



LABORATÓRIO DE INSTRUMENTAÇÃO
E FÍSICA EXPERIMENTAL DE PARTÍCULAS
partículas e tecnologia

Challenges and Opportunities

Jorge Gomes

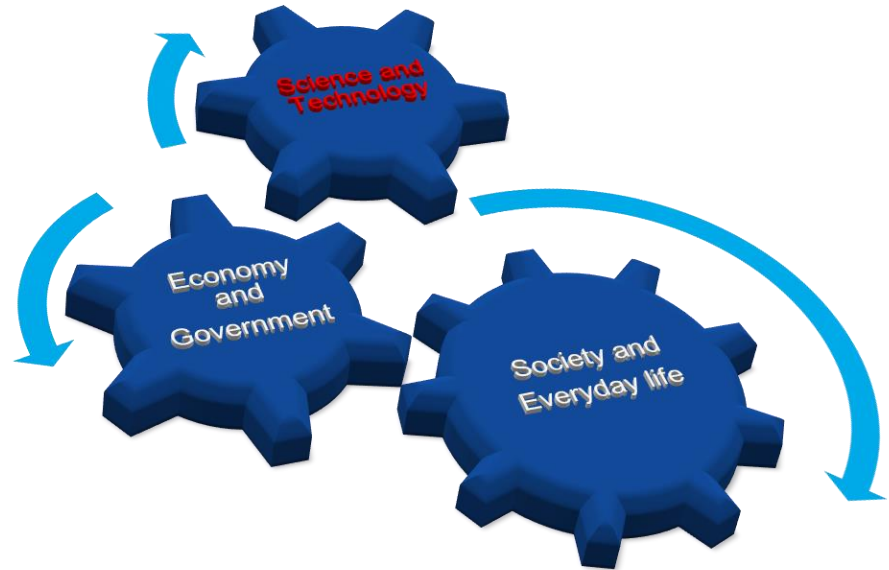
Tribute to Gaspar – *digital transformation challenges* 11/09/2019

Digital Transformation

Change driven by the power of digital technologies

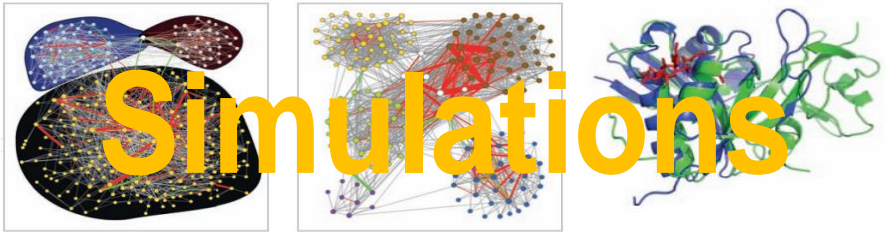
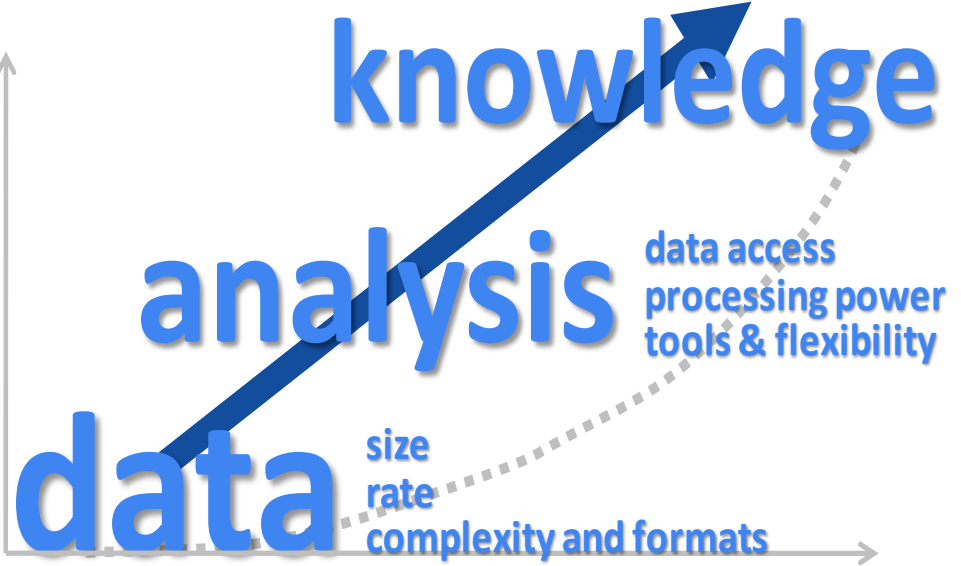
- Cloud computing
- Advanced computing
- Artificial intelligence
- Mobile technologies
- ...

