DEOS-FY2013-BT-01E



# DS-Bench/Test-Env (D-Cloud) Execution Manual

**Version E1.00**

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JST-CREST

Research Area

“Dependable Operating Systems for Embedded Systems Aiming at Practical Applications”


Japan Science and Technology Agency

# Contents

# 1. Introduction

DS-Bench is a system which combines a benchmark test with evaluation of the execution result. This DS-Bench/Test-Env (D-Cloud) execution manual describes the system configuration and benchmark configuration in the following four cases, and explains the operation method of DS-Bench/Test-Env (D-Cloud) in these cases..

- Case to run the benchmark on one physical machine
- Case to run the benchmark on one virtual machine
- Case to run the benchmark on multiple physical machines and virtual machines
- Case to run the benchmark collaborating with D-Case Editor

This document assumes that the DS-Bench/D-Cloud environment is already setup.

Please refer to the DS-Bench/Test-Env Environment Setup Manual (DEOS-FY2013-BI-01E) for environment setting-up.

*** In subsequent sections the words "Test-Env (D-Cloud)" are simply shown as "D-Cloud".**

# 2. Configuration and Environment

In this book, four cases are considered. Refer to the setup manual for installation of the package in each environment.

## 2.1. Case to run the benchmark on one physical machine

- DS-Bench Controller

  Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

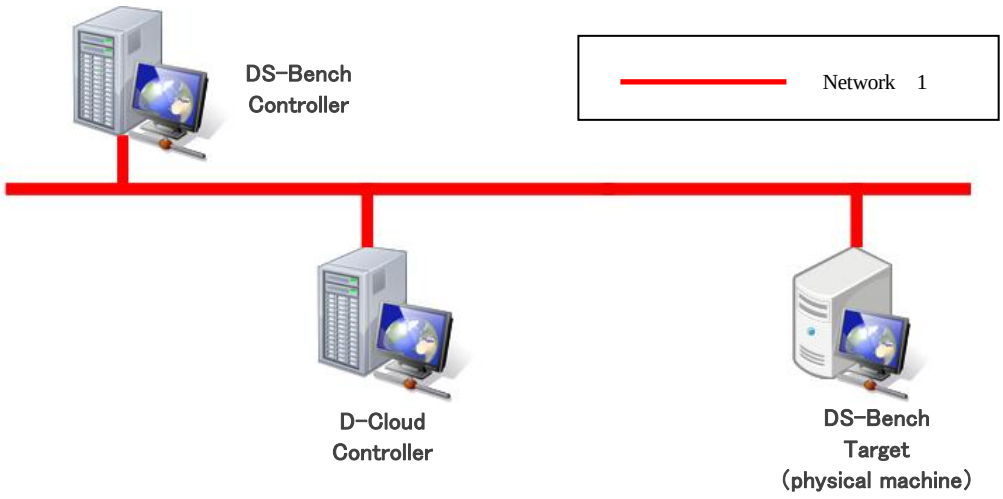
  Sedna XML DB

- DS-Bench Target (physical machine)

  Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

- D-Cloud Controller

  Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1



## 2.2. Case to run the benchmark on one virtual machine

- DS-Bench Controller

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

Sedna XML DB

- DS-Bench Target (virtual machine)

ubuntu-10.04-server-cloudimg-amd64 or ubuntu-12.04-server-cloudimg-amd64

- D-Cloud Controller

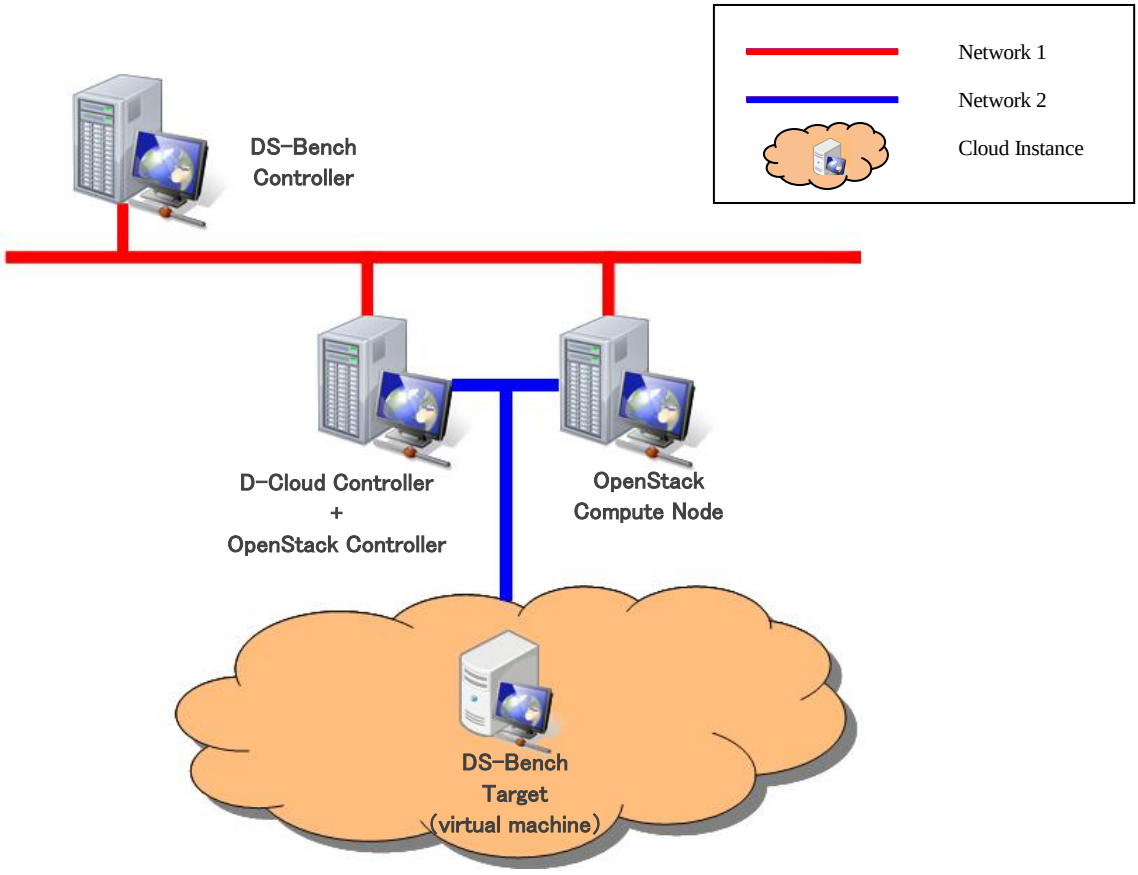
Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

OpenStack 2011.3 (Diablo) or OpenStack 2012.1.3 (Essex)

- OpenStack Compute Node

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

OpenStack 2011.3 (Diablo) or OpenStack 2012.1.3 (Essex)



## 2.3. Case to run the benchmark on multiple physical machines and virtual machines

- DS-Bench Controller

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

Sedna XML DB

- DS-Bench Target (physical machine)

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

Apache HTTP Server

- DS-Bench Target (virtual machine)

ubuntu-10.04-server-cloudimg-amd64 or ubuntu-12.04-server-cloudimg-amd64

- D-Cloud Controller + OpenStack Controller

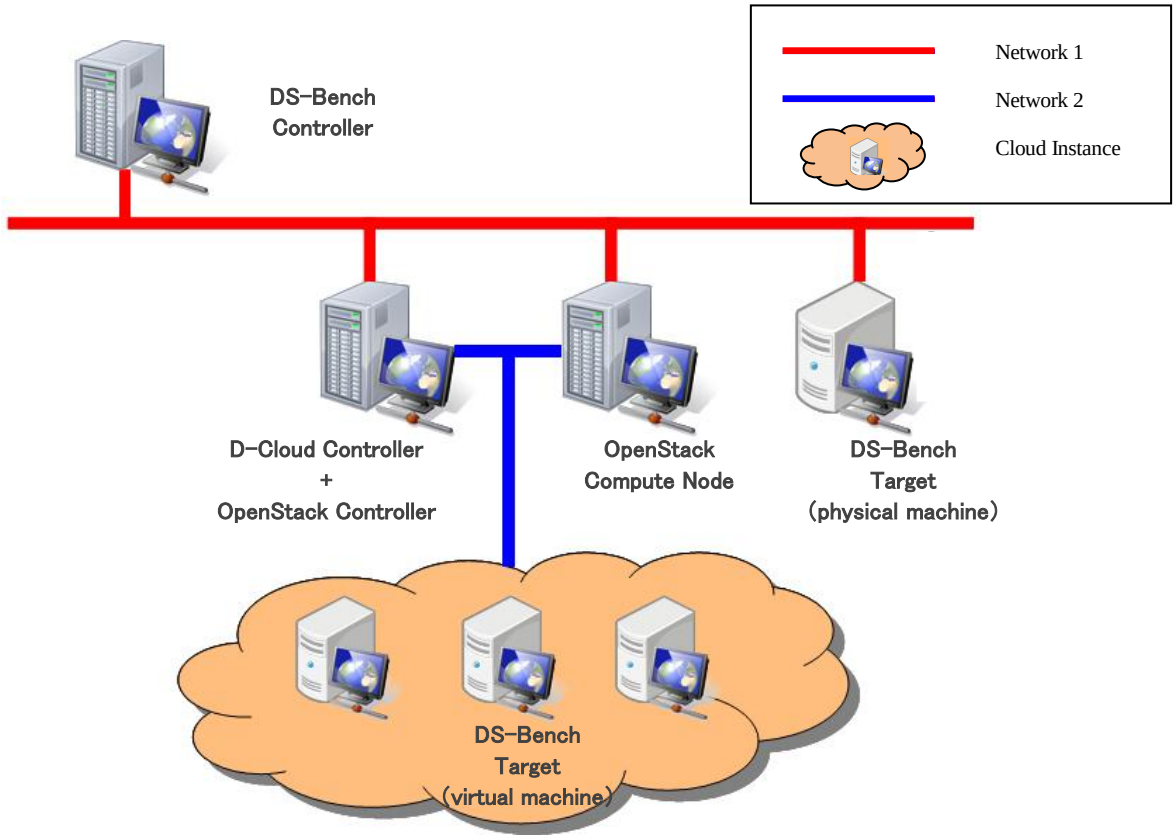
Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

OpenStack 2011.3 (Diablo) or OpenStack 2012.1.3 (Essex)

- OpenStack Compute Node

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

OpenStack 2011.3 (Diablo) or OpenStack 2012.1.3 (Essex)



## 2.4. Case to run the benchmark collaborating with D-Case Editor

- DS-Bench Controller

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

Sedna XML DB

- DS-Bench Target (virtual machine)

ubuntu-10.04-server-cloudimg-amd64 or ubuntu-12.04-server-cloudimg-amd64

- D-Cloud Controller + OpenStack Controller

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

OpenStack 2011.3 (Diablo) or OpenStack 2012.1.3 (Essex)

- OpenStack Compute Node

Ubuntu Server Edition 64-bit 10.04.3 or Ubuntu Server Edition 64-bit 12.04.1

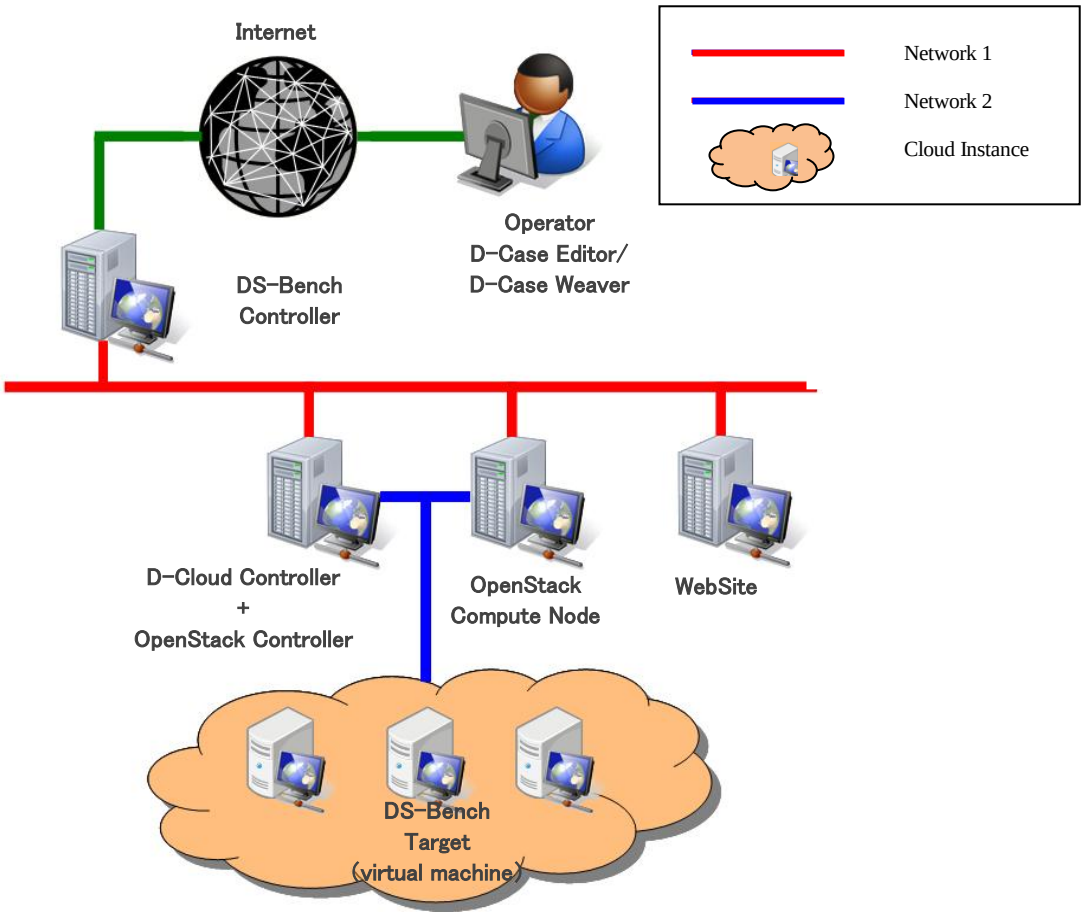
OpenStack 2011.3 (Diablo) or OpenStack 2012.1.3 (Essex)

D-Case Editor http://www.dependable-os.net/tech/D-CaseEditor/D-Case_Editor_J.html

D-Case Weaver http://www.dependable-os.net/tech/DCaseWeaver/index_J.html

- WebSite

Apache HTTP Server



# 3. Details of the Execution Procedures

## 3.1. Case to run the benchmark on one physical machine

Prepare the DS-Bench/Test-Env as in the configuration of Section 2.1. Register DS-Bench under the management of D-Cloud. Here, you create / run a scenario on a DS-Bench single Target that you registered and confirm test results.

In this case, select the "Bonnie" in the benchmark list. The performance of the server in sequential access random access, etc. will then all be measured , and the results will be saved. The sequence of steps involved in checking is explained below.

### 3.1.1. Installation of DS-Bench/D-Cloud

Install a DS-Bench controller, a D-Cloud controller, and a DS-Bench physical target. Please refer to the "DS-Bench/Test-Env (D-Cloud) environmental setup manual" for the procedure of installation.

### 3.1.2. Adding a physical machine to D-Cloud

Login into the D-Cloud Controller.

Determine the location of the management file. The value of "DCLOUD_DESC_PATH" is the path to the management file. Here, it is "/var/dcloud/config/ resource_dsb.xml".

```
$ cat /etc/dcloud.conf
 .
 .
export DCLOUD_DESC_PATH=/var/dcloud/config/resource_dsb.xml
 .
 .
$
```

Add the information on the DS-Bench target (physical machine) to the management file of the D-Cloud controller.

```
$ vi /var/dcloud/config/resource_dsb.xml
<dsb_resource_desc>
    <target type='physical'>
 .
 .
    </target>
    <target type='physical'>
 .
 .
</dsb_resource_desc>
```

Machine information is entered between <target> and </target>.

Here is an example of a description.

```
<target type='physical'>
    <name>trg-tutorial</name>
    <cpu>
        <arch>x86_64</arch>
        <vendor>Intel</vendor>
        <model>core2duo</model>
        <mhz>2400</mhz>
        <cores>2</cores>
        <threads>2</threads>
    </cpu>
    <memory type='DDR3'>
        <speed type='mhz'>800</speed>
        <size>2048</size>
    </memory>
    <devices>
        <device type='ethernet'>
            <target dev='eth0' type='1g' vendor='Intel' model='e1000' ip='*.*.*.*' priority='primary'/>
        </device>
        <device type='storage'>
            <controller type='sata' model='ich9'></controller>
            <target dev='/dev/hda' type='sata2' vendor='WesternDigital' model='Cavier Green' size='1T'
ip='' priority=''/>
        </device>
    </devices>
    <os>
        <family>Linux</family>
        <vendor>ubuntu foundation</vendor>
        <name>Ubuntu</name>
        <version>10.04</version>
        <arch>x86_64</arch>
    </os>
    <softwares>
        <software type='kernel'>
            <version>2.6.32-21-server</version>
        </software>
        <software type='library'>
            <name>libc</name>
            <version>glibc2.6.??</version>
        </software>
        <software type='package'>
            <family>RPM</family>
        </software>
        <software type='compiler'>
            <lang>C</lang>
            <family>GNU</family>
            <name>gcc</name>
            <version>4.4</version>
        </software>
    </softwares>
</target>
```

**Items in red in the above description are mandatory.**

After "ip", specify the IP address with which communication with a DS-Bench controller and a D-Cloud controller is possible.

Moreover, an interface whose priority is "primary" is used for communication. The information on the target in blue letters is displayed on the following "Target detail" screen of DS-Bench. Please specify optional items as appropriate.

*Since any item can be set up according to the user's preference, check of the compatibility between the specified items is not performed.

*In the case of the above-mentioned sample, the items are displayed as follows.

**Target detail**

| | | | | |
|---|---|---|---|---|
| **cpu** | | | | |
| arch | x86_64 | | | |
| vendor | Intel | | | |
| model | core2duo | | | |
| mhz | 2400 | | | |
| cores | 2 | | | |
| threads | 2 | | | |
| **memory(DDR3)** | | | | |
| speed(mhz) | 800 | | | |
| **devices** | | | | |
| **device(ethernet)** | | | | |
| eth0 | 1g | Intel | e1000 | |
| **device(storage)** | | | | |
| /dev/hda | sata2 | WesternDigital | Cavier Green | 1T |
| **os** | | | | |
| family | Linux | | | |
| vendor | ubuntu foundation | | | |
| name | Ubuntu | | | |
| version | 10.04.3 | | | |
| arch | x86_64 | | | |
| **softwares** | | | | |
| **software(kernel)** | | | | |
| version | 2.6.32-34-server | | | |
| **software(library)** | | | | |
| name | libc | | | |
| version | glibc2.6.?? | | | |
| **software(package)** | | | | |
| family | RPM | | | |
| **software(compiler)** | | | | |
| lang | C | | | |
| family | GNU | | | |
| name | gcc | | | |
| version | 4.4 | | | |

Close

* The description of the minimum necessary items is as follows.

```
<target type='physical'>
    <name>trg-tutorial</name>
    <devices>
        <device type='ethernet'>
            <target ip='*.*.*.*' priority='primary'/>
        </device>
    </devices>
</target>
```

The daemons of D-Cloud are rebooted after the completion of a postscript to a management file.

