Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)

Submission Title: [Frame Synchronization to Combat In/Out Interference in WBAN]
Date Submitted: [19 March 2008]
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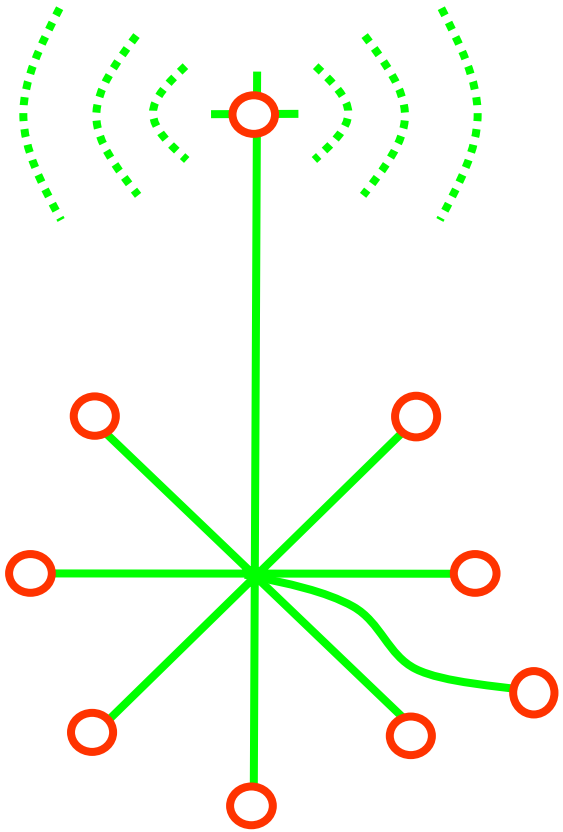
Re: [Contribution to IEEE 802.15.6 Meeting, March 2008]

Abstract: [Propose frame synchronization method to avoid interference problems]

Purpose: [Proposal]

Frame Synchronization to Combat In/Out Interference in WBAN



March 2008

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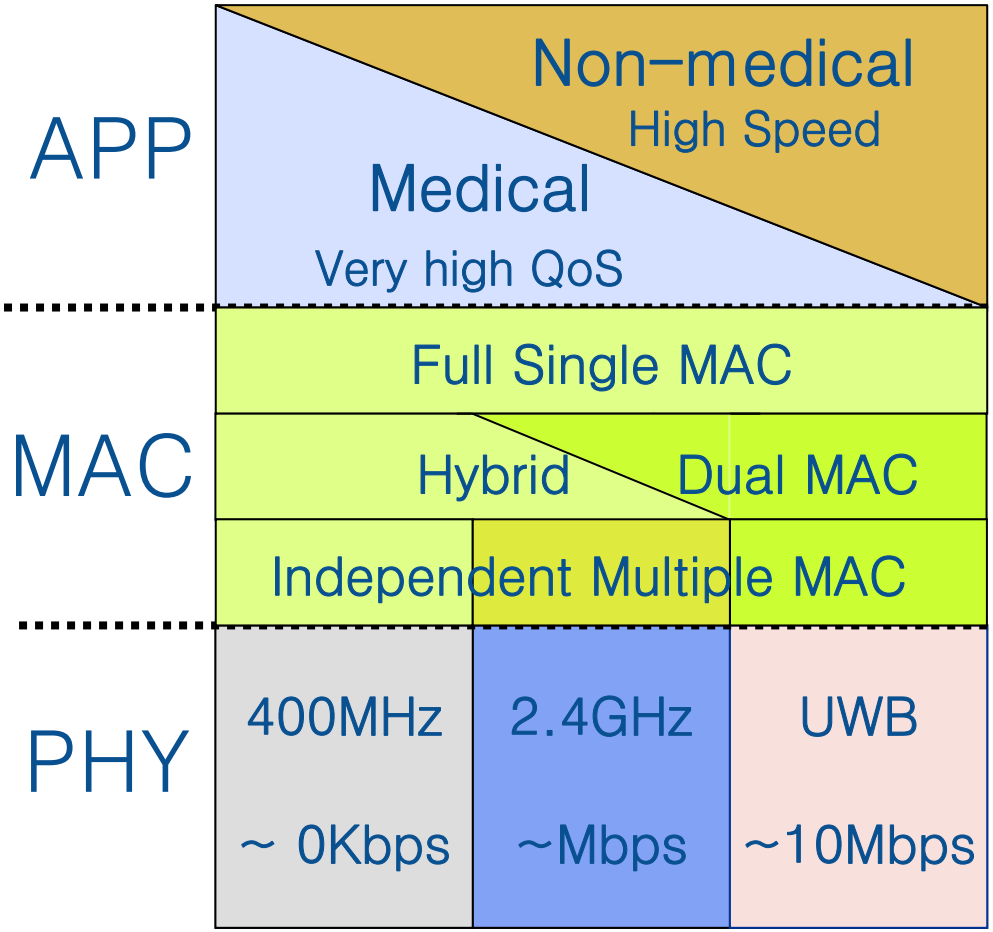
Issues in WBAN Work Scope



