Future Internet
The Solution to Data Explosion

March 8, 2011

Yanghee Choi

Seoul National University
Future Internet Forum

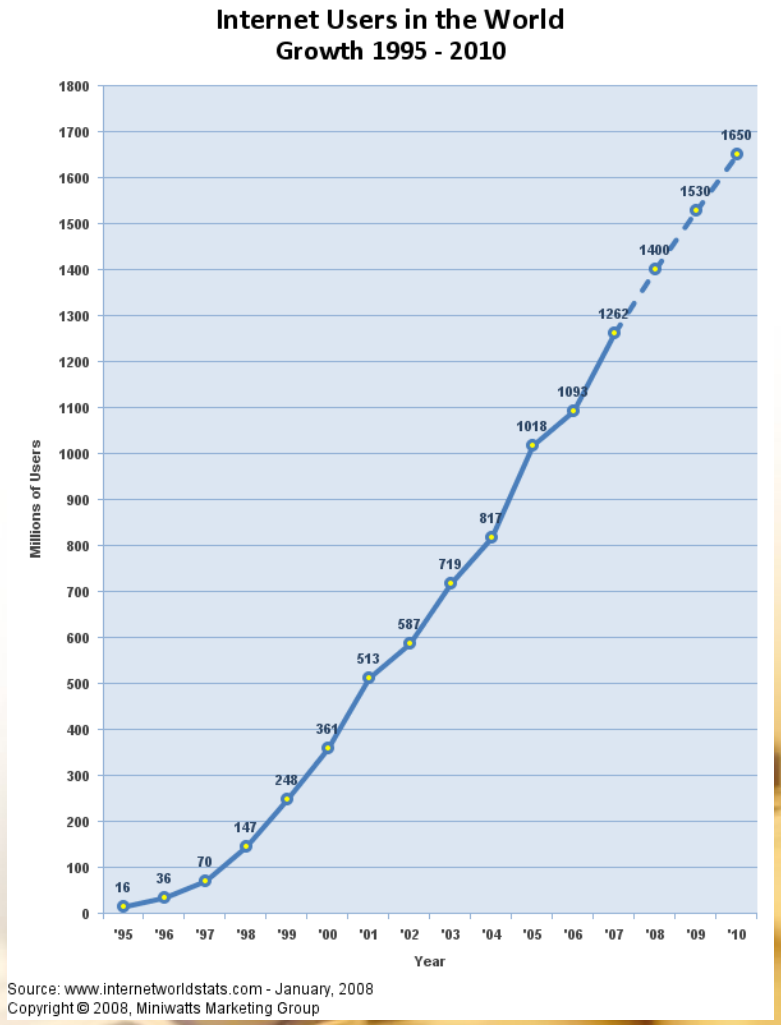
CONTENTS

- ❖Internet Trends
- ❖Data Explosion
- ❖Solutions
  - Network Centric
  - Content Aware Networking
- ❖Korean Policy on FI
- ❖Future Internet Forum

