Transmission of Warnings to Local Levels (Session II)

Sharing Knowledge on Disaster Warning: Community-based Last-Mile Warning System
Bangladesh University of Engineering Technology
Dhaka, Bangladesh
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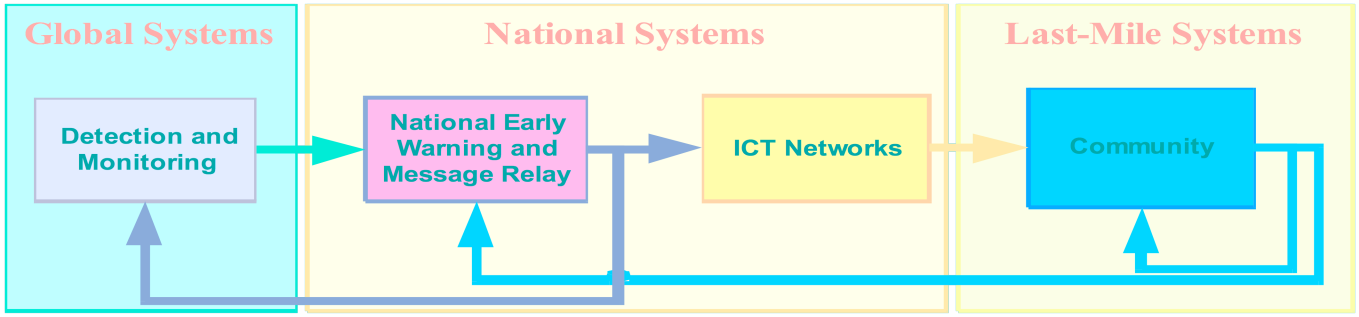
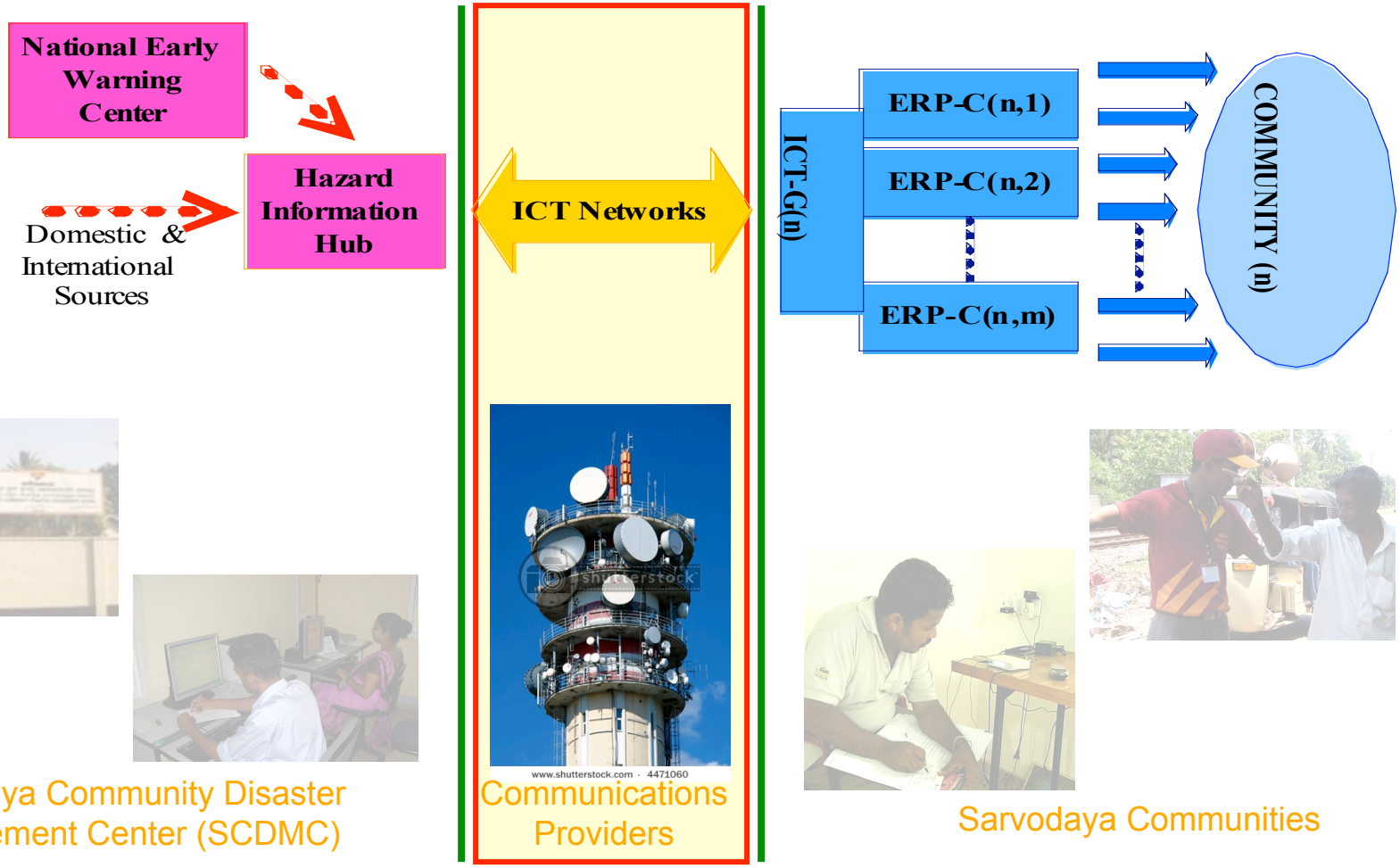
Nuwan Waidyanatha
12 Balcombe Place,
Colombo 08, Sri Lanka

