Adaptive Frequency Reuse for Interference Management in IEEE 802.16m System

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Base Contribution: C802.16m-08/034r1
Purpose: Introducing the idea of adaptive frequency reuse and the possible design issues in IEEE 802.16m

Motivation

- According to IEEE 802.16m-07/002r4 “IEEE 802.16m System Requirements”, its states that:

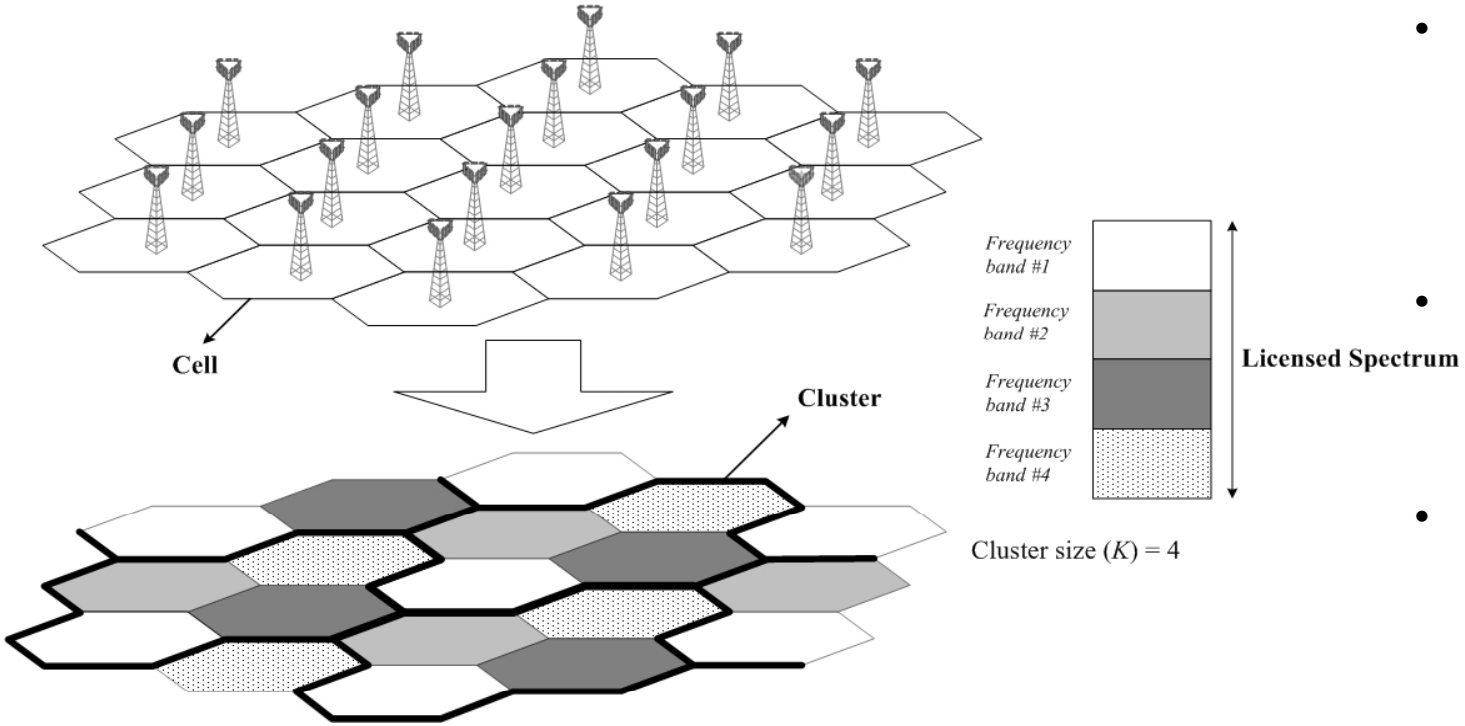
6.4.2 Interference Management

IEEE 802.16m shall support interference mitigation schemes

IEEE 802.16m shall support flexible frequency reuse schemes

