# Using Location-Based Social Networks for Disaster Management

## Presentation for the
## United Nations/Latvia workshop on the
## Applications of Global Navigation Satellite Systems

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Yuval Ne'eman Workshop for
Science, Technology
and Security

UNOOSA

TEL AVIU UNIVERSITY

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# Outline

## MOTIVATION



Flickr.com

## ENABLERS



iphonebuzz.com

## ASSUMPTIONS



discovery.com

## CASE STUDIES



standard.net

## CHALLENGES



hackingtricks.blogspot.ccm

## RECOMMENDATIONS



Esa.int

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May 15, 2012

# Motivation

- Based insights from a research for Israel Emergency Authority

- Using infrastructure grids as sensors for situational awareness in crisis

- Analysis of most deployed infrastructure grids (electricity, gas, water, ICT, alarms etc.)

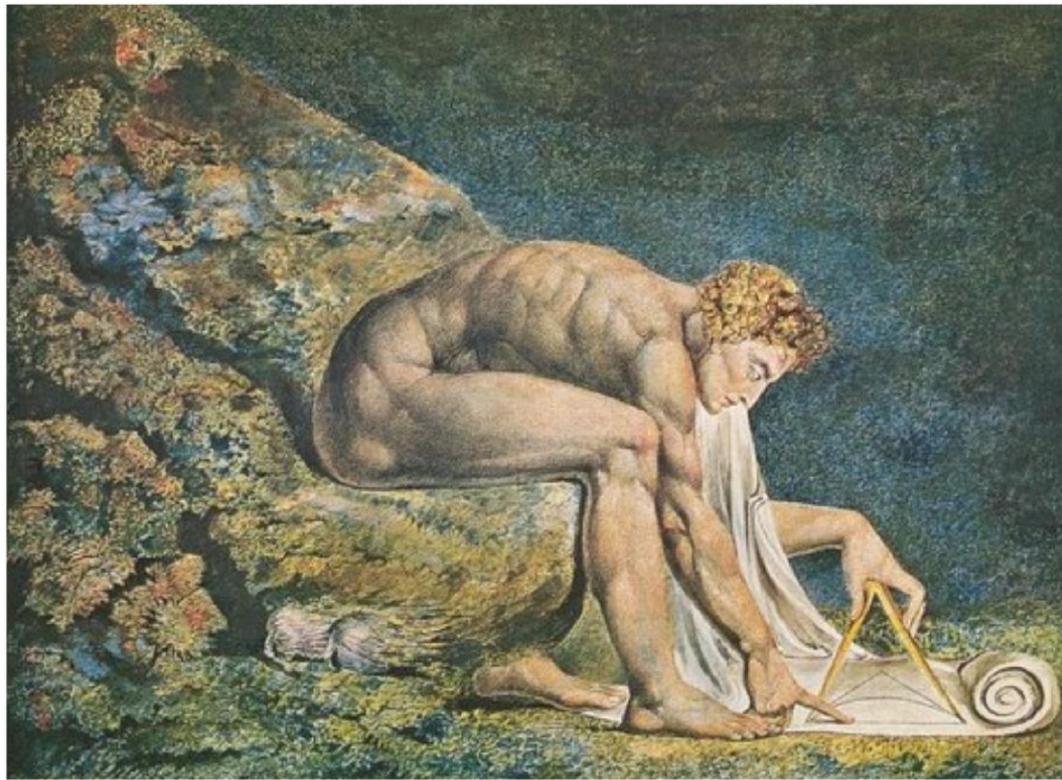- Key finding: new sensors are needed

- Mobile Crowdsensing for Emergency

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# Current Research

- Social Networks Applications (SNA) are a new phenomenon that changes the way people communicate

- GNSS based SNA applications are used for various applications: social navigation, geo-social consuming, etc.

- Search and rescue efforts recently show increase use in SNA+GNSS that is likely to increase

- <span style="color:red">How could SNA be utilized in crisis management to better respond in future crises?</span>

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# Mobile Crowdsensing

"Mobile crowdsensing applications leverage consumer mobile devices (e.g., smart phones, GPS gadgets, and cars) to collect and share information about the user or the environment, either interactively or autonomously, towards a common goal."

Source: IBM




Nasa.gov


talentgenius.co.uk


May 14, 2012
geek.com/

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*"If I have seen further
it is by standing on the shoulders of giants"*

-Sir Isaac Newton





William Blake, Newton, 1795
Source: http://blog.julianlass.com

Augmented Reality in NYC, 2011
Source: http://www.gizchina.com

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# Trend 1 - GNSS

- GPS IOC in 1993, Removal of Selective Availability in 2000
- GLONASS announced IOC on GNSS meeting December 2011
- Areas covered with up to 4 systems
- Price, size and **power consumption** decreasing dramatically

**"Global shipments of GNSS-enabled mobile phones are expected to reach 1 billion in 2020. This is driven by increasing attractiveness and affordability of devices …"**

(The Space Report 2011)



Levi
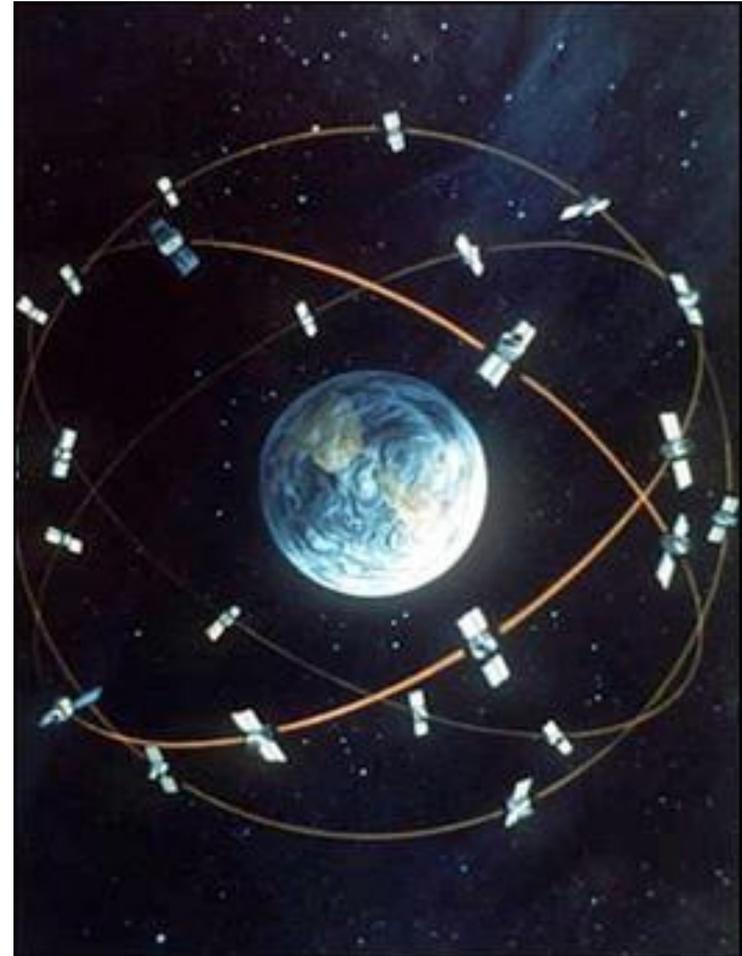
# Trend 2 – Internet

- Began in 1960s but rapid commercial acceleration in 1990s

- Services less than "15 years old": Email, search wikipedia, social networks, e-payments, blogging and more

- Recent development of cloud services as part of BCP.



Source: isoc.org

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# Trend 3 – Social Networks



facebook

December 2010

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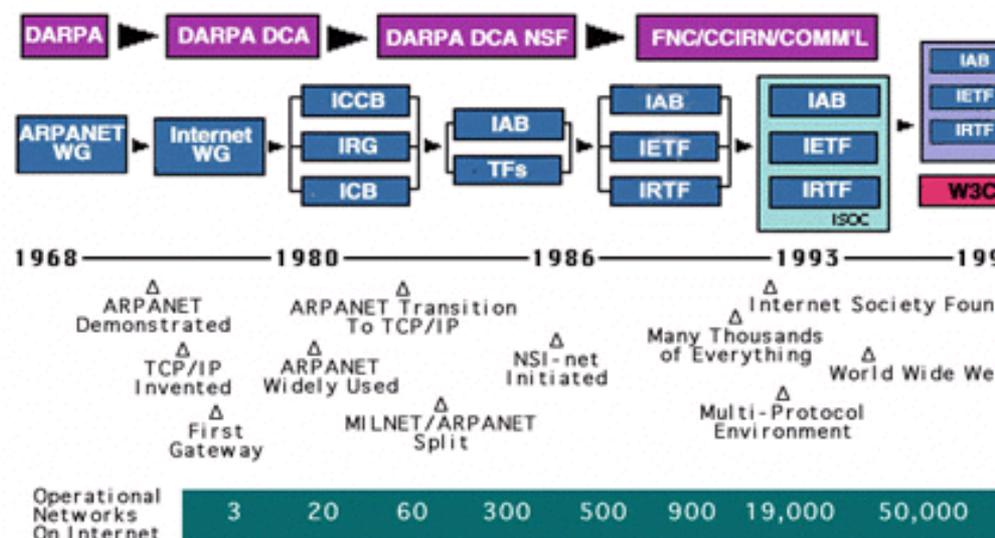
# Trend 3 – Social Networks

- Increase the speed at which a community can better communicate, coordinate, mobilize and use resources

- User spending more time on social networks

**Community resilience and the ability to adapt to change is related to the strength of its social networks**

(source: National Research Council)

Source: facebook.com

am Levi

May 14, 2012

# Benefits of Social Networks

- <span style="color:red">Interactivity</span> – Users can interact and disseminate information in one-to-many and many-to-many forms
- <span style="color:red">Virallity - messages can be exponentially spread using online services.</span>
- Measurability – online actions of users can be measured
- Documented history – actions online can be stored for past analysis.
- <span style="color:red">In sociological terms, ongoing contact with people can improve resilience.</span>
- Information intelligence gathering  to improve situational awareness in crisis.

