

15-413

Handout 2

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15-413 Software Engineering

Carnegie Mellon University
School of Computer Science

Problem Statement

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The FRIEND System

Overview

The wealth of information government service providers possess are invaluable during emergencies. Our communities deserve the best possible use of this information to insure their safety or reduce risk or injury to the population. Unfortunately most local government systems are established on "normal" or expected call loads. When an unusual event or multiple events occur the system is immediately overloaded. Information held by individual service providers is not adequately disseminated for informed decision making.

Planning, fire, police, emergency medical services (EMS), administrative, public works, and building inspection departments compile seemingly unlimited amounts of paper based information. This information becomes extremely hard to use during an emergency, and for all intent and purpose it is rarely used.

Each employee in these departments has historical information that is not a part of the paper data base. This information is so massive that it would not be economically feasible to catalog to catalog it in a paper system.

Emergency Response

During an emergency each responder may acquire information that might, and probably would, be useful to the decision makers. This information is not communicated because of limited radio frequency air time. Administrative information is not transmitted by voice unless asked for or is in direct support of an evolving emergency response. In practice this means life and death information is transmitted, not decision support data.

If the decision makers could have the situational support information of each of the first responders, informed direction could be given. As the available information curve increases the possibility of a more successful response increases. I am interested in a successful response.

The manner in which municipalities respond to emergencies or how they recover varies

widely depending on the type or severity of the disaster and the preparation and resources available to the local government. Whatever the sizes of the government entity there are several tasks that are common to all disaster responses, they are: the need for information gathering and severity assessment organizational arrangements mobilization of resources planning, administration, and budgeting coordination and interaction training and evaluation
Emergency Operations Plan

Unusual events or incidents are handled by the municipal Emergency Operations Plan (EOP). This plan attempts to address the need for unusual coordination between the departments or agencies of critical service providers during an event.

A link not provided in the EOP between the business and government -- creating a crucial information void. The EOP details safety requirements such as the Inspection of vulnerable facilities specifies regulations required to comply with hazardous or dangerous materials reporting and assists the local government with preparing for unusual events. A problem exists with respect to the timeliness and availability of information, especially during emergencies.

For instance, Carnegie Mellon staff have information that changes daily. Currently, in the event of an unusual incident at CMU, the staff must assemble and provide this information on paper or by voice. As another example, take an emergency at a business location -- say an auto body shop. What is the danger of a 55 gallon drum of Toluene spilled in the shop? The information needed by any emergency service provider is similar regardless of location. Emergency personnel need information to make decisions. The more data they can have, the better chance they have to make a proper decision.

Information System Needs

I need a system that allows every police officer, fire fighter, ems or maintenance worker to give me information without the need for acknowledgment before transmitting. I need a system that allows me to respond to an incident at CMU and instantly use the information they have been collecting for possibly years. I need to know if this incident has occurred in this location in the past and if so how was it handled, was it handled well, and what were the opinions of the post incident reviewing officers. If Wean Hall is on fire, where are my fire hydrants? If I hook up to two hydrants on the same water main, with 3" lines, is the water pressure and flow enough to provide me with water to effectively fight the fire?

The system must provide geographical information. The system must produce maps including above and underground utilities. Utility objects include but are not limited to telephone, cable, , gas and oil lines, sanitary and storm sewer lines and collectors. Object information must be displayed for each utility such as cable size, pipe diameter, directional flow etc. . . . The system must provide government resources available to respond to emergencies. Municipal resources include but are not limited to, people in all departments, vehicles and equipment by types.

Target Environment

The system is to be used by Bellevue Police Department personnel responding to

emergency situations. There are two levels of functionality envisioned for FRIEND. First, the system should work as a stand alone service within the Bellevue Police Department. Second, the system is to be used by a group of municipalities with the ability to "hand-off" information to higher levels of government. Higher levels of government include the county, state and federal emergency management agencies.

Municipal responses are managed by the Emergency Management Operations Center (EMOC). The EMOC is an assembly of officials identified in each municipal Emergency Operations Plan (EOP). These officials need a system that provides geographic data, text based and graphical information and real-time responses between them and the first responders. Some of the needed information can be acquired before the incident occurs. This information is developed during the preparedness phase of emergency management and usually includes response plans, locations and quantities of hazardous materials, identification of vulnerable facilities and citizens in need of special help. Other information changes by the minute during an actual emergency, such as traffic patterns, person-power availability and equipment status. This is the environment in which the FRIEND system must operate. I may be familiar with the area or even the building as a local official, but I do not know what each of my officers know or what the occupants of the building know. The FRIEND system must be compatible with existing means for acquiring and inputting data.

