PHYSICS

oPTIMIZED HYBRID SPACE-TIME SERVICE CONTINUUM IN FAAS

D.7.3 – COMMUNICATION, DISSEMINATION AND STANDARDIZATION PLAN AND ACTIVITIES

Lead Beneficiary	INNOV
Work Package Ref.	WP7 – Exploitation, Dissemination and Impact Creation
Task Ref.	T7.1 – Exploitation, Dissemination and Impact Creation
	T7.3 - Standardization & Open Source Activities
Deliverable Title	D.7.3 Communication, Dissemination and Standardization Plan and Activities V2
Due Date	2022-12-31
Delivered Date	2022-12-23
Revision Number	3.0
Dissemination Level	Public (PU)
Type	Other (ORDP)
Document Status	Final
Review Status	Internally Reviewed and Quality Assurance Reviewed
Document Acceptance	WP Leader Accepted and Coordinator Accepted
EC Project Officer	Mr Stefano Foglietta

H2020 ICT 40 2020 Research and Innovation Action

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REVISION HISTORY

Version	Date	Partner(s)	Description
0.0	2022-10-24	INNOV	ToC Version
0.1	2022-11-25	INNOV	1st Version
1.0	2022-12-07	INNOV	Version for Peer Reviews
1.1	2022-12-19	HPE & FTDS	Revision
2.0	2022-12-20	INNOV	Version for QA
2.1	2022-12-21	DFKI	Revision
3.0	2022-12-21	INNOV	Version ready for submission

LIST OF ABBREVIATIONS

CSP	**Cloud Service Provider**
D.	Deliverable
FaaS	Function as a Service
GDPR	General Data Protection Regulation
IaaS	Infrastructure as a service
IoT	Internet of things
IP	Intellectual property
IPR	Intellectual property rights
KPI	Key Performance Indicator
PHYSICS	oPtimized HYbrid Space-time servIce Continuum in FaaS
RAMP	Reusable Artefacts Marketplace Platform

EXECUTIVE SUMMARY

This deliverable aims to report on the PHYSICS's project progress on communication, dissemination, and standardization activities between M12-M24 of the project. The deliverable is the updated version of D.7.2 Communication, Dissemination, and Standardization Plan and Activities V1 submitted in December 2021. The aim of this deliverable is to demonstrate the project's activities and actions towards achieving the KPIs for communication, dissemination, and standardization plan and activities as defined by the project's dissemination and communication strategy. The deliverable reports on the means employed for extending and further engaging the project's activities in Year 2 and further reports on the changes and progress made during this project year and while the project is reaching its top maturity phase. More specifically, this deliverable outlines the further development of the project's communication channels, enhanced publication pipeline, community engagement events and synergies which have been developed. It then reports on the standardization activities which have been completed this year.

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1. INTRODUCTION

This deliverable is the second in a series of three deliverables on the Communication, Dissemination and Standardization Plan and Activities. The objective of this deliverable is to report on the activities performed in Tasks 7.1 and 7.3 of WP7. The present report describes updated dissemination, communication and standardization activities that took place during the second year of the project and outlines the planned activities for the remaining duration of the project. More specifically, the deliverable outlines the dissemination and communication objectives and strategy of the reporting period and presents the tools and activities that are used to accomplish the KPIs.

During the second year of the project, the maturity of the project increased. Furthermore, the project has participated in and organized many events. The partners continue creating tangible results that are being presented in the dissemination channels Twitter, LinkedIn, YouTube, Newsletters, and Website. In parallel, it is significant to mention that the review comments for the improvements of the website have been considered and implemented by the time this deliverable is submitted.

The rest of this section describes the objectives of the deliverables and the content of each of the following Sections.

Objectives of the deliverable

This deliverable outlines how the PHYSICS project upgrades its strategy in web channels during the second year of the project and how this strategy works and creates and engages a community with specifically targeted personas. To shed light on the progress made, where possible, it also compares the KPIs reached in Year 2 of the project compared to Year 1. A significant addition in this deliverable is the chapter with the "Online Tools" that are used to create the Newsletters and to measure the analytics of the site. It also reflects on the additions on the dissemination and communication section regarding the project's dedicated YouTube Channel and the Marketplace that have been enhanced during the last months.

More specifically, the structure of the deliverable is the following:

- **Section 2** provides information about the online tools that are being used for the data metrics of the website and the newsletter creation.

- **Section 3** provides the updated content of the PHYSICS website, analyses the sitemap, reports on the analytics of the website, countries of origin for each visit (with specific metrics) and website development.

- **Section 4** includes tables and screenshots of the PHYSICS publications, such as scientific papers and poster presentations at conferences for the community, which are used in both digital channels. Also, it includes events and presentations in which PHYSICS has organized or participated.

- **Section 5** lists the events and presentations in which the members of the PHYSICS project took part.

- **Section 6** describes the newsletters and includes print screens of all the newsletters that have been sent in the second year of the project.

- **Section 7** includes all the Social Media actions, the present followers on social media, analytics of each medium, and screenshots of posts.

- **Section 8** refers to the clustering with other projects to broaden the publics' awareness of the project and its results.

- **Section 9** contains the next steps for the following year to continually achieve optimal results. Also, it contains the dissemination activities which partners will follow by the next year.

- **Section 10** is the Standardization & Open-Source Activities.

2. WEBSITE

The PHYSICS project website is fully functional. It contains comprehensive information on the PHYSICS aims and objectives, with easy access and a friendly interface to retrieve information and any public material generated within the project. The website's content has been enhanced during the second year of the project. As shown in Figure 1, the project website's home page has evolved into a clear and clean communication interface that is easily navigable and contains all relevant project-related public information. The site includes the PHYSICS logo and the EU flag with the respective message and is structured into the following sections (Figure 2).
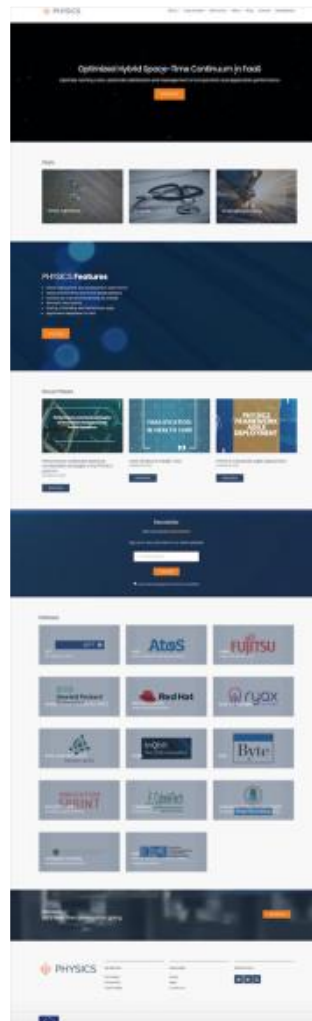
Figure 1 - PHYSICS website homepage

Figure 2 - PHYSICS sitemap

- **About:** This section provides information on PHYSICS' vision & strategy and presents the consortium members
- **Case Studies:** This category presents PHYSICS applications that cover three major areas of European everyday life and economic activity, including eHealth, Smart Manufacturing and Smart Agriculture scenarios.
- **Resources:** Contains all PHYSICS publications, deliverables, promotional materials, and newsletters (See Table 1)
- **News**: The News section provides information about the latest news of the project and the events in which participate or organize
- **Blog**: This page includes all the blog posts written by the partners of the project (See Figure 4 and Table 2)
- **Contact**: This page allows visitors to directly contact the project through a dedicated email form
- **Marketplace**: This section leads to https://marketplace.physics-faas.eu/. The section includes Reusable Artefacts of the H2020 PHYSICS project. (See Figure 3 and Table 1)
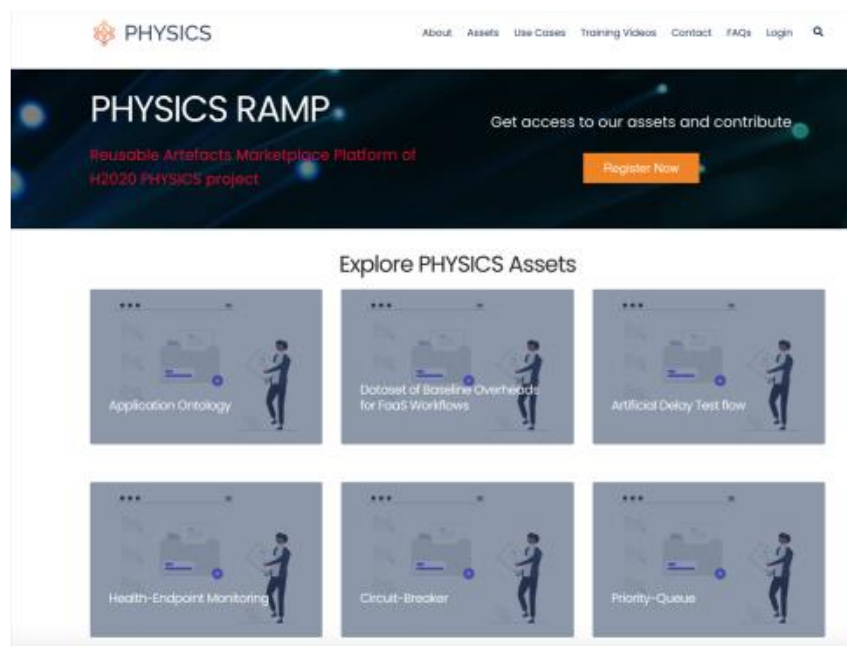
Figure 3 - PHYSICS Marketplace

Table 1 - A general overview of Blog Posts - Publications - Marketplace Assets

Category	In 2022
Blog Posts	15
Publications	7
Marketplace Assets	17

After the comments of the midterm review the PHYSICS website has been enhanced to offer a better user-friendly experience. More images have been added in subsection "About - The project" and the text has been reduced. Meanwhile, the subcategory "Video" has been created under the category "Resources". This subcategory includes all the videos   uploaded in the YouTube channel.

Blogposts
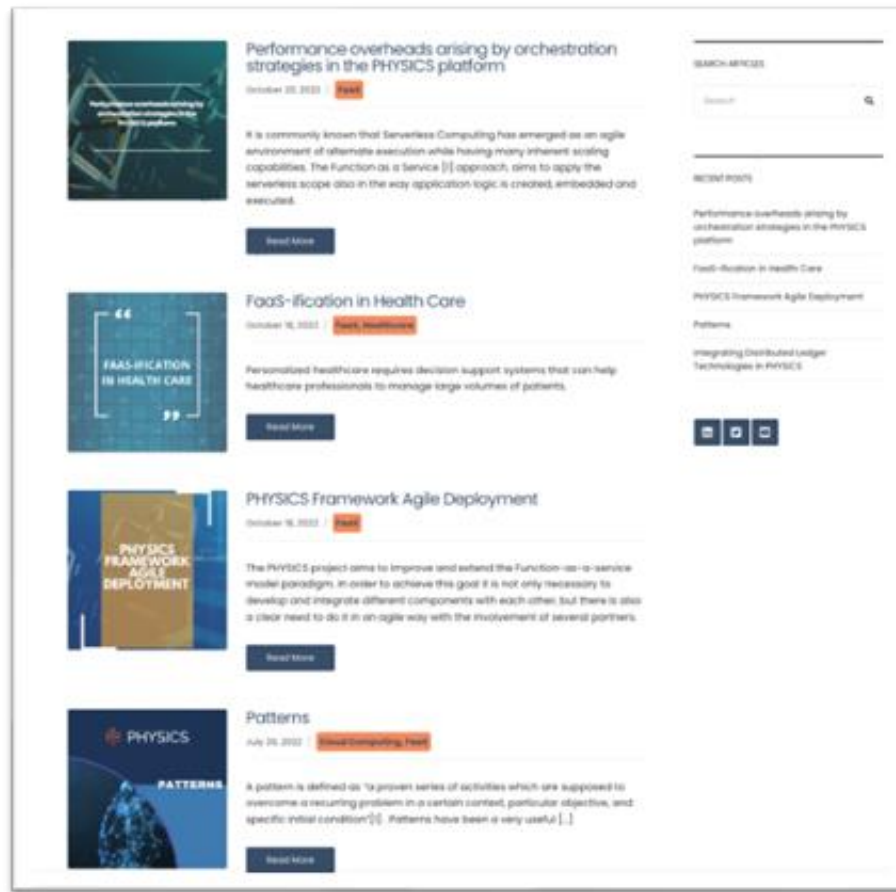
Figure 4 - PHYSICS Blog post

As blogging is one of the most essential facets of dissemination marketing, this strategy is also exploited by the PHYSICS project. The project partners generated unique content as they created blog posts elaborating on   specific subjects. Content generation was indeed one of the priorities of Y2 dissemination. As illustrated in the Table 2, 16 blog posts have been produced as a result up till M24.

Table 2 - Total blog posts for Y2

Title	Date
Modelling FaaS Graphs: The Semantic Building Blocks	January 31, 2022
Enhancing greenhouse control system efficiency and reliability using Faas and Edge computing.	February 14, 2022

Industrial Use Cases of FaaS: The basics you need to know	April 6, 2022
PHYSICS Reusable Artefacts Marketplace Platform – An ecosystem of assets	April 29, 2022
Unleashing PHYSICS potential through open innovation	May 6, 2022
Challenges in PHYSICS Flows Deployment	June 14, 2022
Ontologies and Semantic Description of Cloud Resources in PHYSICS	June 20, 2022
Integrating Distributed Ledger Technologies in PHYSICS	July 21, 2022
Patterns	July 26, 2022
PHYSICS Framework Agile Deployment	October 18, 2022
FaaS-ification in Health Care	October 18, 2022
Performance overheads arising by orchestration strategies in the PHYSICS platform	October 20, 2022
Taking advantage of PHYSICS to implement reliable data collection pipelines on the edge	November 17, 2022
DFKI participation in the event "Innovationstag 2022" of the "Technology Initiative SmartFactory-KL e.V"	November 17, 2022
PHYSICS Design Environment	December 5, 2022

2.1 Website Analytics

Google Analytics was set up on the PHYSICS website from the early beginning of the project. Various insights can be analyzed with this analytics tool. We note that information on analytics extracted from the website and social media platforms reflects on information collected between 1st January and 20th of December 2022.

