THE VIRTUAL CRISIS MANAGEMENT CENTRE
An ICT implementation to canalize information!

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Abstract: In The Netherlands a special crisis team is active for environmental disasters. This team is called BOT-mi. The Virtual Crisis Management Centre is an application specially made to structure communication and information exchange as a tool to support BOT-mi. This web based application is not only an information website, but it is also an activation page for structural information gathering, notification and mobilization.

1 INTRODUCTION

Large-scale emergencies usually require the involvement of the national crisis management organization in support of, or to coordinate the response of local and regional emergency management teams. Information flow between the national and local organizations, and within the national ministries and agencies involved in a multi-disciplinary response can be challenging, slow and ineffective, which in turns often creates a significant disconnect between the national and the local responses. The reasons include the following:

Unlike local organizations, national ministries and agencies do not always have a 24/7 full standing response capability;

The recall key national personnel to a joint crisis management centre can take hours; and

The data communication infrastructure to link local and national emergency management organizations is often limited in scope and in capability.

In the Netherlands, as in many countries, there is considerable expertise residing in national institutes that, if available to local and regional emergency organizations, can greatly enhance the effectiveness of the response in case of major chemical accidents. The Dutch BOT-mi (Beleidsondersteunend Team Milieu Incidenten, or Policy Support Team for Environmental Incidents) was created to make that expertise promptly available to regional crisis management organizations. One of the key challenges of BOT-mi, and one of the key factors of its success, is the development of a web-based Virtual Crisis Management Centre (VCMC): the BOT-mi web-site.

The VCMC allows BOT-mi members to share information in real time, to discuss the information and to generate integral advice for the regions. It also offers the possibility of a common information platform for all emergency organizations, BOT-mi members and its partners, to exchange key data related to the accident. Furthermore, the VCMC offers extra functionality for alerting, notification, data management and communication. This paper describes the conceptual and technical functionality of the BOT-mi VCMC.

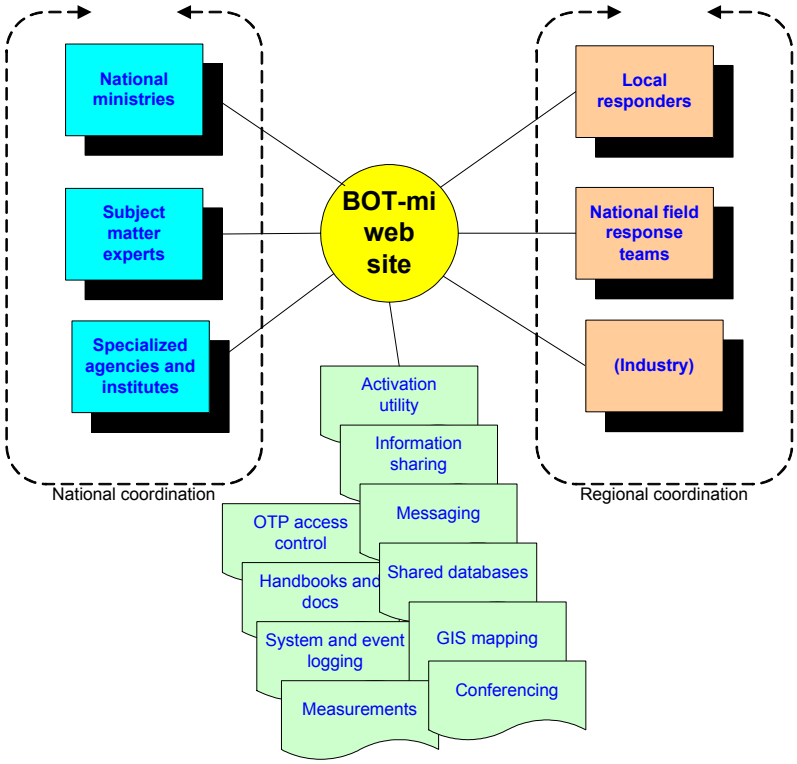

Figure 1: BOT-mi information management conceptual design

2 CONCEPT

The system concept is illustrated in Figure 1. It incorporates several essential elements required for information management, risk evaluation and decision-making. In addition, the system includes an activation feature, which allows a duty officer to alert all key national response personnel via several means, including telephone, mobiles, pager, email, fax, etc. The system also features a text-to-speech (TTS) conversion utility so that the text entered to notify key personnel can be read automatically over the phone. This prevents the message from altering between different recipients and receivers, which in crisis situations has lead to terrible results in the past. The system keeps track of the readiness status of notified personnel. The system uses One Time Password (OTP) user access control using tokens and or chip card terminal authorization in combination with user profiles. The system provides extensive system logging of users and events.

3 SYSTEM REQUIREMENTS

Operational Requirements

Consistent with existing work processes

The system must comply with existing working processes of the individual organizations and agencies.

