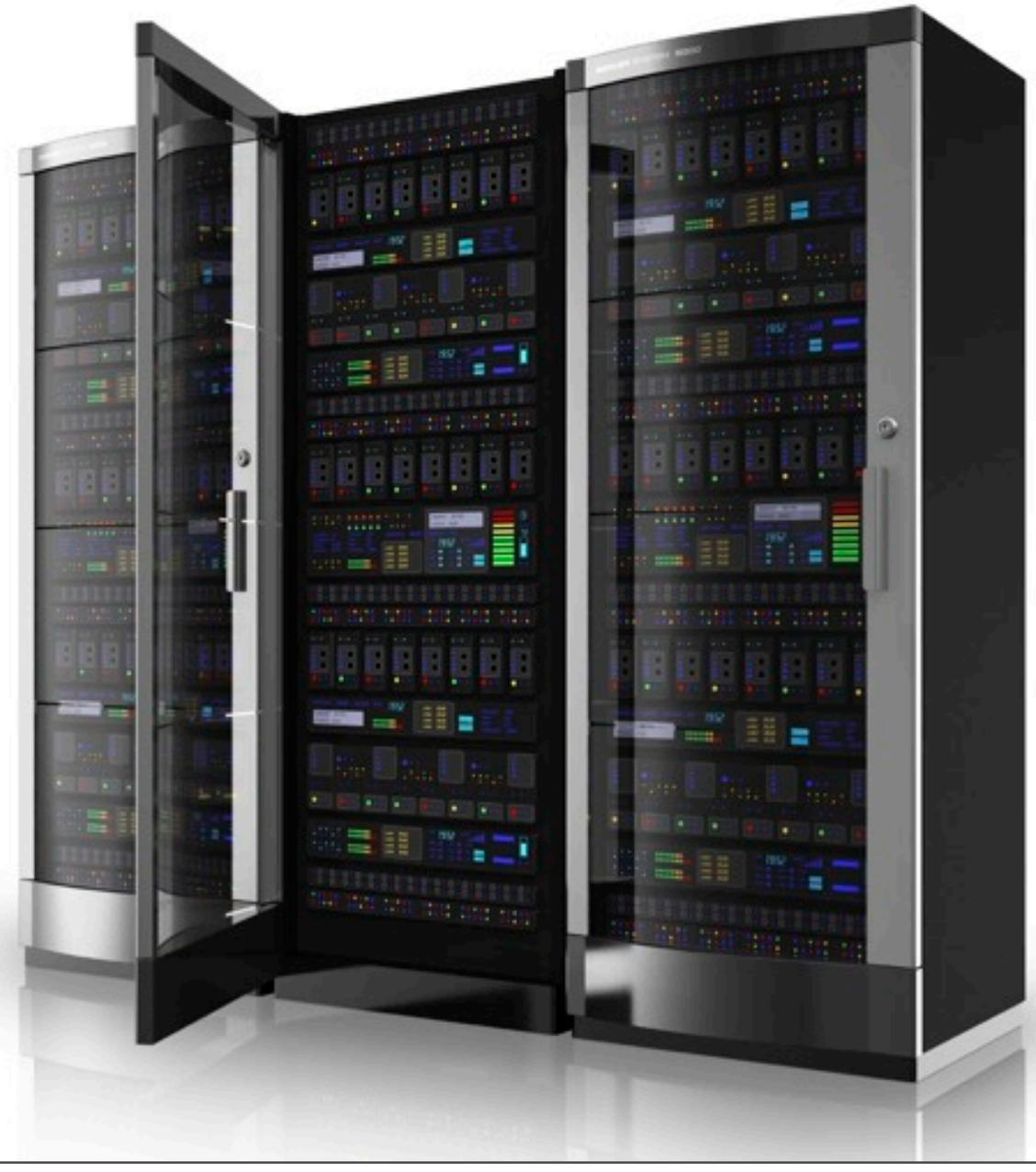
Using JMeter for Testing a Data Center



Siegfried Goeschl

"Siegfried, do you want to do some performance testing?"

"Well, what would you like to test?"

