# Wireless Broadband Measurement in California

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# Overview of Talk

- Background
- Software Tools
- First Field Testing
- Conclusion

# Background

- **Our Sponsor**
  - The California Public Utilities Commission (CPUC)
- **The project is a part of an ARRA grant administered by the NTIA.**
  - The grant allows the CPUC to conduct state-wide testing two times per year through 2014.

# Background – Main Purpose

- Objectively evaluate the major providers of mobile wireless broadband service across the state of California
- Provide Californians with additional information about their mobile broadband connection
- Build awareness about the importance of mobile broadband in getting information and services from the Internet

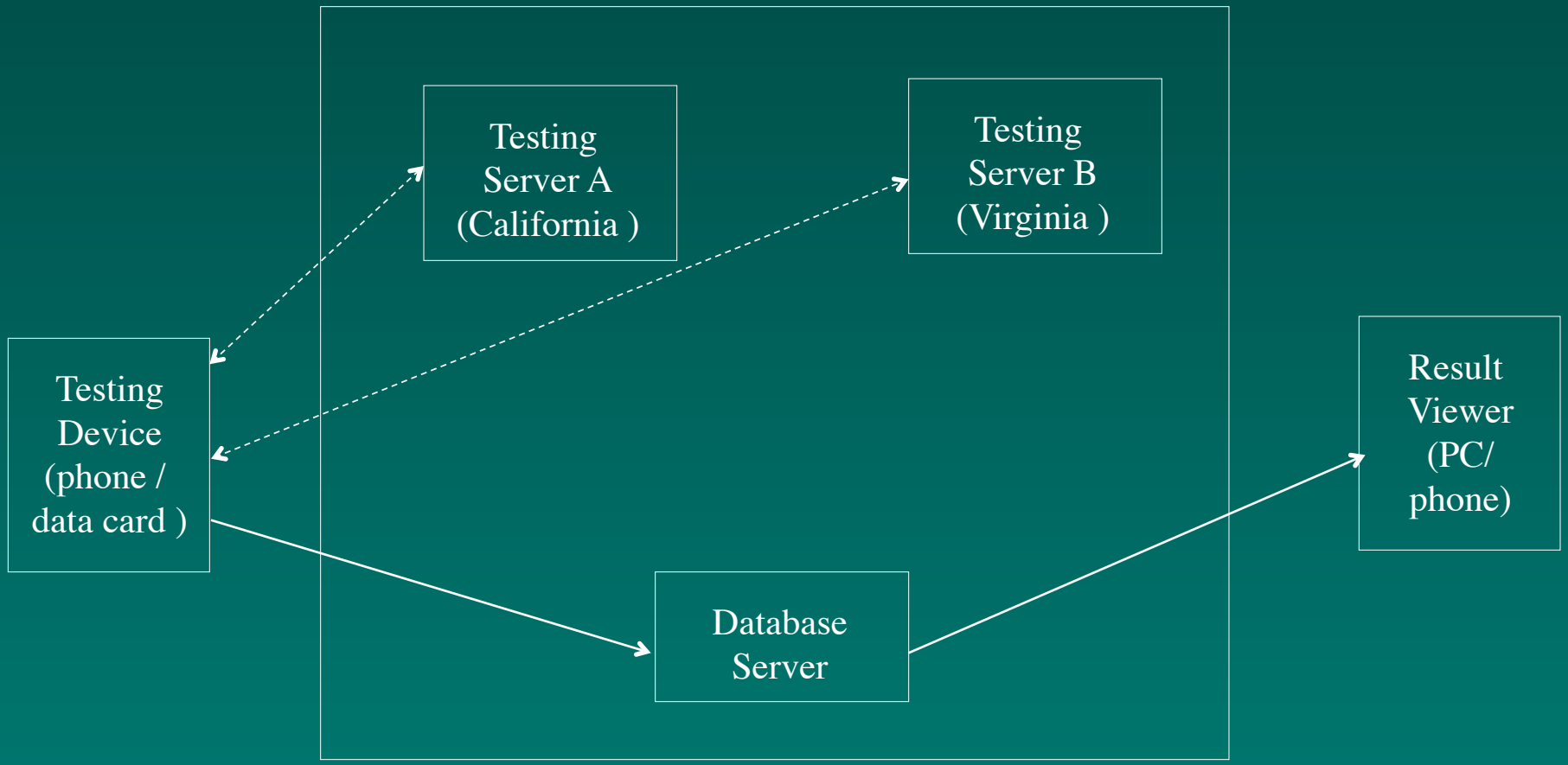
# Background – Goal and Deliverables

- **Measurement results will be made public on the California Interactive Broadband Map and summarized in a white paper**
  - http://www.broadbandmap.ca.gov/
  - Additionally, the measurement software will be available to the general public for their own measurement.

# Measurement Team

- **CPUC**
  - Project management.
- **California State University – Monterey Bay**
  - Software tool development to measure wireless performance.
- **California State University – Chico**
  - Real measurement throughout the state.

