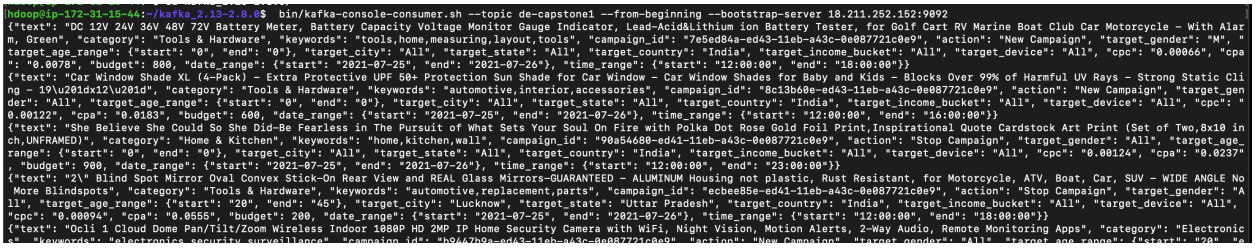
# Code Logic: Online Advertising

First, I inspected the data using kafka console consumer by running this command -

bin/kafka-console-consumer.sh --topic de-capstone1 --from-beginning --bootstrap-server 18.211.252.152:9092




ad_manager.py

We are getting the data from kafka sink via initialising pykafka consumer then dumping the data with necessary modification to our mysql server using mysql python connector.

Our core functionality of ad_manager.py lies in process_row function where we compute cpm, current_slot_budget and status value as per provided formulas.

```
def calc_date_time_diff_in_minutes(self,msg):
    start_date = msg.get('date_range').get('start').split('-')
    end_date = msg.get('date_range').get('end').split('-')
    start_time = msg.get('time_range').get('start').split(':')
    end_time = msg.get('time_range').get('end').split(':')
    datetime_start = datetime(int(start_date[0]),int(start_date[1]),int(start_date[2]),int(start_time[0]),int(start_time[1]),int(start_time[2]))
    datetime_end = datetime(int(end_date[0]),int(end_date[1]),int(end_date[2]),int(end_time[0]),int(end_time[1]),int(end_time[2]))
    datetime_diff = datetime_end - datetime_start
    datetime_diff_minutes = datetime_diff.total_seconds() / 60
    return datetime_diff_minutes

# Process single row
def process_row(self, msg):
    # Get the db cursor
    db_cursor = self.db.cursor()

    #calculate CPM by provided formula
    cpm = (0.0075 * float(msg.get('cpc'))) + (0.0005 * float(msg.get('cpa')))

    #calculate current slot budget as per 10 minute interval
    datetime_diff_minutes = self.calc_date_time_diff_in_minutes(msg)
    slot_time_size = 10
    number_of_slots = datetime_diff_minutes/slot_time_size
    current_slot_budget = msg.get('budget')/number_of_slots

    #status of campaign
    status = 'INACTIVE 'if msg.get('action') == 'Stop Campaign' else 'ACTIVE'

    # DB query for supporting UPSERT operation
    sql = "REPLACE INTO ads(text,category,keywords,campaign_id,status,target_gender,target_age_start,target_age_end,target_city,target_state \
        ,target_country,target_income_bucket,target_device,cpc,cpa,cpm,budget,current_slot_budget,date_range_start,date_range_end,time_range_start,time_range_end) \
        VALUES (%s, %s, %s, %s, %s, %s, %s, %s, %s, %s, %s, %s, %s,%s, %s, %s, %s, %s, %s,%s, %s, %s)"
    #values from kafka msg
    val = (msg.get('text'),msg.get('category'), msg.get('keywords'), msg.get('campaign_id'),status, msg.get('target_gender'), msg.get('target_age_range').get('start'), m
        , msg.get('target_city'), msg.get('target_state'), msg.get('target_country'), msg.get('target_income_bucket'), msg.get('target_device'), msg.get('cpc'), msg.get(
        , current_slot_budget, msg.get('date_range').get('start'), msg.get('date_range').get('end'), msg.get('time_range').get('start'), msg.get('time_range').get('end'
    db_cursor.execute(sql, val)
    # Commit the operation, so that it reflects globally
    self.db.commit()
    #output to console
    print(msg.get('campaign_id') + ' | ' + msg.get('action') + ' | ' + status)
```

we run our ad_manager.py script via below command -

```
^CKeyboardInterrupt, exiting...
(base) sahiljain@Sahils-MacBook-Pro Capstone % python ad_manager.py 18.211.252.152:9092 de-capstone1 localhost root root1234 advertisement
8e91093a-ed76-11eb-a43c-0e087721c0e9 | New Campaign | ACTIVE
9dfa233e-ed76-11eb-a43c-0e087721c0e9 | New Campaign | ACTIVE
```

Then, we write down our ad_server.py script to serve ads from database based on Second-Price Auction strategy

1). Main endpoint which will serve ads

```python
#add serving route
@app.route('/ad/user/<user_id>/serve', methods=['GET'])
def serve(user_id):
    query_params = request.args
    # Parameter validation
    if "device_type" not in query_params or "state" not in query_params or "city" not in query_params:
        return abort(400)
    device_type = query_params['device_type']
    state = query_params['state']
    city = query_params['city']
    user = None
    res = None
    # Generate the request identifier
    request_id = str(uuid.uuid1())
    if user_id != '1111-1111-1111-1111':
        user = get_user_data(user_id)
        if not user:
            return abort(400)
        res = target_ad_campaign(device_type, city, state, user)
    else:
        res = non_targeted_ad_campaign(device_type, city, state)
    if not res:
        return abort(404)
    create_served_ad_entry(request_id, res['ad'], user, res['auction'])
    return jsonify({
        "text": res['ad']['text'],
        "request_id": request_id
    })
```

If the user_id is 1111-1111-1111-1111 then we will run non targeted campaign whereas we can get user from database then we will show them ads according to their age, income bucket, and gender. So I have create two functions target_ad_campaign and not_targeted_ad_campaign where we use Second-Price Auction strategy. Screenshots are added below for respective functions.

