Embedded System Design
Practice 1

Jeonghoon Kim
Hanyang University

Contents

1. Lecture Introduction
2. the progress of a class
3. SYS-LAB II
4. VPOS 2.0
5. Install Linux and Environment setting
6. Linetracer

Lecture introduction

Introduction

- Embedded System Design

- **Practice Location: IT/BT 813@every thursday (11:00~13:00)**
- **TA**
  - Jeonghoon Kim
    - Email: rlawjdgns527@hanyang.ac.kr
  - Jinhwan Kim
    - Email: adsll156@hanyang.ac.kr

Schedule (1/2)

- **March**
  - 7: Introduction & Grouping
  - 14: ARM Assembly
  - 21: U-Boot
  - 28: VPOS
- **: April**
  - 4: UART
  - 11: Interrupt
  - 18: SWI
  - 25: Midterm Period (There will probably be no practice classes.)

Schedule (2/2)

- **May**
  - 2: HWI
  - 9: Timer interrupt, context switching (Finalizing the Line Tracer Group Configuration)
  - 16: LED & Linetracer intro
  - 23: Linetracer(Team project)
  - 30: Linetracer
- **June**
  - 6 :
  - 13: Final
  - 20: Linetracer

THE PROGRESS OF A CLASS

Practice :Syslab , Linetracer

- **Syslab practice: no groups(individual practice)**
- **Linetracer : group practice(same as before)**

- **Previous Syslab practice: Using syslab board**
  - Due to board problems, syslab practice was conducted in groups

- **From this semester(Syslab practice)**
  - Virtual emulation using QEMU
  - Currently being reviewed for practice
  - If a problem arises using QEMU, we plan to conduct group practice as before.

Practice – Syslab(To be modified)

- **There will be two groups as below.**

- **syslab group: 3 people form 1 group. The evaluation will be conducted in groups. This grouping will be determined by me at my discretion.**
  - This group is randomly determined. This is a meeting for device sharing, so please cooperate with each other.
  - Evaluation excluding attendance will be conducted in groups, and attendance will be evaluated individually.
- **MAC OS(See only MAC users)**
  - If you are using a **Mac OS**, you will be limited in your ability to use the SYSLAB board (Using the board itself is fine, but LAN and serial connections may not work as well as they do on Windows.), so please tell me you are a Mac user. I will include them in the group with the Windows users.
  - There is currently no support for macOS. macOS will need to install and run the necessary programs on its own.
  - Using the board itself is fine, but LAN and serial connections may not work as well as on Windows. Mac OS users will have to configure the connections themselves.

Practice - Linetracer

- **LineTracer group: 2 people in 1 group. You will be evaluated as a team.**
  - For Line Tracer groups, you can pick who you want to team up with and let me know. Both people you want to team up with must come to me for confirmation.
  - Groups are not required, so if you want to go it alone, you can.
  - You can decide on your group until the actual line tracer lab starts. If you change your mind, please send me a e-mail.

Class & PDF

- Except for line tracer, syslab is designed to be able to proceed sufficiently after watching the pdf even if you miss the class content.
- If you miss it, try following the pdf slowly.

- **For the line tracer, we spend a week or two explaining the device. We'll give you the basics, but you'll have to design your own path.**
- **We'll be explaining how to use the device to escape the maze, and if you miss the explanation, the PDF will be available for you to view and understand.**

Grading policy

- **Practice classes are worth of 30% of Embedded system design class grade.**
  - Syslab Report 10%
    - Syslab reports must be submitted individually.
  - Linetracer 20%
- **Attendance is checked consolidated**
  - e.g. if you are late twice for a theory class and once for a lab -> it is counted as one absence.
  - Today we do not check attendance.

