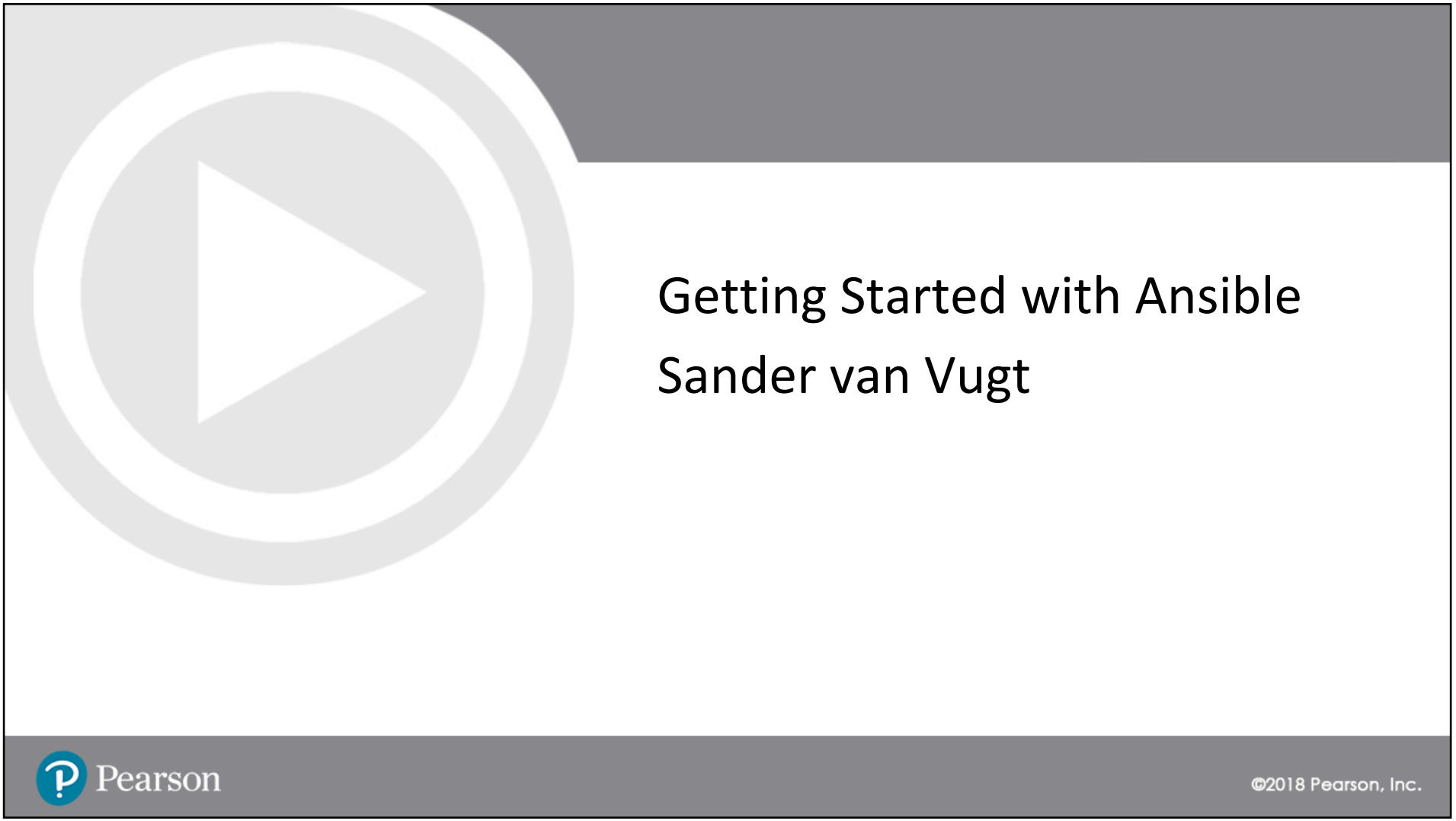
Getting Started with Ansible
Sander van Vugt
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Agenda

Agenda

- What is Ansible?
- Installing Ansible
- Configuring Ansible Managed Servers
- Running Ansible Ad-hoc Commands
- Running Ansible Playbooks


What is Ansible?
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What is Ansible

