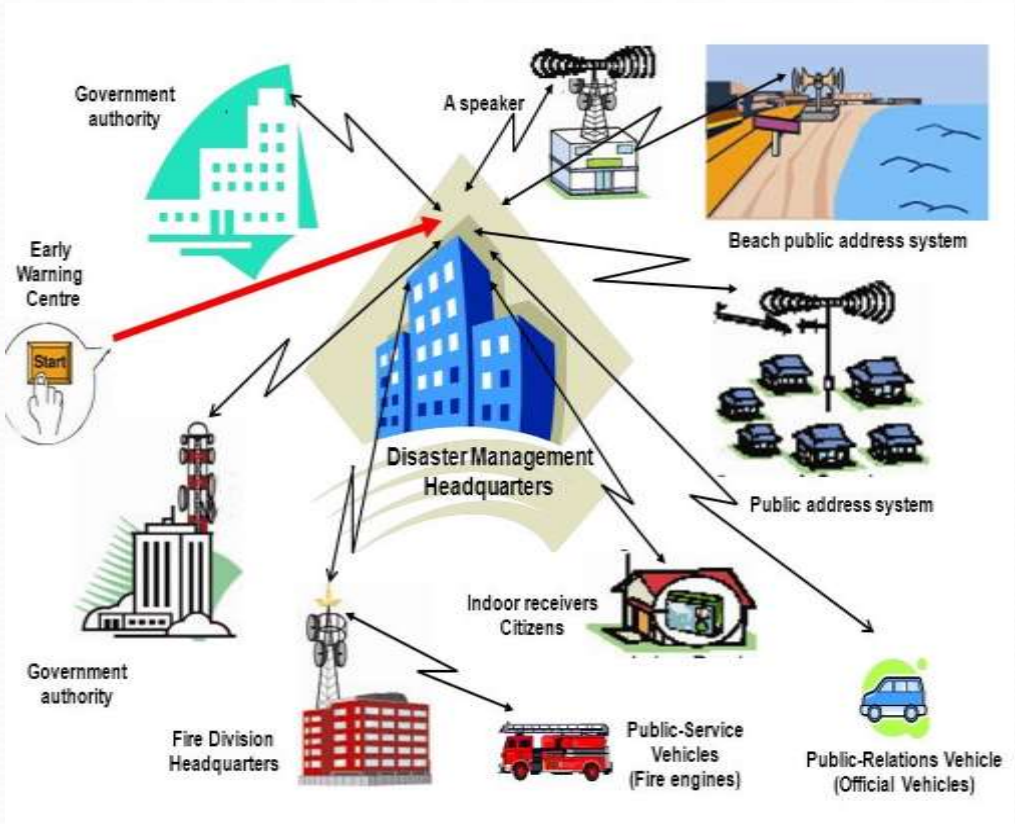
Planning Resilient IT & Communication Infrastructure in Disasters



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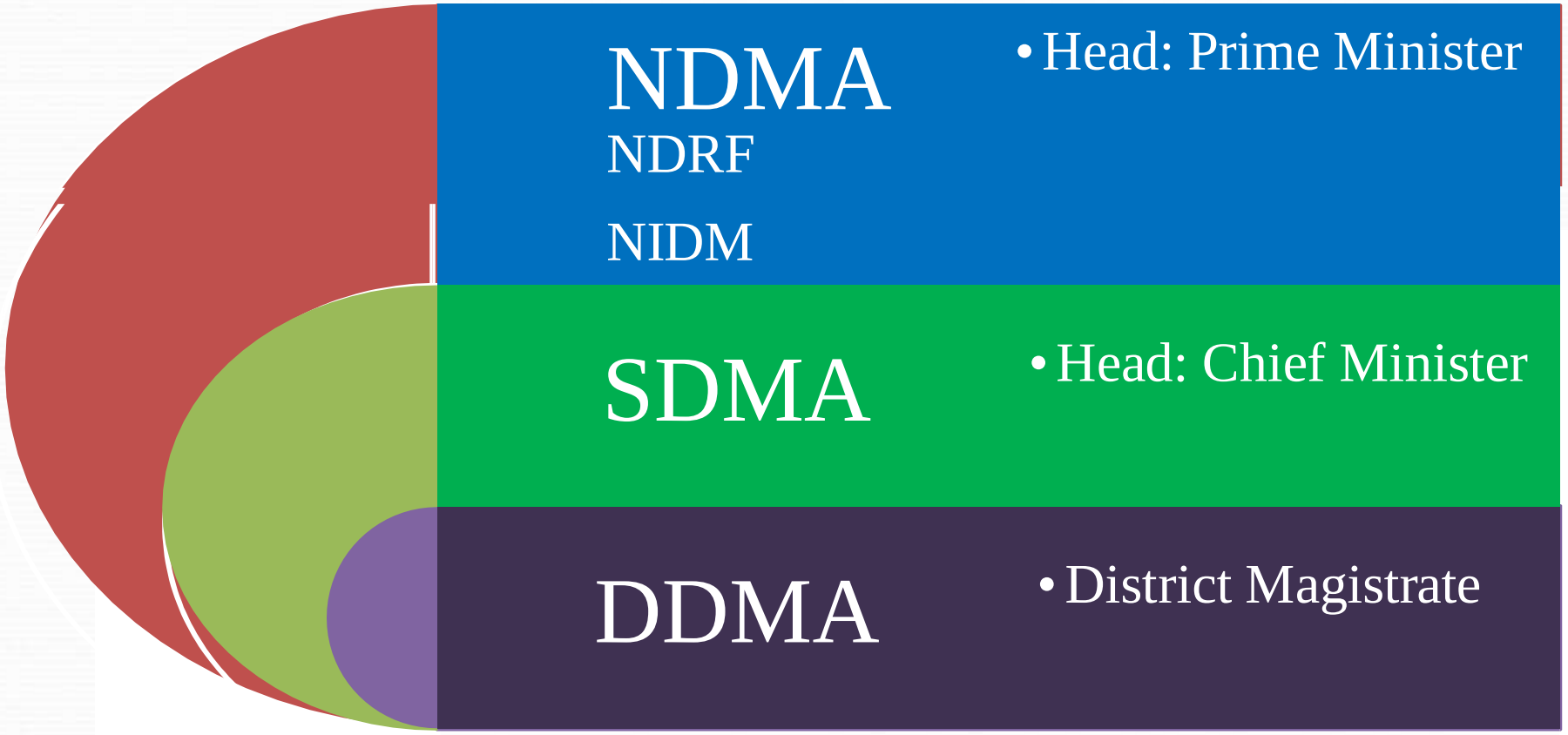
Disaster Management in India

