PostgreSQL

A ***QSS*** Webinar

October 17, 2012

10:00 AM – 12:00 PM

Audience

- System administrators, operators, technical support staff
- Already familiar with system administration and operations of QSS/OASIS Version H using TurboIMAGE databases
- Presentation is very technical.
- Previous exposure to Linux is helpful.

PostgreSQL

- Version
  - QSS Requires a minimum version of 8.2
  - Examples will be shown using 8.3.x
  - Available versions 8.2, 8.3, 8.4, 9.0, 9.1, 9.2
- Installation
  - From Linux distribution if 8.2 or better
  - From source if not
- Website
  - www.postgresql.org

End of Life Dates

source: http://www.postgresql.org/support/versioning/

Version	Current minor	Supported	First release date	EOL date
9.2	9.2.1	Yes	Sep-12	Sep-17
9.1	9.1.6	Yes	Sep-11	Sep-16
9	9.0.10	Yes	Sep-10	Sep-15
8.4	8.4.14	Yes	Jul-09	Jul-14
8.3	8.3.21	Yes	Feb-08	Feb-13
8.2	8.2.23	No	Dec-06	Dec-11

QSS Databases

- Version ‘L’
  - finance
  - hrspay
  - pque
  - strsmf
  - sysctl
- Version ‘H’
  - GLDSYS, ACTRCV, BDEVOL, CONVRT, ECOMRC, FASSET, RECON, STRSYS
  - PERPAY, BENMGT, PPHIST, PYHIST, RETSYS, STTSYS
  - PQUE
  - STRSMF
  - SYSCTL, MENU, MENCTL, QDACTL, QSSPRE

PostgreSQL Database Admins

- Are valid Linux users
- postgres (usually has no password set)
  - PostgreSQL's admin user, not used by QSS
  - Created during PostgreSQL install
- qssdba - QSS's database administrator
  - create/alter/drop databases
  - create/alter/drop tables in databases
  - read/write access to all data in all databases
  - has superuser role

Additional User/Roles

- Are database users only, not real Linux users.
- qssdbr
  - read only access to all data in all databases
- qssdbu
  - read/write access to all data in all databases
- SQL Scripts for creating qssdbr / qssdbu available on version ‘L’ Linux server
  - PostgreSQL: /opt/qss/install/sql/qssdbx-pg.sql
    - Needs to be re-run after any database changes which create tables

psql - PostgreSQL interactive terminal

- Command line, text-based interface
- Connects to PostgreSQL database
- View structure of database and/or tables
- Maintain structure of database and/or tables using SQL data definition language (ddl) commands
- View or Maintain data using SQL data manipulation language (dml) commands

List databases

```
qssdba@linux-demo:~> psql -l
           List of databases
     Name       |  Owner   | Encoding
----------------+----------+-----------
 finance        | qssdba   | SQL_ASCII
 hrspay         | qssdba   | SQL_ASCII
 hrsweb         | qssdba   | SQL_ASCII
 postgres       | postgres | UTF8
 pque           | qssdba   | SQL_ASCII
 strsmf         | qssdba   | SQL_ASCII
 sysctl         | qssdba   | SQL_ASCII
 template0      | postgres | UTF8
 template1      | postgres | UTF8
(9 rows)
```

To connect to a database

- psql <*database*>

```
qssdba@linux-demo:~> psql finance
Welcome to psql 8.3.5, the PostgreSQL interactive
  terminal.

Type:  \copyright for distribution terms
       \h for help with SQL commands
       \? for help with psql commands
       \g or terminate with semicolon to execute query
       \q to quit

finance=#
```

Commands inside psql

- Any valid SQL statement
- \q to exit
- \h for list of sql commands
- \h <sql command> for help on the command
- \? for help on PostgreSQL commands
- psql output is piped to less so you can move forwards, backwards, search, etc. Use ‘q’ to exit viewing output.
- If PostgreSQL built correctly psql has same redo, auto-completion features as bash

Show list of tables

```
finance=# \d
                List of relations
 Schema |          Name           | Type  | Owner
--------+-------------------------+-------+--------
 public | ac_bdg_detail           | table | qssdba
 public | account                 | table | qssdba
 public | account_sum             | table | qssdba
 public | acct_sum_ctl            | table | qssdba
 public | acct_sum_rule           | table | qssdba
 public | acq_reason              | table | qssdba
 public | ap_detail               | table | qssdba
 public | ap_header               | table | qssdba
 public | apc_odometer            | table | qssdba
 public | apy_accounts            | table | qssdba
 public | apy_x_ref               | table | qssdba
 public | ar_cust_type            | table | qssdba
 public | ar_customer             | table | qssdba
lines 1-16
```

Show a table layout

```
finance=# \d account
                Table "public.account"
      Column       |          Type          | Modifiers
-------------------+------------------------+-----------
 di_no             | numeric(3,0)           | not null
 yr_no             | numeric(4,0)           | not null
 acctclass         | character(50)          | not null
 pseudo            | character(24)          |
 status            | character(1)           |
 roll_flag         | character(1)           |
 date_closed       | date                   |
 app_bdg           | numeric(15,2)          |
 rev_bdg           | numeric(15,2)          |
 work_bdg          | numeric(15,2)          |
 expense           | numeric(15,2)          |
 pend              | numeric(15,2)          |
 enc               | numeric(15,2)          |
lines 1-16
```

Show data in a table

```
finance=# select * from account where di_no=40 and yr_no=2009;
 di_no | yr_no |                     acctclass                      |          p
seudo          | status | roll_flag | date_closed |    app_bdg    |    rev_bdg
  |   work_bdg    |    expense    |  pend  |    enc     | pre_enc |
descr              |        state_code        | date_used  |  time_used  | last_
process_name | opr_used | date_changed | opr_changed | time_changed
-------+-------+-----------------------------------------------------+----------
---------------+--------+-----------+-------------+---------------+-------------
--+---------------+---------------+--------+------------+---------+-------------
------------------+--------------------------+------------+-------------+------
-------------+----------+--------------+-------------+--------------
    40 |  2009 | 01000000000000008011890551000                       |
               | 0      |           |             |  120379781.00 |  107694655.0
0 |  107694655.00 | -119336394.00 |   0.00 |       0.00 |    0.00 |
                  |                          | 2009-08-24 | 08:59:08.78 | AT010
0            | char     | 2009-08-24   | char        | 10:37:04.74
    40 |  2009 | 01000000000000008019890551000                       |
lines 1-4
```

Expanded view of data in a table

```
finance=# \x
Expanded display is on.
finance=# select * from account where di_no=40 and yr_no=2009;
-[ RECORD 1 ]-----+-------------------------------------------------
di_no             | 40
yr_no             | 2009
acctclass         | 01000000000000008011890551000
pseudo            |
status            | 0
roll_flag         |
date_closed       |
app_bdg           | 120379781.00
rev_bdg           | 107694655.00
work_bdg          | 107694655.00
expense           | -119336394.00
pend              | 0.00
enc               | 0.00
pre_enc           | 0.00
descr             |
lines 1-16
```