# Trend 4 – Smartphones and applications

- *Global increase in mobile-cellular subscription*

- Mobile Apps

- Integrated MULTI GNSS GPS and GLONASS (iPhone 4s)

- High relevance to emergency response

Cellular Subscriptions
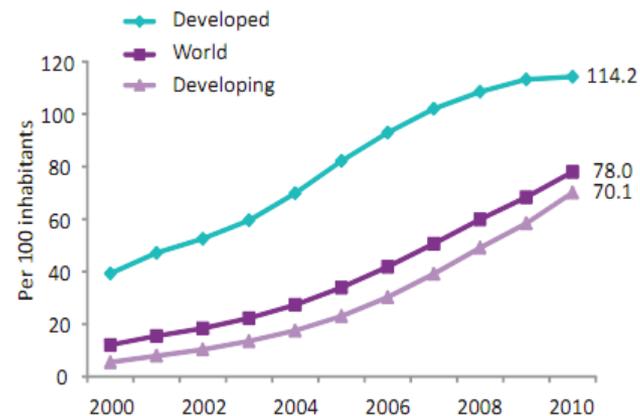


Broadband Subscriptions



Source: ITU

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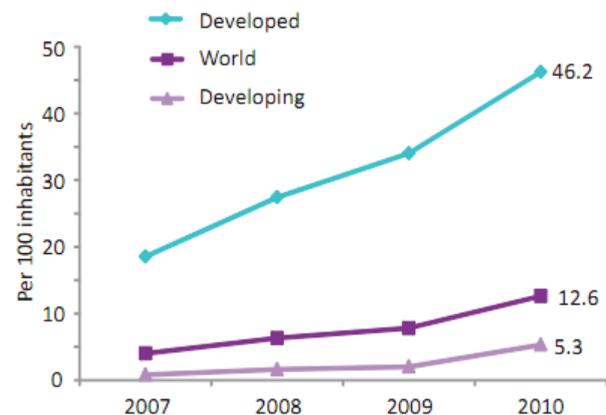
# Timeline of Major Technology

**Social Networks**

Hotmail **1996**

PayPal **1998**

Facebook **2003**

Twitter **2006**

Wikipedia **2001**

YouTube **2005**

**Internet**

Email 1966

Arpanet **1967**

Internet **1995**

Google **1997**

**1960**    **1990**    **2000**    **2011**

**GNSS**

Satellite Triangulation **1970**

GPS / GLONASS IOC **1993**

GPS s/a **2000**

GLONASS renewal **2001**

GLONASS IOC **2011**

**Mobile & Cellular**

GSM 2G **1991**

1st SMS **1992**

Palm Pilot **1996**

Wi **1997**

3G / WiMAX **2001**

iPhone **2007**

Dual GNSS iPhone 4S **2011**

Quad Core Galaxi SIII **2012**

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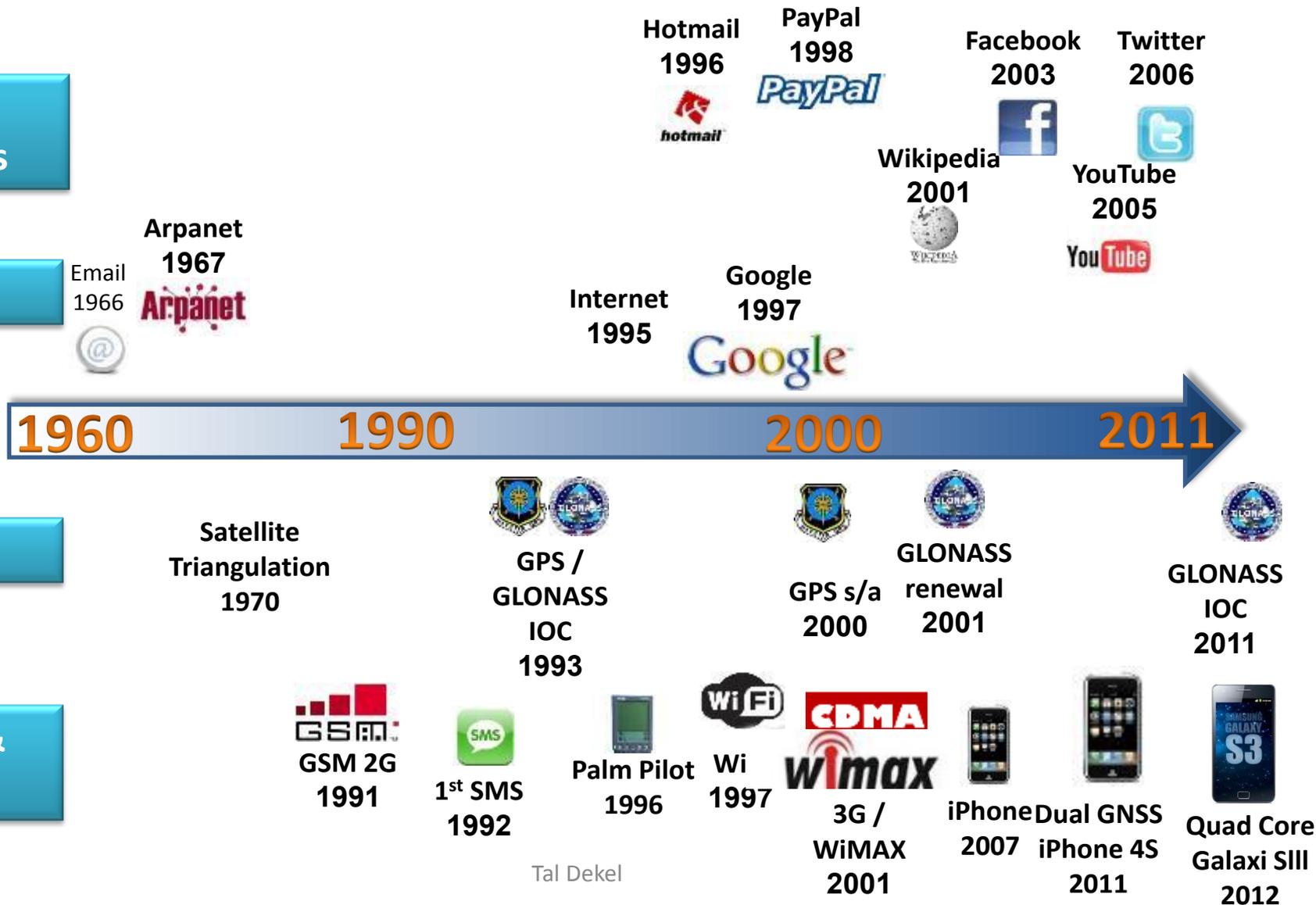
# Assumptions

