

beAWARE

beAWARE

Enhancing decision support and management services in extreme weather
climate events

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D5.1

Empirical study and requirements analysis for emergency report generation

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Abstract

This deliverable reports on the findings of the empirical study of the multilingual reports that are to be communicated to the stakeholders that are addressed within the beAWARE pilots. It outlines the types of reports that are to be generated for each of the three types of end users, namely authorities, first responders and citizens, along with illustrative examples, and reports on the preliminary set of ensuing specifications for the text planning and linguistic generation tasks, which are addressed in T5.3 and T5.4, and which comprise the two steps through which the generation of written language reports is realised.

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Executive Summary

This deliverable reports on the empirical study of the types of multilingual textual reports that are to be generated within the targeted pilots, with respect to each of the addressed stakeholders, namely authorities, first responders and citizens. The study drew largely upon the initial requirements and use case scenarios described in D2.1, but also upon ongoing discussions with the user partners towards their further refinement and crystallisation. Outlining the different contents and purposes served by the considered reports, the study lays the preliminary specifications for the text planning and linguistic generation tasks that realise the structuring and verbalisation of the semantic representations of the report contents in the language of the targeted end users.

Abbreviations and Acronyms

KB	Knowledge Base
PSAP	Public Safety Answering Point

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1 Introduction

Tapping into the integration and contextualised interpretation of a multitude of information sources, beAWARE targets enhanced situational awareness and understanding of the unfolding emergency situation for the three types of stakeholders involved, namely i) authorities in charge of assessing vulnerability and exposure and of determining appropriate course of actions, ii) first responders operating on the field, and iii) civilians, whose safety and routine depend on timely updates (e.g. about nearby relief places during a heat wave or flooded areas and consequent traffic deviations). The information, to be communicated to the pertinent end user groups through dedicated PSAP and mobile application channels, is of multimodal nature, ranging, depending on the situation at hand, from textual messages to video streams and GIS-based encoded visualizations.

This deliverable examines the textual contents of the beAWARE system reports, laying the groundwork for the investigations and developments with respect to text planning and linguistic generation, i.e. the modules that realize the generation of written language. For our analysis, we've drawn upon the initial requirements and use case scenarios descriptions of D2.1, as well as on ongoing discussions with the user partners towards further clarifications and refinements about the desired contents; relevant insights have been afforded also within the ongoing work within WP7 for the mapping of the D2.1 user requirements into respective technical requirements.

The rest of the document is structured as follows. Section 2 positions the generation of multilingual reports within the overall beAWARE system, setting the reference context of its deployment. Section 3 explicates the different types of textual reports targeted for each pilot, along with representative examples, as elicited from D2.1 and discussions with the user partners. Section 4 outlines preliminary specifications with respect to the selection of content for inclusion in the reports to be generated and their linguistic characteristics. Section 5 concludes the study, summarising the currently identified types of textual reports to be generated and communicated to the stakeholders of the targeted pilots, the key characteristics and the open questions to be addressed in the next steps.

2 Multilingual report generation

The generation of textual reports is realised in two steps. The first is text planning, where the contents to be included in the report are selected and structured into a coherent discourse; the second is linguistic generation, where the previously delineated discourse contents are rendered as natural language.

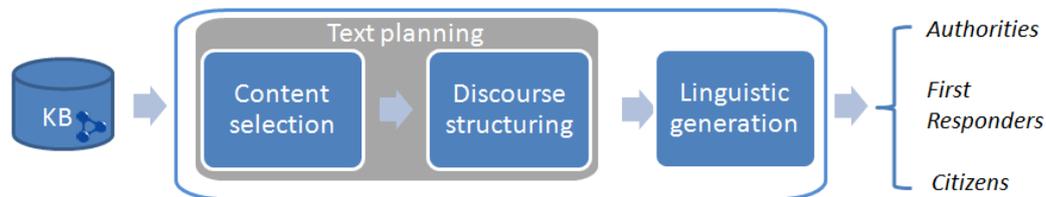


Figure 1 - High-level view of multilingual report generation pipeline

As shown in Figure 1, text planning performs over the Knowledge Base (KB) that includes the integrated and cross-interpreted semantic knowledge of the system, as derived based on the information extracted from the deployed heterogeneous input sources (weather forecast, social media posted material, reports provided via the mobile application by first responders and civilians, opportunistic sensors, including static cameras and water level ones, etc.) and the application of reasoning. Text planning is independent of the targeted language of the report to be generated and is driven strictly by semantic criteria, tailored to the information needs of the different end users.

