e-Resilience in support of Emergency Communication: "contingencies"

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LIRNEasia

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Contribution to AP-IS Master Plan

Main contribution is to E-Resilience

- Resilient ICT networks (Services)
- Support for disaster management systems
- Ensuring last-mile disaster communication

"The Asia-Pacific Information Superhighway initiative aims to enhance the resilience of existing/planned ICT infrastructure through methods such as enhanced network diversity, while recognizing the importance of resilient infrastructure to sustainable development and the critical role played by ICT in disaster risk reduction and management."

Secondary contribution to Broadband for all

- Bridging digital divides
- Promoting affordable access to underserved areas
- Policy and technical support to Governments

The Chautara Story (2015 Nepal Earthquake)

- Telecom damage
  - To avoid theft of base-station batteries, they were place on the top floor of buildings; structures could not hold during the earthquake
  - Nepal Telecom & NCell towers were intact and functional but had to be relocated because building were unstable
  - SmartTel tower, far away from the Bazaar on ground, was unharmed
  - After 48 hours batteries drained & some were stolen

- Electricity
  - Bazaar and villages in darkness for four weeks
  - Solar powered mobile device charge centers were popular

- Radio Sindu was down for two days
  - Bamboo hoist to compensate fallen antennas
  - Transmission equipment unharmed but lacked power
  - Generators donated by ISOC and others to restore transmission

- What worked well
  - ISPAN WiMax was proven to work well; especially with solar; in mountains
  - Nepal Police use VHF both data and voice with Pactor modems

REPORT

Internet Society
Nepal Chapter

LIRNEasia
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Report: https://lirneasia.net/wp-content/uploads/2016/04/Nepal_Report_on_Emergency_Communications_v1.0.pdf

Nepal, post earthquake reporting delays

Days to first report: 05
Density: 1.61

Days to first report: 04
Density: 1.67

Days to first report: 09
Density: 1.42

Days to first report: 08
Density: 5.78

Days to first report: 06
Density: 2.14

Days to first report: 07
Density: 1.51

Did it take 4 days to restore telecoms or 4 days for reporting teams to arrive in these areas?

Why 9 days for cluster closest to the road?

MAP LINK: http://tinyurl.com/j4uobtw

Did it take 6 days to restore telecoms or 6 days for reporting teams to arrive in these areas?

Does the 6,7,8 9 days imply the reporting team's travel circuit? (Arrows indicate the possible travel path)

