Concepts for 802.16-based Mobile Multi-hop Relay Networking

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None

Purpose:

Present concepts in support of formation of a new study group for mobile multi-hop relay networking in IEEE 802.16 systems

Concepts for 802.16-based Mobile Multi-hop Relay Networking

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Background

- At the IEEE 802.16 Session #37 meeting in Sorrento, Italy, (http://www.ieee802.org/16/meetings/mtg37/), KDDI Labs and Samsung had proposed a new study item entitled “Mobile Multi-hop Mesh/Relay Networking in IEEE 802.16”
- A mailing list was created. Establishment of a new study group is under way (proposed schedule indicated in next slide)
- At this early stage, high level discussion like system concept, requirements and underlying issues are appropriate for discussion
- In this presentation we propose a few concepts relevant to high-level deployment scenario and frequency assignment strategy for a 802.16-based Mobile Multi-hop Relay Networking

Proposed Schedule

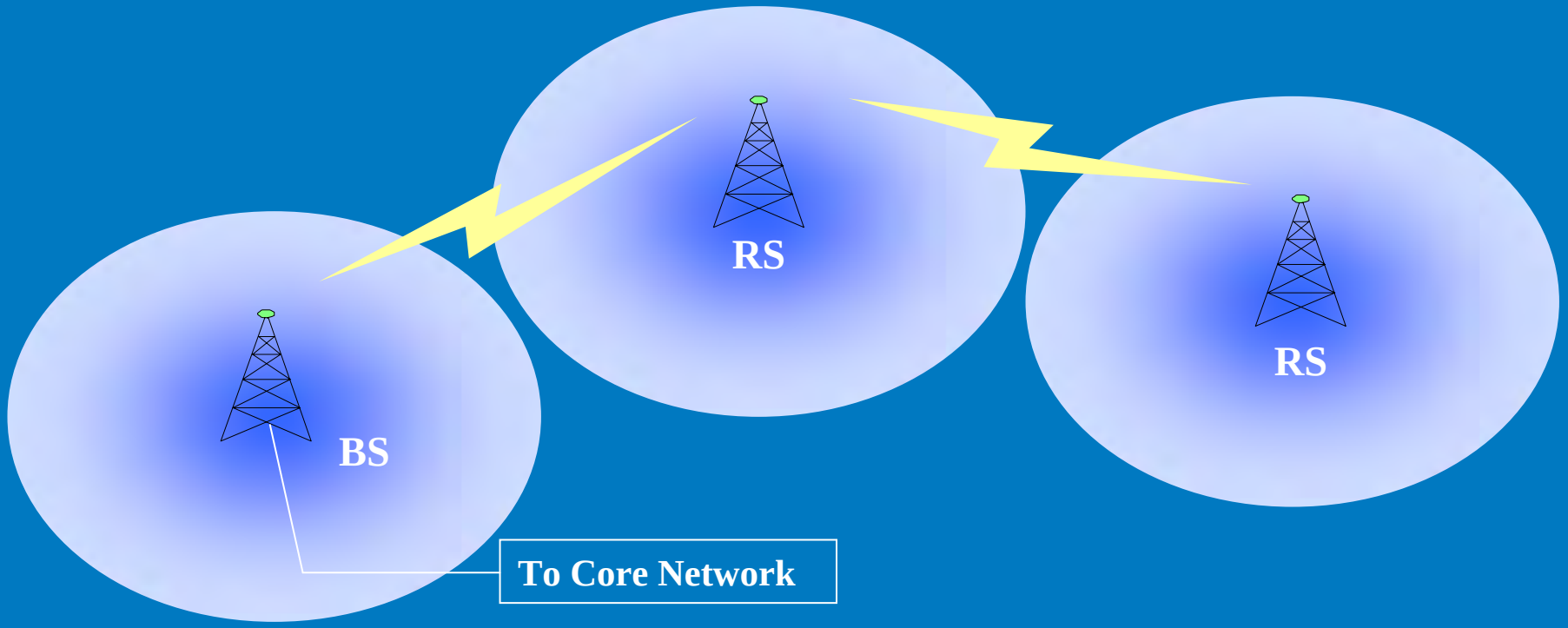
Year	Month	802.16session	Actions
2005	May	#37 Interim	Call for Interest
	July	#38 Plenary	Propose to form SG–Approved
	Sept.	#39 Interim	SG: the 1stmeeting
	Nov.	#40 Plenary	SG: the 2ndmeeting
2006	Jan.	#41 Interim	SG: the 3rdmeeting–Complete a PAR
	Mar.	#42 Plenary	802 EC endorses PARapproval
	May	#43 Interim	TG: the 1st meeting
	July	#44 Plenary	TG: the 2nd meeting
	Sept.	#45 Interim	TG: the 3rd meeting
	Nov.	#46 Plenary	TG: the 4thmeeting

