Research Topics for Senior Projects 2016

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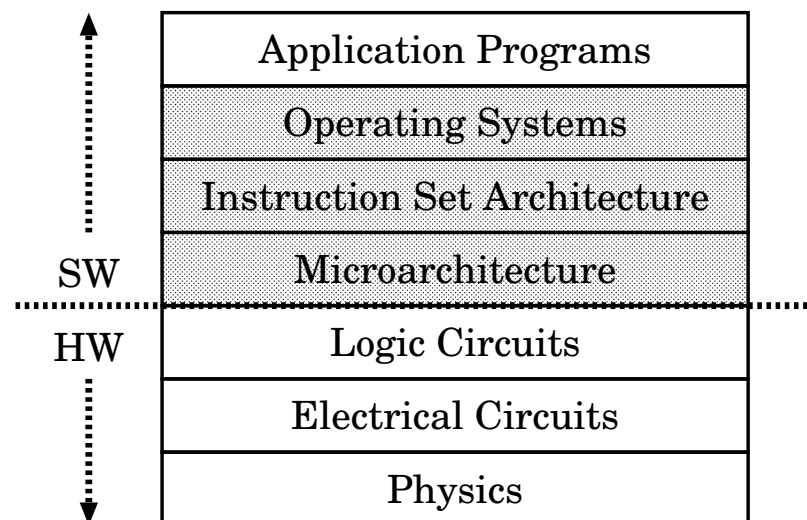**April, 2016**

CAOS

Computer Architecture and Operating Systems Group

Think "Why and How"

Not just memorize "what"

Customize Your Project Your Way

Tailor your thesis project with your technical expertise and interests, but don't forget the bill is on *you*.

Computer Systems Abstraction Layers

Application Programs
Operating Systems
Instruction Set Architecture
Microarchitecture
Logic Circuits
Electrical Circuits
Physics

SW

HW

We are mostly working on the shaded layers

Research Interests in General

Hardware/Software Interaction and Co-Design

- How modern (& realistic) software accesses hardware components ?

- How modern computer systems are designed and how they can be better utilized ?

Primary Metrics

- Performance: How many tasks (or much work) can be finished in a fixed amount of time ?

- Power-efficiency: How can we reduce the power consumption for the same amount of work ?

Past and Current Students' Project Topics

- Heterogeneous Multi-Core

- Securiy in Internet of Things

- Virtualization Overhead in a Java Application Server

- Inter-Domain (VM) Network Overhead and Optimization

- Sensor Network Communication Algorithm

Suggested Research Topics (1)

Linux File Systems

- File systems store various and huge amount of information, such as programs, user data, system configuration.

- In addition to the increasing capacity (amount of stored information), various requirements are emerging: speed (latency and throughput), reliability, flexibility, . . .

- Study the designs of current file systems and identify the issues for further improving the file systems.

- Study the types and characteristics of the workload against file systems.

Suggested Research Topics (2)

Inter-Domain Communication in Virtualized Systems

- Multiple independent "machines" can be accommodated on a single platform (virtual machines, VMs, or domains).

- When multiple VMs form a large system (multi-tier system), communication between VMs takes place.

- Inter-domain communication goes through different paths than that of physical machines (NIC, network switch, LAN cable..)

- Investigate the inter-domain communication overhead, and relate it to the behavior of the applications and configurations of the VMs.

Suggested Research Topics (3)

Hardware Acceleration of Java Virtual Machine

- Java programs (source files) are compiled into an abstract machine instructions, Java Bytecodes.

- The, Java Bytecodes are either interpreted or compiled by the CPU of the system executing the Java application (Java Virtual Machine, or JVM).

- JVM has advantages, such as platform independence, but some operations are inefficient.

- With a programmable hardware platform (e. g. FPGA), we can design a module to which inefficient operations can be offloaded.

Suggested Research Topics (4)

Heterogeneous Multi-Core Systems

- Multi-core CPUs are ubiquitous: even your smart phones should have dual or quad-core CPUs.

- Also, in addition to the main (general-purpose) CPUs, GPUs are included for faster-graphic processing

- Another type of multi-core CPUs are emerging: heterogeneous-microarchitecture. Example of commercial product: ARM big.LITTLE

- Cores have the same ISA (in a simple word, can run the same machine code programs), but implementations are different. The difficult (but worth investigating) part is how to assign a right job to a right core.

We need students who ...

- come to the lab and spend substantial time of your day in the lab (you do this because you are interested, not because you are forced).

- come to the meeting and other activities of the lab. Please note that if you miss the group meeting too many times without notice and justifiable reasons, you will be dismissed from the lab.

- Assignment should be adjusted according to the academic level and interest of each student. However, you should expect some literature study to acquire necessary knowledge and understanding of the field you are going to work.

References

- Group Website: `http://www.oslab.biz` follow links:

  Public Area: Theses of past students

  Update: Group's activities

  YouTube, ustream: videos of thesis and conference presentations

- Open Campus website: `http://opencampus.oslab.biz`
  A bit old but written in plain Japanese for general public.

- Research page:
  `http://www.u-aizu.ac.jp/~hitoshi/RESEARCH/`
  publication and other research activities.

- Posters outside the lab (Research Quadangles 241-E).

Contact Information

- Please send email for inquiry and appointment. (for the 1st semester of AY2016, the office hours are "by appointment only.").

- It is advised that student who are interested should contact and discuss the research topics before registering on the school's admin system.

- Office: Research Quadangles building 242-C