Common Policies and Practices (Version 0.3)

Introduction

The Common Alerting Protocol (CAP) standard, International Telecommunication Union (ITU) Recommendation X.1303, is recognized worldwide as the key standard for emergency alerting. Online media are increasingly leveraging CAP to help alerting authorities disseminate emergency alerts, which has many advantages in comparison to only using traditional over-the-air broadcasting. Online alerting can also allow people to selectively see warnings based on what they need/want and what they are doing, an improvement over alerts based solely on where they are. When a CAP message includes geographic information, alerts can be more precise--geo-targeting only those who need to be alerted. CAP-enabled alerting can also efficiently address a wide range of devices: desktop and laptop PCs, tablets, smart phones, cell phones, highway signs, and in-car navigation devices, among others.

Although CAP is essential in that it standardizes the content of alert messages, the CAP standard does not address any of the policies that establish context for a given public alerting operation. The CAP standard is also silent with regard to specific practices affecting how CAP alert messages are presented to receivers of the message. Accordingly, online alerting system developers make their own presentation design choices. Yet, different online systems that present CAP alerts often reach overlapping audiences. One result is that people online receive inconsistent presentations of alert messages for the same emergency. Inconsistent presentation can be confusing, and confusion can be dangerous during life-threatening emergencies.

This document describes many policies and practices used in common by several organizations in their operation of "Listed CAP Services" (see table, below). Notations are provided where any of the Listed CAP Services does not use that policy or practice, or uses a variation of it. This document is helping to increase harmonization among the Listed CAP services. Hopefully, it will also be useful to developers of other CAP-enabled emergency alerting systems and tools for creating, publishing, or using CAP alerts. A very useful tool for evaluating alignment to the guidance in this document is provided by the Hong Kong Observatory, which operates the Severe Weather Information Centre (SWIC) on behalf of the WMO. [1]

This document presents topics in three groups: matters pertinent to individual CAP Alerts, CAP Alert Feed topics, and Additional Dissemination Modes, which includes the aggregation services known as CAP Alert Hubs.

Listed CAP Services

This document focuses on the CAP services operated by the listed organizations. Three of these are CAP Alert Hubs: IFRC Alert Hub, WMO Alert Hub, and WMO Severe Weather Information Center (SWIC).

CAP Service	**Organization**
Google Public Alerts	Google Crisis Response team
IFRC Alert Hub	International Federation of Red Cross and Red Crescent Societies (IFRC)
MeteoAlarm	European Meteorological Network of National Meteorological Services (EUMETNET)
meteoblue	meteoblue.com
TPEG-EAW	Traveller Information Services Association (TISA)
WMO Alert Hub	Alert-Hub.Org CIC, on behalf of the United States government

[1] The HKO CAP Checker tool is at https://portal.worldweather.org/cap-checker/wmo-member.php

WMO SWIC	operated by the Hong Kong Observatory, on behalf of WMO

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1. CAP Alerts

An individual CAP alert is the basic unit of any CAP-enabled emergency alerting system. From a technology perspective, a CAP alert is an XML document following the schema defined in international standard CAP. [2] Normally, a CAP alert is attributable to a particular alerting authority at the particular time it was issued. From a policy perspective, a CAP alert is a public, legal document. According to the online Free Dictionary: "A public document is one that is, or should legally be, readily available for inspection by the public, as a document issued by [...] a governmental department."

A Listed CAP Service might maintain CAP alerts as a "collection of records". The records (emergency alerts) can be arranged according to time of publication or other criteria to serve different purposes. For instance, selecting alert series across multiple alerting authorities can be key to the shared situational awareness function of emergency management. Aggregation of alerts into collections can be applied at any geospatial scale (city, province, nation, region, or global) or other criteria can be applied for special purposes of any kind.

A "series of alerts" is typically provided as time-ordered links to CAP alerts through a publish/subscribe service known as an Internet news feed. (Publish/subscribe is necessary to assure the receiver can get every alert in the series of alerts, even in the event of interrupted communications.) The CAP Alert Feed publish/subscribe service needs to be compliant with one of the three Internet standards for news feeds: RSS [3], ATOM [4], or MQTT [5].

1.1. General

A guidance document for various CAP alert elements, entitled "Example Practices: CAP Elements", is published as an OASIS Committee Note. [6] Those example practices are consistent with the policies and practices described in this document.

Google publishes Google-specific differences from the CAP standard: "Google Public Alerts CAP v1.0" [7] and "Google CAP requirements". [8]

1.1.1. Each CAP Alert is a Separate File

Each CAP alert accepted by a Listed CAP Service must be a separate file. The CAP alert file must pass XML validation according to its referenced schema. [9]

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[2] Two versions of the CAP standard (ITU Recommendation X.1303), 1.1 and 1.2, are in use. Each has an XML schema that is used to determine whether a given CAP alert file is valid. These schema are in the CAP Specifications by version at http://docs.oasis-open.org/emergency/cap/

[3] RSS (Really Simple Syndication) is described at http://blogs.law.harvard.edu/tech/rss

[4] ATOM is described at https://en.wikipedia.org/wiki/Atom_(Web_standard)

[5] MQTT is described at https://en.wikipedia.org/wiki/MQTT

[6] *Example Practices: CAP Elements Version 1.0.* 12 August 2013. OASIS Committee Note 01 is available at http://docs.oasis-open.org/emergency-adopt/cap-elements/v1.0/cn01/cap-elements-v1.0-cn01.html

[7] The Google Public Alerts CAP v1.0 document is available at https://developers.google.com/public-alerts/reference/cap-google

[8] The Google CAP Requirements document is available at https://developers.google.com/public-alerts/reference/google-cap-requirements

[9] It is important to validate each CAP alert. A tool for this is at https://cap-validator.appspot.com/

1.1.2. Each CAP Alert should reference an XML Stylesheet

Each CAP alert accepted by a Listed CAP Service should include an XML Stylesheet reference, to avoid having raw XML displayed to human receivers. [10] The link to the XML Stylesheet must be an absolute URL, not a relative URL. Whenever a CAP alert is provided via HTTP/HTTPS, the stylesheet must be available on the same host as the CAP alert, or the host must have a CORS (Cross-Origin Resource Sharing) rule to allow it to be provided.

Note: CAP Services operated by Alert-Hub.Org CIC check if a CAP alert contains a stylesheet instruction. If yes, then the Alert Hub publishes a link to the CAP alert at its original host. If not, then the Alert Hub publishes a link to an Alert Hub host copy of the CAP alert. (Linking to the copy is intended to enhance reliability of access and to relieve workload on the site hosting the original CAP Alert.)

