cron and Scheduled Jobs

5.2

Cybersecurity

Archiving and Logging Data Day 2

Class Objectives

By the end of today's class, you will be able to:

Schedule regular jobs for individual users with crontab.

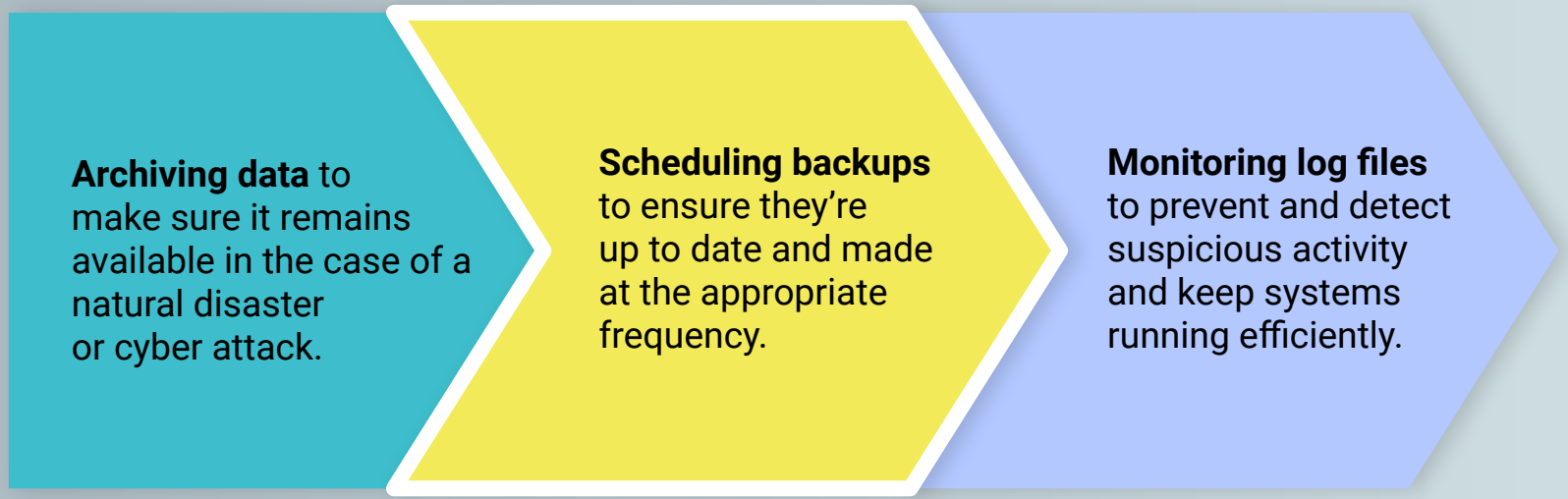
Write simple scripts for maintenance and security tasks.

Use `cron` to automate the execution of security scripts to perform maintenance on a regular basis.

Review tar and cron concepts

Scheduling Backups

Today, we'll learn how to write scripts and use a tool called `cron` to automate many of the tasks performed in the last class.



Automating

Automating a series of tasks takes two forms:

Scripts are files that contain multiple commands. The commands are executed by calling the script name.

Scheduled jobs run commands or scripts at specific, designated times.

Using Scripts in a Professional Context

Sysadmins use scripts and scheduled jobs in their workflow.

Fix an issue.

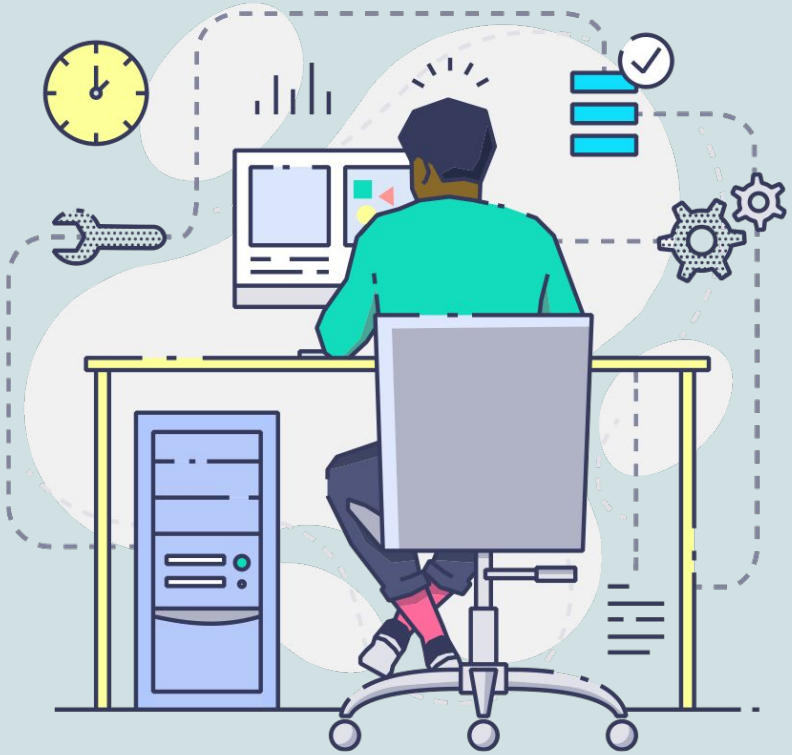
Example: Make a list of all users with old passwords, and force these users to update their credentials.

Write a script to automatically solve a problem.

Example: Write the script **`find_stale_users.sh`** to fix the issue.

Run the script and email the results regularly, using `cron`.

Example: Schedule **`find_stale_users.sh`** to run every Saturday at noon.



Overview of cron

Introducing `cron`

Consider the following scenario:

Before leaving work, you spend 10 minutes deleting your cache and your trash bin, and backing up your documents folder.

You also spend one hour per day installing software updates.

Introducing cron

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Before leaving work, you spend 10 minutes deleting your cache and your trash bin, and backing up your documents folder.

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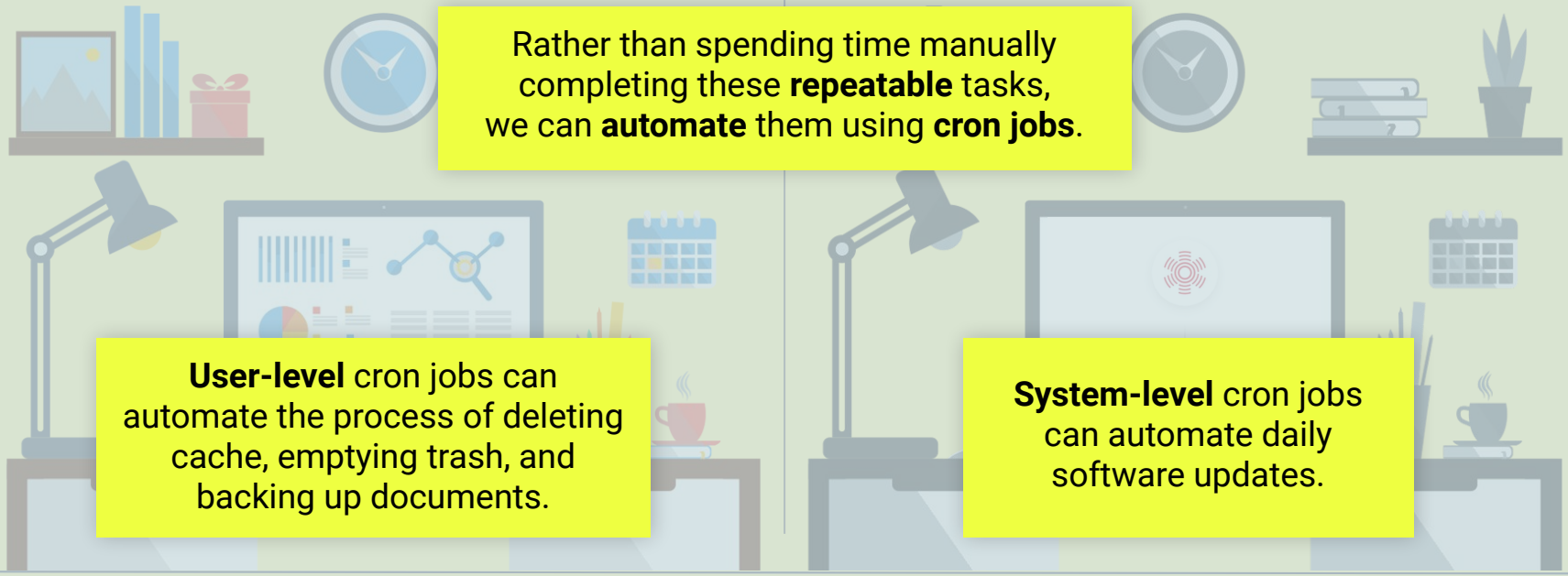


Rather than spending time manually completing these **repeatable** tasks, we can **automate** them using **cron jobs**.

User-level cron jobs can automate the process of deleting cache, emptying trash, and backing up documents.

System-level cron jobs can automate daily software updates.

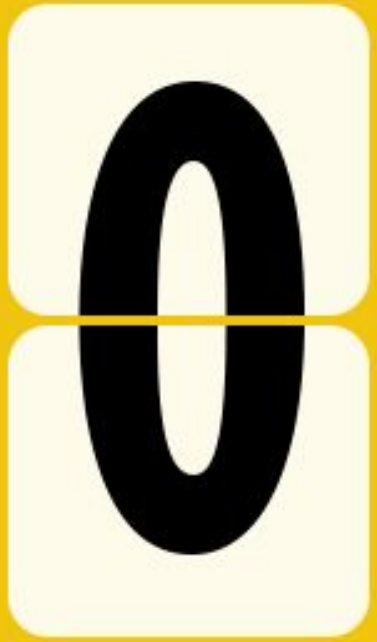
A **cron job** is a script or command designated to run at periodic, predetermined intervals.

Cron

A **daemon** is a computer program that runs as a background process, rather than being directly controlled by an interactive user.

`cron` is a robust task scheduler that allows users to schedule repetitive tasks to run on a regular basis.

Daemons are often started at boot up. While other daemons respond to network requests and hardware activity, `cron` is initiated at designated time intervals.



crontabs

Tasks are stored and scheduled in a file called a **crontab** (*cron table*).

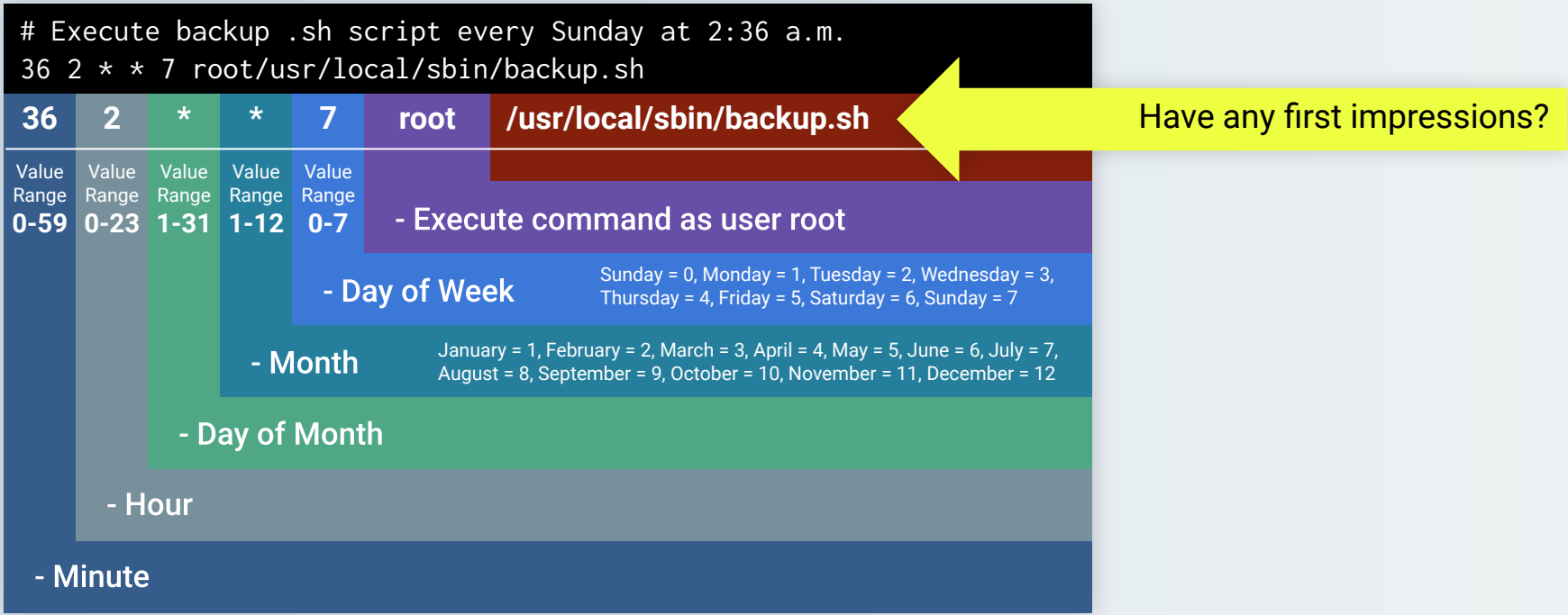
- Each user has their own individual, private crontab.
- System crontabs for system level actions.
- Tasks scheduled by users are run under that user's privilege level.
- Root users can have a crontab too.

(*Do you think this can pose threats?*)

cron Syntax

While they may seem intimidating, crontab rules can be learned relatively easily with some practice.

Let's look at crontab on the command line.