Show number of records in a table

```
finance=# select count(*) from account;
 count
--------
 173035
(1 row)

finance=# select di_no, yr_no, count(di_no) from account group by
   di_no, yr_no;
 di_no | yr_no | count
-------+-------+-------
     0 |     0 |     1
    40 |  2009 | 34382
    40 |  2011 |     5
    40 |  2008 | 28372
    40 |  2010 | 56717
(5 rows)
```

Execute a SQL script

```
qssdba@linux-demo:~> psql hrspay
hrspay=# \i sqlppu3.sql
SELECT
DROP TABLE
psql:sqlppu3.sql:277: NOTICE:  CREATE TABLE / PRIMARY KEY will create implicit index
    "bfte_ctl_month_di_yr_bfte_m_pk" for table "bfte_ctl_month"
CREATE TABLE
psql:sqlppu3.sql:312: ERROR:  column "bfte_pos_rel_01" of relation
    "bfte_ctl_month_save" already exists
INSERT 0 0
psql:sqlppu3.sql:333: NOTICE:  CREATE TABLE / PRIMARY KEY will create implicit index
    "emp_odometer_di_ssn_yr_type_pk" for table "emp_odometer"
CREATE TABLE
psql:sqlppu3.sql:353: NOTICE:  CREATE TABLE / PRIMARY KEY will create implicit index
    "paf_distribution_di_list_pk" for table "paf_distribution"
CREATE TABLE
psql:sqlppu3.sql:366: NOTICE:  CREATE TABLE / PRIMARY KEY will create implicit index
    "distribution_method_method_pk" for table "distribution_method"
CREATE TABLE
psql:sqlppu3.sql:401: NOTICE:  CREATE TABLE / PRIMARY KEY will create implicit index
    "bfte_ctl_sched_di_yr_bfte_s_pk" for table "bfte_ctl_sched"
CREATE TABLE
ALTER TABLE
ALTER TABLE
```

Sizes of PostgreSQL databases and tables

- To see the size of a database

```
qssdba@linux-demo:~> psql finance
finance=# SELECT pg_size_pretty(pg_database_size('finance')) As dbsize;
 dbsize
---------
 2207 MB
```

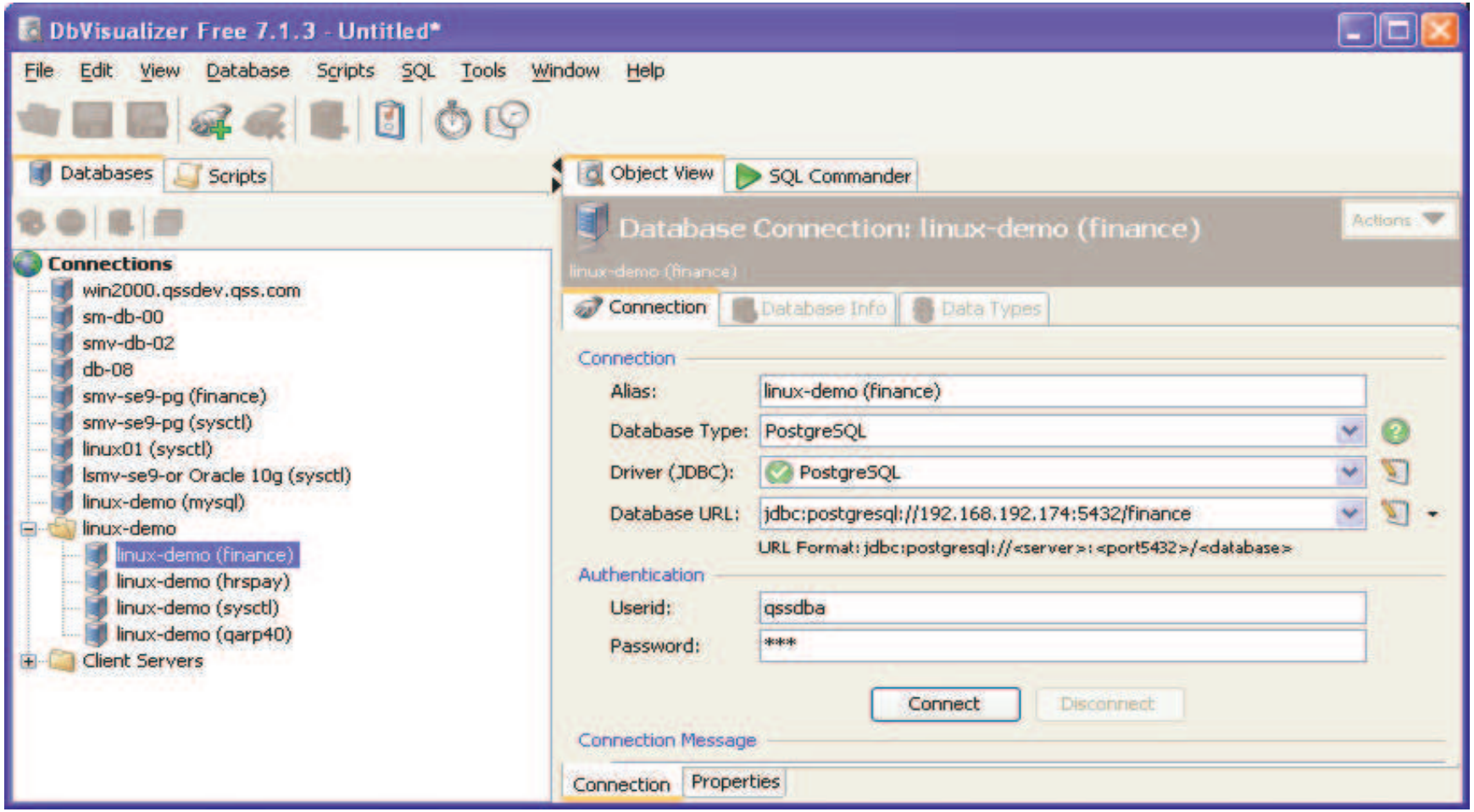
- To see the size of a table's data, or table's data plus indexes

```
finance=# pg_size_pretty(pg_relation_size('public.account')) AS tablesize,
finance=# pg_size_pretty(pg_total_relation_size('public.account')) As totalsize;
 tablesize | totalsize
-----------+-----------
 48 MB     | 76 MB
```

