Comparing Web Feeds and Tweets for Emergency Management

Robert Power
CSIRO ICT Centre
G.P.O. Box 664
Canberra, ACT 2601, Australia
robert.power@csiro.au

Bella Robinson
CSIRO ICT Centre
G.P.O. Box 664
Canberra, ACT 2601, Australia
bella.robinson@csiro.au

Catherine Wise
CSIRO ICT Centre
G.P.O. Box 664
Canberra, ACT 2601, Australia
catherine.wise@csiro.au

ABSTRACT

This paper describes ongoing work with the Australian Government to assemble information from a collection of web feeds describing emergency incidents of interest for emergency managers. The developed system, the Emergency Response Intelligence Capability (ERIC) tool, has been used to gather information about emergency events during the Australian summer of 2012/13. The web feeds are an authoritative source of structured information summarising incidents that includes links to emergency services web sites containing further details about the events underway.

The intelligence obtained using ERIC for a specific fire event has been compared with information that was available in Twitter using the Emergency Situation Awareness (ESA) platform. This information would have been useful as a new source of intelligence: it was reported faster than via the web feed, contained more specific event information, included details of impact to the community, was updated more frequently, included information from the public and remains available as a source of information long after the web feed contents have been removed.

Categories and Subject Descriptors

H.4 [**Information Systems Applications**]: Miscellaneous

General Terms

Experimentation, Measurement

Keywords

Disaster Management, Situation Awareness, Social Media

1. INTRODUCTION

ERIC is a collaboration between the CSIRO and the Australian Government Department of Human Services (the department). The project is focused on the work practices of the department's Emergency Management team which is responsible for intelligence gathering and situation reporting during emergency events.

The ERIC tool integrates information from numerous sources: statistical regions from the Australian Bureau of Statistics (ABS); context data including demographics and details of the natural and built environments; departmental regional

profile data; web feeds describing emergency events as they progress; and the historical record of previous web feeds.

Social media is used informally by individuals within the Emergency Management team but is not used as a source of information in terms of 'official' intelligence gathering. There is an opportunity to use social media in the ERIC tool, for example monitoring Facebook and Twitter accounts of emergency service organisations, and to include summaries from these sources as a new form of intelligence.

To demonstrate the potential of social media for emergency management, ESA was used to review the content available from Twitter for a specific fire event. The results demonstrate the advantages of integrating social media as part of the intelligence gathering aspect of the ERIC tool.

The rest of the paper is organised as follows. First, background information is presented about the Australian Government Department of Human Services, the ESA platform and the web feeds and Twitter accounts used. Then the operational needs of the department's Emergency Management team are described. The tools developed are then outlined along with a description of their use by the department in the summer of 2012/13 during two bushfire events. One of these events was also explored using the ESA platform to compare the Twitter information available at the same time. The conclusion provides a summary of our findings and plans for future work.

2. BACKGROUND

2.1 Emergency Management in Australia

The States and Territories have jurisdiction for managing emergencies with the police taking command during the response phase. When the scale of the incident is beyond the capacity for the local authorities, the Federal Government provides financial and other assistance.

2.2 The Emergency Management team

The Australian Government Department of Human Services Emergency Management team has specific responsibilities for large scale emergency events. They deliver services on behalf of various levels of Australian governments to the community during an emergency. Examples of the activities performed are noted in Section 3.2 below.

2.3 The ESA Platform

Social media provides a new stream of data from which crisis coordinators, media communicators and national security stakeholders can obtain near-real-time awareness of

developing situations. The ESA platform [2, 4] provides all-hazard information captured, filtered and analysed from Twitter with results accessible via an interactive website.

In particular the ESA platform has the ability to: automatically detect unusual events or topics; summarise clusters of related Tweets; show tweets in a cluster; and locating the approximate origin of a related set of Tweets. The ESA website, `http://esa.csiro.au/`, can be used as both a live monitoring tool and for investigating historical events.

2.4 Web Feeds

ERIC monitors web feeds from emergency services agencies and other organisations providing information about cyclones, fires, road closures, accidents, weather warnings and satellite 'hot spots'. In total, ERIC tracks eight RSS feeds, eight GeoRSS feeds, three KML sources, nine GeoJSON and thirteen GML files. The KML and GML files are mostly geometries, containing little descriptive information, while the eight RSS feeds contain no geocoding and locations are detected using standard phrasings. The RSS and GeoRSS feeds are structured to be human readable whereas the GeoJSON files are machine readable and highly structured.

On average the feeds are updated every 38 minutes. ERIC checks for updates every ten minutes, since during an emergency information is updated more frequently and this is when it is most crucial to keep up-to-date.

2.5 Emergency Services and Twitter

The Australian emergency services also publish incident information on social media sites. In the state of New South Wales (NSW) there are active official Twitter accounts for the NSW Rural Fire Service (RFS), Fire and Rescue NSW (FRNSW), NSW Police, NSW State Emergency Services and NSW Roads and Maritime Services (RMS).

This use of social media provides a new communication channel to inform the public and also provides a mechanism for sourcing information from the community. Users can retweet or share an official message to 'spread the word' to their followers or friends. They can also send messages directly to the emergency services to provide local information, such as photos. Myth busting is another important aspect of social media interaction with the community.

Increased use of social media has resulted in growing expectations on emergency services by the general public. In a recent survey by the Canadian Red Cross[1], 63% of respondents think response agencies should answer calls from social media networks and 35% think emergency services would respond to a request for help posted on social media with 74% of those believing help would arrive within one hour.

Another study [3], found that 52% of Australian social media users would post a request on a response agency's Facebook page, 18% would send a message via Twitter requesting help and 75% would use social media to ask other people to help contact a response agency.

3. ERIC

The ERIC concept is predicated on the need to deliver the right information in the right format to the right people in the right place at the right time by supporting the intelligence gathering and situation reporting activities of the department's Emergency Management team.

_____
[1] `http://www.redcross.ca/article.asp?id=44311`

3.1 System Overview

Figure 1 shows examples of the ERIC map interface. The Emergency Management team compile information about the department's clients who may be affected by an event. For example, the number of people in a region receiving certain benefit types and cultural information, such as preferred languages or indigenous indicators. This information is termed *departmental demographics* and is useful for preparing the appropriate response for a region. Similarly, ABS demographic data is also useful, such as population, age profile and average household income. Figure 1(b) shows this information for the highlighted postcode area.

The ERIC tool, available at `http://eric.csiro.au/`, consists of an Open Street Map user interface operated using a web browser, an Apache web server and the Flask web application extension. All static data (ABS regions, demographics and so on) was pre-loaded into a PostgreSQL/PostGIS database. The web feeds are regularly polled with the results stored in the same database. As new dynamic data is obtained, it is compared with the previously obtained information allowing the user to be informed of any differences. All server side code has been developed in Python with JavaScript used for the client interface.

3.2 Operational Needs

The Australian Government Department of Human Services divides Australia into 16 Service Zones and has over 700 office locations and Smart Centres. The process of responding to an event requires the department to make operational decisions to deploy staff and equipment into the affected region to provide services to the community. The movement of staff and equipment in this manner has an impact on the business as usual (BAU) operations of the rest of the department as well as the front line services being deployed during an emergency.

The Australian disaster season typically involves bushfires, floods and cyclones with numerous events occurring at the same time across multiple Service Zones. The department's Emergency Management team, located at the head office in Canberra, coordinates the response and provides an overview of all events around the country in a single Situation Report (*SitRep*) detailing the impact: on local communities, the department's staff who may live or work in the affected region, and the department's existing customers.

