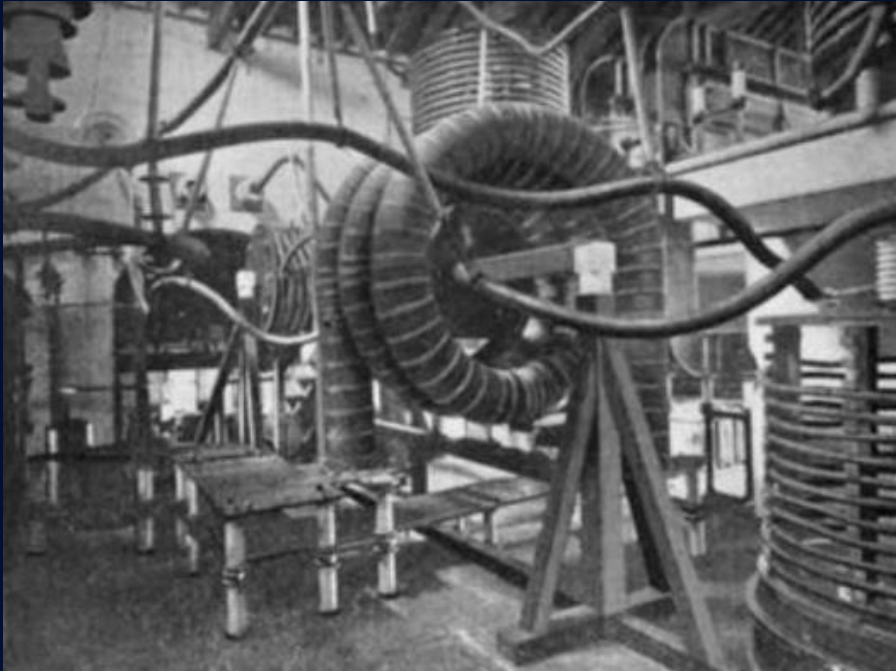


Results of the Demonstration of Licensed Shared Access with Sensing of Secondary Signal

Spectrum sharing model – LSA
ANACOM Webinar , May 19, 2021

Dr. Seppo Yrjola, Nokia Enterprise

100 years of interference avoidance – from one to many



Wireless Station In Constant Operation

Messages Cannot be Transmitted and Received
at the Same Time, But Marconi Hopes to
Overcome Difficulty by Additional
Equipment

Special to The Morning Chronicle.

SYDNEY, N. S., Oct. 29.—The Marconi system of trans-Atlantic communication is now fairly well established, and with very few intermissions the station at Glace Bay has been in constant operation since its opening for commercial business on Thursday last. That Marconi himself is reasonably sure of the continued success of his improved system is best testified to by the fact of his leaving shortly for New York, thus leaving to his subordinates here the actual carrying on of the business.

The wireless wizard now claims that he has no intention whatever of competing with the cable companies for some time to come, until his trans-Atlantic stations, at all events, are better equipped to successfully handle the great amount of business they are constantly being deluged with. This will mean that until

such time as the Cape Cod and Poldhu plants are re-constructed with the unidirectional system and until the machinery of all stations is duplicated in every detail.

At present the most serious difficulty apparently being met with is the inability of the system to transmit and receive messages at the same time. This necessitates the moving of operators from one room to another at intervals of ten minutes and admits of some confusion arising in the operation of the two stations in communication. It is also somewhat of a bar to absolute accuracy for if, for any reason the receiving operator is unable to read the message being sent, it is impossible for him to acquaint the sender until his station is prepared to receive the message. The loss of time entailed because of this is manifest.

Continued on page Two.

100 years of interference avoidance – Local



Michael Faraday invented Faraday cage in 1836

570 5th April 1836

571 Take an wire of jessell for 8 or 10 fathoms

572 Try spots of wire - put up arrangements - self-panels of anti-ting - iron - d. d. thought - spread above all

573 Make points ground or wind with soap

574 Try various points in atmosphere of various of return - But all the Hydrogenous d. d.

575 Try them in liquid oil - d. d. in open water


576 Make well wire with wire - points of wire

577 It has occurred many times as if when lightning was in an amount that the best he never finds on the Centre side of the field - except the

