Creating Coastside Communication Resilience

Prepared for Coastal Leadership and the General Public of San Mateo County, CA

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Topics:
- Introduction
- Fiber Optic Cables
- Generator Backup
- Cellular Phone Coverage
- Looking To The Future

Introduction:
What happened?

- 14,000+ Coastal residents lost power, some for multiple days

- Primary fiber optic communication lines where damaged

- Coax based internet & VoIP phone based systems failed

- Emergency Services had to rely on only 2-way radio communication

- Cellular service failed for many

Fiber Optic Cables:

Keeping communities connected

What do fiber optic cables do?

- Fiber optic cables carry large amount of information long distances

- Fiber optic cables provide service to television, phone, home internet, and cellular service

- AT&T Wireless, Verizon, and T-Mobile use fiber optic cables to deliver phones calls and data

- They provide essential safety communication during natural disasters

Fiber Optic Redundancy:

- Fiber optic redundancy usually means a second optic cable with a different path

- Data systems can instantly switch to redundant fiber optic in the case of damage to one of the cable paths

- Fiber optic cable paths transverse the earth on telephone poles, underground and under the ocean

- Other forms of redundancy can come in the form of microwave links, coaxial cable, or even telephone cables

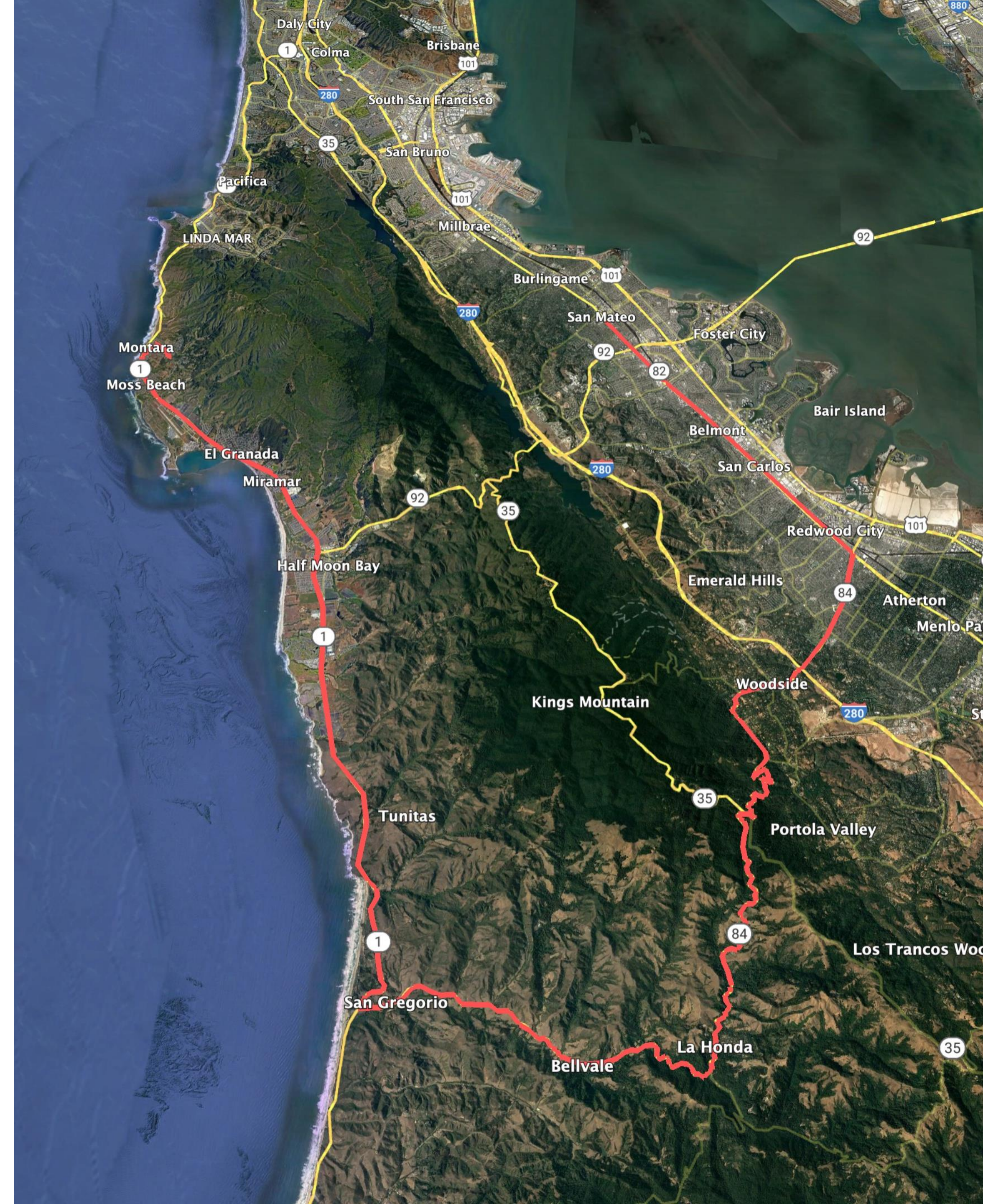# Current Coastal Status:

AT&T fiber

- AT&T Fiber & Comcast/Xfinity both have fiber optic cables that cover the coast

- AT&T Fiber has a redundant fiber optic path through Pacifica via the Tom Lantos Tunnel

- AT&T Fiber provides data for:

    1. AT&T Fiber Home

    2. AT&T Home/Business DSL

    3. AT&T Home/Business POTS/VoIP Phone Service

    4. AT&T Wireless Cellular Service

    5. T-Mobile Cellular Service

    6. Some Verizon Cellular Service redundancy and one primary connection

    7. Coastside.net DSL, Sonic DSL

    8. Some Government Buildings
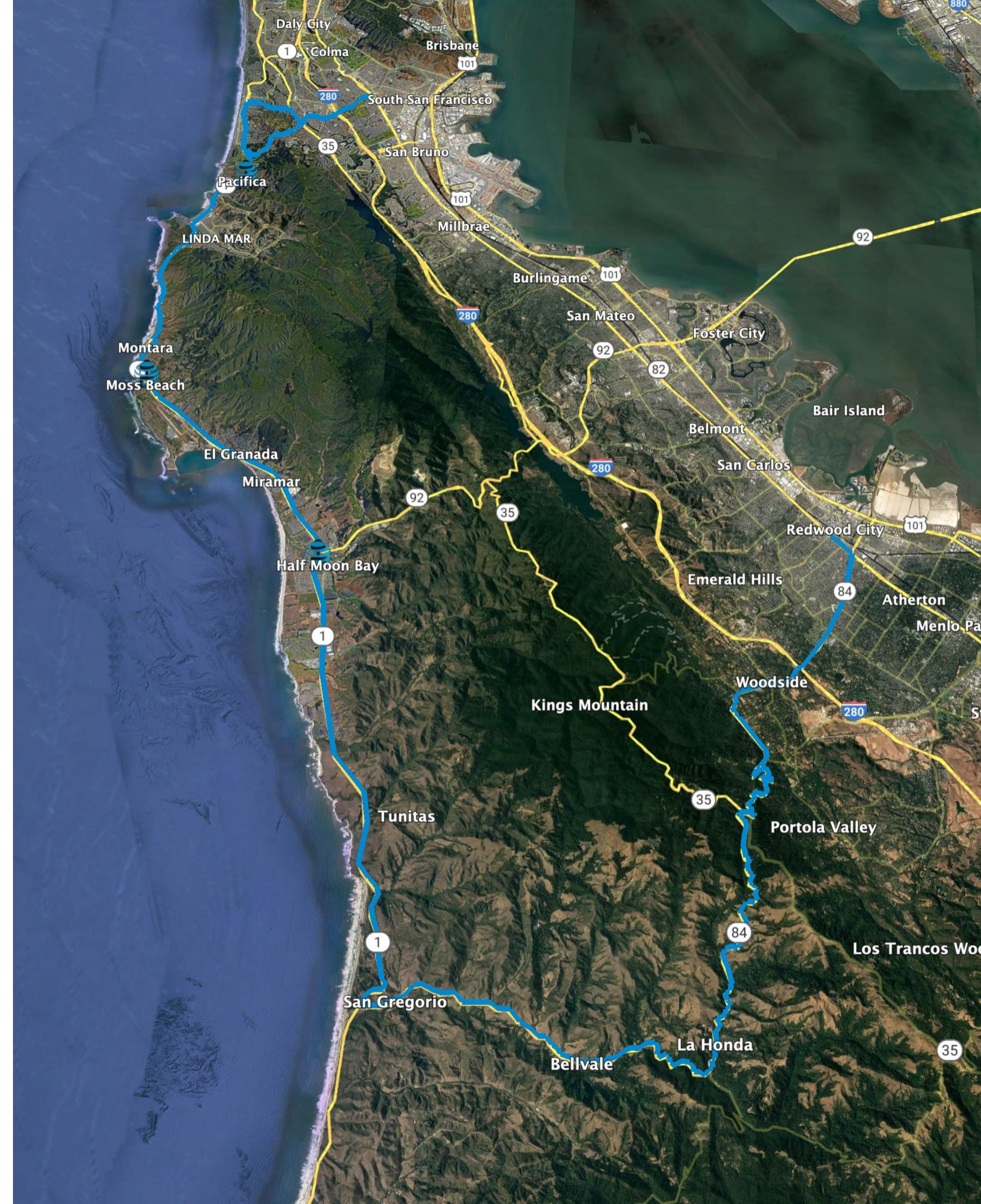
Current Coastal Status:

- Comcast has **no redundant fiber path** on the Coast and as of their 2021 statement, is not currently planning to install one

- Comcast/Xfinity provides data for:

  1. Xfinity Home Internet, Television, and Phone

  2. Comcast Business Internet, Television, and Phone

  3. Verizon Cellular Service

  4. Cruzio Internet Service

  5. Some Government Buildings

- Comcast's fiber optic cable path ends in Montara

- Comcast services the largest amount of coastal customers

- Comcast regularly experiences outages lasting minutes to days

Current Coastal Status:

- Cruzio Fixed Wireless Internet uses Comcast Fiber to supply its system data

- **Has microwave links as a redundant path off of the coast**

- Offers service to customers in many coastal locations

Comcast lack of redundancy

Poses a great risk to coastal residents

- Comcast/Xfinity provides services to nearly 15,000 People

- Many residences have very little or no cellular coverage

- Without home internet/WiFi calling, these people cannot call for emergency services and won't receive Zonehaven evacuation alerts

- Comcast/Xfinity has stated they have tried to run multiple redundant paths with no success, but doesn't offer details on why they can't follow the existing northern AT&T fiber path

- Comcast/Xfinity hasn't stated why they can't lease redundant fiber capacity from AT&T's existing infrastructure as a temporary solution

CPUC Resiliency strategies:

CPUC High Fire Threat District (HFTD)
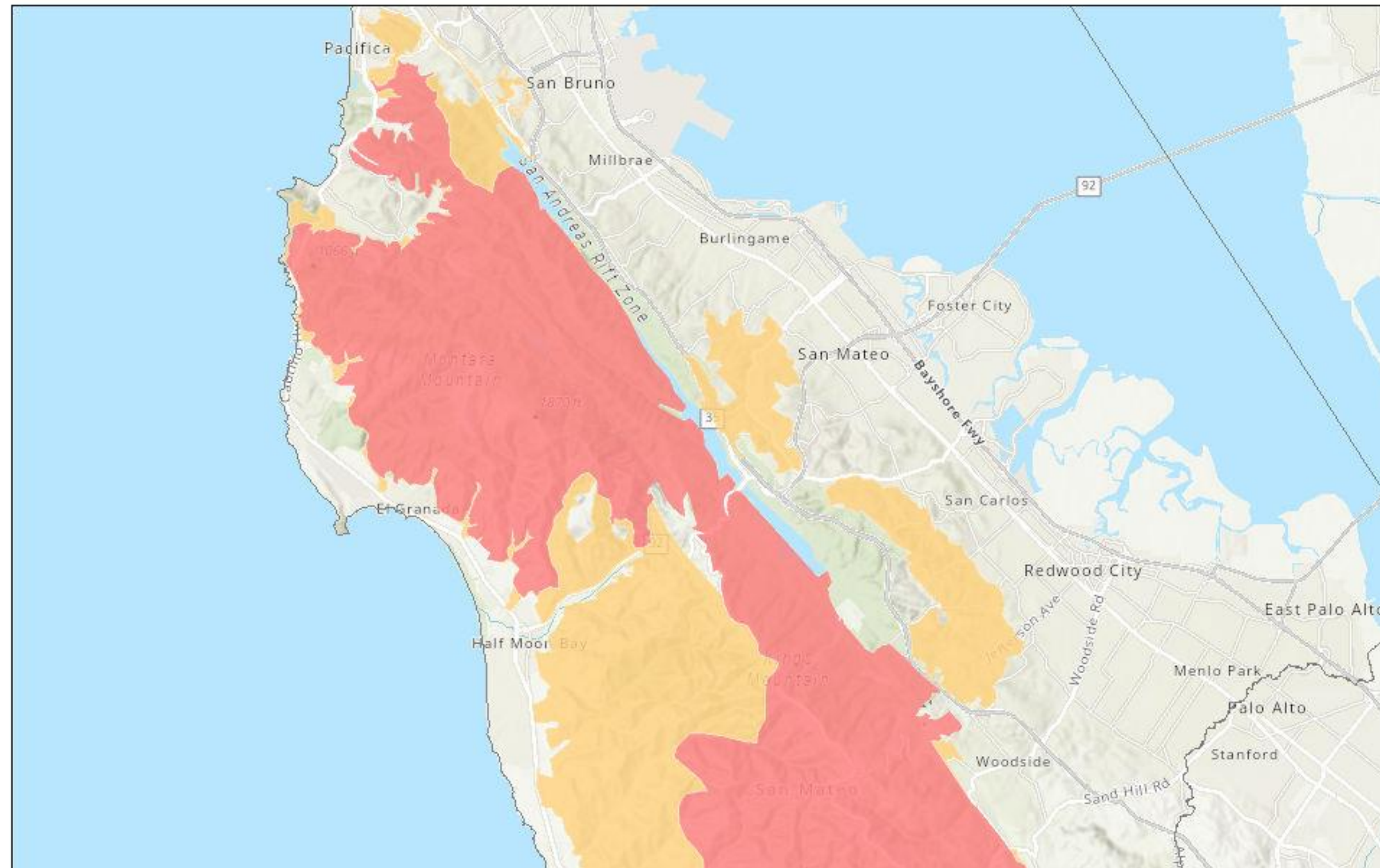
2/5/2023

CPUC High Fire Threat District - Tier 3

CPUC High Fire Threat District - Tier 2

CPUC HFTD-Zone 1 (CAL FIRE High Hazard Zones Tier1)

California County Boundaries

World Hillshade

1:221,005

Esri, NASA, NGA, USGS, California State Parks, Esri, HERE, Garmin, SafeGraph, METI/NASA, USGS, Bureau of Land Management, EPA, NPS,

A. Implement 72-hour back-up power to support essential communications equipment and minimum service levels for the public

B. Build and maintain redundant communication networks

C. Harden communication networks to withstand damage

D. Restore service to damaged or destroyed facilities. Use temporary facilities (mobile cell sites, mobile satellite, and microwave backhaul, etc.)

E. Establish communication and coordination processes with first responders, other public utilities, the Commission, and the general public

F. Establish preparedness planning for employees and ensure sufficient staffing levels

Comcast: Redundant Alternatives

To correct lack of fiber optic redundancy Comcast/Xfinity could:

1. Lease fiber optic strands from AT&T Fiber's infrastructure

2. If AT&T Fiber won't lease to Comcast/Xfinity then create legislation to help

3. Bury a new fiber optic cable along the same path as the current

4. Run a redundant fiber optic cable using the same path as AT&T Fiber via the Tom Lantos Tunnel

5. Find a new underground path

How can our leaders help?

