An Open Source Advertisement Server

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Agenda

- Introduction to Online Advertising
- Project Idea
- Google's Advertising platform
- Different types of auctions
- Advertisement ranking using Cosine Similarity
- Advertisement placing service in Yioop
- Advertisement Platform in Yioop
- A novel Auction System in Yioop
- Conclusion and Future Work

Why Online Advertising ?

- Can reach a targeted audiences anywhere in the world

- Unique targeting Capabilities

- Simple and fast

- Cost Effective

- Flexibility

Search Engine Marketing

- Important type of online Advertising
- Promotion of Product or Service by increasing its visibility in search engine results pages
- Advertisements are placed on the basis of key search terms entered in search engines
- Involve auction systems to price and place advertisement
- Initially, advertisement spaces sold on a per-thousand-impression basis
- 1997, onwards sold on a per-click-basis

Project Idea

- Design and Implement a new Online Advertisement System for the open source search engine, Yioop

- Supports selling advertisements and displaying them within search results

- Involves a novel auction system

- Also supports display of advertisements from external advertisement servers

Overview : Google AdWords

- Google's Online Advertising Platform, started in 2002

- User can create advertisement, attach keywords to it and send to Google's database

- Google returns advertisements if search keyword matches with attached keywords

- Ads displayed on search results page are based on search query contents

Creating A Google AdWords Campaign

Your first campaign

A **campaign** focuses on a theme or a group of products. To create a campaign, you'll set a budget, choose your audience, and write your ad. Keep in mind, you won't be charged for selecting options, and you can always make changes later.

1. Decide how much to spend

Your budget	$2.00 per day	⇦ **Select maximum amount for Ad campaign**	✎

2. Choose a target audience

Locations	United States and Canada	⇦ **Region where you want to display your advertisement**	✎

Networks	Search Network, Display Network	⇦ **Sites that shows ad along with other content**	✎

Keywords	search php open source	⇦ **Keywords associated with advertisement**	✎

3. Set your bid

Bid	Automatically set my bids to get the most clicks within my budget	✎

4. Write your ad

Text ad	YoopSearch yoopsearch.com PHP Search Engine Open source Search Engine	⇦ **Actual text Ad with link to lading page and text associated with it.**	✎

Google AdSense

- Allows website owners to earn revenue

- Works by matching images and text to the owner's site based on content

- Advertisements are managed, arranged, and maintained by Google

- Publishers are not allowed to click their own advertisements

- Variety of advertisement formats such as mobile web pages, videos, online games, TV inventory etc.

Google AdSense(2)

- To display advertisements, website owners place a Javascript code provided by AdSense on web pages

- The script makes use of inline JSON to render content fetched from the Google server

- Javascript makes possible for website owners to use of the AdSense program

- Use of valuable text content is encouraged to get more revenue

AdChoices

- An icon in the corner of the advertisement
- Not a advertising provider
- Used for interest based advertising
- Helps to show ads based on the individual's interests

Questions to ask

- Where will my advertisement appear on the list ?
    - Using advertisement space allocation strategy

- When will advertisers pay ?
    - Only when someone clicks on link

- How much to pay ?
    - Revenue derived from number of clicks

Introduction to Auction System

- Allocates advertisement space according to some rule
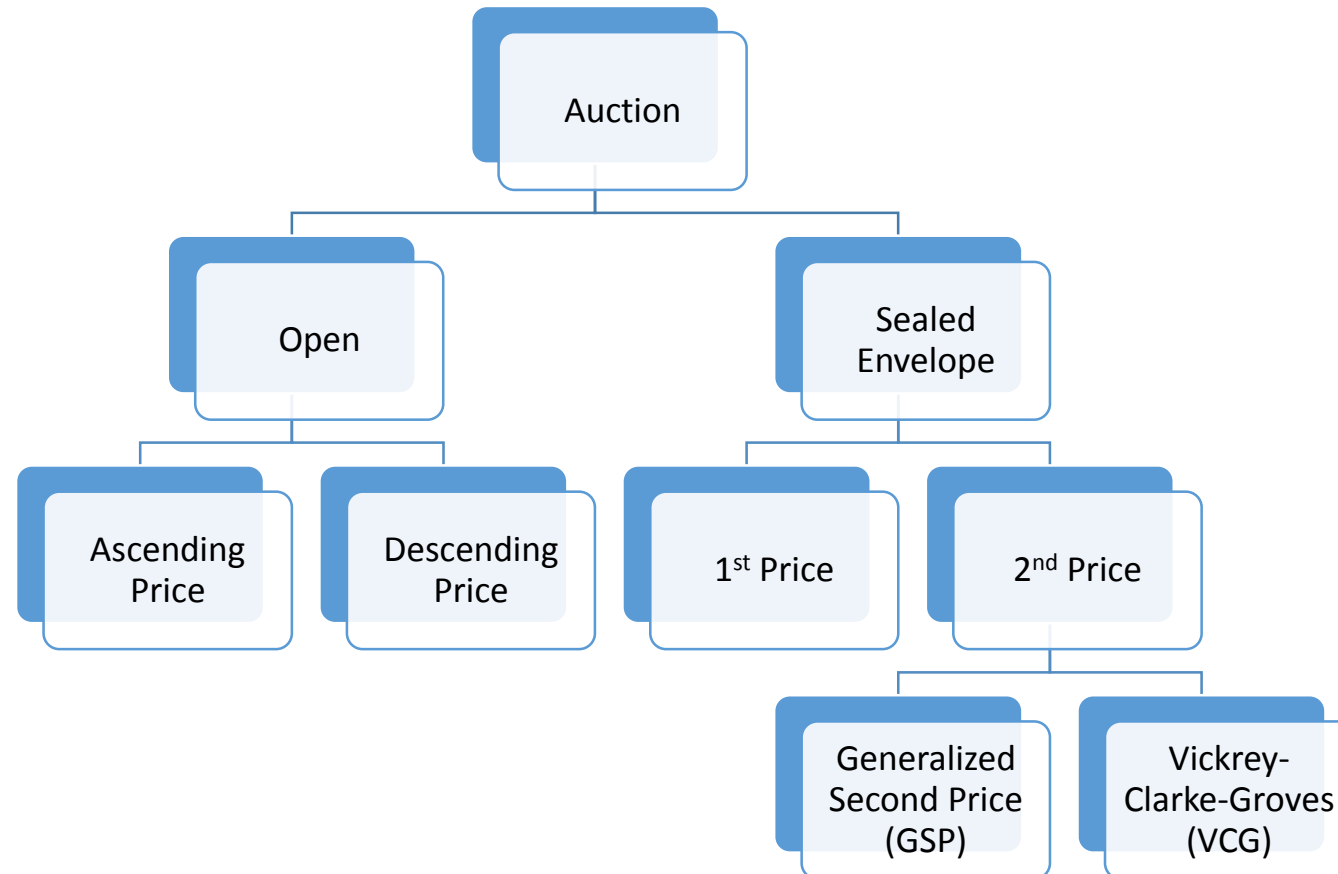
Open Auctions

