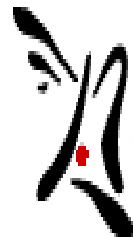# Human Perspective and Service Concepts (WG I)

WIRELESS WORLD

RESEARCH FORUM

Royal Meridien Hotel
Chennai, India
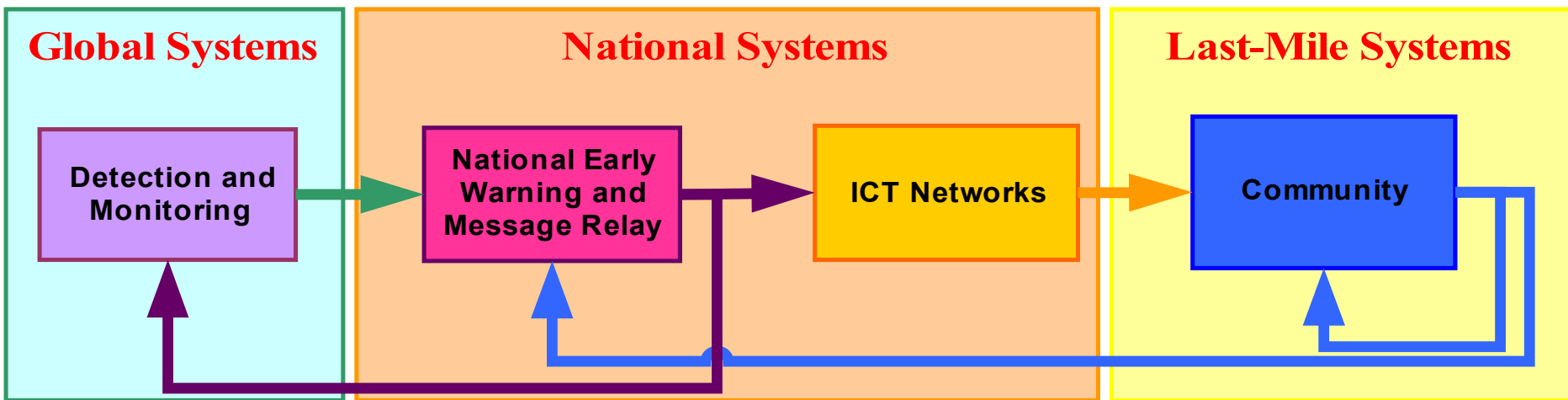**05 November 2007**

LIRNE*asia*

Learning Initiatives on Reforms for Network Economies

Nuwan Waidyanatha
**12 Balcombe Place,**
Colombo 08, Sri Lanka

Tel: +94 773710394, +86 13888446352
Email: waidyanatha@lirne.net

Hazard Detection and Notification Chain of Systems

Global Systems

Detection and Monitoring

National Systems

National Early Warning and Message Relay

ICT Networks

Last-Mile Systems

Community

- Det/Mon Systems and NEWS can work as a closed system but purpose of saving lives is defeated if not connected to the Last-Mile; better through ICT Networks

- Without the inputs from NEWS to the Last-Mile they cannot provide feedback to the NEWS to measure its performance and correct the shortcomings; performance of the ICT Networks are also measured through the Community feedback

- Communities have a self-feedback to ensure ERPs are reliable and effective

- Communities can work as standalone closed systems but would require ERPs that can be executed in Zero time; i.e. be able to function without Institutional NEWS but depend on global media, tacit knowledge, and natural observations
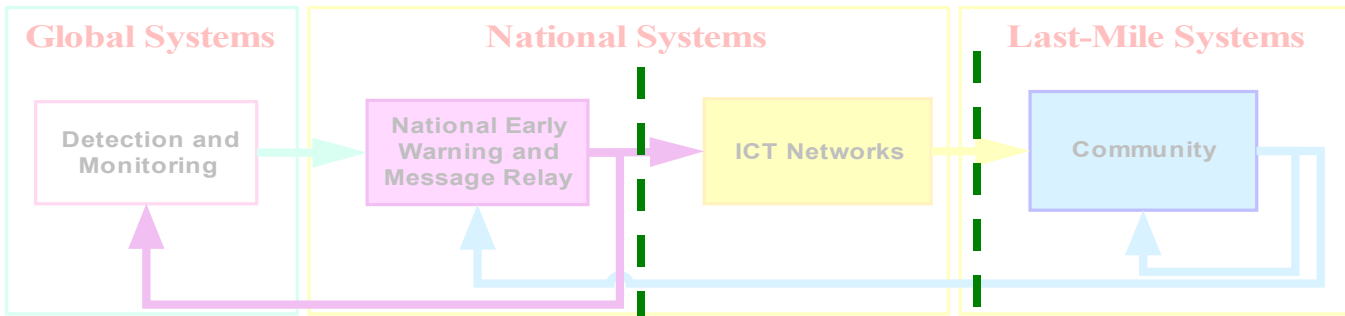
Components of the Community-based
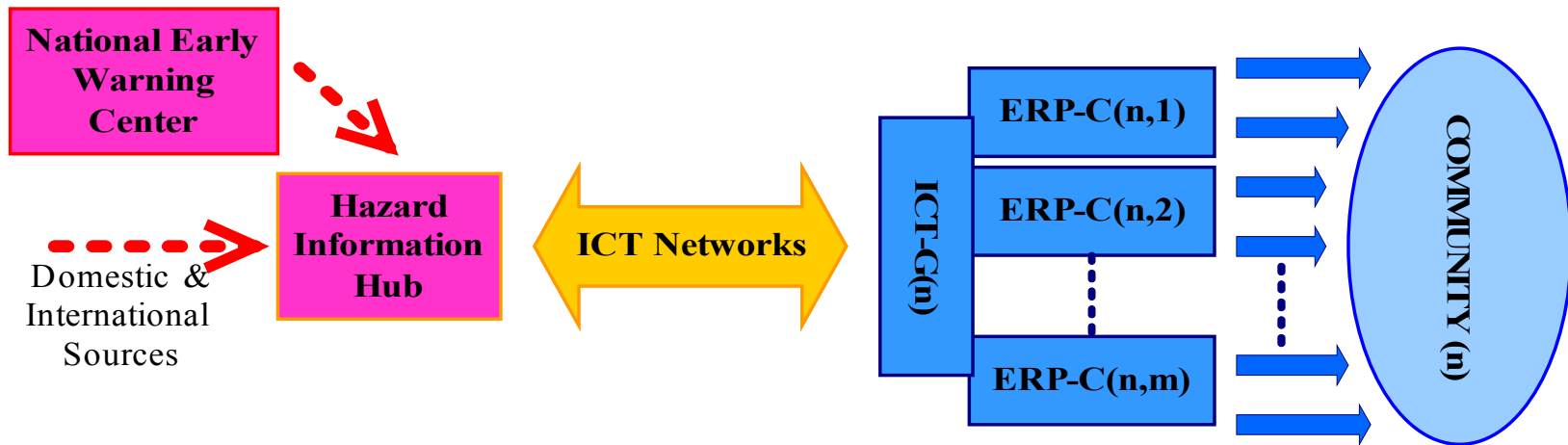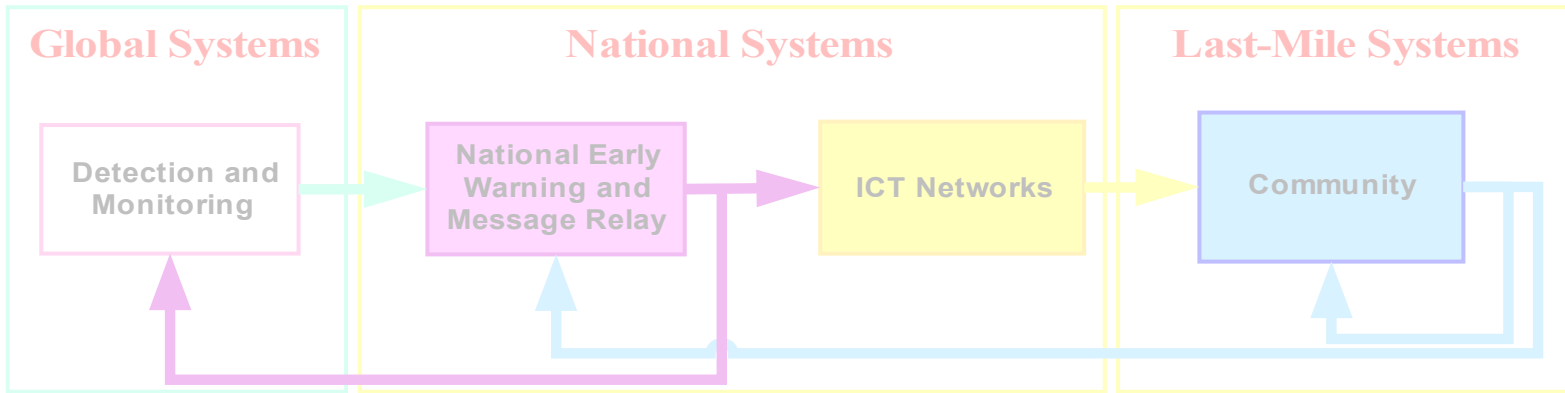
Community-based Model --

