Opportunities of Cognitive Radio Technologies for advanced Regulatory Regimes

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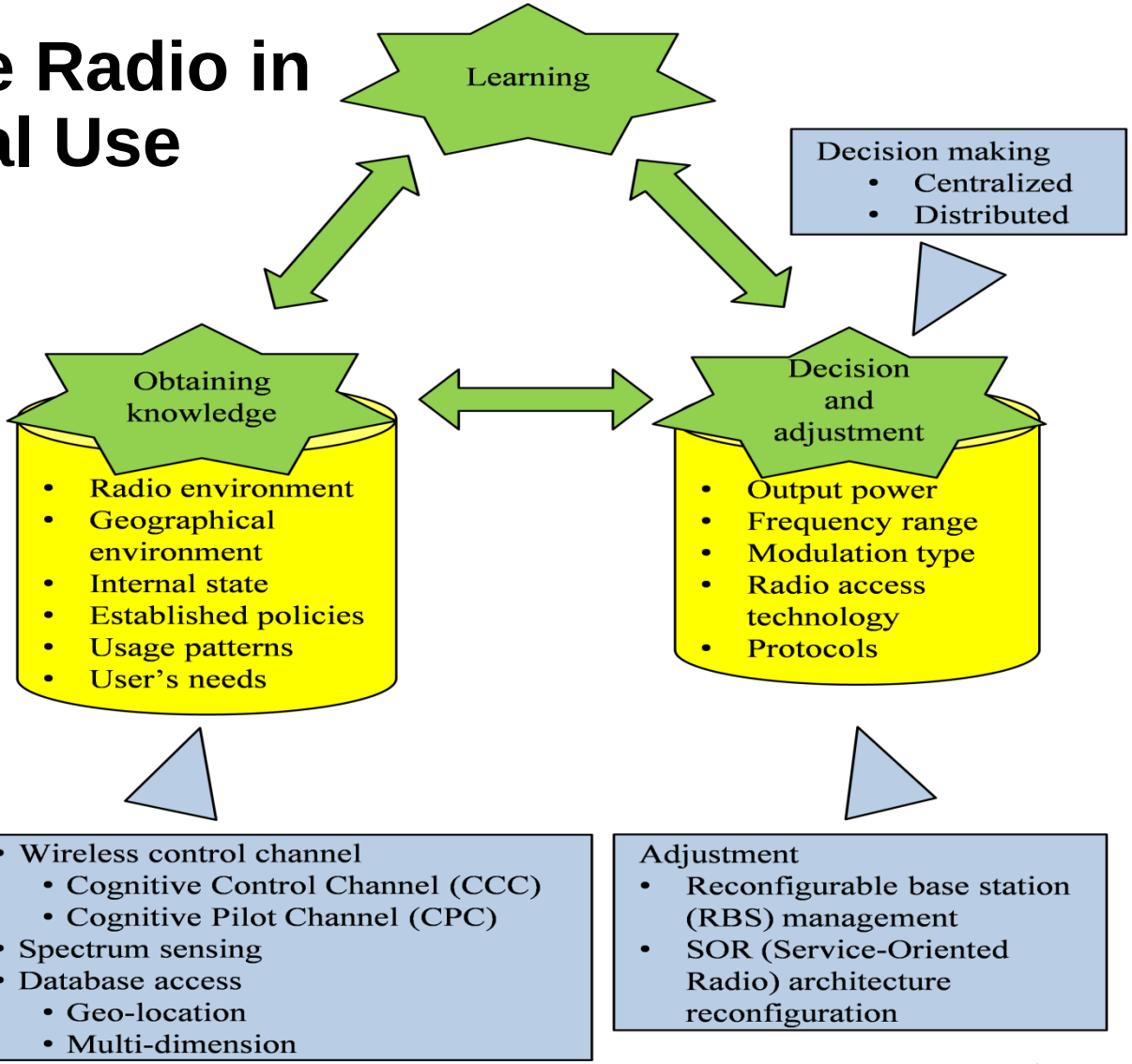
Outline

