Online Advertising  Business Models, Technologies and Issues: From “Mad Men” to Wall Street

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RuSSIR 2009, Petrozavodsk, Russia
3rd Russian Summer School in Information Retrieval
September 11 – September 16, 2009
Brief Bio

• 20 years in the field AI and information management
  – Principal and Founder, Boutique Data Consultancy
    • Clients include: Digg, SearchMe, SkyGrid, MyOfferPal, Ancestry.com
  – Adjunct Faculty, University of California Santa Cruz (UCSC)
  – Chief Scientist, Turn Inc. (A CPX ad network, Bay Area, CA)
  – Principal Scientist, Clairvoyance Corp (CMU spinoff; sister lab to JRC)
  – Research Scientist, Xerox Research
  – Research Engineer, Mitsubishi Group
  – PhD in machine learning (1998), University of Bristol, UK;
    B.Sc. Comp. Science (1989), Uni. of Limerick, Ireland

• Now: Machine Learning Consultant (San Francisco)
  – IF (you have large data problems and need a consultant)
    THEN {email me at James.Shanahan_AT_gmail.com}
  – Where problems ∈ {web search, online advertising, machine learning,
    ranking, user modeling, statistics, social networks, “∗” }
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- No publication or further distribution in full or in part permitted without explicit written permission from the author.
- Living vicariously!
From Mad Men To....

- Set in New York City, *Mad Men* begins in 1960 at the fictional Sterling Cooper advertising agency on New York City's Madison Avenue. (Broadcast by AMC Cable Channel)
- The show centers on Don Draper (*Jon Hamm*), the agency's creative director, and the people in his life in and out of the office.
From Mad Men To Wall Street

- Set in New York City, *Mad Men* begins in 1960 at the fictional Sterling Cooper advertising agency on New York City's Madison Avenue.

Increasingly

Human Intensive
Lots of guess work
Forward Market

Technology
Data Driven
Forward Market
Spot Markets
Executive Summary

- Advertisers deliver a message to consumers via publishers
- Online advertising revenue growing annually @ 10% (from 26%)
  - $23.4 billion in USA (2008), $65B worldwide (10% of overall ad spend)
  - Business Models: CPM, CPC, CPA (not popular yet but will be), dCPM
  - Online advertising is location, location and location ($11B M&A, 2007)
  - ....and data, features, objectives and optimization
- Key directions
  - Forward markets → Spot Markets
    - Advertising transformed from a low-tech, “Mad Men” process to highly optimized, mathematical, computer-centric (Wall Street-like) process
  - Technology: Economics, IR, ML, OR, Game Theory, Stats, Social Sciences (estimating CTR/AR; auction systems; learning algorithms; targeting display advertising; behavioral targeting)
  - Click fraud is the spam of online advertising ($Billion problem)
  - New Directions: Web 3.0; games; social advertising; data exchanges
  - Gap: perceived gap between academia and industry?
Outline: CoAd

• Introduction
  • Online advertising background
  • Business models
  • Creating an online ad campaign
  • Technology and Economics
    – Forward Markets (Operations research)
    – Auction Theory and Game Theory
    – Spot Markets (ML, IR, Ranking, Quality)
• New Directions
• Challenges in online advertising
• Summary
Outline: CoAd Lectures

• Introduction

L1 • Online advertising background
  • Business models, Campaigns

L2 • Technology and Economics
  – Forward Markets
    • Gradient Descent, Operations research, LP, QP
  – Auction Theory and Game Theory

L3 • Spot Markets
  • ML, Ad quality, Ranking, Budgeting

L4 • New Directions
• Challenges in online advertising
• Summary

CoAd Lectures

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<thead>
<tr>
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<th>Date</th>
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Course philosophy

• **Socratic Method (more inspiration than information)**
  – participation strongly encouraged (please state your name and affiliation)

• **Highly interactive and adaptable**
  – Questions welcome!!

• **Lectures emphasize intuition, not rigor or detail**
  – Build on lectures from other faculty
  – Background reading will have rigor & detail

• **Action Items**
  – Read suggested books first (and then papers), read/write Wikipedia, watch/make YouTube videos, take courses, participate in competitions, do internships, network
  – Prototype, simulate, publish, participate
  – Classic (core) versus trendy (applications)
Advertising is a paid, one-way communication

1. Deliver marketing messages and attract new customers
2. To inform potential customers about products and services and how to obtain and use them.
3. Many advertisements are also designed to generate increased consumption of those products and services through the creation and reinforcement of brand image and brand loyalty (ads contain both factual information and persuasive messages).
4. Every major medium is used to deliver these messages, including: television, radio, movies, magazines, newspapers, video games, the Internet, and billboards

In 2008, Worldwide online advertising was $65B i.e., 10% of all ad spending across all media [IDC, 2008]

[Source: http://en.wikipedia.org/wiki/Advertising]
Advertising as Information

• Online advertising is a form of advertising utilizing the Internet and World Wide Web in order to deliver marketing messages and attract customers [wikipedia.com]

• Advertising annoys people! Advertising works!
  – "Half the money I spend on advertising is wasted; the trouble is, I don't know which half." - John Wanamaker, father of modern advertising.
  – "I do not regard advertising as entertainment or an art form, but as a medium of information...“, “Ogilvy on Advertising” by David Ogilvy

• Goals of Online advertising
  – Deliver/push an advertiser’s message with quantifiable measures of consumer interest
  – Enable ads as a medium of information!
  – Generate revenue for the publisher and ROI for the advertiser
# Online Advertising Stages

## Parallels with existing media

1. **Print<->webpages**
   - **Questions:**
     - **Server-side:** Did anyone see it and how often?
     - **Client-side:** Did it get through technical firewalls?
   - **Model:** Reach/Frequency
     - Sources: audience panels, ad servers, email providers

2. **Direct Response<->interactivity**
   - **Questions:**
     - **Server-side:** Do they know of the brand and the message?
     - **Client-side:** Did it get through mental firewalls?
   - **Model:** Brand survey data points
     - Sources: most commonly third-party survey research companies, could also be inferred from search volume as a related indicator of awareness and interest

3. **TV<->Online Video**
   - **Questions:**
     - **Server-side:** Do they think favorably of the brand?
     - **Client-side:** Would they consider it?
   - **Model:** A variety of behavior metrics (e.g., rollover, play, click-thru, view-thru, sales)
     - Sources: ad technology, ad/server, email server, retail sales

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Online Marketing Goal/Measurement Hierarchy

Purchase Funnel

1. Cast a wide net (big reach)
2. Corral /Brand
3. Close the sale

Online Marketing is like courting: need to build trust with consumers

From Branding to Direct Marketing

**Branding**

Hitachi | true stories
HOPE IN HOUSTON
The True Story of a New Weapon in the War on Cancer

Watch how doctors at Houston’s renowned M.D. Anderson Cancer Center are using proton beam therapy to help keep a Baton Rouge pilot in the cockpit, and his cancer on the ground.

