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Study on enhancements of Public Warning System;

(Release 16)

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Contents

Foreword [5](#__RefHeading___Toc18932016)

1 Scope [5](#__RefHeading___Toc18932017)

2 References [5](#__RefHeading___Toc18932018)

3 Definitions and abbreviations [6](#__RefHeading___Toc18932019)

3.1 Definitions [6](#__RefHeading___Toc18932020)

3.2 Abbreviations [6](#__RefHeading___Toc18932021)

4 Stage 2 Requirements for enhancements of Public Warning System [6](#__RefHeading___Toc18932022)

5 Key issues [7](#__RefHeading___Toc18932023)

5.1 Key Issue 1: Support of language-independent content mapped to an event or a disaster in a warning message [7](#__RefHeading___Toc18932024)

5.1.1 General description [7](#__RefHeading___Toc18932025)

5.1.2 Open issues [7](#__RefHeading___Toc18932026)

5.2 Key Issue 2: Identification of characteristics of an event or a disaster for UEs with no user interface [8](#__RefHeading___Toc18932027)

5.2.1 General description [8](#__RefHeading___Toc18932028)

5.2.2 Open issues [8](#__RefHeading___Toc18932029)

5.3 Key Issue 3: Support of the relay of Warning Notification [8](#__RefHeading___Toc18932030)

5.3.1 General description [8](#__RefHeading___Toc18932031)

5.3.2 Open issues [8](#__RefHeading___Toc18932032)

6 Solutions [9](#__RefHeading___Toc18932033)

6.1 Solution 1: Support of language-independent content mapped to an event or a disaster in a warning message [9](#__RefHeading___Toc18932034)

6.1.1 Description [9](#__RefHeading___Toc18932035)

6.1.2 Procedure [9](#__RefHeading___Toc18932036)

6.1.3 Impacts on existing nodes and functionality [9](#__RefHeading___Toc18932037)

6.1.4 Solution Evaluation [9](#__RefHeading___Toc18932038)

6.2 Solution 2: Identification of characteristics of an event or a disaster for UEs with no user interface [10](#__RefHeading___Toc18932039)

6.2.1 Description [10](#__RefHeading___Toc18932040)

6.2.2 Procedure [11](#__RefHeading___Toc18932041)

6.2.3 Impacts on existing nodes and functionality [11](#__RefHeading___Toc18932042)

6.2.4 Solution Evaluation [11](#__RefHeading___Toc18932043)

6.3 Solution 3: Support of the relay of Warning Notification [11](#__RefHeading___Toc18932044)

6.3.1 Description [11](#__RefHeading___Toc18932045)

6.3.2 Procedure [12](#__RefHeading___Toc18932046)

6.3.3 Impacts on existing nodes and functionality [12](#__RefHeading___Toc18932047)

6.3.4 Solution Evaluation [12](#__RefHeading___Toc18932048)

6.4 Solution 4: Support of a stored language-independent content referenced by a warning message [12](#__RefHeading___Toc18932049)

6.4.1 Description [12](#__RefHeading___Toc18932050)

6.4.2 Procedure [12](#__RefHeading___Toc18932051)

6.4.3 Impacts on existing nodes and functionality [12](#__RefHeading___Toc18932052)

6.4.4 Solution Evaluation [13](#__RefHeading___Toc18932053)

6.5 Solution 5: Carrying characteristics of an event or a disaster for UEs with no user interface in the message payload [13](#__RefHeading___Toc18932054)

6.5.1 Description [13](#__RefHeading___Toc18932055)

6.5.2 Procedure [13](#__RefHeading___Toc18932056)

6.5.3 Impacts on existing nodes and functionality [13](#__RefHeading___Toc18932057)

6.5.4 Solution Evaluation [14](#__RefHeading___Toc18932058)

7 Conclusions and recommendations [14](#__RefHeading___Toc18932059)

7.1 Conclusions [14](#__RefHeading___Toc18932060)

7.1.1 Key issue 1: Support of language-independent content mapped to an event or a disaster in a warning message [14](#__RefHeading___Toc18932061)

7.1.2 Key issue 2: Identification of characteristics of an event or a disaster for UEs with no user interface [14](#__RefHeading___Toc18932062)

7.1.3 Key issue 3: Support of the relay of Warning Notification [14](#__RefHeading___Toc18932063)

7.2 Recommendations [14](#__RefHeading___Toc18932064)

Annex A: Classification of disasters [15](#__RefHeading___Toc18932065)

A.1 Statistic data per disaster type [15](#__RefHeading___Toc18932066)

A.2 Classification of disaster group [16](#__RefHeading___Toc18932067)

Annex B: Change history [19](#__RefHeading___Toc18932068)

# Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

# 1 Scope

The present document studies and evaluates possible enhancements of Public Warning System(ePWS) to address the following objectives:

- to develop stage 2 specifications to support stage 1 requirements on ePWS as follows

1) Specify how to support the language-independent contents (e.g. non-text based icon or image mapping to a disaster). In detail, this is to specify how to map the disaster by using symbols or images so that users can recognize the disaster in their screens. (It is a useful scenario for foreigners who do not know languages.)

