Pragmatic Performance

@giltene

Gil Tene, CTO & co-Founder, Azul Systems

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About me: Gil Tene

- co-founder, CTO @Azul Systems
- Have been working on "think different" GC approaches since 2002
- A Long history building Virtual & Physical Machines, Operating Systems, Enterprise apps, etc...
- I have made a lot of mistakes
- I learned from some of those...

* working on real-world trash compaction issues, circa 2004

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Pragmatic Performance

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prag·mat·ic

/pragˈmadik/

adjective

dealing with things sensibly and realistically in a way that is based on *practical* rather than *theoretical* considerations.

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Performance

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Performance

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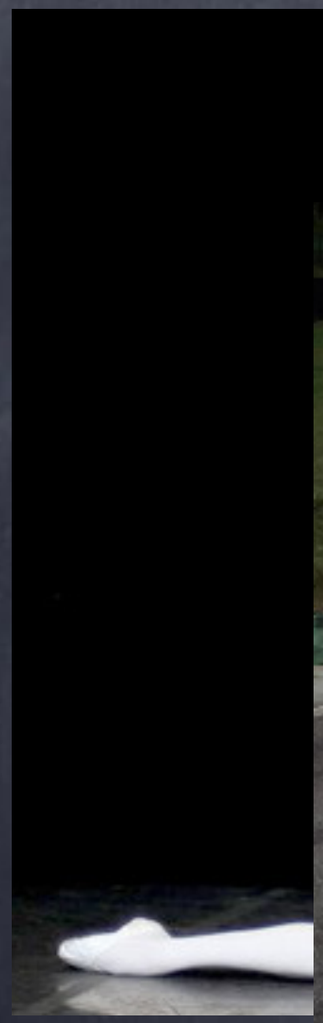
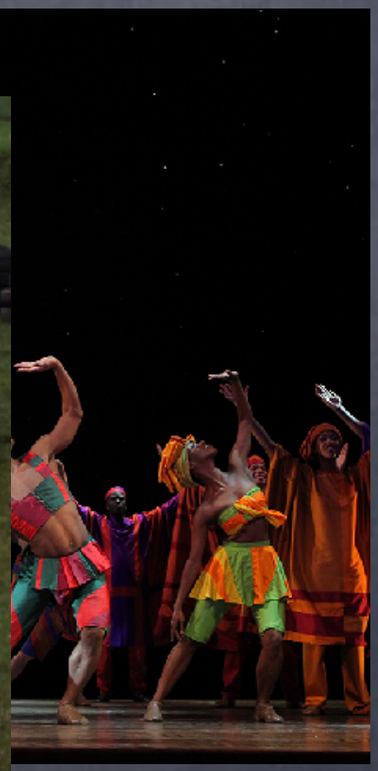
Performance





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per·for·mance

/pərˈfôrməns/

noun

1. an act of staging or presenting a play, concert, or other form of entertainment

2. the action or process of carrying out or *accomplishing* an *action*, *task*, or *function*.

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Performance

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Theoretical Performance

Question: How fast can this car go?

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Theoretical Performance

Question: How fast can this car go?

Theoretical Performance answer: 189mph

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Theoretical Performance

Faster?

Slower?

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Pragmatic Performance

Faster?

Slower?

How about now?

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Pragmatic Performance

Pragmatic Question: How fast can this car go without crashing into things?

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Theoretical Performance

How many queries per second
can "cool tool X" answer?

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Theoretical Performance

How many queries per second can "cool tool X" answer?

Examples of important questions to ask:

- Do all the answers have to be correct?
- Is it OK to only answer easy questions?
- Is it OK to take 1,000,000,000,000 questions now and answer them all next week?

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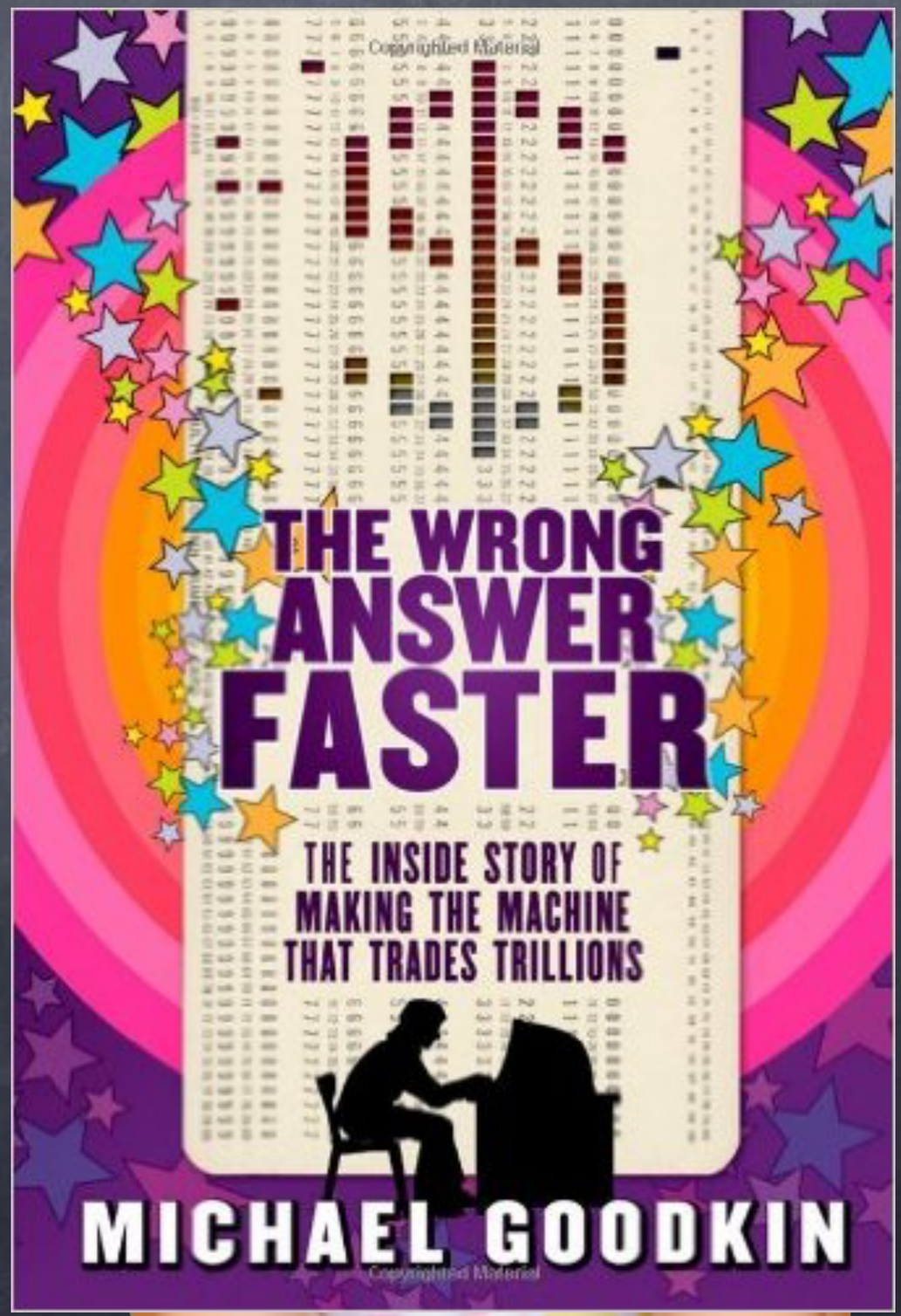
Comparing Performance

- System A does X things per second. But fails some key requirements
- System B does 0.9x things per second, and meets all key requirements
- "System B is slower but more reliable" — WRONG
- How fast can system A go while meeting requirements?