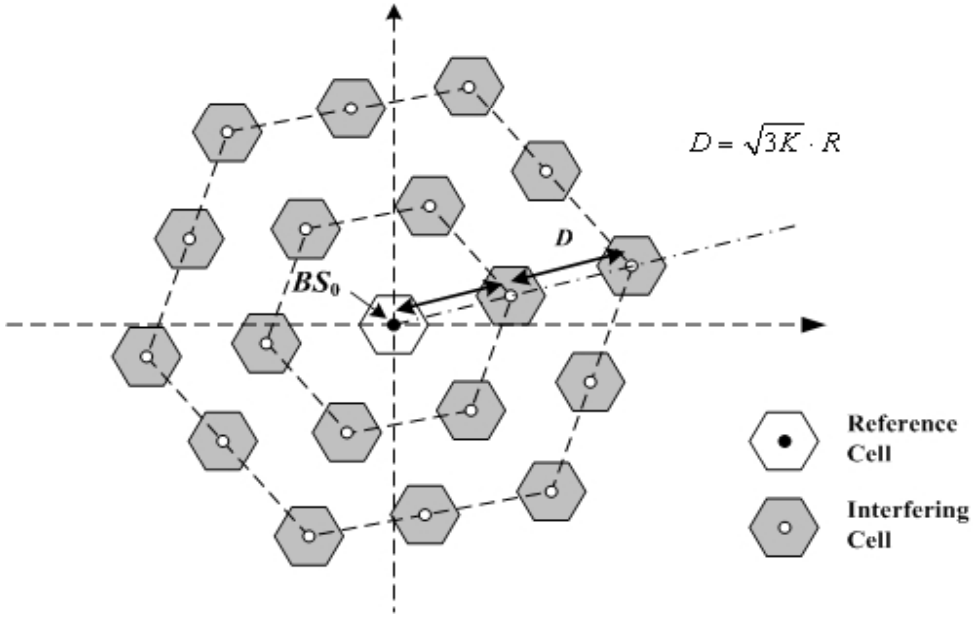
- Motivation of this contribution:
  - Introduce the adaptive (flexible) frequency reuse and its benefit to IEEE 802.16m
  - Discuss the possible design issues for enabling the adaptive frequency reuse in IEEE 802.16m

Frequency Reuse in Cellular Systems



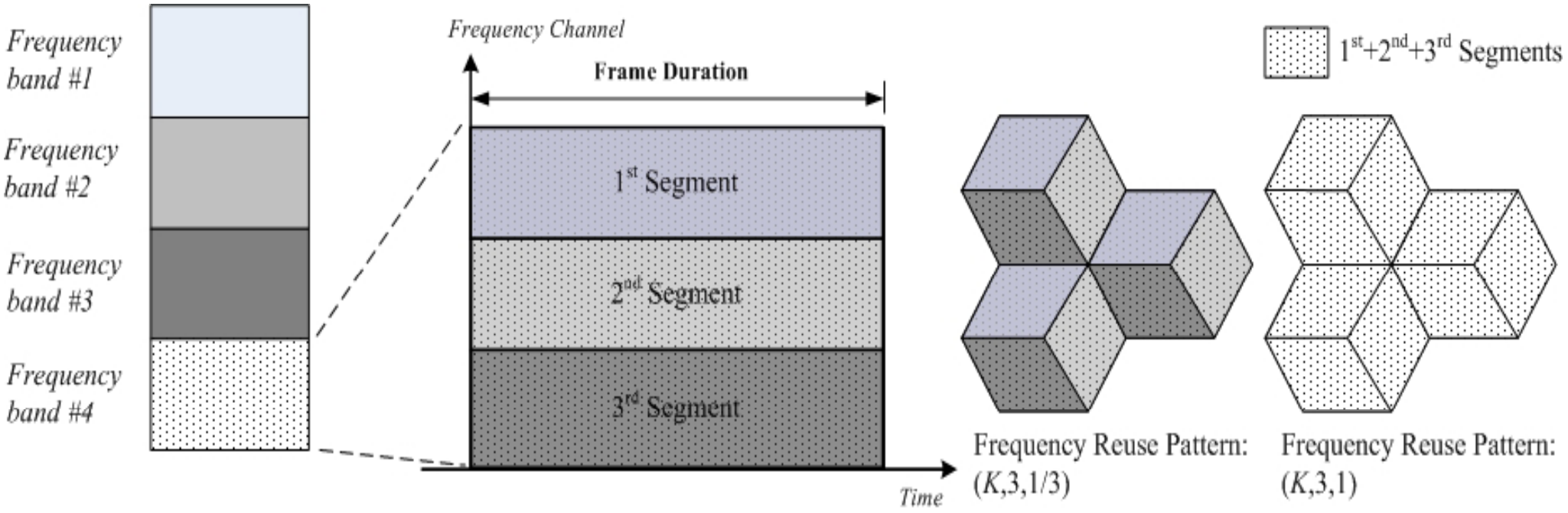
- Divide the available radio bandwidth into *K* frequency bands
  - *K*: cluster size
- Reuse the frequency bands in different cells which are geographically separated
- In OFDMA systems, each frequency band may be composed by a set of sub-carriers.

