Before the
Federal Communications Commission
Washington, D. C. 20554

In the Matter of	)	
	)	
Public Safety and Homeland Security Bureau	)	PS Docket No. 16-32
Seeks Comment on Ways to Facilitate	)	
Earthquake-Related Emergency Alerts	)	
	)	

May 9, 2016

Comments of Sage Alerting Systems, Inc.

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1 Introduction

Sage Alerting Systems has been active in EAS and emergency notification and warning since 1994 when the Commission studied ways to improve the delivery of emergency messages to the public via Radio, TV and Cable. During that time, Sage developed the widely used Sage ENDEC which was the first EAS encoder/decoder to receive FCC Part 11 certification, and its follow-up CAP/EAS model. Over the years we have worked closely with the FCC, FEMA and local emergency management agencies to improve the delivery of warnings to the public.

2 Scope of our comments

The commission seeks comment on all aspects of earthquake alerts delivered via IPAWS. We limit our responses here to the interface between IPAWS and EAS devices such as the Sage ENDEC, and the interface between the Sage ENDEC and the Radio/TV transmission chain.

3 Summary

- The current polling scheme used for the IPAWS EAS interface (C interface) is not suitable due to polling latency. A different method, such as a publish/subscribe model, must be used for earthquake message delivery.
- Once received, it is possible for the Sage ENDEC to start delivering audio to the chain in less than two seconds, though downstream delays, such as with HD Radio, can add as much as seven seconds of delay, even to analog listeners of HD radio stations.
- The existing EAS message format – headers and the eight-second attention tone - is not suitable for an earthquake warning. A special alert message playout format would be needed.
- The station to station "daisy chain" should be abandoned for the earthquake warning.
- The existing Sage Digital ENDEC hardware would be capable of providing the desired functionality alongside its existing CAP and EAS capabilities with a field installable software update.

4 Comments

4.1 IPAWS C interface

The current IPAWS C interface uses a polling mechanism based on an ATOM feed. This allowed for the use of standard web-based tools, well known security techniques, server redundancy, and it scaled well. A slow polling rate (to reduce resource utilization) precludes its use for event dissemination with a required maximum latency of a few seconds. A different system must be used for "earthquake early warning" (EEW).

Fortunately, there are several internet protocols that are suitable for such a task, particularly a class called Publish/Subscribe. It is important to use a technology that allows the EAS participant to make an outbound connection to IPAWS, so that EAS participant, that is, the subscriber, need not open a hole in its firewall to allow an outside connection *from* IPAWS, instead, as with the current model, the subscriber connects *to* IPAWS. This also removes the need for IPAWS to maintain a list of IP addresses for each EAS participant.

While Sage is recommending the use of Publish/Subscribe for EEW messages, we do not suggest that IPAWS switch over to use Publish/Subscribe for other EAS messages. The existing system is working well, and deals with a large number of users and frequent messages. If the NWS starts to use issue EAS CAP messages, that will result in hundreds or thousands of messages a day, most where longer latency is acceptable. The EEW system would be optimized for a handful of messages per year.

Further, Sage recommends that only those earthquakes that result in a level of shaking that would require citizen action be sent to EAS participants as EEW messages. Existing methods of dissemination of low magnitude events should continue to be used for non-broadcast applications.

If anything other than the existing IPAWS C interface is used, then a method of testing that system must also be defined. These would include periodic heartbeat messages to allow the ENDEC to verify low level connectivity; weekly log-only messages to allow the EAS participant to verify high-level functionality, and a periodic test function that goes to the air chain, possibly in place of a RWT every few months.

EEW messages can also be disseminated via the various proprietary CAP transport systems now in use that are fed by IPAWS, but we strongly recommend that the messages be available directly on IPAWS as well.

4.2 Audio Latency

For these comments, we're defining audio latency as the delay between the arrival of the alert at the ENDEC, and the first transmission of audio to the broadcast chain.

Once the CAP message is received, its digital signature is checked. This cryptographic operation can take up to a second. Determining the intersection of the EAS participant's service area and the alert's polygon depends on the complexity of the polygon. FIPs codes, a circle, or a simple polygon do not require significant processing time. In the typical case, an EEW alert using Text to Speech would be ready to air in two seconds or less. If the alert includes the URL of an audio file, the fetch time of the file would be added to the delay. That delay depends on the length of the file and the speed of the internet connection.

We assume that the format of an EEW alert would be a short warning tone, following by short warning information. A lengthy location description, a list of towns or cities, a description of an epicenter that local listeners might not recognize, may be counterproductive to the main intent of a warning. Delays in the system will also make the use of overly precise times in the message misleading, especially with the coverage of broadcasters being many seconds of S-wave propagation time wide.

We won't discuss all of the additional delays between the first click of a relay in the ENDEC and the first time the audience hears the audio or sees the start of the crawl. One source of delay worth mentioning, however, is the HD radio delay. This is approximately seven seconds long, and applies to legacy analog as well as digital listeners for the typical station that is delaying its analog audio to match the digital delays.