**Direct Marketing**

Your Opinion Matters!
Please take our survey.

It didn’t take long for Schwartz to show his stuff. Sun, which had fallen far from its perch as one of the highfliers of the dot-com era, has emerged from a five-year funk to turn in two strong quarters of revenue growth and market share gains. The stock has shot up 38% since late July, and Schwartz looked golden while making the rounds of Wall Street and New York customers in early September. “We think Sun is on the way to turning around,” says analyst Ben Reitzes of UBS (UBS), who recently upgraded the...
Ad Formats: popunder, image+text

- Limited Time Offer:
  Earn a free domestic round-trip airline ticket
- Earn 1 point for virtually every dollar you spend
- Fly any airline anytime

STATISTICA - Data Mining
Winner of all comparative reviews since 1993 - Free Evaluation CD
www.StatSoft.com
Ad sizes (See IAB)

- Wide Skyscraper
  160 x 600 pixels

- Leaderboard
  728 x 90 pixels

- Medium Rectangle
  300 x 250 pixels
Interactive Advertising Bureau (IAB) is comprised of more than 375 leading media and technology companies who are responsible for selling 86% of online advertising in the United States.

### IAB Standards

#### Rectangles and Pop-Ups

<table>
<thead>
<tr>
<th>Size</th>
<th>Recommended</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>300 x 250 IMU - (Medium Rectangle)</td>
<td>View IMU</td>
<td>40k</td>
</tr>
<tr>
<td>250 x 250 IMU - (Square Pop-Up)</td>
<td>View IMU</td>
<td>40k</td>
</tr>
<tr>
<td>240 x 400 IMU - (Vertical Rectangle)</td>
<td>View IMU</td>
<td>40k</td>
</tr>
<tr>
<td>336 x 280 IMU - (Large Rectangle)</td>
<td>View IMU</td>
<td>40k</td>
</tr>
<tr>
<td>180 x 150 IMU - (Rectangle)</td>
<td>View IMU</td>
<td>40k</td>
</tr>
<tr>
<td><em>NEW</em> 300x100 IMU - (3:1 Rectangle)</td>
<td>View IMU</td>
<td>40k</td>
</tr>
<tr>
<td><em>NEW</em> 720x300 IMU - (Pop Under)</td>
<td>View IMU</td>
<td>40k</td>
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</table>

#### Banners and Buttons

<table>
<thead>
<tr>
<th>Size</th>
<th>Recommended</th>
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<tbody>
<tr>
<td>468 x 60 IMU - (Full Banner)</td>
<td>View IMU</td>
</tr>
<tr>
<td>234 x 60 IMU - (Half Banner)</td>
<td>View IMU</td>
</tr>
<tr>
<td>88 x 31 IMU - (Micro Bar)</td>
<td>View IMU</td>
</tr>
<tr>
<td>120 x 90 IMU - (Button 1)</td>
<td>View IMU</td>
</tr>
<tr>
<td>120 x 60 IMU - (Button 2)</td>
<td>View IMU</td>
</tr>
<tr>
<td>120 x 240 IMU - (Vertical Banner)</td>
<td>View IMU</td>
</tr>
<tr>
<td>125 x 125 IMU - (Square Button)</td>
<td>View IMU</td>
</tr>
<tr>
<td>728 x 90 IMU - (Leaderboard)</td>
<td>View IMU</td>
</tr>
</tbody>
</table>

#### Skyscrapers

<table>
<thead>
<tr>
<th>Size</th>
<th>Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td>160 x 600 IMU - (Wide Skyscraper)</td>
<td>View IMU</td>
</tr>
<tr>
<td>120 x 600 IMU - (Skyscraper)</td>
<td>View IMU</td>
</tr>
</tbody>
</table>
Ads Formats and sizes

- **Text Ads**
- **Display Ads**
  - Graphical, Flash, Rich Media (sound, video)
- **Different sizes types:**
  - For details see [http://www.iab.net/standards/adunits.asp](http://www.iab.net/standards/adunits.asp)
  - Rectangular, Rectangles and Pop-Ups, Banners and Buttons
- **See IAB for standards**

[source: www.active responsiveness group.com]
Advertising: ROI is King
(in French and in Advertising)

CPA = Spend/Transactions

Campaign 1
CPA = $2/2 = $1

Campaign 2
CPA = $2/6 = $0.33
Advertising: ROI is King
(in French and in Advertising)

- Diminishing Returns
- Lower Quality Leads
- Competitive Market
- Fraud?

CPA = $1.50
Marginal cost $4/1 = $4

CPA = $1
Marginal cost $3/2 = $1.50

CPA = $2/1 = $0.5

Widget ad budget is $2

How many marginal dollars do I spend for each marginal action over a budgeted spend of $4?

- Marginal cost of an action
- Marginal utility
- Law of diminishing returns
Advertising: ROI is King

(in French and in Advertising)

High CPA
- Direct Mail

Internet

Low CPA

Poor Performance
- Consumer behavior
  - seasonality, time-of-day
  - demographics: geo, age, income, etc.

Advertiser Side
- Creative
- Landing page experience
- Pricing

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Forms of Online Advertising

- Advertising online comes in all shapes and sizes and we run into it all the time be through
  - Websearch
  - reading the newspaper online
  - paying the bills
  - or purchasing a book
Sponsored Search

Google

Results 1 - 10 of about 491,000,000 for advertising [definition]

Web | Videos | News | Images | Books | More

LocalAdLink - Online Power

www.LocalAdLink.com - Advertising at Fraction of the Cost Recruit Agents and Make Big Money

Advertising - Wikipedia, the free encyclopedia  - 23K - Cached - Similar pages -

For content guidelines on the use of advertising in Wikipedia articles, see Wikipedia:Spam. A proposal on advertising about Wikipedia. ...

en.wikipedia.org/wiki/Advertising - 240K - Cached - Similar pages -

Advertising | Facebook - 26K - Cached - Similar pages -

Advertising with Facebook Ads allows you to reach the exact audience you want with relevant targeted advertising.

www.facebook.com/advertising/

platform-a.com - Our Platform puts your brand where life happens - 26K - Cached - Similar pages -

Apr 1, 2009 ... Our platform of trusted AOL brands, quality, Advertising.com networks and ...

