

Evaluating a Real-Time Biosurveillance Program: A pilot project

RESEARCHERS

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Outline

- ❑ ***INTRODUCTION TO THE RESEARCH***
- ❑ ***DISEASE INFORMATION***
 - determinants of Morbidity in India
 - determinants of notifiable diseases in Sri Lanka
- ❑ ***MOBILE HEALTH DATA COMMUNICATION***
 - Minimizing the data sets
 - Affordable technologies
 - Standards – MIDP, CLDC, XML
- ❑ ***RTBP TECHNOLOGY ASSESSMENT***
 - Mobile vs paper
 - Statistical data mining vs heuristics
 - Present vs Reengineered
- ❑ ***POLICY IMPLICATIONS***
 - Government
 - Resources



Other m-Health Initiatives on disease control:

- ❑ **Panacea THIRRA** (<http://thirra.primacare.org.my/>)
 - Portable system from telehealth and health information in rural & remote areas
- ❑ **Cell-Life**: preventing HIV/Aids (<http://www.cell-life.org/>)
 - monitoring and intervention programs by communicating relevant data via mobile phones and GPRS connected workstations
- ❑ **EpiSurveyor**: Software developed by DataDyne (<http://www.datadyne.org/>)
 - Desktop tool to develop “forms” for handheld mobile devices; J2ME mobile phone solution
 - Tested on PDAs in Uganda, Tanzania; on “CDC Maternal Health Evaluation Forms”;live stock development board Sri Lanka
- ❑ **OpenRosa/JavaRosa**: (<http://www.openrosa.org/>)
 - consortium developing standards based tools for collecting data via mobile phones, analyzing data, and reporting data via mobile phones
 - Free software downloads – <http://code.javarosa.org/wiki/GettingStarted>
 - “Gather” is a project supporting the openrosa work and testing solutions in Africa
- ❑ **D-Tree**: Offers Childcare solutions (<http://www.d-tree.org/>)
 - They use javarosa code base; e-MICI project in Uganda – household questionnaire to monitor Child diseases; doing work with BRAC in Tanzania on gathering household health info
 - CommCare – XForms based solution for collecting community health information
- ❑ **InSTEDD**: create and advocate open source tools (<http://www.instedd.org/>)
 - Social network approach
 - Tested in Mekong river basin
 - Event based surveillance techniques



Contrast and Compare

<i>Other m-Health projects</i>	<i>RTBP</i>
Surveying spread of specific diseases	Detect all diseases and anomalies
Software is a sequence of set questions with yes/no answers or set answers	Sets of patient disease, symptoms, signs, age-group, gender, & location
Works mostly on PDAs or high end mobile phones (USD 200 or more)	Less than USD 125 mobile phones (Nokia 3110c)
Only on GPRS	GPRS and SMS (GPRS is cheaper but SMS is ubiquitous)
Solutions used by trained community healthcare professionals	Mixed – trained/untrained community healthcare workers
Mobile phone solutions already tested	Untested software developed from scratch; available solutions don't meet the specs and objectives
“Voxiva” matches RTBP requirements but expensive proprietary software	Free and open source software???
Not completing the cycle	Full cycle - upstream, analysis, and downstream

INTRODUCTION TO THE RESEARCH

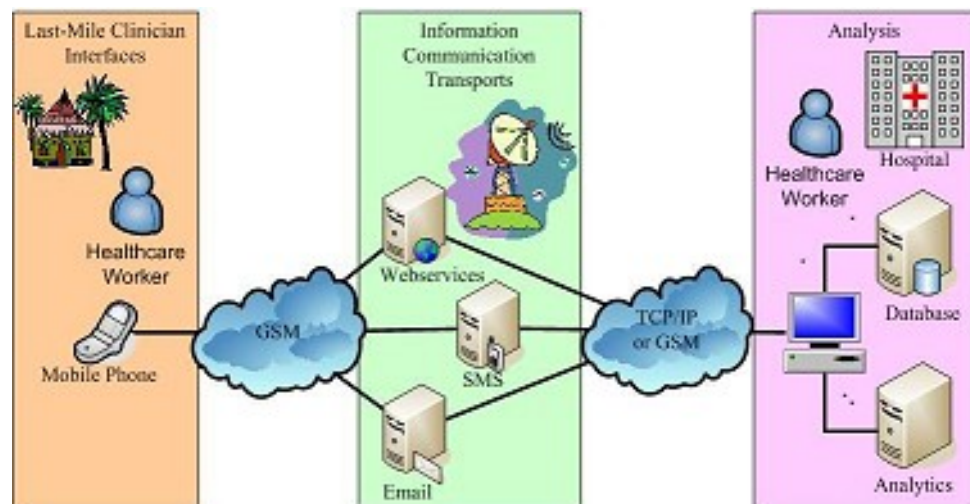


Objective of the research:

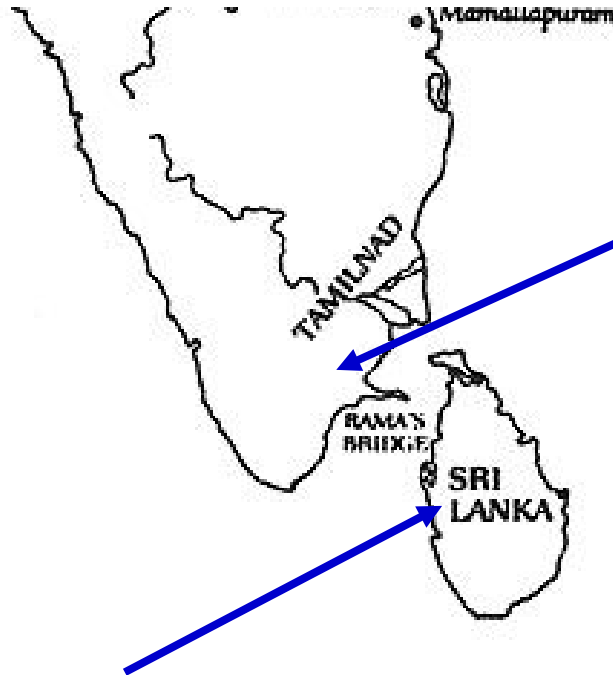
Research Question: “Can software programs that analyze health statistics and mobile phone applications that send and receive the health information potentially be effective in the early detection and notification of disease outbreaks?”