- Removing trees to clear a path for critical infrastructure

- Create a public task force to help identify above and under-ground construction opportunities

- Reduce construction regulation for fiber optic systems

- Assist service providers in finding both public and private land to run communication cabling

- Demand the CPUC audit communication infrastructure to enforce their own resiliency strategy

Generator Backup:

Redundancy does not exist without power

75%

of Coastal home internet has backup generators

ONLY
20%

of Coastal cellular sites have backup generators

0%

of Comcast/Xfinity residential or business networks have generator backup

Without generator backup communication systems last an average of

4 HOURS

without utility power

Critical infrastructure power:

AT&T fiber

- Has multiple buildings along the fiber path

- Each building distributes neighborhood connections from one central location

- Each building has fast acting battery backup

- Each building had generator backup

- Customer must have backup power to continue service

comcast xfinity

- Has a single origin for fiber path

- Fiber signal is repeated through many devices that are chained throughout neighborhoods

- Each neighborhood is powered locally

- Each neighborhood has no more then 6.5 hours of fast acting battery backup power

- Customer must have backup power to continue service

Cruzio Internet
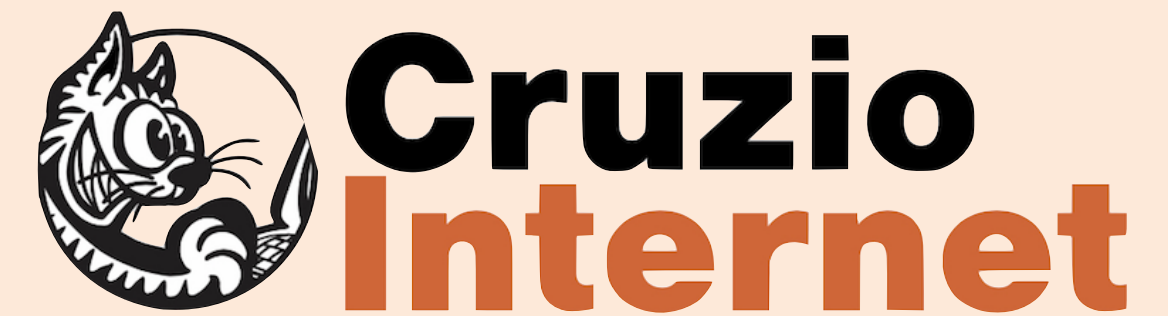
- Has fast acting battery backup

- Has generator backup at tower location

- No other codependent hardware

- Customer must have backup power to continue service

Cellular site power:

- All cellular sites have redundant fast acting battery backups

- Battery backup power is generally limited to 2-6 hours; on the coast most last about 4 hours

- Few coastal cellular sites have installed generator backup

- All cellular sites have mobile commercial generator connections

Cellular Site Generator Power:

AT&T 4%

verizon 48%

T Mobile 26%

Coastal areas covered by sites with an installed generator

What should be done?

1. Demand the CPUC to audit communication infrastructure enforce their own resiliency strategy

2. Install and maintain 72 hour generator backup at every cellular location

3. Require Comcast to make backup battery capacity at least 24 hours or install generator backup

4. Implement fines for carriers who are not compliant

5. Require VoIP telephone providers to furnish a phone battery backup capable of continuing service in a power outage for at least 12 hours

Cellular Phone Coverage:

Modern essential connectivity

Radio Frequency Facts:

Cellular towers use different radio frequencies to transmit data and calls.

Frequency types:

HIGH BAND	MID BAND	LOW BAND
Ultra fast data speeds. >600Mbps+ download	Super fast data speeds. 50-750 Mbps+ download	LTE data speeds. 10-160Mbps download
Can connect thousands of users with high speed data	Can connect 100's of users with high speed data	Can connect many users with high speed data
Usually less then 1000' line of sight coverage	Better coverage without being within line of sight	Good through trees, and homes, penetrate mountains
Cannot penetrate past trees	Difficulty penetrating past trees, low signal in homes	Long range reception
24Ghz-39Ghz	**1.7Ghz-5.2Ghz**	**600Mhz-850Mhz**
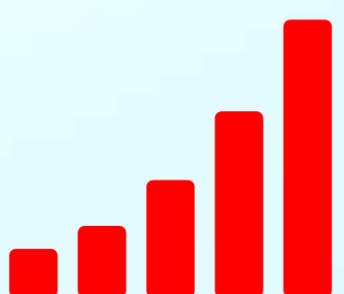
How RF signal works:

Carrier Report:

AT&T

- Best coverage and overall usability

- Minor challenges in Montara and Moss Beach

- **Zero cellular sites with permanent generator backup**

- Possible new cellular site proposed at the top of Alta Vista Road

- All cellular sites use AT&T Fiber giving them fully redundant fiber paths.

Max Cellular Download/Upload:
280/92.9
Mbps

Average Cellular Download/Upload:
73.1/12.3
Mbps

Carrier Report:

T··Mobile™

- Overall good coverage, and usable service

- Challenges in North & East Montara

- Ultra fast tower in Montara that is nearly useless due to position

- Highest number of towers on the coast due to acquisitions

- All cellular sites use AT&T Fiber giving them fully redundant fiber paths

- Single site with generator backup

Max Download/Upload:
319/59.4
Mbps

Average Download/Upload:
41.8/15.3
Mbps

Carrier Report:

verizon✓

- Highest amount of coverage challenges

- Largest challenges in Moss Beach & Montara, some challenges in El Granada

- Poor Tower placement for Moss Beach & Montara

- Ultra fast cellular site in Montara is nearly unusable due to position

- Single tower without fiber redundancy, all others are backed up by AT&T Fiber at a slower rate

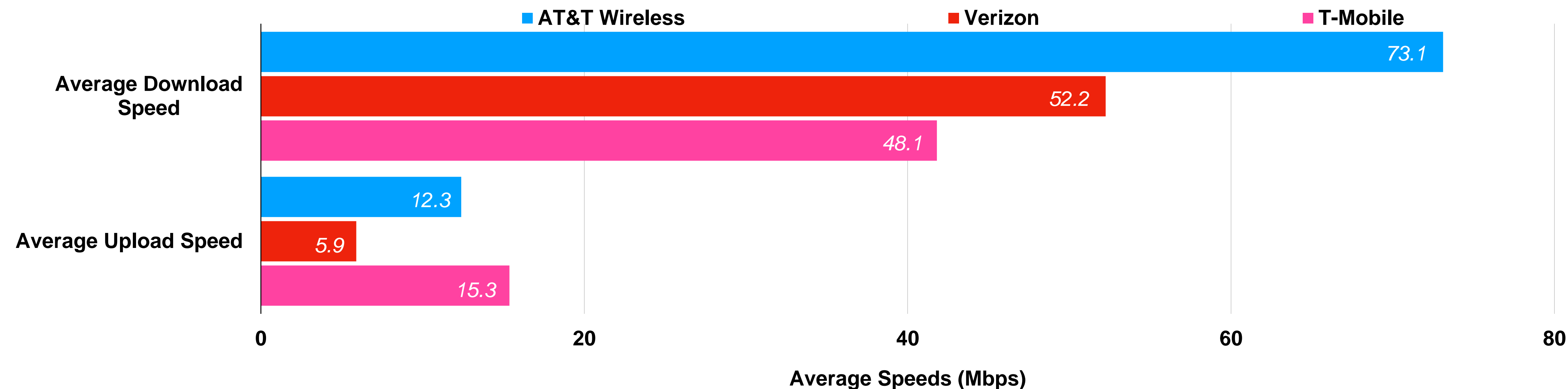- Highest number of generator backed up cellular sites

Max Download/Upload:
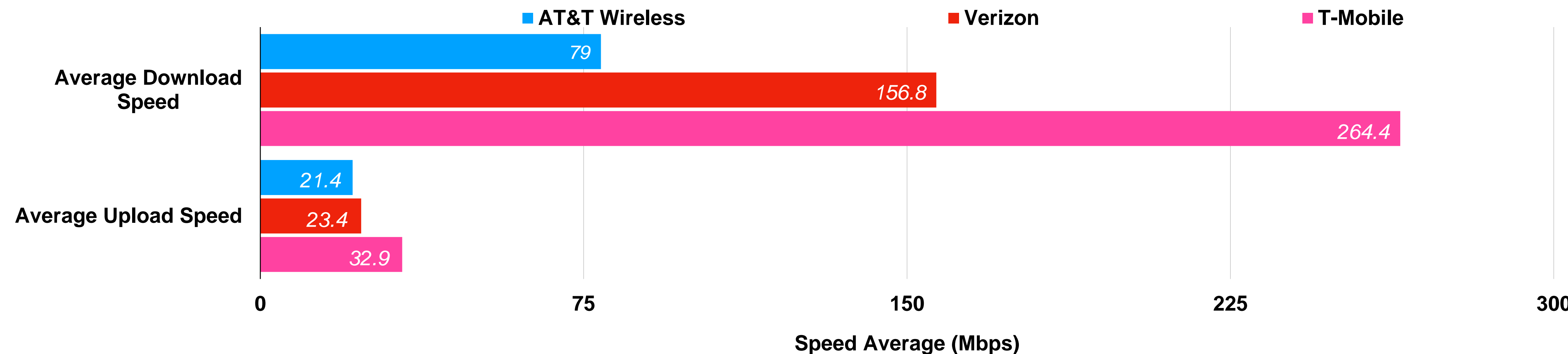
286/52.1

Mbps

Average Download/Upload:

52.2/5.9

Mbps

Coastal Average Carrier Speed:

Legend: ■ AT&T Wireless ■ Verizon ■ T-Mobile

Average Download Speed
- AT&T Wireless: 73.1
- Verizon: 52.2
- T-Mobile: 48.1

Average Upload Speed
- AT&T Wireless: 12.3
- Verizon: 5.9
- T-Mobile: 15.3

Average Speeds (Mbps)

National Average Carrier Speed:

Legend: ■ AT&T Wireless ■ Verizon ■ T-Mobile

Average Download Speed
- AT&T Wireless: 79
- Verizon: 156.8
- T-Mobile: 264.4

Average Upload Speed
- AT&T Wireless: 21.4
- Verizon: 23.4
- T-Mobile: 32.9

Speed Average (Mbps)

Overall Coastal Carrier Grades:

Carrier Average
Download to upload ratios:

AT&T Wireless: **5.86: 1**

T-Mobile: **2.97: 1**

Verizon Wireless: **8.20: 1**

	verizon✓	AT&T	T Mobile
Good	**30%**	**37%**	**30%**
Ok	**7%**	**37%**	**33%**
Poor	**36%**	**23%**	**20%**
None	**27%**	**3%**	**17%**

To calculate the following information we conducted 30 different speed tests in residential neighborhoods from Montara to Miramontes Point Road that represent the average customer use. We then scored carriers with 4 grades (Good, Ok, Poor, None), based on download and upload speed and the ratios of both together. This ratio is helpful in determining the usability of the coverage that a carrier is providing to a given area, the lower the ratio the better. If the ratio of download to upload is too large or the upload speed is very low (<1Mbps), then despite the signal strength the carrier is not usable. If the carrier provides a good upload and a great download it makes for superior service.

How should legislation change?

- Require cellular towers to be taller and disguised as trees *(as shown on the right)*

- Require cellular sites to be built above tree lines

- Require service providers to use as many radio frequencies as possible on every cellular site

- Require cellular site providers to use microwave radio data path between cellular sites with line of site of each other

How should cellular carriers change?

continued

- Host services on the same tower

- Deploy a "Cell On Wheels" during an outage

- Firmware updates to cellular sites to be at times when they are being used least

- Allocation of space on towers for public safety radios systems

How should cellular carriers change?

continued

Example of cellular micro site

Example of cellular macro site

Require cellular providers to install micro site towers in places where coverage challenges exist

How should cellular carriers change?

Build new cellular sites: Montara/Moss Beach **Current** Coverage
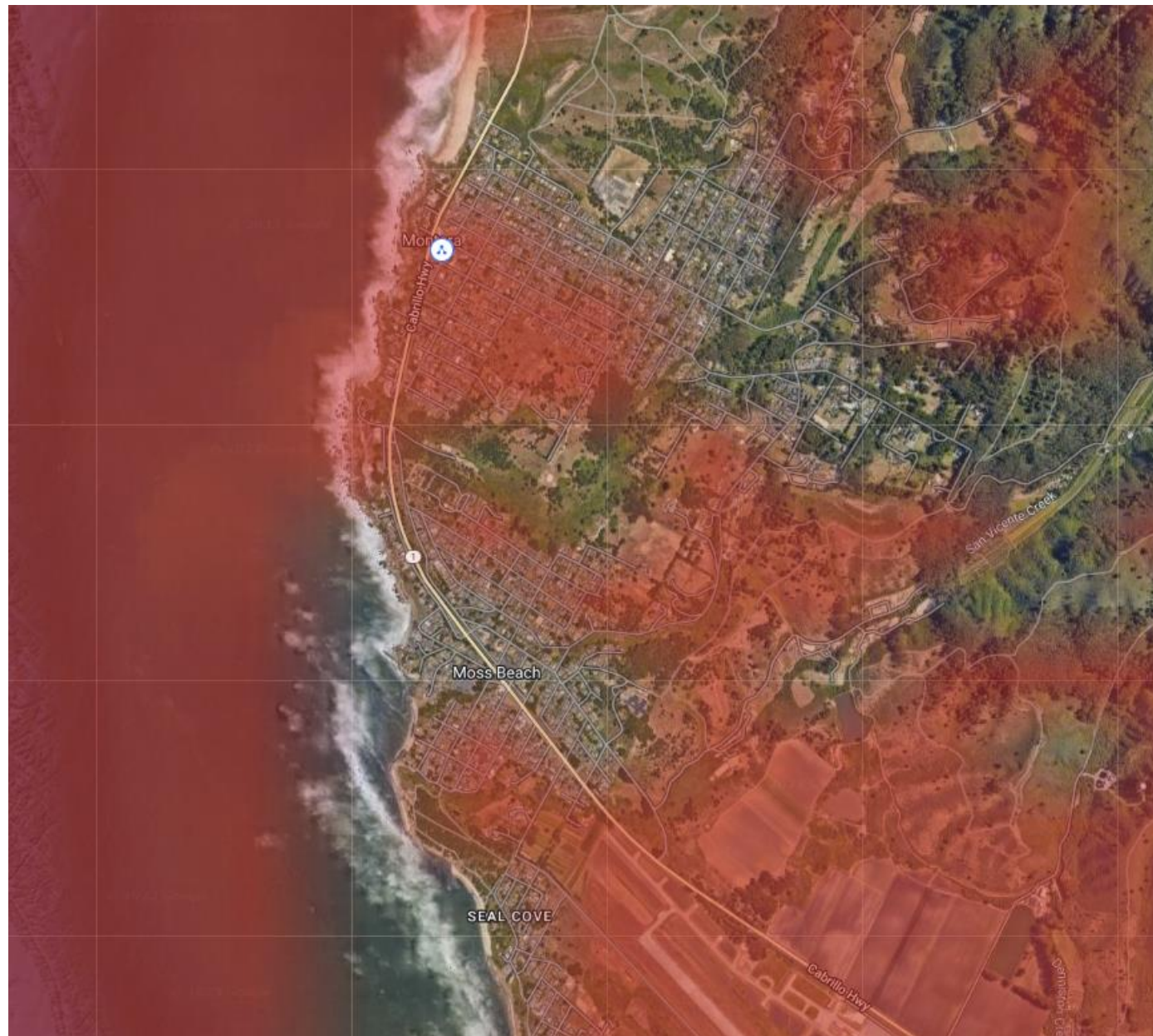
How should cellular carriers change?

