Intricacies of Implementing an ITU-T X.1303 Cross-Agency Situational-Awareness Platform in Maldives, Myanmar, and the Philippines

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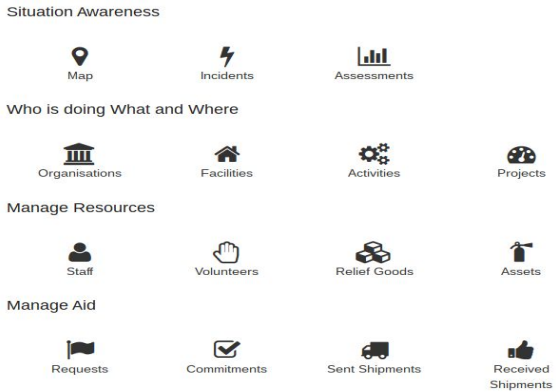
Presentation Outline

- About Sahana
  - Who we are and what we do
  - Introduction to SAMBRO and its principals
- Project Design
  - Goals and objectives
  - Implementation strategy
- Evaluation Methodology
  - Objective and Subjective
  - Usability, Acceptance, and Utility
- Results and Outcomes
- Conclusion

What is Sahana?

Sahana is an Open Source Community with a mission to **save lives** by providing **free and open source** information management systems that improves the effectiveness of organizations and communities throughout the disaster cycle.

Driving adoption to over 25 countries with 20 different disaster management modules: https://sahanafoundation.org/eden/features/



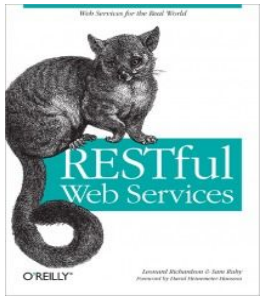
- Sahana EDEN is open source.
- No licensing fees or restrictions.
- You have “ the rights to study, change, and distribute the software to anyone and for any purpose.”
- Sahana adopts MIT license

Sahana EDEN Architecture

Host locally in the command center on a **Laptop**

Synchronize these 2 together...

Host in the **Cloud**

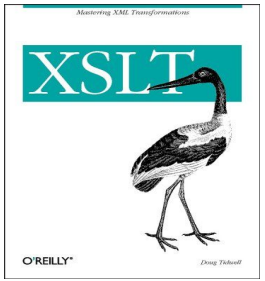


WEB2PY

python

PostgreSQL

MySQL



CAP on a Map Project (Jan. 2015 - Oct. 2016)

GOAL: Improve institutional responsiveness to coastal hazards through Cross-Agency Situational- in Myanmar, Maldives, and the Philippines through cross-agency situational-awareness

ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness

The ESCAP Trust Fund for Tsunami, Disaster and Climate Preparedness was established in 2005, originally to support tsunami early warning through a multi-hazard approach. The destructive Indian Ocean Tsunami that occurred in December 2004 stressed the need for an effective regional disaster preparedness mechanism in the Indian Ocean and Southeast Asia. In 2010, the scope of the Fund was broadened to include overall disaster and climate preparedness within the Fund's core areas of support. The Fund contributes to narrowing the capacity gaps in the region and ensures the development of an integrated regional early warning system.

http://www.unescap.org/disaster-preparedness-fund

Myanmar Department of Meteorology and Hydrology (DMH)

Philippines Atmospheric, Geophysical, and Astronomical Service Administration (PAGASA)

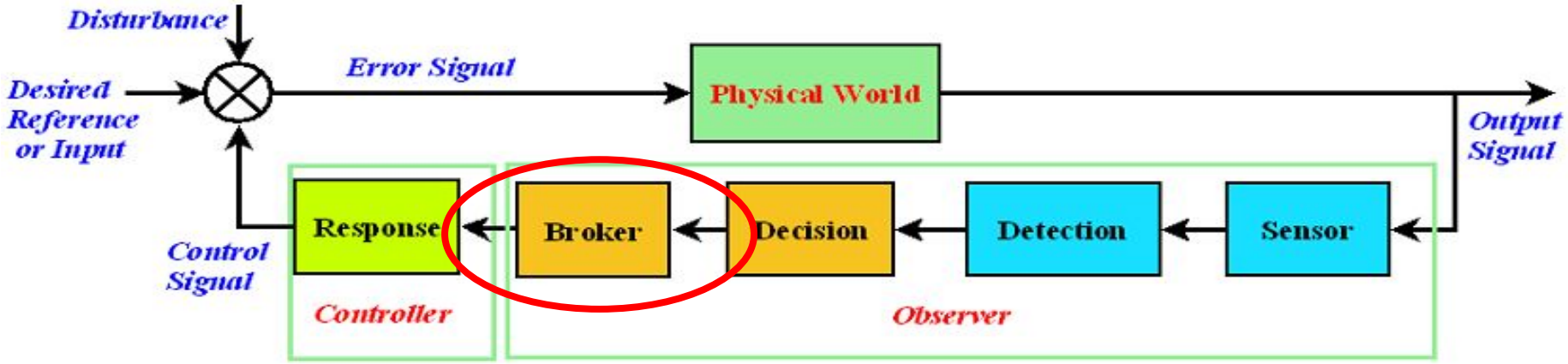
Maldives National Disaster Management Center (NDMC)

UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

AIT

SAHANA SOFTWARE FOUNDATION

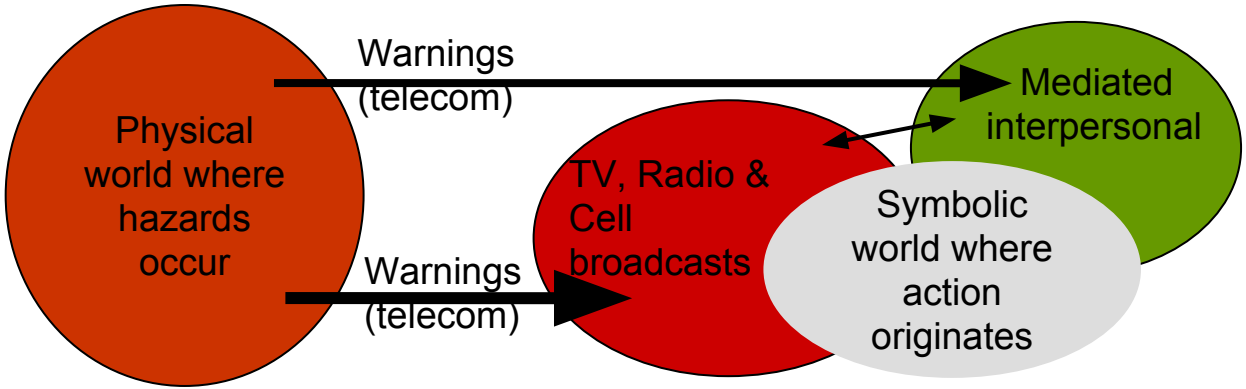
“CAP on a Map” Project is bridging the Last-Mile



Definition: “*Early Warning System* (EWS)”: A chain of information communication systems comprising sensor, detection, decision, and broker subsystems, in the given order, working in conjunction, forecasting and signalling disturbances adversely affecting the stability of the physical world; and giving sufficient time for the response system to prepare resources and response actions for minimizing the impact on the stability of the physical world.

- Waidyanatha, “Towards a Typology of Functional Early Warning Systems, 2010

Role of Telecoms in Early Warning



The physical, the symbolic & their linking through ICTs, simplified **More time to run; more lives saved**

ICTs enable the linking of the physical world within which hazards occur and symbolic world of the human likely to be harmed by those hazards, so that they may take life saving action. But the effective linking of these worlds requires not only ICTs, but also the existence of institutions that allow for the effective mobilization of their potential

- *Samarjiva: mobilizing ICTs for disaster warning, 2005*)

What is Situational-Awareness?

“Cross-Agency Situational Awareness System is an information aggregation **system** that facilitates sharing **situational awareness** within the public safety community. Information shared relates to incidents and planned events. It includes public alerts, risks to responders, and community profiles.” - Canada’s Multi-Agency Situational-Awareness

Why do we need Situational-Awareness

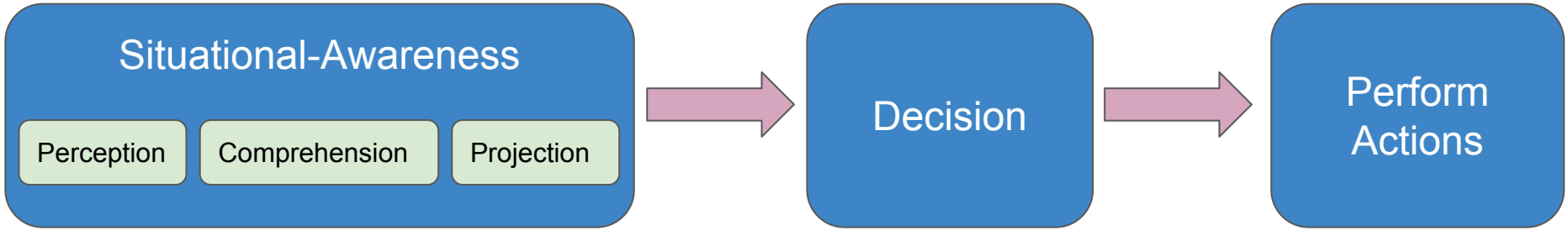
Perception → Comprehension → Projection

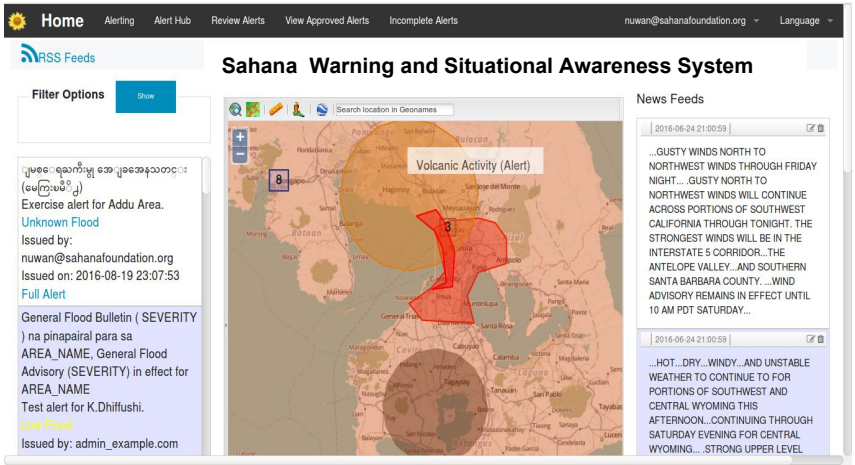
What is happening?

Why do I care?

What do I do about it?

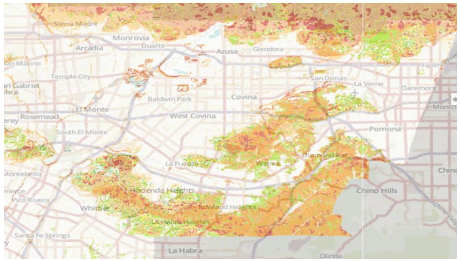
Effects of Situational-Awareness



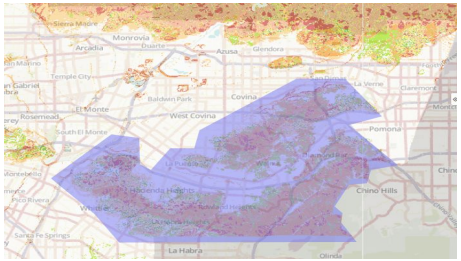


1. Improves information sharing among first-responders (e.g. Common Alerting Picture)
2. Immediate collaboration in response and mitigation
3. Creates connected agencies for public safety
4. Manages resource more efficiently and cost effectively
5. **Saving lives and Livelihoods**

SAMBRO supports Impact-based Alerting

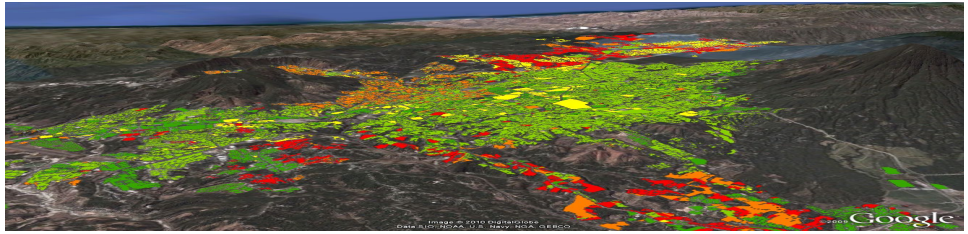


Using hazard, vulnerability, and exposure to identify risk (e.g., landslide prone area)



Define risk-based predefined alert area polygons for alerting authors to use when issuing alerts (e.g. landslide areas induced by heavy rain)

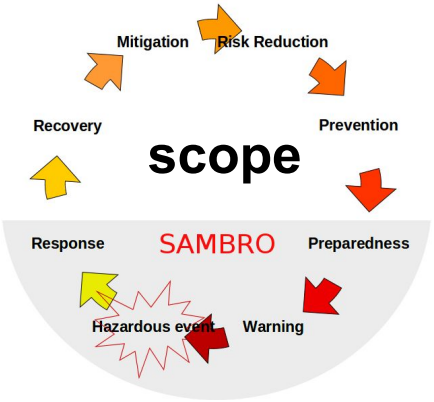
Overlay with telecommunications signal coverage data to ensure warnings go through to intended recipients



- High risk
- Low risk
- No risk

Sahana Alerting and Messaging Broker

1

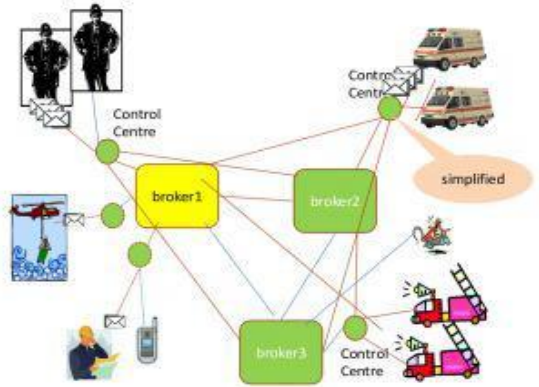


2 **function**

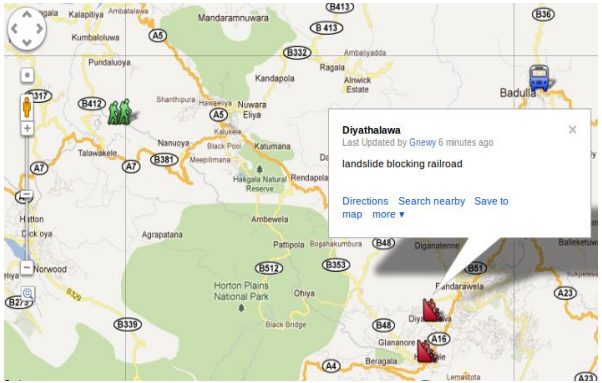
Alerting / Warning

CAP

3 **architecture**



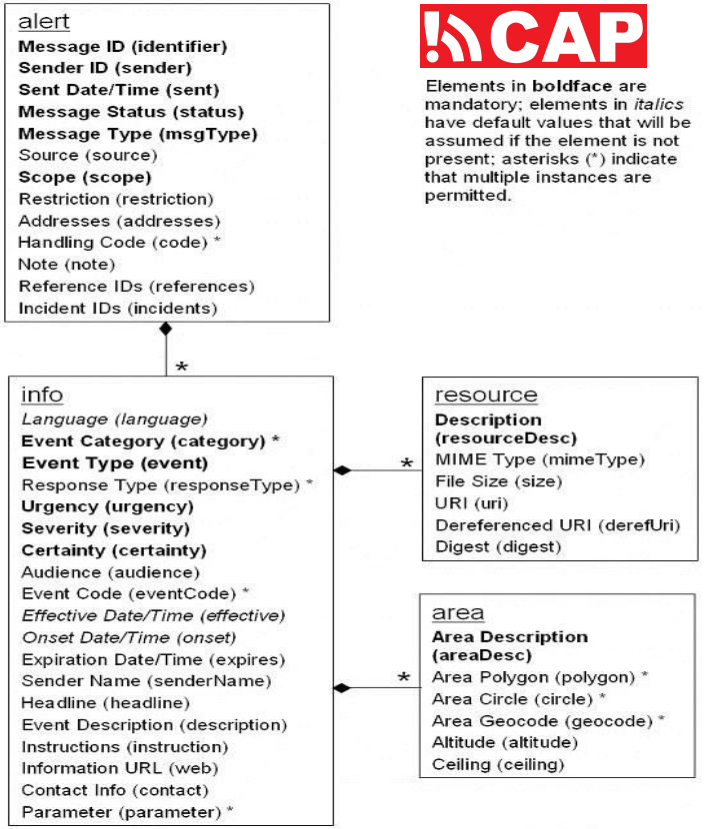
4 **keep it Simple**



SAMBRO Principles

1. Application scope lies within disaster **response** and preparedness
2. Key function is to bring **efficiency** to Alerting / Warning dissemination
3. Apply a Messaging Broker architecture for improved **interconnection** and scalability
4. Keep it simple with Map-based visualization and interaction for improved **situational-awareness**

About CAP (XML)



Standard is Managed by **OASIS** - Organization for the Advancement of Structured Information Standards - EM-TC

Recommended (**X.1303**) by the International Telecommunications Union Standardization Sector (**ITU-T**) – aligned with **ASN1** (Abstract Syntax Notation One) ISO standards notation

