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Rule-based Marketing Platform to Manage Call Detail Record

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TRANSCENDING DISCIPLINES, TRANSFORMING LIVES

Call Detail Record (CDR)

Produced by data generator

Data Generator

ID
CALLING_NUM
CALLED_NUM
START_TIME
DURATION
CALL_TYPE
CHARGE
CALL_RESULT

CDR

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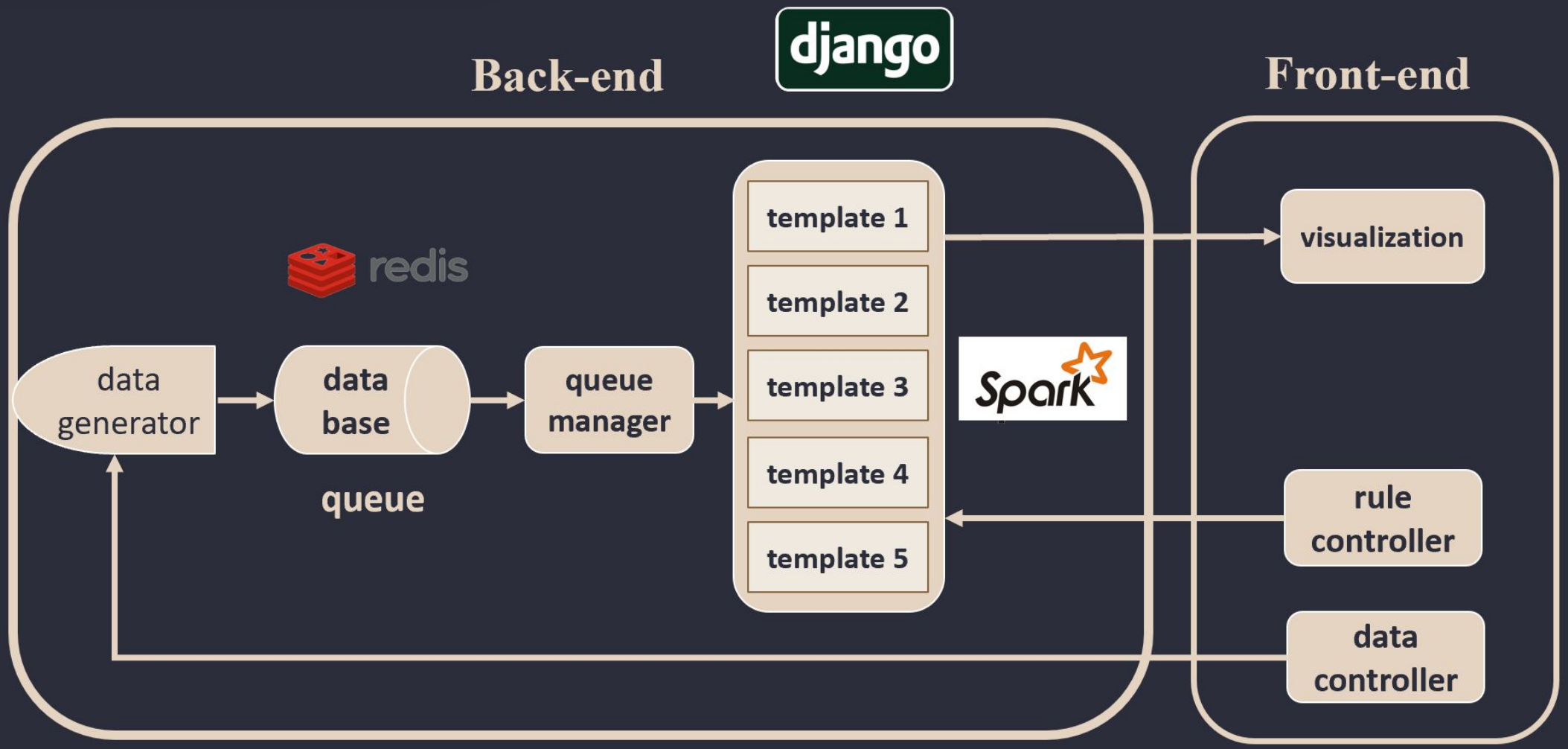
Our Solution

template 1	Total duration Analysis
template 2	Business Type Analysis
template 3	International Analysis
template 4	Individual Tag Classification
template 5	Available Calling Time

