

T1 highlights Dicembre 2022

Risorse approvate dal referaggio calcolo per pledge 2023

	Crescita netta LHC		
	CPU (kHS06)	Disk (TB-N)	Tape (TB)
ALICE	13,32	1.530	5.700
ATLAS	11,70	1.800	7.290
CMS	9,10	1.950	7.280
LHCb	10,31	1.100	2.217
LHCb-T2	5,40		
Totale	49,83	6.380	22.487
Totale effettivo	39,86	6.380	22.487

+ Extrapledge ancora in fase di decisione da GE (25PB Tape)

	Crescita netta CSN1 no LHC		
	CPU (HS06)	Disk (TB-N)	Tape (TB)
Belle II		200	
LHCf		10	
Totale Tier-1		210	

Risorse approvate dal referaggio calcolo per pledge 2023

Crescita netta CSN2 HTC

	CPU (HS06)	Disk (TB-N)	Tape (TB)
CTA		100	200
HyperK	10.838	152	605
DAMPE	5.000	100	
AMS-02	4.000	200	350
Euclid		450	
SWG0	210	150	
LIMADOU	200	40	2
Borexino		10	24
XENON		100	
ICARUS		300	1000
GAPS	300	30	
NUCLEUS		160	83
NU AT FNAL			475
CUORE		300	
JUNO	8.850	1000	500
Tristan	600		
AUGER	800	100	100
QUBIC	300	15	25
KM3NeT	500	200	50
ET	100	50	
Darkside		50	50
QUAX			120
Cygn0			10
Totale	31.698	3.507	3.594

Crescita netta CSN2 Cloud

	CPU (HS06)	Disk (TB-N)
QUAX	100	130
AMS-02	200	
HERD	1.000	100
SWG0	40	
Fermi	1.100	
AUGER	80	
Cygn0	160	10
Totale	2.680	240

Crescita netta CSN2 HPC

	CPU Mcore-hours	GPU GPU-hours
LSPE	0.9	
Euclid	21.5	
LiteBIRD	2	
AUGER		43.200
ET	10	
Totale	34.4	43.200

Risorse approvate dal referaggio calcolo per pledge 2023

Crescita netta CSN3 HTC

	CPU (kHS06)	Disk (TB-N)	Tape (TB)
FOOT	0,2	20	
GAMMA	2.5	154	50
CHIRONE		20	200
LUNA	0.5	10	50
JLAB12	8	100	
N-TOF	1.5	5	
Totale	12.7	309	300
Totale effettivo	10.2	309	300

T1 highlights - stato gare Dicembre 2022



- CPU
 - **Aggiudicata** su NOVAPA gara da 60kHS06
 - **Da installare nel CNAF attuale**
 - ~~In arrivo entro fine anno~~ **In arrivo Q1 2023**
- Disco
 - **Aggiudicata gara da 14PB**
 - **Da installare nella sede attuale - 2 rack**
 - **Graduatoria da approvare lunedì 19/12 – aggiudicazione provvisoria a sistemi Lenovo ThinkSystem DE6600**
 - **Consegna prevista Q1 2023**
 - ~~Approvato in GE 19 Ottobre~~ **11 Novembre 26 Novembre** AQ per disco 2023 e 2024 (64+14PB)
 - **Da Installare al tecnopolo**
- TAPE
 - **Siamo a pledge 2022 - 130.5PB**
 - **Da pubblicare Q1 2023 gara per nuova libreria**
 - **Da pubblicare Q1 2023 gare per nastro pledge (27PB) + repack libreria Oracle (30PB?)**
- RETE
 - **In fase di valutazione 2 gare** su NOVAPA per cablaggio ed apparati attivi del tecnopolo
 - **2M core core switch+mgmt**
 - **750k cablaggio**
 - **Scadute 22/11/22**
 - **Buste amministrative valutate**
 - **Nominate commissioni**

- **Infrastruttura**
 - Interventi di manutenzione ai quadri elettrici nei giorni scorsi
 - Qualche problema su presiere in fase di investigazione
 - Individuate azioni per risparmio energia in vista dei rincari
 - i.e. spegnimento di un KS
 - Effort su lavori infrastrutturali al Tecnopolo
 - Variante lavori edili, apparati meccanici+elettrici + rack in fase di realizzazione
 - In preparazione gare:
 - trasloco apparati (cnaf)
 - manutenzione pluriennale dei sistemi (cineca)
- **Rete**
 - Link LHCONE e GeneralIP passati su GARR-T
 - Contestualmente General IP banda raddoppiata 40Gbit/s
 - Link con CERN 100+100Gbit/s da HA a Load Balancing
 - Prototipo di DCI diretto con CERN configurato: 400Gbit/s



