

Wireless Mesh Networking With The XO Laptop

Aaron Maxwell

QA Engineer, SnapLogic, Inc.

amax@redsymbol.net

Bay Piggies Presentation

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Mesh Networks

- Every mesh-enabled node acts as a relay to extend the wireless network range
- Meets many technical challenges for deploying in developing and rural environments
- IEEE 802.11s – draft for mesh networking

Pro and Cons of using Mesh Network Architecture

- Range extension
- (potential) power efficiency
- dynamically self-configuring/healing
- reduced throughput
- greater complexity of nodes (each is a router/transmitter)
- security challenges

Networking Requirements

- Extremely low power needs
- Incrementally updateable (to improve functionality, standards adherence)
- Machines can act as mesh points even with main CPU powered off

Networking Hardware

- Marvel 88W8388 and 88W8015 (Libertas series)
- Regular 802.11b/g (2.4GHz) interface; mesh networking chip
- Effort to eliminate dependency on closed-source code: <http://dev.laptop.org/ticket/46>

802.11s Mesh Architecture

- Mesh Point (MP) – a device in the mesh network
- Mesh Portal (MPP) – an MP that is connected to the external network
- Mesh paths formed over inter-MP links using a routing protocol

XO Mesh Protocol

- Goal is to follow 802.11s as close as possible, but there are some compromises
- routing protocol: simplified version of HWMP (Hybrid Wireless Mesh Protocol)
- Dynamic, Reactive

Dynamic Path Selection

- Mesh Points (MPs) will want to find (good!) paths to other mesh points
- Custom routing protocol – mainly takes place at data link layer
- Each laptop acts as an MP. Mesh links established via an RREQ/RREP cycle

RREQ/RREP Cycle (Path Discovery)

- broadcast route request (RREQ)
- propagating nodes receiving RREQs create “reverse routes” in their routing tables
- When RREQ reaches destination node, unicast route reply (RREP) is sent back to source
- Nodes propagating RREP record “forward routes”

External IP Subnets

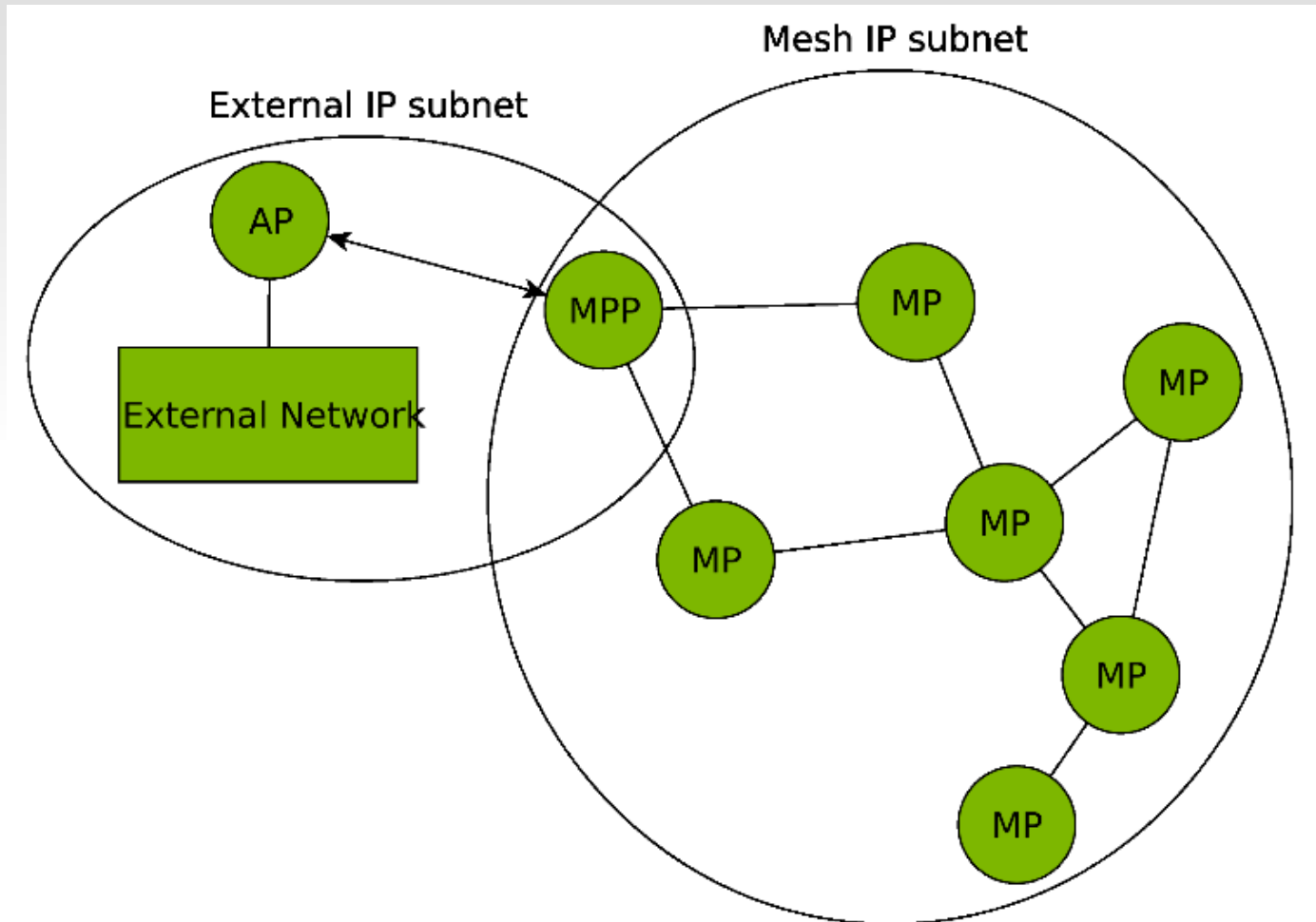


Image Credit: cozybit OLPC Mesh white paper

Mesh Portal Association

- MPs (mesh points) must find a path to an MPP (mesh portal) to access the internet
- For power efficiency and maximum throughput, need to select “close” MPP
- Builds on RREQ/RREP cycle
- Clever solution...

Mesh Portal Selection

- RREQ sent to ANY_MPP_MAC_ADDRESS, a special anycast address claimed by all MPPs
- Path selection algorithm gives higher precedence to lower cost routes
- Current metric: link cost based on transmission power needed to send a data frame

More info

- Slides and links: <http://redsymbol.net/talks/>
- “Wireless Networking in the Developing World”:
<http://wndw.net/>
- Cozybit (Javier Cardona):
<http://www.cozybit.com/whitepapers/olpc-mesh.pdf>
- Or email me at amax@redsymbol.net, or post on the bay-piggies email list (<http://baypiggies.net>)