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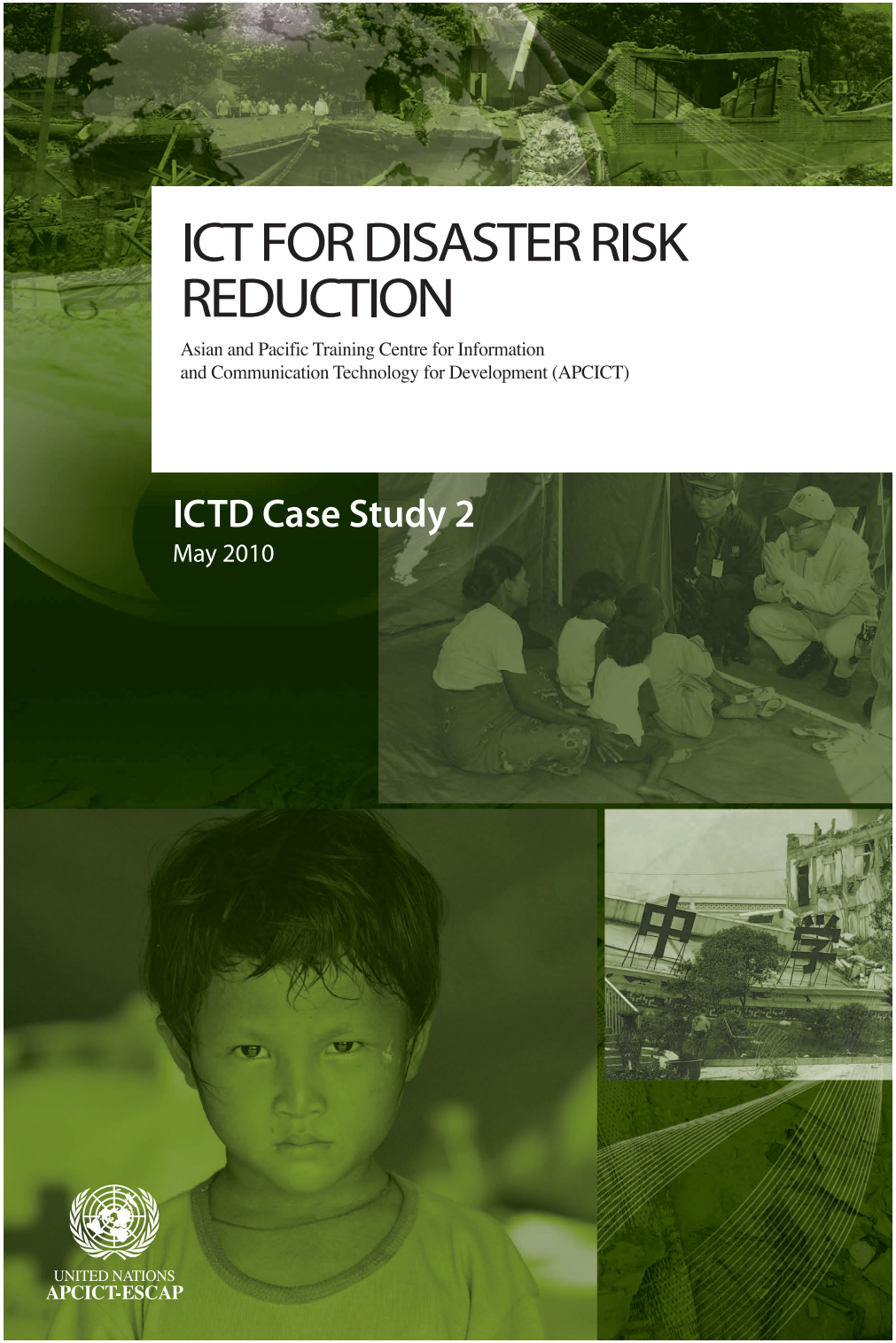
ICTD Case Study 2 May 2010

ICT FOR DISASTER RISK REDUCTION

UNITED NATIONS APCICT-ESCAP



ICT FOR DISASTER RISK REDUCTION

Asian and Pacific Training Centre for Information and Communication Technology for Development (APCICT)

ICTD Case Study 2

May 2010

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The Sahana Free and Open Source Disaster Management System in Haiti

Chamindra de Silva and Mark Prustalis

1. Introduction

In the afternoon of 12 January 2010, a 7.0 magnitude earthquake struck the poverty-stricken Caribbean nation of Haiti. The impact of the earthquake, occurring just south of the densely populated capital city of Port-au-Prince, was devastating as scores of multi-storied concrete structures in the capital and surrounding municipalities collapsed, killing tens of thousands instantly, injuring and trapping thousands of others beneath the rubble.

