Consortium GARR
THE ITALIAN EDUCATION & RESEARCH NETWORK

Between autonomy and innovation

M.Carboni

the hidden costs of digital transformation

Linux Day (2024) Palermo

CC BY

GARR: the Italian Research & Education Network

GARR stand for **G**ruppo **A**rmonizzazione **R**ete della **R**icerca
Research Network Harmonization Group, started late 80'

- **The Community**: 1,000+ sites, 3 milion of end users (research istitutions, universities, schools, ehealth, ...)
- **The Network**: 20,000 km of fibre, 100 PoPs, 10 DC, 4Tbps (BB), 100G+
- **Lightweight Organisation**: 80+ staff that evolve, manage and control network, cloud, applications

Since **Nov/87**

The Community

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The Today Network

Numbers

- ⋆ 3M+ end users
- ⋆ 20,000+ km Fibre
- ⋆ 1,500 km Submarine Spectrum
- ⋆ 100+ PoPs (Optical/Packet)

Network Capacity

- ⋆ **new (BB) 21T / (Access) 5T**

BackBone links

- ⋆ **new 200G, 400G ⇒ upto 1T+**

Access Capacity

- ⋆ **new 10G ⇒ 400G+**

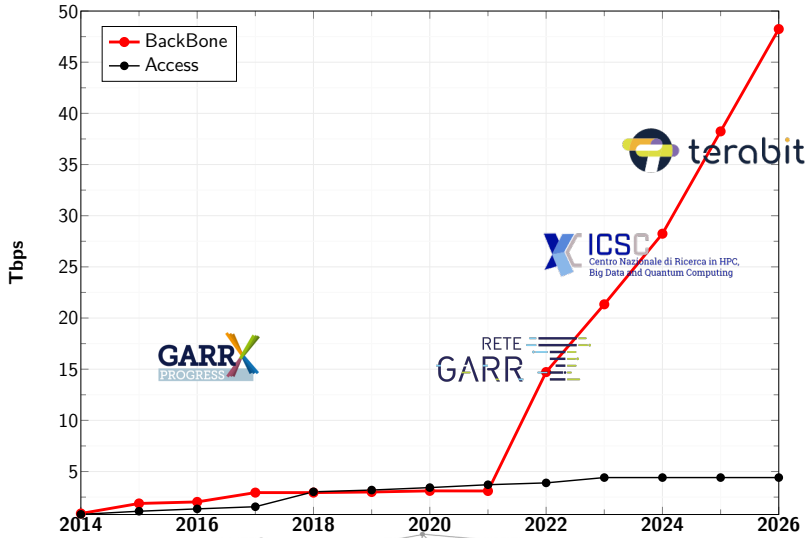
Computing and Storage

- ⋆ 1 DC: distributed on 9 POPs
- ⋆ **∼20,000 vCore**, **∼12PB Storage**

Interconnessioni

- ⋆ **Ricerca 2T+**
  - ➠ GEANT, CERN, ecc.
- ⋆ **Global Internet: 400G+**
  - ➠ Arelion, Cogent, MIX, Namex, ecc.
- ⋆ **Peering Diretto: 800G+**
  - ➠ Microsoft, Google, Amazon

