Demonstration proposal for CROWNCOM 2016:

Field Trial of Citizens Broadband Radio Service (CBRS) / Spectrum Access System (SAS)

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Abstract

This demonstration presents a field trial of the latest US spectrum sharing concept for mobile broadband. The proposed demonstration is part of the Finnish spectrum sharing trial continuum that started in 2013 with the World's first Licensed Shared Access (LSA) trial [Figure 1]. The demonstration is now expanded towards the US three-tier Citizens Broadband Radio Service (CBRS) model [Figure 2] for 3.5 GHz band that introduces an additional more dynamic sharing layer in addition to the two layers available in the LSA model. The trial is implemented based on the Federal Communications Commission (FCC's) definitions and Wireless Innovation Forum (WInnF) Spectrum Sharing Committee's recommendations. The trial consists of commercial LTE network components like base stations, user equipment, network management system, and core network. Additional spectrum sharing specific components are developed on top of the LTE system including Domain Proxy and advanced algorithms for Spectrum Access System (SAS) to enable frequency allocation for the CBSDs. Both the standalone and operator driven CBSDs are considered. Our trial gives a unique opportunity to see live how a commercial LTE network adapts to the SAS frequency allocation. Furthermore, performance and latency measurements (e.g. evacuation time) are performed based on the real life behavior of the network.

