Future Internet for The Other Billions

2008.10.28

Kilnam Chon
Keio University, KAIST

- Would you like to be without the Internet access?
- Only one billion out of 6.5 billions in the world have the Internet access today.

Example: One Million Schools

- How can we connect one million schools in Africa, China, India,…?
- Can the current Internet technology handle such a network? Or, do we need "future internet technology"?

Contents

1. History of the Internet

1960s Research on computer networks

1970s Arpanet - predecessor of the Internet

1980s Global research & education networks

1990s Commercialization

2000s Becoming social infrastructure

2. The Internet Today

1 Billion Users with

- ~ 500 millions with computers
- ~ 500 millions with cellular phones

3. Issues on the Internet toward Future Internet

Security

Mobility

Scalability

Management

4. Future Internet Projects around the World

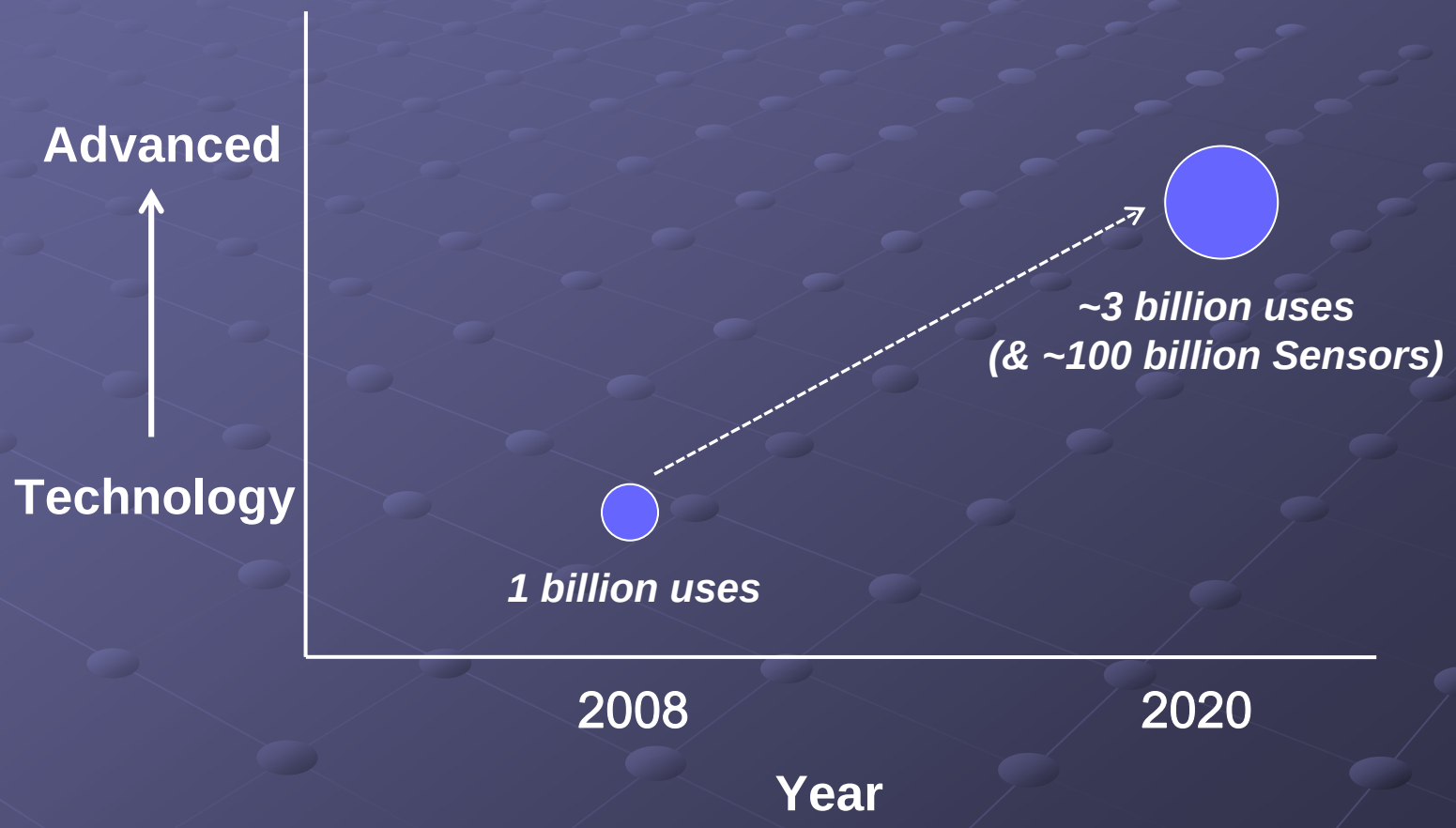
USA: NSF(GENI, FIND,...)
Federal Government