SYS-LAB II

Hanyang University
Division of Computer Science & Engineering

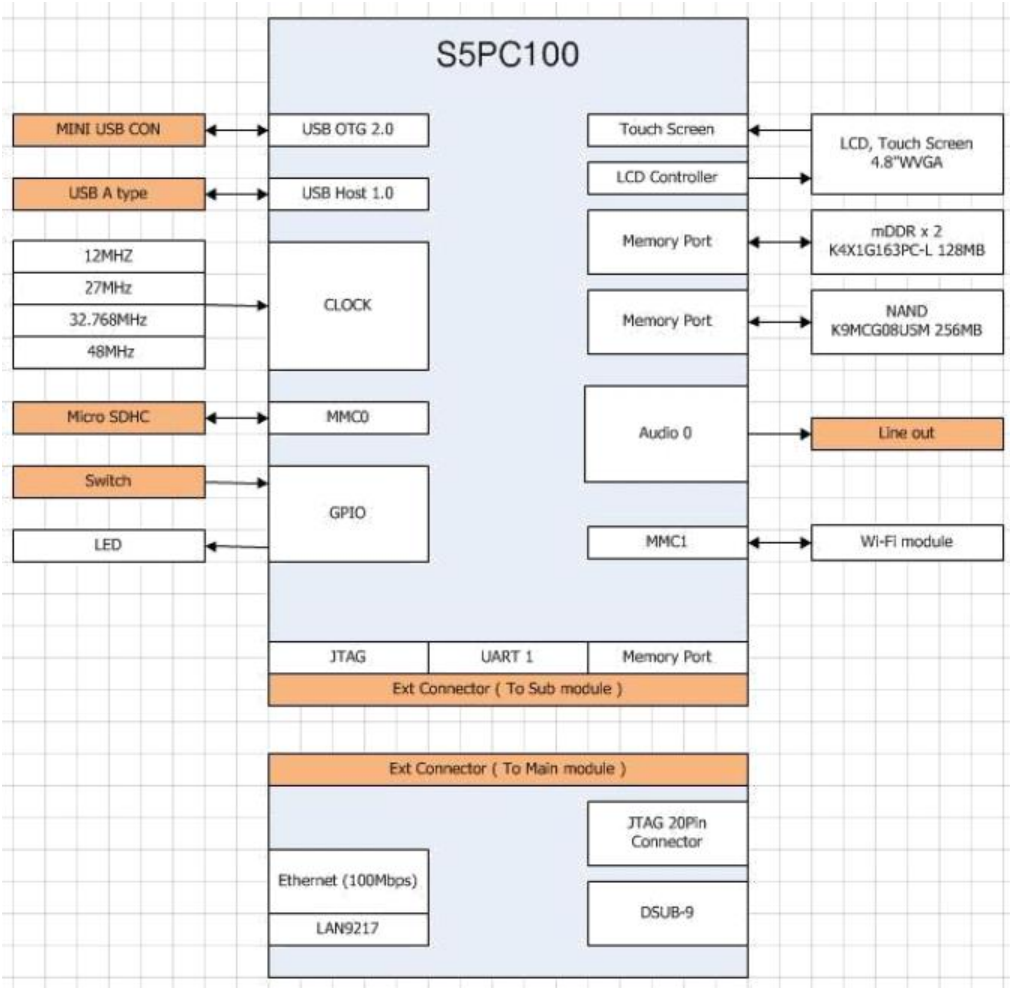
Introduction to SYS-LAB II

- **SYS-LAB II**
  - Embedded system development board with Samsung's S5PC100 processor
  - Support Embedded Linux and Google Android
  - GNU Tools for ARM
    - Support GNU-based cross-compiler

Hardware Specification

- **CPU**
  - S5PC100
    - ARM Cortex-A8 based application processor
- **Memory**
  - mDDR
    - K4X1G163PC-L(F)/GC6 (64x16) x2
  - NOR Flash
    - S29AL008D90TFI020-8Mb(1Mbyte x 8bit / 512k x 16bit)
  - NAND Flash
    - K9F4G08UOM-512M x 8bit