Specific Objectives:

- Evaluating the effectiveness of the m-Health RTBP for detecting and reporting outbreaks
- 2) Evaluating the benefits and efficiencies of communicating disease information
 - 3) Contribution of community organization and gender participation
 - 4) Develop a Toolkit for assessing m-Health RTBPs



Pilot to be tested in two Countries (case studies)

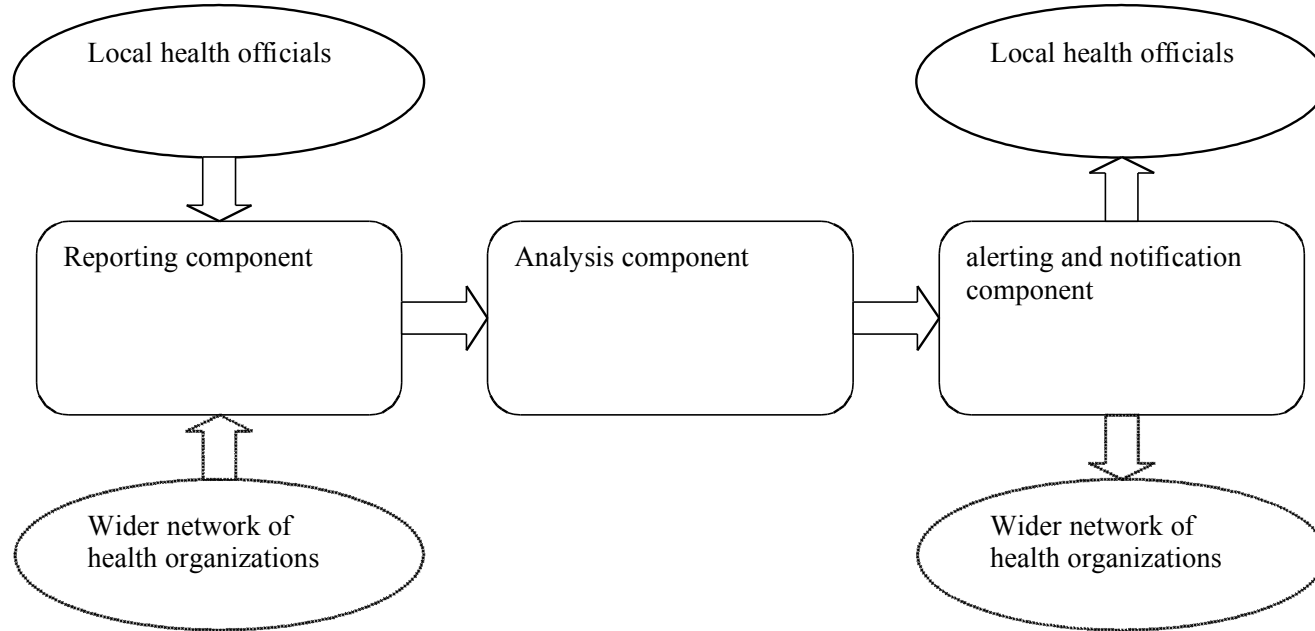


25 Government Village Healthcare Nurses from Public Health Centers – *Thirupathur* block, *Sivaganga* District, state of *Tamil Nadu*, India

16 Sarvodaya Volunteers in Sarvodaya Suwadana Centers - *Kurunegala* District, *North Western* Province, Sri Lanka



Problem Domain



“Problem that this program promises to solve is to strengthen existing disease surveillance and detection communication systems, reduce latencies in detecting and communicating disease information and set a standard interoperable protocol for disease information communication with National and International health related organizations in the region”



Research Matrix

	Exposed to RTBP				Unexposed to RTBP			
	Division 1		Division 2		Division 3		Division 4	
+	C01	C05	C09	C13	C17	C21	C25	C29
	H01	H03	H05	H07	H09	H11	H13	H15
-	C02	C06	C10	C14	C18	C22	C26	C30
+	C03	C07	C11	C15	C19	C23	C27	C31
	H02	H04	H06	H08	H10	H12	H14	H16
-	C04	C08	C12	C16	C20	C24	C28	C32

- Hxx denotes Community-Healthcare-worker (“yellow” cells); 16 total
- Cxx denotes 32 Communities;
- Cells with “magenta” background have a presence of a Community-based Healthcare facility (+)
- Cells with “orange” background do not have a formal Community-based Healthcare facility (-).



Hypothesis (Themes):

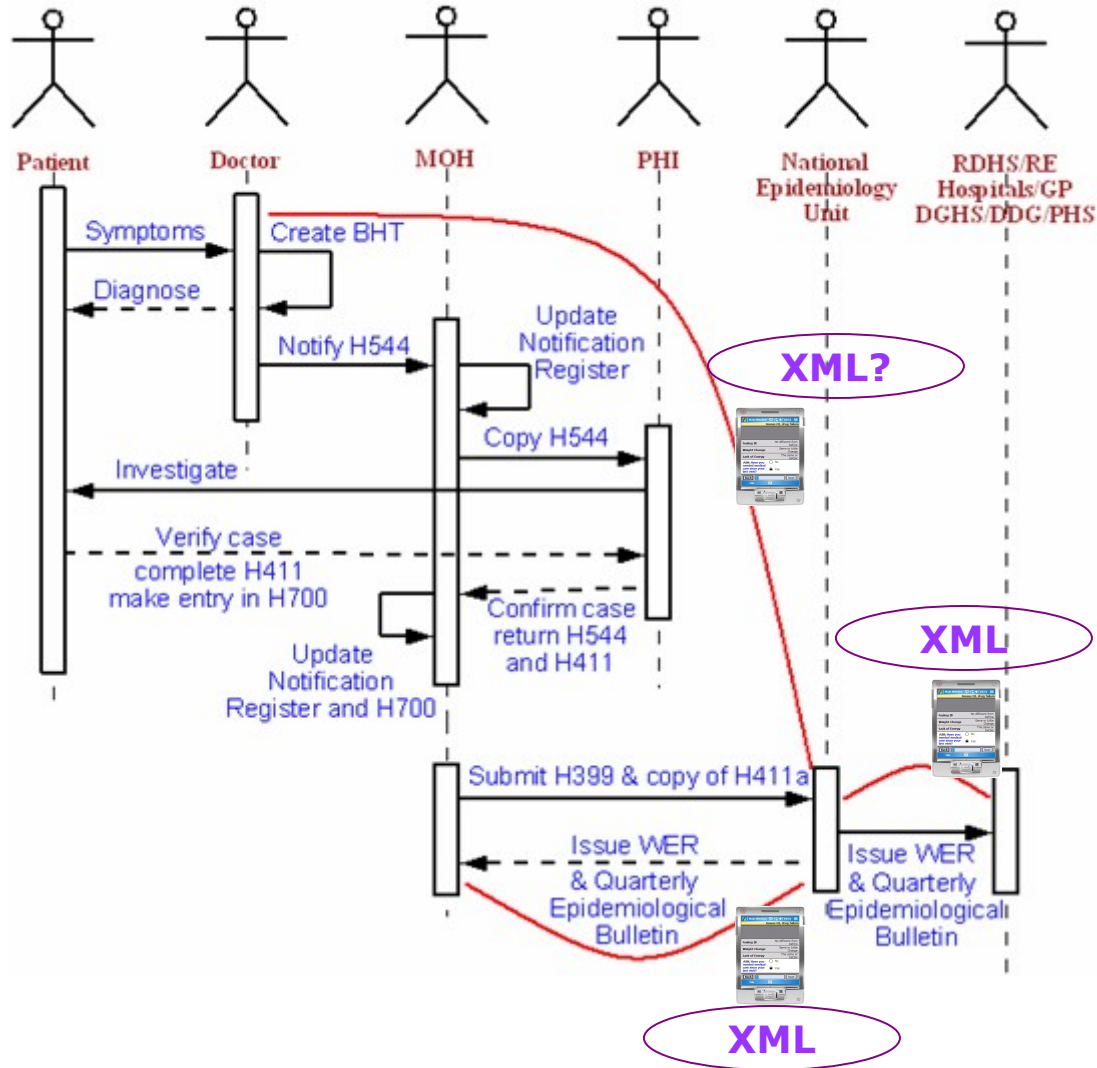
- 1. Healthcare Workers exposed to the RTBP will respond more effectively than the Healthcare Workers in the Control Divisions**
- 2. Epidemiology Units exposed to the RTBP will detect disease outbreaks and contain than Epidemiology Units in Control Divisions.**
- 3. Healthcare Workers and Epidemiology Units exposed to the RTBP will show interest and recognize the benefits in adopting m-Health programs opposed to Control Divisions.**
- 4. Communities exposed to the RTBP will have confidence in the National Disease Surveillance and Notification programs more than Control Divisions.**
- 5. Healthcare Workers and Epidemiology Units exposed to the RTBP will leverage ICTs in other areas more than the Control Divisions.**
- 6. Communities that have non governmental Community-based Healthcare Organizations will perform better than communities that do not**