The earthquake struck mere weeks after the five year anniversary of the Indian Ocean Tsunami. Haiti also represents the first time since the Tsunami that the international community has been called upon to respond to a disaster of such magnitude with a lifesaving search and rescue and emergency relief effort under the coordination of the United Nations and foreign governments. The use of Sahana Free and Open Source Disaster Management System (Sahana) in the Haiti relief effort is only fitting as the system grew out of the devastation leveled by the Tsunami. Haiti, and Sahana's application in the relief effort, represents another instance of what the international community has learned since the Tsunami in terms of humanitarian response, and how it has applied such lessons to disaster relief and management.

This Case Study examines the development of Sahana that grew out of the devastation of the Tsunami in Sri Lanka, and has evolved to serve and support a variety of ICT related needs of the disaster response and relief operations in Haiti. Sahana and its community of dedicated contributors illustrate the potential and lifesaving power of effective and coordinated ICT use in disaster relief and management operations.

2. Sahana Genesis and Vision

The Sahana Free and Open Source Disaster Management System (Sahana) was conceived during the December 2004 Indian Ocean Tsunami in Sri Lanka. It was developed by volunteers from the ICT industry in Sri Lanka to help manage the scale of the disaster, and was deployed by the Sri Lankan government to help coordinate its relief efforts. The initial system helped to track families and coordinate work among relief organizations during and after the disaster. Based on the success of this initial application and the lack of good large scale disaster management solutions, a second phase was funded to make the project a global public good by utilizing Free and Open Source Software (FOSS) in conjunction with humanitarian response operations. Humanitarian FOSS (H-FOSS) was the result these efforts.

Box 1. Sahana H-FOSS

Humanitarian FOSS (H-FOSS) is the application of Free and Open Source Software in the support of humanitarian response. In conceptualizing Humanitarian-FOSS (H-FOSS), the Sahana community references the Red Cross and its Code of Conduct[119].

- No Access Discrimination : FOSS eliminates delays in getting permission for a license as anyone has the freedom to download and use the software. Once available under a FOSS license, the software effectively becomes a global public good, available for anyone from around the world
- Trust and Transparency : The software design and mechanism for building FOSS is transparent, thus building trust. Additionally, with truly global and diverse FOSS communities, the software becomes resistant to any particular political agenda.
- Low Cost and Local Capacity : Few countries, whether rich or poor invest significant resources in pre-disaster management, because there are always higher priorities that need funding. H-FOSS helps reduce the digital divide as there is no additional cost for the product itself. Though people are still needed to maintain the software. a nation has the freedom to reduce costs by promoting the type of local capacity development encouraged by FOSS communities.
- Shared Inter-Organizational Development : NGOs and humanitarian relief groups all need software tools to be effective; however, not all have the funds to purchase the needed tools. H-FOSS projects can be developed and shared globally when a disaster strikes. The FOSS community has a proven track record to build, distribute and maintain such global systems. FOSS can easily provide a vehicle by which organizations can contribute a fraction of the resources, yet benefit from the whole.
- Adaptability : No two disasters are alike; often localizations and customizations are needed for the software before it can be applied effectively to a disaster. Furthermore, no two nations handle the humanitarian response in the same manner. Thus, there are many variances expected of software, including translation, before it can be used by different nations. With FOSS and its blueprints so freely available, anyone is able to modify the software as required to suit a nation's disaster needs.

119. http://www.ifrc.org/publicat/conduct/).

The second phase of Sahana was funded by the Swedish International Development Cooperation Agency (SIDA) and run by the Sri Lanka Software Foundation. The funds supported a core team of 6 full time people that built a more generic disaster management platform, and worked with the growing number of volunteers that joined the Sahana community during subsequent disasters and use of Sahana applications. Today, the Sahana community includes over thirty active individuals supplemented by over hundred members and organizations that further disaster response research and development.

2.1 Disaster Coordination and Information Needs

The vision of Sahana is to help alleviate human suffering and help save lives through the effective use of ICT to help manage disaster coordination problems during a disaster. During its development, Shana identified scale as the primary cause of coordination problems. Large scale disasters affect a million or more people within a very short span of time, and wipe out transport, communications and local emergency management infrastructure such as policing forces, hospitals or fire brigades. Even if infrastructure is left intact, the scale of the disaster can still greatly overwhelm the local resources available to handle those emergencies. To effectively handle the scale of the situation, therefore, the response needs to be quickly supplemented with foreign and local donations, support from civil society, and often the very victims acting as first-responders. Though support is often forth coming, coordinating chaos ensures because each relief group on scene has little idea what the other is actually doing. As a result there is a waste of pledged support, imbalances in aid distribution and a lack of proper coverage of support and services.