System block diagram of S5PC100



VPOS 2.0

VPOS 2.0

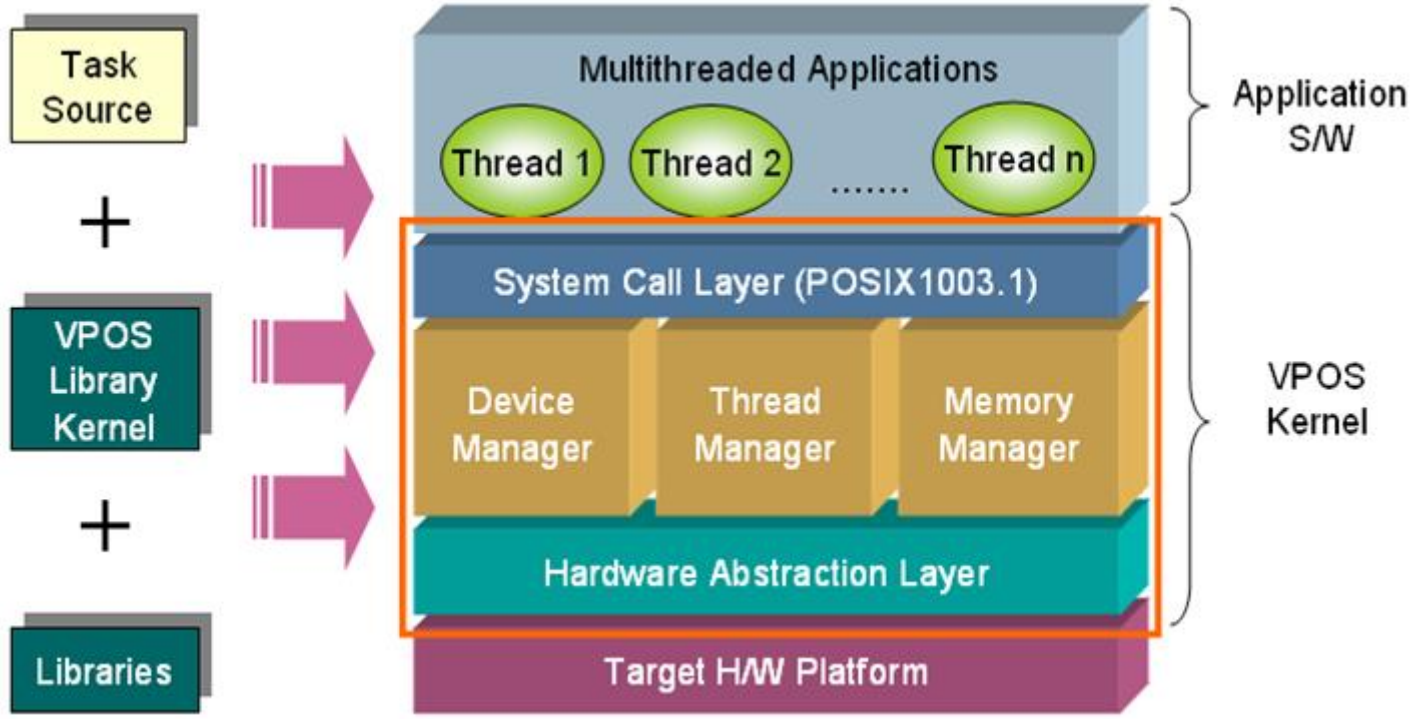
- **VPOS**
  - Verification-Purpose OS

- **Motivation**
  - More complex SOC logic design
    - Too long design and verification time
  - Traditional verification approach is too expensive
    - Complex kernel structure
    - Do not provide functions for SoC development
    - High additional costs (license fees, technical support…)

Features of VPOS 2.0

- **A small and simple kernel structure**
- **Priority based Preemptive kernel**
  - Static priority-based round-robin scheduling
- **Real-time support**
  - using PIP(Priority Inheritance Protocol) synchronization techniques
- **Use HAL(Hardware Abstraction Layer)**
- **Device driver structure for Linux compatibility support**

Structure of VPOS 2.0 kernel



Install Linux and Environment Setting (For Window)

Hanyang University
Division of Computer Science & Engineering

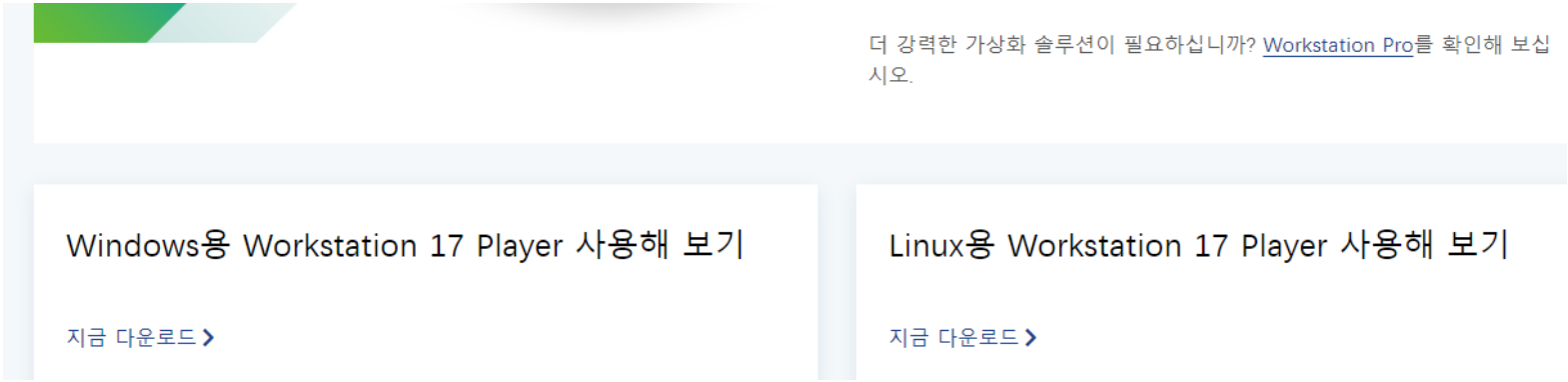
Install Linux

- **For Mac OS : Not required**
- **Ubuntu**
  - The most popular Linux distributions in Korea with Fedora Linux
  - Practice version
    - 22.04(LTS)
  - Basic UI
    - GNOME(GNU Network Object Model Environment)
  - Website
    - http://www.ubuntu.com/
    - http://ftp.daumkakao.com/ubuntu-releases/trusty/

