HSMM-MESH

A freely distributable presentation for any Amateur Radio organization.

Created January 2013 by WN8U
How would you like to have...

A portable network...
that is wireless...
that is high speed...
that is fault tolerant...
that is self discovering...
that is low power...
that is inexpensive?
Your solution is...

No, really!
What is HSMM-MESH?

http://www.hsmm-mesh.org/

HSMM-MESH is a high speed, self discovering, self configuring, fault tolerant, wireless data network that uses very low power.

High Speed Multi Media (HSMM) in general is often referred to as being the Hinternet (Ham Internet).

HSMM-MESH uses older generation Linksys Wi-Fi routers with a custom firmware to operate on Part 97 frequencies and power levels.

When paired with high gain antennas it can provide links of distances from 10 miles (common) to 130 miles (extreme).
What is a Mesh Network?

A typical star network, no redundancy
What is a Mesh Network?

A mesh network is fault tolerant.
What is a Mesh Network?

Each node in an HSMM-MESH network is a repeater.

Each node in an HSMM-MESH network communicates only with the other reachable HSMM-MESH nodes.

Each node in an HSMM-MESH network exchanges available routes/maps with other reachable nodes.

If any node in an HSMM-MESH network is connected to the internet, it can provide internet access to the entire network.

All nodes in an HSMM-MESH network are remotely managed, you do not need physical access once installed.
Additional Information

Part 97 - Amateur Radio Rules & Regulations – licensed, allows higher power and high gain antennas

Part 15 - Wi-Fi Rules & Regulations – unlicensed, restrictions on power and antenna size

ISM - Industrial, Scientific and Medical wireless bands
802.11g Wireless Band

2.39 GHz  2.40 GHz  2.45 GHz  2.50 GHz

ISM Band

Overlap

Part 97 - 13 cm
## 802.11g Wireless Band

<table>
<thead>
<tr>
<th>Channel</th>
<th>Low Freq</th>
<th>Center Freq</th>
<th>High Freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.401 GHz</td>
<td>2.412 GHz</td>
<td>2.423 GHz</td>
</tr>
<tr>
<td>2</td>
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<td>2.421 GHz</td>
<td>2.432 GHz</td>
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<td>6</td>
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<tr>
<td>10</td>
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<td>2.468 GHz</td>
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Wi-Fi channels 1, 6 and 11 are most commonly used because they do not overlap.

Almost all Wi-Fi routers are pre-configured to use channel 6 by default.

HSMM-MESH nodes run on channel 1, part of the 13cm band.
HSMM-MESH is High Speed

HSMM-MESH links are around 54 Mbps

Compare that to other known services:

- Packet Radio/APRS: 0.0012 Mbps
- Pactor III: 0.003 Mbps
- Dialup: 0.056 Mbps
- D-Star: 0.128 Mbps
- DSL: 0.25 Mbps up / 1.5 Mbps down
- Fi optics: 10Mbps up / 30 Mbps down
- Time Warner Cable: 5Mbps up / 30 Mbps down
**HSMM-MESH is Low Power**

Using HSMM-MESH, a Linksys WRT54G has a maximum power output of 79mW. That’s 0.079W! It uses a standard 12V input (accepts from 4V to 16V).

Operating time on one time use alkaline batteries:
- 00:22 – 1x 9V
- 05:15 – 8x AA
- 08:30 – 6x C
- 01:36 – 4x AA
- 05:20 – 4x D
- 09:55 – 1x 6V Lantern

Operating time using rechargeable sealed lead acid:
- 2:30 – 1.3 Ah
- 32:00 – 7.5 Ah

A 55 Ah SLA battery with a 45W solar panel under sub-optimal conditions can run a WRT54G indefinitely.
HSMM-MESH is inexpensive

Linksys WRT54G routers are previous generation devices; they are available used and very common.

Sources can include: eBay, Craigslist, eHam, etc.

Prices average about $20 - $30 per unit

But...

HSMM-MESH is only supported on specific versions of WRT54G, WRT54GL and WRT54GS devices
# WRT54G and versions


<table>
<thead>
<tr>
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<tr>
<td>WRT54G</td>
<td>1.0 - 4.0</td>
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<tr>
<td>WRT54GL</td>
<td>1.0 - 1.1</td>
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HSMM-MESH Adoption

HSMM-MESH has been applied in many different uses:

- Live video feeds for foot races and bicycle races (El Paso, TX - Susan G. Komen race for the Cure)
- Emergency networks in disaster areas
- Field Day logging
Typical HSMM-MESH Node Setup

- To Directional Antenna
- To Omni Antenna
- To Internet Connection
- To MESH connected devices
Portable HSMM-MESH Node

- 15 dBi gain omni-directional antenna
- 24 dBi gain directional antenna
- Weather-proof enclosure mounted as close to antennas as possible with node inside
- 20ft (not to scale) pole
- 5 gallon bucket with sand/cement
- Battery for portable power
HSMM-MESH Accessories

TP-LINK  24dBi
Type-N   $49.99
Directional

TP-LINK  15dBi
Type-N   $50.99
Omni-Directional
HSMM-MESH Accessories

TP-LINK TL-POE200
Power over Ethernet
$28.99