Security

The system must provide protection with respect to unauthorized users (hacker-free). The different levels of security are as follows:

- Authentication of the sender: verification of the identity of the user by OTP (one-time password) verification;
- Confidentiality of the content: only the authorized services have the capability of reading the messages;
- The system will use data encryption between the server and client applications; and
- The system will use firewalls for extra server security.

Rapidity

The response time is the end-to-end elapsed time from when the information is sent until it is received. The response time of the BOT-mi VCMC telecommunication system is the time between the first generation of a message by a contact point to the system and the reception of this message by the other members. The response time has to be less then 30 minutes.

Alarm mechanism

The system has to provide for an alarm system that ensures the warning of member organizations (even if the PC is off).

Tailor made alarming

In addition to the general alarming, the system must provide the possibility for each organization to administer its own alarm profile and the possibility to exercise these procedures outside general BOT-mi exercises.

Notification

The system must provide a form in the notification format described in the BOT-mi emergency handbook.

Situation Report (Sitrep)

The system must provide a form in the sitrep format described in the BOT-mi emergency handbook. The system must also provide organization-specific sitrep formats and shall display formats that can provide important additional information.

Back-office

The system must provide for a back-office where user and group rights are administered.

Exercises

The system must provide the possibility for the individual organizations and BOT-mi as a whole to initiate and perform exercises.

Integral Advice Procedure

The system must assist in the generation of an integral advice, including a draft advice followed by a final advice.

Clear Communication of the Advice

The system must facilitate the communication of the advice to the "client".

Extensive Logging

The system must keep a log of all critical communications and information.

Functional Requirements

Decentralized management

The system must allow BOT-mi to work without its members being co-located.

Attachments

The system must provide for the upload and display of attachments to and from the central site.

PDA Interface

For extensive mobile connections, the system must provide for a PDA interface that will give access to at least messages and the pre-alarm functions and must entitle the user to react to the messages.

Central storage

The system must provide for a central storage solution for documents, memos, news items and links to BOT-mi related subjects.

Navigation

The system must provide for a comprehensive navigation system. The available menu items and functions must also be generated for the user and user group profile combinations.

GIS Functionality

The system must provide for the display of GIS-based information for localizing the place of the incident and adding additional data in a later stadium.

User-customized

The system must allow users to create "my VCMC" by generating user menus and functions by user and user group profiles.

Graphical Interface

The system must provide a user-friendly graphical interface for the comprehensive utilization of the site and its functions.

Information Streams

The system must facilitate the information streams of relevant data between the source and the BOT-mi community.

Availability

The availability of the service is the ratio up-time/total service time, expressed in percent. The system must be continuously available 24 hours a day and the global (main system and back-up systems) availability must be 99% where the 1% is for changing between servers and services during operation.

Data mining

The system must provide tools for search of key information (message listings and search engines).

Technical Requirements

Modular Architecture

The system must be modular for flexible activation and de-activation of new modules. This is a challenge since each module is quite complex but linked to the overall application.

Open Source

The system must make use of open source and W3 standards as much as possible.

Backup

The central database must be backed up regularly.

Standards

The system must be tailor-made in an iterative fashion using the DSDM standard. This allows for flexible development procedures and keeps the system adaptable to changes in environment and techniques, which is where many other applications have failed before.

Security

Security features for data and servers must be state of art.

User-Friendly

The system must use user-friendly interfaces that will increase the speed, effectiveness and quality of the messages. During an emergency, these properties are essential.

The Graphical User Interface (GUI)

In the development and evaluation of the GUI as means of communication and control, a number of global factors must be taken into account. An outline of these factors[1] is given in this section, which can be considered to be a more detailed description of the one given in the ESA PSS-05 standard.

From a managerial point of view, **productivity** is the most important factor. The software must be first and foremost applicable to the task at hand. When this is the case, one may consider the factors of quality and quantity of work performed. For emergency software such as the BOT-mi VCMC, this means that the software must be able to manage the given tasks as described by the operational and functional requirements. This of course is at least as important for the program as the way in which it is implemented.

Human performance is an observable factor that is most often used in assessing the ergonomics of a system. Performance is function of three basic variables: **speed, accuracy,** and **quality**. Well-designed systems reduce the time that it takes the user to perform a task. At the same time, error rate should be kept at a minimum. The severity of errors depends on their type. Some are easy correctable, others are devastating. Finally a well-designed system should promote optimal solutions to problems. This is the ultimate goal of many systems that involve planning, decision-making, design and information handling.

The speed, accuracy, and quality factors are taken into account by implementing the following features:

- The possibility of quickly generating emergency notifications and situation reports.
- The implementation of checks that prompt the user when mandatory fields are either blank or incorrectly filled-in. This helps the user increase the speed of creating the emergency messages.

[1] Ledger, Singer and whiteside, 1981

- Using as much pre-defined menu selection items as possible (also pre-defined lists are considered to be menu selection item). This increases speed when a BOT-mi message is prepared (the user does not have to type in the answer to the question), as well as accuracy and quality (pre-defined answers are thoroughly checked).

