Overview of the History of the Telecommunications Industry

COMPTEL
Back to basics ...what did Bell invent?
The First Interconnection Dispute

• 1878 Western Union begins developing exchanges using a patented telephone developed by Thomas Edison.

• Western Union refuses to install telegraph lines to premises with a Bell telephone. Bell and WU sue each other.
  – Western Union withdraws from telephone for 17 years.
  – Bell agrees to stay out of the telegraph business.
Local Competition – First Try (1894-1907)

• Bell patents expire – the patent on the telephone was the basis for the first monopoly.

• Independent (i.e., not Bell) Companies form in rural areas.

• Competition develops in cities with multiple networks.
Outcome: Settle with DOJ

1913 Kingsbury Commitment

– Sell Western Union
– Allow interconnection
– Quit buying independents
A Stable Monopoly: (1913-1950)

AT&T Long Lines Division

The Tandem Switch

Everything built by Western Electric and invented by Bell Labs.

Local Bell Company
Timeline of Customer Equipment (CPE) Competition

1948
Hush a Phone Complaint

1955
Court Overturns FCC

1956
FCC Decides Device Reduces Quality

1968
CarterPhone Extends Interconnection

1975
AT&T Requires Protective Devices

1984
CPE Separated with AT&T Divestiture

FCC Adopts Certification
Timeline of Long Distance Competition

- 1959: Above 890 “opens” microwave
- 1963: MCI Applies for Chi-St Louis
- 1969: FCC Approves MCI for Private Line
- 1973: MCI gets local interconnection
- 1975: MCI offers “Execunet”
- 1977: Court rules FCC must conclude monopoly is better than competition to deny MCI
- 1982: Divestiture Announced
- 1984: Divestiture Implemented
Analog Transmission Limited by Noise

Analog Amplification: Noise Accumulates
Analog to Digital Conversion

Original Signal

zero

one

zero
Telecom Architecture

Lots of great CO based copper ... it must be protected!
History of Copper Cable

• Substantial portion of copper cable installed under “rate of return” regulation paid for by ratepayers.

• Most ILECs have depreciated the value of their copper cable but have not reduced their rates.

• New entrants are privately funded since 1996 with no beginning customer base or revenue stream.

• ILECs have the revenues from existing customers to fund new fiber deployment and preservation of copper. (80% market share)
The Pressures for Grand Bargain – 1996 ACT

- **CLECs** want to offer traditional switched local services.
- **RBOCs** want to offer long distance service.
- **RBOCs** concerned that “universal service” obligations are a perpetual disadvantage.
- **Long Distance Carriers (IXCs)** fear the power of RBOC pre-divestiture problems and want access reform.
Local Entry Strategies

• **Resale** of the incumbent local telephone companies service. (Avoided Cost Discount)

• **Lease** of the incumbent local companies network. (Cost-Based Rates)
  – UNE-Loop
  – UNE-Platform

• **Build** your own network and then **interconnect** with ILECs for exchange of traffic.

• **Offer** Internet services and new applications
Revenues ($ Billions - Year End 1995)
Revenues ($ Billions - Year End 2007)
Traditional Wireline/Cable/Wireless
A history of bandwidth

<table>
<thead>
<tr>
<th>Downstream Data Rate (Mbps)</th>
<th>1984</th>
<th>1994</th>
<th>1998</th>
<th>2002</th>
<th>Now</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISDN</td>
<td>1.5Mbps</td>
<td>Max ~8Mbps</td>
<td>Max ~25Mbps</td>
<td>50Mbps @ 1kft</td>
<td>Bonded VDSL2 on the way!</td>
</tr>
<tr>
<td>HDSL</td>
<td>Max 1.5Mbps</td>
<td>13Mbps @ 6kft</td>
<td>13Mbps @ 6kft</td>
<td>1998</td>
<td>2002</td>
</tr>
<tr>
<td>SHDSL</td>
<td>Max 1.5Mbps</td>
<td>7Mbps @ 9kft</td>
<td>5.7Mbps @ 5.5kft</td>
<td>2002</td>
<td>Bonded VDSL2 on the way!</td>
</tr>
<tr>
<td>ADSL1</td>
<td>Max 1.5Mbps</td>
<td>13Mbps @ 6kft</td>
<td>7Mbps @ 9kft</td>
<td>2002</td>
<td>Now</td>
</tr>
<tr>
<td>ADSL2</td>
<td>5.7Mbps @ 5.5kft</td>
<td>13Mbps @ 6kft</td>
<td>7Mbps @ 9kft</td>
<td>2002</td>
<td>Now</td>
</tr>
<tr>
<td>ADSL2+</td>
<td>5.7Mbps @ 5.5kft</td>
<td>13Mbps @ 6kft</td>
<td>7Mbps @ 9kft</td>
<td>2002</td>
<td>Now</td>
</tr>
<tr>
<td>2BaseTL</td>
<td>50Mbps @ 1kft</td>
<td>13Mbps @ 6kft</td>
<td>7Mbps @ 9kft</td>
<td>2002</td>
<td>Now</td>
</tr>
<tr>
<td>ESHDSL</td>
<td>5.7Mbps @ 5.5kft</td>
<td>13Mbps @ 6kft</td>
<td>7Mbps @ 9kft</td>
<td>2002</td>
<td>Now</td>
</tr>
<tr>
<td>VDSL2</td>
<td>5.7Mbps @ 5.5kft</td>
<td>13Mbps @ 6kft</td>
<td>7Mbps @ 9kft</td>
<td>2002</td>
<td>Now</td>
</tr>
</tbody>
</table>

Note: Bandwidth numbers are approximations and vary with wire gauge and noise assumptions.

Stuck here unless you have access to UNE-L Copper
Copper Innovation Continues … but

- Copper loop plant is a national treasure and generally available anywhere today.
- DSL innovation has connected tens of millions of consumers and businesses to the internet … an absolute necessity today for broadband availability.
- Bandwidth speeds via copper have already exceeded what many thought was possible and this innovation continues today with speeds up to 1 Gbps per customer*.
- Copper applications now include video and Ethernet at lower costs than fiber. It is critical to preserve copper to take advantage of opportunities created by these new technology advances.
- Access to copper is not guaranteed. Incumbents are retiring a record number of copper loops and transport which directly affect CLECs and their customers.

The IP Network Layers

- Physical Layer -- Fiber/Copper
- Structure Layer – Poles, Conduit, and Rights-of-Way
- Application Layer (i.e., “The Payload”)
- Transport Layer
- Data Link Layer
- IP Layer

Layers in Each Individual Packet

Small/Medium Business  Fiber/Conduit