Source : Leeds

Internet Trends

- Steady Growth
- Mobile Users
- Traffic Explosion



Things : will invade Internet

100 billion nodes by 2020

Source : dvice

Nike + iPhone

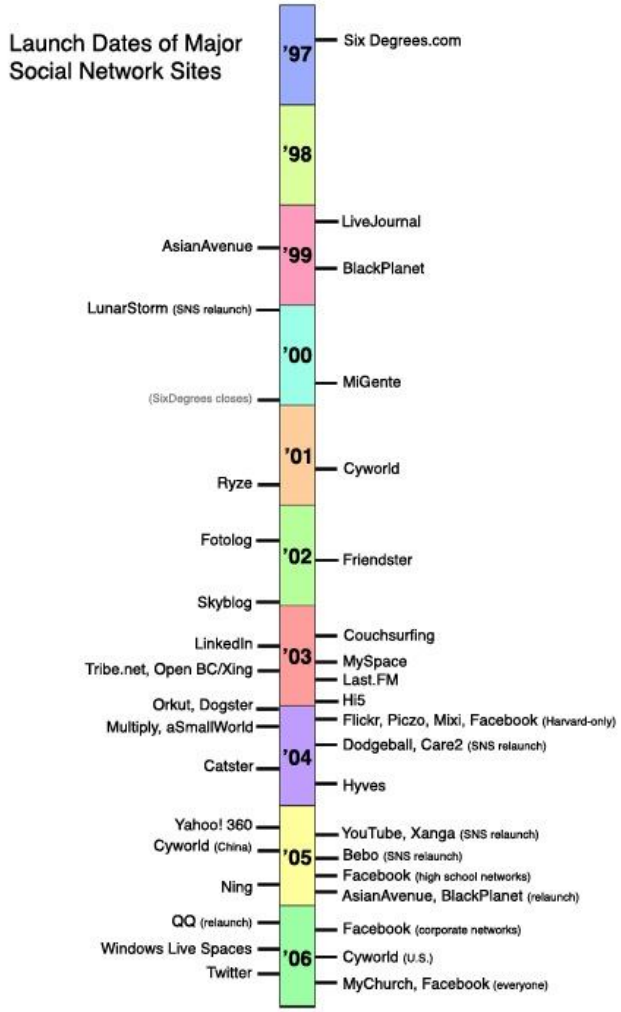
Source : Nike

Wine rack + RFID

Moisture Sensor + Twitter

Source : gizmodo

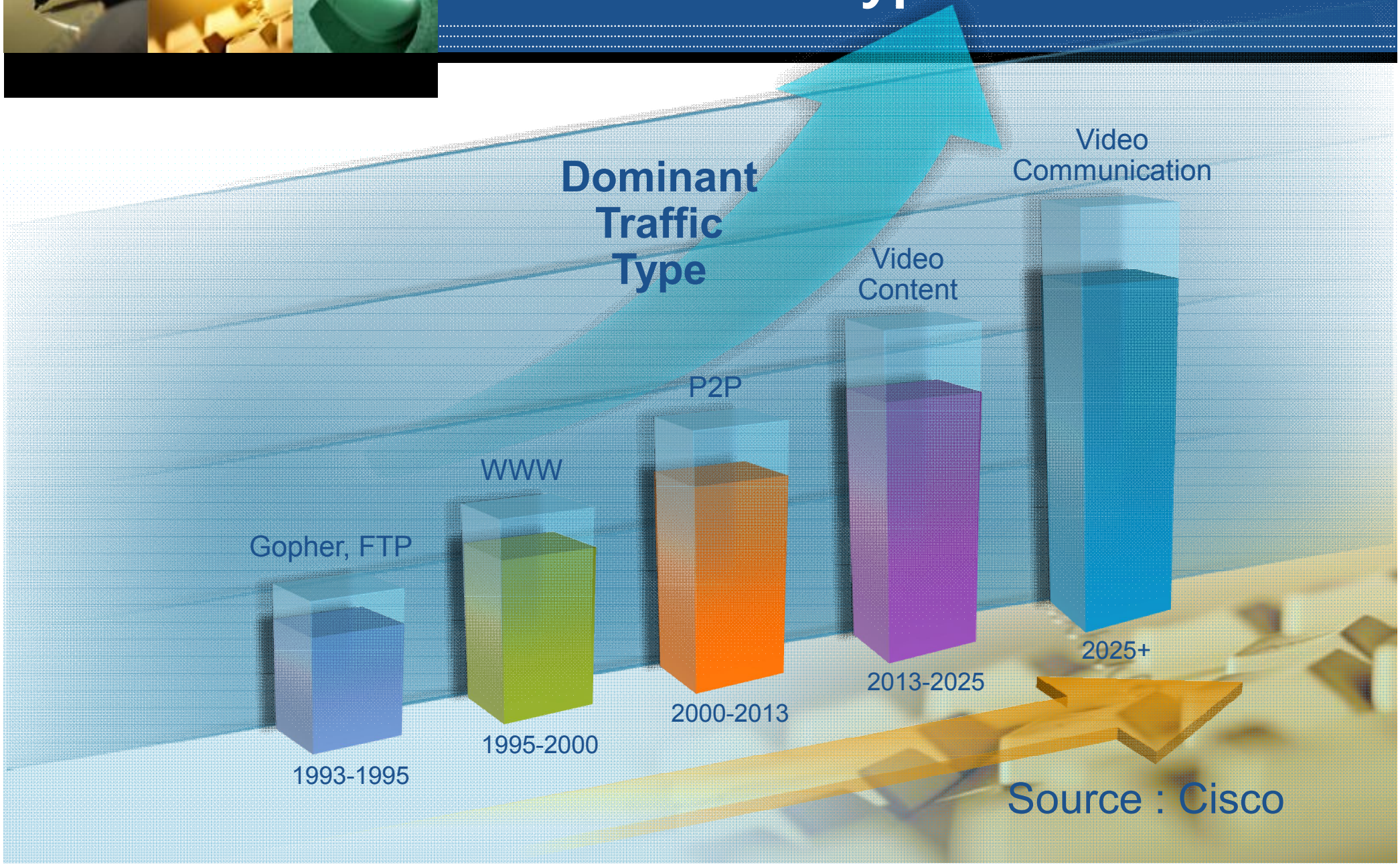
Social Network will evolve into Social Media