The statistical comparison between these 2 years, depicts a significant increase in the number of users visiting the website https://physics-faas.eu/. Specifically, as illustrated in Figure 5 in 2022 1,1K users visited the website, while in 2021 visitors were almost half of them. Additionally, the number of page views increased by 1000 times. On the other hand, there was a little drop in the Average Engagement time by 0,21 seconds.

Figure 5 - Comparison of website analytics

Demographics

The countries of origin for each visit in 2022 are presented in the following charts. The charts below (Figure 6 and Figure 7) show the top 20 countries according to the website analytics. As in the previous year, the leading country regarding the website's visits is Greece; instead the second one is United States (contrary to the past year, when Italy was in the second position), and in the third position is Spain as in the first year.

Figure 6 - The absolute traffic of the 10 countries with the most website traffic for 2022

Figure 7 - The percentage of the 10 countries with the most traffic on the website for 2022.

Google   **Analytics**

In order to create reports that will be used to enhance the websites and social media content, we have linked the website with the Google Analytics app (Figure 8). Google Analytics is a free web analytics tool used to track website traffic. Also known simply as GA, this online service provides in-depth reports that allow us to understand the site's performance, drive traffic to the website, and make data-driven decisions for the PHYSICS project. Furthermore, it is significant to mention that website analytics provide us with the actual reports and analytics on how PHYSICS H2020 site visitors behave on the website; who they are by their age, gender, location, etc.; how they landed on the site (traffic source). Meanwhile, Google Analytics provides the Users Flow report, a graphical representation of the path's users took through the website, from the source, through the various pages, and where along their paths they exited your site. Generally, website analytics are important both to create a better user experience for website visitors and relative content.
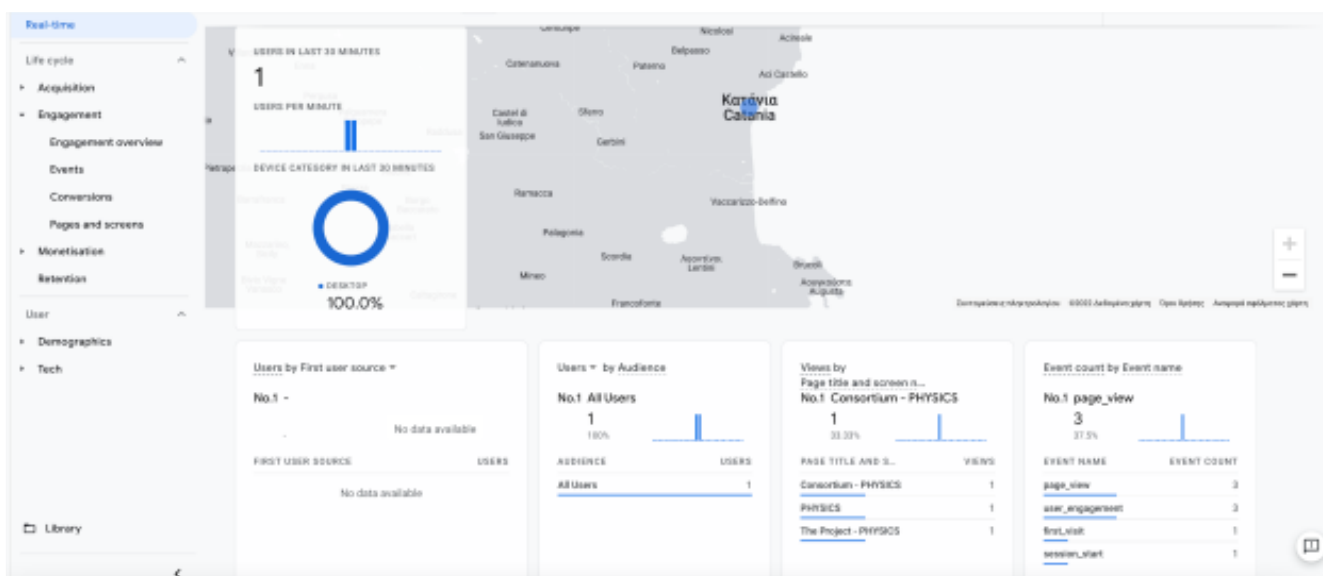

Figure 8 - Google Analytics Interface

3. PUBLICATIONS & PRESS RELEASES

The PHYSICS H2020 website provides access to the PHYSICS publications such as scientific papers and poster presentations at conferences, for the community to consult and reuse. (See Figure 9)
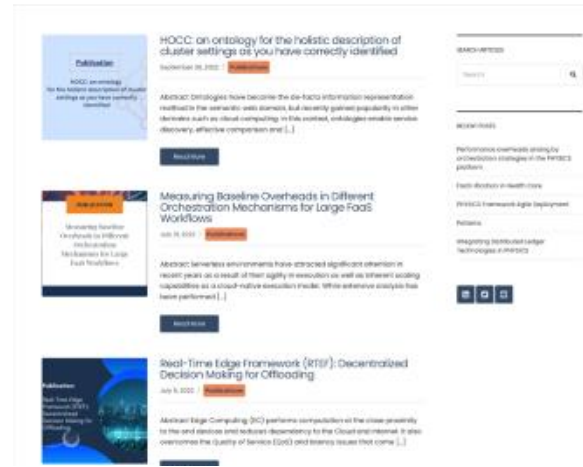

Figure 9 - Sample of publications on website

The KPI set for the 36 months of the PHYSICS project is a minimum of **15 publications**. As of month 24 , the consortium has contributed to the research community with **10 publications** as described below**.** The PHYSICS website provides access to the PHYSICS publications.

Research Publications in Y1, 2021 (M1-M12)

1. Kousiouris, G. and Kyriazis, D., 2021. Functionalities, Challenges and Enablers for a Generalized FaaS based Architecture as the Realizer of Cloud/Edge Continuum Interplay. In *CLOSER* (pp. 199-206) [Open Access].

2. Kousiouris, G., 2021. A self-adaptive batch request aggregation pattern for improving resource management, response time and costs in microservice and serverless environments. In 40th IEEE International Performance Computing and Communications Conference.

3. Volkan Gezer, Achim Wagner.,2021 Real-Time Edge Framework (RTEF): Decentralized Decision Making for Offloading 7th International Conference on Engineering and Emerging Technologies (ICEET 2021) [Open Access].

Research Publications in Y2, 2022 (M13-M24)

4. Franke, N., Mohr, F. and Hennecke, A., (2022). Entwicklung und Auswahl geeigneter Use Cases und KPIs zur erfolgreichen Einführung neuer Hochtechnologie am Beispiel von „Function-as-a-Service ". Mensch und Computer 2022-Workshopband [Open Access].

5. Kousiouris, G., Giannakos, C., Tserpes, K. and Stamati, T., (2022). Measuring Baseline Overheads in Different Orchestration Mechanisms for Large FaaS Workflows. In Companion of the 2022 ACM/SPEC International Conference on Performance Engineering (pp. 61-68) [Open Access].

6. Kyriazis, D. (2022). HOCC: An ontology for holistic description of cluster settings [Open Access].

7. Kousiouris, G., Ambroziak, S., Costantino, D., Tsarsitalidis, S., Boutas, E., Mamelli, A. and Stamati, T. (2022). Combining Node-RED and Openwhisk for Pattern-based Development and Execution of Complex FaaS Workflows. arXiv preprint arXiv:2202.09683, [Open Access].

8. Volkan Gezer, et al. (2022): Industrial Edge Cloud für die Smart Factory. In: atp magazin Bd. 63 Nr. 4 (2022): atp magazin 4/2022 - Hauptbeitrag / Peer-Review.

9. Jimenez-Peris, R., Burgos-Sancho, D., Ballesteros, F., Patiño-Martinez, M. and Valduriez, P. (2022). Elastic scalable transaction processing in LeanXcale. Information Systems, 108, p.102043, [Open Access].

10. Fatouros,G., Poulakis,Y., Polyviou, A. Tsarsitalidis,S., Makridis,G., Soldatos,J., Kousiouris, G, Filippakis,M., Kyriazis, D. (2022). Knowledge Graphs and interoperability techniques for hybrid-cloud deployment of FaaS applications. In Proceedings of CloudCom 2022, [Open Access].

Aiming to disseminate the project activities and results to the wider audience, PHYSICS also released five press releases in year two (M13-M24).

Table 3 presents an indicative sample of press releases regarding year two. The press releases have been uploaded on the website and on social media of the project list is indicative of the press releases made). Press releases were also distributed to project's partners to further share to their audiences through their communication channels.
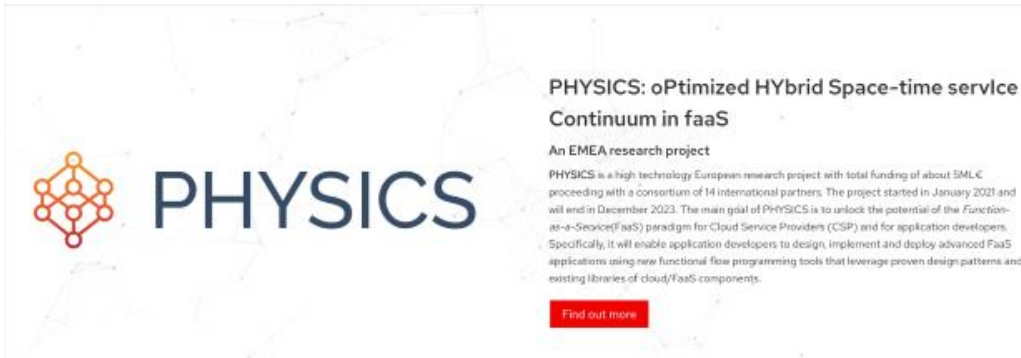
Table 3 - Press Releases of Y2

Placement	Quotation
PHYSICS website	**Press Release: PHYSICS 5th General Assembly** November 18, 2022 / News, Press Release The 5th PHYSICS project General Assembly meeting was held on November 15th – 16th, 2022 in Madrid, Spain and was hosted by ATOS.Partners had the opportunity to update the consortium on the progress of different tasks and deliverables, [...]
PHYSICS website	**Press Release: PHYSICS 4th General Assembly** July 8, 2022 / News, Press Release The 4th PHYSICS project General Assembly meeting was held on July 4th – 6th, 2022. The meeting was hosted by RYAX in Athens, Greece. During the meeting, the partners analyzed the project's growth and had [...] Read More

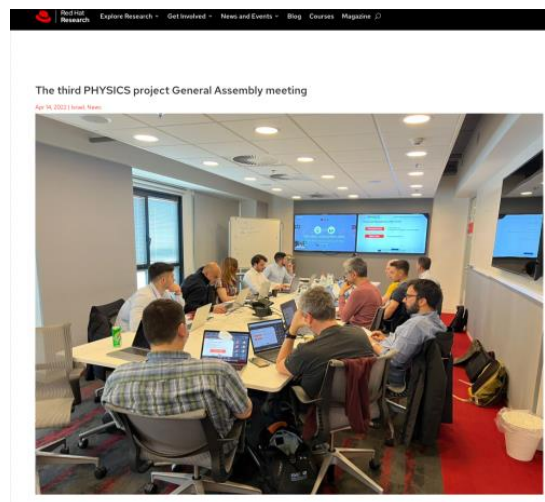| PHYSICS website	
PHYSICS website & ellak.gr	
PHYSICS website & Horizon Cloud website	

CHARITY project	

PHYSICS - Optimized Hybrid Space-Time Service Continuum In FaaS

PHYSICS aims at delivering a complete vertical solution enabling CSPs to offer advanced cloud application design environments to their end customers (Application Developers), for abstractly creating workflows of their applications, exploiting generalized Cloud design patterns for functionality enhancement with existing application components, easily designed and reused through intuitive visual flow programming tools (CSP Cloud Design Environment).

Furthermore, PHYSICS will create platform-level functionalities to be easily incorporated by providers to translate the created application workflows to deployable functional sequences, based on the Faas model, optimizing their placement across the Cloud computing domain and exploiting the computational space-time continuum as well as advanced semantics for the definition of a global service graph (CSP Optimized Platform Level FaaS Services Toolkit). Finally, it will deliver provider-local resource management mechanisms enabling to offer competitive and optimized services with extended interfaces offering local fine grained control of elasticity rules and policies, while applying a holistic set of provider-local strategies based on a wide set of controlling techniques and tackling key aspects of multitenancy (CSP Backend Optimization Toolkit)

Indicative samples of press releases shared via the project's partner communication channels (See Table 4).