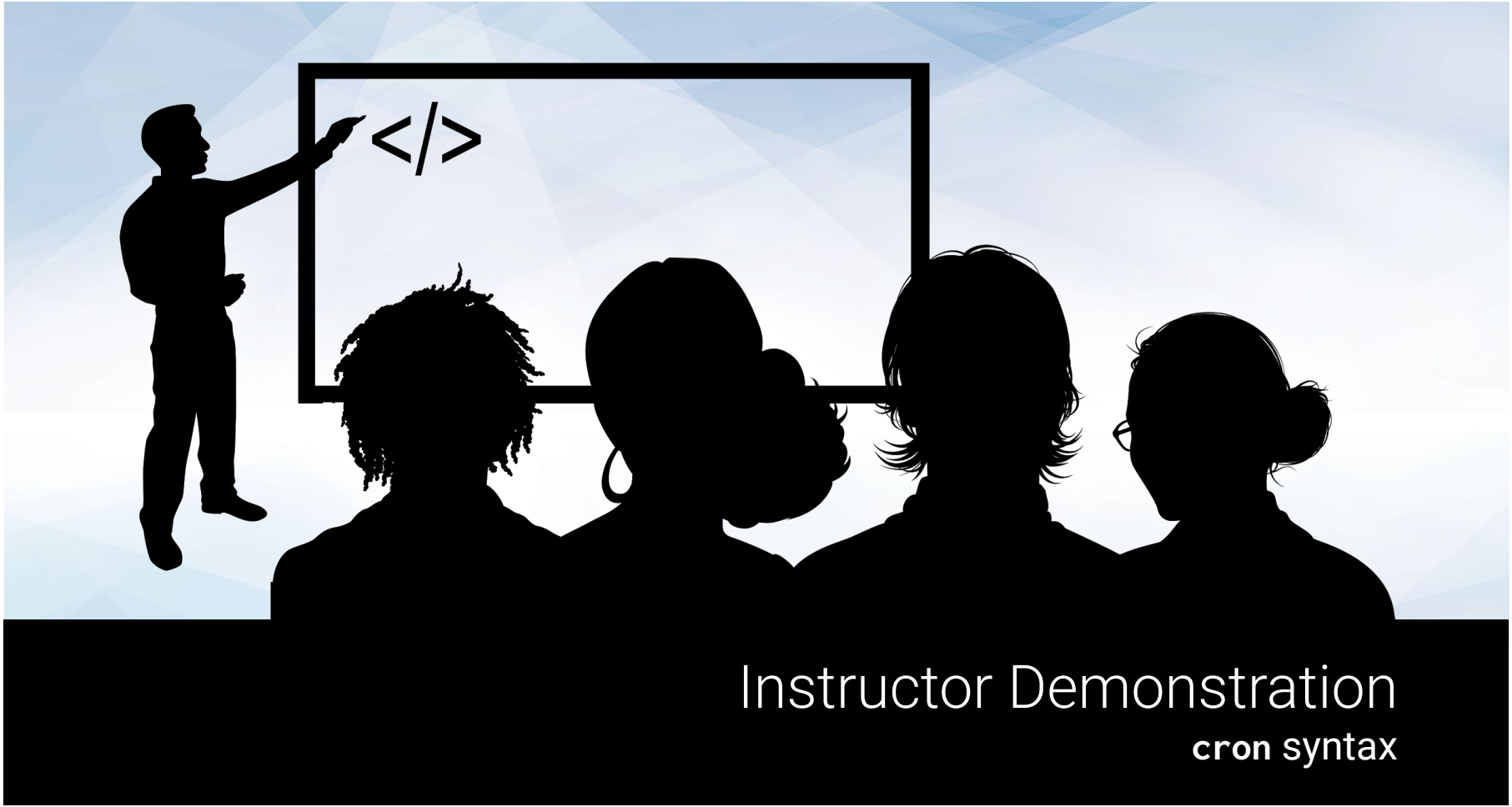


Source: linuxconfig.org

`cron` Syntax Walkthrough

In the upcoming demo, we will focus on the following:

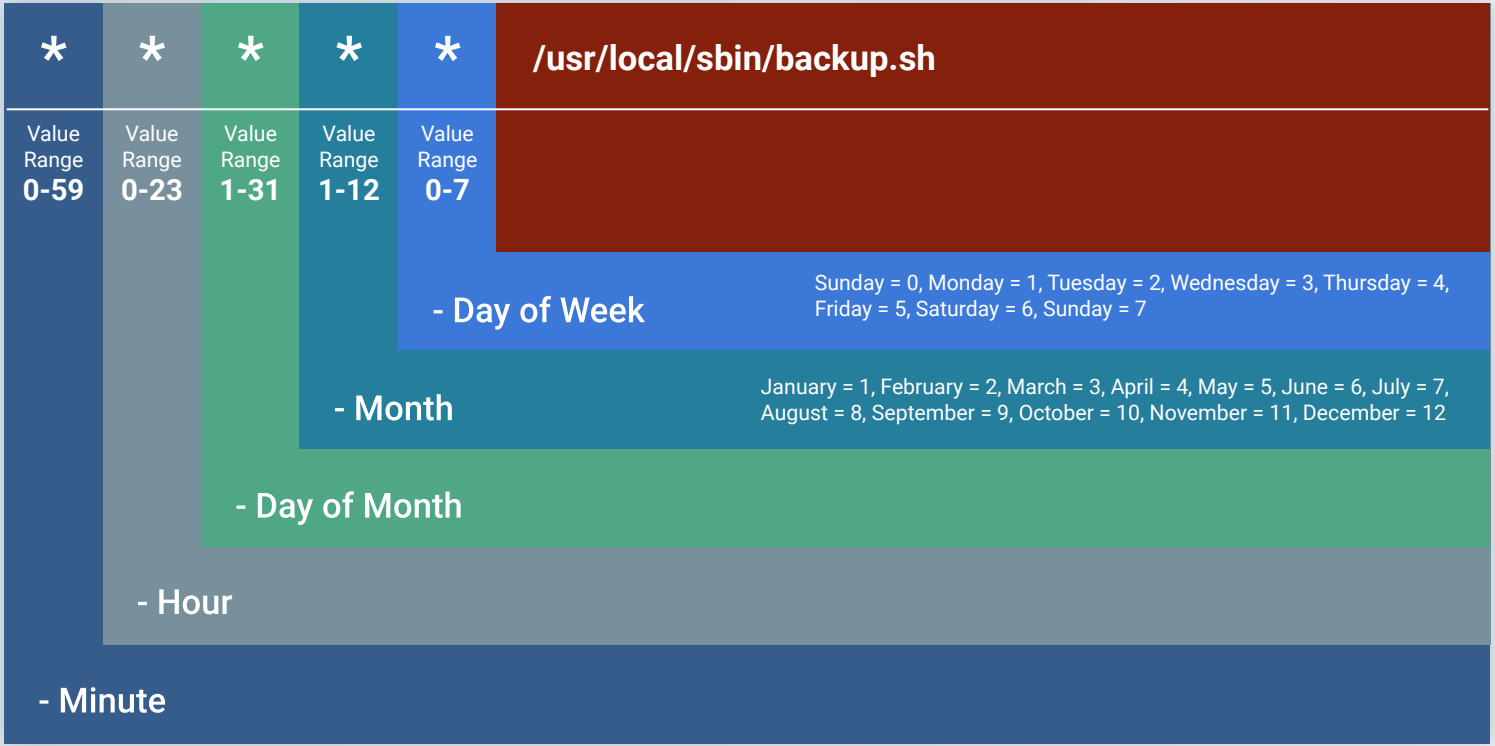
1. General `cron` command line syntax.
2. Editing a crontab with `crontab -e`.
3. Listing the contents of the crontab using `crontab -l`.



