



Authorized Shared Access Optimising spectrum utilisation

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Key requirements towards 2020

Support up to 1000 times more traffic



Manage up to 10 times more users



Bring mobile broadband services to rural areas



Enable Gbps peak speeds



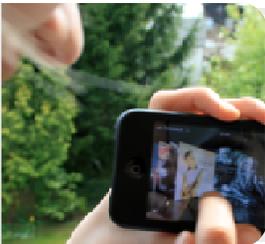
Improve energy efficiency



Deliver superior experience for a heterogeneous customer base



Reduce latency to milliseconds

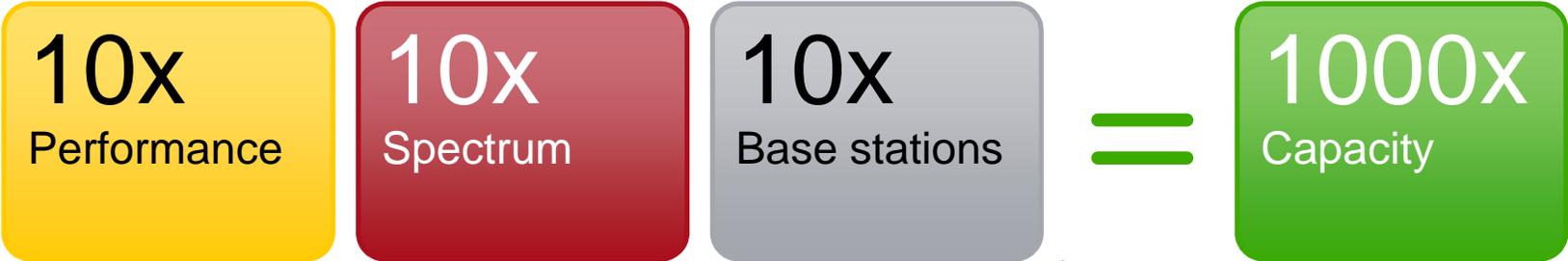


Make networks self-aware, self-adaptable, and intelligent

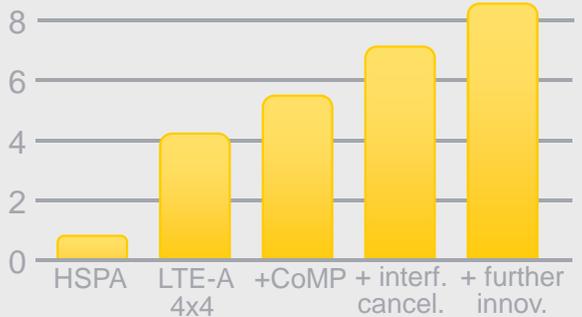


We cannot predict all the use cases so flexibility is a key requirement

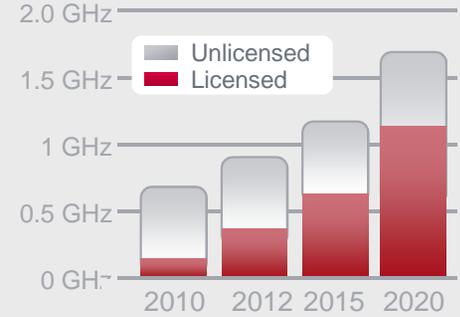
Support of up to 1000 times more capacity in wireless access



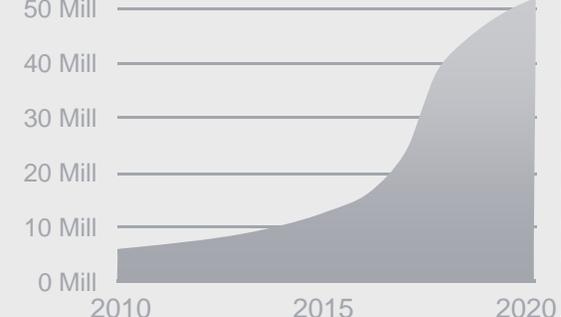
Spectral efficiency [bps/Hz/cell]



