EmerGent

EMERGENCY MANAGEMENT IN SOCIAL MEDIA GENERATION

Final Report

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University of Paderborn

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Work Package 1

Project Coordinator

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List of Abbreviations

Abbreviation	Expression
A2C	Authorities to citizens
API	Application Programming Interface
CAP	Common Alerting Protocol
C2A	Citizens to authorities
C2C	Citizens to citizens
C&C	Command and Control
DoW	Description of Work
EAB	End User Advisory Board
EAC	Ethics Advisory Committee
EMC	Emergency Management Cycle
EmerGent	Emergency Management in Social Media Generation
EMS	Emergency Management Services
ES	Emergency Services
HCI	Human Computer Interaction
IG	Information Gathering
IM	Information Mining
IR	Information Routing
IQ	Information Quality
M	Month
O	Objective
OSNs	Online Social Networks
PB	Project Board
PIA	Privacy Impact Assessment

SME	Small and Medium-sized Enterprises
T	Task
TB	Technical Board
TL	Task Leader
WP	Work Package
WPL	Work Package Leader

1 Introduction

This report responds to generic requirements as stated in the Grant Agreement.

1.1 Relation to other documents

[1]   Grant Agreement

[2]   Consortium Agreement

1.2 Target audience

The core of the report for the period is addressed exclusively to the European Commission. There is an additional part which is publishable; this will be made available via the project website.

2 Executive Summary

EmerGent aims at understanding the positive and the negative impact of social media. This can currently be described as a continuous feed of an unstructured, not validated real-time record of citizens' experiences in emergencies. By gaining a better understanding EmerGent aims to enhance objective and perceived safety and security of citizens before, during and after emergencies. Furthermore, EmerGent aims at strengthening the role of European companies dealing with services and products related to the aimed research and development results.

During a large-scale emergency, such as a flood, earthquake or rioting, a lot of valuable information is shared on sites such as Twitter, Facebook or Instagram. During recent catastrophes throughout the world, like hurricane Sandy in 2012, the European floods 2013/14 and terrorist attacks in Paris and Brussels in 2015, social media has been widely used [HSPA14]. Indeed, the terrorist attack in Paris generated around 6.7 million posts with the hashtag "#prayforparis" on Twitter within 10 hours [GoEm15]. And during recent years, the amount of information shared, especially on Twitter and Facebook, has grown enormously [Ethe12]. Yet, emergency services struggle to harness the potential lying within social media. EmerGent positions itself exactly in this dilemma and aids emergency services by providing instructions for the use of social media before, during and after emergencies, as well as by processing and intelligently representing the sheer amount of information generated during emergencies.

To achieve this goal, EmerGent

- Regarded current attitudes towards social media within emergency services and citizens,
- Studied the past, current and future impact of social media before, during and after emergencies using the theory of change,
- Analysed potentials of the social media usage before, during and after emergencies,
- Assessed methods to handle enormous amounts of user-generated content from social media, including text messages, images and videos,
- Implemented methods to turn high volume - low information social media data streams into low volume - information rich ones,
- Researched methods to assess the quality of social media content,
- Implemented semi-supervised machine methods to classify the quality of social media content,
- Designed, developed and evaluated a service-oriented IT-System that includes a mobile application (112.social app) and an interface for emergency services.
- Researched and evaluated existing guidelines for social media usage, especially regarding the use in the emergency service's processes,
- Developed guidelines for the use of social media in emergency services before, during and after emergencies,
- Created explainer videos to showcase the impact and potentials of the use of social media in emergencies

While EmerGent mainly focused on the use of social media in large-scale emergencies and disasters, the results are applicable as well to smaller incidents, such as accidents.

For detailed information, please visit the project website at www.fp7-emergent.eu.

3 Project Context and Main Objectives

The overall objective of EmerGent is to understand the positive and negative impact of social media in emergencies in order to:

- Enhance the safety and security of citizens before, during and after emergencies,
- Strengthen the role of European companies supplying services and products related to EmerGent's results.

Wherever emergencies or crises occur, ad-hoc communities are built through existing social media channels. These communities are often not connected at all or perhaps are weakly linked to the emergency management services. A systematic research project concerning the effective identification and integration of valuable and reliable information from social media into emergency management processes is needed.

3.1 Project context

Social media is a serious and fast growing phenomenon for creating and maintaining social links. The convergence of social networking and mobile media technology is also shifting the way people communicate, and gain or share information, even in emergency or crisis situations. Social media, especially social network providers like Facebook, Google+ and Twitter have high impact when citizens share their observations, opinions and emotions, and this is not restricted to normal life events. Facebook as the largest social network, receiving 85% of the clicks on social media websites [Stat16], shows ever growing numbers of monthly active users [Face16]. And Twitter for instance had more than 100 million active users in 2011, posting 230 million tweets a day. One year later, the number of active users and the number of tweets per day had doubled [Ethe12]. This means, that the general usage of social media is getting more and more important to share information. Additionally, Twitter has a history of breaking important stories before traditional news media [POMM13]. Hence, to handle the vast amount of data, information from social media streams has to be transformed into a low volume but rich information model. Because of the huge amount of potentially useful data created on a variety of social networks, direct usage of social media is impracticable to extract useful information. Hence, advanced filter techniques are required [Piro09]. This need is amplified by the fact that even the main social network providers are using different concepts for communication, information sharing and the establishment of relationships. Furthermore, observers try to help other users by supplying relevant information to the public via social networks ([HuPa09, PaLi07, QHZZ11]). Wherever emergencies or crisis situations appear, ad-hoc crisis communities are often built on existing social media communities [ReMP11]. These ad-hoc crisis communities are made possible by social media that supports "crowdsourcing" approaches ([Gool10, Howe08]) to use the wisdom of the crowd. However, these communities are generally only weakly connected to emergency management services (EMS)/public authorities and the corresponding emergency management processes. Hence, a systematic research activity concerning the effective integration of valuable and reliable information flows from social media to EMS, and from EMS to social media is needed.

3.2 Main objectives

The overall concept of EmerGent is shown in the figure below. Today the "emergency management cycle" (EMC) with its phases does not capture social media (represented by the

cloud on the left-hand side) with its highly valuable information. Although existing social apps (e. g. for mobile devices) are sometimes used by citizens to share their observations and feelings which are only weakly connected to existing emergency services (ES) systems. To achieve the goal of EmerGent (right hand side in the figure) the consortium has developed a strong research oriented methodology (centre of figure).
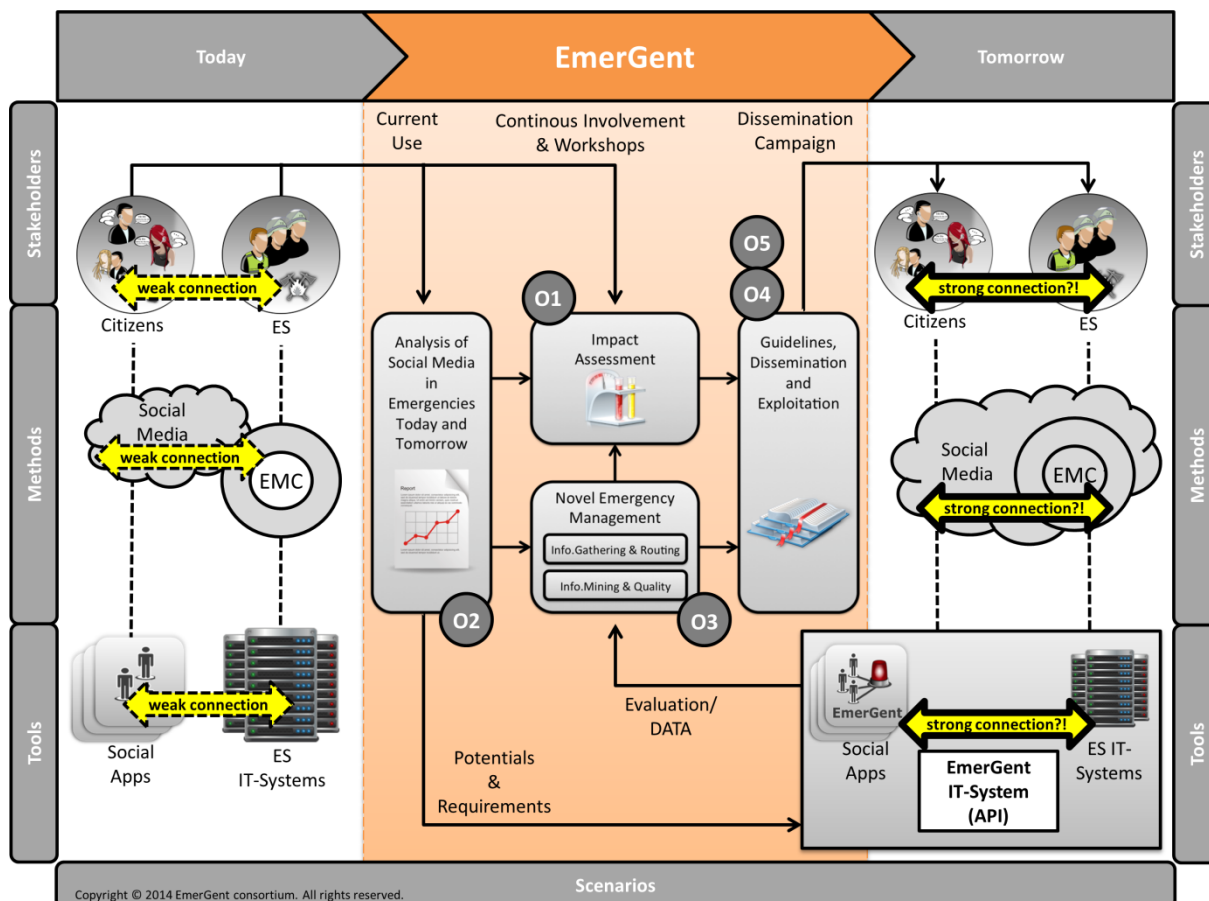

Figure 1 The overall concept (source: DoW)

Within the "Analysis of Social Media in Emergencies Today and Tomorrow" **(O2)**, EmerGent investigates the current use of social media during emergencies, and the future potential for citizens and ES involvement within the EMC when using social media. It also performs an analysis of the methods and tools for citizens and ES to integrate on a technical level.

The results of the analysis are used to assess the impact of social media in emergencies for citizens and ES **(O1)** through continuous citizen and ES involvement through social media and workshops. This includes the acquisition of users who participate long-term as well as the development of basic infrastructures to maintain and support a relationship via social media. The methodology of the impact assessment consists of case studies, analyses of emergencies in the past where social media played a crucial role, workshops with experts and deep content analysis to get precise knowledge about feelings and reactions on both sides.

To handle the vast amount of valuable and distributed information on social media, methods for Information Mining (IM) and Information Quality (IQ) are developed to classify and rate the available and provided data from users. Information Gathering (IG) and Information Routing (IR), including the development of new social apps, are done as part of the "Novel Emergency Management" **(O3)**. The development of new social apps is undertaken to obtain

and provide visualisations of the most relevant information (as assessed by EmerGent) integrated with several social network providers.

All analysis and impact assessment results lead to the creation of guidelines **(O4)**. These guidelines enable ES and all other involved stakeholders to understand the benefits of social media and its integration into their process on different levels (conceptual & technical) **(O5)**. The insights and results from the studies are incorporated into these guidelines. Through the collection and presentation of Information, the analysis of social media in emergencies and the development of IM and IQ methods, an IT-system for the "Novel Emergency Management in Social Media Generation" were developed.

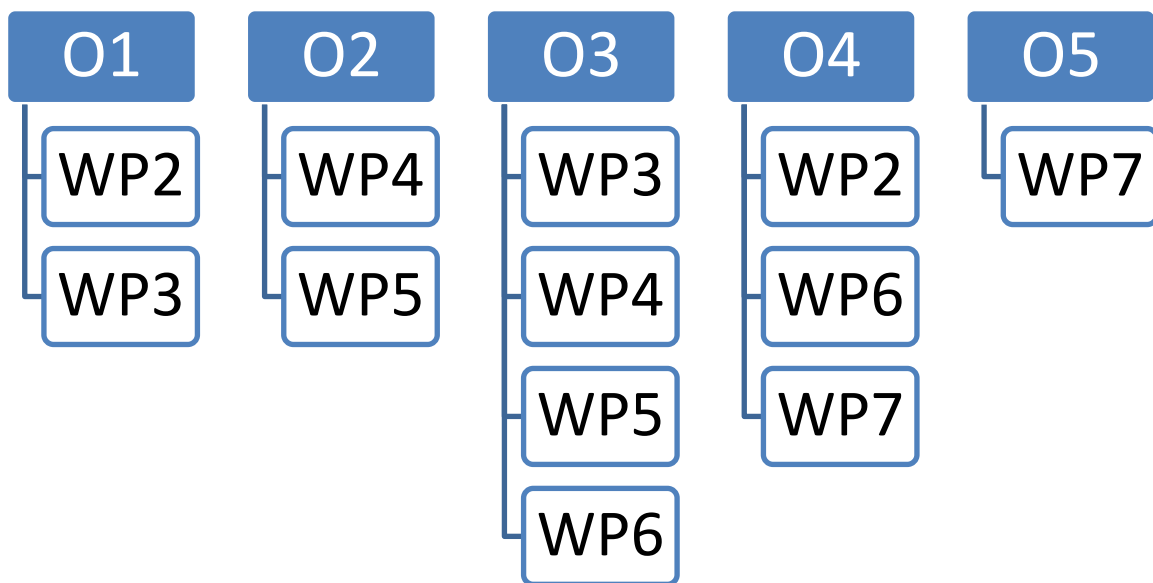All objectives are related to work packages in the (see Figure 2).

Figure 2 Objective-Work Package Relations

EmerGent

4 Main Scientific and Technological Results / Foregrounds

4.1 *Significant Results from Work Packages*

4.1.1 WP2 Impact of Social Media in Emergencies

The objective of WP2 was to conduct an impact analysis of social media in emergencies, in the light of approaches used by EmerGent. This included the use of in-depth case studies to explore the current and potential future use of social media in emergencies, and to explore the results of these case studies and the EmerGent results overall with a group of experts and stakeholders in order to help shape the EmerGent concept, platform and tools.

The work done as part of this WP combined case studies and online surveys of citizens and emergency services. This included case studies of the London riots (2011), floods in six European countries between 2010 and 2015, two terrorist attacks in 2013 and 2016, and eight organisations already using technologies to collect and analyse social media data. This was complemented by surveys of emergency services (conducted in 2014 and 2017) and of citizens – including a survey of an opportunity sample of over 1000 citizens across Europe in 2015 and representative online surveys of citizens in Italy, Netherland, the UK and Germany conducted between October 2016 and March 2017.

The case studies and surveys have shown that currently very few emergency services collect and use social media data extensively – although there is a growing trend towards such use since the start of the project. This is illustrated in the changing attitudes of emergency service staff in response to the surveys in 2014 and 2017. In particular, as can be seen in Table 1 below, there appears to have been a significant change in attitude among them with regard to the extent to which they see social media as an important tool in general and for gaining situational awareness during emergencies more specifically since 2014. It shows that their use of social media before and during emergencies has increased, although the change is largest for sharing information with the public – both about how to behave in emergencies and how to avoid accidents.

Table 1 Use of social media in 2014 and now

Type of use – at least occasionally:	2014 %	2017 %
To receive messages from the public during emergencies?	41	53
To gain situational awareness during emergencies	45	62
For two-way communication with the public	58	73
To share information about how to behave in emergencies	59	77
To share information about how to avoid accidents	68	87

The flooding case studies analysis highlighted four main sets of obstacles to the more widespread use of social media in emergencies: i) lack of organizational structures and

procedures in place – on the whole the structures and networks already developed in emergency services to support the use of social media were limited; ii) lack of resources, staff and skills; iii) lack of systems and procedures to deal with information overload and iv) verification of information – services were often not confident about the veracity of the information circulated through social media. This means that in the flooding case studies the impact on emergency services was quite limited.

In contrast, the case studies and online surveys of citizens showed that there is a growing trend in citizens' use of social media before, during and after emergencies both to look for and share information. Analysis of the representative citizen surveys showed that almost half (45%) of citizens across the four countries have used social media during an emergency. However, as can be seen in Figure 3 below, there are significant differences in the level of use across the four countries included in the survey.
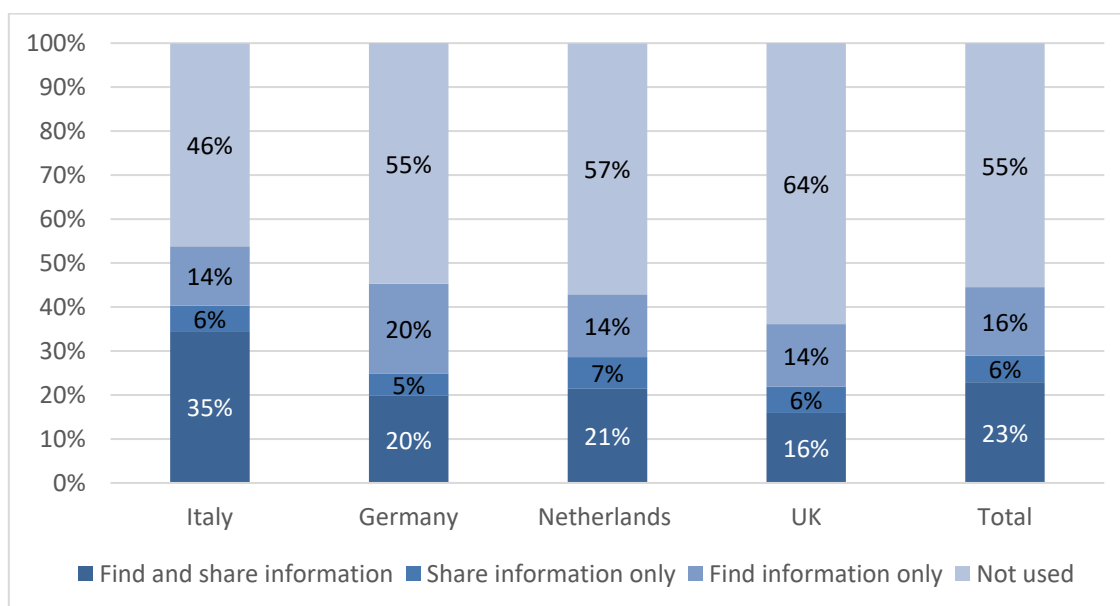

Figure 3: Use of social media during an emergency

The evidence from the case study analysis shows that the use of social media by citizens and some emergency services had positive impacts particularly during and after the flooding emergencies. The key impacts of the use of social media in the flooding emergencies analysed can be summarized as follows:

- More efficient and effective co-ordination of information by volunteers, often in real-time, on events related to the flooding
- More effective and fast dissemination/broadcasting of timely information on what was happening more widely by emergency services and volunteers
- Providing emotional support and solidarity, particularly among citizens

Given the relatively low use of social media by emergency services in the flooding case studies, case study wave 3 therefore focused on eight specific services or authorities in which particular tools were used to collect and analyse social media data. We were particularly interested in i) examples of emergency services that had embedded the use of social media in their organisational structures, systems and practice ii) specific platforms and technologies that were being used by emergency services iii) examples of real emergencies that illustrated i) and ii).

The case study analysis shows that the case study organisations used a combination of free and paid-for tools to access and analyse social media. Coosto is reported as simple to use, automated and provides comprehensive searching, and has a support service that is seen as very useful and effective. In other cases free data management and analysis tools, such as Tweetdeck or Hootsuite were used, but only 'on demand', in emergency situations. One disadvantage of some of the commercial tools such as Coosto in particular is that they have been developed as commercial tools mainly for use in communication and marketing scenarios. This means that they are not designed with the aim of finding appropriate, timely and relevant information for emergency scenarios.

The case studies also showed that social media data is seen as providing useful information relating to three main categories: information, behaviour and sense-making. By interrogating the information coming in through social media according to these three types, social media analysts can make a distinction in an emergency situation between people who are actually affected; people who think they are affected and people who are not directly affected. Collecting and analysing social media data effectively before, during and after an emergency relies heavily on specialist social media to provide the technical expertise necessary to support emergency services and similar agencies in crisis situations.

The impact of social media in emergencies is enhanced when social media is incorporated within broader systems and processes aimed at supporting transparency and open government. On the whole, the case studies show relatively modest organisational resistance to the incorporation of social media into emergency service systems and practices. This is because in all of the cases analysed buy-in and ownership of social media strategy happened at the top level. Where suspicion of and resistance to the use of social media was encountered, it was at grass roots level. This was effectively addressed through awareness-raising campaigns, education and training programmes and, crucially, demonstrating to front-line staff that social media gets results.

The case studies showed that the main barriers to the wider implementation of social media in these emergency services are:

- the cost of commercial social media analysis tools
- difficulties in using the analysis tools in particular in relation to choosing the right search terms to identify relevant information
- some emergency services staff not fully understanding the 'world' of social media, the language used in it and how it operates
- a residual organisational culture in emergency services that devalues the contribution of 'non-professionals'
- difficulties in keeping in touch with and responding to developments in social media technologies, their applications and their users
- variability in expertise and experience across agencies and departments, leading to some inconsistency in the quality and usefulness of the social media analysis carried out, and highlighting the need for greater standardization in recruitment and training and the application of some kind of quality assurance system for social media analysis.

The case study analysis highlighted four main lessons that have implications for the ongoing design and exploitation of the EmerGent tools and resources: that there are now many rival tools available to analyse and manage social media data; that such tools are used to provide different types of information to emergency services including situational awareness, behaviour and emotions; training in using and analysing social media needs to be directed at

the right staff; and finally that guidelines on using social media need to be tailored to the existing levels and types of social media use among emergency services staff.

The overall methodology of WP2 as presented in Deliverable 2.1 was based on the Theory of Change in order to explore the expected impacts of social media in general, and the EmerGent project more specifically, on citizens and emergency services. The evidence from each successive wave of case studies was used to update this Theory of Change, and concluded with a contribution analysis in Deliverable 2.4 to explore the impact of the project overall relative to its different aims and objectives. The contribution analysis showed that EmerGent's Theory of Change was coherent, and relatively plausible, though all of the assumptions embedded in the Theory of Change can be questioned to some degree. The primary explanatory mechanisms embedded in EmerGent's Theory of Change are largely supported by the evidence. This evidence suggests that the activities carried out in the project are likely to lead to its desired outcomes and goals, although the contribution analysis highlights some implications for future exploitation and sustainability of EmerGent. These include that:

- the likely impact of the EmerGent tools will vary depending on the cultural and organisational context in which they are used. EmerGent therefore needs to take account of changes in social media technologies, which reflect greater differentiation in the use of different services by different groups for different purposes
- the organisational culture of a service will shape how social media tools are embedded in the organisation's emergency management processes / procedures, and hence the impact EmerGent tools are likely to have. EmerGent needs to ensure that the EIS, App and Guidelines reflect the typology of 'whole system enthusiasts', 'bottom up enthusiasts', 'top down professionals' and 'worried pragmatists' identified by the impacts work carried out
- to improve situational awareness the EmerGent tools need to be able to identify the geographical source of information, and reduce the amount of irrelevant information gathered. The EmerGent system needs to be able to handle search strings to strike a balance between general categories (e.g. capturing information about 'fires' 'floods' etc.) but also to reflect local contextual conditions, particularly the geography of the area in which the tools are being used
- given emergency services' apparent lack of support for an EmerGent 'App', more work needs to be done to identify the potential value of an App for emergency services and citizens, and how this value could be realized
- more attention needs to be paid to how the EmerGent tools can be used to help integrate social media and traditional media within the systems of emergency services
- if the EmerGent guidelines are going to effect change, they have to cater for a range of experiences and needs
- in order to help emergency services use the tools provided by EmerGent they need to be provided with help and guidance on how to do this, including advice and support to acquire the specialist skills needed to use the tools.
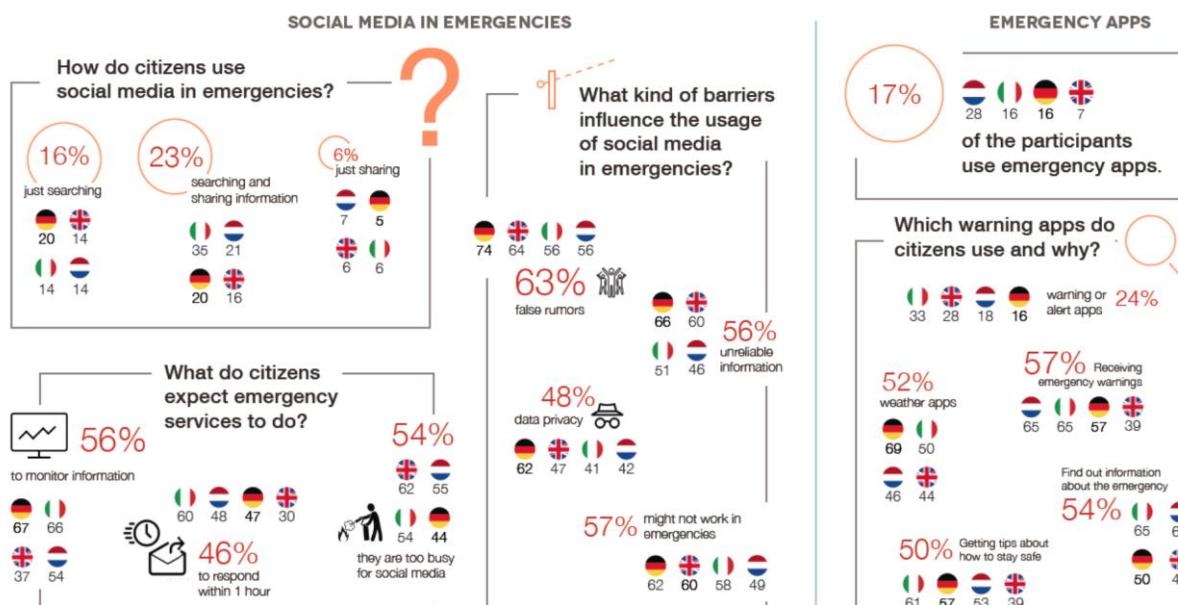
Figure 4 Infographic of the comparative study

4.1.2   WP3 Analysis of Social Media in Emergencies Today and Tomorrow

The objective of WP3 was to focus on the continuous analysis of social media in emergencies in order to identify the potentials of new communication media at all phases in the EMC. The analysis of both EMS processes and social media should provide a foundation for the following questions: Which stakeholders have to be considered? How is the information flow designed and which communication channels are used? Which events and patterns of social media use should be investigated? What kind and quality of information is needed? Based on those questions this WP aimed to define the requirements for the project.

Results on Current Use of Social Media in Emergencies (T3.1)

We have researched Social Media usage before, during and after emergencies. The analysis is based on a comprehensive study of the Social Media related behaviour of authorities (among EMS) and the public in past emergencies.

Based on a study of social media use in various emergencies we provide insights into the current use of Social Media in emergencies. This includes a discussion of a wide range of recent papers on this topic leading to *usage patterns*, a typology of Social Media usage in crisis management and *role patterns*, the different types of Social Media users during an emergency, examples and typologies of data quality problems as well as approaches for resolving these problems, an overview of the various other related projects relevant to EmerGent and results of own interviews with authorities about their current and prospective use of Social Media.

Social media constitute a direct and fast channel for communicating with the public and spreading accurate and trusted information, especially during emergencies, when it is even more important for people to have access to trusted information. Social media provide a possibility for bi-directional communication and are currently used in most of the cases. However, the current practice shows higher use of broadcasting information to citizens, rather than responding to individual cases.

The use of social media during the different stages of an emergency management cycle highlighted the importance of information gathering and validation. This is considered as one of the great challenges in the use of social media and in some cases it may prevent or restrict further use. To overcome this barrier, an alternative model of operation is explored by some authorities, where the purpose of using social media is divided into use for operational purpose versus informational purpose, or use during an emergency versus use during normal operation. The emerging difficulty in handling social media data streams triggers the need for supporting these processes with applicable tools. Authorities already experiment with the use of different tools, although the current study reports a lack of clear understanding of what tool to use or which tool is more suitable in which situation.

While implementation strategies or models for integration with current workflows are clearly interesting topics and some authorities currently explore or discuss different options, no clear or documented plans or goals were identified. Interviewees were not active in the research field of social media and emergency management. However, all shared an interest to follow the advances of this theme and expect the importance of social media in emergencies to rise in the future.

Publications:

Reuter, C., & Kaufhold, M.-A. (2018). Fifteen Years of Social Media in Emergencies: A Retrospective Review and Future Directions for Crisis Informatics. Journal of Contingencies and Crisis Management (JCCM), 26(1).

Reuter, C. (2015). Der Einsatz sozialer Medien in Katastrophenlagen. Crisis Prevention – Fachmagazin Für Innere Sicherheit, Bevölkerungsschutz Und Katastrophenhilfe, 5(4), 43–44.

Findings on Processes and Interoperable Tools within EMS (Task 3.2)

The results of semi-structured interviews done with representatives of the main types of EMS (Police, Fire and Rescue Service, Medical Service, PSAP) from Belgium, Germany, the Netherlands, Norway, Slovenia and Poland reveal that only one-directional communication via Social Media, namely from Authority to Citizens, currently dominates the existing information flows. The reasons for this include a lack of operators skilled in Social Media and insufficient user-friendly software solutions that would combine gathering and forwarding information to citizens. The interviewees stated that a better Social Media integration into existing workflows of the EMS would require user friendly, easy software using most common protocols and standards that will monitor and gather relevant data from the citizens or even disseminate data before, during and after emergencies.

The state-of-the-art analysis of the current tools for receiving and providing information via Social Media indicates that integration into the current generation of C&C systems could hardly be done. This is due to the fact that the tools, no matter how sophisticated the software is, have technical limitations regarding information exchange with typically monolithic structured C&C systems. The choice to integrate software at the inbound and outbound interfaces of C&C systems that analyses data and detect relevant information about emergencies could be a sound technical solution to avoid a radical change in currently used C&C solutions. Standard data formats for information exchange between EmerGent and EMS should be a relevant aspect for defining the information routing requirements.

Publications:

Kaufhold, M.-A., & Reuter, C. (2017). The Impact of Social Media in Emergencies: A Case Study with the Fire Department of Frankfurt. In T. Comes, F. Bénaben, C. Hanachi, & M. Lauras (Eds.), *Proceedings of Information*

Systems for Crisis Response and Management (ISCRAM) (pp. 603–612). Albi, France. Retrieved from http://idl.iscram.org/files/marc-andrekaufhold/2017/1494_Marc-AndreKaufhold+ChristianReuter2017.pdf

Findings on Interfaces to Mobile Devices and Major Social Network Providers (Task 3.3)

D3.3 provided insights into the technical analysis of social media in emergencies; this includes a review of different OSN's policies for both end users and developers, characterization of technical limitations and potentials of existing social networks, design issues based on existing limitations, a situation aware design in mobile apps, a useful overview of strategies for design patterns and interaction design, a constructive discussion on capturing and sharing relevant information for EMS using OSN and the need to provide direct communication channels between the citizens and EMS.