DISEASE SURVEILLANCE INFORMATION



Sri Lanka disease surveillance and notification

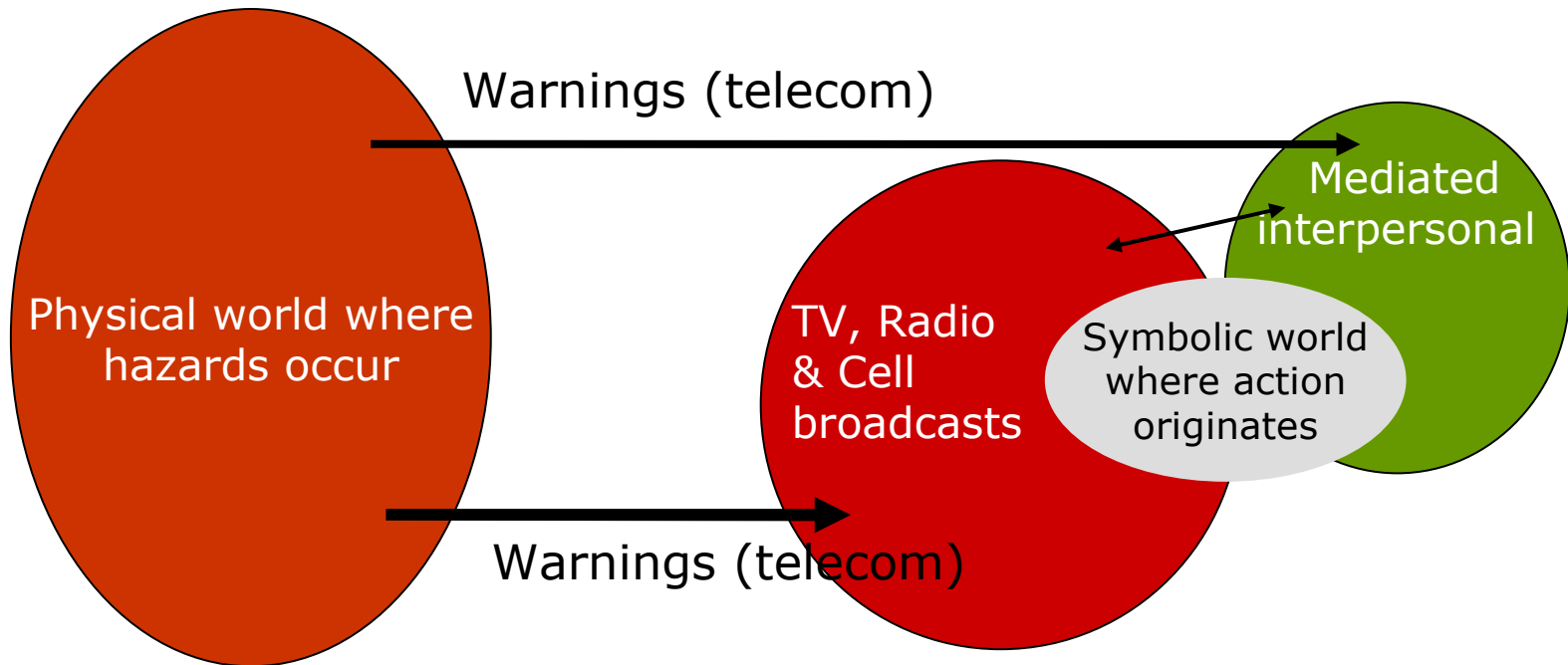


- **Black arrows:** current manual paper/postal system for health data collection and reporting
- **Red lines:** RTBP mobile phone communication system for health data collection and reporting