"Some Data Centers with 300 servers, MSSQL clusters, Oracle RACs, large SAN storage, 1.5 million registered users, 750 call center agents, backup data center over dark fiber"

The Challenge Ahead

- Performance testing on critical path
  - Prohibitive contractual penalties
- Lots of politics and finger-pointing
  - "*Your performance tests are broken*"
- Complex test scenarios
  - Often broken by new deployment

Performance Test Scope

- End to end performance acceptance test
- Mandatory and client-witnessed test
- Strict acceptance criteria regarding
  - throughput
  - number of errors
  - severity of errors

Subsystems Under Test

- Transaction web service interface processing 10,5 million transactions per day
- CRM web service interfaces being used by 750 concurrent call center agents
- Public self-care web portal supporting 400 concurrent & active web user sessions

Performance Test Types

Baseline Test	One hour average load
Stress Test	One hour peak load
Endurance Test	24 hours maximum load

Performance Test Tools

Subsystem	Planned	Delivered
CRM Web Service	JMeter	JMeter
Public Web Portal	JMeter	WAPTPRO
Transaction Interface	soapUI pro	JMeter

Testing Hardware

- Six dedicated load injectors
  - Windows 2008 Server
  - 3 physical and 3 virtual boxes
  - Dual quad-cores with 8 GB RAM
- No direct access
  - Citrix over RDP over RDP

What Is JMeter?

- Performance Test Tool
  - Web Testing (HTTP/HTTPS)
  - SOAP
  - JDBC, LDAP, SMTP, JMS, ...

Why Using JMeter?

- It's coming from the ASF
- Field-tested software
- No costs for virtual users
- Extensible using scripts and Java libraries
- Run from GUI, Ant task and command line

JMeter Goodies

- Proxy server to record script
- Save request and response on error
- Constant Throughput Timer
- Summarizer for non-GUI tests
- Remote shutdown of running tests

Speed Up JMeter

- Use SOAP/XML-RPC Request Sampler
  - faster than WebService(SOAP) Sampler
- Avoid HTTPS when possible
- BeanShell scripts work best
- Minimize scripting
- Move large junks of scripting into libraries

JMeter Ant Integration

```
<jmeter
  jmeterhome="${jmeter.home}"
  testplan="${jmeter.test.script}"
  failureproperty="jmeter.test.failure"
  jmeterproperties="${jmeter.work.dir}/jmeter.properties"
  resultlog="${jmeter.test.result}">
  <jvmarg value="-Xmx${jmeter.memory.max}" />
  <jvmarg value="-Dsun.security.ssl.allowUnsafeRenegotiation=true" />
  <property name="jmeterengine.nongui.port" value="${nongui.port}"/>
  <property name="log_file" value="${jmeter.report.dir}/jmeter.log"/>
  <property name="user.language" value="en"/>
</jmeter>
```

Things We Did To JMeter

- Three million WS requests over HTTPS requests where the server closes the socket after each request
- Sending up to 400 SOAP requests / sec
- Sending 400 KB SOAP requests
  - 70 MByte/sec over the wire
- Using up to 750 worker threads per JVM
  - 64-bit JVM with -Xmx=2048M

JMeter Reporting ASP.NET Website

JMeter Reporting

- No “Service Level Agreement” reporting
- HTML reports done using XSLT
- XSLT does not scale
  - We have huge JMeter result files
  - Unable to create formal test report

JMeter Reporting

Load Test Results

Designed for use with JMeter and Ant.

Summary

Tests	Failures	Success Rate	Average Time	Min Time	Max Time
8,997,465	58	99.9994 %	41 ms	2 ms	119,058 ms

Result of a 2,6 GByte JTL File

JMeter SLA Report

- Merge multiple JTL files
- StAX parser to process large JTL file
- Statistic processing done by JAMon
- HTML export of JAMon model
- Available under https://github.com/sgoeschl/jmeter-sla-report

Summary

Tests	Failures	Success Rate	Average Time	Min Time
435,410	0	100.0000 %	785 ms	8 ms

Pages Overview (ms)

Label	Tests	Avg	Total	StdDev	Min Time	Max Time	First Access	L
Initialize	1	213	213	0	213	213	22:12:02	
Video:InsertTo	112,800	724	81,707,461	550	13	12,785	22:12:03	
Video:InsertVe	112,800	820	92,491,768	627	15	12,875	22:12:03	
Video:InsertIn	112,800	826	93,181,050	638	53	30,686	22:12:03	
OBU:InsertTol	48,504	724	35,118,713	529	13	12,593	22:12:03	
OBU:InsertVeh	48,504	811	39,314,347	616	16	12,830	22:12:03	
Dispose	1	8	8	0	8	8	23:44:08	

