

# Performance Testing

**CS585 Software Verification and Validation**

**February 23th, 2015**

**<http://cs585.yusun.io>**

**Dr. Yu Sun**

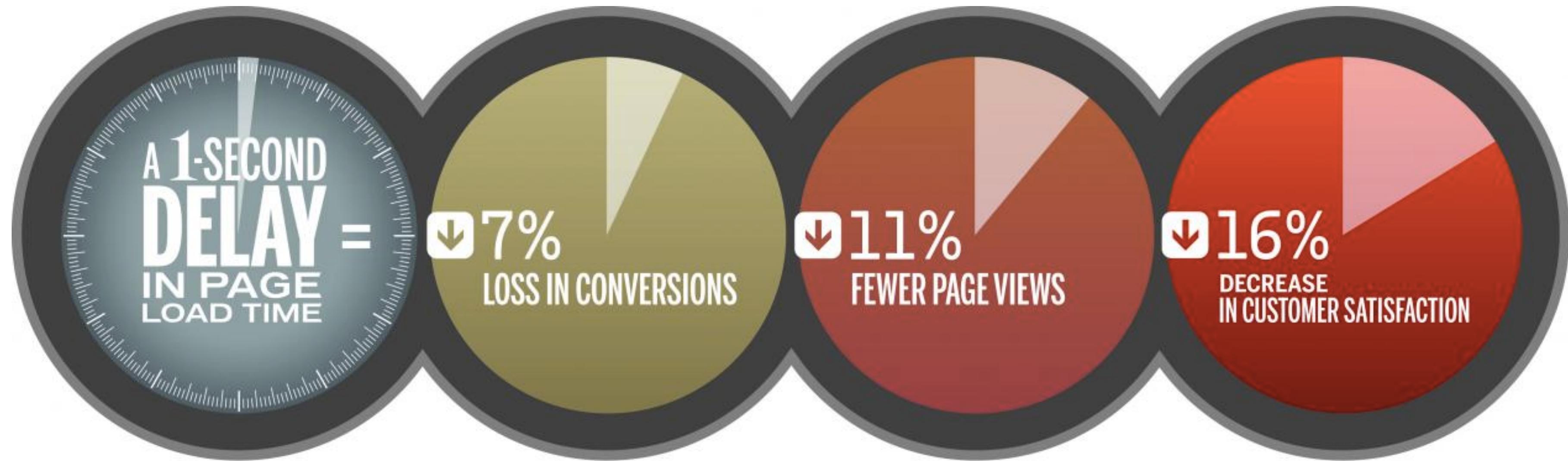
**<http://yusun.io>**

**[yusun@cpp.edu](mailto:yusun@cpp.edu)**



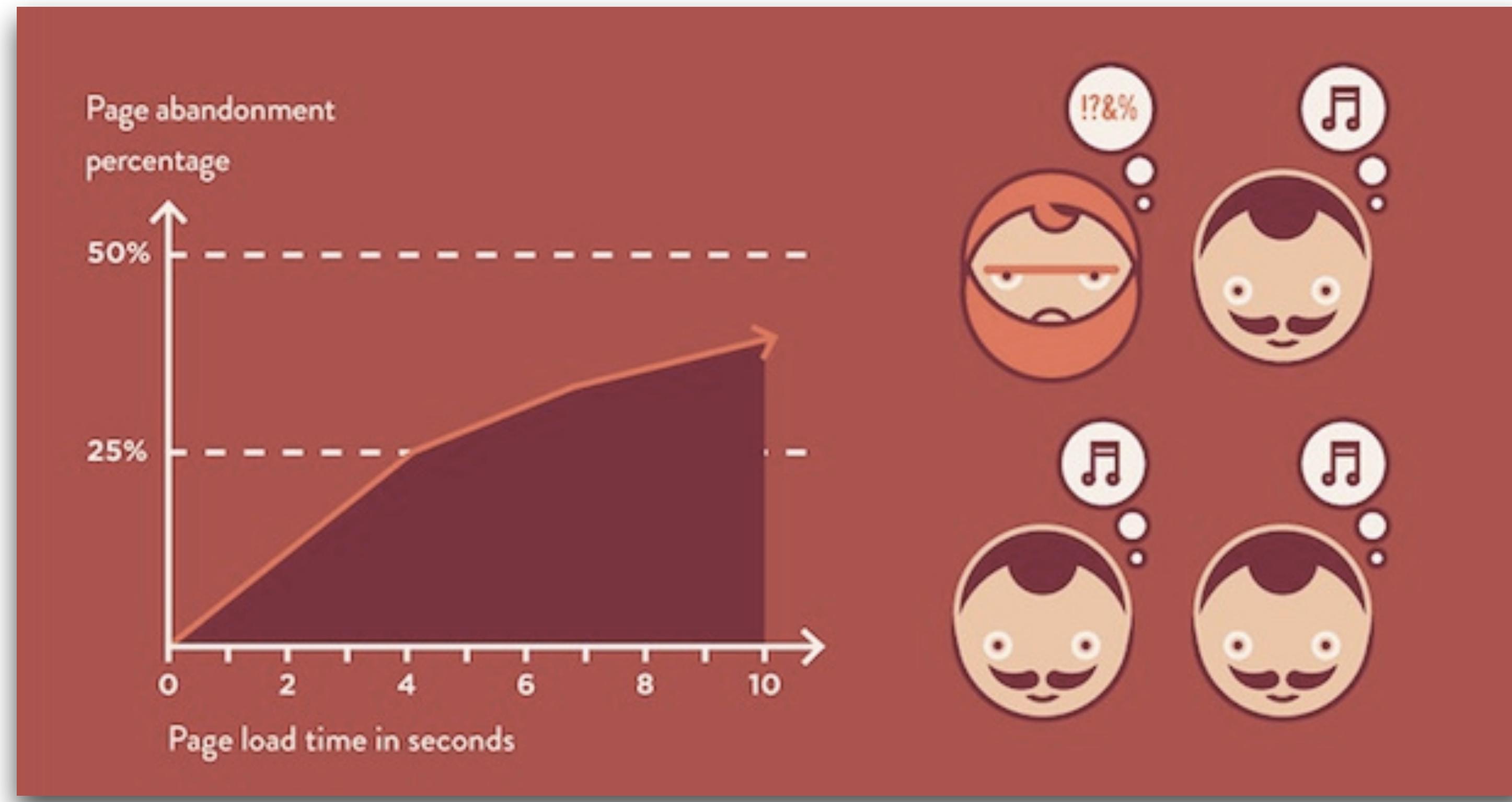
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**CAL POLY POMONA**



**IN DOLLAR TERMS,**  
this means that if your site typically earns \$100,000 a day, this year  
**you could lose \$2.5 MILLION in sales.**

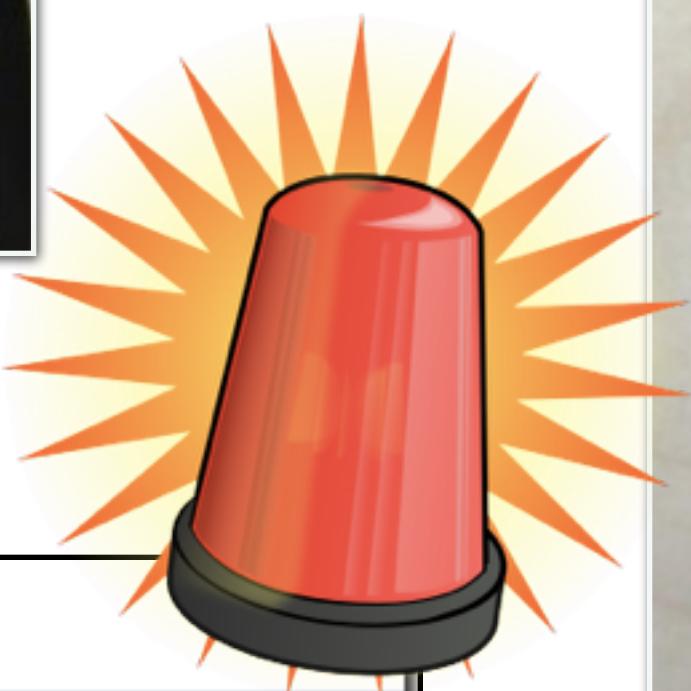
SOURCE: Aberdeen Group



- Amazon: a page load slowdown of just **one second** could cost it **\$1.6 billion** in sales each year.
- Google: by slowing its search results by just **four tenths of a second** they could lose **8 million** searches per day.