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

Mapping Early Warning Systems to Community-based Warning System



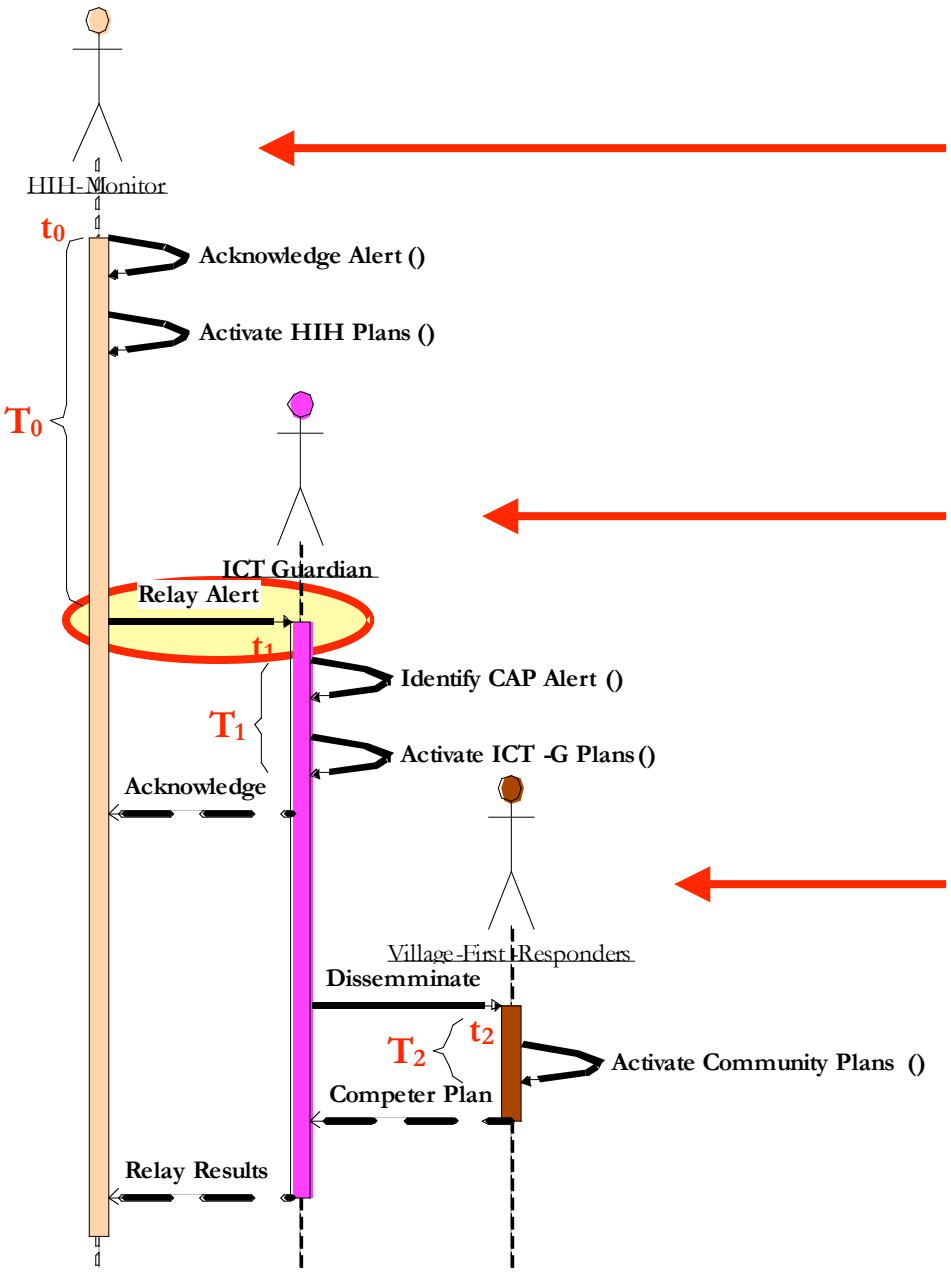


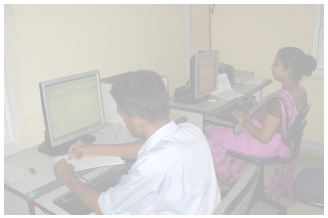
Sarvodaya Community Disaster Management Center (SCDMC)