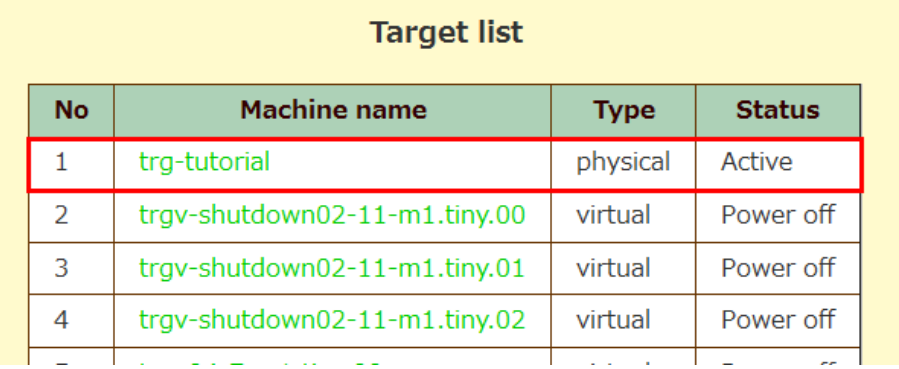
The rebooting demon is "dc-resource-dsb".

```
$ sudo /etc/init.d/dc-resource-dsb restart
Stopping  ... success
Starting  ... success
$
```

Check that the target you have registered has been added to the target list in the DS-Bench screen.

In the case of the sample, "trg-tutorial" is displayed.

Main screen > Configuration screen > Target List



Target list

| No | Machine name | Type | Status |
|---|---|---|---|
| 1 | trg-tutorial | physical | Active |
| 2 | trgv-shutdown02-11-m1.tiny.00 | virtual | Power off |
| 3 | trgv-shutdown02-11-m1.tiny.01 | virtual | Power off |
| 4 | trgv-shutdown02-11-m1.tiny.02 | virtual | Power off |

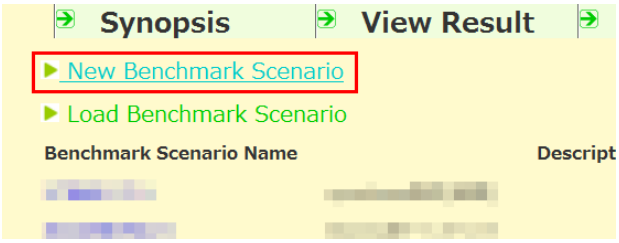
### 3.1.3. Creation of a benchmark scenario

Start up the browser, and open the main screen of the DS-Bench.

http://[The IP address or host name of a DS-Bench controller]/cgi-bin/main.cgi

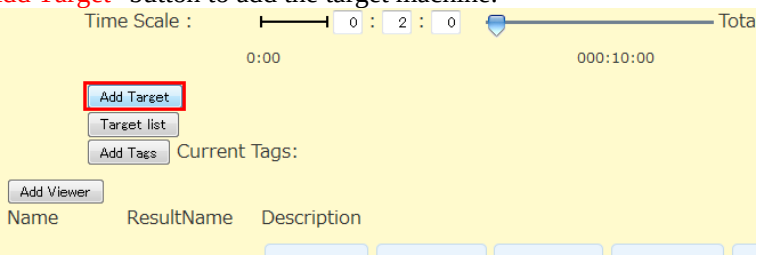
(The case where the DocumentRoot that is specified during the installation of the DS-Bench controller is the same as the Apache DocumentRoot).

Click "New Benchmark Scenario" in the main menu.



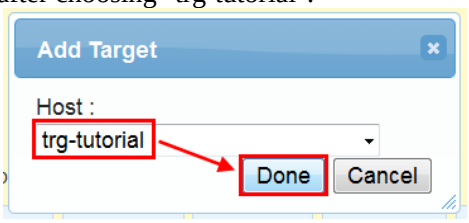
A scenario creation screen opens in a new window.

Click the "Add Target" button to add the target machine.

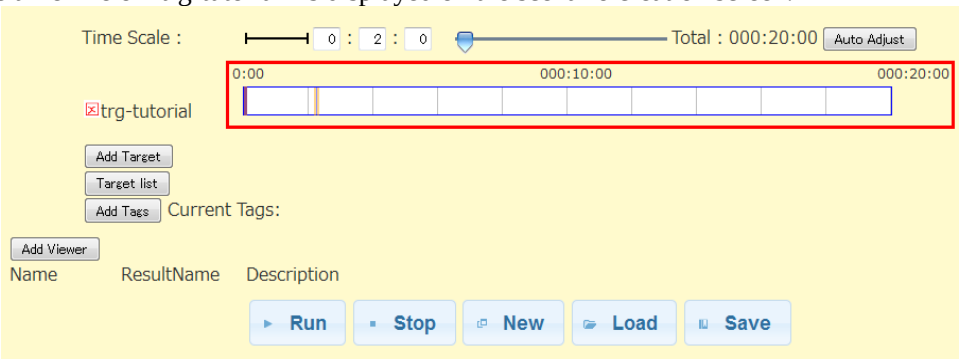



When a dialog appears, select the machine that you added in Section 3.1.2. Here, "trg-tutorial" is selected.

Click the "Done" button after choosing "trg-tutorial".

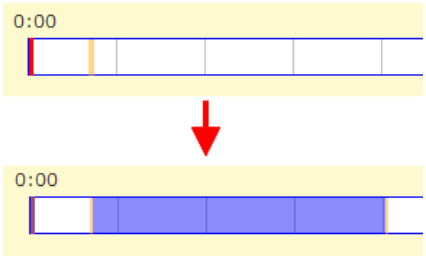



The time line of "trg-tutorial" is displayed on the scenario creation screen.




Add the benchmark scenario on the timeline.

A thin orange bar is displayed when you click on the timeline. Please drag this to the right. The dragged range becomes blue. And, please drop the bar at the point where you want to end. The start and the end of this blue range are entered as the start time and end time in the benchmark setting dialog.

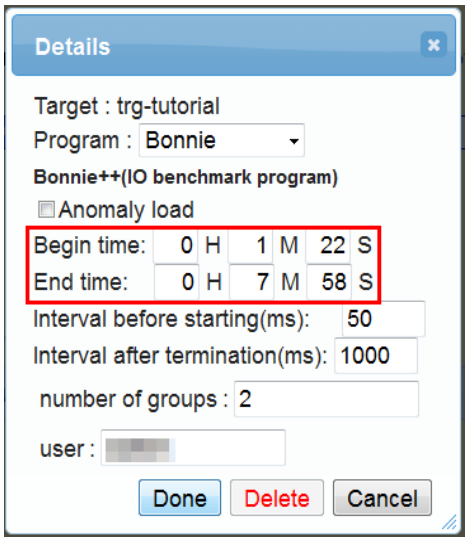



The dialog of benchmark setup is displayed after the completion of the drop.

Select "Bonnie" as the Program, specify an existing user name in the "user" box, click the "Done" button, and adjust the parameters of the benchmark program in accordance with the environment to be used.

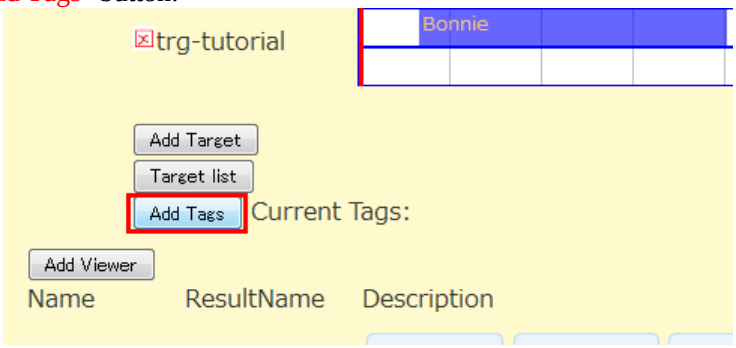
Specify "Begin time" and "End time" if you want to specify in detail the how long after the scenario

starts the benchmark starts and ends.



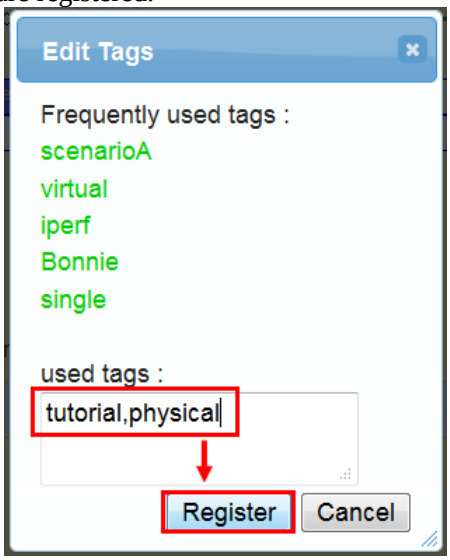

Add the tags. Although setup of a tag is optional, a scenario execution result can be easily searched if a tag is set.

Click the "Add Tags" button.

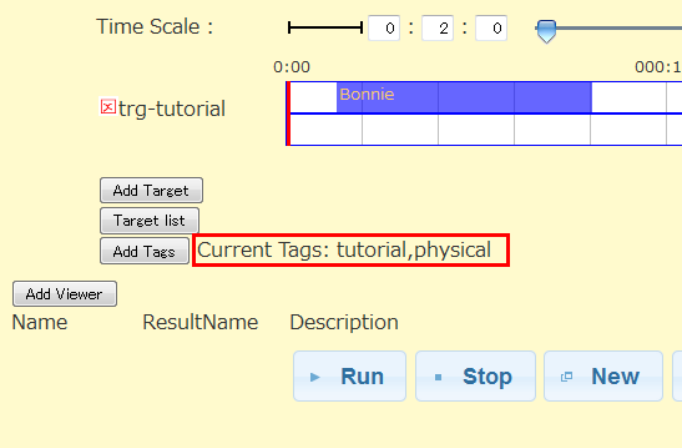



A dialog is displayed. Write a tag in text area, and then click the "Register" button . Two or more tags can be specified if they are separated with a comma..

Here, "tutorial" and "physical" are registered.

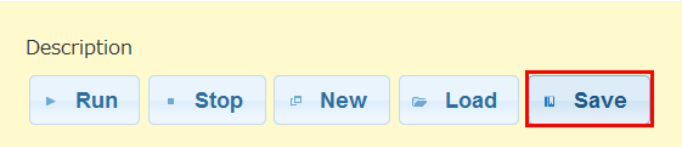



”Current Tags” displays the tags that have been set.



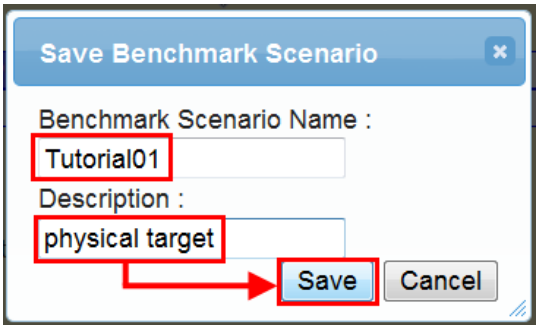

The "Add Viewer" button is for setting the parameters of result values to be passed to D-Case Editor, when the scenario is executed from D-Case Editor. Section 3.4 will explain the details.

Click the "Save" button on the screen to save the created scenario.

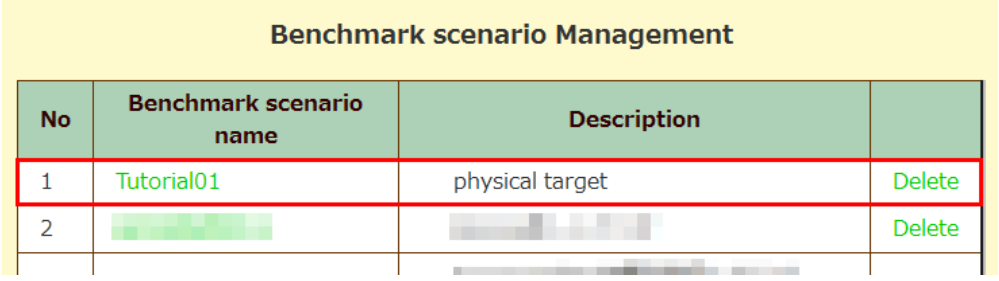



A dialog will be displayed. Click the "Save" button after inputting a scenario name and scenario explanation.

Here the inputted scenario name is "Tutorial01" and the inputted scenario explanation is "physical target".




*The saved scenario can be confirmed or deleted by following the links "Main > Configuration tab > Benchmark Scenario".

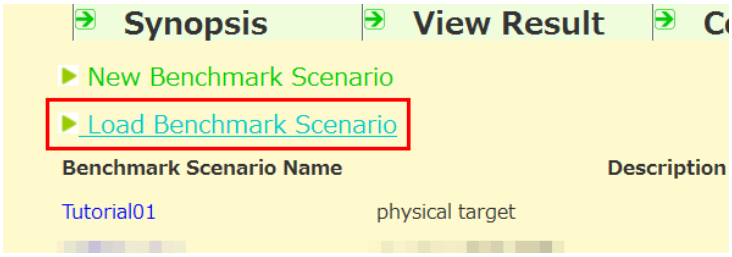



This completes the explanation of preparation of a scenario..

### 3.1.4. Execution of a benchmark scenario

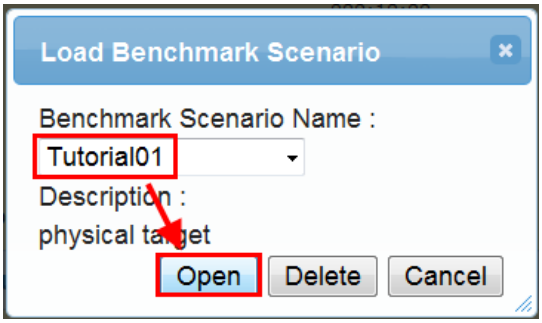
Load the scenario that you created in Section 3.1.

Click the "Load Benchmark Scenario" link in the main screen of DS-Bench.




A scenario selection dialog opens in a new window.

Choose the scenario created in Section 3.1.3 and click the "Open" button. Here, "Tutorial01" is selected.




The created scenario is loaded and displayed.

*A scenario can also be loaded by the following methods.

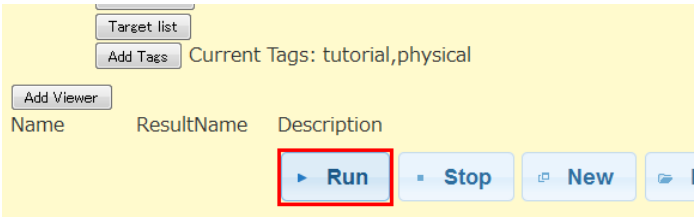
- Click the scenario name under the "Load Benchmark Scenario" link on the main screen

  Main screen > Scenario name
- Click the "Load" button of the benchmark creation screen

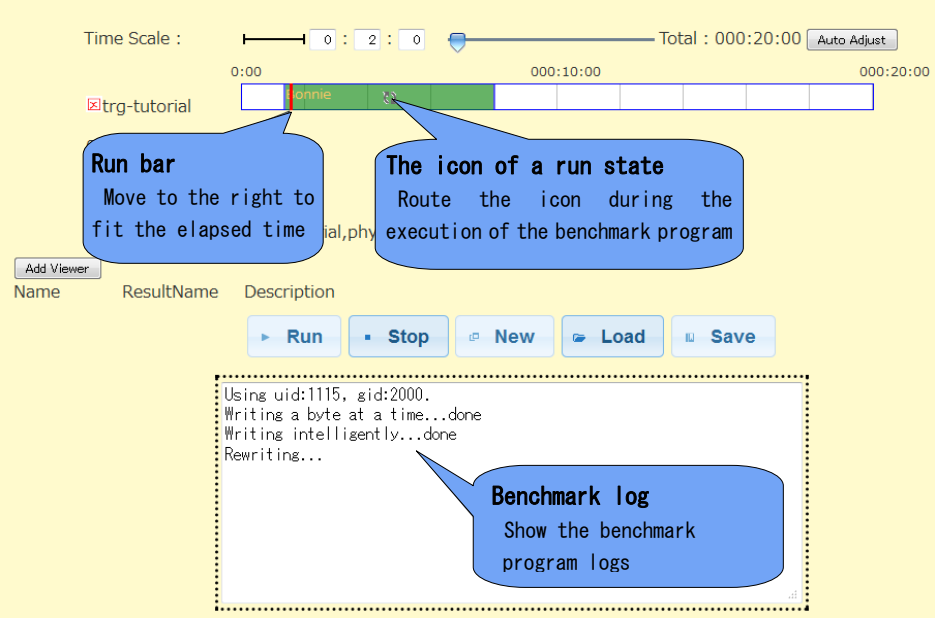
  Main screen > New Benchmark Scenario > Load
- Click the scenario name on the benchmark scenario setting screen

  Main screen > Configuration > Benchmark Scenario > scenario name

Click the "Run" button on the screen in order to execute the benchmark scenario.



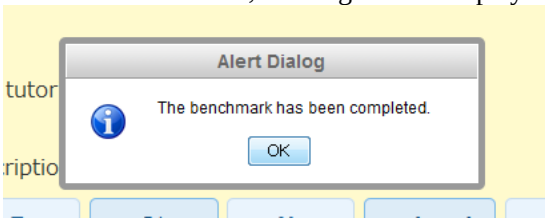

Below is a screen when a scenario is running.



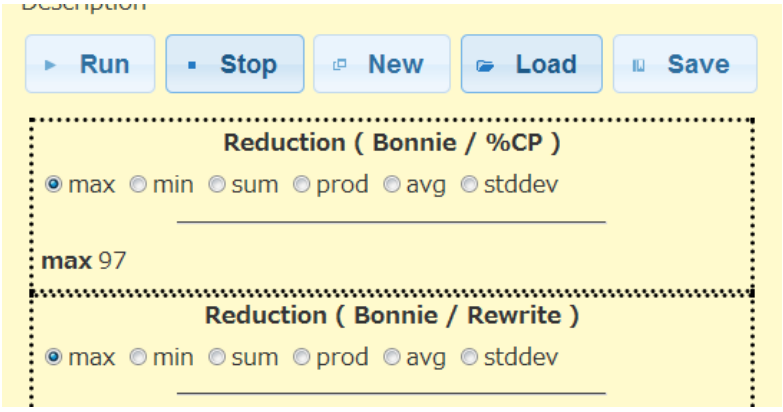

When the run bar reaches the end of the benchmark area, the scenario has been completed.

### 3.1.5. Checking the results from the benchmark scenario

Upon completion of execution of a scenario, a dialog will be displayed.



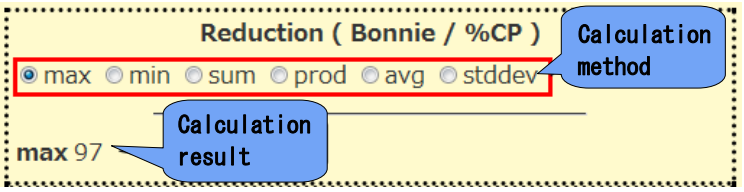

The results of the benchmark scenario will be shown at the bottom.




