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Pivot Tables in MySQL 5

FrOSCon

June. 24th/25th. 2006

About me

http://datacharmer.org

Agenda

- Introducing pivot tables
- Common solutions
- The SQL way
- Pivot tables with stored procedures
- The OO approach

Introducing pivot tables (1)

- Pivot tables, or CROSSTABS
- Statistical reports
- Spreadsheets tools
- Usually on the client side
- On servers, dedicated tools
- Some vendors have language extensions
- Can be done in standard SQL

Introducing pivot tables (2)

Some online resources

- MySQL wizardry (2001)
- DBIx::SQLCrosstab (2004)
- See the addresses on my site (http://datacharmer.org)

Introducing pivot tables (3)

An example (raw data)

person

id	name	gender	dept
1	John	m	pers
2	Mario	m	pers
7	Mary	f	pers
8	Bill	m	pers
3	Frank	m	sales
5	Susan	f	sales
6	Martin	m	sales
4	Otto	m	dev
9	June	f	dev

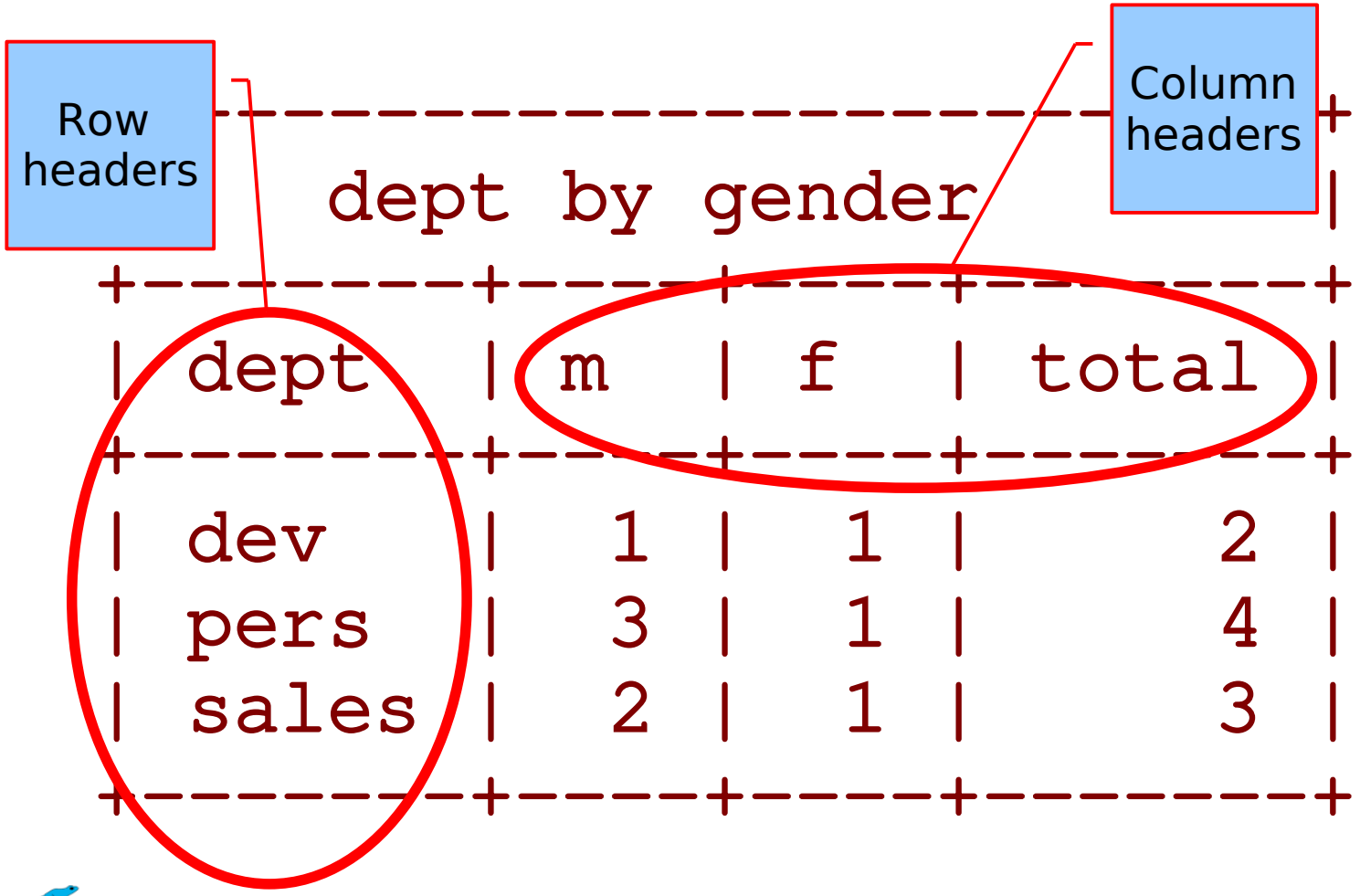
Introducing pivot tables (4)

