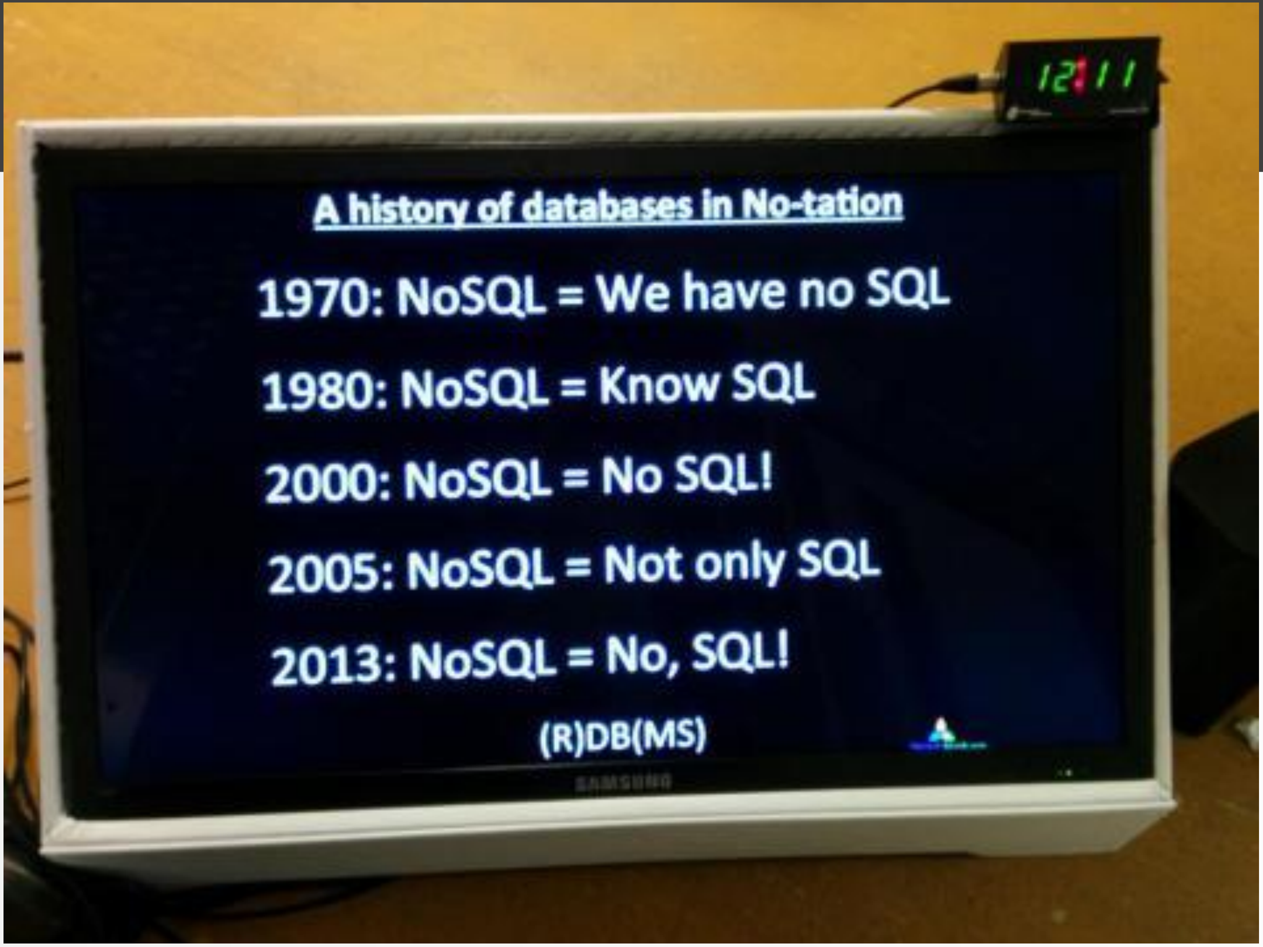
SQL, the underestimated "Big Data" technology

No – tation



A history of databases in No-tation

1970: NoSQL = We have no SQL

1980: NoSQL = Know SQL

2000: NoSQL = No SQL!

2005: NoSQL = Not only SQL

2013: NoSQL = No, SQL!

(R)DB(MS)

12:11
SAMSUNG

Seen at the 2013 O'Reilly Strata Conf:
History of NoSQL by Mark Madsen. Picture published by Edd Dumbill

NoSQL?

NoSQL?

No, SQL!

Our vision at Data Geekery

- SQL dominates database systems
- SQL is very expressive
- SQL is very type safe

“SQL is a device whose mystery is only exceeded by its power!”

Me – @lukaseder

- Head of R&D at Data Geekery GmbH
- SQL Aficionado
- Java Aficionado

“Java developers can get back in control of SQL with jOOQ”

Big Data? NoSQL?

- You're giving up on **ACID**
- You're giving up on **type safety**
- You're giving up on **standards**
- You're giving up on **tooling**
- You're giving up on **relational algebra**
- You haven't asked operations
- You don't actually have «Big Data»

Big Data? NoSQL?

- You're giving up on **ACID**
- You're giving up on **type safety**
- You're giving up on **standards**
- You're giving up on **tooling**
- You're giving up on **relational algebra**
- You haven't asked operations
- You don't actually have «Big Data»

Also Not SQL

```
@Entity @Table(name = "EVENTS")
public class Event {
  private Long id;
  private String title;
  private Date date;

  @Id @GeneratedValue(generator = "increment")
  @GenericGenerator(name = "increment", strategy = "increment")
  public Long getId() { /* … */ }

  @Temporal(TemporalType.TIMESTAMP)
  @Column(name = "EVENT_DATE")
  public Date getDate() { /* … */ }
```

Also Not SQL – Annotatiomania™

```
@OneToMany(mappedBy = "destCustomerId")
@ManyToMany
@Fetch(FetchMode.SUBSELECT)
@JoinTable(
    name = "customer_dealer_map",
    joinColumns = {
        @JoinColumn(name = "customer_id", referencedColumnName = "id")
    },
    inverseJoinColumns = {
        @JoinColumn(name = "dealer_id", referencedColumnName = "id")
    }
)
private Collection dealers;
```

Found at http://stackoverflow.com/q/17491912/521799

Also Not SQL – JPA 3.0 Preview

```
@OneToMany @OneToManyMore @AnyOne @AnyBody
@ManyToMany @Many
@Fetch @FetchMany @FetchWithDiscriminator(name = "no_name")
@JoinTable(joinColumns = {
    @JoinColumn(name = "customer_id", referencedColumnName = "id")
})
@PrefetchJoinWithDiscriminator
@IfJoiningAvoidHashJoins @ButUseHashJoinsWhenMoreThan(records = 1000)
@XmlDataTransformable @SpringPrefechAdapter
private Collection employees;
```

Might not be true

Shocker! You can now write SQL in Java.