Arrange Requirements

- List up user requirements
- Check realizability
- If no, reduce requirements

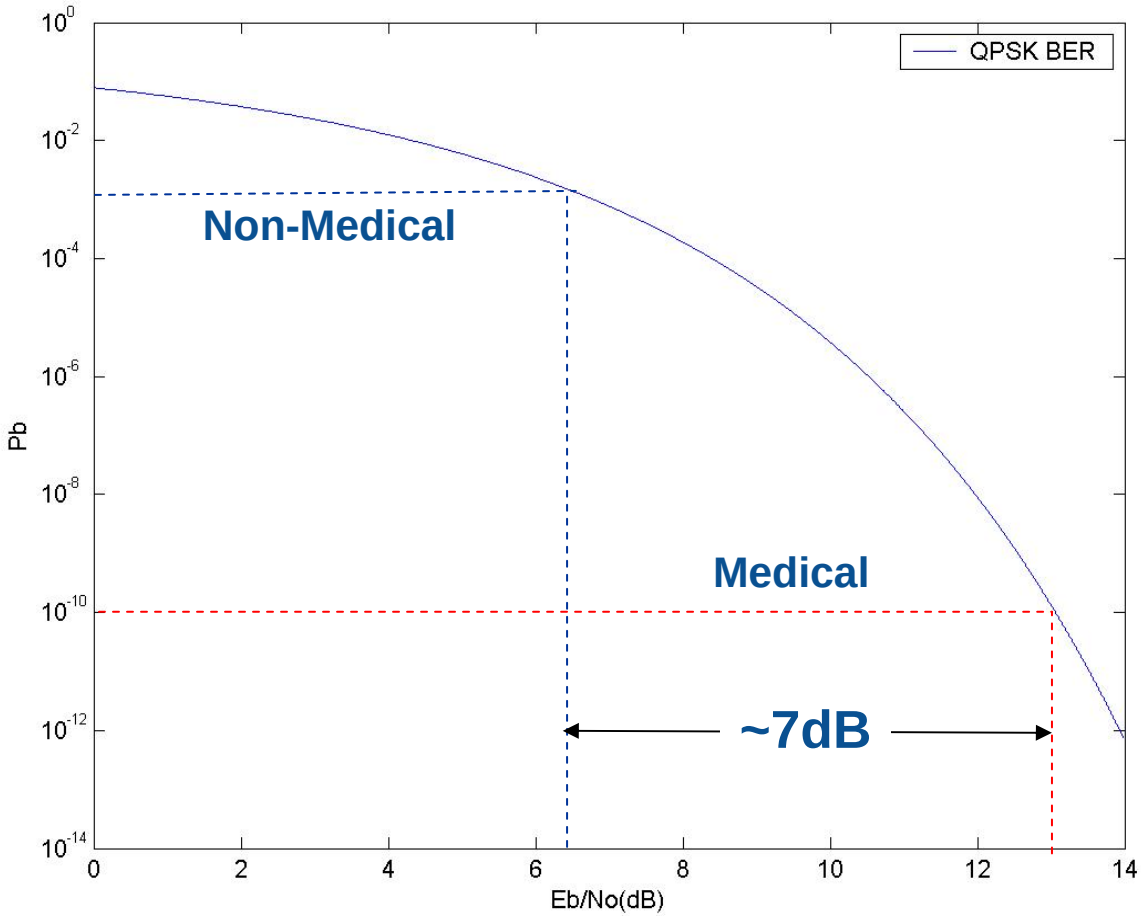
Check Stumbling Blocks

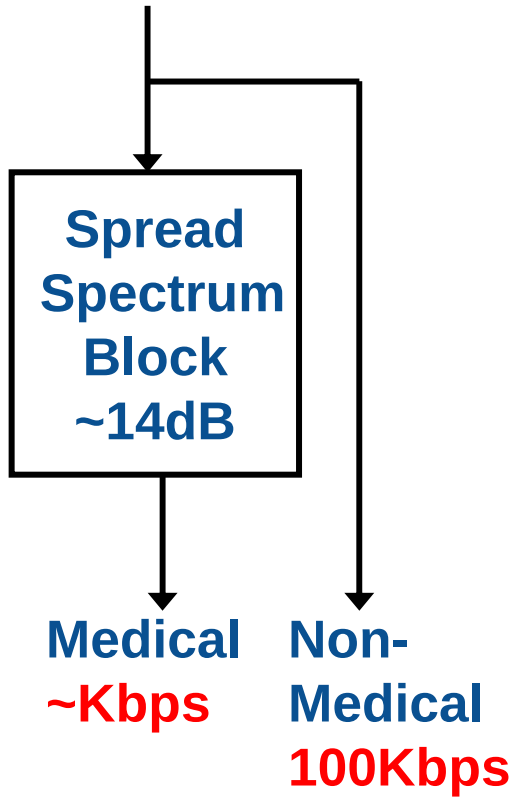
- On-body / Out-body Interference
- Multiple MAC or Single MAC ?
- Compromize power & speed
- Medical / Non-medical support

Choose existing technique

- Select good chip
- Enhance antenna matching
- Reduce system size & Good design
- Add process gain for medical use ?

Process Gain for Medical Use