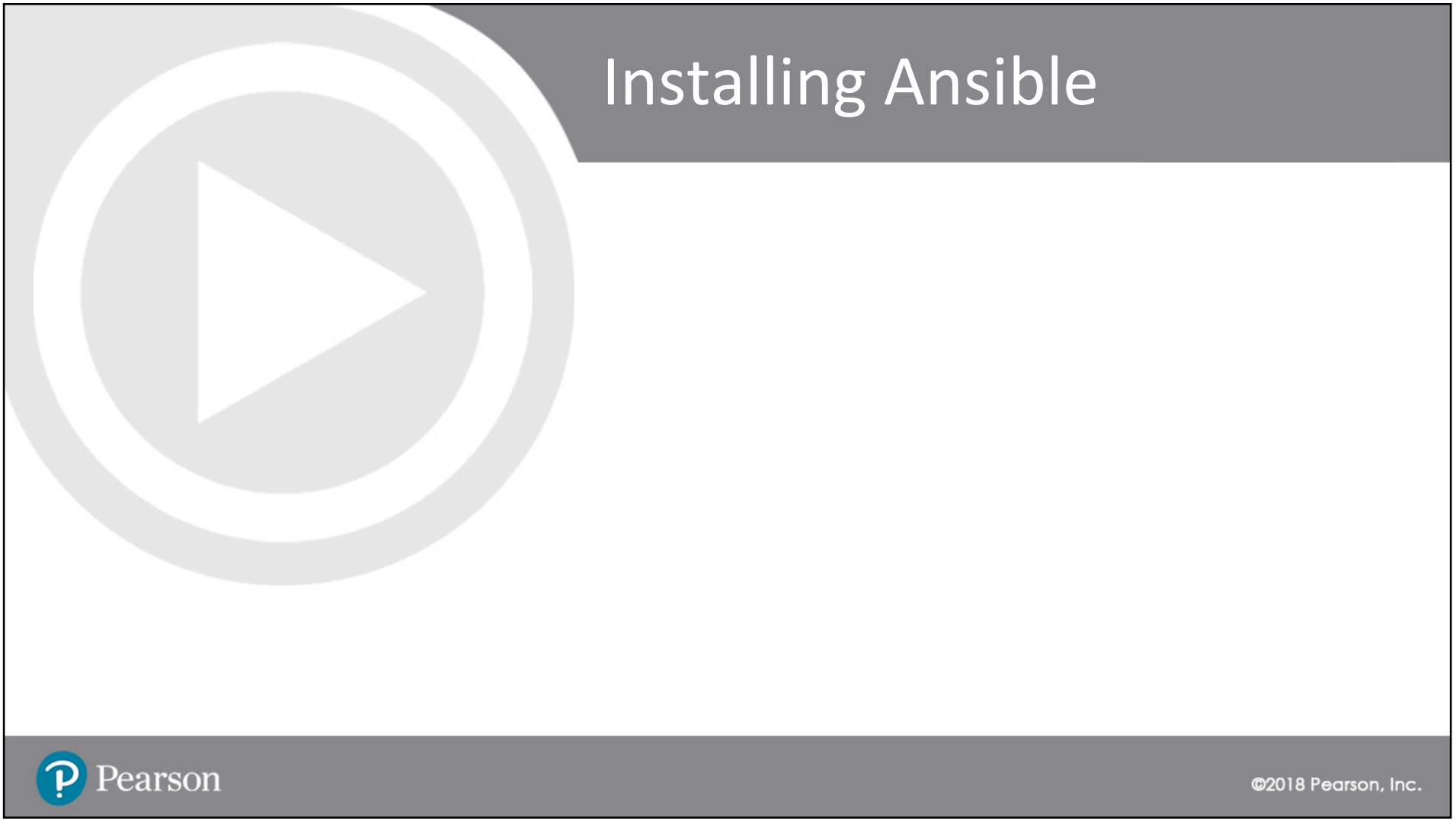
- Configuration Management and deployment of applications
- Used for provisioning as well
  - Interfaces cloud using specific modules
- Using a Push mechanism on top of SSH
- Using playbooks that define plays, containing tasks that should be running on managed hosts

