

TrafficObjects 1.1.3

User Guide

Monitor data from remote databases and files with real-time, streaming charts.

TrafficObjects can be downloaded at www.traffic-objects.com

Contact us: support@traffic-objects.com (English or Spanish):

- support
 - report a bug
 - request new feature
 - request support for a specific RDBMS or input file format
-

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1. Description

TrafficObjects allows users to easily create real-time, streaming charts for monitoring and data mining.

The main features for the creation of charts are:

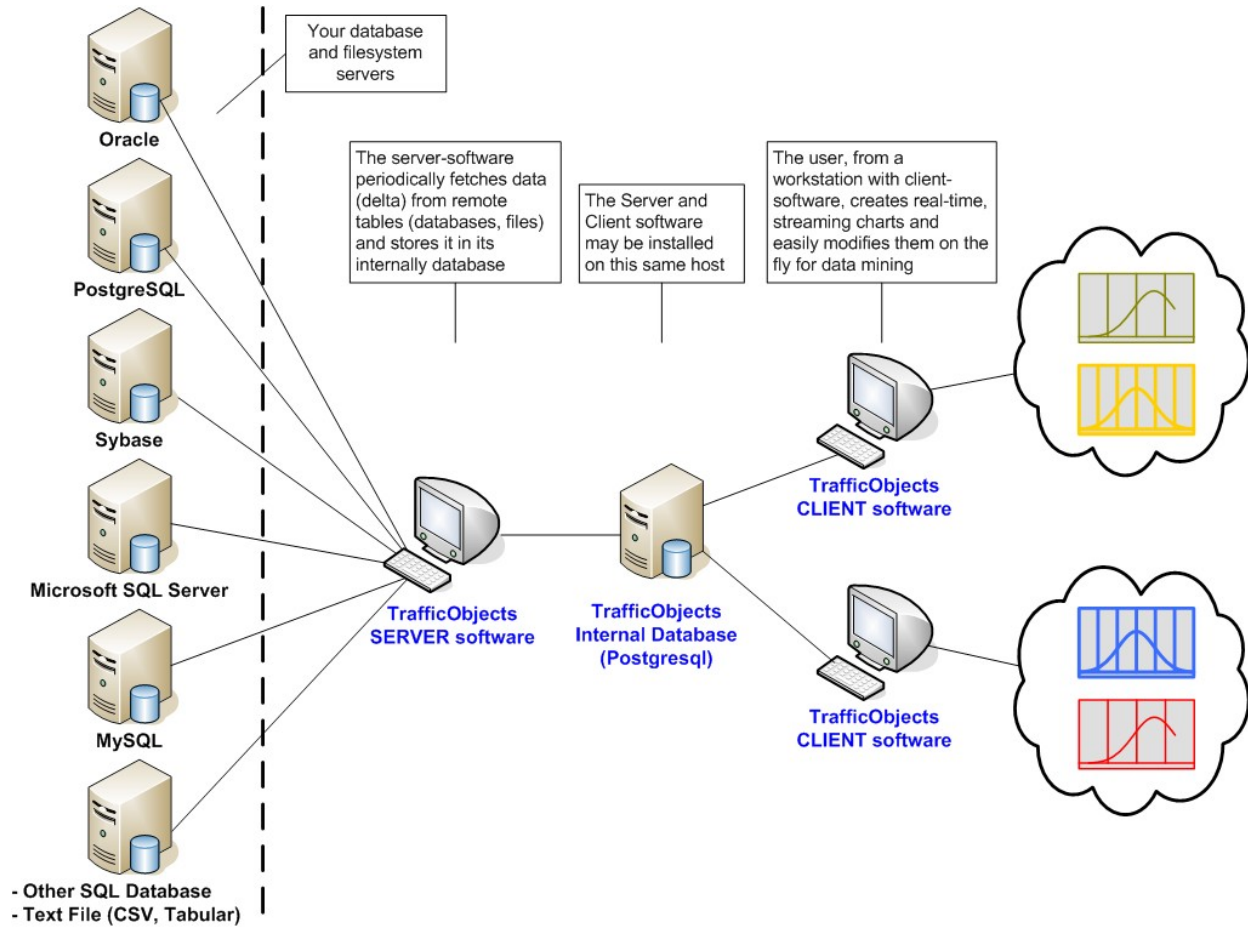
- **LOV:** A list of values (LOV) is automatically generated in real-time for each dimension. The user can use this LOV to filter the values on each dimension represented in the chart.
- **History Overlay:** Each series in a chart can be shown with a history overlay, which is that same series but with a displacement in time. This is useful for comparing trends at different times. The amount of time displacement is configurable by the user for each chart.
- **Percentage representation:** A series can be represented as a percentage of multiple series aggregation. The user can specify more than one group for each chart.

The chart data is periodically and automatically fetched by TrafficObjects from user-specified remote databases and files. The currently supported remote database systems and text-files are:

- **Oracle**
- **PostgreSQL**
- **Microsoft SQL Server**
- **Sybase**
- **MySQL**
- **CSV file**
- **Tabular text file**
- **Postgresql Log file**

Any other database system or text-file format can be supported upon request.

2. Architecture Overview



3. Installation Instructions

3.1. *Requisites*

TrafficObjects is implemented in Java and therefore can run on most hardware and operating systems.

3.1.1. Firewall

Make sure that any firewall allows the connection between the following hosts and protocols:

Host originator	Host accessed	Protocol
TrafficObjects Server	Your remote DBMS	RDBMS port
TrafficObjects Server	Your remote File system	FTP port
TrafficObjects Server	TrafficObjects internal database (Postgresql)	Postgresql port
TrafficObjects Client	TrafficObjects internal database (Postgresql)	Postgresql port

3.2. *Install Java on Sever and Clients machines*

Install Java JRE 1.6 or higher on the host where the TrafficObjects server software will be installed and on all hosts where TrafficObjects client software will be installed.

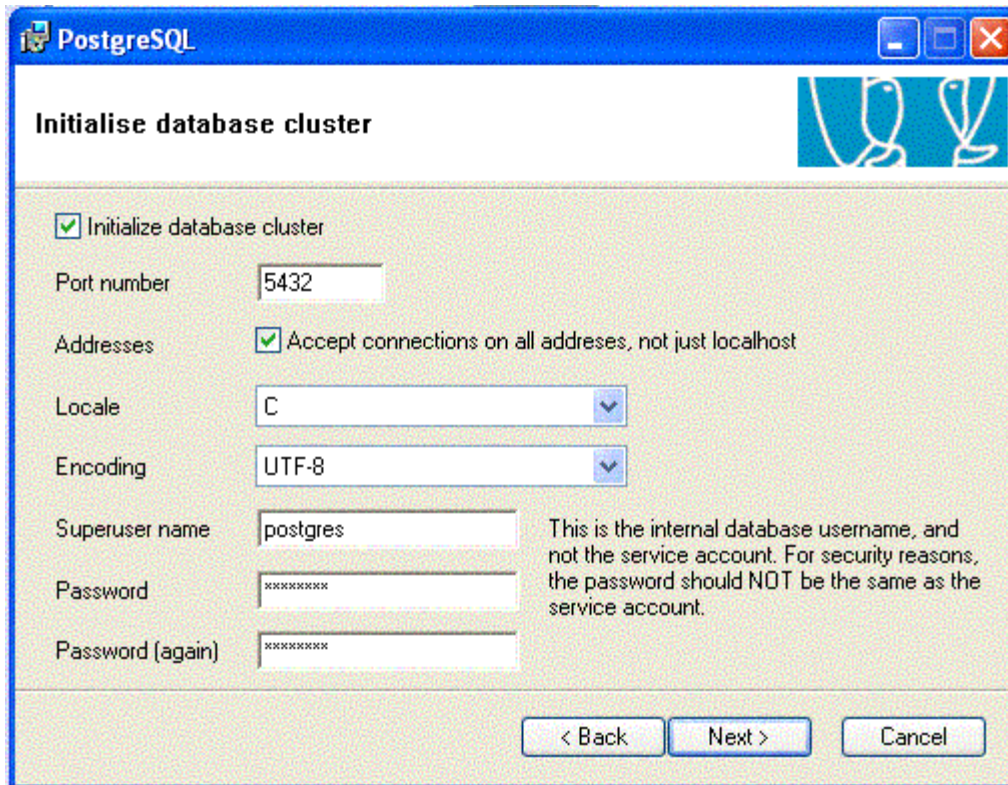
3.3. *Install Postgresql database on server machine*

Install Postgresql 8.1 or higher on a host that can be reached by the host running TrafficObjects server software and the hosts running TrafficObjects client software. Postgresql server, TrafficObjects server and TrafficObjects client software may be installed on separate hosts, all on the same host or any combination of this. You can find the latest release of this open source relational database system at www.postgresql.org.

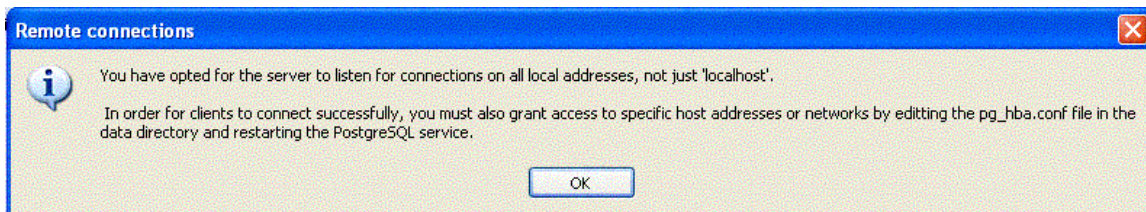
Accept all default settings in the installation if nothing else is specified below.

On the following installation screenshot, make sure to:

- Select “Accept connections on all addresses, not just localhost”
- Encoding UTF-8.
- Set super user password to “postgres”

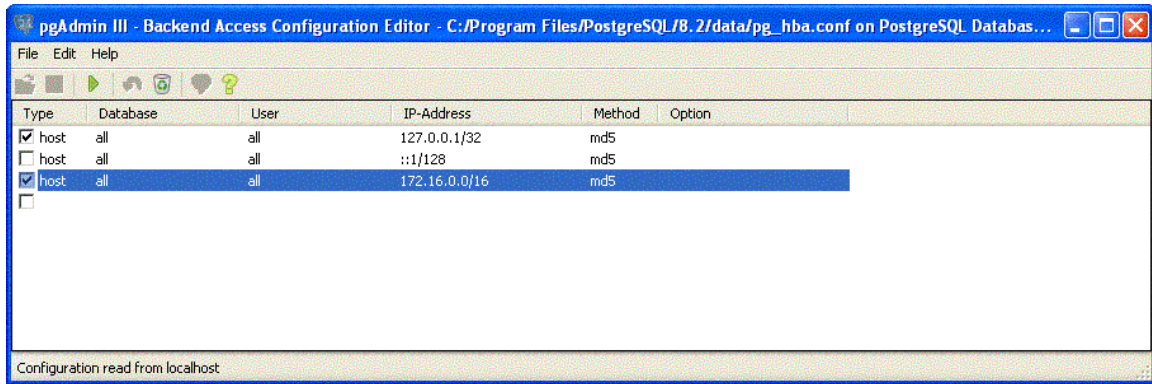


You will get the following warning that will be resolved by a procedure later on in this instruction:



Once postgresql has been installed:

- Start the GUI application “pgAdmin III”
- Select menu Tools→Server Configuration→pg_hba.conf
- Create line as the one highlighted in the screenshot below. Set IP-Address to cover the domain of all clients. In this example, all clients are in domain 172.16.xxx.xxx and “/16” specifies that only the first 16 bits (2 numbers to the left) are significant.



3.4. Create TrafficObjects Database

The following procedures are all done from Postgresql's administration GUI tool "pgAdmin"

1. Create user "to":

- In the object browser frame, select "Login Roles"
- Select menu item Edit→New Object→New Login Role
- Create user "to" with password "to"

2. Create trafficobjects schemas:

- In the object browser frame, select database "postgres"
- Select menu Tools→Query tool
- Open the file "**trafficobjects_schema_x_x_x.sql**" that is found in the TrafficObjects zip file.
- Select menu Query→Execute

TrafficObjects has two schemas:

- **trafficobjects_core**: contains configuration tables
- **trafficobjects_tables**: contains tables that hold the data retrieved from the remote data sources

3.5. Install TrafficObjects

- Unzip file TrafficObjects.zip
- Place TO_Server directory under any directory
- Place TO_Client directory under any directory

3.6. Start TrafficObjects

- Server application:
java -jar ../TO_Server/TO_Server.jar
-or- start it with supplied script
- Client application:
java -jar ../TO_Client/TO_Client.jar
-or- start it with supplied script

3.6.1. Distribute TrafficObjects Client through Java Web Start

TrafficObjects Client can also be installed/started from a web browser. To enable this:

- put directory TO_Client in your Web Server home directory tree.
- edit file launch.jnlp and set the 'codebase' parameter to the Web Server IP address.

4. Upgrade Instructions

Contact us for support on upgrading from a previous version of TrafficObjects.

5. User Manual

The first step to be able to create a chart in TrafficObjects' Client GUI is to define the table that holds the data to be plotted in TrafficObjects' Server GUI.

5.1. TrafficObjects Server – RDBMS data source

Create a table that has a remote database table as the data-source.

1. Frame Connect
 - Specify remote database connection information. The remote database is where the source database table is located.
2. Frame Available External Tables
 - Select the source database table
3. Frame External Table Columns
 - Select which columns will be available from this table for the creation of the charts.
 - Select Value Type (Dimension/Measure) for each column.
4. Frame Create Table
 - Indexed Sequence Column: In this field you specify which column in the source database table represents the chronological sequence of the event (record) and also has a database index on it. In its simplest form it would be a column of type date/time but it could also be of another type, always numeric, if there were not an index on the time column.
 - Indexed Sequence Prefix Format: This field is to specify the format of the 'Indexed Sequence' column.
 - Time Column: This column is the time stamp of the event for each record. It could be the same as the Indexed Sequence Column.
 - Time Zone Column: If the date/time in the 'Time column' does not include time zone information but time zone information exists in another column, you specify this in this field. The time zone format in this column must be any of the listed in section 7.1 Time zones or the following format:

	Example	
sign digit	+8	8 hours ahead
sign digit digit	+08	8 hours ahead
sign digit : digit digit	+8:15	8 hours and 15 minutes ahead
sign digit digit : digit digit	+08:15	8 hours and 15 minutes ahead

To take into account DST (Daylight Saving Time), the time zone column at the data source must use the full name format as for example “America/Los_Angeles” or switch between “-8:00” and “-7:00” at the corresponding dates during the year.

Be careful to not include spaces in the time zone column at the data source table or it will be

ignored and defaulted to GMT.

- Time Granularity (secs): The data from the source database table will be aggregated with this granularity. When creating a chart based on this table, it will not be possible to do with a granularity higher than specified here, only lower. The main reason for this functionality is to reduce the amount of data transferred from the source database table and stored in TrafficObjects server.
- Update Interval (mins): This is the periodicity with which TrafficObjects server will fetch new data from the source database table. This is directly related to how often the charts will be updated with new, real-time, streaming data.

