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Seismology Group – http://www.cens.ucla.edu/Project-Descriptions/Seismology/index.html

Wide Area Wireless Networks for Geophysics

Mexico Experiment: Deployment (May 2005)

Science in a unique location

- Most earthquakes in Mexico occur at the coast.
- 1985 Mexico Earthquake destroyed some buildings and left others standing.
- Analysis of seismic wave propagation from coastal earthquakes will aid in understanding this phenomenon.

Line of radio linked (blue) and standard stand alone (red) seismometers spaced every 5 km to study wave-propagation and the subducting slab. This experiment will give the seismic community a strong understanding of the benefits of real-time analysis during temporary deployments.


Pino Suarez Towers Looking North

- Volcano-creating magma should occur when slab is at ~70 km depth, but volcanoes seen when slab is at +100 km.
- Array will allow us to map magma path by providing the upper plate and subducted slab geometry, and also an estimate of the viscosity in the mantle wedge.

Cocos and North American Plate Intersection

Site selection and construction

•To date, selected 40 sites and installed 19.

•CENS-developed Duiker data acquisition software used to collect 24-bit, 100Hz data.

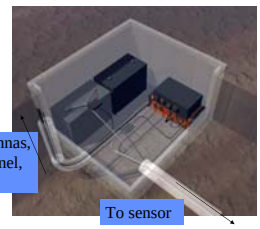
•Most CDCCs are wirelessly (802.11b) connected, distance is 5km – 15 km.

•Data is delivered to RAID array at UNAM, then to UCLA by conventional Internet.

•Each station has a masonry sensor vault that is approximately 1 meter deep and an adjacent recorder/battery hole connected via an underground conduit.

•The antennas used are 15 dB YAGI and 24 dB parabolic.

•A comfortable distance is 5-8 km with YAGIs and 8-20 km with parabolics



Mexico Experiment: Testing and System Integration (January, 2005)

17 hop wireless test

•Successfully tested link quality and throughput with simple file mover generating 1 min files on each node

•1 Mbps through last 2 mile long hop at 100x Mexico rate

• Increased file rate to 120 MB/h to find the throughput limit.

•Queue was stable with 1-2 entries

•With Roofnet routing and possible interference from other nodes, every node could see each other

Standard node configuration

• 2-way splitter with 15 dB YAGI antennas

•10' PVC mast over 3' metal stake drive 1' into soil

•CDCC with 20' antenna cable

•Ethernet connection to laptop

•12V auto-type battery

Scouting trips

Designed waterproof rugged iPAQ enclosures to use with external antennas. Proved very convenient and useful in the field environment.
Better than laptops, no booting required.

All tests used ping from VxUtil on IPAQs

Discovered many wireless features impossible to ignore:

- •Importance of line-of-sight: cannot tolerate too many trees even for one mile intervals
- •Some nodes with splitters on each end no connection, with no splitters, have ~40% packets through
- •Good round trip times with both splitters: 4-5ms, up to 10ms, no drops

Garner Valley Experiment: Data Acquisition and Dynamic Routing (August 2004)

•Collaborative study conducted by USGS, UCSD, UCSB, UTSA, and UCLA

•CENS to deploy 9 sets of broadband sensor pairs (Guralp 3T) and provide 6 sets of weak motion sensors (Mark Products L4)

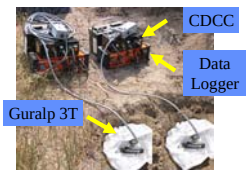
•T-Rex Seismic Shaker Truck to generate ground waves


UCSD Wi-Lan and T-Rex

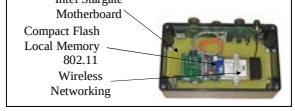
CENS testbed

9 Sensor sites consisting of

- •2 Guralp's 3T, broadband
- •2 Q330 data loggers – one with GPS and one using external timing
- •2 CDCCs with wireless enabled
- •Batteries and 40W solar panels



CDCC Closeup



- •Field tests of acquisition software and Roofnet routing are providing data for further development
- •Testing of distributed network timing
- •Ongoing software and hardware integration.
- •Testing of CDCCs and Q330s in an extreme hot environment, preparing for Mexico deployment.