

Encyclopedia of Information Science and Technology

Volume I–V

Mehdi Khosrow-Pour, D.B.A.
Information Resources Management Association, USA



IDEA GROUP REFERENCE
Hershey • London • Melbourne • Singapore

Rotating Banner Advertisements on the World Wide Web

Subhasish Dasgupta

The George Washington University, USA

Rajesh Chandrashekar

Fairleigh Dickinson University, USA

INTRODUCTION

Advertising spending on the Internet has soared. Indeed, by some accounts, Internet advertising is projected to reach \$23.5 billion by 2005 (eMarketer, 2002). Although there are several ways of advertising on the Internet, for example, buttons, banners, paid links, superstitials, and so forth, banner advertising is the most common form of advertising on the Internet (Meland, 2000). Advertising using banners (usually placed near the top of a page) is currently the most popular form of online advertising. Banners may be static (stationary) or dynamic (rotating). In the case of static banners, all visitors to a particular site are exposed to the same banner. In contrast, dynamic banners describe cases where ad servers to a particular site deliver different banners to different clients/visitors. This approach presents the possibility of time/space sharing among different advertisers.

This article discusses one particular type of dynamic/rotating banner advertising. Specifically, we present a model to deliver and track the effectiveness of dynamic rotating banner advertisements. The advertising is dynamic in that different banners may be delivered to different users, and it is rotating in that each user (depending on the length of time spent at that site/page) will be exposed to multiple advertisements. These banners may be from a single advertiser (different executions of an ad) or from different advertisers. The latter allows for better space/time sharing and cost effectiveness.

Rotating ads provide the ability to deliver multiple ads to users by associating many ads with a single Web page. Most Web sites have popular pages that users visit often. Rotating banners allow companies to deliver more than one advertisement for these pages, thereby increasing their yield from the page.

Measuring click-through, that is, clicking on an ad banner, has been and remains important in assessing the effectiveness of online advertisements. Research has shown that there are many factors that influence peoples' click-through behaviors (Cho, 2003a). For example, many banner-related factors, for example, the size of the banner,

location of the banner, and dynamic animation (Razzouk & Seitz, 2003) and other individual factors, for example, person's involvement with the product/service being advertised (Cho, 2003b; Yoon, 2003) determine the effectiveness of banner ads on the Internet. For example, Cho (2003b) confirmed that while people whose involvement is low are generally less likely to seek additional information, they are also more likely to be influenced by ad-related factors.

However, of late, click-through rates have been declining (Dreze & Husherr, 2003). This disturbing trend has caused advertisers to think about ways in which click-through rates may be improved. Recent findings suggest that advertisers may be able to reverse the trend by using rotating and dynamic banner advertisements. For example, Chatterjee, Hoffman and Novak (2003) found that there is significant heterogeneity in consumers' click-proneness to banner advertisements and that there are significant gains from repeated exposures to banner ads—but mainly for consumers who are not otherwise click-prone. In addition, consumers who are more involved with the product are more likely to click than those who are not (Cho, 2003b). Such findings might suggest that rotating (rather than static) banner ads, which allow for space/time sharing enabling multiple exposures to messages from multiple advertisers, may be an effective way to improve click-through rates and effectiveness of banner advertisements. Recent experimental evidence also confirms that the level of attention and message recall or association of banner advertisements is also a function of position (i.e., top versus bottom) and graphics (Razzouk & Seitz, 2003).

BACKGROUND

Review of Web Advertisement Models

The process of advertising on the Web consists of two parts: delivery of advertisement to a client computer using the Internet, and tracking effectiveness of the delivered



advertisement. There are two basic types of advertisement delivery models: delivery-focused and measurement-focused. Delivery-focused models emphasize the advertisement delivery method and do not have the ability to track effectiveness of the advertisement. Measurement-focused models use modified advertisement delivery mechanisms that help in measuring effectiveness.

We consider two delivery-focused models: the static ad model and the dynamic ad model. In the static ad model, when a user requests a page, the Web server responds with the requested page. The page has content and HTML code to insert a banner image into the Web page. This banner image is the advertisement. A server finds the requested banner image for the Web page. The page content and banner image are then transmitted to the user's computer, that is, the client, over the Internet. A Web server log records transfer of the content page as a "hit" in the server's log. When an ad file is sent out to the client, the server also records that the user's browser successfully downloaded the advertisement. In this model each page has only one ad associated with it and this ad is changed in batches, either once per day or once per week.

The dynamic ad model is very similar to the static ad model described previously. In addition to the Web server, there is a separate server called an ad server that stores all the banner advertisements that are delivered to the client. The ad server also has special software that makes a decision regarding which ads should be served to the client or user. A summary of delivery-focused models is provided in Table 1.

