WIRELESS INTERNET

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GREAT EAST JAPAN EARTHQUAKE (東日本大震災)

- 20 thousands of people were died or lost
- 400 thousands of people evacuated initially (now it is around 70 thousands)
- 120 thousands of houses were broken
- 180 thousands of houses were half-broken

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EARTHQUAKE AND THE INTERNET

- The disaster reminds us that we need to revisit our activities
  - What we did?
  - What we could do?
  - What we should do?

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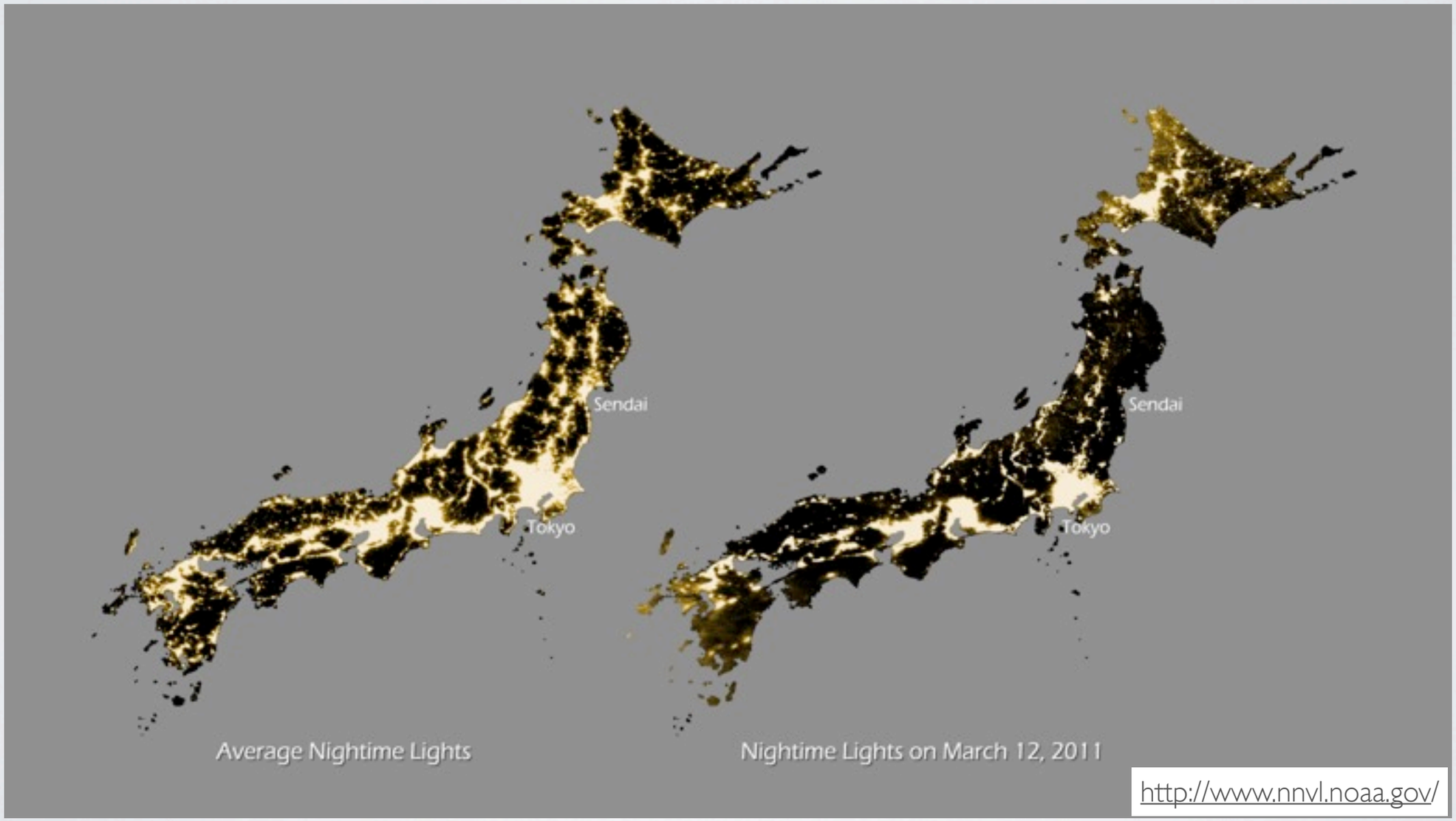
EARTHQUAKE AND THE INTERNET

- Great contribution of the Internet technologies
  - Safety confirmation using Twitter / Skype
  - Local information dissemination which is not covered by public broadcasting
  - Information sharing using mash up technologies

EARTHQUAKE AND THE INTERNET

But... Who actually could use the Internet?