Available radio spectrum



Global base station forecast



Most of these will be small cells

In addition over 500M WiFi APs



Spectrum will be **optimized** across all layers



Coverage

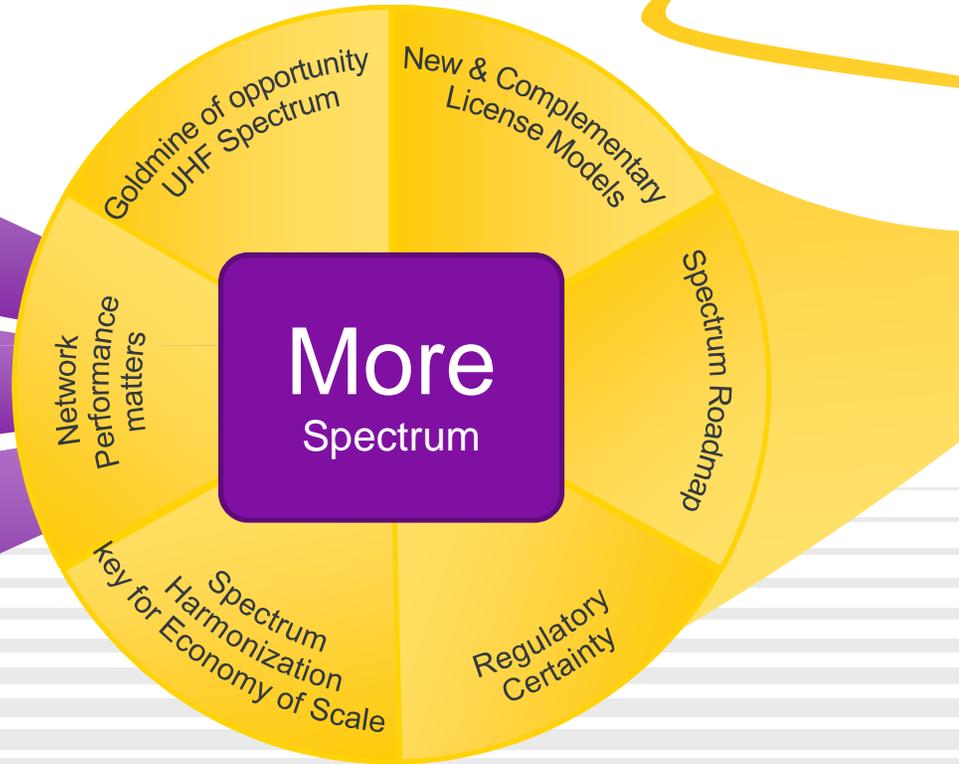
800, 900, 700, UHF
FDD, 10M, co-primary

Capacity

2100, 1800, 2600
FDD, 20M, light HetNet

Densification

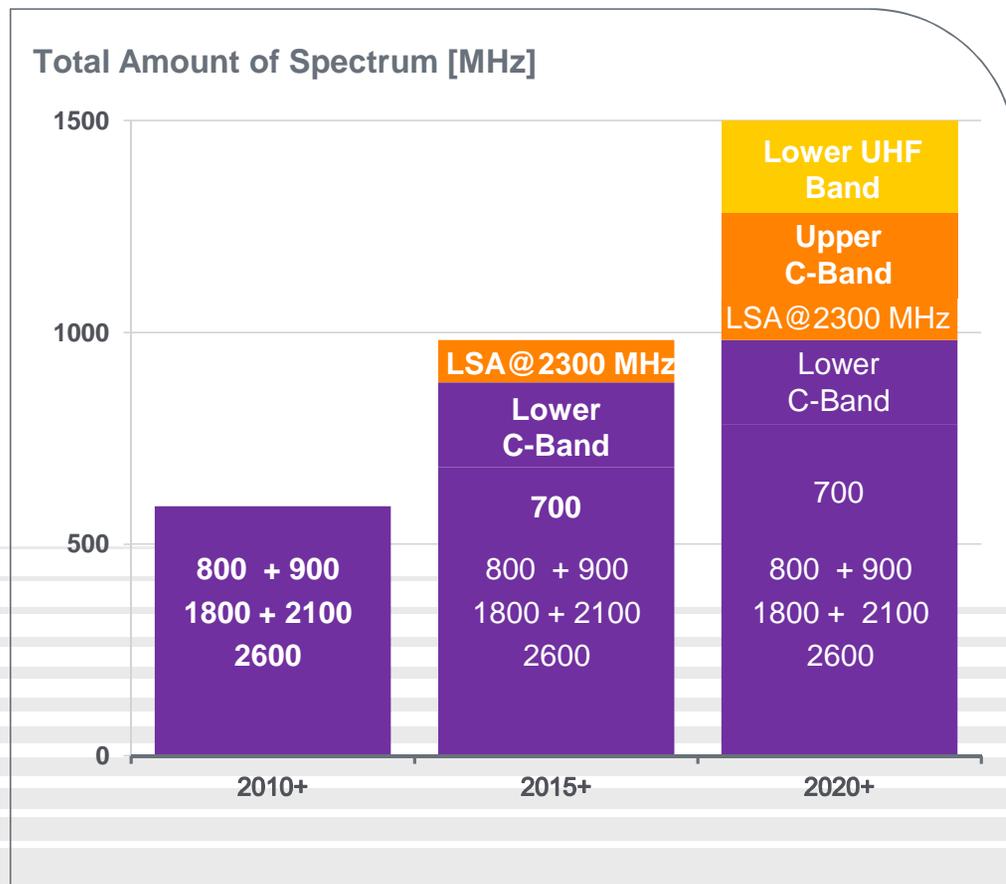
2600, 3500, 2300
TDD, >20M, dense HetNet



We cannot generate new Spectrum,
but we can optimise its use!

