Introduction to Operationalizing the Common Alerting Protocol

Session 8 Workshop Report

Version 1.0

by

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1. Executive Summary

"Prevention pays if it is done right, and building stronger institutions and networks and making information more accessible is part of the solution."[1] In this regard, a multi-agency multi-hazard disaster management approach requires improved exchange of real-time risk information of significance. Session 8: "Introduction to Operationalizing the Common Alerting Protocol (CAP)", of the overall workshop: "Use of Telecommunication/ICTs in Disaster Management", was designed to familiarize the participants of a multi-hazard and multi-agency disaster information exchange approach to better serve towards saving lives.

The session speaker/instructor: Nuwan Waidyanatha (LIRNEasia Senior Research Fellow), introduced the "CAP essentials[2]" to the participants and then explained the policy and procedural steps for operationalizing CAP in ones own country. Thereafter, the participants assembled in to groups to experiment with the Sahana CAP-enabled Messaging Broker (SAMBRO). The groups put SAMBRO software in to practice to simulate both inter-jurisdictional (between agencies) and intra-jurisdictional (within the agency) as well as direct and cascade (i.e. Agency-A alerts Agency-B, the Agency-B alerts its subscribers) alerting procedures.

A key outcome of the hands-on exercise was that the participants gained practical knowledge beyond CAP theories by experimenting the intricacies of CAP through a piece of Free and Open Source Software (FOSS). The exercises encouraged the participants in self-realizing the ease-of-use and usefulness of the ITU-T recommended X.1303 interoperable CAP content standard[3] . They were able to experience multi-hazards risk information dissemination over multiple technologies like SMS, Email, Web, RSS/Atom, and Twitter, in real-time.

Given their limited experience with CAP, the participants voiced several concerns. The questions were mainly on the uncertainties around the Internet accessibility, network congestion, multilingual dissemination capabilities, capacity building requirements, cost-benefits, and the socio-political buy-in. There are ways and means to overcome the perceived technical complexities with very little investments such as by applying the "axiomatic design framework[4]". Capacity building regimes can be optimized by augmenting them with streamlined self-intuitive software and self-guided training aids. Realizing the cost-benefits and overcoming socio-political obstructions may be the harder problem to solve but is not impossible.

A significant opportunity, the participants realized, was a CAP-enabled National Incident Management System[5]

1 Apurva Sanghi's (Senior Economist, World Bank, UN-World Bank). "Natural Hazards, UN Natural Disasters: The Economics of Effective Prevention", Third Session of the Global Platform for Disaster Risk Reduction, published by the International Institute for Sustainable Development: http://www.iisd.ca/download/pdf/sd/ymbvol141num6e.pdf

2 The Organization for the Advancement of Structured Information Standard (OASIS) documentation on the Common Alerting Protocol: http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.html

3 The ITU recommendation X.1303 can be accessed over the web: http://www.itu.int/ITU-T/formal-language/itu-t/x/x1303/2007/CAP-1-1.html%20

4 To learn more about the Axiomatic Design Framework for removing uncertainties refer this website: http://www.axiomaticdesign.com/

5 To learn about NIMS refer to the literature on the web: http://www.scemd.org/index.php/what-is-nims

(NIMS) would better integrate with other national and international systems[6]. Moreover, a CAP-enabled NIMS would decentralize the alerting responsibilities by authorizing local emergency managers to take the helm opposed overwhelming a single national authority with accountability.

The automation of a single consistent message to be channeled simultaneously through cellular, broadcast, and social media technologies were intriguing, especially when an alerting authority is constrained by a rapid-onset narrow warning horizons. Software can manage the messaging sequence, whereby first-responders would be notified first before informing the public and media. The single entry of the CAP message can be transformed to audio (or voice) messages with additional reference material and resources accompanying the single message. The message can be in all relevant languages with an initial message followed by updates and a final “all-clear” message with people being systematically informed removing the need to guess or any ambiguity.

The workshop revealed that there is a growing need for countries to adopt a standard and operating guidelines such what CAP has to offer. There is very little awareness among emergency practitioners of the potentials of the CAP interoperable standard. Facilitating awareness campaigns and sharing of knowledge through hands-on exercises would better inform member states in adopting best-practices. ITU-D, if it chose to do so, should take the lead in developing programs that would assist the member states with implementing the CAP technical content standard and adopting CAP defined operating procedures that helps build a stable ecology for early warnings and situational-awareness in the respective member states.

6 Youtube video on NIEM exemplifies the need for interoperability: http://www.youtube.com/watch?v=BA1jY8LJ8tM

2. Introduction

A training workshop[7] on the *Use of Telecommunications/ICTs for Disaster Management* was held between 20 – 23 November 2012. The workshop, jointly organized by the Thai National Broadcasting and Telecommunications Commission (NBTC) and the International Telecommunications Union (ITU), took place at Pullman Hotel in Bangkok, Thailand. Session 8 of the workshop was a hands-on training designed to Introduce the participants to the CAP emergency communication standard and experiment it's capabilities with the use of the Sahana CAP-enabled Messaging Broker (SAMBRO).

