



# RMHAM Network Operations

RMHAM University  
Nerdfest

February 11, 2023

# Your Host





# Quick Intro to HSMM

# High-Speed Multimedia (HSMM) Radio

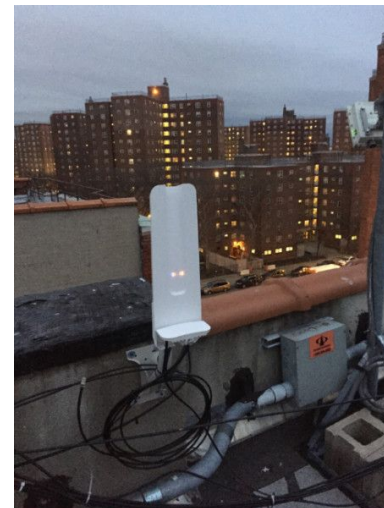
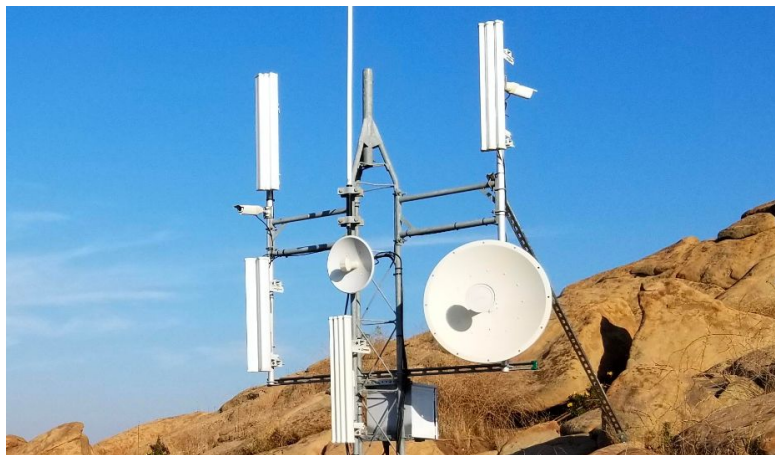


- Use consumer/commercial WiFi 802.11 gear
- Nudge it over to ham allocations
- Or other WISP tech (60GHz)



## Examples

- Broadband-Hamnet
- AREDN (CARBBN)
- NYC Mesh





**Rocky Mountain  
Ham Radio**

- 

## Compare to...

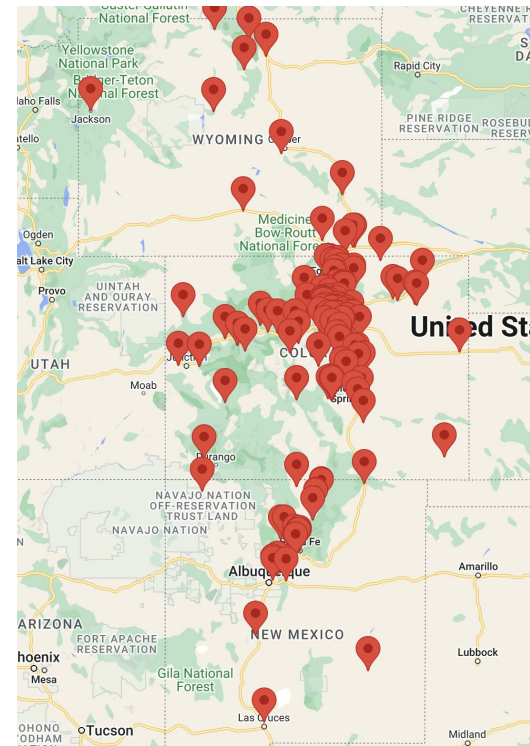


# Overview of the RMHAM Network

# RMHAM Network



- **137** sites (and growing!)
- Coverage from northern Wyoming to southern New Mexico
  - Grand Junction to Burlington
- Centrally managed by RMHAM and partner organizations
- Stated purpose is **emergency communications**

