



Joint Venture  
SILICON VALLEY

# HayWired Telecommunications

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Prepared for SF Lifelines, Sept 2020

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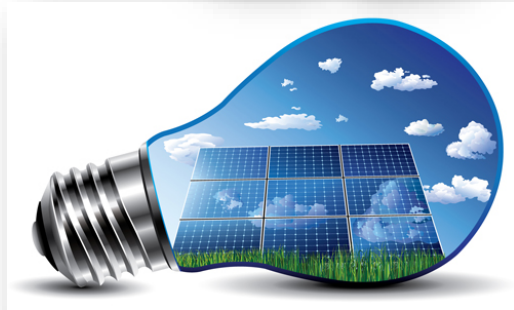
408-889-9741

# My Bio



- 30+ years in telecommunications
- B.Sc. Electrical Engineering (@ UC Davis, focus on wireless & RF)
- CEO & Founder, Oku Solutions LLC
- Joint Venture Silicon Valley
  - Calif. Emerging Tech Fund (Advisor)
  - NIST GCTC Wireless (Co-Chair)
  - IEEE Future Networks (Co-Chair: Deployment)
- Fellow: RCA, Sr. Member: IEEE

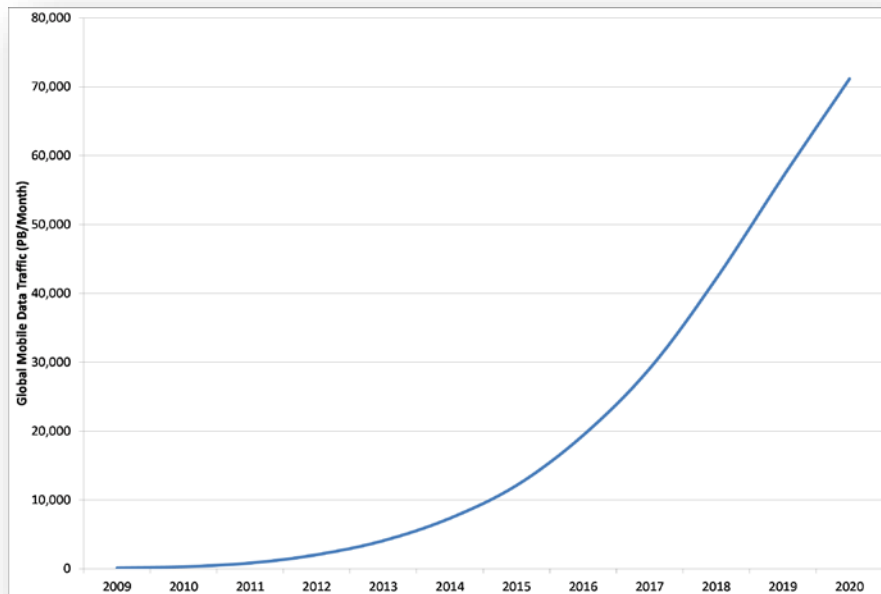
# Basic Requirements of 21<sup>st</sup> Century Life



# Not a Luxury or Toy



# Mobile Data

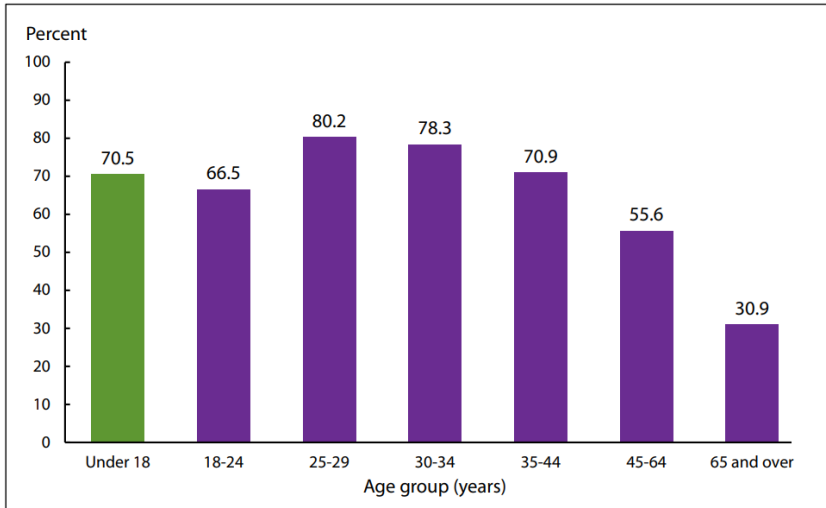


- Data in North Amer.
  - 1.3 EB/month in 2015
  - 9.1 EB/month in 2021
- Usage per Phone
  - 3.7 GB/month in 2015
  - 22 GB/month in 2021

