

Editorial

Dear reader,

A lot of work has been done within the SPEED-5G project in the first half year. In this second issue of the bi-annual SPEED-5G Newsletter, we would like to inform you about selected activities of our project.

The current issue features a brief report of SPEED-5G's ongoing work on 5G value chain analysis as well as event reports about the project's involvement at relevant events like the 5G Huddle 2016 event in London and the recent CLEEN 2016 workshop in Grenoble. In addition, we also inform you about our recent standardisation activities, i.e. a paper presented at the 3GPP SA WG1 standardization meeting in Venice.

We hope you find the information in our newsletter interesting and valuable, and we look forward to any questions or comments you may have.

Kind regards,

Milon Gupta, Eurescom

Editor

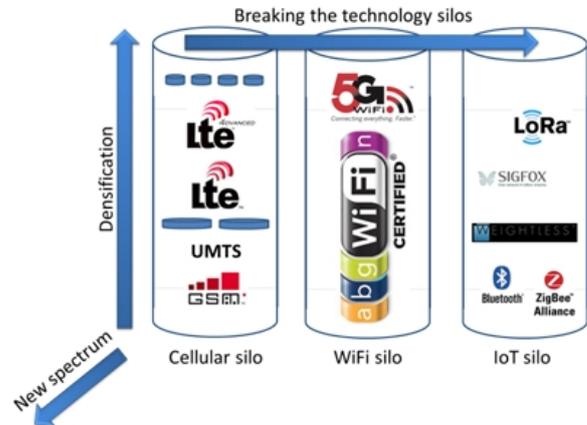
Project highlights

SPEED-5G value chain analysis

The SPEED-5G project is performing a value chain analysis for 5G. The project has been particularly exploring the implications of its novel three dimensional extended-Dynamic Spectrum Allocation (eDSA) model for stakeholders in the 5G value chain. This article presents some of the project's initial insights.

Relevance of the eDSA model for stakeholders

SPEED-5G aims at breaking up the conventional wireless technologies framework by proposing a novel three dimensional extended-Dynamic Spectrum Allocation (eDSA) model. The three main dimensions of the model include: 1. ultra-densification through small cells, 2. additional spectrum, 3. exploitation of resources across technologies.



SPEED-5G three dimensional extended-Dynamic Spectrum Allocation (eDSA) model

This model is being investigated for indoor and indoor/outdoor scenarios where capacity demands are at the highest, but also where the eDSA is most effective at exploiting co-operation across technologies and bands. The analysis of the eDSA model under different scenarios is valuable for key stakeholders to decide not only their positions in the telecommunication market, but also business aspects arising from SPEED-5G key notions. These stakeholders are: operators, vendors, end users, services provider and regulators.

Operators

Operators will use the results of SPEED-5G to strengthen their positions in European collaborative research in telecommunication by acquiring knowledge in the important area of capacity increase by using small cells in 5G networks. For example, the 'home-hub' series of domestic small cells will be developed to have LTE added, but the roadmap beyond this depends on the success of flexible layer 1 and 2 as results from SPEED-5G. Moreover, operators will also use the results of SPEED-5G to move more vigorously and confidently into adjacent markets, such as IoT, both in building and for longer range. Finally, SPEED-5G outcome shall also identify possible gaps that need further research and this awareness will be used to steer future research directions of the telecom operators.

Vendors

Vendors will play a very important role as one of the key stakeholders for SPEED-5G. Vendors will be encouraged to make new devices which will be

compatible to SPEED-5G technologies. For example, these new devices will have multiple MAC interfaces (i.e. FBMC, OFDMA etc.) to download gigabytes of data faster than with currently available devices. New SPEED-5G devices will also lead to significant enhancements in augmented reality, industry automation, and wearable devices.

End users

End users will become the true beneficiaries of SPEED-5G and will experience a completely distinctive user experience in terms of “Mobile Internet” over Speed-5G Heterogeneous Networks (HetNets).

Service providers

Service providers can utilize new features and services that SPEED-5G can provide, enabling them to deliver amazing infotainment services.

