



IDAF:

Interdisciplinary Data Analysis Facility

Dr. Yves Kemp, DESY IT
CDCS opening symposium
Hamburg, 28.4.2022

DESY research divisions ... In a nutshell (those in Hamburg)



Accelerators »

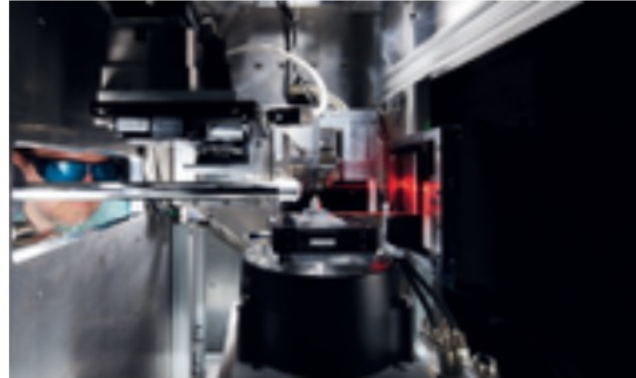
Running / Operating:

- Petra III, FLASH, XFEL, ...

Planning:

- Petra IV

General Accelerator R&D



Photon science »

Petra III, FLASH, EXFEL,
CFEL, CSSB, EMBL, HZG

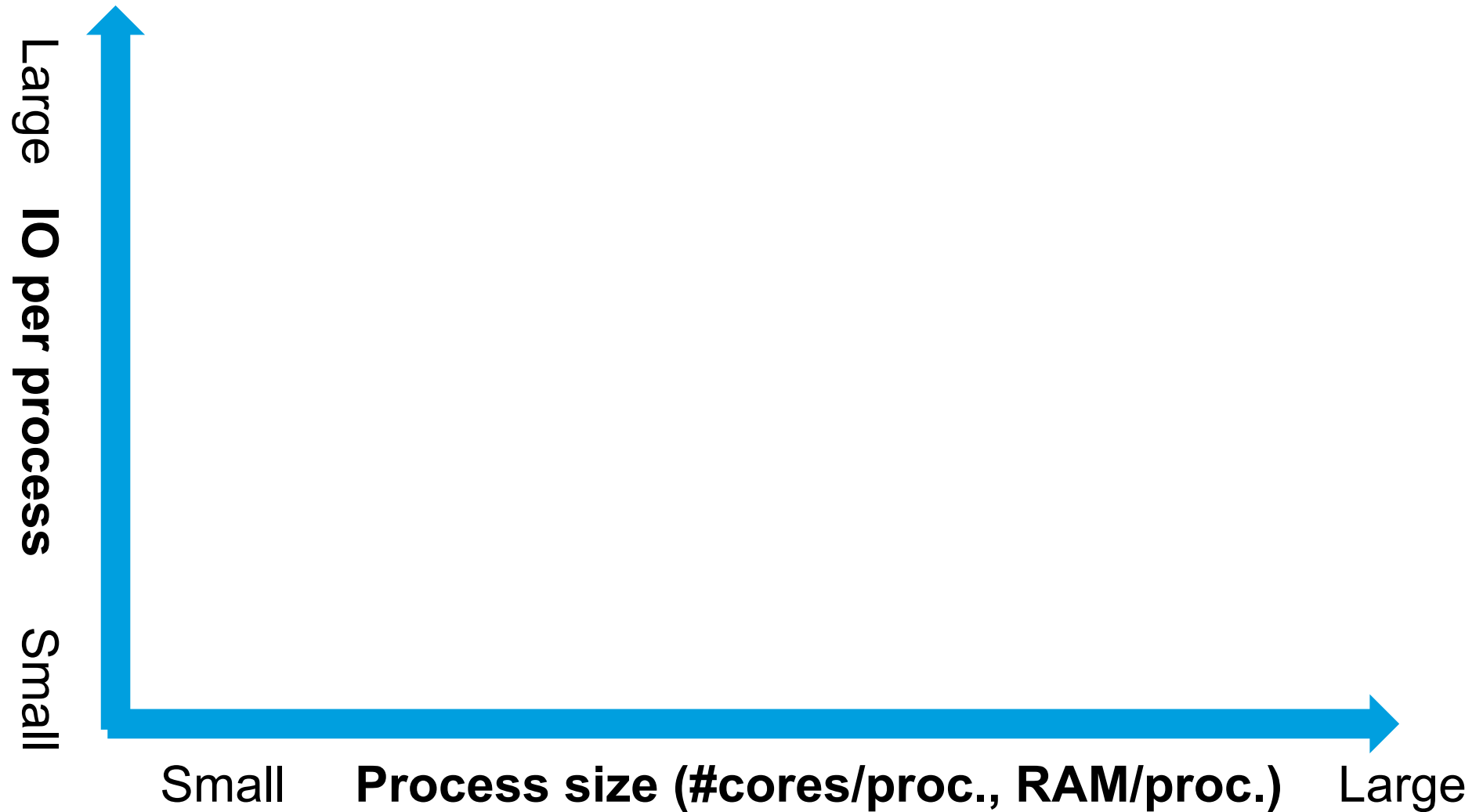


Particle physics »