System Structure



Data generator

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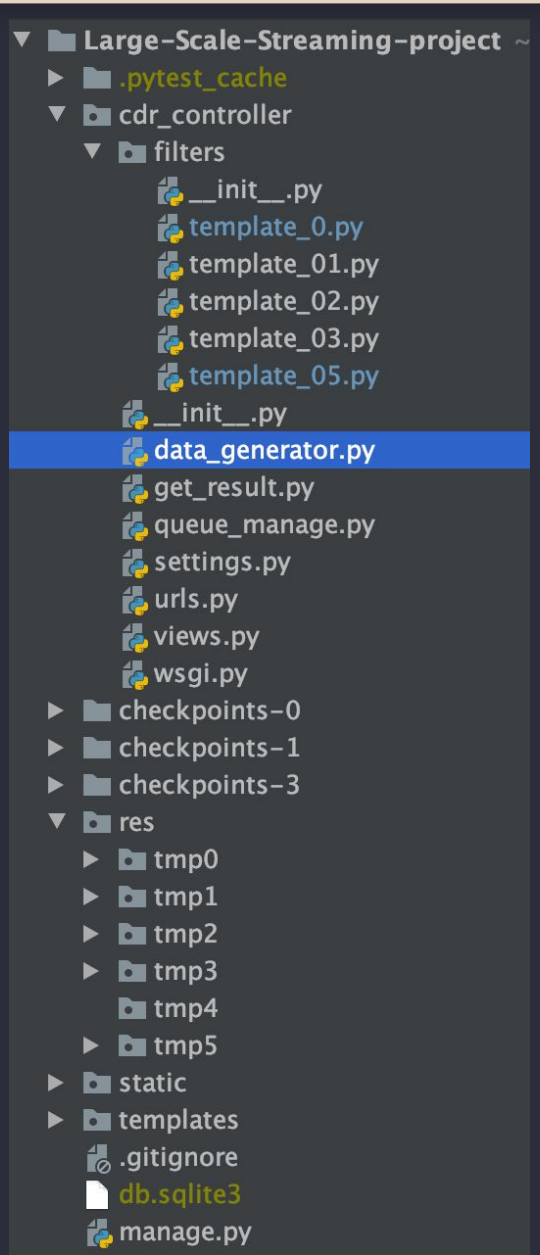
Single CDR




```python
def __init__(self, ID=None, callednumber=None, teltime=None, teltype=None,
             charge=None, result=None, type=None,
             pick_type_distribution="default", rate_type_distribution=0.1,
             pick_call_distribution="default", delta_distribution="default",
             rate_place_distribution=0.7):

    self.ID = self.gen_ID()
    self.callednumber = self.gen_callednumber(rate_place_distribution)
    self.teltime = self.gen_teltime(pick_call_distribution,
                                    delta_distribution)
    self.teltype = self.gen_teltype()
    self.charge = self.gen_charge()
    self.result = self.gen_result()
    self.type = self.gen_type(pick_type_distribution,
                              rate_type_distribution)
```

```python
def gen_ID(self):
    return uuid.uuid1()

def gen_callednumber(self, rate_place_distribution):
    r1 = random.randint(1, 100)
    if r1 < 100 * rate_place_distribution:
        place = "1"
    else:
        place = random.randint(1, 300)
        while (region_code_for_country_code(place) == "ZZ"):
            place = random.randint(1, 300)

    first = str(random.randint(100, 999))
    second = str(random.randint(1, 888)).zfill(3)
    last = str(random.randint(1, 9998)).zfill(4)
    return '+{}-{}-{}-{}'.format(str(place), first, second, last)
```

```python
startt = 1588278283
pastt=1451624400
b = 133920 * startt - pastt
time1 = cur_t * 133920 - b
time2 = time1 + 133920
if call_distribution == "midnight mode":
    starttime = asctime(localtime(uniform(time1, time2)))
    while int(starttime.split(" ")[3].split(":")[0]) > 6 and i < 4:
        starttime = asctime(localtime(uniform(time1, time2)))
        i += 1
```

```python
def gen_teltype(self):
    if (random.randint(0, 1) == 0):
        return "SMS"
    else:
        return "VOICE"

def gen_charge(self):
    return random.random()

def gen_result(self):
    r = random.randint(1, 10)
    if (r < 9):
        return "AWNSERED"
    else:
        return "Busy"
```

```
np.random.exponential
np.random.poisson
np.random.binomial
```

Data generator

People

```
type = {
    # "Business",
    0: "Business",
    1: "Banking",
    2: "Financial agency",
    3: "Job",

    #  "Agency",
    4: "Legal agency",
    5: "Housekeeping and property management",

    #  "Education",
    6: "School",
    7: "Extracurricular training camp",

    # "Health",
    8: "Hospital (including health care)",
    9: "Clinic (including dentist)",

    # "AD",
    10: "Food (including takeaway)",
    11: "Dress code (booking and buying)",
    12: "Housing (including rental)",
    13: "Traveling",

    14: "Emergency",
    # "Private",
    15: "Private",
    16: "Private"
}
```

```
def gen_calltimes(self):
    return random.randint(10, 50)

def gen_data(self, ID=None, callednumber=None, teltime=None, teltype=None,
             charge=None, result=None, type=None,
             pick_type_distribution="default", rate_type_distribution=0.3,
             pick_call_distribution="default", delta_distribution="default",
             rate_place_distribution=0.7):
    for i in range(self.calltimes):
        data_generator_temp = data_generator(ID, callednumber, teltime,
                                             teltype, charge, result, type,
                                             pick_type_distribution,
                                             rate_type_distribution,
                                             pick_call_distribution,
                                             delta_distribution,
                                             rate_place_distribution)
        self.data.append(data_generator_temp)
```

```
def save_in_redis(self):
    for i in range(self.calltimes):
        tempdata = str(self.ID) + "|" + str(self.callnumber) + "|" \
                   + (str(self.data[i]))
        self.output_redis_1(self.data[i].ID, tempdata)
```

```
def output_redis_1(self, ID, tempdata):
    rds.lpush('ID_0',str(tempdata))
    rds.lpush('ID_01',str(tempdata))
    rds.lpush('ID_02',str(tempdata))
    rds.lpush('ID_03',str(tempdata))
    rds.lpush('ID_05',str(tempdata))
```

Template

```
def __init__(self, IP="localhost", interval=10, port=9000):
    # create spark context
    self.spark = SparkSession.builder.appName('template0').getOrCreate()
    self.sc = SparkContext.getOrCreate(SparkConf().setMaster("local[2]"))
    # create sql context, used for saving rdd
    self.sql_context = SparkSession(self.sc)
    # create the Streaming Context from the above spark context with batch interval size (seconds)
    self.ssc = StreamingContext(self.sc, 1)
    self.IP = IP
    self.interval = interval
    self.port = port
    # read data from port
    self.lines = self.ssc.socketTextStream(self.IP, self.port)
```

*

```
def count_duration(self):
    """
    This function is to read data from port 9000, then count the call time duration sum of every hour.
    """

    def updateFunc(new_values, last_sum):
        return sum(new_values) + (last_sum or 0)

    self.lines = self.lines.filter(lambda x: x)
    id_time_duration = self.lines.map(
        (lambda x: (x.split("|")[2], x.split("|")[4], x.split("|")[5])))
    temp_id_duration = id_time_duration.map(
        lambda x: (x[1].split(" ")[3].split(":")[0], int(x[2])))
    temp_id_duration_total = temp_id_duration.reduceByKey(
        lambda x, y: x + y).updateStateByKey(updateFunc)

    temp_id_duration_total.pprint()
    temp_id_duration_total.foreachRDD(
        lambda rdd: rdd.sortBy(lambda x: x[0]).toDF().toPandas().to_json(
            os.path.join(STORE_DIR, "tmp0",
                         "tmp0.json")) if not rdd.isEmpty() else None)
```

0

```
process_lines=self.lines.map(helper)
# process_lines.pprint()
people_type_count=process_lines.countByValue().map(lambda x: (x[0][0],x[0][1],x[1]))
# people_type_count.pprint()
# First, people with type
people_type_max=people_type_count.transform(lambda rdd: rdd.sortBy(lambda x: (x[0],-int(x[2]),x[1])).map(lambda x: (x[0],x[1])).reduceByKey(lambda x,y:x))

# people_type_max.pprint()
people_type_max.foreachRDD(lambda rdd: rdd.sortBy(lambda x: x[0]).toDF().toPandas().to_json(os.path.join(STORE_DIR, "tmp2", "pptype2.json")) if not rdd.isEmpty() else None)
# Second, people with tag
people_tag=people_type_count.map(mapper)
people_tag_max=people_tag.transform(lambda rdd: rdd.sortBy(lambda x: (x[0],-int(x[2]),x[1])).map(lambda x: (x[0],x[1])).reduceByKey(lambda x,y:x))
people_tag_max.pprint()
people_tag_max.foreachRDD(lambda rdd: rdd.sortBy(lambda x: x[0]).toDF().toPandas().to_json(os.path.join(STORE_DIR, "tmp2", "pptag2.json")) if not rdd.isEmpty() else None)
```