TM

JDBC

MyBatis

Groovy

spring

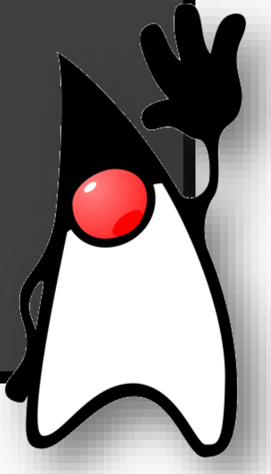
Apache Commons™
http://commons.apache.org/

commons
dbutils™

SQL in Java 7 – JDBC

```
try (PreparedStatement stmt = c.prepareStatement(sql);
     ResultSet rs          = stmt.executeQuery()) {

    while (rs.next()) {
        System.out.println(
            new Schema(rs.getString("SCHEMA_NAME"),
                       rs.getBoolean("IS_DEFAULT"))
        );
    }
}
```



SQL in Java 8 – jOOQ

```
DSL.using(c)
   .fetch(sql)
   .map(rs -> new Schema(
       rs.getValue("SCHEMA_NAME", String.class),
       rs.getValue("IS_DEFAULT", boolean.class)
   ))
   .forEach(System.out::println);
```

Typesafe SQL in Java – jOOQ

```
DSL.using(c)
   .select(s.SCHEMA_NAME, s.IS_DEFAULT)
   .from(INFORMATION_SCHEMA.SCHEMATA.as("s"))
   .orderBy(s.SCHEMA_NAME)
   .map(rs -> new Schema(
        rs.getValue(s.SCHEMA_NAME),
        rs.getValue(s.IS_DEFAULT)
   ))
   .forEach(System.out::println);
```

SQL in Java 8 – Spring JDBC

```
new JdbcTemplate(
        new SingleConnectionDataSource(c, true))
    .query(sql, (rs, rowNum) ->
        new Schema(
            rs.getString("SCHEMA_NAME"),
            rs.getBoolean("IS_DEFAULT")
        ))
    .forEach(System.out::println);
```

SQL in Java 8 – Apache DbUtils

```
new QueryRunner()
    .query(c, sql, new ArrayListHandler())
    .stream()
    .map(array -> new Schema(
        (String) array[0],
        (Boolean) array[1]
    ))
    .forEach(System.out::println);
```

SQL in Groovy

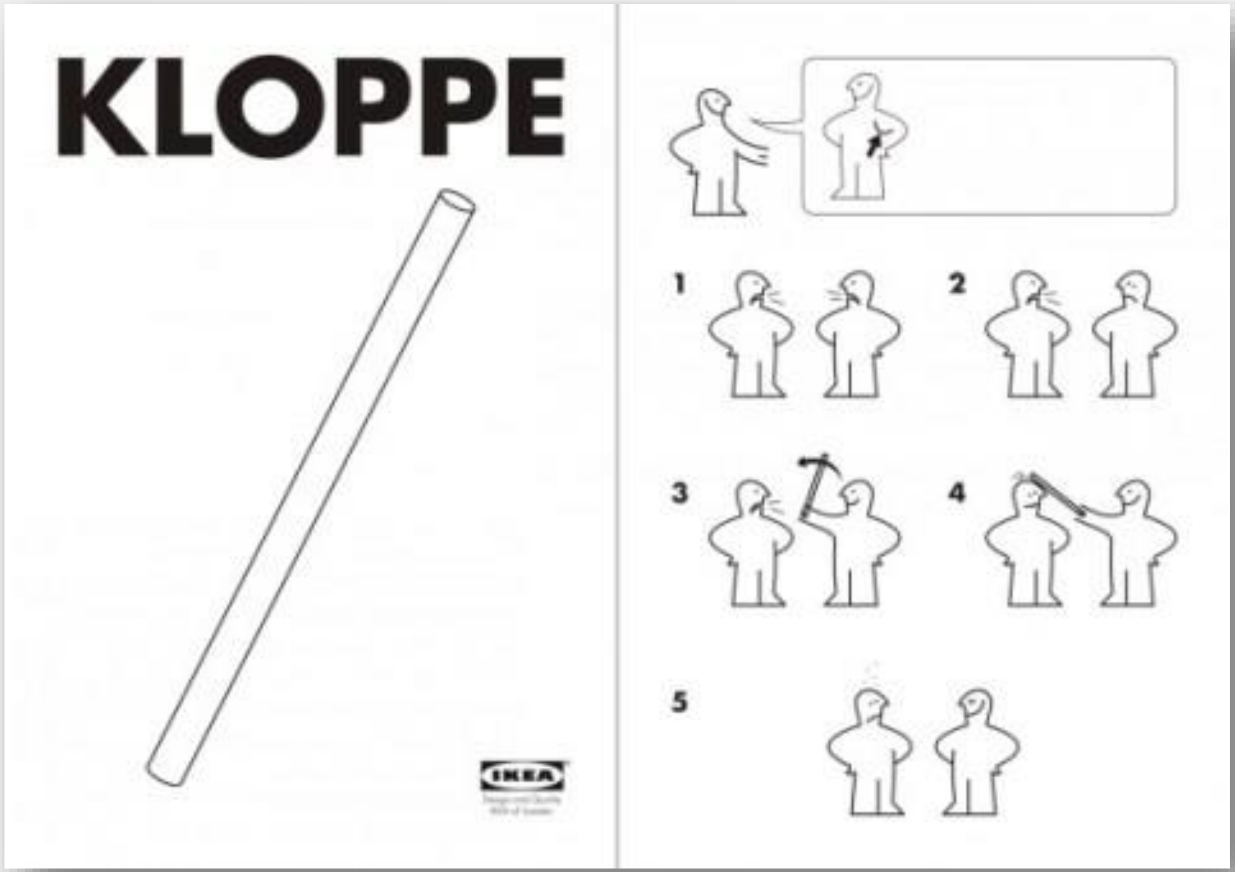
```
sql.eachRow( 'select * from tableName' ) {
    println "$it.id -- ${it.firstName} --"
}
```

When you should use SQL – indicators

- You need JOINs, UNIONs
- You need functions, aggregations
- You need bulk reads / writes

“Calculations should be done close to the data”

Please, run that calculation in your DB



SQL Trivia – NULL

```
-- What does this query return?
SELECT 1 AS a FROM dual
WHERE 1 IN (NULL)
UNION ALL
SELECT 2 AS a FROM dual
WHERE NOT(1 IN (NULL))
```

SQL Trivia – NULL

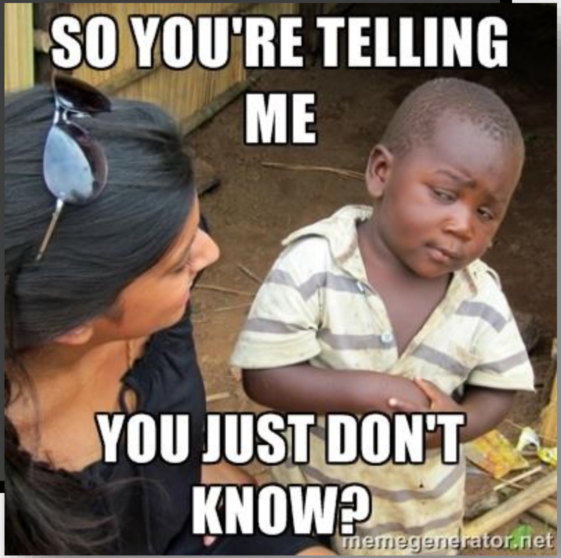
```sql
-- What does this query return?
SELECT 1 AS a FROM dual
WHERE 1 IN (NULL)
UNION ALL
SELECT 2 AS a FROM dual
WHERE NOT(1 IN (NULL))
```

SQL Trivia – NULL

```
-- Nothing! It's the same as this
SELECT 1 AS a FROM dual
WHERE  1 = NULL
UNION ALL
SELECT 2 AS a FROM dual
WHERE  1 != NULL
```

SQL Trivia – NULL

```
-- Nothing! It’s the same as this
SELECT 1 AS a FROM dual
WHERE “UNKNOWN”
UNION ALL
SELECT 2 AS a FROM dual
WHERE “UNKNOWN”
```



