

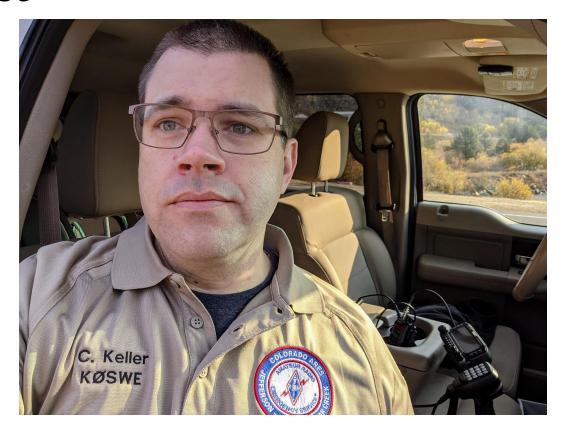
RMHAM Network Operations

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

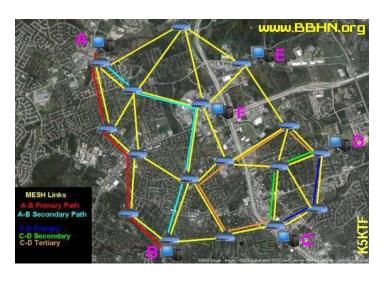




Mesh Networks



- Autonomous stations run by individuals/clubs
- Any ham can join
- Self-configuring
- General purpose
- No coordinating body
- No availability guarantees



Compare to...



Overview of the RMHAM Network

RMHAM Network

Rocky Mountain Ham Radio

- **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

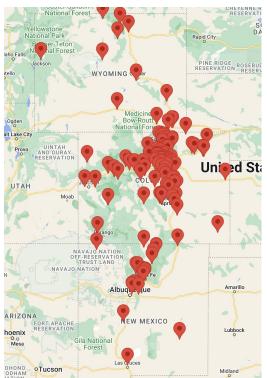


RMHAM Network

Carries linked repeater systems:

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





RMHAM Network Tech

Rocky Mountain Ham Radio

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



RMHAM Network

Rocky Mountain Ham Radio

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

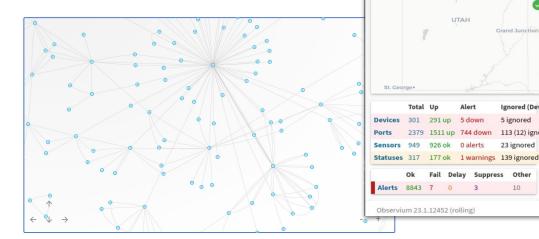


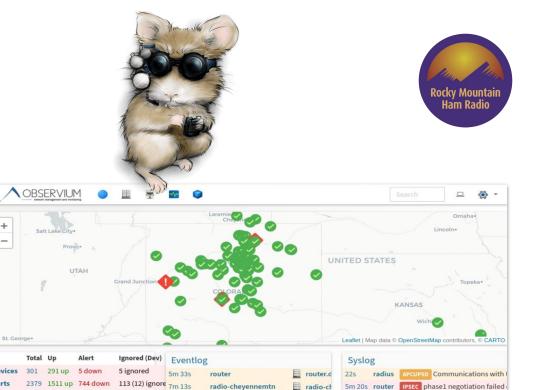


Network Operations

Observium

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





10m 35s

12m 5s

32m 3s 32m 7s radio-chevennemtn

radio-cheyennemtn

OUTE src address=172.16.120.1

** Src address=172.16.120.4

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



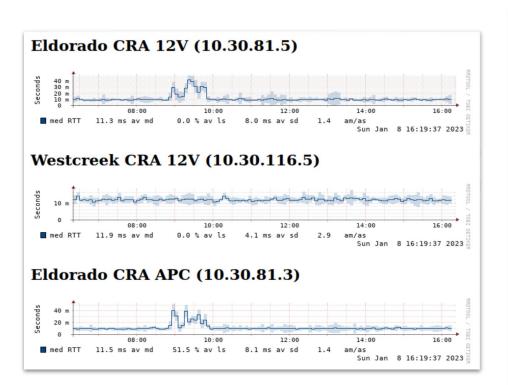


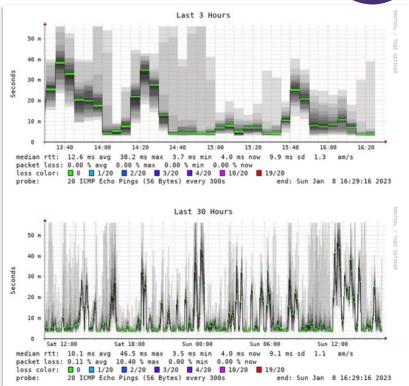
Sites

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 [39.2947018886145
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 [39.92289
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
costateeoc.rmham	Colorado State EOC	10.30.111.0/24	9195 E Mineral, Centennial
conifer.rmham	Conifer RMHAM	10.30.130.0/24	Conifer [39.525506706267

SmokePing





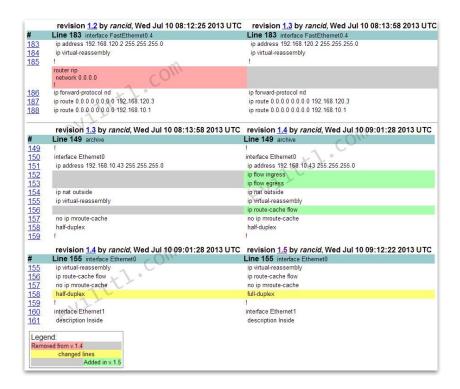


cping (continuous ping)



