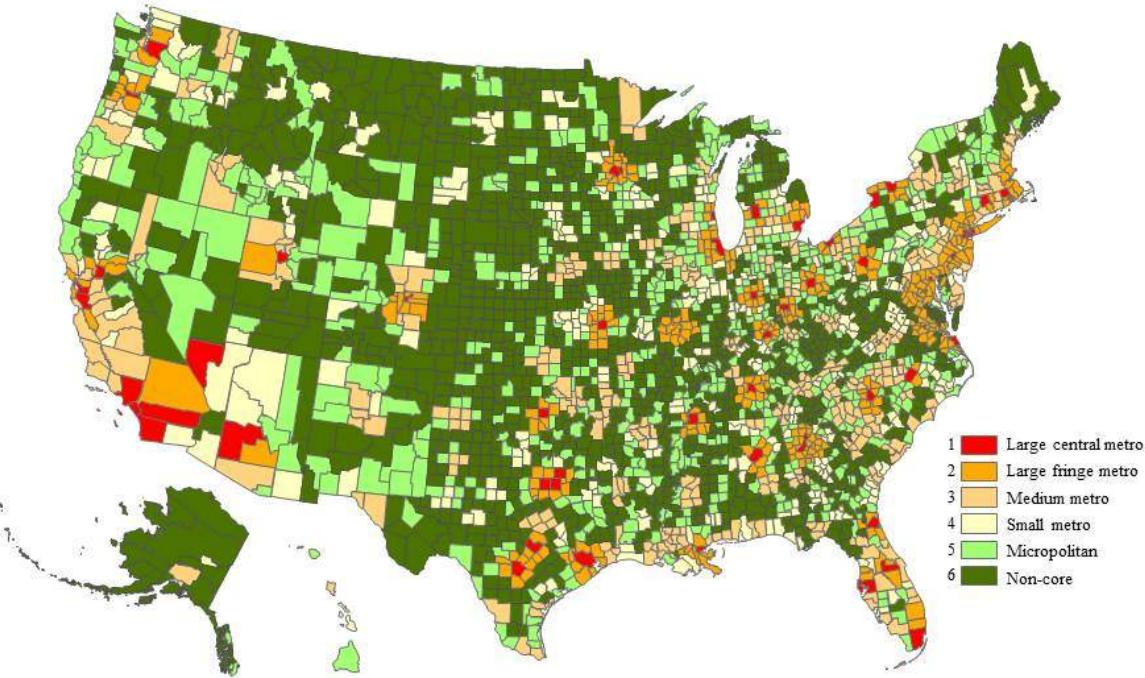# A Rural Lens on Intelligent Infrastructure

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# First, some data



https://www.cdc.gov/nchs/data_access/urban_rural.htm

Legend:
1 — Large central metro
2 — Large fringe metro
3 — Medium metro
4 — Small metro
5 — Micropolitan
6 — Non-core



https://www.fcc.gov/reports-research/maps/bpr-2016-fixed-25mbps-3mbps-deployment/