2

Template

1

```
def count_type(self):
    """
    This function is to read data and extract the call type.
    """
    def helper(x):
        rds_type = redis.Redis(host="localhost", port=6379,
                               decode_responses=True,
                               db=1)  # host是redis主机，需要redis服务端和客户端都启动 redis默认端口是6379
        res = "private" if rds_type.get(
            x.split("|")[3]) is None else rds_type.get(x.split("|")[3])
        rds_type.close()
        return res
    process_lines = self.lines.map(helper)
    def updateFunc(new_values, last_sum):
        return sum(new_values) + (last_sum or 0)

    resultstream = process_lines.map(
        lambda word: (word.lower(), 1)).reduceByKey(
        lambda x, y: x + y).updateStateByKey(updateFunc)
    resultstream.pprint()
    resultstream.foreachRDD(
        lambda rdd: rdd.sortBy(lambda x: x[0]).toDF().toPandas().to_json(
            os.path.join(STORE_DIR, "tmp1",
                         "type.json")) if not rdd.isEmpty() else None)
```

3

```
def count_place(self):
    def updateFunc(new_values, last_sum):
        return sum(new_values) + (last_sum or 0)
    callednumber = self.lines.map(lambda x: (x.split("|")[3]))
    place = callednumber.map(lambda x: region_code_for_country_code(
        int(x.split("-")[0].split("+")[1])))
    place_count = place.map(lambda place: (place, 1)).reduceByKey(
        lambda x, y: x + y).updateStateByKey(updateFunc)
    place_count.pprint()
    place_count.foreachRDD(
        lambda rdd: rdd.sortBy(lambda x: x[0]).toDF().toPandas().to_json(
            os.path.join(STORE_DIR, "tmp3",
                         "region.json")) if not rdd.isEmpty() else None)
```

Template


```
people_calltime = self.lines.map(
    lambda x: (x.split("|")[0], x.split("|")[4]))

people_calltime_w = people_calltime.map(
    lambda x: (x[0] + ":" + x[1].split(" ")[0], 1))
people_calltime_d = people_calltime.map(
    lambda x: (x[0] + ":" + x[1].split(" ")[3].split(":")[0], 1))

people_calltime_w_count = people_calltime_w.reduceByKey(
    lambda x, y: x + y).map(
    lambda x: (x[0].split(":")[0], x[0].split(":")[1], x[1]))
people_calltime_d_count = people_calltime_d.reduceByKey(
    lambda x, y: x + y).map(
    lambda x: (x[0].split(":")[0], x[0].split(":")[1], x[1]))
people_calltime_w_count.foreachRDD(lambda rdd: rdd.sortBy(lambda x: (x[0], -x[2], x[1])).map(lambda x: (x[0], x[1])).distinct().reduceByKey(lambda x, y: x)
                                   .sortBy(lambda x: x[0]).toDF().toPandas().to_json(os.path.join(STORE_DIR, "tmp5", "day2.json")) if not rdd.isEmpty() else None)
people_calltime_w_count.pprint()
people_calltime_d_count.foreachRDD(lambda rdd: rdd.sortBy(lambda x: (x[0], -x[2], x[1])).map(lambda x: (x[0], x[1])).distinct().reduceByKey(lambda x, y: x)
                                   .sortBy(lambda x: x[0]).toDF().toPandas().to_json(os.path.join(STORE_DIR, "tmp5", "clock2.json")) if not rdd.isEmpty() else None)
people_calltime_d_count.pprint()
```

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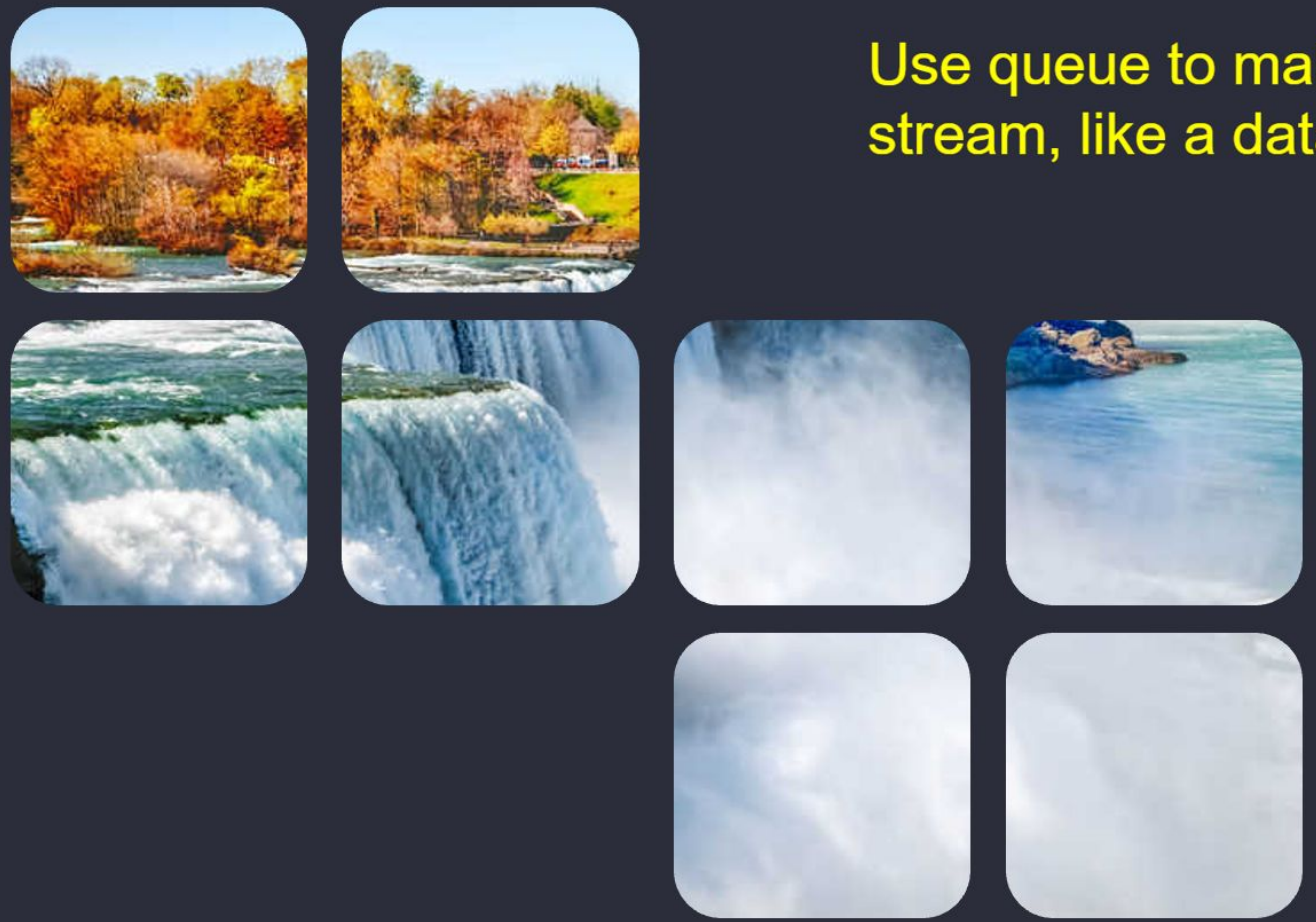
How was streaming used

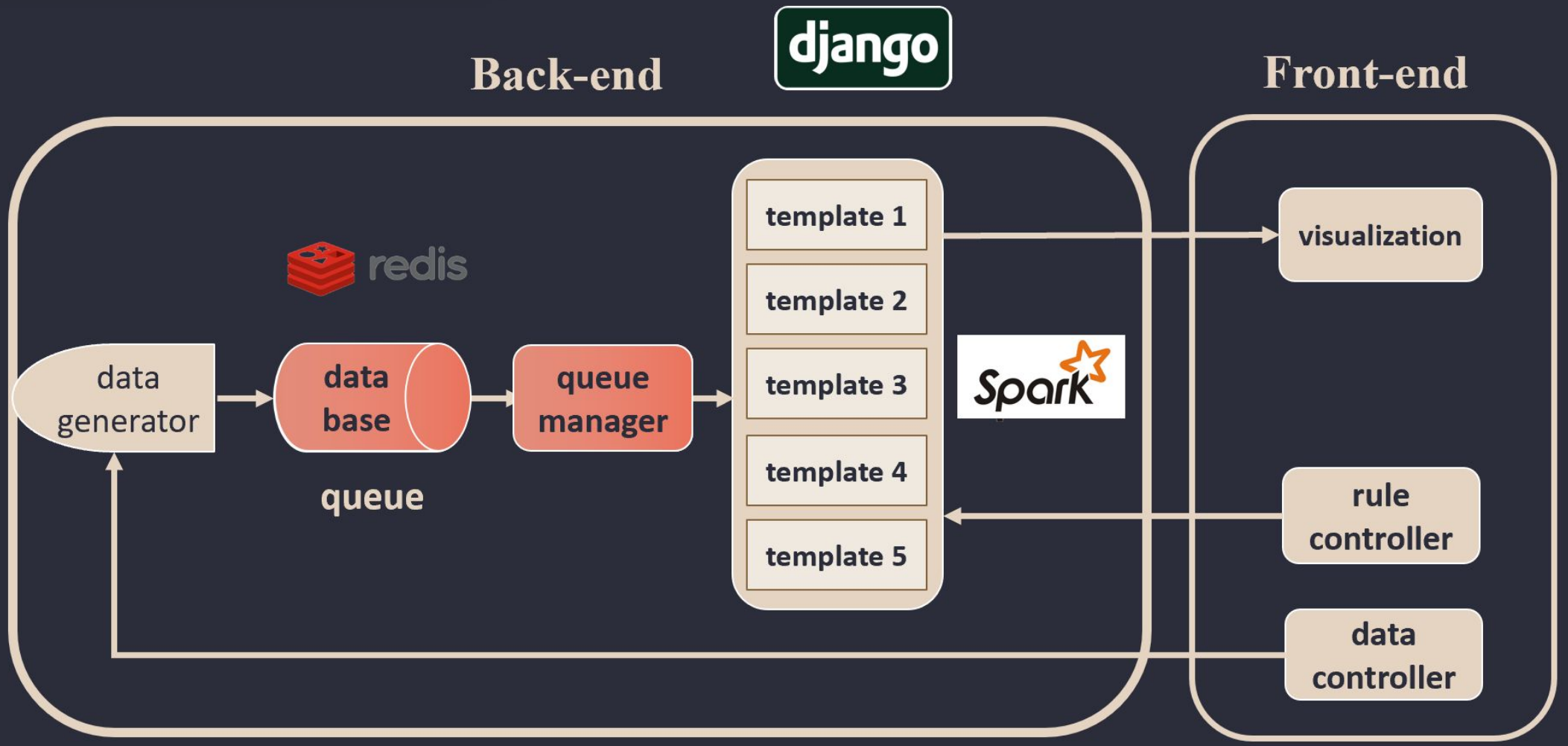
Database



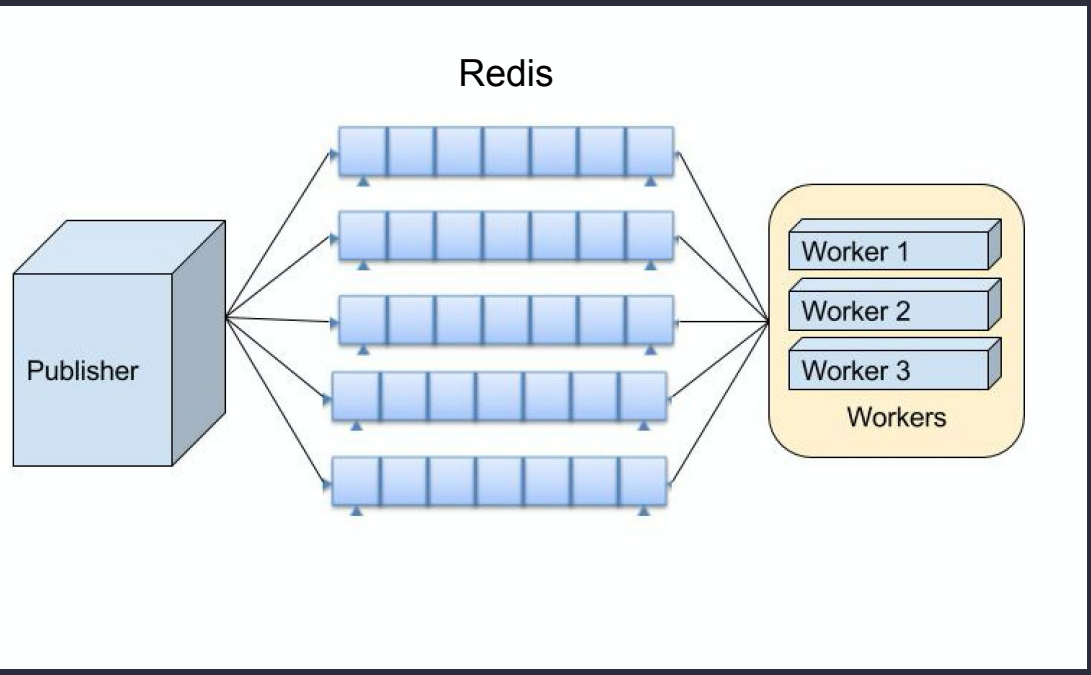
Use queue to make it like a stream, like a dataflow.

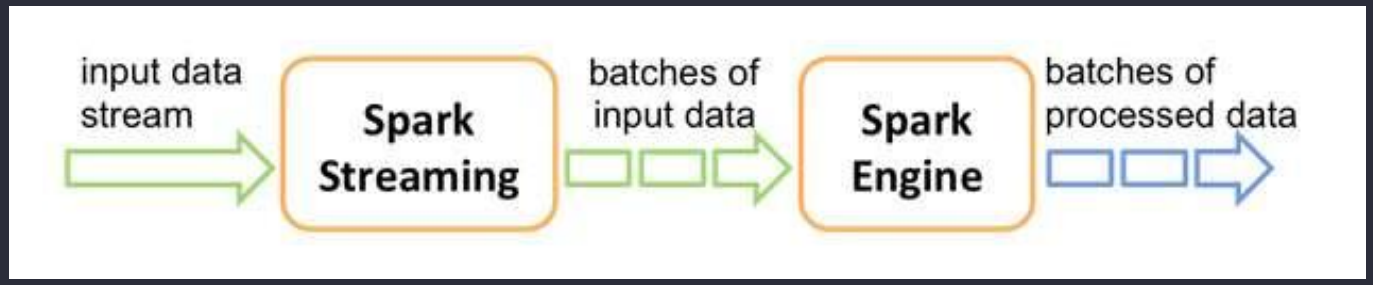
Streaming

System Structure

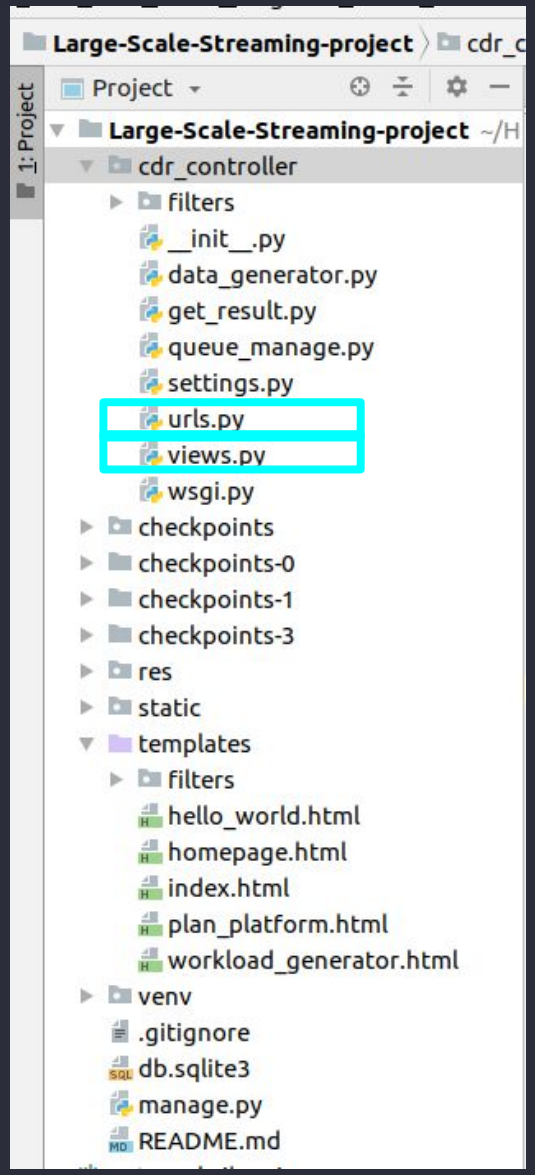


Redis Queue and Spark Streaming





Front-end Code




```python
from django.conf.urls import url
from django.contrib import admin
from django.urls import path

from . import views

urlpatterns = [
    # path('admin/', admin.site.urls),
    url(r'hello/', views.hello_world),
    url(r'admin/', admin.site.urls),
    url(r'index/', views.index, name="index"),
    url(r'workload_generator', views.workload_generator,
        name="workload_generator"),
    url(r'page1/', views.page1_view),
    url(r'page2/', views.page2_view),
    url(r'plan_platform', views.plan_platform, name="plan_platform"),
    url(r'show_info', views.show_info),
    url(r'^data_gen_start', views.data_gen_start),
    url(r'^data_gen_stop', views.data_gen_stop),
    # custom templates
    path(r"filters/template0", views.custom_template0, name="template0"),
    path(r"filters/template1", views.custom_template1, name="template1"),
    path(r"filters/template3", views.custom_template3, name="template3"),
    # data source
    path(r"data/template0", views.data_template0),
    path(r"data/template1", views.data_template1),
    path(r"data/template3", views.data_te
    url(r'', views.homepage, name="homepa
]
```

```python
85
86      def homepage(request):
87          return render(request, 'homepage.html', {})
88
89
90      def index(request):...
98
99
00      def workload_generator(request):...
30
31
32      def plan_platform(request):...
45
```

