Broadband in Asia

October 11, 2002

Lee Daniels
AT&T Experience in USA

- Project Angel in Chicago Area
- Resale RBOC Facilities
- Duplicate Telecom Infrastructure
- DirecTV Investment
- TCI Acquisition @$44 Billion
- Time Warner Telecom Deal
# Residential BB Access Technology Comparison

<table>
<thead>
<tr>
<th>Medium</th>
<th>Characteristics &amp; Functions</th>
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</thead>
<tbody>
<tr>
<td><strong>HFC Cable Modem</strong></td>
<td>Up to 27 Mbps down, 0.5 to 2 Mbps up (both shared) Cable plant needs fiber build-out, digitization and 2-way upgrade</td>
</tr>
<tr>
<td><strong>ADSL</strong></td>
<td>1.5 to 9 Mbps down, 16 Kbps to 640 Kbps up DSL capable copper loops up to 18,000 ft.</td>
</tr>
<tr>
<td><strong>uADSL (&quot;DSL Lite&quot;)</strong></td>
<td>1.5 Mbps down, 384 Kbps up DSL capable copper loops up to 18,000 ft.</td>
</tr>
<tr>
<td><strong>Fixed Wireless MMDS</strong></td>
<td>Same up/down rates as HFC cable modem 30 Miles radius downlink only to be upgraded to 2-5 miles radius 2-way cellular-like infrastructure</td>
</tr>
<tr>
<td><strong>Satellite</strong></td>
<td>400 Kbps down, Telco POTS return path</td>
</tr>
</tbody>
</table>
Mature markets are penetrated in all sectors, however, developing markets growing from:
• central to distributed
• voice to video
• core to sub-sector
Telecom Industry Status

- Key activity in each sector
  - Voice (wireline)
    - Increasing wireless penetration is resulting in net line decrease in mature markets
    - VoIP is displacing circuit switched for both initial deployment in developing markets, e.g. China Netcom and new entrants in mature markets, e.g. Fusion (Japan)

  - Broadband
    - Wireless
      - This is the high-growth area in most Asian markets, some to point of saturation
      - Capital intensive network upgrades to launch of 3G services is next wave
      - Application and content development becoming hot sectors, albeit venture
    - Data (wireline)
      - DSL has taken off in mature markets, e.g. penetration of >50% in Korea
      - Business (customer) services moving towards higher value-add services, e.g. VPN
      - Business bandwidth requirements have grown: Low-end 1.5M to High-end SANs
    - Cable TV
      - Incremental data business has made this more attractive in the specific metros with high TV penetration and consolidated operations, however, these markets are few
      - Convergence of Broadcast TV – Data – Voice
      - Digital broadcasting – the “3G” of Cable TV
Opportunity Assessment Framework

- **Paradise Lost**
  - narrowband
  - competitive
  - low returns

- **Gold Rush**
  - broadband
  - competitive
  - high growth

- **War of Attrition**
  - narrowband
  - regulated
  - low growth

- **Gilded Cage**
  - broadband
  - regulated
  - high returns

Broadband businesses in regulated sectors will offer the most attractive opportunities – namely mobile and proprietary, last-mile infrastructure.
Trends: Mobile + Data = 3G?

- Mobile subs set to exceed wireline voice – Taiwan already has
  - This may be especially interesting in countries without existing wireline network
- Frequency allocation / licensing provides a natural barrier to entry for competition

Mobile data revenues set to grow, as is projected in Korea

- PC penetration in many Asian countries is low relative to the west – suggesting handset is key terminal
- But, 3G applications not yet proven
  - ‘Jury still out’ on Japan launch
  - Question of technical scalability

Mobile is proven, but 3G take-up is unclear due to costs and adoption of the new applications
Trends: Industry Restructuring