Sharing will complement licensed spectrum for mobile broadband

European example



- 470-698 MHz convergence will optimize shared use of the coverage spectrum between BroadCast and BroadBand
- Shared use in C-band will enable wider bandwidths for dedicate small cell layers
- **Licensed Shared Access (LSA) will unlock additional spectrum for LTE**
- Additional Spectrum shall be allocated and put into use quickly
- Exclusive Spectrum Access has top priority

**More licensed
MBB spectrum**

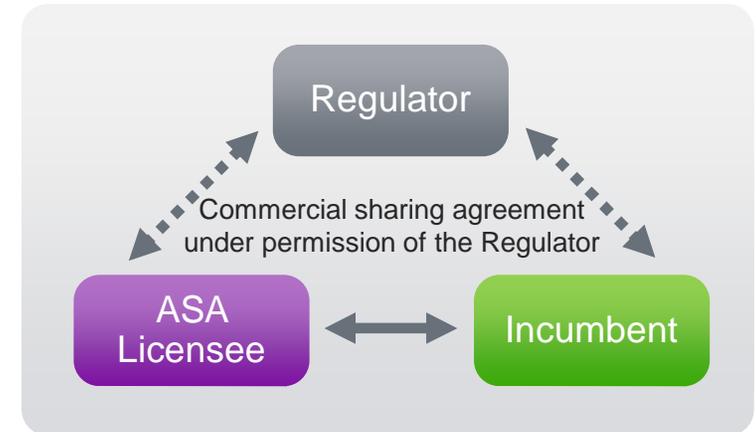
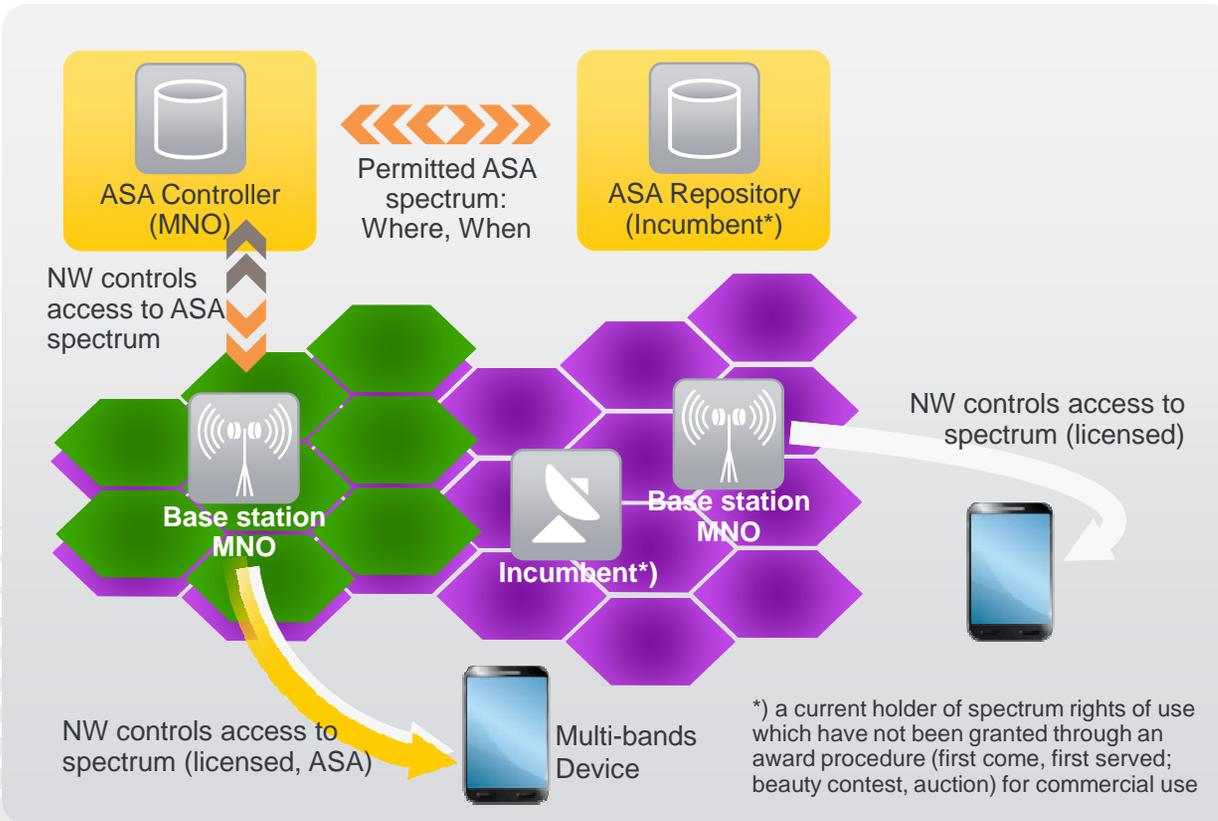
A new way of licensing spectrum