15th April 1836

578 Have been for some days past engaged in building up a cube of 12 feet on the side. A consist of a slight wooden frame constitutes the timber beam edge held steady by diagonal ties of cord the whole being surrounded on four glass feet 2 1/2 inches long to insulate it. The sides top and bottom are covered in with paper ()

The top and bottom have each a wire frame of layers of copper wire three which with the diagonals of cord support the two large sheets of paper which cover them in the copper wire



also seeing to put the paper surface with solemnity. The frames at the top of bottom of copper wire

Megatrends in wireless

Enables unbundling of investments in spectrum, infrastructure and services

Cloud, NFV and network slicing are transforming network infrastructure deployment



Shared spectrum is 'virtualizing' the spectrum asset ownership, altering valuation and utility

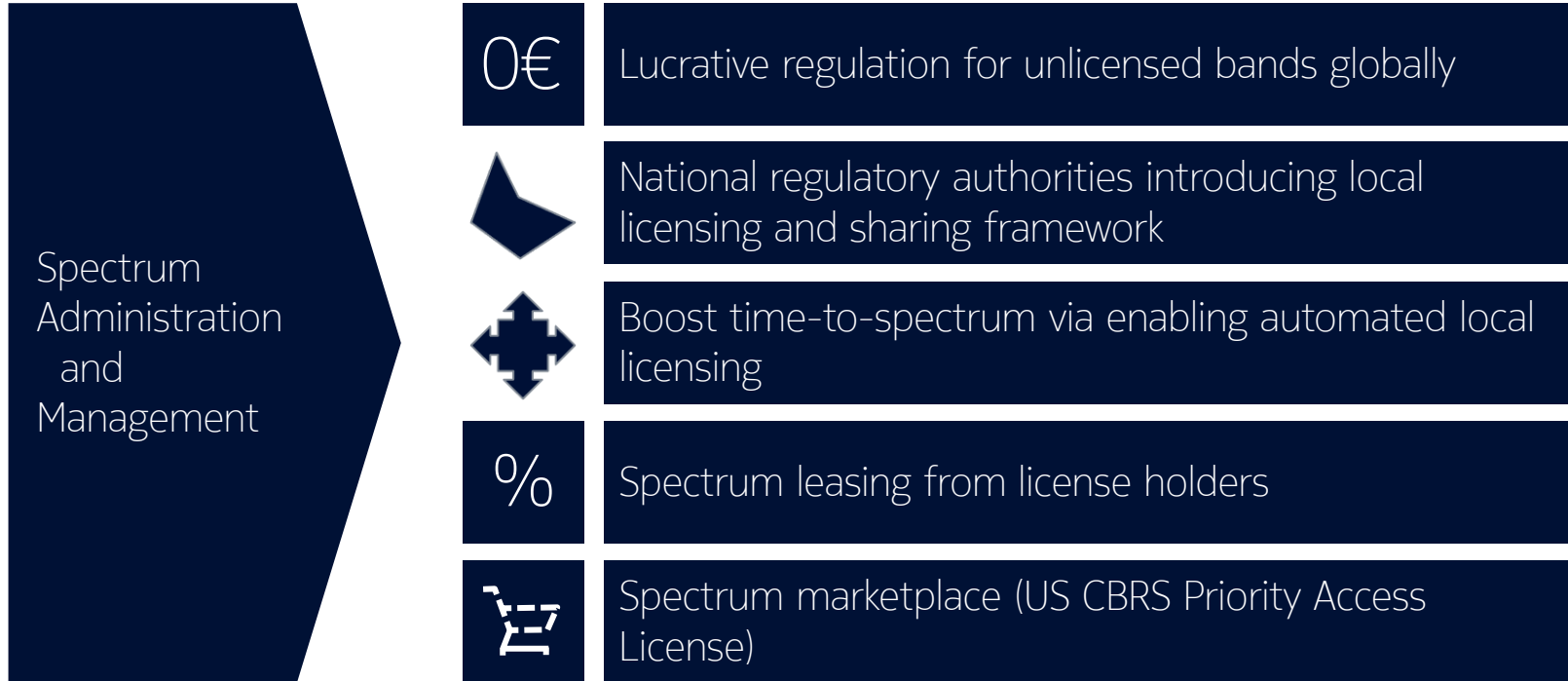


Localized edge services and ultra low latency, high reliability applications emerging with vertical needs

