Sustainability Net

Proposal for combining vehicle charging with community wireless for resiliency

by Sam Churchill

A state-wide network of Electric Vehicle Charge stations using standardized containers is proposed in this paper. Oregon Lawmakers plan to curb carbon emissions with the 2019 Clean Energy Jobs bill. These EV charge stations may help make electric transit practical in rural areas while generating self-sustaining revenue.

There are two goals for this paper:

- Plan for an energy future with the lowest emissions.
- Provide for resilient communications after the expected earthquake.

Container buildings have grown in popularity. They are strong, cheap, and easily moved. Whole Container Cities have been created.

Communications after a subduction zone earthquake may be nearly impossible. Solar-powered wireless (with satellite backhaul) can be faster and cheaper than cellular. Everything in one container. Easily shipped. No installation. Self-contained. Self-supporting.

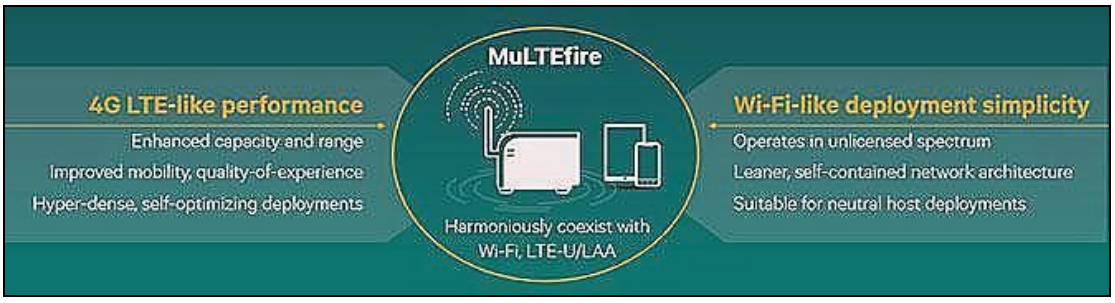
A state-wide network of container-based charge stations could provide both power and communications. Charge stations and community wireless provide resiliency and revenue along with bike/car sharing and other enterprises. Anywhere.

A Community PrepHub could supplement the containers' self-sustaining electric and communications gear, providing water, hand-held radios, first aid supplies, and other post-earthquake resources.

Container Components

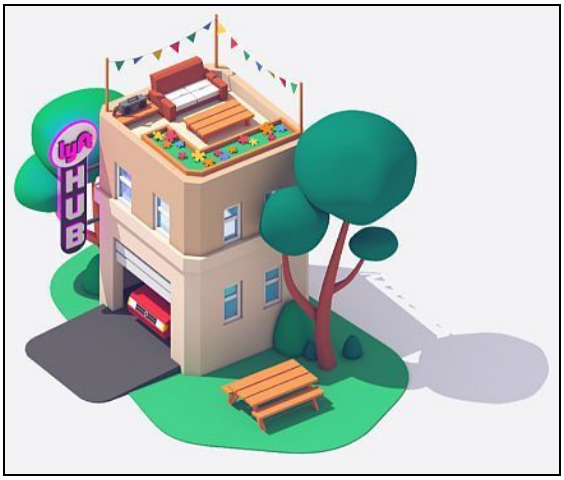
1. Electric Vehicle charge stations fit in one 20 ft container. It utilizes 6 KW of solar, battery storage, and Level 2 charging for EVs. Resilient. Cheap.

2. Community Broadband Radio Service (CBRS) spectrum provides community broadband for a radius of 3-5 miles using 3.5 GHz — available on phones this year. Backhaul by satellite broadband. One 20 ft container, with a utility pole mast, delivers communications resiliency.



3. **Bike/scooter sharing**, funded by Uber or Lyft (Motivate), could be housed at the Hub. Bikes and scooters can be tracked with the wireless link. A coffee shop or bike share provides additional revenue…and Last Mile transportation.

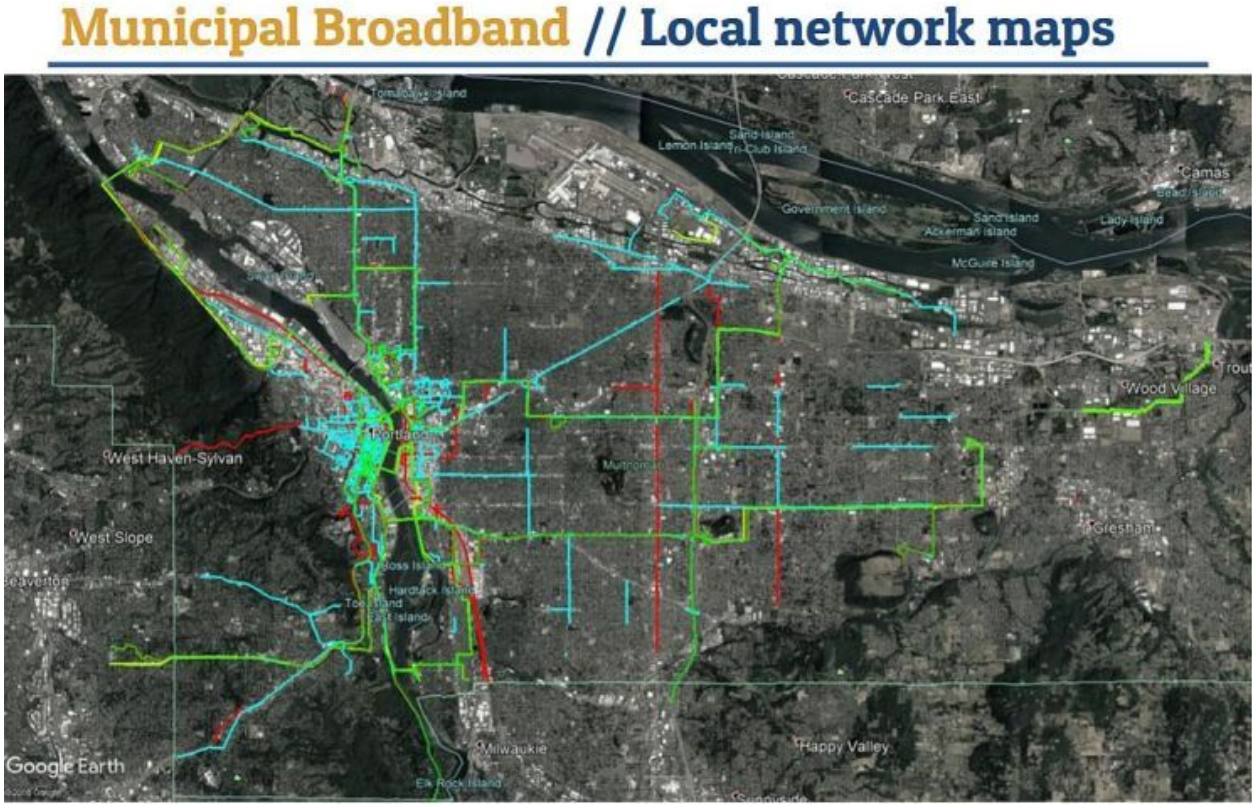
4. **Electric transit** could save thousands every month. On demand or scheduled. Why burn money up? Lyft will allow drivers to rent electric vehicles using their Green Mode.



5. Personal Tracking. If there's a need to track things, a LoRa device, using the unlicensed 900 MHz band, like a $50 Micro Tracker can track people and things at vivirtually no cost or cell fees.

Broadband Everywhere

Broadband everywhere in the State of Oregon would be a key feature. Municipal fiber would cost consumers 2-5 times more for the same 100 Mbps–1 Gbps performance…with ***no mobile access***.



It's basic economics. Wireless is more affordable than fiber. Digital equity manifest. T-Mobile claims it would deliver "100-Mbits" to two thirds of the US if it merges with Sprint. Sprint's 1 Gbps LTE uses 2-3 channels (40-60 GHz total bandwidth in their 2.5 GHz band). Same deal here.

The current 150 MHz-wide, 3.5 GHz band has lots of spectrum. Plug & Play. Shared spectrum, shared radios, shared infrastructure. Lower cost.

