The Quake-Catcher Network: A Distributed Computing Seismic Network

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Project website: qcn.stanford.edu
• **The Goal:** To network computers with internal or USB-connected accelerometers for rapid earthquake detection.

• **The Method:** We use distributed computing to monitor sensors internal or connected to computers when they are not otherwise being used.
Distributed vs. Parallel Computing

Distributed Computing:

Parallel Computing:
Demo - Laptop Accelerometer

Significance
max=-30.01
min=0.00

Z-amp
max=301.67
min=176.33

Y-amp
max=65.00
min=43.17

X-amp
max=25.67
min=20.87

Small Tick Mark = 1 Second
Large Tick Mark = 10 Seconds

Demo Mode - With Live Sensor
Challenges:

**Noise:** Man-Made

**Timing:** NTP

**Location:** always changing
Earthquake Detection

- Probable earthquake detection when the QCN receives many triggers from a region
- Otherwise just people bumping their laptops
- For big earthquakes:
  - only strong vibrations will be detected
  - Only large earthquakes will cause consistent triggers across a region of the network
Trigger Map for the Last Month (Generated on March 05 2009 00:15:10 UTC)

Legend: 🖥️ = QCN participant laptop, 📡 = QCN participant USB sensor, 🌋 = Earthquake of minimum magnitude 4.1

Note: locations changed at the kilometer-level to protect privacy

Los Angeles Participants

USB sensors at San Jacinto High School
Reno Earthquakes Captured!
LA/Chino Earthquake Captured!
**Desktop Network**

- With a USB sensor, any computer can be turned into a strong motion seismometer with QCN software
  - Schools can use the software to educate students about earthquake & seismology
  - School sensors can be distributed evenly with population

USB Sensors Available! $5 for teachers

Subset of K-12 schools in LA Basin
Educational Outreach

What we provide:
- Classroom Demo software.
- Seismology related in-class activities.
- Classroom USB Sensor.
- Classroom BOINC Software.

Request Sensors at: qcn.stanford.edu
Science Benefit

- Shake Maps
- Buildings
- Rupture
- Structure
Eventual Goal: *Earthquake Early Warning*

M 5.6 (October 30, 2007)  
Honshu, Japan

M 7.2 (August 16, 2005)  
Alum Rock, California
Conclusions

- Distributed computing could be a hugely beneficial to seismology & other data-centered fields
  - Rapid earthquake detection techniques
  - Monitor all types of sensors, easily scalable

- Potential for Earthquake Early Warning Application!

- Great education and outreach opportunities!

More information @ http://qcn.stanford.edu