The new INFN Data Center at Bologna Tecnopolo

A brand-new data center for CNAF



- Renew infrastructures to be ready for the HL-LHC era
 - up to ~ 2035 and beyond
- Use more compact computing
 - from today's ~ 20 kW/rack to 80 kW/rack DLC
 - Integration with CINECA-Leonardo Supercomputer
- Lower the PUE (*power usage effectiveness*)
 - Targeting 1.08-1.10
- Extend and expand networking for a future-proof infrastructure

The opportunities

- In **2017**, Bologna won a bid to host the datacenter of the “*European Centre for Medium-Range Weather Forecasts*” - ECMWF
- The Emilia Romagna region decided to repurpose the “*Manifattura Tabacchi*” area to host a technology district, hosting ECMWF and more

Roughly
250x250 m²

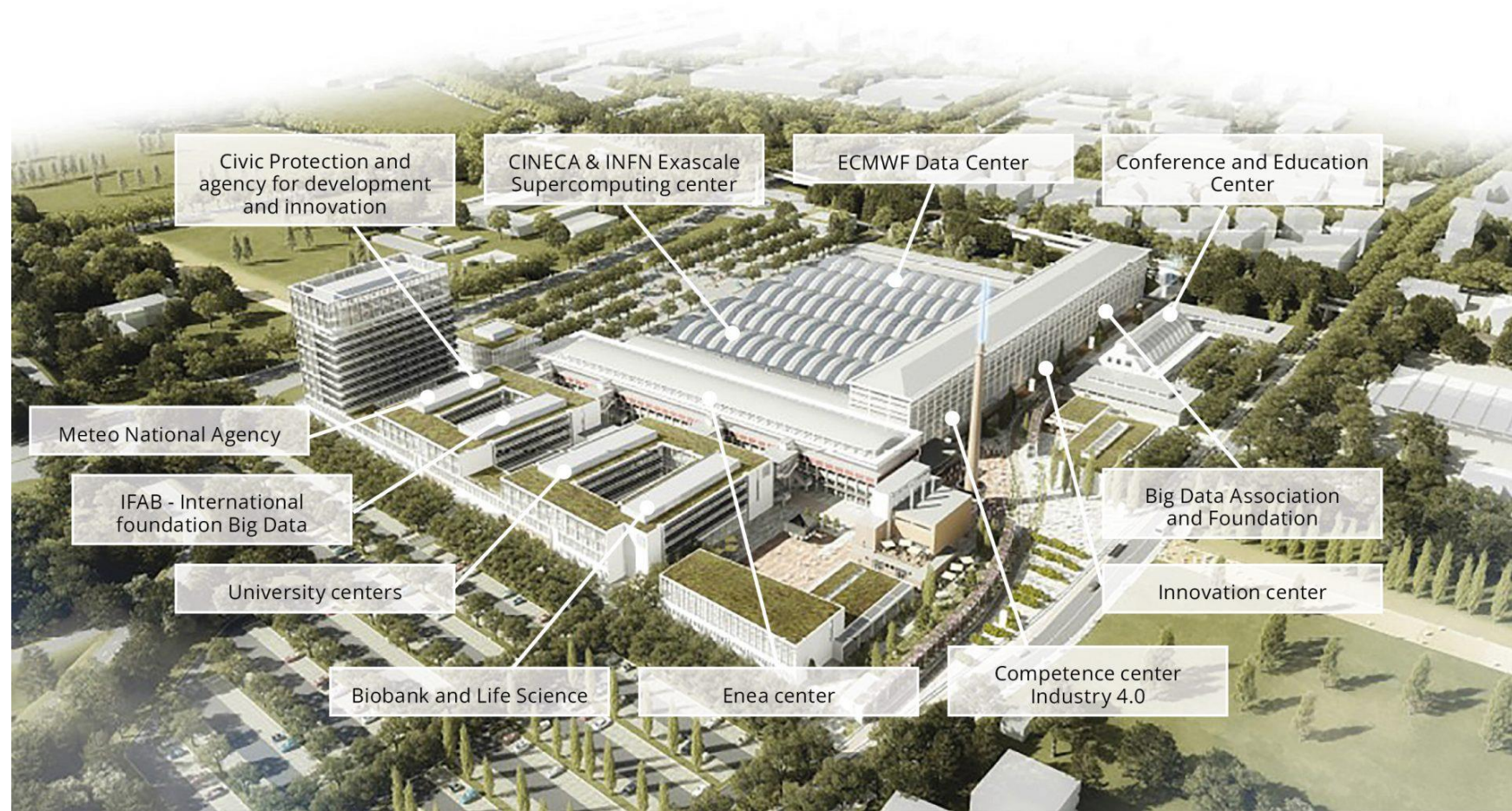


How it will be



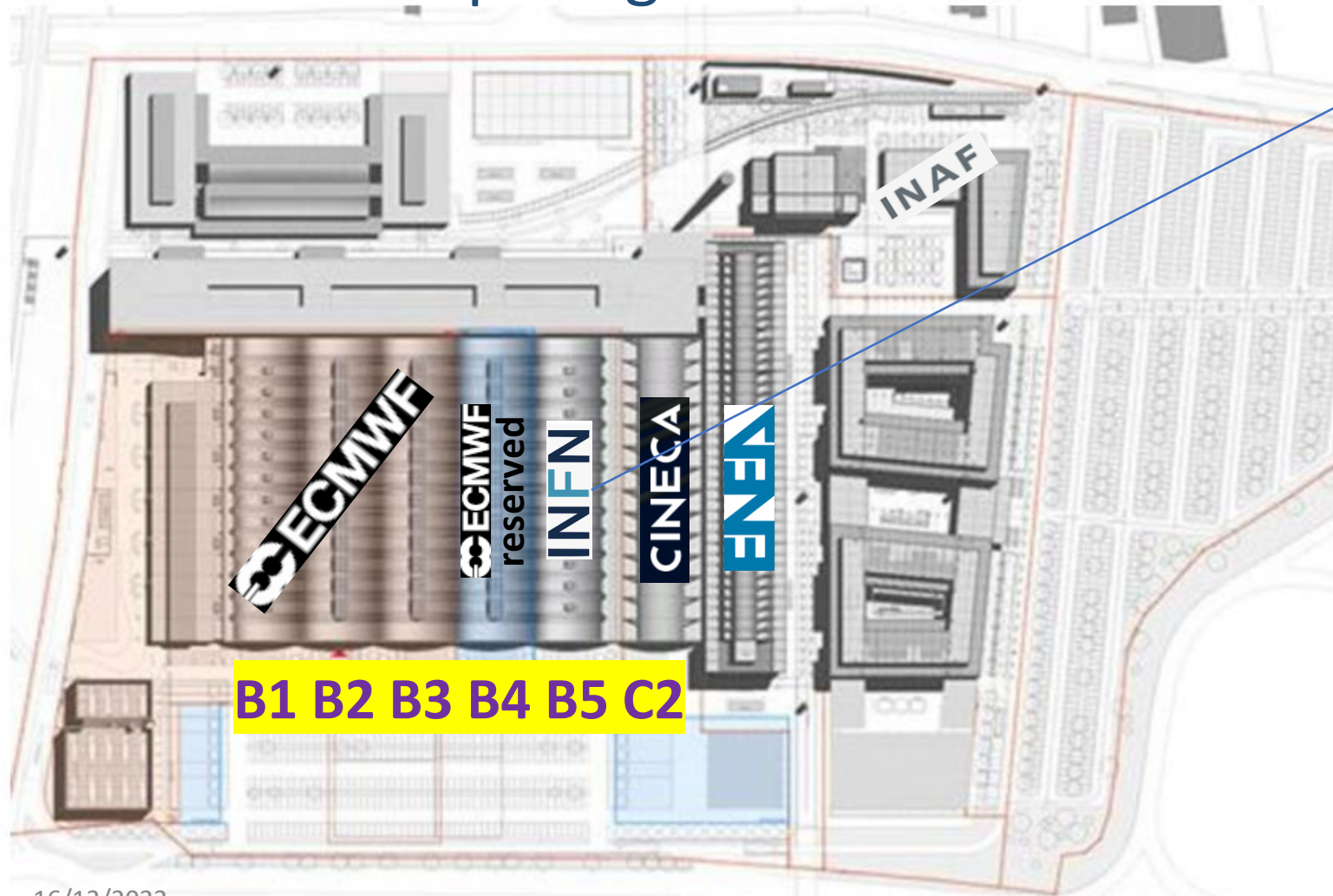
What can the Tecnopolo host?