**Dis-aggregation** – competitive pressures forcing split between network specialists and marketing specialists
- Network (wholesale) specialists
  - Key is scale and lowest unit price
  - E.g. eAccess, Acca, Thrunet, Heisei Denden
- Marketing (& Content) specialists
  - Keys are brand recognition and scale
  - E.g. AOL, MSN, voice resellers
  - No clear winners in Asia yet
- Parallels seen in other regions
  - Wireless Towers business
  - MVNO business

**Consolidation** – “up or out” phenomenon as mid-sized players can not keep up with business requirements
- Especially in un-regulated areas where over-competition has driven down margins
- E.g. ISPs, data centers, Sub sea cable, fragmented mobile markets (India, Malaysia, etc)
- Potentially very interesting if economies of scale can be leveraged into scope
  - E.g. CATV incremental service model of adding data and digital services

Industry restructuring to specialize or to gain economies of scale will afford significant opportunity for investment – albeit risky
Trends: Bottleneck shifted to “Last Mile”

- Broadband is a key driver of IP traffic growth - particularly DSL in mature markets
  - Korea: 11mn DSL/Cable subs
  - Japan: 3mn, adding 300k/month
- Bandwidth utilization still growing rapidly, but not fast enough to fill capacity in LD networks or Data Centers (i.e. central infrastructure)
  - Asia Content
- Resulting in rapid price erosion, business failure and consolidation
  - L3 sold to Reach
  - 360networks, AGC, Tycom, PCL, Exodus entered Ch11

- Local Access still generally under-serviced in most markets
  - Consumer Market
    - Telephone is the default monopoly except for CATV in key metropolitan markets
      - Figure 18: Broadband statistics for Asia

<table>
<thead>
<tr>
<th></th>
<th>Cable ARPu (US$/month)</th>
<th>ADSL ARPu (US$/month)</th>
<th>Per capita GDP (US$)</th>
<th>Cable subs (’000)</th>
<th>ADSL subs (’000)</th>
<th>Total households (’000)</th>
<th>Total Penetration rates (%)</th>
<th>Cable ARPu as % of income</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>31.3</td>
<td>33.0</td>
<td>20,000</td>
<td>100</td>
<td>200</td>
<td>300</td>
<td>7.127</td>
<td>4.2%</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>29.5</td>
<td>33.3</td>
<td>21,200</td>
<td>150</td>
<td>350</td>
<td>530</td>
<td>2.127</td>
<td>23.6%</td>
</tr>
<tr>
<td>Korea</td>
<td>24.1</td>
<td>29.6</td>
<td>9,600</td>
<td>3,000</td>
<td>4,000</td>
<td>5,300</td>
<td>13.011</td>
<td>40.5%</td>
</tr>
<tr>
<td>Singapore</td>
<td>40.6</td>
<td>45.6</td>
<td>21,100</td>
<td>40</td>
<td>48</td>
<td>88</td>
<td>974</td>
<td>9.0%</td>
</tr>
<tr>
<td>Taiwan</td>
<td>21.7</td>
<td>44.1</td>
<td>12,654</td>
<td>200</td>
<td>400</td>
<td>600</td>
<td>7098</td>
<td>8.3%</td>
</tr>
</tbody>
</table>

Source: Ziff Media, IDC, DB Research estimates

- Business Market
  - Building access networks are slowly being served by CLECs

Proprietary last-mile access continues to be attractive
**Investment Thesis and Risks**

**Investment Thesis**
- Regulated broadband sectors offer most potential – namely, (3G) mobile
- Centralized infrastructure a commodity, but last-mile a bottleneck
- Asset sharing likely to become a new business opportunity
  - Towers, MVNO, wholesale
- Scope for consolidation of fragmented sectors
  - ISPs, CATV, 2/2.5G Mobile
- Bankruptcies and exit of some global players creating opportunities
- High capital & license entry barriers

