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Latency SLOs Done Right

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Service Level Objectives

SREcon 2018 SLO workshop (Google)

Latency SLI

The proportion of valid requests served faster than a threshold

Which requests are valid?
What is the threshold?

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SREcon 2018 SLO workshop (Google)

Latency SLO

99% of home page requests in the past 28 days served in < 100ms

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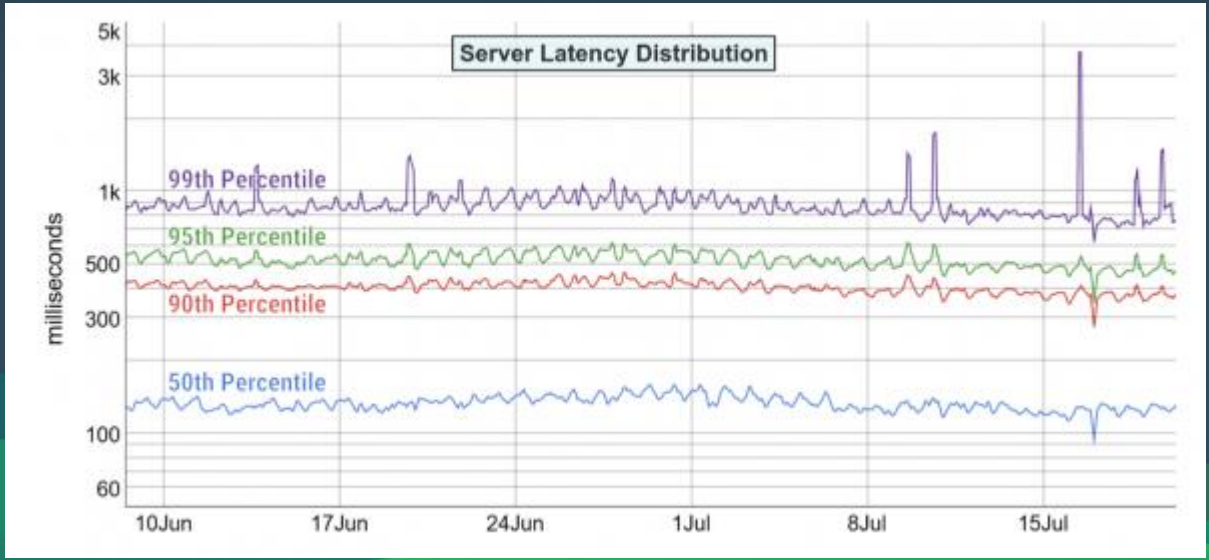
SREcon 2018 SLO workshop (Google)

What is the p90 computed over the full 28 days?



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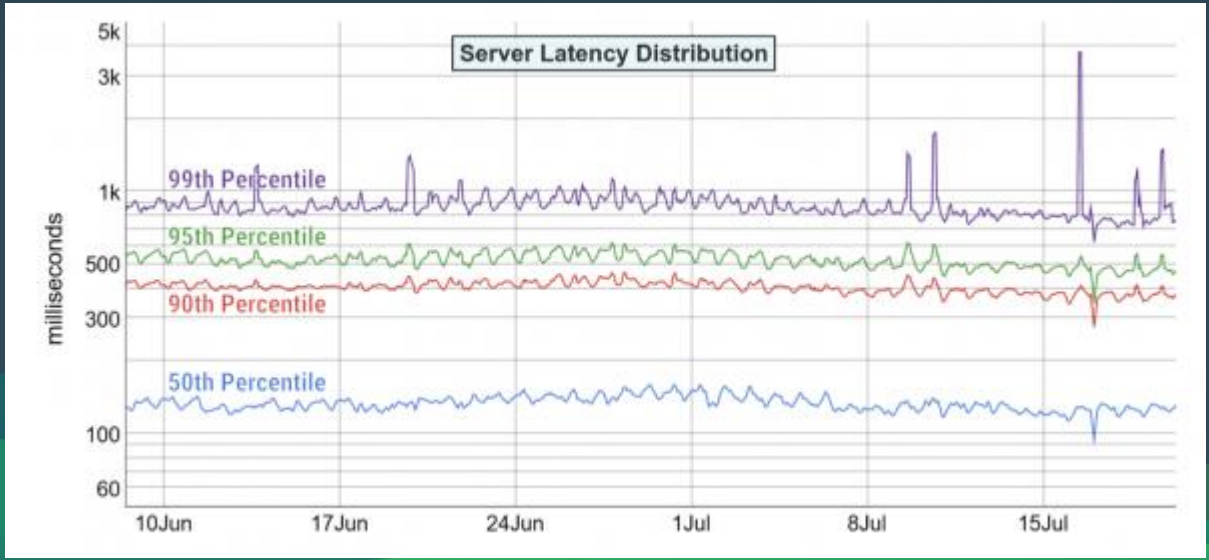
SREcon 2018 SLO workshop (Google)

