

Proposal for 802.16 Connection Oriented Mesh

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Source:

Jim Dickerman, Kamlesh Rath, Lalit Kotecha
CoWave Networks
47224 Mission Falls Court
Fremont, CA 94539

Voice: 510 657-0612

Fax: 510 657-0605

E-mail: jim@cowave.com, rath@cowave.com, lalit@cowave.com

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Purpose:

Presentation regarding need for connection oriented mesh in 802.16.

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Proposal for 802.16 Connection
Oriented Mesh
March 2003

Service Provider Feedback

- Surveyed leading service providers in US, China, India, Latin America, and Mexico
- Reported Benefits of Mesh Solutions
 - ▶ Pay as you grow investment
 - ▶ Cost effective coverage
 - ▶ Fast payback
- Mesh requirements
 - ▶ Licensed band operation
 - ▶ Scalable, high density solution
 - ▶ Multi service support

Limitations of current 802.16 Mesh

➤ Limited scalability

- ▶ 802.16 MAN intended to serve 100s - 1000s of subscribers per sector
- ▶ 802.16 Mesh deployment limited to <100 subscribers due to centralized scheduling message structures

➤ Quality of Service (Connection management)

- ▶ 802.16 MAN intended to serve data as well as real time voice and video services
- ▶ 802.16 Mesh MAC is connectionless and can't be used to support guaranteed QoS over multiple hops
- ▶ Current method of UDP tunneling of MAC control messages puts L2 messages on L4 and adds large latencies

➤ Interference

- ▶ 802.16 Mesh Coordinated Distributed Scheduling – nodes coordinate transmissions in extended 2-hop neighborhood
 - ▶ Assumes no interference more than 2 hops away

Scalability

- ▶ 802.16 Mesh MAC limits network to <100 subscribers due to centralized scheduling messages
 - ▶ MSH-CSCF (Table 56x – pg 44)
 - ▶ For n nodes in Mesh network and average of 4 child nodes per sponsor, message length = $5n + 11$ bytes
 - ▶ Typical control message has 3 overhead symbols + 4 message symbols @ 25 bytes/symbol = 100 bytes – only supports 19 nodes
 - ▶ 64 nodes → 331 bytes – MSH-CSCF message of ~16 symbols
 - ▶ Large message rebroadcast by every sponsor node in network
 - ▶ 16 times in example – 8 frames @ 32 symbols/control sub-frame
 - ▶ MSH-CSCH structure (Table 56w – pg 43)
 - ▶ MSH-CSCH message length (for n nodes) = $n + 12$ bytes
 - ▶ Typical control message (100 bytes) can support up to 84 nodes
 - ▶ Needs to be rebroadcast grant message 21 times for 84 nodes – 6 frames @ 4 messages per control sub-frame
 - ▶ Requests take 21 frames for 84 nodes – 4 requests per frame
 - ▶ Implies MSH-CSCH schedule validity = 27 frames
 - ▶ At 8ms per frame takes 216ms
 - ▶ Each node needs to know the burst profiles of all other nodes via MSH-CSCF

Quality of Service (Connection Management)

- 802.16 Mesh MAC is connectionless and can't be used to support guaranteed service provider QoS needs for voice
 - ▶ Requires traversing IP stack up to L3 at each node
 - ▶ Segmentation and Reassembly
 - ▶ IP Routing – limited to Diffserv QoS capabilities
 - ▶ Connections are only on a link basis, no concept of end to end connections
- L2 MAC messages unnecessarily tunneled over UDP at L4 (Section 6.2.15)

Connection Oriented Mesh Proposal

- ▶ Add Optional Connection Oriented Mesh
- ▶ Utilize as much of existing connection based PMP structures as possible
- ▶ Utilize existing mesh specific structures where possible
 - ▶ Scalability
 - ▶ Use modified mesh centralized scheduling mechanism and tables to allow >1000 nodes per sector from current <100
 - ▶ Use sparse MSH-CSCH format for scalability, only changes in allocations sent in message
 - ▶ Use scaling to fit allocation in small multiple of frames and then repeat allocation until next MSH-CSCH message
 - ▶ Eliminate MSH-CSCF as link burst profiles don't need to be broadcast – grants are in # of mini-slots, not in bits/sec
 - ▶ Connection oriented QoS
 - ▶ Modify design to support end to end connections with 802.16 PMP QoS parameters and manageable latency
 - ▶ Replace UDP tunneling mechanism for management messages and utilize end to end control connections consistent with PMP