EENA Operations Document

Overload of calls

Title:	Overload of calls		
Version:	1.3		
Code:	3.2.2		
Revision Date:	3-12-2012		
Status of the document:	Draft	For comments	**Approved**

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1 Introduction

All emergency services can be affected by an overload of calls in case of large emergencies, e.g. severe weather events. Other situations such as earthquakes, terrorist attacks, multi-vehicle traffic accidents, etc. can also multiply the risk of a greatly increased call volume. A large number of citizens seeing or suffering the same incident, e.g. a fire, may alert emergency services at the same time. Furthermore, the large amount of false emergency calls[1] arriving at European public-safety answering points (PSAPs) multiply the possibility of an overload.

Overload of calls prevent people who may be in life-threatening situations, and who need urgent help, from contacting the emergency services. This can mean the difference between life and death for someone in trouble. Due to the limited visibility into the network and correlating calls of this type, it is very difficult to estimate how many of these calls were placed on hold, received a busy signal or never even made it through to the PSAP due to overload issues.

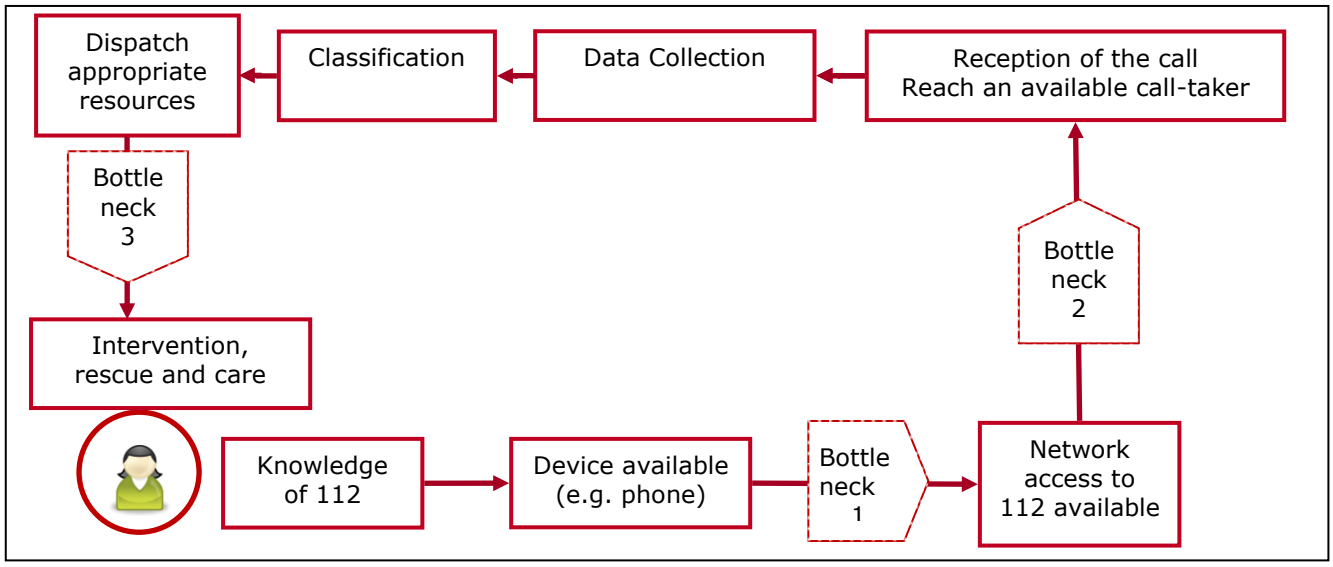
Most European emergency services combat overload of calls using different approaches. The scope of this document is to assemble information about this issue and outline some of the 'best practice' approaches from the authorities' perspective. The description of practices was obtained through information sent by EENA members. As a conclusion, EENA's recommendations and requirements are outlined.

2 Abbreviations and Glossary

All definitions of terms and acronyms related to 112 are available in the 112 Terminology EENA Operations Document.[2]

3 Bottlenecks in the emergency service chain

A call to emergency services starts a sequence of tasks by different stakeholders taking part in the emergency service chain.[3] From the moment a person in distress dials 112 until the intervention of emergency services organisations three main bottlenecks can be described:



Bottleneck 1: Network access to 112

[1] False Emergency Calls EENA Operations Document: : www.eena.org/view/en/Committees/112operations/index/psaps.html
[2] www.eena.org/view/en/Committees/112operations/index/generalframework.html
[3] 112 Service Chain EENA Operations Doc.: ww.eena.org/view/en/Committees/112operations/index/generalframework.html

Nowadays, emergency services are normally contacted only through phone calls. This is the reason why the availability of mobile and fixed telephony networks plays an essential role.

