ETSI TR 122 968 V8.0.0 (2009-01)

Technical Report

Digital cellular telecommunications system (Phase 2+);
Universal Mobile Telecommunications System (UMTS);
LTE;
Study on requirements for an Public Warning System (PWS) service
(3GPP TS 22.968 version 8.0.0 Release 8)

Reference
DTR/TSGS-0122968v800

Keywords
GSM, LTE, UMTS

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Sous-Préfecture de Grasse (06) N° 7803/88

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Foreword

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Contents

Foreword

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

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1 Scope

This Technical Report (TR) represents the results of the Study on Public Warning System (PWS). The intent of this study is to identify requirements and aspects for a Public Warning System. The regulatory requirements and use cases for a public warning service have not been finalized in all regions (i.e. in the USA) therefore, the results of this study are not applicable for those regions which do not have regulatory requirements defined.

The Public Warning System is intended to interwork with external networks to provide an end-to-end service. Therefore, service interactions with a Warning Notification Provider in external networks are considered within the scope of this document, although the specification of these interactions may be in other standards. If this occurs, a reference to that specification shall be made.

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] ETSI TS 102 182: "Emergency Communications (EMTEL); Requirements for communications from authorities/organizations to the individuals, groups or the general public during emergencies".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 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 TR 21.905 [1].

Notification Area: is an area where *warning notifications* are sent.

Public Warning System: is a system that delivers *Warning Notifications* provided by *Warning Notification Providers* to the UEs which have the capability of receiving *Warning Notifications* within *Notification Areas* through the 3GPP network.

Public Warning Service: is a service that delivers Warning *Notifications* provided by Warning *Notification Providers* to the UEs which have the capability of receiving *Warning Notifications* within *Notification Areas* through the 3GPP network.

Warning Notification: is information which notifies users of the occurrence of the events and may provide users with additional information, such as instructions on what to do and or where to get help as long as the emergency lasts.

Warning Notification Provider: is an agency (e.g. government and or public service organisations) that provide *warning notifications* and requests PLMN operators to deliver them.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 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 TR 21.905 [1].

EEW Earthquake Early Warning
PWS Public Warning System

4 Background

4.1 Regional requirements

The following sections provide a collection of regional requirements that may be applicable to the Public Warning System. The cellular system is expected to consider only those requirements of the PWS that are relative to the transmission to the UE of the warning notification which is received from the relevant national/regional authority.

4.1.1 Japan

The Japanese government intends to create early warning earthquake detection systems, which is called Earthquake Early Warning (EEW) System, during 2006 and expects that mobile operators study the feasibility of realizing a system for delivering earthquake early warning information to mobile phone users.

An interim Japanese government report on the earthquake early warning information describes an idea of the requirements for the earthquake early warning information for the general public as follows:

Earthquake early warning information should be published only once per occurrence of earthquake. Subsequent publication of the information should be avoided except for real necessity such as correction of wrong information, expansion of area where big earthquake is expected, etc..

Earthquake early warning information should be published only when occurrence of big earthquake is expected.

Publication of wrong earthquake early warning information should be avoided.

Earthquake early warning information should be published as soon as possible.

Possible error in terms of accuracy should be taken into account in the expression of earthquake early warning information.

Publication of earthquake early warning information can be limited to the area where evacuation is required.

Earthquake early warning information should contain visual information for delivering through, for example, television.

The first six requirements are related to the use of the system and the last two requirements are related to the functionality of the system.

The feasibility study in this TR needs to take the relevant requirements for the Public Warning System from the above list into account.

4.1.2 United States of America (USA)

4.1.2.1 WARN Act Summary

On Friday October 13, 2006, the Warning Alert and Response Network (WARN) Act as part of the SAFE Port Act was signed by the U.S. President and became law. The WARN Act defines the process, procedures, and schedule for the development of the recommendations, requirements, and regulations for the emergency alert systems for commercial wireless systems. The full text of the WARN Act is contained as Title VI Commercial Mobile Alert Systems of the Safe Port Act H.R.4954 and can be found at http://thomas.loc.gov/cgi-bin/bdquery/z?d109:h.r.04954:

Based upon the process, procedures, and schedule defined within the WARN Act, the FCC will not be issuing regulations for the wireless emergency alert systems in the United States until April 2008. Therefore, the 3GPP requirements for Public Warning Systems for the United States can not be completed until after April 2008.

NOTE: The information included within { } brackets below are the references to the specific clauses of the WARN Act.

Major Milestones of the WARN Act

The major milestones that have been identified in the WARN Act are as follows:

- The FCC is to establish the Commercial Mobile Service Alert Advisory Committee ("Advisory Committee") within 60 days of enactment {Sec. 603.(a)}
  - Membership in the Advisory Committee is by appointment of the FCC chairman {Sec. 603.(b)}
  - The Advisory Committee will be responsible for the development of system-critical recommendations {Sec. 603.(c)}
- The Advisory Committee is to develop recommendations for mobile alerts within one year of enactment {Sec. 603.(c)}
- The FCC is to define the Commercial Mobile Service Regulations within 180 days after completion of recommendations by the Advisory Committee {Sec. 602.(a)}
- The FCC is to amend commercial mobile service license within 120 days after the FCC modifies commercial mobile service regulations {Sec. 602.(b)(1)}
- Since support of emergency alerts is voluntary, the mobile operators must file decisions on providing alert services within 30 days after FCC modifies commercial mobile service regulations {Sec. 602.(b)(2)(A)}

The schedule of the WARN Act is portrayed on the following timeline:

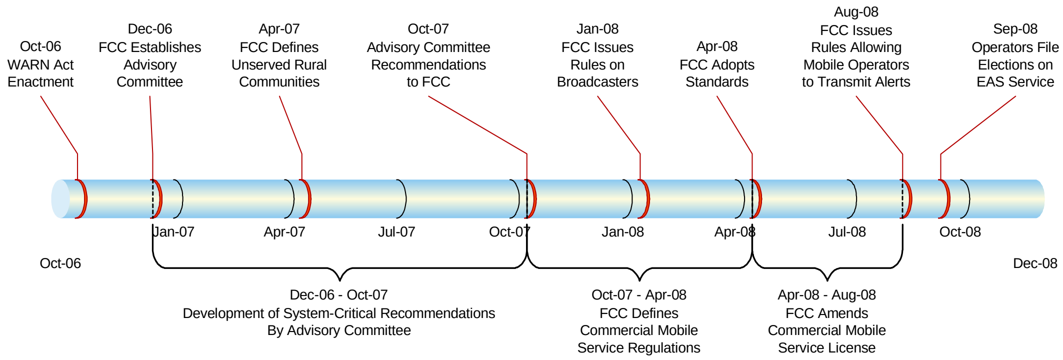

Figure 1: Major Provisions of the WARN Act

Detailed recommendations for the following items are to be developed by the Advisory Committee. The FCC will develop requirements after the recommendations of the Advisory Committee have been completed in October 2007.

1. Support of Emergency Alert Services is voluntary by wireless operators within the United States. Elections for support of Emergency Alert Services can be in whole or in part {Sec. 602.(b)(1)(B)}
2. The Advisory Committee will define the process when all devices or equipment are not capable of receiving alerts (e.g., legacy mobile devices) {Sec. 603.(c)(6)(a)}.
3. The Advisory Committee will define the process when alerts can not be offered in the entire service area {Sec. 603.(c)(6)(a)}.
4. The wireless operator may offer subscriber opt-in based upon classes of alerts {Sec. 602.(b)(2)(E)} {Sec. 603.(c)(5)}. The classes of alerts are to be defined by the Advisory Committee. The subscriber will not be allowed to opt-out of Presidential level alerts.
5. The distribution of emergency alerts to the wireless operators will be via the digital broadcast television signals of the non-educational broadcast stations and the public broadcast stations {Sec. 602.(c)}.
6. The Common Alert Protocol (CAP) will be used by the digital broadcast television stations to distribute emergency alerts to the wireless operators {Sec. 602.(c)}.
7. Devices & equipment used for alerting will have to undergo technical testing {Sec. 602.(f)}.
8. The protocols, capabilities, and procedures to receive, verify, and transmit alerts will be defined by the Advisory Committee {Sec. 603.(c)(1)}.
9. Priority transmission of alerts will be defined by the Advisory Committee {Sec. 603.(c)(2)}.
10. The transmission in languages in addition to English should be supported to the extent where it is practical and feasible {Sec. 603.(c)(4)}.
11. There should be no fees for the emergency alert services {Sec. 602.(b)(2)(C)}.
12. While there are no specific requirements in WARN Act for support of individuals with disabilities, the specified membership list of the Advisory Committee includes national organizations representing individuals with special needs {Sec. 603.(b)(3)(F)}. Therefore, it is anticipated that the Advisory Committee will include recommendations for the support of individuals with disabilities and other special needs.
13. The National Institute of Science & Technology (NIST) and the FCC will under joint research programs {Sec. 604.(a)}. The initial topics of these research programs will be as follows:
    a. Development of innovative technologies that will transmit geographically targeted emergency alerts to the public {Sec. 602.(b)(2)(A)}.
    b. Research on understanding and improving public response to warnings {Sec. 602.(b)(2)(B)}

4.1.2.1.1 Draft Conclusions and Working Assumptions

These draft conclusions and working assumptions of the FCC Commercial Mobile Service Alert Advisory Committee (CMSAAC) are extracts of work in progress and are subject to change. Some of these conclusions and assumptions are outside the scope of 3GPP but are provided in order to better understand the requirements and functionality of the entire solution. It is not anticipated that 3GPP will define specifications in the areas which are outside the scope of 3GPP.

