



Germany@CERN

The CERN IT Department and Business Opportunities

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IT Département Head (*ad interim*)

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Outline

- What we do
- Worldwide LHC Computing Grid
- Nature of expenses
- Market worries
- The future

IT: What do we do

- **Run core IT services for the lab (all sectors) and its users, 24x7**
 - 109 Service Elements (186 FE's)
 - Incl. the MCC and server procurement
- **Manage and operate the World Wide LHC Computing Grid**
- **Manage and operate the CERN openlab**
- **Host the UNOSAT Organisation and operates its IT**
- **Run the Computer Security**
- **Run the CERN School of Computing**
- **Coordinate and participate in EU Projects**
- **Host the Quantum Initiative Project**

Resources

[IT Annual Report \(2020\)](#)

[CERN openlab annual report \(2019\)](#)

[WLCG RRB report \(Oct. 2020\)](#)

The Worldwide LHC Computing Grid (WLCG)

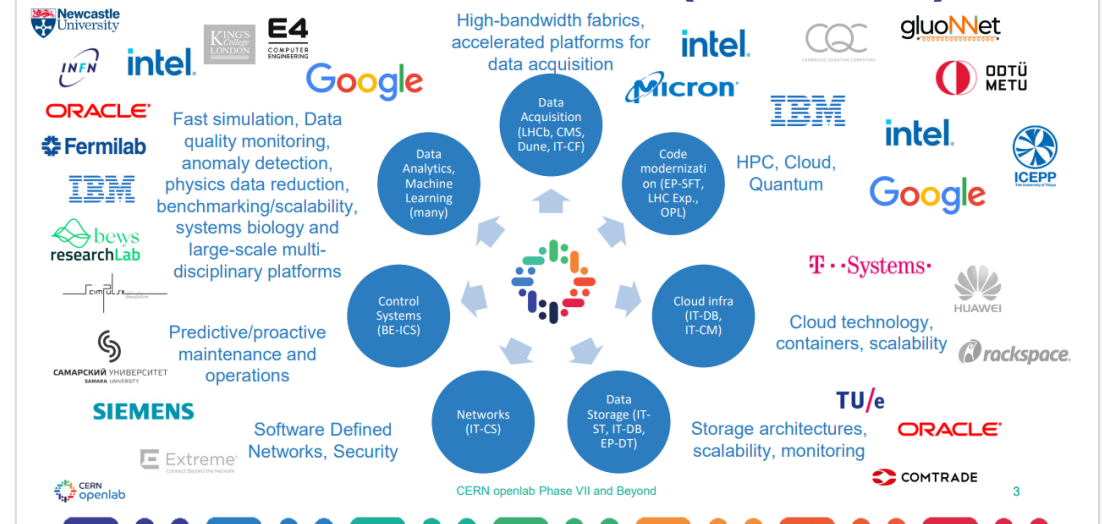


Used to store, distribute, process and analyse data.

1 million processing cores in about 160 data centres and 42 countries.

More than 1000 Petabytes of CERN data stored world-wide.

JOINT R&D PROJECTS (PHASE VI)