Proposed Concepts

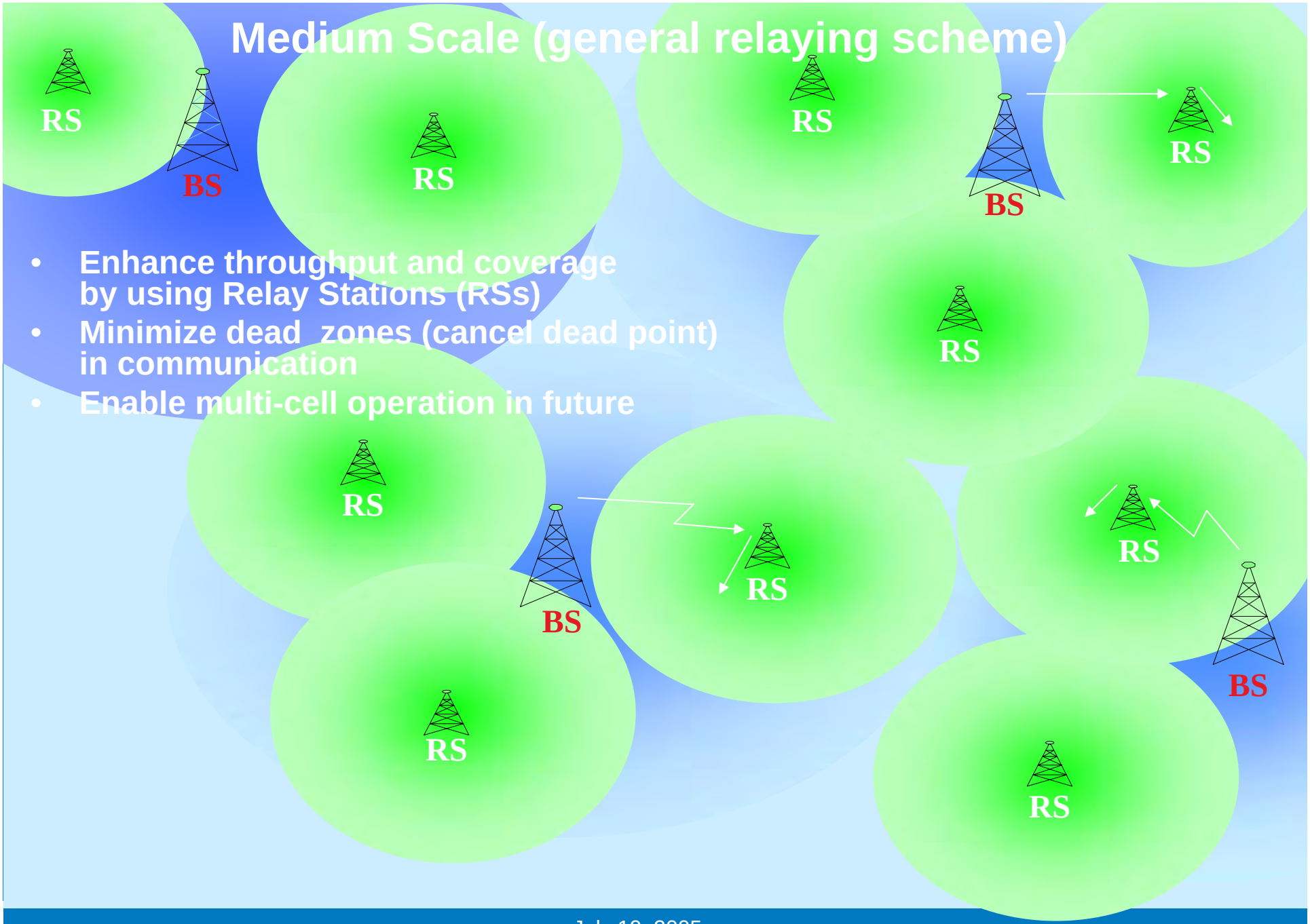
- **Deployment Scenario: Scalable Relay Station**
  - 16e-based multi-hop protocol enables support for various sizes of relay stations (RSs)
  - Scalable RSs could belong to typical sizes:
    - Large size
    - Medium size
    - Miniature size
- **Frequency Assignment Strategy**
  - Different Carrier Frequencies
  - Same Carrier Frequency but Different Subchannel Assignment
  - Same Carrier Frequency but RS is a Dummy Relay
    - **Dummy Relay simply relays all information from BS to MSS and vice versa with no change**

