School of Electrical and Information Engineering
University of the Witwatersrand, Johannesburg
ELEN4002/4012: Project Specification Outline

Project Title:	Accelerating Edge and Fog Computing With Data Compression

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Project Specification:

Edge and fog computing are important in the area of IoT applications and are becoming more and more popular with the need for the ability to process large sets of data from various edge devices. One reason for the shift to edge and fog computing is for the improved response times of the queries given that edge devices need not send all their data to the fog gateway or cloud.

To further decrease the response time of these systems this project proposes to use various filtering and compression techniques to further accelerate edge and fog computing. One filter example is an accommodative Bloom which is a way to test if a piece of data exists in a set or not when the data set is significantly large. One compression method is using perceptually important points to represent a dataset which is similar to time series compression or sampling however can be modified to capture points of interest in the datasets such as maxima and mimima.

The fog gateway will be simulated using a Dell Inspiron laptop and the edge devices will be simulated using various Android smartphones and tablets including a Samsung Note 3 and a Samsung Galaxy Tab 10.1v GT-P7100. These devices will all be rooted and running Ubuntu so as to make communication easier. The compression and filtering algorithms will be implemented on the devices and various computations and queries will be run with and without compression and filtering.

The results will be validated and the response times compared. It is expected that the compression and filtering will cause significant reductions on the response times while having minimal effects on battery life and power used by the edge devices. The project will be documented and all code and instructions will be published on a public repository on Github so that if the projects results are to be tested, all necessary information will be available.

Milestones:

The milestones to be achieved are listed below:

- All smart devices to be used as edge devices are to be acquired, rooted and to have ubuntu installed.

- Final decisions based on queries that will be used for testing and compression and other filtering techniques are to be made.

- Fog gateway environment on the Dell laptop is to be set up.

- Communication between edge devices and between edge devices and fog gateway is to be established.

- The decided upon queries are to be timed without having implemented any filtering and data compression techniques.

- Bloom Filter algorithm is to be implemented.

- Compression algorithm/s is/are to be implemented.

- The decided upon queries are to be timed having implemented filtering and data compression techniques.

- Compression and filtering techniques are to be optimised.

- Final project report is to be completed.

Preliminary Budget & Resources:

To model a IoT microcosm it is necessary to have a number of edge devices (ideally 5 but 4 will suffice) and a fog gateway. The devices that are already owned and the ones that need to still be purchased are listed below.

Already own:

- 1 Samsung Galaxy Note 3 smartphone (edge device).
- 1 Samsung Galaxy Tab 10.1v GT-P7100 (edge device).
- 1 Samsung Smartphone provided by supervisor, model unknown (edge device).
- Dell Inspiron 15-3567 laptop (fog gateway).

Need to Purchase:

- 1 Android smart phone/tablet. It is suggested that a Samsung Galaxy S5 be used as this device was found online for R1600 and is the cheapest option with respectable processing power and SD card compatibility.

This brings the total budget to R1600.

List of Possible Risks	Likelihood (High/ Medium/Low)	Impact On Project (High/Medium/Low)	Mitigating Factors
To create a more realistic model access to a cloud might be needed. This may not be possible.	Low	Medium	Simulate cloud using a computer
Purchasing smartphone might cause project to be over budget.	High	High	Attempt to gain access to donated devices. Attempt to find cheaper smartphones elsewhere online.

Processing power of the device(s) may be insufficient .	Low	Medium	Reduce data set that is being processed by each edge device.
Devices may incur damage over time of project.	Low	High	Perform simulations with care and ensure a safe environment for the devices.
Might not be possible to install Ubuntu on all the acquired devices.	Medium	High	Do extensive research to determine multiple ways to install Ubuntu on android devices.

Risks / Mitigation: