All Source Intelligence and Operational Fusion

Fusing Crowd Sourcing and Operations to Strengthen Stability and Security Operations

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Executive Summary

Experience in Afghanistan and Iraq clearly shows that combat operations and stability and security operations are no longer separate concepts. In virtually every conceivable area of operations, US forces will operate in and around large civilian populations. U.S. civil-military doctrine and capabilities have largely kept pace with these requirements. However, the doctrine and capabilities for effectively fusing and using information from civilian sources is in its infancy. Further development of the spectrum of Doctrine, Organization, Training, Materiel, Leadership and Education, Personnel, and Facilities (DOTMLPF) can potential significantly expand U.S. capabilities to effectively conduct both combat operations and stability and support operations in populated areas.

A combination of technology and social forces are coming together now that makes effectively integration information from civilian sources into an all source intelligence picture possible. Cellular technology and smart phones are now present in virtually every area on the globe. More people are now connected than at anytime in history. And they are talking. The rising technology of smart phones and even the ability of other cellphones to send text messages now means there is an abundance of potential information available within a commander's area of operations. In cases, the information is there for the commander to take as it courses through the networks.

Generally speaking, U.S. forces have been very successful at intercepting cellular calls and incorporating them into our intelligence framework. However, these operations are just the tip of the iceberg of what can be done through cooperative techniques such as crowdsourcing.

Crowdsourcing represents a tremendous opportunity to rapidly gain information about the operating environment in order to fuse development efforts, and security operations in order to rapidly respond to both threats and opportunities. While crowdsourcing came to prominence during the Haiti earthquake relief operations in January of 2010, it has been effectively used for several years in Africa and elsewhere. Haiti, however, showed the power of crowdsourcing during coordinated civil-military operations.

DARPA and others are looking hard at the potential for using crowdsourcing techniques in Afghanistan and elsewhere. The DARPA More Eyes project is an exploratory effort to use these techniques in order to expand the commander's view of the battlespace and improve cooperation in civil-military development and security efforts. Thermopylae Sciences + Technology (TST) is a major part of the More Eyes effort, based upon our crisis proven technology in Afghanistan, Haiti and elsewhere and our proven ability to rapidly deliver effective solutions that deliver critical capabilities to armed forces, diplomats and the development community. TST rapidly effectively integrated crowdsourcing into US Southern Command's User Defined Operating Picture (UDOP) and is now poised to help the Department of Defense and the Department of State to develop the DOTMLPF and operational techniques to further integrate crowdsourcing into a mature capability.

Crowdsourcing is also a logical extension of LandISRNet and Relevant ISR to the Edge (RITE). Inclusion of fused crowdsourced information will help U.S. forces to respond rapidly to developing situations to

exploit opportunities, respond to situations that impact security and improve communications with the local populace.

Background

Success in both combat and stability and security operations increasingly depends upon a fusion of all source intelligence that can rapidly inform and guide operations to respond to events that undermine security.

To do this, crowdsourcing provides an opportunity for a "viral" distribution of the application and reporting capability through smartphone applications, smartphone web pages, traditional web pages, and SMS texting. This combination provides an integrated information umbrella that includes not only smartphone technology, but also existing cell phones and traditional web pages into a holistic architecture that provides a rich information environment for decision-makers.

Some of the key data that crowdsourcing can collect are:

- Physical road conditions – bridges, passes, tunnels passable
- Checkpoints, both authorized and unauthorized
- Incidents that affect safety and security
- Economic conditions such as:
    - Markets
    - Gas/food/lodging
    - Natural resources
    - Developmental projects

Effectively integrating crowdsourcing into both a public and a secure network provides:

- Open forum for queries and collaboration
- Location history (one week or more)
- Common Operating Pictures for development and security
- Fusion of crowdsourcing information with other sources to rapidly and effectively respond to events that impact security and stability

In order for crowdsourcing to work, the key stakeholders must feel they are getting fair value for the information that they provide. In the case of the international development and aid community, this value is based upon obtaining the information that they need to do their job in a safe and secure manner and additional tools to help them improve the targeted delivery of aid and developmental resources. In the case of individuals living and working in the area of operations, this value is a steadily increasing view and understanding of the goods and services they can obtain as well as to increase their overall security. For the military, the key value is to find those events that undermine a safe and secure environment and rapidly respond to them, as well as to help coordinate their efforts with the international aid and developmental communities.

