

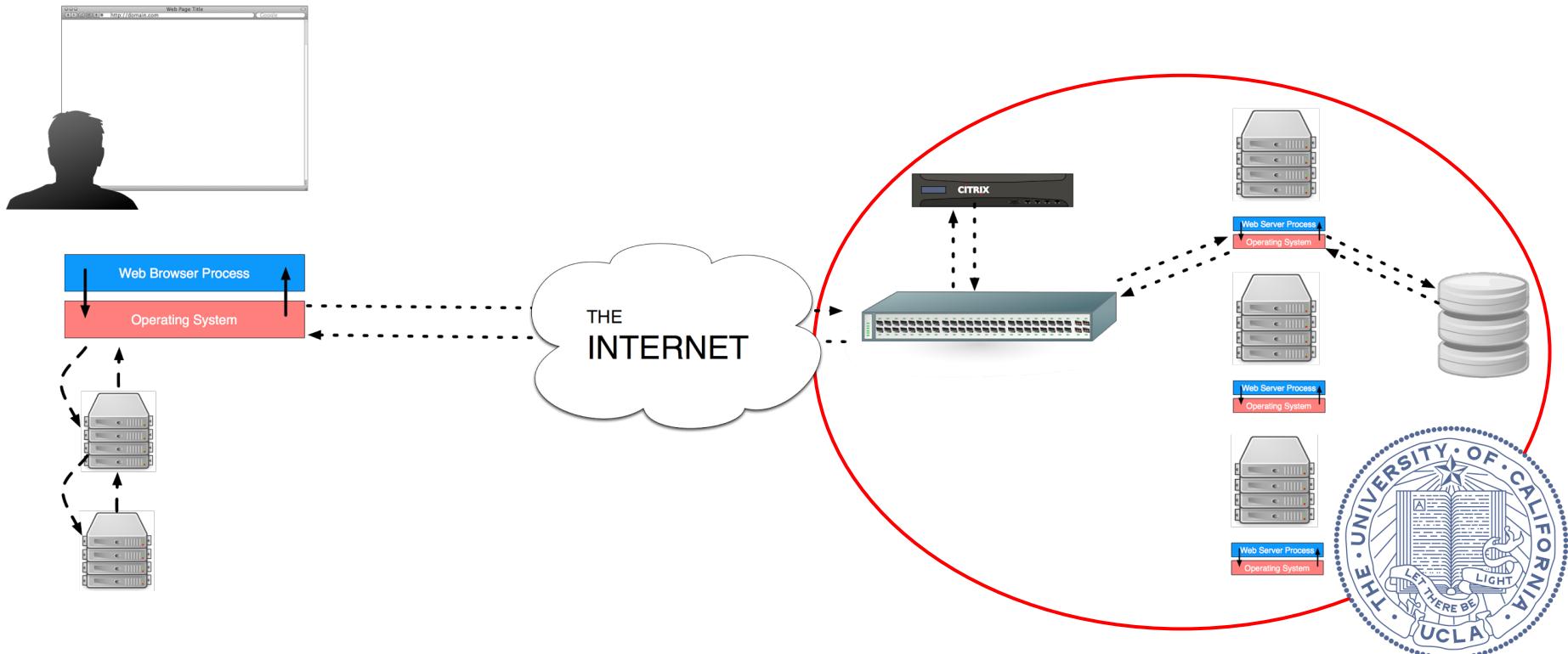
CS 188/219

Scalable Internet Services

Andrew Mutz
May 3, 2015



For Today



Motivation

After today you will know how to evaluate the scalability of a deployed application using Tsung.

Today will be interactive, so if you've brought your laptops, please get them out.



Motivation

We will want one app and testing instance per team. So please:

- Sit with your team
- Deploy one micro instance of your app on EC2
- Deploy one Tsung instance per team
 - I will explain how to do this on the next slide.



Motivation

Why Tsung?

- There are many load testing tools out there
- Most make you choose between flexibility and performance
- If you use a low-performance tool, you need to deploy a fleet of machines to do load testing
- Tsung is extremely configurable and delivers high performance



Tsung

Starting up an instance of Tsung testing is easy.