DRAFT CONCLUSIONS:

- The alerting initiation platform should perform an alert aggregation function, presenting an integrated alert interface to the alerting gateway that includes alerts from all authorized sources. This alerting initiation platform should be administered by a government agency to ensure authenticity and prioritization of alerts.
- The Commercial Mobile Alerting System (CMAS) must only be used for the dissemination of public alerts regarding immediate, serious and likely threats to life, health or property; and for updates, amendments and cancellations of such alerts.
- The CMAS must be available for alert origination only on the authority of federal, tribal, state and local government officials with responsibilities for public safety, health and security.
- The CMAS must support a method for credible and reliable authentication of authorized originators.
- The CMAS must support a method for ensuring the integrity of message content as delivered to the carrier, ensuring that the alerts delivered to that point accurately reflect the originator's input.
- The CMAS must provide reliable attribution of each alert message to its authorized originator.
- Responsibility for the accuracy, completeness and appropriateness of CMAS alert content must rest solely with the originating agency.
- Within the constraints of a standard input format, the CMAS must not filter, edit, amend or restrict any authorized originator's message content or intent, with the exception of such automatic and consistent transformations as may be required for technical purposes.

- The CMAS must deliver all alerts to the carrier from authorized originators without avoidable procedural or technical delays. However, where multiple alerts are in process at the same time, they may be sequenced on the basis of the urgency, severity and certainty of the alert information.
- The CMAS should, if possible, provide a unique and consistent user experience to all alert recipients, using, for example, standardized audio tones, vibration cadences and language-independent visual symbology. These standard signals must be available for authorized use within the CMAS without charge, but must be legally protected against other uses.
- The CMAS must, to the greatest extent feasible, restrict alert delivery to recipients located in the geographic area at risk and minimize delivery in other areas.
- The alert may be retransmitted in the geographic area until the alert expires, is updated, or is cancelled subject to the capabilities of the delivery technologies. Any mobile device users entering the target area may receive the emergency alert subject to the delivery technologies, device capabilities and inter-carrier roaming agreements.
- The CMAS must provide a consistent technical interface to alert origination applications using the OASIS CAP format, which must be available at multiple geographic and network locations. Any authorized originator must be able to submit an alert through any reachable instance of the input interface.
- The CMAS must provide reasonable redundancy to avoid, to the greatest extent feasible, the creation of a single point of failure.
- The CMAS must implement a comprehensive trust model for the issuance and maintenance of access credentials.
- Specific legal authority must be established for prohibiting unauthorized or improper use of the CMAS or for willful interference with its functioning.

DRAFT WORKING ASSUMPTIONS:

- The CMAS is based upon service profiles.
  - Service Profiles define the underlying delivery attributes.
    - Include text, audio, video, and multimedia
  - The goal is to define service profiles and not specific delivery technologies.
    - Multiple technologies are available for each service profile.
    - The operator has options to use any available technology that supports a given profile if they elect to transmit alerts.
      - Based on operator business needs and technology availability
  - Text is viewed as the "universal service profile".
    - Minimum capability that must be supported by an operator that elects to transmit alerts.
      - Across delivery technologies
      - Across mobile devices
    - Additional profiles can be supported as technology advances and operators commercially deploy those technologies.
- WARN Act → an operator may choose to elect to transmit alerts "in whole or in part".
  - Not necessarily a simple "yes" or "no".
  - Deployment scenarios identified based upon:
    - multiple technologies.
    - mobile device capabilities.
    - product availability.
    - implementation phases.
    - wireless operator election to support wireless alerts.
    - other.
  - Scenarios will be used to develop a process under which wireless service providers can elect to transmit emergency alerts for each scenario.
- During emergencies, support for first responder users and 9-1-1 emergency calls is important.
  - Need to minimize the potential for Wireless Alerts resulting in severe network congestion that inhibits critical communications.
  - An alert to a wireless device encourages subscribers to immediately use that device.
- CMSAAC is working on the assumption that point-to-point or unicast delivery technologies (i.e. SMS point-to-point, MMS) are not feasible or practical for the support of wireless alerts.
  - Especially on a nationwide or large city scale.
  - Point-to-point will quickly congest a network, resulting in message delays or messages not delivered, as well as denying voice service.

- CMSAAC is also assuming that distribution of the alerts to the wireless subscribers will be unidirectional from the wireless operator network to the mobile device of the subscriber.
    - No acknowledgement or confirmation of receipt by the mobile device in order not to add to network congestion.
- CMSAAC is assuming only alerts that are immediate, severe, or likely threat to life, health or property will be delivered to mobile devices.
    - Minimize the "cry wolf" syndrome.
    - Mobile devices have limited capabilities.
        - Number of characters, screen size, etc.
- A common experience across all carriers and technologies is desirable.
    - For example, a standardized alerting tone for the notification of an emergency alert message.
- It is anticipated new mobile devices are required.
    - Replaced by normal subscriber device lifecycle.
    - Some devices, such as pagers, may support some of the service profiles with over-the-air or programming changes.
- The Alerting Gateway, which is the interface between the aggregator and the wireless operator network, should support multiple media profiles (text, audio, video, multimedia) from the aggregator and should support multiple media profiles (text, audio, video, multimedia) to the carriers' networks.
    - The Alerting Gateway should support protocol mapping from the input to the output protocols.
    - The Alerting Gateway should format messages properly so that carriers should not be required to modify or edit the alert message content.
- The Alerting Gateway should have an architecture to support Alerting Gateway deployment with redundancy and reliability.
    - Multiple access points and delivery points
    - Multiple platforms (mated-pair at the same site)
    - Multiple sites (geo-redundancy)
    - Multiple vendors (number of vendors to be further discussed)
- All Alerting Gateways should use the same format and same message identifier when sending the same message to carriers' network. This should allow carrier to identify and ignore duplicated alerts.

4.1.2.2 EAS Usage for Earthquake Warnings

The State of California is the most populous state in the United States with the highest probability of occurrence of earthquakes. The State of California Emergency Alert System Plan (EAS) plan (http://eas.oes.ca.gov/Pages/script.htm) contains the following statement regarding the use EAS for earthquakes:

> "*d. THE EAS CAN'T WARN OF AN EARTHQUAKE. No reliable earthquake warning system has been found or adopted by the authorities. Thus the EAS can never warn of an earthquake. The EAS might be warranted for warnings related to subsequent events following an earthquake.*"

4.1.3 Europe

The European requirements have been supplied by EMTEL and described in the document titled: "Requirements for communications from Authorities/ organizations and citizens to individuals, groups or the general public during Emergencies" [2]. The EMTEL Requirements have been summarized below:

4.1.3.1 Service objectives and features

An effective Public Warning System will be capable of disseminating information to a large number of individuals within specifically affected areas. Emergency Notification systems shall:

1) Provide high speed notification delivery to a large audience.

   Systems intended to deliver high volumes of warning notifications at high speed shall be capable of addressing congestion management.

2) Deliver messages within a planned specified time.

   It shall be possible to provide an alert

- to 50% of the citizens in the relevant area within 3 minutes, and
- to 97% of the citizens in that area within 5 minutes

The period of three minutes is the period between the moment when the message is submitted to the Public Warning System and the moment the notification is provided to the citizen.

In networks that support a "message delivery acknowledgement" facility, Public Warning Systems shall be able to retry until acknowledgement is received. In systems that do not support delivery acknowledgement, the message shall be repeated at a regular interval for as long as the notification is valid.

3) Offer sufficient details of the emergency situation and sufficient instructions regarding actions to be taken by the public.

4) Allow information delivery to specific targeted audiences or geographies.

Public Warning Systems shall support delivery of notification messages to those with special needs, such as hearing and vision impaired.

The ability to deliver messages in government authorized languages shall be supported.

Citizens need to have relevant information that is specific to their location and the location of the emergency. A reference indication for the grid of the coverage area could be:
- 1 km inside community boundaries,
- 5 km outside community boundaries,
- 30 km in rural areas,
- 60 km over sea or desert

5) Be fully accessible to the right authorities.

Emergency notification systems shall provide multiple means for authorized users to launch a notification event

Public Warning Systems shall provide protection of data used for operation of the system.

Emergency notification systems shall be capable of tracking, capturing, and reporting performance criteria associated with individual notification events.

6) Be intrusive.