Backbone Traffic Growth



Dark Fibre 12,000 km

Submarine 1,500km

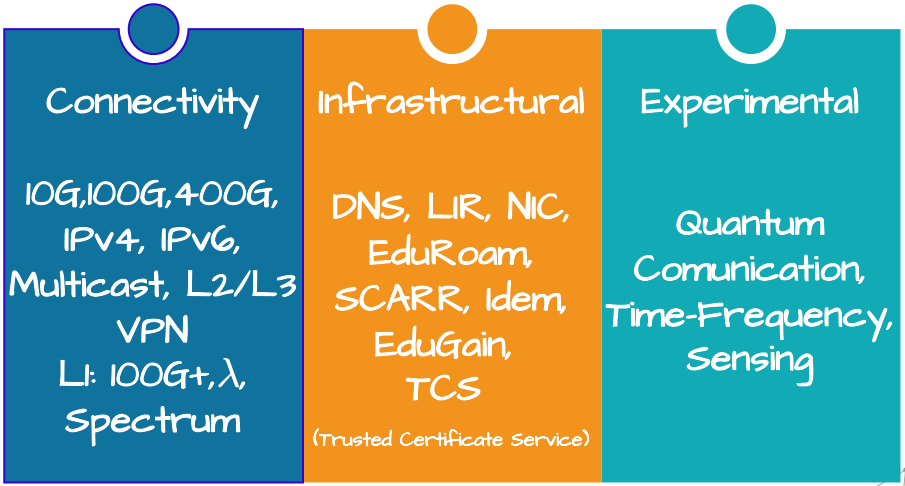
Backbone 20T, 50T+

Access 100G+, 400G+, 1T+

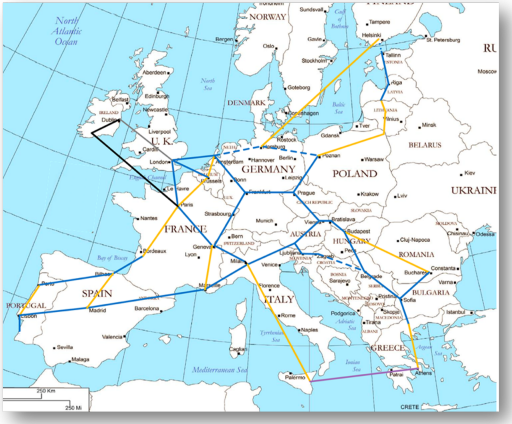
Global Connectivity

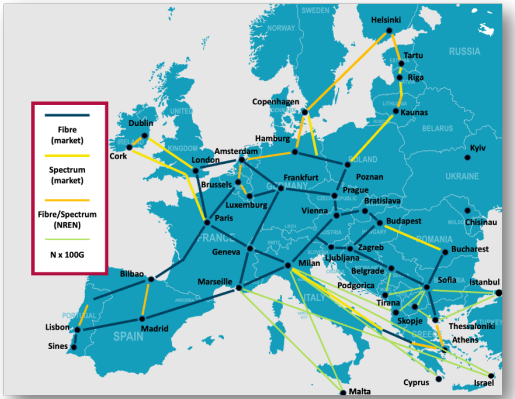
Experimental Infrastructure

Network Services



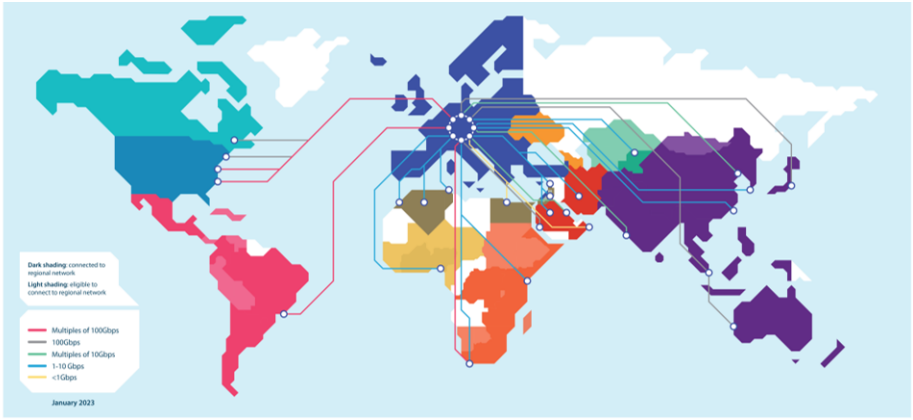
GEANT Network





Total kilometers fibre/spectrum 30,928km

Global Networking attraverso GEANT



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Innovation Impact

Investigation and Developments

from limited resources to new possibilities

Ballon - open optical network

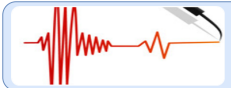
- Optical Network Design and Planning Tool
- Open Optical Network Controller
- Performance Optimization

Politecnico di Torino

Spectrum Sharing

- CNAF-CERN DCI pilot (Multidomain GARR+GEANT)
- Spectrum Sharing User Service Definition

GÉANT INFN CERN



Sensing

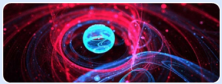
- Sensing over Subsea Cables
- GEANT WP7T2 Demo activity
- SUBMERSE project relationship

UNDER construction

Time and Frequency

- White Rabbit over DWDM
- Pan-European Infrastructure (CLONETS)
- GN5-2 Incubator

INRiM ISTITUTO NAZIONALE DI RICERCA METROLOGICA



Quantum Technologies (QKD)

- University of Padua: QKD + Data link field trial
- Quantum Initiative
- GEANT Quantum Strategy group