Hint - it's not the average of each p90 sample shown



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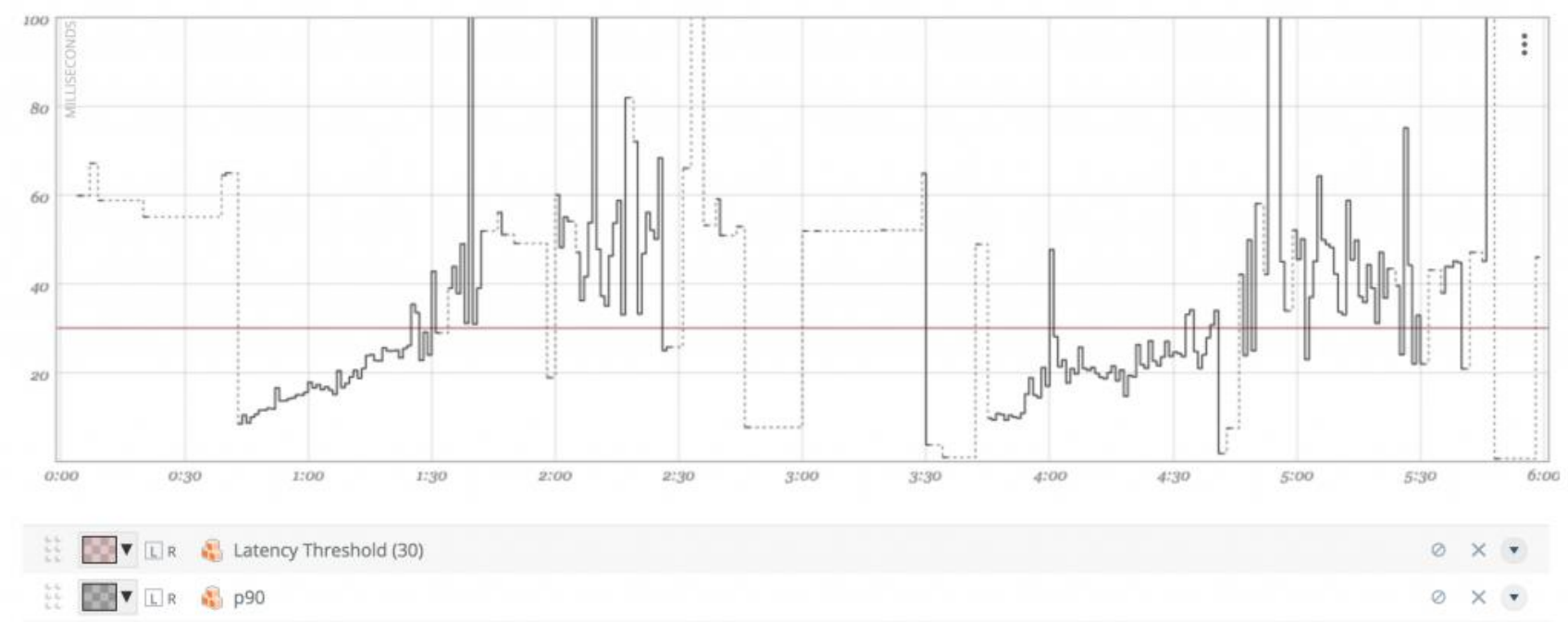
A more dramatic example

Calculated p90 (10-100ms) != averaged p90 (36ms)



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Rethinking computing SLO latency

1) Compute the SLO from stored raw data (logs)

2) Count the number of bad requests

3) Use histograms to store latency distribution

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1) Compute the SLO from stored data

Possible with many tools (Splunk, ELK, awk/grep)

Not always tenable for large volumes of data

Tough to do in real time

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1) Compute the SLO from stored data

An example of calculating percentiles w/ Splunk

```
mydata | stats perc90(responsetime) as response90,
perc99(responsetime) as response99 by
ApplicationName
```

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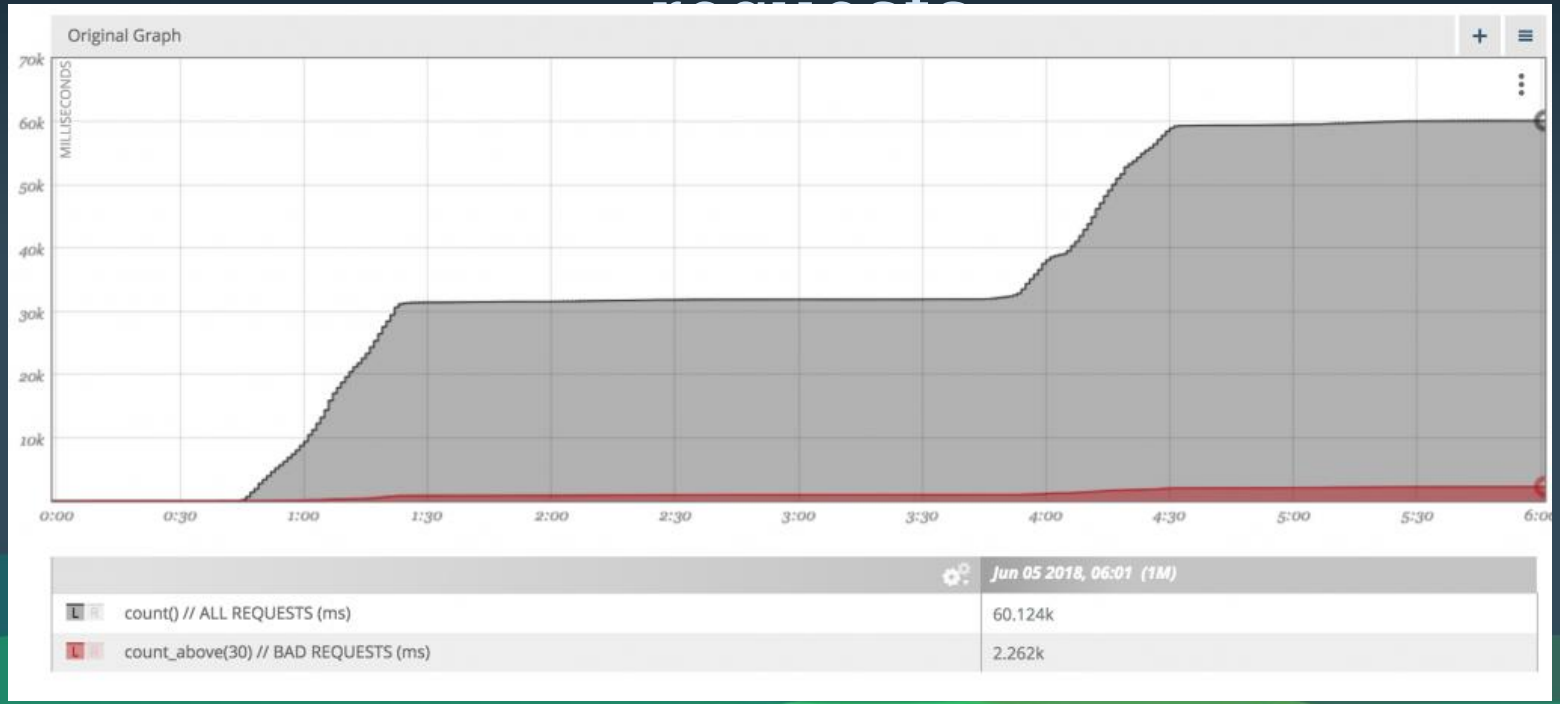
2) Count the number of bad requests



