

# Significance of Satellite Communication During Disaster

by  
Madhu Sudan Dahal  
Nepal

Space Science Mission  
Thailand

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# Abstract

- Satellite Communication has led to the development of solutions for various national development programs like disaster management, Tele-Education and e-Health care using telemedicine. Nepal is a small country with more than 30 million population, which is predominantly rural and distributed at distant geographical locations apart from the high-density urban areas. The recent severe earthquake of magnitude 7.8 is considered as the second strongest shake in Nepal ever. Tele-medicine using the satellite communication is playing an important role to address the health care requirements of people living in remote areas, rural areas, soldiers in battlefields etc. This describes utilization of Satellite Communication in providing solutions to areas of primary importance in rural development and also during times of emergency .

# How Satellites are used in Nepal

- Service Types
  - Fixed Service Satellites (FSS)
    - Example: Point to Point Communication
  - Broadcast Service Satellites (BSS)
    - Example: Satellite Television/Radio
    - Also called Direct Broadcast Service (DBS).
  - Mobile Service Satellites (MSS)
    - Example: Satellite Phones

# Cont....

- KU based VSAT system has been a technological boon for providing telecommunication services in rural areas
- Satellite services is put into operation for service continuity and to facilitate rescue team at times of natural disaster.
- KU band VSAT/DSAT network is being used as a backhaul for GSM Mobile at the base camp of Mount Everest.

# Satellite Status during Disaster

- Nepal has currently 1491 Satellite circuits using 26.5x1.024 Mbps capacity through Intelsat 60<sup>0</sup>E & 64<sup>0</sup>E Satellites.
- Nepal has 74 BTS ( 54 GSM & 20 CDMA BTS ) via satellite
- Nepal has about 400 VSAT Tele-centers , about 90 Internet lines & 585 customer phone lines via these telecenters.
- Nepal has 5 large Antenna , 3 C-Band & 2 Ku band viz STH-01B(11 M), STH-02A(16.4 M), STH-03B ( 9.3 M) in C-Band & two 6.3 m Ku band Hub antenna.

# April 25<sup>th</sup> ,2015, Saturday

- A 7.8 Richter scale earthquake
  - at 11:56 local time
  - lasted for about 56 seconds
  - Epicentre:
    - Gorkha: approximately 80 km North-west of Kathmandu.
- After shocks:
  - about 400 aftershocks measuring over 4 on the local Richter scale since then
- Initial government reports:
  - 30 out of 75 districts affected in the Western and Central Regions,
  - including Kathmandu Valley districts
  - with densely populated cities, rural and mountainous regions.
- 14 Districts most affected

# NEPAL EARTHQUAKE

## 2 0 1 5

Updated 21 May 2015



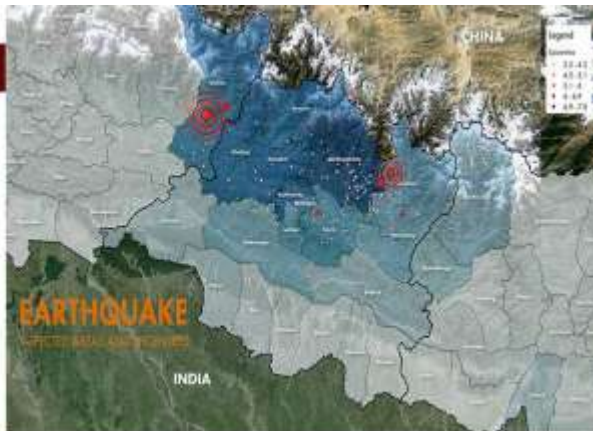
8,622 Dead  
16,808 Injured  
39 Districts affected  
2.8 million People displaced  
10 billion (\$) in economic losses

### MAJOR EARTHQUAKES

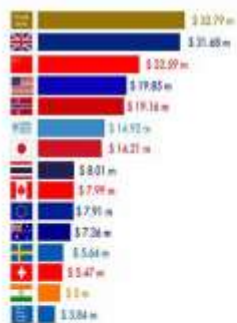
<b>7.8</b> magnitude 1.5 km depth 25 April 2015 (11:56 AM) Bajura, Gorkha Latitude: 28° 08' 49.2" Longitude: 84° 42' 28.8"	<b>7.3</b> magnitude 15 km depth 12 May 2015 (12:50 PM) Chitwan, Dolakha Latitude: 27° 50' 13.199" Longitude: 86° 4' 37.199"
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27 Dead	383 Injured
95 Dead	560+ Injured
4 Dead	200 Injured

### MOST AFFECTED DISTRICTS



### RESCUE AND RELIEF RESPONSE

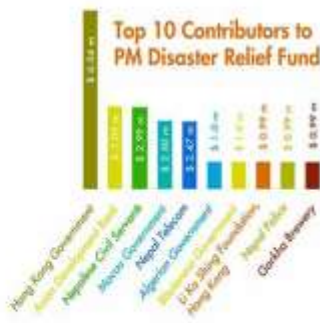


\$ 92.73 m

Relayed from PM Disaster Relief fund

\$ 13.83 m

Available in PM Disaster Relief fund



66,069 Nepal Army  
44,629 Nepal Police  
21,812 Armed Police Force

15,719.78 Tons Dispatched

703,234 Units dispatched

48 International Medical teams  
101,182 People Treated

### KEY ORGANIZATIONS ON THE GROUND

Small text describing key organizations on the ground, including their roles and contact information.

Sources: UNICEF, UNFPA, UNHCR, IOM, UNWFP, UNDP, UN Women, UNWOMEN, UNWOMEN, UNWOMEN





# Nepal: 2015 Earthquakes

Nepal experienced two major earthquakes on April 25 and May 12, 2015 at magnitudes of 7.8 and 7.3 respectively.

Number of people killed  
As of 03 Jun 2015

# 8,702

Number of people injured  
Source: UNRCO/Gov. of Nepal

# 22,493

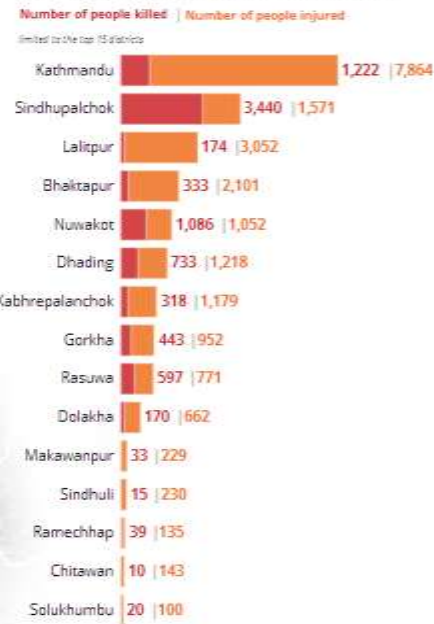
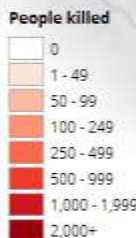
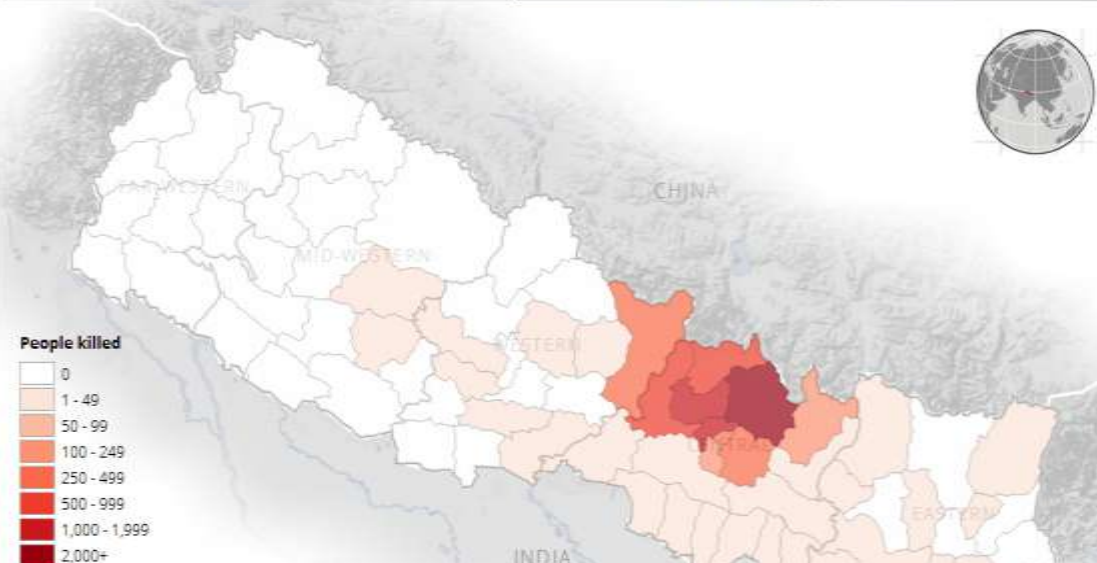
INTERACTIVE MAP

