

[Usage scenario considerations for 802.16 relay]

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Purpose:

For usage scenario discussion and definition on IEEE802.16j.

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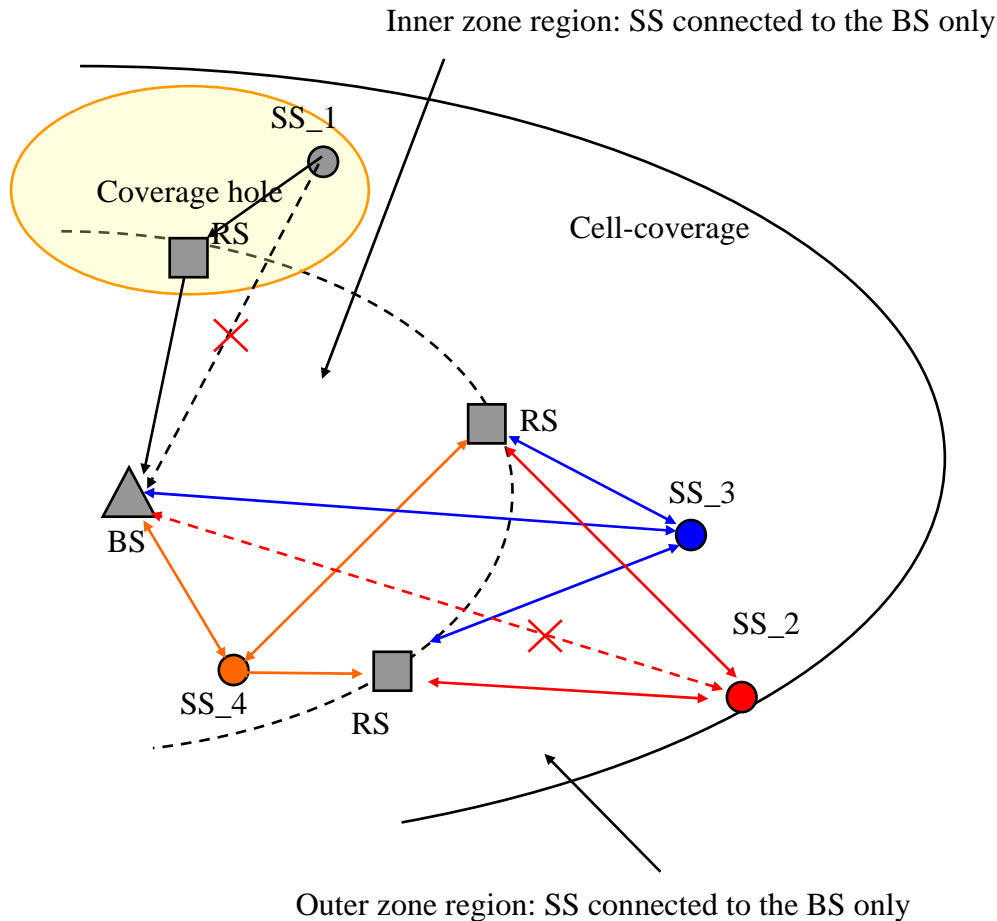
Usage scenario

(1) Relay's and access control

- Type of relays
 - Fixed relay (mandatory)
 - Nomadic/mobile relay (optional)
 - Difficulties with NLOS, tracking, complexity, ownership
- Access control
 - Centralised control by the BS
 - Coverage area by BS defined as the inner zone
 - Coverage area by RS defined as the outer zone
- BS controlled – RS assisted access (mandatory)
 - RS's (assist) forward requests from SS when SS's are out of BS range
- BS, RS controlled access (mandatory)
 - SPECIAL CASE: SS assisted access (optional)
 - SS senses neighbouring BS, RS and decides about connection point
 - Can be combined with other methods
 - Subcase: RS as a SS to BS and RS as a BS to SSs
- Important to define the capabilities and properties of the RS

Usage scenario

(1a) Illustration of access control schemes

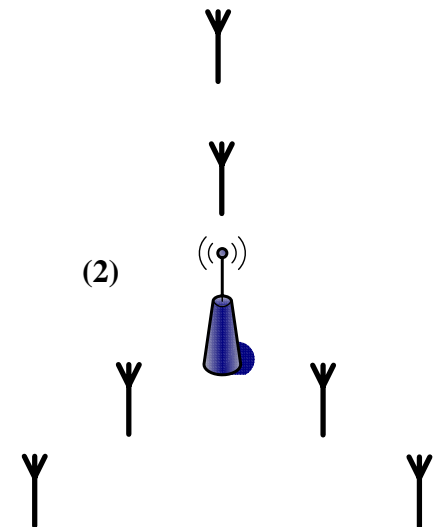
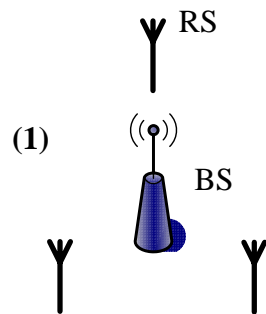