Emergency messages shall be specifically recognisable as being an emergency message that cannot be mistaken for an ordinary message.

The Warning Notification should stay active regardless of the user setting, until the notification is acknowledged by the user. This does not necessarily mean that any response shall be sent back over the network, merely that the user must click a key to stop the notification.

It shall be possible for the user to review the message at a later time.

5 Aspects

5.1 Duration of delivery time

Duration of the delivery time can be affected by several factors including

- Amount of information in warning notification to be delivered
- Priority of the warning notification
- Size of the notification area for the delivery of the warning notification
- Number of subscribers within the notification area
- Requirements for the formatting of the warning notification suitable for the delivery technology being used and suitable for the capabilities of the receiving mobile device

- Radio access technology being used for the delivery of the warning notification (e.g., GSM, EDGE, GPRS, UMTS, I-WLAN)

- Technology being used for the delivery of the warning notification (e.g., SMS, CBS, MBMS)

Duration of the delivery time for wireless operators is the time from the receipt of the warning notification by the wireless operator, i.e. the edge of the 3GPP network, to the time that the warning notification is received sufficiently by the mobile device to initiate appropriate action.

Message delivery provisioning may be required to satisfy Warning Notification Provider requirements.

5.1.1 Delivery time for most urgent warning notifications

Delivery time of the most urgent PWS warning notification should be as short as possible (i.e. seconds rather than minutes). Warning notifications may also contain supplementary information (e.g. map to refuge facilities, time table of food distribution, etc.). Such notifications may be of lesser urgency.

5.2 Granularity of the distribution

Warning notification should be able to be delivered to the notification area desired by the warning notification provider.

Aspects from the perspective of the granularity of the distribution are following.

- It should be possible for the mobile operators to select the notification areas based on their network configuration of the area coverage such as distribution of cells, Node Bs, RNCs, etc.

- the Notification Area, e.g. prefecture, county, can be statically or dynamically designated by Warning Notification Provider.

- In case of power failure, cells may loose their operational status, which could impact the granularity of the coverage area.

- If the notification message includes a geographic area (e.g. latitude/longitude coordinates) and/or a civil area description of the emergency impacted area, the use of such data for PWS is for further study and up to operator policy.

5.3 Information element and volume

Aspects from the perspective of information element and amount of data are following.

- PWS should provide the mechanisms for the delivery of all types or categories of warning notifications and alerts to mobile subscribers within the area desired by the warning notification provider.

- PWS should be flexible to allow support for all current and future types or categories of emergency events and not be designed to support specific type(s) of emergencies or events requiring notification.

- PWS should have the flexibility to support new categories or types of warning notification or alerts that may be defined by the regional regulatory or other requirements.

- PWS should be able to transfer warning notification with a minimal amount of data in order to support regional requirements such as the Japanese-specific Earthquake Early Warning system.

- Based upon regional requirements or operator preference, PWS should be able to transfer large data (e.g. as for audio or video data) within the warning notification in order to send, for example, a map of safe area or emergency facility.

- UE behaviours after receiving a Warning Notification (e.g. whether to display text in the foreground, whether to ring a buzzer, whether to vibrate).

- Warning Notification should be distinguished from notification generated for other notification services

- Specific contents of PWS warning notifications are not defined by 3GPP. The contents of warning notifications are highly dynamic in nature and are subject to regulatory requirements. The PWS standards should define the mechanisms and associated flexibility to support various types of warning notification data types.
- Amount of data required for each information element (e.g. UE behaviours, emergency types) should be clarified for Stage2, Stage3 specifications, especially for most urgent warning notifications.

5.3.1 Information element and volume for most urgent warning notifications

The length of the message will affect the speed of delivery. Therefore the notification sent by the notification provider should be as short as possible for the fastest delivery. However, it should be noted that the notification provider may not be able to optimise its notifications for PWS. Therefore it may be necessary to optimize the notifications before PWS however this optimization function is outside the scope of 3GPP.

5.4 Network Resilience

It has to be noted that after a major incident big parts of the network infrastructure might be destroyed/damaged (e.g. after flooding, earthquake). As the main goal for PWS is to notify as many users as possible network resilience should be studied further.

5.5 User Interface

The warning notification delivered to the user's terminal should be understood by the user with minimal knowledge of the UE. The 3GPP PWS standards should therefore provide generic guidelines for UI aspects.

If PWS reception is activated on the UE, these guidelines could include e.g.

- A designated acoustic/visual signal dedicated to PWS
- Terminal behaviour when a warning notification is received in IDLE mode. An example can for instance be;
    - The terminal is set to ringing mode (if previously being in silent mode)
    - Speaker is set to highest volume (PWS warning notification dependent)
    - The vibrator is being activated
    - The warning notification is automatically played out (PWS warning notification dependent)
    - The warning message should stay on regardless of user settings until the message indication is acknowledged by the user.
- Terminal behaviour when a warning notification is received in ACTIVE mode
    - It should be possible for users to configure the behaviour of a terminal when having ongoing communication. The configurable part should concern at least volume adjustment. Note that different regulatory requirements might exist with regards to pre-emption of ongoing calls.
- Terminal capability for user operation when/ after a warning notification is received. An example can for instance be;
    - The acoustic/ visual signal can be suppressed by users' manual operation (e.g. by pushing keys)
    - After the signal is suppressed by manual operation, it should be possible to suppress duplicate notifications received later. A duplicate is a repetition of a previous notification as determined by a parameter such as a message ID.
- PWS should support users with special needs e.g. deaf, blind, elderly people and children. An example terminal capability can for instance be;

  - Terminal behaviours (e.g. specified ring tone, vibration) can help these users understand emergency events easily. In order to improve the user experience and simplify user education a single special notification tone and/or vibration cadence is desirable.

- It should be possible to store the received Warning Notifications in the UE and access them at a later time.

  - It should be possible for the user to review the message at a later time.

- The Warning Notification should be presented to the user

5.6 Priority

Aspects from the perspective of priority are following.

- The priority of warning notifications is given in accordance with regional regulatory requirements or operator's policy.

- Notifications are processed in the order they are received by the network.

- In addition, Notifications may be sequenced by the PLMN according to priority of notification if each Warning Notification Provider is directly connected to the PLMN.

5.7 Security

Aspects of security are following.

- Spoofing prevention: it should not be possible to spoof a warning notification.

- Integrity protection of warning notifications should be possible.

5.8 Support of roaming subscribers

A PWS service should be able to alert roaming subscribers users just as it alerts its home subscribers users and it should do so in relevant languages , or in such a way that the warning notification can reasonably be understood. Under no circumstances, shall the network will translate, or in any other way, change the content of the notification. The network will neither filter notifications nor select the notification based on the subscription data of the subscribers stored in the network entities.

5.9 Support in legacy handsets

Legacy handsets, related to PWS, are handsets that may not be PWS capable.

Support of PWS in legacy handsets is subject to regulatory requirements and/or operator's policy.

5.10 Support of Warning Notification Providers

Following are example functionalities that Warning Notification Providers may provide through interaction with PLMN operators.

- activation of Warning Notification delivery

- cancellation of Notification Message

A cancellation is a command to the Public Warning System to stop dissemination of a specific Warning Notification.

5.11 UE Aspects

Battery life should not be significantly reduced by PWS. Guidelines for supporting PWS capabilities should be clarified by type of terminal (e.g. handset, PCMCIA).

5.11.1 User Interface

The warning notification delivered to the user's terminal should be understood by the user with minimal knowledge of the UE.

Depending on regulatory requirements and operator policy terminal behaviour should follow the user defined settings or predetermined settings. A special group of settings may be used for warning notifications in which case the user may or may not be able to change the settings.

The 3GPP PWS standards should therefore provide generic guidelines for UI aspects. For instance these guidelines could include:

- Activation of a special acoustic/visual signal dedicated to PWS
- Terminal behaviour when a warning notification is received in IDLE mode can, for instance be:
  - The terminal is set to ringing mode (if previously being in silent mode)
  - Speaker is set to highest volume (PWS warning notification dependent)
  - The vibrating alert is activated
  - The warning notification is automatically played out (PWS warning notification dependent)
  - The warning notification should stay on regardless of user settings until the message indication is acknowledged by the user.
- Terminal behaviour when a warning notification is received in ACTIVE mode
  - It should be possible for users to configure the behaviour of a terminal when having ongoing communication. The configurable part should concern at least volume adjustment. Note that different regulatory requirements might exist with regards to pre-emption of ongoing calls.
- Terminal capability for user operation when/ after a warning notification is received. An example can for instance be;
  - The acoustic/ visual signal can be suppressed by users' manual operation (e.g. by pushing keys)
  - After the signal is suppressed by manual operation, it should be possible to suppress duplicate notifications received later. A duplicate is a repetition of a previous notification as determined by a parameter such as a message ID.
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  - Terminal behaviours (e.g. specified ring tone, vibration) can help these users understand emergency events easily. In order to improve the user experience and simplify user education a single special notification tone and/or vibration cadence is desirable. These same behaviours can benefit all users.
- It should be possible to store the received Warning Notifications in the UE and access them at a later time.
  - It should be possible for the user to review the message at a later time.
- The Warning Notification should be presented to the user

Note: Care should be used in selecting the predetermined settings. It may not be advisable to override the silent mode and set the volume to maximum for instance when the users are in hospitals, doctor"s offices, restaurants, or theatres. In addition, this behavior may not be advisable when users are connected to the device with an earpiece including headsets for the hearing impaired. An objectionable user experience could lead to users disabling warning notifications.