EARTHQUAKES AND AFTERSHOCKS

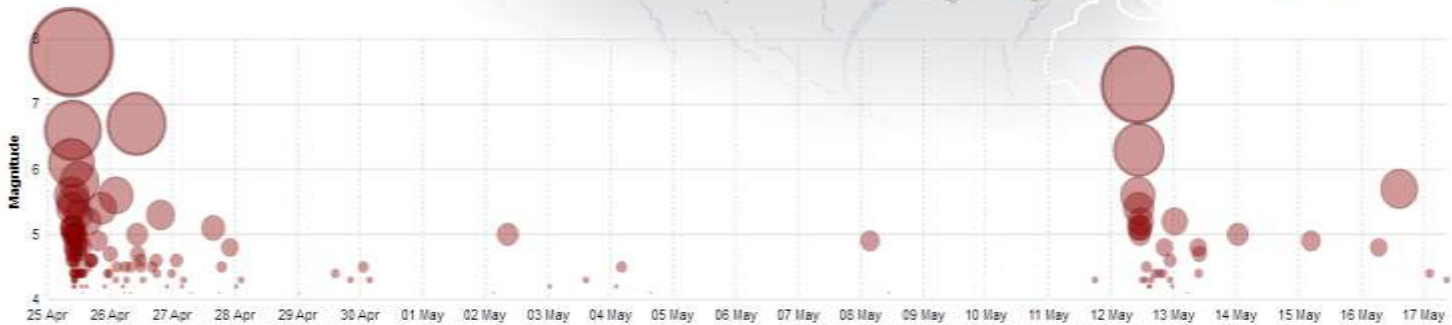
PEOPLE KILLED BY DISTRICT

PEOPLE INJURED BY DISTRICT

PEOPLE KILLED AND INJURED BY DISTRICT



EARTHQUAKES AND AFTERSHOCKS Source: USGS



## People killed by district



# Infrastructure