

802.22 Coexistence Considerations

Author:

Name	Company	Address	Phone	email
Gerald Chouinard	Communications Research Centre, Canada	3701 Carling Ave. Ottawa, Ontario Canada K2H 8S2	(613) 998-2500	gerald.chouinard@crc.ca

Abstract

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This contribution summarizes graphically the difficulty of coexistence between 802.22 for regional area networks and 802.11 for local area networks and illustrates some features developed in the 802.22 Draft Standard to help coexistence.

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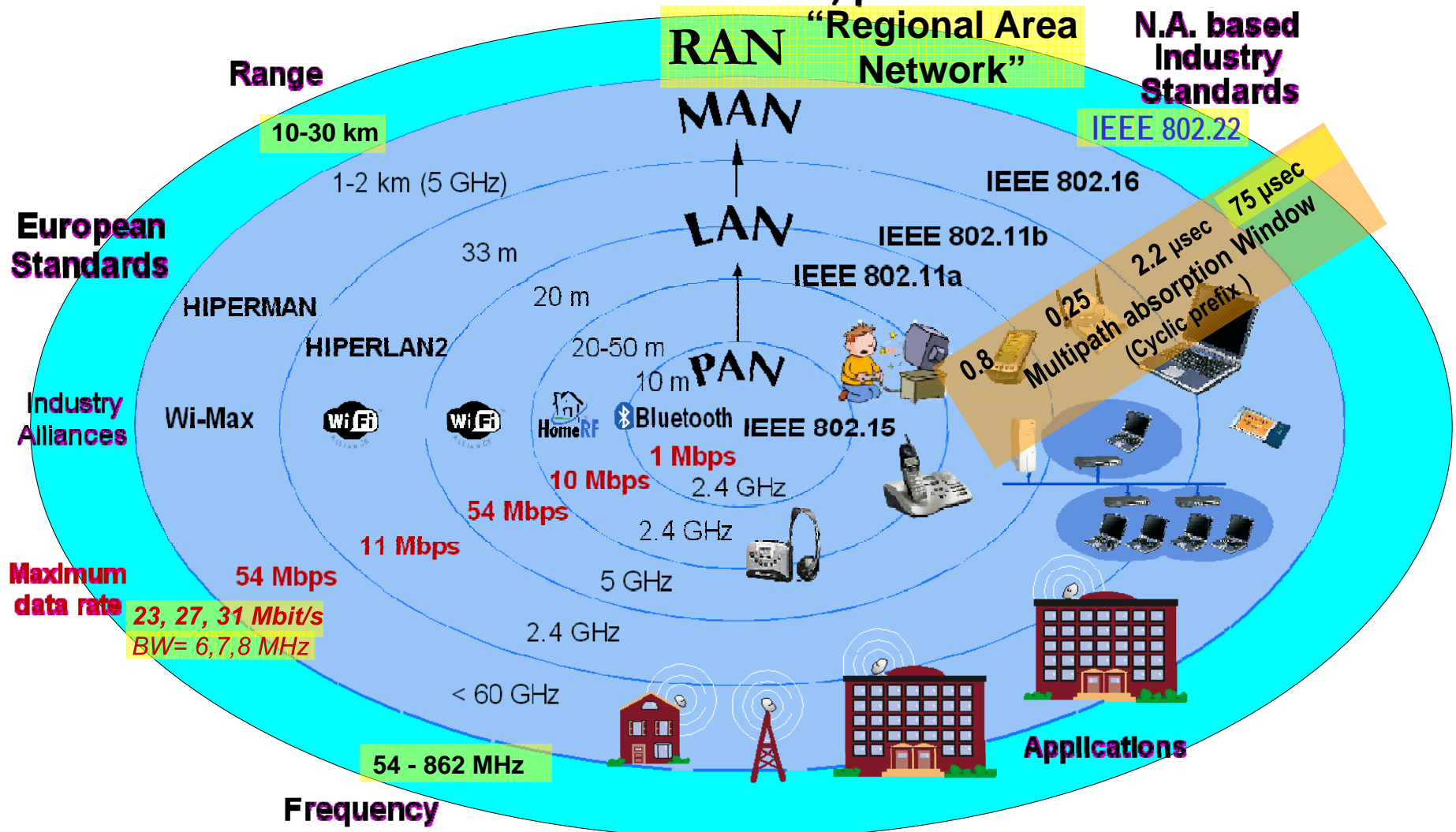
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Outline

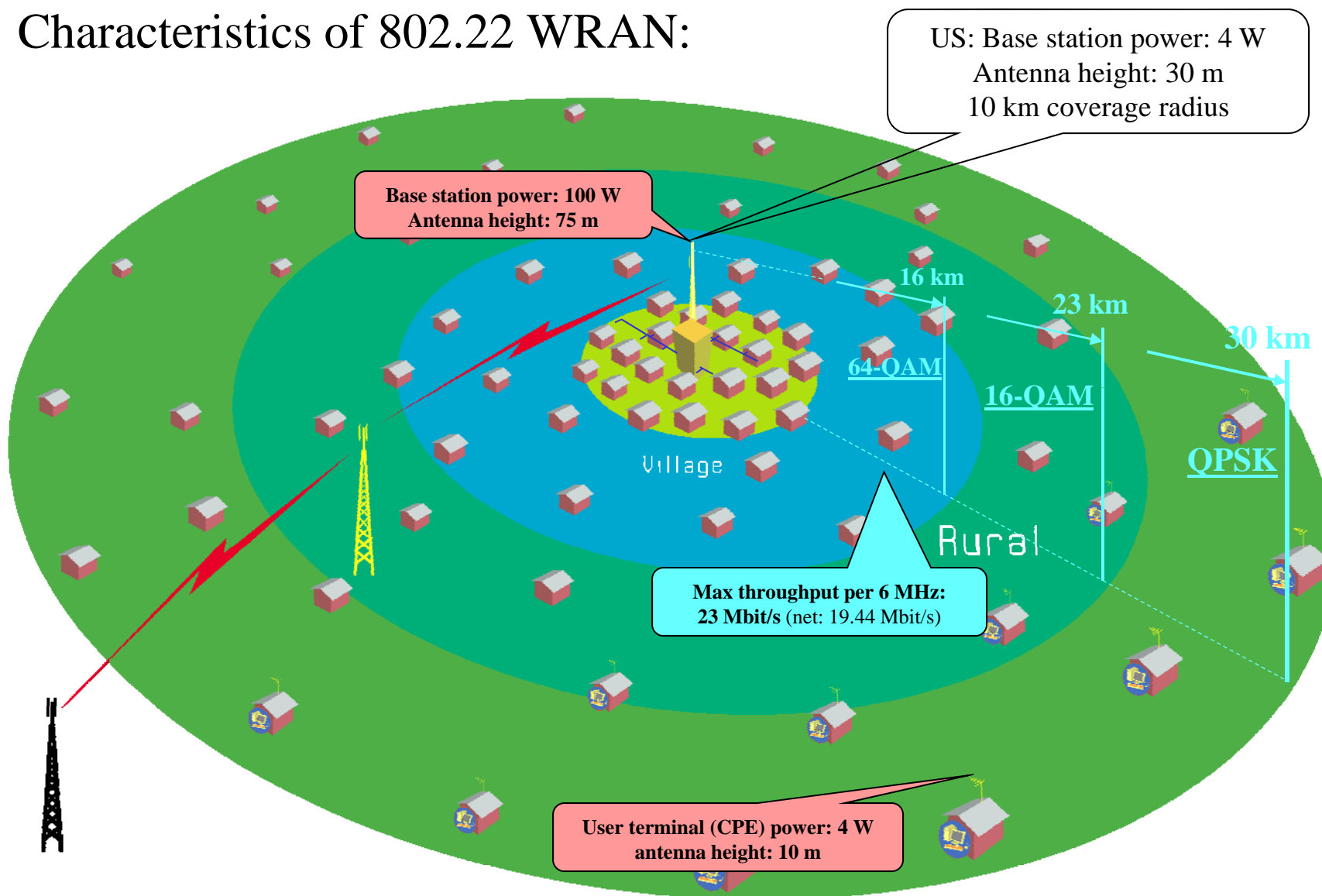
- **Summary of 802.22 characteristics**
- **Coexistence use case: 802.22 \rightleftharpoons 802.11**
 - Detection distance versus interference distance
 - 802.11 detection thresholds to coexist with 802.22
- **802.22 coexistence tools**
 - Spectrum etiquette
 - Channel re-use
 - Terrestrial geolocation
 - Spectrum Manager
- **Conclusion**

IEEE Standards

Network Type



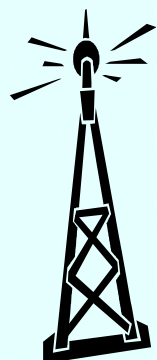
Characteristics of 802.22 WRAN:



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802.22 WRAN



WRAN BS
4 Watt
30 m

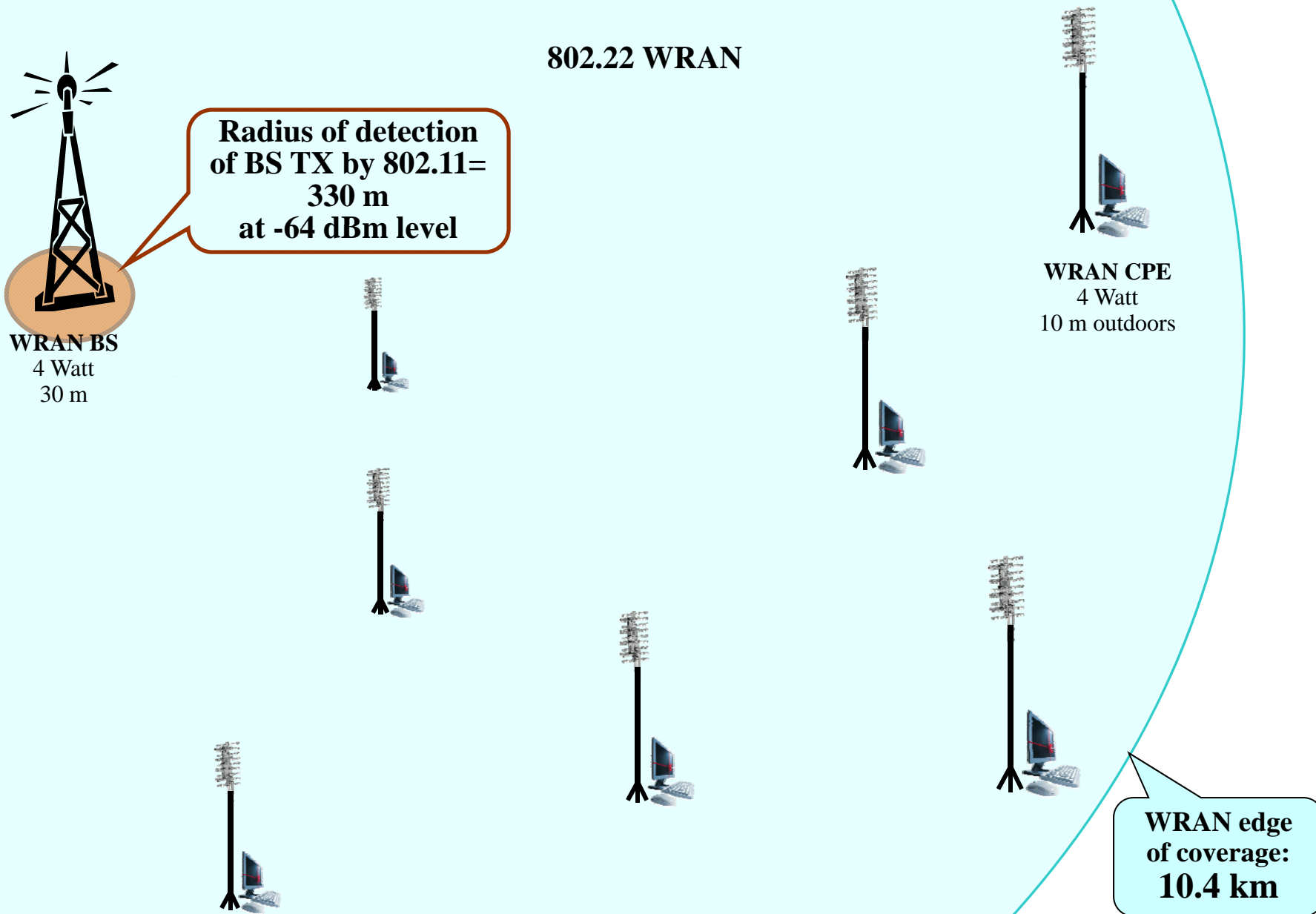


WRAN CPE
4 Watt
10 m outdoors

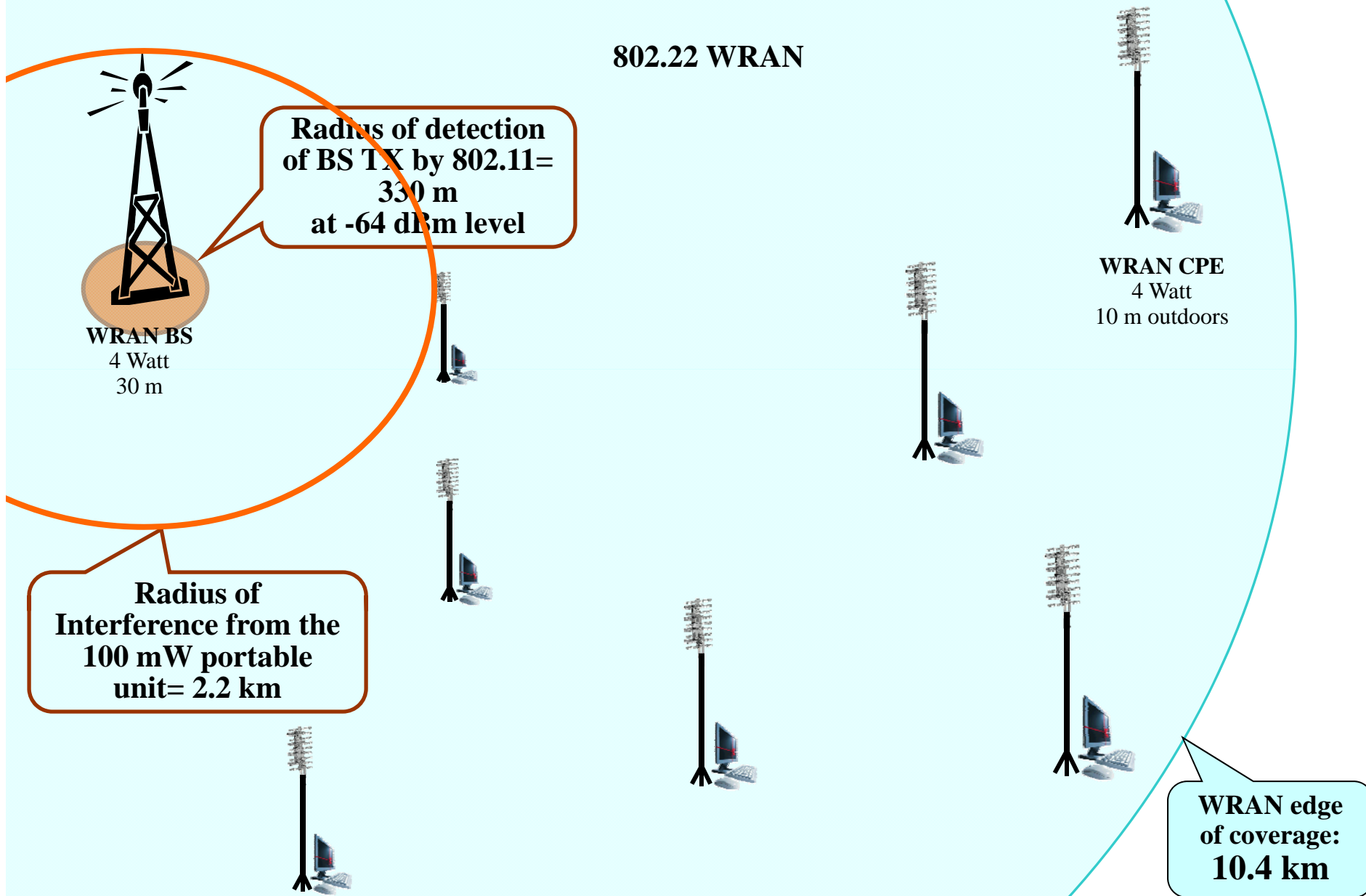


**WRAN edge
of coverage:
10.4 km**

