CMPS 261 Server Management - Module 1: Introduction to Servers and Server Operating Systems

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Course Modules

- *Module 0: Course Design*
- **Module 1: Introduction to Servers and Server Operating Systems**
- Module 2: Getting Started with FreeBSD Server
- Module 3: Software Maintenance
- Module 4: Tuning and Configuration
- Module 5: Storage Management
- Module 6: Networking
- Module 7: Shell Scripting
- Module 8: Building a WordPress Server

Course Logistics

- Introductions
- Syllabus
- Extra credit for active participation
- A variety of necessary tools will be discussed later
- [A reminder on how to be successful](#)
- [A reminder on how to ask questions](#)
- [A reminder to build a portfolio](#)

Course Objectives

- Upon successful completion of this course, you should be able to:
  - Install an operating system
  - Remotely install software on an operating system
  - Configure and run the installed programs
  - Install security patches
  - Perform maintenance remotely
  - Learn to write simple shell scripts for automating common tasks

Module 1

- **Introduction to Servers and Server Operating Systems**
- Part A
  - Set up Element, use the jump box, and connect to your FreeBSD jail
  - Explain what a server is and what a system administrator does
  - Review the history of computing including virtualization
  - Install VirtualBox and create a FreeBSD VM
  - Browse the FreeBSD Handbook Part I Getting Started
- Part B
  - Review the different forms of cloud computing
  - List available operating systems
  - Review the basic operation of FreeBSD
  - Use FreeBSD in VirtualBox and run basic commands
  - Browse the FreeBSD Handbook Part I Getting Started

Objectives

- Upon successful completion of this module, you should be able to:
  - Define the purpose and roles of servers
  - Describe the available server operating systems and understand tradeoffs and choices
  - Install virtual machine hosting software
  - Install FreeBSD as a virtual machine
  - Understand the basic structure and operation of the server

PART A

Using Element

- [Follow the instructions to use Matrix/Element](#)
- Ask the instructor to join the course room on Element
  - Additional course information will be posted on there
  - Provides option to ask questions and interact
- Also request to join the Point Park University Space
  - Make sure to join the Applied Computer Science room
  - Receive updates about the Applied Computer Science program
  - Learn about internship and co-op opportunities
  - Stay in touch even after you graduate

Utilizing the Jump Box

- The purpose of the jump box is to be able to connect to your FreeBSD jail
- Unfortunately we are not allowed to connect to the jails directly anymore
- [Follow the instructions to use the jump box](#)
- Make sure access was provisioned (ask your instructor)
- You can use PuTTY to connect to your FreeBSD jail over SSH
- You can use FileZilla to upload files to your FreeBSD jail

Using Your FreeBSD Jail

- Make sure a jail was provisioned to you (ask your instructor if unsure)
- Use PuTTY to connect to your jail
- Save the settings to prevent reentering credentials every time
- [Watch the second half of this video for the steps](#)

Installing VirtualBox

- [Follow the instructions to use VirtualBox](#)
- Download a recent version of [FreeBSD](#) for installation
- Make sure to select the amd64 architecture and the disc1 ISO
- Create a FreeBSD VM image and install the FreeBSD ISO
- Boot into the new system and log in to make sure it works

What is a Server?

- According to Google Dictionary:
  - A server is "a computer or computer program that manages access to a centralized resource or service in a network".
- A server provides resources and services to clients

What do Servers do?

- Serve web pages (internal and external)
- Manage print services
- Provide access to files
  - Both remotely and over a LAN
- Run database management systems
- Provide network services
  - Firewall, DHCP, DNS, etc.
- Provide authentication services

What do System Administrators do (I)?

- Manage user accounts
- Add and remove hardware
- Perform backups
- Install and upgrade software
- Monitor operations
- Troubleshoot
- Maintain documentation
- Maintain security

What do System Administrators do (II)?

- Interact with management for budgeting
- Participate in turnover management activities
- Perform production turnover
- Contribute to software design and implementation
- Plan for future upgrades

A Brief and Incomplete History of Computing

- Mainframes
- Minicomputers
- (Rackmount) Servers
- Server farms

Mainframes I

Mainframes II

- The term mainframe was derived from the large cabinet (called a main frame)
- It housed the central processing unit and main memory of early computers
- Later, the term mainframe was used to distinguish high-end commercial computers from less powerful machines
- [Read more on Wikipedia](#)

Minicomputers I

Minicomputers II

- Smaller general-purpose computer developed in the mid-1960s
- Sold at a much lower price than mainframe and mid-size computers from IBM and its direct competitors
- The class formed a distinct group with its own software architectures and operating systems
- Relied on the use of transistors and core memory technologies
- [Read more on Wikipedia](#)

Servers I

Servers II

Servers III

- A server is a piece of computer hardware or software that provides functionality for "clients"
- A single server can serve multiple clients, and a single client can use multiple servers
- A client process may run on the same device or may connect over a network to a server on a different device
- Typical servers are database servers, file servers, mail servers, print servers, web servers, game servers, application servers
- [Read more on Wikipedia](#)

Server Farms I

Server Farms II

- Collection of computer servers
- Usually maintained by an organization to supply server functionality far beyond the capability of a single machine
- They often consist of thousands of computers which require a large amount of power to run and to keep cool
- [The 10 largest server farms ever built](#)
- [Read more on Wikipedia](#)

