CHARISMA

CHARISMA NEWS

#2 – May 2016

Editorial

Dear Reader,

This is the second issue of CHARISMA News, the newsletter of the Horizon 2020 5G-PPP Project CHARISMA: **C**onverged **H**eterogeneous **A**dvanced 5G Cloud-**R**AN Architecture for **I**ntelligent and **S**ecure **M**edia **A**ccess.

This second edition provides a detailed focus on the CHARISMA architecture, as well as on our various dissemination activities.

I hope you will find the contents of this newsletter interesting, and your comments and suggestions are always appreciated.

Dr. Ioannis Neokosmidis (INCITES CONSULTING, i.neokosmidis@incites.eu), Editor

Project results & activities

CHARISMA Architecture

CHARISMA is working on an innovative architecture for future 5G networking, which will achieve many of the 5G KPIs as defined by the 5G-PPP program as well as other key technology drivers. This architecture is built on three main ideas:

- Combination of heterogeneous broadband technologies, such as mm-wave communications at 60 GHz, free-space optics (FSO) and a new passive optical network (PON) solution based on orthogonal frequency division multiplexing, i.e. OFDM-PON.
- Hierarchical and quasi-distributed structure, via the use of four self-similar Converged Aggregation Levels (CALs).
- Use of software-defined networking (SDN) and network functions virtualisation (NFV) providing the required functionality as well as distributed security with self-configured setup of secure and fast virtualised sub-networks.

The ever growing demand for secure, high data rate, and low latency communications highlights the importance to design a simple, flexible and efficient architecture that facilitates the seamless fixed-mobile convergence with gigabit/s connectivity speeds over an intelligent open access infrastructure.

Elements of CHARISMA Network

The CHARISMA architecture can be considered in a classical multi-layer fashion as composed of the data plane (DP), control plane (CP), and service plane (SP) all above an overall software-defined infrastructure (SDI) and managed and orchestrated by the CMO plane (see Figure 1). The SDI can be considered to host all the logical implementation architectures, consisting of

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virtual functions connected by virtual links, each belonging to a heterogeneous set of resource domains across multiple administrations.

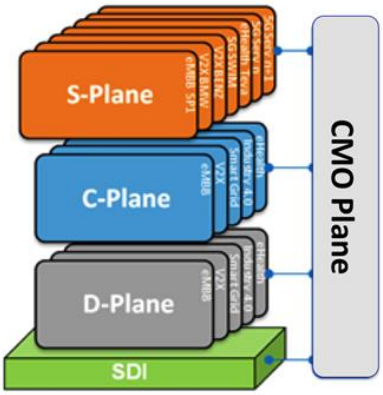

Figure 1: Generic multi-plane (S-, C-, D-planes) view of CHARISMA 5G networking architecture

The control plane is where routing (forwarding) decisions are made. In addition, the CP needs to enable multi-vendor interoperability, and provide dynamic and flexible service provisioning, recovery, and concurrent network re-optimisation. The CP lies above the data plane, which is where the data flowing through the network is processed using the forwarding tables, routing tables, and queues, i.e. the hardware components (e.g. switches, routers, and processing elements) in the DP carry out the commands of the CP to configure the network. Located at the top of the architectural layers is the service plane, consisting of services ranging from mobile broadband, media (VoD, and RTSP-based video systems) streaming, gaming, and peer-to-peer file swapping, as well as newer services (e.g. machine type communications, MTC) associated with Internet of Things (IoT) and cyber-physical systems (CPS), as well as the monitoring of the network performance (QoS, QoE, latency & jitter etc.) to aid in enforcement of service level agreements (SLAs). All these layers (with their various functions and virtualized functions, NFVs) are managed and orchestrated by the CMO plane, which allows automated instantiation and management of the elements of each plane.

Converged Aggregation Levels (CALs)

A key architectural innovation of CHARISMA is the adoption of a self-similar hierarchical approach, with active nodes intermediate to the central office (CO) and end-users. Each active node (i.e. CAL) has its own scalable intelligent management unit (IMU) performing data storage/caching, processing and routing functionalities. The CHARISMA 5G architecture described has been designed to exhibit low-latency (towards the 1-msec KPI of the 5G-PPP program) as well as security and multi-tenancy (open access) by handling data as close to where it is required using TrustNode routing capabilities and caching. This implies that low-latency architecture requires network intelligence to be located as near to the edge as possible. Overall, this requires the CHARISMA architecture to be much more distributed in nature. Indeed, CHARISMA is more of a distributed cloud type architecture. To that end, CHARISMA architecture is designed to be hierarchical, with a set of self-similar intelligent aggregation nodes located between the CO and end-users.

