Issues and Scope of MMR

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This is a response to http://ieee802.org/16/sg/mmr/docs/80216mmr-05_021.pdf (call for contributions: IEEE 802.16’s Mobile Multi-hop Relay Study Group) to present some discussion material.

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Introduction

- Provides input on scope of the work in MMR SG
- Attempts to describe possible approach for solving RS problem
- Suggests to simplify RS problem space for cheaper RS

- Topics for discussion
  - Security
  - Same Frame or Different Frame Relay
  - Mobile RS
Security Issues

Current 3-party security model

With RS, it will become 4-party security model
Impact of RS on PKM

• From key management perspective, adding one RS, will convert the security problem into a 4 party model.
• In the 4 party model, the following security associations need to exist for ensuring trust and distributing session keys:
  – AAA$\leftrightarrow$RS: New
  – AAA$\leftrightarrow$BS: Existing
  – AAA$\leftrightarrow$MS: Existing
  – BS$\leftrightarrow$RS: Existing
  – RS$\leftrightarrow$MS: New
  – MS$\leftrightarrow$BS: Existing
• Channel binding will be needed in the 4 party model
• Given the complexity of 4 party model, and the requirement that AAA server maintains a secure tunnel between each middle-party (be it BS or RS), it’s better to minimize the RS involvement in the security mechanisms.
• RS could be involved in traffic encryption and message authentication
Impact of RS on the Traffic Encryption

- We can keep traffic encryption/decryption in the BS and MS, the RS doesn’t need to take part in the traffic encryption.
- The advantage of this approach is that RS doesn’t require key-exchange and any new security association between the AAA-server and RS, and doesn’t suffer from the channel binding concerns of the “four-party” model.

Impact of RS on the Message Authentication

- Even with minimal functionality on RS, certain management messages (e.g. RNG-REQ/RSP) still need to be authenticated between the RS and MS.
- Moreover, there would be some messaging between RS and BS.
- This may require a mechanism at RS for message authentication.
Possible Approaches for Relaying

**Same Frame Relay**

- BS->RS burst
- RS relays the burst to MS in the same frame

**Different Frame Relay**

- BS->RS burst
- RS relays the burst to MS in a later frame
Same Frame Relay vs. Different Frame Relay

**Same Frame Relay**
- Scheduling is centralized at the BS: BS schedules for BS<->RS, and also for RS<->MS.
- BS provides MAP for RS also, alleviates RS from managing MAP allocation.
- QoS setup between BS and MS is not impacted with the addition of RS.
- BS and RS transfer frame within a frame boundary. In this way relaying doesn’t increase delay beyond the frame size.
- Fast feedback can be delivered within one frame.

**Different Frame Relay**
- Scheduling is distributed: BS schedules for BS<->RS, and RS schedules for RS<->MS.
- BS provides MAP for BS<->RS, and RS needs to provide MAP for RS<->MS.
- Requires QoS setup on each hop.
- RS receives frame and then relays bursts in a later frame. Adds delay in frame transfer. Delay increases with the number of hops.
- Fast Feedback may have to go through multiple frames, could become slow.

- A simpler RS can be achieved with the same frame relay.
- Different frame relay adds more issues and consideration.
• Mobility of RS means that 802.16 air interface is also on the MS/SS side

• Mobile 802.16 RS may make sense, when an RS is moving with its associated MS/SS, e.g. on a bus or boat…. Continued
Do we need Mobile RS?

- However, in such use cases, an 802.16 MS with 802.11 (WLAN) interface towards the clients is more feasible.
- 802.11 is suitable because it is designed for local area coverage.
- This is not an extending coverage case, 802.16 client could simply connect to the BS directly.
- Therefore, suggestion is to consider only fixed RS in the scope of MMR.
- Earlier contributions, in the MMR SG, also demonstrated a decrease in throughput if the RS is not positioned at an optimal location.
Summary

• We need to resolve security issues with the addition of RS
• Same Frame Relay simplifies functionalities in RS
• Fixed or Nomadic RS is appropriate for extending coverage and maximizing throughput