

*In the name of God*



*Cognitive ultra wide band  
Radio*

Soodeh Amiri

Supervised by: Dr.M.Omidi

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# OUTLINE:

- **INTRODUCTION**
- **UWB PROBLEMS**
- **CR in UWB**
- **STRUCTURE OF COGNITIVE UWB SYSTEM**
- **Differences between CR and UWB**
- **Spectrum sharing in Cognitive UWB Radio**
- **Spectrum sensing in Cognitive UWB Radio**
- **Conclusion**
- **References**

# INTRODUCTION

- **Large bandwidth**

High data rate communications, multiple access communications  
, Ground and wall penetration and geolocation

- **Carrierless signal**

Hardware simplicity and small low cost hardware

- **Ultra short pulse width**

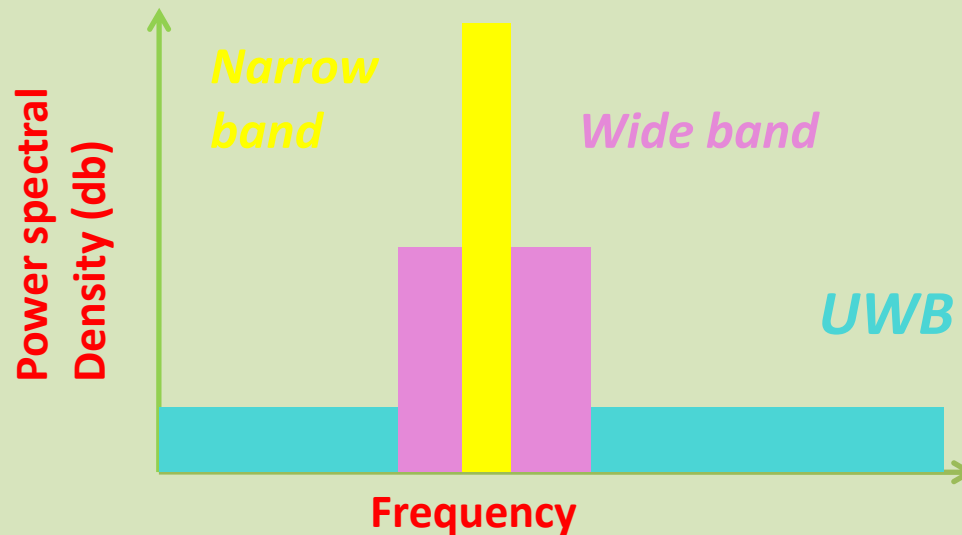
Multipath components of UWB signals can be resolved directly

# INTRODUCTION

bandwidth of UWB system is generally over 20% of center frequency or more than 500MHz.

# INTRODUCTION

- *In terms of bandwidth*
  - ❖ *Ultra wide band  $BW \gg$  wideband  $BW \gg$  Narrowband  $BW$*



## ***Differences between CR and UWB***

- **A CR utilizes only unused spectrum segments or spectrum holes at a given time and location, whereas the UWB signal spectrum may overlap with the PU signal spectrum.**
- **the UWB technology is aimed at short-range communications due to transmission power constraints, but the CR may use higher transmit power levels and therefore may be deployed the CR may therefore may be deployed in longer-range communications. .**

# UWB PROBLEMS:

- *Because UWB occupying very wide spectrum, and effect from/to other existing systems within the same band.*
- *Even UWB system transmits under limited power level, it could cause interference to other systems.*