*(Per Cisco VNI, Ericsson Mobility Report, Mobile Experts LLC, etc.)*

# Wireless-Only

Figure. Percentages of wireless-only adults and of children living in households with only wireless telephone service, by age group: United States, January-June 2019



NOTE: Wireless-only adults are adults who live in households with only wireless telephone service and have their own wireless telephone.  
SOURCE: NCHS, National Health Interview Survey.

- CDC Wireless Substitution (Bi-annual, June 2019)
- Wireless-only
  - Adults: 58.4% (West: 61.8%)
  - Renters: 75.1%
  - In Poverty: 67.1%
  - Hispanic: 71.2%
  - *52 million children (70.5%) live in wireless-only households.*
  - *80% of 911 calls are mobile*

# Telecom & ICT are Major Policy Issues



# FC



# Telecom Resiliency



- CPUC 20-07-001  
“Decision Adopting  
Wireless Provider  
Resiliency Strategies”
  - <https://bit.ly/32QK5ug>
  - 72 hours backup at *all* cellular sites w/o waiver
  - *Does not apply to ISPs*

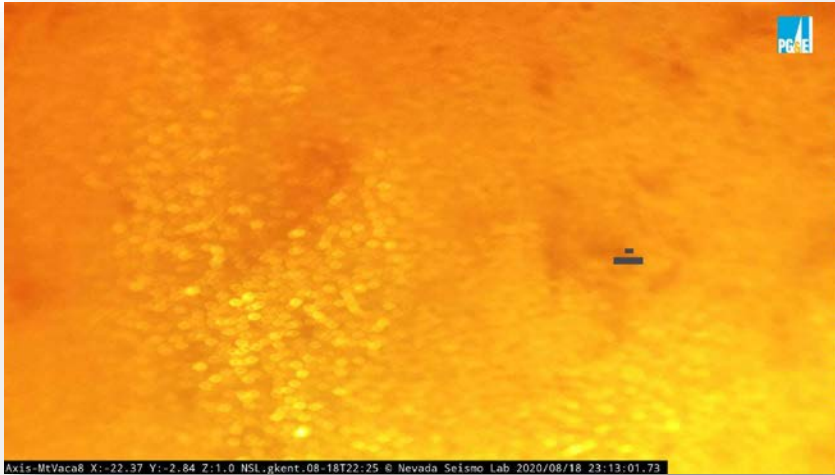
# Telecom Resiliency



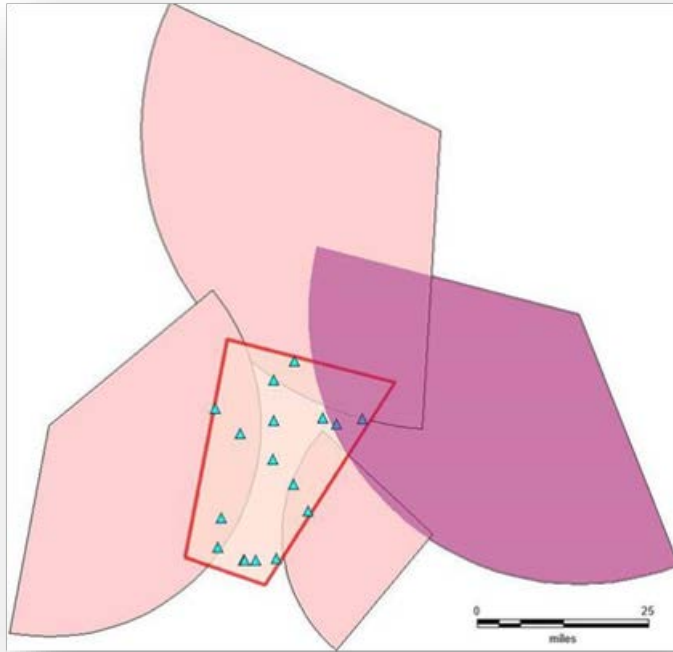
- 2020 CZU Wildfire
  - *Site: Empire Grade*
  - *Status: Total Loss*