Technical shortcomings of selected existing OSNs: Access to information from social media is generally possible. Besides mere statistical data, such as profile information, it is possible to request additional information about the connection of users and groups. The technical possibilities for integrating other applications are widely diversified by the provider; especially in the mobile sector the trend goes towards mobile SDKs, which make standard functionalities of the social networks accessible to each type of program similar to Facebook's "Like" button. The access to internal data is subjected to security measures such as the OAuth protocol. The protection of personal data is in the foreground so that access to it must be approved by the users themselves. In addition to safety aspects, the use of these services is only possible in the context of the granted query rate. If, for example, a search query met the capacity in a specific time interval, the use would only be possible after the end of this interval. These rate limits are dynamic for many requests and systems; if the given number of possible requests is not sufficient, it will be necessary to make a separate request to the system owner. It is required to provide detailed information to the relevant application and provide access to this. However, the limitations allow the connection of different services of the individual networks. Thus, not only the exchange between the networks, but also the collection and dissemination of information according to quality and relevance become possible.

Design patterns for citizens' targeted information: Design patterns are used to describe best practices and effective design solutions, and to capture and share design knowledge with other people faced with the same problem and context. Supporting collaboration across authorities and citizens in complex and time-critical situations is extremely challenging. Designing suitable interfaces and interactions is a vital aspect for enabling actors to deal with this complexity. Moreover, the significance of situation awareness in designing mobile apps is discussed in this section. In T3.4, design patterns and interaction issues related to mobile devices are combined with the gathered requirements to scope out the most relevant requirements for the intended purpose.

Need for distinctive interface for the mobile EmerGent apps: Considering the state of the art, it becomes clear that there aren't applications covering all phases of EMC at the same time, and that the one existing generally introduces new methods for sharing information taking advantage of last generation smartphones.

Publications:

Reuter, C., & Scholl, S. (2014). Technical Limitations for Designing Applications for Social Media. In M. Koch, A. Butz, & J. Schlichter (Eds.), Mensch & Computer: Workshopband (pp. 131–140). München, Germany, Germany: Oldenbourg-Verlag.

Kaufhold, M.-A., Reuter, C., Ludwig, T., & Scholl, S. (2017). Social Media Analytics: Eine Marktstudie im Krisenmanagement. In M. Eibl & M. Gaedke (Eds.), *INFORMATIK 2017, Lecture Notes in Informatics (LNI), Gesellschaft für Informatik*. Bonn.

Reuter, C., Ludwig, T., Kotthaus, C., Kaufhold, M.-A., Radziewski, E. von, & Pipek, V. (2016). Big Data in a Crisis? Creating Social Media Datasets for Emergency Management Research. *I-Com: Journal of Interactive Media*, *15*(3), 249–264. https://doi.org/https://doi.org/10.1515/icom-2016-0036

Requirements (Task 3.4)

We created a description of the "requirements engineering methodology" applied in EmerGent. The document also presents first versions of conceptual, technical, visual and user requirements for including social media in the emergency management for both ES and citizens.

The requirements for a system are the descriptions of what the system should do—the services that it provides and the constraints on its operation. Requirements engineering is one of the earliest phases of software development and has the maximum impact on the product in the long run. Hence, properly collected requirements have great influence on the design phase of software development. The EmerGent requirements engineering process was based on a use case driven approach, involving both EmerGent end-users and technology providers who are part of the consortium as well as End User Advisory Board (EAB) members. Two scenarios form the basis for the identification and development of use cases and requirements. This process has culminated in a number of specific requirements that can be used as the basis of the software development process.

In the second period, we created an updated description of the "requirements engineering methodology" applied in EmerGent. The document also presents the second version of user requirements for including social media in the emergency management for both ES and citizens.

Potentials of Social Media and Citizens Involvement for Emergency Services (Task 3.5+3.6)

Results from our surveys: Based on quantitative and qualitative surveys with emergency services we have found that the majority of Emergency Service staff has positive attitudes towards the use of social media for both private and organizational purposes. However, there are significant differences in the attitudes among different types of Emergency Service staff, in terms of their gender, age, and geographical location – thus, female, young staff and those based in countries with high levels of social media use are, on average, significantly more likely to express positive attitudes towards the use of social media for both private and organizational purposes. More than 50% of the survey participants use social media in many ways before and during emergencies at least sometimes; of these, they are currently most likely to use social media to share information with the public about how to avoid accidents or emergencies – however, only 16% of the survey participants indicate that they do this often. According to around half of the survey participants, social media are used by their organizations to receive messages from the public during emergencies at least sometimes; but only 5% state that this happens in their organizations often.

Results of the Evaluation of the Interface: The participants expressed their feedback to the system. The majority of the participants expressed a positive attitude towards the presented application seeing potential as it can support them in their work. Only a few don't think it would be helpful, mostly because they don't have the time to use it or are not familiar with social media at all. According to the first evaluation, the forwarding of information is one of

the most appreciated features and the interviewees already wished for its extension to enable the communication with other services and organizations involved in crisis situations. Another positively perceived feature is filtering. Filtering the social media input helps dealing with the massive amount of posts and therefore enables the users to focus on the helpful information. Nevertheless, the participants think that this might also be problematic, as an automatic system cannot replace the human expertise and might therefore lead to missing important information. Most participants were not able to answer the question about the EmerGent notification because it was not visible. The main challenge and problem of social media use in general, in Emergency Services and in crisis situations at all, is the risk of false information. The interviewees expressed that concern repeatedly and said that it could cause panic.
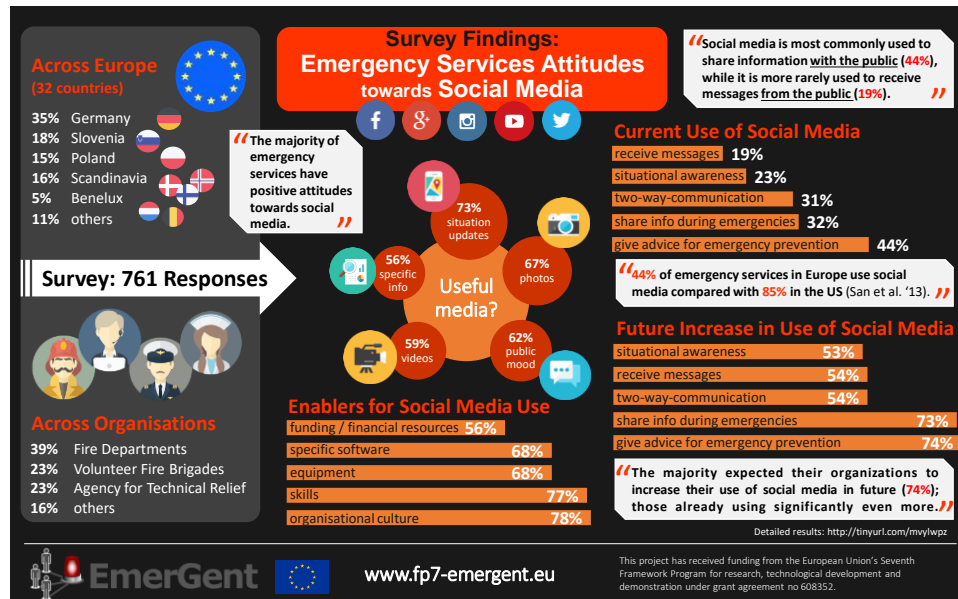
Figure 5 Infographic of the emergency service survey

Summary:

- Summary on statistics on current social media use across Europe
- Identification of potentials for social media in emergencies from the consortium
- Results of the survey on potentials of social media in emergencies with 700 participants including qualitative and quantitative results
- Translation and distribution of survey results

Publications:

Reuter, C., & Spielhofer, T. (2017). Towards Social Resilience: A Quantitative and Qualitative Survey on Citizens' Perception of Social Media in Emergencies in Europe. *Journal Technological Forecasting and Social Change (TFSC)*, *121*, 168–180.

Reuter, C., Ludwig, T., Kaufhold, M.-A., & Spielhofer, T. (2016). Emergency Services Attitudes towards Social Media: A Quantitative and Qualitative Survey across Europe. *International Journal on Human-Computer Studies (IJHCS)*, *95*, 96–111.

Reuter, C., Amelunxen, C., & Moi, M. (2016). Semi-Automatic Alerts and Notifications for Emergency Services based on Cross-Platform Social Media Data –Evaluation of a Prototype. In H. C. Mayr & M. Pinzger (Eds.), *Informatik 2016: von Menschen für Menschen*. Klagenfurt: GI-Edition-Lecture Notes in Informatics (LNI)

Reuter, C., Kaufhold, M.-A., Leopold, I., & Knipp, H. (2017). Informing the Population: Mobile Warning Apps. In M. Klafft (Ed.), *Risk and Crisis Communication in Disaster Prevention and Management* (pp. 31–41). epubli. Retrieved from http://publica.fraunhofer.de/eprints/urn_nbn_de_0011-n-4527283.pdf#page=35

Reuter, C., Kaufhold, M.-A., Leopold, I., & Knipp, H. (2017). Katwarn, NINA or FEMA? Multi-Method Study on Distribution, Use and Public Views on Crisis Apps. In *European Conference on Information Systems (ECIS)*. Guimarães, Portugal. Retrieved from http://aisel.aisnet.org/ecis2017_rp/139/

Kaufhold, M.-A., Reuter, C., & Stefan, M. (2017). Gesellschaftliche Herausforderungen des Missbrauchs von Bots und sozialen Medien. In *Mensch & Computer 2017: Workshopband* (p. accepted). Regensburg, Germany: Gesellschaft für Informatik e.V.

Reuter, C., Pätsch, K., & Runft, E. (2017). IT for Peace? Fighting Against Terrorism in Social Media – An Explorative Twitter Study. *I-Com: Journal of Interactive Media*, *16*(2).

Reuter, C., Kaufhold, M.-A., & Steinfort, R. (2017). Rumors, Fake News and Social Bots in Conflicts and Emergencies: Towards a Model for Believability in Social Media. In T. Comes, F. Bénaben, C. Hanachi, & M. Lauras (Eds.), *Proceedings of the Information Systems for Crisis Response and Management (ISCRAM)* (pp. 583–591). Albi, France.

Kaufhold, M.-A., & Reuter, C. (2016). The Self-Organization of Digital Volunteers across Social Media: The Case of the 2013 European Floods in Germany. *Journal of Homeland Security and Emergency Management (JHSEM)*, *13*(1), 137–166.

Reuter, C., Pätsch, K., & Runft, E. (2016). Terrorismus und soziale Medien – Propaganda und Gegenpropaganda. In W. Prinz, J. Borchers, & M. Jarke (Eds.), *Mensch & Computer: Tagungsband*. Aachen, Germany: Gesellschaft für Informatik e.V.

4.1.3 WP4 Information Mining and Information Quality

The objectives of this WP was to analyse the nature and usefulness of the information from social media data sources, and exploring the opportunities for refining the information into a more useful form for further processing. The WP focused primarily on extracting and refining information present in social media streams. The overall objective was to define a tool which transforms high volume data, into low volume but rich information content (See Figure 6). During the project runtime WP4 was strongly connected to other WPs like WP5 and WP6.
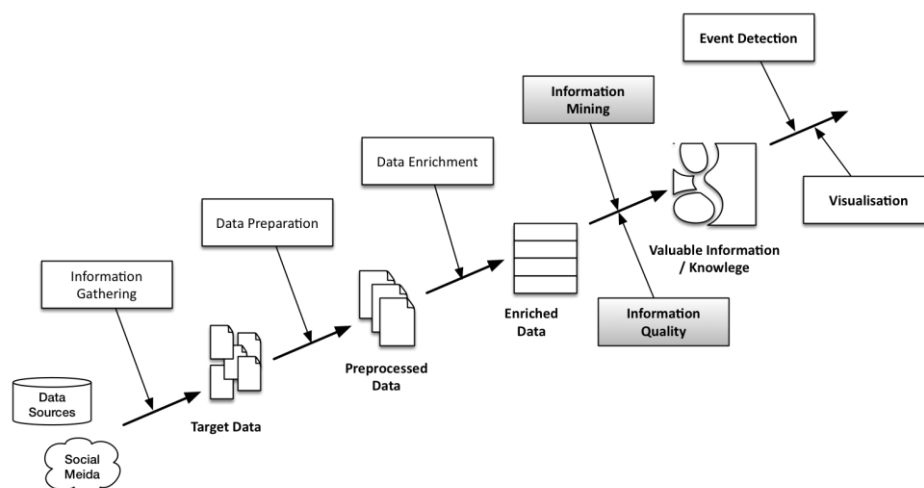
Figure 6 Simplified process for processing and analyzing SM data

Summary of the main outcomes:

- Information mining methods to enrich and classify social media data before during and after emergencies.
- Evaluated IQ Framework to estimate IQ on social media data
- Semantic data model to structure and understand information from social media in a structured way
- Framework to visualize data from social media data streams.

Information Mining

During this task, we assessed techniques that were implemented for extracting and refining information present in social media streams, as well as providing guidance for our next steps. Regarding their strengths and weaknesses as demonstrated by their application to test data, as well as their context in the field as a whole, we have chosen algorithms and we informed about them in D4.4. Moreover, we showed the benefits of the algorithms we have implemented, to emergency services. F.i. we used a test case of flooding in the UK to evaluate our implementation. We captured a subset of Twitter data using the public Twitter API between 25 November 2015 and 13 January 2016 (inclusive) which were in English and contained any of the following phrases:

- Flood[1];
- Heavy rain;
- Stormy weather.

Over this fifty day period, we collected a total of 970,106 tweets. From this collection of tweets, we created two random sets of 1,000 tweets each: (i) a training set and (ii) a testing set. We used our training set of data to train our Naïve Bayes Classifier for information classification. Following this, we used the classifier to label our test set of data. For our test data, we compared the classification labels to those determined manually. A summary of our results can be seen in Table 2. We find that 76.1% of our tweets have been correctly labelled by the classifier, when compared to our manual labels. These success rates are similar to those of other text classification studies in the literature [ICLM14].

Category	Automated label	Manual label	Proportion
True Positive	Not spam	Not spam	31.9%
True Negative	Spam	Spam	44.2%
False Positive	Not spam	Spam	20.6%
False Negative	Spam	Not spam	3.3%

Table 2: Comparing manual and automatic labelling for a set of tweets

Examining the results, it is particularly striking that we see a large number of false positives, but a low number of false negatives. One of the main reasons we are getting a large number of false positives is that many messages are about flooding outside the UK, thus have a lot of similarities with messages about flooding in the UK. If we only use posts with geotags, we could eradicate messages from outside the UK easily. The other reason we got more false positives is that, if we have not seen any of the words in a message (aside from the keyword), it is automatically classified as "not spam" to avoid losing potentially relevant information. It is more important that emergency services do not miss important tweets than encounter some irrelevant tweets. This emphasis on reducing false negatives at the expense of including false positives is specific to our ES users; this approach would not be considered with brand

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[1] This includes any words for which flood is the stem, e.g. flooding or flooded.

management tools. Future activities with our end users should confirm this approach. Even with the large number of false positives included, we have reduced the number of tweets the ES need to examine by 44%. More details can be found in the deliverables of WP4.

Information Quality

Regarding the overall approach in EmerGent for designing the EmerGent IT-System we decided to develop the IQ Framework based on existing knowledge from the literature, user requirements, use cases as well as results from workshops with experts that were performed within the project lifecycle. We evaluated the performance of the IQ graph regarding correct ratings. Therefore, we let three human experts rate the IQ of posts belonging to a real-world incident. We then compared the human ratings with the automatic ratings of IQ supported by machine learning. The performance in our experiment was above average. The IQ framework to compute IQ is in shown in Figure 7.
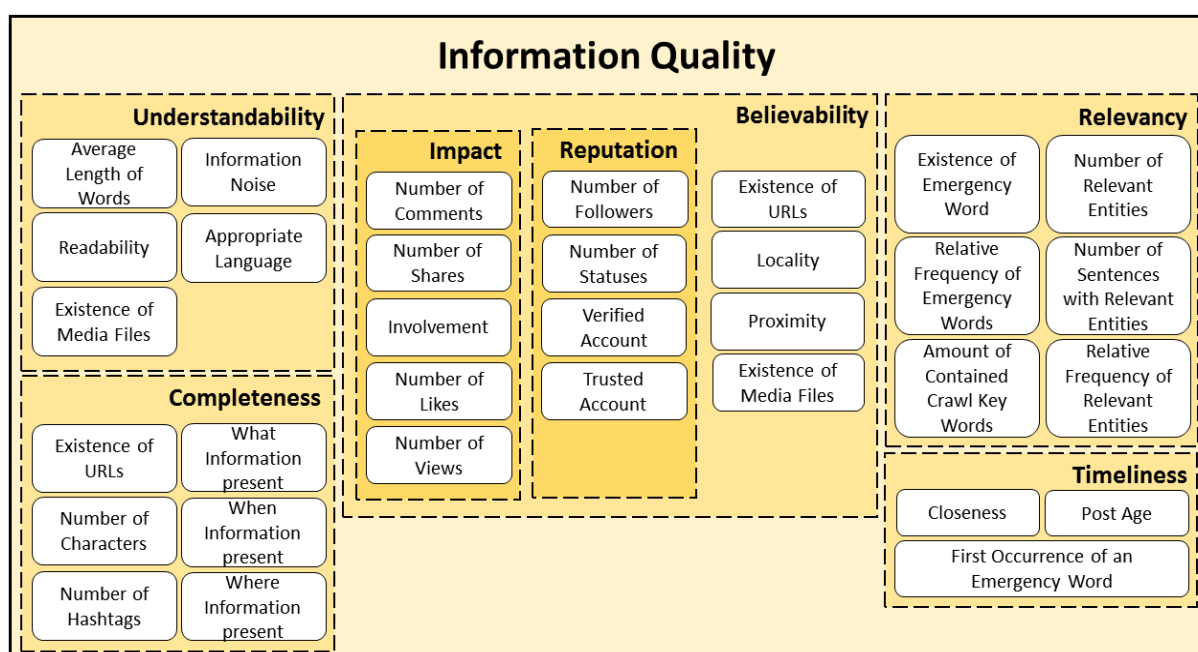
Figure 7: Information Quality Framework for EmerGent

To evaluate how well machine learning algorithms (and, by extension, the EmerGent IQ framework) can rate the IQ value of posts, the machine learning software Weka[2] was used. For each rater, different configuration options of the Multilayer Perceptron were evaluated. The configurations were:

1. Training time: 500, Number of decimal places: 2, Layers: 1 (Weka's default configuration)
2. Training time: 1000, Number of decimal places: 4, Layers: 1
3. Training time: 2000, Number of decimal places: 4, Layers: 2

The result of this evaluation is shown in Table 3. We highlighted the best configuration for each rater in green. We measured the performance of the learned IQ graph in terms of accuracy. The accuracy is the relative frequency of posts that are rated correctly by the IQ graph according to the expert. It can be seen that the accuracy of the neural network depends highly on the training data that was created by each expert. For Expert A, it managed to classify

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[2] https://sourceforge.net/projects/weka/

ca. 59% of the posts correctly, for Experts N and R ca. 65%. Further details can be found in D4.5.

Table 3: Accuracy of different backpropagation configurations for each expert

	Expert A	Expert N	Expert R
Configuration 1	57.1%	64%	66.3%
Configuration 2	59.1%	65%	65.1%
Configuration 3	58.6%	65.4%	65.6%

Semantic Data Model

The EmerGent ontology is used to model all data that is related to the project (see Figure 8). It defines the schema to structure extracted domain knowledge from social media. Since this information represents several different domains, the ontology consists of different parts. These different parts describe information from, e.g. social media and alerts. The EmerGent ontology fulfils, especially due to using existing standards, ontologies and EmerGent alerts, all requirements that were placed in it by citizens and authorities.
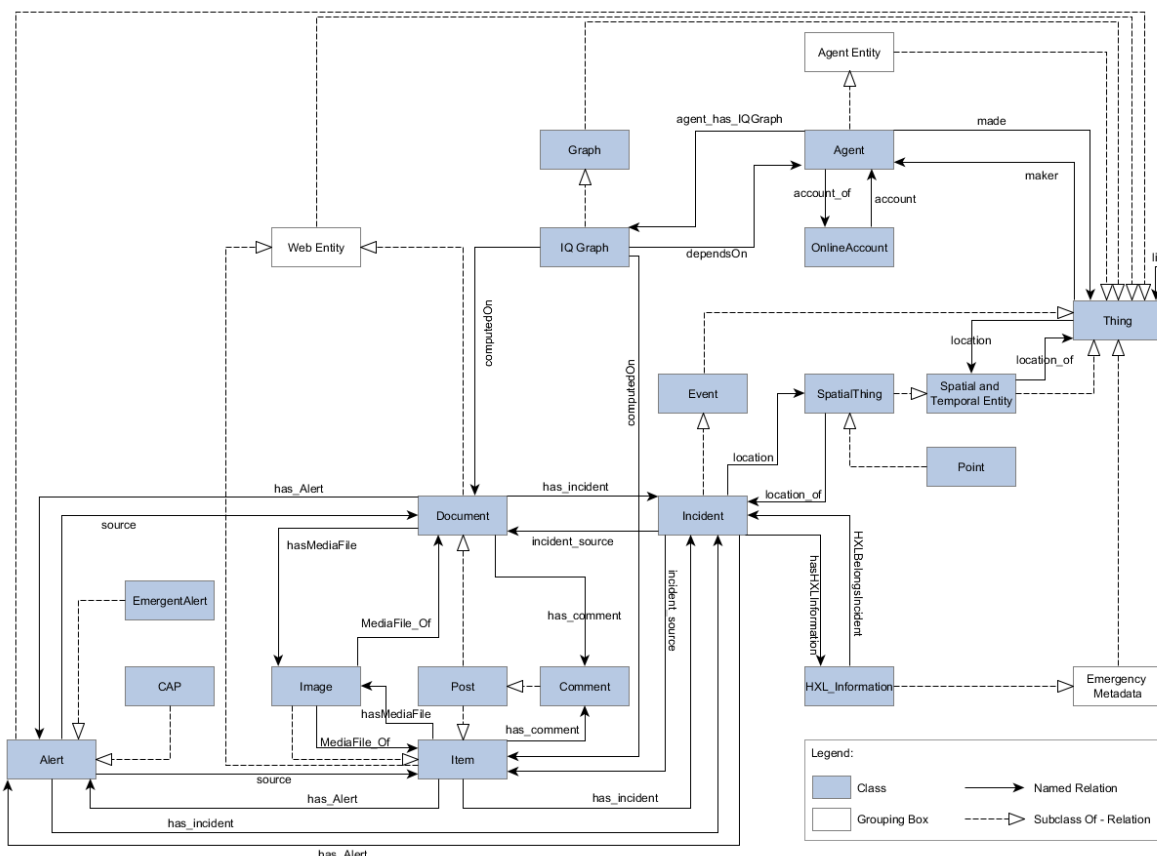
Figure 8 Main classes of the EmerGent ontology

Since the objective is to increase the information interoperability on a conceptual and IT-level, the EmerGent ontology and the *SemanticDataStore* rely on existing standards rather than creating completely new standards. These standards have been described and evaluated

based on their scalability. The conclusions drawn from this led to the creation of the *SemanticDataStore* as it is already implemented in EmerGent which uses the openRDF Sesame Framework together with BigData from Blazegraph in order to have a fast RDF-Storage backend combined with a powerful API supporting common W3C standards to process RDF data. Benchmarking was conducted, as the goal was to create the *SemanticDataStore* as a good performing graph based database in terms of scalability. In this benchmark different types of queries were defined, some of which being efficient, others not. The storage system was tested with realistic workloads of use case motivated queries.

Development of IT for information mining and information quality

Based on the research done a software subsystem called Processing and Analysis Subsystem (PAS) has been developed in order to show the positive and negative impact of social media usage in emergencies like riots, flooding's or fires.

The Processing and Analysis Subsystem of EmerGent acts to extract the key information from SM messages and creates relevant alerts that can be sent to ES. An outline of this subsystem, and its main interactions with other subsystems of EmerGent, can be seen in Figure 9. The PAS components are shown in black whilst other EmerGent components are depicted in grey. All components in the subsystem are controlled by a central controller via RESTful web services.
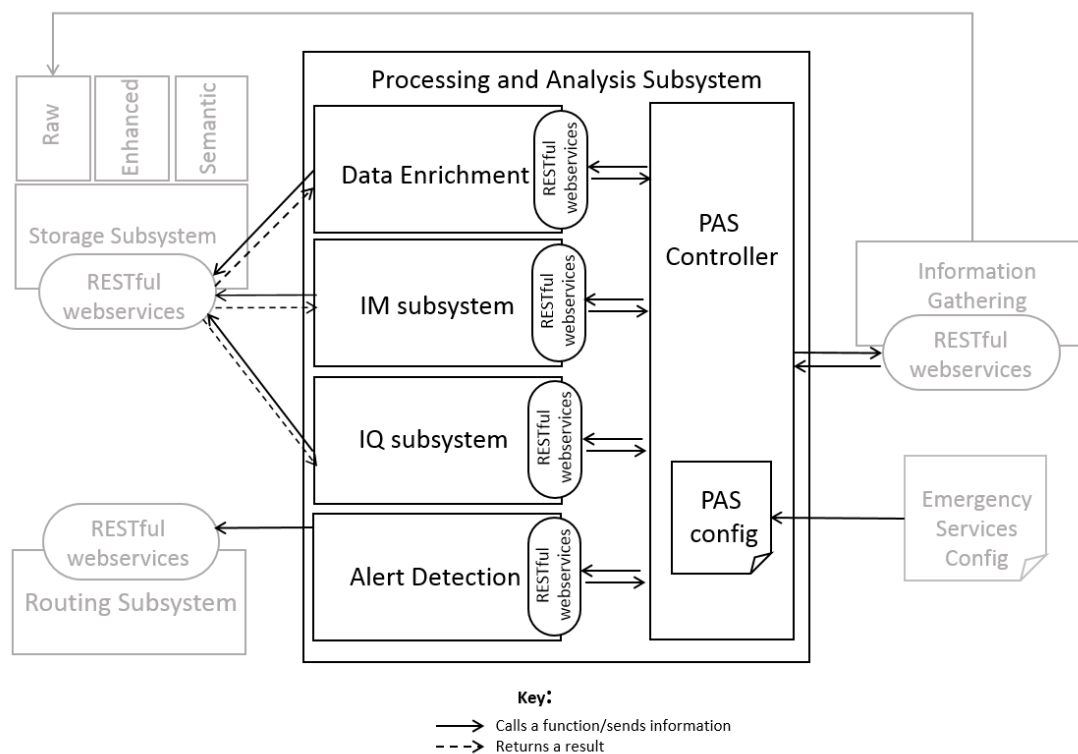
Figure 9: PAS within EmerGent

4.1.4   WP5 Information Collection and Presentation

It was the objective of WP5 to research and specify appropriate APIs for gathering data from Social Media. The goal was to be able to acquire data both from public streams and also from approved private streams. To allow the transferring of messages to ES, routing mechanisms were to be designed and implemented. Regarding the reverse direction of transfer, the routing mechanisms also provide support for targeted broadcasts of messages from

Emergency Services to interested citizens. Additionally, the results of the WP were to be implemented in an EmerGent App for smart phones to give the citizens wanting to report a comfortable environment. Information presentation also deals with presenting information in an appropriate way to ES, by targeting the specific needs of ES staff.

Implementation of Social Media API

This part of WP5 aimed to establish a technical basis infrastructure for the following technical EmerGent work packages regarding the access to social media services.

The implementation of Facebook and Twitter access is written in Java and realized as Apache Tomcat server application. Using the Jersey reference implementation of Java API for RESTful Web Services, it provides REST-based endpoints to interact with any client. Endpoint results are returned as JSON documents, processed with the Jettison library. Internally, data structures according the OpenSocial 2.5.1 specification are realized with the OpenSocial Parser, and the Activity Streams 2.0 specification by the OpenSocial reference implementation for Java. The data is processed with the object-relational mapper Hibernate. While Twitter4J provides access to the Twitter REST API, Facebook4J enables the use of the Facebook Graph API in Java. Moreover, Social Media API provides interfaces for implementing other services such as YouTube.

This API enables EmerGent to successfully connect to several social platforms simultaneously and obtain relevant data. Using georeference parameters, such as "latitude", "longitude", and "radius", the API not only enables EmerGent to search social media platforms for keywords, but to search in a specific area as well. Of course, this limits the data to users who have provided location. Additionally, the time can be specified as well, using a "since" parameter. This allows us to specify a date from which data should be gathered. If this parameter is not specified, the earliest messages were more than two months old in some cases.

Routing

Information Routing represents an important concept to link social media (and therefore citizens) to the emergency services. To reach this aim EmerGent is placed between social media and ES C&C systems performing a mediator role in social media oriented C2A and A2C communications. The routing system provides a mechanism that enables EmerGent to forward and address all incoming messages produced by EmerGent Subsystems (like data mining, mobile applications, etc.) as well as by ES to the correct recipients. The system permits us to address alerting messages created by EmerGent (coming from the intelligence analysis of social messages collected) to ES (C2A). On the A2C side, the Routing Subsystem will be used by ES to send emergency messages managed by them, and publish information on social media exploiting EmerGent functionalities.

The design of the Routing Subsystem considers current alerting and emergency data exchange standards (such as CAP and other data formats belonging to the EDXL family of standards), and efforts produced by other EU projects, like REACT (Ref. EmerGent Description of Work) and IDIRA [WWW16]. The aim was to develop communication interfaces that make the integration of existing C&C systems easier to be adopted by ES with EmerGent, and therefore with the social media world. The Routing Subsystem will be the contact point between ES C&C systems and EmerGent.

Requirements for Emergency Mobile App and ES Interface

Based on the results of the corresponding tasks in WP3, requirements for the design and implementation of the mobile application and the emergency service interface were created.

For the engineering of the requirements, a three-step approach, based on the approach used in WP3 was used. During the first step, a scenario from real-life operations was chosen to be illustrated and analysed. In the second step, workshops with end users, development teams and experts were held, where the scenarios and the envisaged use cases where presented, in order to understand different approaches, establish a common understanding and allow interaction with each other. The third stage was to involve a broader community by using an online survey to collect data.

This process resulted in a set of requirements that describes what the mobile application and the emergency interface should do and that had a profound influence during the design phase of both systems.

Emergency Service Interface

The Emergency Service Interface (see Figure 10) provides a web based system, which allows emergency services to interact with the EmerGent System and permits them to interact with citizens through the application and social media channels. The interface also shows relevant data, such as recognized alerts. The interface presents automatically detected incidents from social media platforms on a map and groups and summarizes them. Additionally, alerts from the emergency mobile app "112.social" can be seen and directly interacted with, allowing the emergency services to get into direct contact with the reporting citizen. Also, possibilities to broadcast information via 112.social and the different social media platforms are provided.