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Performance does not live in a vacuum

Performance metrics are (usually) meaningful only when practical considerations and constraints are met

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performance metric examples

- Operations per second
- Latency or Response Time
- Failure rate
- Recovery time (e.g. to "normal") after disruption
- Each of these is best measured when all the others are held to required levels

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performance metric examples

- Operations per second ("speed", "throughput")
- Latency or Response Time ("quickness")
- Failure rate ("reliability", "availability")
- Recovery time (e.g. to "normal") after disruption
- Each of these is best measured when all the others are held to required levels

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Capacity planning:
How much "capacity" do we need?

- A system takes 200 usec to respond to a request
- The system will receive 250 req/sec during peaks
- Requirement: 99.9% of operations must complete in 10 msec of less, even during busiest second
- Does the system have the capacity to handle the the load with the required behavior?
- Maybe…
- Not enough information…

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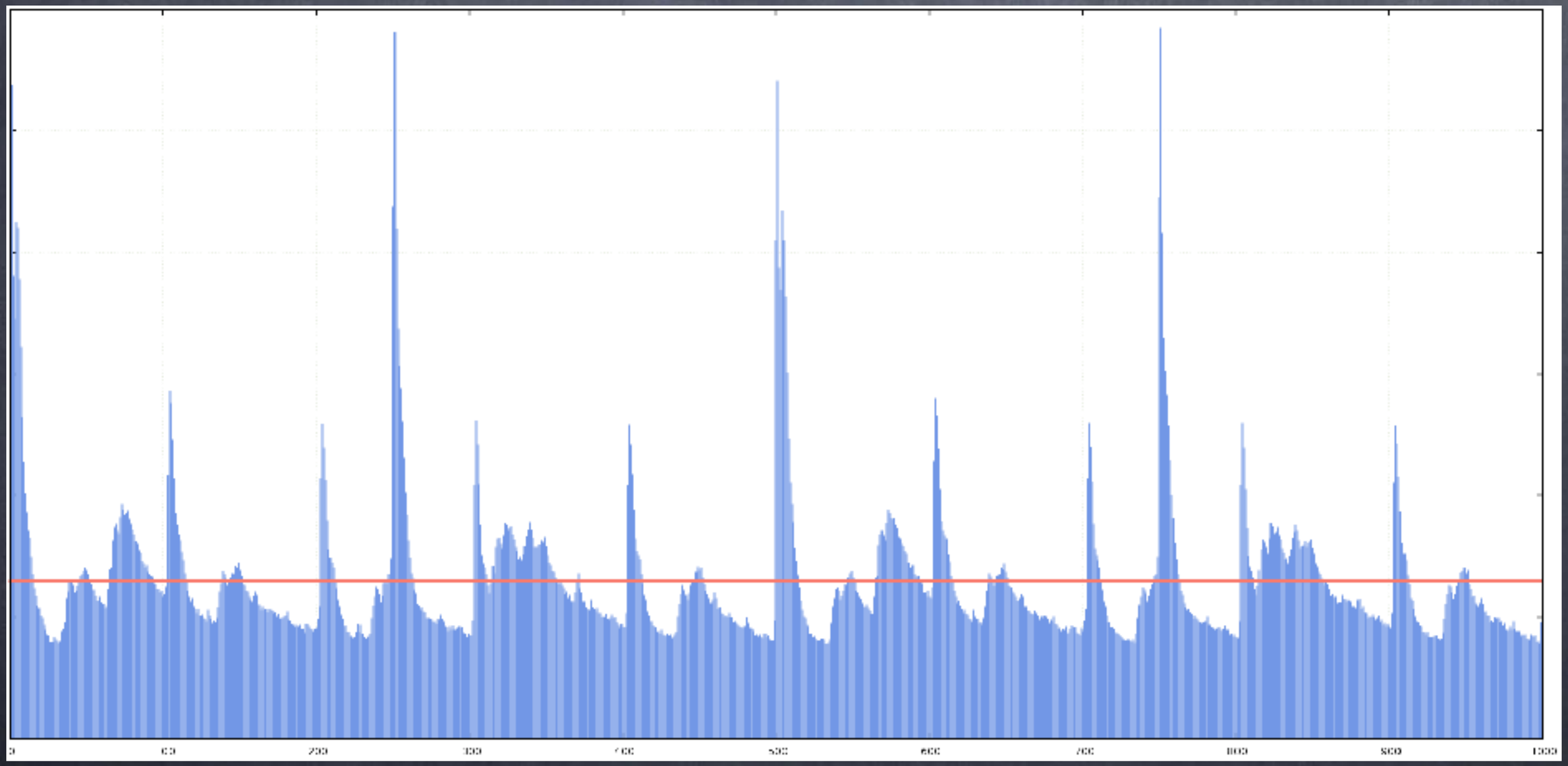
Arrival times



Example: arrival rate within a second
(averaged over entire day)

