Mobile Multi-hop Relay Networking in IEEE 802.16

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None

Purpose:

Proposal of a new study group for mobile multi-hop relay networking in IEEE 802.16 systems

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Mobile Multi-hop Relay Networking in IEEE 802.16

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Outline

- Scope of Proposed Relay Project

- Purpose

- Network Topology in IEEE802.16

- Classification

  - Mesh vs. Relay

  - Fixed / Nomadic / Mobile RS

- Concept of Proposed Relay mode

- Schedule

- Summary

Scope of Proposed Relay Project

- Develop Proposed Relay mode for fixed / mobile terminal

    - PHY: Enhance normal frame structure

    - MAC: Add new protocols for the Relay networking
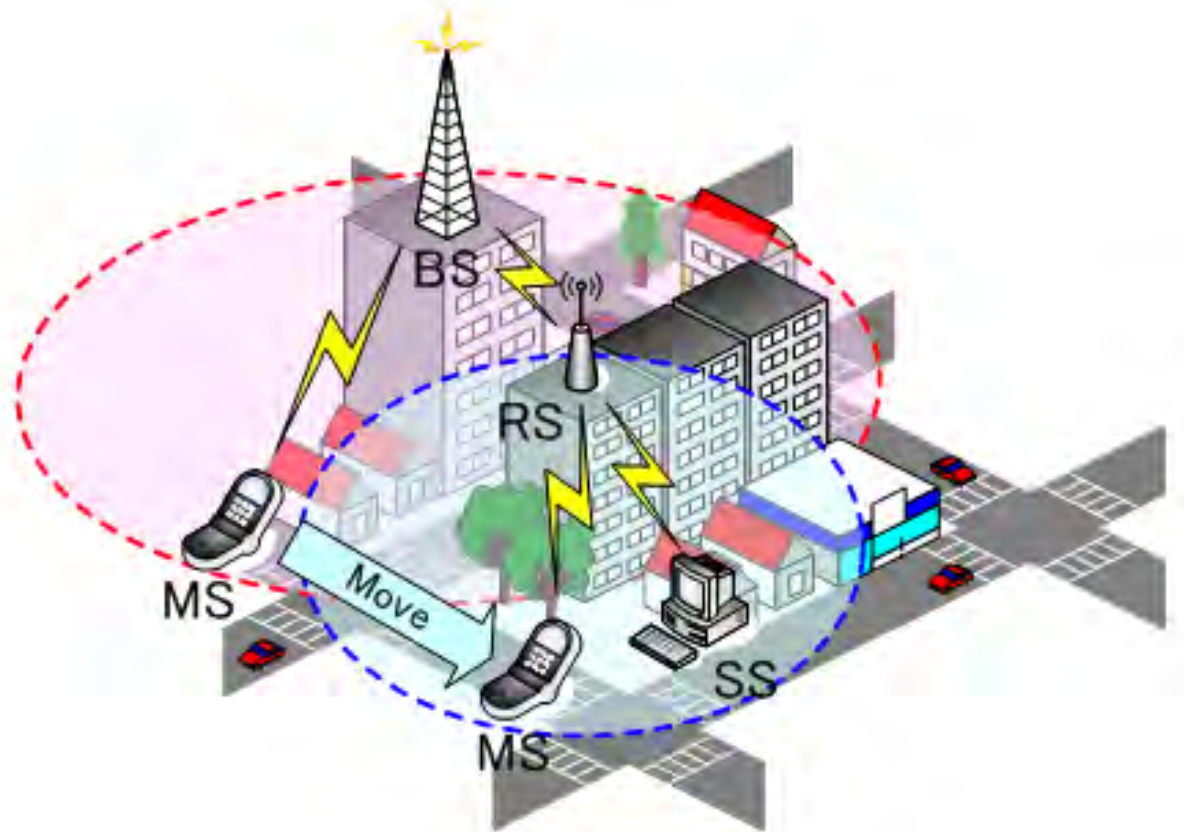
Purpose