- LHC, HL-LHC
- Belle II
- ILC, ALPS,
- Theory division

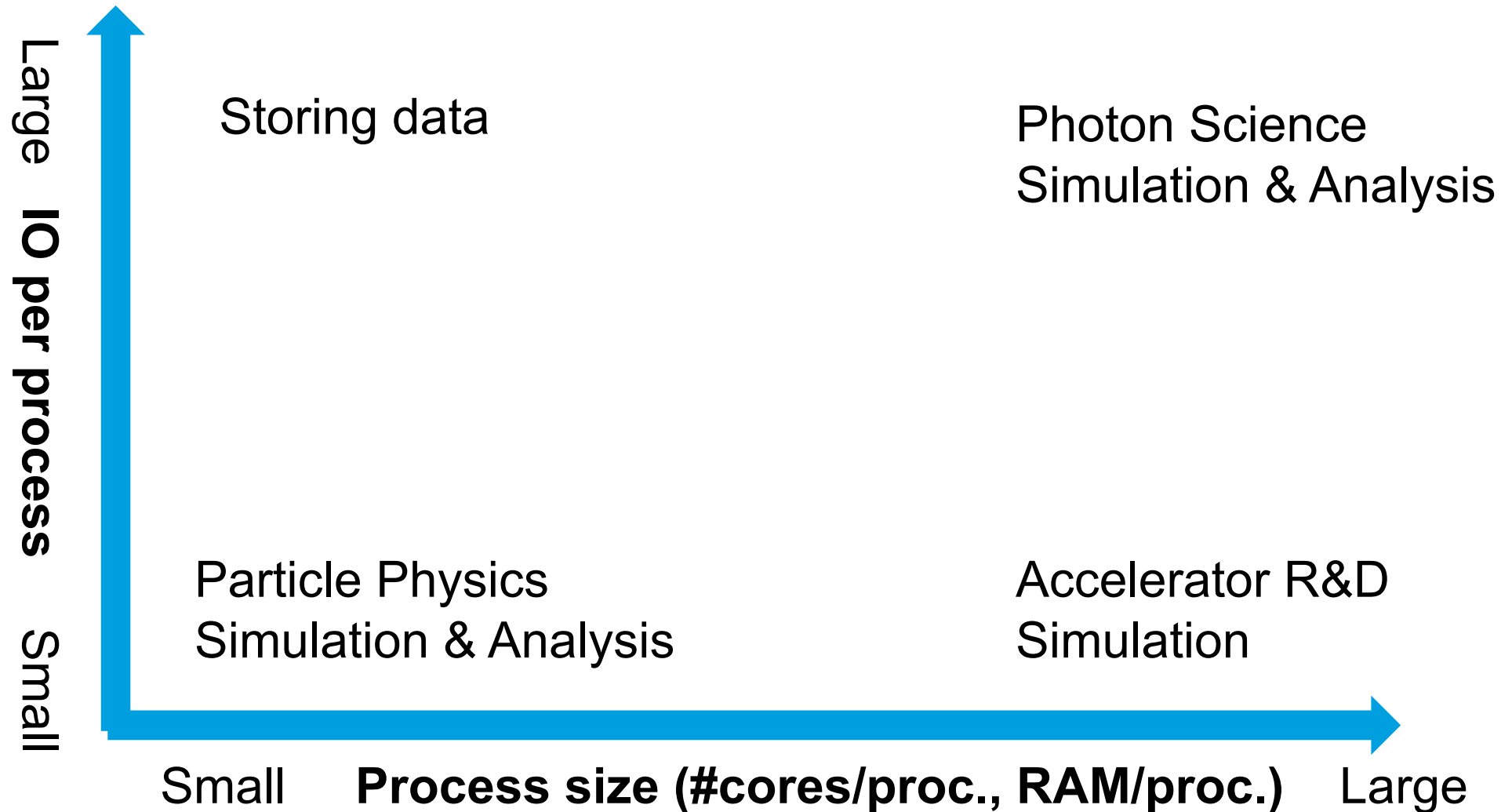
Computational requirements: Job size vs IO needs