SQL Trivia – Oracle VARCHAR2

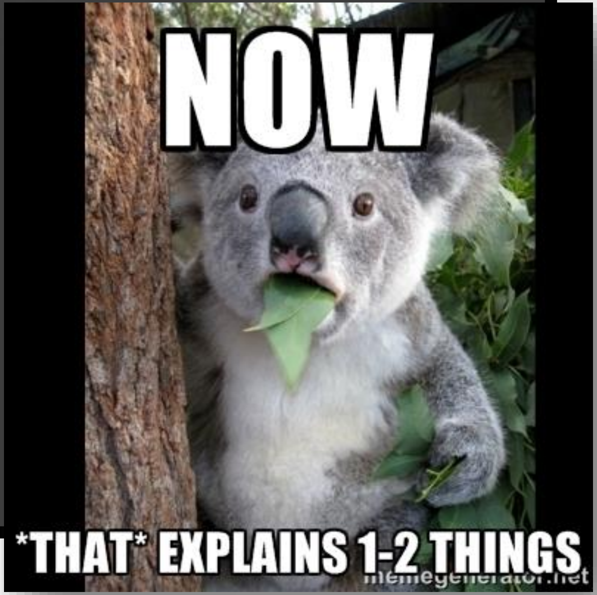
```
-- What does this query return?
SELECT 1 AS a FROM dual
WHERE '' = ''
UNION ALL
SELECT 2 AS a FROM dual
WHERE 'a' != ''
```

SQL Trivia – Oracle VARCHAR2

```
-- Nope! Nothing again (only in Oracle).
SELECT 1 AS a FROM dual
WHERE NULL = NULL
UNION ALL
SELECT 2 AS a FROM dual
WHERE 'a' != NULL
```

SQL Trivia – Oracle VARCHAR2

```
-- Nope! Nothing again (only in Oracle).
SELECT 1 AS a FROM dual
WHERE NULL = NULL
UNION ALL
SELECT 2 AS a FROM dual
WHERE 'a' != NULL
```



Stockholm Syndrome:

“We love ~~JavaScript~~ SQL”

Winston Churchill:

“SQL is the worst form of database querying, except for all the other forms.”

Let’s calculate a running total

```
SELECT   *
FROM     v_transactions
WHERE    account_id = 1
ORDER BY value_date DESC,
         id         DESC
```

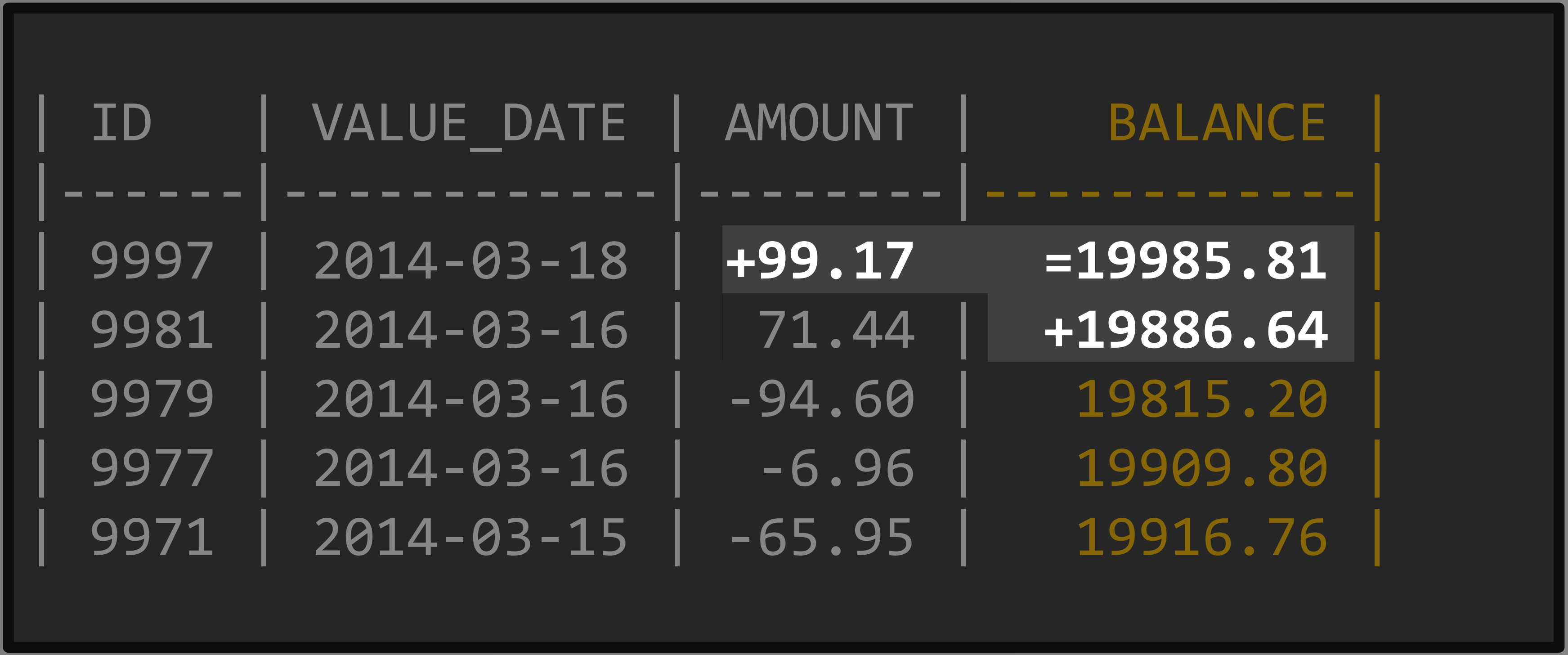
Let’s calculate a running total

```
| ID   | VALUE_DATE | AMOUNT |
|------|------------|--------|
| 9997 | 2014-03-18 |  99.17 |
| 9981 | 2014-03-16 |  71.44 |
| 9979 | 2014-03-16 | -94.60 |
| 9977 | 2014-03-16 |  -6.96 |
| 9971 | 2014-03-15 | -65.95 |
```

Let’s calculate a running total

```
| ID   | VALUE_DATE | AMOUNT |    BALANCE |
|------|------------|--------|------------|
| 9997 | 2014-03-18 |  99.17 |   19985.81 |
| 9981 | 2014-03-16 |  71.44 |   19886.64 |
| 9979 | 2014-03-16 | -94.60 |   19815.20 |
| 9977 | 2014-03-16 |  -6.96 |   19909.80 |
| 9971 | 2014-03-15 | -65.95 |   19916.76 |
```

Let’s calculate a running total



```
| ID    | VALUE_DATE   | AMOUNT   |      BALANCE |
|------|-------------|---------|-------------|
| 9997 | 2014-03-18  | +99.17       =19985.81 |
| 9981 | 2014-03-16  |  71.44  |   +19886.64 |
| 9979 | 2014-03-16  | -94.60  |    19815.20 |
| 9977 | 2014-03-16  |  -6.96  |    19909.80 |
| 9971 | 2014-03-15  | -65.95  |    19916.76 |
```

Let’s calculate a running total

```
| ID     | VALUE_DATE   | AMOUNT   |      BALANCE |
|------|------------|---------|------------|
| 9997 | 2014-03-18 |    99.17 |     19985.81 |
| 9981 | 2014-03-16 |   +71.44       =19886.64 |
| 9979 | 2014-03-16 |   -94.60 |    +19815.20 |
| 9977 | 2014-03-16 |    -6.96 |     19909.80 |
| 9971 | 2014-03-15 |   -65.95 |     19916.76 |
```

Let's calculate a running total

```
| ID   | VALUE_DATE | AMOUNT |    BALANCE |
|------|------------|--------|------------|
| 9997 | 2014-03-18 |  99.17 |   19985.81 |
| 9981 | 2014-03-16 | +71.44    =19886.64 | n
| 9979 | 2014-03-16 | -94.60 |  +19815.20 | n+1
| 9977 | 2014-03-16 |  -6.96 |   19909.80 |
```

$$\text{BALANCE}(\text{ROW}_n) = \text{BALANCE}(\text{ROW}_{n+1}) + \text{AMOUNT}(\text{ROW}_n)$$

$$\text{BALANCE}(\text{ROW}_{n+1}) = \text{BALANCE}(\text{ROW}_n) - \text{AMOUNT}(\text{ROW}_n)$$

“How can we do it?”

How can we do it?

- In Java
- Calculate on UPDATE
- Nested SELECT
- Recursive SQL
- Window functions
- MODEL clause (Oracle)
- Stored procedures

How can we do it? – With SQL!

- ~~In Java~~
- ~~Calculate on UPDATE~~
- Nested SELECT
- Recursive SQL
- Window functions
- MODEL clause (Oracle)
- ~~Stored procedures~~

“Using nested SELECTs”

Ex 1

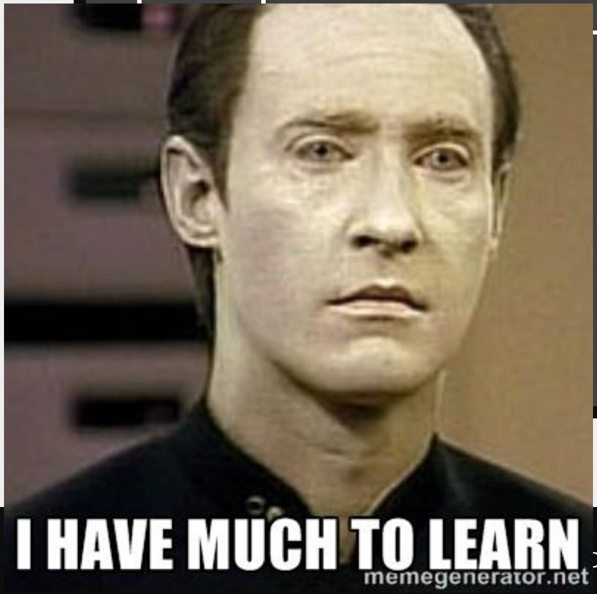
```
SELECT
  t1.*,
  t1.current_balance - (
    SELECT NVL(SUM(amount), 0)
    FROM   v_transactions t2
    WHERE  t2.account_id = t1.account_id
    AND   (t2.value_date, t2.id) >
          (t1.value_date, t1.id)
  ) AS balance
FROM     v_transactions t1
WHERE    t1.account_id = 1
ORDER BY t1.value_date DESC, t1.id DESC
```

```
SELECT
  t1.*,
  t1.current_balance - (
    SELECT NVL(SUM(amount), 0)
    FROM   v_transactions t2
    WHERE  t2.account_id = t1.account_id
    AND    (t2.value_date, t2.id) >
           (t1.value_date, t1.id)
  ) AS balance
FROM     v_transactions t1
WHERE    t1.account_id = 1
ORDER BY t1.value_date DESC, t1.id DESC
```

```
SELECT
  t1.*,
  t1.current_balance - (
    SELECT NVL(SUM(amount), 0)
    FROM   v_transactions t2
    WHERE  t2.account_id = t1.account_id
    AND    ((t2.value_date > t1.value_date) OR
            (t2.value_date = t1.value_date AND
             t2.id         > t1.id))
  ) AS balance
FROM     v_transactions t1
WHERE    t1.account_id = 1 ORDER BY ...
```

Using nested SELECTs

```
| ID   | VALUE_DATE | AMOUNT    |      BALANCE |
|------|------------|-----------|--------------|
| 9997 | 2014-03-18  -(99.17)|     +19985.81 |
| 9981 | 2014-03-16  -(71.44)|      19886.64 |
| 9979 | 2014-03-16 -(-94.60)|      19815.20 |
| 9977 | 2014-03-16 |   -6.96 |     =19909.80 |
| 9971 | 2014-03-15 |  -65.95 |      19916.76 |
| Id  | Operation                      | Name             | A-Rows |   A-Time    |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT               |                  |     50 |00:00:00.77 |
|   1 |  SORT AGGREGATE                |                  |   1101 |00:00:00.76 |
|*  2 |   TABLE ACCESS BY INDEX ROWID  | T_TRANSACTIONS   |   605K |00:00:00.69 |
|*  3 |    INDEX RANGE SCAN            | I_TRX_ACCO_ID    |  1212K |00:00:00.21 |
|   4 |  SORT ORDER BY                 |                  |     50 |00:00:00.77 |
|   5 |   NESTED LOOPS                 |                  |   1101 |00:00:00.01 |
|   6 |    TABLE ACCESS BY INDEX ROWID | T_ACCOUNTS       |      1 |00:00:00.01 |
|*  7 |     INDEX UNIQUE SCAN          | SYS_C006991      |      1 |00:00:00.01 |
|   8 |    TABLE ACCESS BY INDEX ROWID | T_TRANSACTIONS   |   1101 |00:00:00.01 |
|*  9 |     INDEX RANGE SCAN           | I_TRX_ACCO_ID    |   1101 |00:00:00.01 |
-------------------------------------------------------------------------------
```



“Using recursive SQL”

We need to number transactions

```
| ID   | VALUE_DATE | AMOUNT | TRANSACTION_NR |
|------|------------|--------|----------------|
| 9997 | 2014-03-18 |  99.17 |              1 |
| 9981 | 2014-03-16 |  71.44 |              2 |
| 9979 | 2014-03-16 | -94.60 |              3 |
| 9977 | 2014-03-16 |  -6.96 |              4 |
| 9971 | 2014-03-15 | -65.95 |              5 |
CREATE OR REPLACE VIEW v_transactions_by_time
AS
SELECT
  t.*,
  ROW_NUMBER() OVER (
    PARTITION BY account_id
    ORDER BY     t.value_date DESC,
                 t.id DESC
  ) AS transaction_number
FROM
  v_transactions t;
```

Ex 2

```
WITH ordered_with_balance (
  account_id, value_date, amount, balance, transaction_number
)
AS (
  SELECT t1.account_id, t1.value_date, t1.amount, t1.current_balance,
         t1.transaction_number
  FROM   v_transactions_by_time t1
  WHERE  t1.transaction_number = 1

  UNION ALL

  SELECT t1.account_id, t1.value_date, t1.amount, t2.balance - t2.amount,
         t1.transaction_number
  FROM   ordered_with_balance t2
  JOIN   v_transactions_by_time t1
  ON     t1.transaction_number = t2.transaction_number + 1
  AND    t1.account_id = t2.account_id
)
SELECT *
FROM     ordered_with_balance
WHERE    account_id = 1
ORDER BY transaction_number ASC
```

```
WITH ordered_with_balance (
  account_id, value_date, amount, balance, transaction_number
)
AS (
  SELECT t1.account_id, t1.value_date, t1.amount, t1.current_balance,
         t1.transaction_number
  FROM   v_transactions_by_time t1
  WHERE  t1.transaction_number = 1

  UNION ALL

  SELECT t1.account_id, t1.value_date, t1.amount, t2.balance - t2.amount,
         t1.transaction_number
  FROM   ordered_with_balance t2
  JOIN   v_transactions_by_time t1
  ON     t1.transaction_number = t2.transaction_number + 1
  AND    t1.account_id = t2.account_id
)
SELECT *
FROM     ordered_with_balance
WHERE    account_id = 1
ORDER BY transaction_number ASC
```

```
WITH ordered_with_balance (
  account_id, value_date, amount, balance, transaction_number
)
AS (
  SELECT t1.account_id, t1.value_date, t1.amount, t1.current_balance,
         t1.transaction_number
  FROM   v_transactions_by_time t1
  WHERE  t1.transaction_number = 1

  UNION ALL

  SELECT t1.account_id, t1.value_date, t1.amount, t2.balance - t2.amount,
         t1.transaction_number
  FROM   ordered_with_balance t2
  JOIN   v_transactions_by_time t1
  ON     t1.transaction_number = t2.transaction_number + 1
  AND    t1.account_id = t2.account_id
)
SELECT *
FROM     ordered_with_balance
WHERE    account_id = 1
ORDER BY transaction_number ASC
```