- **Introduction**
- **Regulatory Regimes**
- **What is Shared Spectrum Access**
- **Role of Cognitive Radio Technologies in Shared Spectrum Access**
- **Conclusions and outlook**

Introduction (1/2)

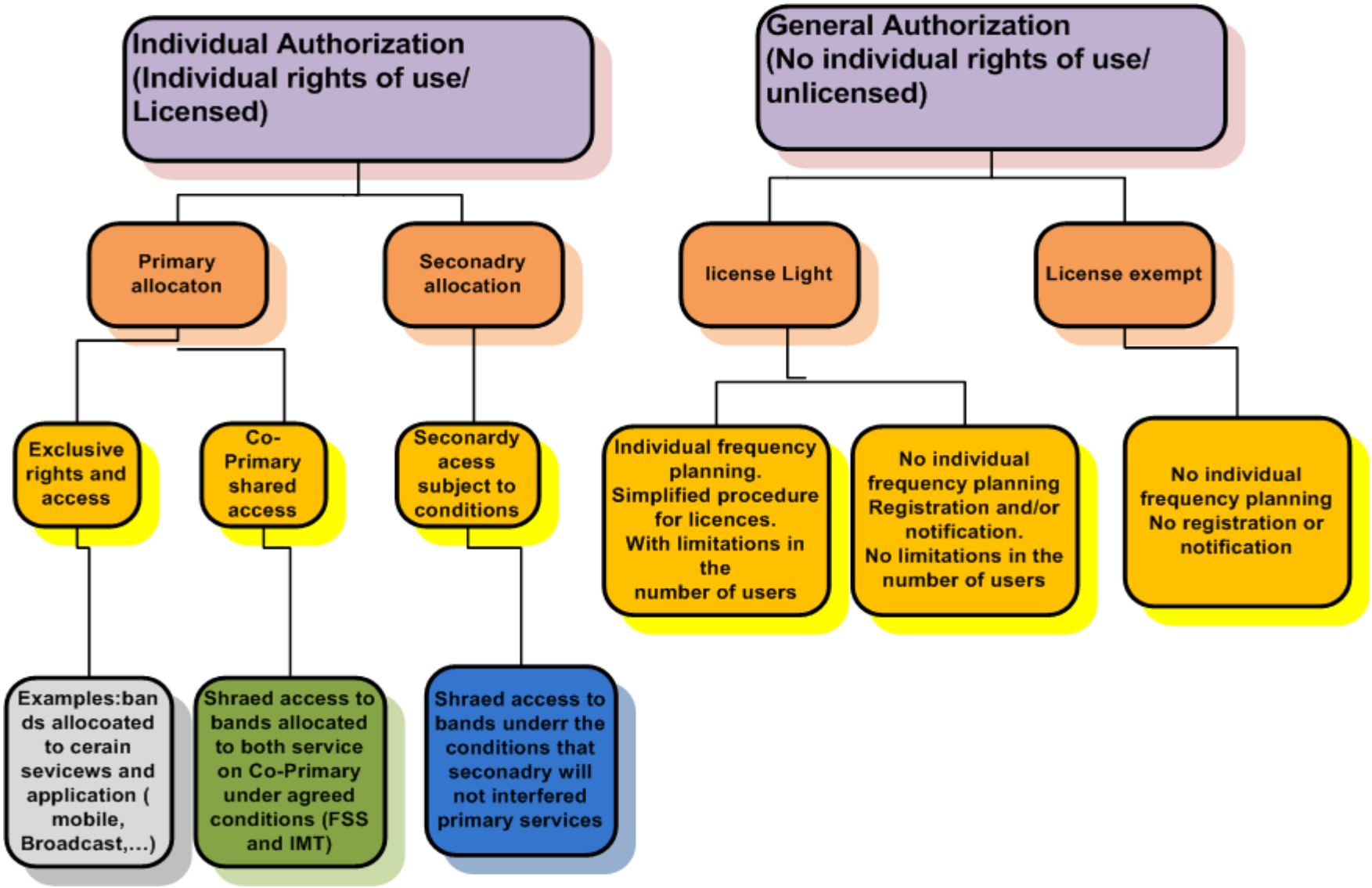
Cognitive Radio in Practical Use



Introduction (2/2)

- **Potential Cognitive Radio Technologies**:
  - Sensing
  - Geo-location and access to databases
  - Use of beacon or control channel such as CPC or CCC
- **Possible deployment of Cognitive Radio System:**
  - in frequency bands allocated exclusively to the mobile service; or
  - in frequency bands that have multiple radiocommunication service allocations (shared and opportunistic access)
- **Possible and Potential application of Cognitive Radio technologies:**
  - TV white space application
  - to improve the management of spectrum resources
    - In single operator case
    - In multiple operators domain
  - ***In shared access of spectrum based on dynamic spectrum access.***

Characteristics of the different Regulatory Regimes



Shared Spectrum Access

"Shared spectrum access" is where users or wireless applications are authorized to utilize the same range of frequencies on a non-exclusive basis in a defined sharing arrangement.

Key Features of Spectrum Shared Access:

- No limitation on **applications and /or technology** other than those required to avoid harmful interference and to reduce the risk of interference while maintaining an **acceptable quality of service** ;
- **Licensing or coordination** to avoid interference to non-collective use applications or to facilitate future the QoS could be ensured

Advanced regulatory Approach: Licensed shared Access or Authorization Shared Access

Licensed Shared Access (LSA) or Authorized Shared Access (ASA is a framework that enable sharing of spectrum between a number of licensed users. the primary licensed user(s) or incumbent utilising the spectrum for a specific application would share spectrum with one or several new users (ASA or LSA users) for the same, or a different, application in accordance with a set of conditions to be defined through regulation

Key Features of ASA/ LSA:

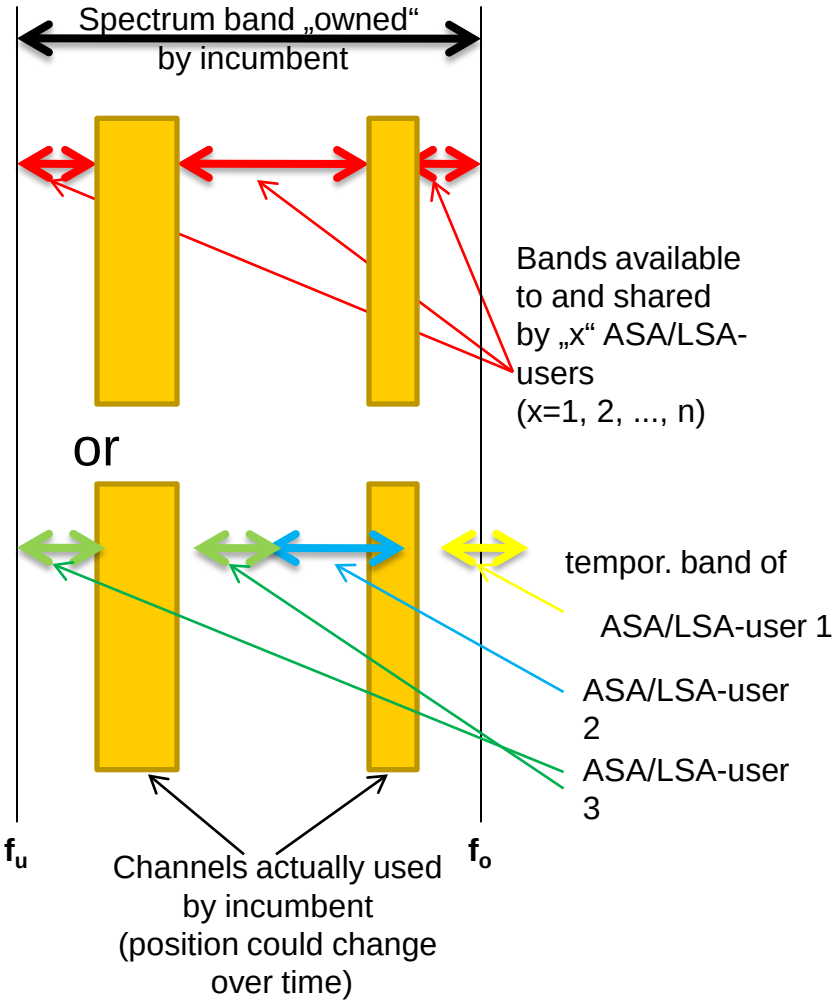
- Unlock the band used by incumbent (primary user of the band) for new users
- ensure predictable quality of service for all right holders
- sharing agreements/ conditions among incumbent and the new users