Linguistic generation, on the other hand, deals with the verbalization of the text planning-selected contents in the language of the targeted user. It takes as input the triple representations of the text planning module and will successively produce all the layers foreseen by the Meaning-Text Theory (semantics, syntax, morphology) through a pipeline of graph transducers and classifiers, leading eventually to the triple's projection into natural language text. According to the pilots, the targeted languages are Greek, Italian, Spanish as well as English as the control language.

Although it carries out the delivery of multilingual textual reports, it should be noted that it is not the report generation module the one that determines when a report should be generated and communicated to the system's end users. This decision falls within the responsibilities of the reasoning (T4.5) and crisis classification (T3.1) tasks that capitalize on the integrated semantic knowledge of the system to propel and underpin their decision making mechanisms. It is only once the decision for communicating a report has been taken, that the "listening" multilingual report generation module navigates the knowledge base in order to draw the information necessary for compiling the requested report. Likewise, the report generation module is not responsible for assessing how often or how many times a certain textual message should be communicated; such decisions fall mainly within the scope of the PSAP and mobile application that implement the actual interfacing with the end users. Last, multilingual report generation addresses the textual only contents of the information that is to be communicated to the end users; as described in the next Section, there are various cases, where the textual information is coupled with visualisations,

especially in the form of color-coded classifications, and superimposed over the map of the affected area.

3 Textual emergency report types

This section presents the types of textual emergency reports that are to be displayed to the considered stakeholders within the targeted pilots; their delineation has drawn largely upon the initial requirements and use cases descriptions of D2.1, as well as following discussions and clarifications with the user partners. Section 3.1 describes the reports to be presented to authorities, Section 3.2 the ones to be communicated to first responders, and Section 3.3 those addressed to affected citizens.

3.1 Reports for authorities

Based on the currently described use cases scenarios, three types of textual reports have been identified as of interest for authorities, namely alerts, updates on the status of tasks to be undertaken as part of the emergency management response, and updates on the overall unfolding of the situation. Although not currently reflected in the D2.1 scenarios, during the ongoing discussions with the user partners, a fourth type of report, namely emergency summaries capturing the temporal sequence of the occurred events, emerged as of potential interest for post incidence analysis and reference purposes; whether, and to what extent and scope these will be addressed remains to be investigated as the scenarios and pertinent requirements are being worked out. In the following, the descriptions of the currently considered textual report type, along with illustrative examples, are given.

3.1.1 Alerts

As suggested by the name, these involve alert messages about monitored indicators pertinent to the pilot domains, i.e. flood, fire and heat wave emergencies. For example, within the flood pilot, such indicators include, among others, the level of rainfall and the overtopping of rivers; respective examples for the fire and heat wave pilots, include the fire risk level and the forecasted heat index. The main role of alerts is to support authorities in commencing the mobilization and assignment of tasks to first responders, as well as the dispatching of corresponding notifications and/or warnings and conduct recommendations to citizens.

Alert reports come with visual counterparts, namely color-coded visualizations that provide a classification of the situation with respect to pertinent alert thresholds, and pin the alert to the referenced position (address, area, etc.) on the map of the affected area. Acting complementary, the role of the textual alert messages is to elaborate on the conditions that triggered the color-coded information, as well as on additional relevant information, thus allowing of further contextual understanding as well as insights into the incoming information that led the system to generate the alert.

For example, in the case of river overtopping alerts, for which four classifications are deployed (not overtopped; overtopped 1st threshold; overtopped 2nd threshold; overtopped 3rd threshold), the textual information is expected to elaborate on the four respective color-coded classifications, by explicating the triggering measured water level, as well as relevant information such as forecasted precipitation volume and expected duration. Likewise, color-coded classifications of heat wave imminence risk levels are expected to be augmented with textual information about the forecasted maximum temperatures and humidity levels, as well as the predicted duration of the phenomena.

