Baltic Large-Scale Computing

Report on Institutional Capacities to Provide LSC Services

Version 1.00

Priority 1: Innovation

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Report on Institutional Capacities to Provide LSC Services

Work package	WP2
Task id	A2.2
Document number	O2.2
Document type	Report
Title	Baltic Large-Scale Computing
Subtitle	Report on Institutional Capacities to Provide LSC Services
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Accepting	Michał Śmiałek (WUT)
Version	1.00
Status	**Final version**

Interreg Baltic Sea Region
EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

History of changes

Date	Ver.	Author(s)	Change description
12.11.2019	0.01	Thanos Papaioannou	Document creation
12.12.2019	0.02	Ann-Chistin Uusitalo Eriksson	Decument review
13.12.2019	0.03	Jussi Karlsson	Decument review
17.12.2019	1.00	Thanos Papaioannou	Final version

Executive summary

The main aim of WP2 is to perform research being the basis for exploiting the Baltic Large-Scale Computing (LSC) Environment and to promote widely its use. The WP results will allow for adjustment of the environment's functionality to market demands for LSC services and institutional capacities to provide such services, with specific focus on the Baltic region. Individual activities will identify and analyze barriers for use of LSC and will propose ways to eliminate them. The results of this WP will be used and combined with the results of other WPs to communicate and promote achievements of the project in relation to identified problems.

The objective of the task 2.2 is to encompass study and analysis of institutional capacities to provide LSC services for SMEs in the Baltic Sea region.

The objectives that are planned to be achieved in task 2.2 as described in the proposal are:

- To identify the potential providers of Large-scale computing services in the countries across Baltic Sea Region.
- To build or acquire a database with contact details to institutions which provide computation and analytical solutions or could be interested in providing such services, in all markets involved in the research (all partners).
- To carry out a Computer Assisted Web Interview (CAWI) survey to be completed by the institutions to assess their current scenarios on the provision of Large-scale computing services particularly to SMEs.

This deliverable includes the description of work done in the task 2.2 and will be provided at 9th month of the project. This deliverable describes models of providing computation/analytical services by institutions, resources these institutions possess, directions these institutions intend to develop, barriers in provisioning of LSC services and entities interested in providing LSC solutions for SMEs.

The research will be conducted through implementing a survey method: computer assisted web interview (CAWI). CAWI survey is realized with the use of on-line standardized questionnaires to be filled out by the respondent. The first step of performing the study is defining research design (e.g. research questions, sampling) and tools to gather the data. Due to the quantitative nature of the study, the questionnaire will mainly contain closed questions with predefined answers, but also semi-open questions with the ability to enter individualized opinion.

The results from the survey will form the basis upon which further measures are taken to engage institutions or other entities for the provision of large-scale computing services in the BalticLSC network.

We will draw conclusion from the task 2.2 to design a road map for the smooth running of the project.

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List of abbreviations

1	CAWI	Computer Assisted Web Interview
2	CPU	Central Processing Unit
3	CRM	Customer Relationship Management
4	EU	European Union
5	GDP	Gross Domestic Product
6	HPC	High-performance computing
7	LSC	Large-Scale Computing
8	NDA	Non-Disclosure Agreement
9	PRACE	Partnership for Advanced Computing in Europe
10	SLA	Service Level Agreement
11	SHAPE	SME HPC Adoption Programme in Europe
12	SME	Small and Medium Enterprise
13	WP	Work Package

1. Methodology

Large scale computing refers to the application of state-of-the-art computation systems to carry out advanced and complex applications efficiently such as design, simulations, calculations etc., in different fields such as engineering, natural sciences, meteorology, nanotechnology, finance and many more. This selection of LSC applications show that it can play a very important role for many small and medium scale enterprises and research institutions across the Baltic sea region and beyond.

The institutions providing large scale computing services are very investigative and innovative in nature. Since most of the providers are focused on the academic workload, the main customers currently are academic institutions. With this project, the aim is to disseminate and motivate small and medium enterprises to increase the uptake of LSC services which currently constitutes a very small part of the LSC providers' workload.

