Pricing Scholarly Information

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Outline of talk

- Pricing transport
  - Demand for bandwidth?
  - Usage-based pricing on Internet?
- Pricing content
  - Cost recovery strategies
  - Profit seeking strategies

Pricing transport

- IP has one quality of service
- Will probably want multiple QoS in future networks
  - 1) applications (e.g., point to point video)
  - 2) users (e.g., financial markets)

Incentive problem

If all qualities cost the same...why not choose the best?

- how do you get applications to truthfully reveal their requirements?
- economics jargon: how do you make QoS "incentive compatible"?

One answer: pricing

- quotas
- rebates
- dollars: generate revenues for expansion

Different QoS

- Multiple networks with different QoS
  1) voice, video, data, etc on different networks
  2) several lines to the home/office
- One network with different prices for different QoS
  1) probably has a cost advantage
  2) but may require regulation (natural monopoly)
  3) if a network supports 2 way video, ASCII is free

Congestion

Congestion is a kind of QoS

Examples

- Web/ftp sites
- Europe (T1 backbone) and transAtlantic links
- NAPs and other traffic exchange points

May have to implement pricing to control congestion

- settlements at NAPs?
- New Zealand experience

Pricing mechanisms for IP: 1

Bohn, Braun, Claffy and Wolff: "Mitigating the coming Internet crunch"

- use precedence fields of IP header
- higher precedences serviced first
- have quota of precedence points
- payment depends on level of priority

Pricing mechanisms for IP: 2

MacKie-Mason and Varian: "smart markets"

- use precedence field of IP header
- router establishes cutoff precedence
- precedences higher than cutoff are admitted, lower ones dropped (or buffered)
- everyone admitted pays *cutoff price*
- this turns out to be incentive compatible
- basic idea: price should depend on state of network

Pricing mechanisms for IP: 3

- IPv6: dropable/expendable packets
- ATM: various proposals

Pricing is a lot easier with a connection oriented protocol

- can plan QoS for session
- exchange billing/accounting info in setup
  with IP, this info has to be in every packet

How big would prices be?

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

- per packet
  carries 60,000 x 10^6 packets (5% utilization)
  cost per packet = 1/600 cents
- per user
  10 million users of NSFNET?
  10 cents per month per user
- but video could be 10^3 as much = $100 per month

Billing and accounting

"80% of the cost of a telephone call is billing cost"

- fixed cost, incremental/marginal cost, and total cost
- 100% of the *incremental* cost of an off-peak call is billing cost
- part of *incremental* cost of on-peak call is billing
- average *incremental* cost is probably 50-80%
- but billing as share of *total* cost is about 6%

Distributed accounting

- but IP and telephony are different in many ways
- centralized telephone billing
- stamps and postage machines
- digicash and digistamps
  1) easy to do with secure physical device
  2) is there a software only solution?

Summary

- probably need some form of pricing to support different QoS and congestion management
- congestion problems may occur sooner rather than later
- technological progress *may* bail us out but ...
  1) technological progress increases both supply and demand for bandwidth
  2) better to think about this carefully now
  3) room for creative thought on pricing, billing, accounting

Pricing content

Information goods

- software
- movies
- games
- databases

Cost structure

- high fixed development costs
- zero incremental cost

Industry structure

- Difficult to sustain a competitive market
- Likely result is oligopoly/monopoly
- Price war problem
  1) airlines
  2) software
  3) telecom?
- Highly competitive now *because* of eventual oligopoly

Examples of pricing

Consider some examples of pricing problem

- single provider
- high fixed costs, 0 incremental costs

Example 1:

Person A: willing to pay \$5 for book

Person B: willing to pay \$3 for book

cost of book = \$7 fixed cost, 0 variable cost

Observations about example 1

A wtp $5, B wtp $3, total cost=$7

- efficient to produce book
- can't recover costs at any uniform price
- can recover costs with price discrimination

Example 2

A wtp $8, B wtp $3, total cost=$7

- welfare max => A and B both get books
- uniform price + cost recovery => only A gets book
- price discrimination => both get books

Example 3

A wtp $20, B wtp $8, total cost=$7

- uniform price + profit max =>
  only A gets book
  even though B is wtp total cost of production!
- price discrimination =>
  both get books

Conclusions

Generally want to have price discrimination
- for cost recovery
- for profit maximization

Dimensions on which to discriminate
- want something correlated with WTP
- examples

  who you are: education, business, big user, off-peak, subscriber, foreigner

  what you want: immediacy, size, part of document

  quality: screen res, print res, ASCII, formatted, structured data

Complexity of pricing

human agents: information professionals

software agents

- bargaining and negotiation
- standardized contracts

  "spontaneous commerce"
- mechanism design
- agent security

Price discrimination

Self selection problem

1) want to charge users with high WTP more

2) constrained by fact that they can choose product meant for low WTP users

3) airlines

a) business travel: high WTP

b) tourist travel: low WTP

c) airline solution: Saturday night stayover

Observations

- Supplier will want to degrade quality/quantity

  examples: student versions of software, 486SX, IBM LaserPrinterE
- application to information goods

  immediate, delayed

  high resolution, low resolution
- quality degradation may be better for everyone
- Dupuit quote

Bundling

Sell packages of goods bundled together

- Microsoft Office Suite
- journals = bundle of articles
- subscription = bundle of journals
- bundling journals by subject matter

Example of bundling

Math professor A

will pay $120 for *Journal of Addition*

will pay $100 for *Journal of Subtraction*

Math professor B

will pay $100 for *Journal of Addition*

will pay $120 for *Journal of Subtraction*

Publisher

sells journals separately gets $400

sells bundle gets $440

Summary

Pricing transport

- probably will happen
- will be negligable for text
- an issue for multimedia

Pricing content

- differential pricing
- lots of experimentation
- expect significant complexity