Obtaining the right information in these scenarios is critical in preventing chaos and in order to alleviate human suffering and save lives. The right information can provide relief and support to a host of effected peoples; from a crying mother desperately searching for news about her missing child, to camp personnel waiting for the right medical supplies to treat victims; and relief coordinators trying to distribute resources to the right place and in the right quantity. However, managing information is also crucial as large scale disaster relief involves hundreds of humanitarian agencies and organizations that in turn generate massive amounts of data. That is where ICT helps manage information. Through ICT the right data can be shared and accessed instantaneously by government, field operatives, civil society groups, victims and the victims' friends and relatives to enhance the relief effort. If used properly, ICT managed data will empower these stakeholders to build off each other's work. Governments, especially in developed nations, often have 'in-house' systems that manage the tracking of people during disasters. These systems and the data they contain, however, are often protected by privacy regulations that prevent access by relief groups and volunteers that want to help. Furthermore, government operated relief infrastructure can sometimes get in the way due to inadequate resources on the ground, which can then prevent independent relief groups and volunteers from directly and immediately helping the victims.

Clearly then, the right information needs to be both shared and well managed to allow all relief entities to coordinate and operate as one, and effectively distribute aid and services. A centralized portal for government and relief groups would provide a lot of value, if it were not so inflexible to allow for customization necessary in unique disaster environments. Sahana, however, is flexible and does not dictate a portal approach, though it can be deployed as one if required. Sahana's strength lies in its Open Source nature and its ability to be downloaded and customized by anyone to work with specific countries, organizations and purposes. Many governments welcome this approach as it allows them to maintain ownership and control over the system and the data.

3. The Sahana Platform

In order to face the challenges created by large scale disaster and meet the needs of those responding to them, the Sahana platform was designed on principles reflecting an ability to adapt to the constrained environment ICT solutions encounter during a disaster response effort. In addition to the macro-level problems of scale and quantity of data noted about, disaster response initiatives also encountered every day, operational constraints.
The additional ICT related problems that are faced include:

- Telecoms and Internet access is either down, or intermittently available.
- Bandwidth is often at a premium, so every character counts.
- Power outages reduce reliability and availability.
- Potential data center or infrastructure damage due to the disaster.
- Human resources unfamiliar with new systems.
- Off the shelf systems often have to be customized for the requirement or risk not capturing specific aspects of gathered data.
- Local developers have very little time to learn and support the system.
- Interoperating with existing systems and creatiing ad-hoc spreadsheets is often difficult.

When a systems does not address many of these concerns, it was noted that most organizations and volunteers quickly revert to using spreadsheet based systems, which eventually become difficult to clean, match and collate into useful information. However, even if a system is available to address the above, it will not be available to all responders. Thus, one organization will always have to handle the import and export to spreadsheets as part of the solution. Therefore, Sahana was designed by taking such considerations into account.
The principles the Sahana platform was built upon are:

- Bandwidth Efficient : The system has to make efficient use of bandwidth. Thus, the architecture was built so that the developer was quite aware of what his/her module will produce in XHTML or XML on the wire. XHTML without style information is sent back and the entire visual look and feel of the UI is generated entirely from CSS style sheets.

- Quickly Accessible Interface : The system was build to have a clean, uncluttered and simplistic interface which a responder could understand intuitively. Additional help text and tool tips are provided to help familiarize the new user to the system.
- Easily Modifiable : As no two disasters are identical, the system strives to be a rapidly customizable solution. Many of the key customizations (e.g. localization) are available to be done through supporting administrative interfaces. However, if more is needed, the framework's simple design is such that not much more than knowledge of vanilla PHP development is required.
- Framework Components : Features such as GIS, From creation, Security, Language, Tool-tips, translation and reports are built into the Sahana framework, so that a new developer can focus primarily on the business logic.
- Portability and Synchronization : Sahana is also available as a portable application and, thus, moving the program with its data is as simply a matter of copying a directory to a USB disk. If the USB disk is fast enough, the entire program can be run from the disk. When necessary, the data in the portable version can be synchronized with another instance[120] or a central server.
- Ubiquitous Hardware : Though Sahana in using the LAMP stack and can scale up to a server farm to support higher concurrency and throughput, it can also run on low hardware specifications. Therefore, it will run on most existing hardware in developing countries that run XP or above on the server side. Linux is, however, a more efficient way to run Sahana as it supports Ubunutu and Redhat versions on the server
- Resilient Architecture : The architecture adheres to the KISS (Keep it Simple Stupid) principle, which in turn makes the system easy to maintain and reduces the number of potential failure points. Dependencies in the system are kept to a minimum. For example, though internet access is needed to display map tiles, the system degrades gracefully by using alternative GIS to plot points if an internet connection is not available.
- Open Standards Support : Currently, Sahana supports multiple Open Standards from the GIS options such as WFS, WMS, GeoRSS, KML, GML, GPX, to domain specific ones like EDXL-HAVE, CAP and PFIF found in Table 1. Data from these standards can also be exported onto any number of spreadsheet formats[121].