- For higher *K*,
  - the inter-cell interference can be reduced by longer separation (*D*) between adjacent interfering cells
  - the cell throughput may be degraded by less bandwidth allocated to each cell
- Tradeoff between cell throughput and inter-cell interference when design *K*



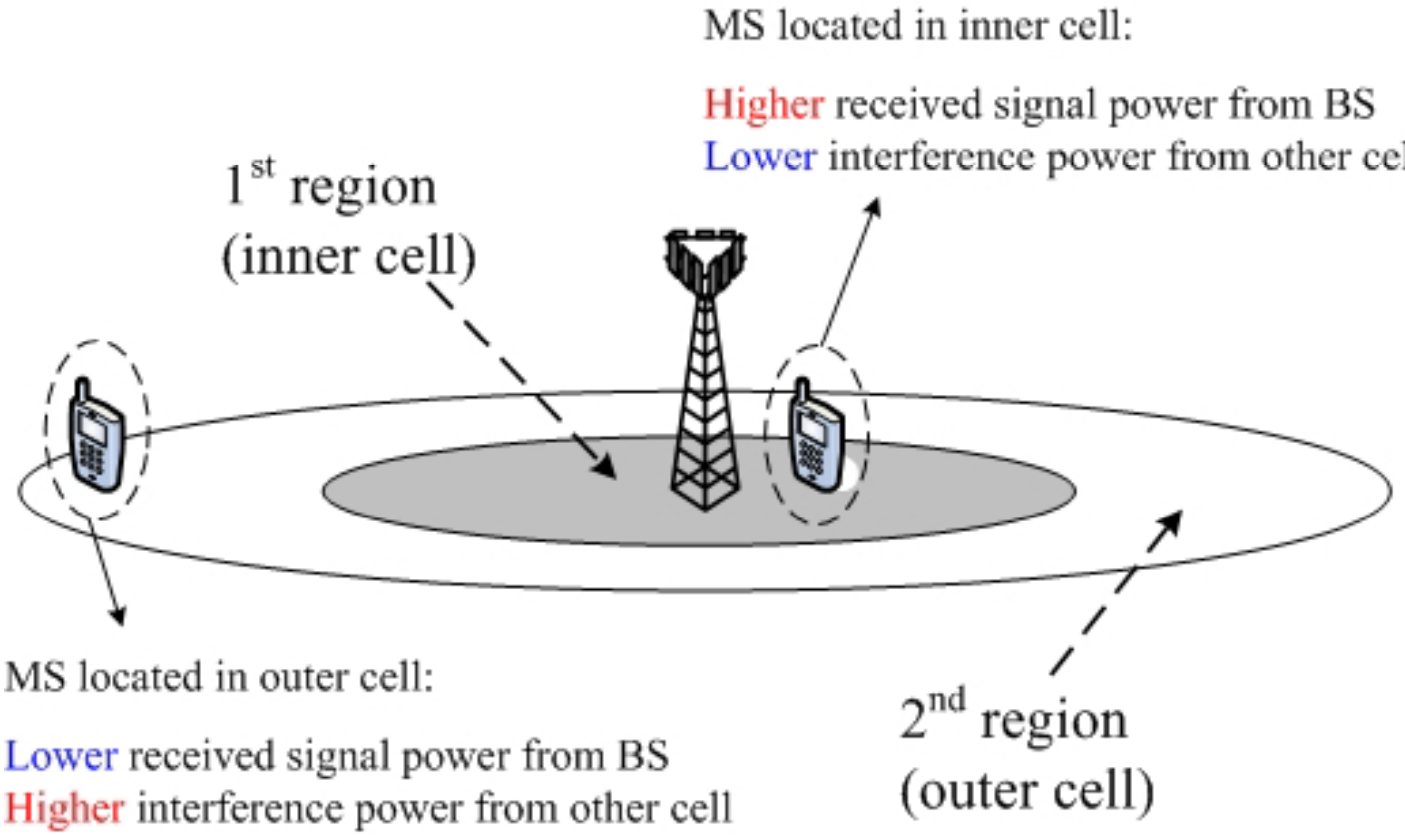
Frequency Reuse in Cellular Systems

- For easy presentation, the frequency reuse pattern (*K*,*J*,*X*) is defined:
  - *K* Cluster size
  - *J* Number of sectors in each cell
  - *X* (BW available for each sector)/(BW available for each cell)