Advertising.com's self-service interface for publishers. ...

www.platform-a.com/

AdAge - the leading global source of news, intelligence - 57k - Cached - Similar pages -

Publishers in the advertising field: marketing to consumers, business-to-business, marketing across borders, and the creative world.
adage.com - 57k - Cached - Similar pages -

advertising Tag Page - 26K - Cached - Similar pages -

Advertising is a form of communication that attempts to persuade potential customers to purchase a particular brand or product or service. ...

technorati.com/tag/advertising - 73k - Cached - Similar pages -

Advertising - Advertising Careers and Jobs - Advertising - 31k - Cached - Similar pages -

Get advertising career help for freelance copywriters and other advertising pros and find insight for businesses needing advertising guidance as well.
advertising.about.com - 31k - Cached - Similar pages -

Google Advertising - 10k - Cached - Similar pages -

Allows you to buy advertising on the Google search engine, or on other sites through its AdSense program. Includes a tour and FAQ.

www.google.com/intl/en/ads/

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Sponsored Search

Also try: advertising agencies, free advertising, More...

Need Customers Visiting Your Website?
5,000 Free Today Targeted Traffic Guaranteed Sign Ups Email Marketing.
www.webtrafficus.com

Online Advertising System
Get All-in-One Online Advertising 1000s of Big Companies Trust Us.
www.Lyris.com

Free Online Advertising
Find and Compare prices on free online advertising at Smarter.com.
www.smarter.com

Advertising For Free
Find Local Advertising For Free. Post free classifieds at Kijiji.
www.Kijiji.com

Advertising - Wikipedia, the free encyclopedia
History | Types of advertising | Criticism of advertising | Regulation
Advertising is a form of communication that typically attempts to persuade potential customers to purchase or to consume more of a particular brand of product or service. "While now central to the contemporary global economy and the reproduction of global production... en.wikipedia.org/wiki/Advertising - 240k - Cached

advertising. Definition. Synonyms from Answers.com
advertising n. The activity of attracting public attention to a product or business, as by paid announcements in the print, broadcast, or electronic
www.answers.com/topic/advertising - 376k - Cached

Advertising - How To Information - eHow.com
Research basic advertising concepts and advanced strategies, from choosing an agency to do-it-yourself online advertising. With eHow, get tips on finding cheap and...
Contextual Advertising

For standards see IAB
http://www.iab.net/standards/adunits.asp
House Ads....
OA is cavalier! : business models; ad placement; e:b wants to be online
Bad Ad Placement? Moral Conscience

[Source: Neatorama.com]

[Source: www.livingsweb.com]
Bad Ad Placement?

Leverage sentiment to avoid?  
[Shanahan et al., AAAI Symposium 2005]

One toddler dead, another critical after house fire

Source: AAP | Published: Friday June 29, 11:17 AM

A baby has been killed and a toddler critically injured in a house fire in Perth.

The 15-month-old boy died in the fire, and his two-year-old brother is now in intensive care in the Princess Mary Hospital.

Police say they’re still investigating the cause of the blaze, that broke out around 7pm (WST) last night.

But they say it may have started from an open fire.

[Source: LivingWeb.com]
A Bitter-Sweet Advertising Moment!
Outline

• Introduction
• Online advertising background
  • Business models
  • Creating an online ad campaign
  • Technology and Economics
  • New Directions
• Challenges in online advertising
• Summary
Online Advertising

Advertiser-Publisher-User

User

Publisher

Advertiser

Select Ads

Ads

Direct
Search Engine
Ad Network
Ad Exchange, Etc.

Direct
Ad Agencies
Search Engine Marketers
Etc.
Advertising network refers to an infomediary, which serves between a group (network) of web sites (which want to host advertisements) and advertisers which want to run advertisements on those sites.

Aggregate publishers provide reach for Adv.
1. Auctioneer
2. Targeting Engine
Example Ad Networks [2004]

- The Google Network consists of Google sites & partner properties that use Google AdSense to serve AdWords ads.

* Adapated: comScore Media Metrix (September, 2004)
Yahoo and Google Ad Networks

Sponsored Search Advertising

Contextual Advertising

Sponsored Search Advertising

Contextual Advertising

[Adapted from Think Partnership, 2007]
As a publisher I can sell …

- As a publisher (e.g., NYTimes, Google, MS)
  - Sell my inventory directly; let advertiser’s (or advertiser surrogates) reserve with guaranteed payments [Premium pricing]
  - Remnant inventory; Low-cost advertising space that can be relatively undesirable or otherwise unsold (usually sell as revenue share)

- Via Ad networks (e.g., Google, Yahoo.com, Turn.com)
  - Arbitrage and remnant;
  - Media aggregators and advertiser aggregators with targeting and auction mechanism

- Via Ad Exchanges (e.g., RightMedia.com, AdECN)
  - Remnant; Media aggregators with auction and primitive exclusion policies (e.g., no alcohol ads, may provide category of page/site)

- Publisher-side Optimization networks (Yield Managers)
  - Work directly with publishers; E.g., Pubmatic, Rubicon, AddKick
  - Select advertiser/network that offers best revenue
Yield Management

- Yield management, also known as revenue management
- The process of understanding, anticipating and influencing consumer behavior in order to maximize revenue or profits from a fixed, perishable resource
  - such as airline seats or hotel room reservations;
- The challenge is to sell the right resources to the right customer at the right time for the right price.
- This process can result in price discrimination, where a firm charges customers consuming otherwise identical goods or services a different price for doing so
  - Airline ticket: refundable; change fees; Saturday night stay

[Wikipedia.org]
Publisher-side Optimization Networks

- **Yield Management Systems**
  - Similar to airline industry software for pricing tickets and keeping track of available seats
  - *It forecasts how much a publisher can get for ad placements, and whether they should sell the spots themselves or use ad networks*
  - *Provides online ad analytics e.g., Rapt acquired by Microsoft in 3/2008*
  - Can simplify ad network management by giving publishers one set of ad tags (html code) and one integrated reporting interface across multiple ad networks.
Google Ad Manager

Me: the publisher

Google Ad Manager delivers all of your directly-sold and network-based inventory

Via DoubleClick
Yield mgt. example: Publisher-side
Yield mgt. example: Publisher-side
ad quality restrictions...