EARTHQUAKE AND WIRELESS

- Great contribution of wireless technologies
  - Mobile carriers' base stations operated with emergency backup battery (first few hours)
  - Satellite links setup by carriers and volunteers (e.g. PDRNET) (for months)
  - 3G-WiFi bridge to the Internet (after 3G network is recovered)

EARTHQUAKE AND WIRELESS

- We reconfirmed that
  - The wireless communication technologies are quite useful
  - Especially in the case that the communication infrastructure is widely damaged

TECHNOLOGY PIECES

- We've researched and developed a lot of wireless/radio access technologies and operation techniques

- Unidirectional Link Routing (UDLR): Internet routing technologies for asymmetric communication paths such as satellite links

- Asian Internet Interconnection Initiative (AI3): Construction and operation of a satellite network covering east asia region

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TECHNOLOGY PIECES

- We also have a lot of research output in mobile area
  - Mobile IP/LIN6/MAT: IP mobility technologies in L3
  - MANET: Mobile ad-hoc networking
  - DTN: Message dissemination technologies for intermittent connectivity

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DID INTERNET SUCCEED?

- Yes, in some sense: e.g. Twitter, mashuped web services
- Not sure considering as a connectivity provider
  - Satellite links, 3G links, and WiFi bridges worked well, but what about other technologies?
  - Is the limit of the Internet?

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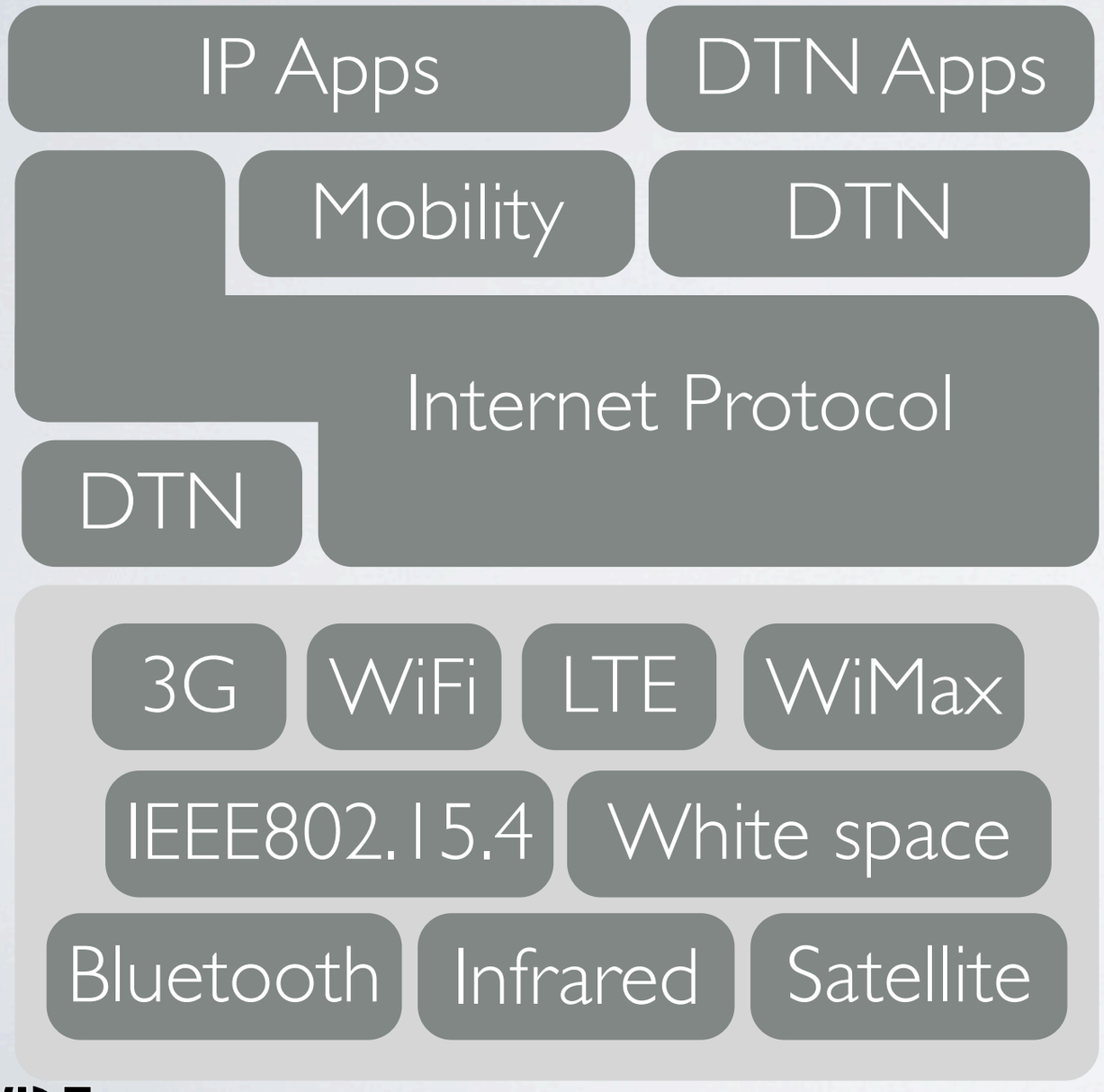
DID INTERNET SUCCEED?

