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D4.6
Report on tools for start-ups and SMEs in HPC

Final

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Author(s): Maike Gilliot, ETP4HPC
François Bodin, Université Rennes 1
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Authorship	**Written by:**	Maike Gilliot, ETP4HPC François Bodin, Université Rennes 1
	Contributors:	Manuel Arenaz, Appentra Claudio Arlandi, CINECA Alexander Bob, Fujitsu Olivier David, Atos Kai Diethelm, GNS Hugo Falter, ParTec Frank van der Hout, ClusterVision Guy Lonsdale, scapos Colin McMurtie, CSCS Avi Mendelson, Technion Oliver Oberst, IBM Dirk Pleiter, FZ Jülich Dominik Ulmer, Cray
	Reviewed by:	Hugo Falter, ParTec Katia Soto, PRACE Aisbl
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References and Applicable Documents

[1] http://www.exdci.eu
[2] http://www.prace-project.eu
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List of Acronyms and Abbreviations

AISBL	Association Internationale Sans But Lucratif (International Non-for-Profit Association)
BDEC	Big Data and Extreme-scale Computing
BDV	Big Data Value
CoE	Centre of Excellence for Computing Applications
cPPP	contractual Public-Private Partnership
CSA	Coordination and Support Action
D	Deliverable
EC	European Commission
EESI	European Exascale Software Initiative
EsD	Extreme scale Demonstrators
EU	European Union
FET	Future and Emerging Technologies
FP7	Framework Programme 7
H2020	Horizon 2020 – The EC Research and Innovation Programme in Europe
HPC	High Performance Computing
ISV	Independent Software Vendor
IT	Information Technology
KPI	Key Performance Indicator
PCP	Pre-Commercial Procurement
PPI	Public Procurement of Innovative Solutions
R&D	Research and Development
R&I	Research and Innovation
SHAPE	SME HPC Adoption Programme in Europe
SME	Small and Medium Enterprise
SRA	Strategic Research Agenda
SWOT	Strengths, Weaknesses, Opportunities and Trends
TRL	Technology Readiness Level
WG	Working Group
WP	Work Package

1 Introduction

During the first year of EXDCI, the activities related to start-ups and SMEs focused on how start-ups and SMEs in HPC[1] perceive their situation and what hurdles they are facing. This is summarised in EXDCI Deliverable 4.2 [5].

For EXDCI's second year of activities, the idea was (1) to take also the point of view of other stakeholders into account and (2) to agree on some recommendations and best practices worth sharing within the ecosystem. More precisely, the goal was to understand how the ecosystem could be of help to SMEs and start-ups[2]: Where can HPC centres make things easier for SMEs? And how can a large company help an SME or a start-up?

This has been a strong collaborative effort, implemented by a group of experts, representing different stakeholders (denominated the "Core Group"):

- For the SMEs and Start-ups:
  Manuel Arenaz (Appentra) and Frank van der Hout (ClusterVision)
- For the HPC centres:
  Dirk Pleiter (Jülich Supercomputing Centre)
- For the large companies and vendors:
  Dominik Ulmer (Cray) and Oliver Oberst (IBM)
- For the academic ecosystem and as liaison person to EuroLab4HPC:
  Avi Mendelson (Technion)

The Core Group set up a one-day workshop with around 15 participants, gathering different stakeholders. The workshop was organised around three topics that the experts considered as key for the development of SMEs and start-ups[3].

1. **Procurement**:
   An important part of the HPC market is subject to public procurement regulations. It seems however, that SMEs and start-ups find it difficult to comply with the legal and financial requirements of procurements [5]. Are there ways to leverage these hurdles? And are procurement schemes such as PPI, PCP easier to access for SMEs and start-ups? As one member of the Core Group pointed out, recommendations in this area could be applied on a very short term.

2. **Strategic collaborations**: To align with partners is central in many phases of an SME's life: at an early stage to improve the product/offer, to get feedback, and also as a first customer reference. At a later stage, collaborations are often on the basis of joint R&D efforts, necessary for the technological advantage of the SMEs. Are there best practices to share on how to make such collaborations a success for both parties?

[1] EXDCI focuses mainly on technology providing SMEs and start-ups.

[2] With "start-up" we refer to any kind of project (whether formally established as a company or not) developing a commercial product from an existing piece of technology, with neither a clearly identified business model nor a final product as yet.

