack
  - Virtual networks
  - Ceph block storage
  - Ceph object storage
  - Dashboard and APIs
  - Access to GPUs T4/K40

New @ Lisbon

Upgraded HPC/HTC Capacity

New Slurm Partition

Being prepared for the 3rd CPCA

- **Computing capacity upgrade**
  - ~ 2000 CPU cores & ~10TB of RAM
    - Dell PowerEdge R6525 & R7525
    - Dual AMPD Epyc 7643 2.3GHz
    - 96 CPU core per server
    - 512GB of RAM per server
    - 480 GB SSD + 8 TB HDD
    - IB FDR + 10 GbE
    - A100 GPUs 80GB + 8 TB NVME

- **Storage capacity**
  - ~ 2 PB raw storage
    - Dell PowerEdge R740xd2
    - Dual Xeon Silver 4210R
    - 20 CPU core per server
    - 96 GB RAM per server
    - 960 GB SSD per server
    - 480 TB HDD per server
    - IB FDR + 40 GbE

INCD Computing farms

- **Infrastructure**
  - **Slurm batch systems**
  - **Lustre file system**
  - **CVMFS (EGI, LHC, INCD)**

- **Software**
  - **Modules**
  - **udocker and singularity**
  - **Some commercial sw e.g. Intel OneAPI**

- **Management**
  - **Nagios**
  - **Prometheus**
  - **Grafana**
  - **Ansible**
  - **Own scripts**

Head Nodes

Batch
Scheduler
(Slurm)

Computing farm

File
System
(Lustre)
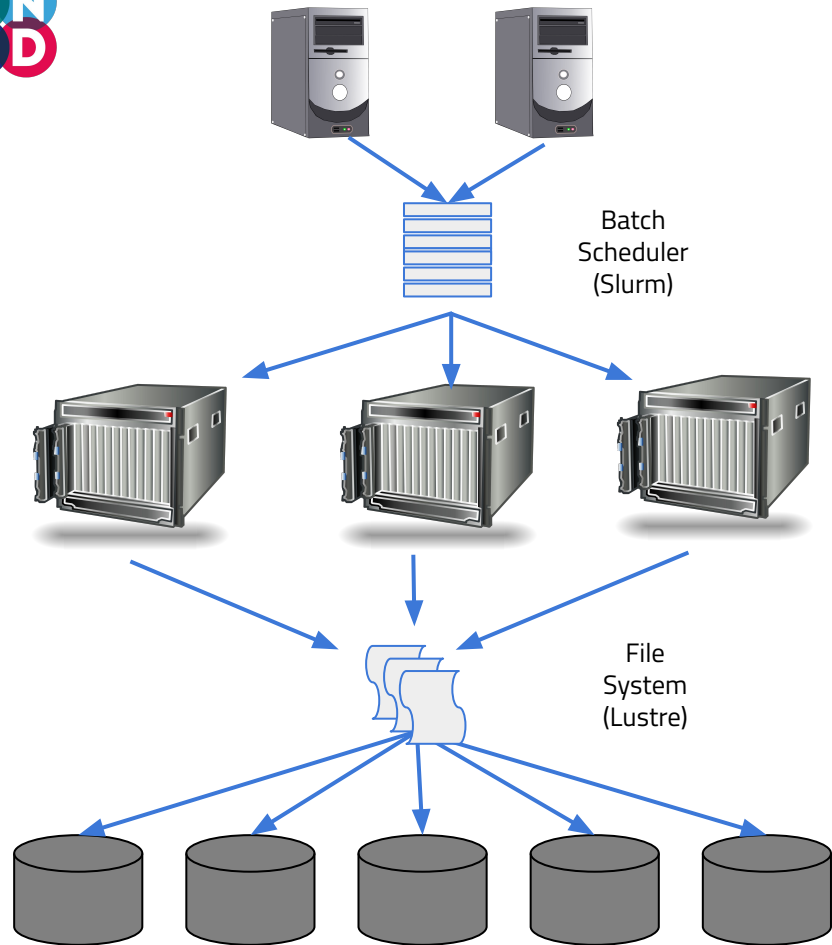
Data Storage

INCD Farm federation

- **Compute**
  - ○ **ARC-CE for job management**

- **Storage**
  - ○ **XRootD**
  - ○ **StoRM (gridftp, webdav)**
  - ○ **CVMFS**
  - ○ **Squid (CMS)**