- Conducted at a public venue

- General idea
  - Winner pays highest bid – own bid

- Useful in one item auctions

- Types
  - Ascending Price
  - Descending Price

Sealed Envelope Auctions

- Each bidder submits bid privately
- All bids are then reveled to Auctioneer who decides allocation
- Useful in multi-item auctions
- Types
    - First Price Auction
        - ➢ Winner pays the highest bid
    - Second Price Auction
        - ➢ Winner pays the second highest bid

Second Price Auctions

- Winner pays bid from the next highest bidder

- Sounds "wrong"
  - why not bid extremely high so that I can win the item, and then pay a much lower price for it?

- The Assumption does not hold when everyone uses same strategy

Generalized Second Price Auction (GSP)

- The highest bidder gets the most valuable ad space
- The Bidder is then left out from future bidding

Advertising Space	Clicks /day
1	400
2	200

Value per Click	Bidder	Advertising Space	Valuation
12	1	1	4800
		2	2400
8	2	1	3200
		2	1600
4	3	1	1600
		2	800

- Bidder 1 gets ad space 1 and pays $8 per click - payoff $1600
- Bidder 2 gets ad space 2 and pays $4 per click – payoff $800

VCG Auction

- Truth Telling is not dominant in GSP
- Modification to previous example
    - Bidder 1 bids $7 to target ad space 2 and has expected clicks per day 300
    - Difference between the click through rates is not large enough relative to the difference in per-click payment

- In VCG, seller computes matching
- Maximizes total valuation of the system

Example: VCG Auction

Advertising Space	Click Through Rate
1	5
2	3
3	1

Bidder	Advertising Space	Valuation
1	1	50
	2	30
	3	10
2	1	25
	2	15
	3	5
3	1	5
	2	3
	3	1

- Matching of {(1, 1), (2, 2), (3, 3)} would return a total valuation 50 + 15 + 1 = 66 which is the maximum

Advertising using Cosine Similarity

- Search Engines use a bag of words model to retrieve relevant documents

- Ranking algorithms are used to rank the documents

- We extend this technique to get contextual advertisements

- We used words from the retrieved documents to get advertisements

Advertising using Cosine Similarity(2)

- Built a bag of words model using an inverted Index

- Positional Index is used to build inverted Index

< term: number of docs containing term
doc1:position1,position2...;
doc2:position1,position2...; >

- With a positional index, it is easy to deal with phrase queries

Advertising using Cosine Similarity(3)

- Bag of words model built using document indexing. Following URL's are used.

```
https://pushkarumaranikar.wordpress.com/
http://en.wikipedia.org/wiki/Android_(operating_system)
http://en.wikipedia.org/wiki/Online_and_offline
http://software.canon-europe.com/
http://www.canonrumors.com/
http://en.wikipedia.org/wiki/Database
http://en.wikipedia.org/wiki/Cloud_computing
http://www.microsoft.com/enterprise/it-trends/cloud-computing/default.aspx#fbid=DGpI5SyUMGd
http://www.interoute.com/what-are-cloud-servers
http://www.rackspace.com/cloud/servers
```

- Tokenized words from these URL's and formed a bag of words model

Cosine Similarity Ranking

- Measure of Similarity between two vectors
- Calculated using the inner product space of two vectors that measure the cosine of the angle between them
- Gives judgment of orientation
- For a query vector $\vec{q}$ and a document vector $\vec{d}$, when similarity is defined as the cosine of the angle between them

$$\text{sim}\ (\vec{d},\vec{q}) = \frac{\vec{d}}{|\vec{d}|} \cdot \frac{\vec{q}}{|\vec{q}|}$$

Finding relevant documents

Cosine similarity applied to the query vector and document vector

```
Enter search query:
cloud
Document vector created for document :0
Document vector created for document :1
Document vector created for document :2
Document vector created for document :3
Document vector created for document :4
Document vector created for document :5
Document vector created for document :6
Document vector created for document :7
Document vector created for document :8
Document vector created for document :9
 cosine similarity for given query with document 0 :0.0
 cosine similarity for given query with document 1 :0.004937291752307908
 cosine similarity for given query with document 2 :0.0
 cosine similarity for given query with document 3 :0.0
 cosine similarity for given query with document 4 :0.0
 cosine similarity for given query with document 5 :0.0035790073207718753
 cosine similarity for given query with document 6 :0.5771441342195869
 cosine similarity for given query with document 7 :0.19466739886057416
 cosine similarity for given query with document 8 :0.43019880494981483
 cosine similarity for given query with document 9 :0.0

http://en.wikipedia.org/wiki/Cloud_computing => 0.5771441342195869
http://www.interoute.com/what-are-cloud-servers => 0.43019880494981483
http://www.microsoft.com/enterprise/it-trends/cloud-computing/default.aspx#fbid=DGpI5SyUMGd => 0.19466739886057416
http://en.wikipedia.org/wiki/Android_(operating_system) => 0.004937291752307908
http://en.wikipedia.org/wiki/Database => 0.0035790073207718753
https://pushkarumaranikar.wordpress.com/ => 0.0
http://en.wikipedia.org/wiki/Online_and_offline => 0.0
http://software.canon-europe.com/ => 0.0
http://www.canonrumors.com/ => 0.0
http://www.rackspace.com/cloud/servers => 0.0
```

