

D7.4

Report on dissemination, innovation management and exploitation as well as standardisation

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Executive Summary

This document provides a report of the dissemination of the activities carried out by the MAESTRO project from September 2018 (M1) to November 2021 (M39).

This report includes a complete list of tasks related to the corporate image of the project as well as to its communication channels (website and social media). This document reports also on the dissemination material and any press coverage, events, and publications of MAESTRO. This dissemination report is necessary for evaluating the actions carried out by the consortium.

During the first 39 months of the project, the consortium participated in a total of 38 conferences or other events. 10 conference contributions/publications, 14 outreach and communication activities, 56 news items on the website, 83 posts on social media and 6 workshops and outreach events. In order to build a community around the project, the dissemination team posted regular updates of all the activities described above on MAESTRO's website and social media channels. MAESTRO also collaborated with other European projects in terms of visibility.

Project activities	Amount
Number of conferences or events attended with presentations of project members	38
Number of conference contributions/publications	10
Number of outreach and communication activities (press releases, interviews, popular science articles etc.)	14
Number of new news items and articles on the public website about project achievements	56
Number of posts through social media channels	83
Number of workshops/outreach events	6

Table 1. Amount of MAESTRO dissemination activities

Regarding innovation and exploitation, each partner has benefited from a significant number of exploitable outcomes, both internally and externally. Individual partner exploitation details are provided along with corresponding Intellectual Property Rights remarks, when applicable.

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1. Introduction

This report documents the dissemination efforts of the MAESTRO Project (hereafter called 'the Project') as well as the dissemination plan extending beyond the Project. The original plan for this work had been defined in deliverable D7.2 "Dissemination Plan".

The activities were carried out to make the project work visible and create a community around it, as well as to build its own identity.

2. Dissemination objectives and target audiences

The aim of WP7 on the dissemination side is to ensure the visibility of the MAESTRO project to a broad variety of stakeholders and target audiences and, on the exploitation side, to identify exploitable results. The specific objectives of the dissemination and exploitation are the following:

- Dissemination of the achievements of the MAESTRO project to major HPC stakeholders, to the European HPC technological ecosystem and the general public.
- Promote and showcase the innovations to potential interested parties.
- Record the innovation and related IP produced by MAESTRO and facilitate its exploitation.
- Initiate a process towards standardisation of the results of the MAESTRO project.

The activities and outputs have been oriented to engage with the following target audiences beyond the Project's consortium:

- Scientific community, people with similar research or technical interests to the MAESTRO project;
- MAESTRO developers, technical people also contributing code to the open-source project;
- MAESTRO users, people using but not contributing to the development of MAESTRO (e.g. systems software developers);
- Wider HPC community, people working at other HPC centres and vendors that are potential users of MAESTRO;
- Non-traditional users, people not working in traditional HPC field and that are using cloud services, data analytics, and machine learning;
- General public, which includes a wider audience with a non-scientific background such as media related to technology and R&D, and influencers of other's opinions through social media and blogs.

In order to achieve the objectives above, a number of target audiences and stakeholders were identified in the dissemination and exploitation plan (see D7.2). The key messages, dissemination channels and activities, as well as the target audience are identified in the table below:

Target audience	Key messages	Description	Dissemination channel and activities
Scientific community	MAESTRO's technology	Those with similar research or technical interests	Peer-reviewed scientific papers Project workshops, conferences MAESTRO website

		to the MAESTRO projects	Whitepapers Infographics and flyers
Wider HPC community	MAESTRO's technology and benefits	Other HPC centres, other vendors, potential users of MAESTRO	ETP4HPC Board High-level HPC conferences MAESTRO website Link with related H2020 activities Participation in advisory boards supporting best practices and standards Large or interdisciplinary conferences Infographics and flyers. Social Media
Non-traditional users	MAESTRO's technology and benefits	Scientists using cloud services, data analysts, machine learning experts	MAESTRO website Inter-disciplinary publication Presence at Machine Learning (ML) conferences Presence at Analytics conferences Presentation at broad technology events Infographics and flyers. Social Media
General public	MAESTRO impact for society and industry	A wider audience with a non-scientific background	MAESTRO website and blog Promotional videos Media articles Social media

Table 2. Target audiences table

3. Corporate image

A consistent graphic identity facilitates recognition of the Project by stakeholders and improves the effectiveness of communication. The identity/brand guidelines specify the requirements for the Project's image where all the visual aspects are consolidated to ensure coherence and consistency for partners and third parties.

In the deliverable **D7.2 Dissemination Plan**, the brand guidelines were detailed, including the colour palette, types of logos, typography and the project templates. That deliverable is up to date as no updates were required during the execution of the Project.

4. Dissemination channels

A variety of communication channels and tools have been used to ensure reaching a broad variety of stakeholders and target audiences. The website provides the primary information source for the Project, as well as social media where the project announces all activities, blog articles, events attended etc.

The following sections describe in detail the selected channels and tools.

4.1 Website (<https://maestro-data.eu/>)

The MAESTRO website was launched at the beginning of the project and updated with new news, events information, publications, new pages etc. The software platform uses the Wordpress CMS framework.

	Sessions	Users	Page views	Average session duration
AT M18	1,717	1,279	3,879	01' 21"
AT M36	3,281	2,505	7,470	01' 18"
AT M39 (project extension)	3,770	2,914	8,181	01' 15"

Table 3. Main indicators of the MAESTRO website, M1-M39

Table 3 above shows the main indicators of the MAESTRO website. The total number of sessions during the period M1-M39 is 3,770. The total number of users during the same period is 2,914 and the total number of page views is 8,181.

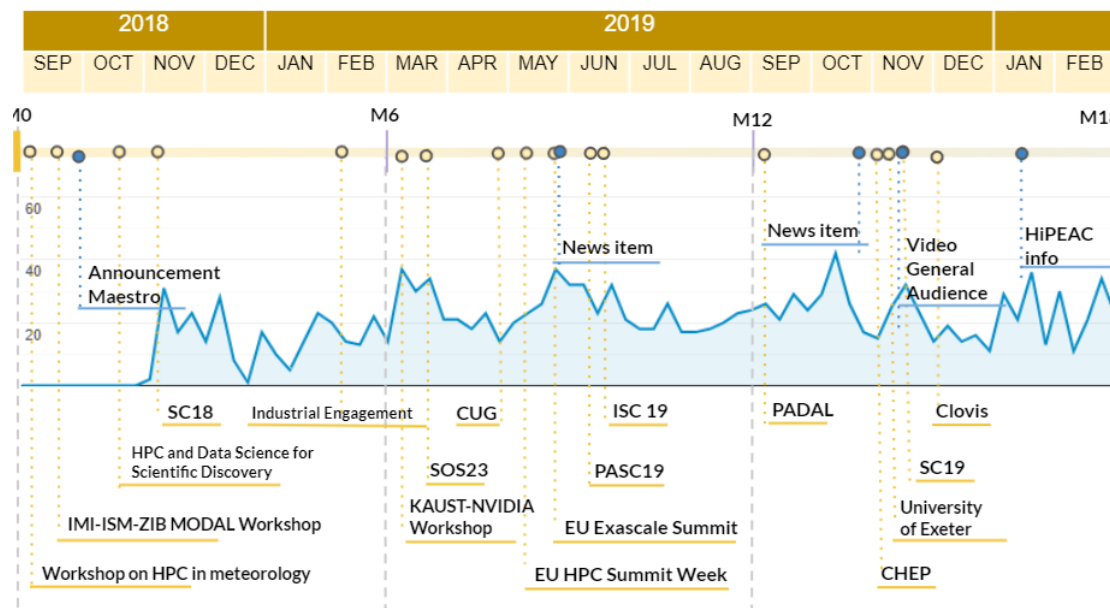


Figure 1. Weekly sessions on the MAESTRO website along with dissemination activities, M1-M18

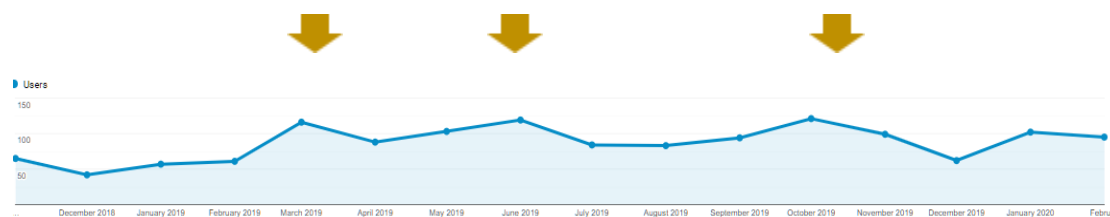


Figure 2. Monthly sessions on the MAESTRO website, M1-M18

As demonstrated in Figure 1, the graph helps to see the evolution of the page in the period M1-M18 along with some of the different dissemination activities. In Figure 2, the peaks in the number of sessions that coincide with these activities from M1 to M18 are shown in a simplified way.

A high number of sessions is observed in March 2019 due to the SOS 23 Workshop and the post on social media about the F2F meeting of the consortium held in Reading (UK). Another peak was seen in May 2019 to June 2019 because of ISC 2019, CUG 2019, European HPC Summit Week and the European Exascale Summit. A peak was seen in October 2019 to November 2019 because of CHEP, and SC 2019. Other users came through press links.

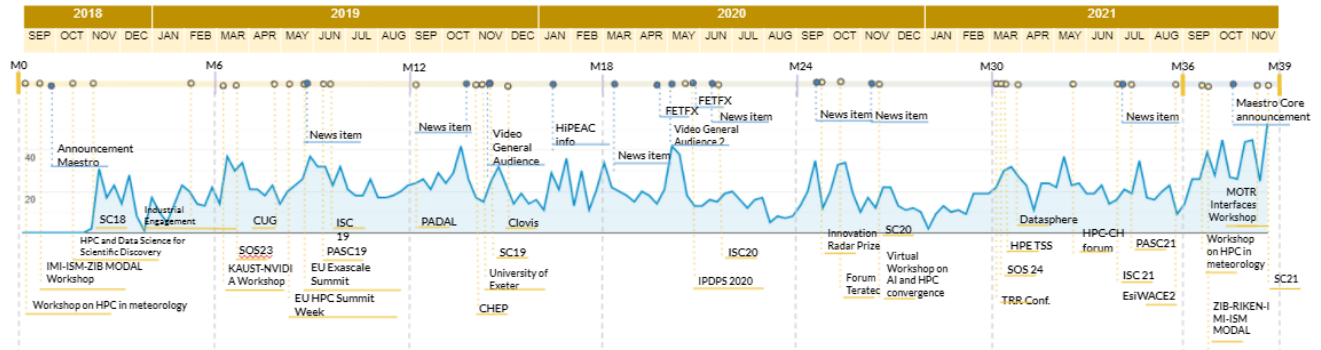


Figure 3. Weekly sessions on the MAESTRO website along with dissemination activities, M19-M39

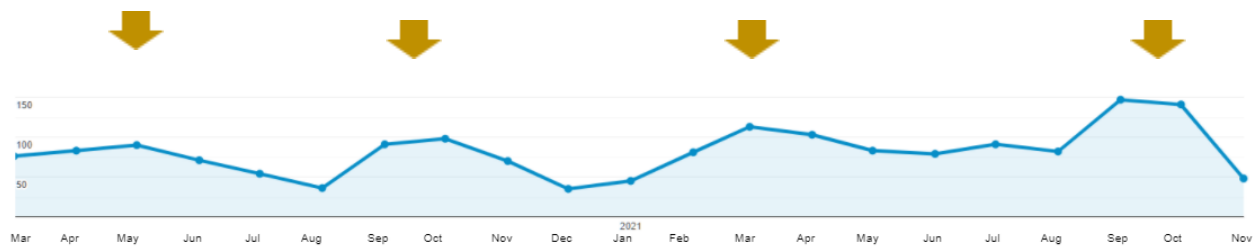


Figure 4. Monthly sessions on the MAESTRO website, M19-M39

In Figure 3 and 4, the graphs show the evolution of the page in the period M19-M39, this period includes the last three months of extension of the project.

A high number of sessions is observed in April and May 2020 due to a piece of news that FETFX published about MAESTRO on their website with the title: "Maestro Large Scale Data Management For Better Weather Prediction". Moreover, the project created a video for the general audience entitled "MAESTRO: the next-generation solution to the data movement challenge in HPC centers", published on the MAESTRO website and social media channels; it was also published by FETFX through all its dissemination channels (website, social media, newsletter).

The **second peak** during September and October 2020 is probably due to new news published on the project web and social media channels. The **third peak** is due to the activities carried out during different events concentrated in those two months, March and April 2021.

The **fourth peak** is the highest in the entire history of the project, which coincides with the last three months, September, October and November 2021, where the official launch of Maestro Core was announced via different channels (website, social media and press releases). Furthermore, project members attended the events shown in figure 3.

The most visited pages of the MAESTRO website are shown below. The homepage is the most visited followed by the information page about the project, and then by publications and the partners pages.

- Home (<https://www.maestro-data.eu/>)
- The project (<https://www.maestro-data.eu/project/>)
- Publications (<https://www.maestro-data.eu/category/publications/>)
- Partners (<https://www.maestro-data.eu/project/partners/>)
- News (<https://www.maestro-data.eu/category/news/>)
- Applications and Workflows (now switched to Co-design applications) (<https://www.maestro-data.eu/project/codesign-applications/>)
- Events directory (<https://www.maestro-data.eu/event-directory/>)
- Downloads (now switched to "Software") (<https://www.maestro-data.eu/software/>)
- Contact (<https://www.maestro-data.eu/contact/>)
- Deliverables (<https://www.maestro-data.eu/project/deliverables/>)

1.	/		3,558 (41.95%)
2.	/project/		1,406 (16.58%)
3.	/category/publications/		516 (6.08%)
4.	/project/partners/		317 (3.74%)
5.	/category/news/		236 (2.78%)
6.	/project/applications-and-workflows/		223 (2.63%)
7.	/event-directory/		221 (2.61%)
8.	/downloads/		213 (2.51%)
9.	/contact/		209 (2.46%)
10.	/project/deliverables/		196 (2.31%)

Figure 5. Most visited pages of the MAESTRO website, M1-M39

As shown below, 91,3% of visits come from new visitors and 8,7% from returning visitors.



Figure 6. New visitors vs. returning visitors on the MAESTRO website, M1-M39

As shown in Figure 9, the top channel from which visits come to the web is organic search (47.6%) (that is any traffic that comes from search engines and is earned, not paid) while the direct channel is 30.6% (visits that result from typing the URL directly in a browser).

18.1% of visits come from links on other web pages, which are called 'referrals'. The top 10 websites that provide the most visits to our website are Juelich Supercomputing Center, EXDCI, Baidu, HPE, academicpositions.com, CSCS, European Processor Initiative, Appentra, and Cray.

3,7% come from social media channels, specifically in this order: Twitter (63.64%), LinkedIn (17.36%), Facebook (10.74%) and ResearchGate (8.26%).