Build new cellular sites: Montara/Moss Beach Proposed Coverage
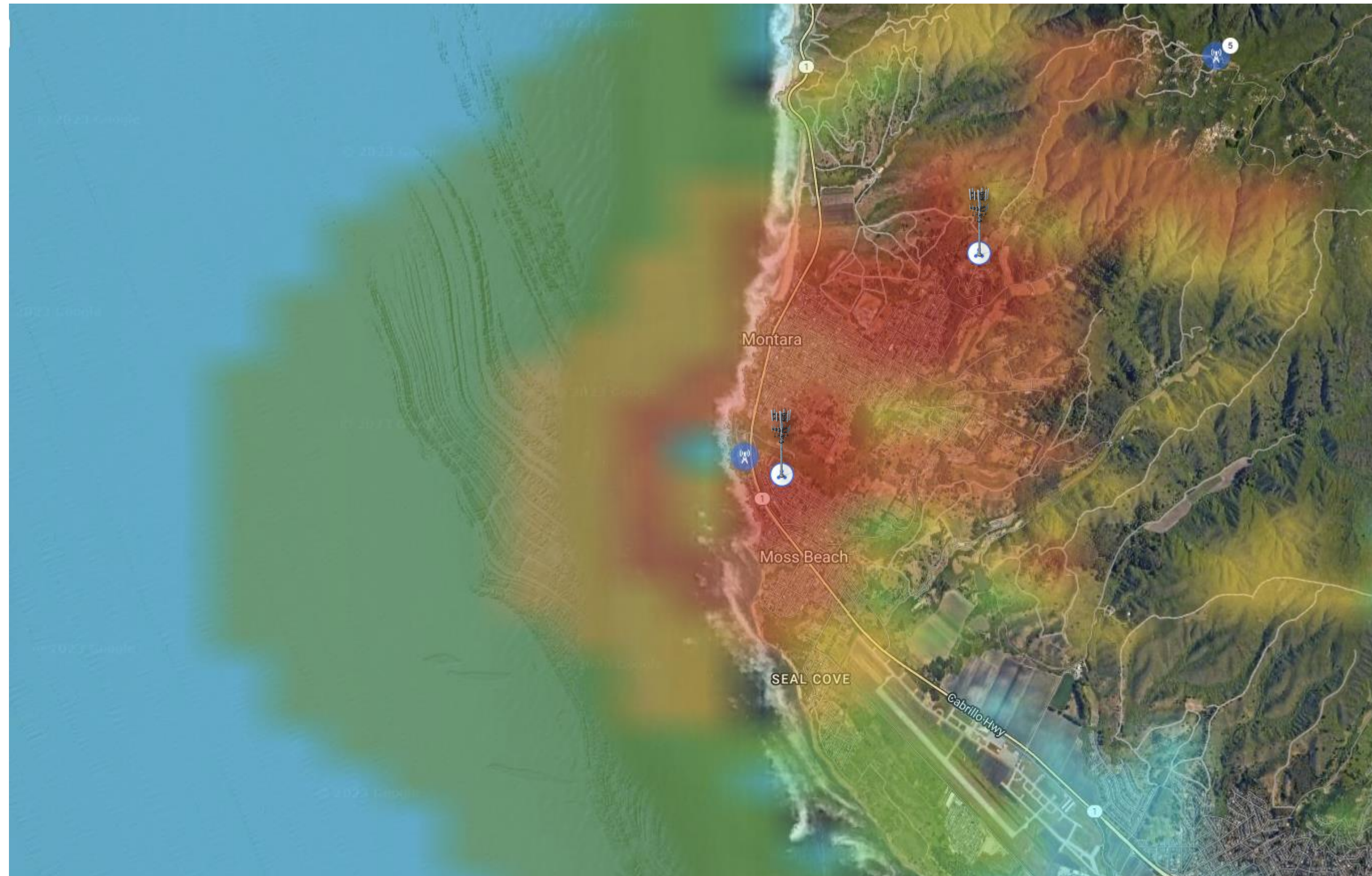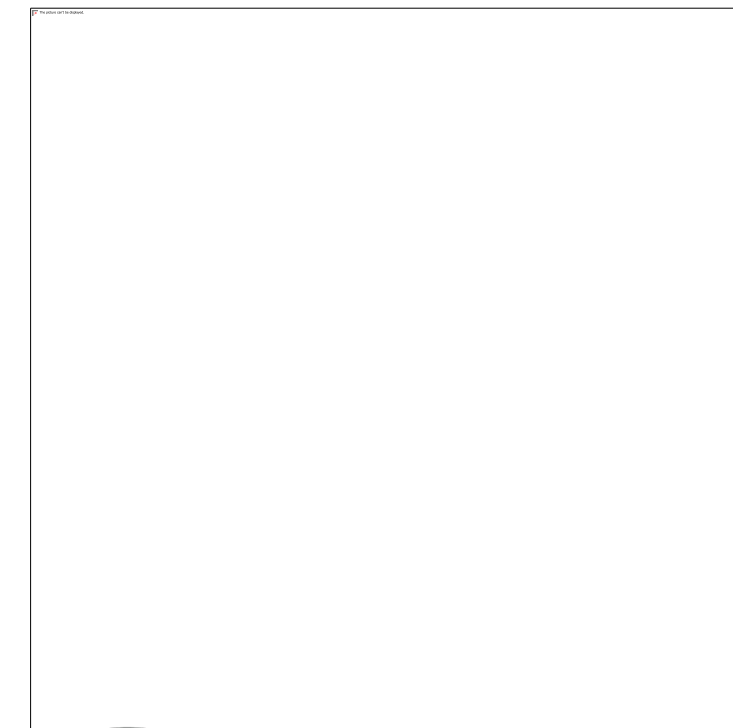

Proposed combined site coverage

Looking to the future

& the Current Lack of Accessibility to Modern Service:

Coastal DSL Powered by AT&T

Neighborhood A

Neighborhood B

Neighborhood C

ADSL2+

VDSL2

Copper Telephone Lines
Up to 10,000'

(Distances more than 10,000')

Fiber Optic Cables

AT&T U-verse
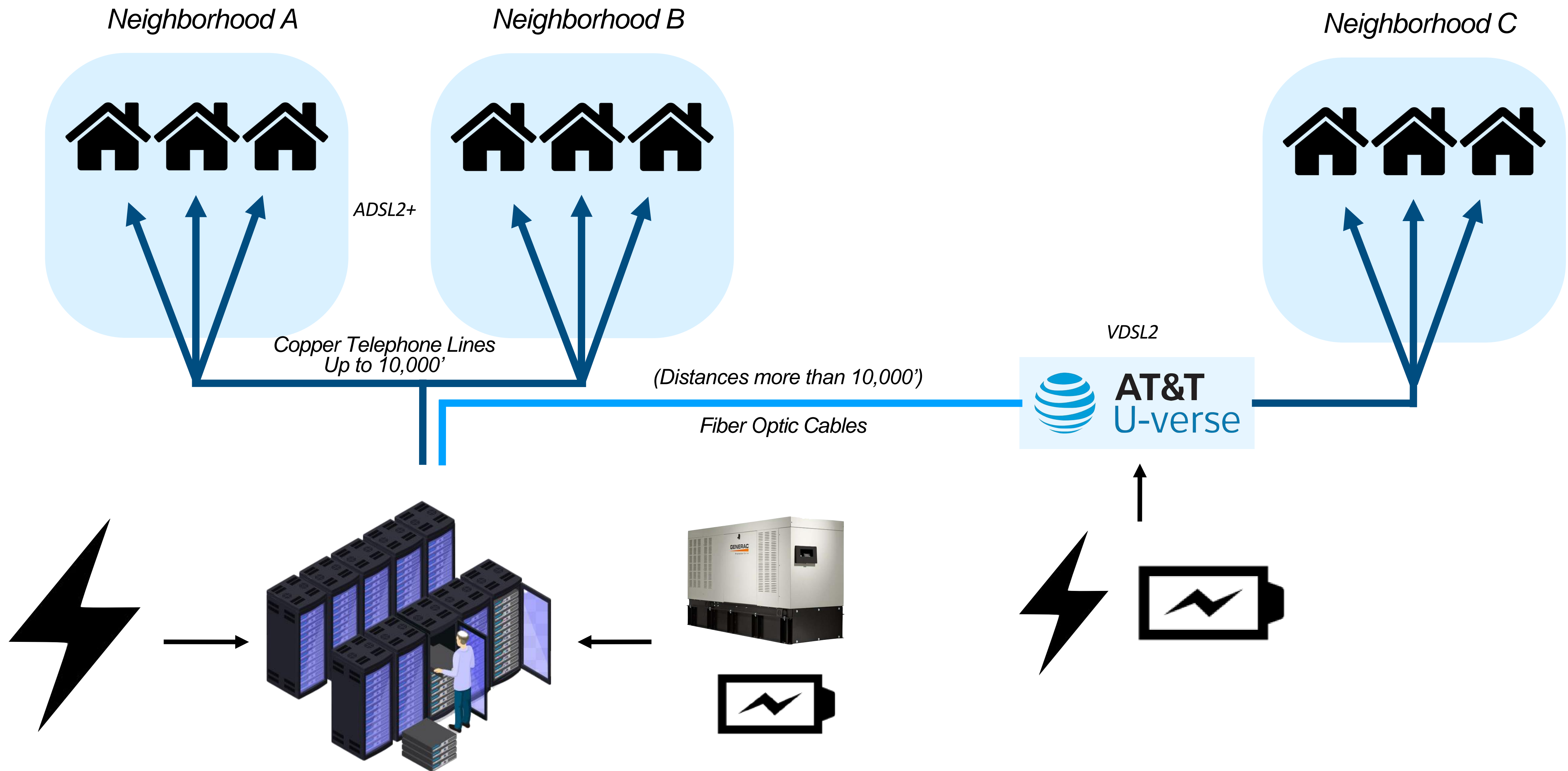
Companies using AT&T DSL infrastructure on the coast:

