Information event on the Swiss participation in EuroHPC

P. Brönnimann, 14.06.2019

Agenda

- Introduction to the EuroHPC Joint Undertaking
- Presentation of the two EuroHPC pillars

  (1) INFRASTRUCTURE
  - a) EuroHPC's Infrastructure Procurement
  - b) Swiss (ETH Zurich / CSCS) involvement in the LUMI consortium

  (2) RESEARCH & INNOVATION
  - a) Draft version of the EuroHPC R&I Workplan for 2019
    - i. Towards Extreme scale technologies & applications
    - ii. Innovating & Widening the HPC use & skills base
    - iii. The European Processor Initiative (EPI)
  - b) Role of Euresearch

- Outlook post-2020

Introduction to the EuroHPC Joint Undertaking

Reasons for action at EU level (1/2)

- Fragmentation of HPC services across the EU and within MS leads to inefficient use of resources and only partial cross-border exchange of expertise.
- HPC is an essential instrument to address societal challenges like health and security. Both policies of shared European interest.
- HPC is fundamental to build the data economy ⇨ Political priorities in the Digital Single Market (DSM)
- The scale of the resources that are needed to realize a sustainable exascale level HPC infrastructure and ecosystem is beyond what national governments can nowadays afford to invest

Reasons for action at EU level (2/2)

- Demand is not met (many EU researchers use HPC resources outside Europe). Europe provides 5% of HPC resources worldwide, but consumes 1/3 of them
- Weak integration of EU technology in HPC machines
- The EU has no top ranked supercomputers and depends on non-EU technology
- Funding gap in HPC in Europe compared to USA, JP, CN (500 - 700 Mio EUR/year)
- Complicate negotiations with four different Programme Committee configurations (FET, LEIT, RI from Horizon 2020 and CEF)

Initiative with a clear mission

"**EuroHPC**" Joint Undertaking

1. acquiring and providing a world-class petascale and pre-exascale supercomputing and data infrastructure for Europe's scientific, industrial and public users, matching their demanding application requirements by 2020

2. supporting an ambitious research and innovation agenda to develop and maintain in the EU a world-class High-Performance Computing ecosystem, exascale and beyond, covering all scientific and industrial value chain segments.

EuroHPC JU = EC + Participating States + BDVA + ETP4HPC

Co-Investment

EuroHPC
Joint Undertaking

€ 0.5 bn

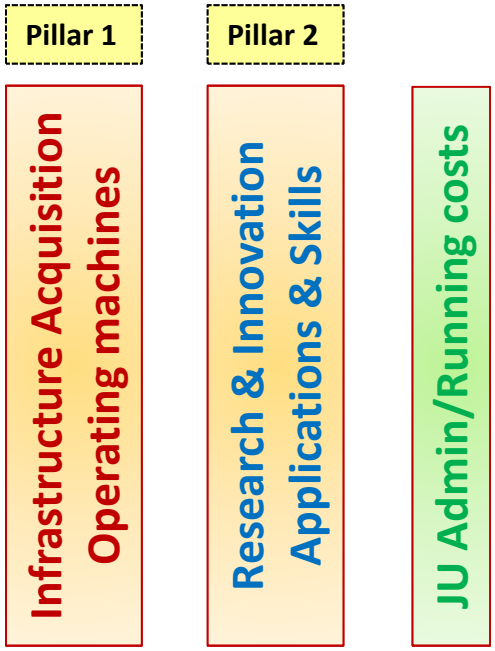
INFRASTRUCTURE + **R&I**

€ 0.5 bn

ETP4HPC

BDVA

Activities & Budget (until 2020)



- **Pillar 1: Infrastructure Acquisition & Machine Operation**

  2-3 pre-exascale machines and at least 2 mid-range (petascale) machines

- **Pillar 2: Research and Innovation – Application and Skills**

  European exascale technologies and systems (incl. low-power processor); Applications & Skills

- **JU Admin/Running costs**

EUR 486 Mio (From the EC)
+ EUR 486 Mio (From the Participating States)

= EUR 972 Mio (Total Budget)

Governance

There are 3 bodies in the EuroHPC Joint Undertaking:

1. **Governing Board** composed of representatives of the EU and Participating States.