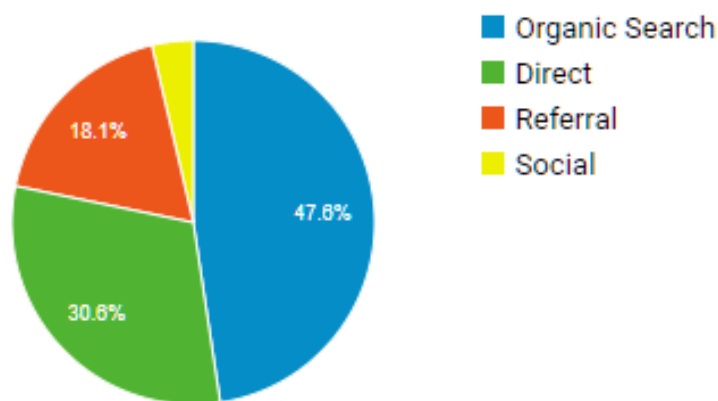


Figure 7. Traffic source channels for the MAESTRO website, M1-M18

Google Analytics provides the interests of the audience through the activity they manifest online. Below are the interests within the market segment of the users who visit the website, from highest to lowest:

5.61%		Software/Business & Productivity Software
4.57%		Business Services/Business Technology/Enterprise Software
3.80%		Employment
3.50%		Financial Services/Investment Services
3.37%		Business Services
2.89%		Business Services/Business Technology/Network Systems & Services/Hosted Data & Cloud Storage
2.76%		Education/Post-Secondary Education
2.63%		Employment/Career Consulting Services
2.60%		Business Services/Advertising & Marketing Services
2.60%		Computers & Peripherals/Computer Accessories & Components

Figure 8. Audience interests in the MAESTRO website, M1-M39

In the figure below shows the ranking of the countries with the most visits on the MAESTRO website:

1.	 United States	721 (22.23%)
2.	 United Kingdom	284 (8.76%)
3.	 Germany	237 (7.31%)
4.	 France	237 (7.31%)
5.	 Spain	151 (4.66%)
6.	 India	144 (4.44%)
7.	 China	128 (3.95%)
8.	 Switzerland	107 (3.30%)
9.	 Italy	65 (2.00%)
10.	 Australia	53 (1.63%)

Figure 9. Countries with the most visits to the MAESTRO website, M1-M39

4.2 Social media

Social media have been used by the Project to contribute to establishing and maintaining public engagement with the project. Social media are used to promote relevant news, impact, activities and outputs of the project, including pictures from meetings or workshops, retweets from related Twitter accounts of partners and projects. The deliverable D7.1 “Project Website” specifies the social media used throughout the Project, namely Twitter and LinkedIn.

Below is the summary of the analytics for the number of publications, followers, likes and shares of Twitter and LinkedIn:

	N° of posts	Followers	Likes	Shares
Twitter	45	119	212	145
Linkedin	38	33	195	26
Total	83	150	484	171

Table 4. Social media analytics AT M39

4.2.1 Twitter

MAESTRO opened its Twitter account (<https://twitter.com/maestrodata>) in October 2018, in which it has achieved, up to M39, 119 followers. The profiles of these followers range from other European projects, engineers, computer centers, to a more general audience. MAESTRO’s two most popular tweets are shown below.

One was about a team picture at the F2F meeting in Zurich, in January 2020 (see Figure 8). This has resulted in 12 likes and 6 retweets. This tweet was potentially viewed by almost 2500 people on Twitter.

<https://twitter.com/maestrodata/status/1222815060436844544>



Figure 10. Twitter post in @maestrodata

The second one was about the publication of a video for the general audience, explaining MAESTRO in a simple manner, on May 1, 2020 (see Figure 9). This has resulted in 13 likes, 7 retweets and 2 quote retweets by CSCS Lugano and FETFX. The video was viewed by 750 people and the tweet was potentially viewed by almost 8,572 people on Twitter.

<https://twitter.com/maestrodata/status/1256191527988183042>



Figure 11. Twitter post in @maestrodata

4.2.1 LinkedIn

MAESTRO opened its LinkedIn account (www.linkedin.com/company/maestrodata/) in October 2018, used to disseminate MAESTRO news and updates to a professional and industrial network.

At M39 it has 33 followers, although the news published is quite well received, such as this post (Figure 10) with 14 likes, 3 shares and a 13.74% of engagement rate, about the shared booth with other European Exascale Projects and Infrastructure at SC19.



Figure 12. MAESTRO LinkedIn post.

4.3 Dissemination pack

4.3.1 Brochure

The general double-sided brochure (see Figure 10) was created for the Project to communicate the project's objectives to the intended audience at events, workshops, conferences and other outreach opportunities. In addition, another single-sided brochure was created for digital formats, with content on MAESTRO technology, to be shown at events with more specialized audiences. The format of both brochures is an A5 sheet. It is available to download on the MAESTRO branding page.



Maestro will build a data-aware and memory-aware middleware framework that addresses ubiquitous problems of data movement in complex memory hierarchies and at many levels of the HPC software stack.

Though HPC and HPDA applications pose a broad variety of efficiency challenges, it would be fair to say that the performance of both has become dominated by data movement through the memory and storage systems, as opposed to floating point computational capability. Despite this shift, current software technologies remain severely limited in their ability to optimise data movement. The Maestro project addresses what it sees as the two major impediments of modern HPC software:

- Moving data through memory was not always the bottleneck. The software stack that HPC relies upon was built through decades of a different situation – when the cost of performing floating point operations (FLOPs) was paramount. Several decades of technical evolution built a software stack and programming models highly fit for optimising floating point operations but lacking

in basic data handling functionality. We characterise the set of technical issues at missing data-awareness.

- Software rightfully insulates users from hardware details, especially as we move higher up the software stack. But HPC applications, programming environments and systems software cannot make key data movement decisions without some understanding of the hardware, especially the increasingly complex memory hierarchy. With the exception of runtimes, which treat memory in a domain-specific manner, software typically must make hardware-neutral decisions which can often leave performance on the table. We characterise this issue as missing memory-awareness.

Maestro proposes a middleware framework that enables memory- and data-awareness.

DATA ORCHESTRATION IN HIGH PERFORMANCE COMPUTING. This project has received funding from the European Union's Horizon 2020 research and innovation program through grant agreement 801101.

FORSCHUNGSZENTRUM JÜLICH GMBH (JÜELICH)

CRAY COMPUTER GMBH (CRAY)

APPENTRA SOLUTIONS S.L. (APPENTRA)

EUROPEAN CENTRE FOR MEDIUM-RANGE WEATHER FORECASTS (ECMWF)

EIDGENÖSSISCHE TECHNISCHE HOCHSCHULE ZÜRICH (ETH ZÜRICH)

SWISS NATIONAL SUPERCOMPUTING CENTRE (CSCS)

CEA

SEAGATE SYSTEMS UK LIMITED (SEAGATE)

DATA ORCHESTRATION IN HIGH PERFORMANCE COMPUTING. This project has received funding from the European Union's Horizon 2020 research and innovation program through grant agreement 801101.

MAESTRO DATA ORCHESTRATION

www.maestro-data.eu



Middleware for Memory and Data-Awareness in Workflows

Run time
3-year project, started in September 2018

Current status
Description of the requirements of partner's applications and workflows in order to design the first specification of the Maestro middleware API

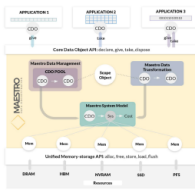
Next steps
Finalize the specifications of the Maestro middleware architecture and design the demonstrators for the ECMWF and SIRIUS use cases

Partners
Jülich, Appentra, ETH Zürich, CSCS, ECMWF, Seagate, Cray

Motivation
• HPC and HPDA workloads are more and more I/O-intensive
• Performance bottlenecks are usually in the memory and storage systems
• Reducing and minimising data movement is very hard in general
• The HPC software stack was designed in a different era, to solve a different problem
• Few abstractions exist that capture data semantics of applications, so reasoning about data movement and memory in software is impossible
• Few useful models of memory systems and data movement exist, so estimation of cost of data movement is hard
• The memory storage hierarchy is becoming more heterogeneous and complex, so a unified API and automatic promotion are needed

Maestro consortium is building a middleware library that characterises application data, reasons about how to load and store that data, assesses the cost of moving it and automates data movement across diverse memory systems

Approach and Methodology
• Co-design: ascertain data movement and access requirements of target applications
• Develop new data-aware abstractions
• Design a middleware and library that enables:
• Modelling of memory hierarchy
• Reasoning based on cost of moving data objects
• Automatic movement and promotion of data in memory
• Powerful data transformations and optimisation
• Explore data-based performance portability of Maestro applications



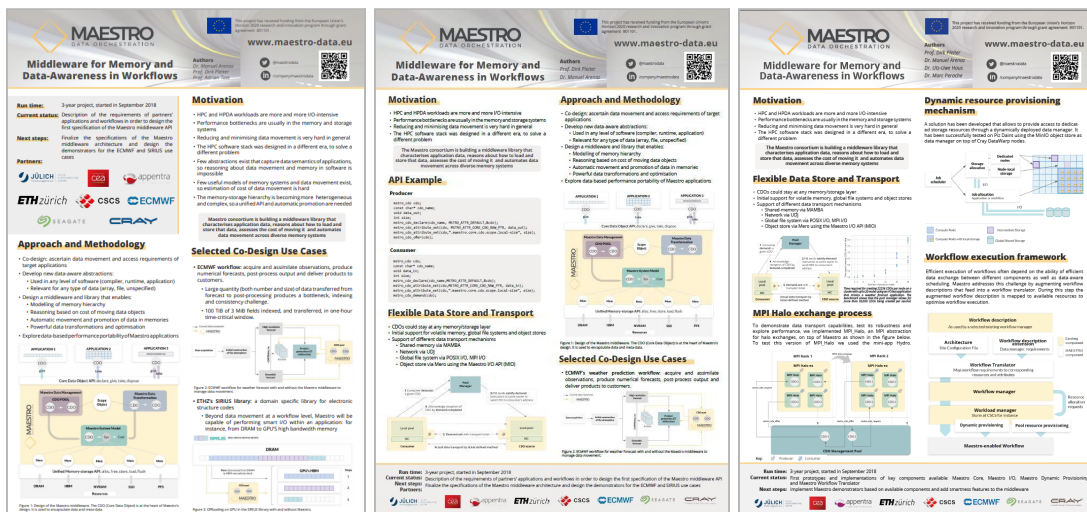
MAESTRO DATA ORCHESTRATION

www.maestro-data.eu

Figure 13. General double-sided brochure and technical single-sided brochure.

4.3.2 Poster

MAESTRO has attended and participated (some under the committee's acceptance) in different events where the project poster has been shown (ISC19 Project Poster, SC19 EXDCI2 / PRACE booth, ISC20 Project Poster, ISC21 Project Poster, PASC21 Project Poster). It describes MAESTRO's approach and methodology, results and roadmap. The poster has evolved over time, below are three (3) of the versions (click to see each one):



The figure displays three versions of the MAESTRO Project poster, arranged horizontally. Each poster is titled 'MAESTRO DATA ORCHESTRATION' and 'Middleware for Memory and Data-Awareness in Workflows'. The posters show the evolution of the project's content, including sections on Motivation, Approach and Methodology, API Example, Flexible Data Store and Transport, and Workflow execution framework. The final version on the right includes additional sections like 'Dynamic resource provisioning mechanism' and 'MPI Halo exchange process'.

Figure 14. MAESTRO Project poster initial, mid-term and final version.

4.3.3 Videos

The videos allow to explain concepts in a more simplified way and also tend to have more interest among the general audience than other types of materials. During the project, two (2) videos have been made aimed at the general audience, where it is explained what MAESTRO is and in which areas of society it can impact; these videos were published in a blog post on the MAESTRO website and published on social media. We also have three (3) technical videos shown in events about how MAESTRO works.

Videos for general audience:

The following video explains what MAESTRO is and shows how it can impact the daily lives of citizens through an example of how it can improve numerical weather forecasting.

Video link:

<https://www.maestro-data.eu/wp-content/uploads/2019/11/General-audience-video.mp4>



Figure 15. Video for general audience "What is Maestro about?"

The second video is titled 'MAESTRO: the next-generation solution to the data movement challenge in HPC centers' where it is explained through a trending example, the challenge of finding a faster mechanism to share a massive amount of information when running videoconferences during the COVID-19 pandemic.

Video link:

<https://www.maestro-data.eu/wp-content/uploads/2020/04/General-audience-2-datamovement-challenge.mp4>

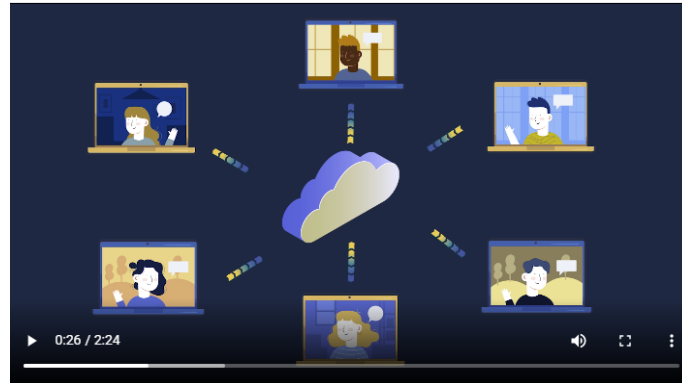


Figure 16. Video for general audience “MAESTRO: the next-generation solution to the data movement challenge in HPC centers”

Technical videos shown at events:

Some examples of technical videos that were shown at different HPC events are as follows:

Motivation

"A supercomputer is a device for turning compute-bound problems into I/O bound problems"

Ken Batchner

- HPC and HPDA workloads are more and more I/O-intensive
- Performance bottlenecks are usually in the memory and storage systems
- Reducing and minimising data movement is very hard in general
- The HPC software stack was designed in a different era, to solve a different problem

The Maestro consortium is building a middleware library that characterises application data, reasons about how to load and store that data, assesses the cost of moving it and automates data movement across diverse memory systems.

101101100101



0:51 / 4:47

DATA AWARENESS

MEMORY AWARENESS

MAESTRO

Figure 17. Video for ISC20 Project Poster Session
Video link: <https://www.youtube.com/watch?v=Irq0dmeSZKw&t>

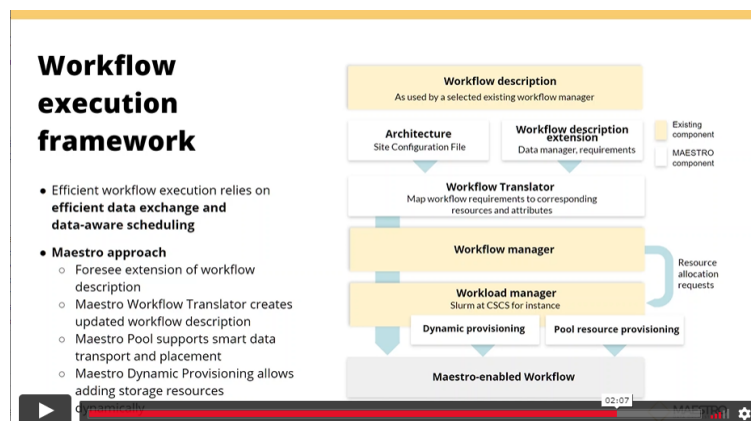


Figure 18. Video for ISC21 Project Poster and PASC21 Project Poster Sessions

Video link: <https://player.vimeo.com/video/560347487>



Figure 19. Video recorded at the 19th Workshop on HPC in Meteorology.

Video link: <https://vimeo.com/610643511>

4.4 Press

In October 2018, the first MAESTRO press release was launched. It was titled “MAESTRO Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows”¹. The press release was distributed to technical media (HPCWire, Top500 etc.) to announce MAESTRO’s objective of addressing the ubiquitous problems of data movement in data-intensive applications and workflows. Four press clippings were released. Some partners also published it on their websites such as Jülich Supercomputing Center, Appentra and CSCS.

Other interesting press mentions come from HiPEAC magazine which published the articles titled “Solving data movement, the MAESTRO project”² or “MAESTRO Core C library launched”³. FETFX have also published two news items for general audience “MAESTRO Large Scale Data Management For Better Weather Prediction”⁴ and “MAESTRO: The Next-generation Solution To The Data Movement Challenge In Hpc Centers”⁵.

In total MAESTRO has had 14 press mentions from M1-M39. The press mentions can be found in the Press Coverage (<https://www.maestro-data.eu/press/>) page of the website and is listed in the table below.