Ansible compared to others

- YAML is easy to learn and read
- No agent to install on managed hosts
  - You'll need Python and SSH though
- Push based, which gives you more control over the process
  - An optional ansible-pull tool is available for if you want to be able to pull configurations
- Many modules are available
- Idempotent: running the same playbook multiple times will give you the same results

Required Skills

- Use SSH
- Use Linux Commands
- Install software
- Use sudo
- Manage permissions
- Manage services
- Work with variables


Installing Ansible
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Installing Ansible

- On Linux: use the version in the repositories
  - Might bring you a somewhat older version
  - Easiest and for that reason recommended
- On MacOS, use Homebrew package manager
- Or else, use the Python package manager pip

Configuring SSH

- Set up SSH Key-based authentication
  - **ssh-keygen**
- This creates a public key as well as a private key
  - The server that has the public key sends a challenge that can only be answered with the private key
  - Keep the private key in the local user account on the control node
  - Send the public key to the ~/.ssh/authorized_keys file in the target user home directory
    - Use **ssh-copy-id user@remotehost**
    - Notice that the local user name and the remote user name do NOT have to be the same
  - Don't forget to include the controller host as well if you want to manage that also

Inventory File Location

- The inventory file is indicated with the **-i** option
- Typically, you would create an Ansible project directory in your home directory, and put an inventory file in there
- You can specify which inventory to use in the ansible.cfg file

Managing Managed Hosts

- After installation, you can use the **ansible** command against remote hosts
- Remote hosts need to be specified in the inventory file
- The inventory file allows you to define managed hosts
- Hosts are specified by their name or IP address
- Hosts may be mentioned in the inventory more than once
  - This allows you to create logical groups
- In **ansible** commands, you'll mention host names, as well as the inventory file that you're going to use
  - **ansible server1.example.com,server2.example.com -i myinventory --list-hosts**

Lab 1: Installing Ansible

1. **useradd ansible; passwd ansible; su - ansible**
2. On both nodes: **sudo yum install python2 epel-release -y**
3. Remaining steps on control: **sudo yum install -y ansible**
4. **ssh server1.ansible.local**
5. **ssh-keygen**
6. **ssh-copy-id server1.ansible.local**
7. **mkdir ~/install**
8. **vim ~/install/inventory**

```
[all]
control.ansible.local
server1.ansible.local
```

9. **ansible all -i inventory --list-hosts**

More about Inventory

Understanding Inventory

- Ansible uses an inventory file, which must be used to identify managed hosts
- The location of the inventory file can be anywhere and is specified in the ansible.cfg file
  - /etc/ansible/hosts
  - current project directory
  - specified with the -i option while running Ansible commands
- Inventory files may be statically created or dynamically generated
  - Static inventory works for small environments
  - Dynamic inventory uses 3rd party scripts to identify hosts in a specific environment

Working with Dynamic inventory

- When using the **ansible** command, use the **-i** option, followed by the inventory script you'd like to use
  - Ensure that the inventory script is executable
- Write your own script or use a script that is available for the different externally supported cloud environments

Using Groups in Inventory

- An inventory file contains a list of hosts
- Hosts may be grouped to make referring to hosts easier
- A host can be a part of multiple groups
- The host group **all** is always present and doesn't have to be defined

Nesting Host Groups

- Host Groups may be nested in inventory

```
[webservers]
web1.example.com
web2.example.com

[dbservers]
db1.example.com
db2.example.com

[servers:children]
webservers
dbservers
```


Configuring ansible.cfg
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The ansible.cfg file

- The ansible.cfg file is used to specify variables
  - How to escalate permissions
  - Where to find the inventory file
  - And more
- The following locations are used
  - $ANSIBLE_CONFIG
  - ./ansible.cfg
  - ~/.ansible.cfg
  - /etc/ansible/ansible.cfg
- It is common practice to put it in the current project directory
- Using section headers is important!

