

RTB (Real Time Bidding) 101

— Where Computational Advertising Meets BigData

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RTB (Real Time Bidding) is one of the most exciting developments in computational advertising in recent years. It drives the transparency and efficiency in the display advertising ecosystem and facilitates the healthy growth of the display advertising industry. It enables advertisers to deliver the right message to the right person at the right time, publishers to better monetize their content by leveraging their website audience, and consumers to view relevant information through personalized ads.

In the RTB-enabled display advertising ecosystem, there are two important players, ad exchange and DSP (Demand Side Platform). The ad exchange aggregates ad impressions from multiple publishers and sends the bid request of each ad impression to several DSPs. The bid request contains the information about this ad slot such as the size and URL of the ad slot, and audience such as IP address and cookie ID of the audience. Receiving the bid request, Each DSP will check the advertiser and user profile database, use bidding algorithms to make two following decisions: 1) Decide whether to bid this ad impression or not. If DSP finds the ad slot and audience match what at least one of advertisers are looking for, DSP will bid this impression; 2) decide what is the bidding price for the ad impression and send the bid response back to the ad exchange. The ad exchange does the auction after receiving bid responses from all participating DSPs or the deadline is passed. If the DSP wins the auction, the advertiser ad served by the DSP will show up on the browser. The real-time bidding process of an ad impression is step-by-step illustrated in Figure 1.

Step 1: The user uses the web browser to visit a publisher website, say, www.yahoo.com. The publisher Yahoo! shows the content of this website such as news to the user. In the meantime, there are some ad slots on the web page where the publisher shows ads to the user. The publisher's main job is to produce and show the high-quality content to the user. On the other hand, the publisher has to monetize their content in some way. One major monetization method is the advertising. The publisher can use its own sales force to sell the ad inventory to advertisers. RTB is the other, increasingly important, way for the publisher to sell its ad inventory. Here we assume the publisher Yahoo! decides to monetize its top-right 300*250 ad slot through RTB.