Very very coarse



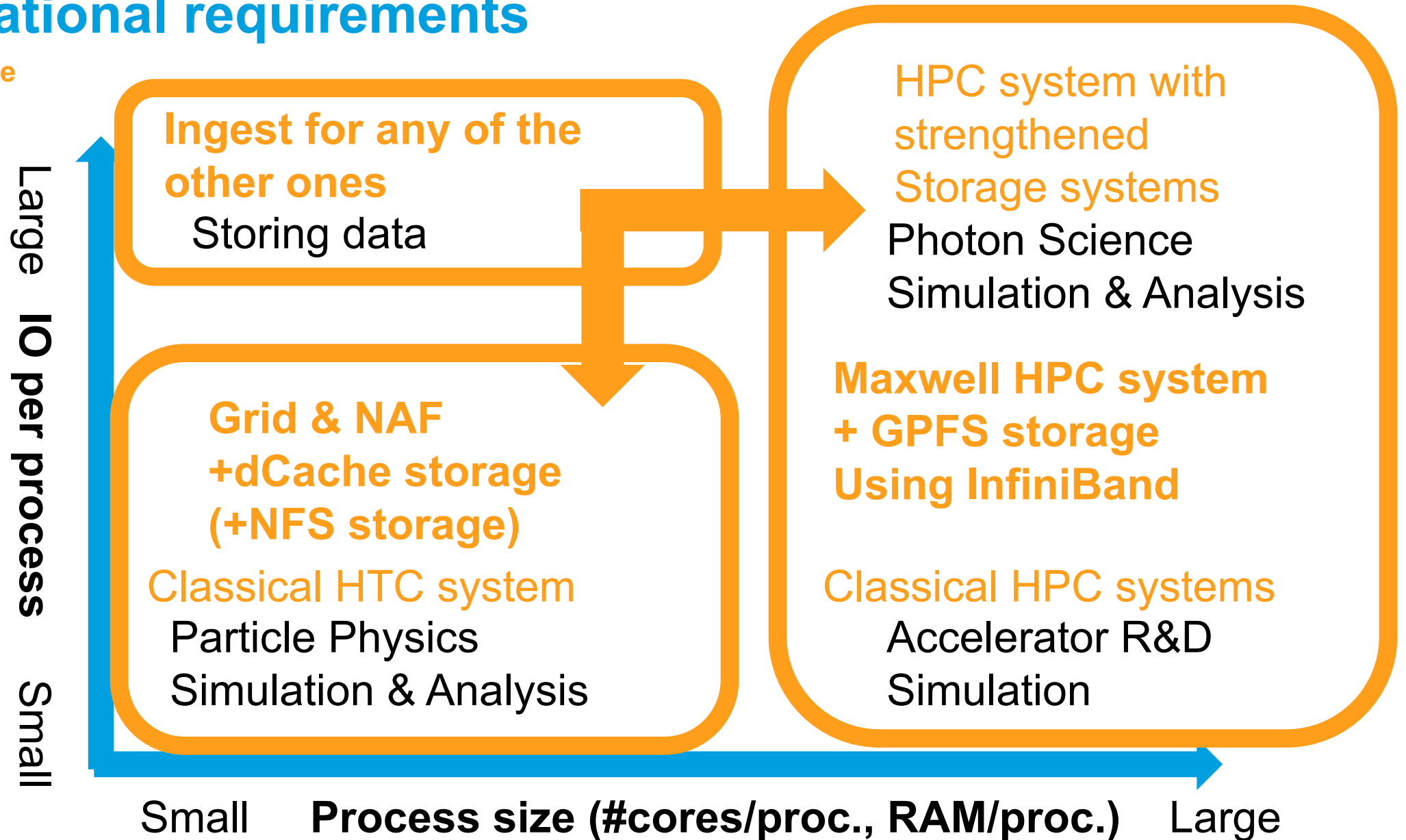
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Computational requirements

