



# **Super WiFi (TV Whitespace) Networking & Extending Library Services into the Community**

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Delta County Library District

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# What is Super WiFi (aka TV Whitespace)

- Spectrum made available with the move of TV broadcasting from analog to digital
- Frequency range in the VHF (174-216 Mhz) & UHF bands (470-786 MHz)
- Unlicensed use under FCC part 15

# Uses of Super WiFi/TVWS

- Backhaul facilities (middle-mile)
- Point to point multi-point networking ( ex. SCADA)
- Point to multi-point (ex. WISPs)

# Characteristics of Super WiFi/TVWS

- Better reach than WiFi networking
  - Penetrates tree canopy and foliage
  - Diffracts around hills and buildings
  - Less attenuation from weather (rain/snow)
  - Long range ( up to 10 Km)
- Easy to set up...plug and play
- Cloud and Local Management options

# Where does Super WiFi/TVWS fit

- Where other wireless solutions have failed
- Where heavy tree foliage exists
- Hilly areas
- Rural, unserved and underserved areas
- Where towers are prohibited or impractical
- Areas of low population density

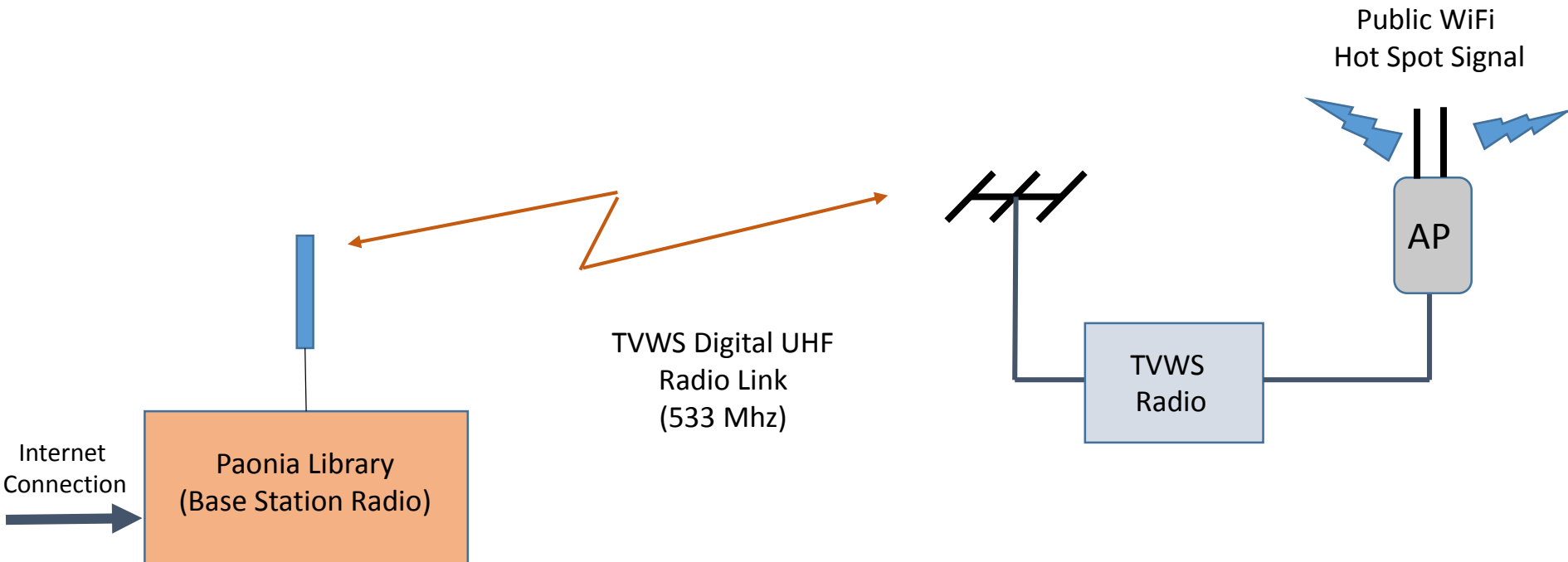
# Super WiFi/TVWS enablers

- FCC order issued (Part 15 h)
- Interactive spectrum database established (Spectrum Bridge, iConnectiv, Google)
- Technology enablers
  - Software Defined Radio (SDR) technology supports broadband operation in the VHF and UHF bands and FCC required “Brick wall” filtering
  - High speed multi-core DSP’s for advanced modulation (QAM16 used for highest throughput)

# Super WiFi/TVWS limitations

- TVWS is just another “tool in the wireless toolbox”
- It is not a replacement for 2.4 and 5 GHz point to multipoint WISP technologies
- Today, it is pricy but this will likely change with time
- Throughput is limited. Typical data rates are up to 10 Mbps in aggregate so you can only support up to 10 clients per base radio for WISP service and up to 40 for SCADA applications

# Super WiFi System Architecture



## Super WiFi (TVWS) Benefits

- Can punch through tree canopy, buildings and obstructions
- Easy to set up and manage
- Has a range of up to 10 miles
- Uses available TVWS spectrum
- Can support up to 16 Mbps data rates