PADUA QTECH

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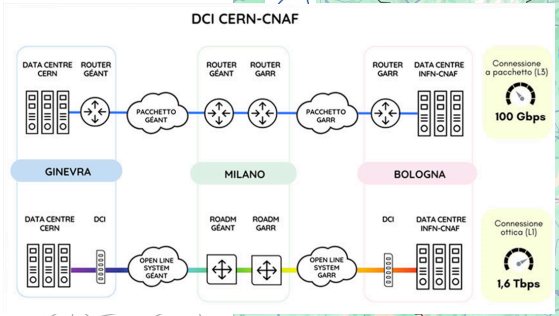
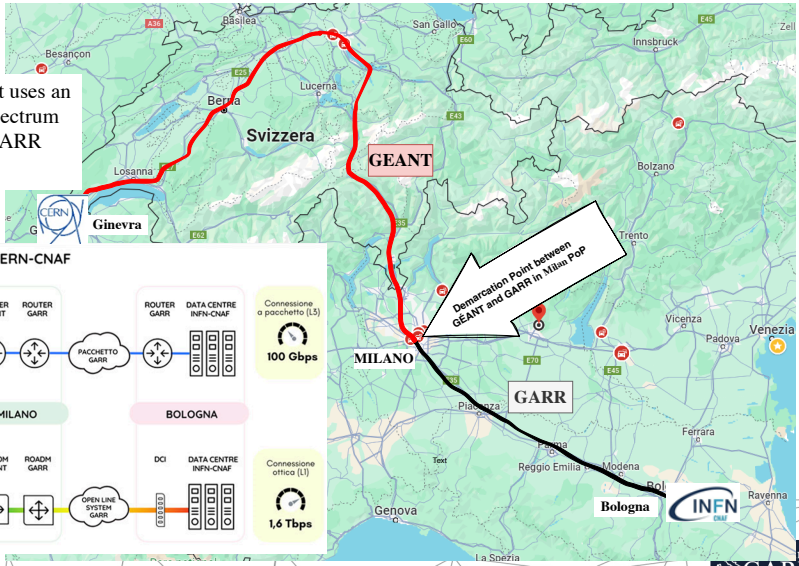
1.6Tbps CERN-CNAF INFN DCI

Pure Optical connection that uses an empty slice of the optical spectrum available on GÉANT and GARR fibre infrastructure

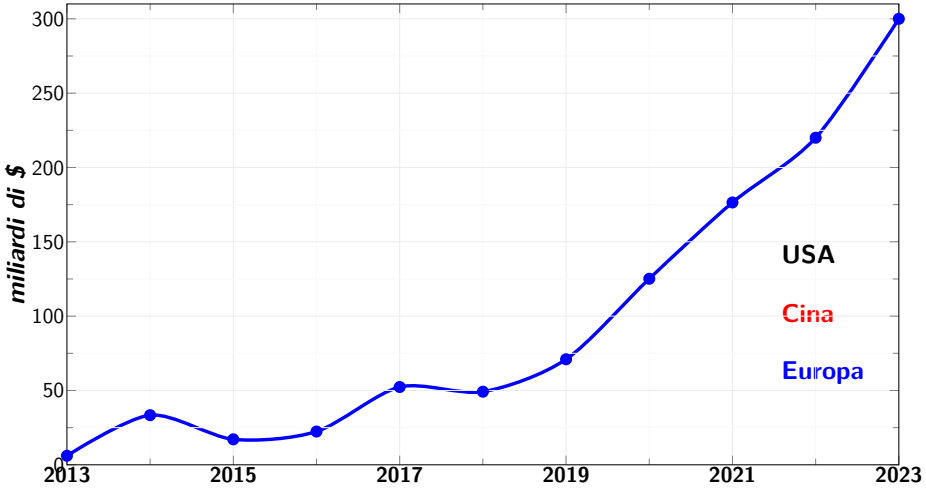




What if innovation is growing too fast?

In some cases resources for technology seem to be unlimited, and limitless growth feels within reach...

AI: Global Investments from 2013 to 2023



Fonte: Our World in Data

HPC start from 10MW to 100MW (Leonardo, ECMWF, ecc.)

