Towards EXtreme scale Technologies and Accelerators for euROhpc hw/Sw Supercomputing Applications for exascale

WP7 Dissemination, Communication and Exploitation

D7.8 Final report of the collaboration plan with definition of common objectives and activities including milestones

http://textarossa.eu

This project has received funding from the European Union's Horizon 2020 research and innovation programme, EuroHPC JU, grant agreement No 956831

TEXTAROSSA

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Grant Agreement No.: 956831

Deliverable: D7.8 Final report of the collaboration plan with definition of common objectives and activities including milestones

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Please see http://textarossa.eu for more information on the TEXTAROSSA project.

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The content of this document is the result of extensive discussions within the TEXTAROSSA © Consortium as a whole.

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List of Acronyms

Acronym	Definition
BoF	Birds of a Feather
CA	Collaboration Agreement
CGP	Complementary Grants Project
CoE	Centre of Excellence
CPCB	Cross-Project Collaboration Board
DoW	Description of Work
ECMWF	European Centre for Medium-Range Weather Forecasts
EoCoE	Energy Oriented Centre of Excellence
EIC	European Innovation Council
FPGA	Field Programmable Gate Array
GA	Grant Agreement
HPC	High Performance Computing
JU	Joint Undertaking
PO	Project Officer

Executive Summary

This deliverable is an update of deliverables D7.5 and D7.7. They respectively presented a Collaboration Plan and relative objectives envisaged to build an effective collaboration network with other EU research projects and the main HPC European competence centres, and the activities performed during the project's first two years. In this deliverable, we report the activities implemented during the project's final year to implement the proposed plan.

The reported activity concerns task T7.3: “Networking with EU HPC landscape and Centres of Excellence” and task T7.5: “Common task for complementary grants”, as they are strictly related in some respects. It must be noted that this is an internal TEXTAROSSA Collaboration Plan that includes but is not limited to the Collaboration Plan that has been defined together with the complementary grants.

1 Introduction

Establishing an effective collaboration between TEXTAROSSA and companion EuroHPC initiatives is crucial for paving the way toward a European research and innovation ecosystem in the HPC area. As introduced in D7.6, we identified three aims for establishing an effective collaboration activity.

- **A1: Collaboration with complementary grants,** actively participating in the collaboration activity implemented in the context of complementary grants projects.
- **A2: External Networking**, establishing contacts, and implementing specific actions for collaborating with the main actors of the European HPC landscape, such as Centres of Excellence, innovation, and technology transfer bodies such as industry associations, competency centres, and the forthcoming European Digital Innovation Hubs; this task is also related to the exploitation activity in selecting the appropriate industrial venue to improve the TEXTAROSSA results in uptake
- **A3: Internal Activity**, focused on preparing material tailored to the specific objectives and selecting roles for implementing and monitoring networking activity; this task is strictly related to dissemination activity in producing presentations, flyers, and organizing events.

The corresponding Collaboration Plan, summarized in Figure 1, is based on the strategy of iteratively refining objectives by way of a periodic exchange with representatives of complementary grants (A1), aiming at disseminating and exploiting results in the external network (A2) by way of materials produced by the internal activity (A3). The plan updates and the collaboration activities performed during the TEXTAROSSA final year are reported in the following sections.

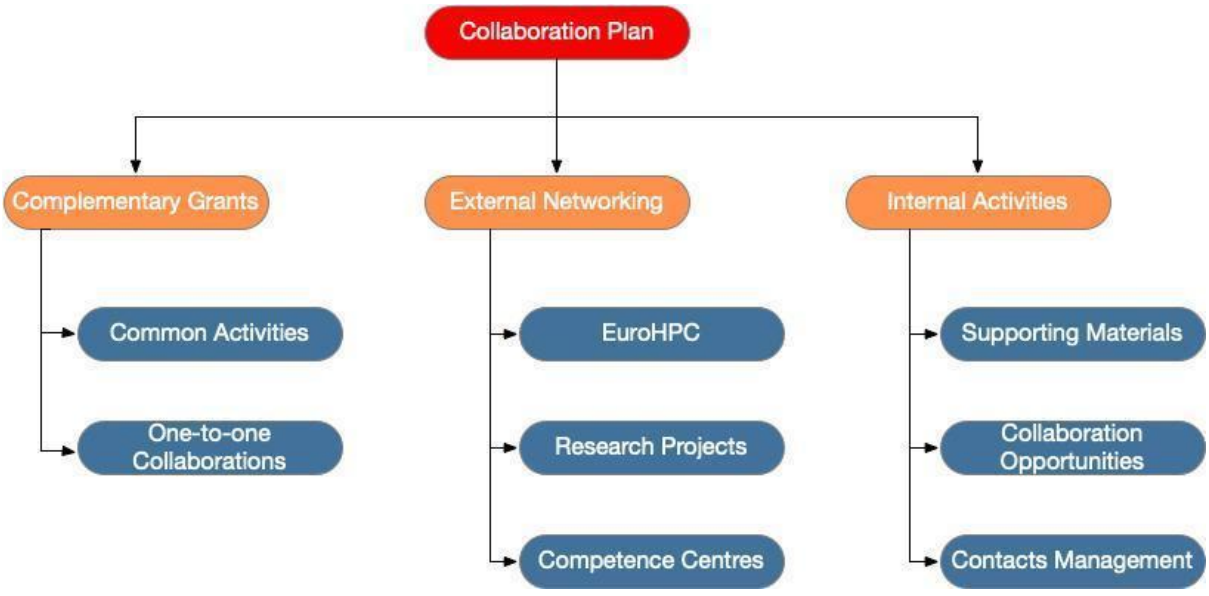

Figure 1: Collaboration Plan

2 Collaboration with Complementary Beneficiaries

A specific task (Task 7.5: Common task for complementary grants) has been introduced in the TEXTAROSSA DoW to organise all efforts to establish synergies and collaboration with complementary grants projects (see Table 1) listed under Article 2 of the Grant Agreement (GA)[1]. All the complementary grants projects (CGPs) must identify common objectives and define a shared collaboration strategy to implement them.

