CEN

WORKSHOP

AGREEMENT

CWA 18022

August 2023

ICS 13.200; 35.240.99; 91.010.99

English version

Exchanging of building and infrastructure damage information with Common Alerting Protocol

This CEN Workshop Agreement has been drafted and approved by a Workshop of representatives of interested parties, the constitution of which is indicated in the foreword of this Workshop Agreement.

The formal process followed by the Workshop in the development of this Workshop Agreement has been endorsed by the National Members of CEN but neither the National Members of CEN nor the CEN-CENELEC Management Centre can be held accountable for the technical content of this CEN Workshop Agreement or possible conflicts with standards or legislation.

This CEN Workshop Agreement can in no way be held as being an official standard developed by CEN and its Members.

This CEN Workshop Agreement is publicly available as a reference document from the CEN Members National Standard Bodies.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

Ref. No.:CWA 18022:2023 E

Contents

Page

European Foreword

This CEN Workshop Agreement (CWA 18022:2023) has been developed in accordance with the CEN-CENELEC Guide 29 “CEN/CENELEC Workshop Agreements – A rapid prototyping to standardization” and with the relevant provisions of CEN/CENELEC Internal Regulations - Part 2. It was approved by a Workshop of representatives of interested parties on 2023-07-07, the constitution of which was supported by CEN following the public call for participation made on 2022-03-22. However, this CEN Workshop Agreement does not necessarily include all relevant stakeholders.

The final text of this CEN Workshop Agreement was provided to CEN for publication on 2023-07-14.

This CEN Workshop Agreement (CWA) has been elaborated as part of the EU-funded research project STRATEGY, which received funding from the European Union's HORIZON 2020 research and innovation programme under grant agreement (GA) N° 883520. More specifically, upon investigation of the standardization universe across its thematic streams of research and prioritization of the identified gaps against the operational perspective of end-users, STRATEGY underlined the need and supported the drafting of the CWA in discussion.

The following organizations and individuals developed and approved this CEN Workshop Agreement:

- SATWAYS/ Katerina Valouma – WG CWA RDA Chair,
- SATWAYS / Leonidas Perlepes,
- SATWAYS / Ioannis Chasiotis,
- SATWAYS / George Eftychidis,
- SATWAYS / Charalampos Papadakos,
- SATWAYS / Lefteris Voumvourakis,
- SATWAYS / Souzana Sofou
- KEMEA / Danai Kazantzidou-Firtinidou,
- KEMEA / Georgios Sakkas,
- Joint Research Centre – European Commission / Monica Cardarilli,
- EUCENTRE Foundation / Chiara Casarotti,
- Institute of Communication and Computer Systems (ICCS) / Michalis Panagiotis,
- Unidade Militar Laboratorial de Defesa Biológica e Química / Centro de Investigação da Academia Militar (UMLDBQ/CINAMIL)/ Wilson Antunes,
- Unidade Militar Laboratorial de Defesa Biológica e Química / Centro de Investigação da Academia Militar (UMLDBQ/CINAMIL)/ Luís Carvalho ,

- Corpo Nazionale dei Vigili del Fuoco – Italian National Fire and Rescue Service – Perugia HQ/ Andrea Marino,
- Corpo Nazionale dei Vigili del Fuoco – Italian National Fire and Rescue Service – Perugia HQ/ Marcello Marzoli,
- Deep Blue SRL / Alessia Goleftti,
- Deep Blue SRL / Andrea Capaccioli,
- Safety Region IJsselland / Janny Nijsingh,
- OASIS Open / Mark Woods
- OASIS Open / Rex Brooks
- Asociatia de standardizare din Romania – ASRO/ Speranta Stomff – WG CWA RDA Secretary

Attention is drawn to the possibility that some elements of this document may be subject to patent rights. CENCENELEC policy on patent rights is described in CEN-CENELEC Guide 8 “Guidelines for Implementation of the Common IPR Policy on Patent”. CEN shall not be held responsible for identifying any or all such patent rights.

Although the Workshop parties have made every effort to ensure the reliability and accuracy of technical and nontechnical descriptions, the Workshop is not able to guarantee, explicitly or implicitly, the correctness of this document. Anyone who applies this CEN Workshop Agreement shall be aware that neither the Workshop, nor CEN, can be held liable for damages or losses of any kind whatsoever. The use of this CEN Workshop Agreement does not relieve users of their responsibility for their own actions, and they apply this document at their own risk. The CEN Workshop Agreement should not be construed as legal advice authoritatively endorsed by CEN/CENELEC.

