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From Vision to Impact

MetaOS Project

Smart Media/City: Cloud-Edge-IoT solutions for modern-day Media.

Background

Urban city marathons and races have been used for decades as public events to enhance the image of a city, provide tourist attractions and exemplify the value of sports for healthy living and dedication. With thousands of local visitors and viewers, media channels strive to provide the best possible viewer media experience by dedicating more and more resources to cover it in detail and also foster visitor attendance and interest. Currently, local viewers of the race have limited ways to stay informed on the race status. They can either locate passing runners at their location or monitor radio or live-streaming TV shows. All choices leave them with little information on the race status they are interested in and without the possibility of involvement unless they use social media channels.

The Companies

The development is undertaken as part for the Smart Media City Living Lab Trial of the Next Generation Meta Operating System (NEMO) EU research project. The solution is developed by the following technical partners Universidad Politécnica De Madrid (UPM), Novomatix P.C (NOVO), Telefonica Investigacion Y Desarrollo SA (TID), Cumucore OY (CMC). Resources and support is provided by the Hellenic Telecommunications Organization S.A. (OTE). Use case Trial leader is the Foundation of the Hellenic World (FHW).



The image a City Marathon viewer would see. Enhancing the viewing experience by analyzing images like these on the cloud is the core essence of the project.

The Needs

The Cloud provides virtually unlimited resources, and high availability is considered a commodity. Inherent cloud features, like elasticity and multitenancy, allow production-level delivery of services in image/video resolution and Artificial Intelligence (AI), which can lead to the emergence of applications with ultra-low latency. This use case enhances the live-running sports event spectating experience by enriching the content through AI-driven data and content analysis. During the race, media content is captured by cameras and drones positioned along the circuit, and many spectators use their smartphones to capture it. A dedicated smartphone app allows visitors to watch customised media content, post media themselves, and comment on others' content.

The solution

The Smart Media City use case will use the Next Generation Meta Operating System (Nemo Meta OS) framework to enhance the boundaries of live media capture and user involvement in live outdoor events, providing an effective broadcast, analysis and productivity solution for European media oriented businesses, that seek to enhance user engagement and satisfaction by offering a Personalized Content Delivery solution with tailored content to user preferences based on AI-driven recommendation/information.

The solution will provide flexibility in the usage of available network 5G and computing resources, which can reside in the whole near/far edge – cloud spectrum to handle the intense media content that is captured. Usually, in a race, a variety of video sources are deployed along the race track; the sources can be cameras, Drones, Go Pro cameras attached to runners and, of course, user smartphones. Therefore, to provide real-time adaptation and low latency, the meta Network Cluster Controller and Intent-based Migration module of the NEMO MetaOS will be used to provide advanced network management to ensure strict latency/bandwidth requirements. Fast time-sensitive migration across the continuum for large media is a prominent feature and the underlying cornerstone of this solution.

Besides handling large content, the current advances in AI/ML solutions are mature and can be leveraged for live events broadcast coverage. The use case will use resources available on the near/far edge and cloud continuum for media processing and AI/ML annotation. The content of the video sources will be



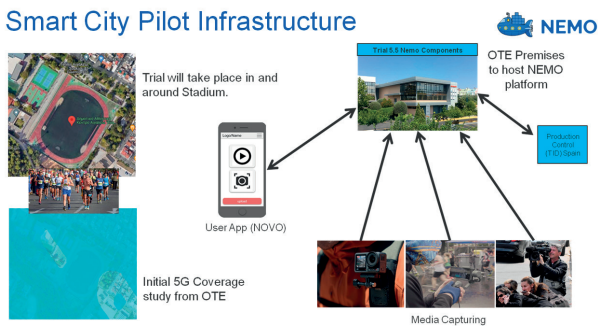
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enriched using AI-driven data and content analysis. The videos will be analysed based on location, the runners depicted and race events. An Artificial Intelligence Machine Learning node will perform recognition of Runners' BIB Numbers and of Landmarks in the video sources to be able to annotate the video feeds with accurate GPS positioning, runners depicted in them and potential race events that happened.

The audience of the race will use a dedicated smartphone app and have the option to view, interact and provide video feeds. The spectators of the race will be able to view these curated and annotated sources and also be able to contribute and watch content through a dedicated Smartphone Application. The Smartphone Application will allow viewers to watch selected video sources based on their preferences and also allow them to contribute videos straight from within the application. Each user video can be annotated with additional text, and each viewer will be able to watch, comment and interact with the contributions of other viewers.

The Challenge



High level Infrastructure of the Solution

The implementation of this solution faces several challenges, including integrating large video feeds and IoT devices with existing media infrastructures and ensuring a user-friendly experience for outdoor events. The solution leverages a novel cloud-based meta-OS framework to provide and manage the resources needed for a) handling and analysing the video feeds, b) for AI annotation of the video feeds, and c) for interfacing with a consumer smartphone app. Various risk factors are involved in implementing such a solution, such as the usage of high computing resources, network latency, high video latency, the synchronisation of events with media content, the right access to content with privacy preservation and the quality of Experience (QoE) optimisation.

Project involved

The Smart Media/City solution emerged from the ongoing three-year scientific research NEMO project and has received funding from the European Union's Horizon Europe Framework Programme under Grant Agreement No. 101070118. The solution was developed by specific partners of the consortium as part of the Living Labs validation of the NEMO meta-OS.

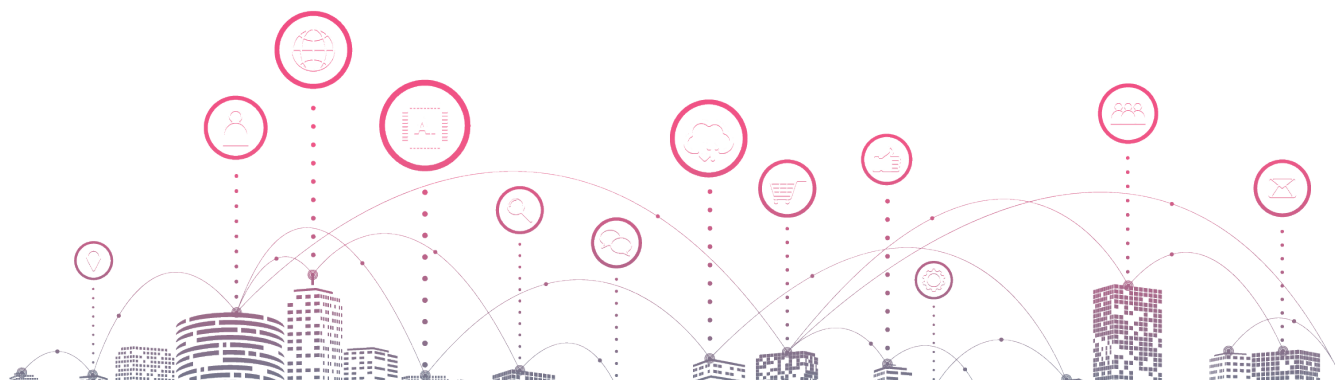


Impact

A pronounced contribution to both domestic and international ambitions for live streaming and real-time content combined with personalised content delivery. The Smart Media/City use case provides a solution that validates the meta operating systems such as NEMO not only from a citizen viewpoint for Live sports events featuring cost-effective enhanced coverage, presentation and participation but also presents a sustainable business solution for media channels and the media industry because of its additional environmental sustainability features which consider CO2 emissions for all components and migration procedures such as energy consumption & efficiency and green energy usage in service allocation and delivery.

Noticeable effects derive from the specific applications of NEMO's Smart City solution:

- ▶ Energy-aware service orchestration: by deploying or migrating workloads on available edge and cloud resources, media service delivery can be optimised to achieve a reduction in energy consumption. This could open the way for cleaner technologies, decoupling economic growth from environmental degradation.





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- ▶ **Advanced network management:** Leveraging the power of IoT, edge, and the cloud, as well as the programmability of network resources across the continuum, allows for the optimisation of the usage and allocation of available bandwidth. This allows for heavy media content to be streamed in real-time, opening up the way not only for economic growth but also for human well-being and mental uplifting through innovative and engaging media content.
- ▶ **AI-enhanced spectating experience:** using AI-based real-time video augmentation with personalised information may yield significantly improved user experience with highly increased interest for each, thus changing the way people perceive sports. The use case acts as a living example of supporting economic growth and human prosperity through technological advances.

Recommendations for policymaking

- 1. Specific social dynamics and user needs must be apprehended to create effective and impactful solutions:** any product or service that is brought into the market, whether completely new or enhancing existing ones, can be successful only if future consumers really appreciate it. Customers' desires, needs, fears, and wills have been the focus of business planners for decades; likewise, today, this is also the first step to the success of a commercialised solution.
- 2. Boost interoperability, sustainability and maintenance:** in today's fast-paced societies and fast-changing world of technology, interoperability among devices, platforms, and applications is considered a commodity. Therefore, compliance with standards, as well as the adoption of open source and APIs, are generally safe, good practices for avoiding self-lock-in. Also, new or enhanced products and applications must ensure an acceptable period of future support and maintenance with future company updates and platforms.
- 3. Think globally and feel part of the ecosystem:** envisioning a future filled with countless connected devices and applications, applications and services cannot be any more in isolation. Integration into wider multi-purpose ecosystems may expand opportunities for adoption.



Useful material related to this story

- meta-os.eu
- https://meta-os.eu/wp-content/uploads/2024/06/NEMO_D5.2-Living-Labs-and-Data-Management-Plan-DMP.-Final-version_v1.0.pdf
- <https://youtu.be/O4HmCh8qYFk>

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