EXPANDING THE OVERALL EFFICIENCY OF TOMORROW'S DATA CENTERS THROUGH PROCESSOR OPTIMIZATION

William Putnam, University of New Haven

INTRODUCTION

As consumers start to utilize cloud-based services, the data centers that house them can be very inefficient. On average, data centers worldwide consume an average of 30 nuclear power plants worth of power, as well as a supplement of round-the-clock diesel generators, in the hopes of preventing any outage for any period of time. In today's era of financial microtransactions and social media, a denial-of-service (DDoS) error can be fatal to business. But at an average of 10% processor utilization per server, the wasted power conflicts with the desire to shift to environmentally-friendly trends.

OBJECTIVES

The two main objectives to this project are:

1) Developing a set of models based off of testing various computers under various processor loads to determine how much power is needed for which process.
2) Developing an application that controls the power consumed by a processor that can be automatic (based off the models) or manual (controlled by the user).

MODEL COLLECTION

The data was collected from 4 different units:

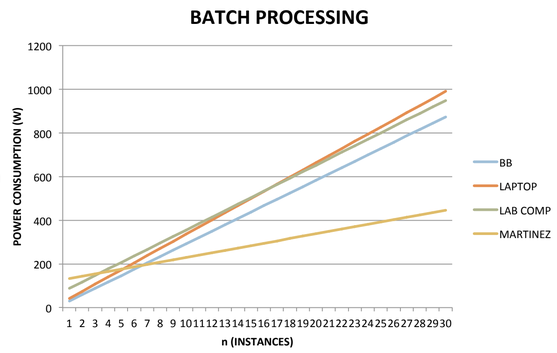
- BeagleBoard XM, ARM
- Dell Latitude E6500, Intel C2D T9600
- Dell Optiplex 780, Intel C2Q Q9400
- Asus Maximum IV Extreme Z, Intel I7-2600

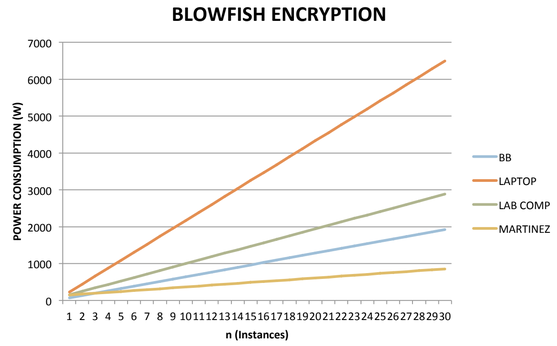
There were 8 different tests carried out:

- Idle
- Batch processing
- Interactive processing
- Realtime processing
- Server benchmark
- System benchmark
- Processor benchmark
- Blowfish encryption

The results were then graphed to consider which type of processor was best suitable for n processes of a certain format.

$$P_T = (P_{idle} + t_{test} * P_{test} * n) + t_{test} * n$$





PROGRAM DEVELOPMENT

P

Pandect, meaning comprehensive overview, is the application that controls the processors on the network. It was developed in the C++ programming language paired with Win32 API headers. The application was developed in Windows due to its availability in the workplace and the fact that each type of operating system communicates with its processor differently.

Pandect monitors the status of all processor and cores of each computer on an intranet, or local network, and toggles which cores and/or processors should be used for a program. The application is designed to include ceilings for core and processor usage, an automatic mode for off-peak periods of time, a manual mode for an administrator to control the limits, and an emergency override that automatically brings the units to full power in case of a sudden spike in traffic to prevent a denial of service error.

AWAITING COMPLETION

- Pandect is still in development.
  - Dynamic allocation has shown complications.
  - Models must be incorporated into the program.
- Pandect will be tested using an intranet of computers with varying processors.
- Terminal-based control and support for operating systems, including Mac OSX and the Linux kernel, are possible additional objectives following the completion of a working application.

REFERENCES

- Glanz, James. "Power, Pollution and the Internet." *New York Times* 22 Sept. 2012: n. pag. 22 Sept. 2012. Web. May-June 2013.

ACKNOWLEDGEMENTS

- Prof. Christopher Martinez, Ph.D. for his assistance with all hardware-related support
- Prof. Alice E. Fischer, Ph.D. for her assistance with all software-related support
- Prof. David W. Eggert, Ph.D. for his assistance with initial debugging of testing software