The *SitRep* also describes the response activities undertaken such as the staff mobilised, the BAU impact, statistics about phone calls received, claims summary and amount of money paid. Social media is used informally by individuals within the Emergency Management team as a source of intelligence but is not recorded in the *SitRep*.

4. THE ERIC EXPERIENCE

4.1 Preliminary Investigations

In early January 2013 a number of fires were active around Australia. In Tasmania, the region near the historic site of Port Arthur was under threat with the worst affected area being the village of Dunalley. For the period 3–18 January, 587 GeoRSS feeds were recorded in the ERIC database describing this fire as published by the Tasmanian Fire Service.

The ERIC tool replicates the work practices of the Emergency Management team to gather intelligence to produce a
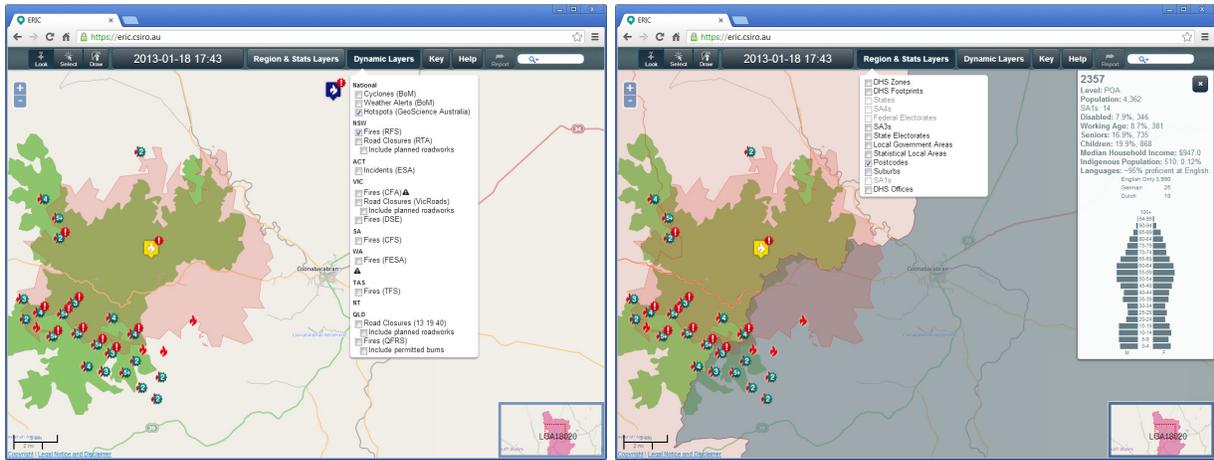
(a) Hotspots and fire extent   (b) Postcode Demographics

Figure 1: ERIC showing the 'Wambelong WNP' Fire near Coonabarabran on 18 January 2013.

SitRep. The team can use ERIC as a single point of reference for the fire events described by the different fire agency GeoRSS feeds. Their previous work practice was to manually review each of the various web sites for each state and territory. They also use ERIC to easily obtain ABS demographic information, their own *departmental demographics* and to easily produce overlays of other incident information, such as the satellite hotspots and cyclone tracks.

4.2 Further Evaluation

Fires were also active around this time near Coonabarabran in the Warrumbungle National Park (WNP), shown in green in Figure 1. The 'Wambelong WNP' fire was first reported in ERIC on 12 January as a *Fire* which escalated to an *Emergency Warning* on the 13th. This can be seen in Figure 2 which plots the published times from the web feed of the alert levels for this fire.
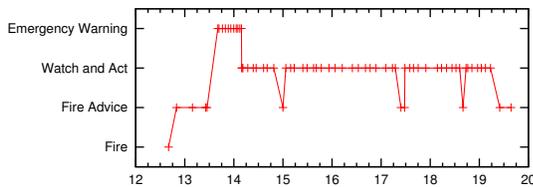

Figure 2: Wambelong WNP alerts for 12–19 Jan.

This event threatened the Siding Spring Observatory, destroyed over 50 properties and burned a region in excess of 53,000 hectares.