Large Scale (infra-mesh-like deployment)

- Wireless extension of cell coverage
- RS may be used with wireless backhaul from BS



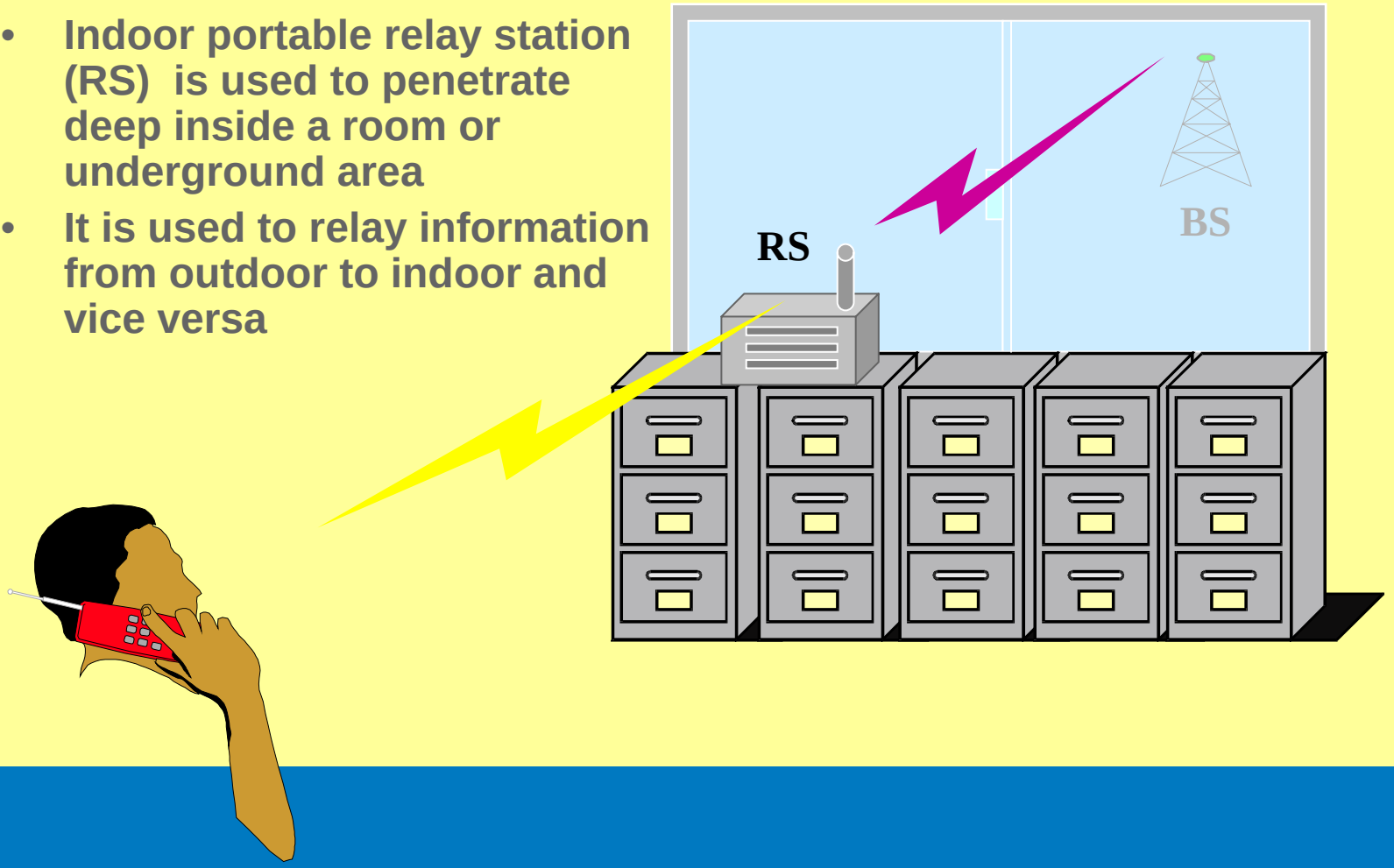
Medium Scale (general relaying scheme)