Frequencies assigned in the 3.6 GHz band spectrum auction

FREQUENCIES		METROPOLITAN AREAS						REGIONAL AREAS							
		ADEL	BRIS	CANB	MELB	SYDN	PERT	NQLD	CQLD	RNSQ	RSWN	RVIC	TASM	RESA	REWA
3575	3580														
3580	3585														
3585	3590														
3590	3595														
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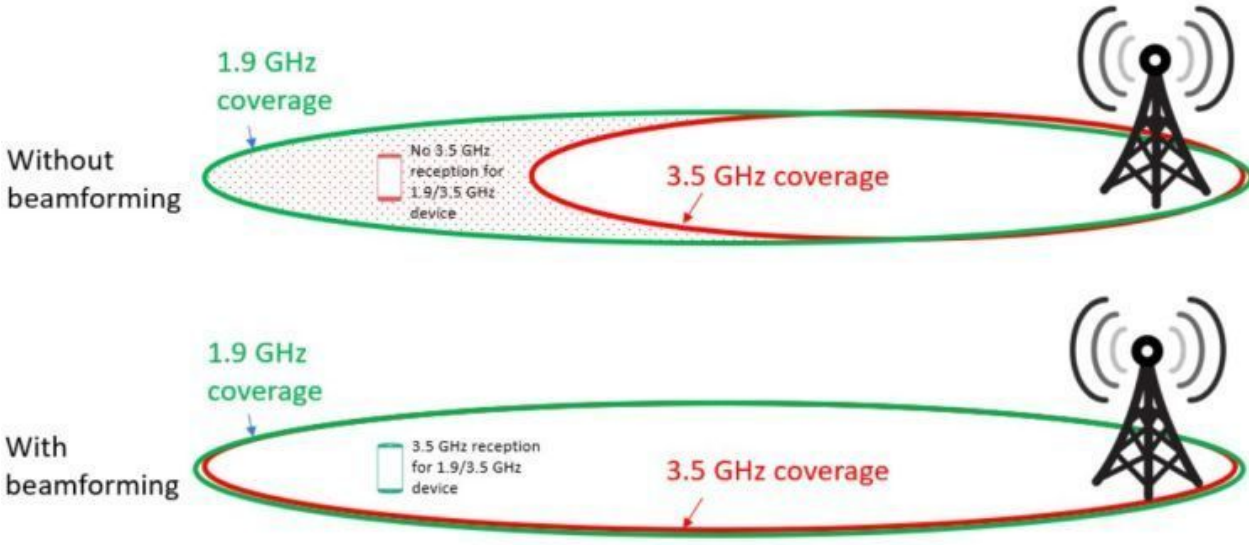
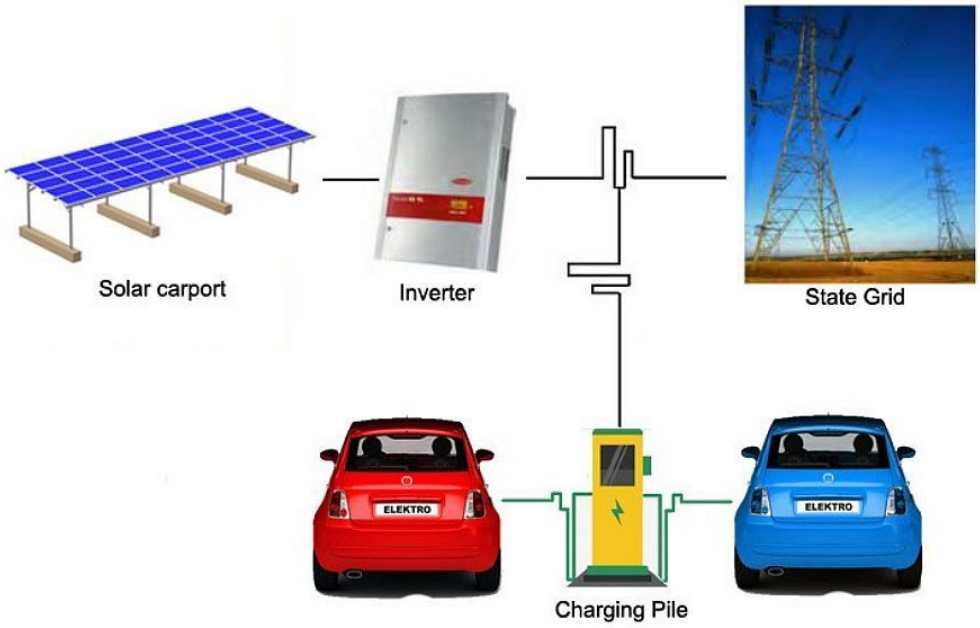
Australia auctioned off their 3.5 GHz spectrum for 5G. The USA provides it free. Get a hockey puck or phone. Done. No trenching. No truck roll.