Introduction

The dissemination of buildings and infrastructures damage information is essential for public services and practitioners to make timely and informed decisions following a disaster. Usually, emergency inspections should start within hours after the disaster to identify the buildings and infrastructures that require urgent support. However, in some cases, damage should be assessed rapidly, in near-real time after the event and communicated immediately to the relevant authorities. Therefore, a formalized way to describe the potential damage is necessary, aiming to optimize the efficiency and effectiveness of the public safety agencies. This need is partially related to the operational requirement to share information on disaster damages among a significant number of public services involved in mitigation, response, and recovery activities.

As such, the members of this CEN workshop decided to initiate this agreement. This document falls under the area of RDA and does not address the standardisation of RDA itself (with tools and/or methodologies). It aims to the enhancement of an existing communication standard on exchanging damage information of buildings and infrastructures based on the Common Alerting Protocol (CAP) [OASIS, 2010].

The envisaged CWA will be based on methodologies to monitor accurately and quickly the status of the buildings, which are used by the relevant authorities and the security officers of infrastructures following a disaster. Guidelines and protocols will be developed, formalizing how the information on the damage can be commonly shared. An enhanced CAP profile (the CAP-RDA) is proposed within this CWA, which considers using customized parameters to deliver damage information to the different interested parties (e.g., asset managers, civil protection agencies, etc.) even if operating with alerting systems of other characteristics.

1 Scope

This document specifies a protocol that aims to cover the dissemination of the status of buildings, after the occurrence of a natural hazard or a man-made incident, in a form of an alert. The related results/alerts are communicated to the command-and-control centres of the agencies that manage the emergency.

This CWA describes an interpretation of the OASIS CAP v1.2 standard necessary to meet the needs of the public alerting in situations of potential damage.

The message can be targeted to the designated groups such as civil authorities or responders, general public or to specific individuals.

The CAP-DAMAGE profile that is proposed on this CWA defines a list of parameters so that damage information would be delivered to the interested parties (e.g. asset managers, civil protection agencies etc.) even if operating with alerting systems of different characteristics.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

OASIS Standard Common Alerting Protocol Version 1.2, 01 July 2010

OASIS Emergency Data Exchange Language (EDXL) Distribution Element Version 2.0, Committee Specification 02, 19 September 2013

3 Terms and Definitions

3.1
alert
part of public warning that captures attention of first responders and people at risk in a developing emergency situation

[SOURCE: ISO 22300:2021(en)Security and resilience — Vocabulary]

3.2
affected area
location that has been impacted by a disaster

[SOURCE: ISO 22315:2014(en), Societal security — Mass evacuation — Guidelines for planning]

3.3
building
A building is any independent free-standing structure comprising one or more rooms or other spaces, covered by a roof, usually enclosed with external walls or dividing walls which extend from the foundations to the roof, and intended for residential, agricultural, industrial, commercial, cultural, etc., purposes.

[Source: United Nations; 1998 Principles and Recommendations for Population and Housing Censuses, Revision 1].

3.4
command and control system
system that supports effective emergency management of all available assets in a preparation, incident response, continuity and/or recovery process

[SOURCE: ISO 22300:2021(en)Security and resilience — Vocabulary]

3.5
disaster
situation where widespread human, material, economic or environmental losses have occurred that exceeded the ability of the affected organization, community or society to respond and recover using its own resources

[SOURCE: ISO/TR 19083-1:2016(en) Intelligent transport systems — Emergency evacuation and disaster response and recovery — Part 1: Framework and concept of operation]

3.6
incident
event that can be, or could lead to, an operational interruption, a disruption, loss, emergency or crisis

[SOURCE: ISO 22399:2007 – Societal Security - Guideline for Incident Preparedness and Operational Continuity Management]

3.7
incident command
process that is conducted as part of an incident management system, and which evolves during the management of an incident

[SOURCE: ISO 22300:2021(en) Security and resilience — Vocabulary]

3.8
Incident Management System
system that defines the roles and responsibilities of personnel and the operating procedures to be used in the management of incidents

[SOURCE: ISO 22315:2014(en)Societal security — Mass evacuation — Guidelines for planning]

3.9
infrastructure
Engineering structures (bridges, tunnels, etc.) identified as vital by the relevant authorities

3.10
natural hazard
natural phenomena may cause loss of injury, property damage, social and economic disruption or environmental degradation

[SOURCE: adapt from Risk, hazard and people's vulnerability to natural hazards. A review of definitions, concepts and data. European Commission Joint Research Centre. EUR, 21410, 40.]