# Overall Architecture



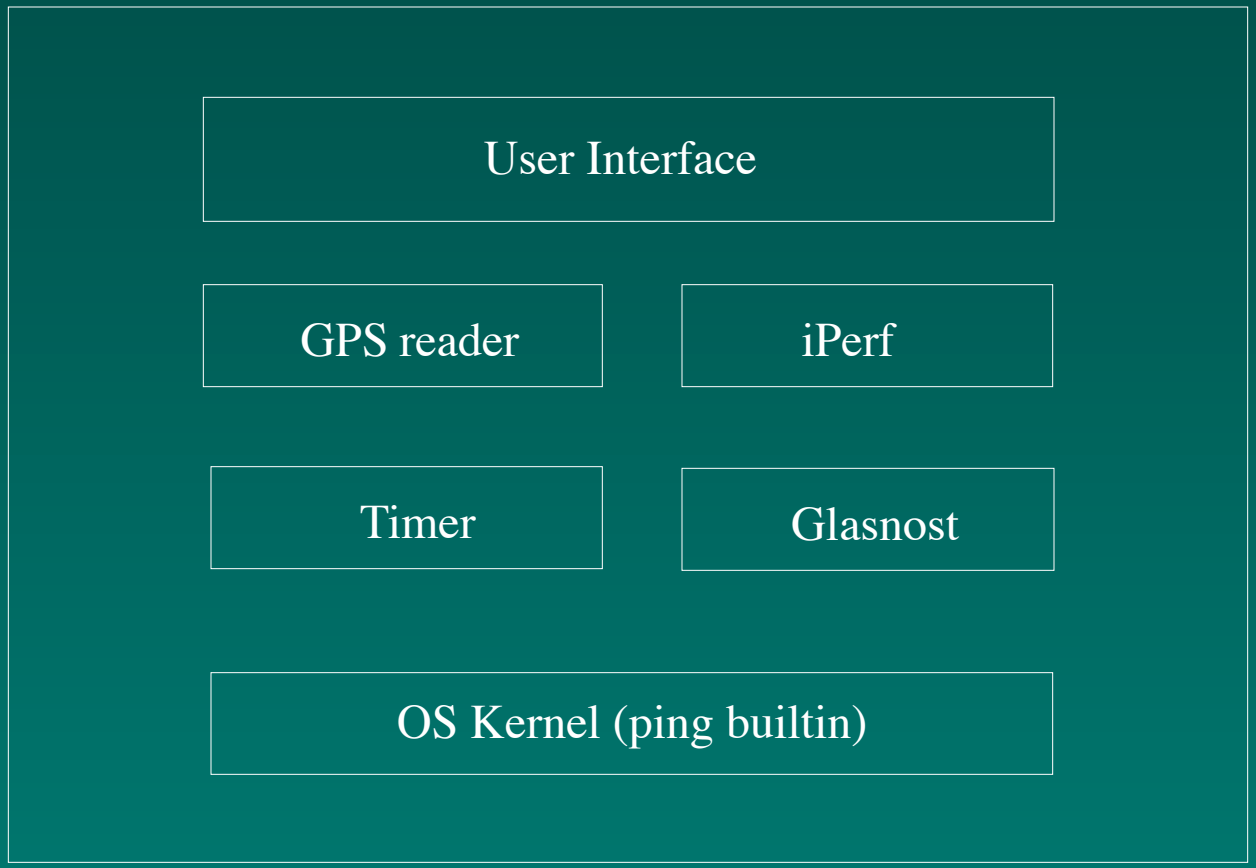
# System Configuration

- **Servers**
  - Two servers in East and West coasts.
- **Clients**
  - Android phone and laptop.
- **Database server**
- **Viewer**

# Measurement Items

- Latitude/longitude
- Date/time
- Provider and network type
  - AT&T, Sprint, T-Mobile, Verizon
  - LTE, UMTS, HSDPA, etc
- Round Trip Time (RTT)
- TCP upload/download speed
- UDP jitter and loss
- Traffic shaping