Pages Detail Table (ms)

Label	Tests	0-10	10-20	20-40	40-80	80-160	160-320	320-640	640-1280	1280-2560	2560-5120
Initialize	1						1/213				
Video:InsertT	112,800		536/17.4	6,011/29.8	11,272/59.1	8,173/106.8	2,057/213.4	5,381/556.4	73,641/868.6	4,246/1,777.3	1,444/3,179.1
Video:InsertV	112,800		188/18.1	4,972/30.5	10,212/59.6	9,783/109.2	2,519/212.5	2,897/530.5	72,416/950.1	7,570/1,575.2	2,182/3,294.1
Video:InsertIr	112,800				564/71.5	11,979/125.6	13,441/212.9	3,293/474.6	76,237/939.8	5,855/1,666.7	1,294/3,286.6
OBU:InsertTo	48,504		226/17.5	2,510/30.3	4,702/59.1	3,632/107.8	979/211.9	2,258/555.7	31,754/870.8	1,856/1,787.5	577/3,165.1
OBU:InsertVe	48,504		73/18.3	2,267/30.1	4,708/59.5	3,898/108	984/211.6	1,328/533	31,362/945.6	2,978/1,618.8	882/3,275
Dispose	1	1/8									

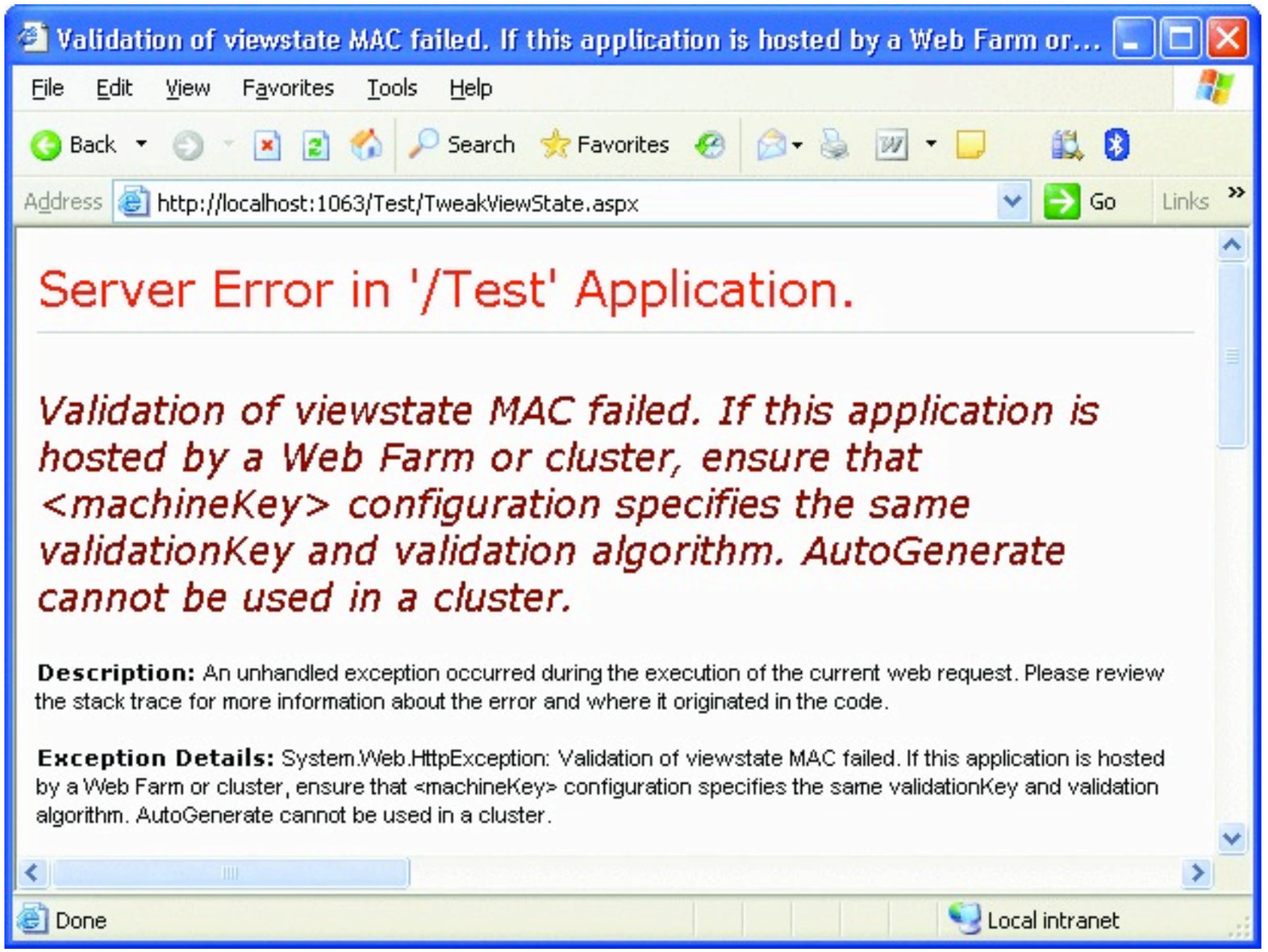
Report Properties

Key	Value
Test Start Date	Sun Sep 25 22:12:02 UTC 2011
Test End Date	Sun Sep 25 23:44:08 UTC 2011
Test Duration (sec)	5,526

JMeter SLA Report

```
<java
  classname="org.apache.jmeter.extra.report.sla.Main"
  classpathref="jmeter.class.path">
  <sysproperty key="jmeter.thread.count" value="..."/>
  <sysproperty key="jmeter.thread.rampup" value="..."/>
  <sysproperty key="jmeter.thread.loops" value="..."/>
  <sysproperty key="jmeter.server.endpoint" value="..."/>
  <arg value="${jmeter.test.summary-report}"/>