- ## Coverage extension

  - Expansion for coverage area

- ## Throughput enhancement

  - Higher throughput over multi-hop paths

3
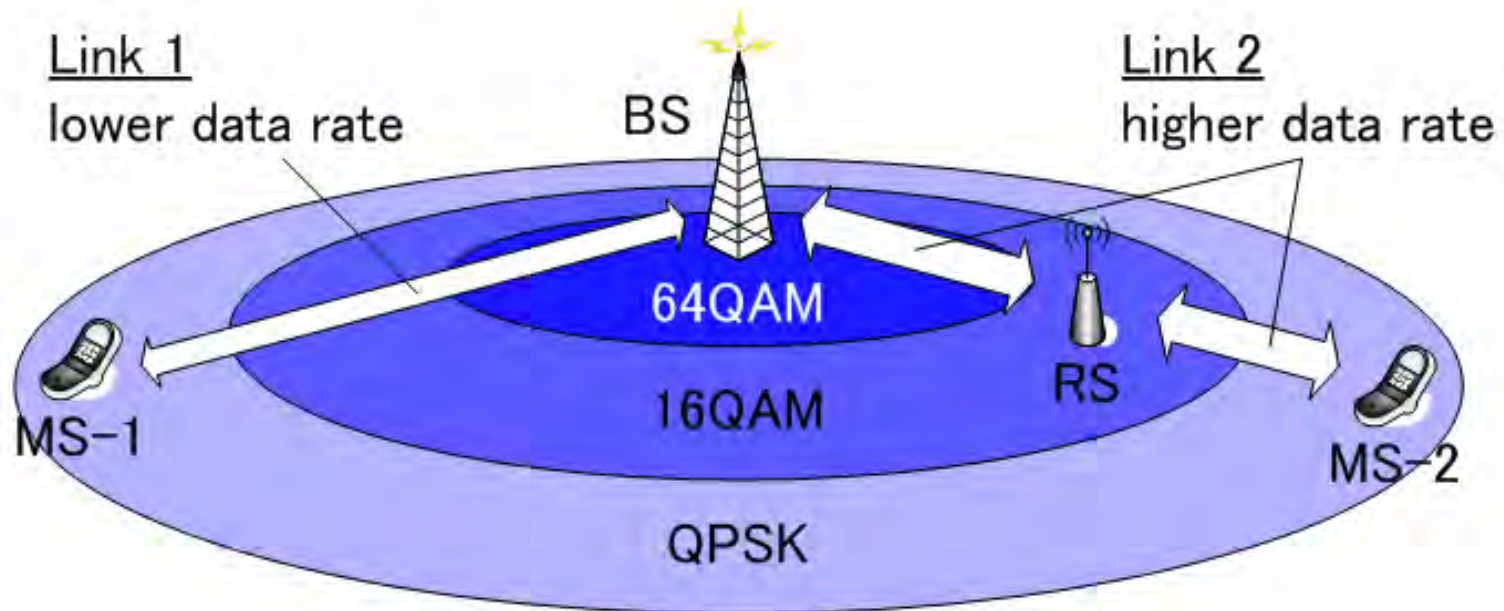
Network Topology in IEEE802.16
PMP and Mesh mode

- ## PMP mode

  - Mandatory topology in 802.16-2004 and 16e

  - " ***traffic only occurs between BS and SS*** "

- ## Mesh mode

  - Optional topology in 802.16-2004 (OFDM PHY only)

  - " ***traffic can be routed through other SSs and can occur directly between SSs*** "

Network Control Configulation of Mesh mode in 802.16-2004

Mesh scheduling		Content
Distributed	Coordinated	Schedule coordination to all neighbor SSs
	Un-coordinated	Schedule negotiation by directed requests and grants between two SSs
Centralized		• Mesh BS Determination of flow assignments by resource requests from SSs • SS Determination of actual schedule from Mesh BS's flow assignments

Classification – Mesh vs. Relay –

	Mesh	Relay
Infra-structure		
Client	**Mesh mode in 802.16-2004 may be classified into this category.**	

- "Infrastructure" means that a operator provides dedicated equipment that has Mesh or Relay function.
- "Client" means that a user terminal has Mesh or Relay function.