NoSQL? No, SQL!

```
-------------------------------------------------------------------------------------------------
| Id  | Operation                                    | Name                   | A-Rows |   A-Time    |
-------------------------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                             |                        |     50 |00:00:35.29 |
|   1 |  SORT ORDER BY                               |                        |     50 |00:00:35.29 |
|*  2 |   VIEW                                       |                        |   1101 |00:00:35.29 |
|   3 |    UNION ALL (RECURSIVE WITH) BREADTH FIRST|                        |   9999 |00:00:35.28 |
|*  4 |     VIEW                                     | V_TRANSACTIONS_BY_TIME |      9 |00:00:00.03 |
|*  5 |      WINDOW SORT PUSHED RANK                 |                        |     18 |00:00:00.03 |
|   6 |       NESTED LOOPS                           |                        |   9999 |00:00:00.01 |
|   7 |        NESTED LOOPS                          |                        |   9999 |00:00:00.01 |
|   8 |         TABLE ACCESS FULL                    | T_ACCOUNTS             |     10 |00:00:00.01 |
|*  9 |         INDEX RANGE SCAN                     | I_TRX_ACCO_ID          |   9999 |00:00:00.01 |
|  10 |        TABLE ACCESS BY INDEX ROWID           | T_TRANSACTIONS         |   9999 |00:00:00.01 |
|* 11 |     HASH JOIN                                |                        |   9990 |00:00:35.08 |
|  12 |      VIEW                                    | V_TRANSACTIONS_BY_TIME |     11M|00:00:29.13 |
|  13 |       WINDOW SORT                            |                        |     11M|00:00:27.19 |
|  14 |        NESTED LOOPS                          |                        |     11M|00:00:13.62 |
|  15 |         NESTED LOOPS                         |                        |     11M|00:00:03.89 |
|  16 |          INDEX FAST FULL SCAN                | SYS_C006991            |  11450 |00:00:00.06 |
|* 17 |          INDEX RANGE SCAN                    | I_TRX_ACCO_ID          |     11M|00:00:02.18 |
|  18 |         TABLE ACCESS BY INDEX ROWID          | T_TRANSACTIONS         |     11M|00:00:06.15 |
                                       PUMP          |                        |   9999 |00:00:00.01 |
                                    ----------------------------------------------------------------
```

“Using window functions”

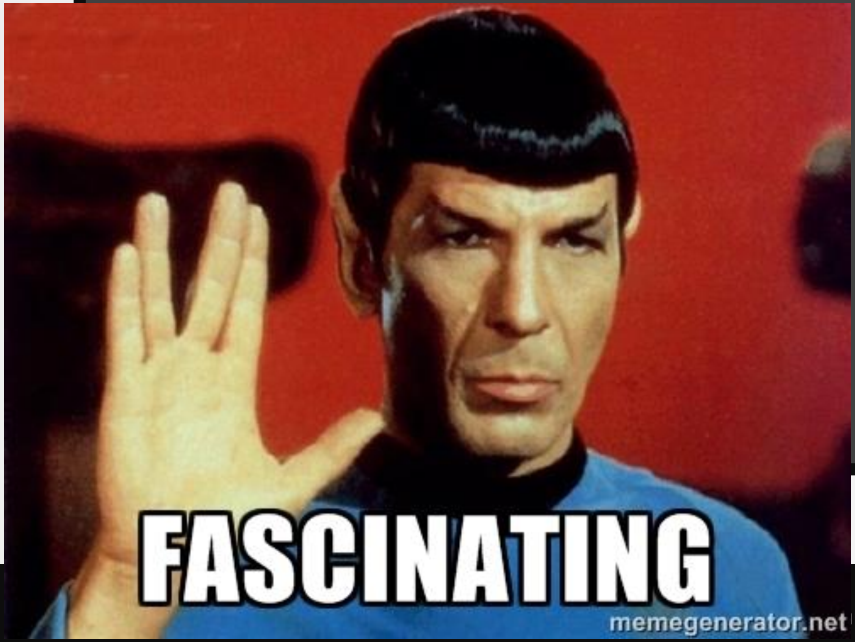
Ex 3

```
SELECT
  t.*,
  t.current_balance - NVL(
    SUM(t.amount) OVER (
      PARTITION BY t.account_id
      ORDER BY     t.value_date DESC,
                   t.id         DESC
      ROWS BETWEEN UNBOUNDED PRECEDING
           AND     1         PRECEDING
    ),
  0) AS balance
FROM     v_transactions t
WHERE    t.account_id = 1
ORDER BY t.value_date DESC,
         t.id         DESC
```

```
SELECT
  t.*,
  t.current_balance - NVL(
    SUM(t.amount) OVER (
      PARTITION BY t.account_id
      ORDER BY     t.value_date DESC,
                   t.id         DESC
      ROWS BETWEEN UNBOUNDED PRECEDING
           AND     1         PRECEDING
    ),
  0) AS balance
FROM     v_transactions t
WHERE    t.account_id = 1
ORDER BY t.value_date DESC,
         t.id         DESC
```

Using window functions

```
| ID   | VALUE_DATE | AMOUNT    |     BALANCE |
|------|------------|-----------|-------------|
| 9997 | 2014-03-18  -(99.17)|   +19985.81 |
| 9981 | 2014-03-16  -(71.44)|    19886.64 |
| 9979 | 2014-03-16 -(-94.60)|    19815.20 |
| 9977 | 2014-03-16 |    -6.96 |   =19909.80 |
| 9971 | 2014-03-15 |   -65.95 |    19916.76 |
------------------------------------------------------------------------------
| Id  | Operation                      | Name             | A-Rows |   A-Time    |
------------------------------------------------------------------------------
|   0 | SELECT STATEMENT               |                  |     50 |00:00:00.01 |
|   1 |  WINDOW SORT                   |                  |     50 |00:00:00.01 |
|   2 |   NESTED LOOPS                 |                  |   1101 |00:00:00.01 |
|   3 |    TABLE ACCESS BY INDEX ROWID| T_ACCOUNTS       |      1 |00:00:00.01 |
|*  4 |     INDEX UNIQUE SCAN          | SYS_C006991      |      1 |00:00:00.01 |
|   5 |    TABLE ACCESS BY INDEX ROWID| T_TRANSACTIONS   |   1101 |00:00:00.01 |
|*  6 |     INDEX RANGE SCAN           | I_TRX_ACCO_ID    |   1101 |00:00:00.01 |
------------------------------------------------------------------------------
```



“Using the Oracle MODEL clause”