- What was the problem?
  - The succeeded technologies are self-completed
    - 3G, Satellite
  - Needless to say, individual technologies are good, however, most of the researchers are focusing only specific issues and have quite narrow view

WIRELESS INTERNET

- The core points
  - IP should be the main component as a glue to bind various information technologies
  - We need to invent flexible wireless operation technologies that is free from existing wireless operators
  - There are a various wireless/radio technologies and many of them are significantly different from wired technology

LAYERS



- We tend to accept L2 properties as is, which may result in ineffective use of L2 functions
- We may hesitate to send requests from IP's point of view to L2 designers

REQUIREMENTS

- Final goal is to deliver a piece of information
- Internet is required to deliver a bit of packets whatever the methods are

REQUIREMENTS

- Radio
  - Freely available and usable radio bands for constructing ad-hoc L2 link
  - Wider range (wider coverage) radio band
  - Autonomous radio frequency allocation and coordination techniques to share precious radio resources among non-authoritative radio users
  - Better antenna design to avoid radio interference
  - Software radio technologies

REQUIREMENTS

- Local L2 link establishment
  - Zero configuration link establishment among devices using the same radio technology
  - Autonomous and automatic segmentation of L2 link to keep scalability of L2 communication
  - Autonomous radio band allocation and coordination to avoid radio conflict

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REQUIREMENTS

- Local L3 link establishment
  - Autonomous and automatic addressing of L3 locators
  - Autonomous registration of L3 identifier and name to locator resolution mechanism

REQUIREMENTS

- L3 interconnection

- Dynamic coordination of L3 locators and identifiers among several L3 links interconnected over wireless networks

- Locator routing mechanism and identifier dissemination mechanism among several L3 links

REQUIREMENTS

- L3 interconnection
  - Coordination technology of local L3 routing and global routing
  - Support of intermittent connectivity
  - Gateway mechanism between stable connectivity area and intermittent connectivity area

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REQUIREMENTS

- Applications
  - New application design model that doesn't depend on TCP
  - New service registration mechanism where there is no global connectivity

DO NOT FORGET

- The reason why Twitter and Skype and Web worked well
  - People got used to use those applications in their daily life
  - No technology will be used in emergency situation unless it is used everyday
- No wireless Internet technology will be used unless it is used everyday

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TOTAL COORDINATION

- Designing a complete architecture and operation scenarios including applications is important, not just thinking a single problem

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WHAT TO DO

- Design a new Internet architecture that will be a combination of managed backbone operators and unmanaged leaf volunteers
- Requirements definition for L2, L3, and upper layers to enable full wireless Internet connectivity and applications
- Revisiting of network and transport protocols that fit wireless Internet
- Keep requesting for more flexible use of radio resources
- Prototyping and experiments using wireless testbed

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