

Business from technology



Spectrum sharing using Authorised Shared Access (ASA): The concept and world's first live trial

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Outline

Introduction

Finnish CORE+ project

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Authorised Shared Access (ASA) concept

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World's first live ASA trial in Finland

Summary

Introduction

- Mobile telecommunication traffic keeps growing significantly in the future as predicted by e.g. ITU-R Report M.2243.
- While the increasing data traffic will be carried by more powerful wireless technology, e.g. LTE, the roll out of the new mobile networks will require new spectrum bands with wider carrier bandwidths to realize the full benefits of the technology.
- Cognitive radio system (CRS) technology with capabilities for obtaining knowledge, decision making & adjustment, and learning can help to:
 - Optimise resource use within the network and across multiple networks
 - Facilitate spectrum sharing between different radiocommunication services

CORE+ PROJECT

Overview of CORE+ project

- “Trial Environment for Cognitive Radios and Networks” program funded by Tekes is on-going in Finland in 2011-2014.
 - Goal is to transform Finland into a globally attractive cluster of expertise and unique trial environment for cognitive radio and networks.
- CORE+ (Cognitive Radio Trial Environment+) project in Trial program in 2013-2014:
 - Three research organisations: VTT Technical Research Centre of Finland, Centria University of Applied Sciences and University of Oulu;
 - Seven industry companies: Nokia Siemens Networks, PPO, EXFO, Elektrobit, Renesas Mobile Europe, PehuTec, and Rugged Tooling;
 - Two governmental organisations: the Finnish Defence Forces and Finnish Communications Regulatory Authority (FICORA).