2. Industrial and Scientific Advisory Board consisting of:
    a. **Infrastructure Advisory Group (INFRAG)** which provide independent advice to the GB on the acquisition and operation of the supercomputers owned by the JU.
    b. **Research and Innovation Advisory Group (RIAG)** draws up and regularly update the draft multiannual strategic research and innovation agenda.

3. **Executive Director**

Ramp-up under Horizon 2020

EU Milestones

- ✓ Signing of the EuroHPC declaration in Rom (03/2017)
- ✓ Several “Sherpa” meetings and workshops (2017/2018)
- ✓ EC releases the EuroHPC Joint Undertaking/JU council regulation proposal (01/2018)
- ✓ Adoption by the European Council (COMPET) (10/2018)
- ✓ Setup of the Governing Board ⇨ JU is operational (11/2018)

Ramp-up under Horizon 2020

CH Milestones

- ✓ Swiss signature of the EuroHPC declaration (10/2017)
- ✓ Participation in the EuroHPC Sherpa Group and in different Experts Working Groups (2017/2018)
- ✗ Blockage (related to the Institutional Framework Agreement) (12/2018)
- ✓ Finally joining EuroHPC (03/2019)

Presentation of the EuroHPC pillar I

(INFRASTRUCTURE)

Infrastructure Procurement

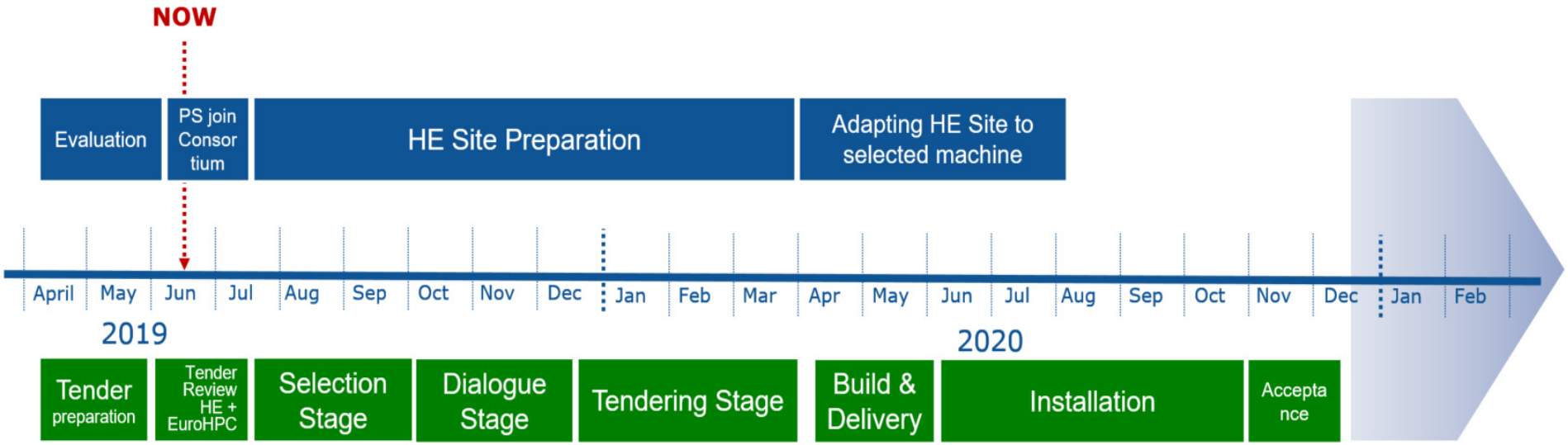
Procurement for petascale machines

 # EUROHPC-2019-CEI-PT-01 (15.02.19 – 15.04.19)

Procurement for pre-exascale machines

 # EUROHPC-2019-CEI-PE-01 (21.01.19 – 04.04.19)

CH-Participation



Petascale Procurement

#	Application	Score	TCO [M€]	PFLOPS
1	**Euro-IT4I** – CZ	95	28.9	9
2	**Meluxina** - LU	90	78.7	10
3	**Deucalion** – PT, ES	81	32.1	10
4	**Vega** – SI	73	24.6	5
5	**PetaSC** – BG	71	17.0	4
		TOTAL	**181.3**	**37**

