Projekat 1 – Big data

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Skup podataka - Brightkite check ins

Brightkite je nekada bio provajder društvenih mreža zasnovan na lokaciji, gde su koriscnici delili svoje lokacije. Prikupljeno je 4 491 143 čekiranja korisnika, odnosno prijavljivanja na određenu lokaciju. Atributi koji su zastupljeni u skupu podataka su:

- User – id korisnika
- Check_in_time – vreme prijave na određenu lokaciju
- Longitude – geografska dužina lokacije
- Latitute – geografska širina lokacije
- Location_id – id lokacije

Primer slogova u skupu podataka

user	check_in_time	latitude	longitude	location_id
0	2010-10-17 03:48:53	39.747652	-104.99251	88c46bf20db295831bd2d1718ad7e6f5
0	2010-10-16 08:02:04	39.891383	-105.070814	7a0f88982aa015062b95e3b4843f9ca2
0	2010-10-16 05:48:54	39.891077	-105.068532	dd7cd3d264c2d063832db506fba8bf79
0	2010-10-14 20:25:51	39.750469	-104.999073	9848afcc62e500a01cf6fbf24b797732f8963683
0	2010-10-14 02:21:47	39.752713	-104.996337	2ef143e12038c870038df53e0478cefc
0	2010-10-14 01:31:51	39.752508	-104.996637	424eb3dd143292f9e013efa00486c907
0	2010-10-13 22:05:43	39.7513	-105.000121	d268093afe06bd7d37d91c4d436e0c40d217b20a
0	2010-10-13 18:41:35	39.758974	-105.010853	6f5b96170b7744af3c7577fa35ed0b8f
0	2010-10-13 05:57:23	39.827022	-105.143191	f6f52a75fd80e27e3770cd3a87054f27
0	2010-10-12 21:56:49	39.749934	-105.000017	b3d356765cc8a4aa7ac5cd18caafd393

Filtriranje

- Iz skupa podataka izdavjamo oblast koja se nalazi između 40. i 60. stepena geografske širine, i, između -104. i –120. stepena geografske dužine.
- Kao vremenski prozor koji posmaramo, uzimamao dane između 15.10.2010. i 31.10.2010. godine.

```
filtered_df = df.filter( (df["latitude"] > latitude_lower) & (df["latitude"] < latitude_upper) & (df["longitude"] < longitude_upper) &
                        (df["longitude"] > longitude_lower) & (df["check_in_time"] > date_lower) & (df["check_in_time"] < date_upper))
```

Broj pojavljivanja korisnika u prethodno definisanoj oblasti i vremenskom intervalu

```
grouped_df = filtered_df.groupBy("user").count().alias("count")
result = grouped_df.select("user", "count")
result.show()
```

```
Podaci grupisani po korisnicima, za odredjenu oblast i odrjenji vremenski interval
+----+-----+
|user|count|
+----+-----+
|  15|    1|
|1092|    1|
|1863|   16|
|2879|    3|
|2937|    1|
|2878|    1|
+----+-----+
```

Ukupan broj prijavljivanja na određenu lokaciju koja pripada prethodno definisanoj oblasti, u definisanom vremenskog okviru

```
grouped_df = filtered_df.groupBy("location_id").count().alias("count")
result = grouped_df.select("location_id", "count")
result.show()
```

```
Podaci grupisani po lokacijama, za odredjenu oblast i odrjenji vremenski interval
+--------------------+-----+
|         location_id|count|
+--------------------+-----+
|9a404eee49b47d7df...|    1|
|5f9fd804781871335...|    1|
|eebadad0a22411ddb...|    1|
|7b062c7e83141c131...|    1|
|1ab85b9dff61c977b...|    1|
|d22e7db4cb988d813...|    2|
|5d2db576912de7550...|    1|
|f52bde44aa45c171a...|    1|
|f54c489c05b23dfcd...|    1|
|eeffd054a22411ddb...|    2|
|eeb9db9ea22411dd8...|    1|
|eeb46b50a22411dda...|    1|
```