2) Specify how to support UEs with no user interface or UEs with a user interface that is incapable of displaying text based warning notification. In detail, there is a specific requirement on UEs with no user interface or UEs with a user interface that can not display a text based warning notification. UEs with no user interface can be IoT device and it was intended that the device performs some dedicated actions when the warning notification is received.

3) Specify how to support relay functionality for providing warning notification.

- to develop stage 3 specifications to support stage 1 requirements on ePWS.

No new functionality for US WEA and Japan ETWS will be introduced.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 22.268: "Public Warning System (PWS) requirements".

[3] 3GPP TS 23.041: "Technical realization of Cell Broadcast Service (CBS)".

[4] 3GPP TS 23.038: "Alphabets and language-specific information".

[5] ECONOMIC LOSSES, POVERTY & DISASTERS 1998-2017, CRED and UNISDR

[6] [www.emdat.be/classification](http://www.emdat.be/classification) (as of 27th August 2019)

[7] CAP v1.2: "Common Alerting Protocol, version 1.2"

# 3 Definitions and abbreviations

## 3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in 3GPP TR 21.905 [1].

# 4 Stage 2 Requirements for enhancements of Public Warning System

It is recognised that UEs with different or no user interface or with different roles (e.g. devices implemented as wrist bands with a tiny screen and a limited or no user interface, sensors that support a simple functionality such as the control for power on/off, or UEs with relay functionality) are on the market. In addition, as 5G brings the connected society with the application of the 3GPP system to non-ICT industry businesses, the number of such UEs in the market is expected to increase in the near future.

In addition, the number of mobile users who internationally travel or live in other countries than their mother country without knowledge of the local language is increasing. So, other means than texts (e.g. globally standardised graphical symbols or images that are mapped to disasters or any event triggering to disseminate a Warning Notification) might be much more powerful and efficient to let such mobile users recognise what is happening from the Warning Notification they receive. UEs may have accessibility capabilities that help mobile users with disabilities (e.g. people with vision impairment) understand text-based and language-dependent Warning Notifications. Warning Notifications may also supplement current content of Warning Notification with additional content tailored to the needs of users with disabilities.

Requirements described in clause 9 of 3GPP TS 22.268 [2] are specified to define behaviours suitable for UEs with no user interface (e.g. things with no display screen) or with a user interface incapable of displaying text-based Warning Notifications and to improve the comprehension of Warning Notification for UEs of users who are not fluent in the language of the Warning Notifications and UEs of users with disabilities who have UEs supporting assistive technologies beyond text assistive technologies.

The relay functionality of UEs is specified to extend the coverage supported by 3GPP system. Requirements described in clause 10 of 3GPP TS 22.268 [2] are specified to define behaviors of UEs that play the role of a relay UE or a remote UE when receiving a Warning Notification via the relay functionality.

In order to support requirements specified in clause 9 and clause 10 of 3GPP TS 22.268, the following requirements shall be addressed to enhance Public Warning System for UEs described above.

- A Warning Notification shall be capable of supporting the inclusion of the information mapped to an event or a disaster that enables a UE with ePWS functionality to identify a warning message and render such information to the user.

NOTE 1: How the information mapped to an event or a disaster included in a Warning Notification is rendered or displayed to a user depends on UE implementation unless the content to be displayed is provided from Warning Notification.

NOTE 2: In case of a UE of a user who is not fluent about the language used in texts described in a Warning Notification, a language-independent content such as pictogram or Unicode symbol can be the information included in a Warning Notification.

NOTE 3: In case of a UE of a user with disabilities that has a user interface providing accessibility extensions for such a user, the information mapped to an event or a disaster can be same as legacy texts that can be displayed in a better comprehensive way to such a user depending on UE implementation.

- A Warning Notification shall be capable of supporting the inclusion of the information that enables UEs with no user interface (e.g. IoT devices such as an elevator, an automotive or a robot with no user interface that are connected to 3GPP networks) and with ePWS functionality to identify a warning message.

NOTE 4: How a UE with no user interface and with ePWS functionality behaves depends on UE implementation when such a UE receives a Warning Notification.

- A UE with ePWS functionality and the remote UE functionality shall be capable of receiving a Warning Notification transmitted from UEs with the relay functionality.