Common ansible.cfg variables

```
[defaults]
inventory = /etc/ansible/hosts
remote_user = ansible
host_key_checking = False

[privilege_escalation]
become = True
become_method = sudo
become_user = root
become_ask_pass = False
```

Configuring sudo for Privilege Escalation

- Privilege escalation needs a sudo configuration
  - Set become parameters in ansible.cfg
  - Or use -b with your ansible command to escalate and run the command as root
- For the Ansible default account, create a sudo file on all Ansible managed hosts:

```
# cat /etc/sudoers.d/user
user ALL=(ALL) NOPASSWD: ALL
```

Testing Connectivity

- At this point, your configuration should be ready for use, time to run some commands
  - **ansible server1 -m command -a who**
  - **ansible all -a who**

Running Ad-hoc Commands

Why Use Ad-hoc Commands

- You'll typically want to create playbooks to automate tasks against multiple Ansible servers
- To quickly make changes to many managed hosts, ad-hoc commands are convenient
- Ad-hoc commands can also be used for diagnostic purposes, like querying a large number of hosts
- In ad-hoc commands, modules are typically used

Understanding Modules

- A module is used to accomplish specific tasks in Ansible
- Modules can run with their own specific arguments
- Modules are specified with the -m option, module arguments are referred to with the -a option
- The default module can be set in ansible.cfg. It's predefined to the **command** module
  - This module allows you to run random commands against managed hosts
  - As command is the default module, it doesn't have to be referred to using -m module, just use **-a command**
  - Notice that the command module is not interpreted by the shell on the managed host and for that reason cannot work with variables, pipes and redirects
  - Consider using the **shell** module if you need full shell functionality

Introducing 3 Modules

- **command**: runs a command on a managed host
  - command is the default module, so you don't really have to specify it
  - If the command you want to run contains spaces, make sure to use quotes
- **shell**: runs a command on managed host through the local shell
- **copy**: copy a file, change content on a managed host in a target file

Ad-hoc Command Examples

- **ansible all -m command -a id**
  - Runs the command module with the **id** command as its argument against all hosts. Notice that this needs [all] to be defined in the inventory
- **ansible all -m command -a id -o**
  - Same command, but provides a single line of output
- **ansible all -m command -a env**
  - Unexpected results, as the command module doesn't work through the shell
- **ansible all -m shell -a env**
- **ansible managed1.ansible.local -m copy -a 'content="Ansible managed\n" dest=/etc/motd'**