Communications Providers

Sarvodaya Communities

Alert and Notification Stages

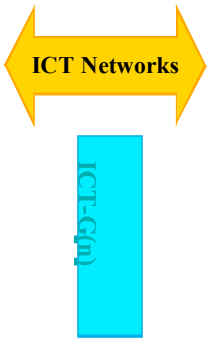


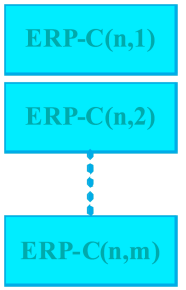


Step 1: HIH Monitors

Step 2: ICT Guardians

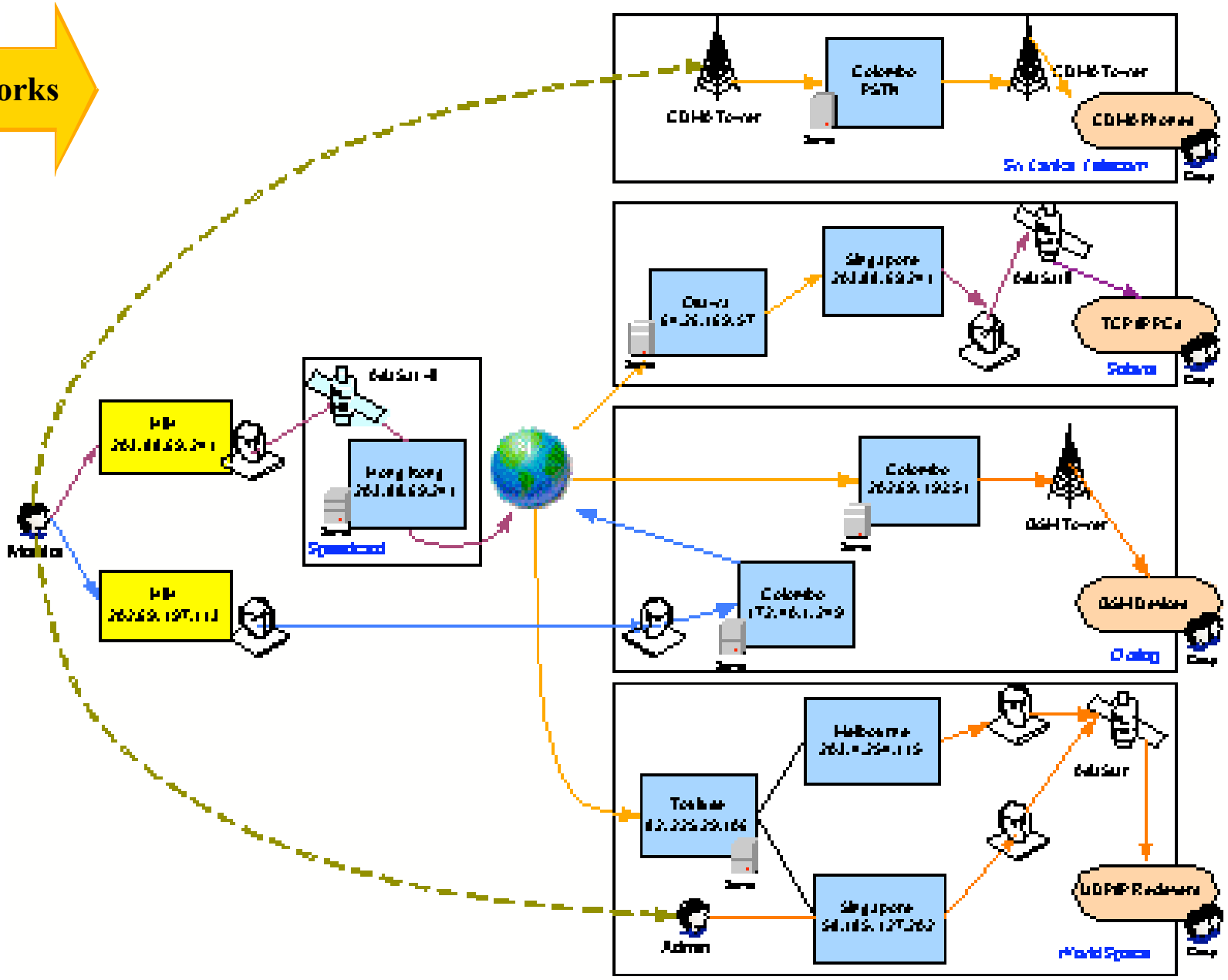
Step 3: ERP Coordinators





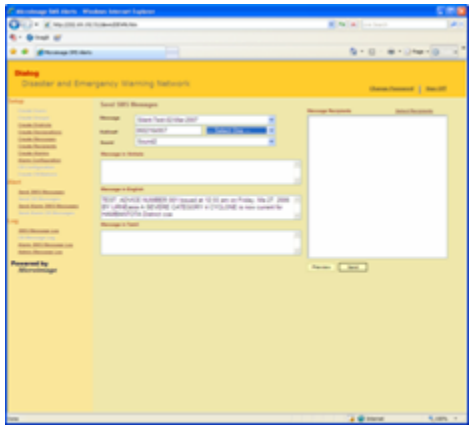
Multiple Paths, Multiple Technologies and Multiple Gateways

