



#workshop #performance

git clone <https://github.com/konradmuh/kick-off-performance>



Kickstart your performance testing



with Konrad Marszałek [konrad.marszalek@spartez.com], Senior Quality Engineer



HOME

PRODUCTS

SUPPORT

MEDIA

ABOUT X-FORMATION

Simply better license management

Software development driven by real business needs

“Get out of your comfort zone”

Konrad Marszałek, Quality Assurance Engineer

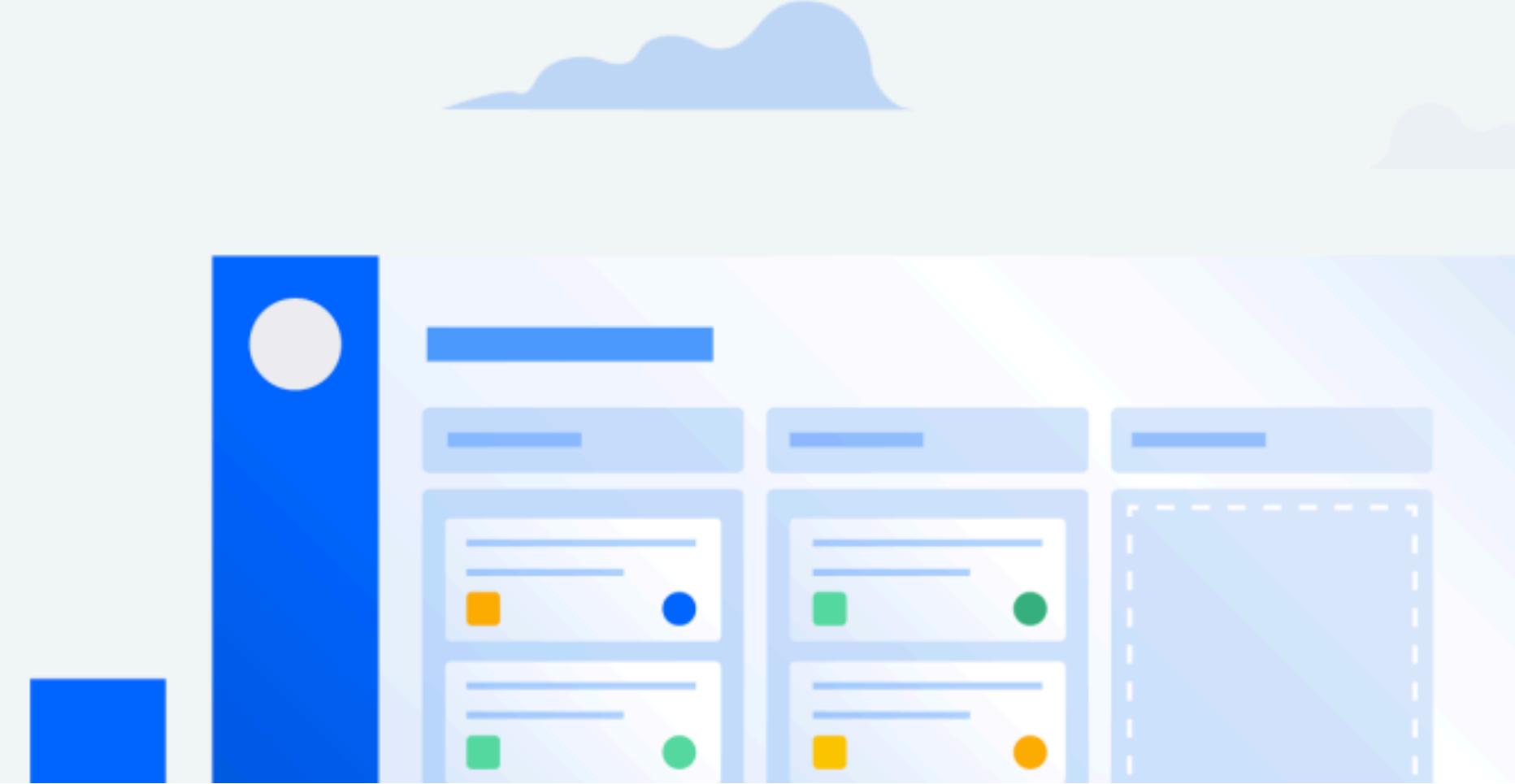


AP invoice automation for greater control & efficiency

“ Monitor performance on production”

Konrad Marszałek, Quality Lead

Czołowe narzędzie do tworzenia oprogramowania dla zespołów korzystających z metodyk zwinnych.



“ How to assure quality for product used by 30k customers?”

Konrad Marszałek, Senior Quality Engineer

Workshop manifesto

Focus on this workshop:

- 1. Learn by doing over theoretical study**
- 2. Test feature under current development over test regression of key features**
- 3. Test application over environment configuration**

That is, while things you learn will be helpful in items on the right, we concentrate on the items on the left more this time.

5

Live demos

4

Exercises with Jmeter tool

6

Pitfalls to fall in

lots
of extras

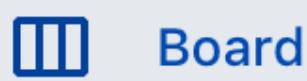
Meet our
SUT
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Teams in Space
Software project



Backlog



Board



Reports



Releases



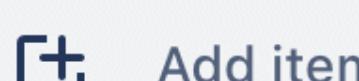
Components



Issues



Repository



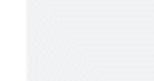
Add item



Settings



Board



Quick filters ▾

Assignee ▾

Sprint ▾

TO DO 5

▽ Super important 11 issues

When requesting user details the service should return prior trip info

SEESPACEEZ PLUS



TIS-37

Requesting available flights is now taking > 5 seconds

SEESPACEEZ PLUS



3



TIS-8



Engage Jupiter Express for outer solar system travel

SPACE TRAVEL PARTNERS



5

TIS-25



Create 90 day plans for all departments in the Mars Office

LOCAL MARS OFFICE



9

TIS-12

Establish a catering vendor to provide meal service

LOCAL MARS OFFICE



4



TIS-15



Engage Saturn Shuttle Lines

IN PROGRESS 5

IN REVIEW 2

DONE 8

Register with the Mars Ministry of Revenue

LOCAL MARS OFFICE



3

TIS-11

Draft network plan for Mars Office

LOCAL MARS OFFICE



3

TIS-15



Homepage footer uses an inline style - should use a class

LARGE TEAM SUPPORT



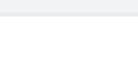
Engage JetShuttle SpaceWays for travel

SPACE TRAVEL PARTNERS



5

TIS-23



Performance checks during exploratory testing

Charles (<https://www.charlesproxy.com/>)

