

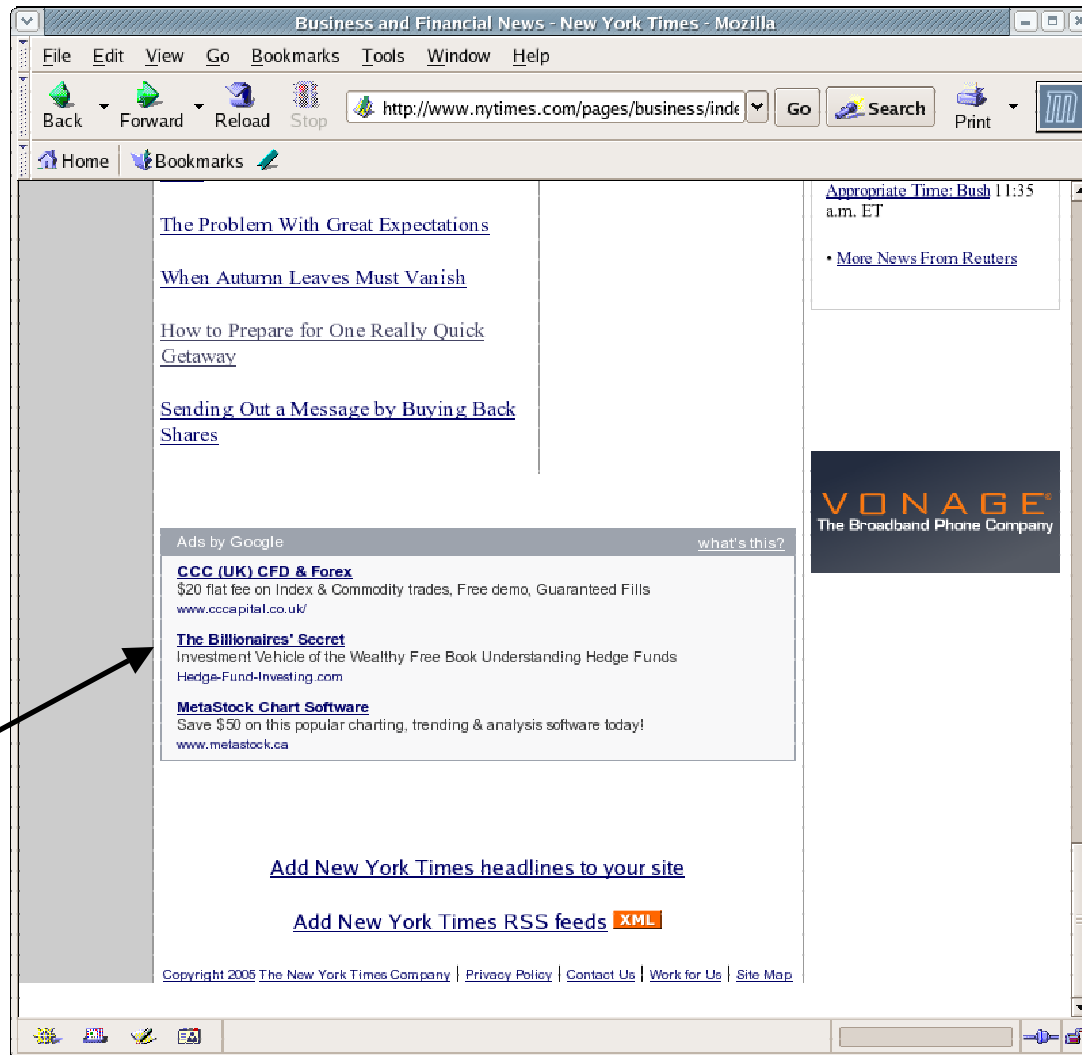
Search engine advertising

Hal Varian

Online advertising

- Banner ads (DoubleClick)
 - Standardized ad shapes with images
 - Loosely related to content
- Context linked ads (Google AdSense)
 - Related to content on page
- Search linked ads (Google Adwords)
 - Related to search terms