[3] This workshop took place at the Municon Conference Centre on Monday, April 10th 2017. The full list of participants can be found in annex.

3. **Risk mitigation:** To involve start-ups and SMEs in commercial offers is sometimes perceived by procurers as "risky" due to less financial resources, less experience, and perhaps, less "proven" products. How could this risk be mitigated? What can be done at an ecosystem level to strengthen the credibility of SMEs and start-ups?

These three topics were at the heart of the workshop, with one session per topic. The sessions were structured as follows[4]:

- Short kick-off presentation by a representative of each of the stakeholder group
- Joint discussion
- Assessment of current situation, and
- Brainstorming on strategies and actions to improve current situation

Section 2 summarises the discussions of the workshop participants on these three topics: Procurement (Section 2.1), Strategic collaborations (Section 2.2) and Risk Mitigation (Section 2.3). Section 3 details the recommendations issued by the workshop participants. The final section gives some overall conclusions of the work conducted within EXDCI with respect to SMEs and start-ups.

2 Workshop discussions

The workshop took place in April 2017 at the Municon Conference Centre. The workshop gathered around 15 participants representing different stakeholders: (1) Start-ups and SMEs, (2) HPC centres, and (3) large companies. This section summarises the discussions on the three main topics during the workshop.

2.1 Public Procurement

The representatives of the HPC centres explain that, especially for the procurement of their very large machines, the pressure from the funding authorities is high in order to deliver "the best system for the users" for the upcoming 4 to 6 years. This also includes reliable technical support during the machine's lifetime.

Therefore, HPC centres are seeking for high quality of delivered equipment and software as well as the organisation of deployment and operation. Furthermore, risk of delay in putting new equipment into operation needs to be minimised. Therefore, HPC centres choose, in most cases, one single contractor who takes the final responsibility. The contractor itself may delegate some of its obligations to its suppliers and subcontractors; however, the main contractor remains the responsible legal entity.

As a consequence, typically it is not considered to be an option to choose a SME as a leading integrator for large procurements, as they are not financially solid enough to endorse the entire responsibility for very large projects and may not have enough leverage over very large subcontractors regarding the resolution of problems.

The requirements of the funding authorities also have an impact on the use of new technology. Regarding novel hardware elements, neither the HPC centre nor the main contractor would take the risk of including less proven hardware in very large supercomputers unless it has been

[4] cf. detailed workshop agenda in annex

delivered by a solution provider with a strong track record[5]. The same applies to software: although software for HPC systems is, at the first glance, "cheap" compared to hardware, its integration into a software stack and its maintenance over the system's lifetime can be very costly and time consuming for the main contractor.

Pre-financing can be another hurdle for SMEs, as they cannot afford to wait for their part of the payment until the system is delivered, integrated, tested and finally approved. Support of the procuring centres, for example, by providing a bank acceptable guarantee, such as a loan or partial payments during the delivery period, could be of help to SMEs.

The participants agree that personal relationships are a cornerstone in building a relation of trust between a SME/start-up on the one hand and HPC centres on the other: The centres are important for the development of SMEs and start-ups, as they offer solid experience in deploying large systems and also have a large network of industrial and academic partners of which young companies may benefit.

Metrics for assessing the quality of a supercomputer were another point of discussion. The participants agree that the fact that today's current metric (*flop/s)* is also a hurdle for new technologies and SMEs. More focus on the value of a machine for its users and less on the mere number of *flop/s* might allow HPC centres to justify the procurement of a larger variety of components.

It was also pointed out by the participants that the "big procurements" of the large European HPC centres are only the visible tip of the iceberg: start-ups and SMEs should not limit themselves to these types of procurements, by also looking for smaller scale public or industrial procurements and by also reaching out towards less traditional HPC markets. This is especially important as SMEs need to present interesting growth rates to investors– and only focusing on large academic HPC systems is not a viable path for such growth.

The representatives of the HPC centres emphasise that large centres typically run many different procurements (with smaller budgets) in between the large acquisitions phases to equip smaller HPC systems, which are used by some HPC centres to test new technologies (hardware and software-wise). The representatives encourage SMEs and start-ups to use these as vehicles for showing their products.

The Swiss computing centre CSCS regularly engages collaborations with SMEs and start-ups for testing and validating novel hardware and software on machines dedicated to this purpose. The collaborations allow CSCS to stay up-to-date in regard to new developments. For SMEs/ start-ups, these collaborations are a way to test and to harden their product.