Table 4-Press releases via project's partners communication channels

Red-Hat Partner	

Red-Hat Partner	
Red-Hat Partner	
Innovation Sprint	

Innov-Acts	
Innov-Acts	

4. EVENTS

In the second year of the project, PHYSICS participated and organized either individually or in synergy with other projects' several events as illustrated in Figure 10. The project advertised information about the events towards the community using the project's communication channels (e.g., social media posts on LinkedIn, Twitter, and YouTube and announcements through Newsletters). When possible, the event was recorded   and added to the project's YouTube channel, whereas relevant follow-up press releases and posts were made to inform the community.
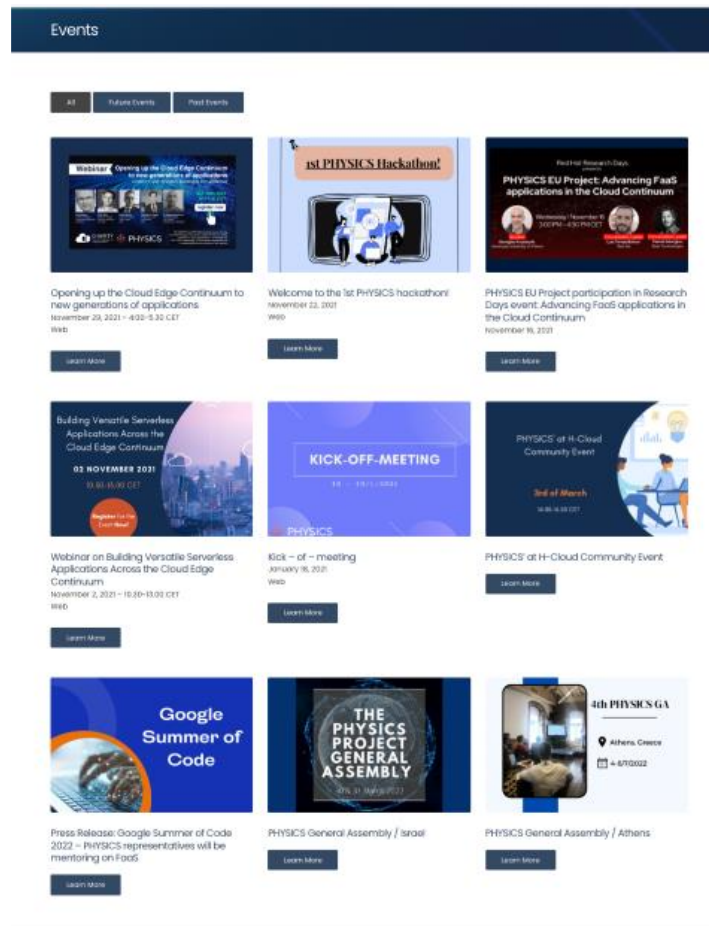
Figure 10 - PHYSICS Events participation

- **PHYSICS organized the 1st 3-day online Hackathon in which creative developers and experts participated to design and implement innovative solutions on 22-24 November 2022. (**Figure 11)

The PHYSICS hackathon aimed to give IoT enthusiasts and cybersecurity experts an exciting opportunity to use the PHYSICS testbed to design and develop runtime solutions, opening the door to further high-level research on this topic, or to assess the security and performance level and suggest specialized solutions. Three tasks made up the hackathon: one on runtime orchestration, one on protected platforms, and one on analyzing performance problems with FaaS systems.

The runtime challenge was looking for applications consuming FaaS functions, available at the PHYSICS testbed or developed specifically for the application, integrating external solutions that allow the orchestration of these functions during runtime for executing the application workflow.

The security challenge looked for an evaluation of the platform vulnerabilities as well as the proposal of easy solutions to be implemented.

The performance challenge looked for the usage of PHYSICS-produced load generators and performance monitors in order to detect performance issues of executed functions as well as enable the mitigation of them through relevant corrective actions.

The hackathon started with a workshop to introduce the three challenges and what was expected from each of them (22 November, 10:00 CET) which was then also uploaded to the project's YouTube channel ;. Each participant had Slack access to a set of mentors providing technical support and answering any doubts. At the end of the hackathon, participants shared (via Drive) their code (only for the runtime and performance challenges) and a short presentation (for the three challenges) to introduce their idea, to have it evaluated by the judges (24 November, 17:00 CET). Finally, the jury decided and announced one winner. The winner has made a significant contribution which is relevant to the aims of the PHYSICS project.
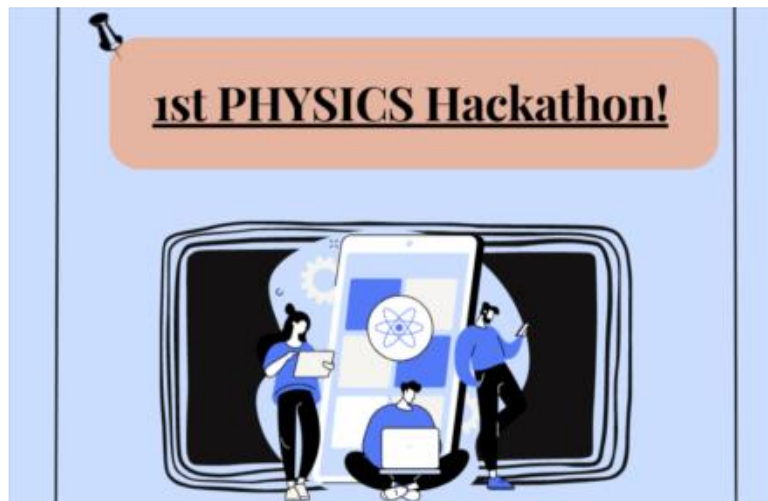
Figure 11 - PHYSICS 1st Hackathon

● **PHYSICS EU Project participated in Red Hat Research Days event: Advancing FaaS applications in the Cloud Continuum, by Red Hat Research. (**Figure 12**)**

The next Research Days event, "PHYSICS EU Project: Advancing FaaS applications in the cloud continuum," was held on November 16, 2022, from 3 PM to 4:30 PM CET. The Function-as-a-Service (Faas) paradigm offers cloud service providers and application designers speed, simplicity, and efficiency, so long as they have accessible tools and techniques to implement it. For this research presentation, Georgios Kousiouris, Harokopio University of Athens, gave an overview of PHYSICS, a large-scale EU Horizon-funded research collaboration that aims to unlock the potential of FaaS in the cloud continuum. Luis Tomás Bolívar, Red Hat, and Yiannis Georgiou, Ryax Technologies, le   d the conversation. Attendees had the opportunity to participate in the live discussion. In this talk, PHYSICS team discussed the goals and current status of the PHYSICS EU Horizon project before exploring some of the main research areas of focus and open-source development. Specifically, the PHYSICS team described how visual flow programming and ready-made patterns can enhance abstract function development, and how the PHYSICS team investigated different function orchestration means and trade-offs in terms of capabilities and performance. The PHYSICS   team also explored   function execution in different clusters while highlighting differences in cluster setup from macroscopically examined load generation and how it   maps to the observed measurements. Finally, the PHYSICS   team looked at   task placement and scheduling optimizations that are being developed and how they can be beneficial, in particular, for FaaS-based applications.

Figure 12 - PHYSICS participated in Research Days event

- **PHYSICS and CHARITY projects join forces to organize a webinar entitled "Opening the Cloud Edge Continuum to new generations of applications". (**Figure 13, Figure 14**)**

    The webinar aimed to bring together audiences with an interest in the Cloud Edge Continuum and showcase the projects' contributions in this area. The webinar focused on showing how both PHYSICS and CHARITY aim to improve the ability of application developers and service providers to create and deploy advanced applications for the Cloud2Edge Continuum, CHARITY addressing XR applications, PHYSICS addressing serverless (FaaS) applications. The event attracted a notable number of participants (53) who engaged in the discussion. The agenda of the event is included below.

AGENDA

- Introduction by the webinar moderator, Uwe Herzog (Eurescom, CHARITY)
- CHARITY Project
    – CHARITY project overview (Dr. Tarik Taleb – ICTFICIAL)
    – Overview and demonstration of CHARITY blueprint design framework (Paolo Barone – Hewlett Packard Enterprise)
- PHYSICS project
    – CHARITY project overview (Fabrizio Di Peppo – GFT)
    – Introduction and demonstration of the PHYSICS FaaS Design Environment (Dr. Georgios Kousiouris – Harokopio University of Athens)
- Q&A

Figure 13 - Agenda of the webinar "Opening the Cloud Edge Continuum to new generations of applications"

Figure 14 - PHYSICS and CHARITY join forces to organize the webinar "Opening the Cloud Edge Continuum to new generations of applications".

Internal Events

The updated list of the internal workshops for the second year of the project is mentioned below:

- The **3ʳᵈ PHYSICS General Assembly** (Figure 15) meeting was held on March 30th & 31st. The agenda included the project overview as well as a technical overview, including Work Packages related: to QoS and orchestration mechanisms and trust; smart contracts and decision support mechanisms; integration, pilots, and evaluation. Discussions on planning the next steps of the project were also held.
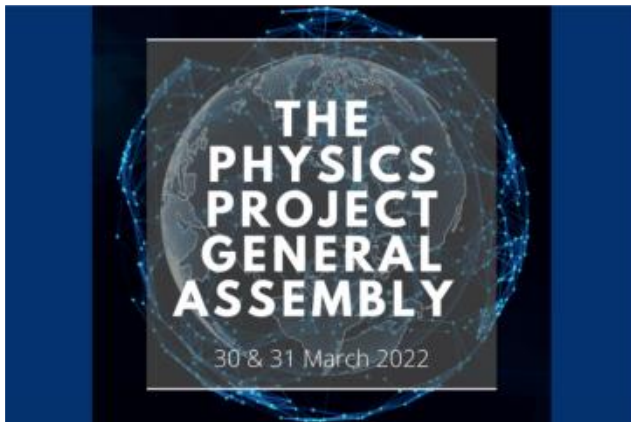
Figure 15 - 3rd PHYSICS General Assembly

- On July 4th – 6th, 2022, the 4th PHYSICS project General Assembly (Figure 16) meeting was held in Athens hosted by RYAX. During the meeting, the partners analyzed the project's growth and had the opportunity to participate   in person or join virtually in discussions about the next goals of the project. An overview of the 4th General Assembly meeting is depicted in Figure 16.

Figure 16 - 4th PHYSICS project General Assembly

- On November 15th – 16th 2022, the 5th **PHYSICS project General Assembly (**Figure 17**)** was held in Madrid, Spain, hosted by ATOS. This **General Assembly was the last one for the second year.** Partners had the opportunity to update the consortium on the progress of different tasks and deliverables, and further discuss any open issues. Led by the coordinator and WP leaders, the consortium also discussed feedback generated by the project's review and future plans regarding the third and final year of the PHYSICS project.

Figure 17 - PHYSICS project 5th General Assembly

- On September 30th, 2022, the internal **Exploitation, standardization, and Handbook** workshop was held by GFT. The key points of this workshop were to enhance the experience of working with open-source communities and to walk through developing a strategy for the open-source project. contributions. In parallel, a detailed review of the exploitable results of PHYSICS has happened as an analysis of PO and experts' suggestions. At the end of the workshop, a detailed discussion of the next steps that should be undertaken was held.

Presentations/Participations in Workshops and Conferences

- WAPS 2022 workshop was held in Vienna, August 23th -26th, 2022

The IWAPS 2022 workshop (Figure 18) brought together researchers, engineers, and practitioners to present and discuss the latest advances and innovations in theories, infrastructure, schemes, and applications for secure computation, privacy technologies, security economics, and human-computer interaction, as well as to identify emerging research topics and define the future trends.

Figure 18 - IWAPS 2022 workshop

- **PHYSICS participated in the EU date of the CCGRID 2022, May 16th -19th, 2022.**

The CCGrid symposium series serves as a major international forum for presenting and sharing recent research accomplishments and technological developments in the field of Cluster, Cloud and Internet computing. CCGrid 2022 is the 22nd edition of the IEEE/ACM international conference on Cluster, Cloud and Internet computing. EU Day, organised by HUB4CLOUD, explores the major developments in the European cloud computing ecosystem, in particular open-source approaches. The presentation was held by prof. George Kousiouris, Harokopio University of Athens. The paper "Combining Node-RED and Openwhisk for Pattern-based Development and Execution of Complex FaaS Workflows" was presented. (Figure 19)
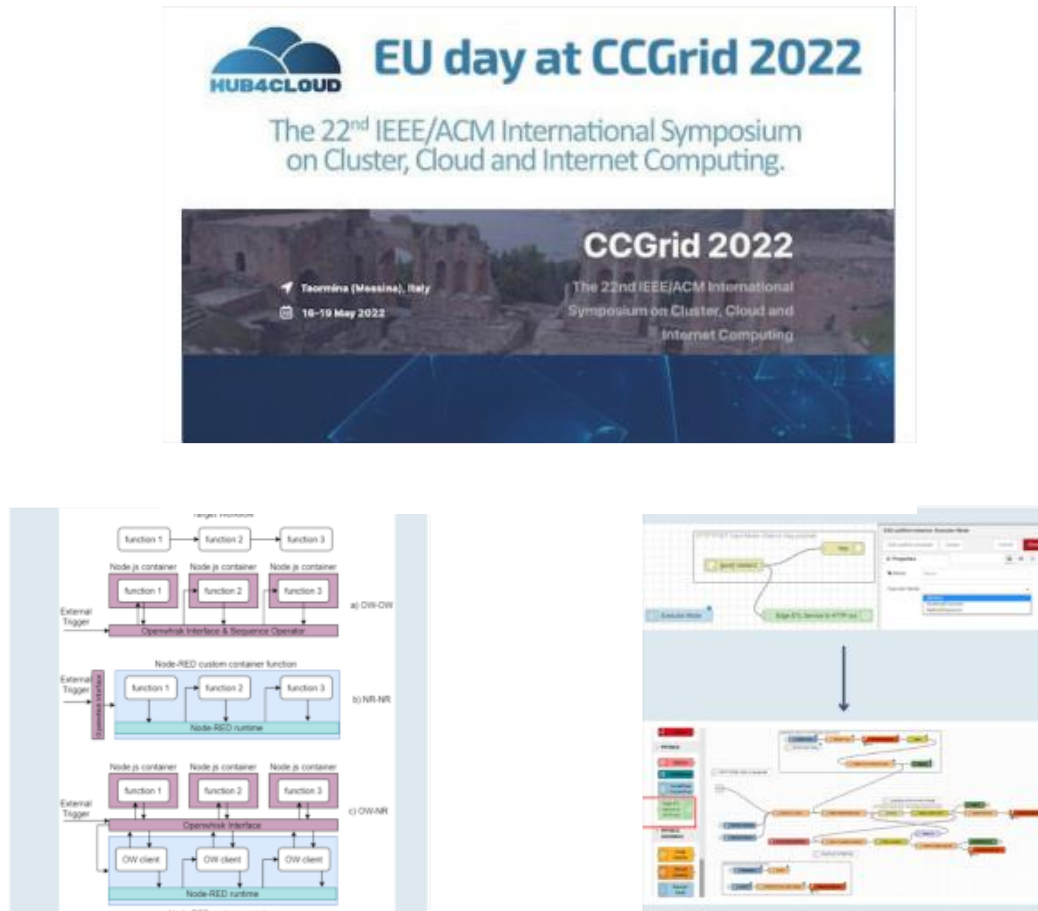
Figure 19 - Participation in the EU date of the CCGRID 2022

● **Mentorship during the "GOOGLE SUMMER OF CODE 2022"**

Google Summer of Code (GSoC) (Figure 20) is a program designed to bring new, excited contributors into open-source communities, with the hope that they will continue to contribute to open-source communities long after their GSoC program ends.