- A UE with ePWS functionality and with the relay functionality shall be capable of unconditionally forwarding a Warning Notification broadcast received from the network.

# 5 Key issues

## 5.1 Key Issue 1: Support of language-independent content mapped to an event or a disaster in a warning message

### 5.1.1 General description

A text-based warning message can be understood by mobile users who know the language used in a text-based warning message. For users such as foreigners who are not fluent about the language used in a warning message, it is necessary to enable a language-independent content (e.g. a unicode symbol) mapped to an event or a disaster to be included in or referenced by a warning message in order to improve the comprehension of a warning message by such users.

### 5.1.2 Open issues

The following aspect should be studied and considered in proposed solutions.

- How to enable a language-independent content (e.g. a unicode symbol) mapped to an event or a disaster to be included in a warning message or referenced by a warning message to a stored language-independent content, e.g. the warning message might contain an identifier of an image of a disaster (e.g. typhoon or hurricane) that is stored on the device

## 5.2 Key Issue 2: Identification of characteristics of an event or a disaster for UEs with no user interface

### 5.2.1 General description

A UE with no user interface (e.g. elevator) is not able to take specific actions by reading a text-based warning message. In addition, characteristics of an event or a disaster (e.g. water in case of flooding, wind in case of hurricane or water and wind in case of typhoon) could be more appropriate to be notified to a UE with no user interface as well as the severity of an event or a disaster than a name of a disaster from the perspective of a UE with no user interface, i.e. things.

In addition, each country has different kind of disasters that are critical to each country for public safety so it is desirable to describe characteristics of an event or a disaster rather than the kind of an event or a disaster in a message identifier dedicated to UEs with no user interface.

### 5.2.2 Open issues

The following aspects should be studied and considered in proposed solutions.

- How to enable UEs with no user interface and with ePWS functionality to identify characteristics of an event or a disaster from a Warning Notification

- How to describe characteristics of an event or a disaster in a Warning Notification in order to make UEs with no user interface and with ePWS functionality take specific actions based on the information of characteristics of an event or a disaster

## 5.3 Key Issue 3: Support of the relay of Warning Notification

### 5.3.1 General description

The relay functionality is specified to extend coverage supported by 3GPP system. The relay of Warning Notification can be useful for users who are not able to receive warning messages and who are near the place where an event or a disaster is occurring. In addition, it is of critical importance to keep warning messages transmitted by authorities for a reasonable period of time in order to be able to relay them to other users who possibly have not had an opportunity to receive those warning messages.

### 5.3.2 Open issues

The following aspects should be studied and considered in proposed solutions.

- How to enable remote UEs which support ePWS functionality and the reception of relayed Warning Notifications to receive Warning Notifications transmitted by a UE which supports the relay functionality

- How to enable a UE with the relay functionality and ePWS functionality to forward a Warning Notification that is received from a 3GPP network

- How to enable a UE which support ePWS functionality and the reception of relayed Warning Notifications that is out of network coverage to inquire of other UEs which support ePWS functionality as well as the relay functionality whether any Warning Notification messages have been received by the other UEs and to connect to such UE to receive those messages.

# 6 Solutions

## 6.1 Solution 1: Support of language-independent content mapped to an event or a disaster in a warning message

### 6.1.1 Description

This solution applies to Key Issue 1 – Support of language-independent content mapped to an event or a disaster in a warning message.

Message identifiers related to additional languages (i.e. 4383 to 4395 and 4397) are specified for foreigners who do not know a local language in 3GPP TS 23.041 [3]. However, most countries do not support additional languages or they support or prepare for supporting only the English language. In some countries, a warning message with a message identifier related to a local language includes texts written in both the local language and an additional language (e.g. English).

Considering conventional use of warning messages by authorities in different countries, it is necessary to enable language-independent content (e.g. a unicode symbol) to be included in a warning message for devices that have a conventional display screen that was assumed when legacy procedures of broadcasting warning messages were specified in 3GPP.

### 6.1.2 Procedure

The inclusion of the language-independent content mapped to an event or a disaster in a warning message should be supported over the legacy architecture of broadcasting warning messages.

NOTE: Language-independent contents mapped to disasters need to be formatted to be suitable to be included in a warming message like texts. It may be a unicode symbol that are standardised in other standardisation bodies. It is desirable that standardised symbols mapped to disasters are applied in all countries that provides warning messages for public safety. This will make it possible for foreigners to intuitively understand the meaning of language-independent contents displayed to their devices.

In order to include language-independent content such as unicode symbol, ISO is requested to define new characters mapping to specific pictograms that intuitively remind users of disasters. In addition, UEs with ePWS functionality should be capable of identifying such new characters if they are included in a warning message and displaying them to users.