HEALTH DATA COMMUNICATION

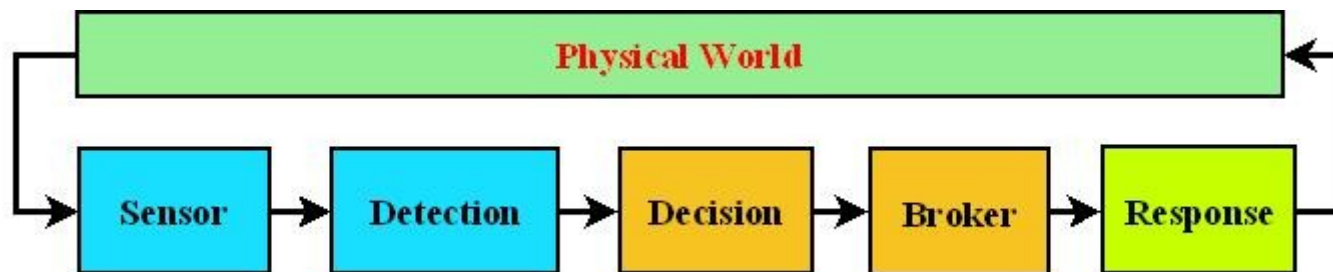


Early Warning System

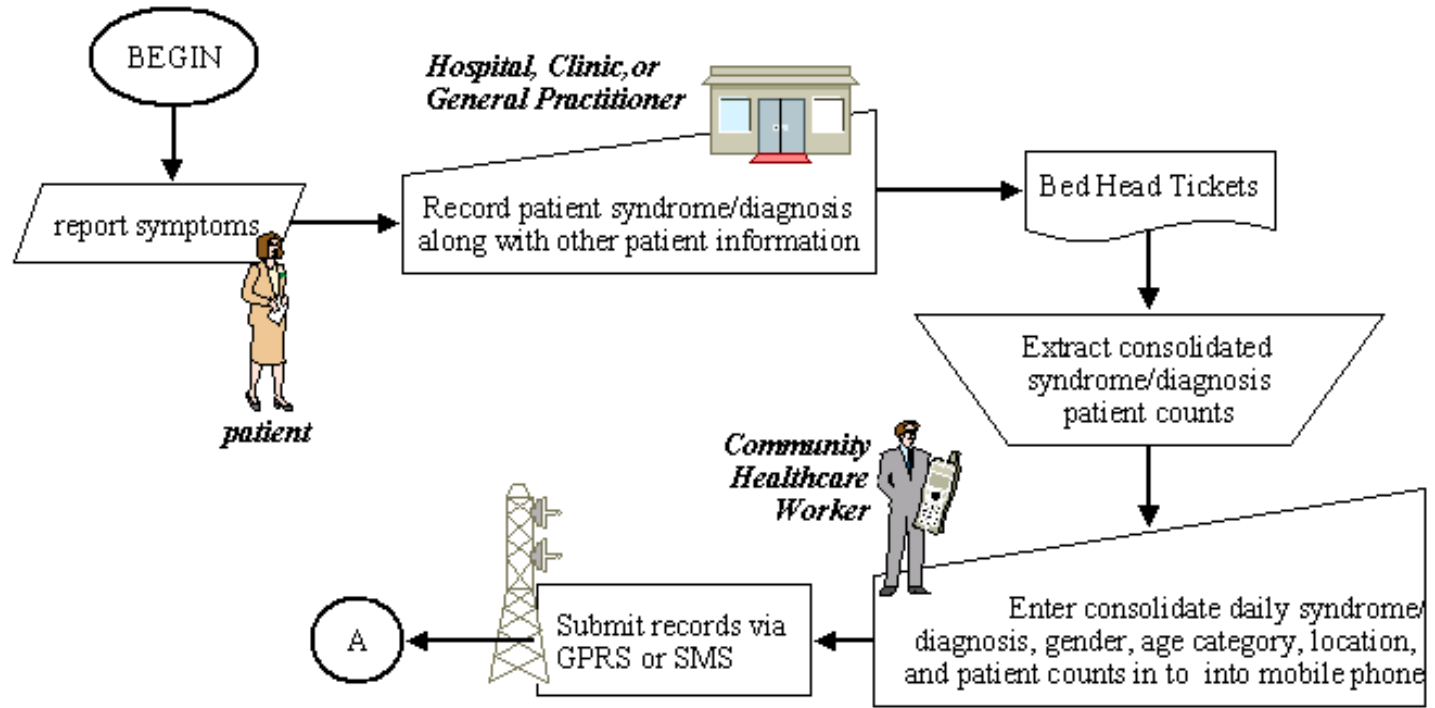


Samarajiva conjecture

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



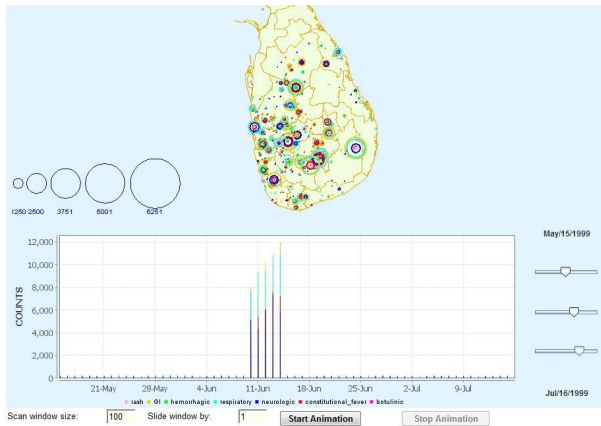
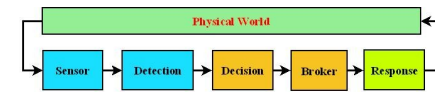
Demo RTBI “m-Health Survey”



- ❑ RMS – memory problems
- ❑ T-Flash card 1GB
- ❑ Does not work with lower version MID 1.0 or CLDC 1.1
- ❑ Only on MIDP 2.0 & CLDC 1.1 otherwise error “java.io.error”
- ❑ Dictionary function required to type diagnosis to minimize spelling
- ❑ Tested on Nokia 3110c, Amoi A636, Gionee v6600, v6900, Motorola, Sony Ericsson s302c