3.11
rapid damage assessment
the process for determining the nature and extent of the loss immediately during the early and critical state of onset of a disaster.

3.12
CAP - Common Alerting Protocol
The Common Alerting Protocol (CAP) is a simple but general format for exchanging all-hazard emergency alerts and public warnings over all kinds of networks.

[SOURCE: OASIS OPEN - Common Alerting Protocol Version 1.2]

3.13
URN
persistent, location-independent, resource identifier used for recognition of, and access to, characteristics of the resource or the resource itself.

[SOURCE: ISO 18626:2021(en) Information and documentation — Interlibrary loan transactions]

4 Domain

The planned CEN/CENELEC Workshop Agreement specifies a protocol that aims to cover the communication of the status of buildings and infrastructure, after a natural hazard or man-made incident in a form of an alert. The related results/alerts are communicated to the command-and-control centers of the agencies that manage or are involved in (meaning that information is shared with them) the emergency. This document could be used to support the actions of:

1. the operators /security officers of the critical infrastructures/entities that will be monitored for damages,

2. the officers of the authorities that should be informed about a damaged building to coordinate the response activities (e.g., civil protection agencies, fire brigades, EMS, police, municipalities, etc.) and

3. the Command-and-Control system manufacturers and developers.

The accurate and quick assessment of the damage, caused to the buildings/infrastructure in an area hit by a natural hazard (earthquake, tsunami, fire, flood, etc.) or a man-made incident, is essential for prioritizing the business continuity and recovery needs and actions. It is a way to achieve a high-level picture of the effects of a disaster and communicate this information quickly. Therefore, a formalized way to describe the damage is needed to optimize the efficiency and effectiveness of the emergency response organizations. This need is partially related to the operational requirement to share information on disaster damages among a significant number of emergency management services involved in mitigation, response, and recovery activities.

5 Descriptors for CAP

5.1 Building and infrastructure descriptors

The proposed protocol will be independent of the methodology used to assess the building's damage grade. It will provide a communication structure that will be used to share relative information integrated in the CAP alert message.

Depending on operational needs and actual survey conditions, the transmitted information can be either synthetic or detailed.

Information with an asterisk (*) are mandatory to be filled by message creator

The formal information to be standardized and shared through the CAP messages may (indicatively) include as a formal way to report building damages:

a. building/infrastructure identity code

This field corresponds to the structure's or asset's unique identifier that could be internal to the building owner or the infrastructure operator, could be appointed by the message sender or could be automatically generated for filing purposes.

b. building/infrastructure asset geographic coordinates*

This can be manually or automatically provided in the coordinates system of the user's preference. The WGS84 system in decimal degrees is proposed.

B1 Polygon / circle describing /identifying the area of building /infrastructure

B2 Coordinates

c. use of building/infrastructure*

In case of a building the primary occupancy shall be given. Some main occupancy options are: residential, touristic unit, industrial, educational building, office, commercial, hospital/clinic, religious building, parking.

In case of an infrastructure, the type and use of infrastructure shall be given. Infrastructure types are differentiated according to their sector and subsector. A list of critical infrastructure is included in EU COM (2005) 576 and EC/2008/114. Although the sector may be also given (e.g. road transport or gas transfer), it is though recommended to include in the message only the specific infrastructure asset that triggers the alert (e.g. bridge or gas pipeline).

This information is mandatory as it is of crucial importance for the responding agencies.

d. year of construction

e. Should the exact year of construction be known, it should be communicated. Alternatively, the approximate decade that the building/infrastructure was designed and erected, or the last year of structural renovation is very useful information when providing rapid situational awareness. construction material

The construction material of the main structural system may be also communicated. Most common options are:

Reinforced concrete, masonry, steel, timber, pre-cast concrete, other

f. number of floors above ground*

The number of floors above ground shall be also transmitted. It is recommended that common agreement between the sender and the recipient of the message is achieved *a priori* upon the assumption of the floor counting (e.g. ground floor is assumed as floor 0 or 1 when the number of floors is transmitted).