ICT Networks



Alert input applications and their respective Terminal devices

DEWNS



ANNY

IPAS

CALL

Common Alerting Protocol Content Standard to Evaluate the ICTs

CAP Profile for Sri Lanka

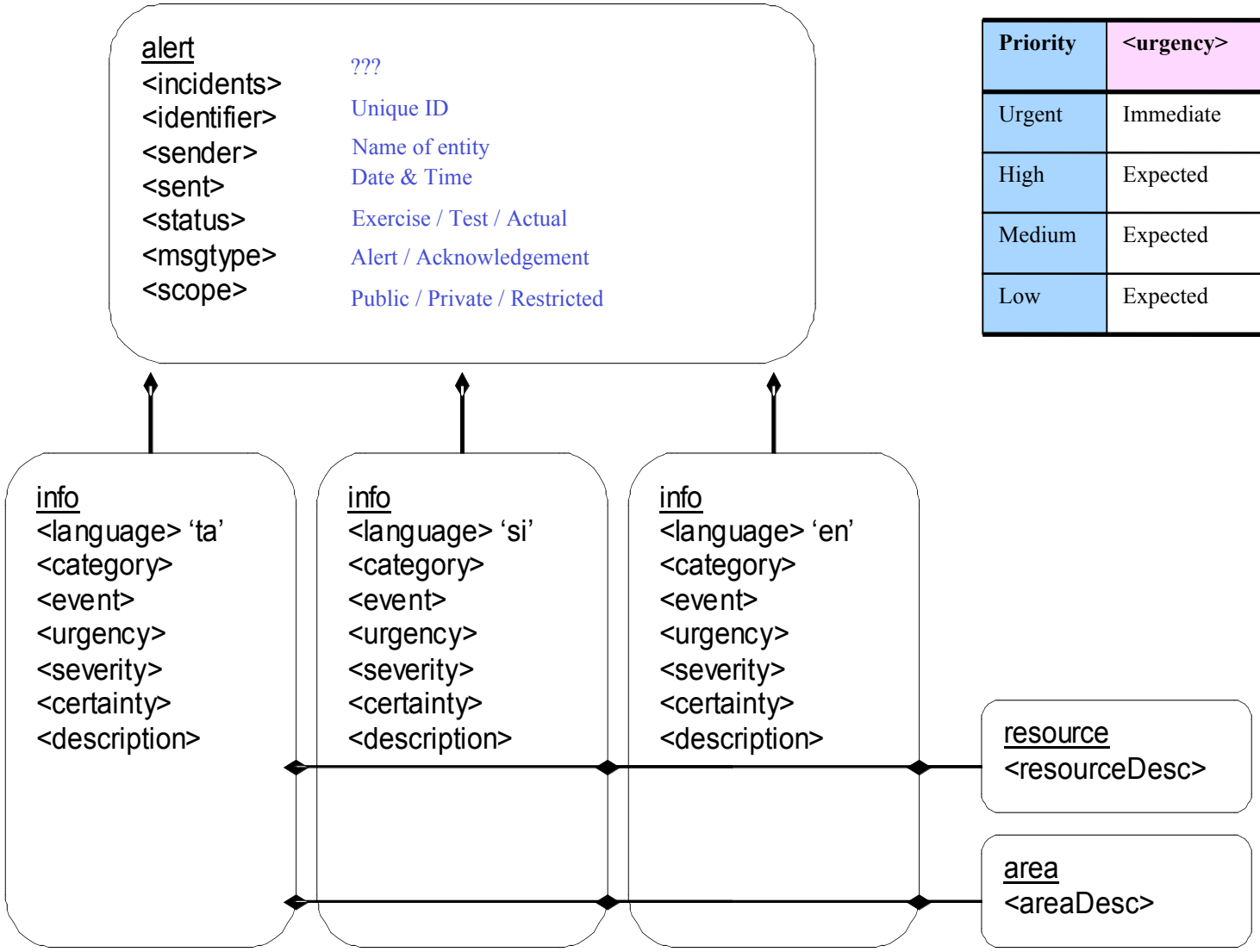


Table to determine priority of the event

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

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

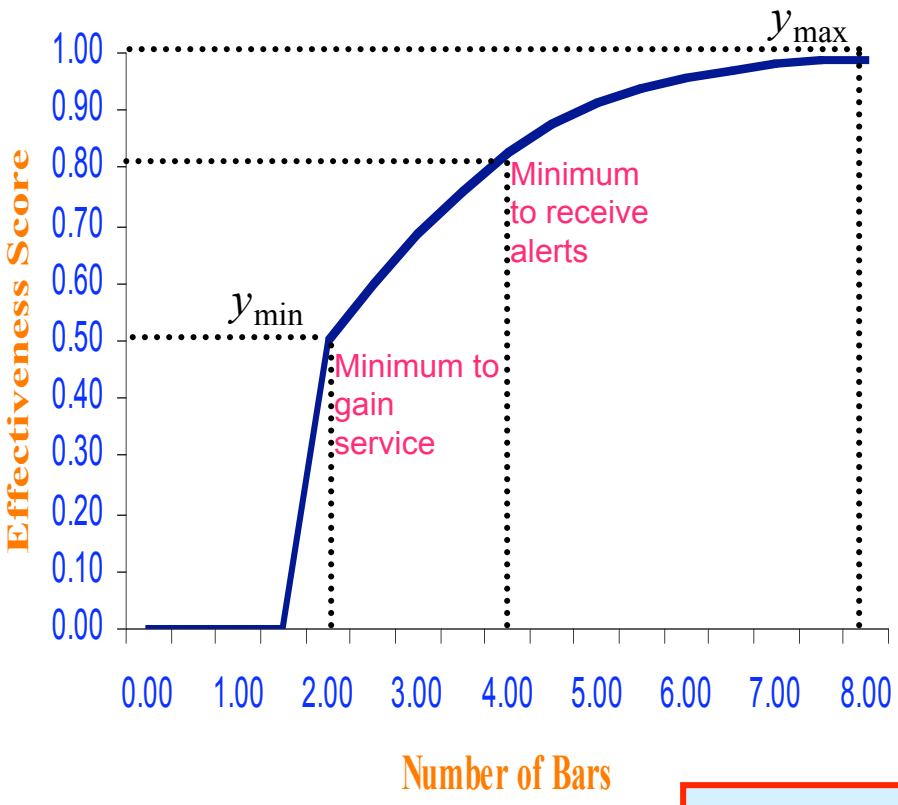
```
<alert>
        <identifier>HIH-2006-12-11T143500</identifier>
        <sender>hih@sarvodaya.lk</sender>
        <sent>2006-12-11T10:20:25.0000000+06:00</sent>
        <status>Exercise</status>
        <msgType>Alert</msgType>
        <source>hazard@lirne.net</source>
        <scope>Restricted</scope>
        <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>
```

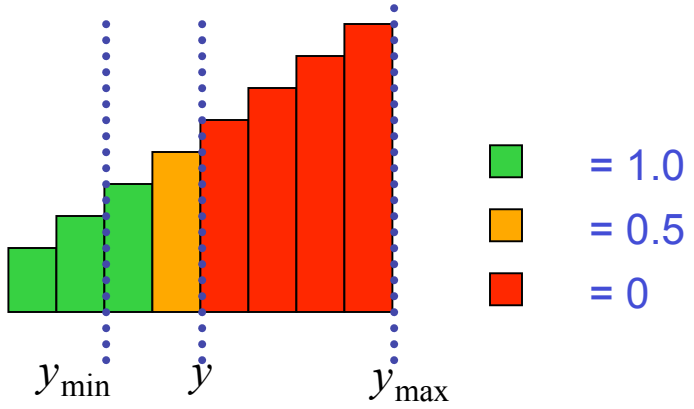
Reliability measure of the Terminal Devices