In short, the key value for all contributors is a growing picture of the environment and tools to help them navigate it, easily find the information they need and then be able to act upon it.

Crowdsourcing

Crowdsourcing is an excellent approach to meet these objectives. It provides a dynamic platform for multiple users, from a wide spectrum of people, to input data into a common situational picture. Once users see the power of mutually shared information, crowdsourcing programs often go viral is users add more information and new users see the value of the program and grow rapidly.

The Haiti earthquake relief effort clearly demonstrated the power of crowdsourcing and brought the concept to the attention of many planners and decision-makers. As relief workers and US military personnel flowed into Haiti, they used the power of smartphones and other devices to rapidly build up situational awareness and share information in a highly collaborative manner.

When the relief operation first started, the Haiti map had very little detail and was missing critical elements required to prioritize and coordinate relief efforts. Users updated maps and added missing detail to the basic maps, as well as linking critical pictures to the map that helped relief workers to see the up-to-date conditions on the ground as the planned and conducted relief efforts. The Haiti geo-spatial map quickly grew from almost nothing into a robust picture of both the crisis and the ongoing relief efforts.

However, the concept of crowdsourcing pre-dates the Haiti relief efforts and has been effectively used in other locations, such as Africa to improve collaboration and developmental efforts, such as Ushahidi in Kenya. It was originally put in place in 2008 to respond to post-election turmoil and was used to map violence and other incidents through both reports submitted via the web and mobile phones. Since then it has grown to include developmental and other efforts. The group's efforts then expanded into help map violence and other issues in South Africa, Gaza, India and Pakistan.[1]

Figure 1 Ushahidi Usage[2]

[1] The Ushahidi website, http://www.ushahidi.com/about
[2] Figure taken from http://www.ushahidi.com/platform

The Ushahidi concept has been exported to Pakistan as well to help with relief efforts there to respond to respond to the flooding and help to guide relief efforts. This ongoing effort helps to show the concept can work in the AfPak area.

Prototype Concept

Overview

TST can provide an integrated set of capabilities that help all stakeholders, the military, the international aid and development communities and the individuals living in the operational area to achieve a greater understanding of the environment and assist them in performing their daily tasks. This set of capabilities rests upon several key functions:

- Provide an integrated geospatial display tailored to each user group
- Progressively move selected information from the WWW portal that is accessible to all user types to classified environments in which government and military analysts can monitor key trends, focus their activities, and quickly view events that may impact a safe and secure environment and respond to them.
- Provide tools to all uses to help them find the information they need, easily provision their cellular and smartphones, and navigate to where they need to go while avoiding unsecure or otherwise unsafe areas.

These steps are logical extensions to Ozone, LandISRNet and RITE. They can be readily deployed using existing technology. Ozone widgets can be rapidly developed using the technology described below and made available in the Ozone marketplace.

Thermopylae overview

Thermopylae is a different type of company. We reward creativity and innovation, and strive to bring emerging technologies to our customers in ways that can enhance organizational performance and further their missions. We combine industry experts in information technology and pair them with team members that are subject-matter experts on our customer's key problem sets. The result: cutting edge solutions that are tailored directly to our customers' needs.

As a strong partner with Google, TST understands the geospatial environment and is a partner in developing new technologies and applications in both geospatial views and mobile applications. Google has clearly recognized our value and has stated that TST is one of the most prolific developers using their technology.

We pride ourselves on our ability rapidly deliver value to our customers, often under extremely trying an stressful situations. An example is our support to the Haiti earthquake relief effort. Within a week, our team, working with SOUTHCOM experts rapidly delivered a highly configurable, User Defined Common Operating Picture (UDOP) that incorporated existing, easy to use Google Earth™ technology, crowdsourcing concepts, and a dynamic approach to easily configure the interface to meet specific requirements and display live, evolving data. This effort clearly helped to save lives and speed the relief effort.

Concept

TST envisions a phased roll out for crowdsourcing that will effectively leverages TST technology already in use in the military, DoS, and the private sector in conjunction with DARPA's More Eyes effort. Using this approach, TST can rapidly configure an implementable solution that can both demonstrate the effectiveness of crowdsourcing to fuse all source information to support operations and to inform DOTMLPF developmental efforts. The technology is ready and has been effectively demonstrated.