We consider two measurement-focused models. The first, cache-measurement, "allows for the appropriate measurements of ads stored and provided from cache by a proxy server or browser, as well as those ads actually provided by the ad server" (Bennett 1998). The second, browser measurement, allows for the recording of ad-related activity using software (e.g., Java) that runs on the requesting browser. A summary of the measurement-focused models is provided in Table 2.

Static and Rotating Banner Advertisements

Static banner advertisements are defined as those in which the banner space is utilized by a single advertiser, whose banner appears along with a Web page through the duration of client's visit. Each such ad provides a link with the advertiser's home page via a "button". We should note that the term *static* simply refers to the fact that the ad belongs to a single advertiser. However, each ad may include moving or animated elements (text, graphics, or both) and other features that attempt to draw attention to the ad.

In contrast, *rotating banner advertisements* refer to ads belonging to different advertisers that can share the same banner space for the duration of the page visit. That is, two or more advertisements appear in succession on the user's screen in the same banner space. Each ad appears on the user's screen for a predetermined duration, and is then replaced by another ad belonging to a different advertiser. This "rotation" continues as long as the page is displayed on the user's screen. Furthermore, similar to static ads, each ad in the rotation provides a link to the advertiser's page for the duration of display.

FUTURE TRENDS

A Framework for Delivery and Tracking of Rotating Banners

In this section we develop a theoretical framework to examine how rotating banner ads may be delivered and evaluated. Figure 1 shows the proposed framework for the delivery and tracking of rotating banners.

The proposed system consists of two components: ad delivery and ad tracking. The following sections describe each in turn.