The participants frequently used the terms Emergency Operations Center (EOC) or a Disaster Management Center (DMC) to refer to an *incident command center*. Under a well-developed NIMS, the EOC/DMC of a Country should be aware of and should map every significant emergency incident or risk in the country, down to the level of something as minor as a landslide caused by torrential rains[8]. The local road maintenance authority would issue an alert about the blocked road to local EOC/DMC, police, health and other authorities. This would prepare all coordinators for emergency events. Health authorities would know not to dispatch an ambulance along that road. Local disaster authorities would be prepared to avoid that route in an evacuation event, if the sever-weather escalated.

A key challenge the EOC/DMC face is adopting a multi-agency situational-awareness approach to coordinating emergency situations. Such an effort requires the buy-in from all stakeholders and their near-unanimous consent to agree on a common national platform that is both vertically and horizontally integrated. The participants recognized the social and politically barriers to enabling such a platform. For example, Malaysian delegates, in their presentation on the MERS 999 common emergency number[9], expressed that it took them almost 5 year for all stakeholders to agree on that number. The Sri Lankan Director General of the National Disaster Management Center, in his presentation[10], emphasized that Government organizations were silo driven that were reluctant to integrate with other organization in fear of safe guarding their territories.

To that end, there are several question that one would raise in the attempt to implement a common platform to foster an integrated NIMS that supports a multi-hazard multi-agency all-media approach . They are:

I. How do we manage the subscribers and publishers?
II. How do we deliver early warnings in local language?
III. How do we use available technologies?

7 ITU and NBTC jointly organized workshop announcement and agenda can be accessed over the web: http://www.itu.int/ITU-D/asp/CMS/Events/2012/NBTC-disaster/index.asp

8 The second item listed, in the Hyogo Framework for Action, is "Identify, assess and monitor risks and enhance early warning." United Nations International Strategy for Disaster Reduction, World Conference on Disaster Reduction, Hyogo, Japan 2005: http://www.unisdr.org/we/coordinate/hfa

9 Presentation slides, on the MERS 999 one Malaysia one emergency number, available on the web: http://www.itu.int/ITU-D/asp/CMS/Events/2012/NBTC-disaster/S4_MERS999.pdf

10 Sri Lanka DMC presentation on ICTs in Emergency Communication available on the web: http://www.itu.int/ITU-D/asp/CMS/Events/2012/NBTC-disaster/S4_SriLanka.pdf

IV. How do we disseminate alerts over multiple channels?
V. How do we interoperate with incompatible systems?
VI. How do we effectively communicate the optimal content?
VII. How do we address the communication strategy?
VIII. How do we accommodate upstream-downstream alerting?

CAP was designed to answer those questions, listed I – VIII. CAP extends beyond its technical aspects by offering the protocol as a guide to operationalizing a multi-hazard multi-agency all-media NIMS.

To experiment with answering those questions and to realize the potential of CAP in addressing those dilemmas, the workshop conducted several exercises. To initiate the exercises, the participants created several publisher and subscriber groups then disseminated messages over multiple channels interchanging information through Short Message Service (SMS) gateways, Email Send Mail Transfer Protocol (SMTP), Web Hypertext Transfer Protocol (HTTP), Really Simple Syndication (RSS), and Twitter short-text messaging technologies. Thereafter, the participants engaged in analyzing the Strengths, Weaknesses, Opportunities, and Threat (SWOT) of the CAP-enabled SAMBRO application for interoperable emergency communications. Outcomes of this portion of the workshop, namely session 8, is discussed in the subsequent section of this report.

3. Overview on Alerting

There participants expressed some confusions with the using term alerting by interchangeably referring it to either with public warning or situational-awareness. The term 'Alerting' in CAP refers to both public warnings as well as public and closed user group situational-awareness messaging (or notifications). Warnings are confined to authorized government mandated entities that may require action (evacuate or prepare) or inaction (do not evacuate). Those government entities are less liable and are protected by Government. A certain level of accountability is bestowed upon them for any misconduct that may lead to adverse effects of a warning originating from or relayed by them.

Situational-awareness messaging is open for any entity provided the messages they disseminate are not warnings but are intended for notifying the recipients of an escalating situation for which any response is at the discretion of the alert recipient. For example, a friend tweeting or SMS-ing the escalation of a cyclone in your area is considered a situational-awareness alert. Nevertheless, one can be held liable and can be prosecuted in the event of any adverse and damaging repercussions that are a consequence of the falsely informing with the malicious intension.

4. Objectives of the CAP standard

CAP was developed by Art Botterell et al[11] (2006) with an all-hazards all-media approach. A key benefit of CAP for sending alert messages is that the sender can activate multiple warning systems with a single input. Using a single input reduces the cost and complexity of notifying many warning systems. A single input message also provides consistency in the information delivered over multiple systems. People receive exact corroboration of the warning through multiple channels. This is very important, as research has found that people do not typically act on the first warning signal but begin looking for confirmation. Only when convinced that the warning is not a false alarm, do they act on it.