This is mandatory information as response may be planned and deployed differently for different building heights and/or height (and units) from the ground for infrastructures.

g. number of basements

The number of floors below ground may be also transmitted. It is recommended that common agreement between the sender and the recipient of the message is achieved *a priori* upon the assumption of a floor characterized as basement (e.g. a floor partially exposed may be or may be not perceived as underground floor).

h. number of building's/infrastructure's occupants/users

An approximation of the number of people that were occupying the building or using the infrastructure prior or during the event, depending on the information available, is necessary information. This can be provided with a specific number or a range (e.g. 50-100).

i. Dangerous substances in buildings and infrastructures

The existence of dangerous substances in a building/infrastructure, and (in known) the type of substance may be also transmitted. When a building or infrastructure is damaged, dangerous substances (e.g. hazardous chemicals, asbestos, lead etc.) may be released or exposed, posing a potential threat to the health and safety of individuals, including emergency responders, workers, or nearby residents.

5.2 Damage descriptors

a. The cause of damage

Although the main hazard type is communicated at the beginning of the message, it may be repeated as first information of the damage descriptor. The main cause of damage is transmitted herein, this being the main hazard or the secondary/cascading hazard generating the damage for which the alert is triggered. The user may refer to the bibliography/knowledge data bases (e.g. https://www.emdat.be/ https://www.desinventar.net/ https://inspire.ec.europa.eu/ https://www.start.umd.edu/gtd/ https://emergency.copernicus.eu/mapping/list-of-activations-risk-and-recovery) since multiple categorizations of terms describing natural hazards, man-made threats and technological accidents are used around the world.

Example: the main hazard may be an earthquake but the damage for which the message is transmitted may have been caused due to structure fire after gas leakage. At this point the message “structure fire” will be communicated or “structure fire due to earthquake”.

b. The overall damage level *

The damage level (e.g., minor, heavy, etc) is essential and mandatory information to be transmitted to provide situational awareness and allow emergency response deployment according to the needs. The damage level might be referred to a specific type of damage. Hereby are proposed two subcategories that should be considered for describing the damage level:

b1. Structural damage (structural e.g. damage to the bearing elements of the building, the damage of which could be critical for the structural integrity

b2. Non-structural damage (to the secondary elements of a building/infra, e.g. partition walls, parapets)

There are different damage scales according to which the damage level is appointed. These depend on the hazard type, the country or the organization. If no agreement has been achieved *a priori* between the sender and the recipient of the message, it is recommended to accompany the level with the name of the scale (e.g. EMS-98 scale) and/or at least the number of the grades of the scale used (e.g. 5-grade)

c. the type of the damage (element…)

The type of damage may be also transmitted as a free text or according to some predefined options by the building/infrastructure owner. This includes information such as cracks to partition walls, main water pipe broken, damage to bridge abutment, etc. It is recommended not to provide detailed structural information on the type of damage (e.g. diagonal shear cracks) unless this is explicitly agreed between the sender and the recipient of the message.

d. the position of the damage in the building

The localization of the damage in a generic way may follow as in some cases those may be coupled. At this field, the location of the damage is given, this being the floor or the element. If the information is already transmitted within the type of damage (e.g. damage to the roof, damage to the columns), there is no reason to be repeated, unless it is of interest, and the information is available, to mention the exact location (e.g. in the north façade, 2nd floor).

e. induced risk

Although a building might not be damaged, it might be at risk due to external hazards that put the building in danger (e.g. the building although not damaged is in danger, or the use of the building is unsafe, due to a heavily inclined tree). It is important to communicate such information to the responsible operator to take appropriate measures to assess and address any potential risks. The field may be free text.

5.3 Usability descriptors

a) Operational condition/capabilities of the building

This information is often the result of engineering usability assessment which is a visual rapid assessment of the structural conditions of the building which allows or prohibits the immediate use and occupation of the building. Depending on the degree of inspection (first or secondary), the national guidelines and other conditions, the scale may be composed of two or three grades of habitability and safe for use. If an inspection has preceded the message (e.g. by in-house engineers), the field may contain one of the pre-defined values of the usability and safety assessment. Alternatively, one of the values below may be communicated, describing in generic manner the state of the building from the operational point of view.

a. Non-operational
b. Partially Operational
c. Fully Operational

b) Affected Services

Although a building/infrastructure may remain operational, the services provided may be affected to a lower or higher extent and this is highly beneficial to be communicated. Information such as electricity, water, heating, telecommunications or traffic disruption is important, and it can be briefly shared. The level of impact is not necessarily assessed and transmitted at this stage. The field may be free text, or a set of preselected services may be given, according to the specificities of the building/infrastructure.