DM Act 2005, provides institutional and coordination mechanism for effective Disaster Management through multi-tiered institutional system



NDMA Envisions

- Providing Strategic leadership and support for Disaster Risk Reduction Measures
- Laying down policies, plan and guidelines
- Coordinating with Central government / State Governments and other DM stakeholders
- Moving towards disaster resilient society

Paradigm Shift- Relief-centric to prevention, mitigation and preparedness

What are the Critical Infrastructures

- Roads
- Energy
- **IT & Communications**
- Hospitals
- Railway
- Airport
- Helipad
- Schools

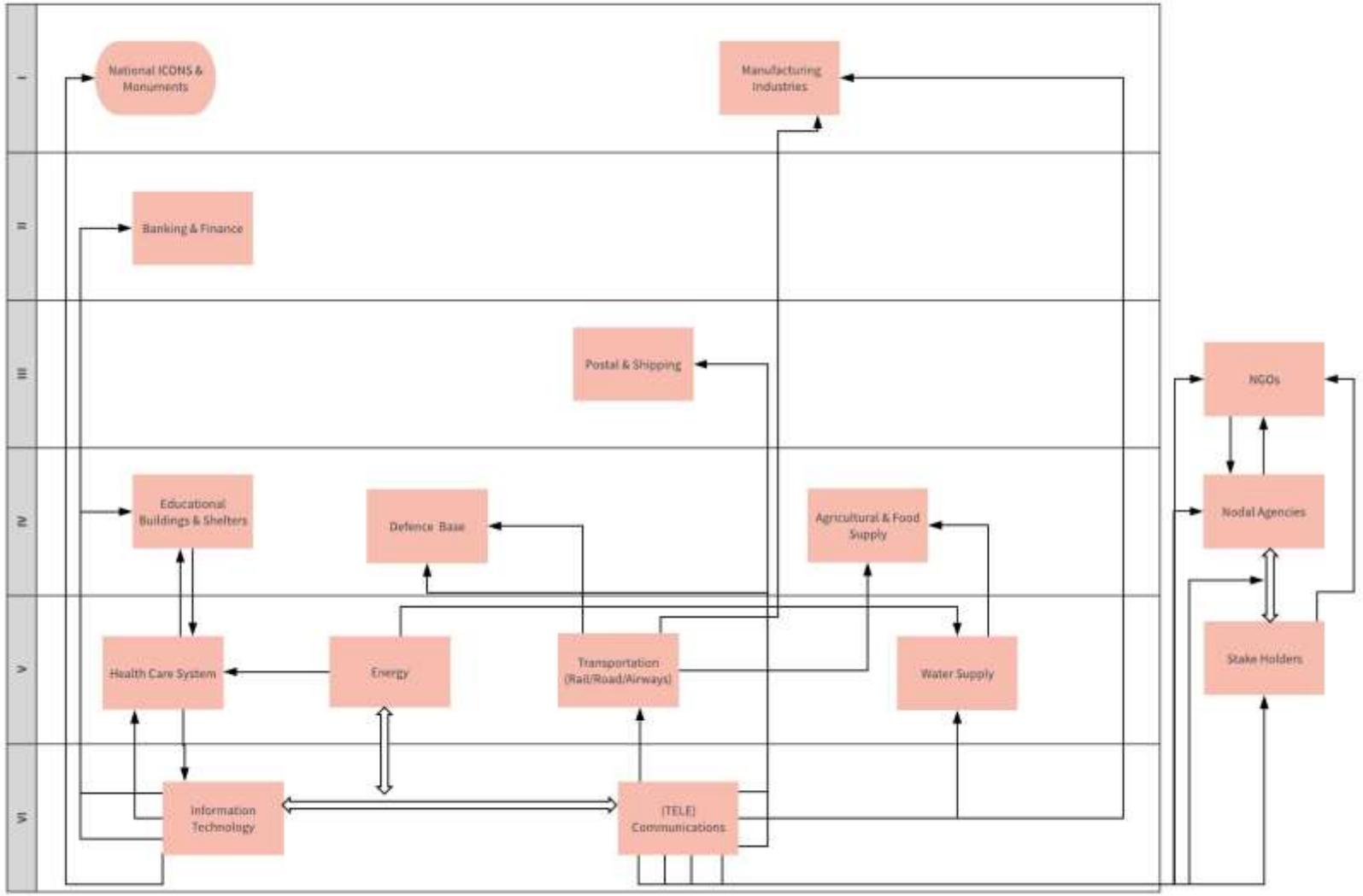
Presentation Focuses on Resilient IT & Communication which

- Plays critical role in different stages of disaster management

Importance of ICT in Disaster Management

- Disaster is a Multiagency, Multijurisdictional and Multidisciplinary Coordination (including NGOs and Stakeholders) event.

