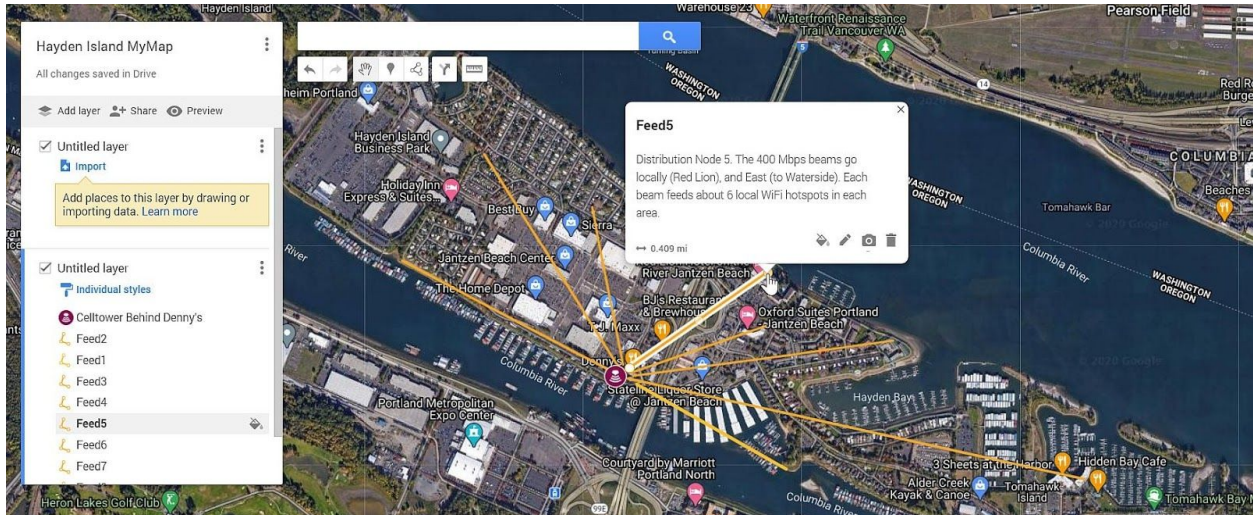


Free WiFi Proposal for Hayden Island

By Sam Churchill (schurchill@gmail.com)

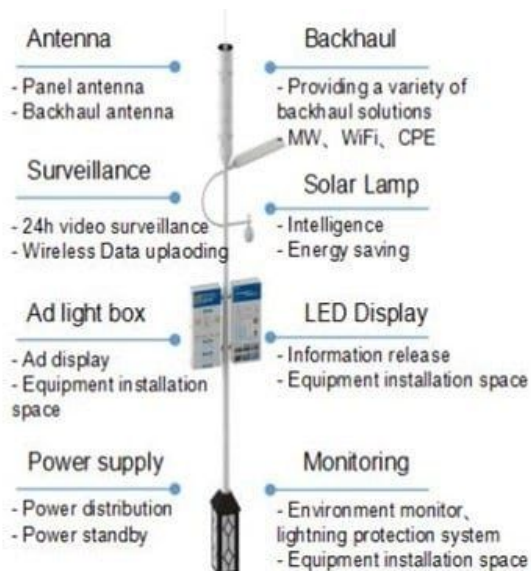
INTRODUCTION

[Some small towns in Oregon, like Sandy, have dozens of free internet access points.](#) The RV park on the west side of Hayden Island provides “free” WiFi to all its residents. I’m using it now. This paper describes a similar “free” system for the entirety of Hayden Island.



REQUIREMENTS

Municipal WiFi must be significantly cheaper, faster and more reliable to make island-wide WiFi feasible. An island-wide free WiFi service would need to make economic sense, be self-sustaining, secure, reliable, technically viable and provide a compelling solution for island residents and businesses.