Using the information quality results calculated by the corresponding subsystems in WP4, the
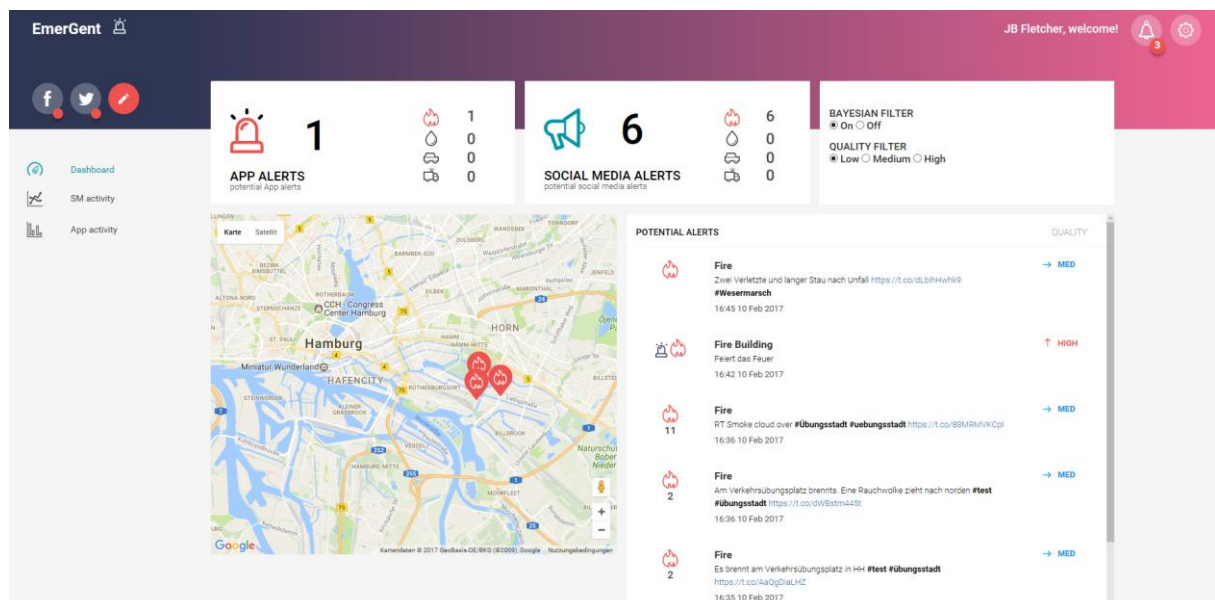
Figure 10: Emergency Service Interface

interface can be used by the emergency services to filter low quality or irrelevant messages.

Emergency Mobile App "112.social"

The Emergency Mobile App enables citizens to report incidents, such as fires, to local authorities, while local authorities have the possibility to broadcast messages to the users. The application is available for iOS and Android through beta program access [Iess17].

The citizens are enabled by the mobile application to share trustworthy information with emergency services (see Figure 11):

- Type of the incident
- Description of the incident
- Location of the incident
- Several types of media files of the incident
  - Images
  - Videos
  - Audio files
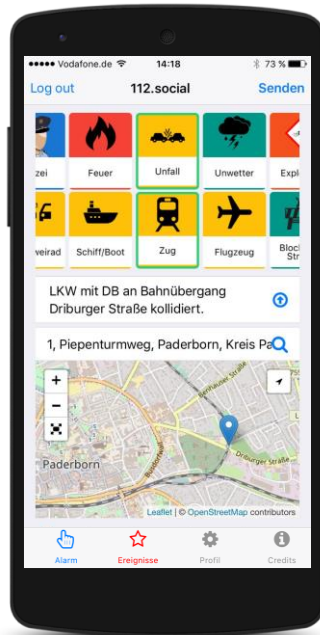
Figure 11: Emergency Mobile App "112.social"

To use 112.social, the user must register using Facebook, Twitter or Google Plus and the application uses information provided by the smartphone, such as location and IMEI. The aim is for the user to give a the description of the event, to generate alerts that are sent into the EmerGent system. The alerts are in accordance with the Common Alerting Protocol Standard published by OASIS [JoSW10] and in comparison to social media alone, provide more trustworthy and helpful information.

Using the routing system mentioned afore, the generated CAP alerts are sent to the correct recipient, e.g. authority, especially depending on the type of reported incident.

4.1.5 WP6 Design and Evaluation of the overall system architecture

The objective of WP6 was to design EmerGent overall system architecture, using a loose-coupled, SOA oriented approach. This included:

- The integration of all EmerGent produced components out of WP4 & WP5 into the EmerGent IT-system, following an agile approach on development.
- The Validation and Evaluation of the overall system against user requirements

The overall system was divided into loosely coupled subsystems. These subsystems were related to specific topics like the processing and analysing social media data streams. F.i. the PAS subsystem was designed to handle this job. After data was gathered from various social media data streams, social media posts were analysed, classified and rated by Information Quality. Due to clearly specified interfaces different sets of subsystems can be used while configuring the system. F.i. if an organization is only interested in gathering data, the system can be configured in that way where only the Storage-Subsystem and the Gathering subsystem are active.
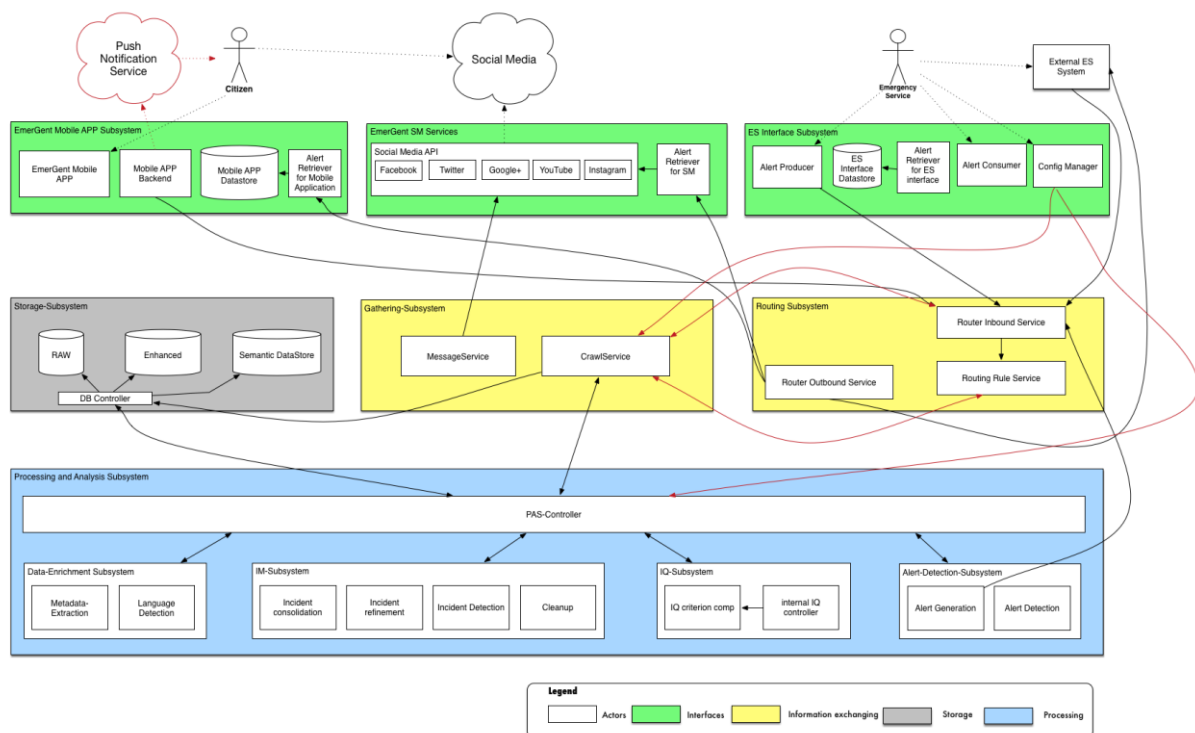
Figure 12 - EmerGent high level architecture (Source: EmerGent / D6.1 with updates highlighted in red)

In Figure 12 the EmerGent architecture with all its subsystems is shown. Details on the design and implementation of the subsystem were specified in deliverables of the work packages WP4 and WP5. The final version of the architecture has been slightly modified to accomplish some specific tasks not foreseen in D6.1 without changing the important foundation of the architecture itself.

The following parts have been updated after the release of D6.1:

- the IG interacts with the IR to read C2A direct messages and improve PAS Controller jobs related to C2A indirect.
- The ES interface provides a settings tool for configuring crawl jobs of the IG and some parameters of the PAS controller.

In addition the previous picture highlights that A2C push notifications are dispatched to citizen's devices through an external push notification service as "Apple Push Notification Service" (APNS) and "Google Cloud Messaging" (GCM).

Beside the design of the overall EmerGent IT-System architecture, 2 validations and 2 evaluations were performed during the project. The Evaluation included field-trails at two European fire brigades. With strong contact to our stakeholders the development has been supported in an iterative way by including feedback within an agile development approach. Details can be found in D6.2, D6.3 and D6.4. Below we briefly outline the results from the second evaluation. Within the project we followed the Design Science Research Cycles approach from [Hevn07]. The DSR is practice-oriented and must "provide methods to organize design and implementation processes in a reflexive and evolutionary way that allows for iteratively revising and improving versions of the system or its modules. It requires sound procedures of iterative design processes and an evolutionary project management which combine methods for modular design, formative evaluation and collective learning in recurring development loops with limited range in order to confine the risks [RSBW09]." For EmerGent our environment was primarily defined by the application domain. The used artefacts were a web interface for ES and a mobile application for citizens. Backend components / subsystems were running in the background. Used foundations were experience & expertise from the consortium and EAB, literature (research papers, reports, and other projects) and knowledge on the development of IT (See Figure 13)
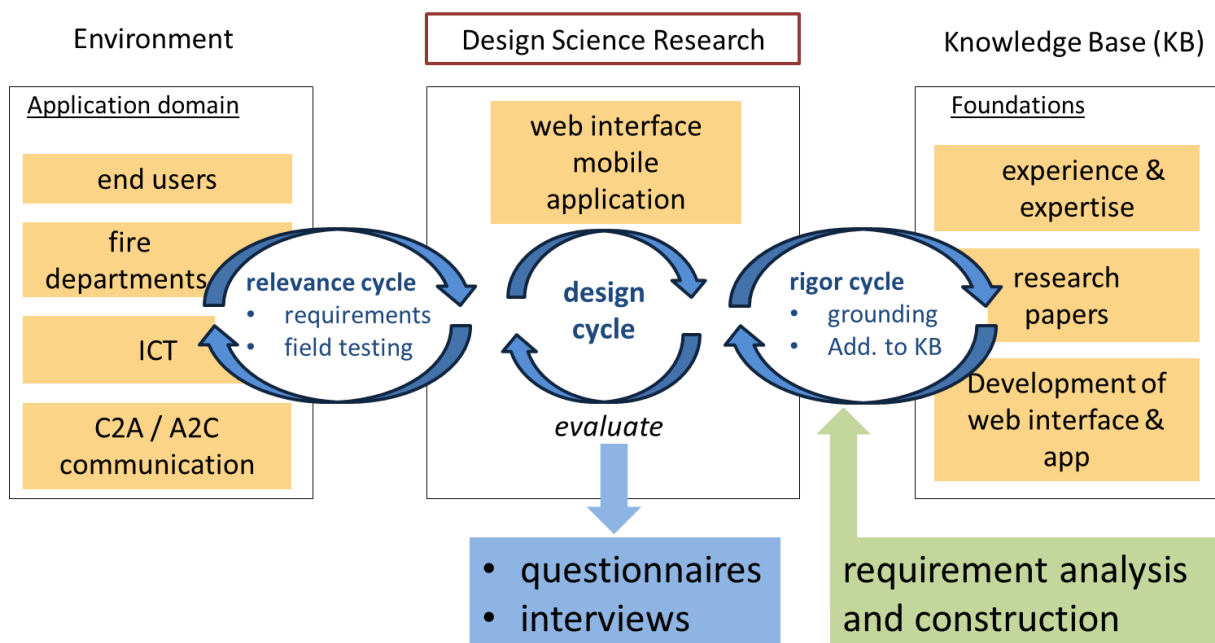
Figure 13. EmerGent in the Design Science Research Cycles, from [Hevn07]

During both evaluations complex question sets were used to gather positive and negative impressions (more than 15 questions). Table 4 provides an overview about the participants in the EmerGent evaluation.

Table 4 Evaluation – Overview about the participants.

	First evaluation	**Second evaluation**	**First App-evaluation**	**Second App-evaluation**
type	interview	interview	questionnaire	questionnaire
Total number	12	19	6	8
gender	12 ♂ / 0 ♀	18 ♂ / 1 ♀	6 ♂ / 0 ♀	6 ♂ / 2 ♀
Organisation *	Fire fighter (12)	Fire fighter (18) Medical (2)	Fire fighter (5) Medical (3)	Research (5) Students (3)
Three main roles *	Incident commander (4) Member of the crew (4) Section leader (3)	Incident commander (8) Member of the crew (8) PSAP supervisor (5)		
Years of experience	15+ (6) 5-14 (5)	15+ (12) 5-14 (5)		
Command level	Bronze (9) Silver (6) Gold (0)	Bronze (7) Silver (8) Gold (3)		

1st & 2nd evaluation addressed the ES-Interface AND the emergency mobile app 112.social
As the app is a new approach, we decided to carry out an additional dedicated app-evaluation.

In the following section we present a small subset of the most interesting findings from the second evaluation. Details on the second evaluation can be found in D6.4. As shown in the table above we performed interviews with more than 25 people.

Results of the Second Evaluation:

How would you evaluate the following functions according to their importance in your job?

It is clear to see that more than 50% of interviewees think that each of the functionalities is medium to maximum important (rating 1 or 2). This can be seen as an encouraging result.

Especially the communication between citizens and authority (C2A) is seen as an added value. In total 10 people rated 1 or 2 for the EMA as well as the filtering and mining through the ESI. But if you have a closer look the interviewees see more importance in the ESI than the EMA. This can maybe be explained by the fact, that there was no real use of the EMA in the field trials. For the authority to citizen (A2C) communication the interviewees preferred the indirect way (9 votes vs. 7 votes for direct). The following figure illustrates the spreading of the results for the answers for question.
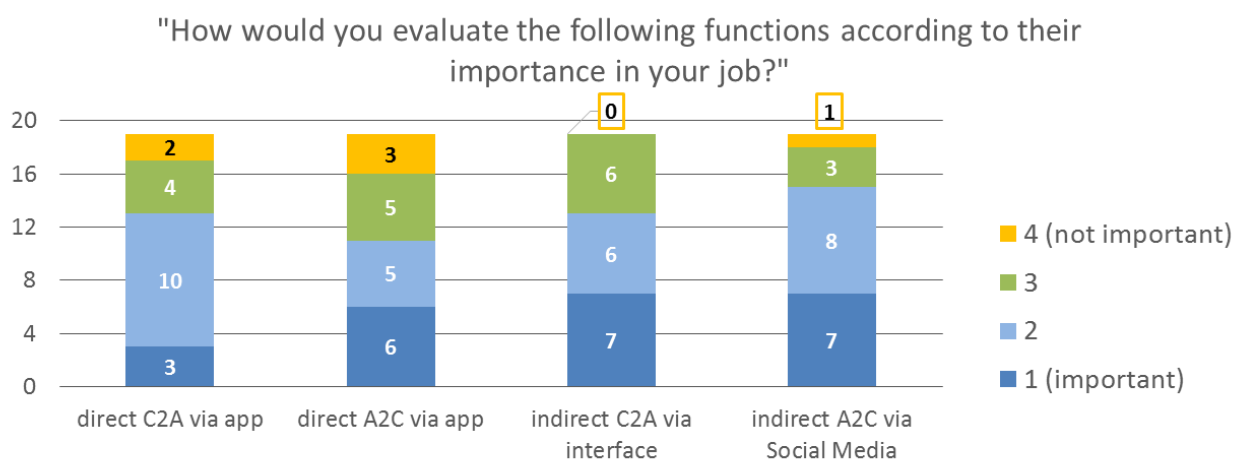
Figure 14 How would you evaluate the following functions according to their importance in your job?