- Not only research infrastructures and supercomputers
- Areas for
 - Technological institutions
 - university
 - innovation hubs
 - technology transfers
 - Industry 4.0
- Restaurants



What can the Tecnopolo host?

The computing infrastructures



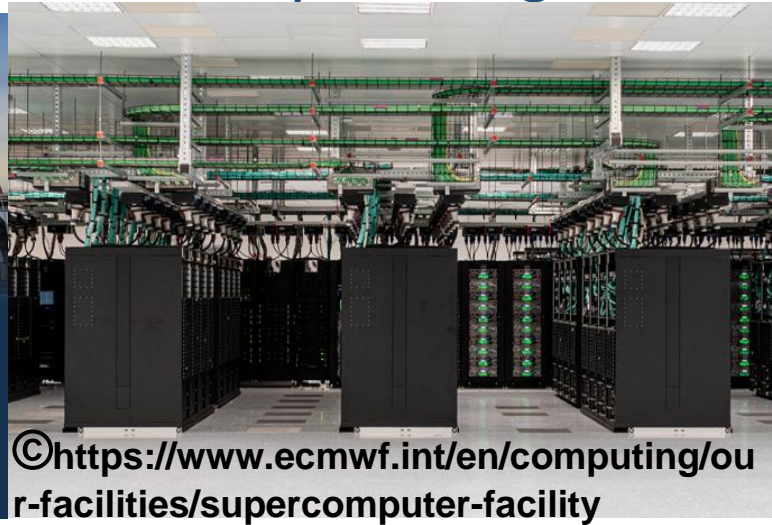
Each of the 6 “botti” (barrels) is
~5000m² of usable IT space



Same architect and design of the
“Sala Nervi” in the Vatican

The INFN+CINECA project

- The ECMWF is already running!



- CINECA Leonardo was commissioned in October 2022
 - 4th in top500.org Nov22



- CNAF “B5” Barrel expected to be ready by mid 2023
- Two phases expected
 - **Phase-1 (2023-2025)**
 - Leonardo + T1-CNAF → 13 MW
 - **Phase-2 (2025+)**
 - infrastructure up to 25 MW ready for post-exascale and for HL_LHC

Current status.....



CNAF Barrel



16/12/2022



16/12/2022



16/12/2022





16/12/2022



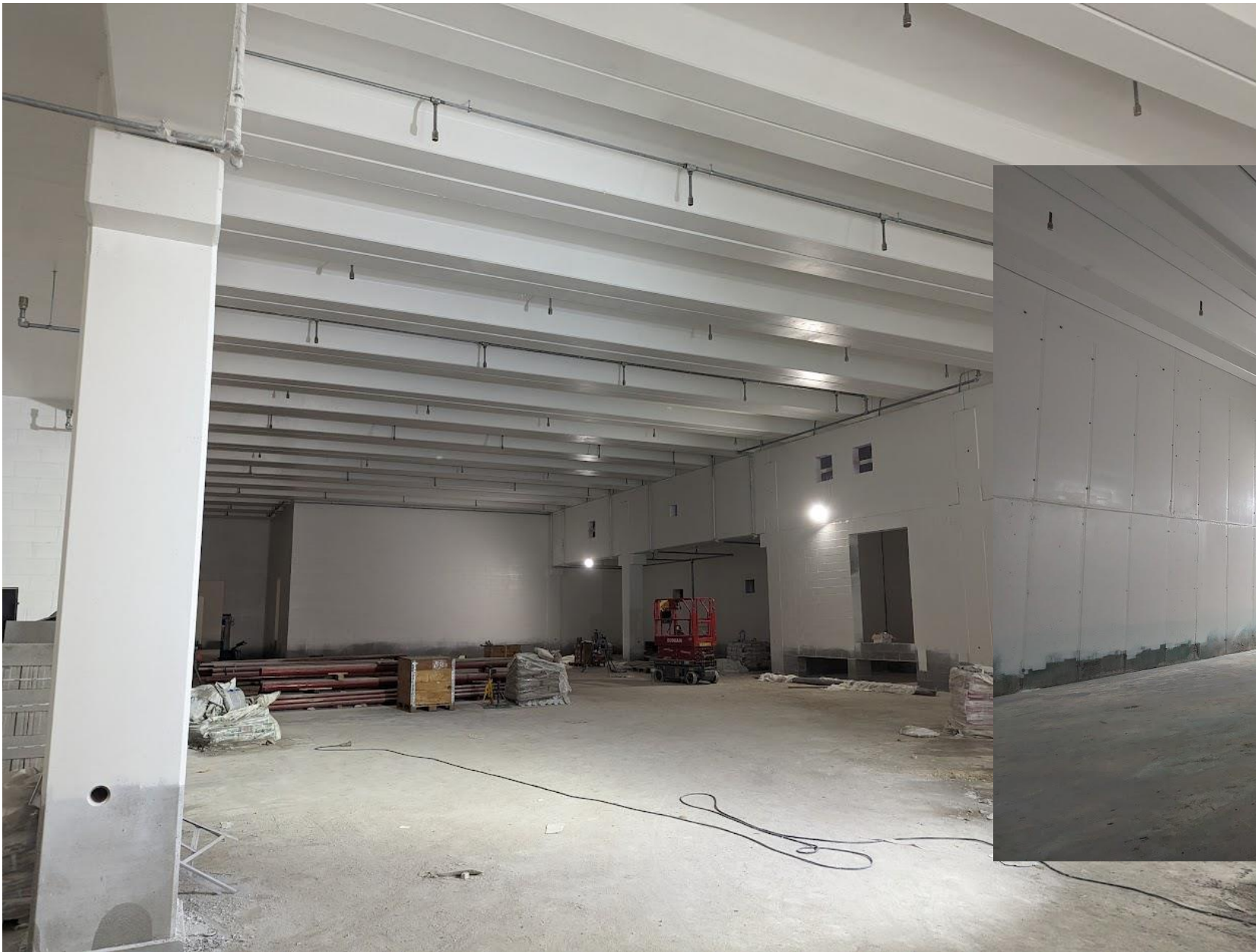
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Zona Esansione