- Tools that will be used in the early stages of a crisis are the ones used before the crisis.

- Communication is essential and thus be restored.

- Changing communication ways are forcing governments to integrate solutions in working platforms instead of developing new ones

# Case Study -1

## 2010 Haiti earthquake



UN Mission Building Port Au Prance

Source: http://news.bbc.co.uk/2/hi/americas/8458690.stm

# Introduction
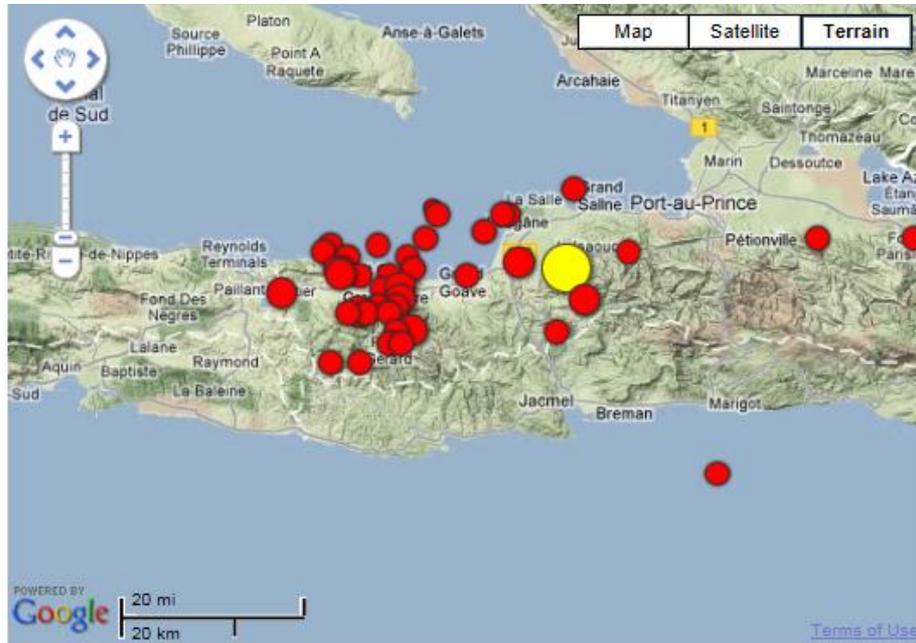


Earthquake and aftershock map





Tent City in Port-au-Prince area
Source: http://www.heartlandalliance.org/international/updates.html

