Name: David Oppenheimer
Role/Title: Project Chief/Seismologist
Organization: USGS Northern CA Seismic Network
Preferred Contact: oppen@usgs.gov

How can new technologies and approaches improve outcomes, reduce costs and/or improve response times for an emergency? Over the past 4 years the USGS has funded the California Integrated Seismic Network to develop an Earthquake Early Warning (EEW) system. Their research shows that an automated analysis of the first few seconds of the "P" wave is sufficient to determine the magnitude of large and potentially damaging earthquakes. Given the proper density of seismic instrumentation with real-time telemetry, it is then possible to locate the earthquake epicenter and release an EEW message ~ 8 seconds after the earthquake origin time. The "S" wave, which causes strong shaking, travels ~3.75km/s and more slowly than the P wave. Hence, EEW can provide a warning of the S wave arrival beginning ~30km from the epicenter, and increasing warnings at greater distances (see http://www.elarms.org/ and http://www.gps.caltech.edu/~mboese/index_files/Page361.htm for more background on the technology and amount of EEW time for different earthquake scenarios). Over the next two years the EEW project will deploy a prototype system to demonstrate feasibility and to show how EEW can be integrated into systems to reduce the impact of earthquake shaking. Example applications include automatic stopping/slowing of trains, issuing alarms to initiate duck-and-cover procedures, directing elevators to the nearest floor and to open their doors, causing fire station doors to open, and stopping traffic that would otherwise enter tunnels or cross bridges.

If you were offered 10-15 minutes to give a short talk, what would it be? An overview of EEW and the technical challenges of distributing the information.

What are the most pressing business, process, organization and technical issues? Because time is so short for an EEW to be effective and the message has life-safety implications, the EEW distribution and client side must satisfy some stringent requirements. First, the message must be simultaneously broadcast so that it is delivered to all recipients within 1 second of release. The message payload must contain the earthquake magnitude, origin time, and latitude/longitude. The client application must have accurate time (via NTP or GPS) and know its position (via GPS or by configuration) so that it can rapidly compute the distance to the earthquake location, compute the attenuation of the seismic wave to determine whether the shaking will be large at the client location, when the S wave will arrive at the client location, and what action to initiate. Message delivery via the Internet will require that firewalls permit inbound broadcast messages. Delivery via wireless systems for mobile devices will require that wireless providers agree to immediately broadcast the message to all customers. Client applications must be running at all times.

What is the role of university research in this area? Development of robust client applications, messaging technologies, and strategies to achieve rapid delivery of EEW messages.

Do you want to propose and help run a new breakout group? No

What is the most important action the DMI can take? Foster support for deployment and utilization of EEW for Citizens, Emergency Responders and Command Centers.