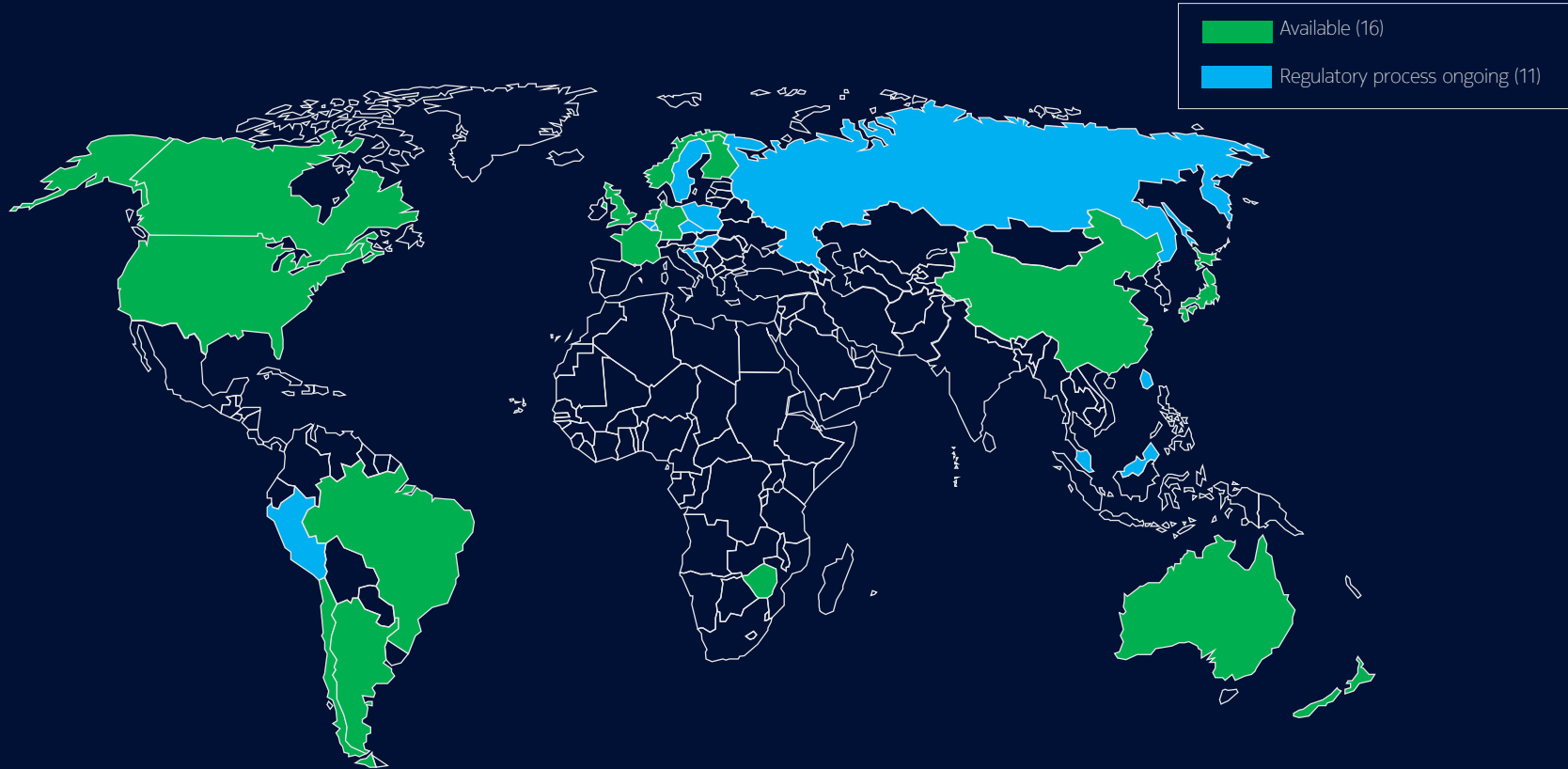


Business model innovation boosting as-a-Service models

Spectrum management unlocks markets and creates opportunities

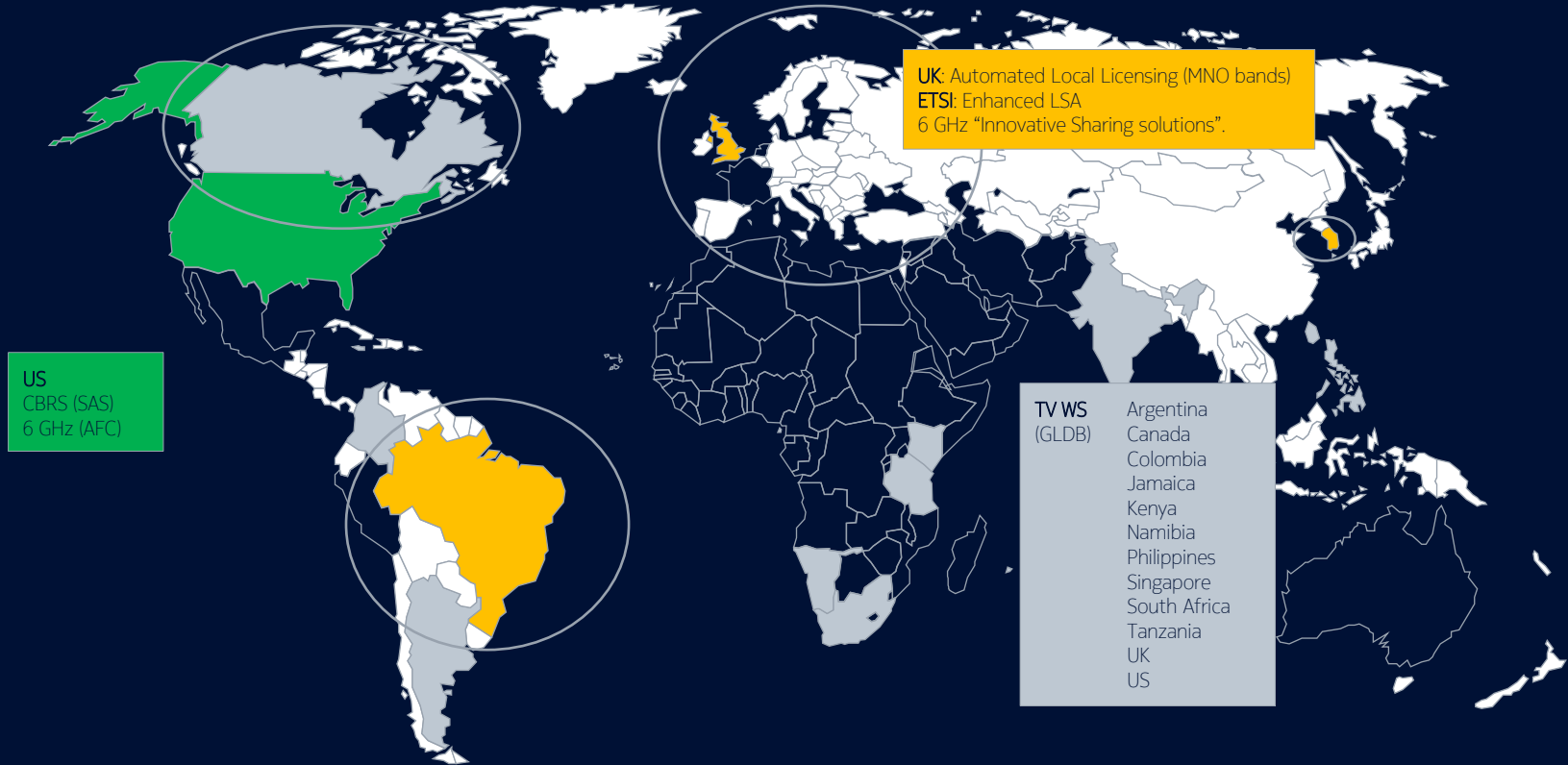


Local licensing – opened e.g., in US, Germany, UK and Japan