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2) Count the number of bad requests

Percent good = 100 - (2262/60124)*100 = 96.238%

Problem - you have to choose latency threshold up front

If your SLO changes, you can’t analyze historical data

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3) Using histogram latency data

Histograms can be aggregated across time

Histograms can be used to derive arbitrary percentiles

Bin (bucket) choices should span sample data

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3) Using histogram latency data

HDR-Histogram – https://HDrhistogram.org

Circllhist – https://github.com/circonus-labs/libcircllhist/

t-digest – https://github.com/tdunning/t-digest

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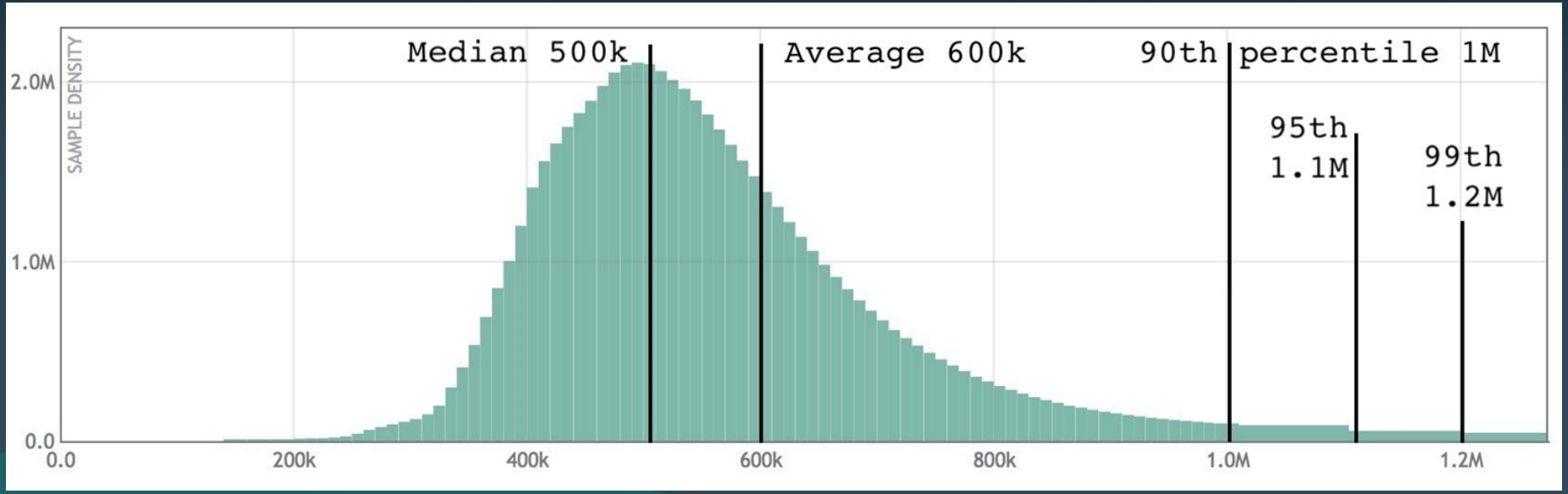
3) Using histogram latency data