Pre-exascale Procurement

#	Application	Score	TCO [M€]	PFLOPS
1	**Lumi** (FI, BE, CZ, DK, NO, PL, SE, CH, EE*, NL*)	97	207	150
2	**BSC** (ES, HR, PT, TU, IE*)	95	214	150
3	**Leonardo** (IT, SI)	84	230	150-180
		TOTAL	**652**	**450-480**

LUMI Supercomputer

Name	LUMI (Large Unified Modern Infrastructure). Lumi means snow in Finnish.
Theoretical peak performance	Planned to be more than 200 petaflop/s with Linpack performance exceeding 150 petaflop/s.
Storage	Over 60 petabyte/s with a sizeable flash layer providing more than 1 terabyte/s of bandwidth.
Used technologies	The supercomputer achieves its high performance with a large number of nodes with accelerators (GPUs). In addition the system is complemented by a CPU only partition, IaaS cloud services and a large object storage solution.
Budget	The budget for the EuroHPC JU in 2019–2020 is approximately 1.4 billion Euros, which includes public investments from the EU and participating states as well as investments from private partners. The total budget of the EuroHPC pre-exascale system in CSC's datacenter in Kajaani is 207.1 million Euros.
Timeline	Machine room construction: June 2019 – June 2020 System procurement: July 2019 – System installations: Q4/2020 Operations: Q4/2020–Q4/2026

CH = € 10 Mio

Presentation of the EuroHPC pillar II

(RESEARCH & INNOVATION)

Multiannual Strategic Research & Innovation Agenda (MSRIA)

"…The EuroHPC MSRIA identifies research and innovation priorities for the development and adoption of technologies and key competences for HPC and Big Data. It covers all scientific and industrial value chain segments, including low-power processor, software architecture and engineering, middleware technologies, algorithms, code design and applications, services and engineering, interconnections, up to system architectures for the next generation supercomputing…"

Responsibility = Research and Innovation Advisory Group (RIAG)

Draft R&I Workplan 2019

DRAFT

CH = € 0.5 Mio

JU Priorities	2019	Financial Contribution EU + PS
1. Towards Extreme scale technologies and applications	1.1 Extreme scale computing and data driven technologies (RIA)	50 M€ (project size 5 M€)
	1.2.a HPC and data driven software environments and application oriented platforms	40 M€ (project size 8 M€
	1.2.b Industrial applications on extreme scale computing environments	20 M€ (project size 4 M€)
2. Innovating and Widening the HPC use and skills base	2.1.a National HPC Competence Centres	EU: 28 M€ / PS: 28 M€
	2.1.b Networking and Coordination of national HPC Competence Centres (CSA)	2 M€
	2.2 Stimulating the innovation potential of SMEs	10 M€
		TOTAL: 95 M€ / **TOTAL: 83 M€**

PRIORITY 1 - Towards Extreme Scale Technologies and Applications

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"…The support for a sustainable extreme-scale HPC ecosystem in Europe requires mastering the R&D process with a co-design approach and a holistic view on the technology supply, hardware, software stack and applications. The goal is to improve time and energy to solution, robustness, reliability, portability, maintainability and productivity on upcoming exascale and extreme performance computing capabilities for scientific, industrial or societal challenges…"

1.1 Extreme scale computing and data driven technologies

DRAFT

- Development of extreme scale computing technologies and system architectures, programming models and tools, and mathematical methods and algorithms in an increasingly complex & heterogeneous computing environment with memory and storage hierarchies.
- Respond to critical demands of application performance, energy efficiency, scale, resilience, programmability, etc., across the levels of the compute stack, including compute elements, networking, data storage and data handling.
- Co-design approach should be followed, covering from the application to the hardware, answering user challenges of industry and research centers/academia and involving the work done at the CoE.