- web debugging proxy
- can repeat requests
 - even simultaneously



Demo: Charles

Feature: View issue

Charles 4.2.7 - Session 1 *

Structure Sequence

Code	Method	Host	Path	Duration	Size	Status	Start	Info
503	GET	aadays.pl	/favicon.ico	2 ms	1.15 KB	Failed	23:07:09	
200	GET	aadays.pl	/	445 ms	11.24 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-content/themes/Events/css/normalize.css?ver=4.2.21	25 ms	3.31 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-content/themes/Events/css/events.pixellove.css?ver=4.1.0	72 ms	1.22 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-content/themes/Events/css/font.awesome.css?ver=4.2.0	49 ms	5.97 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-content/themes/Events/css/small.desktop.css?ver=4.2.21	73 ms	1.03 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-content/themes/Events/style.css?ver=4.2.21	73 ms	14.14 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-content/themes/Events/css/tablet.css?ver=4.2.21	75 ms	1.58 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-includes/css/dashicons.css?ver=4.2.21	2 ms	1.15 KB	Complete	23:09:10	
200	GET	aadays.pl	/wp-includes/js/thickbox/thickbox.css?ver=3.1.1	2 ms	1.15 KB	Complete	23:09:11	
200	GET	aadays.pl	/?custom-css=1&csblob=1	2 ms	1.15 KB	Complete	23:09:11	
200	GET	aadays.pl	/wp-includes/js/jquery/jquery.js?ver=3.2.1	2 ms	1.15 KB	Complete	23:09:11	
200	GET	aadays.pl	/wp-includes/js/jquery/jquery-migrate.min.js?ver=1.4.1	2 ms	1.15 KB	Complete	23:09:11	

Filter: aadays

Overview Contents Summary Chart Notes

Name	Value
URL	http://aadays.pl/
Status	Complete
Response Code	200 OK
Protocol	HTTP/1.1
TLS	-
Protocol	-
Session Resumed	-
Cipher Suite	-
ALPN	-
Client Certificates	-
Server Certificates	-
Extensions	-
Method	GET
Kept Alive	No
Content-Type	text/html; charset=UTF-8
Client Address	127.0.0.1:61028
Remote Address	aadays.pl/85.128.228.192:80
Connection	-
WebSockets	-

Advanced Repeat

Repeat 1 request.

Iterations: 10

Concurrency: 10

Charles will create a new connection for each concurrent iteration, so using a high Concurrency will cause a large number of simultaneous connections to be established.

Show results in new Session

Repeat delay (ms): 0

Use ranges

Cancel OK

Recording

Usefulness

Ability to
quickly flag requests for
further performance **investigation**

Quick response time

User Perception Of Performance Delays

0 to 16ms	Users are exceptionally good at tracking motion, and they dislike it when animations aren't smooth. They perceive animations as smooth so long as 60 new frames are rendered every second. That's 16ms per frame, including the time it takes for the browser to paint the new frame to the screen, leaving an app about 10ms to produce a frame.
0 to 100ms	Respond to user actions within this time window and users feel like the result is immediate. Any longer, and the connection between action and reaction is broken.
100 to 300ms	Users experience a slight perceptible delay.
300 to 1000ms	Within this window, things feel part of a natural and continuous progression of tasks. For most users on the web, loading pages or changing views represents a task.
1000ms or more	Beyond 1000 milliseconds (1 second), users lose focus on the task they are performing.
10000ms or more	Beyond 10000 milliseconds (10 seconds), users are frustrated and are likely to abandon tasks. They may or may not come back later.

Typical results |



All response codes 2**. Duration +/- the same.

Single response duration: 350 ms

Code	Duration [ms]
200	361
200	375
200	359
...	...
200	364
200	370
200	364

Typical results II

All response codes 2**. **Large durations occur.**



Single response duration: 2s

Code	Duration [s]
200	2
200	3
200	8
...	...
200	4
200	11
200	3

Typical results III

All response codes 2**. **Timeout errors occur.**



Single response duration: 2s

Code	Duration [s]
200	23
504	N/A
200	15
...	...
504	N/A
200	3
200	14

Typical results IV



All response codes 2**. **Errors occur.**

Single response duration: 2s

Code	Duration [s]
200	1.0
500	0.1
200	1.1
...	...
500	0.2
200	1.3
200	1.1

What metric describes application performance?



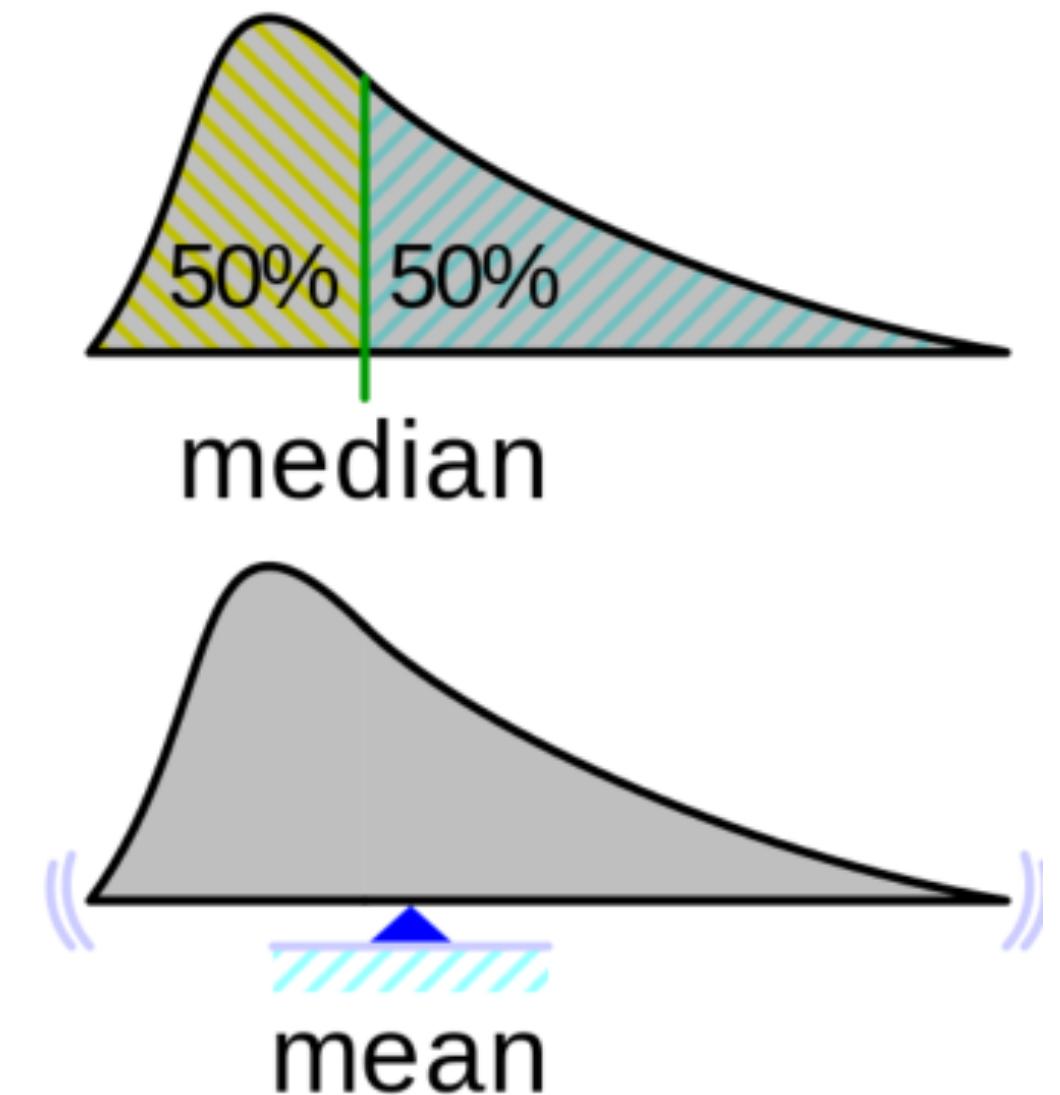
Metric?

