

# **PERFORMANCE TESTING TOOLS**



- (Standalone) Tool
  - Performance Testen (Load, Stress,...)
  - Apache Projekt
  - Frei verfügbar
  - Integration in andere Umgebungen (Maven,...)
  - Breites Spektrum an Funktionalität verfügbar (Web-Tests, DB-Tests, FTP-Tests,...)

# Resources

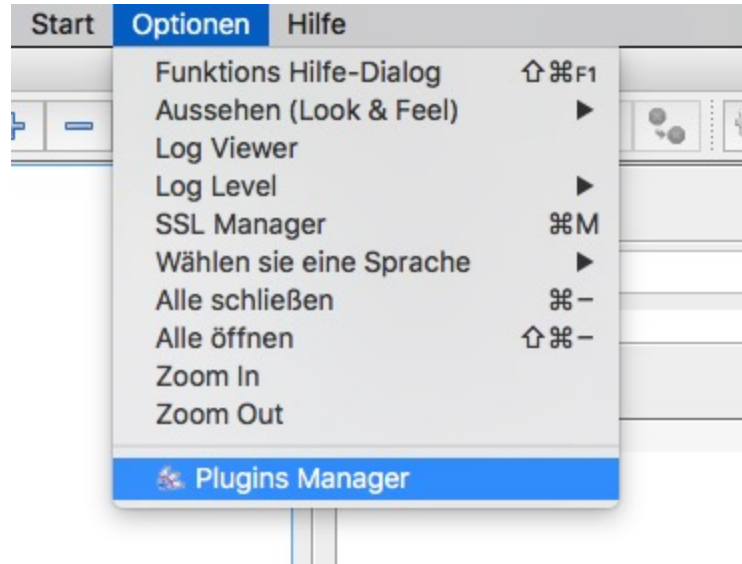
- JMeter
  - <http://jmeter.apache.org/usermanual/get-started.html>
- JMeter Plugins
  - <https://jmeter-plugins.org>
- BlazeMeter
  - <https://www.blazemeter.com>

# **INSTALLATION**

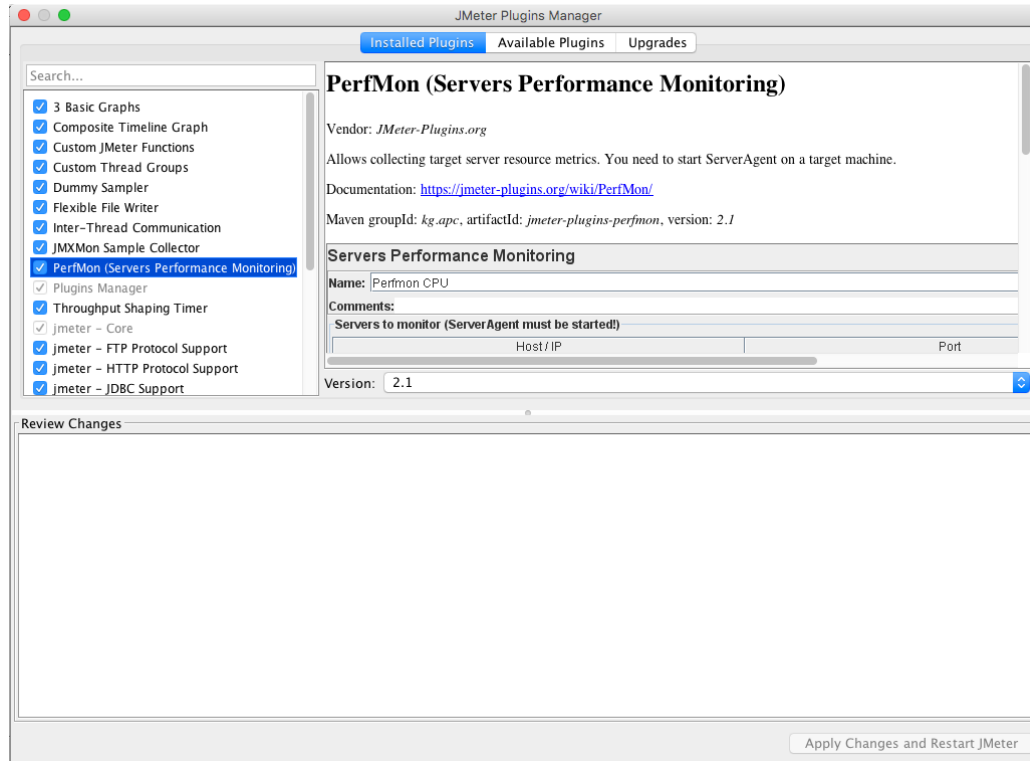
# Installation

- JMeter (JDK necessary)
  - [http://jmeter.apache.org/download\\_jmeter.cgi](http://jmeter.apache.org/download_jmeter.cgi)
- JMeter Plugins Manager
  - <https://jmeter-plugins.org/downloads/all/>
  - Copy to ext/lib → restart JMeter

# Installation



# Installation



# Installation

- Plugins
  - „jpgc – Standard Set“
  - „3 Basic Graphs“
  - „PerfMon“

- ☒ 3 Basic Graphs
- ☒ Composite Timeline Graph
- ☒ Custom JMeter Functions
- ☒ Custom Thread Groups
- ☒ Dummy Sampler
- ☒ Flexible File Writer
- ☒ Inter-Thread Communication
- ☒ JMXMon Sample Collector
- ☒ PerfMon (Servers Performance Monitoring)
- ☒ Plugins Manager
- ☒ Throughput Shaping Timer
- ☒ jmeter - Core
- ☒ jmeter - FTP Protocol Support
- ☒ jmeter - HTTP Protocol Support
- ☒ jmeter - JDBC Support
- ☒ jmeter - JMS Support
- ☒ jmeter - JUnit Support
- ☒ jmeter - Java Components
- ☒ jmeter - LDAP Protocol Support
- ☒ jmeter - Mail/SMTP Support
- ☒ jmeter - MongoDB Support
- ☒ jmeter - OS Process Support
- ☒ jmeter - TCP Protocol Support
- ☒ jmeter - Various Core Components
- ☒ jpgc - Standard Set



# Start

- Testcreation/Testdebugging via GUI
  - jmeter.sh or jmeter.bat
- Testrun
  - Console!

```
ramirez-mon:bin chris$ ./jmeter.sh
```

```
=====
```

```
Don't use GUI mode for load testing, only for Test creation and Test debugging !
```

```
For load testing, use NON GUI Mode:
```

```
    jmeter -n -t [jmx file] -l [results file] -e -o [Path to output folder]
```

```
& adapt Java Heap to your test requirements:
```

```
    Modify HEAP="-Xms512m -Xmx512m" in the JMeter batch file
```

```
=====
```