Authorised Shared Access



Harmonisation and Global Standards Drive Economies of Scale

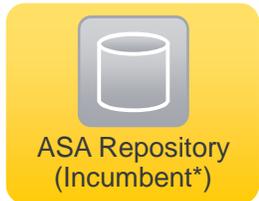
Authorised Shared Access architecture



Authorized Shared Access

ASA Repository and ASA Controller

- **ASA Repository**



- The ASA repository contains the relevant information on spectrum available for use by ASA licensees in the spatial, frequency and time domains.
- It may add safety margins and deliberate distortions to the free spectrum in order to mask the true activity of the incumbent.
- Rationale for this is that the incumbent may not be willing to give precise information about its spectrum use to ASA licensees, for several very good reasons mainly connected to the nature of its service, e.g., defense operations, interference management, network security, emergency services or privacy

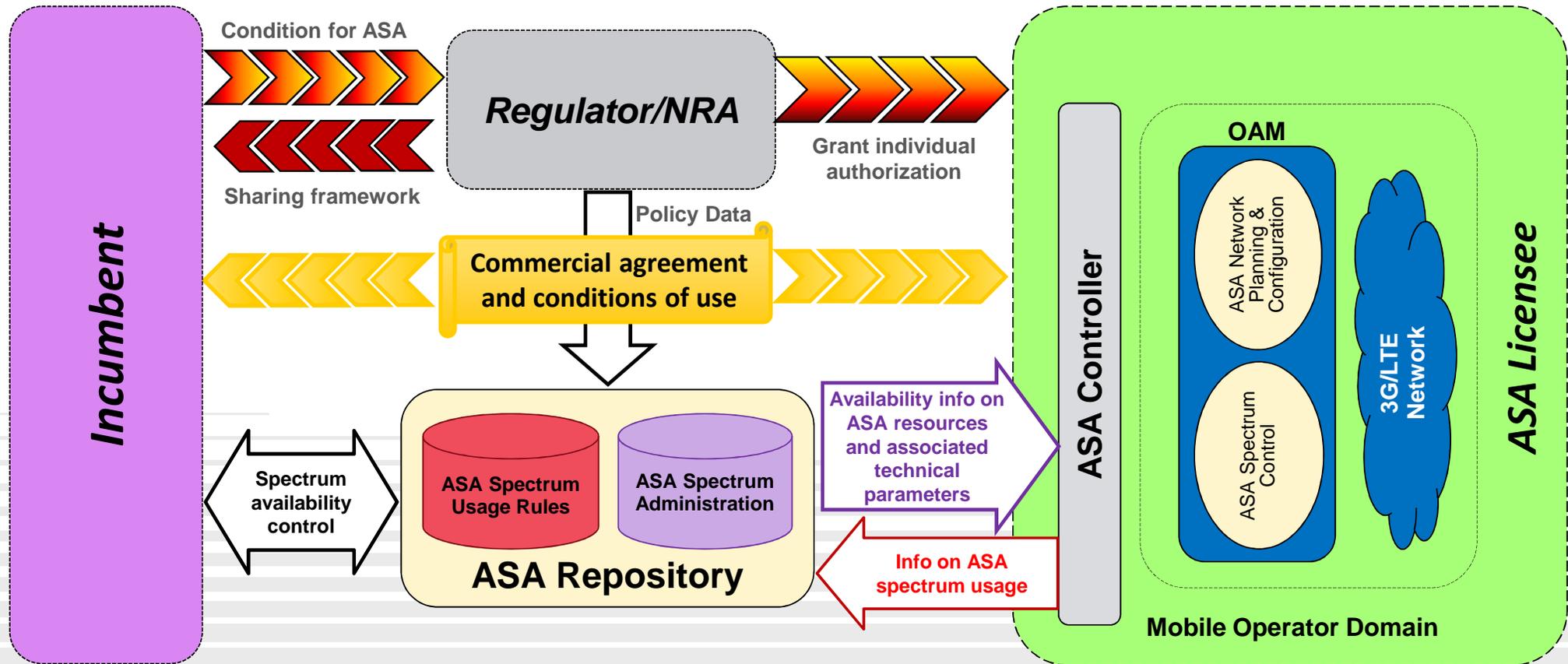
- **ASA Controller**



- The ASA Controller controls the access to the spectrum made available to the ASA licensee based on rules built upon ASA rights of use and information on the incumbent's use provided by the ASA Repository.