TST can readily integrate crowdsourcing integration into a geospatial display as part of a comprehensive solution that provides analytical capabilities and the ability to pass selected information command and control system in order to rapidly respond events that impact safety, stability and security, as well as to help guide and inform developmental efforts.

For example in the More Eyes pilot, TST would provide the ability to easily provision and deliver mobile applications to relief workers and Afghan citizens. Data from the mobile device reporting would then flow through More Eyes and into the Ushahidi public website. The approach will be relatively easily to implement and configure, but will provide limited analytical value or connectivity with ISAF systems. Its primary focus will be to determine how to best distribute devices and applications to relief workers and Afghans and provide immediate value through identifying critical data listed above, such as gas stations, checkpoints and road obstructions.

TST's mobile provisioning will provide the backbone for all application distribution using TST's Ubiquity technology. With Ubiquity, users only need to provision a single mobile application. More Eyes program managers determine what to develop and include within the More Eyes Ubiquity system and quickly develop these items. This will speed capability development and allow new types of data collection and display to be quickly brought online, creating significant value for More Eyes users with very little effort on their part.

In addition, TST can also provide mobile application provisioning and management and add critical collaboration, reporting and analytical capabilities in order to increase the value not only to the Afghan citizens and relief workers, but also to overall USG efforts, to include development programs and ISAF security efforts. TST capabilities will help to connect analysts together to promote sharing, push critical events to analysts and into a SIPR based COP and help to coordinate response efforts where required.

An example scenario

- Afghan citizen reports an NGO convoy came under attack via Crowd Sourcing
- This event is quickly reflected the WWW COP in context with other entries made from crowdsourcing such as gas stations, illegal roadblocks, and other traffic obstructions
- The system sends an alert to the TOC for the unit that controls the area and the event is pushed to a SIPR
- The unit's SIPR based UDOP shows the attack was on Route Red and marks the spot on the map.
    - Creates an "action" polygon to govern contact reaction
    - Pops a contact icon and action polygon on the map so it is visible to the TOC and all impacted users

- Determines the contact is on Route Red and highlights and alerts the TOC that Route Red may not be usable

- The system then determines who is either on Route Red now or will be using Route Red in the next hour.
- It then identifies potential units in the area that can rapidly respond and determines routes for response units and new routes to route other units away from the contact area
- TOC reviews the Ubiquity data and concurs/edits the information and uses the system to send alerts to response units and units that need to be re-routed
- It then helps the TOC to alert a UAV to provide FMV coverage to the situational area. FMV is linked to the map. Users can click on the map link to see the FMV
- TOC monitors the situation via UDOP and can track response units as well as other traffic and devices
- Response element uses Dragon Naturally Speaking to send a report back to the TOC. This is also geospatially recorded for reference and later analysis.
- UAV FMV of the response is geospatially linked to the map for further after action review and analysis
- After area is cleared, the system re-establishes Route Red as a valid route and confirms/re-routes as required

The scenario can be supported by the architecture shown below in Figure 2.