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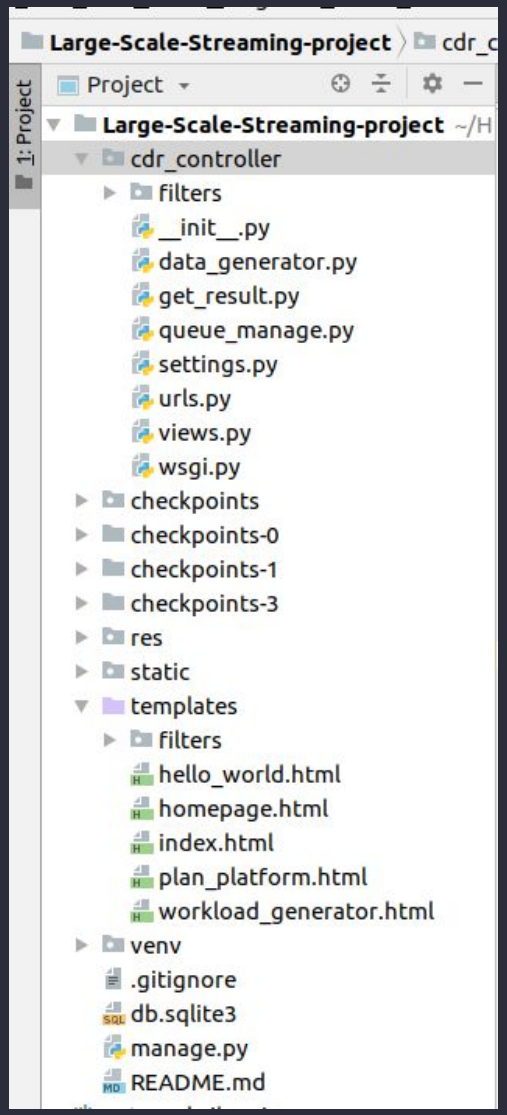
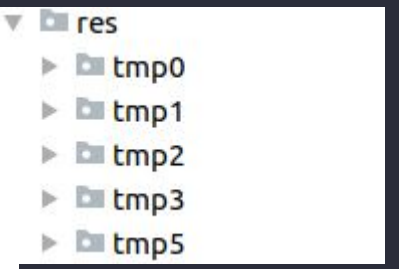
Front-end Code




```python
# custom templates
def custom_template0(request):
    data_tmp0 = get_tmp0_data()
    return render(request, 'filters/template_00.html', data_tmp0)


def custom_template1(request):
    data_tmp1 = get_tmp1_data()
    return render(request, 'filters/template_01.html', data_tmp1)


def custom_template3(request):
    data_tmp3 = get_tmp3_data()
    return render(request, 'filters/template_03.html', data_tmp3)


# data source
def data_template0(request):
    data_tmp0 = get_tmp0_data()
    return HttpResponse(json.dumps(data_tmp0))


def data_template1(request):
    data_tmp1 = get_tmp1_data()
    return HttpResponse(json.dumps(data_tmp1))


def data_template3(request):
    data_tmp3 = get_tmp3_data()
    return HttpResponse(json.dumps(data_tmp3))
```



Final Results

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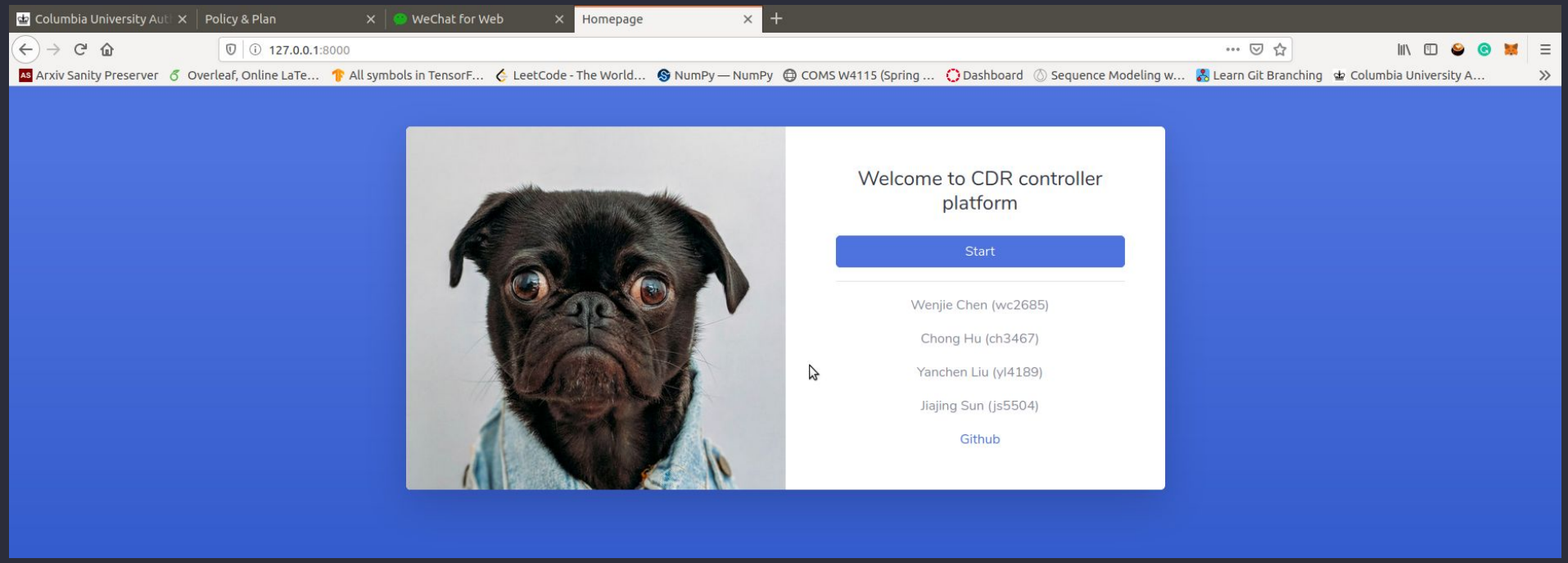
```
Performing system checks...

Watching for file changes with StatReloader
[INFO 2020-04-30 22:19:18,635] Watching for file changes with StatReloader
System check identified no issues (0 silenced).
April 30, 2020 - 22:19:18
Django version 3.0.5, using settings 'cdr_controller.settings'
Starting development server at http://127.0.0.1:8000/
Quit the server with CONTROL-C.
```