Recital 35 of the Universal Service Directive (2009)[4] – amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services states that:

> *"In future IP networks, where provision of a service may be separated from provision of the network, Member States should determine the most appropriate steps to be taken to ensure the availability of publicly available telephone services provided using public communications networks and uninterrupted access to emergency services in the event of catastrophic network breakdown or in cases of force majeure, taking into account the priorities of different types of subscriber and technical limitations."*

Article 23 "Availability of Services" of the same Directive states that:

> *"Member States shall take all necessary measures to ensure the fullest possible availability of publicly available telephone services provided over public communications networks in the event of catastrophic network breakdown or in cases of force majeure. Member States shall ensure that undertakings providing publicly available telephone services take all necessary measures to ensure uninterrupted access to emergency services."*

Emergency calls are routed via one or several public telephone networks, which are all interconnected. On all network elements (switching and transmission resources) as well as interconnection interfaces, an overload can occur and block emergency calls. The blocking due to overload is not necessarily caused by an emergency itself but could be caused by a non-emergency related issue such as a tele-voting competition/event from a TV show. Experience has shown that such events lead to possibly millions of subscribers try to call a voting number simultaneously which, if there is not sufficient capacity and implementation measures in place in the network, it may lead to overload and blocking in some areas of the network which in turn may also affect emergency service traffic.

Public fixed and mobile networks should have special provisions in place to recognise and prioritise emergency calls. Although this practice may not always followed and guaranteed in some areas of Europe, there is in place sufficient legislation (Article 23 above refers) to provide for and prevent this bottleneck from occurring.

Bottleneck 2: Accessing the PSAP

PSAPs are typically connected to public telephone networks by subscriber lines (for example ISDN, analog or IP). These lines provide a limited number of voice channels. In case of high demand this subscriber lines are busy. These lines require to be sufficiently dimensioned to ensure that there are always more available lines than call takers.

As a result, the number of lines should be significantly greater than the number of call takers. Information regarding the data and trends should be captured so as to monitor incidences where capacity is compromised which will lead to decisions regarding the correct dimensioning of the PSAP's staffing requirements.

Bottleneck 3: Reach an available call-taker

Once the citizen has dialled 112 through an accessible network and the PSAP is reached technically, emergency services have to ensure that the citizen reaches an available call taker as soon as possible. Call routing instructions and resources have to be optimised to guarantee a minimum waiting time.

It has to be taken into account that call handling time may be increased in cases where citizens calling 112 are not able to explain where they are and/or what is happening. This fact may cause an additional bottle-neck between the receipt of the call and the collection of the data.

[4] Directive 2009/136/EC of the European Parliament and of the Council of 25 November 2009: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0011:0036:en:PDF

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Statistics of major events have to be analysed to optimise staffing and shift plans for the optimum handling of future events. The challenge for the PSAP overload issue is the treatment of mass calls which are semi-urgent (such as repeat calls for the same incident which is discussed below, non life threatening incidences etc) which may outnumber the urgent calls (heart attacks, urgent medical needs) by causing long answering times or even lost emergency calls.

As a result, the early recognition of these calls during these mass events is crucial to ensuring a successful outcome.

Bottleneck 4: Intervention resources

Having taken the call and appropriately prioritised it, there must be sufficient available resources to respond to the call. Planning needs to take account of predictable surges in demand (such as Friday nights in the run up to Christmas, New Years Eve etc). Plans should also allow for unexpected peaks in demand, such as those caused by an unpredicted decline in temperature or other natural incidences such as flooding etc.

Once the resources have been dispatched, they have to arrive to the location of the incident and assist the citizens who are involved. Availability of resources (particularly during multi-emergency events), accessibility of the preferred travel routes and correct location information are all critical for the effective and efficient response. Pre-developed contingency plans for coordination and use of resources in case of large, multi-agency emergency situations are crucial. Even though this specific bottleneck cause will not be studied in this document, which is only focused on the issue of call overload, there is an up-stream effect on the call handling resources if the intervention resources are over stretched and unavailable.