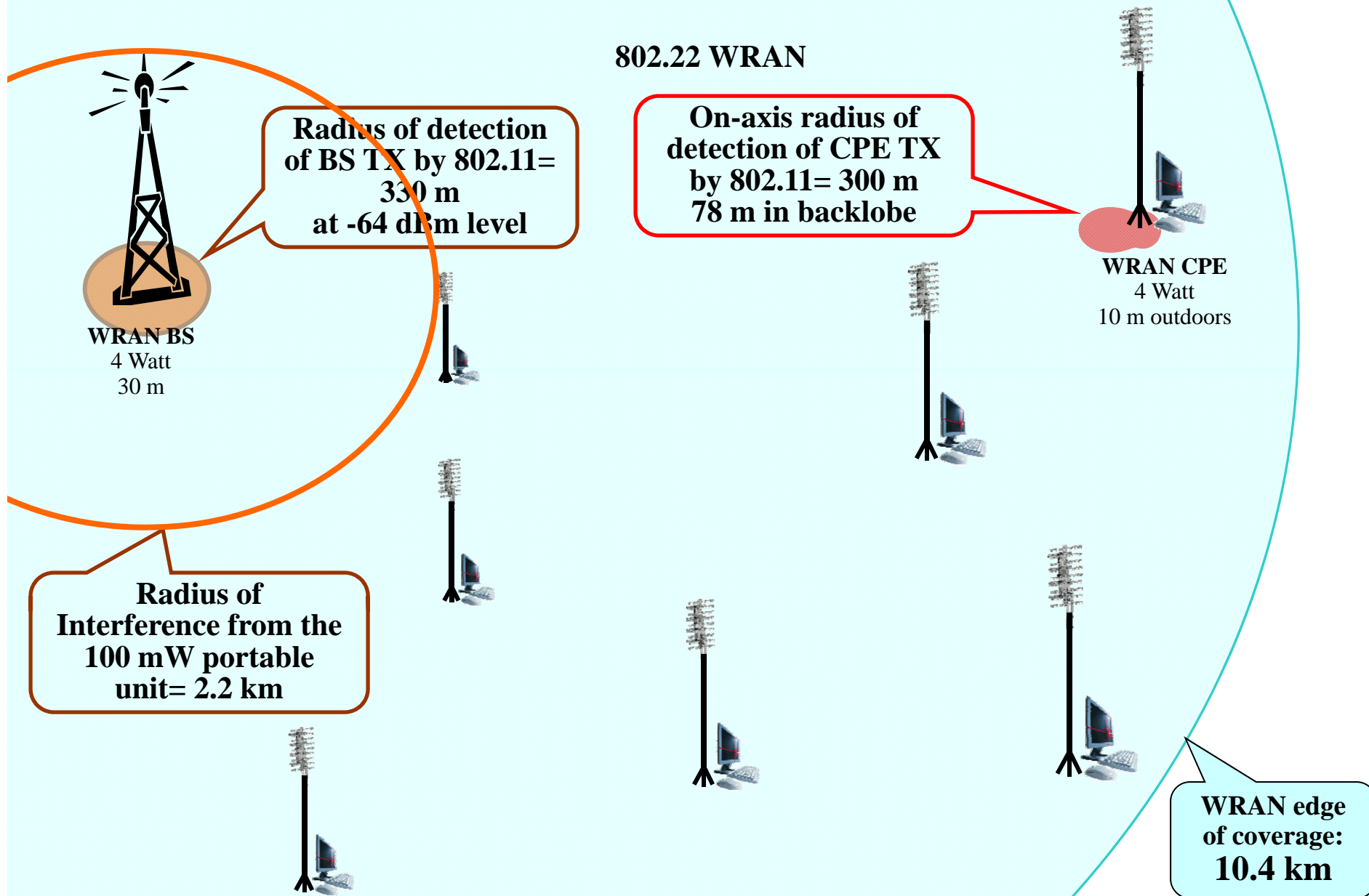
802.22 WRAN



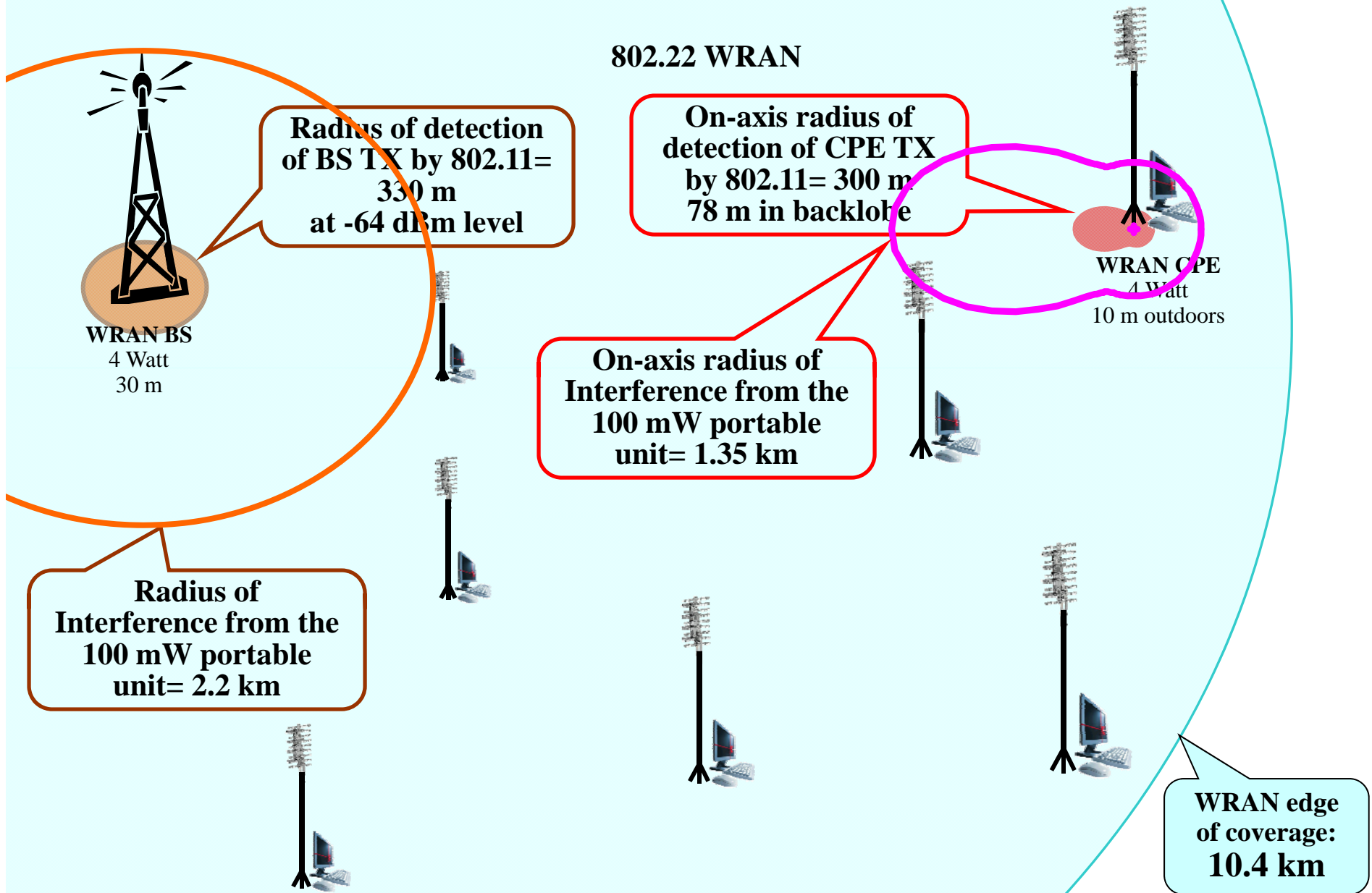
802.22 WRAN



802.22 WRAN



802.22 WRAN



802.11 Detection threshold levels to coexist with 802.22

- **Required 802.11 detection threshold in 6 MHz to limit the 802.22 devices desensitization to 3 dB**
 - Detection threshold = -90.8 dBm (BS transmitted signal)
