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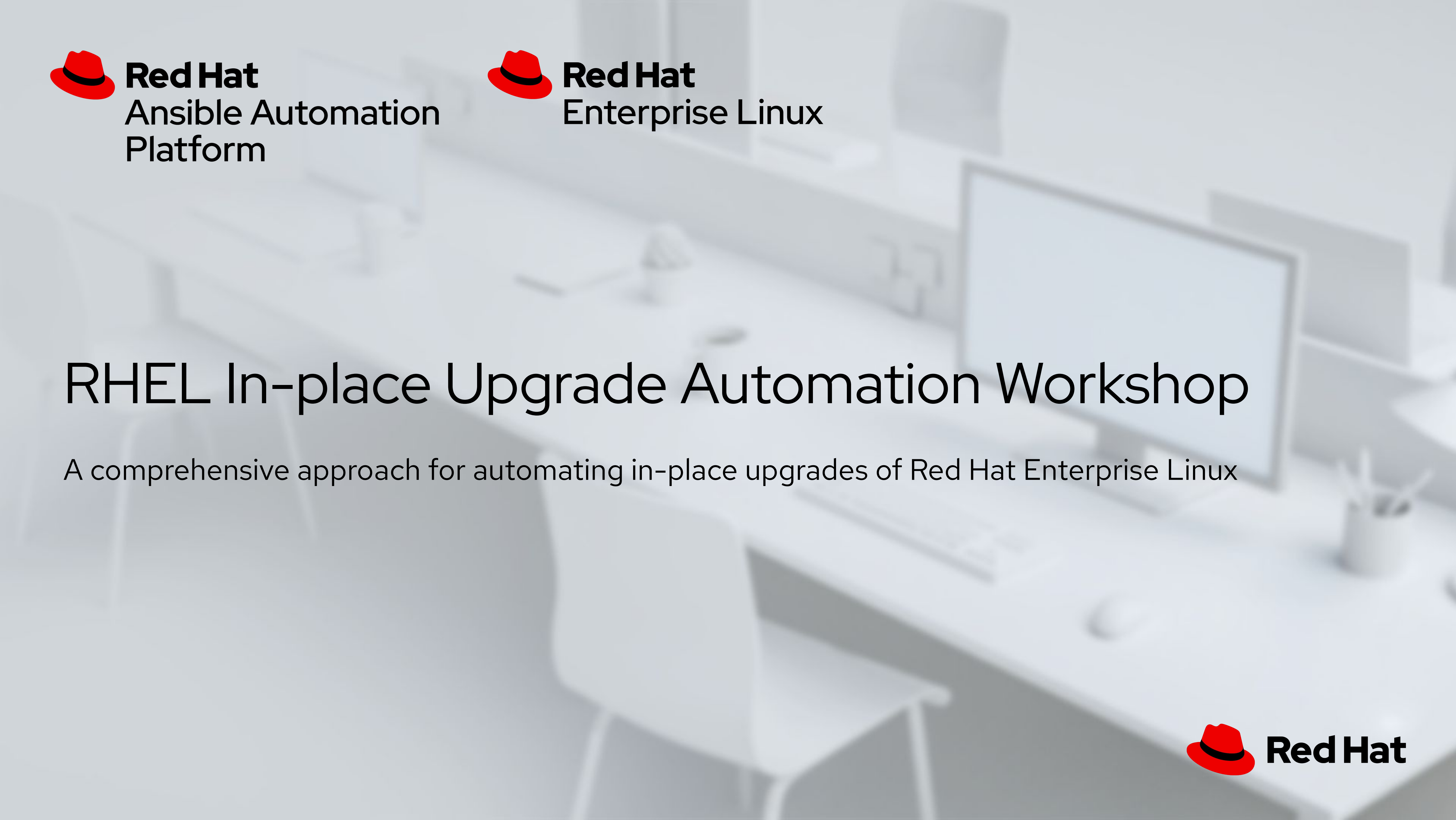
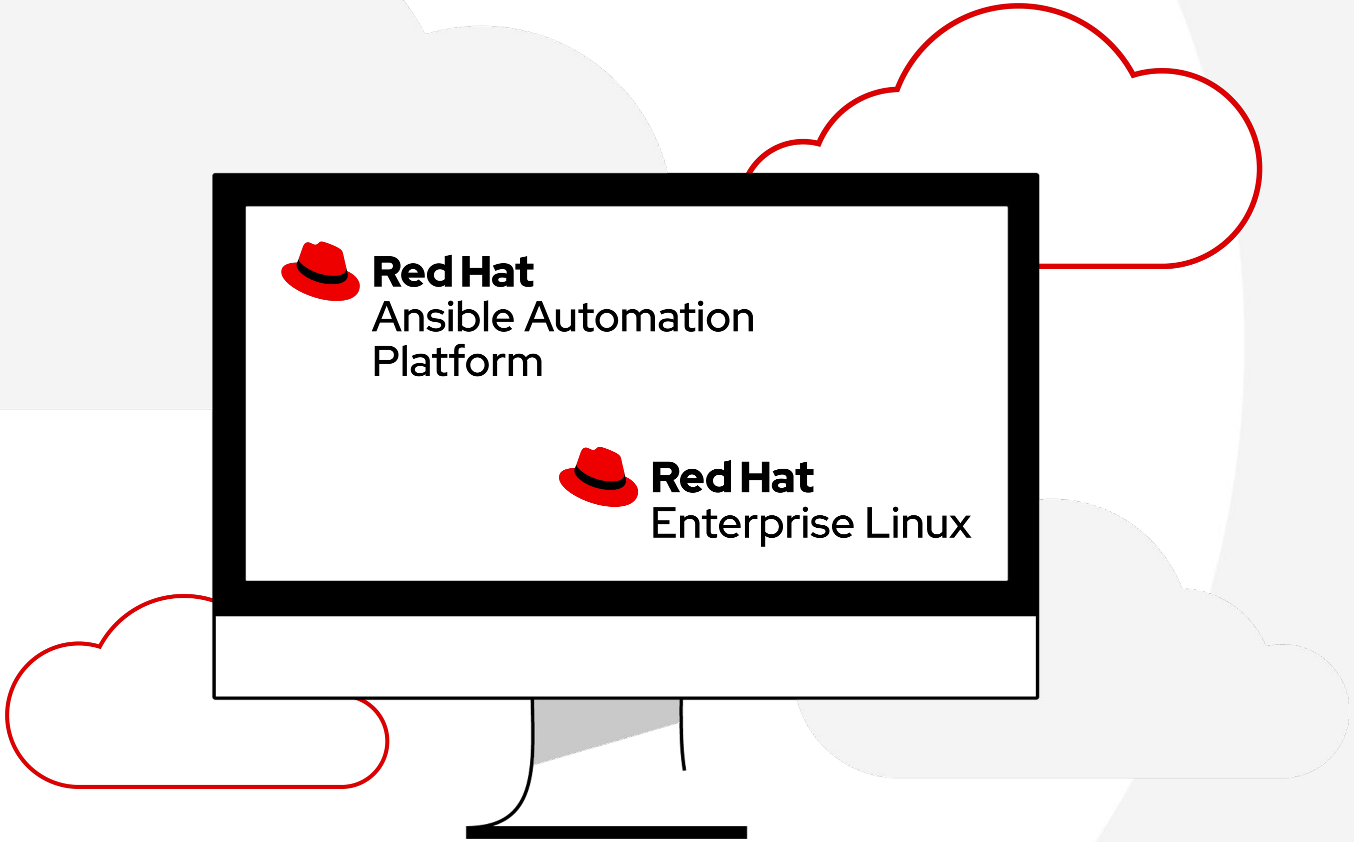


