Hayden Island Community WiFi

Resilient Neighborhood Broadband with Satellite

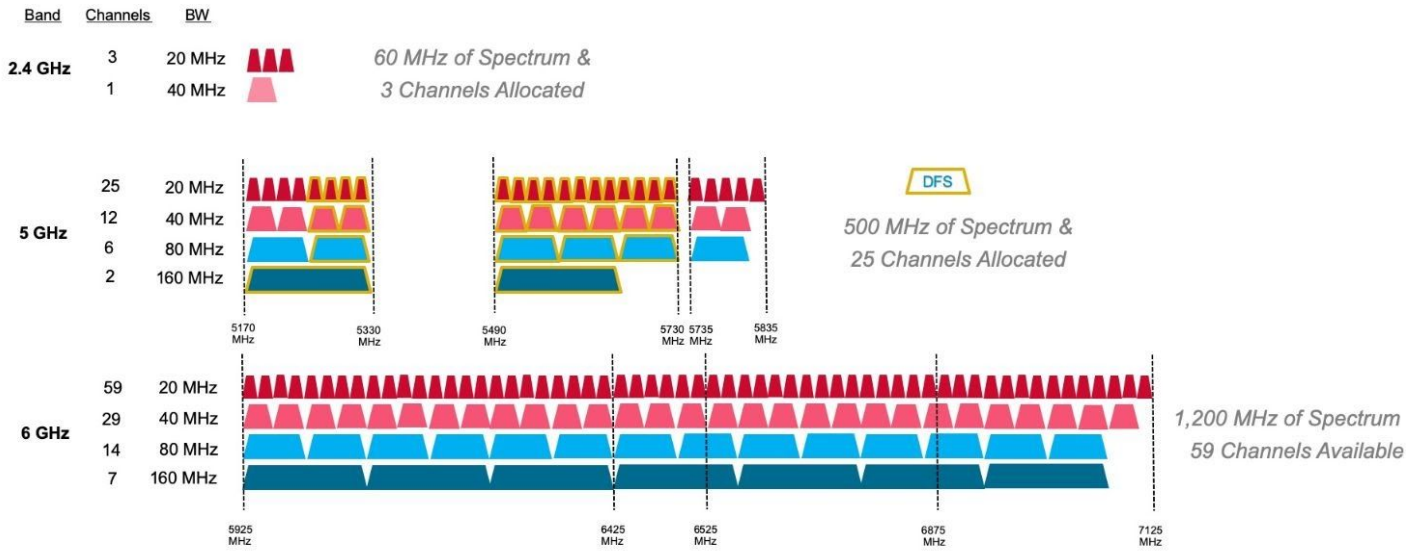
ABSTRACT:
This paper describes a low-cost, community WiFi service for Hayden Island. The goal is to provide communications continuity after a major earthquake. Internet connectivity could be provided without island power or cellular service. Operating power is supplied by 1000 watts of rooftop solar while internet satellite service provides broadband connectivity. The new 6 GHz WiFi band, authorized by the FCC in April, 2020, provides residents with essentially unlimited wireless service for an estimated $20/month.

This is NOT a proposal for internet service on the island. It is a description of what is now possible. The intention is to open discussion for alternatives to Comcast or Cellular that are faster, cheaper, and more resilient.

