



Newsletter #11- Promote, innovate and collaborate: Cloud Continuum for 6G

Project CHARITY is one of the unique projects that 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 6G applications.

The project brings deep insights on the intelligent and autonomous framework spanning across the edge/cloud continuum of the network can facilitate the deployment and orchestration needs of Real-time Holographic Applications, Immersive Virtual Training and Mixed Reality Interactive Applications services with high quality of experience (QoE) to users.

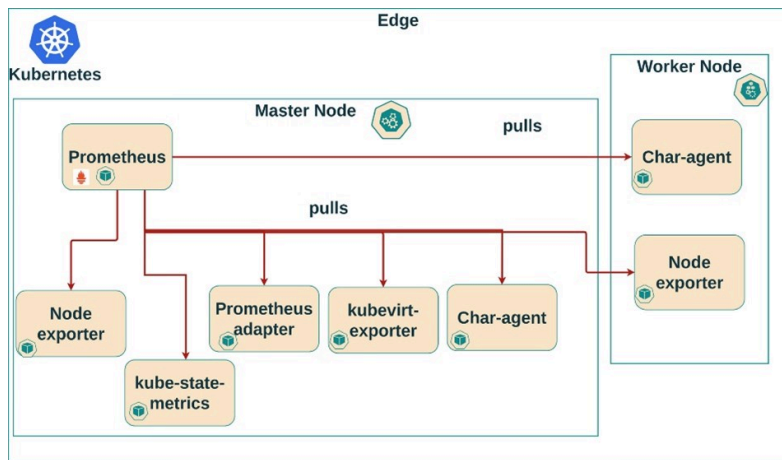
In this newsletter you learn about the latest topics the project is working on, some of the recent publication from CHARITY partners, interesting blogs and information on the opportunity to meet the team at the EuCNC 2024 as the project demonstrates the use cases developed.

Enjoy reading and let us know your [thoughts!](#)

New Publications Released

The CHARITY website has a section where papers produced by project partners are available for download from [Papers & Conferences section](#). Below we highlight some of the most recent ones..

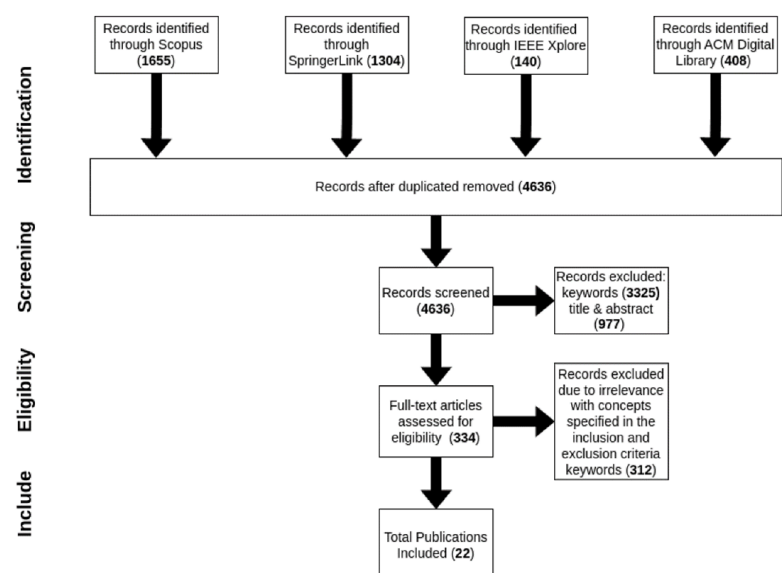
EdgeCloud Mon: A lightweight monitoring stack for K3s clusters



A recent publication by HUA was published in SoftwareX, Elsevier. In this paper, the authors present a software called EdgeCloud Mon, which guarantees consistent monitoring of application components, whether deployed on Edge or Cloud resources, while also addressing the multitude of computing power variations within the Edge and Cloud continuum.

For more details follow the link: Full paper (Gold access): <https://www.sciencedirect.com/science/article/pii/S2352711024000463?via%3Dihub>.

A Survey on Modeling Languages for Applications Hosted on Cloud-Edge Computing Environments



Another, CHARITY publication was published in Applied Sciences, MDPI. In this paper, the authors present a classification of Cloud Modeling Languages based on their effectiveness in describing deployment and adaptation of applications in both cloud and edge environments.

For more details follow the link: Full paper (Gold access): <https://www.mdpi.com/2076-3417/14/6/2311>.

Pro-active component image placement in Edge computing environments

Another publication, a collaborative effort between CHARITY partners Harokopio University of Athens (HUA) and Consiglio Nazionale delle Ricerche (CNR), published in "Future Generation Computer Systems" (Elsevier), presents that the distributed, dynamic and heterogeneous environment in Edge computing with the diverse applications' requirements is complex and the placement of applications in the network system is important to minimize each application's runtime. In this paper the authors propose an empirical experimental analysis, by comparing the results of different placements strategies and various edge communication networks. In particular, they model the problem of proactive placement of application images as a Minimum Vertex Cover problem and demonstrate that the Greedy implementation offers the best tradeoff in terms of performance, cost function and execution time.