Open Standard	Definition
WMS	The Web Map Service provides georeferenced map images over the Internet that are generated by a map server using data from a GIS database
WFS	The Web Feature Service provides an interface allowing requests for geographical features across the web using platform-independent calls
GeoRSS	Is a standard for encoding geographical location as part of a Web feed
XML	The Extensible Markup Language is a standard for encoding documents electronically, noted for its simplicity and usability over the internet
GML	Geography Markup Language is used to encode geographic content for any application
KML	The Keyhole Markup Language code allows for the visualization of geographic information found on 'Google Earth
GPX	The GPS eXchange Format is an XML schema designed as a common GPS data for software applications
EDXL-HAVE	The Emergency Data Exchange Language is tailored to provide information on hospital availability (Hospital Availability Exchange)
CAP	The Common Alerting Protocol is a data format used for exchanging public warnings and emergencies between ICTs
PFIF	the People Finder Interchange Format is used to provide a cyclical flow of data relating to missing and found persons

Table 1. Sahana Employed Open Standards Definitions

4. Sahana Applications

Sahana and its principled Humanitarian Free and Open Source Software (H-FOSS) approach (see Box 1 for detailed explanation) helps empower a diverse set of actors from Government, Emergency Management, NGOs, INGOs, volunteers and victims allowing them to share and coordinate information on a common platform.

However, Sahana should not be considered one platform, or one simple tool, but rather a rapid application development framework for the rapid creation of solutions for the preparing and relief phase of a disaster. The system supports multiple sub-applications that address the common coordination problems governments and relief agencies encounter in the aftermath of a disaster. Each of these sub-applications exists as independent pluggable modules that can either be included or removed from the final custom solution.

Though the modules presented below were initially conceived during the Indian Ocean Tsunami, and continue to be quite relevant today, many more modules have been contributed by the community. New contributions are often variations of existing modules that have been customized to meet the specific requirements of relief agencies working in unique disaster.

120. An 'instance' refers to a specific deployment of Sahana in either a portable form, or as server
121. Sahana can import data onto the following spreadsheets; JSON, RSS, XML, CSV and XLS

4.1 Sahana Missing Persons Registry

The objective here is to reduce the trauma caused by waiting to be found and to help connect families and acquaintances quickly in order for them to support each other. This type of trauma damage is especially acute for children waiting for loved ones to find them. For example, in Sri Lanka after the Tsunami there were hundreds of bulletin boards with pictures of missing people pinned on them. Physical reviews of hundreds, even thousands of pictures can take quite a while. ICT can help connect people with an online bulletin board to be searched by name, appearance, and age group. Even if the victims or family members do not have access themselves, it is quite easy for any authorized NGO/civil society group to hook up to the central portal and provide that service in the areas that they operate.

The Missing person registry is an online bulletin board of missing and found people. It not only captures information about the people missing and found, but also information of the person seeking missing persons, which adds to the chances of people finding each other. For example, if two members of a family unit are looking for the head of the family, we can use this data to at least connect those two family members. A significant amount of meta data about the individual, such as identity numbers, photos, visual appearance, last seen location, status, can be stored and searched using a 'sounds-like' name search.

4.2 Sahana Organization Registry

During the Tsunami disaster, there was a massive outpouring of support from INGOs, NGOs and the general civil society. In Sri Lanka, there were over three hundred registered NGOs providing support. If all groups are not coordinated effectively, it results in problems such as clogged up supply routes, and uneven distribution of support among within affected areas, double vaccinations and unfulfilled expectations. As a result, all the goodwill and pledged aid will be wasted and under-utilized. However, this can be an overwhelming coordination task for authorized emergency controllers to do manually. An ICT solution can help by providing an organization registry to keep track of who is doing what, where and more importantly where nothing is being done at all (or there is no coverage of a certain service). In this way, aid organizations could self-distribute themselves more evenly across affected regions just by being aware of what other relief groups are doing.

The Organization Registry keeps track of all the relief organizations and civil society groups working in the disaster effected region. It captures not only the places where organizations are active, but also captures information on the range of services they are providing in each area. The module has the ability to obtain public registrations from organizations operating in the region; registering all associated meta data to it and creating a 'who is doing what and where' view of the disaster zone. More importantly is the drill down reporting on the converge of services and support in the region, and the identification of area where no aid services are being provided. The coverage can also be visualized through mapping of relief organizations in the field.

4.3 Sahana Request Management System and Inventory

In the immediate aftermath of the Tsunami there was an unprecedented response in terms of aid and supplies; however 8 months after the Tsunami many of those pledges of aid were not utilized. The main reason for this was a lack of awareness and visibility to the aid available between those that require aid to those that can provide it. For example, while only one NGO might get a specific request for aid, probably only one out of a hundred will actually have a supply of that aid item. It would be impractical for this NGO to check with hundreds of potential places to see if that item is available. Instead, what we need is a well structured central repository of aid being pledged and a system tracking requests for aid. An ICT system should additionally help by intelligently matching requests and aid items.

The Sahana request management system is a central online repository where all relief organizations, relief workers, government agencies and camps can effectively match requests of aid and supplies to pledges of support. It essenyially looks like an online aid trading system that tracks requests through to fulfillment. The inventory system, in turn, is a simple logical system to track the storage and distribution of aid between the time a pledge is delivered to a warehouse to its final distribution among recipients. Its preset categorizations are based on the WHO catalog for the classification of items, which also tracks expiry dates and re-order levels for certain items in the inventory.