damage- Nepal Telecom-the incumbent operator

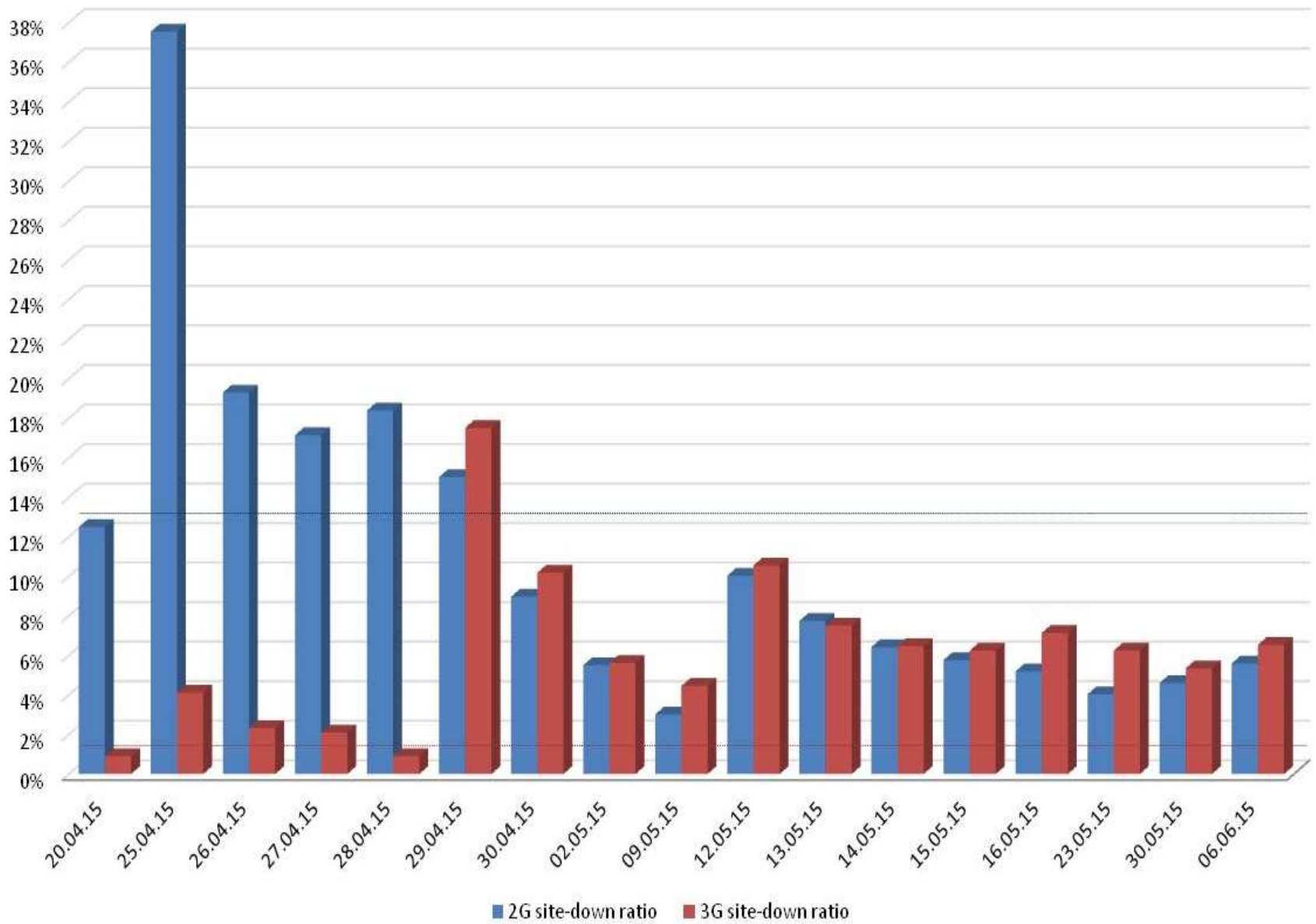
<b>S.N.</b>	<b>Asset</b>	<b>Count</b>
1	BTSs Affected	525
2	Transmission Towers Affected	10
3	Fiber Backhaul Affected	2
4	Microwave Links Affected	15
5	Physical Buildings Affected	197