**TOOL - GUI**

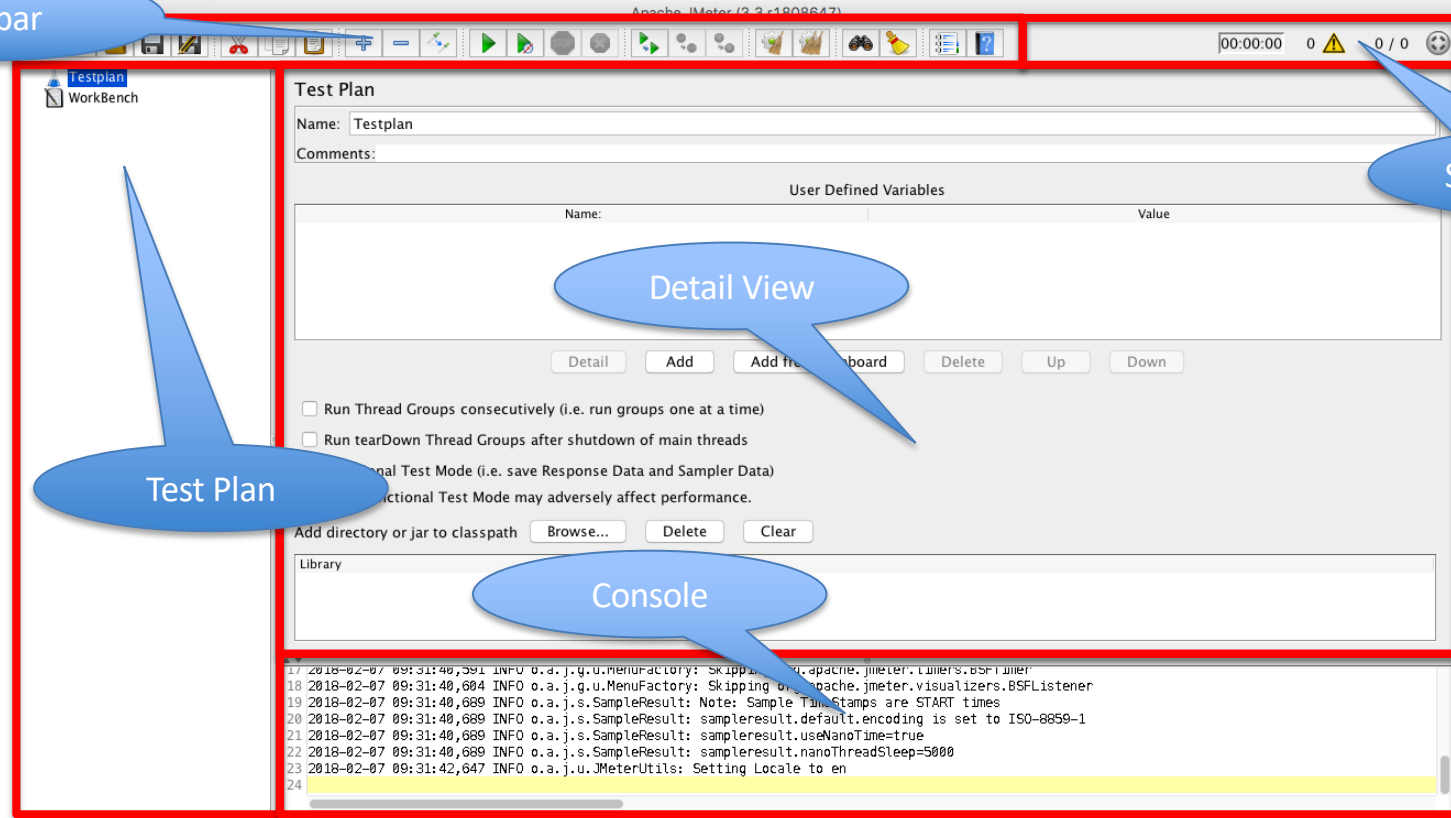
Toolbar

Statusanzeige

Detail View

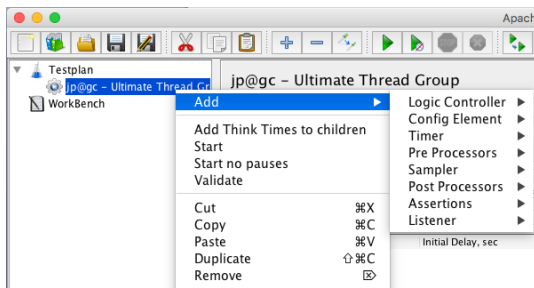
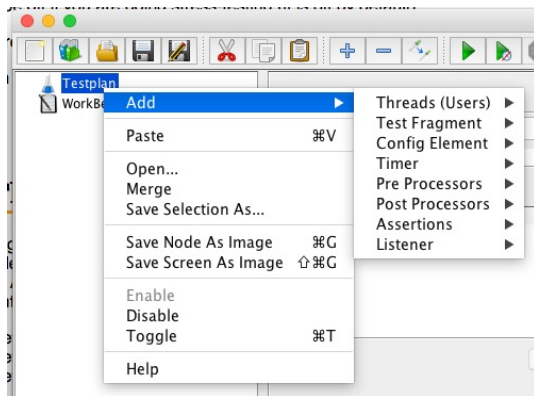
Test Plan

Console



# JMeter Tests

- Test consist of different elements
  - Threads
  - Configurations
  - Samplers/Logic
  - Listeners
  - Assertions
- Grouping is possible (z.B. Sampler)

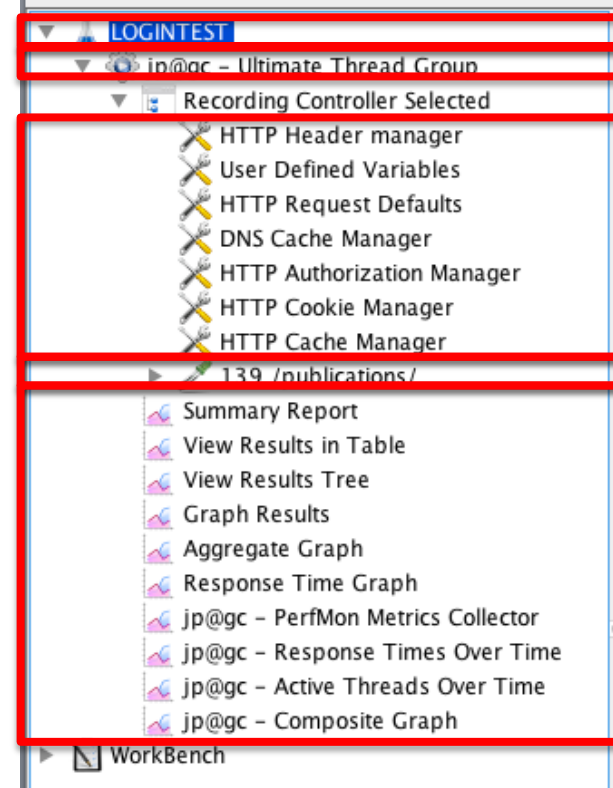


# JMeter Tests

- Execution Order
  - Configuration elements
  - Pre-Processors
  - Timers
  - Sampler (in order)
  - Post-Processors (unless SampleResult is **null**)
  - Assertions (unless SampleResult is **null**)
  - Listeners (unless SampleResult is **null**)