Note: CAP alerts published by MeteoAlarm at present do not use XML Stylesheets.

1.1.3. CAP Profiles and Guidelines

Some alerting authorities specify a "CAP Profile" or other kind of CAP guidance document that is intended to constrain the contents of CAP alerts or to make additional information available in a machine-readable way (e.g. key-value pairs using via the "parameter" or "eventCode" element). A Listed CAP Service cannot be expected to check CAP alerts against such a Profile or other guidance. Ingested CAP Alerts are processed by a Listed CAP Service subject only to XML validation.

1.1.4. Republishing an exact copy

A Listed CAP Service operating as a CAP Alert Hub republishes each CAP alert without any change to its content and in near real-time.

1.1.5. No Access Constraints or Use Constraints

Each CAP alert ingested to a Listed CAP Service operating as a CAP Alert Hub must be published without legal constraints (e.g., Intellectual Property Rights) on access or use of that CAP alert worldwide, except for the requirement for attribution. A Listed CAP Service operating as a CAP Alert Hub republishes each CAP alert without further legal constraints on its access or use worldwide.

The content owner assertion that CAP alerts are free from use constraints requires that each CAP Feed (not each CAP alert) includes a "copyright notice". It is important to recognize that works published without a copyright notice reserve all rights to the content owner.

The content owner can choose whether the required copyright notice asserts "public domain" or the copyright notice asserts copyright by the owner plus licensed use of with attribution, i.e., "Creative Commons BY 4.0". [11]

The specification for RSS states that the "copyright" element provides "Copyright notice for content in the channel". The specification for ATOM states: "The "atom:rights" element is a Text construct that conveys information about rights held in and over an entry or feed." Accordingly, here below are examples of the two acceptable copyright notices in a CAP Feed, compliant with the RSS or ATOM news feed specifications:

Copyright notice in the RSS "copyright" element (typically placed after the RSS "language" element):

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<copyright>public domain</copyright>
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or

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<copyright>Copyright, National Emergency Management Agency. Licensed under CC BY 4.0.</copyright>
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[10] An example of an XML Stylesheet that renders a CAP alert in HTML is at https://cap-sources.s3.amazonaws.com/af-andma-en/alert-style.xsl Note that the stylesheet is language-specific.

[11] The attribution requirement can be asserted through the Creative Commons license "Attribution 4.0 International (CC BY 4.0)", described at https://creativecommons.org/licenses/by/4.0/

Copyright notice in the ATOM “rights” element (typically placed after the ATOM “id” element):

<rights>public domain</rights>

or

<rights>Copyright, National Emergency Management Agency. Licensed under CC BY 4.0.</rights>

1.1.6. Identifying the Type of Event

It is sometimes necessary to identify the type of event (e.g., tornado, tsunami, typhoon) as part of the process of selecting how CAP alerts trigger a public warning. This term can be given in free text through the mandatory CAP “event” element value or given as a code through the optional CAP “eventCode” element value. However, re-publishers of CAP alerts face a formidable challenge to identify the type of hazard solely though free text values provided in the CAP “event” element. At minimum, the specific rules used by a Listed CAP Service to identify the type of event should be easily accessible.

Note: Google Public Alerts CAP v1.0 specifies that the "event" value must not exceed 35 characters and a list of event values must be submitted to Google.

The OASIS Emergency Management Technical Committee published in December 2020 a Committee Note concerning an Event Terms List. [12] Alert-Hub.Org and Google subsequently selected a subset of the OASIS Event Terms, version 1.2. [13] This subset aligns to the WMO recommended terms [14] and to the hazard type terms used in Loss and Damage applications. This subset of OET 1.2 has also been adopted by MeteoAlarm.

In this OET subset, each of the “eventCode” values is tied to one of the 12 “category” values in CAP. For each OET “eventCode” supported in this subset, there is also a corresponding “event” value suggested for each of 33 languages, and more languages can be added easily. This subset of OET “eventCode” terms is demonstrated by a PHP program that requires a "lang" query string parameter as an ISO 639 language code (2 character or 3-character if there is no 2-character code). The program also accepts "code" as an optional query string parameter. The code value must be one of the 49 OET “eventCode”s currently in this subset. Here are two example queries:

https://cap.alert-hub.org/OET(v1-2)-G50.php?lang=es
https://cap.alert-hub.org/OET(v1-2)-G50.php?lang=es&code=OET-068

1.1.7. Geo-targeting of Alerts

Alerts should be disseminated according to the geographic information available in the CAP alert, specified in the "area" CAP elements. It should be noted that diverse alerting areas can be specified in a single alert, i.e., an alert may specify multiple "info" elements, each having separate alerting areas with diverse values of the warning selection criteria. When the alerting area is the whole Earth, a "bounding box" polygon (SW SE NE NW SW) should be used in the CAP area element, i.e., <polygon>-90,-180 -90,180 90,180 90,-180, -90,-180</polygon>.

Listed CAP Services highly recommend that each CAP alert specifies at least one polygon or circle. Alerting authorities should not expect a Listed CAP Service to process geocodes in a CAP alert into corresponding polygons. A Listed CAP Service will treat as an error an unclosed polygon or a polygon with intersecting sides. A Listed CAP Service will occasionally notice and report as an error a misplaced alerting area, typically due to apparent errors in the coding of geographic coordinates. A Listed CAP Service will not treat as an error a polygon with a winding order that is reversed, nor a polygon with a vertex coordinate value having unrealistic precision.

Hazards such as meteorological and geological events often cross city, town, province, state, and national boundaries. Poor coordination among alerting agencies can result in each agency issuing its own alert. Multiple

[12] The document at https://alert-hub.s3.amazonaws.com/cap-etl-v1.2.docx describes an Event Terms List referenced here as version 1.2. The list of 224 OASIS event terms is in Appendix B of that document.

[13] The subset of OET version 1.2 event terms selected by Alert-Hub.Org and Google is freely available at https://alert-hub.s3.amazonaws.com/OET(v1-2)-G50.json

[14] The WMO recommended event terms are described in this document.

alerts are generally acceptable to avoid gaps and provide corroboration. However, inconsistent alerts can cause confusion, and a large number of duplicative alerts can clog delivery channels and desensitize recipients.