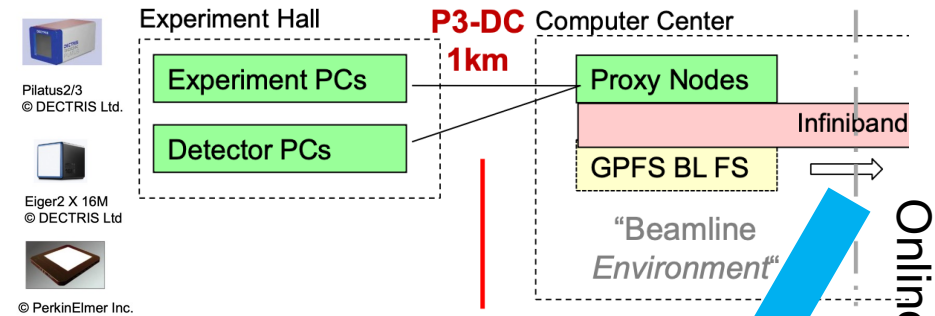
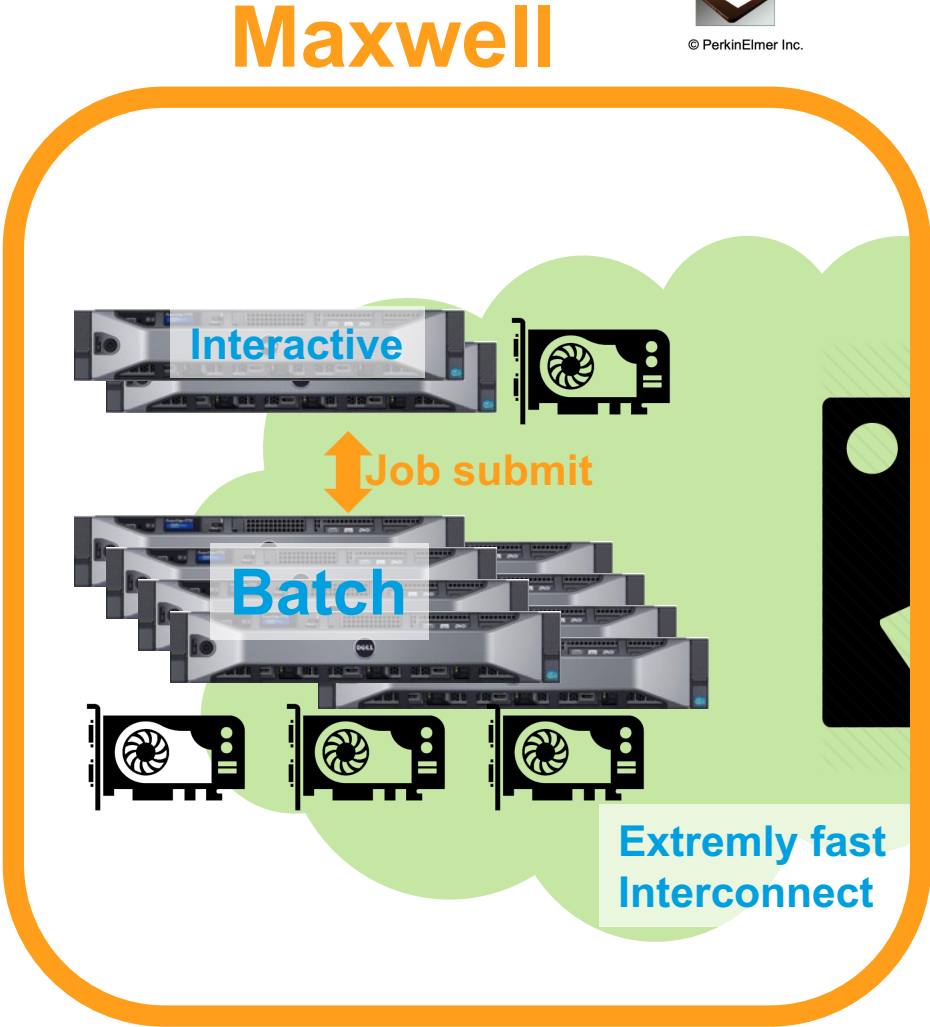
Very very coarse