4 Avalanche of 112 calls

An avalanche of calls occurs when a large number of 112 calls are made at the same time. This causes some calls to be placed on hold, some receive a busy signal or some never even made it through telephone network bottlenecks to ring at the PSAP. This sometimes referred to as a spate incident. The principle reasons can be:

- Large scale emergencies:

Emergencies can affect an entire area and consequently a big amount of citizens. Examples of large scale emergencies are weather events, earthquake, Terrorist attack, and large area forest fires.

It can also happen that a large scale emergency in one region causes an overload in another PSAP or PSAPs which not have primary responsibility for that region. If the phone network is congested, or if the responsible PSAP is overloaded, 112 calls may be rerouted to another PSAP. For example, in a flood event, if the primary PSAP has 20 inbound 112 lines and 50 callers dial 112 for assistance, the subsequent 30 calls may be rerouted to a neighboring PSAP, causing an overload there.

Handling of severe weather events and possibly incidences of forest fires, can typically be prepared as often weather forecasts indicate increased risks of such events occurring. In preparation, extra resourcing of staff or implmentation of pre-arranged standby shifts can be undertaken. On the contrary, unforecasted incidiences such as earthquakes or terrorist attacks appear without any warning where the relevant contingency plans (discussed further below) are deployed.

- Calls for the same incident:

The longer delays typically happen when multiple people call about the same incident (e.g. fires, traffic accidents, cars being driven in opposite direction in the highway, explosions in factories, etc.). Nowadays, the use of mobile phones has made it very easy to make a 112 call on observing a need. It is well known by emergency services that sometimes an incident, e.g. a fire in a building, is seen by multiple citizens who will call 112. In some cases, once the incident is known by emergency services, these callers only repeat the same information. For example, a traffic accident on a major highway may result in multiple 112 calls reporting the same location. In other type of incidents, e.g. terrorist attacks, some calls may add valuable information, such as additional descriptions of the suspects, number of people affected, better descriptions of the weapon and such like.

- Inadequate Public-warning systems

If sirens are triggered as a result of a civil protection alarm, a significant number of concerned citizens may react by calling the dedicated emergency number and seek advice and what they should do. In particular if sirens sound without the correct effective supporting information (e.g. on radio and TV) explaining the reason for the alarm, this will lead to increased calls to PSAPs potentially creating an overload situation to occur. This supporting information should also inform the citizens of the correct steps to take and if possible, not to call the dedicated emergency number unless absolutely necessary..

As a result, the provision of adequate public information to support the public warning system should be in place to help alleviate the possibility of call overload.

- Non-emergency calls:

This type of calls does not usually cause an avalanche of calls. Normally non-emergency calls will impact a PSAP's resources by requiring additional time to handle that could have been used to address 112 calls.

Nevertheless it may happen that a deliberate attack is organized to overload the 112 service. A group of individuals determined to overload the 1-1-2 system may place large numbers of calls to the non-emergency lines and 112 at the same time.

There have been cases of a large increment of 112 calls caused by malfunction or incorrect programming of the routing system for calls. Citizens dialing another short number dedicated to other services, e.g. traffic information, have been routed to the 112 call centre.

- Hoax calls

Hoax calls from the public can create additional burden on the PSAP as resources and personnel are assigned to fictitious incidents, preventing them from responding to real and more appropriate events. As a result, the PSAP or appropriate authority should take action by engaging in public awareness and educational campaigns to highlight this problem to citizens.

- Automatic calls from malfunctioning devices:

Some PSAPs receives automatic calls from devices (e.g. sensors, automatic alarms, etc.). In case of malfunction these devices may generate a large amount of 112 calls and cause an overload of the PSAP.

5 Measures to minimise bottlenecks

5.1 Preventive measures

- Emergency services plans and organisation:

Public authorities have to create and maintain contingency plans. In these plans, steps to be taken in case of overload must be detailed. All stakeholders, e.g. telecommunication operators, PSAPs, etc. have to be taken into account and informed about how they will need to react in case of overload.

A policy of rerouting emergency calls to another PSAP in case of unavailability or overload has to be established. For this, a minimum interconnection of centres is needed. These policies should be automated in the telephony network and not require human involvement to implement. Also important to note in this context is how the data is to be exchanged between the main PSAP and the supporting PSAP so as to ensure no important information is lost and the relevant systems are integrated and interoperable. This concept of sharing a common interface is supported in EENA's NG112 Long Term Definition document[5].