Jointly with task status updates (see Section 3.1.2) and situation updates (see Section 3.1.3), alert reports afford a comprehensive capturing of the incidence evolution, supporting authorities in making swift, well-informed assessments and initiating appropriate response actions. For example, receiving an alert about the water level at a monitored bridge that has exceeded the 2nd threshold, and in parallel being notified about posts and images on social media about people seen on the roofs of their homes, can contribute in mobilizing forces for the securing of neighboring streets (e.g. placing lines of sand packs), but also rescue forces.

3.1.2 Tasks Status Updates

Task status update reports are used to inform authorities about the status and execution state of the tasks decided to be undertaken as a response to the unfolding incidence. More specifically, their main role is to support authorities in managing and coordinating the different first responder teams (e.g. by sending assistance requests to available teams for personnel/equipment support), but also to assist authorities in identifying cases, where notifications should be send to citizens in order to avoid interferences in the areas where the first responders serve or to inform about proactive actions that should be taken.

Similar to alerts, task status reports are also accompanied with visual counterparts, namely color-coded visualisations that position on the map the referenced first responders team and that provide information on the task status classification (e.g. assigned, assigned and completed, assigned and not completed). As for the case of alerts, the textual status updates are expected to elaborate on the color-coded classifications, drawing upon the actual feedback received by the first responders. For instance, showing a task as assigned but not completed, does not offer particular insights into the underlying reasons and hence into possible mitigation actions; adding further color-based classifications (e.g. for distinguishing between personnel and equipment shortage, or being on-hold because of weather versus man-related reasons, such as traffic) could offer visual information at higher granularity, but would also easily get overwhelming taking into account all possibilities that may occur. Furthermore, the textual rendering enables to transparently list, order and group the

assigned tasks according to the authorities needs at the time, e.g. based on the time of assignment and location, status and type of forces/equipment involved, and so forth.

Table 1 illustrates representative task status updates examples. As shown, the messages adhere to an underlying structure, including the description of the reference action, the status of execution, as well as any possible feedback and/or comment by the reporting first responders.

Table 1 - Task status update examples to be presented to authorities.

Flood	Azione: Posizionare una fila di sacchi lungo via Nervesa della Stato del task: Non completato Commento: Ho bisogno di più tempo	Action: Place a line of sand packs along Nervesa della Battaglia street Status of the assignment: Not Completed Comment: I need more time
Fire	Los bomberos ya han controlado el incendio, prácticamente ya no se ven llamas, y van a iniciar las labores de remate y liquidación.	The firefighters have already controlled the fire, which is no longer visible, and are going to start the liquidation.
Heat wave	Κατάσταση: Αίτημα υποστήριξης Αποστολή: Άνθρωποι εγκλωβισμένοι σε ασανσέρ Διεύθυνση: Οδός XX, νο. YY	Status: Assistance Required Incidence: People stuck in elevator Address: Street XX, no. YY
Heat wave	Απεγκλωβισμός / απομάκρυνση ηλικιωμένων ολοκληρώθηκε Θέση: Συντεταγμένες: Βορράς , Ανατολή Διεύθυνση: Οδός XX, νο. YY	Evacuation Complete Location: coordinates: North , East Address: Street XX, no. YY

3.1.3 Situation updates

Situation updates capture the current context based on the integration and aggregated interpretation of the incoming data, as derived based on information made available by first responders (via the mobile application), civilians (via posts in social media and the mobile application), as well as the deployed opportunistic sensors (cameras, thermal sensors, etc.).

Lacking in principle the accurate map positioning of alerts and tasks status reports, situation update reports may or may not encompass explicit location information, and thus may or may not be pinpointed on the reference affected area map. When no exact location information is available or when it is too coarse, their display admits to alternative principles, namely ordering and grouping criteria, so as to allow their effective digestion. Example of such criteria include the temporal sequence of the reported incidences, the types

of reported incidences, the mentioning or not of elements of risk and the different categories involved (e.g. people, buildings, societal, economic, etc.), and so forth. Furthermore, unlike alert and status updates, the scope of situation updates is practically unbounded, as the range of incidences that may take place during a fire, flood or heat wave emergency and that could be of relevant to the its management and mitigation, cannot be predetermined. As such, situation update reports are not expected to have visual counterpart renderings in principle; however, a coarse classification, for instance by drawing upon their ordering and grouping criteria, could be useful and as such under investigation with the user partner.