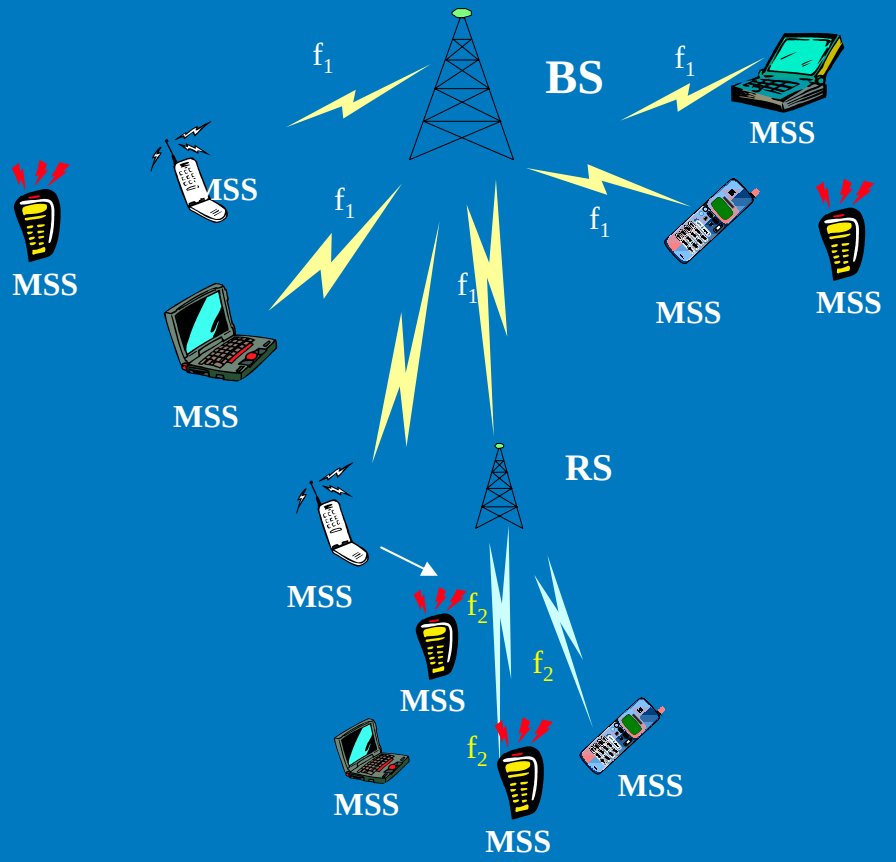
- Enhance throughput and coverage by using Relay Stations (RSs)
- Minimize dead zones (cancel dead point) in communication
- Enable multi-cell operation in future

