Scientific Letter

Analysis of integrating Computer-Aided Dispatch information with the Multi-Agency Situational Awareness System

Background

In April 2013, Defence Research and Development Canada (DRDC) Centre for Security Science (CSS) initiated a project with the City of Kelowna to determine the feasibility of integrating local situational awareness from a Computer Aided Dispatch system into the national Multi-Agency Situational Awareness System (MASAS). MASAS enables a system-of-systems collection of interoperable systems [1] [2] that can exchange real-time, location-based incident information relevant to emergency managers and responders, using common technologies that are based on national geospatial and public safety communication standards. MASAS enables pan-Canadian and Canadian/US interoperability [3] [4] and is recognized as a leading operational pilot project enabling national public safety community interoperability. The project objective was to contribute to the body of knowledge and enhance National Situational Awareness in Canada. The project also documented operational requirements, best practices and technical approaches of integrating Computer Aided Dispatch systems with the MASAS. The technical integration focused on Kelowna's FDM Computer Aided Dispatch system as a case study, but the approach and guidelines are applicable to the wider emergency management community.

Methodology

The project region was the Kelowna Fire District protected by the Kelowna Fire Dispatch who serves over a quarter million residents and an additional 3 million visitors annually in the Central and Okanagan Similkameen Regional Districts of BC (an area of 13,500 km²).They handle over 30,000 incidents a year [5].

Within Kelowna and many other local governments emergency incidents are entered and managed through a Computer Aided Dispatch (CAD) system. CAD systems are defined as "software to assist in initiating calls for service, dispatching, and maintaining the status of responding resources in the field" [6]. In Kelowna, the CAD system is provided by FDM Software Inc.

The project had two main goals:

1. Test the interoperability between the Kelowna CAD System and MASAS.

2. Move content from MASAS to the Kelowna CAD System. The Kelowna operational requirement was to automatically pass information between both systems.

To achieve CAD integration with MASAS, two technical approaches were proposed. A direct approach, where systems connect directly to MASAS through their built-in adapters or integration capabilities and an indirect approach, where an intermediate service can be created to connect the CAD system to MASAS [7]. For this project study, the direct approach was determined to be optimal because of its simplicity and expected higher reliability.

MASAS uses an open structured information exchange format to enable interoperability between systems. This approach allows emergency management and public safety organizations to work with the systems and tools of their choosing without all having to use the same application. With this approach, CAD information can be shared with many other existing systems including Geographic Information Systems (GIS) and incident management systems.

Central to information flow in MASAS is the use of standards-based methods for information exchanges and information portrayal. The adoption of published standards such as the Common Alerting Protocol – Canadian Profile (CAP-CP) [8], Atom, and the Canadian Emergency Management Symbology (EMS) version 1.0 enable this information flow [9].

Incidents in MASAS are represented using the EMS Taxonomy. Whereas, for alerts, the CAP-CP Event References [8] are used, most of which are included in the aforementioned taxonomy. The EMS taxonomy follows a four level, hierarchical structure with the highest level being the EMS domain. Within that domain there are categories for Incident, infrastructure operation, aggregate and other. The EMS taxonomy has Tier 1 and Tier 2 classes. For example, ems.incident.fire is a Tier 1 class, while ems.incident.aviation.aircraftCrash is a Tier 2 class. Each Tier has an associated symbology [9].
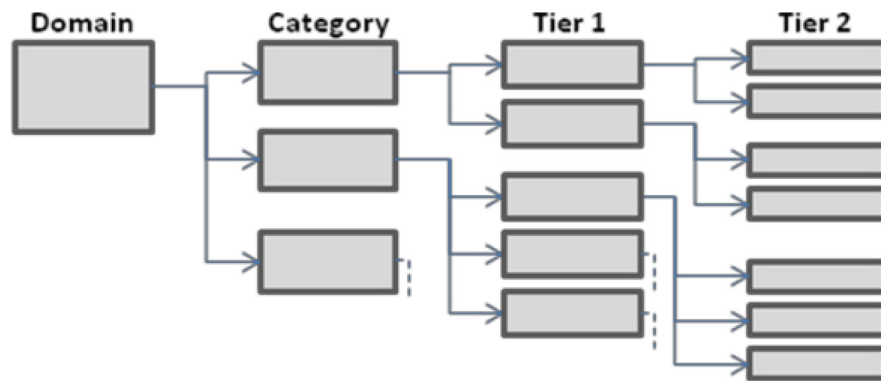

Figure 1: Emergency Management Symbology and Taxonomy Structure.

The following table shows examples of Tier 1 and Tier 2 classes along with the associated symbols.

Domain	Category	Tier 1	Tier 2	Symbology
ems	incident	fire		
ems	incident	flood		
ems	incident	aviation	aircraftCrash	
ems	infrastructure	energy	nuclearPowerPlant	

Table 1: Example of Emergency Management Symbology.