Table 1: List of Complementary Grant Projects

Complementary Grants projects	Specific Connections with TEXTAROSSA
956213 (SPARCITY)	Contact through coordinator
955776 (RED-SEA)	Common beneficiaries (INFN, ATOS)
955701 (TIME-X)	Contact through coordinator
956748 (ADMIRE)	Common beneficiaries (CINI, BSC, E4, INRIA, PSNC)
955606 (DEEP-SEA)	Common beneficiaries (BSC, ATOS, Fraunhofer)
956702 (eProcessor)	Common beneficiaries (BSC) Contact also via UNIBO, La Sapienza
956201 (DComEX)	Contact through coordinator
955811 (IO-SEA)	Common beneficiaries (ATOS)
955513 (MAELSTROM)	Common beneficiaries (E4)

The collaboration has been regulated through a Collaboration Agreement (CA) signed by all the participants in March 2022[2]. The purpose of the CA, as reported in "Article 2" is to coordinate the work, create synergy in the mutual activities, implement the provisions of the respective Complementary Grant Agreements, Implement and update Collaboration Plans and jointly decide upon commonly shared dissemination and upcoming activities. The TEXTAROSSA collaboration plan has been updated according to these joint activities, as reported in the following sections.

2.1 Objectives and plan

The objectives of the Collaboration Plan were introduced and discussed in D7.6 and D7.7 and are summarised in Table 2. They fully comply with the ones discussed and agreed upon with the complementary projects. In the next section, we discuss the activities done and provide information about their accomplishment.

[1] Grant Agreement Number 956831 - TEXTAROSSA - H2020-JTI-EuroHPC-2019-1
[2] Collaboration Agreement EuroHPC-01-2019, Final version 08 March 2022.

Table 2: Collaboration with Complementary Beneficiaries objectives

Main Objectives	
A1-Obj1	Jointly addressing cross-cutting issues
A1-Obj2	Sharing results and best practices as relevant
A1-Obj3	Participating in benchmarking exercises of products across projects
A1-Obj4	Working towards joint publication, dissemination, and exploitation of results
A1-Obj5	Actively contributing to the definition of the overall EuroHPC-JU strategy and road mapping, following common objectives

2.2 Activity Report

Milestones 1-5 were reached in the first 18 months of the projects and were already discussed in D7.6 and D7.7. A summary is available in Table 3. The other ones are discussed below.

Table 3: Summary of the milestones reached in the first 18 months of the project

A1-Milestone 1	Defining an official communication channel among all the projects.	An email list has been established between the coordinators of projects[3].
A1-Milestone 2	Presenting each other's projects as a starting point for further collaboration.	Mini-workshop organized on May 25th, 2021
A1-Milestone 3	Identify point-to-point collaborations between projects' specific technical topics.	The project coordinators have elaborated a collaboration matrix between projects (see D7.7)
A1-Milestone 4	Establish a collaborative workspace to share information, presentations, documents, and other helpful material for collaboration.	A "EUROHPC-2019-1-Projects" SharePoint has been established and shared by Forschungszentrum Jülich to facilitate the exchange of files and documents[4]
A1-Milestone 5	Prepare and agree on a Collaboration Agreement to be signed by the end of December 2021.	The CA was signed on March 22nd, 2022. The delay occurred mainly due to the need of sharing, discussing and signing among all the 61 partners in the CGPs. More information is available in D7.7.

- **A1-Milestone 6:** "Create (and participate) in common boards and advisory structures to decide on collaboration and synchronization of activities, including on management of outcomes,

[3] eurohpc19_coord@fz-juelich.dev
[4] https://fz-juelich.sciebo.de/s/5S9Jzub4DTRQNML?path=%2F

common approaches towards standardization, SME involvement, links with regulatory and policy activities, and commonly shared dissemination and awareness raising activities" as stated in the GA.

Article 3 of the CA states, "The Parties will establish a Cross-Project Collaboration Board (CPCB). It will be composed of one representative of the Coordinator of each on-going EUROHPC-01-2019 Project ("CPCB member") ".
The CPCB has been set up to have a different chair for each 6-month slot. Specifically:

- from 01-04-2022 to 30-09-2022, Peter Dueben (ECMWF), MAELSTROM coordinator;
- from 01-10-2022 to 31-03-2023, **Massimo Celino (ENEA), TEXTAROSSA coordinator;**
- from 01-04-2023 to 31-09-2023, Didem Unat (Koç University), SparCity coordinator;
- from 01-10-2023 to 31-03-2024, Jesus Carretero (Universidad Carlos III de Madrid), ADMIRE coordinator.

The scope of the CPCB was organising collaboration sessions and discussing all the joint activities:

- An online CPCB meeting was organized on April 11th, 2023[5] by the current chair Didem Unat.
- An in-person CPCB meeting was organized by TEXTAROSSA partner on June 5-7, 2023, at the University of Torino (Italy) with a joint technical session (more details are provided while discussing A1-Potential Milestone 11).

Table 4: Potential Milestones not pursued

A1- Potential Milestone 7	Invite other project representatives inside each project advisory board	This has not been pursued as a general coordination action.
A1- Potential Milestone 8	Provide guest presentations at the General Assemblies on the different projects.	This has not been pursued as a general coordination action.
A1-Potential Milestone 9	Prepare a joint newsletter to update on the progress of the different projects.	This milestone has not been pursued due to the complexity of organising the activity among all CGPs.

Some Potential Milestones were not pursued due to their complexity (Table 4). For A1-Potential Milestone 9, a joint website was considered more straightforward and dynamic (see A1-Potential Milestone 12).
Concerning Potential Milestones 7 and 8, the collaboration was performed working at two different levels:

- Coordinators level, sharing general project knowledge and organising joint activities through the CPCB;
- Technical level, sharing and integrating involved project technologies and results through working groups defined according to specific Work Streams.

The following Work Streams were active during the overall project duration:

- Malleability (ADMIRE, DEEP-SEA, IO-SEA, TIMEX), led by Ahmad Tarraf and Jesus Carretero;
- I/O traces and performance analysis (ADMIRE, IO-SEA, RED-SEA, TEXTAROSSA), led by Philippe Deniel and André Brinkmann;
- Optimisation cycles (DEEP-SEA, IO-SEA), led by Alexander Geiss (DEEP-SEA);
- Benchmarking (IO-SEA, DEEP-SEA, MAELSTORM, TEXTAROSSA), led by Yannik Müller;
- Codesign (DEEP-SEA, TEXTAROSSA, ADMIRE, RED-SEA), led by Hans-Christian Hoppe.