Table 1 summarizes the proposed Descriptors as presented in detail in Chapter 5

Table 1 —Descriptors for CAP

Category	Descriptor	Options (If applicable)
1. Building and infrastructure	a. Building/infrastructure identity code	
	b. Building/infrastructure asset geographical coordinates	
	c. Use of building/infrastructure	
	d. Year of construction	
	e. Construction material	

Category	Descriptor	Options (If applicable)
	f. Number of floors above ground	
	g. Number of basements	
	h. Number of building's/ infrastructure's occupants/users	
	i. Dangerous substances in buildings/ infrastructures	
2. Damage descriptors	a. Cause of damage	
	b. Damage level	b.1 structural b.2 non-structural
	c. Type of the damage	
	d. Position of the damage in the building	
	e. Induced risk	
3. Usability descriptors	a. Operational condition/capabilities of the building	a. Non-operational b. Partially Operational c. Fully Operational
	b. Affected Services	

6 Alerting Protocol Enhancement

In order to meet the needs of the systems intended to receive alerts from RDA, this CAP v1.2 DAMAGE profile constrains the CAP v1.2 standard for receipt and translation with and among exchange partners.

Table 2 specifies the REQUIRED constraints placed by the CAP-DAMAGE Profile on a CAP v1.2 message in order for the message to be a valid CAP-DAMAGE Profile message. This table contains only those elements of CAP v1.2 for which there is a Profile Specification or Profile Note. CAP v1.2 elements not included here simply means there is no specific constraint or condition in the use of those elements for the Profile. Within the CWA-DAMAGE profile, each of the new parameters is represented using a dedicated Uniform Resource Name (URN). This list of URNs is defined into a namespace that is defined within the future CWA: "Semantic layer definition and suitability of EDXL-CAP+EDXL-SitRep".[1]

[1] The planned CEN Workshop is aimed to develop two CEN Workshop Agreements (CWAs):
Draft title CWA 1- Semantic layer definition and suitability of EDXL-CAP+EDXL-SitRep standards for crisis management in Critical InfrastructuresDraft title CWA 2- Emergency management – Incident situational reporting for Critical Infrastructures.
The KOM was helded in March 2022

Table 2 —CAP parameters

Descriptor Name	URN	CAP Element	Element Specification
Building/infrastructure identity code	urn:SSLy:damage_assessment:building_code	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:damage_assessment:building_code" with an <value> of the structure unique code.
Building/infrastructure asset coordinates	urn:SSLy:facilities:coordinates	parameter	Messages intended for damage-related information dissemination MUST include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:coordinates" with an <value> of the damaged structure's coordinates in WGS84.
Use of building/infrastructure	urn:SSLy:facilities:Use	parameter	Messages intended for damage-related information dissemination MUST include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:Use" with an <value> of the structure's use.
Year of construction	urn:SSLy:facilities:Construction_year	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:Construction_year" with an <value> of the structure's year of construction.
Construction material	urn:SSLy:facilities:Construction_material	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:Construction_material" with an <value> of the structure's material. Possible values are: Reinforced concrete, masonry, steel, timber, pre-cast concrete, other
Number of floors above ground	urn:SSLy:facilities:Number_floors_on_ground	parameter	Messages intended for damage-related information dissemination MUST include an instance of <parameter> with an <valueName> of

Descriptor Name	URN	CAP Element	Element Specification
			"urn:SSLy:facilities:Number_floors_on_ground" with an <value> of the number of the floors above the ground.
Number of basements	urn:SSLy:facilities:Number_Basements	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:Number_Basements" with an <value> of the number of basements.
Number of building's/ infrastructure's occupants/users	urn:SSLy:facilities:Number_occupants	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:Number_occupants" with an <value> of the approximation of the number of people that were occupying the building or using the infrastructure.
Dangerous substances in buildings and infrastructures.	urn:SSLy:facilities:Dangerous_substances	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:Dangerous_substances" with an <value> of existence of dangerous substances (including types of these substances) in the building/infrastructure.
Cause of damage	urn:SSLy:damage_assessment:Damage_Cause	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:damage_assessment:Damage_Cause" with an <value> of the cause of the damage.
Overall Damage level	urn:SSLy:damage_assessment:Damage_Level	parameter	Messages intended for damage-related information dissemination MUST include an instance of <parameter> with an <valueName> of "urn:SSLy:damage_assessment:Damage_Level" with an <value> of the overall damage level.