Major Challenges of WBAN MAC (1)

1. **On(In)-body / Out-body Mutual Interference**
   - On-body transmission fatally obstructs reception from out-body
   - Conventional techniques(CSMA, LBT) are helpless
   - Any solution to overcome the On/Out problem?

2. **Multiple PHY & Single MAC**
   - Inevitable to use multiple PHYs, yet a single MAC is desired.
   - Any solution to support multiple speeds with a single MAC?

Major Challenges of WBAN MAC (2)

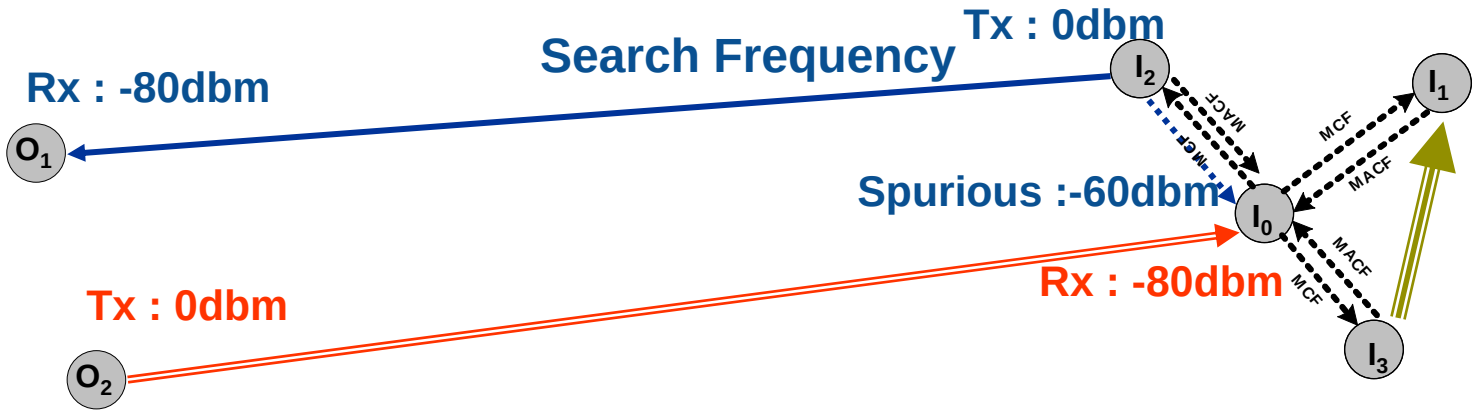
3. Power Consumption vs Speed & Duty Cycle