## 2010 Census:
- 19.3% of population is rural
- 59.5 million people

## 2015 FCC broadband definition:
- Download speeds of 25Mbps+
- Upload speeds of 4Mbps+
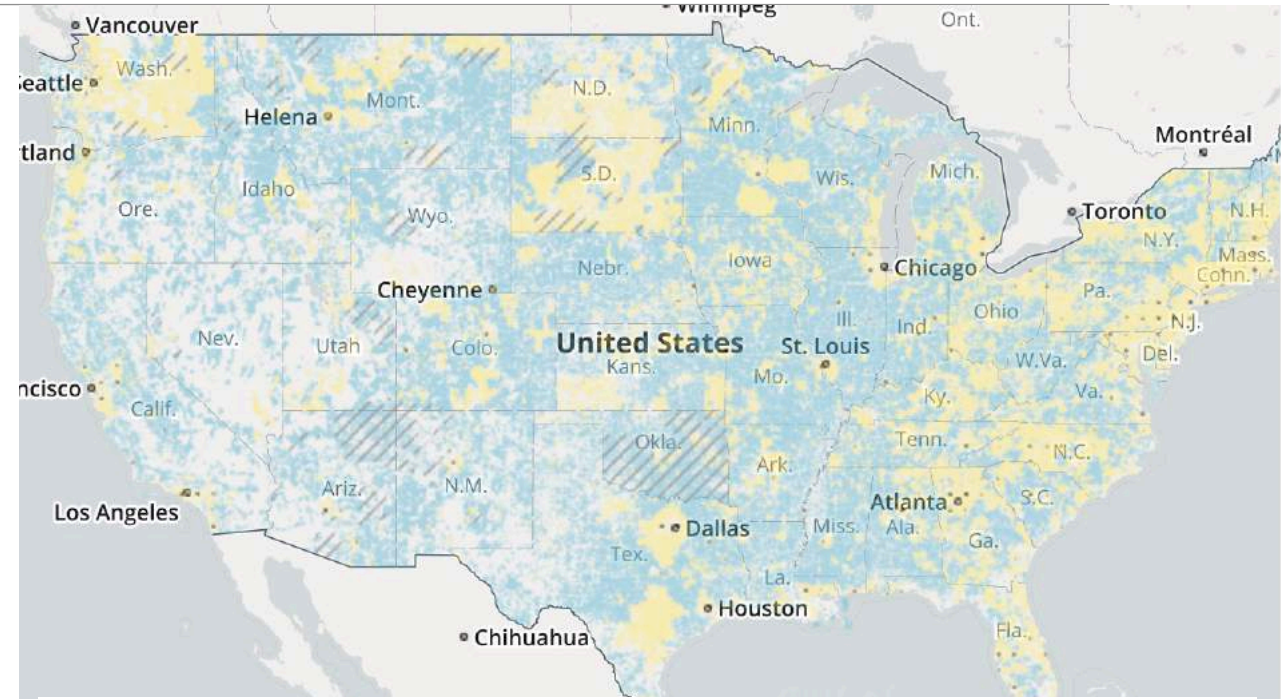
## Who lacks broadband access?
- Only 10% of Americans
- 39% of rural Americans
- 85% of Native American reservation residents!!

Laguna reservation, wikipedia


Navajo reservation, inthesetimes.com (David McNew)


Hopi Village, america.aljazeera.com (Tomo Muscionisco)

# Why the difference in access rates?

Rural area challenges:

- Remote and difficult terrain

- Inadequate and outdated infrastructure

- Sparse population densities

- Lack of private investment due to profitability concerns

- Lack of IT education

Infrastructure requirements:

- Robust to power outages

- Extreme weather

- Easy to operate (far from IT experts and significant data processing capability)