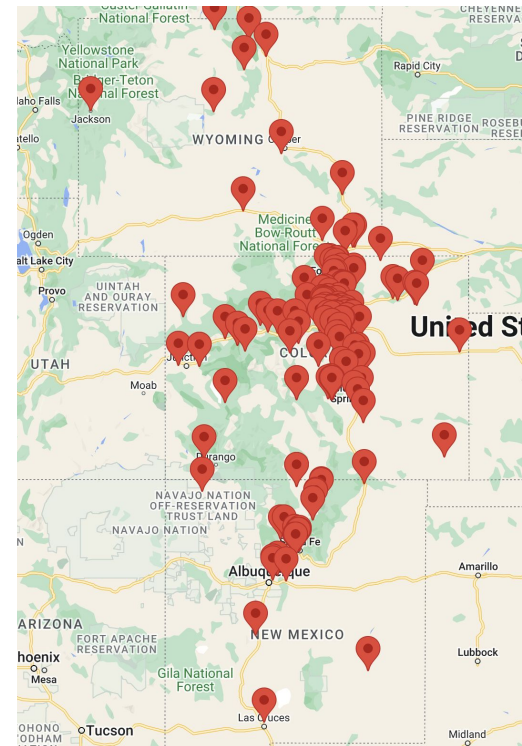


# RMHAM Network



Carries linked repeater systems:

- Colorado Connection
- Fun Machine
- RMHAM DMR
- Colorado Repeater Association
- Cheyenne Mountain Repeater Group
- Aurora Repeater Association



# RMHAM Network Tech



- Mostly MikroTik networking hardware
- Static private IP assignments
- OSPF routing
- *Long* microwave shots! 50+ miles!



# RMHAM Network



- Team of ~10 volunteers manage day-to-day operations
- How do we keep track of everything?

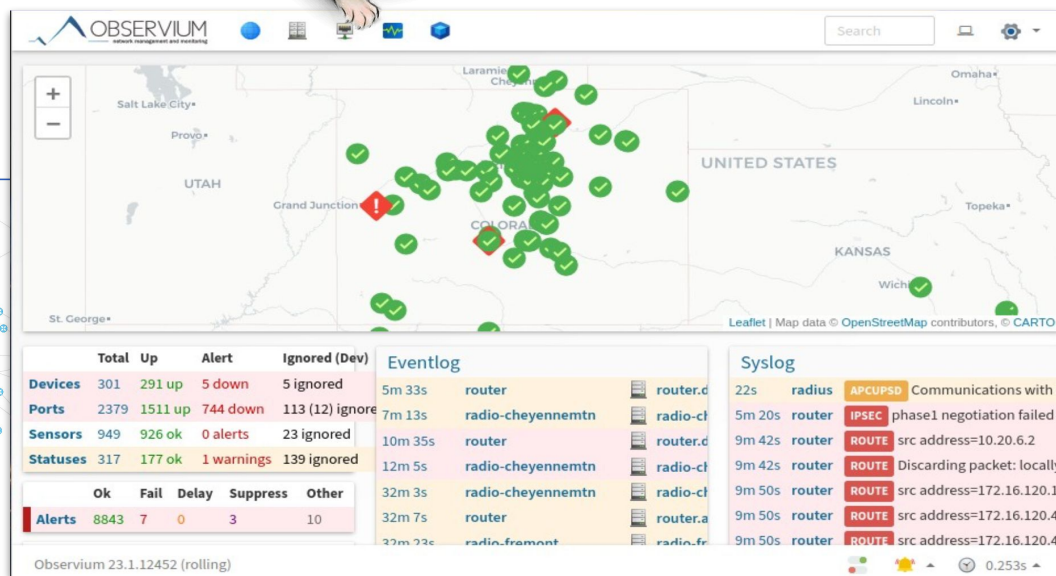
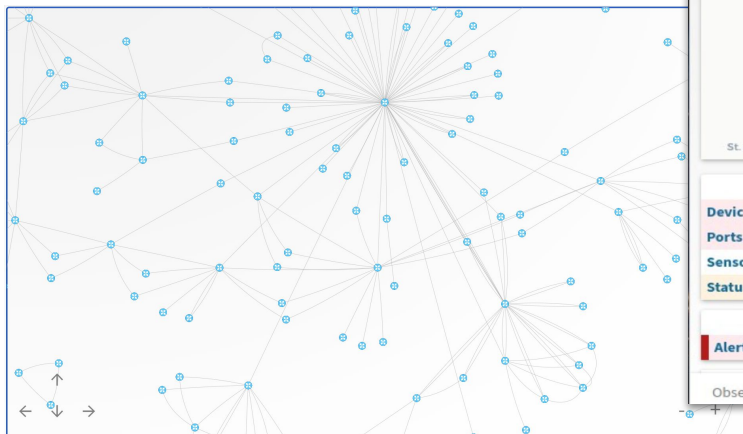




