

# Demo Descriptions



## **Project title: 4K ultraHD TV wireless REmote PROduction SYStems**

### **Short description of the project:**

New cost-effective approach for the production of 4K TV content covering the needs from indoor studio production up to large and mobile outdoor events such as Olympics, cycling, and car races.

### **Demo:**

#### **Live 4K/HD HEVC Coding with Wireless HD Transmission and Content Protection**

In the project, High Efficiency Video Coding (HEVC), selective encryption, and Software-Defined Radio (SDR) technologies are developed by Tampere University of Technology (TUT), INSA Rennes, and Siru Innovations. HEVC standard halves the bit rate over the previous video coding standards, the HEVC-compliant encryption hides the Region-of-Interest (ROI) in video, and SDR technologies enable congestion-free wireless transmission of HEVC video.

In the demonstrator, video is compressed by award-winning Kvazaar open-source HEVC encoder and decompressed by OpenHEVC that is the most well-known open-source decoder. End-to-end selective encryption of ROI is currently under standardization in MPEG. Selective encryption and decryption operations, relying on the AES encryption standard, are integrated into Kvazaar and OpenHEVC, respectively. Wireless transmission relies on Siru's SDR20 transceiver which is performance scalable, multi-touch, and portable platform for next-generation radio designs. These solutions are being developed for ultra-low delay and secure 4K TV content production and delivery in crowded areas.

Two parallel video streams are demonstrated:

- 1) **Wired 4K Video.** The raw 4K video is shot by 4K action camera, captured by HDMI card from the camera, encoded in real-time by Kvazaar on 22-core Xeon processor, sent via wired IP link, and decoded by OpenHEVC decoder for playback on a laptop. The encoding process is also monitored in real-time by Kvazaar Visualizer.
- 2) **Wireless encrypted HD Video.** The HD video shooting, capture, and encoding are done as in case 1, but now the content is partially encrypted by selective encryption and the wired transmission is replaced by Siru's SDR wireless link. The stream with and without decryption is separately displayed by two laptops. The decrypted video is completely visible, whereas non-decrypted video only provides visual access to non-encrypted area (background).



## **Project title: Advanced Sensing for Urban Automation**

### **Short description of the project:**

The ASUA project's aim is to develop key technologies and solutions in Smart Cities domain. Focus of these technologies are **Constrained Devices**, **Communication Networks** and **Information Management** which can be explained as follows:

**Constrained Devices:** ASUA provides techniques for coping with extremely resource constrained embedded devices even in challenging environments, such as deep sleep / auto-wake functionality, model based compression, simulation etc...

**Communication Networks:** ASUA utilizes and improves adaptive communication technologies such as DSR algorithm, ZigBee and BLE mesh network. Also, provides middleware layer (**ASUA Communication System Manager**) for managing, monitoring dynamically operating network systems.

**Information Management:** Harnessing cloud-based technologies and distributed storage, **ASUA IoT Server** provides OGC SWE compliant services, distributed storage, tools for autonomic alarm/event generation and dashboards for advanced monitoring. It also provides rich GUIs for configuration of these functions.

These technologies developed by ASUA consortium will be utilized in various prototype applications to show that they are applicable for real-world problems. These prototypes are Mine, Tunnel, Water Quality and Health Monitoring Systems.

Also, one of the key project outcomes is what we will refer to as the "**Urban Automation Reference Platform**" - a **conceptual platform** design which will include the main functionalities and mechanisms that are identified by the partners during the project as critical for sensing applications in the domain of urban automation.

### **Demo**

#### **Tunnel Monitoring Prototype**

Demonstrates a typical Urban Automation connectivity scenario in Tunnel Monitoring prototype. Also, demonstrates usage of model based compression technique on a gateway for energy efficiency.

The gateway gathers data from geomonitors sensors (inclinometers). Then compresses the data using a mathematical model and transmits this data to the ASUA IoT Server. Then user logs in to ASUA IoT Server and monitors their observation data. Please see ASUA Communication System Manager and ASUA IoT Server sections.