✓ Works for hazards with time > 30min only; where physical world of hazards are distant from the community such as tsunami, cyclone, floods

✗ Does not work for rapid onset hazards such as dam breach, earthquakes

Community-based Warning System – ICT Component

Global Systems

- Detection and Monitoring

National Systems

- National Early Warning and Message Relay
- ICT Networks

Last-Mile Systems

- Community

National Early Warning Center

Domestic & International Sources

Hazard Information Hub

ICT Networks

ICT-G(n)

ERP-C(n,1)

ERP-C(n,2)

ERP-C(n,m)
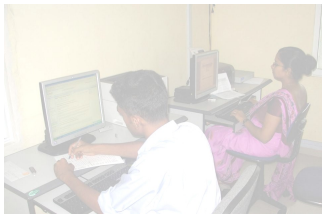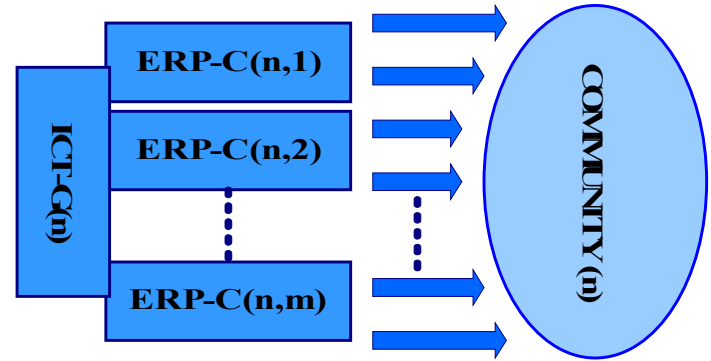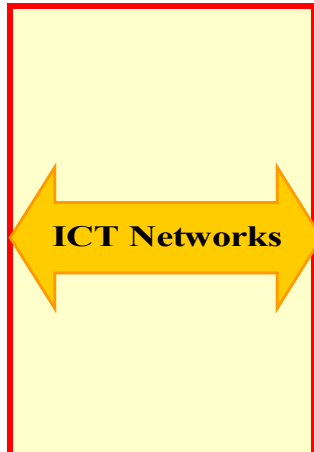
COMMUNITY (n)

Sarvodaya Community Disaster Management Center (SCDMC)

Communications Providers

Sarvodaya Communities

Alert and Notification Actors and Sequence of Operations

- **National Early Warning Center**
- **Hazard Information Hub**
- Domestic & International Sources
- **ICT Networks**
- **ICT-G(n)**
- **ERP-C(n,1)**
- **ERP-C(n,2)**
- **ERP-C(n,m)**

HIH-Monitor

t_0

Acknowledge Alert ()

Activate HIH Plans ()

T_0

ICT Guardian

Relay Alert

t_1

Identify CAP Alert ()

T_1

Activate ICT -G Plans ()

Acknowledge

Village-First-Responders

Dissemminate

t_2

T_2

Activate Community Plans ()