22 01 00 20 57	:15 #34962 Period Is Ping time x1 x10 x100 x1000 x1000			
23-01-08 20:57: rget	:15 #34962 Period Is Ping time x1 x10 x100 x1000 15557 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0	ms hop	min	avg max
		29.8 12	18.7	39.8 68.5
rLink	1111124142113413433111233333144313343 9 33244414313234422141131 9 133224111344423131333443441331334434232311122232113331243333343133333114141 9 334313433333 * 4223125152351233131	18.0 8	9.0	30.0 57.7
tan	22222452543355245542323454452554344642554555254254455343522432245445222555534242445656524%3545%354342322334322444245554455344452253533244553465435434237263463344243	30.2 12	21.6	42.9 70.2
shdot	4444467476457746767444566665776466764776777476466677565744654466567444777756465667877746947677675765645445565446664586666774666744757546676567657657656459485674566455	54.3 20	39.7	61.5 97.1
	221113414311341343311123333323431334493324441331323442224113199332231113344231312345444133133442311922232123331244333431233411424193343134333334223125152351233131		8.6	30.1 57.2
udFlare		32.5 9	20.8	42.0 69.4
nt		0.2 2	0.1	0.8 37.3
		22.9 12	8.6	30.4 56.7
kbone				
				19.1 63.9
				17.4 56.7
	138324513212563413232142312612144524312421132516211632535234132313442133241211211151152113113341314449121121332213327332574291435211323251334445128351727334528183352644			35.3 110.7
			7.4	18.0 58.4
	114124113111232112192141212312131221491196132751111211221283111191211111119111181111811			22.2 115.0
	. 11411118111122112191141211312321128341171112241191112211131111711111111811118189181111218921911112117161981181121212214191132111111221295111113119211113182951951212			16.9 56.8
	114/449921112221121911421133122211274511961122111311118111181111811118111181118111		7.5	19.4 67.8
	2,347,367,367,367,367,367,367,367,367,367,36		4.5	13.2 47.5 7.2 44.6
	/34//40/054/14/90000944901.11.1319/25003.9444902/12/10/70/34033007/3445441/40/254/25/24/41/40/94402/43/1054401.1054401.11.1319/25/003.944402/43/1054401.11.1319/25/003.944402/43/1054401.11.1319/25/107/25		1.9	2.8 37.2
norodin addleback		0.2 2	0.9	
		0.2 2	0.2	0.8 35.5 1.5 36.1
	$\frac{1}{1}$			13.3 47.6
	1.111121111111111111111111111111111111			17.2 49.2
	11112212111123132212217121113111111313211321			
	1412122122111232322733121212325532112113261322312211111233212212232232212122322322			
	.364334445543344564335434444545475454354344549554474443454446544353444443444444776886674985616718873464443444444333453333443454343333444454344363443634446456413354433			
	. 46434444554434343434343434343434343435485443443333344454433333344534443347768886674886616718873464443443335333333333333333333334444553443363344345454433353333334334444553443634634634634634634634634634634634634			
	12222222221322322122121212222233311113242221311222112223122211112223222221211122122			
h				
	1271545252123634122332332312322443323411412132557171722525124212312231221141212111151151112112441212459623351332212316332465182434231212221325446228241728334519172352544	43.6 8	10.8	34.1 101.6
NC	11413421412223211211313122131223122241211315274211221222111411211122111912111219211111113221131211111111	39.5 8	8.6	24.5 111.2
sc	127274522212583413232233321522433524411412142557111722536134222312542133241212221151141112113441314459623371332312326432566281424222313242334446228251728365621813353535	58.4 8	8.4	37.1 113.2
amaqua	127274525232363453233253324424453423411412132557111723535124522312242231145212212151362112112441314459623562332212226332565182434231213232335446228251728335619183353744	46.7 9	11.1	37.3 103.9
ldorado		13.2 5	6.8	13.6 244.8
			6.0	12.3 53.7
	463434335533346465455344334545475454334548344443344553435444333345464434447758756748865 1 6898963365543443634434333543434333444433334445444363333633 xx 44445444364564 1 4343834			48.9 108.9
		3.2 3	2.0	3.9 46.6
			4.2	7.6 48.5
ritchell		9.4 5	5.8	10.3 51.2
			10.6	17.3 55.3
	112212111111132211122111212111122211112211111212221111		13.0	19.3 55.2
	1222212127221132227127122211222117221112217213112227112711			
	1.1222112222222422212222222213221223221312222123122212312221232212322123212212			
	127223272222422211222221323132122332442222132231222232213222132221322222222			
	227332337323343222223337253243222733337422232733327342733273327322732			
	233232423252336344232433225333445223343342732322233333222362325434333423332224322533333322333332243233332243243233442232333422333224323332233322333223332233322333223332233322333223332233322333223332233322333223332233322333223333			
irmesatast		16.0 4	10.2	18.3 243.9
	5565464335542664333347534346554535646645754434474733445222323594671473321222225224665657756667556535555655455454556234522725364231264374453644733235276627225223282	25 0	10.4	E1 7 226 2
EECHH		23.9 4	19.4	
		47 4 5	20 0	65 A 326 C
andia	55654666555624875668677665467565535646645756537674755567544556459969167357347452844466565775666755535454555545455517674274536646156457465565966659881616747714425674			

RANCID





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

Telegram

• Alerts and team coordination

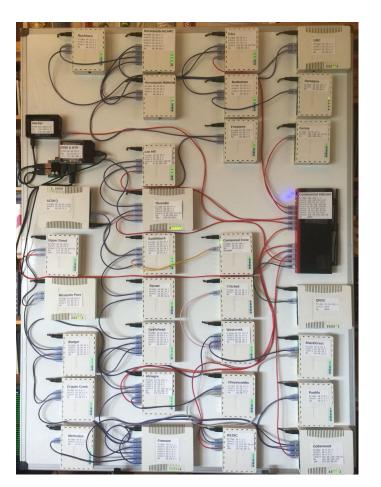




NetLab

 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

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