Cruzio Internet Network *Fixed Wireless*
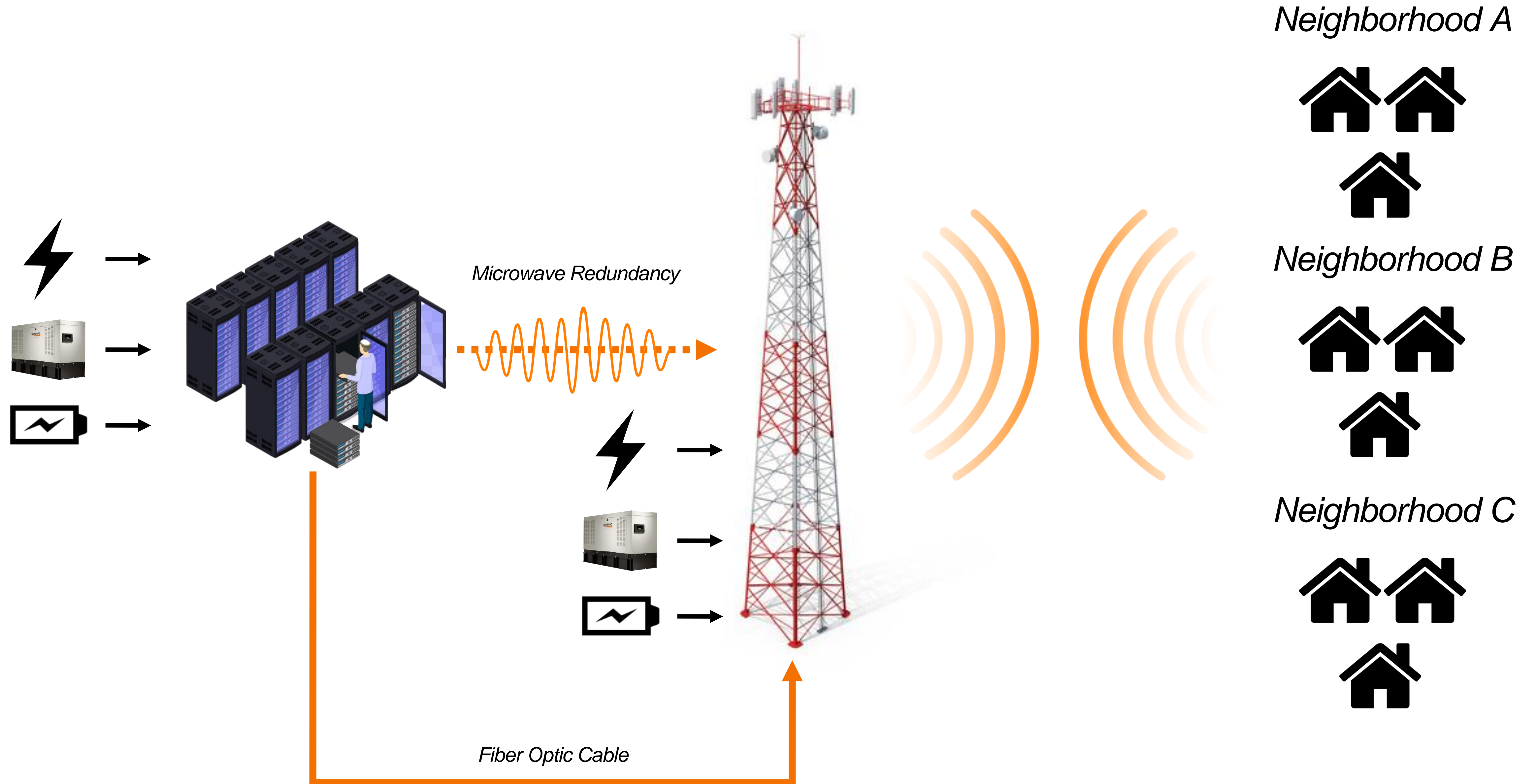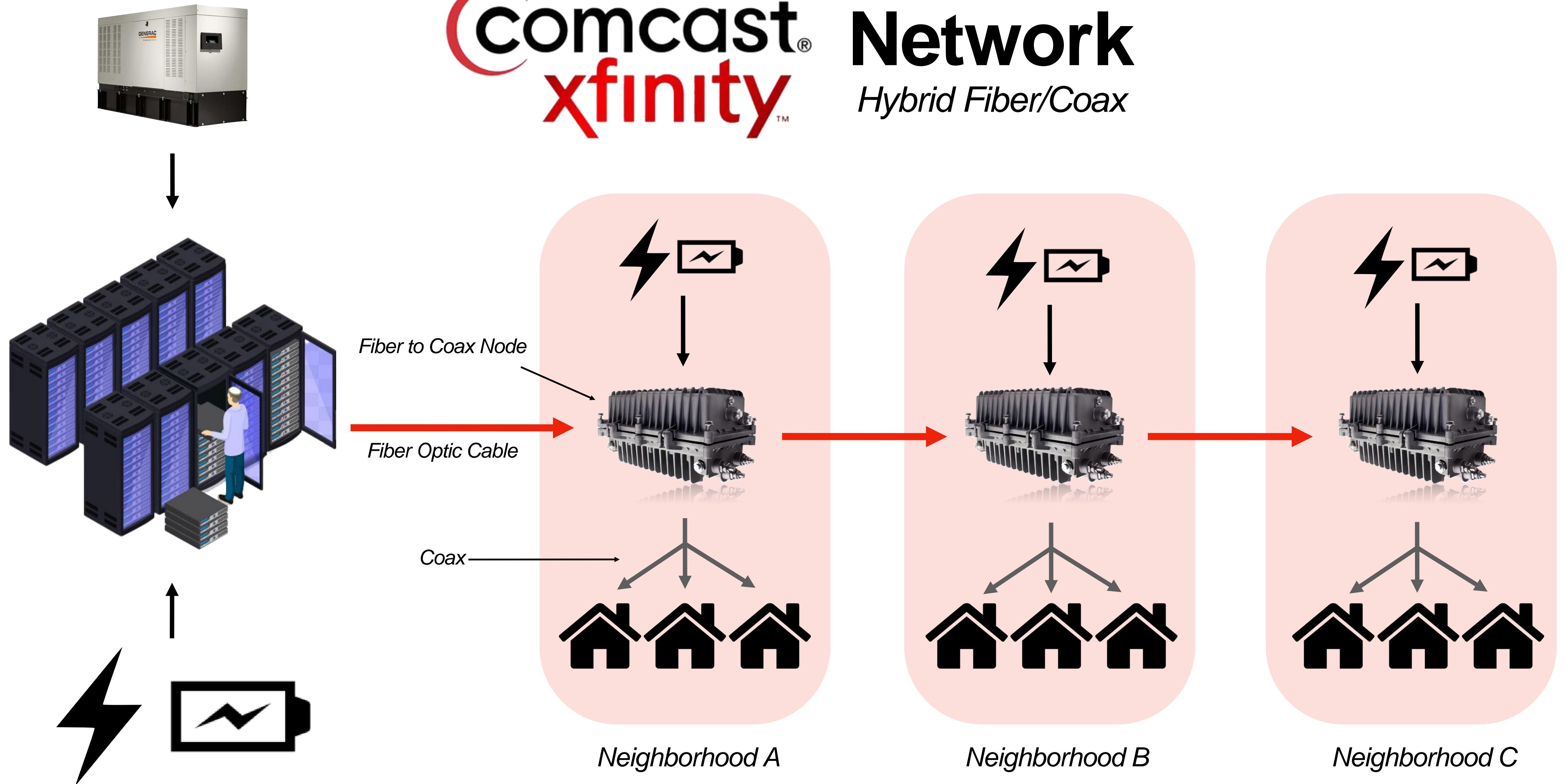
Microwave Redundancy