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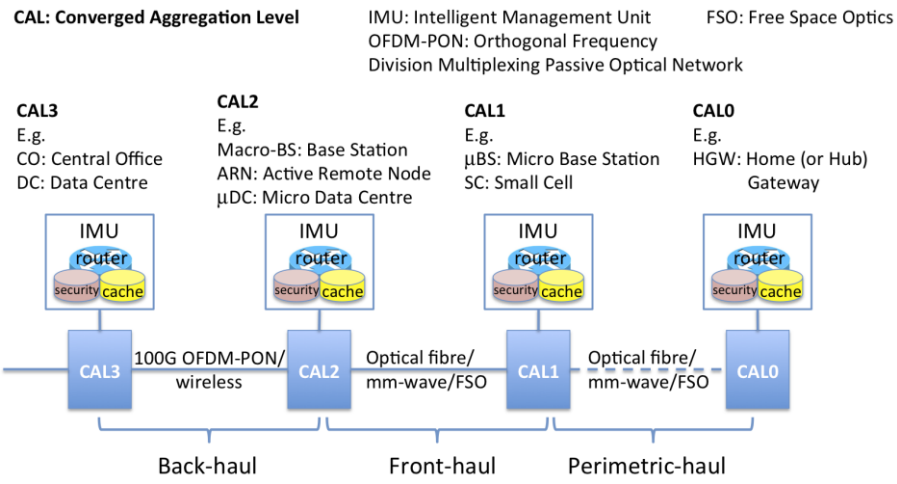

Figure 2: Physical layer description of hierarchical Converged Aggregation Levels (CALs)

Each node is labelled a Converged Aggregation Level (CAL) and is designated with a number, to signify its level in the hierarchy.

Control, Management and Orchestration (CMO) plane

The high-level design of the CHARISMA control, management, and orchestration plane is shown in Figure 3. It closely follows the ETSI NFV architecture which is geared towards virtualization and multi-tenancy.

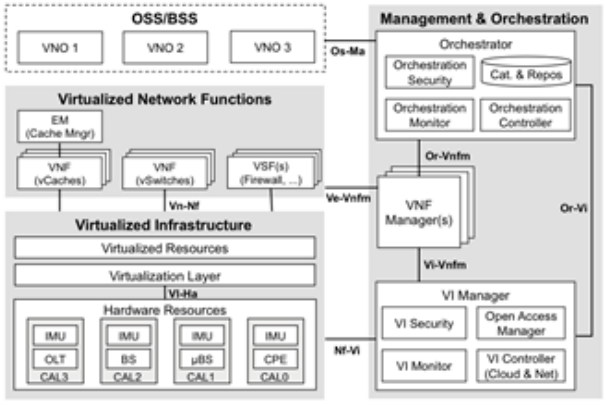

Figure 3: High-level CHARISMA control, management, and orchestration (CMO) plane

The architecture consists of four groups of components:

- Virtualized Infrastructure (VI),
- Virtualized Network Functions (VNFs)
- Management and Orchestration (MANO),
- Operations and Business Support Systems (OSS/BSS).

The VI group virtualizes the hardware resources (computing, storage, and network) via e.g., a hypervisor at the Virtualization Layer, which pools the resources and exposes them for consumption by VNFs. The hardware resources constitute the CHARISMA access network, with the addition of an IMU at each CAL. The IMU models computing and storage resources that are either spare within access network equipment (e.g., BSs) or introduced with commercial off-the-shelf hardware (e.g., servers). The VNFs group comprises software components that implement network functions destined to run on the VI (and finally on the IMUs). CHARISMA looks specifically to implement VNFs for caching, switching, and security. However, any other network function, e.g., CDN, would be able to run on the VI. The

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MANO group includes components for the combination of VNFs into graphs implementing network services, the lifecycle management of VNFs, the coordination of allocating VNFs to virtualized resources, the homogenized control and management of the hardware resources, and the slicing of resources for supporting multi-tenancy. MANO operates under the policy set by the owner of the hardware infrastructure and communicates with the OSS/BSS of VNOs to report status and possibly to receive requirements.

Dissemination Activities

In this period two papers have been accepted (one conference, EuCNC, and one workshop, 5GArch 2016 - IEEE ICC 2016, paper). In addition, a paper describing CHARISMA key drivers and architecture has been submitted to Transactions on Emerging Telecommunications Technologies. CHARISMA partners are constantly participating in the 5G-PPP Working Groups where they are actively contributing CHARISMA's concepts.

Upcoming Events

EuCNC 2016

The conference will take place from 27th to 30th June 2016 in Athens, Greece. The aim of EuCNC is to showcase the status of research in advanced 5G networking and associated topics.

The CHARISMA project will have an exhibition booth presenting three demos. One paper has also been accepted and will be presented during the conference while two more papers will be presented in the special parallel sessions.

EuCNC website

CHARISMA Summer School

5G-PPP CHARISMA project is co-organizing with the National and Kapodistrian University of Athens, a summer school "Key Challenges for 5G Networks", that will be held from 30th June to 1st July 2016, at the NKUA. The school is also supported by the 5G-PPP SESAME project.

The event will gather official representatives from ENISA, National Authorities, academia as well as industry stakeholders, in order to present the challenges and new trends of 5G networking. Indicative topics are: architectures, security, regulation and business.

CHARISMA Summer School website

About CHARISMA

The CHARISMA project is funded by the European Commission (Horizon 2020 program) within the 5G Public-Private Partnership (5G PPP) initiative under the grant agreement No: 671704. The project is set to run for thirty months from July 2015 to December 2017.

It is aiming to develop a new 5G Open Access network architecture where the same physical network is shared by multiple fixed and mobile services. On top of multiple physical layers, intelligent hierarchical routing is enabled and a new end-to-end virtualized security service will also be demonstrated. The project aims to fulfill many of the important 5G-PPP key performance indicators (KPIs) such as 1,000x higher speed, 100x more devices and 5x reduced latency for the wireless Internet of things (IoT).

CHARISMA website

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