#### **Health Monitoring Prototype**

Demonstrates another typical Urban Automation connectivity scenario in Health Monitoring Prototype. Also, demonstrates a reliable Bluetooth low energy mesh network using a combination of connection oriented and connectionless topologies.

First reads out a sensor data (heart rate). Shows the flat BLE mesh option by forwarding data to gateway. Then emulates high traffic. And based on performance metrics, the system will reconfigure the routing protocol (by adding more nodes, adding extra sensor). Then gateway integrates to ASUA Communication System Manager (CSM) and ASUA IoT Server. Then user logs in to ASUA

Communication System Manager and ASUA IoT Server to monitors their network and observation data. Please see ASUA Communication System Manager and ASUA IoT Server sections.

### **ASUA Communication System Manager**

Demonstrates network managing and monitoring capabilities of the ASUA Communication System Manager (CSM).

The CSM receives SNMP messages from the different prototypes, which contain information about certain network variables. Then it extracts these variables asynchronously, and checks them against a series of rules. When a rule is fulfilled, an alarm is triggered. At this point, the alarms can be stored in the dashboard to be visualized or generate an email to an administrator. And the **CSM Dashboard**, is the place from where the network parameters and the alarms can be visualized. It also serves as a portal to configure the gateways and to select the parameters that will be tracked.

### **ASUA IoT Server**

Demonstrates storage, management, orchestration and visualisation of urban data with ASUA IoT Server.

ASUA IoT Server receives sensor and observation data from prototypes. Queries, reports, dashboards and maps show these observation, sensor, alert data. Then admin defines rules to create alerts. Adds subscriptions to alerts which sends an SMS / sends an email / sends a MQTT message which entails automation of sensors – actuators. This will be shown in action.

Also, standards based **ASUA IoT Server API** (OGC SWE, MQTT) and **ASUA Developer Web Site** will be demonstrated.:

# CONVINcE

## Project title: Consumption Optimization in Video Networks

### Short description of the project:

The concept of the CONVINcE project grew out of two observations. That the Internet's carbon footprint would exceed that of air travel by a factor of two by 2020 and that Internet traffic is driven by video.

CONVINcE addresses the challenge of reducing the power consumption in IP-based video networks with an end-to-end approach, from the Head End where contents are encoded and streamed to the terminals where they are consumed, embracing of course the CDN and the core and access networks.

### Demo description:

Consumption measurement on a smartphone: How much does watching a video drain your smartphone battery? Greenspector demonstrates power consumption measurements on a smartphone to show the energy impact of video streaming. Several scenarios regarding resolution and protocols can be compared.

GoGreen routing for video delivery in access networks: In future access networks, one of the main challenges is to reduce power consumption while preserving the Quality of Service (QoS) perceived by the end-user. In this demonstration, CEA presents an energy-efficient routing algorithm, called GoGreen routing, for video delivery in access networks. This algorithm allows reducing the total network power consumption while preserving QoS by ensuring the requested bandwidth for video traffic. Energy saving comes from the computation of several paths providing a sufficient bandwidth, and then from the selection of the path showing the lowest power consumption.

Mobile terminal power consumption reduction: All forms of videos constitute over 80% of total IP traffic. Even a small power reduction in individual devices could lead to substantial energy savings. In this demonstration, VTT presents methods to reduce power consumption in video terminals. It is shown that, by using the selected techniques, substantial energy savings can be achieved in both terminals and network delivering the video. The reduction comes from more efficient coding of videos, applying energy saving techniques in the playback software and energy-savvy settings in terminals.

Energy Efficient multi-tier Wireless Multimedia Sensor Network (WMSN): WMSN can provide richer information for several applications that have vital scientific, social, and strategic relevance. These include, in wildlife, monitoring to determine guidelines for human/predator coexistence, monitoring airport areas, monitoring the conditions of affected people during a natural disaster, etc. In this demonstration, University of Oulu presents techniques that can be applied to extend the battery life of such vital devices for a long period of time. Long battery life is achieved by putting the high power camera nodes into deep sleep mode; and using low power scalar sensor nodes for motion detection and waking up the camera nodes when needed.

