Economics, QoS, and charging in the next great telecom revolution

Andrew Odlyzko
School of Mathematics and
Digital Technology Center
University of Minnesota
http://www.dtc.umn.edu/~odlyzko

Main points:

- Next great revolution: convergence of wireless and IP
- Economics, user preferences, and regulation will be more important than technology
- Success by mistake to continue:
  - high uncertainty
  - stubborn adherence to misleading myths
  - struggles for control
  - …

A few macro issues:

- What are the costs and incentives?
- Who is being served?
- What is the service?

4 dimensions of communications technology:

- Volume: How much data can it transmit?
- Transaction latency: How long does it take to do something?
- Reach: Where can the service be provided?
- Price: How much does it cost?

- Reliability, …

Network technologies and architectures:

- Irrelevant to users
- Cannot compensate completely for weaknesses of applications

Telecom industry hobbled by many misleading dogmas:

- Carriers can develop innovative new services
- Content is king
- Voice is passe
- Streaming real-time multimedia traffic will dominate
- There is an urgent need for new “killer apps”
- Death of distance
- QoS and metered rates: may finally become relevant!

Content vs. connectivity:

- Long historical tradition of overemphasis on content
- Connectivity has traditionally been valued much more than content
- Social connectivity very important but neglected

Note: Content (defined as material prepared by professionals for wide distributions) is big and important, it is just not as big or as important as connectivity.

Quantitative measures:

- Sarnoff's Law: Value of content distribution network grows like n
- Metcalfe's Law: Value of connectivity network grows like n^2
- Briscoe, Odlyzko & Tilly: Metcalfe's Law wrong, value of general connectivity network grows like n*log(n)

n*log(n) grows faster than n, but difference is sufficiently slow to enable the "content is king" dogma to persist

n = number of participants

Content vs. connectivity conclusions:

- Content is valuable
- Content not as valuable as connectivity
- Social content-enriched connectivity should be promoted

Telecom of last decade (conventional view):

- 2 giant disasters: long-haul fiber bubble and European 3G spectrum auctions

- 1 qualified success: Google

"Google envy"

Disasters overshadowed by great telecom success:

- US wireless: from $33 B in 1998 to $160 B in 2010
- US wireless data services in 2010: $50 B (about half SMS, included in $160 B)

- Google worldwide 2010 revenues: $29 B
- Cable TV video revenues: $53 B (in US, 2009)

Wrong lessons drawn from wireless:

- industry view: profits from tight control of wireless vs losses from the wild and uncontrolled Internet
- reality: success from providing mobility for voice and simple text messaging
- wireless voice and messaging provided in admirably net-neutral fashion
- usual reluctance to recognize reality
- continued fixation on content and control

Voice:

- killer app of yesterday
- killer app of today
- killer app of tomorrow:
  - "orality of human culture"
  - sadly neglected
  - many still unexploited enhancements (higher quality, …)
  - …

Revenue per MB:

• SMS:	$1,000.00
• cellular calls:	1.00
• wireline voice:	0.10
• residential Internet:	0.01
• backbone Internet traffic:	0.0001

Voice to text substitution (US):

year	billions of voice minutes	billions of texts
2005	1,495	81
2006	1,798	159
2007	2,119	363
2008	2,203	1,005
2009	2,275	1,563
2010	2,241	2,052

Natural evolution of telecom networks:

- dumb pipes
- overprovisioned

  "Waste that which is plentiful"

  George Gilder
- dominated by cascades of computer-to-computer interactions, driven by human impatience
- horizontal layering, structural separation
- market segmented by size of (dumb) pipe

Continuing constraints on fine-grained pricing:

- bundling
- mental accounting costs, decision fatigue, …
- …

Implications of current growth rates:

- wireline requires continued innovation and investment
- wireline does not require big capex increases
- “muddling through” appears feasible and likely: can get to “natural evolution” state
- wireless very likely different

Wireless data:

- many signs of explosive growth (500+% in some cases)
- start from small base (about 3% of wireline now)
- already greater than wireless voice in volume
- overall growth rate 100+%
- growth rates of even 100% per year likely not sustainable without huge increases in capex

Wireless data (cont'd):

- wireless data same order as wireless voice in volume
- low willingness to pay for wireless data (except for messaging and a few other services)
- huge volumes of wireline traffic that users would happily handle via radio
- wireless transmission gains lag behind photonics
- mismatch between wireline and wireless bandwidth to persist

Underlying trends:

- incentives to price discriminate are increasing
- technology to price discriminate is improving (the great promise of wireless!)
- privacy will be victim, since it inhibits price discrimination

Price discrimination likely to be most notable feature of *The New Economy*

Standard economic argument for price discrimination:

Charlie: willing to prepare a report on digital cash for $1,500

Alice: willing to pay $700

Bob: willing to pay $1,000

Uniform pricing makes transaction impossible

Charging Alice $650 and Bob $950 makes everybody better off (in conventional economic model)

Versioning is motivated by incentives to price discriminate:

It is not because of the few thousand francs which have to be spent to put a roof over the third-class carriages or to upholster the third-class seats that some company or other has open carriages with wooden benches. What the company is trying to do is to prevent the passengers who pay the second class fare from traveling third class; it hits the poor, not because it wants to hurt them, but to frighten the rich.

And it is again for the same reason that the companies, having proven almost cruel to the third-class passengers and mean to the second-class ones, become lavish in dealing with first-class passengers. Having refused the poor what is necessary, they give the rich what is superfluous.

Jules Dupuit, 1849

Versioning is increasingly leading to "damaged goods": higher costs for lower functionality

IBM, 1990:

Laser Printer:	10 pages/min.
Laser Printer E:	5 pages/min.

