

# 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.

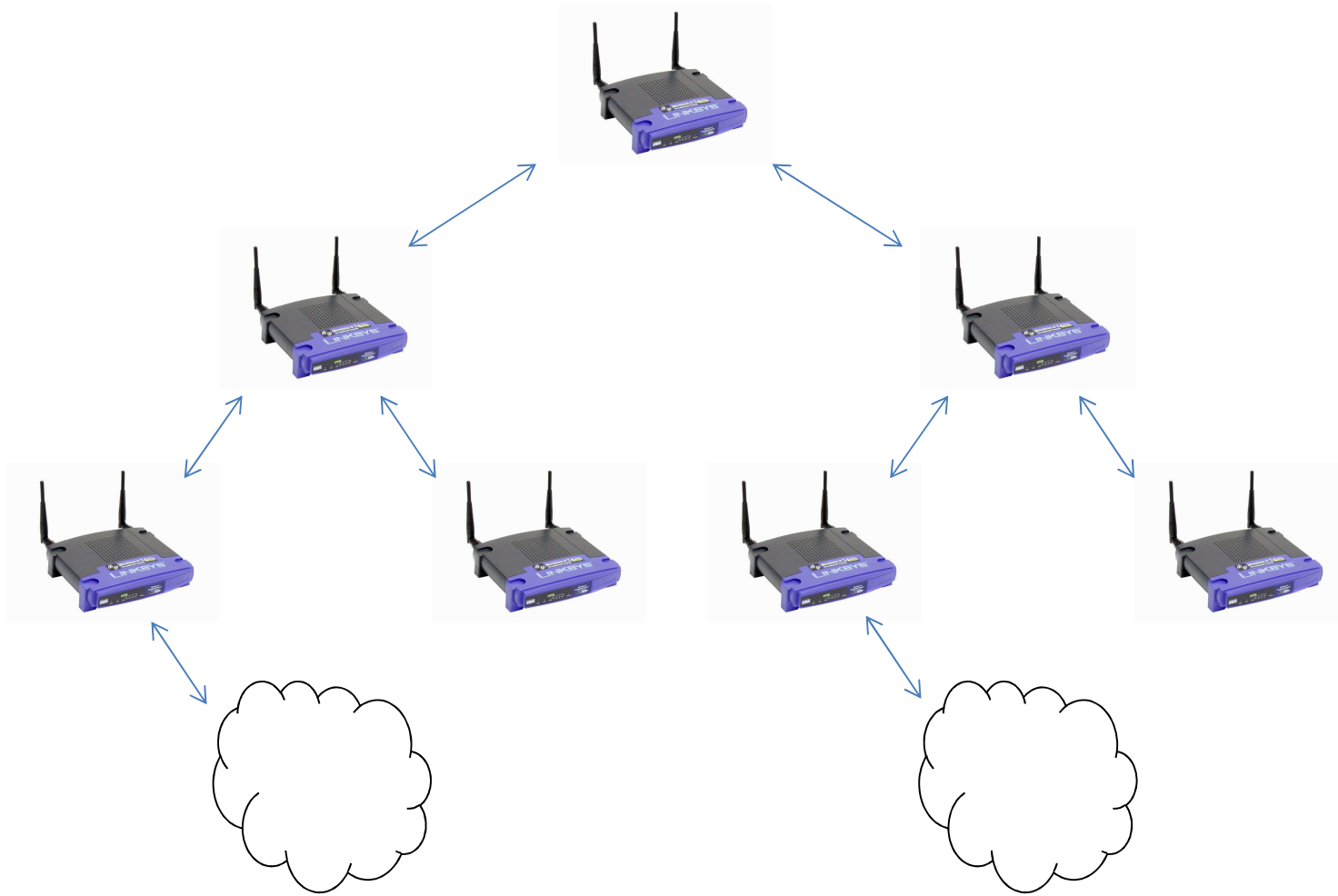
High Speed Multi Media (HSMM) in general is often referred to as being the Hinternet (Ham Internet).

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).