Note: Google CAP Requirements specify that polygon coordinate values can have a maximum of six decimal points of precision (approximately one meter). Google specifies that zero-radius circles are not supported. Google also specifies that the value of the "areaDesc" element cannot exceed 50 characters.

Note: Google Public Alerts CAP v1.0 specifies that the "area" value is always required. It also notes that the value of the "areaDesc" element may be used by Google to generate a location text string used in the alert title/headline. Google specifies that intersections among polygons and/or circles are not supported.

Note: Meteoblue will not republish any alerts having a circle with a radius of more than 2,000 square kilometers or a polygon with an area larger than 10,000 square kilometers. Such alerts are regarded as likely errors.

Note: Whether the CAP polygons have significant areas falling on neighboring countries is checked by SWIC.

1.1.8. Duration

A Listed CAP Service might disseminate alerts according to the starting date/time in the CAP alert or update, and the expiration time if the value of the "expires" element is in the CAP alert. The starting date/time is the value of, in preferred order: the "effective" element (if included), the "onset" element (if included), or the value of the "sent" element (always included). The starting date/time (with time zone localized to the targeted device) should be displayed in the warning. The date/time of expiration, if in the CAP alert, should also be displayed in the warning (with time zone localized to the targeted device). No warning should be disseminated for alerts having an expiration time that is past.

Note: Google Public Alerts CAP v1.0 specifies that the "expires" value is always required.

1.1.9. Updates

A CAP alert with its "msgType" element having the value "Update" is defined to update and supersede (replace in full) all earlier messages identified in the value of the "references" element. All updates to warnings previously disseminated should be evaluated because an update may change one or more of the CAP values of urgency, severity, or certainty, or otherwise affect the duration of the warning.

1.1.10. Distinguishing "High Priority" Alerts

The Listed CAP Services advocate for international consensus on distinguishing a "high priority" class of CAP alerts. This distinction can be useful as a threshold for alerting media such as automatic sirens and cell broadcasts throughout the alerting area. Only a tiny fraction of all CAP alert messages (about 0.1%) qualify as high priority according to the criteria used by the United States, for example. [15] Canada CAP alerts have a "yes/no" parameter that determines whether an alert is to be handled as "broadcast immediately". [16]

1.1.11. Alerts with Multiple "info" Elements

A CAP alert may specify multiple "info" elements, each one having sub-elements that affect the warning selection criteria, as well as a different language, different alerting areas, etc.

Note: CAP Alert Hubs operated by Alert-Hub.Org CIC discourage the use of multiple info elements that are distinguished by language. This policy is to simplify the alert content presented to receivers, and recognizes that

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[15] The United States Code of Federal Regulations (47 CFR 10.400) specifies that an "Imminent Threat Alert" is a CAP alert wherein each of the CAP “urgency”, “severity”, and “certainty” elements is set to one of its top two values. That setting of values means the threat: requires people to act within the next hour (high urgency), is life-threatening (high severity), and is at least 50% likely (high certainty). This distinction determines which alerts are sent via cell broadcast to all cellular phones in the alerting area.

[16] Requirements of "broadcast immediately" alerting in Canada is referenced in "Broadcasting Decision CRTC 2011-438" available at http://www.crtc.gc.ca/eng/archive/2011/2011-438.htm

many deployed CAP-aware devices will process only one “info” element in the CAP alert. Also, when CAP alerts are disseminated via CAP Alert Feeds, each news feed is in one language only.

Note: The Google CAP Requirements recommend that the alerting authority issue alerts containing multiple "info" elements with each “info” element specific to one language. That practice conflicts with Alert-Hub.Org practice described in the note above.

Note: Google Public Alerts CAP v1.0 specifies certain requirements for a CAP alert with multiple "info" elements. The "category" and "eventCode" sub-elements of each "info" element must have the same values. Also, all "info" elements with the same value of the "language" sub-element must have the same value for the "event" sub-element. Meteoblue aligns with Google on this point.

1.1.12. Digital Signing of CAP Alerts

The Listed CAP Services strongly urge the alerting authority owning the CAP feed to ensure that each of the published CAP alerts is digitally signed, using the digital signing method prescribed by the CAP standard.

1.1.13. XML Processing Instruction Needed

The Listed CAP Services strongly urge the alerting authority owning the CAP feed to ensure that each of the published CAP Feeds and CAP Alerts starts with an XML Processing Instruction. This is especially important to ensure that the encoding is explicitly asserted. [17] Here is an example of a simple XML Processing Instruction:

```
<?xml version="1.0" encoding="UTF-8"?>
```

1.1.14. CDATA Wrappers Not Allowed

The Listed CAP Services require the alerting authority to ensure that none of the published CAP Feeds and CAP Alerts have any elements that contain a CDATA wrapper. [18] This is necessary to maintain the readability of XML content.

1.2. Specific Elements

1.2.1. Description

The Listed CAP Services advocate for alerting authorities to make their CAP alerts easily understood by people in harm's way. The text in the "description" element should be relevant and useful for the audience in the alert area. Scientific and technical alerting authorities might benefit from the messaging guidance promoted by the "Impact-Based Forecasting" initiative. [19]

Note: Google Public Alerts CAP v1.0 specifies that the "description" value is always required.

1.2.2. Instruction

To make their CAP alerts easily understood by people in harm's way, the Listed CAP Services advocate for alerting authorities to have text in the "instruction" element that is relevant and useful for the audience in the alert area. The “instruction” text should be actionable and it should focus on appropriate protective action to be taken by the public or the specified target audience of the alert. To enhance understanding and simplify processing by recipients, text in CAP alerts should use common phrases, drawn from a published source, if possible. A useful

[17] Incorrect encoding is often the cause for peculiar characters showing up in displayed text. Whenever text is copied from any source, such as HTML, a “pure text” function must be used to paste that text into any XML element. This is necessary to strip out formatting that may be not visible. Also, CAP developers are urged to ensure that all program code is encoded the same way that the CAP information is encoded (e.g., UTF-8).

[18] An explanation of CDATA is available at https://www.w3schools.com/xml/dom_cdatasection.asp

[19] The document titled "WMO Guidelines on Multi-hazard Impact-based Forecast and Warning Services" is available at https://library.wmo.int/index.php?lvl=notice_display&id=17257#.YYqmJWDMJPZ Also, the “WMO Guidelines on Multi-Hazard Impact-Based Forecast and Warning Services: Part II Putting Multi-HazardIBFWS Into Practice” is available at https://reliefweb.int/sites/reliefweb.int/files/resources/1150_en.pdf

source of field-tested messages is provided by the IFRC Public Awareness and Public Education (PAPE) Key Messages. [20]

1.2.3. Web

Note: Google Public Alerts CAP v1.0 specifies that the "web" value is always required, as an absolute URL (i.e., not a relative URL). Google also notes that this URL should link to a copy of the original alert.