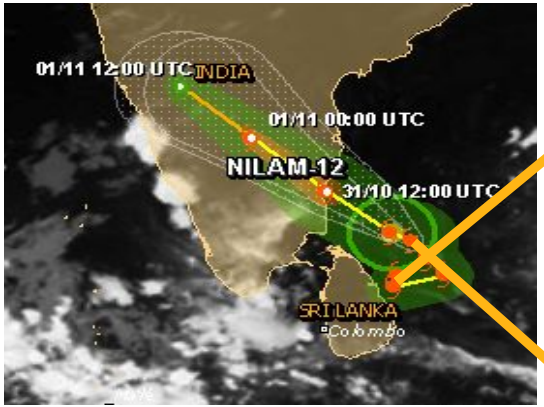
Strongly advocated by the World Meteorological Organization's Public Warning Services

Complies with the US National Science and Technology Council (**NSTC**) six principles of alerting, designed for :

- Coordination (avoid duplication)
- Consistency (believable)
- Channels (Multiple)
- Completeness (unambiguity)
- Coverage (Geo-targeting)
- Control (security)

Multi-lingual Multi-sequence Alerting

CAP



Cyclone NILAM-12
2012 October 31

<Alert> NILAM-12
LK Met Dept
Alert / Update /All-Clear

<AREA>

<INFO>
02:00 UTC

'si'
ඉහළ
කාලගුණ

'ta'
உயர்
வானிலை

'en'
HIGH
MET

North
Northeast
வடக்கு
வடகிழக்கு
උතුර
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<INFO>
12:00 UTC

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'en'
HIGH
MET

North
வடக்கு
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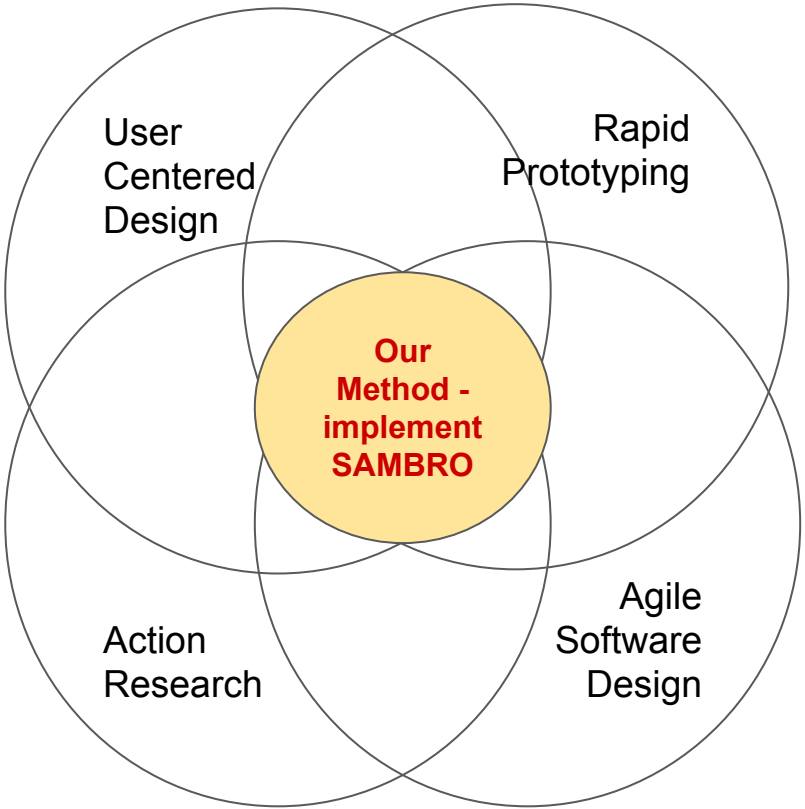
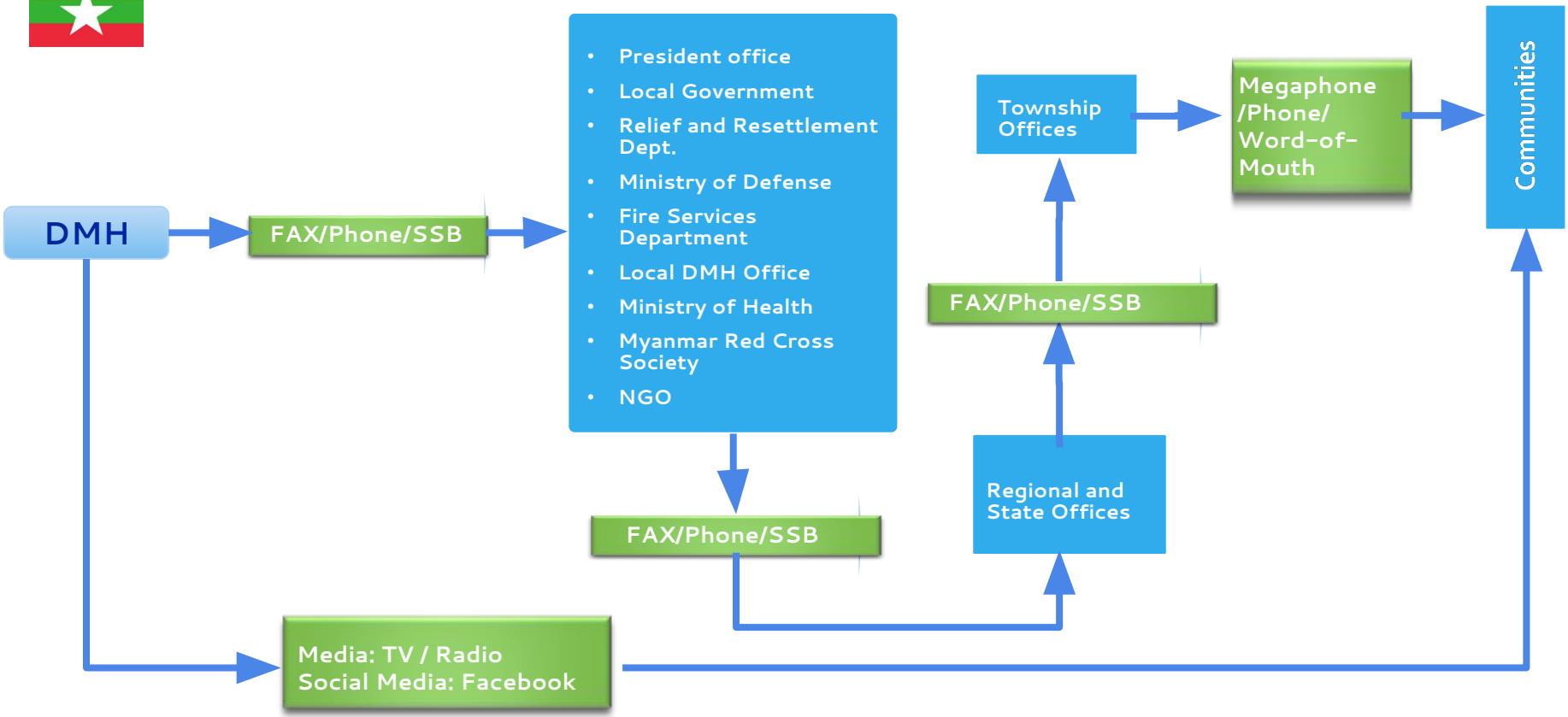
Four areas of Information System Design