# JMeter Test Plan

- Typical Test Plan
  - Root
  - User
  - Configuration
  - Actions
  - Results/Reports



**USERS/THREADS**

# JMeter Test Plan – Users

jp@gc – Ultimate Thread Group

Name: jp@gc – Ultimate Thread Group

Comments:

[Help on this plugin](#)

Action to be taken after a Sampler error

☒ Continue ☐ Start Next Thread Loop ☐ Stop Thread ☐ Stop Test ☐ Stop Test Now

Threads Schedule

Start Threads Count	Initial Delay, sec	Startup Time, sec	Hold Load For, sec	Shutdown Time
50	0	300	90	10

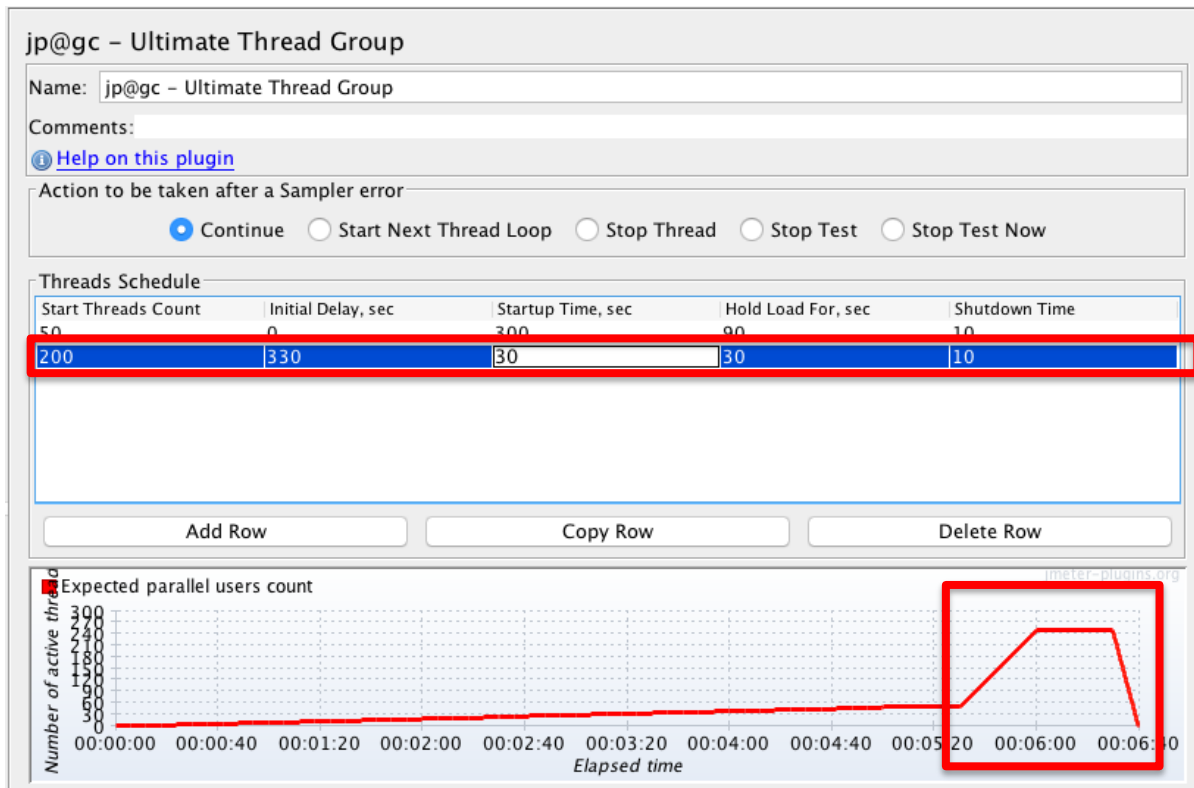
Add Row Copy Row Delete Row

Expected parallel users count

Elapsed time



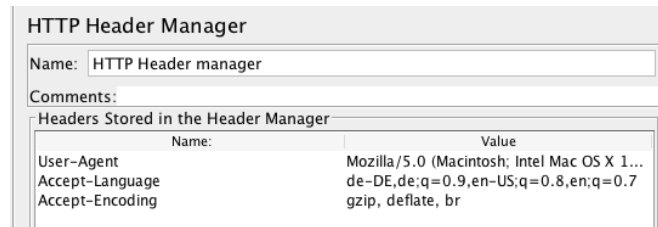
# JMeter Test Plan – Users



# CONFIGURATION

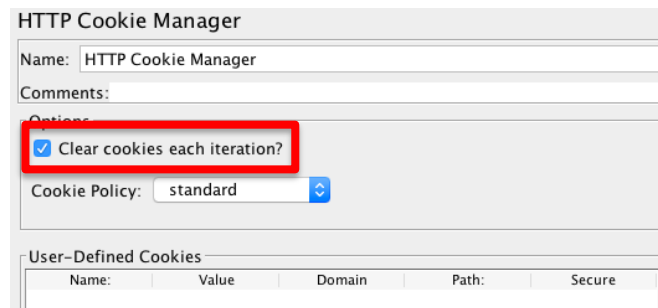
# JMeter Tests – Configuration

- HTTP Header Manager
  - User-Agent, Accept-Language, Accept-Encoding,...
- HTTP Cookie Manager
  - Own Cookies oder Cookies of the page



The screenshot shows the 'HTTP Header Manager' configuration window. The 'Name' field is set to 'HTTP Header manager'. The 'Comments' field is empty. Below, the 'Headers Stored in the Header Manager' table lists three headers: 'User-Agent' with value 'Mozilla/5.0 (Macintosh; Intel Mac OS X 1...', 'Accept-Language' with value 'de-DE,de;q=0.9,en-US;q=0.8,en;q=0.7', and 'Accept-Encoding' with value 'gzip, deflate, br'.

Name:	Value
User-Agent	Mozilla/5.0 (Macintosh; Intel Mac OS X 1...
Accept-Language	de-DE,de;q=0.9,en-US;q=0.8,en;q=0.7
Accept-Encoding	gzip, deflate, br



The screenshot shows the 'HTTP Cookie Manager' configuration window. The 'Name' field is set to 'HTTP Cookie Manager'. The 'Comments' field is empty. The 'Options' section has a checkbox 'Clear cookies each iteration?' which is checked and highlighted with a red rectangle. The 'Cookie Policy' is set to 'standard'. Below, the 'User-Defined Cookies' table is empty.

Name:	Value	Domain	Path:	Secure
-------	-------	--------	-------	--------

# JMeter Tests – Configuration

- HTTP request defaults
  - Server, IP, Port, Path,...
- User defined variables
  - Placeholder

The screenshot shows the 'HTTP Request Defaults' configuration window in JMeter. It has a 'Name' field set to 'HTTP Request Defaults' and an empty 'Comments' field. There are two tabs: 'Basic' (selected) and 'Advanced'. Under the 'Basic' tab, the 'Web Server' section includes a 'Protocol [http:]' dropdown, a 'Server Name or IP:' text field containing 'localhost', and a 'Port Number:' text field containing '8080'. The 'HTTP Request' section includes a 'Path:' text field and a 'Content encoding:' dropdown. Below these are two more tabs: 'Parameters' (selected) and 'Body Data'. Under the 'Parameters' tab, there is a section titled 'Send Parameters With the Request:' followed by a table with columns 'Name', 'Value', 'Encode?', and 'Include Equals?'. The table is currently empty.