Europe: FP6/FP7

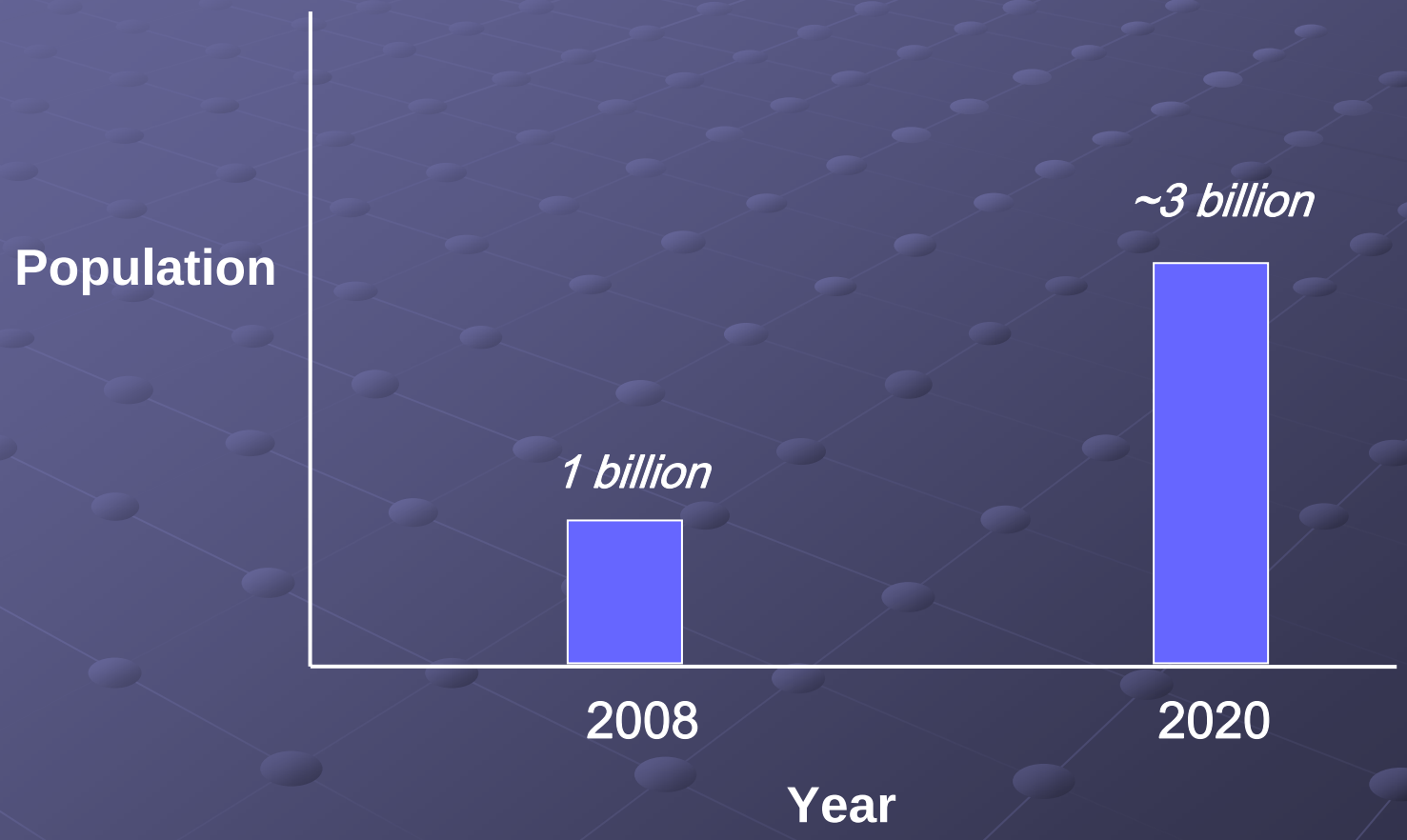
Asia: China/CNGI
Japan/NWGN
Korea/FIF

5. The Other Billions

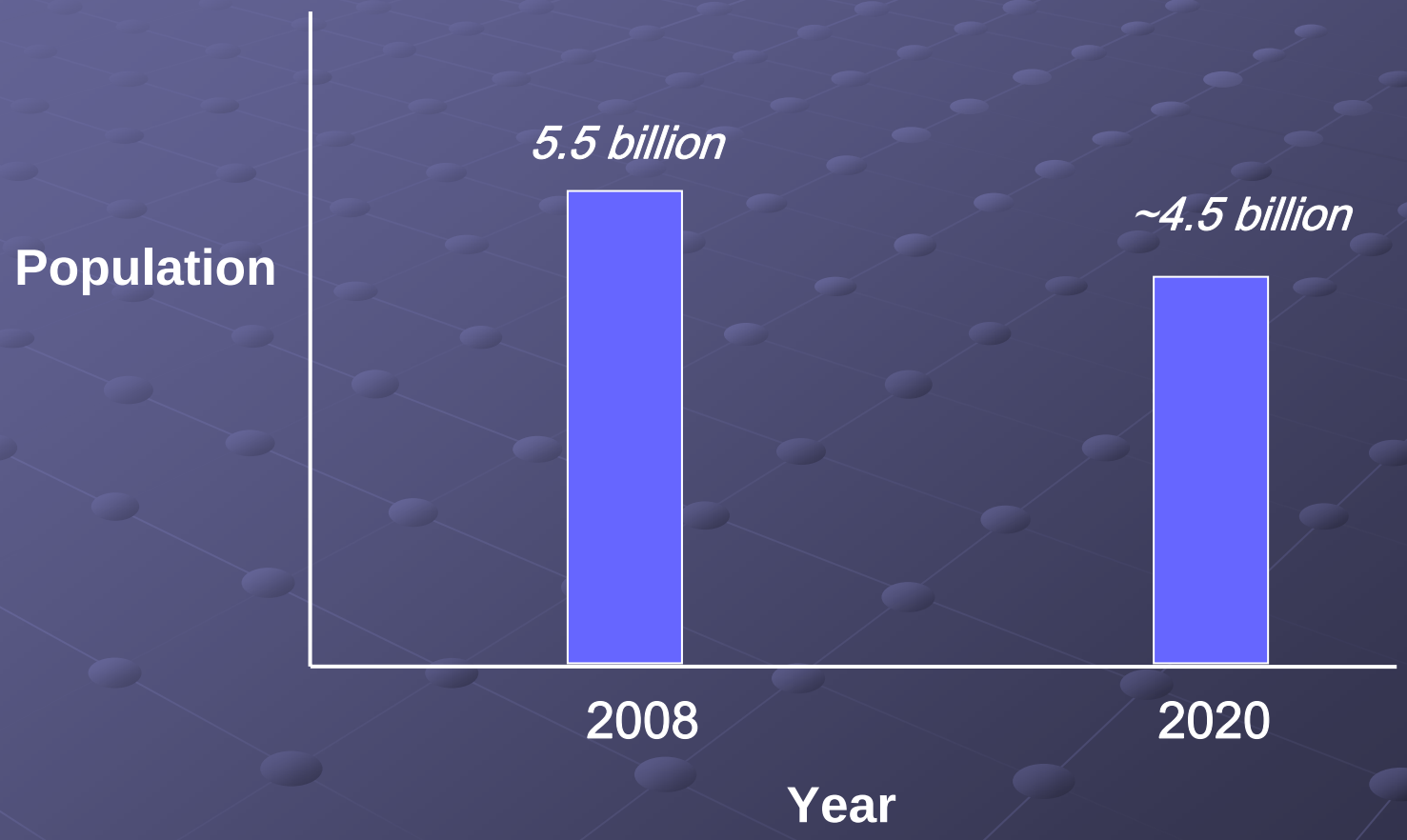
5.1 Future Internet Projects



5.2 People with Internet Access



5.3 People without Internet Access



6. Issues for The Other Billions

Poor infrastructure

Lack of human resource

Lack of content

Weak economy

Remark: Future Internet projects are primarily for developed countries and for the current one billion users.

