

# Spectrum Sharing of Mobile Systems

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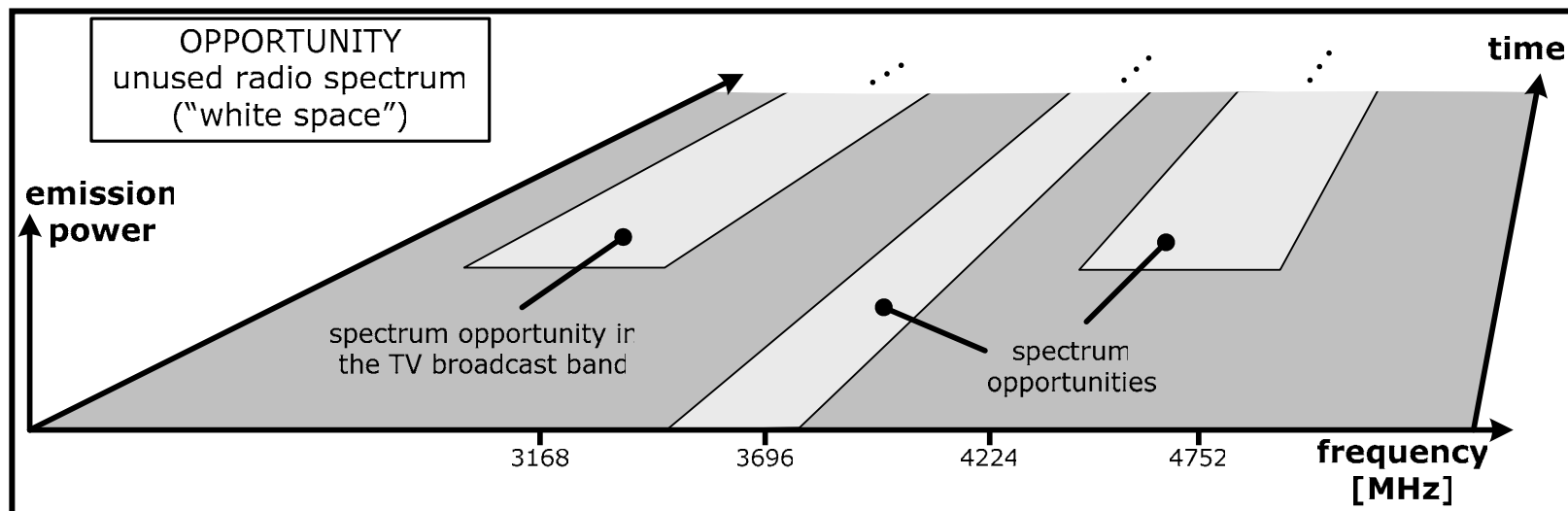
## Trends in wireless

- Rapid growth of wireless services over past years
  - Unlicensed (WLAN/WPAN) and licensed (cellular) bands
  - Growing demand for wireless communication services
- Access to spectrum is frustratingly difficult
  - Unlicensed bands are filling up
  - Licensing process complicated, slow, expensive
- In contrast, in measurements only 10% of the spectrum is in use at all
- Conclusion:
  - There may be enough spectrum, usage is just not permitted
  - The existing regulatory regime leaves room for improvement

Agile radios attempt to solve this problem !

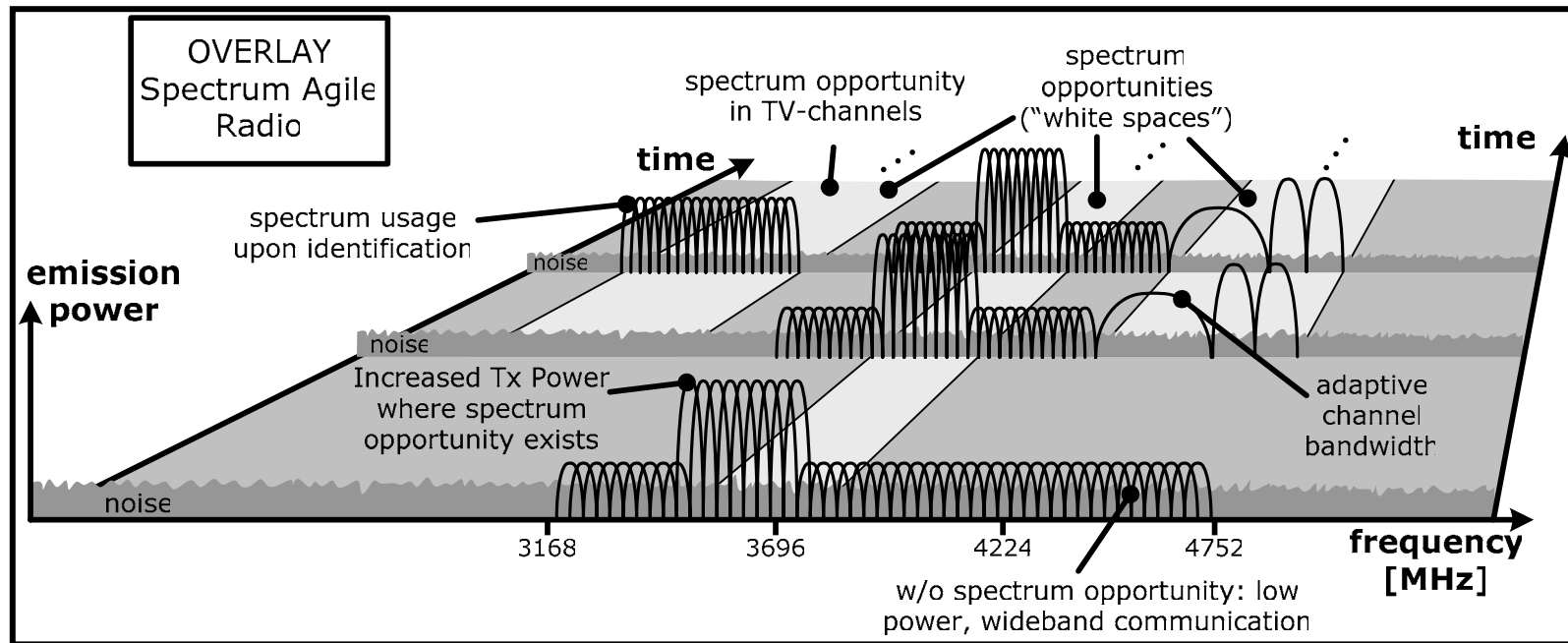
# Opportunistic spectrum usage

- Underlay  $\rightarrow$  overlay sharing of "white space"



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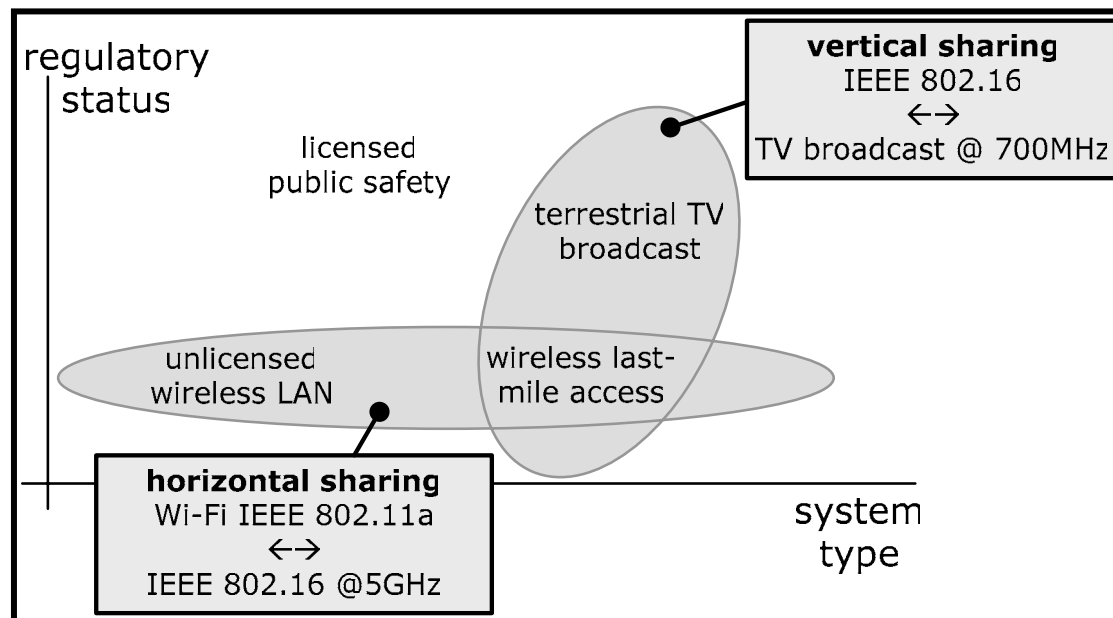


## Spectrum agile radio solution

- Agile radios use the licensed spectrum “opportunistically”
- Agile radios decide on their own about spectrum usage
  - eased regulatory constraints
  - vertical spectrum sharing to protect incumbents
  - horizontal spectrum sharing to coordinate among different agile radios
- Agile radios can benefit from the DARPA XG framework
  - to protect incumbent, licensed radio systems
  - to allow flexible radio regulation

## Vertical and horizontal sharing

- Future radio systems may have to consider the effects of their decisions on other radio systems
  - Other radio systems can be completely different
- Dissimilar radio systems may operate using the same radio resources
  - In vertical and horizontal sharing





## References

- Academia
  - MIT open spectrum, USA
  - WINLAB, USA
  - ComNets, Germany
- New America Foundation
- Various European IST FP6 projects
- U.S. Defense DARPA XG
- <http://www.google.com/search?q=Open+Spectrum>
- <http://www.google.com/search?q=Spectrum+Etiquette>
- <http://www.google.com/search?q=Cognitive+Radio>
- <http://www.google.com/search?q=Spectrum+Agile+Radio>