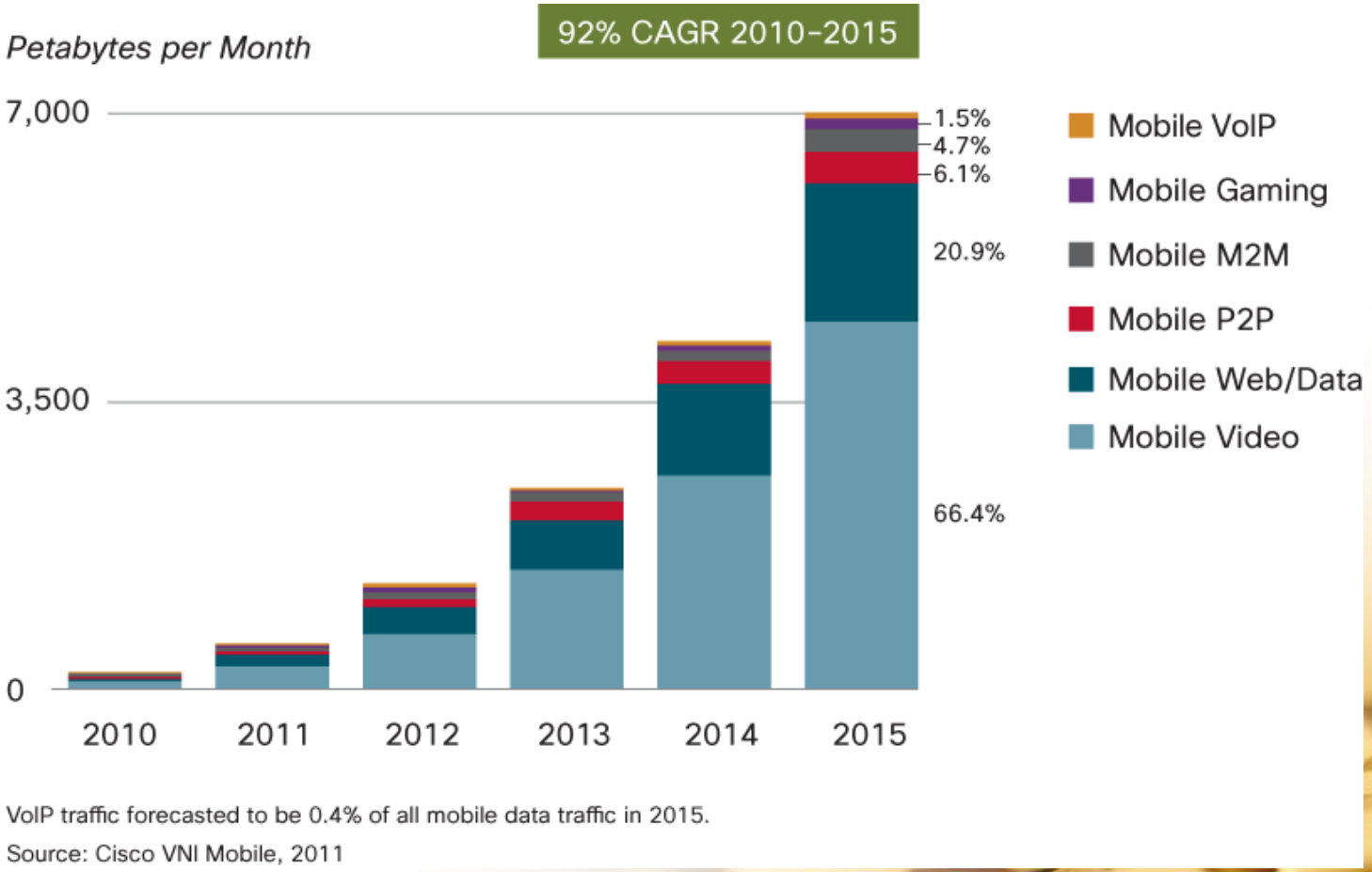
Source : Indiana University

Source : Lifehack

New Types of Traffic



Video : leading app for the mobile devices



VoIP traffic forecasted to be 0.4% of all mobile data traffic in 2015.

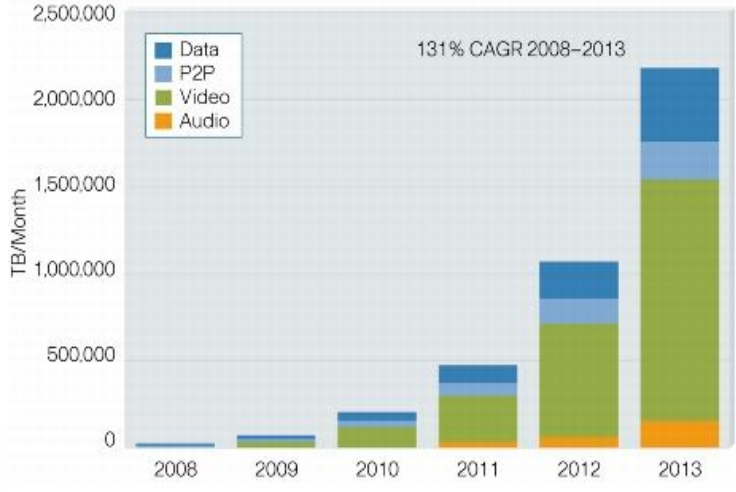
Source: Cisco VNI Mobile, 2011

Video accounts for 66%

Why Video ?