Competer Plan

Relay Results
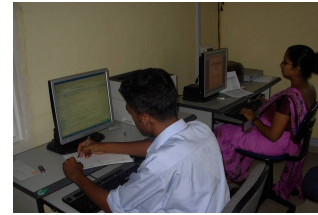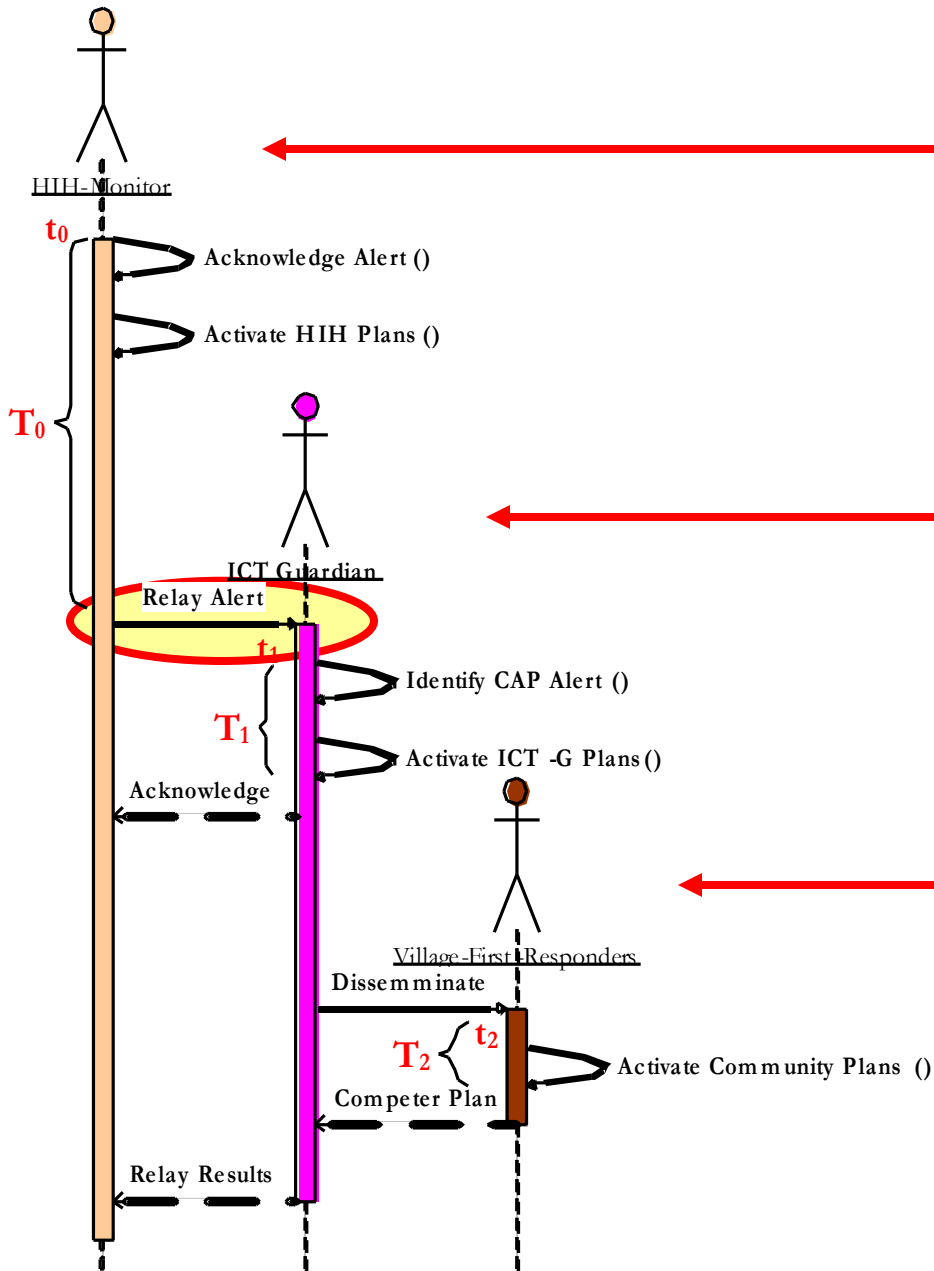
Actor 1: HIH Monitors

Actor 2: ICT Guardians

Actor 3: ERP Coordinators
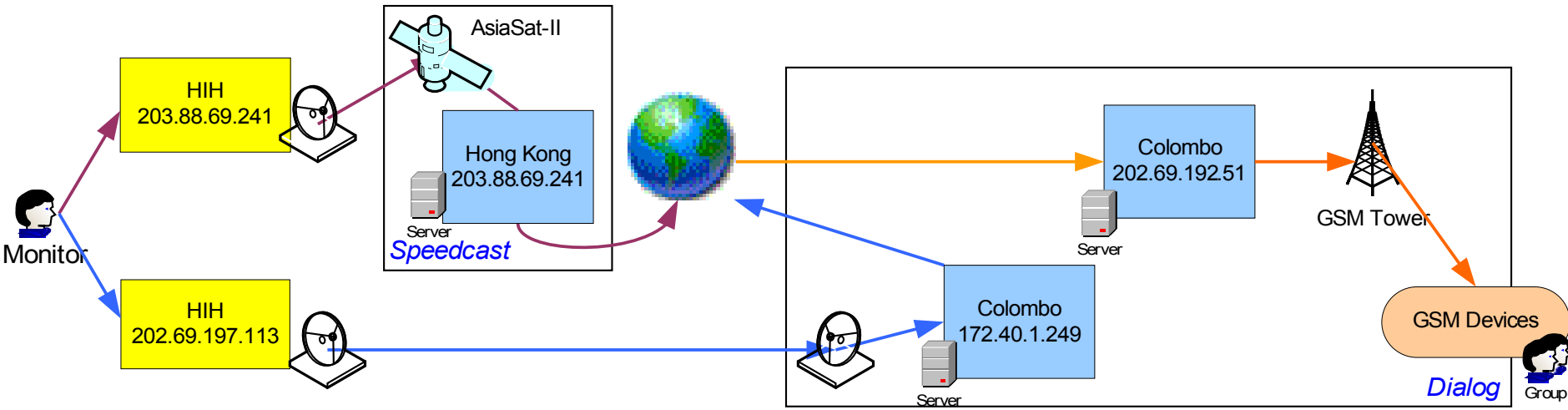
Disaster and Emergency Warning Network

Microimage SMS Alerts - Microsoft Internet Explorer

File   Edit   View   Favorites   Tools   Help

Back   Search   Favorites

Address http://202.69.192.51/midews/SMSAlert.htm

Search Web   Upgrade your Toolbar Now!   Mail   My Yahoo!   Baseball   Games   Music

Microimage SMS Alerts   Add Tab

Dialog
Disaster and Emergency Warning Network

Change Password   Sign Off

Setup
- Create Users
- Create Messages
- Create Recipients
- Create Alarms
- Alarm Configuration
- CB Configuration
- Create CBStations

Alert
- Send SMS Messages
- Send CB Messages
- Send Alarm SMS Mess
- Send Alarm CB Messe

Log
- SMS Message Log
- CB Message Log
- Alarm SMS Message L
- Admin Message Log

Powered by

Send SMS Messages

Message: Cyclone

Hotline#: 602164957   602164957

Sound: Sound1

Message in Sinhala

සුළි සුළඟක් එනවා !!!

Message in English

Cyclone

Message in Tamil

சூறாவளி !!!

Message Recipients   Select Recipients

DDMU - Galle - 773145707
Mr S K Pathmasiri (DDMCU Member) - 777036544
Mr Y G S Premathilake (DDMCU Member) - 77997809
Mr L K Paranawithana (DDMCU Member) - 777118121
Mr H D N De Silva (DDMCU Member) - 779754616
Mr M D Gunasekara (DDMCU Member) - 779752170
DS - Galle - 777765310
Mr W Weerakoon - Adl DS (Galle) - 777470160
Mr P H Wimalarathne - Asst DS (Galle) - 777257659
Transport Supirentendant (CTB) - 777978384
Mr Abeyrathne (Transport Sptd - Private) - 777105442
Mr S H A Dickman - Station Master) - 777628907