Partners of the PHYSICS project were mentored through ELLAK, the Greek free and open-source community, with a focus on implementing workflow, parallelization and cloud design patterns in Node-RED for Function as Service coordination.

Figure 20 - Participation in Google Summer of Code

- **PHYSICS participated in the 5th workshop on hot topics in Cloud Computing performance (HOTCLOUDPERF 2022) at ICPE 2022, April 9th, 2022.**

The HotCloudPerf workshop (Figure 21) created a meeting venue for academics and practitioners, from experts to trainees, in the field of cloud computing performance. The new understanding of cloud computing covers the full computational continuum from data centers to edge resources to IoT sensors and devices. The workshop aimed to engage this community and lead to the development of new methodological aspects for gaining a deeper understanding not only of cloud performance, but also of cloud operation and behavior, through diverse quantitative evaluation tools, including benchmarks, metrics, and workload generators.

Figure 21 - Participation in HotCloudPerf workshop

- **Presentation at Horizon Cloud Events, March 3rd, 2022.**

During the event (Figure 22), the motivation framing the PHYSICS project alongside the project's goals, objectives and use cases. The introduction to the PHYSICS project was followed up by the presentation on the PHYSICS Function-As-A-Service (FaaS) approach and the design environment for FaaS. In particular, the presentation discussed the characteristics of FaaS as well as the challenges of application development in the FaaS model. Then, it also introduced the audience to the PHYSICS Design Environment and patterns employed to support reusability, manageability and abstracted functionality.
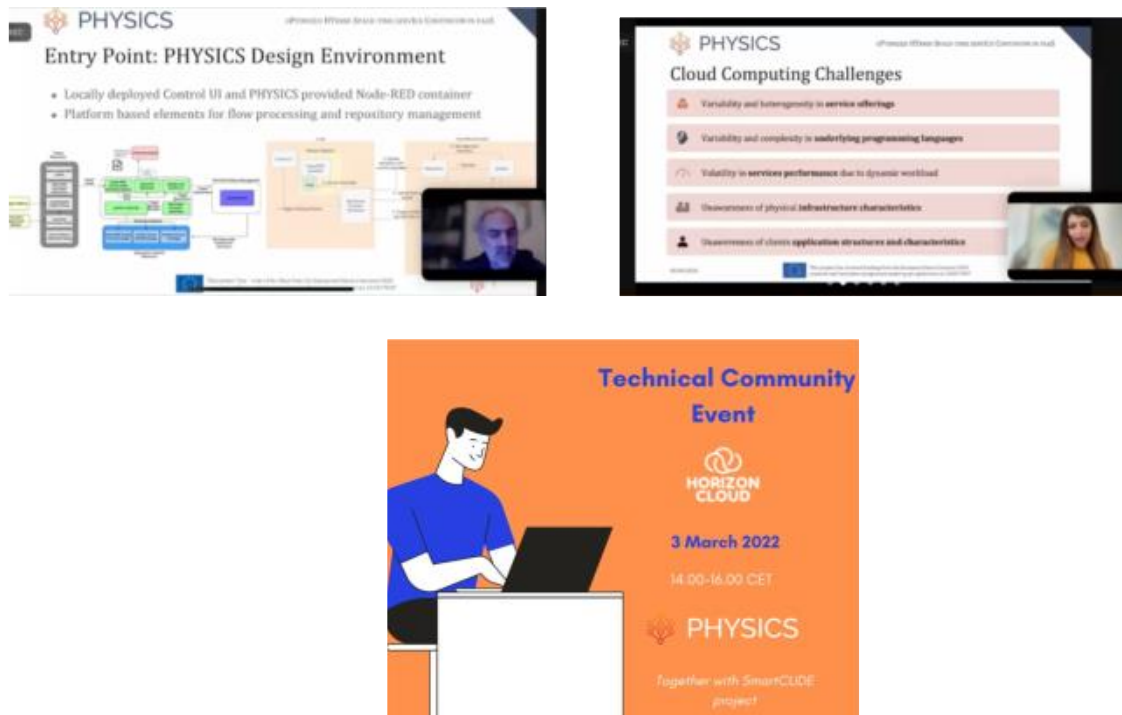
Figure 22 - Participation in the technical community event

● **Presentation to the "Innovationstag 2022" event organized by the "Technology Initiative SmartFactory-KL e.V".**

DFKI participated in the event "Innovationstag 2022" of the "Technology Initiative SmartFactory-KL e.V" (Figure 23) to evaluate **professional opinions** regarding the smart manufacturing use case. The SmartFactory-KL has nearly **50 different industrial and research partners** in its partner network which DFKI is part of. The presentation of the project at this event which takes place **once a year** was very successful.

Figure 23 - PHYSICS partner DFKI presented PHYSICS to the event

- **Red Hat talked at Devconf Europe about AI, Edge and Microshift, in January 28-29, 2022.**

PHYSICS partner presented **a live demo** of the Microshift project and performed at DevConf.CZ (Figure 24). DevConf is annual, free, Red Hat sponsored community conference for developers, admins, DevOps engineers, testers, documentation writers and other contributors to open source technologies. At DevConf.CZ, FLOSS communities sync, share, and hack on upstream projects together. DevConf. cz Mini is a bi-annual, highly focused, local, in-person version of DevConf.CZ. It offers an opportunity to return to our conference themes in a smaller setting and establishes a platform for the Czech Republic and EMEA based community to sync, share and hack on upstream projects together.

Figure 24 - Red Hat at Devcon Europe about AI, Edge and Microsoft

- **PHYSICS presented its manufacturing use case in the frame of the "IoT, Cloud, Edge Computing Continuum from Research to Deployment" webinar organized by EUCloudEdgeIoT**

The webinar aimed to bring together audiences with an interest in IoT, Cloud, Edge Computing. In particular the event aimed to present and discuss some of the important topics that can help to understand how this transformation can be achieved from research, policy and standardization point of view and what resources and collaboration is needed. The main topics of the webinar   covered by the event's agenda included: A common definition of edge topology, Key use cases for Edge Computing, APIs and standardization as an element for edge platform, Use of open source / Eclipse. Individuals from different projects presented from the perspective of ongoing EU funded projects in IoT, Cloud, and Edge continuum in the Horizon Europe program (UnlockCEI, OpenContinuum, HiPEAC), exploring how to build on AIOTI's experience on platform building and collaborate with those projects on open architectures, APIs and standards supporting an open, vibrant ecosystem perspective. The aim was also to demonstrate the latest implementations and showcase how several projects contribute in this domain through hands-on examples of use cases employed by different H2020 and Horizon Europe projects. In the frame of this activity, Niklas Franke presented the project's manufacturing use case on behalf of PHYSICS. The webinar took place on November 30th, 2022 and was organized by EUCloudEdgeIoT (Figure 25).

Figure 25 - Smart Manufacturing presented at the webinar "IoT, Cloud, Edge Computing Continuum from Research to Deployment"

● **Red Hat participated in Athens K8s Meetup: Microshift: a lightweight OpenShift for the Edge. Talk at the Athens K8s meetup to introduce Microshift**

● **Harokopio University of Athens participated in the webinar AI4PublicPolicy <> Physics, which was held on April 14-15, 2022. Approximately, 10 participants gathered in the webinar. The aim of PHYSICS participation was to enhance the collaboration and external entity involvement investigation.**

● **Harokopio University of Athens has been involved in Open Research Europe. Representatives of Harokopio University of Athens undertook the role of advisors in the Cloud Technologies topic.**

● **The Harokopio University of Athens has presented to the University the PHYSICS project. Significant key points of the project were analysed. The participants/ target audience was 30 pre-postgraduates.**

5. NEWSLETTERS

During the M12 – M24 period, the PHYSICS project has sent **9 Newsletters** to a valuable mailing list. The mailing list of the PHYSICS project has **143 members, who are relevant and interested** in the project. According to the KPI for newsletters, the goal was set to send at least 8 newsletters in the second year.

The average open rate for the Newsletters that have been sent in year two is 29.3% and the average click-through- rate is 30.3%.

11th Newsletter

Figure 26 - 11th Newsletter

The **11th Newsletter** was sent on 15th February 2022 and included an announcement about the participation of   PHYSICS at the H'Cloud Community event.

Table 5 - Statistics of the 11 Newsletter for 2022

Statistics	11th Newsletter: H-Cloud Technical Community Event X PHYSICS
Successful Deliveries	141
Total Opens	374
Clicks per Unique Opens	12.5%

Figure 27 - Top Locations | 11 Newsletter for 2022

12th Newsletter

Figure 28 - 12th Newsletter for 2022

In the **12th Newsletter** which was sent on 25th of February 2022, the latest PHYSICS updates such as blog posts of the project were presented. It is important to mention that the PHYSICS newsletter has a specific layout to achieve a branding identity and as a result, it is easily recognized by the users. At the end of the newsletter, there is also a mini video that calls the users to subscribe to the project on social media. This mini video is included approximately in all the newsletters.

Table 6- Statistics of the 12th Newsletter

Figure 29 - Top Locations | 12 Newsletter

Statistics	12th Newsletter: Hey! We've got special news! Take a look! 😵
Successful Deliveries	142
Total Opens	159
Clicks per Unique Opens	5%

13th **Newsletter**

Figure 30 - 13th Newsletter

The **13th Newsletter** was sent on the 1st of March 2022 and it was a friendly reminder about the H-Cloud Community event which was held on the 3rd of March. In this newsletter, a dynamic countdown was created which counts how many days, hours, and minutes are left until the webinar. This is the FOMO strategy which is about the fear of missing out on something, and it was used for this specific email to register.

Table 7-Statistics of the 13th Newsletter

Statistics	13th Newsletter: H-Cloud Technical Community Event X PHYSICS
Successful Deliveries	142
Total Opens	80
Clicks per Unique Opens	14%

Top locations by opens

🇺🇸	USA	39	**61.9%**
🇩🇪	Germany	6	**9.5%**
🇪🇸	Spain	6	**9.5%**
🇬🇷	Greece	4	**6.3%**
🇫🇷	France		

Figure 31 - Top Locations 13th Newsletter

14th Newsletter

Figure 32 - 14th Newsletter

The **14th Newsletter** was of high importance since it was sent on the last day of open registration to the next H-Cloud Community Event. This newsletter was sent on 2nd of March 2022.

Table 8 - Statistics of the 14th Newsletter

Statistics	14th Newsletter: H-Cloud Technical Community Event X PHYSICS
Successful Deliveries	142
Total Opens	94
Clicks per Unique Opens	23.4%
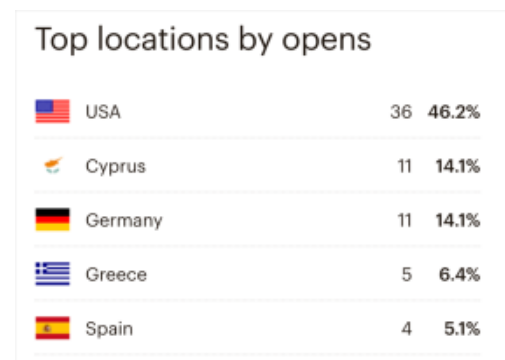
Figure 33 - Top Locations 14th Newsletter

15ᵗʰ Newsletter

*Figure 34 - 15th
Newsletter*

The **15th newsletter for 2022** was a brief update about the latest news of the project. In this newsletter it was   underlined that PHYSICS partners of the project were mentored through ELLAK, the Greek free and

open-source community, with a focus on implementing workflow, parallelization and cloud design patterns in Node-RED for Function as Service coordination. This email was sent on 29th of March 2022.

