A Task-based Messaging Approach To Facilitate Staff Work

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ABSTRACT

A central part of the work in *Incident Commands (ICs)* deals with handling messages that contain relevant information. Classification schemes for messages can be exploited by command staff and assisting tools to support this work, given that a common understanding of the scheme is shared among participants. We present user studies on two such classifications, which imply some disagreement among participants. Interpretations of the studies and a revised scheme are presented. All users in our studies are highly trained experts and represent the state of the art in german IC work.

Keywords

Incident Command (IC), User Studies, collaboration, messages, communications

INTRODUCTION

The collaboration of command staff in ICs is essential for an efficient and well-organized reaction on the incident(s). Messages are used for timely communication and play a central role in organizing and documenting the work of the command staff. After a brief sketch of the characteristics of IC work in Germany with focus on fire departments, we present our approach to support the command staff in their work with messages. Although the focus of our studies was on fire department staff, the results could be applied to other IC branches, as similar organization schemes apply. Our approach of task-based messaging is motivated by user studies presented. These studies show exciting results about non-matching mental models of IC work participants.

Characteristics of Incident Command (IC) Work for Fire Department Staff in Germany

IC work in Germany [5] [7] is regulated through the "Feuerwehrdienstvorschrift[1] FwDV 100" [4]. In addition to the cooperation of fire services of different federal states and hierarchies, the FwDV 100 describes the cooperation with other organisations, institutions and authorities. Similar regulations exist for police and other IC organizations.

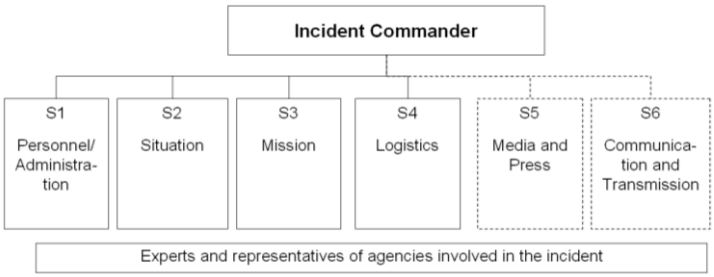

Figure 1: Setup of a German Incident Command

[1] Federal fire department regulations / manual

Roles that support the incident commander (cf. fig. 1) are also described in the FwDv100. Depending on the size of the incident, a person might fill out several roles, or may even have assistants to fulfil a single role.

Additionally to the S-roles, advisors (**FB**[2]) of other involved organisations like the Red Cross or THW[3] are comprised to the IC.

Messages are essential to IC work, as they are used to organize, inform and document the progress. They are the main form of communication between the IC staff and the outside world. Therefore the messages are written on a special fourfold form. This form contains, among other things: date and time, sender, kind of transmission, the message and recipients.

Because of the tremendous number of incoming and outgoing messages in a complex incident, a message dispatcher has to check, separate and dispatch the information to the responsible staff members. He hereby ensures that every staff member gets the information needed, but on the other hand is not flooded with irrelevant information.

Within the SoKNOS project[4], a framework and platform was developed to support IC work [3] [6]. Supporting staff in their work with messages is part of this approach.

First Approach: Message Classification

In order to create supporting tools for working with messages, classification of messages seemed to be a useful approach [2]. We implemented a Classifier for incoming messages based on a set of messages from a large practice in Berlin. Eight different message types, such as "announcement", "alert", "order", "supplies", etc. were deduced from this set and assigned to test messages.

A classifier based on well-known data mining techniques was built to automatically assign incoming messages their message type. The next logical step was to evaluate the usage of the message types with staff members.

The result in short was that the mental model of the staff members did not directly map to the message categories. They preferred to classify messages according to recipient roles (cf. introduction). Consequently, we subsequently conducted an explorative study aimed at obtaining a set of training data for this type of classification. But it was revealed that, due to different reasons which will be discussed later, the way of distributing messages is not standardized but depending on various factors.

RESULTS OF USER STUDIES REGARDING THE CLASSIFICATION APPROACH

In this section, we present the facts gathered through user studies, which will be discussed in the subsequent section. We used trained fire department IC staff experts. Our goal was to identify a set of messages types that could be understood and used by all IC staff members, so we could apply it for messaging tool support (dispatcher and other roles as well). The first study resulted in the rejection of our initial set of message types and led us to conduct study two. As results from study two were unexpected, another study with a different department of fire fighters was conducted to verify our findings.

First Study: Berlin, February 2009, 14 participants

In the first study, users were given 80 messages, with the task to assign them to eight given categories (cf. section on the Classifier Approach).

Since our given categories did not meet the user's expectations, a free classification with categories selected by the users was conducted. On average, between two and six categories were chosen – significantly less than the eight given previously. In total, 23 categories were named which then were used for the next study.

Second Study: Berlin, April 2009, 13 participants

In the second study, we attempted to figure out a standard set of categories that all staff members could agree on to identify a common mental model. For this purpose, the users were asked to cluster the 23 categories obtained in the first evaluation. Categories that were considered unnecessary could be removed.

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[2] In German: Fachberater (FB)

[3] THW: Federal Agency for Technical Relieve, German: Technisches Hilfswerk

[4] http://www.soknos.de

To make sure that this clustering was covering all possible types of messages, we asked the users afterwards to sort 32 randomly selected messages from two practices into their own clusters.

It is noteworthy that the users considered these messages to be relatively close to messages in a real life situation. The only difference was that the average information content was higher, while in a real life situation, a higher percentage of messages containing information of lesser relevance occurred.

The clustering of categories was very similar between the different groups of users. Most groups ended up with a very consistent clustering into four categories, which reflected the four roles S1-S4 (personnel, situation, mission, logistic).