For more details follow the link: Full paper: <https://www.sciencedirect.com/science/article/abs/pii/S0167739X24001353?dgcid=author>.

News and Highlights

Development: CHARITY Platform



ORAMA has successfully developed and optimized a dissected VR pipeline comprising a Remote Rendering edge service, a Physics cloud server, and a commercial Relay cloud service. This novel VR pipeline underwent successful validation through experimentation involving 50 concurrent VR users, interacting in real-time with the virtual patient and the virtual medical tools, within the same virtual operating room. Participants from diverse geographical locations interacted and collaborated in real-time with each other, during a medical training simulation of knee arthroplasty. The

experimentation utilized CloudSigma cloud resources in Sweden and GPU resources in ORAMA lab. The final integration stages of these services with the CHARITY platform are almost complete

Shaping the Future of XR: Innovations in Multi-Domain Orchestration

OneSource and ICT-FI teams are working on a



new architectural multi-domain edge-to-cloud orchestration paradigm, placing primary focus on Cloud-Native environments, Cloud-Native XR services, AI-driven deployment, and lifecycle management. This framework is inspired by the fundamental tenets of Zero-Touch Service Management (ZSM) architecture but is

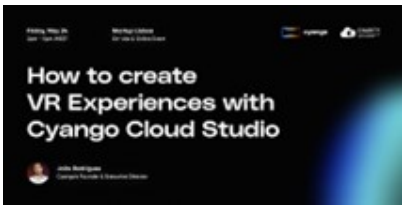
specifically tailored to meet and exceed the requirements of the forthcoming era of extended reality (XR) services. At the infrastructure level, we harness the power of open-source technologies like Liqo for connecting Kubernetes clusters across various domains, facilitating effortless resource sharing and workload distribution. Additionally, we integrated ClusterAPI to extend and streamline the orchestration of Kubernetes clusters across diverse infrastructures and providers. Together, these tools establish a robust multi-domain computing environment, essential for deploying Cloud-based XR applications and services with efficiency and scalability. The concept of such interconnected domains and multi-domain orchestration aims to remove barriers from single-domain (and vendor) architectures and, at the same time, hide their complexities from the application developers. Furthermore, the approach considers the deployment and lifecycle management of services and infrastructure as potential autonomous and intelligent tasks that need coordination. For that, AI-driven closed-loop control systems, such as the OODA (Observe, Orient, Decide, Act) loops, can play a vital role. This real-time AI-driven decision-making and resource orchestration unlocks the ultimate idea of a high-quality and uninterrupted AR/VR experiences, even when faced with unexpected network fluctuations or viewer numbers.

Webinar on "Cognitive Cloud Infrastructure"



On the 26th of March, the CHARITY Project participated in the "Cognitive Cloud Infrastructure" webinar, which took place as part of the "EUCloudEdgeIoT.eu RIA Showcase" webinars, organized by the EUCEI initiative. The webinar is available [here](#)

Workshop: How to create Virtual Reality Experiences with Cyango Cloud Studio



On May 24th CHARITY partner Cyango presented in a workshop at Startup Lisboa. This workshop was about how to create Virtual Reality Experiences with Cyango Cloud Studio, led by Cyango Executive Director, João Rodrigues. It provided the participants an opportunity to get hands-on experience with cutting-edge technology. It was well attended by participants with diverse backgrounds like

content creator, business owner, or marketer, who learned to immerse themselves in cutting-edge AR, VR & XR Experiences. This enabled their use of Cloud Studio and empowered them to Create, Explain, Show, Teach, and Sell immersive digital content and expand their skills and network.

Event link <https://www.youtube.com/watch?v=0tgi9KBBfal>

Blog Release

1. Advancing Cloud-based XR Applications by Decoupling the Physics Engine

This blog article delves into the significance of this advancement for XR cloud applications, the main challenges encountered, and highlights the architecture of the proposed XR pipeline.

2. Challenges of Multi-cluster Monitoring

This blog covers the challenges of multicluster monitoring and how it is being handled in scope of the project CHARITY.

EVENT PARTICIPATION

Participation in the European Conference on Networks and Communications (EUCNC) 2024



We're delighted to announce our participation in the European Conference on Networks and Communications (EUCNC) 2024, happening in Antwerp from June 3rd to 6th 2024. At our booth, we'll be spotlighting the latest advancements achieved through our involvement in the CHARITY project funded by the European Union's Horizon 2020 research and innovation programme.

We'll have live demonstrations divided into two primary themes including the CHARITY platform and some of the project use cases such as VR Tour Creator, VR Medical Training, Collaborative Gaming. The first theme of the demo offers an in-depth examination of technological CHARITY core components and how they are set to support the next generation of cloud based XR services. Whereas the second theme will feature and showcase the latest advances in different XR use cases and their integration with CHARITY orchestration system. Together, both themes, not only highlight CHARITY's capabilities but will be used to foster a broad discussion about the management of cloud-based infrastructure and XR services across the edge-to-cloud.

We extend a warm invitation for you to join us at EUCNC 2024 to explore these innovative solutions and engage in enriching discussions with our team. Stay tuned for further updates on our participation at EUCNC 2024. We eagerly anticipate your presence.



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