FEASIBILITY

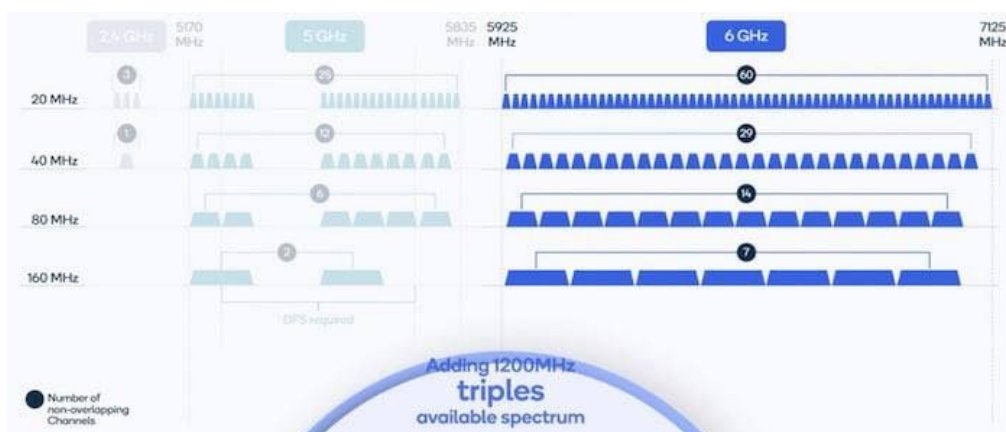
Simpler architecture, faster speed, better range, and lower cost wireless broadband is now available. That is made possible by "free" [1000 MHz of spectrum in the 6 GHz WiFi band](#), "free" 80 MHz in the 3.5 GHz CBRS band, and integrated hardware and software that make managing a system relatively easy and cheap. No cell service required.

Below are the Portland internet providers with the greatest coverage.

INTERNET PROVIDERS IN PORTLAND	TYPE OF INTERNET	COVERAGE AVAILABILITY
XFINITY from Comcast	Cable	98.8%
CenturyLink	DSL and Fiber	DSL: 75.7% Fiber: 65.2%
Stephouse Networks	Fixed Wireless	22%
Frontier Communications	DSL and Fiber	DSL: 16.1% Fiber: 16%
Viasat Internet (formerly Exede)	Satellite	100%
HughesNet	Satellite	100%

Recent developments that make "free" WiFi for Hayden Island feasible include:

- The WiFi band extended into the 6 GHz band with 1000 MHz of free spectrum
- The (free) CBRS band at 3.5 GHz with mobility and range similar to cellular
- MIMO beamforming antennas for feeding multiple hotspots on each beam
- Consumer WiFi hotspots with (local) 3.5 GHz backhaul
- A single integrated management system for provisioning.



CITIZENS BAND RADIO SERVICE

[CBRS stands for Citizens Broadband Radio Service](#). It's free, like WiFi, with improved range and service like cellular. Anyone can put up a tower and use it.



