System Administration & Security

COMP 175 | Fall 2021 | University of the Pacific | Jeff Shafer

Course Motivation

System Administration

> ↗ Sysadmins are responsible for the "care and feeding" of a computer system
>> ↗ *Installation, configuration, maintenance to ensure reliable operation*
>> ↗ Manage user accounts/logins
>> ↗ Manage file systems & data
>> ↗ Install and configure software and services
>>> ↗ Web server? File server? Email? Database? Backup?
>> ↗ Automate tasks (scripting)
>> ↗ Monitor and optimize system performance
>> ↗ Maintain system security (Updates, configuration, user training…)
>
> ↗ Sysadmin work varies significantly depending on the type of system
>> ↗ Desktop? **Server**? Cluster computer? The network itself?
>
> ↗ The job scope shifts as you go from 10 to 1,000 to 100,000 systems to manage

Are your servers **pets**? Or **cattle?**

Pets? Or Cattle?

Pets? Or Cattle?

"In the old way of doing things, we treat our servers like **pets**, for example *Bob the mail server*. If *Bob* goes down, it's all hands-on deck. The CEO can't get his email and it's the end of the world. In the new way, servers are numbered, like **cattle** in a herd. For example, `www001` to `www100`. When one server goes down, it's taken out back, shot, and replaced on the line."

http://cloudscaling.com/blog/cloud-computing/the-history-of-pets-vs-cattle/

Pets -vs- Cattle

Pets

↗ **Single** servers or server **pairs**

↗ Treated as indispensable and can never be down

↗ Manually built and managed

↗ Examples: Mainframes, solitary servers, HA loadbalancers/firewalls (active/active or active/passive), database systems designed as master/slave (active/passive), …

Cattle

↗ **Large arrays** of servers

↗ Designed for failure (none are irreplaceable)

↗ Built using automated tools

↗ No human intervention required during failure
   ↗ Data replication, redundant coding, …

↗ Examples: web server arrays, multi-master datastores such as Cassandra clusters, cluster computers, …

http://cloudscaling.com/blog/cloud-computing/the-history-of-pets-vs-cattle/

Certifications

↗ Myriad certifications specializing in every nuance of every type of system on the planet, and for both "pets" and "cattle"!

↗ Examples

  ↗ Microsoft Certified Solutions Expert (MCSE)

  ↗ CompTIA Server+

  ↗ RedHat Certified Engineer (RHCE)

  ↗ VMware Certified Professional – Data Center Virtualization (VCP-DCV)