The screenshot shows the 'User Defined Variables' configuration window in JMeter. It has a 'Name' field set to 'User Defined Variables' and an empty 'Comments' field. Below these is a table titled 'User Defined Variables' with columns 'Name', 'Value', and 'Description'. The table contains one row with the name 'BASE\_URL\_1' and the value 'localhost'.

Name	Value	Description
BASE_URL_1	localhost	

**ACTIONS (LOGIC/SAMPLER)**

# JMeter Tests – Actions

- HTTP Request
  - GET request to an address

The screenshot shows the 'HTTP Request' configuration window in JMeter. The 'Name' field is set to '139 /publications/'. The 'Basic' tab is selected. The 'Web Server' section is highlighted with a red box, showing 'Protocol [http]: http', 'Server Name or IP: \${BASE\_URL\_1}', and 'Port Number: 4000'. The 'HTTP Request' section is also highlighted with a red box, showing 'Method: GET' and 'Path: /publications/'. Below this, the 'Parameters' tab is highlighted with a red box. The 'Send Parameters With the Request' section is highlighted with a red box, showing a table with columns 'Name:', 'Value', 'Encode?', and 'Include Equals?'. The 'Parameters' tab is also highlighted with a red box.

HTTP Request

Name: 139 /publications/

Comments:

Basic Advanced

Web Server

Protocol [http]: http Server Name or IP: \${BASE\_URL\_1} Port Number: 4000

HTTP Request

Method: GET Path: /publications/ Content encoding:

☐ Redirect Automatically ☒ Follow Redirects ☒ Use KeepAlive ☐ Use multipart/form-data for POST ☐ Browser-compatible headers

Parameters Body Data Files Upload

Send Parameters With the Request:

Name:	Value	Encode?	Include Equals?
-------	-------	---------	-----------------

# JMeter Tests – Actions

- Some other actions
  - DB
  - FTP
  - JMS
  - SMTP
  - JUnit!
  - Selenium
  - ...

# **RESULTS AND REPORTS**



# JMeter Tests – Results

- Summary Report

Summary Report

Name:

Comments:

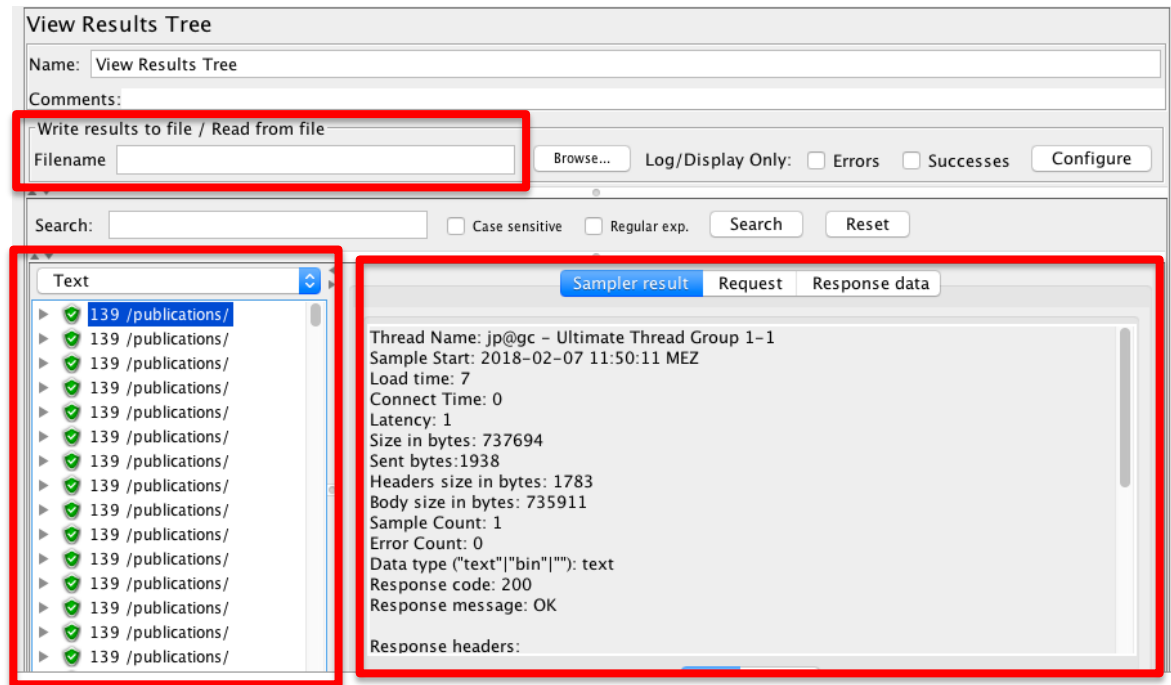
Write results to file / Read from file

Filename   Log/Display Only: ☐ Errors ☐ Successes

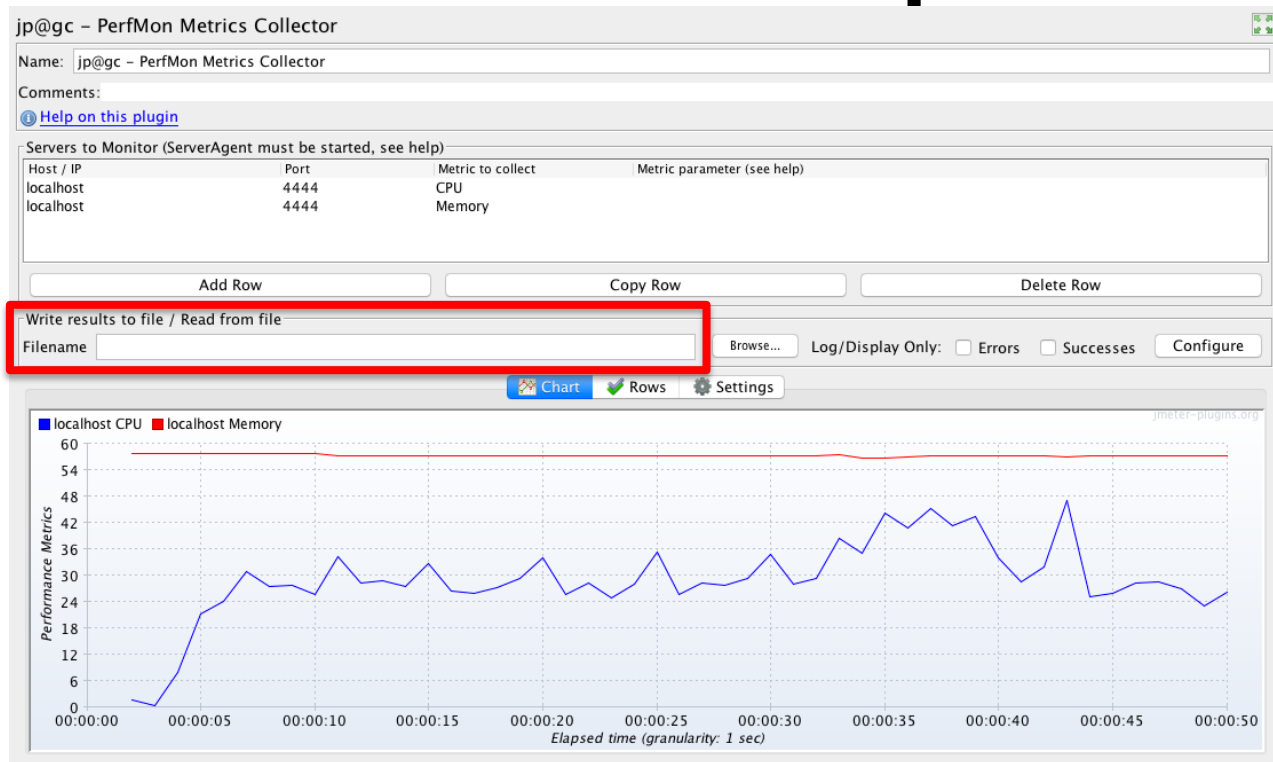
Label	# S...	Average	Min	Max	Std. Dev.	Error %	Throughput	Received KB...	Sent KB/sec	Avg. Bytes
139 /publications/	10788	18	3	351	15,44	0,01%	224,7/sec	161896,73	425,33	737660,3
TOTAL	10788	18	3	351	15,44	0,01%	224,7/sec	161896,73	425,33	737660,3