Miniature Scale (portable & indoor)

- Indoor portable relay station (RS) is used to penetrate deep inside a room or underground area
- It is used to relay information from outdoor to indoor and vice versa

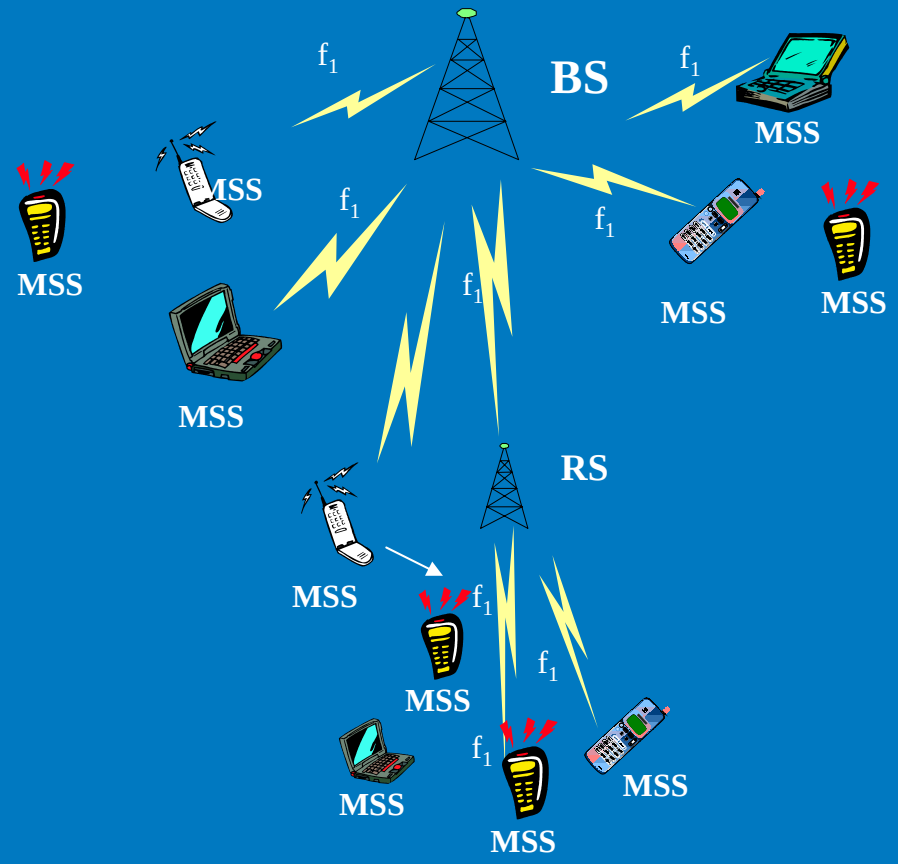


Different Carrier Frequencies



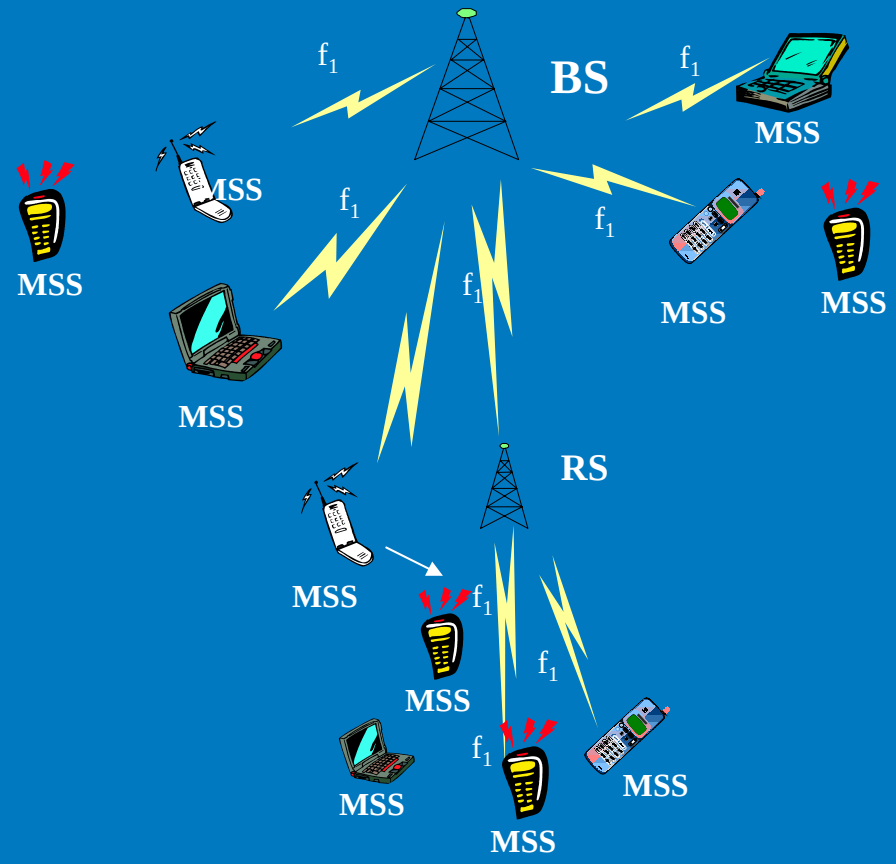
- RS deals with two frequencies, one communicates with BS in f1 and one communicates with its subordinate MSSs in f2
- MSS moving into an RS zone (within the coverage of RS antenna) will be hard handover to RS
- In this case, RS is simply a smaller-scale BS which schedules its uplink and downlink transmission with its subordinate MSS in f2 and relay the aggregated traffic with BS in f1
- BS has backhaul connection to the CO while RS doesn't have backhaul access
- This proposal requires RS to perform full BS functionalities except the backhaul access (typically more costly)
- Advantage: no interference between MSSs under RS and MSSs under BS (due to different frequencies)

Same Carrier Frequency but Different Subchannel Assignment



- MSS may communicate directly with BS or indirectly with BS via RS
- BS communicates with ‘normal’ MSS (16e-based) and the RS in one larger set of subchannels
- RS communicates with its subordinate MSSs in a smaller set of subchannels to minimize interference
- In this case, RS also has to perform full BS functionalities however only to a smaller set of subchannels
- Advantage: smaller interference between MSSs under RS and MSSs under BS (due to different subchannels)