We're focused on off-the-shelf CBRS gear. Phones like Pixel, Motorola and Essential *already* have 3.5 GHz built-in, with 3.5 GHz mobile hotspots available soon. Some 400 megahertz of mid-band spectrum may be available – nearly the combined capacity of the top three carriers.

Vehicle to Grid

If grid power is lost or unavailable, solar power kicks in. A single 13.5 kWatt/hr Tesla Powerwall can supply 500 watts X 20 hrs or 10 kWatt/hrs. That's our working power budget. No A/C, 150 watts for satellite, 250w for CBRS, 100w for lights. Is it stingy? Yes.



Twenty, 350 Watt panels produce up to 7kW in a 14′ X 16′ space. Over 8 hrs, that's up to 56 kWatt/hours.

Vehicle to Grid, in a 60 KW/hr Nissan Leaf, can use the car's battery *to provide power* in an emergency.

The car *is* the emergency battery.

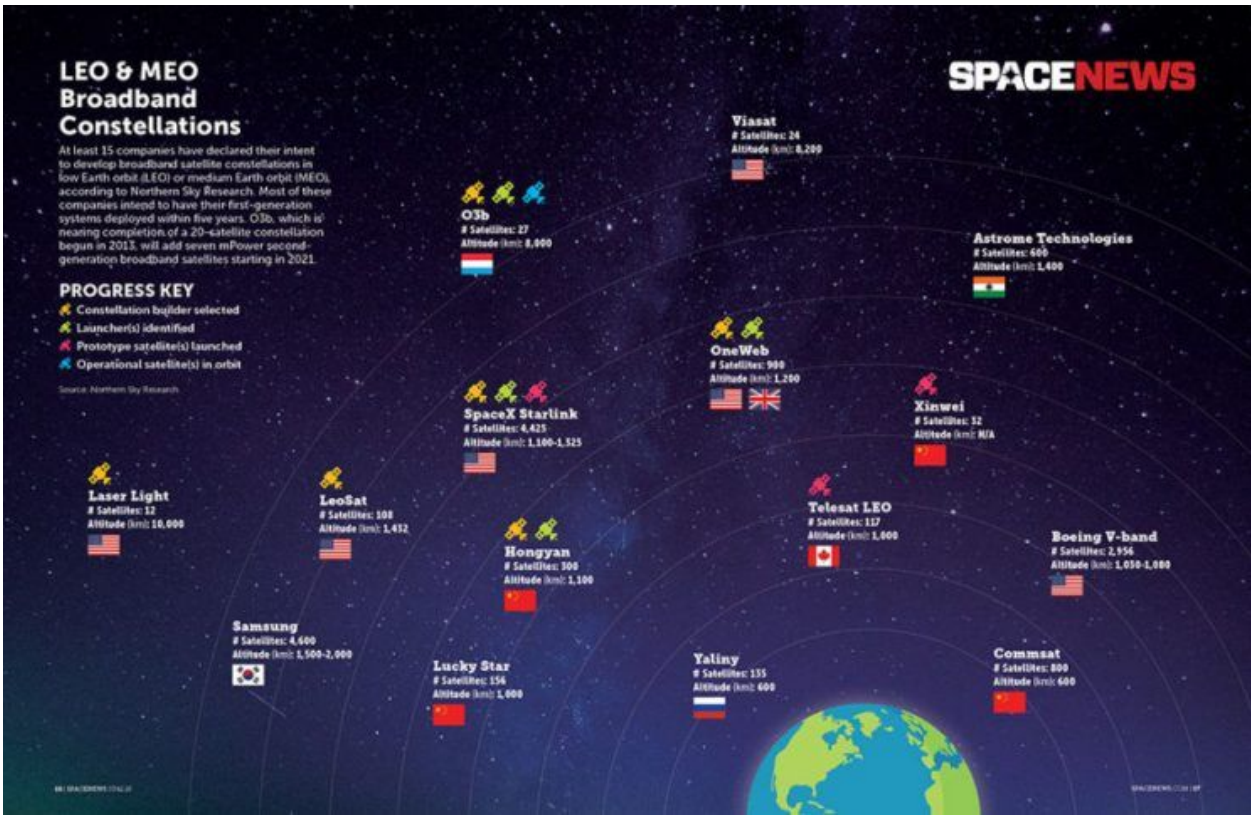
Expensive and bulky batteries can be eliminated from the container, saving weight and cost. More capacity, more flexible, resilient.