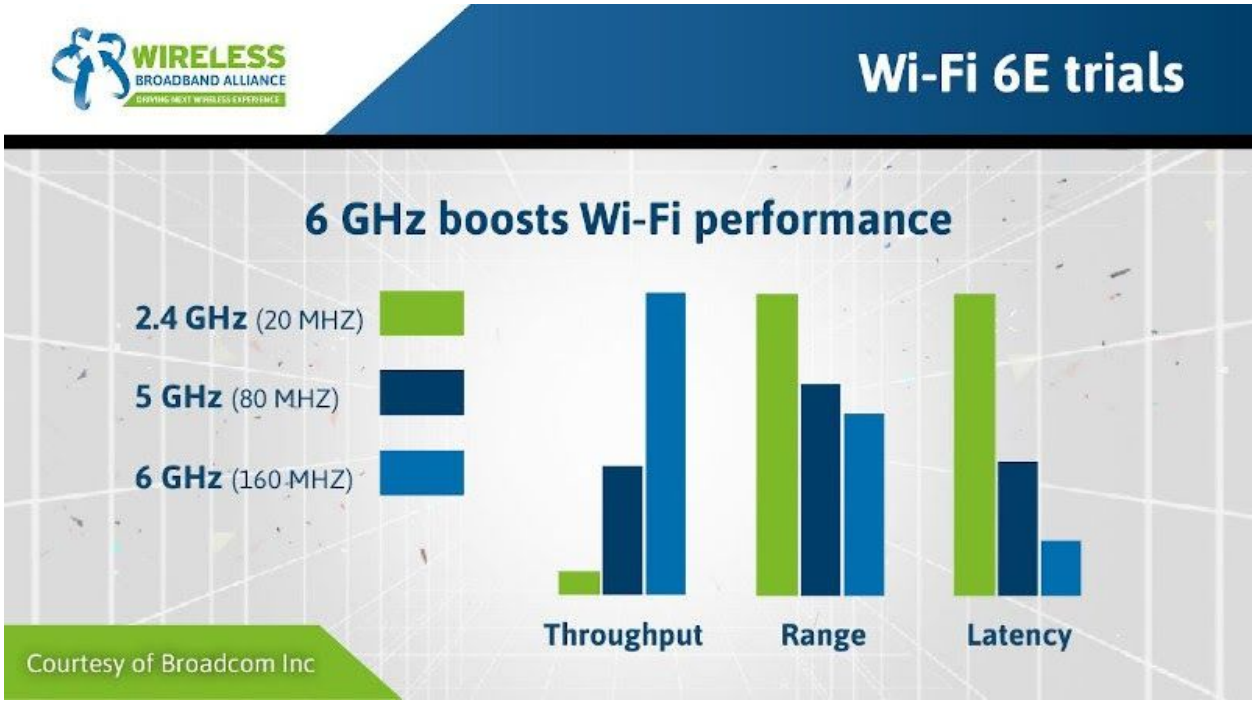
INTRODUCTION

Three recent developments are expected to revolutionize wireless internet in the next 6 months. They are; (1) the WiFi6e standard - with 1.2 GHz of additional spectrum, (2) the SpaceX Low Earth Orbit satellite internet service, and (3) cost/effective solar panels and lithium batteries that can power a community antenna.

The newest WiFi standard is WiFi6e (for “extended”). It adds 1.2 GHZ of additional spectrum (from 5.925 GHz - 7.125 GHz), effectively doubling WiFi’s spectrum. This spectrum was once used by satellite broadcasters and by terrestrial microwave. On April 23, 2020, the FCC mandated this band to be repurposed for unlicensed WiFi, effective immediately.



For the first time, more than 100 users should be able to share one community antenna. WiFi6e access points make it possible. The previous standard, WiFi 6 (802.11ax), already doubled speeds over WiFi 5 (802.11ac). WiFi 6e will double speeds again, mostly because of the extra 1.2 GHz of spectrum now available. Rooftop antennas (on a community center or tall building), may provide a line of sight range of 1-3 miles, with a bandwidth supporting hundreds of simultaneous users.



This paper proposes a resilient Hayden Island community WiFi service. It would be available free or for low cost.

SATELLITE BROADBAND

Satellite broadband is currently used by RVers and rural residents, over ViaSat (69W) and HughesNet (101W). Hughes has enabled 32,000 community Wi-Fi hotspots. But geosyncronous orbit internet satellites provide high latency and unsatisfactory internet service. That's where the SpaceX terminal, Starlink, comes in. It provides sub 20ms latency (similar or better than LTE service) at (presumed) competitive prices. OneWeb expected to have user terminals between $1,000 to $1,500 for community Wi-Fi services.

Currently, geosynchronous satellite providers ViaSat and HughesNet provide a solution for RVers. I live in an RV park on Hayden Island, but few RVers subscribe to satellite internet. That's because geosynchronous satellite internet suffers from long latency, bulky equipment, difficulty pointing at satellites and high cost (about $100/month).