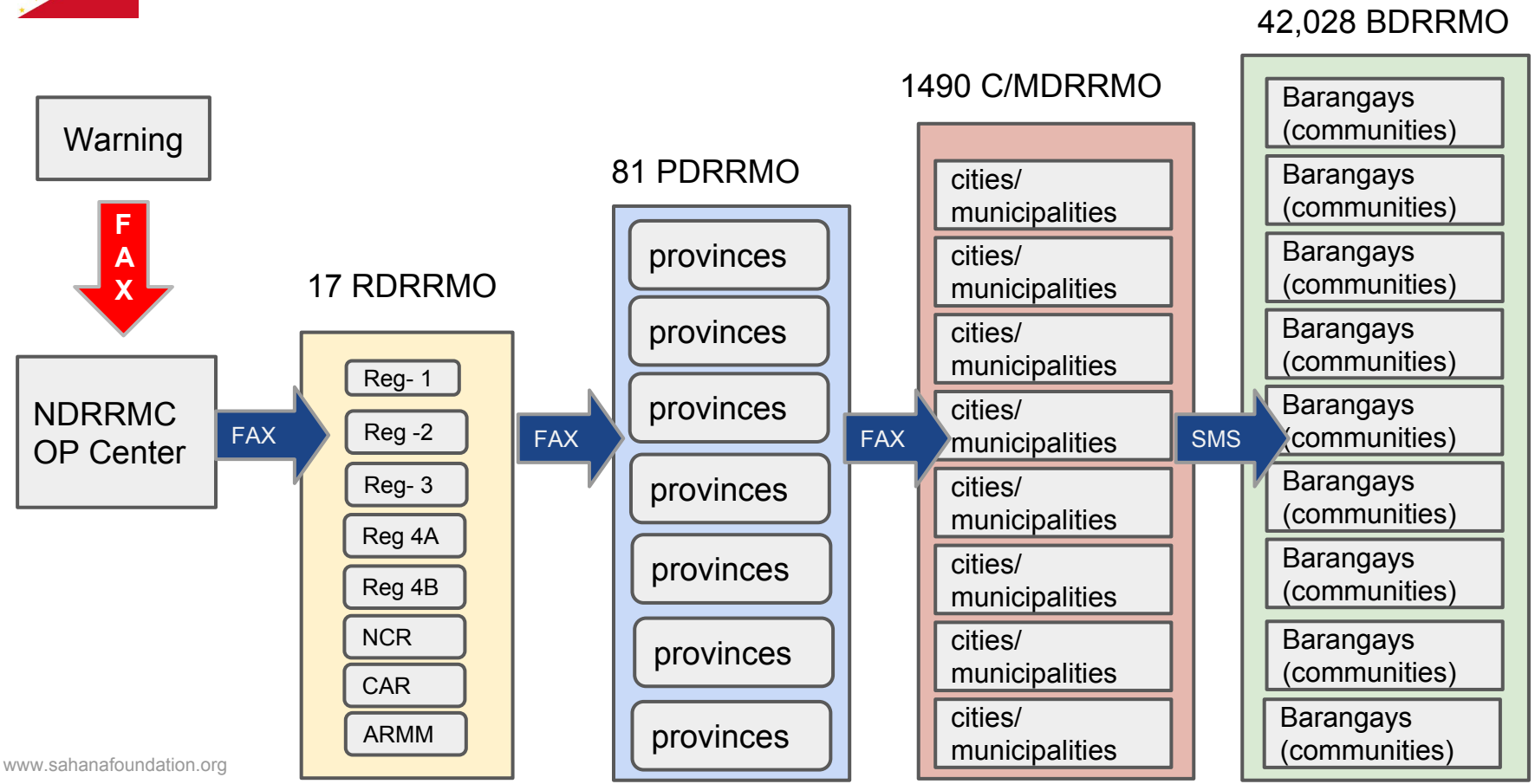
1. User Centered Design
   a. Designing for users
   b. Involving users
2. Rapid Prototyping
   a. Realistic model of the interfaces and functionality
   b. Users involved early in the design
   c. User model, workflows, information needs
   d. Iterate the testing and revising until agreed
3. Agile Software Design (SCRUM)
   a. SCRUM Lightweight software engineering framework
   b. Tightly-knit teams, close collaboration
   c. Business side user stories
4. Action Research
   a. Knowledge generation with planned action
   b. Understand the problem and provoke change, actionable outcomes



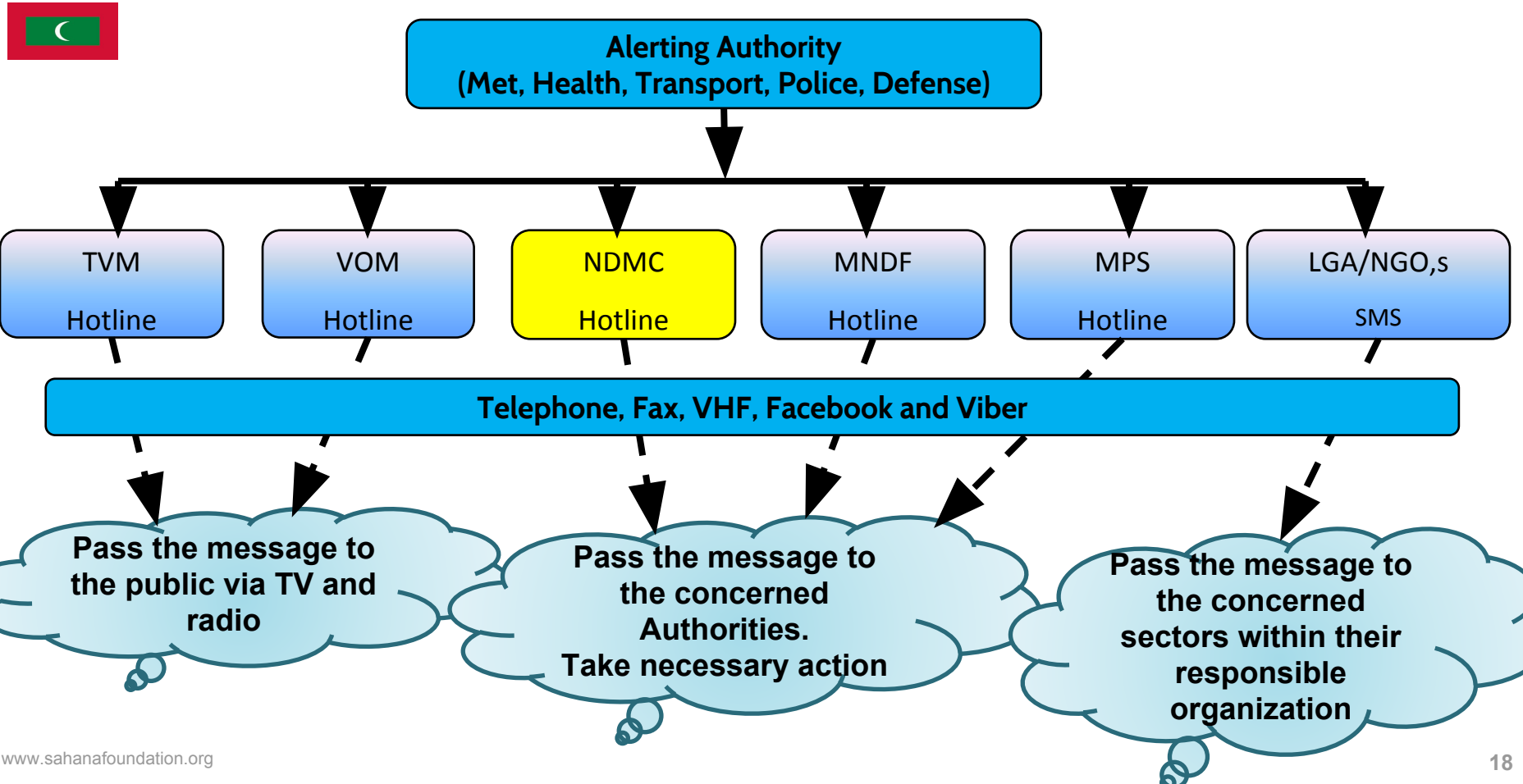
Myanmar Previous Warning Practice



Philippines Previous Warning Practice



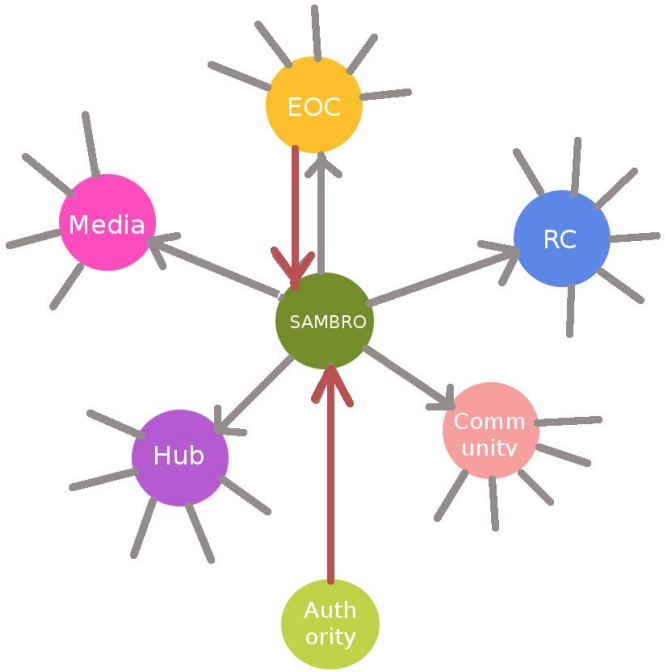
Maldives Previous Warning Practice



Problems in the Current Practices

1. Each Alerting Authority has their own dissemination system (SMS, facebook, twitter); cost of multiple system and monitoring multiple channels
2. Multiple hops with National to Regional / State / Province to City / Town to Households causing delays and possible information mutation
3. Using labour intensive technologies such as hotlines (phones), FAX that takes several minutes to complete
4. Chances of forgetting to alert / warn and Organization
5. Inconsistent terminology and ambiguous language, requires call back to confirm and comprehend