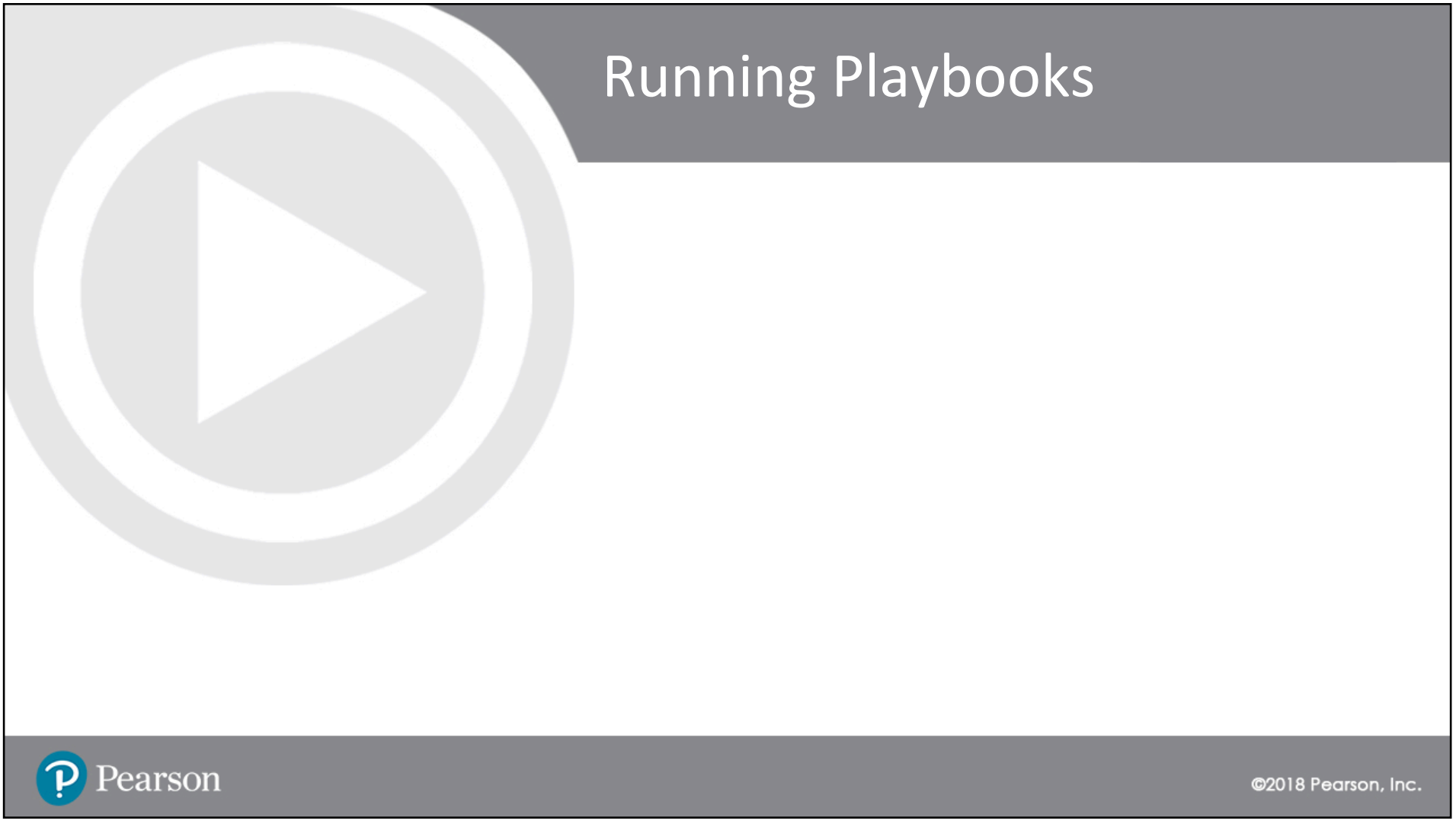
Ansible Module Documentation

- Authoritative documentation is on docs.ansible.com
- Request a list of currently installed modules using **ansible-doc -l**
  - Use **ansible-doc <modulename>** to get module specific information
  - Use **ansible-doc -s <modulename>** to produce example code that you can include in a playbook

From Ad-hoc to Playbook

- Modules can be included using the **ansible -m <modulename>** command
  - **ansible -m yum -a "name=vsftpd state=latest" all**
- Or included in an Ansible task in a playbook

```
tasks:
- name: Install a package
  yum:
    name: vsftpd
    state: latest
```


Running Playbooks
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Sample Playbook

```
---
- name: deploy vsftpd
  hosts: node1.example.com
  tasks:
  - name: install vsftpd
    yum: name=vsftpd
  - name: enable vsftpd
    service: name=vsftpd enabled=true
  - name: create readme file
    copy:
      content: "welcome to my ftp server"
      dest: /var/ftp/pub/README
      force: no
      mode: 0444
...
```

Adding more features

- *Variables* make it easier to repeat tasks in complex playbooks
- *Facts* contain information that Ansible has discovered about a host
  - They can be used in conditional statements in Playbooks
  - The setup module is used to gather fact information
    - **ansible server1 -m setup**
- *Filters* are used to filter information out of facts
  - **ansible server1 -m setup -a 'filter=ansible_kernel'**
- *Custom facts* can be defined by administrators to store host properties
  - Should be stored in /etc/ansible.facts.d
  - **profile = web_server** will define a fact "profile"

Adding More Features (2)

- *Handlers* are like a task, but will only run when they have been notified by a task
- A task notifies the handler by passing the handler's name as argument

```
handlers:
- name: restart httpd
  service: name=httpd state=restarted
- name copy file
  copy: scr=downloads/index.html dest=/var/www/html
  notify: restart httpd
```

About handlers

- Common use for using handlers is to restart a service or to reboot a machine
- Handlers will restart services conditionally
- You may want to consider restarting these services any way, as restarting services typically is fast enough

More About Variables

Understanding Variables

- Using variables makes it easier to repeat tasks in complex playbooks and are convenient for anything that needs to be done multiple times
  - Creating users
  - Removing files
  - Installing packages
- A variable is a label that can be referred to from anywhere in the playbook, and it can contain different values, referring to anything
- Variable names must start with a letter and can contain letters, underscores and numbers
- Variables can be defined at a lot of different levels

Defining Variable Scope

- Variables can be defined with a different scope
  - Global scope: these are variables that are set from the command line or ansible configuration file
  - Play scope: relates to the play and related structures
  - Host scope: set on groups or individual hosts
    - This can be done through the inventory file
- When using multiple levels of conflicting variables, the higher level wins
  - So global scope wins from host scope

Defining Variables

- Variables can be defined in a playbook, from inventory or included from external files
- Defining variables in a playbook

```
- hosts: all
  vars:
    user: linda
    home: /home/linda
```

Defining Variables in Inventory

- Variables can be assigned to individual servers
- Or to host groups (recommended)

```
[webservers]
web1.example.com
web2.example.com

[webservers:vars]
documentroot=/web
```

Using Variable Files

- When using variable files, a YAML file needs to be created that contains the variables
  - This file uses a path relative to the playbook path
- This file is called from the playbook, using **vars_files:**

```
- hosts: all
  vars_files:
    - vars/users.yml
$ cat vars/users.yml
user: linda
home: /home/linda
user: anna
home: /home/anna
```

group_vars and host_vars

- Defining Variables in the Inventory is not recommended
- Instead, create a group_vars and a host_vars directory in the current project directory
- In these directories, create files that match the names of (inventory) hosts and host groups
- In these files, set variables in a key: value format

```
cat ~/myproject/host_vars/web1.example.com
package: httpd
cat ~/myproject/group_vars/web
documentroot: /web
```

Using Directories and Files in Ansible

- With the group_vars and host_vars included, it is common for Ansible projects to work with a directory structure:

```
myproject
|--ansible.cfg
|--group_vars
|    |--web
|    |--db
|--host_vars
|    |--web1.example.com
|    |  ...
|--inventory
|--playbook.yaml
```

Using Variables

- In the playbook, the variable is referred to using double curly braces
- If the variable is used as the first element to start a value, using double quotes is mandatory

```
tasks:
  - name: Creates the user {{ user }}
    user:
      name: "{{ user }}"
```

- Notice the different uses of the variable user!

Using register

- The **register** statement can be used to capture output of a command into a variable
- Use **debug** to show the value of the variable
- While running the playbook, the [debug] section will show the output of the command in the specific task

```
- name: show command output
  hosts: server1
  tasks:
    - name: fetch output of the who command
      command: who
      register: currentusers
    - debug: var=currentusers
```


Using Inclusions
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Why inclusions?

- When playbooks are becoming too long, separate files can be used to manage individual tasks and variable groups
- This makes it easier to delegate management tasks for specific parts
- Also, it adds modularity
  - Newly installed servers need to run a complete configuration
  - Existing servers may need to run just a subset of the total amount of available task files
- Use **include** to include task files
- Use **include_vars** ton include variable files
- In the final lab that follows next, you'll see how inclusions can be used to manage more complex tasks

Final Lab

Lab

1. Create an Ansible configuration that sets up hosts Ansible1 and Ansible2 for automatic installation. Create custom facts for both hosts and use variable inclusion to realize this. To configure ansible1, use a host group with the name "file", to configure ansible2, use a host group with the name "lamp"
2. Create a file with the name custom.fact that defines custom facts. In this file, define two sections. The section package contains the following:
   smb_package = smb
   ftp_package=ftp
   db_package=mariadb
   web_package=http
   The section service contains service variables for the packages mentioned above. Use the name smb_service etc. and set the variable to the appropriate name of the service
3. Create a playbook with the name copy_facts.yml that copies these facts to all managed hosts. Define a variable with the name "remote_dir" and a variable with the name "fact_file" and use these. Use the file and copy modules.
4. Run the playbook and verify it worked

Lab (continued)

5. Create a variable inclusion file with the name ./vars/allvars.yml and set the following variables
   web_root: /var/www/html
   ftp_root: /var/ftp
6. Create a tasks directory in the project folder. In this directory, create two YAML files, one that installs, starts, and enables the LAMP services; and one that installs, starts, and enables the file services
7. Create the main playbook that will set up the lamp servers and the file servers with the packages they need, using inclusions to the previously-defined tasks file. Also, ensure that it opens the firewalld firewall to allow access to these servers. Finally, the web service should be provided with an index.html file that shows "managed by Ansible" on the first line
8. Run the playbook
9. Use ad hoc commands to verify the services have been started