Examples



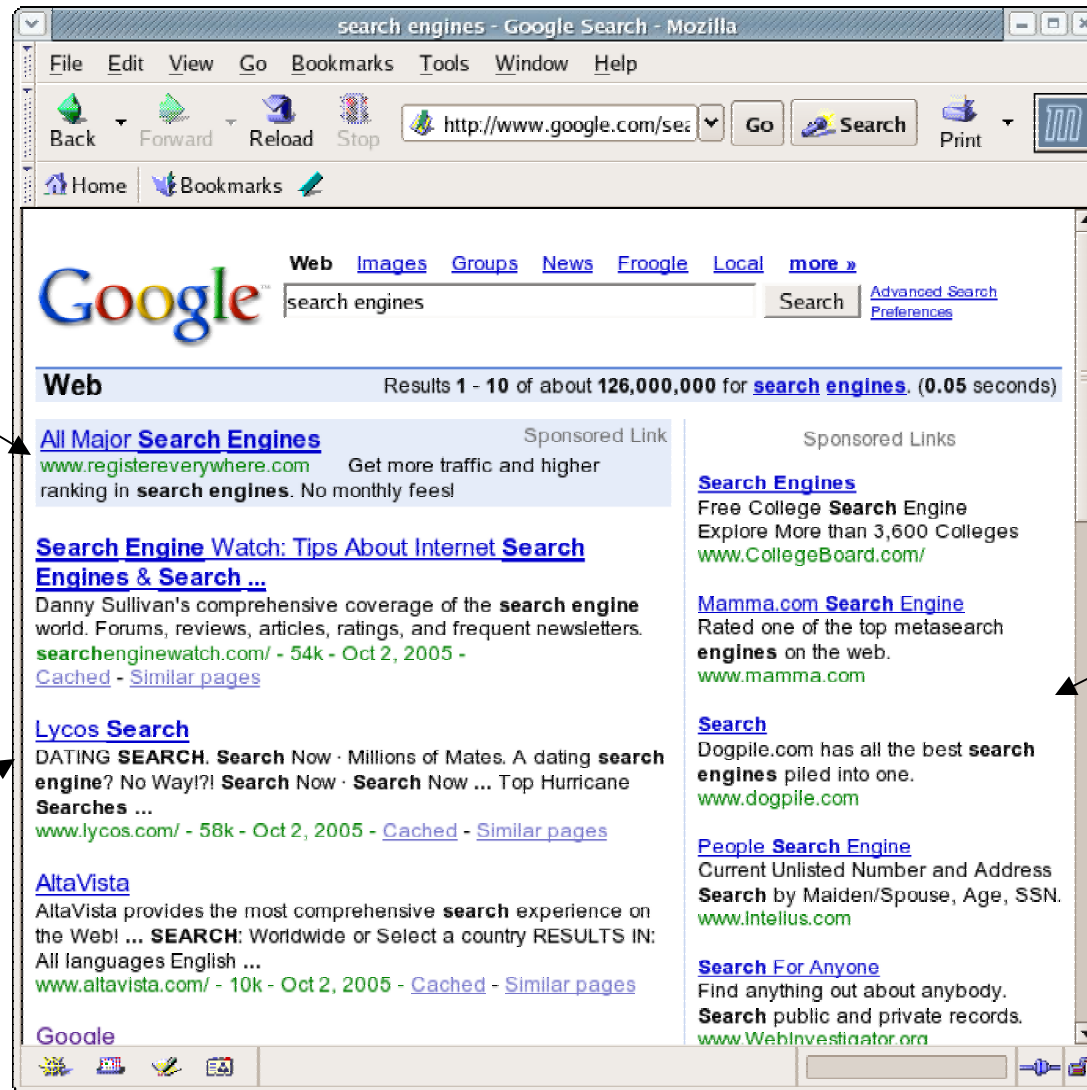
Content
ads

banner ad

Search ads

Promoted
ad

Search
results



RHS ads

Search linked advertising

- High relevance
- Results in very good performance in cost-per-acquisition (adv expenditure per sale)
- Rapid growth but still small part of advertising market
 - Total US adv spend ~ \$220 billion, growth ~ 1-2% per year
 - Online advertising: ~ \$10 billion, growth ~ 26% last year

Advertising spend

	Morgan- Stanley 04	Media Metrics 04
News papers	65	57
Direct Mail	51	51
Broadcast TV	45	43
Radio	20	19
Cable TV	18	17
Magazine	21	12
Yellow Pages	15	
Internet	10	9.6
TOTAL	245	209

Stock market valuation of Google

GOOGLE INC CL A
as of 3-Oct-2005



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How does Google work?

- Advertiser bids on search terms
 - Can use “Traffic Estimator” to see how many clicks they will get
 - Can choose “exact” or “broad” match
- Ordering
 - Overture: high bidder gets first position, 2nd highest bidder second position, and so on, with exact match first.
 - Google: rank by bid x predicted CTR. Puts best ads on top of page.

Aligning incentives

- Google sells ad impressions (views)
- Seller generally wants clicks and ultimately conversions (purchases)
 - Rank ads by how much advertisers are willing to bid for impressions
 - $\text{Value/click} * \text{clicks/impr} = \text{value/impr}$
 - Disable added if there are too few clicks per impression (CTR)

How do you estimate pCTR?