  <arg value="${jmeter.test.result}"/>
</java>
```

ASP.NET Web Sites



ASP.NET Web Sites

- Hidden fields and JavaScript parameters
  - ViewState
  - EventValidation
  - EventTarget
- ASP.NET security features
- Ajax calls

ASP.NET Web Sites

- Customer registration increased from 8 to 32 HTTP requests over a few weeks
- “ViewState Errors” were popping up after each and every release
- Impossible to fix broken scripts under pressure

ASP.NET Web Sites

- Switched from JMeter to WAPT Pro with ASP.NET module
  - 4-6 hours to write new script
  - Disabled security ASP.NET feature since we still got errors under heavy load

Some More Thoughts

- Test your test tools
- No software installation
- Take two (or more)
- Automation is your friend
- Performance test for everyone

Test Your Test Tools

- Tests tools are buggy
  - Multi-threading issues with soapUI Pro
  - Multi-threading issues with WAPT Pro
  - Replaced soapUI Pro with JMeter

No Software Installation

- Portable Apps on USB Stick
  - Run JMeter directly from USB Stick
  - Clone USB Stick to hard disk
- Have all your tools on the USB stick
  - Editor, Portable Git, ...

Take Two (or more)

- A minimum of two share-nothing load injectors are required to prove that the servers is causing the performance bottleneck (and not your test tool)
- We used a maximum of five share-nothing load injectors simultaneously