# Communication infrastructure
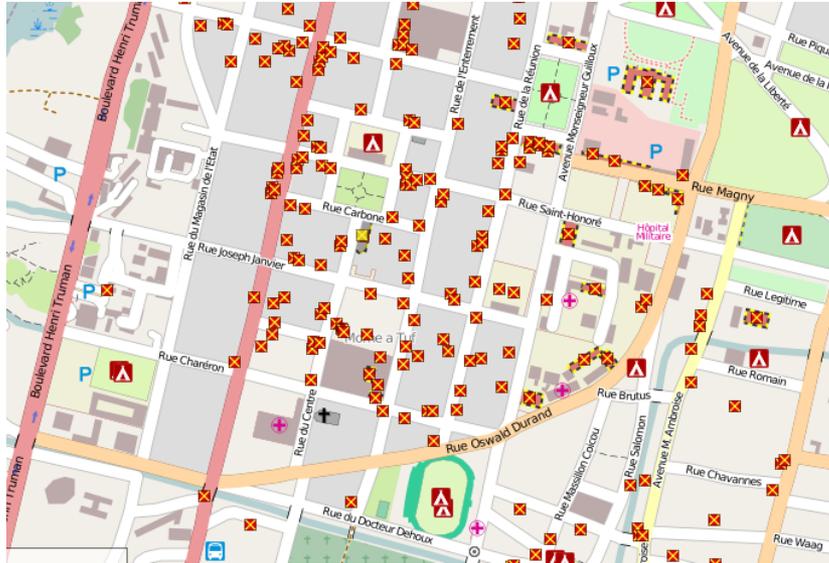


Haiti Earthquake damage map
Source: OpenStreetMap





Damaged communication infrastructures

Source: http://www.itu.int/ITU-D/emergencytelecoms/response/haiti2010.html

# All Partners Access Network (APAN)
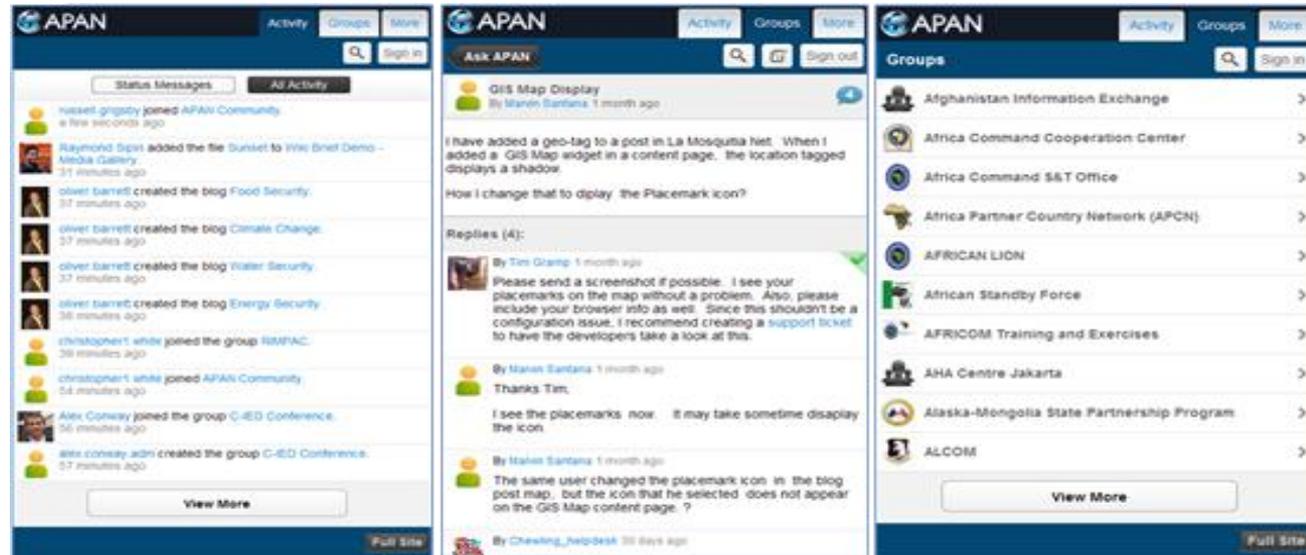


APAN mobile app screen shots

Source: APAN.org

# Mission 4636
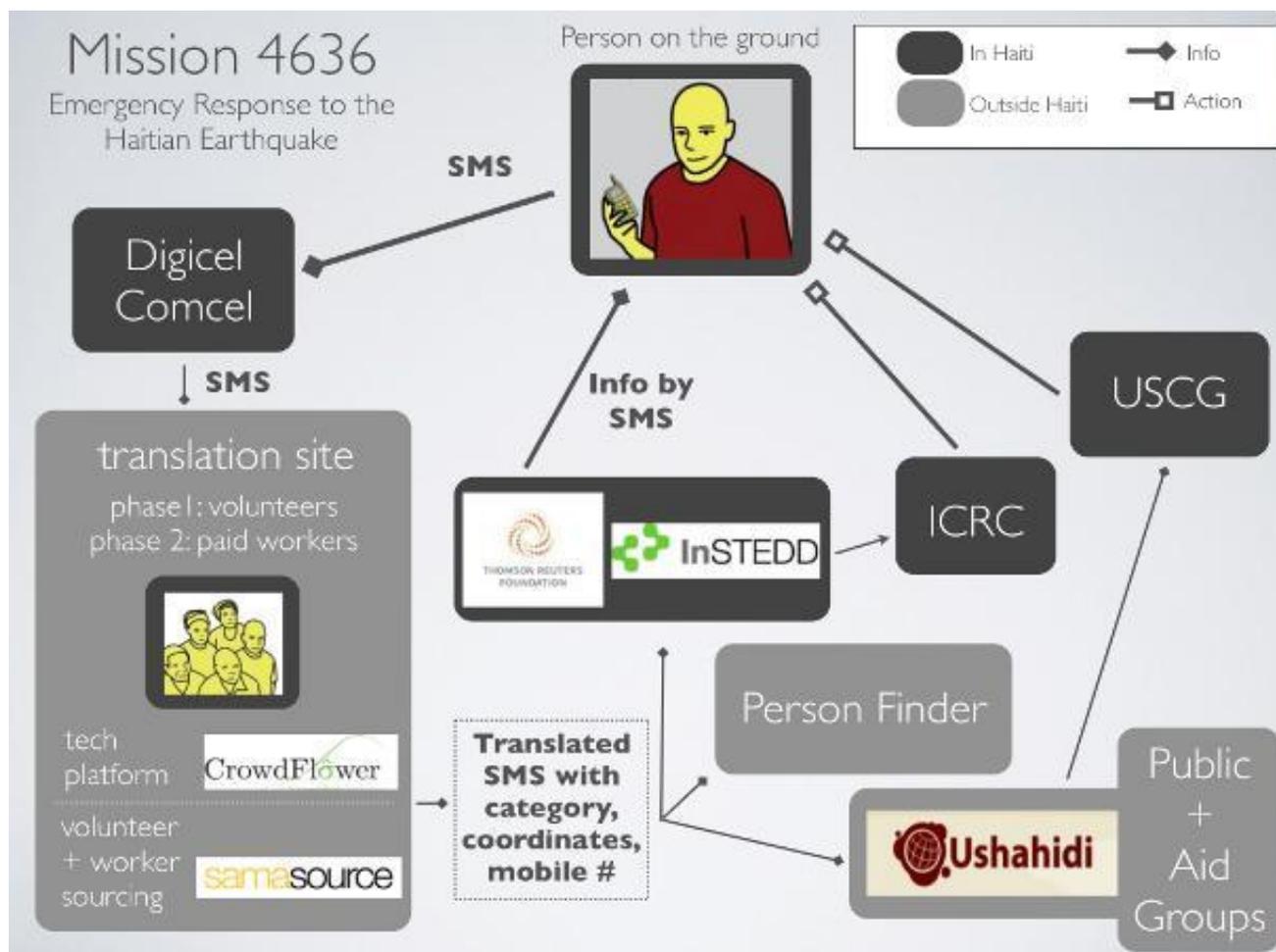


Mission 4636 architecture
Source: http://www.search-internetmarketing.com/tag/mobile-services/

# Disaster management systems



Ushaidi Report Map
Source: http://haiti.ushahidi.com/

# Google Crisis Response Team
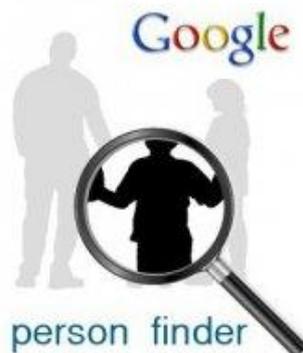


Google earth images before and after the earthquake
Source: http://www.pcworld.com/article/186897/google_earth_reveals_the_devastation_in_haiti.html

# OpenStreetMap Response team

# Success stories



Health facilities location



The Israeli hospital – Haiti
Source : http://www.tampabay.com



Israeli search and rescue team in action
Source : http://www.vosizneias.com

# Case Study -2

## 2011 Japan earthquake and tsunami



People wait to be rescued in Kesennuma, Miyagi Prefecture March 12

Source: http://www.boston.com/bigpicture/2011/03/japan_earthquake_aftermath.html

# Introduction







The U.S. Indian Ocean Tsunami Warning System (IOTWS)

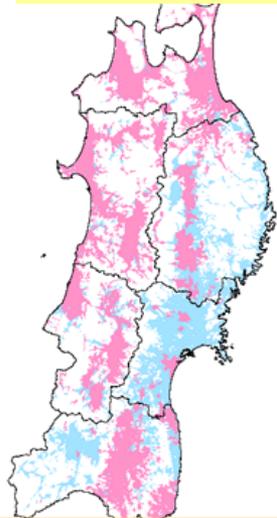Source: http://www.boston.com/

Source: http://www.boston.com/bigpicture/2011/03/japan_earthquake_aftermath.html

# Communication infrastructure
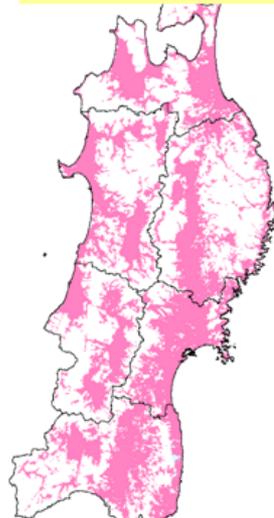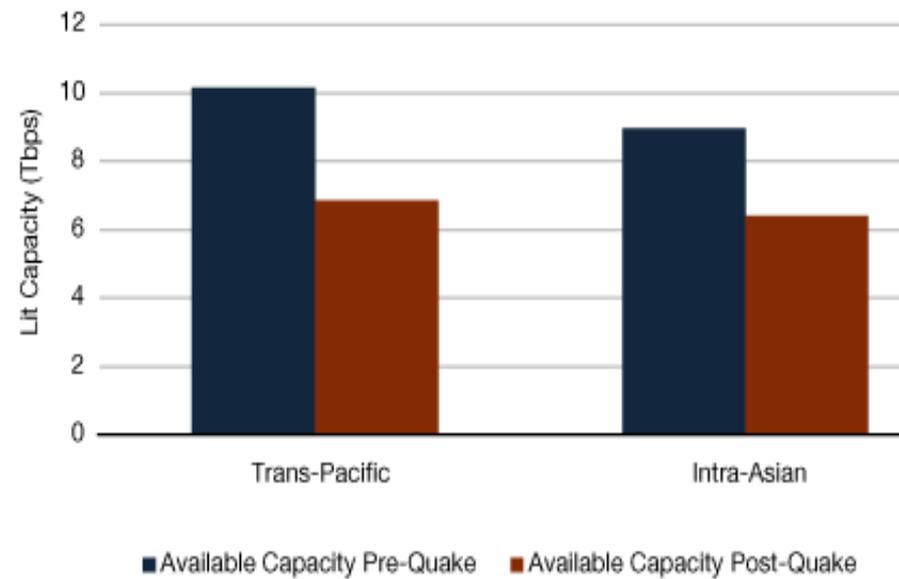


NTTDoCoMo disaster recovery scheme
source: http://www.nttdocomo.com/disaster/index.html

Earthquake's Impact on Japanese International Bandwidth
Source:http://www.telegeography.com/press/press-releases/2011/04/11/earthquakes-and-red-tape-challenge-carriers/index.html

# Introduction

"While there are so many technologies at this time that isolate us …social networking tools have shown their ability once again to unify us as human beings"

**Fumiya Imagawa**

I'm in Japan, near Tokyo. Our transportation is train, but some rails got broken. My father is in a business trip. I wish he returns ASAP.

Like · Comment · March 12 at 12:28am via mobile · 🌐

#Japan: Telephone lines disrupted; try contacting loved ones by email, text (SMS) message, or through @twitter & #facebook. #earthquake

TravelGov, [+] Fri 11 Mar 08:17 via web

**Japan Earthquake**
Widespread Tsunami waning but no threat to Australia says BOM.

**Tsunami warning for pacific region after 8.8 magnitude quake strikes Japan | News.com.au**
www.news.com.au

THE Pacific Tsunami Warning Centre in Hawaii says a tsunami warning is in effect for a large swathe of the Pacific after a magnitude 8.8 earthquake hit Japan.