- 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

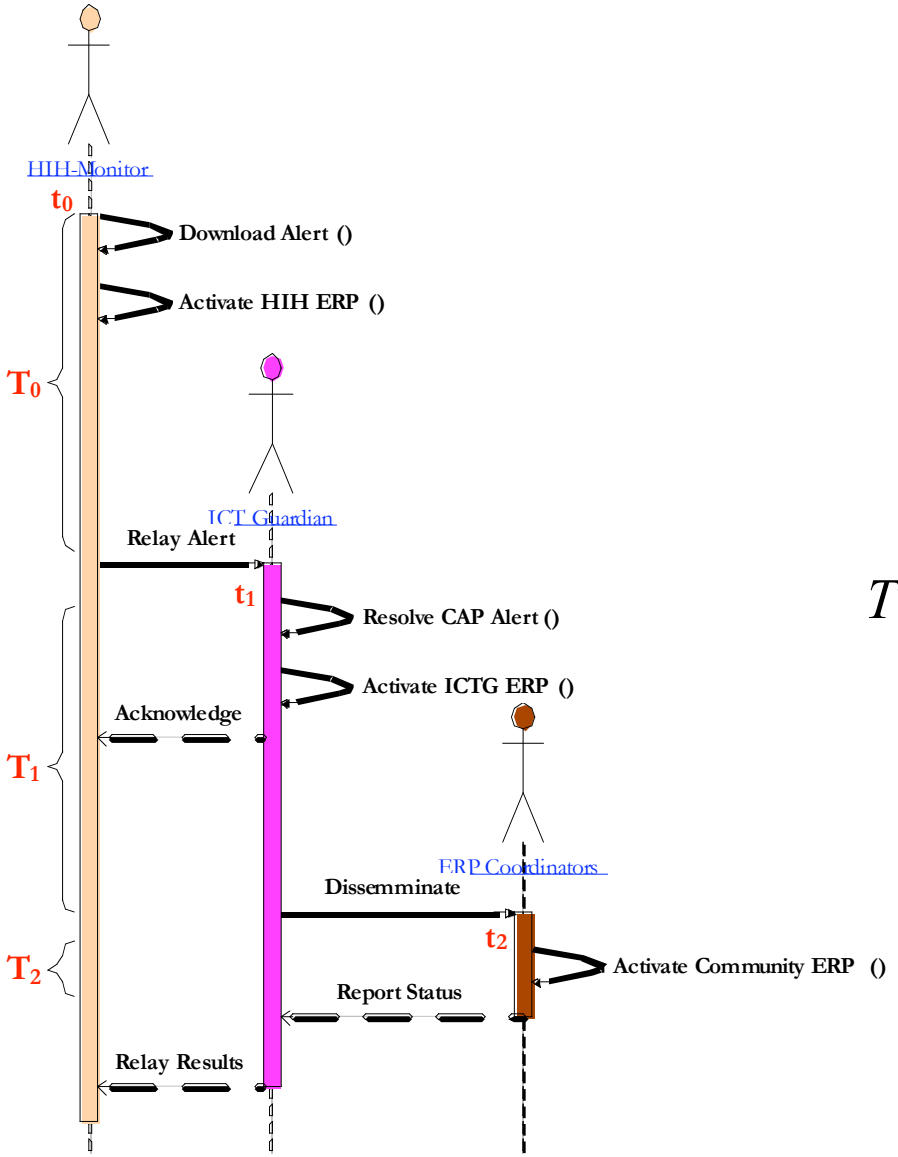




- Maximum available number of bars y_{max}
- Measured number of bars $y \le y_{max}$
- Minimum required number of bars y_{min}

$$R_c = \begin{cases} 1/1 + e^{(y_{min} - y)} & , y \ge y_{min} \\ 0 & , y < y_{min} \end{cases}$$