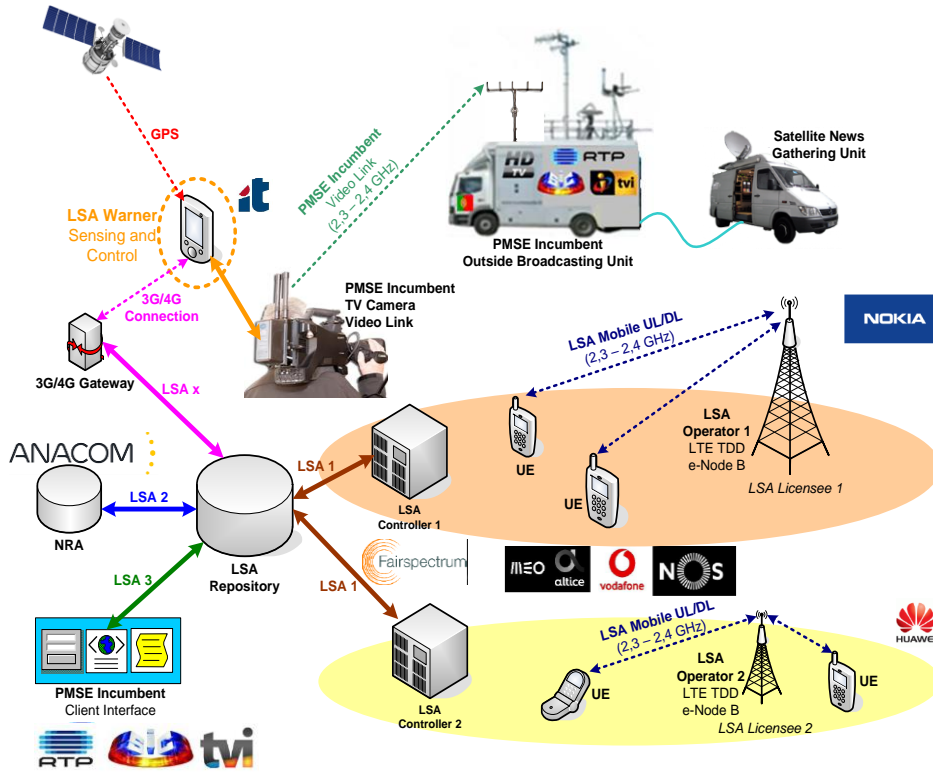


Managed spectrum sharing – US CBRS commercial 6 GHz AFC, and niche TVWS

	Available now (CBRS)
	Regulation, limited use (TVWS)
	Future opportunity



LSA pilot set-up