The process that is followed to fulfil the objectives of the task is as follows:

1. Previous study is carried out with the help of online surveys to find out the current scenarios of institutions with the provision of LSC services.
2. Reach as many potential LSC service provider institutions as possible:
   Several LSC competence centres are currently providing services to research and academic institutions but only a few centres have focused their services towards SMEs. The search was to identify centres who can potentially involve more SMEs in their business models to improve the value chain.
3. Competence centres data is built up and surveyed with the help of CAWI. Only those institutions that show a positive feedback in involving the SMEs in their business are assessed to see if they can be benefitted from the provision of LSC services.
4. From the survey, output data is gathered and cleaned and studied to refine understanding of the institutional capacities to provide LSC services.
5. The results will be presented for every country separately and they will also be summarized in the context of similarities and differences between markets. Based on results obtained, recommendations for developing BalticLSC environment in accordance with the capabilities of its potential LSC service providers are carried out. It is worth pointing out that the recommendations will be trans-national, so they will allow for adjusting the service to expectations of every Baltic market included in the project. Recommendations will refer to areas such as:
   - scale of current institutional capacities to provide LSC services for SMEs
   - potential interest in development of other entities able to provide such services
   - how the product should be designed to enable convenient administration of BalticLSC
   - model of providing services that will be the most suitable for these institutions
   - do institutions possess enough resources (infrastructure, competences) to provide SME LSC services (including analytical consulting)

   In addition, defining the barriers that restrain from taking advantage of LSC services will allow to design BalticLSC environment in a way that will eliminate or at least reduce these problems.

1.1 Reaching LSC service providers

Many competence centres spread across the Baltic countries were reached out through the project partners. The list of LSC providers contacted can be found in the annexure II.

The means used to contact LSC service providers include CRM tools, workshop organized in partner countries, BalticLSC.eu website, emails, LinkedIn, contact forms etc.

1.2 Interest of centres in BalticLSC project

LSC centres who previously had SME customers and those who potentially wanted to involve SMEs in their value chain showed interest by giving a positive feedback to the online survey questionnaire, by acknowledging to attend follow up workshops and training sessions and by participating in any BalticLSC dissemination events.

1.3 Precursory assessment of LSC service providers

The responses of the LSC competence centres are recorded and an analysis is carried out. Technological partners from the project are also involved in the assessment of the results. The challenge is to find institutions that can clearly gain advantage by involving SMEs in the value chain and understand their business models and current methodologies of LSC service provision to use these results as source of information for the design of LSC hardware and software platform to make it easier for SMEs to utilize the services across the Baltic sea region.

1.4 Analysis of Case

All the necessary information is gathered and analyzed along with the help of technological partners. This will aid in the preparation of a business model for the continuity of the BalticLSC environment throughout the duration of the project and beyond.

2. Institutional Capacities to Provide LSC Services (Online Survey)

The online survey is considered very important and the first step is to have the contacts with LSC service providers. The biggest target of the online survey is not to make a deep analysis of LSC but to identify what is the model of LSC service provision with the aim of connecting institutions with SMEs.

The online survey aims to find out the current and future needs of SMEs and institutions in different industries and research areas in the Baltic Sea Region to perform complex computations. This online survey plays as a main tool to gather the feedbacks from LSC service providers thanks to its advantages:

- Non-intrusive: the online survey is very convenient and not intrusive or time-consuming, compared to other survey methods (interview, calls, on-paper surveys, etc.)
- Accessible: the survey is made online and public in the website of the projects, which is easy and fast to access from computers or smart phones with Internet connection. One good point is that the online survey is written in non-technical language, so participants do not need to have deep computing knowledge to complete the survey.
- Brief: the survey is not long (requires no more than 10 minutes to complete) without complicated, unclear, very technical questions.