Code	Duration [s]
200	2
200	3
200	8
...	...
200	4
200	11
200	3

?

Average vs. median

Type	Description	Example	Result
<u>Arithmetic mean</u>	Sum of values of a data set divided by number of values:	$(1+2+2+3+4+7+9) / 7$	4
Median	Middle value separating the greater and lesser halves of a data set	1, 2, 2, 3, 4, 7, 9	3



source: <https://en.wikipedia.org/wiki/Median>

Average vs. median

The median is used primarily for **skewed distributions**

Consider the **multiset** { 1, 2, 2, 2, 3, 14 }.

The median is 2 in this case,
and it might be seen as a better indication of **central tendency**
(less susceptible to the exceptionally large value in data)
than the **arithmetic mean** of 4.

Average vs. median

Averages hide the outliers, so you can't see them.

Outliers skew averages, so in a system with outliers,
the average doesn't represent typical behaviour.

99th percentile

99th percentile is the value below which 99% of the observations may be found.

{ 1, 2, 2, 2, 3, 14 }

99th shows a plausible worst-case scenario
Google measures to the 99.9% percentiles

Apdex - Application Performance Index

$$Apdex_t = \frac{SatisfiedCount + \frac{ToleratingCount}{2}}{TotalSamples}$$

$$Apdex_3 = \frac{60 + \frac{30}{2}}{100} = 0.75$$

0 = no users satisfied,
1 = all users satisfied

tolerable time = 4 x satisfied time

sources: <http://apdex.org/overview.html>
<https://en.wikipedia.org/wiki/Apdex>

Load generation

JMeter (<https://jmeter.apache.org/>)

- Free and open source
- Platform independent
- Industry standard existing for 20 yrs
- Ease of use: Graphical

Demo: JMeter

Feature: View issue

Get ready for exercise

Goal: Open JMeter

Exercise 1: JMeter Simple request

Feature: Kanban board

Goal: Find out how many concurrent requests our application can handle so that median response time is below < 1s

How many concurrent users were there?

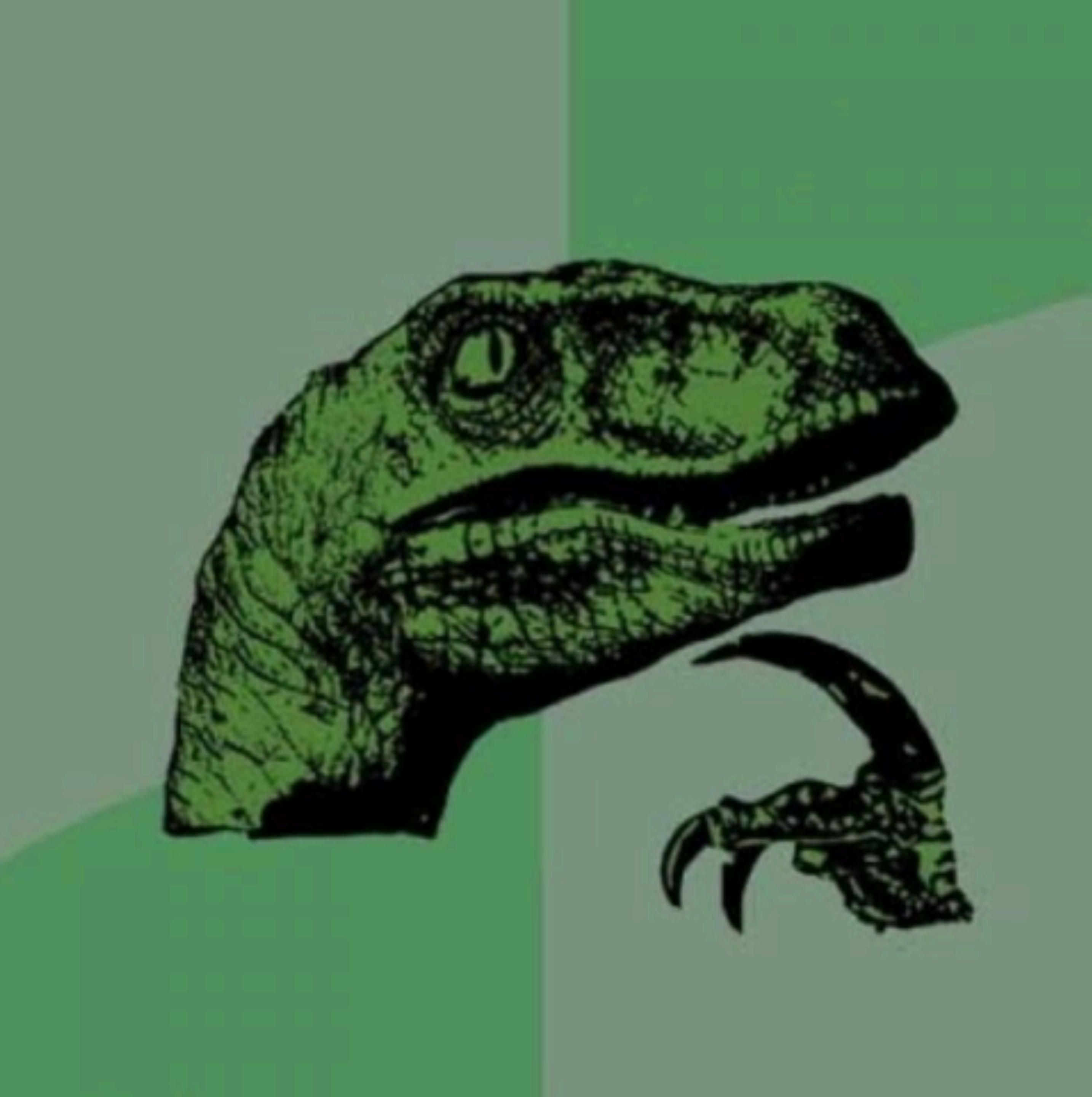


Answer: Use ‘Active Threads Over Time’ listener to check

Load shaping

Meet the Ultimate Thread Group

Performance test types



Load test

JMeter File Edit Search Run Options Help solution.jmx (/Users/kmarszalek/code/kick-off-performance/exercises/2/solution/solution.jmx) - Apache JMeter (5.0 r1840935) 88% 88% Sun 17:05 00:00:02 0 0/20