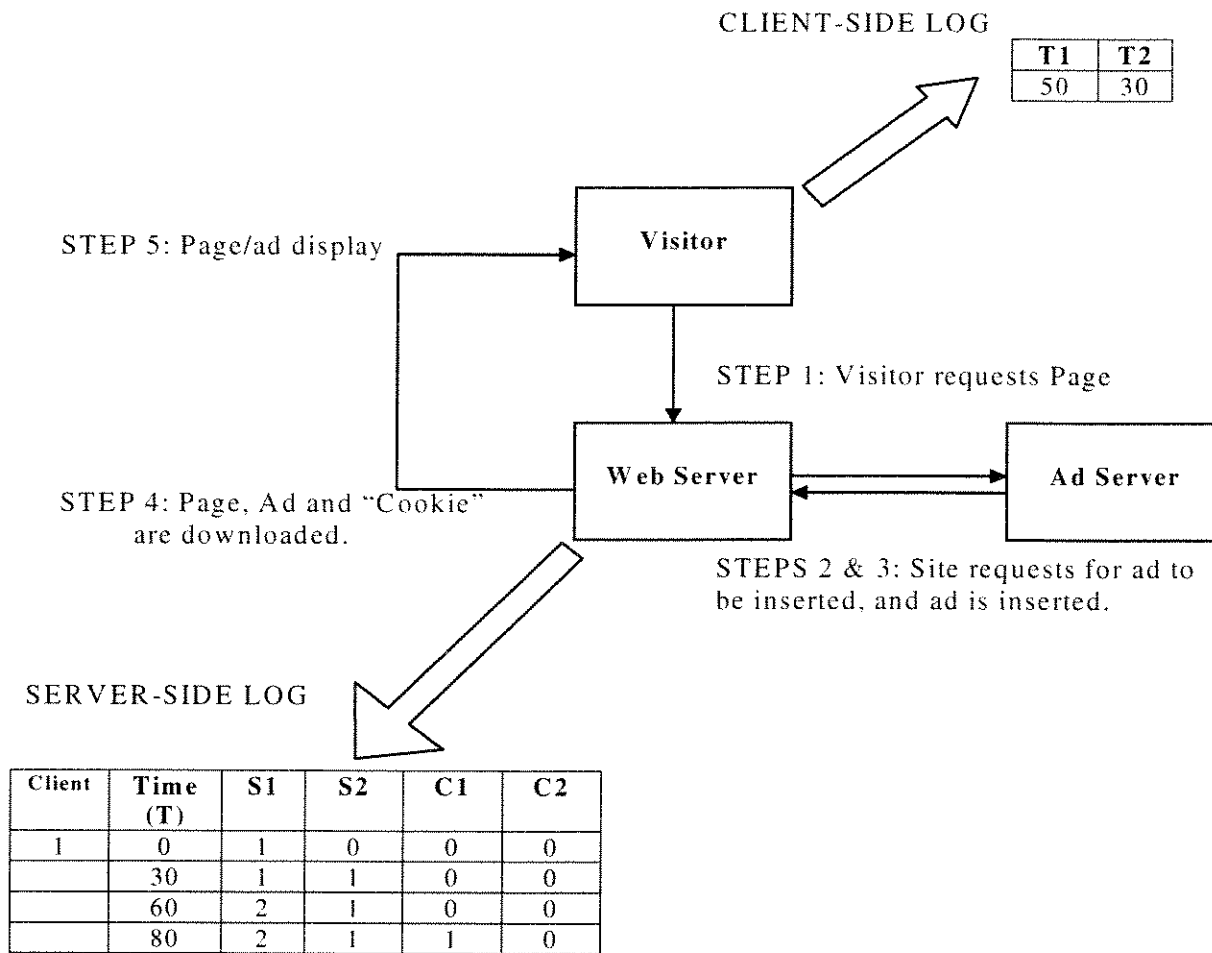
Table 1. Delivery focused models

Model	Content Delivered by	Ad Delivered by	Delivery Mechanism
Static Ad Model	Web server	Web Server	One ad associated with each page. These ads are changed in daily or weekly intervals.
Dynamic Ad Model	Web server	Ad server	Different ads are dynamically associated with each page. This can be done based on the user.

Table 2. Measurement focused models

Model	Content Delivered by	Ad Delivered by	Measurement Mechanism
Cache-measured	Web server	Ad server	Emphasis is on counting ads provided from cache by a proxy server.
Browser-measured	Web server	Ad server	A browser run program keeps track of Ads downloaded.

Figure 1. Ad delivery and tracking system



Note:

T = Time elapsed since page and ads were downloaded

S1 and S2 = Number of opportunities to see ads 1 & 2 respectively

C1 and C2 = Click status of ads 1 & 2 respectively

T1 and T2 = Total time of display of ads 1 & 2 respectively

Ad Delivery

When a Web page is downloaded from the server it downloads the contents of the page (containing the Java Script for the rotation of the ad images), the ad images, and a program to keep track of time spent on the page (T_p) and click status of each ad (C_i). Once the page and the ads have been loaded on the client's browser, the Java Script program that is built into the Web page is executed using the client-computer's resources and provides the ad rotation. This program is crucial to the implementation of the rotating banner system.

Ad Tracking

The tracking system consists of two sub-systems. The one that resides on the Web (or ad) server is called the server side sub-system, and the other, which utilizes the user's computing resources, is called the client side sub-system. Each sub-system is further described next. For explanation purposes we consider a system that consists of two rotating ads: Ad 1 and Ad 2.

Server Side Sub-System

The server-side sub-system is responsible for maintaining a log of the time (T) elapsed since the page was sent (start of the download by client). In addition, it maintains counts (S_1 and S_2) of the number of opportunities that the user has had to see each ad (ads 1 and 2 respectively). S_1 and S_2 are incremented based on the frequency of rotation, that is, how many seconds (t) each ad is displayed for. The log file also maintains a record of the "click status" of each ad using counters C_1 and C_2 for ad 1 and ad 2 respectively. Initially, all counters are set to zero. When the client clicks on a particular ad (say Ad 1), the respective counter (here, C_1) is incremented by one, but C_2 remains unchanged (refer to server side log in Figure 1).

Using this program, the Web server can not only measure the click-through rate of each ad, but can also measure the number of opportunities the client has had to see each ad. The latter measure can be used to determine reach, gross impressions, and other variables that may be used in sophisticated pricing models. This additional information also allows the server to estimate an ad's effectiveness on dimensions other than those that are behavioral in nature. Existing models concern themselves only with click-through rates (see IAB and MB Interactive study, 1997).

Client-Side Sub-system

The client-side sub-system is responsible for maintaining a log on the client's side. This log contains such informa-

tion as the client code and duration of display for each ad (T_1 and T_2). The sub-system uses a program that is downloaded to the client's computer along with the Web page requested. The code in the program creates a time stamp when the ad was received using the client's own computer clock and stores it in the hard drive. This mechanism operates like a "cookie," and can be implemented using programs like Java applets.

Consider the scenario when the client clicks on one of the rotating banners. At this time, the data in the cookie (i.e., the entire log from the client's side) are transmitted back to the server log, which then updates the appropriate fields. In this case, the time is noted based on when the click-through was made. Based on the start time and end time transmitted to the server log, the actual time duration (T_1 and T_2) for which each ad was displayed on the client's browser can be calculated and stored in the server log.

Consider another scenario in which the client does not click on any of the ads on the page, but moves to a different page on a different server. In this case, as soon as the user moves to a different page the end time is noted from the computer's internal clock and stored on the hard disk as a "cookie" by the client-side program. The next time the same client connects to the Web site (server), the data in the cookie are transmitted back to the server log, and the actual ad display times are recorded in the log.