# Damage in Backhaul

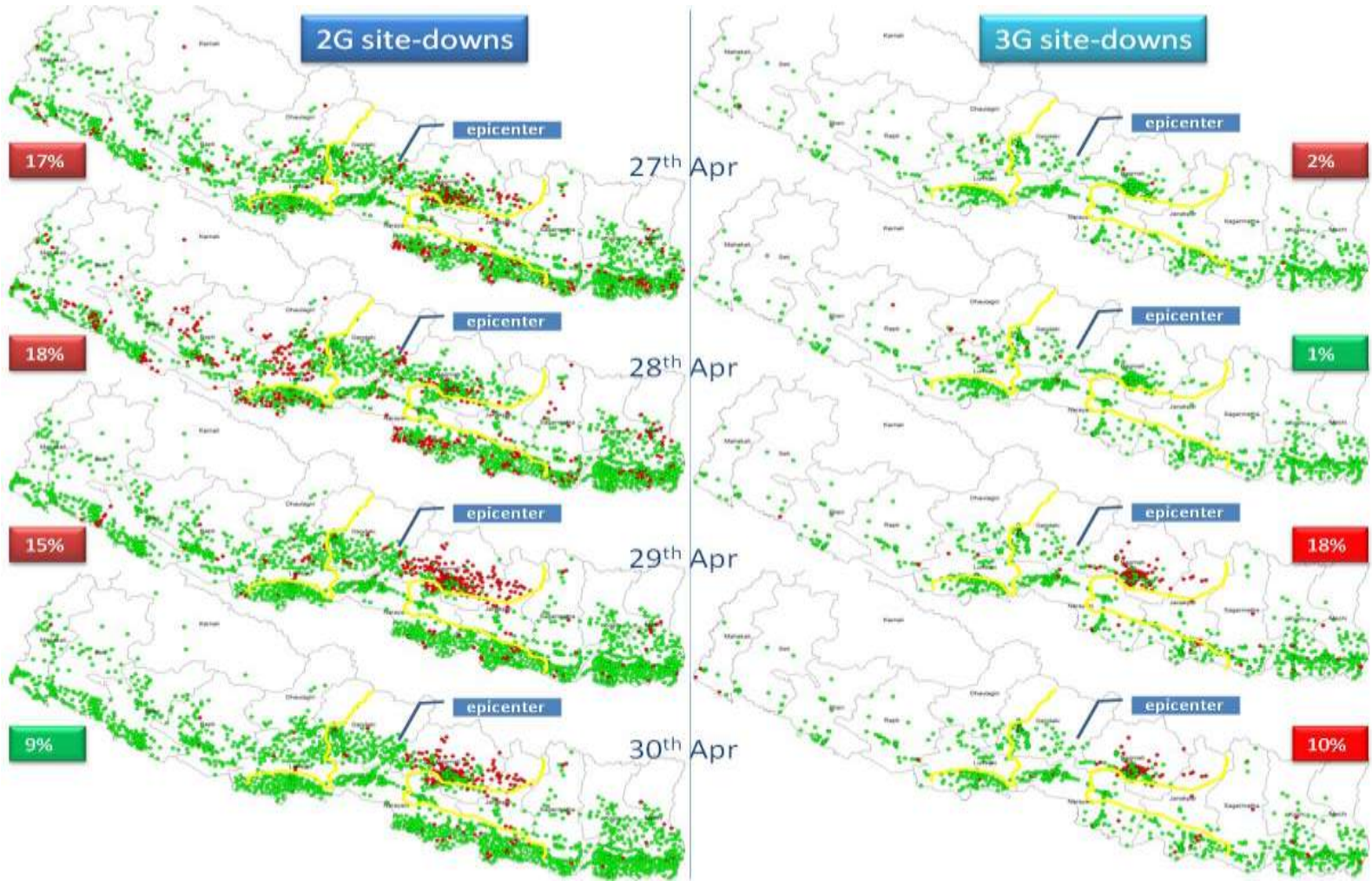
- Network fiber optic infrastructure and microwave links were damaged in a number of areas.
- There were fiber breaks on the hilly parts of the central region.
- Teams took action to recover fibers and microwave links, but the transportation was problematic due to closed roads and landslides.