Descriptor Name	URN	CAP Element	Element Specification
Structural Damage level	urn:SSLy:damage_assessment:Damage_Level_Structural	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of “urn:SSLy:damage_assessment:Damage_Level_Structural” with an <value> of the structural damage level.
Non-structural Damage level	urn:SSLy:damage_assessment:Damage_Level_Non-structural	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of “urn:SSLy:damage_assessment:Damage_Level_Non-structural” with an <value> of the non-structural damage level.
Type of the damage	urn:SSLy:damage_assessment:Damage_Type	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:damage_assessment:Damage_Type" with an <value> of the type of damage.
Position of the damage in the building	urn:SSLy:damage_assessment:Damage_Floor	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:damage_assessment:Damage_Floor" with an <value> of the position of the damage in the building.
Induced risk	urn:SSLy:damage_assessment:Induced_risk	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of “urn:SSLy:damage_assessment:Induced_risk” with a <value> of the risk due to external hazards that put the building/infrastructure in danger.
Operational condition/capabilities of the building	urn:SSLy:facilities:Operational_status	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of

Descriptor Name	URN	CAP Element	Element Specification
			"urn:SSLy:facilities:Operational_status" with an <value> of the operational conditions/capabilities of the structure.
Affected Services	urn:SSLy:facilities:affected_services	parameter	Messages intended for damage-related information dissemination MAY include an instance of <parameter> with an <valueName> of "urn:SSLy:facilities:affected_services" with an <value> of the list of affected services.

It is noted that, according to the CAP v1.2 specification, the CAP element of type “parameter” may have more than one occurrence in a CAP message.

This profile is conformant with the Common Alerting Protocol.

This document is managed and versioned independently of the *CAP v1.2* document so that it is not dependent on updates to either document and is not subject to update each time the others are updated.

6.1 Dissemination of Damage

The dissemination of this alerting message is enabled through the EDXL-DE standard. EDXL Distribution Element (DE) describes a messages distribution framework for data sharing among emergency information systems. Its primary purpose is to carry a payload and provide information about the sender and recipient. It is designed to package and deliver EDXL standards or other data messages.

In the context of the CAP-DAMAGE message type, the information will be created automatically by a rapid damage assessment system. This information will be structured according to the CAP-DAMAGE profile. Next, this message structure will be embedded into an EDXL-DE, enabling the forwarding of this information to the list of recipients that should have access. Upon receiving the EDXL-DE, the recipients will be able to decode the information that is contained in the CAP-DAMAGE message and be informed about the damaged structures.

Annex A

Use cases

A.1 Use Case: Earthquake

A 7.5 magnitude earthquake has struck a southern European capital, causing widespread damage to buildings and infrastructure. The earthquake struck at 3:00 p.m. local time on a weekday when many people were at work or school. The epicenter was located approximately 30 km east of the city and the earthquake was felt throughout the region.

The earthquake has caused significant damage to the buildings and infrastructure of the city. Many buildings have collapsed or sustained heavy damage, and there are reports of people trapped inside. Roads and bridges have also been damaged, making it difficult for emergency responders to reach affected areas.

There are reports of multiple casualties, including both civilians and first responders. The exact number of casualties is unknown at this time, but it is expected to be significant. Emergency responders, including police, firefighters, and medical personnel, are working to assess the situation and provide assistance to those in need. It is also important to assess the condition of critical infrastructure, such as water supply systems, power lines, and transportation networks. They should identify areas that require immediate attention and prioritize response and recovery activities. The local government has declared a state of emergency and is coordinating with state and regional agencies to provide additional resources and support.

A critical infrastructure facility (i.e. a hospital) had deployed state-of-the-art sensors to estimate the damage induced by the seismic event and assess the extent of potential structural damage. The deployed sensors detected the seismic vibrations caused by the earthquake and quickly processed the data to generate a comprehensive damage assessment report. The analysis revealed that the infrastructure had suffered severe damage, with a potential crack identified on the second floor of the facility. This critical information was swiftly relayed to the infrastructure operators, who immediately initiated the necessary protocols to ensure the safety of the facility and its occupants. The swift alert system was crucial in providing the infrastructure operators with timely information that allowed them to take quick and decisive action to prevent further damage and ensure the continued functioning of the facility.