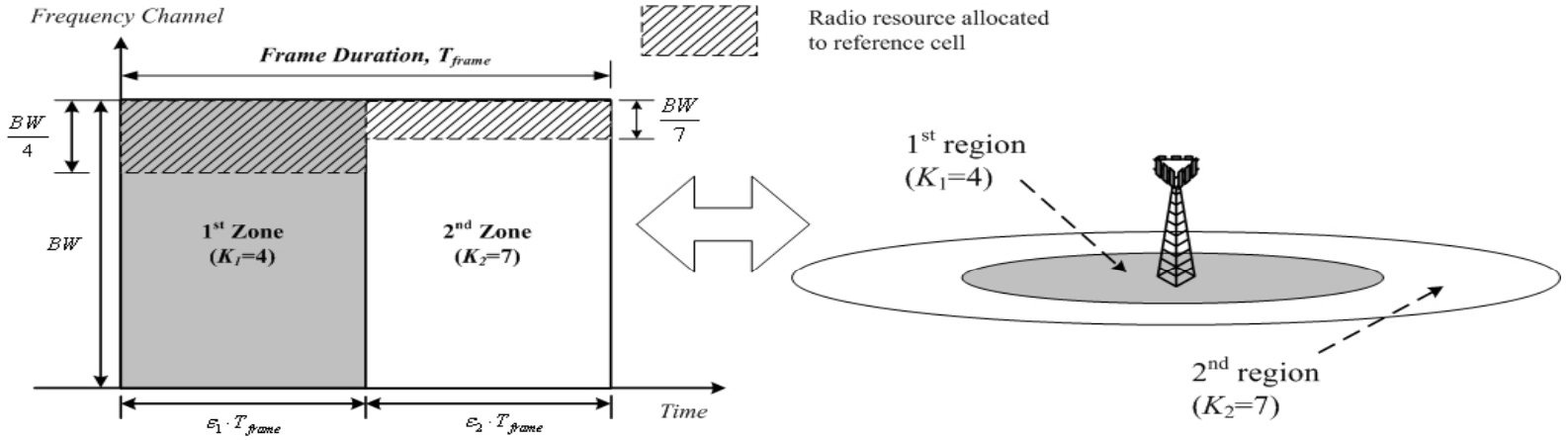
Adaptive Frequency Reuse

- Motivation:
  - The interference suffered by each MS may be different
    - The location of each MS may be different
    - The propagation loss from MS to each interfering source may be different
  - The best frequency reuse pattern to server each MS may be different
    - The following is an example for discussion