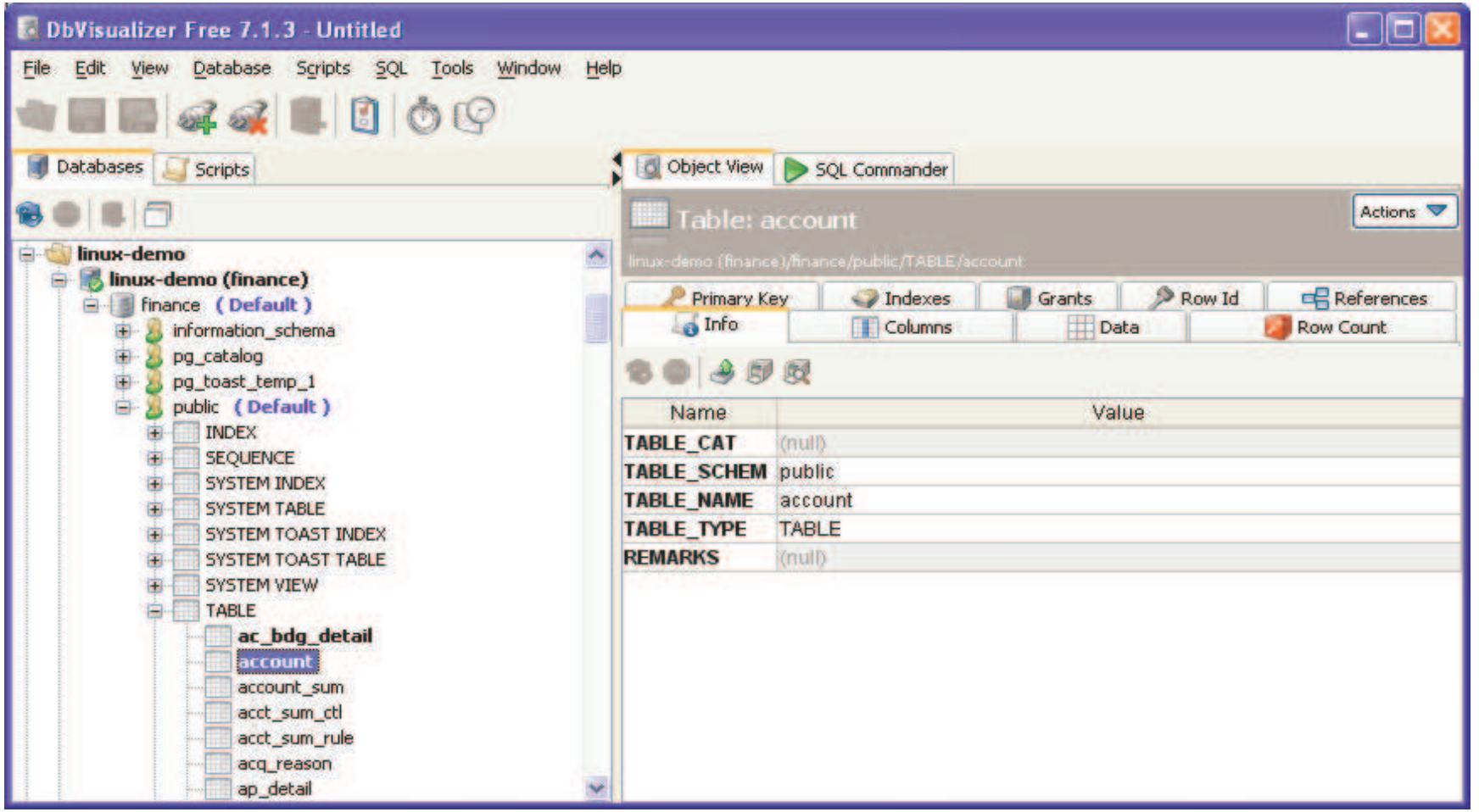
DbVisualizer

- Database tool that can connect to most SQL platforms.
- Graphical interface on your desktop that remotely connects to SQL database server.
  - Lets you see list of tables, table structure, table data. Can filter data. Has SQL command interface.
- Free version has fewer features than licensed version but is still very useful.
- Different SQL platforms have differences
  - Slightly different views in object tree (free vs licensed versions have differences too)
  - May be able to connect to all databases or only one

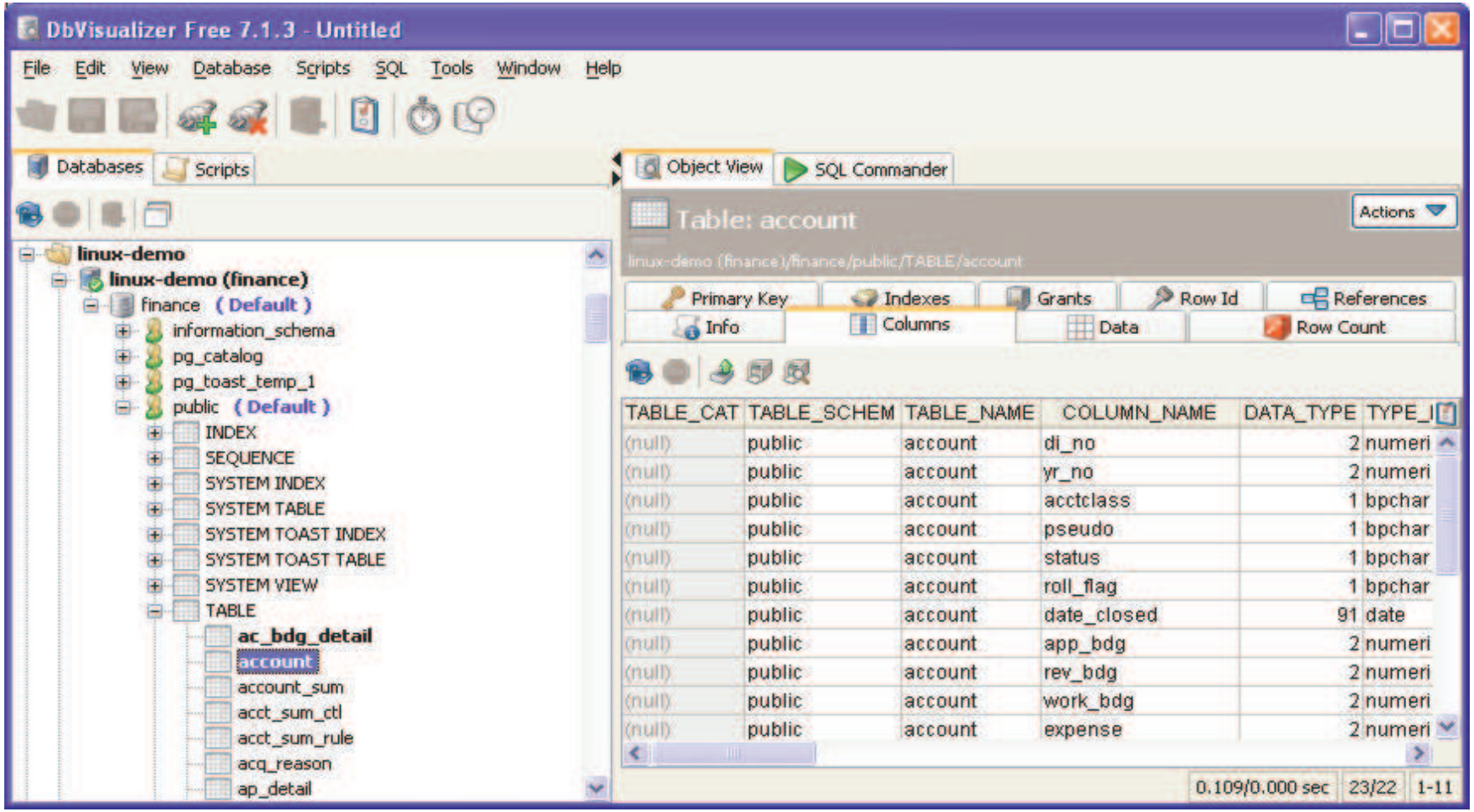
Sample DbVisualizer connection for PostgreSQL