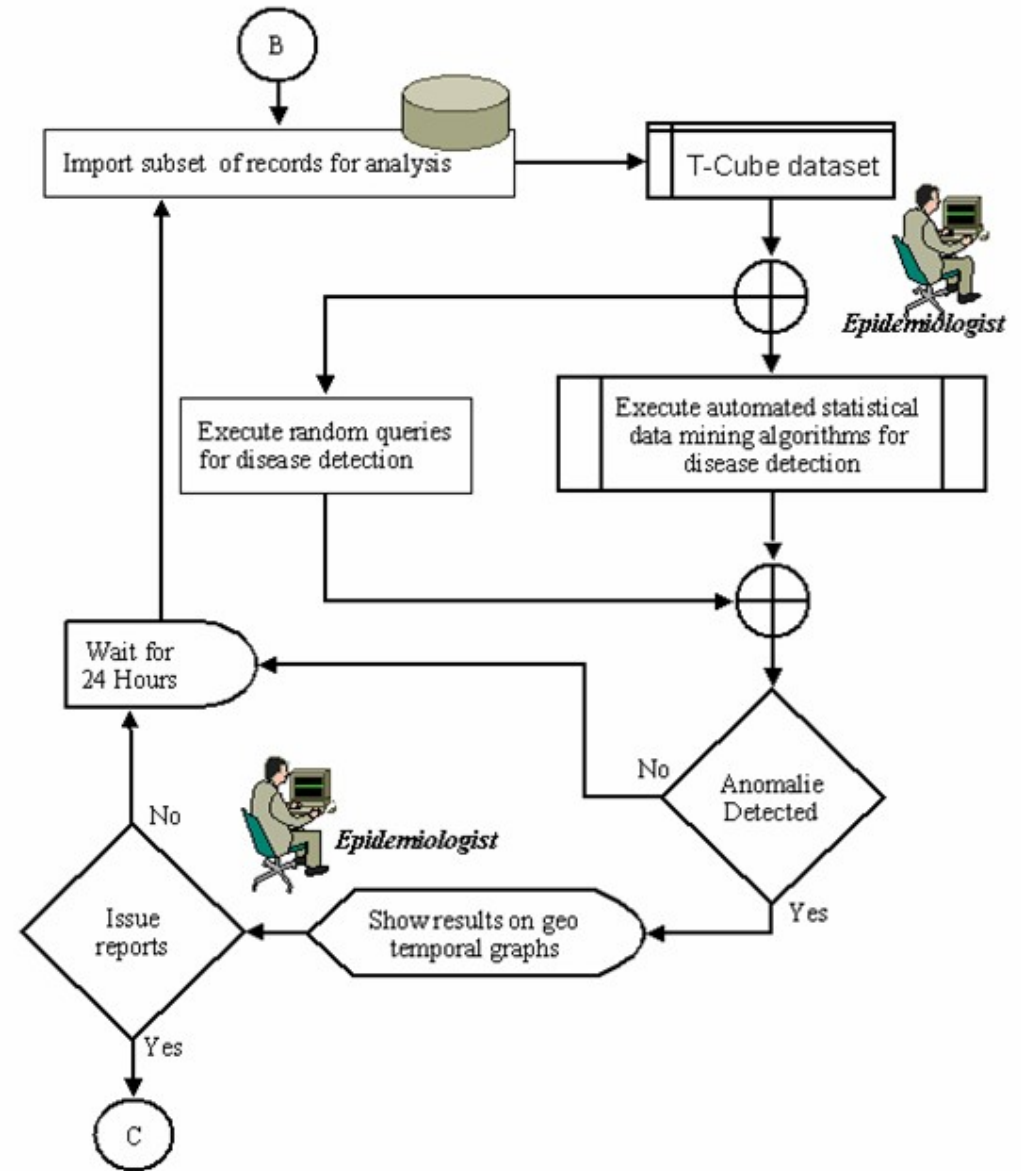
Demo Auton Lab spatial and time scans



Geospatial

Time series

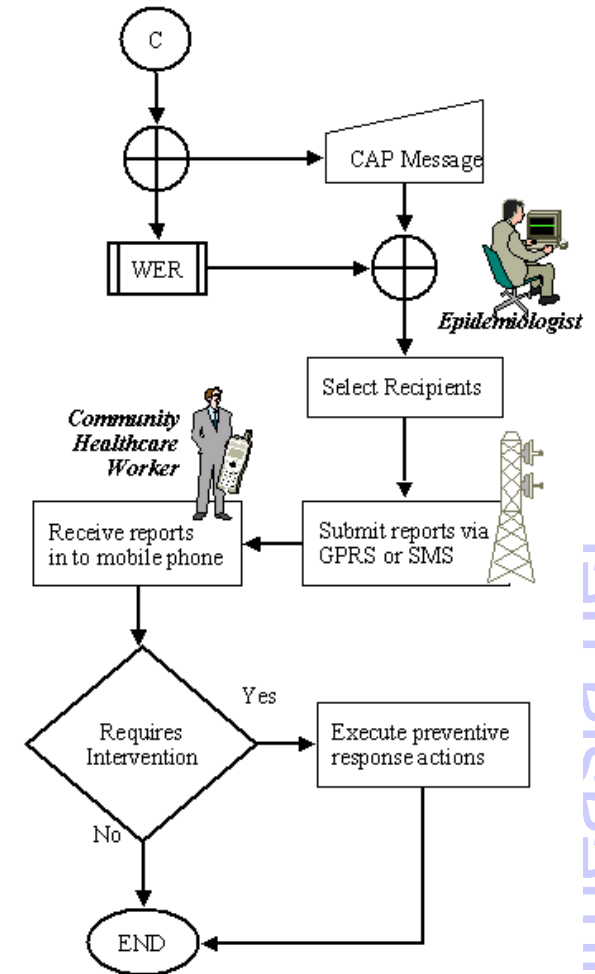
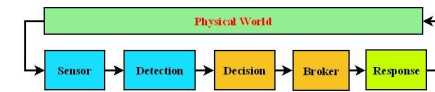
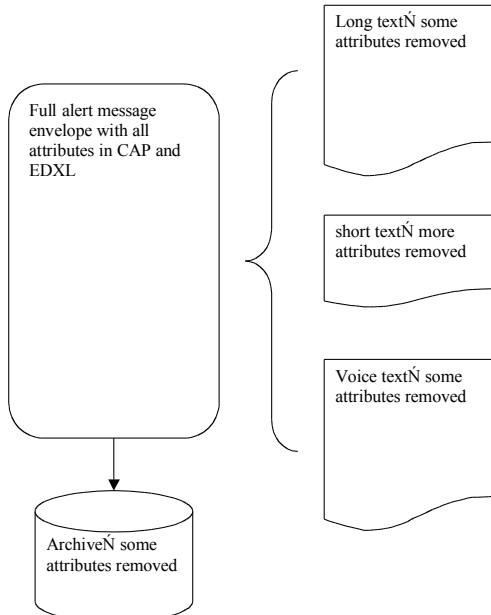
- ❑ Shapes of the country and organizing the geometric-spatial and time-series GUIs
- ❑ Google maps too slow for real-time assessments
- ❑ GPS illegal in Sri Lanka due to war
- ❑ Intellectual property of algorithms
- ❑ Fear may not get enough data to prove concept