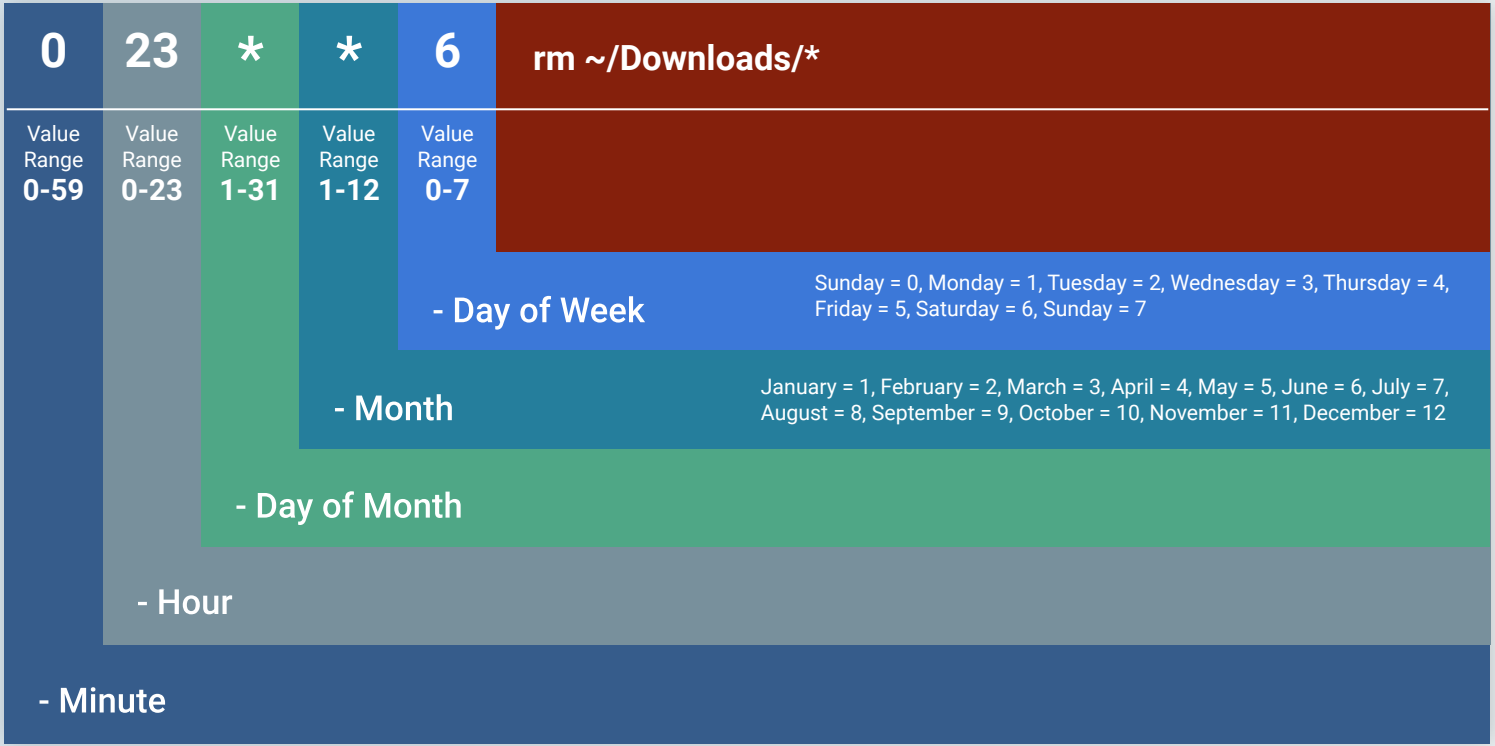
Instructor Demonstration

cron syntax

cron jobs


* * * * *
/usr/local/sbin/backup.sh
Value Range 0-59
Value Range 0-23
Value Range 1-31
Value Range 1-12
Value Range 0-7
- Day of Week
Sunday = 0, Monday = 1, Tuesday = 2, Wednesday = 3, Thursday = 4, Friday = 5, Saturday = 6, Sunday = 7
- Month
January = 1, February = 2, March = 3, April = 4, May = 5, June = 6, July = 7, August = 8, September = 9, October = 10, November = 11, December = 12
- Day of Month
- Hour
- Minute

cron jobs


0
23
*
*
6
rm ~/Downloads/*
Value Range 0-59
Value Range 0-23
Value Range 1-31
Value Range 1-12
Value Range 0-7
- Day of Week
Sunday = 0, Monday = 1, Tuesday = 2, Wednesday = 3, Thursday = 4, Friday = 5, Saturday = 6, Sunday = 7
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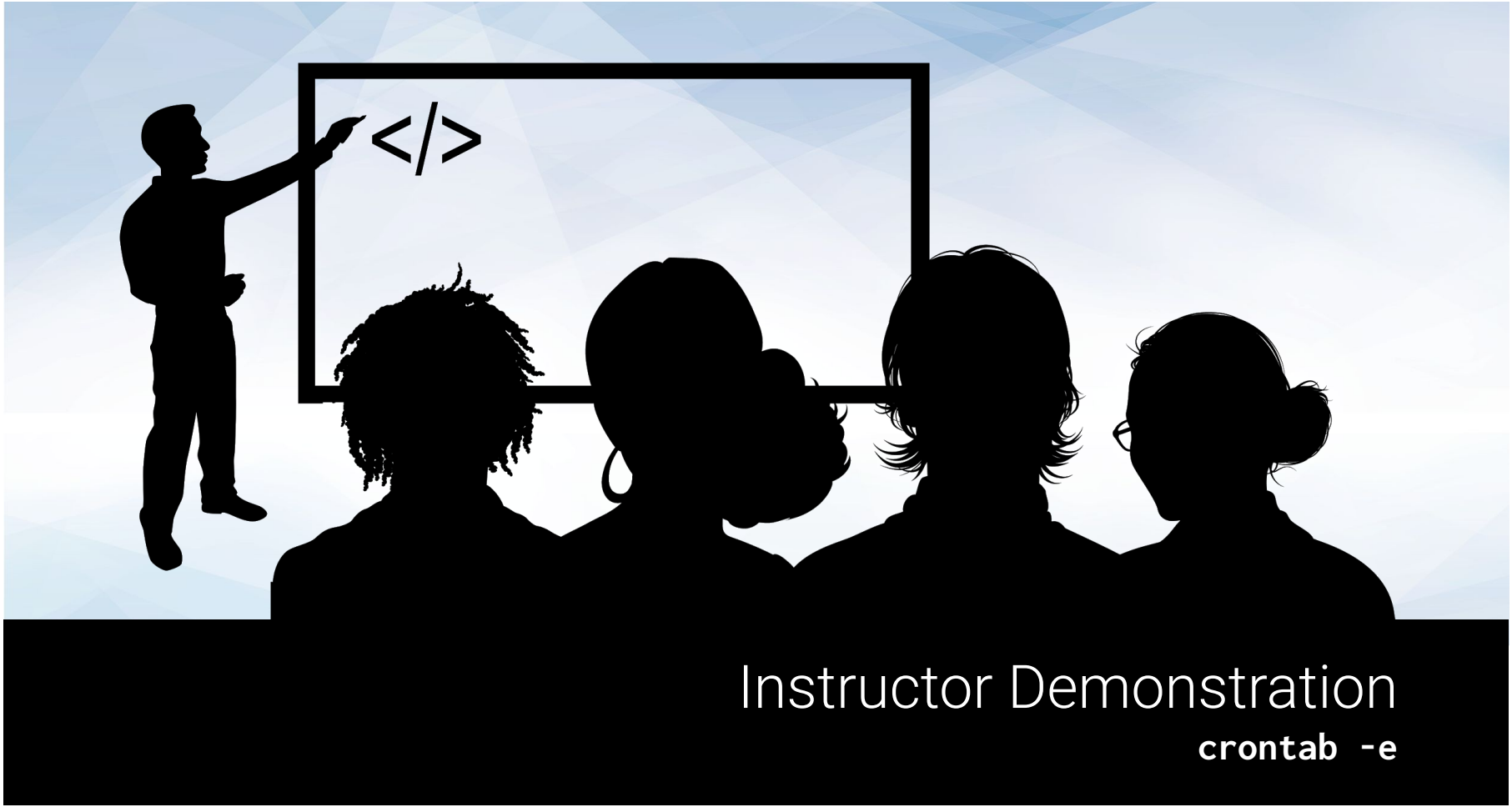