SAMBRO Pub-Sub-Hub Simplifies Warnings

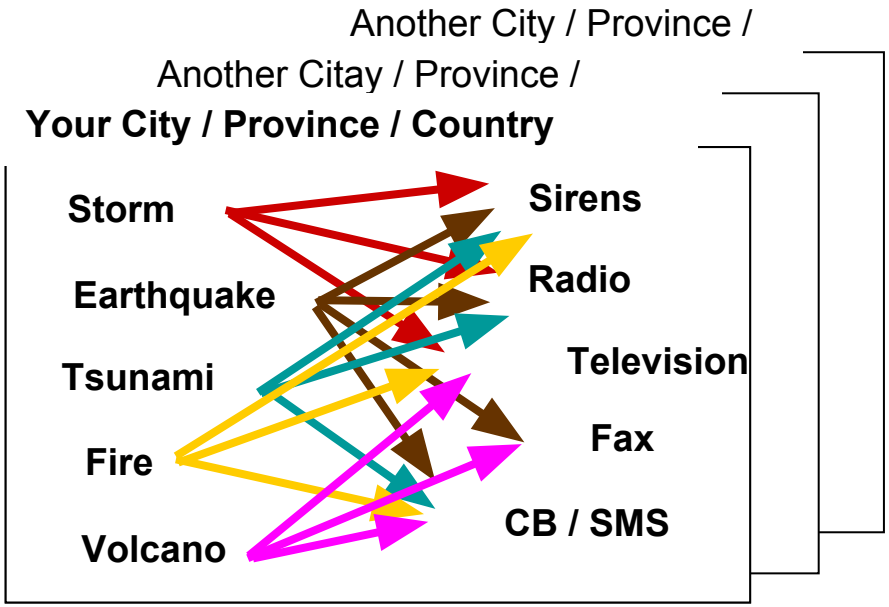


- No one is forgotten because:
  - Subscribers manage their own alert needs
  - Automation ensures reliability
- Alert-HUB is a single point for:
  - Monitoring or subscribing to all alerts
  - Disseminating alerts from all agencies
- Efficiency gains by:
  - Reducing tree traversal time with a single hop
  - Automating the dissemination process

EOC - Emergency Operation Center RC - Red Cross (Society) Community - community of practice
Authority - Alerting Authority Hub - other relay and rendering agents Media - TV, Radio, SocMed
line Agencies emergency services - police/fire/SAR/health…

SAMBRO Simplifies All-Hazard All-Media Warning

COMPLEXITY → **SIMPLIFIED**



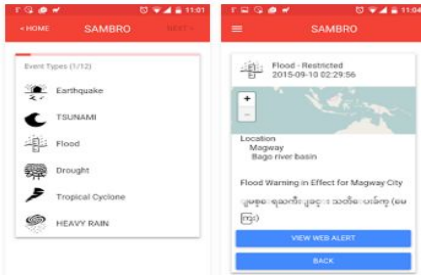
SAMBRO System-to-Human Interfaces

1 Subscribe to Event, Warning Priority, and Language specific **Email** & **SMS** alerts of choice

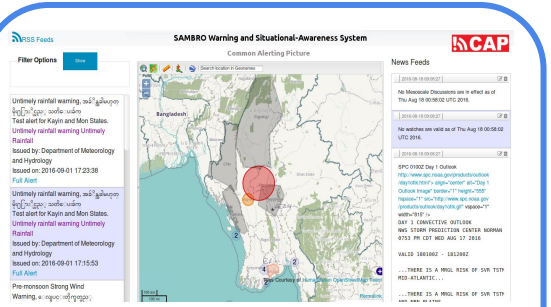
2

3 **Twitter** Feeds

4 **Mobile App (GCM)**

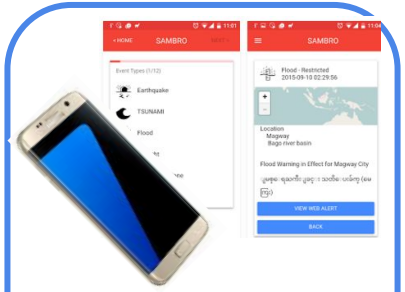


SAMBRO System-to-System Interfaces



BROWSER APP

REST API

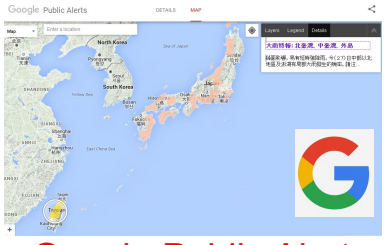


MOBILE APP

SAMBRO Server (Browser App) and Mobile APP talk to each other through RESTful **APIs**

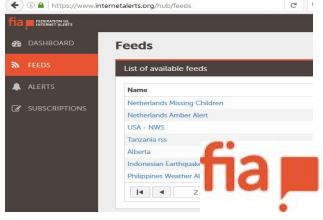
Google, IFRC, FIA, and any other CAP Alert Hubs can talk to SAMBRO through **RSS**

RSS Feeds



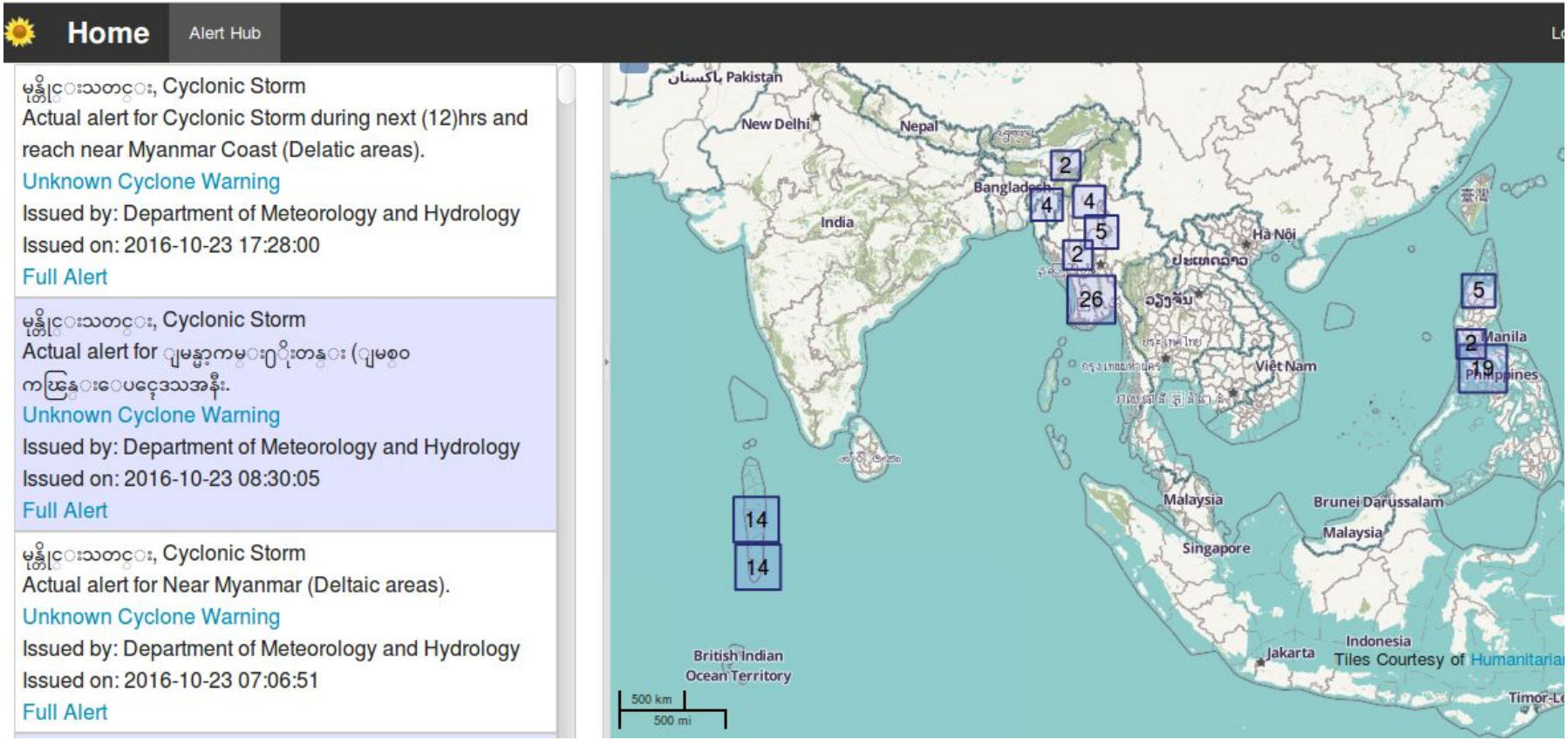
Google Public Alerts

Red Cross Hazard APP



Federation of Internet Alerts

Alert-Hub and Common Alerting Picture



SAMBRO Full Alert Message

MESSAGE ID :: 1ff91cc6-ecd8-46f9-8a13-dfa71e099a2f

SOURCE :: None@http://sambro.meteopilipinas.gov.ph

HEADLINE :: **General Flood Advisory (Final)**

DESCRIPTION :: Under present weather conditions, Easterlies affecting the eastern section of the country. . The 24 hour rainfall forecast is light rains with isolated thunderstorm. Water courses likely to be affected : + **Palawan** - Rivers and its tributaries particularly Abongan, Lian, Barabakan, Rizal, Caramay, Langogan, Babuyan, Bacungan, Iwahig Penal, Inagauan, Aborlan, Malasgao, Apurauan, Baton-Baton, Aramayawan, Ihawig, Panitian, Pulot, Lamakan, Kinlugan, Eraan, Tiga Plan, Malabangan, Ilog, Bansang, Conduaga, Culasian, Iwahig (Brookes), Okayan, Canipan and Busuanga, Coron. + **Oriental Mindoro** - Rivers and its tributaries particularly Malaylay-Baco, Pulang Tubig, Mag-asawang Tubig, Butas, Pula, Agsalin, Bansud, Samagui, Bongabon, Baroc, Bulalacao and Balete. + **Occidental Mindoro** - Rivers and its tributaries particularly Abra de Ilog, Cagaray, Labangan, Magbando, Lunintao, Anahawin, Monpong, Amnay, Pola, Pagbahan, Mamburao and Ibod. + **Marinduque** - Rivers and its tributaries particularly Tawiran-Tagum (Marinduque) and Boac.