The corroboration and intention to act on an alert is based on the trusted alert source. A trusted alert source is one that the recipient has established a relationship with. For example, a secured EOC/DMC official website or a designated short code telephone number to receive an SMS, a Cell Broadcast (CB) message from the cellular operators, or licensed Radio/TV broadcasts. CAP was developed for exchanging trusted and timely hazard information.

There are six principles of alerting categorized by the US National Science and Technology Council highlighting the benefits of improved interoperability that CAP content standard has to offer[12]:

- *Coordination*: an alerting system should avoid duplication of effort where possible and support a shared understanding of the situation among different agencies involved in managing the incident.
- *Consistency*: messages must be consistent across different sources if they are to be believed by the general population. Conflicting messages tend to create uncertainty and will delay responsive action.
- *Channels (multiple)*: messages should be delivered over a variety of devices in order to reach people engaged in a range of activities and settings (e.g., at home, sleeping, travel ling).
- *Completeness*: message content should include all pertinent details presented in a way that is easily and quickly understood by the population. This includes multiple languages in some cases, as well as the use of multimedia for illiterate or hearing/visually impaired individuals.
- *Coverage*: messages should be targeted to those communities at risk in order to reduce growing complacency from the larger population receiving alerts that do not apply to them.
- *Control*: messaging systems must be secure and have a means of authenticating users to reduce incidents of accidental activations and prevent malicious attempts to issue false alerts to a population.

11 Botterell, A. and Addams-Moring, R. (2007). Public warning in the networked age: open standards to the rescue. Communications of the ACM, 30 (7), 59-60.

12 “Effective Disaster Warnings” Report by the Working Group on Natural Disaster Information Systems Subcommittee on Natural Disaster Reduction (US National Science and Technology Council, Committee on Environment and Natural Resources, Nov. 2000) http://www.sdr.gov/NDIS_rev_Oct27.pdf

5. CAP Country Profile

Disseminating risk information among multiple agencies can be complicated. CAP lays out emergency policies and procedures for streamlined information sharing. In this vein, CAP Profile for the Country would establish a comprehensive emergency communication protocol for that Country.

CAP country profile objectives are

- Define policies and procedures for administering and operationalizing multi-hazard all-media alerts and warnings.
- Maintain a register of alerting authorities[13] in the form of an Object Identifier (OID) Structure[14].
- Specify message originators, dissemination channels, and recipients under the OID scheme.
- Categorize alerting authorities by location (typically administrative units) and event types.
- Define other constraints, rules and conventions applicable to the Country context
- Ensure the alerts, at least, make basic sense to recipients that are unaware of the profile restrictions.

When implementing NIMS and the CAP country profile there are several questions that must be addressed as to 'who' can issue alerts, who can receive alert, 'what' methods or technologies does one use, 'what' strategies should one follow in a dissemination cycle, 'when' should alerts be issued, and 'where' should they be disseminated? The basic ***who***, ***what***, ***where***, and ***when*** guiding questions are typically associated with developing a CAP country profile. Those questions can be more specific as discussed in the subsections below:

5.1. What event types would you address?

The country would have conducted a risk assessment to develop their national risk profile[15]. The profile identify geographically bounded hazard risks; whereby, hazard events would affect those economies. An EOC/DMC entrusted with early warnings must be aware of the risk profile and be equipped to notify those populations of any emerging hazard events. For the sake of managing and indexing the hazard events a country profile may adopt a set of incident codes and event codes. Those codes would follow a sub categorization hierarchical indexing structure.

5.2. Who is your audience or your alerting scope?

The EOC/DMC must decide whether they are restricting their scope to alerting first-responders only, alerting public only, or both (alerting first-responders and public). The alerting scope would define the alerting strategy. At the time of detecting a hazard event, a strategy might be to immediately alert the first-responders to activate

13 The Administrative Procedure for Registering WMO Alerting Authorities; url to document: http://www.wmo.int/pages/prog/amp/pwsp/documents/AIR_PWS-20.pdf

14 The OID standard promulgated jointly by the International Standards Organization (ISO) and ITU-T uniquely and universally identifies any object in the telecommunications or information processing world: http://www.oid-info.com/

15 The Global Risk Information Platform (GRIP) portal can be accessed over the web: http://www.gripweb.org/gripweb/

them in executing their emergency response plans. The first-responders, based on the emergency response plans, may decide to be vigilant and observe the situation or begin exercising evacuation procedures. A reason to alert the first-responders in advance of the public is to give them adequate time to be better prepared and man their stations before the situation escalates to a state of public panic. Thereafter, once the hazard event is confirmed and pronounced as an eminent threat, the strategy would call for alerting the public. The strategies defined by the scope would require varied sequencing and capacities in terms of man-power and ICTs for disseminating the messages.