- It retrieves information about available ASA spectrum from the ASA Repository through a secure and reliable communication path and propagates the permission or interdiction of use of ASA spectrum to the radio access network (RAN)

Authorized Shared Access

ASA Architecture with logical functions and message exchange



Global Operation Administration and Maintenance Centers

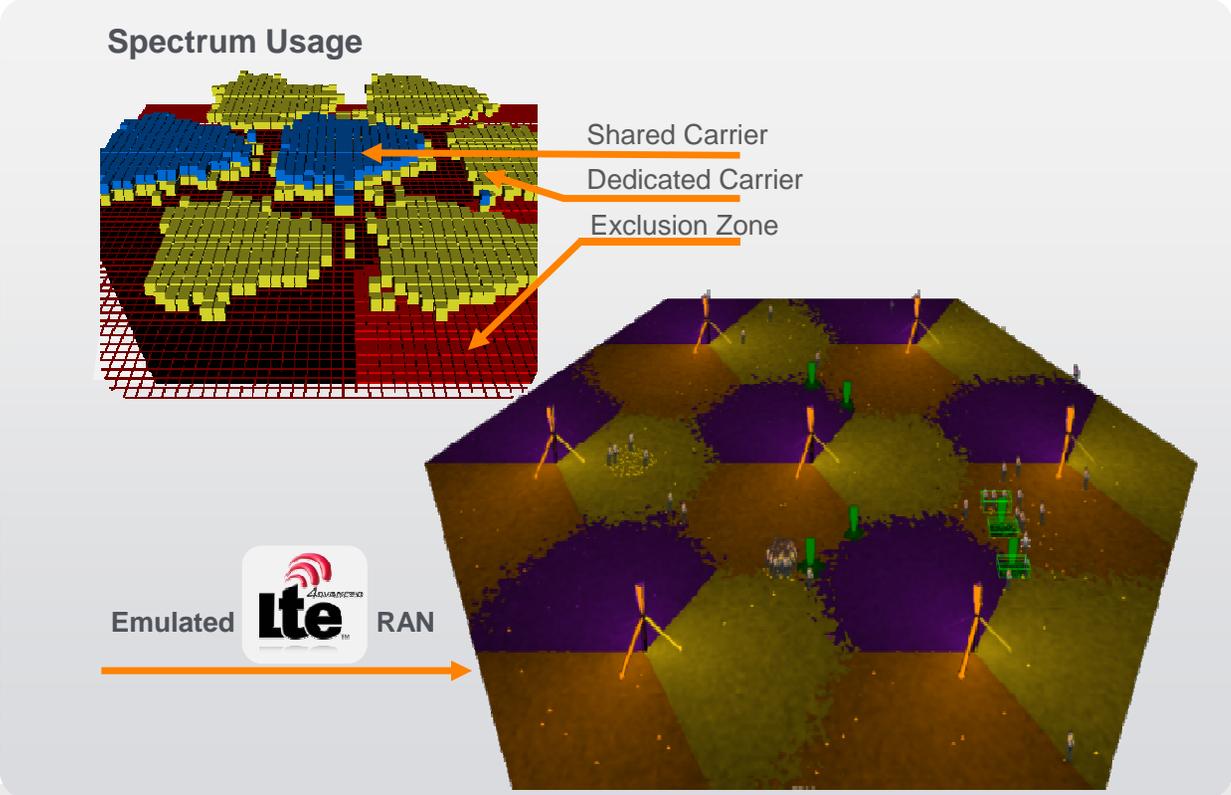


ASA Spectrum control via the OAM system of mobile networks

- Translate the information on spectrum availability obtained from the LSA Controller into Radio Resource Management commands.
- Transmits the RRM commands to base stations in the LSA licensee's network.
 - For allowing BSs to tune to different channels or to power down.
 - For enabling UEs to access the LSA spectrum or
 - For ordering UEs to hand off seamlessly to other frequency bands as appropriate depending on LSA spectrum availability, QoS requirements, data rates, etc.