The Setup for Photon Science



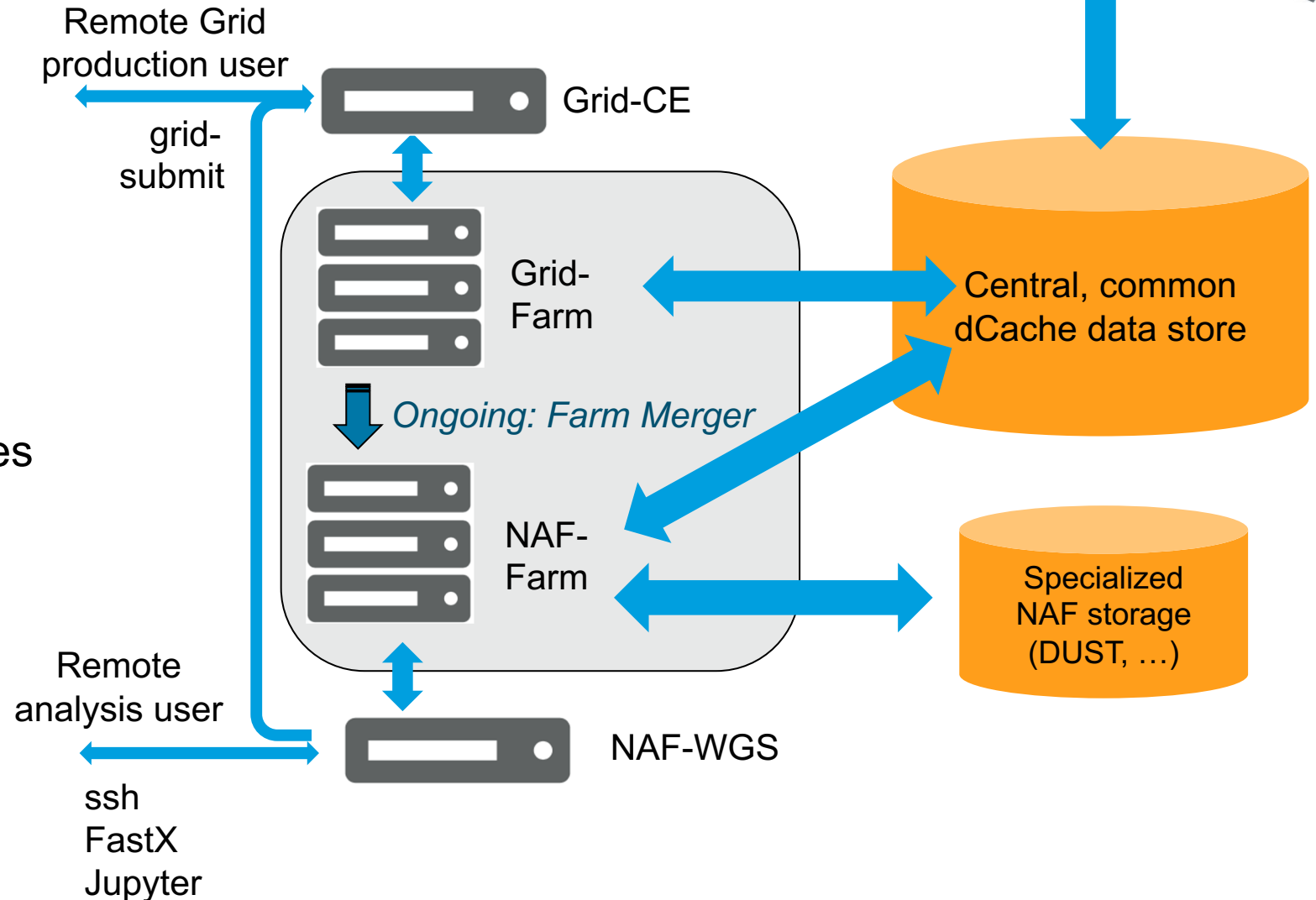
ssh /
FastX /
Jupyter



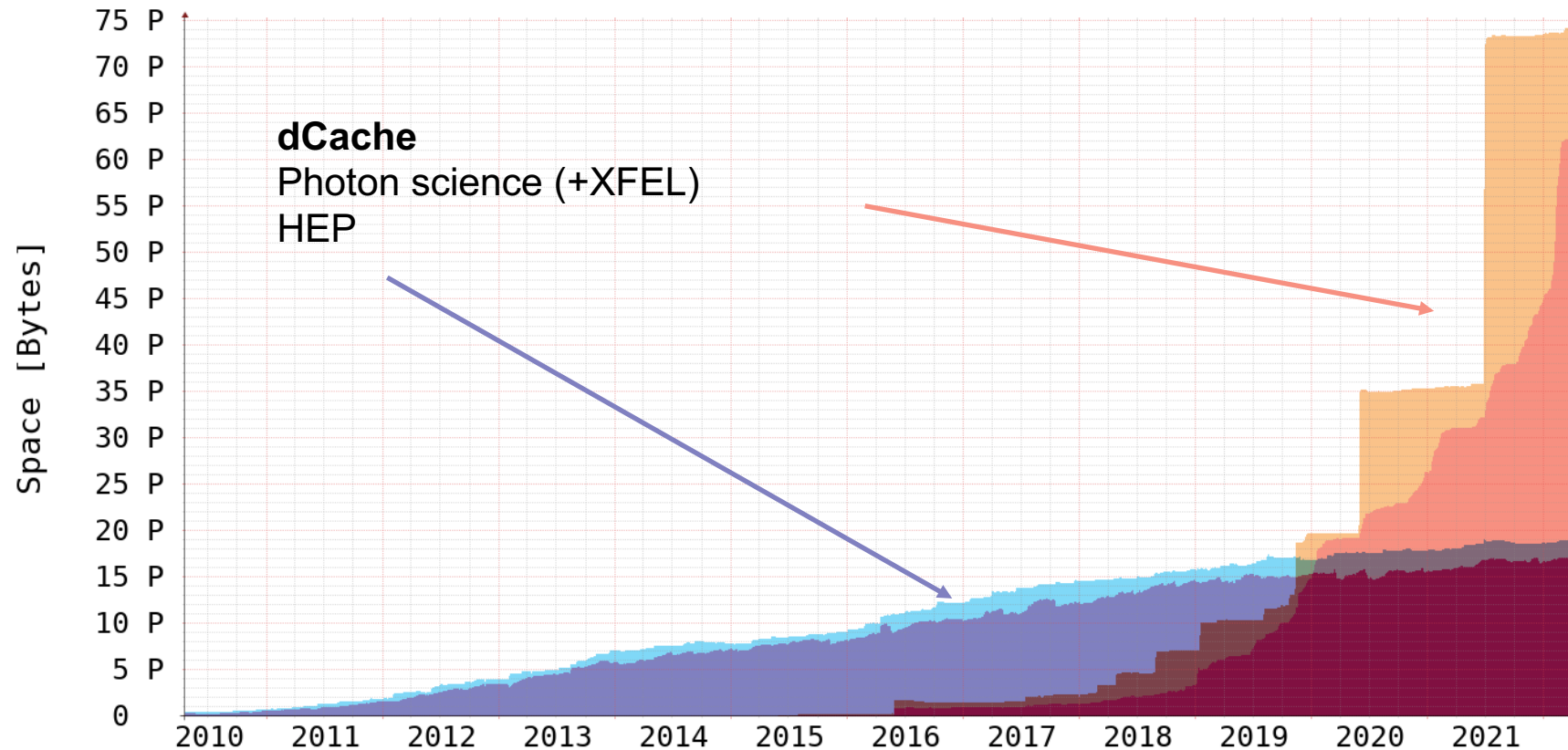
GRID & NAF: The big detailed picture

Grid: Serves worldwide HEP community through Grid protocols
NAF: Serves national HEP community through interactive protocols