Preview   Send

Done   Internet

Operational States of the DEWNS Terminal Devices
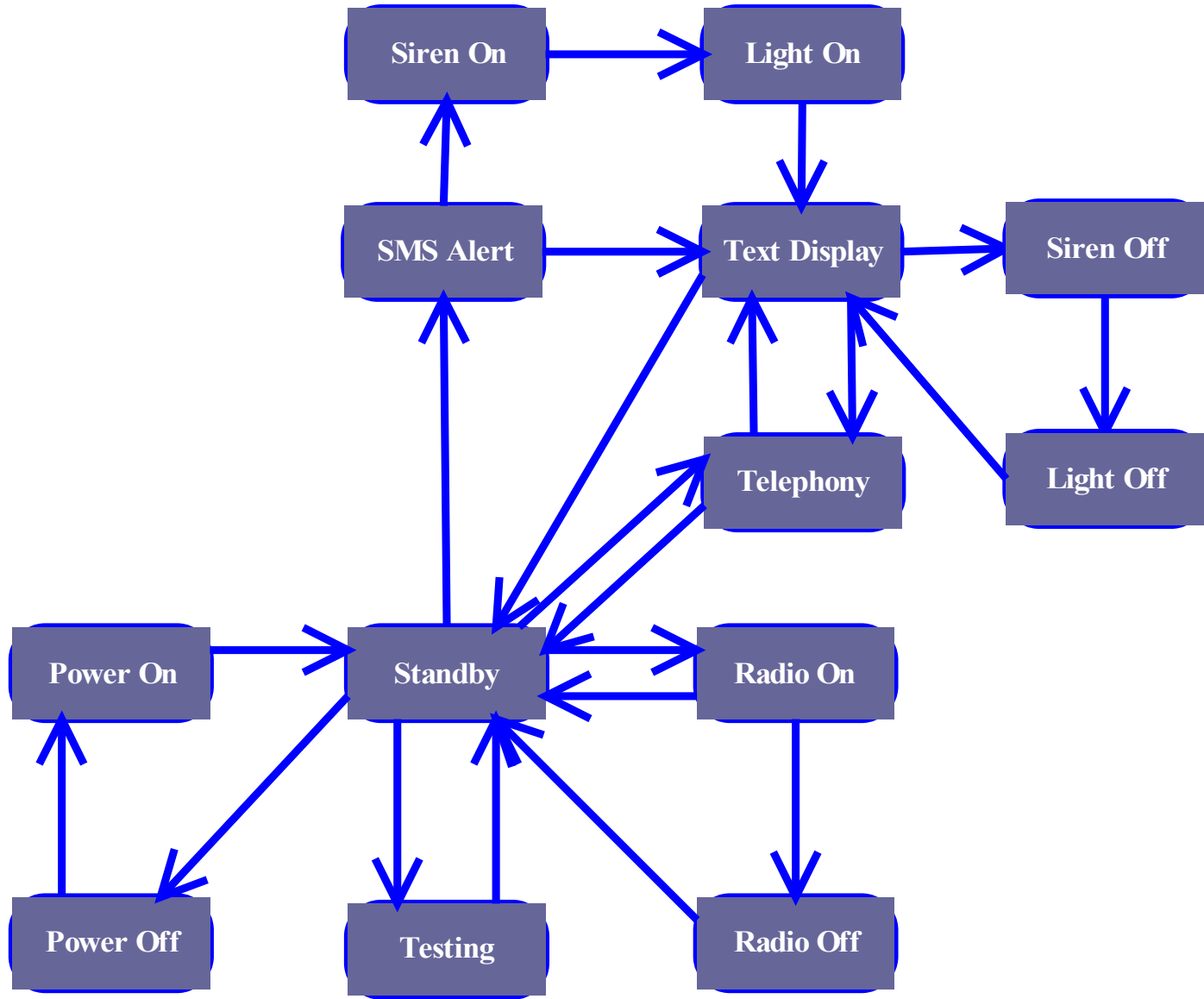
HazInfo Project Research Design and the deployment of GSM devices

	With ERP Training				No ERP Training			
Sarvodaya Stage 1, 2, 3	VSAT Urawatha (Galle)	MoP Nidavur (Batticalo)	FxP Thirukadalar (Trincomalee)	AREA Moratuwella (Colombo)	MoP Meddhawatha (Matara)	MoP Thambiluvil (Kalmunai)	FxP Oluville (Kalmunai)	AREA Maggona (Kalutara)
	AREA + RAD Modarapallassa (Hambantota)	AREA + FxP Wathegama North (Matara)	AREA + MoP Palmunnai (Batticalo)	Control Village Abeyasinghepura (Ampara)	AREA + RAD Thondamanar (Jaffna)	AREA + FxP Karathivu (Kalmunai)	AREA + MoP Munnai (Jaffna)	Control Village Modara (Colombo)
Sarvodaya Stage 4	VSAT Modaragama (Hambantota)	MoP Diyalagoda (Kalutara)	FxP Periyakallar (Batticalo)	AREA Panama North (Ampara)	MoP Satur-kondaghya (Batticallo)	MoP Samodhagama (Hambantota)	FxP Indivinna (Galle)	AREA Brahamana-wattha (Galle)
	AREA + RAD Kalmunai II (Kalmunai)	AREA + FxP Samudragama (Trincomalee	AREA + MoP Valhengoda (Galle)	Control Village Mirissa South (Matara)	AREA + RAD Venamulla (Galle)	AREA + FxP Kottegoda (Matara)	AREA + MoP Thallala South (Matara)	Control Village Thalpitiya (Kalutara)

AREA: Addressable Radio for Emergency Alerts, Class B configuration of WorldSpace System

MoP: Java enabled Mobile Phone, Dialog-Microimage innovation MiDews application

RAD: Remote Alarm Device, Dialog-University-of-Moratuwa Innovation

FxP: CDMA Wireless Fixed Phones with 1xRTT functions, Sri Lanka Telecom

VSAT: Very Small Aperture Terminals coupled with Internet Public Alerting System Innovative-Tech & Solana Networks

Common Alerting Protocol Content Standard to Evaluate the ICTs
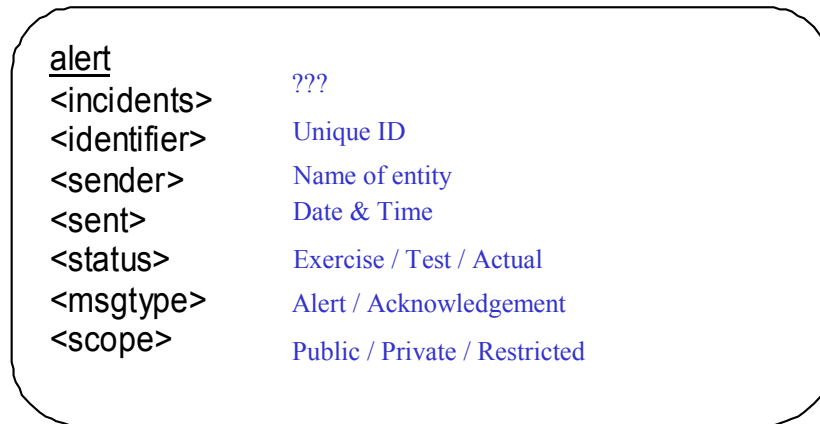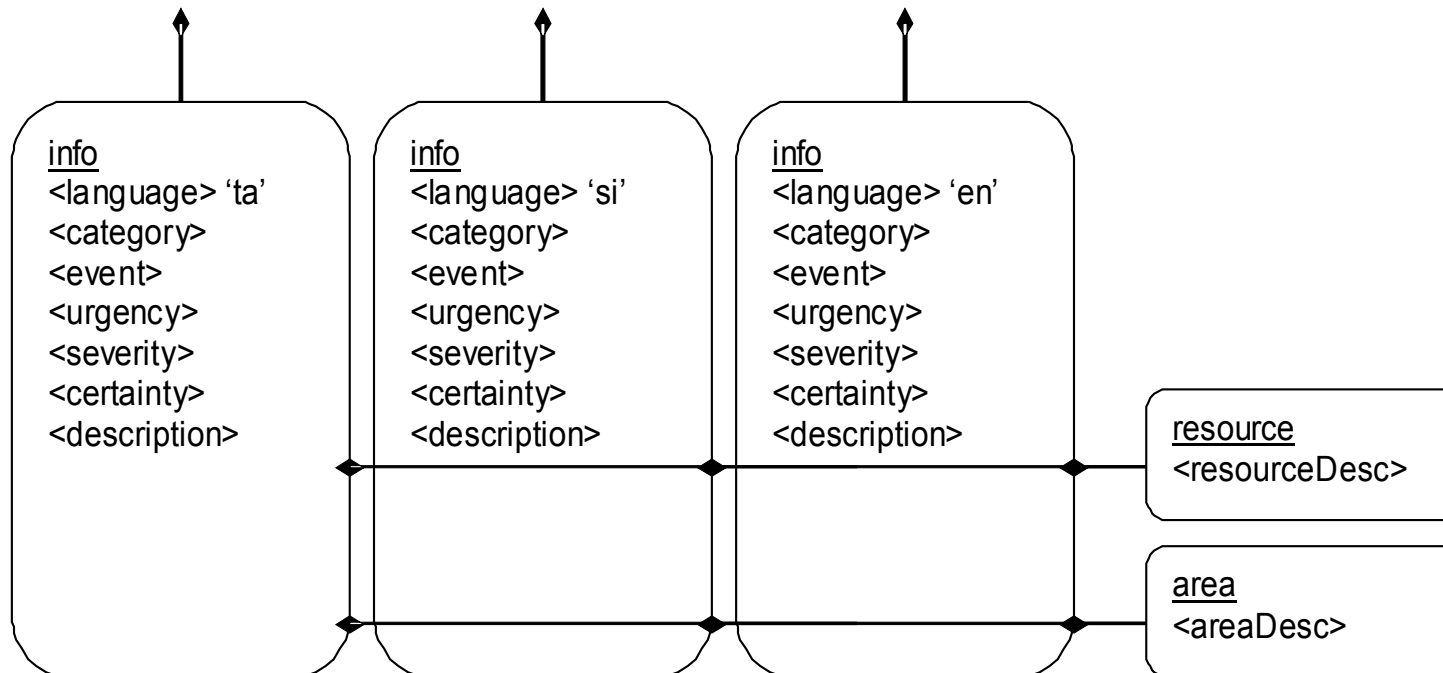
CAP Profile for Sri Lanka

alert
<incidents>   ???
<identifier>   Unique ID
<sender>   Name of entity
<sent>   Date & Time
<status>   Exercise / Test / Actual
<msgtype>   Alert / Acknowledgement
<scope>   Public / Private / Restricted

Table to determine priority of the event

Priority	<urgency>	<severity>	<certainty>
Urgent	Immediate	Extreme	Observed
High	Expected	Severe	Observed
Medium	Expected	Moderate	Observed
Low	Expected	Unknown	Likely

info
<language> 'ta'
<category>
<event>
<urgency>
<severity>
<certainty>
<description>

info
<language> 'si'
<category>
<event>
<urgency>
<severity>
<certainty>
<description>

info
<language> 'en'
<category>
<event>
<urgency>
<severity>
<certainty>
<description>

resource
<resourceDesc>

area
<areaDesc>

Example of Input Message to the last-Mile Hazard Warning System

**TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST
Last-Mile HazInfo Simulation. No Repeat No Real Event is Effect**

TROPICAL CYCLONE ADVICE NUMBER 001
Issued at 09:55 am on Monday, December 11, 2006
BY Anonymous

A **SEVERE CATEGORY 4 CYCLONE** is now current for AMPARA and MATARA District coastal areas. At **06:00 am** local time SEVERE TROPICAL CYCLONE MONTY was estimated to be **80 kilometres northeast of Ampara District** and moving southwest at **10 kilometres per hour**. Severe Tropical Cyclone Monty is expected to cross the coast in the vicinity of Ampara and Matara Districts during Monday. Gales with gusts to 180 kilometres per hour are likely in coastal communities in Ampara and Matara District during the day.

This is to **alert** the residents of Ampara and Matara District about the potential of a very **dangerous storm** tide as the cyclone centre approaches the coast. **Tides are likely** to rise significantly above the normal high tide mark with very dangerous flooding, damaging waves and strong currents.

Widespread heavy rain and further flooding are likely in southern parts of the Ampara and Matara Districts over the next few days.

**TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST TEST
Last-Mile HazInfo Simulation. No Repeat No Real Event is Effect.**

Example of Output Message from Hazard-Information-Hub to the Last-Mile

```
<alert>
        <identifier>HIH-2006-12-11T143500</identifier>
        <sender>hih@sarvodaya.lk</sender>
        <sent>2006-12-11T10:20:25.0000000+06:00</sent>
        <status>Exercise</status>
        <msgType>Alert</msgType>
        <source>hazard@lirne.net</source>
        <scope>Restricted</scope>
        <info>
                <language>en-US</language>
                <category>Meto</ category>
                < event>A Sever Category 4 Cyclone</event>
                <responseType>Prepare</responseType>
                <urgency>Expected</urgency>
                <severity>Severe</severity>
                <certainty>Observed</certainty>
                <description>At 06:00 am local time SEVERE TROPICAL CYCLONE MONTY was estimated
                to be 80 kilometers northeast of Ampara District and moving southwest at 10 kilometers per
                hour. Severe Tropical Cyclone Monty is expected to cross the coast in the vicinity of Ampara
                and Matara Districts during Monday. Gales with gusts to 180 kilometers per hour are likely in
                coastal communities in Ampara and Matara District during the day.
                This is to alert the residents of Ampara and Matara District about the potential of a very
                dangerous storm tide as the cyclone centre approaches the coast. Tides are likely to rise
                significantly above the normal high tide mark with very dangerous flooding, damaging waves
                and strong currents. Widespread heavy rain and further flooding are likely in southern parts of
                the Ampara and Matara Districts over the next few days. </description>
</alert>
```
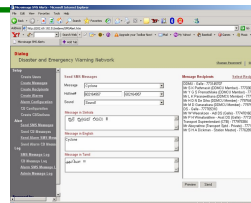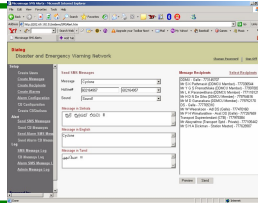
Effectiveness of CAP Alerts over Mobile Phones & RADs

Interface	HIH Monitor issued CAP Message	ICT Guardian received Message elements
DEWN Internet Browse	<info> sub element with <Language>en <Description> … {no size restriction} <Language>si <Description> … {no size restriction} <Language>tm <Description> … {no size restriction}	"Warning" <info> <Language>en <Description> A SEVERE CATEGORY 4 CYCLONE… {restricted by 160 characters}