Also, Jülich Supercomputing Centre has a long track record of engaging with SMEs. Key software components used on current supercomputers are provided by SMEs. Furthermore, development projects (including H2020-funded FET HPC projects) are used as an opportunity for working with SMEs. Small-scale procurements serve as pathfinders for next large-scale procurements and are organised in such a way that smaller companies are provided with an opportunity to demonstrate their capabilities and to grow through the experiences made by deploying and operating these smaller systems.

[5] HPC centers often act as lead customer.

The participants agree that SMEs are often the carriers of innovation – however, SMEs and their products are not per definition innovative. As such, SMEs and start-ups must accept the requirement to demonstrate the innovative character of their product and its added value compared to existing solutions. On the other hand, HPC centers must provide SMEs with opportunities for demonstration.

The participants acknowledge that negotiated procurement procedures are more favourable for SMEs, as they help to overcome the SMEs potential lack of experience in procurement (cf also [8]). The use of schemes such as PCP should be promoted widely.

The participants also discussed the type of software typically distributed along with the HPC system. Usually the integrators provide the necessary software stack along with the machine (compilers, workload manager and monitoring tools). Due to potentially high integration costs and SLA commitments, the integrator must, as much as possible, control the software delivered along with the hardware. Therefore, a long term business partnership and an integration of the support processes of the HPC system manufacturer is needed if a SME wants to distribute its software in HPC system procurements. Whereas this basic software stack is part of the hardware procurement, application software will rarely be part of the large hardware procurement, being purchased through a different process.

2.2 Strategic Collaborations

Different kind of collaborations for technology providing SMEs and start-ups were discussed.

The nature of the collaborations between large vendors and SMEs/start-ups depend, particularly, on the maturity of the product. If the product of the SMEs/start-ups is in an early phase of its life cycle, the goal is often to harden the product via large tests. Whereas SMEs at this stage mostly focus on “more features”, large vendors/integrators typically are more interested in stability/quality. IP issues can be another hurdle in fruitful joint developments at this stage.

Collaborations related to an established product face other hurdles. Firstly, a bundle of the vendor product, which includes the SME’s product, might be more difficult to sell. A client would need very good reasons in replacing the vendor built-in solution with a solution provided by an external partner. A second issue may arise from the different road-mapping strategies of the two partners. To ensure a strong relationship, the SME might need to adapt to the vendor’s roadmapping, which, on the other hand, may hinder the SMEs in addressing the market at large.

The important role that HPC centres can play for SMEs and start-ups has – again – been underlined. As a “local innovation hub”, a HPC centre can offer a technical playground and provide support in accessing funding. The participants point out that collaborations are also beneficial for engaging in R&I projects. Moreover, the HPC centres can help in hardening the SMEs/start-ups’ product, and provide use cases and customer references. These collaborations should not be limited to procurement periods, but should ideally cover longer periods. Also, the HPC centres can provide expertise on the market, such as existing products and market niches, and also connect SMEs and start-ups with potential customers.

According to the participant’s experience, SMEs and start-ups are looking more for expertise and know-how rather than for computing power to test their products. Despite the importance of HPC centres in the development of SMEs and start-ups, the participants insist on the fact that SMEs and start-ups should not focus on HPC centres as a sole and primary market.

Nevertheless, examples of successful collaborations do exist. For example, a scheduler (provided by a SME) was tested and "validated" by a HPC centre, which in turn recommended this product to a large vendor and as of today, this product is part of the large vendor's software stack.

Slurm (Simple Linux Utility for Resource Management) is a free and open-source job scheduler. The company SchedMD provides support and services for Slurm. Today, Slurm is the most used scheduler in the Top-500 systems (cf.[7]).

CSCS collaborated at an early stage with SchedMD and ran Slurm on its production Cray systems. As a consequence of this good collaboration between SchedMD and CSCS, they recommended Slum to its vendor Cray. Following this recommendation, Cray went on to integrate Slurm as native scheduler in its software portfolio. As a consequence of this early collaboration, Slurm is today particularly well tailored for Cray systems.

Another collaboration scenario is one of SMEs teaming up. Customers are often large(er) companies, which are interested in long term relations with their business partners, and who often want a single, integrated solution for a complex task. However, SMEs and start-ups are highly specialised, only offering partial solutions. By teaming up, they are able to provide a complete solution for the customer.