¹ <https://www.maestro-data.eu/maestro-consortium-addresses-ubiquitous-problems-data-movement-data-intensive-applications-workflows/>

² <https://issuu.com/hipec/docs/hipecinfo59/30>

³ <https://www.hipeac.net/news/6971/hipeac-blog-maestro-core-c-library-launched/>

⁴ <http://www.fetfx.eu/news/maestro-large-scale-data-management-better-weather-prediction/>

⁵ <http://www.fetfx.eu/news/maestro-next-generation-solution-data-movement-challenge-hpc-centers/>

Media	Link	Date
HPC wire	MAESTRO Consortium to Address Data Movement in Data-Intensive Applications and Workflows https://www.hpcwire.com/off-the-wire/maestro-consortium-to-address-data-movement-in-data-intensive-applications-and-workflows/	October 25, 2018
Jülich Supercomputing Center News	JSC Coordinates Maestro Project https://www.fz-juelich.de/SharedDocs/Meldungen/IAS/JSC/EN/2018/2018-10-maestro.html?nn=2276004	October 24, 2018
Top500	European Consortium Tackles Data Movement Problem in HPC https://www.top500.org/news/european-consortium-tackles-data-movement-problem-in-hpc/	October 28, 2018
Primeur Magazine	MAESTRO Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows http://primeurmagazine.com/weekly/AE-PR-11-18-125.html	October 25, 2018
Exascale Newsletter issue 02 / 2018 by Jülich	Data Awareness https://www.fz-juelich.de/SharedDocs/Downloads/PORTAL/EN/publications/exascale-newsletter/exascale_nl_02_2018.pdf?__blob=publicationFile	October, 2018
CIO Spain	Abordando los problemas del trabajo con HPC https://www.ciospain.es/industria-y-utilities/abordando-los-problemas-del-trabajo-con-hpc	October 29, 2018
Appentra Blog	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows https://www.appentra.com/maestro-consortium-problems-data-movement-data-intensive-applications-workflows/	October 30, 2018
CSCS News	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows https://www.cscs.ch/publications/news/2018/maestro-consortium-addresses-the-ubiquitous-problems-of-data-movement-in-data-intensive-applications-and-workflows/	October 31, 2018
HiPEACinfo Magazine 59	Solving data movement, the MAESTRO project. https://issuu.com/hipeac/docs/hipeacinfo59/30	January 2020

FETFX	MAESTRO Large Scale Data Management For Better Weather Prediction http://www.fetfx.eu/news/maestro-large-scale-data-management-better-weather-prediction/	April 2020
FETFX	MAESTRO: The Next-generation Solution To The Data Movement Challenge In Hpc Centers http://www.fetfx.eu/news/maestro-next-generation-solution-data-movement-challenge-hpc-centers/	May 2020
EsHorizonte2020	La empresa española Appentra reconocida como innovación de vanguardia en el 'Innovation Radar' de la Comisión Europea https://eshorizonte2020.es/ciencia-excelente/tecnologias-futuras-y-emergentes-fet/noticias/la-empresa-espanola-appentra-reconocida-como-innovacion-de-vanguardia-en-el-innovation-radar-de-la-comision-europea	October 2020
HiPEAC Blog	MAESTRO Core C library launched https://www.hipeac.net/news/6971/hipeac-blog-maestro-core-c-library-launched/	November 2021
HiPEACinfo Magazine 65	Upcoming in January issue about Maestro Core Software	January 2022

Table 5. MAESTRO press mentions, M1-M39

4.4.1 News/articles items

In the website, the section of News is dedicated to articles and general news about the MAESTRO project (<https://www.maestro-data.eu/category/news/>). In addition, the website has a page where all the events attended by the partners are published with a little information about them (<https://www.maestro-data.eu/event-directory/>). The objective of this is to drive traffic to the website to increase awareness of the project.

From M1 to M39, there were 10 news items written to appear on the MAESTRO news page and 44 events published.

So far, 2 articles on project use cases have been published, so that a wide audience knows the impact of MAESTRO on society:

- Towards higher resolution and reliability in weather prediction through smart large-scale data management
(<https://www.maestro-data.eu/maestro-the-next-generation-solution-to-the-data-movement-challenge-in-hpc-centers/>)
- MAESTRO: the next-generation solution to the data movement challenge in HPC centers

(<https://www.maestro-data.eu/maestro-the-next-generation-solution-to-the-data-movement-challenge-in-hpc-centers/>)

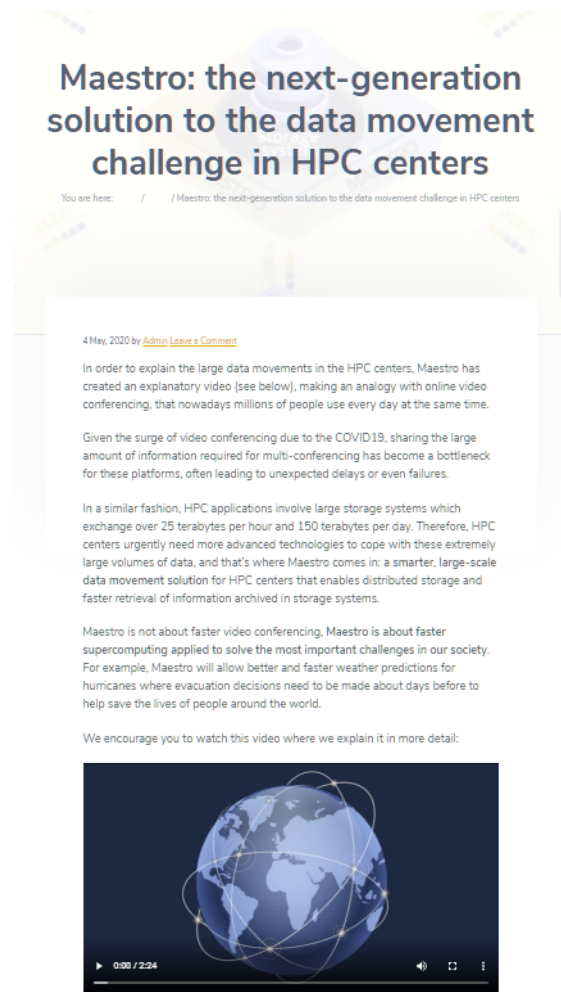


Figure 20. Image of the blog item on the MAESTRO website

4.5 Events

The MAESTRO project has been represented in a series of International events and conferences in the field of High Performance Computing (HPC), computer architecture, supercomputing, etc. These events have been attended by the Project's partners. Event participation had one or more of the following intended impacts:

- Engage with specialist groups of stakeholders;
- Disseminate outputs of the Project;
- Build impact by encouraging uptake of appropriate outputs;
- Engage with scientific and industry leaders in discussions about standards;

- Presentation of peer reviewed papers, scientific proceedings, whitepapers, documentation, demonstrations, workshops with invited presentations, and webinars.

During the period M1-M39, consortium partners participated in **44 events**, including **presentations in conferences (38), workshops, and outreach events (6)**. As shown below in Table 5, within some of the conferences, the project has participated in different activities:

Events	Activites	Date
18th Workshop on high performance computing in meteorology, ECMWF	Presentation : "Towards Enabling Memory- and Data-Aware HPC"	September 24, 2018
3rd IMI-ISM-ZIB MODAL Workshop on Challenges in Real World Data Analytics and High-Performance Optimization	Presentation: Optimization of Data Movement in Complex Workflows.	September 26, 2018
Science at Extreme Scales: Where Big Data Meets Large-Scale Computing Workshop II: HPC and Data Science for Scientific Discovery	Presentation: "Memory- and Data-Centric Abstractions for Management and Optimisation of Data Movement"	October15, 2018
SC18 Booth	PRACE Booth - Presentation: "Leveraging Parallelware in MAESTRO"	November 16, 2018
SC18 BoF	BoF ETP4HPC- Session:"Consolidating the European Exascale Effort",	November 16, 2018
Industrial Engagement Event 2019 - University of Edinburgh's Informatics Forum	Showcased MAESTRO as one of the H2020 research projects implemented by CERL.	February 19, 2019
6th KAUST-NVIDIA Workshop on "Accelerating Scientific Applications using GPUs"	Presentation: "OpenACC, GPU Programing and Parallelware Tools"	March 12, 2019

SOS 23 Workshop	Presentation: "Exascaling and Federation: Using Brain Research as Science Driver"	March 28, 2019
CUG 2019 Paper	Publication: Presentation "Dynamically Provisioning Cray DataWarp Storage"	May 6, 2019
	Presentation: Dynamically Provisioning Cray DataWarp Storage	May 6, 2019
European HPC Summit Week	Presentation: MAESTRO: Towards a Memory- and Data-aware Middleware	May 13, 2019
European Exascale Summit	Outreach event: Talk about the challenges tackled in MAESTRO and how the consortium is dealing with them.	May 29, 2019
European Exascale Summit Presentation	Presentation title: "Memory-centric Programming, Data Abstraction and Workflows"	May 29, 2019
PASC 19	Minisymposium: Abstraction, Orchestration and Modelling of Data Movement in Heterogeneous Memory Systems.	June 14, 2019
	Presentation: Abstractions for Reasoning about Data Object Movement.	
International Workshop on OpenPOWER for HPC (IWOPH'19) (Co-located with ISC19)	Paper :Parallelware tools: An experimental evaluation on POWER systems	June 16, 2019
	Presentation:Parallelware tools: An experimental evaluation on POWER systems	
ISC 19 Project Poster	Project Poster: Middleware for Memory and Data-Awareness in Workflows (MAESTRO)	June 18, 2019
ISC19 Booth	European Exascale Projects and Infrastructure booth	June 17, 2019
5th workshop on Programming Abstractions for Data Locality (PADAL)	Presentation: MAESTRO: Middleware for Memory and Data-Awareness in Workflows	September 9, 2019

24th International Conference on Computing in High-Energy and Nuclear Physics (CHEP)	Presentation: "HPC Systems in the next decade- what to expect, when, where"	November 6, 2019
University of Exeter	Presentation: Abstractions for Reasoning about Data Object Movement	November 12, 2019
SC19 Booth	European Exascale Projects and Infrastructure booth	November 19, 2019
SC19 Booth	EXDCI2 /PRACE booth - Presentation : "MAESTRO: Towards a data- and memory-aware HPC middleware"	November 20, 2019
Clovis workshop	Discussion: MIO for use by Sage2 applications Contribution: The usage of the outcomes of MAESTRO for use in Sage2 project.	December 5, 2019
IPDPS 2020	Workshop: High Performed Storage Presentation: Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers	May 22, 2020
ISC20 Project Poster	Poster: Middleware for Memory and Data-Awareness in Workflows (MAESTRO) Live video presentation: Middleware for Memory and Data-Awareness in Workflows (MAESTRO)	
European Research and Innovation Days "Innovation Radar Prize"	MAESTRO was mentioned at the partner Appentra's presentation, who was winner of the Innovative Science category of the Innovation Radar 2020 Prize at the European Research and Innovation Radar Prize. Innovation title: "Parallelware Technology: analysis tool aiming to reduce the burden of making code parallel."	September 24, 2020
Forum Teratec	MAESTRO participated at the EXDCI2 booth at the exhibitor dedicated space Europa Village.	October 13, 2020
SC20 Booth	MAESTRO at the European Processor Initiative (EPI) booth	November 18, 2020

Virtual Workshop on AI and HPC convergence	Presentation title: "MAESTRO: Orchestrating Data for HPC (and AI) Applications"	November 18, 2020
TRR Conference: Trends in Mathematical Modelling, Simulation and Optimisation: Theory and Applications	Title: 'The brave new world of Exascale computing: Computation is free, Data Movement is not'	March 2, 2021
SOS24 Workshop	Talk Title: Orchestrating Data at System Level and Beyond	March 15, 2021
HPE Technology and Solutions Summit	Webinar title: Challenges and Solutions for Data Abstraction and Movement in Heterogeneous High Performance Computing Systems	March 17, 2021
Datasphere 2021 Panel	Panel Title: Open Source Object Storage for All: Join the Mass-Capacity Storage Revolution	March 30, 2021
HPC-CH forum - Virtualization	Presentation: Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers	May 20, 2021
ISC21 Project Poster	Project poster 'Middleware for memory and data-awareness in workflows (MAESTRO)'	June 24 - July, 2021
Forum Teratec FETHPCs Booth	MAESTRO participated at the HPC-GIG virtual booth at the exhibitor dedicated space Europa Village.	June 22, 2021
ISC21 SuperCompCloud Workshop	Workshop: 'A Middleware Supporting Data Movement in Complex and Software-Defined Storage and Memory Architectures'	July 2, 2021
HP-C/DA Workshop 2021 (ISC21)	Talk title: "Advancing Object storage architectures for Extreme scale"	July 2, 2021
PASC 21 Project Poster	Project Poster: Middleware for Memory and Data-Awareness in Workflows (MAESTRO)	July 6, 2021
PASC 21 Minisymposium	Minisymposium: Data Movement Orchestration on HPC Systems	July 6, 2021

EsiWACE2 V4IO Summer School	Workshop topic: Modern Storage	August 23, 2021
19th Workshop on high performance computing in meteorology	Presentation: "Bridging gaps: The Maestro Data-Aware Middleware"	September 20, 2021
5th ZIB-RIKEN-IMI-ISM MODAL Workshop on Optimization, Data Analysis and HPC in AI	Presentation: "Bridging gaps: The Maestro Data-Aware Middleware"	September 27, 2021
MOTR Interfaces Workshop/ Hackathon	Presentation: "Maestro I/O Interface"	November 5, 2021
PRACE Booth SC21	Presentation: "Middleware for memory and data-awareness in workflows"	November 15, 2021

Table 6. Events in which MAESTRO participated, M1-M39

It is important to point out that MAESTRO has collaborated with other European initiatives on several events. MAESTRO has shared different booths with other European projects, whose organizers were the following:

- European Exascale Projects and Infrastructure - *ISC19 and SC19*
- EXDCI2 - *SC18, SC19 and EuroHPC Summit Week 2019 (co-organized with ETP4HPC)*
- European Processor Initiative (EPI) - *SC20*
- PRACE - *SC19, SC21*
- HPC-GIG - *Forum Teratec*
- SAGE2- *Clovis Workshop*

To see the **detailed information of each event please go to Annex 2**, where you can see multimedia elements, links etc.

4.6 Conference contributions and publications

There were a total of 10 conference contributions and publications . They can all be found on page <https://www.maestro-data.eu/category/publications/>.