# JMeter Tests – Results

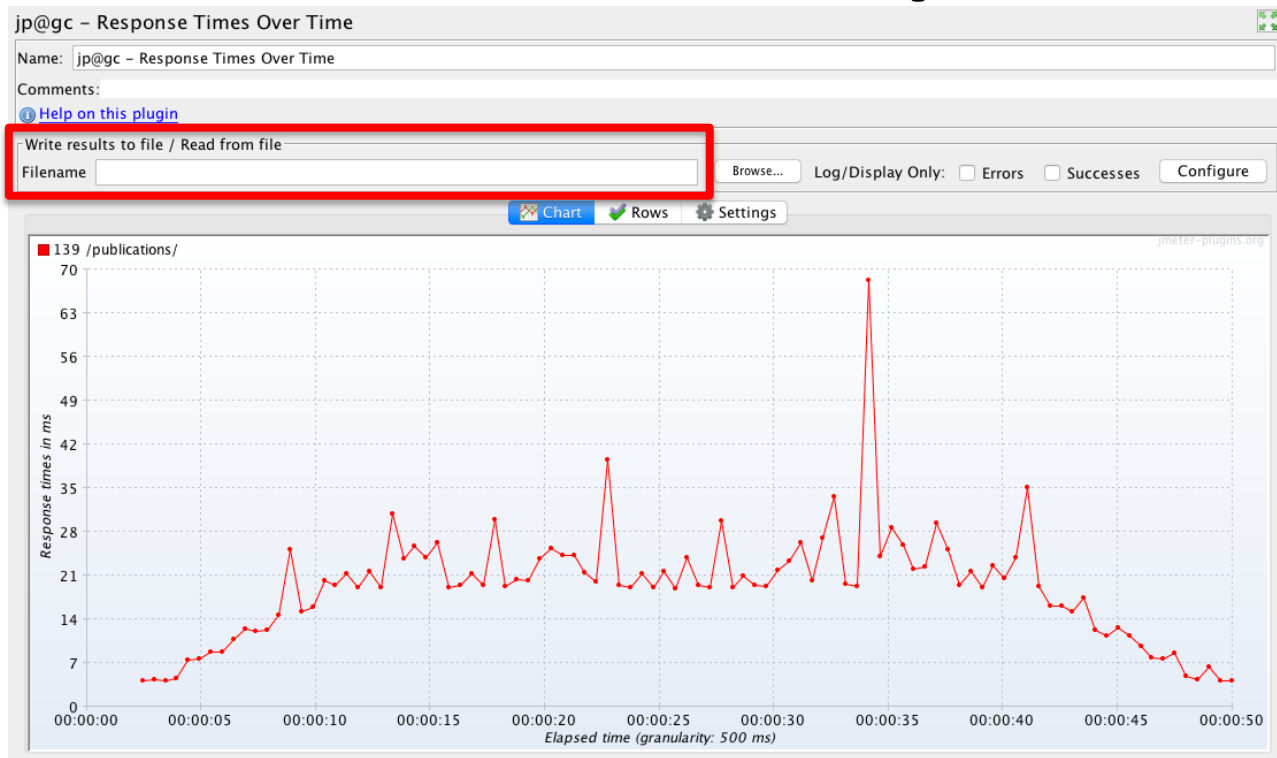
- Results in Table/Tree



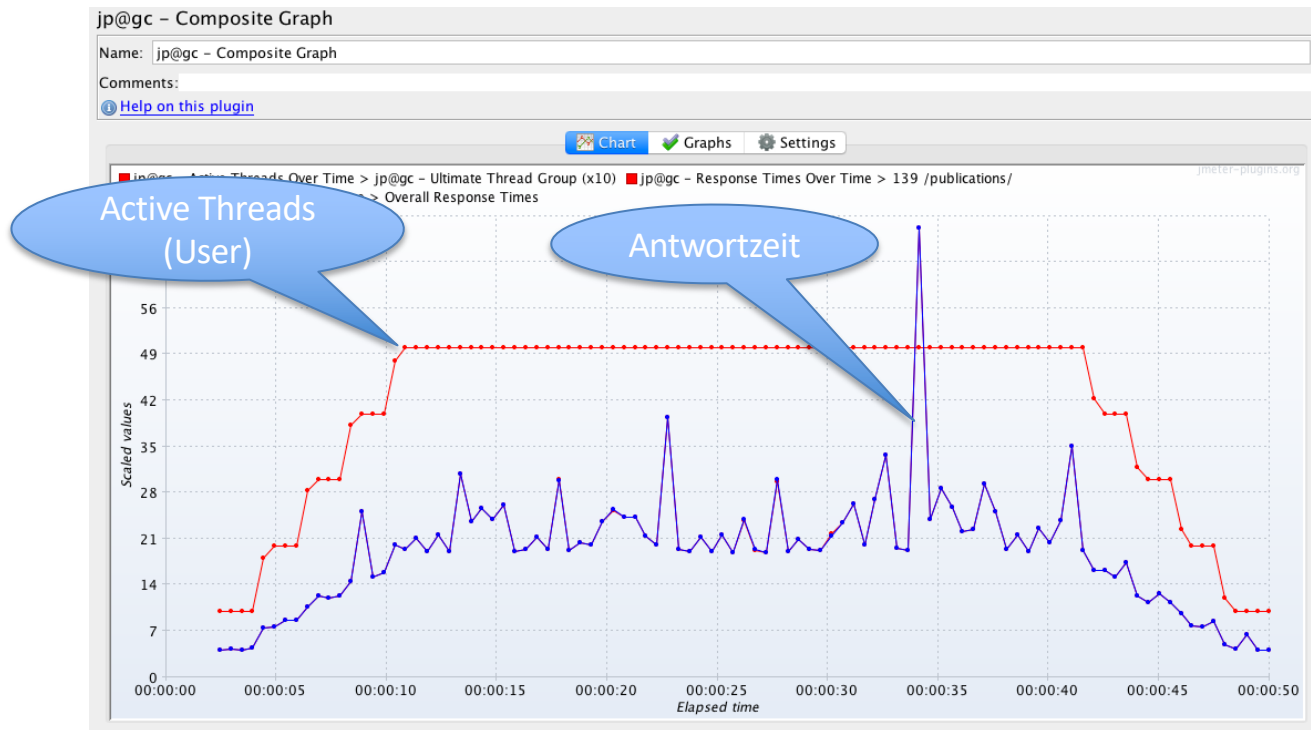
# JMeter Tests – Reports



# JMeter Tests – Reports



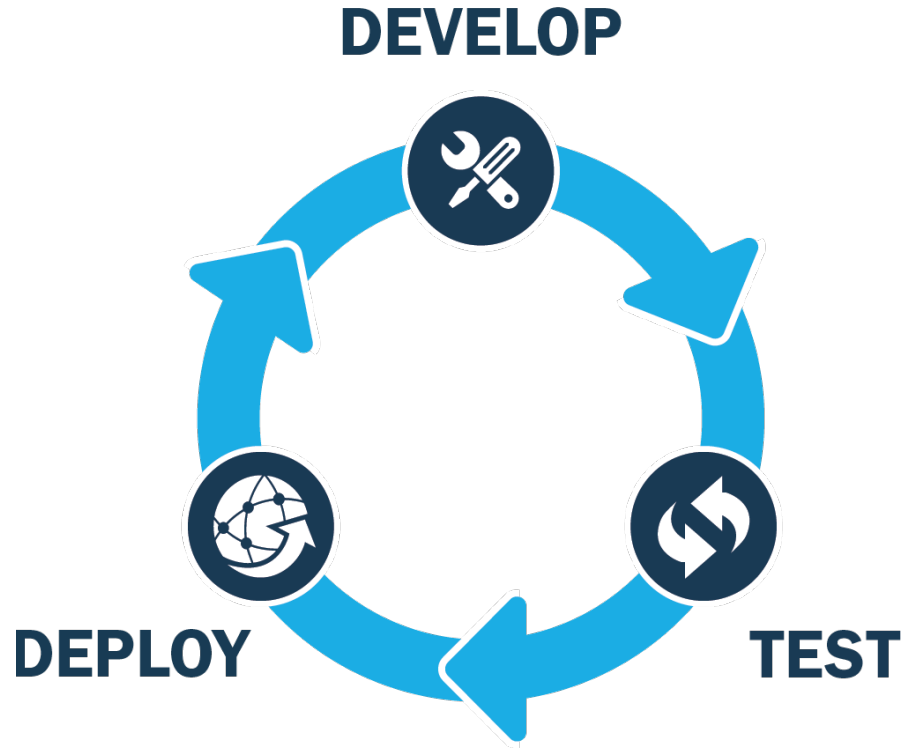
# JMeter Tests – Reports



# JMeter „Best Practice“

- Record tests
  - Built-in recorder (proxy)
  - BlazeMeter (browser plugin)
- Combination with other tools
  - Selenium (via JUnit tests or Selenium WebDriver plugin)