The EMS Taxonomy provides a common taxonomy for emergency incidents. Kelowna Fire Department, however, follows the U.S. National Fire Incident Reporting System (NFIRS) standard for incident naming and classification [10]. The study focused on correlating the NFIRS standard to the EMS taxonomy used in MASAS.

A technical interface was developed between the Kelowna CAD System, FDM and MASAS. Its key capabilities included the ability to geographically control what national situational awareness information is of interest and to filter what information is shared from Kelowna to MASAS.

Testing was successfully completed in March 2014, using the Kelowna Fire Department's virtual development environment, which mimics their production environment by pulling information from the MASAS operational environment into CAD.

Results

The project demonstrated that CAD systems are valuable sources of first responder information that can contribute to national situational awareness. However, key to this workflow is to ensure that information procedures and technical capabilities are in place to limit the amount and type of information that is shared. During the study, Kelowna started by sharing nearly all processed calls. They quickly decided against this once it became clear that not all information should be shared. For example, after testing, Kelowna stopped sharing a significant number of non-collaborative, minor type incidents because it led to over-alerting. Health related calls were also stopped due to information privacy concerns [11].

It was determined that posting information from multi-agency response incidents are the most appropriate for National situational awareness systems such as MASAS. The following incidents where identified as incidents to share [11]:

- Fires
    - Structure fire (three alarm or higher)
    - Wildfire
- Explosions
    - Explosion
    - Bomb threat/scare

- Rescue and emergency medical service incidents
  - Aircraft accident
  - Extrication, rescue
    - Building collapse
    - Vehicle; with high multi-casualty incident or scene is spread out
  - Swift water, ice
  - Technical high angle
  - Confined space
  - Trench/below grade
  - Inland water
- Hazardous conditions
  - Flammable liquid spill
  - Natural gas/LPG leak
  - Chemical spill
  - Radioactive spill
  - Aircraft standby
- Severe weather and natural disaster

While the study focused on correlating the NFIRS standard to the EMS Taxonomy, it was noted that there are some problematic areas. The EMS Taxonomy used in MASAS is designed for multi-agency emergency incidents and is missing incident details that would typically be found in a CAD system. The project highlighted the need for a common standard, specific to emergency incidents at the local government level. To further this finding, the APCO Public Safety Communications Common Incident Types of Data Exchange, an existing ANSI Standard [6], was investigated by the MASAS advisory committee. The APCO standard was found to provide a more meaningfully correlation of CAD incidents than the EMS Taxonomy supported in MASAS. However, of the 205 emergency incident types in the APCO Standard, 46 were deemed to be appropriate for sharing through MASAS. Many of those not included related to police activities or privacy concerns. The advisory committee recommendations are presented as a MASAS resource.[1]

The study demonstrated that local governments have a requirement for national situational awareness information. The key to accessing it is having a standards-based interface that can be integrated into their existing system. The study also showed that, for a very minimal cost (under $20K) and engineering effort, the ability to interface CAD systems with MASAS is readily possible. In other words, existing CAD systems can be interfaced to access and feed highly useful situational awareness information into the national MASAS data aggregation hub with minimal engineering required. Figure 2 shows MASAS data being accessed in the Kelowna CAD system.

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[1] Further information on MASAS CAD Integrations: http://www.masas-x.ca/en/newsroom/1624-masas-cad-integrations.
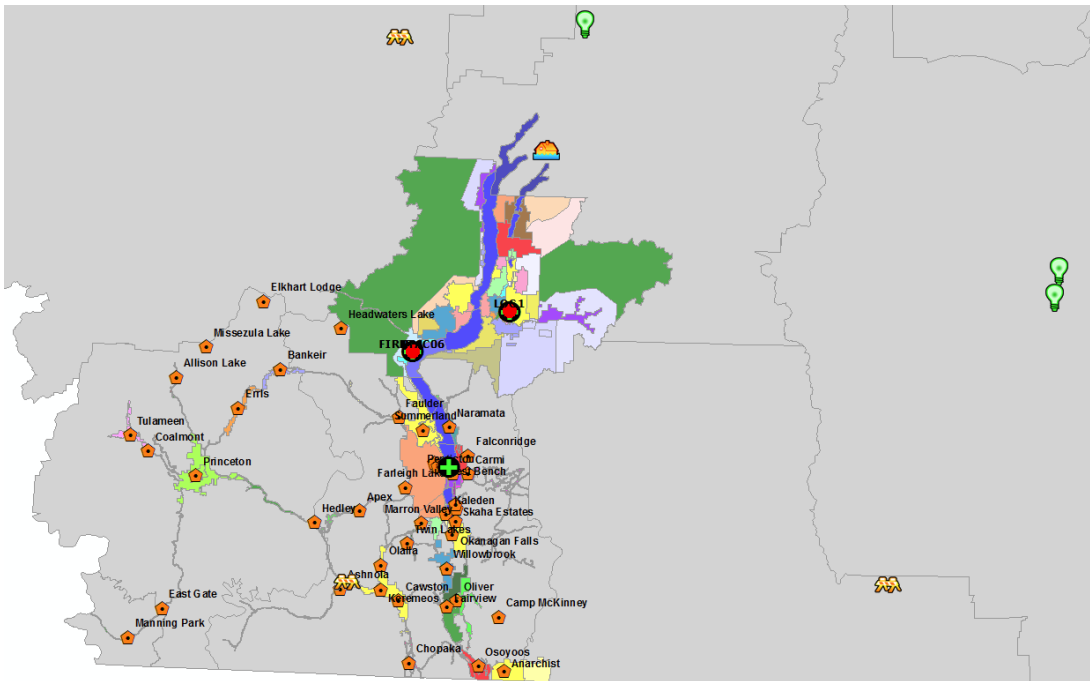
Figure 2: MASAS Data integrated into the Kelowna CAD System.