Table 9-Statistics for 15th Newsletter

Statistics	15th Newsletter: Get informed about PHYSICS' project! 😊
Successful Deliveries	143
Total Opens	66
Clicks per Unique Opens	7.3%

Figure 35 - Top Locations |15th Newsletter

16th Newsletter for 2022
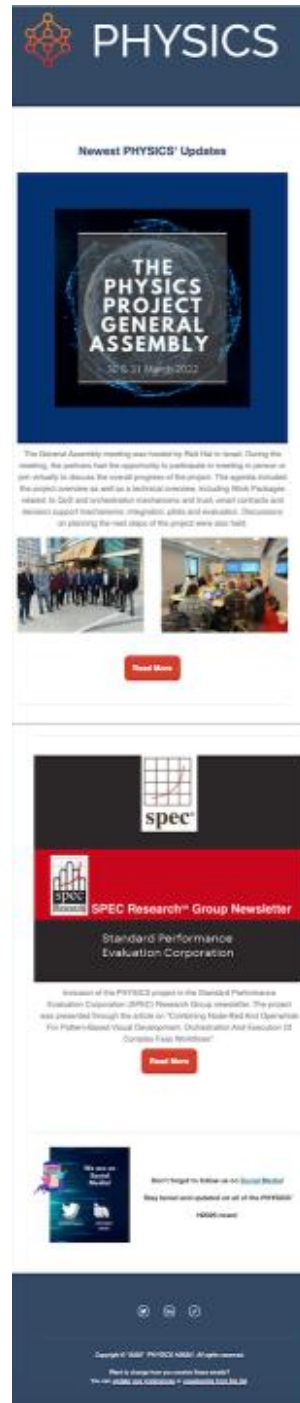
Figure 36 - 16th Newsletter for 2022

This newsletter was sent on 14th April 2022. It reported about the General Assembly meeting that was hosted by Red Hat in Israel, and the Inclusion of the PHYSICS project in the Standard Performance Evaluation Corporation (SPEC) Research Group newsletter.

Table 10-Statistics for 16th Newsletter

Statistics	16th Newsletter: 👉 G.A Meeting in Israel & 👉 PHYSICS has been included in the SPEC RG newsletter!
Successful Deliveries	142
Total Opens	66
Clicks per Unique Opens	8.9%

Figure 37 - Total Opens | 16th Newsletter

17th Newsletter

Figure 38 - 17th Newsletter

This was a more significant Newsletter because it announced the PHYSICS Marketplace. In the Marketplace the user can explore the provided solutions, tools, artefacts, and services based on their category. The newsletter was sent on the 10th of May 2022.

Table 11 - Statistics for 17th Newsletter

Statistics	17th Newsletter: PHYSICS Marketplace is on! 👏
Successful Deliveries	139
Total Opens	75
Clicks per Unique Opens	18.2%
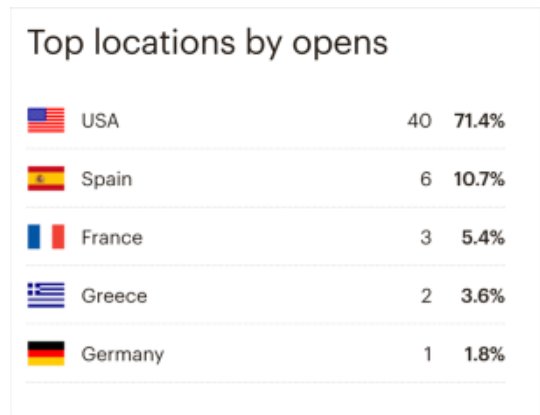
Figure 39 - Total Opens | 17th Newsletter

18th Newsletter

Figure 40 - 18th Newsletter

In **the 18th newsletter** sent on the 25th of October 2022, the blog posts and project news have been released, including   blog posts from the website as well as the midterm review meeting that was completed on September 20th, 2022.

Table 12-Statistics for 18th Newsletter 2022

Statistics	18th Newsletter: Do not miss PHYSICS updates!
Successful Deliveries	135
Total Opens	73
Clicks per Unique Opens	6%

Top locations by opens

🇺🇸	USA	30	51.7%
🇷🇺	Russia	7	12.1%
🇬🇷	Greece	4	6.9%
🇮🇹	Italy	4	6.9%
🇸🇪	Sweden	3	5.2%

Figure 41 - Top Locations | 18th Newsletter

19th Newsletter

Figure 42 - 19th Newsletter

The **19th newsletter** was sent on the 18th of November 2022. The scope of this newsletter was to introduce to the target audience the 1st hackathon organized by PHYSICS, as well as the participation of PHYSICS and CHARITY projects in the webinar entitled "Opening up the Cloud Edge Continuum to new generations of applications", which was held on 29th of November 2022.

Table 13-Statistics for 19th Newsletter

Statistics	19th Newsletter: Did you notice 👀 the latest PHYSICS' events?
Successful Deliveries	132
Total Opens	50
Clicks per Unique Opens	7.7%

Figure 43 - Top Locations | 19th Newsletter

Mailchimp

A fundamental pillar in PHYSICS communication is the creation of Newsletters. The newsletters refer to a specific target audience such as partners of the project, consortium members, and other interested users. So far at M24, we count **142 subscribers**.

Regarding the PHYSICS Newsletter campaigns' creation, the dissemination team uses the Mailchimp platform (Figure 44). Mailchimp is a polished, professional platform designed to help the execution of communication campaigns.
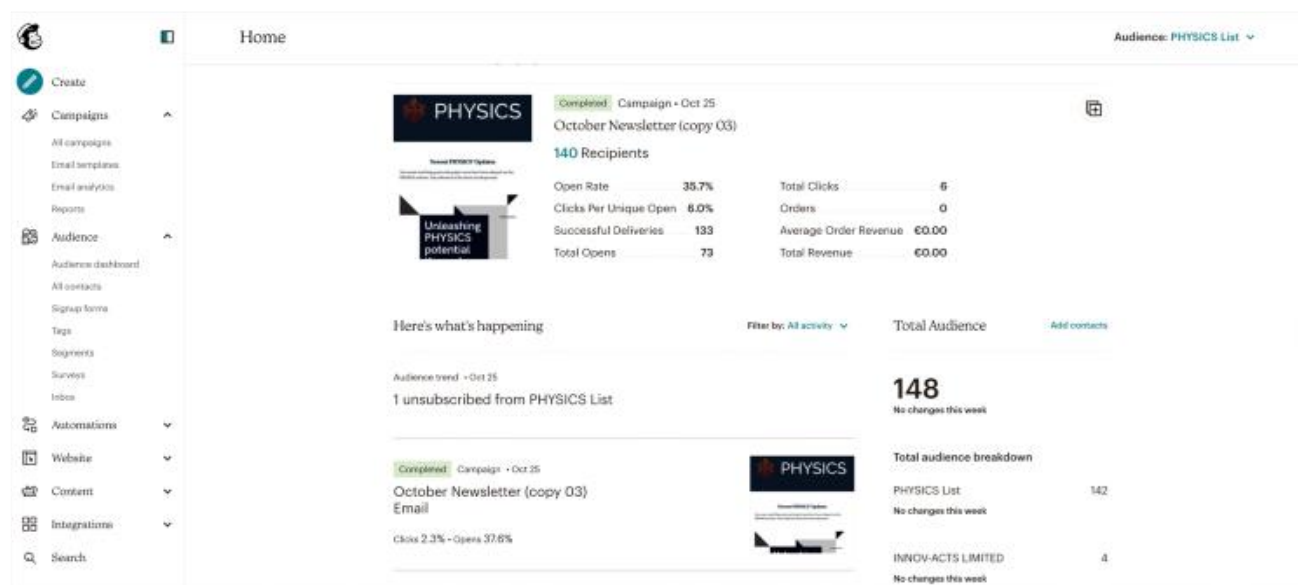
Figure 44 - Mailchimp Interface

Newsletters are one of the most powerful digital marketing tools since they let us communicate directly with the target audience. The newsletters tactic is one of the most significant personalized ways to deliver valuable content straight to the desired audience inboxes. Newsletters aim to raise awareness and share relevant and valuable information and results to PHYSICS' mailing list.

Given that the Mailchimp platform is a fundamental tool in the Dissemination process. It is now necessary to explain the ability to monitor the relative analytics such as open rate, total clicks, most clicked buttons or images, and total opens of the Newsletters that have been sent. These metrics are available via the reporting analytics tool of the platform used.

Figure 45 Developing a Newsletter campaign requires specific phases, eventually   leading to a successful Newsletter.
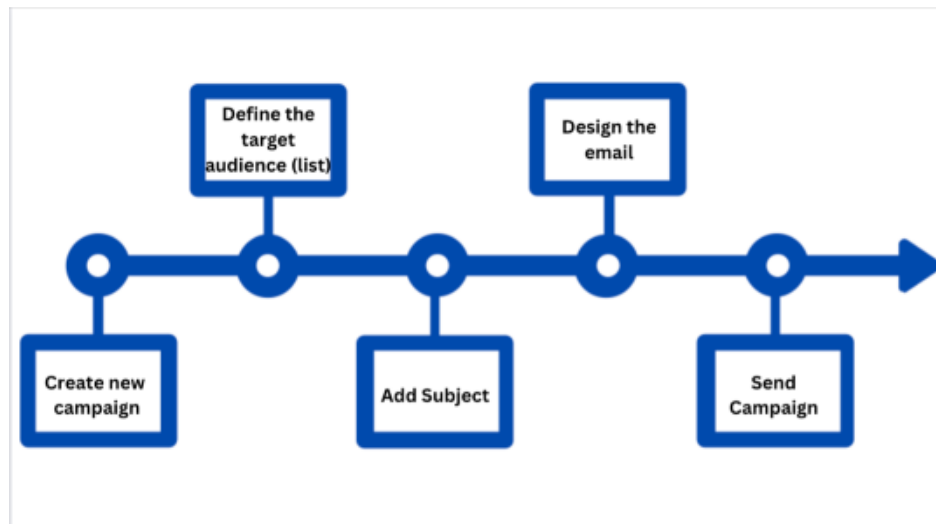
Figure 45 - The 5 steps to send the Newsletter Campaign

6. SOCIAL MEDIA

The PHYSICS H2020 Social Media strategy is focused on **Twitter** and **LinkedIn** and in July 2022 the project's **YouTube** channel was created and enhanced with relevant content.
Using these two platforms (Twitter and LinkedIn) a community has been established. The content refers to the target audience. Moreover, it is vital to regularly   engage with stakeholders, connect with relevant accounts, and promote regular news of the PHYSICS project and (virtual) events that PHYSICS H2020 is attending or organizing, as well as for the dissemination of the project's outcomes and updates.

In the first year, there were some relevant hashtags and topics with which users were able to interact on both social media channels. The goal was to increase outreach and awareness, while building upon a strong presence in these channels.

The digital footprint of the PHYSICS project has been established during these two years.

The social media of the PHYSICS project have regular updates. During the two years of the project, the publishing posts consist of a fresh graphic with a specific layout, which is suitable for the purpose of each post. Additionally, every post uses the PHYSICS logo, as promoting branding awareness is vital for the project. Furthermore   , every post has a text with an appealing call to action (CTA), which guides users to relevant material on the PHYSICS H2020 website or at a partner's event. Social media posts generally point to news articles, events, or publications posted on the PHYSICS' website.

The hashtags which were used, are the following: **#cloudcomputing, #faas, #physicsh2020, #edge_computing, #Function_as_a_Service, #H2020PHYSICS, #cloudcomputingservices**

: https://twitter.com/H2020Physics

: https://www.linkedin.com/company/physicsh2020/

An official PHYSICS YouTube account is already set up and valued content has been included.

- : https://www.youtube.com/channel/UC1otUEHDmUGNmsdcBw6QFsA

As depicted in the Table 14 - Statistics from Social Media (Data retrieved on December 7th, 2022), there was an increment in the number of followers.

Table 14 - Statistics from Social Media (Data retrieved on December 7th, 2022)

Medium	Followers 2022	Followers 2021
Twitter	138	97
LinkedIn	105	67

Twitter

The Twitter channel gained 41 followers during the second year of the project. Regarding the online strategy of the Twitter account, the PHYSICS account retweets every working day a tweet that is related to the content of the project, such as cloud computing, and FaaS.

The project's network of collaborators is also further contributing to the engagement of the community as plenty of accounts have retweeted some of our posts and other accounts have mentioned the project in their posts, as depicted in the Figure 47 below.
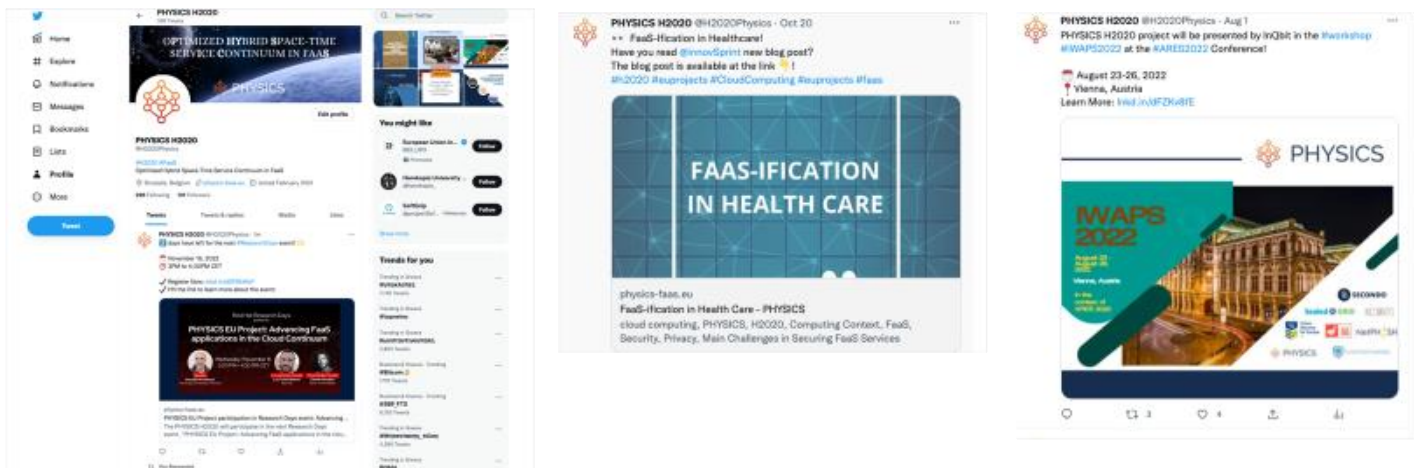
Figure 46 - Samples of Twitter Posts

Table 15 also includes some examples of mentions on Twitter associated with the PHYSICS project:

Table 15 - Examples of mentions of other accounts on Twitter

Organization	Date	Link of the post
H2020 SECONDO	Jul 26 2022	https://twitter.com/H2020Secondo/status/1551890749876224000
INNOVACTS Ltd	Jun 14 2022	https://twitter.com/InnovActsLtd/status/1536683487817760770
HORIZON CLOUD	May 19 2022	https://twitter.com/HCLOUD_Project/status/1527246988554665986
HORIZON CLOUD	Feb 18 2022	https://twitter.com/HCLOUD_Project/status/1494651828017025027

SealedGRID	Sep 02 2022	https://twitter.com/SealedGRIDH2020/status/1565721544705409024

Figure 47 - Examples of mentions

The project's account on Twitter includes a plethora of posts made during Year 2, which aimed at engaging and informing the PHYSICS community. Table 16, reports on the project's top tweets during this time as reflected through the number of impressions, engagement, and engagement rate.

Table 16 - PHYSICS Top Tweets

Top Tweets sort by Impressions	Impressions	Engagements	Engagement rate
	439	26	5.9%
	276	26	9.4%

PHYSICS H2020 @H2020Physics · Mar 1 👋 Mark your calendars! 📝 Interested in the latest cloud solutions across design, deployment, and operations? Do not miss the #Technical_Community_Event by @HCLOUD_Project! 🟠 3rd of March 🟠 14:00 - 16:00 CET 🟠 Register Now: lnkd.in/dyxcQkdD @SmartCLIDE pic.twitter.com/6TPAn2cJBG	251	19	7.6%
PHYSICS H2020 @H2020Physics · Mar 31 Take a look 👀 at what happened on the 1st day of the PHYSICS H2020 project General Assembly at @redhatopen, #Israel. Our project coordinator, @FabrizioDiPeppo presented the PHYSICS project to the Red Hat staff during lunchtime. pic.twitter.com/gkV89wT1s9 View Tweet activity	206	17	8.3%
PHYSICS H2020 @H2020Physics · Jan 24 📅 3 March 2022 ⏰ 14:00 - 16:00 CET @HCLOUD_Project Technical Community Event with @SmartCLIDE and #PhysicsH2020 research projects! ⏳Register now: bit.ly/3qSVVS2 twitter.com/HCLOUD_Project…	174	9	5.2%

LinkedIn

In Year 2, PHYSICS has further developed its community on the LinkedIn platform. (Figure 48)

In particular, the demographics of the LinkedIn followers show that the project has attracted audience from different locations worldwide, including **Greece (18.2%)** and Italy, Milan (7.1%) and Genoa (5.1%) and in the following position   Greater Madrid Metropolitan Area, Spain (3.8%). (Figure 50). Regarding the business field of   the followers on PHYSICS LinkedIn page, 22,2% of PHYSICS' followers, as presented in Fi, are engineers, a percentage of 11.1% are researchers and 10.1% are working in business development (Figure 51). We can also notice differences in the target audience of the page. In both years, the LinkedIn page has a quality targeting the specific audience.
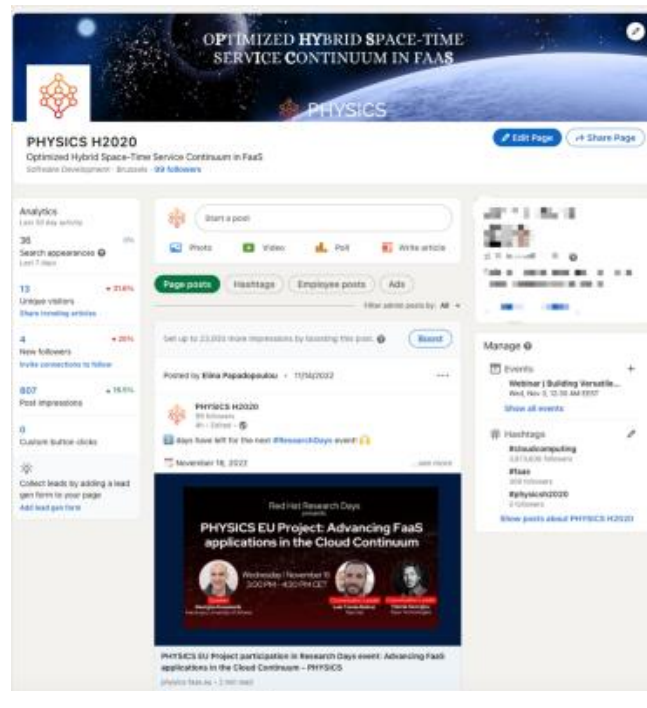
Figure 48 - LinkedIn Homepage

Figure 49 illustrates some samples of the LinkedIn posts.
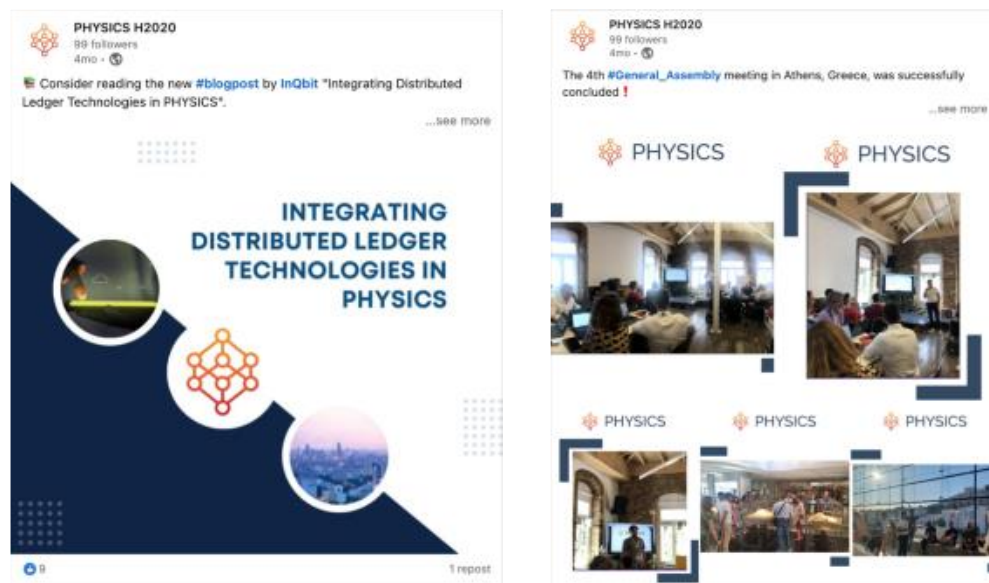
Figure 49 - Samples of LinkedIn Posts
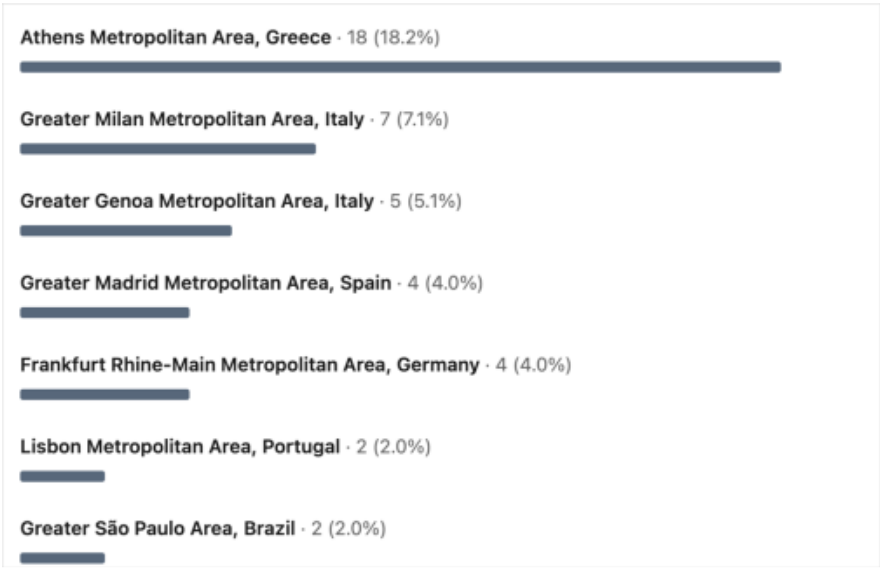
Figure 50 - Followers' Demographics
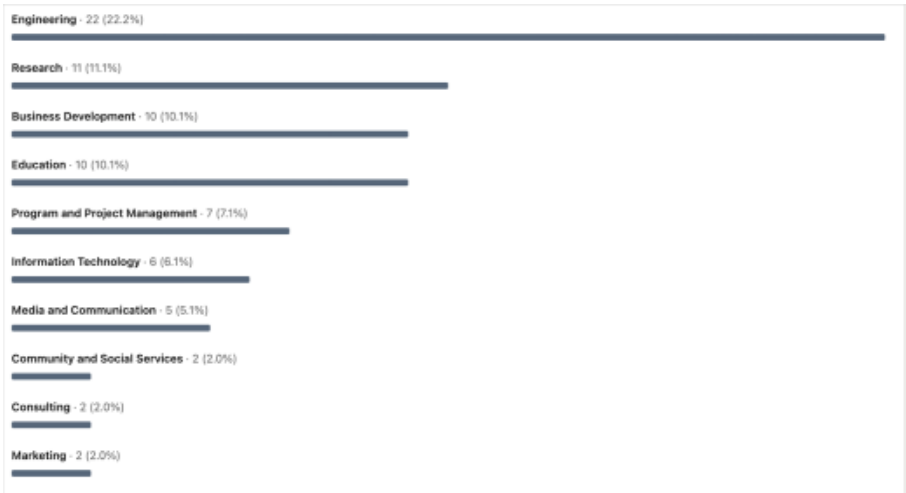
Figure 51 - Job Functions

YouTube

In Year 2, the project also created a YouTube channel to further inform its community through video content. The PHYSICS YouTube channel   promotes vision, techniques, and objectives, but also promotes and ensures enhanced visibility of the target audience and engaged stakeholders.

Although the PHYSICS YouTube channel was   created only on July 15th, 2022, it currently includes 15 subscribers. According to Figure 52 there are 43 total views and 799 times the audience has watched the videos. The impression click-through rate is 3% (any rate higher than 2% is above average).
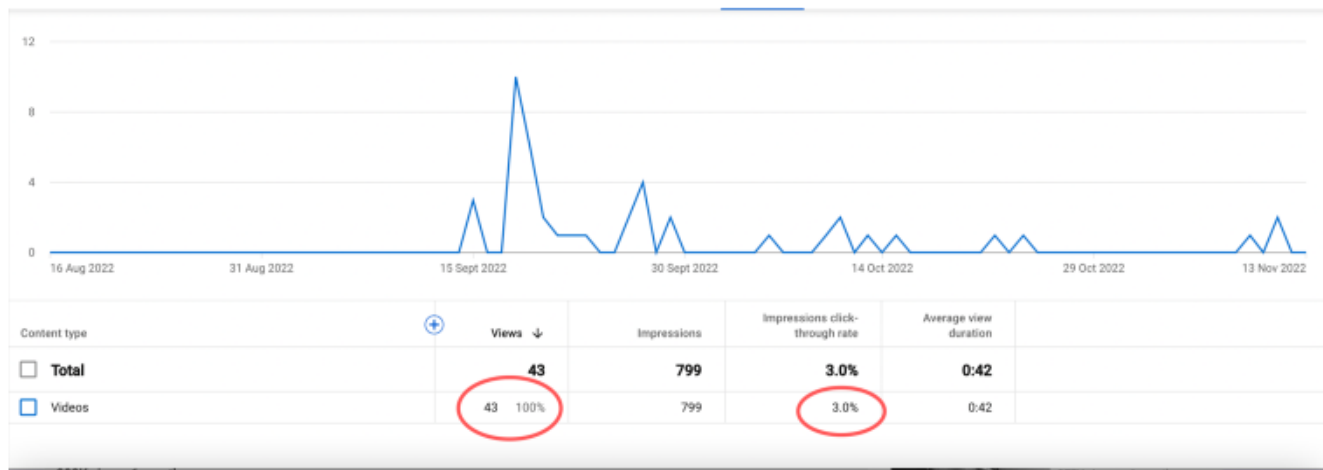
Figure 52 - YouTube Statistics

