WIRELESS COMMUNICATION USING TV WHITE SPACE

Charles Bundala

Wilson Chanhemo

Said A Kombo

Noel Chintelele

University of Dodoma

October 8, 2015

OUTLINE

- OVERVIEW OF TV WHITE SPACE (TVWS)
- MOTIVATION TO USE TV WS
- UNIQUE CHARACTERISTICS OF TVWS
- AVAILAIBLE STANDARDS
- SENSING THE TVWS
- CURRENT RESEARCH ISSUES

OVERVIEW OF TV WHITE SPACE

- Locations where spectrum allocated for some wireless communication system is unutilized appear as white areas in system coverage maps
- Therefore, they are referred to as White spaces
- In a spectrum band that is licensed to primary users, the part of spectrum that is unused by the primary user at specific locations and sometimes at specific time

  Example Television Channels: not every channel is used in every town

OVERVIEW OF TV WHITE SPACE..cont

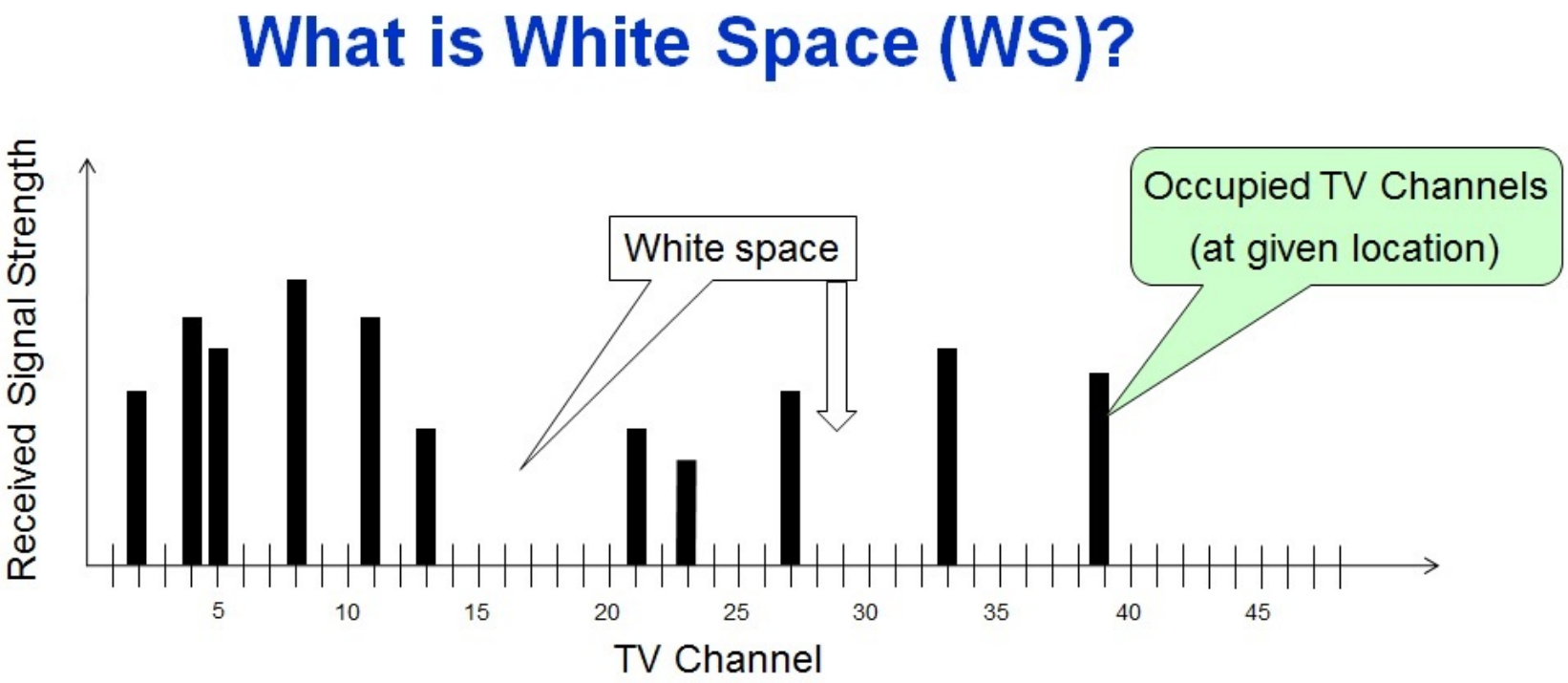


Figure: 1 TV white space

MOTIVATION TO USE TV WS

- Driving force is due to spectrum shortage
