AdX: A Model for Ad Exchanges

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Increasingly, display advertisements (ads) on the Internet are sold via marketplaces that bring publishers and advertisers together in real time when an opportunity arises to present an ad to a viewer. In this note, we present the *AdX Model* for such marketplaces.

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1. INTRODUCTION

Viewers who browse to various web pages on the Internet are shown advertisements. These are called *display ads*, in contrast to *sponsored search ads* that are shown in response to viewer queries. The precise display ad shown is determined by the contents and features of the web page, the contracts between the publisher of the page and various advertisers, often represented by ad networks who act as intermediaries, and possibly, the characteristics of the viewer. Traditionally, the contracts are negotiated offline between publishers and ad networks or advertisers. Instead, increasingly, now ads are being sold via marketplaces where they are determined by realtime decisions. Examples of such marketplaces include [RightMedia], [AdECN] and [AdExchange]. In this note, we describe a model for them.

2. ADX: THE MODEL

There are a number of decisions involved in designing ad marketplaces. For example, what commodities should be traded? One can imagine trading contracts for bulk impressions (eg., 1M impressions per day in YouTube homepage for a movie trailer). Instead, typical ad exchanges trade individual impressions. More sophisticated contracts can be crafted on top of this spot market. Another issue is who will be the participants in the market? Much like financial exchanges that let licensed brokers trade, ad exchanges let ad networks trade on the exchange on behalf on individual advertisers. There are a number of other design decisions which are explicit in the abstract *AdX* model introduced in [Muthukrishnan 2009] for ad marketplaces. We describe the AdX model here. It is defined as a sequence of events.

(1) User u visits the webpage w of publisher $p(w)$ that has, say, a single slot for ads.
(2) Publisher $p(w)$ contacts the exchange E with (w, u, ρ) where ρ is the *minimum price* $p(w)$ is willing to take for the slot in w.

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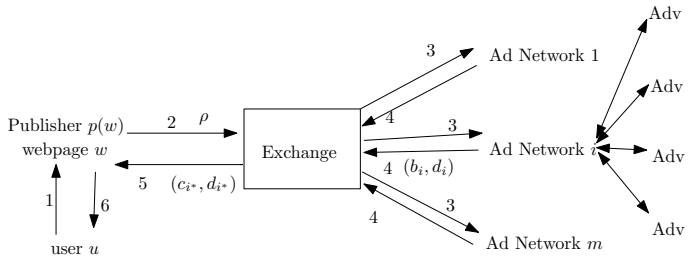

Fig. 1. AdX Model

(3) The exchange E contacts ad networks $a_1, \ldots, a_m$ with $(E(w), E(u), E(\rho))$, where $E(w)$ is information about w provided by E, $E(u)$ is the information about u provided by E, and likewise $E(\rho)$, information about ρ provided by E.

(4) Each ad network a_i returns (b_i, d_i) on behalf of its customers which are the advertisers; b_i is its *bid*, that is, the maximum it is willing to pay for the slot in page w and d_i is the ad it wishes to be shown. The ad networks may also choose not to return a bid.

(5) Exchange E determines a winner i^* for the ad slot among all (b_i, d_i)'s and its price $\rho \leq c_{i^*} \leq b_{i^*}$ via an *auction* and returns (c_{i^*}, d_{i^*}) to $p(w)$.

(6) The publisher $p(w)$ serves webpage w with ad d_{i^*} to user u. This is known as an *impression* of ad d_{i^*}.

The flow of the model is shown in Figure 1.

There are many research problems within this model about auctions, optimization, machine learning and data mining, and Economics. More details about the AdX model and the research problems are described in [Muthukrishnan 2009].

REFERENCES

AdECN. Whitepaper at `http://www.adecn.com/resources/ATrueExchangeforOnlineAdvertising.pdf`. In *`http://www.adecn.com/`*.

AdExchange. Overview at `www.google.com/adexchange/AdExchangeOverview.pdf`, product information at `http://www.doubleclick.com/products/advertisingexchange/index.aspx`. In *`http://www.doubleclick.com`*.

Muthukrishnan, S. 2009. Ad exchanges: Research issues. In *Proc. WINE*. LNCS, New York, 1–12.

RightMedia. `http://www.rightmedia.com/right-media-101/`. In *`http://www.rightmedia.com/`*.