- Create a new CloudFormation stack
- Name it something like TEAM_NAME-tsung
- For the Template, copy and paste this link from the utils:

Other Templates

- **Tsung:**

This instance provides an installed version of Tsung at your disposal. You will need to copy/rsync over your tsung xml tests. <https://scalableinternetservices.s3.amazonaws.com/SingleTsung-ami-f56657c5.json>

- Select a branch that has your tests on them
- Select your TeamName
- Turn off rollback.



Tsung

Once your Tsung stack is up, you will see two important values in the “Outputs section”:

Key	Value	Description
SSH	ssh -i demo.pem ec2-user@ec2-52-24-67-201.us-west-2.compute.amazonaws.com	AppServer SSH connect string
URL	http://ec2-52-24-67-201.us-west-2.compute.amazonaws.com	The URL to the rails application.

- SSH tells you how to SSH into your Tsung instance
- URL tells you where to go to view the logs in a browser



Tsung

Let's SSH into our tsung instance

```
~/credentials >>> ssh -i demo.pem ec2-user@ec2-52-24-67-201.us-west-2.compute.amazonaws.com
Last login: Mon May  4 04:34:42 2015 from cpe-172-250-57-243.socal.res.rr.com

      _|_ _|_
     -| (   /
      __| \__|__| Amazon Linux AMI

https://aws.amazon.com/amazon-linux-ami/2014.09-release-notes/
20 package(s) needed for security, out of 120 available
Run "sudo yum update" to apply all updates.
Amazon Linux version 2015.03 is available.
[ec2-user@ip-172-31-24-226 ~]$ ls -l
total 65628
drwxr-xr-x 12 ec2-user ec2-user      4096 May  4 04:33 app
drwxrwxr-x  4 ec2-user ec2-user      4096 May  4 02:01 opt
drwxrwxr-x 11 ec2-user ec2-user      4096 May  4 01:52 otp_src_R16B03-1
-rw-rw-r--  1 ec2-user ec2-user 66253556 Jan 24 2014 otp_src_R16B03-1.tar.gz
-rw-rw-r--  1 ec2-user ec2-user     1086 May  4 02:14 test.xml
drwxr-xr-x  9 ec2-user ec2-user      4096 May  4 02:01 tsung-1.5.0
-rw-rw-r--  1 ec2-user ec2-user  925026 May 24 2013 tsung-1.5.0.tar.gz
```



Tsung

opt, otp_src_R16B03-1, otp_src_R16B03-1.tar.gz, tsung-1.5.0, tsung-1.5.0.tar.gz can be ignored. They are the installed version of erlang and tsung.

```
~/credentials >>> ssh -i demo.pem ec2-user@ec2-52-24-67-201.us-west-2.compute.amazonaws.com
Last login: Mon May  4 04:34:42 2015 from cpe-172-250-57-243.socal.res.rr.com

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Tsung

“app” is your rails application. You can easily access performance tests in here.

“test.xml” is a simple tsung config that will benchmark www.google.com

```
~/credentials >>> ssh -i demo.pem ec2-user@ec2-52-24-67-201.us-west-2.compute.amazonaws.com
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drwxrwxr-x  4 ec2-user ec2-user      4096 May  4 02:01 opt
drwxrwxr-x 11 ec2-user ec2-user      4096 May  4 01:52 otp_src_R16B03-1
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```

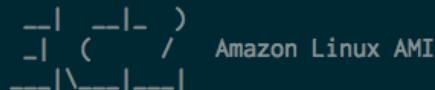


Tsung

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```
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Last login: Mon May  4 04:34:42 2015 from cpe-172-250-57-243.socal.res.rr.com
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-rw-rw-r--  1 ec2-user ec2-user   925026 May 24 2013 tsung-1.5.0.tar.gz
```



Tsung

Let's kick the tires by testing how www.google.com responds to light load:

```
tsung -f test.xml start
```

```
[ec2-user@ip-172-31-24-226 ~]$ tsung -f test.xml start
Starting Tsung
"Log directory is: /home/ec2-user/.tsung/log/20150504-0444"
[ec2-user@ip-172-31-24-226 ~]$ cd /home/ec2-user/.tsung/log/20150504-0444
[ec2-user@ip-172-31-24-226 20150504-0444]$ tsung_stats.pl
creating subdirectory data
creating subdirectory gnuplot_scripts
creating subdirectory images
warn, last interval (5) not equal to the first, use the first one (10)
No data for Bosh
No data for Match
No data for Event
No data for Async
No data for Errors
```



Tsung

This will take a little time to run. Afterwards we compile the report:

```
cd /home/ec2-user/.tsung/log/20150504-0444; tsung_stats.pl
```

```
[ec2-user@ip-172-31-24-226 ~]$ tsung -f test.xml start
Starting Tsung
"Log directory is: /home/ec2-user/.tsung/log/20150504-0444"
[ec2-user@ip-172-31-24-226 ~]$ cd /home/ec2-user/.tsung/log/20150504-0444
[ec2-user@ip-172-31-24-226 20150504-0444]$ tsung_stats.pl
creating subdirectory data
creating subdirectory gnuplot_scripts
creating subdirectory images
warn, last interval (5) not equal to the first, use the first one (10)
No data for Bosh
No data for Match
No data for Event
No data for Async
No data for Errors
```



Tsung

Once we have compiled the report, switch over to the web interface:

Overview	Outputs	Resources	Events	Template	Parameters	Tags	Stack Policy			
Key	Value					Description				
SSH	ssh -i demo.pem ec2-user@ec2-52-24-67-201.us-west-2.compute.amazonaws.com					AppServer SSH connect string				
URL	http://ec2-52-24-67-201.us-west-2.compute.amazonaws.com					The URL to the rails application.				



This just serves up the files from `~/.tsung/log/` through a web interface



Tsung

Once we have compiled the report, switch over to the web interface:

Index of /

<u>Name</u>	<u>Last modified</u>
Parent Directory	2015/05/04 02:14
20150504-0444/	2015/05/04 04:47

WEBrick/1.3.1 (Ruby/2.1.5/2014-11-13)
at ec2-52-24-67-201.us-west-2.compute.amazonaws.com:80



Tsung

Once we have compiled the report, switch over to the web interface:

Index of /20150504-0444/

<u>Name</u>	<u>Last modified</u>
Parent Directory	2015/05/04 04:44
data/	2015/05/04 04:47
gnuplot.log	2015/05/04 04:47
gnuplot_scripts/	2015/05/04 04:47
graph.html	2015/05/04 04:47
images/	2015/05/04 04:47
match.log	2015/05/04 04:44
report.html	2015/05/04 04:47
test.xml	2015/05/04 04:44
tsung.log	2015/05/04 04:45
tsung_controller@ip-172..	2015/05/04 04:45



WEBrick/1.3.1 (Ruby/2.1.5/2014-11-13)
at ec2-52-24-67-201.us-west-2.compute.amazonaws.com:80



Tsung

Once we have compiled the report, switch over to the web interface:

Tsung

version 1.5.0

Stats Report

- Main statistics
- Transactions
- Network Throughput
- Counters
- HTTP status

Graphs Report

- Response times
- Throughput graphs
- Simultaneous Users
- HTTP status

XML Config file

tsung - Statistics

Main Statistics

Name	highest	10sec mean	lowest	10sec mean	Highest Rate	Mean	Count
connect	0.42 sec	9.26 msec	0.5 / sec	0.35 sec	6		
page	0.57 sec	66.26 msec	0.4 / sec	0.40 sec	6		
request	0.57 sec	66.26 msec	0.4 / sec	0.40 sec	6		
session	0.48 sec	68.15 msec	0.5 / sec	0.41 sec	6		

Transactions Statistics

Name	highest	10sec mean	lowest	10sec mean	Highest Rate	Mean	Count

Network Throughput

Name	Highest Rate	Total
size_rcv	68.01 Kbits/sec	127.47 KB
size_sent	560 bits/sec	840 B

Counters Statistics

Name	Highest Rate	Total	number

Name Max

Name	Max
connected	1
finish_users_count	6
users	2
users_count	6

HTTP return code

Code	Highest Rate	Total	number
200	0.4 / sec	6	

We will go over this report
in more detail later today



Tsung - test.xml

Let's go over the basic xml file:

```
<?xml version="1.0"?><tsung loglevel="notice" version="1.0">  
  <clients>  
    <client host="localhost" use_controller_vm="true" maxusers="15000"/>  
  </clients>  
  <servers>  
    <server host="www.google.com" port="80" type="tcp"/>  
  </servers>  
  <load>  
    <arrivalphase phase="1" duration="10" unit="second">  
      <users arrivalrate="1" unit="second"/>  
    </arrivalphase>  
  </load>
```



Tsung - test.xml

XML Boilerplate

```
<?xml version="1.0"?><tsung loglevel="notice" version="1.0">  
  <clients>  
    <client host="localhost" use_controller_vm="true" maxusers="15000"/>  
  </clients>  
  <servers>  
    <server host="www.google.com" port="80" type="tcp"/>  
  </servers>  
  <load>  
    <arrivalphase phase="1" duration="10" unit="second">  
      <users arrivalrate="1" unit="second"/>  
    </arrivalphase>  
  </load>
```



Tsung - test.xml

Client-side configuration. Maxusers is the maximum number of simulated users.

```
<?xml version="1.0"?><tsung loglevel="notice" version="1.0">  
  <clients>  
    <client host="localhost" use_controller_vm="true" maxusers="15000"/>  
  </clients>  
  <servers>  
    <server host="www.google.com" port="80" type="tcp"/>  
  </servers>  
  <load>  
    <arrivalphase phase="1" duration="10" unit="second">  
      <users arrivalrate="1" unit="second"/>  
    </arrivalphase>  
  </load>
```



Tsung - test.xml

Server configuration: where we are directing load.

```
<?xml version="1.0"?><tsung loglevel="notice" version="1.0">
<clients>
  <client host="localhost" use_controller_vm="true" maxusers="15000"/>
</clients>
<servers>
  <server host="www.google.com" port="80" type="tcp"/>
</servers>
<load>
  <arrivalphase phase="1" duration="10" unit="second">
    <users arrivalrate="1" unit="second"/>
  </arrivalphase>
</load>
```



Tsung - test.xml

Defining phases of user arrival rates

```
<?xml version="1.0"?><tsung loglevel="notice" version="1.0">  
  <clients>  
    <client host="localhost" use_controller_vm="true" maxusers="15000"/>  
  </clients>  
  <servers>  
    <server host="www.google.com" port="80" type="tcp"/>  
  </servers>  
  <load>  
    <arrivalphase phase="1" duration="10" unit="second">  
      <users arrivalrate="1" unit="second"/>  
    </arrivalphase>  
  </load>
```



Tsung - test.xml

A section to set options (timeouts, useragents)

```
<options>
  <option name="glocal_ack_timeout" value="2000"/>
  <option type="ts_http" name="user_agent">
    <user_agent probability="100">Mozilla/5.0 (Windows; U; Windows NT 5.2; fr-FR; rv:1.7.8) Gecko/20050511 Firefox/1.0.4</user_agent>
  </option>
</options>
<sessions>
  <session name="http-example" probability="100" type="ts_http">
    <request>
      <http url="/" version="1.1" method="GET"/>
    </request>
  </session>
</sessions>
</tsung>
```



Tsung - test.xml

We define the actual series of requests that a user will perform.

```
<options>
  <option name="glocal_ack_timeout" value="2000"/>
  <option type="ts_http" name="user_agent">
    <user_agent probability="100">Mozilla/5.0 (Windows; U; Windows NT 5.2; fr-FR; rv:1.7.8) Gecko/20050511 Firefox/1.
0.4</user_agent>
  </option>
</options>
<sessions>
  <session name="http-example" probability="100" type="ts_http">
    <request>
      <http url="/" version="1.1" method="GET"/>
    </request>
  </session>
</sessions>
</tsung>
```



Tsung - test.xml

Lets change our tests to point to our server

```
<?xml version="1.0"?><tsung loglevel="notice" version="1.0">
<clients>
  <client host="localhost" use_controller_vm="true" maxusers="15000"/>
</clients>
<servers>
  <server host="ec2-52-24-120-129.us-west-2.compute.amazonaws.com" port="80" type="tcp"/>
</servers>
<load>
  <arrivalphase phase="1" duration="10" unit="second">
    <users arrivalrate="1" unit="second"/>
  </arrivalphase>
</load>
```



Tsung - test.xml