[5] https://docs.google.com/presentation/d/16g_XApX0hM1tRsVPtaeuB3XXreyztEn9/edit#slide=id.p1

TEXTAROSSA was involved in I/O traces with the INFN partner, Benchmarking with E4 (Fabrizio Magugliani), and Codesign activity with E4 (Fabrizio Magugliani) and INFN (Alessandro Lonardo).

Beyond this, there have been point-to-point collaborations between TEXTAROSSA and other projects. Daniele Gregori (E4) collaborated with MAELSTROM (and EXAFOAM, not a CGP) to use their application on Nvidia Hopper.

- **A1- Milestone 10:** Organise joint sessions at specific events, for example, a Birds of a Feather Session at the Supercomputing conference, HiPEAC, and ISC.

Joint participation at ISC 2023[6], in Hamburg on 21-25 May, was organized by joining both the "EuroHPC Village" organized by EuroHPC JU and the E4 booth[7], which hosted representatives of several European projects and offered a preview of the TEXTAROSSA liquid-cooled server prototype (more details in section 3.2).

A full-day workshop, "EuroHPC Projects Shaping Europe's HPC Landscape", was organised jointly by all the CGPs on January 17th at HiPEAC 2024[8] in Munich and presented by CPCB chair Jesus Carretero. As the end of the projects' cycle was approaching, in this workshop, each project presented its progress and developments, and highlighted its important contributions to the field of HPC, to raise interests from stakeholders who wished to get a global view of all ten projects (Figure 2).

Figure 2: Jesús Carretero presenting the agenda of the "EuroHPC Projects" workshop at HiPEAC 2024

TEXTAROSSA contributed with the talks:

- "Multi-FPGA performance scaling of High-Level synthesis applications through the APEIRON framework" by P. Palazzari (ENEA), C. Rossi (INFN) (Figure 3).

[6] https://www.isc-hpc.com/
[7] https://www.e4company.com/en/eventi/e4-isc-high-performance-2023/
[8] https://www.hipeac.net/2024/munich/#/program/sessions/8085/

- The presentation highlighted some of the key results obtained within the TEXTAROSSA project, specifically demonstrating the use of the APEIRON framework that enables Vitis HLS flow to accelerate image processing and data compression by means of a set of interconnected FPGA boards.

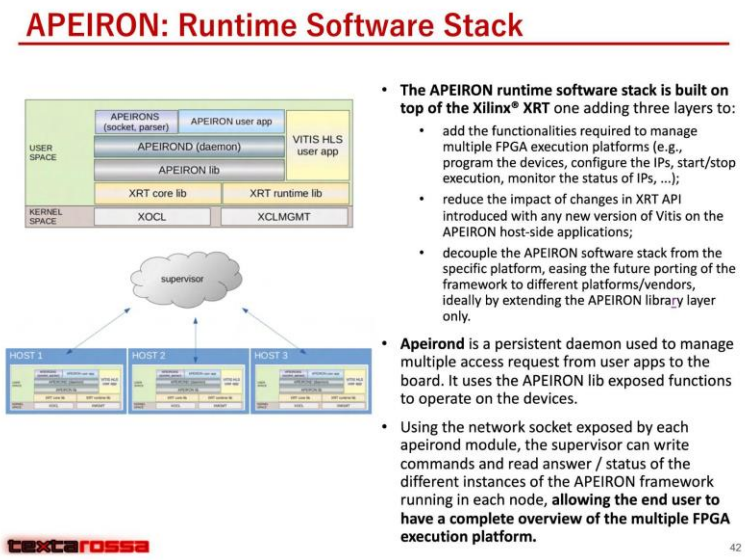

Figure 3: Excerpt from the Apeiron presentation at the "EuroHPC projects" workshop at HiPEAC 2024

- "Innovative Thermal Management of Next-Generation HPC Servers through Two-Phase Flow Cooling Pumped Loop in Textarossa project" by Giuseppe Zummo (ENEA).
  - The presentation focused on the novel two-phase flow cooling technology developed in TEXTAROSSA that exploits the high heat transfer coefficients of boiling and evaporation, offering a promising solution.

A Bof entitled "Enabling I/O and Computation Malleability in High-Performance Computing" participated by members of several CGPs has also been organized on November 15th, at SC23 in Denver[9] (Figure 4).

Figure 4: Presentation of the joint BoF at SC23

[9] https://sc23.conference-program.com/presentation/?id=bof236&sess=sess373

A joint workshop entitled " Co-Designing the Future of European HPC: Eco-friendly Technologies, Systems and Software"[10] was also organized on March 19th, 2024, during the EuroHPC Summit held in Antwerp, Belgium[11]. TEXTAROSSA participated with representatives Daniele Gregori (E4) and project coordinator Massimo Celino, and contributed to the talk:

- "European System Architecture Advancements" presented by Hans-Christian Hoppe (Figure 5) where integrated co-design activities in collaboration among CGPs were presented.

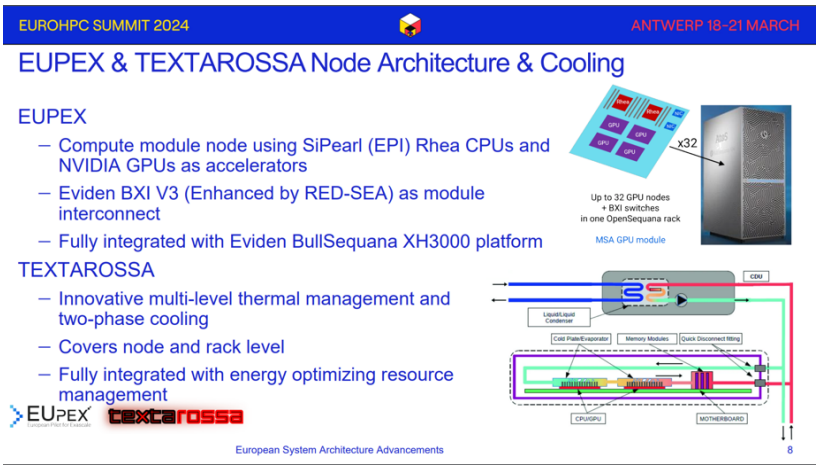

Figure 5: Excerpt from "European System Architecture Advancements" presentation at Euro HPC Summit 2024

- **A1-Potential Milestone 11:** Organise joint workshops between the CGPs.

