A Case for Multihop Backhaul

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Purpose:

Discussion on the scope and the PAR document for the proposed MMR TG.

A Case for Multihop Backhaul

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Multihop Backhaul

- MMR-BSs communicate with other MMR-BSs over the IEEE 802.16 air-interface.
- Each MMR-BS forwards its traffic towards the Gateway BS across multiple hops.
- Gateway BSs carry traffic out of the IEEE 802.16 network.
- Tree topology, rooted at the Gateway BS.
- Centralized control at the Gateway BS.
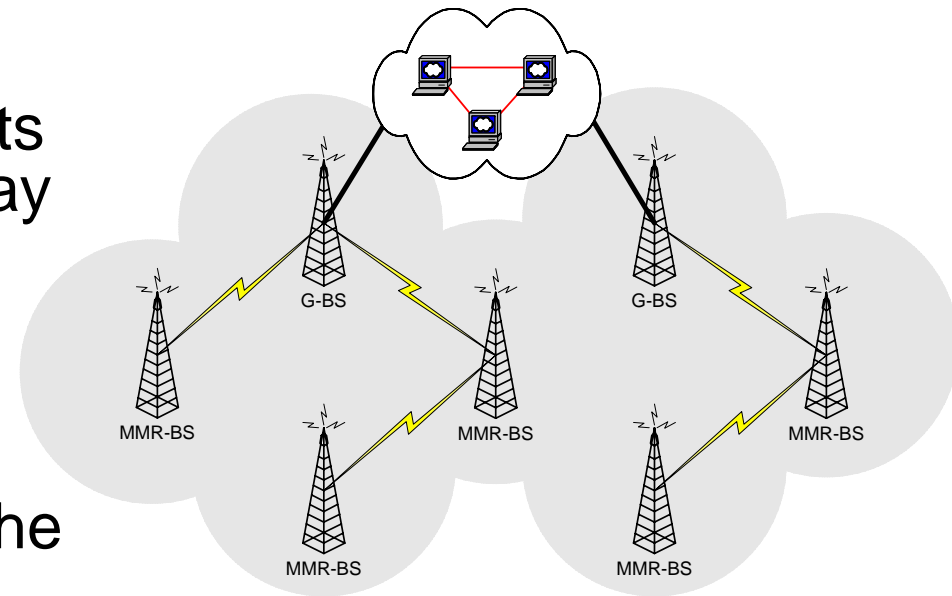
Benefits of a Multihop Backhaul

- Lower Deployment Cost
  - Significant savings by way of reduction in number of wired network terminations
  - Permits gradual rollout as dictated by traffic growth

- Improved Fault Tolerance
  - Inherent path redundancy
  - Automatic topology reconfiguration

- Improved Load Balancing
  - Route around bottlenecks

Relays in a Multihop Backhaul

- RS are complementary to the multihop backhaul.
- RSs multihop to the MMR-BS within the cell.
- RS and MMR-BS are managed by the network operator.