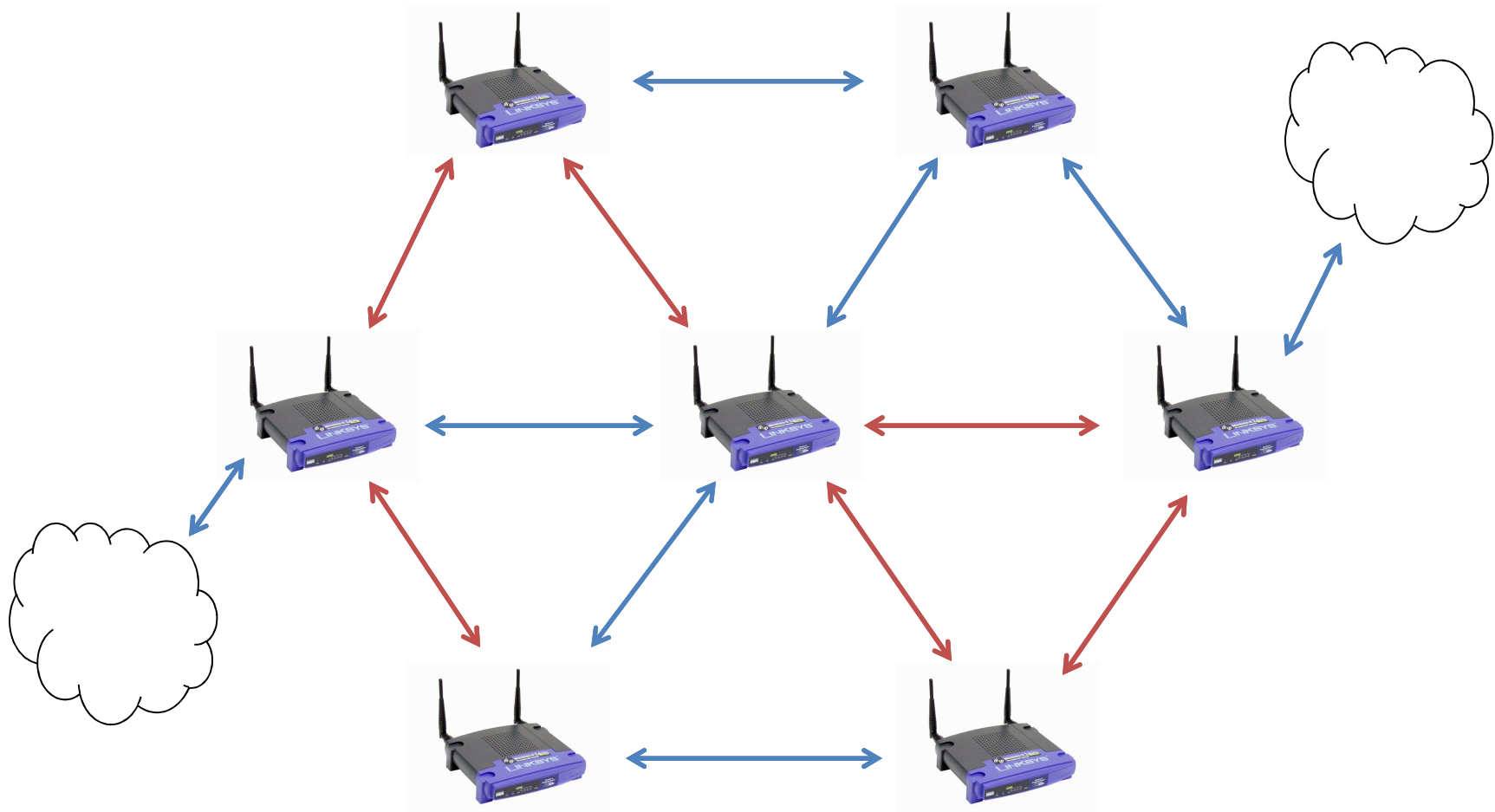
# What is a Mesh Network ?