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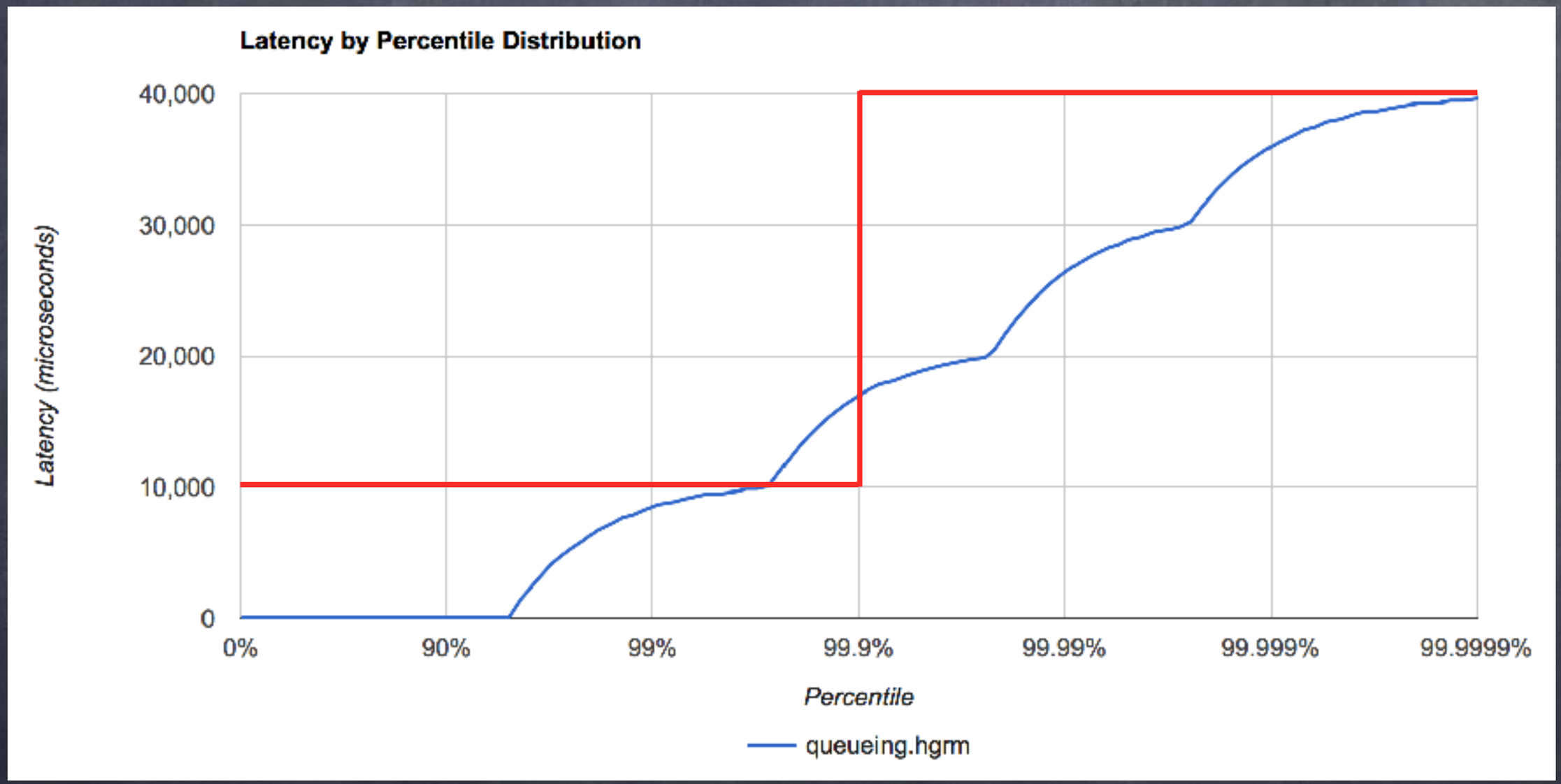
Latency behavior when bursts occur



200 usec service time, 5K msg/sec capacity
250 requests/sec, arriving in bursts of 50

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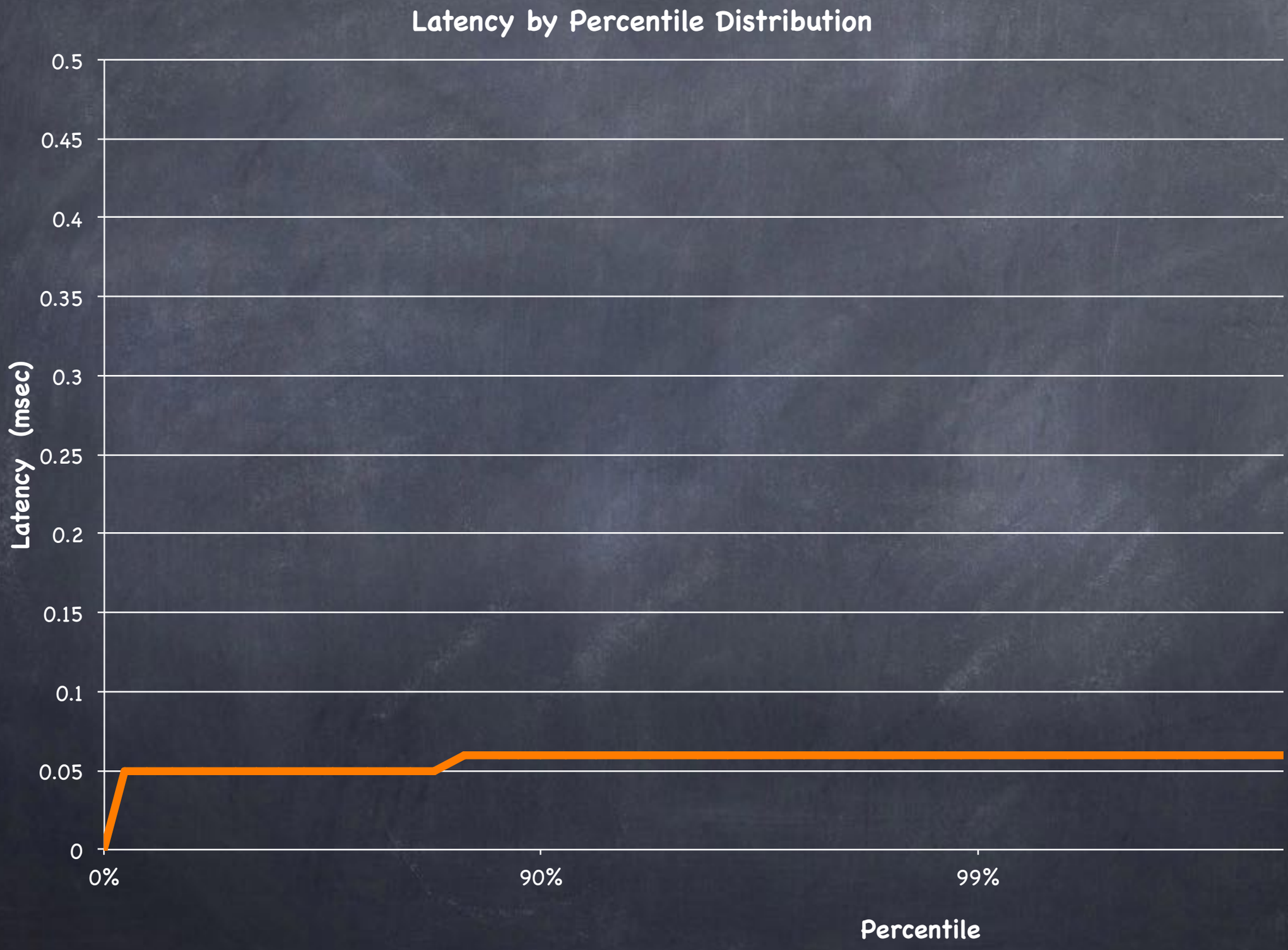
The real world: latency distribution



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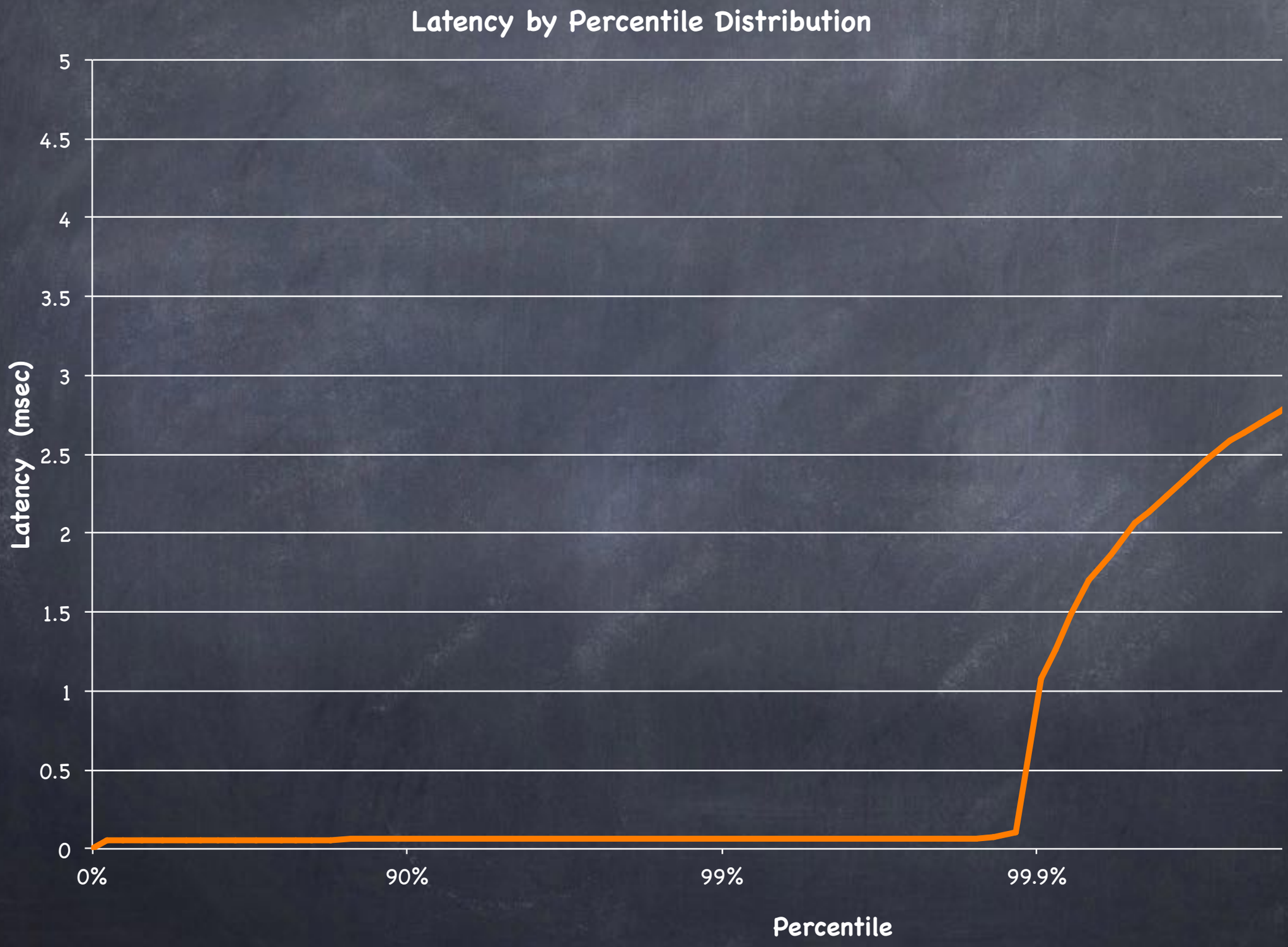
The real world: latency distribution



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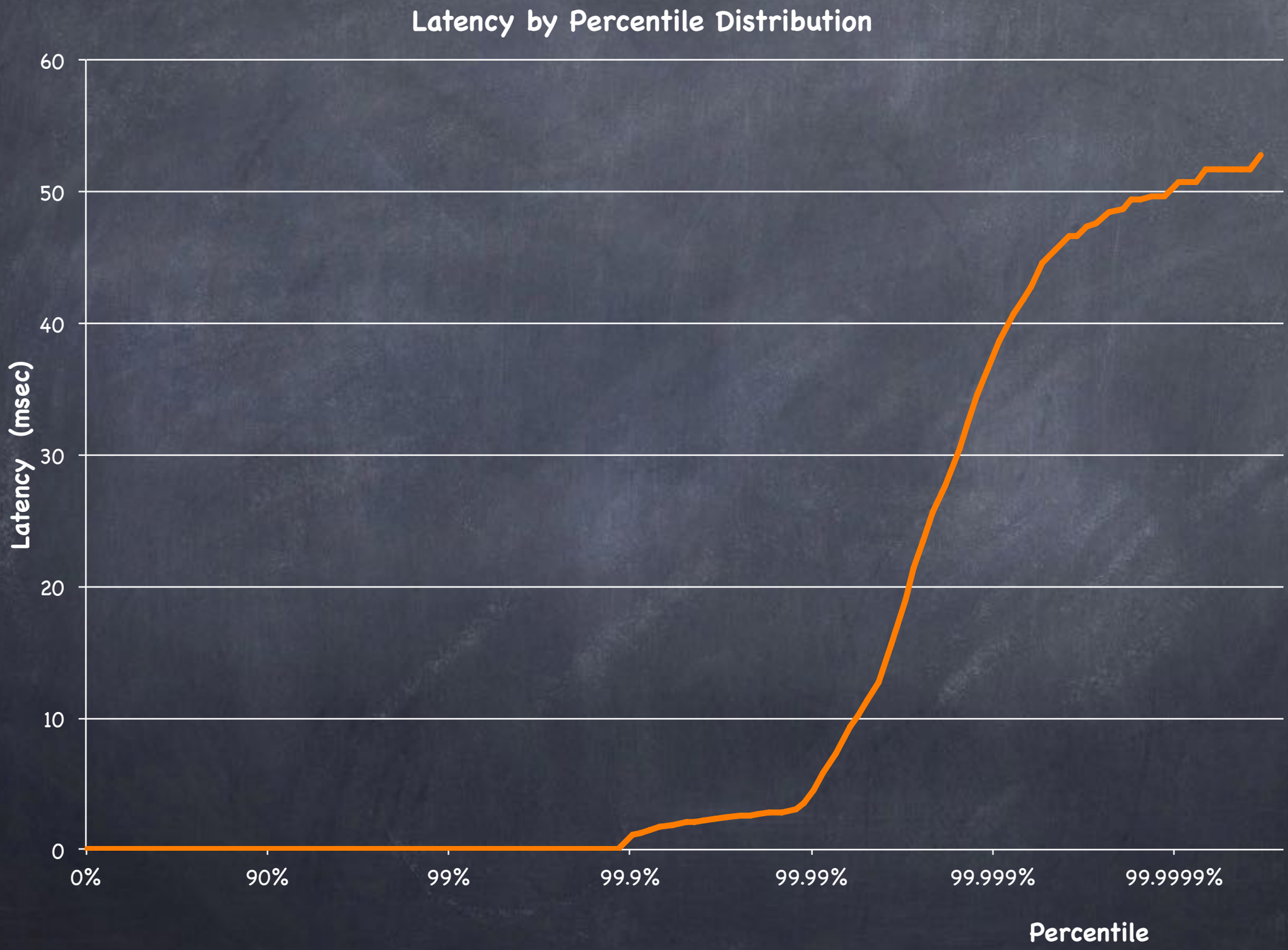
The real world: latency distribution