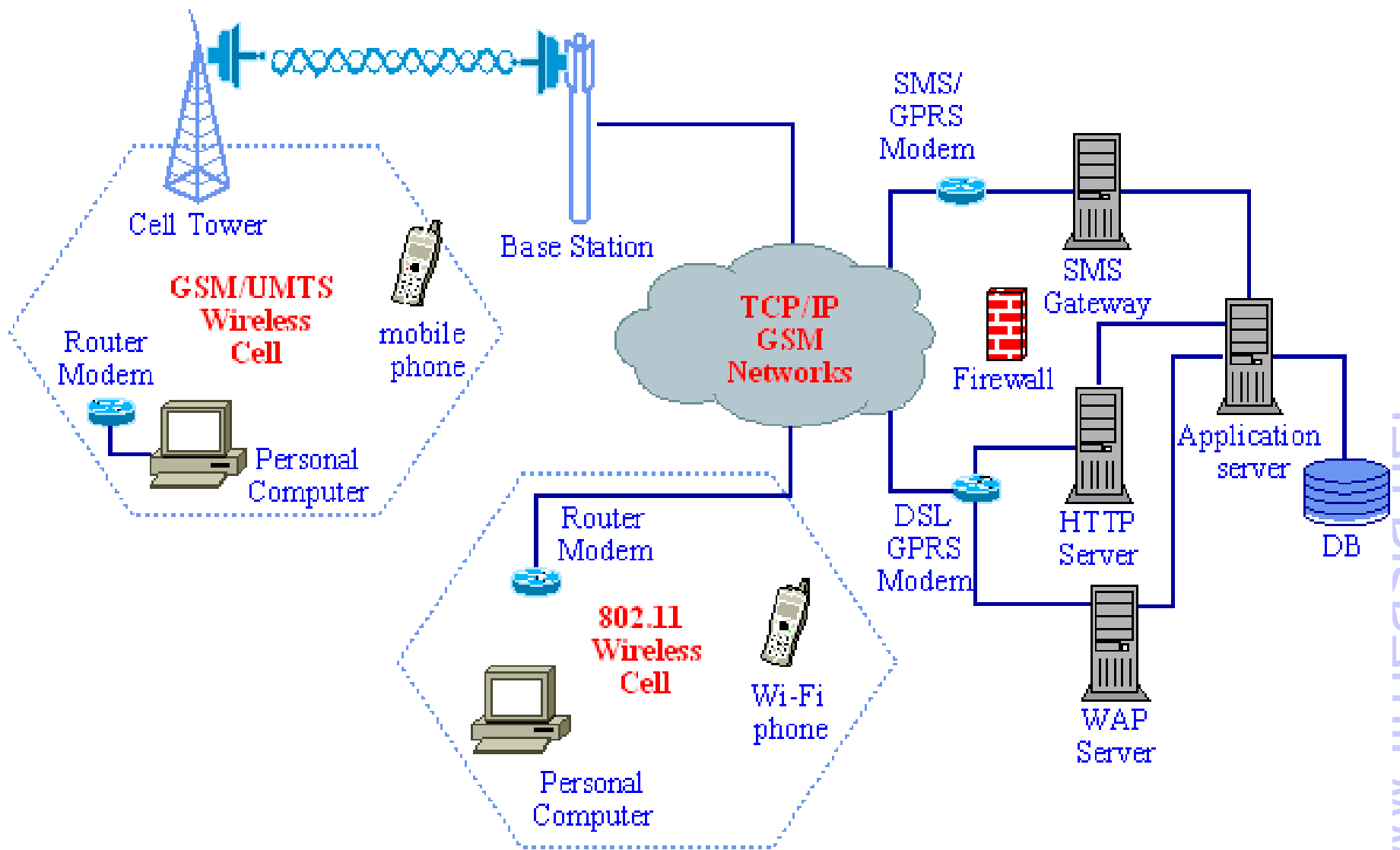
Demo Sahana SITREP concept



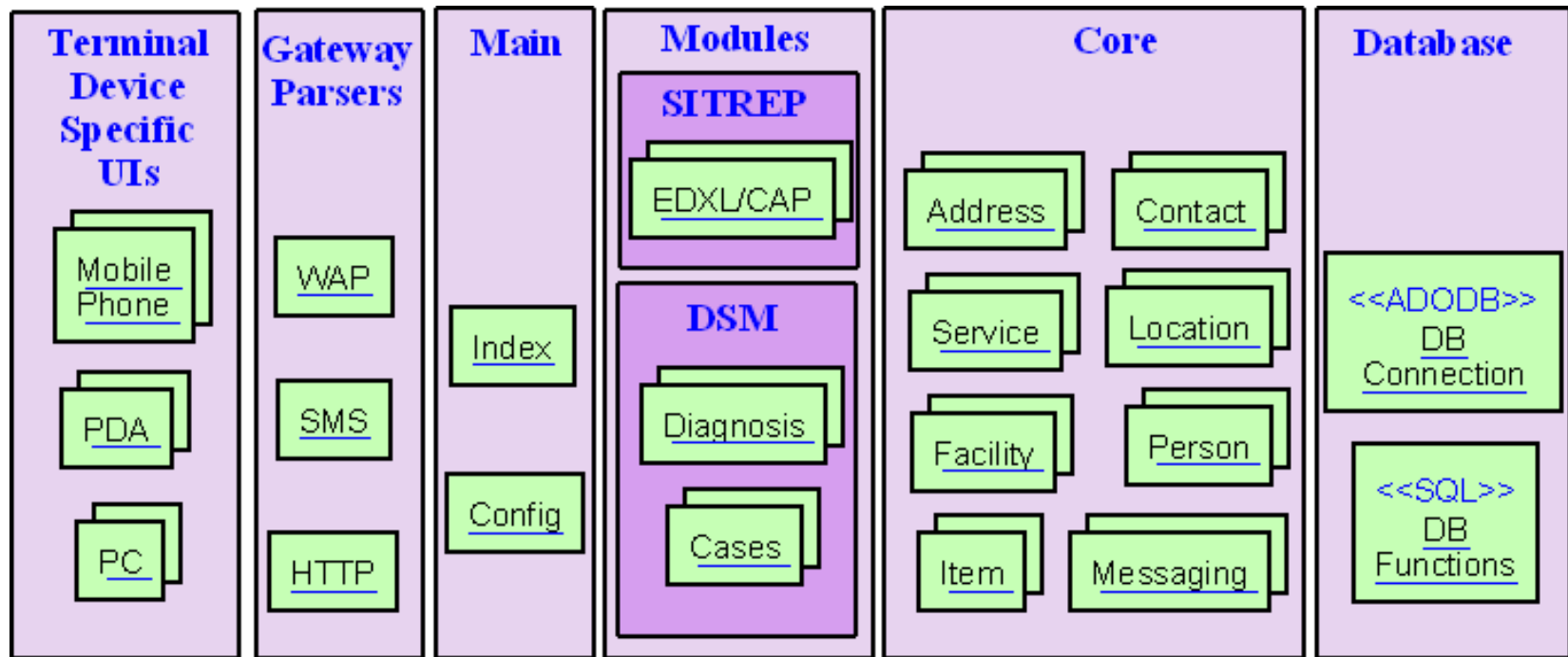
- ❑ Adopt PHIN Communication and Alerting Guidelines for EDXL/CAP
- ❑ Challenge of creating the EDXL/CAP template editor
- ❑ Relating the template editor with the SMS/Email Messaging module
- ❑ Understanding direct and cascading alert from a regional jurisdictional prospective
- ❑ Designing the short and long text messages
- ❑ Addressing in multi languages



Network Architecture



Sahana Software Structure

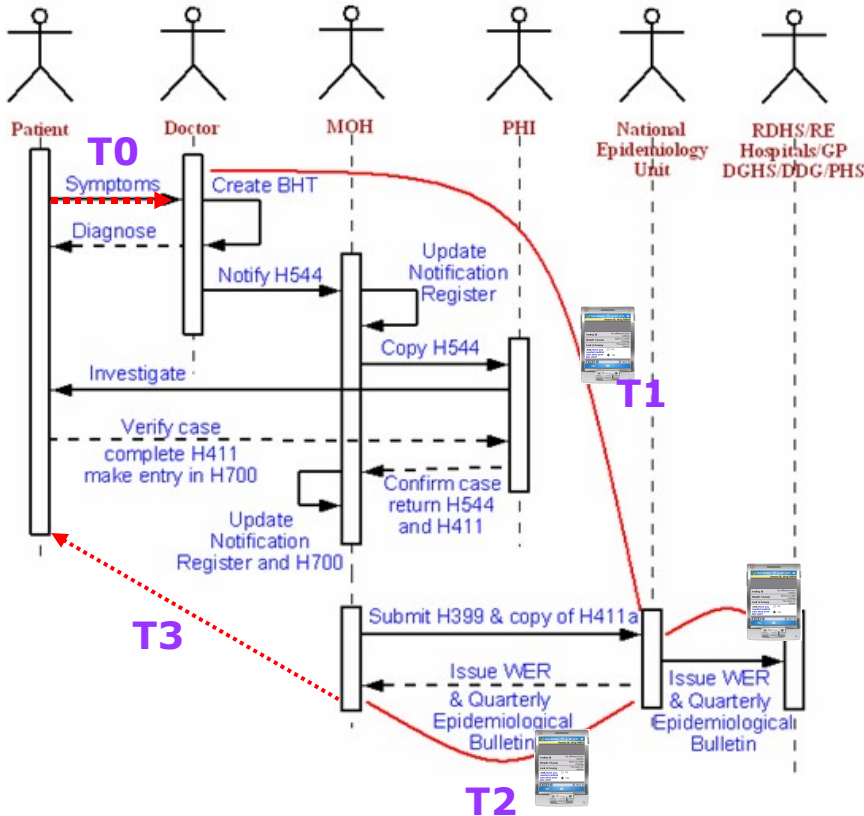


- ❑ Network client – server based layered software architecture
- ❑ Communication between components is through message passing
- ❑ Provides for domain specific software architecture
- ❑ Reuse abstract object of the “core” classes; e.g. generate a camp registry module using location, person, and facilities classes
- ❑ Remote session style architecture allows for more client side processing

RTBP Technology Assessment



Efficiencies



T_i : time interval taken to complete process i

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

d : minimum “distance” (not necessarily length) between epicenter and impact zone