LEO broadband satellite alternatives promise far better latency, size and cost. The SpaceX satellite service, **StarLink**, uses satellite constellations some 350 miles high, not 25,000 miles up. Service is expected to start in the fall of 2020. Hughes, an EchoStar company, is a distribution partner for OneWeb. Terminals are small and don't require pointing at satellites, enabling faster, cheaper and easier broadband.

Mobile LTE hotspots are faster and cheaper than most current satellite broadband alternatives,, especially if they support Band 71 (600 Mhz), Band 41 (2.5Ghz) and Band 48 (3.5GHz). But they NEED cell service.

For local service 1-3 miles away from the community WiFi antenna, ordinary mobile hotspots like the InSeeGo 8000 can be used. Adding the 6 GHz band (for WiFi backhaul) to the community center antenna, could enable floating homes, boat residents, RV users, and others to get unlimited broadband for $20/month. The "new" bandwidth, in the 6 GHz band, enables four times the number of users to share one gigabit/sec connection. Because the band will be added in many WiFi hotspots next year, the end user device will be cheap.

EMERGENCY BROADBAND

After an emergency, normal communications may not be available. Phone lines, cellular communications and basic electrical power may be down. Perhaps for weeks or months. The only real solution to this dilemma is satellite internet.

After a magnitude 9.0 earthquake, Hayden Island residents may lose virtually all power since the Columbia River power transmission towers near the west side of the island may topple. That would then remove all power from Hayden Island's PGE substation by the railroad tracks. Without power, cellular towers can only operate about 8 hour (on batteries), if they're not damaged themselves. Satellite broadband may be the only alternative for internet access.

Figure $1000 for a Starband terminal with one WiFi access point. The satellite broadband would actually be a backup. The main internet connection would be a fiber connection based on Comcast's 1 Gigabit service. The satellite connection is just a supplementary service and always "hot". It's a practical solution to the lack of broadband after an emergency, and a cost/effective broadband solution the rest of the time.

SOLAR POWER

Solar power and lithium power packs are getting cheaper. A van rooftop can support up to 1000 watts of solar panels (for about $2 a watt). Combined with two, 1000 watt/hour lithium powerpacks with built-in 1000 watt sine wave inverters ($1200 each) the community antenna could provide 24/7 broadband communications to a neighborhood. Grid power or not. If Comcast is down we still have satellite internet.

A total battery capacity of 2000 watt/hours means a power load of about 200 watts should last 8-10 hours. A small gas generator or an 800 watt wind turbine could provide back-up. No power? No problem. Add $2000 of solar panels and $2500 for two battery/generators. Problem solved.

REVENUE

Could this community WiFi service pay for itself? I don't see why not? Let's say it costs us $200/month for a broadband connection to both cable and the satellite. If we offered 50 Mbps service at $20/mo, then just ten users might pay for the community connection costs. Maybe weekly service to boats or RVs could also be offered for $10/week.

BUDGET

How much will this cost? The idea is not to spend any money. We don't want to waste money on anything that couldn't be acquired at little or no cost. Our motto is think small, but plan for big events. We are only interested in real solutions for community safety and well being. With this in mind here's a VERY rough cost estimate:

1. One, rooftop mast with two 17dB panels and two WiFi6e hotspots …... ……$1000
2. Starlink terminal and one Comcast connection at 1 Gbps …...……..…….$1000
3. Five WiFi6e mobile hotspots @$200 each ……..……..……$1000
4. Ten, 17db external antennas for mobile hotspots @$50 each ……..$ 500
5. Five, 200 watt solar panels @ $400 each ……..…….$2000
6. Two, 1000 w/hr Ecoflow Delta battery banks with 1Kw inverters @$1250 ….$2500
7. Site installation and survey costs …….. $1500
8. Misc. (connectors, wiring, misc. Gear, etc.) ……..…...……$1500

$10,000

SUMMARY

This paper proposes a Hayden Island community WiFi antenna using a satellite internet connection and WiFi6e for the "last mile" connection to the community antenna. The main idea is to provide island residents with access to broadband internet after an earthquake. It would utilize Starlink Low Earth Orbit (LEO) satellite broadband, free community WiFi, and solar panels to provide broadband communications. No grid power or cell service required. The goal is to provide neighborhood resilience and communications in the most cost/effective manner with a budget under $10k. It's anticipated that grants would fund at least 50% of the project.

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