❖ High demand from the users

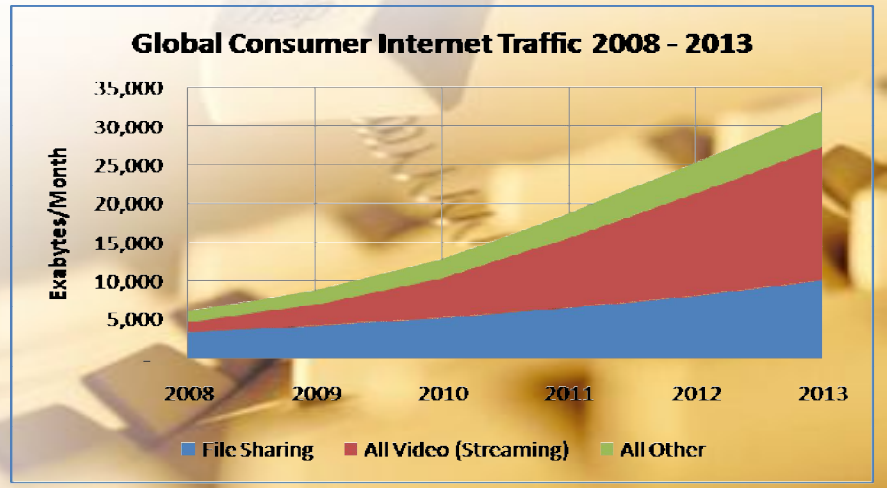
- Higher quality video (Ex. HDTV)
- # of contents increased dramatically as UCC becomes popular



[source: Cisco Visual Networking Index: Forecast and Methodology, 2008-2013]

❖ Video : download & streaming

- Diverse mode of consuming video contents
- In 2013, over 90% of all contents will be in video
- The current Internet unable to support the massive realtime traffic

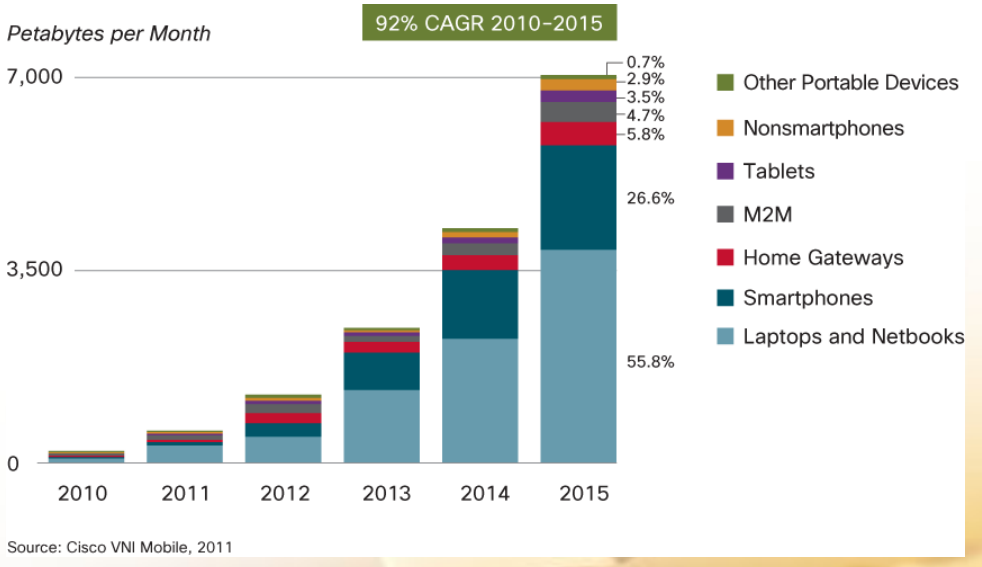


Smartphone + Notebook

Smartphone	=		x 24*
Handheld Gaming Console	=		x 60*
Tablet	=		x 122*
Mobile Phone Projector	=		x 300*
Laptop	=		x 515*

* Monthly basic mobile phone data traffic

Source: Cisco VNI Mobile, 2011



Source: Cisco VNI Mobile, 2011

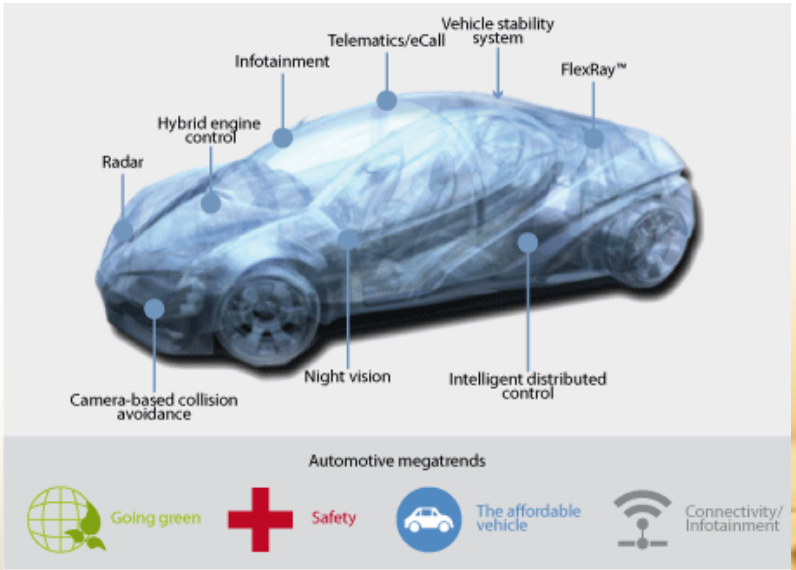
Smartphone 27%, Notebook 56% of traffic

Data Explosion

- Smartphone, Pad
- Unlimited use of Data
- In 2010 alone
  - ~10-fold increase (KT)
  - ~5-fold increase (SKT)
- Prediction
  - 1000-fold increase until 2014 (KT)
  - 50-fold increase in three years (AL)
  - Especially critical in Korea

