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FLUG Wireless Mesh Network Talk

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This document located at:
http://802.11junk.com/jeffl/FLUG-talk-2015-02-28/

- How Wi-Fi works
  - One transmitter on the air at a time.
  - CSMA/CA. Half Duplex. Store and forward repeaters.
  - Half or full duplex backhaul.
  - Indoor and outdoor are very different.
- Buzzwords etc.
  - Mesh is ad-hoc networking. All wi-fi is on MAC layer 2.
  - Repeaters and WDS. Partial mesh, no routing. Acts as both access point and store and forward repeater at same time.
  - Metricom. Partial mesh with geographic routing.
  - WDS, NPG, OLSR, etc
- Routing
  - Each hop reduces max speed by using air time to send extra packets.
  - Table OLSR – Optimized link state routing.
  - Dynamic OLSR – self organizing.
  - Hierarchical CBRP (Cluster based routing protocol)
  - AODV – On Demand Distance Vector.
  - CBRD – Cluster Based Routing Protocol.
- Types of mesh networks.
  - Ad-hoc pretzel. No controller as in infrastructure.
  - Single band store and forward. Most common.
  - Dual band. One for users, one for backhaul.
- Advantages of Wireless Mesh Networks.
  - Saves on cost of wired backhaul.
  - Self configuring, self provisioning, self organizing, self healing, self-monitoring.
  - Grow or move as needed.
  - Standardized as 802.11s with HWMP routing. Used by OLPC for small mesh networks. http://en.wikipedia.org/wiki/IEEE_802.11s
- Disadvantages or why mesh sucks.
  - Doesn't scale.
  - Maximum speed limited my number of hops.
  - Congestion near wired access points.
  - High collision rate due to hidden nodes.

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    - Usually requires omnidirectional antennas, which are not optimum pattern for rooftops. Directional antennas create hidden nodes.
    - What's wrong with this picture? http://wndw.net/pdf/wndw3-en/ch08-mesh-networking.pdf
    - 802.11 not designed for large networks. Polling is more efficient for WISP. http://www.solectek.com/files/pdf/techtalk/White_Paper-polling_MAC_advantage_v1.2.pdf
    - Indoor vs Outloor. Few AP's versus thousands.
    - Low percentage of packet delivery due to interference, hidden nodes, and retransmissions. MIT Rooftop Networks.
    - http://802.11junk.com/jeffl/FLUG-talk-2015-02-28/MIT-roofnet-b.pdf
    - http://pdos.csail.mit.edu/grid/pubs.html
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    - Speed drops to the slowest speed (802.11b=1Mbit/sec, 802.11a/g=6Mbits/sec)
    - Limited encryption. Must use RADIUS server. Cannot encrypt IP header.
    - http://telehash.org
    - Too many wireless mesh routing protocols (70) http://en.wikipedia.org/wiki/Wireless_mesh_network#Routing_protocols
    - Google does not support Ad-Hoc networking in Android.
    -
- Examples
    - San Francisco (6 -> 22 nodes per square mile)
    - Philadelphia (Cost over-runs)
    - Meraki. Bought by Cisco for $1.6 billion in 2012 mostly for cloud management technology.
    - Tropos
    -
    - Metricom
- Links and reading
    - Wireless Networking in the Developing World http://wndw.net
    - http://www.muniwireless.com
    - https://www.eero.com
- Speed slowdown with repeater demo
    - http://www.techrepublic.com/blog/linux-and-open-source/using-jperf-to-check-network-performance/
    - Iperf https://iperf.fr/
    - Jperf http://sourceforge.net/projects/iperf/files/

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- Jperf https://code.google.com/p/xjperf/downloads/detail?name=jperf-2.0.2.zip
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