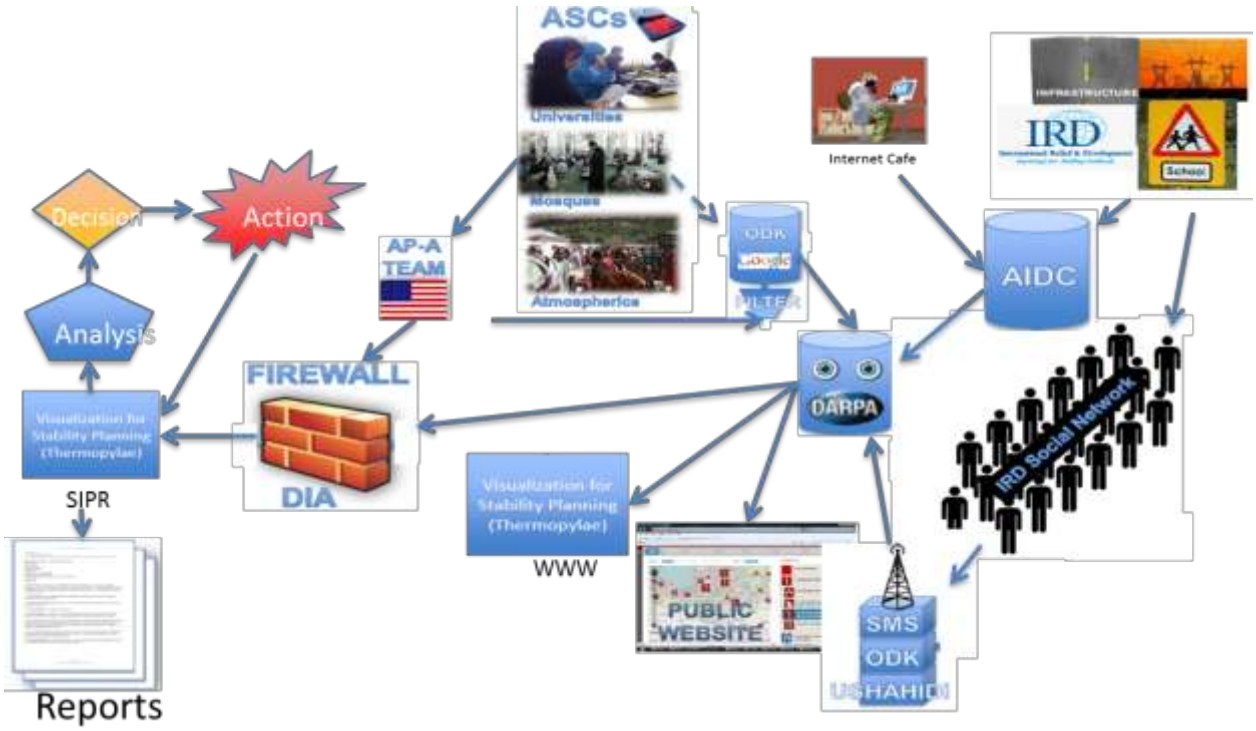

Figure 2 Potential Crowdsourcing architecture

The architecture above shows how existing efforts in Afghanistan can be rapidly tied together to provide information for the public, for the aid and development community and for ISAF command and control.

When integrated together, this architecture helps decision-makers to find the key pieces of information that promote success and to respond to rapidly evolving situations that could undermine security and stability. This architecture can be rapidly built using both COTS and GOTS solutions that are already employed in critical applications.

Key capabilities illustrated

User Defined Common Operating Picture

UDOP is a government owned solution that TST rapidly developed for the US Southern Command to respond to the Haiti earthquake in January 2010 using its iSpatial technology. It allows users to rapidly fuse data from multiple sources into user defined geospatial displays in order to fuse information in time and space to assist decision-makers to rapidly understand evolving situations, see trends and find the critical factors that impact success and then make effective decisions. UDOP has significantly evolved from its first implementation to support the Haiti relief efforts and is now an integral part of SOUTCOM's command and control systems.

Blue Force Tracker-One

Blue Force Tracker-One enables the U.S. Department of State's Bureau of Diplomatic Security to maintain enterprise-wide situational awareness and emergency response for its most critical missions. Users can visualize and explore geospatially referenced data on a 3-D globe, manage real-time intelligence feeds, sensor feeds and mobile messaging devices—all layered over high resolution georectified imagery with 3-D terrain, structural models and user-generated graphics. These common operational pictures are shared by DoS headquarters and embassies utilizing SIPRNET and secure satellite links.

iSpatial

iSpatial is a powerful, Web-enabled software framework that allows intelligence, operations and data fusion in a visual, geospatially aware environment. iSpatial brings the value of pre-built components and application functionality by leveraging the Google Earth™ Enterprise API, which can be quickly customized to your specific requirements. iSpatial can be rapidly deployed as a standalone solution or interfaced with nearly any existing and legacy database systems, including live feeds. This framework is completely configurable to customer specifications and can be tailored for specific solutions.

