

## Multiple Frame and Relay Operation for 802.16 MMR Networks

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Purpose: Propose a Multiple Frame and Relay Node Operation

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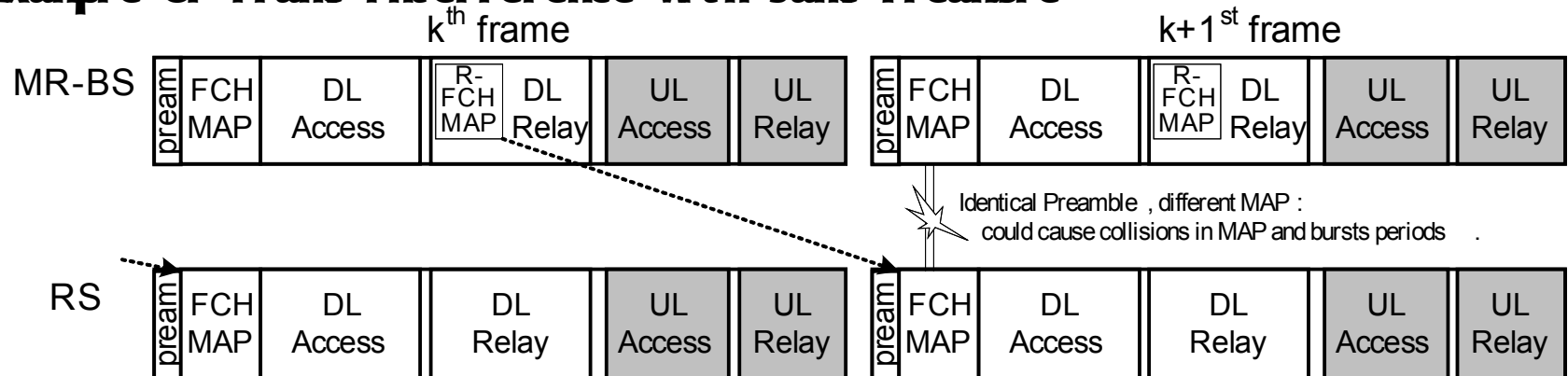
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# Problems

- ❑ **Different Preambles between MR-BS and RSs**
  - ❖ performance degradation at the boundary zones of RS coverage
  - ❖ a legacy MS treats these as different BS
  - ❖ the MS starts initial ranging procedures for handoff
- ❑ **The same Preamble and PN sequence between MR-BS and RSs**
  - ❖ collision occurs at receiver side (MS, RS) if different MAP Data received
  - ❖ MS could not decode signals from different sources