Regulators

There is growing interest in Dynamic Spectrum Access (DSA) from regulatory agencies (e.g. FCC, Ofcom) and a variety of industry standardisation forums including IEEE SCC41, 802.11y, and 802.22. The SPEED-5G approach enables real-time optimization of spectral resources and radically changes spectrum management that depends on pre-planned frequency assignments. SPEED-5G targets bands below 5GHz which is also the main target of many regulators before next WRC in 2018. The regulatory stipulations for 5G technologies must be taken care of by the regulatory bodies. Although 5G technologies are in developing and evolving process it ought to be regularized for the betterment of deployment.

The following aspects should be addressed in 5G regulation:

- Location Accuracy – More advanced accurate location finder in 5G.
- Lawful Intercept – The technical challenge is to develop a 5G architecture that enables communications not necessarily passing over centralized network elements, whilst ensuring compliance with lawful intercept regulations.
- Tower sharing – The 5G architecture should support solutions to minimize the number of antennas in shared multi-RAT environments.
- Flexible Spectrum Use – spectrum licenses should be flexible enough to allow operators to meet the rollout demand while being capable of using 5G spectrum for backhaul when and where appropriate.

Accessibility – Broadband wireless services are becoming part and parcel of our daily life, so 5G services must have easy access to physically challenged people.

Events

SPEED-5G at CLEEN 2016 workshop in Grenoble

SPEED-5G had an active role in the Fourth International Workshop on Cloud Technologies and Energy Efficiency in Mobile Communication Networks (CLEEN 2016), which took place on 31 May 2016 in Grenoble. Other supporting projects were 5G NORMA and FLEX5GWARE. The workshop was part of the 11th EAI International Conference on Cognitive Radio Oriented Wireless Networks (CROWNCOM).

Network challenges

The last decades brought an exponential increase in mobile traffic volume. This will continue and a 1,000-fold increase by 2020 has been forecasted. Hence, mobile communication networks and user behaviours are permanently evolving. For instance, heterogeneous networks, i.e. macro-cellular networks complemented by dense small-cell deployments, promise to provide the required data rates through an increased spatial utilisation of the spectrum.

Due to strong inter-cell interference, heterogeneous networks will require a high degree of coordination as offered by centralised processing. Furthermore, cloud-processing has been established as a way to scale computational resources to centralize data and processing towards data centres, and to exploit computational diversity.

SPEED-5G presentations

Several presentations at the workshop addressed the issues mentioned above. First, SPEED-5G Project Manager Uwe Herzog from Eurescom gave an introduction to the project. In a second presentation from SPEED-5G, Benoit Miscopein from CEA spoke about “Dynamic spectrum allocation and energy efficiency in 5G systems”. This presentation gave an overview on the SPEED-5G activities and current ideas related to the workshop topics, i.e. energy efficiency and cloud hosting.



Uwe Herzog, Eurescom, presenting SPEED-5G at the CLEEN 2016 workshop



Benoit Miscopein, CEA, explaining dynamic spectrum allocation and energy efficiency in 5G systems

The SPEED-5G architectural concept is built upon concepts such as NFV, SDN and slicing, and hosting of network functions in the cloud will thus be an element that can contribute to efficient use of resources. The extended Dynamic Spectrum Allocation (eDSA) concept which SPEED-5G is developing will enable resource management with three degrees of freedom: densification, rationalized traffic allocation over heterogeneous wireless technologies, and better load balancing across available spectrum. This is thus considered a powerful technique to address also the energy-efficiency aspect.

To give an example, in a situation where several radio access technologies (RAT) are available at a user's place, the 5G system can choose the RAT to be used also under the aspect of energy efficiency. This could not only save energy and valuable resources in the network, but also save energy on the user terminal leading to longer battery lifetimes.

Panel discussion

The workshop concluded with a panel discussion in which SPEED-5G was again represented by Uwe

Herzog. The panel discussed various questions including:

- How are R&D projects exploring novel concepts to allow for flexibly centralised radio access networks using cloud processing based on open IT platforms?
- What about energy-efficiency goals and the need for long-term sustainability of network infrastructure and devices?
- What is the role of MEC (Mobile Edge Computing) in this context?