"Got Signal?" All current commercial WiFi access points severely underutilize available bandwidth and only use a small fraction of the available capacity. This wastes power and energy. Fountain coding makes it possible to use almost all of the available theoretical capacity in an efficient manner. Fountain codes are erasure-resilient codes more appropriate here than error-correcting codes or retransmission techniques which are usually used. TelHoc demonstrates how power can be saved and mobile device battery lifetime extended, by using fountain coding, smarter encryption and adaptive security over lossy wireless links."



## **Project title: E-health services Everywhere and for Everybody**

### **Short description of the project:**

E3 builds an E2E platform able to allow Everybody (provide low cost high quality video conference & e-health services reusing in-home infrastructures) access to E-health services Everywhere (both rural & urban areas, both Patients & Professionals).

### **Demo:**

E3 will showcase several video conferencing ehealth solution involving both portable devices (smartphones and tablets) as well as professional end to end point solutions.

E3 will also showcase several ehealth applications and devices

E3 will also showcase the living Lab Prometee which proposes the realization of subjective tests on medical images / videos in order to assess a « quality » to the usage of the images / videos. We will be able to perform quality assessment demos.



## **Project title: From empowering to Viable Living**

### **Description of the project:**

FRONT-VL will focus on smart and efficient technical solutions to increase possibilities for the elderly to live at home without being dependent on children or in-home care.

By enabling elderly people to live at home – either independently or assisted – for as long as possible, a good quality of life can be maintained while at the same time drastically reducing care costs.

Based on five use cases I) Rehabilitation, II) Fall Prevention, III) Mental Health, IV) Palliative Care and V) Nutrition Care, end-user services will be defined and developed to support the end-user with ICT relevant to all stakeholders. This supports the analysis and interpretation of data of individuals and also on a big scale. The use of state-of-the-art machine learning and big data analysis methodologies, together with a profound IoT based data acquisition, will allow the development of sophisticated predictive health related services. FRONT-VL will ensure highest standards of privacy and data ownership of the individual.

### **Main innovations of FRONT-VL lie in two domains**

First, based on the end-user services for the defined use cases, FRONT-VL aims to create a common service model and a service delivery framework which is able to provide ICT-based home care and health services to the end-users and care professionals in a modular and flexible way. This framework introduces an abstraction layer between the care provider and the end user so that both sides are flexible in the choice of the actual software solution supporting the same service definition language.

Second, automated data collection is utilized to enable peer-to-peer learning and knowledge transfer rather than being used in the mainly one-way fashion by health care professionals of today. Technically, this feedback loop will enhance the quality of services by providing findings based on big data approaches. This also motivates end-users towards a healthier lifestyle by introducing a community aspect



## **GOLD**

### **Project title: Gigabits Over the Legacy Drop**

#### **Short description of the project:**

The GOLD project focuses on improving the hybrid-fibre-copper standard G.fast to open a potential mass market in dense city areas by development of cost-effective high rate access.

#### **Demo:**

##### **High capacity optical backhaul for next-generation G.fast deployments**

Telnet Redes-Inteligentes has developed a novel solution based on WS-WDM-PON<sup>1</sup> technology for high-capacity G.fast backhauling in order to reach future 5G requirements, mainly to face the growing volume of traffic. The WS-WDM-PON system includes the WPONverter+ equipment (WS-WDM-OLT<sup>2</sup>) with a total of 24 SFP+ (10GbE) ports to distribute between metro and access network (40 C-Band channels for both Downstream and Upstream, i.e., 20 DWDM<sup>3</sup> access links) with optical terminations based on totally tunable 10G WS-WDM-ONUs<sup>4</sup> (named as WDD-10G). During the GOLD project, this development has been addressed towards the compatibility with G.fast technology in order to extend the fiber connectivity over the last short segment of the copper loop. In this way, Telnet has designed a High-Capacity G.fast DPU that can support up to 64 G.fast based copper lines. To achieve this level of aggregation Telnet HW integrates 4 different Giga G.fast modules and an Ethernet switch converter, which routes the 10G backhaul traffic from a certain WDM-ONU. The Celtic event demonstration will show the end-to-end performance of the proposed solution (Control and data plane evaluation).