- Rethink traditional Internet access models

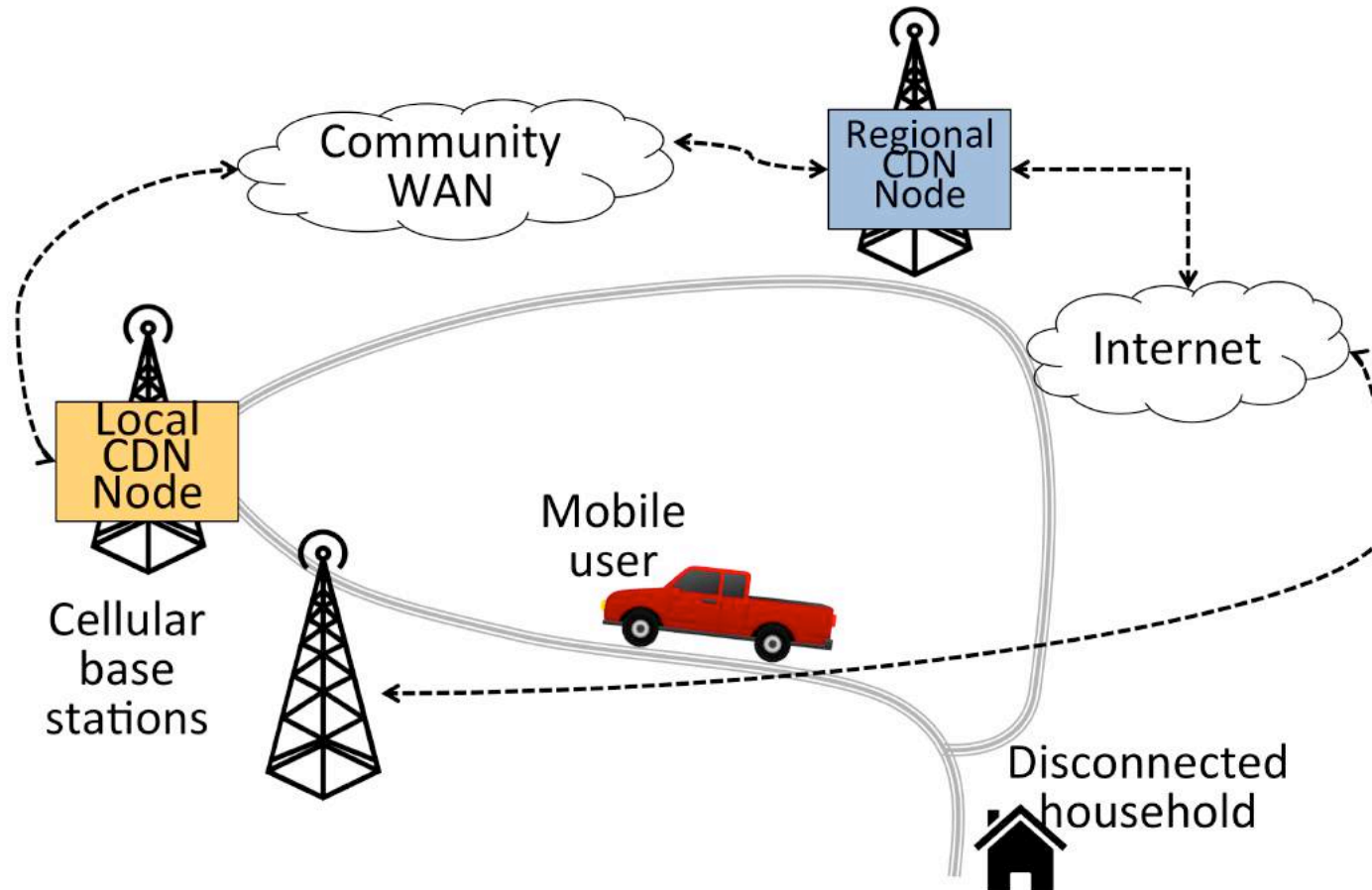Opportunities for fundamental socio-technological innovations!