### 6.1.3 Impacts on existing nodes and functionality

This solution is assumed to be applied over the legacy procedure and architecture and the language-independent content is assumed to be a compatible format as texts to be included in a warning message.

So there is no impact on existing nodes and functionality in terms of the network architecture and network procedure of broadcasting warning messages.

And this solution requires UEs with ePWS functionality to be capable of identifying new characters mapped to specific pictograms that represent disasters and displaying them to users.

### 6.1.4 Solution Evaluation

This solution solves Key Issue 1 based on legacy procedure and architecture of broadcasting warning messages over the 3GPP system.

## 6.2 Solution 2: Identification of characteristics of an event or a disaster for UEs with no user interface

### 6.2.1 Description

This solution applies to Key Issue 2 – Identification of characteristics of an event or a disaster for UEs with no user interface.

Things as devices capable of receiving warning messages, i.e. UEs with no user interface, were not assumed when the legacy procedure and architecture of broadcasting warning messages was specified in 3GPP. In near future, diverse forms of things as devices capable of receiving warning messages are expected to be launched in markets.

However, legacy text-based warning messages can not be understood by UEs with no user interface and may be useless to make UEs with no user interface properly take actions for damage reduction or public safety when a legacy text-based warning message is received.

So it is necessary to address how to make UEs with no user interface take actions for damage reduction or public safety when they receive the legacy form of a warning message broadcast over the legacy architecture of broadcasting warning messages.

Disasters that may cause severe damages are different in countries (for example, hurricane causes severe damage in the east of the United State of America but there is no severe damage caused by hurricanes in Korea), which means that the finite set of disasters may not be possible to be listed. In addition, characteristics of disasters could be more useful information to be notified to things than the type of disaster.

So it is desirable to define new message identifiers of warning messages targeted for things so that things can directly extract information on characteristics of a disaster from message identifiers.

Legacy message identifiers specified in 3GPP TS 23.041 [3] are classified by following categories and support the indication of the risk level about a disaster to be alerted.

- 4370 for a local language and 4383 for additional language: a warning message shall be always displayed.

- 4371 to 4379 for a local language and 4384 to 4392 for additional language: a warning message shall be displayed when a user selects opt-in option.

1) In case of CMAS CBS messages, 4371 to 4379 and 4384 to 4392 are classified by severity, urgency and certainty.

2) In case of EU-Alert messages, 4371 to 4379 and 4384 to 4392 are classified by level 1, level 2 and level 3.

- 4352 for earthquake warning, 4353 for tsunami warning and 4354 for earthquake and tsunami warning by ETWS messages

However, in most countries a single message identifier (e.g. 4371 in case of a local language) is conventionally used because authorities select high level of risk indications regardless of the risk level specified in 3GPP when a warning message is broadcast to users. Considering the conventional use of message identifiers, it might be good to simplify the risk level of disasters to be notified to things from authority's perspective as a user of public warning system.

Therefore, it is desirable to define new message identifiers classified by following categories to inform things of characteristics of disasters.

- one message identifier to make UEs with no user interface and with ePWS functionality always take action when a warning message is received

- A group of message identifiers (e.g. the group of three message identifiers) per the characteristic (e.g. water) of disasters to indicate the risk level of characteristics of a disaster to be alerted. For example, three message identifiers per the characteristic of disasters can be defined to mean:

a) both severity and urgency are high;

b) severity is high but urgency is not high;

c) severity is not high but urgency is high.

Considering the conventional use of message identifiers and the important information about a disaster from things' perspective to decide whether proper action shall be taken immediately when receiving a warning message, the definition of new message identifiers targeted for things, i.e. UEs with no user interface and with ePWS functionality, should be described to take into account all aspects addressed above.

### 6.2.2 Procedure

Message identifiers from 4400 to 6399 are reserved for future PWS versions. A single new message identifier should be defined to make UEs with no user interface and with ePWS functionality always take pre-defined actions when a warning message is received like 4370 and 4383 regardless of the type of disasters and characteristics of a disaster.

Example of characteristics of disasters or events that may cause serious damage to things is water, fire, pressure, wind, dust, chemical material and electricity. New message identifiers should be defined per the characteristic of disasters. A group of a few (e.g. three) message identifiers may need to be defined per the characteristic of disasters and a few message identifiers among a group may need to be defined to indicate the risk level of the characteristics of a disaster.

NOTE 1: What number of reserved message identifiers are allocated is to be decided when the normative work starts.

NOTE 2: How many characteristics of disasters are classified will be studied and reviewed by a few countries if possible and is to be decided when the normative work starts.

NOTE 3: How many message identifiers among a group of message identifiers mapped to one of combined characteristics of disasters will be studied (e.g. three message identifiers to indicate the risk level are sufficient or not) and reviewed by a few countries if possible. Then, it will be decided when the normative work starts.