*WS-WDM-PON<sup>1</sup>: Wavelength Selective - Wavelength Division Multiplexing - Passive Optical Network*

*WS-WDM-OLT<sup>2</sup>: Wavelength Selective - Wavelength Division Multiplexing - Optical Line Terminal*

*DWDM<sup>3</sup>: Dense Wavelength Division Multiplexing*

*WS-WDM-ONU<sup>4</sup>: Wavelength Selective - Wavelength Division Multiplexing - Optical Network Unit*



**H-OPTO (Together with booth of Gold project; no demo, only posters)**

**Project title: Maintenance and deployment of optical and in-home networks**

**Short description of the project:**

**Maintenance and deployment of optical and in-home networks**

H-OPTO aims at establishing best practices and create new knowledge about optical networks, with focus on cost reduction and quality.

Up to today research efforts on optics have gone towards increasing the bitrates and developing new optical components. Less research has gone in the direction of optical access networks and the costs of their deployment, operation and maintenance. The rate of fibre deployment is very sensitive to these costs. In addition, the uncertainty associated with the cost of deploying a large scale optical fibre network and even more so, the costs associated with operating and maintaining such a network is prohibitive when it comes to making investment decisions.



## **Project title: On Demand Secure Isolation**

### **Short description of the project:**

ODSI Project targets two main objectives: Firstly, deliver new security models with the properties and the benefits of both hardware and software approaches. These models provide certified and proved minimal properties for isolation (Common Criteria compliant), to be used in mass production (low-cost and constrained CPU) as M2M or IoT environment.

Secondly, offer an end-to-end security evaluation (CC) thanks to the certification of the elementary bricks at the highest assurance level combining with the Lego Methodology to reach a high global assurance level.

### **Demos:**

#### **1: Security and proven isolation model**

The ODSI project aims at providing an isolated and proven kernel for IoT systems.

This demo illustrates the definition and the implementation of a specific open-source toolchain for building proven models from mathematical model language.

#### **2: Approach of the Lego Methodology Certification**

A poster on ODSI Lego Methodology explains the approach of end-to-end security evaluation for IOT solution.

The presentation illustrates how the Lego Methodology certification provides assurance for composed security functions within dynamic systems. This new methodology proposes to build security functions robustness assessment when these functions are distributed over several components of heterogeneous robustness level.

#### **3: ODSI system management**

To guarantee end-to-end security and isolation properties the remote management has to define and verify some specific mechanisms to implement. Three main actors have been defined and each of them has a particular role and rights.

The Demo presents how the constraints and the security functions can be distributed in all the architecture of an ODSI domain.



## **Project title: Reliable Industrial Communication Over the Air**

### **Short description of the project:**

To enable the industry in the context of advanced manufacturing and processing (industry 4.0), i.e. Industrial Internet of Things, to use wireless communication instead of traditional wired connections for controlling and monitoring, confidence in and reliability of the wireless connections must be given. This requires proofing the suitability of a wireless communication system for a given application with a standardized validation/rating system.

Although much network planning and connectivity estimation is done, still no such system exists. In the RelCOvAir project the necessary standards, methods and tools for providing proof are developed, standardized and integrated into a single comprehensive software and hardware testbed solution. By gathering requirements from the industry, current research activities (e.g. FITS project), and standardization activities (e.g. LTE-M, LoRa alliance), a rating system for wireless communication systems is being developed (e.g. maximum delay and packet error rate under certain interference conditions).

A set of relevant test-cases for the rating process is being defined. These consist of standard use cases (e.g. an interference scenario) as well as methods of referencing individual reception scenarios to a given standard test case (e.g. finding the worst-case scenario of a real deployment). Both rating system and test cases are going to be provided to European standardization bodies.