Google announces plan to build 7 nuclear reactors to power AI systems

AI drives 48% increase in Google emissions

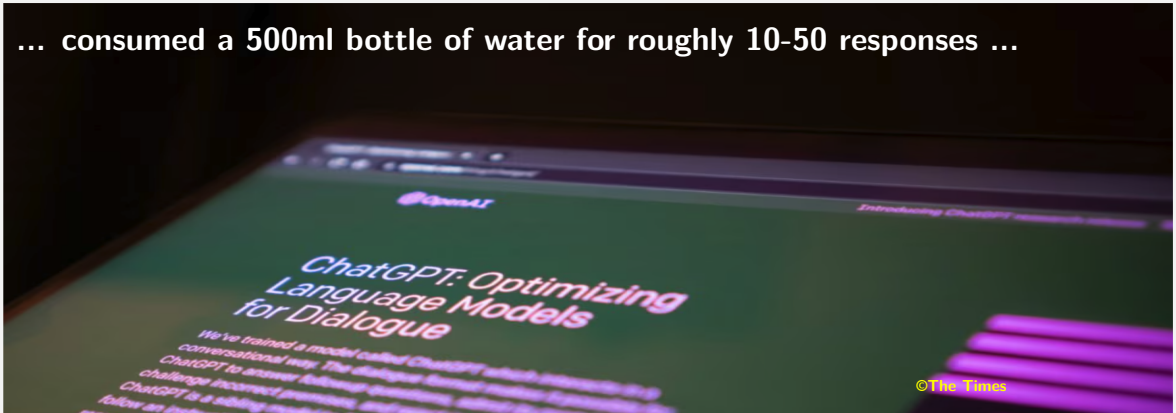
3 July 2024

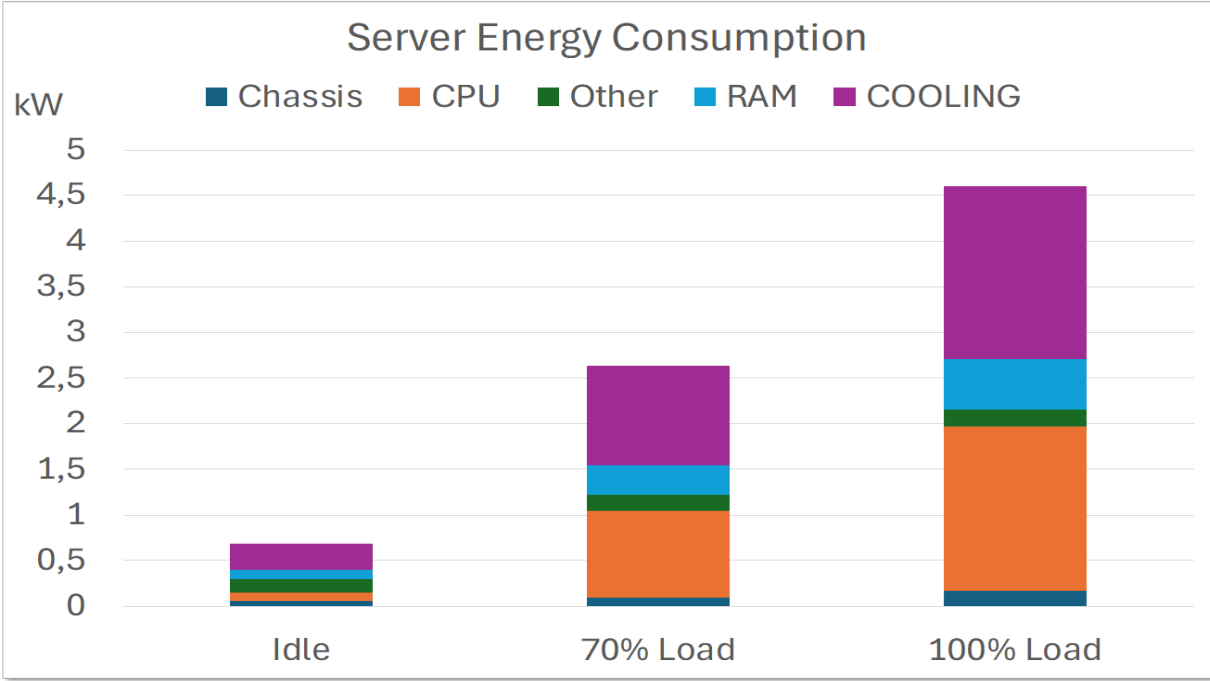
Share Save

Imran Rahman-Jones
Technology reporter

ChatGPT consumes more water than expected

According to a study by the University of California, the clusters that power OpenAI's intelligence require a lot of water, four times more than was thought.