Fiber Optic Cable

Neighborhood A
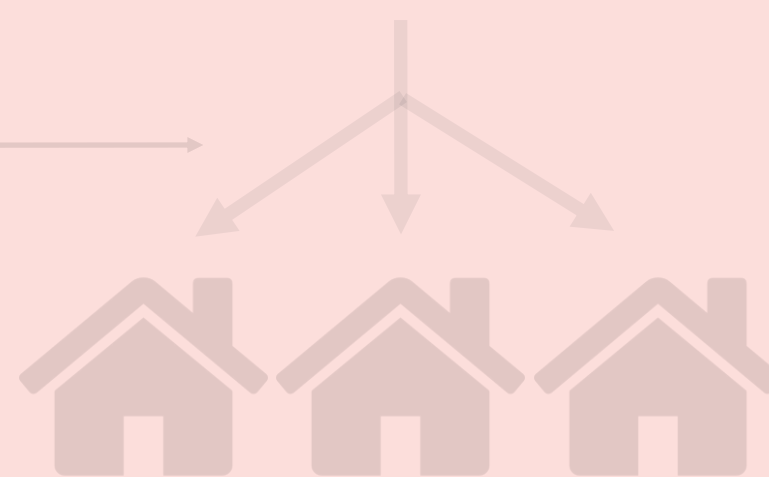
Neighborhood B

Neighborhood C

comcast® xfinity™ Network
Hybrid Fiber/Coax

Fiber to Coax Node

Fiber Optic Cable

Coax

Neighborhood A

Neighborhood B

Neighborhood C

Comcast xfinity Network
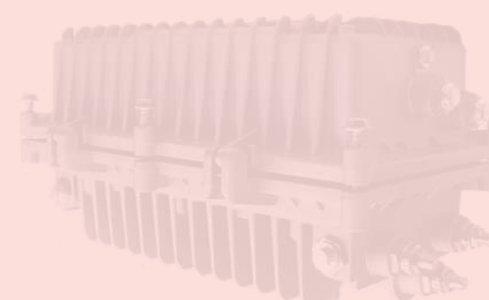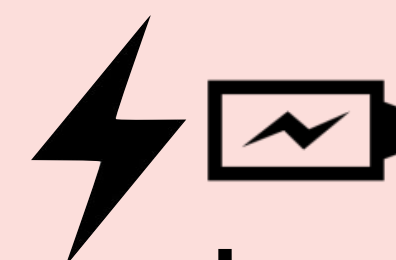*Hybrid Fiber/Coax*
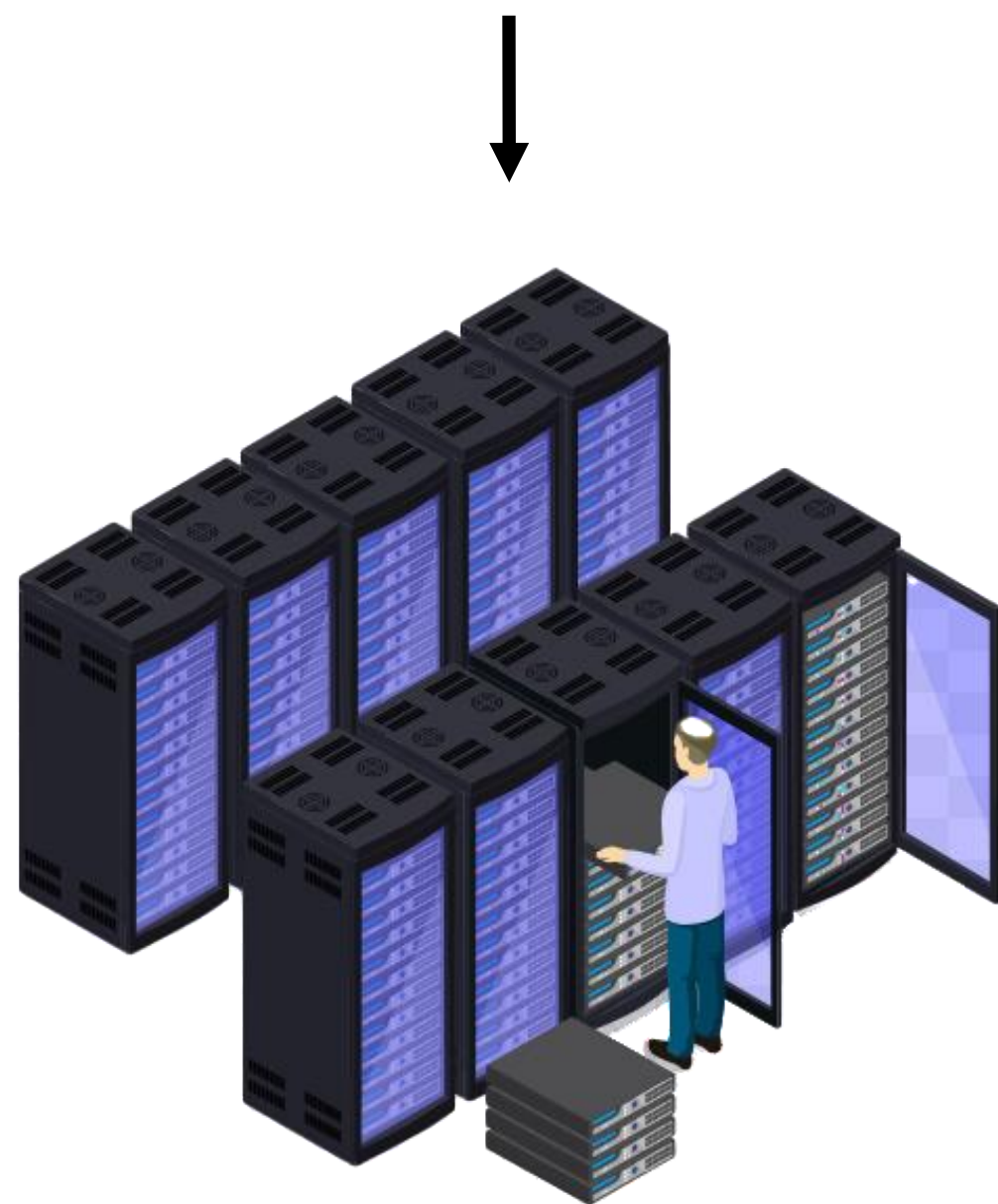
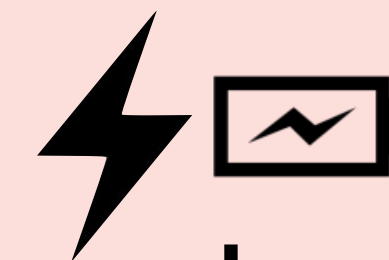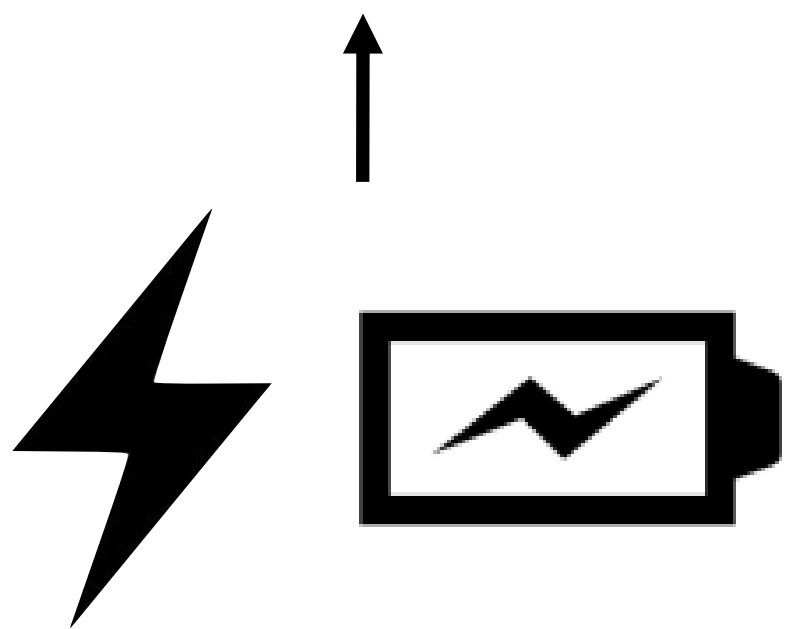Fiber to Coax Node