We note in passing the difficulties in implementing low latency delivery on cable systems with multiple generations of set top boxes.

4.3 EAS daisy chain

The station to station EAS "daisy chain" should not be used for a low latency EEW message. Transmission of the standard EAS header with a small number of county codes, with the required repeats and silence, is about 6 seconds. The attention tone is another eight seconds. About 14 seconds would pass before the next station in the relay would begin to send the alert.

If the header tones aren't sent, listeners would receive the audio six seconds sooner, possibly a significant portion of the available warning time. Legacy EAS is not able to use polygons or circles, something that would be critical to have if the ENDEC is

estimating the shake start time. Adding polygon or circle information to the legacy EAS format would add latency to the warning.

4.4 Use of Existing CAP/EAS equipment

The existing Sage Digital ENDEC hardware is capable of providing the desired functionality alongside its existing CAP and EAS capabilities with a field-installable software update. We suspect other manufactures of CAP/EAS equipment will be able to do the same.

A CAP converter box paired with a legacy EAS device is not suitable for low latency delivery, as at least six seconds are lost in sending the EAS message to the legacy hardware.

The EAS and CAP protocols, and the IPAWS C interface, are open protocols. We recommend that any new protocols involved be public and accessible to any manufacturer.

5 FCC Questions

Our answers to some of the specific questions the commission has asked are provided below.

How long does it take an EAS Participant to receive a CAP-formatted alert from IPAWS?

> Using the current IPAWS ATOM feed, the average delay is half of the polling rate. That rate is user adjustable, but 30 seconds is typical. If a Publish/Subscribe method was used, the delay would be much less.

How long does it take an EAS Participant to deliver a CAP-formatted alert received from IPAWS to the public?

> The delay for our equipment is two seconds or less to the start of the EAS message, plus the time needed to fetch external audio if it is provided. That time depends on the length of the audio and the speed of the internet connection.

How long does it take an EAS Participant to transmit an EAS Protocol-formatted alert to the public through the broadcast-based "daisy chain" architecture?

An EAS header for a single county alert is about one second; with the required silence periods and the repeats, the data portion of the alert is approximately six seconds long. This is followed by the eight-second attention tone and a one second pause. This adds about 15 seconds for each transmission. An origination and one hop delays the start of the audio by 30 seconds for listeners of the second station. Each additional FIPS code adds about 30ms to the total length of the three headers, adding three seconds for an alert with ten counties.

Alternatively, if a complex polygon would be the most appropriate method of describing the alert area for an earthquake in some scenarios, to what extent would the transmission of complex polygon coordinates implicate message delivery latency?

> Since EAS does not send the polygon through the legacy headers (just the FIPS codes), the only delay is in the CAP message itself. As this rate is typically at least 56kbits, the addition of a few vertices is of little consequence. We recommend against the use of multiple high resolution polygons and instead suggest a limit of 100 vertices.

To what extent would the effectiveness of the concentric circle or polygon approach be affected by the type, quality or availability of WEA, EAS or other IPAWS-based alerting services in an area to which an EEW would be sent?

> In the EAS case, especially for radio and TV, coverage is over a large area. Legacy EAS does not permit the use of polygons or circles. If EEW messages are to be sent in EAS format, FIPS codes are all that can be used. If EEW messages use EAS equipment in a non-EAS mode, then circles and polygons could be used.
>
> Special rules defining non-EAS EEW would need to be defined and these could include the use of circles/polygons. Legacy EAS has no easy way to add polygons, and it probably doesn't make sense to try to add it when the goal is a low latency response with short transmission times.

Some downstream devices use protocols that rely on the use of FIPS codes – these will have polygon implications.

Would existing message length limitations (two minutes for EAS messages and 90 characters for WEA messages) have an effect on the ability to deliver EEWs?

The short lead-time EEW, in effect a shake warning, should by their very nature be short length. The two minute length limitation for EAS should not be an issue.

Would it be appropriate to alert the public of an imminent earthquake via a rapid primary message that contains the minimum information necessary to move the public to take protective action, followed by a secondary message that contains more information about the earthquake?

An imminent earthquake warning is something new for EAS, where the required delivery time is measured in seconds, and the public must take action in less than a minute. Those messages must be short.

The secondary message is similar to any other EAS natural disaster event code. While some fast moving events such a dam break might be a candidate for EAS, many, such as lists of medical centers, should be handled by broadcasters in their disaster coverage role, and should not be interrupted by wide-area automated messages.

What one-time and annual costs would be implicated by either updating current alerting platforms to support earthquake alerting, or by creating a new alert and warning platform built specifically for this purpose?

Speaking for the Sage ENDEC only, depending on the complexity of the changes required, there would likely be a one-time charge for the required software update, with no annual costs.

Designing the EEW system to permit the use of existing CAP/EAS devices, albeit with a software update, will result in lower cost for existing EAS users, and maintain compatibility with existing interfaces to downstream equipment, logs, text display, remote control/notifications, etc.

Respectfully submitted:

/s/

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