Tekes Trial program: <http://www.tekes.fi/programmes/Trial>

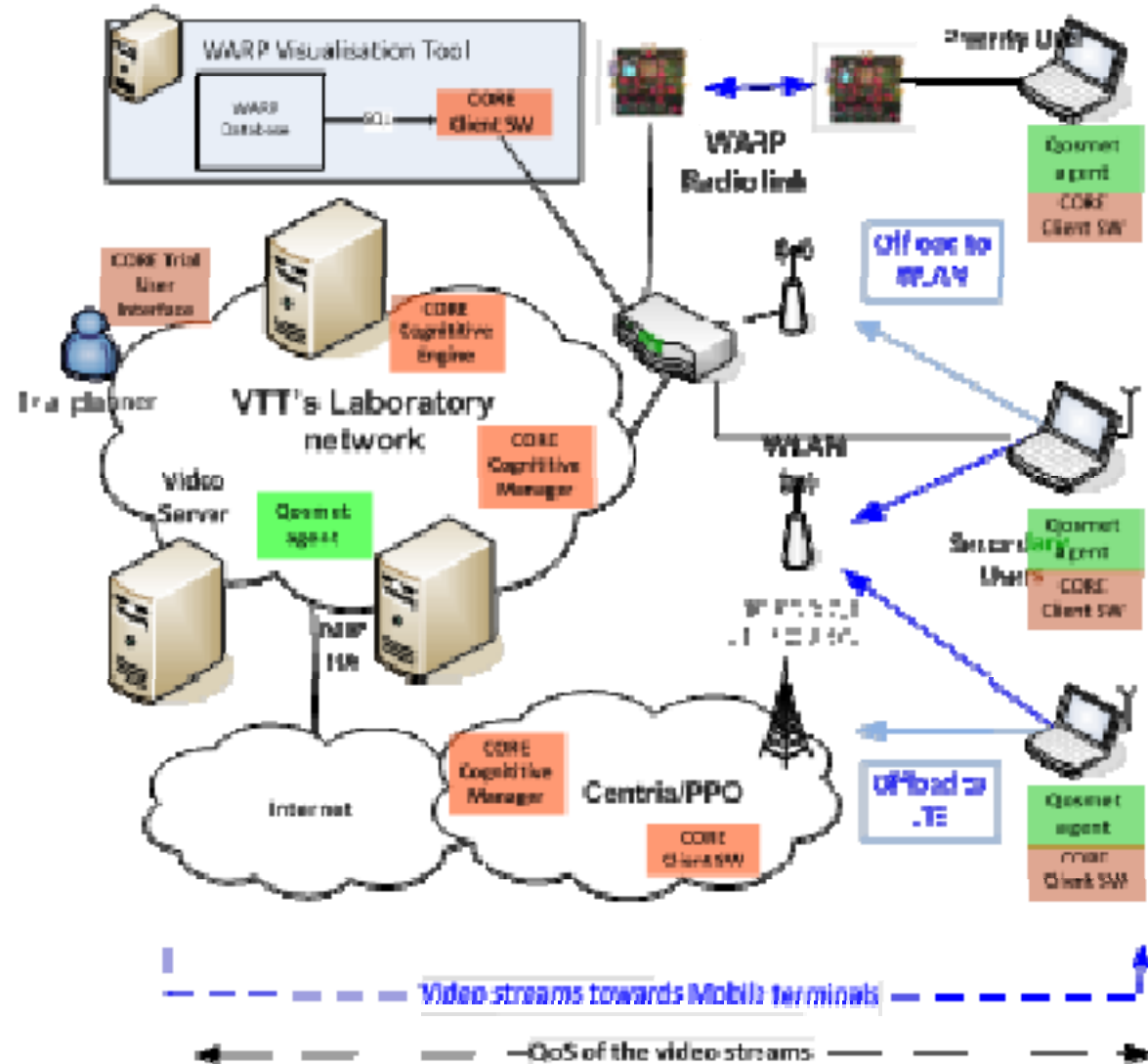
CORE project: <http://core.willab.fi/>

CORE+ goals

- Develop cognitive radio trial environments and trial new spectrum sharing concepts based on cognitive radio system (CRS) technology with a particular focus on Authorised Shared Access (ASA) and Active Antenna System (AAS) concepts and also device to device (D2D) and full duplex radio concepts (FDR)
- Develop cognitive engines for the above concepts to improve the resource use of future mobile systems.
- Research the impact of spectrum sharing with CRS on the business ecosystem and business models in the mobile broadband business.
- Influence the international spectrum regulation to include spectrum sharing with CRS technology and follow the relevant CRS related standardization activities.