LSA or ASA is not a **sharing technique** or a system, but ASA/LSA relies on **dynamic/cognitive radio** based sharing techniques (e.g. databases, sensing, …)

Difference between ASA/LSA and other licensing methods

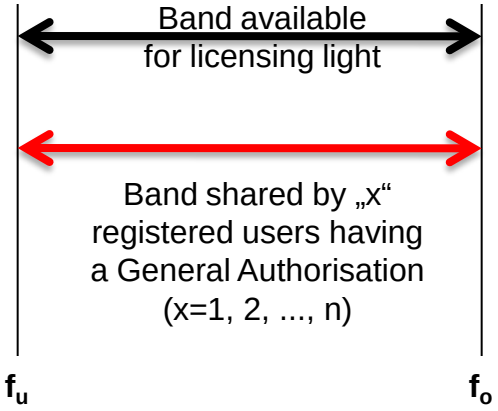
ASA/LSA

(i.e. incumbent exists)

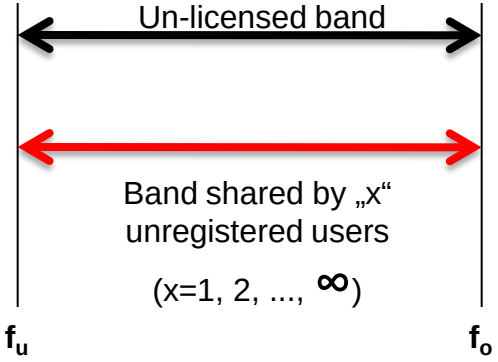


Licensing light

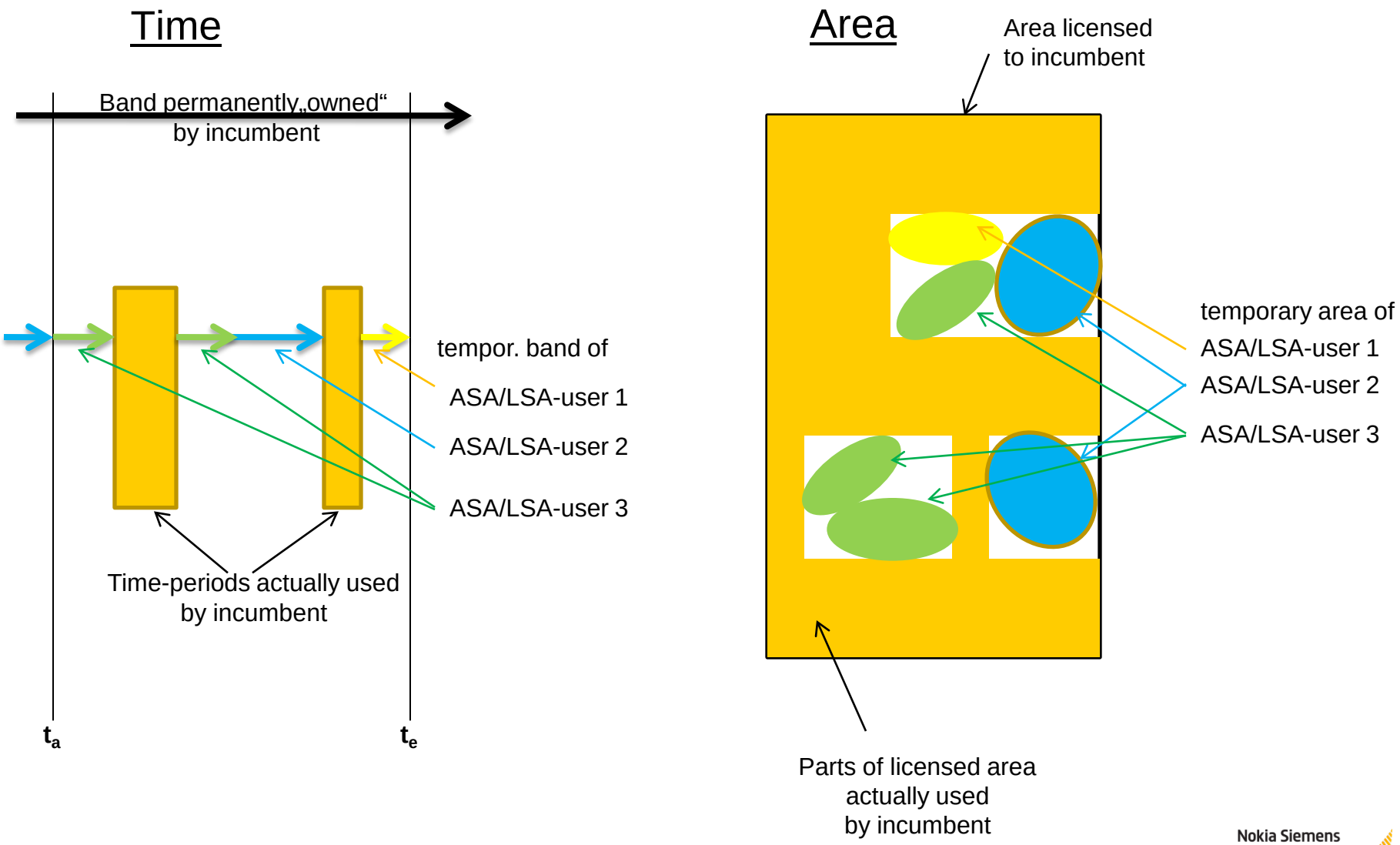
(no incumbent)



