Broadband Networks

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1. Broadband Networks

Broadband Backbone Network
Broadband Access
Broadband Application
2. Current Status of Internet

<table>
<thead>
<tr>
<th>Region</th>
<th>Population (in million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>258</td>
</tr>
<tr>
<td>Europe</td>
<td>231</td>
</tr>
<tr>
<td>Canada &amp; USA</td>
<td>222</td>
</tr>
<tr>
<td>Latin America</td>
<td>56</td>
</tr>
<tr>
<td>Middle East</td>
<td>17</td>
</tr>
<tr>
<td>Oceania</td>
<td>16</td>
</tr>
<tr>
<td>Africa</td>
<td>13</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>813</strong></td>
</tr>
</tbody>
</table>

3. Broadband Backbone Network - Bandwidth

0.6 Gbps → 2.5 Gbps → 10 Gbps → 40 Gbps

1 Gbps
4. Broadband Access

4.1 Wireline
4.2 Wireless
4.3 Broadband Subscribers per 100 inhabitants
4.1 Wireline

(1) Dialup ~ 64 Kbps

(2) DSL/Cable 0.1 ~ 50 Mbps
   Cable 1~10 Mbps(shared)
   ADSL 1~10 Mbps(dedicated)
   VDSL 20~50 Mbps or more(dedicated)

(3) Ethernet 100 Mbps ~ 10 Gbps(dedicated)
## 4.2 Wireless

### (1) Wireless LAN

<table>
<thead>
<tr>
<th>Standard</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>802.11b</td>
<td>11 Mbps (shared)</td>
</tr>
<tr>
<td>802.11a</td>
<td>54 Mbps (shared)</td>
</tr>
<tr>
<td>802.11g</td>
<td>54 Mbps (shared)</td>
</tr>
<tr>
<td>802.16</td>
<td>50 Mbps (shared)</td>
</tr>
<tr>
<td>802.20</td>
<td>2 Mbps with mobility (shared)</td>
</tr>
</tbody>
</table>

### (2) Mobile Phone

<table>
<thead>
<tr>
<th>Standard</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5~3G</td>
<td>0.1~2 Mbps (dedicated)</td>
</tr>
<tr>
<td>4G</td>
<td>20~50 Mbps (dedicated)</td>
</tr>
</tbody>
</table>
4.3 Broadband Subscribers per 100 inhabitants

Source: ITU Internet Report 2004
5. Broadband Applications

5.1 Classification
5.2 "Killer Application"
5.3 Case Study - Korea
5.4 Next Generation Broadband Applications
5.1 Classification

(1) General Internet Access
   - Browsing
   - Messaging
   - File Downloading
   - Games

(2) Audio and Video
   - Audio Delivery
   - Internet Telephony
   - Video Delivery
   - Video Conference

(3) New Applications
   - Peer-to-Peer Applications
   - Distributed Work
   - Distance Learning
   - Home Content
5.2 "Killer Application"

All countries are looking for "KILLER APPLICATIONS" now. General consensus is multimedia, in particular video such as Television, Movie, Video Conference, VoIP.
5.3 Case Study - Korea

(1) Killer Applications - First Wave
   - Heavy Internet users (always on)

(2) Killer Applications – Second Wave
   - Adult content
   - Stock exchange (Day Trader)
   - Online game

(3) Killer Applications - Third Wave
   - Broadband Portal
   - Education
   - Music
   - Movie
   - Television Program
5.4 Next Generation Broadband Applications

(or Why do we need 100~1,000 Mbps?)

(1) Higher Definition Video (HDV, HDTV)
   Streaming
   Down loading
(2) High Definition Video Conferencing and Class
(3) High Definition Video Education
(4) High Definition Online Game
(5) Bulk File Transfer
(6) P2P
(more to come)
6. Country Report
6.1 Korea

Broadband Subscription – Growth Rate

* ( ): Growth Rate

(Unit: Thousand)
6.1 Korea - continue

(1) Broadband Is Fully Deployed
   - 80% of household
   - Dialup has become "horse carriage"
   - Broadband is social infrastructure like telephone or automobile or television

(2) Looking for Next Generation Broadband
   - VDSL vs FTTH/FTTB (100 Mbps~)
   - LAN (~FTTB) deployment at 10~15%

(3) Side Effects
   - Intrusion
   - Virus

(4) Mobile and Wireless
   - Mobile Internet is taking off (2.5G)
   - Major deployment of wireless LAN (802.11)
   - Major deployment plan of wireless MAN (802.16 “Wi-Bro”)
6.2 Japan

   3 millions --> 8 millions (--> 15 millions in 2004)
   Tough price competition (~ $20/month)

(2) Looking for Killer Applications
   VoIP
   Video

(3) Mobile Internet
   50% penetration
   2.5G/3G are taking off

(4) FTTH in taking off
   2004 : 1 million
   2005 : 5 million (estimate)
6.3 Greater China

(1) Internet is taking off in China
   90 millions in 2003 (2nd after USA)
   Expected to take over USA in 2005~2006

(2) Broadband is taking off in major cities.

(3) Hong Kong and Taiwan are following Korean pattern
    with 10~20% penetration and taking off.
6.4 Singapore

(1) Internet is well deployed.

(2) Broadband penetration is around 10%.
6.5 South East Asia

DSL and/or Cable Modem are becoming popular.
7. What’s Next?

7.1 Next Generation Broadband Access

VDSL (50~100 Mbps)
FTTH/FTTB (100Mbps ~ 1 Gbps)

Remark: - Looking for “killer applications”
    Digital Video, Interactive Video, …
- Replacing wired telephone
  (and television ?)
7.2 Ubiquitous Network

“Broadbandization” of wireline and wireless networks

Integration of wireline and wireless networks

Networking everything
7.3 Wireless Network

Integration or Natural Selection

Mobile Phone
Wireless LAN
Bluetooth
RFID
7.4 Universal Service

Is Broadband Access Universal Service?
8. Remark

1) Once a system is extensively developed such as dialup in USA and DSL in Korea, we may need very big inertia to migrate to another system.

2) Is the broadband Internet (Northeast) Asian phenomenon?

3) What is the role of Wireless Broadband Access such as Wi-Fi and Wi-Max?
Reference

Kilnam Chon, Broadband In Asia, ESI, DC, 2001.10.5.
ESI, Broadband: Opportunities & Challenges for Telecom Industry, DC, 2002.3.11.
NCA, Broadband Internet in Korea, 2002.
CSTB/NRC, Broadband: Bringing home the bits, 2002.
YT Lee, Broadband Network in Korea, Asia Broadband Summit, Tokyo, 2002.10.17
Andrew M. Odlyzko, http://www.dtc.umn.edu/~odlyzko
Appendix : Average Peak Traffic

Japan  ~0.5 Tbps  
Korea  ~1 Tbps  
USA    ~1 Tbps  

Remark: Average peak traffic is typically measured as the average of peak traffic of 10~60 minutes. 
Remark: The peak traffic could be observed at ISP as in the case of Japan, which includes the end-user traffic and ISP-ISP traffic. 
Remark: Residential broadband traffic is 2/3 in Japan and Korea, but 1/2 in USA. 
Remark: Growth rates in Japan and Korea are 100% per year. 
    Growth rate in USA is 50~60% per year. 
Remark: The total traffic(day, week, or month) may be better indication. 
    This could be done at the end-users or at ISPs. 
Remark: The total traffic per capita per month is

    4~5 GBytes in Hong Kong and Korea  
    1 GBytes in USA