Building the Brickhouse

Enhancing Hive with our UDF library

Data Pipeline in Hive

Advantages:

- Able to prototype quickly
- Extensible with UDFs

Disadvantages:

- Still need to understand "under the hood".
- Still "bleeding-edge"
- Enough rope to hang yourself

Solution: The Brickhouse

Generic UDF's to handle common situations

Design patterns and tools to deal
    with "Big Data"

Approaches to improve performance/scalability

(Not just a bunch of functions)

Not necessarily only solution, but our solution.

Solution: The Brickhouse

Functionality centered along certain functional areas.
Cookbook of "recipes" to solve certain general problems.

- `collect`
- `distributed_cache`
- `sketch_set`
- `bloom`
- `json`
- `sanity`
- `hbase`
- `timeseries`

Array/Map operations

```
collect
collect_max
cast_array
map_key_values
map_filter_keys
join_array
map_union
union_max
truncate_array
```

collect

Similar to Ruby/Scala collect (and Hive collect_set())

UDAF aggregates multiple lines,

  Returns map/array of values

Use with explode

```
select ks_uid,
collect(dt),
collect(score)
 from
maxwell_score
group by ks_uid;
```

```
select ks_uid,
  collect(actor_id, score )
from actor_score_table
group by ks_uid;
```

collect

Opposite of UDTF

Avoids "self-join" Anti-pattern

```
select a.id,
    a.value as a_val,
    b.value as b_val
 from ( select * from
mytable where type='A' ) a
join
(select * from mytable
where type='B' ) b
on ( a.id = b.id );
```

```
select id,
  col_map['A'] as a_val,
  col_map['B'] as b_val
from
  ( select id,
     collect( type,value)
   from mytable
    group by id );
```

collect_max

Similar to collect, but returns map with top 20 values.

Utilize Hive map-side aggregation to reduce sort size.

```
select ks_uid,
   combined_score,
from maxwell_score
  order by combined_score
limit 20;
```

```
select collect_max(
ks_uid, combined_score )
from
  maxwell_score
 where dt=20121008;
```

union_max

Salt your queries, and do in two steps,
if your job is too big.

```
create table salty_aggs as
select ks_uid,random_salt,
  collect_max( actor_ks_uid,
actor_klout_score)
  as top_score_map
from (
      select ks_uid,
      rand()*128 as random_salt,
      actor_ks_uid, actor_klout_score
  from big_table ) bt
group by ks_uid, random_salt;
```

```
select ks_uid,
   union_max(
     top_score_map )
   as top_score_map
from salty_aggs
group by ks_uid;
```

distributed_map

Uses distributed-cache to access values in-memory.

Avoids join/resort of large datasets

```
select
  ks_uid
from big_table bt
join
 ( select *
   from celeb where
   is_celeb = true )
celeb
on
bt.ks_uid = celeb.
ks_uid;
```

```
insert overwrite local
directory 'celeb_map';

add file 'celeb_map';

select * from celeb
  where is_celeb = true;
add file celeb_map;

select * from big_table
   where
distributed_map( ks_uid,
'celeb_map' ) is not
null;
```

multiday_count

Generates counts for 1, 3, 7, 21 days with one pass of the data.

```
select count(*),
   collect( actor_ks_uid )
 from   action_table
 where dt <= today
   and dt > days_add(
today, -7 ) union all
select count(*),
   collect( actor_ks_uid )
  from action_table
 where dt <= today
   and dt > days_add(
today, -14) union all...
```

```
select multiday_count(
   dt,cnt, actors, today,
   array( 1,3,7,30,60,90))
 from action_table
   where dt <= today
     and dt > today -90;
```

conditional_emit

Emit several different rows depending upon different conditions, in one pass

```
select ks_uid,
    'ALL' as feature_class
from user_table
union all
select ks_uid,
    'NY' as feature_class
from user_table
  where city = 'NY'
union all
select ks_uid, 'CELEB'
from user_table
 where is_celeb(ks_uid)
union all ...
```

```
select ks_uid
  conditional_emit(
   array( true,
     city = 'NY',
     is_celeb( ks_uid ) ),
    array('ALL','NY','CELEB')
)
  as feature_class
from user_table;
```

sketch_set

Estimate number of uniques for large sets with a fixed amount of space.