- Reduction result

The execution results of a benchmark program are collected, and calculations are performed.

The calculation method can be changed with a radio button.

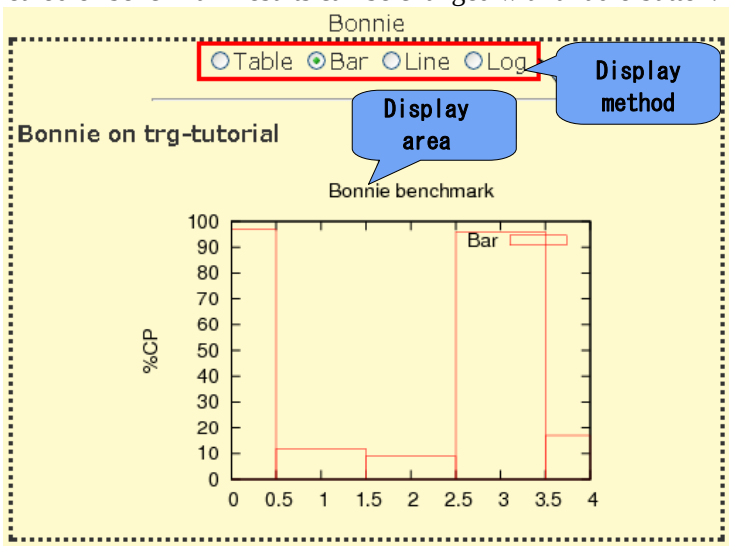



| max | min | sum | prod | avg | stddev |
|---|---|---|---|---|---|
| Maximum value | Minimum value | Total | Product | Average | Standard deviation |

Benchmark results

The execution results of a benchmark program are displayed.

The display method of benchmark results can be changed with a radio button.



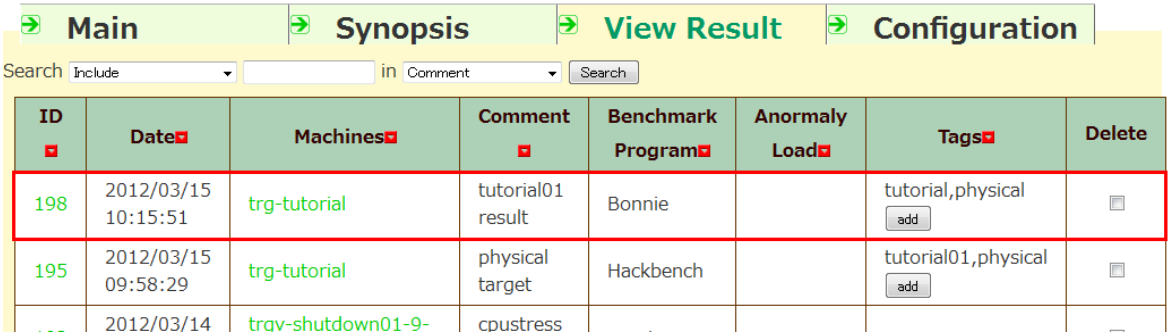

- ◆ Table The results are displayed in table form.
- ◆ Bar The results are displayed in a bar chart.
- ◆ Line The results are displayed in a line graph.
- ◆ Log Benchmark execution log is displayed.

- Register a comment

  A comment on the execution result of a scenario can be registered.

  Click the "Update comments" button after entering a comment in the text area.

When a comment is registered, it is displayed on the "Comment" column of a scenario execution result list screen (View Result screen) or a scenario list screen (Synopsis screen). This list allows a quick check of the type of scenario execution results that have been obtained.




※ The methods of checking scenario execution results.

- Scenario execution result list screen (View Result screen)

  Main screen > View Result > ID

- Scenario list screen (Synopsis screen)

  Main screen > Synopsis > ID

## 3.2. Case to run the benchmark on one virtual machine

In the case of creating a scenario using a virtual machine and checking the results, set up a virtual machine (image) to be used as the DS-Bench Target. Select "Memstress" from the benchmark list. This provides a big data load in the memory area that is allocated to the target virtual machine.

### 3.2.1. Creation and registration of a virtual DS-Bench target

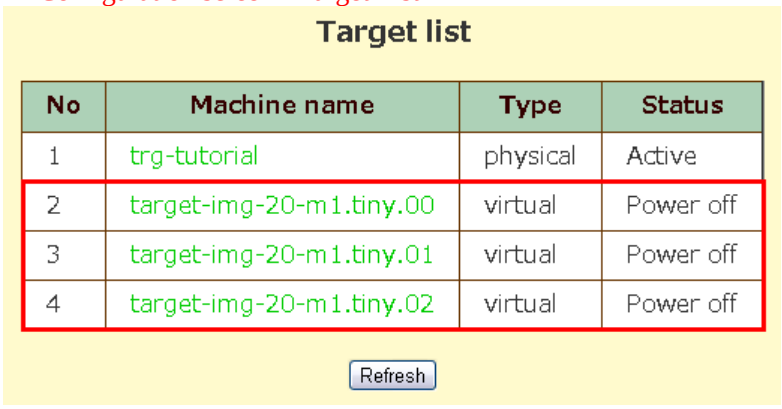
Create a virtual DS-Bench target, and register it with D-Cloud. For the procedure, refer to Section 4 of the "DS-Bench/Test-Env (D-Cloud) Environment Construction Manual".

***The daemon of D-Cloud must be rebooted after registration is completed.**

```
$ sudo /etc/init.d/dc-mapserver restart
Stopping  ... success
Starting  ... success
$
$ sudo /etc/init.d/dc-resource-dsb restart
Stopping  ... success
Starting  ... success
$
$ sudo /etc/init.d/dcld restart
Stopping  ... success
Starting  ... success
$
```

Check that the target you have registered has been added to the target list linked to the DS-Bench screen.

Main screen> Configuration screen> Target List



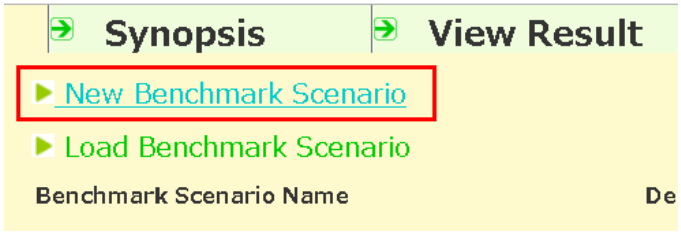

### 3.2.2. Creation of a benchmark scenario

Start up the browser, and open the main screen of the DS-Bench.

http://[IP address or Host name of DS-Bench controller]/cgi-bin/main.cgi

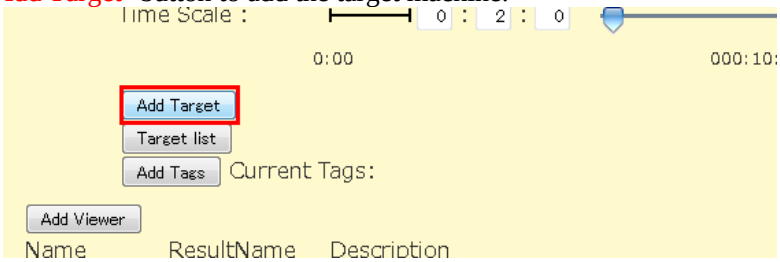
(in the case where the DocumentRoot that was specified during the installation of the DS-Bench controller is the same as the Apache DocumentRoot.)

Click the main menu "New Benchmark Scenario" link



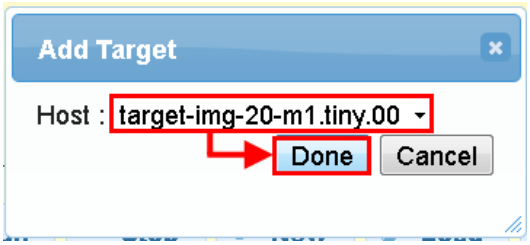

The scenario creation screen will open in a new window.

Click the "Add Target" button to add the target machine.

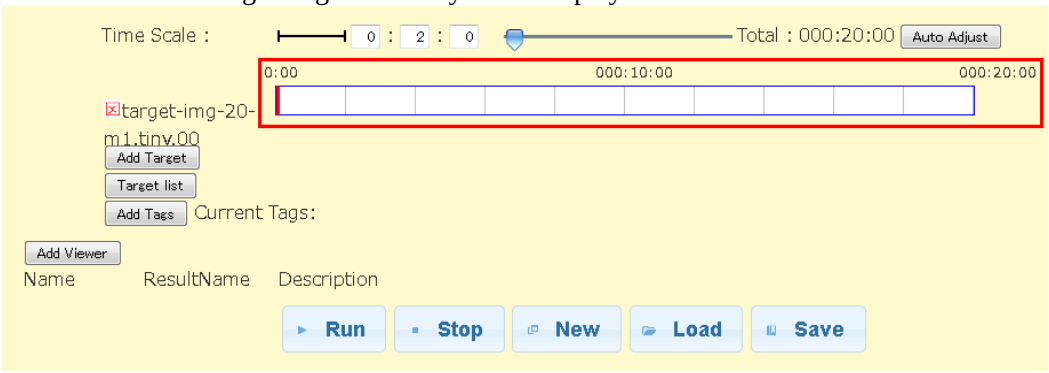



In the dialog that appears, select the machine that you added in Section 3.1.2. Here, the "target-img-20-m1.tiny.00" is selected.

Click the "Done" button after choosing "target-img-20-m1.tiny.00".

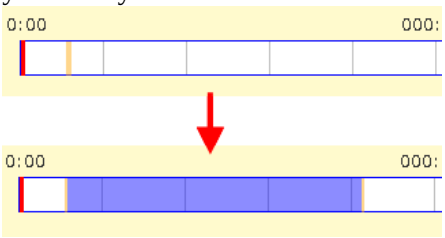



The time line of " target-img-20-m1.tiny.00" is displayed on the scenario creation screen.



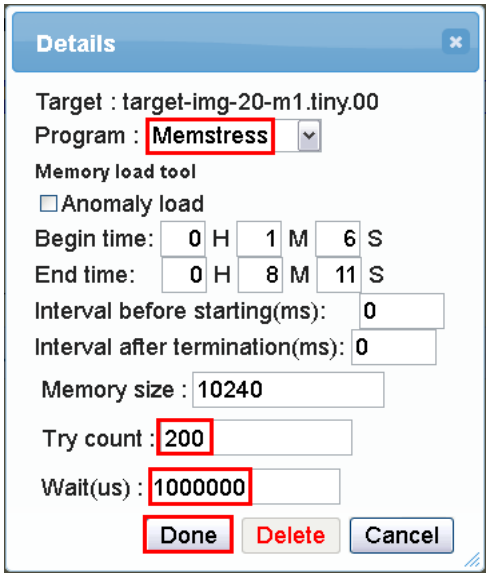

Add the benchmark scenario on the timeline.

A thin orange bar is displayed when you click on the timeline. Drag this to the right.

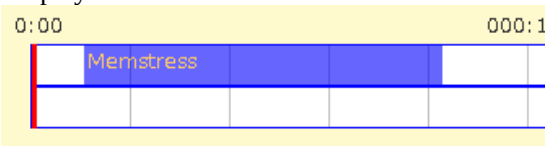



A dialog box for benchmark settings is displayed after dropping the bar.

Select "Memstress" as the program and adjust parameters. The memory size specified every second (Wait = 1000000 microseconds) is secured, and this is repeated 200 times (Try count = 200) to apply a load to the memory. Please adjust the parameters of the benchmark program in accordance with the environment in use. Click the "Done" button after the adjustment is completed.

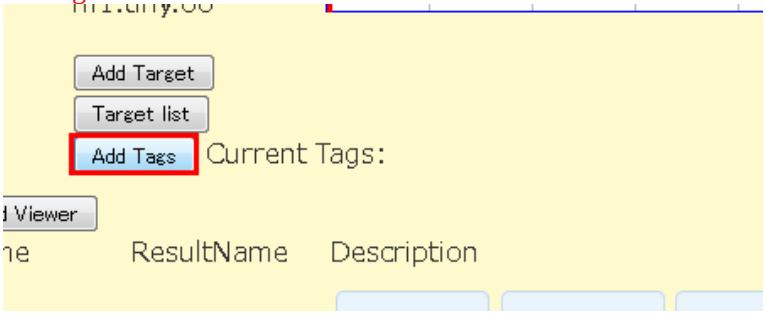



The benchmark bar is displayed on the timeline.

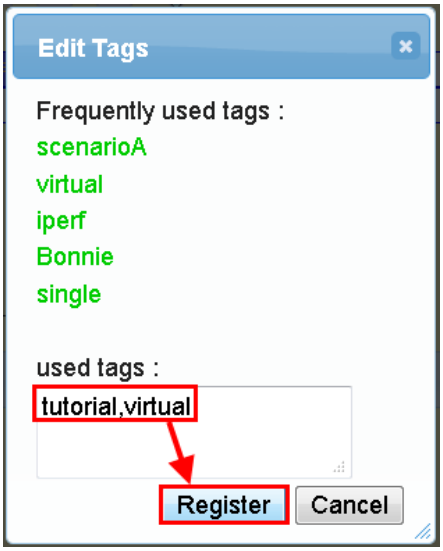



Add the tags. Although setting a tag is optional, a scenario execution result can be easily searched with a tag.

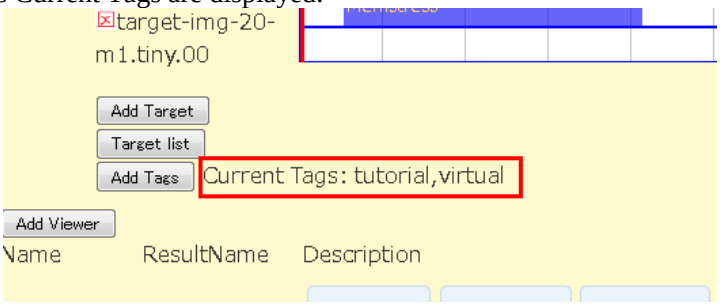
Click the "Add Tags" button.



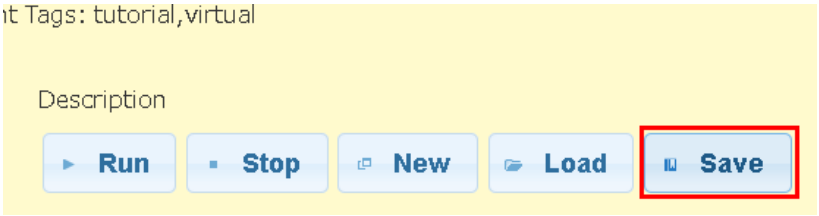

When the dialog box is displayed, enter a tag in text area and then click the "Register" button. Two or more tags can be specified by dividing with commas. Here, "tutorial" and "virtual" are registered.




The tags set as Current Tags are displayed.

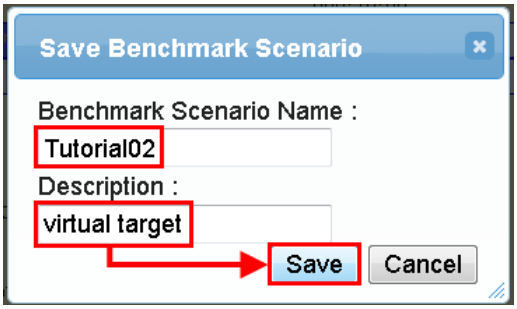



Click the "Save" button on screen to save the created scenario.




When a dialog box is displayed, input a scenario name and scenario explanation, and then click the "Save" button.

Here, "Tutorial01" is inputted as the scenario name and "physical target" is inputted as the scenario explanation.

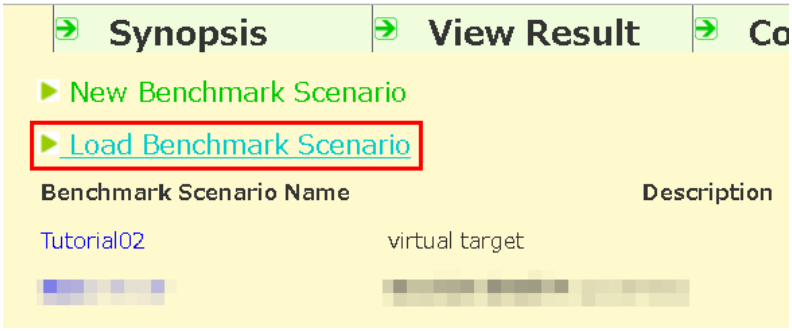



This completes the benchmark scenario creation.

### 3.2.3. Execution of a benchmark scenario

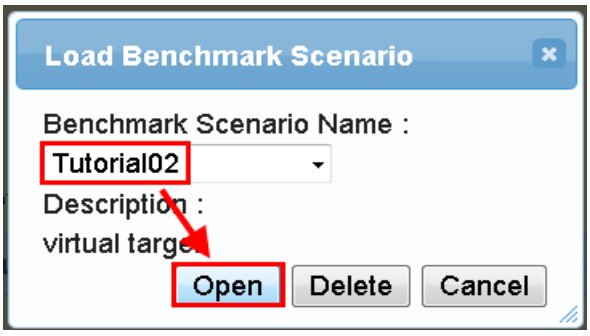
Load the scenario that you created in Section 3.2.2.

Click the "Load Benchmark Scenario" link in the main screen of DS-Bench.




A scenario selection dialog opens in a new window.

Choose the scenario created in Section 3.2.3 and click the "Open" button. Here, "Tutorial02" is selected.




The created scenario is loaded and displayed.

*A scenario can also be loaded by the following methods.

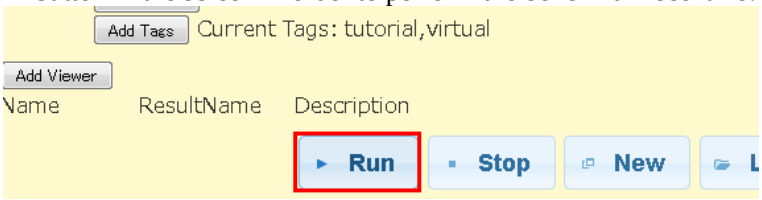
- Click the scenario name in the window that appears after clicking the "Load Benchmark Scenario" link on the main screen

  Main screen > scenario name
- Click the "Load" button of the benchmark creation screen

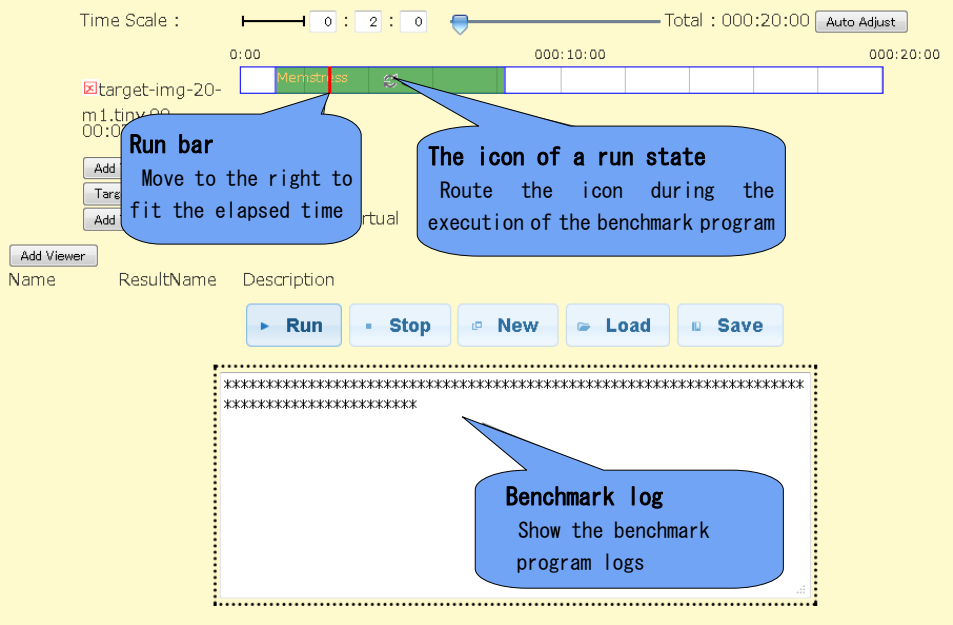
  Main screen > New Benchmark Scenario > Load
- Click the scenario name in benchmark scenario setting screen

  Main screen > Configuration > Benchmark Scenario > scenario name

Click the "Run" button in the screen in order to perform the benchmark scenario.




Below is a screen showing the run state..

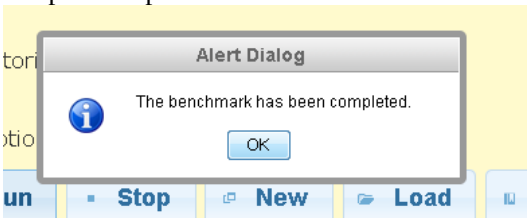



While executing Memstress, the number of times domains have been secured is displayed as that number of "*" marks in the log screen.

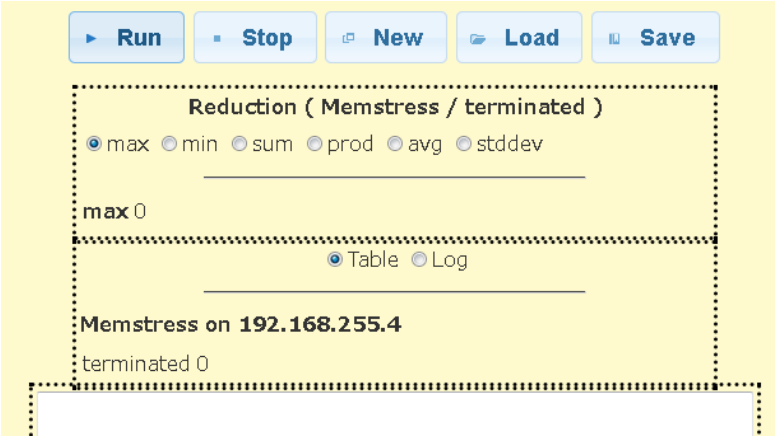
When the vertical run bar reaches the end of the benchmark area, the scenario has been completed.

### 3.2.4. Checking of the results from the benchmark scenario

A dialog box will appear upon completion of execution of the scenario.



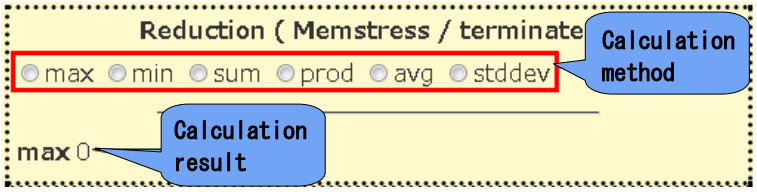

Results of the benchmark scenario will be shown at the bottom.




- Reduction result

This is calculated after collecting the execution results of each benchmark program.

The display format of the calculations can be changed with a radio button.



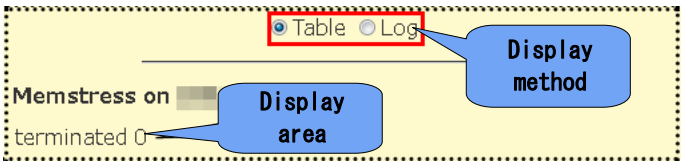

| max | min | sum | prod | avg | stddev |
|---|---|---|---|---|---|
| Maximum value | Minimum value | Total | Product | Average | Standard deviation |

- Benchmark results

The execution results of a benchmark program are displayed.

The display format of benchmark results can be changed with radio buttons.

*The graph settings available depend on the benchmark tool. "Bar" and "Line" do not appear in this case.



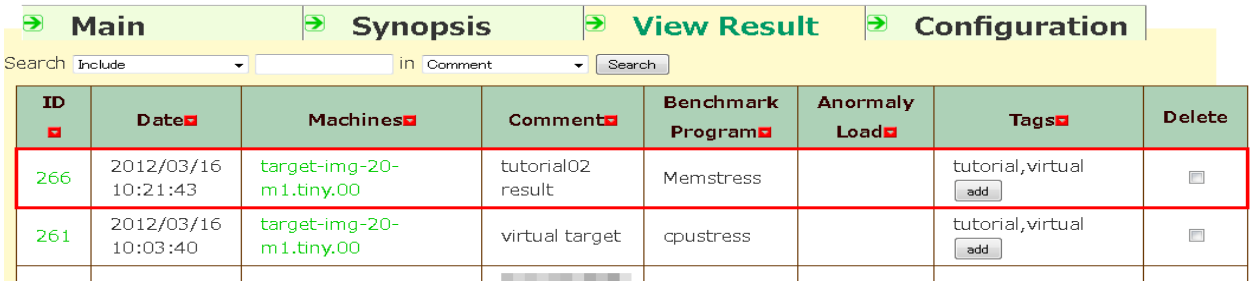

- ◆ Table The results are displayed in a table form.
- ◆ Bar The results are displayed in a bar chart.
- ◆ Line The results are displayed in a line graph.
- ◆ Log Benchmark execution log is displayed.

- Register a comment

A comment regarding a scenario execution result can be registered.

After entering a comment in the text area, click the "Update comments" button.


When a comment is registered, it is displayed on the "Comment" column of a scenario execution result list screen or a scenario list screen, so that the type of the executed scenario can be checked by viewing the list.



※ Methods of checking scenario execution results.

- Scenario execution result list screen (View Result screen)

  Main screen > View Result tag> ID link

- Scenario list screen (Synopsis screen)

  Main screen > Synopsis tag > ID link

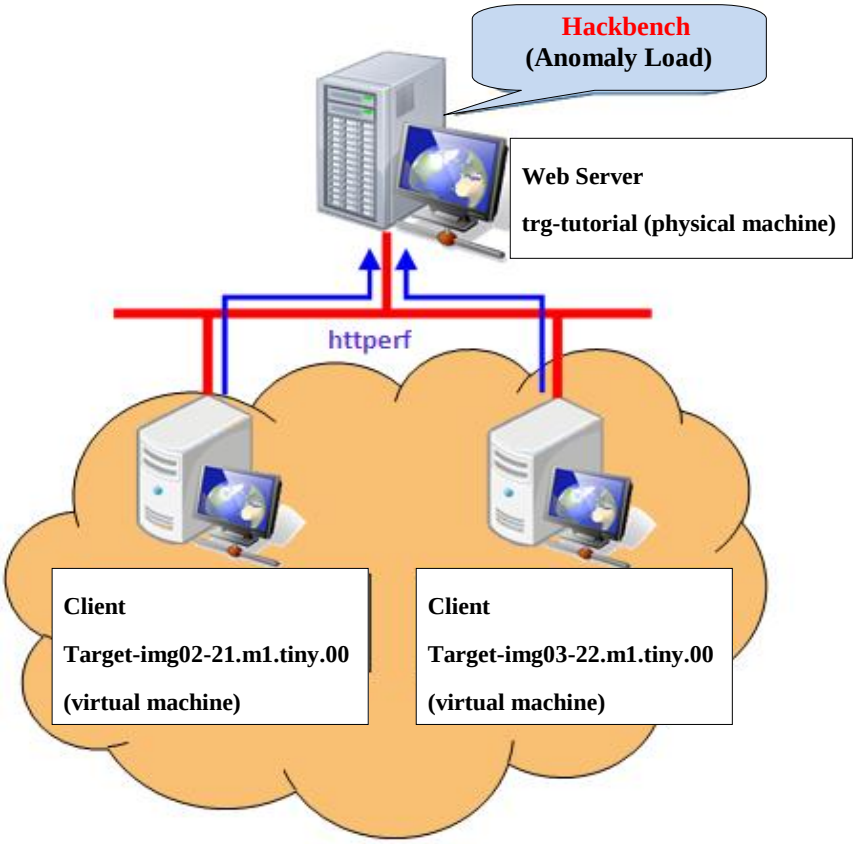
## 3.3. Case to run the benchmark on multiple physical machines and virtual machines

This is the case when the configuration of Section 2.1 and Section 2.2 are combined. Here, two virtual machines are set as clients, one physical machine is set as a server and we choose benchmark "Httperf" to perform. On the server side, Hackbench is used as Anomaly Load.

Each virtual client accesses the physical machine which is set up with Anomaly Load 2 times/second, until the total number of accesses is 200. We monitor and record the response time after these accesses.

A schematic view of this environment is as follows.

| | |
|---|---|
| Server | trg-tutorial (physical machine) |
| Client1 | target-img02-21.m1.tiny.00 (virtual machine) |
| Client2 | target-img03-22.m1.tiny.00 (virtual machine) |



### 3.3.1. Advance preparation

Add the (virtual) DS-Bench target to be used as a client.

Login to the server in which OpenStack is installed.

```
$ cd /var/nova/images/test/
$ pwd
/var/nova/images/test/
$
$ ls –l
total 1991356
-rw-r--r-- 1 root root 1476395008 YYYY-MM-DD hh:mi lucid-server-cloudimg-amd64.img
-rw-rw-rw- 1 root root    4110432 YYYY-MM-DD hh:mi lucid-server-cloudimg-amd64-vmlinuz-virtual
-rw-r--r-- 1 root root 1476395008 YYYY-MM-DD hh:mi target-img
$
```

The display then moves to the directory where i the virtual target image was saved as described in Section 3.2.1. In this case; this is "/var/nova/images/test".

Copy the "target-img"

```
$ sudo cp -p target-img target-img-02
$
$ ls –l
total 2986876
-rw-r--r-- 1 root root 1476395008 YYYY-MM-DD hh:mi lucid-server-cloudimg-amd64.img
-rw-rw-rw- 1 root root    4110432 YYYY-MM-DD hh:mi lucid-server-cloudimg-amd64-vmlinuz-virtual
-rw-r--r-- 1 root root 1476395008 YYYY-MM-DD hh:mi target-img
-rw-r--r-- 1 root root 1476395008 YYYY-MM-DD hh:mi target-img-02
$
```

Register in OpenStack the image you copied. In the same way, the kernel used is "org-kernel"

```
$ sudo nova-manage image image_register target-img-02 admin --name=target-img02 --kernel=00000001
--cont_format=ami --disk_format=ami
Image registered to 21 (00000015).
$
```

Registration is checked.

```
$ glance index
ID          Name                         Disk Format       Container Format  Size
----------- ---------------------------- ----------------- ----------------- -----------
21          target-img02                 ami               ami                1476395008
20          target-img                   ami               ami                1476395008
1           org-kernel                   aki               aki                   4108960
$
```

Register "target-img-03" in the same way. Check after registration.

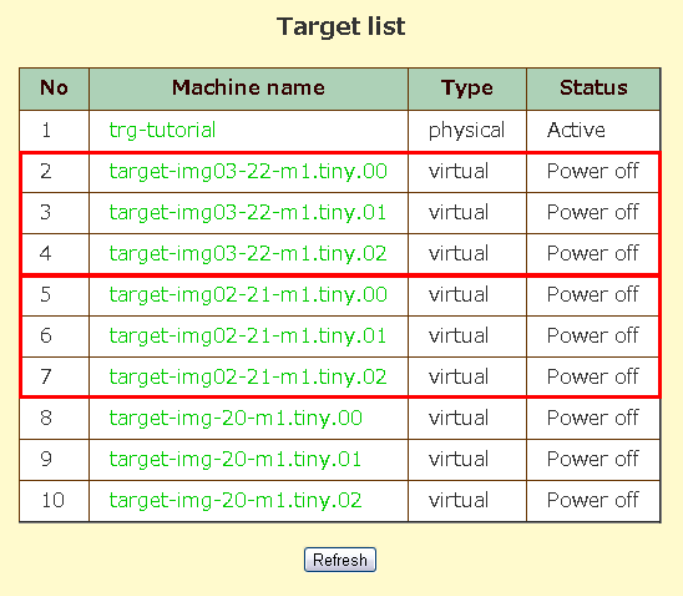
```
$ glance index
ID           Name                         Disk Format       Container Format  Size
------------ ---------------------------- ----------------- ----------------- -----------
22           target-img03                 ami               ami                 1476395008
21           target-img02                 ami               ami                 1476395008
20           target-img                   ami               ami                 1476395008
1            org-kernel                   aki               aki                    4108960
$
```

Reboot the demon of D-Cloud after the completion of registration.

```
$ sudo /etc/init.d/dc-mapserver restart
Stopping  ... success
Starting  ... success
$
$ sudo /etc/init.d/dc-resource-dsb restart
Stopping  ... success
Starting  ... success
$
$ sudo /etc/init.d/dcld restart
Stopping  ... success
Starting  ... success
$
```

In the DS-Bench screen, check the DS-Bench targets (virtual) which are registered.

Main screen > Configuration screen > Target lists



**Target list**

| No | Machine name | Type | Status |
|---|---|---|---|
| 1 | trg-tutorial | physical | Active |
| 2 | target-img03-22-m1.tiny.00 | virtual | Power off |
| 3 | target-img03-22-m1.tiny.01 | virtual | Power off |
| 4 | target-img03-22-m1.tiny.02 | virtual | Power off |
| 5 | target-img02-21-m1.tiny.00 | virtual | Power off |
| 6 | target-img02-21-m1.tiny.01 | virtual | Power off |
| 7 | target-img02-21-m1.tiny.02 | virtual | Power off |
| 8 | target-img-20-m1.tiny.00 | virtual | Power off |
| 9 | target-img-20-m1.tiny.01 | virtual | Power off |
| 10 | target-img-20-m1.tiny.02 | virtual | Power off |

Refresh

Next, check whether the Apache has started on the physical machine used as a server.

Log into the physical machine and check whether some processes have started.

*If Apache is not installed in the DS-Bench target (physical machine), install it now.

```
$ ps -ef | grep apache
root      1905     1  0 MMMDD ?        00:00:06 /usr/sbin/apache2 -k start
www-data  1907  1905  0 MMMDD ?        00:00:04 /usr/sbin/apache2 -k start
www-data  1909  1905  0 MMMDD ?        00:00:04 /usr/sbin/apache2 -k start
www-data  1911  1905  0 MMMDD ?        00:00:04 /usr/sbin/apache2 -k start
*******   8985  7025  0 hh:mi pts/0    00:00:00 grep apache
$
```

Check whether "index.html" specified at the time of httperf execution exists in DocumentRoot.

```
$ ls -l /var/www/index.html
-rw-r--r-- 1 root root 177 YYYY-MM-DD hh:mi /var/www/index.html
$
```

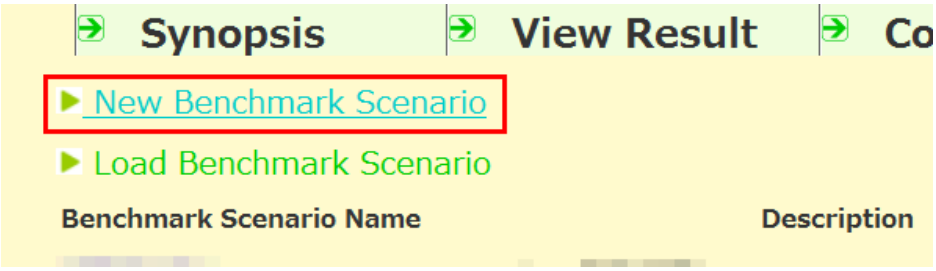
### 3.3.2. Creation of a benchmark scenario

Start up the browser, and open the main screen of the DS-Bench.

http://[The IP address or host name of a DS-Bench controller]/cgi-bin/main.cgi

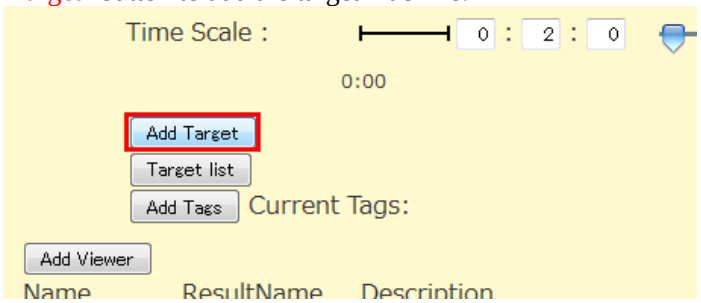
(In the case where the DocumentRoot specified during the installation of the DS-Bench controller is the same as the Apache DocumentRoot).

Click the "New Benchmark Scenario" link of the main menu.



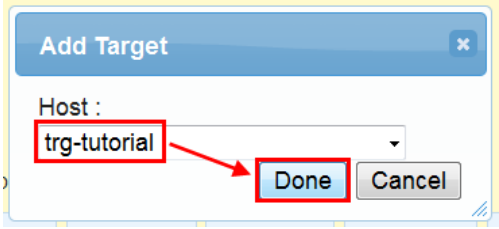

A scenario creation screen opens in a new window.

Click the "Add Target" button to add the target machine.

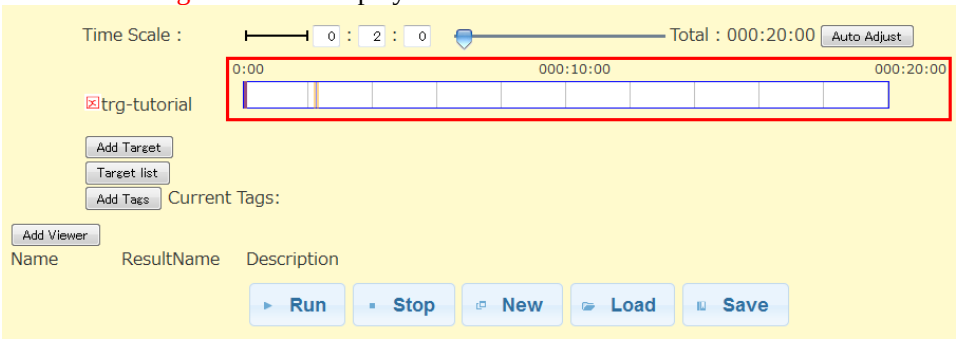



In the dialog box that is displayed, select the physical machine used as the server. Here, "trg-tutorial" is selected.

The "Done" button is clicked after choosing "trg-tutorial".

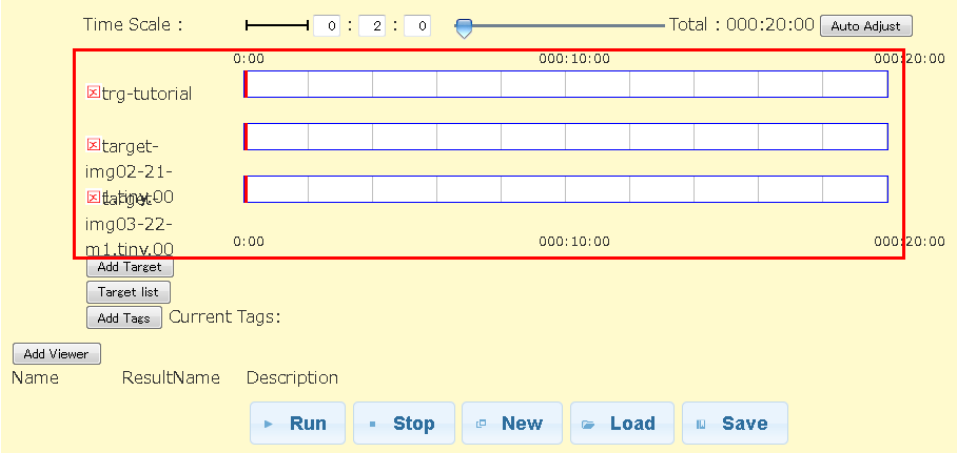



The time line of "trg-tutorial" is displayed on a scenario creation screen.




In the same way, add two virtual machines which will become clients.

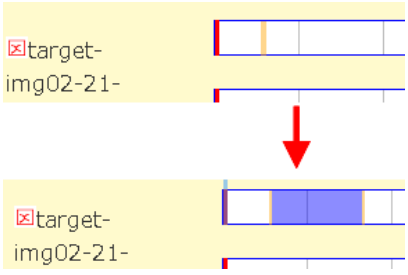
After adding, the scenario creation screen will show the following.




Add a benchmark program, as follows.

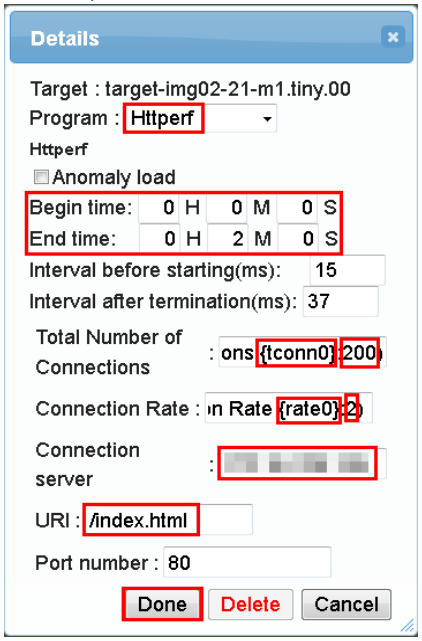
First, add "httperf" to a virtual machine.

Drag-and-drop on the time line of one of virtual machines.



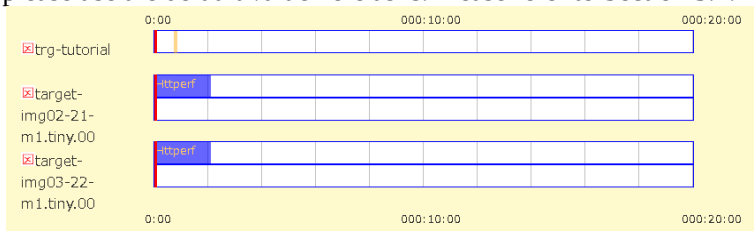
A dialog for benchmark settings is displayed.

Select "httperf" as the Program. Enter the start time"0H 0M 0S", end time"0H 2M 0S", total number of connections"$(param:Total Number of Connections {tconn0}:200)", the number of accesses per second"$(param:Connection Rate {rate0}:2)", the destination server, and the reference URL (the URL of the index.html confirmed in Section 3.3.1). Create a scenario to perform the connection 200 times, 2 times per second, to the Web server, and click the "Done" button.




Add “httperf” on another virtual machine.

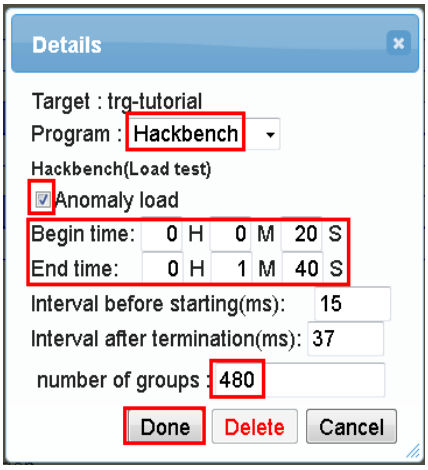
*Since a parameter which starts with "$ (param-)" is for changing a value when executing from D-Case editor, please use the default value here as is. Please refer to Section 3.4.1 for an explanation.




Next, in order to generate a load on the server side, add "Hackbench" to the physical machine "trg-tutorial". Drag-and-drop on the time line of the physical machine.

When the dialog box of benchmark setup is displayed, select the following items.

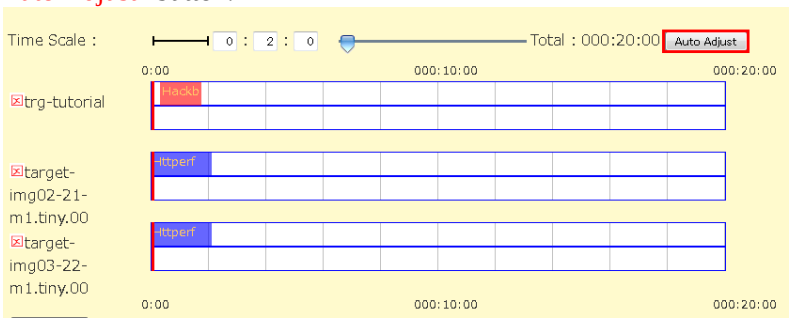
Select "Hackbench" as the Program, check Anomaly load. Enter the Start time"0H 0M 20S", end time "0H 2M 0S", and the magnitude of the load "480", and click the "Done" button.



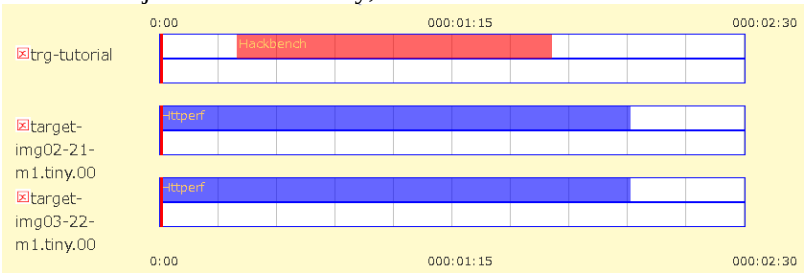

After these additions, the scenario screen is as above.

When the scale of the time line is not correct, it self-adjusts

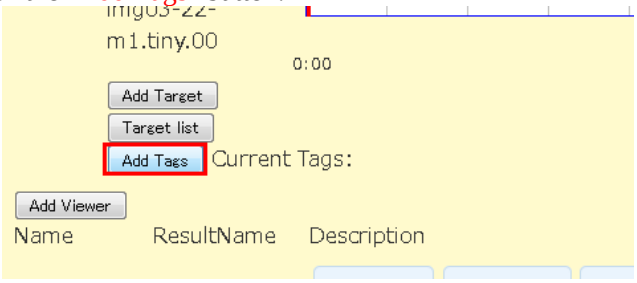
Click the "Auto Adjust" button.



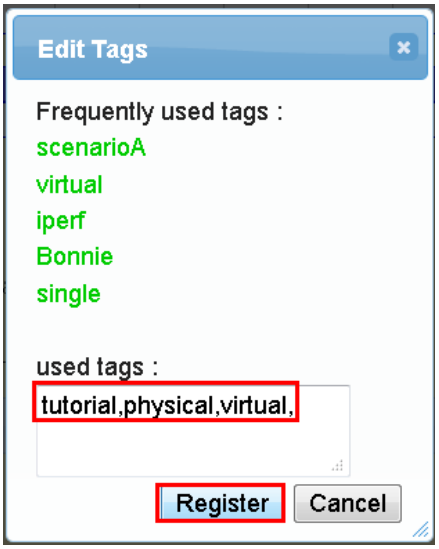

Because the scale is adjusted automatically, it becomes easier to understand.



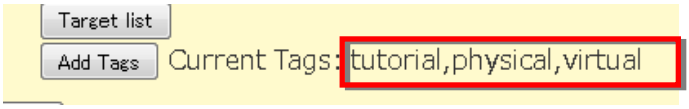

Add the tags. Click the "Add Tags" button.



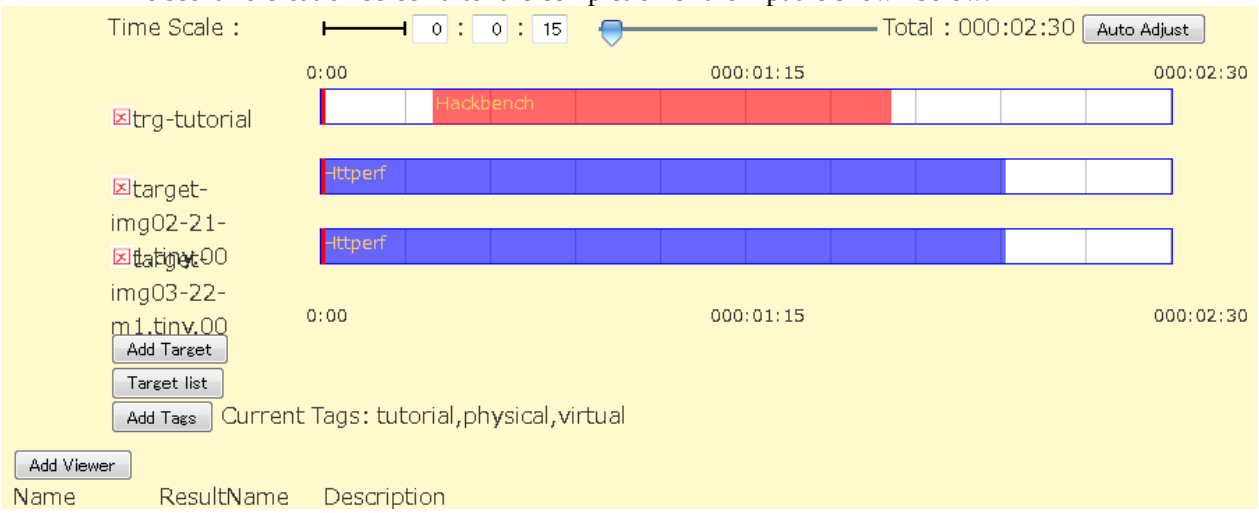

When a dialog box is displayed, enter "tutorial", "physical" and "virtual" here. After entering, please click the "Register" button.




A tag is added to the scenario creation screen.

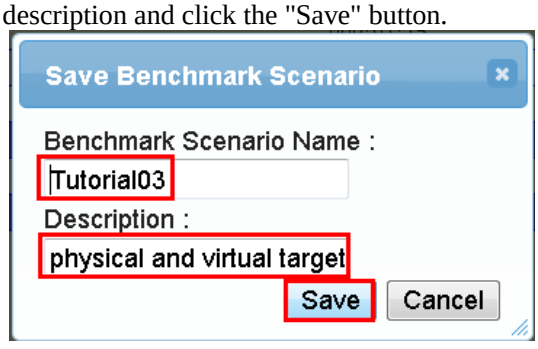



The scenario creation screen after the completion of the input is shown below.




Save the created scenario.

Click the "Save" button. Since a dialog is displayed, enter the scenario name "Tutorial03", "physical and virtual target" in the description and click the "Save" button.

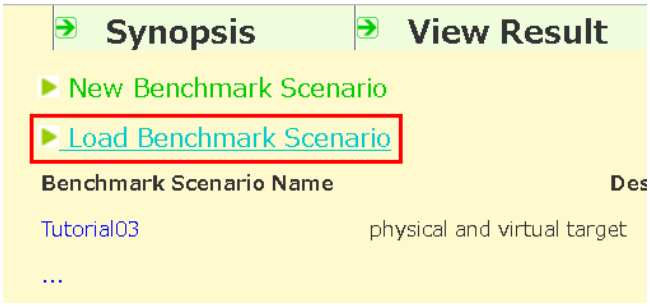


This completes the benchmark scenario creation.

### 3.3.3. Execution of a benchmark scenario

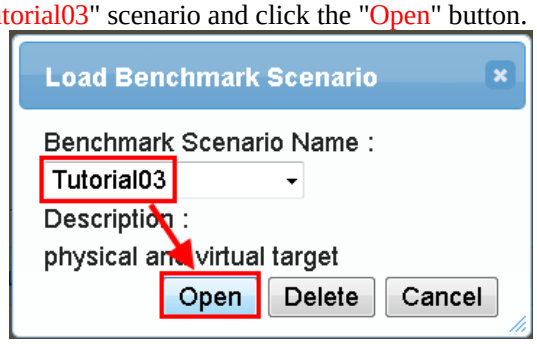
Load the scenario created in Section 3.3.2

Click the "Load Benchmark Scenario" link in the main screen of DS-Bench.




A scenario selection dialog opens in a new window.

Please choose the "Tutorial03" scenario and click the "Open" button.




The created scenario is loaded and displayed.

*A scenario can also be loaded by the following methods.

- Click the scenario name under the "Load Benchmark Scenario" link on the main screen

  Main screen > scenario name

- Click the "Load" button of a benchmark creation screen.

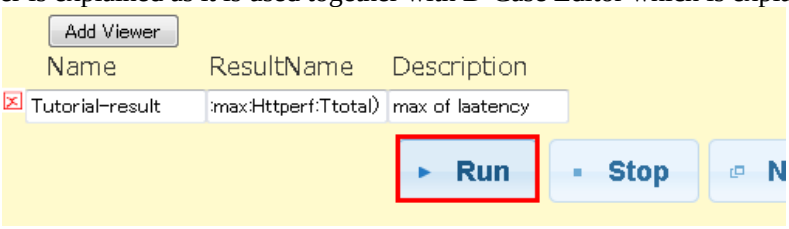
  Main screen > New Benchmark Scenario > Load

- Click the scenario name in the benchmark scenario setting screen.

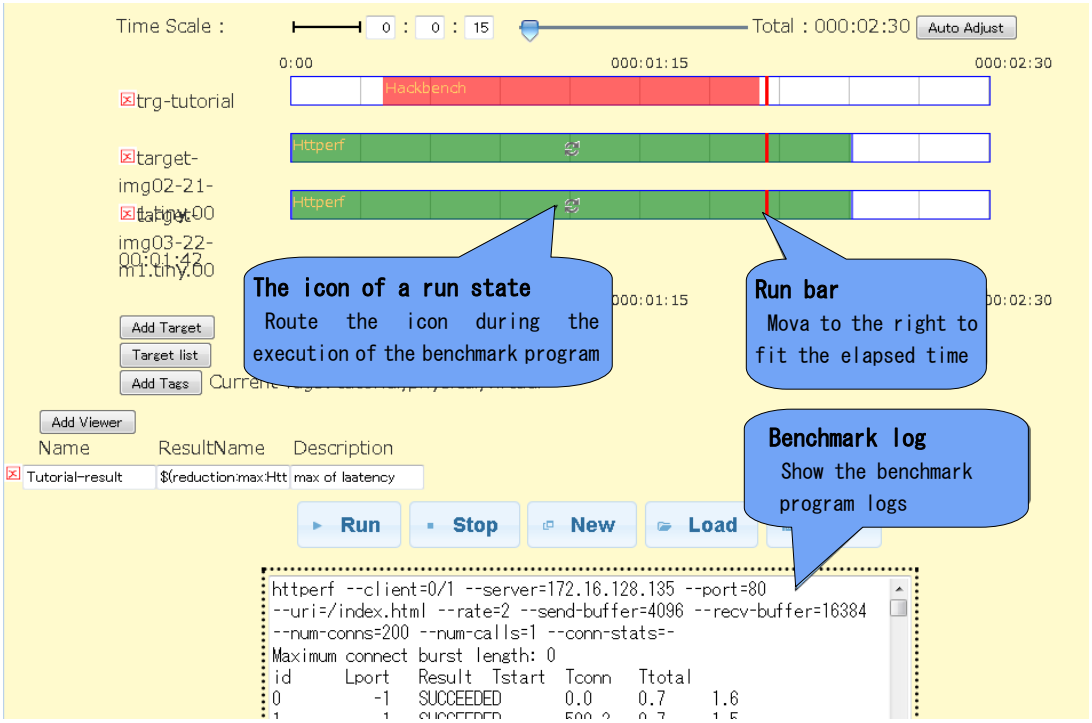
  Main screen > Configuration > Benchmark Scenario > Scenario Name

  Click the "Run" button on the screen in order to perform the benchmark scenario.

* Add Viewer is explained as it is used together with D-Case Editor which is explained below.



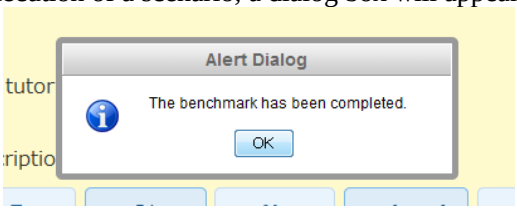
Below is the screen in a run state.



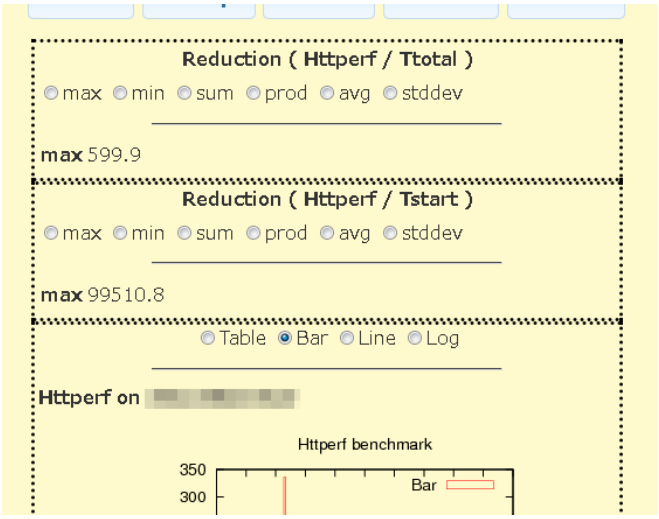

When the run bar reaches the end of the benchmark area, the scenario has been completed.

### 3.3.4. Checking the results from the benchmark scenario

Upon completion of execution of a scenario, a dialog box will appear.




Results of the benchmark scenario will be shown at the bottom.

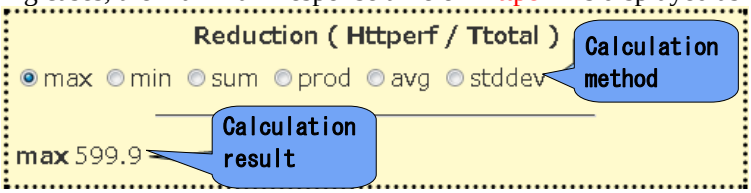



- Reduction result

This is calculated after collecting the execution results of each benchmark program.

The calculation display format can be changed with radio buttons.

In the following cases, the maximum response time of "httperf" is displayed as "599.9 milliseconds".



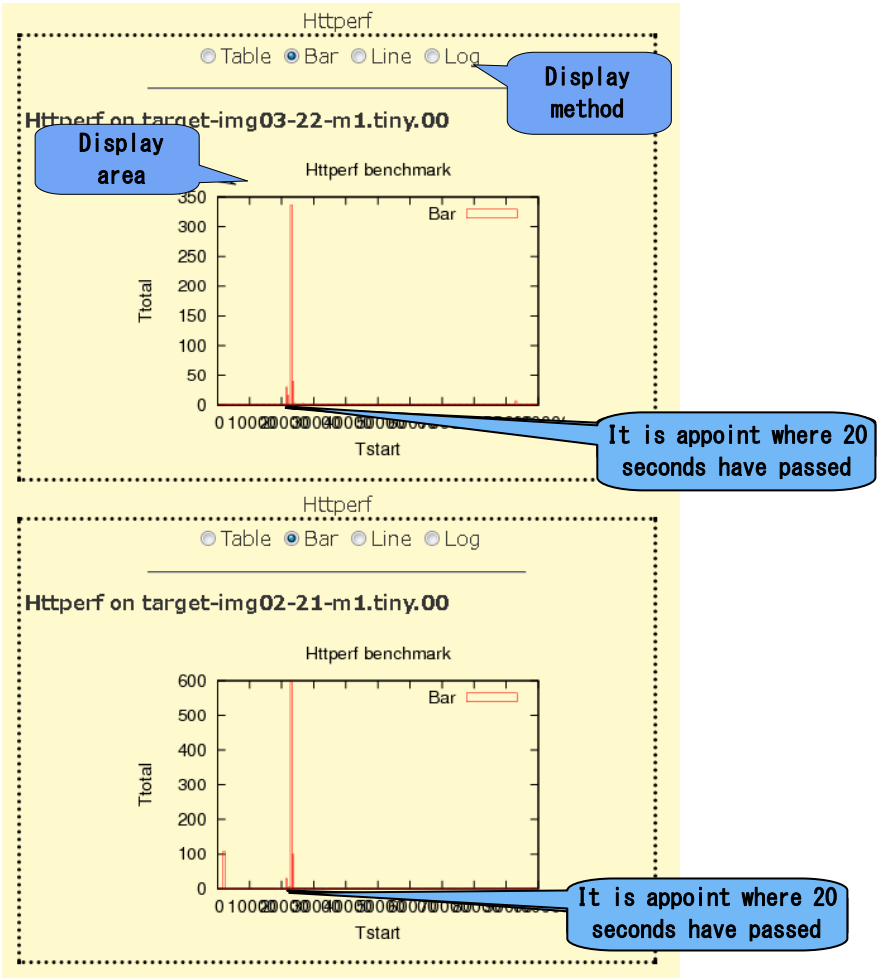

| max | min | sum | prod | avg | stddev |
|---|---|---|---|---|---|
| Maximum value | Minimum value | Total | Product | Average | standard deviation |

- Benchmark results

The execution results of a benchmark program are displayed.

The display format of benchmark results can be changed with radio buttons.

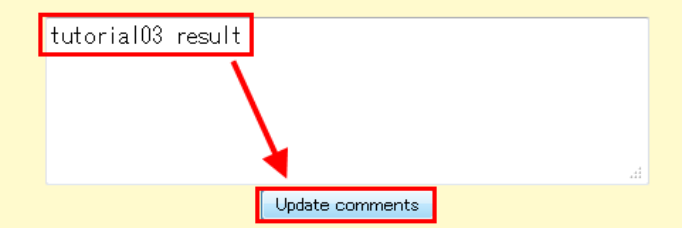
As seen in the following graphs, load occurs 20 seconds after the start of the server, and it can be confirmed that the response is late.



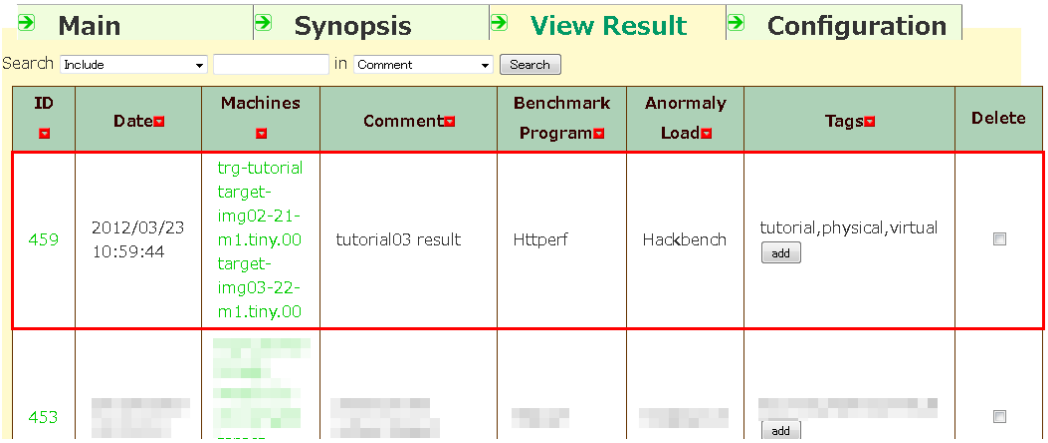
- Registering a comment

  A comment regarding the execution result of a scenario can be registered.

  Enter a comment in the text area, and click the "Update comments" button .




When a comment is registered, it is displayed in the "Comment" column of a scenario execution result list screen (View Result screen) or a scenario list screen (Synopsis screen) , so that what kinds of scenario have been executed can be easily checked from the list.




※ Method of checking scenario execution results

- Scenario execution result list screen (View Result screen)

  Main screen > View Result > ID

- Scenario list screen (Synopsis screen)

  Main screen > Synopsis> ID

## 3.4. Case to run the benchmark collaborating with D-Case Editor

Please refer to http://www.dependable-os.net/osddeos/en/concept.html regarding D-Case. Regarding D-Case Editor, refer to http://www.dependable-os.net/tech/D-CaseEditor/index-e.html . Regarding D-Case Weaver, refer to the http://www.dependable-os.net/tech/DCaseWeaver/index-e.html .

When it is required that the measurement results of the Benchmark be set into Evidence Nodes at the time of D-Case creation, this configuration is created using D-Case Editor or D-Case Weaver.

As an example, it will here be verified whether at "response time is less than three seconds if the number of accesses to a Web server is less 1500 times a minute".

The configuration used here is that of Section 2.4: a D-Cloud controller +OpenStack controller, a Web

server, and the DS-Bench target (virtual machine) created in Section 3.2.

Create a DS-Bench scenario in order to verify the example scenario described above.

A virtual machine is set as the client, and “httperf” in which a web site is the server benchmark is used.

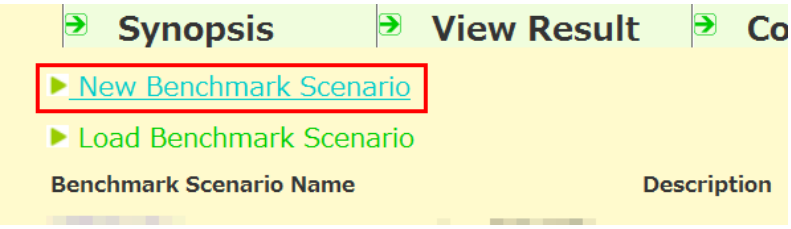
The scenario created by the D-Case editor is loaded. The expected value "the maximum response time is less than 3 seconds" is set up as a goal node.

*Install Apache on a Web server and check that "index.html" file is in the "/var/www/" folder.

### 3.4.1. Creation of a benchmark new scenario

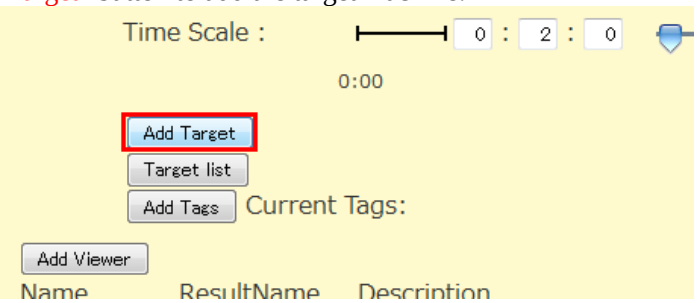
In order to verify, create a scenario which accesses the Web server 1500 times per minute and measures each response time. .

Click the "New Benchmark Scenario" link of a main menu.



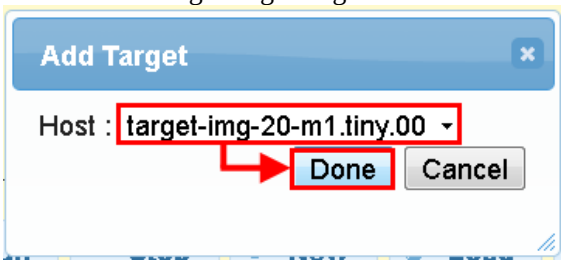

A scenario creation screen opens in a new window.

Click the "Add Target" button to add the target machine.

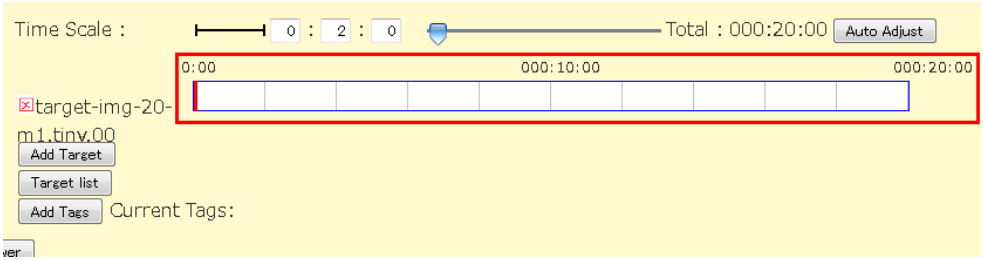



In the dialog box that is displayed, select the virtual machine to be used as the client. Here, "target-img-20-m1.00" is selected.

Click the "Done" button after choosing "Target-img-20-m1.00".




The time line of " target-img-20-m1.00" is displayed on a scenario creation screen. Drag-and-drop virtual machines on the time line.

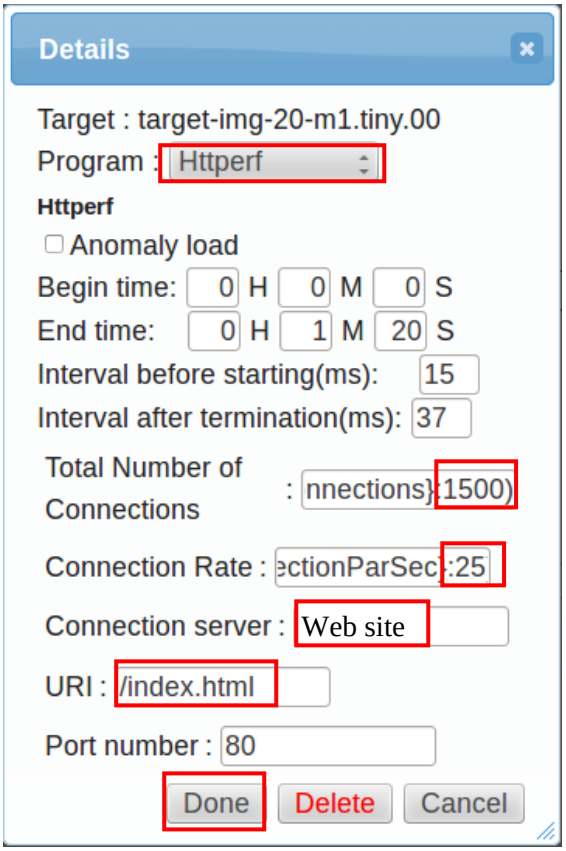



A dialog box for benchmark settings is displayed.

Select "httperf" as the Program. Set the start time and the end time.

Enter the total number of connections"$(param:Total Number of Connections {tconn0}:1500)", the number of accesses per second"$(param:Connection Rate {rate0}:25)", the destination server, the reference URL (URL of the index.html identified in Section 3.3.1). Click the "Done" button.

*Set an IP address in "Connection server".




*「A parameter which starts with "$ (param-)" is for changing a value when executing from a D-Case editor. Input rules are as follows.

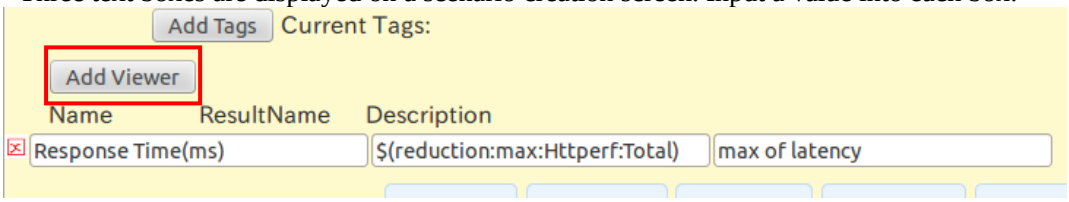
$(param:[Description]{[variable name]}:[value])

- [Description] It is a description of the variable name. Specify any value.
- [variable name] The variable name that appears in the D-Case Editor. Please specify a value that is unique within the scenario.
- [value] The value to be assigned to a variable. Specify the suitable value in your environment.

Set the expected value obtained by executing the order so as to determine if the response is less than 3 seconds in D-Case Editor.

Click the "Add Viewer" button.

Three text boxes are displayed on a scenario creation screen. Input a value into each box.




- Name Input a variable name. Here, "Response Time (ms)" is inputted.
- Result Name The value of the variable is set. Input rules are as follows.

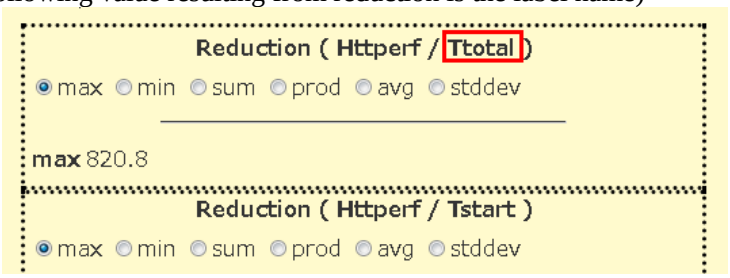
  $(reduction:[mathmatical operation method]:[ benchmark program name]:[ label name])

  Since the maximum of the reduction results of Httperf is acquired here, the input is as follows.

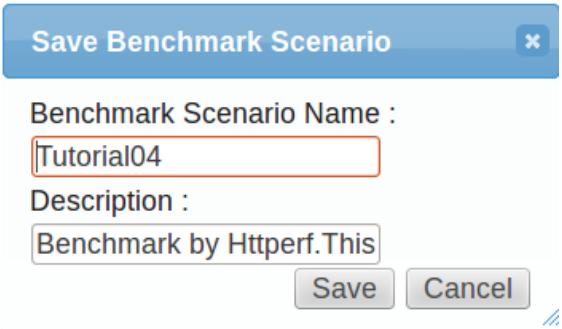
  $(reduction:max:Httperf:Ttotal)

  *The label name "Ttotal" is a variable, the value resulting from reduction of response time.

  (The following value resulting from reduction is the label name)




- Description The description of a variable is inputted. Here, "max of latency" is inputted. Click the "Save" button on screen to save the created scenario. In the dialog that is displayed, enter the scenario name ”Tutorial04”, and enter the explanatory note ”Benchmark by Htgtperf. This Benchmark accesses the Web server **{ConnectionPerSec}** times a second until the number of accesses reaches**{TotalConnections}**. Input “Evaluate whether the expected value **({Response Time(ms)}[ms])** is fulfilled or not”, and click the "Save" button.



The explanatory note (Description) specified here is displayed as explanation of the Goal node when a scenario is called by the D-Case.

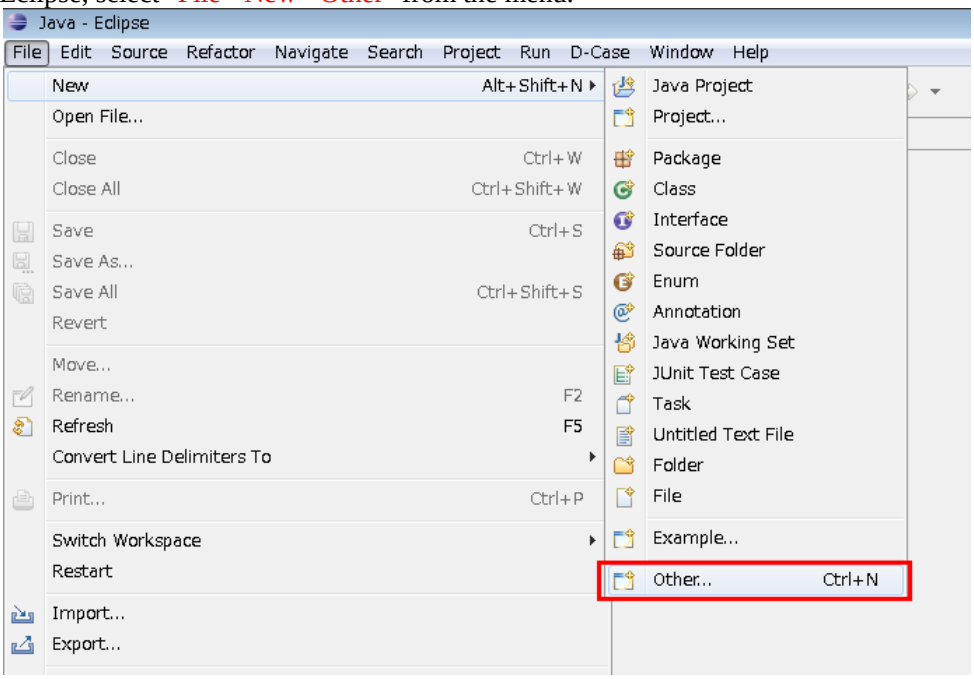
If the variable name set up by "(param: description {[variable name]}: [value])" at the time of scenario creation is entered in an explanatory note enclosed by {}, it's called-up state will not be the variable name but rather the value.

This completes the creation of this scenario.