These are mini-conferences with one talk for each project, where updates on each project's progress are presented and discussed, continuing the mini-workshop in Milestone 2.

TEXTAROSSA organised the Collaboration Workshop on 6-7 June 2023 at the University of Turin premises, hosted by Prof. Marco Aldinucci (CINI-UNITO) [12](Figure 6).

Figure 6: Collaboration Workshop in Turin, June 2023

[10] https://cdn.sanity.io/files/461i44gu/production/8d63ba90fa0e4c2ded75411aa326b5ec6a5e6213.pdf
[11] https://eurohpc-ju.europa.eu/news-events/events/eurohpc-summit-2024-2024-03-18_en
[12] https://alpha.di.unito.it/eurohpc-meeting-2023/

Presentations from each Work Stream were given (Figure 7 and Figure 8):

- Malleability, presented by Ahmad Tarraf and Martin Schreiber;
- IO traces and performance analysis, presented by Nafiseh Moti;
- Optimization Cycles, presented by Ahmad Tarraf;
- Benchmarking, presented by Yannik Müller;
- Codesign, presented by Hans-Christian Hoppe;
- Sparse Computation, a new workstream led and presented by Didem Unat (SparCity, DCOMEX).

Figure 7: Presentations of "Optimization Cycles" and "Benchmarking" Work Streams during the Collaboration Workshop

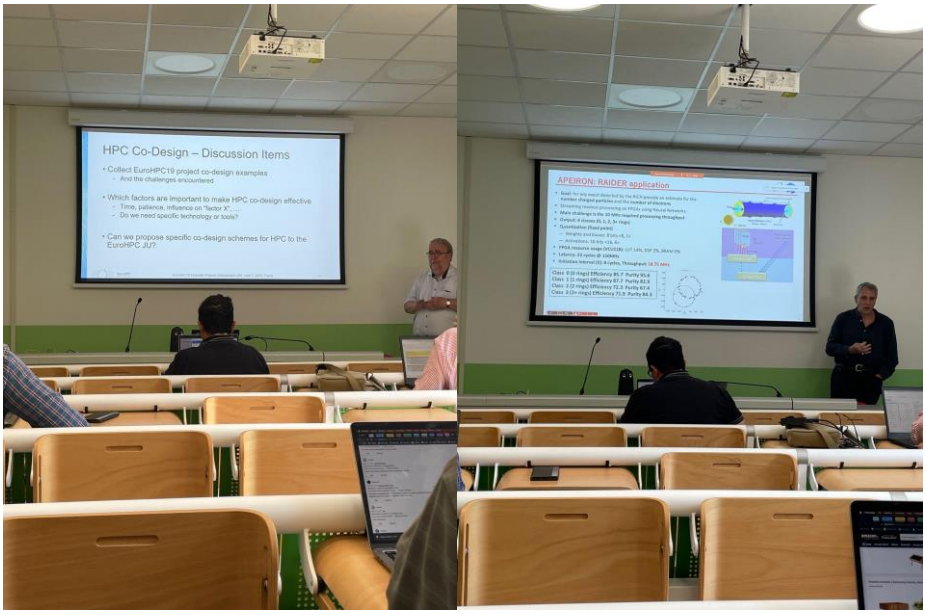

Figure 8: Presentations of "Codesign" Work Stream during the Collaboration Workshop

In particular, as an example in the Codesign Work Stream, the activity and results of TEXTAROSSA were also presented by Piero Vicini (INFN). The collaboration meeting ended with a discussion of the results and was then followed by the coordinators' meeting session. A visit to the University of Turin HPC4AI@UNITO data centre was also included in the meeting (Figure 9).

Figure 9: Visit at the HPC4AI@UNITO datacentre following the Collaboration Workshop

- **A1-Potential Milestone 12:** Include references to the other CGPs in each project website or create a joint website with regard to the project and everyday events and dissemination material.

As anticipated, and already discussed in D7.7, the approach chosen for better disseminating projects information was through a joint CGPs website. It is currently online at `https://exascale-projects.eu/`.

The structure discussed and agreed upon among the CGPs starts with a homepage (Figure 10) presenting the objectives of the projects and how they fit into the EuroHPC strategy ("Learn more about us"). Among other sections, it also includes:

- A blog-style list of specific collaboration events and activities (ExaBlog)
- A list of events.
- The list of the projects, with a link to the page containing the project presentation and references.