- Disadvantage: reduced BS capacity since BS cannot use the full set of subchannels

Same Carrier Frequency but RS is a Dummy Relay



- BS is the only node that generates DLMAP and ULMAP for scheduling
- RS simply forwards traffic between BS and RS's subordinate MSSs in a time-delayed way

Issues to consider:

- How does the MAC request and grant work going through RS?
- Latency due to relaying

Detailed investigation of Multi-hop Relay Networking presents a number of study items, including, but not limited to the following:

- **Frequency reuse strategy**
- **Spectrum efficiency**
- **System capacity**
- **Interference consideration when blanket deployment is employed**
- **Multihop system protocol with backward compatibility (PMP)**
- **Latency**
- **Mobility (handover options)**
- **Cost**
- **Reliability**
- **Coverage**
- **Dynamic selection (between BS and RS)**
- **Battery life**

Summary

- **This presentation introduced two concepts relevant to 802.16 Multi-hop Relay Networking.**
  - Scalable Relay Stations supported by single 802.16-based multihop protocol enabling flexible deployment options
  - Flexible Frequency Assignment Strategies, such as,
    - **Multiple frequencies**
    - **Single frequency with sub-channels**
    - **Single frequency with Dummy Relays**
- **Detailed investigation of these and additional related architecture concepts are necessary to enable effective 802.16-based multi-hop relay networking systems**