Unlicensed band



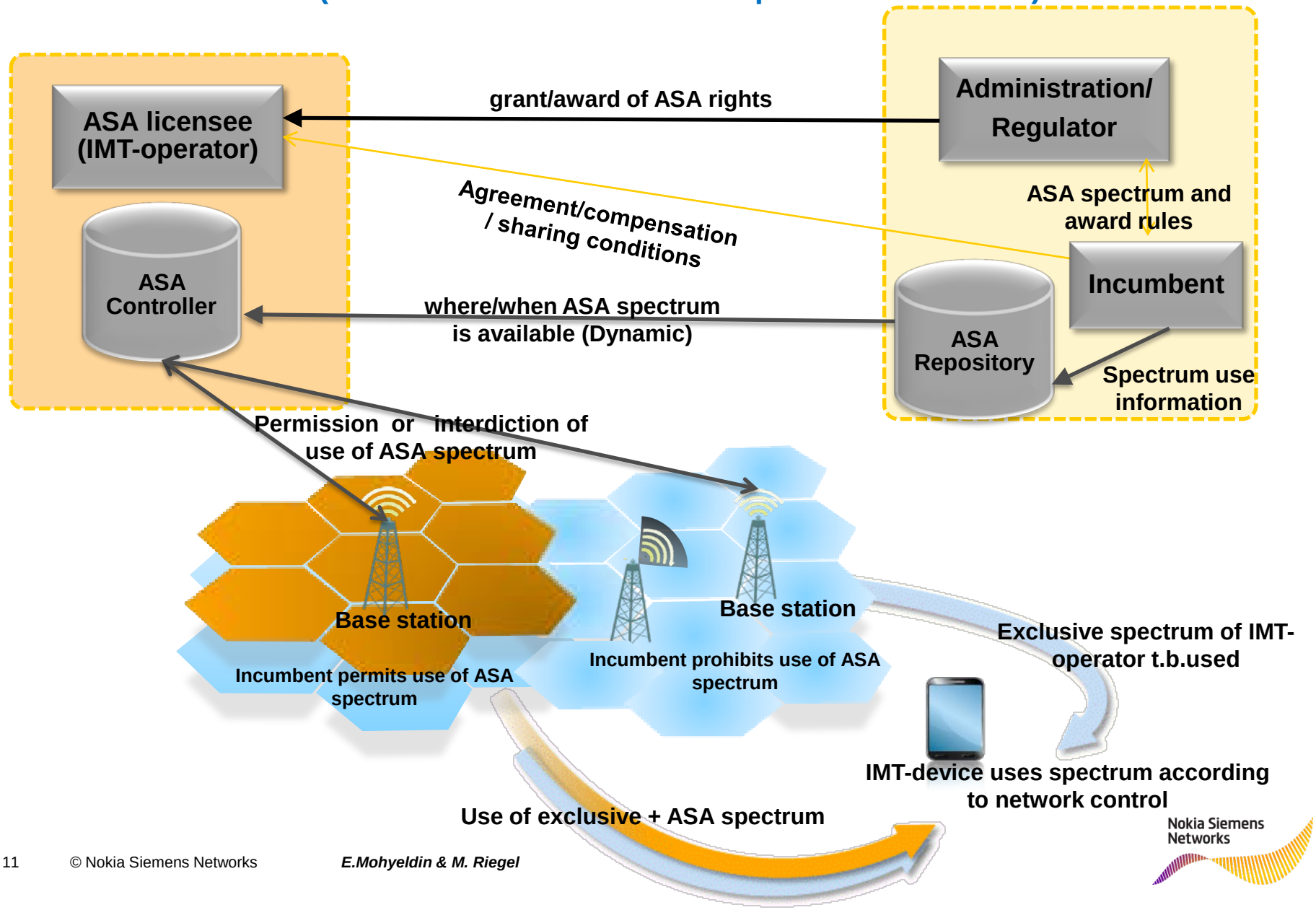
Other/additional dimensions of ASA/LSA: Time- and area based sharing



Drivers for Licensed/Authorized Shared Access

- **Demand of spectrum is continuously increasing**
- **Many services use their spectrum**
  - not everywhere
  - not all the time
  - not in the entire allocated (licensed) band
- **Spectrum is scarce**
  → increase of “overall spectrum efficiency” is a “must”!
- **Technical means (databases) exist to enable access to spectrum that is unused or under-utilised by the incumbent in**
  - Spatial (geographical) domain
  - Time domain
  - Frequency domain
  - or any combination of the above three
- **There seems to be no appropriate licensing method to permit co-usage of unused spectrum of incumbent for a restricted number of co-users in a controlled manner guaranteeing not harmful interference to incumbent**

Example of an ASA-Implementation using Database (Source: Annex 2 of CRCG report to ECC WGFM)



Conclusions

- Cognitive technologies enable new ways to share spectrum more efficiently
- Dynamic spectrum access schemes are essential enabler for accessing additional spectrum
- Advanced regulatory approaches for spectrum authorisation are needed to allow more flexibly shared use of spectrum
- The big advantage of ASA/LSA: Enabling *Timely Availability* and Licensed Use of *Harmonized Spectrum* for mobile services with *predictable QoS*
- With Cognitive Radio technology such as geo-location databases ASA/ LSA would be applicable to all bands and to all application sharing's

Outlook

- To foster actions on LSA/AS different action in **Regulation** as well **Standardization** are required
- In Europe some action have been started in the Regulation domain, need to be **followed and crystallized**
- The standardization path should allow the way to define **requirements, functional architecture, protocols** .

Thank you!

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