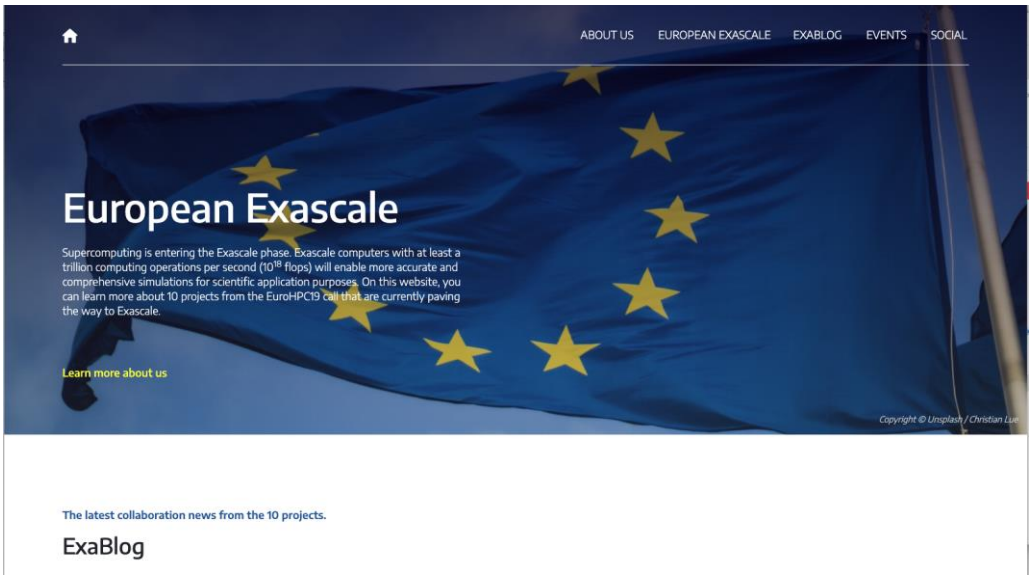

Figure 10: Homepage of the joint CGPs website

3 External Networking

The External Networking activities in the TEXTAROSSA were aimed to enable the consortium to reach early adopters and engage critical stakeholders to facilitate impact and large-scale uptake and are the main focus of “Task 7.3: Networking with EU HPC landscape and Centres of Excellence”. Activities included attending and presenting TEXTAROSSA at critical events throughout the project to broaden the visibility of the solutions developed in the project and to establish links with external stakeholders; therefore, they are strongly related to the general dissemination task. Partners also established contacts with the leading EU organization in the context of HPC. The TEXTAROSSA partners, and more importantly, the people directly involved in TEXTAROSSA, have several links with the most important and influential networks in Europe and disseminated TEXTAROSSA results in the related contexts.

3.1 Objectives and plan

We have already identified the main objectives as discussed in D7.6. They are summarised in Table 4.

Table 4: External Networking activity objectives

Main Objectives	
A2-Obj1	Align with **EuroHPC initiatives** and the open architecture European strategy by participating in main European HPC networking events, such as EuroHPC Summit week, Teratec forum, and HiPEAC.
A2-Obj2	Establish solid links with the **European Centre of Excellence** to discuss with a wide range of application **domain users** and improve the co-design approach.
A2-Obj3	Enlarge the network with **industries** starting with the already established links, in the context and collaboration with the project exploitation activity.
A2-Obj4	Participate in **events** organized by public administration sponsoring research in either **Energy or HPC-related domains** or organize side events at large networking conferences to lobby for the adoption of state-of-the-art HW and SW solutions to increase productivity and adopt cleaner energy solutions.
A2-Obj5	**Standardization Bodies**: Investigate the possibility of participating and collaborating in standardization bodies and working groups close to TEXTAROSSA's technological development core.

3.2 Activity Report

Collaboration activities were strictly connected with the dissemination and exploitation roadmap. In this context, we are only reporting activities focused specifically on collaboration opportunities. The corresponding milestones are easily related to the objectives.

- **A2- Milestone 1**: Establish links with the European Centre of Excellence, starting with, but not limited to, The European Centres of Excellence (CoEs) for High-Performance Computing (HPC)[13].

TEXTAROSSA partners CNR and ENEA were involved in the EoCoE (Energy Oriented Centre of Excellence)[14] projects, EoCoE-I and EoCoE-II, providing strong and consolidated interaction with CoEs in the energy context. They further consolidated their collaboration by being WP leader in "EoCoE-III: Energy Oriented Center of Excellence: Fostering the European Energy Transition with Exascale A Center of Excellence in Computing Applications"[15], a new EuroHPC Project started in January 2024.

Every year since it started, TEXTAROSSA has participated in the EuroHPC Summit week. This year, Euro HPC Summit 2024 took place on 18-21 March in Antwerp, Belgium[16] and, as already anticipated in Section 2.2, TEXTAROSSA participated with several representatives. Among the others, Massimo Celino, the TEXTAROSSA coordinator, William Fornaciari (CINI-POLIMI), Marco Aldinucci, Daniele Gregori (E4) and Tommaso Boccali (INFN) were present (Figure 11).

Figure 11: TEXTAROSSA partner representatives at EuroHPC Summit 2024

- **A2- Milestone 2:** Enforce and enlarge the network with industries already established by the consortium partners.

During ISC High Performance 2023[17], held in Hamburg from 21 to 25 May 2023, E4 unveiled the world premiere of the TEXTAROSSA innovative liquid-cooled server prototype[18] (Figure 12), featuring the innovative two-phase cooling system. E4 participated both as an exhibitor and by hosting representatives of several European projects. In this context, Daniele Gregori (E4) and Giuseppe Santomauro (ENEA) had the opportunity to present the TEXTAROSSA project.

[13] https://www.hpccoe.eu/eu-hpc-centres-of-excellence2/
[14] https://www.eocoe.eu/
[15] https://eurohpc-ju.europa.eu/research-innovation/our-projects/eocoe-iii_en
[16] https://eurohpc-ju.europa.eu/news-events/events/eurohpc-summit-2024-2024-03-18_en
[17] https://www.isc-hpc.com/conference-history/id-2023.html
[18] https://www.e4company.com/en/2-phase-cooling-system/

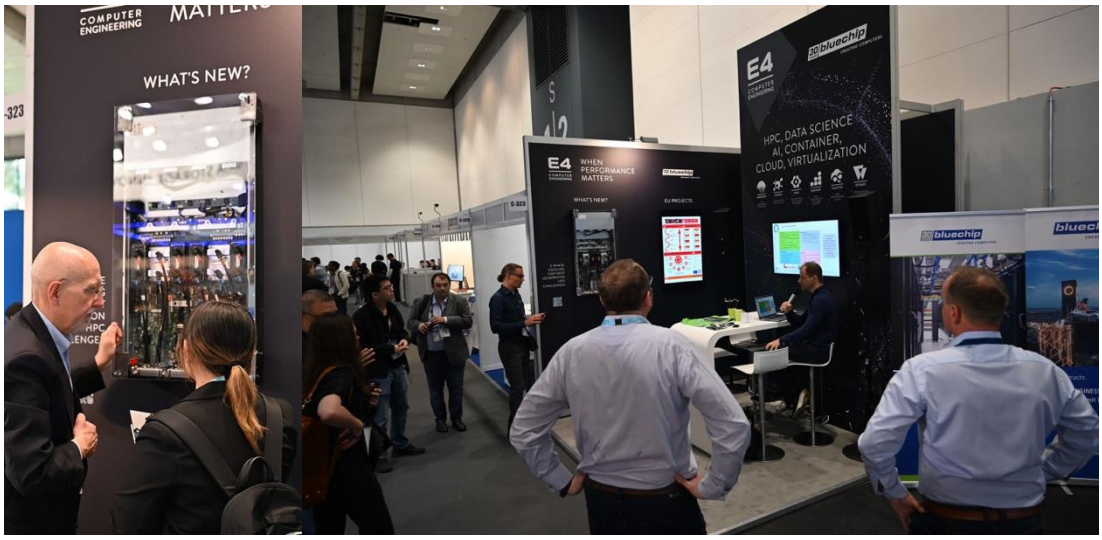

Figure 12: E4 booth at ISC 2023 showcasing the two-phase cooling system (on the left)

As already anticipated, TEXTAROSSA was also present at HiPEAC 2024[19], held on January 17-19, 2024, in Munich, Germany. In addition to participating in the EuroHPC Projects workshop (see Section 2.2), the project was also hosted at the European projects poster session (Figure 13) and the E4's booth (Figure 14).