Such teaming up is happening in Lower Saxony, inspired by a successful similar approach with SMEs related to Mechanical Engineering. With the support of the local employers' association, 17 SMEs (mostly family-owned businesses) have teamed up and submitted – if appropriate – joint proposal to tender offers. However, these SMEs are still free to submit individual tender offers without including their partners [6].

All SMEs are related to ICT, however with different focuses; they are geographically close, and the leading managers know each other. The workshop participants agree that this facilitates legal and commercial negotiations, regarding responsibility issues, financial and IP issues.

Would such a setup work in HPC despite the missing geographic proximity, for example for the HPC software stack? One of the HPC centres pointed out that it would see a real value in such a group of SMEs providing an "integrated" solution. European R&I projects could provide the basis for such collaborations, such as the example within *Mont Blanc* and *DEEP*. In both cases, the consortium brings the research result to a product, with a mitigated financial risk due to EU funding.

SMEs and start-ups using HPC technology are especially in need of expertise. Here again, HPC centres may serve as local hubs of information and expertise, for instance this approach is also promoted by the *SESAME Net* project. Moreover, the participants agree that pay-on-demand based models (as implemented in *Fortissimo*) are suitable for SMEs and start-ups.

2.3 Risk Mitigation

From a SME's point of view, sustainability is necessary in growing and developing a vision on a longer term basis. This includes sustainable financial support and sustainable partnerships. The financial support may be provided either via public funds (for example in form of grants, loans or via co-development contracts with HPC centres) or from private parties, such as VCs.

The partnerships allow engaging in co-development efforts – both with academic and industrial customers.

One way to encourage HPC centres and larger companies to engage in such collaborations with SMEs and start-ups could be via regulations such as imposing a fixed percentage of SMEs in European R&I funded projects or imposing within public procurements a fixed percentage of the budget for SMEs (cf. US's Small Business Act [4]).

Whereas the participants agree that collaborations should be promoted and facilitated, the idea of a legal threshold is controversial. Besides potential legal obstacles, the participants also point out that this should not limit the client's freedom to purchase the system it identified at the best value for money and with the best technical solution according to the criteria identified in the call for tender.

From the HPC centres' side, the major risk (in collaboration with SMEs and integrating novel pieces of technology into their operational systems) is that of destabilising the system. If the SME acts as a subcontractor or is part of a consortium, the HPC integrator and consortium respectively carry the obligation of giving full support over a long period, which reduces the risk for the procuring entity.

The participants agree that the notion of "risk" is strongly based on perception. Knowledge on mutual constraints and personal relationships are key in mitigating the perceived risk. For example, the software provided by big companies is not necessarily, or by default, safer than that provided by SMEs. Again, partnering up with larger vendors is presented as an interesting option, as showing a "joint" roadmap with a large vendor may leverage the HPC centres' doubts.

One HPC centre points out that on occasions the procurement boundary conditions are not well understood by smaller companies. An easy way to make get in contact with HPC centres is through events such as Supercomputing and ISC High Performance. This allows engaging in discussions with HPC centres in order to understand their procurement landscape.

SMEs using HPC technology need to first of all properly understand their needs (regarding HPC) and to estimate the cost/benefit ratio. Many SMEs and start-ups have a strong need for expertise. Therefore, according to the participants, centralised platforms providing information and facilitating matchmaking with experts and tools are helpful for SMEs – and mitigate the risk in engaging in HPC. It is not as yet whether fully integrated offers meet the customers' needs.

3 Recommendations

The goal of the workshops was to agree amongst the participants on recommendations and best practices worth sharing within the ecosystem. As has been shown in the discussion, the three topics "Procurement", "Strategic Collaborations", and "Risk Mitigation" are strongly intertwined and cannot be considered separately.

1. **SMEs are encouraged to team up with larger partners as a way towards larger procurement.** The financial and legal obligations upon the principal contractor for large HPC systems are so high, that – in general – SMEs cannot take over this role. However, by teaming up with larger bidders, SMEs and start-ups can integrate into such procurements.