Test Plan

- Thread Group
- View Results Tree
- Aggregate Report
- jp@gc - Active Threads Over Time
- jp@gc - Ultimate Thread Group

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
10	0	30	3600	10

Add Row Copy Row Delete Row

Expected parallel users count

Number of active threads

Elapsed time

jmeter-plugins.org

Stress test

JMeter File Edit Search Run Options Help

HTTP Request.jmx (/Users/kmarszalek/code/kick-off-performance/exercises/1/solution/HTTP Request.jmx) - Apache JMeter (5.0 r1840935)

00:00:02 0 0/20

Test Plan

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
10	0	3600	360	10
10	0	3600	360	10
10	0	3600	360	10
10	0	3600	360	10
10	0	3600	360	10
10	0	3600	360	10
10	0	3600	360	10
10	0	3600	360	10

Add Row Copy Row Delete Row

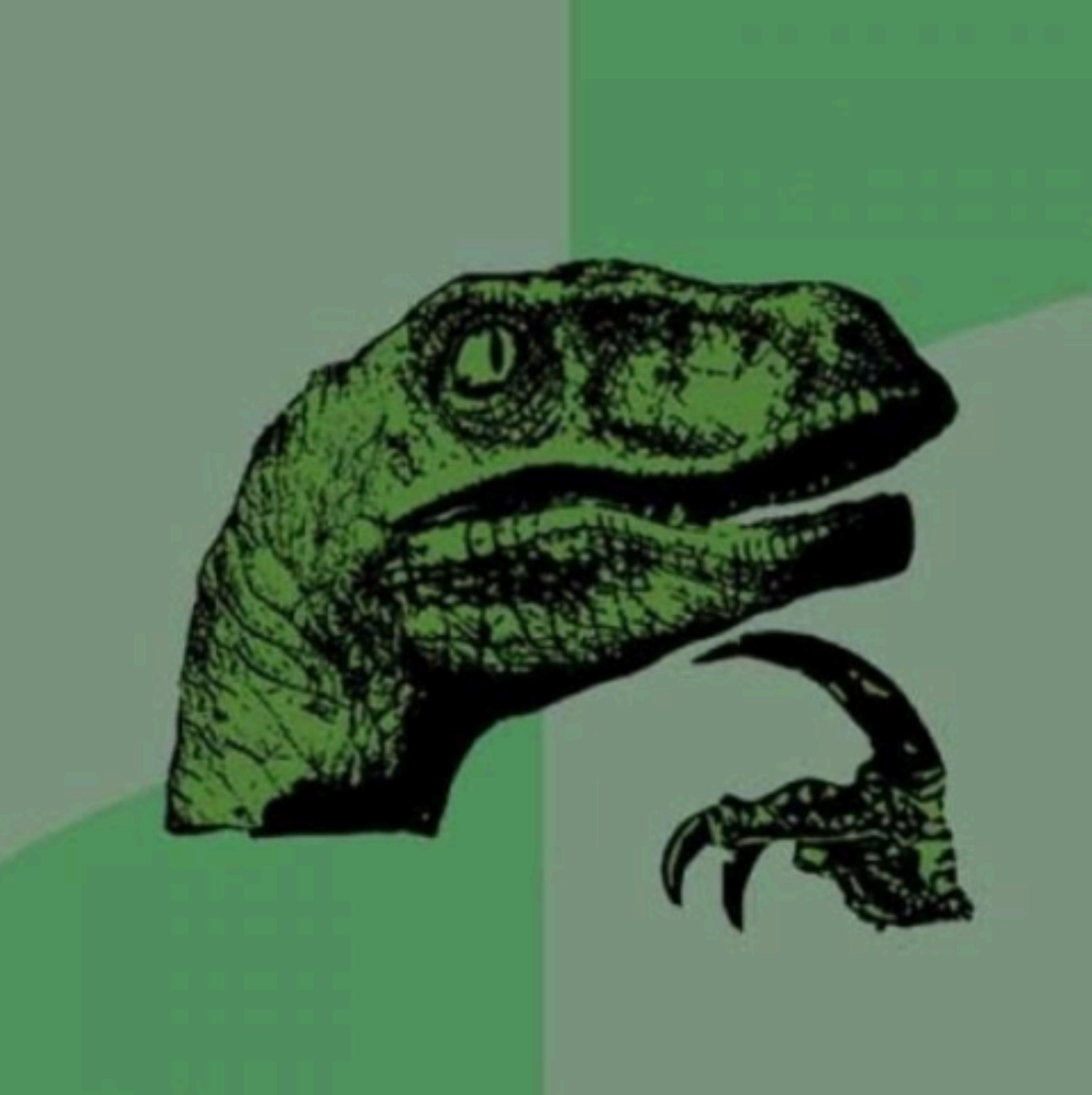
Expected parallel users count

Number of active threads

Elapsed time

jmeter-plugins.org

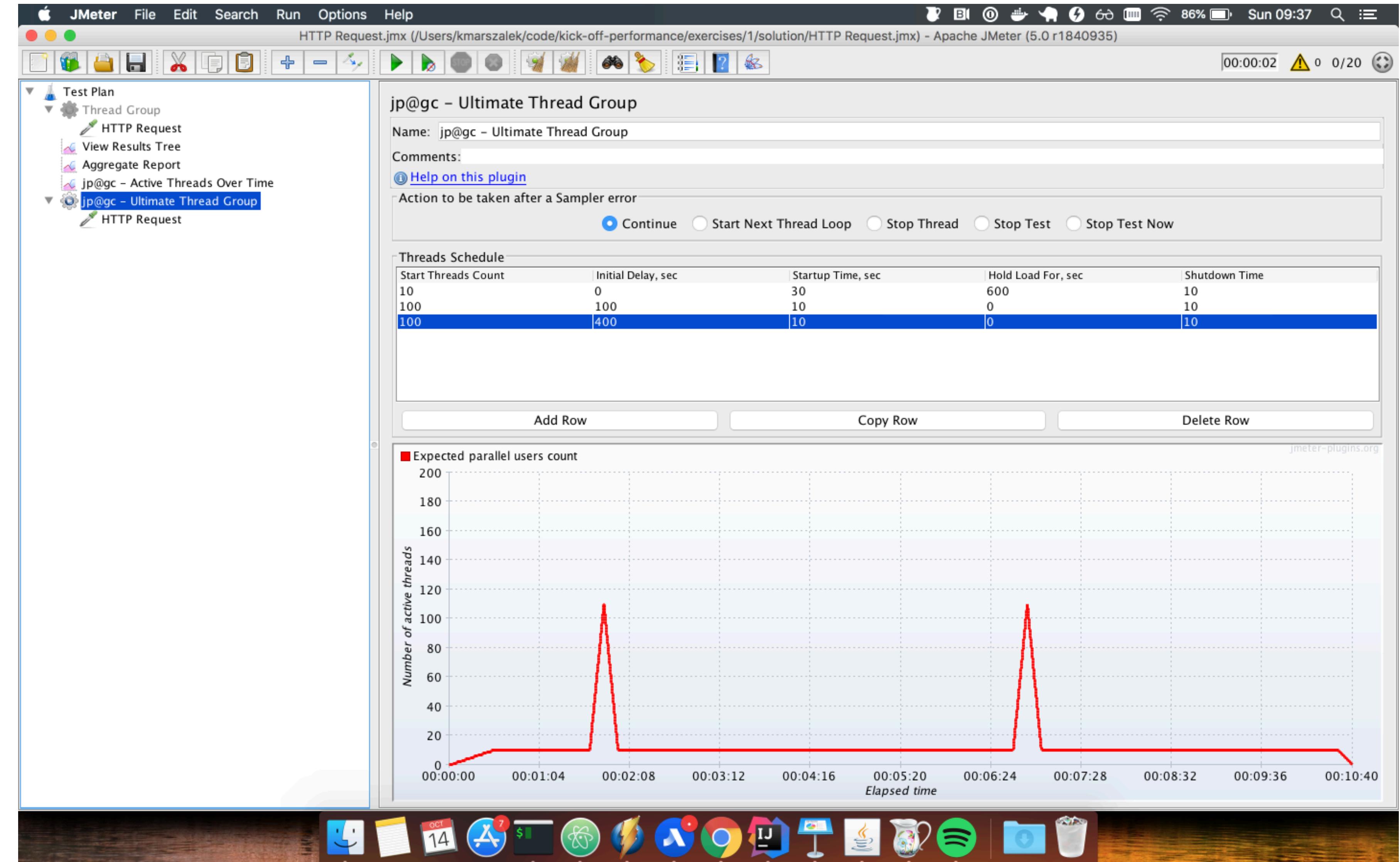
When breakpoint is reached during stress test?



Answer: When at least one of the conditions is met:

- Response time starts to be unacceptable (e.g. above 4 x satisfying time)
- When errors start to occur (e.g. above 1% error rate)
- When resources utilisation (CPU, RAM) starts to be above 70% for most of the time

Spike test



Endurance test

JMeter File Edit Search Run Options Help

HTTP Request.jmx (/Users/kmarszalek/code/kick-off-performance/exercises/1/solution/HTTP Request.jmx) - Apache JMeter (5.0 r1840935)