Instructor Demonstration

`crontab -e`

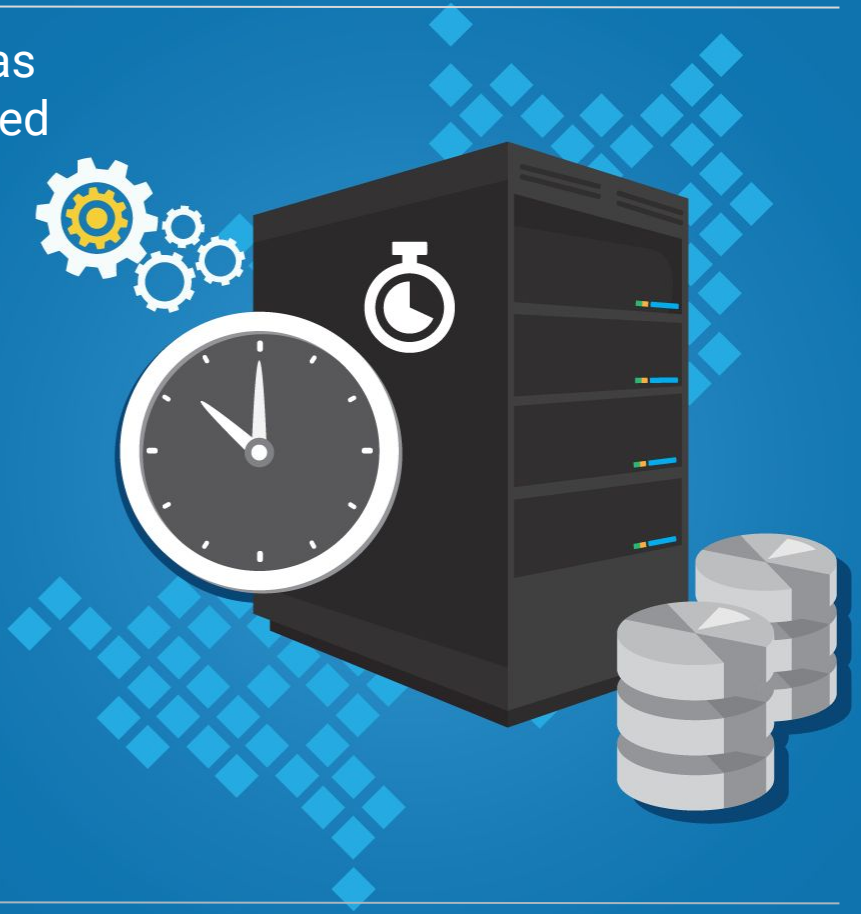
crontab

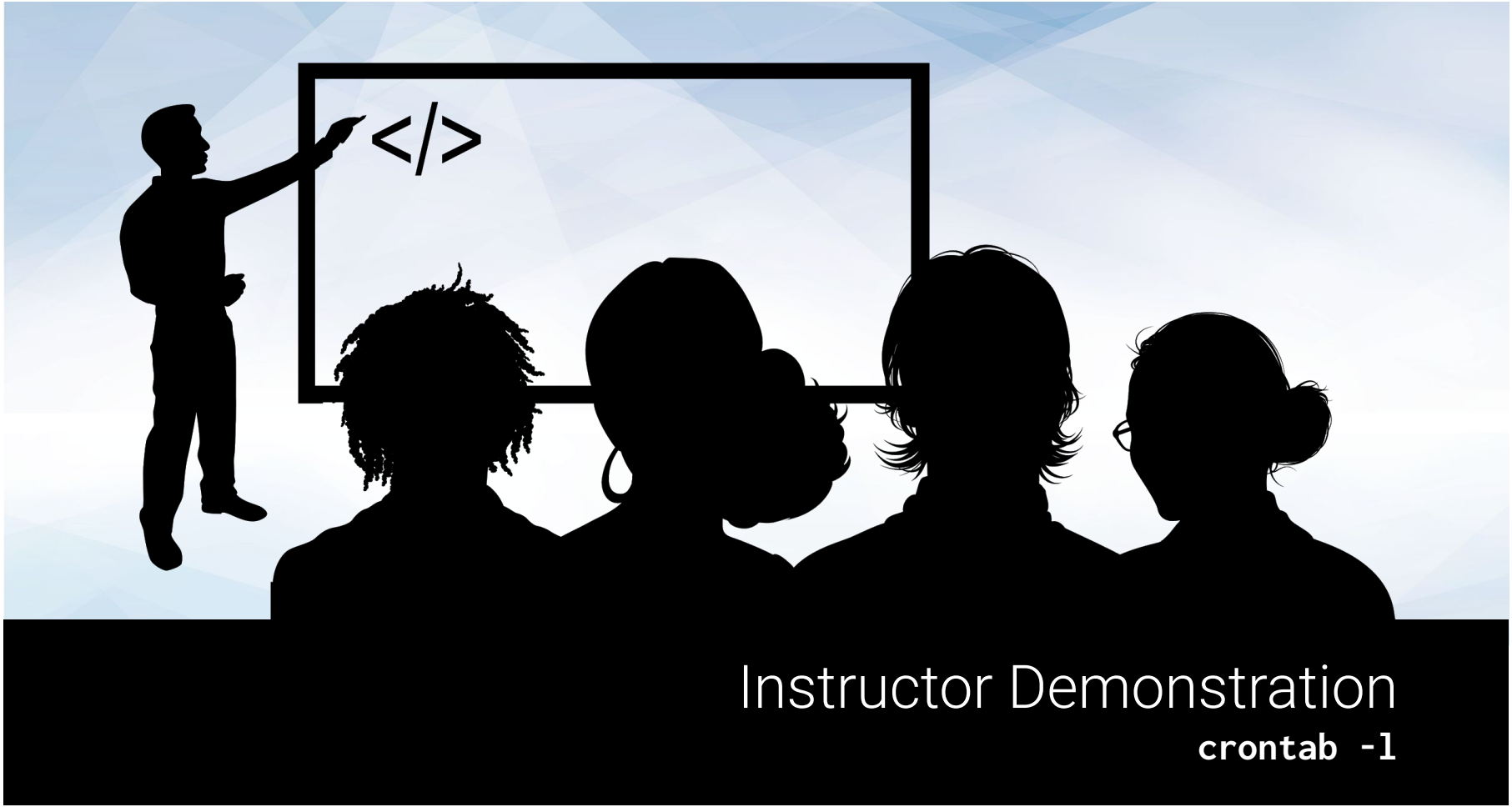
Cron jobs run under the same permissions as the user who creates them. A cron job created by user `root` will run with root privileges.

This introduces security risks. Anyone capable of privilege escalation can add a malicious cron job to the root crontab.

- We'll revisit the risks of using `cron` with root privileges later in the unit.
- Best practice is to avoid using the root crontab.

Inspecting the root crontab for unauthorized or malicious entries is a critical step in ensuring the integrity of any system that uses it. **Let's take a look.**





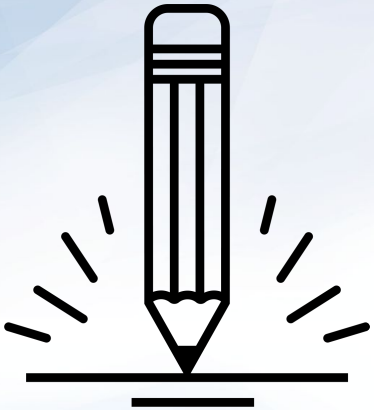
Instructor Demonstration

`crontab -l`

Today's Scenario

In today's activities, we'll act the role of a junior administrator at the company Rezifp Pharma Inc.