Keep in mind, the fewer restrictions you place, the greater your revenue potential.
Note: these restrictions only apply to networks the Rubicon Project brings to you.

- No Restrictions (note, the Rubicon Project does not serve adult ads)
- Some Restrictions
- More Restrictions

**ALLOWS**
- Audio Ads (User Initiated)
- User Expandable Ads

**RESTRICTS:**
- Audio Ads (Auto Play)
- Auto Expandable Ads
- Casino/Gambling Ads
- Dating Ads
- Download Ads (smiley, wallpaper, screen savers)
- Embedded Game Ads
- Pop-up Ads (spawned from banner)
- Provocative Ads
- Shaky/Flashy Ads
- Windows Dialog Ads
these questions are optional...

...but answering them accurately will confirm our supercomputer’s audience analysis, to deliver better targeted ads to your site (if more data is useful).

Approximately what percent of your site’s visitors are in the following age ranges:

- 0-17: 5%
- 18-24: 15%
- 25-30: 20%
- 31-34: 20%
- 35-44: 20%
- 45-54: 15%
- 55-64: 15%
- 65+: 5%

Approximately what % of your site’s traffic is Male or Female:

- Male: 49%
- Female: 51%

Approximately what % of your site’s traffic comes from the following regions:

- USA: 60%
- Canada: 20%
- Mexico: 5%
- South America: 5%
- Europe: 15%
- Asia: 15%
- Other: 5%
Performance: Network Detail

Active Response Group

Revenue by Day [This Month]

<table>
<thead>
<tr>
<th>Date</th>
<th>Revenue</th>
<th>eCPM</th>
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</thead>
<tbody>
<tr>
<td>Apr 01</td>
<td>220</td>
<td>0.7</td>
</tr>
<tr>
<td>Apr 02</td>
<td>176</td>
<td>0.6</td>
</tr>
<tr>
<td>Apr 03</td>
<td>126</td>
<td>0.5</td>
</tr>
<tr>
<td>Apr 04</td>
<td>98</td>
<td>0.4</td>
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<tr>
<td>Apr 05</td>
<td>44</td>
<td>0.3</td>
</tr>
<tr>
<td>Apr 06</td>
<td>22</td>
<td>0.2</td>
</tr>
<tr>
<td>Apr 07</td>
<td>8</td>
<td>0.1</td>
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<td>Apr 08</td>
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<td>Apr 09</td>
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<td>Apr 10</td>
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<tr>
<td>Apr 11</td>
<td>0</td>
<td>0.0</td>
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Revenue by Size [This Month]

<table>
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<tr>
<th>Size</th>
<th>Percentage</th>
<th>Revenue</th>
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</thead>
<tbody>
<tr>
<td>Leaderboard (728x90)</td>
<td>72%</td>
<td>$1,993.00</td>
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<tr>
<td>Wide Skyscraper (160x600)</td>
<td>28%</td>
<td>$569.97</td>
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</table>

Revenue by Network [This Month]

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<tr>
<th>Ad Tag</th>
<th>Impressions</th>
<th>Paid Impressions</th>
<th>Defaults Killed</th>
<th>Fill Rate</th>
<th>eCPM</th>
<th>rCPM</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rubicon Tag</td>
<td>1,022,000</td>
<td>919,800</td>
<td>51,100</td>
<td>90%</td>
<td>$1.04</td>
<td>$0.94</td>
<td>$959.97</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,022,000</td>
<td>919,800</td>
<td>51,100</td>
<td>90%</td>
<td>$1.04</td>
<td>$0.94</td>
<td>$959.97</td>
</tr>
<tr>
<td>Leaderboard (728x90)</td>
<td>[1 Ad Tag]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rubicon Tag</td>
<td>1,035,000</td>
<td>931,500</td>
<td>51,750</td>
<td>90%</td>
<td>$1.11</td>
<td>$1.00</td>
<td>$1,033.03</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1,035,000</td>
<td>931,500</td>
<td>51,750</td>
<td>90%</td>
<td>$1.11</td>
<td>$1.00</td>
<td>$1,033.03</td>
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</tbody>
</table>
**Site Summary**

**Impressions by Ad Size**

- Leaderboard (72...)

**Daily Impressions**

- April 05: 1M
- April 06: 800K
- April 07: 600K
- April 08: 400K
- April 09: 200K
- April 10: 100K
- April 11: 50K

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**Get your ad tags:**

Here's where you get the snippets of code you need to cut and paste into your site or ad server.

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**Rubicon Video | Internet Advertising - the Rubicon Project - Mozilla Firefox**


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**52**
Ad Agencies

Publisher/Ad Network

User

An advertising agency or ad agency is a service business dedicated to creating, planning and handling advertising for its clients. E.g., SEMs, Omnicom Group
An ad agency is a service business dedicated to creating, planning and handling advertising for its clients.