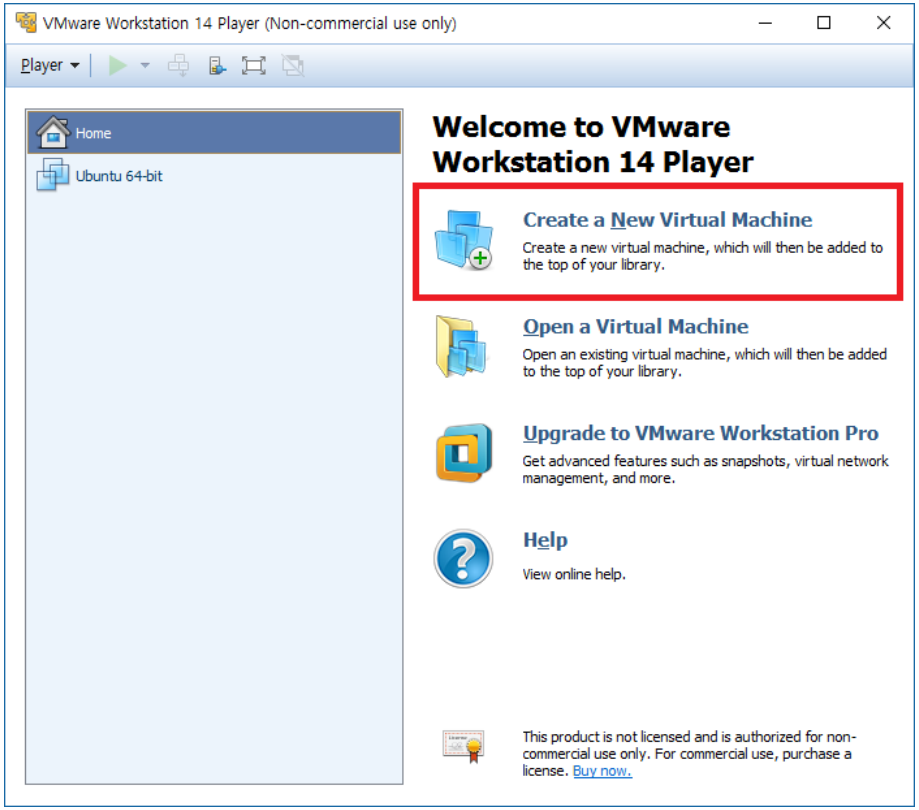
VMware

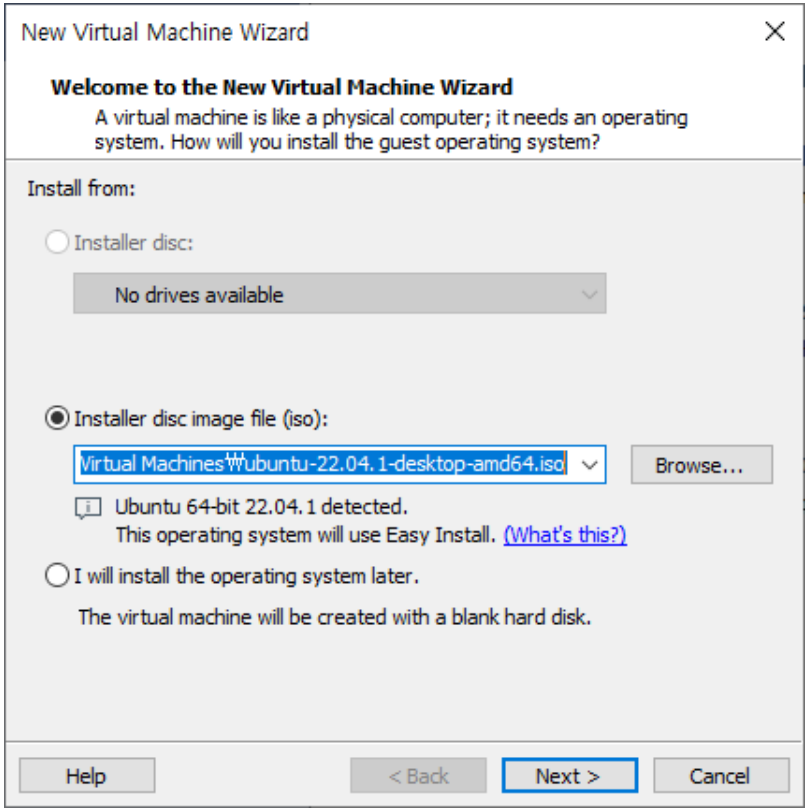
- **VMware Workstation Player**
  - X86 virtualization software to virtualize guest OS
  - Website
    - https://www.vmware.com/kr/products/workstation-player/workstation-player-evaluation.html