# Telecom Resiliency

- 2020 LNU Wildfire
  - *Site: Mt. Vaca*
  - *Status: Total Loss*



# Wireless Emergency Alerts

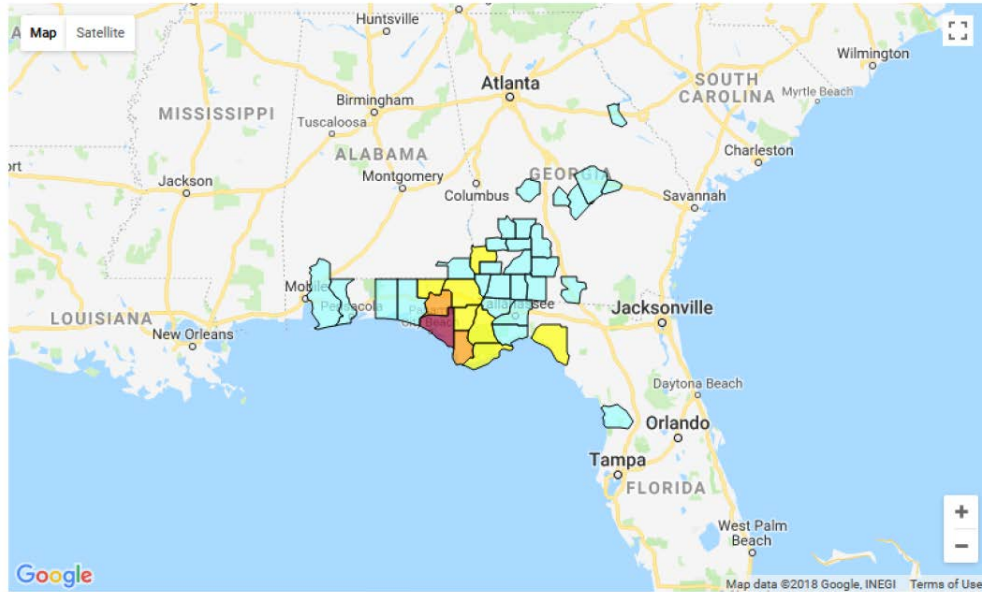


- Redundancy is the key to resiliency
- *A single tower/site is a single point of failure*

# Telecom Impact & Restoration

## Percent Cell Sites Out-of-Service By County

10/15/2018 11:01:06 AM



1 - 15 16 - 30 31 - 45 46 - 60 61 - 100

YAHOO! NEWS

## Storm left wide swath of Florida a communications dead zone

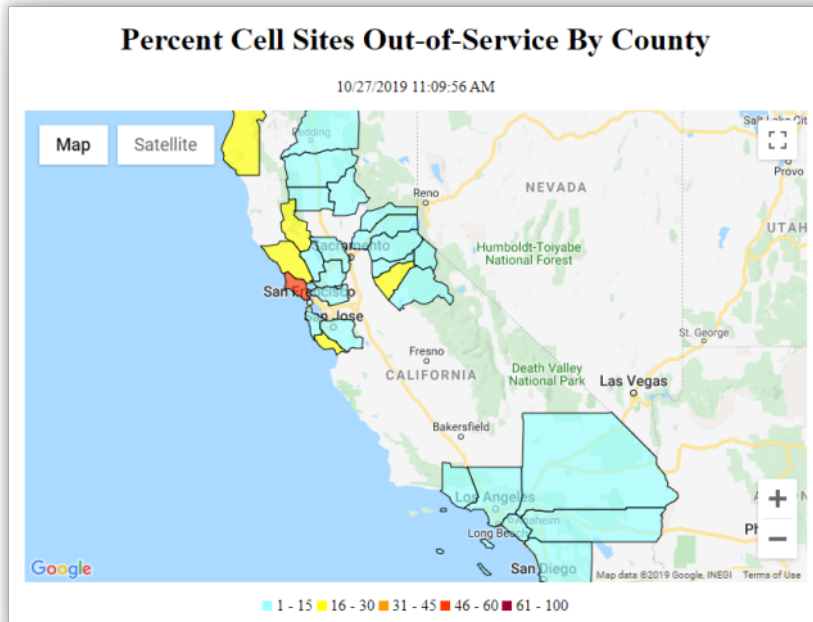
CYRIL JULIEN OCTOBER 13, 2018



Utility workers have been working nonstop since Hurricane Michael devastated a wide swath of the Florida coast, but many areas remain in the dark, without power, phone or internet service (AFP Photo/Brendan Smialowski)