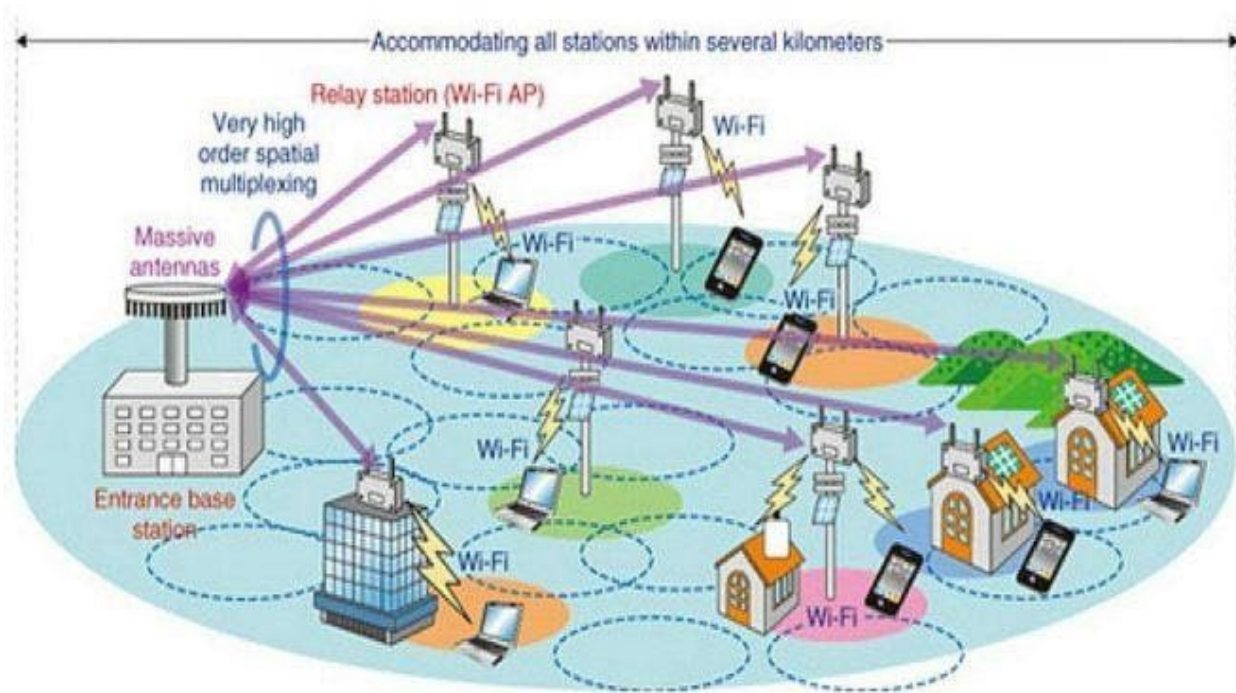
The new free 3.5 GHz band can connect literally hundreds of outdoor Wi-Fi hotspots. Goes more than a mile from the tower. WiFi would be lucky to get 600 feet. It makes municipal WiFi significantly cheaper, faster and more reliable. In addition, 1000 MHz of clean, new WiFi spectrum is now available at no cost. Combine it with the (free) 3.5 GHz band and you have simpler architecture, faster speed, lower cost, and better range and service.



CBRS enables a small community like Hayden Island to provide VERY low cost wireless service. The island could support security cameras, free public WiFi, residential broadband averaging 25 Mbp and other services. At little or no cost.

SYSTEM ARCHITECTURE

The local Wi-Fi access points provide residential (or mobile) access. Each cluster of homes is served by numerous WiFi access points. Those access points are fed by a wireless regional distribution node (a CBRS base station) on top of nearby buildings. Those, in turn, connect by wireless backhaul to a fiber termination point. A Network Manager provides system-wide provisioning.



Here's how I would do it:

- I'd run 10 Gigabit fiber up the cell tower or the water tank behind Denny's.
- The Denny's mast would deliver 6 GHz (WiFi 6e) for a 1Gbps network backbone to distant building rooftops.
- CBRS Access Points, located on rooftops at 5-10 key population centers on the island, provide the neighborhood 3.5 GHz connection to local WiFi hotspots.
- Some 30-50 Mobile hotspots connect to the rooftop distribution hub and provide local WiFi. Each WiFi hotspot provides (free) local internet access to about 20 people.

COST

How much would this cost?

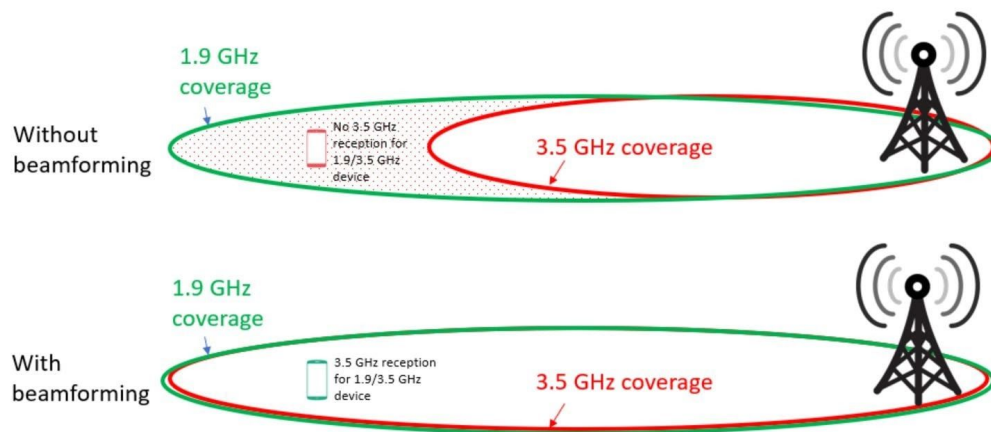
- Local WiFi Access Points - About \$200/each x 50 for \$10K
- Regional 3.5 GHz Hubs - About \$1000/each x 8 for \$8K
- Point to Point links - About \$500/pair x 8 for \$4K
- System engineering and installation - \$8K
- **TOTAL - let's say \$30K-\$50K**