Table 2 shows example situation update textual reports that could be presented to the authorities, along with their originating source based on the D2.1 scenarios. Although the delineation of their scope is not practically feasible, the study of the current scenarios has revealed a subset of important topics that should be considered. These include: i) reports about the area affected, the spreading of the fire, elements at risk, the access and status of evacuation roads, as well as information about possible causes of the fire, ii) reports about flooded areas, elements at risk, transportation implications and meteorological information for the flood scenario, and iii) reports about information related to traffic, places of relief and incidences related to power outage for the heat wave pilot.

Table 2 - Situation update examples along with origin source for the considered pilots.

Fire	First responders	El incendio todavía no es muy grande pero se puede descontrolar rápidamente, el viento sopla con fuerza.	The fire is still not very big but it may be quickly uncontrolled, the wind blows hard.
Fire	First responders	Se habrán quemado unos 20 metros cuadrados, el frente principal ya tiene aproximadamente 4 metros de longitud, y se dirige hacia la pinada.	About 20 square meters have been burnt so far, the main front has already reached approximately 4 meters, and is being directed towards the pinnacle.
Fire	Cizitens		
Fire	Citizens		
Flood	First responders	Macchine e cassonetti trasportati dalla corrente. Chiudere l'accesso alla strada.	Cars and dumpsters are transported by the flow. Close the access to the street.
Flood	First responders	Rigurgito da rete fognaria. Richiesta di rinforzi dotati di idrovore.	Surcharge of the drainage network. More forces required, equipped with pumping stations.
Flood	Citizens	Un albero trascinato dalla corrente si è incastrato nel ponte e il deflusso è impedito. L'allagamento	A tree, transported by the flow, is blocking the bridge's openings. The flow is limited and the river

		è prossimo.	level is reaching the embankment's top.
Flood	Citizens	Alcune persone stanno cercando di spostare la propria macchina per metterle al sicuro ma vengono trascinate via dalla corrente.	Some people are trying to move their cars in order to save them, but they are drag away by the flow.
Heat wave	First responders	Ο χώρος στην οδό «X, no. Y» έχει φτάσει στο Z% της χωρητικότητας του.	The place of relief in street X, no. Y has reached Z% of its capacity.
Heat wave	First responders	Υπάρχουν ηλικιωμένοι εγκλωβισμένοι σε σε σπίτι χωρίς A/C. Διεύθυνση: Οδός XX, νο. YY	Elder people stuck at home with no A/C. Address: Street XX, no. YY
Heat wave	Citizens	Η κίνηση στην οδό «X» είναι σε επίπεδο «υψηλό».	Traffic in Street X has reached level "High"
Heat wave	Citizens	Οι σηματοδότες στην διασταύρωση των οδών "X" και "Y" δεν λειτουργούν, υπάρχει διακοπή ρεύματος.	The traffic lights in the crossing of streets "X" and "Y" are out of order; power outage.

3.2 Reports for first responders

The types of reports that have been currently identified with respect to first responders include tasks assignments and updates on relevant (in terms of objective, proximity, etc.) tasks that have been assigned to other teams sent on the field.

Table 3 - Example reports for first responders for the considered pilots.

Fire	Diríjase al restaurante La Duna, desde allí están viendo una columna de humo próxima.	Go to the restaurant La Duna, from where citizens have reported seeing a smoke column.
Fire	A partir de este momento, por favor céntrense en controlar los accesos al camino donde se colocan los vehículos Autobombas, cortándolos totalmente si fuera necesario para facilitar el tránsito a los vehículos de extinción de incendios y de asistencia sanitaria.	From this moment, please stick to the accessing control to the road where the pumping vehicles are parked, cutting them completely if necessary to facilitate the transit of fire-fighting and assistance vehicles.
Flood	Azione: Verificare lo stato del terrapieno Posizione: coordinate: Nord , Est Indirizzo: Via XX	Action: Verify the status of the embankment Location: coordinates: North , East Address: Street XX
Flood	Squadra X raggiunga Via XX per procedere a rimuovere albero che ostruisce il ponte.	Team X reached Street XX to remove a tree blocking the bridge's openings.
Heat wave	Ο χώρος στην οδό «X, no. Y» έχει φτάσει στο όριο της χωρητικότητας του. Οδηγήστε τους πολίτες στο/στους χώρο/ χώρους που	Place X (address: Street XX) has reached its capacity, please direct citizens to place(s) Y/Z (address:

	βρίσκεται/ βρίσκονται στην οδό XX, νο. YY	Street YY) for relief.
Heat wave	Το νοσοκομείο «X» έχει δεν έχει πλέον διαθεσιμότητα κλινών. Οδηγήστε τους ασθενείς σε άλλα νοσοκομεία: - νοσοκομείο "X": οδός XX, νο. YY	Hospital X has reached its capacity and cannot receive more patients. Redirect patients to other hospitals: - hospital X: Street XX, no. YY

The authorities validate tasks that the KB service has deduced (based on standardised actions as described e.g. In the civil protection plan) and/or input ones determined on the fly, based on the unfolding situation.

3.3 Reports for citizens

Textual reports addressed to civilians include notifications/warnings and general recommendations. They can be discriminated into two categories, namely generic ones and location-aware ones. Sources: based on civil protection plan/protocols; mined from relevant official diffuse channels (e.g. civil protection twitter account; written by authorities?)

The authorities validate the messages the KB service has deduced and that have been generated by the ReportGeneration (based on standardised actions as described e.g. In the civil protection plan).

Table 4 - Example reports for citizens for the considered pilots.

Pilot	Report for citizens in pilot language	Report for citizens in English
Fire	Evacúa en primer lugar a niños, mayores y personas con dificultades respiratorias.	Evacuate first children, elderly and people with breathing problems.
Fire	Aviso de alerta 3 de riesgo de incendio extremo. Prohibida la acampada en toda el área de La Devesa.	Warning of extreme risk of forest fire. Camping in the whole area of La Devesa is forbidden.
Flood	Non percorrere strade inondate e sottopassagi!	Do not move in flooded streets and subways!
Flood	Alluvione in corso. Sono stati identificati i seguenti luoghi sicuri non soggetti ad allagamento o esondazione: - via Pforzheim - viale Cricoli (park Cricoli) - via Baden Powell (cittadella degli studi)	Flood in progress. Safe places include: - via Pforzheim - viale Cricoli (park Cricoli) - via Baden Powell (cittadella degli studi)
Heat wave	Ο χώρος στην οδό «X, νο. Y» έχει φτάσει στο όριο της χωρητικότητας του. Θα σας συνιστούσαμε να μεταβείτε στο χώρο (ή χώρους) που βρίσκεται (ή βρίσκονται) στην οδό XX, νο. YY.	Place in street X, no. Y has reached its capacity, please be advised to use place(s) Y/Z (address: Street YY) for relief.
Heat wave	Η κίνηση στην οδό «X» είναι σε επίπεδο «υψηλό». Σας συνιστούμε να επιλέξετε μία εναλλακτική διαδρομή για τον προορισμό σας.	Traffic in Street X has reached level "High". Please be advised to avoid Street X and use alternate routing to your destination.

4 Preliminary report generation specifications

This section presents preliminary specifications for the text planning and linguist generation tasks, as elicited from the study of the different types of reports that are to be generated for the addressed system stakeholders. These will be revised and further elaborated, as the use case scenarios and respective user requirements are further worked out and crystallized, and as the investigations and developments of the respective techniques advance. Furthermore, as the beAWARE ontologies are under development and the interdependencies with content analysis, report generation and the PSAP still under discussion, and hence largely underspecified, the observations listed in the following, cover only consideration that directly ensue from the use case scenarios.

4.1 Text Planning

The key observation pertinent to the selection of the contents that need to be included to the generated report lies in the need for an event-centric approach that can effectively navigate the referenced knowledge base and identify the associated pieces of information (e.g. time, location, involved actors, etc.) so as to meaningfully capture the message that is intended for communication. In addition, given the largely overlapping, and often redundant nature of the incoming information (e.g. social media posts), content selection needs to provide the means to effectively discriminate the prominent aspects of the unfolding situations and to aggregate them so as to afford instead a complete, yet succinct account of the reference situation.

Moreover, and given the highly dynamic and evolutionary nature of the targeted situation, the selection criteria should encompass the notion of temporal update, so as to avoid overwhelming the end-users with previously repeated information, and instead ensure changing conditions are swiftly communicated. Last, and given the strong interest expressed by user partners for allowing different groupings and orderings of the report contents along different "filter" dimensions (including temporal sequence, location proximity, etc.), both content selection and discourse structuring should afford the flexibility of such tailoring.