- E.g., Search Engine Marketing (SEM), Search Engine Optimization (or SEO), paid placement, and paid inclusion
  - E.g., Efficient Frontier
- Services include designing and build ad creative, landing page, optimization, media purchase etc.
  - Saatchi & Saatchi
Online Advertising

User

Plug and play
Very modular (and confusing)

Publishers

Ad Network
Ad Exchange
Yield Manager

Ad

Agencies

Advertisers

Ads

RuSSIR 2009, Petrozavodsk, Russia. Online Advertising © 2009 James G. Shanahan (San Francisco) James.Shanahan_AT_gmail_DOT_com
Online advertising: who serves who

<table>
<thead>
<tr>
<th>Party</th>
<th>Goal</th>
<th>$$$</th>
<th>Biased towards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publisher</td>
<td>Generate Revenue</td>
<td>Revenue</td>
<td>User/varies</td>
</tr>
<tr>
<td>Advertiser</td>
<td>Communicate a message</td>
<td>ROI</td>
<td>Themselves</td>
</tr>
<tr>
<td>Ad Network</td>
<td>Connect advertisers with consumers</td>
<td>Fees</td>
<td>Advertiser</td>
</tr>
<tr>
<td>Yield Mgt</td>
<td>Connect Advertisers with consumers</td>
<td>Fees</td>
<td>Publishers</td>
</tr>
<tr>
<td>User</td>
<td>Being informed (and entertained)</td>
<td></td>
<td>Themselves</td>
</tr>
</tbody>
</table>

- Advertiser (ROI)
- Ad network (revenue, fees)
- Publisher (revenue and a happy user)
  - Yield managers work for publishers
- Some big players have potential conflict of interests
  - Provide all services
Outline

• Introduction
• Online advertising background
  • Business models
• Creating an online ad campaign
• Technology and Economics
• New Directions
• Challenges in online advertising
• Summary
- **CPM (Cost Per Thousand)**
  - Advertisers pay for exposure of their message to a specific audience. (M in the acronym is the Roman numeral for one thousand)

- **CPC (Cost Per Click) aka Pay per click (PPC)**
  - Advertisers pay every time a user clicks on their listing and is redirected to their website.

- **CPA (Cost Per Action) or (Cost Per Acquisition)**
  - The publisher takes all the risk of running the ad, and the advertiser pays only for the amount of users who complete a transaction, such as a purchase or sign-up.
Business Models: Hybrids

• dCPM Dynamic CPM a newer hybrid pricing model
• dCPM pricing optimizes a campaign towards the sites and site sections that perform best for the advertiser, dynamically paying the most efficient CPM for the value of the inventory to the advertiser.
• dCPM campaigns are driven by two parameters, your Maximum/Average Bidding CPM and your CPA target.
  – As a campaign runs, it “learns” which sites and site sections deliver the CPA targets while staying within your Max CPM requirements.
• E.g., CPM of $10; CPA of $1
Some of the Industry Players

• **Ad Networks/Exchanges**
  – Google, Yahoo, Microsoft (CPM, CPC, some CPA)
  – Turn.com (CPA, CPC, CPM, dCPM)
  – TribalFusion, 24/7, Kanoodle (CPM, CPC)
  – Advertising.com (CPM, CPC) [platform-A]
  – RightMedia, DoubleClick (CPM)

• **Yield managers (Pubmatic, Rubicon, AddKick)**

• **Affiliate networks**
  – Performics, Hydra Network, Commission Junction/BeFree, LinkShare or Motive Interactive, Amazon (CPA, CPL)

• **Agencies**
  – Omnicom Group, WPP Group, Interpublic Group of Companies and Havas
  – Efficient Frontier, Optimost, Offermatica, TaguchiNow,

• **Ad Platforms (DoubleClick, Atlas, Zedo, OpenX)**
Online Advertising History

CPM
• 1994 Banner ads, CPM Banners
  • 1996 Affiliate networks

CPC
• 1997 Goto.com, a 25 employee startup company (later Overture, now part of Yahoo!), created a PPC search engine
  • 1998 Ad Networks (DoubleClick)
  • 2000 Google launches AdWords (ECPM 2002); AdSense (2003)
  • 2001 Behavioural Targeting (Revenue Sciences etc.)
  • 2003 Yahoo acquires Overture

CPA
• 2003 Ad Exchanges, CPA targeted networks

dCPM
• 2005 Publisher-side optimization networks/Yield Management
  • 2007 Yahoo acquires RightMedia and BlueLithium (1$B)
    Google acquires DoubleClick ($3B)
    Microsoft Acquires Aquantive ($6B)
    AOL acquires Quigo ($340M), Tacoda (~$300M)
  • 2008 Social Advertising, Data Exchanges
Don't have a cow!

Famous animal lover Jeffrey Moussaieff Masson, the author of “The Face on Your Plate,” talks about why you should consider giving up the burgers -- and the fromage

By Katharine Mieszkowski

Politico's twisted take on granting anonymity
By Glenn Greenwald

“Crank: High Voltage”: Ace kicking hit man returns
By Stephanie Zacharek

Columbine questions we still haven’t answered
By David Sirota

Torture debate: G. Gordon Liddy and me
By Joan Walsh

You say “transpanic,” I say “hate”
By Tracy Clark-Flory

Wires 24/7

Show: All Wires

Car-crazed LA tries to rev up taxi culture
Remote Mexican town denies being drug lord’s home
Reverse discrimination case could transform hiring
Grisly slayings brings Mexican drug war to US
Man accused of triple stabbing deaths denied bail
NJ scallop boat sinking victim was misidentified
Public skeptical that woman killed, raped girl
Shoot first: Columbine transformed police tactics
New laws treat teen prostitutes as abuse victims
Italy, Malta argue about stranded migrants
Why Online Advertising?

• **Advertiser perspective**
  – Fine-grain targeting
  – *Deliver an advertiser's message with almost realtime* quantifiable measures of consumer interest (Actions/Clicks/Impressions)
    • ECPM, CTR, ATR, Impressions
  – Cheaper
  – Reach (volume and time)
  – Optimization, dynamic

• **Publisher perspective**
  – Offline revenue is on the decline
    • E.g., media giants such as newspapers, TV (20-40% decline)
  – Efficient market places
  – Optimization
  – Fine-grain targeting => utility to consumer

• **User** *(free/reduced price goods/services), less annoying?*
Performance based pricing dominates

Internet Ad Revenues by Pricing Model – 2004 – 2008

- Performance basis (e.g., cost-per-click, sale, lead or straight revenue share);
- CPM or impression basis (includes sponsorships);
- Hybrid basis (e.g., mix of impression-based pricing plus performance-based compensation)

[IAB & PwC 2009]

RuSSIR 2009, Petrozavodsk, Russia. Online Advertising © 2009 James G. Shanahan (San Francisco)
James.Shanahan_AT_gmail_DOT_com
Online Reach: 25% of the world today

Measuring the Online World

Billions Online

1996  2000  TODAY  2012 (est)

[John Gantz, IDC's Digital Marketplace Model and Forecast, IDC 2008]

Source: IDC, 2008

[Image of graph showing the growth of the online population from 1996 to 2012, with an estimate of 30% online by 2012.]
2/3 of Americans are online.....