### 6.2.3 Impacts on existing nodes and functionality

This solution is assumed to be applied over the legacy procedure and architecture, so there is no impact on existing nodes and functionality in terms of network architecture and network procedure of broadcasting warning messages except for defining new message identifiers from 4400 to 6399 reserved for future PWS versions.

### 6.2.4 Solution Evaluation

This solution solves Key Issue 2 based on legacy procedure and architecture of broadcasting warning messages over the 3GPP system.

## 6.3 Solution 3: Support of the relay of Warning Notification

### 6.3.1 Description

This solution applies to Key Issue 3 – Support of the relay of Warning Notification.

The relay functionality was initially specified in 3GPP from the demand of public safety domain and then, other 5G vertical domains also have such demands to address their issues over 5G system. In order to satisfy such demands from diverse vertical domains including public safety domain over 5G system, studies related to the relay functionality supported over 5G system are ongoing in 3GPP to be targeted to start a normative work in 3GPP Release 17 as follows.

- FS\_REFEC (Study on enhanced Relays for Energy eFficiency and Extensive Coverage) for Stage 1study in SA WG1

- FS\_5G\_ProSe (Study on System enhancement for Proximity based Services in 5GS) for Stage 2 study in SA WG2

Considering current progress in 3GPP, devices with relay functionality and devices receiving relayed messages from devices with relay functionality are expected to be on market from 3GPP Release 17 onwards. So it is desirable not to specify solution 3 for support of the relay of Warning Notification in 3GPP Release 16 specification.

### 6.3.2 Procedure

NOTE: There is no specified procedure in 3GPP Release 16 because devices with relay functionality are expected to be on markets from 3GPP Release 17 onwards.

### 6.3.3 Impacts on existing nodes and functionality

There is no impact on existing nodes and functionality

### 6.3.4 Solution Evaluation

This solution solves Key Issue 3 based on legacy procedure and architecture of broadcasting warning messages over the 3GPP system.

## 6.4 Solution 4: Support of a stored language-independent content referenced by a warning message

### 6.4.1 Description

This solution applies to Key Issue 1 – Support of language-independent content mapped to an event or a disaster in a warning message.

It is recently recognised that devices incapable of displaying text-based warning messages (e.g. devices with an augmented reality-based user interface or devices with a hologram-based user interface) are expected to be launched. Considering the limited capacity of a warning message broadcast from authorities, legacy procedures for broadcasting warning messages do not allow contents to be properly displayed to such devices.

Assuming that users have several devices capable of receiving warning messages broadcast from authorities, it is desirable to alert users by displaying a stored language-independent content referenced by a warning message. In such case, there might be the limit of the number of language-independent contents stored in devices incapable of displaying text-based warning messages because of the restriction of those devices (e.g. memory size).

Devices incapable of displaying text-based warning messages, such as devices with a augmented reality-based user interface or devices with a hologram-based user interface, were not assumed when the legacy procedure and architecture of broadcasting warning messages was specified in 3GPP. In addition, legacy warning messages are broadcast with the single message identifier (e.g. 4371) in most countries that currently provide warning messages, regardless of the type and severity of disasters. So it is desirable to make a stored language-independent content of such device be referenced in order to be displayed to a user of such device when a warning message is received.

### 6.4.2 Procedure

Message identifiers specified for legacy UEs with the conventional display method (i.e. display screen to be able to present text-based warning messages) should be able to make UEs with ePWS functionality incapable of displaying text-based warning messages reference a stored language-independent content from such UEs when warning messages are received.

UEs with ePWS functionality incapable of displaying-text-based warning messages shall be capable of mapping message identifiers of received warning messages to contents stored in UEs with ePWS functionality.

### 6.4.3 Impacts on existing nodes and functionality

This solution is assumed to be applied over the legacy procedure and architecture by using legacy message identifiers to reference a stored language-independent content to be displayed to users.

So there is no impact on existing nodes and functionality in terms of the network architecture and network procedure of broadcasting warning messages.

And this solution requires UEs with ePWS functionality to be capable of mapping message identifiers of warning messages to contents stored in UEs with ePWS functionality.

This solution does not require any changes of information sent over radio interface.

How to manage a stored language-independent content is out of the scope of this solution and depends on the manufacturers’implementation.

### 6.4.4 Solution Evaluation

This solution solves Key Issue 1 based on legacy procedure and architecture of broadcasting warning messages over the 3GPP system.

## 6.5 Solution 5: Carrying characteristics of an event or a disaster for UEs with no user interface in the message payload

### 6.5.1 Description

This solution applies to Key Issue 2 – Identification of characteristics of an event or a disaster for UEs with no user interface.