☞ Connect to the site, download and install

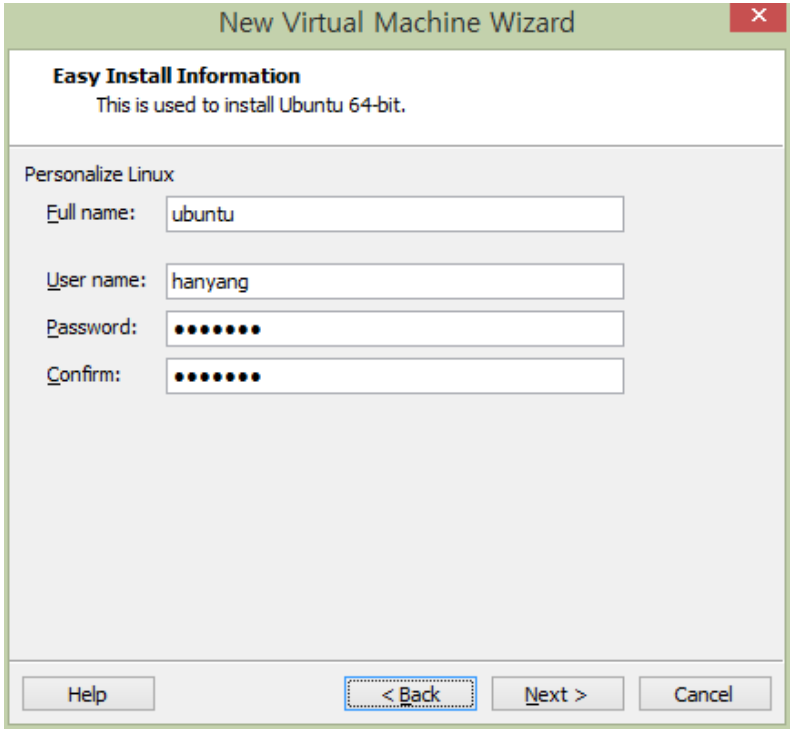


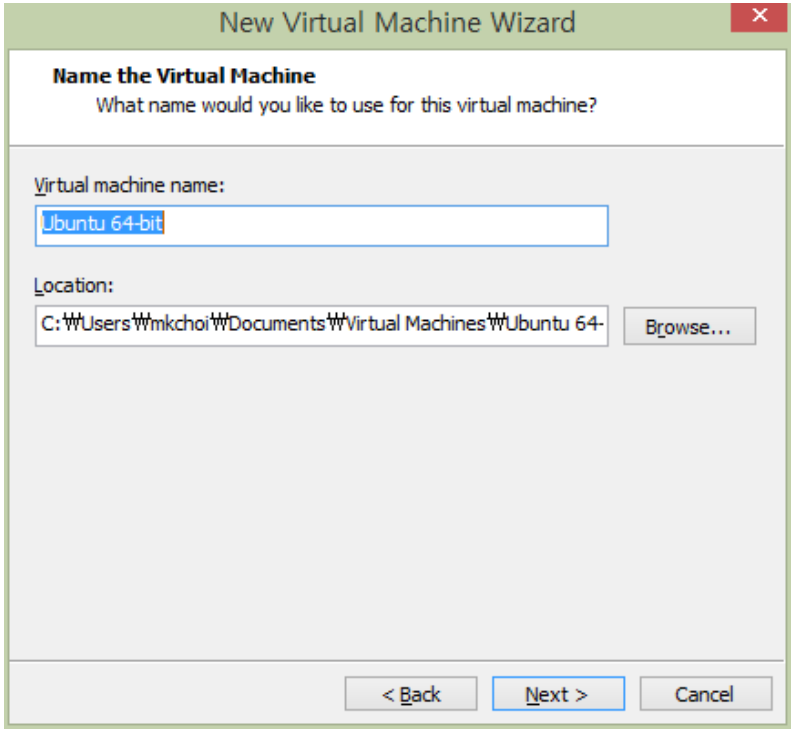
Create a virtual machine (1)



