

# ShakeAlert™

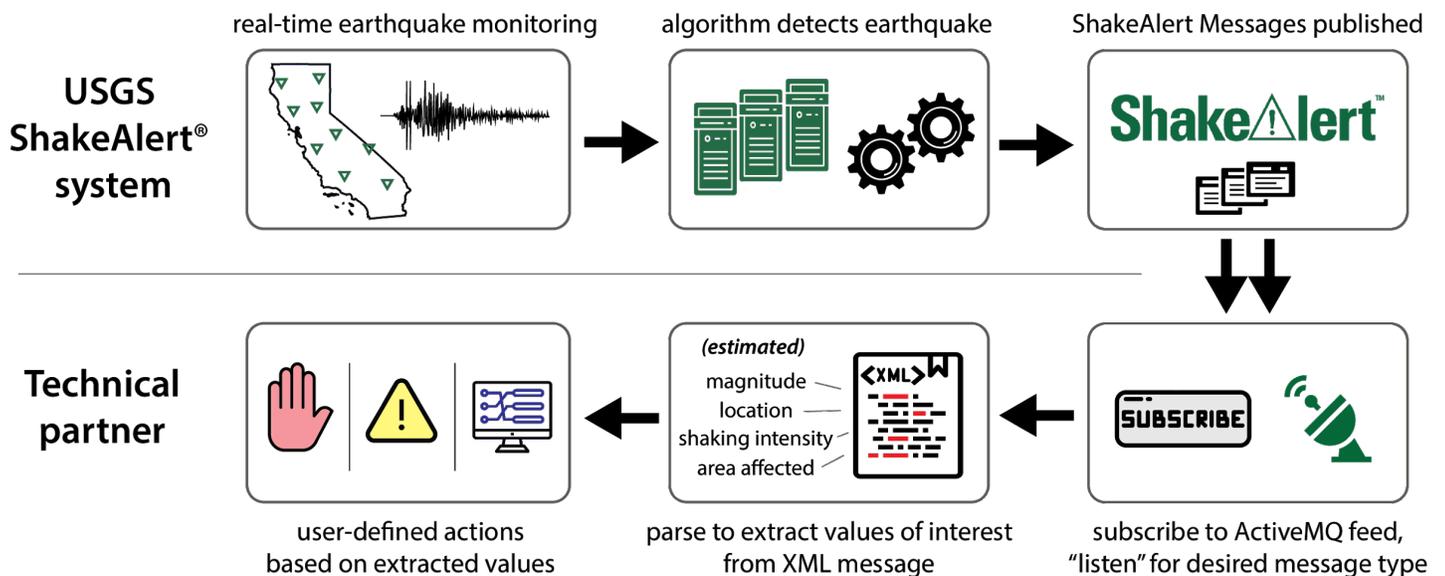
ShakeAlert Earthquake Early Warning System  
Technical Engagement Program  
California – Oregon – Washington

## Quickstart Guide for Prospective Technical Partners

Last modified 4/01/21

### Purpose of this Guide

This Quickstart Guide is designed to inform prospective technical partners about the ShakeAlert® Earthquake Early Warning system as they decide whether to pursue a Technical Partnership with the USGS. This guide provides basic details about the flow of information from the USGS to technical partners, the contents of ShakeAlert Messages, and a list of considerations to help assess technical needs and requirements.



### Information Flow from the USGS to the Technical Partner

**USGS Role:** The USGS and its university partners monitor ground shaking using an array of seismic sensors, and use this data to detect earthquakes and issue a variety of ShakeAlert Messages in XML, a structured plain text format.

**Technical Partner Role:** Develop alert delivery and automated control solutions based on the ShakeAlert messages. As a Technical partner you will subscribe to USGS message brokers ("Alert Layer" ActiveMQ brokers) and listen continuously for ShakeAlert Messages. When you receive messages, you will use the ShakeAlert published shaking estimates to protect your clients or assets, by alerting people and/or initiating automated controls.

# ShakeAlert® Messages have three components

Technical Partners can subscribe to one or more components

1

## EVENT ONLY

ActiveMQ "topic": *eew.dm.data*



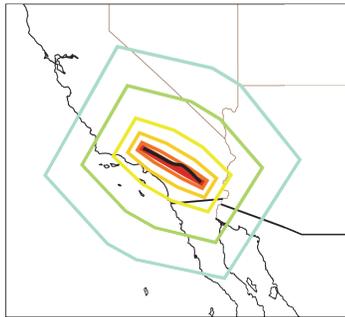
Provides estimated earthquake **magnitude** and **location**, along with uncertainty. For earthquakes M6.0+, **fault geometry** is included.

Technical Partner must calculate shaking effects and affected areas.