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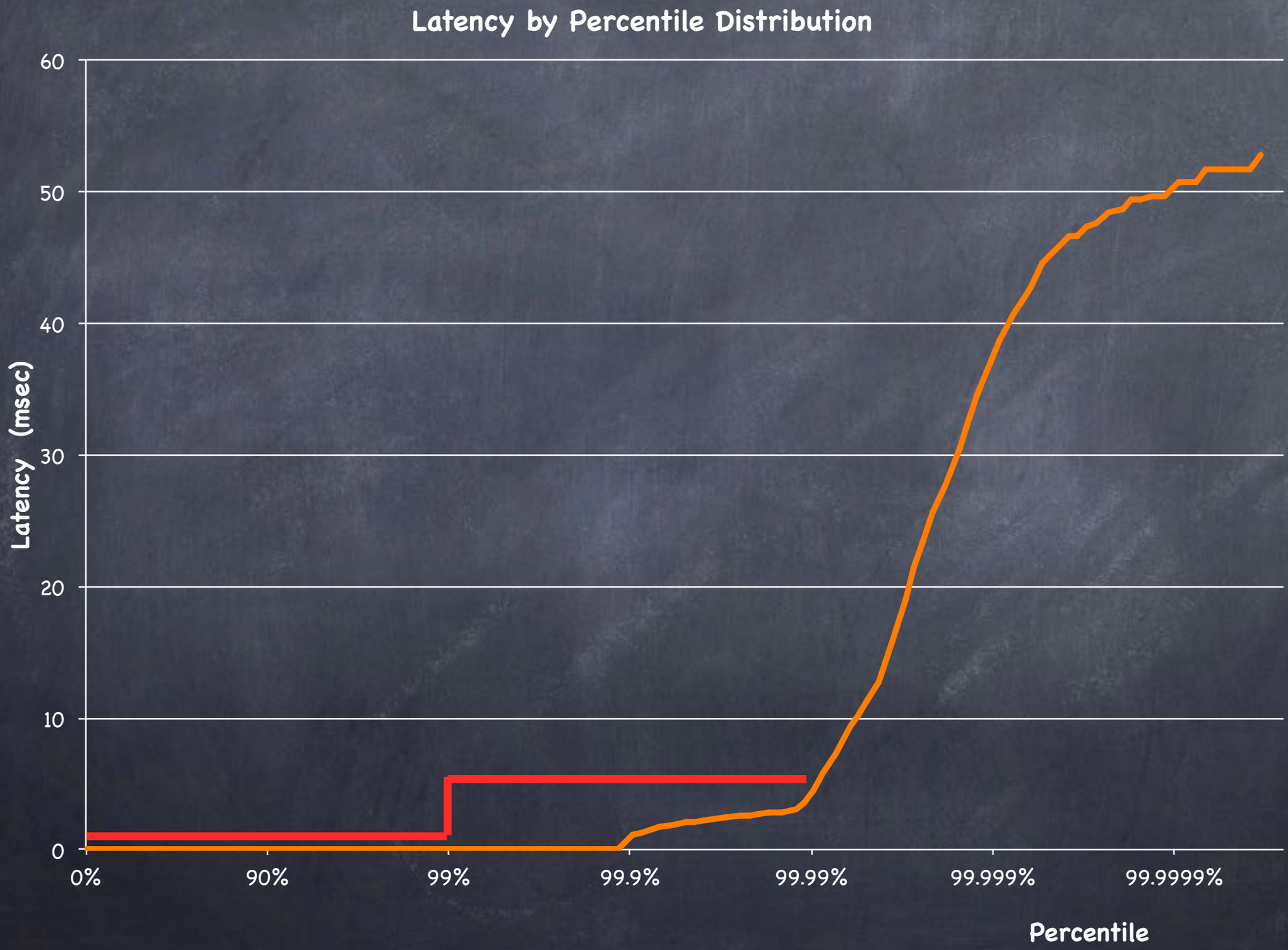
The real world: latency distribution



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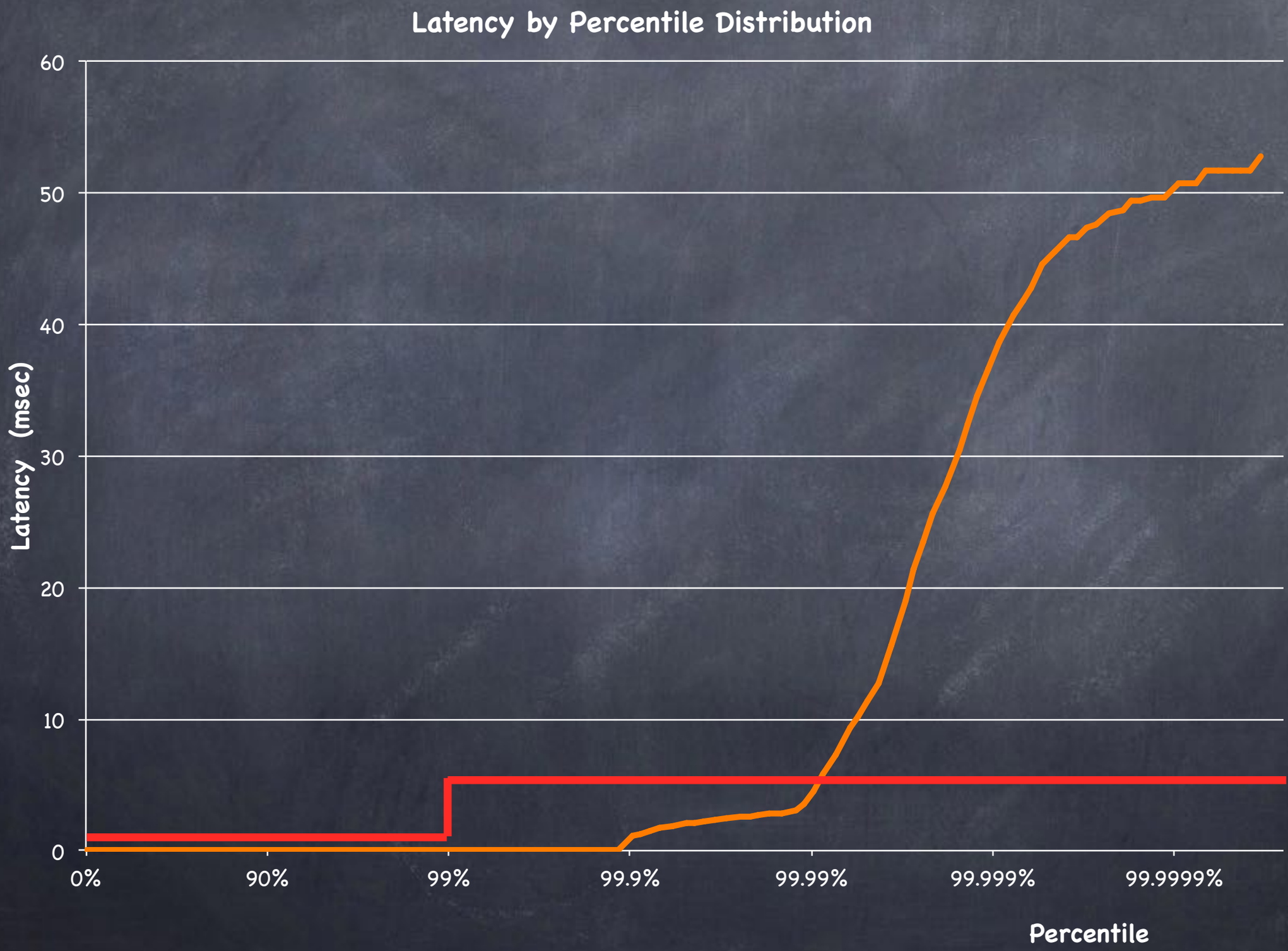
The real world: latency distribution



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Service Time vs. Response Time

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Lines can get pretty long…

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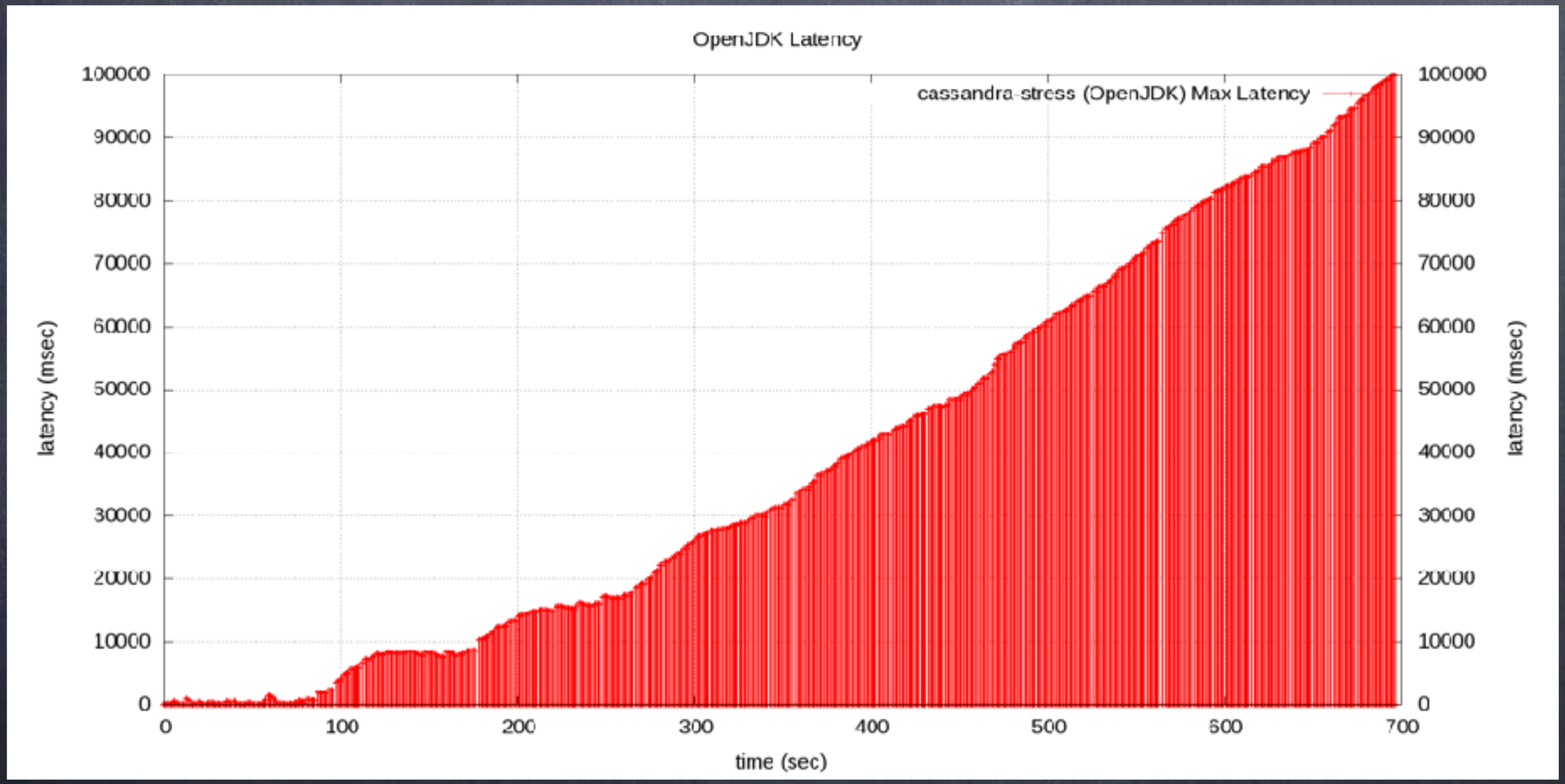
Response time grows when incoming rate is consistently faster than what we can handle



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Cutting corners in performance testing

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Typical Reaction

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And most commonly

Repeat. Repeat. Repeat.