# Intelligent Infrastructure: Connectivity Innovations

UCSB + Tribal Digital Village: new white spaces installations to connect homes to Internet
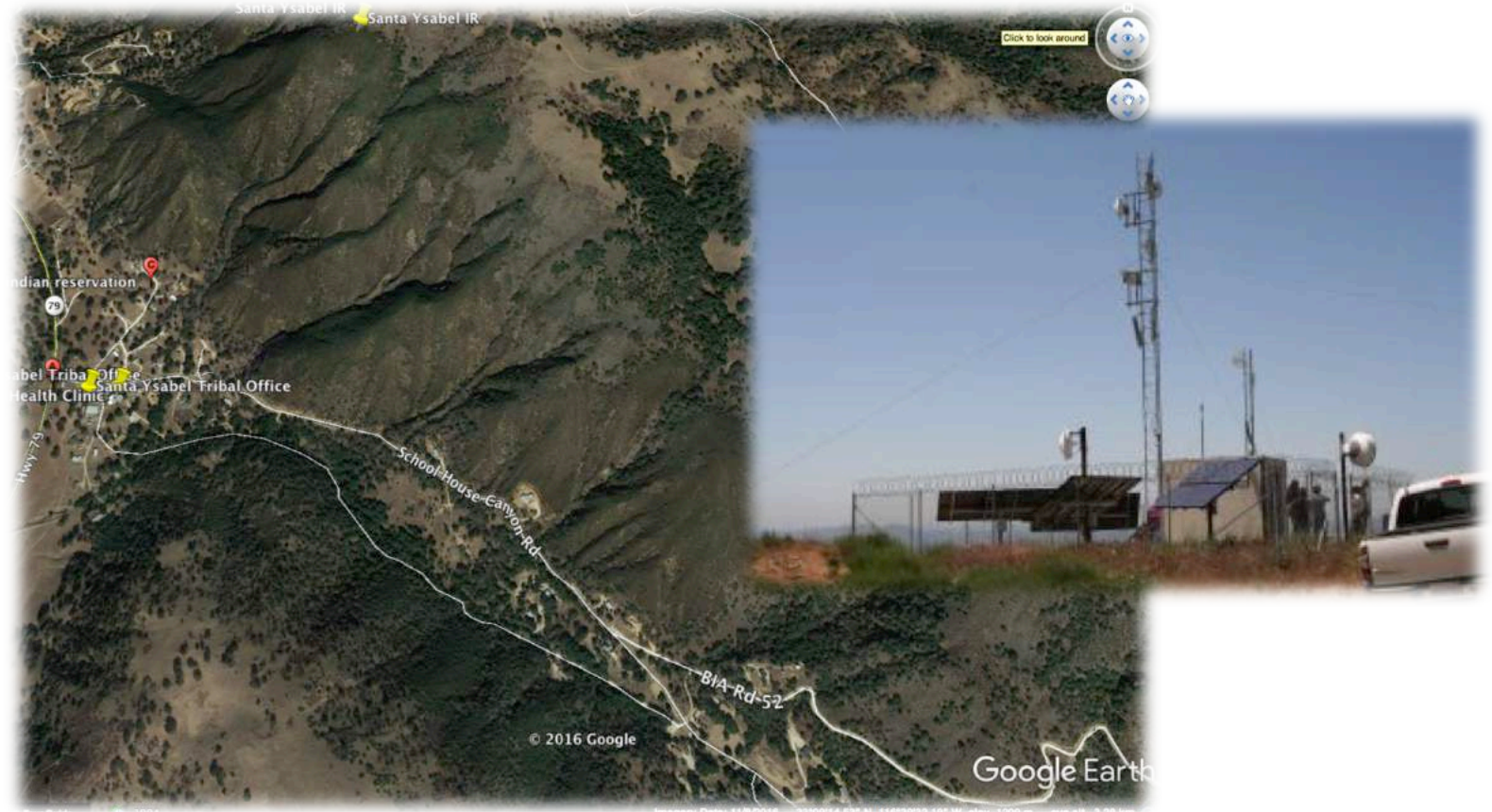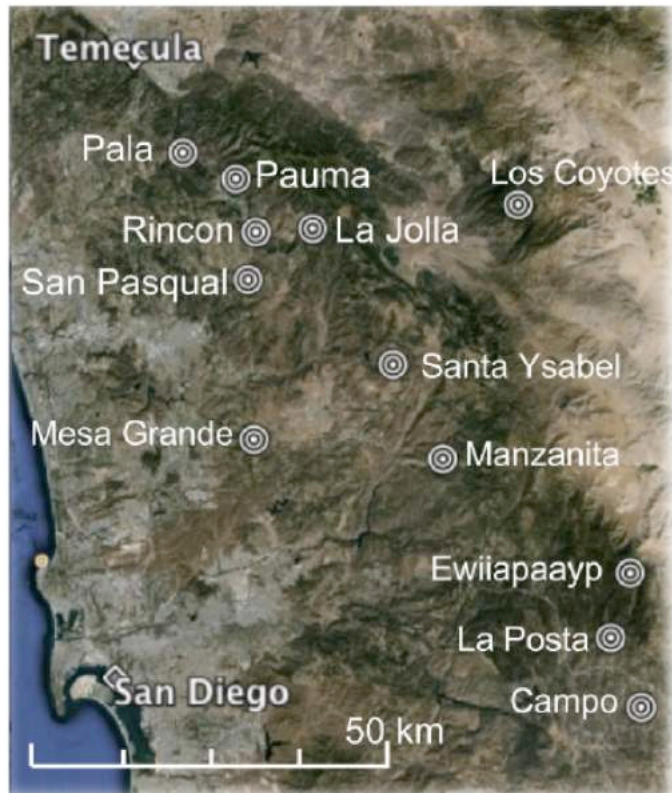
# Intelligent Infrastructure: Connectivity Innovations

