

<b>File name</b>	YTM Resilience Testing
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<b>Confidentiality</b>	Internal
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## 1 Introduction

Software resilience testing is a method of software testing that focuses on ensuring that applications will perform well in real-life or chaotic conditions. In other words, it tests an application's resiliency or ability to withstand stressful or challenging factors.

In this particular case, the resilience testing will include the following tools and testing scenarios:

1. DB Analyzer - is a tool that helps you analyze database servers, database structures, and its data.
2. Java resilience testing - simple Java standalone application that generate a heavy load on the database by performing a resource-consuming operation such as copying large tables or updating its column with the new set of values.
3. JMeter testing - allows you to simulate the test-taking process in a multi-user environment. The option "Retake test" can be convenient because it enables a virtual user to take the test over a relatively long period continuously.

## 2 Prerequisites

Database performance testing is impossible to do without a relatively large amount of data. For this purpose, PostgreSQL schema “ytm1\_resilience\_testing.dmp” was uploaded to the FTP server, and it should be imported in a target database for testing purposes.

/resilience_testing/				
Name	Size	Changed	Rights	Owner
..		10/27/2019 11:28:11 PM	rwxr-xr-x	5284759
dbanalyzer 1		10/28/2019 3:59:09 PM	rwx---r-x	5284759
java_resilience_testing 2		10/28/2019 4:05:49 PM	rwx---r-x	5284759
jmeter 3		10/28/2019 3:59:18 PM	rwx---r-x	5284759
postgresql_testing_database 4		10/27/2019 11:56:58 PM	rwx---r-x	5284759

The PostgreSQL 10 schema restore process consists of several commands:

1. Create a target database if it doesn't exist:  
\$ psql -h [DATABASE\_IP] -U postgres -c 'create database testdb';
2. Create database role **ytm1** if it doesn't exist:  
\$ psql -h [DATABASE\_IP] -U postgres -c "create role ytm1 with password '2ytm1';"
3. Restore downloaded database schema in the **testdb** database:  
\$ pg\_restore -v -h [DATABASE\_IP] -U postgres -d testdb ytm1\_resilience\_testing.dmp

Verify the status of the previous operation by connecting to the restored schema **ytm1** and executing the following commands to retrieve the number of application users:

- \$ psql -h [DATABASE\_IP] -U ytm1 testdb
- **testdb=#** select count(\*) from users;

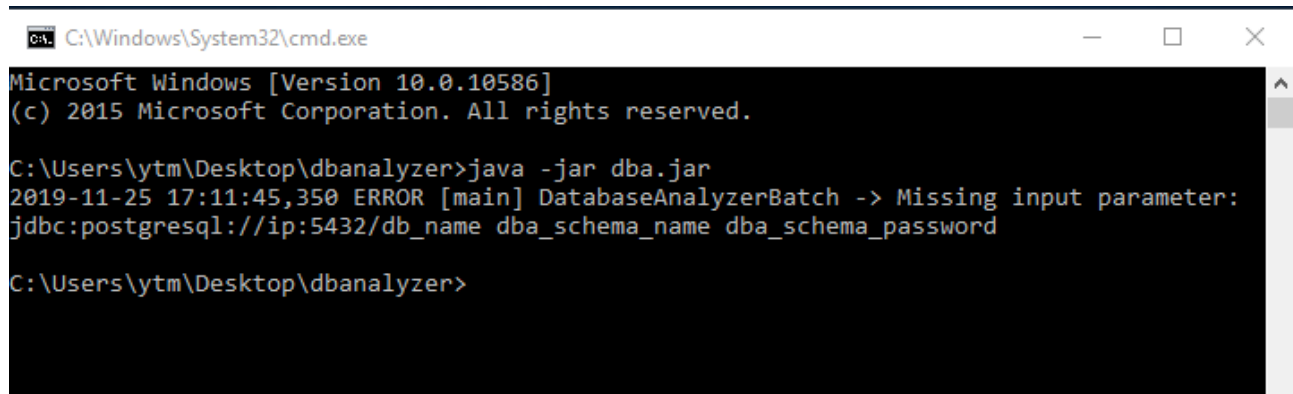
Optional: grant login privilege to role **ytm1**:

- alter user ytm1 with login;

### 3 DB Analyzer

To start DB Analyzer from the command line, please download the content of “dbanalyzer” directory, and execute the following command (**JDK 8** required):

```
$ java -jar dba.jar
```



```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.10586]
(c) 2015 Microsoft Corporation. All rights reserved.

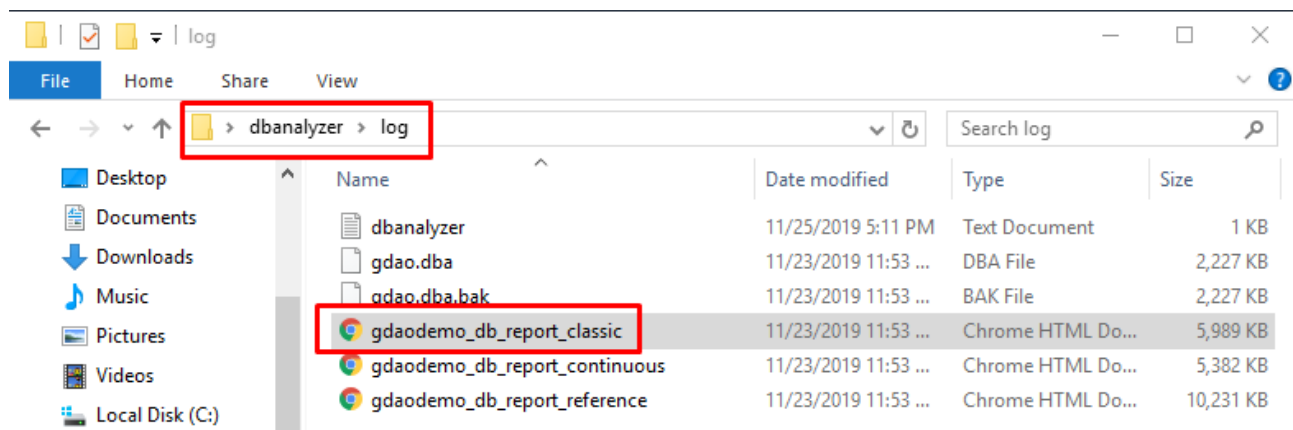
C:\Users\ytm\Desktop\dbanalyzer>java -jar dba.jar
2019-11-25 17:11:45,350 ERROR [main] DatabaseAnalyzerBatch -> Missing input parameter:
jdbc:postgresql://ip:5432/db_name dba_schema_name dba_schema_password

C:\Users\ytm\Desktop\dbanalyzer>
```

The output suggests you to enter the specific parameters, similar to the following:

```
$ java -jar dba.jar jdbc:postgresql://IP:5432/testdb ytm1 2ytm1
```

After the process completed, you can check the produced log files and find out much useful information, such as a list of database objects and their size, redundant objects, detailed table information, etc.



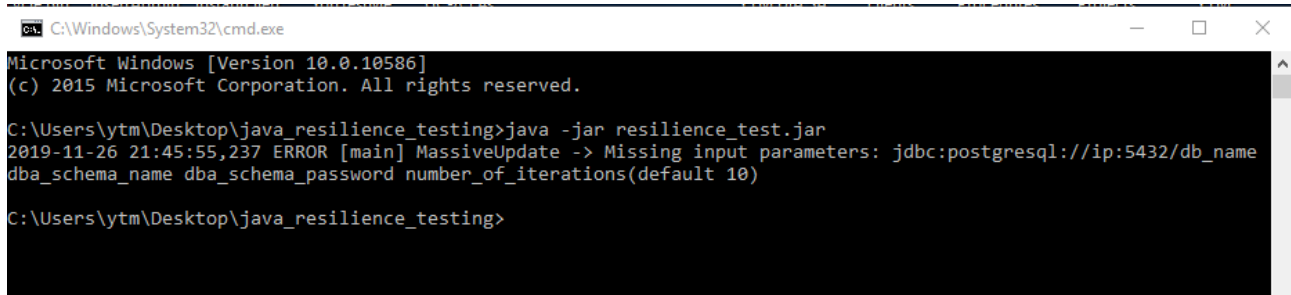
DB Analyzer can be used as a useful tool for database performance testing. Critical errors in database design and nonoptimized views will cause a significant increase in total runtime, so DBA can help you to identify them.

**Note:** The additional file “gdao.cfg” specifies the advanced functions of DBA, that will not be covered in this tutorial. It is already modified to support in-depth database analysis.

## 4 Java Resilience Testing

To start Java resilience test, download content of “java\_resilience\_testing” directory and execute the following command (JDK 8 required):

```
$ java -jar resilience.jar
```



```
C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.10586]
(c) 2015 Microsoft Corporation. All rights reserved.

C:\Users\ytm\Desktop\java_resilience_testing>java -jar resilience_test.jar
2019-11-26 21:45:55,237 ERROR [main] MassiveUpdate -> Missing input parameters: jdbc:postgresql://ip:5432/db_name
dba_schema_name dba_schema_password number_of_iterations(default 10)

C:\Users\ytm\Desktop\java_resilience_testing>
```

The output suggests you to enter the specific parameters, similar to the following:

```
$ java -jar dba.jar jdbc:postgresql://IP:5432/testdb ytm1 2ytm1 100
```

After the proper database parameters were specified, and the test is started, ten threads will be created and run concurrently. Each of them will perform the following operation in each iteration: create a copy of the correspondent table with the highest number of rows and delete it.

### Possible test scenario:

1. Take a database server snapshot before resilience testing
2. Start the test by specifying a relatively high number of test iteration (1000, or even more)
3. If the test was completed successfully, compare the system parameters before and after the test was taken and check if anything went wrong, like no free disk space or RAM reached its limit.

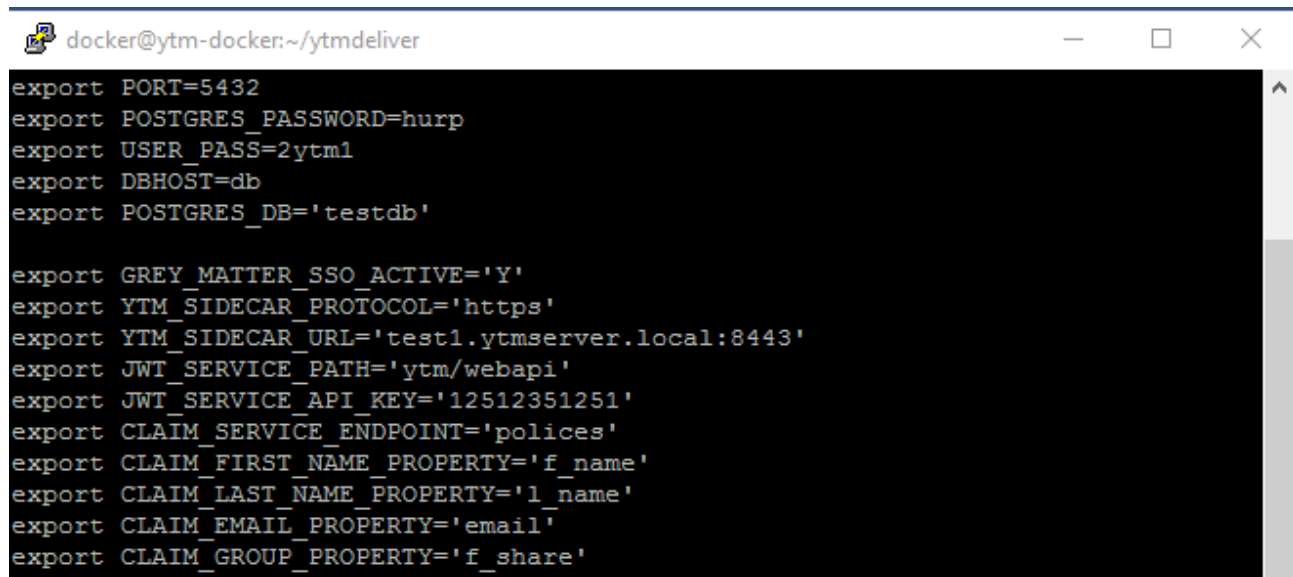
This type of testing can expose some database misconfiguration or prove that an insufficient amount of hardware resources (physical or virtual) was allocated to a database server.

## 5 JMeter Testing

JMeter Apache software can be used for both performance and resilience testing. In the “jmeter” directory located on the FTP server, you can find relevant “.jmx” and JMeter property files, whose purpose will be explained in the following chapters.

### 5.1 Setting Up Testing Environment

The first step would be to link the YTM application with the test database. It can be accomplished by modifying “*values.source*” configuration file and specifying the new values for environment variables (inside docker .tar file).




```
docker@ytm-docker:~/ytmdeliver
export PORT=5432
export POSTGRES_PASSWORD=hurp
export USER_PASS=2ytm1
export DBHOST=db
export POSTGRES_DB='testdb'



export GREY_MATTER_SSO_ACTIVE='Y'
export YTM_SIDECAR_PROTOCOL='https'
export YTM_SIDECAR_URL='test1.ytmserver.local:8443'
export JWT_SERVICE_PATH='ytm/webapi'
export JWT_SERVICE_API_KEY='12512351251'
export CLAIM_SERVICE_ENDPOINT='polices'
export CLAIM_FIRST_NAME_PROPERTY='f_name'
export CLAIM_LAST_NAME_PROPERTY='l_name'
export CLAIM_EMAIL_PROPERTY='email'
export CLAIM_GROUP_PROPERTY='f_share'
```

**Note:** The PostgreSQL schema restored from the dump file stored in FTP server is compatible with the following version of YTM application: **8.1.8s**

To verify the app version, log in as “admin” user and navigate to **System -> System settings** page, and choose **System information** tab.



System settings

---

System settings

Mail server
Internal network
Custom emails
SFTP transfer
System information
System preferences
Theme
Additional modules
System support

System information

VM IP address	192.168.1.100
Database name	testdb
Database startup time	Nov-28-2019 10:05 PM EST
Database IP	127.0.0.1/32
Database Schema	ytm1
Database port	5432
Build Time	Dec-04-2019 10:47 AM EST
Revision	12164
Version	GC-8.1.8s
Release Info	<a href="#">Open Release Info</a>

After you can access the application via any browser, log in and check the following:

1. Is there a test named "Jmeter"?
2. How many users have been assigned to the test? (it should be 500)
3. Is the test status "Not attempted" for each assigned user?
4. Is there a valid testing session created, and is it available for the test taker in the testing time?

See the pictures below for more details (log in to YTM application as "admin" user):

Users
Tests
Surveys
Training courses
Reports

New test
Manage tests
Manage certificates
Question pools
Grading scales
Testing locations

Create survey
Create a survey and categorize its results automatically using grading scale option

## Manage tests

## All tests

ID	Name	Date of creation
Search	J	
2254	Ajax Spirit	Nov-14-2019 04:40 PM EST
3343	Jack of Hearts	Nov-14-2019 04:50 PM EST
2154	Jack of Hearts	Nov-14-2019 04:24 PM EST
2183	Jigsaw Lord	Nov-14-2019 04:24 PM EST
3519	Jmeter	Nov-18-2019 11:12 AM EST
1758	Juggernaut	Nov-14-2019 04:20 PM EST