1.2.4. Urgency, Severity, Certainty

The Listed CAP Services caution alerting authorities that they should not expect receivers of its CAP alerts to correctly process a CAP alert with "Unknown" as the value for the CAP “urgency”, “severity” or “certainty” elements. This is an issue because some CAP processors may treat an "Unknown" value in the CAP "severity" element as equivalent to "Not Severe", for instance. The Listed CAP Services strongly urge the owner alerting authority to ensure that published CAP alerts do not use the value "Unknown".

Note: Alert-Hub.Org and Google Public Alerts do not allow CAP alerts with "Unknown" as the value for the CAP “urgency”, “severity” or “certainty” elements.

1.2.5. Resource

The Listed CAP Services encourage the owner alerting authority to use the "resource" element to embed links to content, such as images or audio files as an aid for receivers to better understand the situation. However, it must be noted that the "resource" element should NOT be used to communicate essential information. The CAP alert should be complete and actionable by itself.

1.2.6. Restriction and Addresses

The Listed CAP Services primarily handle CAP messages intended for public distribution, i.e., alerts having the "scope" value set to “Public”. Accordingly, a Listed CAP Service cannot be expected to process the "restriction" value of an alert with the "scope" value set to “Restricted”, nor the "addresses" value of an alert with the "scope" value set to “Private”.

1.2.7. All Clear

The Listed CAP Services encourage each alerting authority to publish an "AllClear" CAP alert to inform that the situation has been resolved after the alerting authority has disseminated one or more CAP alerts for that emergency. Such a CAP alert will have "Update" as the value of its "msgType" element, "AllClear" as the value of its "responseType" element, and the prior CAP alert(s) will be identified in the value of the "references" element. It is also intended that dissemination of that CAP alert to its alerting areas cease on receipt of the “AllClear” update.

The alerting area (including all polygons and circles) must be retained in each subsequent CAP alert with “Update” as its “msgType” element value, including those with “AllClear” as its “responseType” element value.

Note: Google recommends that authorities follow the CAP Common Policies and Procedures guidance for officially taking down alerts by issuing a new CAP alert with its “msgType” value as “Update” and its “responseType” value as "AllClear". Google will also deactivate alerts when past their expiration date/time.

1.2.8. Cancel

The Listed CAP Services encourage each alerting authority to use correctly the “Cancel” value of the CAP “msgType” element to convey that the prior alert was sent in error. The cancellation CAP alert will have "Cancel" as the value of its "msgType" CAP element, and the prior CAP alert(s) being canceled will be identified in the value of the "references" CAP element. The intent is that dissemination of that CAP alert to its alerting areas should cease on receipt of the cancellation.

[20] An IFRC Public Awareness and Public Education (PAPE) Key Messages document is at https://www.ifrc.org/sites/default/files/PAPE-2.0-English.pdf

The alerting area (including all polygons and circles) must be retained in each subsequent CAP alert with the value “Cancel” as its “msgType” element value.

Note: Google will also deactivate alerts when past their expiration date.

1.2.9. Test and Exercise

Those involved in helping to disseminate public warnings should routinely simulate for test and exercise purposes the dissemination of CAP alerts. In these cases, the Listed CAP Services will disseminate valid CAP alerts wherein the "status" element has the value "Test" or "Exercise". It is noted that an exercise identifier might be carried in the value of the "note" element of CAP alerts with a “status” CAP element having the value “Exercise”.

1.2.10. “Ack” and “Error” msgType values

The Listed CAP Services are typically aggregators, disseminators, or re-publishers of CAP alerts rather than original publishers. Accordingly, for any CAP alert having the value “Ack” or “Error” in its “msgType” element, the Listed CAP Services take no action other than republishing.

1.2.11. “identifier” element values

The Listed CAP Services accept valid values of the CAP “identifier” element. However, whenever the identifier value uses an ITU standard Object Identifier (OID), it must conform to the ITU specification. The OID should also adhere to the WMO specification for CAP identifiers [21] . An example OID value in a CAP “identifier” element that aligns with the WMO specification is “<identifier>urn:oid:2.49.0.1.231.0.2024.9.1.10.0.0</identifier>” wherein:

> The first value "2" indicates this is an OID registered by ISO and ITU. The value "49" indicates this is related to an emergency alert system. The following value "0" indicates the alert publisher is registered in the international Register of Alerting Authorities. The following value "1" indicates this is a published alert (rather than information about the publisher which would be indicated with a "0" in this position). The value "231" is the ISO 3166 numeric code for Ethiopia. The following value "0" indicates "Ethiopian Meteorological Institute" as found in the Register of Alerting Authorities, specifically at this record https://alertingauthority.wmo.int/authorities.php?recId=48.

1.2.12. “language” element values

The Listed CAP Services accept valid values of the CAP “language” element, which is described per RFC 3066 [22] as having a mandatory ISO 639 code (lower case). The ISO 339 three-letter code is to be used only in those cases where the language does not have a two-letter code. The ISO 639 code is optionally followed by a dash and an ISO 3166 Country Code (alphabetic, Upper Case). However, the broadest interoperability among CAP alert receivers is achieved by publishing CAP alerts without the optional country code (commonly known as a “locale”).

1.2.13. “sender” element values

The Listed CAP Services accept valid values of the CAP “sender” element.

Note: Google Public Alerts requires that the “sender” value must be an e-mail address.

1.3. Design Principles

1.3.1. Understandability and Constancy

Given the potentially life-critical nature of public warnings, it is important that the CAP Alerts are readily understandable by people who receive them. The results of surveys can be instructive in this regard, and should be supplemented by realistic and representative user testing. In general, the public warning should be as simple as possible while communicating essential information, with the most important information presented first.

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[21] The document titled "WMO/TD No. 1556: Administrative Procedure for Registering WMO Alerting Identifiers” is available here. Each CAP alert with an OID must have its identifier start with 2.49.0.1.

[22] RFC 3066 is at https://www.ietf.org/rfc/rfc3066.txt

Unless there is a compelling need for revising the design of a warning, the design should be constant over long periods of time.