```
<load>
  <arrivalphase phase="1" duration="30" unit="second">
    <users arrivalrate="1" unit="second"></users>
  </arrivalphase>
  <arrivalphase phase="2" duration="30" unit="second">
    <users arrivalrate="2" unit="second"></users>
  </arrivalphase>
  <arrivalphase phase="3" duration="30" unit="second">
    <users arrivalrate="4" unit="second"></users>
  </arrivalphase>
  <arrivalphase phase="4" duration="30" unit="second">
    <users arrivalrate="8" unit="second"></users>
  </arrivalphase>
</load>
```

For examples of more complex load testing, see the demo app's [`load_tests/critical.xml`](#)

Increasing the rate of user creation over time.



Tsung - test.xml

```
<load>
  <arrivalphase phase="1" duration="30" unit="second">
    <users arrivalrate="1" unit="second"></users>
  </arrivalphase>
  <arrivalphase phase="2" duration="30" unit="second">
    <users arrivalrate="2" unit="second"></users>
  </arrivalphase>
  <arrivalphase phase="3" duration="30" unit="second">
    <users arrivalrate="4" unit="second"></users>
  </arrivalphase>
  <arrivalphase phase="4" duration="30" unit="second">
    <users arrivalrate="8" unit="second"></users>
  </arrivalphase>
</load>
```

For examples of more complex load testing, see the demo app's [`load_tests/critical.xml`](#)

Increasing the rate of user creation over time.



Tsung - test.xml

```
<sessions>
  <session name="http-example" probability="100" type="ts_http">
    <!-- start out at the dashboard. -->
    <request>
      <http url='/' version='1.1' method='GET'></http>
    </request>
```

For examples of more complex load testing, see the demo app's [load_tests/critical.xml](#)

The session defines the virtual user that you will be simulating.

This one starts at “/”



Tsung - test.xml

For examples of more complex load testing, see the demo app's [load_tests/critical.xml](#)

```
<!-- wait for up to 2 seconds, user is looking at posts -->  
<thinktime value="2" random="true"></thinktime>
```

Insert realistic random wait times in your simulations.



Tsung - test.xml

```
>      <!-- create a random number to make a unique community name -->
<setdynvars sourcetype="random_number" start="1000" end="999999">

    <var name="random_community_name" />
</setdynvars>

<!-- post to /communities to create a community.
     remember the url of the created community so we can delete
it later -->

<request subst="true">
    <http
        url='/communities'
        version='1.1'
        method='POST'          contents='community%5Bname%
5D=community_name_%random_community_name%%amp;
commit=Create+Community'>
        </http>
</request>
```

For examples of more complex load testing, see the demo app's `load_tests/critical.xml`

Deal with uniqueness constraints by defining dynamic variables.

Insert dynamic variables by using `%%` syntax.



Tsung - test.xml

```
<request subst="true">
  <dyn_variable name="created_submission_url" re="[L1]ocation:(http://.*)\r"/>
  <dyn_variable name="created_submission_id" re="[L1]ocation:http://.*/submissions/(.*)\r"/>
  <http
    url='/submissions'
    version='1.1'
    method='POST'
    contents='submission%5Btitle%5D=link_%random_submission_name%%
&submission%5Burl%5D=http%3A%2F%2Fwww.article.com%2F%
_random_submission_name%%amp;submission%5Bcommunity_id%5D=%
_created_community_id%%amp;commit=Create+Submission'>
  </http>
</request>
```

For examples of more complex load testing, see the demo app's `load_tests/critical.xml`

At times, you will need the output of one request to feed into the next.

Use dynamic variables for this



Tsung - test.xml