Classification – Mesh vs. Relay – (cont'd)

|	Mesh		Relay	
	Infrastructure	Client	Infrastructure	Client
Network topology	Multi-connection to other nodes		Tree	
Purpose	Inter-BS communication for backhaul	Inter-SS/MS communication (such as ad-hoc mode)	• Coverage extension • Throughput enhancement	
Who is the repeater?	All of BS/RS	All of SS/MS	Fixed RS or Nomadic RS	• Nomadic RS • SS/MS that has relay function
Licensed band?	Business use: Licensed band Other one: Unlicensed band			

Classification – Fixed / Nomadic / Mobile RS –

		Relay Station		
		Fixed RS	Nomadic RS	Mobile RS
Scenario	Infrastructure	• Permanent installation • Coverage extension for non-service area	Temporal / portable installation	Installation to public vehicle, such as train and bus
Scenario	Client	Coverage extension by SS that has relay function	• Allow user to enable/ disable relay function • Coverage extension for indoor	Inter-MS communication
Higher Layer		• Out of scope of IEEE 802		
MAC	Infrastructure	• Optimal route selection (L2 Routing) • Control of relayed SS by BS or RS		
MAC	Client	• Substitute route selection *Avoidance of service interruption by SS power off	Control of relayed SS by BS	• Dynamic / optimal route selection • Centralized control by BS
PHY	To fixed terminal	(802.16-2004) OFDM 256, OFDMA 2048		
PHY	To mobile terminal	(TGe) OFDM 256, OFDMA 128, 512, 1024, 2048		
RF Band	Infrastructure	Relay mode and PMP mode share a same frequency band or use different but adjacent frequency bands		
RF Band	Client	Relay mode and PMP mode share a same frequency band		