Retrieving relevant advertisements

- Use a subset retrieved documents to build a document vector for ranking advertisements
- New set of documents is formed with the entered keywords and the immediate three words associated with it on either side
- For Example, set of documents for query "cloud" is,

```
systems allocated needed cloud hosting multiple cloud
place key benefits cloud servers flexibility scalability
example longer required cloud servers also offer
information different version cloud servers please visit
```

Retrieving relevant advertisements(2)

- Cosine similarity measured for each of these documents with advertisements in inventory

- Most relevant advertisements for query "cloud" are,

```
Relevant Ads:
cloud computing for dummies => 0.9045340337332909
applications in the cloud => 0.6666666666666666
servers for businesses => 0.3535533905932737
web design and marketing solutions for business websites => 0.2773500981126146
```

Advertisement Placing Service in Yioop

- Allows advertisements from an external advertisement server to be displayed on a web page

- Provider shares revenue with web site owner

- Easy way to make money

- In Yioop, we are providing a configurable option for an advertisement placing service

Getting into it…

- Added configuration options for advertising space and advertisement placing service
- Select advertisement space within Yioop
- Place a Javascript code provided by the external advertisement network for the selected advertising space
- Currently , Yioop supports top, side, and both alignment options
- Javascript is passed to the search controller and is executed during rendering the view

Flow Chart for Advertisement Placing Service
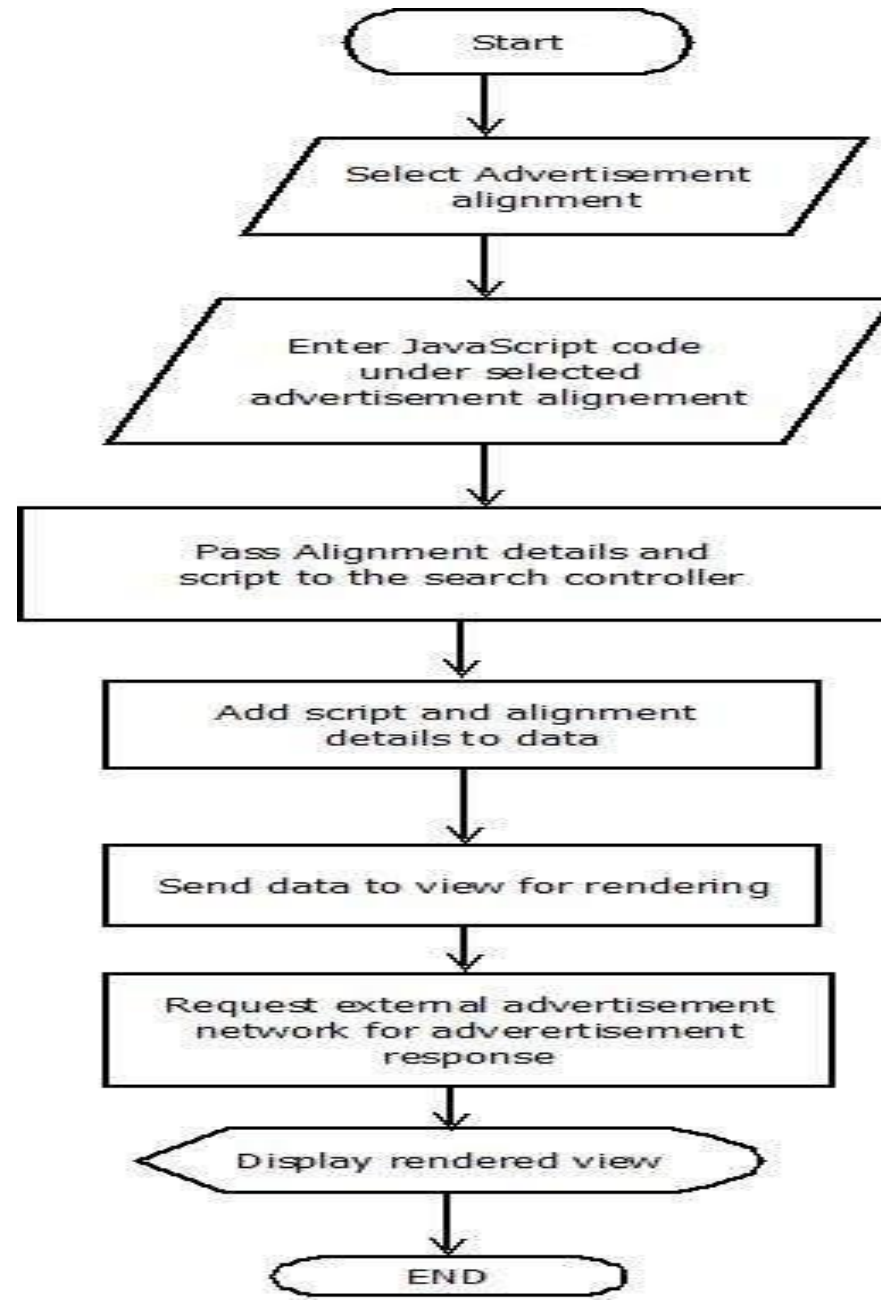
Configuration of Ad Placing Service

Ad Server Configuration ?