```
<!-- Uncomment the following to debug print your dynamic variables  
-->  
  
<!--  
  
<setdynvars sourcetype="eval" code="fun( {Pid, DynVars} ) ->  
    io:format([126, $p, 126, $n, 126, $n], [DynVars]),  
    ok end."  
    <var name="dump" />  
</setdynvars>  
-->
```

For examples of more complex load testing, see the demo app's [load_tests/critical.xml](#)

If you have difficulty with your dynamic variables, use this code to debug



Tsung - test.xml

Name
submissions
S1
application-f3e64a74b7ab4dff6d9d9f6f8038945dd.css
application-f221elec5ab975eedbb83b9e995b0d3.js
bootstrap.min.css
bootstrap-theme.min.css
bootstrap.min.js
nr-632.min.js
33e249c12fba=5272963&pl=1430718915465&v=632.2b17625&to=jQ5dQUUWWwvR...
favicon.ico

X Headers Preview Response Cookies Timing

General
Remote Address: 52.42.120.129:80
Request URL: http://ec2-52-24-120-129.us-west-2.compute.amazonaws.com/submissions
Request Method: POST
Status Code: 302 Found

Response Headers
Cache-Control: no-cache
Connection: Keep-Alive
Content-Length: 137
Content-Type: text/html; charset=utf-8
Date: Mon, 04 May 2015 05:55:15 GMT
Location: http://ec2-52-24-120-129.us-west-2.compute.amazonaws.com/submissions/51
Server: WEBrick/1.3.1 (Ruby/2.1.5/2014-11-13)

Set-Cookie: _demo_session=0UuuyenRoclVD@0zb1nhNfwuXZNZVzd300BgdxZ5bEVnZGhb0hjahZ4VEpITy9WNG0wb0M2k24yUmP0dm1WeEpGVHFKgDSLcTfFnSmLlNGFF0TVYjZ2aFfCfLB2D3JMezanlYUljTDy09rNx0dWra1rdmZnEw51gSrLWv3HQNCNCV1JWh1LM4yU2UNvMnzsDh0QkwUSU5INhK53NWhVTfPfINXBEdFRVpVld3p3lZvSEUE1dG1nQ3RJdH0BQjkWa92MnxLeF12RzRJY1cxdf1FwcvQmNbd1RE9XdgAxV2NCTEBzefNvMnbvQwpPNzVXbmZuJxuZzdrdpmhwKxKwFjWnV12yCSUixaZwC9p50tzcZPahoyV3cd43FcCamxul2dhevZadz09--3ec242e7eb210b1c8177fb2da1b21130de34146; path=/; HttpOnly
