Slides for “802.16j (Mobile Multihop Relay) Usage Models”

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Purpose:

The purpose of this slide set is to introduce our contribution C802.16j-06_017. This contribution is proposed as the basis for the 802.16j Process Document. The process described in this contribution is proposed as the process that the 802.16j TG should follow.

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Overview

- There is no one-to-one mapping between usage models, RS types, and deployment strategies
- Different types of RSs can be used to implement any usage model
- We define separately:
  - RS Types
    - Based on complexity/cost of implementation and deployment
  - Usage Models
    - Based on usage in the network
  - Deployment Strategies
    - Based on ways to plan cell site locations

RS Types

- Simple RS
  - Low cost RS
  - One transceiver
  - No control functionality, but:
    - Transmits preamble
    - Relays broadcast and control messages
  - Antenna switch to optionally support multiple antennas
- Full Function Fixed/Portable RS
  - operates on multiple OFDMA channels
  - optionally supports MIMO
  - implements distributed control functions
- Mobile RS – Full function RS with mobility

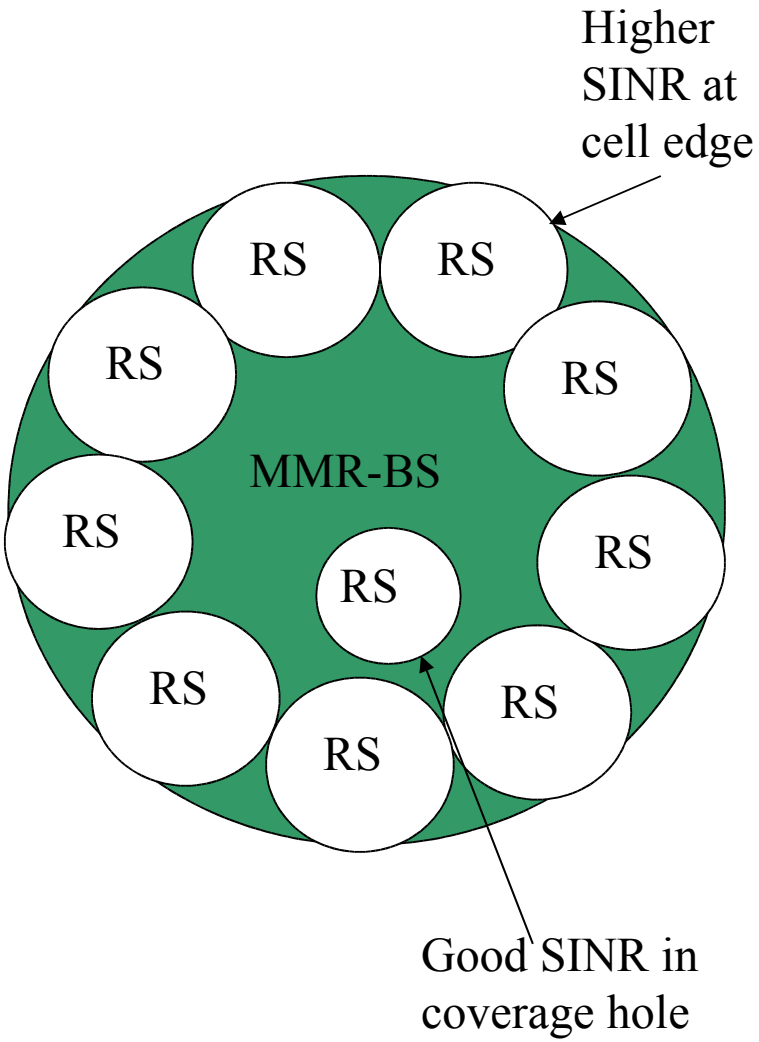
Major RS Capabilities

	Simple RS	**Full Function Fixed/Nomadic RS**	**Mobile RS**
Number of OFDMA channels	1	>1	>1
Duplexing on MMR and access links	TDD	TDD or FDD	TDD or FDD
Frequency sharing between access and MMR links	Yes	Yes or No	Yes or No
Control Functions	Centralized in MMR-BS	Centralized in MMR-BS or distributed in RSs	Centralized in MMR-BS or distributed in RSs
Mobility	Fixed/Nomadic	Fixed/Nomadic	Mobile
Antenna support	SISO or MIMO	MIMO	MIMO

Usage Models

- Enhanced Data Rate Coverage
  - Provide higher SINR to MSs in low SINR areas of cell
  - Provide higher SINR to MSs in “coverage holes”
- Range Extension
  - Provide coverage to users outside edge of the cell
- Capacity Enhancement
  - Increase system capacity by enabling more aggressive frequency reuse