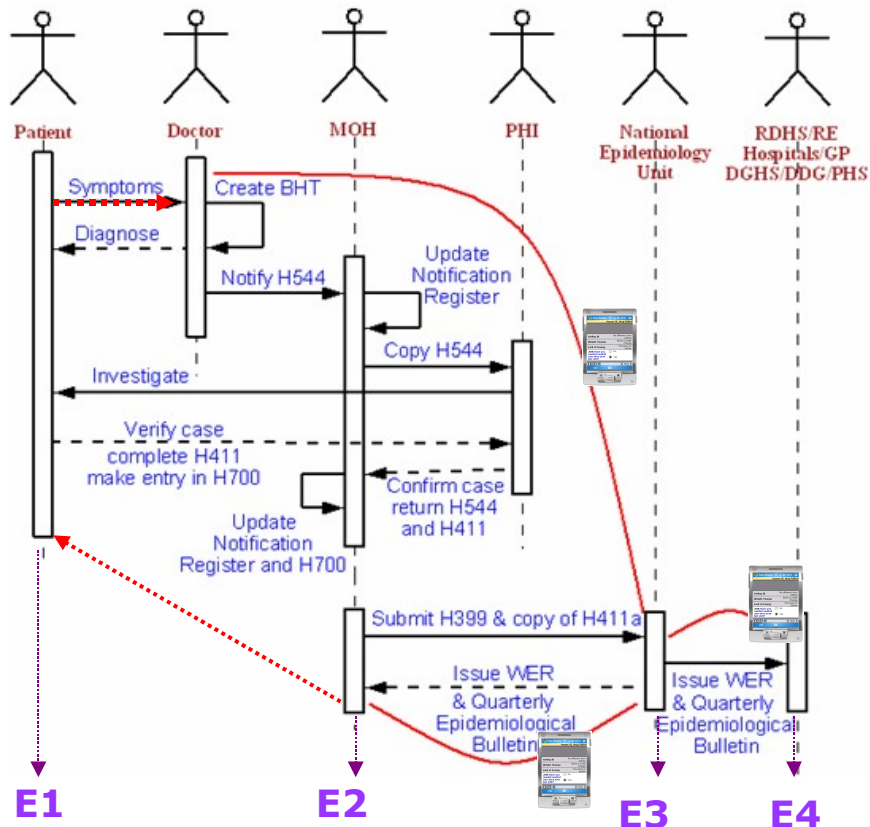
S : speed (rate) at which hazard is traveling

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

R_i : Reliability of process i

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

Effectiveness



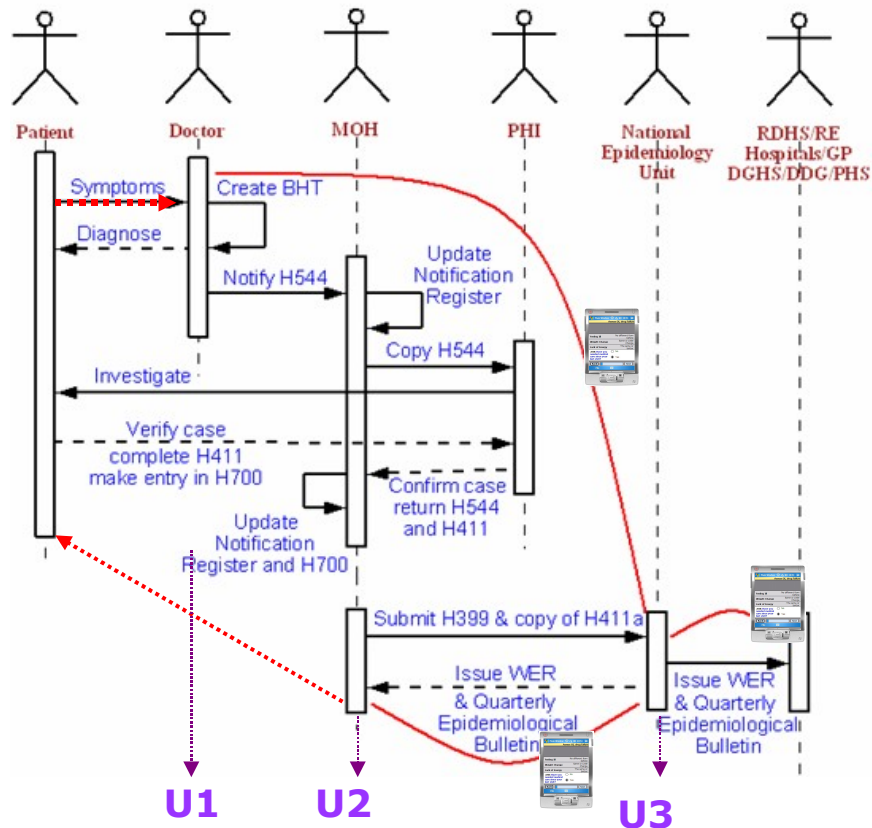
- ❑ **E1: Village perception**
 - E1.1: change in awareness
 - E1.2: state of health care changed
 - E1.3: interoperability

- ❑ **E2: MOH/DDH Perceptions**
 - E2.1 received info on mobile phone
 - E2.2 aggregated reports on desktops
 - E2.3 Situational reports on desktop
 - E1.3: interoperability

- ❑ **E3: EPID Unit perception**
 - E3.1: Automatic detection
 - E3.2: Alerting capabilities via web/email/sms
 - E3.3: Reporting capabilities
 - E1.3: interoperability

- ❑ **E4: State/Regional perception**
 - E4.1: Changed the decision and response processes
 - E4.2: interoperability

Human Computer Interface (Usability)



- ❑ **U1: RTBI m-Health Survey**
 - U1.1: apply acceptable HCI evaluation
 - U1.2: connectivity issues
 - U1.3: health domain requirements
- ❑ **U2: Auton Lab detection programs**
 - U2.1: apply acceptable HCI evaluation
 - U2.2: connectivity issues
 - U2.3: health domain requirements
- ❑ **U3: Sahana SITREP messaging**
 - U3.1: apply acceptable HCI evaluation
 - U3.2: Connectivity issues
 - U3.3: Health domain requirements



POLICY IMPLICATIONS



Comparison of direct costs

	INDIA		SRI LANKA	
	<i>Morbidity only</i>	<i>RTBP all</i>	<i>Notifiable only</i>	<i>RTBP all</i>
<i>Collect data</i>		Package 1Mb data @ \$2.5/mo	Postage \$.0.06/doc set for 4 weeks = \$0.24/month for 250 MOH offices = \$60.00/mo	GPRS:= \$ 400/mo (or SMS:= \$1,000/ mo) (20 working days , 50 patient records per day, 250 MOH, 4 PHI per MOH)
<i>Analyze data</i>	20 person days with SW/HW @ \$1,200/mo	Auto detect with SW/HW @ \$600/month	20 person days with SW/HW @ \$900/mo	Auto detect with SW/HW @ \$600/month
<i>Report data</i>			Postage \$.0.06/doc set for 4 weeks = \$0.24/mo for 250 MOH offices + 50 others = \$72.00/mo	GPRS:= \$ 5/mo SMS:= \$25/mo (4 weekly reports, 1 SMS page each, to 250 MOH and cascade of 4 PHI per MOH)
TOTAL (Min)	/mo	/mo	\$ 1044/mo	\$ 1030 /mo

How to convince Epid/CDC?