Kindle Fire vs iPad



Suggestions

See All

**Brian Willis**  
You and Brian smoke weed and take a dump at the same time every night.  
[Add as Friend](#)

**Tim Martin**  
You and Tim made eye contact at a party you both attended 3 days ago.  
[Add as Friend](#)

**Rachel Cooper**  
You and Rachel haven't had sex in 2 weeks.  
[Set up a date on her Wall](#)

You have a friend suggestion. What's this?

**Friend Suggestions**

Your friend suggestions are generated when one of your friends select you as someone who knows someone else on Facebook. If you add your suggested friends as friends, a normal friend request will be sent. If you do not, no one will be notified that you ignored a suggestion.

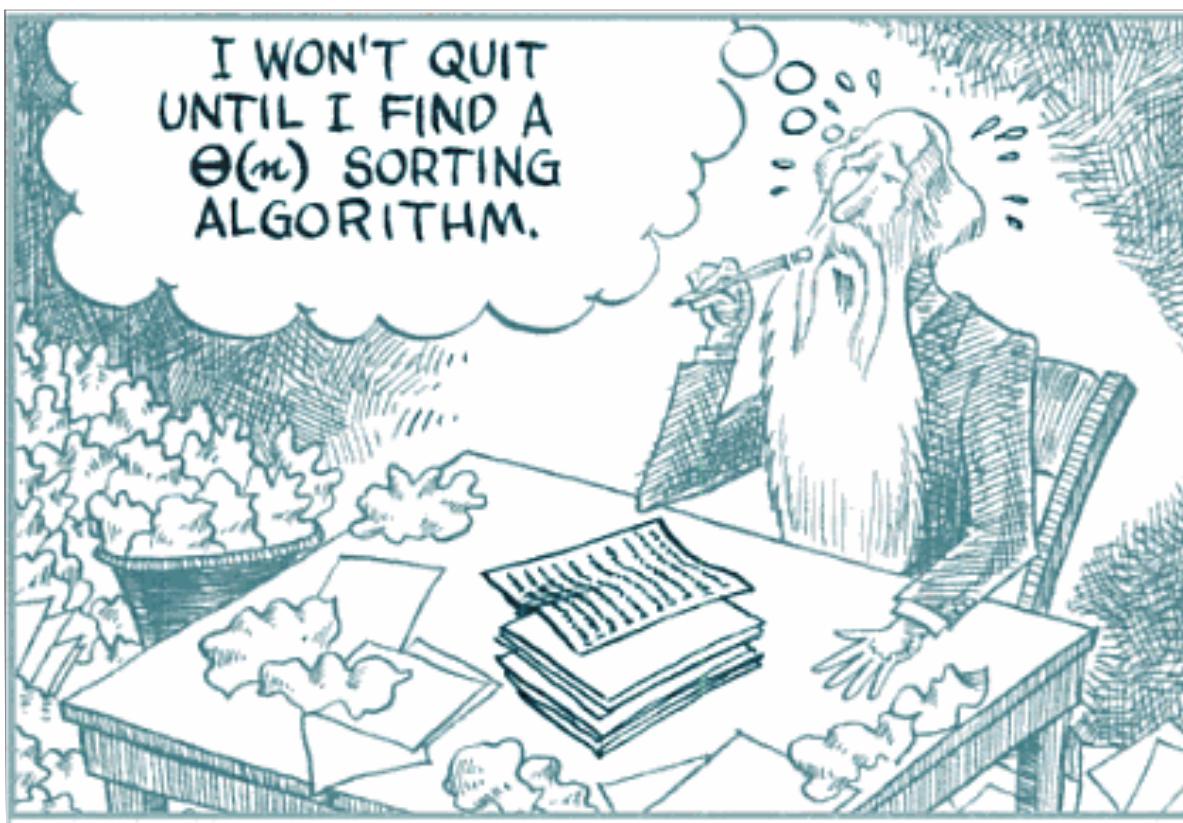
Okay

Facebook Performance Monitoring

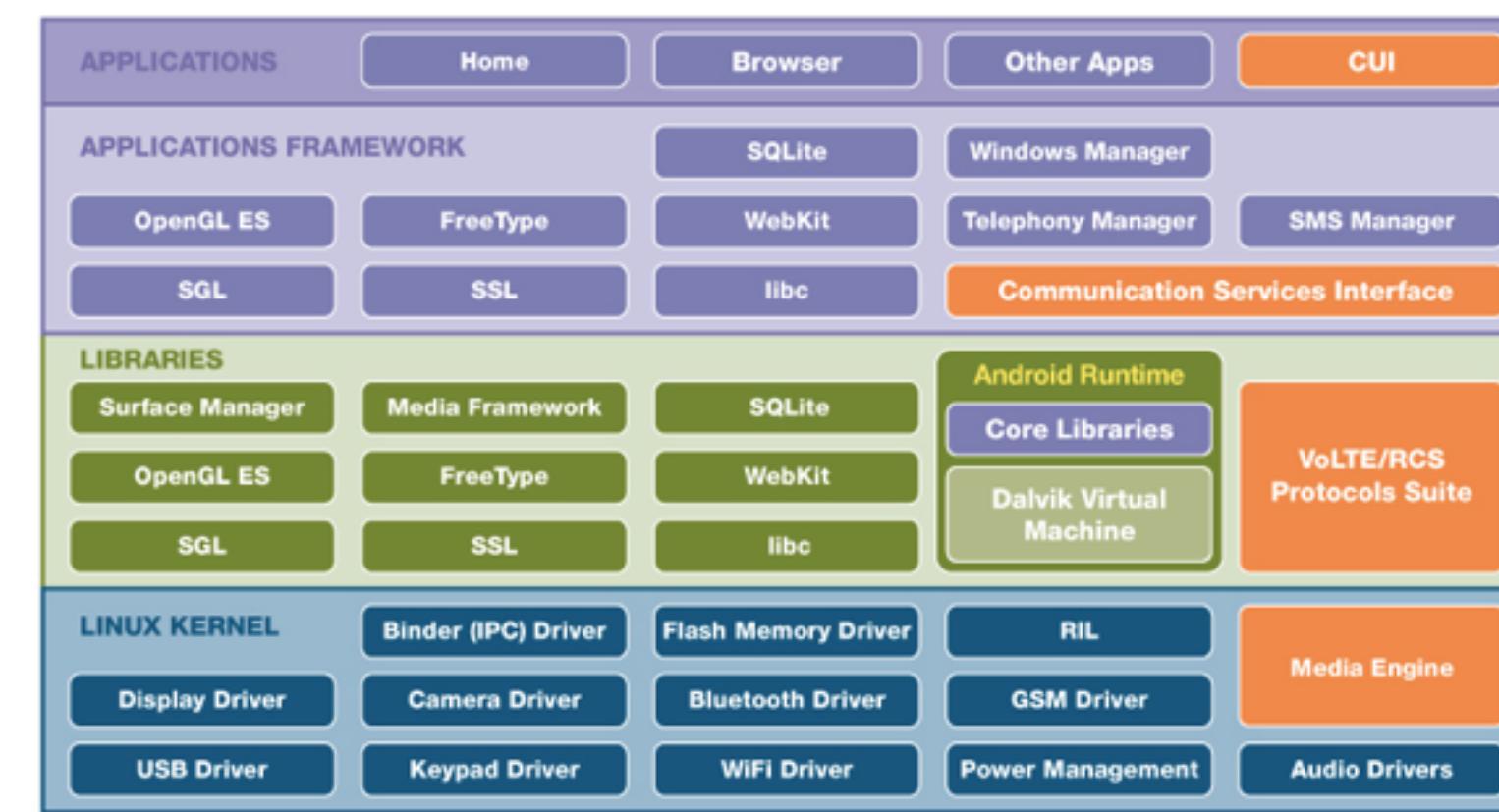


Samsung Android Kernel

# Performance in Different Layers



Modules and Components  
(Code)