Training time and effectiveness is also an extremely important factor. How long does it take for the user to come up to speed? This involves both the acquisition of knowledge about the system, skill in using it, and the ability to accommodate changes[3]. Bumblehart and Norman (1978) refer to the following three components: *accretion, tuning*[**], and *restructuring*[***] . Training may result in the user learning the main functions of a system without being able to figure out how to perform other functions. Systems should be designed as to minimize the need for training.

In order to reduce training time and therefore improve effectiveness, menu selection systems often use menus that list and explain all of the options. In this case, speed is reduced due to transmission and display of text as well as reading time. For the BOT-mi VCMC, it is important to keep the system as simple as possible in order to keep the training time low and the effectiveness high. The first reason for keeping the system this user-friendly is that the user can be in a very stressful situation when operating in an emergency situation. The second reason is that user training can reduce stress, but the risks of the user making mistakes in an emergency situation cannot be justified.

The improvement in speed, accuracy and quality of the use of the BOT-mi VCMC is dramatically improved by the launch of a training[2] website where individual organizations now prepare themselves and extensively exercise their individual skills. The launch of the training site allows them now to exercise outside of the regular BOT-mi exercises.

The amount of **documentation** for the user varies greatly from system to system. More documentation is not necessarily better, and a high frequency of reference to the documentation during use is not considered to be user friendly. Menu systems have been used to drastically reduce the amount of references to documentation. In particular, in older systems that used to operate under slower processors, the use of menu items took up too much of the total processing time. In newer systems this may not be a factor, which allows for easier access to pull-down and pop-up menu displays. The BOT-mi system uses comprehensive menus and also has on-line help features.

Pop-up and pull-down menu displays will be implemented for the use of displaying warning messages. Also the development of an on-line help section is under consideration and could be one of the future tasks as soon as an acceptable prototype of the user interface is developed.

3 DISCUSSION

As a national system, the VCMC offers the following advantages:

Shorter activation time for key national resources;

National coordinators can work from a location where they have the tools, information and resources to manage their part of the crisis;

Delays in communicating between the joint crisis management centre and the ministry emergency centres are eliminated;

All national teams work from the same information;

National and regional teams work from the same information, in quasi real-time; and

The crisis management overhead is reduced by eliminating the need for liaison officers between the joint crisis management team and the ministry crisis management teams.

The BOT-mi VCMC has been tested on several occasions, including in real emergencies. Activation time of the national institutes has been reduced to a few minutes. BOT-mi members can now operate from wherever they are at the time of an emergency. Discussions of experts leading to an integral advice

[3] Bumblehart and Norman (1978)

[**] The modification of categories or adjustment.

[***] Reinterpreting, reorganising, or gaining a new understanding of information.

[2] The launch of this training site has been realized on 31 march 2004.

has been optimized through the use of the system interface. Information that is critical to decision-making is now available to all national experts in real time, as soon as it is generated by the respective institute.

The full potential of the BOT-mi VCMC is still being assessed and developed. The modular architecture of the system allows for prompt upgrades without the need for system overhaul. As experience develops, new features are constantly being added. However, these new features do not alter the basis concept and operation of the system and allows continued and sustained operation without the need for re-training or changes in procedures.

At the moment, the system access is limited to the national institutes that are members of BOT-mi. At a later stage, access will be expanded to include BOT-mi partners, i.e. other national, provincial, regional and local emergency organizations through a controlled interface. This interface will effectively layer the information so that only the relevant data is available to relevant organizations and so that the confidentiality of internal discussions between BOT-mi members is preserved. It is also envisaged to include a tribune function that will allow limited access to critical information by senior government staff and media organizations. This feature is still being investigated.

Some regions also have their own emergency information management system. Future work will also consider how the BOT-mi VCMC can be effectively interfaced with these systems to allow for a seamless transfer of information without jeopardizing the inherent qualities of the existing systems. As such, one can see that the BOT-mi VCMC concept can also be extended to the international exchange of key emergency information.

4 CONCLUSION

The BOT-mi VCMC is a novel concept for the coordination of information between emergency organizations at all levels: international, national, provincial, regional and local. Its modular architecture allows for sustained developments in a rapidly changing ICT environment. By facilitating the exchange of emergency information through a common information platform, it has the potential to lead to measurable enhancement of emergency response for accidents that involve a large number of organizations over several jurisdictions.

EXPERIENCE

The Communication module of VCMC is already in use by a lot of organisations worldwide. Some users are:

- ✓ Lufthansa, KLM, Delta Airlines, Aer Lingus;
- ✓ Fire dep. Frankfurt, The Hague, Rotterdam;
- ✓ USAR;
- ✓ Pentagon;
- ✓ Shell, Lyondell Chemical, Chemelot;
- ✓ JP Morgan Bank.