Yet to come ---

❖Smart TV ❖Smart Car



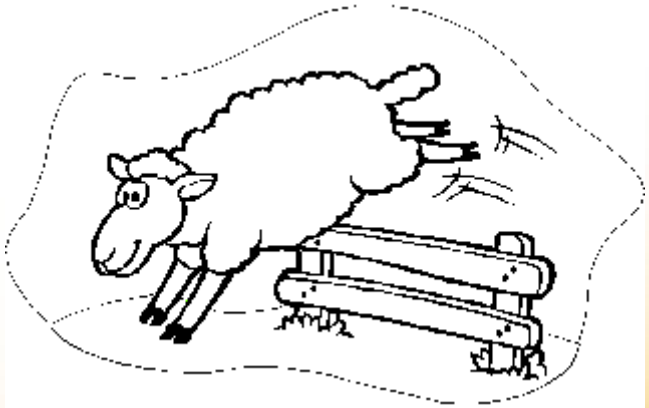
Issues

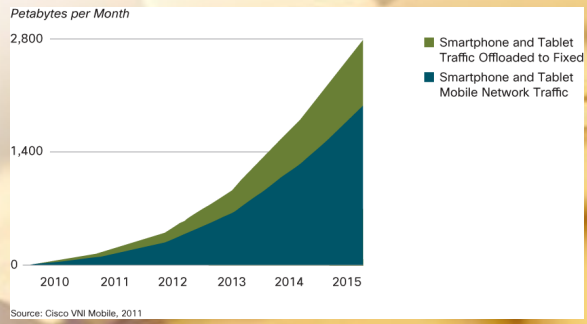
- **Limited network capacity**
  - Capacity Increase needed for
    - Wired backbone
    - Wired access
    - Mobile/wireless access
  - 6-7 times/year
  - Two problems
    - Capital expenditure
    - Technology limits

Solutions ?

- Investment for capacity expansion
  - Billing schemes
- Technology innovation
  - Offloading to WiFi, WiBro
  - LTE and beyond n-G
  - New Optical Backbone

- **Need Paradigm Shift**





Internet vs. Telecom

- Telecom has met increasing demands through periodic technology innovations
  - wirelesss : 2G, 3G, 4G, beyond
  - Core network : digital exchange, ISDN, B-ISDN, IP backbone
  - Boradcasting : analog, digital, HD, 3D, UD
- Give up the backward-compatibility
  - Any technology could enter
  - Creation of enormous new market for equipment, facilities, services, terminals

Internet : no change !

- Internet respected backward-compatibility for the last 40 years
  - Many patches, creating more problems
  - New Future Internet to solve all identified problems
    - May or may not be backward-compatible
    - Gradual migration
    - Global effort