FedEx: afternoon delivery only in the afternoon.

Limitations on price discrimination:

Intense negative popular reaction, rooted in behavioral economics factors, especially concerns about fairness

Basic dichotomy: Is usage to be minimized or maximized?

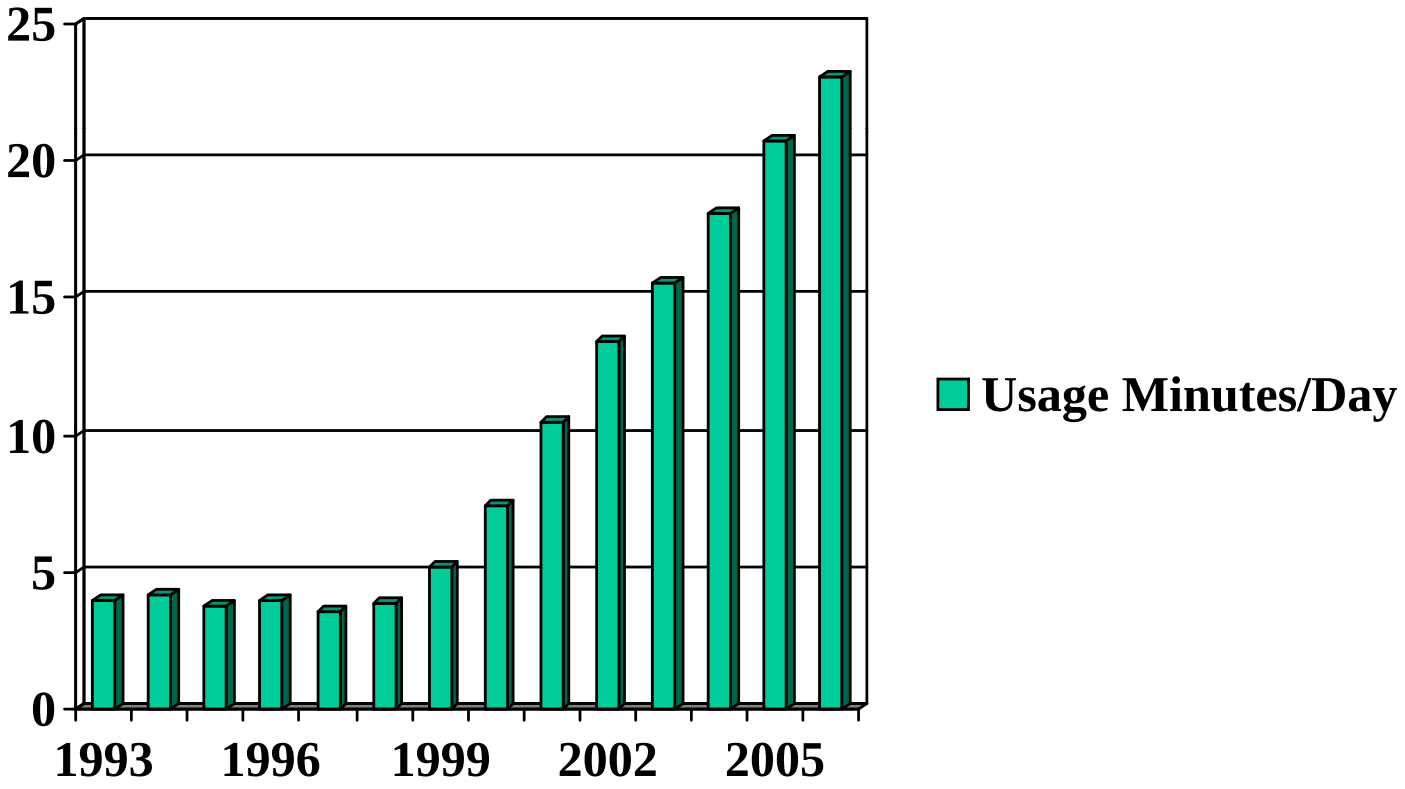
- Transportation: usually (but not always) to be minimized
- Communication: usually (but not always) to be maximized, to fill the growing pipes

  Contrary to many claims, Internet traffic growth is declining: see MINTS project

  http://www.dtc.umn.edu/mints

Almost flat rates :

U.S. cell phone usage, minutes per day around June of each year.



It's not how much you charge, but how you charge, that matters (cont'd):

- If want to encourage use, use simple (flat rate) plans
- If want to discourage use, use intrusive and annoying schemes (for example, for London Congestion Charge, require separate prepayment of each day's fee, …)

Implications of wireless data growth:

- old issues (QoS, net neutrality) to be revisited, with possibly different outcomes
- high value of mobility may bring big new revenues
- expectations of seemless transition from wireline to wireless unrealistic
- innovation seeks profits, so may shift to wireless, and to low-bandwidth access
- future traffic levels result of interaction of complex feedback loops

Implications of wireless data growth (cont'd):

- possible kludgy solutions with multiple networks (appeal of all-IP uniform network vs need to protect high-value voice services)
- faster growth and larger pie with innovation of open architecture vs drive to control (iPhone and its app store)
- unavoidable and unsolvable tussles between large players
- technology likely to be overshadowed by economics and regulation
- much frustration for users and technologists

Implications for new service creation:

- don’t forget voice!
- forget streaming (except for voice and videoconferencing)
- exploit locality
- privacy erosion to continue (jerkily)
- …

Further data, discussions, and speculations in papers and presentation decks at:

http://www.dtc.umn.edu/~odlyzko