Broadband Access Platforms for the Mass Market – An Assessment

FCC Technical Advisory Council
Optical Working Group
December 4, 2002
• Summarize Task

• Define services offered over broadband access platforms today.

• Provide synopsis of suitability of platforms

• Discuss key economic factors

• Propose next steps
# ANALYSIS OF BB ACCESS PLATFORMS FOR THE MASS MARKET

<table>
<thead>
<tr>
<th>Task</th>
<th>Comments</th>
<th>Key Issues for FCC</th>
</tr>
</thead>
</table>
| Define Services                           | • Define services purchased by mass market today over broadband access platforms  
– Voice  
– High Speed Internet Access  
– Multi-programming video services  
• Defer discussion of tomorrow’s services for future work | • Definition of Broadband  
• Viability of Intermodal Competition  
• Availability of Broadband to All Americans |
| Analyze BB Platform Feasibility           | • Assessment of Broadband Access Platforms  
– Status  
– Feasibility  
– Roadblocks to deployment |                                                                                                                                          |
| Understand Economics                      | • Analyze economics of deployment (frame question for FCC – actual studies beyond scope)  
– Cost of deployment with different service bundles  
– Various geographies  
– Cable and DSL as baseline |                                                                                                                                          |

**Supporting Documents:**  
• Broadband Access Assessment Oct. Meeting Notes by Stagg Newman  
• Broadband Access Assessment Action Plan by Stagg Newman
OUTLINE

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### Definitions of Today’s Services Provided by BB Access

<table>
<thead>
<tr>
<th>Service</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Voice**                | • Primary line  
  – Feature set, availability, toll quality voice, reliability as basic service  
  – E911 w/o AC power, CALEA, Operator and emergency services  
  – CLASS and customer calling  
  – Transparent to customers’ environment (extension phones, add’l lines)  
• Secondary Line  
  – Lower cost, limited features, disclaimer |
| **High Speed Internet Access** | • Always-on  
• Speeds comparable to DSL or Cable Modem today  
• Performance comparable to DLS or Cable Modem including latency |
| **Multi-prog. Video svcs** | • Basic and premium video channel packages  
• Pay per view  
• Comparable to Cable or DBS services today  
• Near Video on Demand and true VOD just starting to gain traction |

**Supporting Documents**

- Primary versus secondary line telephony service from Ralph Brown of Cable Labs
- Broadband Access for Multiprogramming Video/Audio Services from Barry Singer of Philips.
- DSL-Cable Modem Comparison from Niel Ransom of Alcatel
• Summarize Task

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The TAC had previously supplied the FCC with an analysis of many BB platforms. These analyses were updated, more detailed material was supplied, and one additional platform was added. The key features, advantages, disadvantages and limitations were addressed. The analysis focuses on serving existing homes and small businesses, not new builds. A separate set of charts has been done for new builds. (see supplementary documentation)

<table>
<thead>
<tr>
<th>Suitable</th>
<th>Cable</th>
<th>DSL</th>
<th>VDSL</th>
<th>FTTx</th>
<th>PLC</th>
<th>Satellite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Voice – Primary Line**
  - **Suitable**
    - Cable
    - DSL
    - VDSL
    - FTTx
    - PLC
    - Satellite
  - **Not Suitable**
    - Available now
    - In early deployment
    - Not available

- **Voice – Secondary Line**
  - **Suitable**
    - Cable
    - DSL
    - VDSL
    - FTTx
    - PLC
    - Satellite
  - **Not Suitable**
    - Available now
    - In early deployment
    - Not available

- **High Speed Internet**
  - **Suitable**
    - Cable
    - DSL
    - VDSL
    - FTTx
    - PLC
    - Satellite
  - **Not Suitable**
    - Available now
    - In early deployment
    - Not available

- **Multi-Program Video**
  - **Suitable**
    - Cable
    - DSL
    - VDSL
    - FTTx
    - PLC
    - Satellite
  - **Not Suitable**
    - Available now
    - In early deployment
    - Not available

Suitable includes technical ability to deliver desired services as well as costs as a function of addressable market.
The TAC had previously supplied the FCC with an analysis of many BB platforms. These analyses were updated, more detailed material was supplied, and one additional platform was added. The key features, advantages, disadvantages and limitations were addressed. The analysis focuses on serving existing homes and small businesses, not new builds.