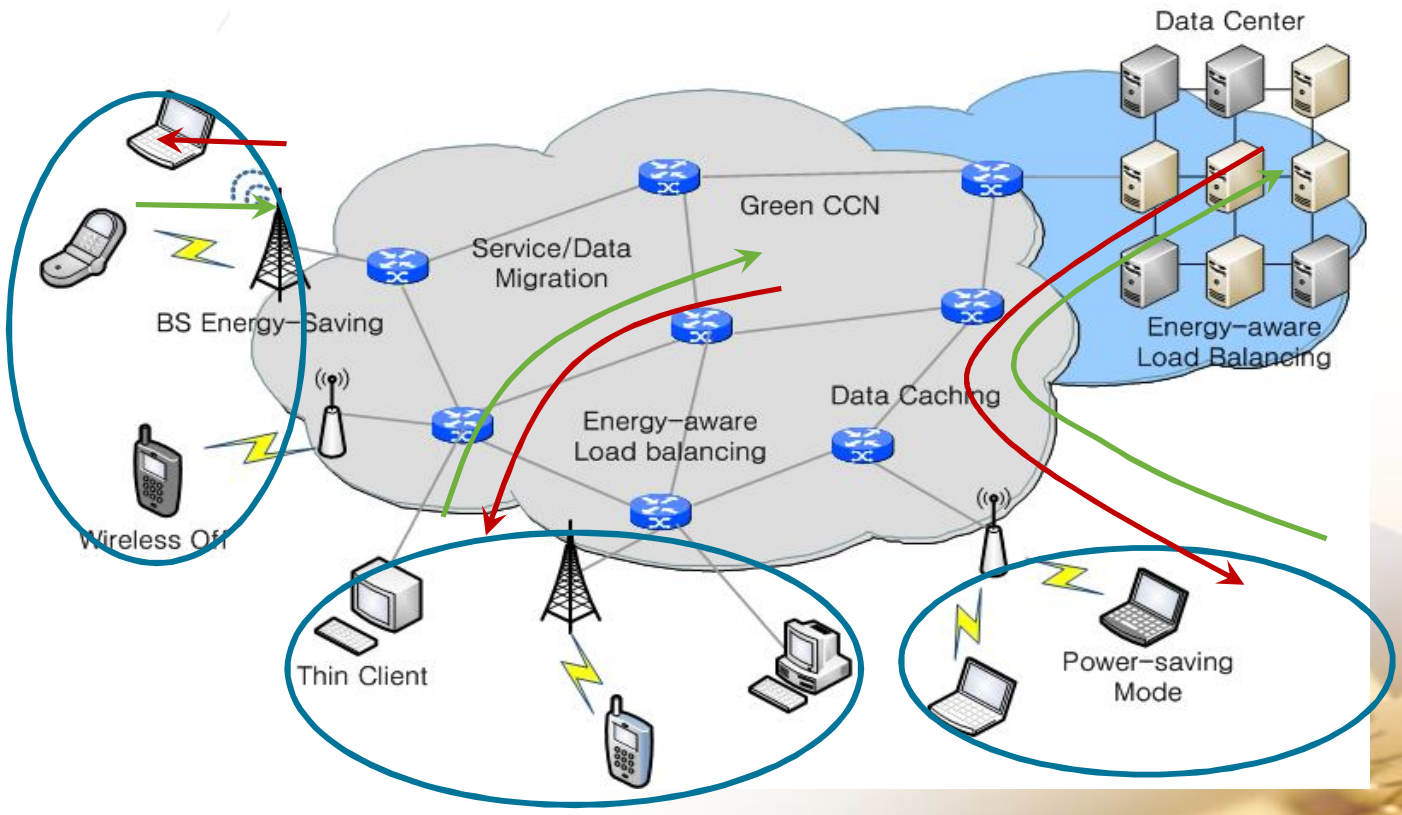
Approach 1 : smart network

- Independently evolving architecture
  - terminal
  - network
  - Content/service/application & data centers
- Inefficient, overlapping functions
- Network companies lost the control

- Redesigning by the network-centric architecture
  - Terminal simplified
  - Data centers/servers distributed and integrated in the network components (routers)
  - Smart and intelligent network

Network-centric :