Access protocol is just one/few boxes large compute behind, as well as storage infrastructure and access is (mostly) identical



Facts and figures



- Executive Summary:
 - Maxwell + Grid + NAF
 - dCache + GPFS + BeeGFS
- ~60.000 CPU cores, ~320 GPUs
- ~150 PB data on disk
- ~2.700 server (compute, storage, management)
- ~ 0.5 Megawatt

GPFS increase: See e.g. André Rothkirch talk yesterday

Unified Compute Infrastructure
a.k.a.

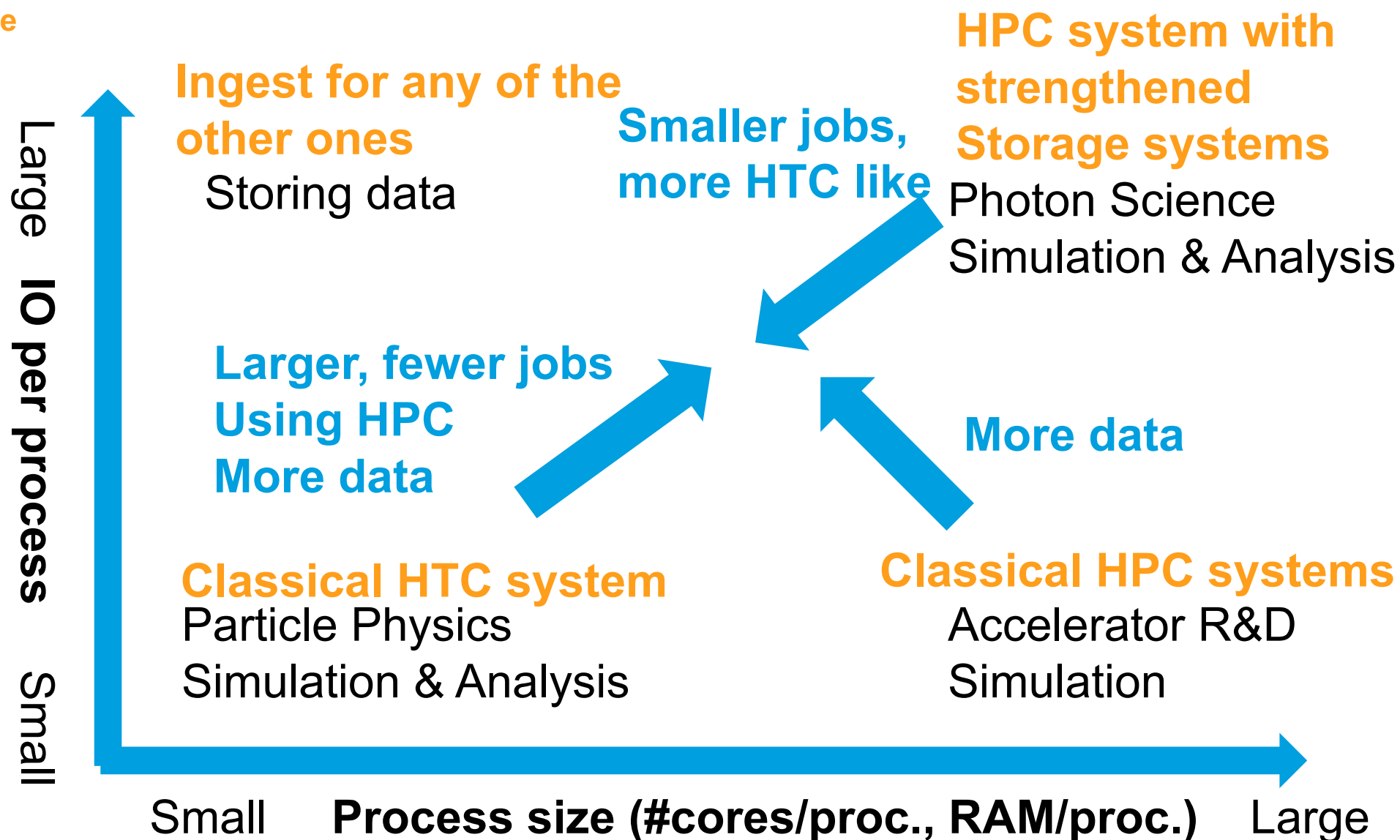
**Interdisciplinary Data
Analysis Facility IDAF**