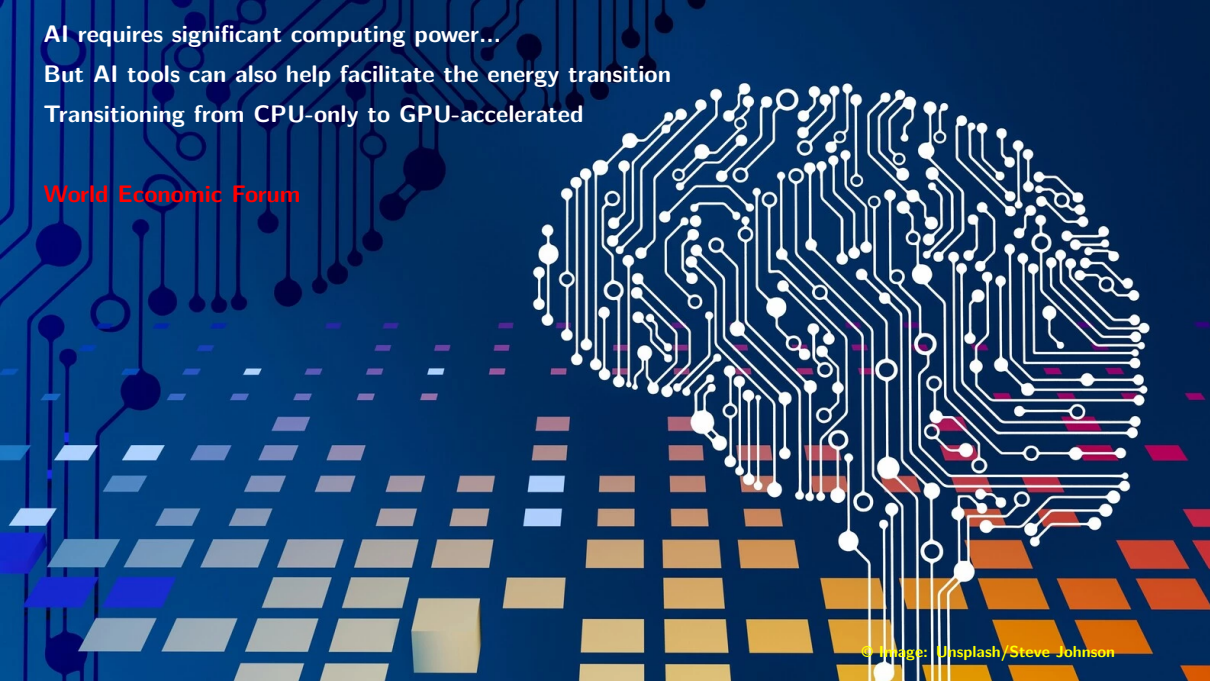

Server Energy Consumption
kW
Chassis
CPU
Other
RAM
COOLING
5
4,5
4
3,5
3
2,5
2
1,5
1
0,5
0
Idle
70% Load
100% Load

AI requires significant computing power...

But AI tools can also help facilitate the energy transition

Transitioning from CPU-only to GPU-accelerated

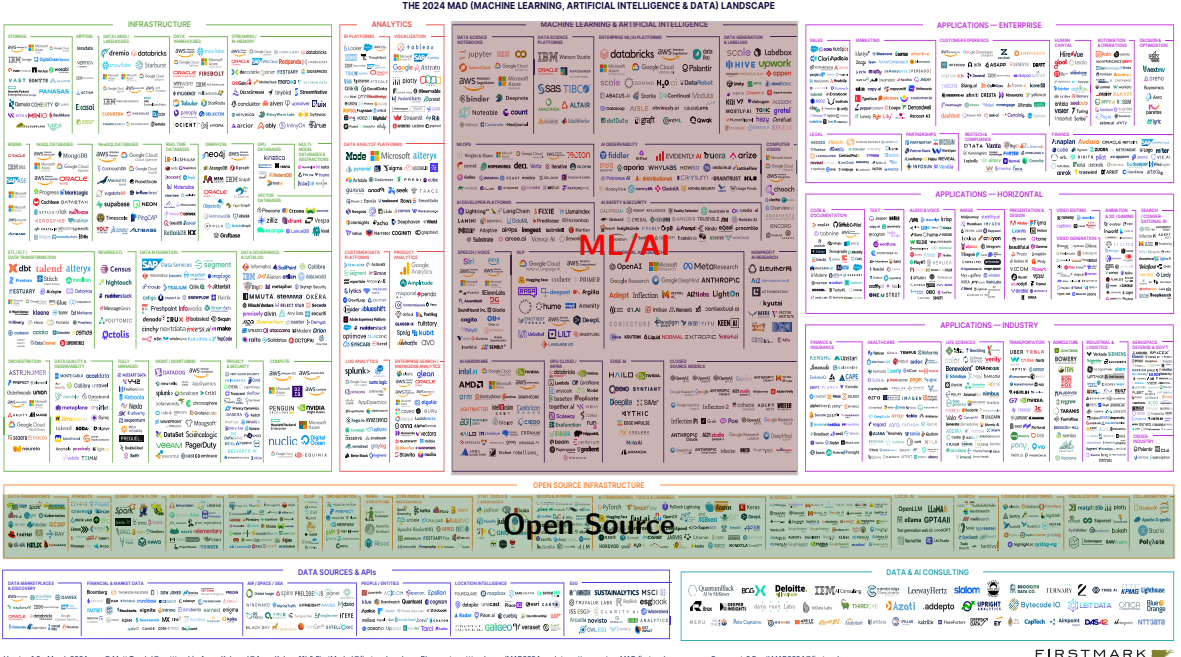
World Economic Forum



© Image: Unsplash/Steve Johnson

technology

THE 2024 MAD (MACHINE LEARNING, ARTIFICIAL INTELLIGENCE & DATA) LANDSCAPE



Version 1.0 - March 2024 © Matt Turck (@mattturck) , Aman Kabeer (@AmanKabeer11) & FirstMark (@firstmarkcap) Blog post: mattturck.com/MAD2024 Interactive version: MAD.firstmarkcap.com Comments? Email MAD2024@firstmarkcap.com

