TimesTen In-Memory OLTP (Transactional) Load Testing

This guide gives you an introduction to conducting OLTP (Online Transaction Processing) workloads on the Oracle TimesTen Database.

Introduction

The Oracle TimesTen in-Memory provides close compatibility to the Oracle Database with both OCI connectivity and PL/SQL support. Consequently with minor differences the HammerDB OLTP test for TimesTen can make use of the majority of the Oracle functionality. This guide provides supplementary information on installing, configuring and running an OLTP test against TimesTen where do differences occur compared to running the same test against an Oracle Database. The guide uses examples from TimesTen configuration on Linux systems, refer to the TimesTen installation guide referenced later in this document for differences on Windows platforms.

To test TimesTen you only need to install the Oracle TimesTen software, you do not need to install any software from a standard Oracle Database installation in order to enable OCI connectivity for TimesTen.

TimesTen Server Installation and Configuration

This sections describes the procedure to install and configure the TimesTen server for Oracle OCI connectivity .

TimesTen Server Installation

To install the TimesTen server as described in the following sections ensure that you pay careful attention to the specification of the client libraries using the libraries provided with TimesTen. Also make sure that the network configuration is correctly configured to allow connectivity on both the client and server side.

If using large memory pages configure the `/etc/sysctl.conf` by setting the vm.nr_hugepages parameter to your desired total value comprised of 2MB pages for example:

```
# Oracle-Validated setting for vm.min_free_kbytes is 51200 to avoid OOM
killer
vm.min_free_kbytes = 51200
vm.nr_hugepages = 25000
```

Note that you do not need to set the `vm.hugetlb_shm_group` parameter in /etc/sysctl.conf however you do need to set the `memlock` parameter in the file `/etc/security/limits.conf` to a value above the number of huge pages you wish to use. Once you have started TimesTen and connected to your datastore check `/proc/meminfo` to ensure that the large pages you configured are being used.

```
HugePages_Total:   25000
HugePages_Free:    21717
HugePages_Rsvd:    17717
HugePages_Surp:        0
Hugepagesize:       2048 kB
DirectMap4k:        8192 kB
DirectMap2M:     2056192 kB
```

TTadmin User Configuration

Create the ttadmin user and groups on the TimesTen Server, configure a bash profile such as follows, paying particular attention to the highlighted section detailing where the TimesTen OCI client libraries are installed.

```
-bash-3.2$ more .bash_profile
# .bash_profile
if [ -t 0 ]; then
stty intr ^C
fi

if [ -f ~.bashrc ]; then
      . ~/.bashrc
fi

umask 022
export ORACLE_BASE=/home/ttadmin
export ORACLE_HOME=$ORACLE_BASE/TimesTen/tt1122
export TIMESTEN_INSTALL_ROOT=$ORACLE_HOME
source ${TIMESTEN_INSTALL_ROOT}/bin/ttenv.sh
export ORACLE_SID=tpcc_1122
export PATH=$ORACLE_HOME/bin:$PATH
export
LD_LIBRARY_PATH=$ORACLE_HOME/lib:$ORACLE_HOME/ttoracle_home/instantclient_11_2:$
ORACLE_BASE/hammerdb-2.14/lib
export
ORACLE_LIBRARY=${TIMESTEN_INSTALL_ROOT}/ttoracle_home/instantclient_11_2/libclnt
sh.so.11.1
export TNS_ADMIN=$ORACLE_BASE/TimesTen/tt1122/network/admin
export DISPLAY=londonmgr1:0.0
```