- In order to handle all the cycle of disaster in a collaborative manner IT & telecommunication works as most important “Backbone” of the whole disaster management system to provide a effective and efficient disaster risk management.



ISM model

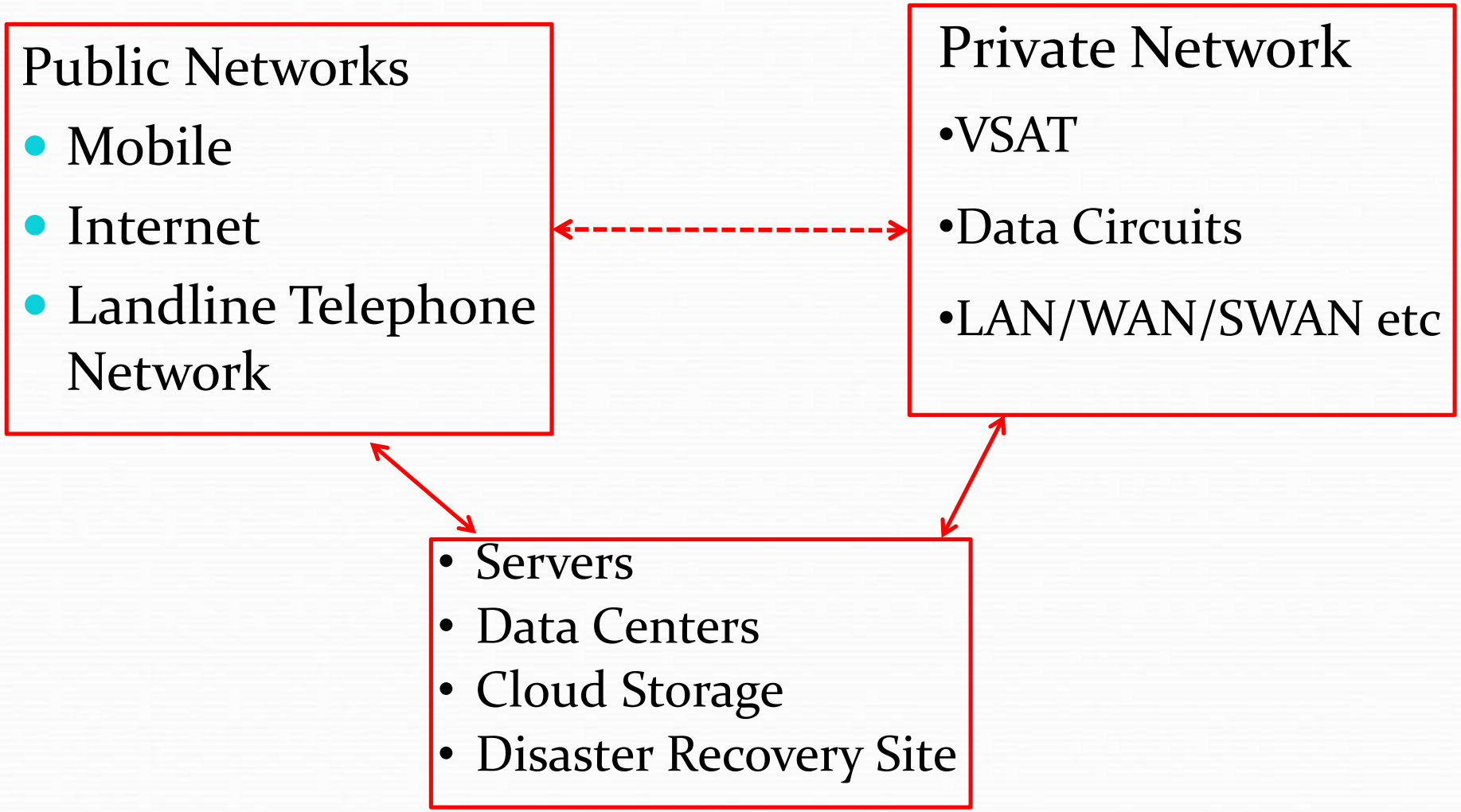
Resilient IT & Communication Infra Required For Disaster

- Prevention & Risk Mitigation
- Preparedness
- Timely relief and response
- Recovery, search and management

Success of Which Necessitates

- Integrated Emergency Management for
  - Visibility, cooperation and interoperability among stakeholders
    - Emergency service organizations, Government organizations, NGOs, community groups, private infrastructure operators etc

IT & Communication Network Infrastructure Involves



Communication during Disaster

- Network for first responder/ disaster managers

(i) Terrestrial network viz. landline, mobile, internet

(ii) Satellite Communication i.e. VSAT, Portable satellite terminals, Internet

(iii) Wireless communication viz. HF/VHF used by Defense, Paramilitary, Police etc.

(iv) HAM Radio

- Network for Public

(i) Terrestrial network viz. landline, mobile, internet, data circuits

(ii) Broadcast Network through Television & Radio

IT & Communication Infra Vulnerable to

- Earthquake
- Land Slide & Avalanche
- Fire
- Flood and Flash floods
- Cyclone
- Tsunami etc.
- Network designed vulnerabilities
- Cyber Attack

What happens to Communication Infra in Disaster

(Vulnerabilities of ICT Infra)

- Physical Destruction of Network Infrastructure
  - Destruction of equipment/Installation
  - Disruption in line connectivity
  - Disruption of routes
- Disruption in Supporting Infrastructure
  - Disruption in power supply, Fuel Supply
  - Water logging
  - Physical Damages
- Disruption Due to Congestion
  - High levels of voice/data traffic
  - Affected people seek to contact family and friends
  - Emergency personnel work to coordinate relief efforts

Need resilient infrastructure with diversified technologies for failsafe communication

Remedial Measures

- Regular monitoring of Communication Establishments towards resiliency.
- Redundancy and Path diversity / Satellite Backhaul / Microwave Links
- Feasibility of Alternative modes of Transportation.
- Alternate source of Energy / Power viz. Solar Power, wind energy etc
- Water proofing: All major electronic equipment (Exchange etc.), power plants (Gensets) and battery bank should be on high rise grounds.
- Provision of Intra Circle Roaming (ICR).
- Awareness among general public about not to use voice calls and communicate over SMS during disaster as far as possible.
- Priority Call Routing.

