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Share information & knowledge to create new collaborations
US-Mexico Collaboration
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About connectivity

• As we all know, in today’s academic and research institutions worldwide, it’s imperative for them to count on computer networks and infrastructure of ultra-high bandwidth, on the order of gigabits per second.
• These allow for collaborative projects among research institutions on a global basis, which also require high performance computing power and great amounts of storage.
CICESE and ICT Infrastructure

- CICESE has always been a provider of training and a collaborator of many academic institutions as well as of government agencies at all levels, national and international (especially in California).
Some examples …
US/MEX Collaboration on Seismic data

- CICESE and USGS deploy an information-sharing system to be better prepared when a seismic event occurs.

- This implies transferring very large volumes of data among these institutions – on the order of hundreds of Gigabytes.
BAJA CALIFORNIA

• Baja California is located in the tectonic border of the Pacific and the North America plates.
• This region is tectonically active and generates seismic activity continuously.
• This region is capable of generating moderate to big earthquakes that could be dangerous to populated region.
Advanced National Seismic System Earthquake Monitoring

USGS

Elizabeth S. Cochran
Cross border collaborations with Mexico: *Earthquakes Don’t Stop at the Border*
SCSN-CICESE-CENAPRED Collaboration

• USNORTHCOM provided funds to improve cross border seismic data sharing between US and Mexico
• 42 new seismic stations in the region of Mexicali Valley, Mexicali and Tijuana
  • 23 accelerometers stations, 5 in Tijuana and 18 in Mexicali.
  • 26 Broadband and accelerometer seismic stations in the Mexicali Valley and in the Baja California state.
• Stations connected to CICESE in real time.
• CICESE managing data through AQMS
• Gbs/day seismic data from CICESE and SCSN are shared in real time (both directions).

Described in detail by V. Wong and J. Stock at the October 2013 BDBN Workshop
Big Data Big Network

- **Problem 1:** Hundreds of seismic stations streaming high sample rate data from urban and remote places throughout the US and Mexico
- **Problem 2:** Reliable systems require redundant sharing of data and derived information
- **Problem 3:** Mass distribution of earthquake information in seconds to the emergency managers, first responders, public.

All of these require reliable, redundant communication within and across state and national borders.
US/MEX Collaboration: LiDAR Geospatial Information

- Initiative of CICESE Computer Science and Geology departments to share INEGI LiDAR data to SDSC. The area of interest is "LiDAR Data Analysis and Processing".
- They need a high speed network connection to SDSC for sharing this type of files.
Collaborative Interactive Analysis of LiDAR Data

- Joann Stock, Caltech
- Alejandro Hinojosa Corona, CICESE
- Arturo Martín Barajas, CICESE
April 4\textsuperscript{th} 2010 M7.2 Earthquake (EQ)

\textbf{Alias:} Easter EQ or El Mayor-Cucapa EQ

- **Major EQ 7.2Mw**, registered instrumentally
- **Surprise!** on a fault with no previous important activity
- **Surface rupture** \( \sim 110 \text{ km}, \ H \& V \text{ slip} \sim 3\text{m} \)
- **Scarce vegetation**, arid region bare rock-soil,
  - Perfect target for remote sensing studies
- **Previous measurements**: seismic, gps, optical images, SAR images, LiDAR,…
- **Close to Border** between Californias,
- **Major scientific interest**
- **Before-After** analysis of big EQ effects

Natural events hasn't country distinction
Searching for surface rupture:
Seismic pattern, aerial recon.
Remote sensing: InSAR (DS, YF, EF),
Optical images (SL), Field Mapping (JF, OT..).
Surface rupture, ~110 km
Right lateral-normal slip
Up to ~3m
Tools, Team and Cyber infrastructure

- Networks
  - Implementation of 40 Gbps LAN at CICESE.
  - Connected to CENIC through 10Gb fiber
- Team: UC Davis, ASU, UCSD, UK, UNAVCO, NCALM, CICESE, INEGI, USGS, GeonGRID, NFS, CONACYT
- Specialized Portals and infrastructure SDSC
  - [http://www.opentopography.org](http://www.opentopography.org)
- Software (open source)
  - LidarViewer, Oliver Kreylos, UC Davis [http://keckcaves.org/software/lidarviewer](http://keckcaves.org/software/lidarviewer)
US/MEX Collaboration: CICESE Optiportal

- Infrastructure to promote collaborative research among institutions distributed locally, nationally and internationally using display walls.
Landfall sites in Mexico: 1970-2010

93 East coast
44% Quintana Roo
29% Tamaulipas
27% Veracruz
23 major hurricanes
Two were category 5 (G88, D07)

122 West/Pacific coast
33% Baja California Sur
25% Sinaloa
7 major hurricanes
Observations and forecast tracks from →
- National Hurricane Center
- Official forecast (National Hurricane Center)
- Operational models (NOAA)
- HWRF model applied at CICESE (black line/boxes)

← HWRF model simulations
- Input data from global scale analysis
- Telemática/Cómputo resources
- 5-day (120 hour) forecast

Figure shows 10-m streamlines and isotachs for Lane (2006) at landfall
Rainfall rate is an important component of the model output.