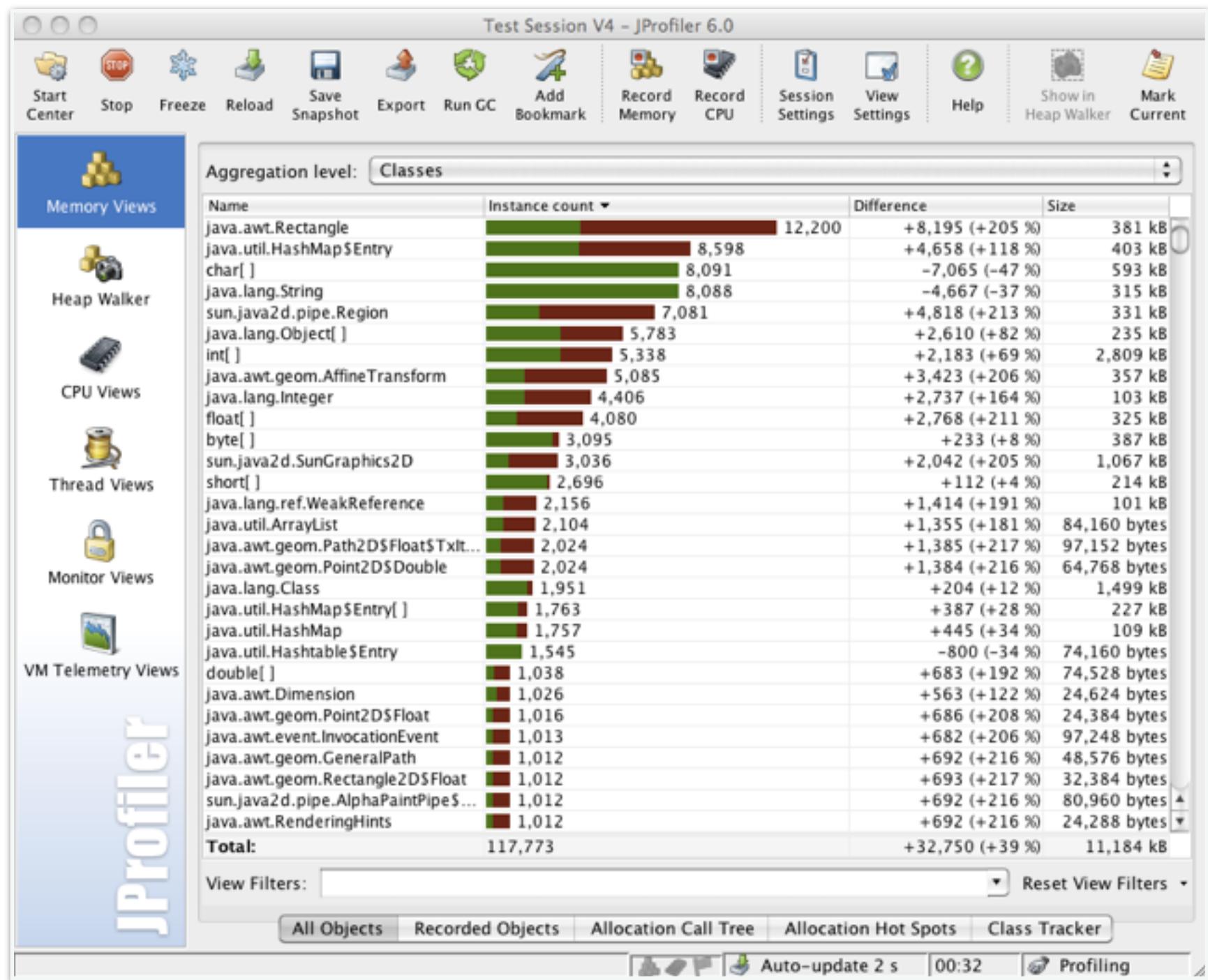
Applications and Services  
(Application)



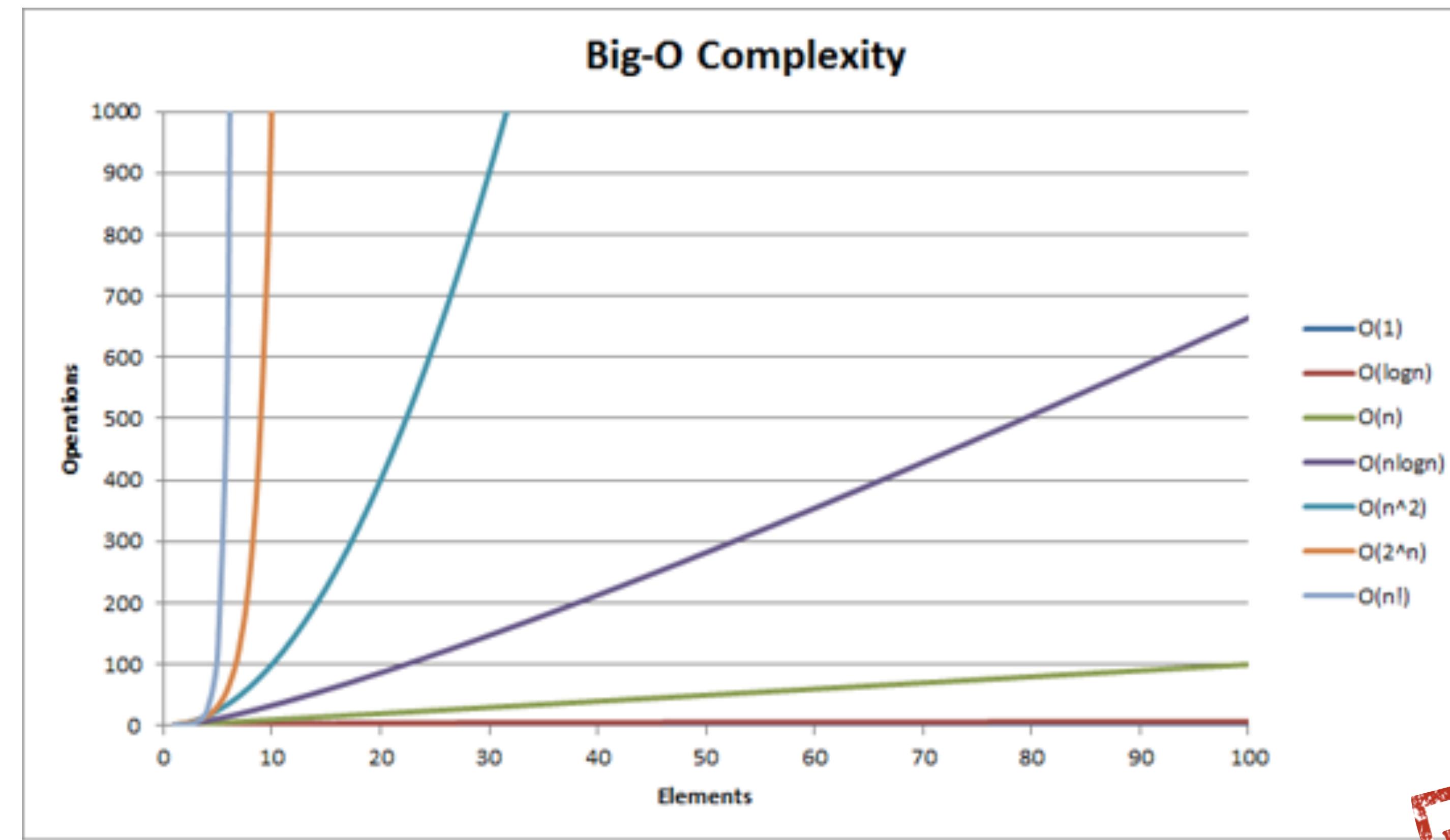
Infrastructure and Platforms  
(System)