1.2 HPC & data driven applications to ensure European leadership

DRAFT

1.2.a) HPC and data driven software environments and application oriented platforms (IA)

- Development of data driven HPC software environments and application oriented platforms to generate innovation and value creation (for instance in sectors such as manufacturing, farming, health, mobility, natural hazards, climate or cybersecurity).
- Co-design advanced workflows, e.g. mixed/integrated simulation, HPDA & AI.
- Ensuring wide adoption in production use.

1.2 HPC & data driven applications to ensure European leadership

DRAFT

1.2.b) Industrial applications on extreme scale computing environments (IA)

- Improve industrial software and codes for industrial users to fully exploit the new capabilities of extreme performance HPC environments.
- Adaptation to new software engineering and programming environments.
- Optimization for novel HPC hardware and system software of increased computing performance.
- Focus on software and codes of relevance for increasing the European industrial innovation capability and competitiveness.

PRIORITY 2 - Innovating and Widening the HPC use and skills base

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"…The take-up of HPC services by industry and SMEs, academia and the public sector is a crucial element for the full development of a sustainable HPC ecosystem in Europe. Widening the use of HPC requires federating resources, and attracting new talents requires the further development of existing and the creation of new national HPC Competence Centres and their networking and coordination across Europe. These Centres will inter alia engage in training and outreach activities for academic, industrial and public sector users. SMEs need better access to HPC tools and services to increase their innovation capability…"

2.1 HPC Competence Centers

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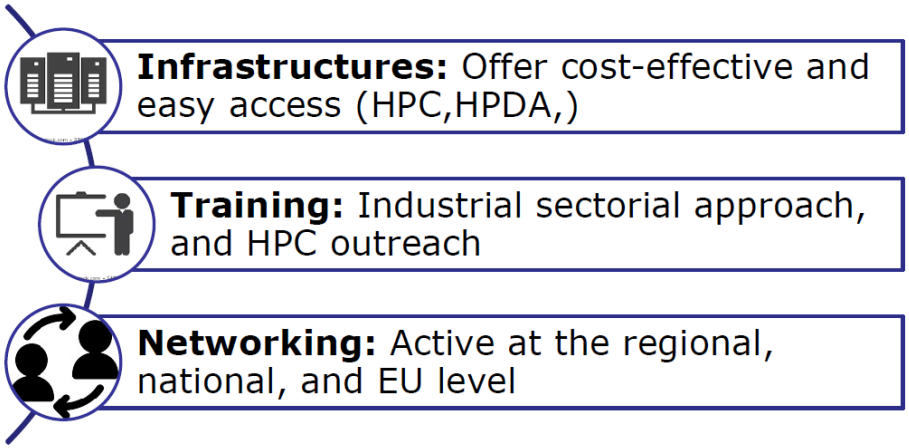
2.1.a) National HPC Competence Centers (RIA)

- The aim is to support existing or the creation of up to one national HPC Competence Center (HPC-CC) in a maximum number of EuroHPC Participating States.



2.1.b) Networking and coordination of national HPC Competence Centers (CSA)

- Exchange of best practices & information, networking and training across national HPC-CCs.

2.2 Stimulating the innovation potential of SMEs

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- Define an outreach approach for identifying and attracting SMEs whose innovation potential and competitiveness could be increased as users of advanced HPC services.

- Focus preferably at European engineering and manufacturing SMEs.

- Provide support to third parties in the form of grants (typically the financial support will be in the order of EUR 50 000 – 150 000 per party).

The European Processor Initiative (EPI)

"…The objective is the development of a European processor for integration in the exascale supercomputers to be acquired by the EuroHPC JU in 2022/23…"

- EPI Phase 1 (funded under H2020) to develop European microprocessor technology for HPC, but also for embedded applications that demand high-end computing capabilities (i.e. "embedded HPC"), notably automotive & future autonomous driving.
- EPI Phase 2 (funded under EuroHPC – 2020 Workplan) is expected to further advance the low-power microprocessor designs and bring them closer to an operational device (integrated in extreme-scale demonstrators to test the technology readiness of the underlying concept, scalability to exascale & compatibility with the applications).