Mobile-RS

RS

G-BS

MMR-BS

RS

RS

RS

RS
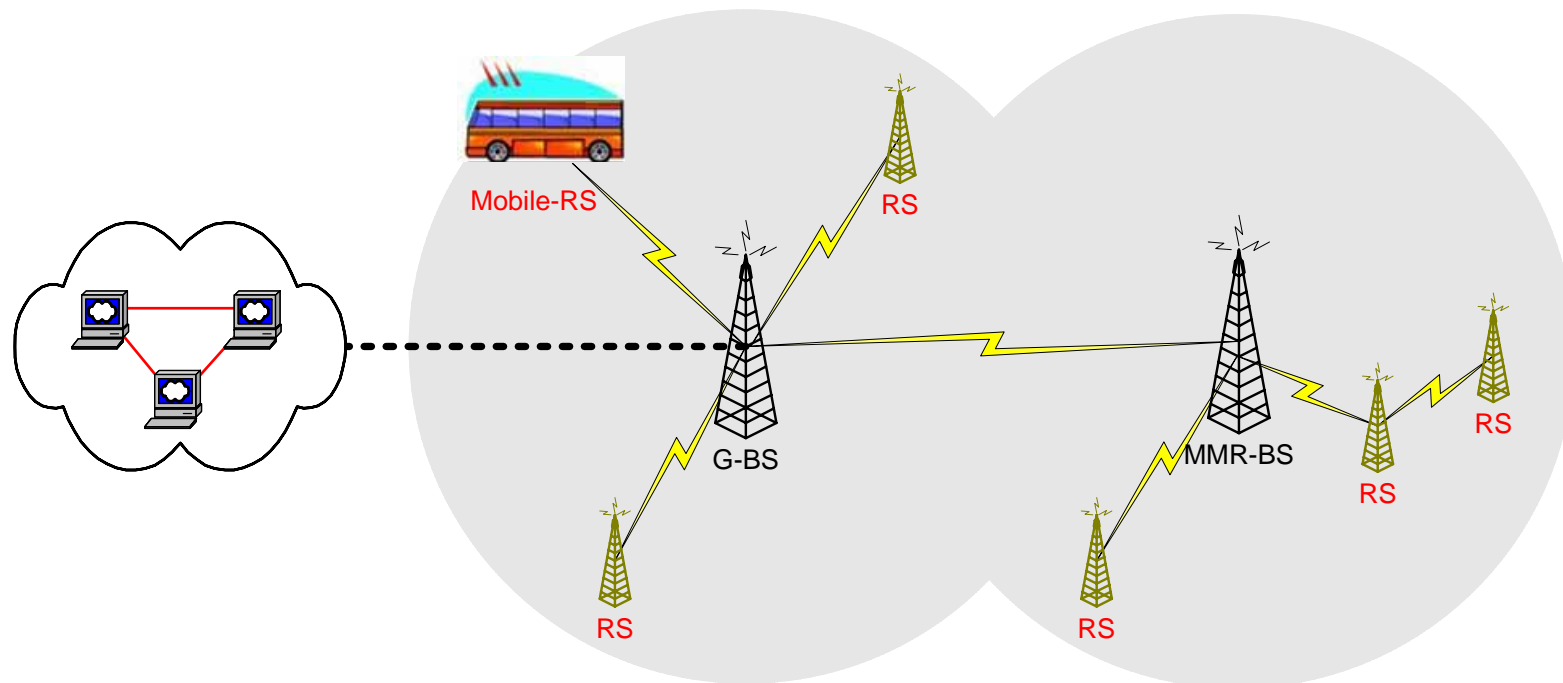
Relay Station Capability

- RSs vary in terms of the level of complexity or capability.
- Simple Relays (high throughput)
  - Repeat data traffic only
- High Capability Relays (coverage extension)
  - Repeat or create own control information including preamble
  - Control and manage their own CIDs
  - Are operator managed entities
  - Look a lot like BSs
- Both types of RSs are subsets of existing BSs

Observations Thus Far ...

- Based on the discussions to date,
  - Multihop communications is beneficial
  - There are different types of multihop devices
    - Simple RS, High Capability RS, MS, BS
  - There are several use cases to benefit from
    - Throughput improvement, coverage extension
  - The challenges and solutions largely overlap

What we need is a multihop framework.

Requirements for a Multihop Framework

- Multihop zones/regions in frame structure
  - Declare and assign multihop zones
  - Occupy and sub-allocate multihop zones
- Connection management
  - Establish E2E connections
  - Map hop-by-hop connections
- Network Discovery
  - Active probing
  - Passive scanning
- E2E metrics
  - Better measurements, tighter PHY/MAC coupling at each node
  - Vehicle to transport metrics and/or measurements
- Security
  - End-to-end
  - Hop-by-hop

Device Type Independence

- Multihop capability need not be restricted to a specific device type.

- Framework generic enough for MMR-BSs as well as one or more kinds of RSs.

- Identify device specific limitations and restrictions later.

The PAR should allow for all the above.

Conclusion

- There are several benefits of a multihop backhaul.

- Relaying within each cell, is complementary to the multihop backhaul.

- There is an interest in different types of multihop-capable devices.

- The MMR SG PAR should not restrict multi-hopping to a specific device type.