Manage tests

All tests > Jmeter

Information	Testing sessions	Candidates	Monitoring	Questions	Summary report	Report builder	»
Assign or remove candidates from this test. Manipulate candidate attempts and view progress							
Select session: All sessions							
Session must be selected in order to add more candidates.							
List of candidates							
<input type="checkbox"/>	Username	Started	Finished	Status	Result	Score (%)	Session
<input type="checkbox"/>	99101	-	-	Not attempted			Session1
<input type="checkbox"/>	99102	-	-	Not attempted			Session1
<input type="checkbox"/>	99103	-	-	Not attempted			Session1
<input type="checkbox"/>	99104	-	-	Not attempted			Session1
<input type="checkbox"/>	99105	-	-	Not attempted			Session1
<input type="checkbox"/>	99106	-	-	Not attempted			Session1
<input type="checkbox"/>	99107	-	-	Not attempted			Session1
<input type="checkbox"/>	99108	-	-	Not attempted			Session1
<input type="checkbox"/>	99109	-	-	Not attempted			Session1
<input type="checkbox"/>	99110	-	-	Not attempted			Session1
Displayed columns				1 2 3 4 5 10			

Manage tests

All tests > Jmeter

Information	Testing sessions	Candidates	Monitoring
-------------	------------------	------------	------------

[New testing session](#)

Session1

America

Available now

Start: Nov-17-2019 12:00 AM EST

End: Nov-30-2021 11:13 AM EST

Web access link: <http://192.168.1.100:9001/login.xhtml?testSessionId=10445>

Candidates: 500

Status: Unlocked



## 5.2 Performance Testing

The particular performance test using “performance.jmx” file should prove how many users can log in and take the test concurrently. To check this, modify the testing parameters in “performance.property” file according to the desired number of test-takers.

To run the test, navigate to the downloaded directory “jmeter” and execute the following command:

```
$ /path_to_jmeter_binary_dir/jmeter -n -t performance.jmx -p performance.properties
```

After the test was started, you can monitor the running testing process logged in as “admin” user along with Tomcat and PostgreSQL log files to find possible errors.

Manage tests
Options ?

All tests > Jmeter



















































Information Testing sessions **Candidates** Monitoring Questions Summary report Report builder >>

Assign or remove candidates from this test. Manipulate candidate attempts and view progress
Got it!

Select session: All sessions

Session must be selected in order to add more candidates.
Show additional options

List of candidates

	Username	Started	Finished	Status	Result	Score (%)	Session	Actions
	Search							
<input type="checkbox"/>	99101	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    
<input type="checkbox"/>	99102	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    
<input type="checkbox"/>	99103	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    
<input type="checkbox"/>	99104	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    
<input type="checkbox"/>	99105	Nov-28-2019 04:39 PM EST	-	In progress		30.00	Session1	    
<input type="checkbox"/>	99106	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    
<input type="checkbox"/>	99107	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    
<input type="checkbox"/>	99108	Nov-28-2019 04:39 PM EST	-	In progress		30.00	Session1	    
<input type="checkbox"/>	99109	Nov-28-2019 04:39 PM EST	-	In progress		30.00	Session1	    
<input type="checkbox"/>	99110	Nov-28-2019 04:39 PM EST	-	In progress		20.00	Session1	    


Displayed columns
1 2 3 4 5 >> > 10
Rows: 500

If the application breaks or freeze during the test, these are the most likely reasons for that:

1. PostgreSQL or tomcat server misconfiguration (**max\_connections** PostgreSQL parameter, for example)
2. Insufficient hardware resources allocated to the system components (tomcat heap size, for example)
3. Incorrect or underrated values for the JMeter parameters defined in the property file (try to increase ramp-up period, or the following user-defined JMeter settings **answdelay** and **pwdelay**)

### 5.3 Resilience Testing

After the test-taking process is finished, you can log in as one of the testing users, and verify the status of “Jmeter” test:



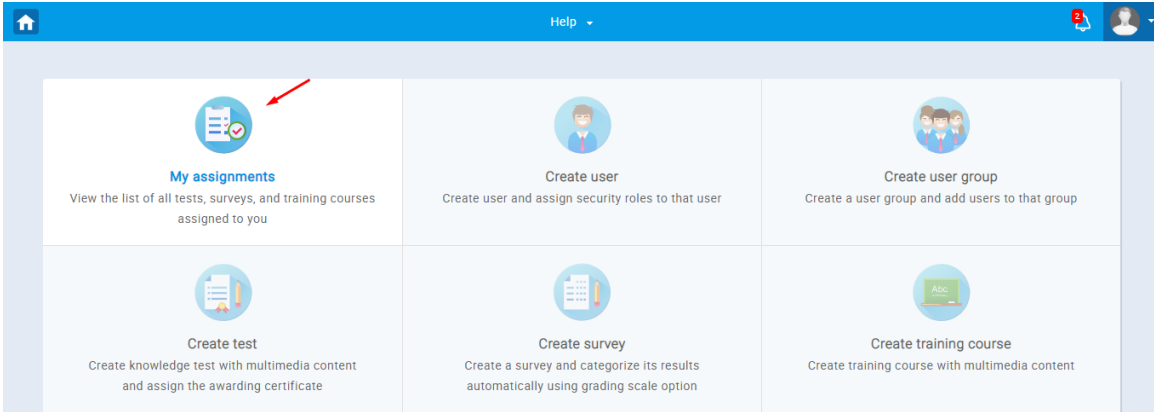
Username

Password

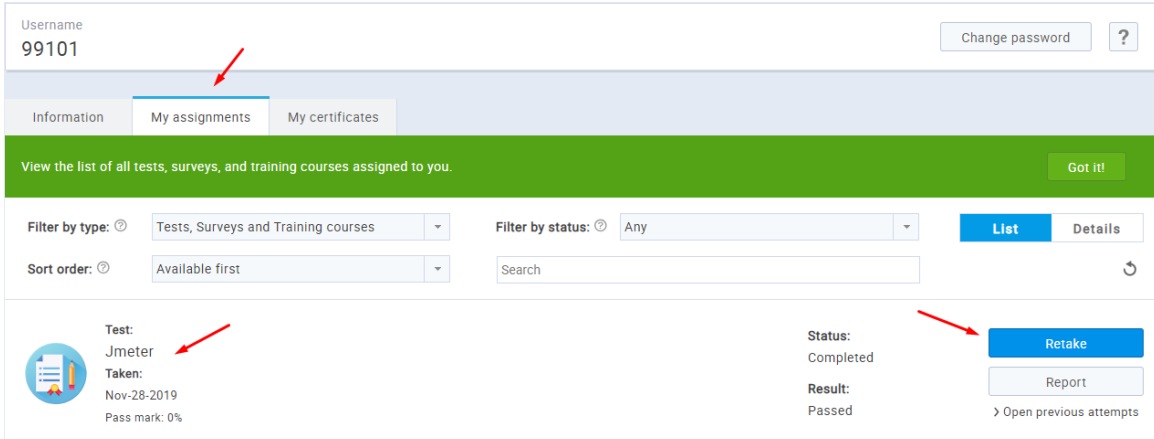
[Forgot your password?](#)

**SIGN IN**

Don't have an account? [Register](#)



The dashboard shows a grid of six options: My assignments (highlighted with a red arrow), Create user, Create user group, Create test, Create survey, and Create training course.



The user profile section shows the username 99101 and tabs for Information, My assignments (highlighted with a red arrow), and My certificates. Below the tabs, there's a green bar with the text "View the list of all tests, surveys, and training courses assigned to you." and a "Got it!" button. The assignments table has filters for type (Tests, Surveys and Training courses), status (Any), and sort order (Available first). A search bar is also present. The table lists a test named "Jmeter" (highlighted with a red arrow) taken on Nov-28-2019 with a pass mark of 0%. The status is "Completed" and the result is "Passed". There are buttons for "Retake" (highlighted with a red arrow) and "Report", and a link to "Open previous attempts".