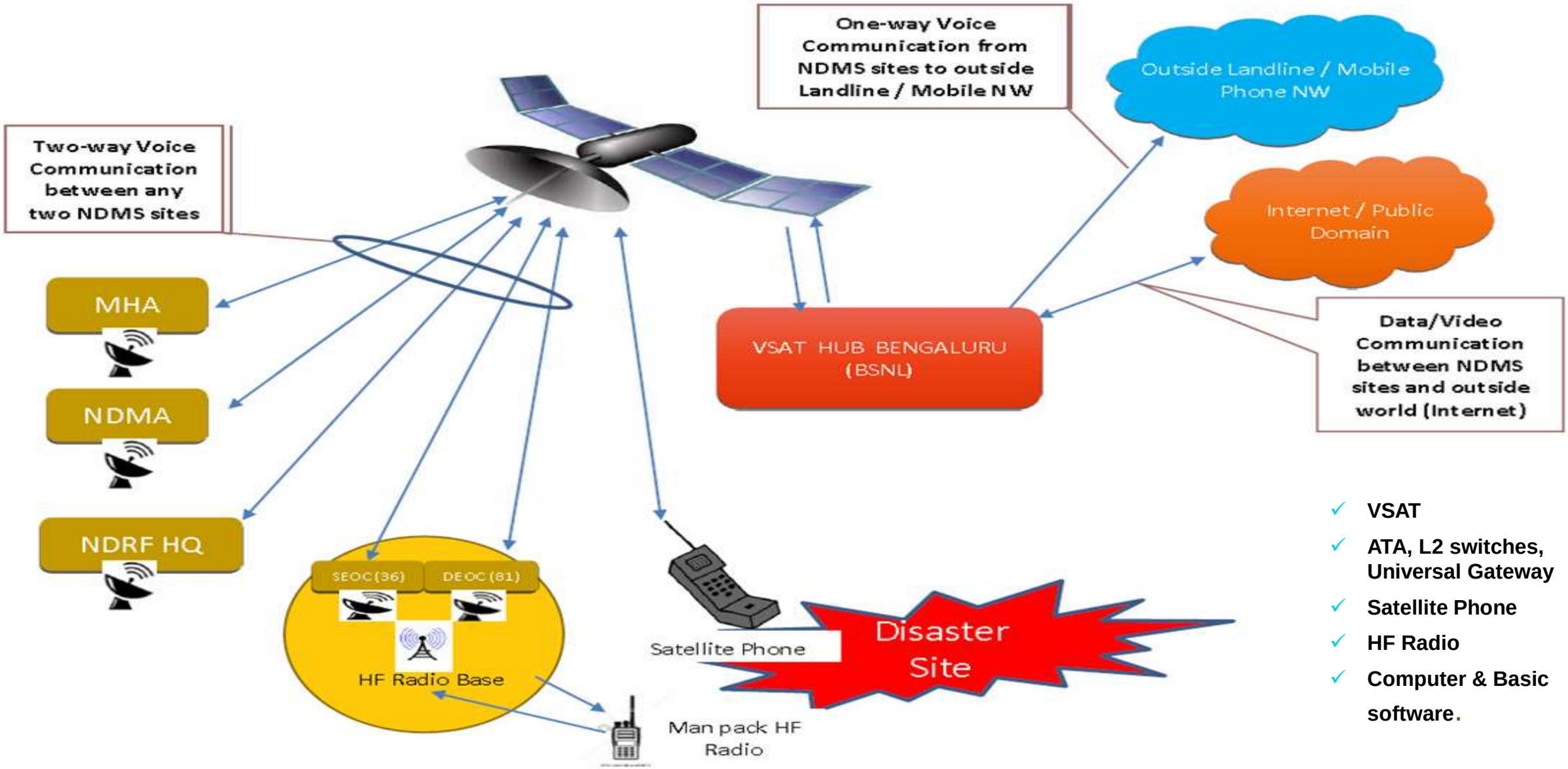
Alternative Disaster Resilient Communication measures (NDMA initiatives)

- National Disaster Management Services (NDMS)
- Common Alerting Protocol (CAP)
- Priority Call Routing
- Use of ICT (CDR) in DRM
- GIS database
- Emergency Response Mobile Vehicle
- HAM Radio
- LoRa Network for DRM
- Use of UAV in Disaster Management
- NCRMP

National Disaster Management Services (NDMS)

- Satellite Communication network backed with terrestrial network & HF Radio.
  - 120 locations
  - NDMA, NDRF HQ, MHA & 36 State / UT Capitals
  - 81 vulnerable districts
  - Provide failsafe communication infrastructure and technical support.
  - Facilitate Voice calls, Internet, Landline & Mobile
  - Capacity Building programme
- Can be integrated with existing networks like SWANs

SCHEMATIC DIAGRAM OF VSAT COMMUNICATION AT NDMS SITES



- ✓ VSAT
- ✓ ATA, L2 switches, Universal Gateway
- ✓ Satellite Phone
- ✓ HF Radio
- ✓ Computer & Basic software.