- ❑ Input in all three languages but output only in English

- ❑ Terminal scrolling display only 160 characters; no full description

- ❑ Qualifier elements NOT displayed to determine priority level of hazard

- ❑ Always displays "Warning" inappropriate for CUG Alerting

Effectiveness of CAP Alerts over Mobile Phones & RADs

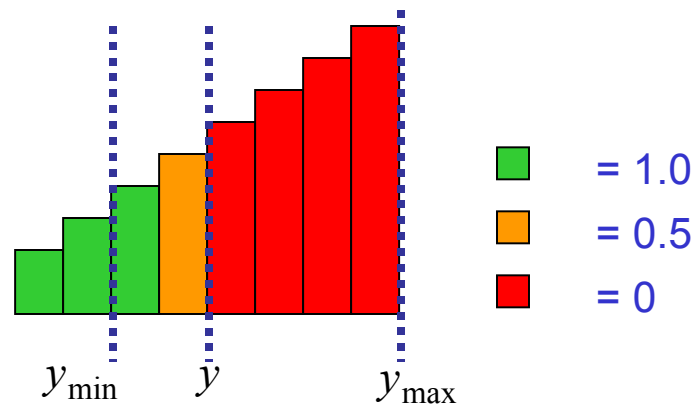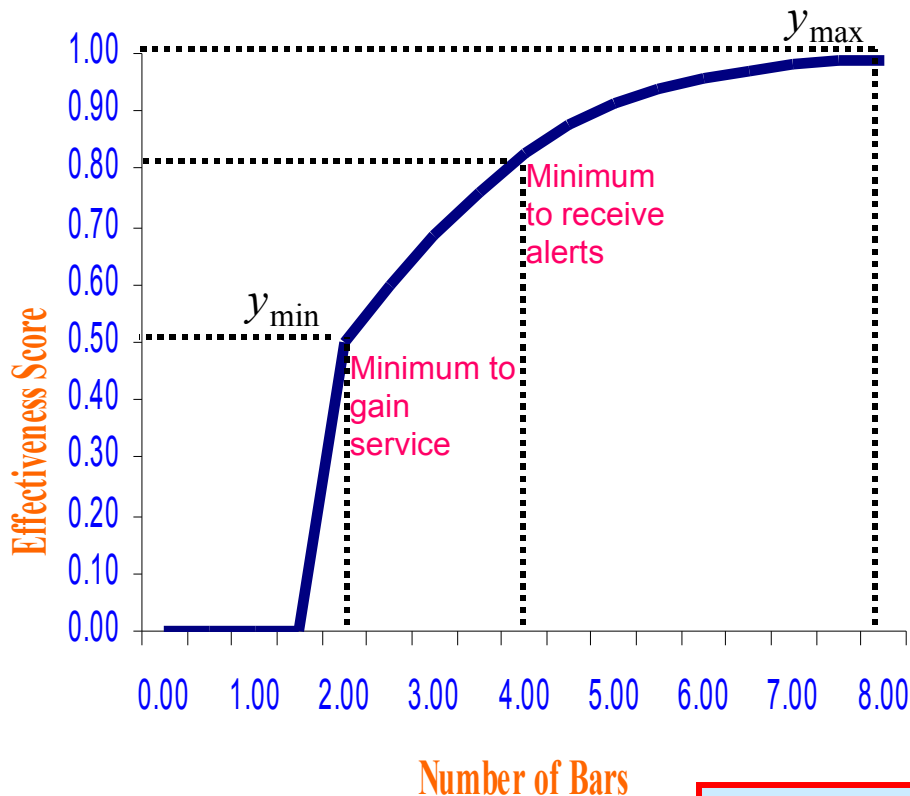| Interface	HIH Monitor issued CAP Message	ICT Guardian received Message elements
DEWN Internet Browse	<info> sub element with <Language>en <Description> … {no size restriction} <Language>si <Description> … {no size restriction} <Language>tm <Description> … {no size restriction}	"Warning" <info> <Language>en <Description> A SEVERE CATEGORY 4 CYCLONE… <Language>si <Description> …{sinhala} <Language>tm <Description> … {tamil} {restricted by 130 characters}

- ❑ Input in all 3 languages but output only in all 3 languages
- ❑ Limited to 130 characters to display message in all 3 languages
- ❑ Qualifier elements NOT displayed to determine priority level of hazard
- ❑ Always displays "Warning" inappropriate for CUG Alerting

❑ Basic question: "Did the ICT work on the day of the exercise?"

❑ Two aspects of *Reliability* measure: *Certainty* and *Efficiency*

- ■ *Certainty* is the operational state of the device (variable: R_c)

- ■ *Efficiency* is the time taken to complete the transmission (variable: R_e)

- ■ *Reliability* $R = R_c \times R_e$

Formula for Calculating the **CERTAINTY** of Terminal Devices

Enumaeration of the Effectiveness Parameter:
Signal Strength in Terminal Devices

- Green = 1.0
- Orange = 0.5
- Red = 0

Effectiveness Score vs Number of Bars

y_{max} at 1.00

y_{min}

Minimum to receive alerts

Minimum to gain service

☐ Maximum available number of bars y_{max}

☐ Measured number of bars $y \leq y_{max}$

☐ Minimum required number of bars y_{min}

$$R_c = \begin{cases} 1/1 + e^{(y_{min} - y)} & , y \geq y_{min} \\ 0 & , y < y_{min} \end{cases}$$
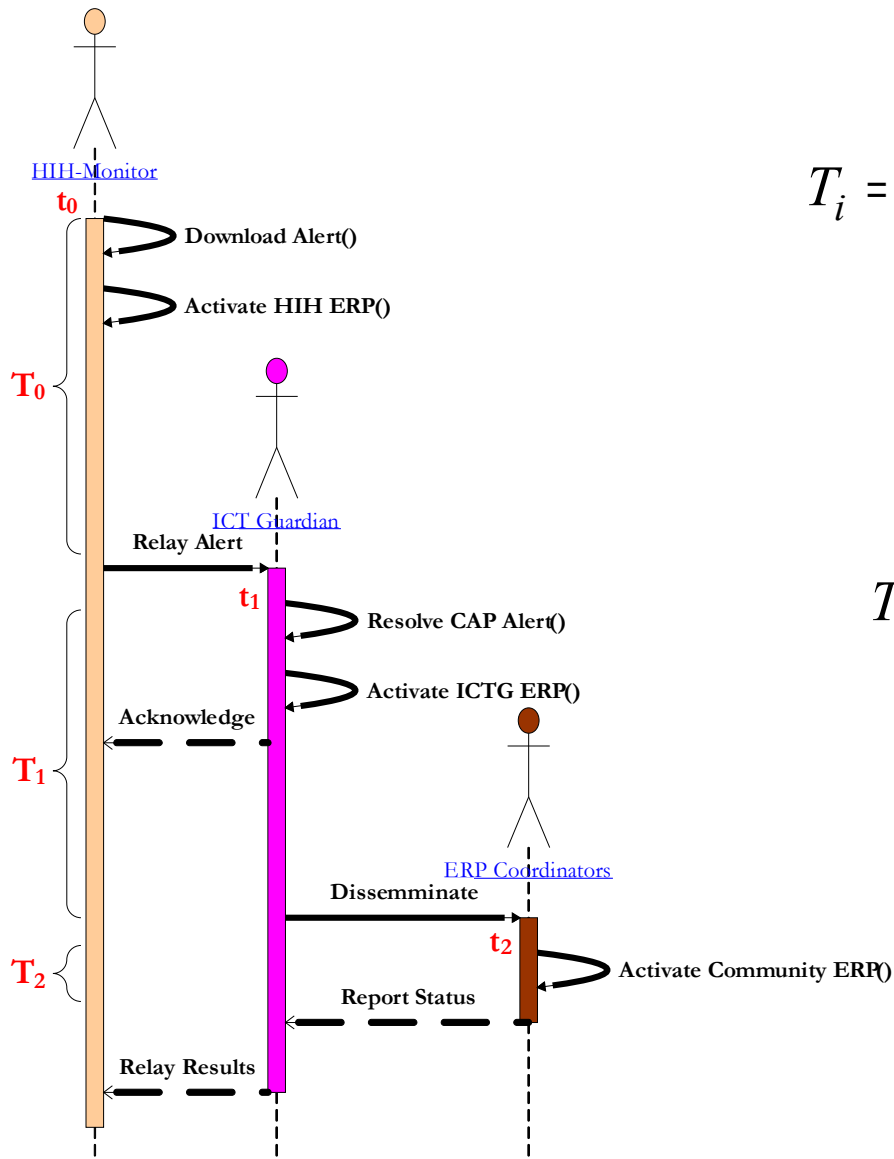
t_i : time process $i = \{0, 1, 2\}$ is initiated