• The considered scope in a new relay mode is filled with cyan color

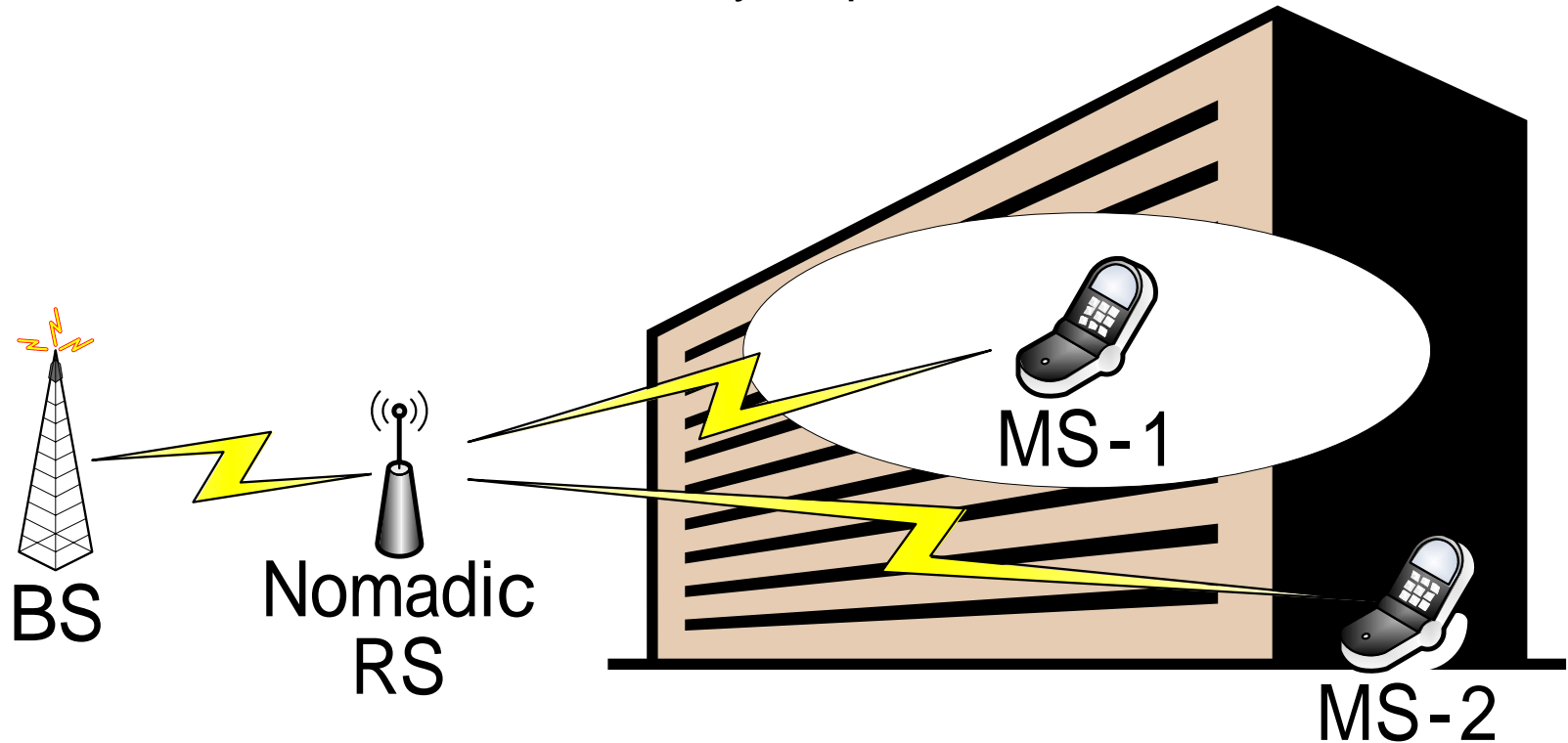# Concept of Proposed Relay mode

- Fixed RS for infrastructure relay
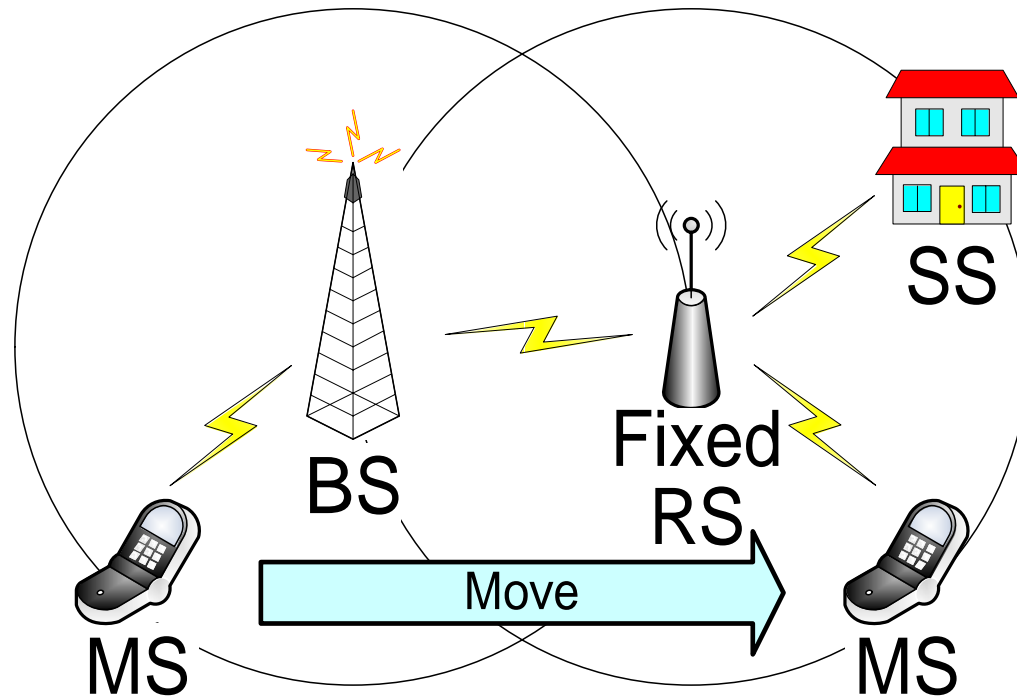
- RS is located within BS coverage
- RS connecting with BS shares radio resource with other SS/MS

Concept of Proposed Relay mode
(cont'd)

- ## Nomadic RS for infrastructure relay

  - Providing BWA service for an event, exhibition etc.
  - Nomadic RS shall be installed by a operator

Concept of Proposed Relay mode
(cont'd)