4.4 Sahana Volunteer Management System

There is often a massive outpouring of volunteer support during a disaster, as motivated people contribute their skills in support of the relief efforts. Volunteers come from a variety of professional backgrounds including medical practitioners, engineers, logistics management professionals, drivers or generic spontaneous volunteers looking to help out. This presents a vast resource that if tapped effectively can provide a massive impact to the relief effort. However, the personnel numbers to be managed can be in the tens of thousands. Thus, a system is needed to track the individuals, their skills/professions, their availability and what projects they are currently working on. The Volunteer Management module also has a self-registration system that permits the scalable entry of all the volunteer data and search a system that allows for a database search of volunteers for a particular project.

4.5 Situation Mapping System

Mapping and GIS are important features for the effective visualization of a disaster, and for preparing an effective response. Sahana supports Open Layers, which permits Sahana to get any map tile or feature layer that supports the common GIS Open Standards such as WFS, WMS, GeoRSS, KML, GML, and GPX to name a few. This is important because most of the Sahana's modules, including the organization and shelter registries, geolocate their entries as part of their workflow, which can in turn be seen on the central map. The mapping functionality is essentially a core part of the Sahana framework and is accessible to be utilized by any module that needs to enter points or display custom maps.

4.6 Displaced Victim Registry

In contrast to the missing person registry, the displaced victim registry is about tracking displaced families or groups by their composition. One does not have to enter all family members, but you need a brief break down of the number of babies, children, adult males/females and elderly in the displaced family and brief details of the head of the group. Their location is attached to a camp, organization or generic GIS coordinate. This data is used to track families and estimate the amount and type of aid to be distributed.

4.7 Shelter Registry

The Shelter Register is a simple system to plot the location of temporary and permanent shelters for victims, illustrating the main concentration points of shelters after a disaster. Shelter data includes numbers and capacity, so that organizations are aware when a shelter is reaching full capacity or when it is not being fully utilized.

5. Documented Shana Deployments

Since its inception, Sahana has achieved much in delivering value to disaster management efforts, and its vision and applications have been utilized in countries throughout the world, building a community inspired by and dedicated to relief through the use of H-FOSS. By the very nature of being a free and open source project that is available to download from popular public repositories without notification, it is difficult to determine exactly where Sahana has been used, customized and by whom. Nevertheless, the many instances of Sahana application customizations with little contact to and support from the Sahana community is a testament to Sahana's simplicity and functionality.

The deployments noted in Table 2, however, were instances when the Sahana community were actively involved in the deployment and thus, more aware of its ability to delivery. In most cases, deployments were government led and front-ended by an influential local group[122]. In the case of the New York City deployment, Sahana was implemented as a pre-disaster component of the City's Costal Storm Plan.

Year	Disaster	Location	Partner(s)
2005	Tsunami	Sri Lanka	CNO, Government of Sri Lanka
2005	Asian Quake	Pakistan	NADRA, Government of Pakistan
2005	Southern Leyte Mudslide	Philippines	NDCC and ODC, Government of Philippines
2006	Sri Lanka Disaster Preparedness	Sri Lanka	Sarvodaya - Sri Lanka's largest NGO
2006	Sri Lankan Civil War	Sri Lanka	Terre des Hommes
2006	Yogjarkata Earthquake	Indonesia	ACS, urRemote, Indonesian Whitewater Association, Indonesian Rescue Source
2007/08	Pre-deployment	New York City	Costal Storm Plan
2007	Ica Earthquake	Peru	Government of Peru
2008	Shizuan Earthquake	Chengdu	Chengdu Police
2010	Haiti Earthquake	Haiti	WFP, InSTEDD, U.S. State Department, Ushahidi, Sahana Foundation

Table 2. Documented Sahana Deployments and Users

122. IBM has been a strong partner in this regard, with its local IBM country offices taking the lead. Through the country offices the IBM Foundation often recommend and donate Sahana help with hardware to the government.

6. Sahana in Haiti

The Sahana Software Foundation and the Sahana community responded with a massive voluntary effort immediately following the earthquake in Haiti. Working around the clock, members of the Sahana community set up a hosted instance of Sahana (the first post-disaster deployment of Sahana's python-language[123] version - SahanaPy) on a public website that served to fill gaps in the information management requirements of the massive relief operation. This hosting utilized for the first time SahanaPy, Sahana's first version of the popular python programming language. Sahana's response culminated in the launch of The Sahana Haiti 2010 Earthquake Disaster Response Portal, a live and active website that provided responder with access to all of Sahana's modules[124]. Documented below is a discussion of the some of the most utilized modules, why they were utilized by responders, and what results they achieved.