Kolona – time_spent

Veštački je generisana nova kolona "time_spent", koja sadrži informaciju o tome koliko je korinsik proveo vremena na nekoj lokaciji. Skup podaka nakon dodavanja te kolone je prikazan na slici.

user	check_in_time	latitude	longitude	location_id	time_spent
0	2010-10-17 03:48:53	39.747652	-104.99251	88c46bf20db295831...	124
0	2010-10-16 08:02:04	39.891383	-105.070814	7a0f88982aa015062...	99
0	2010-10-16 05:48:54	39.891077	-105.068532	dd7cd3d264c2d0638...	121
0	2010-10-14 20:25:51	39.750469	-104.999073	9848afcc62e500a01...	227
0	2010-10-14 02:21:47	39.752713	-104.996337	2ef143e12038c8700...	291
0	2010-10-14 01:31:51	39.752508	-104.996637	424eb3dd143292f9e...	165
0	2010-10-13 22:05:43	39.7513	-105.000121	d268093afe06bd7d3...	201
0	2010-10-13 18:41:35	39.758974	-105.010853	6f5b96170b7744af3...	78
0	2010-10-13 05:57:23	39.827022	-105.143191	f6f52a75fd80e27e3...	237
0	2010-10-12 21:56:49	39.749934	-105.000017	b3d356765cc8a4aa7...	178
0	2010-10-11 04:51:09	39.891077	-105.068532	6f3a2db56d4fa788f...	29
0	2010-10-09 07:45:25	39.891077	-105.068532	6f3a2db56d4fa788f...	148
0	2010-10-08 05:33:37	39.758974	-105.010853	11da318f0ea3c4a8f...	320

Kolona – check_in_date

Dodata je nova kolona, "check_in_date", koja izvlaći informaciju o datumu iz kolone "check_in_time", jer ona sadrži informaciju i o vremenu i o datumu. Ovo je urađeno da bismo u nastavku projekta mogli da grupišemo slogove po datumu.

```
# Dodavanje nove kolone koja ce da sadrzi samo informaciji o datumu
df = df.withColumn("check_in_date", to_date(col("check_in_time"), "yyyy-MM-dd'T'HH:mm:ss'Z'"))
```

Određivanje statističkih paramatera za atribut time_spent na ordeđenoj lokacijij, određenog datuma

```
grouped_df = df.groupBy("location_id", "check_in_date").agg(
    min("time_spent").alias("min_time_spent"),
    max("time_spent").alias("max_time_spent"),
    avg("time_spent").alias("avg_time_spent"),
    coalesce(stddev("time_spent"), lit(0.0)).alias("stddev_time_spent")
)
```

```
Podaci grupisani po lokacijama i datumima:
+--------------------+-------------+--------------+--------------+------------------+------------------+
|         location_id|check_in_date|min_time_spent|max_time_spent|    avg_time_spent| stddev_time_spent|
+--------------------+-------------+--------------+--------------+------------------+------------------+
|dd7cd3d264c2d0638...|   2010-04-07|           111|           111|             111.0|               0.0|
|34d9fb11d6e4e875b...|   2010-03-12|           251|           251|             251.0|               0.0|
|3c416dba5f9811deb...|   2010-02-05|           231|           231|             231.0|               0.0|
|6db9d82229f1e0eb2...|   2010-01-06|             2|            35|              18.5| 23.33452377915607|
|7648bcecaf9911deb...|   2009-10-02|           172|           351|             261.5|  126.572113832392|
|7a22ad4e9e3f11ddb...|   2009-08-16|             1|           188|              94.5|132.22896808188437|
|2356b384f6c4c8095...|   2010-06-24|           325|           325|             325.0|               0.0|
|901ec5410896ff121...|   2010-04-23|            23|            23|              23.0|               0.0|
|8fde23d6245c11deb...|   2010-01-21|           276|           345|             319.2| 27.79748190034486|
|ee81e0b8a22411dda...|   2009-07-02|            34|           351|207.55555555555554|122.32856484802629|
|ee6b8534a22411dd9...|   2009-04-21|            51|           325|          188.8125| 69.84575267449458|
```