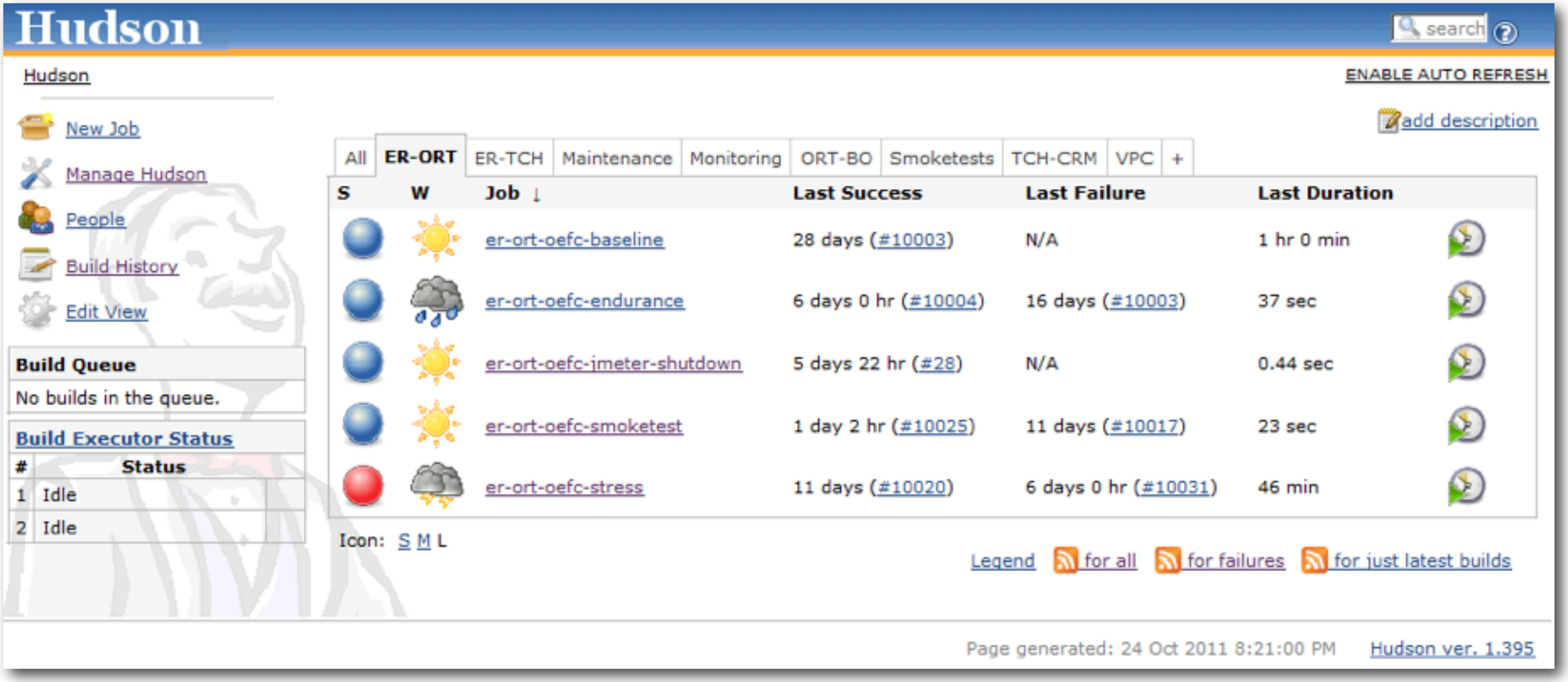
Automation Is Your Friend

- Testing at night and over the weekend
- Test execution managed by Hudson
- Test failures triggers email notification
- Test protocols are copied to FTP server

Performance Tests for Everyone

- All test scenarios are configured as Hudson jobs
  - Baseline, stress & endurance test
- Everyone can start and monitor a performance test scenario over the web browser
- Even developers can run performance tests