Ex 4

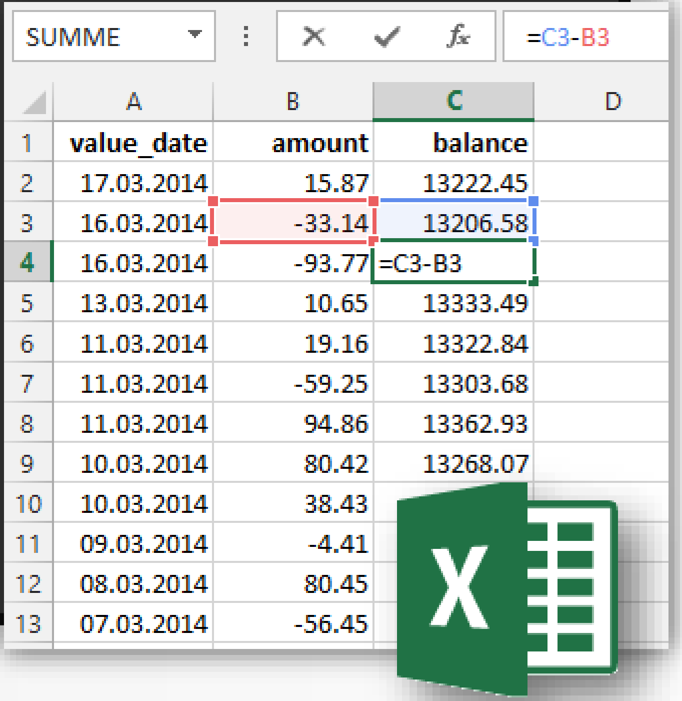
```
SELECT account_id, value_date, amount, balance
FROM (
  SELECT id, account_id, value_date, amount,
         current_balance AS balance
  FROM   v_transactions
) t
WHERE account_id = 1
MODEL
  PARTITION BY (account_id)
  DIMENSION BY (
    ROW_NUMBER() OVER (ORDER BY value_date DESC, id DESC) AS rn
  )
  MEASURES (value_date, amount, balance)
  RULES (
    balance[rn > 1] = balance[cv(rn) - 1] - amount[cv(rn) - 1]
  )
ORDER BY rn ASC
```

```
SELECT account_id, value_date, amount, balance
FROM (
  SELECT id, account_id, value_date, amount,
         current_balance AS balance
  FROM   v_transactions
) t
WHERE account_id = 1
MODEL
  PARTITION BY (account_id)
  DIMENSION BY (
    ROW_NUMBER() OVER (ORDER BY value_date DESC, id DESC) AS rn
  )
  MEASURES (value_date, amount, balance)
  RULES (
    balance[rn > 1] = balance[cv(rn) - 1] - amount[cv(rn) - 1]
  )
ORDER BY rn ASC
```

```
RULES (
   balance[rn > 1] = balance[cv(rn) - 1]
                   - amount [cv(rn) - 1]
)



-- does it look familiar?
```



SUMMME =C3-B3

	A	B	C	D
1	value_date	amount	balance	
2	17.03.2014	15.87	13222.45	
3	16.03.2014	-33.14	13206.58	
4	16.03.2014	-93.77	=C3-B3	
5	13.03.2014	10.65	13333.49	
6	11.03.2014	19.16	13322.84	
7	11.03.2014	-59.25	13303.68	
8	11.03.2014	94.86	13362.93	
9	10.03.2014	80.42	13268.07	
10	10.03.2014	38.43		
11	09.03.2014	-4.41		
12	08.03.2014	80.45		
13	07.03.2014	-56.45		

NoSQL? No, SQL!

```
-------------------------------------------------------------------------------
| Id  | Operation                         | Name            | A-Rows |   A-Time    |
-------------------------------------------------------------------------------
|   0 | SELECT STATEMENT                  |                 |     50 |00:00:00.02 |
|   1 |  SORT ORDER BY                    |                 |     50 |00:00:00.02 |
|   2 |   SQL MODEL ORDERED               |                 |   1101 |00:00:00.02 |
|   3 |    WINDOW SORT                    |                 |   1101 |00:00:00.01 |
|   4 |     NESTED LOOPS                  |                 |   1101 |00:00:00.01 |
|   5 |      TABLE ACCESS BY INDEX ROWID| T_ACCOUNTS      |      1 |00:00:00.01 |
|*  6 |       INDEX UNIQUE SCAN           | SYS_C006991     |      1 |00:00:00.01 |
|*  7 |      TABLE ACCESS FULL            | T_TRANSACTIONS  |   1101 |00:00:00.01 |
-------------------------------------------------------------------------------
```

“The MODEL clause is Oracle’s most powerful and underused feature”

Our vision at Data Geekery - Revisited

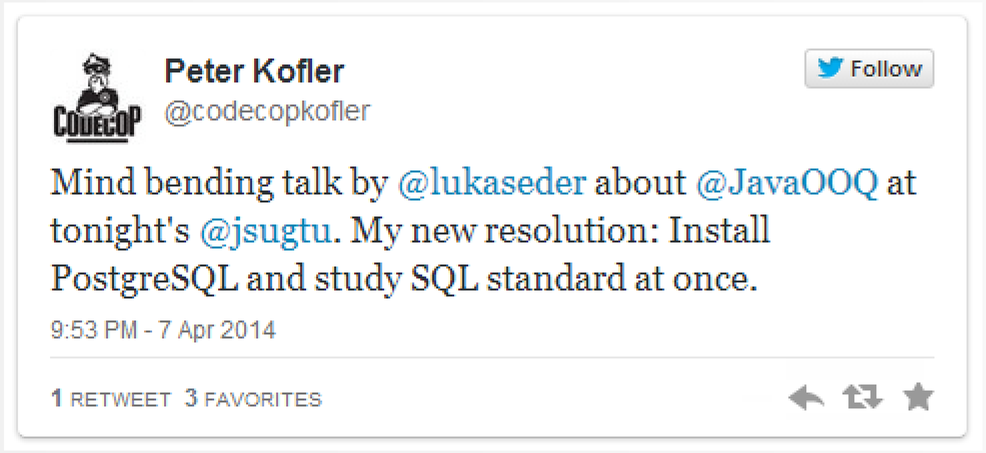
- SQL dominates database systems
- SQL is expressive
- SQL is type safe

“ SQL is a device whose mystery is only exceeded by its power! ”

Our vision at Data Geekery - Revisited

- SQL dominates database systems
- SQL is expressive
- SQL is type safe

“



Peter Kofler
@codecopkofler

Mind bending talk by @lukaseder about @JavaOOQ at tonight's @jsugtu. My new resolution: Install PostgreSQL and study SQL standard at once.

9:53 PM - 7 Apr 2014

1 RETWEET 3 FAVORITES

”

Our vision at Data Geekery - Revisited

“jOOQ is the best way to write SQL in Java”

```
SELECT
  t.*,
  t.current_balance - NVL(
    SUM(t.amount) OVER (
      PARTITION BY t.account_id
      ORDER BY     t.value_date DESC,
                   t.id         DESC
      ROWS BETWEEN UNBOUNDED PRECEDING
           AND     1         PRECEDING
    ),
  0) AS balance
FROM     v_transactions t
WHERE    t.account_id = 1
ORDER BY t.value_date DESC,
         t.id         DESC
```

```
DSL.using(connection)
   .select(t.VALUE_DATE,
           t.AMOUNT,
           t.CURRENT_BALANCE.sub(
             sum(t.AMOUNT).over(
                partitionBy(t.ACCOUNT_ID)
               .orderBy    (t.VALUE_DATE.desc(),
                            t.ID        .desc())
               .rowsBetweenUnboundedPreceding()
               .andPreceding(1)
             )
           ).nvl(0).as("balance"))
   .from   (V_TRANSACTIONS.as("t"))
   .where  (t.ACCOUNT_ID.eq(1))
   .orderBy(t.VALUE_DATE.desc(),
            t.ID        .desc())
```