5.11.2 Support in legacy handsets

Legacy handsets, related to PWS systems, are handsets that may not be PWS capable.

Support of PWS in legacy handsets is subject to regulatory requirements and/or operator's policy.

5.11.3 Physical Aspects

Battery life should not be significantly reduced by PWS.

Guidelines for supporting PWS capabilities should be clarified by type of terminal (e.g. handset, PCMCIA).

5.11.4 Enabling and disabling of PWS warning notifications

It should be possible for users to "opt-out" of some or all warning notifications provided by the PWS service. The "opt-out" concept assumes that the PWS functionality is enabled in the UE without any user intervention when the UE is initially put into use. The user then can select UE options via the UI to disable, or later re-enable, the terminal behaviour in response to some or all warning notifications The ability to disable some of the PWS warning notifications may be subject to regulatory requirements.

Editor Note: If the UE is enabled for PWS in the HPLMN then it should remain enabled for PWS when roaming, likewise when the roamer returns to the HPLMN then PWS should be returned to the original state, subject to the regulatory requirements and operator policy.

5.12 Subscription & Charging Aspects

It should be noted that some regulators may require unregistered UEs to receive PWS messages. Therefore, the ability to provide PWS to unregistered UEs is for further study.

It should be possible to provide PWS service without charging the subscriber.

It should be possible for the PLMN to charge the warning notification provider.

5.13 Delivery & Receipt Confirmation Aspects

Message alert confirmation should not be required. Although message confirmation is a logical vehicle for verification of message delivery, establishing and utilizing a schedule for message repetition can also increase the likelihood of a successful delivery.

A major reason for not requiring message confirmation relates to the additional load that will be put on the network during a time when network resources are very scarce and highly needed by first responders, such as an ambulance and medical services. This was aptly demonstrated during the 2005 subway and bus bombings in London.

5.14 Periodic Testing Aspects

Testing aspects are outside the scope of 3GPP. Test messages, if any, are defined outside of 3GGPP. These test messages are transparent to the Network Operator and 3GPP network and are treated like all other messages.

5.15 Relationship of PWS with Other Regulatory Aspects

Provisioning of PWS services, should be in accordance with regional requirements and operators' policy. Fulfilling regional regulatory requirements for existing regulatory services such as emergency call services, Wireless Priority Service, and Lawful Intercept Service may have an impact on PWS requirements which should be taken into consideration.

5.16 Congestion situation

The PWS should be able to deliver warning notifications under network-congested conditions within the required time frame.

5.17 Enabling and disabling of PWS service

The PWS functionality should be enabled in the UE without any user intervention when the UE is initially put into use.

It should be possible for the user to fully or partially enable and disable the PWS functionality. The ability of disabling some of the PWS functionalities may be subject to regulatory requirements.

If the PWS requires provisioning, this will be done according to the regulatory requirements and operator policy.

If the UE is provisioned for PWS in the HPLMN then it should remained provisioned for PWS when roaming, likewise when the roamer returns to the HPLMN then PWS should be returned to the original provisioned state, this will be done according to the regulatory requirements and operator policy.

7 Conclusion

7.1 Overall Conclusions

TSG SA1 has studied requirements for a global Public Warning System. In writing the present document requirements relevant to the European region has been identified [2] and additional requirements have been received from Japan for most urgent warning notifications (EEW). It may be expected that new additional requirements could arrive from the North American Region and thus the requirement set for a global PWS is not yet fully stable.

The requirements/working assumptions from the 3 regions included in the study are significantly different. However it is desirable to specify a PWS, which could fulfill all regions" requirements.

With the European region requirements provided in [2], as well as the even stricter requirements (eg. for Japan) in some aspects for most urgent warning notifications, SA1 concludes that current specifications are not sufficient to cover all the scenarios identified in this document. The support for most urgent warning notifications is a matter for each PLMN operator or each region.

Annex A: US - Public Warning System (PWS) use cases

A.1 Public Warning System (PWS) use cases

The mechanisms for the delivery of alerts via the Public Warning System are sensitive to the geographic size and the subscriber density within the alerting area. Consequently, the following five PWS use cases vary in geographic size and subscriber density:

use case #1 – Small local area.

use case #2 – Small town or city

use case #3 – Average size city

use case #4 – Large city or metropolitan area

use case #5 – National

For all use cases, it is assumed that all details associated with the emergency alert including instructions of actions to take by the subscriber are being delivered. Consequently, large emergency alert messages would be sent to the subscribers as noted in the common parameter section below.

A.1.1 Common Parameters for use cases 1-5

The alert messages will have the following characteristics:

Notification of hazardous situation that poses an imminent threat to public health or safety

Provide appropriate instructions for actions to be taken by individuals affected or potentially affected by such a situation

Notify public when hazardous situation has ended or has been brought under control.

The following are the assumptions and parameters which are common for all of these use cases:

- 30% of the population in the affected area has GSM phones[1]
- 80% of subscribers have their mobile phones turned on
- 8 SDCCH per square mile
- Block probability of 2%
- Average call duration is 60 seconds
- Alert messages will be issued during the Busy Hour (BH)
- Two alert messages will be issued
  - First alert message will be the event notification
    - If text, message content is 1,000 characters[2]
    - If audio, message content is 60 seconds[3]

---

1 CTIA estimates cellular penetration to be approximately 60% in the United States and it is assumed for this analysis that 50% of the cellular phones in the US are GSM based and 50% are CDMA based.

2 Based upon an actual flash flood warning message issued by the National Weather Service for the state of Utah in the United States on Tuesday October 18th, 2005

- Second alert message will be the event cancellation
    - If text, message content is 500 characters[4]
    - If audio, message content is 30 seconds[5]
- The first and second alert messages will be initiated 60 minutes apart

A.2 Use case #1 – Small Local Area

A railroad car containing chlorine gas has derailed in an urban area. The railroad car has been damaged and chloride gas is starting to escape. Based upon the current wind and weather conditions, the public safety officials have determined that the surrounding areas need to be evacuated immediately. Based on this determination, the local authorized government agency has decided to activate the Public Warning System to send an evacuation message to the citizens in the affected area.

Emergency alert parameters for this use case:[6]

- Size of affected area is 3 square miles
- 2,850 people per square mile
- 1,275 housing units per square mile

A.3 Use case #2 – Small Town or City

A tornado has been spotted 10 miles southwest of a small town in "tornado alley" of the US Midwest. This tornado is moving northwest directly toward this small town at approximately 20 miles an hour. The local public safety officials have determined that there is a high probability that the tornado will hit their small town in approximately 30 minutes. Based upon this determination, the local authorized government agency has decided to activate the Public Warning System to send a tornado warning alert message to the citizens in this small town and to advise them to take cover.

Note**:** For an actual tornado related event, a series of alert messages would be issued as the tornado moved and remained a public safety issue. For simplification of the analysis, it is assumed that only one notification message and one cancellation message will be sent.

Emergency alert parameters for this use case:[7]

- Size of small town is 16 square miles
- Population of the small town is 45,000
- 2,850 people per square mile
- 1,275 housing units per square mile

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3 Based upon an actual flash flood warning message issued by the National Weather Service for the state of Utah in the United States on Tuesday October 18th, 2005

4 Based upon the actual cancellation message of a severe thunderstorm warning message issued by the National Weather Service for central Arizona of the United States on Tuesday October 18th, 2005

5 Based upon the actual cancellation message of a severe thunderstorm warning message issued by the National Weather Service for central Arizona of United States on Tuesday October 18th, 2005

6 Census data of 2000 for Redmond, Washington USA was used to determine population and household density

7 Census data of 2000 for Redmond, Washington USA was used to determine city size, population and household density

A.4 Use case #3 – Average Size City

A large explosion has occurred at a nuclear power plant which is located near an average size city. It is currently unknown if the explosion was a terrorist act or an industrial accident. The containment vessel and control mechanisms of the nuclear reactor have been severely damaged. There is an imminent risk that the nuclear reactor may melt down with the resultant release of radioactive material. The current predominant winds would carry any airborne radioactive material to this average size city. The local authorized government agency has decided to activate the Public Warning System to warn the citizens of this average size city and to instruct them to immediately shelter in place.

Note: For an actual nuclear plant related event, a series of alert messages would be issued as the situation changed. For simplification of the analysis, it is assumed that only one notification message and one cancellation message will be sent.