Type	Title	Authors	Conference or/and journal
Publication in Conference Proceedings	Dynamically Provisioning Cray DataWarp Storage https://www.maestro-data.eu/dynamically-provisioning-cray-datawarp-storage/	François Tessier, Maxime Martinasso, Matteo Chesi, Mark Klein, Miguel Gila	CUG 2019
Publication in Conference Proceedings	Parallelware Tools: An Experimental Evaluation on POWER Systems https://www.maestro-data.eu/parallelware-tools-an-experimental-evaluation-on-power-systems/	Manuel Arenaz, Xavier Martorell	ISC19
Minisymposium	Abstractions for Reasoning about Data Object Movement https://www.maestro-data.eu/abstractions-for-reasoning-about-data-object-movement/	Christopher Haine, Utz-Uwe Haus, Adrian Tate	PASC 19
Project Poster	Middleware for Memory and Data-Awareness in Workflows (MAESTRO) https://www.maestro-data.eu/middleware-for-memory-and-data-awareness-in-workflows-maestro/	Manuel Arenaz, Dirk Pleiter, Adrian Tate	ISC19
Project Poster	Middleware for Memory and Data-Awareness in Workflows (MAESTRO) https://www.maestro-data.eu/middleware-for-memory-and-data-awareness-in-workflows/	Manuel Arenaz, Dirk Pleiter	ISC20
Publication in Workshop	Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers https://www.maestro-data.eu/dynamic-provisioning-of-storage-resources/	François Tessier, Maxime Martinasso, Matteo Chesi, Mark Klein, Miguel Gila	IEEE Explore IPDPS 20

	urces-a-case-study-with-burst-buffers/		
Project Poster	Middleware for Memory and Data-Awareness in Workflows (MAESTRO) https://www.maestro-data.eu/middleware-for-memory-and-data-awareness-in-workflows-2/	Dirk Pleiter, Manuel Arenaz, Utz-Uwe Haus, Marc Perache	ISC21
Publication in Conference Proceedings	A Middleware Supporting Data Movement in Complex and Software-Defined Storage and Memory Architectures https://www.maestro-data.eu/a-middleware-supporting-data-movement-in-complex-and-software-defined-storage-and-memory-architectures/	Christopher Haine, Utz-Uwe Haus, François Tessier, Domokos Sármany, Maxime Martinasso, Tiago Quintino, Dirk Pleiter, Simon Smart, Adrian Tate	ISC 21 SuperCompCloud Workshop
Minisymposium	Data Movement Orchestration on HPC Systems https://www.maestro-data.eu/data-movement-orchestration-on-hpc-systems/	François Tessier, Christopher Haine, Utz-Uwe Haus	PASC 21
Project poster	Middleware for Memory and Data-Awareness in Workflows (MAESTRO) https://www.maestro-data.eu/middleware-for-memory-and-data-awareness-in-workflows-pasc21/	Dirk Pleiter, Adrian Tate, Utz-Uwe Haus, Manuel Arenaz	PASC21

Table 7. MAESTRO publications and contributions, M1-M39

5. Related organizations and projects

- **HiPEAC** (<https://www.hipeac.net/network/projects/6944/maestro/>)
In January 2020, an article about MAESTRO, titled "Solving data movement: The MAESTRO project" (<https://issuu.com/hipeac/docs/hipeacinfo59/30>), was published in HiPEAC magazine no. 59. In January 2022 will be published the "MAESTRO Core C library launched" in the magazine no. 65.
- **PRACE** (<https://prace-ri.eu/>)
MAESTRO presented "MAESTRO: Towards a data- and memory-aware HPC middleware" (<https://prace-ri.eu/event/prace-sc19/>) and showed the project poster at the co-organized booth by PRACE and EXDCI-2 at the SC19, as well as presenting "Middleware for memory and data-awareness in workflows" at the PRACE booth at SC21.
- **EXDCI-2** (<https://exdci.eu/collaboration/fethpc>)
MAESTRO participated in EuroHPC Summit Week 2019, which was co-organized by EXDCI-2 and ETP4HPC, giving a talk on "Towards a Memory- and Data-aware Middleware" (<https://exdci.eu/events/eurohpc-summit-week-2019>).
- **ETP4HPC** (<https://www.etp4hpc.eu/euexascale.html>)
MAESTRO has featured in the yearly European High-Performance Computing Handbook, distributed by ETP4HPC in:
 - 2018 (https://www.etp4hpc.eu/pujades/files/ETP4HPC_Handbook_2018_web_20181210.pdf)
 - 2019 (https://www.etp4hpc.eu/pujades/files/ETP4HPC_Handbook_2019_web.pdf)
 - 2020 (https://issuu.com/etp4hpc/docs/h0702_etp4hpc_handbook_assemblage_v3.2-m).
- **European Exascale Projects** (<http://www.exascale-projects.eu/>)
MAESTRO has shared the European Exascale Projects booths with other European projects at ISC19 and SC19.
- **European Processor Initiative**
(<https://www.european-processor-initiative.eu/>)
MAESTRO has shared the European Processor Initiative booth with other European projects at SC20.
- **FETFX** (<http://www.fetfx.eu/project/maestro/>)
FETFX has allowed us to publish two case studies of MAESTRO to increase the reach, since they publish it through their website news, social media and newsletter.
- **Sage2** (<https://sagestorage.eu/>)

Used the outcomes of Maestro which is MIO and MAESTRO used the SAGE prototype.

- **EpigramHS** (<https://epigram-hs.eu/>)
Areas of work such as Mamba.

6. Key Performance Indicators

The table below shows MAESTRO's dissemination Key Performance Indicators (KPIs), set in D7.2 Dissemination and exploitation plan. The total target is shown and compared with the current total from M1-M39.

KPI name	Total target (by the end of the project)	Achieved
Number of conferences or events attended with presentations of project members	30	38
Number of conference contributions/publications	17	10
Number of outreach and communication activities (press releases, interviews, popular science articles etc.)	5	14
Number of new news items and articles on the public website about project achievements	18	56
Number of posts through social media channels	36	83
Number of workshops/outreach events	3	6

Table 8. Target and achieved Key Performance Indicators of MAESTRO Dissemination

A brief description about each KPI as well as future plans and actions for each of the items are listed below:

- **Number of conferences or events attended with presentations of project members:**

MAESTRO has attended a total of thirty-eight (38) events and conferences internationally with the aim to help to disseminate the project among the scientific and industrial target audience through the presentations. They can all be found on page <https://www.maestro-data.eu/event-directory/>.

Regarding the KPIs, as shown in the table below, in the period M1-M39, the first two periods have been overachieved, while in M12-M18 there is an event missing to attend. Until month 24, MAESTRO only participated in 2 events out of 5, since due to the COVID-19 pandemic, many of the events were canceled for several months. In the rest of the periods the objectives have been met.

AT M6		AT M12		AT M18		AT M24		AT M30		AT M36		AT M39	TOTAL	
Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Achieved	Target
6	5	8	5	4	5	2	5	4	5	10	5	4	38	30

Table 9. Conferences or events attended KPI report in period M1-M39

- Number of conference contributions/publications

Ten (10) conferences publications and contributions have been reported. They can all be found on page <https://www.maestro-data.eu/category/publications>.

We observe, in particular, underperformance in terms of number of publications. From today's perspective we consider the KPI to be too optimistic as it neither took into account the time for producing first results as well as the time needed for having contributions accepted for high-impact conferences.

The number of canceled events during 2020 has also contributed to a low number of publications.

AT M6		AT M12		AT M18		AT M24		AT M30		AT M36		AT M39	TOTAL	
Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Achieved	Target
0	1	4	3	0	3	2	3	0	3	4	4	0	10	17

Table 10. Conference contributions/publications KPI report in period M1-M39

- Number of outreach and communication activities (press releases, interviews, popular science articles etc.)

Fourteen (14) press clippings were released and some partners also published it on their websites. They can all be found on page <https://www.maestro-data.eu/press/>.

This KPI is successfully achieved in the total period as shown below.

AT M6		AT M12		AT M18		AT M24		AT M30		AT M36		AT M39	TOTAL	
Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Achieved	Target
8	1	0	1	1	0	2	1	1	1	0	2	2	14	5

Table 11. Outreach and communication activities KPI report in period M1-M39

- **Number of new news items and articles on the public website about project achievements**

Fifty-six (56) news items (use cases, announcements, events) are published on the MAESTRO website to increase awareness of the project.

This KPI is successfully achieved in each period as shown below.

AT M6		AT M12		AT M18		AT M24		AT M30		AT M36		AT M39	TOTAL	
Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Achieved	Target
9	3	12	3	11	3	6	3	3	3	10	3	5	56	18

Table 12. Outreach and communication activities KPI report in period M1-M39

- **Number of posts through social media channels**

Eighty-three (83) publications have been published through Twitter and LinkedIn, which are the social media platforms that MAESTRO has chosen to spread news about the project and redirect users to the website.

This KPI is successfully achieved in each period as shown below.

AT M6		AT M12		AT M18		AT M24		AT M30		AT M36		AT M39	TOTAL	
Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Achieved	Target
6	6	16	6	18	6	12	3	13	6	13	6	5	83	36

Table 13. Workshops/outreach events activities KPI report in period M1-M39

- **Number of workshops/outreach events**

MAESTRO has participated in six (6) workshops. This KPI is successfully achieved shown below.

AT M6		AT M12		AT M18		AT M24		AT M30		AT M36		AT M39	TOTAL	
Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Target	Achieved	Achieved	Target
0	0	2	1	2	0	0	1	0	0	2	1	0	6	3

Table 14. Workshops/outreach events activities KPI report in period M1-M39

7. Summary outlook

The total number of dissemination audiences was around **85.700**, detailed in the Annex 1: “Dissemination register”, where all dissemination activities are recorded for M1-M39.

The project partners have promoted MAESTRO through the different channels described above. Due to COVID-19 the half part of actions were realized within a virtual context and therefore the Dissemination and Communication plan had to adapt to the new circumstances. For this reason, once the project is finished, it is planned to carry out other new actions that generate impact. The public launch of Maestro Core software will offer the project better opportunities focused on generating research publications.

The consortium is planning to write on the following topics:

- A less domain specific coupling of scientific applications
- A summary of results from Maestro-enabled application demonstrators
- (Semi)-automatic porting of applications to new middleware libraries
- A new new I/O-server for numerical weather prediction
- A Maestro-enabled model workflow for numerical weather prediction

Furthermore, consortium members plan to leverage the following events for communicating results on MAESTRO:

- International Supercomputing Conference 2022 (ISC 22)
- Platform for Advanced Scientific Computing 2022 (PASC 22)
- SOS 25
- Supercomputing Conference 2022 (SC22)
- IPDPS 2022
- CUG 2022

Other dissemination activities that will be attempted are the organization of tutorials and hands-on sessions.

8. Innovation management and exploitation as well as standardisation

The strategy and implementation for managing innovation and supporting exploitation for the Maestro project was presented in Deliverable 7.3 “Innovation Management and Exploitation Plan”⁶.

In terms of exploitation, the aim of the Project is to create a data-aware and memory-aware middleware framework that addresses ubiquitous problems of data movement in complex memory hierarchies and at many levels of the HPC software stack. Its general availability and widespread usage represents the main exploitation goal of the Project. The three main groups of stakeholders still apply, namely: project partners as well as direct and indirect users of Maestro middleware.

The development of the Project requires a variety of new technologies and techniques which may constitute exploitable items by themselves. According to the devised plan, each partner has provided a complete description of its individual exploitation plan, including:

- General exploitation plan;
- Internal exploitation (strengthening of partner position);
- External exploitation (to the market);
- Expected exploitable results; and
- Intellectual Property Rights remarks

These individual exploitation plans are disclosed in [Annex 3: Individual Exploitation Plans](#). The items therein presented, along with the Maestro framework, the demonstrators and software tools are the outcomes in terms of innovation for the Project.

No changes in the Intellectual Property Rights Management was required. Thus, the original plan presented in D7.3, which is based on the Consortium Agreement that follows the DESCA model version 1.2, still applies.

Regarding standardisation, Maestro has been implementing new concepts with new interfaces from scratch. For making efforts towards establishing data- and memory-aware middleware frameworks sustainable, de facto standards need to be established. While establishing such standards are beyond the scope of the project, the project aimed for targeting communication efforts to initiate a process that could lead to a standardisation. These efforts started much earlier than planned, once the main concepts, the relevant semantics as well as the interfaces had been defined within the work package WP3. The

⁶ Available at https://www.maestro-data.eu/wp-content/uploads/2021/04/MAESTRO_D7.3.pdf

presentations (both talks and posters) at the SC, ISC and SOS conferences and workshops as well as during the EuroHPC Summit weeks included a detailed explanation of the interfaces and proposed programming models combined with an invitation to the community to provide feedback. Starting from project month M19, all events became online events. This made it significantly more difficult to collect feedback and initiate a community building that could lead to a process that would lead to the establishment of a de facto standard.

Annex 1: Dissemination register

The MAESTRO dissemination register, where all dissemination activities are recorded for M1-M39, can be found below:

Partner	Type of Activity	Details	Starting Date	Total Size Audience	Type of audience (Scientific Community, Industry, Civil society, General public, Media)
HiPEAC	Press	MAESTRO Core C library launched [Magazine issue 65]	Jan, 2022		Scientific Community, Industry, General public, Media
PRACE	Social Media	[Twitter] PRACE booth SC21	Nov 18, 2021	9	Scientific Community, Industry
HiPEAC	Website	[Blog] MAESTRO Core C library launched	Nov 2, 2021	19	Scientific Community, Industry
HiPEAC	Social Media	[Twitter] Maestro Core launched	Nov 2, 2021	936	Scientific Community, Industry
HiPEAC	Social Media	[Linkedin] Maestro Core launched	Nov 2, 2021	350	Scientific Community, Industry
HiPEAC	Press	MAESTRO Core C library launched	Nov 2, 2021	N/A	Scientific Community, Industry, General public, Media
Consortium	Conference presentation	PRACE Booth at SC21	November 15, 2021	15	Scientific Community, Industry
Seagate	Conference presentation	MOTR Interfaces Workshop/Hackathon	November 5, 2021	25	Scientific Community, Industry
Consortium	Website	Event information	November 5, 2021	1	Scientific Community
Consortium	Website	Event information	November 5, 2021	1	Scientific Community

Consortium	Social Media	[Linkedin] Maestro Core Software Announcement	October 21, 2021	340	Scientific Community, Industry
Consortium	Social Media	[Linkedin] Workshop on High Performance Computing in Meteorology	September 30, 2021	147	Scientific Community, Industry
HPE	Conference presentation	5th ZIB-RIKEN-IMI-ISM MODAL Workshop on Optimization, Data Analysis and HPC in AI	September 27, 2021	45	Scientific Community, Industry
HPE	Social Media	[Twitter mention] 5th ZIB-RIKEN-IMI-ISM MODAL Workshop on Optimization, Data Analysis and HPC in AI @IreneFerrario	September 28, 2021	4	Scientific Community, Industry
HPE	Conference presentation	19th Workshop on high performance computing in meteorology	September 20, 2021	70	Scientific Community, Industry
Consortium	Social Media	[Twitter] Maestro Core Announcement	Oct 21, 2021	895	Scientific Community, Industry, Media
Consortium	Website	Event information	September 20, 2021	1	Scientific Community
Consortium	Social Media	[Twitter] 19th Workshop on HPC in Meteorology	September 30, 2021	242	Scientific Community, Industry
Consortium	Website	Event information	September 29, 2021	1	Scientific Community
Consortium	Social Media	[Twitter] Handbook 2021 European HPC projects	August 31, 2021	173	Scientific Community, Industry
Seagate	Workshop	EsiWACE2 V4IO summer school	September 20, 2021	20	Scientific Community
Consortium	Social Media	[Linkedin] Handbook 2021 European HPC projects	August 31, 2021	515	Scientific Community, Industry

Consortium	Website	Event information	August 31, 2021	1	Scientific Community
Consortium	Social Media	[Twitter] PASC21 Project poster	July 6, 2021	408	Scientific Community, Industry, General public, Media
François Tessier	Social Media	[Twitter] PASC21	July 6, 2021	6	Scientific Community, Industry
Consortium	Social Media	[Twitter] PASC21 Minisymposium reminder	July 6, 2021	219	Scientific Community
Consortium	Website	[Publication] Middleware for memory and data-awareness in workflows (PASC21)	July 18, 2021	1	Scientific Community, Industry
Consortium	Social Media	[Twitter] PASC 21 Minisymposium announcement	July 7, 2021	3654	Scientific Community
Consortium	Social Media	[LinkedIn] PASC 21 Minisymposium announcement	July 7, 2021	64	Scientific Community
Consortium	Website	[Publication] Middleware for memory and data-awareness in workflows (ISC21)	July 7, 2020	2	Scientific Community, Industry
Consortium	Conference publication/contribution	PASC 21 Project Poster	July 6, 2021	1	Scientific Community, Industry
François Tessier	Social Media	[Twitter mention] PASC21 @F Tessier	July 6, 2021	6	Scientific Community
Consortium	Website	[Publication] Data Movement Orchestration on HPC Systems	July 6, 2020	2	Scientific Community
HPE	Conference publication/contribution	PASC21 Minisymposium	July 6, 2021	50	Scientific Community
Consortium	Website	Event information	July 5, 2021	1	Scientific Community