00:00:02 0/20

Test Plan

Thread Group

HTTP Request

View Results Tree

Aggregate Report

jp@gc - Active Threads Over Time

jp@gc - Ultimate Thread Group

HTTP Request

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
10	0	30	86000	10

Add Row Copy Row Delete Row

Expected parallel users count

Number of active threads

Elapsed time

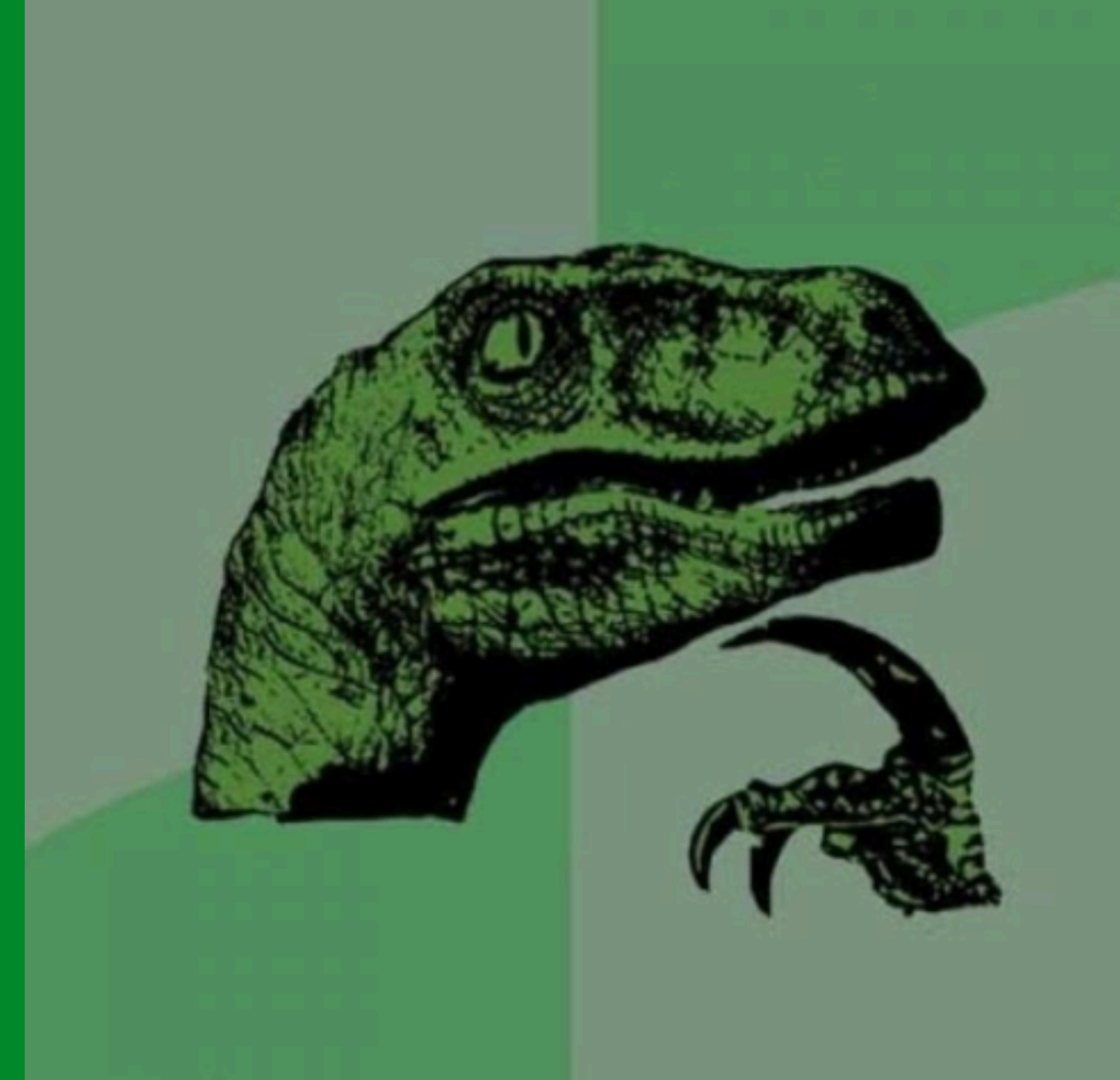
jmeter-plugins.org

Exercise 2: JMeter Load shaping

Feature: Kanban board

Goal: What is median response time for 10 concurrent users?

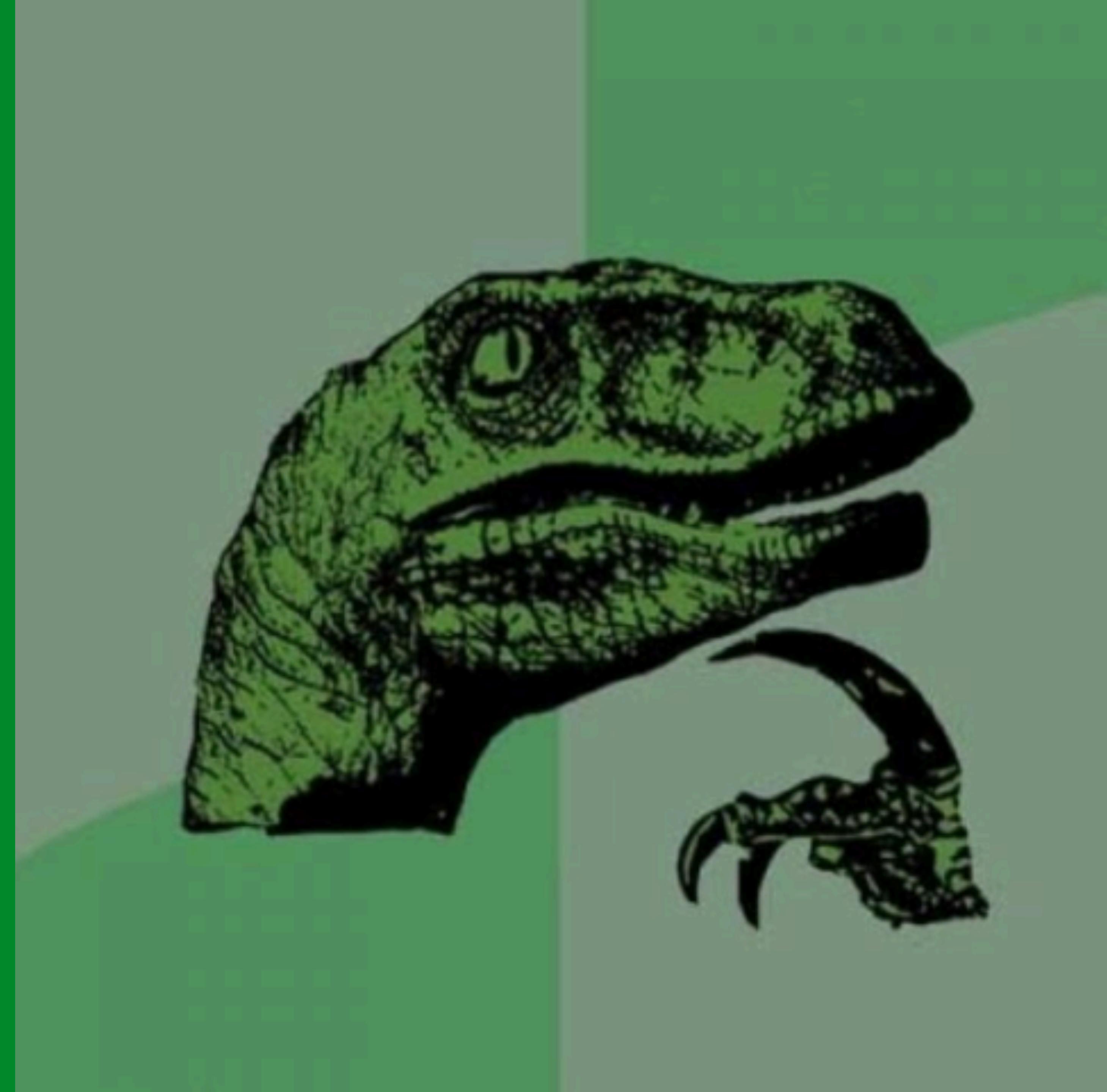
What should be load test duration?



Answer: Typically 1h

General rule: It should be long enough so that result does not depend on duration