Things as devices capable of receiving warning messages, i.e. UEs with no user interface, were not assumed when the legacy procedure and architecture of broadcasting warning messages was specified in 3GPP. In the near future, diverse forms of things as devices capable of receiving warning messages are expected to be launched in markets.

However, legacy text-based warning messages cannot be understood by UEs with no user interface and may be useless to make UEs with no user interface properly take appropriate action when a legacy text-based warning message is received.

Therefore, it is necessary to address how to make UEs with no user interface take appropriate actions when they receive the legacy form of a warning message broadcast over the legacy architecture of broadcasting warning messages.

Disasters have different characteristics in different in countries, which means that it may not be possible to list an exhaustive list of disasters, but characteristics of disasters could be more useful information to be notified to things than the type of disaster.

The content of the message could be a CAP message, which would make the characteristics independent of 3GPP specifications.

The CAP v1.2 [7] protocol provides a generic format to relay warning messages, but the format is in XML which needs to be compressed (economized) in order to relay it in a CB message. The message identifier would relate to the device class (e.g. a device that understands a CAP payload) and not to an event.

### 6.5.2 Procedure

Legacy Warning Message Delivery as specified in TS 23.041 [3] would be used but a specific message identifier would need to be allocated to identify messages that have a CAP payload.

The CB Data element (payload of CB message) is populated with a compressed version of a CAP message. The compression format is out of scope of the present study.

Alternatively, the CB Data element could consist of one or more numbers which could be the same as the message identifiers that would be allocated in solution 2 to identify event characteristics.

### 6.5.3 Impacts on existing nodes and functionality

There is no impact on existing nodes and functionality in terms of the network architecture and network procedure of broadcasting warning messages.

This solution requires UEs with ePWS functionality to be capable of parsing the compressed CAP message in the CB Data element in order to take appropriate action.

### 6.5.4 Solution Evaluation

This solution is an alternative to solution 2. The information about the disaster is carried in the payload (i.e. CB Data element) rather than in the value of the message identifier. The CAP elements allow characterizing the disaster and also the action that needs to be taken.

Adding new characteristics of events is done in the CAP payload and is flexible and independent of 3GPP specifications.

# 7 Conclusions and recommendations

## 7.1 Conclusions

### 7.1.1 Key issue 1: Support of language-independent content mapped to an event or a disaster in a warning message

Solution 1 and solution 4 are recommended for normative work to support language-independent content mapped to an event or a disaster in a warning message.

### 7.1.2 Key issue 2: Identification of characteristics of an event or a disaster for UEs with no user interface

Solution 2 is recommended for normative work to address the identification of characteristics of an event or a disaster for UEs with no user interface based on legacy procedure and architecture of broadcasting warning message over the 3GPP system.

### 7.1.3 Key issue 3: Support of the relay of Warning Notification

For key issue 3, it is recommended that no solution be specified for normative work in 3GPP Release 16 specification.

## 7.2 Recommendations

It is recommended to start the normative work based on the conclusions described in clause 7.1 to address key issues described in chapter 4.

Annex A:   
Classification of disasters

# A.1 Statistic data per disaster type

UNISDR (United Nations Office for Disaster Risk Reduction) which is now renamed as UNDRR (UN Office for Disaster Risk Reduction) published the report [5] by the collaboration with CRED (Centre for Research on the Epidemiology of Disasters) and its report describes the statistic data on what kind of disasters cause economic loss as well as human death in the world from 1998 to 2017.

According to the report [5], the number of disasters per type from 1998 to 2017 is as follows.

Table A.1-1: Number of disasters per type from 1998 to 1997

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Disaster | Flood | Storm | Earthquake | Extreme temperature | Landslide | Drought | Wildfire | Volcanic activity | Mass movement (dry) |
| **Number** | 3,148 | 2,049 | 563 | 405 | 378 | 347 | 254 | 99 | 12 |
| **Percentage** | 43.4% | 28.2% | 7.8% | 5.6% | 5.2% | 4.8% | 3.5% | 1.4% | 0.2% |

In addition, pictograms mapped to disasters described in Table A.1-1 are described in the report [5].

Disaster type responsible for the majority losses in top 10 countries or territories is also provided in its report [5] as follows.

Table A.1-2: Disaster type responsible for the majority losses in top 10 countries or territories from 1998 to 1997

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Disaster | Earthquake | Earthquake & Tsunami | Storm | Extreme temperature | Flood | Drought |

In addition, the number of people affected and the number of deaths per disaster type from 1998 to 2017 are also provided in its report [5] as follows.