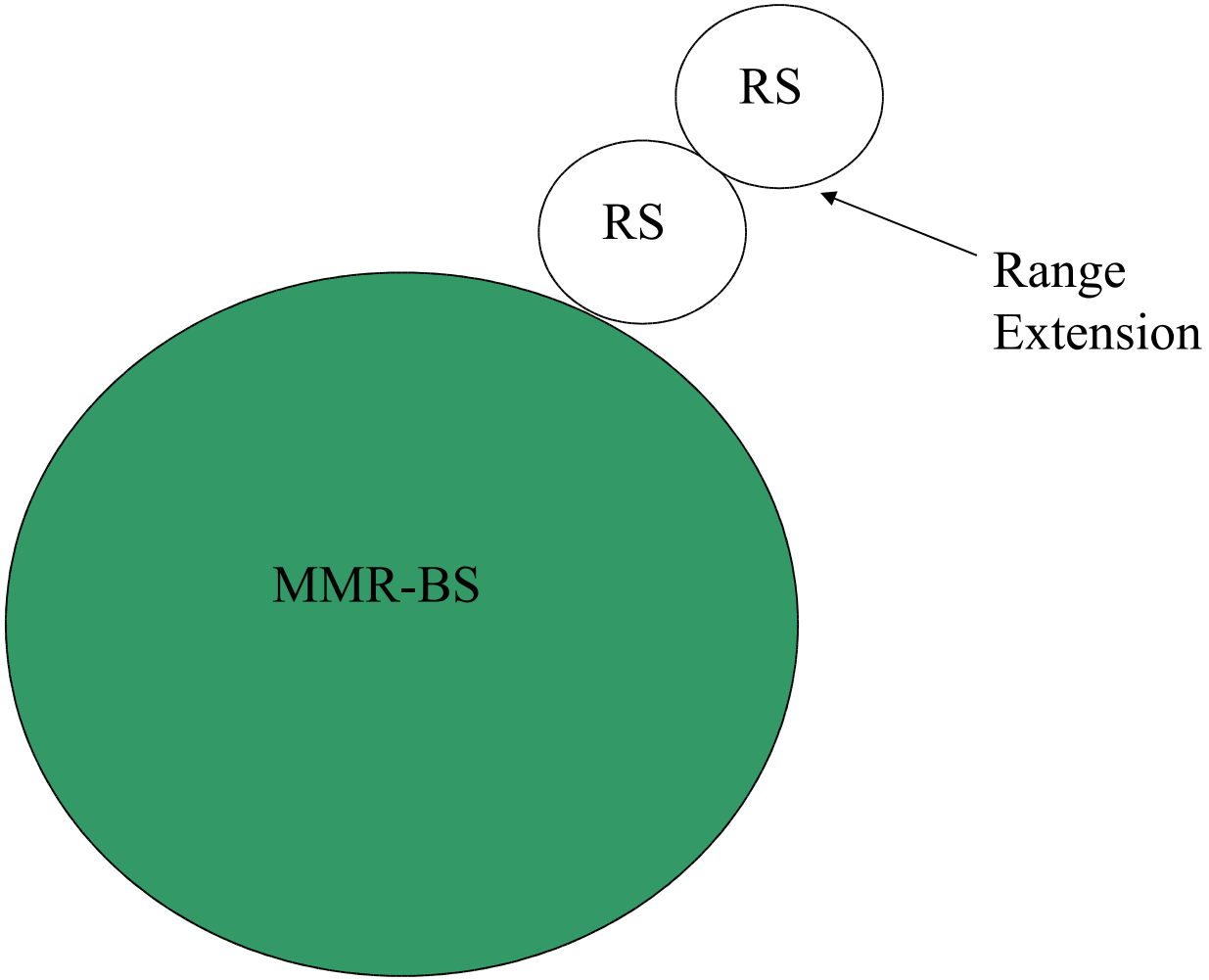
Enhanced Data Rate Coverage Topology



Enhanced Data Rate Coverage Model

- Frequency Usage
  - Capacity not an issue, thus aggressive frequency reuse not required
  - If interference not an issue
    - Channel can be shared among access and MMR links
    - Separate channels can be used for access and MMR links
  - If interference is an issue
    - Separate channels for MMR and access links
    - TDM partitioning and coordination to reduce
- Implementation by Simple RS
  - One channel for both access and MMR links
  - TDM partitioning of transmit opportunities if interference is a problem
- Implementation by Full Function RS
  - Can use one channel for both access and MMR links
  - Can use different channels as well