It is important to note that there may be differences between the server-side and client-side logs because the server-side log does not consider the time taken to transmit data and images from the server to the client and back. The client program will be more accurate since its time logs are not affected by the time taken to transmit data and images. To reconcile these differences, the client side data are used to calculate the final values of S_1 , S_2 , T_1 and T_2 .

CONCLUSIONS

In this article we have presented an overview of models used for delivery and tracking banner advertising on the Web. We introduced the concept of rotating banner advertising and presented a model that can be used for delivery and measurement of such advertising. For advantages and limitations of this model see Dasgupta and Chandrashekar (2001).

We would like our readers to note that technology in this field is changing rapidly and newer methods of Web advertising are being introduced all the time. But we still believe that this encyclopedia article provides the right overview of technologies issues, marketing concepts, and terms and definitions related to the field of Web-based advertising.



REFERENCES

- Bennett, R. (1997). How Internet ads are delivered and measurement information. ABC Interactive. White Paper. Retrieved August 2001 from <http://www.accessabvs.com/webaudit/admeasurement.html>
- Chatterjee, P., Hoffman, D.L., & Novak, T.P. (2003). Modeling the clickstream: Implications for Web-based advertising efforts. *Marketing Science*, 22(4), 520-541.
- Cho, C.H. (2003a, summer). Factors influencing clicking of banner ads on the WWW. *CyberPsychology & Behavior*, 6, 201-215.
- Cho, C.H. (2003b). The effectiveness of banner advertisements: Involvement and click-through. *Journalism and Mass Communication Quarterly*, 80(3), 632-645.
- Dasgupta, S., & Chandrashekar, R. (2001). Delivery and tracking of rotating banner advertisements on the World Wide Web: An information systems model. In A. Gangopadhyay (Ed.), *Managing business with electronic commerce*. Hershey, PA: Idea Group Publishing.
- Dreze, X., & Husser, F. (2003). Internet advertising: Is anybody watching. *Journal of Interactive Marketing*, 17(4), 8-23.
- EMarketer. (2002). Online advertising perspective. Retrieved August 2001 from http://www.emarketer.com/analysis/eadvertising/20010412_ead.html
- IAB Online Advertising Effectiveness Study. (1997). Retrieved on August 27, 2004 from <http://www.mbinteractive.com>. San Francisco, CA: Millard Brown Interactive.
- Kurose, J.F., & Ross, K.W. (2000). *Computer networking*. NY: Addison-Wesley Longman Inc.
- Meland, M. (2000, February 13). Banner ads get sexy. *Forbes*, 28-29.
- Razzouk, N., & Seitz, V.A. (2003). Banner advertising and consumer recall: An empirical study. *Journal of Promotion Management*, 9(1, 2), 71-80.
- Yoon, S.-J. (2003). An experimental approach to understanding banner adverts' effectiveness. *Journal of Targeting, Measurement and Analysis for Marketing*, 11(3), 255-272.
- page, much in the same way an image is included. When you use a Java technology-enabled browser to view a page that contains an applet, the applet's code is transferred to your system and executed by the browser's Java Virtual Machine (JVM) (<http://java.sun.com/applets/>).
- Browser:** A computer software program that requests Web pages and other associated applications over the Internet and that can display these files using the right format
- Browser Log:** Browser log is a computer file (program) running on the client's browser that lists all requests for individual files and ads.
- Cache:** Cache is a storage area on the user computer's hard disk where recently viewed Web pages are stored.
- Client:** A client refers to a computer that requests and receives data and services from servers on a computer network. Computer users work with clients to access information on the Internet and World Wide Web.
- Cookies:** A collection of information, usually including a username and the current date and time, stored on the local computer of a person using the World Wide Web, used chiefly by Web sites to identify users who have previously registered or visited the site (<http://dictionary.reference.com>).
- HTML:** HyperText Markup Language is the language in which most pages on the World Wide Web are written. These pages can be read using a browser.
- Java:** Java is an object-oriented language that is widely used for Internet or Web-based applications. It was designed specifically for distributed environments.
- Javascript:** Javascript is Netscape's simple, cross-platform, World Wide Web scripting language. Javascript runs in only three environments – as a server-side scripting language, as an embedded language in server-parsed HTML, and as an embedded language run in Web browsers, where it is the most important part of DHTML (<http://dictionary.reference.com>).
- Proxy Server (or Web Cache):** This is a server that lies in between the organizational network and the Internet. It has its own disk storage and stores copies of recently requested objects (Kurose & Ross, 2000).
- Web Server:** A Web server is a computer that is addressable by a URL and that houses objects. Objects include Web pages (HTML files), JPEG images, and other applications or programs.
- Web Server Log:** Also called an Access log, this is a list of all requests for individual files and ads that users (or clients) have made from a Web site (Whatis.com 2000).

KEY TERMS

Applet: An applet is a program written in the Java™ programming language that can be included in an HTML