Is this thread a real user?



Answer: It would mimic real user much better if:

- There are pauses between requests similar to real user think time
- The scenario is longer -> user profile
- The measurements include multiple user profiles combination

Blazemeter plugin for Chrome

Makes your life easier

Allows to record requests

Outputs JMeter Test Plan file (.jmx)



SPARTEZ

<https://chrome.google.com/webstore/detail/blazemeter-the-continuous/mbopgmdnpscbohhpnfglgohlbfongabi>

Exercise 3: Blazemeter Chrome plugin

Feature: Kanban board

Goal is the same: What is median response time for 10 concurrent users?

Demo: Authentication

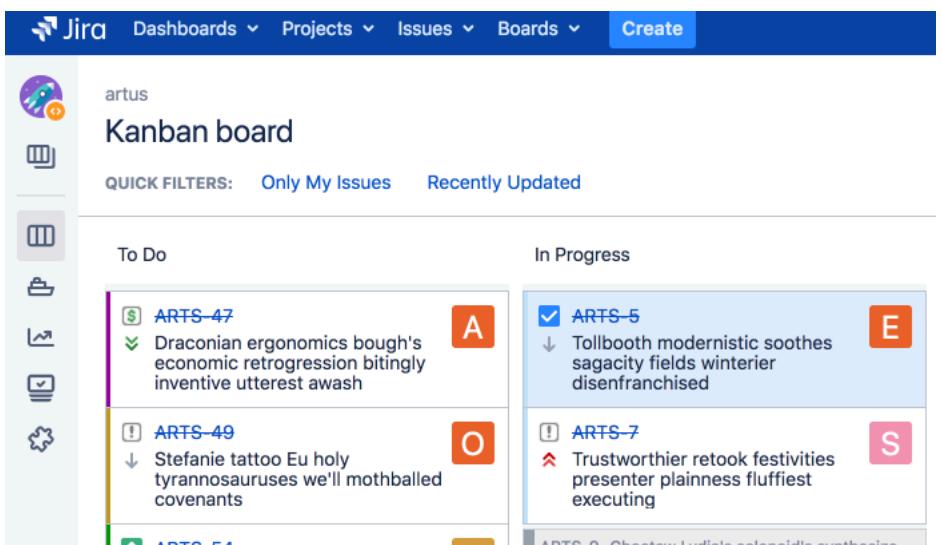
Feature: Kanban board

What are we measuring?