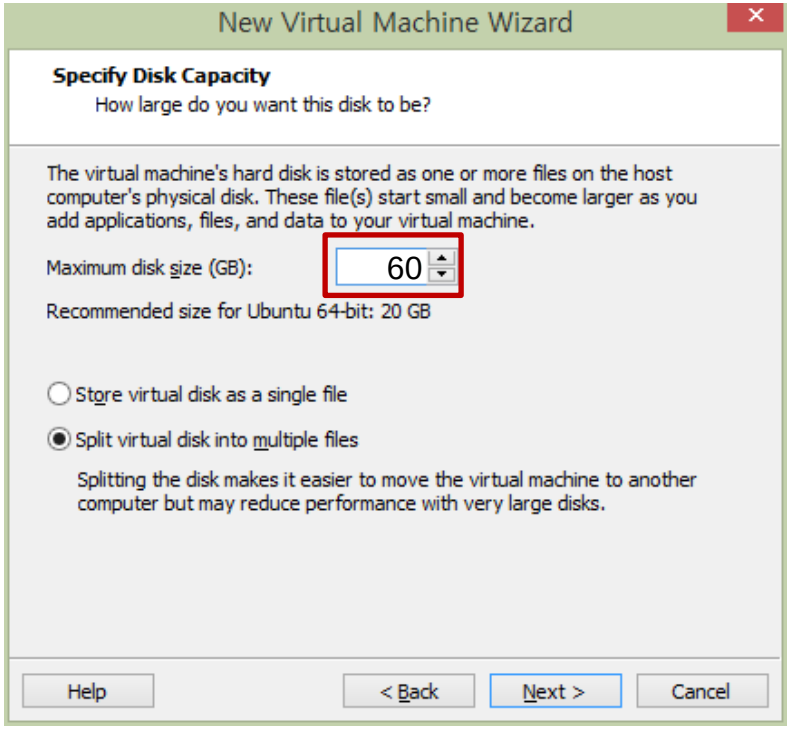


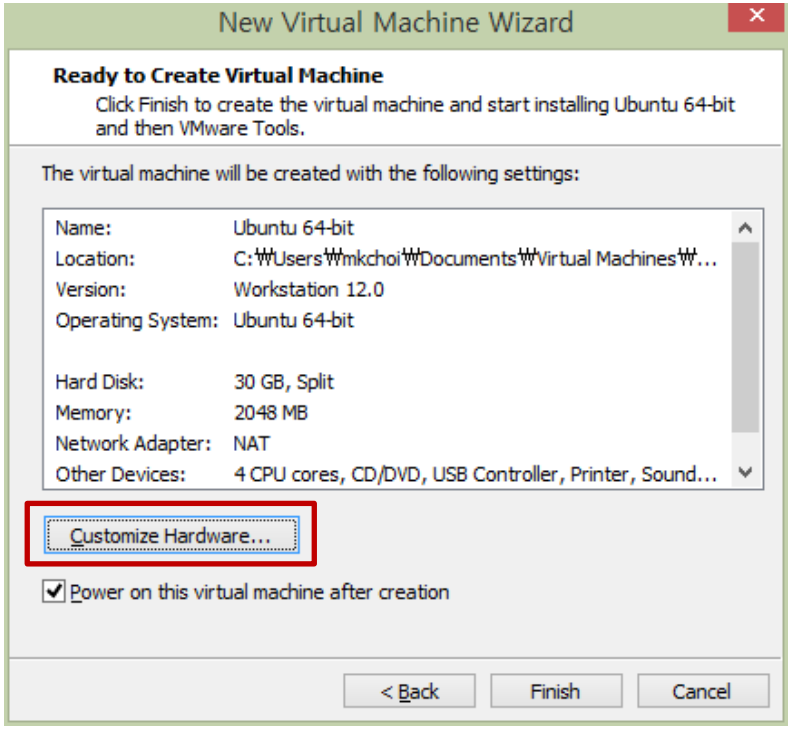
Create a virtual machine (2)