RESPONSE TYPE :: AllClear

INSTRUCTIONS :: With this development and unless significant rain occurs, this is the final general flood advisory for this event.

AREA :: Palawan, Oriental Mindoro, Occidental Mindoro, Marinduque

INFORMATION EVENT :: General Flood Advisory (Final)

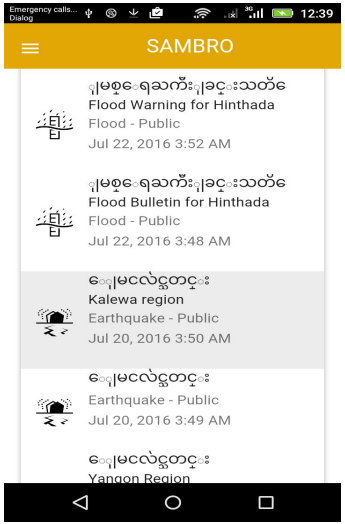
Category :: Met - Meteorological (inc. flood)
Urgency :: Past - Responsive action is no longer required
Severity :: Minor - Minimal to no known threat to life or property
Certainty :: Unlikely - Not expected to occur (p ~ 0)
Effective Date :: 2016-10-24 03:46:47
Onset Date :: 2016-10-24 03:46:47
Expiry Date :: 2016-10-22 19:17:19
Information URL :: http://sambro.meteopilipinas.gov.ph/eden/cap/public/211
Sender :: PAGASA-DOST
Contact Info :: PAGASA-DOST
Parameters :: layer:Google:Region:0.1: Region 4-B (MIMAROPA)

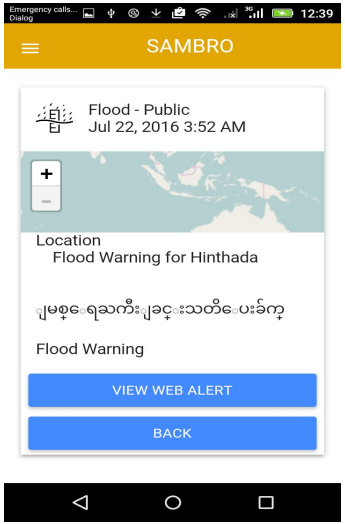
ALERT QUALIFIERS

Sender ID :: PAGASA-DOST
Sent Date/Time :: 2016-10-22 07:17:19
Message Status :: Actual - actionable by all targeted recipients
Message Type :: Alert
Scope :: Public

Mobile APP

We invested in developing the iOS APP despite of the difficulties dealing with the Apple Store because of the Android vs. iOS market share: Maldives 50/50, Myanmar 90/10, Philippines 80/20);





1. Designed for local alerting authorities to issue CAP-alerts for village, townships, Islands
2. GCM push serves as a wakeup function with a Siren (limited e.g. China)
3. Requires a data connection but future versions will make use of SMS as a data transport

Typical SAMBRO Software Implementation

SYSTEM

- Configure
  - eden/template/sambro/country/organization
  - Unique Identifiers (CAP OID)
  - SMS Gateway
  - Email SMTP
  - CAP to Media XSLT (SMS, Email, Twitter)
- Implement
  - Event Types
  - Warning Classifications (Urgency, Severity Certainty)
  - Predefined Alert Area Polygons
  - Message Templates (pre populated CAP messages)
  - Feeds (External CAP RSS, Social Media, other feeds)

USERS

- Publishers
  - Editors and Approvers (author and disseminate)
- Subscriptions
  - Self Subscribe (Passive push) - events, priority, location, ICT
  - Admin Subscribed (Active push) - groups of recipients

Evaluation Methodology

On the day of the exercise did the technology and the people work?

1. No Surprises, prior the the exercises
   a. Implementation should be complete (terminology, classifications, templates)
   b. Users should have been trained for for originating / relaying messages
   c. Siltet-test should have been carried out
2. During the exercises
   a. Users defined a scenario, KPI, goals, intent, and actions
   b. Discuss the steps for issuing with SAMBRO
   c. Issue the alert/warning with SAMBRO
3. Evaluation
   a. Observers record the user's' behaviour applying a complexity index
   b. Record the behaviour with screen capture software (CamStudio)
   c. Users indicate the gulf of execution; i.e. “achieved level of the goal, intent, and actions”)
   d. Users indicate their perception on the technology acceptance (usefulness, ease-of-use,

Carried out with both Publishers and Subscribers

Controlled-Exercise Workflows

Heavy Rain Threatening floods and landslides

Dept Meteo & Hydro **originates** (issues) a “heavy rain” warning

Dept Irrig & Dam Safety **relays** the message to their First-Responders

Dept Irrig & Dam Safety Last-Mile focal person **relays** the message to other First-Responders

ITERATION 1: Issue **Alert** for the event (first instance)

ITERATION 2: **Update** alert for wit new information / status of the event

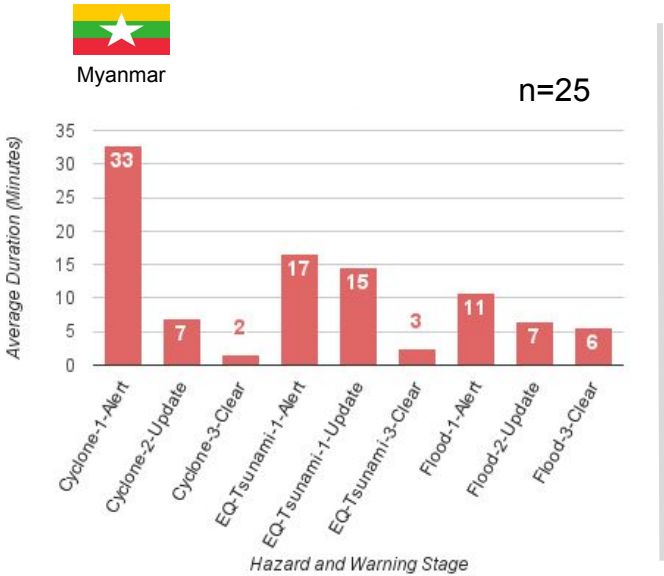
ITERATION 3: Issue an **All-Clear** to indicate event is no longer a threat

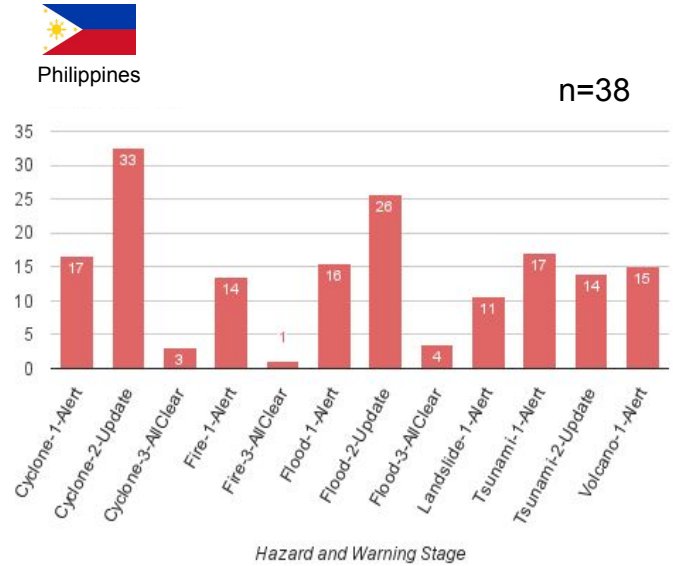
Participation in the Controlled-Exercises