Figure 13: TEXTAROSSA poster displayed at the EU projects poster session during HiPEAC 2024

Targeting the industrial context, Prof. Aldinucci also participated in the NVidia GTC conference 23, on March 2023, with the talk "Experimenting with Systems for Decentralized Machine Learning", where he took the opportunity to introduce the results of the TEXTAROSSA project.

- **A2- Milestone 3**: Participate in public administration and networking events to sponsor TEXTAROSSA objectives.

[19] https://www.hipeac.net/2024/munich/#/

Figure 14: TEXTAROSSA poster at the E4 booth during HiPEAC 2024

Prof. Aldinucci, participated in many research and networking events where he could also provide an overview of the TEXTAROSSA project. In particular, we mention some keynote talks:

- "High-Performance Computing and Federated Learning", Keynote talk at FLW workshop (co-located with the ACM Web conference), Austin, TX, USA, March 29th, 2023;
- "Federated Learning: A distributed system viewpoint" Keynote talk at the WAFL workshop[20] (co-located with the ECML-PKDD conference[21]), Torino, Italy, September 18th, 2023.

Presentations of TEXTAROSSA were also included in internal seminars at European Universities:

- B. Casella (CINI-UNITO), "Federated Learning: A distributed system viewpoint", Invited seminar at TU Dortmund University, Germany, 15th December 2023;
- M. Aldinucci, "Federated Learning: A distributed system viewpoint", Invited seminar at Computer Science Department of the Bicocca University, Milan, Italy, December 19th, 2023;
- M. Aldinucci, "HPC4AI@UNITO", Invited seminar at the University of Padova, Italy, March 12th, 2024.

Finally, two major events in the Italian HPC community were organized by CINI partners and included TEXTAROSSA's presentation.

Specifically, the "Annual symposium of the HPC-KTT national lab" [22] took place at the University of Pisa, Italy on 21-22 October 2023 (Figure 15). During the event, the European projects in the HPC area involving CINI partners were showcased: TEXTAROSSA, EUPilot, ACROSS, EUPEX, ADMIRE and EUMAster4HPC. TEXTAROSSA was presented by William Fornaciari (Figure 16).

[20] https://sites.google.com/view/wafl-ecml2023
[21] https://2023.ecmlpkdd.org/
[22] https://www.consorzio-cini.it/index.php/it/laboratori-nazionali/hpc-key-technologies-and-tools

Figure 15: Prof. Aldinucci opening remarks at the Annual symposium of the HPC-KTT national lab

Figure 16: Excerpt from TEXTAROSSA presentation at the annual symposium of the HPC-KTT national lab

In the context of the ICSC (Italian "National Research Centre for High Performance Computing, Big Data and Quantum Computing") activities, the Spoke 1 "FutureHPC and Big Data"[23] workshop was held in Turin on February 14th, 2024. It was open to all research partners and companies involved in the ICSC Spoke1.

At the end of the workshop, an overview of the TEXTAROSSA two-phase cooling system (Figure 14) was provided by Elisabetta Boella (E4). Afterward, all the participants were invited to a guided visit with Prof. Marco Aldinucci to the HPC4AI@UNITO datacentre where the first commercial prototype of the two-phase cooling system with GPUs has been installed (Figure 15).

[23] https://www.supercomputing-icsc.it/en/spoke-1-future-hpc-big-data-en/

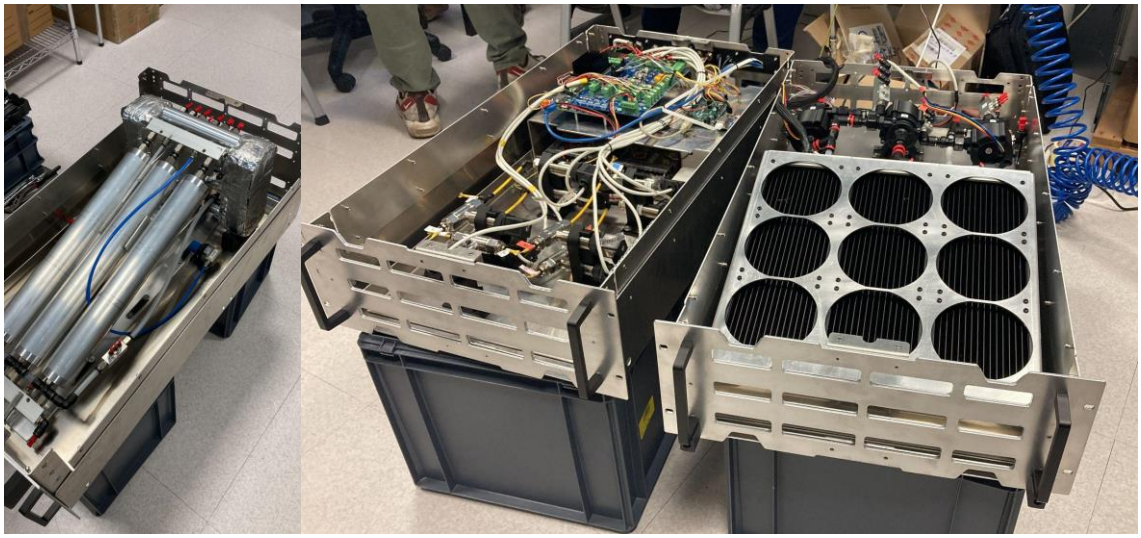

Figure 17: Components of the two-phase cooling system installed at the HPC4AI@UNITO datacentre