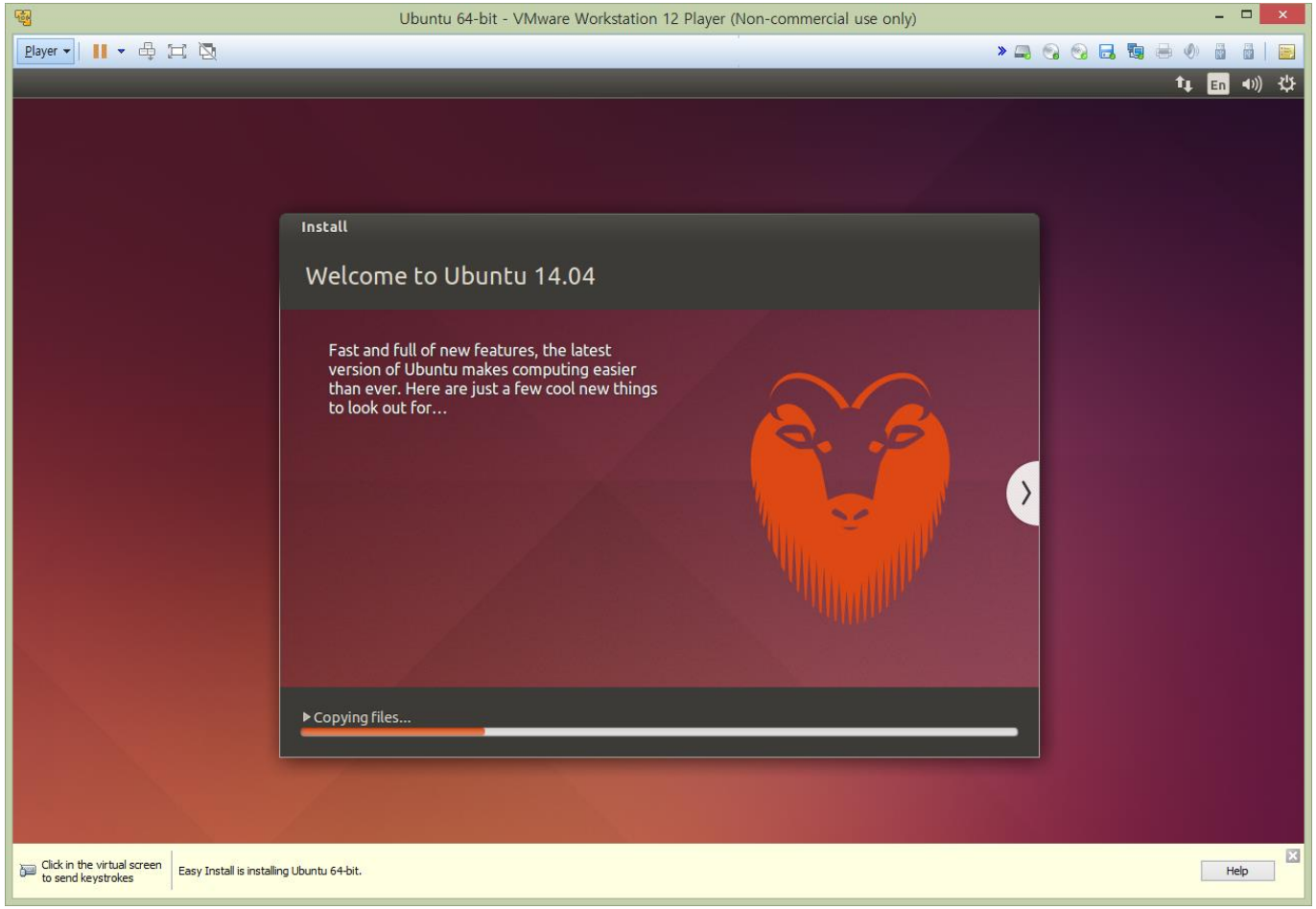


Create a virtual machine (3)

