The Effect of Grid Delivery using Peering Portal’s Streaming Technology on Video UCC Service

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PANDORA.TV

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Company
History

**Oct, 2004**
- Launched Pandora.tv site

**Oct, 2005**
- Obtained membership of 500,000 and daily visitor of 100,000

**Nov, 2005**
- Established Pandora.tv Japan ([www.pandora.tv.jp](http://www.pandora.tv.jp))
- Became the master content provider (MCP) for LG Electronics
- Launched mobile Pandora.tv service via KTF

**June 2006**
- Raised 6 billion KRW (US$6.3 million) of funding from a silicon valley VC-led consortium

**July 2006**
- Achieved daily visits of 800,000, daily video streams of 3.5 million, and daily page view of 14.5 million
- Content distribution agreements with Yahoo, Naver, Daum, Empas and MSN
What is PANDORA.TV?

- **Personal TV Network/Station**
  - Offers VOD and live video programs/shows to everyone

- **Video-Based Portal**
  - Video search capabilities

- **New Media**
  - Provides videos not found in TV and cable channels

- **Video Platform**
  - Allows watching and sharing UCC videos
## Annual Growth

<table>
<thead>
<tr>
<th></th>
<th>June 2005</th>
<th>June 2006</th>
<th>Increase %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly Unique Visit</td>
<td>386K</td>
<td>5,778K</td>
<td>1,397%</td>
</tr>
<tr>
<td>Sum of Daily Visitors</td>
<td>576K</td>
<td>10,881K</td>
<td>1,789%</td>
</tr>
<tr>
<td>Page Views</td>
<td>13,000K</td>
<td>251,190K</td>
<td>1,832%</td>
</tr>
</tbody>
</table>
### Today’s PANDORA.TV

<table>
<thead>
<tr>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uploaded Contents</td>
<td>500,000 files</td>
</tr>
<tr>
<td>Uploading Contents</td>
<td>4,000 files/day</td>
</tr>
<tr>
<td>Storage</td>
<td>40 TBytes</td>
</tr>
<tr>
<td>Page View</td>
<td>20 million/day</td>
</tr>
<tr>
<td>Unique View</td>
<td>1.5 million/day</td>
</tr>
<tr>
<td>Max. Concurrent Users</td>
<td>30,000</td>
</tr>
</tbody>
</table>
Missions
Missions for Global Service

- Cost saving
- High quality service
- Various additional features

Grid Delivery using Pcube Stream™

※ Pcube Stream™ or P³ Stream™ is the trade mark of Peering Portal
Cost Problem

- **Example of network cost**
  - Max. concurrent users: 30,000
  - Bit- rate: 600Kbps
  - Total bandwidth: 18Gbps (30,000*600Kbps)
  - Network cost: $180,000/Month
    (Unit price in Korea: $10,000/Gbps.month)

- **Server/network cost is proportional to the number of concurrent users & bit-rate**

- **Traditional streaming such as MS WMT and Adobe Flash CANNOT solve the cost problem**
Service Quality Problem

- Server or network bottlenecks cause inconvenience
  - Freezing
  - Long latency

- Traditional streaming such as MS WMT or Adobe Flash CANNOT overcome bottlenecks
Need for Distinctive Features

- Video UCC service market is becoming the “Red Ocean”
  - Network effect in UCC services
  - Distinctive features are essential for continuous growth

- Traditional streaming such as MS WMT or Adobe Flash can hardly offer differentiations from competitors
Why Pcube Stream™?
Why Pcube Stream™?

- **Uniqueness**
  - The only streaming solution using Grid Delivery

- **Many references**
  - More than 40 streaming services including AoD/BGM/VoD/IPTV are using Pcube Stream™
  - Result proven by many service companies

- **Proved by users**
  - More than 50 million client modules installed
Case Study - AoD Service

Number of contents: 350,000
Case Study - BGM Service
Case Study - VoD Service
# Cost Saving Forecast