# Advanced Usage – Continuous Integration



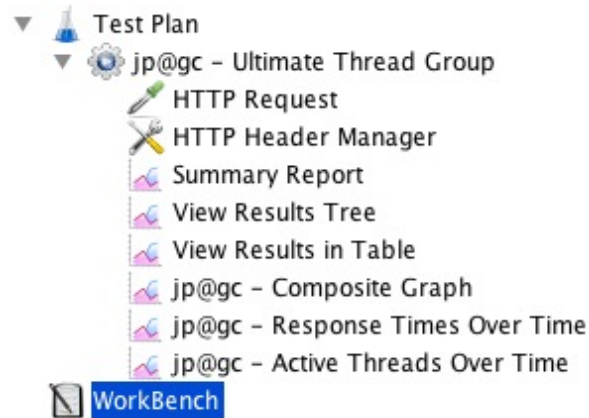
# Advanced Usage – Continuous Integration

- JMeter with Apache Maven
  - Maven as build tool
  - JMeter as performance testing tool
- Uses the plugin mechanismus of Maven
  - JMeter out-of-the-box functionality is no problem
  - Extensions (plugins) not trivial (dependencies)
- Convention over Configuration
  - JMeter tests in src/test/jmeter

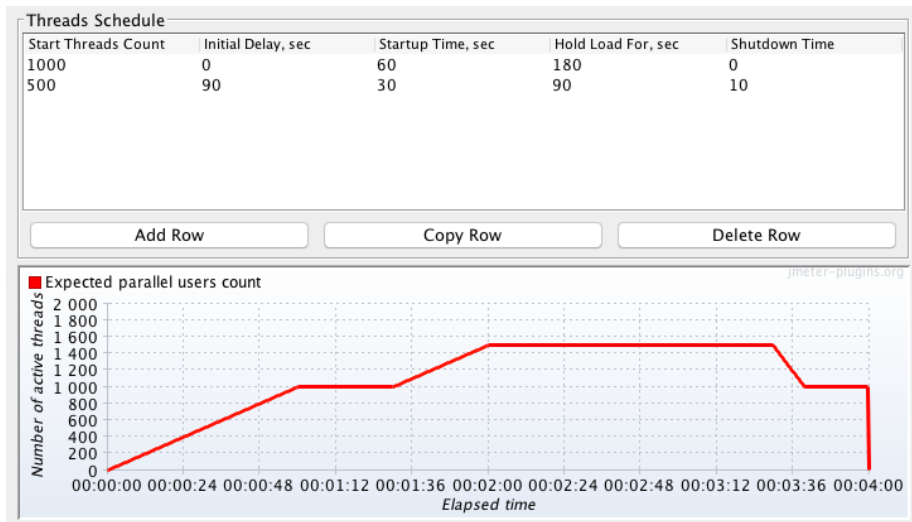
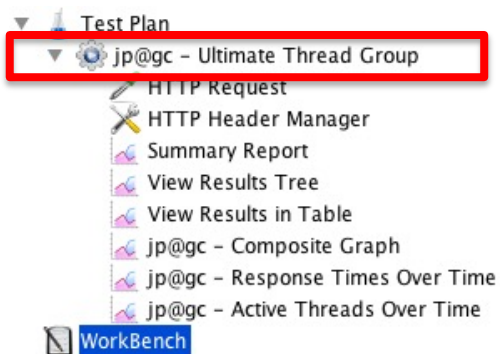