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<tr>
<th>Suitable</th>
<th>LMDS</th>
<th>Low Ghz Licensed Wireless</th>
<th>Unlicensed Wireless</th>
<th>Stratospheric Platforms</th>
<th>3G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Voice – Primary Line

Voice – Secondary Line

High Speed Internet

Multi-Program Video

Low Ghz Wireless refers to portable and fixed wireless systems using licensed frequency below 4 Ghz. Suitable includes technical ability to deliver desired services as well as costs to do so.
References to Detailed Descriptions for Broadband Access Platform


- Very High Speed DSL (VDSL), FCC Tutorial, April 14, 2002, Stagg Newman


- Wireless Data: The Impact of 802.11 on Intermodal Competition by John Ryan of RHK.

Note that the assessment of Low Ghz licensed wireless platform in the proceeding chart draws from the material from the MMDS FCC Tutorial with the material form the Portable Broadband Tutorial. Some of the new Portable BB technologies can use MMDS spectrum.

Note that the assessment of Unlicensed Wireless from the proceeding chart draws from the material from the Unlicensed Wireless, Wireless Mesh, and WLAN tutorials as well from the Wireless Date: The impact of 802.11

Note that the assessment of FTTx in the proceeding chart 7 draws from the Passive Optical Networking Tutorial as well from the Passive Optical Networking charts referenced in the note on slide 10.
# EXPLANATION OF THE SUITABILITY AND STATE OF DEPLOYMENT FOR THE BROADBAND ACCESS PLATFORMS

<table>
<thead>
<tr>
<th>BB Platform</th>
<th>Observations</th>
</tr>
</thead>
</table>
| **Cable**   | - High addressability and low cost structure for multi-programming video and HS Internet access  
              - Support of primary line telephony plus additional lines requires deployment of “Smart NID” and truck roll or equivalent thereof at cost of several 100 dollars  
              - Capable of supporting NVOD and VOD  
              - Cox and Comcast (ATT BB) have deployed primary line. Secondary line offered by Wide Open West. |
| **DSL**     | - Not capable of multi-programming video services  
              - Currently only available to about 60% of households  
              - Expensive to extend DSL addressability to additional households as requires deeper fiber, new RTs. Installation may require truck roll to both RT and home unless pre-installation is done. |
| **VDSL**    | - High costs for multi-programming video due to capacity reinforcement in network.  
              - Very limited addressability (at most 20% of homes) with current technology.  
              - Very high costs (>2000 per home) to extend addressability beyond 20% due to cost of building deep fiber, placement of RTs, and small number of homes per node to spread fixed costs over.  
              - Early VDSL trials were not followed up by any further deployment. |

**Supporting Documents**  
- Cable Opportunities: Cable Access Technology from Niel Ransom of Alcatel  
- Cable Telephony from Niel Ransom of Alcatel
EXPLANATION OF THE SUITABILITY AND STATE OF DEPLOYMENT FOR THE BROADBAND ACCESS PLATFORMS (con.)

<table>
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<tr>
<th>BB Platform</th>
<th>Observations</th>
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</table>
| FTTx        | • Very high costs of installation ($20 to $100 per foot unless existing poles are available)  
• Costs of customer equipment including converter box(es)  
• Cost of customer equipment for primary line (“Smart NID”)  
• FTTx is promising for new builds where the cost of “digging” is common to all technologies. Can provide full services including all multi-programming video.                                                                 |
| PLC         | • Cost of shared network technology but recent substantive progress  
• Compliance with Part 15 line conductive emissions (Class A or Class B issues)  
• Engineering shared media bandwidth and harsh RF environment  
• Cost of customer equipment and install, particularly for primary line (“Smart NID”). Recent progress on self-install claimed.  
• Lack of commercial deployment experience and even field trials are limited |
| Satellite    | • Latency problem for real time services, particularly two-way, and for TCP-IP  
• Limited upstream bandwidth to share  
• Not suitable for primary line telephony due to latency, etc  
• Inside/outside problem (i.e. outside antenna must be connected to inside wiring)  
• More costly than cable of DSL for high speed Internet access  
• DirecTV may withdraw from consumer Internet access market  
• Real-time VOD challenging due to bandwidth constraints |