7. What would happen if we don't work on The Other Billions?

Digital divide becomes more severe.

8. What we are doing and what we could do?

- Technology development for The Other Billions
- Paradigm shift on access (from computer to cellular phone)
- Infrastructure development for The Other Billions

9. Technologies needed for The Other Billions

- Disrupt/Delay Tolerant Network (DTN)
- Wireless network
- Storage network
- Access Device
- User interface

9.1 Disrupt/Delay Tolerant Network(DTN)

DTN was originally developed for inter-planetary Internet, and was applied to wireless networks.

We need to apply DTN to The Other Billions in developing and developed countries.
Some of the technologies developed above shall be evaluated for these environments.

9.2 Wireless (backbone) network

Wireless networks may be exploited extensively for The Other Billions due to lack of good wired backbone and access networks.

9.3 Storage network

Good storage networks may be needed for The Other Billions due to

- unreliable backbone and/or insufficient bandwidth
- paradigm shift to publish/subscribe
- inexpensive storage(petabyte disc for computer would be common in future)

9.4 Access Device

- Access devices would primarily be either cellular phones or low-cost computer.

- 70% or more access would be done by cellular phones in the next decade.

- "$100 Computer" may become common among The Other Billions along “$100 Cellular Phone with Internet access”.

9.5 User Interface

Small screen, in particular of cellular phone as primary interface to the Internet would require substantial changes on the user interface.

- Zooming technology found in iPhone and others may be very important.
- Need good input methods.

Harmonization of the user interfaces of cellular phone and computer would be important.

10. Future Scenario

Internet Users:

1 billion in 2008 (0.5 billion with computer, 0.5 billion with cellular)

↓

~3 billion in 2020 (1 billion with computer, 2~ billions with cellular)

4 Major Categories of Internet Users:

- **Cellular + Computer**
- **Cellular + Shared Computer (~Internet Cafe)**
- **Cellular (Own, Shared)**
- **Shared Computer(~Internet Café)**

11. Issues

a. Open research with open source and open content will be very important since much development shall be done locally.

b. Costs of software, and contents as well as access need to be minimal.

c. R&D effort for The Other Billions including the necessary funding shall be coordinated properly.

d. Engineering of the Internet for The Other Billions has to be done properly so that it can be sustained well.

e. Global and regional coordination is needed.

12. Concluding Remarks

a. Future Internet projects have been launched around the world after 40 years of the Internet.

b. Future Internet projects primarily focus on the current users of the developed countries.

c. We need the complimentary projects on Future Internet for The Other Billions.

d. The following technologies shall be included for Future Internet for The Other Billions;

- Access Device
- Network
- Storage
- User Interface

Reference

AsiaFI, www.AsiaFI.net

Eric Brewer, et al, “The case for Technology in Developing Regions,” IEEE Computer, June 2005.

Vint Cerf, et al, Delay-Tolerant Networking Architecture, IETF RFC 4838, 2007.

Kilnam Chon, Digital Divide and the Internet, CACM, 2001.

Kilnam Chon, Digital archive of human civilization, Digital Archive Workshop, Seoul, 2006.

Kilnam Chon, Fair share, Future Internet Workshop, Seoul, 2007.

David Clark, et al, GENI Research Plan, GDD-06-28, 2007.

EIFFLE, The Future Networked Society - A White Paper, 2007.

Internet World Statistics, www.InternetWorldStats.com

OLPC (One Laptop Per Child), www.laptop.org.

Rainer Zimmerman, European Research on Future Internet, NWGN Symposium, Tokyo, 2008.

Appendix: Collaboration Plans

- We plan " APAN-AsiaFI Joint Workshop on Future Internet for The Other Billions" in March 2009.

We also plan to form Africa-Asia Network Research and Engineering Collaboration Forum in 2008~2009.