Rent the car. A Nissan LEAF e+, hooked to a 100 kW charger, can fill-up in about 30 minutes.

Arcimoto has a $12,000 three-wheeled electric vehicle. Cheaper than a couple of Tesla Powerwalls.

GEO-based ViaSat 2 & 3

Satellites work when cellular is down. High throughput satellites today provide cheaper broadband than any cellular plan.



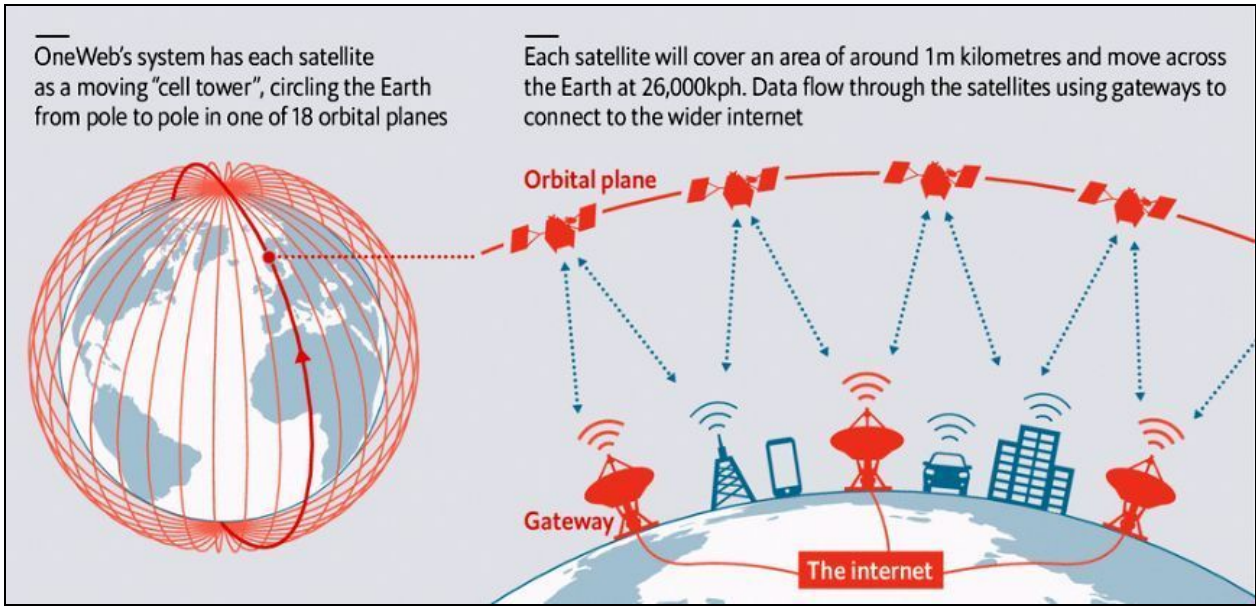
U.S. satellite broadband providers Hughes Jupiter-2 (97 West) and ViaSat-2 (70 West) both have massive new geostationary satellites launching in 2020. Hughes Jupiter-3 will deliver half a terabit per second while ViaSat-3 expects to deliver around 1 Terabits/sec.

But geosynch satellites are designed to operate for 15 years, making the platforms obsolete within a few years, notes SpaceNews.

LEO Backbone Networks

Proposed new LEO internet satellites such as OneWeb, SpaceX Starlinkand Telesat all plan LEO broadband constellations starting in 2020.

Cheap electronically steered flat panels are the key breakthrough here. ALCAN, Isotropic and Viasat have $200-$500 flat panel antennas. Kymeta, Phasor and ThinKom are pricier.



MEO Backbone Networks

SES' O3B has a MEO orbit. An SES fleet of seven "super-powered"mPOWER Medium Earth Orbit is also scheduled to launch in 2021. O3b mPower has triple the capacity of the ViaSat-3 constellation with a spot beam delivering up to 10 Gigabits to one terminal. Latency like fiber.

These LEO and MEOs will compete with today's GEO-based ViaSat and HughesNet. Figure several hundred dollars per month for 100-200 Mbps satellite service to the hub. ViaSat is providing Community Broadband thoughout Mexico. The State of Oregon could do the same.

Containerization

Here's the thing. Microsoft Azure, Google and Amazon Web Services, pioneered container software called Kubernetes.