# TESTPLAN

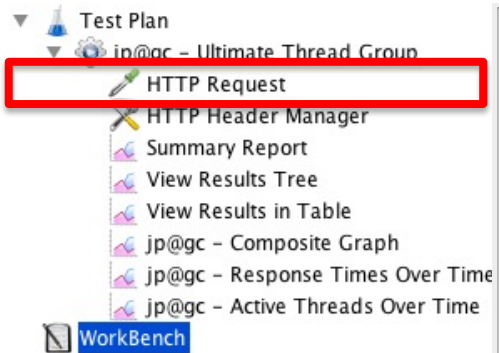
# Advanced Usage – Continuous Integration



# Advanced Usage – Continuous Integration



# Advanced Usage – Continuous Integration



### HTTP Request

Name:

Kommentare:

☐ Basic ☐ Advanced

Web Server

Protokoll [http]:  Server Name oder IP:  Port Number:

HTTP Request

Methode:  Pfad:  Content Kodierung:

☐ Automatisch Redirects folgen ☒ Folge Redirects ☒ Benutze KeepAlive ☐ Use multipart/form-data for POST ☐ Browser-compatible headers

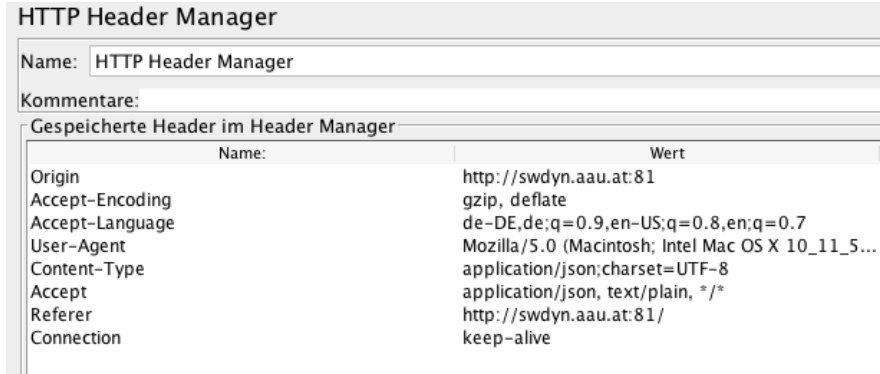
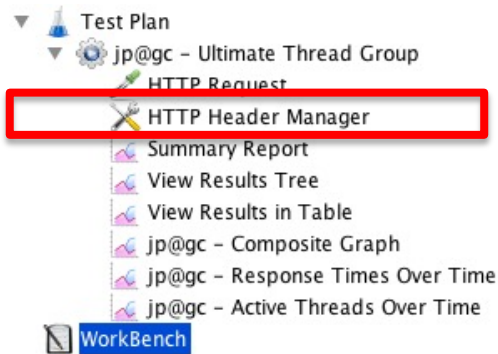
Parameters ☒ Body Data ☐ Files Upload

```

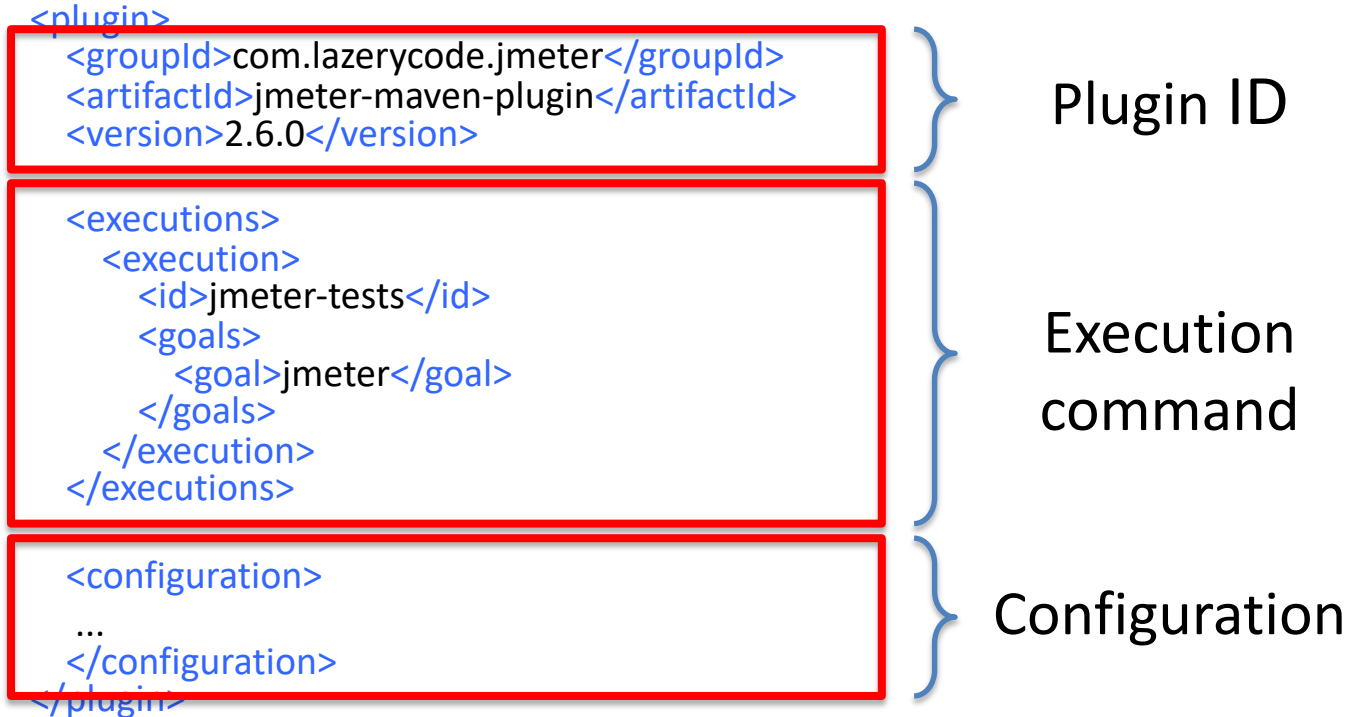
1 {"src":
"nCgJ a2FnZSBhdC5hYXU7D0QnCNb1YmcpYyBj bGfZcyBNYXZlb1B5b2p1Y3R3NXZRYaMzIhSnc1AgICBwcm12YXRlIExvbmcmcGymxvYz0wbD
sNC1Ag1CgBwcm12YXRlIExvbmcmcGJ3b2M9MGw7D0QogICAgCHJpdmF0ZSBMb25nIG51bURlCgVuZGVuY21lc20wbD5NC1AgICBwcm12YXRlIE
xvbmcmcgbnVtUGx1Z2Zlc20wbD5NC1AgICBwcm12YXRlIExvbmcmcgbnVtQ29uZm1ndXJlZFBzZwdpbm9MGw7D0QogICAgCHJpdmF0ZSBMb25n
IG51bU1vZHVhZS12YXRlIExvbmcmcGw7D0QogICAgCHJpdmF0ZSBMb25nIGRpdD0wbD5gYy91c2VkJGZlIG1eRpdCBpb1BvdmVYyXs1IG1ldHJpY3MNC1A
gICBwcm12YXRlIE1jaWxkSGFsc3RlYmQgaGfsc3RlYmQ7D0QogICAgCHJpdmF0ZSBMb25nIGN1c3Rvbm16YXRpb25TaXpLPtB80w0KLY8gIC
Ag12JpYyAiaW50ZXJyYmZGVuZGVuZS5kZW5jaWVhZlZlV4dG9ybWFSIGRlCgVuZGVuY21lc2Y1IChhcycBzdWJzdGld0XRlIEZVc1Bj b2hlc21vb
1Ihbm90Z291cGxpbmcvPyNkNC1AgICAvLWYhZmhhdG12S2BudW1EZAXgYw5kIG51bV85wdpbmGdG8gdG90Ym9wYyYyYm9mQvB31gbG5z
b2MNC1AgICAvLW1jY2F1ZTogCG9zC21ibGldgd2F5cy08byBdW4gdGh1IG1jaWxkPyaOy2h1Y25gcHJvZm12S1M5IGF1ZCBwblNaW5zP28