For user_ids and user in database using below

```
#get ad campaign to be run
def target_ad_campaign(device_type, city, state, user):
    db_cursor = db.cursor()
    device_type = ' '.join(device_type.split('-'))
    #get eligible ad
    sql = "select * from advertisement.ads  where status = 'ACTIVE' and current_slot_budget > 0 and (target_device = 'All' or target_device like '" + device_type + "') \
        (target_city = 'All' or target_city like '" + city + "') and (target_state = 'All' or target_state like '" + state + "')"
    #user age check
    if user['age'] :
        sql  = sql + " and (target_age_start <= " + str(user['age']) + " and " + str(user['age']) +" <= target_age_end)"
    #user gender check
    if user['gender'] :
        sql  = sql + " and (target_gender = 'All' or target_gender like '" + str(user['gender'])  + "')"
    #user income bucket check
    if user['income_bucket'] :
        sql  = sql + " and (target_income_bucket = 'All' or target_income_bucket like '" + str(user['income_bucket'])  + "')"
    sql = sql + " order by cpm desc limit 2"
    db_cursor.execute(sql)
    rows = get_results(db_cursor)
    #handle 0 rows returned here?
    if len(rows) == 0:
        #no eligble ads;
        return None
    if len(rows) == 1:
        #If there is a single eligible Ad, the campaigner has to pay the price same as the original bid.
        ad = rows[0]
        return { 'ad' : ad, 'auction' : { "cpm" : ad['cpm'], 'cpc' : ad['cpc'], 'cpa' : ad['cpa']} }
    else:
        #The highest bidder will win the auction, but the winner has to pay the price that is bid by the second-highest bidder.
        ad_first = rows[0]
        ad_second = rows[1]
        return { 'ad' : ad_first, 'auction' : { "cpm" : ad_second['cpm'], 'cpc' : ad_second['cpc'], 'cpa' : ad_second['cpa']} }
```

For user_id as 1111-1111-1111-1111

```
#get ad campaign to be run without user info
def non_targeted_ad_campaign(device_type, city, state):
    db_cursor = db.cursor()
    device_type = ' '.join(device_type.split('-'))
    db_cursor.execute("select * from advertisement.ads  where status = 'ACTIVE' and current_slot_budget > 0 and (target_device = 'All' or target_device like '" + device_
        (target_city = 'All' or target_city like '" + city + "') and (target_state = 'All' or target_state like '" + state + "') \
        order by cpm desc limit 2")
    rows = get_results(db_cursor)
    if len(rows) == 0:
        #no eligble ads;
        return None
    if len(rows) == 1:
        #If there is a single eligible Ad, the campaigner has to pay the price same as the original bid.
        ad = rows[0]
        return { 'ad' : ad, 'auction' : { "cpm" : ad['cpm'], 'cpc' : ad['cpc'], 'cpa' : ad['cpa']} }
    else:
        #The highest bidder will win the auction, but the winner has to pay the price that is bid by the second-highest bidder.
        ad_first = rows[0]
        ad_second = rows[1]
        return { 'ad' : ad_first, 'auction' : { "cpm" : ad_second['cpm'], 'cpc' : ad_second['cpc'], 'cpa' : ad_second['cpa']} }
```

Then we create entry of served ad in served_ads table for record and then so to recalculate budget further after user feedback.

```
    return results

#save ad served to user in database;
def create_served_ad_entry(request_id, ad, user, auction):
    db_cursor = db.cursor()
    user_id = user['id'] if user else None;
    campaign_start_time = ad['date_range_start'] + ' ' + ad['time_range_start']
    campaign_end_time = ad['date_range_end'] + ' ' + ad['time_range_end']
    target_location =  ad['target_city'] + ', '  + ad['target_state'] + ', '  + ad['target_country']
    target_age_range = str(ad['target_age_start']) + '-' + str( ad['target_age_end'])
    ts = time()
    timestamp = datetime.fromtimestamp(ts).strftime('%Y-%m-%d %H:%M:%S')
    sql = 'insert into served_ads(request_id,campaign_id,user_id,auction_cpm,auction_cpc,auction_cpa, \
        target_age_range,target_location,target_gender,target_income_bucket,target_device_type,campaign_start_time, \
        campaign_end_time,timestamp) VALUES (%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s)'
    val = (request_id, ad['campaign_id'], user_id, auction['cpm'], auction['cpc'], auction['cpa'], target_age_range , target_location, ad['target_gender'], \
        ad['target_income_bucket'], ad['target_device'], campaign_start_time, campaign_end_time, timestamp)
    db_cursor.execute(sql,val)
    db.commit()

#get ad campaign to be run
```