- The huge growth of mobile data utilization has showed that current spectrum allocations for cellular or Wi-Fi networks are inadequate
- Drawback of strict regulation is that the spectrum utilization is not optimal. Depending on wireless system there can be substantial temporal and geographical differences how spectral resources are utilized
- The transition from analog TV transmissions to digital TV frees up large amounts of frequencies in VHF and UHF bands

UNIQUE CHARACTERISTICS OF TVWS

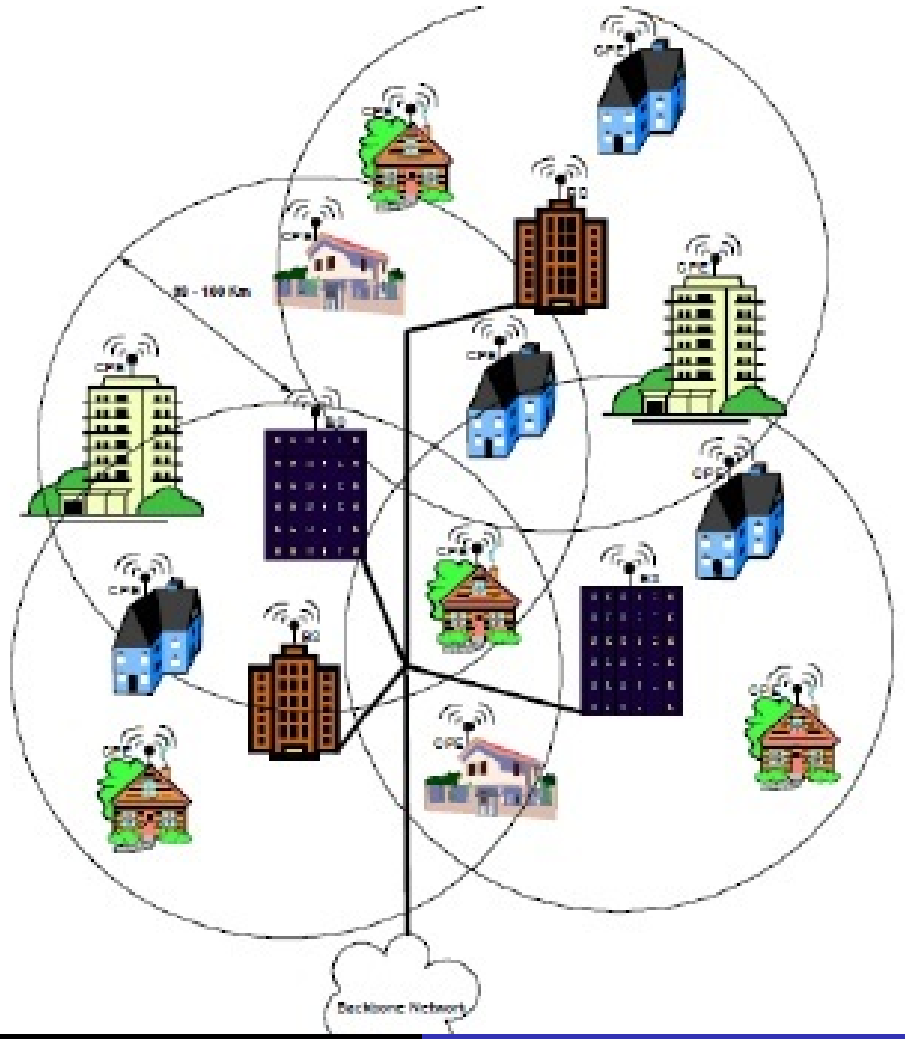
- Most of the spectrum expected is already assigned to the primary user (licensee)
- Spectrum varies from region to region
- Dynamic Frequency Selection
- Avoidance of co-channel operation
- Adaptive Modulation/Coding
- Transmit Power control

AVAILAIBLE STANDARDS:IEEE 802.22 WRAN

- Wireless Regional Area Networks (WRANs)
- Provide Wireless broadband access e.g to rural areas
- Topology: Point-to-multipoint and Master slave
- Entities: Base Station, Consumer Premise Equipment (CPE)

AVAILAIBLE STANDARDS

IEEE 802.22 WRAN ...



