Distinct OFDMA-based Ranging Code Sets for Relay Station and Mobile Station

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Purpose:

Propose the text regarding distinct ranging code for RS and MS

Problems for RS & MS Using Same Ranging Code

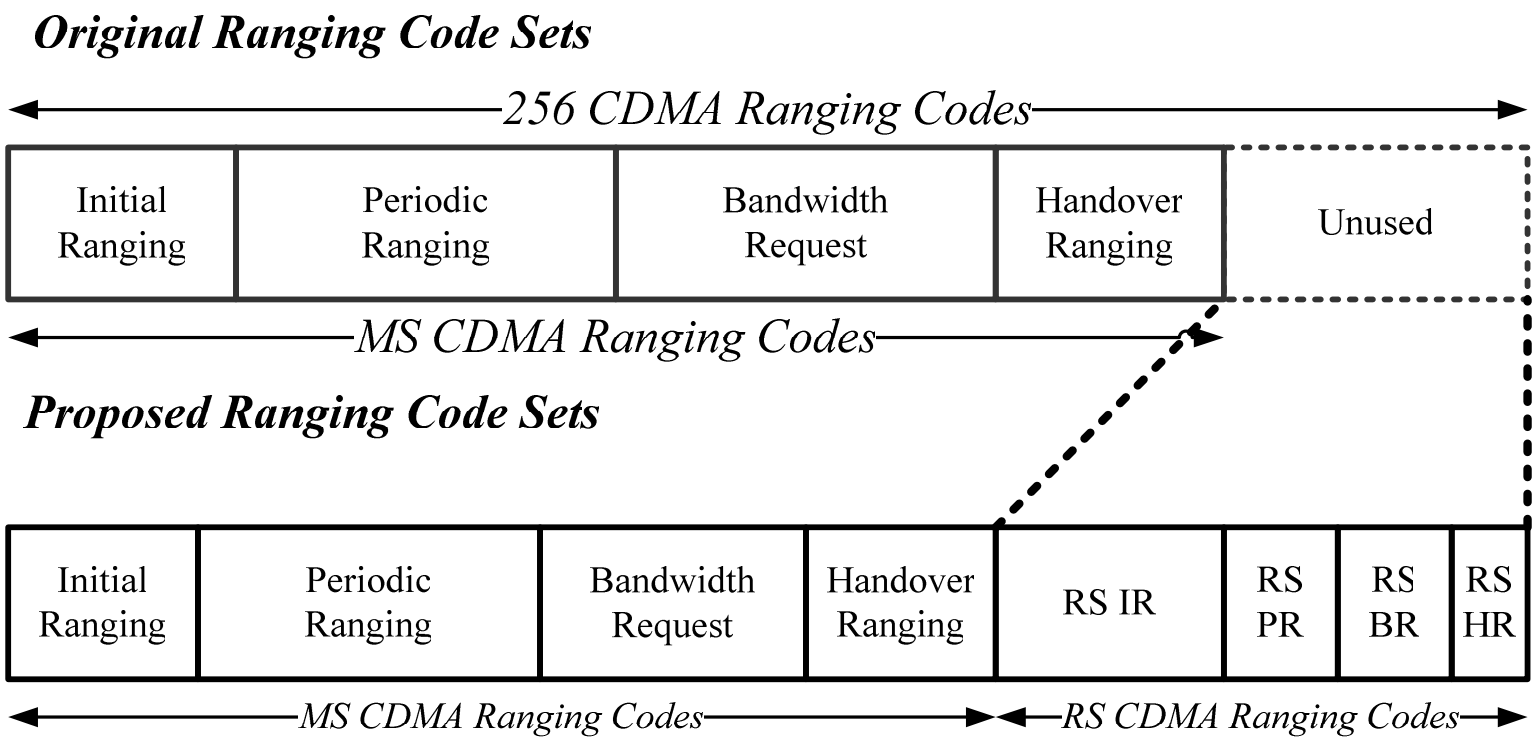
Based on current ranging code,

1. RS and MS cannot be differentiated by MR-BS
   - *Until capability negotiation phase for network entry & handover*
   - *Overhead (radio parameters adjustment, CID allocation) will be introduced when a RS joins an MR network by trial and error approach*
2. RS cannot avoid collisions with MS
   - *Number of RS << Number of MS*
   - *RS should play more important operating role than MS especially for initial ranging, periodic ranging, handover ranging, and bandwidth request*