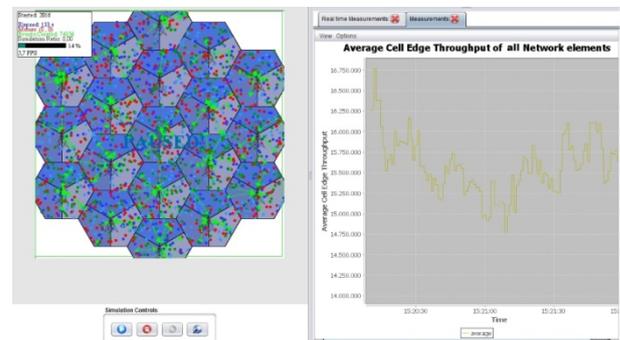
The path toward CRAN and virtualization is driven by a better infrastructure efficiency and costs savings. What about the next challenges and future network evolution focused on energy efficiency and cost-effectiveness?

Participation to the workshop has been a good opportunity for SPEED-5G to exchange views and disseminate project ideas with a targeted audience of experts.

Workshop website:
http://crowncom.org/2016/show/technical-session#ws_clean

Demonstration of SPEED-5G results at 5G Huddle 2016 event in London

At the 5G Huddle 2016 event in London, which took place on 26-27 April 2016, SPEED-5G project partner WINGS ICT Solutions presented some of the latest project results. It included a live demonstration of SPEED-5G's RRM/MAC solutions and their benefits. Specifically, the demonstration included a performance evaluation for allocating the best possible channel of all the available channels to users. This dynamic Channel selection was performed based on the minimal interference of each channel and some preliminary results were also presented.



WINGS ICT Solutions simulation tool running SPEED-5G's RRM/MAC solution

The figure above illustrates the simulation tool running the specific RRM/MAC algorithm that was presented in the workshop/demonstration session of the conference by Ioannis-Prodrimos Belikaidis and Andreas Georgakopoulos. In addition, Andreas Georgakopoulos, participated in the panel which discussed the demonstrated outcomes of SPEED-5G and other demonstrators.

During the two-day conference, the participants discussed the work that needs to be done in order to make the 5G vision a reality. The conference offered a platform to assess the outcomes of the recent World Radio Communication meeting (WRC-15) in November 2015, and the spectrum that is needed to fuel 5G. Participants also sought to identify the unique challenges that lay ahead as we move towards wide-scale rollout by 2020.



Andreas Georgakopoulos (left) and Ioannis-Prodrimos Belikaidis (both from WINGS ICT Solutions), presenting the SPEED-5G demonstration at 5G Huddle 2016.

Further information is available on the 5G Huddle 2016 event website:

http://eu-ems.com/summary.asp?event_id=2285&page_id=4637

Paper presented at 3GPP SA WG1 standardization meeting in Venice

At the latest 3GPP SA WG1 standardization meeting #74 held in Venice on 9-13 May 2016, Intel presented on behalf of the SPEED-5G consortium the discussion paper “Enhanced spectrum access use cases for 5G systems: the vision of the European funded projects ADEL and SPEED-5G” (S1-161308). It is linked to the ongoing Release 13 Study Item called SMARTER (New Services and Markets Technology Enablers).

The discussion paper was meant as a collaboration among two EU-funded projects SPEED-5G and ADEL, and it aimed at disseminating the work done

in SPEED-5G on 5G use cases, scenarios and related KPIs, providing some useful insights and details also on deployment scenarios.

The document was well received by the 3GPP group. It was noted in the meeting minutes, and several interesting discussions followed offline, mainly focusing on clarifying some aspects of the proposed deployment scenarios.

Documents from the 3GPP SA WG1 standardization meeting in Venice:

http://www.3gpp.org/ftp/tsg_sa/WG1_Serv/TSGS1_74_Venice/Docs/

Imprint

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