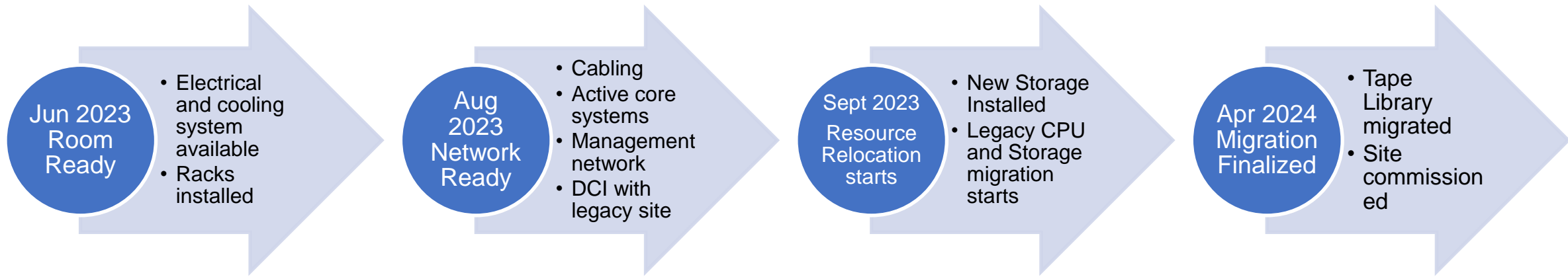


Zona Alta densità



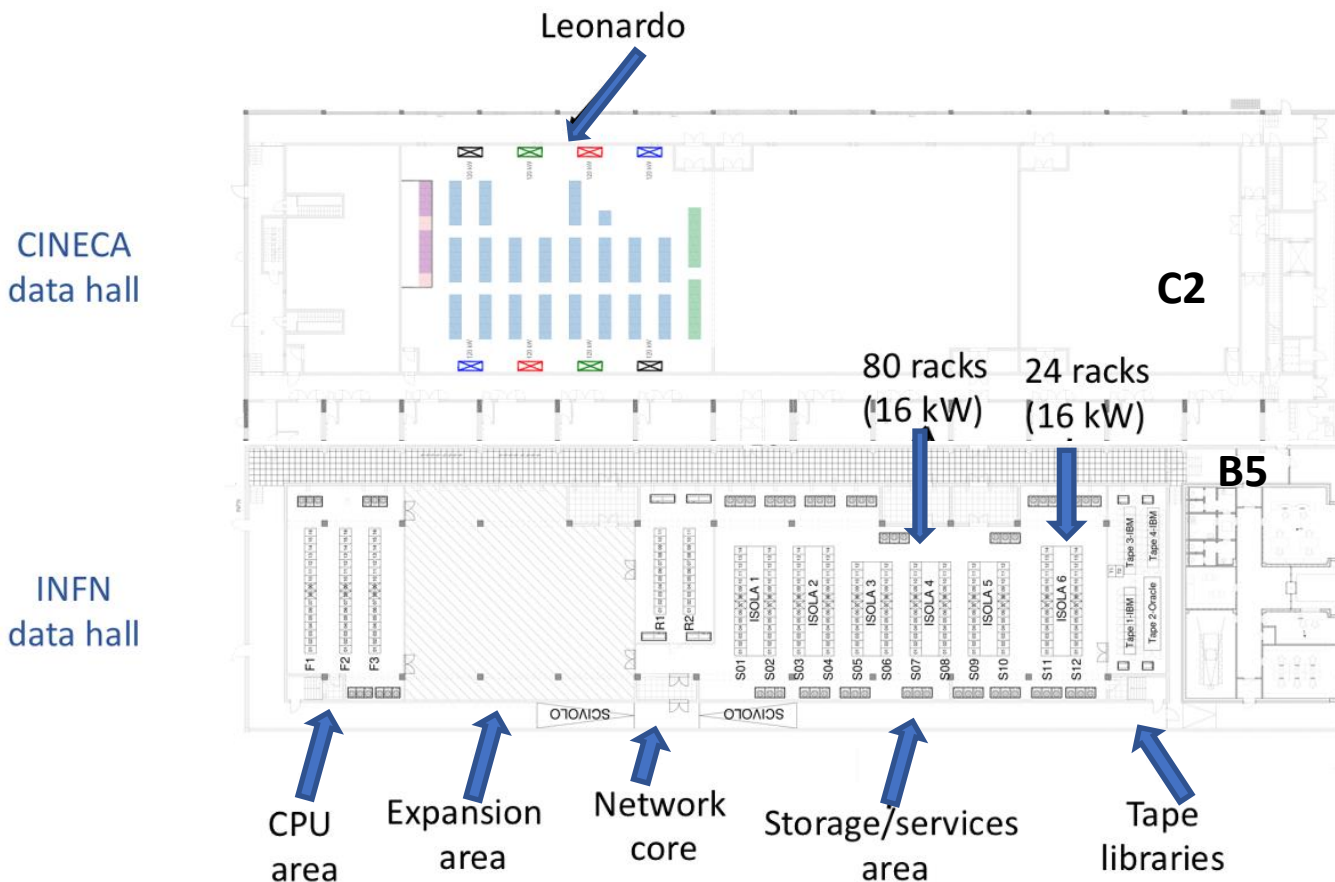
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Live Relocation Timeline



- **Live Migration**
 - Legacy site “extended” through a DCI channel 1.2Tbit/s
 - Data moved to a new storage
 - CPUs moved in chunks
- Down only for tape libraries
 - Need dismantle and re-assembling

CNAF and CINECA data halls



- The new CNAF Datacenter will feature the following main areas
 - High Density – 2-3 rows for 80kW racks
 - Low density – 80+24 16kW racks
 - Expansion area
 - Tape libraries areas
 - Up to 4 libraries
- The CPU area can host up to 3MW of CPUs via 42 DLC high density racks
- The low-density area will be used to host
 - Storage systems
 - CNAF Cloud Infrastructures
 - ISO certified Cloud racks
- Cooling
 - Air cooled Cold Corridor aisles
 - Direct Liquid in High Density
- 3+1 redundancy in all the infrastructure facilities