2. **HPC centres should be open to exploring new solutions**: They should practice a culture allowing SMEs and start-ups to present their solutions and their capabilities. Moreover, they should also look for opportunities of acting as reference clients, in particular to start-ups and SMEs.
3. The SME instrument within the H2020 programme provides financial support for SMEs at different stages of the product life cycle. This support leverages the financial risks of R&D efforts. **The SME instrument should be better promoted amongst the HPC community and – if necessary – better adapted to the HPC sector.**
4. The model of SMEs teaming up relies strongly on trust and personal relationship between the partners. This model has not been explored as yet. **Mechanisms to build trust and collaborative relationships amongst SMEs and start-ups should be encouraged.**
5. Start-ups and SMEs consider larger vendors and HPC centres as strategic partners and advising bodies. Despite existing hurdles, **partnerships of SMEs / start-ups with HPC centres and large vendors shall be encouraged.**
6. **Regular meetings should be organised, which involve HPC centres, large companies and vendors** in order to improve SMEs and Start-ups understanding on how large-scale procurements are organised and also to allow identification of opportunities for teaming up.

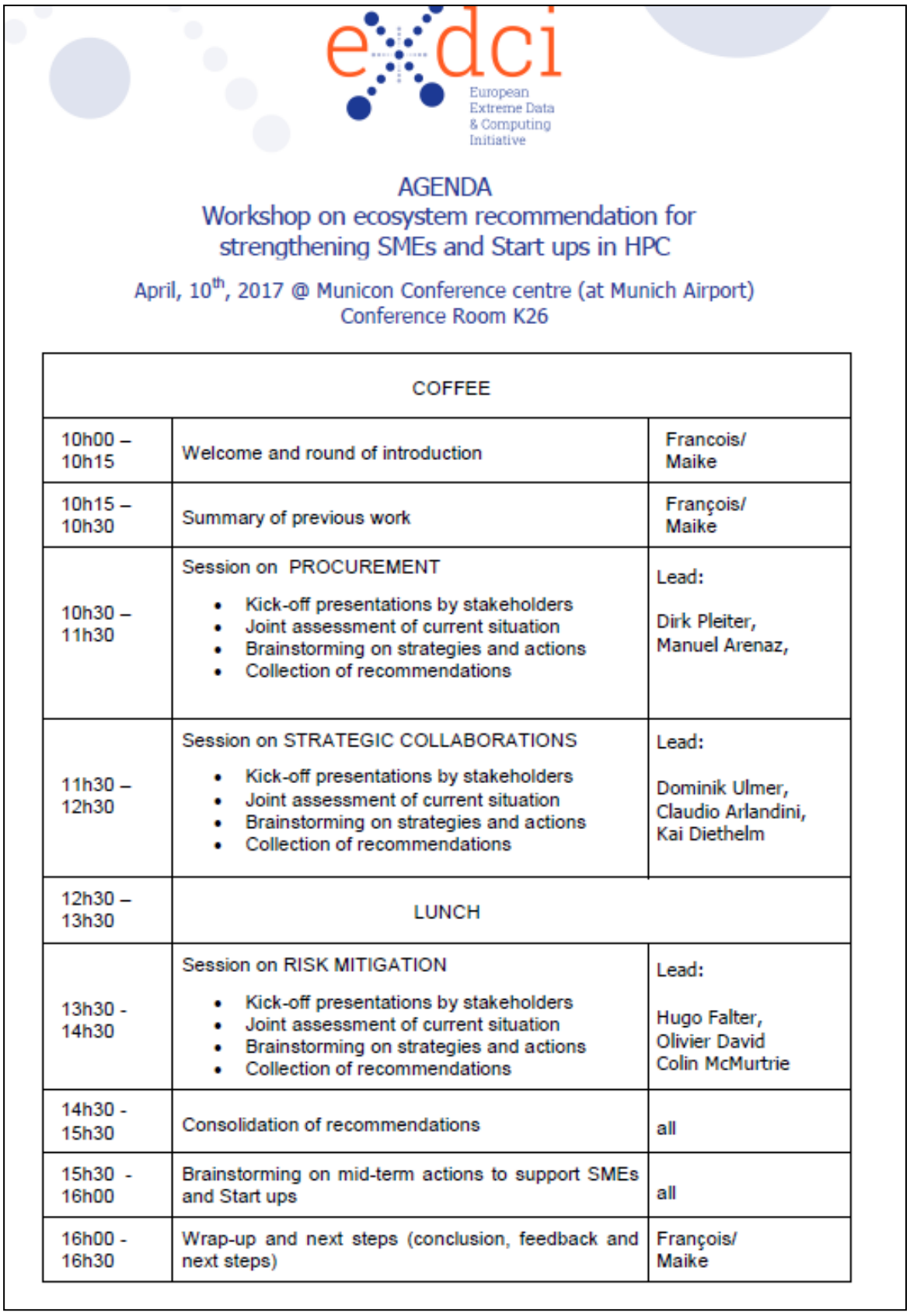
4 Conclusion

The study conducted during the first year of EXDCI shows that despite many different support actions at European and national level, SMEs and start-ups in HPC find it difficult to access the market [5]. Based on these findings, a workshop gathering SMEs/start-ups, HPC centres and large vendors was organised under the aegis of EXDCI in order to understand how the ecosystem can support the development of SMEs and start-ups. The workshop gathered around 15 participants and focused on three topics, which had been identified as key by a group of 6 experts: (1) Procurement, (2) Strategic Collaborations and (3) Risk Mitigation. The workshop participants issued a set of recommendations at an ecosystem level.

The discussions and the issued recommendations show the importance of collaborations, which are strongly based on personal relationships. Organisational and finical means of strengthening existing relationships and collaborations (e.g., within European R&I projects) and of establishing new relationships should be supported by the ecosystem itself and also potentially through EC-coordinated actions.

5 Annexes

5.1 Workshop Agenda