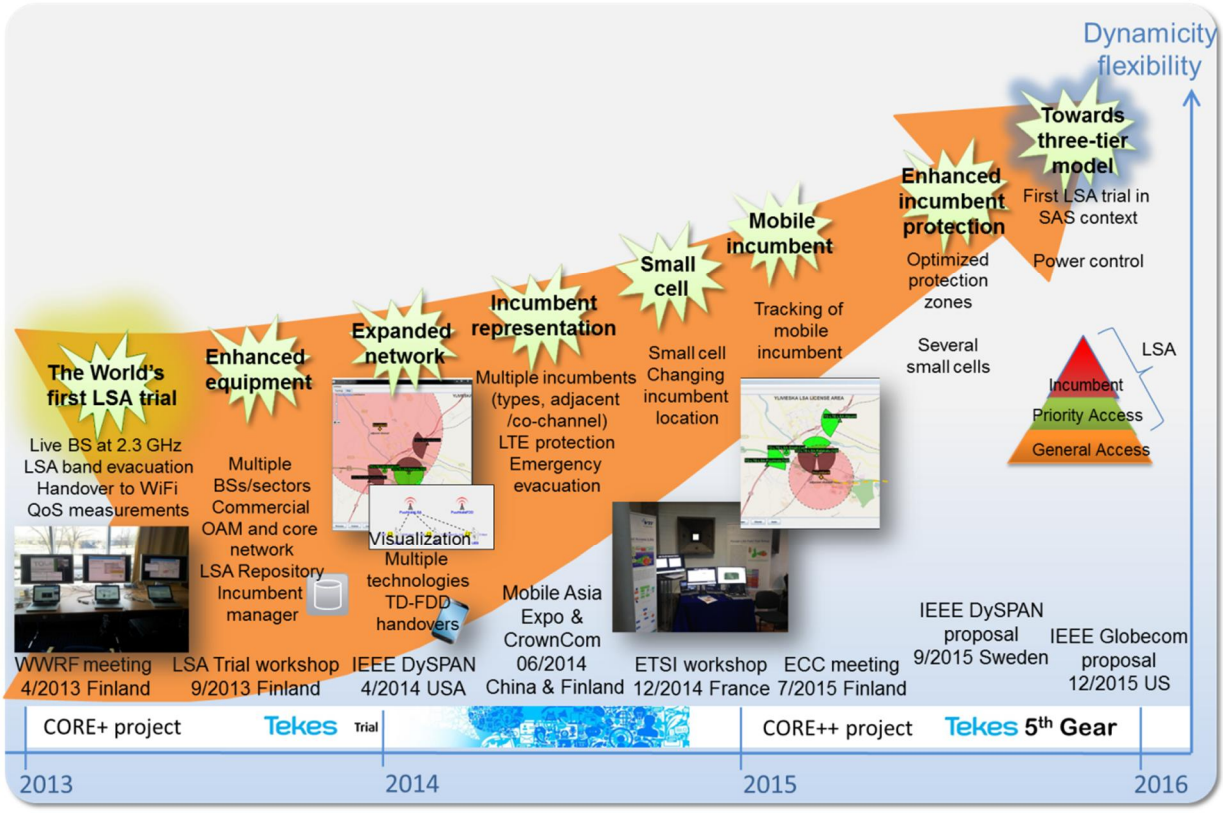

Figure 1. Evolution of the Finnish LSA trial activity towards more dynamic sharing models.

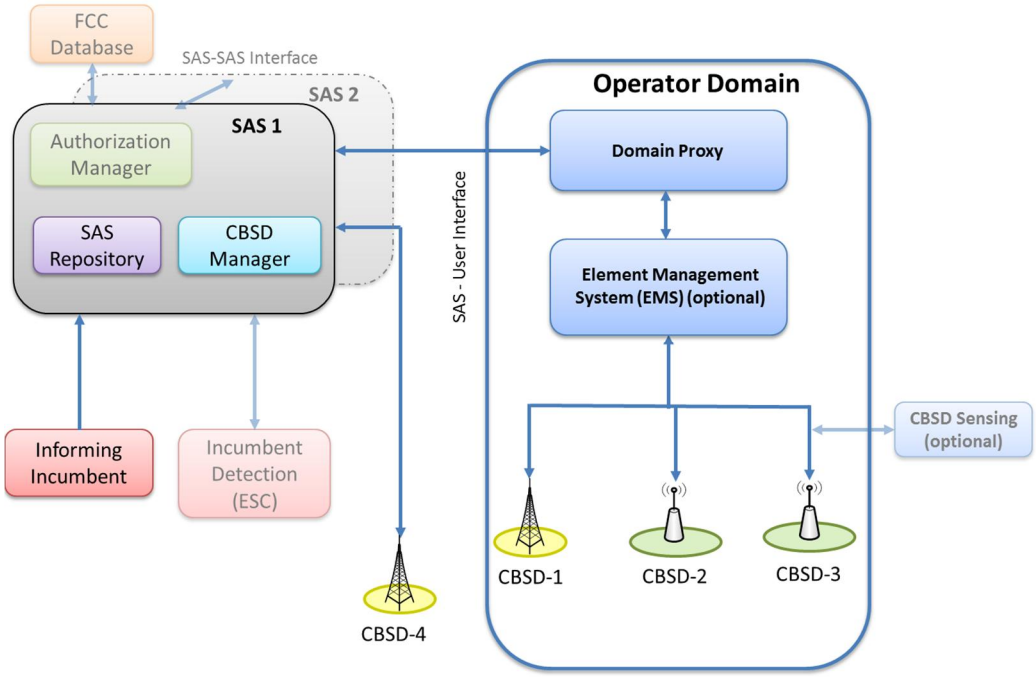

Figure 2. CBRS Trial architecture.

Trial description (Objectives, Importance and Timeliness)

Spectrum sharing trials are extremely timely as the recent and on-going regulation and standardization efforts in Europe and US have focused on making new spectrum available for mobile broadband systems through sharing. In Europe, Licensed Shared Access (LSA) concept has gained significant interest in industry and academia and is currently being standardized in European Telecommunications Standards Institute (ETSI) and promoted in spectrum regulation in European Commission (EC) and European Conference of Postal and Telecommunications Administrations (CEPT). In US, Federal Communications Commission (FCC) has adopted new spectrum sharing concept called Citizens Broadband Radio Service (CBRS), being further defined by Wireless Innovation Forum (WInnF).

The proposed demonstration will showcase the US CBRS model that introduces an additional layer of lower priority users in addition to incumbent access and priority access. Building on top of the pioneering work on LSA by the Finnish trial consortium in Europe, the demonstration is now expanded towards the US three-tier CBRS concept, enabling spectrum sharing and flexible use of spectrum in the 3.5 GHz band. The three tiers are: (1) Incumbent licensees; (2) Priority Access licensees (PAL); and (3) General Authorized Access (GAA) [Figure 1.]. The first tier consists of the incumbent federal users (military radars) and fixed satellite service (FSS) operators. These incumbents will have complete interference protection from the two lower CBRS tiers. The second tier is PAL which is entitled to interference protection from GAA CBSDs. The third tier, GAA, is license free tier, but all devices operating in the band are required to be authorized.