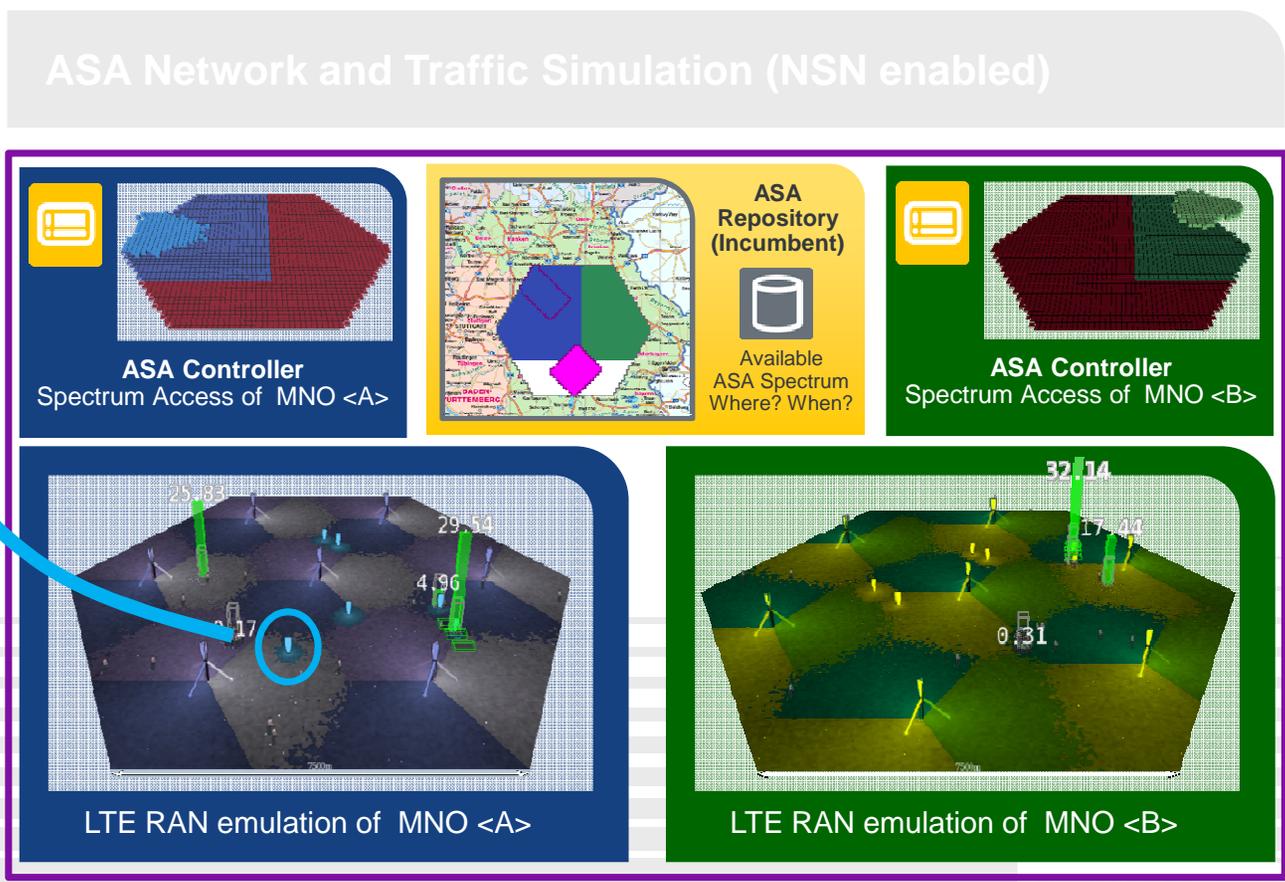
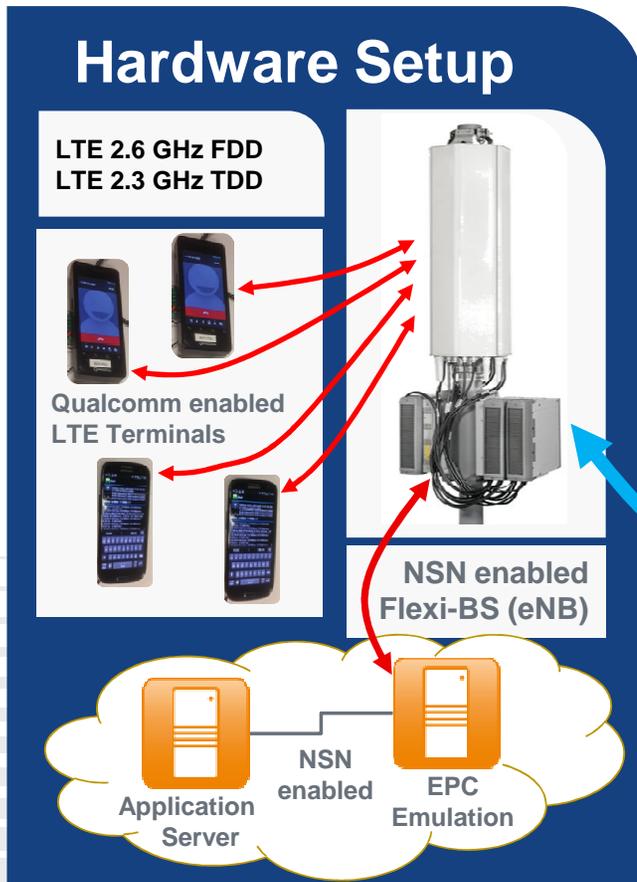