An example (crosstab)

dept by gender			
dept	m	f	total
dev	1	1	2
pers	3	1	4
sales	2	1	3

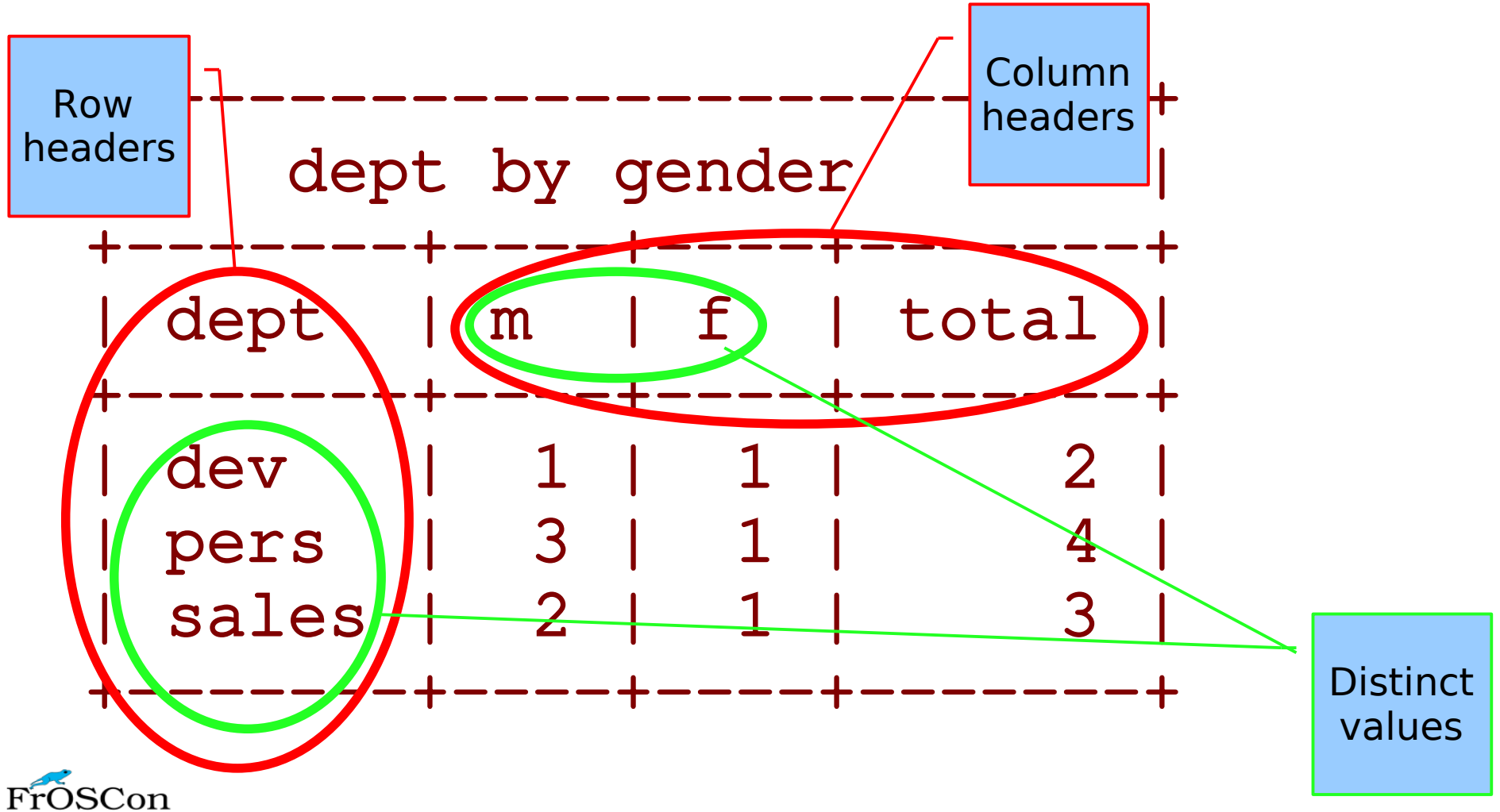
Introducing pivot tables (5)