6.1 Core Applications

In the first 48 hours after the earthquake, what responders wanted to know was who else was responding, what organizations already had staff in Haiti, where were they located, and what assets and resources did they have available to them. Sahana's Organization Registry (OR), served to track organizations and offices working on the ground in Haiti. The OR provided a searchable database of organizations responding to the disaster, the sector where they were providing services, their office locations, activities and their contact details. It became one of the primary repositories of organization, office and contact information for the relief operation during the first couple of weeks of the response. The Sahana team encouraged organizations to self-register by email and report their office locations, and volunteers were organized to assist with data entry and to aggregate lists from many sources. Data from pre-disaster lists of organizations working in Haiti available from the United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), as well as active contact lists used by the United Nations Disaster Assessment and Coordination (UNDAC), InterAction and other sources with official and accurate points of contact was entered into Sahana. Next, responders wanted to know where relief and life-saving efforts were most needed. To address this, Sahana provided a simple Request Management System (RMS) to allow requests for assistance (such as "send water") to be made visible to relief organizations working on the ground. Sahana added the capability for organizations to claim requests for fulfillment and later mark them as completed. The RMS

123. Python is a general-purpose high0level program language that emphasizes code readability
124. http://haiti.sahanafoundation.org

also contained a simple ticketing, tracking and reporting system.

The Sahana Software Foundation worked with the U.S. State Department, Ushahidi, Innovative Support To Emergencies Diseases and Disasters (InSTEDD) and others on a project to process SMS messages with requests for assistance and information sent from Haitian citizens. SMS text messages sent to short code 4636 in Haiti were translated from Creole by Haitian volunteers and put into a structured data format identifying the sender's name, location (to the extent possible), and category of the message. The messages were published by a GeoRSS feed from Ushahidi that was captured by Sahana. Sahana could also push updates back to Ushahidi, so that others could see which requests had been responded to. Immediate lifesaving requests were sent from Ushahidi direct to the US Coast Guard and other first responders, while Missing Persons reports went into Google's site that was aggregating missing and found persons data.

The RMS also captured structured messages posted to Twitter using a Hashtag System[125] devised by the Tweak the Tweet project that came out of the Crisis Commons/Crisis Camps community and led by Project Epic at the University of Colorado at Boulder[126]. These messages were also available for review, response and fulfillment within Sahana, although a human filter to separate actionable messages from clutter was needed to make this effective. The RMS was later adapted for use in helping to manage requests for assistance, resources, staff, medical supplies for the Hospital Management System.

During the second week of the relief operation, there were multiple requests to identify the location and operating status of hospitals and medical facilities within Haiti. Sahana organized a volunteer effort to geo-locate approximately one-hundred hospitals with names but without known coordinates over a twenty-four hour period. These efforts added over 160 hospitals to the Sahana registry that had been set up to manage medical and health facility capacity and needs assessment. Sahana's hospital data was published through open standards, making it available to others. A KML feed of the hospital location data remained the most accurate and complete source of operating hospital facilities throughout the first two months of the relief operation, and was accessed by thousands of users world-wide. Sahana also publishes all of its hospital data as GeoRSS, JSON, XML, CSV, GPX, XLS and EDXL-HAVE.

Once immediate lifesaving needs, and health and medical needs for the injured had been addressed, the next challenge faced by relief operations was ongoing support and care for the victims. To address the needs of their food distribution planning, the World Food Programme (WFP) asked the Sahana Software Foundation to adapt its request management system for use by WFP's Implementing Partners made up of relief agencies responsible for distributing food aid to the Haitian population. About one month after the earthquake, the Food Cluster Food Request Portal (FRP) system was available for such use. FTP allows WFP's Implementing Partners to identify their location and the number of beneficiaries they are serving, categorized by age and gender to allow WFP to determine the appropriate types and quantity of food aid needed. The agency also requests a delivery, or agrees to pick up the food aid at a WFP warehouse. WFP receives the request and confirms it, then schedules a delivery or pickup and communicates back to the Implementing Partner through an SMS message generated by Sahana. This simple request-based planning tool may end up being used by the World Food Programme and the Food Cluster for its global relief operations. This system was set up on a separate server to better isolate the sensitive and operational data

125. A method that allows short messages to be tagged by utilizing the hash symbol '#'
126. http://epic.cs.colorado.edu/tweak-the-tweet/helping_haiti_tweak_the_twe.html

6.2 Additional Applications

In addition to these core modules notes, the Sahana portal supported supplementary functionality by utilizing various other applications in collaboration with other partners operating in Haiti. These applications include registries that document shelter capacity and up to date, in country responder contact information, mapping portals that track medical facilities and responders, and translation function to allow relief agencies to easily translation between English, French, Spanish and Creole. Furthermore, there were various independent deployments of Sahana, the most prominent involving the National Library of Medicine.

