Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**OFDMA for Mesh Topology**
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Re:	Working with OFDMA within a Mesh topology
Abstract	This document contains information and description of working with OFDM within a mesh topology for the 802.16b system
Purpose	This explanation should be included within the OFDMA part of the 802.16b
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OFDMA for Mesh topology

1 General

The support for mesh topology was introduced into the 802.16b system, more as a MAC element then a Physical one. We will focus on explanation of how to use OFDMA within a mesh topology to improve the networks throughput and the number of hopes needed to cover a certain area.

2 Down Link and Up Link

The OFDMA system definition, defines different configuration of the carriers and the pilots within the OFDMA symbol structure for the downlink and uplink. Therefore in a mesh topology network, where each node in the network can function as a Base-Station (BS) and as a Subscriber-Unit (SU), the uplink and downlink should be identical to allow synchronized multiple transmission with the same symbol format.
To allow the downlink and uplink to be the identical, the defined down link should be used for the up link also, this is motivated due to the fact that transmissions from each node should be allowed independently to each other.

3 Management

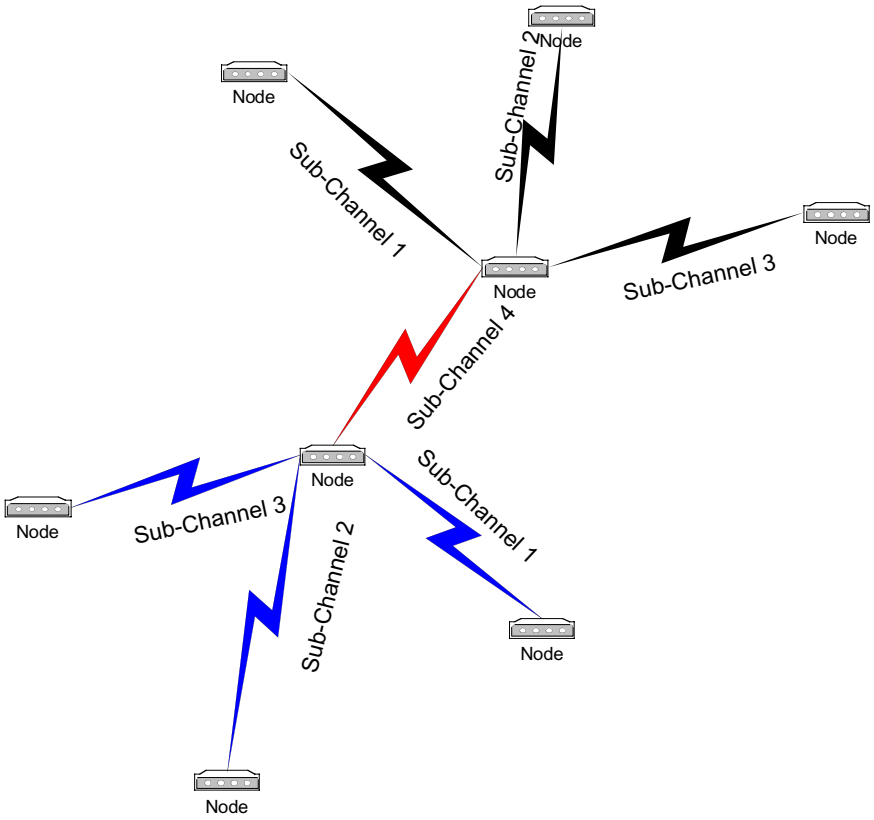
Management of the network in the mesh topology is performed by a centralized entity synchronizing the network and sending management information throughout the network, while each node is responsible of distributing the management information and scheduling the link for it s nearest neighbors.
Using OFDMA the same functionality is satisfied, each node handles the resources he allocates in both frequency and time domain while taking advantages given by the OFDMA properties:

1. Long symbol duration and multipath immunity
2. Power concentration — which can be used to lower CPE cost, better throughput, better coverage etc.
3. Bigger neighborhood

The difference in the management is only in the way the management entity or the node allocates the resources:

- OFDM — time domain only
- OFDMA — time and frequency domain (allocating Sub-Channels)

The next figure illustrates OFDMA within the mesh topology:



4 Synchronization

Each node in the system shall first synchronize in frequency to the receiving transmission from his neighborhood, lock his clocks and lock his frequency reference and then start ranging transmission within his neighborhood. This method of clock distribution which is being used in regular PMP configuration is also used for the mesh topology. Each node then synchronizes it s neighborhood by scheduling the resources to be used.

5 Conclusion

1. OFDMA could be used in mesh topology as long as both up link and down link are symmetrical.

2. the currently defined up link can be used in the mesh topology to satisfy the up link and down link.

3. Frequency synchronization is distributed within the system by forcing each node to synchronize in frequency before transmission (done in any topology)

4. each node should handle the resources in both time and frequency

5. the OFDMA will give the mesh topology many advantages:
   - Long symbol duration and multipath immunity

- Power concentration — which can be used to lower CPE cost, better throughput, better coverage etc.
- Bigger neighborhood

6 References

[1] 802.16.ab-01_01 — draft document of the 802.16ab standard