DLC 80kW



16/12/2022



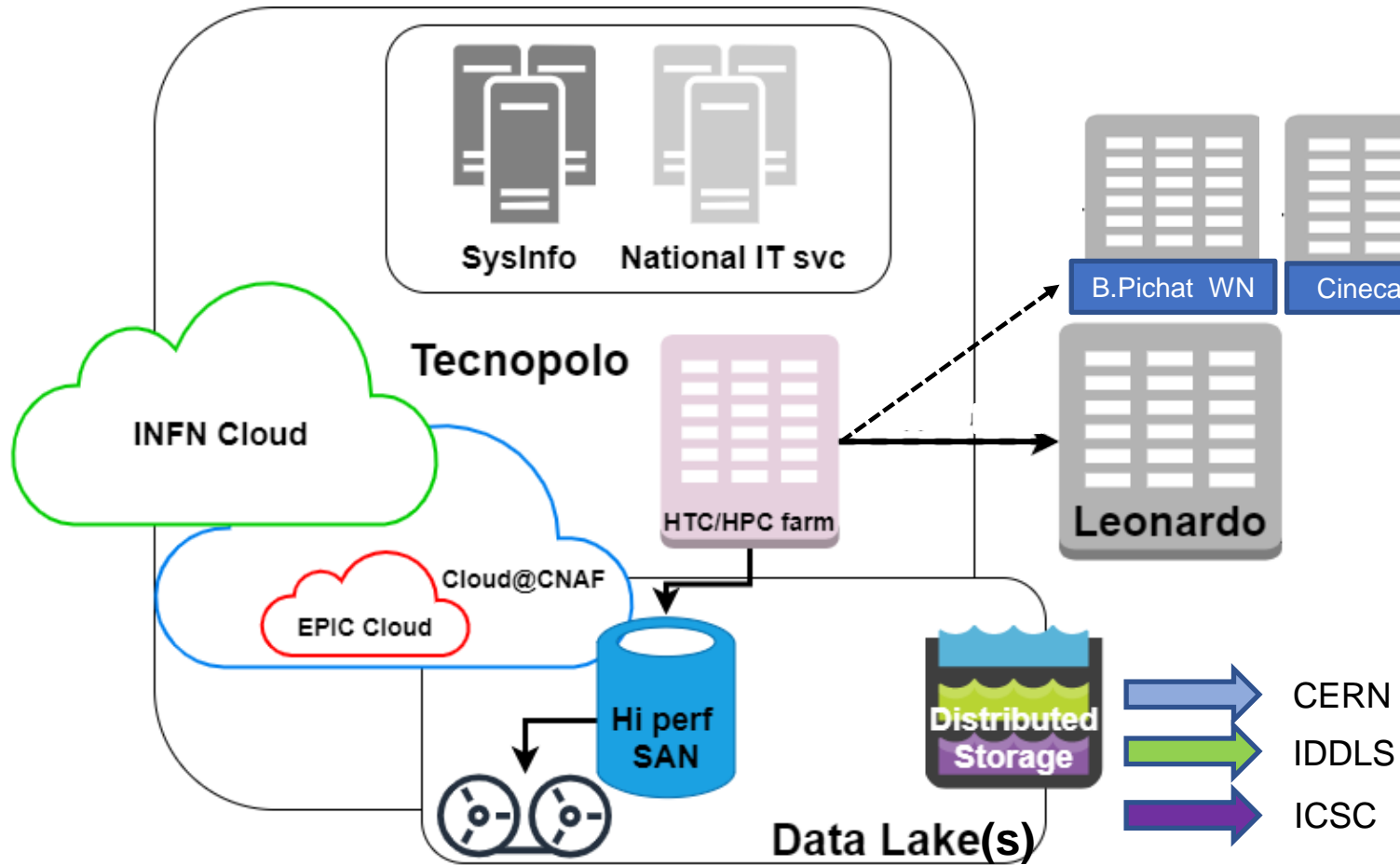
The cooling system and the PUE

- 4 central refrigerator Units
 - 3+1 redundancy
- Chilled water 19-26 °C for the low density air cooled racks
 - 2 MW Chillers
 - Total/partial free cooling is possible
- Warm water 37-47 °C for DLC racks
 - 2,25 MW Chillers
- To be doubled in the second phase
- **High Density CPU Area**
 - 4 CRAH - 200 kW each (3+1)
- **Network Area**
 - 4 CRAH - 75 kW each (3+1)
- **STORAGE Area**
 - 16 CRAH - 200 kW each (12+4)
 - Cold corridor aisles
- **TAPE Area**
 - 4 CRAH - 25 kW each (3+1)