Definitions



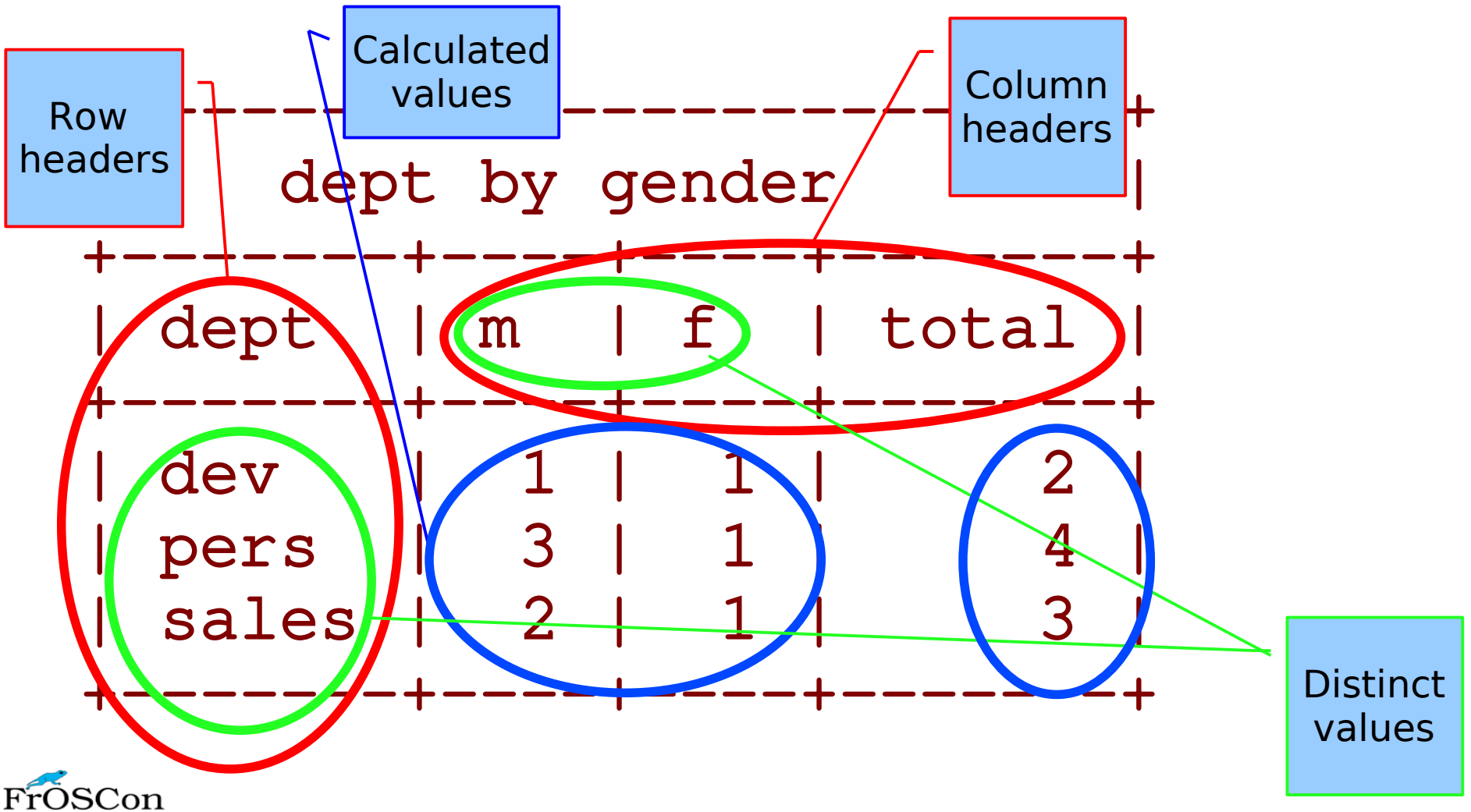
Introducing pivot tables (6)

Definitions



Introducing pivot tables (7)

Definitions



Introducing pivot tables (8)

Some important points

- **Row headers are defined in one go**
- **Column headers are defined in two separate steps.**