Emergency alert parameters for this use case:[8]

- Size of city is 68 square miles
- Population of the city is 633,500
- 9,316 people per square mile
- 4,476 housing units per square mile

A.5 Use case #4 – Large City or Metropolitan Area

In a manner similar to the subway bombings in London in September 2005, a series of explosions have occurred almost simultaneously at three subway platforms in a large city. The subway system of the large city is temporarily halted while public safety officials assess the damage and the potential risk of additional bombings. These bombings are believed to be terrorist attacks and there is a possibility of more imminent bombings at other subway platforms or other types of mass transportation. The local authorized government agency has decided to activate the Public Warning System to warn the citizens of the large city and to instruct them to remain where they are (e.g., stay in their offices and homes).

Note: For an actual subway bombing event, a series of alert messages would be issued as the situation changed. For simplification of the analysis, it is assumed that only one notification message and one cancellation message will be sent.

Emergency alert parameters for this use case:[9]

- Size of city is 33 square miles
- Population of the city is approximately 2.21 million
- 66,940 people per square mile
- 34,756 housing units per square mile

A.6 Use case #5 – National (entire United States)

Two radiological devices (i.e. "dirty bombs") have been detonated nearly simultaneously in two US cities. These detonations occurred in one large metropolitan city and one average size city. Based upon intelligence information, there is a possibility that detonation of additional radiological devices in other large and small US cities may occur in the very near future. The threat level of the Homeland Security Advisory System has been raised to the highest level or

8 Census data of 2000 for the city of Washington, D.C. USA was used to determine city size, population and household density

9 Census data of 2000 for the city of Manhattan, New York. USA was used to determine city size, population and household density

the Red Level. The President of the United States has decided to issue a national alert on the Emergency Alert Systems to advise and warn all people in the United States.

Emergency alert parameters for this use case:[10]

- 3.5 million square miles
- Population of the US is approximately 296 million
- 108 million housing units
- Approximately 90% of population live in top 100 metropolitan areas

A.7.1 Use case: Provide Information to UE

When a flood is caused, a Warning Information Provider might deliver three kinds of information related to the flood (e.g. flood warning, current status of damage, and a map to emergency facilities) by Public Warning System, and required UE behaviours by information might be different.

For example, flood warning is urgent information, so a Warning Message of flood warning with a buzzer helps the users become aware of the Warning Message and take actions quickly. On the other hand, information on a map to emergency facilities is not always urgent information, so ringing a buzzer is not always required.

Therefore, it is convenient for a Warning Information Provider or PLMN operator to be able to provide information to the UE which enable it to alert the user as to the urgency of the warning (e.g. combination of whether to ring a buzzer, whether to vibrate, and whether to display text of Warning Message in the foreground).

A.7.2 Emergency Type

In order for PWS to support a multilingual subscriber base, one of solutions might be to deliver a Warning Notification with text in the native language of the subscriber. But, this solution is impractical especially for most urgent message because it takes delivery time five times longer to deliver the five Warning Notifications, which means in five different languages, more than to deliver a Warning Notification in a language by CBS, for instance.

In this case, Event Code, which is used for Emergency Alert System in the US, might be useful. For example, assuming that a PWS service is provided in Thailand and an emergency event occurs there, Warning Notification in Thai and common language such as English might be delivered, but not in Japanese. Then, if Japanese people, who don't familiar with both Thai and English are visiting there, they can not understand the warning notification in these languages. In order to resolve this issue, event codes might be useful because each Event Code is corresponded to each emergency type, so can be corresponded to each predefined text in their native language in their handsets. Thus, subscribers can understand the warning notification with Event Code, even if not described directly in their native languages.

Note: Information on Event Code in detail is provided in the following web site: (http://en.wikipedia.org/wiki/Specific_Area_Message_Encoding)

10 United States census data of 2000. was used to determine population and household density

Annex B:
Japan - Public Warning System (PWS) use cases Earthquake and Tsunami warning

B.1 General description - earthquake

This section describes overall procedure of earthquake warning with Figure X.

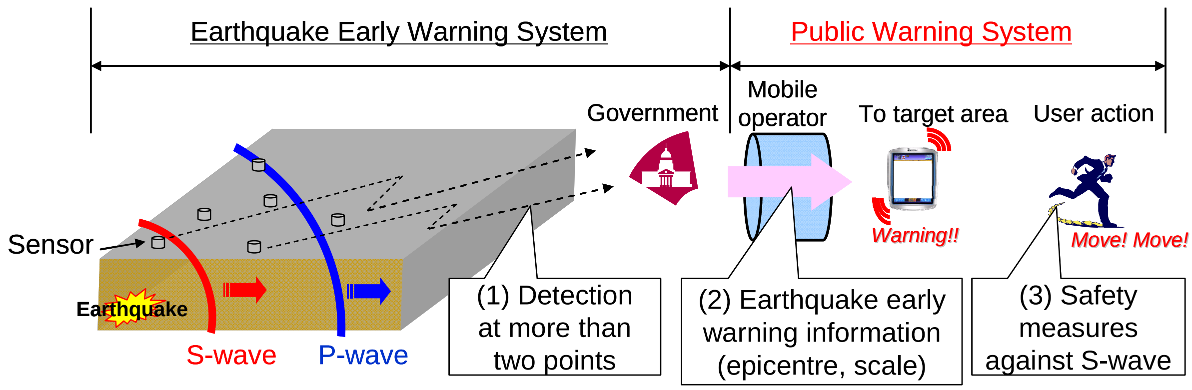

Figure B.1: Overall procedure of Earthquake Early Warning

- Primary wave of earthquake

When an earthquake happens, two types of waves are produced: Primary wave and Secondary wave. Primary waves (P-wave) which have little destructive force travel at 7 km/sec speed, whereas Secondary waves (S-wave) which have a major destructive force travel at 4 km/sec. Therefore, detection of Primary waves can provide early warning information for earthquakes before damage has been caused in the affected area.

- Overall procedure of Earthquake Early Warning

(1) When the Earthquake Early Warning System deployed by the Japanese Government detects Primary wave at more than two sensors, and then estimates the epicentre and Japanese earthquake scale per district (e.g. 186 districts are designated by the Japanese Government). When the system creates Earthquake Early Warning information, which includes the estimated epicentre and scale, the system sends it to Public Warning System which is deployed by mobile operator.

(2) When a delivery server for PWS receives the information, the server delivers it to handsets in target areas. When the handsets receive the information, they display it or sound.

(3) When users become aware that Secondary wave is going to reach soon, and they take safety measures (e.g. extinguishing gas stoves, opening doors, hiding under the table, moving to a safer place).

B.1.1 Importance of shortening delivery time

This section shows importance of shortening delivery time for Earthquake Early Warning.

B.1.1.1 Delivery time for Earthquake Early Warning

Earthquake Early Warning (i.e. Primary wave indication) makes no sense unless it is delivered to users before Secondary wave arrives at the area where the users camp. The shorter delivery time over PWS is, the higher percentage of the notification area can be notified. The following describes importance of shortening PWS delivery time with actual data.

The difference of speed between Primary wave and Secondary wave is about 3 km/sec. The distance from the earthquake epicentre to the area nearest to the epicentre in disaster areas is about 10-50 km. Therefore, arrival time interval at the area between Primary wave and Secondary wave is about 3-17 seconds. Whereas it takes about 5 seconds for earthquake detection system to send Earthquake Early Warning information to a mobile operator and it takes about 2-3 seconds for users to take safety measures. Therefore, it is meaningful to shorten PWS delivery time by the second.

B.1.1.2 Delivery time analysis over current CBS

This section shows delivery time from RNC to UE based on the procedures of CBS.

Regarding CBS, it takes about 8.4 seconds to deliver a message. Delivery time estimation of each procedure is based on the following.