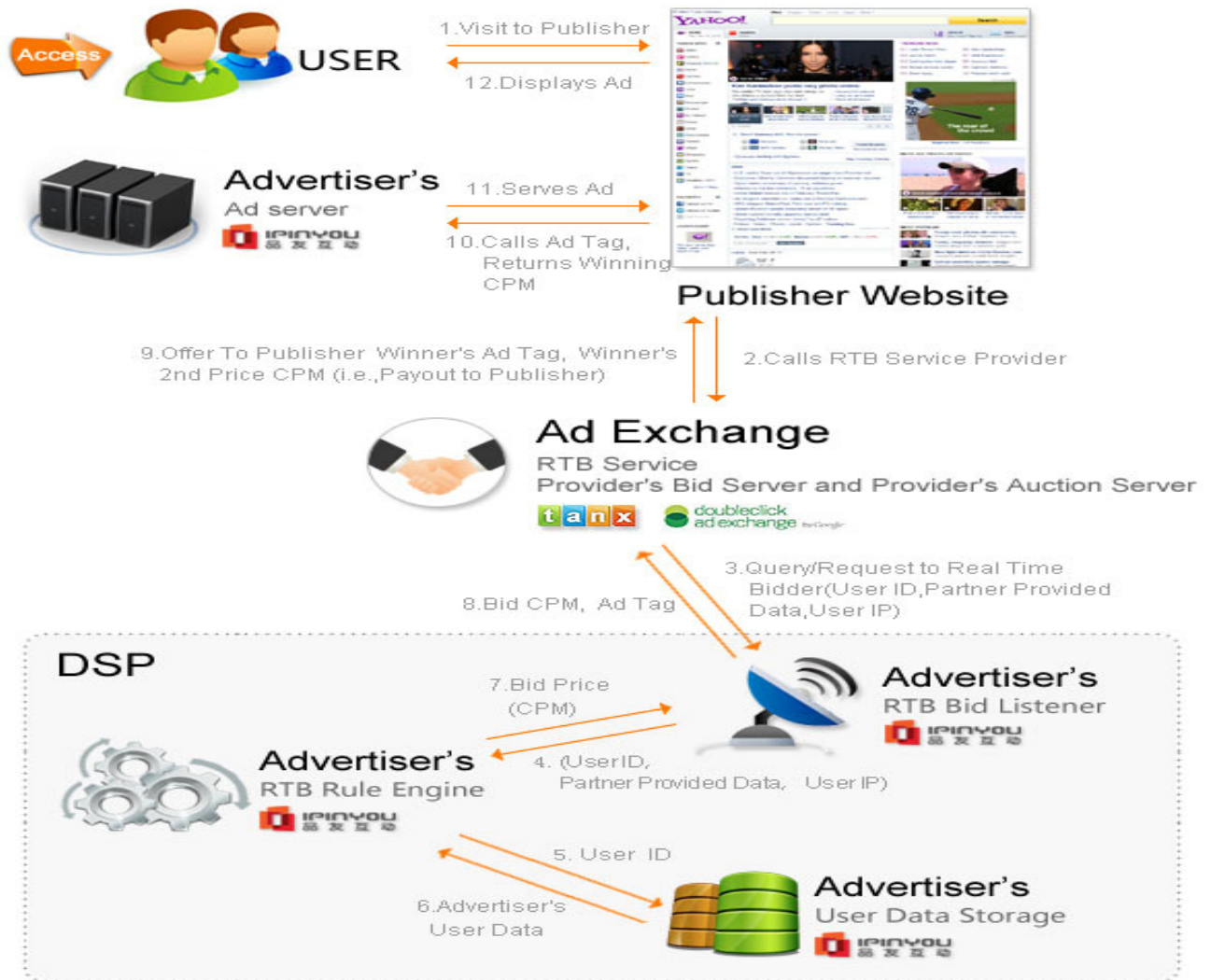


Figure 1

Step 2: The publisher Yahoo! passes the information to the ad exchange, say, Google DoubleClick AdX, including the URL where the ad slot is located, vertical of the web page content such as sports, and user cookie id.

Step 3: The ad exchange AdX composes a bid request and sends the bid requests to several DSPs. Let's assume the DSP iPinYou is one of them.

Step 4: When the iPinYou DSP server receives the bid request from the ad exchange AdX, it passes the information to the bidding engine.

Step 5: The bidding engine sends the user ID to the user profile and advertiser database to look up whether there is a match between the user and one of its advertisers.

Step 6: The bidding engine receives the information about the user and advertisers, and makes the decision whether to bid the impression and how much to bid.

Step 7: The bidding engine composes a bid response and passes it to the DSP server. The bid response includes the bidding price and other information such as where to fetch the ad.

Step 8: The iPinYou DSP server sends the bid response to the ad exchange AdX.

Step 9: The AdX does the auction after receiving bid responses from all DSP servers or the deadline is passed. The AdX have 100ms deadline, which measures the time from when the bid request is sent out from AdX to when the bid response is received at AdX. The Ad exchange usually runs the Vickery auction, a.k.a., the second-price auction, in which the highest bidder wins the auction and pays the second-highest bid price. Here let's assume that the iPinYou DSP is the winner of this ad impression auction.

Step 10: The AdX notifies the user's web browser the auction winner and the web browser will send the ad impression request to the ad server where the ad creative is located.

Step 11: The ad server sends the creative to the user's web browser.

Step 12: The user views the ad on the publisher Yahoo! website. If the user is interested in the ad, (s)he will click the ads, which leads to the landing page of the advertiser. The user browses the advertiser website and may do some further actions. For example, if the advertiser is an eCommerce company, the user may make a purchase on the eCommerce website. We call this kind of action as a conversion. Usually the advertiser decides what kind of actions are conversions.

The goal of the DSP bidding algorithm optimization is to optimize advertisers' KPI (Key Performance Indicator) such as the number of impressions, clicks and/or conversions. Given the fixed campaign budget, the advertisers want to get as many as impressions, clicks and/or conversions as possible.

The DSP bidding algorithm is essential to a successful DSP. It's where computational advertising meets BigData. The design of a DSP bidding algorithm touches many computer science areas such as machine learning, data mining, statistics, optimization, and game theory. It has been of great interest to academic researchers. Computational advertising has become a hot research topic in the past several years. But academic researchers are greatly bothered by the lack of the real data set and the lack of live evaluation platform.

iPinYou strongly believes the quality of the DSP bidding algorithm is the core of a DSP company and has invested huge amount of resources on the research and development of DSP bidding platform and algorithm design since its DSP went live in March 2012. By designing a set of the bidding algorithms and using both offline and online experiments to evaluate them, iPinYou has improves campaign performance significantly for a variety of advertisers, which has verified the power of a high-quality DSP bidding algorithm.