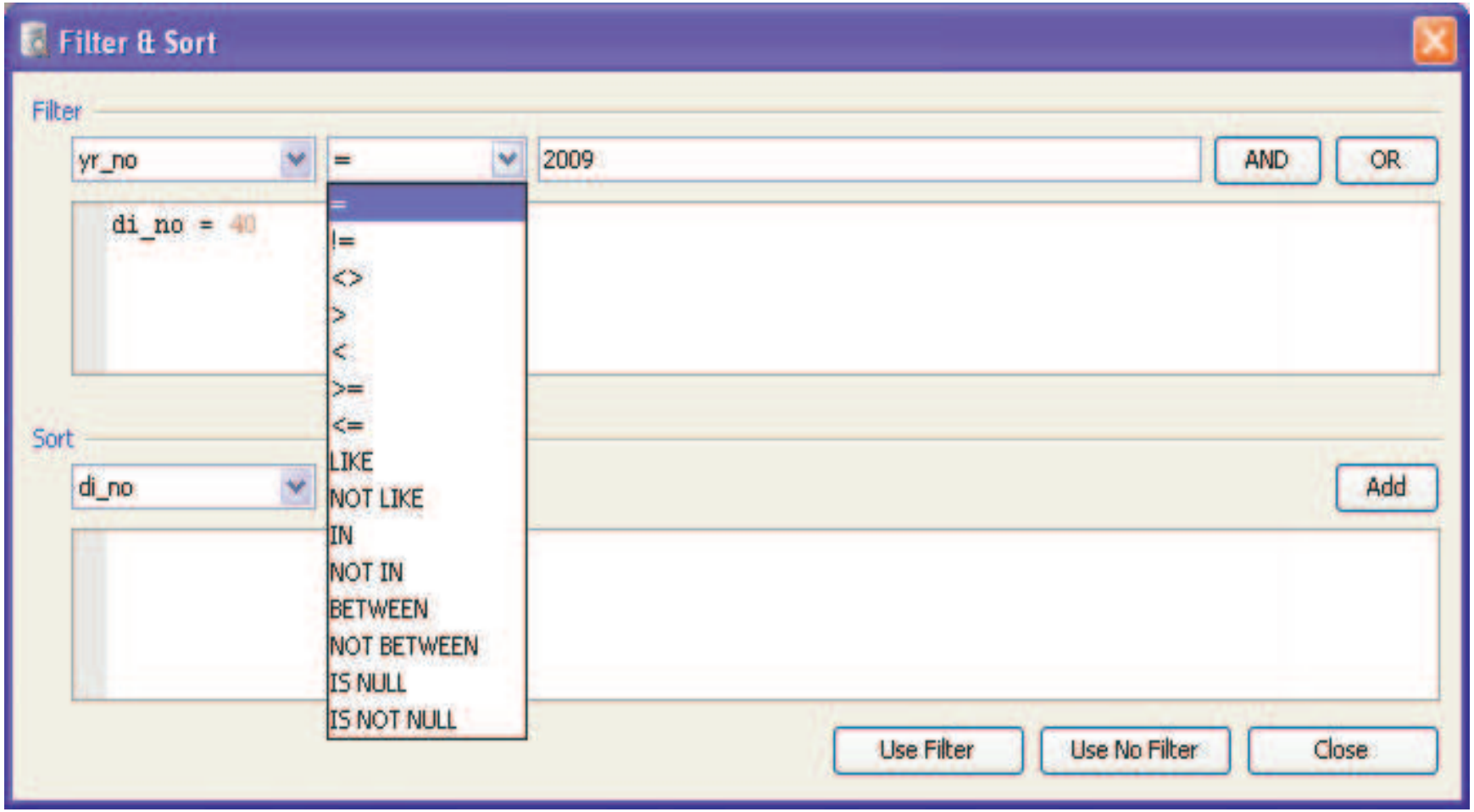
Sample DbVisualizer object tree for PostgreSQL



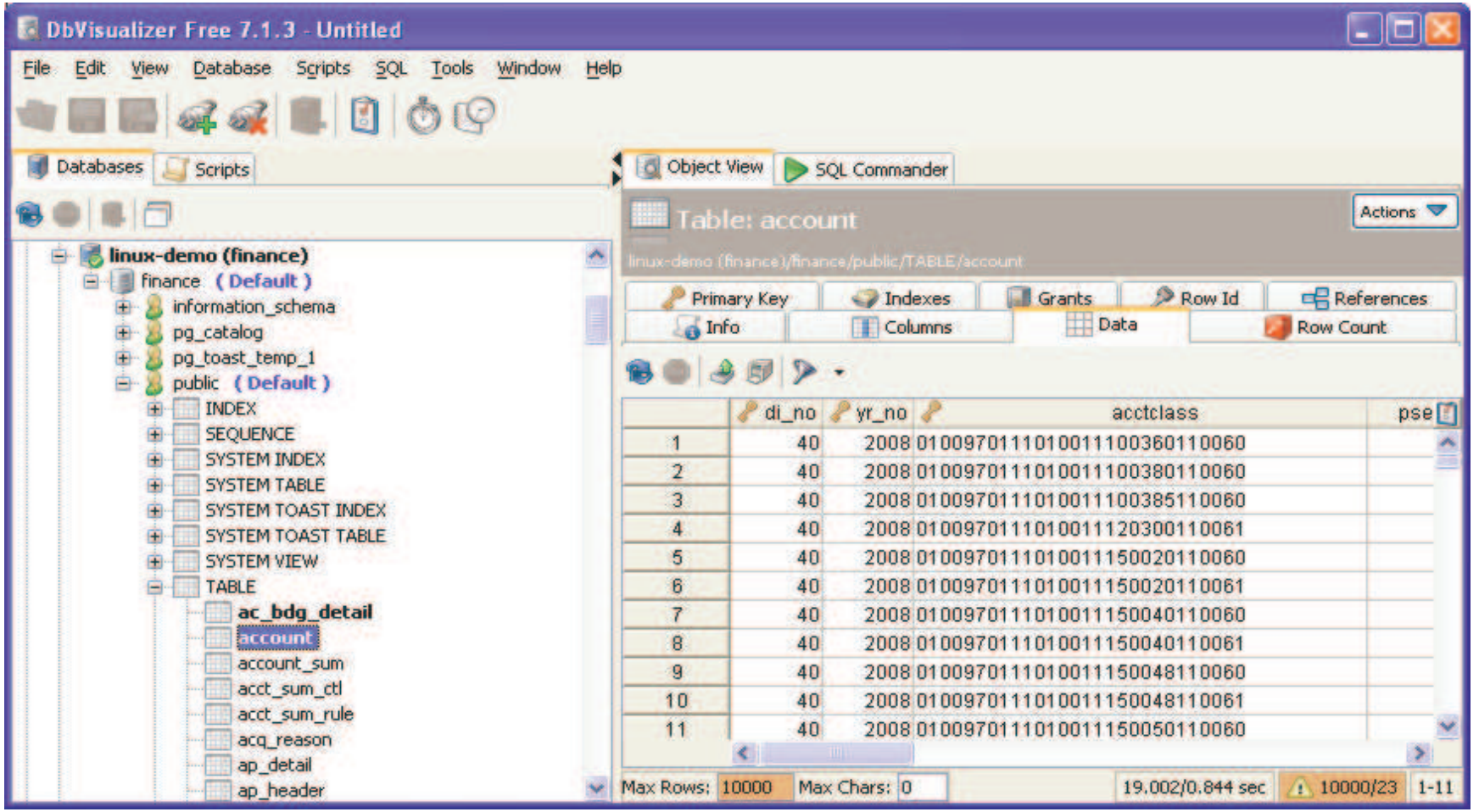
Sample DbVisualizer ‘Columns’ Object View