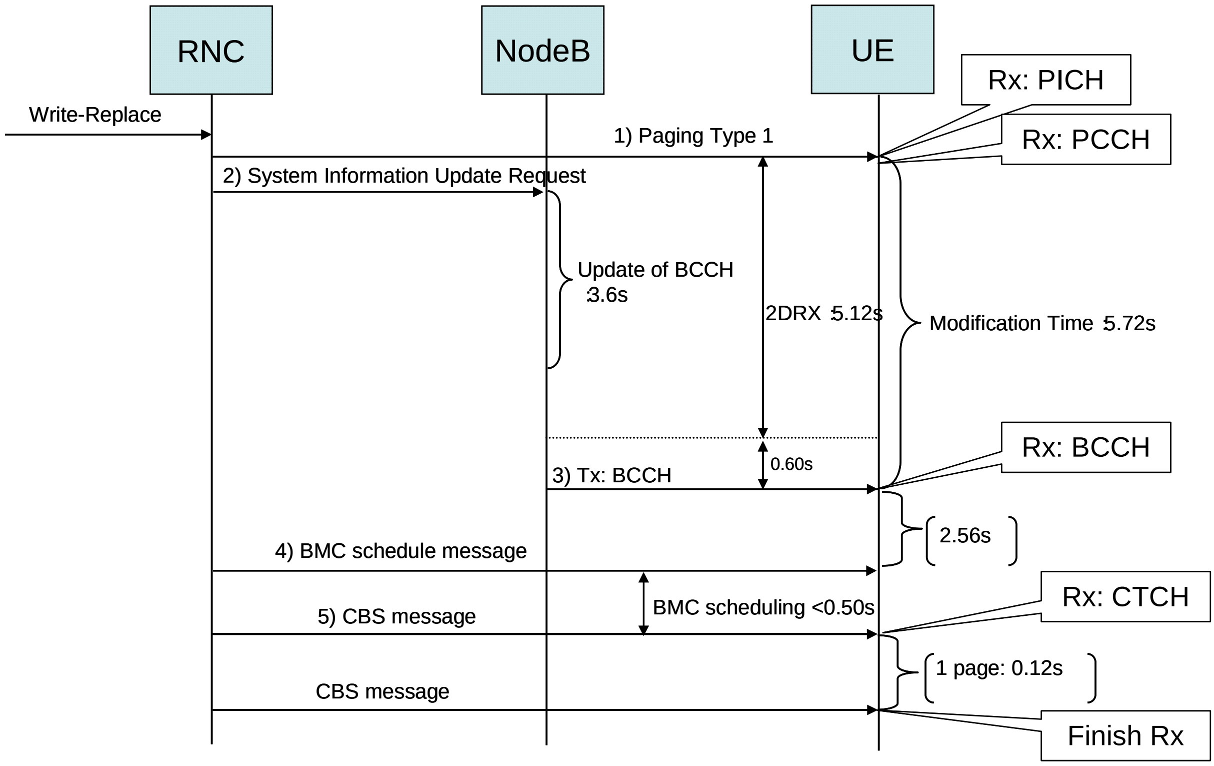

Figure B.2: Procedure of CBS

1) When RNC receive a Write-Replace message from CBC, the RNC transmit Paging Type 1 messages to target UEs per group through NodeB within PCCH. Then, the UEs triggered by PICH see the corresponding PCCH.

2) The RNC transmit System Information Update Request to NodeBs, and then the NodeBs update BCCH.

3) The NodeB transmit within BCCH, all the UEs in target areas see within the corresponding BCCH.

4) The RNC transmit BMC scheduleing message within CTCH, UEs see the corresponding CTCH and know the schedule for CBS messages within the CTCH.

5) The RNC transmit CBS message within the CTCH, UEs receive the CBS message within the CTCH.

It takes 5.72 seconds from step1 to step3, 2.56 seconds from step3 to step4, and 0.12 seconds from step4 to completion of receiving a page under the condition of delivering 1 page.

B.1.1.3 Effect of shortening delivery time

In this section, effect of shortening delivery time is described according to evaluation of one of past earthquakes. In the evaluation, delivery time of EEW message over PWS is compared with arrival time of S-wave and then it shows that how important shortening delivery time is for earthquake early warning.

Evaluation data

A target of this evaluation is the 2004 Chuetsu earthquake because this earthquake is the most recent and great one in Japan and it is also one of inland earthquakes which are likely to cause greater damage than submarine earthquakes. Therefore, it is worse case and it is necessary to deliver PWS messages faster.

Then, in order to estimate arrival time of S-wave, 61 earthquake sensors which measured quakes greater than or equal to "5 Lower" on the Japanese earthquake scale when the 2004 Chuetsu earthquake happened are picked out from a database of past earthquakes published by Japanese government. The reason is that damage would be greater in cases greater than or equal to "5 Lower", so the EEW system issues EEW information. The number of sensors shows how wide affected areas are i.e. how many target users there are, because most sensors are deployed at each administrative district (e.g. city, town, and village) and like about 10km mesh (i.e. an average coverage area per sensor is about $100km^2$).

Note 1: The EEW system collects information measured by each sensor and makes a database of location (i.e. latitude and longitude) of sensor and earthquake scale. The database is published by Japanese government on its web site and quoted from the following: (http://www.seisvol.kishou.go.jp/eq/shindo_db/shindo_index.html)

Note 2: "5 Lower" shows degree of damage that walls fall and windowpanes break. The greater the scale is, the greater the damage would be.

Procedure of evaluation

The following procedure describes how to evaluate effect of shortening delivery time by means of above mentioned data.

1. Calculate a propagation distance of S-wave between the epicentre and a sensor: D
   D is equal to the square root of geographical distance between the epicentre and a sensor squared plus depth of epicentre squared. The depth of epicentre is equal to 13 [km] and given by the database.

2. Propagation speed of S-wave: V
   V is equal to 3.5 [km/s] and given by the paper below.

3. Calculate arrival time of S-wave: T
   T is equal to D divided by V.

4. Draw a histogram, and then compare arrival time S-wave with delivery time of EEW message.

Note 3: Propagation speed of S-wave is quoted from the following paper: H. Yamanaka, et al., "Estimation of local site effects in the Ojiya city using aftershock records of the 2004 Chuetsu earthquake and micro tremors", (http://www.eri.u-tokyo.ac.jp/hirata/chuetsu/kakenHoukoku/5.2yamanaka.doc)

Evaluation: shortening delivery time

The following graph in Figure Y shows a histogram of arrival time of S-wave measured at each earthquake sensor in the 2004 Chuetsu earthquake. X-axis shows arrival time of S-wave of the earthquake, and Y-axis shows the number of sensors which measured the S-wave for the same 2.5 seconds of time interval.

Assuming that it takes 5 seconds for the EEW system to estimate the earthquake scale and then issue EEW information after an earthquake happens, delivery time of EEW message is assumed 8 seconds like in the estimation in section B.1.1.2, this graph shows that the EEW message is delivered to only about 37% of disaster areas before S-wave arrives. Then, taking extra time for taking safety measures into account, a delivery time of 8s can provide notification in time in only 13% of disaster areas.

At this moment, the only thing that 3GPP systems contribute to notify in time a higher percentage of the disaster area is shortening delivery time because both estimation time of earthquake scale and extra time of safety measures are not variable by 3GPP systems. If the delivery time is shortened by 5 seconds, it can deliver the message to 74% of the disaster areas and notify in time in about 37% of disaster areas.

Note 4: The statistics of past earthquakes says that it averagely took 5 seconds for the EEW system to estimate the earthquake scale and then issue EEW information after an earthquake happened.

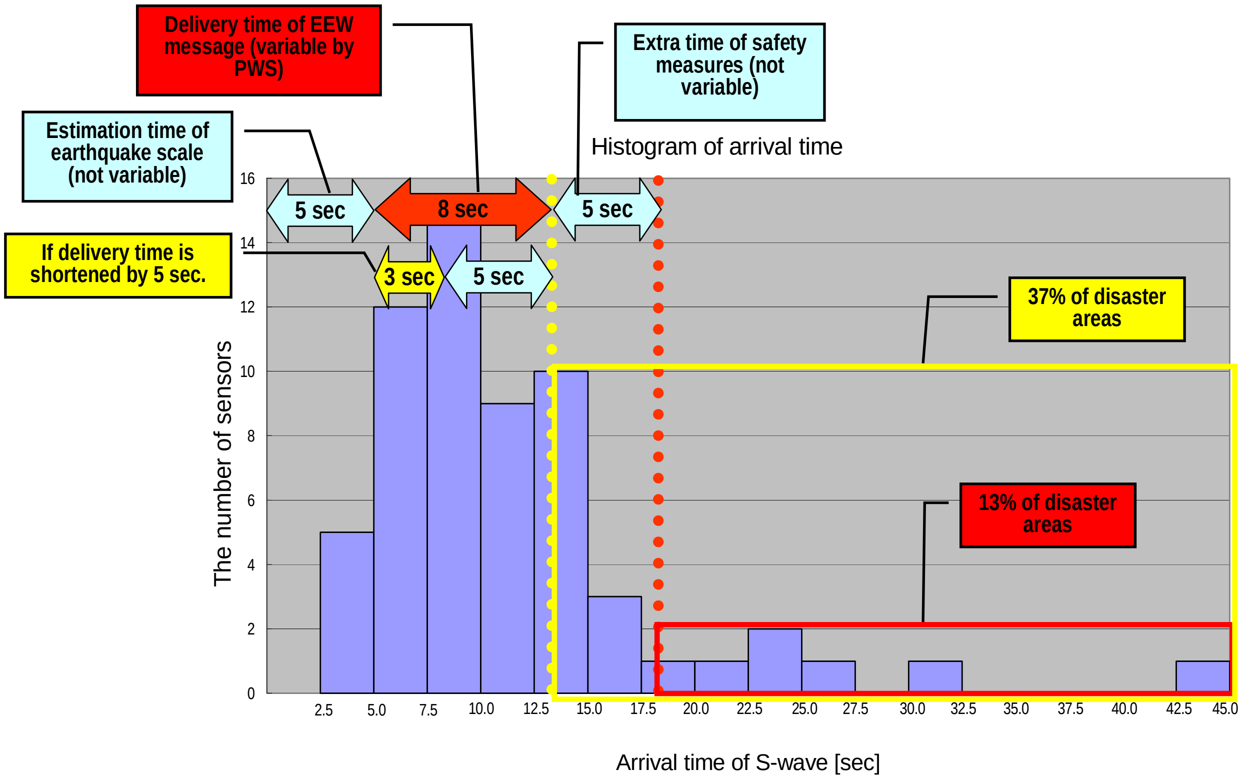

Figure B.3: Effect of shortening deliver time

Conclusion of the evaluation

In the case of EEW, shortening delivery time by seconds as much as possible is quite effective to provide notification in time a larger percentage of the notification area.