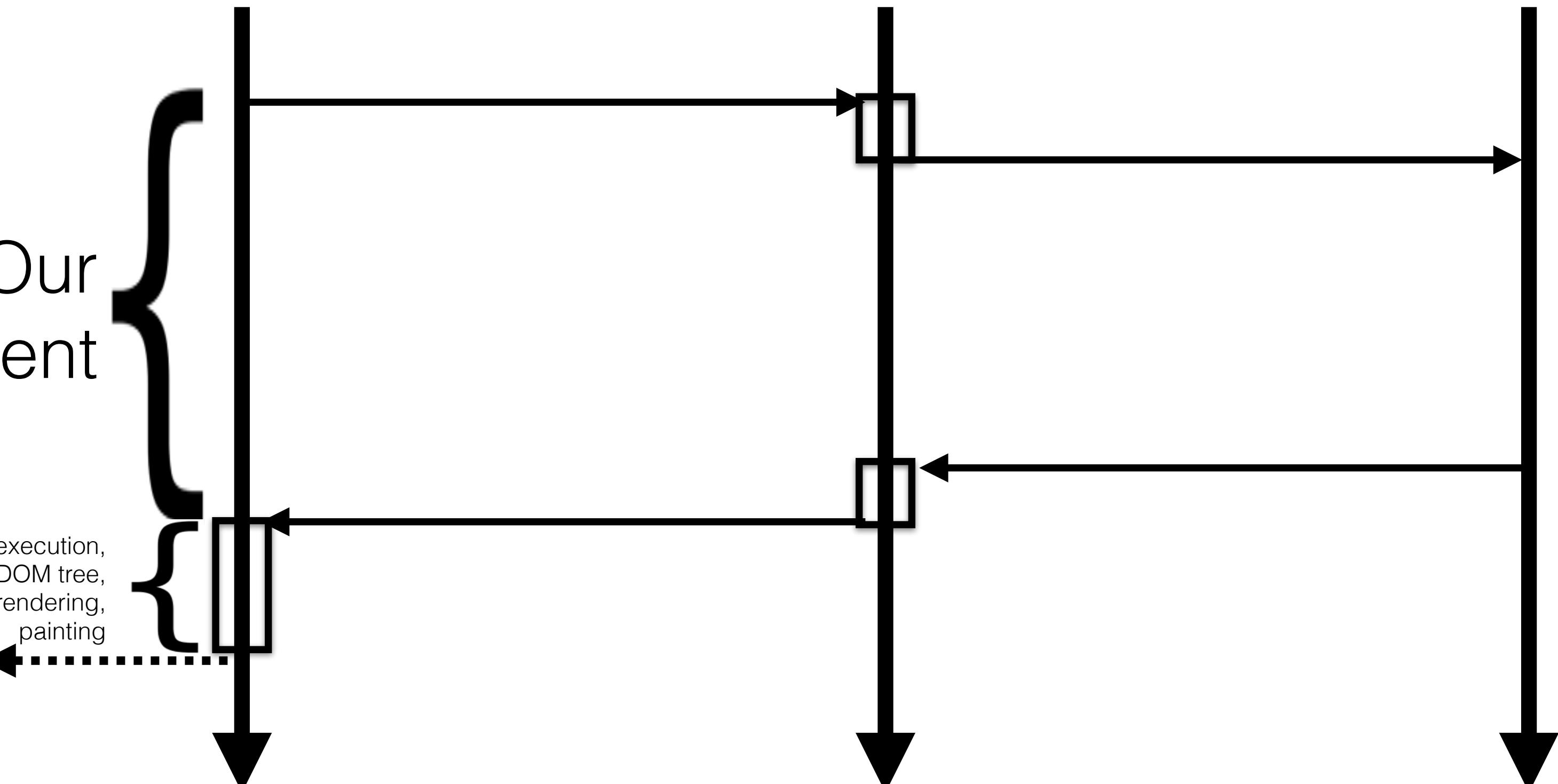


Our
measurement

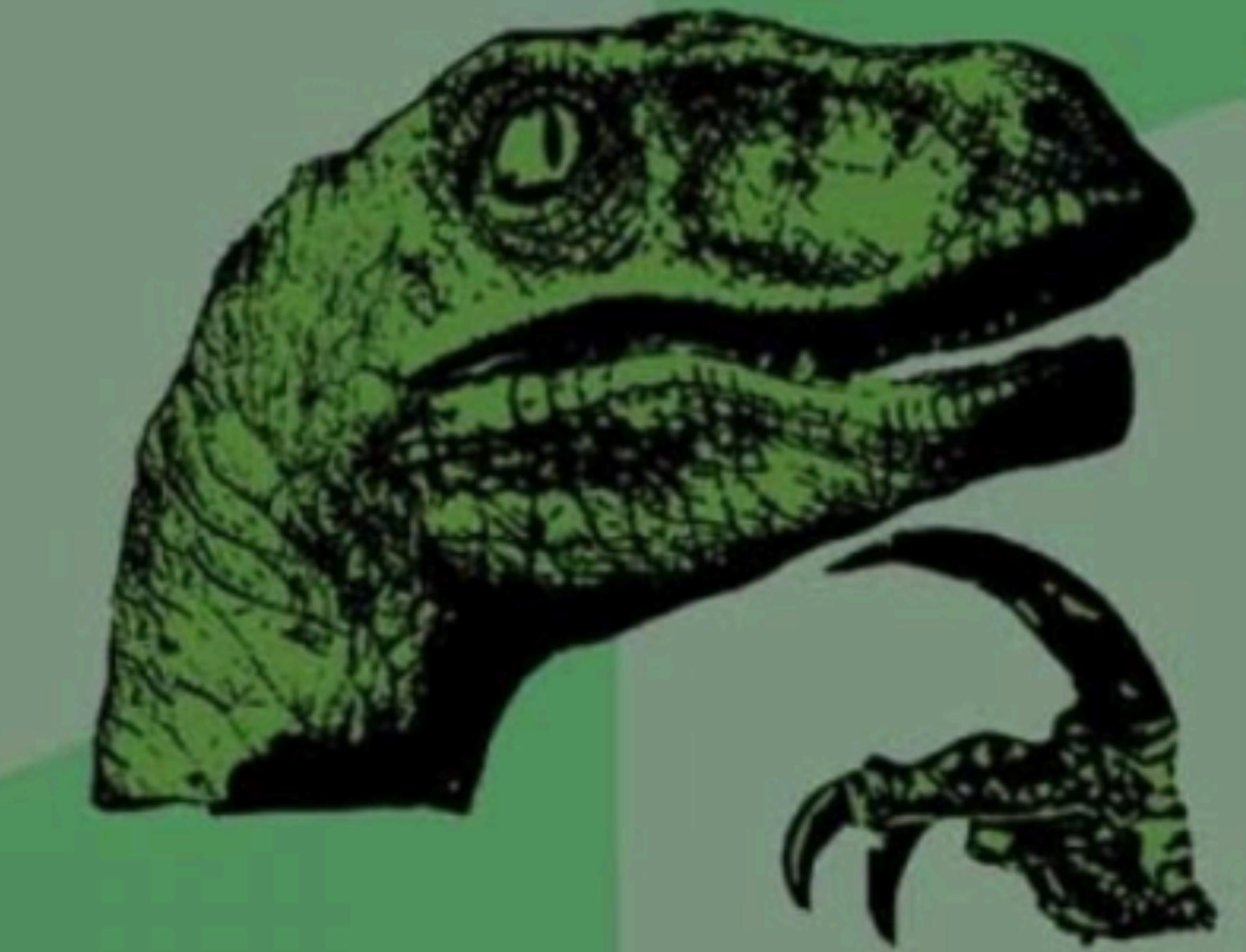
JS execution,
DOM tree,
rendering,
painting