The survey includes four different sections with totally 35 questions:

1. Section 1: Current use: this section aims to collect the information about current model of providing infrastructure related services, data storage services, commercial software licenses available, consulting services, software development services, graphical based access mechanisms and if their current model has service extension particularly to SMEs.
2. Section 2: Business model: this section helps provide information about domains these institutions are providing services in, pricing models, best practices and information on involvement of SMEs in the business model of these institutions.
3. Section 3: BalticLSC project: this section gathers the information about the interest to attend more activities of the project: receiving the result of this online survey, updated newsletter, participating in a follow-up interview, training courses, collaborating with LSC centres on pilot R&D projects, attending technical workshops.
4. Section 4: Contact details: provides the contact information of the respondent including name, email address, phone number, company name, web page address.

The platform used to conduct the survey is Google Forms and the survey is published in the project's website https://www.balticlsc.eu/survey/

Figure 1: BalticLSC project webpage and the link to the online survey

Then choose the *Network Service Provider Survey* section

Figure 2: Link to the online survey for LSC service providers

2.1 Dissemination efforts

Dissemination at the Baltic Region level was undertaken by Baltic Large-Scale Computing partners. Each partner in the project disseminated the online survey to its contacts in its geographical area. Each partner built their LSC service provider contact lists based on their own network that would have an interest in BalticLSC project. Also, through the workshops organised and through social media sites such as Facebook, Twitter, Linkedin etc the link to the survey available on the website was shared.

3. LSC Centres Supply

The information about the institutions providing LSC services is retrieved from two main sources to prepare this report. First, with the help of questionnaire circulated among the LSC service providers as a part of task A2.2. The information thus obtained provided relevant data about the current models of LSC service provision among the institutions.
The second source is the extensive desktop research carried out to find out the service range, customers, partners, training and pricing models of the institutions.
Generally, the services provided by the institutions could be classified as follows:

- Renting of the computational power
- Helping with access to LSC resources
- Collaboration in Research and Development
- Consultancy services
- Training

All the services mentioned above are offered to companies and firms irrespective of size. Although not all the LSC service providers focus specifically on offering services to the SMEs, some of the institutions are willing to assist SMEs with the use of LSC services. There are also grants and project supported by the European Union to help SMEs access resources provided by the LSC service providers. Many projects such as FORTISSIMO, HPC-EUROPA3, PRACE-SHAPE, EURO-HPC, TETRAMAX, CLOUD-SME etc. have been brought into existence to promote the development of European supercomputing ecosystem thus stimulating an industry to supply technology and making the supercomputing resources available to a number of public and private users, including small and medium scale enterprises in a variety of application areas.

3.1 Renting of the computational power

Based on the availability of the computational power or computational cycles, the HPC services are rented out to the customers. For the customers coming from public sector or having an academic background, the computational cycles are provided for free of cost. For other companies, irrespective of their size, the renting of computational cycles is provided on contractual basis. These renting out of computational power can have various payment modes such as pay as you go, subscription model or pay for a share.

3.2 Helping with access to LSC resources

Some customers identify the need for large scale computing services but lack the necessary expertise required for the use of LSC services. Hence a large number of LSC service providers based on the availability of time and expert human resources provide assistance to the customers to achieve the necessary objectives of the task. This can vary from institution to institution. The assistance ranges from problem definition, development support, documentation, technical assistance, training etc.

3.3 Collaboration in Research and Development

Although the HPC institutions focus mainly on serving academic centres in their research and developmental work, they also serve companies coming from various industrial domains besides renting out the computational power. This service is mostly suitable for firms that lack experience with the use of large-scale computing. Following are some of the industrial domains that LSC institutions serve:

- Mobility
- Engineering
- Climate research
- Health
- Neuroscience
- Biotechnology
- Fintech
- Chemistry and Material Science
- Aerospace

3.4 Consultancy services

Another source of revenue for the LSC centres are the consultancy services. Following are some of the consultancy services provided by the LSC centres to both large companies and small and medium enterprises:

- Software development
- Data storage
- Data science
- Performance benchmarking
- Application tuning
- Code optimization
- HPC infrastructure management

3.5 Training

The LSC service providers also offer training to the academic institutions as well as companies with the use of services. Some of them also extend training to SMEs to increase the uptake of high-performance computing application by SMEs. The trainings are typically provided in the form of workshop and are provided through 1-5 days courses with hands-on exercises and combine lectures. Some of the course topics included in training are as follows:

- Parallel programming
- GPU programming
- Open Foam
- Fortran
- C/C++
- OpenACC
- CUDA
- Scientific Visualization

3.6 List of Services

With the help of the computer assisted web interview, some of the services provided the LSC institutions were identified.

Following are the services offered by the institutions related to infrastructure:

- High performance computing services
- Big Data

- Infrastructure as a Service
- Hadoop as a Service
- Software as a Service
- Remote visualization
- Networking services
- MS Windows support
- Near real-time support
- Infrastructure scalability with external resources

Following are the data storage services offered by the institutions:

- High performance parallel file system
- Virtual drive
- Data repository Backup

Following are the consulting and support services offered by the institutions:

- Problem definition
- Team building
- Development support
- Training
- Design and optimization of HPC infrastructures
- Normal support
- Help desk
- Individual consulting

Following are the software development related services offered by the institutions:

- Complete development of a tailored solution
- Parallelization of existing software
- Code porting existing software
- Application tuning
- Modelling of the solution
- Benchmarking of existing software
- Application's web portals development
- Collaborative research
- Fundamental research in algorithms

Following are the graphical based access mechanisms that institutions support:

- Web portal
- Graphical user interface for job management
- Graphical tools
- Command line
- Bullx, HPC Sauletikis portal etc.

Following are some of the other services offered by the institutions:

- Agreement with independent software vendors to provide licenses to SMEs
- Online collaborative tools to SMEs
- Secure internet connections
- External collaborators for process modelling and applications expertise. E.g.: universities, technological centres, companies etc.
- LSC services for commercial purposes

4. LSC Centres Business Model

For any LSC centre to run successfully it is very important to have an effective business model. The aim of this deliverable is to understand the current business model of such institutions to provide necessary input and feedback for the generation of a handbook on doing business using the BalticLSC system which is a deliverable of the activity A2.3 from work package 2 i.e., "Business models for the BalticLSC system."

Majority of the LSC centres are set up and aided by the local government bodies. The expenses of these LSC service providers such as operating, promotional, platform, maintenance and management costs are taken care of by the national grants. Another source of income comes from joint undertaking such as EuroHPC in cooperation with programs such as Horizon 2020, PRACE, GÉANT etc. The LSC centres also operate privately through their renting of computational cycles or collaborative research in order to cover their other expenses.

A lot of LSC service providers are engaging SMEs in their business models and consider them as relevant to their business models. With programs like Horizon 2020, these institutions aim to provide best available and competitive large-scale computing to SMEs and support them in the development of their applications and technologies over a wide range of domains. These centres also help in the search for external public funding in order to help SMEs to finance their HPC needs. Currently, a large proportion of income that these institutions obtain by servicing the SMEs is through public funding.

Although these institutions are focused mainly towards large companies and academic research institutions, they want to include more potential SME clients into their business models. Below are some of promotion activities undertaken by the LSC centres:

- Discount policies related to CPU volume hour
- Discount policies for starting projects
- Incentive for specific projects, strategic field or interest to the institution
- Trial and buy mechanism
- External public funds to help SMEs funding HPC needs
- Training – Free or affordable fees

Some of the best practices undertaken by these institutions involve Contract/Service Level Agreement (SLA) and Non-Disclosure Agreement (NDA). Service Level Agreement is signed by the service providers and the end users. The contents of SLA include Representatives' details, End user responsibilities, Service provider responsibilities, scope and quality of services, downtime and credits and review procedure. Following are the objectives fulfilled by SLA:

- Co-operation between two parties
- Documentation of roles of both parties
- Ensure good quality service
- To define details about the level of services offered and expected

In addition to SLA, one-way or two-way Non-Disclosure Agreements are prepared to enable the exchange and safety of sensitive data or information. Confidential and technical information includes:

- Patents
- Trademarks
- Service marks
- Rights in any designs
- Applications for any foregoing patents, trades or copyrights
- Others

5. Lessons learnt from the online survey

After some first experience and some feedbacks from the survey, we sum up with some changes for a better method:

Section 4: Contact details: in this section the respondent's name, email address and company name are required. This is for further contact with the service provider institutions for the projects and related activities such as involving in the network, detailed clarification, training etc. However, some institutions may do not want to disclose contact information to avoid advertisement, chasing emails, etc. Therefore, we should provide clear explanation for the contact detail requirement.

Hard copy version of the survey should be introduced: Some institutions may want to only extend their services for the network or particularly to SMEs only after a clear understanding during the meetings or the workshops. Hence by having hard copy version of the survey during such sessions makes it convenient for them to fill out and helps capture their interest and current models concerning the large-scale computing.

Repeat of the survey: LSC products and services change over time, hence the survey should be conducted from time to time during the lifetime of the project so that we can obtain the actual information about models of LSC service provision.

6. Barriers identified

Below are the initial barriers which were identified during the survey and desktop research so far:

- Majority of the LSC service providers have low experience when functioning with the SMEs. This is because most of these institutions are academic or research focused. Hence, they lack offerings particularly to SMEs.
- Since a lot of SMEs are not aware of the uses of LSC or lack appropriate knowledge with the use of LSC services, they do not approach the institutions.
- Due to academic nature of these institutions, the type of service needed to provide to the SMEs changes drastically as financial models and other business model elements come into picture.
- Although LSC centres have good LSC knowledge, they lack domain related knowledge which is very crucial for SMEs coming from different domains.
- The LSC centres have limited resources to extend their services to SMEs as most of them are funded by local government or European funding and are limited to focus their services to only academia or research institutions.
- The survey questionnaire is still so long which requires time for respondents to complete which led to reduced response rate from the LSC institutions.

All these above-mentioned barriers will be discussed to find out a solution to minimize them.

7. Conclusions and further actions

After the analysis of the online survey, there are some further actions that are suggested for consideration:

- More contacts to LSC service providers in the Baltic Region so that there will be more potential centres for LSC project. One way to do this is research for more contact information of centres in online sources and send more invitation to the online survey/events of the LSC project.
- Try to use the contact network of associated local government bodies and authorities to reach more potential LSC service providers.
- Organize workshops/events for LCS providers and SMEs to meet, this may increase the LSC need of SMEs after having more information about LSC in the workshops/events and in turn help LSC institutions come up with models to provide services tailored to SMEs through BalticLSC project.
- Create two levels of questionnaires. The first questionnaire is designed with general questions and contact information sections which helps to identify whether a service provider has the interest in offering LSC services to SMEs. Then, if the provider shows its interest, we can invite them to the second questionnaire to get more details about LSC implementation.
- Involve more service providers in the network who can be potential providers of large-scale computing across the Baltic Sea Region.

Many SMEs do not realise the need of high-performance computing due to lack of knowledge and due to minimal marketing of the LSC institutions towards SMEs as they are mostly academia or research oriented in nature. Another factor that hinders the uptake of LSC by SMEs is the fact that it is expensive, and SMEs do not possess skilled personnel for the use of LSC services. Through BalticLSC network, the idea is to incorporate more and more LSC institutions and potential SMEs for the provision of LSC services to other SMEs and to provide sufficient knowledge, training and the benefits associated with the use of large-scale computing.

ANNEX I: Network Service-Provider Survey

BalticLSC.eu Network Service-Provider Survey

There are 35 questions in this survey.

Section 1: Services

What is the name of your centre?

……

Which of the following services related to infrastructures does your centre offer to SMEs?