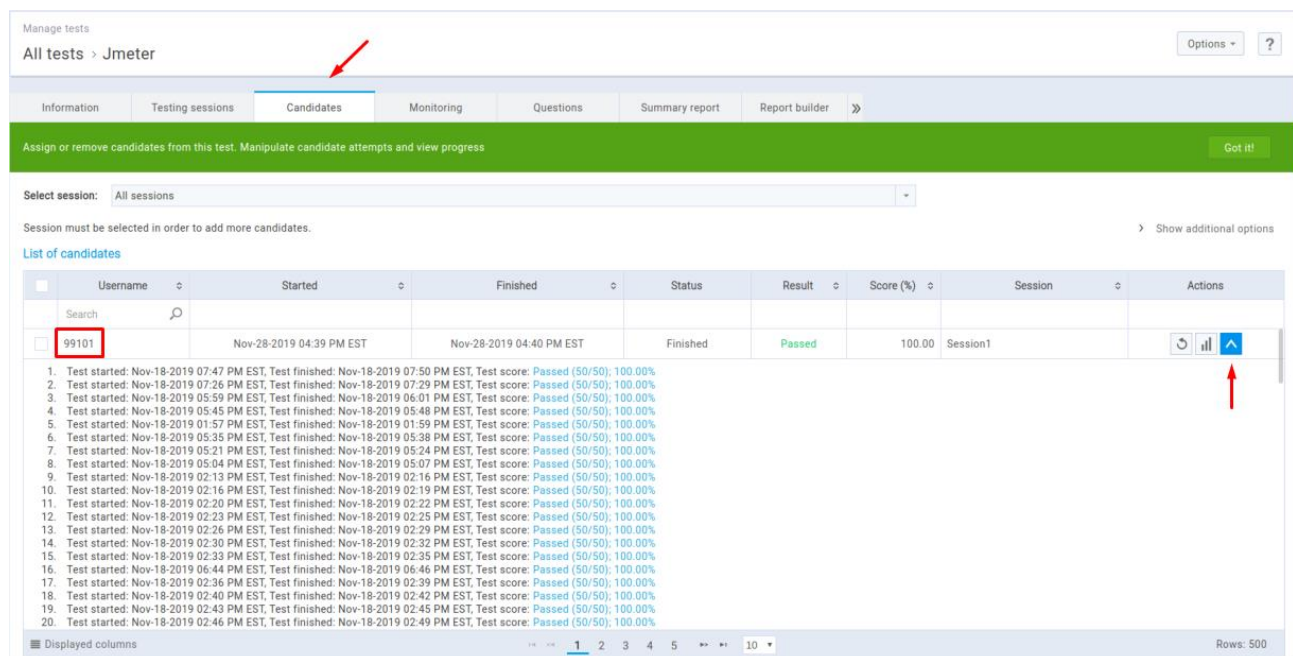
“RETAKE” option can be useful for resilience testing because it allows a theoretically infinite number of test-taking repetitions. For example, after 100 users have passed the test, we can schedule 100 repetitions of the same experiment for all of them.

This particular resilience test will generate a heavy load both on the tomcat server and the database. It could be a trigger for unexpected system events that will expose the bottlenecks and help operational engineers to allocate system resources better.

To start the resilience testing, navigate to the downloaded directory “jmeter” and execute the following command (adjust specific JMeter parameters in property file):

```
$ /path_to_jmeter_binary_dir/jmeter -n -t resilience.jmx -p resilience.properties
```

After the test was started, you can monitor the running testing process logged in as “admin” user along with Tomcat and PostgreSQL log files to find possible errors.



Manage tests

All tests > Jmeter

Options ?