Login as ttadmin to check the configured environment variables

```
NOTE: unknown or unsupported java version, setting values for JDK 1.5

LD_LIBRARY_PATH set to
/home/ttadmin/TimesTen/tt1122/lib:/home/ttadmin/TimesTen/tt1122/ttoracle_home/in
stantclient_11_2

ANT_HOME set to /home/ttadmin/TimesTen/tt1122/3rdparty/ant
```

```
PATH set to
/home/ttadmin/TimesTen/tt1122/bin:/home/ttadmin/TimesTen/tt1122/quickstart/sampl
e_code/oci:/home/ttadmin/TimesTen/tt1122/quickstart/sample_code/odbc:/home/ttadm
in/TimesTen/tt1122/quickstart/sample_code/odbc/xla:/home/ttadmin/TimesTen/tt1122
/quickstart/sample_code/jdbc:/home/ttadmin/TimesTen/tt1122/quickstart/sample_cod
e/odbc_drivermgr:/home/ttadmin/TimesTen/tt1122/quickstart/sample_code/proc:/home
/ttadmin/TimesTen/tt1122/quickstart/sample_code/ttclasses:/home/ttadmin/TimesTen
/tt1122/quickstart/sample_code/ttclasses/xla:/home/ttadmin/TimesTen/tt1122/ttora
cle_home/instantclient_11_2:/home/ttadmin/TimesTen/tt1122/ttoracle_home/instantc
lient_11_2/sdk:/home/ttadmin/TimesTen/tt1122/3rdparty/ant/bin:/usr/kerberos/bin:
/usr/local/bin:/bin:/usr/bin

CLASSPATH set to
/home/ttadmin/TimesTen/tt1122/lib/ttjdbc5.jar:/home/ttadmin/TimesTen/tt1122/lib/
orai18n.jar:/home/ttadmin/TimesTen/tt1122/lib/timestenjmsxla.jar:/home/ttadmin/T
imesTen/tt1122/3rdparty/jms1.1/lib/jms.jar:.

TNS_ADMIN set to /home/ttadmin/TimesTen/tt1122/network/admin
```

TimesTen Installation

Follow the **Oracle TimesTen In-Memory Database Installation Guide** to install TimesTen, in this example TimesTen was installed in the `/home/ttadmin` directory.

Database Configuration

If using large memory pages configure the `ttendaemon.options` file with the total allocation of large pages in MB as shown.

```
# Commented values are default values
#-supportlog /home/ttadmin/TimesTen/tt1122/info/ttmesg.log
#-maxsupportlogfiles 10
#-maxsupportlogsize 10485760
#-userlog /home/ttadmin/TimesTen/tt1122/info/tterrors.log
#-maxuserlogfiles 10
#-maxuserlogsize 0x100000
#
-linuxLargePageAlignment 2
-verbose
-tns_admin /home/ttadmin/TimesTen/tt1122/network/admin
-server 53397
```

Configure the database in the `sys.odbc.ini` file, in this example it is located in the `/home/ttadmin/TimesTen/tt1122/info` directory. The sections in bold have been added to this file.

```
[ODBC Data Sources]
TT_1122=TimesTen 11.2.2 Driver
tpcc_1122=TimesTen 11.2.2 Driver

[tpcc_1122]
Driver=/home/ttadmin/TimesTen/tt1122/lib/libtten.so
DataStore=/u01/timesten/DemoDataStore/tpcc_1122
LogDir=/ u02/timesten/logs/
MemoryLock=4
PermSize=32000
#for 1k users,
#PermSize=120000
TempSize=4000
```

```
LogBufMB=4096
LogFileSize=4096
LogBufParallelism=16
PLSQL=1
PrivateCommands=1
DatabaseCharacterSet=US7ASCII
ConnectionCharacterSet=US7ASCII
RecoveryThreads=16
```

Network Configuration

Configure the tnsnames.ora file for local connectivity, in this example the tnsnames.ora file is located in `/home/ttadmin/TimesTen/tt1122/network/admin`. Note that the SERVICE_NAME corresponds to the ODBC Data Source defined previously and also note that SERVER is set to `timesten_direct` to specify a local connection.

```
# tnsnames.ora Network Configuration File

tpcc_1122 = (DESCRIPTION = (CONNECT_DATA = (SERVICE_NAME = tpcc_1122)(SERVER =
timesten_direct)))
```

Database and Schema Creation

This section details the creation of the TimesTen Database and hammerdb schema.