The RelCOvAir exhibition highlights the following topics:

- Challenges of wireless industrial communication and the need for standardization of methods and testing tools
- QuaDRiGa, the RelCOvAir channel model: bringing the factory to the lab for performance validation
- RelCOvAir testbeds: test systems for certification of wireless industrial communication systems applying standardized criteria



## **Project title: Secure Networking for a data center cloud in Europe**

### **Short description of the project:**

Large Data Centers (DCs) are forming the most important control centers of the Internet nowadays. Within DCs, business as well as private data is stored, edited, forwarded, and processed. Although current DCs have a huge computing power, massive storage capacities, and an enormous performance based on centrally stored data, they are located far away from the customer, use the network only for transport, and are mostly run by non-European companies. This leads to low flexibility, long delays to customers, and security concerns.

New application scenarios of our digital society such as Industrial Internet, mobile connected objects, Internet of Things, health applications, and especially 5G lead to a huge number of end devices and an enormous increase of traffic volume. The high demands on security, location awareness, service guarantees, flexibility, and latency require a convergence of telecommunication networks and IT as well as distributed data centers, which are placed close to the customers. Innovative approaches such as Network Functions Virtualization (NFV) in combination with Software Defined Networking (SDN) are the basis for a secure, flexible, low latency, and locality-aware distributed data center approach to support the upcoming application scenarios.

The goal of the SENDATE research program is to provide the scientific, technical, and technological concepts and solutions for

- A clean-slate architecture supporting the application scenario demands
- Intra-DC -security, -control, -management, and –orchestration
- Inter-DC -security, -control, -management, and –orchestration
- Placement, control, and management of Virtual Network Functions (VNF)
- High speed transport networks to interconnect servers in a DC, data centers together, and the end users.

This includes on the one hand the development of a flexible control-plane using SDN, and on the other hand a powerful data-plane with high flexibility. Security is an integral part of all sub-parts.

### **Demos:**

During the Celtic Event, we will show the general structure of SENDATE, provide an overview of each sub-project and show the SENDATE video on the large monitor.



## **Project title: Service-oriented optimization of Green mobile networks**

### **Short description of the project:**

Today, mobile networks are witnessing an exponential growth of traffic volumes, linked to new services. In particular, video services constitute a major part of the traffic and their share is expected to increase. In the same time, Internet of Things (IoT) related traffic will gain in importance with the explosion of the number of connected objects.

SooGREEN project is targeting to reduce the energy consumption of the services in different mobile architectures in interaction with smart-grid.

SooGREEN is focused on the services energy consumption modelling and measurement, the dynamic optimization of the mobile access network and of the content delivery, the design of an Energy Efficient Virtualized and Centralized Access Network (RAN), and the bi-directional interaction of the mobile network with the smart-grid.

### **Demo:**

#### **1: Lithium balancing test & Battery Management System specification/validation:**

Battery Management System (BMS) performances, for telecom batteries working in smart-grid context, are achieved thanks to high modularity assembling for cell replacement, fast initial commissioning charge and low heat emission at high balancing current. The Orange simulator has permitted to validate a new voltage balancing strategy on 4 small cells (8Ah) , on-going tests is addressing 4 to 16 big cells (< 100 Ah) to refine balancing algorithms for the industrial prototype under development by Arelis for Soogreen project.

#### **2: Energy Efficiency KPI: a key performance indicator for supervising networks energy efficiency**

A global KPI is being adopted by standardization bodies under the lead of Orange. The KPI is basically the ratio between the served traffic volume and the corresponding consumed energy. A ranking is proposed based on capacity analysis from 2G to 5G networks taking into account that the traffic has more than one degree of magnitude variation compared to energy. The demonstration shows a geographic map where the KPI of different radio sites is lightened depending on the delivered traffic and the consumed energy observed during a peace of life of the network.

#### **3: Interplay between energy and capacity consumption in Cloud/Virtualized Radio Access Networks**

We modelled the network's energy and midhaul's bandwidth consumption based on different options for centralizing or distributing the communication functions processing. We proposed an optimization framework that minimizes a linear combination of power and bandwidth while satisfying digital units' processing and midhaul links' capacity constraints.

#### **4: Service oriented energy market for mobile operators.**

An energy market proposal trades capacity and energy for mobile operators for each service to minimize the energy consumption of mobile services.