- There has been a wave of recent ransomware attacks. You will be responsible for using `cron` to automate tasks that backup E-Prescription Treatment database.
- Rezifp maintains a large number of files related to patients, doctors, and treatments.
- Administrators at various clinics often create files that contain Personal Identifiable Information or (PII) such as email addresses, passwords, biometric records, etc.



Activity: Simple Cron Jobs

In this activity, you will play the role of a junior administrator at a pharmaceutical company, tasked with using `cron` to automate the backup of treatment databases.

Activity file shared by the instructor.

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

Activity Review: Simple Cron Jobs

Completing this activity required the following steps:

01 Using `systemctl` to verify that the `cron` daemon is installed and running.

02 Using `crontab -l` to inspect user crontabs and verify validity.

03 Using `crontab -e` to edit user crontab files.

04 Using crontab to automate `cron` jobs to move and archive files and directories.

05 Verifying archives *after they are written* by checking for errors.

Let’s Review

In the previous section, we learned:

- Crontabs come in two varieties:
  - User-level: runs for a specific user under their privilege level.
  - System-level: runs for the system as a whole under root privileges.
- User-level crontabs are often used for “personal” tasks, such as organizing files.
- The general syntax for a crontab:

```
minute hour day-of-month month day-of-week command
```

- Tools like crontab.guru can verify the syntax of cron jobs before they run.

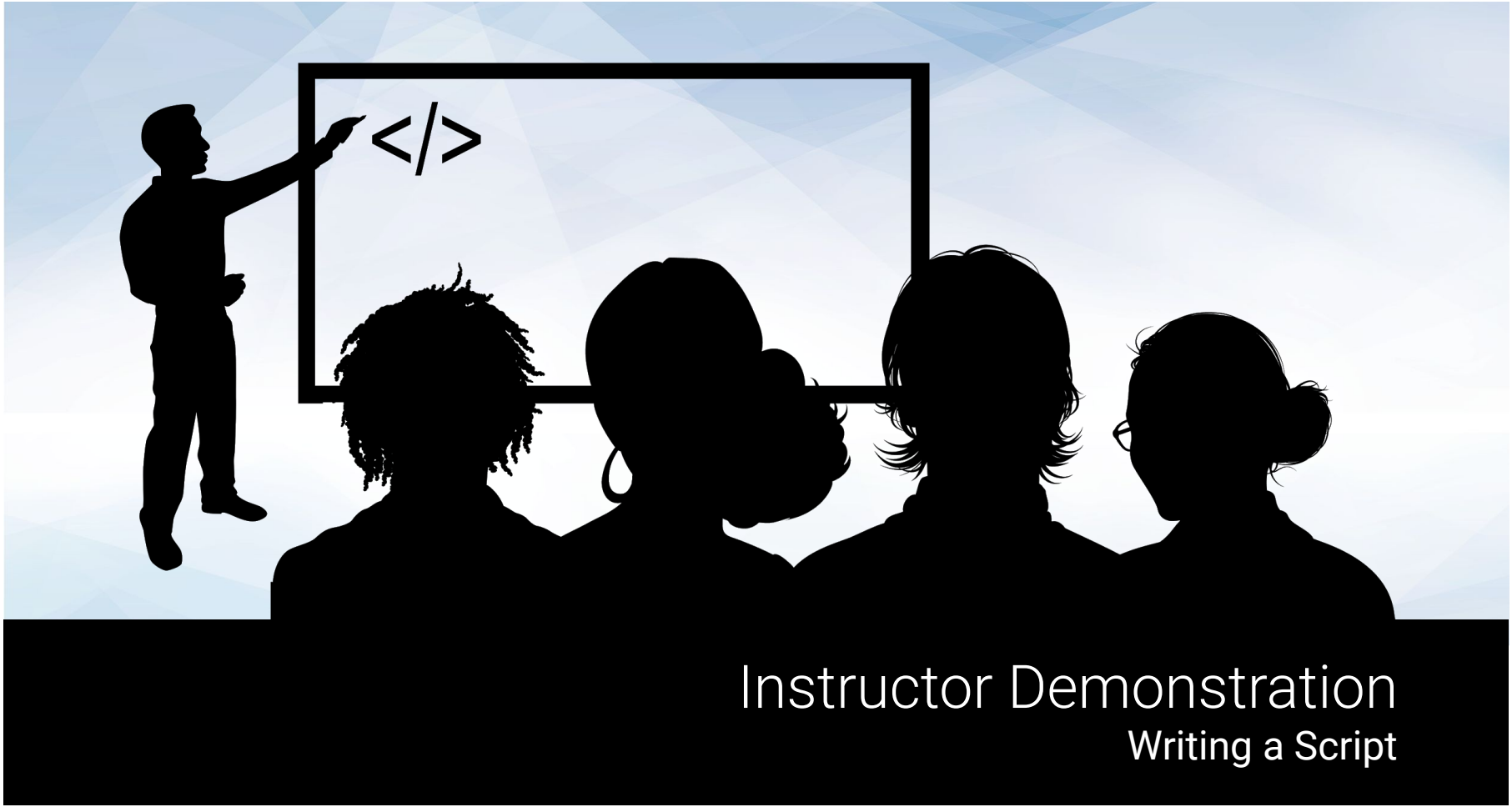
Introduction to Scripts

Why Scripts?

`cron` is useful for single tasks, like backing up a single user's directory, but not for backing up several users' directories.

- Scripts allow us to complete complex tasks, like creating backups or cleaning up multiple directories, by executing a single script.
- This results in cleaner crontabs with fewer lines of code, and allows us to schedule complex jobs that can't be expressed by a single command.

Next, we'll use cron to run a script that executes several commands simultaneously that run once per day.

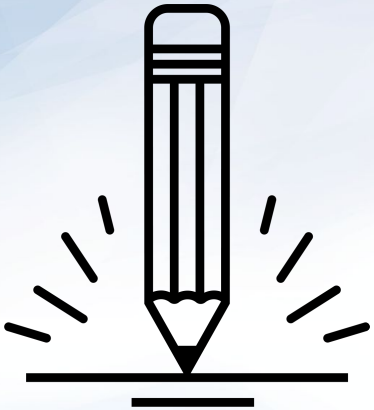


Instructor Demonstration

Writing a Script

Demo Summary

In the previous walkthrough, we did the following:



Activity: Scripting

In this activity, you will assume the role of a junior administrator tasked with creating a shell script that keeps the system clean, up-to-date, and ensures backups remain current and uncorrupted.

Activity file shared by the instructor.

Suggested Time:
20 Minutes

Time’s Up! Let’s Review.

