



ResInfra
EU-LAC

Identification of best practices on HPC for LAC



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Summary

EU-LAC ResInfra aims to identify a number of CELAC Research Infrastructures (RIs) that may be considered eligible for the construction of a bi-regional collaboration. This will be carried out through the definition of minimal key requirements these RIs would need to develop in the coming years. Also, EU-LAC ResInfra will use all the results and information obtained for drafting a Sustainability Plan, which will be presented to the EU-LAC RI Working Group for discussion and endorsement. The Plan will include specific actions to support the bioregional collaboration in a mid-term perspective.

The objective is to design specific variable geometry instruments for cofounding RIs of common interest, and to design measures that pursue the strengthening of the bi-regional RI cooperation, seeking to maximise the impact of the RI collaboration in the construction of the EU-LAC Common Research Area.

In this scenario, the 'Red Iberoamericana de Computación de Altas Prestaciones' (RICAP, Ibero American High Performance Computing Network, <http://www.red-ricap.org/>), one of the project's pilot, reports on the identification of best practices on High Performance Computing (HPC) for Latin America and Caribe. This report is the second one after the one identifying strategic partners for HPC infrastructure sustainability.

1. Introduction

Sustainability of shared infrastructures between EU and LAC is a must. There are several fields of actions for achieving it, but one of those is a correct identification of best practices that could leverage the work towards success. In a first report, EU LAC ResInfra identified key entities that could carry out these best practices for achieving sustainability¹.

RICAP is focused on High Performance Computing (HPC, i.e. supercomputing) infrastructure, probably the most multidisciplinary field nowadays as their resources are broadly used worldwide by almost every scientific and technological field, humanities included.

As part of the EU-LAC ResInfra project, RICAP describes in this report those best practices that have been identified as key for achieving a sustainable effort in EU and LAC on HPC. They are expected to be the base for designing a roadmap in 2021 as final outcome and success story of RICAP within the project.

Thus, best practices are also extracted from results and milestones achieved by several initiatives that have been fostering HPC in EU and LAC in the last decade. EU co-funded projects such as EELA, EELA-2, GISELA, CHAIN, CHAIN-REDS, RISC, EUBra-BIGSEA, ENERXICO, or HPC4E have been essential for academic and industrial development on advanced IT services on computation.

Also, major Pan-European or international initiatives have provided several outcomes. Just to mention a few, the Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC²), the Partnership for Advanced Computing in Europe (PRACE³) and their advisory group for Strategic Technologies (STRATOS), the European Technology Platform for HPC (ETP4HPC⁴), the Advanced Computing System for Latin America and the Caribbean (SCALAC⁵), or the HPC Ibero American Network (RICAP⁶).

As a result, what it follows aims to be a qualified representation of the best practices in the EU-LAC region pursuing to progress towards boosting viable innovative outcomes that will be

¹ See the EU LAC report 'Identification of potential EU and LA partners for sustainability of the RICAP pilot'

² <https://www.hipeac.net/>

³ <https://prace-ri.eu/>

⁴ <https://www.etp4hpc.eu/>

⁵ https://twitter.com/scalac_computo?lang=en

⁶ <http://www.red-ricap.org/>

exploited by the European and Latin American and Caribbean academia and industry. They all aim to reinforce in the coming future:

- The expertise in the domains of High Performance Computing and Supercomputing
- The expertise in the area of Computational Science, tackling large-scale scientific and industrial problems
- The capacity to organise high-level events and to involve the key policy and research actors as well as attracting good students;
- The expertise in the specific processes that are of interest to EU-LAC ResInfra
 - Policy and market observation
 - Virtual community building and research networking
 - Support to development, exploitation, and dissemination of developed activities
- The validation of results and formative evaluation

2. Context

In the last few years, especially with the advent of artificial intelligence (AI) and the development of an Internet of Things (IoT) based society, HPC has become a predominant factor in everyone's life, profoundly affecting almost every field or topic. A recent example is the role of HPC in the fight against COVID-19. All major developed countries have started important HPC programmes to reach Exascale capability by 2023 or earlier. The EU authorities have launched a major HPC Joint Undertaking programme in 2018 called EuroHPC, which is now made up of 32 Participating States, well beyond the 27 EU member states. The objectives of EuroHPC are acquiring and providing a world-class pre-exascale supercomputing infrastructure for Europe's scientific, industrial and public users, matching their demanding application requirements, and supporting the development of a European innovation ecosystem in supercomputing technologies, applications and skills.

