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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Latency SLO

99% of home page requests in the past 28 days served in < 100ms
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What is the p90 computed over the full 28 days?
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Hint - it’s not the average of each p90 sample shown
A more dramatic example

Calculated p90 (10-100ms) != averaged p90 (36ms)
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
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
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
2) Count the number of bad requests.
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
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
3) Using histogram latency data
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99% of home page requests in the past 28 days served in < 100ms

% requests = \( \frac{\text{count_below}(100\text{ms})}{\text{total_count}} \times 100 \)

ex: 99.484 percent faster than 100ms

This is an inverse percentile.
3) Using histogram latency data
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libcircllhist: C, Java, Go, Javascript

Envoy uses libcircllhist, for example.
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 99.5th% is... $p(99.5)$ or $q(0.995)$
- We actually care what percentile is at 100ms... $q^{-1}(0.1)$
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.
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.
SLOs... the undisussed 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)
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.
Questions?

Tweet me @postwait

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