Wide Area Wireless Networks for Geophysics

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Mexico Experiment: Science in a Unique Location

•CENS vision is to develop distributed embedded network systems with an ability to run large scale environmental monitoring applications.

•Seismic implementation - deploying a network of seismic sensors in Mexico with continuous data collection and processing. A study of how recent developments in wireless networks could be applied to measure the seismic wavefield around Mexico City.

•The UCLA CENS array of seismometers are installed in addition to the Caltech ones to improve the resolution of the MASE (Middle America Subduction Experiment) network that is being run by the California Institute of Technology in collaboration with National Autonomous University of Mexico (UNAM).

•The use of multi-hop wireless networking (802.11/16) is an emerging technology. CENS is examining how it can be adapted for seismic networks whereby the network acts as the transmission line, with the ultimate goal of real-time characterization of the incoming seismic waves as they develop downstream.

- Most earthquakes in Mexico occur at the coast.
- 1985 Mexico Earthquake destroyed some buildings and left others standing.
- Analysis of seismic wave propagation from earthquakes at the coast 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 the slab is at ~70 km depth, but volcanoes are seen when slab is at +100 km.
- Array will allow us to map magma path.
- It will provide the upper plate and subducted slab geometry and an estimate of the viscosity in the mantle wedge.

Cocos and North American Plate Intersection

Mexico Experiment: Testing and System Integration, Site Selection and Construction.

•The site selection involves dealing with officials, local people, students, technicians mostly in Spanish.

•The site construction is unique to every site and requires a lot of tower and roof climbing, digging and managing cables.

•To date, selected 60 sites and installed 53. All wireless links were tested to ensure good connection.

•Most CENS Data Communication Controllers (CDCC) are wirelessly (802.11b) connected, distance is 5km – 20 km. Several stream data directly to the Internet, some sites in the mountains will be standalone because of the forest.

•Importance of line of sight, can not tolerate too many trees even for one mile intervals

•Big site diversity: Telmex radio towers, local Universities, UNAM, elementary schools, Museum of Light, private houses, hospital, military base, fire station, open area.

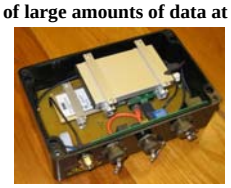
Mexico Experiment: Data Collection, Processing, and Archiving

•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

CDCC modified to use laptop hard drives for storing of large amounts of data at some critical points



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

•The Duiker data acquisition program is designed to run on a stargate microserver. It connects over an Ethernet connection to a Q330 A/D converter, siphons data off the Q330, and stores it locally in a ”bundle.”

•The File Mover tool is designed to run on a stargate with the CENS-seismic file system and push the data to the next hop until it gets to the RAID at UCLA.

•Data is delivered to RAID arrays in Mexico, then to UCLA by conventional Internet.

•The raw data is archived at UCLA then converted to mseed format and sent to Caltech for further archiving, analyzing and processing.

RAID at the University of Huejutla: