

Synthetic Testing of the G-FAST Geodetic Earthquake Early Warning System

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The Cascadia subduction zone poses one of the greatest risks for a megaquake in the continental United States, and because of this, the Pacific Northwest Seismic Network (PNSN) at the University of Washington is building a joint seismic and geodetic earthquake early warning system. We have taken a two-stage approach to earthquake early warning: (1) detection and initial characterization using strong-motion data from the PNSN with the ElarmS package and (2) the triggering of geodetic modeling modules using GPS data from the Pacific Northwest Geodetic Array (PANGA) and combined seismogeodetic (GPS + strong-motion) data. Because of Cascadia's relatively low seismicity rate, and the paucity of data from plate boundary earthquakes there of any size, we have prioritized the development of a test system and the creation of several large simulated events. The test system permits us to: 1) replay segments of actual seismic waveform data recorded from the PNSN and contributing seismic network stations to represent both earthquakes and noise conditions, and 2) broadcast synthetic data into the system to simulate signals we anticipate from earthquakes for which we have no actual ground motion recordings. The test system lets us also simulate various error conditions (latent and/or out-of-sequence data, telemetry drop-outs, etc.) to explore how to protect the system from them. Here we report on the performance of the joint early warning system and the geodetic modeling modules in a simulated real-time mode using simulated 5-Hz displacements from Mw 6.8 Nisqually earthquake. The results show that the geodetic modeling modules are able to properly characterize the event, and we discuss the limitations with respect to latency, network architecture, and earthquake location throughout the Pacific Northwest.

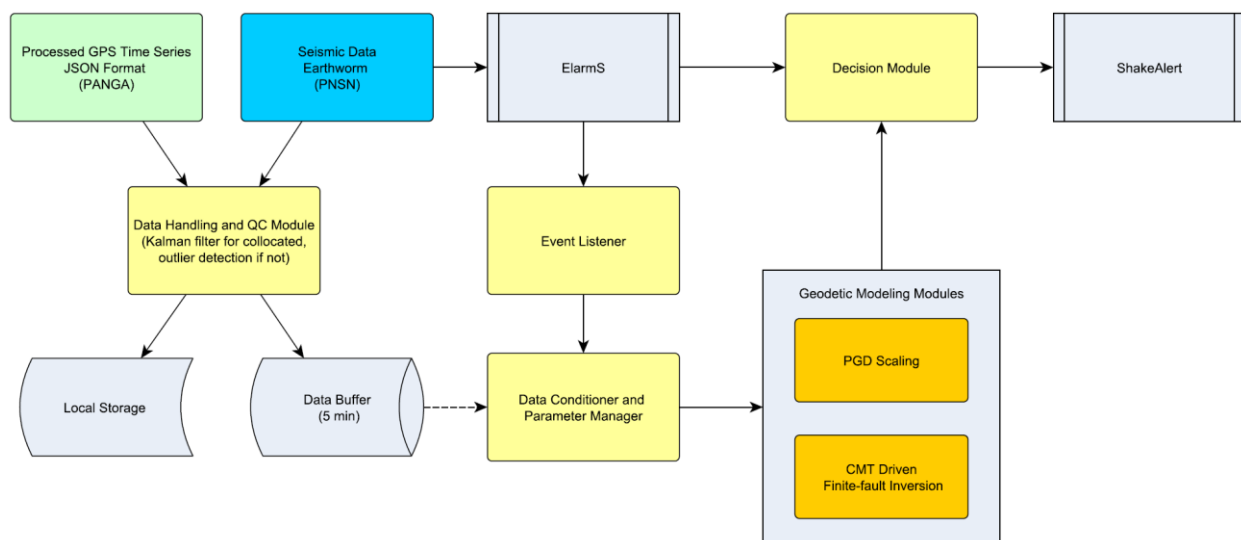


Figure: Flowchart of the G-FAST earthquake early warning system