Outlook post-2020

«Digital» in the next MFF (2021-2027)

Horizon Europe
(> Horizon 2020)

> € 12 bn for digital

Digital Europe (DEP)

€ 9.2 bn

€ 2.7 bn for HPC

Connecting Europe Facility (CEF)

€ 3 bn for digital

Creative Europe including MEDIA

€ 1.1 bn

HPC in the next MFF (2021-2027)

The EuroHPC JU will be the main vehicle for implementing the European HPC activities.

The EuroHPC JU aims to achieve:

- A world-class exascale and post-exascale supercomputing infrastructure and innovation ecosystem in Europe

How:

- By pooling resources of its Participating States and coordinating their efforts in a common public procurement and research and innovation agenda.

Via three digital main programme:

1. Horizon Europe
2. Digital Europe
3. Connecting Europe Facility

HPC in «Horizon Europe»

"… the R&I Horizon Europe Programme will aim to create a leading innovation ecosystem in Europe that covers the full value chain from research to prototyping, piloting and demonstration accelerating wider market uptake & deployment …"

i. Developing the next generation of low-power microprocessor and novel computing architectures and technologies for exascale and post-exascale systems built using a co-designed approach with large users.

ii. Supporting software & tools and their integration in novel supercomputing architectures and in prototype/pilot systems.

iii. Maintaining Europe's world leadership in supercomputing applications by supporting the development of innovative HPC and big data enabled test-beds and application pilots in strategic European industrial sectors.

HPC in «Digital Europe»

"… aims to build essential digital capacities for HPC as well as the advanced digital skills needed to "operate" them and accelerating the adoption and best use of HPC…"

i. Infrastructure building: acquisition of 2 exascale systems and post-exascale systems (first hybrid HPC/Quantum computer).

ii. Creating a federated supercomputing infrastructure, connecting all European supercomputing.

iii. Supporting large-scale HPC capacity building and widening HPC use (e.g. by supporting and coordinating the activities of a network of HPC competence centres, launching and deployment of service platforms of Industrial HPC codes & Industrial software, etc…

HPC in «Connect Europe Facility»

"… a hyper-connected network of Europe's supercomputing centers through the CEF-2 Programme will include activities for ensuring a terabit connectivity between supercomputing centers and enable the EuroHPC infrastructure to be accessible for HPC services to industry, research community and public administrations throughout Europe…"

GÉANT backbone expansion

PHASE I (2020-2023)

Scope

- PRACE Tier-0 sites
- EuroHPC supercomputers (pre-exascale and petascale)
- Current Federated HPC/Data Infrastructures (FENIX)
- Other Large Scale Facilities (CERN & SKA)

Architecture

- Backbone connectivity: up to 800Gbps
- Site connectivity: up to 200 Gbps

GÉANT backbone expansion

PHASE II (2024-2033)

Scope

- Includes Phase I facilities
- Additional EuroHPC exascale and post-exascale systems
- Additional national Tier-0 systems