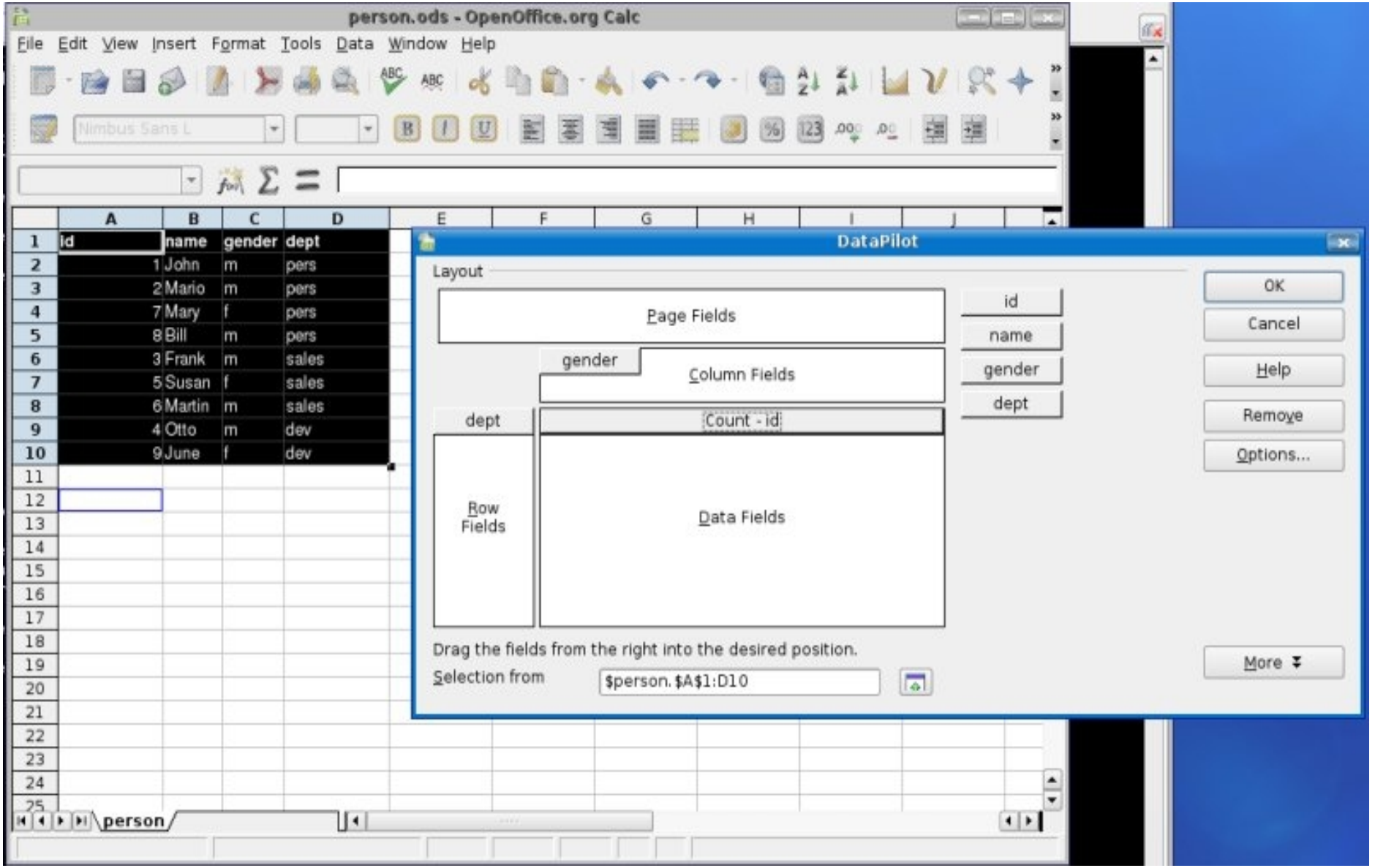
Common solutions

- The spreadsheets approach
- Using dedicated tools

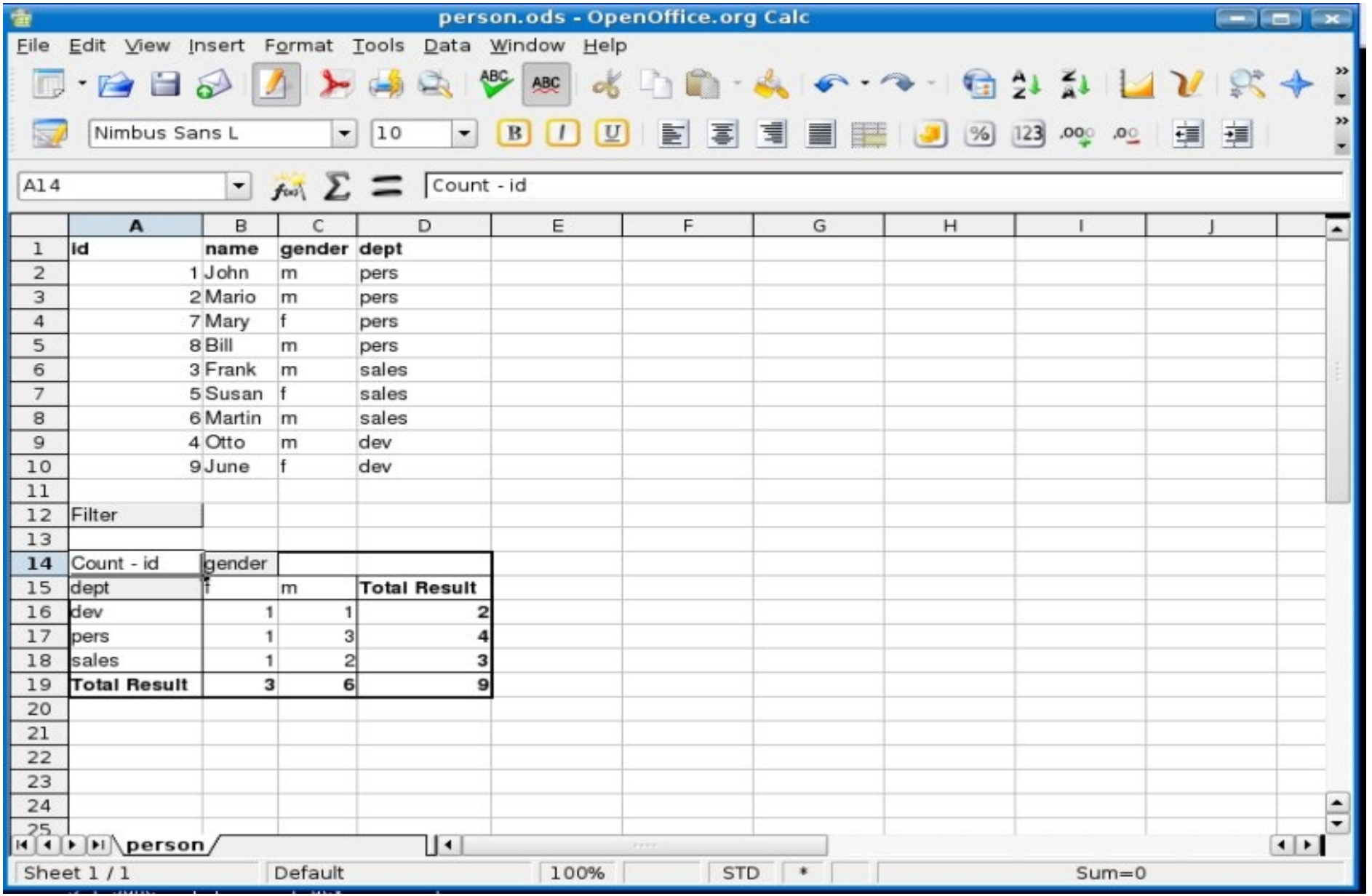
The spreadsheet approach (1)

- Copy the raw data from the server to a spreadsheet
- Use the Pivot Table feature

The spreadsheet approach (2)



The spreadsheet approach (3)



	A	B	C	D
1	**id**	**name**	**gender**	**dept**
2	1	John	m	pers
3	2	Mario	m	pers
4	7	Mary	f	pers
5	8	Bill	m	pers
6	3	Frank	m	sales
7	5	Susan	f	sales
8	6	Martin	m	sales
9	4	Otto	m	dev
10	9	June	f	dev
11				
12	Filter			
13				
14	Count - id	gender		
15	dept	f	m	**Total Result**
16	dev	1	1	**2**
17	pers	1	3	**4**
18	sales	1	2	**3**
19	**Total Result**	**3**	**6**	**9**
20				
21				
22				
23				
24				
25				

The spreadsheet problems (4)