B.1.2 Information element and volume for Earthquake Early Warning

Regarding the quantity of data of Earthquake Early Warning information it is sufficient to transfer a few bit data for having handsets be ringing, making buzzer, or display short text prepared in a handset (e.g. "Earthquake Warning! Do safety measures!") because there is not plenty of time to read the text in order from users to quickly execute safety measures (e.g. extinguishing gas stoves, opening doors, hiding under the table, moving to a safer place), before the arrival of the destructive Secondary wave.

After an earthquake happens, it would be effective to delivery more data such as map for navigation to safe area or emergency facility where users can get important information, some foods, or essentials for life.

B.1.3 Earthquake Early Warning to handsets with some communications

Earthquake Early Warning information should be notified to users even if they have some communications in progress (e.g. voice or data service). After release of the communications, meaning after the arrival of the destructive Secondary wave, it is too late to identify the Earthquake Early Warning information.

B.2 Emergency types in the case of earthquake

When a submarine earthquake happens, a tsunami might be caused by the earthquake, but EEW and Tsunami warning message are different information, and they are not always transmitted in the same areas because the areas affected by tsunami are likely wider than earthquake. Therefore, two emergency types, "Earthquake" and "Tsunami" are differentiated in the case of earthquake.

B.3 General description - tsunami

This section describes overall procedure of tsunami warning with Figure X.

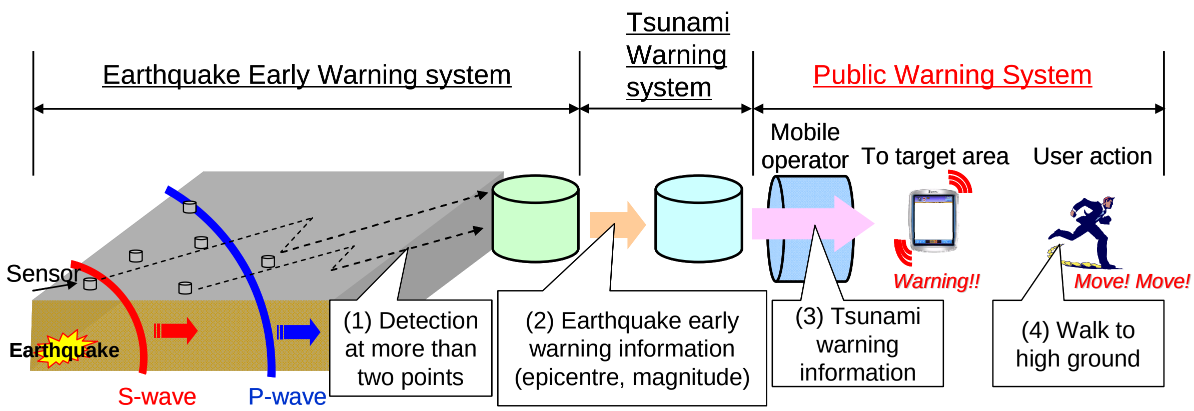

Figure B.4: Overall procedure of tsunami warning

When a submarine earthquake happens, it might causes tsunami. Primary waves (P-wave) which have little destructive force travel at 7 km/sec speed, whereas tsunami travels at an average of 35.7 m/sec speed at most. Therefore, detection of earthquake can provide tsunami warning information before damage by tsunami has been caused in the affected area.

- Overall procedure of Tsunami Warning

(1) When the Earthquake Early Warning System deployed by the Japanese Government detects Primary wave at more than two sensors, and estimates the epicentre and magnitude of the earthquake. Then, the system sends the information of the epicentre and magnitude to the Tsunami Warning System which is also deployed by the government.

(2) The Tsunami Warning system estimates affected areas and tsunami height per each area according to the epicentre and the magnitude, and then the system sends tsunami warning information on the areas and height to PWS.

(3) When a delivery server for PWS receives the information, the server delivers it to handsets in target areas. When the handsets receive the information, they display it or sound.

(4) When users become aware that tsunami is going to reach soon, and they take a safety measure i.e. walking to high ground where tsunami doesn't reach.

B.3.1 Importance of shortening delivery time

This section shows importance of shortening delivery time for Tsunami Warning.

B.3.1.1 Delivery time for Tsunami Warning

Tsunami Warning makes no sense unless it is delivered to users and the users can also walk to high ground where tsunami doesn't reach. The following describes importance of shortening delivery time for tsunami warning with actual data.

The average propagation speed of tsunami is about 35.7 m/sec in water over continental shelves. On the other hand, the speed is about 5 m/sec on the ground. If the distance from the epicentre to the nearest shore is 10 km, the propagation time of tsunami in water is about 280 seconds and the time on the ground is about 33 seconds. Then, it takes at least about 120 seconds for tsunami warning system to send Tsunami Warning information to a mobile operator. Assuming that delivery time of PWS message is 30 seconds, users at the shore have about 163 (= 280 + 33 – 120 – 30) seconds to walk 163 metres away from the shore. However, it is not always true that 163 seconds is enough for the users to walk to high ground where tsunami doesn't reach. Therefore, it is meaningful to shorten delivery time as much as possible in order for the users to walk away as far as possible.

Note: The average speed of walk is about 1 m/sec. The elderly and the disabled are more slowly.

B.4 Correspondence of emergency type to message category

PWS message can be categorized into any of three categories i.e. "Critical", "Severe" and "General", according to its degree of urgency. "Critical" means the most urgent, "Severe" means the second, and "General" means the third. The following describes correspondence of emergency type to message category, taking Earthquake and Tsunami for instance.

PWS messages, which contain Earthquake Early Warning information or Tsunami Warning information, are categorised into "Critical" because the messages should be delivered in a few seconds with minimal amount of data. On the other hand, PWS messages, which contain information of map to safe areas or emergency facilities, are categorised into "General" because the message should be delivered with large amount of data as fast as possible.

	"Critical"	**"Severe"**	**"General"**
Earthquake	EEW information	-	Map
Tsunami	Tsunami Warning information	-	Map

Table B.1: Correspondence of emergency type to message category

B.5 Priority control for PWS

A PWS message is urgent and time-sensitive, so it should be transmitted in the target area as soon as possible. However, it might be delayed or dropped under congestion conditions. Therefore, priority control is required for PWS and the priority associated with alert message category could be given by regional regulations or mobile operator's policy.

B.5.1 Sequencing of warning notifications

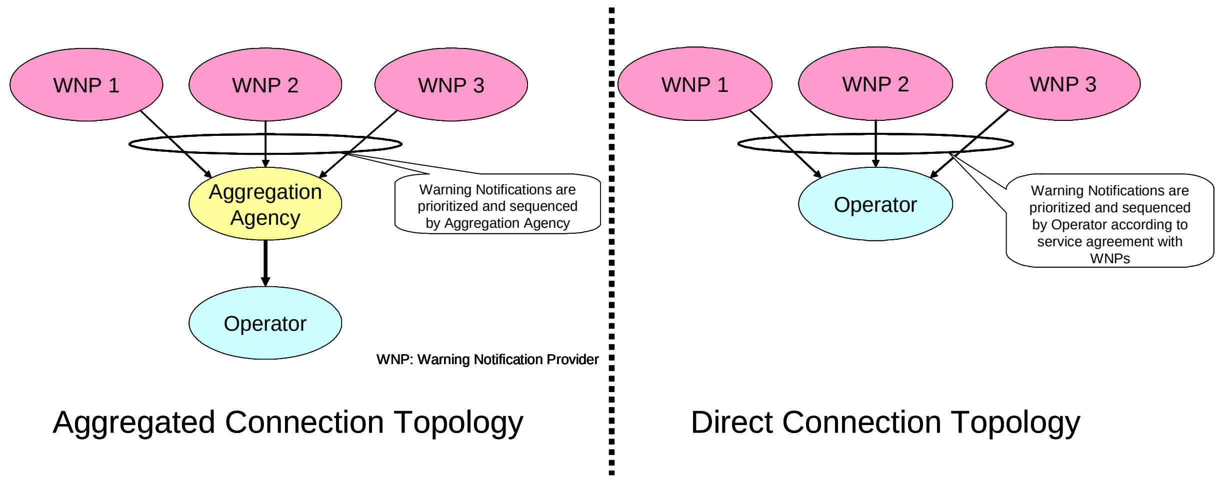

Figure B.5: Assumed connection topologies between Operator and WNP

It is assumed that there are two kinds of connection topologies between PLMN operator and Warning Notification Providers as depicted in Figure B2. One is that Warning Notification Providers are connected to an Aggregation Agency and warning notifications are relayed to the PLMN operator. The other is that Warning Notification Providers are directly connected to a PLMN operator and warning notifications are directly transferred to the PLMN operator.