Most Powerful Solution for the Data Explosion

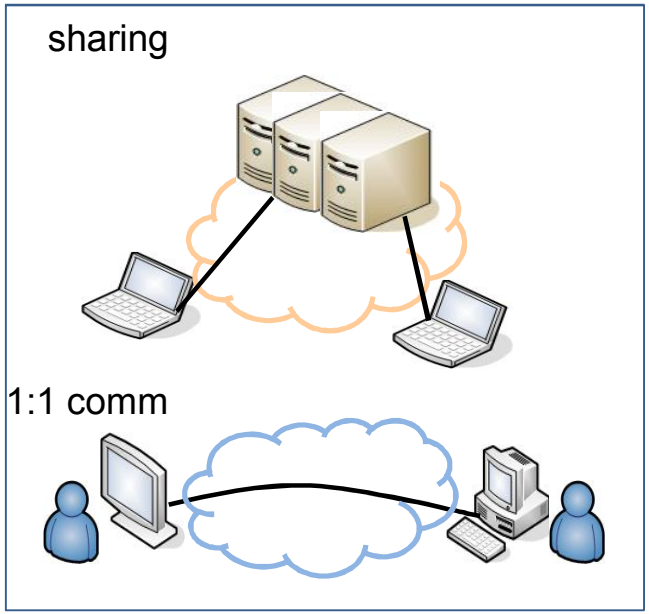


Service request

response

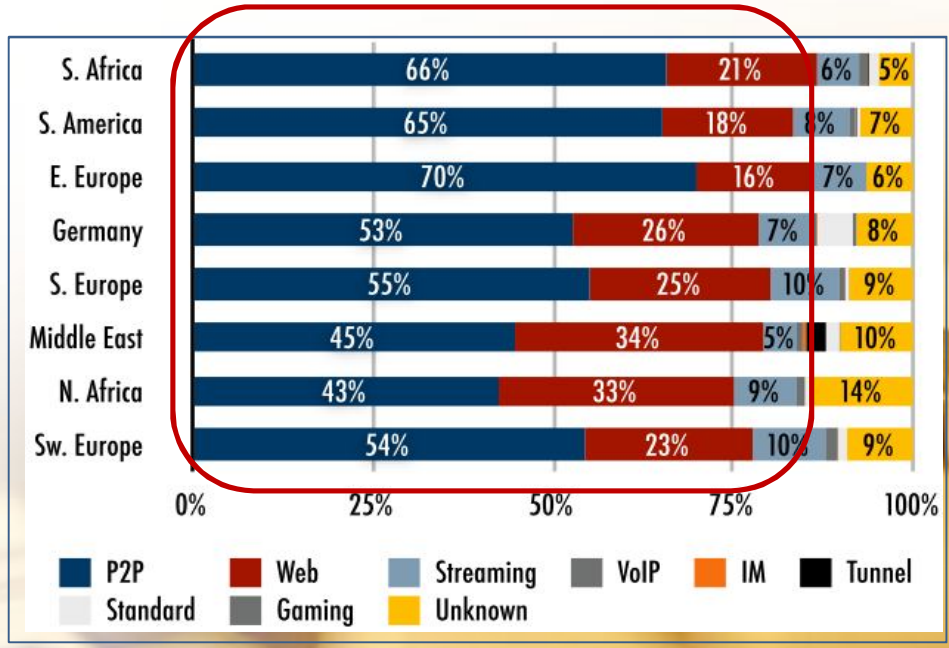
Approach 2 : Content-oriented Network

- **Early Days (60's,70's)**
  - Sharing of networks and machines
  - One-to-one communication
- **Present**
  - Internet is used to get contents (Ex. P2P file download, web surfing, video streaming)



From "where"

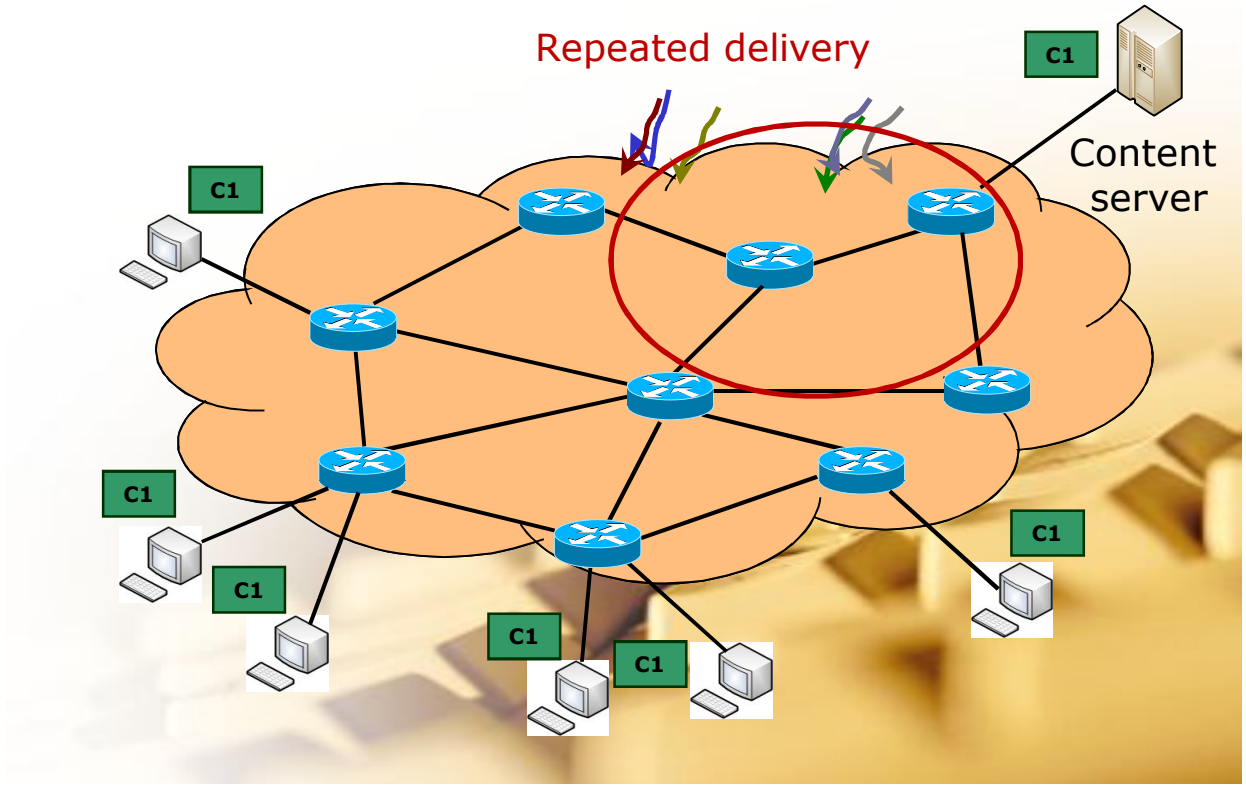
To "What"



Distribution of protocol classes 08/09 [source: ipoque]

Video Internet

- **Video : the main reason for data explosion**
  - **Broadcast and multicast**
  - **Repeated use of the same content**



Solving Data Explosion by Content aware network

- **New Content-aware Network Architecture**
  - Eliminating content redundancies by content caching at routers – solving the data explosion problem
  - New content-based names
  - Multipath, multicast, broadcast easily supported
  - System-on-chip will solve the speed and scalability problem