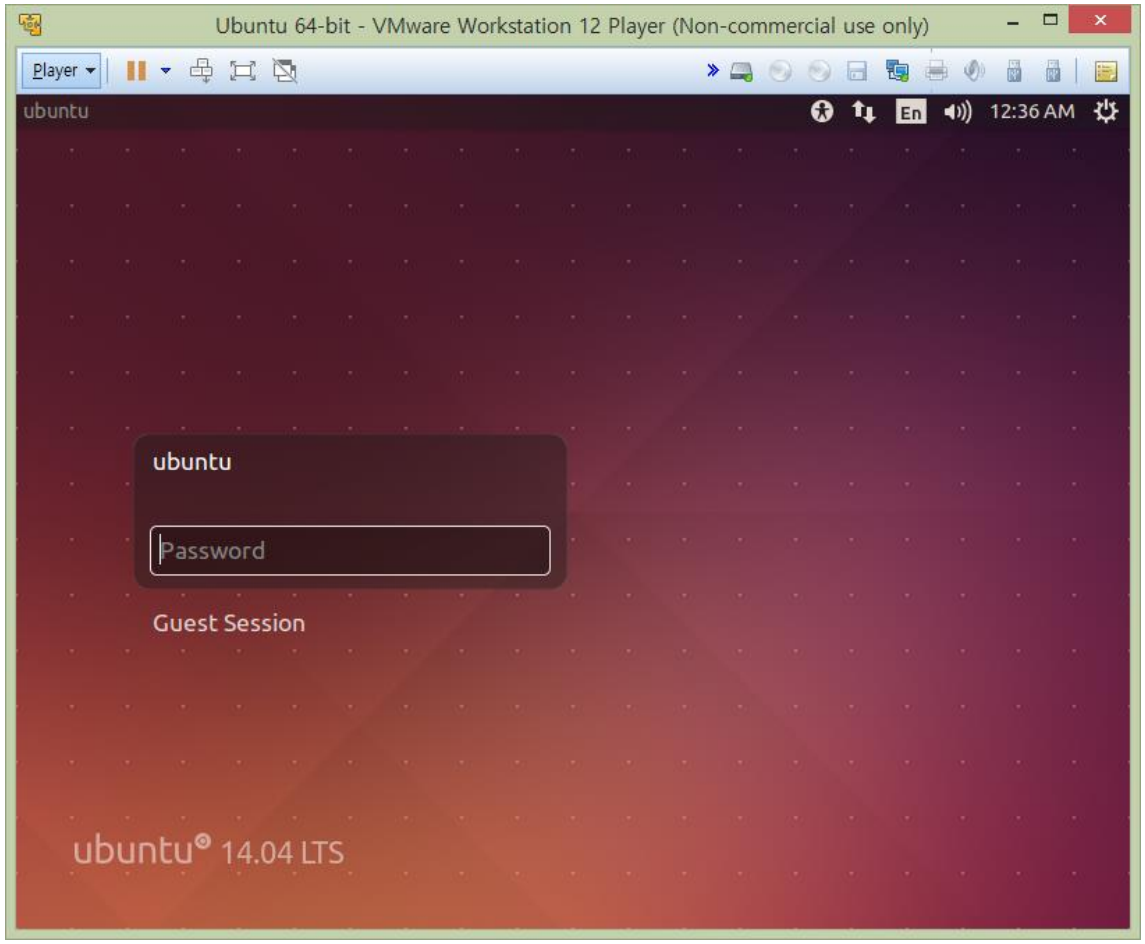




Install Ubuntu (1)



Install Ubuntu (2)



Install required programs

vim

- **What is vi?**
  - Abbreviations for Visual edit
  - Benefits
    - Every action is possible with the keyboard
    - Various features
  - Install
    - Ubuntu: # apt-get install vim

minicom

- **What is minicom?**
  - Used for serial monitoring on Linux
    - Same as HyperTerminal in Windows
  - Install
    - Ubuntu: # apt-get install minicom
  - Run
    - # minicom -s

Linetracer

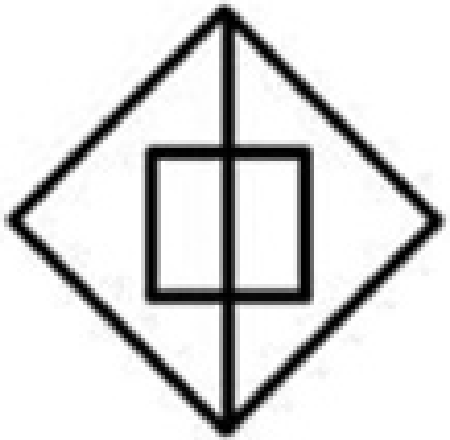
LineTracer

- **A line tracer designs a program to follow an Eulerian Trail and succeeds if it completes the trail with the given devices.**

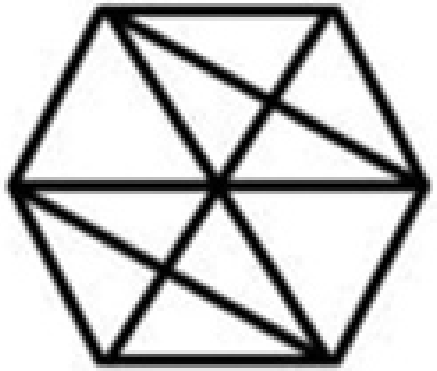
- **Phase 1 Explore Eulerian trail.**
  - This is an exploratory phase to identify a valid Eulerian Trail.
  - navigate the Eulerian Trail map and remember the path.
- **Phase 2**
  - Based on the exploration in Phase 1, Linetracer must generate and follow a path that satisfies the single-stroke drawing criteria.
  - The performance will also be evaluated on the ability to complete the drawing in the shortest possible time

LineTracer – Eulerian Trail example

Start/end



Start/end



Next Week

- **Next week:**
  - Arm Assembler Basic Knowledge and Simple Practice
- **To do by 3/21(not an assignment):**
  - Install vmware, install Ubuntu 22.04 on vmware, and install other elements (git(optional), vim(require), minicom(require))
  - Any version of vmware is fine.
  - If you have difficulty installing vmware, or if you can't install it after watching the ppt, you can email me.
  - For mac os users, you can connect directly to mac os without installing vmware.

GENDER(If your computer only has USB-C type)

- **If your computer only has USB-C ports, then you will definitely need a gender that converts USB-A to USB-C.**

This is required by LineTracer.

Thank you