# Code Performance

## Java



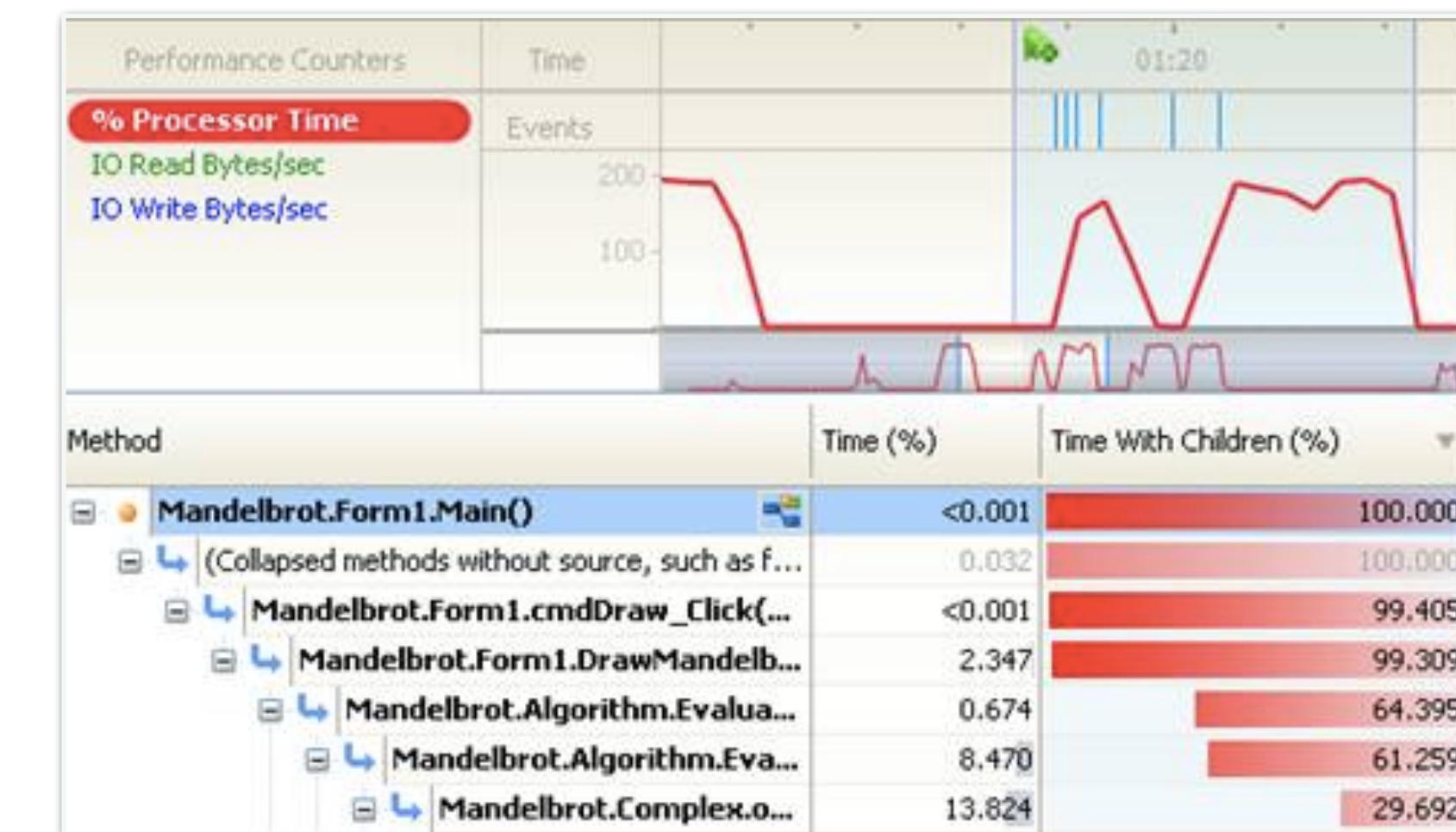
# Time Complexity



**IMPORTANT**

# Code Profiling

**Profiling** is a form of dynamic program analysis that measures the **space** (memory) or **time** complexity of a program, the **usage** of particular instructions, or the **frequency** and **duration** of function calls



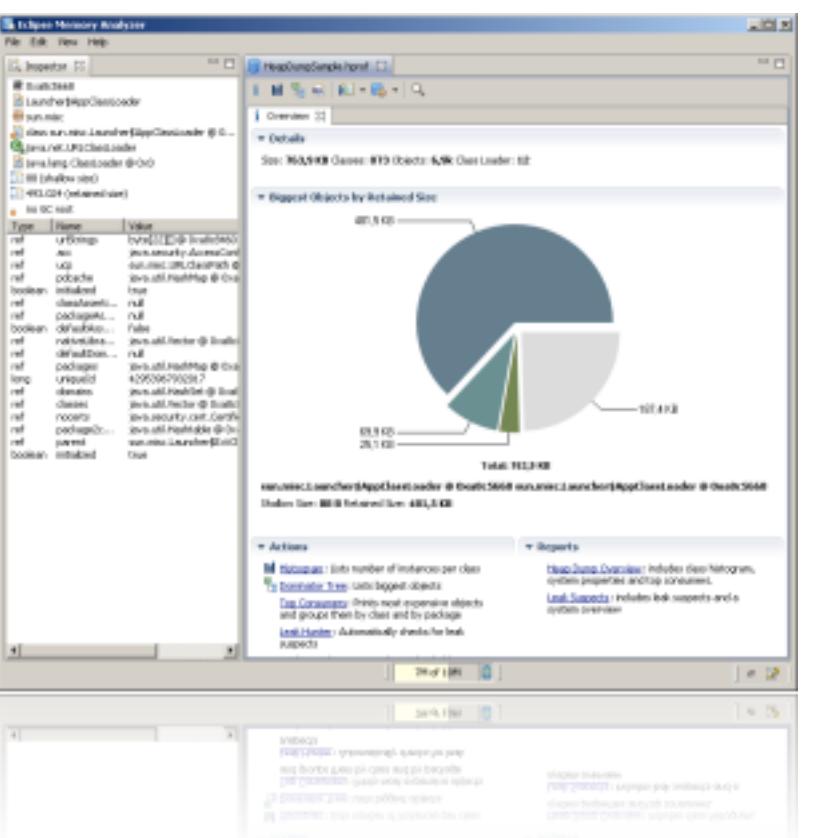
# Memory Leak

A **memory leak** is a type of resource leak that occurs when a computer program incorrectly manages memory allocations in such a way that memory which is no longer needed is not released



"Hey! Your application has a memory leak."

# Memory Analyzer (MAT)



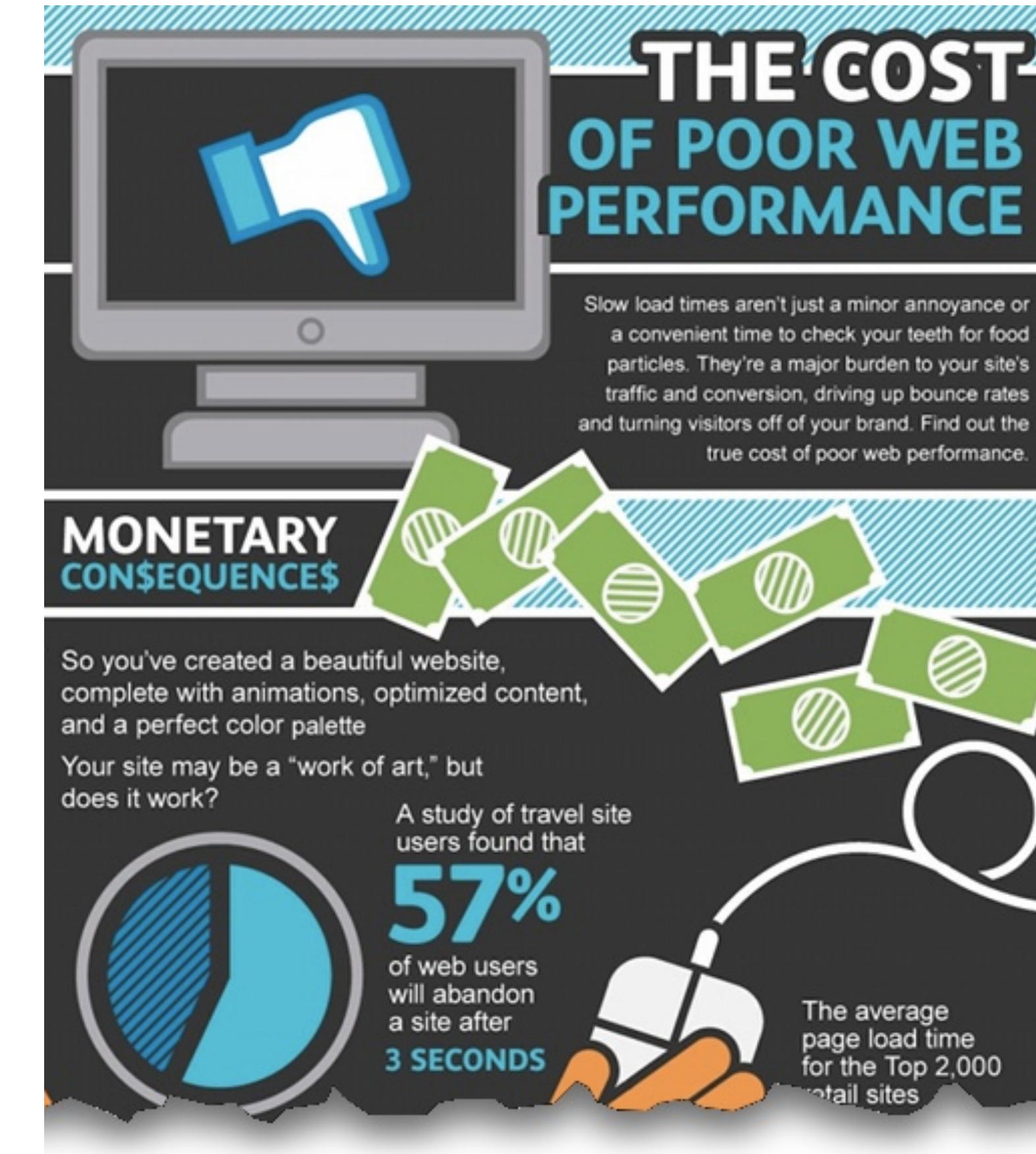
<https://eclipse.org/mat/>



"Hey! Your application has a memory leak."