The extent of the fire reported by the NSW RFS is shown in red in Figure 1(a) with satellite 'hotspots' indicating where the active fire fronts were. For the period 12–19 January, ERIC recorded 2,846 NSW RFS feed entries describing 690 fire incidents of which 32 were serious fires with alert levels of *Watch and Act* or *Emergency Warning*. Since the web feed describes all active fires for the state, as information is updated for one fire, the entire feed contents are updated. For example, 144 entries were recorded in ERIC by 19 January for the 'Wambelong WNP' fire, however only 77 contained new information.

Table 1 is an abbreviated example of the NSW RFS web feed giving a summary of the current situation. The feed includes a point location of the fire and may contain a polygon outline of the fire scar. By regularly polling the web feed the changes to the published information can be identified and the user notified. Note that this structure is specific to the NSW RFS web feed. The different fire agencies have their own structure but do use common terminology to describe fire events; notably the alert levels are nationally consistent.

Table 1: Example Wambelong WNP GeoRSS feed.

Alert level	Emergency Warning
Location	Wambelong Camping Area . . . [2]
Status	Out of Control
Type	Scrub fire
Size	4 ha
Agency	Rural Fire Service
Updated	13 Jan 2013 16:08

5. ESA INFORMATION

5.1 Tweet Gathering

The ESA platform collects Australian Tweets with the aim of identifying information about emergency events. Tweets containing the keyword *wambelong* or *coonabarabran* and published by the users *NSWRFS*, *LiveTrafficNSW*, *nswpolice* and *FireRescueNSW* for the period 12–19 January were collected from the ESA Tweet cache, termed the 'official' Tweets' below. Table 2 compares the number of web feeds from these agencies with the Tweets. The total number of Tweets sent is shown along with the 'original' Tweets (excludes retweets), the number of 'retweets' and the maximum and average retweets. There were a further 3,762 'public' Tweets collected by the ESA platform within this time period containing the same keywords.

Table 2: 'Official' Web feeds and Tweets.

Agency	Feed	Tweet	Original	RT	max	avg
RFS	77	87	83	862	104	10.5
RMS	108	7	7	26	9	3.7
Police	n/a	23	17	56	14	3.3
FRNSW	n/a	10	2	9	6	4.5

---

[2]Full text: *Wambelong Camping Area, north of creek, 1km West of the Visitors Centre, north of John Renshaw Parkway. 40 kms west Coonabarabran.*

5.2 Comparing Web Feeds and Tweets

The ERIC web feed contents and the ESA Tweets were loaded into a timeline[3] to assist in the comparison of information from the different sources. Figure 3 shows the timeline when the fire was first elevated to an *Emergency Warning* with the web feed contents on top and the Tweets below. Note that viewing 'public Tweets' can be toggled.
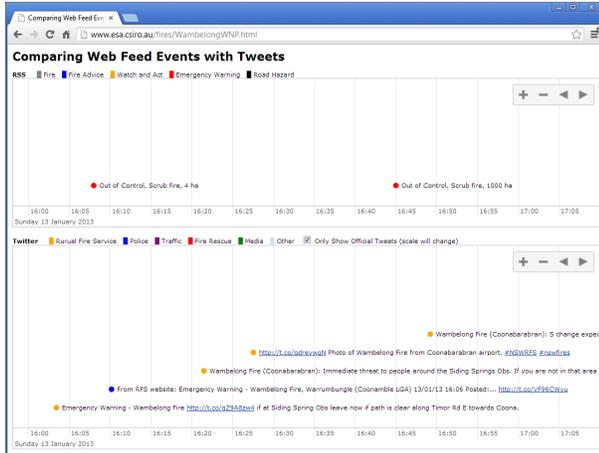
Figure 3: Wambelong WNP Timeline.