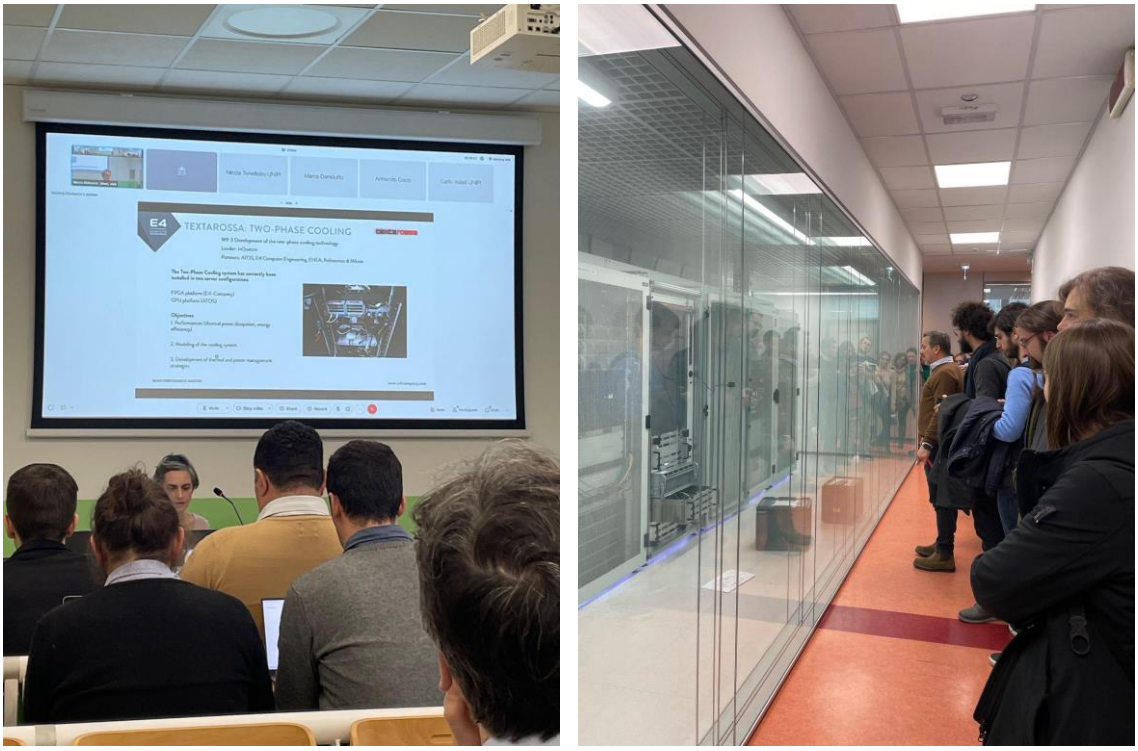

Figure 18: Elisabetta Boella (E4) presenting the cooling system and Marco Aldinucci guiding the visit to HPC4AI@UNITO

- **A2- Milestone 4**: Participate in standardization bodies and technology working groups.

TEXTAROSSA partners worked to bring technological interests and results from the project in technology working groups. The main action involved participation in the EuroHPC Work Streams (see Section 2.2), disseminating projects' results in research and technical communities where the partners are involved.

4 Internal Activity

To collaborate with complementary beneficiaries and external networking, we selected several internal activities to be included as supporting actions in the Collaboration Plan. The main objectives that guided this activity are summarized in Table 5.

Table 5: Internal Collaboration activity objectives

Main Objectives	
A3-Obj1	Provide support for an effective networking activity in the general context of main EU stakeholders (e.g., projects, organizations, industry).
A3-Obj2	Finding collaboration opportunities regarding events, standardization involvement, and exploitation actions (i.e., dissemination and exploitation actions in the collaboration context).
A3-Obj3	Involve all the partners of the TEXTAROSSA consortium in the Networking activities, taking into account their specific roles in the project and their competencies.

As we discussed in D7.6 and D7.7, internal collaboration is strictly related to the Dissemination and Exploitation activity (WP7). It is mostly an iterative process in which the action results need to be continuously monitored and updated starting from an initial milestone.

- **A3-Milestone 1**: Reserve a dedicated folder in the TEXTAROSSA SharePoint to collect all the valuable material for collaboration issues.

A dedicated subdirectory was created in the General folder of the project SharePoint[24] to collect all information and dissemination material needed for collaboration. It is worth noticing that usual dissemination and exploitation material has also been used in the collaboration context, but it has been maintained in the respective dedicated space to avoid replication.

- **A3-Milestone 2:** When needed, and depending on the specific needs, prepare material (e.g., presentations and document templates) for enabling internal and external collaboration actions.

Standard dissemination material such as project presentations and posters have been used to present the project also in collaboration meetings and events. A project flyer (Figure 19) and a poster were designed and are digitally available on the TEXTAROSSA website[25]. They were also made available in digital and/or paper format during conferences and events. Concerning the project presentation, starting from the official dissemination material, the template has been tailored to meet the goals of specific events, for instance, highlighting the possible collaboration topics in the collaboration meetings and workshops organised in the context of CGPs.