Formula for calculating the EFFECIANCY of Terminal Devices



t_i : time process $i = \{0, 1, 2\}$ is initiated

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

: time interval taken to complete process i

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

d : minimum distance between epicenter and impact zone

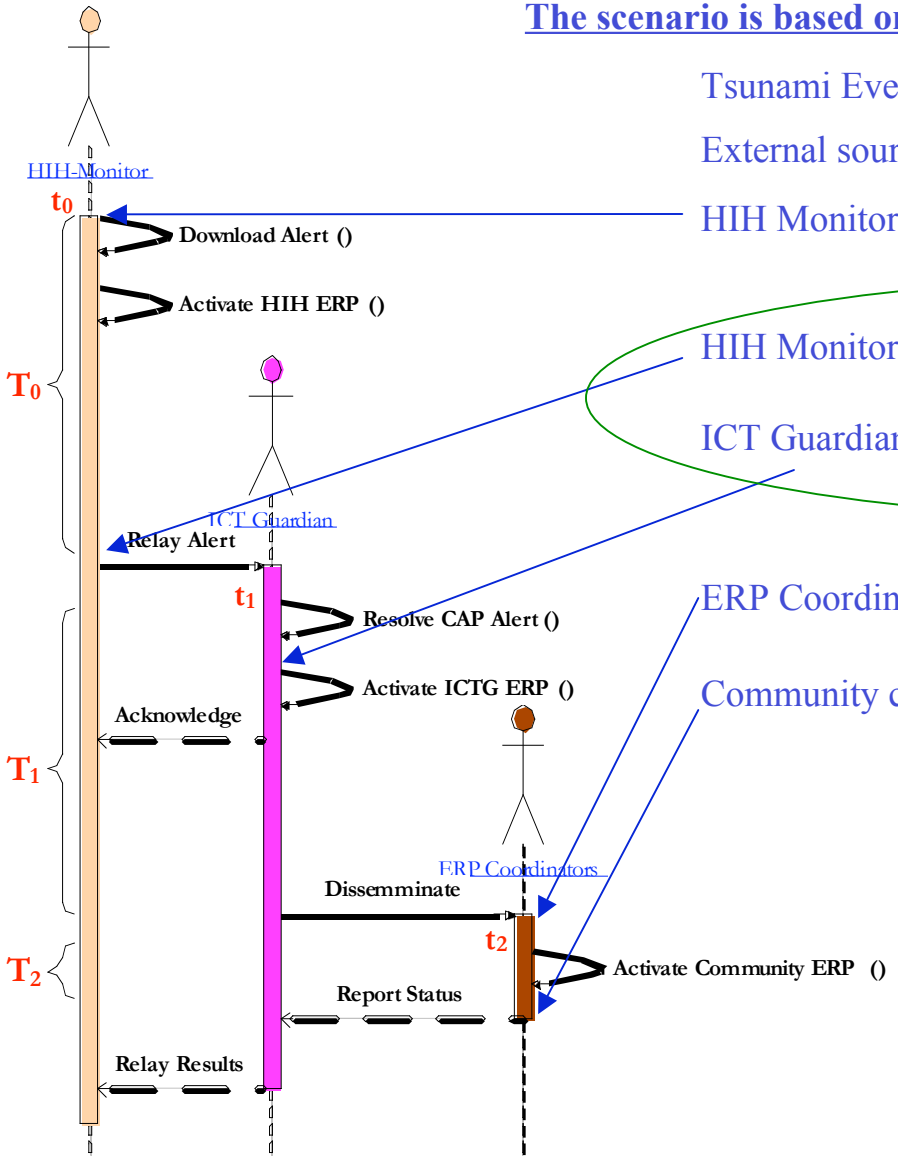