Određivanje statističkih paramatera za atribut time_spent na ordeđenoj lokacijij, određenog datuma, za svakog korisnika

```
grouped_df = df.groupBy("user", "location_id", "check_in_date").agg(
    min("time_spent").alias("min_time_spent"),
    max("time_spent").alias("max_time_spent"),
    avg("time_spent").alias("avg_time_spent"),
    coalesce(stddev("time_spent"), lit(0.0)).alias("stddev_time_spent")
)
```

```
Podaci grupisani po lokacijama i datumima, za odredjenog korisnika:
+----+--------------------+------------+--------------+--------------+--------------+------------------+
|user|         location_id|check_in_date|min_time_spent|max_time_spent|avg_time_spent| stddev_time_spent|
+----+--------------------+------------+--------------+--------------+--------------+------------------+
|   0|7a0f88982aa015062...|  2010-08-07|             8|             8|           8.0|               0.0|
|   0|f6f52a75fd80e27e3...|  2010-06-30|            53|           328|         190.5|194.45436482630058|
|   0|5b1e75de2fd3acfcb...|  2009-06-18|           338|           338|         338.0|               0.0|
|   0|ec71ac1659d211de9...|  2009-06-15|           245|           273|         259.0| 19.79898987322333|
|   0|0b8d9aa2489d4a8b0...|  2009-05-27|            90|            90|          90.0|               0.0|
|   1|c18334382591a7534...|  2010-04-02|           271|           271|         271.0|               0.0|
|   1|dbacc50b61ae8d7df...|  2010-03-04|           209|           209|         209.0|               0.0|
|   1|e4b85ebcf23911dda...|  2009-10-19|           333|           333|         333.0|               0.0|
|   1|ee8403d4a22411dd8...|  2009-08-18|           229|           229|         229.0|               0.0|
|   1|ee6b8534a22411dd9...|  2009-05-06|             6|             6|           6.0|               0.0|
|   1|ee81e0b8a22411dda...|  2009-04-03|           122|           229|         183.0|55.054518434003214|
|   2|6e3768ee94fc11dea...|  2010-06-16|           325|           325|         325.0|               0.0|
```

Najposećenija lokacija za svakog korisnika

user	max_visits	most_visited_location
0	213	ba494e1ceff294a80...
1	297	c0b8fc511887b932c...
2	247	3534836081ca2913b...
3	119	3410de6ca0f4d8c77...
4	132	9325dd207bed11dea...
5	92	ee81e0b8a22411dda...
6	110	dab6294e732d36c2d...
7	300	74a3b18100c1bb81d...
8	4	4080a0d997eaeb739...
9	23	2d144622e8333f8de...
10	56	737eafcefd83b2554...
11	441	af9bc69f55fa74cd3...
12	320	81091f83e687d1bc0...
13	105	48697cc9ceb4fe0fb...
14	63	d9988f09bff65eefb...
15	464	50b5757e7bdc11de9...
16	39	9e7eacc95b1ed4eec...
17	155	d1ab6766ae5f31894...
18	66	f99685b6643511deb...
19	210	9c25dbbc444011deb...