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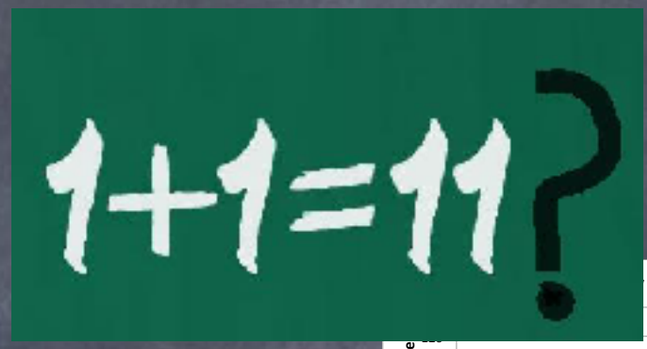
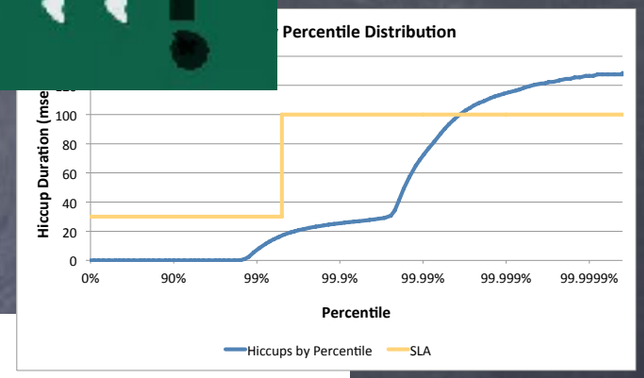
So before you start to measure something like widgets/sec:

- Establish requirements





  - Correctness
  - Timeliness
  - Availability, etc.
- Understand expected environmental limitations
  - Governing bottlenecks and realities

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And most importantly

DO NOT consider "performance results"
from non-passing tests

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Managed Runtimes

What's so special about them?

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?

?

Scala

?

Ruby

?

Java

Go

F#

Python

?

PHP

Clojure

C#

JavaScript

Erlang

?

Objective-C

?

C

C++

?

?

?

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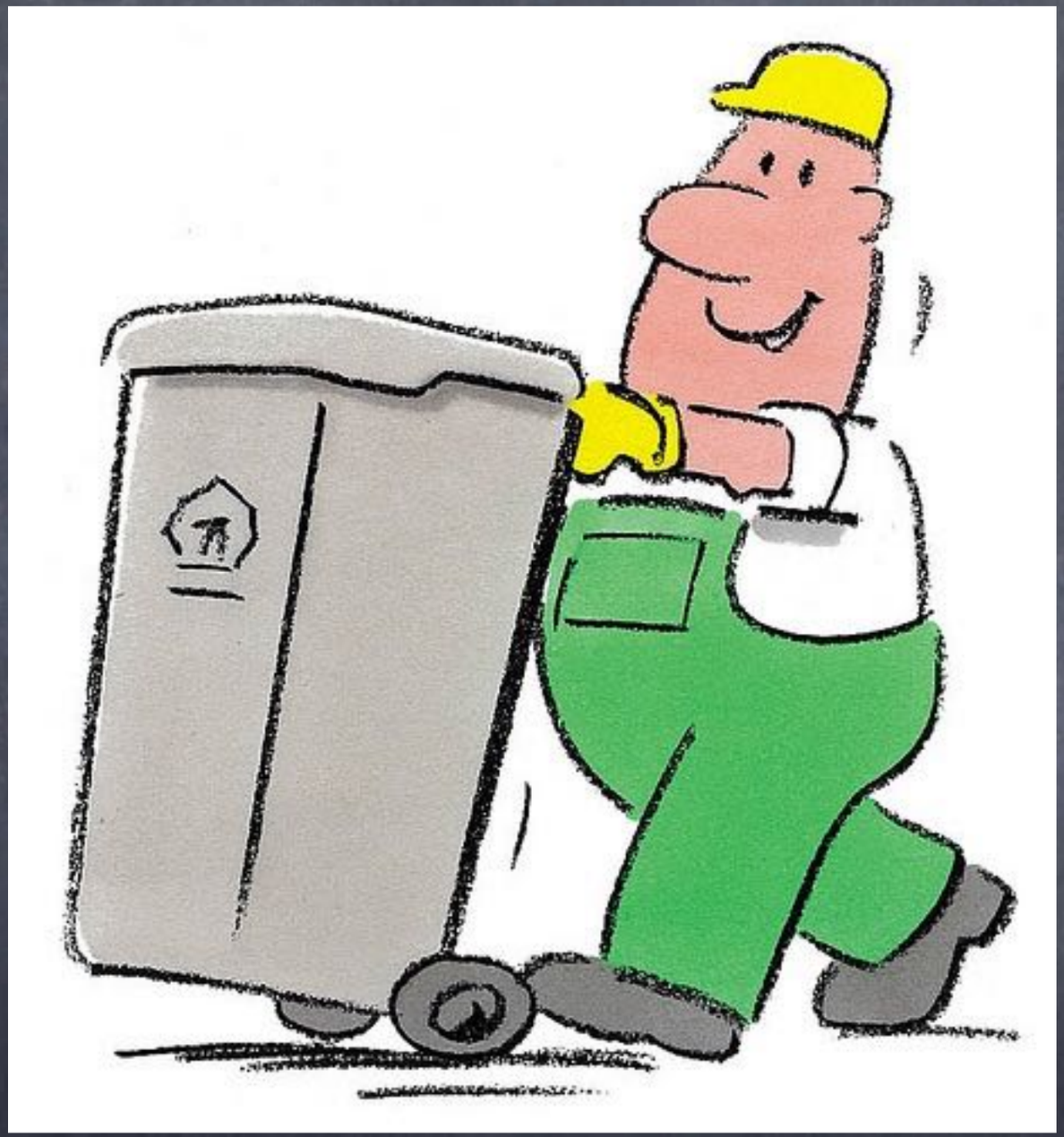

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Why?

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Garbage Collection is… Good

- Productivity, stability
  - Programmers not responsible for freeing and destroying objects
  - Eliminates entire (common) areas of instability, delay, maintenance
- Guaranteed interoperability
  - No "memory management contract" needed across APIs
  - Uncoordinated libraries, frameworks, utilities seamlessly interoperate
- Facilitates practical use of large amounts of memory
  - Allows for complex and intertwined data structures
  - Within and across unrelated components

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But most importantly

Garbage Collection makes things go fast faster

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Time to market

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Time to performance

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Theoretical Performance

Fastest?

Fast

Slower?

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Which of these is fast enough
to get to work in 15 minutes or less?