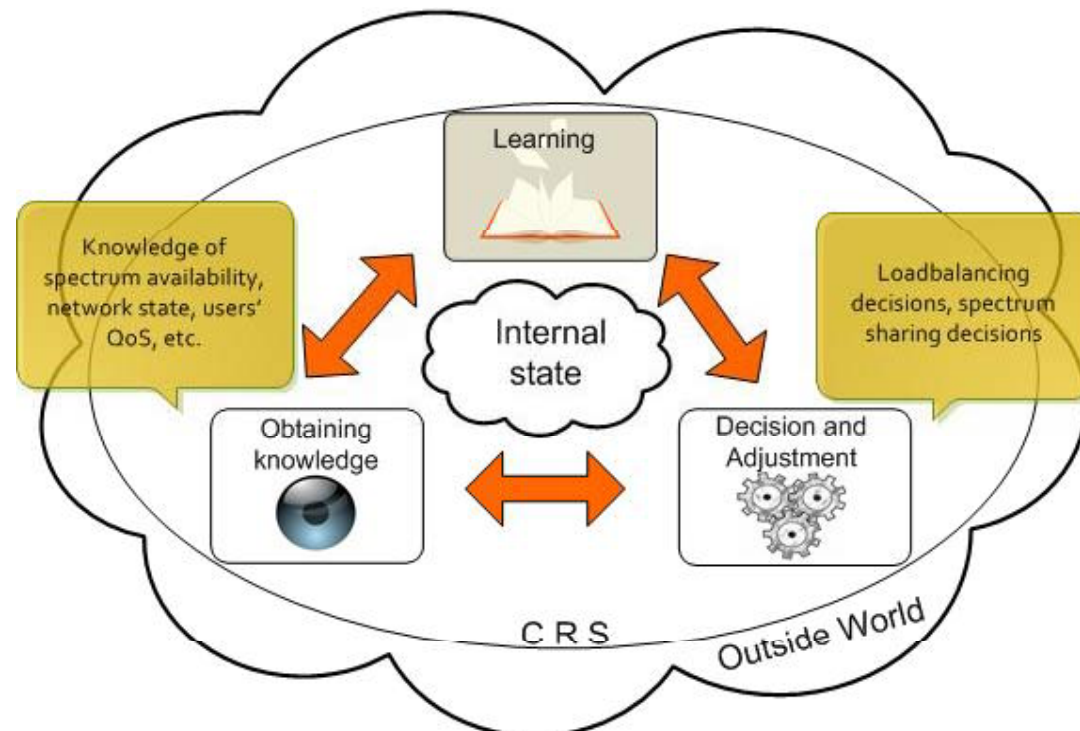
CORE+ trial environment

- Centria:
 - Live field trial LTE networks in Ylivieska in several frequency bands.
- VTT:
 - Cognitive decision making system in Oulu to collect data and control the networks.
- University of Oulu:
 - WARP system in Oulu.
- Companies:
 - Parallel industry project with trials.



CORE+ trial environment and cognitive cycle

- CORE+ trial environment implements the cognitive cycle and allows researchers to carry out experiments with cognitive decision making and quantify its benefits.



Modified from: Report ITU-R M.2225. Introduction to cognitive radio systems in the land mobile service. 2011.

AUTHORISED SHARED ACCESS (ASA)

Overview of ASA

- Authorised Shared Access (ASA) concept aims at allowing dynamic use of spectrum whenever and wherever it is unused by the incumbent spectrum user.
 - Spectrum sharing can be realized across multiple dimensions (e.g. frequency, time, and geography possibly using cognitive radio system (CRS) capabilities.
- There are bands allocated to the mobile service that currently encompass other primary usage and thus cannot be used by the mobile communication networks.
 - ASA is an industry driven approach aiming at taking these bands into actual use for the mobile communication networks.

Overview of ASA

- ASA concept is a complementary approach to traditional exclusive licensing and license-exempt approaches allowing a spectrum band to be shared between an incumbent spectrum user (i.e., incumbent) and another system (i.e., ASA licensee) with pre-determined rules and conditions and licensing agreements.
 - A key benefit of the ASA concept is to ensure controlled predictable quality of service (QoS) levels for both incumbent and the ASA licensees.
- The ASA concept can provide a cost-efficient and harmonized way to utilize existing spectrum allocations and to achieve economies of scale by making IMT bands available worldwide with existing user equipment and minimum modifications to the infrastructure.
- The first application area for the ASA concept currently under study in regulation and standardization in Europe is the 2.3-2.4 GHz band under the licensed shared access (LSA) regime.