Range Extension Topology

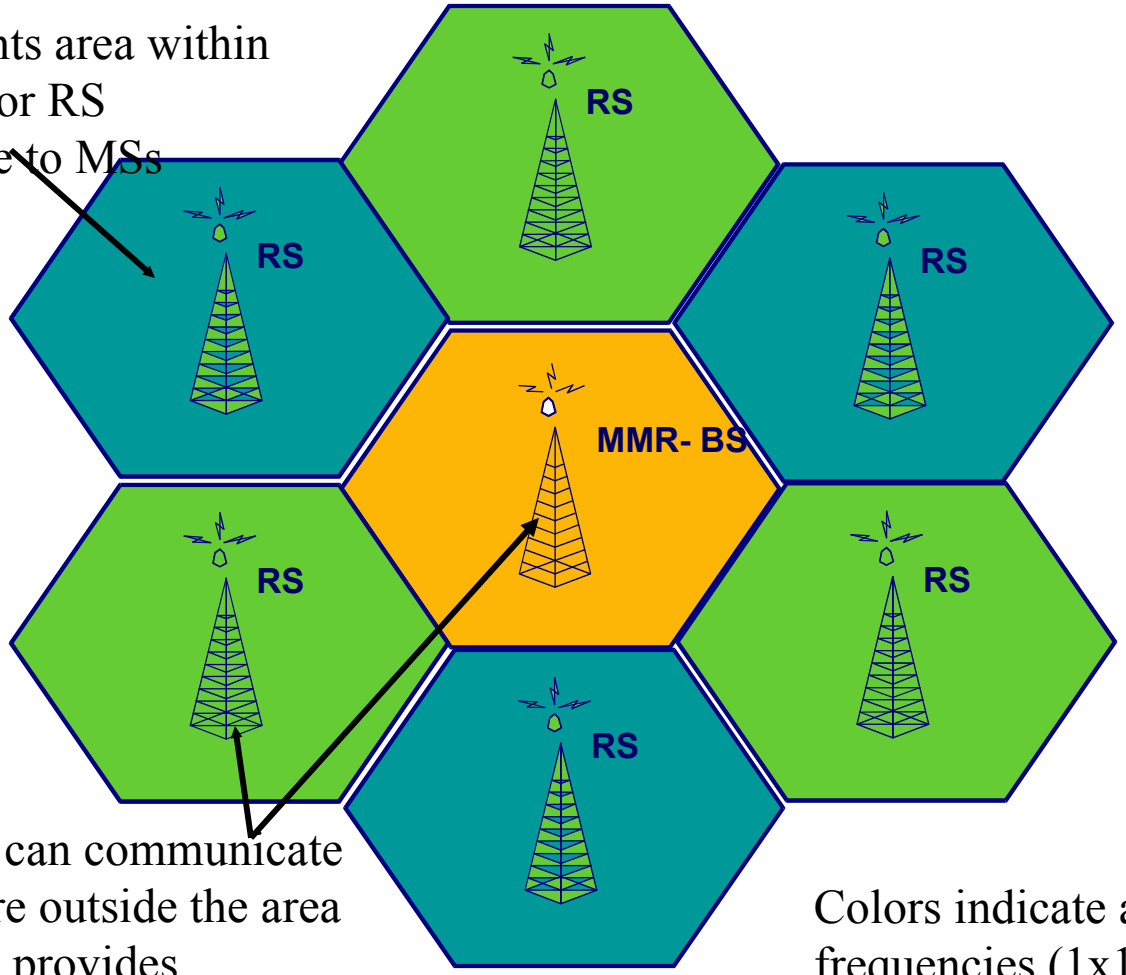


Range Extension Model

- Frequency Usage
  - Similar to Enhanced Data rate Coverage Model
- Implementation by Simple RS
  - Similar to Enhanced Data rate Coverage Model
- Implementation by Full Function RS
  - Similar to Enhanced Data rate Coverage Model