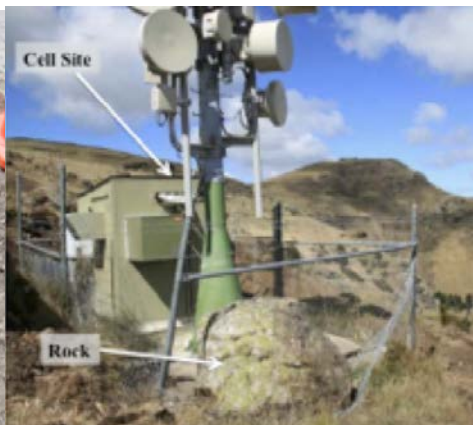
Panama City (United States) (AFP) - Since Hurricane Michael roared through on Wednesday, a wide swath of Florida's northwest coast has been without telephone or Internet service, adding to the daunting challenges facing residents, loved ones trying to reach them, and the work crews struggling to bring them relief.

# Telecom Impact & Restoration



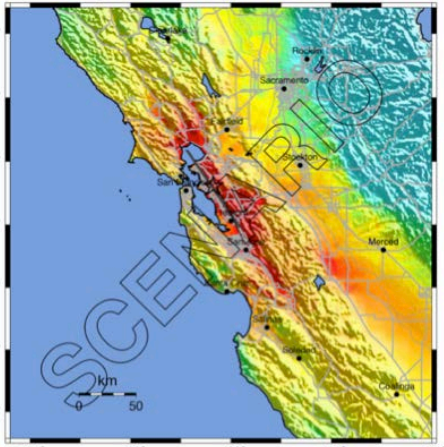
- PSPS: 27-Oct-2019
  - Marin: 49.6%
  - Lake: 19.3%
  - Sonoma: 17.1%
  - Santa Cruz: 16.4%
  - Napa: 10.1%
  - San Mateo: 9.3%

# Earthquake Hazards



# HayWired

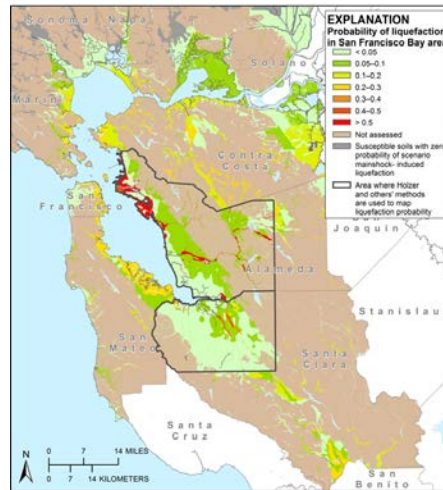
- Shaking
- Surface rupture
- Liquefaction
- Landslide
- Fire following
- Aftershocks



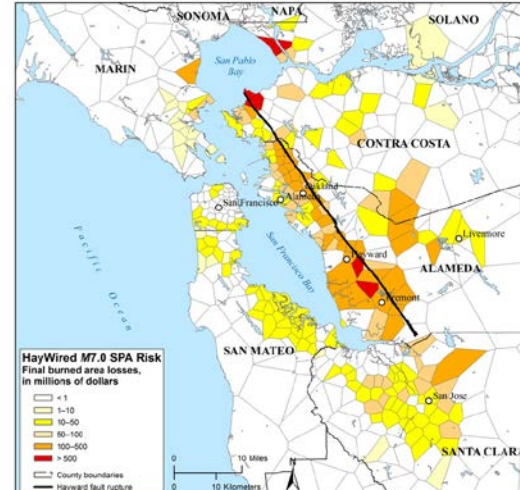
PLANNING SCENARIO ONLY -- Map Version 28 Processed 2015-05-13 22:46:39 UTC

PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	None	Very light	Light	Moderate	Mod/Heavy	Heavy	Very Heavy
PEAK ACC. (%)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL. (cm/s)	<0.02	0.1	1.4	4.7	8.6	20	41	86	>178
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

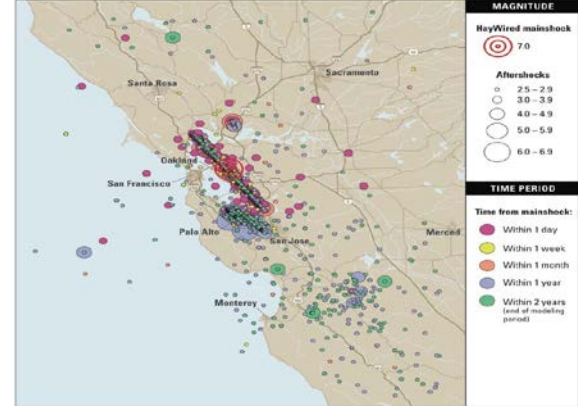
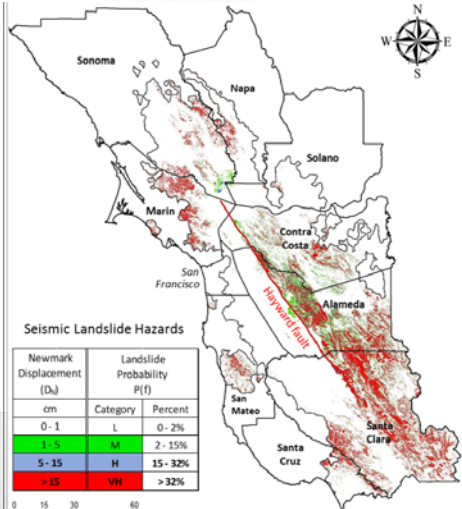
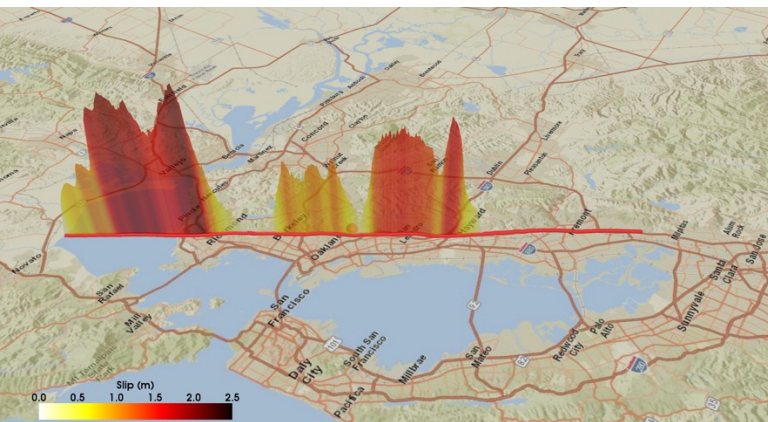
Scale based upon Worden and others (2012)



Hydrology from U.S. Geological Survey National Hydrography Dataset, 2016. Boundary data from U.S. Census Bureau TIGER data, 2016, and Federal Emergency Management Agency Hazus-MH 2.1, 2014. North American Datum of 1983 (NAD 83) projection. Central meridian, 123° W, latitude of origin, 01° N.



HayWired M7.0 SPA Risk Final burned area losses, in millions of dollars



Detweiler and Wein 2017:  
 HayWired Volume 1





# HayWired Telecommunications

- On publication, HayWired telecommunications findings will be publicly available
  - Earthquake hazard exposure and damage of telecommunication components
  - County restoration curves for cases of permanent and portable back up power and user behavior management

# Looking forward...

- User experiences during PSPS & wildfire events show we are *not* (my opinion) telecom resilient
  - CPUC backup power decision covers only wireless carriers, will not cover small cells & DAS, nor cable utilities
  - Little understanding in public of personal power preparedness (UPS, gateways, hotspots)

# Looking forward...

- On the positive, PSPS and wildfire events are providing people with direct understanding of the need for telecom power resiliency – similar to the “Day Without Power” exercise recommended in HayWired Telecom

# Looking forward...

- HayWired Telecom & ICT Report is in the USGS publication queue.
- We are hosting a series of webinars to bring awareness and provide a starting place for discussion.
  - How can we engage the media to draw attention?



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