In the case of aggregated connection topology, warning notifications are sequenced and relayed according to priority of notification if multiple notifications are issued simultaneously by the aggregation agency.

In the case of direct connection topology, the same sequencing function provided by Aggregation Agency may be requiredfor the PLMN to deliver warning notifications according to priority of notification and service agreements with Warning Notification Provider.

Annex C: Europe - Public Warning System (PWS) use cases

C.1 Use case #01 - accident in nuclear power plant

The accident in Chernobyl affected huge areas in Europe. To inform the public and give instructions it is necessary to reach millions of people. For this use case the challenge is not to send out the warning within a few seconds but to reach millions of subscribers and to provide guidance what to do.

C.2 Use case #02 - coastal flooding

The threat of coastal flooding is not only a topic for Germany, Netherlands and UK. It can be caused by strong winds or breach in the dyke (also as result of a terror attack).

Public safety officials might see the need to evacuate large areas and big cities as e.g. Hamburg and Bremen. Instructions regarding actions to be taken by the public will be sent as emergency notification message.

C.3 Use case #03 - dam failure

In case of risk of dam failure public safety officials might order to evacuate all people in a given area (e.g. a valley in the Alps). All people in villages and cities next to the river shall be evacuated.

C.4 Use case #04 - volcanic eruption

For example in Italy, the Vesuvius volcano is a danger for Naples and the surrounding area. When experts predict a major eruption it might be necessary to inform the public and give instructions not only to the locals but also to travelers, tourists and people in transit.

C.5 Use case #05 - accident in a chemical plant

Public safety officials need to inform the public in the surrounding area which measures of precaution have to be taken by the people. The affected area might change based upon wind and weather conditions.

The size of the area might be 4 to 1000 square kilometers, The number of people to be informed might reach several million (e.g. in the German Ruhr Basin).

Annex D: Threat in warning information delivery

D.1 Threat analysis

In warning information delivery spoofing prevention and integrity protection are important because spoofing and data tampering would cause confusion among users.

Whereas eavesdropping protection is not so important because warning information is for publicity and non charged one.

D.2 Key delivery

Warning information is delivered to many users. One-to-one key delivery is not efficient because it consumes great amount of traffic resource.

Annex E: Relationship between PWS and ETWS

PWS is general Warning Notification System provided by mobile network operators and delivers many types of *Warning Notification* for various types of emergency. ETWS is an optional element of PWS and is used specifically for delivering *Warning Notifications* specific to Earthquake and Tsunami to UEs in *Warning Notification Areas* as shown in Figure.E1. UEs have the capability of receiving *Warning Notifications* within *Notification Areas* through the 3GPP network.

ETWS specification may be required in a shorter timeframe and is characterized by the capability to provide very short notification period.

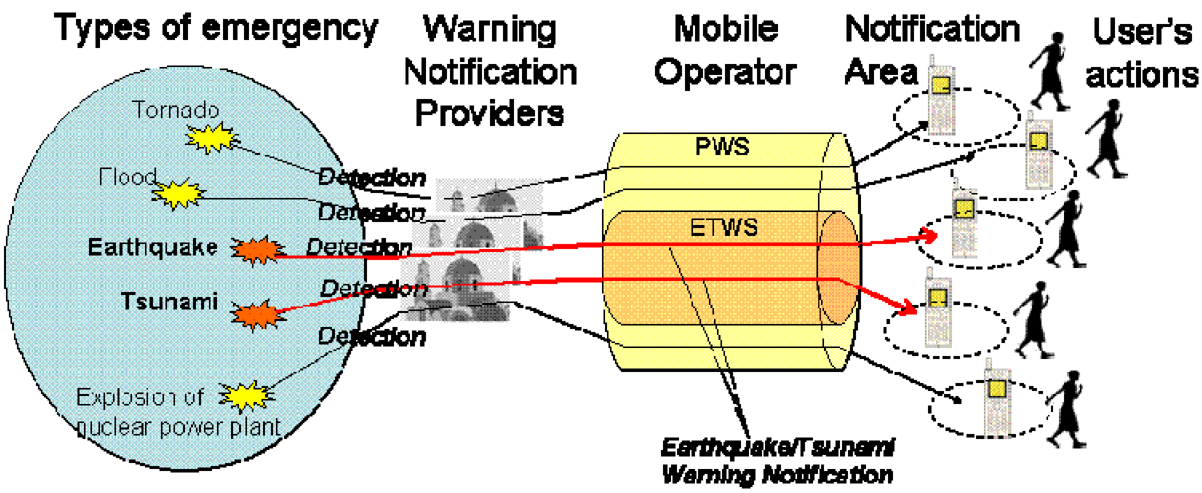

Figure E.1: Relationship between PWS and ETWS

Annex F: Service Provisioning

F.1 PWS overview

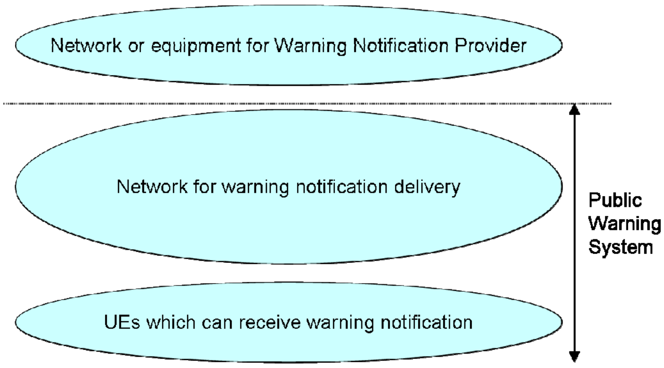

Figure F.1 : PWS Overview

PWS service is provided to users by PLMN operators with or without Warning Notification Providers. PLMN operators or Warning Notification Providers produce Warning Notification to PLMN operator when some events (e.g. disasters) happen. Warning Notification Provider is a PLMN operator or an external body which requests PLMN operators to transmit Warning Notification to users through their networks. PLMN operators deliver Warning Notification to users by utilizing Public Warning Systems.

Public Warning System includes network for Warning Notification delivery and UEs which have a capability of receiving Warning Notification. Network for Warning Notification delivery is a network which enables data transfer. PLMN operators can choose types of network for the delivery.

F.2 Provisioning

Configuration provisioning includes a configuration of the UE and/or the network.

Configuration provisioning includes aspects like: duration of delivery time, determination of the Notification Area, information element and size, indication with user interface, indication with interaction with the other services activation in the handset, priority, security, Warning Notification cancellation, delivery and receipt confirmation, and indication of test warning notification …

Warning Notification Delivery Provisioning includes aspects like: determination of the Notification Area, information element and size, indication to the user...

Annex G: Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2006-06	-	-	-	-	First Skeleton	-	0.1.0
2006-08	-	-	-	-	Text added as agreed in the SA1#33 ad hoc in Sophia Antipolis	0.1.0	0.2.0
2006-10					Text assed as agreed in the SA1 #34 Plenary in Paris	0.30	0.4.0
2007-01					Text added as agreed in the SA1 #35 Plenary in Bangalore	0.4.0	0.5.0
2007-02					Text added as agreed after SA1 #35 Plenary in Bangalore	0.5.0	0.6.0
2007-04					Text added as agreed in SA1 SWG Meeting in Sophia Antipolis	0.6.0	0.7.0
2007-04					Editorial changes after SA1 SWG Meeting in Sophia Antipolis	0.7.0	0.7.1
2007-04					Text added as agreed in SA1 SWG Meeting in Madrid	0.7.1	0.8.0
2007-04					Agreed by SA1#36 for presentation at SA#36	0.8.0	1.0.0
2007-06					Text added and deleted as agreed in SA1 SWG Meeting in Orlando	1.0.0	1.1.0
2007-07					Text added and deleted as agreed in SA1 SWG Meeting in Sophia Antipolis and S-1070026 page 2 agreed in Bangalore PWS SWG	1.1.0	1.2.0
2007-11					Text added and deleted as agreed in SA1bis meeting in Sophia Antipolis and SA1 SWG Meeting in Ljubljana	1.2.0	1.3.0
2008-01					Text removed as agreed in SA1 plenary in Ljubljana and general editorial changes	1.3.0	1.4.0
2008-01					Text removed as agreed in PWS SWG in Puerto Vallarta	1.4.0	1.4.1
2008-01					Editorial changes in preparation for submission to SA for approval	1.4.1	2.0.0
2008-03	SA#39	SP-080049			Raised to v.8.0.0 by MCC following SA#39 approval	2.0.0	8.0.0

History

Document history		
V8.0.0	January 2009	Publication