Ad Location
○ Top ○ Side ● Both ○ None ⟵ **Option to select advertisment alignment on search result page**

Global Element Ad Script

Top Element Ad Script

```
<!-- AdSpeed.com Serving Code 7.9.7 for [Ad] Click Me [Text Ad] -->
<script type="text/javascript" src="http://g.adspeed.net/ad.php?do=js&aid=216142&oid=18025&target=_blank">
</script>
<!-- AdSpeed.com End -->
```

Add ad script from external advertisement program based on option selected

Side Element Ad Script

```
<!-- AdSpeed.com Serving Code 7.9.7 for [Ad] Click Me [Text Ad] -->
<script type="text/javascript" src="http://g.adspeed.net/ad.php?do=js&aid=216142&oid=18025&target=_blank">
</script>
<!-- AdSpeed.com End -->
```

Advertisements rendered from Ad Placing Service

Online Auction System in Yioop

- Accepts bids for every Campaign
- Calculates minimum bid required and campaign created only when budget is over minimum bid
- Program then runs a ranking algorithm when users enter certain search queries
- Factors considered for ranking are budget and keywords association
- Only contextual advertisements are displayed on the search results page

Details...

- Added new user role, known as "Business user"

- Only Business user can create campaign

- Anyone can become a business user by providing credit card details

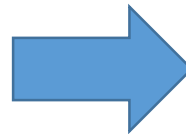- Configuration available under Manage Accounts section

Manages Advertisements Activity

Account Access

Manage Account

Social

Manage Groups

Feeds and Wikis

Mix Crawls

Advertisements

Manage Advertisements

Advertisement activity for Business users only

Create Advertisement

Advertisement Name: testAdv

Text Description: test advertisement

Destination URL: test.com

Start Date: 04/30/2015

End Date: 05/03/2015

Keywords: test, describe

Minimum Bid Required: 8

Expensive word: describe

Add Keywords

Advertisement Type: Text Ad

Budget: 16

Value should be more than minimum budget required

Save

Advertisement List

- Option for activate and deactivate advertisement is available

- Expired advertisements gets automatically deactivated

Advertisement List

Row 0 to 7 of 7 Show 50 ▼ [Search]

Ad Name	Destination URL	Keywords	Budget	Start Date	End Date	Impressions	Actions	
Test	google.com	search	6	2015-05-13	2015-05-13		Edit	Deactivate
Testadv	yahoo.com	google	12	2015-05-11	2015-05-13	15	Edit	Deactivate
Yioop	yioop.com	search,yioop	48	2015-05-13	2015-05-20	11	Edit	Deactivate
adv600Update	google.com	test,describe	100	2015-05-08	2015-05-15	15	Edit	Deactivate

About Create Advertisement Form

- Includes name, description, destination URL, start date, end date, keywords and budget
- Minimum bid required value is calculated by the auction system depending upon the number of keywords and their popularity
- Enter a budget amount that is equal to or greater than the minimum required budget
- System also displays expensive words among the keywords associated
- It helps to manage budget

Database Schema for an Auction System
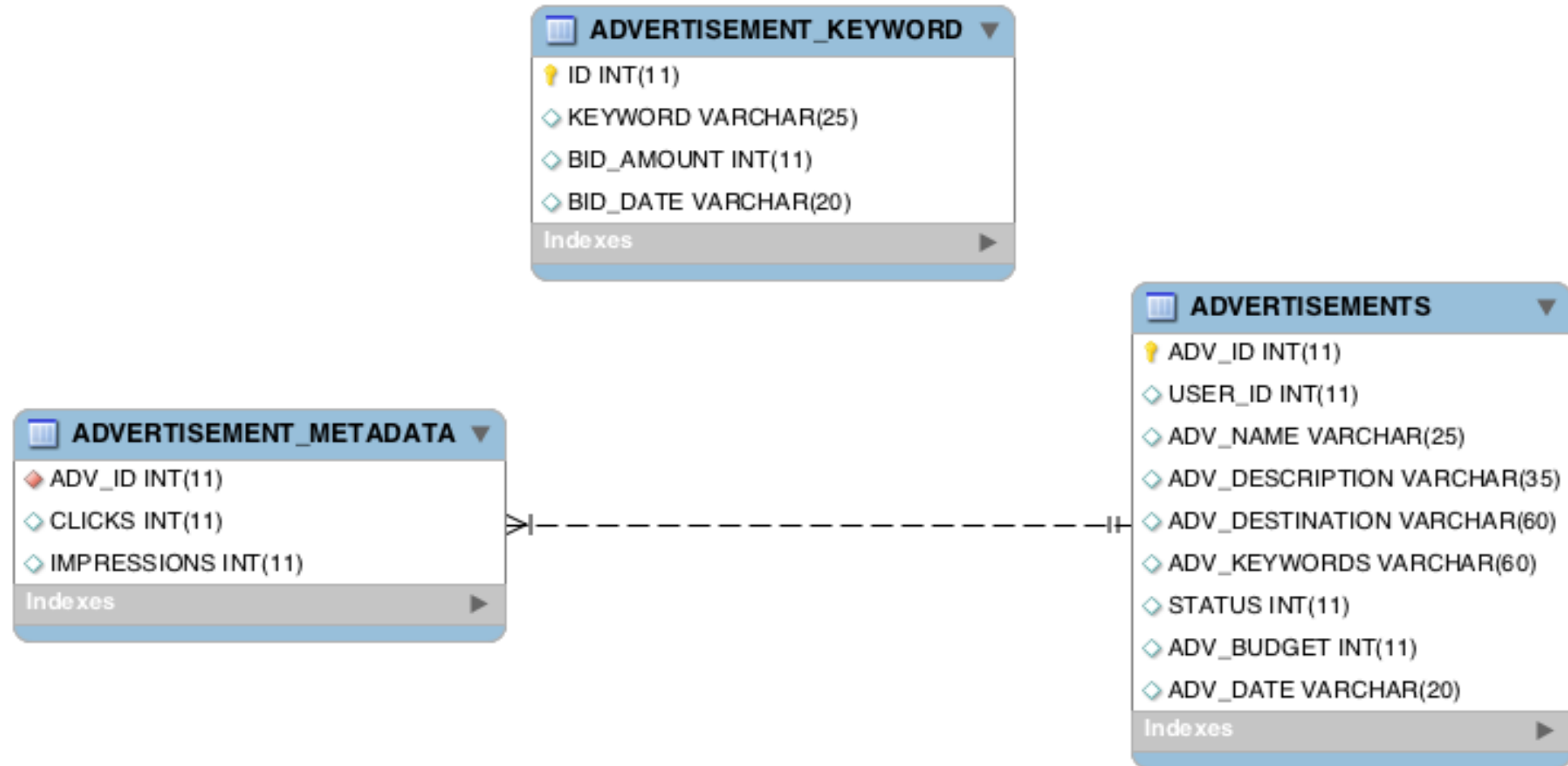
How system calculates minimum bid ?