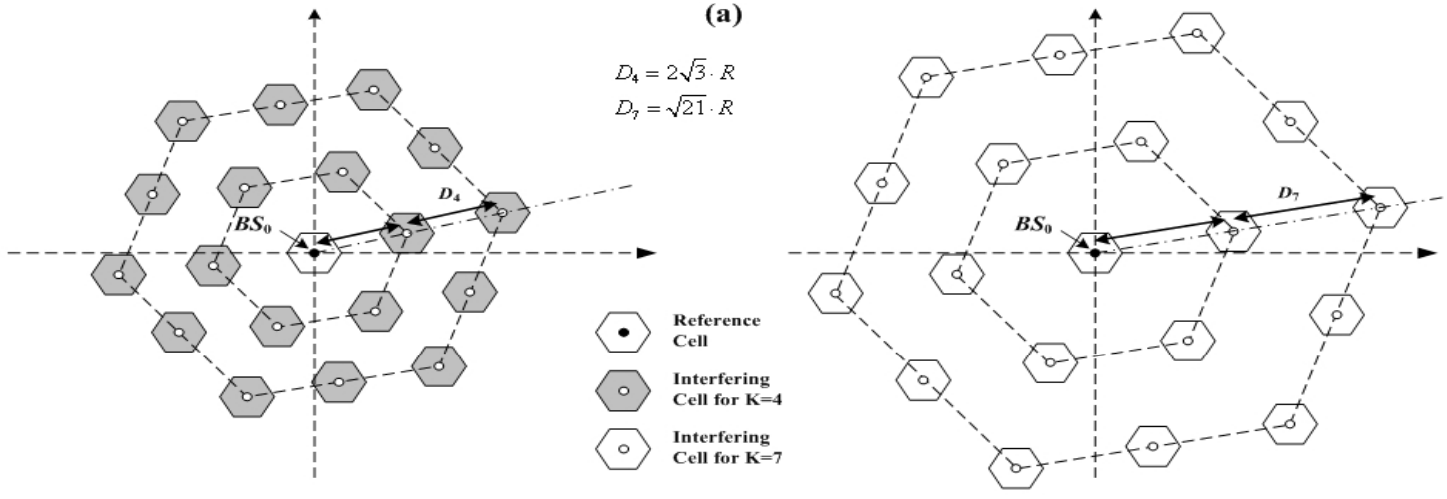


Adaptive Frequency Reuse

- In order to achieve a better tradeoff between cell throughput and interference level, BS may schedule the MSs be served by different frame zones which apply different frequency reuse patterns.
  - This is also called fractional frequency reuse or reuse partitioning



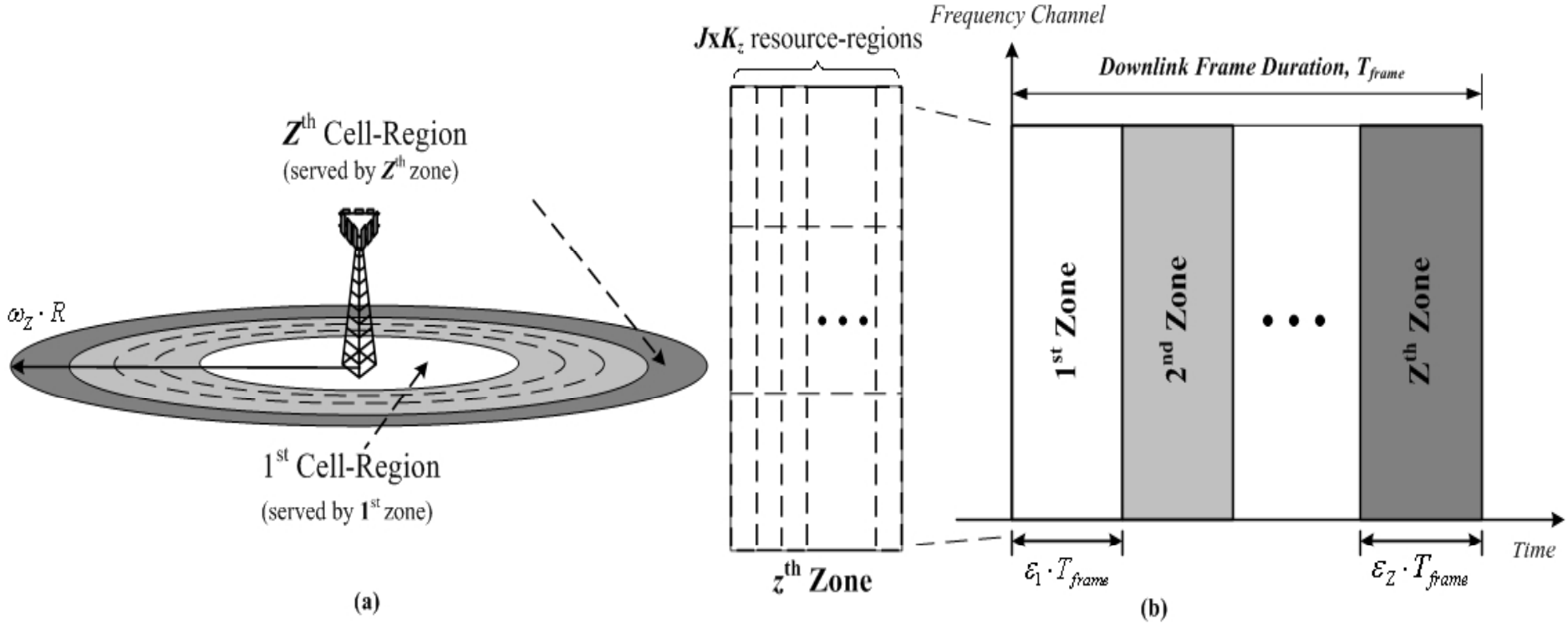
(a)



(b)

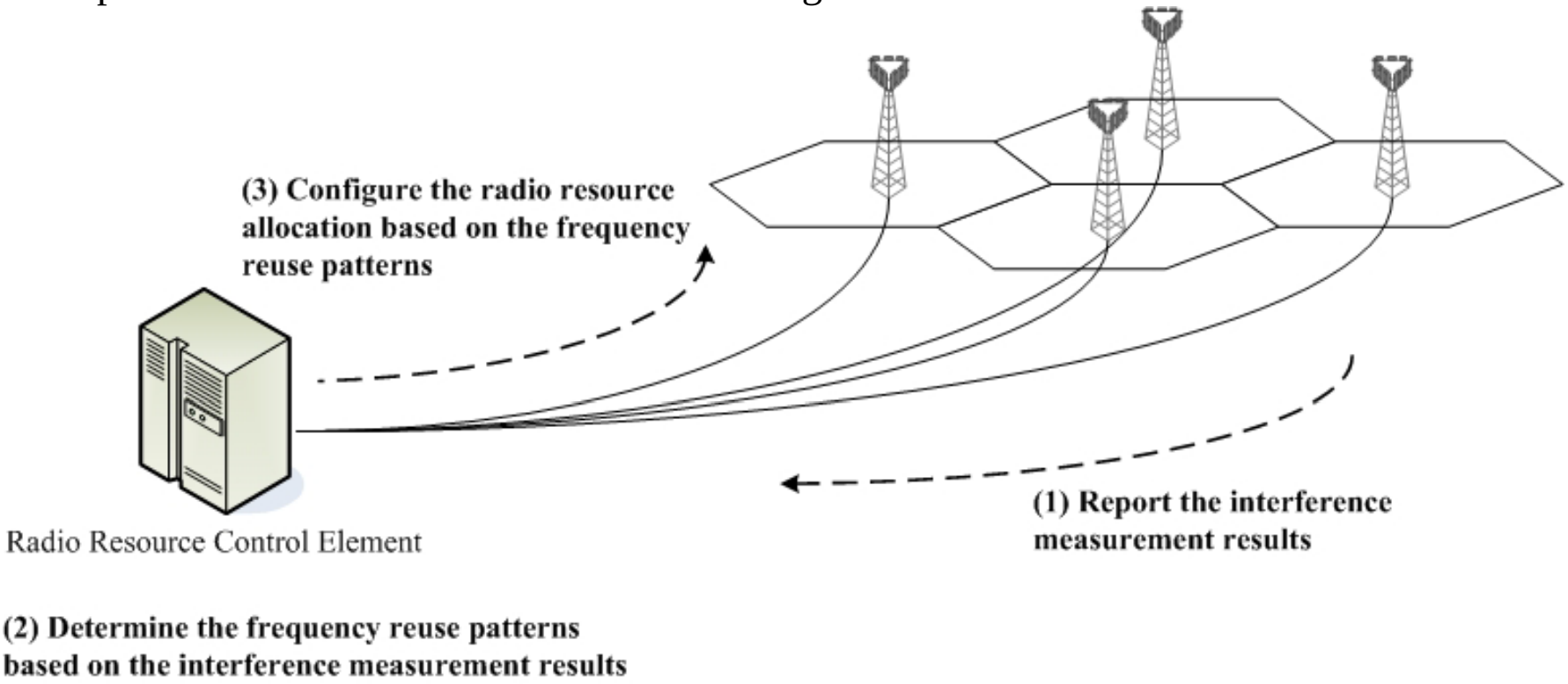
New Design to Enable Adaptive Frequency Reuse

- In order for easy coordination, partitioning the radio resource with proper structure will be necessary. New parameters may be designed in IEEE 802.16m for: (informative)
  - The basic radio resource allocation unit for inter-cell coordination (i.e. the size of resource-region in following figure) of each frame zone
  - The size of each frame zone
  - The frequency reuse pattern applied for each frame zone



New Design to Enable Adaptive Frequency Reuse

- New measurement/reporting mechanism and messaging procedure will be necessary to enable adaptive frequency reuse in IEEE 802.16m
  - Measurement/reporting mechanism: MS to report the received interference level to BS for scheduling decision
  - Messaging procedure: BS can report the interference measurement results or its traffic demand in each frame zone to a backhaul RRC element. The RRC element can reconfigure the radio access network based on the reports from BSs. Then send the radio parameters to each BS for network reconfiguration.



Text Proposal

[*Add the following text into the 16m SDD document [1]*]

XX Support for Interference Management

XX.1 Adaptive frequency reuse

[1] IEEE C802.16m-07/320r1, “Draft Table of Content for the IEEE 802.16m System Description Document”.