Accelerate innovation
Improve performance
Enhance interactions



Large
Challenges

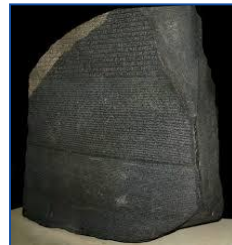
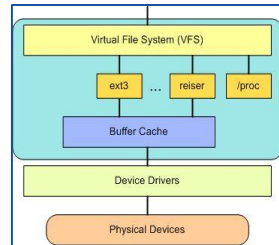
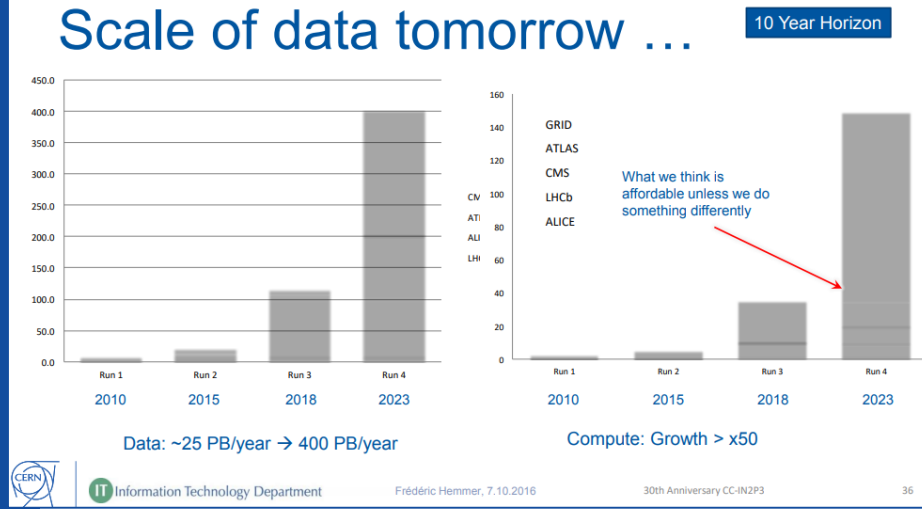
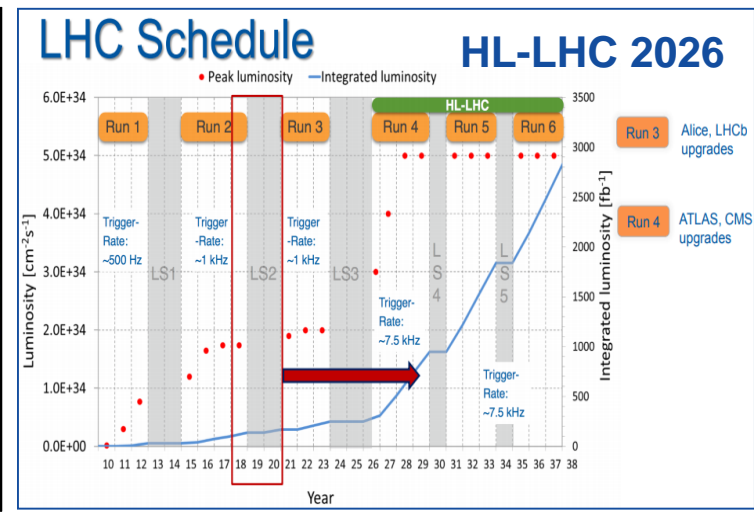
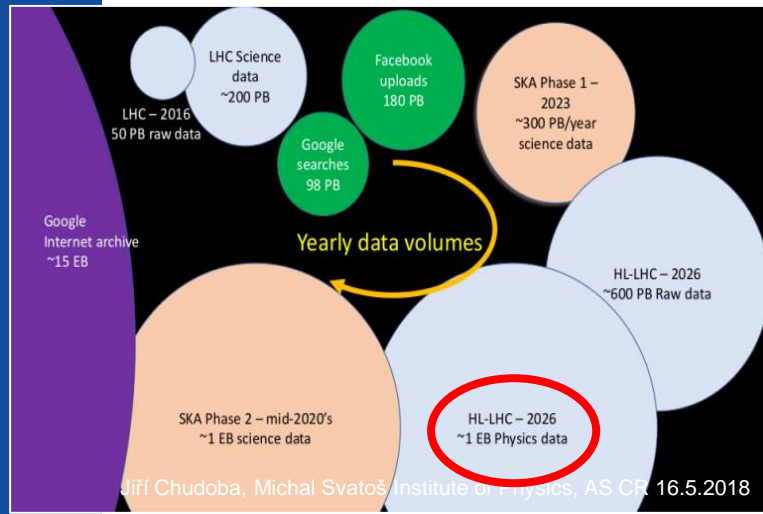
Motivation
for change