European Extreme Data & Computing Initiative

AGENDA
Workshop on ecosystem recommendation for strengthening SMEs and Start ups in HPC

April, 10th, 2017 @ Municon Conference centre (at Munich Airport)
Conference Room K26

COFFEE		
10h00 – 10h15	Welcome and round of introduction	Francois/ Maike
10h15 – 10h30	Summary of previous work	François/ Maike
10h30 – 11h30	Session on PROCUREMENT • Kick-off presentations by stakeholders • Joint assessment of current situation • Brainstorming on strategies and actions • Collection of recommendations	Lead: Dirk Pleiter, Manuel Arenaz,
11h30 – 12h30	Session on STRATEGIC COLLABORATIONS • Kick-off presentations by stakeholders • Joint assessment of current situation • Brainstorming on strategies and actions • Collection of recommendations	Lead: Dominik Ulmer, Claudio Arlandini, Kai Diethelm
12h30 – 13h30	LUNCH	
13h30 - 14h30	Session on RISK MITIGATION • Kick-off presentations by stakeholders • Joint assessment of current situation • Brainstorming on strategies and actions • Collection of recommendations	Lead: Hugo Falter, Olivier David Colin McMurtrie
14h30 - 15h30	Consolidation of recommendations	all
15h30 - 16h00	Brainstorming on mid-term actions to support SMEs and Start ups	all
16h00 - 16h30	Wrap-up and next steps (conclusion, feedback and next steps)	François/ Maike

5.2 Workshop attendees

Workshop on ecosystem recommendation for strengthening SMEs and Start ups in HPC

April, 10th, 2017 @ Municon Conference centre (at Munich Airport)
Conference Room K26

Positioning of the workshop

In the frame of the H2020 funded project EXDCI, we are investigating on the specific challenges that European SMEs and Start ups in HPC face and how the ecosystem can provide support to SMEs and Start ups.

To this end, the members of the Core Group conceived this one-day workshop. The goal of the workshop is to understand the difficulties and to suggest jointly ready-to-apply recommendations in order to overcoming these difficulties. The workshop will focus on three topics, which seem particularly relevant, as shown by previous studies by EXDCI for the development of SMEs and Start ups.

Core Group members

• Arenaz	Manuel	Appentra
• Mendelson	Avi	Technion
• Oberst	Oliver	IBM
• Pleiter	Dirk	FZ Jülich
• Ulmer	Dominik	Cray
• van der Hout	Frank	Clustervision

Attendees

• Alexander	Bob	Fujitsu
• Arlandini	Claudio	CINECA
• Auweter	Axel	Megware
• David	Olivier	Atos - Bull
• Diethelm	Kai	GNS
• Falter	Hugo	ParTec
• Lonsdale	Guy	Scapos
• McMurtie	Colin	CSCS

Back office support

• Bodin	François	IRISA, Univ. Rennes I
• Gilliot	Maike	ETP4HPC Office