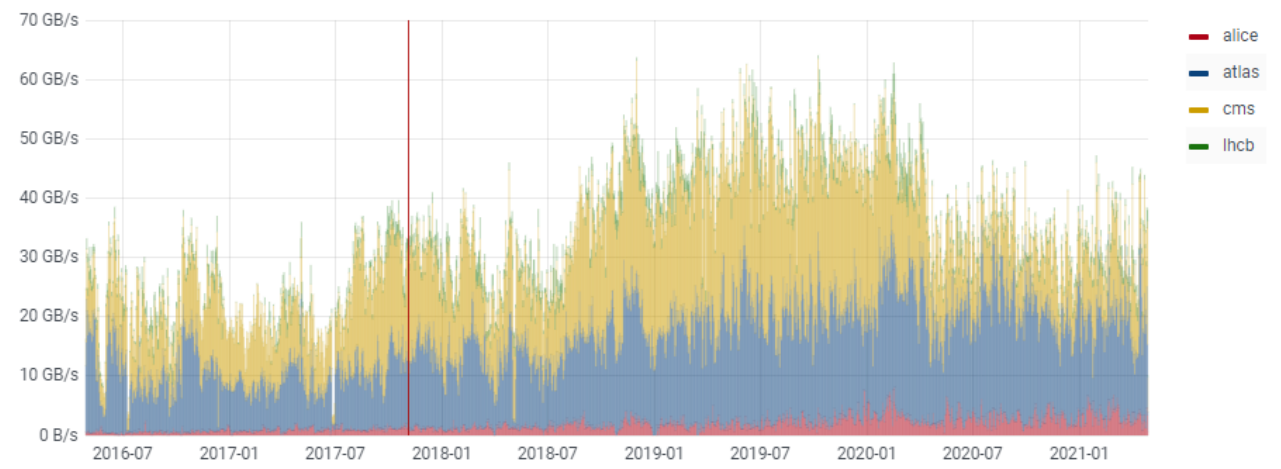
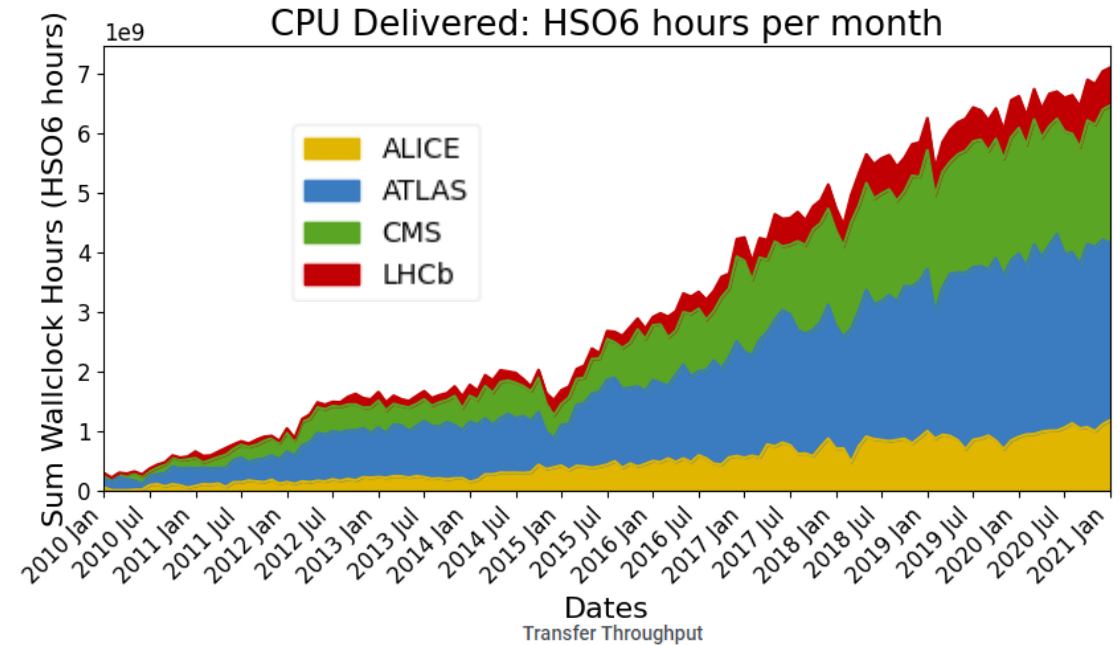
Objectives for the coming years

- **Operate 24x7 core (secure) IT services for the lab and its users**
 - *Possibly in difficult pandemic conditions*
- **Manage and operate 24x7 (securely) WLCG**
- **(Prepare for) RUN 3**
 - *ALICE (and LHCb)*
 - *NXCALS*
 - *CERN commitments to WLCG*
- **Reduce dependencies on licensed software and cloud offering**
 - *And mitigate CentOS*
- **Contribute to the establishment of the European Open Science Cloud**
 - *Including Pre-Commercial Procurements*
- **Prepare for HL-LHC**
 - *Including commissioning of the PCC by 2023*
 - *WLCG Computing models and HSF*
- **Implement Data Privacy**
 - *Not only technically...*
- **Introduce the next generation of Firewall and EDR**
- **Future of Telephony**
 - *Including Mobile and Tetra*
- **Contribute to Catia replacement**