3 National Locations, 36 State / UT HQs and 81 Selected Vulnerable Districts

Common Alerting Protocol

- Automatic dissemination of Early Warning to targeted people in minimum possible time through multiple media like Mobile, Land Line, Internet, TV, Radio, Siren, Digital Signage etc. using CAP (Standard ITU protocol).
  - About any kind of hazard situation (Weather, Landslides, Earthquakes, Fires, Volcanoes etc.)
  - To anyone: the public at large; designated groups (civic authority, responders, etc.); or specific people
  - In any language understood by the respective region.
  - Geo-intelligent : in any geographical area selected with polygon
  - Enables simultaneous communication of alerts over all alerting media

Today's Public Early Warning Patchwork

Different Alerting Agencies-Different Dissemination Mechanism via Different Media

Limitations

- Delay
- Problem of interagency coordination
- Inaccurate geographical area for dissemination of early warning
- Duplicity / Omission

Alerting & Warning System Vision

All Alerting Authorities

Common Alerting Protocol (CAP)

IPAWS Alert Aggregators

Television

Radio

Cell Phone

Computer

Home Phone

Expressway Monitoring and Advisory System & Electronic Siren

CAP Implementation Status

- **Implemented :** USA, Germany, Canada, Australia etc…
- **Being implemented :** Finland

→ India : Initiative for CAP implementation

CAP : A Pilot Project

- CAP based Early Warning Platform for Disaster Management framework has been tested as pilot project
- Integrated with BSNL as output agency and IMD as input agency
- GIS based intelligence has been incorporated for Geo-Physical areas
- 2 tier approach with authentication feature at the moment

Future course of action

- Integration with other early warning agencies
- Integration with other Telecom Service Providers, RSS feed, Radio, Television, Electronic Sirens, Digital Signage etc.

Priority Call Routing for Network Congestion

- Facilitates decision maker's and management team's calls on top priority over general public.
- Network automatically drops call of low priority
- NDMA has associated Deptt. of Telecom (DoT) for implementation.

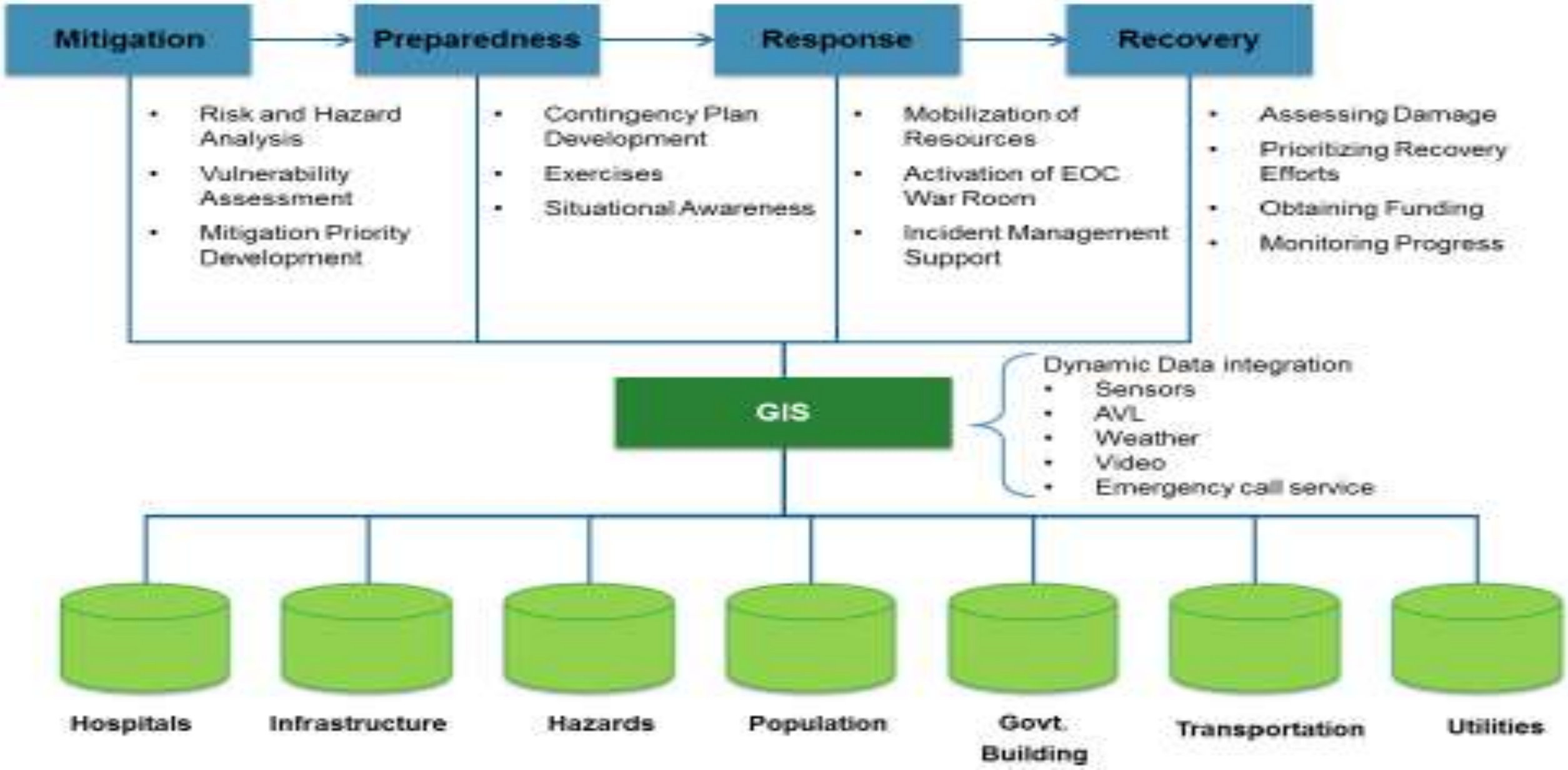
Geographic Information Systems (GIS) Database