<table>
<thead>
<tr>
<th>Year</th>
<th>Users (Millions)</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>188.1</td>
<td>3.4%</td>
</tr>
<tr>
<td>2008</td>
<td>193.9</td>
<td>3.1%</td>
</tr>
<tr>
<td>2009</td>
<td>200.1</td>
<td>3.2%</td>
</tr>
<tr>
<td>2010</td>
<td>206.2</td>
<td>3.1%</td>
</tr>
<tr>
<td>2011</td>
<td>211.9</td>
<td>2.8%</td>
</tr>
<tr>
<td>2012</td>
<td>216.9</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

Note: eMarketer defines an Internet user as any person who uses the Internet from any location at least once per month
Source: eMarketer, January 2008

• US Internet users spent 15.3 hours a week online last year [eMarketer.com, 2008]
Mobile Access will be big!

- Users accessed the Internet through more than 1.5 billion devices worldwide in 2008, including PCs, mobile phones, and online video game consoles.
- By 2012, the number of devices accessing the Internet will double to more than three billion, half of which will be mobile devices.
- China passed the US in 2007 to become the country with the largest number of Internet users. China’s online population is forecast to grow from 275 million users in 2008 to 375 million users in 2012.

[John Gantz, IDC 2008]
By 2012, emerging markets will have majority of the world’s online users and devices while their share of ecommerce will grow from approximately 20% to 30%

[John Gantz, IDC 2008]
# 61 Billion Worldwide Searches/Month

## Worldwide Search by Region, August 2007

<table>
<thead>
<tr>
<th>Region</th>
<th>Unique Searchers (000)</th>
<th>Searches (M)</th>
<th>Searches Per Searcher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worldwide</td>
<td>754,459</td>
<td>61,036</td>
<td>80.9</td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>257,952</td>
<td>20,295</td>
<td>78.7</td>
</tr>
<tr>
<td>Europe</td>
<td>209,678</td>
<td>17,846</td>
<td>85.1</td>
</tr>
<tr>
<td>North America</td>
<td>206,278</td>
<td>15,976</td>
<td>77.4</td>
</tr>
<tr>
<td>Latin America</td>
<td>49,995</td>
<td>4,784</td>
<td>95.7</td>
</tr>
<tr>
<td>Middle East-Africa</td>
<td>30,556</td>
<td>2,134</td>
<td>69.8</td>
</tr>
</tbody>
</table>

Notes:
1. Searchers were aged 15 and older, using home and work locations.
2. Results exclude traffic from public computers, such as Internet cafes, and access from mobile phones and PDAs.

Source: comScore, 2007
## Top 10 Worldwide Search Properties, August 2007

<table>
<thead>
<tr>
<th>Search Property</th>
<th>Searches (M)</th>
<th>% Searches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worldwide</td>
<td>61,036</td>
<td>100</td>
</tr>
<tr>
<td>Google</td>
<td>37,094</td>
<td>60.8</td>
</tr>
<tr>
<td>Yahoo</td>
<td>8,549</td>
<td>14.0</td>
</tr>
<tr>
<td>Baidu.com Inc.</td>
<td>3,253</td>
<td>5.3</td>
</tr>
<tr>
<td>Microsoft</td>
<td>2,166</td>
<td>3.5</td>
</tr>
<tr>
<td>NHN Corp.</td>
<td>2,044</td>
<td>3.3</td>
</tr>
<tr>
<td>eBay</td>
<td>1,319</td>
<td>2.2</td>
</tr>
<tr>
<td>Time Warner Network</td>
<td>1,212</td>
<td>2.0</td>
</tr>
<tr>
<td>Ask Network</td>
<td>743</td>
<td>1.2</td>
</tr>
<tr>
<td>Fox Interactive Media</td>
<td>683</td>
<td>1.1</td>
</tr>
<tr>
<td>Lycos Inc.</td>
<td>441</td>
<td>0.7</td>
</tr>
</tbody>
</table>

### Notes:
1. Searchers were aged 15 and older, using home and work locations.
2. Search properties were based on the top 50 properties worldwide where search activity is observed.
3. Results exclude traffic from public computers, such as Internet cafes, and access from mobile phones and PDAs.
4. Source: comScore, 2007
Where people spend time?

- Only 20 domains capture a whopping 39% of all our time spent online.
- Only 2.1% of our time is spent on Google.com (includes all subDoms)
- Revenue from search accounts for 41% (in US)
  - [http://www.iab.net/media/file/IAB_PwC_2007_full_year.pdf]
What are people doing online?

• Online Publisher Organization's (OPA) Internet Activity Index [Nielsen/NetRatings].
  – 47% of consumers time is spent viewing online content
    • including video-sharing sites, news sites, video, social nets, weather and blogs (Up from 34% in 2003)
  – 33% is spent on communications, (46% in 2003).
  – 15% Commerce
  – 5% search (Search-based OA revenue > 50%)

• 14 hours per week online (versus 14 hours watching TV) [JupiterResearch.com, 2007]

• Online advertising is ROI-centric; Brand advertising has still to catch on
Why Online Advertising?

• Advertiser perspective
  – Fine-grain targeting
  – *Deliver an advertiser’s message with almost realtime* quantifiable measures of consumer interest (Actions/Clicks/Impressions)
    • ECPM, CTR, ATR, Impressions
  – Cheaper
  – Reach (volume and time)
  – Optimization

• Publisher perspective
  – Offline revenue is on the decline
    • E.g., media giants such as newspapers, TV (20-40% decline)
  – Efficient market places
  – Optimization
  – Fine-grain targeting => utility to consumer

• User (*free/reduced price goods/services*), less annoying?
Internet advertising revenues accounted for approximately 5.9% of total U.S. ad spending in 2006 (285B), up from approximately 4.7% in 2005; An annual growth of 25% versus of an overall growth of 7%
Online Advertising is about 10% [2008]

Overall Advertising spend across all media (direct marketing not included here runs at $50B)
U.S. Advertising Market-Media Comparisons—2006 ($ Billions)

Direct Mail: $65.7
Newspapers: $61.2
TV Networks: Broadcast & Cable: $39.9
TV Distribution: $32.5
Magazines: $24.8
Radio: $20.8
Internet: $18.0
Outdoor: $8.2

*The total U.S. advertising market is estimated at approximately $235 billion, and includes other segments not charted here.