 - Detection threshold = -88 dBm (CPE transmitted signal)
 - Detection threshold = -104 dBm (BS signal received at CPE, 10 m height)
 - Detection threshold = **-120.9** dBm (BS signal received at CPE, 1.5 m height)

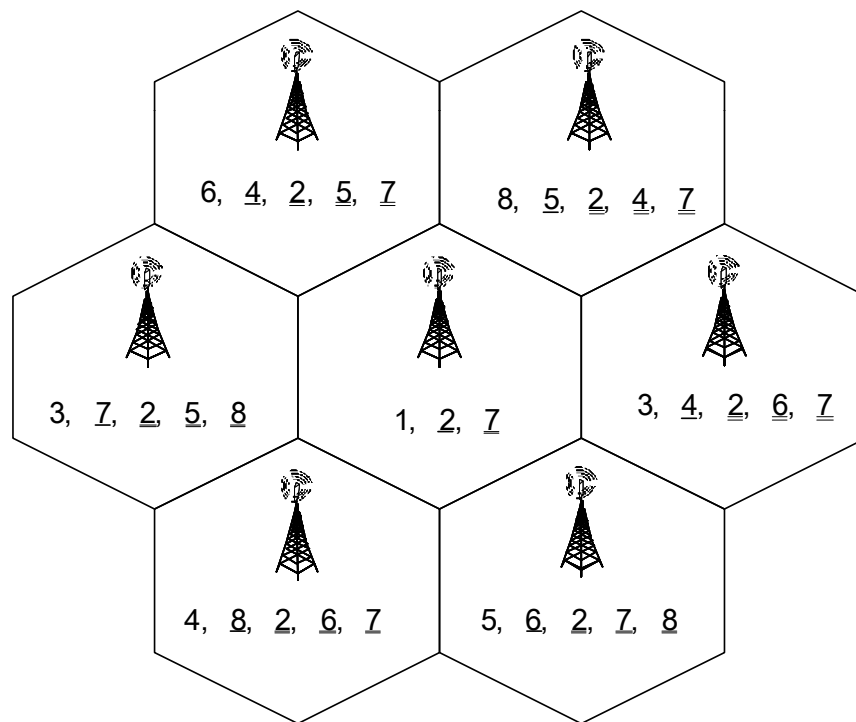
To be able to detect the downstream burst from the distant BS sending the DS/US-MAP