1.3.2. Localization

In designing for presentation of text in warnings, the principles of internationalization and localization should be used to optimize the user experience. The design should take into account preference settings, typically selectable at the device level and often selectable at the application level as well.

1.3.3. Graphics Design and Coloring

Creatives used for public warnings might include a pictograph depicting the action to be taken (example tsunami pictograph shown right). Pictographs used in any particular country should be from a common design set, such as one of those sets of symbols noted in Prior Work, an Appendix to this document.

Among the creatives used by a Listed CAP Service might be the logo of an alerting authority (example shown right) linked to the alerting authority Web site.

Colors are often applied to the alerting area on a map as a means to focus attention. For instance, "traffic light" colors (red, yellow, green) are often used to distinguish between high priority, medium priority, and low priority. However, a Listed CAP Service at global scale encompasses many sources of alerts that are not harmonized with regard to the coloring of alerts. This can lead to confusion in cases where the applied map color does not match a color code mentioned in the CAP Alert message text.

1.3.4. Text Design

The main warning text should be presented as solid color against a background color of solid color of high contrast. Text fonts should be selected for high readability at all sizes anticipated. Text should be presented statically, rather than with any animation effects or scrolling.

The presentation medium rarely has enough space for long text passages. More commonly, there is room for only an excerpt of the text passage. To create an excerpt, an ellipsis can be used to indicate where the text has been truncated. However, finding a word break is problematic in some languages. In those cases, consultation with an expert is needed on how to process text passages that need to be truncated.

1.3.5. Interaction Design

CAP Alert messaging presented on an interactive media such as a Web page may be interactive for the click action. (Herein, the click action encompasses a range of user actions including a tap or press gesture and various other ways for users to trigger a click event.) For example, the default action for a click on the authority logo might be to navigate to a Web site of the alerting authority.

1.3.6. Official Emergency Tone

When specifically agreed by the relevant alerting authorities, the presentation of a public warning through a Listed CAP Service might be accompanied by a distinctive tone which has particular audio characteristics. However, in the absence of a specific agreement, it may be illegal for CAP Alert messaging to present the message with the official tone.

1.3.7. Persons with Disabilities

In compliance with Section 508 of the U.S. Rehabilitation Act [23], public warnings in the U.S. should be accessible to persons with disabilities by application of the Web Content Accessibility Guidelines [24] and other countries may have similar requirements. It should be noted that whenever there is a choice between displaying text as a graphic

[23] Section 508 of the U.S. Rehabilitation Act is available at http://www.section508.gov/.

[24] The Web Content Accessibility Guidelines are at http://www.w3.org/TR/WCAG/.

versus using actual text, the use of actual text is much preferred. For example, it is better to code an HTML text element with the words "Tornado Warning" than to have those words in an image.

1.3.8. Telecommunications Efficiency

As the speed of telecommunications continues to increase, the file size of messages has tended to become ever larger. However, the efficient use of telecommunications capacity should remain a major concern in the context of public warning during emergencies. This concern is driven by several considerations: it is sometimes necessary to communicate very rapidly to a very large number of devices in an alerting area; the telecommunications capacity in an alerting area may be limited even in normal use and overstressed in an emergency due to its heavy use by the people affected; and, the usual telecommunications capacity may be degraded due to effects of the emergency itself.

1.3.9. Alerting Messages Evolve

Changes can be expected in how hazard threats are communicated to the public by alerting authorities. For instance, many hazard alerting systems today differentiate hazard threats according to an "Advisory, Watch, and Warning" scale. Because surveys have found that this scale remains confusing to the public, the U.S. National Weather Service is working to simplify alert messaging. This simplification should be complementary to the way CAP uses urgency, severity, and certainty to rank a hazard threat according to “how soon”, “how bad” and “how sure”. There is also ongoing work to make public alert messaging less focused on characterizing the hazard event and more focused on what impacts the event will likely have on the particular community. This impact-based alerting should also be complementary to adoption of CAP, especially the CAP distinction between the "description" and "instruction" elements.

2. CAP Alert Feeds

The Listed CAP Services accept from selected sources only emergency alert files that are valid according to the CAP standard. In some dissemination modes, the Listed CAP Service can access CAP files by a wide range of methods. These methods of access include, but are not limited to, CAP Alert Feeds.

2.1. Feeds Link to CAP Alerts

In the case of a Listed CAP Service operating as a CAP Alert Hub, the sources must provide the CAP alerts via CAP Alert Feeds, i.e., Internet publish/subscribe facilities that operate as one of three Internet-standard services, specifically: RSS, ATOM, or MQTT. [25] Each CAP alert accepted by a Listed CAP Service operating as a CAP Alert Hub is a file linked from the CAP feed, i.e., an RSS "item", an ATOM "entry", or an MQTT "topic". It is noted that the CAP feed typically contains other information for display or summary purposes, which may include copies of some or all of the linked CAP alert elements. However, consumers of such CAP Alert Feeds are strongly cautioned against using these as any kind of substitute for the full CAP alert file.

2.2. Selection of alert sources

A Listed CAP Service operating as a CAP Alert Hub republishes CAP alerts from a set of selected sources. Selection of any specific source is primarily a judgment by the Listed CAP Service operator that the emergency alert content published by the source is authentic, trustworthy, and useful in helping people act to protect lives and livelihoods. For instance, WMO Alert Hub publishes a list of its sources. [26]

[25] It is important to validate each RSS or ATOM news feed. A tool for this is at http://validator.w3.org/feed/

[26] The candidate WMO Alert Hub sources is maintained at https://alert-hub-sources.s3.amazonaws.com/json and each of those currently being republished has "operating" as its “capAlertFeedStatus” value.

2.3. Republishing Period

A Listed CAP Service begins republishing CAP alerts from a source when permission to be included in the Listed CAP Service is granted by the owner alerting authority. Republishing ends if and when such permission is retracted by that alerting authority, or the Listed CAP Service operator suspends republishing of that source.

2.4. Sources Accessed through an Aggregator

A Listed CAP Service can access CAP alerts published by an alerting authority through an aggregator, e.g., MeteoAlarm. [27] In that case, the CAP feed URL, the contact name and the contact e-mail address maintained by a Listed CAP Service may refer to the aggregator. However, the agency name and the agency logo always refer to the owner alerting authority rather than the aggregator.