**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

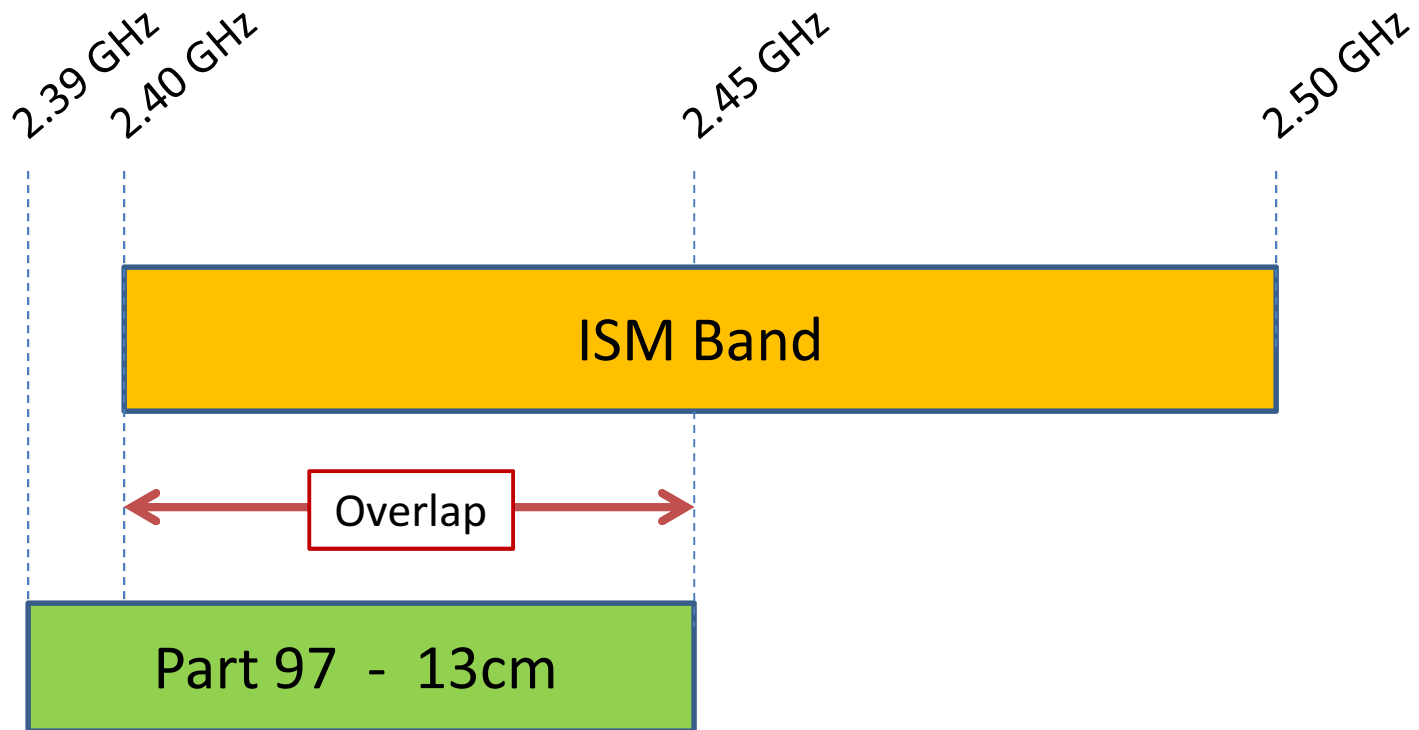
Part 97 - Amateur Radio Rules & Regulations – licensed, allows higher power and high gain antennas

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

ISM - Industrial, Scientific and Medical wireless bands



# 802.11g Wireless Band



# 802.11g Wireless Band

Channel	Low Freq	Center Freq	High Freq
1	2.401 GHz	2.412 GHz	2.423 GHz
2	2.406 GHz	2.417 GHz	2.428 GHz
3	2.411 GHz	2.422 GHz	2.433 GHz
4	2.416 GHz	24.27 GHz	2.438 GHz
5	2.421 GHz	2.432 GHz	2.443 GHz
6	2.426 GHz	2.437 GHz	2.448 GHz
7	2.431 GHz	2.442 GHz	2.453 GHz
8	2.436 GHz	2.447 GHz	2.458 GHz
9	2.441 GHz	2.452 GHz	2.463 GHz
10	2.446 GHz	2.457 GHz	2.468 GHz
11	2.451GHz	2.462 GHz	2.473 GHz