Mobile operators, broadcasters, and national regulatory authority participate in the pilot setup.

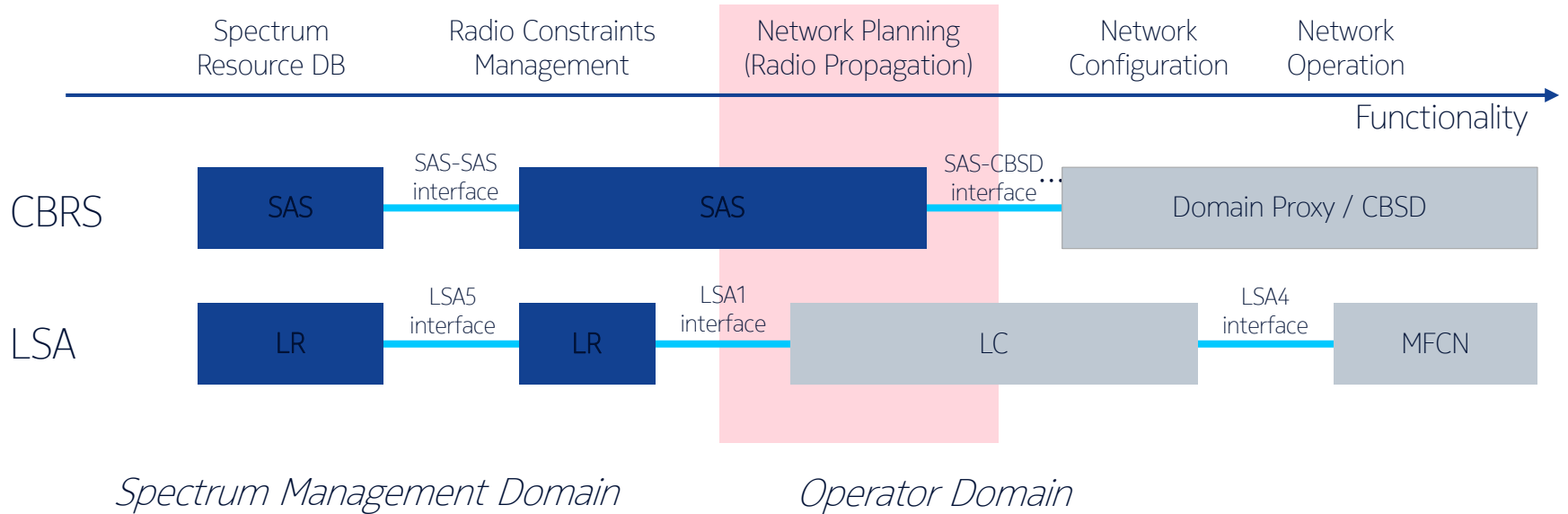
The mobile network uses commercial base stations, core network and network management system.



