

Using siri_vm_4

Table "public.siri_vm_4"		
Column	Type	Modifiers
acp_id	character(20)	not null
acp_lng	double precision	not null
acp_lat	double precision	not null
acp_ts	bigint	not null
location2d	geography(Point,4326)	not null
location4d	geography(PointZM,4326)	not null
info	jsonb	not null

Indexes:

```
"siri_vm_4_acp_id" btree (acp_id)
"siri_vm_4_acp_lat" btree (acp_lat)
"siri_vm_4_acp_lng" btree (acp_lng)
"siri_vm_4_acp_ts" btree (acp_ts)
"siri_vm_4_info" gin (info)
"siri_vm_4_location2d" gist (location2d)
"siri_vm_4_location2d_geom" gist ((location2d::geometry))
"siri_vm_4_location4d" gist (location4d)
"siri_vm_4_location4d_geom_nd" gist ((location4d::geometry) gist_geometry_ops_nd)
```

This schema puts the acm_* fields into their own columns and indexes them, extracts the 2d and 4d positions as geoGRAHPy and indexes those (a few ways, to see what happens) and indexes info as a whole. Significant issues are doing any sort of date extraction from the (string) OriginAimedDepartureTime field, and the fact that location indexes are all in geoGRAPHy and so can only be used with geogRAPHy comparison operators (which doesn't include '~'). There's also the issue that I've never managed to get a gistgeometryops_nd index to be used for anything...

Generally end up using e.g.

```
ST_MakeEnvelope (0.08008, 52.205029, 0.108576, 52.215548, 4326) ~ location2d::geometry
```

for containment tests. Time ranges 1507762800 = 2017-10-12 00:00:00+01:00, 1507849200 = 2017-10-13 00:00:00+01:00

Loading times:

```
BEGIN;
BEGIN
Time: 0.029 ms
DROP TABLE IF EXISTS siri_vm_4;
DROP TABLE
Time: 2.510 ms
CREATE TABLE siri_vm_4 (
    acp_id          CHAR(20) NOT NULL,
```

```

    acp_lng          DOUBLE PRECISION NOT NULL,
    acp_lat          DOUBLE PRECISION NOT NULL,
    acp_ts           BIGINT NOT NULL,
    location2d       GEOGRAPHY(POINT,4326) NOT NULL,
    location4d       GEOGRAPHY(POINTZM,4326) NOT NULL,
    info             JSONB NOT NULL
);
CREATE TABLE
Time: 78.548 ms
COPY siri_vm_4 ( acp_id, acp_lng, acp_lat, acp_ts, location2d, location4d, info ) FROM
STDIN (FORMAT CSV, FREEZE TRUE)
COPY 37980678
Time: 11270490.052 ms
CREATE INDEX siri_vm_4_acp_id ON siri_vm_4 (acp_id);
CREATE INDEX
Time: 512786.429 ms
CREATE INDEX siri_vm_4_acp_lng ON siri_vm_4 (acp_lng);
CREATE INDEX
Time: 243200.378 ms
CREATE INDEX siri_vm_4_acp_lat ON siri_vm_4 (acp_lat);
CREATE INDEX
Time: 244180.254 ms
CREATE INDEX siri_vm_4_acp_ts ON siri_vm_4 (acp_ts);
CREATE INDEX
Time: 230895.257 ms
CREATE INDEX siri_vm_4_location2d on siri_vm_4 USING GIST (location2d);
CREATE INDEX
Time: 1551898.345 ms
CREATE INDEX siri_vm_4_location2d_geom on siri_vm_4 USING GIST (cast(location2d as geometry));
CREATE INDEX
Time: 6254793.236 ms
CREATE INDEX siri_vm_4_location4d on siri_vm_4 USING GIST (location4d);
CREATE INDEX
Time: 1615844.516 ms
CREATE INDEX siri_vm_4_location4d_geom_nd on siri_vm_4 USING GIST (cast(location4d as geometry) gist_geometry_ops_nd);
CREATE INDEX
Time: 1521617.369 ms
CREATE INDEX siri_vm_4_info ON siri_vm_4 USING GIN (info);
CREATE INDEX
Time: 2156703.329 ms
COMMIT;
COMMIT
Time: 199.966 ms

real    426m43.106s
user    57m14.116s
sys      4m9.384s

```

Small box

The box is this: <http://bboxfinder.com/#52.205029,0.080080,52.215548,0.108576> (roughly Maddingly Road inbound). Returns about 30,000 records

```
Testing "select info from siri_vm_4 where acp_lng >= 0.08008 and acp_lat >= 52.205029 and acp_lng <= 0.108576 and acp_lat <= 52.215548" with 10 iterations and work_mem 2GB
```