Lack of funding leading to limited resources, both human and equipment in 112 services, has a consequence of increasing the occurrence of delays and overloads when calling 112 and thus potentially leads to a worse

[5] http://www.eena.org/ressource/static/files/eena_ng112_ltd_v1-0_final.pdf

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outcome for the caller. Although outside the scope of this document, this topic has been covered in more detail previously.[6]

- Telephony networks:

Overload of phone networks may occur in special days, e.g. New Year's Eve and it generally happens in case of large-scale emergencies. Catastrophic situations, e.g. weather events, may have a devastating impact on communications infrastructure. Telecommunication operators and public authorities have to prioritize efforts to assure the public's continued access to emergency services even in force majeure situations.

Both mobile and fixed telephone operators should prioritise emergency calls in their network and in all interconnections to other operators (e.g. in special trunks).

112 calls need to be prioritised above other calls. In some locations only one mobile network operator may be available. In these cases, national roaming, i.e. when emergency calls are handled by another mobile network operator, should ensure that the citizen is able to contact emergency services at all times.

- PSAPs:

The resources needs of PSAPs must take into account large incident scenarios and "worst case" events. Resource planning based on average daily activity levels will leave a PSAP unprepared for any large call event. Resources have to be optimised to guarantee a minimum waiting time in all circumstances. A contingency provision for additional numbers of lines and number of operators and other similar parameters have to be adequate to avoid the overload of PSAPs.

The basic requirement is to provide sufficient dimensioning of subscriber lines for incoming emergency calls at the PSAP. In typical mass calling events the subscriber line should not be busy, even if there are not enough agents on duty to take the calls. From the 'call waiting' data, the right statistics can be counted and future staffing or call forwarding strategies can be derived. If calls are lost because of busy/engaged lines, it may be very difficult for the PSAP to count the number of lost calls, i.e. to assess the degradation of service immediately.

Depending on national conditions and redundancy provisions, PSAPs should be centralised to such a degree, that they have sufficient scale so that they can handle normal avalanches of emergency calls without causing any major stress. These centres should be properly dimensioned based on the population they serve and based on the types of emergency situations and risks that they cover

Appropriate design and use of Automatic Call Distribution (ACD) algorithms for centres with large numbers of positions can assist with large call volumes. Additional staff in the PSAP can be automatically placed into an ACD overflow queue in high call volume situations.

The caller location information of the emergency call can be used to determine whether the call belongs to an area that is affected by a weather disaster or is the scene of a major accident and therefore calls that are not from this area have a reasonably high probability that the call relates to a different incident. Calls suspected to be related to the actual incident itself could be handled differently by the ACD and as such ensures that the service is not degraded in areas of the country which are not affected by the incident. Calls from the disaster area can thus receive special service, e.g. handled by a special team assigned for this area or get special announcements while waiting for the call to be answered (as explained earlier in this chapter).

There should also be the provision to alert additional staff members who are on standby duty in case of such an incident. An internal procedure describing the steps to be taken in case of an avalanche of calls should be prepared and available for PSAP staff. Equipping these staff members with remote call taking infrastructure to enable them to come online very quickly should be considered as an option (as many of the avalanche scenarios are typically over in a short period of time).

Automatic messages can be used to inform citizens about already known incidents in order to free lines as soon as possible, e.g. "*We are already been informed about a fire in Principal Street number 10. If you are calling about this incident please …".* These messages have to be dynamically configured.

[6] http://www.eena.org/ressource/static/files/6.-henrik-jaldell.pdf

Also possible to be considered is the provision of a non-emergency number where citizens who have non-life/non property-threatening type issues to report. These calls could be then handled separately from the really urgent incidents and ensure the expeditious response is given to the right calls. As before, a welcome message or such like from within the PSAP may be useful to support this initiative.

For repeat offenders, numbers may be 'gray listed' to indicate previous hoax events to the call taker. This is not intended to block or deny service, however these calls may be assigned a lower priority than others. This should only be applicable during overload times when routing decisions must be made and needs to be carefully managed.

- Education:

It has been already mentioned in this document that, even if false emergency calls are not the main cause of overload in PSAPs, they are a continuing burden that further stress the PSAPs' resources and increase the risk of overload.