Performance Tests for Everyone



Hudson

Hudson » er-tch-crm-endurance » #10000

- Back to Project
- Status
- Changes
- **Console Output**
- Configure

Executed Ant Targets

- jmeter
- jmeter:info
- jmeter:clean
- jmeter:setup
- jmeter:setup
- jmeter:run

Console Output

```
Started by user anonymous
[erm] $ cmd.exe /C '"ant.bat -file build.xml -Djmeter.timer.before.inbound.activity=7000 -Djmeter.thread.rampup=600 -Djmeter.thread.count=257 -
Denvironment.baseUrl=https://                    443/ -Djmeter.thread.loops=168 -DBUILD_TAG=${BUILD_TAG} -Djmeter.timer.before.account.activity=
jmeter:fail-on-error && exit %%ERRORLEVEL%%"'
Buildfile: K:\work\        \loadtest\modules\tch\crm\build.xml

jmeter:

jmeter:info:
     [echo] BUILD_TAG                          = hudson-er-tch-crm-endurance-10000
     [echo] environment.baseUrl                = https://                    :443/
     [echo] jmeter.home                        = K:\PortableApps\JavaApps\jakarta-jmeter-2.4
     [echo] jmeter.work.dir                    = K:\work\        \loadtest\modules\tch\crm
     [echo] jmeter.configuration               = production
     [echo] jmeter.configuration.dir           = K:\work\        \loadtest\modules\tch\crm/src/jmeter/production
     [echo] jmeter.test.script                 = K:\work\        \loadtest\modules\tch\crm/src/jmeter/callcenter.jmx
     [echo] jmeter.report.dir                  = K:\work\        \loadtest\modules\tch\crm/target/hudson-er-tch-crm-endurance-10000/jmeter
     [echo] jmeter.test.result                 = K:\work\        \loadtest\modules\tch\crm/target/hudson-er-tch-crm-endurance-10000/jmeter/callcent
     [echo] jmeter.thread.count                = 257
     [echo] jmeter.thread.loops                = 168
     [echo] jmeter.thread.rampup               = 600
     [echo] jmeter.ftp.server                  =
     [echo] jmeter.ftp.user                    = perftest2431
     [echo] jmeter.ftp.password                = Ys4v6Gu2
     [echo] jmeter.timer.before.account.activity = 55000 ms
     [echo] jmeter.timer.before.inbound.activity = 7000 ms
     [echo] jmeterengine.nongui.port           = 4445

jmeter:clean:
   [delete] Deleting:                \loadtest\modules\tch\crm\src\jmeter\production\shift.csv
   [delete] Deleting:                \loadtest\modules\tch\crm\src\jmeter\production\shift-close.csv

jmeter:setup:
    [mkdir] Created dir: K:\work\        \loadtest\modules\tch\crm\target\hudson-er-tch-crm-endurance-10000\jmeter

jmeter:setup:

jmeter:run:
   [jmeter] Executing test plan: K:\work\        \loadtest\modules\tch\crm\src\jmeter\callcenter.jmx ==> K:\work\        \loadtest\modules\tch\crm\ta
10000\jmeter\callcenter.jtl
   [jmeter] Creating summariser <summary>
   [jmeter] Created the tree successfully using K:\work\        \loadtest\modules\tch\crm\src\jmeter\callcenter.jmx
   [jmeter] Starting the test @ Sat Jul 02 00:38:02 UTC 2011 (1309567082394)
   [jmeter] Waiting for possible shutdown message on port 4445
   [jmeter] summary +    280 in  58.4s =    4.8/s Avg:    70 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   2446 in 180.0s =   13.6/s Avg:    39 Min:     5 Max:  1062 Err:     0 (0.00%)
   [jmeter] summary =   2726 in 238.4s =   11.4/s Avg:    42 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   5338 in 180.7s =   29.5/s Avg:    36 Min:     4 Max:  1298 Err:     0 (0.00%)
   [jmeter] summary =   8064 in 419.1s =   19.2/s Avg:    38 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   7238 in 180.7s =   40.1/s Avg:    31 Min:     5 Max:  1066 Err:     0 (0.00%)
   [jmeter] summary = 15302 in 599.8s =   25.5/s Avg:    35 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   9177 in 180.8s =   50.7/s Avg:    32 Min:     4 Max:  1544 Err:     0 (0.00%)
   [jmeter] summary = 24479 in 780.6s =   31.4/s Avg:    34 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   8349 in 181.0s =   46.1/s Avg:    27 Min:     4 Max:   939 Err:     0 (0.00%)
   [jmeter] summary = 32828 in 961.4s =   34.1/s Avg:    32 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   8430 in 180.8s =   46.6/s Avg:    28 Min:     4 Max:  1530 Err:     0 (0.00%)
   [jmeter] summary = 41258 in 1142.2s =   36.1/s Avg:    31 Min:     3 Max:  2042 Err:     0 (0.00%)
   [jmeter] summary +   8004 in 180.8s =   44.3/s Avg:    25 Min:     5 Max:  1078 Err:     0 (0.00%)
```

The few things you should take home

Lessons Learned

- Tests tools are buggy
  - Make sure that they work for you
- JMeter is perfectly able to run large performance tests reliably
- JMeter might not be handy for complex web sites
  - Switched from JMeter to WAPT Pro

Lessons Learned

- Performance tests are a valuable asset
  - Testing database failover
  - Testing data center replication & failover
  - Testing different server setups
- Creation and maintenance of complex performance test suite is a project on its own

Questions & Answers

Resources

JMeter SLA Report	**https://github.com/sgoeschl/jmeter-sla-report**
JAMon API	**http://jamonapi.sourceforge.net/**
JMeter ANT Tasks	**http://www.programmerplanet.org/pages/projects/jmeter-ant-task.php**
WAPT Pro	**http://www.loadtestingtool.com**
soapUI	**http://www.soapui.org/**

The Software Stack

JMeter	ANT	Git
soapUI Pro	Hudson	Groovy
WAPT Pro	Portable Apps	JavaScript