Method for integration of cooperative relaying into the 802.16 standard

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Purpose:

Accelerate integration of cooperative relaying into the 802.16 standard

Notice:

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Cooperative relaying system

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Problem description

- Strong competition with networks based on other technologies that operate at different frequencies
- Limitations of 802.16 aimed frequencies
  - Bypass obstacles and penetrate into buildings
  - Uncertain and fast changing channel conditions
- Solution Aim
  - Increase 802.16 system cell size, coverage and throughput
  - Backward computability and easy extension of 802.16e standard.

Suggested solution – cooperative relaying based

- Cooperative relaying means multiple synchronized transmissions from spatially distributed relaying stations of bursts originated at BS and/or multiple MSs
- The BS indicates all relaying transmissions for relayed bursts
- The relaying stations may be MS with relaying capability or dedicated relay stations (RS)

Scenario 1: Simple Cooperative Relaying

Base Station

Relay Station

Relay Station

Destination SS
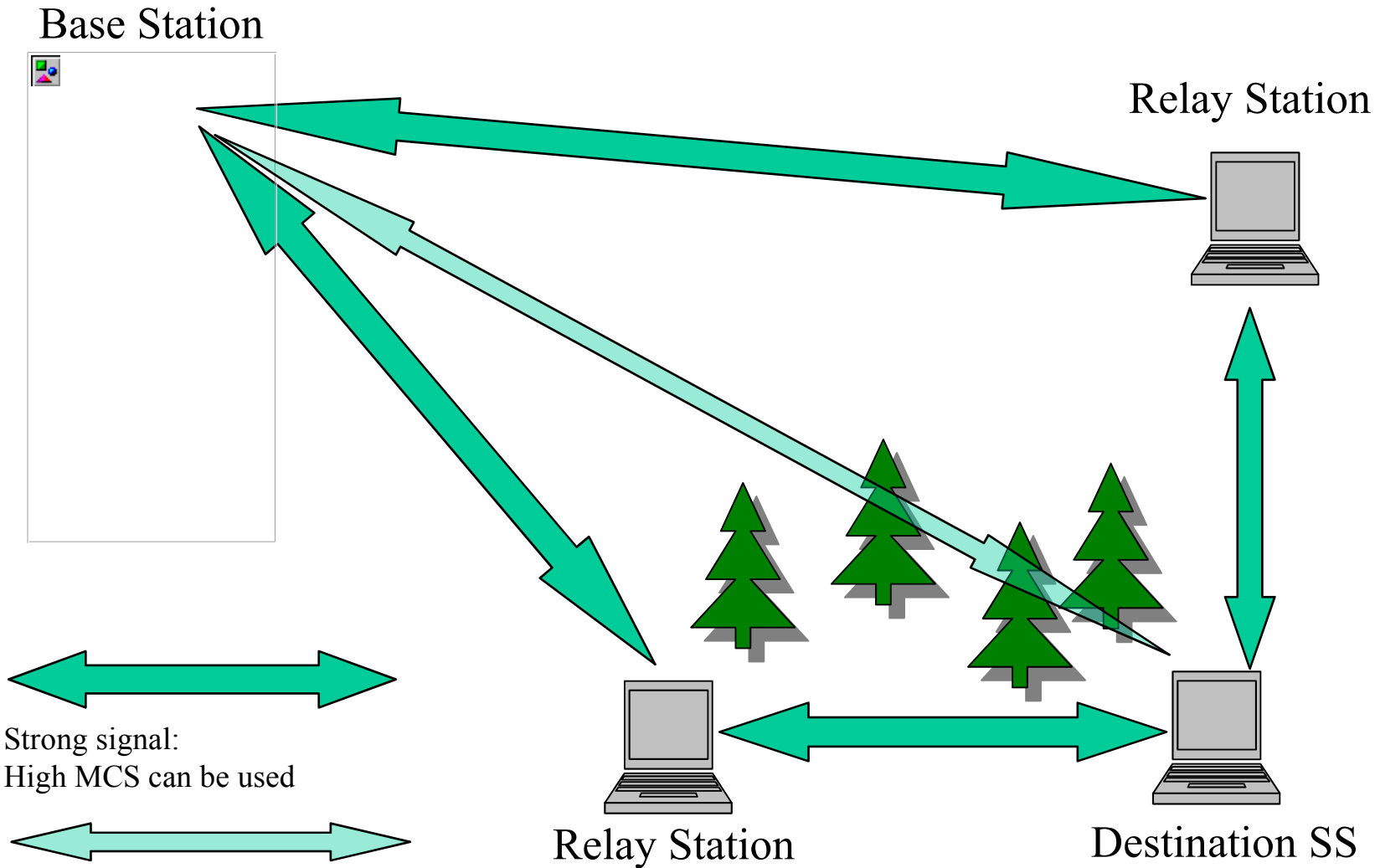
Strong signal:
High MCS can be used