- Every day is considered as a separate transaction for the same advertisement
- If keyword has not already been used before, then a minimum bid set is to 1 on that date
- For the same keyword, the bid amount may vary for different dates
- Example
    - A user is creating a new campaign called "Test Advertisement". Keywords entered are "test" and "adv". Date range is May 1, 2015 to May 7, 2015

How system calculates minimum bid ? (2)

Keyword	Bid Amount	Bid Date
Test	10	May 1
Test	8	May 2
Test	10	May 3
Test	12	May 4
Test	10	May 5
Test	8	May 6
Test		May 7

Keyword	Bid Amount	Bid Date
Adv	8	May 1
Adv	12	May 2
Adv	10	May 3
Adv	12	May 4
Adv	8	May 5
Adv	4	May 6
Adv	12	May 7

- To calculate the minimum bid, half the existing bid amount for every day for every associated keyword. The minimum bid for the word "test"
= (10/2) + (8/2) + (10/2) + (12/2) + (10/2) + (8/2) + 1
= 5 + 4 + 5 + 6 + 5 + 4 + 1 = 30
- Similarly, the minimum bid required for word the "adv" = 33
- The minimum bid required to create the campaign = 30 + 33 = 63
And the expensive word in this case is, "adv".

How system updates bid amount ?

- Let us consider budget entered = 126

$$updateFactor = ((Bid\ of\ the\ day\ \div 2) \div \min bid\ required\ ) \times Budget$$

- It is a fraction of a minimum bid and budget distributed to scale over proportionally
- For Example, Update factor of the keyword "test" on May 1 is,

  $$= (5\ /63) \times 126$$
  $$=\quad 10$$

Keyword	Bid Amount	Bid Date
Test	10 + 10 = 20	May 1
Test	8 +8 = 16	May 2
Test	10 + 10 = 20	May 3
Test	12 + 12 = 24	May 4
Test	10 + 10 = 20	May 5
Test	8 + 8 = 16	May 6
Test	2	May 7

Keyword	Bid Amount	Bid Date
Adv	8 + 8 = 16	May 1
Adv	12 + 12 = 24	May 2
Adv	10 + 10 = 20	May 3
Adv	12 + 12 = 24	May 4
Adv	8 + 8 = 16	May 5
Adv	4 + 4 = 8	May 6
Adv	12 + 12 = 24	May 7

Display relevant advertisements

- Let us imagine, the user has entered the search query as "computer" and system finds 5 advertisements related to query

Advertisement	Budget
Adv1	10
Adv2	20
Adv3	30
Adv4	40
Adv5	50

- We do a sum of the budgets of all advertisements. In this case:-
  Sum = 10 + 20 + 30 + 40 + 50 = 150
- Now , rand function will generate random number between 0 to Sum. In this case, 0 to 150

Display relevant advertisements(2)

Advertisement	Budget	Range
Adv1	10	0-10
Adv2	20	11-30
Adv3	30	31-60
Adv4	40	61 – 100
Adv5	50	101 -150

- Then , we calculate display range for each advertisement using budget. Range for Adv1 is 10, same as Budget. For Adv2 it is 11-30 as budget is 20.