HPE	Conference publication/contribution	ISC'21 SuperCompCloud Workshop	July 2, 2021		Scientific Community
François Tessier	Social Media	[Twitter mention] ISC21 @F_Tessier	July 2, 2021	6	Scientific Community
Consortium	Website	Event information	July 1, 2021	1	Scientific Community, Industry
HPE	Workshop	ISC'21 SuperCompCloud Workshop	July 2, 2021	15	Scientific Community
Consortium	Website	[News] Maestro at PASC21 Conference	July 2, 2021	16	Scientific Community
Consortium	Social Media	[Twitter] SuperCompCloud workshop schedule	July 7, 2021	54	Scientific Community, Industry
Consortium	Social Media	[LinkedIn] SuperCompCloud workshop schedule	July 7, 2021	32	Scientific Community, Industry
Consortium	Social Media	[Twitter] ISC21 Project Poster live	June 30 2021	773	Scientific Community, Industry
Consortium	Social Media	[LinkedIn] ISC21 Project Poster live	June 30 2021	32	Scientific Community, Industry
Consortium	Website	[Publication] A Middleware Supporting Data Movement in Complex and Software-Defined Storage and Memory Architectures	June 29, 2021	8	Scientific Community, Industry
François Tessier	Social Media	[Twitter mention] SuperCompCloud @F_Tessier	June 18, 2021	5	Scientific Community, Industry
Consortium	Social Media	[Twitter] ISC21 Project Poster schedule	June 22 2021	772	Scientific Community, Industry
Consortium	Social Media	[LinkedIn] ISC21 Project Poster schedule	June 22, 2021	103	Scientific Community, Industry
Consortium	Conference presentation	Forum Teratec FETHPCs	June 22, 2021	20	Scientific Community
Consortium	Conference publication	ISC21 Project Poster	June 24, 2021	6	Scientific Community, Industry

	on/contr ibution				
Consorti um	Website	Event information	June 1, 2021	1	Scientific Community
Consorti um	Website	Event information	June 1, 2021	1	Scientific Community
CSCS	Confere nce presenta tion	HPC-CH forum - Virtualization	June 1, 2021	~60	Scientific Community, Industry
Consorti um	Website	Event information	May 26 2021	0	Scientific Community, Industry
Consorti um	Website	Event information	March 31, 2021	1	Scientific Community, Industry
Consorti um	Website	Event information	March 24, 2021	0	Industry
HPE	Confere nce presenta tion	Datasphere 2021 (Seagate)	March 30, 2021		Scientific Community, Industry
Consorti um	Website	Event information	March 24, 2021	0	Scientific Community, Industry
HPE	Confere nce presenta tion	HPE Technology and Solutions Summit	March 17, 2021	~50	Scientific Community, Industry
Jülich	Confere nce presenta tion	SOS24 WORKSHOP	March 15, 2021	50	Scientific Community, Industry
Consorti um	Website	Event information	March 3, 2021	1	Scientific Community, Industry
Consorti um	Social Media	[Twitter] Video General Audience	March 4 2021	798	General Public
HPE	Confere nce presenta tion	TRR Conference	March 2, 2021	~100	Scientific Community, Industry
Consorti um	Website	Event information	Decemb er 14, 2020	1	Scientific Community

Consortium	Conference presentation	Virtual Workshop on AI and HPC convergence	November 26, 2020	100	Scientific Community, Industry
Consortium	Social Media	[Twitter] SC20 EPI Booth live	November 18 2020	748	Scientific Community, Industry, Civil Society
Consortium	Social Media	[Linkedin] SC20 EPI Booth live	November 18, 2020	337	Scientific Community, Industry, Civil Society
Consortium	Conference presentation	SC20 European Processor Initiative (EPI) booth	November 17, 2020	30	Scientific Community, Industry, Civil Society
Consortium	Website	[News] Maestro at SC20 #MoreThanHPC	November 16, 2020	11	Scientific Community, Industry, Civil Society
Consortium	Social Media	[Twitter] SC20 EPI Booth agenda	November 17 2020	1390	Scientific Community, Industry
Consortium	Social Media	[Linkedin] SC20 EPI Booth agenda	November 17, 2020	94	Scientific Community, Industry
DEEP Projects	Social Media	[Twitter mention] SC20 @DEEPProjects	November 13, 2020	15	Scientific Community
Consortium	Social Media	[Twitter] Handbook 2020	November 4, 2020	1148	Scientific Community, Industry, Civil Society
Consortium	Social Media	[Linkedin] Handbook 2020	November 4, 2020	125	Scientific Community, Industry, Civil Society
Consortium	Social Media	[Twitter] SC20 EPI Booth announcement	November 4, 2020	538	Scientific Community, Industry
Consortium	Social Media	[Linkedin] SC20 EPI Booth announcement	November 4, 2020	102	Scientific Community, Industry
Consortium	Website	Event information	October 27, 2020	5	Scientific Community, Industry
ESHorizonte 2020	Press	La empresa española Appentra reconocida como innovación de vanguardia en el 'Innovation Radar' de la Comisión Europea	October 20, 2021	N/A	Scientific Community, Industry, General public, Media

Consortium	Conference presentation	Forum Teratec	October 13, 2020	10	Scientific Community, Industry
Consortium	Social Media	[Twitter] Forum Teratec announcement	October 13, 2020	908	Scientific Community, Industry
Consortium	Social Media	[LinkedIn] Forum Teratec announcement	October 13, 2020	121	Scientific Community, Industry
Consortium	Website	Event information	October 10, 2020	1	Scientific Community, Industry
Consortium	Website	[News] Maestro's partner Appentra, winner of the 'Innovative Science' category at the Innovation Radar Prize 2020	September 30, 2020	11	Scientific Community, Industry, Civil society, Media
Consortium	Social Media	[LinkedIn] Appentra Innovative Radar Prize 2020	September 24, 2020	1346	Scientific Community, Industry, Civil society, Media
Consortium	Social Media	[Twitter] Appentra Innovative Radar Prize 2020	September 24, 2020	1346	Scientific Community, Industry, Civil society, Media
Appentra	Conference presentation	European Research and Innovation Days "Innovation Radar Prize"	September 24, 2020	172	Scientific Community, Industry, Civil society, Media
Consortium	Website	Event information	Sep 10, 2020	2	Scientific Community, Industry
FETFX	Social Media	[Twitter mention] Newsletter @FETFX	Jul 29, 2020	17	Civil society, general public, Media
Consortium	Website	[Publication] Middleware for memory and data-awareness in workflows (ISC20)	June 24, 2020	12	Scientific Community, Industry
Consortium	Conference presentation	ISC20 Poster Video Presentation	June 23, 2020	6	Scientific Community, Industry
Consortium	Conference publication	ISC20 Project Poster	June 23, 2020		Scientific Community, Industry

	on/contribution				
Consortium	Social Media	[Twitter] ISC20 Project poster agenda	June 23, 2020	1702	Scientific Community, Industry
Consortium	Social Media	[Linkedin] ISC20 Project poster agenda	June 23, 2020	4	Scientific Community, Industry
HPE	Social Media	[Twitter mention] ISC20 @IreneFerrario	June 22, 2020	2	Scientific Community, Industry
Consortium	Website	[News] Maestro at ISC20	June 19, 2020	20	Scientific Community, Industry,
Consortium	Website	[Publication] Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers	June 12, 2020	47	Scientific Community, Industry
Consortium	Social Media	[Linkedin] ISC20 Project poster	June 10, 2020	5	Scientific Community, Industry
Consortium	Social Media	[Twitter] ISC20 Project poster	June 10, 2020	1346	Scientific Community, Industry
FETFX	Social Media	[Twitter mention] FETFX blog @FETFX_EU	May 27, 2020	8	Civil society, general public, Media
Consortium	Social Media	[Linkedin] The next-generation solution to the data movement challenge in HPC centers	May 25, 2020	2	Civil society, General public
Consortium	Social Media	[Twitter] The next-generation solution to the data movement challenge in HPC centers	May 25, 2020	576	Civil society, General public
CSCS	Conference publication/contribution	IPDPS 2020	May 22, 2020		Scientific Community, Industry
CSCS	Conference presentation	IPDPS 2020	May 22, 2020	35	Scientific Community, Industry

Consortium	Website	Event information	May 12, 2020	2	Scientific Community, Industry
Consortium	Social Media	[Twitter] United Against COVID	May 12, 2020	1488	Civil society, General public
Consortium	Website	Event information	May 8, 2020	3	Scientific Community, Industry
Consortium	Website	[News] Maestro: the next-generation solution to the data movement challenge in HPC centers	May 4, 2020	27	Civil society, General public
FETFX	Social Media	[Twitter mention] FETFX blog @FETFX_EU	May 2, 2020	7	Civil society, general public, Media
FETFX	Press	MAESTRO: The Next Generation solution to the Data Movement Challenge in HPC Centers	May 20, 2020		Scientific Community, Industry, General public, Media
Consortium	Social Media	[Twitter] What is the data movement challenge and how does Maestro come into play?	May 1, 2020	8630	Civil society, General public
Consortium	Social Media	[LinkedIn] What is the data movement challenge and how does Maestro come into play?	May 1, 2020	12	Civil society, General public
FETFX	Social Media	[Twitter mention] FETFX blog @FETFX_EU	April 22, 2020	7	Civil society, general public, Media
FETFX	Press	MAESTRO Large Scale Data Management for better Weather Prediction	April 17, 2020		Scientific Community, Industry, General public, Media
Consortium	Social Media	[Twitter] "Maestro Large Scale Data Management for Better Weather Prediction" @FETFX_EU	April 20, 2020	978	Civil society, General public
Consortium	Website	Event information	March 9, 2020	1	Scientific Community, Industry
Consortium	Social Media	[LinkedIn] Towards higher resolution and reliability in weather prediction through smart large-scale data management	March 10, 2020	4	Civil society, General public

Consortium	Social Media	[Twitter] Towards higher resolution and reliability in weather prediction through smart large-scale data management	March 10, 2020	4021	Civil society, General public
Consortium	Website	[News] Towards higher resolution and reliability in weather prediction through smart large-scale data management	March 10, 2020	36	Civil society, General public
Consortium	Website	Event information	Jan 30, 2020	1	Scientific Community, Industry
Consortium	Social Media	[Linkedin] F2F Zurich	Jan 30, 2020	7	Scientific Community, Civil society
Consortium	Social Media	[Twitter] F2F Zurich	Jan 30, 2020	2662	Scientific Community, Civil society
Consortium	Website	Event information	Jan 30, 2020	2	Scientific Community, Industry,
Consortium	Social Media	[Twitter] HIPEAC magazine article on MAESTRO	Jan 21, 2020	1338	Civil society, Scientific Community, Media
Consortium	Social Media	[Linkedin] HIPEAC magazine article on MAESTRO	Jan 21, 2020	4	Civil society, Scientific Community, Media
HiPEAC	Press	Solving data movement: The Maestro project	January 20, 2020	N/A	Civil society, Scientific Community, Media
Consortium	Website	Event information	Jan 14, 2020	1	Scientific Community
Consortium	Website	[Publication] Parallelware tools: An experimental evaluation on POWER systems	Dec 30, 2019	19	Scientific Community, Industry,
Seagate	Workshop	Clovis workshop	Dec 5, 2019	20	Scientific Community
Consortium	Website	Event information	Dec 3, 2019	1	Scientific Community
Mont-Blanc project	Social Media	[Twitter mention] SC20 @Montblanc_Eu	Nov 21, 2019	9	Scientific Community, Civil society

Fenix RI project	Social Media	[Twitter mention] SC19 @Fenix_RI_eu	Nov 21, 2019	8	Scientific Community, Civil society
Consortium	Social Media	[Twitter] European Exascale Project booth SC19	Nov 21 2019	1432	Scientific Community, Civil society
Consortium	Social Media	[Twitter] PRACE presentation at SC19	Nov 21 2019	1800	Scientific Community, Industry
Consortium	Conference presentation	SC19 EXDCI2 /PRACE booth	Nov 21 2019	20	Scientific Community, Industry
Fenix RI project	Social Media	[Twitter mention] SC19 @Fenix_RI_eu	Nov 20, 2019	11	Scientific Community, civil society, Industry
Consortium	Social Media	[Twitter] PRACE presentation at SC19	Nov 20 2019	786	Scientific Community, civil society, Industry
Consortium	Social Media	[Linkedin] PRACE presentation at SC19	Nov 20 2019	5	Scientific Community, civil society, Industry
HIPEAC	Social Media	[Twitter mention] HIPEACinfo59 @hipeac	Nov 20, 2019	8	Scientific Community, civil society, Industry
Mont-Blanc Project	Social Media	[Twitter mention] SC19 @MontBlanc_eu	Nov 19, 2019	7	Scientific Community, civil society, Industry
Consortium	Outreach event	SC19 European Exascale Booth	Nov 19, 2019	N/A	Scientific Community, civil society, Industry
Consortium	Social Media	[Twitter] SC19 european exascale project booth	Nov 19 2019	6834	Scientific Community, civil society, Industry
Consortium	Social Media	[Linkedin] SC19 european exascale project booth	Nov 19 2019	17	Scientific Community, civil society, Industry
Mont-Blanc	Social Media	[Twitter mention] SC19 @MontBlanc_Eu	Nov 17, 2019	18	Scientific Community, civil society, Industry
Consortium	Social Media	[Twitter] SC MAESTRO activities	Nov 12 2019	771	Scientific Community, civil society, Industry
Consortium	Social Media	[Linkedin] SC MAESTRO activities	Nov 12 2019	3	Scientific Community, civil society, Industry

Consortium	Website	[Video] How does MAESTRO project impact the daily lives of citizens ?	Nov 12, 2019	90	Civil society, General public
Cray	Conference presentation	University of Exeter	Nov 12, 2019	45	Scientific Community,
Consortium	Social Media	[Twitter] Video general audience	Nov 12, 2019	1334	Civil society, General public
Consortium	Social Media	[Linkedin] Video general audience	Nov 12, 2019	5	Civil society, General public
ETP4HPC	Social Media	[Twitter mention] SC19 @Etp4HPC	Nov 11, 2019	20	Scientific Community, Industry
Fenix Project	Social Media	[Twitter mention] SC19 @Fenix RI EU	Nov 7, 2019	8	Scientific Community, Industry
Mont-Blanc	Social Media	[Twitter mention] SC19 @MontBlanc_Eu	Nov 7, 2019	12	Scientific Community, Industry
Consortium	Website	Event information	Nov 7, 2019	8	Scientific Community, Industry
Jülich	Conference presentation	24th International Conference on Computing in High-Energy and Nuclear Physics (CHEP)	Nov 6, 2019	400	Scientific Community, Industry
Consortium	Social Media	[Twitter] MAESTRO at SC19	Oct 30, 2019	1030	Scientific Community, Industry, Civil society
Consortium	Social Media	[Linkedin] MAESTRO at SC19	Oct 30, 2019	1	Scientific Community, Industry, Civil society
Consortium	Website	Event information	Oct 30, 2019	2	Scientific Community, Industry, Civil society
Consortium	Website	[News] MAESTRO at SC19	Oct 30, 2019	10	Scientific Community, Industry, Civil society
Consortium	Website	Event information	May 16, 2019	1	Scientific Community, Industry
Consortium	Social Media	[Linkedin] SC European Exascale Project Booth	Oct 18, 2019	6	Scientific Community, Industry, Civil society

Consortium	Social Media	[Twitter] SC European Exascale Project Booth	Oct 18, 2019	4359	Scientific Community, Industry, Civil society
Consortium	Website	Event information	Oct 9, 2019	5	Scientific Community, Industry, Civil society
Mont Blanc Project	Social Media	[Twitter mention] SC19 @FMontBlanc eu	Oct 8, 2019	19	Scientific Community, Industry, Civil society
Fenix Project	Social Media	[Twitter mention] SC19 @Fenix_RI_EU	Oct 7, 2019	12	Scientific Community, Industry, Civil society
CSCS	Conference presentation	5th workshop on Programming Abstractions for Data Locality (PADAL)	Sep 9, 2019	25	Scientific Community, Industry
Cray	Social Media	[Twitter mention] MAESTRO implementation @F_Tessier	Aug 20, 2019	4	Scientific Community, Industry
Fenix Project	Social Media	[Twitter mention] ISC19 @Fenix_RI_EU	Jul 30, 2019	12	Scientific Community, Industry
Consortium	Website	[Publication] Abstractions for Reasoning about Data Object Movement	26 July, 2019	2	Scientific Community, Industry
Consortium	Website	[Publication] Middleware for Memory and Data-Awareness in Workflows (Maestro)	Jun 30, 2019	12	Scientific Community, Industry, civil society
Mont Blanc Project	Social Media	[Twitter mention] ISC19 @MontBlanc eu	Jun 18, 2019	14	Scientific Community, Civil society
Consortium	Outreach event	ISC 19 European Exascale Projects booth	Jun 19, 2019	N/A	Scientific Community, Industry, Civil society
DEEP Project	Social Media	[Twitter mention] ISC19 @MontBlanc eu	Jun 18, 2019	15	Scientific Community, civil society
Mont Blanc Project	Social Media	[Twitter mention] ISC19 @MontBlanc eu	Jun 17, 2019	20	Scientific Community, Industry, Civil society
Appentra	Conference presentation	ISC 19 Workshop IWOPH19	Jun 16, 2019	20	Scientific Community, Industry