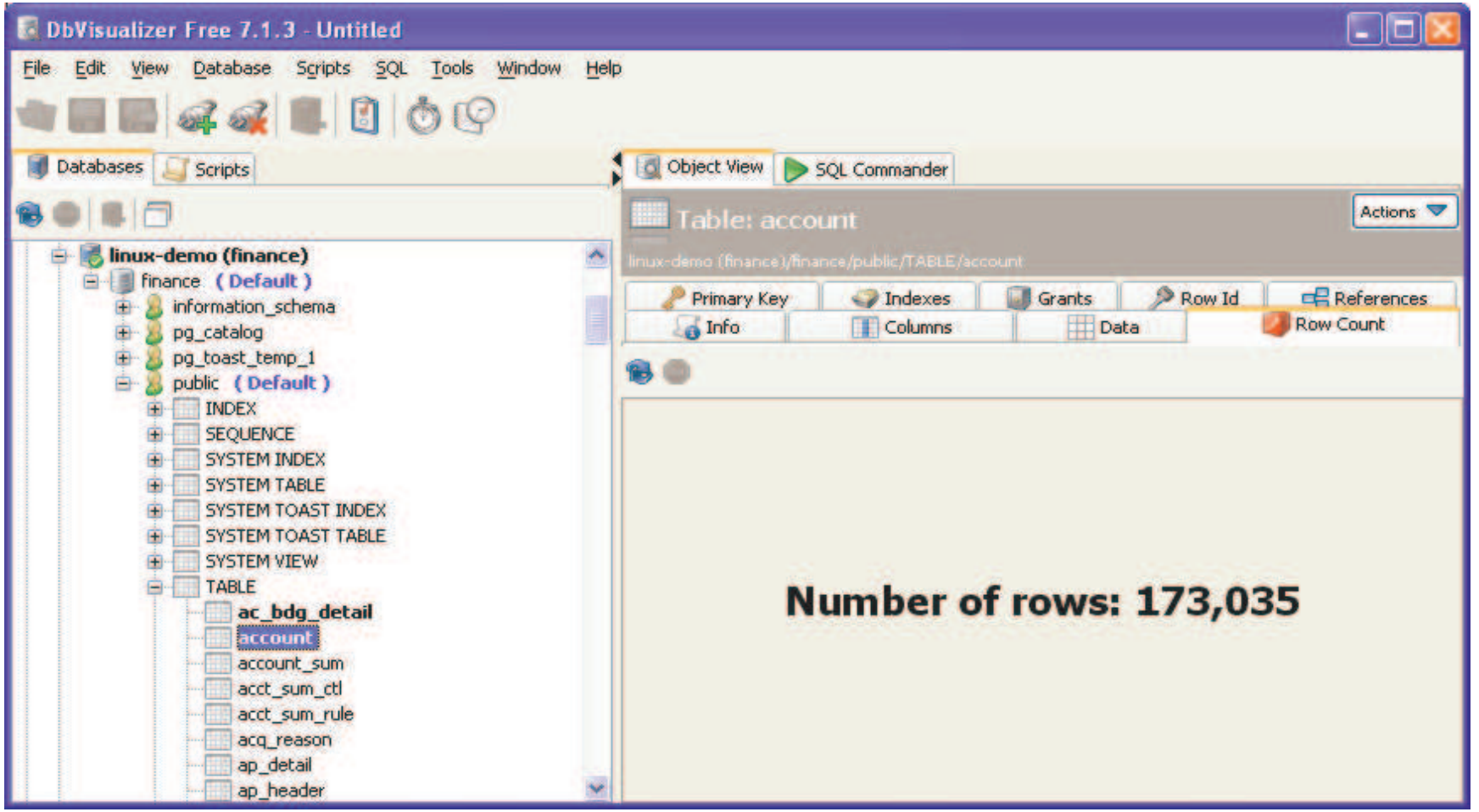
Sample DbVisualizer ‘Configure Filter’