<table>
<thead>
<tr>
<th>Network bandwidth before applying P³</th>
<th>Reduced bandwidth and network cost saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>70% reduction</td>
<td>80% reduction</td>
</tr>
<tr>
<td>90% reduction</td>
<td></td>
</tr>
<tr>
<td>1Gbps</td>
<td>700Mbps $7,000/month</td>
</tr>
<tr>
<td>800Mbps $8,000/month</td>
<td></td>
</tr>
<tr>
<td>900Mbps $9,000/month</td>
<td></td>
</tr>
<tr>
<td>5Gbps</td>
<td>3.5Gbps $35,000/month</td>
</tr>
<tr>
<td>4Gbps $40,000/month</td>
<td></td>
</tr>
<tr>
<td>4.5Gbps $45,000/month</td>
<td></td>
</tr>
<tr>
<td>10Gbps</td>
<td>7Gbps $70,000/month</td>
</tr>
<tr>
<td>8Gbps $80,000/month</td>
<td></td>
</tr>
<tr>
<td>9Gbps $90,000/month</td>
<td></td>
</tr>
<tr>
<td>20Gbps</td>
<td>14Gbps $140,000/month</td>
</tr>
<tr>
<td>16Gbps $160,000/month</td>
<td></td>
</tr>
<tr>
<td>18Gbps $180,000/month</td>
<td></td>
</tr>
</tbody>
</table>

※ Unit price in Korea: $10,000/Gbps.month
How Pcube Stream™ works
Traditional VS. Grid Delivery
Other features of Pcube Stream™

- Low usage of users’ resource
  - Minimized resource usage
- Service provider’s control over contents
  - Instant prevention of unwanted contents that are already cached
- Strong security
  - Protection from unauthorized use without DRM
  - Support 3’rd party DRM
- Easy to apply
  - Easy adaptation to streaming service
Experiments on Pcube Stream™
Experiment – CPU load

- Additional CPU load of client PC
  - When segments are served to other clients
  - Less than 1% per segment

![Graph showing CPU load data]
Experiment – Buffering Latency

- Pentium II 350MHz, 64MB RAM, 192Kbps media
- Windows 98

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>mms</td>
<td>6.38</td>
<td>6.04</td>
<td>6.23</td>
<td>6.02</td>
<td>5.89</td>
</tr>
<tr>
<td>Pcube</td>
<td>3.91</td>
<td>5.89</td>
<td>5.02</td>
<td>4.49</td>
<td>4.31</td>
</tr>
</tbody>
</table>

- Windows 2000

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<td>5.65</td>
<td>4.93</td>
<td>5.03</td>
<td>4.38</td>
</tr>
</tbody>
</table>
Experiment – CPU load

- Overall CPU load of client PC
  - When an audio stream is being played
  - Pentium II 350MHz, 64MB RAM, 192Kbps media

- Windows 98
  - Before playing: 0~4%
  - mms play: 15~19%
  - Pcube play: 13~19%

- Windows 2000
  - Before playing: 1~2%
  - mms play: 9~15%
  - Pcube play: 9~15%
# Experiment – Transfer Speed

<table>
<thead>
<tr>
<th>Internet Service</th>
<th>Speed check(^{(1)})</th>
<th>ftp result(^{(2)})</th>
<th>Pcube(^{(3)})</th>
<th>Increase rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>KT Megapass Multi IP</td>
<td>192,500</td>
<td>48,398</td>
<td>223,544</td>
<td>16.1 461.9</td>
</tr>
<tr>
<td>Thurunet Cable</td>
<td>310,900</td>
<td>168,338</td>
<td>489,599</td>
<td>57.5 290.8</td>
</tr>
<tr>
<td>Hanaro Cable</td>
<td>116,600</td>
<td>107,334</td>
<td>197,950</td>
<td>69.8 184.4</td>
</tr>
<tr>
<td>Hanaro ADSL</td>
<td>132,200</td>
<td>18,121</td>
<td>163,924</td>
<td>24.0 904.6</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Using NCA (National Computerization Agency) tool  
\(^{(2)}\) From FTP server located at Thrunet Back-bone  
\(^{(3)}\) 6 PCs on a couple of external DSL
Experiment – Transfer Stability

Traditional transfer from a server

Pcube (Parallel Harvest)
Results
Service Architecture - IDC

- HUGE investment in servers & network
- The source of problems remain
Service Architecture - CDN

- HIGHEST cost
- Underutilization of servers and network
Service Architecture – Grid Delivery

- Optimal data source
- Shortest route
- Minimum cost
Brief Result of Pcube Stream™

- Bit-rate: 300Kbps
  Max. concurrent user: 10,000
  Network bandwidth: 3Gbps

- Bit-rate: 300Kbps
  Max. concurrent user: 20,000
  Network bandwidth: 2.4Gbps (80% saved)

- Bit-rate: 600Kbps
Effect of Pcube Stream™

- **Network saving**
  - PANDORA.TV can save up to 12.6Gbps network each month

- **High quality service**
  - Bit-rate increased to 600Kbps, and will be 1Mbps in near future

- **Various additional services**
  - PANDORA.TV is planning for new services
Thank You!

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