Such an infrastructure should also have an impact somehow in Latin America and Caribe and ResInfra is working on it. Emerging and more developed economies in LAC are sharing the same preoccupations and interests than in the EU for HPC. HPC adoption has a different impact in the various countries of the Latin America and Caribe region. ResInfra proposes to facilitate alignment of the HPC road-mapping exercise in LAC and EU extending the European advances

on infrastructure related topics (not only the infrastructure itself) to LAC. In this way, exchange of best practices in HPC research is key.

Thus, in the following sections, ideas related to the organization of meetings, thematic workshops and summer schools, and to leverage major HPC events in Europe and in LAC for the evident economy of scale and increased visibility will be described.

If Europe wants to play a leading role in setting the priorities for HPC technology research and development on a global scale, it needs to establish strong and sustainable links with all regions of the world already based on the real needs and interests of all involved stakeholders. Furthermore, to contribute to the social inclusion of these emerging economies, a substantial dialogue between the technology research communities working in Europe and these regions must be started, based on the real needs of these local economies and addressing at the same time development opportunities and efficiency growth.

3. Current situation - SWOT analysis

It is well-known that disruptive technologies are key enablers for economic growth and competitiveness. HPC is a crucial asset for the development of nations. To the best of our knowledge, there is no single regional initiative to give a collective answer to promote the use of HPC and Artificial Intelligence to boost the research and cope with the societal, environmental and industrial challenges that the XXI century brings. Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, and Uruguay have national plans to organise their national HPC communities that are in different stages of development and degrees of funding. Even more, some of those countries have National Networks for supporting HPC activities.

In order to better assess and propose best practices for boosting HPC infrastructures in LAC in collaboration with Europe, the following SWOT analysis based on a similar one already made by the RISC2 consortium is defined:

3.1. Strengths

- The main strength of HPC in LAC comes from the ongoing initiatives whose aim is to replicate the PRACE model in the region. These initiatives, such as SCALAC, RedCLARA, RISC2, and RICAP (ResInfra EU LAC), include a combination of dedicated and experienced institutional partners and researchers who are linked on the EU side in the HiPEAC network and PRACE (see the previous ResInfra report1). They have widely

published and presented their scientific achievements at many conferences and workshops due to their vast experience in HPC, advanced computer architectures, performance modelling, and algorithms for large-scale industrial and scientific problems. Counting on key members with a broad spectrum of HPC infrastructures ensures that the proposed actions and solutions are cutting edge.

- The production of a road map for the future of HPC infrastructure and applications in LAC and the identification of innovation communities looking to use HPC and its impact on societal, industrial and environmental issues will be doable by counting on the inputs from the aforementioned initiatives.
- The ongoing initiatives are working on growing public awareness about HPC and AI research and Environmental issues in order to put pressure on the governments and academia to act and solve them.

3.2. Weaknesses

- Pulling resources together is crucial in the current financial climate –in both regions– and if missed represents a tremendous loss for the countries involved.
- Low responsiveness of knowledge institutions/industry to developmental challenges. LAC may be left way behind in exploiting the advances in HPC and the innovations it can produce in key research areas. This is particularly true for HPC applications and innovation in the industry to improve green productivity and reduce environmental impacts.
- If the research space in LAC is not structured and resources not pulled together, there will be a minimum impact in the research areas considered and in the society. This will end in the disconnection between actual knowledge and policy as well as in the disconnection between policy and social reality.
- There is a lack of awareness in the policy and decision-makers to establish developing HPC as a long-term policy with programs to support it across governments and countries.
- Low participation of women in the HPC and ICT activities.