Capacity Enhancement Topology Example 1

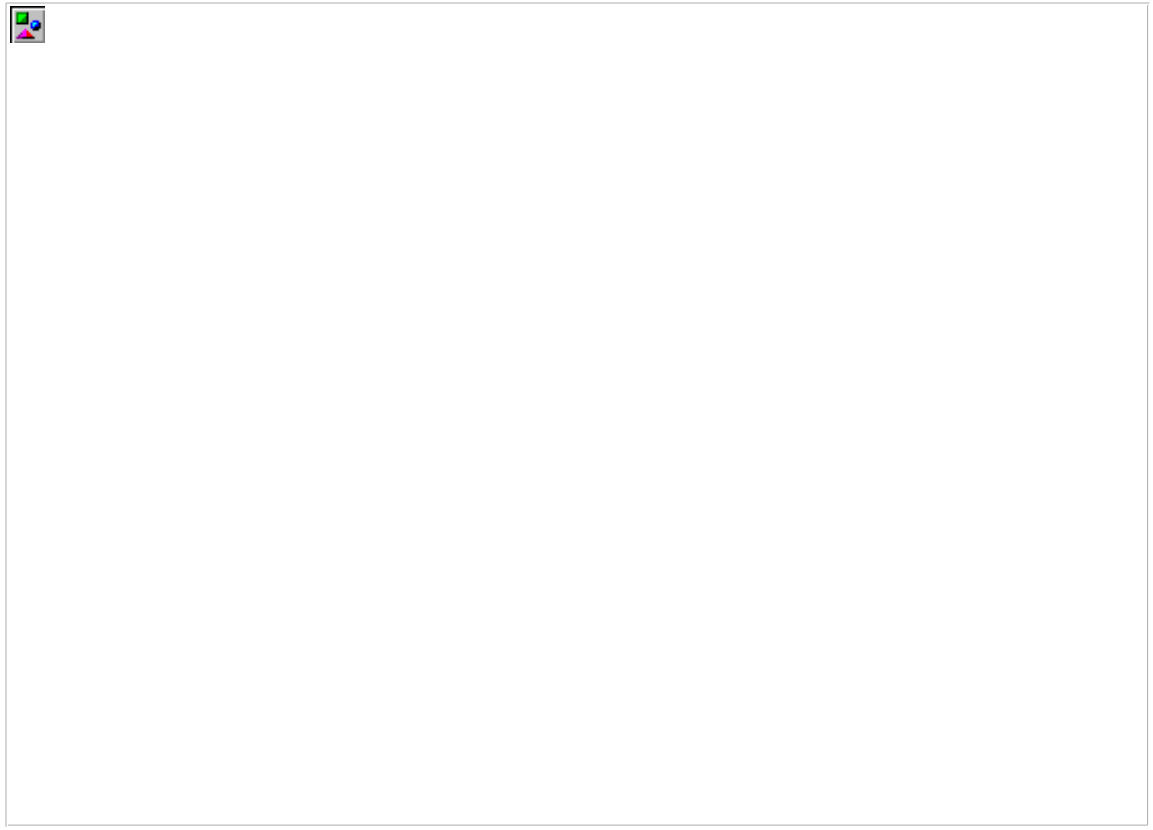
Hexagon represents area within which MMR-BS or RS provides coverage to MSs



MMR-BS and RSs can communicate even though RSs are outside the area in which MMR-BS provides coverage to MSs

Colors indicate access link frequencies (1x1x3 reuse)

Capacity Enhancement Example Topology 2



Capacity Enhancement Model

- Frequency Usage
  - Aggressive frequency reuse assumed
  - Actual distribution of channels across MMR and access links depends on topology, coordination capabilities, etc.
- Implementation by Simple RS
  - One channel for both access and MMR links
  - Each RS on separate channel, reuse pattern to increase capacity
  - Small MMR cell to enable centralized control
- Implementation by Full Function RS
  - Multi-channel support (i.e. access and MMR links can reside on different channels) provides maximum flexibility in frequency planning
  - Distributed control

Usage Model Characteristics

	Enhanced Data Rate Coverage Model	**Range Extension Model**	**Capacity Enhancement Model**
RS Location	Outer donut in MMR-BS cell; coverage holes within MMR-BS cell	Usage clusters outside the perimeter of the MMR-BS cell	Environment Dependant. High capacity demand locations within the MMR-BS cell
MMR Link Capacity	Low	Low	High
Frequency Reuse in MMR Cell	Not required but possible	Not required but possible	Required

Deployment Strategies

- LOS deployment strategy
  - RS locations and antenna placement are carefully planned in order to achieve LOS links between MMR-BS and RSs and between RSs.
- NLOS deployment strategy
  - RS locations and antenna placement are not constrained by the need to achieve LOS links between MMR-BS and RSs.
  - Techniques such as MIMO are used to provide sufficient capacity or link budget enhancement on MMR links
- Mobile RS deployment strategy

Deployment Strategy Characteristics

	LOS Strategy	**NLOS Strategy**	**Mobile RS**
Expected Channel Conditions	LOS, Ricean	NLOS	Varies
RS Deployment	Carefully planned	Convenient location near traffic demand	Random
RS Antenna Location	Tower, building	Tower, building, light post, other	Bus, train
RS Mobility	Fixed, carefully placed portable	Fixed, portable	Mobile
MMR-BS Deployment	Carefully planned	Carefully planned	Carefully planned
MMR-BS Antenna Location	tower	tower	tower