Thank you

3-month jOOQ Enterprise trial:

- Send «JUGS-LU-SQL-2014» to sales@datageekery.com

More free Java / SQL knowledge on:

- Blog: http://blog.jooq.org
- Twitter: @JavaOOQ

This just in… (in case you haven't seen enough)

“There is SQL before and after window functions”

Use-case: Choreo export

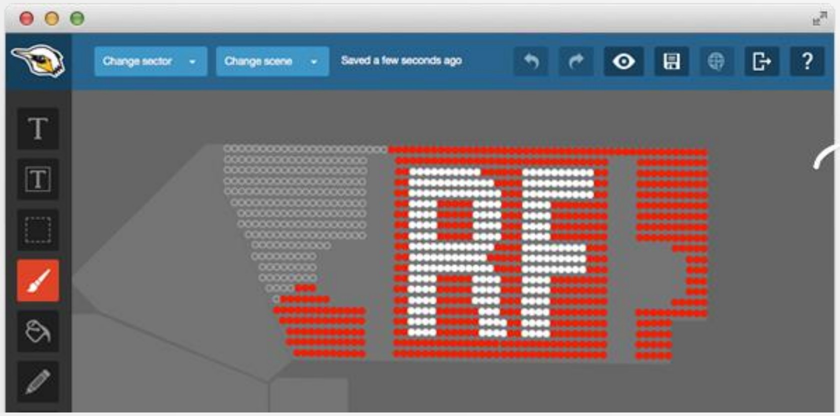
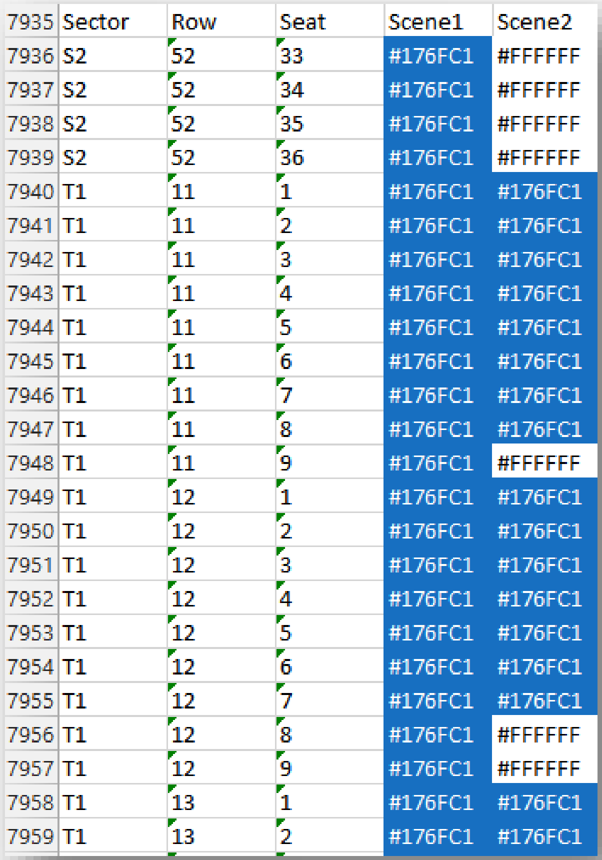


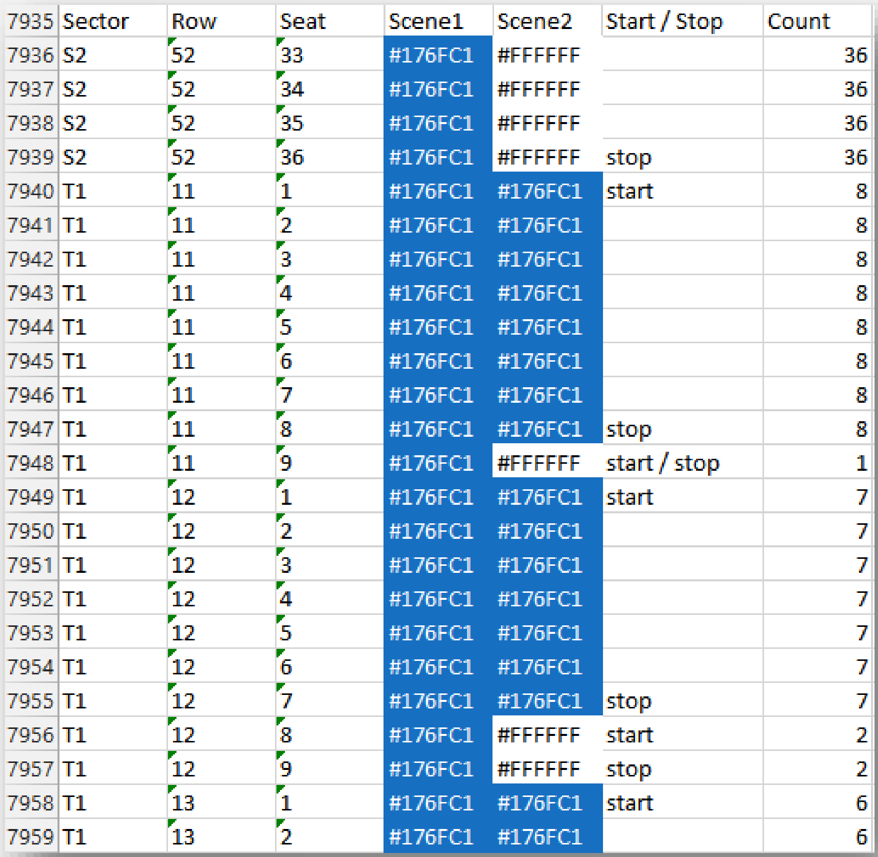
Image Copyright © fanpictor.com

Use-case: Choreo export as Excel



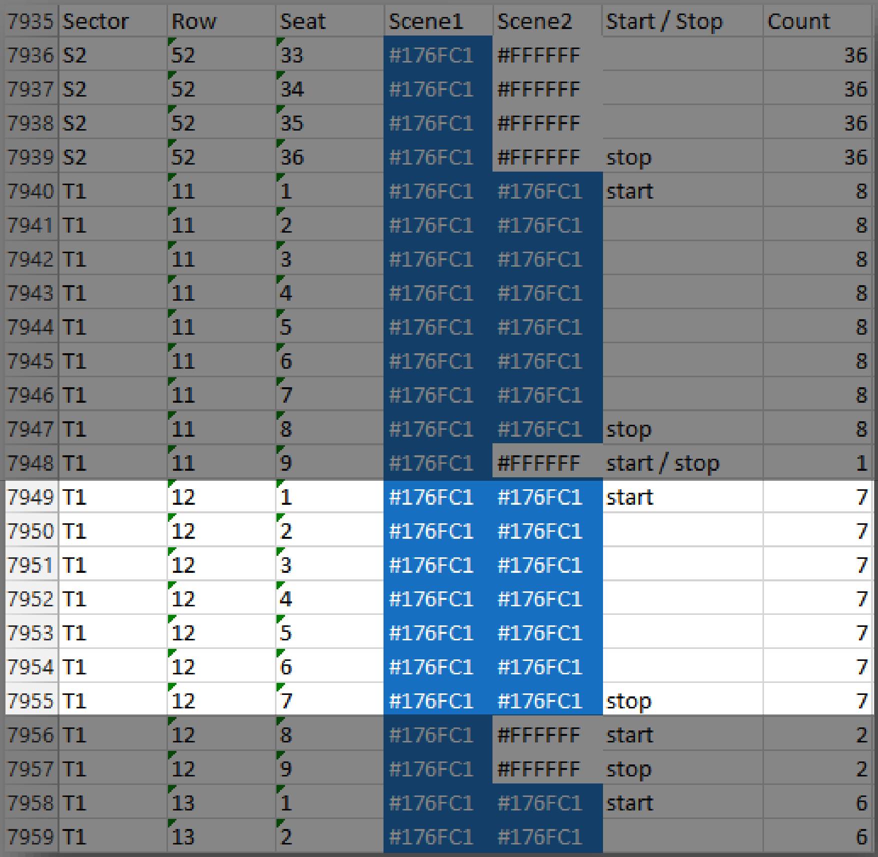
7935	Sector	Row	Seat	Scene1	Scene2
7936	S2	52	33	#176FC1	#FFFFFF
7937	S2	52	34	#176FC1	#FFFFFF
7938	S2	52	35	#176FC1	#FFFFFF
7939	S2	52	36	#176FC1	#FFFFFF
7940	T1	11	1	#176FC1	#176FC1
7941	T1	11	2	#176FC1	#176FC1
7942	T1	11	3	#176FC1	#176FC1
7943	T1	11	4	#176FC1	#176FC1
7944	T1	11	5	#176FC1	#176FC1
7945	T1	11	6	#176FC1	#176FC1
7946	T1	11	7	#176FC1	#176FC1
7947	T1	11	8	#176FC1	#176FC1
7948	T1	11	9	#176FC1	#FFFFFF
7949	T1	12	1	#176FC1	#176FC1
7950	T1	12	2	#176FC1	#176FC1
7951	T1	12	3	#176FC1	#176FC1
7952	T1	12	4	#176FC1	#176FC1
7953	T1	12	5	#176FC1	#176FC1
7954	T1	12	6	#176FC1	#176FC1
7955	T1	12	7	#176FC1	#176FC1
7956	T1	12	8	#176FC1	#FFFFFF
7957	T1	12	9	#176FC1	#FFFFFF
7958	T1	13	1	#176FC1	#176FC1
7959	T1	13	2	#176FC1	#176FC1

Use-case: Choreo export as Excel



7935	Sector	Row	Seat	Scene1	Scene2	Start / Stop	Count
7936	S2	52	33	#176FC1	#FFFFFF		36
7937	S2	52	34	#176FC1	#FFFFFF		36
7938	S2	52	35	#176FC1	#FFFFFF		36
7939	S2	52	36	#176FC1	#FFFFFF	stop	36
7940	T1	11	1	#176FC1	#176FC1	start	8
7941	T1	11	2	#176FC1	#176FC1		8
7942	T1	11	3	#176FC1	#176FC1		8
7943	T1	11	4	#176FC1	#176FC1		8
7944	T1	11	5	#176FC1	#176FC1		8
7945	T1	11	6	#176FC1	#176FC1		8
7946	T1	11	7	#176FC1	#176FC1		8
7947	T1	11	8	#176FC1	#176FC1	stop	8
7948	T1	11	9	#176FC1	#FFFFFF	start / stop	1
7949	T1	12	1	#176FC1	#176FC1	start	7
7950	T1	12	2	#176FC1	#176FC1		7
7951	T1	12	3	#176FC1	#176FC1		7
7952	T1	12	4	#176FC1	#176FC1		7
7953	T1	12	5	#176FC1	#176FC1		7
7954	T1	12	6	#176FC1	#176FC1		7
7955	T1	12	7	#176FC1	#176FC1	stop	7
7956	T1	12	8	#176FC1	#FFFFFF	start	2
7957	T1	12	9	#176FC1	#FFFFFF	stop	2
7958	T1	13	1	#176FC1	#176FC1	start	6
7959	T1	13	2	#176FC1	#176FC1		6

Use-case: Choreo export as Excel



7935	Sector	Row	Seat	Scene1	Scene2	Start / Stop	Count
7936	S2	52	33	#176FC1	#FFFFFF		36
7937	S2	52	34	#176FC1	#FFFFFF		36
7938	S2	52	35	#176FC1	#FFFFFF		36
7939	S2	52	36	#176FC1	#FFFFFF	stop	36
7940	T1	11	1	#176FC1	#176FC1	start	8
7941	T1	11	2	#176FC1	#176FC1		8
7942	T1	11	3	#176FC1	#176FC1		8
7943	T1	11	4	#176FC1	#176FC1		8
7944	T1	11	5	#176FC1	#176FC1		8
7945	T1	11	6	#176FC1	#176FC1		8
7946	T1	11	7	#176FC1	#176FC1		8
7947	T1	11	8	#176FC1	#176FC1	stop	8
7948	T1	11	9	#176FC1	#FFFFFF	start / stop	1
7949	T1	12	1	#176FC1	#176FC1	start	7
7950	T1	12	2	#176FC1	#176FC1		7
7951	T1	12	3	#176FC1	#176FC1		7
7952	T1	12	4	#176FC1	#176FC1		7
7953	T1	12	5	#176FC1	#176FC1		7
7954	T1	12	6	#176FC1	#176FC1		7
7955	T1	12	7	#176FC1	#176FC1	stop	7
7956	T1	12	8	#176FC1	#FFFFFF	start	2
7957	T1	12	9	#176FC1	#FFFFFF	stop	2
7958	T1	13	1	#176FC1	#176FC1	start	6
7959	T1	13	2	#176FC1	#176FC1		6

```sql
WITH data AS (SELECT d.*,
                row(sector, row, scene1, scene2) block
              FROM d)
SELECT data.*,
  CASE WHEN LAG (block) OVER (o) IS DISTINCT FROM block
        AND LEAD(block) OVER (o) IS DISTINCT FROM block
       THEN 'start / stop'
       WHEN LAG (block) OVER (o) IS DISTINCT FROM block
       THEN 'start'
       WHEN LEAD(block) OVER (o) IS DISTINCT FROM block
       THEN 'stop'
       ELSE '' END start_stop,
  COUNT(*) OVER (PARTITION BY sector, row, scene1, scene2)
FROM data
WINDOW o AS (ORDER BY sector, row, seat)
ORDER BY sector, row, seat
```

Full example: http://blog.jooq.org/2014/04/15/how-to-do-this-with-sql-of-course

```
WITH data AS (SELECT d.*,
                     row(sector, row, scene1, scene2) block
              FROM d)
SELECT data.*,
  CASE WHEN LAG (block) OVER (o) IS DISTINCT FROM block
        AND LEAD(block) OVER (o) IS DISTINCT FROM block
       THEN 'start / stop'
       WHEN LAG (block) OVER (o) IS DISTINCT FROM block
       THEN 'start'
       WHEN LEAD(block) OVER (o) IS DISTINCT FROM block
       THEN 'stop'
       ELSE '' END start_stop,
```

We can compare rows with each other, not only columns!

Full example: http://blog.jooq.org/2014/04/15/how-to-do-this-with-sql-of-course

We can reuse window specifications!

```
                 row(sector, row, scene1, scene2) block
              FROM d)
SELECT data.*,
  CASE WHEN LAG (block) OVER (o) IS DISTINCT FROM block
        AND LEAD(block) OVER (o) IS DISTINCT FROM block
       THEN 'start / stop'
       WHEN LAG (block) OVER (o) IS DISTINCT FROM block
       THEN 'start'
       WHEN LEAD(block) OVER (o) IS DISTINCT FROM block
       THEN 'stop'
       ELSE '' END start_stop,
  COUNT(*) OVER (PARTITION BY sector, row, scene1, scene2)
FROM data
WINDOW o AS (ORDER BY sector, row, seat)
ORDER BY sector, row, seat
```

Full example: http://blog.jooq.org/2014/04/15/how-to-do-this-with-sql-of-course