[24] https://eneait.sharepoint.com/sites/TEXTAROSSA
[25] https://textarossa.eu/dissemination/dissemination-material/

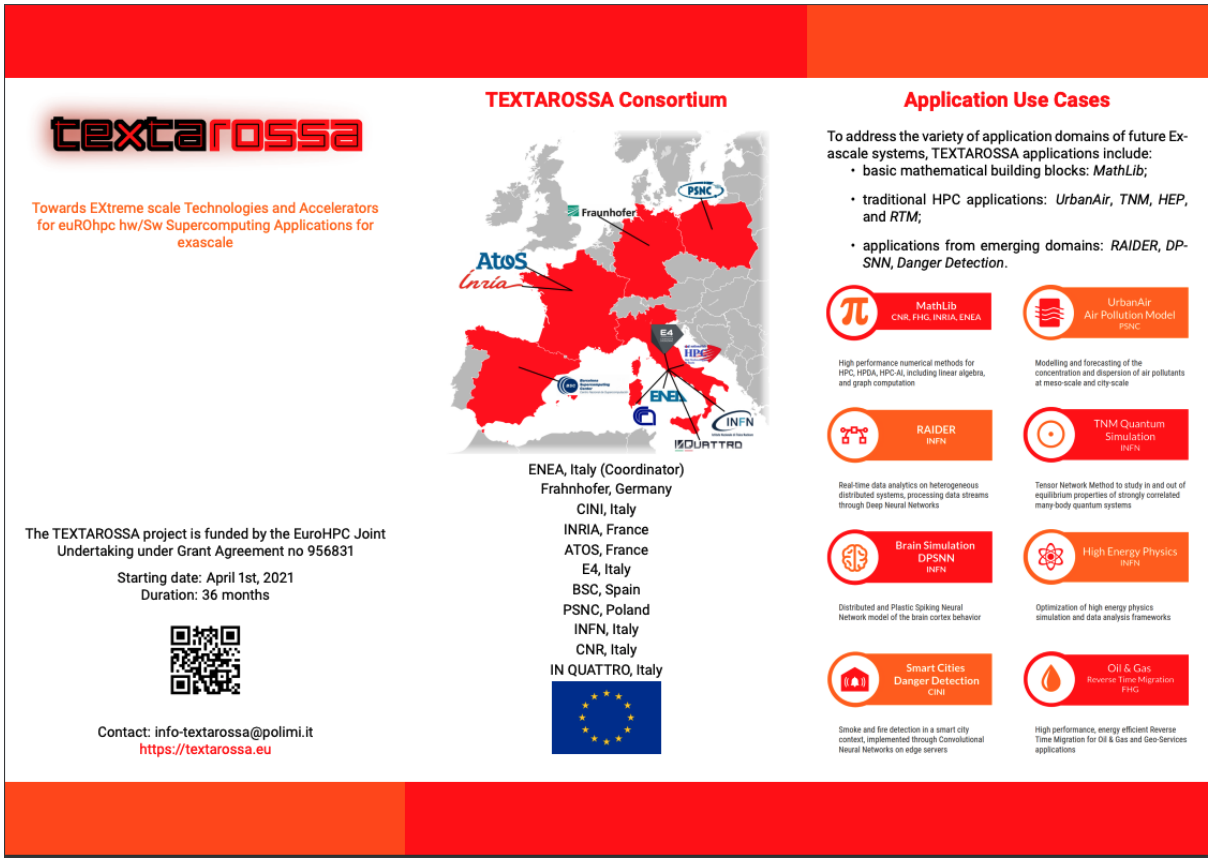

Figure 19: TEXTAROSSA project flyer

- **A3-Milestone 3:** Define a Collaboration Task table where each partner in the consortium provides information on the collaboration opportunities and actions undertaken in the context of TEXTAROSSA, ranging from technical collaboration with other research projects to the organization of joint workshops and participation in standardization bodies.

The table has been initially prepared and then shared in the consortium to allow each partner to provide needed information (Table 6). It was filled both considering the CGPs activity and external networking.

Table 6: Collaboration Task Table

Partner	Collaboration ongoing & planned
CINI-UNITO	• EuroHPC ACROSS Testing of Streamflow on industrial use cases • EuroHPC ADMIRE Coordination language for I/O (CAPIO) • EuroHPC EUPEX Testing StreamFlow and CAPIO on ARM Pilot • EuroHPC EUPilot Distributed streaming at the edge and & FL on RISC-V • EUMaster4HPC Community building
CINI-POLIMI	• EuroHPC EUPEX Run-time management of resources and Dynamic Code Versioning (Lib VC compiler) • EuroHPC EUPilot Run-time management of resources at node (BBQ) and system level (SLURM) • EUMaster4HPC Hosting a Master degree program on HPC, starting in fall 2022 • APROPOS Training network on approximate computing • Possible synergies with projects working on EPI and RISC-V, ACROSS, ADMIRE
CINI-UNIPI	• EPI2 Integrating Posit and Secure solutions with EPAC RISC-V IPs (RISC-V Vec, STX) • EuroHPC EUPilot AI& video IPs compliant with RISC-V VEC and MLS via oneDNN and/or 0NNX DACEML • AERO Secure accelerators for the European Cloud • EUmaster4HPC Advanced learning subjects & additional activities (schools and workshops) • Possible synergies of TEXTAROSSA with E-Processor and ADMIRE

E4	• Maelstrom and Exafoam interested to test the IDV-E and IDV-A platforms to run their Machine Learning codes for Maelstrom and OpenFoam for Exafoam.
PSNC	• Identifying collaboration on the following topics: Mixed precision Performance analysis Energy efficiency Power & thermal models
INFN	• Identifying collaboration on the following topics: Porting and benchmarking of partner's applications on the APEIRON framework Realtime/high throughput analytics on data streams Machine learning (on FPGAs) Scalable reconfigurable systems CGRA In-network computing Low-latency interconnects
CNR	• EuroHPC TIMEX Collaboration on numerical algorithmic advances in multigrid methods for parallel in time integration methods • EuroHPC ADMIRE Collaboration on experimenting malleability tools in multigrid sparse solvers at extreme scales for efficient dealing of coarse-level grids.

5 Conclusions

Collaboration activities were investigated and implemented, providing valuable results. From the technical perspective, collaboration with other projects, mostly EU-funded, allowed knowledge sharing and technology integration. On the dissemination side, collaboration with industry and participation in EuroHPC and CoE initiatives allow TEXTAROSSA and its results to be disseminated to a wide audience with adequate follow-up. The main weakness was the absence of participation in standardization bodies mainly because we could not identify a promising target for this activity. However, we balanced this with active collaboration and effective dissemination of the project results paving the way toward TEXTAROSSA results adoption and follow-up.

Concerning this, it is worth mentioning two main industrial follow-ups of the project: the first commercial GPU-based system with evaporative (two-phase) cooling installed at the University of Turin and the new funded Horizon Europe EIC Pathfinder project DYNAM (DYnamically MANaged self-cooling HPC Data Centers). UNITO is involved in this project with the aim of making concrete innovations in data centre cooling for HPC and AI.