Traffic Objects 1.0.4

Table management | **Create Table from Database** | **Create Table from File** | **Table Update Schedule**

Connect

RDBMS: **POSTGRES** | Port: **5432**

IP address: **localhost** | Database name: **postgres**

User: **to** | Password: **to**

List Tables

Schema filter: **dws_1**

Available Tables

Schema	Table / View
dws_1	cingular_voice_cdr_pk
dws_1	test_pkey
dws_1	test_th_id_pkey
dws_1	time_test_inverted_pkey
dws_1	time_test_pkey
dws_1	copy_test
dws_1	test
dws_1	test_all_types
dws_1	test_th_id
dws_1	time_test
dws_1	time_test_inverted
dws_1	voice_call_data_record

Table Columns

Name	Data type	Value type	Use
answer_time_utc	TIMESTAMPZ	DIMENSION	<input checked="" type="checkbox"/>
answer_tz	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
call_type_name	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
scp	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
mslsdn_prefix	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
cos	INTEGER	MEASURE	<input checked="" type="checkbox"/>
provider	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
cdr_type	INTEGER	MEASURE	<input checked="" type="checkbox"/>
cgl	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
e164	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
rate	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
mou	INTEGER	MEASURE	<input checked="" type="checkbox"/>
cost	INTEGER	MEASURE	<input checked="" type="checkbox"/>
TO_RECORD_COUNT	INTEGER	MEASURE	<input type="checkbox"/>
TO_SNAPSHOT	TIMESTAMPZ	DIMENSION	<input type="checkbox"/>

Create Table

Indexed sequence column: **answer_time_utc**

Indexed seq. prefix format: **TIMESTAMP**

Time column: **answer_time_utc**

Time zone column: **answer_tz**

Time granularity (secs): **60**

Sweep (mins): **5**

Update interval (mins): **3**

Install Table

Once the table has been installed you need to make it start collecting data. See section TrafficObjects Server – Table Management

5.1.1. Snapshot Feature

To create a chart for a table that does not contain history but just the current values of the object it represents, you can use the “Snapshot” feature of TrafficObjects. This feature will continuously take snapshots of the table and add a current time stamp to each of them, creating in this way a history of the table values.

To configure a data-source table with the snapshot feature, select 'TO_SNAPSHOT' at either checkbox 'Indexed sequence column' or 'Time Column' at TO-Server UI → Create Table from Database → Create Table.

5.1.2. Sybase exception

Sybase does not support grouping by 'Text' data type so you should not define a column of 'Text' data type as a Dimension when creating a table in TrafficObjects with a Sybase table as a data source. This does not affect data types such as 'Varchar'.

5.2. TrafficObjects Server – TEXTFILE data source

Create a table that has a remote text-file as the data-source.

1. Frame Source File
 - Specify remote file system ftp connection information.
2. Frame Filename Pattern
 - Set path and filename of the remote file(s). The filename can be specified in regular expression format.
3. Frame Parser
 - Specify the built-in parser that should be applied to the text-file. The standard available parsers are **Tabular** and **Postgresql_Log**. Others parsers can be created upon request.
4. Frame Delimiters
 - For the **Tabular** parser, specify the character that delimits the columns
5. Frame Header and Data Layour
 - For the **Tabular** parser, specify the line numbers where the Header and Data starts in the file.
6. Frame Action after file processed
 - Specify what should be done with the source text-file after it has been fetched from the remote file system:
7. Frame External Table Columns
 - Select which columns will be available from this table for the creation of the charts.
 - Select Value Type (Dimension/Measure) for each column.
 - Specify the Data Type for each column. The following window will open when you click on a Data Type cell.

☒ Text
☐ Integer
☐ Decimal
☒ Date/Time

FIELD	LETTER	VALUES
Day:	d	1..12
Month:	M MMM	1..12 Jan..Dec
Year:	Y	08 2008
Hour:	H h	0..23 1..12
Minute:	m	0..59
Second:	s	0..59
Millisecond	S	0..999
am/pm marker	a	am pm
Time zone:	z Z(RFC-822)	PST or GMT-08:00 -0800

Example Jan.01.2008 13:59:59.999 -8000 => MMM.d.y H:m:ss.SSS Z
 Example 1.01.2008 1:59:59.999 pm PST => M.d.y h:m:s.SSS a z

8. Frame Create Table

- Time Column: This column is the timestamp of the event for each record. It could be the same as the Indexed Sequence Column.
- Time Granularity (secs): The data from the source database table will be aggregated with this granularity. When creating a chart based on this table, it will not be possible to do with a granularity higher than specified here, only lower. The main reason for this functionality is to reduce the amount of data transferred from the source database table and stored in TrafficObjects server.
- Sweep: This is the amount of time or sequence units that TrafficObjects will fetch data with overlap back in time every time it fetches new data from the source database table. This functionality is used for tables that may not get all records in sequence, as for example when the external table is populated with data from more than one source.
- Update Interval (mins): This is the periodicity with which TrafficObjects server will fetch new data from the source database table. This is directly related to how often the charts will be updated with new, real-time, streaming data.
- Table name: Specify the table name (unique) that will be used for storing the chart data.

Traffic Objects 1.0.4

Table management | Create Table from Database | Create Table from File | Table Update Schedule

Source File

IP address: localhost

User (FTP): ftpuser Password: ftpuser

Filename pattern

Set path: /tmp/TO_External_Data/

Filename: *.txt Scan files

Filename examples (regular expression):
 Starts with "abc", ends with anything: abc.*
 Starts with "abc", ends with ".csv": abc.*.csv

Parser

TABULAR

Delimiters: ☐ Tab ☐ Space ☐ Comma Other:

Quotation character:

Header and Data Layout

☒ Column headers at line: 4

Data starts at line: 5

Action after file processed

☒ Delete ☐ Nothing (re-read) ☐ Append to filename:

Table Columns

Name	Data type	Value type	Use
time	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
scp	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
mou	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>

Create Table

Time column:

Time zone column:

Time granularity (secs): 60

Sweep (mins): 5

Update interval (mins): 3

Table name:

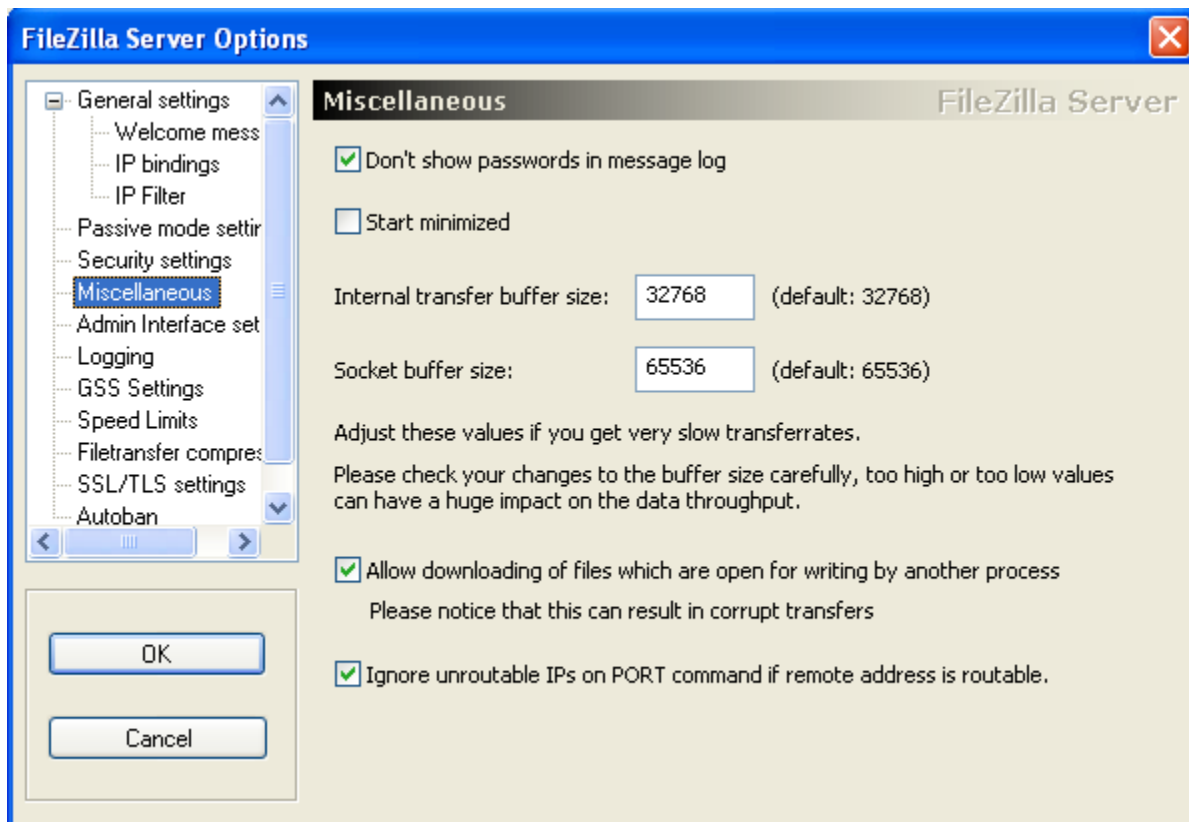
Install Table

2008-Mar-18 18:29:03 Sample file found = 123_space.txt
 # 2008-Mar-18 18:29:03 File: *.txt does not contain a suitable Date/Time column type. This record data is used to represent the x-axis on a chart.

Once the table has been installed you need to make it start collecting data. See section TrafficObjects Server – Table Management

5.2.1.Warning

For TrafficObjects to be able to fetch a remote file that is in “open for writing” state at file system level, the ftp server process must allow this on the host where the file resides. For example, FileZilla server allows this to be configured as shown in the picture below.



5.3. TrafficObjects Server – Table Management

Once a table has been installed, you need to request the scheduler to start updating it with data. You do this by selecting status 'run' in the “Installed Tables” tab and then pressing the button “Apply Changes”.

Data_source	IP_address	Port	User	Password	Table	Time_column	Timezone_column	Time_granul	Update_interval_mins	Status	Retention_days
TEXTFILE	localhost	21	ftpuser	ftpuser	abc	time		60	1	STOP	7
POSTGRES	localhost	5432	to	to	voice_call_data_record	answer_time_utc	answer_tz	60	1	RUN	7

Database	postgres
Schema	dws_1
Table	voice_call_data_record
Sequence Column	answer_time_utc
Sequence Format	TIMESTAMP

Sweep time: 1 HOUR

Max time range retrieval: 10 HOUR

Set sequence range manually - next session only -

Start sequence: [] End sequence: []

Currently programmed to: 2008-10-19 08:54 Unlimited

Delete Table

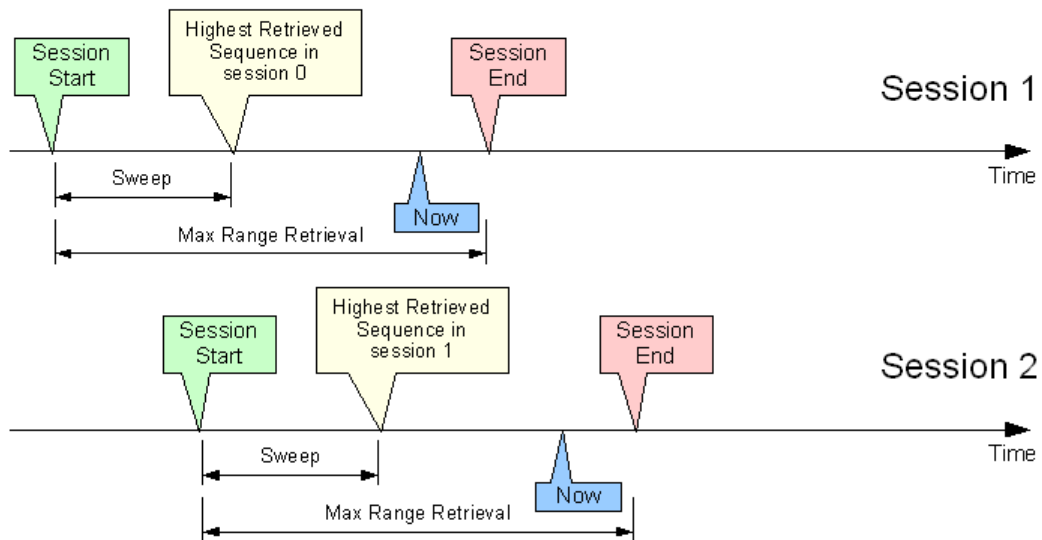
Apply Changes

Undo Changes

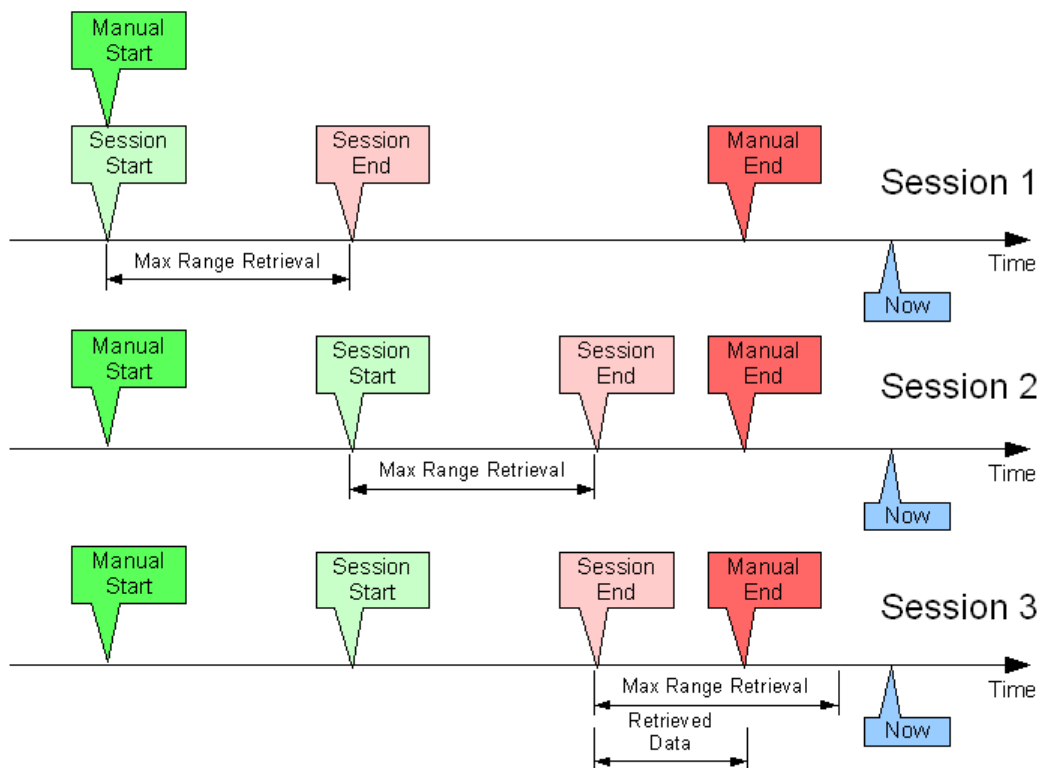
5.3.1. Data retrieval options

- Sweep: Amount of time/sequence units that TrafficObjects will subtract from the previously highest retrieved time/sequence to calculate the start sequence of the next data retrieval session. This functionality is used for tables that may not get all records in sequence, as for example when the external table is populated with data from more than one source.
- Max range retrieval: Amount of time/sequence units that TrafficObjects is allowed to retrieve in one session from the external table. This functionality is used to prevent overloading the external data source
- Start sequence, End sequence: If you need to reload old data from the data source, input the time range in these fields. If you want to reload data up till current time then leave “End sequence” empty. Once a manual load has finished, it switches to real-time data retrieval.