Education of the public in the correct use of the 112 emergency number is crucial to decrease the number of false calls. A standardised use of emergency numbers in all countries is therefore desirable.

The 112 number should be only used in emergency situations. The creation of different numbers for information purposes (e.g. weather information or others) helps reduce the number of non-emergency calls to 112.

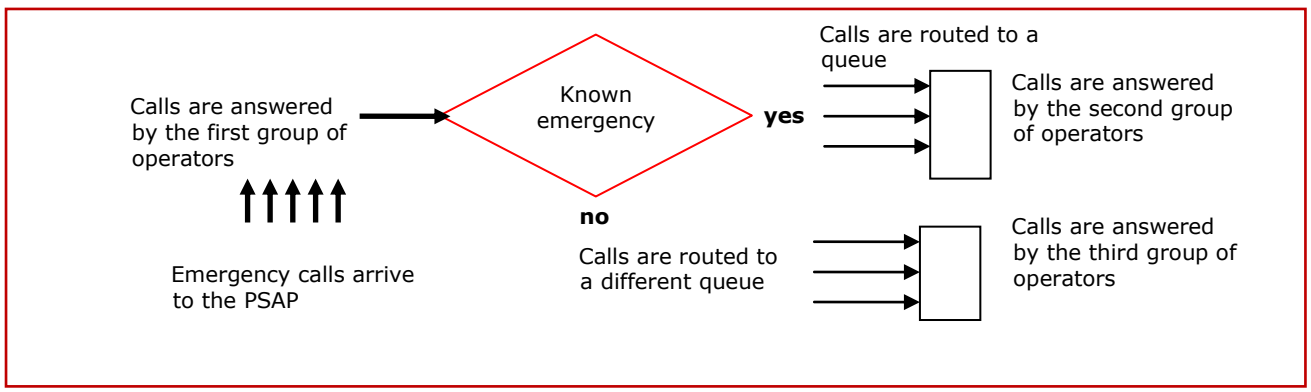
- Public warning systems:

To inform the population about a predicted or a present emergency, an emergency notification system can also prevent overload of calls in PSAPs. If citizens are aware that public authorities already have been alerted about an incident, they are less likely to contact emergency services unless there is a true need. The use in this context of public warning systems (including the use of social networks) has to be described in the general contingency plans.

5.2 Corrective measures

When the PSAP call taking system is filled to capacity, corrective measures have to be taken. If a singular PSAP is not able to handle the number of calls being received, the previously set up contingency plans for overload must be followed. Calls should be then rerouted to other PSAPs, if possible.

Internally, the overloaded PSAP has to try to free its resources as soon as possible. In some emergency centres automatic messages are used. Depending on the nature of the incident, new calls can give further important information about the emergency. If this is the case, in some PSAPs different levels calls queues are established.



Geo-location based routing would allow optimizing the call distribution. It would be possible to route automatically calls from several areas to different queues or answering groups.

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6 European examples

There are some examples in the next table:

Country	Measures
Austria	Overflow is managed within the Police, calls are automatically forwarded to Police's Province Dispatch Centre via internal phone network. Massive amounts of calls (crisis, disaster, State visit) are transferred to special call centres at the Ministry of Interior (0800–number published via media) or at the Province Governments. Fire service PSAPs monitor the weather forecast and increase staff and standby staff in risk situations. Some provinces have a centralised fire PSAP for every day operation and decentralised PSAPs with many additional call taking positions for heavy load. Some fire services in capital cities make announcement for 'shadow' emergency numbers, if the regular emergency number is flooded due to a weather disaster. Medical emergency PSAPs are typically centralised per province or a set of cooperative PSAPs. They run a high number of not urgent ambulance calls integrated into the PSAP. In case of sudden increase in emergency calls, they immediately stop service for ambulance calls and put all resources to the emergencies. This is done automatically on a call by call basis, is effective immediately and means they typically are robust against avalanches.
Bulgaria	In Bulgaria all the PSAPs are interconnected in a common private IP network. They use the same software and a common database. All the PSAPs are interchangeable. If there is an overload in one centre, the other ones are able to handle the calls. That happens automatically. Bulgarian legislation does not allow automatic calls from electronic devices to 112.
Czech Republic	All 14 operations centres use one large information system. In case of overloading of one operation centre the call is routed to another operation centre.
Estonia	The four 112 regional centres use only one database (which allows overflow). Estonia introduced different help and information numbers (rescue information, environment information and the help number of the local government - all of which are managed by the Emergency Response Centre - , medical advice number etc). This has reduced the overload of 112 calls. People are now quite aware of this numbers because they have been advertised.
France	15 (SAMU) Calls are received with a message. 112/18 (Fire fighters) - French & English message
Italy	Lombardia region: Calls are always served by human operators, with a pre-recorded message in case of calls overflow Turin Fire Brigade: At present calls are always answered by operators: In case of an overload of calls we currently assign 2 or 3 out of the 6 or 7 operators we have to the first call taking. This group of 2 or 3 operators intends to understand if callers refer to an emergency that requires many resources or not. If this is the case, the call is transferred to the dispatching operators who manage that particular emergency. Next configuration: step 1, we are developing an answering system that allows citizens to report critical situations (not requiring urgent assistance) for example: flooding, weather conditions. Computer system records the data to enable human resources dispatching. step 2, in case of a large number of call volume of calls due to a one particular event (e.g. traffic accident, factory fire and others), the answering system communicates the news, inviting citizens to report only additional news;