AVAILAIBLE STANDARDS

IEEE 802.11af

- Wi-Fi extension to TVWS

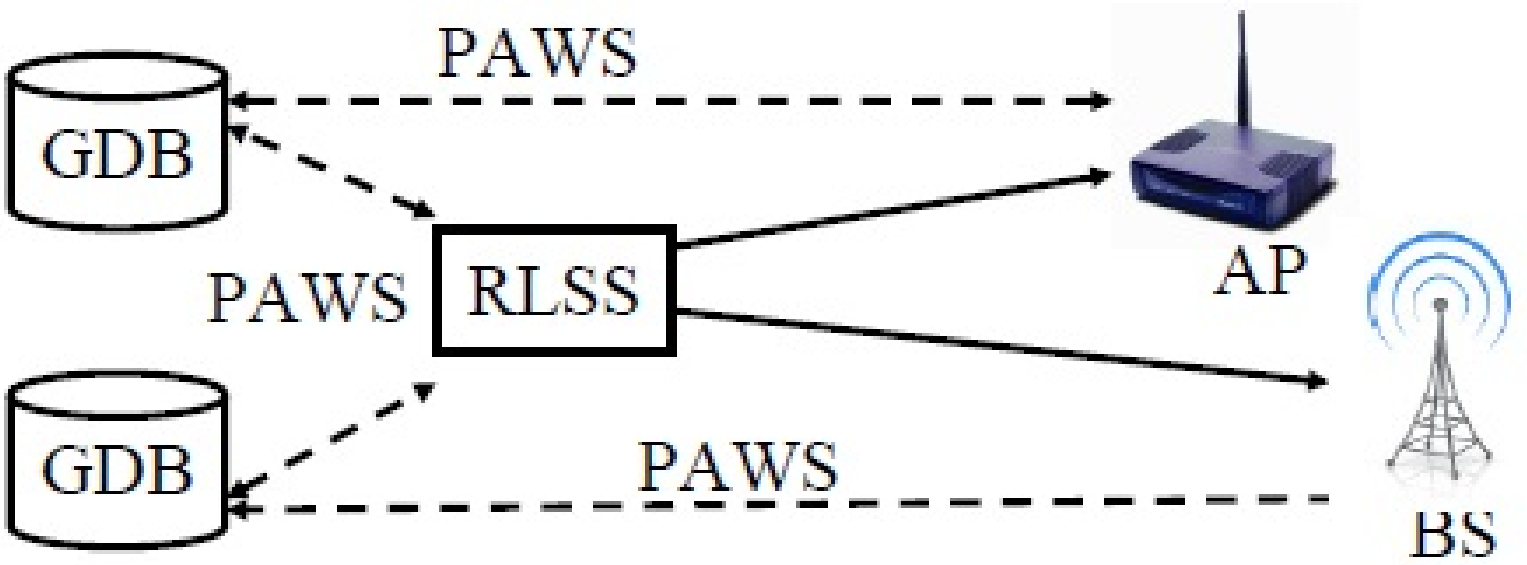


Figure: 4: 802.11af

AVAILAIBLE STANDARDS

Others

- IEEE 802.16h WiMAX extension to TVWS
- IEEE 802.15.4m Extension of PAN standards to TVWS
- IEEE 802.19.1 Co-existence of several white space systems

