

Broadband Pipes
How Many???
or
Wired, Wireless, or Both???

Columbia Institute for Tele-Information
State of the Telecommunications Industry – 2007
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I. Are competing broadband (wired) infrastructures economically sustainable in most US markets?

NO beyond a duopoly - For the mass market of buildings.

and

II. How Many Should We Expect: 2.5? 1.5? 3.5?

2 - in most markets given current public policy and market dynamics.
Question: Is 1 common carrier regulated fixed BB infrastructure optimal?

III. But what about for the portable, mobile and remote markets ?

4 or more - given the success of the wireless public policy in the '90s.

Broadband Deployment From Vision to Reality Executive Summary – Columbia Business School – 4/15/2003

- **Two competing visions of broadband infrastructure**
 - Fiber Vision: Open high-speed IP network with Infrastructure of FTTx with wireless overlay
 - Competition: Choice of multiple deregulated access pipes
 - For more info see FCC TAC – <http://www.fcc.gov/oet/tac/>
 - Report on BB Access Platforms – 12/04/02
 - Broadband Seminar – 4/17/03
- **Reality yields neither the fiber vision nor competitive access**
 - U.S. lags leading nations in the deployment of broadband networks
 - Incumbents not motivated to build open high-speed IP network with FTTx
 - Economics of Cable and DSL make alternative high-speed access plans challenging
- **Likely near-term FCC actions not likely to solve problem**
 - Current broadband directions not likely to create competitive access market nor to foster the development of a natural monopoly common carrier
 - Wireless may be best alternative, but barriers to substantive action are high
- **Therefore a new public policy debate is needed**

What's Changed?

- Demand
- Supply
- Market Dynamics

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Demand side developments

Doubling of bits/user for high speed Internet access lines

- **Digital Video – High Definition**
 - 30% of U.S. homes have bought HD Sets
 - 50% of those buy a second set within a year
- **Peer to peer networking**
- **Rich storage devices**
 - iPods
 - Storage is free

H.264 Rate Predictions in 2004

Year	SD (Mbps)	HD (Mbps)
2005	2.4	11
2006	2.1	9.5
2007	1.8	8.2
2008	1.6	7.7
2009	1.5	7.2
2010		
2011		
2012		

The above rates include both audio and video and are the capped peak rate (capped VBR) needed.

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Supply side developments Wired solutions widen the gap

• **DOCSIS 3.0**

- Raising the ante
- 750 Mhz per home
- Gigabits if needed

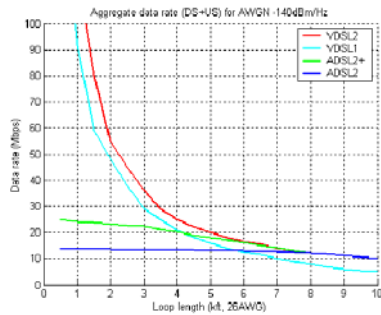
DOCSIS 3.0
 Downstream - 160 Mbps per channel, 5 Gbs per node
 Upstream - 120 Mbps per channel, 170 Mbps per node [1] 750MHz of available downstream spectrum (125 channels)
 [2] Aggregation of four 6MHz channels. With 256QAM = 160 Mbps
 [3] A -25MHz of useable upstream spectrum
 [4] Aggregation of four 6.4 MHz channels. With 64QAM = 120 Mbps

• **xDSL and FIOS**

- Raising the ante
- 10s of Mbps per copper line
- Gigabits to Terabits per fiber

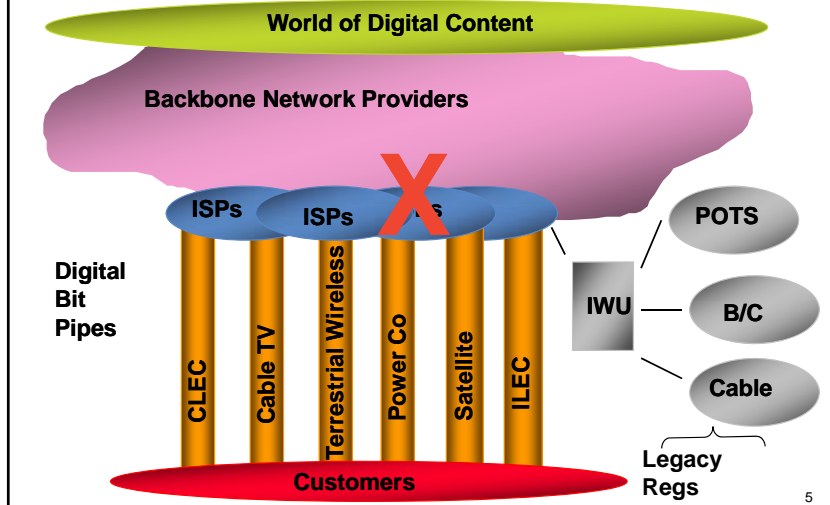
• **4G Wireless**

- Too little, too late for fixed
- < 2 bits/Hz efficiency
- 5-20 MHz per sector



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THE DEREGULATORS VISION OF COMPETITIVE ACCESS - NOT Deregulator's Dream: Circa 2005 - (from Chief Technologist FCC talk - 1999)



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Can wireless deliver switched video to the home competitively?