Outline

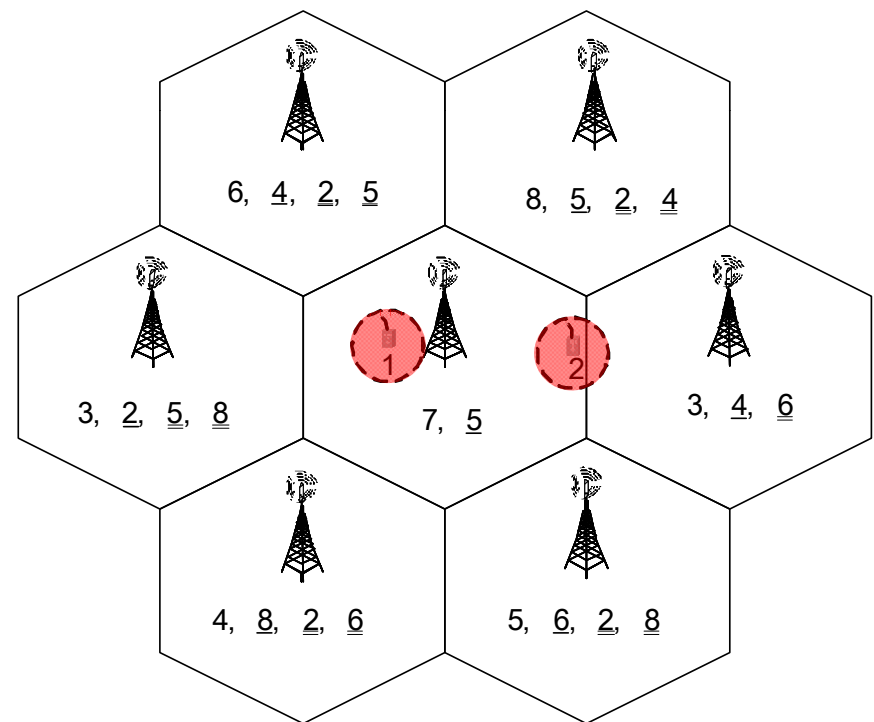
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Spectrum Etiquette

- different operating channel for overlapping or adjacent cells
- different first backup channel



(a)



(b)

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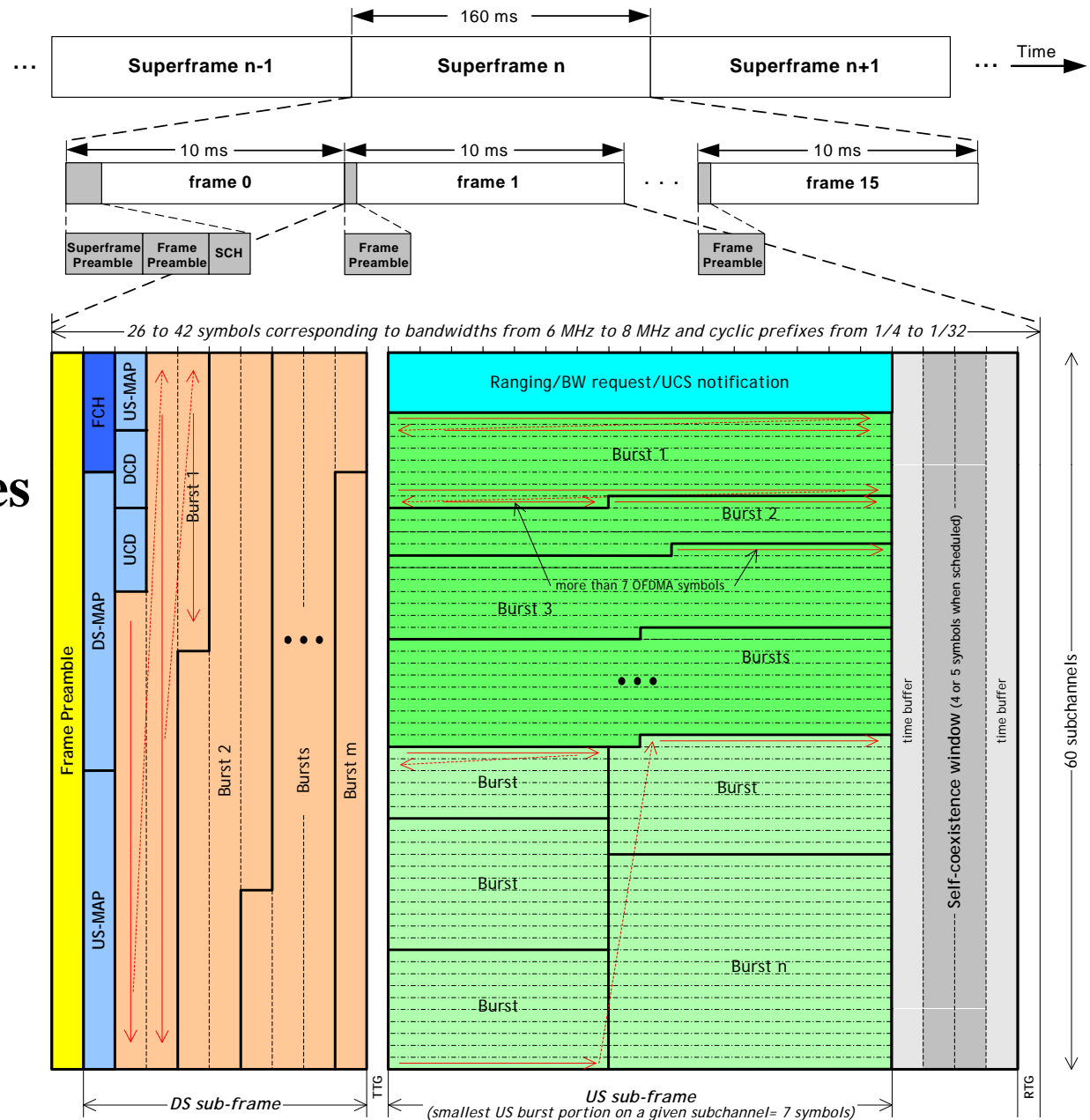
Channel re-use

- **Techniques for channel re-use**
 - **CDMA**: limited signal discrimination ($X < 25$ dB)
 - **OFDMA**: average signal discrimination through FFT ($25 < X < 35$ dB)
 - **TDMA**: very high signal discrimination ($X > 35$ dB) with appropriate time buffer to remove channel time spread

Given the potential large dynamic difference between fixed and portable applications, **TDMA** will be required.