- **NSF : Named Data Networking Project**
- **FP7 : PSIRP, PURSUIT, NetInf, SAIL Projects**

Korean Policies for Future Internet

Future Internet : National Policy in Korea

- Preparing the **smart** ultra-broadband **network** for the future
  - Wired : all optical
  - Wireless : seamless mobile
  - Virtual & intelligent network
  - Open & integrated platform

방송통신위원회
KOREA COMMUNICATIONS COMMISSION

Policy (2)

❖ R&D

- Packet-optical integrated switch
- WDM-PON
- Super WiFi
- Smart Node
- Named-Data Network
- Delay-Tolerant Network
- Network Virtualization
- Context-aware applications

❖ Pilot Trials

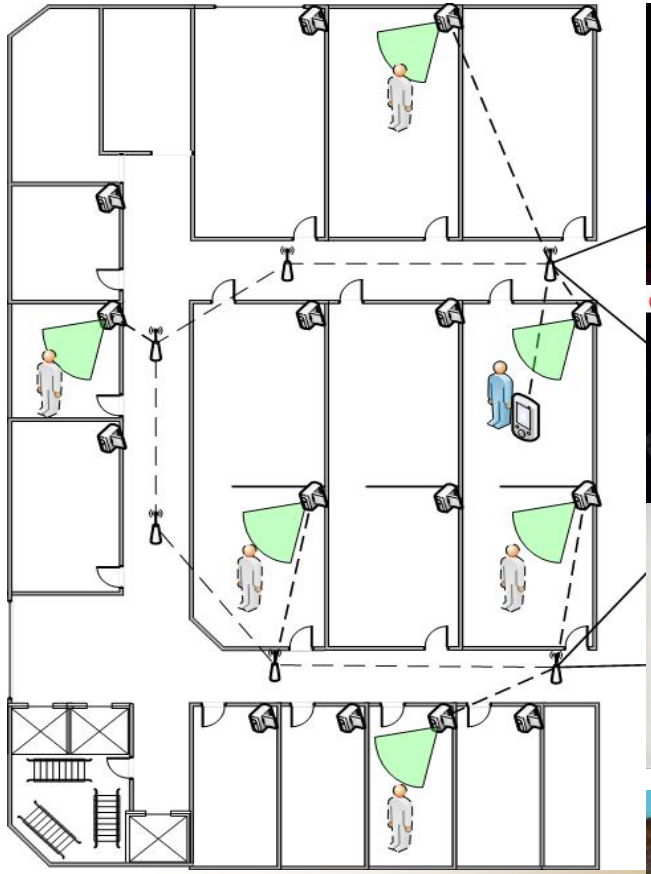
- 3W based seamless mobile service
- Content delivery service
- Personalized intelligent service
- Cloud service
- Internet of Things
- Smart Grid
- **Integrated Convergence Service**

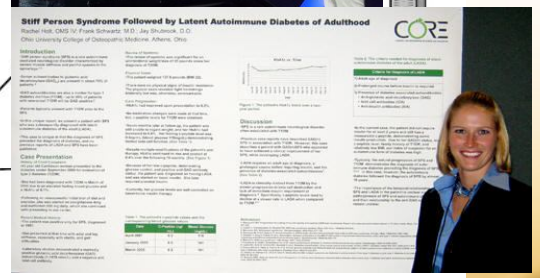
Internet Video Diary basic mode

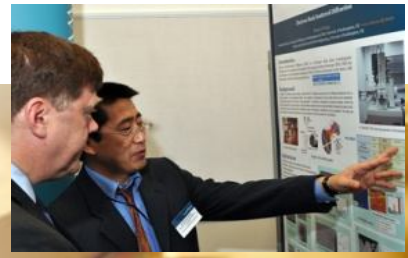
- 1. Collect user location, time, and related info from user's smartphone
  2. Send the user info to Diary Server
  3. The server collects recorded video data from nearby cameras (e.g. CCTV), and puts tags about the user
  4. Later, the video clips for the visited sites are shown on a "Video Diary" web page at the user's request
  5. User can add texts, send the diary to Social Networks etc.

- **Benefit**
  - **Rich information sharing**
  - **Automated and intelligent system**
  - **Advanced application scenarios**

Application Scenario: Exhibition/Conference Report







Policy : Testbed

❖ Three types

- Internet2-like high performance operational network at reduced cost
- KOREN-like national backbone for experiments only.
  PlanetLab, TEIN etc.
- Research testbeds designed and operated by research groups.
  Early ARPA, GENI etc.

Future Internet Forum : Korea

- Established in 2006 to promote R&D collaborations in Future networking
- Building research communities
- http://fif.kr
  - CFI : annual conference
  - Demo event
  - Standard Symposium
  - Newsletter, journal
  - Homepage
  - Meetings
- AsiaFI : for Asian countries

- Working groups
  - Architecture/Wireless/Service
  - Testbed
  - Policy
  - Standard
  - Network Science