How do you evaluate "Information quality"?

Four participants indicated a huge, further four a moderate and three a small benefit from the information quality component. On the positive side, on high settings, the component was perceived as a filter for the most crucial alerts, worked reliable and allowed a focus on important results. Thus, only a small amount of misclassification was observed. Two participants observed that, in tendency, authorities' and media messages were assigned with a higher quality than citizens' messages which was seen sceptical since potential eyewitness reports are rated lower and media reports from hours or days ago are rated higher. Moreover, one participant assumed that too many messages were filtered out and thus a performance feedback of (the different layers of filters) is required.

"How do you evaluate 'Information quality'?"[Q01.05]
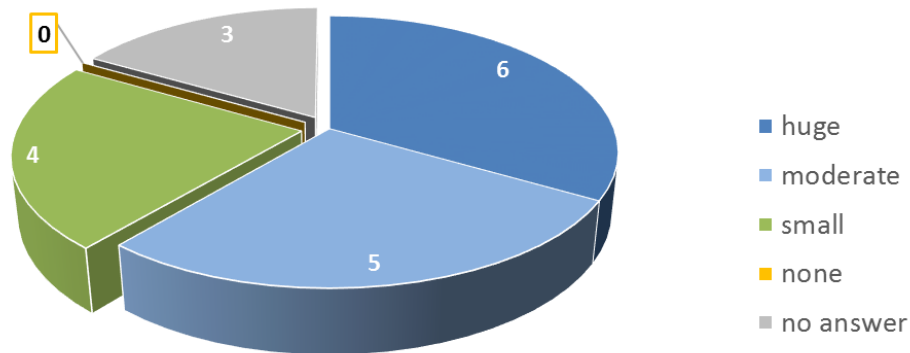
Figure 15 How do you evaluate "Information quality"?

Besides the technical aspects, other participants stated that it is generally difficult to choose relevant information, hard to determine true or false information and impossible to avoid "fake" information. Since a huge benefit was expected, if the component works properly, but a lot of scepticism and potentials of improvement were mentioned, further research should be put into this topic. The figure above illustrates the spreading of the results for the answers for question.

Regarding the mobile app we observed, that most of the implemented and tested features were ranked at least as important. It was quite interesting to see, that the feedback had an overall positive attitude. The following figure provides you an overview of the results.
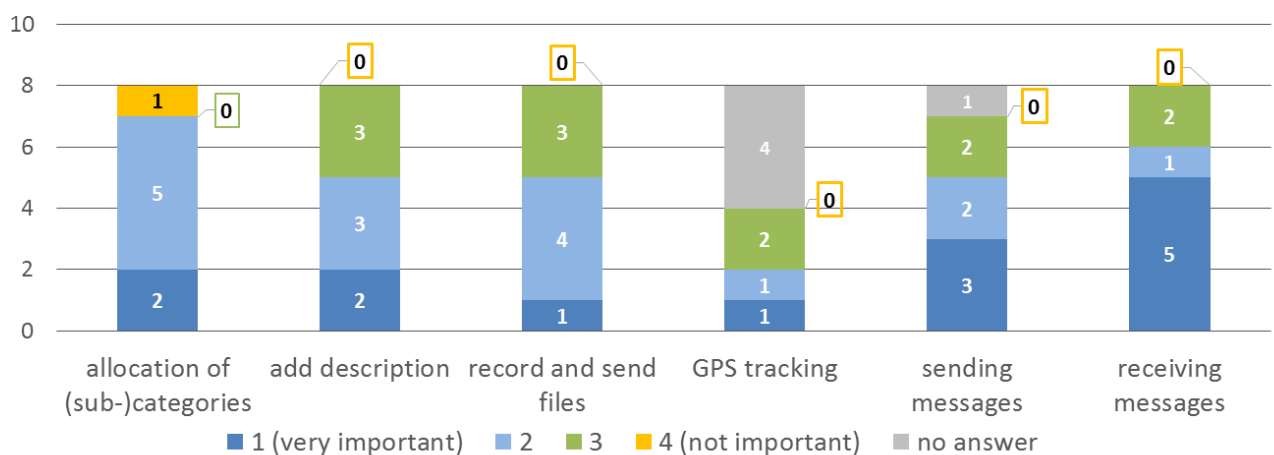
Figure 16 How would you evaluate the following functions according to their importance?

4.1.6 WP7 Guidelines, Dissemination, Exploitation and Ethics

The purpose of WP7 was to deliver a report with the findings of the project, in the form of guidelines for future adoption of social media in the emergency management procedures. Furthermore, this WPs included the following activities:

- Carry out dissemination activities, collect and collate results and outcomes. (See section 4.2 Extended Dissemination)
- Maximise the possible reach of the project findings in as many areas as possible.
- Identification of possible exploitation paths for the project results, both in terms of tools and guidelines.

Guidelines

One of the major outcomes in EmerGent are the guidelines for Emergency Services as well as citizens. The guidelines for Emergency Services are provided in two different versions: a short and brief version and a detailed version. The guidelines are split in four sections corresponding to the phases of an emergency:

- Prepare to start using social media (7 guidelines)
- Before an emergency (5 guidelines)
- During an emergency (6 guidelines)
- After an emergency (2 guidelines)

See Figure 17 for an overview of the different phases. Furthermore, the consortium decided to follow an open source approach. All guidelines are published under CC 4.0:

"You are free to use and extend the guidelines for any purpose, provided an attribution to the EmerGent project is provided. The Guidelines to increase the benefit of social media in emergencies by the EmerGent Consortium are licensed under a Creative Commons Attribution 4.0 International License. "

The guidelines can be accessed at http://www.fp7-emergent.eu/guidelines

Guidelines for Emergency Services

Prepare to start using social media	Before an emergency	During an emergency	After an emergency
1. Consider the legal implications 2. Consider the needs in human and financial resources 3. Prepare a social media strategy 4. Clearly communicate the social media strategy and provide staff training 5. Explore what ICT tools are available for social media monitoring and analysis 6. Use of apps for direct communication (A2C & C2A) 7. Plan the next steps to start using social media	1. Provide information about your organisation, its operations and emergency prevention and preparation 2. Raise awareness on the use of social media 3. Use of ICT tools for social media monitoring and analysis 4. Team up with other groups and organisations 5. Publish alerts for the risk of an upcoming emergency	1. Understand how social media is used by citizens during emergencies 2. Establish communication with the public 3. Request information from the public 4. Use of ICT tools for social media monitoring and analysis 5. Respond to false information & rumours 6. Collaborate with emergent group initiatives, e.g. VOST	1. Continue the communication with the citizens 2. Evaluate your social media use during the emergency **Guidelines for citizens** Additional Content: • Data Protection & Privacy Guidelines for Processing Data • Publication and dissemination of guidelines

Figure 17 Guidelines outline

The guidelines for Citizens are provided in a short graphical version (see Figure 18) and a more detailed version as well. Further information is available in D7.3 and at http://www.fp7-emergent.eu/guidelines/

Figure 18: Graphical version of the citizens guidelines [WWW01]

Dissemination

The dissemination activities carried out by the EmerGent consortium made the project results known widely to all stakeholder audiences. The staff of emergency services and public authorities, companies providing solutions for social media analysis or solutions for emergency services, the research community and academia are amongst the stakeholders of EmerGent. To reach these groups, the consortium established a strong online presence from the beginning of the project through its websites and social media accounts. It produced several dissemination materials for online and offline communication, such as leaflets, poster, videos and infographic. Each item in the list of produced materials contains key messages dedicated to the intended target group. EmerGent aimed to avoid communicating only its deliverables, but strived to extract information from them, transform it into key messages and diffuse it to the intended audience via the most appropriate dissemination channel. Following this approach, the dissemination activities of the project have helped the project raise awareness on the use of social media for emergency management and spark interest in external stakeholders. In addition to the strong online presence, the project consortium has been actively engaged in several publications, including scientific publications and attended several events to represent, present and promote EmerGent. The project's dissemination activities are described in detail in D7.1.

Online Presence

The EmerGent project maintained several online presences: two websites and four social media accounts.

The EmerGent website, available at http://www.fp7-emergent.eu, was set up and launched online at the beginning of the project and represents the project's information hub. All the deliverables and other relevant files, documents, publications, dissemination material and information were made available to all stakeholders via the project website and it also operates as EmerGent's public repository. Background information about the project, its rationale, objectives and achievements are described and it also offers links to the project's social media accounts and its RSS feed.

EmerGent implemented a second website, 112.social, available at http://112.social, parallel to the main project website, as a dedicated web platform to act as a key information point for the dissemination and marketing campaign.

EmerGent uses Twitter and Facebook (see Table 5) to disseminate information in social media. The consortium uses the social media accounts to provide up to date information linked to the project websites and to build a community of stakeholders interested in EmerGent. The use of social media proved to be a very useful method to reach interested stakeholders beyond the project consortium and we received interest from third parties to interact with the EmerGent outputs.

Table 5: EmerGent's Social Media Accounts

Social Media Account	Username
EmerGent on Twitter [WWW02]	@FP7_Emergent
EmerGent in Facebook [WWW03]	@FP7EmerGent

112.social on Twitter [WWW04]	@112Social
112.social in Facebook [WWW05]	@112Social

Marketing Campaign

In addition to our dissemination and exploitation activates, EmerGent performed a marketing campaign on social media to engage citizens during the project. The 112.social website which was developed for this task is a presentation of the main findings of the project customized for a non-research audience. Development of content for the 112.social website was continuous and the findings/results of the research carried out were disseminated through this channel.

The creation of the project videos and infographic work to summarize the project's surveys and guidelines was particularly well received and is now a key tool to disseminate key messages and critical information points going forward.

EmerGent produced three videos. The first video presents the EmerGent architecture and how the four components of EmerGent, information gathering, information routing, information mining and information quality have been implemented in the context of the EmerGent solution. The second video presents what EmerGent is about, its objectives and why it is important to look at the impact of social media in emergencies. The third video presents an overview of the detailed findings of the project studies and aims to raise awareness of the survey findings and the EmerGent guidelines. It directs viewers to the dedicated dissemination web pages for the surveys and the guidelines. All videos are available on the project website, YouTube and Vimeo. A dissemination campaign for the third video was started on 21st August via Twitter (using Tavistock and EmerGent Twitter accounts). This involved sending out 181 direct tweets to contacts, including 151 emergency services, over the following three weeks. The results of this campaign were:

- 455 engagements – including 53 retweets and 55 likes
- 365 views of the video on YouTube
- Positive responses on Twitter from emergency services (see examples below).

Figure 19 Dissemination via Twitter example 1
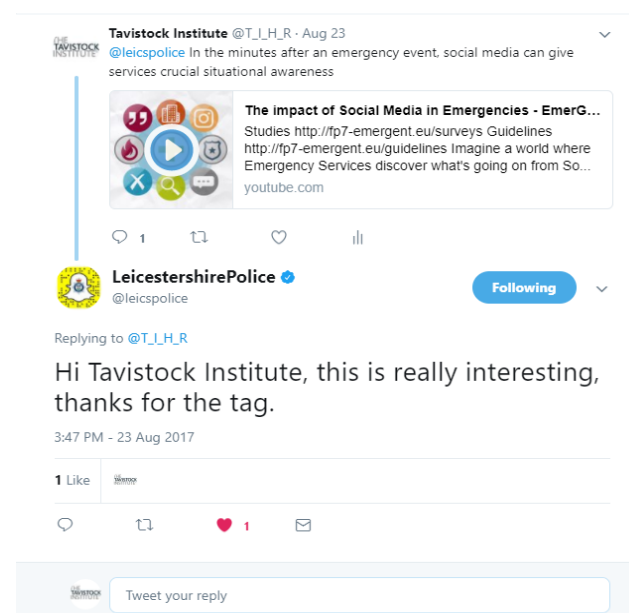
Figure 20 Dissemination via Twitter example 2

Three infographics to report and disseminate the results of the surveys of the attitudes of emergency services staff and citizens towards the use of social media were created (More details can be found at http://www.fp7-emergent.eu). The graphics helped raise awareness on the subject and understand the current attitudes of emergency services and citizens by the presentation of numerical data.

Ethics & Data protection

EmerGent aimed to understand the impact of social media in emergencies, thus had to deal with large quantities of social media data. To ensure the project was respecting the privacy of social media users, the EmerGent consortium was aware of, and compliant with, European laws on data protection and privacy. We continually monitored the relevant laws. We created D7.8 which also provides information about measures that were in place to prevent improper use or disclosure of the data, as well as ensuring forensic readiness of our system. To allow us to continually consider and evaluate data protection risks, an updated Privacy Impact Assessment was provided which was used for the remainder of the project for identifying, assessing and recording risks.
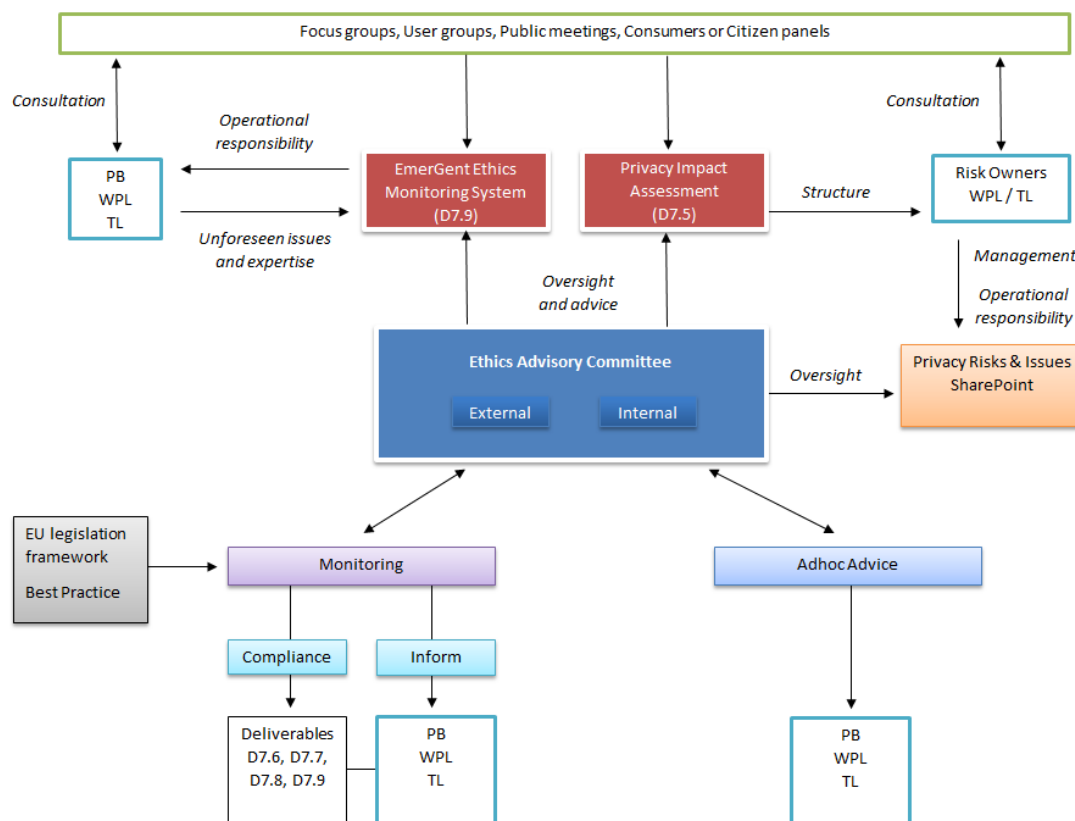
Figure 21: EmerGent Ethics Advisory Committee Operation

During the project, new challenges regarding the EU data protection law reform have been considered.