Real-Time



Manual Reload



5.4. TrafficObjects Server – Job Scheduler Log

In this window you can see the progress of jobs such as data retrieval from data source.

TrafficObjects 1.1

Table management	Schedule	Create Table from Database	Create Table from File	About				
Job name	Session id	Task name	Scheduled time	Start time	Duration sec	Status	Details	Status message
voice_call_data_record	0	Job	2008-10-19 18:02:48	2008-10-19 18:02:48	18	COMPLETED		
voice_call_data_record	0	Read Data Source		2008-10-19 18:02:49	0	COMPLETED	Oct-18 22:55:00 - Oct-19 08:55:00 (Oct-19 08:54:28)	
voice_call_data_record	0	Update Table		2008-10-19 18:02:50	17	COMPLETED		
voice_call_data_record	1	Job	2008-10-19 18:03:48	2008-10-19 18:03:48	14	COMPLETED		
voice_call_data_record	1	Read Data Source		2008-10-19 18:03:48	0	COMPLETED	Oct-19 07:54:00 - Oct-19 17:54:00 (Oct-19 15:51:28)	
voice_call_data_record	1	Update Table		2008-10-19 18:03:49	13	COMPLETED		
voice_call_data_record	2	Job	2008-10-19 18:04:48	2008-10-19 18:04:48	2	COMPLETED		
voice_call_data_record	2	Read Data Source		2008-10-19 18:04:48	0	COMPLETED	Oct-19 14:51:00 - Oct-20 00:51:00 (Oct-19 15:51:28)	
voice_call_data_record	2	Update Table		2008-10-19 18:04:49	1	COMPLETED		
voice_call_data_record	3	Job	2008-10-19 18:05:48		0	CANCELLED		
voice_call_data_record	0	Job	2008-10-19 18:15:03	2008-10-19 18:15:03	4	COMPLETED		
voice_call_data_record	0	Read Data Source		2008-10-19 18:15:04	1	COMPLETED	Oct-19 14:51:00 - Oct-20 00:51:00 (Oct-19 15:51:28)	
voice_call_data_record	0	Update Table		2008-10-19 18:15:05	2	COMPLETED		
voice_call_data_record	1	Job	2008-10-19 18:16:03		0	CANCELLED		
voice_call_data_record	0	Job	2008-10-19 18:15:33	2008-10-19 18:15:34	3	COMPLETED		
voice_call_data_record	0	Read Data Source		2008-10-19 18:15:34	1	COMPLETED	Oct-19 14:51:00 - Oct-20 00:51:00 (Oct-19 15:51:28)	
voice_call_data_record	0	Update Table		2008-10-19 18:15:35	2	COMPLETED		
voice_call_data_record	1	Job	2008-10-19 18:16:33	2008-10-19 18:16:33	2	COMPLETED		
voice_call_data_record	1	Read Data Source		2008-10-19 18:16:33	0	COMPLETED	Oct-19 14:51:00 - Oct-20 00:51:00 (Oct-19 15:51:28)	
voice_call_data_record	1	Update Table		2008-10-19 18:16:34	1	COMPLETED		
voice_call_data_record	2	Job	2008-10-19 18:17:33	2008-10-19 18:17:33	2	COMPLETED		
voice_call_data_record	2	Read Data Source		2008-10-19 18:17:33	0	COMPLETED	Oct-19 14:51:00 - Oct-20 00:51:00 (Oct-19 15:51:28)	
voice_call_data_record	2	Update Table		2008-10-19 18:17:34	1	COMPLETED		

Status

☒ Show all status

SCHEDULED

Order

TIME

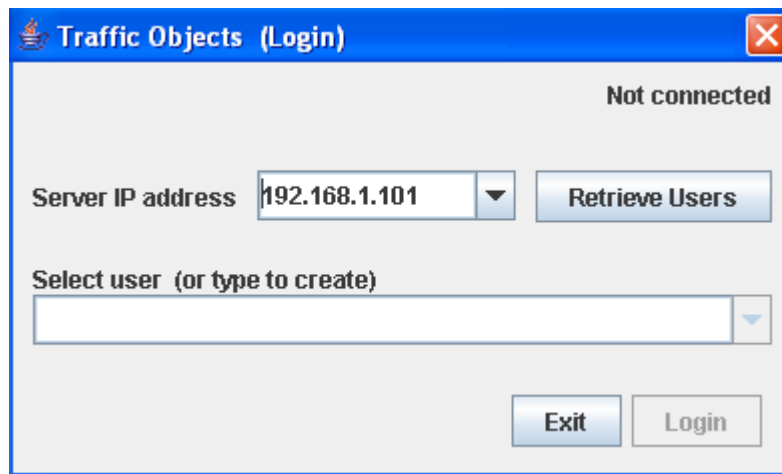
5.5. TrafficObjects Client

5.5.1. Users

A user is able to see anybody's charts but is only able to modify his/her own charts.

When the client software is started, the following window appears.

- Server IP address: The address of the host where the TrafficObjects server software is running.
- Select user: Once the button [Retrieve Users] is pressed, all users will be listed. You can select one of the available users or create a new one by typing it in.



5.5.2.Views

A view can contain none, one or several charts.

Create a view

- Select Menu→ Edit → Create view...
- Enter the desired name

Rename a view

- Select the view to be renamed
- Select Menu→ Edit → Rename view...
- Enter the desired name

Delete a view

- Select the view to be deleted
- Delete all charts, one by one, contained in the view
- Select Menu→ Edit → Delete view

View another user's charts

You can view the views/charts from another user in your own login session. You cannot create modify or delete any view or chart in another user's views.

- Select Menu → Edit→ Activate external views
- Select the users that have the views/charts that you desire to be able to see
- You switch between user's views by selecting the user in Menu→ Views

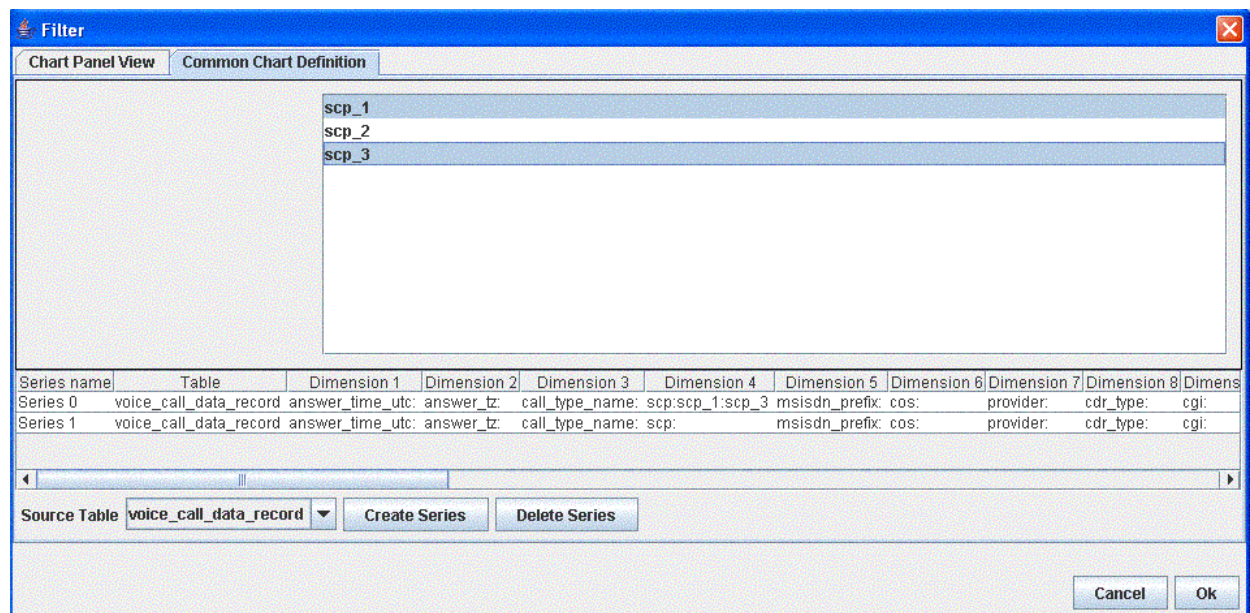
5.5.3.Charts

Create a chart

- Select the view where you want the chart to be contained
- Select Menu→ Edit → Create chart...
- Select tab→ Common Chart Definition and create all desired series with their corresponding dimension filtering.