The following is a speculative example in the form of a CAP XML message.

```
<?xml version = "1.0" encoding = "UTF-8"?>
<alert xmlns = "urn:oasis:names:tc:emergency:cap:1.2">
  <identifier>9472a63e-68d6-4f2a-ad67-3c74fe56d947</identifier>
  <sender>strategy@strategy.com</sender>
  <sent>2023-01-24T13:45:03-00:00</sent>
  <status>Actual</status>
  <msgType>Alert</msgType>
  <scope>Public</scope>
  <info>
      <language>en-us</language>
    <category>Infra</category>
    <event>Building Damage Estimation Report</event>
    <urgency>Immediate</urgency>
    <severity>Moderate</severity>
    <certainty>Likely</certainty>
      <responseType>Assess</responseType>
    <headline>Damage Building</headline>
```

```
    <description>Crack detection on the building</description>
      <parameter>
     <valueName>urn:SSLy:damage_assessment:building_code</valueName>
      <value>114433523</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:coordinates</valueName>
      <value>23.75182, 37.979045</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Use</valueName>
      <value>Hospital </value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Construction_year</valueName>
      <value>1975</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Construction_material</valueName>
      <value>Reinforced Concrete</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Number_floors_on_ground</valueName>
      <value>5</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Number_Basements</valueName>
      <value>2</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Number_occupants</valueName>
      <value>200</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Cause</valueName>
      <value>Earthquake</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Level</valueName>
      <value>Medium</value>
    </parameter>
      <parameter>

<valueName>urn:SSLy:damage_assessment:Damage_Level_Structural</valueName>
      <value>Medium</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Level_Non-
structural</valueName>
      <value>none</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Type</valueName>
      <value>Crack</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Floor</valueName>
      <value>2</value>
```

```
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Operational_status</valueName>
      <value>Partial Operational</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:affected_services</valueName>
      <value>Medical Services</value>
    </parameter>
      <resource></resource>
    <area>
      <areaDesc>Athens, Greece</areaDesc>
      <circle>23.75182, 37.979045,0.1</circle>
    </area>
  </info>
</alert>
```

A.2 Use Case Flood

The use case refers to a flood on the catchment of a river, in Netherland. Flood control is an important issue for the Netherlands. Due to its low elevation, approximately two-thirds of its area is vulnerable to flooding, while the country is densely populated. Natural sand dunes and constructed dikes, dams, and floodgates provide defense against storm surges from the sea.

There has been considerable precipitation in the river basin of the Rhine river over the past two weeks. This downpour has led to an increased discharge of the river (9000 m^3/s). In addition to this, the water levels in the city nearby have risen due the increased discharge of the river. Two days ago, the Dutch Water Management Centre (WMCN) issued a warning for a powerful north-western wind (8 bft) which would cause a further increase of the water levels of the river.

Day of the incident

A cargo ship departs from a sash lock and has taken its course along the river nearby. The ship has lost its course and crashed in the levee. It is not immediately clear whether this is due to a mechanical defect or a human error. Due to the collision, both the levee and the cargo ship have been damaged. The control room (meldkamer) has been informed and the emergency services have been alerted. Based on the situation the operational authorities decide to scale up to the coordinated regional incident procedure, which means that the emergency services and necessary crisis partners start working together in a crisis structure (GRIP 1 - CoPI). The regional water authority went directly to the incident location to make an inventory of the damage. Their conclusion: there is a breach.

The CoPI has decided to scale up to a next level (GRIP 2) by alarming and activate the ROT (tactical team). This alert message contains all the information (such as the name of the river, the location, a description of the detected event, damage probability) and GRIP-level) that is required by the first responders to verify and respond to the situation effectively. This alert message is automatically forwarded to the command-and-control system, informing the commanders about the situation.

The liaisons of The Regional Water Authority are not certain of the damage will be repaired before the dike completely collapses, hence there is a likely chance (75%) that the levee will fail to hold, resulting in a collapse with a high impact probability. While the first responders are busy in the incident area, the ROT has to decide what the impact could be of different scenario's (worst case – best case), and which measures have to be taken to reduce the negative effects. There are approximately 2 hours left until the levee will collapse. This is accompanied by a very fast flow rate, which has a major impact on existing objects and infrastructure.

Involvement of authorities.