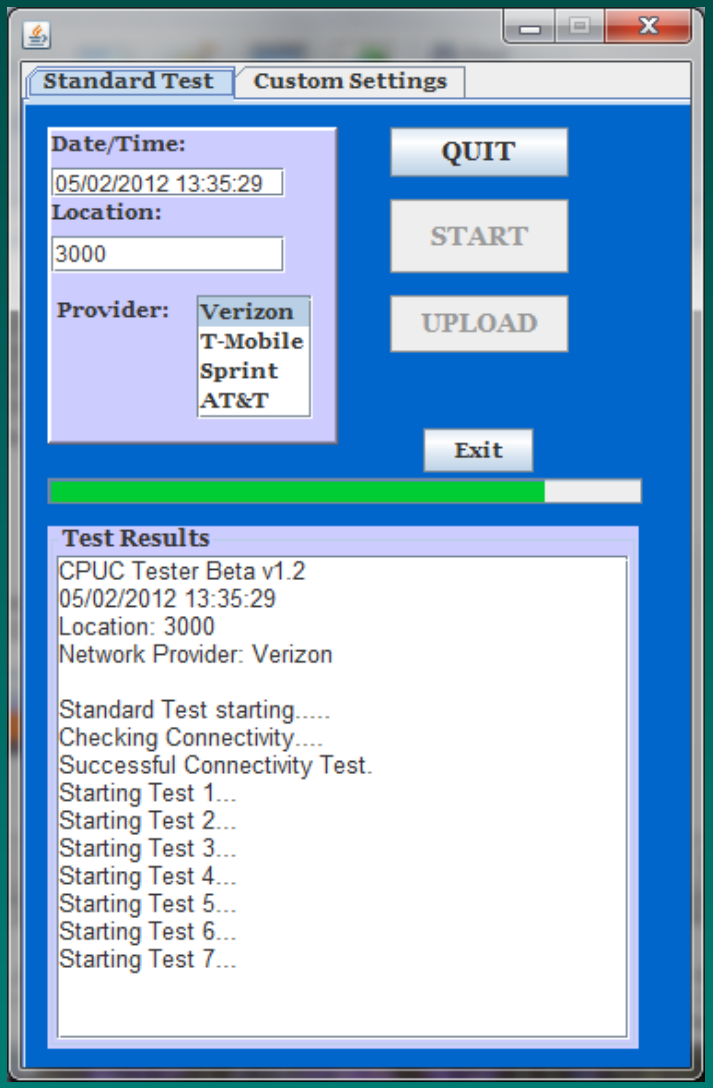
# Software Architecture

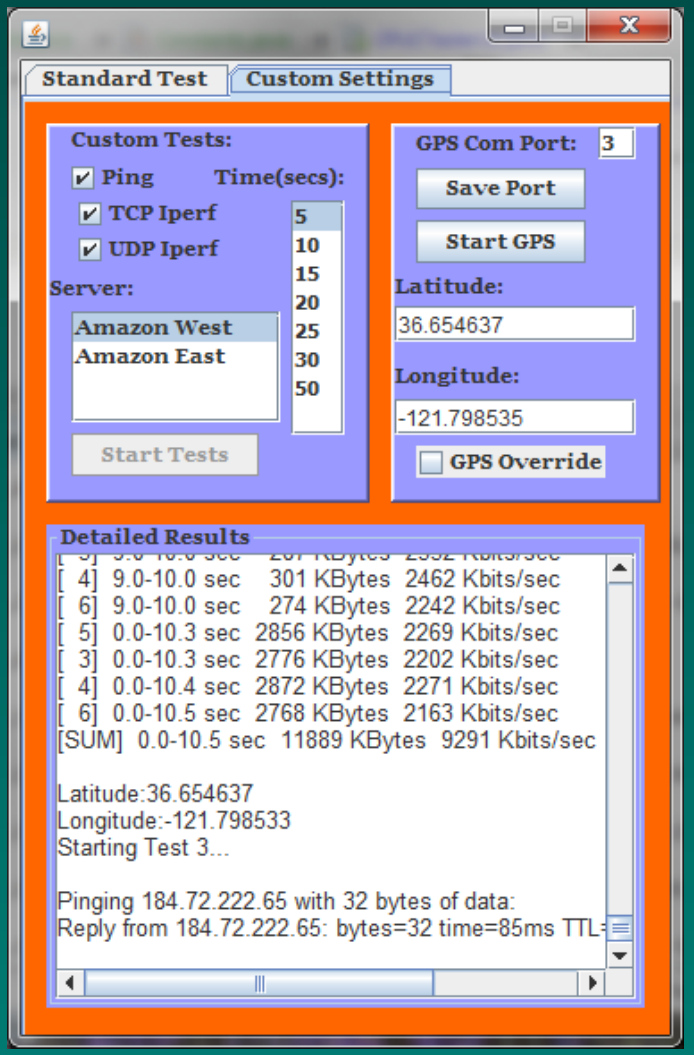


# Test Sequence

- Connectivity checking
- iPerf TCP testing to two servers
- Ping to West server
- iPerf TCP testing to two servers
- Ping to East server
- iPerf UDP testing
- Upload test results to database server

# Software Interface (Laptop Version)



# First Field Testing

- **Mobile Broadband Drive-Test Blog Site**
- http://calbroadbanddrivetest.blogspot.com/

# Field Testing – Phones on dashboard

# Field Testing – Laptop Configuration

# Field Testing – Laptop Configuration

# First Field Testing

- **Eight testers drove over 35,000 miles.**
  - Each tester has equipped with four smartphones and four data cards for four major carriers (AT&T, Sprint, T-Mobile, and Verizon)
- **Testers averaged 10 sites per day.**
- **1,200 randomly selected locations**
  - Urban (23%), rural (67%), and tribal (11%).

# Our Experience and Issues

- GPS locations
- Testing difficulties
- No effective service area
- Server congestion
- Many data cards in a single laptop

# Conclusion and Future Plan

- **The first field testing was successful.**
  - We are analyzing the test results, and a white paper will be forthcoming.
- **We are updating our software for the second field testing which is planned this Fall.**

# Q&A

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