FIRSTMARK
EARLY STAGE VENTURE CAPITAL

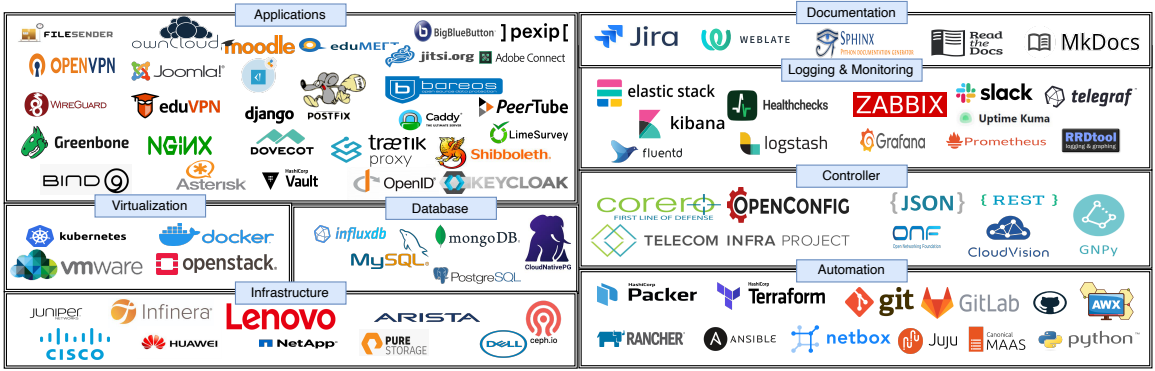
Can we cope?

In some cases resources for technology seem to be unlimited, and limitless growth feels within reach...

An Alternative Approach

The ICT complexity (our playground)

.... GARR toolbox (2016-today)



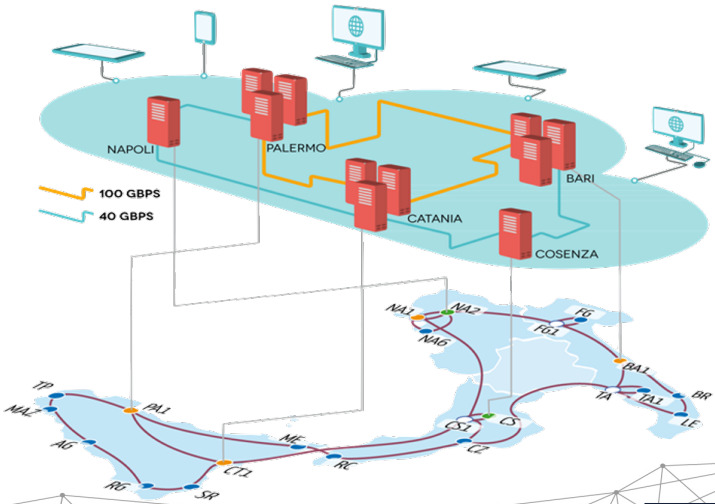
GARR Cloud Distributed Infrastructure

Services:

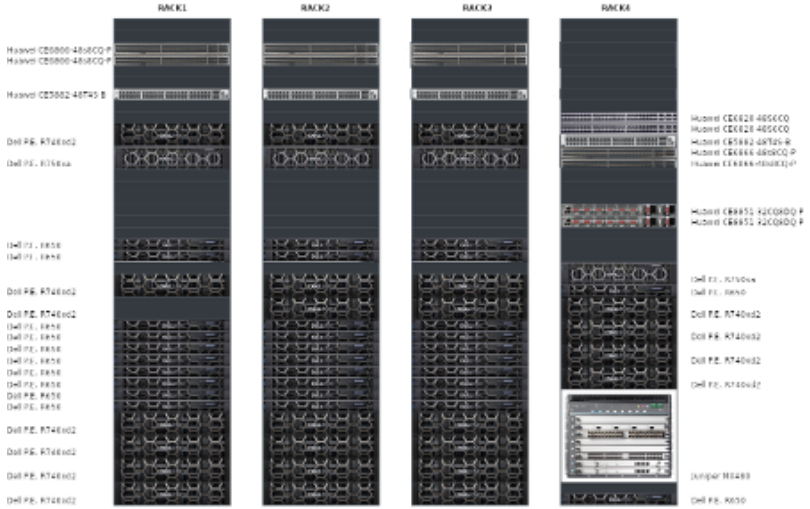
- IaaS
- Object Storage

Resources:

- Cores: 11500
- RAM: 90 TB
- Storage: 16.3 PB (15% SSD)
- GPU: 333 TFlops



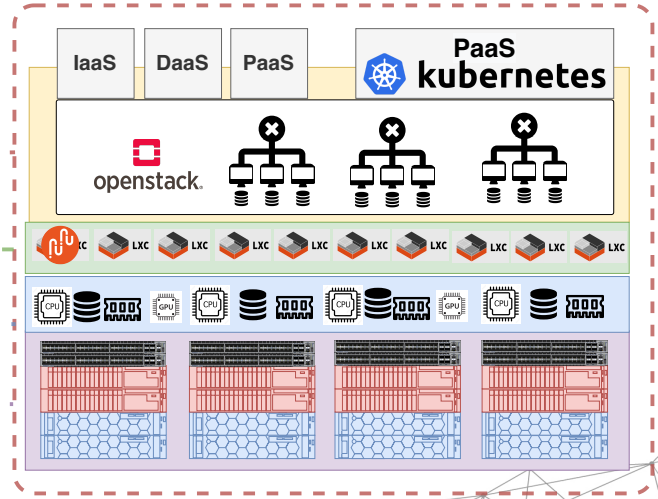
Palermo Cloud Region



- CPUs: 2700 cores
- RAM: 21 TB
- Storage: 1.3 PB
- GPUs: 120 TFLOPS

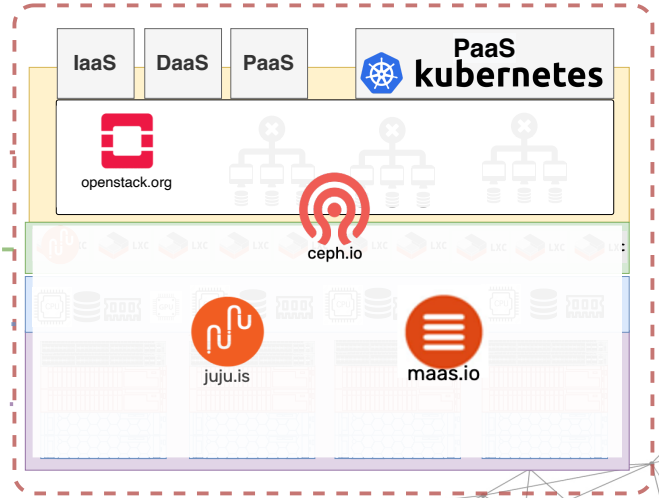
GC: 4-Layers recipe

1. Application Service
2. Infrastructure Virtualization
3. Operating System
4. Physical Resources

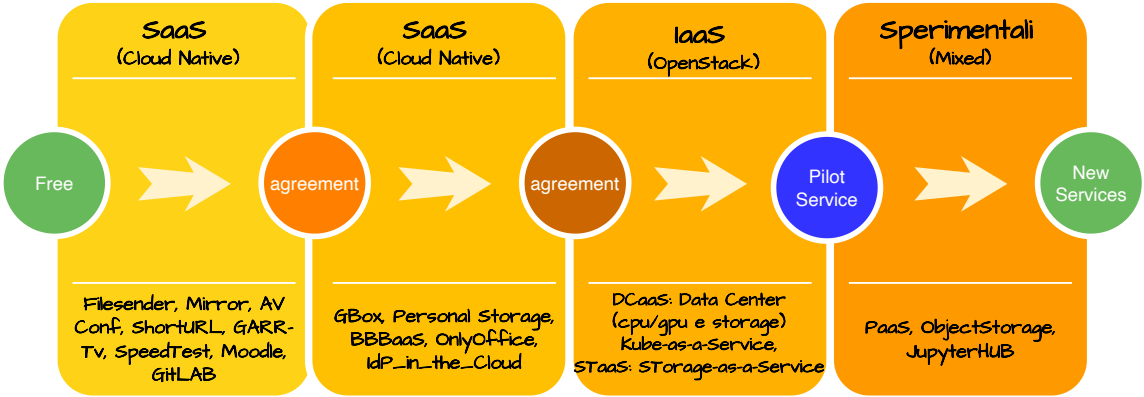


GC: The Engines

1. Application Service
2. Infrastructure Virtualization
3. Operating System
4. Physical Resources



ICT Services



Accounting
Dashboard
Servizi
Enti
Convenzioni
Persone
Tags
Monitoring
Dashboard
Servizi
Floating IPs