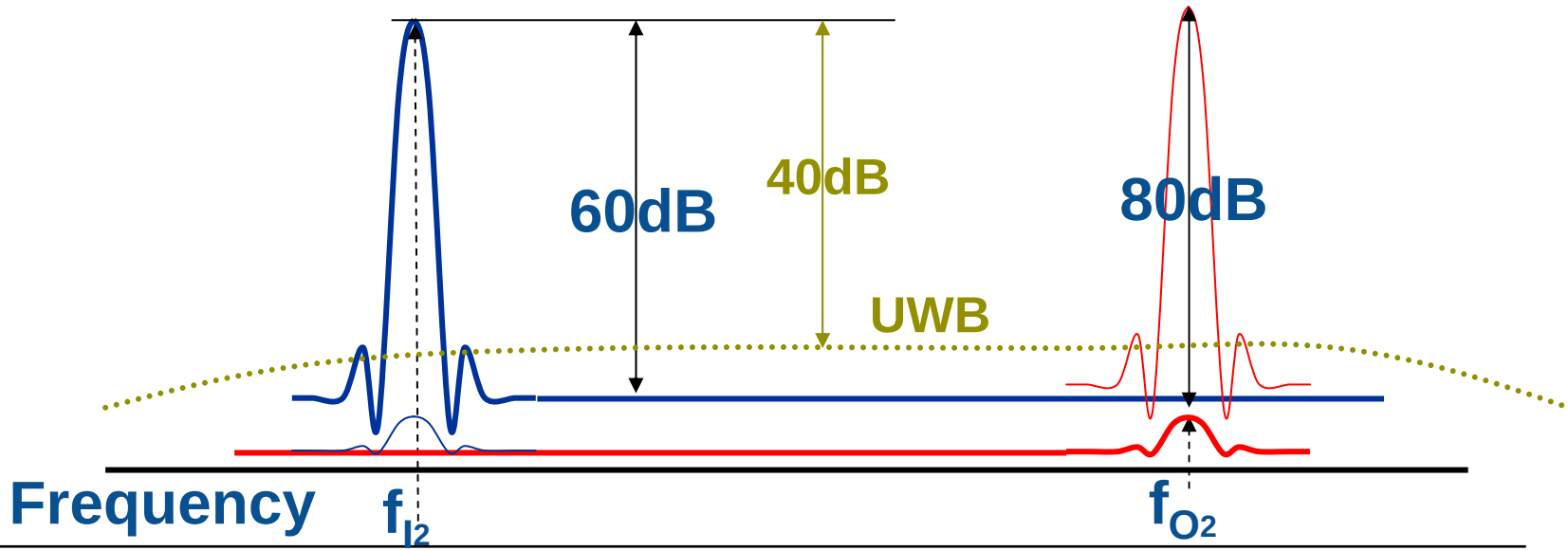
- Higher Speed needs Higher power consumption
- What will be the speed limit to compromise power consumption ?