- The number of people affected per disaster type from 1998 to 2017

1) Flood: 2.0 billion (45% of all disaster types)

2) Drought: 1.5 billion (33% of all disaster types)

3) Storm: 726 million (16% of all disaster types)

4) Earthquake: 125 million (3% of all disaster types)

5) Extreme temperature: 97 million (2% of all disaster types)

6) Wildfire, volcanic activity, mass movement (dry): 6.2 million (0.1% of all disaster types)

7) Landslide: 4.8 million (0.1% of all disaster types)

- The number of deaths per disaster type from 1998 to 2017

1) Earthquake: 747,234 deaths (56% of all disaster types)

2) Storm: 232,680 deaths (17% of all disaster types)

3) Extreme temperature: 166,346 deaths (13% of all disaster types)

4) Flood: 142,088 deaths (11% of all disaster types)

5) Drought: 21,563 deaths (2% of all disaster types)

6) Landslide: 18,414 deaths (1% of all disaster types)

7) Wildfire, volcanic activity, mass movement (dry): 2,398 deaths (0.2% of all disaster types)

Based on the reported economic losses per climate-related disaster type and per geophysical disaster type, following list is also provided in its report [5] as follows.

- Reporting of economic losses per disaster type (climate-related)

1) Storm: 55% reported

2) Wildfire: 41% reported

3) Flood: 32%

4) Drought: 29%

5) Landslide: 13%

6) Extreme temperature: 11%

- Reporting of economic losses per disaster type (geophysical)

1) Earthquake: 43% reported

2) Volcanic activity: 11% reported

3) Mass movement (dry): 8%

# A.2 Classification of disaster group

The classification of disaster group is defined in EM-DAT website by CRED website [6] as follows.

The disaster group is classified into the group of natural disaster and the group of technological disaster. The group of natural disaster is classified as disaster subgroups described in Table A.2-1 and the group of technological disaster is classified as disaster subgroups described in Table A.2-2.

Table A.2-1: General classification of natural disaster group

|  |  |  |
| --- | --- | --- |
| Disaster Subgroup | Definition | Disaster Main Type |
| Geophysical | A hazard originating from solid earth. This term is used interchangeably with the term geological hazard. | Earthquake |
| Mass Movement (dry) |
| Vocanic activity |
| Meteorological | A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days | Extreme Temperature |
| Fog |
| Storm |
| Hydrological | A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater. | Flood |
| Landslide |
| Wave action |
| Climatological | A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability | Drought |
| Glacial Lake Outburst |
| Wildfire |
| Biological | A hazard caused by the exposure to living organisms and their toxic substances (e.g. venom, mold) or vector-borne diseases that they may carry. Examples are venomous wildlife and insects, poisonous plants, and mosquitoes carrying disease-causing agents such as parasites, bacteria or viruses (e.g. malaria). | Epidemic |
| Insect infestation |
| Animal Accident |
| Extraterrestrial | A hazard caused by asteroids, meteoroids, and comets as they pass near-earth, enter the Earth’s atmosphere, and/or strike the Earth, and by changes in interplanetary conditions that effect the Earth’s magnetosphere, ionosphere, and thermosphere. | Impact |
| Space weather |

Table A.2-2: General classification of technological disaster

|  |  |
| --- | --- |
| Disaster Subgroup | Disaster Main Type |
| Industrial accident | Chemical spill |
| Collapse |
| Explosion |
| Fire |
| Gas leak |
| Poisoning |
| Radiation |
| Oil spill |
| Other |
| Transport accident | Air |
| Road |
| Rail |
| Water |
| Miscelleanous accident | Collapse |
| Explosion |
| Fire |
| Other |

In addition, each disaster subgroup in case of the group of natural disaster is classified into several disaster sub-type and disaster sub-sub-type and it is also described in Table A.2-3 to Table A.2-8.

Table A.2-3: Classification of geophysical disaster subgroup

|  |  |  |  |
| --- | --- | --- | --- |
| Disaster Subgroup | Disaster Main Type | Disaster Sub-Type | Disaster Sub-Sub-Type |
| Geophysical | Earthquake | Ground movement |  |
| Tsunami |
| Mass Movement (dry) | Rock fall |
| Landslide |
| Vocanic activity | Ash fall |
| Lahar |
| Pyroclastic flow |
| Lava flow |

Table A.2-4: Classification of geophysical disaster subgroup

|  |  |  |  |
| --- | --- | --- | --- |
| Disaster Subgroup | Disaster Main Type | Disaster Sub-Type | Disaster Sub-Sub-Type |
| Meteorological | Storm | Extra-tropical storm |  |
| Tropical storm |  |
| Convective storm | Derecho |
| Hail |
| Lightning/thunderstorm |
| Rain |
| Tornado |
| Sand/dust storm |
| Winter storm/blizzard |
| Storm/surge |
| Wind |
| Severe storm |
| Extreme Temperature | Cold wave |  |
| Heat wave |  |
| Severe winter conditions | Snow/ice |
| Frost/freeze |
| Fog |  |  |