2.5. Designation of "Official" Sources

For each selected source, a Listed CAP Service should be able to indicate if the alerting authority owning the CAP feed is listed in the international Register of Alerting Authorities. [28]

2.6. CAP Feed URL

Alerting authorities are required to include in their Register of Alerting Authorities records the CAP Feed URL for CAP feeds that are intended to be republished by a Listed CAP Service. Including a CAP Feed URL in that record also constitutes permission to be a source to the Listed CAP Services.

2.7. Attribution and Logo

A Listed CAP Service attributes each republished CAP alert to the alerting authority that published it. A Listed CAP Service should be able to associate to the source a copy of the alerting authority logo rendered to a common size, e.g., as seen in the Web page listing of the CAP Alert Hub sources. [29] It is understood that permission for a Listed CAP Service to use this alerting authority logo image for that purpose occurs when permission is granted for the source to be included in the Listed CAP Service.

2.8. Encryption of CAP Feeds

The Listed CAP Services strongly urge the owning alerting authority to ensure each CAP feed is available to the Listed CAP Service via HTTPS [30] with a valid certificate.

2.9. Each CAP Feed should reference an XML Stylesheet

Each CAP feed accepted by a Listed CAP Service should include an XML Stylesheet reference, to avoid having raw XML displayed to human receivers. [31] The link to the XML Stylesheet must be an absolute URL, not a relative URL.

3. Other Dissemination Notes

Once an alerting authority begins open publishing of CAP alerts, those CAP alert messages can be disseminated by many different methods. This section lists various types of dissemination channels, and provides considerations for dissemination of CAP alerts toward end users.

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[27] MeteoAlarm has a web site at https://meteoalarm.org/

[28] The international Register of Alerting Authorities is at https://alertingauthority.wmo.int/

[29] Sources for the Alert Hub are displayed at https://alert-hub.s3.amazonaws.com/cap-sources.html

[30] HTTPS (Hypertext Transfer Protocol Secure) uses encryption to help secure communication over a computer network.

[31] An example of an XML Stylesheet that renders an RSS CAP Feed in HTML is at https://cap-sources.s3.amazonaws.com/dz-meteo-en/rss-style.xsl

3.1. Dissemination of CAP alerts via internet news feeds

CAP alert publishing via Internet news feed is an especially effective method for empowering Internet-based facilities to help disseminate the alerts. This is because those facilities can simply subscribe to the CAP Feed, which is a ubiquitous method that costs very little. Such facilities can disseminate the information via apps and other specialized tools. For example, Google can disseminate the alerts via its Google Search, Google Maps, and Android Push Notification services. Companies such as AccuWeather, meteoblue, the Weather Company, and Windy.com can disseminate CAP alerts via their apps and web sites as well. Because each CAP alert usually has a persistent and globally unique URL, the CAP alerts can be easily posted to social media such as Facebook, X (was, Twitter), and WhatsApp. [32] Systems exist for disseminating CAP alerts as online advertisement overlays, and for dissemination to in-home Smart Speakers It is also notable that CAP Alert Feeds can be served to a Geographic Information System (GIS) as dynamic, near-real-time, GIS Feature Services. [33] Modern siren systems are CAP-enabled in many cases. CAP alerts can also trigger directly a range of automated devices, such as traffic control signals, that leverage the Internet in their emergency roles.

3.2. Dissemination of CAP alerts via communications media not based on internet

For analog and digital communications media not based on the Internet, some kind of converter transforms the CAP news feed content to their particular electronic interfaces. Prime examples here include broadcast television and radio (both commercial and amateur). For instance, many television stations have equipment that use the CAP alert message in order to insert crawl text into the broadcast television stream. Free tools available from OpenBroadcaster can monitor a CAP feed, convert CAP alert text to voice, and/or translate it to other languages, [34] as described below. These methods can also be interfaced to the large digital billboards seen on highways, and to traffic-control systems that serve highways, railways, and the like. CAP Alert feeds can also be processed by Mobile Network Operators to provide emergency alerts over cell phone networks, as SMS messages and/or Cell Broadcast messages. [35] [36] For example, Cell Broadcast is a common way to disseminate CAP alerts in Canada, China, Europe (where the system is known as EU-Alert), India, and the U.S. There is a free facility, GEONETcast, that transmits high priority CAP emergency messages via satellite direct broadcast, with nearly global coverage. There are also methods that interface CAP alerts with Public Safety & Responder Systems, as well as other Emergency Radio networks. Here it is notable that many Incident Command Systems used by local police and fire departments are CAP-based.

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[32] CEN, the European standards agency, requires: "To ensure consistency, clarity and completeness of the messages disseminated simultaneously across different channels, the social media early warning messages and related notifications shall refer to the persistent unique URL of the CAP message."

[33] Esri developed a CAP Connector for its GeoEvent Server, using the specification: Making GIS Features from CAP Alerts. As described at https://www.arcgis.com/home/item.html?id=6e00ddc7558f48f98996502fb367473f this can be used with any GIS, including but not limited to Esri ArcGIS.

[34] OpenBroadcaster has a website at https://openbroadcaster.com/ This also links to an article on "Emergency Alert Broadcast Automation" at https://openbroadcaster.com/emergency-alert-automation/

[35] In November 2023, the GSM Association published the report "Cell Broadcast for Early Warning Systems). The reports states: "Given the important role that CAP plays in facilitating interoperability between warning systems, it is essential that [CAP] is implemented when developing and implementing Cell Broadcast enabled Early Warning Systems. [...] it is important to recognise that mobile alone will not be sufficient. Multi-channel EWS are essential to ensure the maximum number of people are reached. Channels like radio, television, billboards, satellites, social media and sirens, all serve an important purpose, and each have strengths that can be leveraged for certain contexts and use cases. Only by leveraging multiple channels can everyone at risk be reached."

[36] A presentation about CAP over Mobile Networks is available at https://cap-workshop.s3.amazonaws.com/2022/presentations/OASIS-Mobile.pptx

3.3. Dissemination of CAP alerts via conventional broadcast radio and television media

For analog and digital “over the air” media not based on Internet access, a converter transforms the CAP news feed content to their particular electronic interfaces. Prime examples here include broadcast television and radio (both commercial and community). For instance, many television stations have equipment that use a valid CAP alert message in order to insert crawl text into the broadcast television stream and interrupt and override conventional AM/FM radio programming unattended. Open Source tools for a CAP Alert Player are available from OpenBroadcaster that monitors a CAP feed, converts the CAP alert text to voice using Polly AWS Neural Languages including support for indigenous alert dialects. These methods can also be interfaced to Digital Display Signage like the large digital billboards seen on highways, and to traffic-control systems that serve highways, railways, and the like. It is noted that OpenBroadcaster used the Canadian "Common Look and Feel Guidance" [37] in designing its Alert Player.