- ❑ **Example of frame interference with same Preamble**

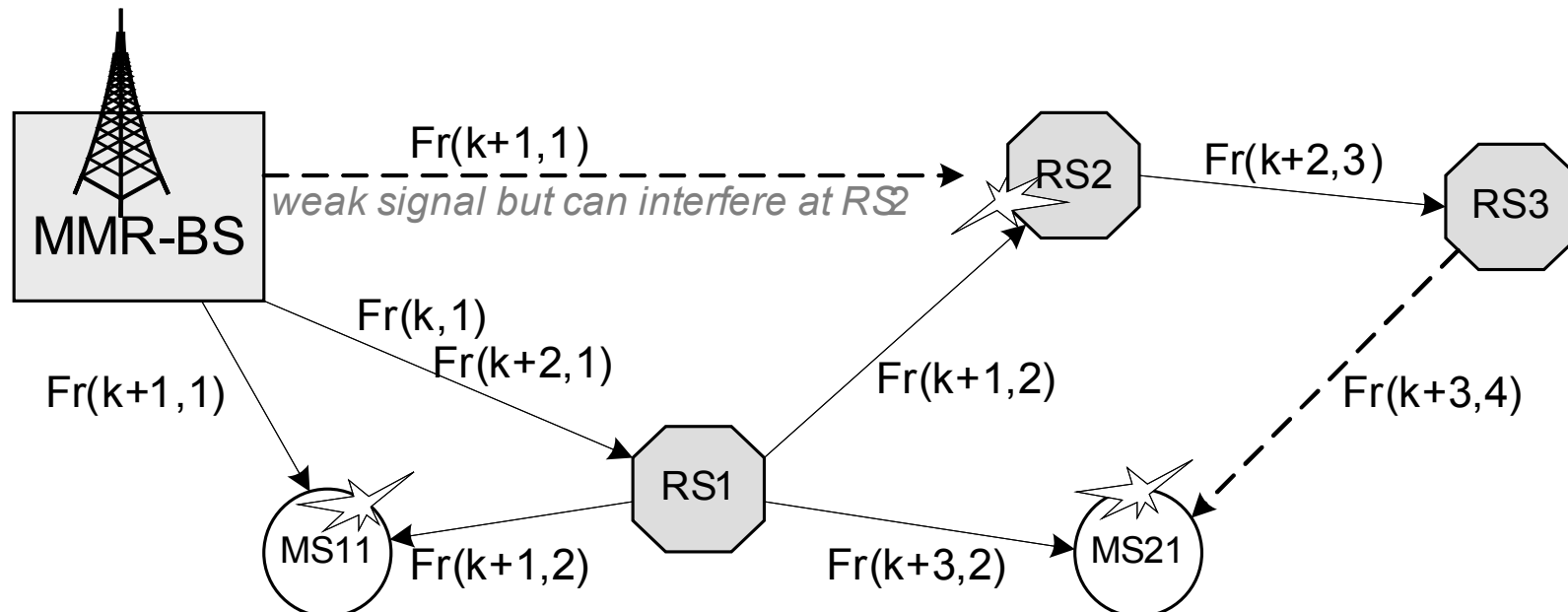


- ❖ If the MAP signals are interfere with each other at the MS, data bursts within the frame could also be damaged by mutual interference

# Problems

- A sample topology for interference scenario when BS and RSs use same Preamble

❖  $Fr(k, h)$  : transmission of a frame on the  $h$ th hop at the frame time  $k$ .



# Multi-frame and Hop-Channels concept

## □ A Multi-frame (Super frame)

- ❖ consists of  $L$  subsequent frames
- ❖ the length of Multi-frame can be set according to the NW topology and traffic load at the Multi-frame decision time at MR-BS
- ❖ Set all the Frame Control Information (Preamble, FCH, MPs, DCD, UCD) of DL subframe to be identical within Multi-frame period

## □ The Hop Channel

- ❖ if the MP is fixed within a Multi-frame, the bursts allocation also fixed
- ❖ this fixed bursts allocations are the Hop Channels
- ❖ a fixed burst allocation is reserved to a hop distance  $M$  traffic
- ❖ different user data can be transmitted using one Hop Channel according to the hop distance
- ❖ user data can travel to its multi-hop destination with the same MP within Multi-frame period
- ❖ Multi-frame length, #of frames in Multi-frame, guarantees hop distance relaying

# Multi-frame and Hop-Channels concept

## □ A Multi-frame structure example for MR-BS when $L=3$

frame number	DL-Subframe					UL-Subframe		
	frame control information		DL-HC1	DL-HC2	DL-HC3	Ranging channel	UL-HC1	UL-HC3
k-2	pre	FCH MAP	BS→MS1x	BS→RS1x	BS→RS1x	ranging	MS1x→BS	-
k-1	pre	FCH MAP	BS→MS1x	RS1x→MS2x	RS1x→RS2x	ranging	MS1x→BS	MS2x→RS1x
k	pre	FCH MAP	BS→MS1x	-	RS2x→MS3x	ranging	MS1x→BS	RS1x→BS

*identical at every frame excluding frame number*    *may be different contents*    *should be the same contents*    *should be the same contents*

*may be different contents*    *should be the same content*

- ❖ DL-HC $n$  carries DL-bursts to  $n$ -hop MS
- ❖ DL-HC1 is assigned to single hop distance MS during Multi-frame period
- ❖ UL-HC  $n$  can be consist of a number of individual bursts to  $(n+1)/2$ -hop distance MS