802.22 WRAN superframe and frame structure

Superframe = 160 ms
Superframe = 16 frames
Frame = 10 ms

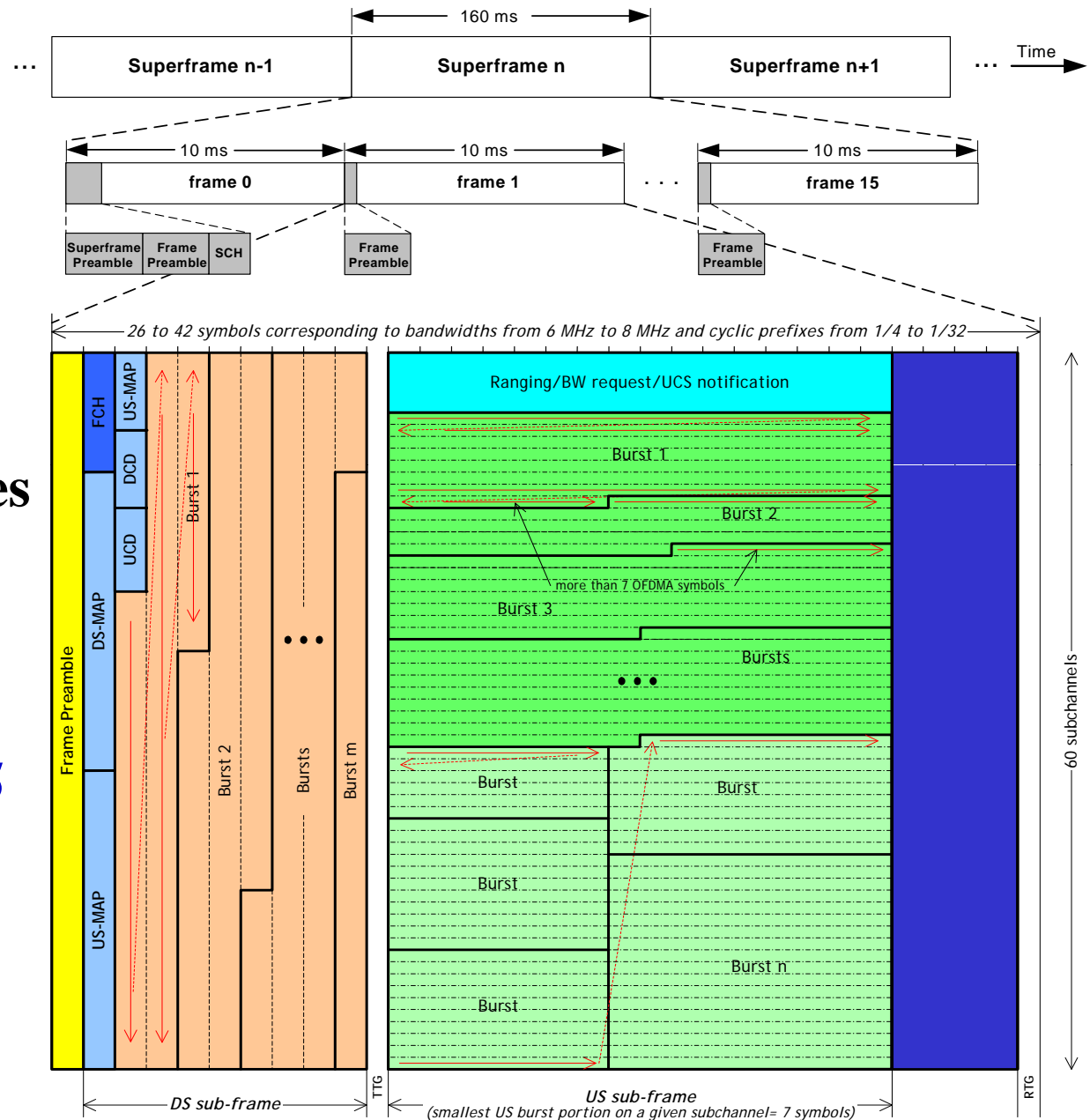


802.22 WRAN superframe and frame structure

Superframe = 160 ms
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Frame = 10 ms

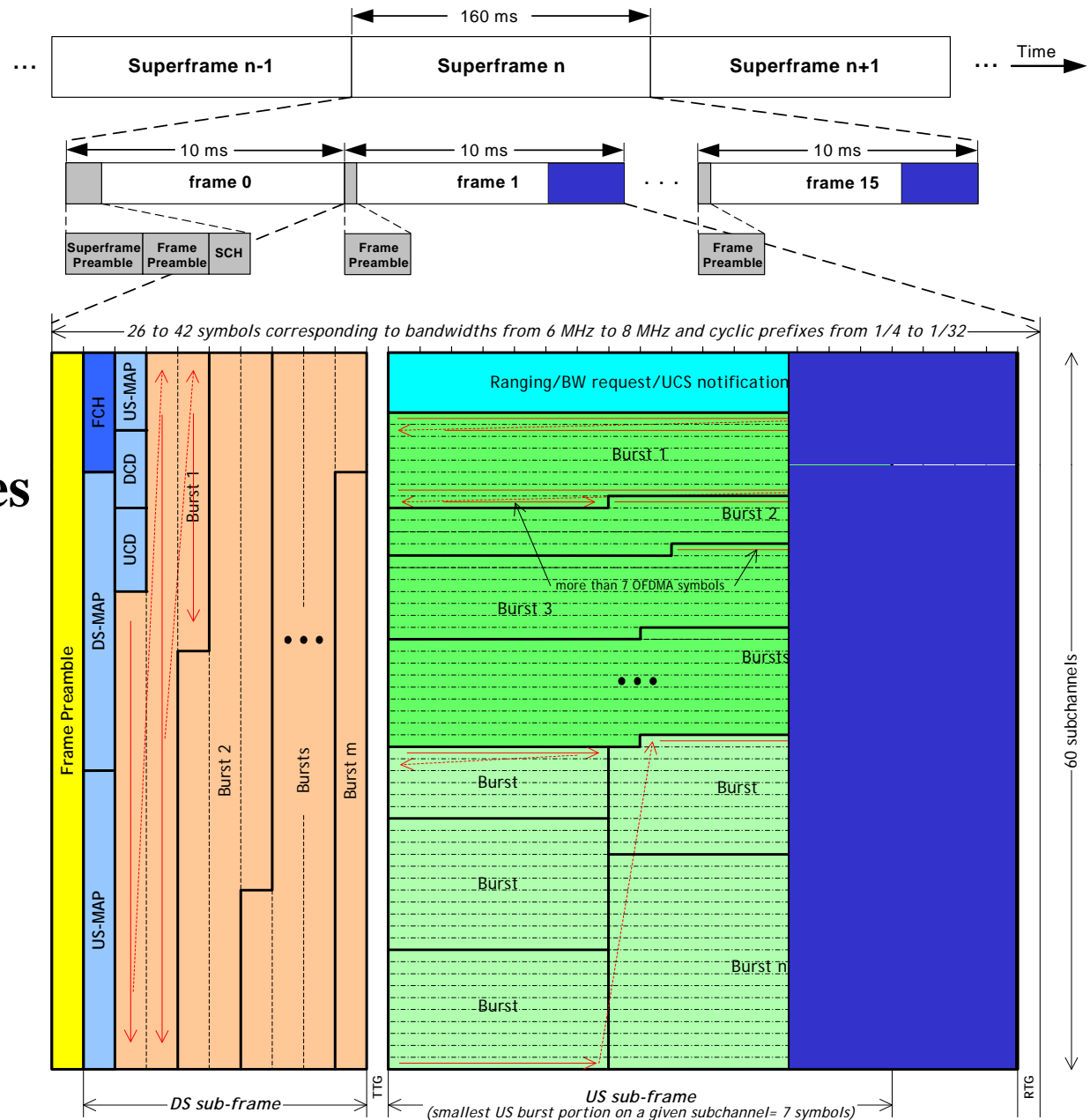
Using the Self-coexistence window (5 symbols, 2.3 ms) for TDMA with other systems



