GP03-SWE3005-DR 06SEP-2017

Group 3 moderator : 여혁수

Members : 김경민, 장민서, 박정훈, 유제영

Executive summary of your discussion on discussion topics

In our first group discussion, first we choose the ways to access our whole topics together, and solve the topics for now and in the future. Considering a difficulty of meeting with all members because of distance with two campuses of our university, so we decided that it is better to discuss superficial direction of our whole topics in class, and choose one topic for each.

And then in the first half of class, we discussed about abstraction of computer systems with ppt slides. First, virtual machine represent the entire computer system. Then computer and other processes represent a computer and running program. Lastly, ISA, virtual memory, files are representing end parts like processor, main memory, and I/O device. We comprehended these feeling of abstraction, and thought about importance and need of these system once.

In second half of class, we decided to go deeply about Instruction Set Architecture. ISA is the abstract interface which contains the necessary infor to write a machine language program. It is like supporter of the hardware to make software executed softly. There are many properties to become good ISA. It should have convenience for programmer. And it should be quiet cheap, fast. Also it is good that size of the code is small considering external part of computer. We got to know the role of ISA and many conditions to being good ISA.

Topic 1

(1) Computer architecture vs. organization

Computer architecture is the design of the abstraction and is equally said ISA. It is visible to a programmer such as i/o mechanisms and memory addressing. Unlike it, organization is physical details that are transparent to a programmer such as depth of pipeline and data paths.

(2) Computation models: Sequential vs. Dataflow computation models

A sequential computational model is one in which instructions are executed one after another. (There may be branches in the program, but the general principle is that each instruction follows on from the previous one. )But dataflow model is about how things happen at runtime, not how programs are structured into parts.

(3) Abstractions of computer system, processor, and process

Abstraction of computer systems consist of four parts. It is the virtual machine that encompasses all of this process. As a sub-process, there is computer and processes that handle the whole systems without o/s. A ISA means actual processor that is included processor.

(4) Instruction Set Architecture vs Application Binary Interface

ISA is the all information which we should know to make machine code program accurately including the interface between hardware and lowest level software, instruction, register, memory access, I/O. ABI is the combination of OS interface which is used by application programmer and user part in instruction set. It is defined to standard of binary portability.

(5) Translation

First, High-level language program(i.e C) is translated to Assembly language program(for MIPS) by Compiler and this Assembly language program is translated to Binary machine language program(for MIPS) by Assembler.

Topic 2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Performance | Reliability | Scalability | Cost |
| **Super computer** | 1 | 2 | 2 | 1(most expensive) |
| **Main frame** | 2 | 2 | 1 | 2 |
| **Embedded Systems** | 3 | 1 | 3 | 3(least) |

1: Best, 2: Not best but not worst, 3: Worst

Before comparing those computer systems, list each definition first.

1. Super computer

: Super computer focused on tasks involving intense numerical calculations such as weather forecasting, fluid dynamics, nuclear simulations, theoretical astrophysics, and complex scientific computations. Supercomputer processing speeds are measured in floating point operations per second, or FLOPS(floating point operations per second). Main frame also focused on those highly intense tasks. However, the difference is that super computer focuses on a few programs or instructions as quickly as possible.

1. Main frame

: Main frame computers focus on handling and processing very large amount of data quickly. They are measured in MIPS(million instructions per second) and can respond to hundreds of millions of users at a time(Best scalability).

1. Embedded Systems

: Embedded system is a device that some microprocessors(CPU) are embedded to handle processes effectively. Windows or Linux are an OS used for personal computers or serval computers. Theses embedded systems are an OS that is used for portable devices, digital TV and many other electrical devices.

Let’s compare them in terms of performance, reliability, scalability and cost.

1. Performance

: Of course, super computer and main frame computer are the best. However, I rank super computer first because super computer focuses on certain tasks intensly.

1. Reliability (NOT YET)

: Reliability is an attribute of any computer-related component (software, or hardware, or a network, for example) that consistently performs according to its specifications.

Actually, it was really hard to rank in terms of reliability. The definition was so ambiguous and can’t find exact information. The reason I rank embedded system as 1st is because the microprocessor should work for several years continuously in device and also should fix its bugs itself. Super computer and main frames were developed before the emergence of microprocessor or embedded systems, so I think the reliability is best in embedded systems.

1. Scalability

: Scalability is the capability of a system, network, or process to handle a growing amount of work, or its potential to be enlarged to accommodate that growth. Main frame computers are specialized in processing several programs or OS simultaneously, therefore ranked in 1st place. Otherwise, the embedded systems are poor in scalability because they use one central Processing unit and are usually used by one person at a time.

1. Cost

: The cost of super computer is extremely expensive and is best among those three systems.

Topic 3

1. What are considerations on designing of the computer in the future.

Let's say I'm designing a computer to be used in about 36 months. It is Moore's law that must be considered at this time. Moore's Law is about the pace of development of microchip technology, which means that the amount of data that can be stored in a microchip is doubled every 18 months. In other words, the performance of a computer is improved 10 times every 5 years, 100 times every 10 years. Thus, 36 months later, a computer with about four times better performance than it is now commercially available. That is, when designing a computer, it is important to keep in mind the above facts, so that you can keep up with the pace of rapid technological development.

1. How to select feasible technologies to design your computer system that would be available in 36 months.

If you design a computer to be used after 36 months considering advanced technology, it is also very important to predict and apply the technology available at that time. First, it is necessary to predict how much circuit integration technology will develop in the semiconductor device. In addition, the speed at which computers can communicate with other computers, as well as the performance of the computer itself, and the development of Internet network technologies must also be predicted and responded to. Second, software should be designed to take advantage of the technologies that are currently being developed. For example, there are various technologies such as deep running, 3D printing, biometrics. Above all, as technology develops, security should not be ignored. Security issues must also be addressed in designing computers.

Discussion Topics on 4-6 Sep 2017 (2) [Topic 4]

|  |  |  |  |
| --- | --- | --- | --- |
| Op | Freq | CPIi | Freq x CPIi |
| ALU | 50% | 1 | 0.5 |
| Load | 30% | 5 | 1.5 |
| Store | 10% | 3 | 0.3 |
| Branch | 10% | 2 | 0.2 |
|  | | | Σ =2.5 |

* How much faster would the machine be if a better data cache reduced the average load time to 2 cycles?

Ans. Average load time goes to 2 cycles, so load Freq x CPI gonna be 0.6. So total becomes 0.5+1.5+0.3+0.2=1.6, and CPU time new = 1.6xICxCC. So 2.5/1.6 means 56.25% faster.

* What if two ALU instructions could be executed at once?

Ans. If so, ALU Freq x CPI will become half. So total becomes 0.25+1.5+0.3+0.2=2.25, and CPU time new = 2.25xICxCC. So 2.5/2.25 means 11.111…% faster.