Correlation of density and first reporting delays

Reporting Time Lag from Day of Earthquake and Cluster Density
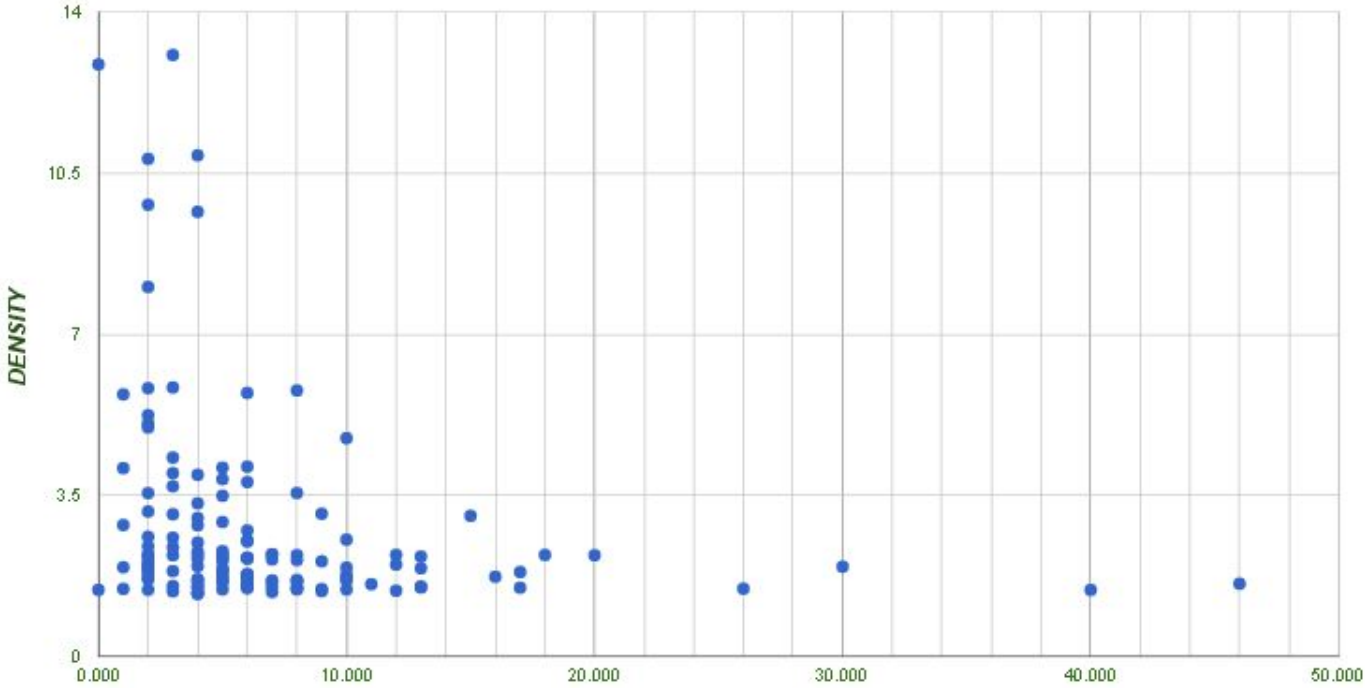
DENSITY

Number of Days from the April 25th Earthquake

Golden 72 hours

High density clusters only during first 4 days

Larger volume of the clusters have a density < 3.5 (first 10 days)

Important to secure continuity upto 20 days

Relevant recommendations to Nepal Government

1. Continue Nepal Wireless experimentation with UHF TV White Space

2. Research & Develop Grab-n-Go kits (in NETP 2013, Action Plan 5.3.2)
   2.1. Serve as voice and data access points in remote areas
   2.2. Use them in training exercises

3. Research & Develop Mobile Comm. Truck (Not in NETP 2013, Action Plan)
   3.1. Serve as an interconnection, transmission hub, and access point for data and voice
   3.2. Serve emergency services, dispatch, and EOCs to exchange information for better coordination
   3.3. Start with truck given by Huawei but were lacking in-house capacity to manage
   3.4. Use in training and exercises

Two lifesaving public emergency comm use-cases

get
Reports

HELP ME!