Database Configuration

In contrast to the Oracle Database with TimesTen you must manually create the database and user before you create the schema with hammerdb. You must also grant the user you create the necessary permissions as shown to be able to create the required files. The database will be automatically created on the first connection and the subsequent user creation accomplished as follows:

```
oracle@sandep1 bin]$ ./ttisql

Copyright (c) 1996-2011, Oracle.  All rights reserved.
Type ? or "help" for help, type "exit" to quit ttIsql.


Command> connect "dsn=tpcc_1122";
Connection successful:
DSN=tpcc_1122;UID=oracle;DataStore=/hadoop/timesten/DemoDataStore/tpcc_1122;Data
baseCharacterSet=US7ASCII;ConnectionCharacterSet=US7ASCII;DRIVER=/home/oracle/Ti
mesTen/tt1122/lib/libtten.so;PermSize=100;TempSize=100;TypeMode=0;
(Default setting AutoCommit=1)
Command> create user tpcc identified by tpcc;

User created.

Command> grant create table to tpcc;
Command> grant create session to tpcc;
Command> grant create procedure to tpcc;
Command> grant create view to tpcc;
Command>

Command> connect "dsn=tpcc_1122;uid=tpcc";
Enter password for 'tpcc':
Connection successful:
```

```
DSN=tpcc_1122;UID=tpcc;DataStore=/hadoop/timesten/DemoDataStore/tpcc_1122;Databa
seCharacterSet=US7ASCII;ConnectionCharacterSet=US7ASCII;DRIVER=/home/oracle/Time
sTen/tt1122/lib/libtten.so;PermSize=100;TempSize=100;TypeMode=0;
(Default setting AutoCommit=1)
con2: Command> quit
Disconnecting from tpcc_1122...
Disconnecting from con1...
Disconnecting from con2...
Done.
```

If the database already exists and you wish to remove completely and recreate it, you can destroy the existing database as follows:

```
-bash-3.2$ ttDestroy tpcc_1122
```

Schema Creation

Follow the standard procedure for an Oracle Database schema configuration. Note that in this example hammerdb has been installed on the same server as the TimesTen Database in order to illustrate local OCI connectivity with the network configuration as previously shown. As shown in figure 1 select the TimesTen Database Compatible checkbox and specify the Oracle Service Name and username and password you created previously. For additional scalability on high CPU core or thread counts you may also opt to partition the order line table.