# CR in UWB

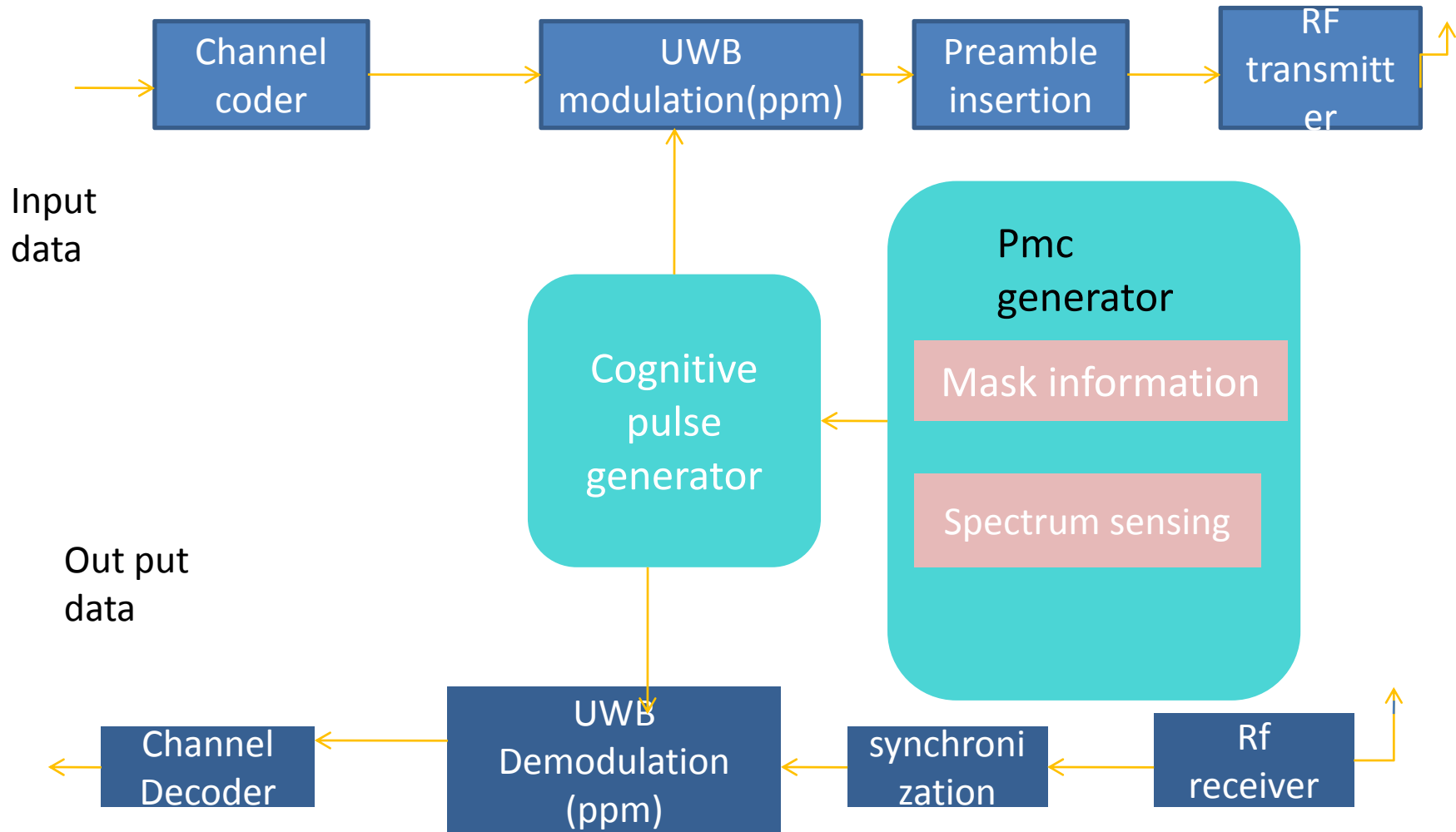
- *cognitive radio can sense the spectrum, to check whether it is being used by licensed services, Cognitive UWB radio can change the radio parameters in order to be able to exploit the unused part of the spectrum.*