- Basic model
 - Actual CTR = position effect x ad effect
 - Determine position effect by randomization
 - Determine ad effect by statistical analysis
 - pCTR = ad effect (also a quality signal)
- Implementation is difficult due to scale and performance requirements

Payment

- Price you pay depends on bidder below you
 - Overture: pay bid of bidder below you
 - Google: pay minimum necessary to keep your position (“AdWords discounter”)
- Why not pay your actual bid?
 - Would then want to cut bid to just enough more than adv below you to keep your position
 - With discounter don’t need to constantly inspect bid landscape

Vickrey auction

- Similar in spirit to proxy bidder on eBay or Vickrey auction in economics
- One item to sell, many bidders
 - English auction: person with highest value wins, pays price equal to second highest value+ bid increment
 - Vickrey auction: award item to highest bidder, who pays 2nd highest price
- Always want to truthfully reveal your value in Vickrey auction

Vickrey auction

- Payoff = $(v - b_2) \text{Prob}[b > b_2]$
 - If $(v - b_2) > 0$, then want to make Prob as large as possible
 - If $(v - b_2) < 0$, then want to make Prob as small as possible
 - Either way truthtelling is optimal
- Ad auctions don't quite have this property, but analysis is similar

Mechanism design

- This is an example of an economic mechanism
 - Agents report messages to center
 - Center makes choices based on messages
 - Agents make payment to center based on messages and outcome of choices
- Problem: incentive compatibility
 - Surprisingly, can find an incentive compatible mechanism for wide variety of cases
 - Vickrey auction is relevant example

Biggest auction in the world

- According to Comscore, there were 4.8 billion web searches worldwide July 2005
- Roughly half of those searches displayed ads, so that's 2.4 billion auctions per month
- This is a very conservative estimate...

Ads system from viewpoint of seller

- Choose your creative text
 - Standardized size
 - Various tips available to aid choice
- Choose your keywords
 - Exact, broad, phrase, negative keyword
 - Follow ad guidelines
- Implement conversion tracking if desired

Setting up ad, cont.

- Choose your bid = maxCPC
 - Value of a click = prob of sale * profit per sale
 - Can use Traffic Estimator to see how many clicks you will get
 - Discounter will set actual CPC to minimum amount necessary to retain position
- Set daily budget
- Let 'er rip

AdSense Program

- “Content ads”
 - Use keyword matching engine to pick ads related to content on page
 - Matching algorithm tweaked to deal with multiple content on page
 - Auction needs tweaking to deal with position effects
 - Generally lower CTRs, lower conversion performance, so adjustments made in payment to compensate for performance difference

Technology

- Engine to match ads to queries
 - Choose most relevant ads using various criteria (plurals, synonyms, elimination of duplicates, etc.)
 - Returns up to 10 ads to show on a page
 - Promotion policy: depends on CTR performance and CPC. Best ads get best position.
- Auction engine
 - Ranks ads by CPM, records clicks, payments, etc.

Factors affecting revenue

$$\begin{aligned} \text{Monetization (RPM)} &= \frac{\text{Revenue}}{\text{Queries}} \times (1K) \\ &= \frac{\text{Revenue}}{\text{Clicks}} \times \frac{\text{Clicks}}{\text{Queries}} \\ &= \frac{\text{Revenue}}{\text{Clicks}} \times \frac{\text{Queries w/ Ads}}{\text{Queries}} \times \frac{\text{Ads}}{\text{Queries w/ Ads}} \times \frac{\text{Clicks}}{\text{Ads}} \\ &= \begin{matrix} \downarrow & & \downarrow & & \downarrow & & \downarrow \\ \text{CPC} & \times & \text{Coverage} & \times & \text{Depth} & \times & \text{CTR per Ad} \end{matrix} \\ &= \underbrace{\text{CPC}}_{\text{Price}} \times \underbrace{\text{Coverage} \times \text{Depth}}_{\text{Quantity}} \times \underbrace{\text{CTR per Ad}}_{\text{Quality}} \end{aligned}$$

Increasing revenue

- Increase CPC
 - Create higher conversion prob for advertiser
 - “Advertiser optimization”
 - Capture more value by increasing competition
 - Acquire more advertisers
- Increasing coverage
 - Get more keywords
 - Match more broadly (affects CTR – like precision/recall tradeoff)
- Increase depth
 - Get more advertisers, more ads via optimization/marketing
- Increase CTR
 - Show more relevant ads

Advertiser optimization

- Choose good creatives, follow tips
- Determine your value per click
 - Can use Google's conversion tracking
 - Or use your own tool
- Maximum bid = maximum value per click
 - Shade down depending on competition
- Minimums
 - Bid: 5 cents
 - Min CTR: around 1%

Syndication network

- Can syndicate search and/or ads
 - AOL = both
 - Ask Jeeves = ads only
 - Yahoo (formerly) = search only
 - MSN formerly served by Overture/Yahoo
- Negotiated revenue share with partners
 - Intensive bidding against Overture/Yahoo
- Content ads network
 - Typically fixed revenue share
 - Provides business model for small web sites

Competition

- Search
 - Intensive competition to improve search
 - Hampered by attempts to manipulate algorithm
 - Entrant has an advantage!
- Monetization
 - Size of ad network
 - Non-exclusive nature – a “media business” like magazines
 - Can partner in various ways, co-opetition issues

Business challenges

- Scale
 - Large, complex system: keeping it running and improving it is a challenge
- Advertising guidelines
 - Detection and enforcement
 - Regulatory issues
- Fraud
 - Credit card fraud
 - Click fraud
 - Spam of various sorts
- Advertiser relations – as online advertising gets more popular, it gets more expensive