SPARTEZ



What are we measuring (test data)?



Answer: Same user and board all the time. If it's cached on backend side our measurements are not representative

Exercise 4: Data diversity

Feature: Kanban board

Goal: What is median response time for 10 concurrent **different** users using 10 **different** boards

Demo: Assertions

Feature: Kanban board

Goal: What is median response time for 10 concurrent different users using 10 different boards?

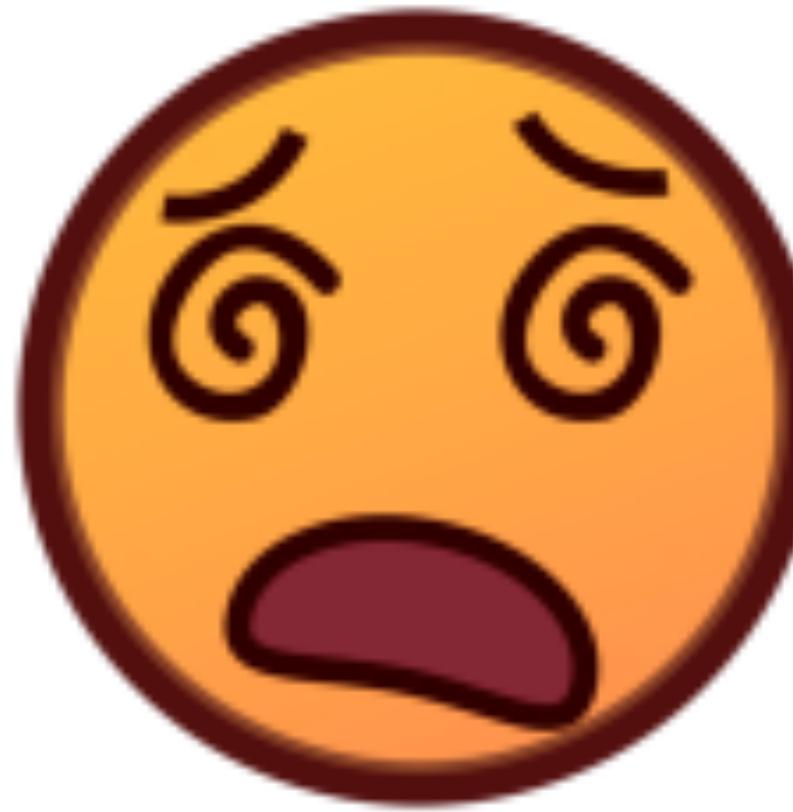
Tips: Add assertion that board is not empty

(less)Typical results V

All response codes 2**. Fast responses.

Functional problems

(e.g. wrong board served for wrong users)



Single response duration: 0.8s

Code	Duration [s]
200	1.0
200	1.2
200	1.1
...	...
200	1.2
200	1.3
200	1.1

Testing gotchas we've seen

Discard Response Time measurements with errors

Measure all relevant requests

Use representative test data

Assertions to make sure you get what you expect

Real measurement: Don't run in GUI mode. Disable listeners.

JMeter should be close in the network to application. Good bandwidth

Product problems we've seen

Slowness

Timeouts

Deadlocks

Race conditions

N+1 query problems

Concurrency functional problems

Memory leak

JMeter drawbacks

JMeter is not a browser - it will not execute Java Script

**Single instance of JMeter can spawn couple hundreds of threads.
If you need more switch to distributed JMeter setup**

Hard to track changes in .jmx files (Taurus helps here a bit)

Vulnerable to Coordinated Omission in typical setup

Demo: New Relic

Application Performance Management tool

Chrome File Edit View History Bookmarks People Window Help

konradmuh/kick-off-perfor... x AADays - New Relic x Inbox – konrad.marszalek@gm... x (10) LinkedIn x +

https://rpm.newrelic.com/accounts/2126520/applications/116516864

ksiazki kuchnia WRK Troy Hunt tmp2

New Relic APM BROWSER SYNTHETICS MOBILE PLUGINS INSIGHTS INFRASTRUCTURE Maps Alerts Tools Help Spartez Sp. z o.o. Sp. k. 1

Applications Service maps Key transactions Your APM Trial expires in 14 days View Pricing Options

APPS AADays TIME PICKER Last 12 hours ending now

MONITORING Overview

Distributed tracing New

Service maps

Transactions

Databases

External services

JVMs

EVENTS Error analytics

Errors

Violations

Deployments

Live instrumentation

Web transactions time 65.4 ms APP SERVER

Apdex score 0.97 [0.5] APP SERVER

Throughput 1.11k rpm AVERAGE

Compare with yesterday and last week AADays 0 ms 0 rpm 0.00 err%

login (1).jmx Viewissue (1).jmx eic_67895823.pdf Your Electronicpdf Viewissue.jmx Show All X

10 9 216

16 OCT



**Thank you !
This is the end of
essential part...**