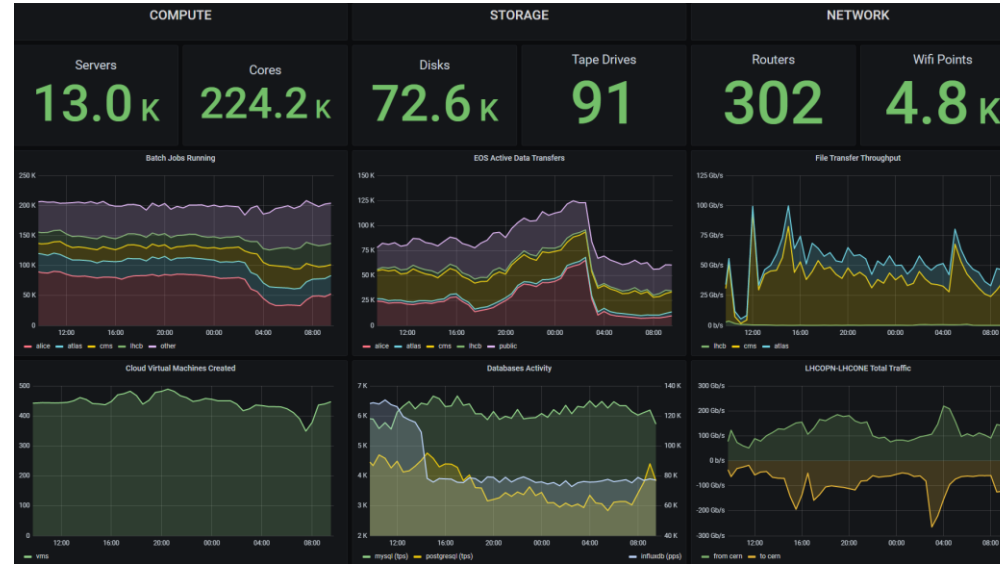
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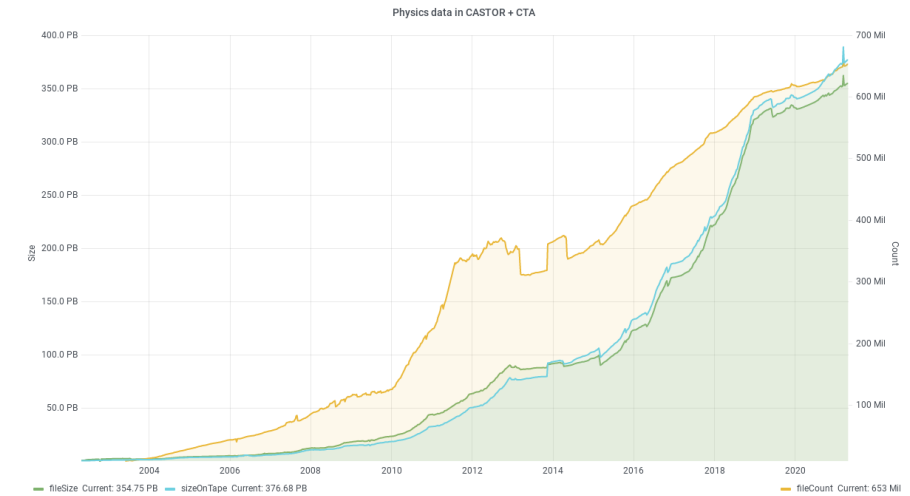