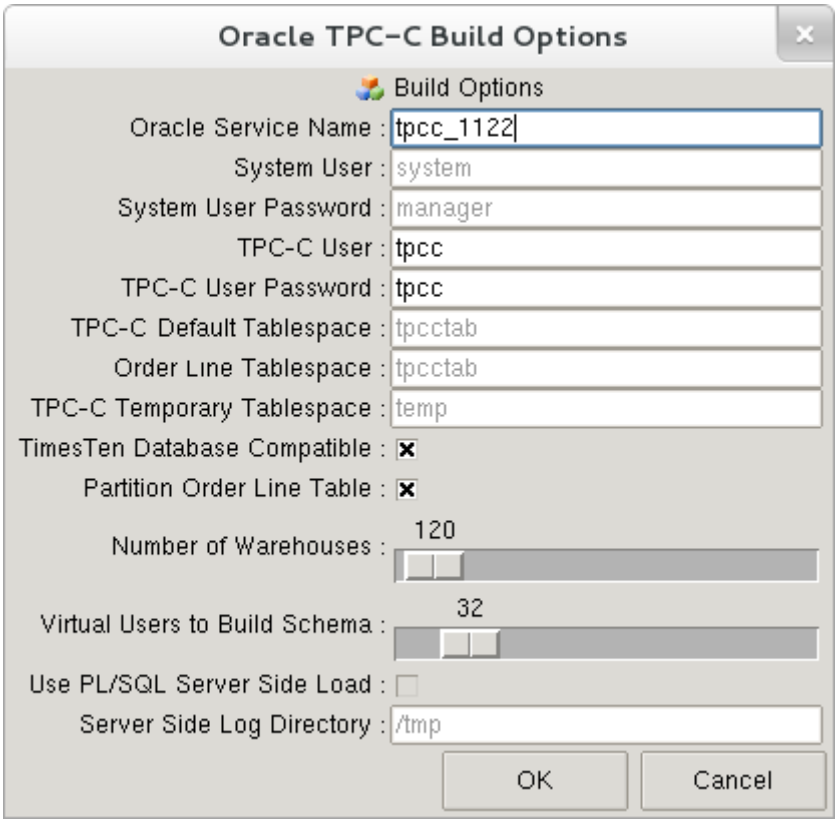

Figure 1 TimesTen Build Options

Click OK and build the schema as you would do for an Oracle Database, figure 2 shows the status of a complete TimesTen build.