Fiber Optic Cable

Coax

Neighborhood A

Neighborhood B

Neighborhood C
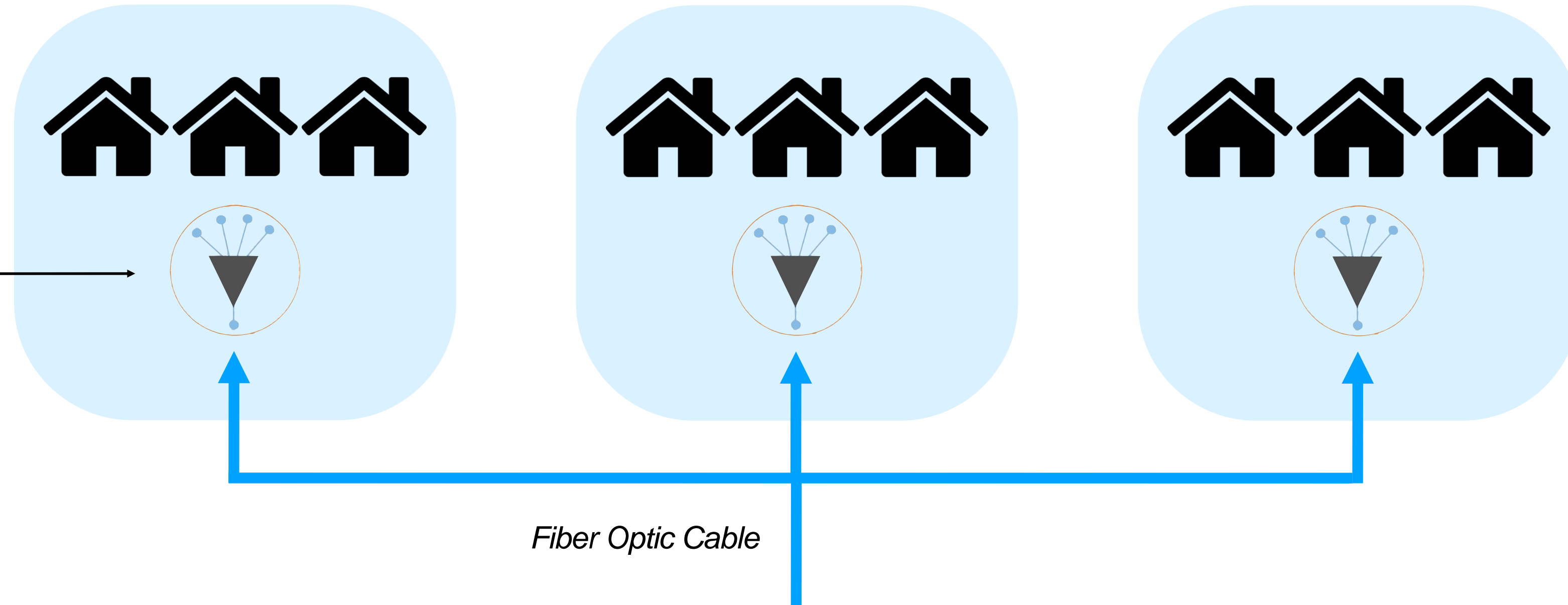
AT&T fiber Network

100% Fiber Optic Shared Network

Neighborhood A

Neighborhood B

Neighborhood C

Passive Optical Splitter

Fiber Optic Cable

Coastal Community Fiber Network

100% Fiber Optic Dedicated Network

Neighborhood A

Neighborhood B

Neighborhood C

Fiber Optic Cable
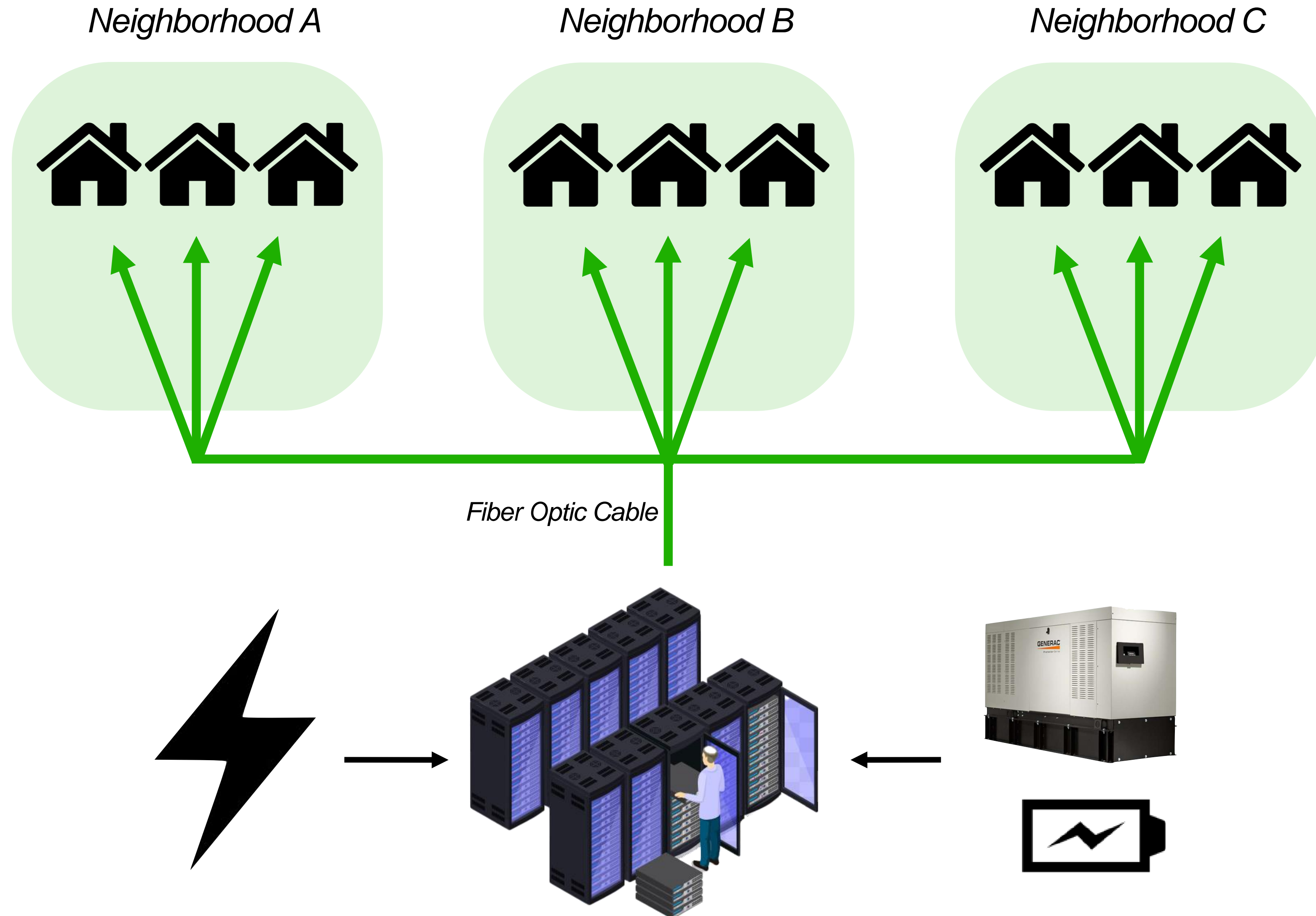
Home Internet Availability:

AT&T fiber
27%~

AT&T SONIC.
86%~

comcast xfinity
100%

Cruzio Internet
43%~

How can you help yourself *now*

General:

- Move your modem to the center of the house, and as high as possible.

- If you have WiFi extenders move them closer to the modem

- Always use ethernet when possible

Comcast/Xfinity:

- Tighten all coax cables in your home

- Remove all unnecessary cables and splitters

- Check for corrosion and replace

Report bad internet to the county:

https://tinyurl.com/smcbadinternet

What should be done?

Construct a community owned fiber optic to home system.

- Require Comcast "Node 0" Technology to be installed in the next 24 months *(currently 0% installed)*

- Require AT&T Fiber to complete their "fiber to home" installation in the next 24 months *(currently 27% installed)*

How can our leaders help?

- Fast track approval and construction paths for providers to install fiber networks

- Create a public task force to help identify above and under-ground construction opportunities

- Mandate that Comcast/Xfinity install their updated "Node 0" Infrastructure

- Help service providers negotiate fiber optic cable paths on private and public property

- Mandate that AT&T Fiber treats its fiber systems like previous DSL/Telephone CLEC's

Summary

The Big Picture

- Our home internet, cellular and emergency communications systems are all vulnerable and threaten health and safety of the Coastside Community.

- A combination of regulatory changes, enforced compliance, and modest investment would solve these problems.

- These suggestions can help other communities in similar circumstances

The full written report will be provided to:

1. Supervisor Mueller

2. OES

3. Ron Osborn, CPUC

4. Senator Becker

5. Comcast Operations

6. Verizon Operations

7. T-Mobile Operations

8. AT&T Wireless Operations

9. AT&T Fiber Operations

10. Montara Water and Sanitary District