Future Internet Research

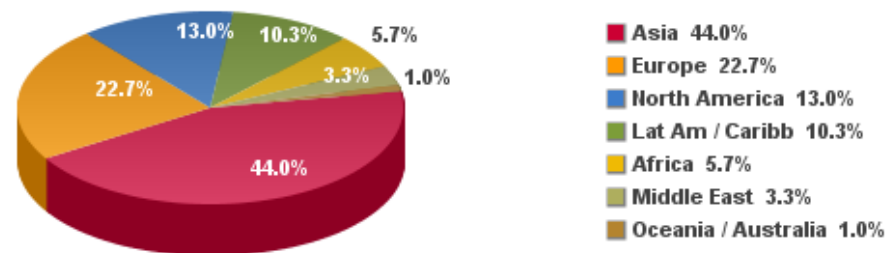MA Yan, BUPT

29 Nov.2011, Seoul

Outline

- Reviewing the past will lead us to consider a better future
  - Internet
  - Future Internet
- Evolution vs. Clean slate
- The Building blocks
- The expectation and the reality
- The research and education
- The research and engineering
- Further works

From past to present

- Scale
  - Our world is so connected
  - Over 2 billions people online
- Traffic
  - Telecommunication decline
  - Internet already so expanded
- Protocols
  - IPv4 still works for us though
  - IPv6 will start
- Application
  - Originally Text based
  - Variety of new types emerging
  - Standardization effort
- Social Impact
  - So many to mention
  - Start migration to information society

Internet Users in the World
Distribution by World Regions - 2011

- 13.0% 10.3% 5.7%
- 3.3% 1.0%
- 22.7%
- 44.0%

- Asia 44.0%
- Europe 22.7%
- North America 13.0%
- Lat Am / Caribb 10.3%
- Africa 5.7%
- Middle East 3.3%
- Oceania / Australia 1.0%

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Basis: 2,095,006,005 Internet users on March 31, 2011
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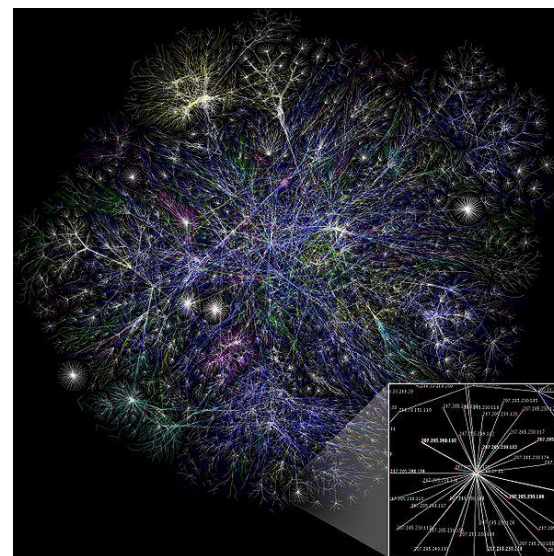
http://en.wikipedia.org/wiki/File:Internet_map_1024.jpg

From present to future

- Scale
  - Global population and objects
  - 5 billions in next decade?
- Connected devices
  - Servers, PC, Smart Phone, IoT
- Naming space
  - Location and ID, new ideas
- Fixed and mobile
  - Mobility
- Traffic type, more real time
- Transmission speed and QoS
- Management capacity
- Energy efficiency
  - From chips, devices to usage
- Virtualization
  - Different layers
- Security, trust model and privacy
  - …
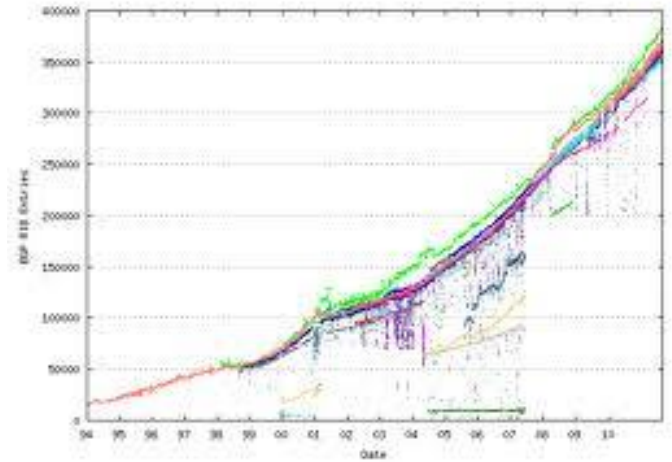
Real world and Cyberspace

- Cyberspace is part of our world that we created, with more dimensions than before
- Many definitions
  - Cyberspace is the electronic medium of computer networks, in which online communication takes place
  - …
- What we shall create
  - We shall expect a more prosperous development in the future
 - Though still tough problems for us

GENI project

- The motto is "Understand. Innovate. Transform – Make an Impact on Global Networks"
- Currently in phase of GENI Spiral 3
- Following projects includes
  - Software Integration
    - *PlanetLab Cluster (B) ProtoGENI Cluster (C) ORCA Cluster (D) ORBIT Cluster (E)*
  - Meso-Scale Deployment and Operations
    - *OpenFlow and WiMAX Meso-Scale Deployment, ProtoGENI Backbone Nodes, Meso-scale Measurement, Operations, Security,*