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

```
set work_mem to '2GB';
```

SET

```
explain analyse select info from siri_vm_4 where acp_lng >= 0.08008 and acp_lat >= 52.205029 and acp_lng <= 0.108576 and acp_lat <= 52.215548
```

QUERY PLAN

```
-----  
-----  
-----  
Bitmap Heap Scan on siri_vm_4 (cost=86948.70..399889.97 rows=88062 width=739) (actual time=1874.141..260740.242 rows=363275 loops=1)
```

```
  Recheck Cond: ((acp_lng >= '0.08008'::double precision) AND (acp_lng <= '0.108576'::double precision) AND (acp_lat >= '52.205029'::double precision) AND (acp_lat <= '52.215548'::double precision))
```

```
    Heap Blocks: exact=349629
```

```
    -> BitmapAnd (cost=86948.70..86948.70 rows=88062 width=0) (actual time=1757.520..1757.520 rows=0 loops=1)
```

```
      -> Bitmap Index Scan on siri_vm_4_acp_lng (cost=0.00..23023.52 rows=1097896 width=0) (actual time=543.768..543.768 rows=1131691 loops=1)
```

```
        Index Cond: ((acp_lng >= '0.08008'::double precision) AND (acp_lng <= '0.108576'::double precision))
```

```
      -> Bitmap Index Scan on siri_vm_4_acp_lat (cost=0.00..63880.90 rows=3046433 width=0) (actual time=954.080..954.080 rows=3002448 loops=1)
```

```
        Index Cond: ((acp_lat >= '52.205029'::double precision) AND (acp_lat <= '52.215548'::double precision))
```

```
    Planning time: 94.700 ms
```

```
    Execution time: 260836.533 ms
```

```
(10 rows)
```

latency average: 1556.459 ms

latency stddev: 27.666 ms

Testing "select info from siri_vm_4 where (ST_MakeEnvelope (0.08008, 52.205029, 0.108576, 52.215548, 4326) ~ location2d::geometry)" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where (ST_MakeEnvelope (0.08008, 52.205029, 0.108576, 52.215548, 4326) ~ location2d::geometry)

QUERY PLAN

Bitmap Heap Scan on siri_vm_4 (cost=1330.77..142445.69 rows=37981 width=739) (actual time=13802.240..272452.122 rows=363275 loops=1)

Recheck Cond: ('0103000020E61000000100000005000000554D10751F80B43FA5DDE8633E1A4A40554D10751F80B43FEE5BAD13971B4A4030682101A3CBBB3FEE5BAD13971B4A4030682101A3CBBB3FA5DDE8633E1A4A40554D10751F80B43FA5DDE8633E1A4A40'::geometry ~ (location2d)::geometry)

Heap Blocks: exact=349629

-> Bitmap Index Scan on siri_vm_4_location2d_geom (cost=0.00..1321.28 rows=37981 width=0) (actual time=13647.534..13647.534 rows=363275 loops=1)

Index Cond: ('0103000020E61000000100000005000000554D10751F80B43FA5DDE8633E1A4A40554D10751F80B43FEE5BAD13971B4A4030682101A3CBBB3FEE5BAD13971B4A4030682101A3CBBB3FA5DDE8633E1A4A40554D10751F80B43FA5DDE8633E1A4A40'::geometry ~ (location2d)::geometry)

Planning time: 687.524 ms

Execution time: 272559.165 ms

(7 rows)

latency average: 206.217 ms

latency stddev: 27.406 ms

One day

Try just retrieving a full day's data:

Testing "select info from siri_vm_4 where acp_ts >= 1507762800 and acp_ts < 1507849200;
" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where acp_ts >= 1507762800 and acp_ts < 1507849200;

QUERY PLAN

```
-----  
-----  
Bitmap Heap Scan on siri_vm_4  (cost=16420.68..1995575.20 rows=773865 width=739) (actual time=168.462..5756.215 rows=792867 loops=1)  
  Recheck Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))  
  Heap Blocks: exact=88173  
    -> Bitmap Index Scan on siri_vm_4_acp_ts  (cost=0.00..16227.22 rows=773865 width=0) (actual time=141.338..141.338 rows=792867 loops=1)  
        Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))  
Planning time: 129.737 ms  
Execution time: 5806.032 ms  
(7 rows)
```

latency average: 118.026 ms
latency stddev: 17.749 ms

Small box and one day

Add in a 24 hour time constraint:

Testing "select info from siri_vm_4 where acp_lng >= 0.08008 and acp_lat >= 52.205029 and acp_lng <= 0.108576 and acp_lat <= 52.215548 and acp_ts >= 1507762800 and acp_ts < 1507849200;" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where acp_lng >= 0.08008 and acp_lat >= 52.205029 and acp_lng <= 0.108576 and acp_lat <= 52.215548 and acp_ts >= 1507762800 and acp_ts < 1507849200;

QUERY PLAN

```
-----
-----
-----
Bitmap Heap Scan on siri_vm_4  (cost=103133.48..110243.72 rows=1794 width=739) (actual
time=1488.610..7277.932 rows=7968 loops=1)
  Recheck Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200) AND (acp_lng >= '0.0
8008'::double precision) AND (acp_lng <= '0.108576'::double precision) AND (acp_lat >=
'52.205029'::double precision) AND (acp_lat <= '52.215548'::double precision))
  Heap Blocks: exact=7735
    -> BitmapAnd  (cost=103133.48..103133.48 rows=1794 width=0) (actual time=1483.028..
1483.028 rows=0 loops=1)
      -> Bitmap Index Scan on siri_vm_4_acp_ts  (cost=0.00..16227.22 rows=773865 wi
dth=0) (actual time=141.759..141.759 rows=792867 loops=1)
        Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))
      -> Bitmap Index Scan on siri_vm_4_acp_lng  (cost=0.00..23023.52 rows=1097896
width=0) (actual time=360.077..360.077 rows=1131691 loops=1)
        Index Cond: ((acp_lng >= '0.08008'::double precision) AND (acp_lng <= '0
.108576'::double precision))
      -> Bitmap Index Scan on siri_vm_4_acp_lat  (cost=0.00..63880.90 rows=3046433
width=0) (actual time=949.508..949.508 rows=3002448 loops=1)
        Index Cond: ((acp_lat >= '52.205029'::double precision) AND (acp_lat <=
'52.215548'::double precision))
  Planning time: 120.735 ms
  Execution time: 7280.187 ms
(12 rows)
```

latency average: 1288.270 ms

latency stddev: 24.990 ms

Testing "select info from siri_vm_4 where (ST_MakeEnvelope (0.08008, 52.205029, 0.108576, 52.215548, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200;" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where (ST_MakeEnvelope (0.08008, 52.205029, 0.108576, 52.215548, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200;

QUERY PLAN

Bitmap Heap Scan on siri_vm_4 (cost=17549.13..20629.26 rows=774 width=739) (actual time=14307.805..19580.101 rows=7968 loops=1)

Recheck Cond: (('0103000020E61000000100000005000000554D10751F80B43FA5DDE8633E1A4A40554D10751F80B43FEE5BAD13971B4A4030682101A3CBBB3FEE5BAD13971B4A4030682101A3CBBB3FA5DDE8633E1A4A40554D10751F80B43FA5DDE8633E1A4A40'::geometry ~ (location2d)::geometry) AND (acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Heap Blocks: exact=7735

-> BitmapAnd (cost=17549.13..17549.13 rows=774 width=0) (actual time=14270.289..14270.289 rows=0 loops=1)

-> Bitmap Index Scan on siri_vm_4_location2d_geom (cost=0.00..1321.28 rows=37981 width=0) (actual time=14064.105..14064.105 rows=363275 loops=1)

Index Cond: ('0103000020E61000000100000005000000554D10751F80B43FA5DDE8633E1A4A40554D10751F80B43FEE5BAD13971B4A4030682101A3CBBB3FEE5BAD13971B4A4030682101A3CBBB3FA5DDE8633E1A4A40554D10751F80B43FA5DDE8633E1A4A40'::geometry ~ (location2d)::geometry)

-> Bitmap Index Scan on siri_vm_4_acp_ts (cost=0.00..16227.22 rows=773865 width=0) (actual time=138.244..138.244 rows=792867 loops=1)

Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Planning time: 803.648 ms

Execution time: 19595.287 ms

(10 rows)

latency average: 213.442 ms

latency stddev: 28.107 ms

Big box and one day

A bigger box (Sawston <-> Cotenham, Camborne <-> Fulbourn) -0.100000,52.110000,0.250000,52.300000

```
Testing "select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52.110000
and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and acp_ts <
1507849200;" with 10 iterations and work_mem 2GB
```

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

```
set work_mem to '2GB';
```