Appentria	Conference publication/contribution	ISC 19 IWOPH19 Paper "Parallelware tools: An experimental evaluation on POWER systems "	Jun 16, 2019	20	Scientific Community, Industry
Consortium	Conference contribution	ISC 19 Project Poster	June 3, 2019	5	Scientific Community, Industry, Civil society
Consortium	Social Media	[Twitter] ISC19 Project poster	Jun 18, 2019	2028	Scientific Community, Industry, Civil society
Consortium	Social Media	[LinkedIn] European Exascale Projects booth	Jun 18, 2019	5	Scientific Community, Industry, Civil society
Consortium	Social Media	[Twitter] European Exascale Projects booth	Jun 18, 2019	1587	Scientific Community, Industry, Civil society
Consortium	Website	Event information	Sep 9, 2019	1	Scientific Community, Industry
Consortium	Website	Event information	Jun 14, 2019	2	Scientific Community, Industry, Civil society
Fenix Project	Social Media	[Twitter mention] ISC19 @FENIX RI EU	Jun 14, 2019	11	Scientific Community, Industry, Civil society
Cray	Social Media	[Twitter mention] PASC event @F_Tessier	Jun 14, 2019	6	Scientific Community, Industry
Mont Blanc Project	Social Media	[Twitter mention] ISC19 @MontBlanc EU	Jun 14, 2019	27	Scientific Community, Industry
Cray	Social Media	[Twitter mention] PASC event	Jun 14, 2019	5	Scientific Community, Industry
Cray	Conference presentation	PASC 19	Jun 14, 2019	60	Scientific Community, Industry
Cray	Social Media	[Twitter mention] PASC event	Jun 14, 2019	9	Scientific Community, Industry
Consortium	Website	[News] MAESTRO at ISC19	May 30, 2019	26	Scientific Community, Industry, Civil society

Cray	Conference presentation	European Exascale Summit	May 29, 2019	50	Scientific Community, Industry
Consortium	Social Media	[Twitter] European Exascale Summit	May 29, 2019	20	Scientific Community, Industry
Consortium	Social Media	[Linkedin] European Exascale Summit	May 29, 2019	5	Scientific Community, Industry
Consortium	Website	Event information	May 28, 2019	1	Scientific Community, Industry
Consortium	Social Media	[Twitter] MAESTRO at ISC19	May 28, 2019	2587	Scientific Community, Industry, Civil society
Consortium	Social Media	[Linkedin] MAESTRO at ISC19	May 28, 2019	5	Scientific Community, Industry, Civil society
Consortium	Website	[Publication] Dynamically Provisioning Cray DataWarp Storage	May 28, 2019	26	Scientific Community, Industry
Cray	Social Media	[Twitter mention] Cray projects.	May 28, 2019	6	Scientific Community, Industry
Cray	Social Media	[Twitter mention] Cray projects. @HPE_Cray	May 27, 2019	10	Scientific Community, Industry
Cray	Social Media	Twitter mention] MAESTRO HPC problems @fedepisani	May 22, 2019	13	Scientific Community, Industry
HPE	Social Media	[Twitter] EuroHPC Summit Week 2019	May 16, 2019	2468	Scientific Community, Industry
Consortium	Social Media	[Linkedin] EuroHPC Summit Week 2019	May 16, 2019	3	Scientific Community, Industry
Jülich	Conference presentation	European HPC Summit Week	May 13 2019	50	Scientific Community, Industry
Cray	Social Media	[Twitter mention] Cray research projects @fedepisani	May 13 2019	4	Scientific Community, Industry
CSCS	Conference contributors/publications	CUG 2019	May 6, 2019		Scientific Community, Industry

CSCS	Conference presentation	CUG 2019	May 6, 2019	40	Scientific Community, Industry
CSCS	Social Media	[Twitter mention] CUG event @F_Tessier	May 7, 2019	12	Scientific Community, Industry
Jülich	Conference presentation	SOS 23 Workshop	Mar 28, 2019	150	Scientific Community, Industry
Consortium	Website	Event information	Apr 10, 2019	1	Scientific Community, Industry, civil society
Consortium	Website	Event information	Apr 10, 2019	2	Scientific Community, Industry
Consortium	Website	Event information	April 10, 2019	6	Scientific Community, Industry
Consortium	Website	Event information	Apr 2, 2019	1	Scientific Community, Industry
Consortium	Social Media	[Twitter] Recruiting post for MAESTRO	Mar 13, 2019	1638	Scientific Community
Consortium	Social Media	[LinkedIn] Recruiting post for MAESTRO	Mar 13, 2019	3	Scientific Community
Appentra	Conference presentation	6th KAUST-NVIDIA Workshop on "Accelerating Scientific Applications using GPUs"	Mar 12, 2019	30	Scientific Community, Industry
Consortium	Website	Event information	Mar 12, 2019	1	Scientific Community, Industry
Consortium	Social Media	[Twitter] F2F Reading	Mar 12, 2019	1667	Scientific Community, Media
Consortium	Social Media	[LinkedIn] F2F Reading	Mar 12, 2019	6	Scientific Community, Media
Consortium	Website	Event information	Feb 22, 2019	1	Scientific Community, Media
Cray	Conference presentation	Industrial Engagement Event 2019 - University of Edinburgh's Informatics Forum	Feb 19, 2019	80	Scientific Community

Consortium	Website	Event information	Feb 19, 2019	1	Scientific Community
HIPEAC	Social Media	[Twitter mention] About MAESTRO @hipeac	Feb 4, 2019	6	Scientific Community, Industry
Cray	Social Media	[Twitter mention] About MAESTRO CRAY @fedepisani	Feb 4, 2019	6	Scientific Community, Industry
Consortium	Social Media	[Twitter] 3rd IMI-ISM-ZIB MODAL Workshop	Dec 31, 2018	1516	Scientific Community, Industry
Consortium	Social Media	[Linkedin] 3rd IMI-ISM-ZIB MODAL Workshop	Dec 31, 2018	6	Scientific Community, Industry
Consortium	Social Media	[Twitter] F2F meeting	Dec 12, 2018	1771	Scientific Community, Media
Consortium	Social Media	[Linkedin] F2F meeting	Dec 12, 2018	2	Scientific Community, Media
Consortium	Website	Event information	Dec 12, 2018	1	Scientific Community, Media
Consortium	Website	Event information	Nov 16, 2018	8	Scientific Community, Industry
Consortium	Conference presentation	SC18 BoF ETP4HPC	Nov 16, 2018	50	Scientific Community, Industry
Appentra	Conference presentation	SC18 PRACE Booth Talk	Nov 16, 2018	15	Scientific Community, Industry
Consortium	Website	Event information	Nov 7, 2018	4	Scientific Community, Industry
Consortium	Website	Event information	Nov 7, 2018	9	Scientific Community, Industry
Consortium	Website	Event information	Nov 7, 2018	1	Scientific Community, Industry
Consortium	Website	Event information	Nov 7, 2018	1	Scientific Community, Industry
Consortium	Social Media	[Linkedin] Announcement MAESTRO	Oct 25, 2018	6	Scientific Community, Industry, Media

Consortium	Social Media	[Twitter] Announcement MAESTRO	Oct 25, 2018	7369	Scientific Community, Industry, Media
Appentra	Press	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 30, 2018	6	Scientific Community, Industry, Media
HPCWire	Press	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 25, 2018	N/A	Scientific Community, Industry, Media
CIO Spain	Press	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 25, 2018	N/A	Scientific Community, Industry, Media
Primeur Magazine	Press	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 25, 2018	N/A	Scientific Community, Industry, Media
Top500	Press	European Consortium Tackles Data Movement Problem in HPC	Oct 25, 2018	N/A	Scientific Community, Industry, Media
Consortium	Website	MAESTRO Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 25, 2018	98	Scientific Community, Industry, Media
CSCS	Press	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 25, 2018	N/A	Scientific Community, Industry, Media
Exascale Newsletter	Press	Maestro Consortium addresses the ubiquitous problems of data movement in data-intensive applications and workflows	Oct 25, 2018	N/A	Scientific Community, Industry, Media
Jülich Supercomputing Center	Press	JSC Coordinates Maestro Project	Oct 24, 2018	N/A	Scientific Community, Industry
Cray	Conference presentation	Science at Extreme Scales: Where Big Data Meets Large-Scale Computing Workshop II: HPC and Data Science for Scientific Discovery	Oct 15, 2018	N/A	Scientific Community, Industry

Cray	Conference presentation	3rd IMI-ISM-ZIB MODAL Workshop on Challenges in Real World Data Analytics and High-Performance Optimization	Sep 26, 2018	50	Scientific Community, Industry
Jülich	Conference presentation	18th Workshop on high performance computing in meteorology, ECMWF	Sep 24, 2018	100	Scientific Community, Industry

Annex 2: Events history

Event: 18th Workshop on high performance computing in meteorology, ECMWF

Date: Sep 24 2018

Information: Presentation on "Towards Enabling Memory- and Data-Aware HPC" given by Dirk Pleiter (Julich) , announcing the MAESTRO project.

URL:

<https://events.ecmwf.int/event/87/timetable/?view=standard#32-towards-enabling-memory-and>

Event: 3rd IMI-ISM-ZIB MODAL Workshop on Challenges in Real World Data Analytics and High-Performance Optimization, National Graduate Institute for Policy Studies, Tokyo, Japan

Date: Sep 26 2018

Information: Utz-Uwe HAUS (Cray) gave an invited talk of the publication on the "Optimization of Data Movement in Complex Workflows."

URL: http://imi.kyushu-u.ac.jp/~3rd_imi_ism_zib_ws/#Program

Event: Workshop II: HPC and Data Science for Scientific Discovery, Institute for Pure and Applied Mathematics, University in Los Angeles, California

Date: Oct 15 2018

Information: Workshop II: HPC and Data Science for Scientific Discovery part of "Part of the Long Program Science at Extreme Scales: Where Big Data Meets Large-Scale Computing".

Presentation: Adrian Tate (Cray EMEA Research Lab) gave a talk on Memory- and Data-Centric Abstractions for Management and Optimisation of Data Movement"

URL: <http://www.ipam.ucla.edu/abstract/?tid=15280&pcode=BDCWS2>

Event: SC18 PRACE Booth Talk, Dallas, USA

Date: Nov 16 2018

Information: Presentation by Manuel Arenaz, CEO Appentra solutions on "Leveraging Parallelware in MAESTRO" at the PRACE booth during the Exhibition of the SC18 conference"

Presentation PDF: <http://www.prace-ri.eu/IMG/pdf/2-slides-PRACE-MAESTRO-EPEEC.pdf>

URL: <http://www.prace-ri.eu/pracesc18-presentations/>



Event: SC18 BoF ETP4HPC, Dallas, USA

Date: Nov 16 2018

Information: This session entitled "Consolidating the European Exascale Effort", Europe presented the results of its Exascale programme to date (covering the entire HPC system stack and application expertise), the ambitions of the new round of basic technology, application, co-design, prototype and processor design projects, its post-Exascale plans, collaboration with Big Data, IoT and other areas, and a selection of best-performing HPC technology SMEs, emphasising Europe's global contributions.

URL: https://www.etp4hpc.eu/pujades/files/Flyer_2018-BoF_final.pdf
<https://www.etp4hpc.eu/sc18-bof-dallas.html>

Event: Industrial Engagement Event 2019 - University of Edinburgh's Informatics Forum, Edimburgh, UK

Date: February 19, 2019

Information: Harvey Richardson (Cray) showcased MAESTRO as one of the H2020 research projects implemented by CERL. PhD students and industry leaders attended the event.

URL:

<http://web.inf.ed.ac.uk/infweb/student-services/cdt/pervasive-parallelism/events/events-important-dates/industrial-engagement-event-2019>

Event: 6th KAUST-NVIDIA Workshop on "Accelerating Scientific Applications using GPUs", Saudi Arabia

Date: March 12, 2019

Information: Presentation by Manuel Arenaz (Appentra) on "OpenACC, GPU Programming and Parallelware Tools" at the 6th KAUST-NVIDIA Workshop

URL: <https://www.hpc.kaust.edu.sa/GPU-2019>



Event: SOS 23 Workshop, Asheville, USA

Date: March 28, 2019

Information: Presentation by Dirk Pleiter (Jülich) on “Exascaling and Federation: Using Brain Research as Science Driver” at the SOS 23 Workshop hosted by ORNL.

URL:

<https://sos23.ornl.gov/sessions/exascaling-and-federation-using-brain-research-as-science-driver/>

Event: CUG 2019, Montreal, Canada

Date: May 6, 2019

Information: Presentation of the publication on "Dynamically Provisioning Cray DataWarp Storage" by François Tessier, Maxime Martinasso, Matteo Chesi, Mark Klein, Miguel Gila (CSCS).

Publication: <https://arxiv.org/abs/1911.12162>

Presentation PDF: http://www.francoistessier.info/documents/CUG2019_talk.pdf

URL: <https://cug.org/cug-2019/>

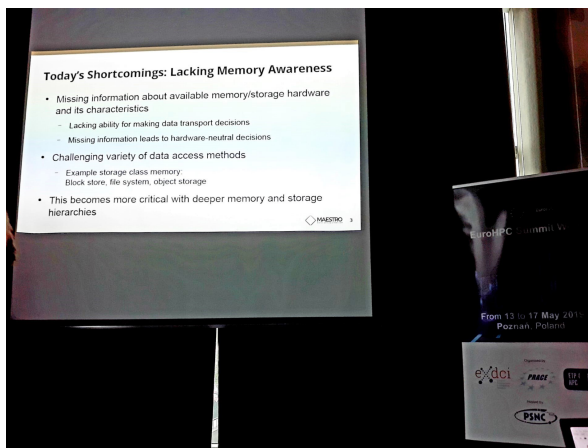


Event: European HPC Summit Week, Poznan, Poland

Date: May 13, 2019

Information: Presentation by Dirk Pleiter (Jülich) "MAESTRO: Towards a Memory- and Data-aware Middleware" at the 1st European Communities Workshop on Exascale Computing - Focus on High Performance Data Analytics

URL: <https://exdci.eu/events/eurohpc-summit-week-2019>



Event: European Exascale Summit, Sorrento, Italy

Date: May 29, 2019

Information: Presentation by Adrian Tate (Cray) on Memory-centric Programming, Data Abstraction and Workflows.