## Hot Spot Locations

- Harvester Building on Grand Ave.
- Paonia Town Park stage



# Carlson OMU

Operations Panel

Stations

Cell Control

Licenses

Channels

Users

Home

## Stations

Register Station

Drag a column header and drop it here to group by that column

ID	Name	Guid	Description	Rbt	After-boot System	Last Reported	Controllable	Versions
<a href="#">546</a>	<a href="#">CSB00778</a>	927a7bdb-f985-43e6-8698-448221b119a5	Delta County Paonia Library Base 778	X	UMS 2013W43	Less than 1m ago	✓	Firmware: 18201 Variant:CWT4BSC Built:at 15:43:55 on May 10 2013 by JENKINSSSLAVE2:JENKINSSSLAVE2\$ Fpga: 15a Variant:NMAC180213_1505 Name:fpga2 Stack: 0.0.5042.8516
<a href="#">1058</a>	<a href="#">CST00166</a>	05a09ec3-994d-41c3-bb4e-bd711f17e1a5	Delta County Paonia CPE 166	X		Less than 1m ago	✓	Firmware: 18201 Variant:CWT4Terminal Built:at 15:40:22 on May 10 2013 by JENKINSSSLAVE1:JENKINSSSLAVE1\$ Fpga: 15a Variant:NMAC180213_1505 Name:fpga2 Stack: null
<a href="#">1060</a>	<a href="#">CST00165</a>	1751ede1-e520-4b13-be51-15638d84ed76	Delta County Paonia CPE 165	X		Less than 1m ago	✓	Firmware: 18201 Variant:CWT4Terminal Built:at 15:40:22 on May 10 2013 by JENKINSSSLAVE1:JENKINSSSLAVE1\$ Fpga: 15a Variant:NMAC180213_1505 Name:fpga2 Stack: null

1

Displaying items 1 - 3 of 3

# Carlson OMU

Station Properties: CST00165

## Terminal 1060 Details

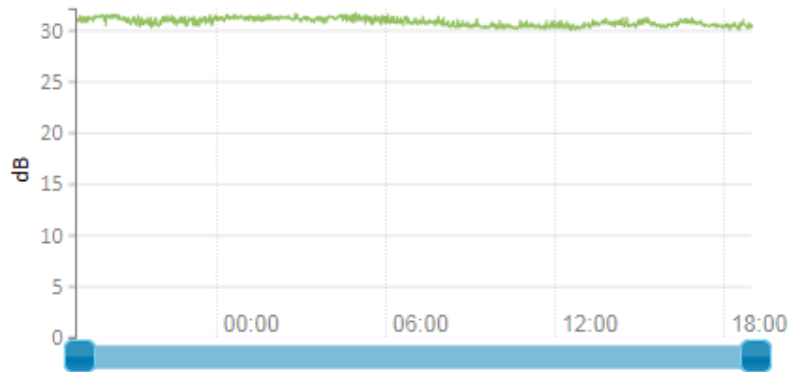
Refresh

Name	CST00165	Whitespace Provider	SpectrumBridgeLiveWsdB
Description	Delta County Paonia CPE 165		
StationGuid	1751ede1-e520-4b13-be51-15638d84ed76		

Reboot

Health Registration Topology Performance

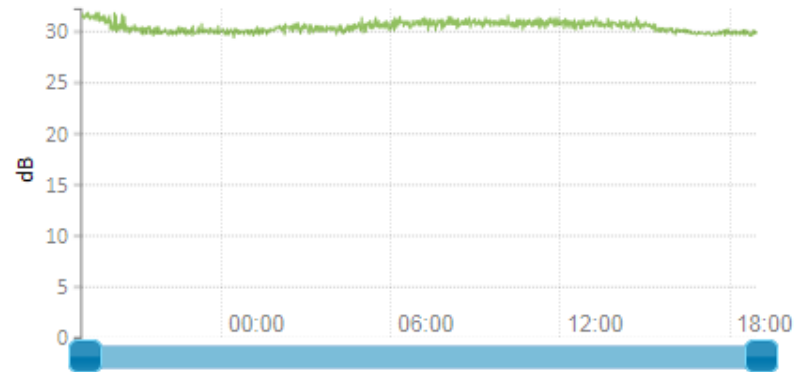
### Uplink SNR



Last Reading: 30.40 dB. at 2014-05-27 19:01:12Z

Last 24 Hours Refresh

### Downlink SNR



Last Reading: 30.00 dB. at 2014-05-27 19:01:12Z

Last 24 Hours Refresh

# Meraki Dashboard

## Monitor

### Overview

Map & floor plans

Access points

Clients

Packet capture

Event log

Air Marshal

Location heatmap

Summary report

PCI report

## Configure

### Organization

### Help

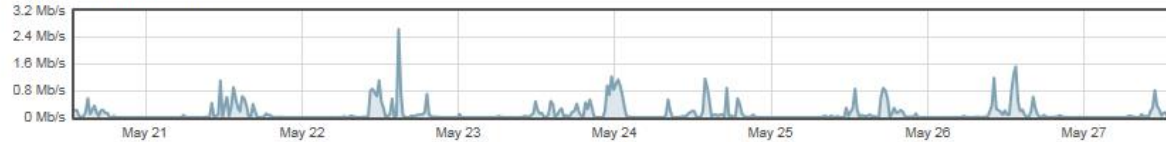
New in Dashboard: [Monitor-only Administrators and 4 other features.](#) [Read more.](#)