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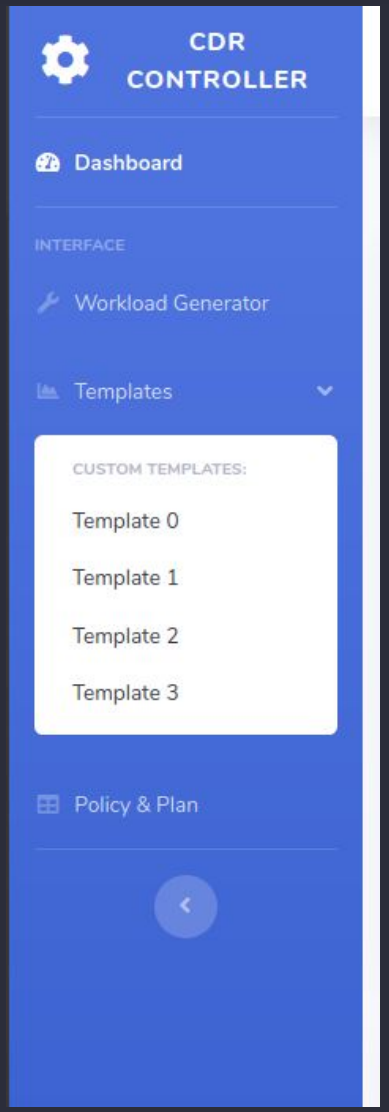
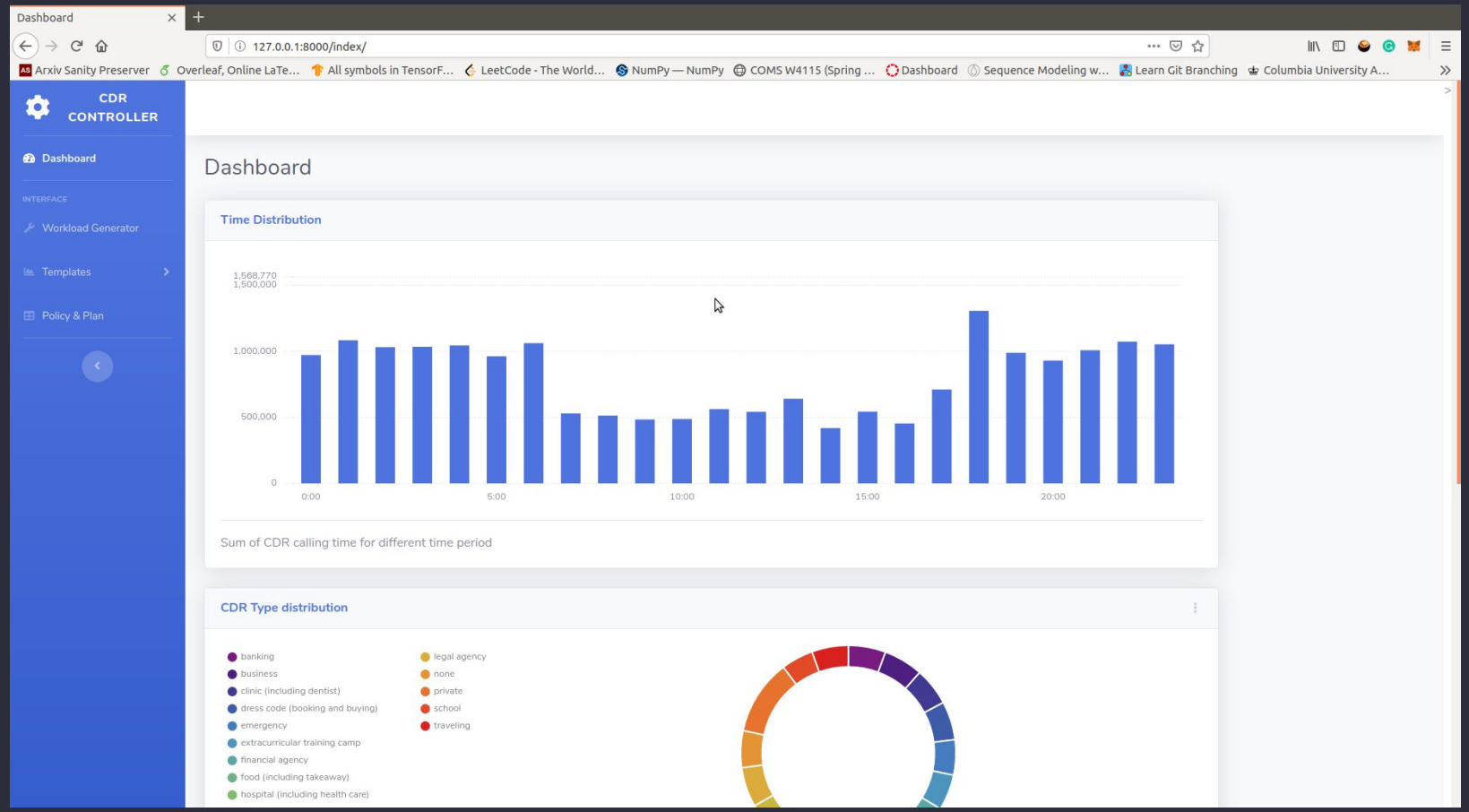
Final Results