The two Sahana supported registries include the Persons Registry (PR) and the Shelter Registry (SR). The Persons Registry serves as the main repository of individual contact information for all Sahana registered users and organization staff. It is utilized by all other Sahana registries to store detailed contact information. The Shelter Registry (SR) used data pulled from other sources through open standards for data exchange to identify the locations of the temporary shelters that were spontaneously set up for the thousands rendered homeless by the earthquake. By pulling the data into a registry rather than simply displaying it as a data layer on Sahana's mapping client, it enables Sahana to manage transactional data in conjunction with its other efforts. Essentially, the SR allows agencies to record the population of an encampment, its needs for water, food, and other supplies, and to manage requests to send supplies; a function that cannot be accomplished with a single plotted point on a map. (At the time of publication, this module had been configured for use in Haiti, but in the absence of a specific end-user. request had not yet been enabled).

The Sahana Haiti portal is also able to map geo-referenced data. The data comes from a variety of sources including temporary shelters, food distribution centers, medical facilities and other data management systems and registries. Working with members of the OSGeo community Sahana has obtained a fast tiled set of the current imagery being made available by Digital Globe[127]. Sahana is also leveraging the constantly updated set of Open Street Map tiles. Other data sources that are being utilized within the system include informational feeds from Ushahidi, various point layers and updated road overlays from Open Street Maps, location names, USGS earthquakes, and locations from GeoNames. Sahana continued to build upon these capabilities as relevant layers were made available to the Haiti relief operation. The Sahana Situation Mapping module is the culmination of these efforts and provides an integrated annotated map of what is happening in Haiti. Sources of data for Situation Mapping are noted in Table 3.

127. http://www.digitalglobe.com/

Base Layers	Lead Agency
Open Street Maps current Haiti maps project (3 options for graphic style and amount of detail)	Sahana Registry (OR, HMS (including 4636 messages), RMS, FRP, SR)
Digital Globe Hi-Resolution Imagery (2010-1-14)	Ushahidi (haiti.ushahidi.com) Events
Ikonos Imagery (2010-1-15, 2010-1-17)	Open Street Maps as an overlay to be displayed over imagery
Google Maps (Terrain, Hybrid, Satellite)	Open Street Maps Points of Interest
1:12.5k Topo Maps for PaP	Other Sahana Locations data
1:50k Top Maps	

Table 3. Situation Mapping data sources

With regard to independent deployment, the National Library of Medicine (NLM), the world's largest medical library and an arm of the National Institutes of Health (NIH), released a version of t Sahana-based "Lost Person Finder", called "Haiti Earthquake Person Locator" HEPL[128]. The site provides an interactive website that provides information about people who have been found in Haiti, or who are still missing. The NLM also developed a specialized "Found in Haiti" iPhone application to geolocate found persons and display it on the site. The HEPL system shares information with other person finder systems using the PFIF standard, including Google's Person Finder, to ensure that all searches operate across the largest possible set of matches. It basically provides a public viewer for Google records (using an interactive Notification Wall), with filters for metadata beyond name, and a supplementary iPhone- or email-based input method (with forwarding to Google so the master registry is maintained).

7. Open Standards for Data Exchange

Sahana's use and promotion of Open Standards for Data Exchange played an important role in Sahana's successful response to the Haitian earthquake, and also had a positive impact on many other efforts and projects. Sahana's REST Controller allows data to be published in numerous standard, common formats including kml, json, georss, gpx, xml, xls, and cs. However, the value of Open Standards was, in particular, noted through the use of EDXL-HAVE and PFIF formats in a hospital management system and missing persons registry respectfully.

For the Missing Persons and Disaster Victim Identification (DVI) registries, Sahana worked closely with Google, Yahoo and others to ensure that a common standard for the exchange of Missing Persons data was implemented using the PFIF (Person Finder Interchange Format) standard. The Google site, (http://haiticrisis.appspot.com/) in turn became the main aggregator for collecting all Missing and Found Persons reports. Sahana embedded Google's widget on the Sahana site for collecting missing person information. While Sahana never established a Missing Persons registry, or its own Disaster Victim Identification registry Shana's participation in producing an agreement on a common standard for the exchange of such data was crucial. Furthermore, Building PFIF compliance into Sahana means that the registry is there to more quickly deploy next time. By importing missing and found persons data into Sahana, others can better manage that data, and utilize data found in the Disaster Victim Identification registry to identify track, trace and handle the bodies of the deceased. Through the Sahana and Google agreement on an open standard for data exchange, any updated missing persons status information that Sahana can provide can also be pushed back to the main Google repository, or another repository that can accept and process PFIF.

However, the real success story in terms of the Sahana Software Foundation and open standards in Haiti concerns the adoption of the EDXL-HAVE standard by the Pan American Health Organization, the American government and responding agencies and technology providers such as Sahana, Google and others involved in collecting hospital data. EDXL-HAVE, or Emergency Data Exchange Language - Hospital Availability Exchange is an XML-based OASIS standard that was designed to meet the type of medical reporting that is necessary in Haiti; specifically, the operational status of a hospital or health facility, its bed availability and resource inventory[129]. Within two weeks of the earthquake, the Sahana portal included a hospital management system that provided an EDXL-HAVE feed. Sahana then worked to extend the use of EDXL-HAVE to other systems working to collect similar data for Haiti, thus ensuring interoperability and the ability to seamlessly exchange data between these systems. In coordination with the PAHO, an EDXL-HAVE based framework is currently being adopted by the Health Cluster for Haiti, and eventually will be handed over to the Haitian Ministry of Health.