NSN ASA demonstration in Simulation MWC2013



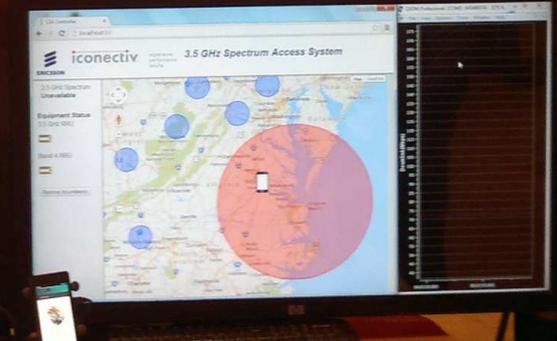
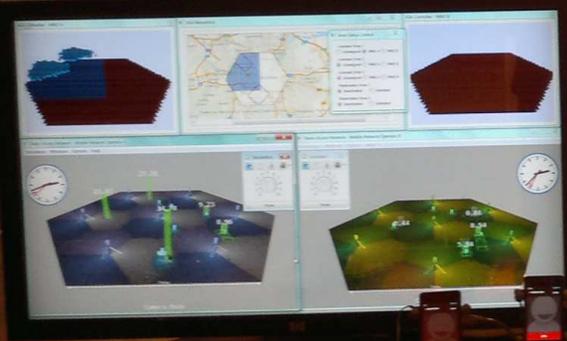
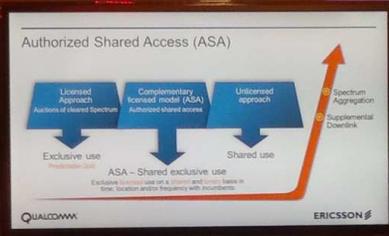
NSN/Qualcomm Joint ASA Demonstration at MWC-2014

Commercial eNodeB HW and real terminal equipment



LTE Advanced Authorized Shared Access (ASA)

Qualcomm Technologies, Inc.



Followed by World 1st LSA LTE 2.3 GHz **on air trial** with Finnish ecosystem

Trials built on NSN Flexi (TD-LTE 2.3 GHz) and NetAct core assets

Flexi & NetAct

Trial included full LSA ecosystem in Finland, joint work with TEKES Trial program