Features and capabilities of iSpatial include:

- Visualization and track data on a 3-D globe
- Managing real-time information, intelligence feeds and mobile messaging devices directly from a Web-based user interface
- View customized data layers of 3-D terrain, models and user graphics
- Plan and simulate missions
- Collaborate and share data instantly in real-time

IHarvest

iHarvest—short for "Interest Harvest"—is an automated, simulated artificial intelligence system that operates unobtrusively and continually monitors user queries, building profiles based on TST's own

advanced proprietary algorithms. User profiles can be custom-tailored and then used to link analysts with common interests, forming powerful collaborative alliances with information-sharing opportunities. Because iHarvest is an adaptive system, it "gets smarter" as it surveys users' search terms, honing in on user-specific needs and becoming more accurate as it is used. This ultimately makes the users' searches more efficient, enabling them to find out what they need, when they need it.

Features and capabilities of iHarvest include:

- Develop profiles of users' specific concepts and interests
- Match user profiles with data repositories to bring pertinent information back to users
- Integrates with installed search applications for minimal disruption
- Recommendation widget alerts users of matching profiles, facilitating collaboration and awareness between interest groups

Ubiquity

Ubiquity is a revolutionary mobile application platform—currently developed for the Google Android™ and Apple iOS—that enables users to create location-specific mobile application functionality through a Web-based interface and then share this functionality with Ubiquity mobile application users. This broad functionality allows businesses, events, locations, individuals, groups and causes to access and contribute to information. This gives users the tools to get substantially more from their mobile experience than anything else currently on the market. Ubiquity can be deployed for commercial, government or military applications.

Features and capabilities of Ubiquity include:

- Contribute information, reviews, reports, photos, etc on nearly everything around you
- Search and browse location-based content around the users via a 2-D map interface or augmented reality viewer
- Custom-developed plug-ins available to enable additional features within the mobile application
- Specialized Ubiquity implementation available for unique use cases including military, venue and government user

The Ubiquity Web application allows users to create an account and define their relevant context (e.g. business, event, concert, stadium, etc.) Once defined, the user can begin customizing pre-built widgets (menus, lists, news feeds, photo galleries, etc.). The context created online is then pushed to the mobile application for Ubiquity users to view on their smartphones.

The Ubiquity mobile application allows users to browse content via a 2-D map interface or utilize a unique augmented reality interface that allows the person to use their smartphone camera as a viewfinder, locating information in the surrounding area. Users can search for content and expose both Google Places™ information and Ubiquity-specific functionality created online with the application.

Putting it all together

TST is working with DARPA to rapidly put these capabilities together into an effective pilot to demonstrate the power of crowdsourcing in the demanding Afghanistan environment. The technology

is now ready to support these capabilities. Users are increasingly familiar with both the technology and the social aspects of information sharing through social networks. The key is to leverage existing technology and user experience into a holistic DOTMLPF approach to effectively develop and deploy a powerful new capability.

The missing links are policy, doctrine, training and the implementing tactics, techniques and procedures. The U.S. Army's Military Intelligence Center of Excellence could well be a tremendous place to complete the DOTMLPF effort in this area and to integrate the lessons learned from Ushahidi, Haiti and the DARPA More Eyes pilot into a holistic approach with effective tactics, techniques and procedures. The center has a wealth of experienced intelligence analysts that couple hard won skills in Afghanistan and Iraq with an innate understanding of the evolving technology and social networking.

Likewise, the Department of State's Coordinator for Reconstruction and Stabilization (S/CRS) and the U.S. Agency for International Development (USAID) have gained tremendous experience in Afghan, Iraq and a host of other crises. They clearly understand the needs to develop capability to support and coordinate development effort and maintain a secure environment. They also have the critical contacts with non-governmental organizations (NGO) and international governmental organizations (IGO) that often support crisis relief. They can clearly help support the development integrated U.S. policy and work to integrate key NGO's and IGO's into the effort to develop techniques that preserve the NGO and IGO independence while effectively coordinating their efforts with governmental efforts.

Concluding Thoughts

We are at both an exciting and a frustrating time. The technology and the social networking concepts are ready to support these efforts. Haiti and other relief operations have even demonstrated some nascent techniques to integrate crowdsourcing into a comprehensive response effort. However, the policies, doctrine, and training need to be developed and integrated. We cannot stop the technological and social networking waves, but we can clearly surf them effectively if we have the institutional and collective wills to work together to develop effective ways to harness technology and social networking to support developmental, stability and security efforts.

TST heartily supports DARPA's More Eyes's effort and stands ready to work with other elements of the Department of Defense, the Department of State and the NGO/IGO community to develop comprehensive solutions that meet the needs of all three communities.