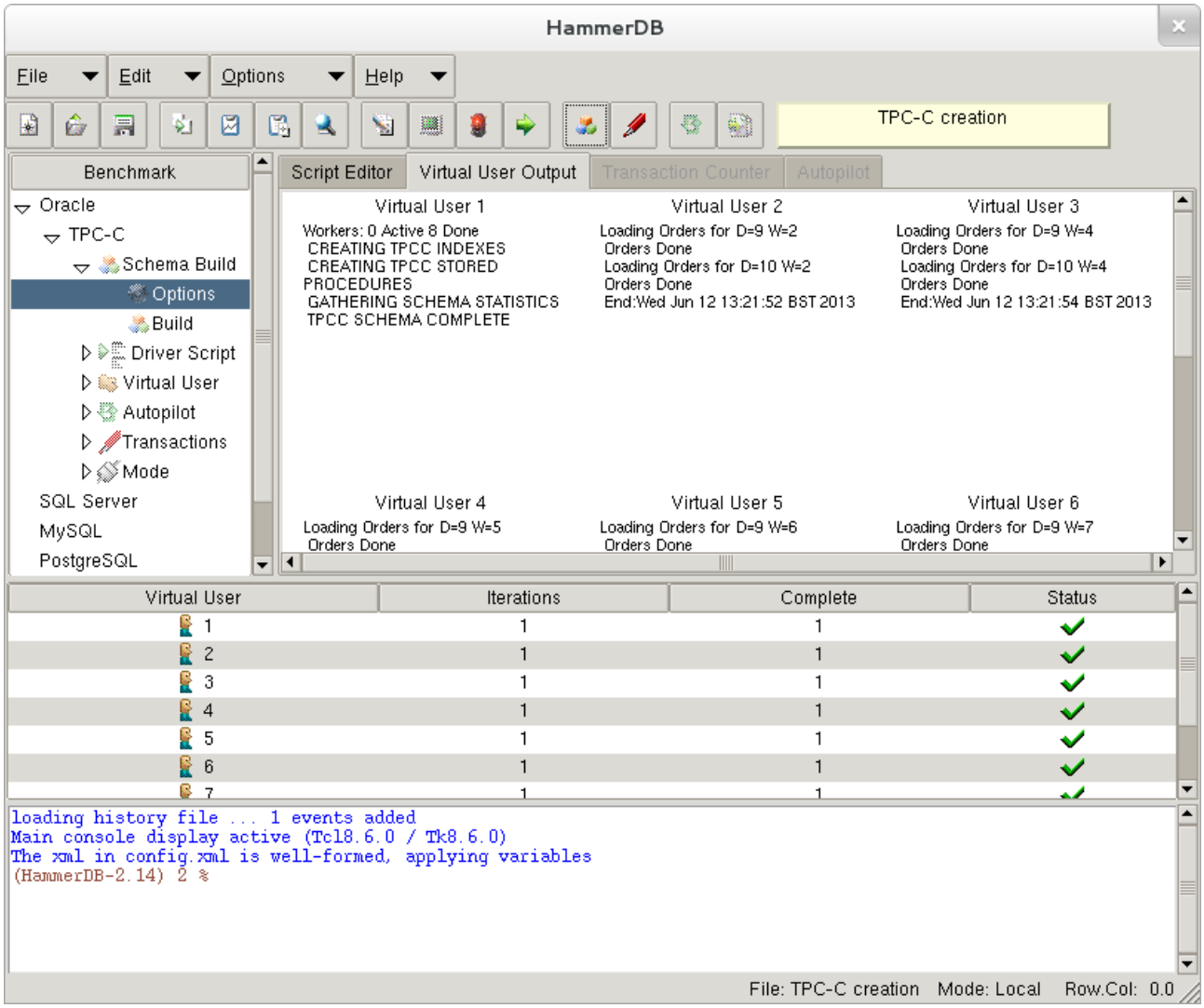

Figure 2 TimesTen build complete

TimesTen OCI Client Configuration and Test

As with the Oracle Database you will most likely wish to test your TimesTen Database in a client server configuration. To do this firstly install the TimesTen client on the load test client where hammerdb is to be installed. Follow the details described for the server configuration ensuring that the bash profile is correctly configured in order that hammerdb can find the correct client libraries. Note that for TimesTen you must use the TimesTen provided client libraries and not the libraries from an Oracle installation. You must also create the test database as previously described on the server itself.

DSN Configuration

On the client set up the DSN information in the `sys.obc.ini file`, for example in`/home/ttadmin/TimesTen/tt1122/info`. Add the following information to specify the details of the TimesTen server. In this example the server itself is called `sandep1.example.com` and the DSN is the name of the database configured on this server. The client name given is `tpccCS_1122`.

```
-bash-3.2$ more sys.odbc.ini
```

```
# Copyright (c) 1999, 2011, Oracle and/or its affiliates. All rights reserved.

##########################################################################
# This following sample definitions should be in the .odbc.ini file
# that is used for the TimesTen 11.2.2 Client.
# The Server Name is set in the TTC_SERVER attribute.
# The Server DSN is set in the TTC_SERVER_DSN attribute.
##########################################################################

[ODBC Data Sources]
tpccCS_1122=TimesTen 11.2.2 Client Driver

[tpccCS_1122]
TTC_SERVER=sandep1.example.com
TTC_SERVER_DSN=tpcc_1122
```

Set the configuration of the TimesTen hostname defined previously as TTC_SERVER in the `sys.ttconnect.ini` file also ensuring that this network name can be resolved either through DNS or an entry in the host file.

```
# Copyright (c) 1999, 2009, Oracle and/or its affiliates.All rights reserved.

##############################################################
# This is a sample sys.ttconnect.ini file that is used for the
# TimesTen Client.  It contains entries for each server.
##############################################################

[sandep1.example.com]
Description=TimesTen Server
Network_Address=sandep1.example.com
TCP_PORT=53397
```

Network Configuration

Again on the client configure the tnsnames.ora file to specify the details previously configured on the client for the DSN. Note that tpccCS_1122 has been used for the SERVICE_NAME and the SERVER in this case is timesten_client.

```
-bash-3.2$ more tnsnames.ora
tpccCS_1122 = (DESCRIPTION = (CONNECT_DATA = (SERVICE_NAME = tpccCS_1122)(SERVER
= timesten_client)))
```

You can test the client server connectivity as follows with the ttisqlcs command.

```
-bash-3.2$ ttisqlcs

Copyright (c) 1996-2011, Oracle.  All rights reserved.
Type ? or "help" for help, type "exit" to quit ttIsql.

Command> connect "dsn=tpccCS_1122; uid=tpcc";
Enter password for 'tpcc':
Connection successful:
DSN=tpccCS_1122;TTC_SERVER=sandep1.example.com;TTC_SERVER_DSN=tpcc_1122;UID=tpcc
;DATASTORE=/hadoop/timesten/DemoDataStore/tpcc_1122;DATABASECHARACTERSET=US7ASCI
I;CONNECTIONCHARACTERSET=US7ASCII;PERMSIZE=32000;TEMPSIZE=2000;TYPEMODE=0;
(Default setting AutoCommit=1)
Command> select count(*) from warehouse;
< 120 >
1 row found.
```