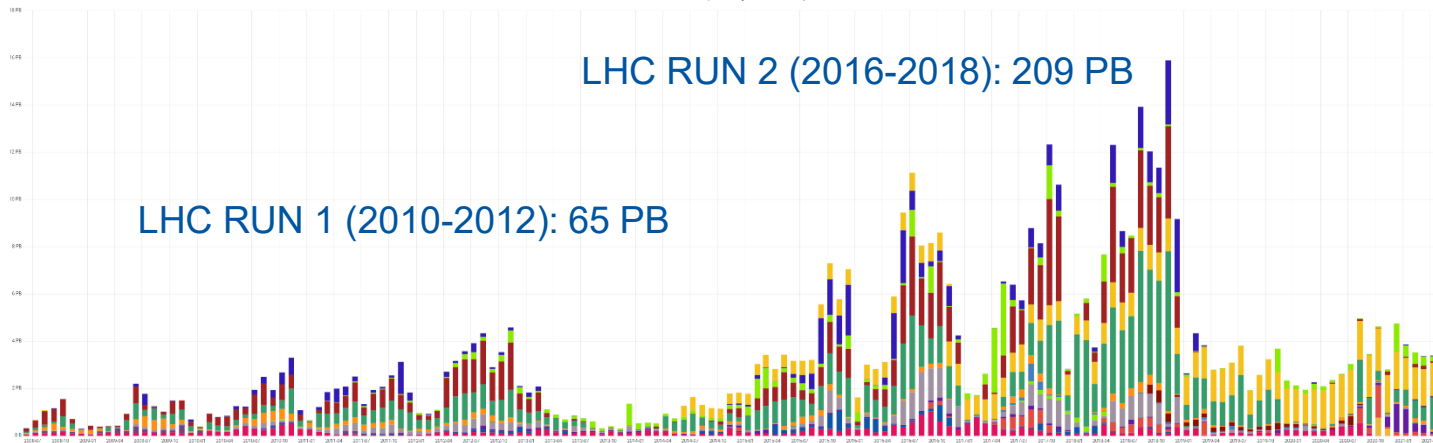
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CERN Computing Facilities