5.3. What are the geographic and jurisdictional demarcations?

Typically a country would exercise a mandated National hierarchical governance structure based on geographically demarcated administrative boundaries. These boundaries, are normally, labeled as Provinces, States, Districts, Divisions, Counties, Cities, Towns, and Villages. However, various sectors such as maritime, health, agriculture, or other autonomous sectors may vary from the typical National administrative geographical boundaries. Epidemics that have no geographical boundaries would require alerting the health sector specific administrative boundaries. These boundaries may cover more than a single district, which the health sector may demarcate as a “region”. In such cases, the EOC/DMC must be aware of those differences. The authorization of local alerting authorities for various regions of the country may differ case by case. Therefore, the CAP Profile should harmonize those variances to reduce the complexities of defining geographic boundary; especially, when authorizing jurisdiction and sector specific alerting organizations. For example, a CB message may bleed in to another District because of the cellular tower coverage. In such cases, the message must be clear and policies must be in place that allows the message recipients to decide on the response actions.

5.4. Who speaks what language?

Glottalization is creating multinational communities with varied ethnicities in many countries. Conversely there are countries with multitude of tribes isolated by culture and language. Tourism invites guests from around the world in to ones country. International trade and free trade zones attracts expatriate communities. When considering the languages the profile should not only restrict to the national languages but also consider the impact of not addressing those people living in the country (permanently or temporarily) who do not speak any of the national languages. English is universal but not all foreign nationals may understand a warning message in English such as Chinese tourists. Similarly, issuing CB messages in Chinese in the Peoples Republic of China would deprive tourists and expatriates of realizing the communicated risk.

5.5. Who does the event detection and decision-making?

Once it is decided the type of events that the EOC/DMC would address, the CAP profile must determine which authority is responsible for detecting those events, then making a decision as to the level of the threat and required responses, and finally who should disseminate the alerts to the targeted populations.

Table 1 illustrates is simple exercise for realizing and establishing a CAP Country profile.

Table 1: A very basic table (but not exhaustive) for developing a CAP Profile (e.g. Sri Lanka)

Hazard	Landslide	Floods
Scope	First-responders only	Both first-responders and public
Jurisdiction	Division-wise	District-wise
Languages	Sinhala, Tamil, English	Sinhala, Tamil, English, German, Italian, Chinese
Detection	Geological Survey and Mines Bureau and the Meteorological Department	Meteorological Department, Department of Hydrology, and the Irrigation Department
Decision	Geological Survey and Mines Bureau	Department of Hydrology
Publishers	Geological Survey and Mines Bureau	Department of Hydrology
Subscribers	Transportation, Health, Media	Health, Transportation, Hydrology, Environment, Media, Public

6. Sahana CAP-enabled Messaging Broker

Sahana Disaster Management System is a collection of Free and Open Source Software (FOSS) modules designed to manage the information needs of the emergency managers responding to an event. It is licensed under the FOSS Gnu Public License (GPL) allowing for any one to reuse the software at no cost, granting the freedom to change the software (customize, add new modules, or change the code), and allowing to redistribute the software. Sahana Software Foundation[16] administers the sahana FOSS community and the Sahana products.

The various Sahana modules cover the preparedness, early warning, and response components of the Disaster Management life-cycle. Missing persons registry, incident reporting, victim management, organization registry, hospital information management, integration of social media application, resource management, messaging and alerting are few of the modules.

The Sahana CAP Broker was developed for assisting emergency communication agencies with disseminating and managing public and closed user group alerts for saving lives. There are two flavors of the Sahana CAP-enabled Broker. First is the older PHP user interfaces and MySQL database (not restricted and can be integrated with other databases) version designed for a single language and single information CAP segment messaging capabilities. The first older version is what was used in this workshop. The second is the Python and Web2Py version that works with any relational database. The second version allows for implementing a country profile and capable of issuing messages in multiple languages (<language>) as well as managing multiple information (<info>) segments of a CAP message.

16 The Sahana Software Foundation website: http://sahanafoundation.org

A copy of the Sahana CAP-enabled Broker was hosted on the NBTC-ITU National Operations Cener (NOC) server. It can be accessed through http://110.164.198.195/sahana/. This installation was made available for the workshop participants to use during the hands on exercises in Session 8[17]: Introduction to Operationalizing the Common Alerting Protocol.

7. Hands On Exercises

The hands-on exercise was constructed for the workshop participants to realize the potential of CAP and it's benefits. SAMBRO software was the basis for experimenting with CAP. The exercises were four fold:

I. ***Present alerting practices*** – each group selected a member state of which one of their group members belong to and then used that country as a case to present to the audience, the end-to-end process, of detecting, deciding, and disseminating risk information, for a given hazard event.

II. ***Manage subscribers*** – each of the groups created a contacts group of alert subscribers (i.e. alert recipient groups); thereafter, conducted simulated an exercise that would resemble a typical periodic (monthly) test to validate the operational status and the subscriber list; for example a policy would be set to conduct the test on every first Monday of the Month; whereby, anyone not having received the test message could contact the system administrator to rectify the problem.

III. ***Alerting*** – use an existing template developed for tropical-cyclone, disease-outbreaks, landslides, floods, transportation, and environment to, first issue a direct intra-jurisdictional alert to all members within the subscriber group, then secondly issue an inter-jurisdictional alert to a designated head-person of another group, finally, a cascade alert whereby, the alert message received by the head-person of a group would relay that message to all members withing his/her group.