Like · Comment · Share · March 11 at 9:45am · 🌐

Tweet from US state department
source: http://idisaster.wordpress.com/

# Online search and rescue efforts
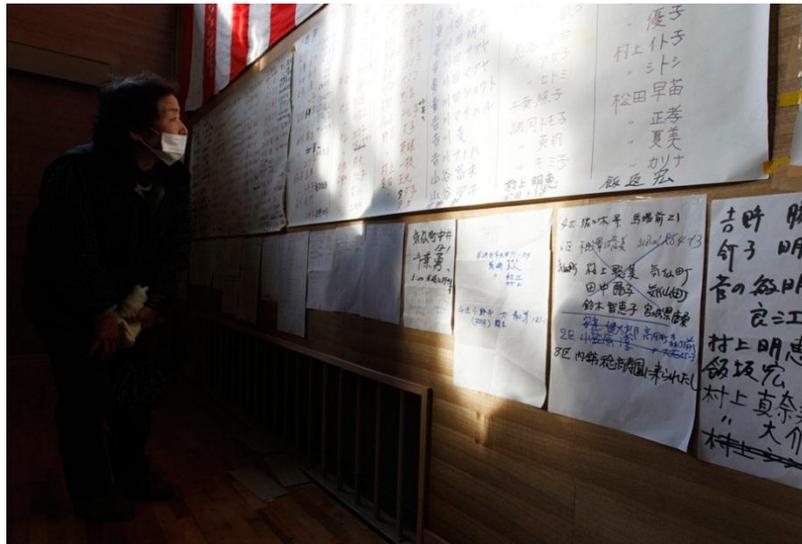




Survivor looking for relative survivors

Source: http://www.boston.com/bigpicture/2011/03/japan_earthquake_aftermath.html

Google person finder received 7000 request in the first few hours

Source: http://www.kochiservnet.com/

# Google Crisis Response Team
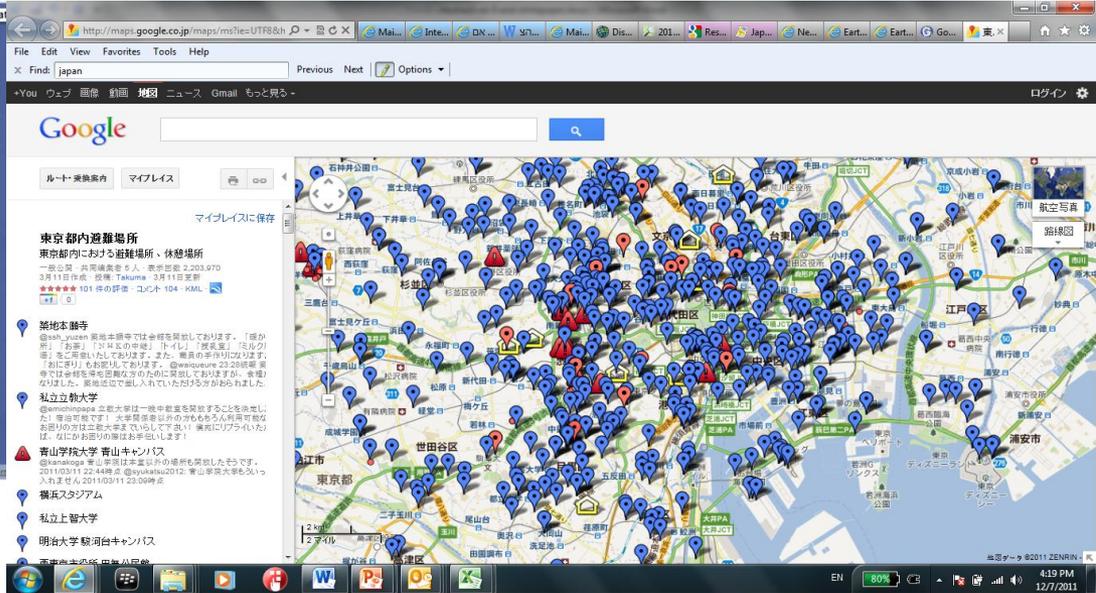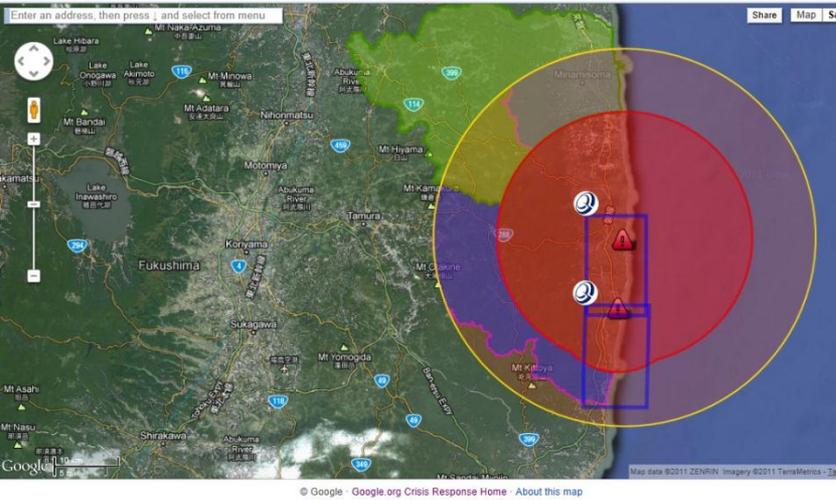


Goggle maps updates on affected ares  source:
http://crisislanding.appspot.com/?crisis=japan_earthquake_2011



Google maps update on  Locations of impromptu shelters

http://maps.google.co.jp/maps



Earthquakes in the last week  map
source: http://googlemapsmania.blogspot.com/2011/03/japanese-earthquake-maps.html
http://earthquakes.tafoni.net/?lat=37.23032838760387&lon=146.22802734375&type=map&zoom=6

# Youtube Person Finder



Source: http://www.nitro-digital.co.uk/blog/2011/04/12/natural-disasters/

# Disaster management systems

# Observations & Conclusions

- In crises people use the same communication methods they use in everyday life with higher intensity

- Unmanaged peak of traffic can cause collapses of the network

- Social networks are lifelines for survivors in the disaster areas

- Translation and location were major efforts for Search and rescue teams in the presented test case

- Social networks served mainly S&R teams in Haiti while in Japan both population and S&R teams used the network

# Challenges

- Rapid restoration of communications
- Gapping the digital divide
    - Developed and developing countries
    - Young and elderly
    - Government entities and the public
    - Men and women
    - Urban and rural areas
- Avoid overwhelming of the network
- Avoid spread of misinformation and Dishonesty
- Understanding of the Social Network Applications by local emergency authorities

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# Recommendations

- Infrastructure Level
  - Prepare relevant regulation and guidelines for cellular  providers preparation to different crisis scenarios

  - Examine network redundancy options, including broadband satellite links or microwave

- Traffic Level
  - Prioritize data over traditional telephony
  - Prepare filtering systems for congestion control

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# Recommendations

- Application level
  - Survey popular social platforms and add "emergency features"
  - Prepare "social channels" in popular social networks
  - Develop Data mining tools to increase crisis situational awareness

- Increase Awareness Programs
  - Communicate with citizens regularly through social networks
  - Train government authorities and decision makers

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# Recommendations

- R&D for knowledge gaps
  - Deepen crowdsensing  R&D
  - Promote local research on Information flow during crisis
- Government Initiatives and International Agreements
  - Constructive and proactive dialog with major social network operators and online services such as Google, Facebook and NGO developing search and rescue software
  - Prepare network cloud based command and control centers (local, regional, international)
  - Encourage innovation through international organizations

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# Summary

- Social networks GNSS based applications used in emergency and crisis

- GNSS, mobile networks and the internet are critical enablers

- Governments need to integrate in a changing communication environment

- Encourage innovation and invest in R&D

- New possibilities for International cooperation

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# Using Location-Based Social Networks for Emergency Response

# Thank You!

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