If ttisqlcs connectivity is successful and you have correctly configured your bash profile in order that hammerdb can find the correct client libraries you can use the TCL shell located in the hammerdb bin directory to manually test the hammerdb can connect to TimesTen in a client server configuration as shown:

```
-bash-3.2$ ./tclsh8.6
% package require Oratcl
4.5
% set connect "tpcc/tpcc@tpccCS_1122"
tpcc/tpcc@tpccCS_1122
% set lda [ oralogon $connect ]
oratcl1
%
```

Driver Options and Test

When configuring the options for the driver script ensure that the TimesTen Database Compatible checkbox is selected and the Oracle service name is the name specified in the tnsnames.ora file depending on whether hammerdb is running on the client or server as shown in figure 3.

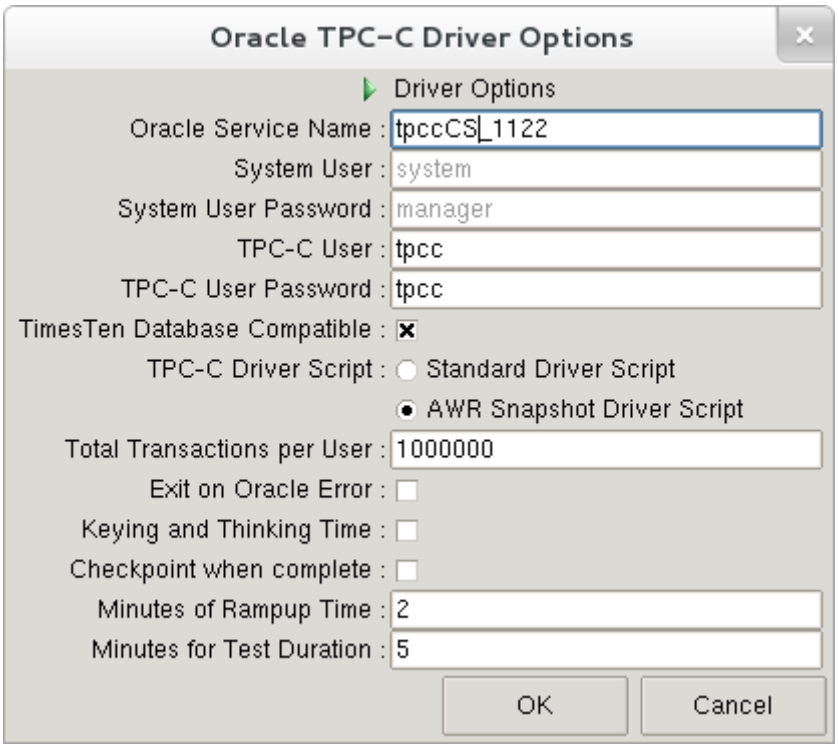

Figure 3 TimesTen Driver Options

You should be aware that with an in-memory database checkpointing has different considerations with the Oracle Database and checkpoints at the end of tests may provide an additional overhead. You should consult the Oracle documentation to understand the difference in functionality on the two databases. TimesTen does not currently support AWR functionality or an equivalent method to call statistic snapshotting from within the database itself. For that reason when the AWR Snapshot Driver Script is selected to run against TimesTen a timed test will be performed and a message displayed that statistics can be gathered externally using the ttStats utility as shown in figure 4. An example of running ttStats externally is shown:

```
$ ./ttStats  -latchstats on -snapshot -xml 1.xml tpcc_1122
```

```
$ sleep 300
$ ./ttStats  -latchstats on -snapshot -xml 2.xml tpcc_1122
./ttStats -report 1.xml 2.xml -html stats.html
```

There is also a utility ttStatsCS for running in a client server configuration.