$t_i^{'}$: time process $i = \{0, 1, 2\}$ is terminated

$T_i = t_i^{'} - t_i$: time interval taken to complete process i

$E(T_i)$: expected value of time interval

d : minimum distance between epicenter and impact zone

S : speed at which hazard is traveling

$T = \dfrac{d}{S}$: minimal allowable time interval to impact

R_i : Reliability of process i

$$R_i = \begin{cases} 1 & \text{when } T_i \leq E(T_i) \\ 1 - \left(\dfrac{T_i - E(T_i)}{T} \right) & \text{when } T_i > E(T_i) \\ 0 & \text{when } i < j : t_i^{'} > E(t_j) \end{cases}$$

Example of Calculating the Efficiency

The scenario is based on the Panama (Ampara District) simulation data

Tsunami Event occurred at 10:15am and will impact at 11:45

External source issued email bulletin at 10:25am

HIH Monitor receives email at 10:35am

HIH Monitor issues CAP alert at **10:46am**

ICT Guardian receives CAP alert over AREA-B at **11:02am**

ERP Coordinator receives alert information at 11:08am

Community completes evacuation at 11:08am

HIH-Monitor

t_0

Download Alert()

Activate HIH ERP()

T_0

ICT Guardian

Relay Alert

t_1

Resolve CAP Alert()

Activate ICTG ERP()

Acknowledge

T_1

ERP Coordinators

Dissemminate

t_2

Activate Community ERP()

Report Status

T_2

Relay Results

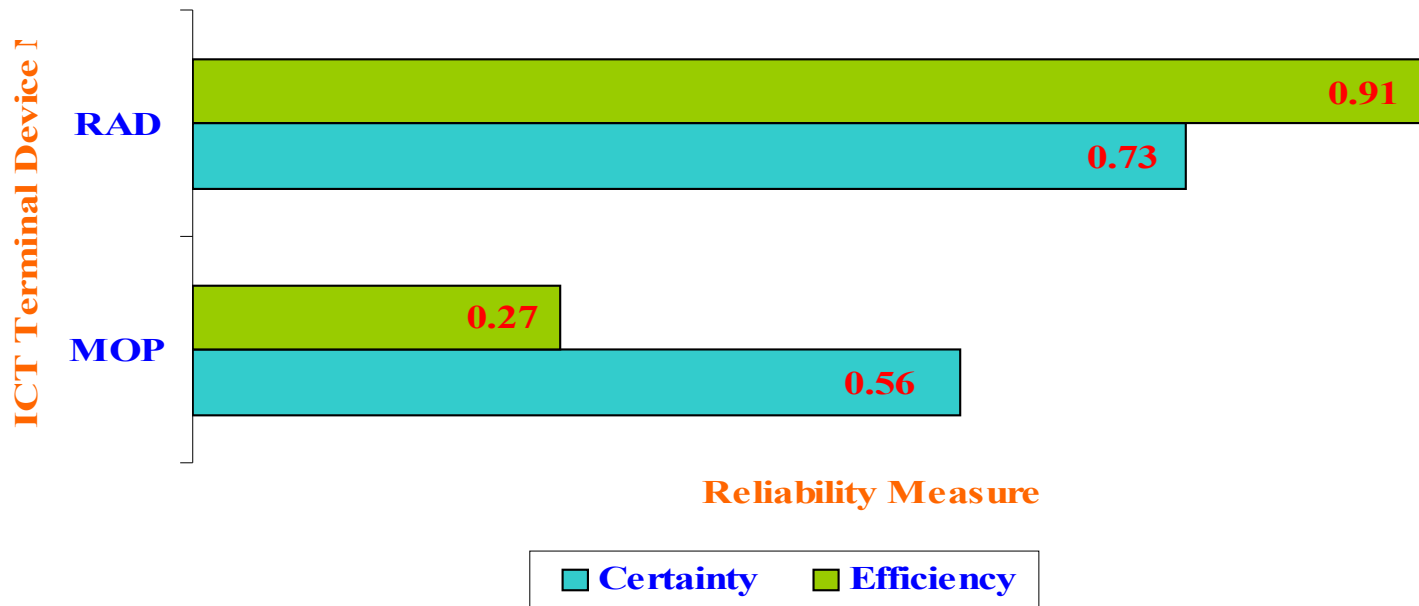Efficiency of ICT Network and ICT Guardian activities