- A spatial database management system that can analyze, query and display data using digitized maps and tables for planning and decision-making for DRR.
- Authoritative & Updated database would facilitated better management of all cycle of DRR.
- Decision support system
  - Image Analysis
  - Vulnerability Analysis
  - Resource Mapping
  - Incident Reporting
  - Analysis of route, buffer, proximity etc.
  - Risk Mapping

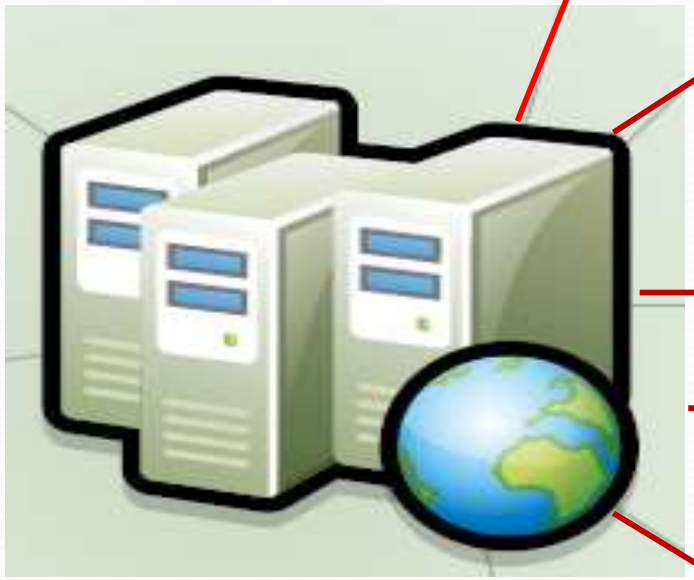
Geo-Database System at NDMA

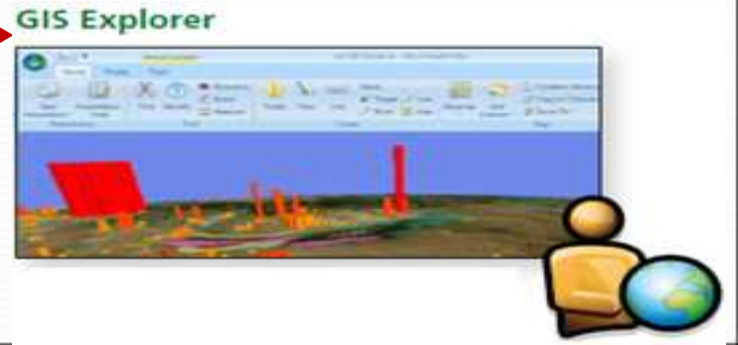
- Integrated geo-database management system for DM
- Web Service for data accessibility
- Provide a framework for decision-support need
- Geo-enable disaster data with intuitive mapping and analytical tools
- Provide critical information on time
- Provide basic life support information

GIS Support for Emergency Management



Server Supports a Wide Range of Applications





Mobile Applications for Disaster Risk Reduction

- **Incident Reporting System**
  - **Reporting system:** allows disaster managers & first responders to report incidents and other information.
  - **Emergency/Distress call:** The application allows immediate call to an emergency response office.
  - **Disaster Alert:** The application allows visualization of current weather and weather forecast updates.
  - **Geo-visualization System**: Map viewer to visualize the current user's location, nearby amenities, weather information and spatial extent of the disaster etc

- **Volunteer Registration System**

- **Integrated mobile application for disaster risk management**
  - Closest Facility
  - Shelter Location
  - Disaster Checklist
  - Do's & Don't

Social Media in DRM

- Leveraging reach through social media
  - Exponential propagation of news/ alerts
  - Mass awareness
  - Crowd Sourcing
  - “Mark Safe” feature
- CDR Analysis: Ascertaining the last activity location of missing people can help in SAR Operations.

Use of ICT (CDR Analysis) in Disaster Risk Management

- Nepal Earthquake

- NDMA opened call centre 1078 & received number of calls
- Non-traceable when tracked back, reasons may be drainage of battery, failure of communication system, no network coverage etc.
- NDMA arranged last location of person with help of DoT and Nepal Telecom
- Although this information took many days, however their last location was given to their kin / contact persons.

Emergency Response Mobile Vehicle (ERMV)

Useful for establishing the Communication from disaster site

Emergency Response Mobile Vehicle (ERMV)

- Designed to operate in adverse disaster situations .
  - ICT infrastructure
    - GSM/LTE/Wi-Fi equipment
    - Fixed satellite phone system
    - Wireless for last mile connectivity,
    - GPS and GIS enabled navigation,
    - Data wall
  - Power supply:-battery, generator, UPS, solar,
  - Public Address system.
  - Furniture, amenities and other conveniences.
  - Safety features.
  - Documentations and spares.
- Different sizes : modular or non-modular
- Modules can be transported nationally to work together or separate as per need