SET

```
explain analyse select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52
.110000 and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and a
cp_ts < 1507849200;
```

QUERY PLAN

```
-----
Bitmap Heap Scan on siri_vm_4  (cost=318896.69..1242506.85 rows=156228 width=739) (act
ual time=4777.157..10623.799 rows=269210 loops=1)
```

```
  Recheck Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200) AND (acp_lng >= '-0.
1'::double precision) AND (acp_lng <= '0.25'::double precision))
```

```
  Filter: ((acp_lat >= '52.11'::double precision) AND (acp_lat <= '52.3'::double preci
sion))
```

```
    Rows Removed by Filter: 39518
```

```
    Heap Blocks: exact=86714
```

```
    -> BitmapAnd  (cost=318896.69..318896.69 rows=294036 width=0) (actual time=4718.670
..4718.670 rows=0 loops=1)
```

```
      -> Bitmap Index Scan on siri_vm_4_acp_ts  (cost=0.00..16227.22 rows=773865 wi
dth=0) (actual time=141.639..141.639 rows=792867 loops=1)
```

```
        Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))
```

```
      -> Bitmap Index Scan on siri_vm_4_acp_lng  (cost=0.00..302591.12 rows=1443105
5 width=0) (actual time=4547.026..4547.026 rows=14489334 loops=1)
```

```
        Index Cond: ((acp_lng >= '-0.1'::double precision) AND (acp_lng <= '0.25
'::double precision))
```

```
    Planning time: 120.608 ms
```

```
    Execution time: 10646.938 ms
```

```
(12 rows)
```

latency average: 4458.203 ms

latency stddev: 46.405 ms

Testing "select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200;" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200;

QUERY PLAN

Bitmap Heap Scan on siri_vm_4 (cost=17549.13..20629.26 rows=774 width=739) (actual time=451913.299..457150.274 rows=269210 loops=1)

Recheck Cond: (('0103000020E610000001000000050000009A9999999999B9BFAE47E17A140E4A409A9999999999B9BF666666666666264A40000000000000D03F666666666666264A40000000000000D03FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A40'::geometry ~ (location2d)::geometry) AND (acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Heap Blocks: exact=85220

-> BitmapAnd (cost=17549.13..17549.13 rows=774 width=0) (actual time=451869.175..451869.175 rows=0 loops=1)

-> Bitmap Index Scan on siri_vm_4_location2d_geom (cost=0.00..1321.28 rows=37981 width=0) (actual time=450979.187..450979.187 rows=12639959 loops=1)

Index Cond: ('0103000020E610000001000000050000009A9999999999B9BFAE47E17A140E4A409A9999999999B9BF666666666666264A40000000000000D03F666666666666264A40000000000000D03FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A40'::geometry ~ (location2d)::geometry)

-> Bitmap Index Scan on siri_vm_4_acp_ts (cost=0.00..16227.22 rows=773865 width=0) (actual time=139.712..139.712 rows=792867 loops=1)

Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Planning time: 711.998 ms

Execution time: 457193.185 ms

(10 rows)

latency average: 5090.329 ms

latency stddev: 38.051 ms

Big box, one day and acp_id

acp_id has its own column and index. This is the IJL 'indicative' query

```
Testing "select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52.110000
and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and acp_ts <
1507849200 and acp_id = 'WP-106';" with 10 iterations and work_mem 2GB
```

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

```
explain analyse select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52
.110000 and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and a
cp_ts < 1507849200 and acp_id = 'WP-106';
```

QUE

RY PLAN

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```

```
Bitmap Heap Scan on siri_vm_4 (cost=17533.85..21404.47 rows=196 width=739) (actual ti
me=225.526..5337.461 rows=2453 loops=1)
```

```
Recheck Cond: ((acp_id = 'WP-106'::bpchar) AND (acp_ts >= 1507762800) AND (acp_ts <
1507849200))
```

```
Filter: ((acp_lng >= '-0.1'::double precision) AND (acp_lat >= '52.11'::double preci
sion) AND (acp_lng <= '0.25'::double precision) AND (acp_lat <= '52.3'::double precisio
n))
```

Heap Blocks: exact=2449

```
-> BitmapAnd (cost=17533.85..17533.85 rows=972 width=0) (actual time=213.854..213.
854 rows=0 loops=1)
```

```
-> Bitmap Index Scan on siri_vm_4_acp_id (cost=0.00..1306.29 rows=47696 width=0) (actual time=56.375..56.375 rows=79114 loops=1)
```

