
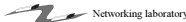


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Introduction to Internet pricing

Lecture slides for S-38.3192
23.2.2006
Mika Ilvesmäki





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Goals of this lecture

- After this lecture you will be able to
 - Know the different options of realizing Internet pricing
 - What data to collect?
 - Discuss the problems in bringing pricing/billing functionality to Internet
 - Know what goals can be achieved with pricing
 - List and detail different pricing schemes





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Definition of pricing

- From an ISP point of view, for any service to survive, it has to collect its costs from its users
 - This includes both capital costs and operational costs
 - Pricing means the way these costs are collected
- Aka charging, accounting




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PSTN vs. Internet


- Telephone networks
 - offered same service quality to all customers
 - Form one connection for a call
 - Have analytically analyzable traffic patterns
- Future Internet
 - Will provide different types of service levels according to customer needs
 - Delivers packets one by one
 - Has very complex traffic patterns at packet level
 - Therefore, telephone network charging is not enough



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Why pricing?


- From the user point of view: A major role of prices is to present information to people about the true costs of their actions. If prices accurately reflect costs then individuals can compare the benefits of their actions to the costs of their actions and make informed decisions.
- ISPs are expanding to
 - Providing access (the usual thing)
 - Providing applications (ASP)
 - Providing content (CSP)
 - Providing services on the move (MSP)
- Peering is becoming more difficult
- Flat-rate pricing is not enough
 - Especially in a QoS network



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Fundamentals of pricing I


- Do you link the the price to the cost that customer's use of network creates or to the value that the customer's service produces (to himself)?
- Remember different time scales
 - Subsecond for packets, minutes for flows/sessions, hours and days and weeks and months
- Collect & measure pricing data to accounting databases



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Fundamentals of pricing II


- What are the things you can measure?
 - Access
 - As you register into the network
 - Content data
 - Information related
 - May include copyright fees etc.
 - Transport data
 - Network usage based
 - Volume or BW-based
 - Congestion data
 - Price the services that are congested



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Pricing basics

- ROI is the prime objective of an ISP
 - Incoming money should cover both the capital and operational costs of running and maintaining the network
- What is cost of packet? Or a flow?
 - Average cost, marginal cost etc.
 - Data volume, burstiness, streaming, elastic
- Pricing of the ISP should first result in a fair way of sharing the networking costs
 - Those who use more, pay more. Is this reality today? To what extent it is/is not?



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Discrimination by pricing

- Pricing can also be used to discriminate users
 - If different users are willing to pay different prices for the same/better service
 - Price discrimination means that price difference between two services is (much) higher than the cost of providing these services
 - QoS
 - Is there a way to prove that one service is always distinctly different from another service (think for example DiffServ AF and BE in an unloaded network)?
 - However, people buy different types of cars, airline tickets, cell phones, clothes...

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Pricing alternatives

- Access pricing
 - Depending on access speed, mostly flat-rate
- Traffic pricing/Usage pricing
 - Price according to data sent
- Content pricing
- Or a combination of the alternatives
 - Like access charge+traffic charge

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Pricing schemes

- Flat rate
 - Independent of any user or network status
- Usage based
 - Depends on the users action, use of bandwidth or amount of transmitted/received data
- Congestion based
 - Depends on network/service status
 - Is not directly dependent on individual user action
- Remember, usage causes congestion and (heavy) congestion reduces usage (eventually)

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Pricing architecture

- Pricing location
 - User – ISP interface
 - ISP – ISP interface (check the lecture on peering)
- Pricing is about collecting data

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Billing systems

- From Hartanto & Carle: Policy-based billing architecture for Internet Differentiated Services, 1999

PT = policy interface; C1 = configuration interface; DI = data interface
Figure 1. Billing System Framework

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Pricing architecture: Edge pricing

- By Shenker et al.
- An example of an architectural solution aiming to support various pricing models
- All pricing mechanisms are set up at the edge of the network
 - Complexity is reduced to local problems
 - Does not support pricing models that charge receivers
 - Does not support multicast

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Charging schemes: Flat fee

- Charge the user daily/weekly/monthly/per annum for her access
 - Provides no incentives for increase or decrease of access usage
 - Does not provide any info on network status and its development (see lecture on Network planning)
 - Based on the single-service best effort model
 - Low-usage customers support high-usage ones
 - Flat fee is easy to implement and provides predictable income.

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Usage sensitive pricing

- User consumes certain amount of resources for a certain amount of time
 - Price either datavolume (packets, bytes) or the duration of usage
 - Volume-based or duration-based
 - Note volume/duration gives average BW-usage
 - Price unit (per byte, per second) may be either static or dynamic.
 - Dynamic pricing examples: Smart market, feedback pricing





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Charging schemes: Per Flow

- Charge for the amount of flows
 - Or the amount of sent/received data, or flow duration
 - Relates to IntServ-architecture
 - Needs metering, ticketing or some such system
 - Is therefore susceptible to scaling problems
- There are always less number of flows than packets
 - Easier to maintain billing databases
 - Aggregate more: Session level, etc.






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Congestion based pricing

- Prioritize usage of a congested resource
 - Such as a server or a link
- Those who value access to the resource the most (are willing to pay the most) get the highest priority
- Usage based prices produce revenue that can be targeted to increasing the service level of the congested resource






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Charging schemes: Smart Market

- By Mackie-Mason & Varian
 - Uses auction mechanism
 - Calculates packet prices as they arrive to a congested router
 - Equilibrium price is the bid of the marginal user and revenue equals the optimal investment to expand network capacities
 - Non-congested router offers free packet forwarding -> well provisioned network has no revenue gain





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Congestion pricing feasibility

- Network resources are not (usually) very scarce (no congestion – no revenue)
 - If they are, the users will find another operator
- How does the user know what prices will be bid and what will be charged for the service?
 - Congestion pricing may produce unpredictable results from a user point of view
- Congestion pricing implementation is more complex than, for instance, simple volume-based pricing with admission control





Final remarks: Pricing guidelines

- Internet is a simple network that works with simple ideas, so KISS (even if it might not be the cheapest solution)
 - Datavolume/Flow based vs. congestion pricing
 - Remember that you can always combine different pricing models: flat fee + congestion pricing of service X + volume charge after threshold Z
- Make money based on true costs (capital and operational)
 - Remember that sometimes price discrimination works
- And remember: Eventually, quality will rise, prices will decrease and revenues will increase