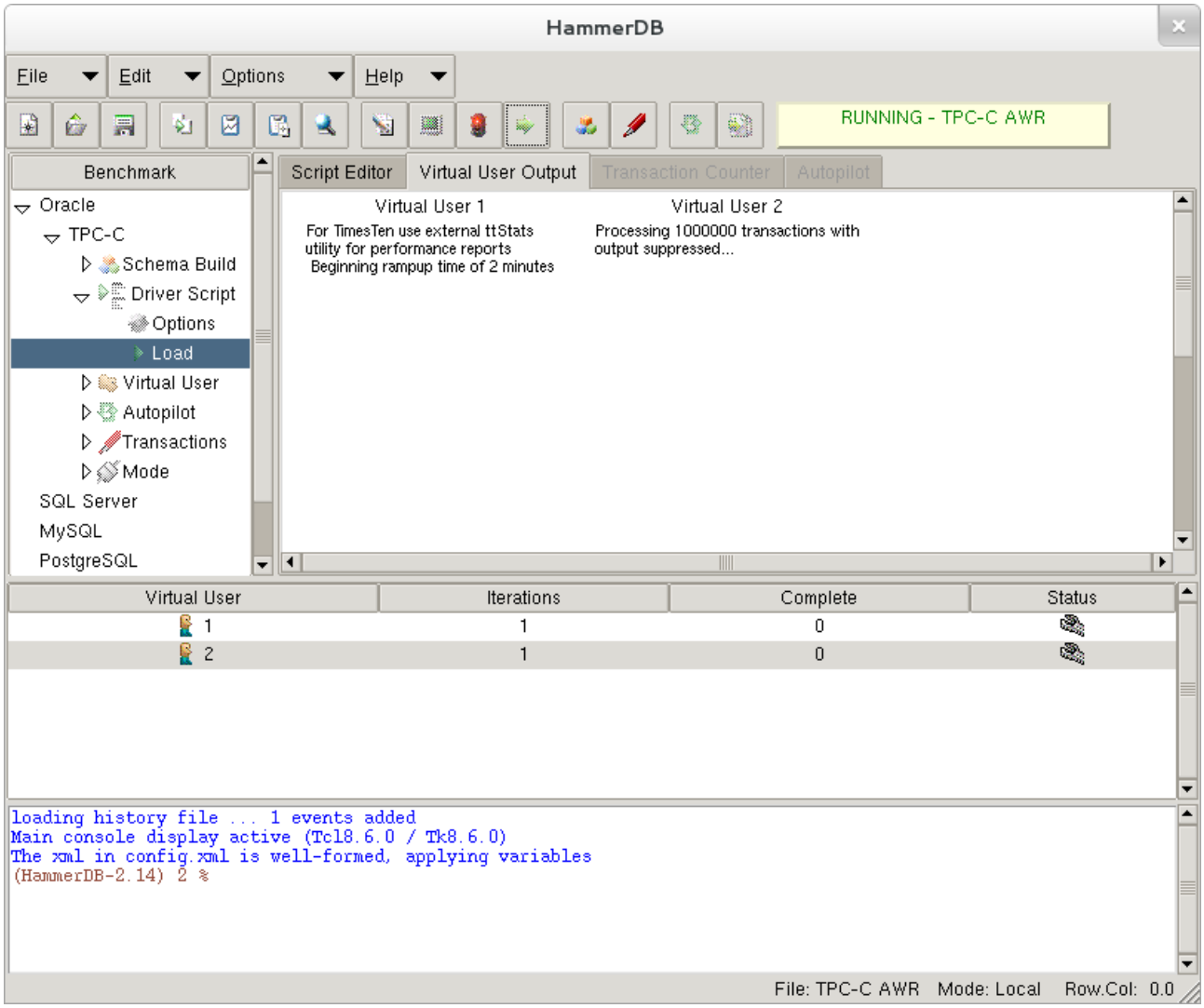

Figure 4 TimesTen Test

You can now proceed to test your TimesTen in-memory database in exactly the same way as you would do for an Oracle database including for example the ability to automate a test sequence with autopilot as shown in figure 5.