8. Conclusion: Recent Lessons Learned

Effective Sahana module deployments in Haiti relief operation further demonstrate the success of open source principles to humanitarian effort. The application and customization of Sahana modules, and their usability

128. http://hepl.nlm.nih.gov/inw/

129. OASIS is a not-for-profit consortium that drives the development, convergence and adoption of open standards for the global information society, http://www.oasis-open.org

and accessibility have had a positive impact on the response to the disaster. However, the application and customization by various organization and agencies in Haiti, and the challenges that this specific disaster faces will allow benefit Sahana and its community through the lessons that will be taught. Indeed, the lessons learned will do much to enhance Sahana and assist it in fulfilling its vision. Though only a short time has passed since the devastating earthquake, the Sahana community has already started to identify lessons and experiences form Haiti that have been incorporated into the way Sahana works.

Preliminary findings include :

- The Sahana community now uses a User Acceptance Testing model on deployment, so that new product versions are well tested before being deployed. With regard to deployment, three instances of Sahana are used and code is propagated from the development version to the UAT version and ultimately to the production instance.
- The use of IRC[130] has been invaluable in coordinating a live response community and also in collaborating with external parties. It is also important, however, to archive IRC chats in order to provide continuing context.
- IRC also has been a fantastic way to recruit new volunteers and to engage them in new efforts. Part of the reason for this is that unlike other systems, no formal subscription / approval is needed to join the IRC Sahana channel and thus, people can easy join a discussion in the passing.
- The CRUD model provided by SahanaPY/Web2Py provides rapid customizing capabilities to Sahana. New fields can rapidly be added to a form with very few data changes.
- Sharing references to data is just as important as sharing information. The REST reference interface in SahanaPy provides simple, transferable references to lists and data records provided that researchers have the right level of clearance to access the data.
- Though the AJAX function provides a lot of added usability, it was an unexpected bandwidth hog and thus, is not recommended in its richest form for disaster management systems.

The Sahana Disaster Management System continues to evolve in order to address coordination needs and to adapt and assimilate new technologies. Haiti was a prime example of multiple Sahana instances being customized and deployed for different purposes. This is a testament to the strength of the H-FOSS model for delivering ICT applications in the field of humanitarian relief. However, as mentioned earlier, an Open Source license is not enough; other aspects of the project need to be in place to make it feasible for rapid customization during disaster response. Open Source communities are not easy to manage as there is a substantial amount of volunteer turnover; however the Sahana project continues to be relevant and used in disaster response. The formation of the new Sahana Foundation should help the project to reach a new height of partnership with the response community and more formal actors from government and the UN. Haiti was an excellent example of such complex partnerships and the importance of open standards in information sharing. Sahana is evolving beyond a simple ICT system to include some of the best practices in the application of ICT for disaster management.

130. Internet Relay Chat is a commonly used online public chat network among Open Source communities.

Establishing and Institutionalizing Disaster Loss Databases: Experience from UNDP[131]

UNDP Regional Programme on Capacity Building for Sustainable Recovery and Risk Reduction

1. Introduction

The United Nations Development Programme (UNDP) Regional Programme on Capacity Building for Sustainable Recovery and Risk Reduction (RP) was established in response to the Indian Ocean Tsunami of 2004. Managed by the Regional Centre in Bangkok's Crisis Prevention and Recovery team, the RP aims to enhance the capacity of Tsunami affected countries in disaster risk reduction (DRR). Its programme activities are in line with the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (HFA).

Risk identification is one of the five priority areas of the HFA as stated: The starting point for reducing disaster risk and for promoting a culture of disaster resilience lies in the knowledge of the hazards and the physical, social, economic and environmental vulnerabilities to disasters that most societies face, and of the ways in which hazards and vulnerabilities are changing in the short and long term, followed by action taken on the basis of that knowledge.[132]

In addressing this priority, one of RP's strategies is to enhance institutional systems for building risk knowledge through the development of disaster loss databases. At the core of any risk knowledge efforts is the need for reliable and easily accessible data on hazards, vulnerabilities and risks. Disaster loss databases provides for systematic collection of relevant data, and their validation and sharing, for the historical analysis and prediction of disasters.

131. This case study has been adapted from UNDP's 2009 publication entitled, Risk Knowledge Fundamentals: Guidelines and Lessons for Establishing and Institutionalizing Disaster Loss Databases. For more information visit http://regionalcentrebangkok.undp.or.th.
132. UN/ISDR, Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters, World Conference on Disaster Reduction, Kobe, Hyogo, Japan, 18-22 January 2005.