cast
Alerts

DANGER!
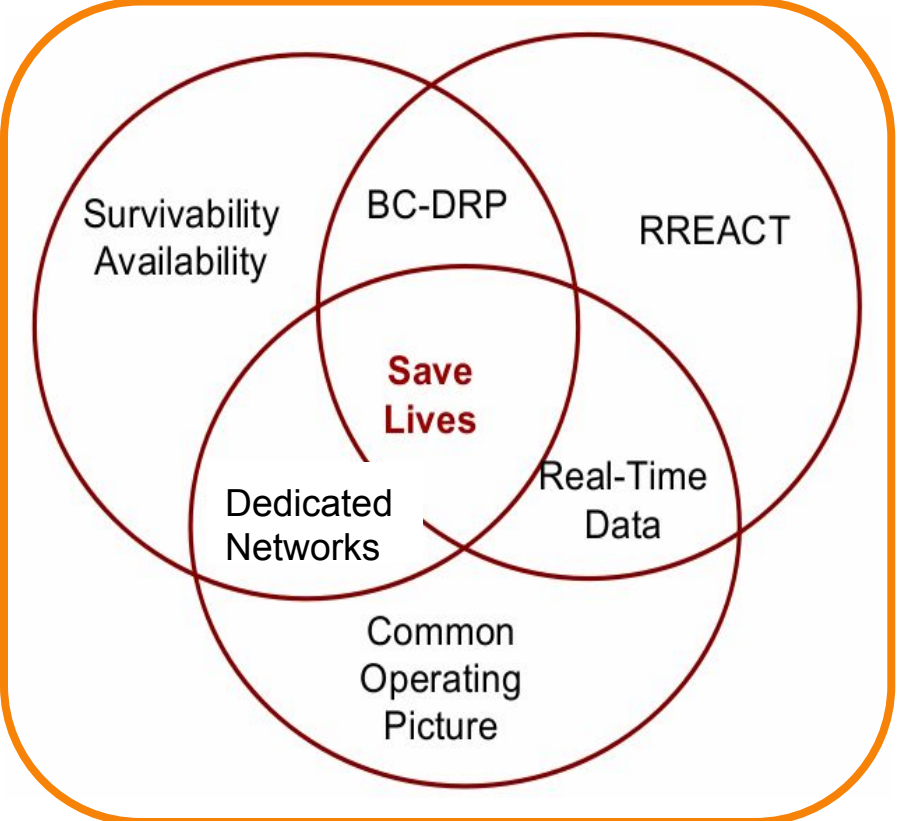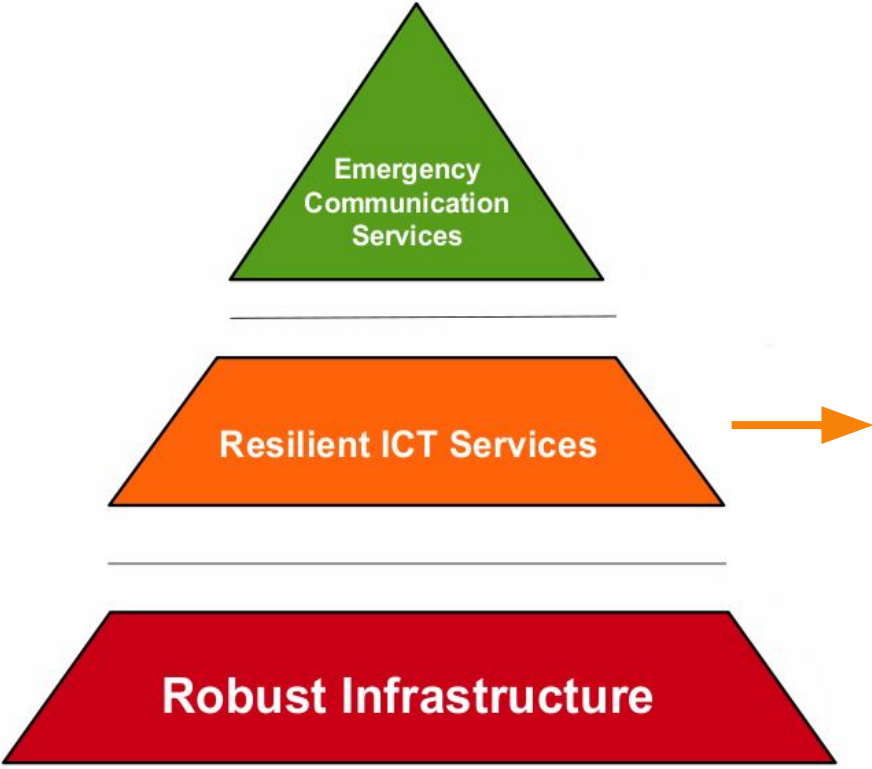
1. Incident Reporting
Person asking for help from the Emergency Management Services indicating hazard (threat) and immediate needs

Emergency Management Services

2. Alerting / Warning
Emergency Management Center Warning the Public in the area indicating hazard and required response actions

Interdependent components

Some definitions

1. Survivability & Availability:

    1.1. Network infrastructure withstand shocks (congestion, damage, power, failures)
    1.2. Geographic coverage (beyond population density coverage)
    1.3. Bypass public network congestion using redundant dedicated networks
    1.4. Building standards (e.g. antennas, data centers)