3.4. Dissemination of CAP alerts to travellers on the move

Travellers on the move require specific considerations for dissemination of CAP alerts. They may not speak the local language (nor English) and may be unfamiliar with the naming of local geography. They may be driving, hence must keep their eyes on the road. Thus, to avoid driver distraction, any alert should be presented succinctly. Furthermore, while they might be located outside the affected area of the alert, their planned itinerary could well lead them inadvertently into the affected area, hence inadvertently into danger.

Considering these challenges, the Traveller Information Services Association (TISA) developed a TPEG2-based dissemination channel to transmit the CAP Alerts to in-vehicle navigation systems, typically sourcing the alerts from a CAP Alert Hub. [38] TPEG2 is a mature, ISO standardized, technology (ISO 21219 series) to bring traffic and travel information into the vehicle, and is in use by many millions of vehicles/navigation systems world-wide.

TISA has extended this TPEG technology with a further specification TPEG2-EAW: Emergency Alerts and Warnings[39] to disseminate CAP alerts into the vehicle. Effectiveness of this TPEG dissemination channel for reaching travellers was evaluated in a field-trial in Germany, held in 2021 in collaboration with the German Federal Office for Civil Protection and Disaster Assistance. This trial showed that the TPEG-based distribution of CAP alerts indeed provides alerts to travellers in a safe way, and helps them reroute out of danger. When navigation systems offer TPEG2-EAW services, all travellers (also non-native speakers as visitors from abroad) can evaluate alerts for impact, stimulating those at risk to take appropriate action.

Alert in navigation system: Image courtesy NNG

3.5. CAP Alert Hubs

Some of the Listed CAP Services operate as a CAP Alert Hub. A CAP Alert Hub is an online aggregation of emergency alerts published in CAP format. In offering aggregated CAP alerts, a CAP Alert Hub simplifies the tasks of other alert disseminators to gain fast, free, reliable, and secure access to aggregated CAP alerts that are relevant to the audiences they serve. A CAP Alert Hub also provides a policy context for that access, much like a referral service provides context.

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[37] The Canadian Common Look and Feel Guidance is available at https://www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/mrgnc-prprdnss/npas/clf-lng-20-en.aspx

[38] The Traveller Information Services Association (TISA) standards work is described at https://cap-workshop.s3.amazonaws.com/2022/presentations/TISA.pptx

[39] An open source evaluation kit for TPEG-EAW is available at: https://gitlab.tisa.org/published/evaluation-kit

3.6. Security, Reliability, and Speed

A Listed CAP Service operator takes reasonable actions to ensure the security and reliability of the CAP Service and fast republishing of CAP alerts. However, the CAP Service may encounter difficulties in any of these respects, which may necessitate suspension of operations for an extended period. Alerting authorities are strongly urged to have their CAP feeds disseminated by multiple means, including multiple CAP Alert Hubs.

3.7. No Personally Identifiable Information

A Listed CAP Service will never collect or exploit personally identifiable information in any manner associated with its public warning activities.

3.8. Geo-location Privacy

General geo-location of user devices in the alerting area during the time of a public warning is essential to the public warning activity and should not require user opt-in. However, "precise geo-location" should require user opt-in.

3.9. Non-proprietary Works

The text and design works used in the presentation of public warnings should be licensed so as to allow the works to be freely copied and redistributed in any medium or format and allow others to transform and build upon the material for any purpose. These are characteristic of the Creative Commons license called "Attribution-ShareAlike 4.0 International". [40]

3.10. All Valid CAP Alerts are Republished

A Listed CAP Service operating as a CAP Alert Hub republishes all valid CAP alerts as published on the source CAP feed. This occurs regardless of whether a CAP alert has the value "Restricted" or "Private" in its "scope" element or the value "Test" or "Exercise" in its "Status" element. A Listed CAP Service operating as a CAP Alert Hub accepts that an alerting authority can publish CAP alerts on its CAP feed that refer to any kind of hazard threat.

3.11. CAP Alerts for Missing Persons

Some CAP Alerts are issued for purposes other than informing those who are in harm's way. For instance, alerting authorities may issue a CAP Alert to enlist public help in locating a missing child or a severely impaired person (known in the U.S. as "Amber alerts" and "Silver alerts"). In that case, the alerting area should not extend beyond where that missing person might be within the duration of the alert.

3.12. Unintentional Blocking of Access

Governments occasionally block access to Internet addresses. To avoid disruption of public alerting, alerting authorities should ensure their National Telecommunications Regulatory Agency has "white-listed" Internet addresses of CAP Alert Feeds and CAP Alert Hubs.

3.13. Prompt Updating and Resolution of Errors

A Listed CAP Service will on occasion encounter errors while processing CAP alerts or CAP feeds published by the selected sources. The Listed CAP Service operator will then inform by email the alerting authority responsible for the source. [41] If the alerting authority fails to promptly correct such errors, the Listed CAP Service operator may need to suspend republishing of that source.

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[40] Creative Commons licenses are described at https://creativecommons.org/. The license "Attribution-ShareAlike 4.0 International" is at https://creativecommons.org/licenses/by-sa/4.0/

[41] Within the sources list at https://alert-hub-sources.s3.amazonaws.com/json the alerting authority contact for each source is noted in the items for that source labeled "authorName" and "authorEmail".

3.14. Prompt Updating of Alerting Authority Information

A Listed CAP Service operator must be informed promptly by each alerting authority with a source in the endorsing CAP Alert Hub of any changes to the agency name, the agency logo, the CAP feed URL, associated records in the Register of Alerting Authorities, the contact name, or the contact email address. Otherwise, the endorsing CAP Alert Hub operator may need to suspend republishing of that source.

3.15. Access to an Alert Hub Archive

A Listed CAP Service operating as a CAP Alert Hub might be able to arrange, on request, access to the archive of CAP alerts for specific purposes such as messaging analysis during or following a major emergency event. Requests for such access should be sent directly to the Listed CAP Service operator.

3.16. Sharing Analytic Data on alerts

Presenting warnings opens the possibility to analyze, in real time as well as post-event, the effectiveness of any particular public warning effort. For instance, variations in click-through rates might indicate that certain neighborhoods are being less responsive to a warning than others, which could then prompt immediate actions to provide additional messaging to certain audiences or to step up warning by other means. Accordingly, a Listed CAP Service should be responsive to requests from alerting authorities for appropriate access to general/aggregated analytic data associated with public warnings.