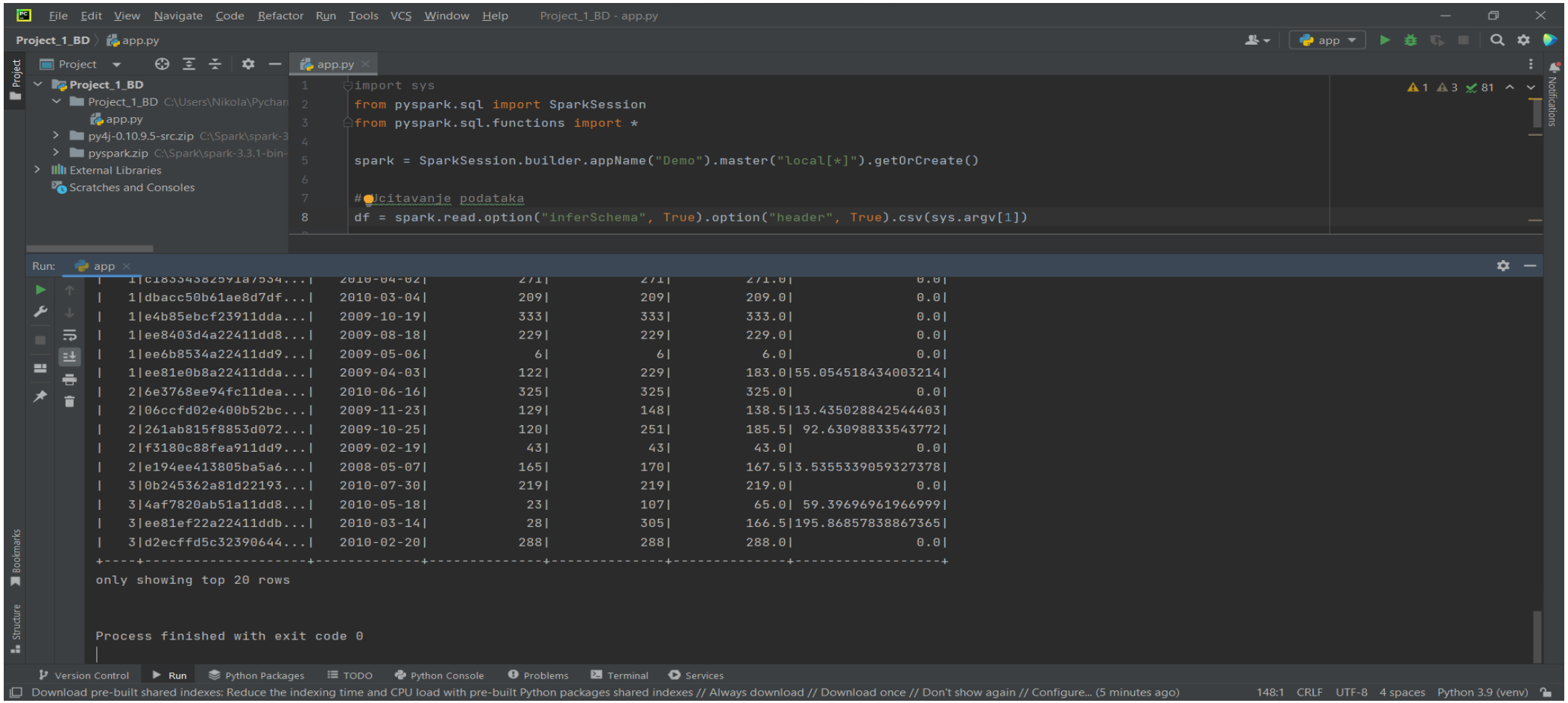
Datumi kada je svaka od lokacija bila najposećenija

location_id	max_visits	most_busiest_date
6d2b50de917111de9...	1	2009-08-25
d6de67abf64236233...	4	2009-12-05
2d766c02ea72f085d...	3	2009-01-12
fd8eacc4b1cb11dda...	5	2009-06-16
26a11bced05811ddb...	3	2009-06-02
3033e2d7a560b5a5c...	2	2008-12-27
11e6ea3656fe520b7...	4	2008-12-01
d1937763c05393367...	2	2008-11-16
5298aa3780e37d294...	1	2010-02-02
3e7f42009fcb11de8...	1	2009-09-26
8ee95c686be11deaf...	1	2009-08-12
2773ea36c7bfae09c...	1	2010-08-04
b6f6070ae12611ddb...	2	2009-07-25
c6ad07a0a83911dd8...	2	2008-11-01
700e4e2929211dda0...	2	2008-10-30
15325f65b6662f0b3...	3	2009-09-20
99774f916e92f1706...	1	2010-03-21
659ac30cabcd11dd9...	1	2008-11-15
4d6416d28b5511dd9...	2	2009-01-30
f79c95e5936a31191...	1	2009-12-09