# Network Operations

# Observium

- Commercial software product
- Keeps track of actual device state
- Provides visibility into the overall network
- Alerting when problems detected



# DevDB

- Homegrown software tool
- Models what the network *should* look like
- Many useful tools
  - Plugs out Test
  - Check OSPF
  - Check firewall
  - Check device config
  - Update sensor limits

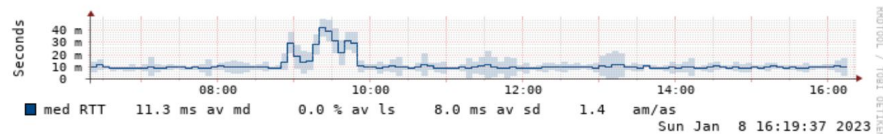
Site	Link	Device	Port	Network	AllStar
<b>Sites</b>					
Domain	Title	Subnet			
ac0kq.rmham	AC0KQ-RPT	10.30.31.0/24	AC0KQ RPT [39.717821,-1		
akron.rmham	Akron	10.30.28.0/24	Akron [40.14869,-103.2847		
almagre.rmham	Almagre	10.30.120.0/24	Almagre Mountain, [38.791		
almagre-master.rmham	Almagre DMR	10.0.100.0/24	Almagre Mountain, [38.791		
auxcomsow.rmham	Auxcom SOW	10.30.108.0/24	Site on Wheels		
badger.rmham	Badger	10.30.60.0/24	Badger Mountain [39.04994		
bellyache.rmham	Bellyache Ridge	10.30.185.0/24	Bellyache [39.656041,-106.		
blackforest.rmham	Black Forest	10.0.10.0/24	Black Forest Fire [39.04376		
blackridge.rmham	Black Ridge, CO	10.30.190.0/24	Black Ridge [39.066136649		
baldy.rmham	Breckenridge/Baldy	10.30.27.0/24	Baldy [39.45916009300782		
brush.rmham	Brush Radio Site	10.30.132.0/24	Brush [40.21722200,-103.6		
buckhorn.rmham	Buckhorn RMHAM	10.16.8.0/24	Buckhorn [40.61680494777		
burlington.rmham	Burlington KNAB TOWER	10.30.101.0/24	KNAB [39.29470188861457		
castlepeak.rmham	Castle Peak	10.30.165.0/24	Castle Peak [39.774975,-10		
cathedral.rmham	Cathedral Bluffs	10.30.102.0/24	Cathedral Bluffs [39.922891		
caviness.rmham	Caviness	10.30.24.0/24	Caviness [37.365023,-108.		
cedarwood.rmham	Cedarwood	10.0.11.0/24	Cedarwood [38.0338, -104.		
cedarwoodtower.rmham	Cedarwood Tower	10.0.12.0/24	90' level in box at Cedarwo		
cheyennemtn.rmham	Cheyenne Mountain	10.30.70.0/24	CheyenneMtn [38.737037,-		
cheyenne.rmham	Cheyenne WY	10.30.110.0/24	CheyenneWY [41.0482015		
costateecoc.rmham	Colorado State EOC	10.30.111.0/24	9195 E Mineral, Centennial,		
conifer.rmham	Conifer RMHAM	10.30.130.0/24	Conifer [39.5255067062670		