Activity Review: Scripting

Completing this activity required the following steps:

01 Creating a directory for your scripts in `~/Security_scripts`.

02 Writing shell script named `backup.sh` that creates gzip-compressed archives.

03 Writing shell script named `update.sh` that updates and removes software package.

04 Writing shell script named `cleanup.sh` cleans up cached files and generates a report of system resource usage.

05 Testing these scripts by running them with the command(s) `./<scripts>.sh`.

Countdown timer

15:00

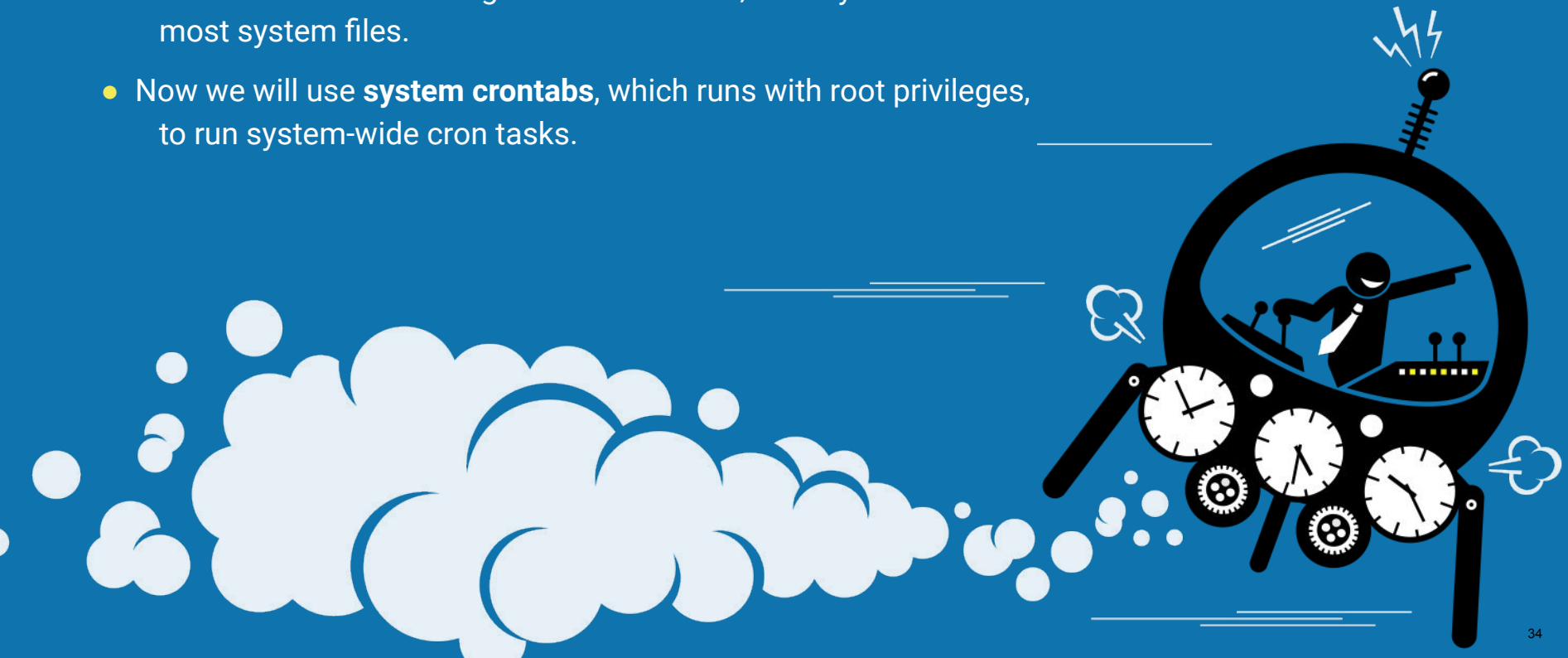
(with alarm)

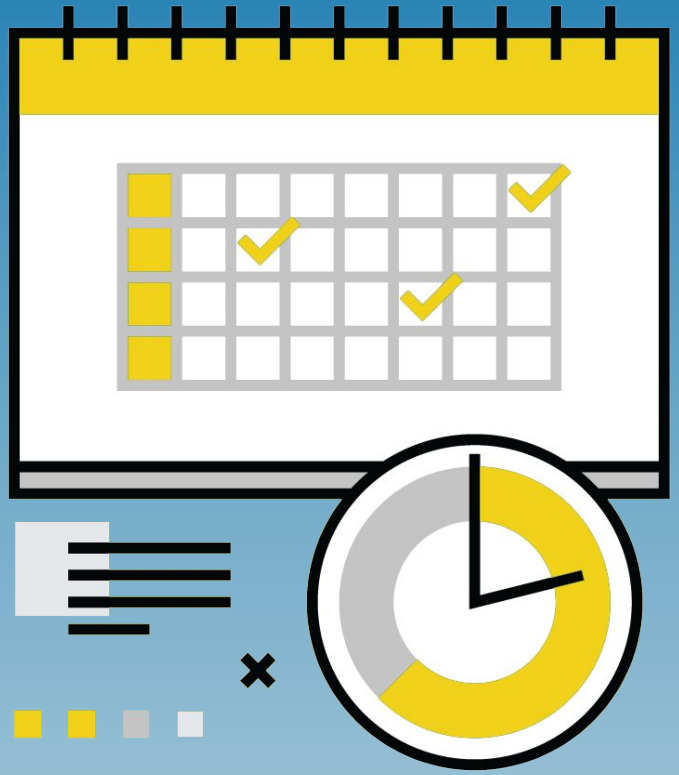
Scheduling Backups, Cleanups, and Security Checks

Scheduling Jobs for Scripts

Remember: user cron jobs are not very useful for system-level maintenance.

- User-level crontabs belong to non-root users, so they are unable to access most system files.
- Now we will use **system crontabs**, which runs with root privileges, to run system-wide cron tasks.





System-Wide Cron Directories

System-wide cron directories are located at:

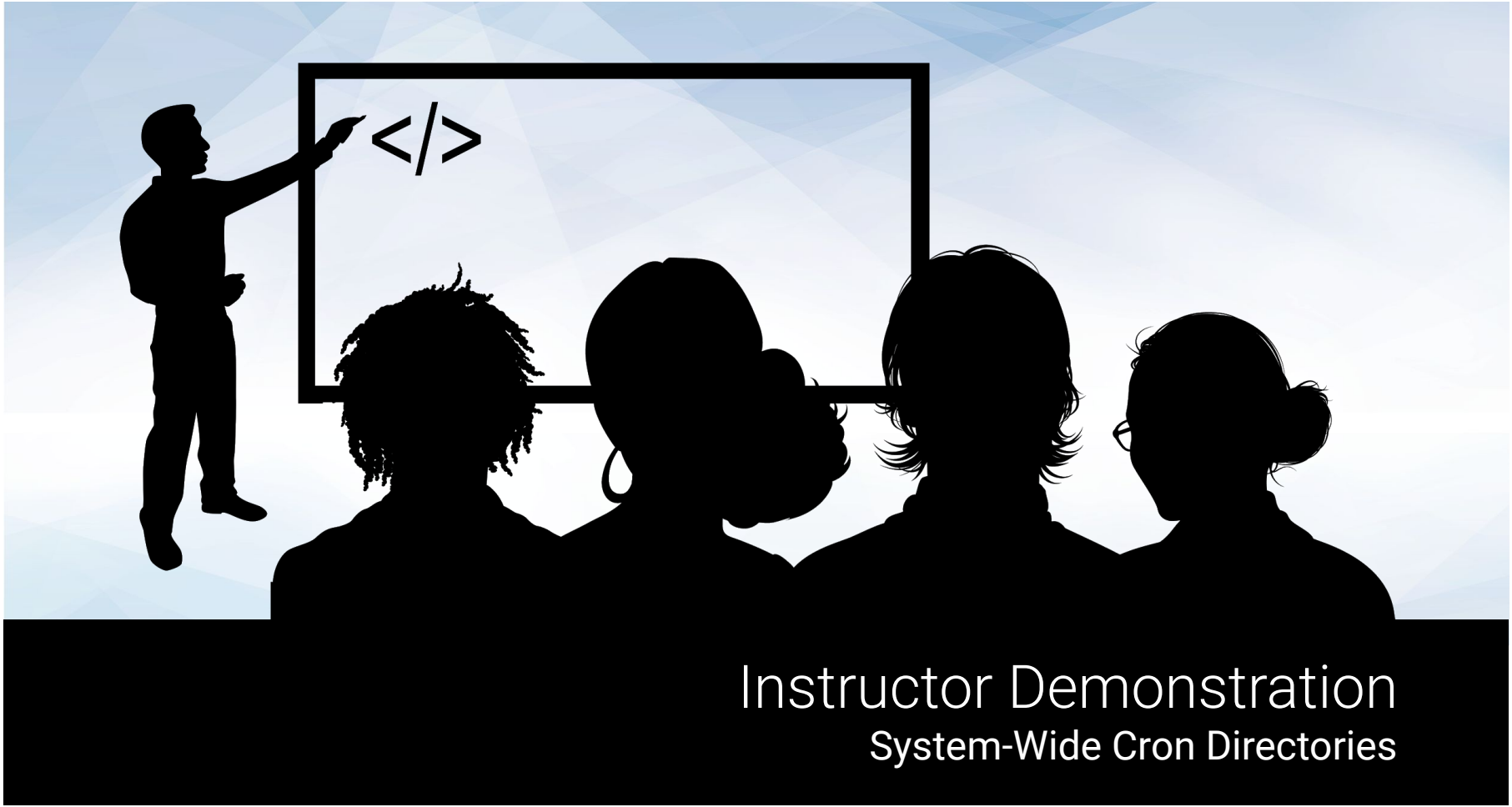
- `/etc/cron/d`
- `/etc/cron.daily`
- `/etc/cron.weekly`
- `/etc/cron.monthly`