Table A.2-5: Classification of hydrological disaster subgroup

|  |  |  |  |
| --- | --- | --- | --- |
| Disaster Subgroup | Disaster Main Type | Disaster Sub-Type | Disaster Sub-Sub-Type |
| Hydrological | Flood | Coastal flood |  |
| Riverine flood |
| Flash flood |
| Ice jam flood |
| Landslide | Avalanche (snow, debris, mudflow, rockfall) |
| Wave action | Rogue wave |
| Seiche |

Table A.2-6: Classification of climatological disaster subgroup

|  |  |  |  |
| --- | --- | --- | --- |
| Disaster Subgroup | Disaster Main Type | Disaster Sub-Type | Disaster Sub-Sub-Type |
| Climatological | Drought |  |  |
| Glacial Lake Outburst |  |
| Wildfire | Forest Fire |
| Land fire : Brush, bush, pasture |

Table A.2-7: Classification of biological disaster subgroup

|  |  |  |  |
| --- | --- | --- | --- |
| Disaster Subgroup | Disaster Main Type | Disaster Sub-Type | Disaster Sub-Sub-Type |
| Biological | Epidemic | Viral disease |  |
| Bacterial disease |
| Parasitic disease |
| Fungal disease |
| Prion disease |
| Insect infestation | Grasshopper |
| Locust |
| Animal Accident |  |

Table A.2-8: Classification of extraterrestrial disaster subgroup

|  |  |  |  |
| --- | --- | --- | --- |
| Disaster Subgroup | Disaster Main Type | Disaster Sub-Type | Disaster Sub-Sub-Type |
| Extraterrestrial | Impact | Airburst |  |
| Space weather | Energetic particles |
| Geomagnetic storm |
| Shockwave |

Annex B:   
Change history

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Change history** | | | | | | | |
| **Date** | **Meeting** | **TDoc** | **CR** | **Rev** | **Cat** | **Subject/Comment** | **New version** |
| 2018-11 |  |  |  |  |  | Initial draft | 0.0.1 |
| 2018-12 | CT1#113 |  |  |  |  | Implementation of the following P-CRs from CT1#113: C1‑188811, C1‑188812, C1‑188813.  Editorial changes by rapporteur. | 0.1.0 |
| 2019-01 | CT1#114 |  |  |  |  | Implementation of the following P-CRs from CT1#114: C1‑190385, C1‑190386, C1‑190387, C1‑190650, C1‑190651.  Editorial changes by rapporteur. | 0.2.0 |
| 2019-04 | CT1#116 | C1-192461 |  |  |  | Clarification on the description of the clause 4 | 0.3.0 |
| 2019-04 | CT1#116 | C1-192462 |  |  |  | Clarification on the description of the clause 5.1 and the clause 5.2 | 0.3.0 |
| 2019-04 | CT1#116 | C1-192463 |  |  |  | Clarification on the description of the clause 5.3 | 0.3.0 |
| 2019-04 | CT1#116 | C1-192464 |  |  |  | Solution 1 for the support of a language-independent content mapped to an event or a disaster in a warning message and Solution 4 for the support of a stored language-independent content referenced by a warning message | 0.3.0 |
| 2019-04 | CT1#116 | C1-192797 |  |  |  | Solution 2 for the identification of characteristics of an event or a disaster for things with no user interface | 0.3.0 |
| 2019-04 | CT1#116 | C1-192148 |  |  |  | Solution 3 for support of the relay of Warning Notification | 0.3.0 |
| 2019-06 | CT-84 | CP-191149 |  |  |  | Version 1.0.0 presented for information to TSG CT | 1.0.0 |
| 2019-08 | CT1#119 | C1-194730 |  |  |  | Solution for carrying characteristics of an event or a disaster for UEs with no user interface in the message payload | 1.1.0 |
| 2019-08 | CT1#119 | C1-194732 |  |  |  | pCR on Annex A (Informative) | 1.1.0 |
| 2019-08 | CT1#119 | C1-194731 |  |  |  | pCR on solutions in clause 7.1 | 1.1.0 |
| 2019-08 | CT1#119 | C1-194125 |  |  |  | pCR on recommendations in clause 7.2 | 1.1.0 |
| 2019-09 | CT#85 | CP-192086 |  |  |  | Presentation for approval at TSG CT | 2.0.0 |
| 2019-09 | CT#85 |  |  |  |  | Version 2.0.0 created after approval | 16.0.0 |