S : speed at which hazard is traveling

$T = d/s$: minimal allowable time interval to impact

R_i : Reliability of process i

$$R_i = \begin{cases} 1 & \text{when} \\ 1 - \left(\dfrac{T_i - E(T_i)}{T} \right) & \text{when} \\ 0 & \text{when} \end{cases}$$

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

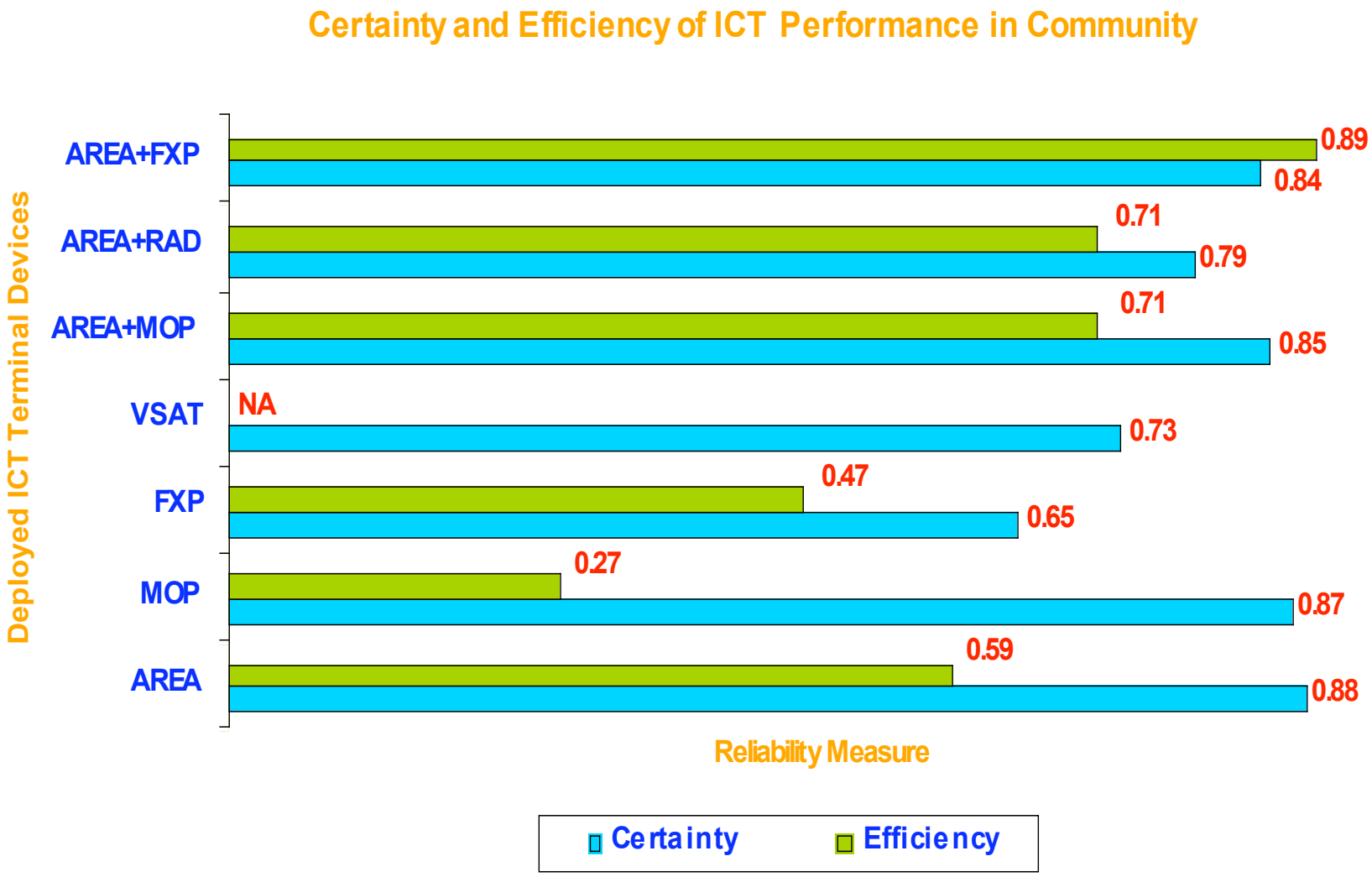
Community completes evacuation at 11:08am