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	step 3, the answering system invites citizens to wait for an operator only in case of urgent need - or invite citizens to leave their details directly to the system or via the fire brigade's website. The purpose is to persuade citizens not to keep operators busy unless they have an urgent request but ensure assistance, if needed.
Lithuania	Redirection of calls between ERC centers in case of overload of calls Recorded message are used for calls from SIM-less devices and blacklisted numbers (eg. mis-configured faxes, insane, drunk callers)
Malta	The civil protection department and the emergency medical services receive 112 calls in case of overflow or if the 112 service of the police is unavailable.
Norway	Overflow arrangements are in place in areas where this is deemed necessary
Serbia	The proposed solution is to have 4 interconnected regional centres, each of them can be a backup for any other.
Slovakia	All PSAPs use the same technology for the reception and the processing of the European Emergency Number, 112. The technology is interconnected and the system allows for the sharing of data.
Spain	Recorded messages identifying the service as an emergency number in some regions. In some cases (not for all regions) overflow agreements between 112 PSAPs from different regions have been set up. Use of automatic messages to filter the call in cases such as big storms or floods to filter calls (in some regions). Procedures to assure a constant number of free operators.
Sweden	PSAPs and emergency services are connected to a national network. This makes it possible that, if needed, PSAPs can assist other overloaded centres.

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7 EENA recommendations

As a summary of this document EENA would like to make recommendations about how to manage overload of calls and inform the stakeholders that are involved. It is not intended that all measures are to be taken in all cases. Each emergency service needs to develop their own contingency plans that fit that agencies unique environment and national conditions. Due to differing regional capabilities and environment, not all the above recommendations are a good fit for all agencies.

In this document it has been explained that taking measures against false/malicious emergency calls is crucial to avoid overload of calls. EENA's recommendations about this subject can be founded in the False Emergency Calls EENA Operations Document.[7]

Furthermore, the importance of Public Warning systems in the context of an overload of calls has been also described. EENA recommendations about Public Warning systems are detailed in the Public Warning EENA Operations Document.[8]

Stakeholders	Actions
European Authorities	• Enforce compliance with the Universal Service Directive • Reinforce education about the use of the 112 number
National telecommunication regulators/ Network operators	• Enforce/ensure compliance with laws about access to emergency services
Telecommunication operators	• Ensure access to emergency services • Ensure prioritization of 112 calls • Ensure rerouting calls to another PSAP in case of unavailability as pre-planned by the national/regional authorities
National / Regional Authorities	• Create contingency plans for call overload situations • Ensure rerouting of calls in case of overload or unavailability of PSAPs • Reinforce education about the use of 112 number
Emergency services / PSAP Management	• Determine PSAP resource needs based on critical need scenarios, not based on average call volumes. • Optimal dimensioning of the PSAPs' resources

8 EENA Requirements

Requirements	
General contingency plan for overload of calls	Compulsory
High level plan to reroute calls to other PSAPs in case of overload or failure	Compulsory
Availability of a configurable automatic short message to inform citizens about an already known emergency situation	Compulsory

[7] False Emergency calls EENA Operations Document: www.eena.org/view/en/Committees/112operations/index/psaps.html

[8] Public Warning EENA Operations Document: www.eena.org/view/en/Committees/112operations/index/psaps.html