- Case SS_1 & SS_2
 - BS, RS controlled
 - BS controlled RS assisted
- Case SS_3 & SS_4
 - BS controlled
 - BS, RS controlled
 - BS controlled, RS assisted
- SS assisted method can be used in all cases

Usage scenario

(2) Topology

- Topology (major cases)
 - (1) RS cannot connect with other RS's (2-hop only)
 - Supports simple star topology within cell (simple, adequate?)
 - (2) RS connects to RS within cell (multi-hop case only)
 - Still simple enough for implementation
 - (3) Mesh options (optional)
 - RS's can connect to surrounding RS's or BS's
 - Resource sharing / interference problems



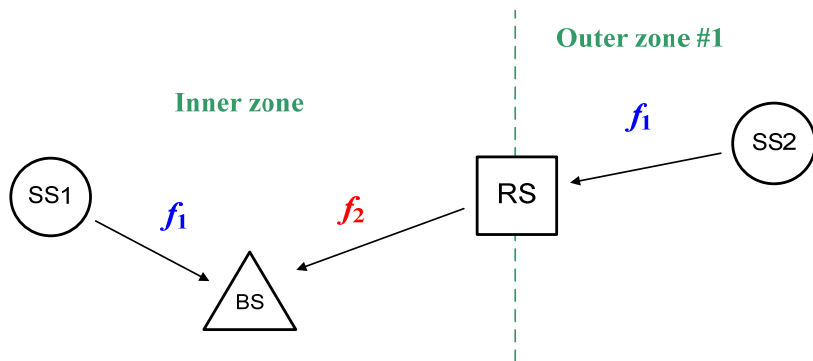
Usage scenario

(3) Radio resources assignment

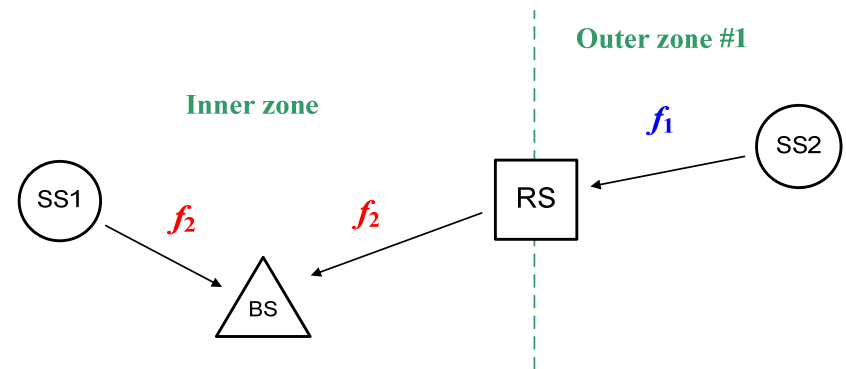
- Requirement for at least 2 radio resources (FDD and/or TDD)
- Different assignments can be made (see below)
- Concepts can be extended to radio resource planning

Example of 2-hop frequency assignment

•SSs in inner and outer zones use the same carrier for uplink transmission. Hence carrier switching is not required when moving between inner zone and outer zones



• SSs require carrier switching between when moving between inner zone and outer zones



Usage scenario

(4) Link types

- BS requires several directional antennas (sectored)
- RS requires at least 2 antennas for sufficient management of resources (for BS-RS and RS-SS links)
- SS should use omni directional or antenna array (at least 2 elements)
- BS-RS link
 - Specific directional fixed link (e.g. pen type – dedicated spatially)
 - Needs extra antenna (interference favourable)
 - Special link (dedicated in frequency)
 - Need for extra resources and antenna (complexity and cost issues)
 - Share resources
 - Omni or directional antennas may be applied
 - Same or different frequencies may be assigned
- RS-SS link
 - Directional antenna coverage

Usage scenario

(5) Handover

- Intra-cell
 - From BS to RS (frequency change, FDD)
 - From RS to RS (no frequency change, FDD)
 - From RS to BS (frequency change, FDD)
- Inter-cell
 - From (CELL A) RS to (CELL B) RS
 - Similar for RS to BS and BS to BS and BS to RS
- Type
 - Make before break (More complexity at SS / Uses more resources)
 - Break before make (Might entail higher call drop probability)
- Challenges
 - Track connection points (BS, RS)
 - Hardware complexity
 - Frequency changes required

Usage scenario

(6) Re-transmission policy

- Types
 - BS controlled (ACK's from BS only)
 - RS informs BS of retransmission need
 - Multi-hop path involved (delay, waist of resources)
 - BS, RS controlled (ACK's from BS and RS)
 - BS handles retransmission to direct MS, RS
 - RS handles re-transmissions for the SS connected to it
 - Requires more complexity at RS (Decode N forward, buffering)
 - Happens on the same link
 - Faster ARQ
 - Normal ARQ protocols should work without much modification

Usage scenario

(7) Environmental considerations

- SS Mobility support (mandatory)
 - Fixed
 - Nomadic
 - Mobile (up to 125 km/h)
- Cell type
 - Outdoor support (mandatory)
 - Macro-cell (radius 5 - 10 km, Sub-urban, Rural)
 - Micro-cell (radius 1 – 3 km, Dense urban)
 - Indoor support (Optional)