UCSB + Georgia Tech (GT): proactive delivery of relevant Internet content

# Potential: Intelligent Disaster Response



Challenges:
- Wildfires, dust storms, tornado alley
- Existing infrastructure – less of it, and less robust

Opportunity: Better leverage citizen reporting (social media) and human intelligence
- Connectivity innovations:
  - UCSB + GT: drones with white spaces/DTN solutions for backhaul
- Better information aggregation and dissemination strategies:
  - UCSB: drone-based localization of devices (i.e. cell phone emitting HELP beacon)
  - UCSB + GT: in-network information aggregation of citizen contributed situational data, automated social media data aggregation platform


startribune.com (Gerald Herbert)


businessinsider.com (Alvin Baez)
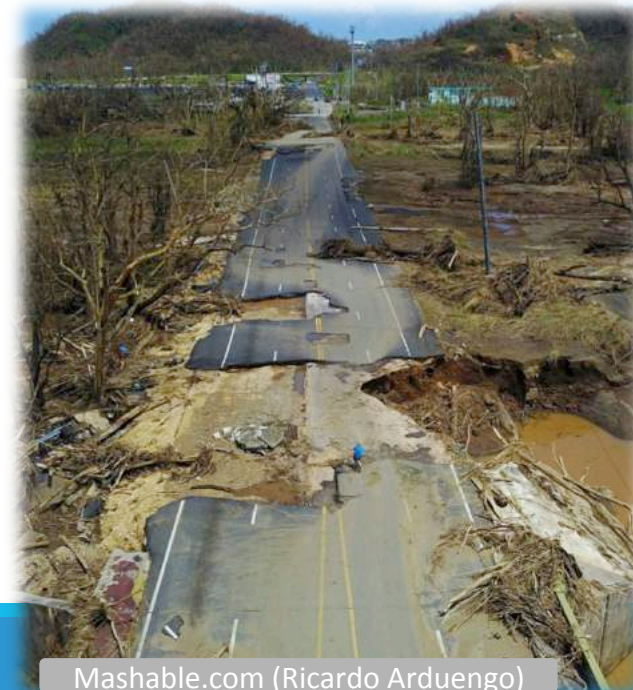

Mashable.com (Ricardo Arduengo)

# Potential: Intelligent Education

FCC:
- 7 in 10 teachers assign homework online
- 1 in 3 households do not subscribe to broadband service

No or limited access to: MOOCs, digital educational aids (Wikipedia), job applications, homework resources

Innovations needed in connectivity solutions, including TV white spaces

# UCSB: Rethinking Rural Internet Access

# Thank you!





Collaborators: Georgia Tech, Penn State, Tribal Digital Village, Red Spectrum Communications, UNHCR

Support: NSF, US Department of State

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http://people.cs.ucsb.edu/ebelding

# Potential: Intelligent Public Safety

Risks: natural disasters, farm safety, crime

Real-time monitoring and analysis is more challenging in rural settings

How do we move the data from sensors to computation facilities?



yesmagazine.org (James Brey)

gcml.org

cdsmr.com