KMV Sketch implementation.

Good for titans (@onedirection, @youtube)

Avoids "count distinct"

```
select
count(distinct ks_uid) as
reach
from
  actor_action
where
some_condition() = true;
```

```
select estimated_reach(
   sketch_set( ks_uid ) )
from
   actor_action
where
   some_condition() = true;
```

sketch_set

Easy to do set unions.

Can aggregate incremental results.

```
insert overwrite table
daily_sketch partition
(dt=20130211)
select
   sketch_set( ks_uid) ss
from
   mytable;
```

```
select estimated_reach(
   union_sketch( ss) )
from
   daily_sketch
where
  dt >= days_add( today(),
-30);
```

sketch_set

Algorithm:

Take MD5 Hash of your string.

Collect 5000 lowest hashes.

If set size < 5000 that is your reach.

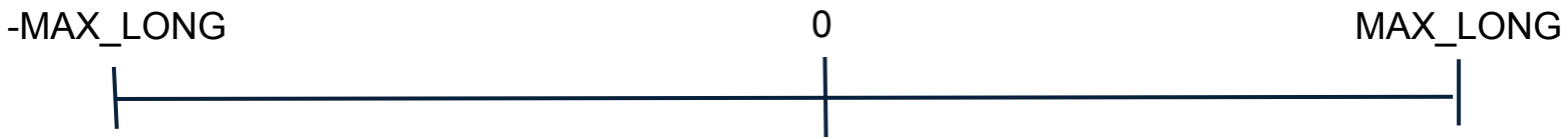
If set size = 5000 use highest hash value to calculate reach

reach= 5000/(maxHash + MAX_LONG) *2*MAX_LONG;

sketch_set

Why does it work ???

You need a very good hash



sketch_set

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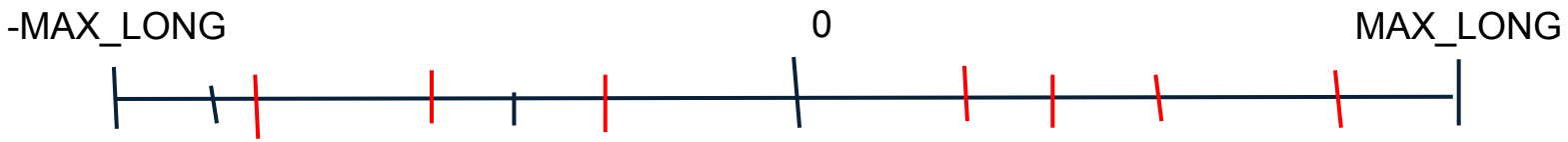
MD5 will distribute hashes evenly.



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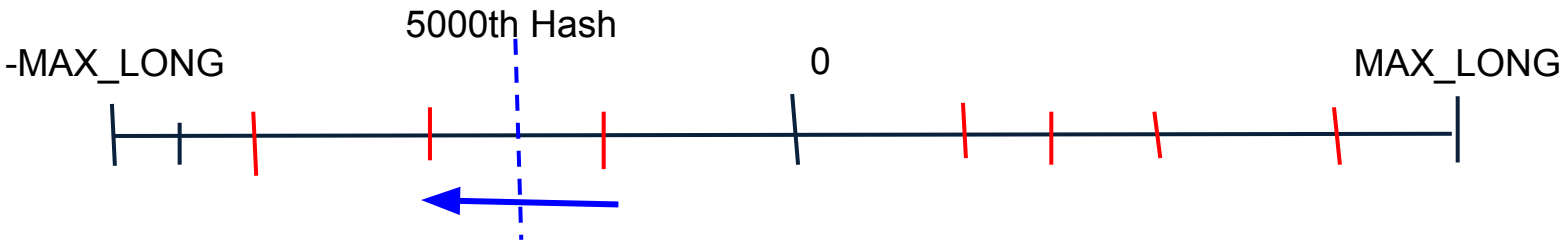