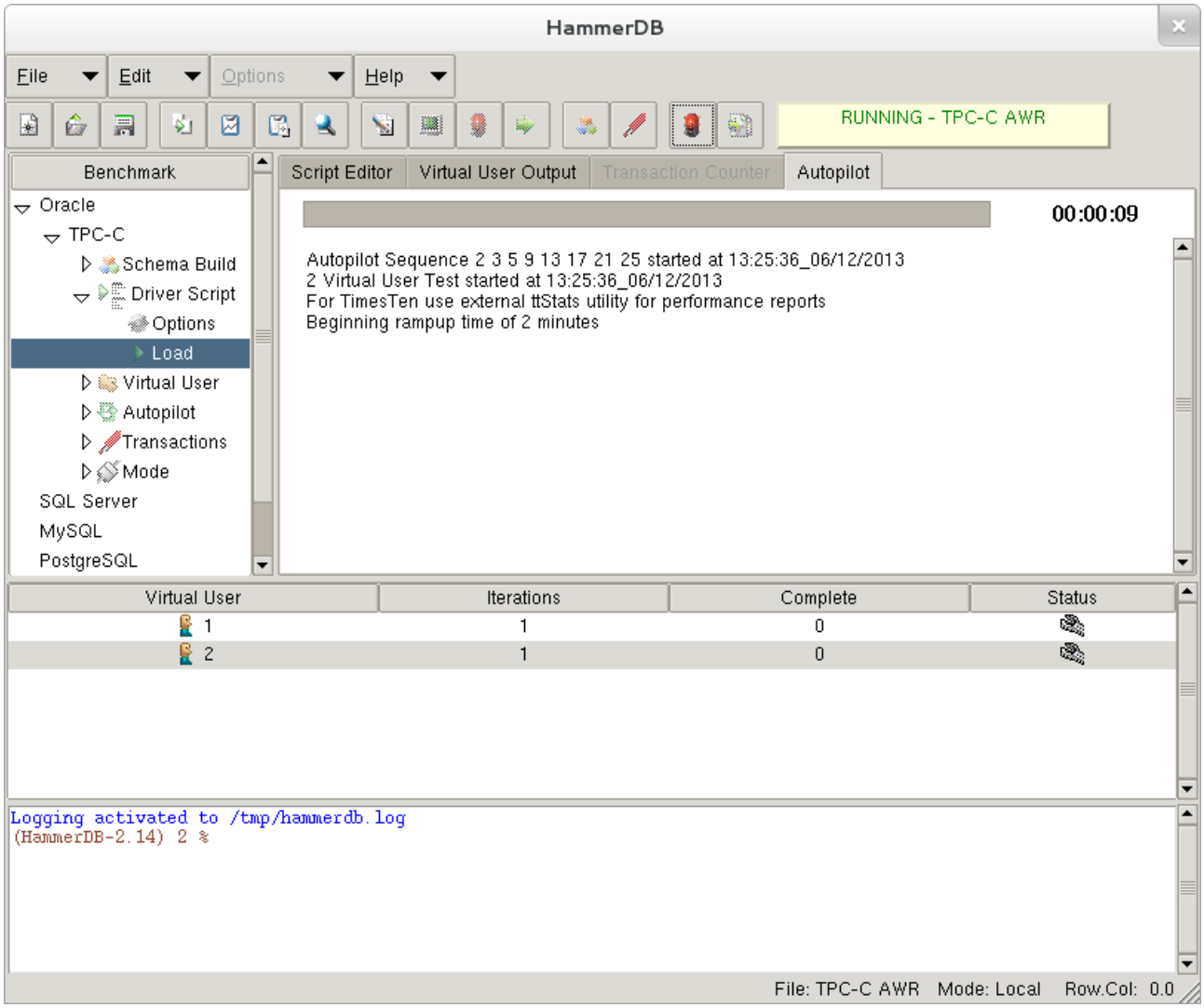

Figure 5 TimesTen Autopilot

Conclusion

This guide provides supplementary information for administrators experienced in load testing Oracle with hammerdb how to install and configure an Oracle TimesTen Client and Server configuration in order to run the same tests as performed against Oracle on TimesTen.

Support and Discussion

Need help? Try the Hammerora Sourceforge forum

Want to discuss your results or have tips on tuning and configuration? open a discussion topic