In order to facilitate dynamic spectrum access in CBRS system, we need Spectrum Access System (SAS), a highly automated frequency coordinator, taking care of the authorization and management of CBRS spectrum. SAS is responsible for protecting the higher tier CBSDs from harmful interference and maximizing the frequency capacity for all CBSDs.

In CrownCom 2016, our demonstration consists of commercial LTE network components including Evolved Node B (eNodeB) base stations as CBSR devices (CBSDs), Evolved Packet Core (EPC) core network, Operational Support System (OSS) and end user equipment (UEs). The demonstration goes beyond our first CBRS/SAS trial (in GLOBECOM 2015) by: 1) Presenting CBRS Domain Proxy implemented as Self Organizing Network (SON) solution integrated into OSS, 2) Using the Finnish Communications Regulatory Authority

issued test license and devices suitable for 3.5GHz band (LTE band 42), 3) Introducing additional spectrum sharing specific components developed on top of the LTE system, including SAS (SAS Repository and SAS controller), Domain Proxy and standalone CBSD without network management system, and 4) Introducing novel and advanced algorithms for SAS. The demonstration will follow standards and recommendations given by WInnF and with the demonstration we aim to contribute to ongoing standardization process.

CBSDs can belong to an operator network or they can operate as a standalone CBSD, depending on the usage scenario. In our demonstration, network management system integrated Domain Proxy will take care of the communication with SAS and pass the commands to CBSDs which belong to operator network. In the case of a standalone CBSD, there is no network management system between CBSD and SAS, so CBSD itself has to communicate with the SAS to get spectrum access information.

We give a live demonstration to the audience on how a commercial LTE network adapts to the new spectrum sharing system. The visualization tools are used to demonstrate the operations of the different trial components to the audience. The actual live trial environment is running in Finland and it is shown and controlled remotely from the conference venue. The visualizations show the locations of the LTE network and incumbent on the map and corresponding activities when the incumbent appears. Performance and latency measurements of the trial system can also be shown to the audience.

Contact information/ Track record of the demo:

Demonstration is presented by Finnish industry and academic trial consortium from Cognitive Radio Trial Environment (CORE++) project (http://core.willab.fi/) coordinated by Pekka Aho, pekka.aho@vtt.fi, VTT Technical Research Centre of Finland Ltd., Kaitoväylä 1, FI-90571 Oulu, Finland.

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The proposed demo is part of the Finnish spectrum sharing trial continuum that started in 2013 with the World's first LSA trial, see Figure 1. Followed by consecutive public trials on academic, industry, regulation and standardization forums in US, Europe and Asia including WWRF meeting (Oulu, Finland, 25 April 2013), LSA Trial Workshop (Helsinki, Finland, 3 Sept. 2013), IEEE DySPAN conference (McLean, US, 1-4 Apr 2014), CrownCom conference (Oulu, Finland, 4 June 2014), Mobile Asia Expo (MAE) and GTI workshop (Shanghai, China, 9-13 June 2014), ETSI RRS Workshop (Sophia Antipolis, France, Dec. 2014), 40th ECC Plenary Meeting (Helsinki, Finland, Jul 2015) and IEEE DySPAN conference (Stockholm, Sweden, Sep 2015). The first CBRS/SAS demonstration was shown in IEEE GLOBECOM conference (San Diego, USA, 6-10 Dec 2015).

Demonstration layout and a list of specific needs on-site:

- A single table (>3m) that accommodates three demonstration laptops and three displays/TVs or a smaller table and stands for the displays/TVs.
- Three large desktop displays or TVs for three demonstrator laptops with DVI cabling.
- Wired internet access over 15 Mbps required. 6 Ethernet ports or one port allowing plug-in an Ethernet switch for 6 IP addresses.