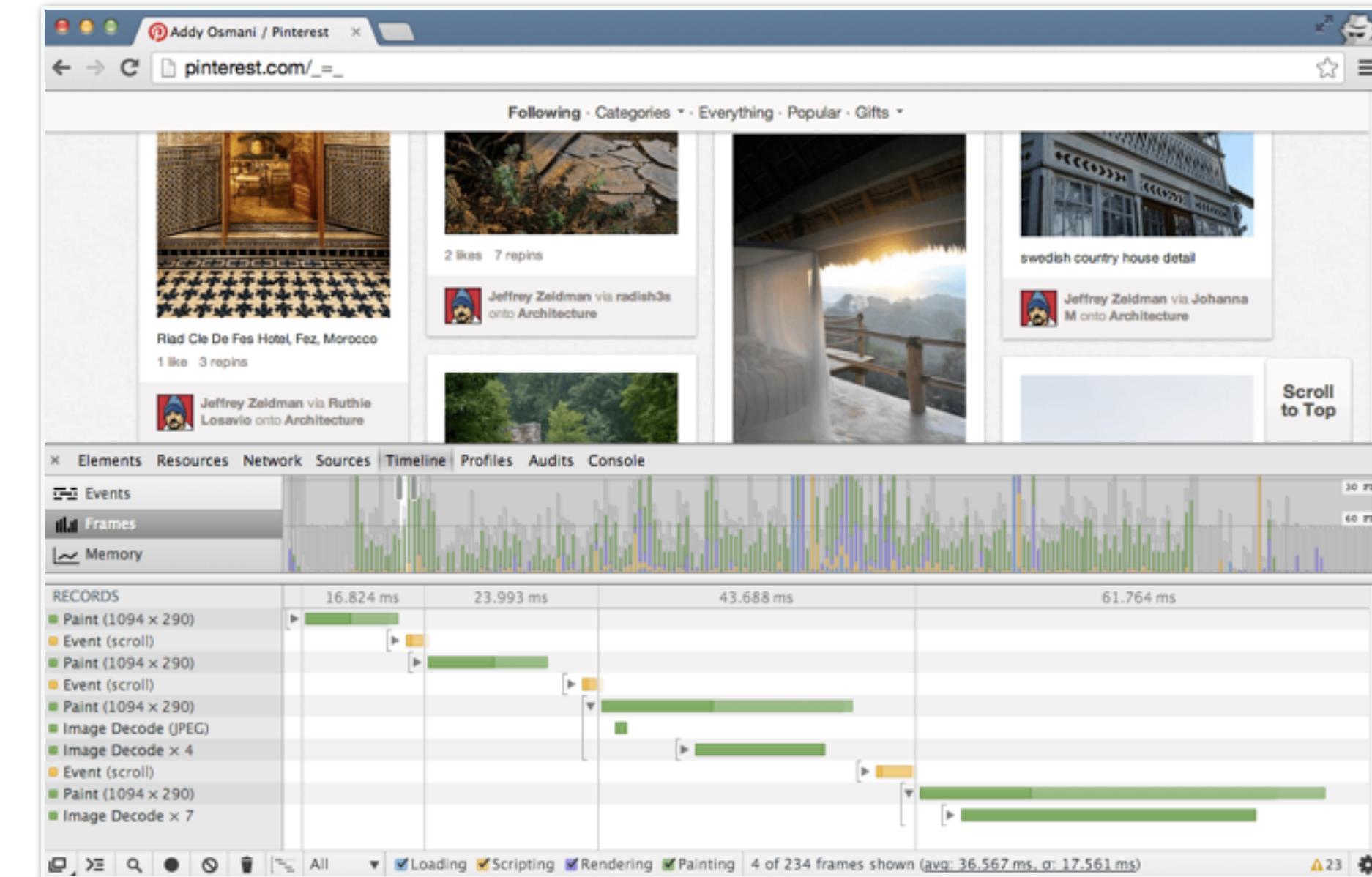
# Application Performance

Web



# Web Profiling

JavaScript  
Chrome  
HAR  
HTTP Archive



# Web Performance Automatic Monitoring

A web service to periodically check and verify the correctness and performance of the web, and send alarms automatically