802.22 WRAN superframe and frame structure

Superframe = 160 ms
Superframe = 16 frames
Frame = 10 ms

**Using the 802.22
capability to schedule
intra-frame quiet
periods for sensing**

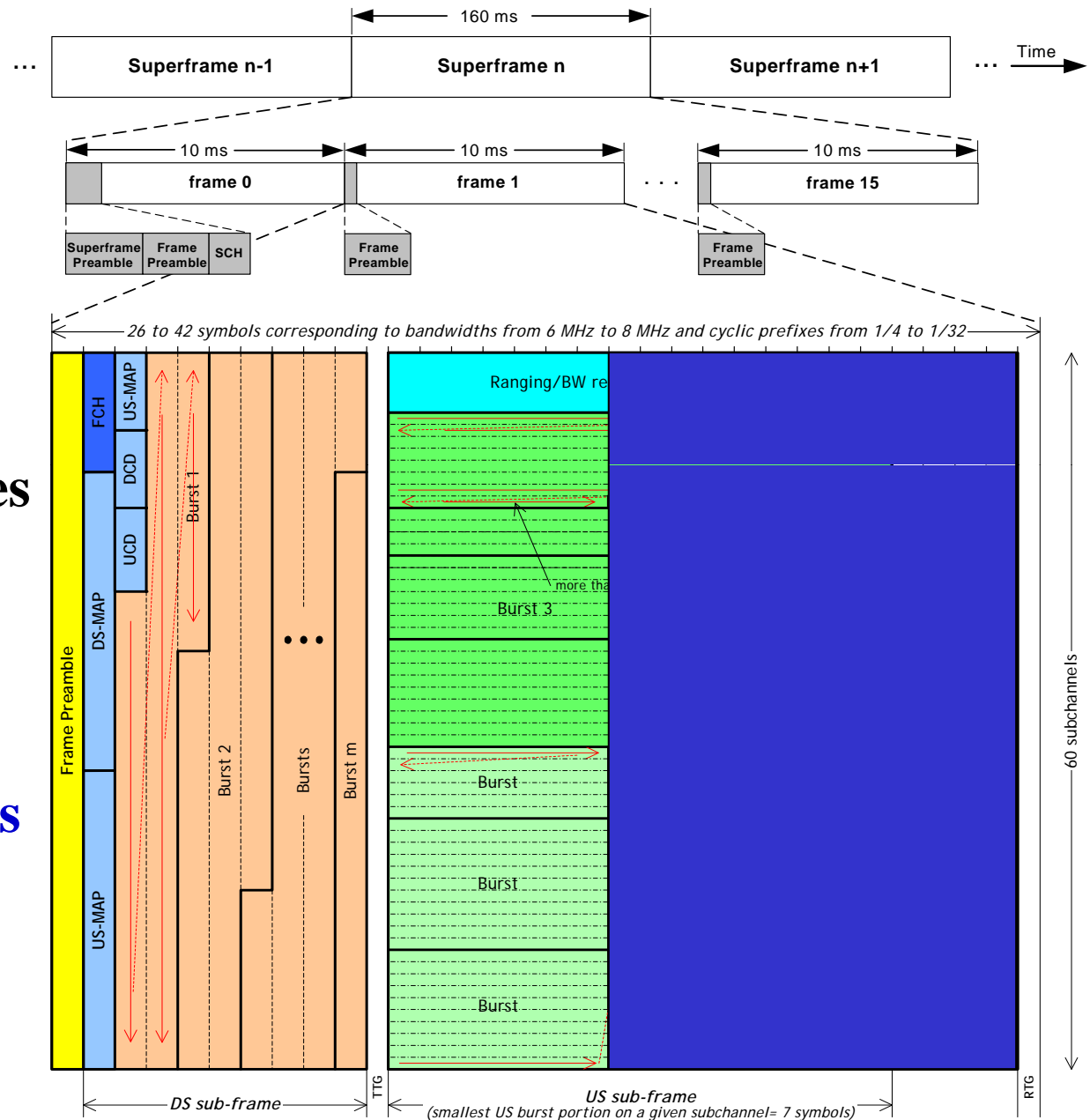


802.22 WRAN superframe and frame structure

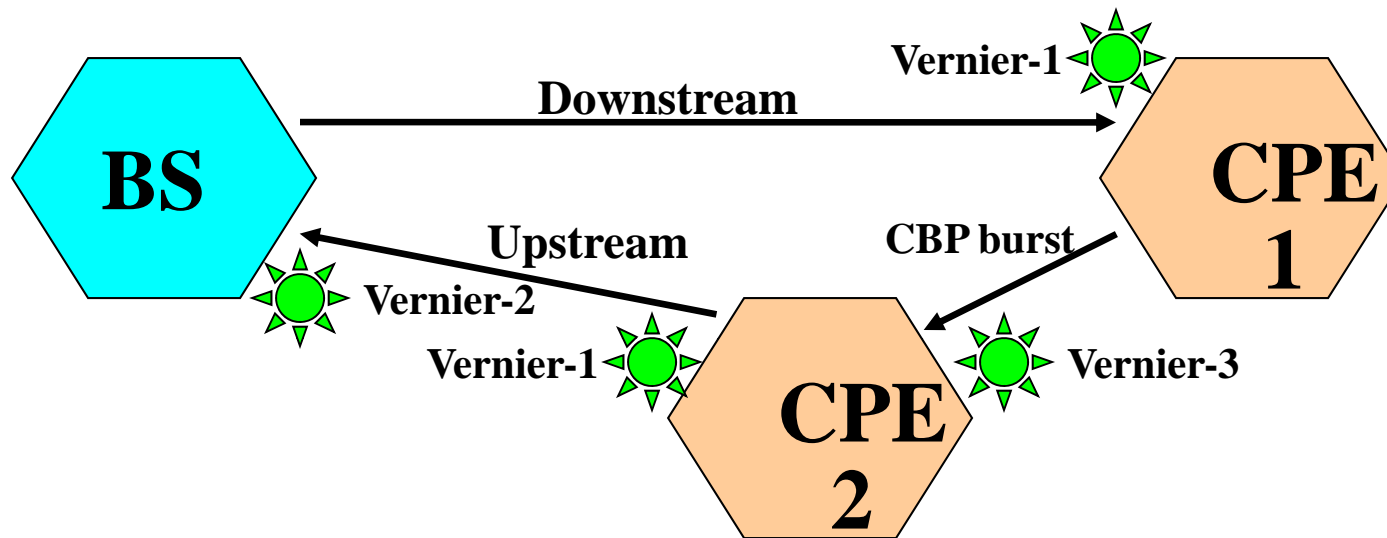
Superframe = 160 ms
Superframe = 16 frames

Frame = 10 ms

Using the 802.22
capability to shorten its
frame under lower
traffic

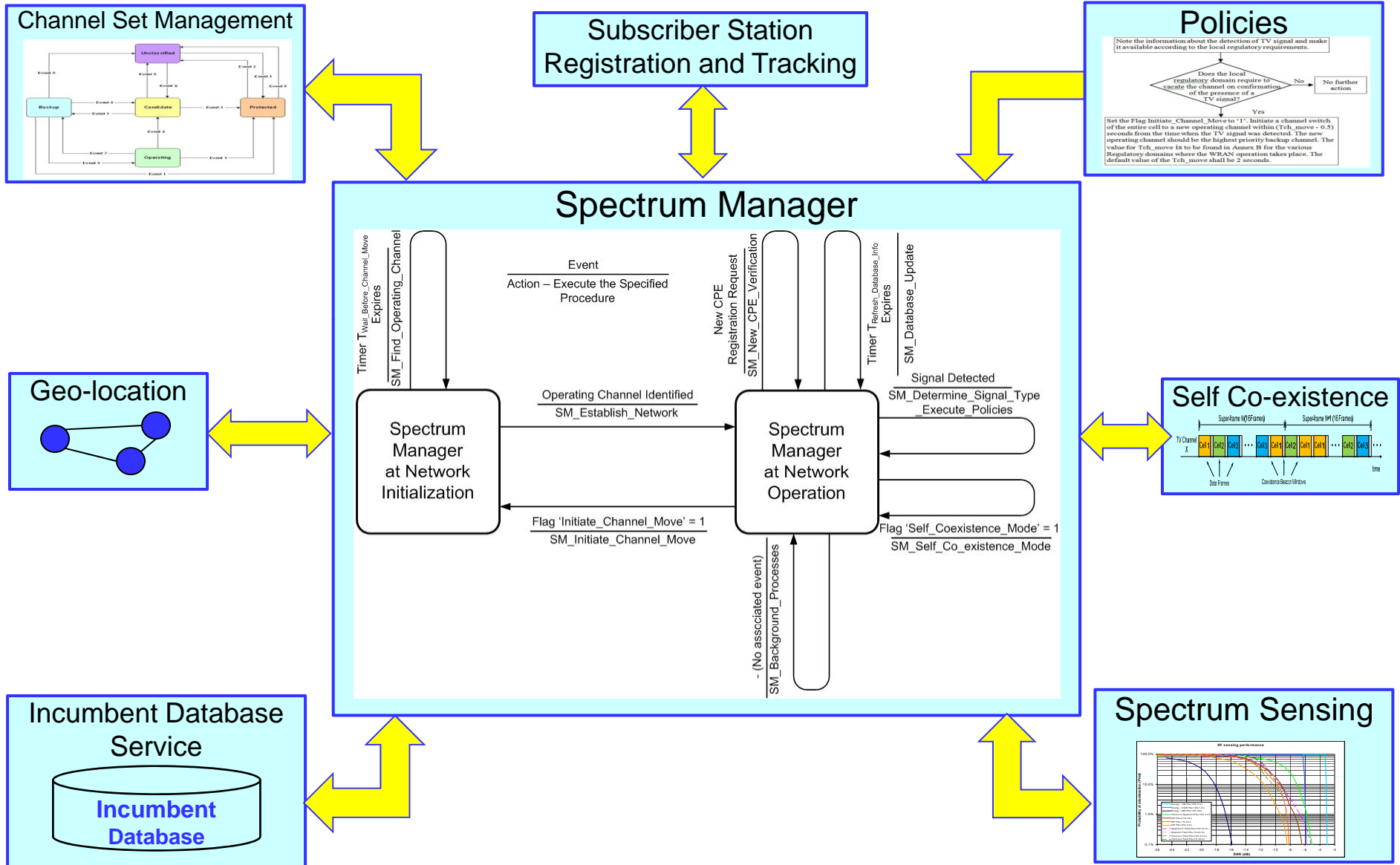


Terrestrial geolocation



- Besides satellite-based geolocation, the 802.22 standard includes terrestrial geolocation using inherent capabilities of the OFDM based modulation and the coexistence beacon protocol bursts transmitted and received among CPEs
- Propagation time measured between BS and its CPEs and among CPEs of the same cell using *Fine Time Difference of Arrival: TDOA*

802.22 Spectrum Manager



Conclusions

- **Current 802.11 CSMA-CA based detection thresholds are not sufficient to enable coexistence with 802.22**
- **802.22 has established spectrum sharing techniques that can be readily adapted to enable coexistence with other 802 technologies**
- **802.22 spectrum manager is capable of autonomously deciding which coexistence mechanism to use and how**
- **802.22 has developed a basic interface for incumbent database service**
- **802.22 will consider providing interface between its spectrum manager and 802.19 coexistence manager**

References

1. IEEE P802.22TM/ DRAFTv3.0 Draft Standard for Wireless Regional Area Networks Part 22: Cognitive Wireless RAN Medium Access Control (MAC) and Physical Layer (PHY) specifications: Policies and procedures for operation in the TV Bands, April 2010
2. 22-10-0123-00-0000-Interference between 802.22 WRAN and Portable Devices.xls