Key stakeholders and phases in ASA concept

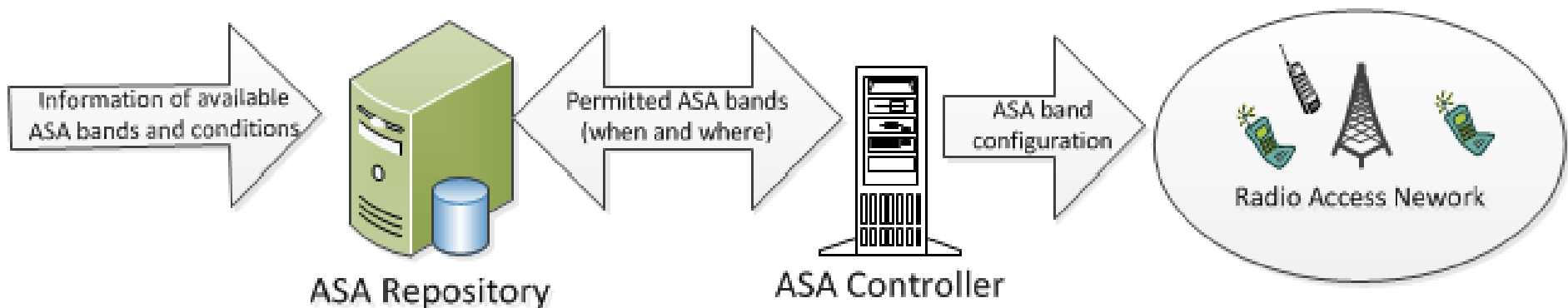
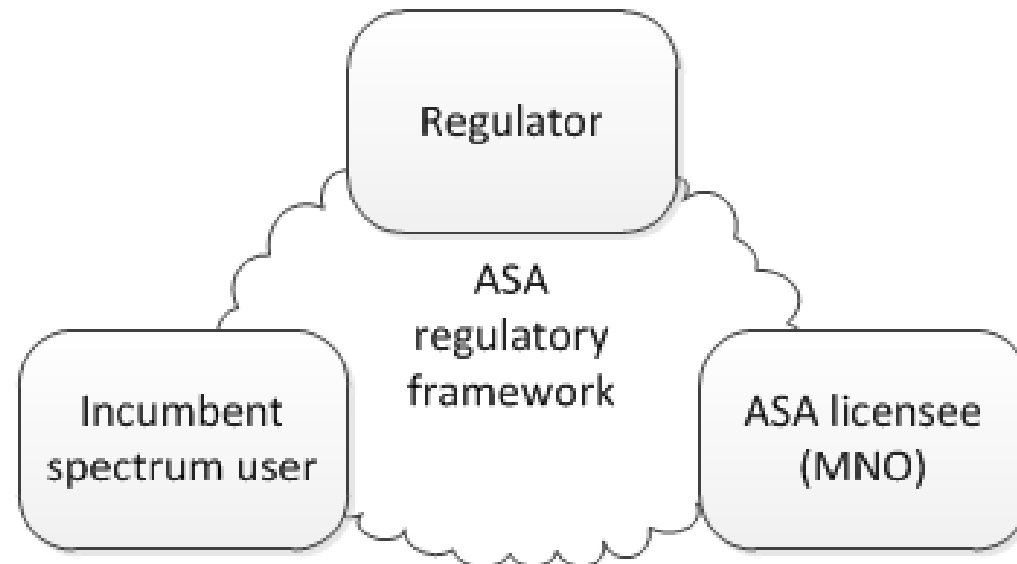
Key stakeholders in ASA:

- Incumbent spectrum user (Incumbent)
- Regulator
- Mobile network operator (MNO) (ASA licensee)

Key phases in ASA:

- Preparation
- Licensing
- Deployment
- Release

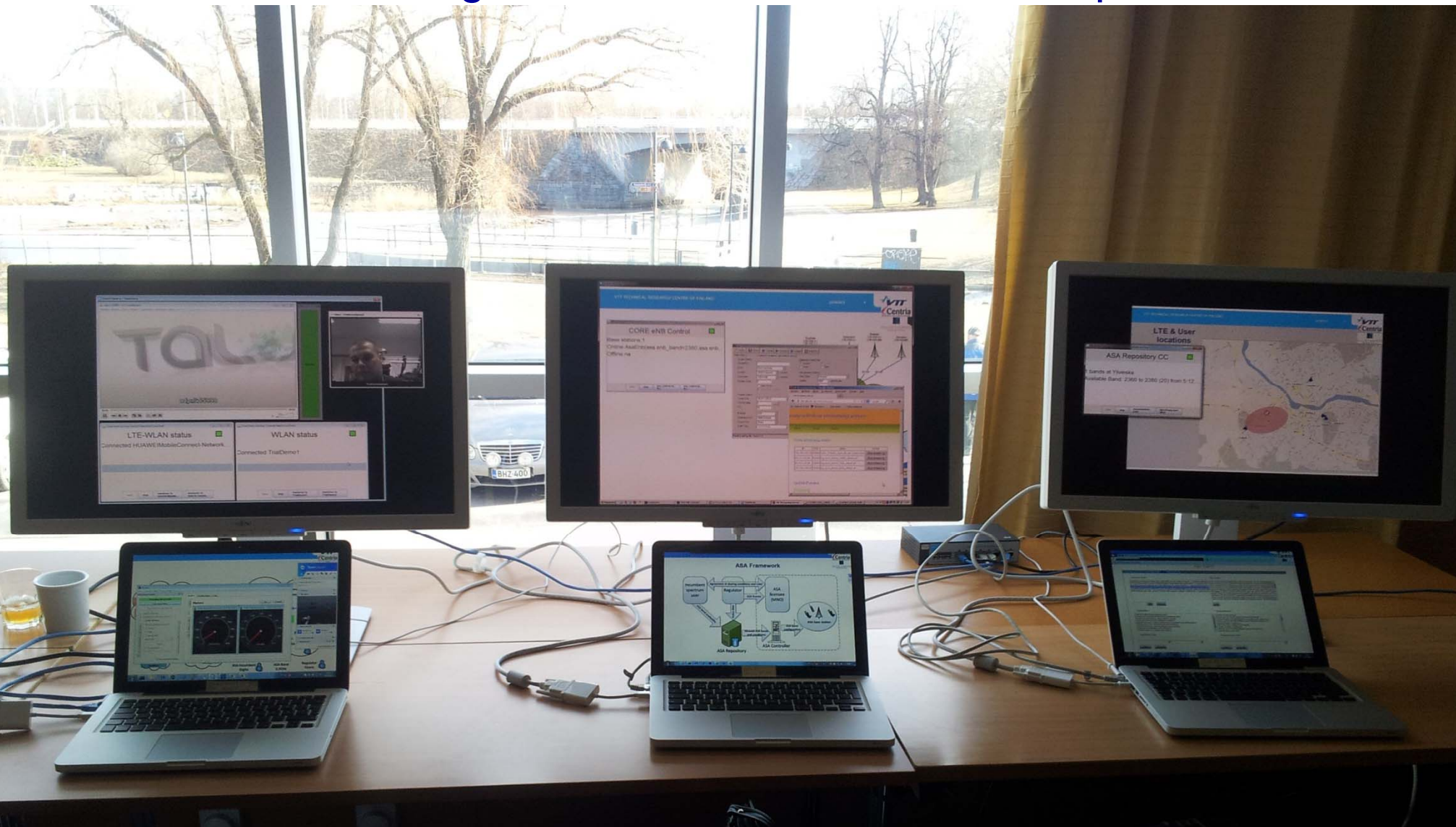
ASA Framework



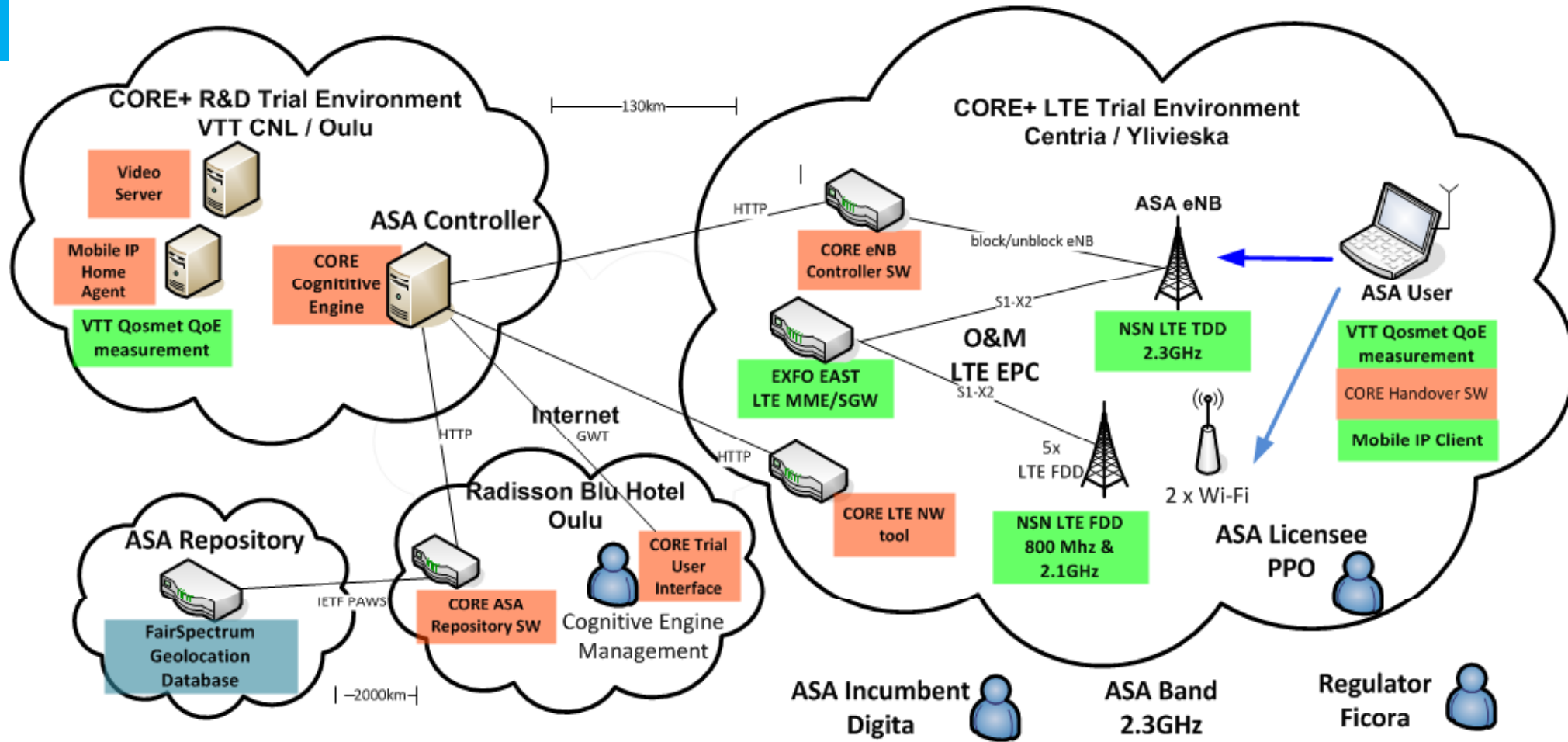
Finnish CORE+ project and ASA concept =>