The RFS *Emergency Warning* Tweet was sent five minutes before the web feed was updated and during this time nine Tweets with specific incident information were sent while the web feed was only updated twice. 92 of the 'official Tweets' contained URLs to further incident information including 14 photos. Important Tweets are retweeted by different emergency services agencies: the NSW Police retweeted the first RFS *Emergency Warning* Tweet seven minutes after it was posted, indicating that they closely monitor Twitter as a source of intelligence and also use this medium to actively communicate with the public.

As noted above, the contents of the NSW RFS web feed contains a summary of the fire event and the contents are only updated in ERIC when the information changes. Further details are available at the 'Major Fire Updates' page[4] however the contents of this page only list information about events that are current. Important information about the fire is not available after the incident is over.

The 'public Tweets' contained 517 URLs to further information with over 180 different photos. These links are to media reports, community websites, blogs and photo sharing sites. One Facebook user[5] made copies of the RFS 'Major Fire Updates' page[4] as the incident unfolded providing an ad-hoc record of official information that is otherwise lost.

The Tweets are not structured, but they provide specific detailed information about the event. For example, the first *Emergency Warning* web feed describes the location of the fire and the region under threat[2] whereas the corresponding Tweet included the advice to leave the Siding Spring Observatory. This is evidence, also reported elsewhere [1], that the emergency services in Australia are embracing Twitter as an effective way of communicating with the public.

5.3 ESA Alerts

The ESA platform includes a burst detector based on a parameter-free statistical model of word occurrences to generate alerts [2]. The alerts are recorded in a database that can be later searched. The keywords 'coonabarabran' and 'observatory' were first recorded as alerts on 13 January at 16:22 and 17:16 respectively and escalated to *red* alerts at 17:25 and 17:24. These alerts first occurred 19 minutes and 73 minutes after the official *Emergency Warning* on Twitter and took almost an hour and a half to appear as 'red' alerts in ESA. This provides an indication of the time taken for the community to notice and respond on Twitter to this event.

6. CONCLUSIONS

ERIC is a web based productivity tool that: automatically gathers dynamic data from a range of sources; stores it in a database; recognises changes to the status of emergency events; presents the data in a map based web site; includes references to further information managed by the data custodians; provides a backup of the web feed contents when a site is unavailable; and supports the generation and management of situation reports.

Further intelligence can be included in ERIC from social media. Our examination of the 'Wambelong WNP' fire shows that information was published on Twitter prior to the web feed, contained more specific incident information, was updated more frequently, included information from the public and was available after the web feed contents were removed.

So far we have focused on a single major fire to test the usefulness of Twitter information for ERIC. Further analysis of other incidents is needed to demonstrate the utility of combining Twitter information with the web feed content.

Future work is planned to integrate features of the ESA platform into ERIC and to promote it to other Federal government agencies involved in emergency management.

Acknowledgments

7. REFERENCES

[1] M. Anderson. Integrating social media into traditional management command and control structures: the square peg into the round hole. In *Australian & New Zealand Disaster and Emergency Management Conference*, pages 18–34, 2012.

[2] M. A. Cameron, R. Power, B. Robinson, and J. Yin. Emergency situation awareness from twitter for crisis management. In *Proceedings of the 21st international conference companion on World Wide Web*, WWW '12 Companion, pages 695–698, New York, NY, USA, 2012. ACM.

[3] M. Taylor, G. Wells, G. Howell, and B. Raphael. The role of social media as psychological first aid as a support to community resilience building. *Australian Journal of Emergency Management*, 27(1):20–26, 2012.

[4] J. Yin, A. Lampert, M. Cameron, B. Robinson, and R. Power. Using social media to enhance emergency situation awareness. *IEEE Intelligent Systems*, 27(6):52–59, 2012.

---

[3] http://esa.csiro.au/fires/WambelongWNP.html
[4] http://www.rfs.nsw.gov.au/dsp_content.cfm?cat_id=684
[5] http://www.facebook.com/southernstormchasing