4. Medical / Non-Medical Dual support

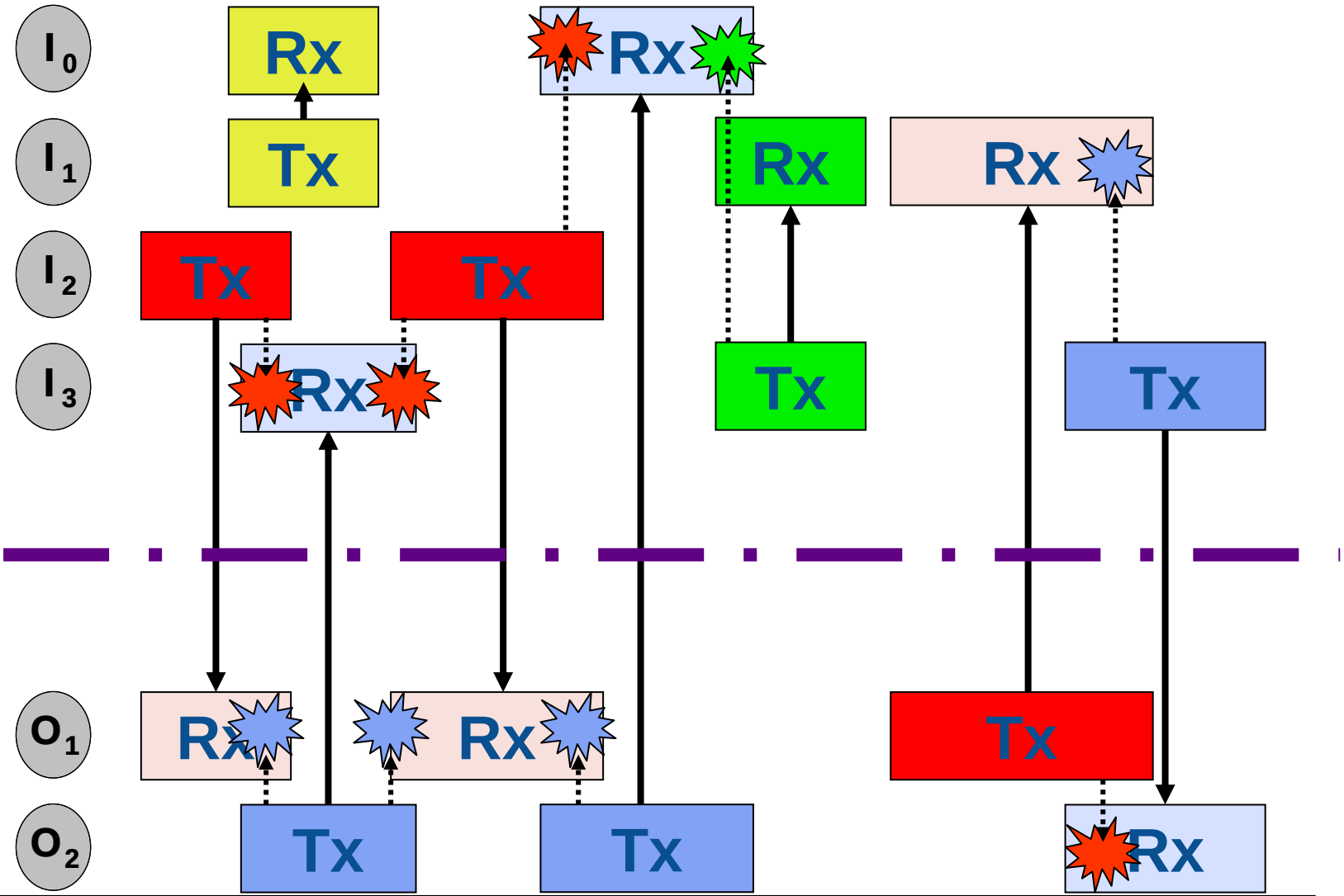
- Medical : Low speed (~Kbps) ;
  - high QoS (BER < 10^{-10})
- Non Medical : Higher Speed is Better ;
  - Reasonable QoS (BER < 10^{-3})
- Any solution to support dual purpose ?

On(In)-body / Out-body Interference

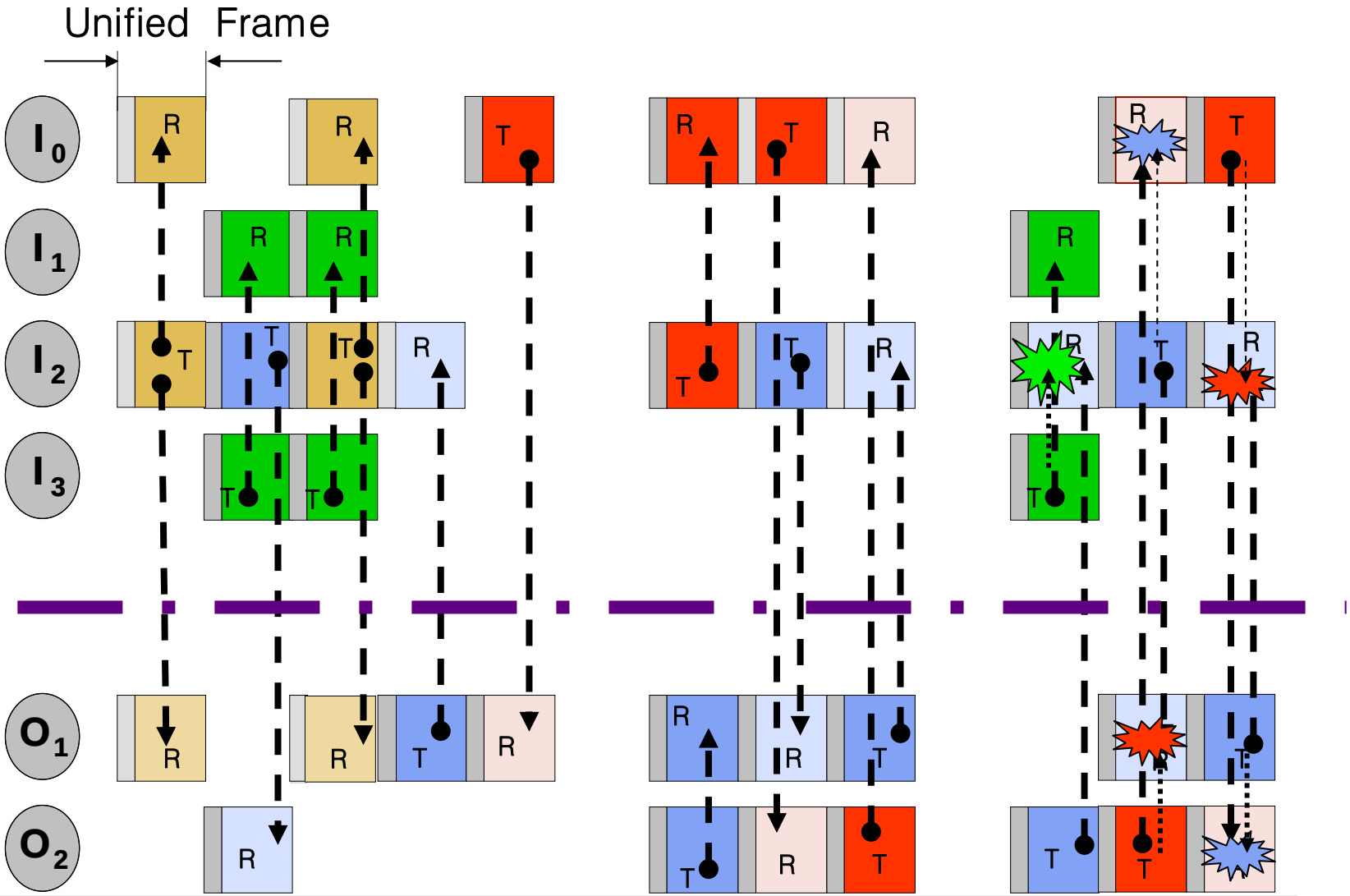




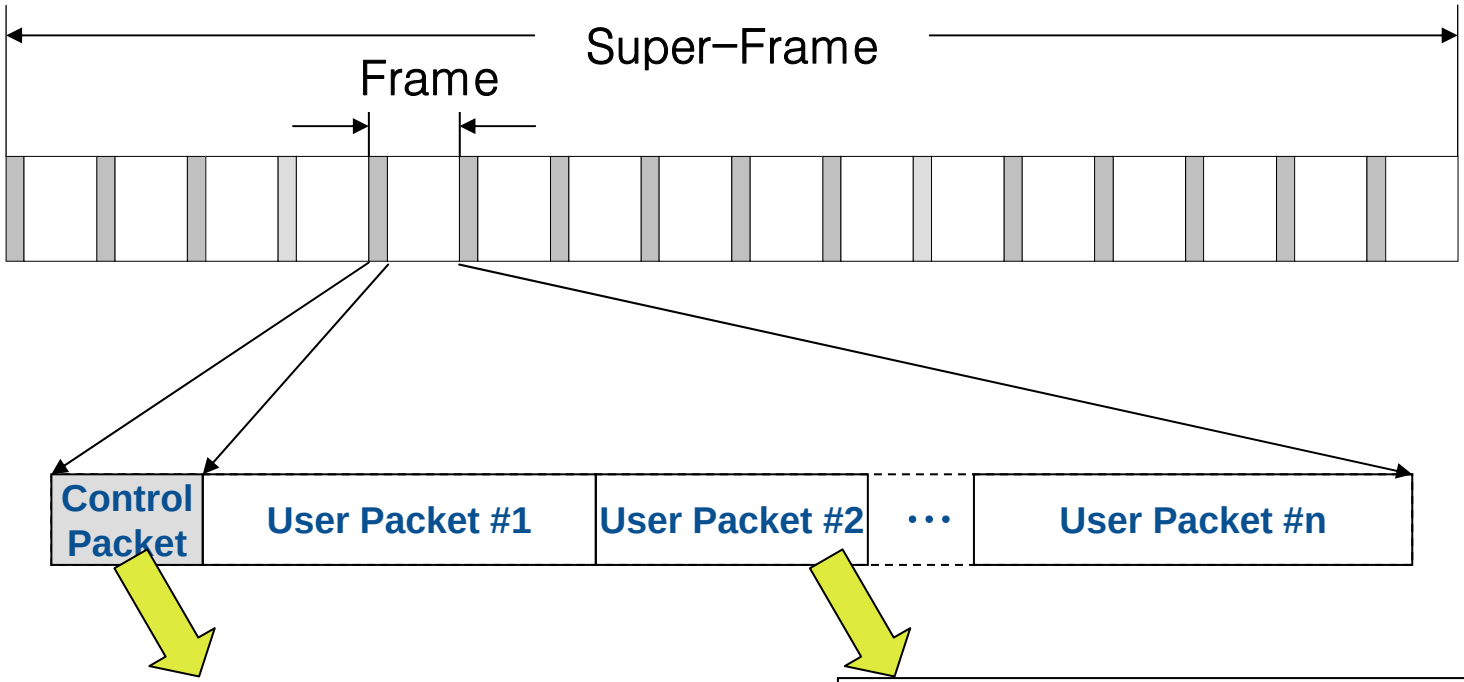
On(In) / Out Interference



Synchronized Frames



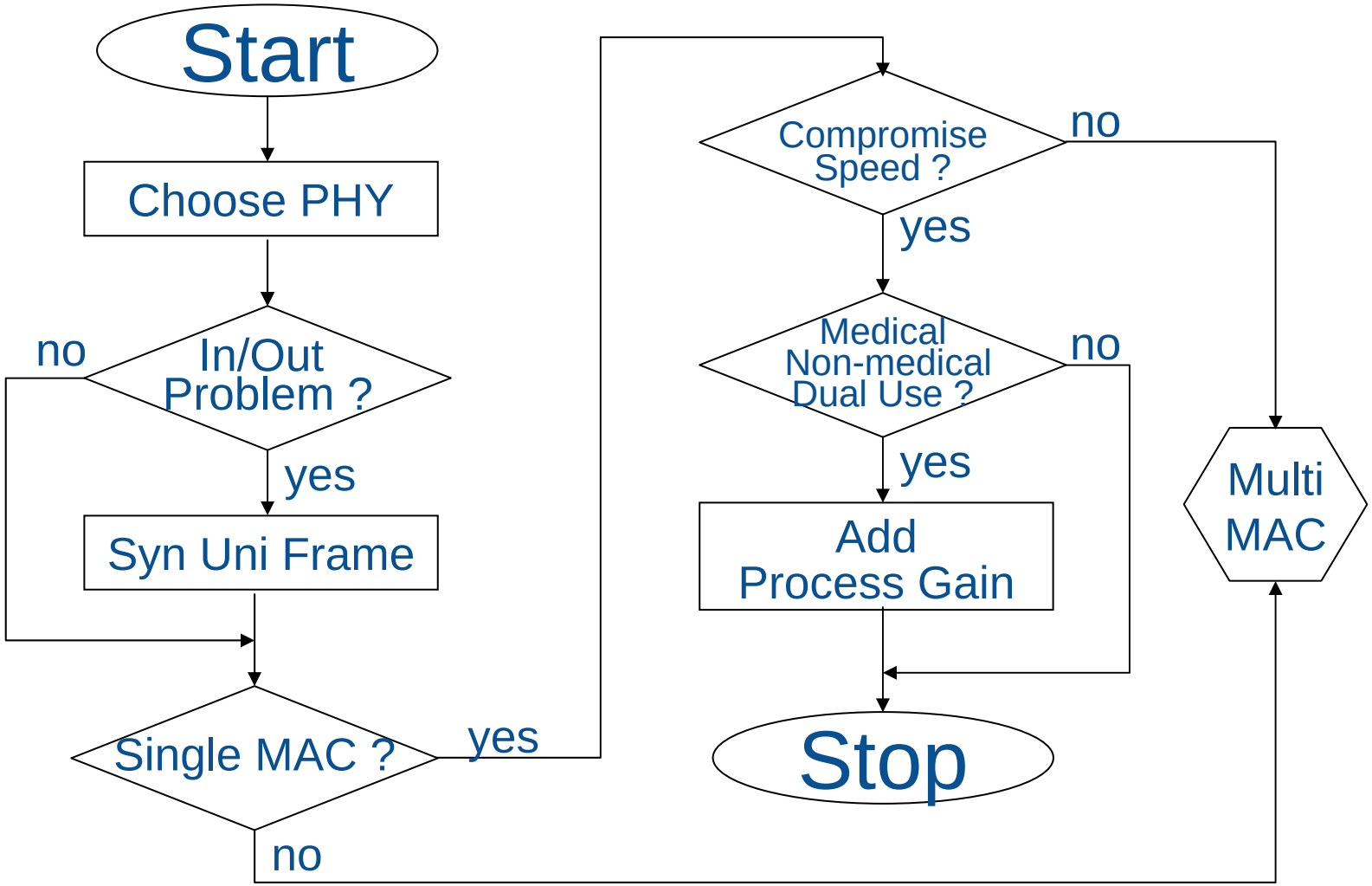
Synchronized (Super-)Frame



- Sync Pattern
- Frequency Set
- Direction (Tx or Rx)
- Control Data
- Constant Speed

- Sync Pattern (?)
- Frequency (?)
- Variable Data Speed
- User Data (Payload)
- Process Gain

WBAN Selection Process



Conclusion

- **On(In)-body / Out-body Interference is fatal in WBAN.**
- **MAC with Synchronized Frames can solve the On(In)/Out Problem.**
  - not Rx during adjacent Tx, there is no interference
- **Synchronized frames may also facilitate multiple payload speeds with a novel control packet design**
  - Thus realizing a single MAC with multiple PHY
- **Synchronized frames for both On(In)/Out Interference Avoidance and Multiple Speeds**