Document Classification: Restricted



The datacenter equipment is renewed ~every 5 years in average



Nature of Expenses in the IT Department

- Recurrent Expenses
 - Contracts
 - Maintenance
 - Software Licences
- Investment Expenses (> 20 MCHF/year)
 - Tapes & Tape libraries
 - Disk storage
 - Compute & Data Servers
 - Routers et Switches
- Significant Projects
 - WiFi (6 MCHF)
 - Acquisitions on behalf of other departments
 - HPC Clusters (1.1 MCHF)
 - HSE (200 KCHF)
 - B 773 (3 MCHF)
 - Firewall (1.8 MCHF)
 - Computer Center (30 MCHF)
 - Quantum Technology Initiative (3 MCHF)
 - TETRA Replacement (2026 – 4.5 MCHF)
 - ...

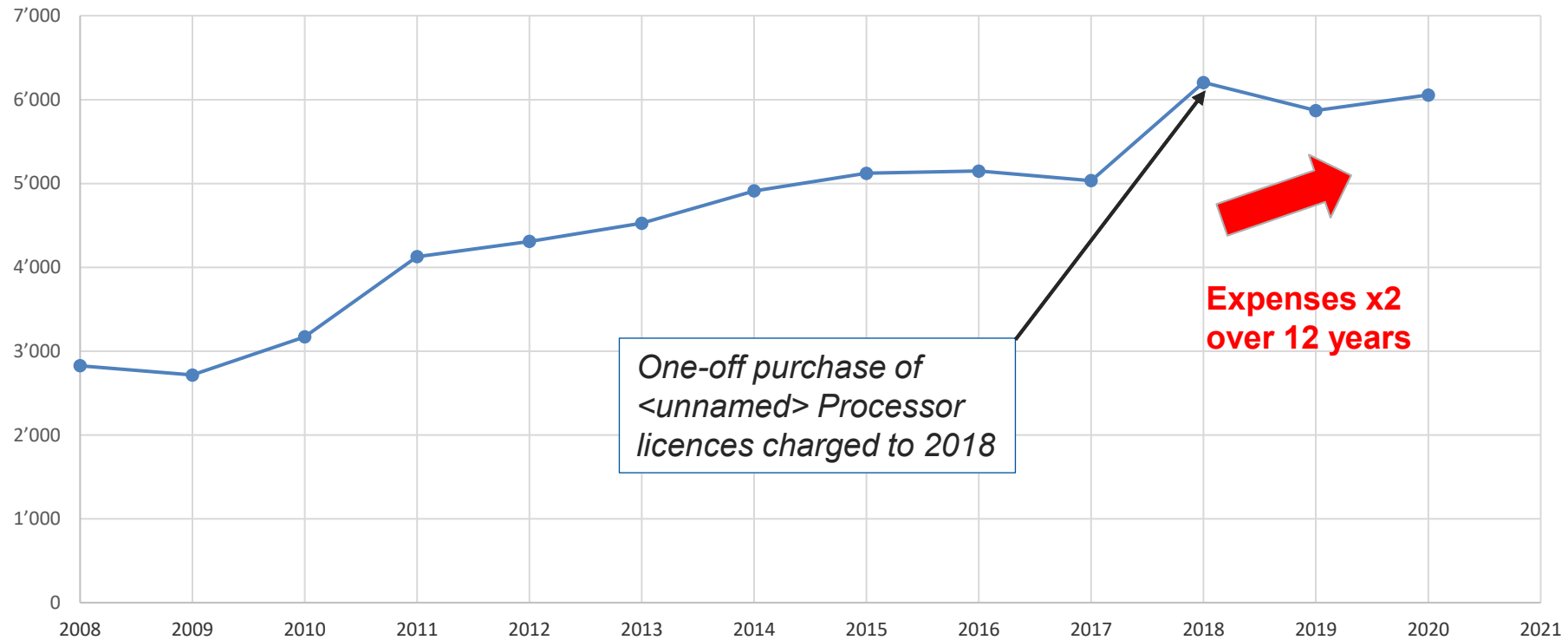
Recurrent Expenses

Nature	Description	Cost (CHF)	Nature	Description	Cost (CHF)	
Maintenance		265,408	Telecom		981,600	
		44,099			216,085	
		117,887			50,000	
		145,526			25,000	
		68,986			5,000	
		28,451			22,222	
		149,982			36,000	
		895,264			17,600	
		31,615			4,240	
		28,506			25,117	
		124,839			146,575	
	40,271					
Maintenance	Subtotal	1,631,327	Telecom	Subtotal	1,529,439	
Services		1,069,099	Subscriptions		3,082	
		942,555			41,184	
		946,927			4,799	
		1,680,127			9,294	
	259,918		87,698			
Services	Subtotal	4,898,626	Subscriptions	Subtotal	154,857	
Software Licences		841,573	Hosting		3,460,146	
		2,000,595			215,695	
		353,173				
		21,277		Hosting	Subtotal	3,675,841
		192,959		General Operations		2,408,168
		185,563				285,000
		1,511,296				62,371
		73,911		General Operations	Subtotal	2,755,539
		8,223				
		214,302				
	1,357,345					
Software Licences	Subtotal	6,760,217	General Operations	Subtotal	2,755,539	

Grand Total: 20,138,173

2008-2020: Major Increase of Software Expenses

Software Licences, Maintenance & Support (kCHF)



Clear Trend:

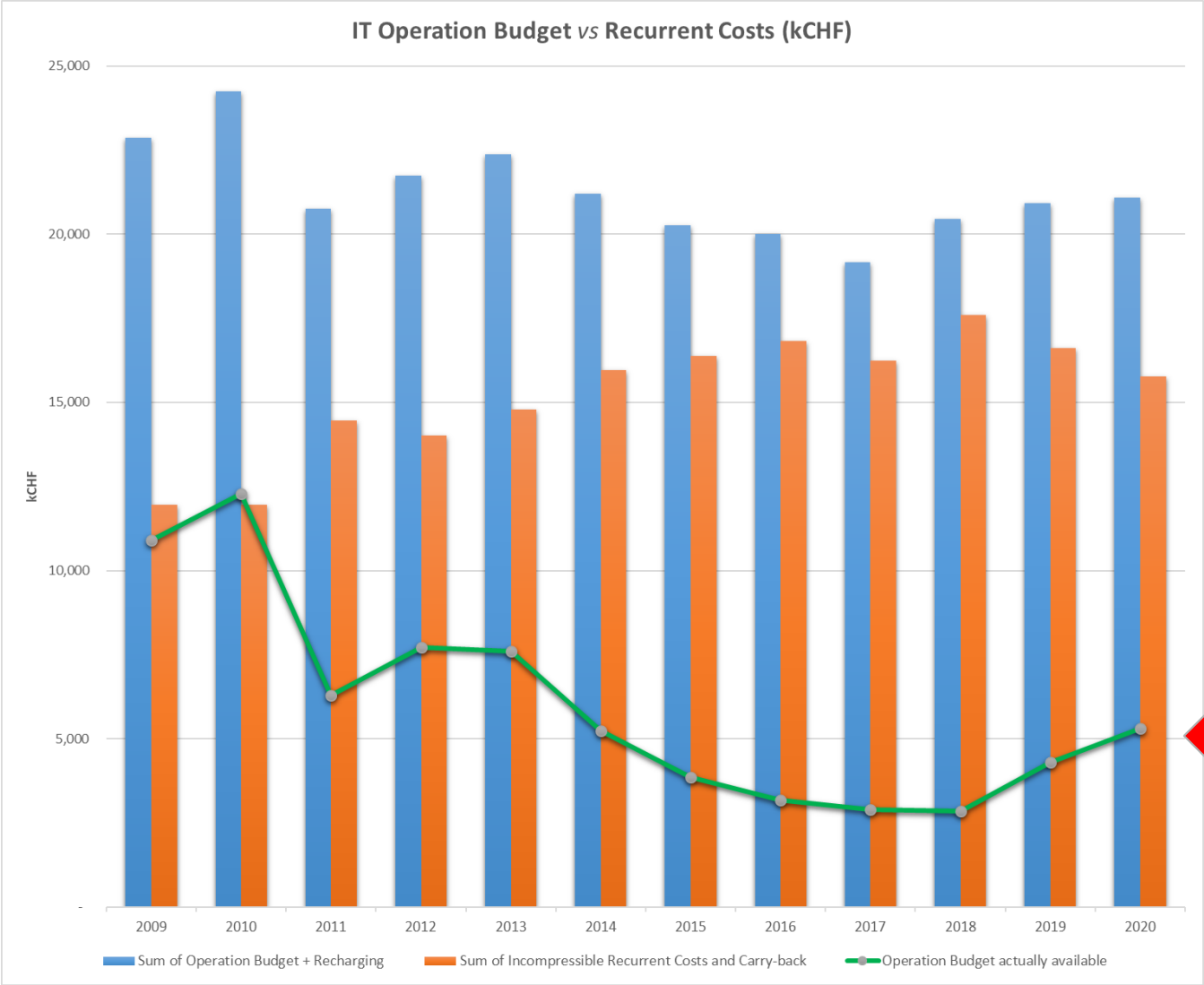
Software costs would continue to increase in the near future due to commercial trends impacting the academic world

- In 2020: Vendor A (+900kCHF/yr), Vendor B (+60kCHF/yr), Vendor C (+40kCHF/yr)
- Uncertainties about *many others*

2009-2020: CERN IT Operation budget

IT Operation budget is dominated by **incompressible costs**

- Licences
- Maintenance
- Support contracts
- etc.



WLCG Funding & Expenditure

Materials planning based on:

LHC Computing Funding and Expenditure

Result 2020, estimates 2021...2023

All figures in MCHF; data extracted on 22 March 2021

	2020	2021	2022	2023
Funding				
From CERN budget ¹⁾				
Personnel	18.0	18.3	17.9	17.1
Material ²⁾	16.6	25.3	19.5	18.9
Total funding	34.6	43.6	37.4	36.0
Expenditure				
Personnel ³⁾	18.0	18.2	17.6	16.4
Material	16.6	26.5	18.6	17.1
Total expenditure	34.6	44.7	36.1	33.5
Balance personnel	0.1	0.1	0.3	0.7
Balance material	0.0	-1.2	1.0	1.9