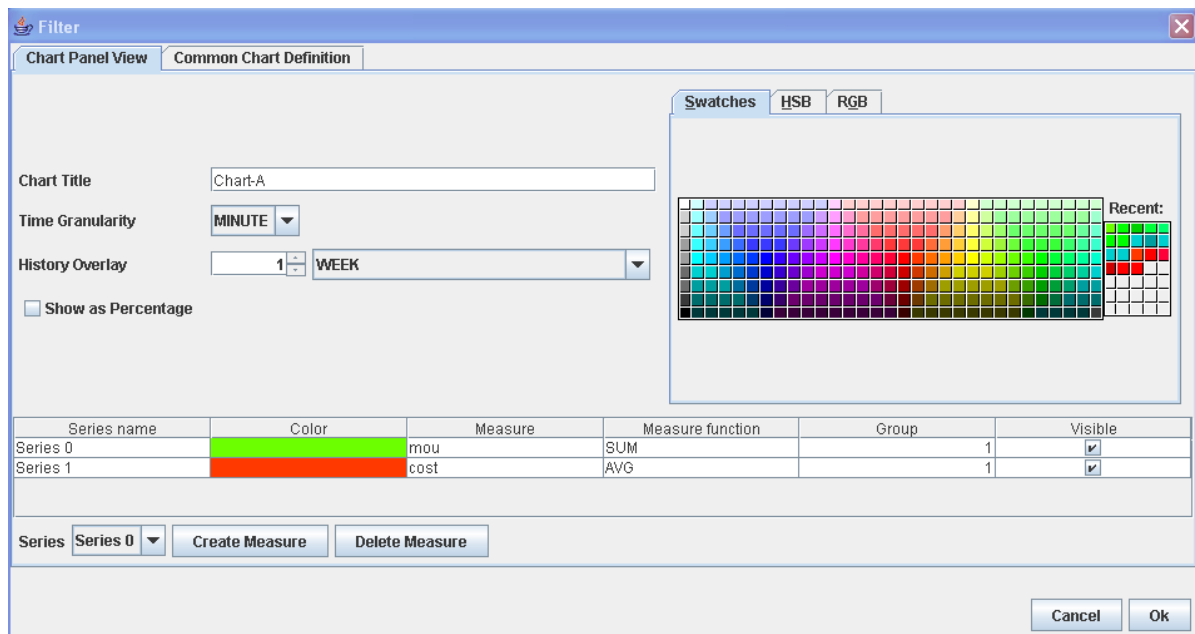
Not selecting any value for a specific dimension is equivalent to selecting all the values except that selecting none has the following advantages:

- You guard yourself against leaving out any new value added in the future to the data source
- System performance is increased



Select tab→ Chart Panel View

- Create all desired measures based on corresponding series.
- The 'Group' field is used to calculate the percentage of each measure belonging to that group. This is only applicable when 'Show as Percentage' is selected.



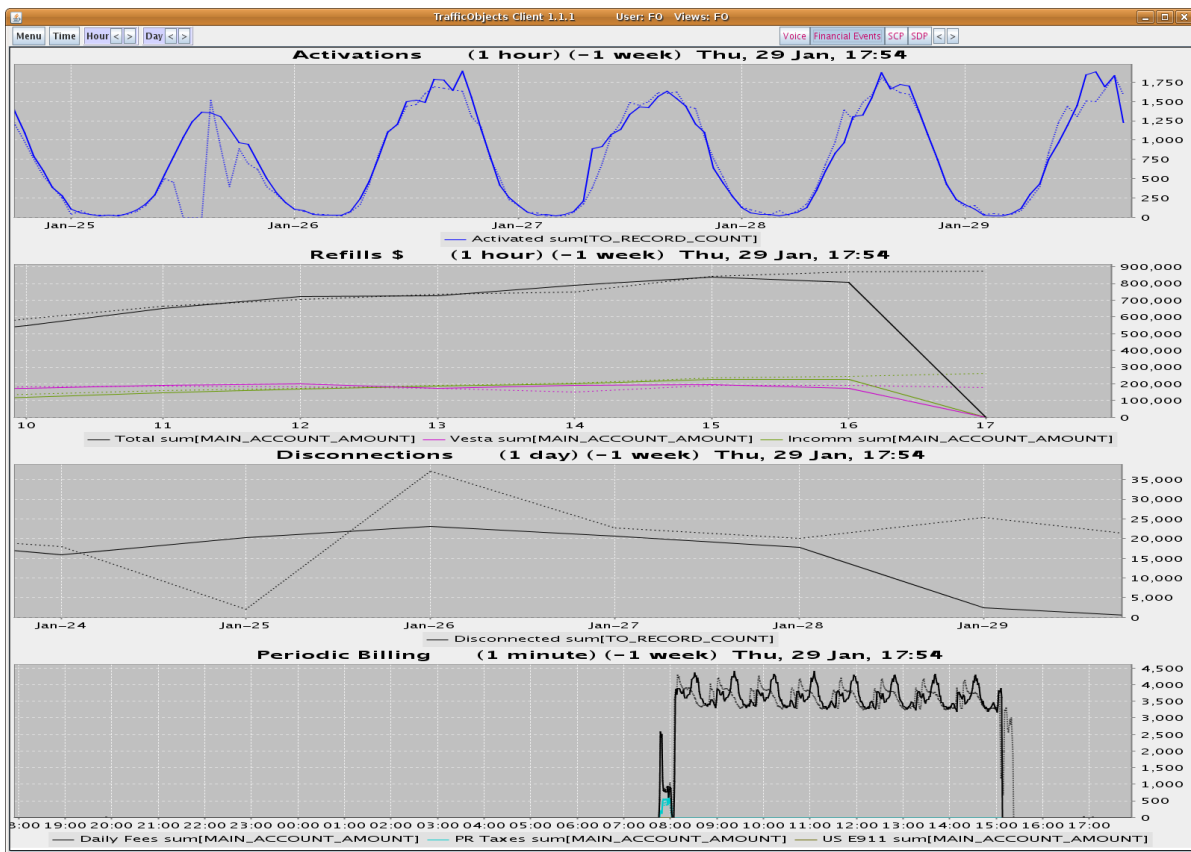
Once you press the “Ok: button, the chart will appear in the view, as showed in the picture below.

Edit a chart

Click on the chart with the right mouse button and select **Edit chart**.

Delete a chart

Click on the chart with the right mouse button and select **Delete chart**. Example of TrafficObjects charts:



6. Case studies

6.1. *Postgresql Statistics tables*

Postgresql system tables such as '**pg_stat_all_tables**' can be monitored with TrafficObjects using the Snapshot feature. See chapter [Snapshot Feature]

You need to leave out column 'relid' or at least change it from Measure to Dimension. If not, you will get the error message “...ERROR: function sum(oid) does not exist...”

You need to leave out any column that may contain 'null' value, such as:

- last_vacuum
- last_autovacuum
- last_analyze
- last_autoanalyze

You leave out columns by de-selecting the check-box 'Use' from TO-Server UI → Create Table from Database → Table Columns.

6.2. Query duration extracted from Postgresql Log

Postgresql's Log file can be monitored with TrafficObjects' text-file data-source functionality. See chapter TrafficObjects Server – TEXTFILE data source and select Parser 'POSTGRESQL_LOG'

Postgresql 8.3 or higher is required for this feature.

