CHARISMA NEWS

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Editorial

Dear Reader,

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

This final edition focuses on the latest CHARISMA results and the dissemination activities that have taken place in the past few months.

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

Dr. Theodoros Rokkas (INCITES CONSULTING, trokkas at incites.eu), Editor

Project results & activities

The project has formally ended at the end of 2017 and the final 3 deliverables have been submitted for approval. The following section highlights the main issues addressed in each of these final deliverables of CHARISMA:

Role of impairments when using physical layer security (PLS)

This CHARISMA deliverable D2.6 discusses the role of impairments when using physical layer security. Both wireless and wired 5G networking technologies are discussed, including radio frequency (RF) and millimetre wave (mmW) frequencies, as well as optical wireless LED-based and laser-based communications systems. The physical layer (PHY) principles of how symmetric random keys can be generated by exploiting the shared randomness of multi-path channels are explained, as is how channel reciprocity and maximal entropy (based upon privacy amplification) can be utilised to generate strong keys. Channel state information (CSI) using uncorrelated channel phase, received signal strength, and quantisation, for key generation is also discussed.

The PHY layer security issues of optical fibre-based wireline technologies are also presented, based upon passive optical networking (PON) topologies, and particularly the 100G OFDM-PON system that has been developed within CHARISMA. In particular the issues of coupling ratios, power levels, and wavelength allocations when an eavesdropper employs a tapping coupler to evanescently leak optical signals from the optical fibre are discussed. In addition, the danger of the SNR advantage model featuring a "security gap" is presented, and the application of punctuated LDPC codes to mitigate against such an attack is described. A quantitative power budget table is also presented for the 100G OFDM-PON architecture, to show the impact of power levels on physical layer security.

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Demonstrators evaluation and validation

The deliverable D4.3 is a technical report of the development work made by all partners of the CHARISMA WP4, at the end of the project, as the final 5G field trial demonstrators were designed, setup and finally validated. It summarizes the work done during the final half-year of the project, building upon all the work done in the previous demonstrator tasks and reported in the earlier deliverables D4.1 and D4.2, and presents the results attained in validating and evaluating the deployed field trials and lab demonstrators designed during the project. It provides the final results analysis of the test-beds and field-trials, and the conclusions with respect to the validations against the relevant 5G-PPP KPIs.

The document first summarizes the setup of the two field trials at the Telekom Slovenije and APFutura premises, and the demonstrator at the NCSRD premises. Detailed descriptions of the field trials and demonstrator were already described in the deliverable D4.2. The document D4.3 also describes the differences between the planned and final hardware used, as well as explaining the software employed, and the test bed integration. In all three field-trial and laboratory environments, the demonstrators focus on the three main features of the CHARISMA project:

- Low latency,
- Open Access / Multi-Tenancy (slicing),
- and Security aspects.

The various sub-system components developed in CHARISMA have been integrated together in the field trial and demonstration environments, such that the results of the integration testing are also reported in this document.

The deliverable D4.3 also provides the validation of the specified CHARISMA use-cases and the overall secure, converged and virtualized distributed CHARISMA 5G architecture, including virtualised security aspects and the network management system solution developed in the project. Results of the validation tests are reported and an analysis has been performed by evaluating them against the KPIs defined in the earlier deliverable D1.2, that are based on the 5G-PPP quantifiable KPIs.

The final goal of the report is to provide the analysis and validation of the results emerging from the CHARISMA 5G field trials and use-case scenarios. Together with the previous deliverables D4.1 and D4.2 it presents the work undertaken in the preparation and execution of the 5G field trials to showcase the features and achievements of the CHARISMA project.

Technoeconomic analysis report

The objective of the deliverable D5.6 is to document the results and the methodological approach of the techno-economic analysis within the CHARISMA project. In the earlier, related deliverables, the roadmapping activity in D5.4 identified possible factors that may affect the introduction of 5G networks, while in D5.6 a reference business model for the CHARISMA architecture is now proposed.

The D5.6 deliverable concludes the work done in WP5 and presents a quantitative assessment of

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the deployment of a 5G network such as CHARISMA, from a feasibility point of view. The deliverable D5.6 contains the following aspects:

- Highlights the results of the 5G market forecast
- Based on this forecast, makes estimates as to the expected revenues from 5G services
- Presents the dimensioning rules that were used to create the techno-economic model
- defines the association between user requirements and network deployment
- Shows the cost benefits that a 5G network based on the CHARISMA architecture can bring
- The sensitivity and risk analysis minimizes the uncertainty in the various factors
- Examines the cost savings in future Data Centres that can be enjoyed by telecom operators.

The starting point for the economic analysis is that a telecom operator owns a 4G network in the beginning of the study period. This network has the necessary capacity to support most of the voice traffic through the study period. But the data traffic creates the challenge, and clearly dominates the capacity need, and therefore drives the deployment of 5G networking.

The results reveal that there are viable business cases in areas with high user density and with operators experiencing high market share. Operators in highly competitive markets with a market share below 20% may experience problems in proposing a viable 5G business plan.

Another aspect that was examined was the cost savings that virtualisation and hardware acceleration can achieve in the future Data Centres that 5G operators will need to use, in order to host the IT equipment infrastructure required to run their virtualisation functions.

Dissemination Activities

Paper presentation

The paper “TCO savings for data centers using NFV and hardware acceleration” was presented at the 2017 Internet of Things Business Models, that was organized in Copenhagen, Denmark.

Paper preparation

The paper “ CHARISMA - 5G Low Latency Technologies and their Interaction with Automotion Control Loops”, has been accepted for presentation at the 2018 International Conference on Information, Networks and Communications (ICINC 2018)

About CHARISMA

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