Set-Cookie: request_method=POST; path=/
X-Content-Type-Options: nosniff
X-Frame-Options: SAMEORIGIN
X-Request-Id: 65906fbc-b0f7-4587-892c-1e0e7e7c81b4
X-Runtime: 0.029938
X-Xss-Protection: 1; mode=block

Request Headers
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.8
Cache-Control: max-age=0
Connection: keep-alive
Content-Length: 274
Content-Type: application/x-www-form-urlencoded
Cookie: _demo_session=0m0vb3FiehJa0DnjWgDMEf3VXkrRfVHk2h4b0Rs0E84eUhGMjV1M1BMa2BuRvgxUfEw1cTNjV2xLShzNTROtUx010dqfTYNhkd2zUf52m55; ZCYzAvk2ouzXrb1ySm1jCE9Y0wIHb09uUmxCM3VRTG1b0ZB0Fe79NZXRVeK1ZNa0pYH14am1veVheH3PT0tlLXFZS02zNEtjdRGSlp1dE5X0GSTR3c9P0%30%-6178d6767929765833c05bed79338bde59645a
Host: ec2-52-24-120-129.us-west-2.compute.amazonaws.com

Form Data

[view source](#)

[view decoded](#)

utf8: %E2%9C%93

authenticity_token: yQ87%2F0xfj%2BkNMJ5Lp6r0hs60BeED1lFY25HeJrf0jL9j7qdVuSRPCJ8Q0Ii8ZD8x%2Fe46eIS9czkQ0

GHFgCzQQQ%3D%3D

submission%5Btitle%5D: this+is+a+test

submission%5Burl%5D: http%3A%2F%2Fwww.testing.com

submission%5Bcommunity_id%5D: 1

commit: Create+Submission

For examples of more complex load testing, see the demo app's `load_tests/critical.xml`

If you are unsure how to simulate your application, use the browser to get a firm idea of the exact HTTP requests.



Tsung - test.xml

At any point in time you can see how tsung is doing, by typing “tsung status” from another terminal



Tsung - Output

Main Statistics					