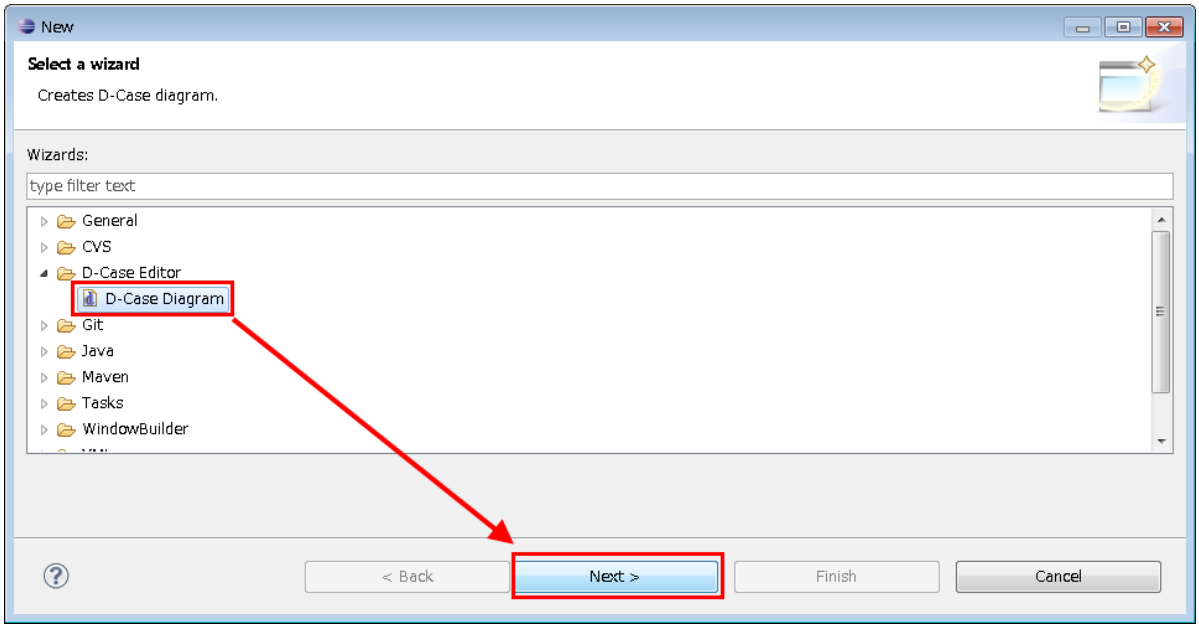
### 3.4.2. Creation of a New D-Case diagram

Make the preparation for running a benchmark scenario from D-Case Editor.

Start Eclipse, select "File> New> Other" from the menu.

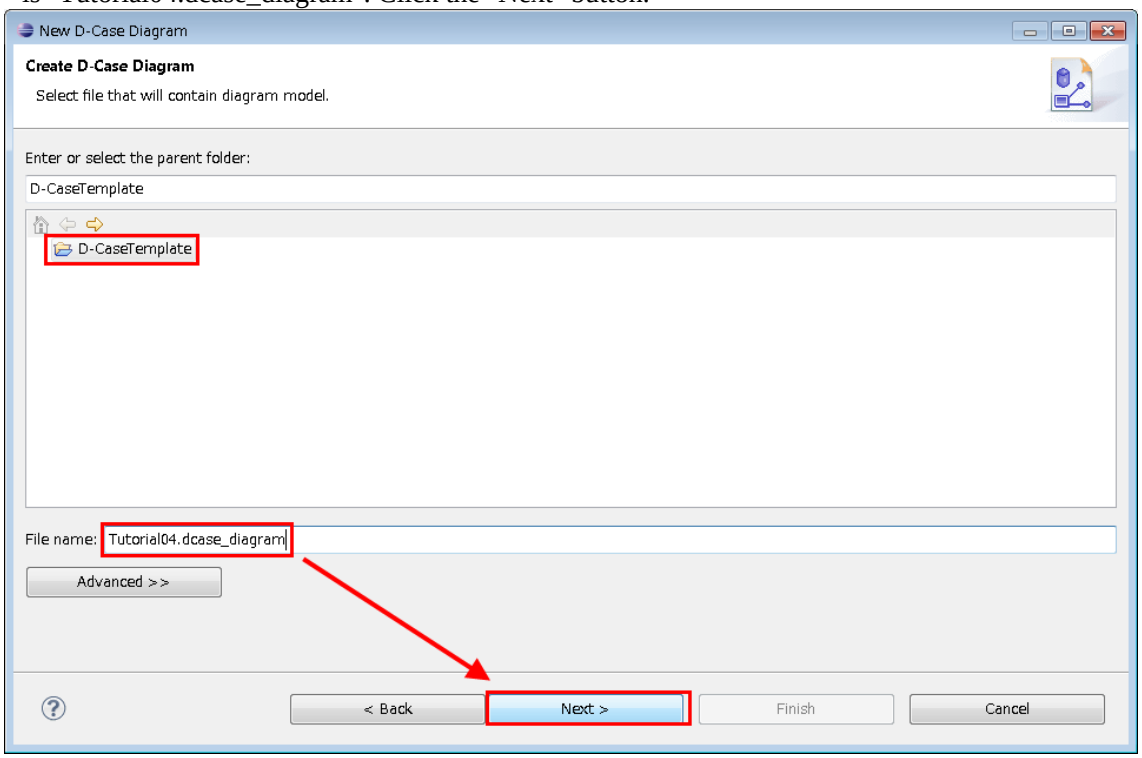



Select the "D-Case Editor> D-Case Diagram" and click the "next" button




Here, a new file will be created in the "D-CaseTemplate" folder.

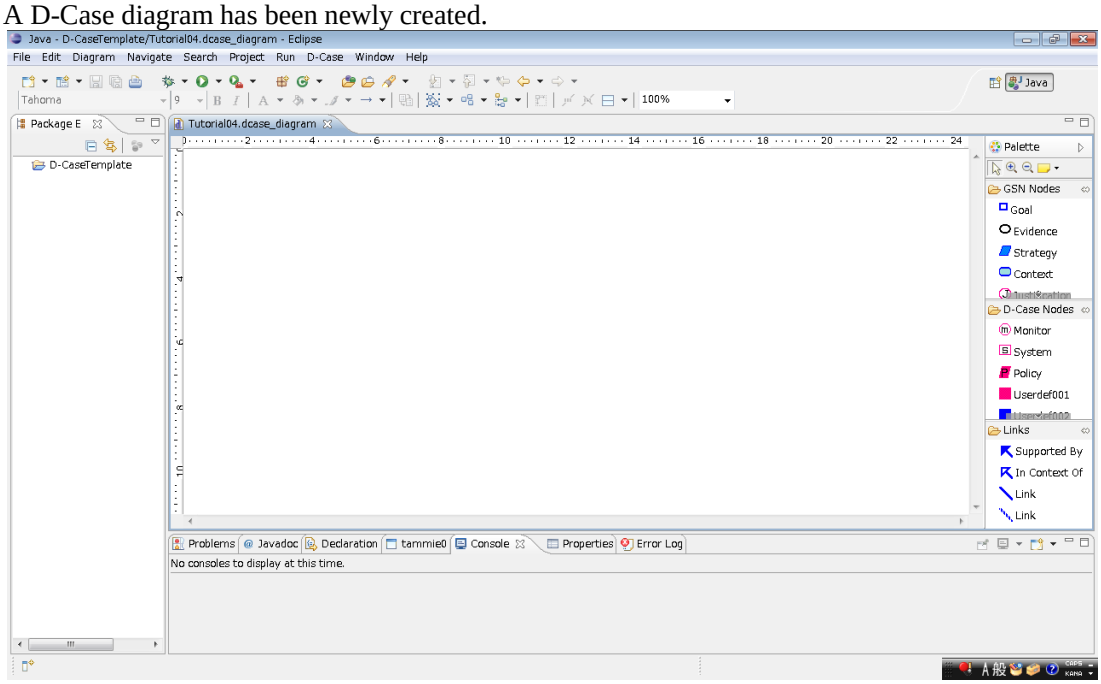
Select the DS-Bench5 folder. Select a diagram name and add the extension ".dcase_diagram". Here, this is "Tutorial04.dcase_diagram". Click the "Next" button.




A model name is specified.

Since the model name is inputted automatically, the Finish button can then be clicked.

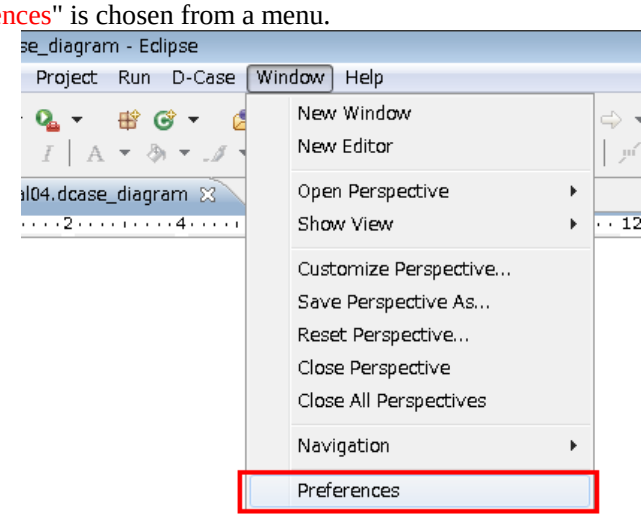
A D-Case diagram has been newly created.




### 3.4.3. Setting up cooperation with DS-Bench

Set up cooperation with DS-Bench as follows.

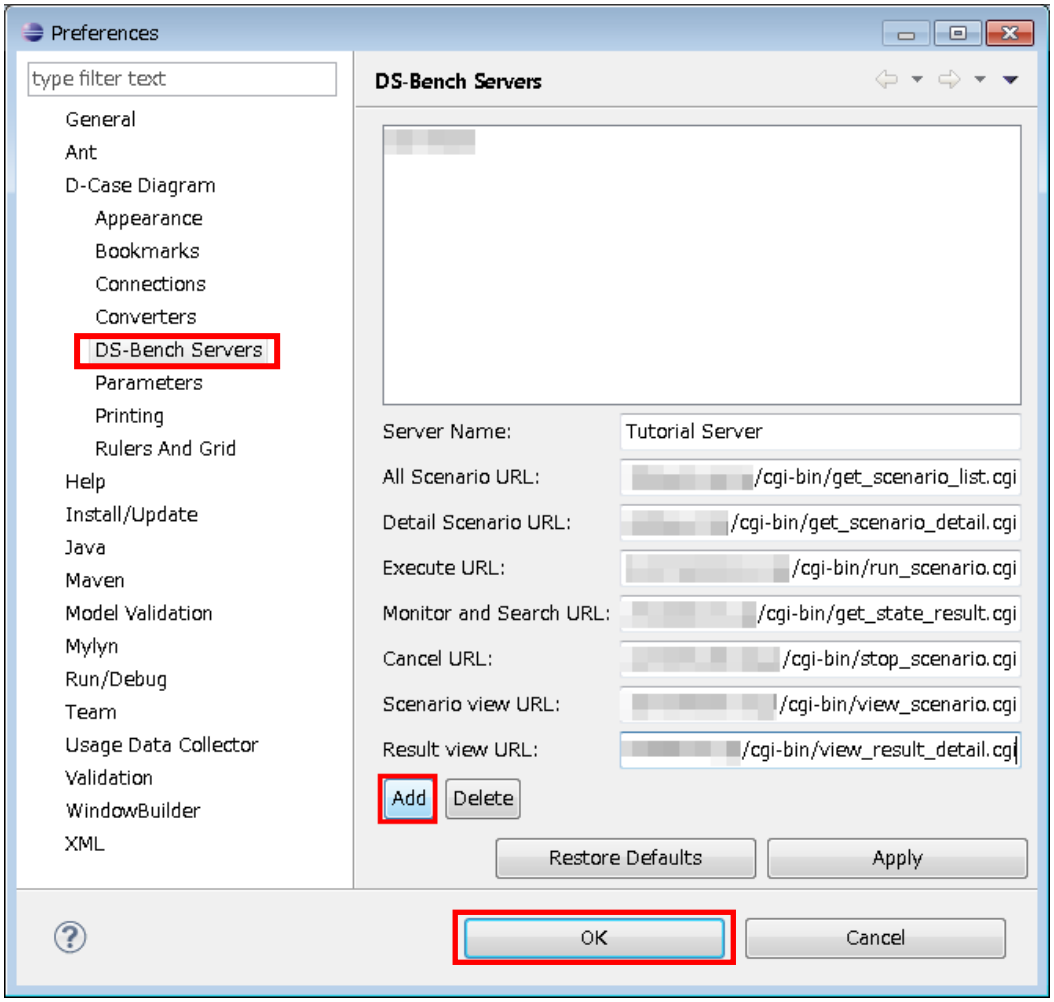
"Window > Preferences" is chosen from a menu.




Select "D-Case Diagram > DS-Bench Servers".

Set up DS-Bench.

Click the "Add" button after the completion of setting.




- **Server Name**

  Specify any name you desire. It will be the DS-Bench server name in the D-Case Editor.

- **All Scenario URL**

  This is the URL to get the scenario list from DS-Bench.

  http:// [IP address or Host name of DS-Bench controller]/cgi-bin/get_scenario_list.cgi

- **Detail Scenario URL**

  This is the URL to get detailed scenario information from DS-Bench.

  http://[IP address or Host name of DS-Bench controller]/cgi-bin/get_scenario_detail.cgi

- **Execute URL**

  This is the URL used to run a scenario from D-Case Editor.

  http://[IP address or Host name of DS-Bench controller] /cgi-bin /run_scenario.cgi

- **Monitor and Search URL**

  This is the URL used to get the scenario execution status from DS-Bench.

  http://[IP address or Host name of DS-Bench controller] /cgi-bin /get_state_result.cgi

- **Cancel URL**

  This is the URL for stopping the scenario from D-Case Editor.

http://[IP address or Host name of DS-Bench controller] /cgi-bin /stop_scenario.cgi

- **Scenario View URL**

  This is the URL to get the scenario execution results from DS-Bench.

  http://[IP address or Host name of DS-Bench controller] /cgi-bin /view_scenario.cgi

- **Result View URL**

  This is the URL to view the scenario execution result screen of DS-Bench.

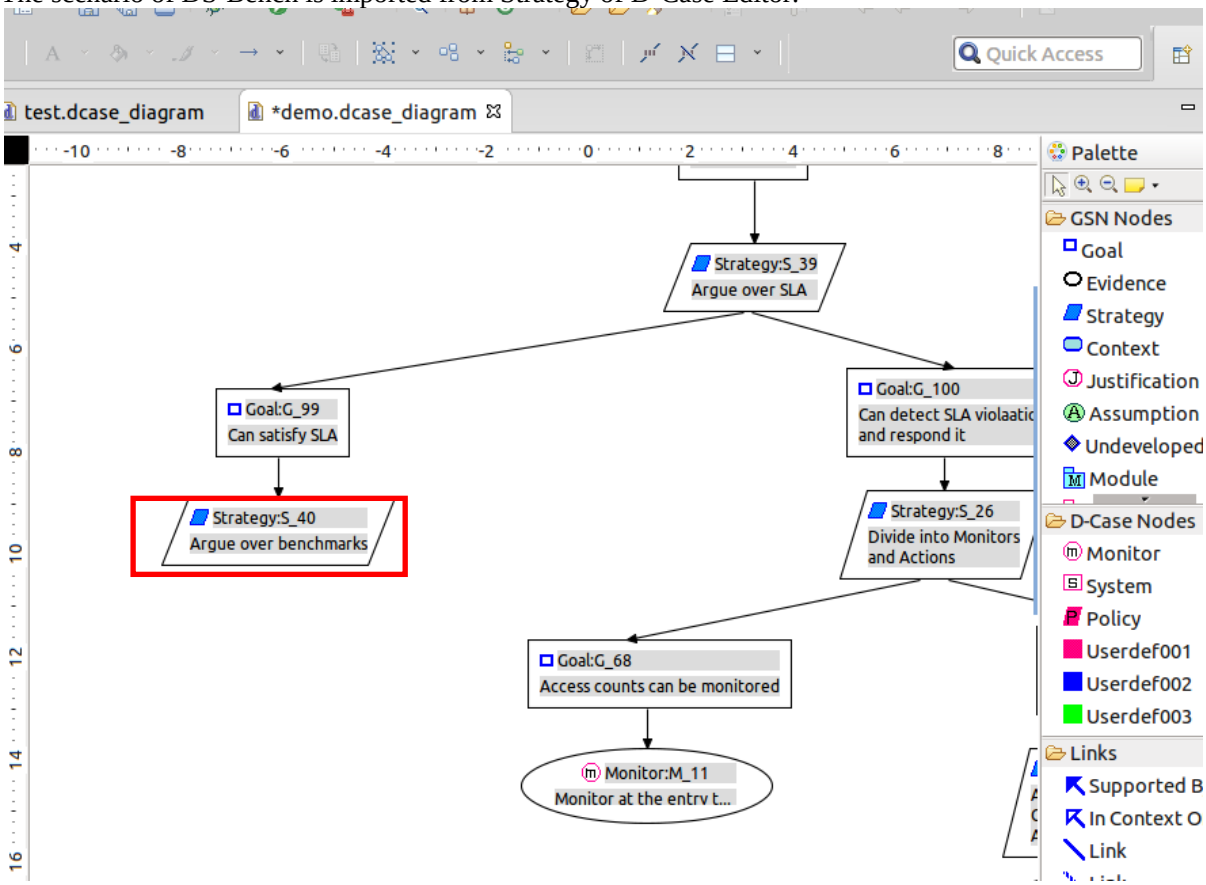
  http://[IP address or Host name of DS-Bench controller] /cgi-bin /view_result_detail.cgi

The DS-Bench server name that has been set is displayed in the top area.

After checking the display, click the OK button.

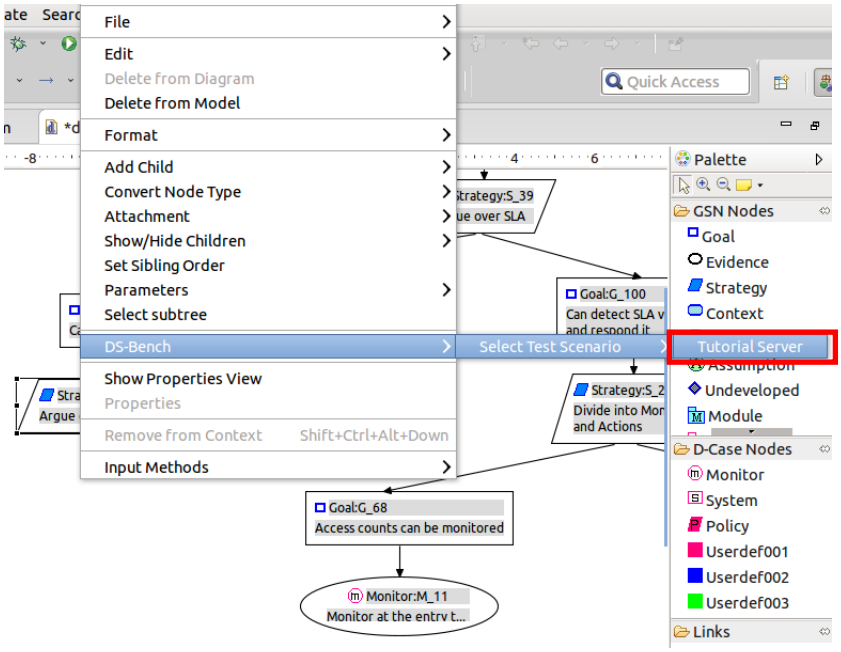
### 3.4.4. Importing a benchmark scenario

The scenario of DS-Bench is imported from Strategy of D-Case Editor.




Acquire the list of benchmark scenarios.

Follow the links "Right-click the Strategy > DS-Bench> Select Test Scenario> [Server Name set as described in Section 3.4.2] ".