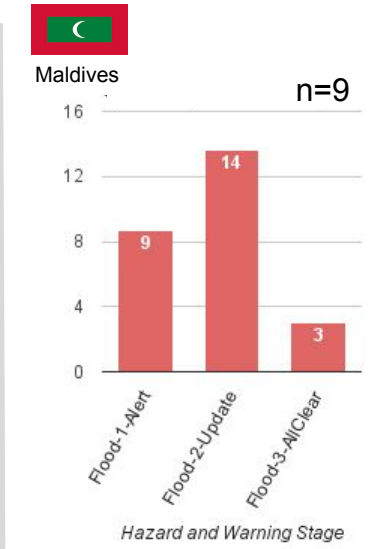
	Publishers	Subscribers
Myanmar	**13** (DMH, RRD)	**38** (Kunyangon, Nyuangdon)
Philippines	**19** (PAGAS, PHIVOLCS)	**21** (Manila Bay, Subic Bay)
Maldives	**06** (NDMC, MOH, MRC)	**10** (Thulesdoo)

DMH - Department of Meteorology and Hydrology RRD - Relief and Rehabilitation Department PAGASA - Philippines Atmospheric Geophysical and Astronomical Service Administration
PHIVOLCS - Philippines Institute of Volcanology and Seismology NDMC - National Disaster Management Center MOH - Ministry of Health MRC - Maldives Red Crescent

Time To Completion (alert, update, all-clear)

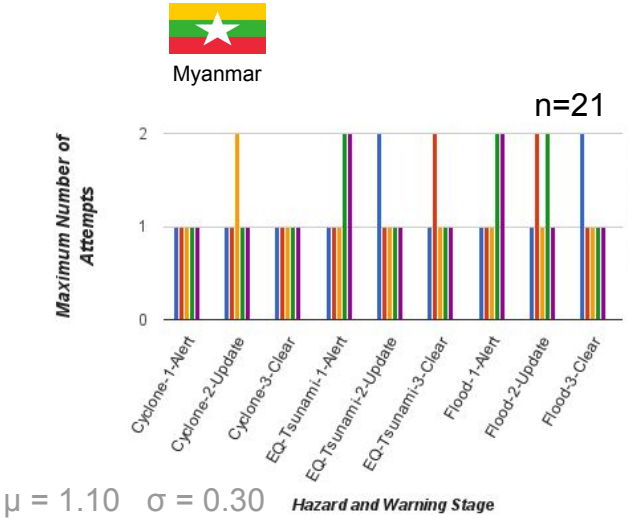


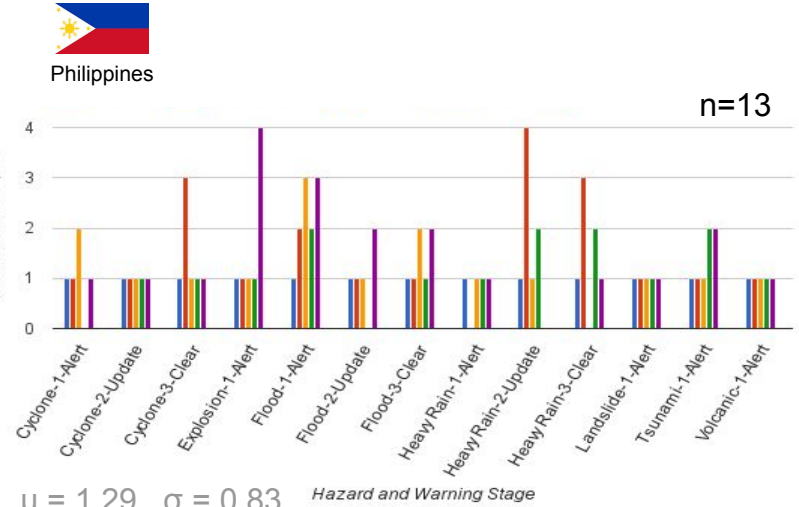


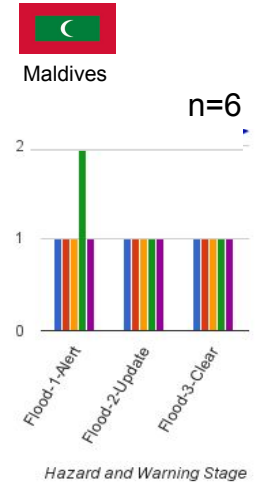


1. Philippines and Maldives (Island Nations) show similar patterns of a bell-shape timing distribution to issue an alert, update, and all-clear message; while Myanmar is exponentially decreasing
2. All three countries show similar timing patterns for issuing cyclone and flood warnings
3. Timing can be reduced if all users make an effort to understand the meaning of the CAP attributes (there were inconsistencies in level of user aptitude)

Observed Maximum Number of Attempts







Step 1 : Login

Step 2 : Select Template or Message

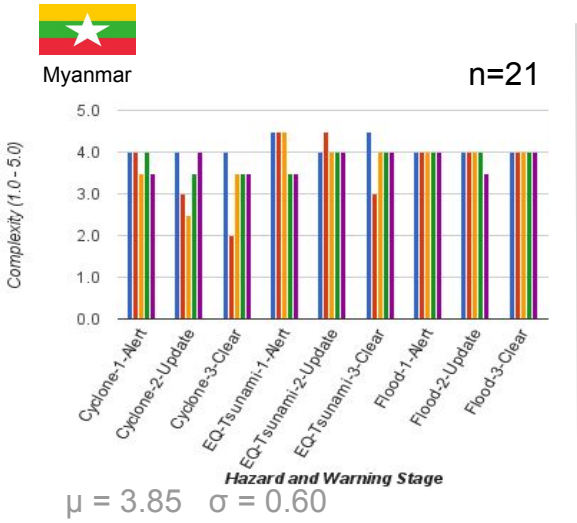
Step 3 : Complete ALERT block

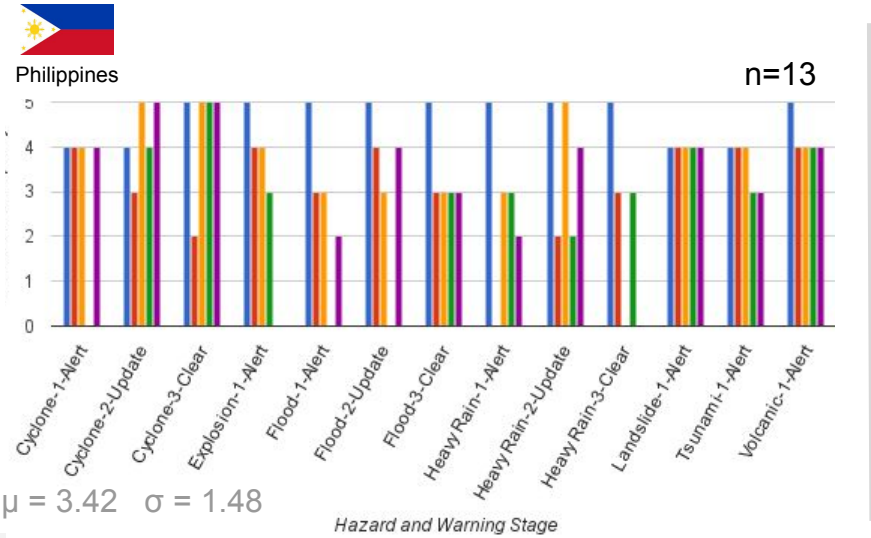
Step 4 : Complete INFO block

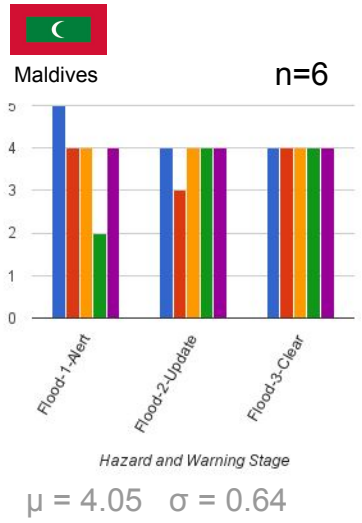
Step 5 : Complete AREA block

1. Myanmar and Philippine Meteorological divisions were seasoned in issuing CAP alerts, while the other divisions were slowly building their aptitude
2. Users kept revisiting the ALERT mostly to ensure the appropriate attributes were set for an message Update
3. Since there were no predefined alert area polygons for tsunami and flood, it took more than one attempt to complete the AREA block