Suggestions See All

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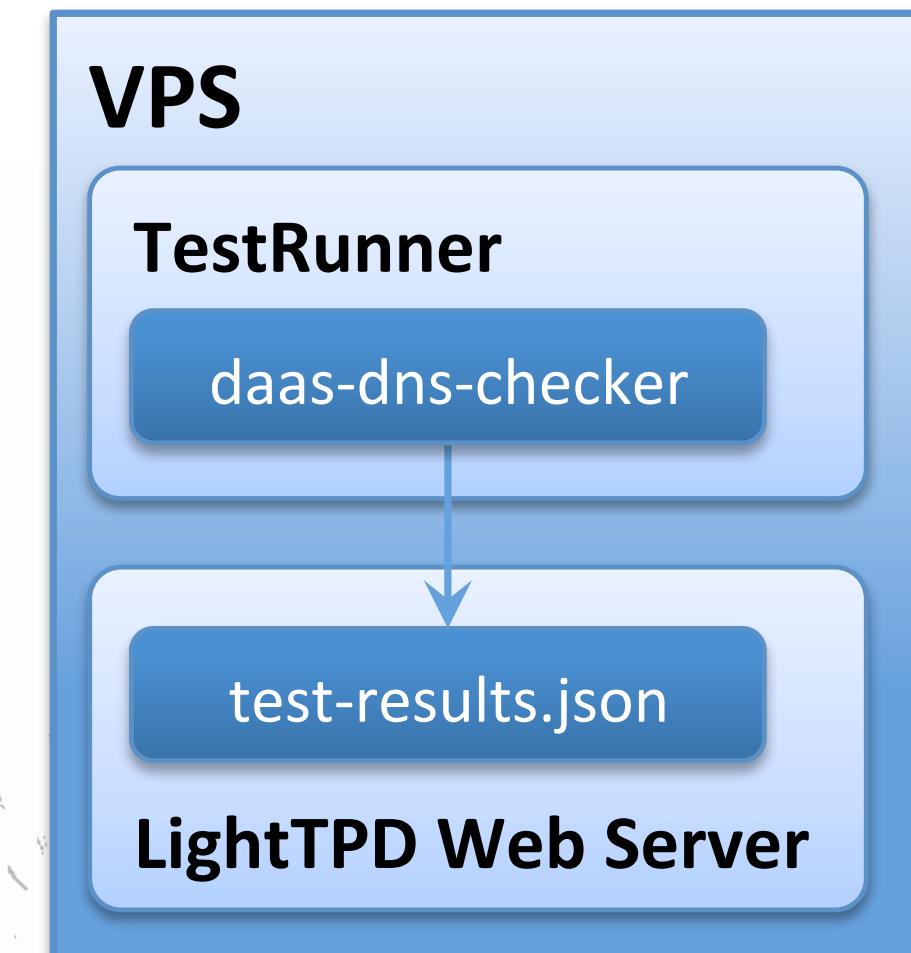
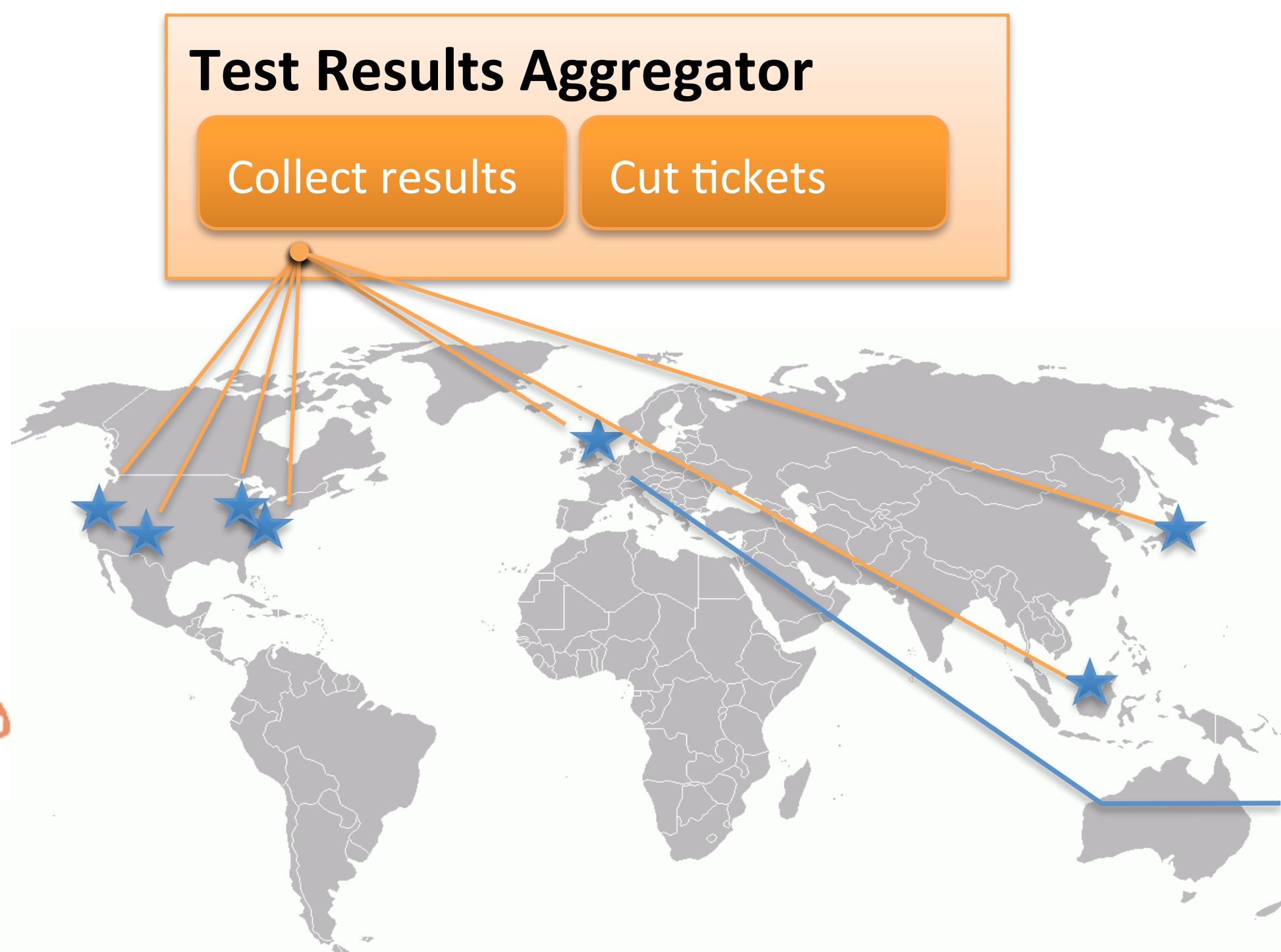
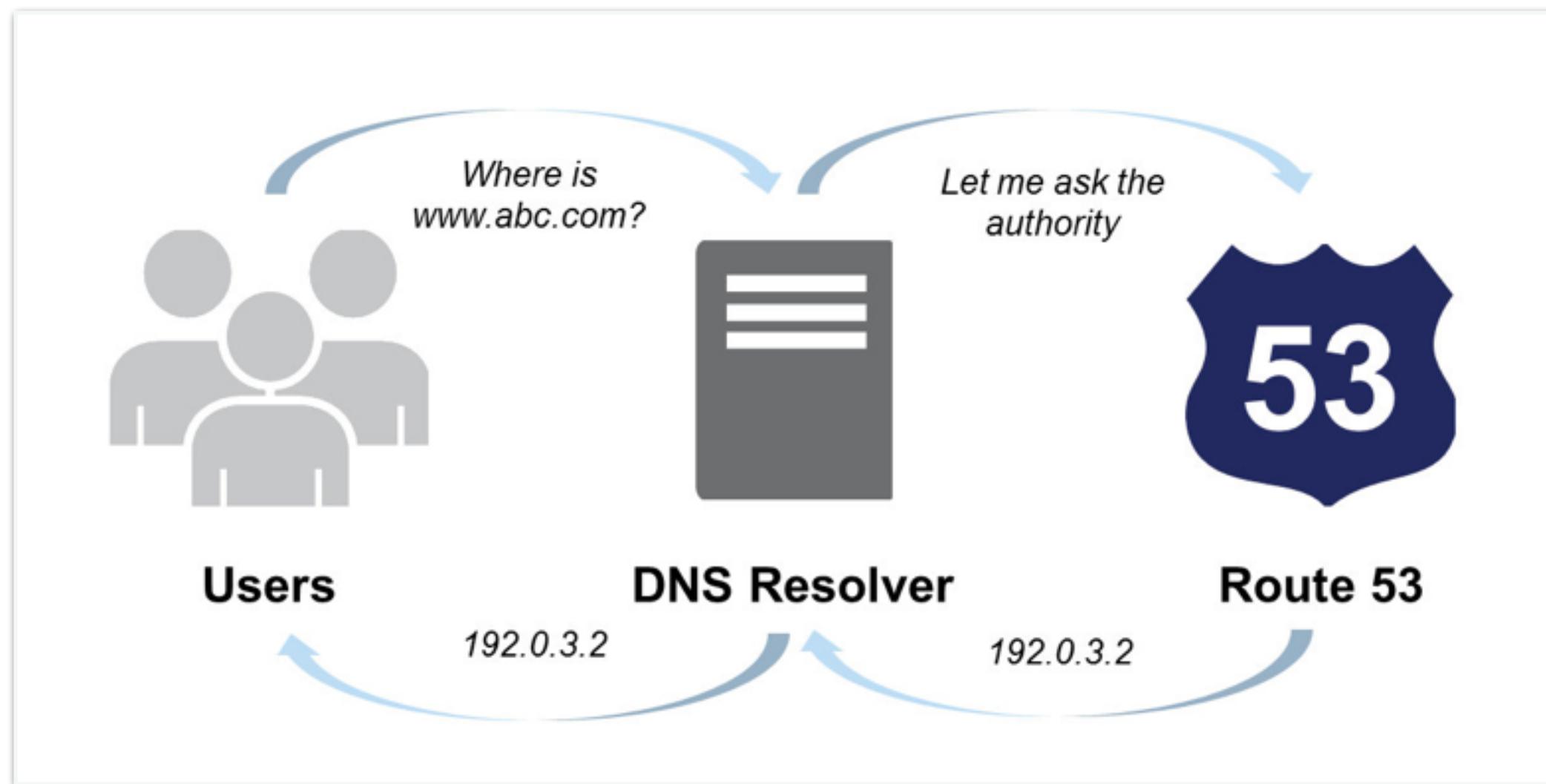
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[Okay](#)