Weak signal:
Received preamble and maps in the DL
Received CDMA,FFB and HARQ ACK/NACK in the UL

Scenario 2: Advanced Cooperative Relaying

Base Station

Relay Station

Relay Station

Destination SS

Strong signal:
High MCS can be used
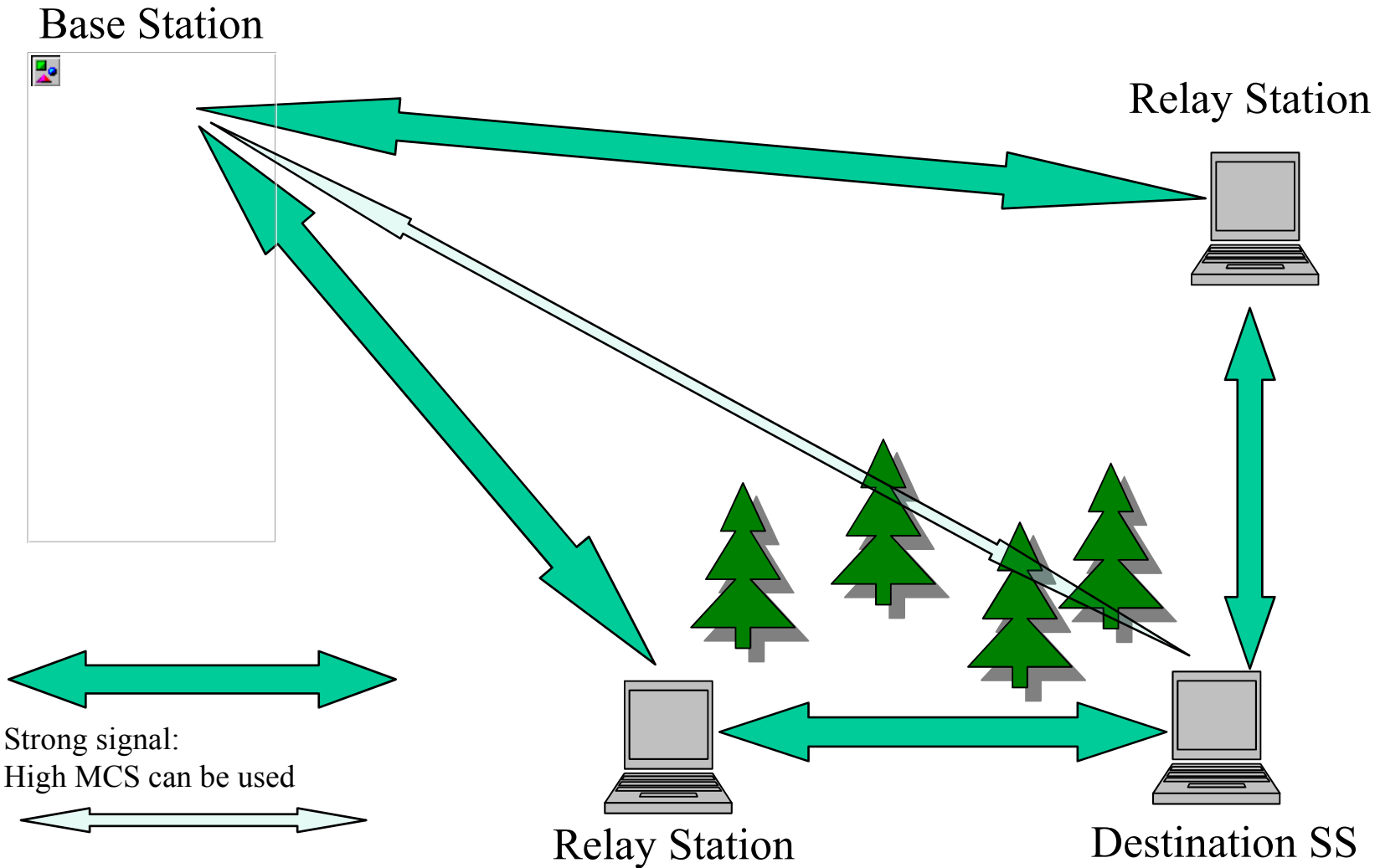
Very weak signal:
Not received preamble and maps in the DL
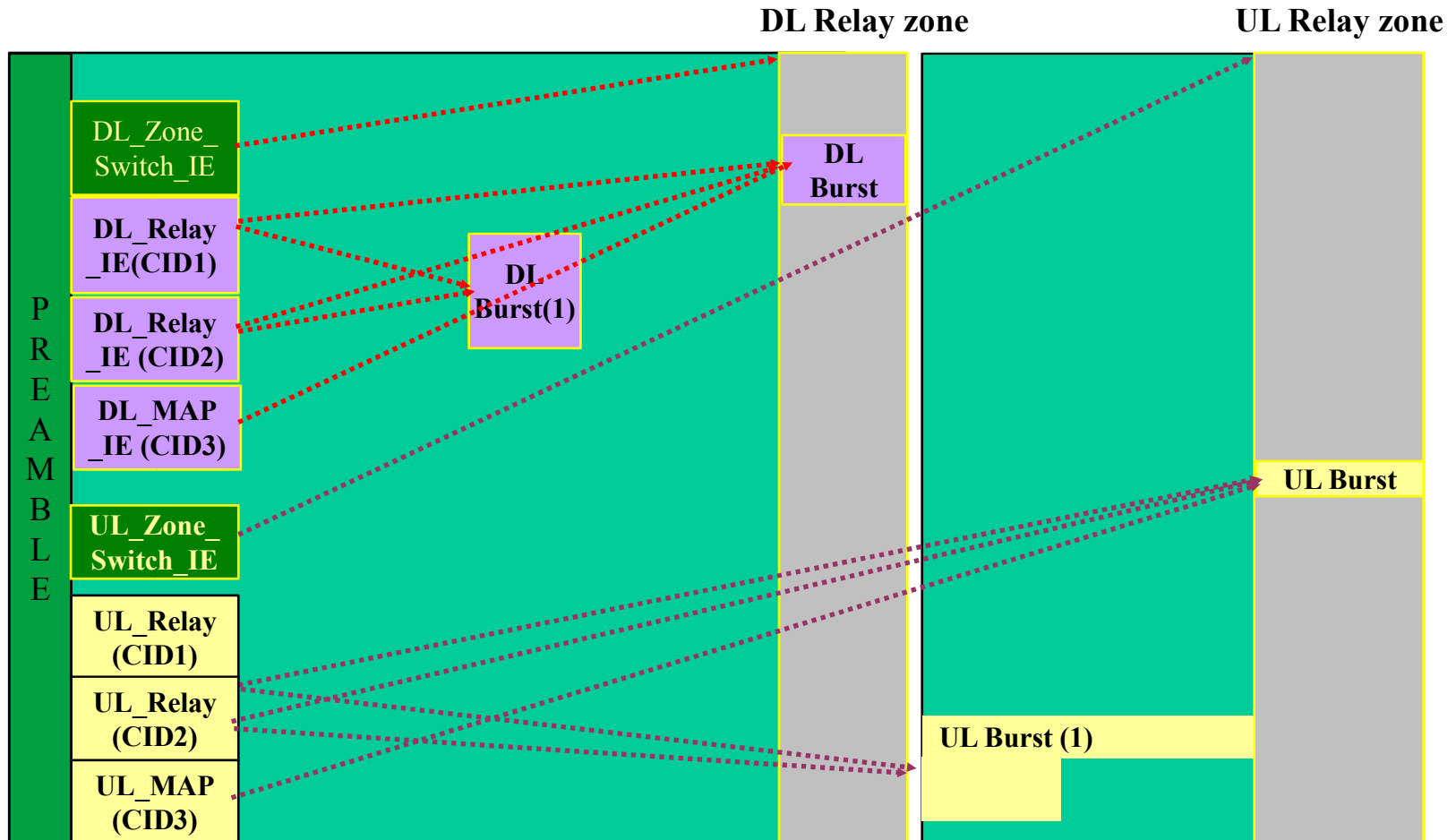Not received CDMA,FFB and HARQ ACK/NACK in the UL