Yes, that's not free. It would cost as much as a car. But world headquarters for this new 3.5 GHz technology is right here at Intel. Plus we live on an island. It's physically isolated -- good for municipal testing. In addition, there are MANY government and private grants available. In the next 30 days some \$2 trillion may be available to communities for CARES II type grants.

REVENUE

Revenue is provided by

- Display advertising,
- Monthly data usage over 100 MB/month (at \$10 per 100MB),
- Discrete data access to individual devices
- Ancillary services (such as tracking devices for boats, etc.)



The basic system would be free. You get 25 Mbps and 100 GB/month. All the time. Need more monthly data? That costs you \$10/month for every 100 GB. Additional high capacity data packages are also available.

If you don't want to "share" a local hotspot, then you could have your own 25 Mbps and 100 GB/month service to your own hotspot for \$12.95/month. Need more monthly data? It's only \$10/month per 100GB.

PRICE COMPARISON

How would this pricing and service compare with Verizon's mobile hot spot plans?

VERIZON: \$30/month = 30 GB data

OURS: \$30/month = 300 GB data

That's 10X more data. The first 100GB is free if you're

sharing the hotspot. Comcast costs \$60-\$120/month. With no mobile. Cut the cable!

Unlimited Plus

Get 5G Ultra Wideband and the most premium data for your tablets, jetpacks, MiFis and hotspots.

\$30

Plan cost per month with an existing smartphone on an Unlimited plan. Plus taxes & fees.

Tablets

Unlimited 5G Ultra Wideband

Unlimited 4G LTE (+30GB premium data)

Unlimited mobile hotspot 30GB of 4G LTE

Jetpacks, MiFis and hotspots

Unlimited 5G Ultra Wideband

Unlimited mobile hotspot 30GB of 4G LTE

Unlimited

Connect your tablets, jetpacks, MiFis and hotspots.

\$20

Plan cost per month with an existing smartphone on an Unlimited plan. Plus taxes & fees.

Tablets

Unlimited 4G LTE (+15GB premium data)

Unlimited mobile hotspot 15GB of 4G LTE

Jetpacks, MiFis and hotspots

Unlimited mobile hotspot 15GB of 4G LTE

Unlimited

Save when you just need to connect a smartwatch.

\$10

Plan cost per month with an existing smartphone on an Unlimited plan. Plus taxes & fees.

Smartwatches

Unlimited 4G LTE (+15GB premium data)

Unlimited Talk & Text

REALISTIC? Is this doable? Does it pencil out? I'm not the expert. Talk to Intel. It's a local call.

LINKS

<https://www.cbrsalliance.org/>

<https://www.cbrsalliance.org/contact/>

<https://www.cambiumnetworks.com/.../the-difference.../>

<https://www.telecompetitor.com/cbrs-backhaul-supports.../>

<https://www.smartcitiesdive.com/.../mcallen-txs.../585863/>

<https://www.fcc.gov/keep-americans-connected>

<https://www.npr.org/2020/05/29/865908114/small-america-vs-big-internet>

<https://cdn.ilsr.org/wp-content/uploads/2012/12/wilson-greenlight.pdf>

<http://www.hayden-island.com/free-wifi/>

<http://www.hayden-island.com/sustainabilitynet/>

<http://www.hayden-island.com/gigabit/>

3 GHz PMP 450m Access Point

Cambium Networks industry-leading 450 platform adds Massive Multi-User MIMO capability with *cnMedusa™* technology, now available at 3 GHz.