Index Cond: (acp_id = 'WP-106'::bpchar)

```
-> Bitmap Index Scan on siri_vm_4_acp_ts (cost=0.00..16227.22 rows=773865 width=0) (actual time=143.234..143.234 rows=792867 loops=1)
```

Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Planning time: 129.162 ms

Execution time: 5339.071 ms

(11 rows)

latency average: 89.356 ms

latency stddev: 21.652 ms

Testing "select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200 and acp_id = 'WP-106';" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200 and acp_id = 'WP-106';

QUERY PLAN

Bitmap Heap Scan on siri_vm_4 (cost=2627.81..2820.41 rows=1 width=739) (actual time=596547.492..645834.677 rows=2453 loops=1)

Recheck Cond: ((acp_id = 'WP-106'::bpchar) AND ('0103000020E610000001000000050000009A9999999999B9BFAE47E17A140E4A409A9999999999B9BF666666666666264A40000000000000D03F666666666666264A40000000000000D03FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A40'::geometry ~ (location2d)::geometry))

Filter: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Rows Removed by Filter: 76661

Heap Blocks: exact=79033

-> BitmapAnd (cost=2627.81..2627.81 rows=48 width=0) (actual time=450440.814..450440.814 rows=0 loops=1)

-> Bitmap Index Scan on siri_vm_4_acp_id (cost=0.00..1306.29 rows=47696 width=0) (actual time=61.300..61.300 rows=79114 loops=1)

Index Cond: (acp_id = 'WP-106'::bpchar)

-> Bitmap Index Scan on siri_vm_4_location2d_geom (cost=0.00..1321.28 rows=37981 width=0) (actual time=450342.941..450342.941 rows=12639959 loops=1)

Index Cond: ('0103000020E610000001000000050000009A9999999999B9BFAE47E17A140E4A409A9999999999B9BF666666666666264A40000000000000D03F666666666666264A40000000000000D03FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A40'::geometry ~ (location2d)::geometry)

Planning time: 711.663 ms

Execution time: 645848.581 ms

(12 rows)

latency average: 4433.860 ms

latency stddev: 46.064 ms

Big box, one day and "VehicleRef" in place of acp_id

Try using info @> '{"VehicleRef": "WP-107"}' instead

Testing "select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52.110000 and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}';" with 10 iterations and work_mem 2 GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52.110000 and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}';

QUE

RY PLAN

Bitmap Heap Scan on siri_vm_4 (cost=16616.40..19702.34 rows=156 width=739) (actual time=763.236..6066.737 rows=2453 loops=1)

Recheck Cond: ((info @> '{"VehicleRef": "WP-106"}'::jsonb) AND (acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Filter: ((acp_lng >= '-0.1'::double precision) AND (acp_lat >= '52.11'::double precision) AND (acp_lng <= '0.25'::double precision) AND (acp_lat <= '52.3'::double precision))

Heap Blocks: exact=2449

-> BitmapAnd (cost=16616.40..16616.40 rows=774 width=0) (actual time=717.813..717.813 rows=0 loops=1)

-> Bitmap Index Scan on siri_vm_4_info (cost=0.00..388.85 rows=37981 width=0) (actual time=563.689..563.689 rows=79114 loops=1)

Index Cond: (info @> '{"VehicleRef": "WP-106"}'::jsonb)

-> Bitmap Index Scan on siri_vm_4_acp_ts (cost=0.00..16227.22 rows=773865 width=0) (actual time=140.281..140.281 rows=792867 loops=1)

Index Cond: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))

Planning time: 135.939 ms

Execution time: 6068.402 ms

(11 rows)

latency average: 210.395 ms

latency stddev: 10.877 ms

Testing "select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}';" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

```
explain analyse select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0
.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts <
1507849200 and info @> '{"VehicleRef" : "WP-106"}';
```