2. Rapid Restoration of Access to Telecommunications (RReAcT):

    2.1. grab-n-go kits (turn-key solutions), community networks
    2.2. mobile communication vehicles (mainly for backhaul & interconnection)
    2.3. policies/procedures and resources (infrastructure, personnel)

3. Common Operating Picture:

    3.1. Sharing trusted, timely, and comprehensible information
   3.2. Inclusive emergency communication, leaving no one behind

Preparedness

Response

Business Continuity - Disaster Recovery

1 + 2
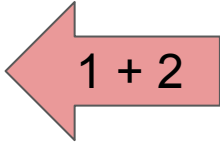
Problem: Public Access and Affordability

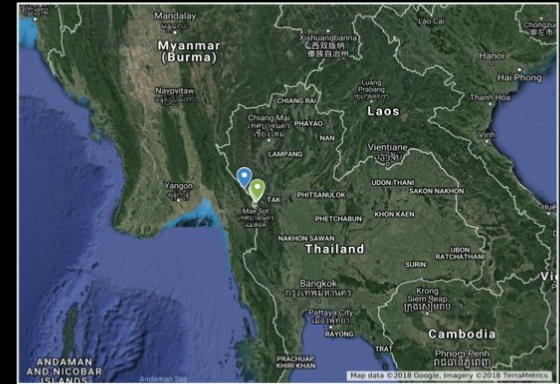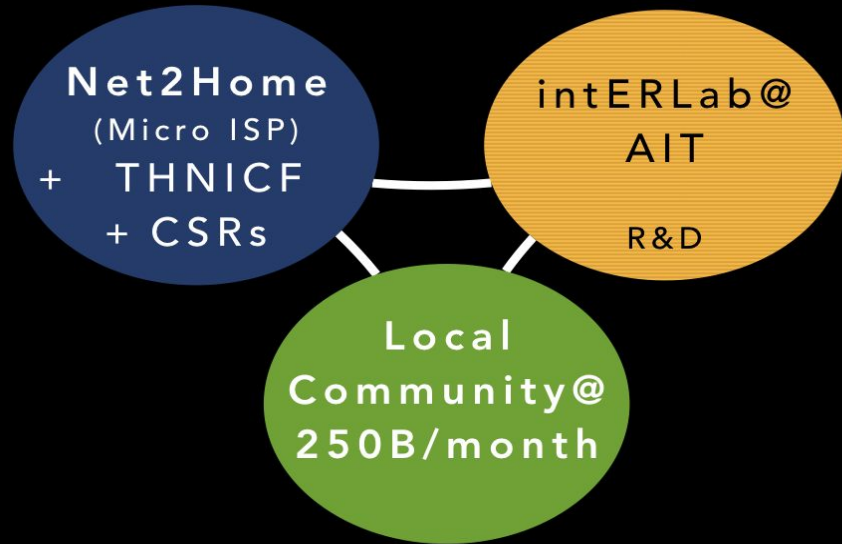| Technology	Governments	Humanitarians	Public
GSM/WCDMA (i.e. 3GPP standards)	✓	✓	✓
ADSL (over copper/fibre)	✓	✓	✓
HF/VHF - police, military, ham radios	✓	✓	
High Altitude Platform Stations (HAPS)	✓	✓	
Satellite-Internet (K, Ku, C, X, L -bands)	✓	✓	
Ham-WiFi (w. Pactor Modems)	✓	✓	
Broadband over Power-lines / TV White Space	✓		
Dedicated 700MHz bands for civil protection	✓		
TETRA networks (only in developed countries)	✓		

Ingredients for a RReAcT

- Local Access Nodes
  - Low cost portable access points
  - Rechargeable, battery powered
- Mesh Network
  - Nodes with embedded routing firmware
  - Easy to scale and geographic coverage
- Backhaul
  - Typically 2.4GHz or 5.2GHz interconnection
  - Other Terrestrial (e.g. TVWS), HAPS, Satellites
- Power
  - Main grid, generators
  - Solar and other sources
- Partnerships
  - Multi-stakeholder partnerships between governments, vendors, operators, civil society
  - E.g. agree with airlines to transport equipment