**WORLD'S FIRST LIVE ASA TRIAL
IN FINLAND 25.4.2013 AT WWRF**

World's first live ASA trial demonstrated at WWRF meeting in Oulu, Finland, on 25th of April 2013



World's First Demonstration of Authorized Shared Access with 4G/LTE



The ASA trial with 4G/LTE

Digita, PPO and Ficora agreed on 2.3-2.4GHz usage for ASA trial. Local operator, PPO, is able to offer ASA band for mobile broadband access based on the band availability information from the ASA Repository. As agreed, when a TV crew is arriving on the area using the ASA band it is cleared. The ASA base station is shutdown and ASA user is switched on another network such as Wi-Fi until the TV crew leaves the area and the ASA band is available again. ASA Controller is based on CORE+ cognitive engine and it controls the ASA eNB based on the ASA band information found from the ASA Repository.

References

- <http://core.willab.fi>
- <http://tki.centria.fi>
- <http://www.nsn.com>
- <http://www.exfo.com>
- <http://www.fairspectrum.com>
- <http://wise.turkuamk.fi>
- <http://www.vtt.fi>
- <http://www.ppo.fi>
- <http://www.digita.fi>
- <http://www.ficora.fi>

- CORE+ project R&D component
- Commercial product
- WISE project R&D component

World's First Demonstration of ASA with 4G/LTE: Trial Progress

- TD-LTE base stations are deployed in the 2.3 GHz ASA band and configured to a vacant channel which is obtained from ASA Repository.
- End user is connected to the LTE base station in the ASA band.
- ASA band is evacuated on demand by shutting down transmission in the band when requested by the incumbent spectrum user or regulator or when licensing agreement expires.
- Before releasing the ASA band to the incumbent, the end user is handed over from the LTE network in the ASA band to Wi-Fi network in ISM band to maintain the end user's connection.
- When the incumbent returned the ASA band back to the mobile communication network, the TD-LTE base station successfully restarts its transmission in the ASA band and the end user is moved back to the ASA band.

http://www.vtt.fi/news/2013/25042013_ASA.jsp?lang=en

Summary

- Mobile telecommunication traffic keeps growing significantly and the roll out of the new networks will require new spectrum bands.
- Cognitive radio system (CRS) technology with capabilities for obtaining knowledge, decision making & adjustment, and learning can help to optimise the resource use and facilitate spectrum sharing between different radiocommunication services.
- Authorised Shared Access (ASA) concept is currently under study in European regulation and standardization under the Licensed Shared Access (LSA) regime.
 - Goal to allow spectrum sharing between a mobile communication system and another primary system with pre-defined rules and conditions and minimum modifications to existing systems.
- World's first live trial of the ASA concept with live LTE networks in 2.3 GHz band was demonstrated in Finland in April 2013 at WWRF meeting.