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



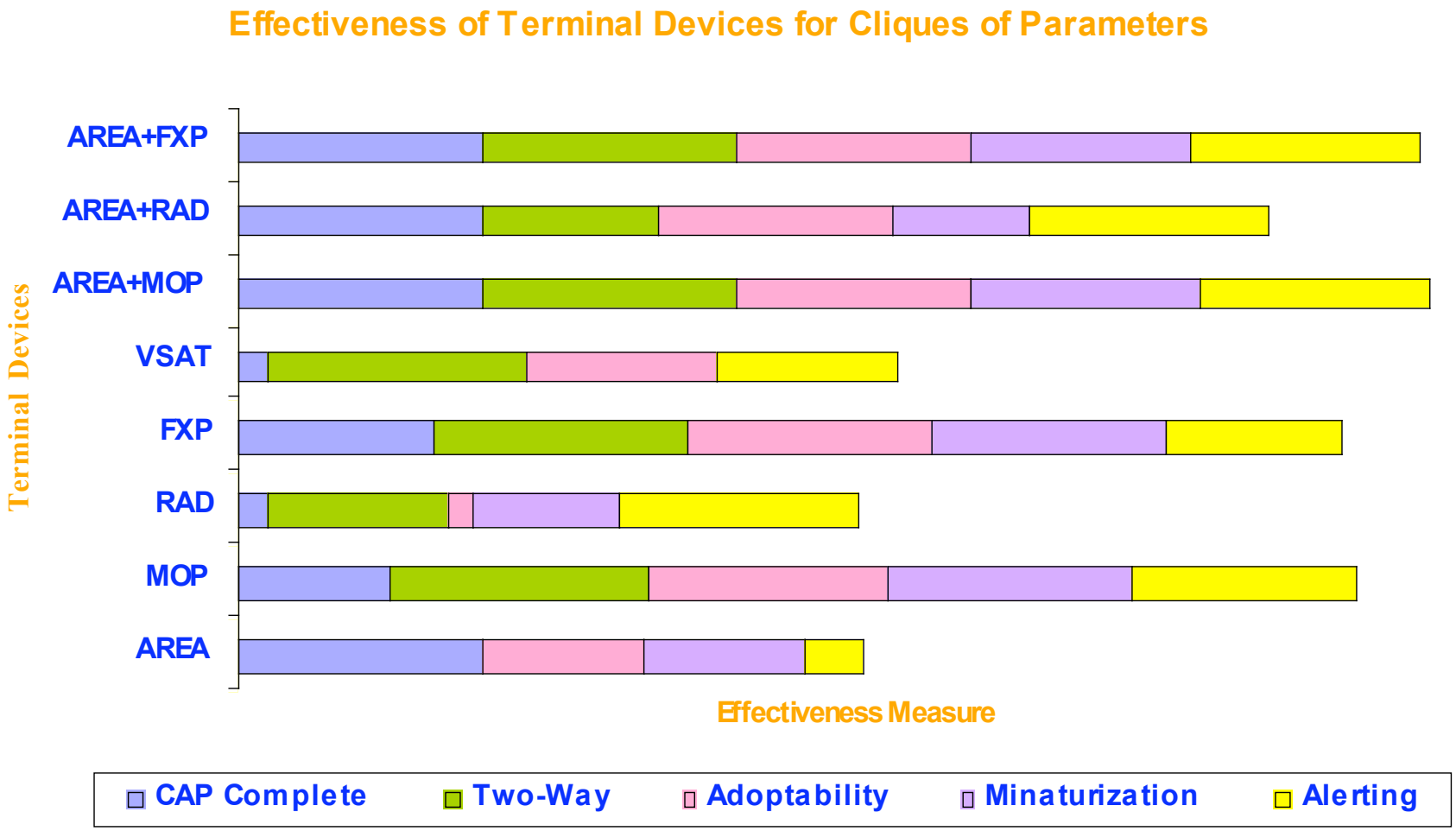
Other factors that drives CERTAINTY of Terminal Devices to ZERO

- *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
  - User removes the 2 AA batteries and powers down the AREA
  - Antenna in AREA is not aligned for maximum signal strength
  - CDMA phone bill was not paid and service is discontinued
  - User covers VSAT modem ventilation shafts with news paper and over heats modem
  - VSAT Network Internet proxy blocks IPAS packets returning to PC
  - RAD not registered under correct District in DEWNS Internet based alerting application

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



Performance of ICT Terminal Devices in a LM-HWS

Comparison of Reliability and Effectiveness of ICT as a Warning Technology in a LM-HWS