```

# Advanced Usage – Continuous Integration



# Advanced Usage – Continuous Integration



# Advanced Usage – Continuous Integration

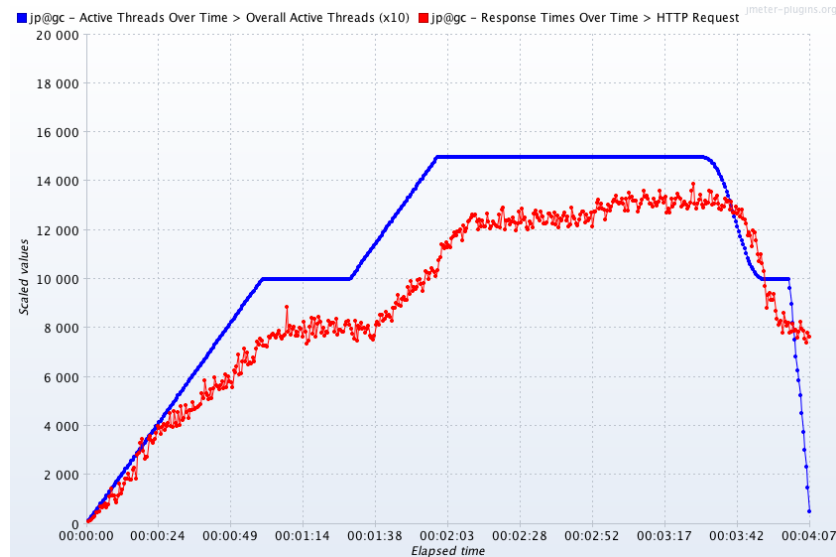
```
<plugin>
...
<configuration>
<jmeterVersion>3.3</jmeterVersion>
  <jmeterExtensions>
    <artifact>kg.apc:jmeter-plugins-casutg:2.5</artifact>
    <artifact>kg.apc:jmeter-plugins-dummy:0.2</artifact>
    <artifact>kg.apc:jmeter-plugins-ffw:2.0</artifact>
    <artifact>kg.apc:jmeter-plugins-fifo:0.2</artifact>
    <artifact>kg.apc:jmeter-plugins-functions:2.0</artifact>
    <artifact>kg.apc:jmeter-plugins-graphs-basic:2.0</artifact>
    <artifact>kg.apc:jmeter-plugins-graphs-composite:2.0</artifact>
    <artifact>kg.apc:jmeter-plugins-cmn-jmeter:0.5</artifact>
    <artifact>kg.apc:jmeter-plugins-jmxmon:0.2</artifact>
    <artifact>kg.apc:jmeter-plugins-manager:0.19</artifact>
    <!--<artifact>kg.apc:jmeter-plugins-perfmon:2.1</artifact>-->
    <artifact>kg.apc:jmeter-plugins-tst:2.1</artifact>
  </jmeterExtensions>
  <downloadExtensionDependencies>>false</downloadExtensionDependencies>
</configuration>
</plugin>
```

**DEMO (REST SERVICE)**

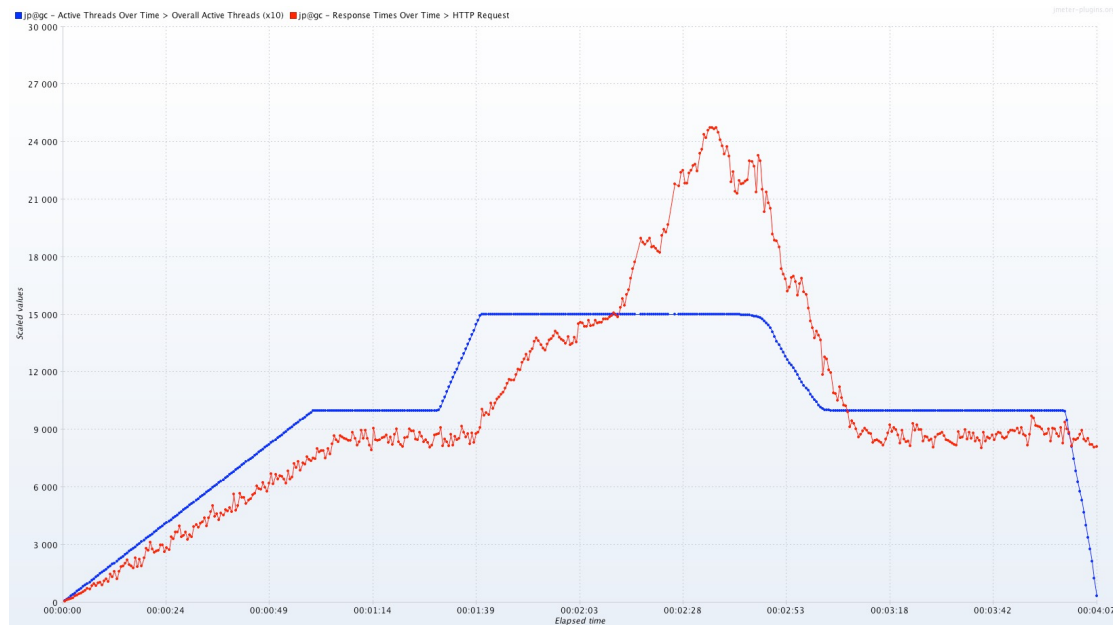


# REST Service

Label ▲	Anz. d...	Durc...	Min	Max	Std. Dev.	% Feh...	Durchsatz	KB/sek	Sent KB/...
HTTP Request	29218	9307	29	20189	3695,23	0,00%	118,5/sec	87,70	1484,43
Gesamt	29218	9307	29	20189	3695,23	0,00%	118,5/sec	87,70	1484,43



# REST Service



# Outlook?

- Other Samplers/Actions
  - Java Tests
  - Selenium
  - ...
- Distributed performance testing
  - Many „physical“ Clients
- Assertions