Supporting Documents
• Broadband Access Platforms – FCC Tutorial – Dec. 02 (PLC Updates by Stagg Newman)  
• Passive Optical Networks from Niel Ransom of Alcatel  
• HSI (High Speed Internet) in low density areas from Niel Ransom of Alcatel
EXPLANATION OF THE SUITABILITY AND STATE OF DEPLOYMENT FOR THE BROADBAND ACCESS PLATFORMS (con.)

<table>
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| LMDS                | • High costs of both customer and network equipment implies suitability is more for medium to large business rather than home and SME.  
                      • Cost of customer equipment installation (inside/outside problem)  
                      • For MDUs and MTUs, costs of roof rights and connecting to I/W, which is typically in basement or ground floor.  
                      • Limited range and Line of sight necessity.  
                      • Backhaul costs due to limited range.                                                                                                           |
| Low Ghz Licensed Wireless | • Acquisition of suitable spectrum. MMDS spectrum is fractured, 700 Mhz UHF spectrum is not yet available. Auctions of government spectrum have been delayed.  
                           • Cost of customer equipment and install, particularly for primary line (“Smart NID”)  
                           • Inside/outside wiring issue for many customers.  
                           • Antennae siting and backhaul costs but much better than unlicensed  
                           • Will not support multiprogramming video.  
                           • Not yet deployed in volume                                                                                                                      |

Low Ghz Licensed Wireless refers to the technologies described in prior TAC documents as Portable Broadband and MMDS. These technologies used licensed spectrum below 4 Ghz to support fixed and nomadic users.

Supporting Documents
• Broadband Access Platforms – FCC Tutorial – Dec. 02 (LMDS and MMDS updates from Kwame Boakye of Harris and Nitin Shah of Arraycomm); unlicensed wireless from John Ryan of RHK and Nitin Shah of Arraycomm  
• Wireless Data: the impact of 802.11 on Intermodal Competition w/ supplemental comments by John Ryan of RHK
EXPLANATION OF THE SUITABILITY AND STATE OF DEPLOYMENT FOR THE BROADBAND ACCESS PLATFORMS (con.)

<table>
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<th>BB Platform</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Unlicensed Wireless</td>
<td>• Limited range and line of sight issues. (Ad Hoc and Mesh as yet unproven in commercial deployment)</td>
</tr>
<tr>
<td></td>
<td>• Shared media and RF Engineering (Interference from other uses and users), i.e. risk of “tragedy of the commons” effect.</td>
</tr>
<tr>
<td></td>
<td>• Cost of customer equipment and install, particularly for primary line (“Smart NID”)</td>
</tr>
<tr>
<td></td>
<td>• Inside/outside issue for many customers</td>
</tr>
<tr>
<td></td>
<td>• Antennae siting, backhaul costs, and need for numerous access points</td>
</tr>
<tr>
<td></td>
<td>• Will not support multiprogramming video.</td>
</tr>
<tr>
<td>Stratospheric Platforms</td>
<td>• Untested technology in commercial deployment, particularly the unmanned platforms</td>
</tr>
<tr>
<td></td>
<td>• Need for new spectrum allocations</td>
</tr>
<tr>
<td></td>
<td>• Need for FAA approval of platforms</td>
</tr>
<tr>
<td></td>
<td>• Cost of customer equipment and install, particularly for primary line (“Smart NID”).</td>
</tr>
<tr>
<td>3G</td>
<td>• Not really for high speed data (dial-up modem type performance likely for most users) without massive expenditures of capital to create dense cell architecture</td>
</tr>
<tr>
<td></td>
<td>• Latency problem for TCP-IP applications given relatively unreliable data link layer</td>
</tr>
<tr>
<td></td>
<td>• Not toll quality for voice</td>
</tr>
<tr>
<td></td>
<td>• Cost of customer equipment and install, particularly for primary line (“Smart NID”).</td>
</tr>
<tr>
<td></td>
<td>• Will not support multiprogramming video.</td>
</tr>
<tr>
<td></td>
<td>• Early deployments have not met expectations; deployment delayed in many parts of world.</td>
</tr>
</tbody>
</table>