- Copying the raw data could be a long operation
- The spreadsheet can handle a limited number of records
- The results could be different in different clients
- It is not easy to scale

Dedicated tools

PRO

- Easy to use
- Rich in features
- Well integrated to BI packages

Dedicated tools

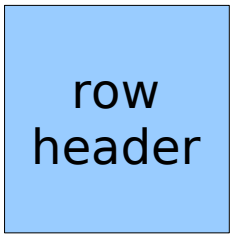
CON

- Client side tools are resource hogs
- Server side tools are either complicated to install and maintain or expensive (or both)

The SQL way (1)

The query for that crosstab

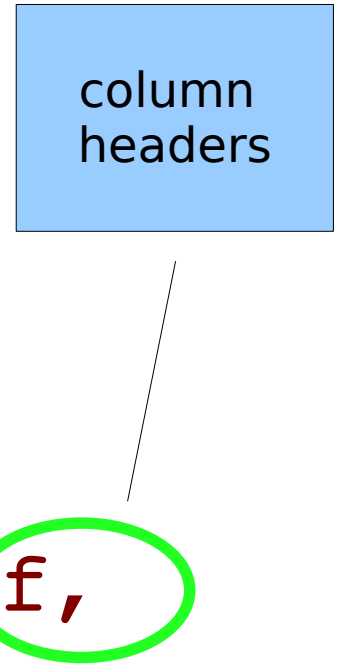
```
SELECT dept,
    COUNT(CASE
      WHEN gender = 'm' THEN id
      ELSE NULL END) AS m,
    COUNT(CASE
      WHEN gender = 'f'
      THEN id ELSE NULL END) AS f,
    COUNT(*) AS total
FROM person
GROUP BY dept
```