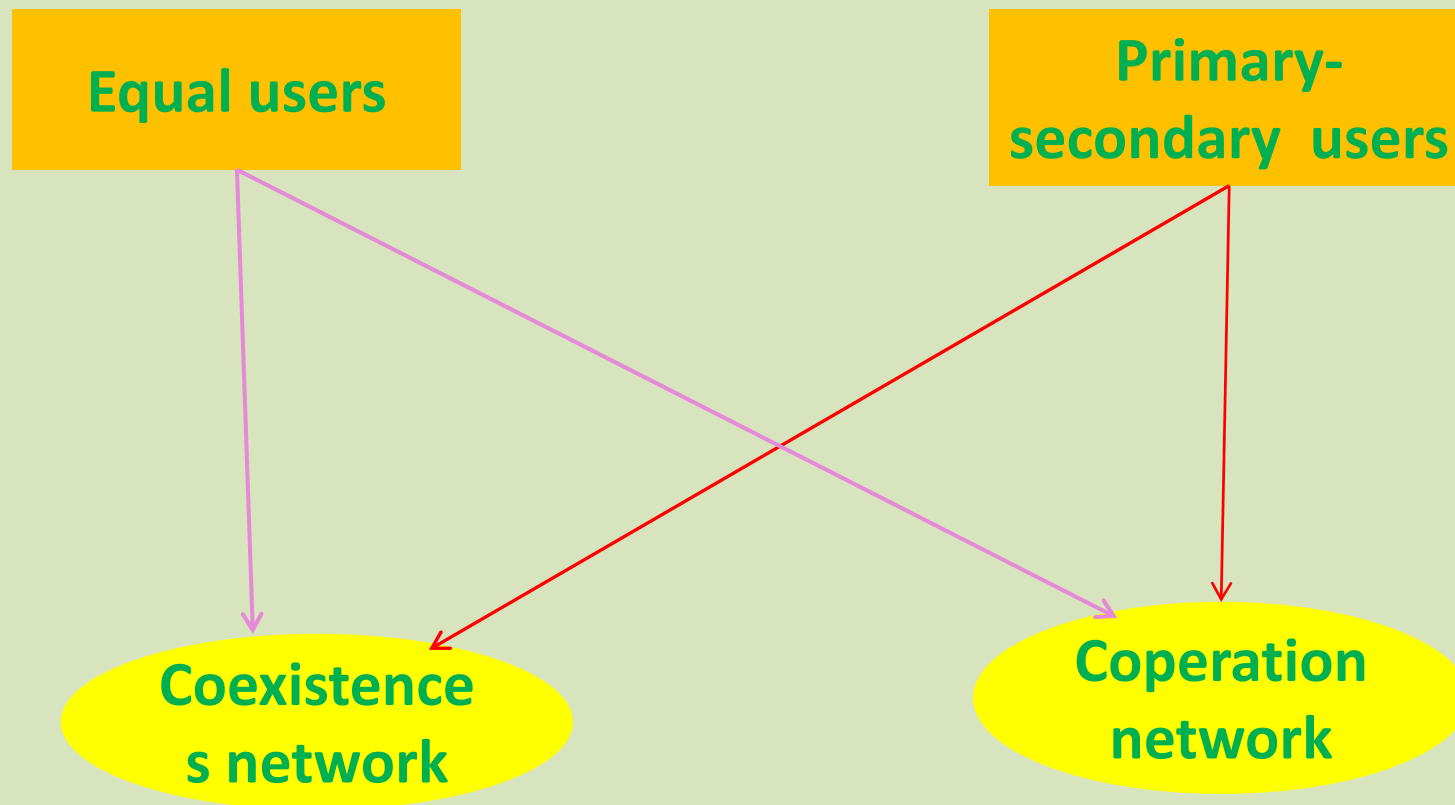
# **STRUCTURE OF COGNITIVE UWB SYSTEM:**

*cognitive UWB system divides the whole band into several sub-bands and selects the ones with good channel condition for its transmission.*

# STRUCTURE OF COGNITIVE UWB SYSTEM:



# ***Spectrum sharing in Cognitive UWB Radio***



# Spectrum sensing schemes

- **Energy detection**

When the receiver cannot gather sufficient information about  $P_{us}$ .

- **Feature detection**

It is computationally complex and requires significantly long observation times.

- **Matched filter detection**

When the information of the primary user signal is known to the CR user, the optimal detector is the matched filter detection.

# Spectrum sensing schemes

From what has been discussed, we may draw the conclusion that the matched filter detection is the optimal spectrum sensing scheme in the UWB-CR. Because the priori knowledge of the primary user signals in the UWB-CR system is known to the CR user.

# **Spectrum sensing in C UWB R**

- **Because of shadowing and fading, it is possible that some devices do not receive a primary user's signal. In order to avoid the hidden PU problem, the spectrum sensing must be distributed among devices.**

# Conclusion:

- **Decrease interference**
- **capacity of the UWB system can be improved**
- **Flexibility**

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*Thank  
you for  
your  
attention*