The Postgresql log must be configured so that the lines start with the time stamp and contains the query duration. This is specified in the configuration file postgresql.conf:

log_line_prefix: %t ...

Example line found in postgresql log file:

2008-03-24 16:10:39 CET LOG: duration: 47.000 ms statement: SELECT description FROM ...

log_min_duration_statement: 0

The screenshot shows the 'Traffic Objects 1.0.4' application window. The 'Table management' tab is active, and the 'Create Table from File' sub-tab is selected. The 'Source File' section on the left contains fields for 'IP address' (localhost), 'User (FTP)' (ftpuser), and 'Password' (ftpuser). Below these is the 'Filename pattern' section with a 'Set path' button and a text field containing 'Program Files\PostgreSQL\8.3\data\pg_log/'. The 'Filename' field contains '*.log' and a 'Scan files' button. A note below states: 'Filename examples (regular expression): Starts with "abc", ends with anything: abc.* Starts with "abc", ends with ".csv": abc.*.csv'. The 'Parser' dropdown is set to 'POSTGRESQL_LOG', and a message below it says 'Nothing to configure for this Parser'. The 'Action after file processed' section has three radio buttons: 'Delete', 'Nothing (re-read)' (which is selected), and 'Append to filename'. The 'Table Columns' section in the center shows a table with columns: Name, Data type, Value type, and Use. The rows are: Timestamp (TIMESTAMPTZ yyyy-MM-dd HH:mm:ss z, DIMENSION, checked), Duration (INTEGER, MEASURE, checked), Action (VARCHAR, DIMENSION, checked), and Statement (VARCHAR, DIMENSION, checked). The 'Create Table' section on the right has a 'Time column' dropdown set to 'Timestamp', a 'Time zone column' dropdown, 'Time granularity (secs)' set to 60, 'Sweep (mins)' set to 5, 'Update interval (mins)' set to 3, and a 'Table name' text field containing 'postgresql_log'. An 'Install Table' button is at the bottom of this section. At the bottom of the window, a status bar shows: '# 2008-Mar-18 18:08:11 Sample file found = postgresql-2008-03-18_180550.log'.

Name	Data type	Value type	Use
Timestamp	TIMESTAMPTZ yyyy-MM-dd HH:mm:ss z	DIMENSION	<input checked="" type="checkbox"/>
Duration	INTEGER	MEASURE	<input checked="" type="checkbox"/>
Action	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>
Statement	VARCHAR	DIMENSION	<input checked="" type="checkbox"/>

7. Annex

7.1. Time zones

ACT, AET, Africa/Abidjan, Africa/Accra, Africa/Addis_Ababa, Africa/Algiers, Africa/Asmera, Africa/Bamako, Africa/Bangui, Africa/Banjul, Africa/Bissau, Africa/Blantyre, Africa/Brazzaville, Africa/Bujumbura, Africa/Cairo, Africa/Casablanca, Africa/Ceuta, Africa/Conakry, Africa/Dakar, Africa/Dar_es_Salaam, Africa/Djibouti, Africa/Douala, Africa/El_Aaiun, Africa/Freetown, Africa/Gaborone, Africa/Harare, Africa/Johannesburg, Africa/Kampala, Africa/Khartoum, Africa/Kigali, Africa/Kinshasa, Africa/Lagos, Africa/Libreville, Africa/Lome, Africa/Luanda, Africa/Lubumbashi, Africa/Lusaka, Africa/Malabo, Africa/Maputo, Africa/Maseru, Africa/Mbabane, Africa/Mogadishu, Africa/Monrovia, Africa/Nairobi, Africa/Ndjamena, Africa/Niamey, Africa/Nouakchott, Africa/Ouagadougou, Africa/Porto-Novo, Africa/Sao_Tome, Africa/Timbuktu, Africa/Tripoli, Africa/Tunis, Africa/Windhoek, AGT, America/Adak, America/Anchorage, America/Anguilla, America/Antigua, America/Araguaina, America/Argentina/Buenos_Aires, America/Argentina/Catamarca, America/Argentina/ComodRivadavia, America/Argentina/Cordoba, America/Argentina/Jujuy, America/Argentina/La_Rioja, America/Argentina/Mendoza, America/Argentina/Rio_Gallegos, America/Argentina/San_Juan, America/Argentina/Tucuman, America/Argentina/Ushuaia, America/Aruba, America/Asuncion, America/Atka, America/Bahia, America/Barbados, America/Belem, America/Belize, America/Boa_Vista, America/Bogota, America/Boise, America/Buenos_Aires, America/Cambridge_Bay, America/Campo_Grande, America/Cancun, America/Caracas, America/Catamarca, America/Cayenne, America/Cayman, America/Chicago, America/Chihuahua, America/Coral_Harbour, America/Cordoba, America/Costa_Rica, America/Cuiaba, America/Curacao, America/Danmarkshavn, America/Dawson, America/Dawson_Creek, America/Denver, America/Detroit, America/Dominica, America/Edmonton, America/Eirunepe, America/El_Salvador, America/Ensenada, America/Fort_Wayne, America/Fortaleza, America/Glace_Bay, America/Godthab, America/Goose_Bay, America/Grand_Turk, America/Grenada, America/Guadeloupe, America/Guatemala, America/Guayaquil, America/Guyana, America/Halifax, America/Havana, America/Hermosillo, America/Indiana/Indianapolis, America/Indiana/Knox, America/Indiana/Marengo, America/Indiana/Vevay, America/Indianapolis, America/Inuvik, America/Iqaluit, America/Jamaica, America/Jujuy, America/Juneau, America/Kentucky/Louisville, America/Kentucky/Monticello, America/Knox_IN, America/La_Paz, America/Lima, America/Los_Angeles, America/Louisville, America/Maceio, America/Managua, America/Manaus, America/Martinique, America/Mazatlan, America/Mendoza, America/Menominee, America/Merida, America/Mexico_City, America/Miquelon, America/Monterrey, America/Montevideo, America/Montreal, America/Montserrat, America/Nassau, America/New_York, America/Nipigon, America/Nome, America/Noronha, America/North_Dakota/Center, America/Panama, America/Pangnirtung, America/Paramaribo, America/Phoenix, America/Port_of_Spain, America/Port-au-Prince, America/Porto_Acre, America/Porto_Velho, America/Puerto_Rico, America/Rainy_River, America/Rankin_Inlet, America/Recife, America/Regina, America/Rio_Branco, America/Rosario, America/Santiago, America/Santo_Domingo, America/Sao_Paulo, America/Scoresbysund, America/Shiprock, America/St_Johns, America/St_Kitts, America/St_Lucia, America/St_Thomas, America/St_Vincent, America/Swift_Current, America/Tegucigalpa, America/Thule, America/Thunder_Bay,