Motivations for a change: User views

- Data deluge:
 - in Photon Science
 - Upcoming: Particle accelerator operation
- Changes in job profiles:
 - Particle physics: Single-core → Multi-core
 - Particle physics: Usage of HPC systems
 - Photon science: Not all processes need large resources
 - Photon science: Need for online analysis (and reduction)
 - Particle accelerator operations: Doing Big Data & Machine Learning
- Changes in hardware needs
 - All relevant communities now employ computational accelerators (GPUs)

Computational requirements are changing

Very very coarse



The IDAF: Consolidation of resources

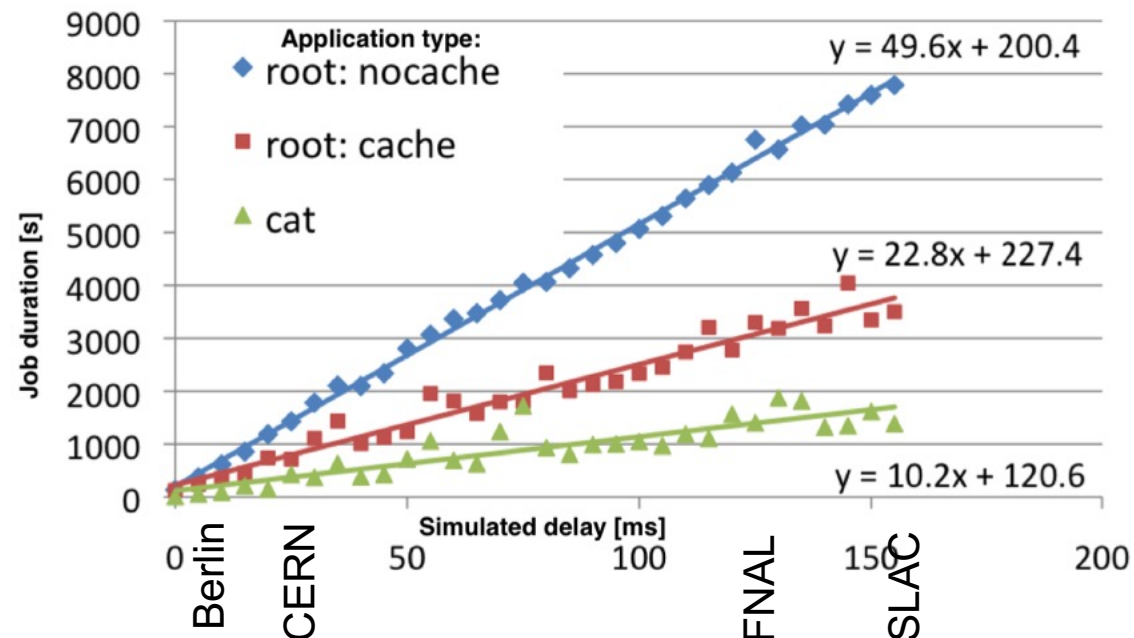
- IDAF:
 - Offering a consolidated access
 - to one resource set
 - via common interfaces
 - for an ever increasing number of communities
 - Common interfaces:
 - Meta-schedulers, workflow engines and pipelines, portals, ...
- Research topic e.g. in DMA, NFDI (PUNCH, DAPHNE), PaNOSC, ExPaNDS, EGI, ...

Integration with external sites / storage

- External access is governed by bandwidth – **and latency!**
- Analysis is data centric
 - Perform analysis on local data is best / Data locality
 - Remote data access needs additional tools:



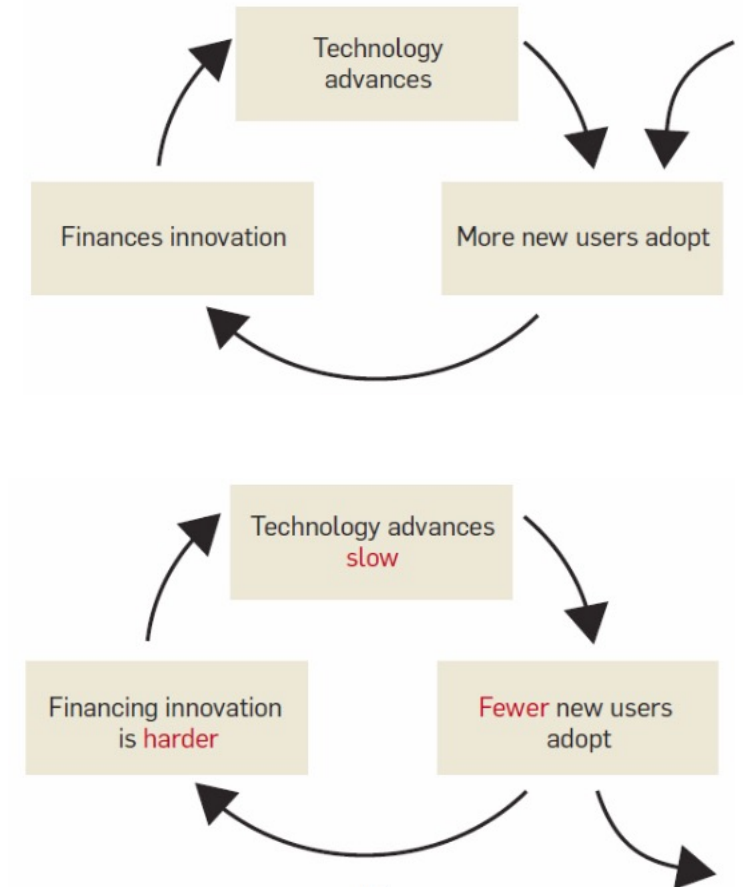
- (transparent) data caches
 - Metadata services
 - Workflow engines
 - Access portals
 - FAIR principles, OpenScience
- Research topic, e.g. HIFIS, ARCHIVER, SciCat, PaNOSC portal



