FAQs about Internet pricing

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Benefits of usage pricing

- make more efficient use of bandwidth and capacity

- generate revenue for growth and expansion

- support new applications more effectively

Costs of usage-based pricing

- accounting and transactions cost
- reduction in voluntarism?
- costs of attention
  (...but computerized agents may help)

Increase profits?

- Profits depend on degree of competition
- Don’t *necessarily* depend on form of pricing
- Profits drive investment for additional capacity

Increase in users’ costs?

- Costs go up due to billing and accounting
- Costs go down due to reduced usage

Low-intensity users would probably pay less
(low-intensity = text rather than multimedia)

How should prices be set?

- Prices should reflect costs
  So people can make intelligent decisions
- More specifically, price should equal *incremental social cost*.
  incremental cost => cost of additional use
    (not counting fixed costs)
  social cost => *all* costs of additional use

What are the costs?

NSF paid $12 million a year for NSFNET backbone
  - 80% of this went to line rental and equipment charges
  - 7% went to Network Operations Center

mostly these are fixed costs

What about "social costs"?

Congestion costs that users impose on each other

When a network is near capacity everything slows down
  - packets are delayed or dropped
  - potentially significant social cost

History of congestion

1987 (56Kbps backbone): congestion was very bad

Temporary fixes to prioritize traffic
- priority went to telnet over ftp
- administrative traffic got special treatment

What's congestion like now?

Applications
- Archie (too successful)
- Mosaic (1.3 million accesses/week)

backbone capacity
- backbone is only 5% utilized on average
- but peak can be 5-10 times average
- start to see problems at 20% average utilization
- just starting to see (small) packet loss on NSFNET

Traffic has doubled every year for the past 5 years

What will multimedia do?

- ASCII text: 44 bits per word
- low-quality voice: 21,000 bits per word
- high-quality sound: 466,000 bits per word
- TV (noncompressed): 100 Mbps
- TV (compressed): 45 Mbps (or less)
- video conferencing: .5-1.5 Mbps

File sizes

1 megabyte = 700 page ASCII book
= 2-4 GIF images
= 8-12 JPG images
= 3 seconds of compressed video

- monthly traffic on NSFNET backbone = 56 billion packets
- 10 million users?
  = 1 megabyte per month per user

What about the future?

- NSFNET traffic has been growing at about 6% per month = doubling every year
- ASCII email is about 15% of network traffic
- 40% is file transfers (10% of these are images)
- Gopher, WWW traffic has had dramatic increase

What about technology?

- Routers are computers
- Increase in the supply of bandwidth...
  also increases demand for bandwidth
- Sometimes demand and supply will be out of sync

Pricing and TOS?

Different types of traffic need different service
- email: tolerates delay
- real time video: no delay
- file transfer: depends

Users have to declare priority/type to deal with traffic appropriately

Have to give them incentive to do this

What about fixed costs?

- Probably don't want usage prices to recover fixed costs of network capacity
- Better done with capacity-based connection fees

Two-part tariff
- subscription fee
- congestion fee

How big would prices be?

NSFNET backbone costs about \$$10^6$ per month

per packet

- carries 60,000 x 10^6 packets
- cost per packet = 1/600 cents

per user

- 10 million users of NSFNET backbone?
- 10 cents per user per month

What if everyone used video?

But video could use 10^3 as much bandwidth!

The point of pricing usage is not to recover costs of current use...

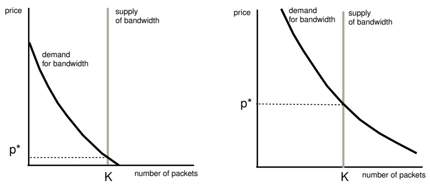
But rather to match use to capacity

How to price?

- Time of day?
- Priority?
- Smart markets?

Smart markets

- Users set "bid" for immediate access
- Users with highest bids are admited
  (others are buffered or dropped)



Other proposals

- Prioritization
- Congestion quotas
- ATM pricing
  theory
  practice

Market pricing

- Prices should be up to market
  (as long as it remains competitive)
- But there needs to be some standardization

Incremental costs of accounts

"Over 80% of your telephone bill is accounting..."

Incremental costs and average costs

Mitchell (1990 RAND report R-3909-ICTF)

- summary billing: 0.1-0.2 cents per call
- itemized billing: 0.7-1.2 cents per call
- account maintenance: 50-75 cents per month

  incremental cost of call
  - non-busy period = essentially 0
  - busy period = 6-11 cents per call
  - averaged = 1.2-2.4 cents per call

Average cost of accounts

- 1984 long distance carriers paid RBOCs \$2 billion for billing and accounting
- ATT's 1984 total revenue from long distance was \$31 billion
- billing/revenue = 6.5%

Telephone and internet

- Phone is connection-oriented
- IP is not; ATM is
- Who should be billed, client or server?

Other ways to do accounting?

Distributed accounting

- centralized model: phone companies
- decentralized model: post office

Practical experience

- Chile: not so good

- New Zealand: not so bad
  NetTraMet
  peak load pricing

Summary

- increased usage and new application are going to radically increase demand for bandwidth
- supply of bandwidth will increase too, but they won't always be in sync
- makes sense to think about ways to price before a crunch rather than after

Bottom line: think about how much bandwidth your application uses...it may not always be free.