First Responders include police, fire, emergency medical services, public works, radiological, and transportation workers. The information system they use will be exposed to weather and rough duty. The user interface must take these conditions into account during the development phase.

The system should be portable to existing hardware available in local governments. Most computer equipment used in municipal governments in Pennsylvania is DOS based machines.

The restrictions on program size is significant when dealing with the Bellevue Police platform. Suggestions for upgrade are expected, but I ask you to sharpen your code pencils because local government expenditures are tighter than the application space on our LAN.
Scenario: Highway Accident

The scenario for this project will give a realistic example of government response to emergencies. It is based on a the local incident which involves internal administrative reporting, local government response and county government involvement together with non government support services.

Bellevue Police Dispatch receives a telephone call for service reporting a vehicle accident. The caller reports a truck ran into a car on State Route 65 (SR65) in Bellevue and the truck ran into a building causing a natural gas leak. The First Responding officer on the scene reports; three vehicles involved in the accident, a tractor trailer crashed through the front wall of a business, two people are trapped inside a vehicle, and a high pressure gas line has been broken.

The response to this accident involves two hospitals, Allegheny County Police officers from the detective and uniform branches, five local police departments, two fire departments, photographers from two agencies, and gas company repair crews.

The accident shut down one mile of state highway for three (3) hours causing traffic to be rerouted. Local streets have a 9-ton weight limit and the state highway carries apportioned vehicles with weights up to 80,000 pounds.

Queries to be answered by FRIEND

- Can this incident be handled locally? If not, what agencies must or can be notified to help with this situation?
- How many municipal employees are available to be deployed in support of this incident?
- Who has been notified and what is the status of all responders?
- What area should be evacuated?
- What routes can detoured vehicles use?
- What locations should be staffed by traffic control personnel?

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- What is the danger with the escaping natural gas?

Target Platform

The Bellevue Police Department operates a LAN using Novell 2.11 and PC's with DOS 3.3 across an Ethernet thin coax cable. The files server is a 386 CPU @ 16 MHz, 2 MB RAM and 410 MB disk space. Eight (8) 286 PC's with 640 Kb RAM and two (2) 386 CPU's with 4 MB RAM act as terminals on the LAN. Five of the terminals are located in the police department, three in the administrative offices, one in the building inspection office and one in the fire department. This equipment is consistent with other municipalities using computers. It represents the equipment in approximately 90% of police departments in Pennsylvania.

If the radio frequency available to the Bellevue police Department can be used, it should be. Bellevue has a police radio frequency of 155.010 with a private line of PL 7. The FCC frequency and power license is for 100 watts. The transmitter/receiver is at the municipal building, 537 Bayne Avenue.

A command post vehicle, preferably a police car, with a mobile data computer interface to the FRIEND system. The vehicle can also act as a repeater for a first responder with wireless wearable computer interface. The User Interface should be designed for easy input and response. Voice recognition is desirable. Touch screen or pen based is

probably more realistic at this time. The goal is to reduce the First Responders need for input as much as possible. A manual response should be limited to buttons or check off boxes to explain needs, situation, or status.

All transactions on the FRIEND system will be saved for future analysis. Information from responses will be used for report writing, investigations, training, response planning, and legal action.

The FRIEND system must be delivered with recommendations for equipment upgrade. Equipment upgrade must be compatible with existing equipment and applications.

Client Contact

I have provided Professor Bruegge with a copy of the entire Emergency Operations Plan for Bellevue Borough on disk. The EOP contains all the Standard Operating Procedures for each response function in addition to the organizational structure for the EMOC. If you have questions during the course that I may be able to answer, please feel free to call me or contact me through e-mail on Andrew. You are welcome to visit our police department to get a better feel for our needs or interview employees. I will be on campus two evenings a week during the semester. If you would like to see me in person, just let me know.

Client Acceptance

The client considers this problem statement to be a broad definition and does not expect all functionality to be delivered this semester. During the Requirement Engineering phase of the project the client will negotiate with the software engineers an acceptable prototype for delivery.

After the negotiation phase the specific requirements for the client acceptance test will be frozen. The client expects to sign off on the negotiated deliverables within 4-6 weeks of the client presentation.

As a minimum the client expects the delivered prototype to be expandable in a future course. As a minimum acceptable test the client expects the negotiated prototype to be successfully demonstrated on the Andrew system with a wireless component. As a desired acceptable test the client expects the prototype to be successfully demonstrated in a field trial at the Bellevue Police Department