- **Management**
  - ○ **Apel**
  - ○ **Argus**
  - ○ **BDII**
  - ○ **Perfsonar**
  - ○ **Netbox**
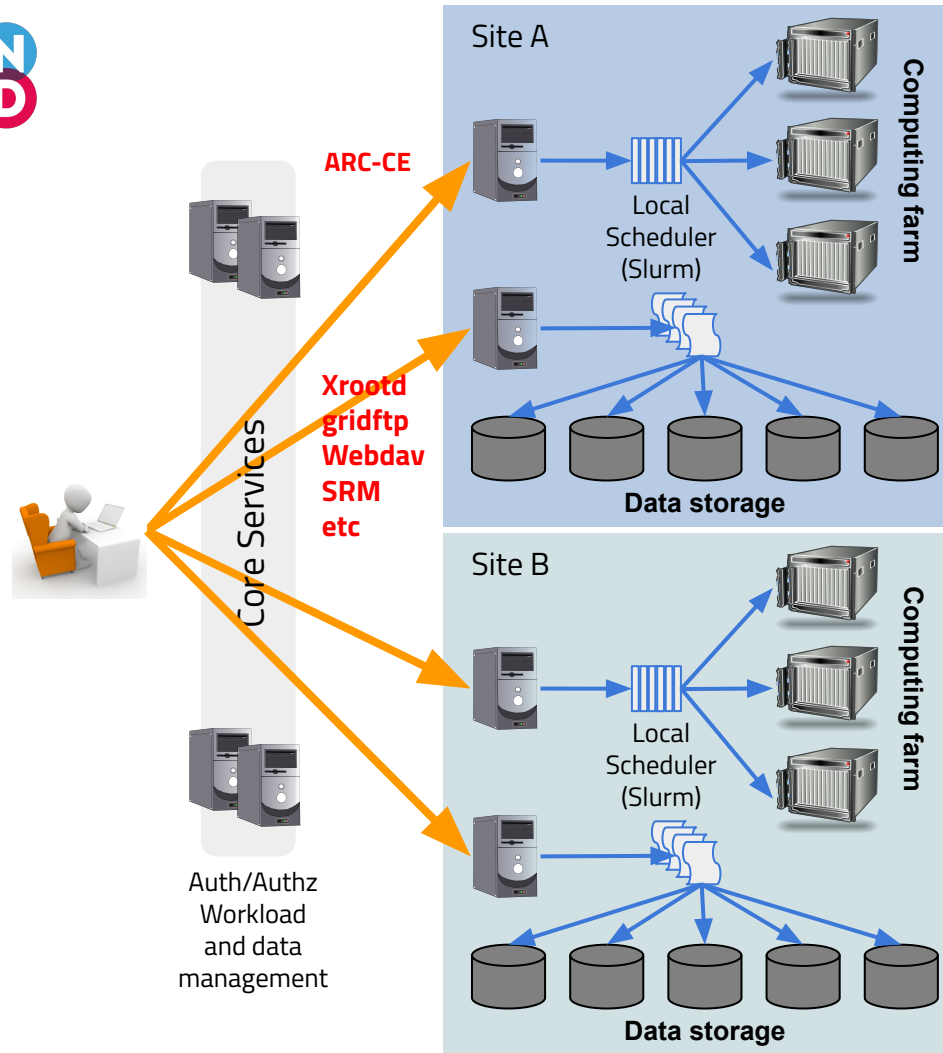
Accelerated Computing

- **GPUs are highly requested**
  - **Insufficient resources for the demand**

- **Nvidia V100 and T4**
  - **Mostly and preferably via the farm either HPC or HTC**
  - **Access either natively or using udocker or singularity**

- **Some older Nvidia GPUs**
  - **For training, testing, development and small projects**

- **New in Lisbon Nvidia A100**
  - **Recently installed available in the same way**
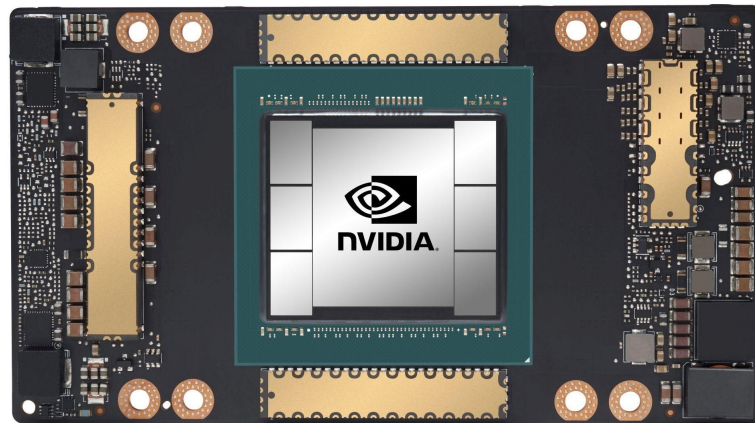
Expected @ UTAD
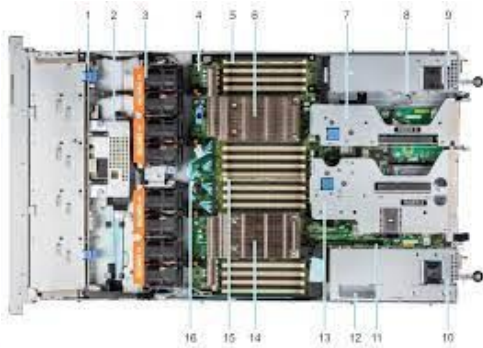
- Compute nodes for the farm
  - ~ 5000 CPU cores & ~ 27TB of RAM
    - Dell PowerEdge R6525 & R7525
    - Dual AMPD Epyc 7643 2.3GHz
    - 96 CPU core per server
    - 512GB or 1024GB of RAM per server
    - 480 GB SSD + 8 TB HDD
    - IB EDR 200 + 10 GbE