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Final Results

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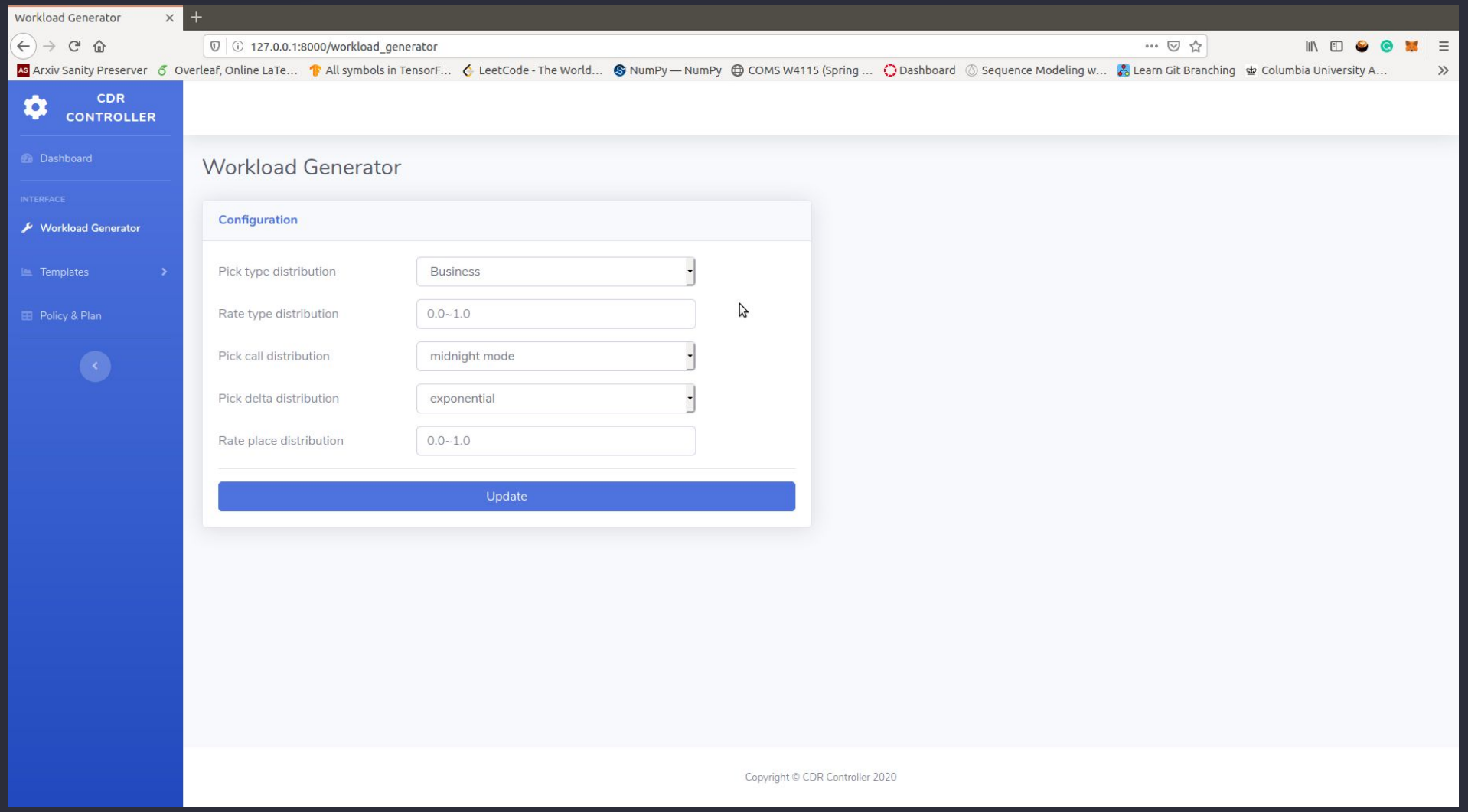

17 | **CDR marketing platform**

Final Results

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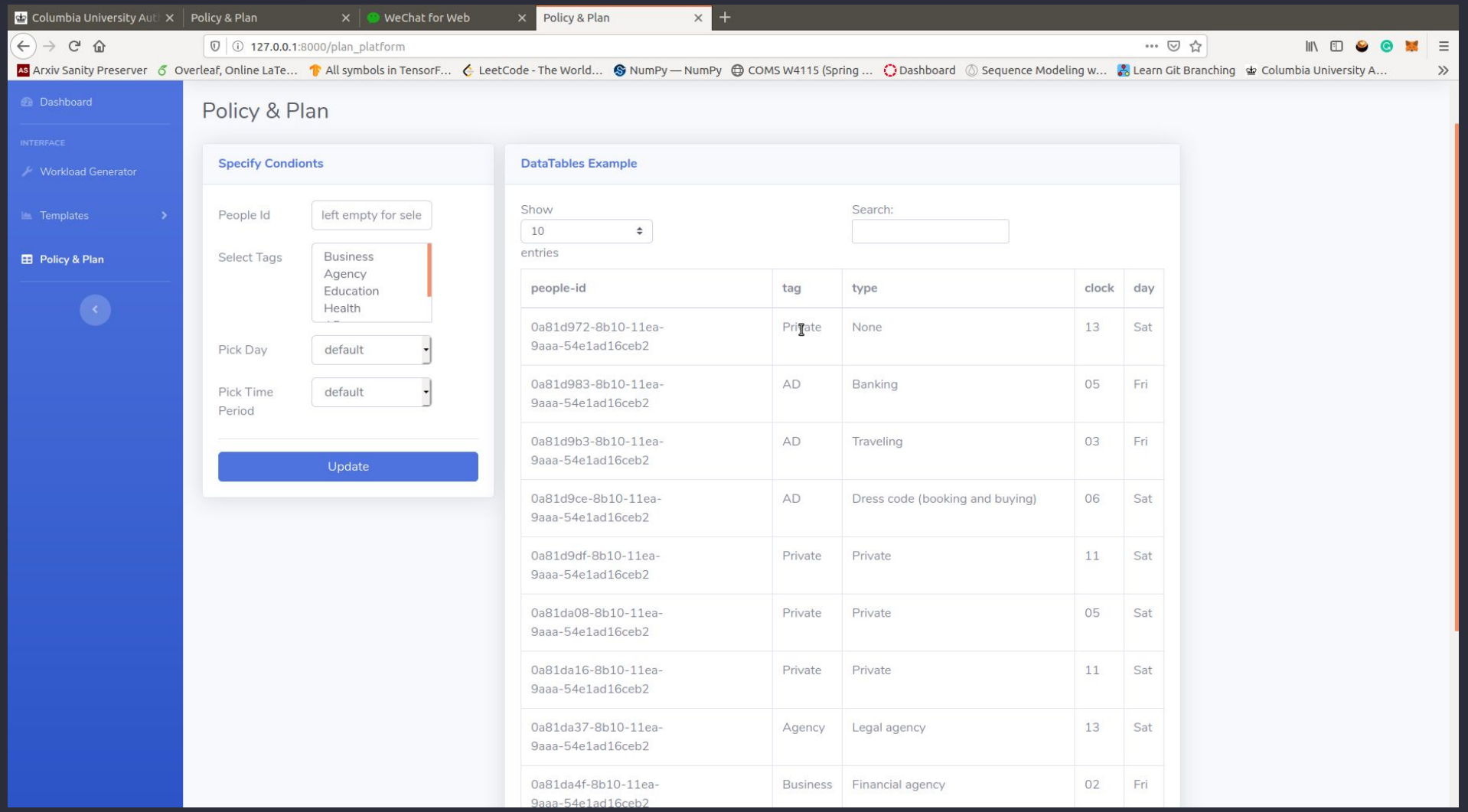

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Future Work

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- System-Side:
  - Use kafka as message queue to deliver message for better extension ability and larger scale data stream
  - Optimize templates and data processing flow
  - Provide more api to control each templates
  - Back pressure

- Front-End:
  - More buttons and options to control templates
  - Login method


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Thank You
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