# Satellite data : important

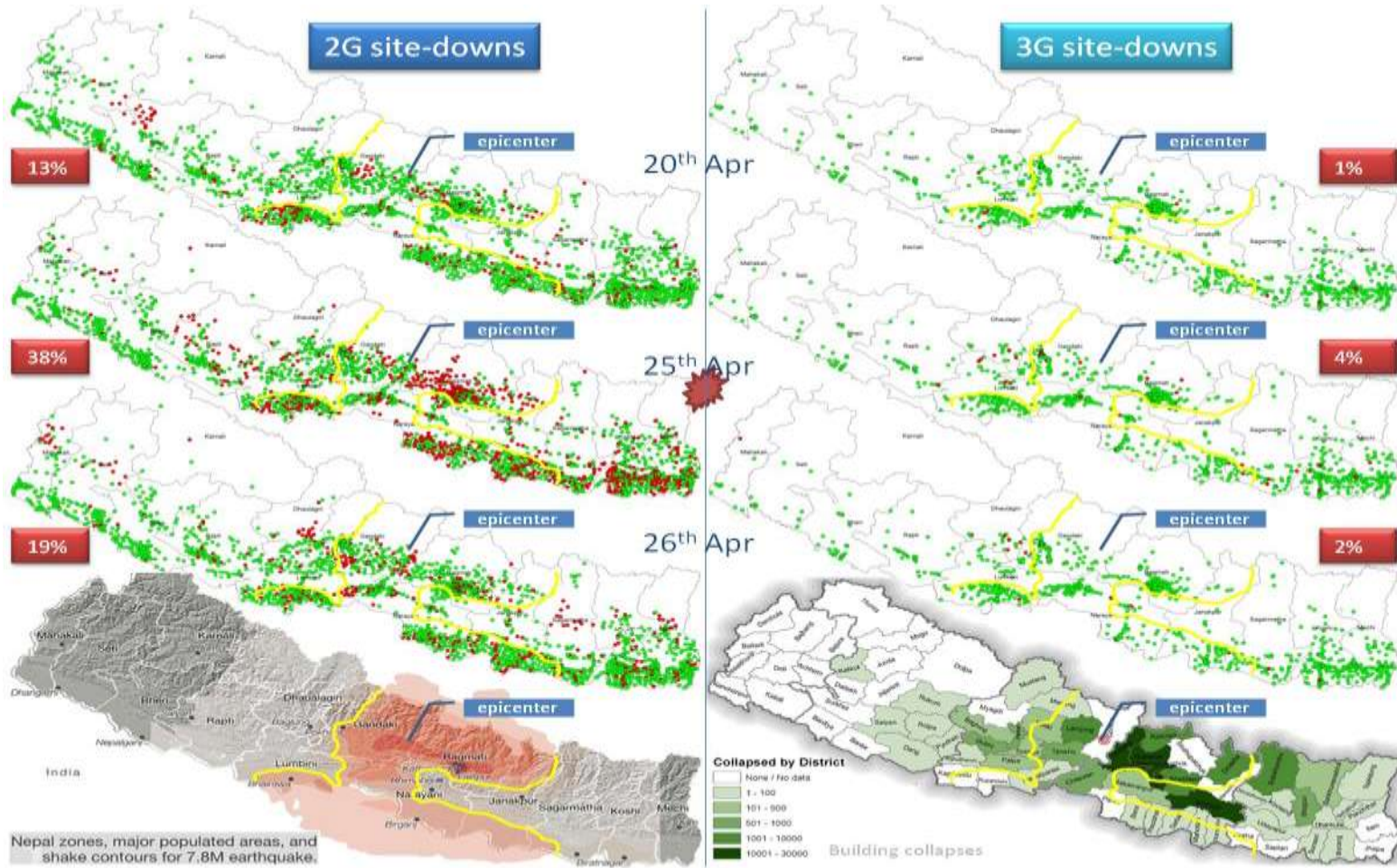
- A commercial company in USA, instructed its satellite, orbiting at 617km above Earth, to start capturing the affected region to support disaster response efforts in Nepal by opening access to satellite data for crowd sourcing analysis which helped initially to identify 3,128 damaged buildings, 1,191 locales of major destruction and 1,129 damaged roads.
- The American Red Cross team began building a “shake map” that shows the areas hit hardest by the earthquake using US Geological Survey EarthExplorer data.



**Site-down ratio**



Site status between 27<sup>th</sup>-30<sup>th</sup> April, 2015



**Site status before and after the earthquake**



Damaged network equipment



**Ad-hoc devised mobile base station**



# Ad-hoc solutions

- Teams devised mobile base stations on a vehicle to increase the coverage and capacity. This solution speed up the recovery process where transportation is possible.
- satellite communications provide unprecedented communications capabilities to a wide range of institutions and communities in disaster areas.
- While major telecommunications facilities were indeed destroyed early on by targeted strikes, Internet service providers were quickly able to fall back to a more decentralized array of secondary links - satellite links, cellular networks, and even amateur packet radio

# Satellite Status during Disaster

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# Post Earthquake Activities in Telecommunications Sector