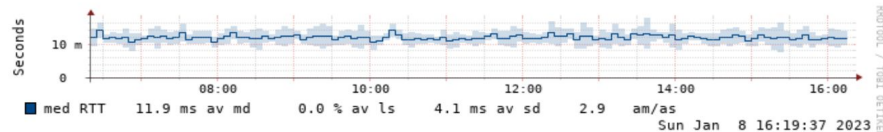
# SmokePing



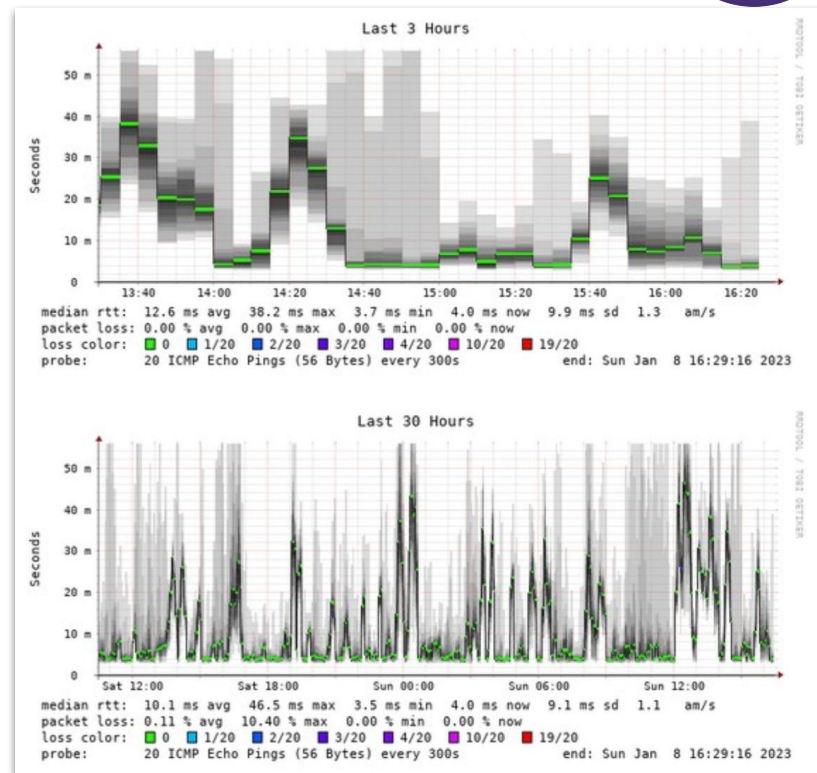
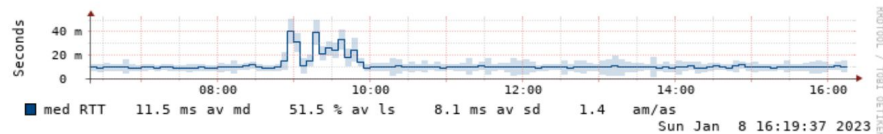
## Eldorado CRA 12V (10.30.81.5)



## Westcreek CRA 12V (10.30.116.5)



## Eldorado CRA APC (10.30.81.3)





Rocky Mountain  
Ham Radio

[illegible]

# RANCID



revision 1.2 by rancid, Wed Jul 10 08:12:25 2013 UTC		revision 1.3 by rancid, Wed Jul 10 08:13:58 2013 UTC	
#	Line 183 interface FastEthernet0.4	Line 183	interface FastEthernet0.4
183	ip address 192.168.120.2 255.255.255.0	183	ip address 192.168.120.2 255.255.255.0
184	ip virtual-reassembly	184	ip virtual-reassembly
185	!	185	!
	router rip		
	network 0.0.0.0		
186	ip forward-protocol nd	186	ip forward-protocol nd
187	ip route 0.0.0.0 0.0.0.0 192.168.120.3	187	ip route 0.0.0.0 0.0.0.0 192.168.120.3
188	ip route 0.0.0.0 0.0.0.0 192.168.10.1	188	ip route 0.0.0.0 0.0.0.0 192.168.10.1
revision 1.3 by rancid, Wed Jul 10 08:13:58 2013 UTC		revision 1.4 by rancid, Wed Jul 10 09:01:28 2013 UTC	
#	Line 149 archive	Line 149	archive
149	!	149	!
150	interface Ethernet0	150	interface Ethernet0
151	ip address 192.168.10.43 255.255.255.0	151	ip address 192.168.10.43 255.255.255.0
152		152	ip flow ingress
153		153	ip flow egress
154	ip nat outside	154	ip nat outside
155	ip virtual-reassembly	155	ip virtual-reassembly
156		156	ip route-cache flow
157	no ip mroute-cache	157	no ip mroute-cache
158	half-duplex	158	half-duplex
159	!	159	!
revision 1.4 by rancid, Wed Jul 10 09:01:28 2013 UTC		revision 1.5 by rancid, Wed Jul 10 09:12:22 2013 UTC	
#	Line 155 interface Ethernet0	Line 155	interface Ethernet0
155	ip virtual-reassembly	155	ip virtual-reassembly
156	ip route-cache flow	156	ip route-cache flow
157	no ip mroute-cache	157	no ip mroute-cache
158	half-duplex	158	full-duplex
159	!	159	!
160	interface Ethernet1	160	interface Ethernet1
161	description Inside	161	description Inside