Supporting Documents
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FOUR MAJOR FACTORS EFFECT BB PLATFORM ECONOMICS

Revenue Generating Services
- Ability to share costs across multiple service offerings
- Ability to share marketing and SG&A across multiple offerings
- Ability to reduce churn
- Market take rate among all services and hence ability to share fixed costs.
- ……….

Customer Equipment & Installation
- Costs of customer equipment
  - For primary line telephony, “Smart NID or equivalent to handle basic phones, extensions, etc.
  - For digital video Set Top Box per TV
- Costs of customer installation
  - For primary line telephony, connection of I/W to “Smart NID” or replacements of same
  - For internet access, connection of PC to network access link
- Cost of customer engineering
  - For wireless, line of sight engineering
  - Compatible w/ computer environment
- ………

Network Access Costs
- Costs per “port” to add customers
- Costs of ROWs and/or antennae sites
- Costs of civil engineering and construction
- Costs of concentration and backhaul
- Cost of network engineering
  - Traffic engineering for shared media
  - RF engineering for wireless
- Network Utilization
- …

Operations, Billing, and Customer Care Systems
- Costs of developing software support systems
- Ability to modify systems for new services/features
- Scalability
- ………
CABLE AND DSL INTERNET ACCESS COST STRUCTURE – AN EXAMPLE
$ per customer per month for model network build – study done in early 2001 and not updated

Mass xDSL deployment for an ILEC

<table>
<thead>
<tr>
<th></th>
<th>2002E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total costs</td>
<td>$47.0</td>
</tr>
<tr>
<td>Transport/network</td>
<td>2.0</td>
</tr>
<tr>
<td>ISP/hosting</td>
<td>5.0</td>
</tr>
<tr>
<td>Customer acquisition</td>
<td>15.5</td>
</tr>
<tr>
<td>CPE</td>
<td>4.5</td>
</tr>
<tr>
<td>Home installation</td>
<td>5.0</td>
</tr>
<tr>
<td>Customer service/billing</td>
<td>11.0</td>
</tr>
<tr>
<td>Maintenance</td>
<td>4.0</td>
</tr>
</tbody>
</table>

Cable

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>Total costs</td>
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<tr>
<td>Customer acquisition</td>
<td>14.0</td>
</tr>
<tr>
<td>CPE</td>
<td>3.0</td>
</tr>
<tr>
<td>Home installation</td>
<td>6.0</td>
</tr>
<tr>
<td>Customer service/billing</td>
<td>7.0</td>
</tr>
<tr>
<td>Maintenance</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Caveat: Not for generalized comparison purposes with other technologies. Detailed comparisons depend on many modeling assumptions including what services are bundled, financial policies, underlying labor costs, maturity of market, per cent customer self install, …..

Costs above are for an ILEC. CLEC would have to pay an additional $2 to $20 per month for line shared UNE loop or entire UNE loop (costs include UNE loop and other recurring CO charges).

Source: JPMorgan and McKinsey analysis, Broadband 2001, analysis was for incremental costs over existing telco or cable business.
BUT NO ONE SOLUTION FITS ALL MARKETS AND SERVICES

Chart based on typical spectrum allocations and assignments today.

Supporting Document

• HSI in low density areas from Niel Ransom of Alcatel
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Next Steps

• Complete delivery of current assessment to FCC
  - revise and transmit documents
  - hold oral briefings and discussions as needed
  - solicit feedback on how we met need and what else is needed

• Propose symposium on next generation broadband for the mass market sponsored by TAC III
BACKUP