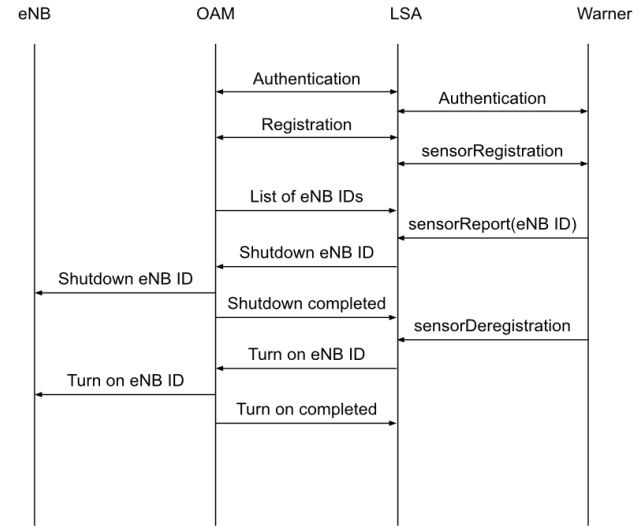
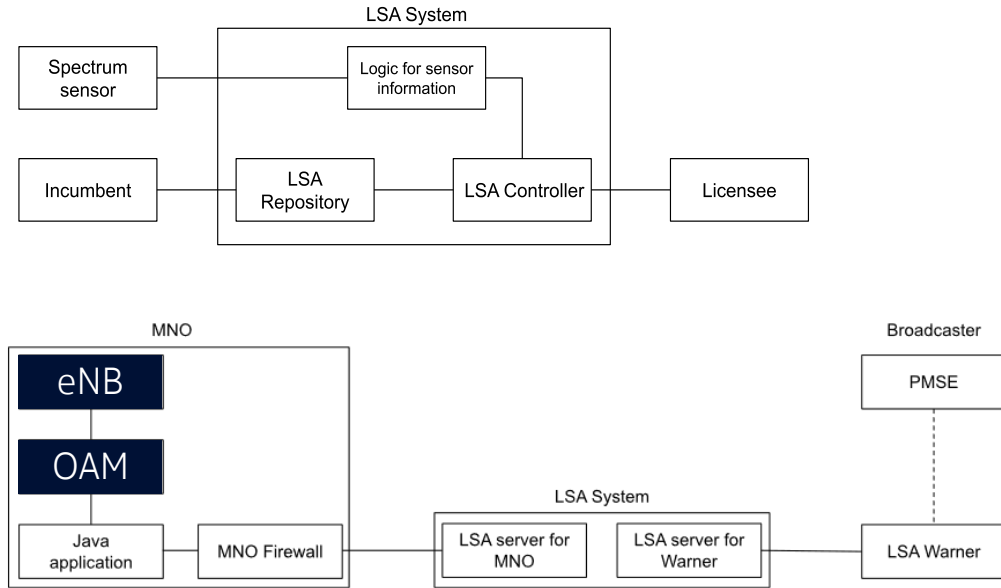
LSA controlled eNB and PMSE camera with a wireless data link

Pilot leveraged CBRS standardization

Comparison of functional architectures



Pilot built on the scale of commercial assets and capabilities



Message flow between Warner, LSA system and OAM.

Sensing the secondary spectrum user can be used as interference protection method in LSA evolution

- Leverages harmonization in regulation & standardization and scale of commercial assets and capabilities
- The interference impact can be evaluated exactly as it is at the incumbent receiver antenna, whereas the propagation model-based methods include estimates, statistical modelling and assumptions.
- We found out that sensing of secondary signal at the receiver location of the primary user is an accurate and cost-efficient interference protection method
- Sensing the secondary signal can be used as a stand-alone interference protection method and to improve the reliability & efficiency of propagation model-based methods by allowing lower protection margin.
- The concept was proven applicable in use cases where PMSE was deployed in a relatively small distinct area.

NOKIA

Thank you
Questions/discussion?

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