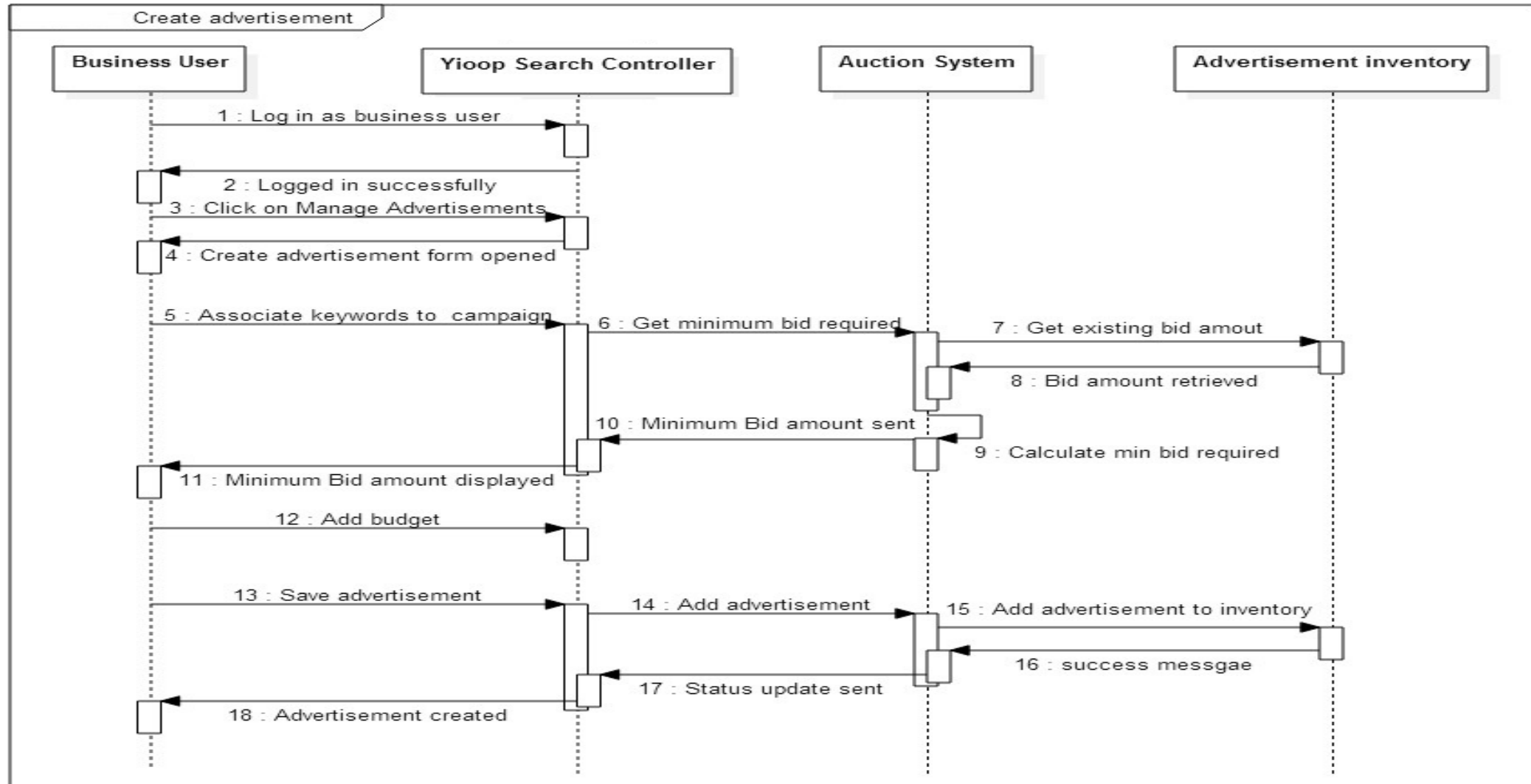- If the random number lies in the range 11-30, Adv2 gets displayed and so on.

Display relevant advertisements(3)