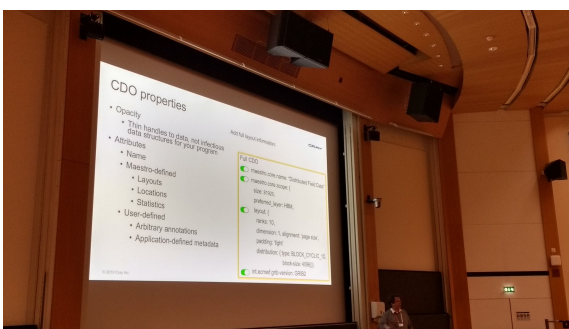
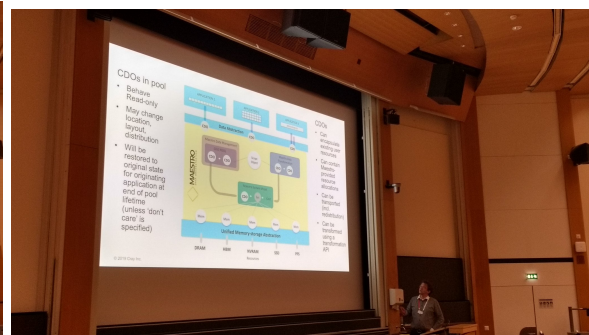
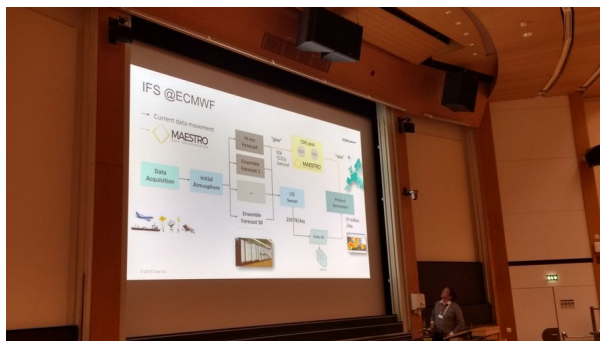
Event: PASC 19, ETH Zurich

Date: Jun 14, 2019

Information: Presentation on “Abstractions for Reasoning about Data Object Movement”. Utz-Uwe Haus and Adrian Tate (Cray) presented the core design of the MAESTRO middleware at PASC 19 Conference

URL:

<https://pasc19.pasc-conference.org/program/schedule/presentation/?id=msa226&sess=sess170>



Event: ISC 19 Project Poster, Frankfurt, Germany

Date: Jun 18, 2019

Information: Project Poster Title "Middleware for Memory and Data-Awareness in Workflows (MAESTRO)" Poster Authors: Manuel Arenaz, Dirk Pleiter, Adrian Tate

URL: https://ssl.linklings.net/conferences/isc_hpc/assets/2019/posters/proj124.pdf



Event: ISC European Exascale Projects and infrastructure booth, Frankfurt, Germany

Date: Jun 17, 2019

Information: Seven projects and infrastructure including MAESTRO funded by European Union's Horizon 2020 programme have joined forces to showcase their work at ISC.

URL: <https://www.montblanc-project.eu/euroexascale>



Event: ISC 19 Workshop IWOPH19 Paper, *Frankfurt, Germany*

Date: Jun 16, 2019

Information: Paper presented by Manuel Arenaz on "Parallelware tools: An experimental evaluation on POWER systems" at the International Workshop on OpenPOWER for HPC

URL: <https://indico-jsc.fz-juelich.de/event/87/>

Event: 5th workshop on Programming Abstractions for Data Locality (PADAL), *Bordeaux, France*

Date: Sep 9, 2019

Information: Presentation by François Tessier (CSCS) on "MAESTRO: Middleware for Memory and Data-Awareness in Workflows"

Presentation PDF:

<https://drive.google.com/file/d/1Z5Z5LIMG7LZTJG8hBIBupVYIKFU0eICP/view>

URL:

<https://sites.google.com/a/lbl.gov/padal-workshop/padal19/abstracts#TOC-Session-1:-Programming-Models-and-Runtime-Systems>

Event: 24th International Conference on Computing in High-Energy and Nuclear Physics (CHEP), *Adelaide, Australia*

Date: Nov 6, 2019

Information: Presentation by Dirk Pleiter (Jülich) on "HPC Systems in the next decade- what to expect, when, where"

Presentation PDF:

<https://indico.cern.ch/event/773049/contributions/3581372/attachments/1939080/321566/9/pleiter-chep19.pdf>

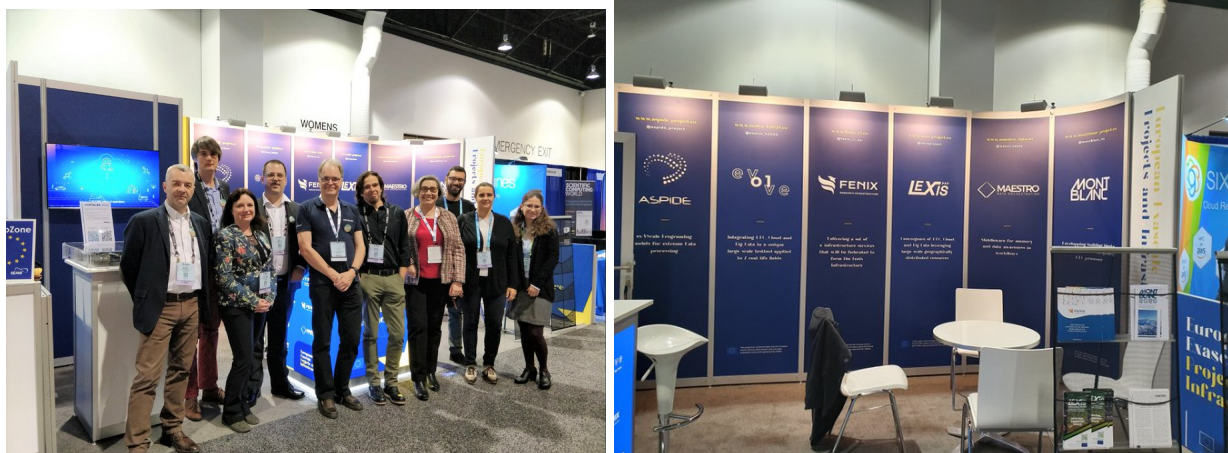
URL: <https://indico.cern.ch/event/773049/contributions/3581372/>

Event: SC19 European Exascale Booth, Denver, USA

Date: Nov 19, 2019

Information: Seven projects and infrastructure including MAESTRO, funded by European Union's Horizon 2020 programme have joined forces to showcase their work at SC.

URL: <https://www.montblanc-project.eu/euroexascale>



Event: SC19 EXDCI2 /PRACE booth, Denver, USA

Date: Nov 20, 2019

Information: Presentation by Dirk Pleiter on "MAESTRO: Towards a data- and memory-aware HPC middleware" at the EXDCI2/PRACE booth.

URL: <http://www.prace-ri.eu/prace-sc19-mini-presentations-programme/>



Event: University of Exeter, South West England, UK

Date: Nov 12, 2019

Information: Presentation by Utz-Uwe Haus on "Abstractions for Reasoning about Data Object Movement"

URL:

<http://emps.exeter.ac.uk/mathematics/news-events/colloquia/event/?semID=2441&dateID=5159#3ttM7v2fESD9E8Bd.99>

Event: Clovis workshop, Abingdon UK

Date: Dec 5, 2019

Information: Discussion: MIO for use by Sage2 applications

Contribution: The usage of the outcomes of MAESTRO for use in Sage2 project



Event: IPDPS 2020, Virtual event

Date: May 22, 2020

Information:

Workshop: High Performed Storage

Paper: Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers

Talk: Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers. F. Tessier, M. Martinasso, M. Chesi, M. Klein and M. Gila

URL: <http://snir.cs.illinois.edu/HPS/#Call for Papers>

Slides: http://snir.cs.illinois.edu/HPS/slides/HPS_Tessier.pdf

Paper: <https://ieeexplore.ieee.org/document/9150373>

Event: IPDPS 2020, Virtual event**Date:** May 22, 2020**Information:**

Workshop: High Performed Storage

Talk: Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers. F.

Tessier, M. Martinasso, M. Chesi, M. Klein and M. Gila

URL: [http://snir.cs.illinois.edu/HPS/#Call for Papers](http://snir.cs.illinois.edu/HPS/#Call_for_Papers)**Slides:** http://snir.cs.illinois.edu/HPS/slides/HPS_Tessier.pdf**Event: ISC20 Project Poster, Virtual event****Date:** June 22, 2020**Information:**

Project Poster Title: Middleware for Memory and Data-Awareness in Workflows (Maestro)

Poster Authors: Manuel Arenaz, Dirk Pleiter

Poster URL: https://linklings-public.s3.amazonaws.com/isc_hpc/2020/posters/proj113.pdf**URL:** <https://2020.isc-program.com/presentation/?id=proj113&sess=sess326>**Event: ISC20 Poster Presentation, Virtual event****Date:** June 23, 2020**Information:**

Live video presentation: Middleware for Memory and Data-Awareness in Workflows (Maestro)

Video Presentation: https://www.youtube.com/watch?v=lrq0dmeSZKw&feature=emb_title**URL:** <https://2020.isc-program.com/presentation/?id=proj113&sess=sess326>**Event: Datasphere 20, Virtual event****Date:** September 23, 2020**Information:** This is an event that Seagate organized that invited all the Maestro consortium members to participate.**Event: European Research and Innovation Days "Innovation Radar Prize", Virtual event****Date:** September 24, 2020**Information:**

Maestro was mentioned at the partner Appentra's presentation, who was winner of the Innovative Science category of the Innovation Radar 2020 Prize at the European Research

and Innovation Radar Prize. Innovation title: "Parallelware Technology: analysis tool aiming to reduce the burden of making code parallel."

Partner: Appentra, Manuel Arenaz

URL: <https://www.innoradar.eu/innoradarprize>
<https://www.innoradar.eu/innovation/37977>

Event: **Forum Teratec**, *Virtual event*

Date: October 13, 2020

Information: Maestro will participate at the EXDCI2 booth at the exhibitor dedicated space Europa Village. The TERATEC Forum is a major event in France and Europe that brings together the best international experts in HPC, Simulation and Big Data.

URL: http://www.teratec.eu/gb/forum_2020/index.html
<https://discovr-360.eu/PRACE/Teratec/>

Event: **SC20 - European Processor Initiative (EPI) booth**, *Virtual event*

Date: November 18, 2020

Information: Dirk Pleiter has been live on the video chat at the EPI virtual booth.

Video:

<https://www.eventscribe.net/2020/SC20/fsPopup.asp?BoothID=422548&rnd=9.929413E-02&MultiCompany=0&mode=exhibitor>

Event: **Virtual Workshop on AI and HPC convergence**, *Virtual event*

Date: November 26, 2020

Information:

- Virtual Workshop on AI and HPC convergence, virtual event organised by EXDCI2
- Presentation title: "Maestro: Orchestrating Data for HPC (and AI) Applications"

Slides URL: <https://exdci.eu/sites/default/files/public/files/maestro-pleiter-20201126.pdf>

URL:

<https://exdci.eu/events/virtual-workshop-ai-and-hpc-convergence#:~:text=The%20workshop%20is%20organised%20in,event%20using%20video%20conference%20software.>

Event: **TRR Conference**, *Virtual event*

Date: March 2, 2021

Information:

Trends in Mathematical Modelling, Simulation and Optimisation: Theory and Applications

Title: "The brave new world of Exascale computing: Computation is free, Data Movement is not"

Partner: HPE , Utz-Uwe Haus

Slides: https://www.trr154.fau.de/wp-content/uploads/2021/03/Haus_UtzUwe.pdf

URL:

<https://www.trr154.fau.de/trends-in-mathematical-modelling-simulation-and-optimisation/>

Event: **SOS 24 Workshop**, *Virtual event*

Date: March 15, 2021

Information:

Title: Orchestrating Data at System Level and Beyond, by Dirk Pleiter

Description: Data orchestration in the presence of more complex memory and storage hierarchies as well as distributed e-infrastructures is an ongoing challenge. In this talk we consider different strategies for addressing this challenge in different context with focus on generic data transport functionality. We discuss different options for how to exploit the middleware both from an application perspective as well as the perspective of adding scheduling and placement capabilities.

URL: <https://sos24.cscs.ch/session/orchestrating-data-at-system-level-and-beyond/>

Event: **HPE Technology and Solutions Summit**, *Virtual event*

Date: March 17, 2021

Information:

Title: Challenges and Solutions for Data Abstraction and Movement in Heterogeneous High Performance Computing Systems

Description: High Performance Computing architectures are becoming increasingly heterogeneous, introducing complex memory hierarchies that present significant challenges for the performance, portability, and productivity, of scientific applications and developers. We present efforts to address these challenges from the perspectives of programmability and data movement optimisation, resulting from activities of the HPE EMEA Research Lab in two ongoing research projects, EPiGRAM-HS and Maestro, funded by the EU Horizon 2020 programme.

Partner: HPE, Christopher Haine

URL: <https://www.hpe.com/be/en/compute/hpc/emea-research-lab.html>
<https://h41382.www4.hpe.com/tss>

Event: **Datasphere 21**, *Virtual event*

Date: March 30, 2021

Information:

Title: Open Source Object Storage for All: Join the Mass-Capacity Storage Revolution

Description: In this session, you'll learn about the CORTX community, as well as how you can participate in influencing the roadmap of the world's only 100% open source object storage that's optimized for data-intensive workloads.

Partner: HPE, Utz Uwe Haus

URL: <https://www.seagate.com/es/es/datasphere-2021/sessions/cortx/>

Event: HPC-CH forum - Virtualization, *Virtual event*

Date: May 20, 2021

Information:

Presentation title: Dynamic Provisioning of Storage Resources: A Case Study with Burst Buffers by Maxime Martinasso

Partner: CSCS, Maxime Martinasso

PDF:

https://indico.psi.ch/event/11205/contributions/28778/attachments/18949/29919/HPC-CHO521_DynPro-3.pdf

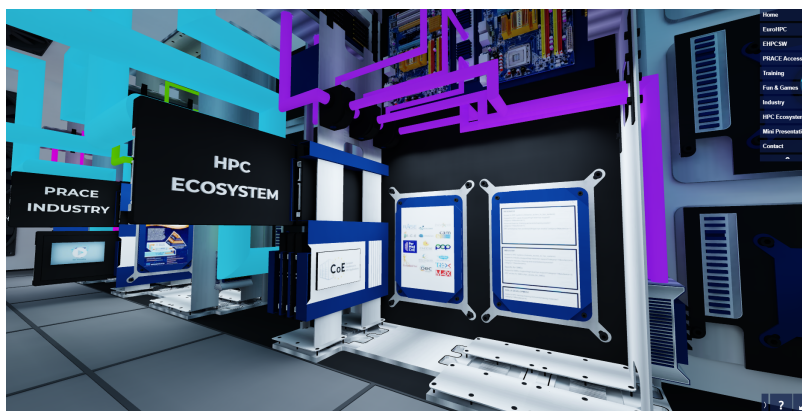
URL: <https://indico.psi.ch/event/11205/timetable/>

Event: Forum Teratec Europe Village, *virtual event*, *Virtual event*

Date: June 22 - June 24

Information: A video was shown about MAESTRO at the HPC-GIG booth within Europa Village.

URL: <https://prace-ri.eu/event/teratec-forum-2021/>



Event: ISC21 Project Poster, *Virtual event*

Date: June 24, 2021

Information: Project Poster Title: Middleware for Memory and Data-Awareness in Workflows (Maestro)

Poster Authors: Manuel Arenaz (Appentra Solutions), Utz-Uwe Haus (Hewlett Packard Enterprise), Marc Perache (CEA), François Tessier (Inria), Dirk Pleiter (Forschungszentrum Jülich)

Poster URL: <https://www.isc-hpc.com/download/poster/proj1080>

URL:

<https://app.swapcard.com/event/isc-high-performance-2021-digital/planning/UGxhbm5pbmdfNDQ2MDQ1>

Event: SuperCompCloud Workshop (ISC'21), Virtual event

Date: Jul 2, 2021

Information: Presentation title: "A Middleware API for Data Movement in Scientific Workflows" by Christopher Haine (HPE EMEA Research Lab) .

Paper title: "A Middleware Supporting Data Movement in Complex and Software-Defined Storage and Memory Architectures".

URL: <https://sites.google.com/view/supercompcloud>

Event: PASC21 Minisymposium, Virtual event

Date: July 6, 2021

Information: Symposium on paper: Data Movement Orchestration on HPC Systems

URL: <https://pasc21.pasc-conference.org/program/schedule/session/?sess=sess137>

Video announcement:

https://www.youtube.com/watch?v=4Zwsg_U2IQ&list=PLeU4yWBiw8jZHBICd1KKGXeD7wBUK8aQa&index=10

Data Movement Orchestration on HPC Systems

Session Chair

- François Tessier, INRIA

Speakers

- Suren Byna, Lawrence Berkeley National Laboratory
- Emmanuel Jeannot, INRIA
- Utz-Uwe Haus, HPE HPC/AI EMEA Research Lab
- François Tessier, INRIA



Event: PASC21 Project poster, Virtual event

Date: July 6, 2021

Information: Project poster title: Middleware for Memory and Data-Awareness in Workflows (Maestro), presented by Dirk Pleiter.