↗ **Goal of this course is not to replace certificates**

  ↗ Or even assume you're interested in that career path

  ↗ Or teach you every last nuance about every system

Motivating Question for Class
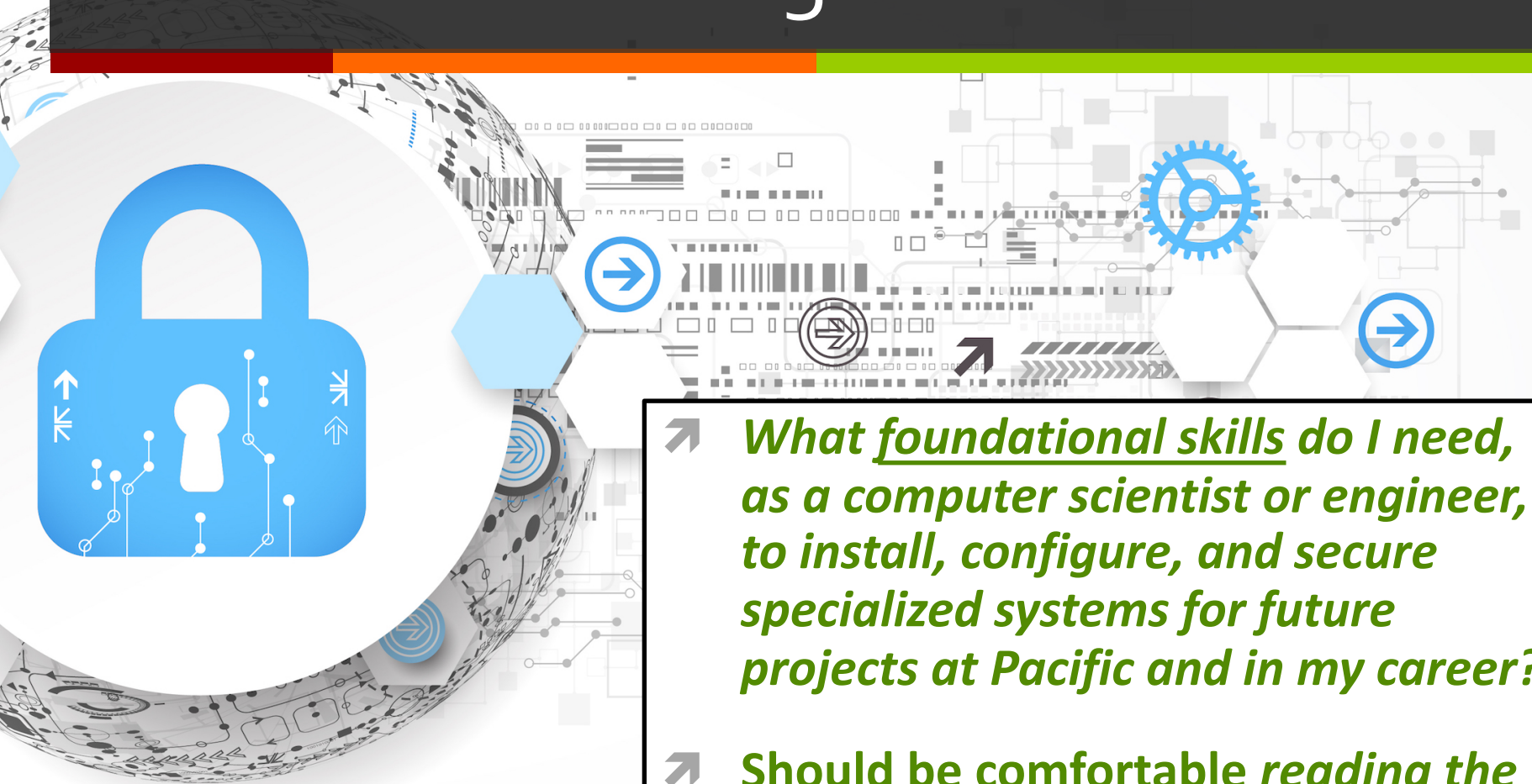
↗ ***What <u>foundational skills</u> do I need, as a computer scientist or engineer, to install, configure, and secure specialized systems for future projects at Pacific and in my career?***

↗ **Should be comfortable *reading the docs* for all the latest details**

*Learning these skills in the abstract
(i.e. Professor Shafer lecturing at you) is boring….*

Let's assemble our own systems and learn along the way!

"Disintegrating" by Fabian Oefner
http://fabianoefner.com/

There might be a "small amount" of complexity to deal with….

Tiger Enterprises, Inc.

↗ **Semester-Long Project**

↗ Build "Tiger Enterprises, Inc."

   ↗ A fast growing startup in the business of ¯_(ツ)_/¯

   ↗ *(Would welcome your suggestions on a mock corporate story)*

↗ Add complexity as needed to support your growing business success

Tiger Enterprises, Inc.

➚ Back in *ye olden times*, this would be done in your literal garage

➚ This is the **cloud era!** We're going to be using AWS for all our infrastructure needs

   ➚ *Including mock desktops, since this whole class is online*

Amazon Web Services (AWS)

https://www.youtube.com/watch?v=a9__D53WsUs

Sounds great!!!

The Mega-Corp is my Friend ☺

Perhaps a few pitfalls to watch out for….

AWS Billing

⤴ Amazon charges **on-demand** based on your usage

- ⤴ Charge for a virtual machine (per-hour for a given machine type)

- ⤴ Charged for storage (per-month for each GB for a given type of storage, i.e. SSD or hard drive)

- ⤴ Charged for *outbound* network traffic (per-month per GB, tiered levels)

- ⤴ … among other items that are billed for

⤴ **Will learn more about AWS Billing in week 2**

- ⤴ *Just assume that, if you can be charged for it, you will be…*

https://calculator.aws/

How are we paying for the course?