Simple Cooperative Relaying

- Aims SS that communicates directly with BS
  - Preamble and maps from BS and ranging from SS are received
  - Only bursts are relayed
- Relaying transmission and receptions are in dedicated zones
- BS transmits in maps all the allocations of relay transmissions for each relayed burst.

Simple Cooperative Relaying frame structure

Downlink sub frame

Uplink sub frame

DL Relay zone

UL Relay zone

DL_Zone_Switch_IE

DL_Relay_IE(CID1)

DL_Relay_IE (CID2)

DL_MAP_IE (CID3)

UL_Zone_Switch_IE

UL_Relay (CID1)

UL_Relay (CID2)

UL_MAP (CID3)

PREAMBLE

DL Burst(1)

DL Burst

UL Burst

UL Burst (1)

CID 1&2 of Relay Station, CID 3 for regular MS.
DL/ UL burst (1) to be repeated in the relay zone burst allocation.

Simple relaying benefits

- Low cost relays
  - Dedicated relays may cost less than SS since MAC is not handled
- Increased cell size
- Higher throughput with higher MCS
- Suitability for higher RF frequencies
  - Bypassing obstacles is improved by far
- Allows direct SS transmissions to other SS without reception at base station

Advanced relaying with respect to simple relaying

- More labor is required for implementing
- Higher coverage inside the cell
  - For example outdoor and indoor penetration
- Increased cell size
  - Limited by efficiency of protocol and not by physical channel
- Consumes more power from relaying stations
  - Additional relaying transmissions (mid-amble, maps, FCH, CDMA for ranging and for bandwidth request, FFB and HARQ ACK/NAK or some of them)