It is a difficult field to predict and one of the most important elements to be used by emergency managers (and general public) in the affected regions.
Numerical Modeling for Tropical Cyclone Landfall in Mexico
Luis M. Farfán, Ismael Villanueva and Julián J. Delgado

• Tropical cyclones are atmospheric systems that may become a source of damage to the population, property and environment

• The application of numerical models has served to issue advance warnings of landfall along coastal areas

• HWRF is a model installed at CICESE’s Computing Department and is able to perform high-resolution forecasts for cyclones in the eastern Pacific Ocean

• By using HWRF, We are studying tropical cyclones that made landfall in northwestern Mexico during the period 2006-2010

• Future work includes HWRF automated applications on a real-time basis and use the WRF model for 24-72 hr predictions for along Baja California.

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- Technical support from CICESE’s Dirección de Telemática.
Use the 10 Gbps link to transfer Big files for backup service using the SDSC Cloud Storage.

Qualcomm Institute 4K Vroom Display Walls / High Speed Storage (FIONA)
Big Data and Network Link

• This will allow the implementation of high performance cyber infrastructure for research and development.
• Establish new ways to collaborate and sharing knowledge in USA and Mexico countries.
• It also represent challenges in order to find new ways of sharing information.
Ensenada- Pacific Wave is first operational 10 Gbps link in the CUDI network

Thanks to:
- Calit2 (Qualcomm Institute)
- Amlight
- NSF
- CONACYT
- CENIC
- CUDI
- Bestel
A Twelve Year Journey: Creating a Great Data Network Between UCSD and CICESE

- UCSD Meeting on Joint CICESE/Calit2 Proposal Sept 2002
- SDSU’s Eric Frost Talk at CUDI Meeting at CICESE April 2003
- Arzberger PRAGMA Talk-CUDI in Puebla, Mexico October 2003
- Visit by CICESE and CONACYT to Calit2 Jan 2004
- Visit by Calit2 and OptIPuter to CICESE March 2004
- Visit by CICESE and CONACYT to Calit2 AHM April 2004
Building Collaborations Across the Border
At the Speed of Light

- March 2012 CENIC Award in Palo Alto, CA
- August 2012 MSI-CIEC Workshop CICESE/Calit2 Demo
- March 2013 CENIC 2013 Meeting CICESE/Calit2 Demo
- October 2013 Big Data Big Network Meeting at CICESE
- February 2014 BDBN2 Meeting at Calit2’s Qualcomm Institute
NSF Contributions to Cross-border Collaborations: AmLight Project, Big Data – Big Networks Workshop

- NSF Contributions to cross-border collaborations – the AmLight Project
- AmLight links and network topology
- USA – Mexico 10GigE Network Link
- Big Data, Big Networks workshop

Julio Ibarra, FIU, PI
Heidi Alvarez, FIU, Co-PI
Donald Cox, Co-PI
Louis Fox, CENIC, Co-PI
BigData&BigNetwork 2013 and 2014

• NSF ACI-1357928 BDBN workshop grant
• Larry Smarr for his leadership
• Keynote speakers Tom DeFanti and Federico Graef
• Speakers
• Program Committee:
  – Nancy Wilkins-Diehr, Greg Hidley, Salma Jalife, Carlos Casasus, Heidi Alvarez, Raul Rivera, Cliff Frost, Julio Ibarra
• CENIC, CUDI, CICESE, CalIT2
Seismology is leading the way
- Earthquakes do not respect national borders!
  - Collaboration essential for developing understanding
- Lead US Partners: Caltech, USGS
- Mexico: CICESE, UNAM, UABC-Mexicali, UABC-Mexicali, UABC-Ensenada, and University of Sonora
- Collaborations:
  - Employing large-scale sensor networks to gather ever larger amounts of data in both countries
  - Computational analysis in US, visualization in both countries
  - Opportunities for students from both countries as well
- Network – reliable, high-bandwidth essential
Network availability and cross border access

February 10, 2014
RedNIBA

• National Network for Broadband Connectivity
  – Government
  – Social Care
  – Education
Conclusions

• This 10 GigE link cross the border connection, represents a change in the way we do science and most importantly is the collaboration between researchers to provide solutions of problems that affect both nations.

• We appreciate the opportunity to share the vision of Larry Smarr of CALIT2 in benefit of Universal Science.
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