QUERY PLAN

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Bitmap Heap Scan on siri_vm_4  (cost=1710.38..1862.90 rows=1 width=739) (actual time=5
97105.815..646259.654 rows=2453 loops=1)
    Recheck Cond: ((info @> '{"VehicleRef": "WP-106"}'::jsonb) AND ('0103000020E61000000
10000000500000009A9999999999B9BFAE47E17A140E4A409A9999999999B9BF66666666666264A4000000000
0000D03F666666666666264A40000000000000D03FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A4
0'::geometry ~ (location2d)::geometry))
    Filter: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200))
    Rows Removed by Filter: 76661
    Heap Blocks: exact=79033
    -> BitmapAnd  (cost=1710.38..1710.38 rows=38 width=0) (actual time=450974.448..4509
74.448 rows=0 loops=1)
        -> Bitmap Index Scan on siri_vm_4_info  (cost=0.00..388.85 rows=37981 width=0
) (actual time=572.376..572.376 rows=79114 loops=1)
            Index Cond: (info @> '{"VehicleRef": "WP-106"}'::jsonb)
        -> Bitmap Index Scan on siri_vm_4_location2d_geom  (cost=0.00..1321.28 rows=3
7981 width=0) (actual time=450365.150..450365.150 rows=12639959 loops=1)
            Index Cond: ('0103000020E6100000010000000500000009A9999999999B9BFAE47E17A
140E4A409A9999999999B9BF66666666666264A4000000000000D03F666666666666264A4000000000000D03
FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A40'::geometry ~ (location2d)::geometry)
    Planning time: 750.785 ms
    Execution time: 646269.619 ms
(12 rows)
```

latency average: 4619.271 ms

latency stddev: 57.872 ms

Big box, one day, "VehicleRef" and "LineRef"

Testing "select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52.110000 and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}' and info @> '{"LineRef": "U"}';" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where acp_lng >= -0.100000 and acp_lat >= 52.110000 and acp_lng <= 0.250000 and acp_lat <= 52.300000 and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}' and info @> '{"LineRef": "U"}';

QUERY PLAN

```
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Bitmap Heap Scan on siri_vm_4  (cost=100.38..253.18 rows=1 width=739) (actual time=149
173.918..198136.064 rows=2453 loops=1)
  Recheck Cond: ((info @> '{"VehicleRef": "WP-106"}'::jsonb) AND (info @> '{"LineRef":
"U"}'::jsonb))
  Filter: ((acp_lng >= '-0.1'::double precision) AND (acp_lat >= '52.11'::double preci
sion) AND (acp_lng <= '0.25'::double precision) AND (acp_lat <= '52.3'::double precisio
n) AND (acp_ts >= 1507762800) AND (acp_ts < 1507849200))
  Rows Removed by Filter: 76661
  Heap Blocks: exact=79033
-> Bitmap Index Scan on siri_vm_4_info  (cost=0.00..100.38 rows=38 width=0) (actual
time=1250.494..1250.494 rows=79114 loops=1)
  Index Cond: ((info @> '{"VehicleRef": "WP-106"}'::jsonb) AND (info @> '{"LineR
ef": "U"}'::jsonb))
Planning time: 135.903 ms
Execution time: 198137.830 ms
(9 rows)
```

latency average: 545.761 ms

latency stddev: 30.189 ms

Testing "select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}' and info @> '{"LineRef": "U"}';" with 10 iterations and work_mem 2GB

Flushing buffers

Restarting Postgres

Timing is on.

Timing is off.

Pager usage is off.

set work_mem to '2GB';

SET

explain analyse select info from siri_vm_4 where (ST_MakeEnvelope(-0.100000,52.110000,0.250000,52.300000, 4326) ~ location2d::geometry) and acp_ts >= 1507762800 and acp_ts < 1507849200 and info @> '{"VehicleRef" : "WP-106"}' and info @> '{"LineRef": "U"}';

QUERY PLAN

Bitmap Heap Scan on siri_vm_4 (cost=100.38..252.99 rows=1 width=739) (actual time=148565.718..197711.300 rows=2453 loops=1)

Recheck Cond: ((info @> '{"VehicleRef": "WP-106"}'::jsonb) AND (info @> '{"LineRef": "U"}'::jsonb))

Filter: ((acp_ts >= 1507762800) AND (acp_ts < 1507849200) AND ('0103000020E610000001000000050000009A9999999999B9BFAE47E17A140E4A409A9999999999B9BF66666666666264A400000000000000D03F66666666666264A400000000000000D03FAE47E17A140E4A409A9999999999B9BFAE47E17A140E4A40'::geometry ~ (location2d)::geometry))

Rows Removed by Filter: 76661

Heap Blocks: exact=79033

-> Bitmap Index Scan on siri_vm_4_info (cost=0.00..100.38 rows=38 width=0) (actual time=1297.056..1297.056 rows=79114 loops=1)

Index Cond: ((info @> '{"VehicleRef": "WP-106"}'::jsonb) AND (info @> '{"LineRef": "U"}'::jsonb))

Planning time: 725.853 ms

Execution time: 197712.987 ms

(9 rows)

latency average: 539.551 ms

latency stddev: 37.996 ms