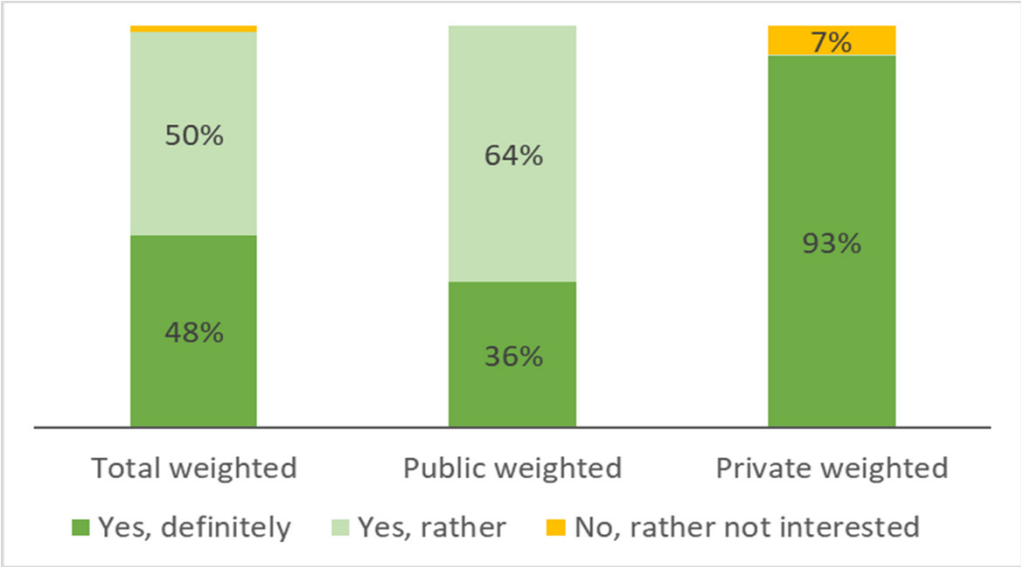
Architecture

- Backbone connectivity: Multiples of Tbps
- Site connectivity: up to 1Tbps

Swiss DEP Survey - HPC

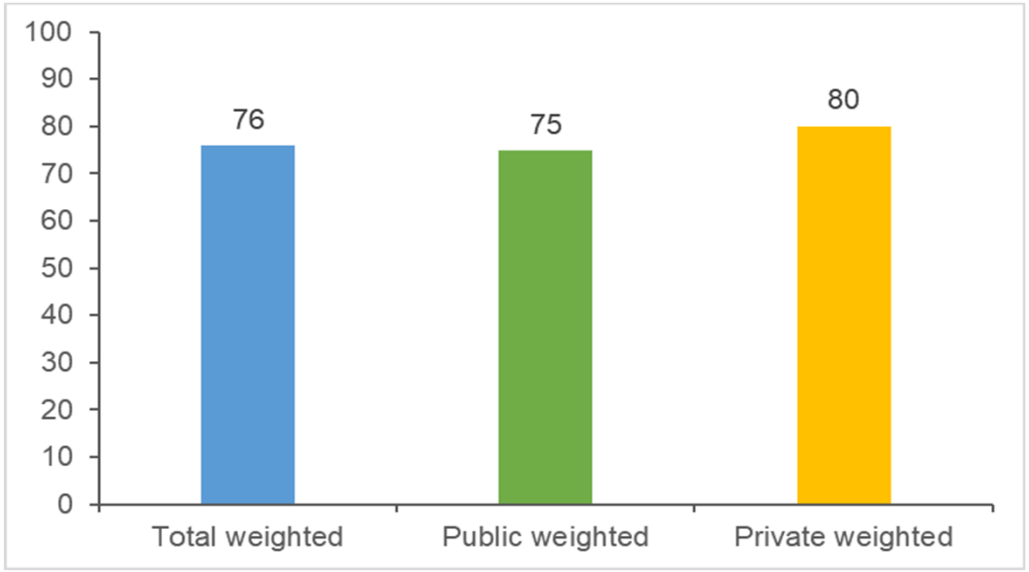
The SERI did an online survey in February 2019 on all DEP activities (incl. DEP Pillar 1 - HPC) ⇨ 150 answers from different institutions/researchers ⇨ The report to be published shortly.

Q: «…Would you participate in activities of this pillar?...»



Swiss DEP Survey - HPC

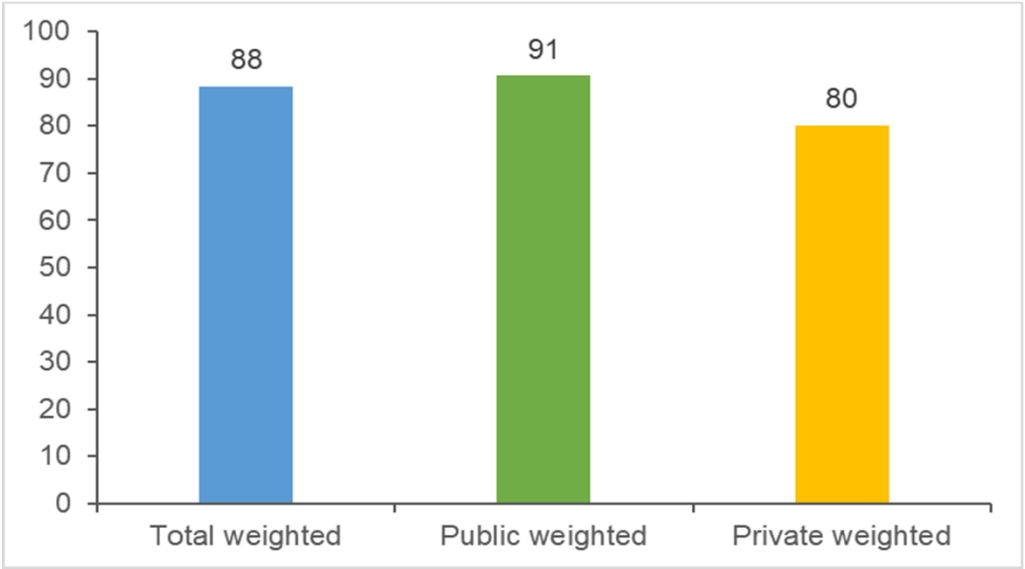
Q: «…One objective in this pillar is the joint procurement of an integrated world-class exascale supercomputing and data infrastructure. How important is it for you that Switzerland can participate in such a joint infrastructure procurement...»



1 = not important at all
100 = very important

Swiss DEP Survey - HPC

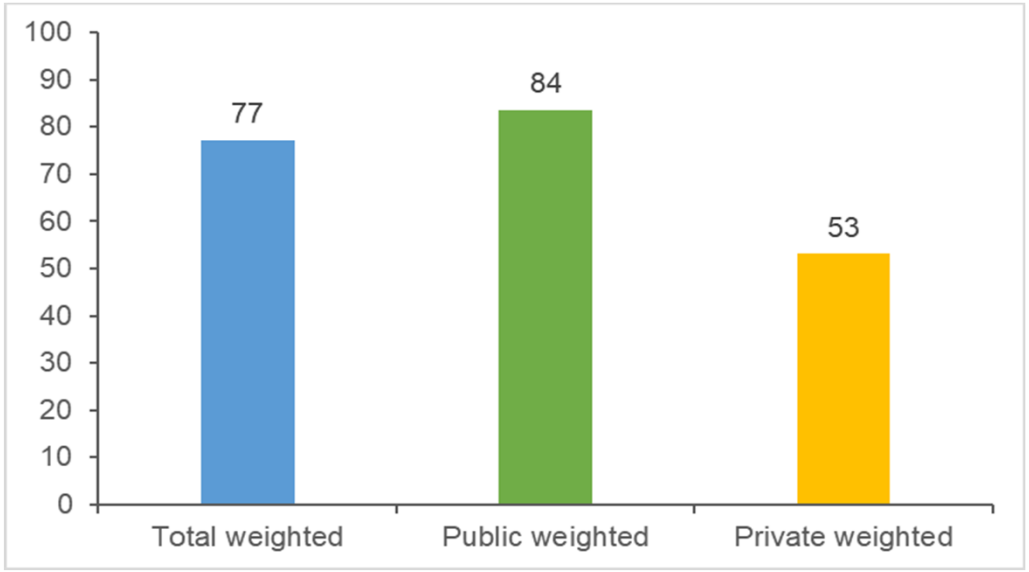
Q: «…One objective in this pillar is the funding of R&I activities for a high performance computing ecosystem, covering all scientific and industrial value chain segments, including hardware, software, applications, services, interconnections. How important is it for you that Switzerland can participate in such joint R&I activities?...»



1 = not important at all
100 = very important

Swiss DEP Survey - HPC

Q: «…One objective in this pillar is the provision of HPC resources, expertise and skills (especially to SMEs) via new "HPC competence centers". Do you consider this important for Switzerland?...»



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Q&A

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