1) Internal budget 2021

2) Includes carry-forward/carry-back, EUR/CHF exchange rate penalty and CVI

3) Excluding data centre operations

- 2021: April 2020 RRB outcome and expected spending till the end of the year
- 2022: October 2021 RRB outcome (will be updated after this RRB)
- 2023: assume +20% increase wrt 2022 (will be updated as 2023 conditions become more clear)
- Cost extrapolations updated based on recent experience and market trends

Market Trends

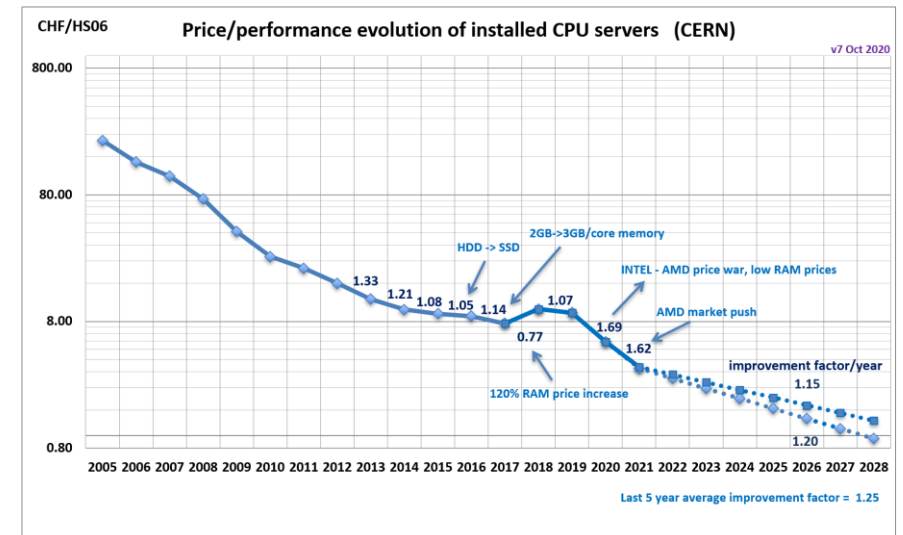
The most worrying trend is the worldwide shortage of semiconductors: demand is much higher than supply

Causes: COVID (demand for notebooks/phones, shortage of air cargo capacity) + trade issue between countries

Effects: price of SSD and memory expected to raise by 10-15% by summer. Delays in procurement (4 months delay at CERN at the moment). This is expected to continue in 2022

The CPU market still benefits from the Intel/AMD competition. We will have the next data point at the October RRB

Courtesy of Simone.Campana@cern.ch



Case Study: IT-4350



European Organization for Nuclear Research
Organisation européenne pour la recherche nucléaire

Group code: IT/CF
IT-4350/IT

Invitation to Tender

Technical Specification CPU Servers for Physics Data Processing

Abstract

This technical specification concerns the supply of CPU Servers for Physics Data Processing with delivery foreseen during the fourth quarter of 2017

June 2017

IT-4350/IT

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IT-4350/IT

2. SCOPE OF THE INVITATION TO TENDER

CERN intends to procure about 690 000 HEP-SPEC06³ of energy-efficient rack-mountable systems suitable for use as computational servers (henceforth called “CPU servers” and hereinafter referred to, in whole or in part, as the “supply”). CERN will perform the adjudication on a third of the supply (i.e.: 230 000 HEP-SPEC06) and intends to procure the supply from at least three different contractors. CERN reserves the right to procure the supply from more than three different contractors. The supply shall originate from CERN Member States and, under certain conditions, from Associate Member States or Candidates for Accession (as specified in the tender form). The delivery is foreseen during the fourth quarter of 2017.

Company	Recipient	Code	Amount
Company 1	IT	47813	721,395.00
Company 2	IT	47813	752,576.00
Company 3	IT	47813	772,823.00
Total			2,246,794.00



WLCG needs for 2022

2010-2021: summary of pledges

2022: CRSG proposal at this (April 2021) RRB

Resource needs for the start of Run-3 are compatible with flat budget (calculated from 2018), with some margin

Caveats:

- This is the global picture. The situation per experiment and per Funding Agency may vary
- Run-3 conditions after 2022 could be challenging
- Market Trends for hardware
- More tape bandwidth needs
- (...)



Longer Term