O HPC
O Big Data
O Cloud (IaaS: Infrastructure as a Service)
O Cloud (HaaS: Hadoop as a Service)
O Cloud (SaaS: Software as a Service)
O Remote Visualization
O Networking services
O Specific infrastructure for SME access1
O Infrastructure scalability with external resources
O Commercial software licenses support
O MS Windows support
O Near real-time support
O Other:

Which data storage service does your centre offer?

O High performance parallel file system
O Virtual drive
O Data repository backup
O Other:

Does your centre has agreements with ISVs (Independent Software Vendor) to provide licenses SMEs?

O Yes
O No
O No answer

List the commercial software licenses available for SME usage

……

When working with a SME which of the following consulting services do you offer? (mark all that apply)?

O Problem definition
O Team building

O Development Support
O Training
O Other:

Related to software development, which of the following services does your centre provide? Check any that apply:

O Complete development of a tailored solution
O Parallelization of existing software
O Code porting existing software
O Application tuning
O Modelling of the solution
O Benchmarking of existing software
O Application's web portals development
O Collaborative research
O Other:

Which of the following support services does your centre offer to SMEs? Check any that apply:

O Normal Support
O Help desk
O 24x7 support
O Other:

Which collaborative tools does your centre offer to SME?

……

Does your centre offer consulting services on design and optimization of HPC infrastructures to organizations that want to implement their own infrastructure?

O Yes
O No
O No answer

Does your centre offer secure internet connections? E.g. VPN security.

O Yes
O No
O No answer

Which of the following certifications does your centre possess?

O ISO 9001
O ISO 20000
O ISO 27001
O FitSM
O Other:

Does your centre have external collaborators for process modelling or applications expertise? e.g. universities, technological centres, companies?

O Yes
O No

O No answer

Which of the following graphical based access mechanism does your centre support? Check any that apply:

O Web portal
O Graphical user interface for job management
O Graphical tools
O Other:

Section 2: Business Model

Does your centre offer HPC services for commercial purposes?

O Yes
O No
O No answer

Which are the main business sectors using the centre?

……

Do your standard default users include SMEs?

O Yes
O No
O No answer

Which are the main applications used in the centre by the companies?

……

Services to SMEs are a core part of your business model, or rather a secondary one?
O Yes
O No
O No answer

Which percentage share represents SMEs of your income? (direct services, not projects)? Only numbers

……

Do services to SMEs have a relevant place in your business model?

O Yes
O No
O Not answer

Does your centre offer trial & buy mechanism?

O Yes
O No
O Not answer

Which of the following price models does your centre apply? Check any that apply:

O Pay as you go based on CPU hours
O Discount policies for starting projects
O Discount policies related to CPU hour volume
O Incentives for specific strategic fields, or projects, of interest to your centre
O Other:

Does your centre pursue promotion task for specific economic sectors in its geographic area? (specify briefly which ones)

O Yes
O No
O Not answer

Does your centre actively engage in the search for external public funding in order to help SMEs to finance their HPC needs?

O Yes
O No
O Not answer

Does your centre include SLA (Service Level Agreement) in the contracts?

O Yes
O No
O Not answer

Does your centre have a contract model for NDA (Non- Disclosure Agreement)?

O Yes
O No
O Not answer

Section 3: BalticLSC Project

Given that BalticLSC is a project aimed at helping SMEs use Large Scale Computing, would you be interested in finding more about what LSC can do for your company through:
Please choose all that apply:

O Attending a technical workshop
O Participating in a follow-up interview
O Attending to a free high-level introductory event to LSC
O Collaborating with LSC centre on a pilot R&D project
O Being informed on relevant local LSC training courses

Would you like to receive the results of our survey?

O Yes
O No
O Not answer

Section 4: Contact Details

* Required

Data about yourself and your company

Your name: *

……

Your email address: *

……

Your phone number:

……

Your position:

……

Your company name: *

……

Webpage address:

……