The Datacenter-as-a-Computer is a production-ready, open source platform that can run 5G networks in (any) data center.

Mobile apps can tap super-computer power. Unleashed. Smartphones battled Telcos for absolute control over app stores some 12 years ago. Telcos tried "walled gardens" on flip-phones. They lost.

Historical Precedence.
Google extracted a 2007 pledge from Verizon in the 700 MHz C Block auction for an "open platform" that "shall not deny, limit, or restrict the ability of their customers to use the applications of their choice." AT&T paid almost twice as much for 700 MHz spectrum in the A&B Blocks simply so they could avoid the "open platform" provisions and exert complete control over what apps were available.

Ironically, one year later, AT&T's iPhone became a monster hit. That happened only **after** AT&T seceded to Apple's demands for control of the app store. Verizon soon followed with the Android app store.

No carrier has since messed with the blueprint for the "Open Handset Alliance, now used daily in 3 billion smartphones. It's instructive. Carriers were apoplectic over "app stores" and clueless about its potential. They nearly killed their golden goose. **Community LTE**, enabled by MuLTEfire, puts carriers on notice. Be competitive or die.

Cost Estimates

Container costs could be paid off in about two years with a lease of $2K a month ($48K). Lyft and Uber may want to use the hub for bike and car rentals. Businesses like coffee shops would be a natural partner as would community electric transit.

Here's what's inside a $30,000 EV charging hub container:

1. 6KW of solar panels ($15K)
2. One, 12Kw/hr Tesla Power Wall ($8K)
3. Level two connectors for all popular EVs ($2K)
4. Connections for grid power ($2K)
5. Misc. ($3K)
6. **Total $30K**

Here's what's inside the $25K Broadband Container.

1. ViaSat-3 Geosynch Terminal ($1K)
2. OneWeb LEO broadband with flat antenna ($1K)
3. One, 3.5 GHz shared spectrum neighborhood hub ($4K)
4. 3KW of solar panels ($8K)
5. One, 12Kw/hr Tesla Powerwall ($8K)
6. Misc. ($3K)
7. **Total 25K**

Revenue
How would it make money? Two ways; EV charging and community broadband.

1. **EV CHARGING:** We make $5 per charge and get maybe 10 charges a day ($50/day or $1500/month). A grid-connected DC Fast charger would likely be necessary. EVGo charges 60¢ per kWh, so a 20kW fillup might cost users $12, but electricity costs about 6¢ per kWh ($1.20 per 20kW).

2. **COMMUNITY BROADBAND:** Community broadband (at 25 Mbps) might generate $20/month per sub. Each 100-200 Mbps hub typically serves up to 50 people at $20/month. That's $1,000/month.

The containerized Charge Station/Wireless Hub might generate $2,500/month which would be close to the cost for the containers and running expenses. After the first 2 years, the $2500/mo revenue is mostly profit. Grants and loans help fund the initial CAPEX. The containers are easily transported state-wide. It starts small, building with success.

Blokable's Vancouver Factory might manufacture the units, perhaps integrated with coffee shops or other facilities.