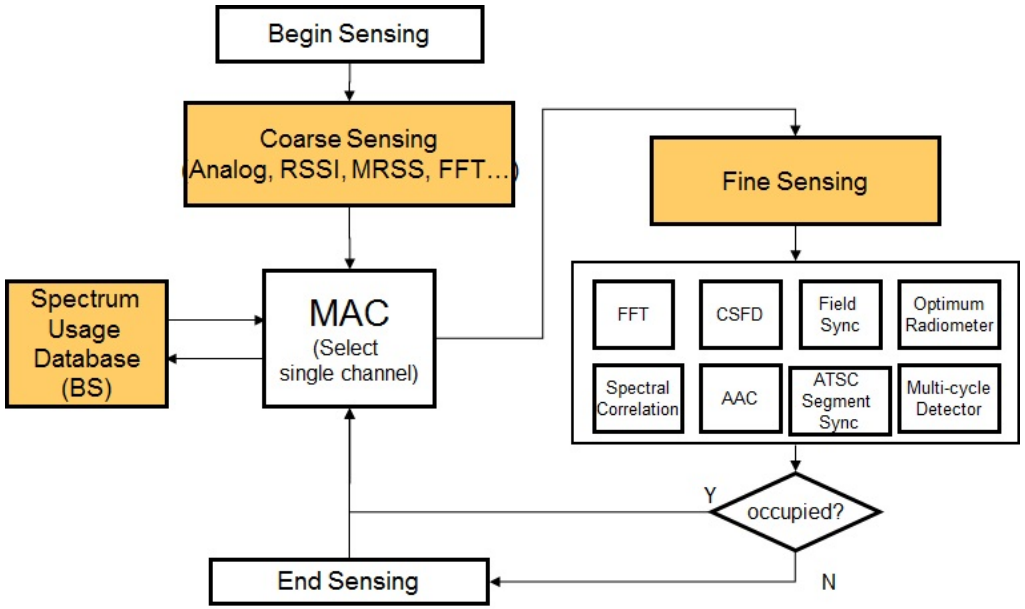
Sensing the TVWS

- COGNITIVE RADIO
- GEO-LOCATION DATABASES

Sensing the TVWS

COGNITIVE RADIO

- enable flexible, efficient and reliable spectrum use by adapting the radios operating characteristics to the real-time conditions of the environment



Sensing the TVWS

GEO-LOCATION DATABASES

- Collection of Databases indicating available TVWS channels

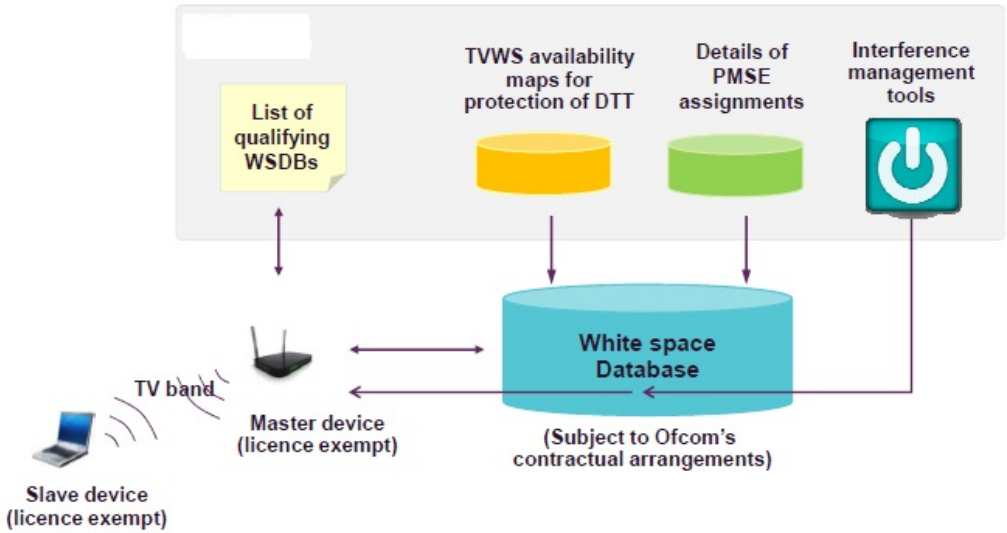


Figure:

CURRENT RESEARCH CHALLENGES IN TVWS USAGE

- Spectrum Sharing and interference management
- Quality of white space channels
- Security challenge: Geo-location Databases are available in the public internet