- ❑ Is there a significant benefit in introducing technology to a acceptable functioning disease surveillance and notification system?
- ❑ Can gov afford to digitize and communicate all patient data
 - All practitioners/facilities will require a communication allowance
 - Present system only communicates 25 known diseases
 - Will all practitioners upgrade handsets to USD 125 sets?
- ❑ Will gov subsidized health system replace gov run postal system with private owned tech system for communications
 - Cheaper SMS/GPRS charges vs Expensive (subsidized postal fees)
 - Data warehousing on hard drives vs heaps of paper stacked in rooms
 - Invest in tech system administration capacity vs reducing work for Postal workers, Peons, and or other minor staff
- ❑ Are the healthcare workers willing to accept technology
 - fear that system may monitor and control their work ethics
 - the application is additional work and cumbersome
- ❑ Although gov protocol require, do the practitioners and healthcare facilities maintain patient syndrome information and will they be willing to make the extra effort to digitize and communicate?



Training requirement assessment

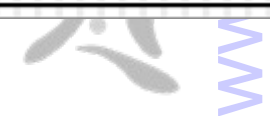
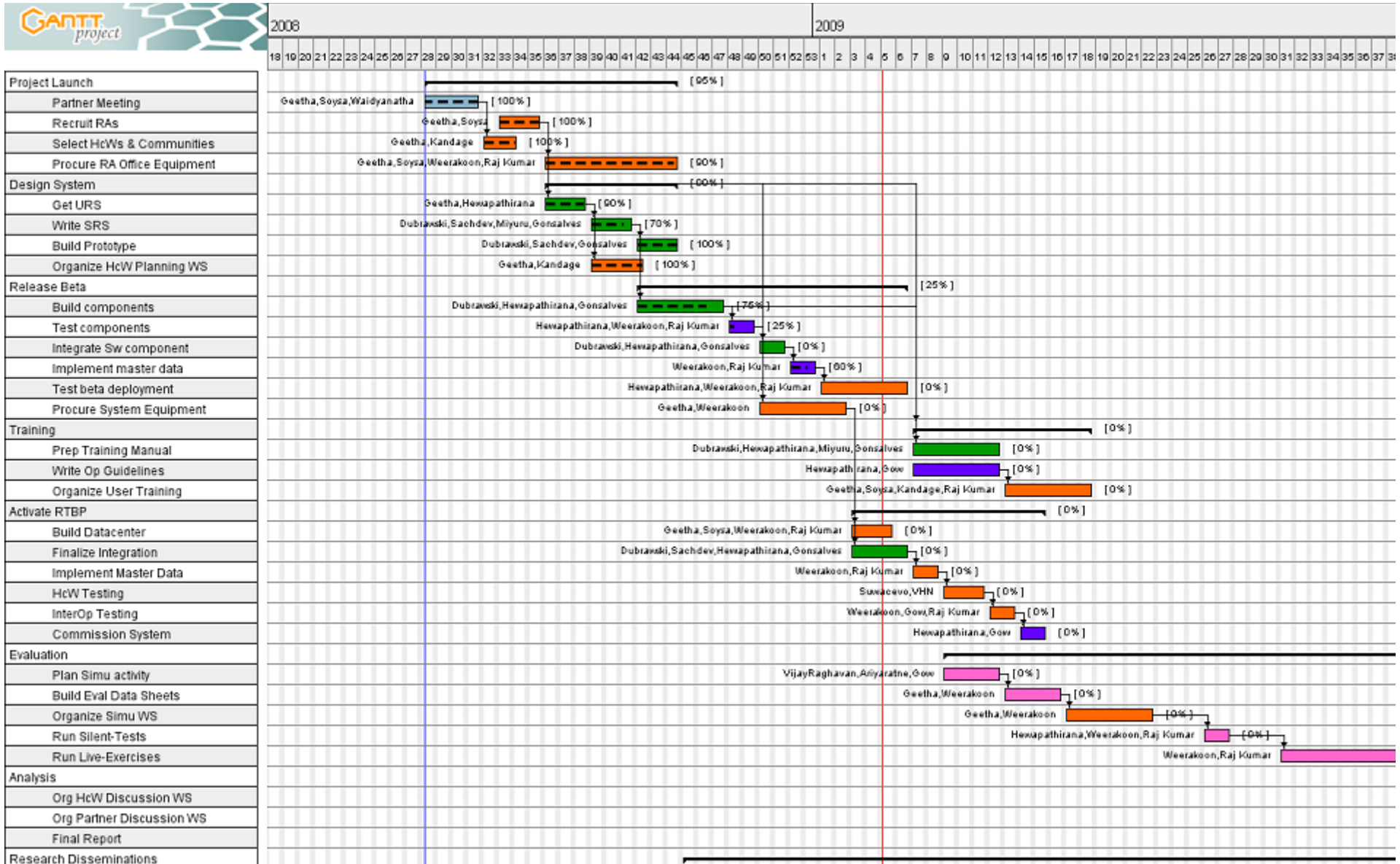
	<i>Indo VHN (22 of 25)</i>	<i>Lanka Suwacevo (15 of 16)</i>
Demographics	Population: 2750 – 7850 (4263) Families: 600 – 1350 (971)	Population: 250 – 300 (819) Families: 50 – 800 (205)
Disease Knowledge	<ul style="list-style-type: none"> • Chickengunya (14), Fever (3), Diarrhea 2002 (2) • All knew about national CDC • All knew difference between communicable and non-communicable diseases; • 21 VHN have witnessed disease outbreak, 1 no 	Dengue Fever (2), Leptospirosis (3), Human Rabies (1) <ul style="list-style-type: none"> • 6 know of disease surveillance system and 6 don't • 13 knew difference between communicable and non-communicable diseases; • 21 VHN have witnessed disease outbreak, 1 no
Tech Ready	21 use a mobile phone 1 doesn't; 12 use sms and 11 cannot, 1 can send email; past month nobody has used MMS, Email, Internet,	9 use a mobile phone 5 no; 7 use sms and 7 not, 1 can send email; past month nobody has used MMS, Email, Internet, 13 agree tech will make job and life easier 11 agree improve health in my community
Strengths and Weaknesses of proposed tech	8 want patient name & address; 4 want treated and referred 2 wrote no comments	1 response incl. village, name & age of patient, sex, disease, & symptoms 2 want fore warning

Capacity building

- ❑ Training of trainer program for country team leaders
- ❑ Community health care workers require disease surveillance and notification knowledge
- ❑ Gov health workers and Community health workers need introductory training in the use of email and sms over mobile phones
- ❑ Localization of material for Community health workers; especially on the alert side
- ❑ On site training and coaching for mock drills



Project Status



Questions?

- What policy questions would you like see answered?
- If this system was made available to you in your country will they adopt it? Why or Why not?
- Is your country's health system's working language English? If not, how does it address the health domain specific language problem?
- Please tell us of any initiatives with similar objectives