Simplicity of Completing: Alert, Update, & All-Clear







Step 1 : Login

Step 2 : Select Template or Message

Step 3 : Complete ALERT block

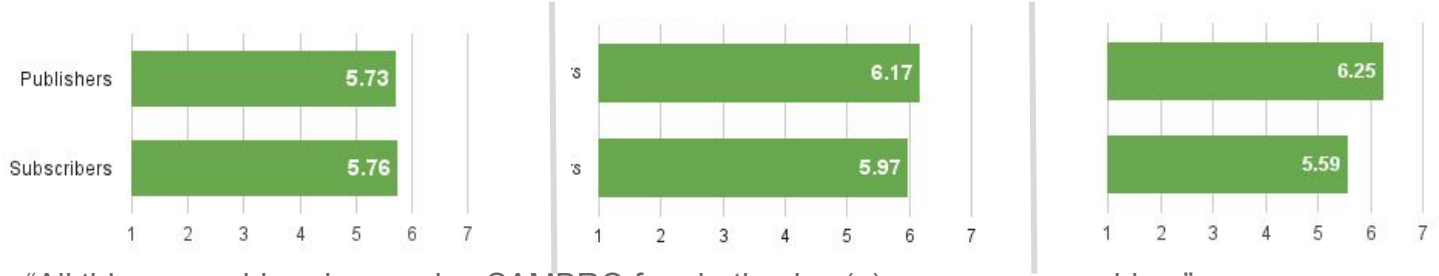
Step 4 : Complete INFO block

Step 5 : Complete AREA block

1. Philippine users, once again, show a level of inconsistency and uncertainty (drills were a first exposure for some users); Myanmar users have been testing and practicing the use of the system
2. Complexities were mostly in populating the INFO block because it requires a lot of detail with respect to the event information
3. Some uncertainties with the ALERT block whether or not to change the alert area

SAMBRO Acceptance (TAM)

1 = Strongly Disagree, 2 = Disagree, 3 = Impartial, 4 = Agree, 5 = Strongly Agree



"All things considered, my using SAMBRO for alerting is a(n) _____ idea."

A = {Bad, Harmful, Foolish, Negative} B = {Good, Beneficial, Wise, Positive}

1 = Extremely A, 2 = Quite A, 3 = Slightly A, 4 = Neither A Nor B, 5 = Slightly B, 6 = Quite B, 7 = Extremely B

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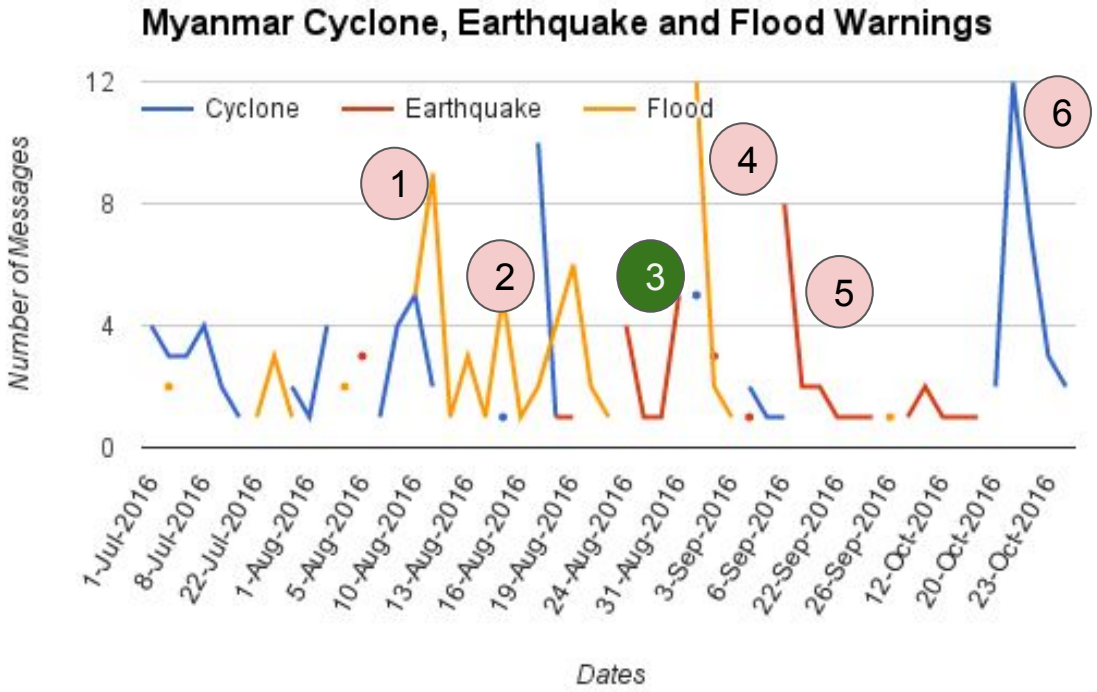
While Myanmar has a slightly lower opinion, users from all three countries, are inclined to, AGREE that SAMBRO is easy to use and useful for their warning practices

The attitude of the users from all three countries is that, all things considered SAMBRO is QUITE a GOOD, Beneficial, Wise, and Positive tool

Implementation Issues

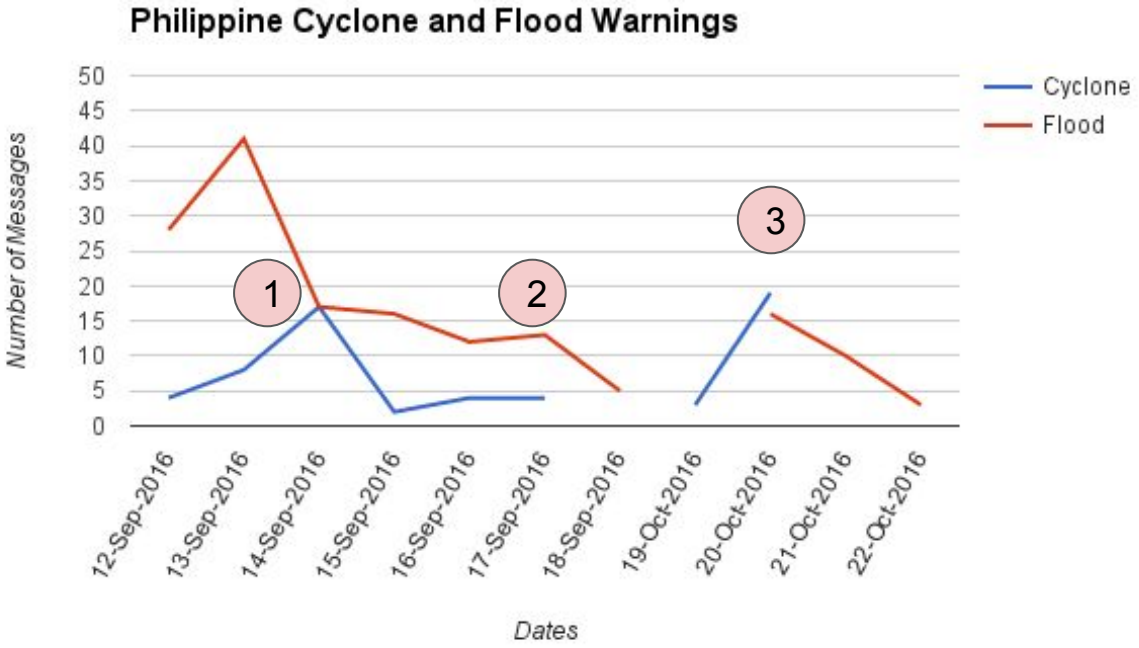
1. Multi-Stakeholder engagement was a challenge with trained staff unable to influence top management (decision-makers)
2. Warning practices National Warning Centers vs. National Disaster Management Organizations; uptake by NDMOs is low
3. Significant number of first-responders, in the townships, do not use email in Myanmar
4. It has been and still is a struggle for DMH to acquire an SMS gateway from MPT; Philippines OCD and the Free Mobile Alert Act not used PAGAS/PHIVOLCS unable to make use of it
5. None or very little use of Predefined Alert Areas because risk maps are limited to few pockets and not for all-hazards; Geocodes are effective for Island nations.

Myanmar SAMBRO Utilization



1. the water level of Bago River at Bago is observed as about (1½) feet below its danger level...
2. the water level of Thanlwin River at Hpa-an is observed as about (1) foot below its danger
3. **A 6.8 magnitude earthquake hit central Myanmar, in the ancient city of Bagan**
4. water level of Chindwin River at Homalin is observed as about (6½) feet below its danger...
5. More earthquakes in Myanmar
6. Unnamed Cyclone in the Myanmar Area of Responsibility;

Philippine SAMBRO Utilization



1. Typhoon Ferdie (Meranti)
2. Typhoon Gener (Malakas)
3. Typhoon Haima (Lawin)

Also includes several Flood bulletins that were issued by PAGASA and displayed on SAMBRO

Next Steps

1. Revise the current implementation and stakeholder engagement strategies for scaling CAP-on-a-Map project into other countries
2. Further analyze and engage with current users to develop hazard specific simplified user interfaces with enhanced automation; continue to improve SAMBRO
3. Introduce guidelines for Standard Operating Procedures for a cross-agency situational-awareness approach

Conclusion

1) There is much more to be done with improving early warning dissemination in the Asia-Pacific Region
2) The uptake of CAP is still poor and policies must be exercised for CAP adoption
3) Nations should consider and practice a cross-agency situational-awareness approach to early warnings

Thank You