The SQL way (2)

The query for that crosstab

```
SELECT dept,
    COUNT(CASE
      WHEN gender = 'm' THEN id
      ELSE NULL END) AS m,
    COUNT(CASE
      WHEN gender = 'f'
      THEN id ELSE NULL END) AS f,
    COUNT(*) AS total
FROM person
GROUP BY dept
```



The SQL way (3)

Two passes

```
SELECT dept,
     COUNT(CASE
       WHEN gender = 'm' THEN id
       ELSE NULL END) AS m,
     COUNT(CASE
       WHEN gender = 'f'
       THEN id ELSE NULL END) AS f,
     COUNT(*) AS total
FROM person
GROUP BY dept
```

Calculated in this query

Previously determined

The SQL way (4)

Two passes

```
# 1
SELECT DISTINCT gender FROM person;
+--------+
| gender |
+--------+
| m      |
| f      |
+--------+
# build the second query
# 2
CROSSTAB QUERY
```

The SQL way (5)

PROBLEMS

- The two passes are not coordinated
- External languages needed (Perl, PHP, Java, etc.)
- For each language, you need appropriate routines

Pivot tables and stored routines (1)

PRO

- Bundling the two steps for crosstab creation
- Adding features easily
- Same interface from different host languages

Pivot tables and stored routines (2)

CON

- Less expressive than most languages
- More burden for the server

Methods to gather column headers (1)

- GROUP_CONCAT
- Cursor + temporary table
- Cursor + dedicated routines

GROUP_CONCAT (1)

```
SELECT GROUP_CONCAT(DISTINCT gender)
  AS column_list FROM person;
```

```
+--------------+
| column_list  |
+--------------+
| m,f          |
+--------------+
```

GROUP_CONCAT (2)

```
SELECT GROUP_CONCAT(DISTINCT
CONCAT('\nCOUNT(CASE WHEN gender= "',
gender, '" THEN id ELSE NULL END) AS
', gender)) AS column_list
FROM person\G

column_list:
COUNT(CASE WHEN gender= "m" THEN id
ELSE NULL END) AS m,
COUNT(CASE WHEN gender= "f" THEN id
ELSE NULL END) AS f
```

GROUP_CONCAT (3)

PRO

- Easy to use
- Dynamic
- Fast (built-in)

GROUP_CONCAT (4)

CON

- Memory limit (1024 bytes)
- Can be increased by setting group_concat_max_len
- But you can't know the length in advance

Cursor (1)

```
# outline only
DECLARE dp char(10);
DECLARE column_list TEXT default '';
DECLARE CURSOR get_cols FOR
  SELECT DISTINCT dept FROM person;
OPEN get_cols;
LOOP
   FETCH get_cols INTO dp;
   SET column_list=CONCAT(column_list,
',', dp);
END LOOP;
```

Cursor (2)

PRO

- No memory limits
- Fast

Cursor (3)

CON

- Not dynamic
- Verbose

Cursor + temp table (1)

```
# dynamic query
SET @q = CONCAT('CREATE TABLE temp
SELECT DISTINCT ', col_name, ' AS mycol
FROM ', table_name);
PREPARE d FROM @q
EXECUTE d;

# routine with cursor
DECLARE dp char(10);
DECLARE column_list TEXT default '';
DECLARE CURSOR get_cols FOR
  SELECT mycol FROM temp;
```

Cursor + temp table (2)

PRO

- No memory limits
- dynamic

Cursor + temp table (2)

CON

- Requires a new table for each crosstab
- Data needs to be read twice

Cursor + dedicated routine (1)

```
# Create a routine from a template


# use routine with cursor
DECLARE dp char(10);
DECLARE column_list TEXT default '';
DECLARE CURSOR get_cols FOR
  SELECT gender FROM person;
```

Cursor + dedicated routine (2)

PRO

- No memory limits
- data is read only once
- no temporary tables

Cursor + dedicated routine (3)

CON

- Not dynamic
- Dedicated routines need to be created by external language

Cursor + Higher Order Routines (1)

- Higher Order Routines are routines that create other routines
- It IS NOT STANDARD
- It is, actually, a hack

Cursor + Higher Order Routines (2)

- Very UNOFFICIALLY
- You can create a routine from a MySQL routine

Cursor + Higher Order Routines (3)

PRO

- Dynamic
- No memory limits
- No temporary tables
- Data is read only once
- Efficient