Lab Solution

1. Create the inventory file (see lab-inventory)
2. see custom.fact
3. see lab-copy-facts.yml
4. ansible-playbook -i lab-inventory lab-copy-facts.yml; ansible -i lab-inventory all -m setup -a 'filter=ansible_local*'
5. see lab-vars/allvars.yml
6. see lab-tasks/lamp.yml and file.yml
7. see lab-playbook.yml
8. ansible-playbook lab-playbook.yml
9. ansible lamp -a 'systemctl status mariadb'; ansible file -a 'systemctl status vsftpd'

Lab solution appendix A: custom.fact

```
[packages]
smb_package = smb
ftp_package = vsftpd
db_package = mariadb-server
web_package = httpd


[services]
smb_service = smb
ftp_service = vsftpd
db_service = mariadb
web_service = httpd
```

Lab solution appendix A: lab-copy-facts.yml

```
---
- name: Install remote facts
  hosts: all
  vars:
    remote_dir: /etc/ansible/facts.d
    facts_file: custom.fact
  tasks:
    - name: create remote directory
      file:
        state: directory
        recurse: yes
        path: "{{ remote_dir }}"
    - name: install new facts
      copy:
        src: "{{ facts_file }}"
        dest: "{{ remote_dir }}"
```

Lab solution appendix A: lab-vars/allvars.yml

```
---
web_root: /var/www/html
ftp_root: /var/ftp
```

Lab solution appendix A: lamp.yml

```
---
  - name: install and start the servers
    yum:
      name:
        - "{{ ansible_local.custom.packages.ftp_package }}"
        - "{{ ansible_local.custom.packages.web_package }}"
      state: latest

  - name: start database server
    service:
      name: "{{ ansible_local.custom.services.ftp_service }}"
      state: started
      enabled: true

  - name: start the web service
    service:
      name: "{{ ansible_local.custom.services.web_service }}"
      state: started
      enabled: true
```

Lab solution appendix A: file.yml

```
---
  - name: install and start file services
    yum:
      name:
        - "{{ ansible_local.custom.packages.smb_package }}"
        - "{{ ansible_local.custom.packages.ftp_package }}"
      state: latest

  - name: start samba server
    service:
      name: "{{ ansible_local.custom.services.smb_service }}"
      state: started
      enabled: true

  - name: start the ftp service
    service:
      name: "{{ ansible_local.custom.services.ftp_service }}"
      state: started
      enabled: true
```

Lab solution appendix A: lab-playbook.yml (pt 1)

```
---
- hosts: all
  vars:
    firewall: firewalld

  tasks:
    - name: install the firewall
      yum:
        name: "{{ firewall }}"
        state: latest

    - name: start the firewall
      service:
        name: "{{ firewall }}"
        state: started
        enabled: true

...
```