Data

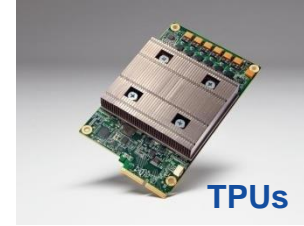
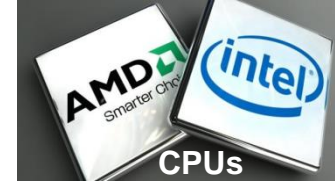
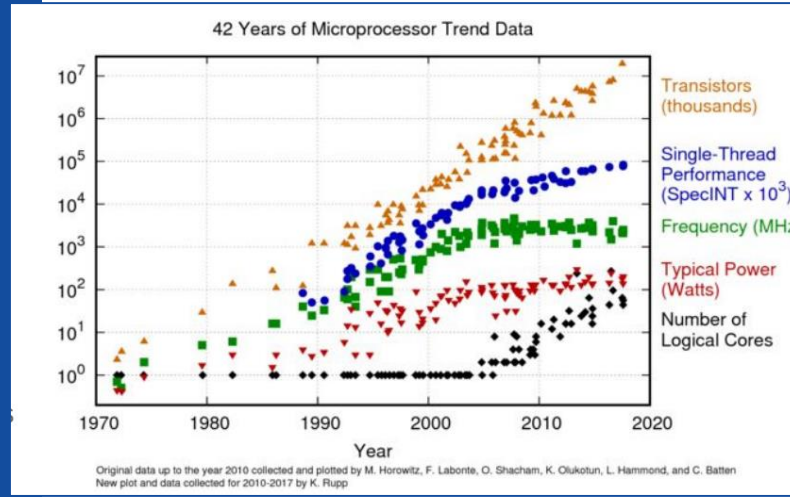
Volume
Bandwidth
Hardware
Software
Management
Preservation

...



Compute

Performance
Efficiency
Cooling
OS
Applications
Libraries
Compilers



CPU cores

L1 cache

L2 cache

L3 cache

Shared memory

GPU cores
(INT, FP, tensor)

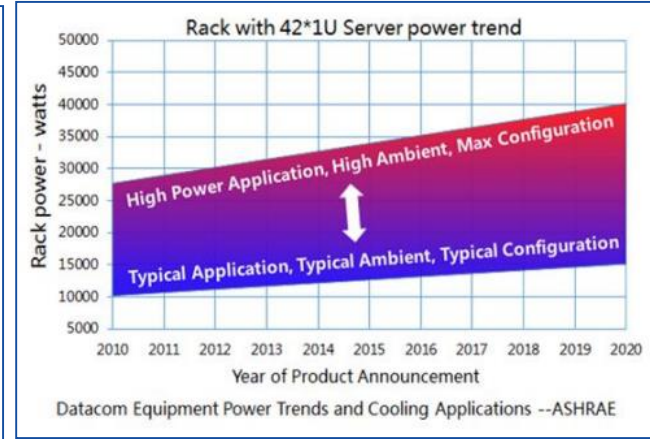
L1 cache

L2 cache

Shared memory

BUS

NVME, NIC, HBA,...

