Adjustments to the Master's Proposal

Profile-guided heterogeneous-aware scheduling for cloud workloads

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Submitted in partial fulfillment of the requirements for the degree of Master in Computer Science.

1 Overview

This document illustrates all the questions and suggestions raised by the Thesis Committee during the presentation of the original Master's Proposal on August 22, 2018. All the points shown here are to be incorporated in the original proposal and to be concluded at the end of Master's thesis.

For organization purposes, I divided this adjustment document into two sections: the Document and the Presentation. Both contain all the raised points and some commentary when necessary.

2 Proposal Document

1. **Improve both the experiments' methodology and the experimentation environment**: A more controlled environment (e.g., ordered keywords) will be introduced in the next experiments for comparison purposes. Regarding the methodology, it'll be extensively detailed and improved whenever it is possible.
2. **Better Timeline:** Please check next page.
3. **Adjust images: the average is missing for some graphs, and also do some approximations regarding the gain.**
4. **Measure the overhead of instrumentation and the migration cost**: This is currently being done and will be available at the Thesis Document.
5. **Maintain a data repository**: This is currently being done at my own private server and will be soon committed to GitHub, along with all the described data.

3 Proposal Presentation

1. **Over 27 minutes of presentation to start discussing the actual proposal**: This is due to the need of motivating the discussed problem. Most of the time pre-proposal was spent on motivation experiments, which were shown and had interesting results for discussion. However, for the actual presentation of the Thesis, this will be taken into account.
2. *(Slide 6)* **A bigger image and more specific diagram for Google Engine anatomy**: The shown diagram was originally taken from Brin and Page (1998) and encompasses all the building blocks of a Search Engine. As the figure is pretty old, I recognize a new one and more context-adapted is necessary, and it'll be done for the Thesis Presentation and Document as well.
3. *(Slides 11-12)* **No good transitions between certain subjects (heterogeneity, energy consumption)**: This is, in part, due to the available time for presentation. However, I recognize the criticized point is far from good and will be adjusted accordingly for the next presentation.
4. *(Slide 14)* **No (good) definition of Tail Latency**: There's no consecrated definition of Tail Latency: texts such as Tail at Scale (Dean, 2013) introduces it through assumptions and ideas. Nevertheless, I'll look for better ways to introduce this theme in the final Thesis Presentation.
5. *(Slide 20)* **It's necessary to run the same experiment (service time per keyword) for little cores**.
6. *(*Slide 25) **Need to study the relationship between energy and time as well.**
7. *(Slide 31)* **If the request is of an "average" load, there's no difference between running on big or little cores. Why?**: An average request will be located at 50-percentile of the service time distribution, which is below the service deadline - so it will have a reasonable service time both in big and little cores.
8. *(Slides 27-57)* **The reason ("Why") for the scheduling work is missing.**

4 Timeline

This is a new proposed timeline which can be altered accordingly to the progress of the research.

4.1 First Trimester: Elasticsearch

- Measure the instrumentation and the migration cost with Elasticsearch at Juno. This is done through the comparison between a non-instrumented version of Elasticsearch with an instrumented version.
- Compare the implemented scheduler results against GTS (Juno's default Scheduler) on throughput. This is done by collecting the service times of both (scheduler-instrumented and non-instrumented) version of Elasticsearch.
- Compare the energy-efficiency between the scheduler-instrumented and non-instrumented version of Elasticsearch. This is done through the occasional checkup of Juno's energy registers while there's load on Elasticsearch.
- If necessary, do possible optimizations on scheduler (programming structures, memory management, scheduling algorithms).

4.2 Second Trimester: Cassandra

- Profile Cassandra and find the hot function. This is done through the means described in Thesis' Proposal Document (Linux's perf tool or proprietary java profiler).
- Repeat the exact methodology regarding energy and service time comparisons for Elasticsearch in Cassandra.

4.3 Third Trimester: Writing

- Draw necessary diagrams (e.g., final algorithm diagram, search engine anatomy, etc).
- Use data to generate new graphics (mainly comparison graphs between the scheduler-instrumented and non-scheduler instrumented versions for Elasticsearch and Cassandra).
- Write actual thesis document as described in the proposal.
- Submit and defend Thesis.