Information Testing sessions **Candidates** Monitoring Questions Summary report Report builder >>

Assign or remove candidates from this test. Manipulate candidate attempts and view progress [Got it!](#)

Select session: All sessions

Session must be selected in order to add more candidates. [Show additional options](#)

List of candidates

Username	Started	Finished	Status	Result	Score (%)	Session	Actions
99101	Nov-28-2019 04:39 PM EST	Nov-28-2019 04:40 PM EST	Finished	Passed	100.00	Session1	<a href="#">Refresh</a> <a href="#">Chart</a> <a href="#">Up</a>

1. Test started: Nov-18-2019 07:47 PM EST, Test finished: Nov-18-2019 07:50 PM EST, Test score: Passed (50/50); 100.00%

2. Test started: Nov-18-2019 07:26 PM EST, Test finished: Nov-18-2019 07:29 PM EST, Test score: Passed (50/50); 100.00%

3. Test started: Nov-18-2019 05:59 PM EST, Test finished: Nov-18-2019 06:01 PM EST, Test score: Passed (50/50); 100.00%

4. Test started: Nov-18-2019 05:45 PM EST, Test finished: Nov-18-2019 05:48 PM EST, Test score: Passed (50/50); 100.00%

5. Test started: Nov-18-2019 01:57 PM EST, Test finished: Nov-18-2019 01:59 PM EST, Test score: Passed (50/50); 100.00%

6. Test started: Nov-18-2019 05:35 PM EST, Test finished: Nov-18-2019 05:38 PM EST, Test score: Passed (50/50); 100.00%

7. Test started: Nov-18-2019 05:21 PM EST, Test finished: Nov-18-2019 05:24 PM EST, Test score: Passed (50/50); 100.00%

8. Test started: Nov-18-2019 05:04 PM EST, Test finished: Nov-18-2019 05:07 PM EST, Test score: Passed (50/50); 100.00%

9. Test started: Nov-18-2019 02:13 PM EST, Test finished: Nov-18-2019 02:16 PM EST, Test score: Passed (50/50); 100.00%

10. Test started: Nov-18-2019 02:16 PM EST, Test finished: Nov-18-2019 02:19 PM EST, Test score: Passed (50/50); 100.00%

11. Test started: Nov-18-2019 02:20 PM EST, Test finished: Nov-18-2019 02:22 PM EST, Test score: Passed (50/50); 100.00%

12. Test started: Nov-18-2019 02:23 PM EST, Test finished: Nov-18-2019 02:25 PM EST, Test score: Passed (50/50); 100.00%

13. Test started: Nov-18-2019 02:26 PM EST, Test finished: Nov-18-2019 02:29 PM EST, Test score: Passed (50/50); 100.00%

14. Test started: Nov-18-2019 02:30 PM EST, Test finished: Nov-18-2019 02:32 PM EST, Test score: Passed (50/50); 100.00%

15. Test started: Nov-18-2019 02:33 PM EST, Test finished: Nov-18-2019 02:35 PM EST, Test score: Passed (50/50); 100.00%

16. Test started: Nov-18-2019 06:44 PM EST, Test finished: Nov-18-2019 06:46 PM EST, Test score: Passed (50/50); 100.00%

17. Test started: Nov-18-2019 02:36 PM EST, Test finished: Nov-18-2019 02:39 PM EST, Test score: Passed (50/50); 100.00%

18. Test started: Nov-18-2019 02:40 PM EST, Test finished: Nov-18-2019 02:42 PM EST, Test score: Passed (50/50); 100.00%

19. Test started: Nov-18-2019 02:43 PM EST, Test finished: Nov-18-2019 02:45 PM EST, Test score: Passed (50/50); 100.00%

20. Test started: Nov-18-2019 02:46 PM EST, Test finished: Nov-18-2019 02:49 PM EST, Test score: Passed (50/50); 100.00%

Displayed columns: 1 2 3 4 5 10 Rows: 500

## 6 Contact

In case you have any difficulties, contact us at [support@youtestme.com](mailto:support@youtestme.com) and our Team can help you with any issue you encounter.