Key Features:

- **cnMedusa™ technology** enhances sector capacity by combining a smart beamforming antenna array with multiple RF transmit and receive chains, effectively multiplying available capacity by more than three times.
- Capable of throughput of **450 Mbps** in a 20 MHz channel, and **over 800 Mbps** per sector when using a 40 MHz channel.
- Multi-User MIMO uses available spectrum more efficiently by making simultaneous transmissions to multiple subscribers, increasing **spectral efficiency** to more than 50 bps/Hz per site.
- **Protects your investment** in the 450 platform equipment by continuing to utilize existing Subscriber Modules (450 and 450i) platform subscribers work with the 450m and *cnMedusa* technology)
- Dramatically reduce the effect of interference in both Uplink and Downlink with **smart beamforming**

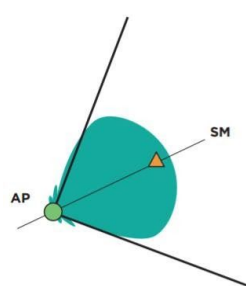


Figure 1
Antenna Pattern for
Sector Mode Operation

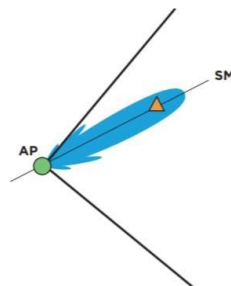


Figure 2
Beamforming to a
single user

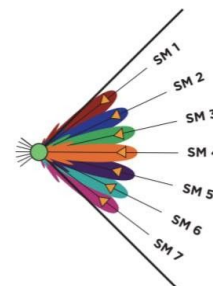


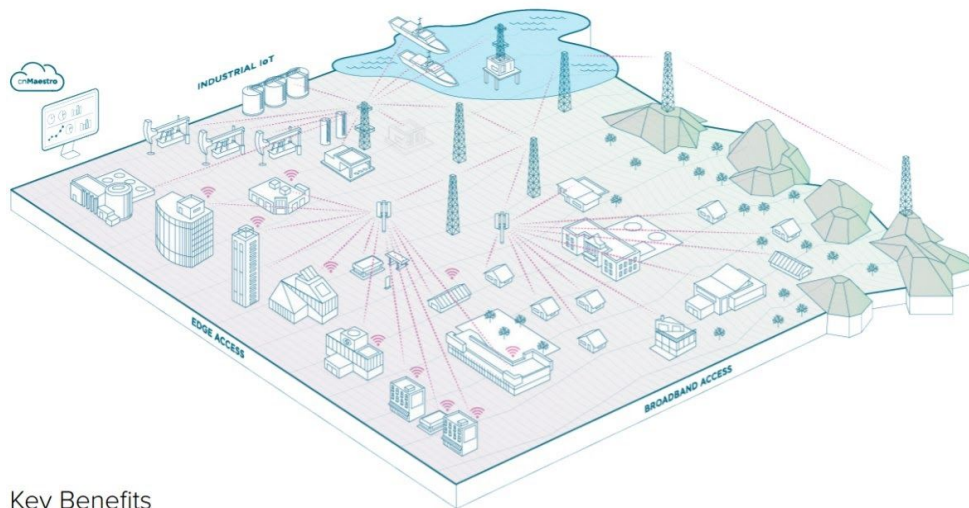
Figure 3
Beamforming to seven
users simultaneously

SUMMARY

I would like to work with someone to craft a basic proposal for island-wide free WiFi. It would need to make economic sense, be self-sustaining, secure, reliable, technically viable and provide a compelling solution for island residents and businesses.

Free Community WiFi is now more practical and enabled by:

- the WiFi band with extended 6 GHz band in clear spectrum,
- the CBRS band with Federated, Google or others managing spectrum,
- MIMO beamforming antennas for multiple hotspots on each beam,
- WiFi hotspots with 3.5 GHz backhaul (not cellular)
- Five to ten Gigabit fiber feeds the basestation tower and wireless backhaul
- A single integrated management system manages and provisions the system.



Key Benefits

Together these enhancements will make municipal WiFi significantly cheaper, faster and more reliable. Simpler architecture, faster speed, better range, lower cost. "Free" 1000 MHz in the clean 6 GHz band and "free" 80 MHz in the 3.5 GHz band. I think it would be fun...and provide an asset for the whole island.