- Nomadic RS for client relay

- Coverage extension to SS/MS which is indoors
- Nomadic RS could be installed by a user, or semi-stationary user terminal might be a nomadic RS
- Centralized scheduling by BS
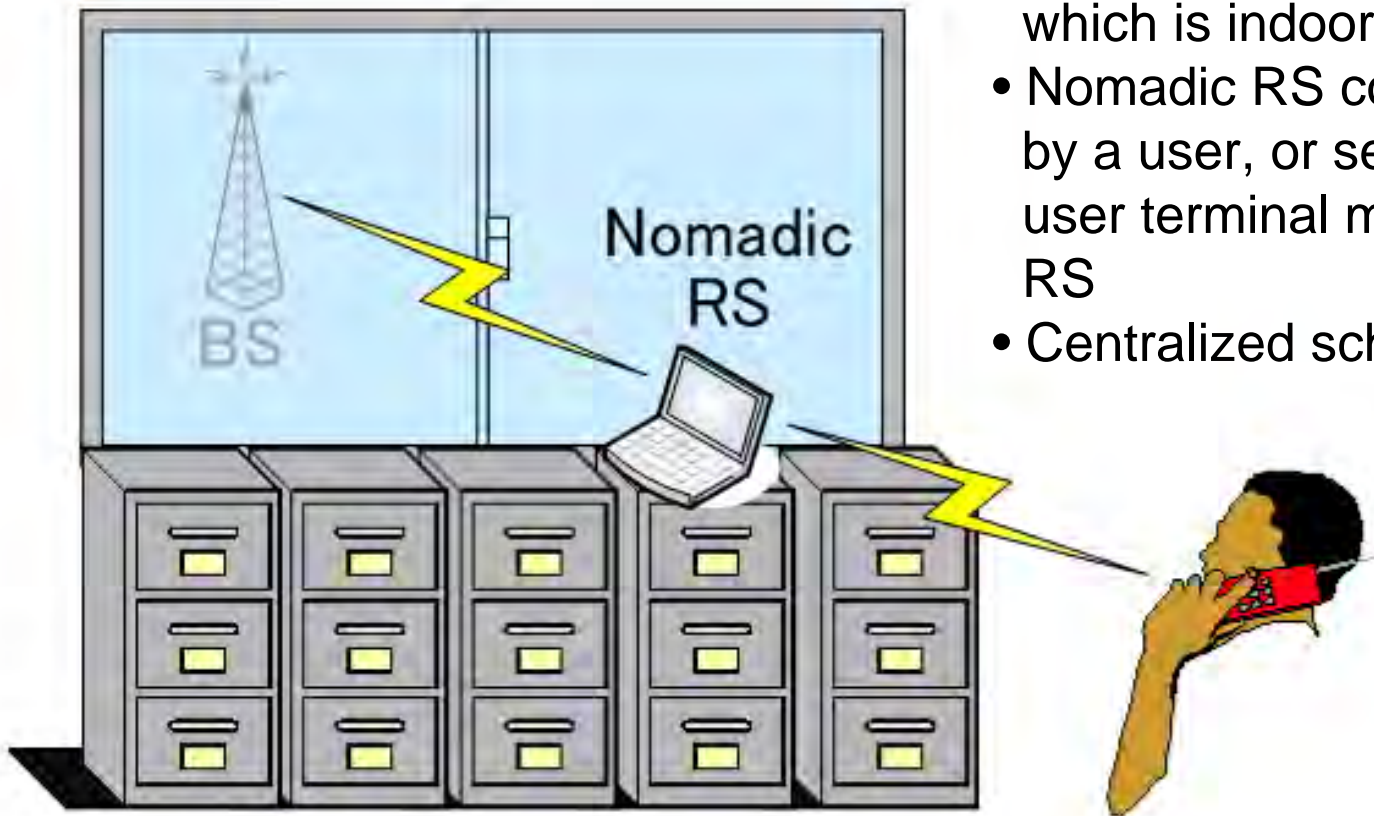
Concept of Proposed Relay mode
(cont'd)

- Mobile RS for infrastructure relay

• Mobile RS is located within
  BS coverage

• Optimal route change
  according to a situation

NOTE : Inter-SS/MS communication
like ad-hoc network is out of scope.