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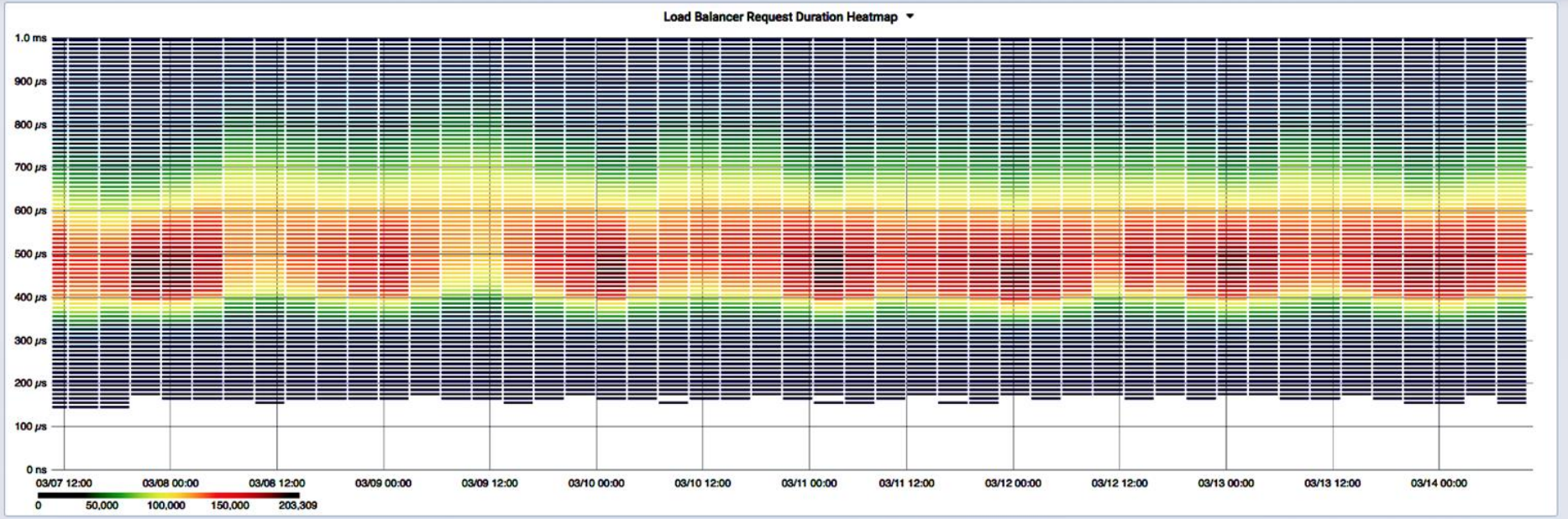
3) Using histogram latency data



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3) Using histogram latency data

99% of home page requests in the past 28 days served in < 100ms

% requests = count_below(100ms) / total_count * 100

ex: 99.484 percent faster than 100ms

This is an **inverse percentile**.