Cursor + Higher Order Routines (4)

CON

- You need just ONE ROUTINE created with SUPER privileges (access to mysql.proc table)

DISCLAIMER

The Very Unofficial method described in this presentation:

- **Is not recommended by MySQL AB**
- **Is not guaranteed to work in future releases of MySQL**
- **May result in any number of damages to your data, from bird flu to accidental explosions.**
- **You use it at your own risk**

Cursor + Higher Order Routines (5)

HOW

- Download the code (all SQL)
- (http://datacharmer.org)
- Unpack and run

```
mysql -t < crosstab_install.mysql
```

- then use it

```
mysql> CALL crosstab_help()
```

Crosstab package (1)

```
CALL crosstab_help()

type "SELECT crosstab_usage()\G for
general usage"
type "SELECT crosstab_example()\G" for
a few examples
type "SELECT crosstab_env()\G" for
modifiers and debugging
```

Crosstab package (2)

```
SELECT crosstab_usage()\G
    == CROSSTAB USAGE ==
    ====================

    PROCEDURE get_crosstab_simple (
        row_name        varchar(50),
    -- the field that identifies each row
        col_name        varchar(50),
    -- from which column we spread the values
        op              varchar(10),
    -- which operation (COUNT, SUM, AVG)
        op_col          varchar(50),
    -- to which column we operate
        from_clause     varchar(1000)
    -- the data origin
     )
```

Crosstab package (3)

```
# A SIMPLE EXAMPLE

set @XTAB_FORMAT = "show";
call get_crosstab_simple (
 "department",     -- row_name
 "gender",         -- col_name
 "COUNT",          -- op
 "person_id",      -- op_col
 "person inner join departments using
(dept_id)"         -- from_clause
);
```

Crosstab package (4)

```
# A SIMPLE EXAMPLE (2)
```

```
+-------------+---+---+--------+
| department  | m | f | total  |
+-------------+---+---+--------+
| dev         | 1 | 1 |      2 |
| pers        | 3 | 1 |      4 |
| sales       | 2 | 1 |      3 |
+-------------+---+---+--------+
```

Crosstab package (5)

```
# Another EXAMPLE

set @XTAB_FORMAT = "show";
set @WITH_ROLLUP = 1;
call get_crosstab_simple (
 "gender",              -- row_name
 "department",          -- col_name
 "COUNT",               -- op
 "person_id",           -- op_col
 "person inner join departments using
(dept_id)"              -- from_clause
);
```

Crosstab package (6)

```
# Another EXAMPLE (2)
```

gender	pers	sales	dev	total
f	1	1	1	3
m	3	2	1	6
NULL	4	3	2	9

Crosstab package (7)

```
# Some input modifiers

@XTAB_FORMAT={show|table|query}

@WITH_ROLLUP=1

@XTAB_ENGINE={MyISAM|memory}

@XTAB_TYPE=temporary
```

Crosstab package (8)

```
# Some output variables

@XTAB_QUERY
query to create the requested crosstab

@XTAB_TABLE
the table being created when requested
```

One step further

Object Oriented Crosstabs (1)

- Based on the Crosstab package
- Requires the MySQL Stored Routines Library (mysql-sr-lib) http://datacharmer.org
- It's a O-O like approach

Object Oriented crosstab (2)

HOW

- Download the code (all SQL)
- (http://datacharmer.org)
- Unpack and run

```
mysql < oo_crosstab_install.mysql
```

- then use it

```
mysql> CALL oo_crosstab_help()
```

Object Oriented Crosstab (3)

```
SELECT oo_crosstab_usage()\G
    == Object Oriented CROSSTAB USAGE ==

PROCEDURE xtab_new( crosstab_name varchar(50) );

PROCEDURE xtab_set( crosstab_name, p_param_name,
p_param_value )

PROCEDURE xtab_check( crosstab_name )

PROCEDURE xtab_show( crosstab_name)

PROCEDURE xtab_exec( crosstab_name)

PROCEDURE xtab_drop( crosstab_name)
```

Object Oriented Crosstab (4)

```
# An example

CALL xtab_new("dept_by_gender");

CALL xtab_set("dept_by_gender", "row_name",
"department");
CALL xtab_set("dept_by_gender", "col_name",
"gender");
CALL xtab_set("dept_by_gender", "op", "COUNT");
CALL xtab_set("dept_by_gender", "op_col",
"person_id");

CALL xtab_check("dept_by_gender");
+--------------+-----------------------------------------+
| check result | error message                           |
+--------------+-----------------------------------------+
|            0 | dept_by_gender: parameter <from_clause> not set |
+--------------+-----------------------------------------+
```