Assumption: since this is the first set of trials and the LM-HWS has no data to calculate an 'expected time we set $E(\overline{T}) = 0$ (i.e. best case scenario)

$$R_c = 1 - \left(\frac{16}{90}\right) = 0.8222$$
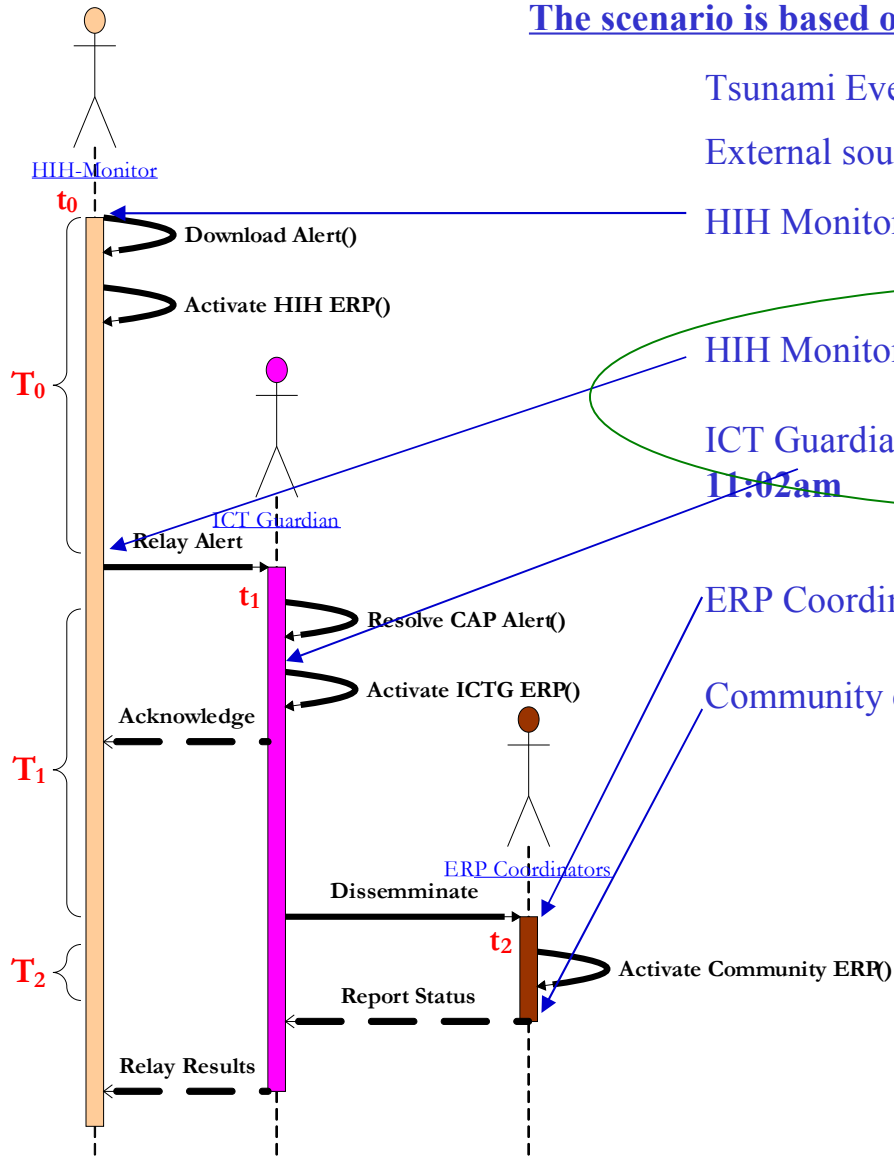
Reliability of ICT Terminal Devices in a LM-HWS

Efficiency and Certainty of GSM Terminal Devices

- ❑ RAD shows high certainty and efficiency because they were tested in urban conditions; however, overall showed least likely to be adopted in a LM-HWS

- ❑ MOP are best coupled with a second ICT that can read a FULL CAP Message

❑ *Examples of mishaps during live-exercises in rural communities*

- ■ User accidentally deletes the tri-language J2ME applet in mobile phone

- ■ Mobile phone is powered down or battery has zero energy

- ■ phone bill was not paid and service is discontinued

- ■ RAD not registered under correct District in DEWNS Internet based alerting application

- ■ Unable to dial the "call-back" function to call the #Hotline (congested)

Parameters to determine the EFFECTIVENESS of ICT Terminal Devices

Clique	Abbreviation	Parameter
CAP Complete	Ethnicity	Language Diversity
	All-media All-hazards	Full CAP Messaging
	Multimedia	Audio and Text Medium
Two-Way	bi-directionality	Upstream Downstream Communication
Adoptability	Utilization	Integration in to communit daily life or development
	affodability	Total Cost of Ownership
Minaturization	Weight	Weight of wireless ICT terminal
	Longevity	DC Power Consumption
	Volume	Dimensions of Terminal Device
Alerting	accountability	Acknowledgement message receipt
	wakeup	Active alerting function

Effectiveness of ICT Terminal Devices in a LM-HWS

Effectiveness of Terminal Devices for Cliques of Paramters

ICT Terminal Device Name

RAD

MOP
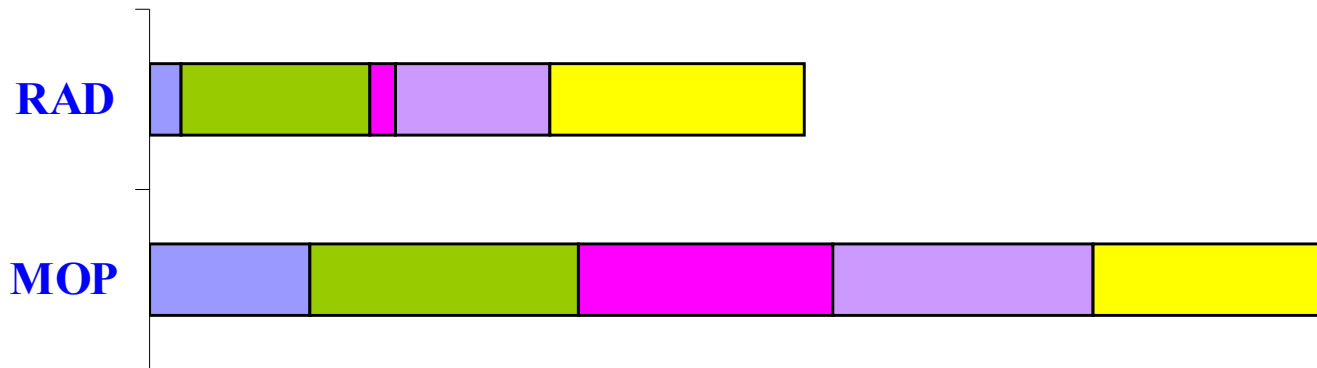
	MOP	RAD
☐ Alerting	0.88	0.95
☐ Minaturization	0.96	0.57
☐ Adoptability	0.95	0.10
☐ Two-Way	1.00	0.70
☐ CAP Complete	0.60	0.12

Effectiveness Measures of the Cliques of Parameters

❑ Communication must be in the local language using a 'all-hazards' 'all-media' approach with the use of the ***Common Alerting Protocol***; (i.e. full CAP messaging to avoid ambiguity)

❑ Deploy multiple terminal devices with the aim of achieving "***complementary redundancy***" in reliability and effectiveness

Proposition for Mobile Manufacturers

- ❑ Think about **onboard CAP decoding** in future design of mobile phones

- ❑ Think about **symbolic schemes** to communicate alerts with the use of Mobile devices

- ❑ Build in **Natural Language Processors** in to the mobile devices to decode CAP based Hazard Alerts

- ❑ Proposition:

  - Use the <event>, <urgency>, <severity>, & <certainty> CAP elements

  - Use an enumeration technique to encode the *Hazard Priority* qualifiers: <urgency>, <severity>, & <certainty> in a single 8 bit character

  - Use the remaining 139 of a 140 character SMS to encode the <event>

THANK YOU!