$$PUE_{DLC} \approx 1.08$$

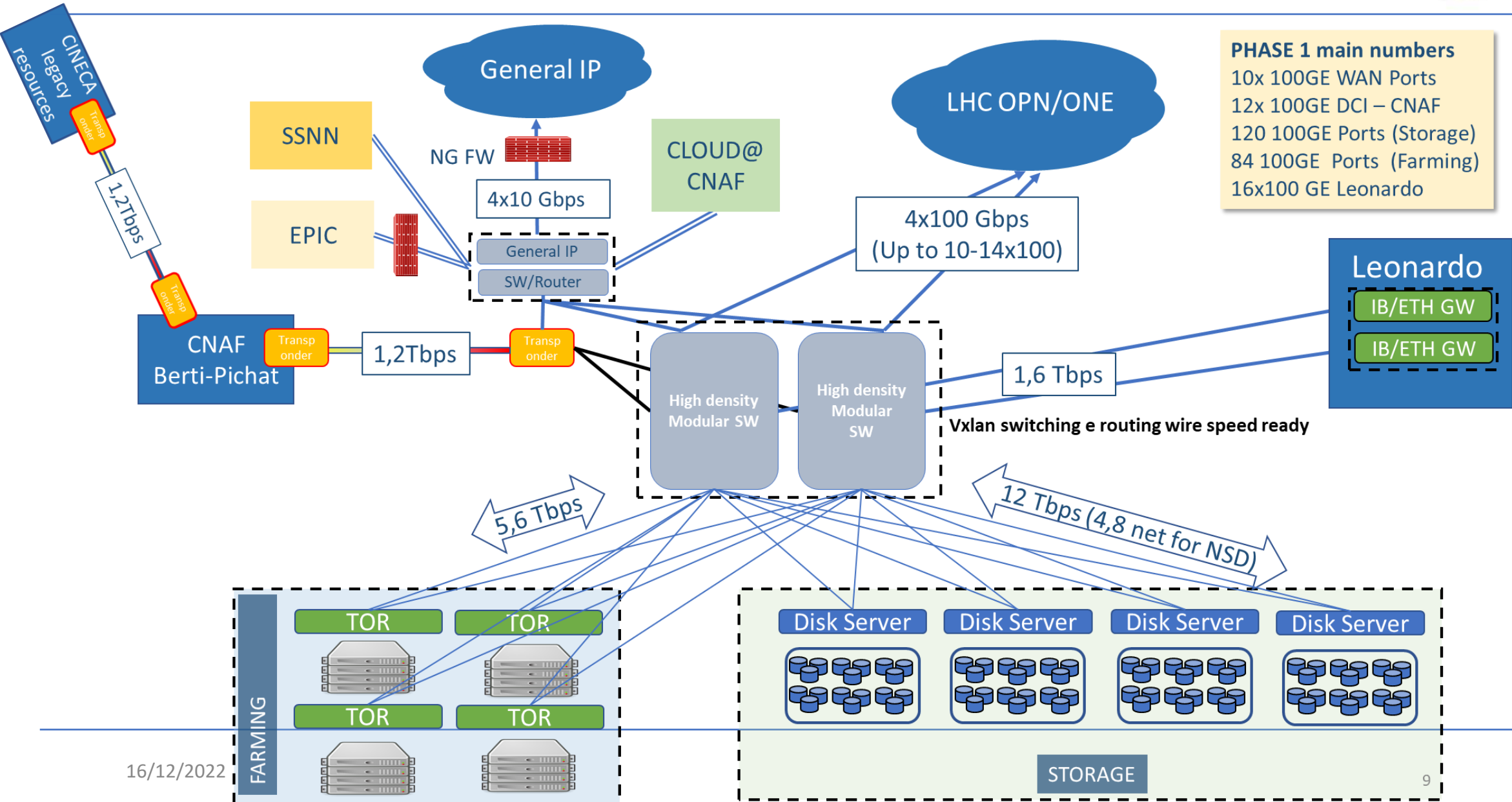
$$PUE_{Tot} \approx 1.2 - 1.3$$

A “distributed” datacenter



- Multiple “locations”
 - CNAF Technopole
 - CINECA Leonardo CPU access
 - INFN-CLOUD federated cloud
 - Data-lake(s)
 - DCI with INFN sites
 - DCI with CERN
 - New national data lake for the ICSC project
 - The ICSC headquarter will be at the Technopole

A Complex Networking Infrastructure



PHASE 1 main numbers
 10x 100GE WAN Ports
 12x 100GE DCI – CNAF
 120 100GE Ports (Storage)
 84 100GE Ports (Farming)
 16x100 GE Leonardo

Communication



But since I was curious, I asked: what can you actually do with these supercomputers?

Data Valley:

<https://www.youtube.com/watch?v=96TfXHCWxf8>



They answered: everything you can think of... and other things you can't even imagine.