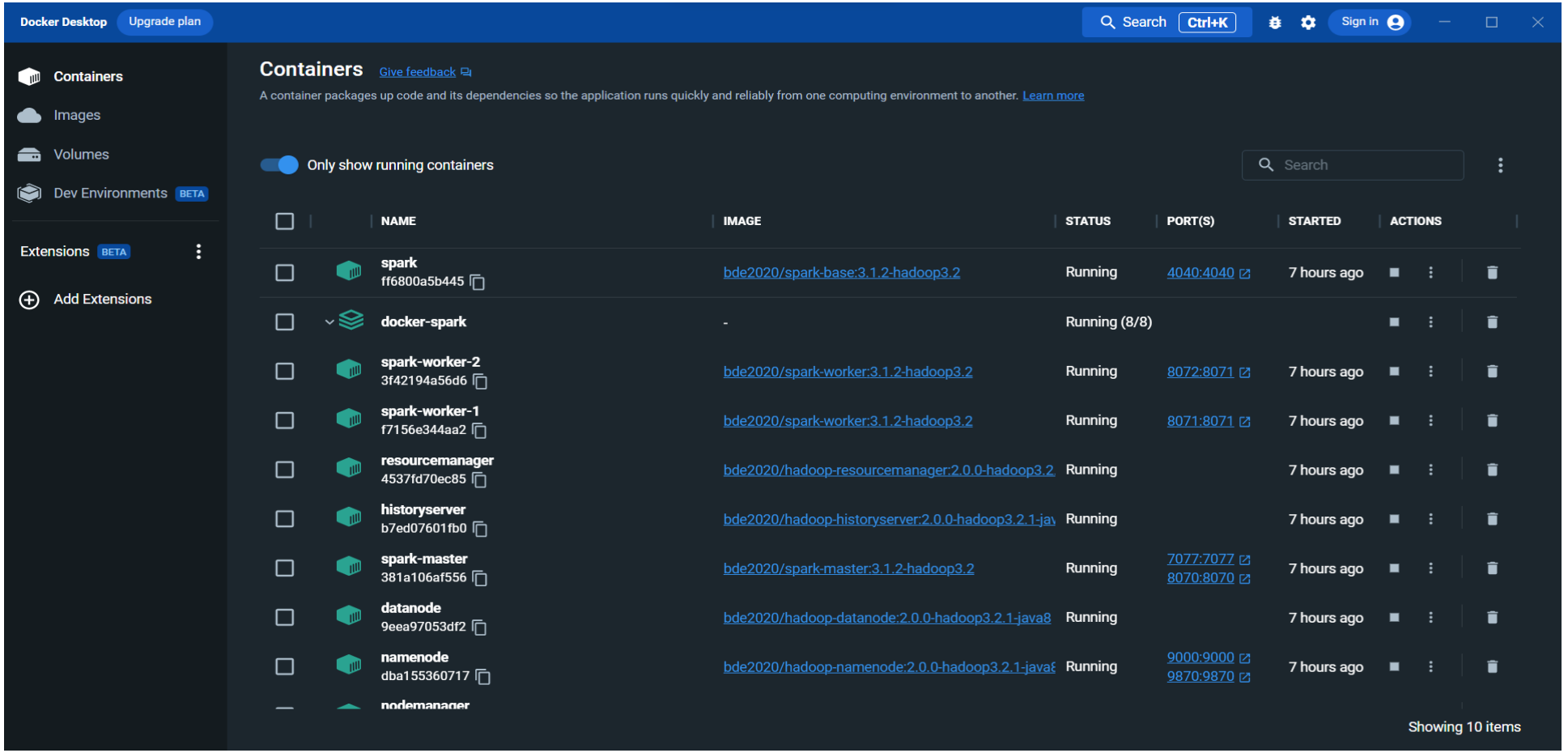
Prosečno vreme provedeno na svakoj od lokacija