Unexpectedly, the sorting of messages to the categories – initially intended to double check the completeness of the clustering – was not consistent at all among the groups of users. To make sure this was not a local phenomenon, we arranged a third test with the Cologne Fire Department.

Third Study: Cologne, May 2009, 4 participants

In the third study, we conducted the same test as in the second but with users from another city. The purpose was to ensure that our result from the study in Berlin was not a local phenomenon.

Result

Overall, the results of Berlin and Cologne did not differ much. Even when combined, in only three out of 32 cases all user groups agreed on the recipient. Those messages were requests for supply. In average, 4.48 out of the 7 user groups, i.e. 64%, agreed on the same recipient. The result showed, that the roles S1 and S3 (personnel and mission) seem to be closely related. This fact was also mentioned by the users.

INTERPRETATION

In this section, we discuss and interpret the numbers given in the previous section. All tests were conducted with highly trained professionals in exactly the task we were testing, so that the reasons for differing results in the evaluation are clearly not a lack of skill but rather of a completely different nature.

Discussions with the users gave us some hints about possible factors. The following interpretations resulted from these discussions.

- Staff members are – especially after working together for a longer period of time – well attuned to each other and might handle things more pragmatically and efficiently than in their training (and according to common procedures as defined in the FwDv100).
- Training of staff members varies greatly between federal state and even cities. But more important: there is no explicit training of classifying mental model for message classification.
- Sometimes implicit load balancing takes place. For instance, if S1 has a lot of work to do, messages might rather be assigned to S3, or vice versa, as these roles are sufficiently close related.
- Infrastructure is an issue (a quote from user in an evaluation: “If S4 has the equipment to handle that, I will assign this message to him, otherwise to S3”)
- Competence and experience in an IC may be distributed differently and personal considerations taken into account, e.g. to give more tasks to experienced members and less to new members.

These interpretations hint that fire department IC staff builds its own mental model based on the FwDV100. The model is adapted to their local organization and even takes co-workers into account. We propose that similar effects can be seen in other IC organizations.

Implicit Load Balancing

The most interesting effect we discovered is the effect of ***implicit load balancing***. The message dispatcher usually tries to distribute messages to the role positions within the IC that are related to the tasks resulting from the message. But if a certain position works at its capacity limits, the dispatcher sometimes tries to redistribute the messages to other roles that have free capacities. Although this seems like a useful pragmatic approach at first sight, it deviates from the desired uniform dispatching according to the regulations and makes it rather difficult to support the message distribution automatically. Furthermore, it cannot be guaranteed that the responsible role has all required information when making a decision. An important message could have been sent to another role.

TASK-BASED MESSAGING

Based on the results of the studies we developed a task based messaging concept. This concept allows the comprehensible and reproducible processing of messages. Messages and the decisions based on the data can be monitored for later analysis. Due to our approach the data for the analysis will become comparable in a more simplified way. This enables a post-processing of mission data for optimization of future work of the IC. If such similar processes based on such a role-based task distribution can be defined for more than one organization, the training effort for new staff members can be optimized.

Roles and Tasks

Deriving a new classification scheme starts with the set of roles S1…S6, as the users preferred these (cf. study one). Our discussion with personnel of the fire department revealed that the definition of the roles given in the FwDv100 is a descriptive one rather than a normative one and thus is subject to interpretation. In order to make the distinction more clear, we started from the role model and added tasks to each role; consequently, making the role definition more precise (for the classification). With this approach, especially personal preferences, experience and implicit load balancing can be reduced. The task-based classification scheme makes the role interpretation more factual.

RECENT WORK

Implementation of prototype

We collected a set of 125 training messages from a practice and digitized them, both as facsimile as well as in transcription. To exploit this set of data, we developed a user interface to visualize and demonstrate our concept of task-based messaging. In the UI, a facsimile of the message along with a transcription is displayed. Additionally, the roles and respective tasks are displayed for selection (cf. fig. 2).

Figure 2: Task-based messaging approach

The aim of this user interface are studies verifying whether this task-based classification scheme will result in a greater match among the users when sorting messages.

This interface could also be used as *training software* in a fire department academy with some slight modification: A pre-defined sample solution can be provided by experienced professionals. Trainees sort messages using the user interface and receive feedback about their match to the sample solution.

First user studies with new approach, 7 participants

In a first evaluation, we presented the new approach to staff members of fire departments and police. The feedback was generally that this might be a step in the right direction, and – although the approach is not completely satisfying – it is a definite improvement over previous approaches.

CONCLUSION

In this paper, we presented multiple user studies conducted with trained professionals and our approach for task-based message classification. The user studies show that fire department IC members disagree on sorting messages to roles as defined in the regulation. Based on these studies, we presented interpretations that emerged from discussions with professionals. They hint that different staff members have different mental models. The subsequently presented task-based classification scheme aims at increasing the match between users when classifying messages. Finally, we presented applications of the classification scheme that are currently being investigated. The presented task based messaging supports the SoKNOS idea of intelligent cooperation between the ICs of different organizations.

OUTLOOK

After evaluating the concept of task-based messaging, it is possible to go back to the original idea and build an automated classifier for incoming messages with this new approach. Here, an important part of the future work will be to create sample solutions provided by experienced dispatchers and teaching personnel. With such sample solutions a reliable evaluation of the system and the work of the IC could be achieved. Another interesting research topic will be the monitoring of the run-time performances of the message distribution with different participants. Here, experienced and non-experienced users can be monitored. The results can give interesting insights if the experience of a user is independent from the ability to process messages in an effective way or not. To achieve all these results the integration into the SoKNOS live system will be another goal to fulfill in the future.

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