IV. ***SWOT analysis*** – after completing the hands-on exercises with using the software for experimenting various alerting scenarios, the individual groups spent 15 minutes discussing the strengths, weaknesses, opportunities, and threats of a CAP-enabled NIMS; thereafter, a designated team member, from each group, presented their SWOT analysis to other participants to stimulate various discussions. It was intended for the participants to realize the potential of adopting a multi-agency multi-language all-hazards all-media approach for closed user group and public alerting in their own countries.

V. ***Action plan*** – the exercise expected the participants to develop an informal action plan; whereby, the action plan would assist them with realizing the follow up work beyond the workshop over the next 2 months, more than 2 months, and as the opportunities arose. Moreover, the action plans would have helped ITU realize the kind of assistance programs they may need to organize in assisting the member states in adopting the CAP standard to improve national and international interoperability. Unfortunately, the workshop time limitation did not foster the opportunities for building a database of action plans to

17 The workshop agenda can be accessed through the URL: http://www.itu.int/ITU-D/asp/CMS/Events/2012/NBTC-disaster/Agenda_final.docx

include any recommendations in this regard.

8. Discussion of the present alerting practices

The groups discussed the following cases:

- Nigerian - flood and epidemics
- Papua New Guinea - earthquake, tsunami, and cyclone
- Mongolian - severe winter weather and drought
- Thailand - SARS epidemic and floods
- Sri Lanka – tsunami and flash floods

Except for Nigeria, a country that exercised a provincial and district level locally empowered alerting and disaster coordination organizational structure, all other countries practiced a centralized federal or national alerting and emergency coordination mechanisms. In the case of floods and the cholera epidemic, in Nigeria, the local provincial and district -level government administrators used mainstream media to inform the public, by-passing federal authorities. Ideally, that is the best practice! Federal resources were requested as and when required. With the many geographically scattered diverse cultures and over thirty (30) languages, in Nigeria, it would be difficult for their federal agency to manage a local crises.

Papau New Guinea, a country with three hundred (300) languages resulting from community isolation from mountain valleys, has the same language and cultural challenges as Nigeria with respect to emergency communication. However, English is common to all communities in Papau New Guinea. Any local warnings must be challenged through the federal emergency management agency. The Mongolian, Thai, and Sri Lankan practiced were the same, with any local risk information, first, communicated to the National authority, who in turn disseminates that local risk back to the local authorities and targeted populations through the centrally established dissemination channels.

The lessons drawn from these discussions are that, in almost all member states, the National EOC/DMC is responsible for the alerting; whether they be for locally targeted populations or for the entire nation. For example, with the heavy rains, when the division of the Irrigation Department responsible for a District is forced to release excess reservoir water, they must request the head office in Colombo to alert the downstream populations.

Recommendation: Apply CAP policy and procedures to dilute accountability and decentralize alerting

Ideally, the District-level authority of the Irrigation department should use CB, SMS, or other established means to communicate the risk, themselves, to the vulnerable populations they are responsible for. Requesting the head office to manage that local even is inefficient. With a well established CAP Profile, Register of Alerting

Authorities, CAP-enabled messaging software, cellular technology, and new media technologies, the message origination and dissemination can be controlled by the local authorities. Thus, diluting the accountability and empowering them with managing their local risk mitigation efforts in cost-effective and timely way. Such a policy and practice, with CAP-enabled software, would decentralize the emergency communication and coordination but still allow the National authority to monitor and moderate (i.e. the Irrigation Department head office in Colombo would see the message appear on their computer screen).

9. Analysis of the SWOT results

Table 2: SWOT listed items the groups had written in their flip-chart sheets (group A and B were combined)

	Strengths	***Weaknesses***	***Opportunities***	***Threats***
A & B	Open source software free of charge user friendly availability of templates	Everyone should agree on the system need a computer capacity building training Mandate	Different hazards can be addressed for different locations Various methods to communicate the message Message can be delivered to end users quickly and accurately	System depends on Internet Everyone needs ICT knowledge Need maintenance and resources
C	Simple process Ease of use Timely and efficient Universal standard	Confirmation of message delivery (one way only) Applies to civilized areas Control authority controls		Communication capitol and operational costs Investments of security legal issues
D	Coordinated effort among authorities Multi channels SMS and Broadcast	No coverage in rural areas Too many agencies take decisions have to follow the steps	Multi channel Specified to targeted groups User management Authorization	Miss-use of the system Lack of support
E	Disseminate alerts to everyone through SMS, Email, Social Media Free to use Reduced time	Reliability of the Internet Power source Too many languages to send an individual message	User friendly Manny levels	Failure of the Internet connectivity
F	Uniformity – many agencies can speak the same language Customization Free	Language No redundancy	Can be used by small communities , groups, or regionally	Miss use of messages on social media Natural disaster can itself be a hindrance

The SWOT analysis identified areas in which there were apparent contradictions between what might be considered both a strength/opportunity and weakness/threat of the CAP technical standard and the CAP-enabled SAMBRO. The sections below address a few of the ambiguities and recommends solutions that may move some of the weaknesses to strengths and threats to opportunities.