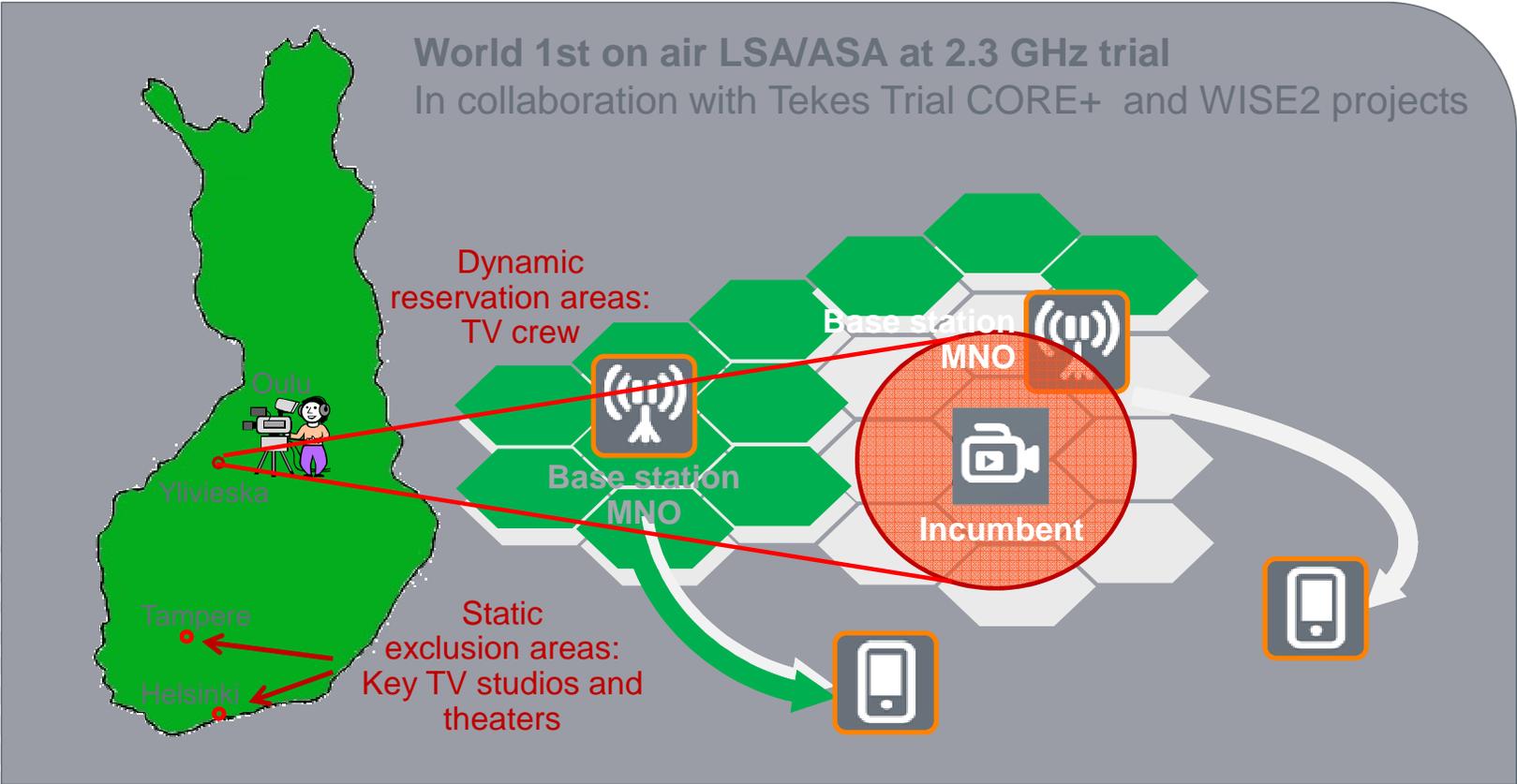
LSA Ecosystem

Trial Cost-Terra LSA workshop in Helsinki, Sept. 3rd



LSA unlocks TD LTE 2300 band for operators in Europe

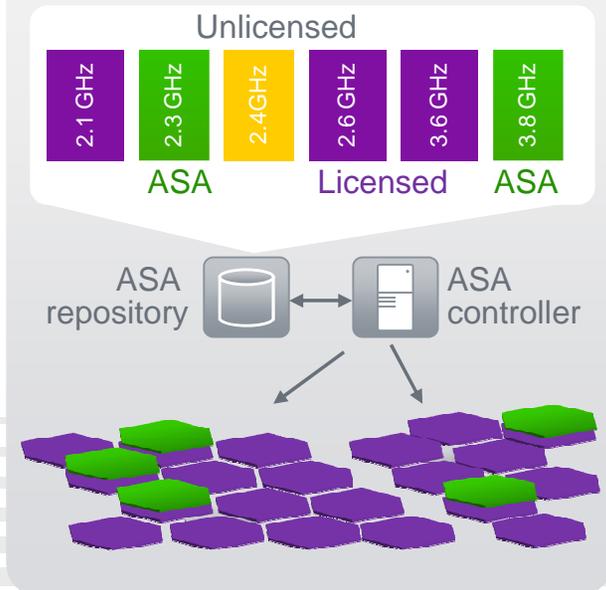
LSA use case in Finland



Authorised Shared Access in a nutshell

- It is a complementary licensing method not a sharing technique
- Allows 'dynamic' use of spectrum whenever and wherever it is not occupied by incumbent users:
 - On a shared and non-interference basis
 - The incumbent has rights to re-claim its entire spectrum anytime (evacuation)
 - Subject to individual authorization (i.e. licensed)
 - using Cognitive Radio techniques i.e. geo-location databases
- Accelerates harmonization and potential re-farming
- Leverages global and available LTE technologies to ensure economies of scale and early use (~2015)
- Enables new business models and fosters business innovation:
 - Incumbent Spectrum Holders: Monetization Opportunity
 - Operators: Opportunity for lower cost and high quality spectrum

Authorised Shared Access



Enables timely availability and licensed use of harmonised spectrum with predictable QoS