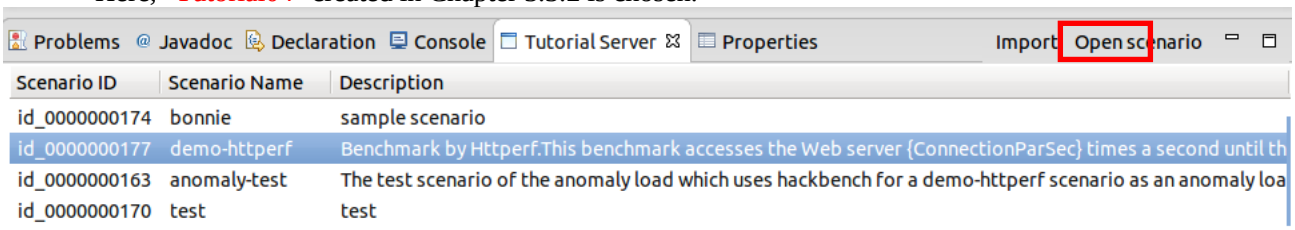

A scenario list is displayed in the lower part of the screen.

### 3.4.5. The addition of a Goal node (import of a benchmark scenario)

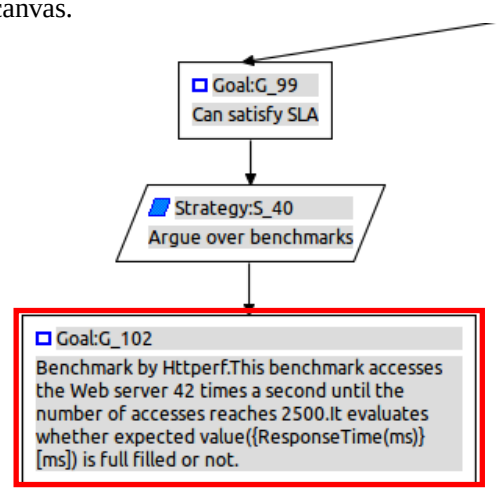
The scenario created by DS-Bench is imported to a D-Case editor.

Choose the scenario to execute from a scenario list and click the "Import" button.

Here, "Tutorial04" created in Chapter 3.3.2 is chosen.

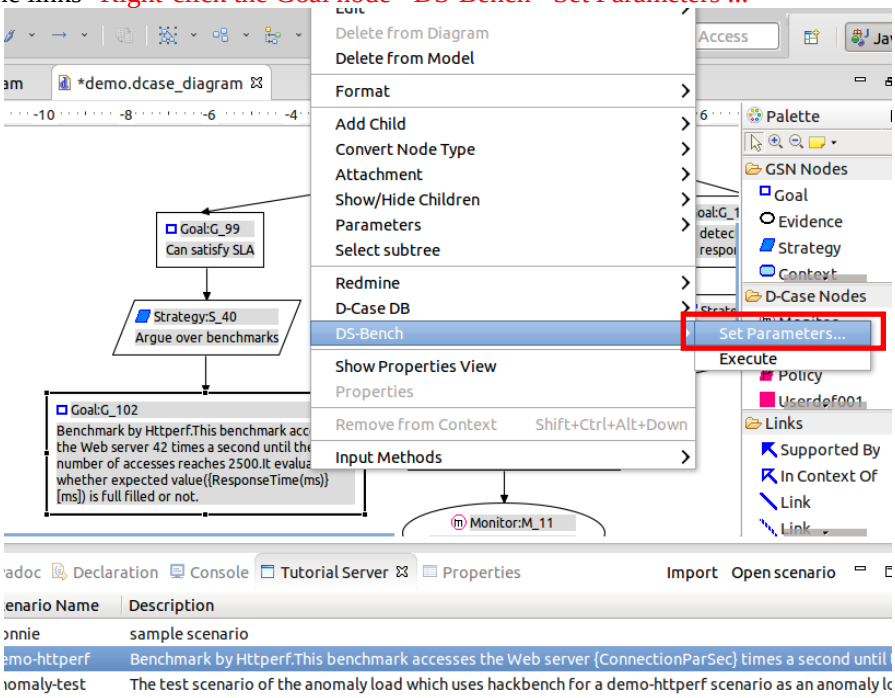



A Goal node is added on canvas.



Specify the parameters of the scenario set in the DS-Bench.

Follow the links "Right-click the Goal node> DS-Bench> Set Parameters ..."

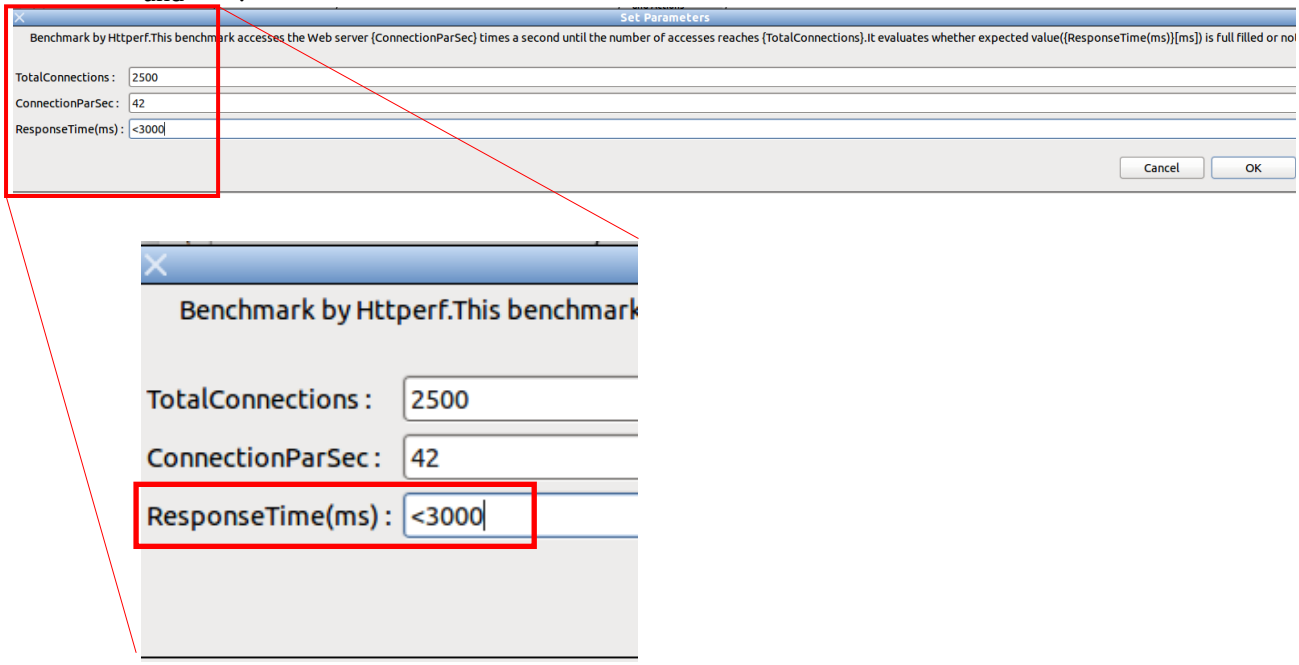



In the dialog box of parameter setup that is displayed, specify each parameter.

Click the OK button after parameter specification.

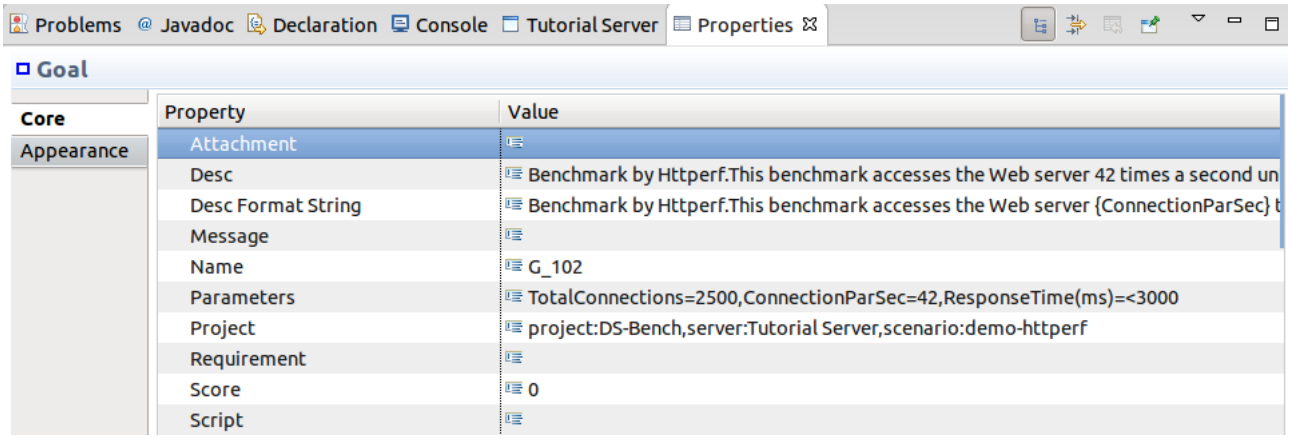
The expected value of maximum response time (variable name: Response Time (ms)) of httperf is set at (<3000 millisecond) 3 seconds in the created "Tutorial04" scenario.

* Comparison operators such as "less than" and "not less than" are input with symbols such as ">"and"<=".



Confirm the set of parameters.

Follow the links "Right-click the Goal node > Show Properties View".



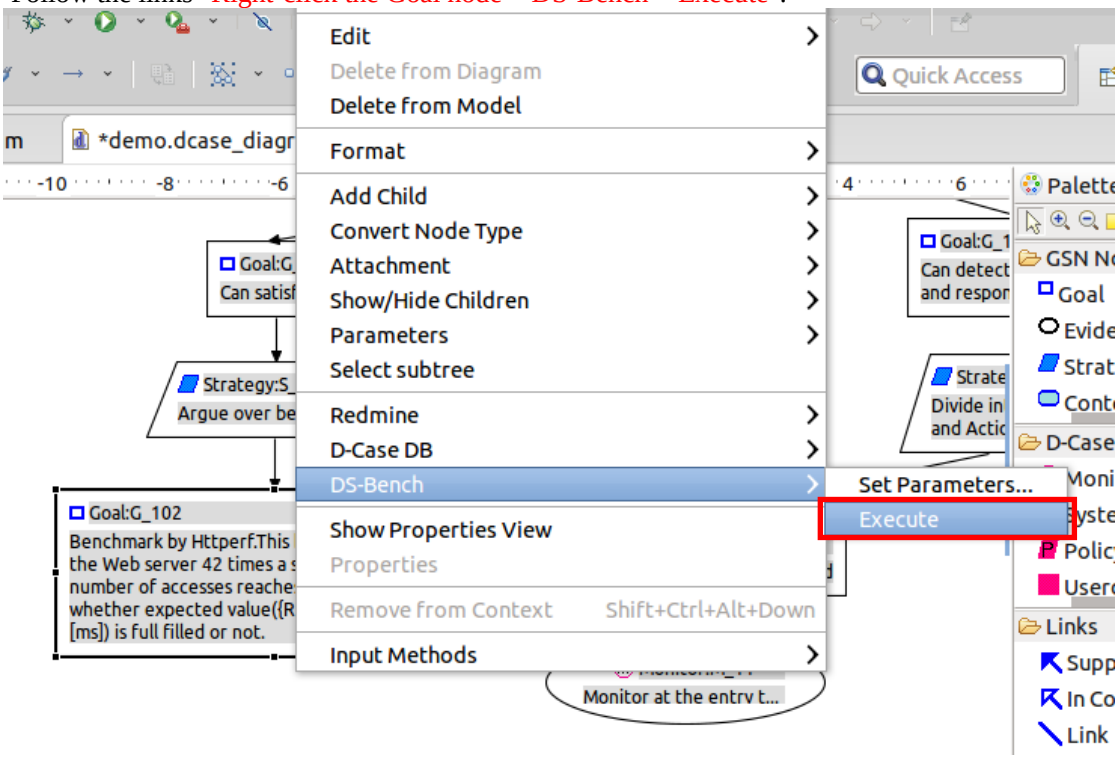

A property is displayed in the lower part of the screen.

Check that the parameters set as “Parameters” are displayed.

### 3.4.6. Execution of a benchmark scenario

Execute a benchmark scenario from a D-Case editor.

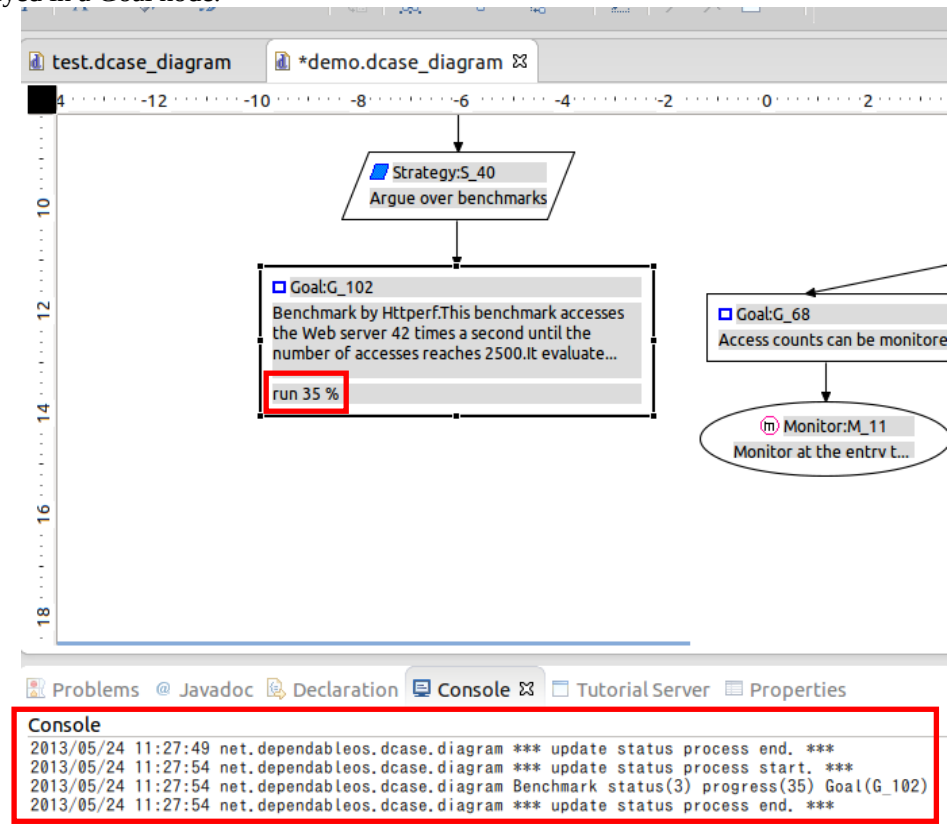
Follow the links "Right-click the Goal node > DS-Bench > Execute".




The dialog box which asks whether to execute monitoring is displayed.

Click the 'OK' button to carry out the monitoring.

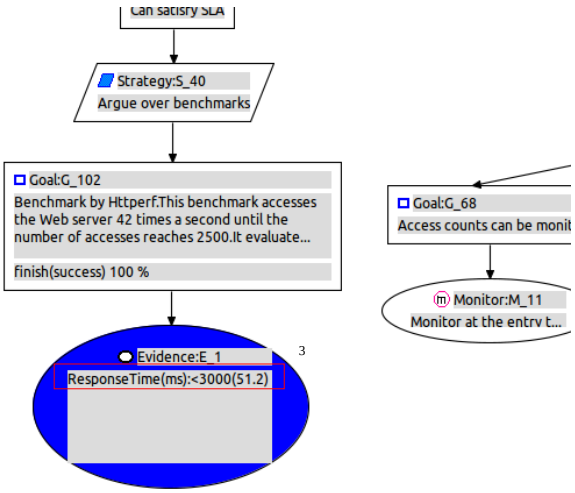
A log is displayed on the lower part of the screen during execution. Moreover, the progress ratio is displayed in a Goal node.




## 3.4.7. Checking and evaluating the result of a benchmark scenario

A result is displayed automatically after performing a benchmark scenario.

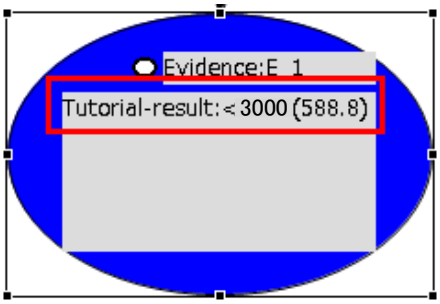
When the benchmark scenario ends, an Evidence node will be created automatically.



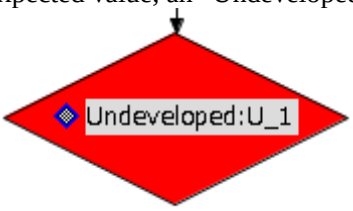

The result of the comparison parameter set in the Evidence node is displayed.

A value of an execution result is shown in parentheses.

The expected value set as the goal is "3 seconds maximum response time of httperf is (3000 milliseconds) less than" and the result is "588.8 milliseconds". Therefore this result satisfies the condition.

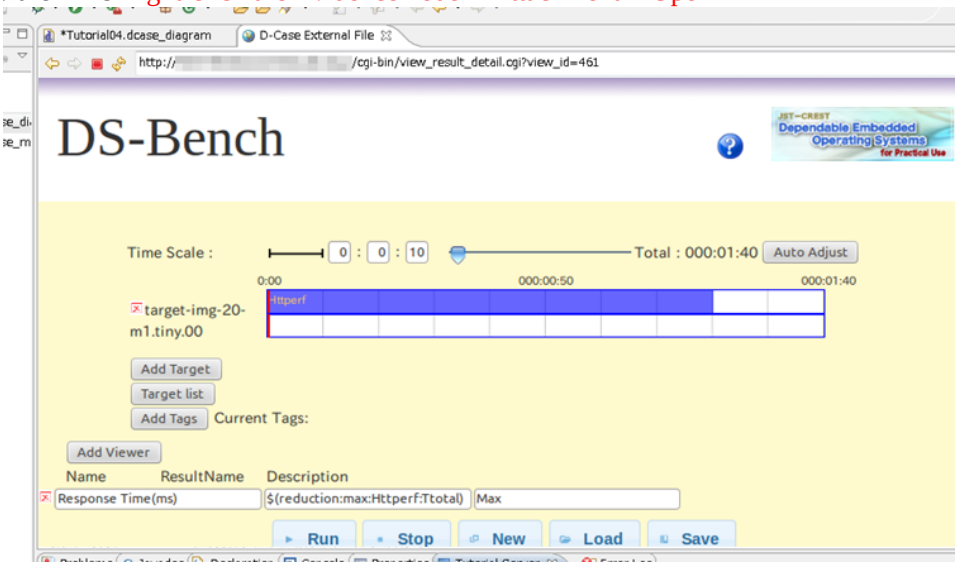



*If the result does not meet the expected value, an “Undeveloped” red node is added.




*The detailed DS-Bench scenario execution results can be displayed in D-Case Editor.

Follow the links Right-click the Evidence node > Attachment > Open




If the measurement results of the Benchmark tool need to be used as Evidence at the time of D-Case creation, DS-Bench is used in coordination with D-Case Editor or D-Case Weaver, which validates the results. It is judged whether the execution results fulfill the expected value.

When the execution result matches the expected value, the contents of the scenario are validated.


# DEOS Project