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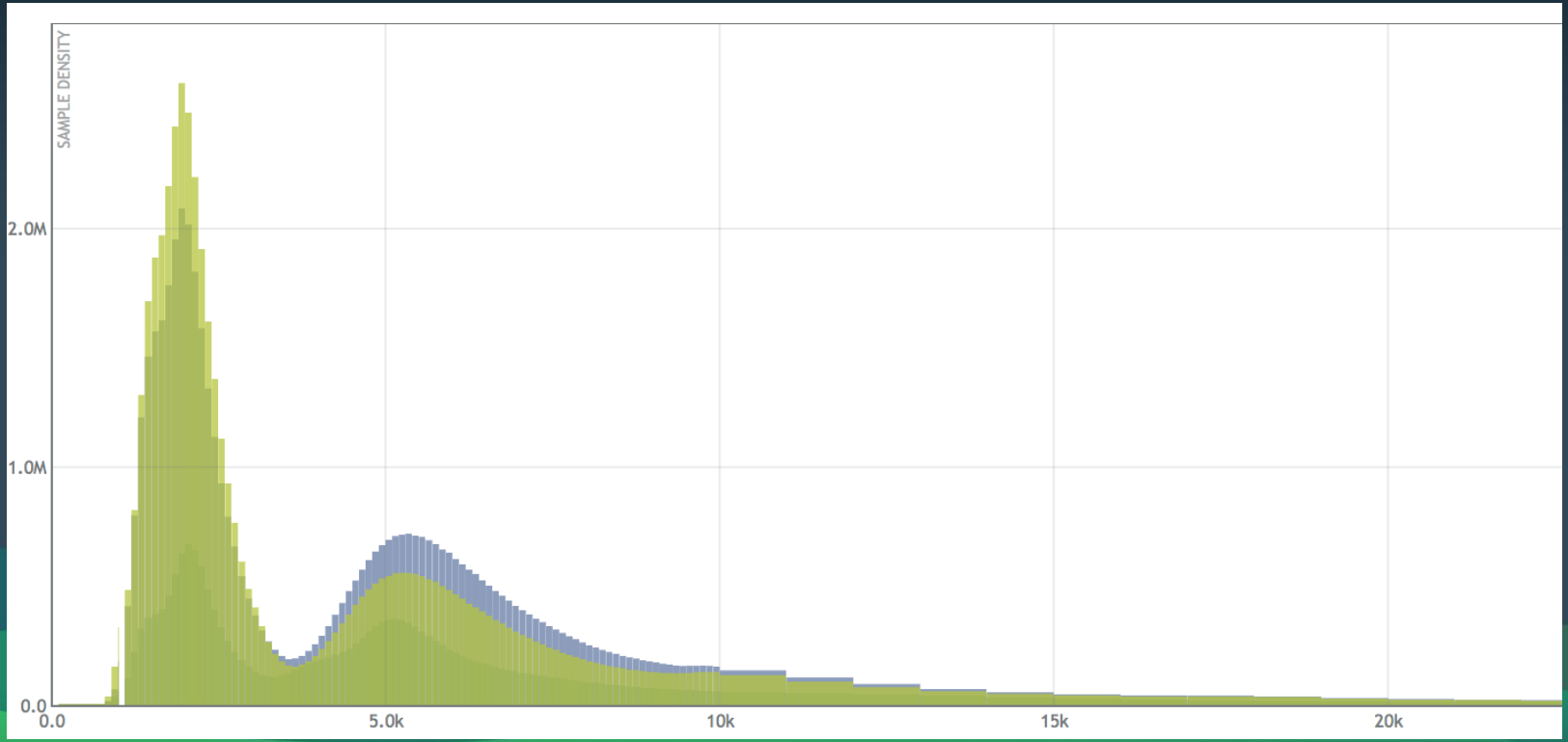
3) Using histogram latency data