Article 8(1) of the Charter of Fundamental Rights of the European Union and Article 16(1) of the EU Treaty enshrines the right to the protection of personal data. Data protection law at a European Union level has recently undergone a wide-scale process of reform which has taken the form of a "package" of measures. These include a wide-ranging General Data Protection Regulation (GDPR) and a Directive on the Processing of Data by "Competent Authorities". Any plans to ensure that EmerGent is embraced commercially needed to embed considerations of the duties and responsibilities enshrined in this new law.

The Emergent Ethics Advisory Committee (EAC) was established as part of D7.5 to be the "guardians of the correct governance practices", which was reviewed annually. The EAC oversaw the evaluation of the compliance with the applicable regulations in terms of

protection of rights and safety of subjects who contributed with the data used in the project. Matters tracked by the EEMS (EmerGent Ethics Monitoring System) were stored on the project's SharePoint and the result of this evaluation was recorded in the Ethical Management Reports (D7.9). See Figure 21 for an overview of the EAC operation.

For tackling potential data protection hazards, a risk assessment process, built around the EAC, has been implemented:

If a privacy protection hazard has been identified, its risk factor (see

Table 8) was derived regarding potential severity (see

Table 7) and likelihood (see Table 6). If the derived risk factor then exceeds the guidelines, actions to mitigate the risk were searched. Once mitigation actions have been identified then the residual likelihood and severity of the hazard need to be recalculated to produce a value as if the mitigation actions have been implemented. The effect should be to reduce the overall mitigated residual risk rating. The Task members can then review the hazard and either:s

- accept that the mitigation actions are required and sufficient to not cause undue risk to the project;
- escalate the mitigated risk to the internal EAC;
- provide guidance;
- refer to the EmerGent Project board.

The internal EAC will then provide guidance on the risk to the project. If the EAC feels that they do not have the expertise to provide the guidance then they will refer to the external EAC committee members. If after consultation, the EAC feels that the risk factor is not controlled then it would advise the Emergent Project Board for direction and inform the Task Leader who raised the hazard accordingly.

Table 6: Hazard Likelihood Scoring

Likelihood score	1	2	3	4	5
Descriptor	Rare	**Unlikely**	**Possible**	**Likely**	**Almost certain**
Frequency (general) How often might it/does it happen	This will probably never happen/recur	Do not expect it to happen/recur but it is possible it may do so	Might happen or recur occasionally	Will probably happen/recur but it is not a persisting issue	Will undoubtedly happen/recur, possibly frequently
Frequency (timeframe)	Not expected to occur for years	Expected to occur at least annually	Expected to occur at least monthly	Expected	Expected to occur at least daily
Probability Will it happen or not	<0.1 per cent	0.1-1 per cent	1-10 per cent	10 – 50 per cent	>50 per cent

Table 7: Hazard Severity Scoring

Severity Score	1	2	3	4	5
Domains	Negligible	Minor	Moderate	Major	Catastrophic
Statutory duty/ inspections	No or minimal impact or breach of guidance/ statutory duty	Breach of statutory legislation Reduced performance rating if unresolved	Single breach in statutory duty Challenging external recommendations/ improvement notice	Enforcement action Multiple breaches in statutory duty Improvement notices Low performance rating, critical report	Multiple breaches in statutory duty Prosecution, complete systems change required Zero performance rating, Severely critical report
Adverse publicity/ reputation	Rumours Potential for public concern	Local media coverage – short-term reduction in public confidence Elements of public expectation not being met	Local media coverage – long-term reduction in public confidence	National media coverage with <3 days service well below reasonable public expectation	National media coverage with >3 days service well below reasonable public expectation. MP concerned (questions in the House) .Total loss of public confidence
Finance including claims	Small loss Risk of claim remote	Loss of 0.1–0.25 per cent of budget Claim less than £10,000	Loss of 0.25–0.5 per cent of budget Claim(s) between £10,000 and £100,000	Uncertain delivery of key objective /Loss of 0.5–1.0 per cent of budget Claim(s) between £100,000 and £1 million, purchasers failing to pay on time	Non-delivery of key objective/ Loss of >1 per cent of budget Failure to meet specification/ slippage Loss of contract / payment by results, claim(s) >£1 million

Table 8: Risk factor rating matrix

Consequence	Likelihood				
	1 - Rare	2 - Unlikely	3 - Possible	4 – Likely	5 - Almost certain
5 - Catastrophic	5	10	15	20	25
4 - Major	4	8	12	16	20
3 - Moderate	3	6	9	12	15
2 - Minor	2	4	6	8	10
1 - Negligible	1	2	3	4	5

Potential Impact, Main Dissemination Activities and Exploitation of Results

EmerGent explored an area of social research and technical development with a high potential impact on the everyday life of citizens. It is estimated that 320 million[3] emergency calls are made every year in the European Union, enabling emergency services to assist citizens in all sorts of difficult situations. For the time being however, most European emergency services can only be reached through the public switched telephone or mobile networks.

In many recent events affecting large numbers of people (e. g., the flooding in Genoa) or dramatic events like the massacre in Utoya, communication through social media has demonstrated its clear potential. In the first case, for alerting the population and coordinating volunteers, while in the second example for gathering first-hand information from on-site people. In particular, social media have become a medium by themselves and video and text based communications are replacing traditional systems such as teletypes for the deaf and hard of hearing. Geographical location based services are increasingly used to submit or lookup close points of interest or a friend's current position. Modern mobile phones from which an emergency call might be placed have the potential to transmit lifesaving location information with the call.

The outcome that EmerGent supports the main objectives of the Security theme:

- improve security for the citizens by creating the understanding of the importance of social media in emergencies (for citizens and EMS) and

- enable an enhanced competitiveness for industry by an enhanced SME participation.

The project has not only assessed the potential impact of social media in the different phases of an emergency, but also identified, implemented and validated tools and methods to increase such impact.

The release of the EmerGent guidelines has been done under CC 4.0., so the guidelines can be used and extended by everybody. They inform about how new media and social networks may improve the bi-directional communication between citizens and emergency services and between different emergency services.

Dissemination and exploitation of the project results were important objectives of the EmerGent consortium to ensure the scientific progress beyond the state-of-the art in the course of the project and for a sustained economic yield after finishing the project. The whole consortium was fully engaged in creating public awareness, scientific interest and a new market.

4.2 Extended Dissemination

4.2.1 Main Workshops, Events and Conferences

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[3] Estimate based on COCOM, EGEA and information provided by EENA emergency services' members.

Table 9: Main Workshops, Events and Conferences

TITLE	DATE	VENUE	DESCRIPTION
4th International Conference on Web Intelligence, Mining and Semantics	June 3, 2014	Greece, Thessaloniki	Information on EmerGent project including (project idea: objectives, research questions and expected outcomes)
Social media as a tool supporting KSRG rescue operations	September 10, 2014	Poland, Suwałki	Information on EmerGent project conducting (brief description: objectives, research questions and expected results)
FEU Council meeting	October 9, 2014	Poland, Poznan	Presentation of the project
Using social media as a new way of communication with society in the scope of emergency management	October 16, 2014	Poland, Bydgoszcz	Information on EmerGent project conducting (brief description: objectives, research questions and expected results)
Social media as a tool supporting emergency services	January 15, 2015	Poland, Szczyrk	Information on EmerGent project conducting (brief description: objectives, research questions and expected results)
Conference	February 27, 2015	Belgium, Brussels	Presentation of the EmerGent project with its overall objectives at the Open Source Intelligence Dissemination
Social media as a tool supporting making a decision	March 13, 2015	Poland, Warsaw	Information on EmerGent project conducting (brief description: objectives, research questions and expected results)
Meeting with highly ranked officers from the Luxembourg City Fire service and representatives from the Luxembourg Fire Service federation, the South-Limbourg safety region (Nl) and the Flemish federation (BE).	April 2, 2015	Luxembourg, Luxembourg	Presentation of the project
EENA Conference (22nd – 24th April 2015)	April 22, 2015	Romania, Bucharest	Findings from citizen and emergency services survey
EENA Conference	April 22, 2015	Romania, Bucharest	Distribution of a flyer prepared for the EENA conference, covering the EmerGent surveys and the EmerGent project

TITLE	DATE	VENUE	DESCRIPTION
EENA Conference (22nd - 24th April, 2015)	April 22, 2015	Romania, Bucharest	Attitudes towards the use of Social Media by Emergency Services and Citizens: Initial Findings from the FP7 EmerGent Project
EENA Conference (22nd - 24th April, 2015)	April 22, 2015	Romania, Bucharest	112 Social Media Generation in the EMS
Data Protection Conference	May 8, 2015	UK, London	Discussion of data protection issues concerning us of social media in emergencies
World Wide Web Conference	May 18, 2015	Italy, Florence	Project presentation
Presentation	May 26, 2015	France, Marseille	Information on EmerGent, with a focus on the interoperability aspect of SM from Emergency Services perspective
EU Project Symposium	May 27, 2015	Norway, Kristiansand	Presentation of the EmerGent project with its overall objectives at the Open Source Intelligence Dissemination
FEU Council meeting	June 4, 2015	Germany, Hamburg	Presentation of the project
EmerGent at the Open Source Intelligence Dissemination	July 8, 2015	Italy, Rome	Presentation of the EmerGent project with its overall objectives at the Open Source Intelligence Dissemination
Presentation	July 9, 2015	Portugal, Porto	Findings from citizen and emergency services survey
30-years Jubileumsseminar of Vestlandsforsking	September 21, 2015	Norway, Sogndal	Presentation of project
COMMON ALERTING PROTOCOL (CAP) IMPLEMENTATION WORKSHOP	September 23, 2015	Italy, Rome	Presentation of the interoperability concepts applied in EmerGent
EENA Members' workshop & Meet your MEP	October 19, 2015	Belgium, Brussels	Social media was a dedicated workshop during this event. EENA described the current work in EmerGent and presented the expected outputs of the project with extra

TITLE	DATE	VENUE	DESCRIPTION
			emphasis on the guidelines and tools being presented, which are of direct interest to the par
Remote demo to MetOffice UK	November 13, 2015	Remote	Emergent with historical data of flooding
European Data Forum	November 16, 2015	Luxembourg	Presentation of EmerGent project and its results.
Online demo to Coosto	November 18, 2015	Remote	Emergent Data Mining, gathering and ESUI trained with historical social media from UK floods
Presentation live Emergent mining to Capita	December 16, 2015	Remote	Emergent Data Mining, gathering and ESUI trained with historical social media from UK floods
Presentation of the EmerGent project and results as well as participation in workshops about future potentials of social media.	February 22, 2016	Austria, Salzburg	Synergy effect between geographical information systems and social media.
EENA Conference 2016	April 6, 2016	Czech Republic, Prague	Discussion about EmerGent and the guidelines with conference participants and EENA committee members.
Project presentation and discussion about future potentials of SMS within VOST	April 16, 2016	Germany, Hamburg	Project presentation, participation in a workshop to derivate potentials of EmerGent for VOST
13th International Conference on Web Based Communities and Social Media	July 1, 2016	Portugal, Funchal	Moi, Matthias, and Nikolai Rodehutskors. "Design of an ontology for the use of social media in emergency management." International Conferences ICT, WBC, BIGDACI and TPMC 2016. IADIS Press, 2016.
EmerGent Musterpoint demo	July 26, 2016	Musterpoint offices, London	Presented slides in person and then remote demo by developer from OCC

TITLE	DATE	VENUE	DESCRIPTION
Remote demo Musterpoint/Tavistock/Emergent	September 2, 2016	Remote	Phone/Skype conference Musterpoint/Tavistock/Emergent
Online conference on social media	September 20, 2016	Remote	Musterpoint invited Police and Fire into discussion of use of social media, with OCC and TIHR. Demo and slides of Emergent
Dissemination of the EmerGent tools + Case Study interview	September 26, 2016	Graz, Austria	Presentation of the EmerGent tools
Communication Management in Public Administration	September 26, 2016	Poland, Szczytno, The Higher Police School	Presentation titled "Social Media in Emergencies" with the main goals and results of EmerGent project and examples of use social media in crisis management. Discussion.
EENA Event: #Attacks: Social Media & Public Warning	October 13, 2016	Belgium, Brussels	EENA described the current work in EmerGent with emphasis on the project outputs and the guidelines.
VOST112 Workshop: Demonstration and Evaluation of the EmerGent tools	October 14, 2016	Hamburg, Germany	Presentation of EmerGent and the Emergency Service Interface. Discussion with Virtual Operation Support Teams (VOST) about the implementation of the ES Interface in VOST. Included an evaluation of the ES Interface and the EmerGent Mobile App.
EmerGent project board meeting	November 10, 2016	Greece, Athens	Short presentation of EmerGent to the Deputy Chief Fire Officer and other staff of the Greek Fire Service.
SMEM: Expectations and Challanges	November 17, 2016	Italy, Rome	EmerGent will be discussed within the talk: Social Media: Social Media: an additional communication channel for a better service to citizen
Presentation to Capita Blue Light	November 18, 2016	UK, Cippenham	Reynold Greenlaw and John Boyle OCC presented Emergent data mining and ESUI

TITLE	DATE	VENUE	DESCRIPTION
Critical Control Rooms	December 5, 2016	Czech Republic, Prague	EENA described the current work in EmerGent with emphasis on the project outputs and the guidelines.
ICT-DM 2016	December 13, 2016	Austria, Vienna	The paper uses Twitter data generated during a recent flooding crisis to gain insights into techniques that could be used in real-time to provide actionable intelligence to emergency services. The paper also includes an exploratory analytical study of the data.
Demo UK Power Networks and EmerGent	January 5, 2017	Demo to UKPN Media Team	Emergent Data Mining, IQ and gathering trained with historical social media from UK power cuts and mock up integration into UKPN website
EmerGent demo	January 7, 2017	UK, Oxford	Emergent trained for UK flooding
Social Media Workshop @ Federal Office of Civil Protection and Disaster Assistance Germany	January 28, 2017	Germany, Bonn	Presentation of EmerGent and Workshop about the potentials and uses of social media in emergencies.
Critical Communications Europe 2017	February 7, 2017	Denmark, Copenhagen	EENA described the current work in EmerGent with emphasis on the project outputs and the guidelines.
EmerGent Final Workshop	February 14, 2017	Austria, Salzburg	Live presentation of the EmerGent system at the VGBF annual conference, followed by a discussion with experts.
XXV Spanish PSAP Directors and Managers Directors Forum	March 8, 2017	Spain, Ceuta	EENA presented the current work in EmerGent with emphasis on the project outputs and the guidelines.
EENA Conference 2017	April 5, 2017	Hungary, Budapest	Discussion about the EmerGent guidelines with conference participants and EENA committee members.