URL:

<https://pasc21.pasc-conference.org/program/schedule/presentation/?id=post132&sess=sess182>

Event: EsiWACE2 V4IO summer school, *virtual event*

Date: August 23, 2021

Information: Seagate discussed Maestro related technologies such as Motr/Mero as part of this workshop., presented by Sai Narasimhamurthy.

Partner: Seagate

URL: <https://hps.vi4io.org/events/2021/esiwace-school>

Video:

https://www.youtube.com/watch?v=8HBhoXAI4&list=PLPBXYCExoO_y2NLI296i44XaQ1H2cj&index=10

Event: 19th Workshop on high performance computing in meteorology, *virtual event*

Date: September 27, 2021

Information: Presentation title: "Bridging gaps: The Maestro Data-Aware Middleware" presented by Utz-Uwe Haus

Partner: HPE HPC EMEA Research Lab

URL: <https://events.ecmwf.int/event/169/>

Slides:

https://events.ecmwf.int/event/169/contributions/2736/attachments/1430/2571/HPC_WS-Haus.pdf

Video: <https://vimeo.com/610643511>



Event: 5th ZIB-RIKEN-IMI-ISM MODAL Workshop on Optimization, Data Analysis and HPC in AI, *Virtual event*

Date: September 27, 2021

Information: Presentation title "Bridging gaps: The Maestro Data-Aware Middleware", presented by Utz-Uwe Haus.

Partner: HPE HPC EMEA Research Lab

URL: <http://optimizationworkshop2020.zib.de/>

Event: MOTR Interfaces Workshop/Hackathon, *virtual event*

Date: November 5, 2021

Information: Presentation title "Maestro I/O Interface", presented by Sining Wu

Partner: Seagate

URL: <https://sagestorage.eu/news-and-events/motr-interfaces-workshop-hackathon>

Event: PRACE Booth SC21

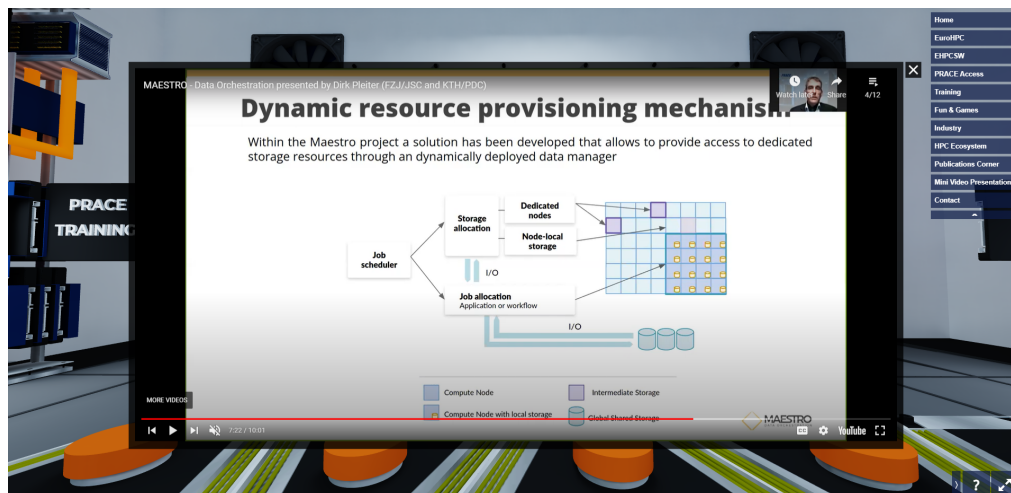
Date: November 15, 2021

Information: Presentation title: "Middleware for memory and data-awareness in workflow", presented by Dirk Pleiter

Partner: Consortium

URL: <https://prace-ri.eu/event/pracesc21/>

URL: <https://discover360.com/PRACE/SC21/>



Annex 3: Individual Exploitation Plans

- Forschungszentrum Jülich

General exploitation plan

Jülich Supercomputing Centre (JSC) at JUELICH is one of the leading supercomputing centers in Europe. As such it has a strong interest in providing programming models that allow for efficient exploitation of the performance of the increasingly complex hardware technologies. Based on this consideration, will exploit the results from the Maestro project on the one hand to improve the use of future supercomputers and on the other hand to enable new scientific applications.

Efficient data transport will be crucial for exploiting the cluster-booster architectural concept, which is currently implemented by coupling JUELICH's JURECA cluster based on Intel Xeon processors with a booster based on Xeon Phi processors, as well as hierarchical storage architectures, e.g. the newly introduced High-Performance Storage Tier.

Several of the application areas, which are part of Maestro's co-design process, are expected to play an important role at JUELICH in the future, in particular Earth System Modelling and materials science. In these areas JUELICH plans to exploit the results from Maestro to enable new research.

Internal exploitation

- The Maestro-enabled application coupler for TerrSysMP will be exploited as a reference implementation for couplers for other application areas to overcome the current situation, where different application fields implement their home-grown couplers
- The Maestro-enabled prototype of a workflow framework based on Pegasus will be used to (a) help the Pegasus developers to improve their solution towards better exploitation of system architectures with complex storage hierarchies and (b) to transfer this knowledge to other workflow frameworks

External exploitation

- The Maestro-enabled version of TerrSysMP will be provided to the application owners for further exploitation

Expected exploitable result

1. Maestro-enabled version of TerrSysMP
2. Prototype of an Maestro-enabled application coupler
3. Prototype for Maestro-enabled workflow framework Pegasus

Intellectual Property Rights remarks

N/A

All MAESTRO code developed by JUELICH in the context of this project has been licensed under the BSD 3-clause license and is available via the JSC gitlab servers.

- CEA

General exploitation plan

Data management is a major concern for upcoming Exascale architectures. CEA aims to exploit Maestro outcomes to offer a complete software stack from applications to storage including tools to diagnose potential misuse. CEA will improve middlewares directly linked to applications such as MPC (MPI implementation) for parallelism management and PaDaWAN/Hercule (used in CEA applications) for IO management, but also the telemetry tool SeLFie. The evolutions in these tools will be validated thanks to a representative workflow based on the Hydro-C code. All these products are used on a day to day basis in CEA computing centers, so all these improvements will directly impact CEA activities.

Internal exploitation

Parallelism and IO management are key features, especially at scale. CEA provides libraries to enable scientific computing codes to deal with data management within running applications thanks to MPI extension, in a workflow thanks to PaDaWAN/Hercule. Maestro will help to extend existing libraries and provide improved features directly accessible to existing applications.

The SeLFie tool is used to monitor all applications CEA clusters. Thus, extending SeLFie with Maestro information will provide to end users all the information to efficiently use our clusters and improve performances.

External exploitation

All the CEA software developed during the Maestro project will be released in open source.

Expected exploitable result

1. Improved MPI data aware MPI implementation.
2. Improved IO libraries optimized for workflows.
3. Improved profiling tool to optimize application data movements.

Intellectual Property Rights remarks

N/A

- Appentra

General exploitation plan

Appentra will focus on further developing and co-designing its products based on Parallelware technology within Maestro. Through the collaboration with use case partners such as CEA, ETHZ and ECMWF, Appentra will improve the Parallelware core technology with new capabilities for the detection of data and memory semantics that help in porting applications to future (pre-)Exascale systems using the Maestro middleware. Such improvements will enhance our Parallelware Analyzer product: a new tool that provides insights into Parallelware internals to supply detailed data, memory and computational semantic information about the code, as well as (semi-)automatic directive-based parallelization of sequential codes using standards-based code. Overall, our contributions to Maestro will help create new solutions for high-productivity parallel programming environments targeting (pre-)Exascale systems.

Internal exploitation

Parallelware technology will be further developed to provide insights on data, memory and computation semantic information about the code. These improvements will be available to all Appentra products based on Parallelware.

External exploitation

The improvements of the Parallelware technology required by Maestro will be reused by products making use of the technology such as Parallelware Analyzer.

The user experience of Maestro will be enhanced through tools based on Parallelware which assist the user on setting up Maestro and/or inserting the proper API calls.

Expected exploitable result

1. Assisted configuration of Maestro settings.
2. Assisted insertion of calls to the Maestro API in the source code.
3. Support for C/C++/Fortran in Parallelware tools.
4. Improved analysis of access patterns and data flow in Parallelware tools.

Intellectual Property Rights remarks

Parallelware technology and Parallelware Analyzer are property of Appentra and protected along with their code by copyright.

- ETH Zurich

General exploitation plan

Data management will become in the near future a mandatory concern for enabling new scientific discovery using simulations on HPC systems. ETHZ aims to exploit Maestro by offering a data management system to scientists with the goal of increased scientific discovery. ETHZ will exploit Maestro-enabled dynamic provisioning as a medium to provide flexible and dedicated data models for scientific workflows together with a better storage usage of the supercomputer. ETHZ will exploit the Maestro abstraction model to improve the productivity of scientific applications running on accelerated systems.

Internal exploitation

Dynamic provisioning will become an important service at ETHZ to enable scientific workflows to access different tiers of storage and different storage backend in on-demand and accountable fashion. To that effect, we will consolidate our work on the dynamic provisioning in Maestro to strengthen the service towards our foreseen requirements.

Maestro will enable transparent management of data movement across multiple memory tiers (host and accelerators). As ETHZ is involved in porting code to accelerators, such part of Maestro capability will be investigated as an option to increase and facilitate the development of scientific applications to accelerators.

External exploitation

ETHZ being a major actor in the HPC community and being involved in porting code to accelerators and executing complex scientific workflows onto HPC systems, plans to expose Maestro capabilities to our partners and to promote Maestro in different related national and international projects.

Expected exploitable result

1. Dynamic provisioning service
2. Maestro data movement abstraction and implementation

Intellectual Property Rights remarks

The dynamic provisioning code developed by ETHZ is licensed under the BSD 3-clause license and available via GitHub.

- ECMWF

General exploitation plan

ECMWF's high-performance computing (HPC) infrastructure supports operation numerical weather prediction (NWP), research activities in NWP (such as climate reanalysis), and NWP data provisioning. The volume of data flowing through the associated pipelines is growing exponentially and is predicted to reach 929 TiB per day in the coming years for time-critical operational forecasts alone. Maestro is envisaged to enhance the data movement and storage capabilities of some of the components in the ECMWF's operational and research workflows. This will ultimately facilitate the development of more scalable forecasting systems and help ensure that ECMWF continues to provide world-leading global numerical weather forecasts to the citizens of its 34 member and co-operating states, as well as to its commercial customers.

Internal exploitation

Maestro will be able to support heterogenous storage architectures and will thus enable more efficient data movement between the workflow components. Software tools will be developed and adapted to be able to make use of the Maestro technologies – they will be 'Maestro-enabled'. Weather and climate researchers as well as computational scientists at ECMWF will benefit from these technologies in their day-to-day work to develop improvements to the quality and efficiency of weather forecasts. For example, a Maestro-enabled version of the post-processing part of the workflow would enable ECMWF to speed up creating and disseminating its forecast products. Another example is Kronos, a workload simulator used for benchmarking various HPC workflows at ECMWF. A Maestro-enabled version of Kronos could be used to help make decisions about where to store and how to move data.

External exploitation

ECMWF is the world-leader in global numerical weather forecasting and plays a central role in a variety of international (mainly European) research collaborations in the field of HPC, weather and climate science, and flood forecasting. Software tools developed as part of the Maestro project will be released as open source and will therefore benefit a potentially wide range of users. The integration of Maestro developments into ECMWF's daily operations would enable the production of better numerical weather forecasts for our member states and commercial clients. Improved weather forecasts will, in turn, allow for better preparedness for extreme weather events – such as severe floods, droughts, thunderstorms, fires – and enhance European citizens' quality of life.

Expected exploitable result

1. Better orchestration of data movement between workflow components.
2. Ability to support a high number of simultaneous read and write operations on heterogeneous architectures.

3. Ability to support a high volume of simultaneous read and write operations on heterogeneous architectures.
4. Efficient management of data flows will enable improvements in weather forecasts.

Intellectual Property Rights remarks

Software created within the Maestro project will be released with an open-source license.

- Seagate

General exploitation plan

Seagate will use the outcomes of Maestro as an Exascale I/O middleware complementary to the Mero Object store, laying the foundation for features such as Guided I/O (and multiple Views for Object data) for extreme scale applications. Maestro will be evaluated as an integral part of any future Mero Object storage enhancements targeting the HPC and HPDA communities. Maestro essentially forms a logical continuation of the Exascale I/O middleware activity started by Seagate through E10. Maestro will also be assessed as part of the SAGE prototype with Mero.

On the Exploitation outcomes from the Maestro project: Seagate will focus on further developing and co-designing its extreme scale computing software technology based on Mero as explained in the previous sections, within Maestro. Seagate will also gather the requirements of future extreme scale storage systems from the use case partners in Maestro such as CEA and ECMWF. These requirements will be provided not just for further developing the Mero Object store as the de-facto Object storage software solution for the European Extreme Scale community, but also for Seagate's disk drive technology, flash/NVRAM technology and enclosure solutions. This helps to provide more optimized storage platforms overall for Extreme scale computing/HPDA markets as suited for the needs of Exascale class workloads.

Seagate will also exploit the work done on Maestro I/O interface to develop and inspire higher level interfaces on top of Mero from the community, considering that MIO is a classical upper level abstraction on top of Mero. MIO has helped to develop the Simple Access Interface (SAI) from Culham Center for Fusion Energy, one of the Sage2 partners, for example. Community participation is a lot more relevant now that Mero is open sourced as Motr and MIO is also fully available to the community. Such interfaces will dramatically expand the user base for Mero/Motr.

The work done in Maestro and the co-design activity have also helped Seagate to provide data points to design products based on Mero/Motr which have already started to become available (for example, "Lyve Drive Rack" products capable of storing extreme amounts of data accessible through well known protocols on top of Motr API, such as S3)

Internal exploitation

- Usage of MIO by partners
- Usage of Mero/Motr by the partners

External exploitation

- MIO to trigger higher level APIs on top of Mero/Motr by the open source community

- Usage of Telemetry infrastructure of Mero/Motr by various performance analysis tools and platforms
- Usage of Mero/Motr as the object storage of choice by the wider HPC/AI community and the big Scientific institutions in Europe based on the proof points provided the Mero adopters (Juelich, CSCS, CEA)

Expected exploitable result

1. MIO (& similar APIs inspired by MIO) for other HPC use cases, as a higher level API for the HPC community.
2. Wider adoption by the scientific community of Motr/Mero now that it is fully open sourced.
3. Exploitation of telemetry mechanisms for use in Mero based solutions.

Intellectual Property Rights remarks

Mero/Motr and the Motr API (Clovis) are now fully open source under the Apache V2 license.

- HPE

General exploitation plan

A viable economic model of software support in HPC is the support of standardised open interfaces sitting on top of a vendor-supported substrate used to differentiate hardware in procurements. Maestro reveals to HPE both the form of that substrate and the likely path towards the standard interfaces. By co-designing middleware alongside customers like ETHZ, CEA, JUELICH and ECMWF, HPE will receive unprecedented access to applications performance concerns and their technical considerations. The secondary purpose of the Maestro middleware is to continue to communicate these technical requirements as the middleware evolves and is used in production. Through Maestro and through the co-design process, HPE will thus design features and components of future systems that are more likely to meet the customer's advanced data movement requirements, an area at which HPE and all other vendors today still fall very short.

Internal exploitation

HPE will derive product requirements for a follow-on product to Cray Datawarp -- an IO accelerator that uses non-volatile storage banks and an intelligent file system access. Maestro and its co-design process have been and will continue to be used to derive customer requirements at the data-movement level and in terms of additional software needed for exploitation. Any developments leading directly from Maestro will lead to European-based R&D and product efforts.

External exploitation

Open-Sourced parts of the Maestro project results will be used in collaborations with third parties in collaboration projects even before the end of the project. Maestro-core is being used.

Exploitable results

1. Maestro data movement abstraction and implementation: maestro-core library
2. MIO layer for object store abstraction
3. Reusable workflow components like pool manager application, archiver, telemetry listener

Intellectual Property Rights remarks

All Maestro middleware code developed by HPE is licensed under the BSD 3-clause license and available via the JSC gitlab servers.