- The service providers provided free sms, calls for about a week
- Additional unused frequency in the 900MHz band for growing traffic management
- Quick decisions with regards to equipment import for operators
- Nepal Government started collecting information about the operational aspects of telecom services and encouraged the operators for early service recovery

# ITU Assistance

- International Telecommunication Unit (ITU) contributed with satellite telecommunications equipment,
  - 35 satellite phones,
  - 10 **BGAN** terminals along with
  - 10 laptops for the BGANs,
  - 25 solar chargers for satellite phones and
  - solar powered batteries.
- Training on the use of the equipment was also provided to different agencies.
- ITU provided technical assistance in formulating Emergency Telecommunication Continuity Management System-draft received recently

# Free Communications..

- It was a challenge for the citizens outside of Nepal to reach and know their loved ones are safe, being able to connect really matters in this situation.
- Microsoft Skype made all Skype calls to landlines and mobiles in and out of Nepal free of charge from 27<sup>th</sup> April to 15<sup>th</sup> June.
- In Australia;
  - Vodafone customers received free calls between Australia and Nepal from 25 April to 1 May (post-paid), from 29<sup>th</sup> April to 5<sup>th</sup> May (pre-paid),
  - Telstra offered free voice calls and texts made from post paid mobiles and fixed lines to Nepal from 12<sup>th</sup> May to 19<sup>th</sup> May,
  - Optus mobile and fixed customers received free standard voice calls to Nepal from 14<sup>th</sup> May to 20<sup>th</sup> May.
- In Germany,
  - T-Mobile allowed free calls and texts to Nepal from 25<sup>th</sup> April to 31<sup>st</sup> May for both prepaid and postpaid customers with a recommendation to restart their phones right away to receive free data if customers are in Nepal.
- In USA;
  - Sprint, Boost Mobile and Virgin Mobile made calling and texting to Nepal free to all postpaid and prepaid customers from 25<sup>th</sup> April to 16<sup>th</sup> May.
  - AT&T did not charge customers for text messages or International long distance calls from U.S.A, Puerto Rico and U.S. Virgin Islands to Nepal from 25<sup>th</sup> April to 31<sup>th</sup> May.
  - Viber switched off 'Viber Out' billing so Nepal users can call any destination for free

# Actions undertaken to restore mobile network

- The core mobile communication network equipment, major POPs and backbone links were not very much affected in the earthquakes to cause total disruption of services.
- 38% of 2G and 4% of 3G network sites were down after the earthquake. The field operation teams and outsources went to the down-sites to recover them. There were 3 challenges:
  - The building collapsed:
    - They could not recover. For some important sites new sites were established.
  - The building damaged:
    - If it was safe to climb to the top of the building where rooftop tower exist, teams recovered.
  - The building was sound and solid but the site equipment damaged:
    - The building owner did not allow entrance:
      - The owners see the rooftop towers as a risk, they wanted to dismantle them.
    - The building owner allowed the entrance:
      - Teams recovered the down-sites
- Mobile network operators needed network equipment; they started the import procurement process for the equipment that was not available in the country.
- After the earthquake the grid power went down.
- Depending on the battery reserves, sites remained to work between 8-14 hours.
- Then power problems raised in the up and running sites, teams changed the batteries by transferring mobile generators among the sites where there is way to go either by car or on foot.

# Animal Prediction

- Unusual animal behavior prior to a disaster
- Greece, 373 BC, rats, snakes and weasels deserted days before an earthquake
- Advanced vibrations?
- Change in electrical charges?
- Change in magnetic field?
- **So far, unable to use unusual animal behavior to predict earthquakes**

# Satellites perform best when...

- Terrestrial infrastructure is damaged, destroyed or overloaded.
- Interconnecting widely distributed networks.
- Providing interoperability between disparate systems and networks.
- Providing broadcasting services over very wide areas such as a country, region or entire hemisphere.
- Providing connectivity for the “last mile” in cases where fiber networks are simply not available.
- Providing mobile/transportable wideband and narrowband communications.
- Natural or manmade disasters occur.



# Thank you for your Time

**Mount Everest : Highest Point**



**Birth Place of Buddha**