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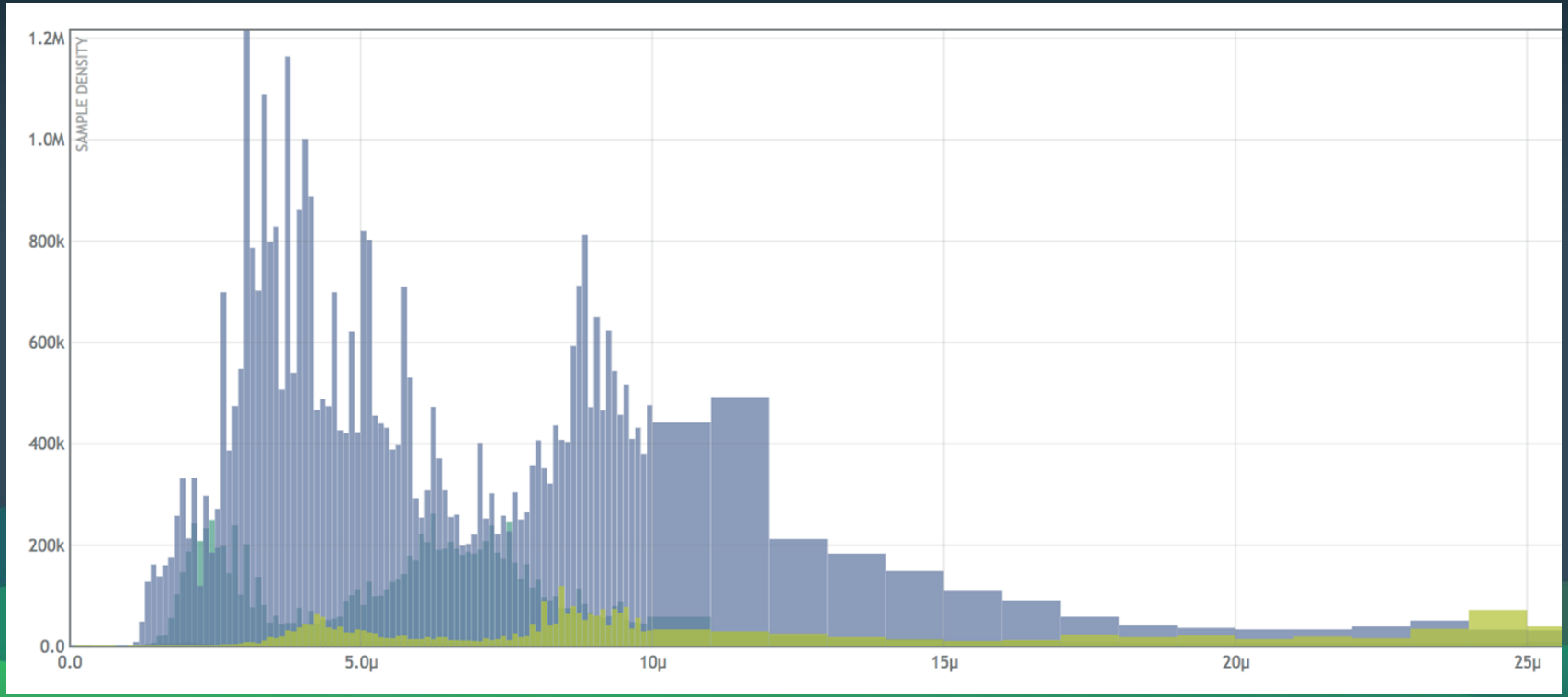
3) Using histogram latency data