By this time PHYSICS YouTube channel contains **23 videos**. This list includes 12 which are part of the project's "Interview series", as they concern the presentation of the partners and their role in the project. Additional content encompasses   recordings from PHYSICS events and demonstrations of project's results such as "Design Environment on PHYSICS platform", "Load Generator Node-Red Flow", a recording of the PHYSICS event Building Versatile Serverless Applications Across the Cloud Edge Continuum". Some of these are illustrated in Figure 53.
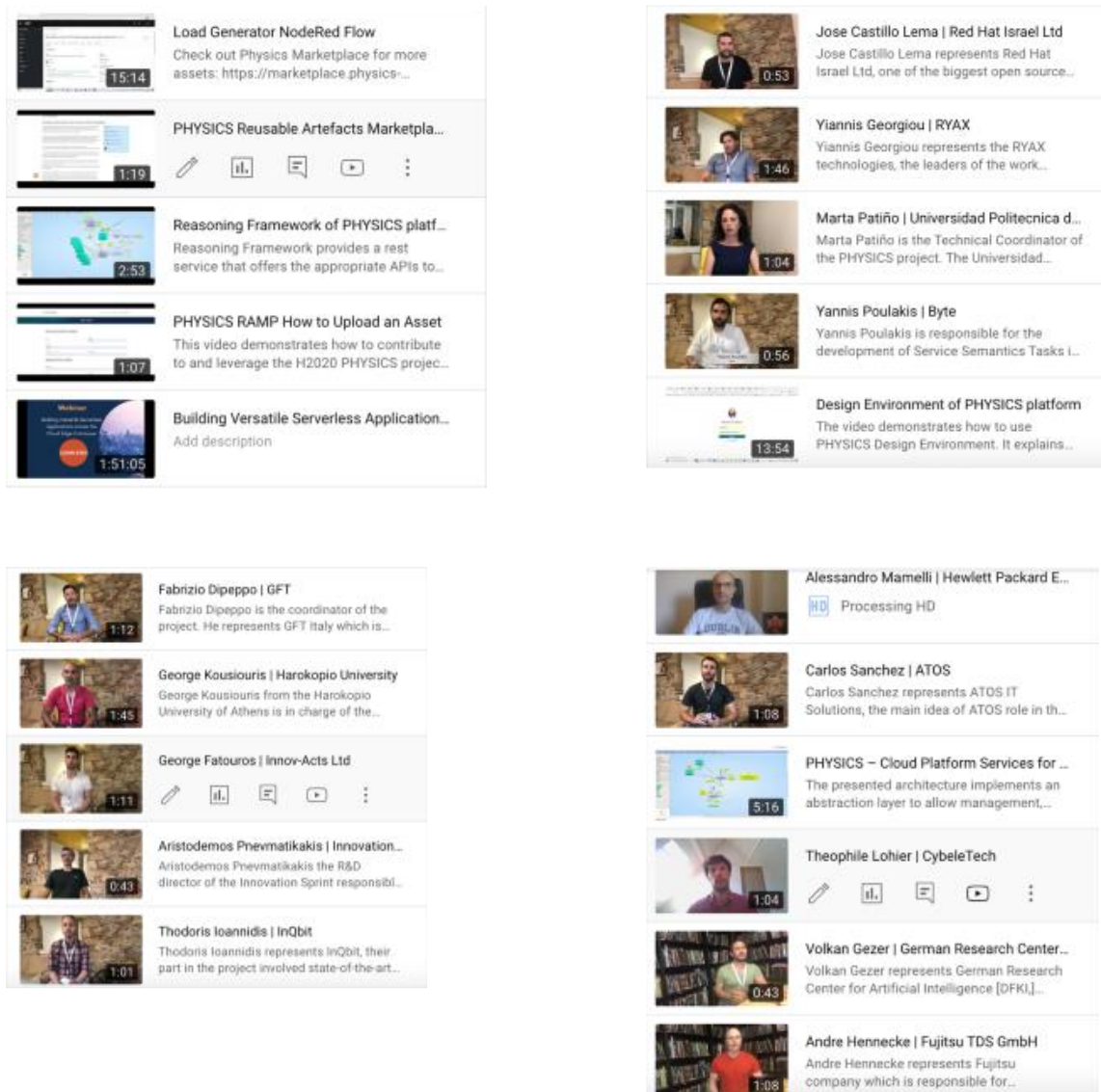
Figure 53 - Overview of YouTube videos

7. CLUSTERING WITH OTHER PROJECTS

The PHYSICS project explores other means of communication and dissemination to broaden the public's awareness of the project and its results. The clustering with other projects is fundamental in raising awareness of the PHYSICS results and added value for potential adopters.

Clustering: a major objective of the PHYSICS project is to build and promote synergies with other existing European initiatives and networks and with similar European projects funded under the same call.

Here is the updated list for the second year of the project:

- **CHARITY:** aspires to leverage the benefits of intelligent, autonomous orchestration of cloud, edge, and network resources, to create a symbiotic relationship between low and high-latency infrastructures that will facilitate the needs of emerging applications. These intelligence tools, that potentially tackle any kind of highly interactive class of services and applications, will be validated against a wide class of highly anticipated applications characterized by extreme levels of interaction and data exchange between the end users and application components, i.e., AR, VR and Holography applications.

Figure 54 - PHYSICS participating in CHARITY

● **SWForumEU:** Sustainable European forum to strengthen the competitiveness of the European Software Industry - European H2020 project.

Figure 55 - PHYSICS participating in SWForumEU

● **THE EUROPEAN CLOUD, EDGE AND IOT CONTINUUM**: EUCloudEdgeIoT.eu aims to realise a pathway for the understanding and development of the CEI Continuum by promoting cooperation between a wide range of research projects, developers and suppliers, business users and potential adopters of this new technological paradigm.

Figure 56 - PHYSICS participating in the EUROPEAN CLOUD, EDGE AND IOT CONTINUUM

● **HORIZON CLOUD:** a European Commission initiative that aims to consolidate and grow the Cloud Computing research and innovation community in Europe. To achieve this ambition, HORIZON

CLOUD brings together innovators, policymakers, Cloud Computing researcher, industry players, and users into an open, participatory, and sustainable forum. HORIZON CLOUD provides a rich set of collaborative content, tools and actions to overcome fragmentation and increase collaboration in Europe and beyond, while aligning on a common direction to help create a Cloud agenda for the future of Europe. https://www.h-cloud.eu/. In this collaboration, PHYSICS participates in monthly meetings reporting on its current and forthcoming project activities and dissemination plans.

Figure 57 - PHYSICS participation in HORIZON CLOUD

8. PHYSICS DISSEMINATION AND COMMUNICATION IN THE NEXT YEAR

In the next year, and as the project reaches greater maturity, the communication and dissemination activities will be enhanced to raise awareness on the project results and guide the community on how to utilize and extract value from the project outcomes. In particular, online content will be enriched with more blogposts, YouTube videos with content emphasizing on results and on how-to videos of the marketplace. Additionally, the project's publication list is expected to grow by targeting a number of high-quality conferences, workshops and book chapters. Newsletters will continue to hold an important role as they will be the channel that will directly inform the target audience on the project's end results. At the same time, as the project has reached a certain level of maturity, additional events will be organized including demos, hackathons, use case workshops to facilitate and drive uptake through early trial testing. Table 17 provides an indicative list of activities that will be targeted regarding the different target audiences and the project's dissemination tactics and goals.

Table 17-PHYSICS next year

Channels and activities	Target audience	Tactics and goals
Social media	Researchers, Industries (IT, Cloud) General public, Scientific community, Innovators (early adopters)	YouTube: YouTube channel will have a fundamental scope in the next year of the project. The valuable video content will include interviews, webinar videos, and how-to videos of the marketplace.
		LinkedIn, Twitter: PHYSICS H2020 has a growing social media network, with connections that count. To increase the engagement of the LinkedIn platform, and the website traffic and to further disseminate the project we can run a LinkedIn campaign.
Newsletters	Researchers, Industries (IT, Cloud), Scientific community, Innovators (early adopters), Policy makers	All of the project's newsletters are sent in a specific list (with 143 subscription members). The Newsletter campaigns will be enhanced with the dissemination of YouTube videos and Marketplace Assets. Partners will also further disseminate the newsletters in their channels.

Events	Researchers, Industries (IT, Cloud), Scientific community, Innovators (early adopters), General public, Policy makers	Hackathon 2: When: Spring 2023 Technical Partners Involved: Harokopio University of Athens Hackathon 3: When: Spring 2023 Technical Partners Involved: Red Hat UC Workshop & Demo 1: When: Spring/Summer 2023 UC Workshop & Demo 2: When: Spring/Summer 2023 Use Case Involved: CYBE UC Workshop & Demo 3: When: Summer/Fall 2023 Use Case Involved: I-SPRINT
		EUCloudEdgeIoT task force joint activities such as the organization of an internal Cloud workshop for presenting the project. Participation/Presentation events and conferences of the field such as CloudExpo 2023, CCGrid 2023 conference, etc. Explore the organisation of joint events with other Horizon Cloud projects
Publications	Researchers, Scientific community	As more results are expected to be released in Year 3, the project aims at identifying and submitting research papers to scientific conferences and journals of the field e.g., CCGrid'23, CloudCom'23

Blog posts	Researchers, Industries (IT, Cloud) General public, Scientific community, Innovators (early adopters)	All the partners will contribute to the blog of the project by preparing blog posts in the third year of the project.
Marketplace	Researchers, Industries (IT, Cloud), Scientific community, Innovators	Enhanced with more valuable assets and boosting dissemination towards relevant communities (e.g., Italy Technology Show Room Centre and the HPE Business Units) Further promote the results aiming to maximize impact to targeted stakeholders (e.g., PLANETIC, the Spanish ICT platform). Furthermore, the plan for the next year includes providing support for the platform's beta testers during their usage of the environment and other artefacts (Node-RED flows etc). In parallel, as for the future steps, more subflows as npm nodes will be published, and their usage by the community will be monitored.

9. STANDARDIZATION & OPEN-SOURCE ACTIVITIES

As stated in the previous deliverable (D7.2) the main target of PHYSICS is to contribute to standardization mainly through contributions to relevant upstream open-source projects and their communities, which represent de-facto software standards. For example, by contributing to Kubernetes which is the de-facto standard for container orchestration.

During the first year of the project (D7.2) the focus was on identifying the initial set of standardization bodies and open-source projects that were relevant to PHYSICS, and defining our approach on how to get engaged and contribute to them. During the second year of the project, thanks to having a more clear and defined architecture, more contributions have been made as well as further alignment with them. That said, we foresee an even bigger impact on the last year of the project. In addition, the project continues keeping close track of relevant upstream projects to ensure alignment with them as well as to join forces when possible (the knative example is presented later in this section).

In order to keep track of the partners record and interests on this matter, we are maintaining a template where the different partners are recording both their contributions (both upstream code and community engagement) as well as the future/tentative plans. Table 18 and Table 19 summarize all relevant contributions.

PHYSICS is contributing to open source in different ways:

- releasing complete components as open source, in public git repositories
- identifying relevant upstream communities/projects where part of the PHYSICS contributions can be targeted
- working on creating new communities around new/starting projects
- Collaborating with upstream communities in bug identification and individuation of missing features, investigating the possible options to address them
- Enriching collections of available artifacts in existing and widely used open-source projects

As part of the above, we have been working closely on the [Submariner](#) project (multicluster Kubernetes interconnect), as well as the new incubation project for a low footprint Kubernetes ([uShift](#)) which targets the low footprint resources at the edges. We plan to continue that path, and for instance help with adding support to manage those edge nodes in a centralized manner via [Open Cluster Management](#). We have also contributed to the flow repository of Node-RED as well as the npm node repository.

In addition to that, Red Hat organized an *"open-source workshop"*, where all PHYSICS partners were present, whose topic was about how to contribute to open-source communities. The main idea behind this workshop was to take advantage of Red Hat's "know-how" working with open-source communities and projects and use it to guide the PHYSICS' partners to either contribute to existing projects or build their own one and bring attention to it, creating a community behind. One of the main intentions for this is to try to make software components that outlive the project duration and make a bigger impact.

The next table details the information about the open-source contributions already or in progress.

Table 18 - Open-source contributions.

Leading partner	Upstream project	Contributions	Ongoing Contributions
Red Hat	Open Cluster Management	- Submariner integration: discussions with submariner folks related to its integration - Report issues related to cluster upgrades and uninstall process	- Add support for MicroShift cluster in remote locations
Red Hat	MicroShift	- Testing and helping to mature this k8s distro for low-footprint/edge devices - Support for other devices, such as raspberry-pis - Integration with Submariner (related to the CNI and submariner, see submariner block)	- Integration with Open Cluster Management
Red Hat	Submariner	- Several bug reports, which also lead to upstream documentation. - Discussions about how to fix or reproduce the issues with the community and bug fixes. One example is the support for ovn-kubernetes CNI, which was broken. We identified the problem, and report the solution for it: - https://github.com/submariner-io/submariner/issues/1608 - https://github.com/submariner-io/submariner/issues/1631 - Integration with Open Cluster Management, also working on bug reporting and fixing - https://github.com/submariner-io/submariner/issues/1625 - Integration with MicroShift, by supporting different CNIs, such as weavenet: - (bug report) https://github.com/submariner-io/submariner-operator/issues/2144 - (fix) https://github.com/submariner-io/submariner-operator/pull/2146	- For now, everything we need is there, until we find another issue. If that is the case, we will work together with the community to fix it and support the PHYSICS use cases
HUA	OpenWhisk	Issue reporting with relation to cold start error messaging: https://github.com/apache/openwhisk/issues/5359	
Innovation Sprint	WOOL Platform	The WOOL Platform is an open-source platform for authoring and executing	Investigating

		dialogue-based interactions between users and virtual agents. In the eHealth use case, such dialogue-based interactions play a role in the delivery of virtual coaching to users of the Healthentia platform. Contributions from the PHYSICS project may be made to various server-side WOOL components to allow deployment on FaaS-platforms.	
HUA, INQ	Node-RED flows repository	HUA is contributing flows and subflows related to functionality created in the context of the PHYSICS project (e.g., patterns, controlling flows, created nodes etc.) INQ develops ready to use flows for security and privacy functionalities that will be used in the PHYSICS projects.	Contributed 9 flows as part of the PHYSICS collection in https://flows.nodered.org/collection/HXSkA2JJLcGA, expected to increase the number in Y3
BYTE, INNOV, HUA	Ontology Repository	The PHYSICS ontologies are provided openly in the RAMP or/and W3 repository which contains a variety of ontology repositories.	Working on developing updated version of them
UPM	Pocket project (own repository)		The Pocket project will be enhanced with consistency properties
UPM	Co-allocation strategies component		- algorithm for deciding the most suitable deployment of a function in a cluster according to the requirements of the workflow it belongs to and the current resource consumption
RYAX	Kubernetes	- Developed a new Kubernetes scheduler to consider the different layers of the container images while deciding the node, to minimize its starting time (less time needed to pull the image). This has been provided as open source in RYAX public repositories.	- Working with Kubernetes Scheduler SIG to fully upstream the efforts and make it available in each Kubernetes installation
BYTE, INNOV	Physics semantic component: https://github.com/yannispoulakis/physics_semantics_block	Both BYTE and INNOV ACTS contribute to the semantics block that is part of PHYSICS, provide the code as an open-source project in GitHub	- Working on new enhancements

| HUA | NPM repository contributions | Npm is considered the largest code repository in the world. HUA is contributing some of the Node-RED subflows in npm, packaged as regular Node-RED nodes. Compared to the subflows version, the npm nodes are more discoverable, automatically installed and tracked related to their usage (downloads per week are counted). However, they cannot be changed/adapted by the respective user, in comparison to the subflows way of packaging. Thus, a subset of the created flows is expected to be offered through this packaging manner | At the moment 1 subflow has been packaged in this way (https://www.npmjs.com /package/node-red-contrib-owmonitor), but this number is expected to increase in Y3. |
| ATOS | PHYSICS FaaS Orchestrator | Translate deployment information into Kubernetes-native format so it can be processed by OCM