Virtualization

- Virtualization is a technology concept of creating a virtual computer that can contain (but is not limited to) a virtual CPU, virtual operating system, virtual storage, or virtual network card
- This virtual computer or virtual machine or guest machine can live inside a physical machine or host machine or virtual host

Hypervisors

- The software used to provide virtualization is referred to as a Hypervisor
- This provides a Virtual Machine Monitor (VMM) used for managing and controlling the underlying physical hardware with the associated virtual hardware
- There are two types of Hypervisors

Type-1 Hypervisor

- This type of Hypervisor is loaded directly on the hardware to abstract the hardware to the virtualization layer and is commonly used on servers
  - It is sometimes called a bare-metal Hypervisor
- Some well-known type-1 Hypervisors are:
  - [VMware's vSphere](#)/[ESXi](#)
  - [Microsoft's Hyper-V](#)
  - [Linux's KVM](#)
  - [Red Hat Virtualization](#)
  - [Xenserver](#)

Type-2 Hypervisor

- This type of Hypervisor is loaded on an operating system and abstracts the virtualization layer through its host operating system and is commonly used on personal computers
  - It is sometimes called a hosted Hypervisor
- Some of the well-known type-2 Hypervisors are:
  - [VMware Workstation](#)
  - [Oracle VirtualBox](#)
  - [VMware Fusion for Mac](#)
  - [Parallels for Mac](#)
  - [bhyve for FreeBSD](#)

Browse FreeBSD Handbook

- Browse [FreeBSD Handbook Part I Getting Started](#)

Assignment

- Install VirtualBox
- Install FreeBSD
- Discuss BSD viability

PART B

Cloud Computing

- [Cloud computing](#) is the on-demand availability of computer system resources
  - Especially data storage (cloud storage) and computing power
  - Without direct active management by the user
- Different types ranked from high effort/control to low effort/control
  - Infrastructure as a Service
  - Platform as a Service
  - Software as a Service

Infrastructure as a Service

- Infrastructure as a Service focuses on the facilities and infrastructure within the data center
  - IaaS encompasses the computing power of servers, storage, network elements, power, and cooling.
- Instead of running servers in the company's data center, IaaS allows an organization to create virtualized servers in the cloud or to virtualize their servers and move their server systems and data center infrastructure to the cloud
- Examples include:
  - [Amazon Web Services](#)
  - [Google Compute Engine](#)
  - [Microsoft Azure](#)

Platform as a Service

- Platform as a Service focuses on application development on any desired platform utilizing cloud computing
- It allows developers to design, test, and implement their software on the same platform that their clients will use in a quick, simple, and cost-effective manner
- Provides a complete development package
  - For example, a managed instance of PostgreSQL or MariaDB
  - Or a Google BigQuery database

Software as a Service

- Software as a Service provides the applications that run on top of the platform and the abstracted infrastructure, and the applications are delivered via the Internet

- SaaS eliminates the need to install and run applications on individual computers, it is easy for organizations to streamline their product delivery, maintenance, and support. Examples are:
  - [Microsoft Office 365](#)
  - [Google Apps](#)
  - [Cisco WebEx](#)
  - [Citrix GoToMeeting](#)

What Operating Systems Are In Use (I)?

- Microsoft Windows Server
  - Proprietary / commercial
  - Closed source

What Operating Systems Are In Use (II)?

- UNIX
  - Proprietary / commercial
  - Closed source
- BSD UNIX
  - Derived from UNIX by University of California at Berkeley.
  - FreeBSD derived from BSD UNIX.
    - As well as NetBSD, OpenBSD, Gentoo.

What Operating Systems Are In Use (III)?

- Linux
  - Open source
  - Linux kernel meant to mimic operations of UNIX
  - Dozens of distributions are available
    - Ubuntu
    - Linux Mint
    - openSUSE
    - Red Hat / Fedora

Operating System Share

- What is the market share of server operating systems?
  - Actual share nearly impossible to determine
  - Due to number of private servers within corporations
  - Approximately 85% of public servers run some variant of UNIX; 15% Windows (source: W3techs.com)
  - Microsoft Windows Server sales not reported separately.

Why Choose FreeBSD?

- UNIX common in marketplace
- Exposure to server management concepts valid with any OS
- Open source eliminates licensing restrictions
- FreeBSD in use within Applied Computer Science department
  - Your jails are based in FreeBSD
- A video about FreeBSD

Brief History of UNIX and Linux

- [A quick history of UNIX](#)
- Originated at A T &T Bell Labs
  - First released in late 1960s
- A T & T licensed source code
  - University of Berkeley developed Berkeley Standard Distribution (BSD)
  - Code so modified from original it is now "free"
    - Spawned FreeBSD, NetBSD and OpenBSD
- Independently, Linus Torvalds developed the Linux kernel circa 1991
  - Numerous distributions have been built on the Linux kernel
- The "marketplace" is today quite vibrant with options

Getting started with FreeBSD in VirtualBox

- Adding a user
- Running basic commands
- [Configure port forwarding](#)
- [Upload files with FileZilla](#)

Browse FreeBSD Handbook

- Browse [FreeBSD Handbook Part I Getting Started](#)

Assignment

- Research what the `/var/run/dmesg.boot` file is
- Set up port forwarding to be able to connect to your FreeBSD virtual machine
- Use FileZilla to download the `/var/run/dmesg.boot` file from your VM
- Explain what kind of information is contained in the file
- [Download the ACS host system `dmesg.boot`](#)
- Compare the VM file to the ACS host system file
- Compare the hardware specs of your laptop to the server

THANK YOU!