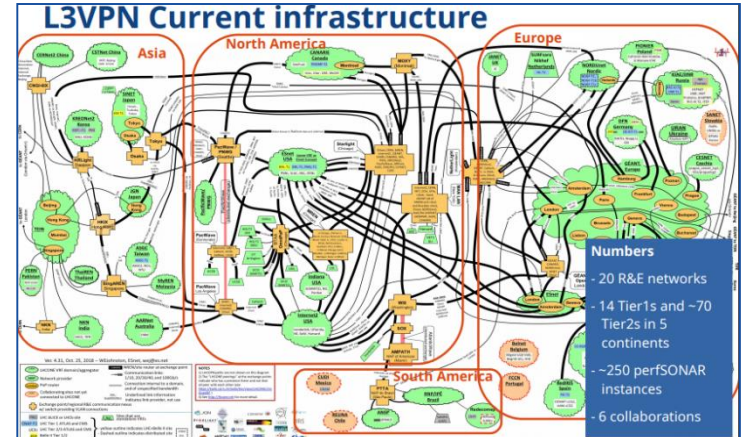
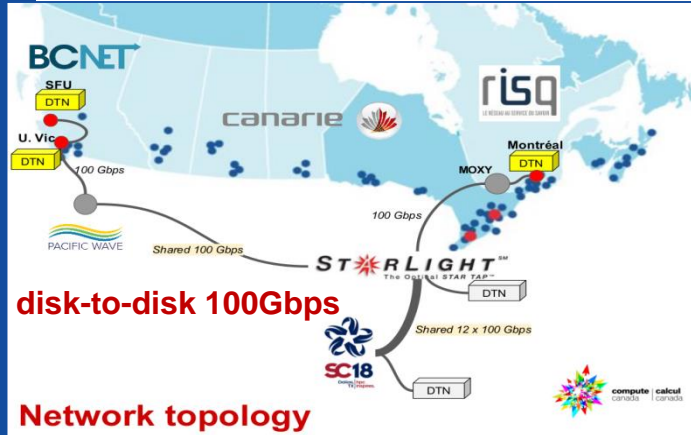
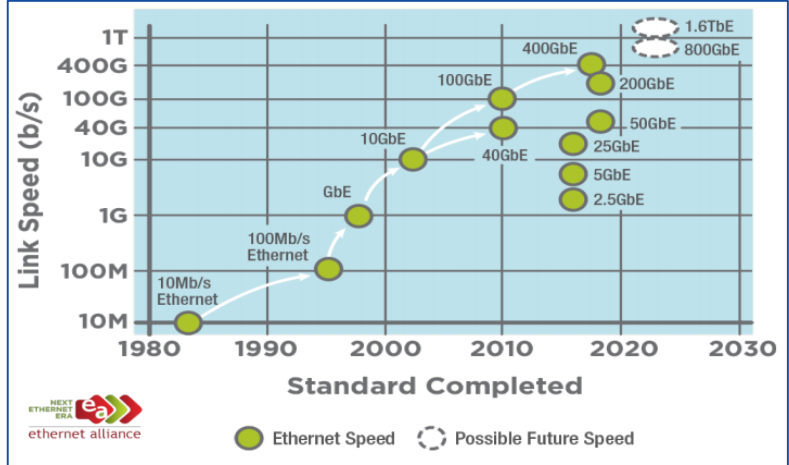
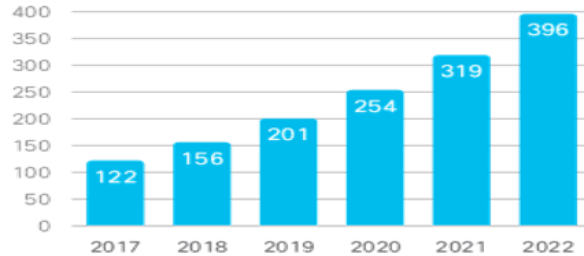


Network Connectivity

- L1 Technology
- L2 Routing
- L3 Protocol
- L4 Application
- End-to-end
- Monitoring
- Security

...

Global Internet Exabytes per month



Software

ML and GPUs
Containers
Virtualization
Cloud
Analytics
Streaming
Storage
Compute

...



theano



Tomas Barton (@barton_tomas)



Lustre®



StoRM



Exploiting Further Resources

Experiment Workload Management System

HTCondor
Workload Management
Aggregator

HTCondor instances
Containers, Virtual Machines, Bare Metal

Private
clouds

Public
clouds

HPC

GRID

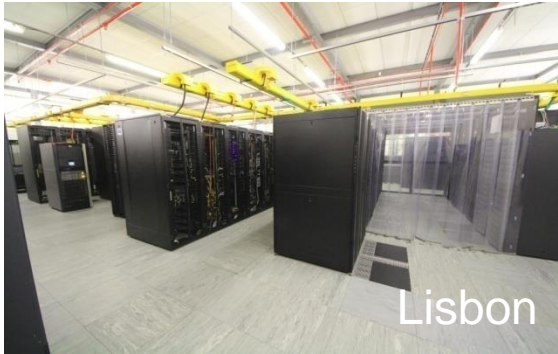
Kubernetes
Mesos

Opportunistic
Computing

Distributed Computing Infrastructure



Generic digital infrastructure for research



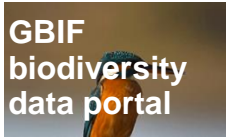
Lisbon



Minho



OPENCoastS



GBIF biodiversity data portal



LHC data processing



Cosmic rays



Genome data



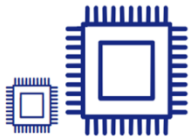
Neutrino physics



Cloud Computing



HTC Computing

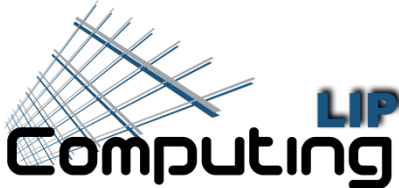


HPC Computing

INCD is a partnership between:
LIP, FCT-FCCN and LNEC

Collaboration and Research

Working
together
Sharing





Thanks