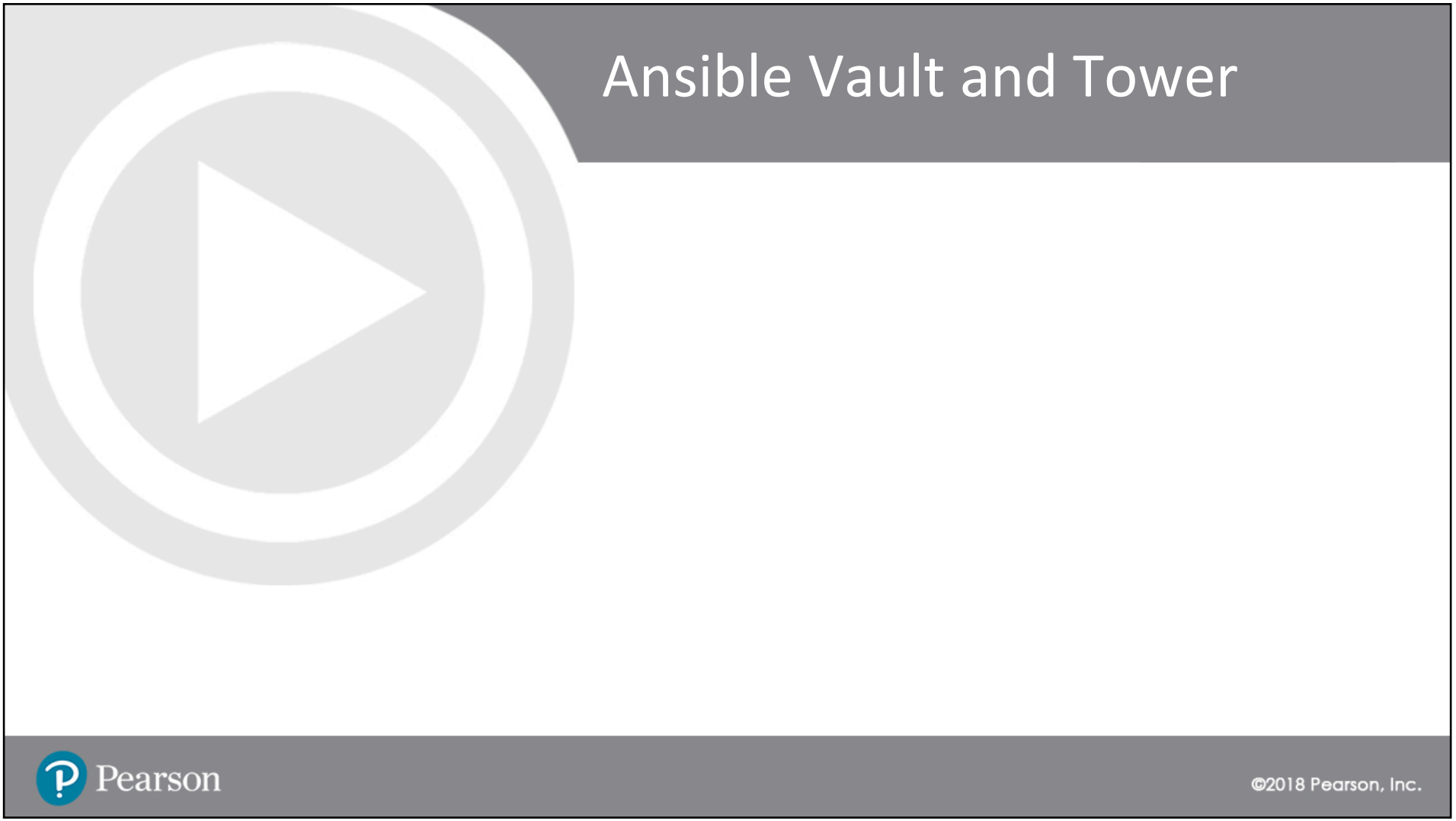
Lab solution appendix A: lab-playbook.yml (pt. 2)

```
- hosts: lamp
  tasks:
    - name: include the variable file
      include_vars: lab-vars/allvars.yml

    - name: include the tasks
      include: lab-tasks/lamp.yml

    - name: open the port for the web server
      firewalld:
        service: http
        state: enabled
        immediate: true
        permanent: true

    - name: create index.html
      copy:
        content: "{{ ansible_fqdn }}({{ ansible_default_ipv4.address }}) managed by Ansible\n"
        dest: "{{ web_root }}/index.html"
```


Ansible Vault and Tower
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Understanding Ansible Vault

- To access remote servers, passwords and API keys may be used
- By default, these are stored as plain-text in inventory variables or other files
- Ansible Vault can be used to encrypt and decrypt data files used by Ansible
  - Vault is default part of Ansible
- Alternatively, external key-managent solutions may be used also

Using Ansible Vault

- The **ansible-vault** command can be used to create an encrypted file
- This can also be decrypted using **ansible-vault**
- From within a playbook, an encrypted file can be referred to
- Run the playbook with the --aks-vault-pass option to ask fro the password
  - **ansible-playbook --ask-vault-pass webservers.yaml**

Understanding Ansible Tower

- Ansible Tower provides a framework for using Ansible at an enterprise level
  - Central repository of Ansible playbooks
  - Scheduled playbook execution
  - Central web interface
  - role-based access control
  - Centralized logging and auditing
  - REST API
- Using Tower allows easy integration of Ansible with other tools like Jenkins, Cloudforms and Red Hat Satellite