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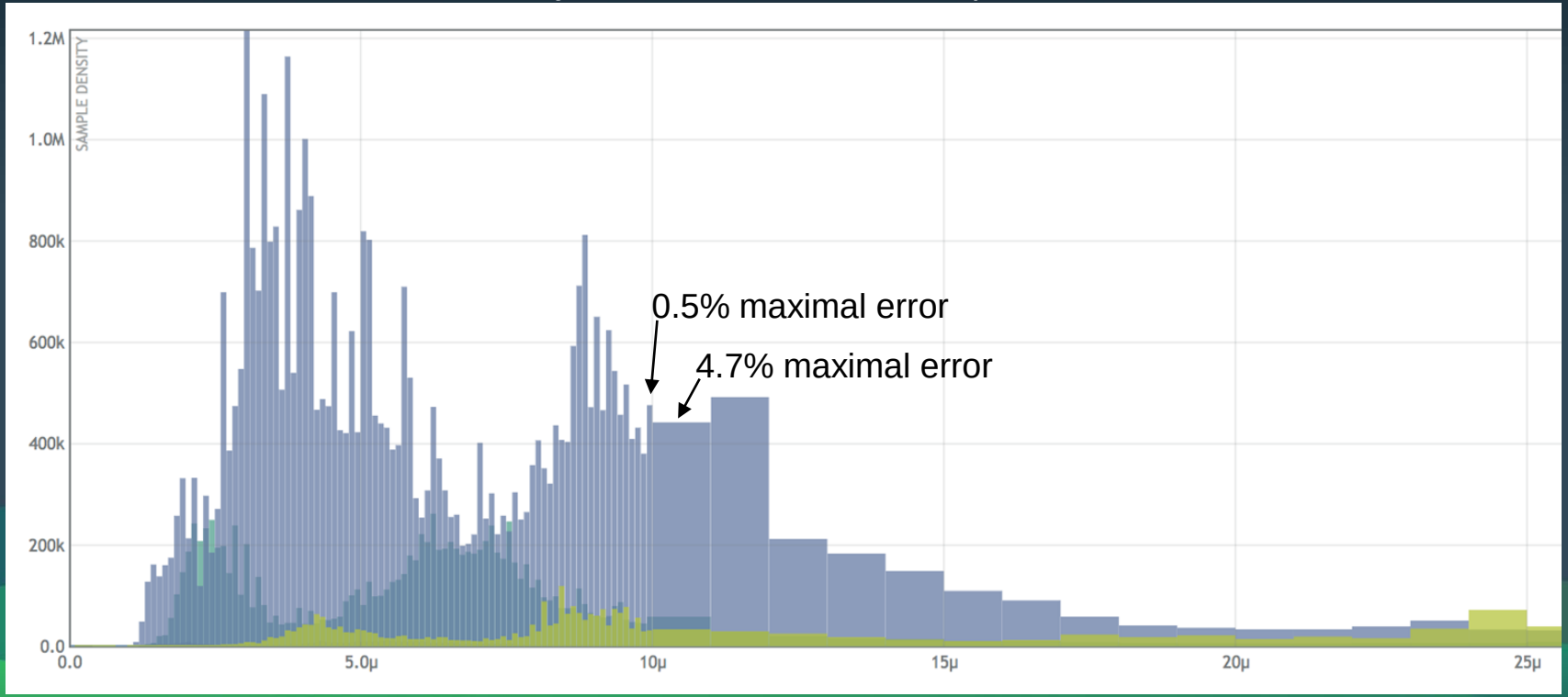
libcircllhist: C, Java, Go, Javascript

Envoy uses libcircllhist, for example.



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Framing SLOs as quantiles is backwards

- When we say:
  99.5%
  of requests should be faster than
  100ms

- We don't care as much about how fast the 99.5^{th}% is... p(99.5) or q(0.995)

- We actually care what percentile is at 100ms... $q^{-1}(0.1)$

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Framing SLOs correctly is important

- If you are “doing SLOs”
  (and budgets around them)
- You are literally investing time, money, and focus based on the answers to math questions.
- Ask the right questions.
- Do the math right.
- Histogram representation is the “right” statistical representation for these questions.
- t-digest and moment sketches are beautiful and awesome and powerful, but they help answer ***different*** questions… and answer these questions poorly.

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Framing SLOs is iterative

- Since we're literally investing around these numbers...

  Why is 99.5% at 100ms right?

  And not 99.2% at 115ms?

- If you can't answer this question...

  maybe you shouldn't take your SLO so seriously.

- By keeping historical data with the right granularity to answer these "new" proposals for SLOs... you can iteratively optimize your parameters.

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SLOs... the undiscussed problem

- There are two times that are important.

  1) the period over which you calculate your quantile.

  2) the period over which you calculate your objective success.

- SLOs don't look like:
  99.5% under 100ms is an incomplete phrasing.

- They actually look like:
  99.5% under 100ms over any five minute period... and
  99.9% of those are satisfied in a rolling 28 day period.

(yes, that's now 4 parameters to select correctly)

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Tool Choices

- You need correct math
- Use a tool that either uses raw data or binned histograms.
- You should be able to quantify statistical error in every answer you get back.
- You need history
- You SLOs (at first) will be offensively arbitrary. In order to improve them you must be able to re-analyze your data.
- You need correlation
- You can’t refit parameters without the data your attempting to fit to.

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Questions?

Tweet me @postwait

Ask us anything on Slack at http://slack.s.circonus.com/