location_id	avg_time_spent
64b925364ac71005a...	211.5
31c4ef9bbd5f8ebe2...	219.7
e5acc4dbe743d713b...	32.0
d9ba7fd062dd11de9...	133.0
db3e5b3257cb11dea...	306.0
8ec18f7210b811deb...	164.75
3033e2d7a560b5a5c...	85.4
ca54a3d67bc011dda...	181.0
cc8795999b01637cf...	309.0
7b9b133c85199c71d...	345.0
f4491cf2fe7c88fb3...	185.7
abc4c6f75f5453484...	174.57142857142858
d2c833d0d13d1c037...	276.0
6ce8b78370a37d7b7...	170.5
f79c95e5936a31191...	90.0
6bdcb8d41bcf11dea...	198.0
4d9b5a6f08993325b...	296.0
6d540229c0547a981...	208.33333333333334
fd8eacc4b1cb11dda...	170.77083333333334
cf86f32c17e211dea...	324.0

Aplikacija u PyCharm-u, na lokalnoj mašini



Aplikacija na klasteru Spark Docker container-a (BDE)



Aplikacija na klasteru Spark Docker container-a (BDE)

```
bash-5.0# /spark/bin/spark-submit --master local[*] project_1.py hdfs://namenode:9000/dir_proj_1 40 60 -120 -104 2010-10-15 2010-10-31
```

```
bash-5.0# /spark/bin/spark-submit --master local[*] project_1.py data_proj_1/data_proj_1 40 60 -120 -104 2010-10-15 2010-10-31
```

Command Prompt - docker e

```
23/01/26 22:03:32 INFO TaskSchedulerImpl: Killing all running tasks in stage 40: Stage finished
23/01/26 22:03:32 INFO DAGScheduler: Job 20 finished: showString at NativeMethodAccessorImpl.java:0, took 0.907657 s
23/01/26 22:03:32 INFO CodeGenerator: Code generated in 5.601293 ms
+--------------------+------------------+
|         location_id|    avg_time_spent|
+--------------------+------------------+
|64b925364ac71005a...|             103.5|
|31c4ef9bbd5f8ebe2...|            163.65|
|e5acc4dbe743d713b...|             173.0|
|d9ba7fd062dd11de9...|             168.0|
|db3e5b3257cb11dea...|             226.5|
|8ec18f7210b811deb...|            170.75|
|3033e2d7a560b5a5c...|             168.6|
|ca54a3d67bc011dda...|             191.5|
|cc8795999b01637cf...|             128.0|
|7b9b133c85199c71d...|             164.0|
|f4491cf2fe7c88fb3...|             193.0|
|abc4c6f75f5453484...|241.85714285714286|
|d2c833d0d13d1c037...|             340.0|
|6ce8b78370a37d7b7...|             148.0|
|f79c95e5936a31191...|              99.5|
|6bdcb8d41bcf11dea...|              28.0|
|4d9b5a6f08993325b...|              35.0|
|6d540229c0547a981...|226.33333333333334|
|fd8eacc4b1cb11dda...|172.55729166666666|
|cf86f32c17e211dea...|             263.0|
+--------------------+------------------+
only showing top 20 rows
```

Vreme potrebno za izvršenje aplikacije

- Izvršavanje aplikacije na lokalnoj mašini

```
Vreme potrebno za izvrsenje aplikacije: 51.465081453323364
```

- Izvrašavanje aplikacije u Docker-u

```
Vreme potrebno za izvrsenje aplikacije: 75.35431814193726
```