- Storage
  - ~ 3.75 PB raw storage
    - Dell PowerEdge R740xd2
    - Dual Xeon Silver 4210R
    - 20 CPU core per server
    - 96 GB RAM per server
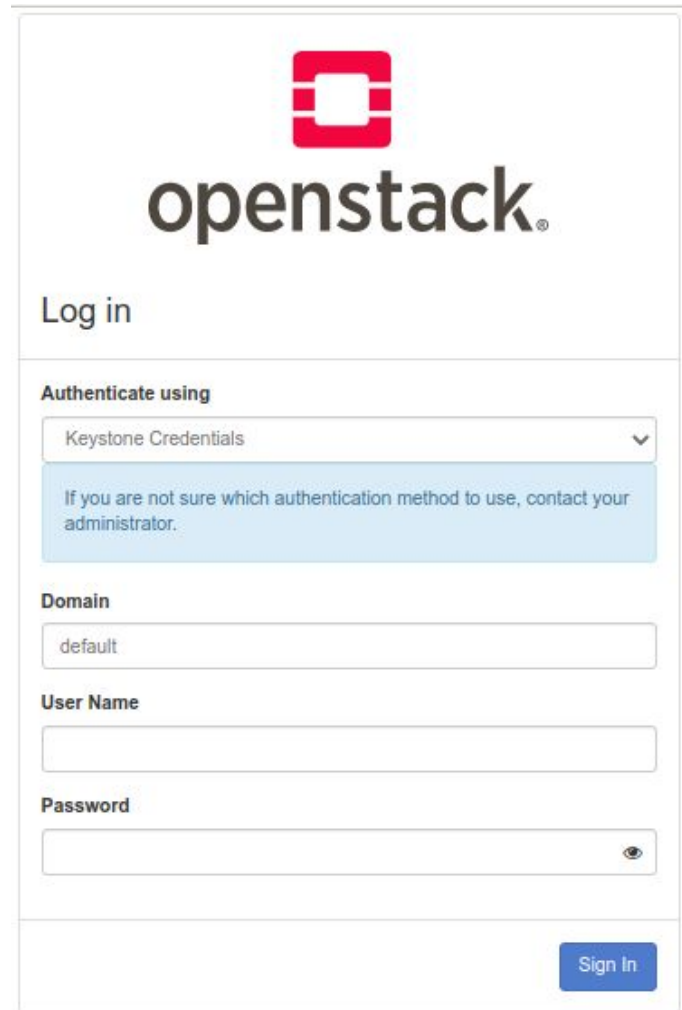   - 960 GB SSD per server
    - 480 TB HDD per server
    - IB EDR 200 + 2x25 GbE

Expected @ UTAD

- **Infiniband HDR 200 switches**
  - **2x Mellanox Quantum QM8700**
    - **40 HDR 200 Gb/s per switch**

- **Ethernet switches**
  - **2x DellEMC S5248F**
    - **48x 10/25 GbE per switch**
    - **4x 100 GbE per switch**
    - **2x 200 GbE per switch**

- **Metadata and support**
  - **7x Dell PowerEdge R650xs**
    - **Xeon Gold 5315Y**
    - **64 GB RAM**
    - **2x NVME 960GB**
    - **IB HDR 200**
    - **2x 25 GbE**

INCD Cloud computing

- **Openstack**
  - **Nova, Glance, Cinder, Neutron**
  - **Using KVM for virtualization**
- **Ceph**
  - **Block storage**
  - **Object storage**
- **Network**
  - **Overlay GRE & Vxlan**
  - **Provider networks (VLANs)**
  - **SRIOV**
- **Monitoring**
  - **Nagios**
  - **Own tools for more complete Accounting including storage**
- **Compute**
  - **AMD Epyc processors**
  - **Some GPUs for small workloads**

INCD Federated cloud

- **Information provider registered in GOCDB**
- **CASO + APEL for accounting**
- **Integration with the EGI Fedcloud**
- **EGI Check-in**
- **Using OIDC**
- **Also had support for the national NREN federation RCTS AAI**

New @ Coimbra

**Upgrade
of tape based
data storage**

**New tape
libraries**

**Data protection
Long term
storage**

- **Tape storage (back-end)**
  - **LTO-9 based tape libraries**
    - **4x IBM TS4300**
    - **20 Petabytes raw capacity**
    - **8x LTO-9 fibre channel tape drives**
    - **18 TB raw capacity per cartridge**

- **Disk storage (front-end)**
  - **640 TB raw storage**
    - **Lenovo SR655 + D1212**
    - **Dual Xeon Silver 4210R**
    - **128 GB RAM per server**
    - **480 GB SSD per server**
    - **320 TB HDD per server**
    - **2x 25 GbE per server**
    - **2x Fibre channel HBA per server**

- **Network switch**
  - **DellEMC S5248F**
    - **48x 10/25 GbE**
    - **4x 100 GbE + 2x 200 GbE**