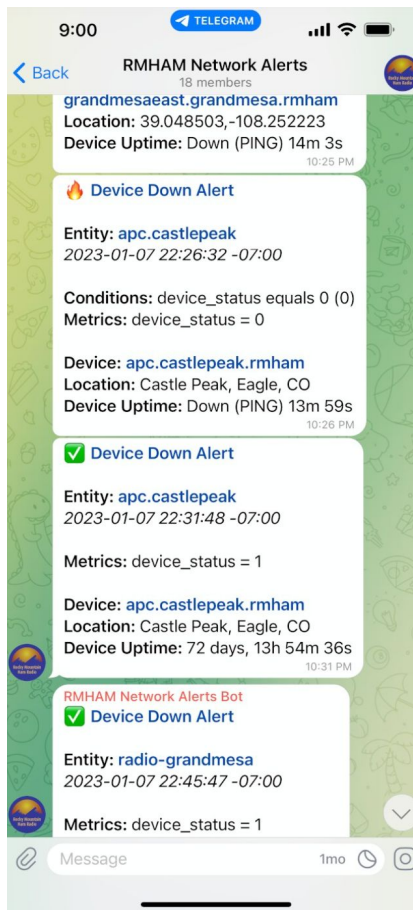
Legend:

- Removed from v.1.4
- changed lines
- Added in v.1.5

- Really Awesome New Cisco config Differ
- Helps us backup and track changes in device configurations

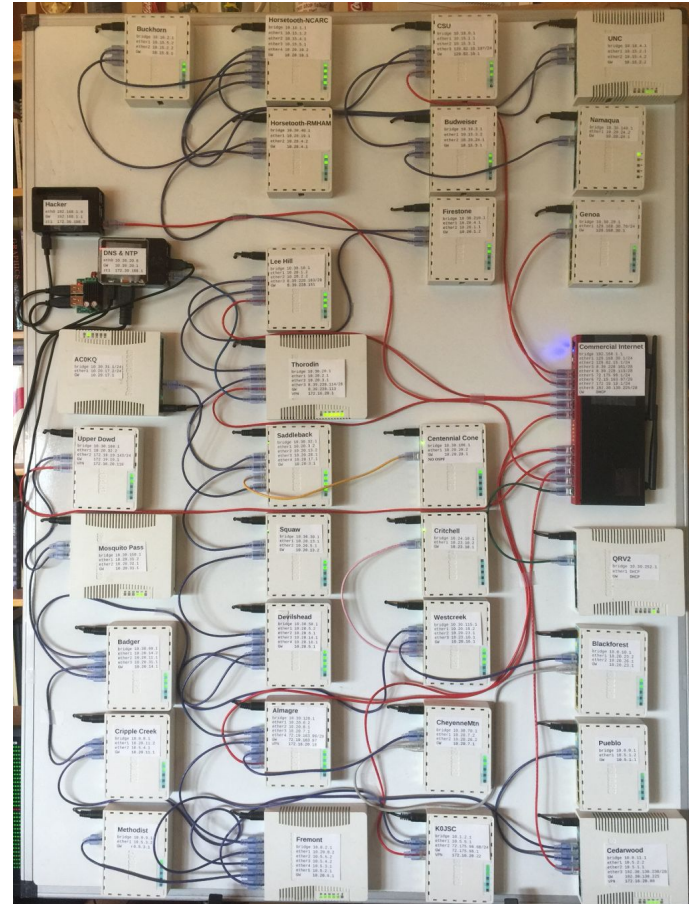
# Telegram

- Alerts and team coordination



# NetLab

- Small-scale model of the network with real routers
- Used to test new or experimental configurations
  - OSPF
  - RouterOS 6 to 7



# Problems Yet to Solve

- Single Sign On





# Contact Me

[k0swe@arrl.net](mailto:k0swe@arrl.net)