



## Virtuose

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### Partners:

BEIA Consult International S.R.L, Romania  
 Daimler Center for Automotive IT Innovations/TU Berlin, Germany  
 DRResearch, Germany  
 Fraunhofer FOKUS, Germany  
 Fraunhofer Gesellschaft Heinrich Hertz Institut (HHI), Germany  
 I2CAT, Spain  
 EXPERIS IT S.L., Spain  
 Koc University, Turkey  
 NETAS Telecommunications A.S., Turkey  
 Nokia España SA, Spain  
 Siemens AG, Germany  
 Sofia Digital Ltd., Finland  
 Teleste Corporation, Finland  
 Tampere University of Technology, Finland  
 Tuxera, Finland  
 Universidad Politécnica de Madrid, Spain  
 Vestel Electronics, Turkey  
 VideoVisit, Finland  
 VTT Technical Research Centre of Finland Ltd., Finland

### Co-ordinator:

Jose Javier Garcia Aranda

Nokia Spain

E-Mail: jose\_javier.garcia\_aranda@nokia.com

### Project Website

[www.celticnext.eu/project-virtuose](http://www.celticnext.eu/project-virtuose)

[www.tut.fi/virtuose](http://www.tut.fi/virtuose)

## Virtualized Video Services

The main goal of VIRTUOSE project is to develop video services utilizing virtualization techniques. With the use of virtualization techniques, we can develop services, which are scalable and secure, and can easily be deployed to different computing platforms. This enables the partners to leverage their services in new markets, and offer cost-efficient solutions. The VIRTUOSE project focuses on four use cases / work areas, which have been recognized to benefit the most from virtualization technologies: cloud gaming, multiparty video communications, video transcoding & distribution, and video analytics. All of these virtualized video services share common problems and require a common knowledge base to solve them

### Main focus

The VIRTUOSE project is driven by business use cases that have been recognized to benefit the most from virtualization technologies. The use cases are *cloud gaming, video transcoding and distribution, multiparty video communications, as well as video analytics and surveillance*. All of these virtualized video services share common problems and require a common knowledge base to solve them. In cloud gaming, the execution of the game logic and updating and

rendering the scenes takes place in cloud servers instead of the client device. This requires encoding and streaming the resultant video to the users with a very short latency. Similar challenges are present in converting live and on-demand video between different formats and quality for heterogeneous devices and networks, and managing their delivery efficiently. Multiparty video has emerged with the ever-increasing number of cameras on consumer devices, which makes the video streaming over networks more symmetric and dynamic than before. Finally, current video analysis and surveillance systems are realized as dedicated installations, operated locally, and designed for a specific set of tasks. Examples include free parking lot and suspicious activity detection. There is a clear need for better flexibility and extendibility of the systems. Virtualization is the common enabler for all the use cases.

### Approach

VIRTUOSE has three development targets, including *virtualized service architecture and component specification, their implementation and evaluation, and demonstrators* integrating and validating the solutions in the context of the aforementioned use cases.

## Virtualized video services



## Virtualized computing, storage and networks

**Cloud gaming**    **Multiparty video communications**    **Video transcoding and distribution**    **Video analytics and surveillance**



The helicopter perspective of the VIRTUOSE architecture consist of the use case applications, using on-demand content, live-camera, real-time gaming as video sources and standard devices for the end users. The basis of the cloud is formed by execution virtualization and deployment components, as well as virtualized content delivery and device management entities. VIRTUOSE will utilize both full virtualization solutions, such as KVM, and lightweight ones, including Linux containers, such as Docker and LXC, depending on the use case requirements. The work on virtualization techniques includes also the definition and implementation of programming and service interfaces.

The video coding components in the cloud address how the inherent parallelism and complexity is tackled on standardized, off-the-shelf platforms for low-delay processing and streaming. VIRTUOSE seeks solutions to the trade-off between distribution of the computation and localization of the data, as well as making the source code portable to different virtualized platforms.

The cloud based video analysis components targets on very large scale, real-time analysis. The key feature is the correlation of massively parallel input video streams. New algorithms for the compressed domain video analysis will allow for low-complexity processing, since video decoding and classical high-complexity pixel

domain processing are avoided. Hierarchical algorithms allow for scalable approaches, which adapt to the complexity of the scene to be investigated.

business perspective, VIRTUOSE contributes to new kind of services such as Game on Video, Video Analysis as a Service, Video Surveillance as a Service, Content Delivery Network as a Service, as

### Business use cases



## Main results

The main results of the VIRTUOSE project are the architectural solutions and the “cloudified” components for video coding, analysis, and streaming. The project will build demonstrators and conduct experimental evaluation in the context of the use cases in order to highlight the benefits of the developed solutions and virtualization technologies. The results will be used for disseminating the best practices in the domain. In the

well as multiparty communications as a cloud-based service. The results will be disseminated as scientific publications, technical papers, contributions to standardization and live demonstrators in project-specific and public events.

## Impact

Virtualization changes dramatically the current approach in video processing, which is traditionally based on dedicated hardware with as thin SW as possible, moderate network capacity and significant client side performance requirements. VIRTUOSE makes a change in the cost-effectiveness due to shift from custom to standard off-the-shelf platforms. This reduces both investments and lifetime costs. Another benefit is the scalability, quality and flexibility of the services, which is the basis for new ecosystem-wide innovations, products, and business opportunities. VIRTUOSE contributes to several R&D areas due to the wide coverage of the considered use cases, ranging from computing, telecommunication, and signal and image processing to artificial intelligence and neural networks. The final impact of the virtualized video service solutions, developed in VIRTUOSE, are better products in terms of better end user experience, security, and safety.

## About Celtic-Plus

Celtic-Plus is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on a new „Smart Connected World“ paradigm. Celtic-Plus is a EUREKA ICT cluster and belongs to the inter-governmental EUREKA network. Celtic-Plus is open to any type of company covering the Celtic-Plus research areas, large industry as well as small companies

or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a Celtic-Plus project under certain conditions.

## Celtic Office

c/o Eurescom, Wieblinger Weg 19/4  
69123 Heidelberg, Germany  
Phone: +49 6221 989 381  
E-mail: office@celticnext.eu  
www.celticnext.eu