3.3. Opportunities

- To produce a policy document, i.e. a roadmap, with input from key partners from EU and LAC that will define the future trends and research clusters and structure further the HPC research in this area.

- To enhance the research and promote systemic innovation through the use of HPC in those areas of interest in LAC as well as in the innovation communities to be created. Innovation is the fundamental engine of long-term growth in low-carbon economies.
- To enhance the research in already identified research clusters as well as the cooperation industry-academia.
- To monitor and contribute to the established on-going initiatives in the region as well as the region's strategy regarding reciprocal use, openness or co-financing of HPC infrastructures as well to assure the European cooperation and presence.
- To actively promote the participation of more women in HPC activities

3.4. Threats

- Due to the investment in other regions of the world, if the research space in LAC is not structured and resources not pulled together, there will be a minimum impact in the research areas considered and in the society.
- LAC may be left way behind in exploiting the advances in HPC and in particular their applications in industry, societal challenges, and key research areas.
- Pulling resources together is critical in the current financial climate and if missed is a tremendous loss for the countries.
- The lack of a common framework for ethics in the use of HPC technologies when applied to societal issues.
- The situation originated by the COVID19 pandemic and their future impact.

4. Best practices

In this document, several best practices are proposed to deepen strategic R&D cooperation between EU and LAC in the field of HPC and close related science by building a multinational and multi-stakeholder community that would involve a significant representation of the relevant HPC R&D EU and LAC actors (researchers, policy makers, users).

In this sense, the previous RISC project already identified common needs, research issues, and opportunities for cooperative R&D on HPC between EU and LAC in the transition to multi-core architectures across the computing spectrum and relevant programming paradigms, algorithms and modelling approaches, thus setting the basis for the formulation of this document and, as a consequence, a global strategy for future research. These outcomes are now updated to the current situation in the HPC field, i.e. the advent of the exascale era.

The proposed best practices are:

- Assessing the ICT collaboration potential in the HPC, Computer Science, and Computational Science areas for the two regions producing a roadmap / green paper on HPC (and related fields such as Data Science and AI) drivers describing needs in LAC, mapping the LAC HPC actors and trends, identifying the opportunities for LAC actors in EU and for EU HPC actors in LAC, and aligning EU and LAC HPC policies and strategies
- Sharing and disseminating information and results in the focus area of EU HPC to a number of research, policy, and practice actors dealing with technology applications in the LAC region; making available existing LAC HPC research to EU research, policy, and practice actors
- Organising awareness-raising events about the EC's ICT R&D programmes, in particular those ones relevant to HPC and exascale computing for LAC HPC actors. Organising Summer Schools and Advanced Workshops between EU and LAC actors to inform and initiate research collaborations between them. Networking, capacity building and training components of these events would enhance the impact.
- Actively engaging the relevant industry by focusing on industrial problems and problems with impact for the society. Providing advanced support services to a selected number of competent LAC actors to build long-term relationships with key EU counterparts. To do so, identification of target areas should be carried out (those reading the ETP4HPC SRIA could be an initial point).
- Extending HPC with links and relationships with complementary technology and tools in the areas of virtualization, data visualization, high performance data analysis and simulation, artificial intelligence aligned with industrial-driven application fields, creating a value chain for final users and practitioners.
- Enhancing HPC R&D policy dialogue between policy makers and stakeholders from EU and LAC communities.
- Creating a fully functioning network focusing on activities to support and to promote coordination of the HPC research between EU and LAC.
- Integrating LAC industrial users among the leading HPC players. HPC plays a pivotal role in stimulating economic growth and innovation, so it is essential to push HPC adoption by Industries to enhance their innovation capabilities and sustain competitiveness.

- Striving to address the lack of qualified personnel by facilitating access to existing training resources -like those of PRACE- that enables engineers and technicians to obtain the required skills and certifications. Ensuring that skills can be transferred over a range of system and application domains.
- Setting up a kind of high-level advisors to assess the quality of the activities and results.



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