Name	highest 10sec mean	lowest 10sec mean	Highest Rate	Mean	Count
connect	0.42 sec	9.26 msec	0.5 / sec	0.35 sec	6
page	0.57 sec	66.26 msec	0.4 / sec	0.40 sec	6
request	0.57 sec	66.26 msec	0.4 / sec	0.40 sec	6
session	0.48 sec	68.15 msec	0.5 / sec	0.41 sec	6

- **request** Response time for each request.
- **page** Response time for each set of requests (a page is a group of request not separated by a thinktime).
- **connect** Duration of the connection establishment.
- **session** Duration of a user's session.



Tsung - Output

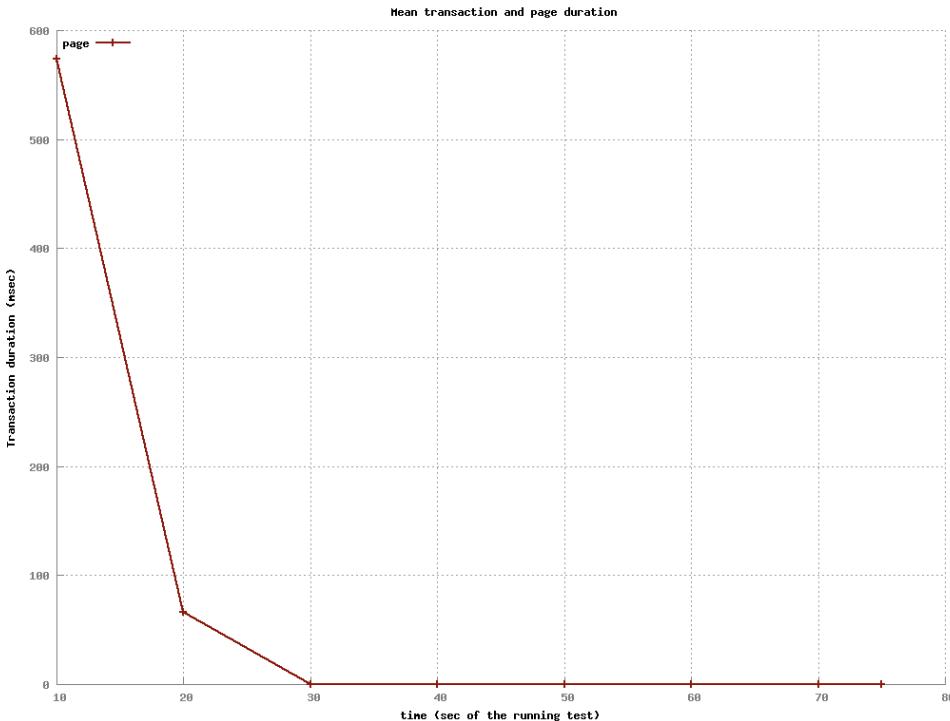
HTTP return code

Code	Highest Rate	Total number
200	0.4 / sec	6

- Make sure you are getting back good status codes.
 - 200s and 300s are good
 - 400s and 500s are usually bad



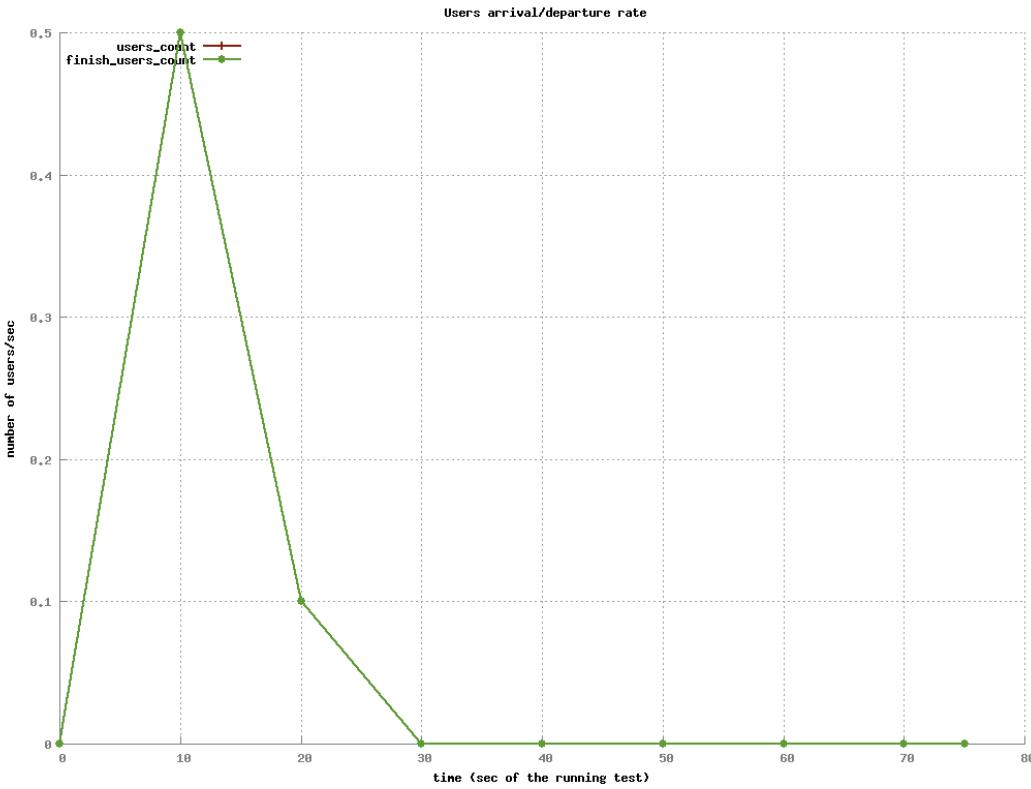
Tsung - Output



Mean transaction and page duration will show you response time over time.



Tsung - Output

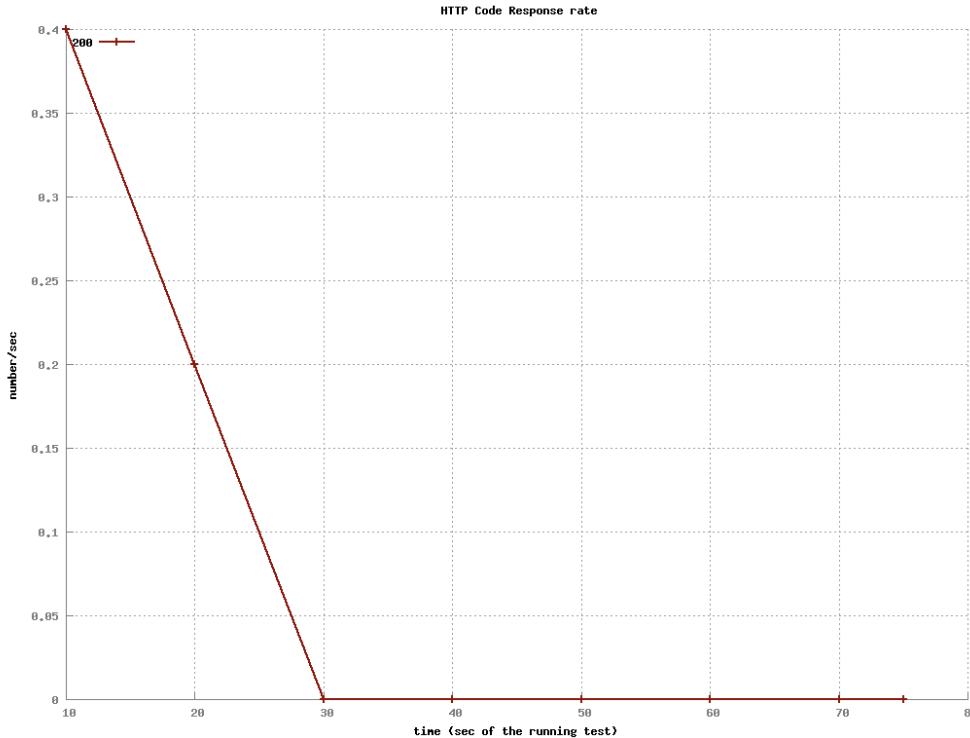


User arrival rate vs. departure rate is important.

You want these to move together. If users stop departing this indicates problems.



Tsung - Output



HTTP response code over time
can show you when your
deployment is past capacity



Tsung

Always remember that your Tsung instances can be taken down at any time (by me), so please scp off any important data or results immediately.



For Next Time...

Read the two papers linked on the course website:

- CAP 12 years later by Eric Brewer,
- Eventually Consistent by Werner Vogels

Attempt to create a simple load testing script for your current app

Keep completing stories!