Class Tools – AWS Academy

↗ Student access to Amazon Web Services

↗ Instructors can create classes
   - ↗ **$100 in credit per course**
   - ↗ 1-click access into AWS console
   - ↗ No student credit card needed
   - ↗ Instructor has access to your class console (only) for grading or troubleshooting

Course Overview

Websites

Main website

- https://cyberlab.pacific.edu/

Canvas CMS
(gradebook, assignments, …)

- http://canvas.pacific.edu

✎ Edit ⋮

COMP_175_01-System Admin and Security Lecture-80825
Students are introduced to an operating system from an administrator's standpoint. Topics include installation with the proper allocation of disk resources, maintaining the operating system and various subsystems, security issues that include server hardening, host firewalls and network security issues. Students also study account administration in a networked environment, change management and intrusion detection. Prerequisites: Completion of all fundamental skills and familiarity with console-based operating systems commands. Junior standing. (Fall, every year)

Course Cheat Sheet

Class Website *(Assignments, lecture slides, resources)*	https://cyberlab.pacific.edu/courses/comp175 ↗
Class Slack *(Use class comp175 channel for all questions that would be helpful to your classmates. DM instructor otherwise)*	https://ecpe.slack.com/ ↗
Instructor Email	jshafer@pacific.edu
Instructor 1:1 Meeting	https://calendly.com/jeff-shafer ↗
Emergency Zoom Classroom *The emergency Zoom link is active only by prior arrangement with instructor for excused absences (e.g. COVID quarantine or illness, etc).*	https://pacific.zoom.us/j/97675949548?
AWS Academy Canvas Site	https://awsacademy.instructure.com/ ↗

Cheat Sheet on front page of Canvas site

Textbook

➚ **No print textbook**

➚ Supplemental online resources will be provided as needed for different class modules

Class Support

Group Q&A

↗ Slack Channel

   ↗ https://ecpe.slack.com/

   ↗ Look for "comp175-fall2021"

   ↗ **Post questions to group unless the issue is unique to you**

   ↗ **DM'ing instructor is preferable to email or Canvas**

Personal Q&A

↗ In-Person Office Hours

   ↗ Tuesday 3-5pm (*1st/3rd week of month*)

   ↗ Thursday 10am-noon

↗ 1:1 Zoom Meeting Office Hours

   ↗ Mon/Wed/Fri afternoons

   ↗ https://calendly.com/jeff-shafer

Lab Topics

BETA

TESTING

TESTING

COURSE FEEDBACK!

Give and Take

I Promise…

↗ To keep the labs fun

↗ To be <u>flexible</u> with *requirements* and *deadlines* as we work through the labs

… If You Promise

↗ To communicate often with me

  ↗ How long did the lab take?

  ↗ What was easy?

  ↗ What was hard?

  ↗ What additional resources (lectures, examples, …) would help?

  ↗ Should we do this lab next year?

Lab Topics

- **Intro to AWS**
    - Quick-Start
    - VPC and Security Groups
    - Billing
    - *Not directly "Tiger Enterprises" but essential so we don't shoot ourselves in the foot unnecessarily*

- **Configuration management with Ansible**

- **Application deployment with Docker and Kubernetes**

- **Classic SysAdmin topics**
    - Account creation, management, security…
    - Web servers
    - File servers
    - Backup servers
    - … and more

- Networking & Security
    - Domain names – `tigerenterprises.org` is OURS to control
    - VPNs & Firewalls

Course Components

→ **Laboratory Assignments – 70%**

- → Construction of Tiger Enterprises, Inc.

- → In-class and homework time

→ **Projects – 20%**

- → Independent / self directed

- → May still be "Tiger Enterprises" focused but your own unique spin on services and systems

→ **Presentation – 10%**

Wrap-Up

↗ Questions?

↗ Concerns?

↗ **Today**

1. Go to Canvas

2. Find the *COMP 175* course

3. Find the first assignment: **Lab 1 Pre-Lab**

↗ **Due Wednesday at midnight!**

↗ **Thursday**

1. **Lab 1** - Configure and Launch a basic Linux Virtual Machine at AWS