America/Tijuana, America/Toronto, America/Tortola, America/Vancouver, America/Virgin,
America/Whitehorse, America/Winnipeg, America/Yakutat, America/Yellowknife,
Antarctica/Casey, Antarctica/Davis, Antarctica/DumontDURville, Antarctica/Mawson,
Antarctica/McMurdo, Antarctica/Palmer, Antarctica/Rothera, Antarctica/South_Pole,
Antarctica/Syowa, Antarctica/Vostok, Arctic/Longyearbyen, ART, Asia/Aden, Asia/Almaty,
Asia/Amman, Asia/Anadyr, Asia/Aqtau, Asia/Aqtobe, Asia/Ashgabat, Asia/Ashkhabad,
Asia/Baghdad, Asia/Bahrain, Asia/Baku, Asia/Bangkok, Asia/Beirut, Asia/Bishkek, Asia/Brunei,
Asia/Calcutta, Asia/Choibalsan, Asia/Chongqing, Asia/Chungking, Asia/Colombo, Asia/Dacca,
Asia/Damascus, Asia/Dhaka, Asia/Dili, Asia/Dubai, Asia/Dushanbe, Asia/Gaza, Asia/Harbin, Asia/
Hong_Kong, Asia/Hovd, Asia/Irkutsk, Asia/Istanbul, Asia/Jakarta, Asia/Jayapura, Asia/Jerusalem,
Asia/Kabul, Asia/Kamchatka, Asia/Karachi, Asia/Kashgar, Asia/Katmandu, Asia/Krasnoyarsk, Asia/
Kuala_Lumpur, Asia/Kuching, Asia/Kuwait, Asia/Macao, Asia/Macau, Asia/Magadan,
Asia/Makassar, Asia/Manila, Asia/Muscat, Asia/Nicosia, Asia/Novosibirsk, Asia/Omsk, Asia/Oral,
Asia/Phnom_Penh, Asia/Pontianak, Asia/Pyongyang, Asia/Qatar, Asia/Qyzylorda, Asia/Rangoon,
Asia/Riyadh, Asia/Riyadh87, Asia/Riyadh88, Asia/Riyadh89, Asia/Saigon, Asia/Sakhalin,
Asia/Samarkand, Asia/Seoul, Asia/Shanghai, Asia/Singapore, Asia/Taipei, Asia/Tashkent,
Asia/Tbilisi, Asia/Tehran, Asia/Tel_Aviv, Asia/Thimbu, Asia/Thimphu, Asia/Tokyo,
Asia/Ujung_Pandang, Asia/Ulaanbaatar, Asia/Ulan_Bator, Asia/Urumqi, Asia/Vientiane,
Asia/Vladivostok, Asia/Yakutsk, Asia/Yekaterinburg, Asia/Yerevan, AST, Atlantic/Azores, Atlantic/
Bermuda, Atlantic/Canary, Atlantic/Cape_Verde, Atlantic/Faeroe, Atlantic/Jan_Mayen,
Atlantic/Madeira, Atlantic/Reykjavik, Atlantic/South_Georgia, Atlantic/St_Helena, Atlantic/Stanley,
Australia/ACT, Australia/Adelaide, Australia/Brisbane, Australia/Broken_Hill, Australia/Canberra,
Australia/Currie, Australia/Darwin, Australia/Hobart, Australia/LHI, Australia/Lindeman, Australia/
Lord_Howe, Australia/Melbourne, Australia/North, Australia/NSW, Australia/Perth,
Australia/Queensland, Australia/South, Australia/Sydney, Australia/Tasmania, Australia/Victoria,
Australia/West, Australia/Yancowinna, BET, Brazil/Acre, Brazil/DeNoronha, Brazil/East,
Brazil/West, BST, Canada/Atlantic, Canada/Central, Canada/Eastern, Canada/East-Saskatchewan,
Canada/Mountain, Canada/Newfoundland, Canada/Pacific, Canada/Saskatchewan, Canada/Yukon,
CAT, CET, Chile/Continental, Chile/EasterIsland, CNT, CST, CST6CDT, CTT, Cuba, EAT, ECT,
EET, Egypt, Eire, EST, EST5EDT, Etc/GMT, Etc/GMT+0, Etc/GMT+1, Etc/GMT+10,
Etc/GMT+11, Etc/GMT+12, Etc/GMT+2, Etc/GMT+3, Etc/GMT+4, Etc/GMT+5, Etc/GMT+6, Etc/
GMT+7, Etc/GMT+8, Etc/GMT+9, Etc/GMT0, Etc/GMT-0, Etc/GMT-1, Etc/GMT-10, Etc/GMT-
11, Etc/GMT-12, Etc/GMT-13, Etc/GMT-14, Etc/GMT-2, Etc/GMT-3, Etc/GMT-4, Etc/GMT-5,
Etc/GMT-6, Etc/GMT-7, Etc/GMT-8, Etc/GMT-9, Etc/Greenwich, Etc/UCT, Etc/Universal,
Etc/UTC, Etc/Zulu, Europe/Amsterdam, Europe/Andorra, Europe/Athens, Europe/Belfast,
Europe/Belgrade, Europe/Berlin, Europe/Bratislava, Europe/Brussels, Europe/Bucharest,
Europe/Budapest, Europe/Chisinau, Europe/Copenhagen, Europe/Dublin, Europe/Gibraltar, Europe/
Helsinki, Europe/Istanbul, Europe/Kaliningrad, Europe/Kiev, Europe/Lisbon, Europe/Ljubljana,
Europe/London, Europe/Luxembourg, Europe/Madrid, Europe/Malta, Europe/Mariehamn,
Europe/Minsk, Europe/Monaco, Europe/Moscow, Europe/Nicosia, Europe/Oslo, Europe/Paris,
Europe/Prague, Europe/Riga, Europe/Rome, Europe/Samara, Europe/San_Marino, Europe/Sarajevo,
Europe/Simferopol, Europe/Skopje, Europe/Sofia, Europe/Stockholm, Europe/Tallinn,
Europe/Tirane, Europe/Tiraspol, Europe/Uzhgorod, Europe/Vaduz, Europe/Vatican, Europe/Vienna,
Europe/Vilnius, Europe/Warsaw, Europe/Zagreb, Europe/Zaporozhye, Europe/Zurich, GB, GB-Eire,
GMT, GMT0, Greenwich, Hongkong, HST, Iceland, IET, Indian/Antananarivo, Indian/Chagos,
Indian/Christmas, Indian/Cocos, Indian/Comoro, Indian/Kerguelen, Indian/Mahe, Indian/Maldives,
Indian/Mauritius, Indian/Mayotte, Indian/Reunion, Iran, Israel, IST, Jamaica, Japan, JST, Kwajalein,
Libya, MET, Mexico/BajaNorte, Mexico/BajaSur, Mexico/General, Mideast/Riyadh87,

Mideast/Riyadh88, Mideast/Riyadh89, MIT, MST, MST7MDT, Navajo, NET, NST, NZ, NZ-CHAT, Pacific/Apia, Pacific/Auckland, Pacific/Chatham, Pacific/Easter, Pacific/Efate, Pacific/Enderbury, Pacific/Fakaofu, Pacific/Fiji, Pacific/Funafuti, Pacific/Galapagos, Pacific/Gambier, Pacific/Guadalcanal, Pacific/Guam, Pacific/Honolulu, Pacific/Johnston, Pacific/Kiritimati, Pacific/Kosrae, Pacific/Kwajalein, Pacific/Majuro, Pacific/Marquesas, Pacific/Midway, Pacific/Nauru, Pacific/Niue, Pacific/Norfolk, Pacific/Noumea, Pacific/Pago_Pago, Pacific/Palau, Pacific/Pitcairn, Pacific/Ponape, Pacific/Port_Moresby, Pacific/Rarotonga, Pacific/Saipan, Pacific/Samoa, Pacific/Tahiti, Pacific/Tarawa, Pacific/Tongatapu, Pacific/Truk, Pacific/Wake, Pacific/Wallis, Pacific/Yap, PLT, PNT, Poland, Portugal, PRC, PRT, PST, PST8PDT, ROK, Singapore, SST, SystemV/AST4, SystemV/AST4ADT, SystemV/CST6, SystemV/CST6CDT, SystemV/EST5, SystemV/EST5EDT, SystemV/HST10, SystemV/MST7, SystemV/MST7MDT, SystemV/PST8, SystemV/PST8PDT, SystemV/YST9, SystemV/YST9YDT, Turkey, UCT, Universal, US/Alaska, US/Aleutian, US/Arizona, US/Central, US/Eastern, US/East-Indiana, US/Hawaii, US/Indiana-Starke, US/Michigan, US/Mountain, US/Pacific, US/Pacific-New, US/Samoa, UTC, VST, WET, W-SU, Zulu