4.2 Linguistic Surface Generation

As afore-described, the linguistic surface generation module is in charge of rendering as text the messages to be delivered to the stakeholders in their language of preference. According to the specifications in Section 3, three types of generation modes are involved: generation of predefined messages, template-based generation and full-fledged one.

4.2.1 Predefined message generation

For this type of generation, the messages are pre-existing and only need to be retrieved and delivered as such. This type of generation applies to cases where the contents and style of

the delivered messages need to follow strict, predetermined, guidelines and contents, as, e.g., in alert messages to authorities, warnings or recommendations to citizens, etc.

Example predefined message addressed to authorities:

Warning of extreme risk of forest fire.

Example predefined message addressed to citizens:

Flood in progress. If you cannot leave your home, reach the highest floors and wait for the rescue teams.

These messages are static and the language used is constrained by issuing authorities. Thus, an exhaustive list of such messages will have to be compiled for all use cases and languages.

4.2.2 Template-based generation

Template-based messages are predefined sentences that contain undefined slots which need to be filled dynamically at the moment of generation with values drawn from the knowledge base, including addresses, numbers, measurements, dates, status, named entities, etc. Templates comprise a simple and effective way of generating text, when the variety of the contents to be communicated is bound to patterns that only differ with respect to distinct value fillers; though more dynamic than predefined messages, they do not allow for any flexibility in the generation, unlike the full-fledge generation described in the next section. They are used when the output text is not static but the targeted sentences are simple and straightforward, so that full-fledge generation is not needed. As for predefined message generation, the templates have to be manually crafted for all targeted languages. In the following examples, X_n denotes the slots to be filled.

Example template messages addressed to authorities:

Team X_1 reached Street X_2 to remove a tree blocking the bridge's openings.

People or buildings at risk: In the risk area are X_3 residents and X_4 important buildings.

Status of the assignment: X_5 .

Example template messages addressed to citizens:

Place in street X_1 , number X_2 has reached its capacity.

You are advised to use place X_3 (address: Street X_4) for relief.

Example template messages addressed to first responders:

Action: Verify X_1 at Location: X_2 .

Traffic in Street X_3 has reached level "High". Redirect to street X_4 .

4.2.3 Full-fledged generation

Full-fledge generation will consist in mapping ontological representations, as provided by the text planning module, onto text, deploying a range of linguistic resources, including generation grammars and lexicons. It will be applied to cases in which the generated textual reports contents are dynamically determined and need support complex sentence structures. For this, grammatical rules that build well-formed sentences and lexicons that cover the domains of beAWARE will be developed for the targeted beAWARE languages. The messages provided by the user partners will be used as a source for resource creation (linguistic constructions and lexical coverage).

Example full-fledged messages addressed to authorities:

The subway and several streets are flooded.

The traffic conditions in street X, which is blocked due to an accident, will be back to normal by 8pm.

5 Summary

Capitalising on the semantic integration of a multitude of information sources, beAWARE aims to afford to each of the addressed end-users, namely authorities, first responders and citizens, enhanced and timely understanding of the unfolding situation, tailored to their individual needs, so as to support and facilitate them in the execution and fulfilment of their goals. The delivery of the pertinent information is realised through the dedicated PSAP and mobile application channels and encompasses both visual and textual means.

This deliverable, addressing the textual contents of the information to be communicated, outlined the different types of multilingual reports that need to be generated, explicating their purpose and characteristics. Furthermore, it reported on the preliminary specifications that issue from the study of the different types of targeted reports with respect to the two steps comprising report generation, namely text planning and linguistic generation. As afore-described, key considerations to be taken into account for content selection and discourse structuring within text planning, include the type and temporal evolution of the referred events, as well as their location and associated elements at risk. As far as linguistic generation is concerned, the key observations sum up to the three modes of generation that need to be supported, and the need for their seamless coupling.

Next steps involve the further refinement of the elicited preliminary specifications and the kick-start of investigations with inputs that comply with the beAWARE semantic representation model and ontologies. Respective advances will be reported in the upcoming D5.2 and D5.3 that will report on the basic and advanced techniques for multilingual report generation.