H.264 Rate Predictions in 2004

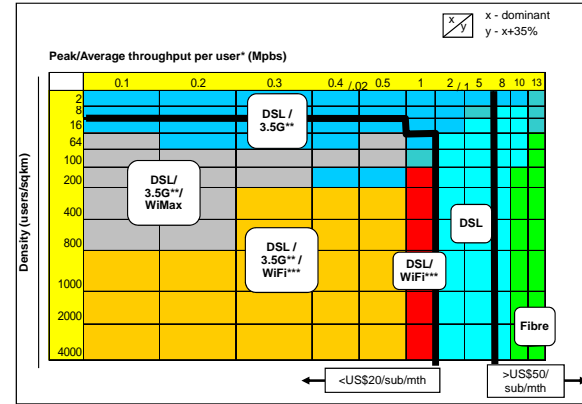
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Yes
 Provided there is one cell tower for every few homes
 or
 Regulators allocate several 100 MHz of prime spectrum
 or
 Radically new architectures and technology develop
 i.e.
NO!

For integrated players DSL dominates, fibre in high bandwidth, 3.5g prevalent, WiFi in high density areas

Technologies with lowest incremental costs/user/month (2010)

CASE EXAMPLE: WESTERN EUROPE

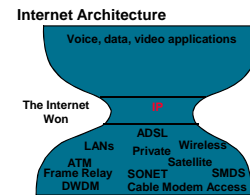


- Strategic Implications**
- Ubiquitous copper+DSL**
 - Market dominated by fixed-line, high-bandwidth plays (inability for mobile plays to churn DSL with a lower bandwidth service)
 - Race for customer with higher bandwidth applications, content
 - Selectively deploy fiber in the high-value segments
 - Ubiquitous copper only**
 - Race for customer with DSL, 3.5G (for bandwidth, mobility preference)
 - Promote high bandwidth applications, content to distinguish vis-à-vis pure mobile players
 - Selectively deploy WiFi in high-density, low-rise building areas

* Assumes contention ratio of 1:20
 ** 3.5G includes HSDPA, EV-DO
 *** Excluding high-rise areas
 Source: Vendor interviews; Analyst reports; McKinsey analysis

**BUT THE WORLD
 IS NOT ALL
 TETHERED**

**IP WIRELESS SERVICES
 THE OPEN INTERNET MODEL WON THE BATTLE FOR WIRELINE?
 FOR WIRELESS???**

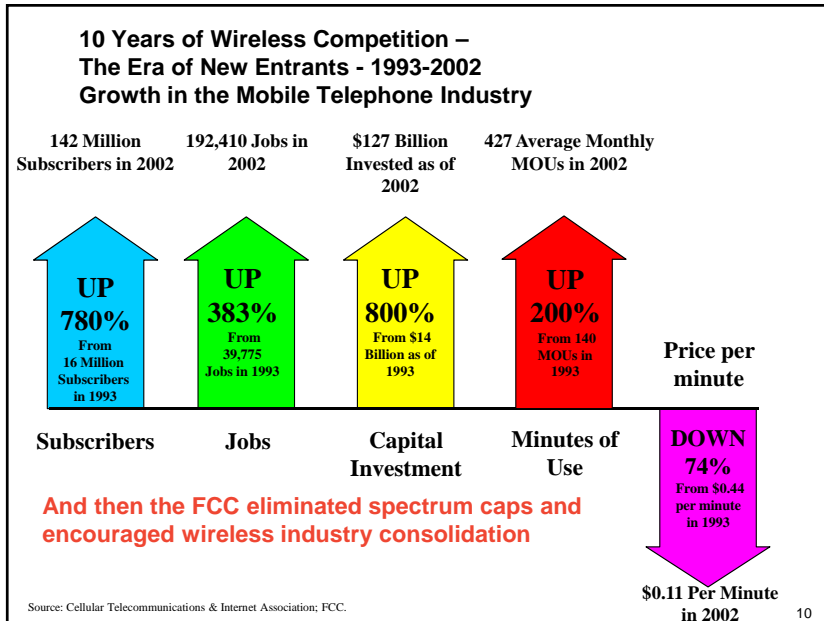


- Virtuous cycle of technology and new services
 - Lower costs
 - Greater customer reach
 - More development

- Reasons for Internet Success
- Driven by hyper-competitive computer industry and needs of end-user
 - WWW provided “killer apps” that fueled demand
 - Technology exploited Moore’s Law
 - Simplicity/scalability of IP architecture
 - Horizontal industry separation
 - Worldwide deregulation
 - Dropping private line prices
 - Flat rate access in U.S.
 - Lack of regulatory impedance
 - **EXPLOITED** existing telephony infrastructure – **MINIMIZING CAPEX**



Given the
 “arrival of
 wireless
 IP”
 what is the
 right
 wireless
 broadband
 policy?



SUMMARY

- **At most two pipes to most buildings is sustainable**
 - Economics of Cable and DSL make alternatives challenging
 - Incumbents not motivated to build open high-speed IP network
- **Likely near-term FCC actions not likely to solve problem**
 - The current broadband directions not likely to create competitive access market nor to foster the development of a pervasive deep fiber infrastructure
 - Wireless is not an general alternative for fixed areas
- **The unmet need is for a pervasive (i.e. high coverage) reliable robust wireless broadband infrastructure. What is the right market structure and policy?**
 - Cellular structure
 - Competitive market or oligopoly
 - Internet industry structure
 - Unlocked devices
 - Open applications

For the U.S. to build a nationally competitive wired and wireless broadband infrastructure, the public policy debate in the U.S. must be changed

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