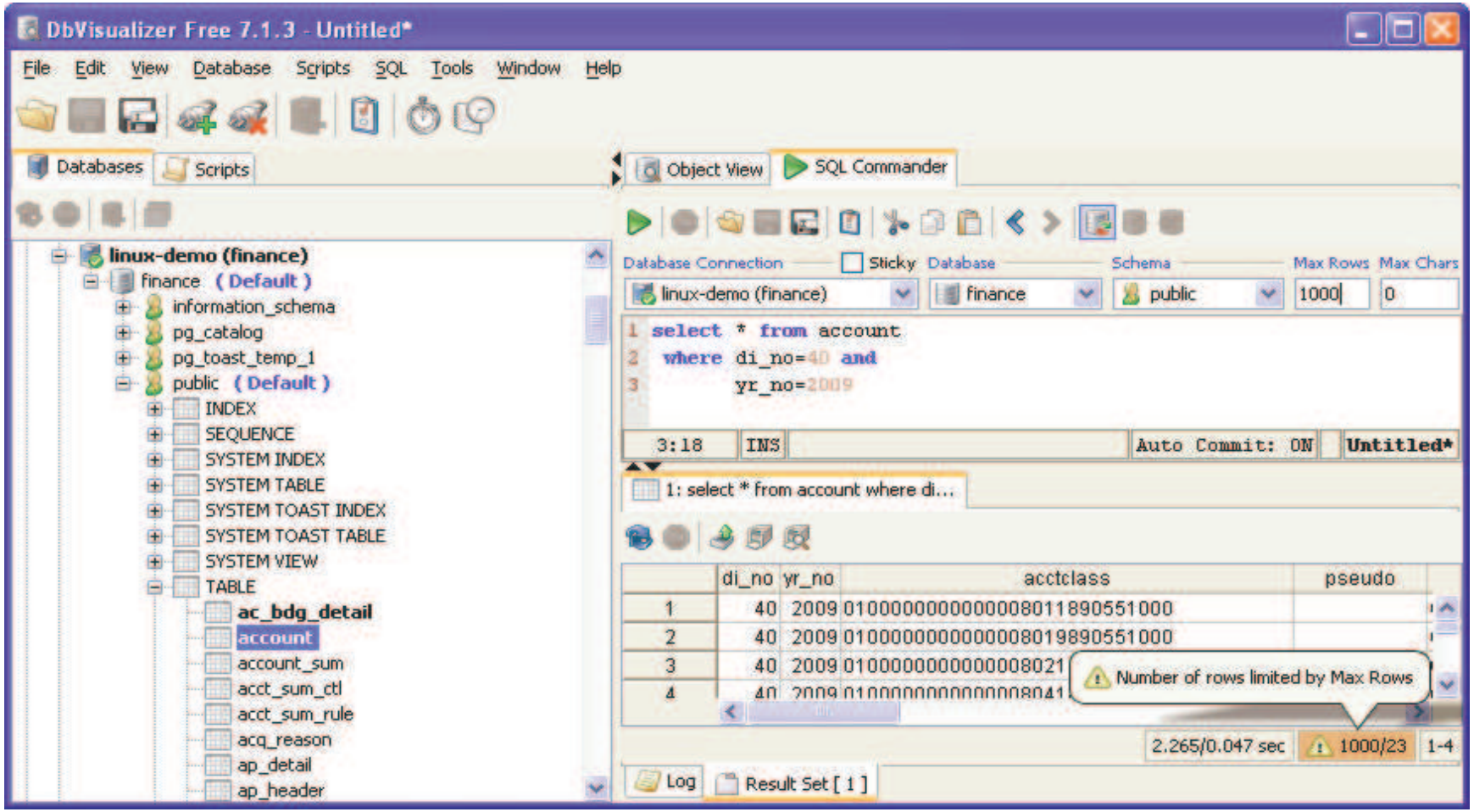
Sample DbVisualizer ‘Data’ Object View



Sample DbVisualizer ‘Row Count’ Object View



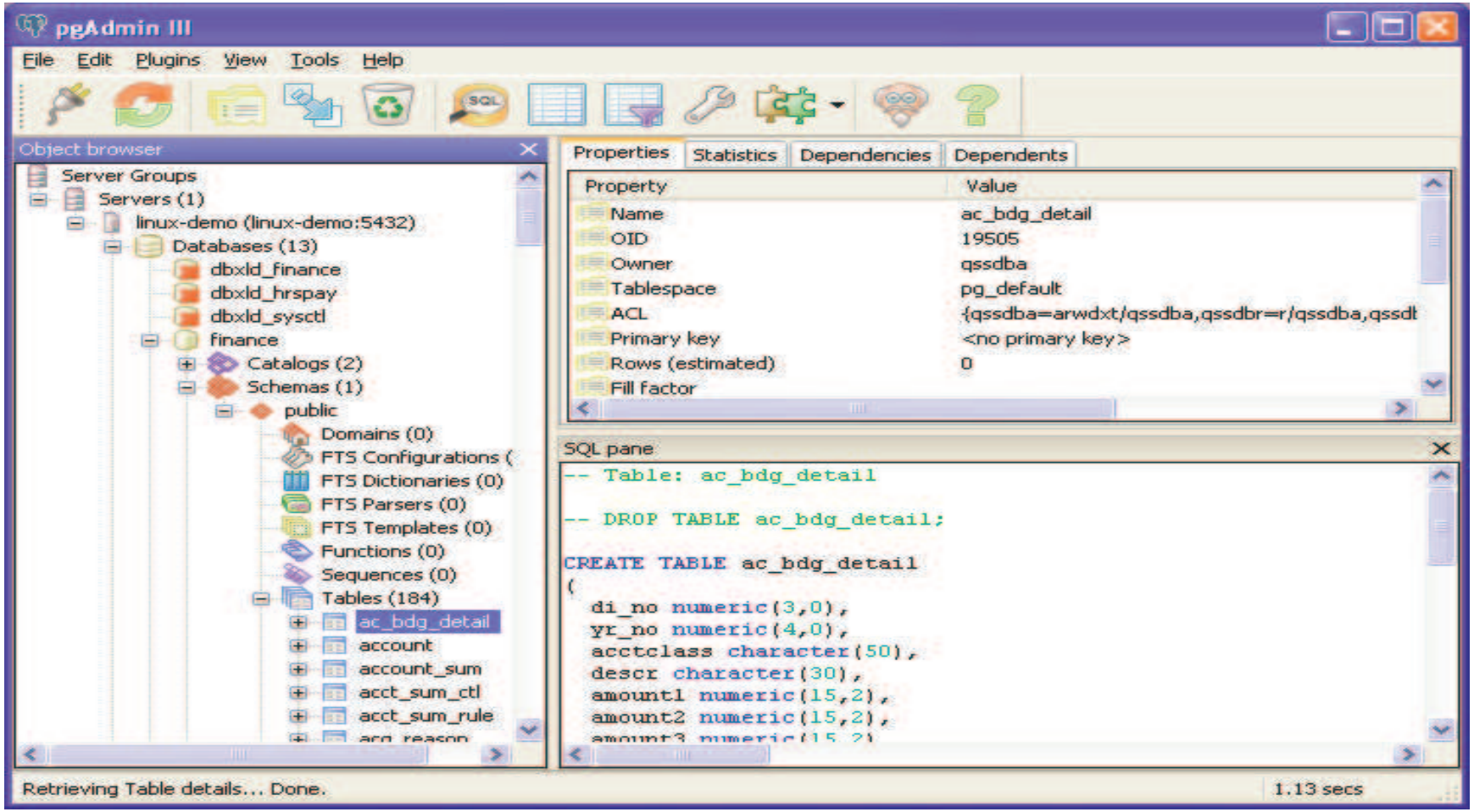
Sample DbVisualizer SQL Commander



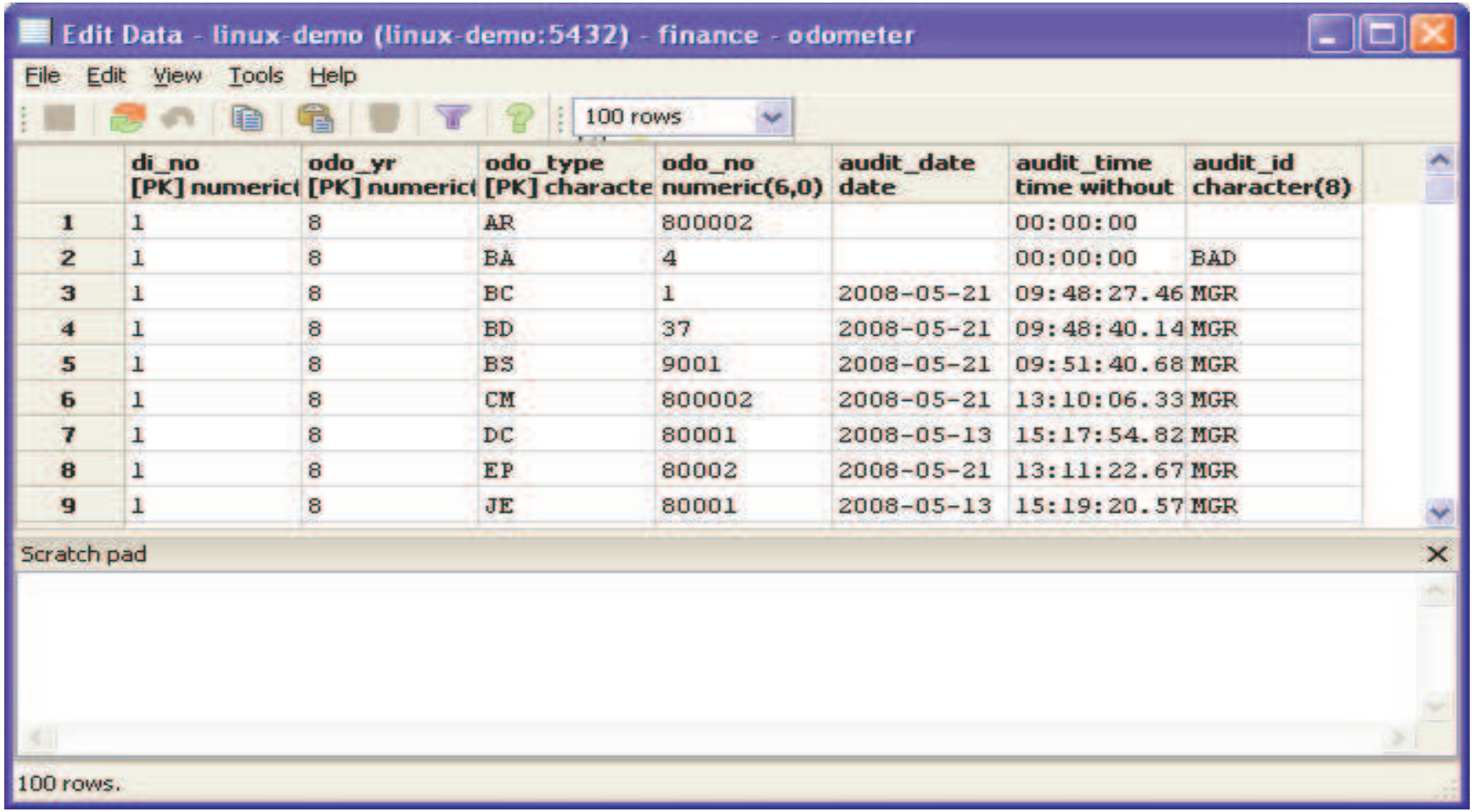
pgAdmin

- Graphical Interface to PostgreSQL database only
- Installed on remote PC desktop
- Can also do security changes
- Open Source (free)
- Website: http://www.pgadmin.org/

pgAdmin - Object tree

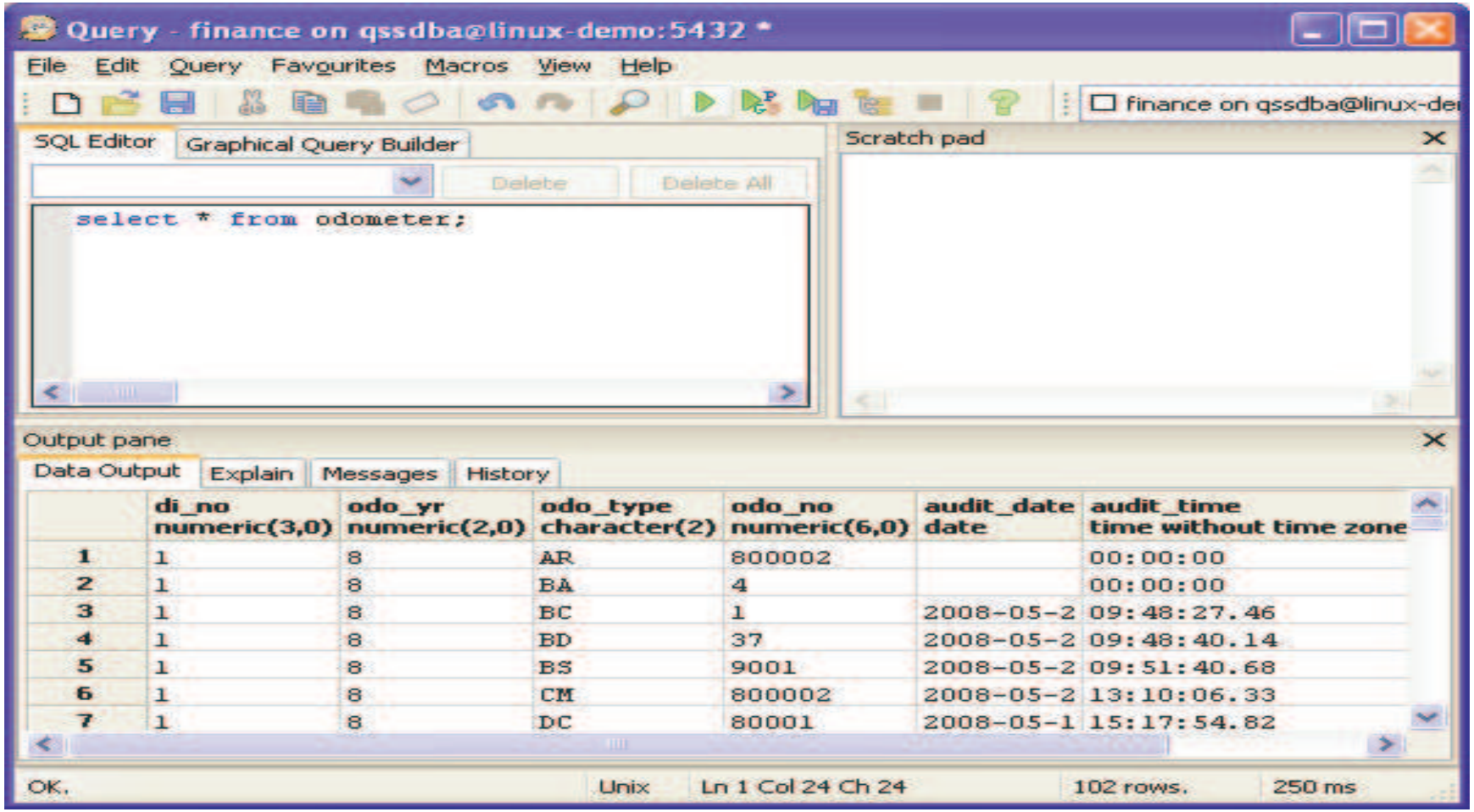


pgAdmin - View Data



	di_no [PK] numeric(	odo_yr [PK] numeric(	odo_type [PK] characte	odo_no numeric(6,0)	audit_date date	audit_time time without	audit_id character(8)
1	1	8	AR	800002		00:00:00	
2	1	8	BA	4		00:00:00	BAD
3	1	8	BC	1	2008-05-21	09:48:27.46	MGR
4	1	8	BD	37	2008-05-21	09:48:40.14	MGR
5	1	8	BS	9001	2008-05-21	09:51:40.68	MGR
6	1	8	CM	800002	2008-05-21	13:10:06.33	MGR
7	1	8	DC	80001	2008-05-13	15:17:54.82	MGR
8	1	8	EP	80002	2008-05-21	13:11:22.67	MGR
9	1	8	JE	80001	2008-05-13	15:19:20.57	MGR

pgAdmin - Query



Data Compaction - vacuum

- Compacts database files by removing no longer used pages
- May take a while depending on size of database
  - Manually done using PostgreSQL command

    vacuum
  - PostgreSQL command vacuumdb is a wrapper for above
  - Autovacuum may be configured in postgresql.conf