[Delta County Library District networks >](#)

## Library Public Hotspots

**100 clients** transferred 1.13 GB in the last day.

Usage over the last week



## Map of clients per access point

Mouse over or click for more information

Place APs on map

Add APs



# Meraki Dashboard

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- Overview
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- Clients**
- Packet capture
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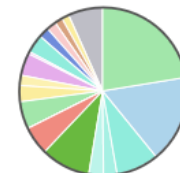
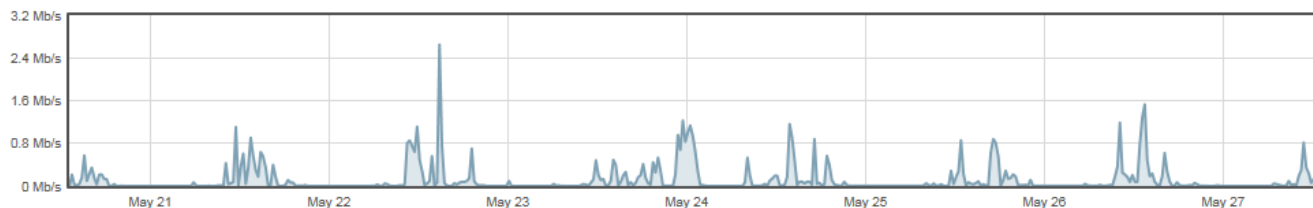
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## Clients

all ▾ for the last week ▾

8.73 GB (↓ 7.42 GB ↑ 1.31 GB)

Applications ▾



[More »](#)

Policy ▾ Search clients... ▾ 272 client devices

[Add client ▾](#) [Download as ▾](#)

<input type="checkbox"/>	Status	Description	Last seen ▾	Usage	OS	First seen	Connected to	+
<input type="checkbox"/>	📶	<a href="#">kindle-0a281bf1b</a>	May 27 13:09	622 KB	Generic Android	Mar 06 17:27	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">bc.cf.cc.0a:2a:64</a>	May 27 13:09	548 KB	Other	May 27 11:29	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">android-88d9d3bda79f7776</a>	May 27 13:09	9.3 MB	Android LG Nexus 5 & 7	Oct 17 17:51	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">android-53db069088cdea3d</a>	May 27 13:09	16.5 MB	Android LG Nexus 5 & 7	Oct 22 16:01	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">Rob-Zieglers-MacBook-Pro</a>	May 27 13:09	430.4 MB	Mac OS X	Oct 16 12:55	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">NWPROJECTION-PC</a>	May 27 13:09	3.3 MB	Windows 7	May 26 17:45	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">ERIC-ACER</a>	May 27 13:09	1.2 MB	Windows 7/Vista	May 27 12:50	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">COLLEENSIPHONE</a>	May 27 13:09	13.8 MB	Apple iPhone	Oct 10 13:24	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">Amy-DeLucas-iPhone</a>	May 27 13:09	7 KB	Apple iPhone	Nov 13 08:46	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">Brian-Amstutzs-MacBook-Pro</a>	May 27 13:07	1 KB	Mac OS X	Jan 29 19:49	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">Sadies-Fresh-iPod</a>	May 27 13:05	468 KB	Apple iPod	Feb 02 18:17	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">android_e6852784c2546e5</a>	May 27 13:04	1.0 MB	Generic Android	Nov 07 23:15	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">android-a598d59ee2eb668</a>	May 27 12:55	2.8 MB	Generic Android	Mar 26 12:19	<a href="#">Library Town AP</a>	
<input type="checkbox"/>	📶	<a href="#">brads-MacBook-Air</a>	May 27 12:49	92.4 MB	Mac OS X	Mar 10 17:28	<a href="#">Library Town AP</a>	

# Our topography – view from the roof



# Omni-directional Base Antenna



**Paonia Library**

# Base-station Radio



# Carlson Rural Connect Client Radio





# Client radio installation in NEMA box



# Client Log Periodic Antenna



# Homebrewed Access Point Bracket



# So, why is a library doing this??

## Delta County is:

- Rural and poor
- The size of Rhode Island
- Has only 30,000 residents
- Has huge areas of underserved and unserved territory
- Incumbent service providers don't invest because of the above conditions

*In Delta County, the Libraries are the Centers of the Community. In many cases, we are the only place where people can go to get on the internet to apply for a job, file a tax return, seek information, do e-mail, browse social media and do the myriad of things that you can only do on the internet!*

**Feel free to contact me !**

**John Gavan**

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