9.1. Costs of operationalizing a CAP-enabled NIMS

The first contradiction in the SWOT analysis was related to cost. Costs were determined as either operational or capital costs. Costs were also defined as the cost of time or easy accessibility as well as finance. Operational costs for the FOSS SAMBRO were considered both strengths and weakness. SMS was specifically identified in terms of tool that was costly in terms of operation. Moreover, their were concerns addressing the needs for capacity building regimes.

Recommendation: Consider the incremental cost effectiveness

The strengths of the FOSS SAMBRO were that it was free to download and use. However, they perceived the infrastructure (or data center) as a considerable cost. In ICT implementations, when considering the data center costs and the Institutional costs, the ICT data center is always less than 10% that of the entire Total Cost of Ownership for operationalizing an EOC/DMC. The operational cost of SMS can be regarded high when the number of SMS text messages issued are in large numbers. In most cases, the government EOC/DMC agencies collaborate with cellular service operators to negotiate an affordable solution; whereby, the bulk SMS packages are largely discounted. Moreover, laws can be set in place, where Government can acquire the full cooperation of the private cellular operators to provide them with all services during a crisis. The cost for end-users, such as Provincial, District, or Divisional EOC/DMC or other emergency response personnel, to access the software system, with the use of a terminal device and connectivity for sharing emergency information, may seem costly. However, if the implementation adopts “every-day-use technologies”, then the proportional cost for using that technology for crisis management is negligible. Such dual purpose technologies that are both integrated in to the daily lives and serves emergency communications solves the sustainability part of the puzzle.

9.2. Reliability of the infrastructure supporting the CAP-enabled system

There were concerns around the inherent dependency on the Internet to access a web-based software such as SAMBRO. There are two key components that constitute operationalizng a web-based software portal for multiple agencies to share in in issuing alerts. One is the accessibility of the portal; i.e. the availability of Internet for the end-user intending to generate and disseminate an alert through web hosted software. Second, the around-the-clock presence of the web application over the world wide web; i.e. the availability of Internet at the data center where the web-based software is hosted for accesses. Other concerns were on the power and data center dependencies.

Recommendation: apply redundancy for reliable business continuity

The simple answer is “redundancy redundancy”. As in implementing any other system, the alert system designers should realize the tolerable “Mean Time To Failure” (or the required level of reliability for minimal downtime). Thereafter, determine the investments that would ensure the required level of reliability for business

continuity.

Both the end-user and the web application host should have redundant Internet Service Providers (ISPs). Thereby, the failure of one ISP can be compensated by the other. Moreover, the web application host could offer a secondary mirrored site (or data center). Thereby, if the data center in one location failed or was a victim of the disaster then the other location would begin serving. The two data centers would be established distant apart. The data centers would be equipped with backup power generators and Uninterrupted Power Service packs.

9.3. Alert receipt confirmation

The participants raised a question, “how would the alerting authority confirm whether the messages were delivered to the intended recipients?” The CAP element <msgType> carries an index value termed “Ack” (short for Acknowledges) specifically designated for communicating the receipt and acceptance of the message. The messages that require acknowledgement are typically identified in the CAP element <references>.

Recommendation: establishing feedback reports to confirm alert receipt

Store and Forward technologies (SMS, Email, or Voice campaigns) allow for the alerting authorities to request for a delivery reports. The report can be an output of the the SMS, Email, or Voice gateway servers: SMS Controller (SMSC), Email Send Mail Transfer Protocol (SMTP) server, Interactive Voice Response (IVR) server, or the Call Detail Record (CDR) database . Typically, the messaging servers receive a confirmation when the end-user terminal device has received the data packets or voice calls. These are standard communications system feature that can be easily integrated with any alert dissemination NIMS.

The dilemma with relying on the communications system generated report is that it does not guarantee whether the intended human recipient had read and accepted the message. A recommended standard operating procedure would be to implement a policy that requires the human recipient reply to the text (SMS, Email) messages with a key word such as “ack”. In the case of a voice campaign the system can calculate whether the calling-time for a particular call matches the duration of the voice audio play time. Processing a list of alert confirmations, in small numbers, is good for first-responders but impractical for public alerting.

Emergency Alert Alberta[18] has established both Twitter and Facebook social media platforms as a mechanism to determine whether public alerts had reached intended audiences. Members in the community would post a message confirming the incident or would indicate that the message was not received. Therefore, Facebook and Twitter platforms works as a feedback mechanism.

A social media group member, uncertain of the alert message's meaning, could post a question to the forum. A

18 Emergency Alert Alberta website can be accessed over the web: http://www.emergencyalert.alberta.ca/

forum member would reply to resolve the question eliminating any ambiguity or doubt that the public may have in understanding the message. For example, let's assume that a message carrying the words “severe weather” may not be understood by a layman. A domain expert or an educated citizen could, subscribing to the social media forum, may reply with the definition. One may think of it as a self organizing system that would remove certain burdens off the emergency managers to respond to every query by passing on some of the responsibilities to the community.