Servizio
GARR Virtual Data Centers
137 VDC
Dettaglio

Servizio
GARR Object Storage
122 VDC abilitati
Dettaglio

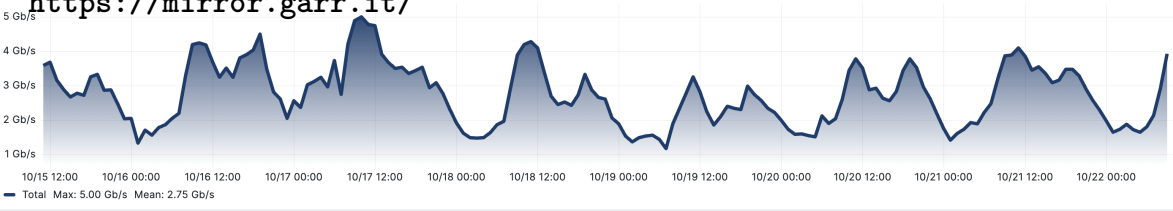
Sum {pa1,ct1,na2}

Enti
97 registrati
Dettaglio

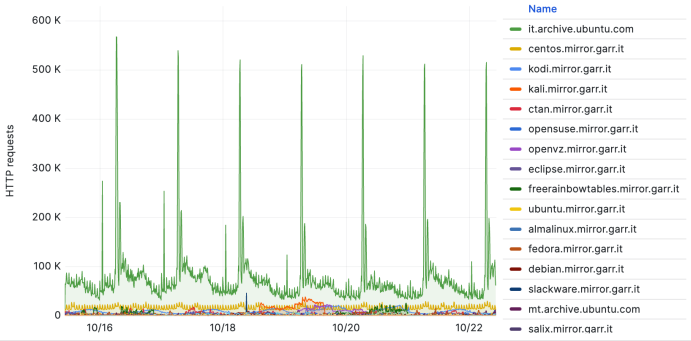
Convenzioni
24 registrate
Dettaglio

Persone
577
Dettaglio

https://mirror.garr.it/



HTTP Request - Top 20 repos



GeoMAP - Countries

Transferred data - Top 20 repos

GARR Meet

Info Contact us Login

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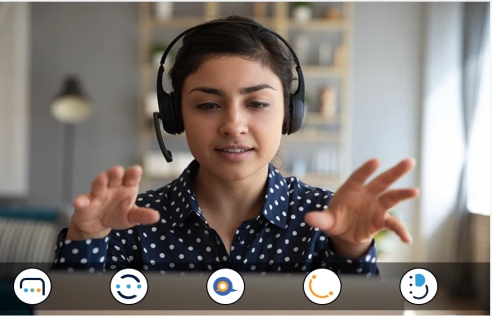

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A wide choice of simple and secure audio and video conferencing tools, in order to meet all the needs of the Italian research and education community.

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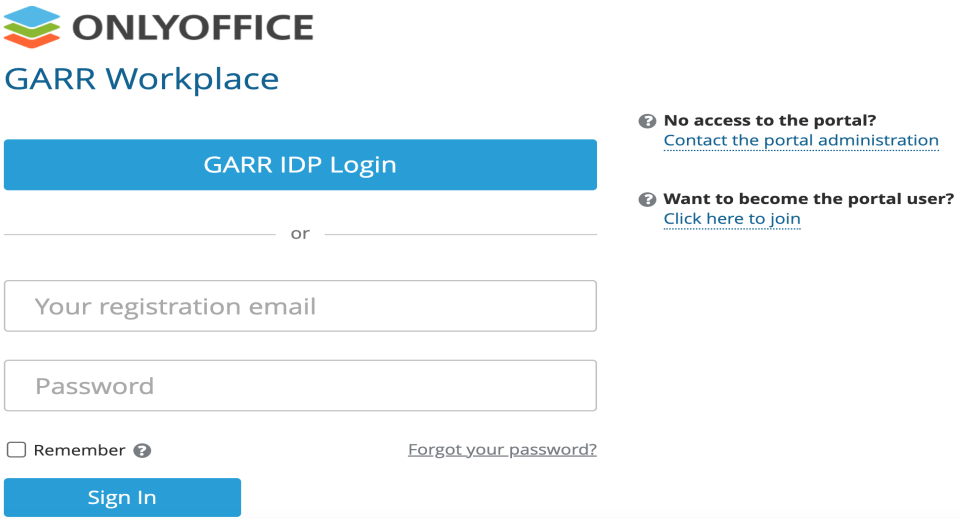
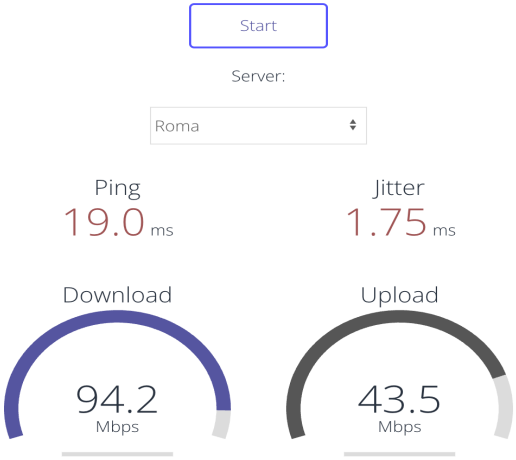


GARR speedtest

https://speedtest.garr.it/

GARR SPEEDTEST

LibreSpeed



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STATISTICHE

no free lunch
knowledge sharing
solidarity

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