- Probability based model is used to display advertisements
- A low budget add would also rendered but with less probability than others
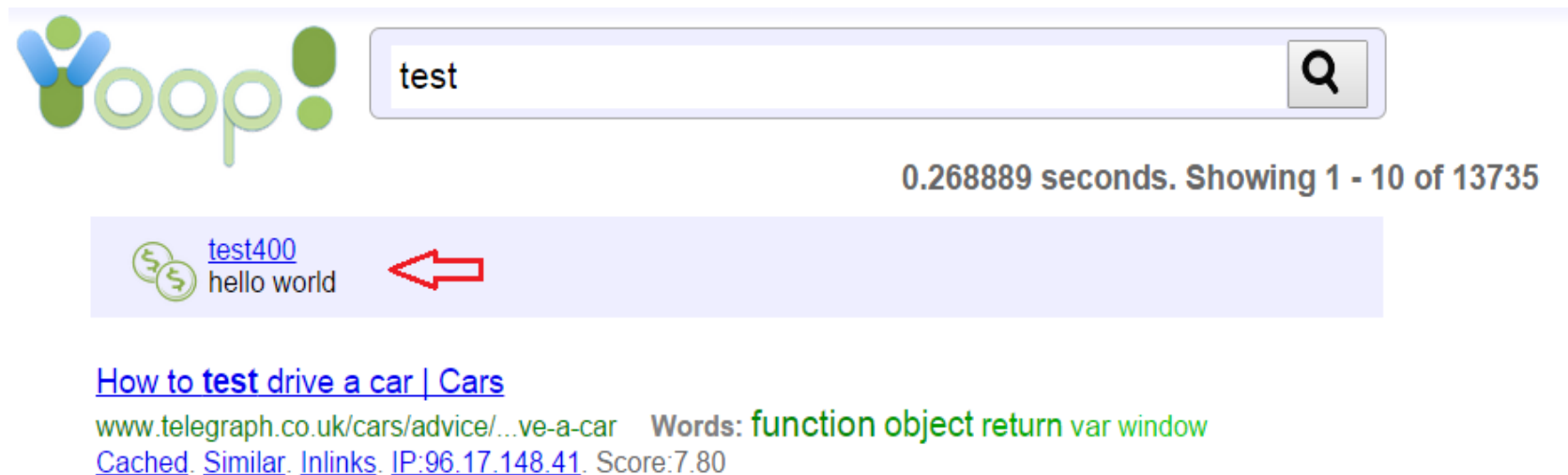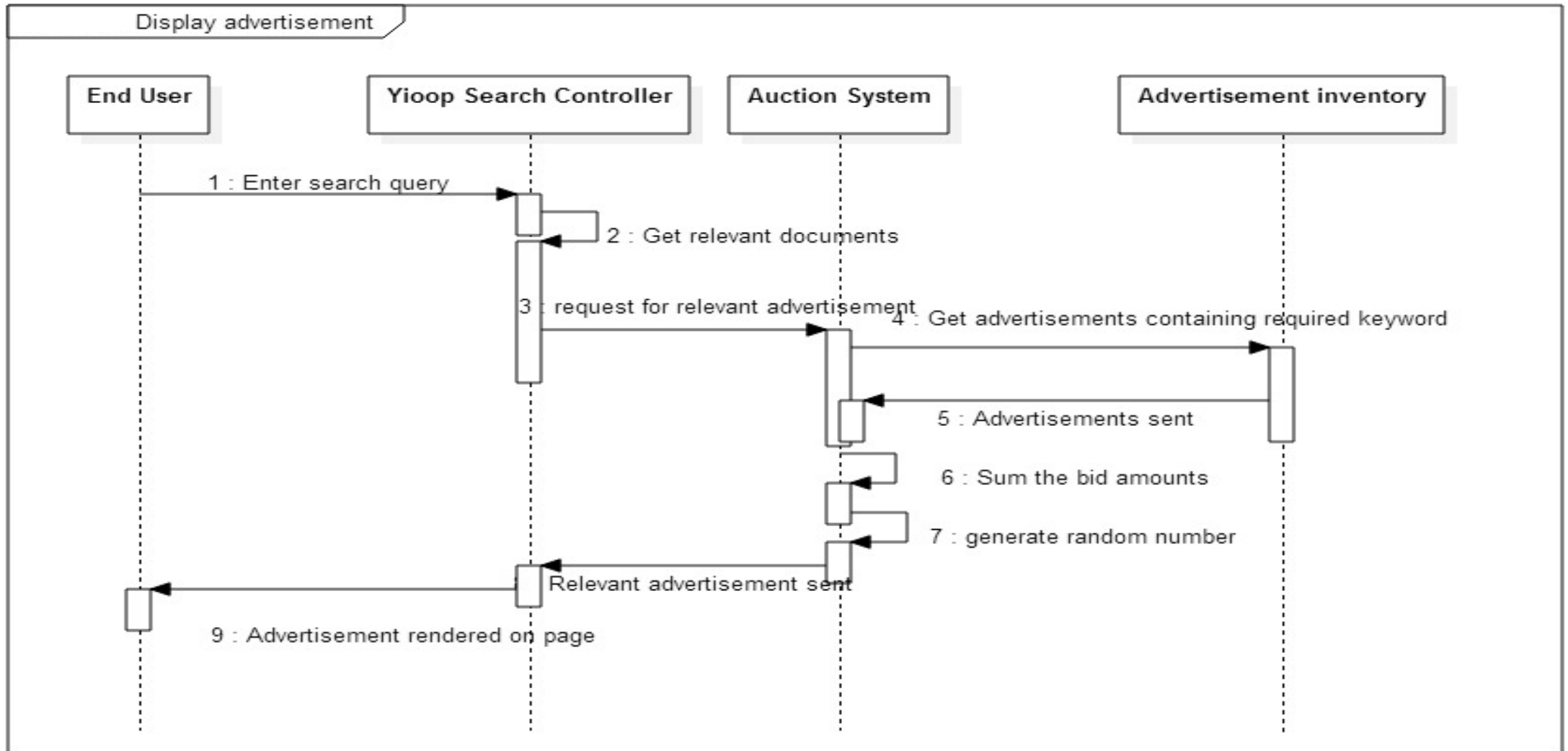

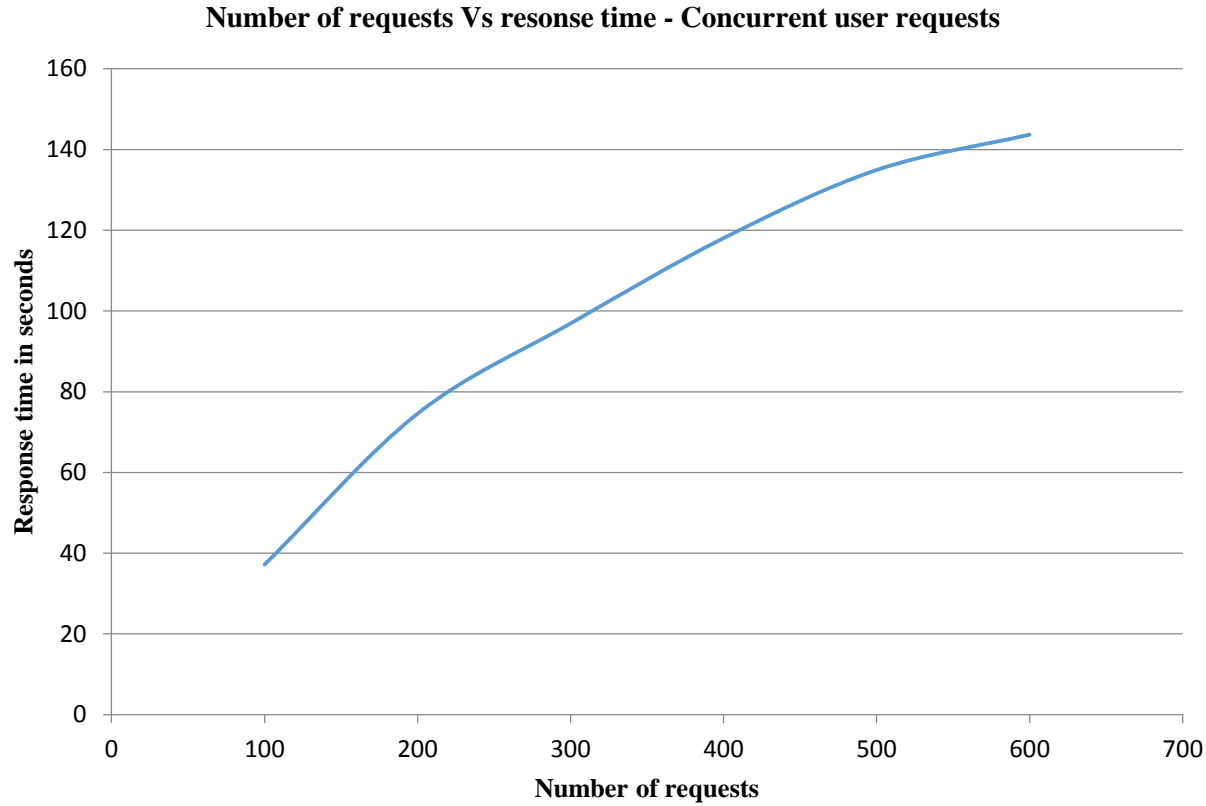- System also monitors clicks and impressions for each advertisement