U.S. Advertising Market – Media Comparison – 2008 ($ Billions)

Newspapers: $34.4
TV Distribution: $28.6
Internet: $23.4
TV Networks: Cable: $21.4
Radio: $17.2
TV Networks: Broadcast Network: $16.0
Consumer Magazines: $12.7
Directory: $13.6
Trade Advertising: $10.0
Out of Home: $7.2

*The total U.S. advertising market includes other segments not charted here.
**TV Distribution** includes national and local TV station ads as well as multichannel system ads.

Sources: IAB Internet Ad Revenue Report, PricewaterhouseCoopers Global Entertainment and Media Outlook

James Shanahan (San Francisco)
James.Shanahan_AT_gmail_DOT_com
US Online Advertising relative spend

<table>
<thead>
<tr>
<th>Year</th>
<th>Internet</th>
<th>Total media</th>
<th>Internet % of total media</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>$16.9</td>
<td>$281.6</td>
<td>6.0%</td>
</tr>
<tr>
<td>2007</td>
<td>$21.4</td>
<td>$287.5</td>
<td>7.4%</td>
</tr>
<tr>
<td>2008</td>
<td>$27.5</td>
<td>$295.5</td>
<td>9.3%</td>
</tr>
<tr>
<td>2009</td>
<td>$32.5</td>
<td>$301.5</td>
<td>10.8%</td>
</tr>
<tr>
<td>2010</td>
<td>$37.5</td>
<td>$309.0</td>
<td>12.1%</td>
</tr>
<tr>
<td>2011</td>
<td>$42.0</td>
<td>$316.0</td>
<td>13.3%</td>
</tr>
</tbody>
</table>

Note: eMarketer benchmarks its US online advertising spending projections against the Interactive Advertising Bureau (IAB)/PricewaterhouseCoopers (PwC) data, for which the last full year measured was 2006; online ad data includes categories as defined by IAB/PwC benchmark—display ads (such as banners), paid search ads (including contextual text links), rich media (including video), classified ads, sponsorships, referrals (lead generation) and e-mail (embedded ads only); excludes mobile ad spending; eMarketer benchmarks its US total media advertising spending projections against the Universal McCann data, for which the last full year measured was 2006; includes television (broadcast and cable), radio, newspapers, magazines, Internet (excludes mobile), outdoor, direct mail, yellow pages and other. Source: eMarketer, October 2007.
Ad Revenue by Ad Format

Internet Ad Revenue Share by Advertising Format – 2004 – 2008*

% of Total Revenue

- Search
- Display Banners
- Classifieds
- Rich Media and Digital Video
- Lead Generation
- Sponsorships

[IAB PwC]
Sponsored Search vs. Contextual

E.g., Google

- Google-owned sites generated revenues of $3.70 billion, or 67% of total revenues [q1, 2009]
- Google Network Revenues - Google’s partner sites generated revenues, through AdSense programs, of $1.64 billion, or 30% of total revenues, in the first quarter of 2009.

Online Advertising – Recap so far

- **Goals of Online advertising**
  - *Deliver an advertiser’s message with* quantifiable measures of consumer interest
  - Enable ads as a medium of information!

- **Online advertising is a relatively new field**
  - $23.4 billion in USA (2008), $65B worldwide (10% of overall ad spend); 57% Performance-based
  - Contextual Advertising is growing (30% for in Q1/2009 for Google)

- **Strengths**
  - Reach, targeted, cheap, quantifiable measures of consumer interest

- **Issues**
  - Privacy, ad placement, deception (e.g., phishing), fraud (e.g., click fraud), moral conscience, bandwidth issues
Outline

• Introduction
• Online advertising background
• Business models
  • Creating an online ad campaign
• Technology and Economics
• New Directions
• Challenges in online advertising
• Summary
Creating an online ad campaign

- **Typical workflow**
  - Create advertiser account (name/address/Credit card details/etc.)
  - Create ad creative
  - Create an ad campaign
  - Upload creative's
  - Specify targeting constraints (e.g., keywords, categories, geo, dates)
  - Specify bid price and budget
    - At Turn Inc. (CPA network), just specify the bid price for an action; no need for keyword portfolio management
    - Deploy action beacon on landing page
  - Optimize ad creative/user-landing-experience, bid price: AB Test, DOE

- **Ad network/exchange**
  - Turn.com (CPA, CPC, CPM), Google (CPC, CPM), Yahoo (CPC, CPM), Right Media (CPM), Etc.

- **SEM: e.g., Efficient Frontier**
A Typical Text-based CPC Ad

1. Specify Start/End Dates of Campaign
2. Specify keywords+bids
3. Specify Budget
4. Specify other constraints (locality/publisher/etc)
E.g., Google AdWords
Advertise your business on Google

No matter what your budget, you can display your ads on Google and our advertising network. Pay only if people click your ads.

Your ads appear beside related search results...

People click your ads...

...And connect to your business

Sign in to Google AdWords with your Google Account

Email:
Password:
Sign in
Forgot your password?

Learn about AdWords

How it works

Why it works

Costs and payment

For local businesses

Assisted signup options

Success stories

You create your ads
You create ads and choose keywords, which are words or phrases related to your business.
Get keyword ideas

Your ads appear on Google
When people search on Google using one of your keywords, your ad may appear next to the search results. Now you're advertising to an audience that's already interested in you.

You attract customers
People can simply click your ad to make a purchase or learn more about you. It's that easy!