Another key requirement for local government agencies accessing national situational awareness is having the capability to limit the enormous amounts of available data in the national system by geographically filtering the information they are most interested in. During the project, capabilities were successfully developed to meet this requirement. The Kelowna Fire Department is responsible for the regional emergency program and for the activation of the Emergency Operations Centre. From past emergencies, it was estimated that the time required to become functionally aware of a situation can take between 15 to 90 minutes [11]. Whereas, with the implemented technical capabilities of MASAS and CAD, this time is substantially reduced and emergency management personnel can be informed regardless of their location. This illustrates the leveraging of National capabilities such as MASAS in a local/municipal government context and demonstrates the potential capability of a multi-agency 'Virtual Operations Centre'.

Conclusions

The project resulted in a methodology and approach to achieve interoperability between local governments and F/P/T Emergency management agencies and successfully demonstrated the benefits of national situational awareness. Although the project was relatively small and only scoped to be a study, Kelowna was able to leverage this activity as a catalyst to help them implement a production version of the MASAS interface to their CAD system. Today, this has resulted in an operational system which shares Kelowna local situational awareness into MASAS. While the study demonstrated the value of CAD information, it's important for agencies to establish standard operating procedures and operational polices on the type of information they are willing to share. The shared content then becomes appropriate and adheres to information distribution constraints.

Although the project proved that the existing capabilities of the MASAS could enable national situational awareness, it also highlighted the need for further investments in standard interfaces

and taxonomies. A key information exchange model that standardizes an approach for interfacing systems is the National Information Exchange Model (NIEM) [12]. Examining how NIEM can be applied in an MASAS context is a logical next step. Some software vendors have already aligned their MASAS interfaces with NIEM-compliant Information Exchange Package Documentation (IEPD) [7]. Furthermore, a key building block to advancing interoperability with CAD related data is the implementation of a Common Incident Type classification, similar to the APCO/ANSI standard. The combination of NIEM and a Common Incident Type classification would facilitate further sharing of CAD information to contribute to Canada's National Situational Awareness for Emergency situations.

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References

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[2] Pagotto, J., O'Donnell, D., Dawe P., Allport, D., Rebane, A., Westfall, J., et al. Multi-Agency Situational Awareness System Architecture Version 2, DRDC-RDDC (In-progress).

[3] Galbraith, J., Miller, M. and Li, G. (October 2013), CAUSE Resiliency (West Coast) Experiment Final Report, (DRDC CSS CR 2012-011) Defence R&D Canada – CSS.

[4] Vallerand, A., Boyd, D., Dawe, P., and et al, (July 2013) A Canada-U.S. Resiliency Experiment (CAUSE RESILIENCY II) on Enhancing Trans-Border Resilience Final Report, A Joint Report by Defence R&D Canada – CSS & the U.S. Department of Homeland Security Science & Technology Directorate First Responders Group, (DRDC CSS Report 2013-006) Defence R&D Canada – CSS.

[5] Kelowna Fire Department (2013), 2012 Annual Report.

[6] APCO, Public Safety Communications Common Incident Types for Data Exchange, ANS 2.103.1-2012.

[7] Dawe, P. and O'Donnell, D. (December 2013) MASAS – Computer Aided Dispatch Integration – DRDC Technical Advisory Note, (CSSP-2012-TI-1061-Z03).

[8] Public Safety Canada, Interoperability Development Office. Common Alerting Protocol Event Resources Version 1, (In-progress).

[9] Natural Resources Canada (March 2010) Emergency Mapping Symbology, Version 1.0.

[10] Federal Emergency Management Agency (January 2012), National Fire Incident Reporting System.

[11] Kelowna Fire Department (March 2014), MASAS/FDM CAD Integration Project Study Report.

[12] NIEM Program Management Office. (February 2007) Introduction to the National Information Exchange Model.

Attachments

Annex A: The quad chart of the Kelowna community development project.

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