Requirements for RS Ranging Code

1. Ranging codes shall be defined for RS initial/periodic/handover ranging and bandwidth request functionalities
2. MR-BS should be able to differentiate RS and MS by ranging codes
3. Collisions between RS and MS should be avoided

Proposed Ranging Code Sets



- 4 new ranging code sets, namely **RS IR (Initial Ranging); RS PR (Periodic Ranging); RS BR (Bandwidth Request); RS HR (Handover Ranging)** are defined for RS
- The allocation of the 8 ranging code sets is determined by MR-BS

Key Points & Benefits

- We propose to define ***distinct code sets*** for RS and MS, respectively
  - *The MS code sets are used in the access links*
  - *The RS code sets are used in the relay links*
- By using distinct code sets for RS and MS, the MR-BS can apply ***different policies*** at the ***earliest stage*** regarding network entry, handover, and bandwidth request

Backup

Background

- In IEEE 802.16 specifications, there are 256 CDMA ranging codes defined, which are partitioned into 4 code sets for ***initial ranging***, ***periodic ranging***, ***bandwidth request***, and ***handover ranging***, respectively.

- A BS broadcasts the information of used codes in the UCD message. Among the used codes, an MS, in general, randomly selects one ranging code for ranging or bandwidth request.

Design Alternatives

- Use dedicated ranging region
  - *Inefficient radio resource utilization due to it has to allocate dedicated resources*
- Use distinct CDMA ranging code sets for RS and MS
  - *Better radio resource utilization with minimized overheads*

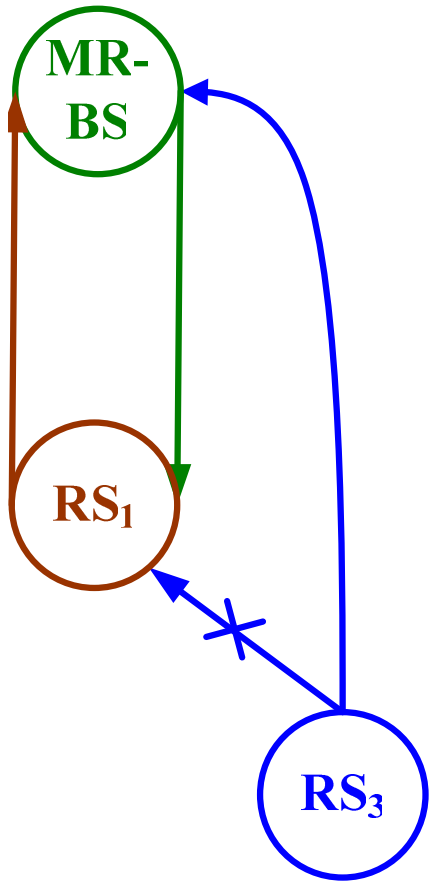
Advantages of Using RS Initial Ranging Code Sets

- MR-BS can differentiate RS from MS in the initial ranging phase of network entry
- MR network topology establishment can be achieved before using routing protocol when RS uses distinct ranging code set from the MS
  - *MR-BS could configure one RS to be the endpoint of a relay path by setting the RS to ignore any request with RS initial ranging code*
  - *MR-BS could apply alternative topology control policy to RS initial ranging code*
- RS IR could be almost collision-free for fixed & nomadic RS

Advantages of Using RS Initial Ranging Code Sets

(*Example: RS cannot join a 2-hop MR network via RS*)

- RS3 cannot join the MR network via RS1 due to policy restrictions (hot count limit, RS limited capability, … etc)
- There are two possible ways for RS3 joining the MR network
  - *RS3 could ramp up its transmission power of initial ranging (IR) until MR-BS can decode the initial ranging message correctly, and alternatively*
  - *RS1 could forward the IR message to MR-BS and MR-BS tells RS3 how to adjust radio parameters so that the RS3 can do initial ranging with MR-BS directly.*



Advantages of Using Distinct RS Ranging Code Sets

- **Using RS Handover Ranging Code Sets**
  - *Similar to the advantages of using RS initial ranging code sets*
  - *MR-BS could apply different policies for RS handover and MS handover*
- **Using RS Periodic Ranging Code Sets**
  - *MR-BS could apply different response policies to RS periodic ranging and MS periodic ranging*
- **Using RS Bandwidth Request Ranging Code Sets**
  - *MR-BS could apply different response policies to RS bandwidth request and MS bandwidth request*