Each directory contains several scripts that run at the dedicated time intervals.

- For example, scripts placed in `/etc/cron.weekly` will run once per week.

Next, we'll take a look

into the `etc/cron` `daily`, `weekly`, and `monthly` directories.



Instructor Demonstration

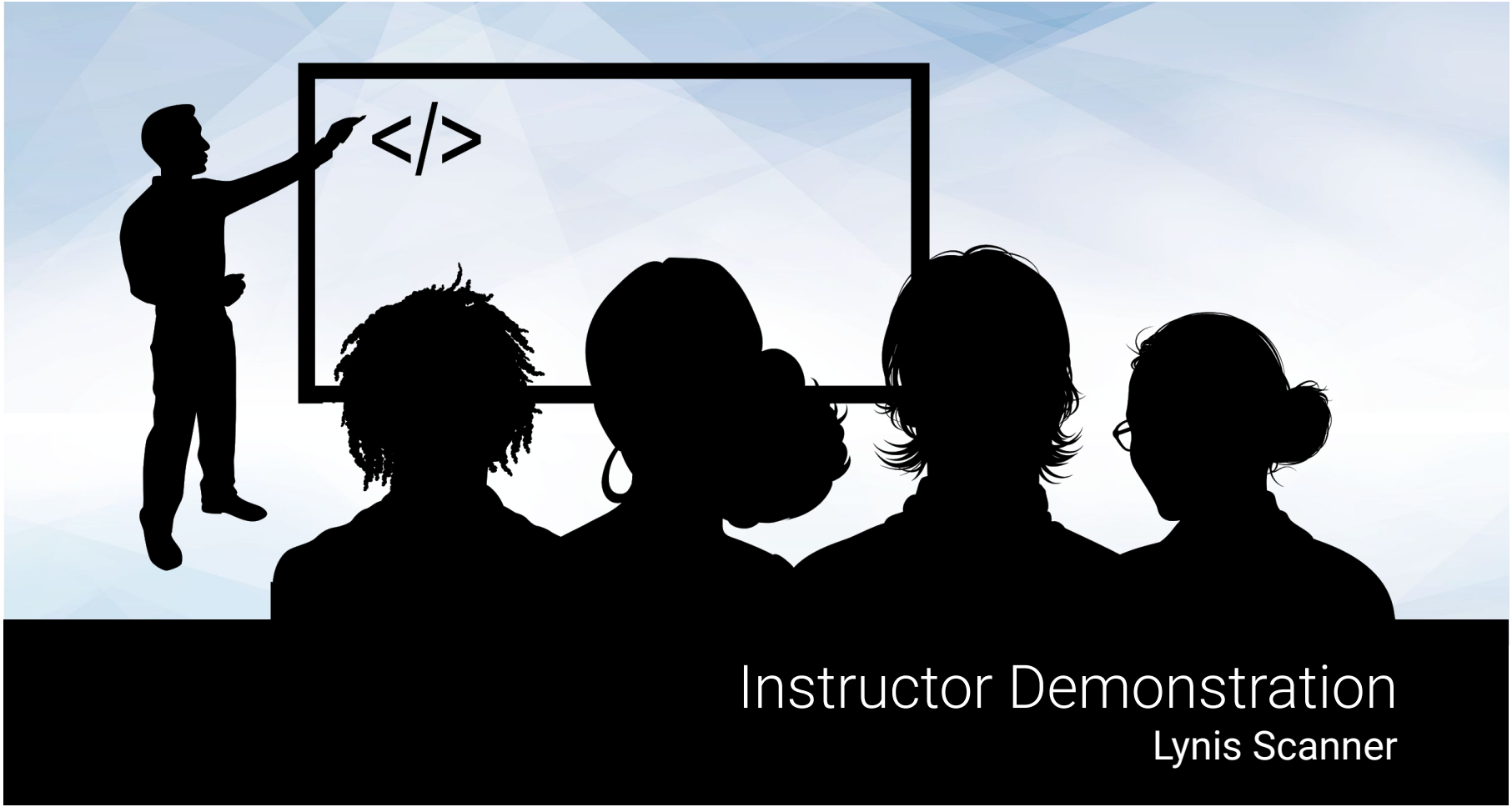
System-Wide Cron Directories

Lynis Scanner

Lynis is a security scanner used to check a machine for vulnerabilities.

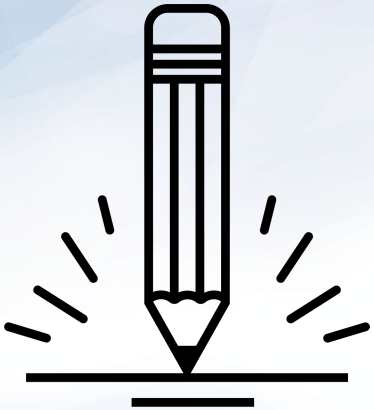
- Generates and saves reports of its findings for administrators to review.
- Offers numerous scan types.

Today, we'll experiment with a few different ones...



Instructor Demonstration

Lynis Scanner



Activity: Scheduling Backups and Cleanups

In this activity, you will assume the role of a junior administrator tasked with creating system-wide cron jobs to schedule your previously made scripts.

Activity file sent via Instructor.

Suggested Time:
15 Minutes

Time’s Up! Let’s Review.

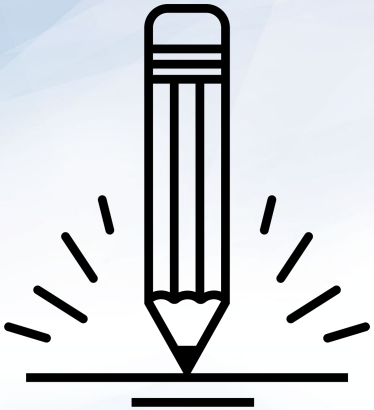
Activity Review: Scheduling Backups and Cleanups

Completing this activity required the following steps:

01 Move the `backup.sh`, `cleanup.sh`, and `update.sh` scripts to their corresponding system-wide cron directories.

02 Create `lynis` scripts to perform security scans.

Reviewing Cron



Activity: Attacking `cron`

In this activity, you will complete an assessment requires you to use your knowledge of tar, cron, and scripting.

Suggested Time:
15 minutes

Time’s Up! Let’s Review.

Any Questions?