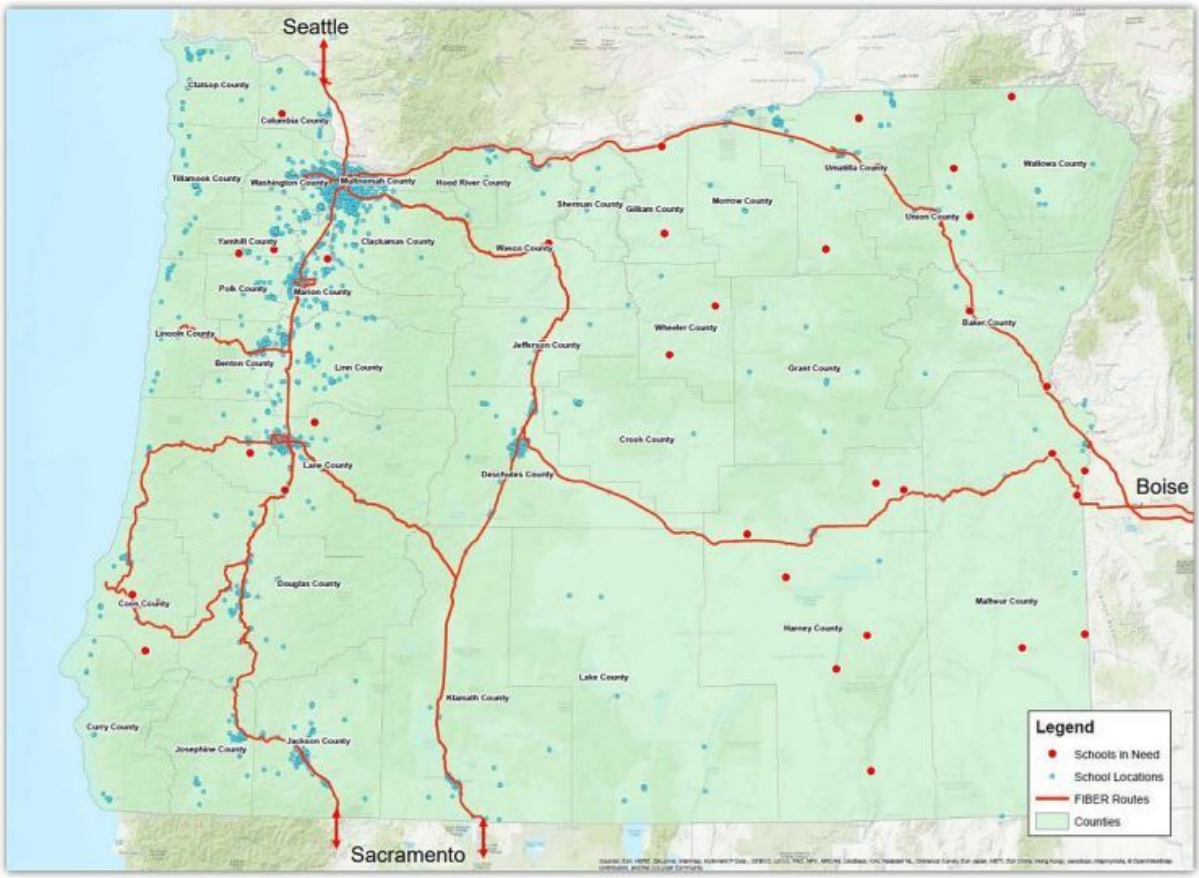
Two words: ***Mobile First***.

Benefits:

1. Resiliency
2. EV Charging
3. Community Broadband
4. Bike Sharing
5. Electric Transit Support
6. Tracking without cellular

Stakeholders

PGE, Pacific Power, Bonneville Power, Cities, Counties, State of Oregon, Education, Lyft, GoForth, Emergency Management, Neighborhood Associations, etc.



Portland's 95 Neighborhood Associations and Oregon's 36 counties can address digital equity while encouraging self-sufficiency.

Municipal fiber can connect these nodes, enabling unlimited wireless – fixed and mobile – at even lower cost. By Q3-2019, you'll be able to order cheap 3.5 GHz devices from Amazon. Plan on it. Resiliency, lower emissions and low-cost broadband are practical and cost/effective.

Links and Resources:

Container buildings
https://en.wikipedia.org/wiki/Shipping_container_architecture
https://prephub.org
https://www.blokable.com/solution

EV Charging
https://en.wikipedia.org/wiki/Charging_station
https://electrek.co/2019/02/08/evgo-switches-charging-prices
http://www.hayden-island.com/ev-charge-stations
https://youtu.be/QCYcsk40FLs

Citizen's Band Radio Service (3.5 GHz)
https://en.wikipedia.org/wiki/Citizens_Broadband_Radio_Service
https://www.federatedwireless.com/technology
https://www.multefire.org
http://www.hayden-island.com/smart-neighborhoods
https://youtu.be/5w5RLX1_TPQ

LoRa IoT (900 Mhz)
https://en.wikipedia.org/wiki/LoRa
https://lora-alliance.org
https://www.thethingsnetwork.org

Satellite Backhaul
https://spacenews.com/viasat-books-falcon-heavy-for-viasat-3-launch
https://en.wikipedia.org/wiki/OneWeb_satellite_constellation
https://en.wikipedia.org/wiki/Starlink_(satellite_constellation)
https://spacenews.com/wyler-claims-breakthrough-in-low-cost-antenna-for-oneweb-other-satellite-systems

Fiber Backhaul
https://residential.wavebroadband.com/city
https://multnomah.granicus.com/MetaViewer.php?view_id=3&clip_id=1847&meta_id=132134