9.4. Addressing multiple languages

Countries such as Nigeria require addressing their local population in 30 different languages and a country like Papua New Guinea in 300 different languages, if they were to consider alerting in all languages. CAP was designed to address multiple languages simultaneously by designating a single <info> segment of the CAP message for each country. The concern was how would one create an alert message for each language in a timely manner?

Recommendation: simultaneously disseminating in multiple languages

CAP templates are pre-populated CAP messages that assist the message creator with consistency of the content as well as improving the efficiencies of generating a message. Those countries that require disseminating messages in multiple languages would generate CAP templates with an <info> segment designated for each language. The language specific message would be pre-populated with relevant content. The template would not be a complete message (possibly 80-90% complete) as it would require inserting event specific information such as date and time information, vulnerable geographic location information, so on and so forth.

An initial step would be for the CAP country profile to determine the optimal set of languages that would cover the largest portion of the population; i.e. apply the 20-80 rule. The official languages used for governance would be a minimal set. However, the CAP profile may require including more. Countries with multiple languages are bound to have citizens familiar with more than one language. The national consensus bureau would have those statistics to leverage towards establishing the optimal set of language for maximal population coverage.

A software such as Sahana allows for managing a database of message string translation[19]. Sahana adopt the l18i Internationalization and L10N Localization standards[20]. The alerting system implementors would translate all English strings to their local languages using local scripting characters. Sahana adopts the Pootle[21] FOSS online

19 Instructions for Sahana wiki on message style translations can be accessed on the web: http://wiki.sahanafoundation.org/doku.php/translate:styleguide

20 A definition on the Internationalization (l18i) and Localization (L10N) gloabally accepted standards can be obtained from the wikipedia: http://en.wikipedia.org/wiki/Internationalization_and_localization

21 The source code for the Pootle online translation engine can be obtained from Github source code repository: https://github.com/translate/pootle or from the sourceforge code repository: http://translate.sourceforge.net/wiki/pootle/index and a description of the Pootle software is available in the wikipedia: http://en.wikipedia.org/wiki/Pootle

translation management engine to facilitate the users with the prefabricated message string translations.

At the time of creating a CAP message for dissemination, by completing the message template with the missing information such as filling the date-time and location information, an automated software process would simply create an identical message for the subsequent languages by inserting the predefined translation string to recreate the information (i.e. CAP <info> segment) for that language.

If the implementation of the alerting system requires generating localized audio messages (or voice messages) to supply to radio and TV broadcasters. The alerting software, using an XSL transformation, would create a human readable localized paragraph. The XSL transformation would insert values from the selected CAP message attributes to formulate the event specific localized message. Thereafter, a trained EOC/DMS resource person could voice the text paragraph to record an audio file in MP3 or AVI file format. Another option is integrating a text-to-speech software engine that would automatically create the same audio file. That file would be made available as an attachment in the <resource> segment of a CAP message or can stored on a web server for the Radio or TV stations to download. The process can be automated through a text-to-speech engine for each of the languages.

10. Other Recommendations to ITU

The following recommendations are for ITU-D Emergency Communications[22] planning and implementation working groups

10.1. CAP Assessment Tool

There are no free and open source tools for member states to assess the potential of CAP. The SWOT analysis revealed participants' enthusiasm to adopt SAMBRO because it was a FOSS tool. SAMBRO FOSS Gnu General Public License (Gnu GPL) allows for re-using the software binaries, changing it and redistributing. Therefore, ITU-D could potentially re-use the Sahana software to customize an ITU-D branded version that is best suited for member states to evaluate and adopt. The software can be augmented with self-learning guides in the form of videos and written documents, examples of alert templates and messages, and exercises to test the CAP-enabled software. Such a one-time investment would benefit all member states.

10.2. Promoting CAP policies and procedures

The common perception is that CAP is a technology. Given that it is a content standard the assumptions are correct to some extend. However, the content standard is also accompanied by a list of policies and procedures that contributes to the ecology of a successful CAP compliant NIMS implementation.

22 ITU-D Emergency Telecommunications website: http://www.itu.int/ITU-D/emergencytelecoms/

The policies and procedures can be country specific but broadly general in most circumstances. Sri Lanka, for example, is an early adopter of CAP and has made several research contributions of which some policy worthy lessons have been adopted by implementors across the globe. Canadian[23] and Australian[24] governments pioneered in institutionalizing the CAP Profile in their respective countries. US Integrated Public Alerting and Warning System[25] (IPAWS) followed them with their CAP Profile. A compilation of implemented CAP profiles as a best practices guide would immensely benefit other member states in their efforts to institutionalize CAP in their countries.

10.3. Establishing Regional Multi-agency Situational-awareness

ITU-D should take the lead in advocating and guiding the member states in operationalizing a CAP-enabled multi-agency situational-awareness platform. Such a vertically and laterally integration would better serve the needs for sharing timely and trusted risk information between national and international agencies; thereby. fostering efficient emergency coordination. This could be done in multiple phases:

- ***Phase I***: Short list a set of countries through an initial assessment of their CAP readiness or inclination to adopt CAP. Then select 5 – 10 member states, who are ready to invest their own resources for implementing CAP, to an action planning meeting. Initial actions would entail developing a framework for implementing a CAP-enabled multi-agency situational-awareness platform.
- ***Phase II***: Provide technical assist to the member states through the multi-agency situational-awareness implementation. The member states would invest their own resources in this national implementation. ITU would monitor and evaluate the implementations, then document the best practices for other member states to adopt.
- ***Phase III*** – Conduct a series of cross-border situational-awareness exercise. The Phase I & II member states would participate in these activities. Lessons learned from these exercises would be augment the Phase II guideline and best practices document for other member states to adopt.