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Channel	Low Freq	Center Freq	High Freq
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11	2.451GHz	2.462 GHz	2.473 GHz

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
- Fioptics: 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
- 01:36 – 4x AA
- 05:15 – 8x AA
- 05:20 – 4x D
- 08:30 – 6x C
- 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

[http://www.hsmm-mesh.org/images/hsmm\\_docs/WRT54Shop.pdf](http://www.hsmm-mesh.org/images/hsmm_docs/WRT54Shop.pdf)



Model	Version
WRT54G	1.0 - 4.0
WRT54G	5.0 and up
WRT54GS	1.0 - 4.0
WRT54GS	5.0 and up
WRT54GL	1.0 - 1.1

# HSMM-MESH Adoption

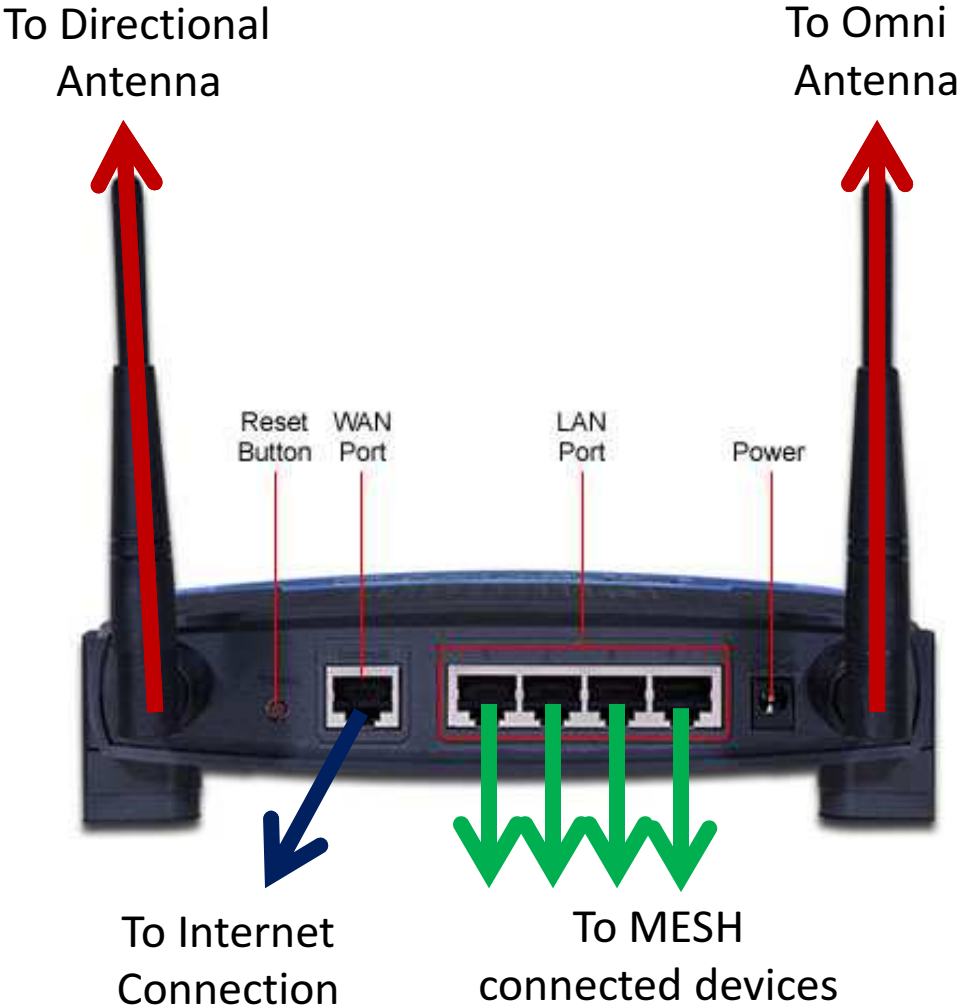
HSMM-MESH has been applied in many different uses:

- 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

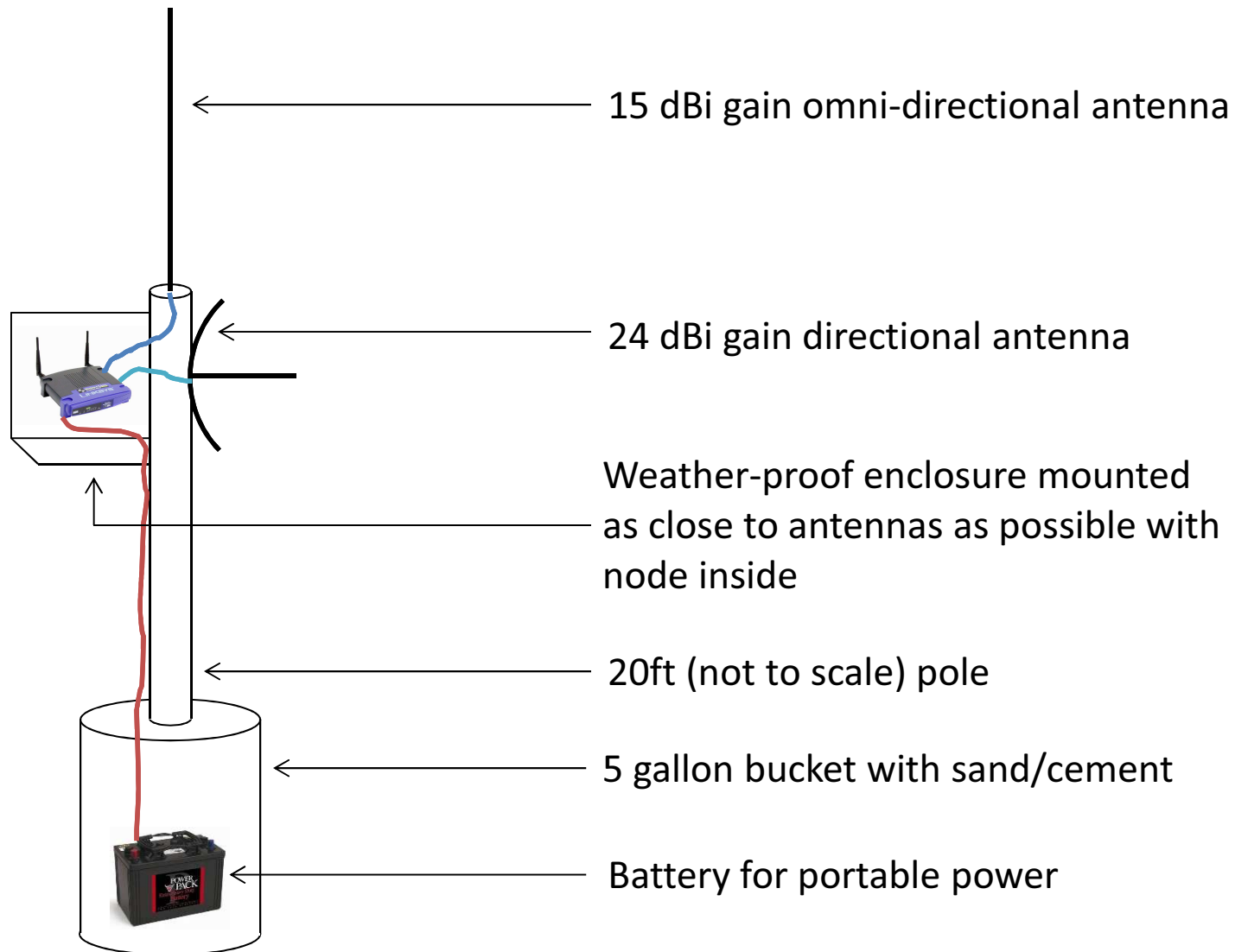




# Typical HSMM-MESH Node Setup



# Portable HSMM-MESH Node



# 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