# System Performance

Infrastructure/Cloud

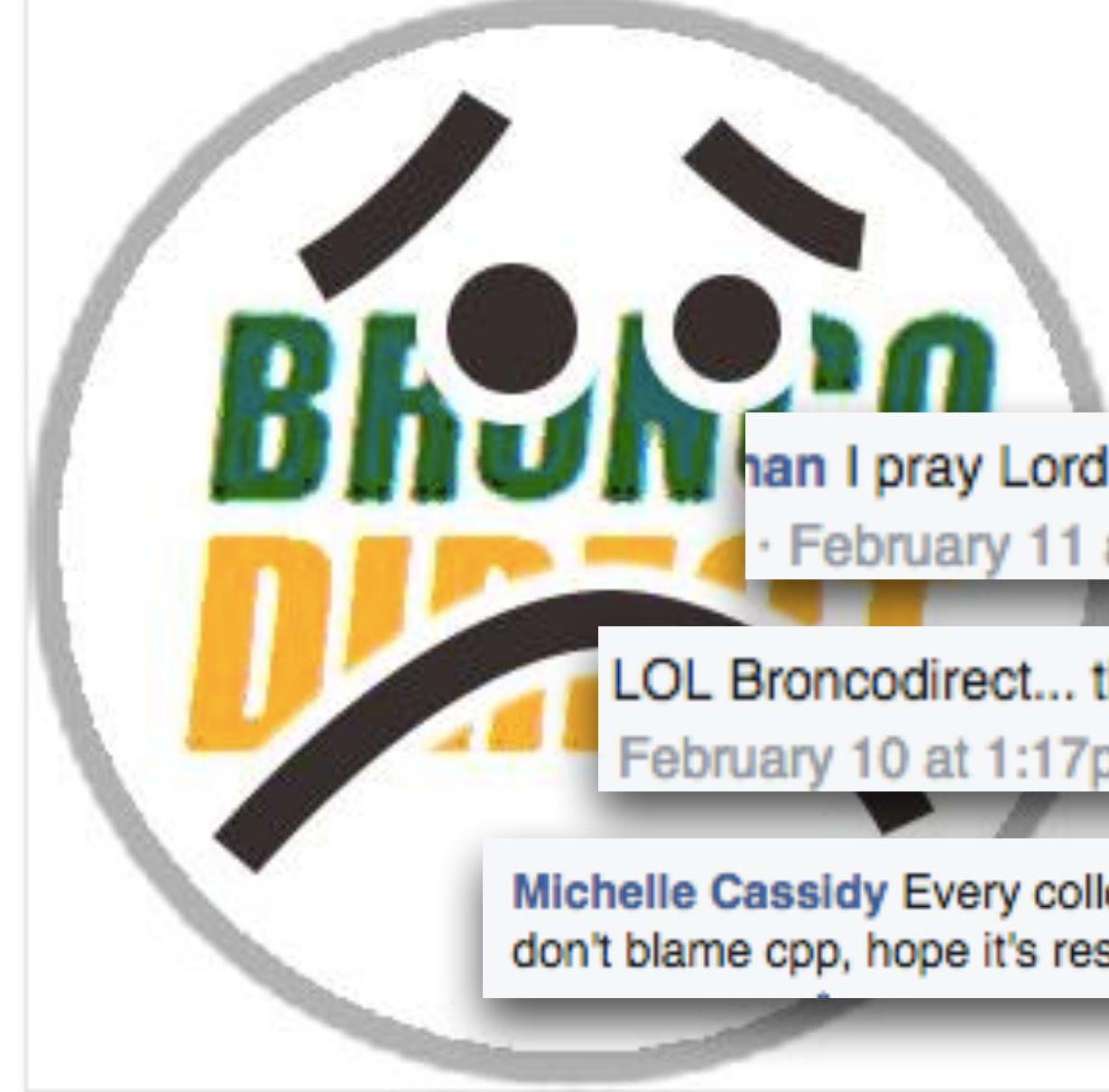


# Scalability

**Scalability** is ability of a system, network, or process to handle a growing amount of work in a capable manner or its ability to be enlarged to accommodate that growth.

Cal Poly Pomona  
February 10 at 11:47am

Broncos, if you're trying to register for classes right now, you've probably noticed that BroncoDirect is having some serious issues right now. We apologize for this. Really, we do. We know that you don't need this extra aggravation while you're trying to get your classes for next quarter. We are working as quickly as we can to fix the situation. We will keep you updated as much as possible. Again, our sincere apologies.

A circular logo for BroncoDirect. It features the word "Bronco" in green and blue block letters, with "DIRECT" in yellow block letters below it. The letters are partially obscured by two stylized black swooshes that resemble the top of a soccer ball.

man I pray Lord for this matter to be resolved...Amen.  
February 11 at 11:56am

LOL Broncodirect... the worst thing about Cal Poly Pomona.  
February 10 at 1:17pm

Michelle Cassidy Every college has these problems during registration, I don't blame cpp, hope it's resolved soon though!

Like · Comment · Share · 106 29 1

# Load Testing

**Load testing** is the process of putting demand on a system or device and measuring its response. Load testing is performed to determine a system's behavior under both normal and anticipated peak load conditions.



