PROJECT PROFILE

CAT121 | Small cell architecture will make smart, high-speed 5G networks a reality [EAST]

This project develops and tests key elements for next-generation, 5G mobile networks to ensure that the 'small cell' approach is successful technically and commercially. This calls for improved data handling, integration, performance and flexibility, as well as, reduced power consumption and costs.

The availability of large amounts of data or content anywhere at any time is crucial to the development of modern economies. To address this need, wireless networks and related communication standards have been continually upgraded to extend their data-handling capabilities. As a result, today's wireless user is served by power-hungry 2G/3G/4G macro- and micro-cell base stations that still have data capacity limitations; while the available spectrum for further increase has become a scarce resource. Fifth-generation (5G) mobile networks – the obvious answer – are expected to overcome these limitations and truly enable smart, high-speed, 'everything everywhere' access to their end-users though the deployment of small cells.

Smaller is better

Key elements to a successful 5G approach are the creation of smaller cells and the use of multiple-input, multiple-output (MIMO) or smart-antenna techniques operating at higher (video) bandwidths with lower power consumption. This will yield a new paradigm in data-handling capability. However, with the introduction of more (small) cells, containing multiple transmitters, data handling, integration, power consumption and cost-reduction become more and more important and need to be drastically improved compared with their macro/micro-cell predecessors. Furthermore, multiband-multimode operation and re-configurability are expected to be essential features of these next-generation, compact, low-cost, small-cell solutions.

In order to achieve all that and also make this 5G approach technically and commercially successful, the following issues have to be dealt with:

- Enhanced data rates (video bandwidths up to and beyond 100MHz);
- Higher transceiver integration (10-100 times size reduction);
- Higher functionality (MIMO/smart antenna);
- Drastic cost-reduction (10-100 times compared to micro/macro base stations);
- Re-configurability (multiple-transmit bands);
- Higher overall system efficiency (greater than 60%);
- Reduced energy consumption;
- Shorter time-to-market.

In 5G networks, the technology/circuit implementations of base stations will have greater similarities to those of handsets than what is currently found in 3G/4G applications. EAST addresses this trend by covering both infrastructure (base stations) and terminal (handsets) for 5G networks up to 6GHz in a generalised design-approach, which allows for easy frequency and power scaling. This clear focus on the 'low' GHz range addresses the general expectation that this market segment will represent the highest economic value, with the largest environmental (energy consumption) impact.

All expertise in one place

The project consortium, which includes both vertical and horizontal actors, from technology developer/provider to the system integrator, works on the infrastructural and handset parts covering the total radio frequency (RF) system. By having all the necessary competences available in a single consortium, optimisation of the different key elements can be approached directly from a system level, rather than on a stand-alone basis, which tends to slow down radical innovations and discourages the introduction of new, revolutionary architectures.

Mobile data and 5G crucial for our economy

EAST's innovations target energy-efficient solutions for mobile-communication infrastructure and terminals. Since communication networks form an essential part of our global infrastructure, their capability and performance, as well as, the pace of their growth and development, largely define our society, our wealth, and our way of life.

PROJECT CONTRIBUTES TO

- Communication
- Energy efficiency
- Design technology
- Process development

PARTNERS

NXP Netherlands
BESI
Bruco
Anteverta-mw
Nokia
TU-Delft
TU-Eindhoven
TNO

COUNTRIES INVOLVED

- Ireland
- The Netherlands

PROJECT LEADER

Dre van den Elshout
NXP Netherlands

KEY PROJECT DATES

1 May 2015 - 30 April 2018

The telecom-services market continues to be the largest IT spending market. According to Gartner analysts, this market will be predominately flat over the next several years as revenue from mobile data services compensates for the decline in total spending for both the fixed and mobile voice services markets. By 2016, Gartner forecasts that mobile data will represent 33% of the total telecom services market, up from 22% in 2012. European-headquartered information and communications technology (ICT) businesses had a global market share in 2011 of more than 43%, and with an ambition to improve this share for 5G infrastructures.

Mobile data is becoming a crucial technology for our economy, and 5G will be the next technology for that. In the forthcoming years, the small-cell base station market will grow rapidly to provide high data-rates to an increasing number of customers. Small cell 5G base stations will add to this growth beyond 2017, exploring new frequency bands. In order to enable such growth, small-cell base stations need to have a large degree of integration to achieve small size and low cost. In the near future until 2020, 5G is expected to be adopted by about 20% of all large mobile service providers.

Basically, 5G is expected to present new opportunities involving video, machine-to-machine (M2M) communication and newer services in order to expand collaboration, communication and surveillance. Today, service providers' chief technology officers want their companies to be prepared for 5G trial-evaluations with standards' participation, as well as, for mobile video surveillance, video conferencing, and video gaming and movie/TV devices, as part of their 5G offerings. Considering that the 5G market is expected to take off after 2020, concrete, reliable 5G market-data and market-size projections are today extremely hard to get. A suitable trend indicator might be, for example, the M2M segment, which will be addressed by 5G. It is expected to increase from US$53 billion in 2014 up to US$199 billion in 2022. Another idea of the expected market volume may come from 4G LTE (long-term evolution, a high-speed wireless communication standard for mobile phones and data terminals) where LTE and LTE-Advanced service revenues are expected to grow at a CAGR of nearly 40% over the next six years, eventually accounting for US$672 billion by end 2020. LTE infrastructure spending is expected to account for nearly US$15 billion by end 2014. This includes spending on LTE macro-cells, small cells and mobile core equipment.

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CATRENE (E! 4140), the EUREKA Cluster for Application and Technology Research in Europe on NanoElectronics, will bring about technological leadership for a competitive European information and communications technology industry.

CATRENE focuses on delivering nano-/microelectronic solutions that respond to the needs of society at large, improving the economic prosperity of Europe and reinforcing the ability of its industry to be at the forefront of the global competition.