Several authorities, such as civil protection, waterboard, fire services, police and emergency services are involved in the situation. Thanks to the data exchanged, the officers of the authorities should be informed about the damaged dike, hazard characteristics, the location of the incident, and the damage state in order to coordinate the response activities. In a similar manner, as the scenario unfolds, alerts of damages inflicted and/or impact sustained to various occasions by additional structures are showcased allowing stakeholders to assess the usability of such a proposed approach in the context of their experience / knowledge.

The following is a speculative example in the form of a CAP XML message.

```
<?xml version = "1.0" encoding = "UTF-8"?>
<alert xmlns = "urn:oasis:names:tc:emergency:cap:1.2">
  <identifier>9472a63e-68d6-4f2a-ad67-3c74fe56d947</identifier>
  <sender>strategy@strategy.com</sender>
  <sent>2022-06-24T12:49:28-00:00</sent>
  <status>Actual</status>
  <msgType>Alert</msgType>
  <scope>Public</scope>
  <info>
      <language>en-us</language>
    <category>Infra</category>
    <event>Building Damage Estimation Report</event>
    <urgency>Immediate</urgency>
    <severity>Moderate</severity>
    <certainty>Likely</certainty>
      <responseType>Assess</responseType>
    <headline>Damage Building</headline>
    <description>The building  has been affected by flood</description>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:building_code</valueName>
      <value>13970876</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:coordinates</valueName>
      <value>6.060470,52.505038</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Use</valueName>
      <value>Power Distribution Center</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Construction_year</valueName>
      <value>1990</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Construction_material</valueName>
      <value>Reinforced Concrete</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Number_floors_on_ground</valueName>
      <value>2</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Number_Basements</valueName>
      <value>0</value>
    </parameter>
```

```
      <parameter>
      <valueName>urn:SSLy:facilities:Number_occupants</valueName>
      <value>10</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Cause</valueName>
      <value>flood</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Level</valueName>
      <value>heavy</value>
    </parameter>
      <parameter>

<valueName>urn:SSLy:damage_assessment:Damage_Level_Structural</valueName>
      <value>heavy</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Level_Non-
structural</valueName>
      <value>none</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Type</valueName>
      <value>flood</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:damage_assessment:Damage_Floor</valueName>
      <value>0</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:Operational_status</valueName>
      <value>Partial Operational</value>
    </parameter>
      <parameter>
      <valueName>urn:SSLy:facilities:affected_services</valueName>
      <value>Energy Supply</value>
    </parameter>
      <resource></resource>
    <area>
      <areaDesc>IJsselland</areaDesc>
      <circle>6.060470,52.505038,0.1</circle>
    </area>
  </info>
</alert>
```

Bibliography

[1] CWA 18028:2023, *Semantic layer definition and suitability of OASIS EDXL-CAP and OASIS EDXL-SitRep standards for crisis management in critical infrastructures*

[2] Document EU COM (2005) 576 Green Paper on a European programme for critical infrastructure protection

[3] Council Directive EC/2008/114 on the identification and designation of European critical infrastructures and the assessment of the need to improve their protection

[4] ISO 22300:2021, *(en),* Security and resilience — Vocabulary

[5] United Nations, Department of Economic and Social Affairs, Principles and Recommendations for Population and Housing Censuses, Revision 3, 2017

[6] ISO/TR 19083-1:2016, *(en),* Intelligent transport systems — Emergency evacuation and disaster response and recovery — Part 1: Framework and concept of operation

[7] ISO 22315:2014, *(en),* Societal security — Mass evacuation — Guidelines for planning

[8] ISO 22399:2007, *(en),* Societal Security - Guideline for Incident Preparedness and Operational Continuity Management

[9] ISO 22315:2014, *(en),* Societal security — Mass evacuation — Guidelines for planning

[10] European Commission. Joint Research Centre, Ehrlich, D., Schneiderbauer, S., Risk, hazard and people's vulnerability to natural hazards – A review of definitions, concepts an data. Publications Office, 2014

[11] The International disaster databases, Centre for Research on the Epidemiology of Disasters – CRED: https://www.emdat.be/

[12] DesInventar as a Disaster Information Management System, UNDRR - Sendai Framework Monitoring Unit: https://www.desinventar.net/

[13] Infrastructure for spatial information in Erope: https://inspire.ec.europa.eu/

[14] Global Terrorism Dtabase. https://www.start.umd.edu/gtd/

[15] COPERNICUS. Emergency Management Service – Mapping, List of EMS Risk and Recovery Mapping Activations: https://emergency.copernicus.eu/mapping/list-of-activations-risk-and-recovery