Public Internet
(Backhaul)

↔ Public Internet
↔ Client-to-MR Link
‑ ‑ ‑► MR-to-MR
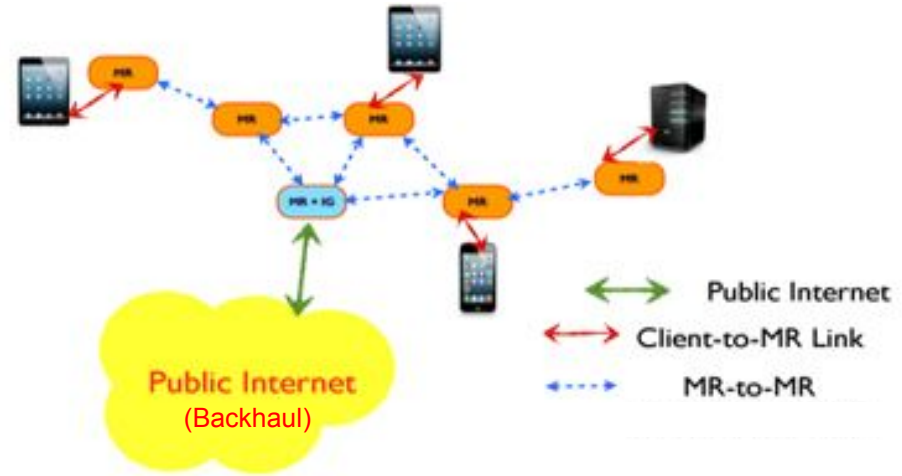
Services:
- VoIP (SIP)
- Text Messaging
- APPs (web + mobile)

TakNet Community Model

Net2Home
(Micro ISP)
+ THNICF + CSRs

intERLab@ AIT

R&D

Local Community@ 250B/month

TakNet: Last meters access solution
Started in late 2013
17 remote communities
190 + deployed nodes
1000+ residents using our network

Deployment by the local ppl

Training the local

BC-DRP Objectives

- BC-DRP = Preparedness and Response (practical & proven plans)
- Preparedness - secure the continuity of the ICT services;
  - Set Key Risk Indicators (KRIs) - survivability and availability; determine incident "frequencies" and "impact", then mitigate those vulnerabilities
  - Apply 80/20 rule to define factors: congestion, damage/break, power, interference, etc
  - Include Social Risk in the KRIs; e.g. affect on children, women, & elderly, trust in public goods, characterize the amount of fear
  - Establish Key Performance Indicators (KPIs):
    - Mean Time To Failure (MTTF) & Mean Time To Recovery (MTTR)
    - Ideal case MTTF + MTTR = 0; unrealisting (e.g. MTTR 12 hours?)
- Response - RReAcT programs that make economic sense;
  - Recovery Time Objectives (RTOs)
    - Must consider the human factors that are always neglected
    - Service-based recovery times (e.g. Data first, SMS last or opposite?)
  - Recovery Point Objectives (RPOs)
    - Prioritize essential services; i.e. which organizations, geographic locations, to what capacity

E-Resilience support to disaster management

1. Tools for communities to assess their E Resilience (add to AP-IS database)
   a. GIS layers of base, hazard, vulnerability, exposure, telecom infrastructure, and coverage (most importantly OPEN DATA)
   b. Communities and Organization to assess the risks and securing continuity (e.g. Raster risk assessment and stepwise refinement method)

2. Inventory of best-practices for developing community networks with options of backhaul for various disaster, geographic constraints and political climates:
   a. WiMax (2.4 & 5.2 MHz) for mountainous areas?
   b. LTE (700MHz) for Mars like terrain?
   c. LEO satellites for small islands?

3. Guidelines, best-practices, and checklists to ensure telecom service provider BC-DRPs:
   a. Meet emergency communication standards (i.e. beyond normal situations)
   b. Including revised language in SLAs between providers and regulators.

Thank You

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ARE YOU READY?