PostgreSQL vacuumdb Help

```
qssdba@linux-demo:~> man vacuumdb
VACUUMDB(1)                    PostgreSQL Client Applications                    VACUUMDB(1)
NAME
       vacuumdb - garbage-collect and analyze a PostgreSQL database

SYNOPSIS
       vacuumdb  [ connection-option... ]  [  [ --full ]  [ -f ]  ]  [  [ --verbose ]  [ -v ]
       ]  [  [ --analyze ]  [ -z ]  ]  [ --table | -t table
        [ ( column [,...] ) ]
        ]  [ dbname ]

       vacuumdb [ connection-options... ]  [  [ --all ]  [ -a ]  ]  [  [ --full ]  [ -f ]   ]
       [  [ --verbose ]  [ -v ]  ]  [  [ --analyze ]  [ -z ]  ]
DESCRIPTION
       vacuumdb is a utility for cleaning a PostgreSQL database.  vacuumdb will also generate
       internal statistics used by the PostgreSQL query optimizer.

       vacuumdb is a wrapper around the SQL command VACUUM [vacuum(7)].  There is  no  effec-
       tive difference between vacuuming databases via this utility and via other methods for
       accessing the server.
OPTIONS
       vacuumdb accepts the following command-line arguments:

       -a
       --all  Vacuum all databases.

       [-d] dbname
Manual page vacuumdb(1) line 1
```

PostgreSQL Backup

- pg_dump, pg_dumpall
- QSS Automated Task module
  - ‘pgbackup’
- Examples
  - backup finance database example

    ```
    pg_dump -Fc finance > finance.2011-02-18
    ```

    - -Fc option is the most flexible format and is compressed by default

PostgreSQL Restore

- pg_restore
- Examples (assumes previous pg_dump -Fc)
  - Restore entire database replacing existing database

```
dropdb finance
createdb -E SQL_ASCII finance
pg_restore -d finance finance.2011-02-18
```

  - Restore entire database to a new database name

```
createdb -E SQL_ASCII finance.2011-02-18
pg_restore -d finance.2011-02-18 finance.2011-02-18
```

PostgreSQL Restore - examples

- Examples (continued)
  - Restore one table replacing existing table
    - Option 1. drops the table and restores data and table definition but not indexes

```
pg_restore -d finance -t bde_budget -c -v finance.2011-02-18
```

    - Option 2. restores data only leaving existing structure in place

```
psql finance -c "DELETE from bde_budget;"
pg_restore -d finance -t bde_budget -a finance.2011-02-18
```

    - Option 3. restore specific entries from dump list file

```
pg_restore -l finance.2011-02-18 | grep bde_budget > finance.restore.list
vi finance.restore.list  #remove lines not associated with desired table
pg_restore -d finance -L finance.restore.list -c -v finance.2011-02-18
```

PostgreSQL Restore - examples

- Examples (continued)
  - Restore one table as table_yyyy_mm_dd

```
# create a temporary database to restore into
createdb -E SQL_ASCII finance.2011-10-26
# restore only what you want
pg_restore -d finance.2011-10-26 -t po_req_header finance.2011-10-
  26
# rename the table to include the date of the backup
psql finance.2011-10-26 -c "alter table po_req_header rename to
  po_req_header_2011_10_26;"
# backup the temporary database
pg_dump -Fc finance.2011-10-26 > finance.po_req_header_2011_10_26
# restore the table named with the date for the temporary database
  backup.
pg_restore -d finance -t po_req_header_2011_10_26
  finance.po_req_header_2011_10_26
#cleanup, temp database, temp backup file, etc.
dropdb finance.2011-10-26
rm finance.po_req_header_2011_10_26
```

QSS Automated Task Module - pgbackup

- Automated method to backup PostgreSQL databases
- Configuration file
  - /etc/opt/qss/qat.d/pgbackup
- Has naming conventions for 3 types of backups
  - Daily, weekly, monthly
  - Definition for end of week, end of month is configurable
- Based on naming conventions files can be saved until manually deleted or overwritten

PostgreSQL Automatic Startup

- Automatic start is setup via Linux
  - Use distribution specific GUI tool to manage servers run levels or chkconfig

Starting / Stopping PostgreSQL

- Using init script
  - Done from ‘root’ user

```
linux-demo:~ # /etc/init.d/postgresql
Usage: /etc/init.d/postgresql {start|stop|status|try-restart|restart|force-reload|reload|probe}
linux-demo:~ # /etc/init.d/postgresql status
Checking for PostgreSQL:                                    running
```

- Using PostgreSQL command
  - Done from ‘postgres’ user

```
linux-demo:~ # su - postgres
postgres@linux-demo:~> pg_ctl --help
pg_ctl is a utility to start, stop, restart, reload configuration files,
report the status of a PostgreSQL server, or signal a PostgreSQL process.

Usage:
  pg_ctl start   [-w] [-t SECS] [-D DATADIR] [-s] [-l FILENAME] [-o "OPTIONS"]
  pg_ctl stop    [-W] [-t SECS] [-D DATADIR] [-s] [-m SHUTDOWN-MODE]
  pg_ctl restart [-w] [-t SECS] [-D DATADIR] [-s] [-m SHUTDOWN-MODE]
                 [-o "OPTIONS"]
  pg_ctl reload  [-D DATADIR] [-s]
  pg_ctl status  [-D DATADIR]
```

PostreSQL config files

- Found in PostgreSQL's data directory
  - For example: /var/lib/pgsql/data
- PostgreSQL Client Authentication Configuration File
  - pg_hba.conf
- PostgreSQL configuration file
  - postgresql.conf

pg_hba file

- Methods
  - “trust” connections are trusted without any authentication and should be use only on local connections such as defaults setup for ‘localhost’
  - "md5" is preferred since it sends encrypted passwords.

```
# TYPE  DATABASE    USER        CIDR-ADDRESS          METHOD

# "local" is for Unix domain socket connections only
local   all         all                               trust
# IPv4 local connections:
host    all         all         127.0.0.1/32          trust
# IPv6 local connections:
host    all         all         ::1/128               trust

# qss
host    all         all         173.164.188.61/32     md5
```

postgresql.conf file

- More info available at http://www.postgresql.org/docs/8.4/static/runtime-config.html

```
listen_addresses = '*‘      # default is ‘localhost’
port = 5432                 # default is 5432
max_connections = 5000      # default is 100
shared_buffers = 256MB      # default is 32MB
max_prepared_transactions = 5000 # >= max_connections
max_locks_per_transaction = 64   # min 10, default is 64
standard_conforming_strings = on
```

Shared Memory Usage

- Increasing max_connections may require changes to other PostgreSQL settings as well as kernel settings.
- See the following for more details. http://www.postgresql.org/docs/8.4/static/kernel-resources.html