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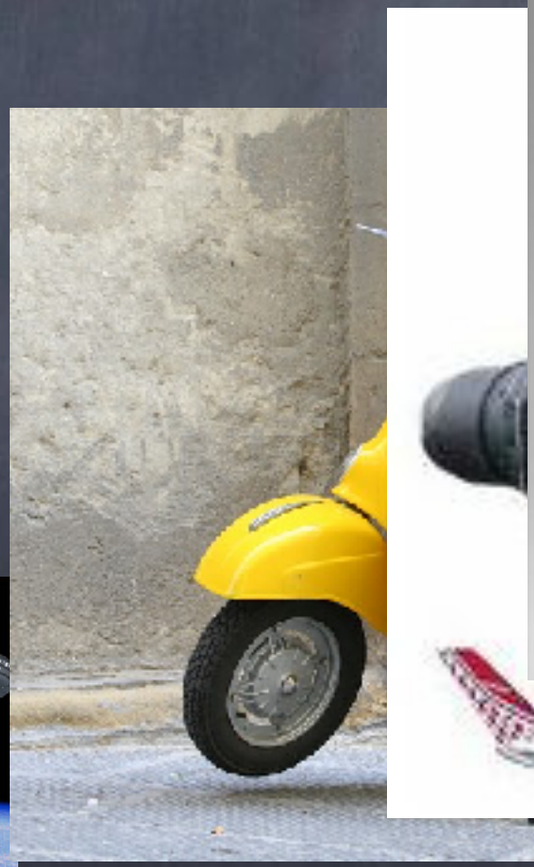
Which will provide the needed speed
by [now + 6 months] ?



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Tomorrow is here

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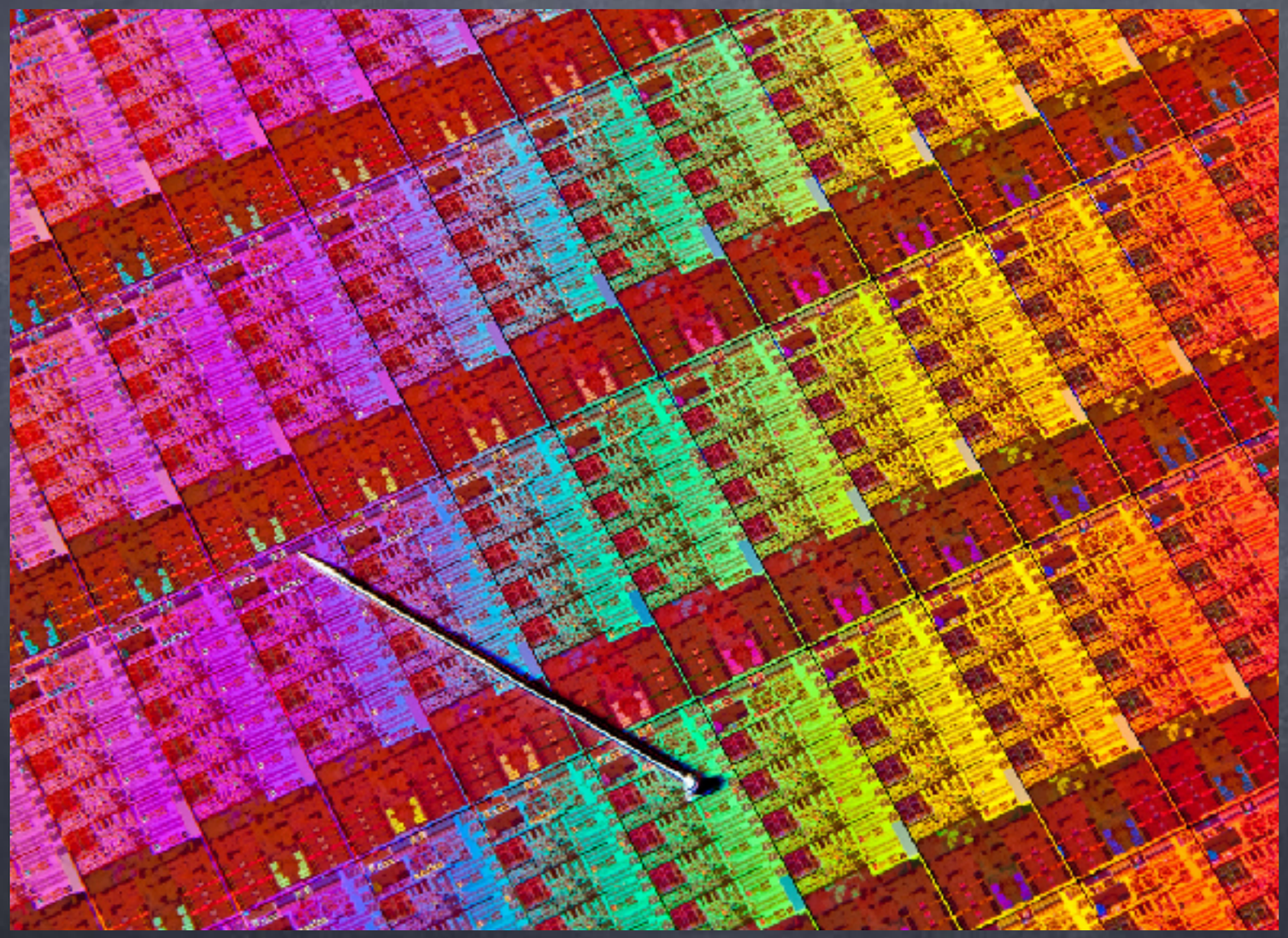
Multicore is so 2012...



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Current (2016) cloud stuff

Region: US East (N. Virginia)

	vCPU	ECU	Memory (GiB)	Instance Storage (GB)	Linux/UNIX Usage
Compute Optimized - Current Generation					
c4.large	2	8	3.75	EBS Only	$0.116 per Hour
c4.xlarge	4	16	7.5	EBS Only	$0.232 per Hour
c4.2xlarge	8	31	15	EBS Only	$0.464 per Hour
c4.4xlarge	16	62	30	EBS Only	$0.928 per Hour
c4.8xlarge	36	132	60	EBS Only	$1.856 per Hour
Memory Optimized - Current Generation					
x1.16xlarge	64	174.5	976	1 x 1920 SSD	$6.669 per Hour
x1.32xlarge	128	349	1952	2 x 1920 SSD	$13.338 per Hour
r3.large	2	6.5	15	1 x 32 SSD	$0.166 per Hour
r3.xlarge	4	13	30.5	1 x 80 SSD	$0.333 per Hour
r3.2xlarge	8	26	61	1 x 160 SSD	$0.665 per Hour
r3.4xlarge	16	52	122	1 x 320 SSD	$1.33 per Hour
r3.8xlarge	32	104	244	2 x 320 SSD	$2.66 per Hour

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"lots" of cores

"lots" of memory

"Waste"

and

Performance

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"Waste"

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Summary

- Pragmatic Performance
  - What actually needs to get done?
  - How much. How quickly. How fast.
  - What needs to remain true while we do the stuff
- Performance is (usually) not about efficiency
  - unless efficiency is your performance metric
- Do not be afraid to come up with creative "waste"

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Q & A

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http://www.azulsystems.com