Sign up now | Next topic »
Advertiser Workflow

Advertising campaign: a series of advertisement messages that share a single idea
Select Portfolio of Keywords

[https://adwords.google.com/select/KeywordToolExternal?defaultView=2]

<table>
<thead>
<tr>
<th>Keywords</th>
<th>Estimated Ad Position</th>
<th>Estimated Avg. CPC</th>
<th>Advertiser Competition</th>
<th>Search Volume: March</th>
<th>Avg Search Volume</th>
<th>Search Volume Trends (Dec 2006 - Nov 2007)</th>
<th>Highest Volume Occurred In</th>
<th>Match Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>data mining</td>
<td>1 - 3</td>
<td>$0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oct</td>
<td>Add</td>
</tr>
<tr>
<td>data mining software</td>
<td>4 - 6</td>
<td>$0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oct</td>
<td>Add</td>
</tr>
<tr>
<td>data mining tools</td>
<td>1 - 3</td>
<td>$0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Apr</td>
<td>Add</td>
</tr>
<tr>
<td>web data mining</td>
<td>4 - 6</td>
<td>$0.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nov</td>
<td>Add</td>
</tr>
<tr>
<td>data mining techniques</td>
<td>1 - 3</td>
<td>$0.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Oct</td>
<td>Add</td>
</tr>
<tr>
<td>data mining</td>
<td>4 - 6</td>
<td>$0.24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Nov</td>
<td>Add</td>
</tr>
</tbody>
</table>
Regional and Local Targeting: Sharpen Your Advertising Focus

With AdWords, you can target your ads to appear only in specific geographic locations. You can choose country-level targeting or narrow your focus to:

- Region and city-level targeting: Show your ads to people searching for results in regional areas you choose. (Available in select countries.)
- Customized targeting: Show your ads to people searching for results in an area you define. (Available worldwide.)

- How does this benefit me?
  When you target regional and local areas, you can reach the prospects who are most appropriate for your business and you can write ads that highlight special promotions or pricing based on geography.

- Which ad targeting option is right for me?
  Use regional and city-level targeting if you know which specific cities and regional areas are appropriate for your market. Choose customized targeting if you want to define your own target area. Indicate your area by choosing a point and a surrounding radius or by picking points to define a border.

- How does this work?
  The AdWords system may analyze a searcher’s query (for example “London florist”) to establish what location that person is searching for. The system may also take note of the person’s Internet Protocol (IP) address to see where he or she is searching from.

- I’m ready to reach new customers now. How do I get started?
  All you need to do is create and activate an AdWords account.

See Local Targeting in Action
View our interactive demo to explore this targeting option and learn how to set up a local or regional AdWords campaign of your own. Start Demo
Upload Ad Creatives 1-by-1 or in Bulk

1. Bulk Upload
2. Or upload raw ingredients and generate ad (list of products)
Analytics: Managing Ad Campaigns

- You choose your own maximum daily spending limit (daily budget)
- Choose how much you want to spend per click for every keyword
- Pay Google for users who click on your ad
- More cost-effective than Yellow Pages, Banner Ads & Direct Mail (CPM)*
- Conversion tracking = real-time return-on-investment data

*Reporting is not real-time. Clicks and impressions received in the last 3 hours may not be included here.
Expensive Keywords

- Most of the keywords hovering around $100 are for personal injury lawyers or lawsuits.
- For example [webmasterworld.com, 10/2006]
  - *mesothelioma* - a type of cancer caused by exposure to asbestos is fetching $100/CPC
  - loan consolidation, $65/CPC; insurance quotes $60/CPC
  - $70.24 Mesothelioma Attorney

Revenues: $1.60 \times 0.026 \times 10^9 = $40M/day = $14B/Year

- $50.00 Investment Fraud
- $19.00 Wisconsin Mortgage; $18.22 Conference Calling; $14.97 Casino
- Average CPC=$1.60 (on Google); Avg CTR=2.6%#
  - Google ECPM = ~$40; Social Networks ECPM of about $0.20; Premier publishers ECPM of $40-$50 (more targeted)

# [MarketingSherpa, 9/2005]  

ECPM $41 = 1.60 \times 0.026 \times 1000
Quarterly Keyword Distribution by CPC, October 2004-October 2005

Source: DoubleClick, 2006
Publisher Workflow

• Similar steps to Advertiser workflow
• Sign up with an ad network (e.g., Google) or with an exchange, or with an advertiser etc.
• May be able to impose constraints on ads shown (e.g., size, border, adtype, category of ad)
• Decide ad types
  – Contextual ads
    • AdSense puts relevant text ads next to content
    • Advertiser puts some Javascript on page and shares in revenue from ad clicks
  – Display ads
    • Advertiser negotiates with publisher for CPM (price) and impressions
    • Ad server (e.g. Doubleclick) serves up ads to pub server
How do the publishers get ads?

Publisher

Publisher-side Optimization
Network

Ad Network

Ad Exchange

Ad Agency

Advertiser

Ad Network

Ad Network

Ad Network

Ad Network

Ad Network
Publisher Workflow

- **Sign up with ad network**
  - e.g., Google, Turn Inc., Right Media (remnant inventory)
- **May be able to impose constraints on ads shown (e.g., size, border, adtype, category of ad)**
- **Insert adcode into target page:**
  - `<td> <div style = "margin: 0px 0px 0px 15px"> <script type="text/javascript">
</script></div>`
You can put these tags on your site immediately; it usually takes about 20 minutes before you will start seeing ads.

Note: You cannot put more than 3 Google tags on a page (this includes any Google tags you put directly on your site).

```html
<!-- Rubicon Project tag -----------------------------------------
Site: Rubicon Demo Zone: My Site Size: Leaderboard (728x90)
----------------------------->
<script language="JavaScript" type="text/javascript">
var cb = Math.random(); var d = document;
</script>
<!-- end Rubicon Project tag -->
```
Surfing

Mui Ne offers a relatively safe environment for low-key surfing. (see kiteboarding below).

Scuba Diving and Snorkeling

The Best diving in Binh Thuan Province (or all of Vietnam for that matter) is at Ca Na Beach. The water is clear, the coral reefs are pristine, and the whole area as bursting with marine life. One thing Ca Na is lacking is very many tourists and the resorts to contain them. Vietnam Scuba has a very "for Koreans, by Koreans" diving establishment there. The website has some English, but we have not confirmed if anyone on staff speaks English fluently. Click here to read more about the scuba diving potentials at Ca Na Beach and the Hon Cau-Vinh Hao Proposed Marine Protected Area. Though all but undiscovered, Phu Quy Island Proposed Marine Protected Area also has a potential for scuba diving and snorkeling in coral reefs (but beware of sharks!).

From time to time, shipwrecks are discovered and salvaged off the coast of Binh Thuan Province. In the summer of 2004, three tannins...
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Search Engine Architecture

- **Offline Processes**
  - crawling, featurizing, Webgraph, Classification, updating ML models
- **Online**
  - query rewriting, ranking, reranking, merging, logging, analytics
- **Realtime web indexing**
- **ML Framework**

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