**Risks & Concerns**
- Foreign ownership and telecom regulations require significant lobbying to circumvent
- Cannibalization of existing markets
- Significant overcapacity in (commodity) markets
  - Unlikely that margins will return
- Incumbents often block competitors’ asset sharing / new entry
- Opportunities often too big or too small/new
  - Incumbent players are very large
  - New entrants require <$25m
- Exit options may be decreasing
  - Fewer strategic buyers around

*Good time to buy, but high (competitive) risk in unregulated sectors*
## Summary of New Submarine Systems in Asia-Pacific

<table>
<thead>
<tr>
<th>Year</th>
<th>System</th>
<th>Peak Capacity (Gbls)</th>
<th>Transpacific</th>
<th>Pan-Asian</th>
<th>Global/Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>SEA-ME-WE 3</td>
<td>160</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>China-US</td>
<td>640</td>
<td>✕</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td>FLAG Euro-Asia</td>
<td>640</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2000</td>
<td>PC-1</td>
<td>640</td>
<td>✕</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>Japan-US</td>
<td>640</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2000</td>
<td>Southern Cross</td>
<td>160</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2001</td>
<td>EAC</td>
<td>2,560</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2001</td>
<td>APCN-2</td>
<td>2,560</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2001</td>
<td>C2C</td>
<td>7,680</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2001</td>
<td>Tiger</td>
<td>640</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
<tr>
<td>2001</td>
<td>Aus-Japan</td>
<td>640</td>
<td></td>
<td></td>
<td>✕</td>
</tr>
</tbody>
</table>

Source: RHK, Inc.
### Snapshot of Network Construction in Asia-Pacific

<table>
<thead>
<tr>
<th>Country</th>
<th>Company</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>Crosswave Communications</td>
<td>Leasing 6,000km of dark fibre from KDDI as it builds its own backbone, which will be 12,000 route km by 2005.</td>
</tr>
<tr>
<td>China</td>
<td>China Unicom</td>
<td>As of 2000, its national network includes nearly 30,000 route km of fibre (mostly in the backbone).</td>
</tr>
<tr>
<td>China</td>
<td>China Netcom</td>
<td>Its phase I, complete at year-end 2000, will give it 23,000 route km of fibre (including four city loops).</td>
</tr>
<tr>
<td>Taiwan</td>
<td>NCIC TFN EBT</td>
<td>Each new licensee is building a national fibre backbone and metro access networks. By 2006, each network must have capacity to serve at lease one million lines (Taiwan currently has ~12 million lines).</td>
</tr>
<tr>
<td>India</td>
<td>Powergrid</td>
<td>Had 3,000 route km of fibre in March 2000, will add 15,000 over the next three years. Wants to be long-distance player post-deregulation.</td>
</tr>
<tr>
<td>Australia</td>
<td>Powertel</td>
<td>Is building a Brisbane-Sydney-Canberra-Melbourne-Adelaide intercity network and metro access networks in most markets. Affiliate of Williams Communications.</td>
</tr>
<tr>
<td>Korea</td>
<td>Hanaro</td>
<td>Already built national backbone using 2.5Gb/s-based WDM. In target cities, it builds STM-16 rings, with subtending STM-1 rings to serve buildings.</td>
</tr>
</tbody>
</table>

Source: RHK, Inc.
Optical communications and Broadband Trends in Asia-Pacific

* 2001 DSL subscriber Distribution by Region

- Asia-Pacific: 44%
- Europe: 25%
- Americas: 2%
- North America: 29%

* 2001 Asia-Pacific DSL Subscribers by Country

- Korea: 4,200,000
- Japan: 1,900,000
- Taiwan: 1,500,000
- Hong Kong: 450,000
- China: 350,000
- Singapore: 150,000
- Australia: 100,000

Source: RHK, Inc.
Japan Broadband Market

Casualties

KDDI Winster
New Century Global Net
Tokyo Metallica

Winner

NTT (Cost Allocation)

Yahoo Broadband
EAccess (Wholesale to JT for ODN)
CATV
Freebit