Experience with HEP analysis on mounted filesystems, *J.Phys.Conf.Ser.* 396 (2012) 042020

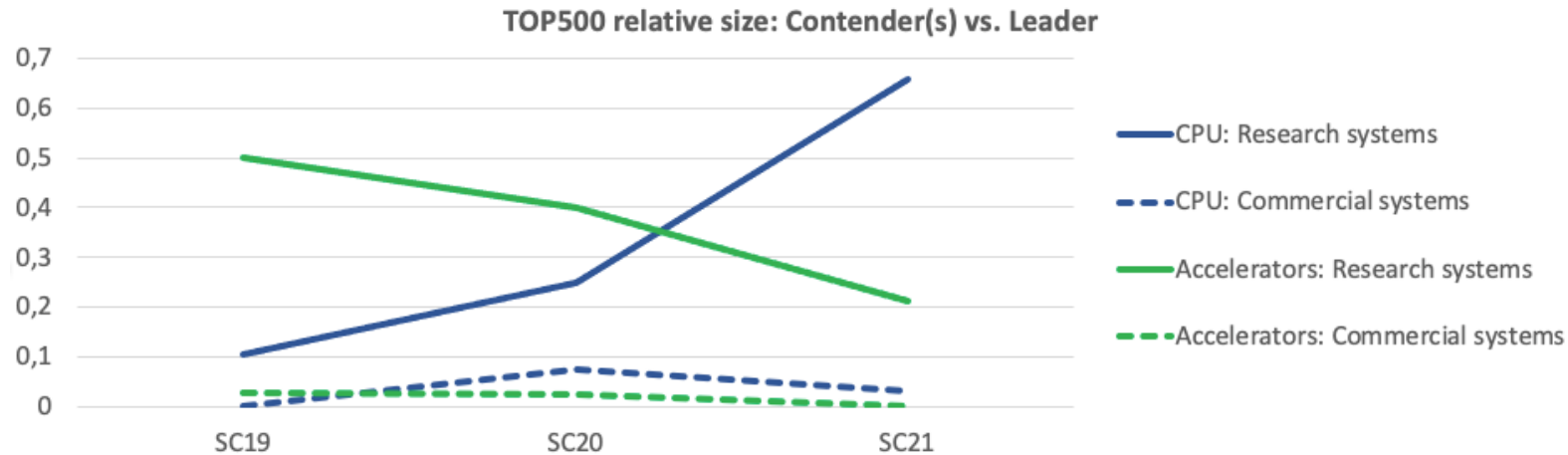
Motivation for a change: Hardware evolution

- With the end of Moore's law and Dennard scaling, there is an economical motivation for leaving the path of universal processors
- Lots of interesting new architectures, products and companies emerge, esp. in the Machine Learning field
 - Leads to fragmentation of technology and hence resources
- As consequence: Consolidate clusters in order to manage technology fragmentation
- How well do we adopt specialised processors?
- How diverse are we?



N. Thompson, S. Spanuth,
<https://doi.org/10.1145/3430936>

Comparison Market leaders vs. competitors



Maxwell #installed systems april2022:

- Intel: 59%
- AMD: 22%
- NVIDIA: 19%
- Non-NVIDIA: 0%

- Maxwell goes with “research” trend: Intel → AMD
- Maxwell goes with “commercial” definition: Compute Accelerator = NVIDIA
- Experience shows: Monoculture & vendor-lock-in come with benefits ... and with costs:
 - Reduced innovation, unmotivated price increases, disruption danger, ...

Data source / raw data:
Erich Strohmaier TOP500 BoF
sessions at SC19, SC20, SC21

Summary & Outlook & a Vision

The IDAF is an excellent tool *for* research

The IDAF is an active area *of* research

CDCS is a unique environment:

- Domain scientists have their domain knowledge
- Computer scientists have solid theoretical foundations
- IDAF systems architects have solid experience and contacts to industry

CDCS brings all three together, and creates an optimal environment, with efficient usage of these powerful yet expensive systems.