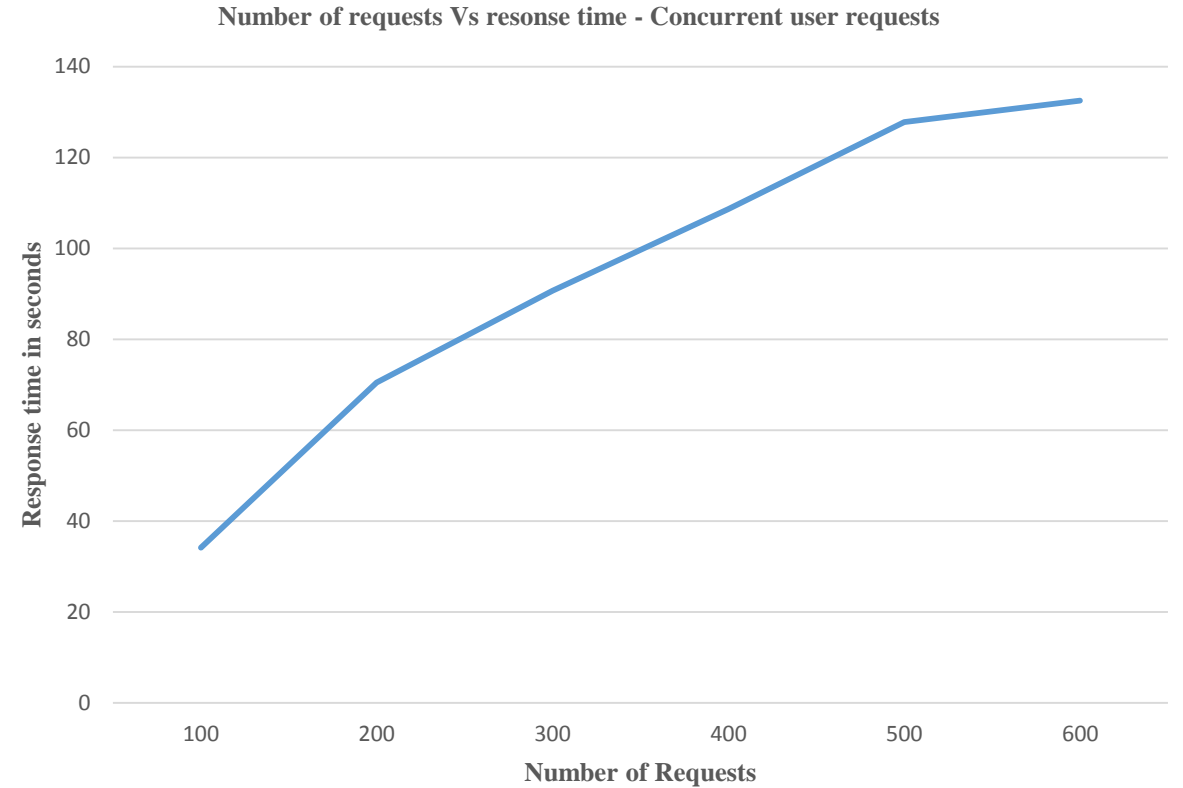# Sequence Diagram – Create Advertisement

Sequence Diagram – Display Advertisement

Performance Testing

Rendering search results when advertisements are enabled

Rendering search results when advertisements are disabled

User Acceptance Testing

- Aim is to check whether users can use the newly designed advertisement platform easily or not

- We noticed difficulties faced by them and received feedback.

- Feedback Comments:
    - Add help text about Add keywords button.
    - It is useful to have a preview of the created advertisement.

Create Advertisement [?] ⟵ Cilck on icon to get wiki help

Advertisement Name: Testadv

Text Description: This is test adv

Destination URL: http://google.com

Start Date: 05/11/2015

End Date: 05/13/2015

Keywords: google

Add Keywords

Advertisement Type: Text Ad

Budget:

Preview:
Testadv
This is test adv

Manage Advertisements [Edit] [X]

Manage Advertisements
You can create an advertisement, view and edit already created advertisements under manage advertisements. You can activate or deactivate advertisements.

Create Advertisement
You need to enter advertisement name, description, destination URL which is a landing page for an advertisement.In addition, you need to enter start and end date for the campaign and associate keywords with it.When you click on "add keywords", the system calculates the minimum bid required to create a campaign along with the most expensive word among keywords that you have entered. You can adjust your bid by altering the keywords association.You can see preview of your campaign under "Preview".

Comparison with Google AdWords

- Based on probabilistic ranking

- Even a low budget campaign gets displayed. Google uses GSP. Hence, low price bidders may not get their advertisements placed

- Users can also select active time periods for a newly created campaign. In AdWords, a user has to manually pause the campaign if the user wants to deactivate it

Conclusion

- Implemented advertising platform to enable search engine marketing in Yioop

- Developed a probability based novel auction system

- Enabled advertisement rendering from external advertisement network in Yioop

- Learned about online advertising, its working, and its importance in the world of advertising

Future Work

- Payment service can be incorporated

- Edit budget functionality can be added

- Implementation of advertisement service to display ads outside Yioop

Thank You