Phases I – III should trigger a domino effect for other members to begin adopting a multi-agency situational-awareness platform to improve regional emergency communication interoperability.

10.4. Asia Pacific Region 3 CAP Implementors Workshop

There are regular (annual or bi-annual) ITU, World Meteorological Organization (WMO) and the Organization for the Advancement of Structured Information Standards (OASIS) hosted CAP implementors workshops. However, these workshop have been taking place in Europe and Northern America. Experts, attending these works, share a wealth of knowledge on CAP related topics. The discussions are very focused such as understanding how one should define a message identifier, or how one should define their jurisdictional and geographical boundaries,

23 Literature on the Canadian CAP Profile can be accessed over the web: http://capan.ca/index.php/en/cap-cp/
24 Literature on the Australian CAP Profile can be accesd over the web: http://www.em.gov.au/Emergency-Warnings/Pages/Australian-Government-standard-for-Common-Alerting-Protocol---Australia-Profile-%28CAP-AU-STD%29.aspx
25 IPAWS http://docs.oasis-open.org/emergency/cap/v1.2/ipaws-profile/v1.0/cap-v1.2-ipaws-profile-v1.0.pdf

how one should implement a CAP implementation change management process, so on and so forth.

Hosting a series of CAP implementers workshop in the Asia Pacific region would benefit the member states in strengthening their own NIMS as well as the region emergency communication interoperability. They would be exposed to policies and procedures of implementing CAP. The lessons learned from those stimulating and practical discussions as well as expanding their network reach for knowledge sharing is immense. ITU would be an ideal candidate to advocate such an event, inviting some of the experts from other parts of the world, to share their knowledge with the Asia Pacific region.

10.5. Standardized symbolism to communicate risks

Countries with diverse languages and lower literacy rates should consider adopting symbolism. For example, an expatriate living in China ignorant of the Chinese scripture would better understand a symbol dedicated for a cyclone. An elderly member in the community with lesser literacy would be able to understand a symbol dedicated for floods or rising waters. Such an initiative would resolve some of the language related issues brought forth by the workshop participants.

There are initiatives by organizations such the United National Office for the Coordination of Humanitarian Affairs (UNOCHA) has developed a set of humanitarian and country symbols[26]. The ITU should invest in facilitating a program or nominate a working group that would standardize a subset of those symbols to associate them with the CAP standard alerting objectives. Such an initiative could drive equipment manufacturers (e.g. mobile hand-held manufacturers) and telcos to embed those symbols in hardware with on-board communications protocols to activate them opposed to transmitting them over the networks.

A CAP message can be programmed to trigger the displaying of the appropriate symbol for the particular hazard event that would be easily understood by a person challenged by reading a description or listening to an alert message. Moreover, a universal symbol eliminates the need to disseminating the same message in multiple languages; i.e. “a picture speaks a thousand words”.

26 UNOCHA humanitarian and country symbols can be accessed over the web: http://reliefweb.int/map/world/world-humanitarian-and-country-icons-2012

11. APPENXIX A – Glossary of Terms

AVI	Audio Visual Interleave
CAP	Common Alerting Protocol
CAP-AP	Common Alerting Protocol Australia Profile
CAP-CP	Common Alerting Protocol Canada Profile
CDR	Call Detail Record
DMC	Disaster Management Center
EDXL	Emergency Data Exchange Language
EOC	Emergency Operations Center
FOSS	Free and Open Source
GPL	General Public License
HTTP	Hyper Text Transfer Protocol
ICT	Information and Communication Technology
IPAWS	Integrated Public Alerting and Warning System
ITU	International Telecommunications Union
ITU-D	International Telecommunications Union Disaster sector
ITU-T	International Telecommunications Union Standardization Sector
IVR	Interactive Voice Response
MERS	Malaysian Emergency Response Service
MP3	Media Player 3
NBTC	National Broadcasting and Telecommunications Commission of Thailand
NIMS	National Incident Management System
OASIS	Advancement of Structured Information Standards
OID	Object Identifier
RSS	Really Simple Syndication
SAMBRO	Sahana Alerting and Messaging Broker
SMS	Short Message Service
SMSC	Short Message Service Controller
SMTP	Send Mail Transfer Protocol
TV	Television
UNOCHA	United National Office for the Coordination of Humanitarian Affairs
WMO	World Meteorological Organization
XML	eXtensible Markup Languages
XSL	XML Style-sheet Language
SWOT	Strengths, Weaknesses, Opertunities, and Threats
CB	Cell Broadcast
SARS	Severe Acute Respiratory Syndrome
NOC	National Operations Center