BS

Get into a bus

MS

MS

Mobile RS

Distinctions

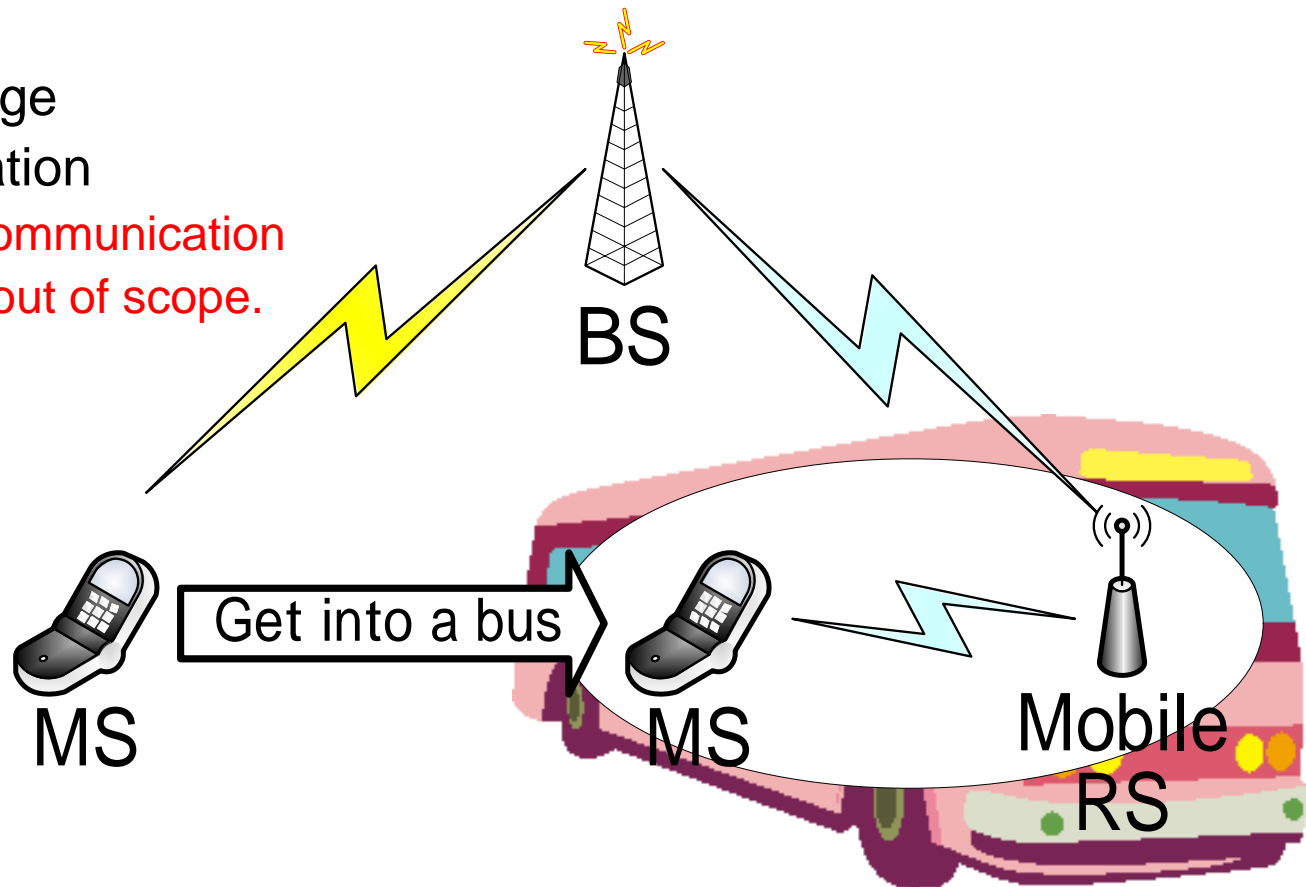- Current Mesh mode in Std 802.16-2004

  - No compatibility with PMP mode

    - PHY   Different frame structure (not compatible to PMP mode),

      OFDM only (for both licensed and unlicensed bands)

    - MAC   Different Network Entry procedure (not compatible to PMP mode)

  - No support for TGe MS (no a fast route change for MS)

- Main differences between Proposed Relay mode and the Mesh mode

  - Efficiently provide Relay connection to SS/MS

  - Support OFDMA as well as OFDM PHY mode

  - Backward compatible to PMP mode

  - One of the end of relay path should be at BS

Tentative Schedule

- Starting new Study Group / Task Group

Year	Month	802.16 session	Actions
2005	July	#38 Plenary	Propose to form SG – Approved
	Sept.	#39 Interim	SG: the 1st meeting
	Nov.	#40 Plenary	SG: the 2nd meeting
2006	Jan.	#41 Interim	SG: the 3rd meeting – Complete a PAR
	Mar.	#42 Plenary	802 EC endorses PAR approval
	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 4th meeting

Summary

- Propose a new SG of Relay mode for fixed / mobile terminal

- Working scope

  - PHY: Enhance normal frame structure

  - MAC: Add new protocols for the Relay networking

- Main features

  - Tree structure: one of the end of relayed data path should be at BS

  - Efficiently provide Relay connection to SS/MS (with small number of hops)

  - Support OFDMA as well as OFDM PHY mode

  - Backward compatible to PMP mode

  - PMP & Relay modes : share a same band, or use different but adjacent bands

- Considered RS types

  - Fixed Infra RS, Nomadic Infra/Client RS, Mobile Infra. RS

- ❖ dot16 "forum" website: http://dot16.org/forum/