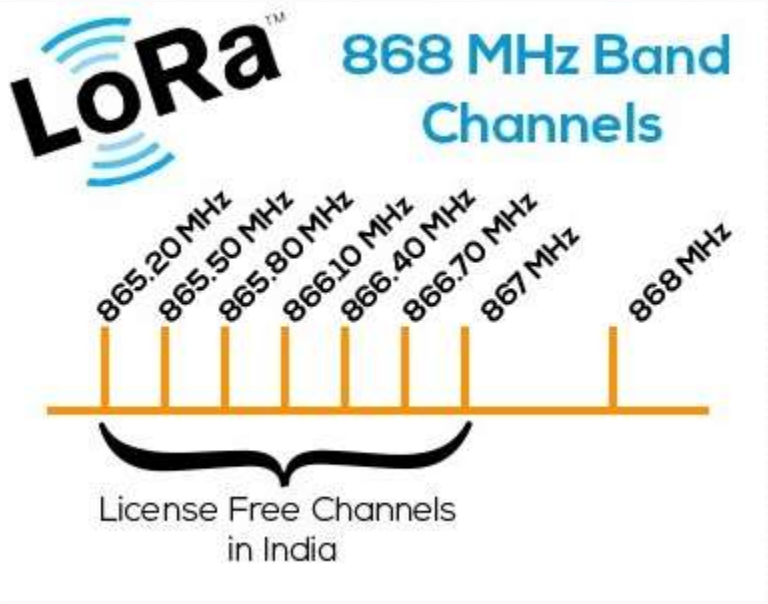
HAM Radio or Amateur Radio

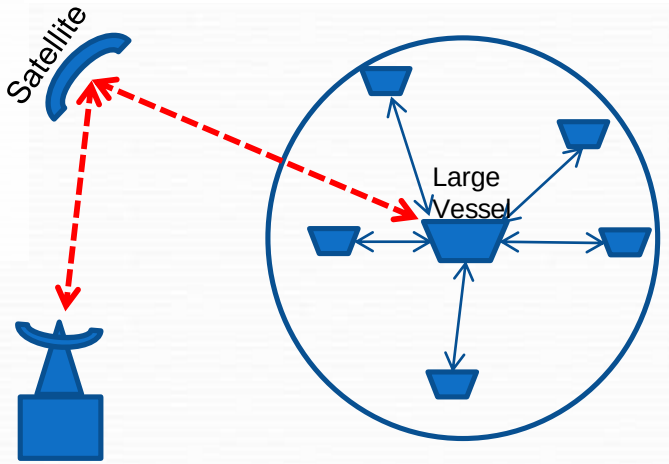
- A popular hobby and service bringing **people**, electronics and communication together.
- **People** use HAM radio to talk across town, around the world all without the Internet or cell phones.
  - HF, VHF, UHF covering almost all distances
  - Effectively used for augmenting the wireless communication of government agencies, particularly for public needs during disasters
- NDMA is actively considering to take HAMs on board in disaster response.

LoRA : Low Power Wide Area Network(LPWAN)

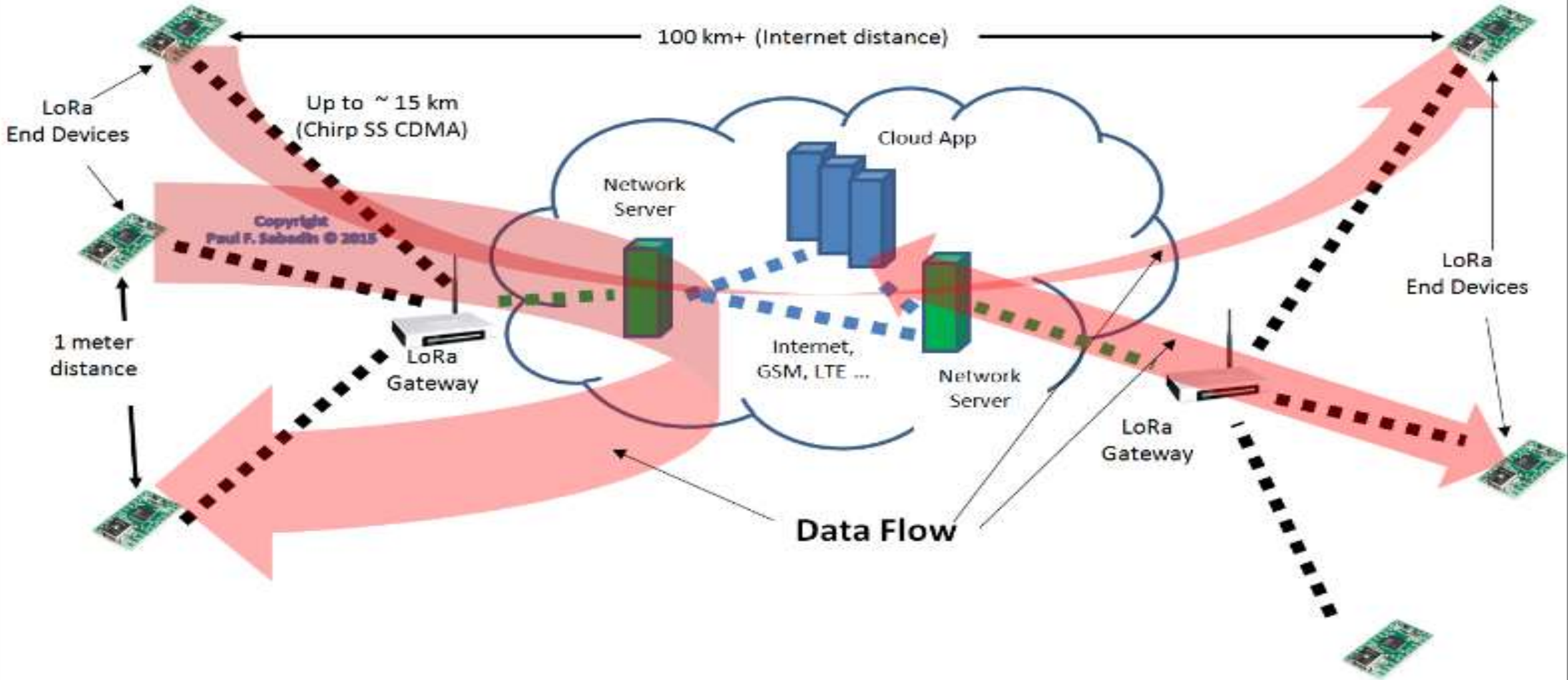
The most critical factors in a LPWAN are:

- Communication range upto 20-30 Km
- Long Battery life because of low power
- Robustness to interference
- Network capacity (maximum number of nodes in a network)
- One-way / two-way communication
- Can be used for boat safety
- Range can be extended by making a master node in large Vessels with satellite backhaul





LoRaWAN (Long Range Wide Area Network)

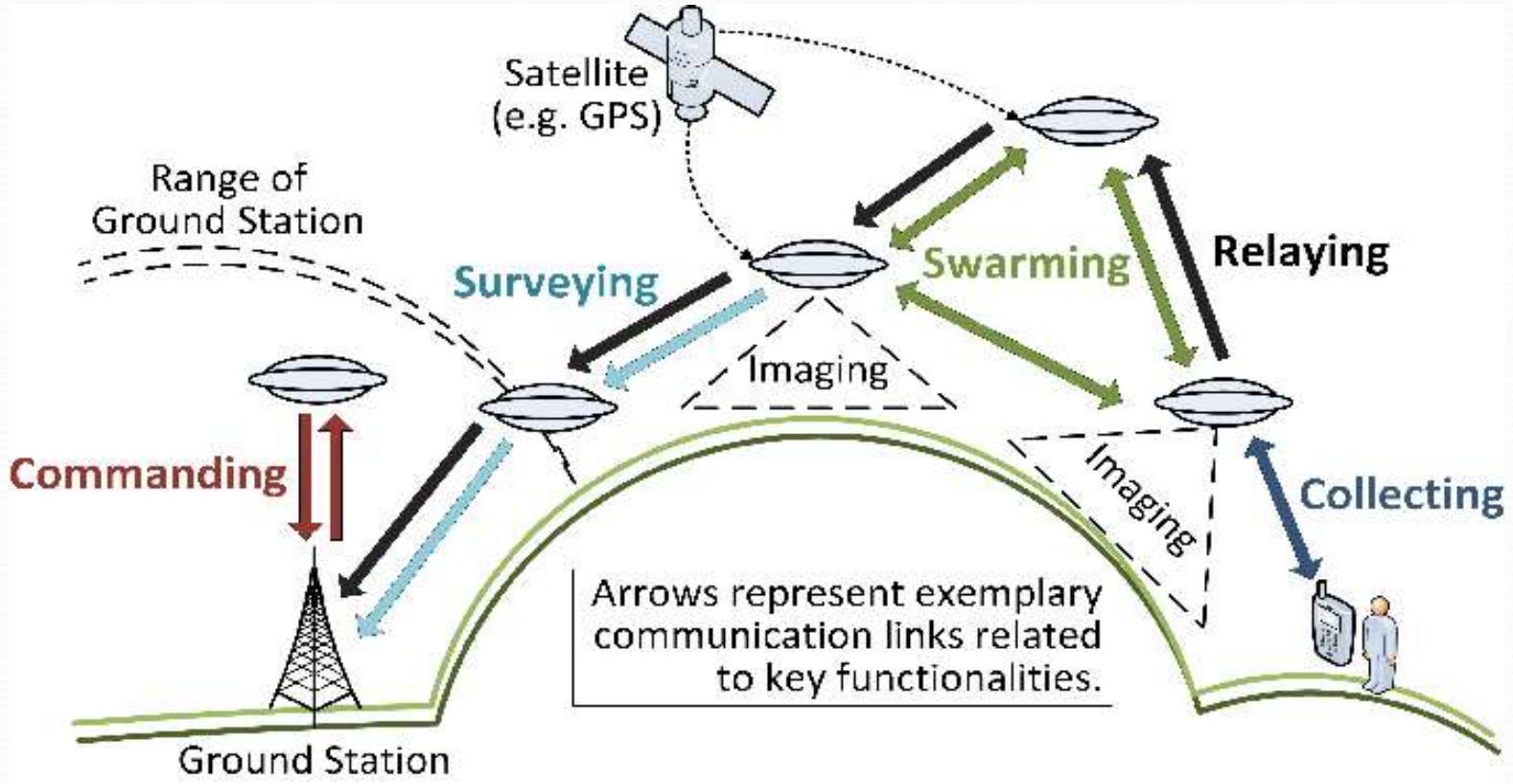


Application of Unmanned Aerial Vehicle (UAV) in Disaster Management

- High Resolution Mapping
- Vulnerability Risk Assessment
- Real Time Monitoring and surveillance
- Response, relief and rescue
- Post Disaster Need Assessment : Medical applications
- **To set up Communication Network**

UAV in disrupted network during Disaster

The UAV network will play a critical task by first establishing short-distance cellular connectivity with the affected users and then transferring data to the backbone cellular infrastructure via a relay network.



Addressing Cyclone Risk: *NCRMP Project*

- Reduce vulnerability of coastal communities to cyclone and other hydro meteorological hazards using :
  - Improved early warning dissemination systems
  - Enhanced capacity of local communities to respond to disasters
  - Improved access to emergency shelter
  - Strengthening DRM capacity at central, state and local levels
- Structural / non-structural measures to mitigate the effects of cyclones
- More than 750 shelters have been constructed
- Network elements

(i) DMR (II) Satellite Video Terminal (iii) Alert Siren (iv) Universal Communication Interface (v) Location Base Alert System

Thank You