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Johannes Fleisch	MeteoAlarm
Rob Hopkins	OpenBroadcaster
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Glossary of Terms

alerting authority - an organization designated as authoritative in the context of alerting

Atom - the Atom Syndication Format is an Internet standard for a news feed, which communicates as a publish/subscribe service

canned text - static text prepared for repeated use under specifically agreed conditions

CAP (Common Alerting Protocol) - an XML-based data format for exchanging public warnings and emergencies between alerting technologies, designated as ITU Recommendation X.1303

CAP Alert - an emergency message in CAP format

CAP Alert Feed - a news feed conforming to either of two Internet standards: RSS or ATOM

CAP Alert Hub - an online aggregation of emergency alerts published in CAP format

creative - used as a noun in the advertising and communications industry to refer to a design work

ITU - International Telecommunication Union

messaging - the practice of sending and receiving written communications by computer or mobile phone [42]

online media - distributors of digital material online, especially including photos, video and audio

opt-in / opt-out - to choose whether or not to participate in something

personally identifiable information - information that can be used on its own or with other information to identify, contact, or locate a single person, or to identify an individual in context

publish/subscribe - a messaging pattern where publishers queue messages on an ad hoc basis and subscribers access the queue on their own schedule

Register of Alerting Authorities - an online facility maintained by the World Meteorological Organization and the International Telecommunication Union (ITU)

RSS - Really Simple Syndication, an Internet standard for a news feed, which communicates as a publish/subscribe service

symbology - a system of symbols

TPEG - Transport Protocol Experts Group, a data protocol suite for traffic and travel related information

TPEG-EAW - Emergency Alerts and Warnings, part of TPEG, provides public emergency warnings to travelers

WEA - Wireless Emergency Alerts, emergency messages sent by authorized government alerting authorities through mobile carriers

WMO - World Meteorological Organization

XML (eXtensible Markup Language) - a set of rules for encoding documents in a format that is both human-readable and machine-readable

[42] "messaging." *Collins English Dictionary - Complete & Unabridged 10th Edition*. HarperCollins Publishers. 07 Apr. 2014. (http://dictionary.reference.com/browse/messaging)

Appendix: Prior Work

CAP-based online media warning to the public was pioneered on a large scale in the Google.Org Public Alerts initiative [43] and Google published its own guidelines for CAP alerts. Various consensus-building initiatives have addressed to some degree the need for harmonized presentations of alert information. The World Meteorological Organization (WMO) provides consensus expert guidance concerning warnings, such as the "Guide on Improving Public Understanding of and Response to Warnings" [44] and the "Guidelines on International and Cross-Border Collaboration in the Warning Process". [45]

A procedure for evaluating image effectiveness in the context of safety symbols is included within the standard "Criteria for Safety Symbols" (ANSI Z535.3-2011), which provides general criteria for the design, evaluation, and use of safety symbols. [46] Canada has published its "Common Look and Feel Guidance" for its National Public Alerting System.[47] Also, the MeteoAlarm initiative standardized certain aspects of weather-, hydro- and geo-related alerts across 37 European nations. The U.S. Wireless Emergency Alert (WEA) system has also defined some details in certain kinds of alerts. An example WEA message disseminated during Hurricane Sandy in 2012 is shown right.

With regard to standardized symbols for emergencies, a report by Nuwan Waidyanatha [48] notes that the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) has defined 500 symbols for humanitarian response. [49] He notes that the government of Canada designed emergency mapping symbols.[50]

Nuwan also notes that the U.S. Department of Homeland Security sponsored development of a set of symbols. [51] (Example symbols from each set respectively are shown right for landslide, fire, and tornado hazard threats).

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[43] Google Public Alerts is described at https://support.google.com/publicalerts/.

[44] "Guide on Improving Public Understanding of and Response to Warnings" (WMO/TD No. 1139) is at http://www.wmo.int/pages/prog/amp/pwsp/pdf/TD-1139.pdf.

[45] "Guidelines on International and Cross-Border Collaboration in the Warning Process" (WMO/TD No. 1560) is at http://www.wmo.int/pages/prog/amp/pwsp/documents/TD_1560_PWS22_en.pdf.

[46] The standard "Criteria for Safety Symbols" (ANSI Z535.3-2011) can be purchased at http://webstore.ansi.org/RecordDetail.aspx?sku=ANSI/NEMA+Z535.3-2011.

[47] Common Look and Feel Guidance for Canada's National Public Alerting System is at http://cradpdf.drdc.gc.ca/PDFS/unc129/p538116_A1b.pdf

[48] The Report prepared by Nuwan Waidyanatha is available at https://sahana-wordpress.osuosl.org/wp-content/uploads/2013/05/report_waidy_CAP2013.pdf.

[49] Links to download the free symbols in various format are in the August 2012 announcement about the OCHA "Humanitarian and Country Icons" at http://reliefweb.int/map/world/world-humanitarian-and-country-icons-2012 provides The announcement also notes an OCHA graphics style book that describes best practices, available at http://www.unocha.org/about-us/publications/thematic.

[50] A description of the Emergency Mapping Symbology developed for the Canadian government is at http://cms.masas-x.ca.s3.amazonaws.com/EMS_Symbology_v1.0.pdf . Icons (all sizes) are at http://cms.masas-x.ca.s3.amazonaws.com/EMS_Symbology_v1.0_full.zip.

[51] The website http://www.fgdc.gov/HSWG/index.html describes a set of symbols for public safety that was developed through 2005 by the Homeland Security Working Group of the United States Federal Geographic Data Committee.

The usefulness of this document can be enhanced to the degree that consensus encompasses not only the endorsing organizations but official alerting authorities and the communities of hazard experts that support them. Some communities of hazard experts focus on a particular type of hazard threat (cyclones, flash floods, earthquakes, tsunami, volcanoes, oil spills, etc.). For instance, advice on design guidance should be sought from the Intergovernmental Oceanographic Commission (IOC) for tsunami warnings, and the International Civil Aviation Organization (ICAO) for volcanic ash warnings. Input should also be sought from the OASIS Emergency Management Technical Committee (EM TC), which maintains the CAP standard. CAP has been very successful with standardizing the exchange of alerting information and some EM TC members are likely to have strong interest in and familiarity with how alerts are presented.