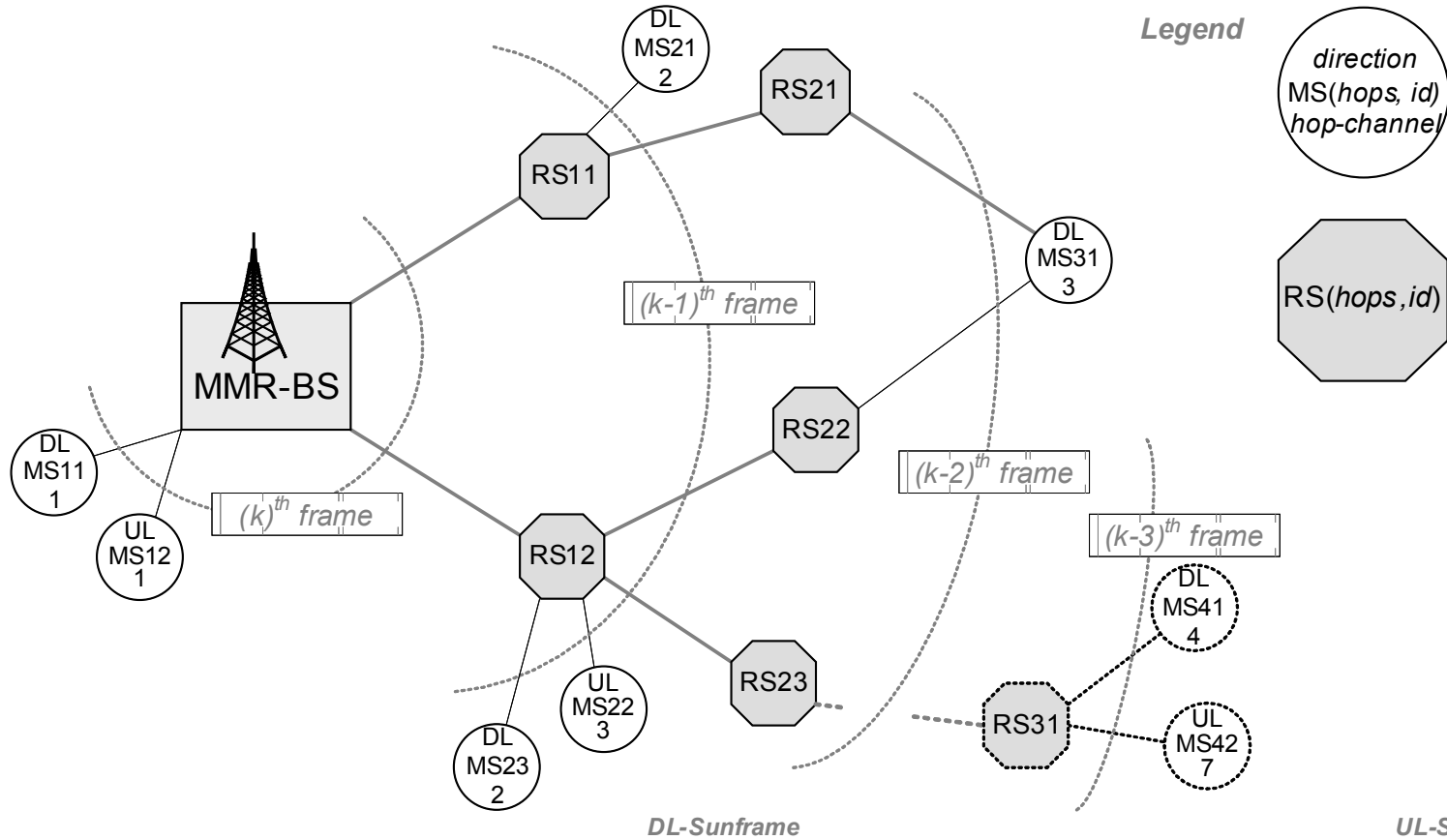
## Operation of MR-BS

- An MR-BS shall maintain the latest network topology for every Multi-frame allocation
- MR-BS should assign one Hbp Channel for RS command which contains the start/end frame ID of the Multi-frame
- An MR-BS generates a Multi-frame and allocates Hbp-Channels for DL/UL bursts with current topology and traffic load
- Within a Multi-frame, all the Frame Control Information of each Legacy frame are the same except the frame number

## Operation of RS

- ❑ RS has two mode of operation, MS-mode and BS-mode
- ❑ When RS is in MS-mode, it receives DL-subframe and transmits the UL-subframe. Default mode of RS is MS-mode.
- ❑ When RS is in BS-mode, it transmits DL-subframe and receives the UL-subframe
- ❑ RS should change its mode alternatively frame by frame
- ❑ Upon receiving Frame Control Information of DL-subframe, the RS shall update the frame number by adding 1 and reconstruct the Frame Control Information and then transmit the information in the next frame time
- ❑ For DL/UL bursts relaying, RS ignores the bursts which are not related to the RS' s subordinates

# Sample topology and Hop Channels



fr. No	DL-Sunframe						UL-Subframe -BS			
	frame control info.		RS CMD	HC1	HC2	HC3	commor access	RS Report	HC3	HC1
k-2	PR	FCH MAP	BS→RS1x	BS→MS1x	BS→RS1x	BS→RS1x	Random access	RS1x→BS	-	MS1x→BS
k-1	PR	FCH MAP	RS1x→RS2x	BS→MS1x	RS1x→MS2x	RS1x→RS2x	Random access	RS21→RS12	MS2x→RS1x	MS1x→BS
k	PR	FCH MAP	-	BS→MS1x	-	RS2x→MS3x	Random access	RS12→BS	RS1x→BS	MS1x→BS



# Frame and burst transaction between nodes