Deployment according to OpenWhisk standards

Connect cluster functions using backend URLs provided by Submariner | Refinement of the extensions for OCM enhanced functionalities. |

Besides the code contributions (of several types   : code, bug fixes, bu   g reports, discussions with community members, …) we have also pushed for standardization through engagement in upstream/community activities. During the first year of the project, we already did some presentations, but in this second year more contributions have been done. The complete list is detailed in the next   Table (Table 19). One example to highlight was the talk about the PHYSICS project presented at the Red Hat Research Days (November 16th, 2022), where both Red Hat engineers and researchers around the world join together to present the result of fruitful collaboration and exploit the synergies betwe en both groups. As a result of this talk, we were contacted by one of the groups working on developing Knative (https://knative.dev/docs/), an open-source solution to build Serverless and Event Driven Applications. This started a collaboration with them, focusing on what they can   learn from development done in PHYSICS projects as well as the other way around, issues that they have already solved and how we could leverage them. One of the initial results of this collaboration is the installation of Knative in our testbed and initial design of using it together with our current choice (OpenWhisk).

Table 19 - Open-source community engagement activities.

Partner	Activity/Event	Description of the activity	Status/Year
Red Hat	Kubernetes meetups	Present some of the contributions made as part of PHYSICS at local Kubernetes in Athens	Two presentations made: - Submariner (Year 1) - Microshift (Year 2)

Red Hat	OpenStack Project Team Gathering, Slack, IRC, mailing list	Involvement in upstream development communication tools and gatherings. Sync on the best way of doing feature X, maximizing their impact and adoption.	Actively involved in all of them, and in several projects: - Submariner (since Year 1) - OCM (since Year 1) - MicroShift (since Year 1) - Knative (since Year 2)
Red Hat	Presenting and attending big community events such as Open Infra Summit and/or Kubecon	Present relevant PHYSICS related components in their relevant community gatherings	Already attended the OpenInfra Summit (Year 2) Also, talk submitted to KubeCon, waiting for aceptance/rejection decision
Red Hat	DevConf	Present PHYSICS contributions on the DevConf conference (open-source community conference)	Talk about submariner (https://www.youtube.com /watch?v=-HE9iq34Zj8, Year 1) Talk about microshift (https://www.youtube.com /watch?v=qwTGn8Iyp4k&t =1s, Year 2)
Red Hat	Blog post at research.redhat.com	Blog post about Red Hat role at Physics at https://research.redhat.com/blog/research_project/physics-optimized-hybrid-space-time-service-continuum-in-faas/ As well as about the GA gatherings: https://research.redhat.com/blog/2022/04/14/the-third-physics-project-general-assembly-meeting/ https://research.redhat.com/blog/2022/09/20/physics-4th-general-assembly-held/	Several blogposts and press releases completed during Year 1 and 2
Red Hat	Red Hat Research Days	Research Days are virtual and in-person events that showcase the research initiatives Red Hat supports at various universities and research institutions	We presented the PHYSICS project in the November edition (Year 2) https://research.redhat.co

		worldwide. It aims to connect researchers with Red Hat engineers, customers, and partners, to move great research ideas into open source communities.	m/events/research-days-physics/
Red Hat	Knative community	After the Red Hat research day talk, we got contacted by Knative community to foster collaboration and benefit both projects	Collaboration started, as part of it we are evaluating the suitability of also supporting Knative at PHYSICS, to also take advantage of its better integration into Kubernetes (compared to OpenWhisk)
HUA	Greek FOSS community	Meeting completed. HUA is leading the work on the group on open source software and open standards (https://opensource.ellak.gr/, https://openstandards.ellak.gr/) and is coordinating relevant actions in the context of the project activities and scope.	One meeting completed (Year1), focus on taxonomy of open-source tools, inclusion of cloud related topics
HUA	HUA Student Community	HUA engaged with the student community during the 1st project hackathon. 1 external artifact has been contributed to the project following this action. Furthermore, 1 more external artifact has been contributed, as a result of B.Sc. thesis mentored by HUA participants in PHYSICS	The activity is expected to be repeated in the next hackathons of the project in 2023. Further relevant thesis are expected to be issued in 2023
HUA	Google Summer of Code Mentoring	HUA through its participation in GFOSS completed the mentoring of a student in Google Summer of Code 2022. The resulting implementation contributed also back to the PHYSICS RAMP 4 software artefacts (Node-RED flows)	1 completed in 2022, expect to perform 1 more for GSoC 2023

Next Steps

In the last year of the PHYSICS project, we will

- Continue with the ongoing activities, such as participating in relevant research and upstream projects (community) events. Examples for this are local kubernetes gathering, Greek FOSS, or project team gatherings (such as Open Infra PTGs). This will allow to more extensively promote project results.

- Participate and presenting (if talks gets accepted) in big community events, such as Open Infra Summit, DevConf, or KubeCon. This will ensure alignment with upstream communities even if the talks are not accepted.

- Continue with the work on blog posting to increase awareness for the solutions developed by PHYSICS and create a larger community around them

- Focus on contributing part of the PHYSICS components to their relevant communities. The clearer example is the work being done towards integrating the developed Kubernetes scheduler into Kubernetes, by following the steps established by the upstream community, in this case the Kubernetes Scheduler SIG (Special Interest Group).

These activities are also described in the next Table (Table 20).

Table 20 - Future activities.

Partner	Activity/Event	Description of the activity	Target
Red Hat	Kubernetes meetups	Present some of the contributions made as part of PHYSICS at some local Kubernetes meetups	Try to present another PHYSICS related component
Red Hat	OpenStack Project Team Gathering, Slack, IRC, mailing list	Involvement in upstream development communication tools and gatherings. Sync on the best way of doing feature X, maximizing their impact and adoption.	Continue active involvement, with special focus on Knative community
Red Hat	Participating in Open Infra Summit and/or Kubecon	Present relevant PHYSICS related components in their relevant community gatherings	Continue to attend those venues and present on them if talks get accepted (high competitive ones)
Red Hat	Red Hat Research Days	Research Days are vitual and in-person events that showcase the research initiatives Red Hat supports at various universities and reserch institutions worldwide. It aims to connect researchers with Red Hat engineers, customers, and partners, to move great research ideas into open source communities.	Target another presentation with newer results from PHYSICS
Red Hat	DevConf	Present PHYSICS contributions on the DevConf conference (open-source community conference)	Target to have another talk or a hackathon related to PHYSICS
Red Hat	Blog post at research.redhat.com	Write blog posts on related topics	Write more blogpost about PHYSICS and its events
Red Hat	Upstream projects	Contributing with code, bug reports, fixes and discussions to the relevant upstream projects: - Submariner - OCM - MicroShift - Knative	Continue contributing to those projects

HUA	Greek FOSS community	Coordinate relevant actions in the context of the project activities and scope	Continue to participate, aim at presenting more results once the project matures
BYTE, INNOV	Physics semantic component: https://github.com/ yannispoulakis/phys ics_semantics_block	Both BYTE and INNOV-ACTS contribute to the semantics block that is part of PHYSICS, provide the code as an open-source project in GitHub	Continue
BYTE, INNOV	Blog Post	Blog post in the scope of metadata management for the deployment of serverless applications in multi-clouds using the semantic representation of both cloud resources and application descriptions.	Planned
INQ	Blog Post	We plan to create a blog post about the utilization of cybersecurity and privacy in the context of FaaS architectures. This will be a complementary post that we have already made in https://physics-faas.eu/main-challenges-in-securing-faas-services/ and it will include examples of the usage of readily available security and privacy functions in such use cases alongside their challenges.	Planned
UPM	Lectures	Presentation to master students of the FaaS model, technical challenges and the PHYSICS platform	Planned
RYAX	Kubernetes	Contribute the Kubernetes Image locally ti aware scheduler to Kubernetes (Scheduler SIG)	Follow the upstream way to provide the contributions and make them available at Kubernetes repositories
HUA	Lectures and Demos	Presentation to B.Sc. and M.Sc. students of the FaaS model, performance challenges and design patterns as well as functionality from the PHYSICS platform (DE, load generation, performance monitoring etc.)	Implemented in Y2, planned to continue in Y3
ATOS	Blog Post	Post on FaaS and Serverless Orchestration	Planned
ATOS	Software Release	Extended functionalities from OCM so it can be easily integrated with other tools	Ongoing

Finally, as regards to standards, PHYSICS continues to:

- nurture standardization by contributing to de-facto (software) standards, such as Kubernetes.
- participate in the SPEC Cloud WG (HUA) and to activities around serverless architectures, methodologies and evaluation processes, resulting in common publications and reports.
- investigate the chance to include results into GAIA-X.

10. CONCLUSIONS

The present deliverable is an updated version of D7.2 –COMMUNICATION, DISSEMINATION, AND STANDARDIZATION PLAN AND ACTIVITIES V2. The deliverable underlines all the processes done during the 2-year of the PHYSICS project.

Overall, the project's dissemination and communications activities are aligned with the project's plan, hence we can conclude that our dissemination efforts are on track. Dissemination and communication at project level are running on a weekly basis and the progress made by the consortium is visible to the community; project partners are actively participating in its communication and dissemination activities. Through monitoring the set of communication and dissemination KPIs, we can keep track of the progress and quickly identify which activities might need more attention.

Table 21 illustrates the project's performance towards its key KPIs under the tasks reported in this deliverable.

Reflecting on the results of the first year and second year of the project:

- During its first 2-year timeframe, the project achieved a high visibility, accessibility, and promotion of its results.

- WP7 activities in Y2 have been intensified and produced tangible results. This was fostered by the fact that overall the project reached greater maturity and more project results could be disseminated to the different audiences.

- The dissemination and communication activities encapsulated a plethora of approaches aiming to reach different communities including: i) publications to journals and proceedings of conferences, ii) presentations of dedicated project results to scientific, conferences and events, iii) organization of webinars, events, and hackathons, iv) participation in webinars, events and hackathons, and v) synergies with relevant projects.

- The dissemination and communication strategy were not only supported by the project's own activities Social Media Channels (Twitter, LinkedIn, YouTube), newsletters, presentations, and webinars, but also through synergies with other projects which also contributed to boosting visibility to a wider audience.

Table 21 - PHYSICS KPIs Y2

Measure	Means	Target KPI	Y2 Achieved Goals[1]
Monthly Web content	Identify and publish new content on a regular basis.	· YR2: min. 3/month,	2-3 blog posts per month were published on the website
In-house newsletters	Produce and circulate monthly newsletter based on stakeholder targets	· YR2: min. 8.	9 newsletters have been created and sent to relevant stakeholders
Promotional material, including video content	Design and produce focused material (for stakeholders / events)	· YR2: min. 6.	14 Mini-interview videos for all the partners have been created. 2 Tutorial videos about the marketplace have been uploaded on the YouTube channel. 2 Videos about the PHYSICS platform have also been uploaded. For each event, a unique visual has been created to properly communicate the event
Press releases for major stakeholders	Produce press releases targeting different media channels	· YR2: min 1	4 press releases have been produced, and published on the project' website informing interested stakeholders on the project's recent activity achievements (e.g., content and recording of webinar, etc.).

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[1] This column reports on the progress between M13-M24 of the project.

Press releases for general public	Lightweight article targeting non-specialized channels	3 press clippings	6 press releases have been produced and published on the project's website informing the general public about the project's activities.
Contributions to Open-Source Projects	Contribute to different upstream projects in different ways, such as code/feature contributions, bug reports or bug fixes	YR2: contribute to at least 2 projects	Contributions have been made to: - OCM: report issues about upgrades and uninstall process - Submariner: contributions with bug reports and bug fixes - OpenWhisk: report issue about cold starting - NodeRed: Contributed 9 flows to its flow repository - NPM package for nodered subflows
Contributions to Open-Source Communities	Engage with Open Source Communities in different ways, such as upstream communication channels (slack, irc, github) or relevant conferences	YR2: being active in at least 3 communities, present in 2 revelant community events	We have been active in slack channels for Kubernetes Scheduler SIG, Submariner, OCM, Knative and MicroShift We have presented both PHYSICS as well as some specific components/projects at different venues: - DevConf 2022 - Athens Kubernetes Meetup - Red Hat Research Days - Google Summer of Code through GFOSS

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REFERENCES

[1] Google Analytics, https://analytics.google.com/

[2] Mailchimp, https://mailchimp.com/