TITLE	DATE	VENUE	DESCRIPTION
Online demo with Fraser Nash Consulting UK	April 11, 2017	Remote	Mockup of UK Power Networks website with Emergent built in. Demo of actual Emergent IM and IQ with Twitter data on power cuts.
Zarządzanie kryzysowe oraz organizacja działań ratowniczych podczas zdarzeń nadzwyczajnych w Polsce i Czechach	April 26, 2017	Poland, Polanica Zdrój	Presentation "Narzędzia teleinformatyczne w zarządzaniu kryzysowym - wybrane wyniki projektów RISKO i EmerGent" during which the use of IT tools in emergency management was presented, as well as the results of RISKO and EmerGent projects.
Informing the Population: Mobile Warning Apps	April 27, 2017	Germany, Wilhelmshaven	Christian Reuter, Marc-André Kaufhold, Inken Leopold, Hannah Knipp(2017)Informing the Population: Mobile Warning Apps, Risk and Crisis Communication in Disaster Prevention and Management, Michael Klafft (ed.), p. 31-41
Zarządzanie kryzysowe w systemie bepieczeństwa narodowego. Zarządzanie kryzysowe w aspekcie zagrożeń terrorystycznych.	May 10, 2017	Poland, Warsaw	Presentation "Media społecznościowe - szansa czy zagrożenie? Wybrane wyniki projektu EmerGent" during which the threats and chances connected with using social media were presented in relation to EmerGent project
EmerGent Current Status and Latest Results	May 17, 2017	Norway, Oslo	Presentation was prepared and presented by Dieter Nuessler and Gasper Bizjak in order to share information about EmerGent to Chief Fire Officers from 20 EU countries. The goal was to inform them about the development of EmerGent project from the beginning
VFDB Jahresfachtagung 2017	May 21, 2017	Germany, Bremen	Presentation of EmerGent and its results at the annual VFDB

TITLE	DATE	VENUE	DESCRIPTION
			conference in Bremen, Germany.
EU-nettverk for Sogn og Fjordane	May 31, 2017	Norway	Presented EmerGent project and presented a case study.
NENA Conference	June 3, 2017	USA, Texas, San Antonio	EmerGent was presented in the framework of in a presentation of how emergency services are using social media in Europe.
4th Workshop of Human-Computer-Interaction in Safety-Critical Systems	September 10, 2017	Germany, Regensburg	Christian Reuter, Tilo Mentler, Stefan Geisler, Michael Herczeg, Thomas Ludwig, Volkmar Pipek, Simon Nestler (2017): 4. Workshop Mensch-Maschine-Interaktion in sicherheitskritischen Systemen, Mensch & Computer 2017: Workshopband, Regensburg, Germany: Ges
II Jagiellońska Konferencja Bezpieczeństwa - Między wiedzą a władzą: bezpieczeństwo w erze informacji.	September 22, 2017	Poland, Cracow	Presentation on challenges to emergency management system and implementing social media into this system titled "EmerGent - media społecznościowe w kontekście wyzwań dla systemu ratowniczego i struktur zarządzanai kryzysowego:
Workshop IT-Rescue 2017: IT-Support in Emergency Management & Response	September 25, 2017	Germany, Chemnitz	Jens Pottebaum, Christian Erfurth, Christian Reuter (2017): IT-Rettung 2017: IT-Unterstützung in Emergency Management & Response, INFORMATIK 2017, Lecture Notes in Informatics (LNI), Gesellschaft für Informatik, Maximilian Eibl, Martin Gaedke (ed.)
EmerGent Webinar	September 27, 2017	Online	A final webinar of EmerGent to present the project findings and outputs to all stakeholders and

TITLE	DATE	VENUE	DESCRIPTION
			announce the EENA working group on Social Media for Emergency Management (SMEM).

4.2.2 Online Dissemination

Project websites

The EmerGent website [WWW06] was set up and launched online at the beginning of the project and represents the project's information hub. All the deliverables and other relevant files, documents, publications, dissemination material and information are made available to all stakeholders via the project website and it also operates as EmerGent's public repository. Background information about the project, its rationale, objectives and achievements are described and it also offers links to the project's social media accounts and its RSS feed. With this information, the website has been the central communication tool of the project aiming to increase the dissemination effort, by specifically describing:

- **Project**: background, objectives, work plan, the corresponding FP7 topic and other related projects
- **Partners**: all consortium partners, the End user Advisory Board (EAB) and the Ethics Advisory Committee (EAC)
- **News**: project news, events, studies, etc.
- **Guidelines**: being one of the main outputs of the project a separate page for the EmerGent guidelines is provided
- **Surveys**: being one of the main outputs of the project a separate page for the EmerGent studies is provided
- **Publications**: a repository of all related publications by EmerGent, including scientific publications, press releases, newsletters, etc.
- **Contact page**

The design of the website (Figure 22) established the graphical style guide and colour palette of the project.

EmerGent implemented a second website, 112.social [Figure 23], in parallel with the project website, as a dedicated web platform to act as a key information point for the dissemination and marketing campaign, defined in Task 7.2. The website and the campaign are not described in detail in this deliverable, but a detailed report is provided in deliverable D7.2 Dissemination campaign [CmSf17].

Social media accounts

EmerGent used Twitter and Facebook to disseminate information on social media. The consortium used the social media accounts to provide up to date information linked to the project websites and to build a community of stakeholders interested in EmerGent. The use of social media proved to be a very useful method to reach interested stakeholders beyond the project consortium and we received interest from third parties to interact with the EmerGent outputs.

Newsletters

Electronic newsletter campaigns have been used by EmerGent to communicate the project's latest news to those who expressed their interest. The newsletters are emailed to the End user Advisory Board (EAB) and a dedicated list of subscribers maintained from the beginning of the project. A newsletter subscription form [WWW07] was made available on both project websites and visitors could subscribe by entering an email address and optionally a name. All newsletters (Figure 24, Figure 25, Figure 26) are also still available on the project website [WWW08].

The newsletters provided short information about the latest project developments, a summary of the recently published documents and covered the past and upcoming events. The reader was invited to access more information about each of these items by following links to the EmerGent website. To increase the reach of the newsletters, consortium partners amplified their dissemination by including links to the newsletters in their campaigns and by posting to their social media accounts.

Videos

EmerGent produced three videos. The first video (Figure 27) presents the EmerGent architecture and how the four components of EmerGent, information gathering, information routing, information mining and information quality have been implemented in the context of the EmerGent solution. The second video (Figure 28) presents what EmerGent is about, its objectives and why it is important to look at the impact of social media in emergencies. The third video (Figure 29) presents an overview of the detailed findings of the project studies and aims to raise awareness on the studies and the EmerGent guidelines. It directs viewers to the dedicated dissemination web pages for the studies and the guidelines. All videos are available on the project website and YouTube or Vimeo.

Infographics

EmerGent has produced several infographics to report and disseminate

- **the results of the surveys of the attitudes of emergency services staff** (Figure 5) **and citizens** (Figure 30) towards the use of social media. The infographics helped to raise awareness on the subject and understand the current attitudes of emergency services and citizens by the presentation of numerical data
- **the results of the representative study on citizens' perception in Europe** (Figure 4). The study researched the perception of citizens on the use of social media in Germany, Italy, the Netherlands and the United Kingdom with a representative survey of more than 7,000 participants. Similar infographics were produced to disseminate the results of the studies in the UK (Figure 31).
- **the citizen guidelines** (Figure 18). This infographic is provided with a free licence to emergency services and public authorities to adapt and disseminate to citizens.

Figure 22: The EmerGent website [WWW06]

Figure 23: The 112.social website [WWW09]

Figure 24: EmerGent Newsletter 1 [WWW10]

Figure 25: EmerGent Newsletter 2 [WWW11]

Figure 26: EmerGent Newsletter 3 [WWW12]

Figure 27: EmerGent architecture video [WWW13]

Figure 28: What is EmerGent? video [WWW14]

Figure 29: The impact of social media in emergencies video [WWW15]

Figure 30: Citizens attitudes towards the use of social media (infographic) [WWW16]

Figure 31: Results of the representative study on citizens' perception in Europe (UK results, infographic)

4.2.3 Exploitation

Capita Blue Light

In the UK the leading supplier of software to emergency services is Capita Blue Light. OCC met Matt Palmer, the Capita Blue Light Control Room Product Manager and Nick Oliver, Strategy and Marketing Manager, Communication and Control Solutions Secure Digital Solutions. Capita stressed EmerGent trials must show efficiency benefits to be attractive to them. Their principle concern was to not create more work for control room staff whilst they are lookin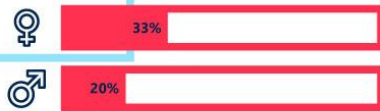g for real time intelligence and were interested in picking up alerts by watching for keywords. Capita were familiar with Coosto and Musterpoint for social media monitoring which they described as easy to set up using just keywords.

They presented a scenario of use: a call comes in about e.g. a fight outside a club. Control room staff have the existing user interface. Capita demonstrated how this works to OCC. There is part of the interface where an operative could use EmerGent to check social media in that location. This may help identify whether this is an isolated incident or part of wider unrest.

Capita suggested signing an NDA to share "scenarios of use" only and asked about costs of EmerGent with firehose (GNIP) access to Twitter. There were DP concerns with anonymous access to twitter we were unable to convince. Capita are developing their own tool for social media management (http://www.capitacontrolsolutions.co.uk/static/downloads/discussion-total-contact.pdf) and said DEIT (https://standards.data.gov.uk/proposal/direct-electronic-incident-transfer-deit-0) has become their standard for data transfer and have a mobile app.

Exploitation with wider EM organisations

The focus in UK commercial exploitation moved away from the Control Room to organisations with more flexibility in software. When large scale emergencies need managing Local

Government resilience organisations are involved. Through networking we approached ResilienceDirect and made a demonstration of EmerGent. ResilienceDirect is based in UK Central Government and creates a common platform for EMS to share information. It is a web based application which integrates GIS mapping (from Ordnance Survey, OS). A presentation of EmerGent to ResilienceDirect lead to a contact with OS emergency management. Meetings with OS in Southampton did not lead to successful exploitation. OS have a data mining team and saw EmerGent as a direct competitor to their component in ResilienceDirect. OS refused to sign a non-compete or non-disclosure agreement.

In the UK there is also a family of local resilience organisations called "PreparedIn<place>" such as PreparedInEssex. We found PreparedInEssex were using a third party application to monitor social media using keywords. They were interested in EmerGent and attended a demonstration. In this case they were concerned about pricing. In Essex County Council three people have part of their work responsibilities to be monitoring for relevant content in social media. They are especially busy during large scale emergencies but are always active looking for incidents including small scale events such as house fires and road traffic accidents.

While PreparedInEssex were initially interested in a tool to help them automated this there were two areas of concern: pricing and versatility. Off the shelf tools for filtering social media such as Tweetdeck or Coosto were seen as both good enough for little or no expense and also more versatile than EmerGent as no training was required. Although EmerGent performed better at identifying and filtering social media emergency PreparedInEssex were not convinced the additional effectiveness would be worth additional cost. This led us to explore relationships with the providers of off the shelf tools.

Exploitation with weather organisations

We presented EmerGent to a team at the Meteorological Office who were monitoring social media using another off the shelf tool: Brandwatch. This is a competitor to Coosto which includes a Query Builder and an Advisor's Dashboard. The Met Office have a power user who has built the following dashboard using advanced queries on weather events.

Around 20 to 60 tweets considered to be 'noise' every day. When the weather is quiet, the vast majority of tweets the query picks up are of no use. As soon as something starts to happen, these get drowned out by actual impact tweets.

The Met Office are specialists weather forecasting and "nowcasting" (detecting the current condition of weather). They are interested in using social media to see what the impact of weather is on the population. For example, they may know that a storm is hitting a town but it is uncertain what the disruption and damage will be. Social media could be a new means of determining this. The Met Office power user we interviewed was investigating if social media over-represents some impacts. She believed traffic disruption features heavily while property flooding is harder to pick up unless it's been reported in a news story. However, it could also be argued that this represents a weighting towards what disrupts most people and therefore could be a fair measure of impact.

The Met Office were given access to an instance of EmerGent trained to mine social media data on flooding. The feedback was similar to those of Local Authorities: that the increased accuracy of data mining was useful but not of sufficient value to justify a higher cost or migration from their existing tool, Brandwatch, which is similar to Coosto.

5 Use and Dissemination of Foreground

5.1 Section A

5.2 Section B

5.2.1 Part B1

5.2.2 Part B2

6 Report on Societal Implications

7 Appendix

7.1 List of Deliverables

Table 10: List of Deliverables

DEL. N°	DELIVERABLE NAME	WP N°	LEAD PART.	DISS. LEVEL[4]
D1.1	Project Management Manual and Project Presentation	1	UPB	CO
D1.2	Final Project Management and Progress Report	1	UPB	CO
D2.1	Concept for Impact Assessment	2	TIHR	PU
D2.2	Impact of Social Media for EMS and citizens	2	TIHR	PU
D2.3	Impact of Social Media for EMS and citizens using EmerGent concepts, Version 1	2	TIHR	PU
D2.4	Impact of Social Media for EMS and citizens using EmerGent concepts, Version 2	2	TIHR	PU
D2.5	Continuous citizens and EMS involvement over Social Media	2	USI	PU
D2.6	Workshops I and II	2	EENA	RE
D2.7	Workshop III	2	EENA	PU
D3.1	Usage patterns of Social Media in Emergencies	3	USI	PU
D3.2	Guidelines for social media integration into existing EMS systems	3	FEU	PU
D3.3	Interaction Design Patterns for using EmerGent in social apps	3	WNRI	PU
D3.4	User Requirements, Version 1	3	WNRI	PP
D3.5	User Requirements, Version 2	3	WNRI	PU
D3.6	End-user based view on Potentials of Social Media Usage for EMS and citizens' involvement in the EMC	3	FDDO	PP
D3.7	Potentials of Social Media Usage by EMS and citizens' involvement in the EMC enabled by EmerGent	3	USI	PU
D4.1	Semantic Data Model, Version 1	4	UPB	PP

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[4] Dissemination level using one of the following codes:
   PU = Public
   PP = Restricted to other programme participants (including the Commission Services)
   RE = Restricted to a group specified by the consortium (including the Commission Services)
   CO = Confidential, only for members of the consortium (including the Commission Services)

DEL. N°	DELIVERABLE NAME	WP N°	LEAD PART.	DISS. LEVEL[4]
D4.2	Semantic Data Model, Version 2	4	UPB	PP
D4.3	Specification of Mining methods to develop, Version 1	4	OCC	RE
D4.4	Specification of Mining methods to develop, Version 2	4	OCC	RE
D4.5	Information Quality criteria and Indicators	4	UPB	PU
D4.6	Specification of Information Mining and Information Quality components	4	OCC	RE
D4.7	Concept for enhanced Data Visualisation & Filtering	4	UPB	PP
D4.8	Documentation of Information Mining and Information Quality components	4	OCC	CO
D5.1	Identification of Social Network Providers and API Design	5	USI	PU
D5.2	Design of Information Routing	5	IES	RE
D5.3	Design of Social Apps	5	USI	RE
D5.4	Information gathering and expected Interfaces	5	OCC	CO
D5.5	Implementation and Verification of Information Routing and Social Apps, Version 1	5	IES	CO
D5.6	Implementation and Verification of Information Routing and Social Apps, Version 2	5	IES	CO
D6.1	Specification of the overall System Architecture	6	IES	RE
D6.2	Validation of Components and the integrated System, Version 1	6	WNRI	CO
D6.3	Validation of Components and the integrated System, Version 2	6	WNRI	CO
D6.4	User-oriented Evaluation	6	UPB	PU
D7.1	Dissemination activities	7	EENA	PU
D7.2	Dissemination campaign	7	IES	PU
D7.3	Guidelines to increase the benefit of Social Media in emergencies	7	EENA	PU
D7.4	Exploitation activities	7	OCC	PU
D7.5	Data Protection and Privacy	7	OCC	PP
D7.6	Continuous Monitoring of Legal Ethical Definitions and Compliance & Measures against improper Use of Data, Version 1	7	OCC	PP

DEL. N°	DELIVERABLE NAME	WP N°	LEAD PART.	DISS. LEVEL[4]
D7.7	Continuous Monitoring of Legal Ethical Definitions and Compliance & Measures against improper Use of Data, Version 2	7	OCC	PP
D7.8	Continuous Monitoring of Legal Ethical Definitions and Compliance & Measures against improper Use of Data, Version 3	7	OCC	PU
D7.9	Ethical Notifications and Approvals	7	TIHR	PP

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