Object Oriented Crosstab (5)

```
# An example (continue)

CALL xtab_show("dept_by_gender");
+-----------------+-----------------+---------+
| xtab_parameter | xtab_value      | check   |
+-----------------+-----------------+---------+
|                 |*dept_by_gender*| ok      |
| ---             | ---             | ---     |
| row_name        | department      | ok      |
| col_name        | gender          | ok      |
| id_name         | NULL            | -       |
| col_from        | NULL            | -       |
| op              | COUNT           | ok      |
| op_col          | person_id       | ok      |
| from_clause     | NULL            | NOT OK  |
| where_clause    | NULL            | -       |
| wanted_result   | NULL            | -       |
+-----------------+-----------------+---------+
```

Object Oriented Crosstab (6)

```
# An example (continue)

CALL xtab_set("dept_by_gender", "from_clause",
"person INNER JOIN departments using(dept_id)");

CALL xtab_check("dept_by_gender");
+--------------+-----------------+
| check result | error message   |
+--------------+-----------------+
|            1 | NULL            |
+--------------+-----------------+
```

Object Oriented Crosstab (7)

```
# An example (continue)

CALL xtab_exec("dept_by_gender");
+-------------+---+---+-------+
| department  | m | f | total |
+-------------+---+---+-------+
| dev         | 1 | 1 |     2 |
| pers        | 3 | 1 |     4 |
| sales       | 2 | 1 |     3 |
+-------------+---+---+-------+
```

Object Oriented Crosstab (8)

```
# Another example (continues)


CALL xtab_copy_from('gender_by_dept',
'dept_by_gender', 'transpose');

CALL xtab_exec('gender_by_dept');

+--------+-------+-------+------+-------+
| gender | pers  | sales | dev  | total |
+--------+-------+-------+------+-------+
| f      |  5500 |  5500 | 6000 | 17000 |
| m      | 16000 | 10500 | 6000 | 32500 |
+--------+-------+-------+------+-------+
```

Object Oriented Crosstab (9)

```
# Exporting crosstabs

SELECT xtab_export('gender_by_dept',
'compact')\G
********************* 1. row **********************
CALL xtab_new('gender_by_dept');
CALL xtab_fill('gender_by_dept',
'row_name=>gender;
col_name=>department;
id_name=>\N;
col_from=>\N;
op=>sum;
op_col=>salary;
from_clause=>person inner join departments
using(dept_id);
where_clause=>\N;
wanted_result=>\N')
```

Object Oriented Crosstab (10)

```
# Exporting crosstabs

SELECT xtab_export('gender_by_dept',
'detailed')\G
********************* 1. row **********************
xtab_export('gender_by_dept', 'detailed'):
CALL xtab_new('gender_by_dept');
CALL xtab_set('gender_by_dept','row_name','gender');
CALL xtab_set('gender_by_dept','col_name','department');
CALL xtab_set('gender_by_dept','id_name',NULL);
CALL xtab_set('gender_by_dept','col_from',NULL);
CALL xtab_set('gender_by_dept','op','sum');
CALL xtab_set('gender_by_dept','op_col','salary');
CALL xtab_set('gender_by_dept','from_clause','person
inner join departments using(dept_id)');
CALL xtab_set('gender_by_dept','where_clause',NULL);
CALL xtab_set('gender_by_dept','wanted_result',NULL);
```

Object Oriented Crosstab (11)

```
# Exporting crosstab query

CALL xtab_query('gender_by_dept')\G
********************* 1. row **********************
query for crosstab:
SELECT gender
, sum( CASE WHEN department = 'pers' THEN salary
    ELSE NULL END) AS `pers`
, sum( CASE WHEN department = 'sales' THEN salary
    ELSE NULL END) AS `sales`
, sum( CASE WHEN department = 'dev' THEN salary
    ELSE NULL END) AS `dev`
, sum(salary) as total
FROM person inner join departments using(dept_id)
GROUP BY gender
```

Object Oriented Crosstab (12)

```
# Listing crosstabs

CALL xtab_list();
```

```
+--------------------+------------+
| CROSSTAB           | executable |
+--------------------+------------+
| category_by_rating | ok         |
| rating_by_category | ok         |
| location_by_dept   | ok         |
| dept_by_location   | ok         |
| gender_by_location | ok         |
| location_by_gender | ok         |
| dept_by_gender     | ok         |
| gender_by_dept     | ok         |
+--------------------+------------+
```

Parting thoughts

- Pivot tables can be made in SQL
- Pivot tables in normal SQL require external languages
- With stored routines, there are various techniques
- Efficient crosstabs are feasible with well designed stored routines

THANKS

Question time

http://datacharmer.org

FrOSCon

June. 24th/25th. 2006