2

## EVENT + CONTOUR

ActiveMQ "topic": *eew.gm-contour.data*



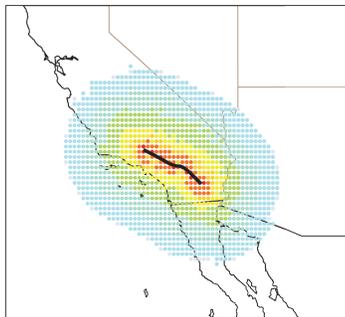
Contains **EVENT COMPONENT** plus data for **contours of shaking intensity**.

Polygons enclose areas according to estimated Modified Mercalli Intensity (MMI), Peak Ground Acceleration (PGA), and Peak Ground Velocity (PGV).

3

## EVENT + GRID

ActiveMQ "topic": *eew.gm-map.data*



Contains **EVENT COMPONENT** plus data for a **grid map of shaking intensities**.

Grid cells are 0.2 x 0.2 degree (~20 x 20 km) identified by latitude and longitude.

Figures derived from: Given, D.D. et al, "Revised technical implementation plan for the ShakeAlert system—An earthquake early warning system for the West Coast of the United States" (2018), <https://doi.org/10.3133/ofr20181155>

## What is a ShakeAlert® Message?

The USGS ShakeAlert system publishes ShakeAlert Messages in XML format on its alert servers. Messages contain estimated earthquake magnitude, location, and, for some message types, the areal distribution of expected shaking intensity levels. The first message of any type is labeled with a message-type of "new," and updates (labeled with a message-type of "update") follow rapidly as more information is processed and the earthquake grows. Minutes after the final update, closure is indicated with a message labeled with a message-type of "follow-up."

## Technical and Coding Considerations

- ❑ Plan to monitor and manage reconnects to ShakeAlert hosts. Network connections can fail. Plan to fail over and try another in a polling fashion over the six hosts.
- ❑ Plan for event updates. Magnitude and location estimates can change as more stations contribute data and the earthquake grows. The number of updates could reach 20 or more over a period of less than a minute for a large event. Updates have a message-type of “*update*”.
- ❑ Event updates mean that estimated magnitudes and/or shaking intensities published in a ShakeAlert Message change; for example, the magnitude could start below an alert delivery threshold and grow to exceed it or start above the alert threshold but drop below it in later estimates. Estimates of location may also change quickly. Be prepared to adjust.
- ❑ Earthquakes can occur in rapid sequence, and aftershocks can be either larger or smaller than the initial earthquake. Plan to enable further actions based on earthquakes in sequence.
- ❑ Plan for follow-up ShakeAlert Messages. Follow-up messages are sent after human review and may come minutes after the initial ShakeAlert Message. Follow-up messages have a message-type of “*follow-up*”, and contain one or more short messages. Follow-up messages will match an earlier event ID.
- ❑ Plan for the possibility that the USGS might publish a false ShakeAlert Message. A follow-up message declaring the error should be sent within minutes.
- ❑ Monitor for connection to ShakeAlert servers using the heartbeat aggregator to confirm connection to the ShakeAlert system.
- ❑ Follow the alert XML schema’s definition of “required” elements. Your code should not fail if optional elements are present or missing, or if undefined elements are encountered. This will improve backward compatibility and offer some protection if a message is missing an optional element.
- ❑ If you are interested in other formats, for example Common Alert Protocol (CAP) format, contact Robert de Groot at the USGS ShakeAlert Project office for details.
- ❑ A ShakeAlert Message test suite is available to test a range of realistic outputs from ShakeAlert.
- ❑ Partners are expected to provide basic performance information for their applications to the USGS following alerts, including whether an alert was communicated to end users, when it was communicated, and an estimate of how many users or locations were targeted. The USGS expects alerts to be delivered by technical partners to 95% of end users within 5 seconds of receipt of the ShakeAlert Message by the technical partner.
- ❑ The number of connections to USGS servers per technical partner is limited. Do not design systems with the expectation that end-user devices can connect directly to ShakeAlert servers. Be prepared to host your own alert redistribution infrastructure.
- ❑ Members of the ShakeAlert Technical User Working Group (TUWG) are available as a resource to guide technical partners as they implement ShakeAlert-enabled products.

## ShakeAlert Resources on GitLab

ShakeAlert documentation and developer resources are available on GitLab, an open-source repository hosting platform. This is intended to provide ShakeAlert technical partners with accurate and timely information about connecting to the ShakeAlert system and using

ShakeAlert Messages. GitLab also houses other important information about the system. *Access to GitLab is limited to USGS-approved and licensed technical partners with Pilot Phase or License to Operate (LtO) agreements.* Partnership agreements are available on the ShakeAlert website: <https://www.shakealert.org/implementation/partners/>.

Resources on the ShakeAlert GitLab platform include, but are not limited to:

- Server and Port information
- Example alert message in XML-formatted text
- Example alert message in CAP format
- Topic subscriptions
- Failover example code
- Scenario Server tutorials