## Project title: Unleash The Power of SIM

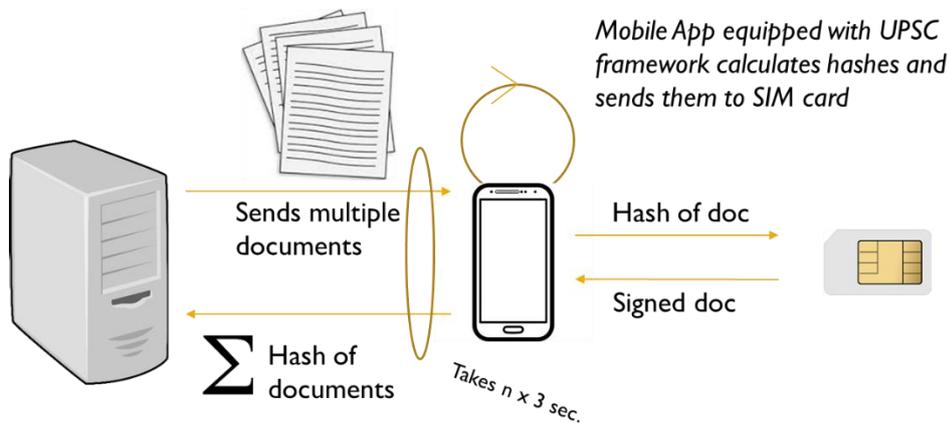
### Short description of the project:

UPSC provides a solution to overcome serious barriers as phishing, virus and sniffer attacks that hinder electronic services as banking and transactional electronic services to run on mobile devices. The SIM-card within connected mobile devices is not yet unleashed to its full potential, instead user-unfriendly security mechanisms around single factor authentication methods as password and log-ins are used. The UPSC project facilitates the e-service application development and speeds up transaction processes for mobile applications using Sim-card features.

### Demo description:

#### 1: Multiple document Signing

Multiple document signing takes minutes with mobile signature. UPSC framework shortens this duration by directly communicating with SIM card.



#### 2: Remote Payment

This remote payment demo will show how SIM card can be used to encrypt the PIN with a secret Key on itself so that PIN is never exposed.



(Standard Authentication Method)



(Novel UPSC Authentication Method)

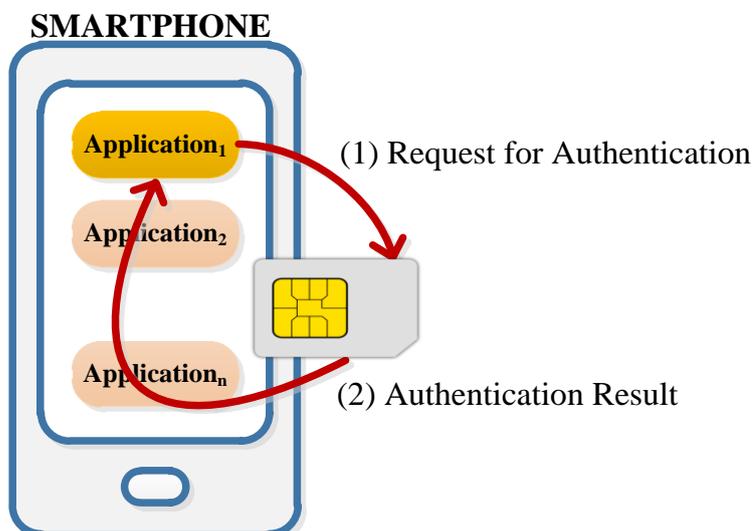
### 3: Point of Sale (POS) and credit card emulation

To buy a product nowadays requires a real credit card to be inserted into a terminal of a so called a Point of Sale (POS). Point of Sale and the credit card are implemented and demonstrated as separate UPSC applications on different mobile devices. One handset is used as a Point of Sale Terminal and the other handset used as a real credit card for electronic payment.

- a. POS emulation
- b. Card emulation
- c. EMV Payment & History

### 4: Mobile Banking

This demo demonstrates how UPSC is used in a real mobile banking application.