As number of hashes grows bigger, value of 5000th hash grows smaller.

bloom

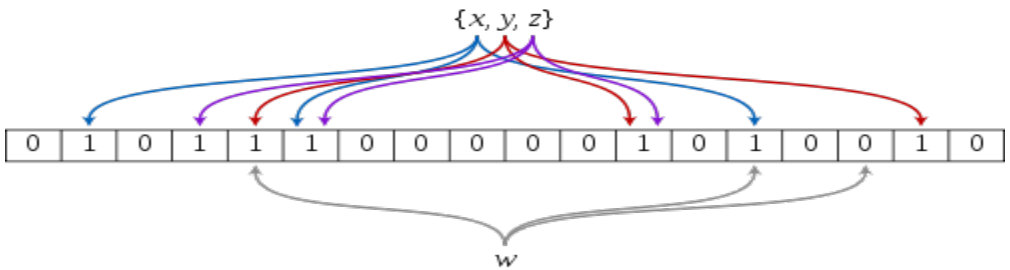
bloom
bloom_contains
distributed_bloom
bloom_and
bloom_or
bloom_not

bloom

Currently uses HBase's bloomfilter implementation.

Uses a large BitSet to express set membership.

Can tell if set contains a key, but can't iterate over the keys



bloom

Use similar to distributed_map.
Avoids a join and a re-sort.

```
select
 *
from
  content_items ci
left outer join
 deleted_content_items
del
on
  ci.content_id =   del.
content_id
where del.content_id is
null;
```

```
insert overwrite local
directory 'del_items_bloom'
select bloom( content_id )
from deleted_content_item;

add file del_items_bloom;
select *
from content_item
where ! bloom_contains(
content_id,
   distributed_bloom(
'del_items_bloom');
```

bloom

Can be merged easily for large sets.

```
insert overwrite local
directory 'thirty_day_bloom'
select bloom_and( bloom )
  from agg_bloom
  where dt >= days_add
(today(), -30);

add file thirty_day_bloom;
```

```
select ks_uid
  from actor_action
 where
 bloom_contains(
  distributed_bloom(
   'thirty_day_bloom' ));
```

assert,write_to_graphite

"Productionize" the pipeline.
Sanity checks for data quality.
Upload statistics to Graphite for visibility.

```
select write_to_graphite(grHost, grPort,
                  "prod.maxwell.count.tw",count(*) ),
       assert(count(*) > 1000, "Low moment count.")
from hb_dash_moment;
```

to_json,from_json

Serialize to JSON

Avoid ugly, error-prone string concat's

```
select
concat("{\"kscore\":",
kscore, ",\"moving_avg\":",
avg,
 ",\"start_date\":",start,
 ",\"end_date\":", end,"}")
from
  mytable;
```

```
select
 to_json(
  named_struct("kscore",
   kscore,
   "moving_avg",avg,
   "start_date",start,
   "end_date", end) )
from mytable;
```

to_json,from_json

Serialize from JSON

Pass in a struct of the type to be returned

```
create view parse_json as
select
 ks_uid, from_json( json,
  named_struct("kscore", 0.0,
   "moving_avg", array( 0.0 ),
    "start_date", "",
    "end_date", ""
  ) )
from moving_avg_view;
```

hbase_batch_put,hbase_get

Alternative to HBase Handler

Distribute keys across HBase regions to balance load.

Uses Batch Puts

```
select ks_uid_salt,
   hbase_batch_put(
      'my_hbase_table',
       ks_uid_key , hb_json , 500 )
  from hb_salted_view
  distribute by ks_uid_salt;
```

Questions ???

Public Repo https://github.com/klout/brickhouse
Wiki/Documentation
https://github.com/klout/brickhouse/wiki

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