Future Internet research in EU

- Current projects
  - The network of the future
  - Socio-economic considerations for the Future Internet
  - Application domains for the Future Internet
  - Future Internet Research and Experimentation (FIRE)
  - Cloud Computing, Internet of Services and Advanced Software Engineering
  - Internet-connected objects
  - Trustworthy ICT
  - Networked Media and Search Systems
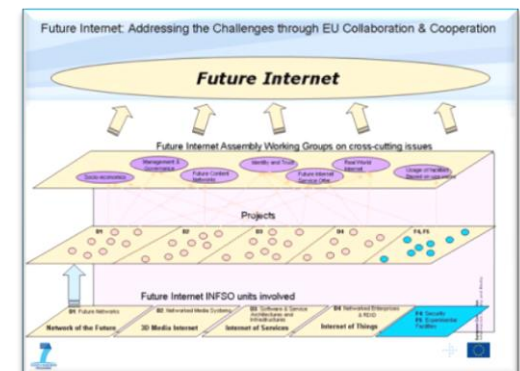
Evolution vs. clean slate

- Creatively thinking while Concretely stepping forward

- We need incremental improvement and also we expect brand-new inventions

- Most of those who are successful in doing clean slate thinking and action, are who have deep understanding of the past

- Words to read and think:
    - http://cleanslatestrategies.com/resources/quotes.aspx

Revisit the old model

- Pros and cons
  - Scalability
  - Variable length of address
  - Global ID and Local routing
  - Distributed name database
  - Centralized hierarchical control
  - Control and data plane separated
  - Intelligent center and dumb terminal
  - Provide the basic necessity
  - More others to consider

The building blocks of Future Internet

- Over all Architecture that we shall consider
- Building blocks
    - Wired and wireless high performance physical layer technologies
    - Addressing, Identification and location separation
    - Routing and Forwarding in fixed and wireless environment
    - Resource naming and searching mechanism
    - Network and service management
    - Traffic control and Quality of service mechanism
    - Framework for trust, security and privacy protection
    - Transition mechanism from current to the future
    - Virtualization and energy saving technology
    - Omnifarious application and service models
    - Others to consider, …

The expectation and the reality

- Scalability is always emphasized
- End to end connectivity model constrain
- Cross layer sensing and coordination
- ID and Locator separation
- Traffic volume and demand
- Security and privacy
- Energy saving consumption
- Others …

The research and education

- Traditional way of education is evolving with the use of Internet
- The success of Future Internet technology research relies on what we can provide to younger generation
  - Capacity of teachers/supervisors
  - Open minded education
  - Methodologies that we do education
  - Facilities we provided to students
  - Student research paper
  - The view towards global environment

The research and engineering

- Get in touch the real network

- Solve the real problem

- Use network as a platform for doing network research

- Setup testbeds in different category

- Connection with the industry

- Experiment and validation

Testbeds

- Difference purpose and scale

- PlanetLab provide an overlay experiment platform

- Openflow currently focused on network layer experiment

- Cross layer testbed is not common ye but we need it in many situation

Works in the future

- Collaborated research
- Using current infrastructure and build testbeds across our region
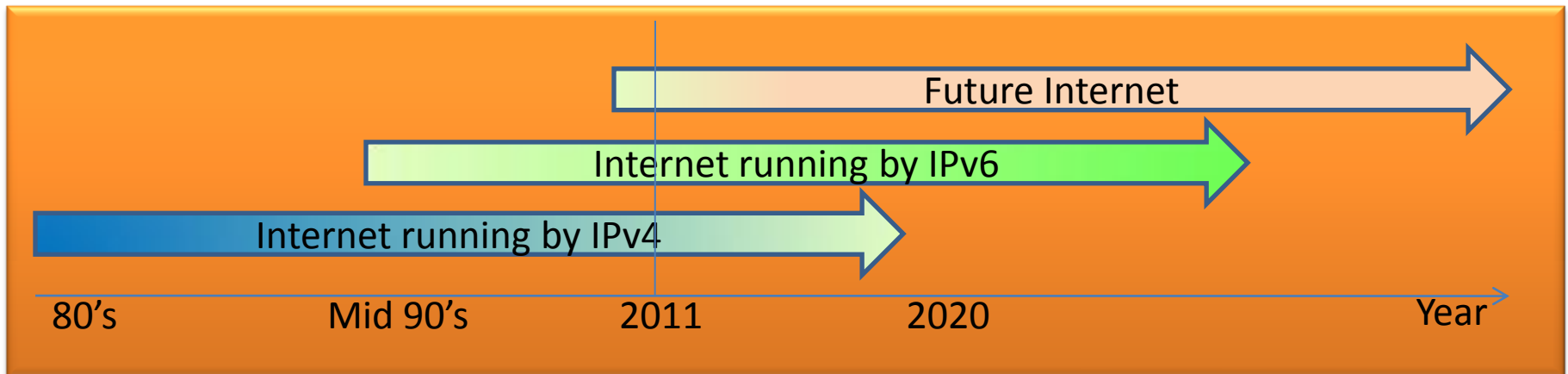
There will be no ideal world, we are all keep approaching.

The future is dependent on what we are doing and done.
Let's working together for a better environment for ourselves.

Thank you.