## Award winners:



# SIGMONA

## Project title: SDN Concept in Generalized Mobile Network Architectures

### Short description of the project:

The project integrated the concepts of Software Defined Networking (SDN) and Network Functions Virtualization (NFV) into LTE mobile networks with specific focus on flexible end-to-end SDN/NFV architecture, efficient backhaul network, optimized mobility management, dynamic resource management and improved security. Cloud computing platforms and open source software are emerging in the mobile networks with SDN and NFV. These technologies were applied in the 4G/LTE networks, and they will further evolve to the forthcoming 5G networks.

### Demo:

#### 1: Title: 5G QoE - programmable and cognitive networking

##### by Nokia Bell Labs

##### Description:

The demo presents a fully automated, dynamic and coherent e2e Quality of Experience (QoE) management solution over a programmable network that applies cognitive and self-learning mechanisms to create, reconfigure, optimize application specific virtual overlays with targeted actions, customized QoS mechanisms and virtual topologies.

The demo GUI illustrates the operation of the cognitive mechanisms (each component is real-time): detection of traffic demands, setting the QoE targets, creating/reconfiguring the networking services, monitoring the network status, detecting and localizing degradations, defining, triggering and executing the required management actions (such as QoE enforcement, scheduling parameter reconfiguration, transport service reconfiguration or rerouting, creating new service overlays, etc).

#### 2: Title: Virtual EPC integrated with SDN managed mobile backhaul

##### by CumuCore (a start-up from Aalto University/Finland based on SIGMONA work)

##### Description:

SDN is used in most of the cases to manage the resources in the cloud and fixed networks. However, we leverage the benefits of SDN in managing and optimizing the resources in the mobile backhaul. We demonstrate a disruptive solution where legacy mobile technologies and tunnelling are replaced with optimized transport networks managed by SDN to achieve 5G high bandwidth and low latency requirements.



**Project title: Next Generation Over-The-Top Multimedia Services**

**Short description of the project:**

We have developed a scalable video streaming solution based on different components able to deliver adapted contents that include quality assurance technology to improve customer satisfaction

- Optimization of CDN for OTT contents: New media distribution architectures have been analyzed using real traffic from our partners. Novel cross-disciplinary approaches to optimize the distribution of OTT contents
- OTT Traffic Analysis: End user traffic has been analyzed & impact of new consumption patterns has been investigated in terms of OTT traffic analysis
- Quality Assurance: Methods for QoE estimation and Quality Assurance monitoring tools for CDN/OTT have been developed



## **Project title: HEVC Hybrid Broadcast Broadband Video Services**

### **Short description of the project:**

H2B2VS boosts the hybrid broadcast broadband television with innovative use cases and a future-proof synchronization mechanism. An important step in the hybrid distribution of video services was taken by the H2B2VS Celtic-Plus project. Before this project started, broadcast and broadband networks were separate worlds in the video consumption business. Some initiatives such as HbbTV (Hybrid Broadcast Broadband TV) have built a bridge between both worlds, but its application was almost limited to provide links over the broadcast channel to content providers' applications such as catch-up TV services. When it comes to reality, the user is using either one network or the other!

H2B2VS allows now to exploit all the potential of real hybrid networks by implementing efficient synchronization mechanisms and using the new video coding standard: High Efficiency Video Coding (HEVC). H2B2VS hybrid network solution enables value added services with an optimum bandwidth usage in each network and with clear commercial applications.

### **Demo/video description:**

During project lifetime, ten use cases were implemented on several demonstrators, reproducing realistic broadcast receiving conditions and making use of an actual broadband network and Content Delivery Network (CDN): A terrestrial demonstrator was setup in France, a satellite one in Spain & Turkey and a cable one in Finland. These trials allowed H2B2VS partners to check that the developed technology was meeting the operational requirements, including specific content protection needs.

The project demonstrated its results on the occasion of several national and international events.

At the booth project, posters and a video on the H2B2VS project results showcased at IBC2015 in the Future Zone can be seen.