# Load Testing Metrics



Throughput



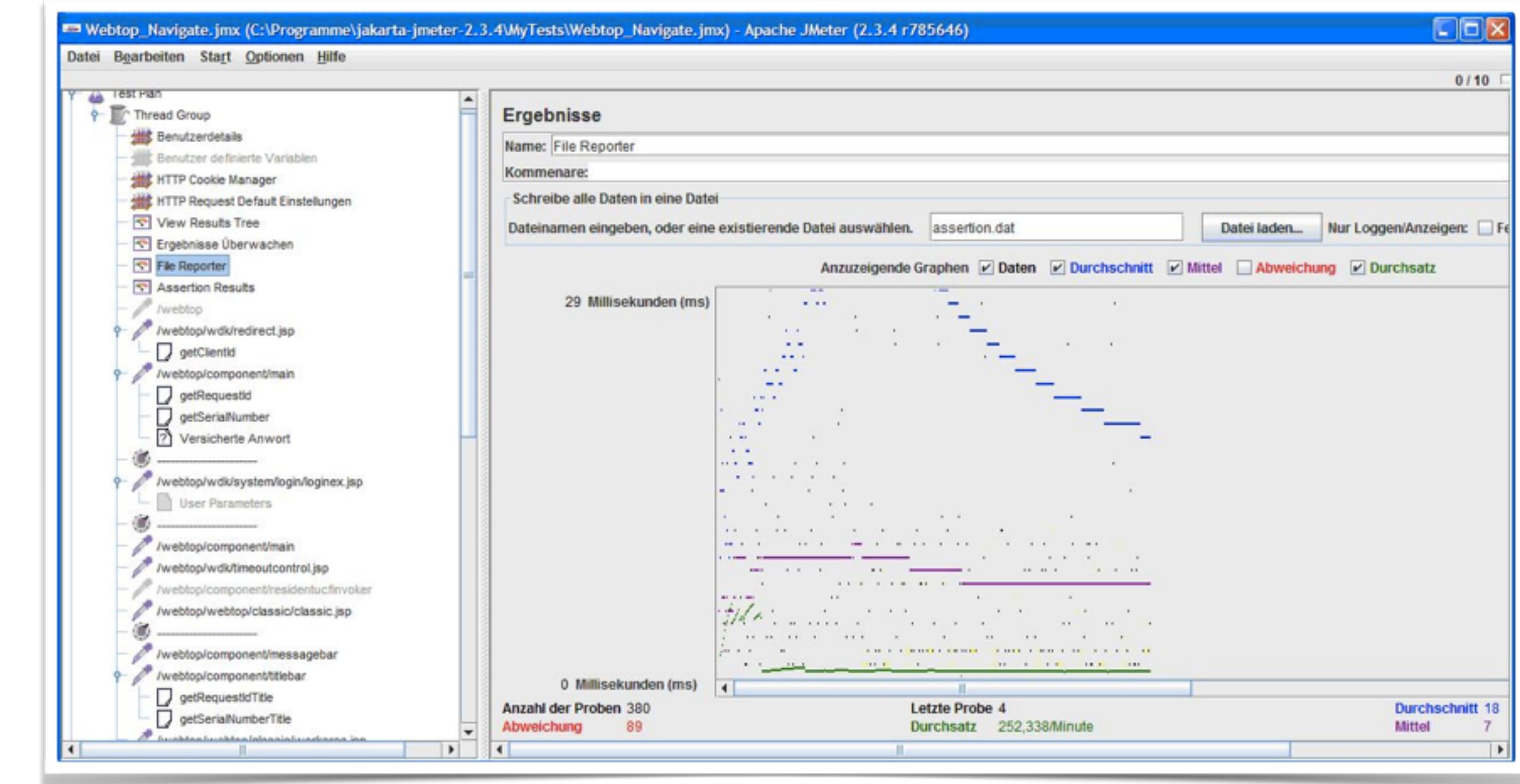
Latency



Error Rate

# Load Testing

JMeter



# The Key to Improve System Scalability

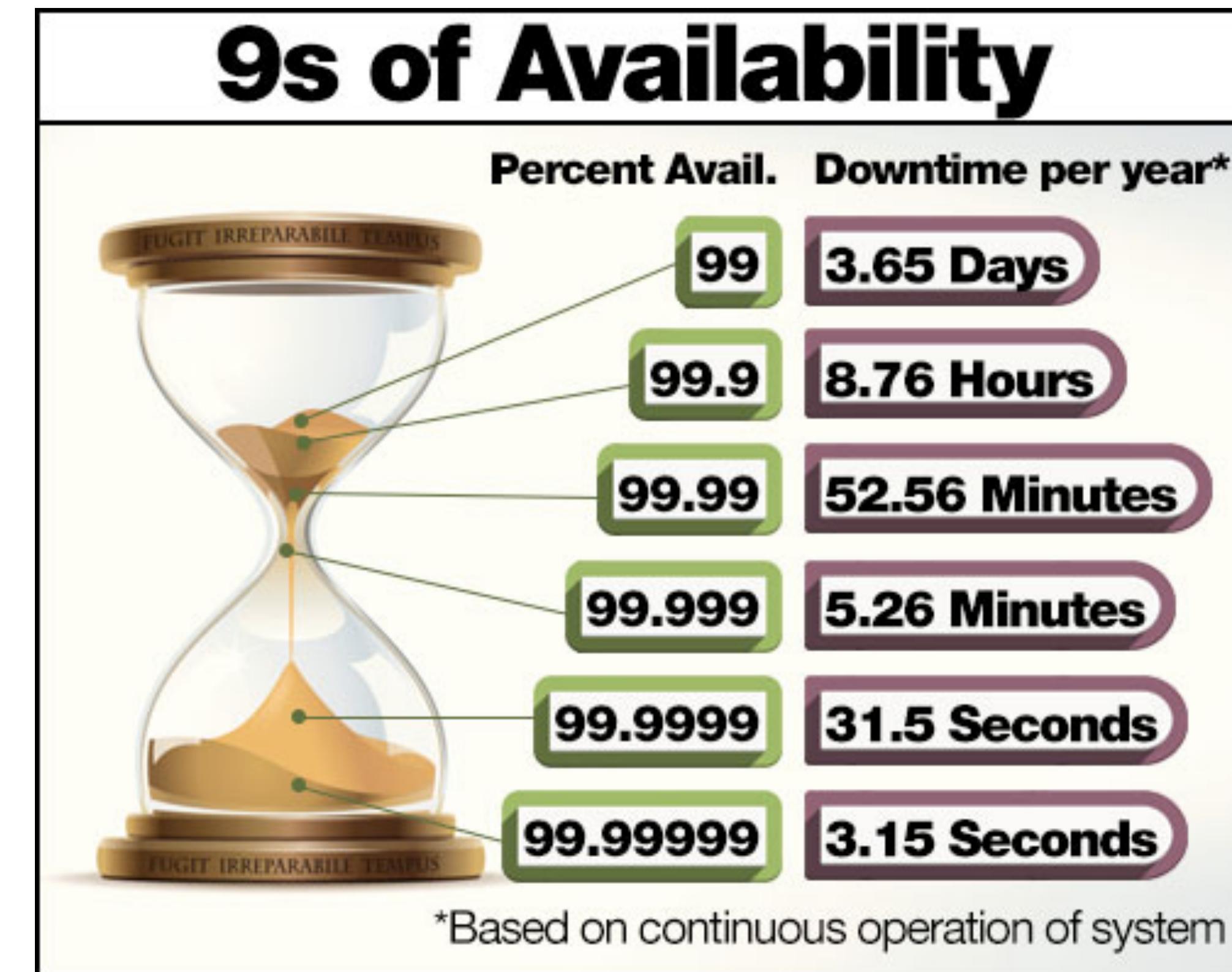


# The Key to Improve System Scalability

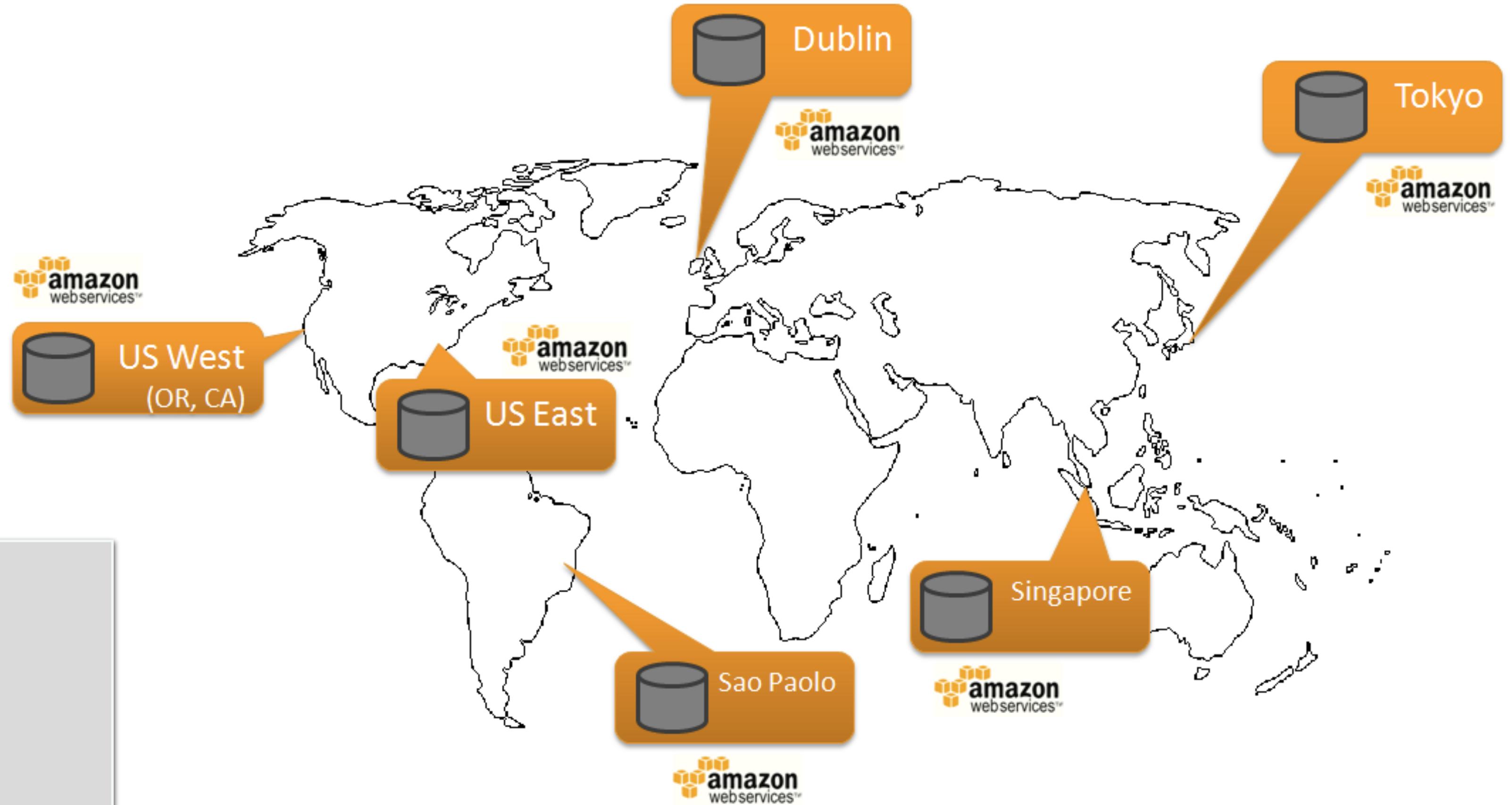
Type	CPU Units	CPU Cores	Memory
T1 Micro (t1.micro) <span style="color: yellow;">★</span> Free tier eligible	Up to 2 ECUs	1 Core	613 MiB
M1 Small (m1.small)	1 ECU	1 Core	1.7 GiB
M1 Medium (m1.medium)	2 ECUs	1 Core	3.7 GiB
M1 Large (m1.large)	4 ECUs	2 Cores	7.5 GiB
M1 Extra Large (m1.xlarge)	8 ECUs	4 Cores	15 GiB
M3 Extra Large (m3.xlarge)	13 ECUs	4 Cores	15 GiB
M3 Double Extra Large (m3.2xlarge)	26 ECUs	8 Cores	30 GiB
M2 High-Memory Extra Large (m2.xlarge)	6.5 ECUs	2 Cores	17.1 GiB
M2 High-Memory Double Extra Large (m2.2xlarge)	13 ECUs	4 Cores	34.2 GiB
M2 High-Memory Quadruple Extra Large (m2.4xlarge)	26 ECUs	8 Cores	68.4 GiB
C1 High-CPU Medium (c1.medium)	5 ECUs	2 Cores	1.7 GiB
C1 High-CPU Extra Large (c1.xlarge)	20 ECUs	8 Cores	7 GiB
High I/O Quadruple Extra Large (hi1.4xlarge)	35 ECUs	16 Cores	60.5 GiB
High Storage Eight Extra Large (hs1.8xlarge)	35 ECUs	16 Cores	117 GiB

# Availability

duplication



# NETFLIX



<http://techblog.netflix.com/2012/07/chaos-monkey-released-into-wild.html>

Highly Available Architecture at Netflix  
<https://www.youtube.com/watch?v=dekV3Oq7pH8>