RHEL In-place Upgrade Automation Workshop

A comprehensive approach for automating in-place upgrades of Red Hat Enterprise Linux

Red Hat



What you will learn

- Key features of the upgrade automation approach
- Workshop setup and walkthrough
- Generating pre-upgrade reports
- Automating recommended remediations
- Understand potential application impacts
- How upgrade from RHEL 7 and RHEL 8
- The importance of snapshot/rollback
- Ansible roles available to help you get started

Introduction

Topics Covered:

- Key features of the upgrade automation approach
- Overview of the workshop lab environment

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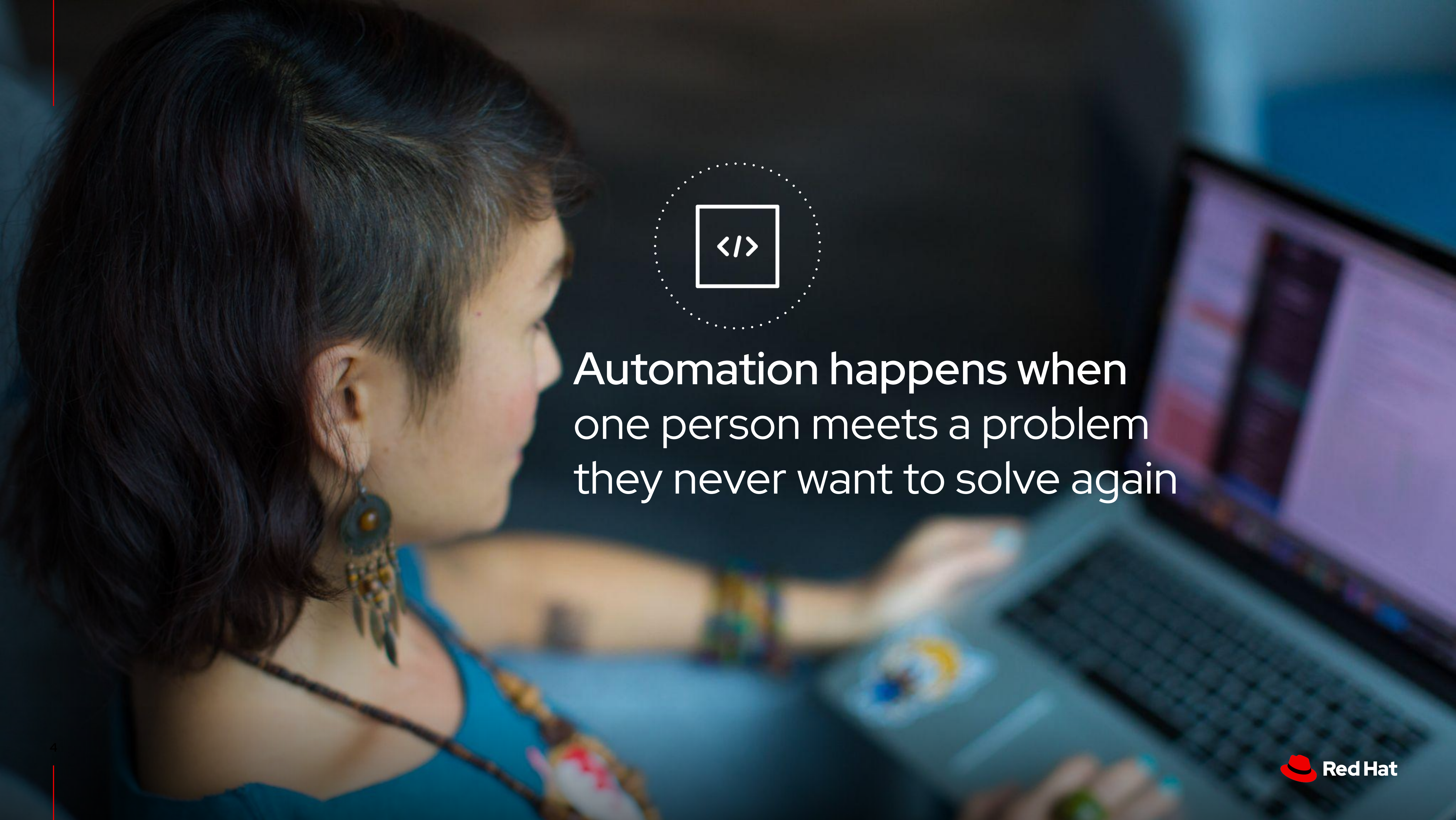


Automation happens when one person meets a problem they never want to solve again

RHEL In-place Upgrade Automation

Key Features to Succeed at Scale

Automate Everything

Make RHEL upgrades a push-button service easily consumable by Ops and App teams

Snapshot/rollback

Eliminate application impact risk so there is never an excuse not to upgrade

Custom Modules

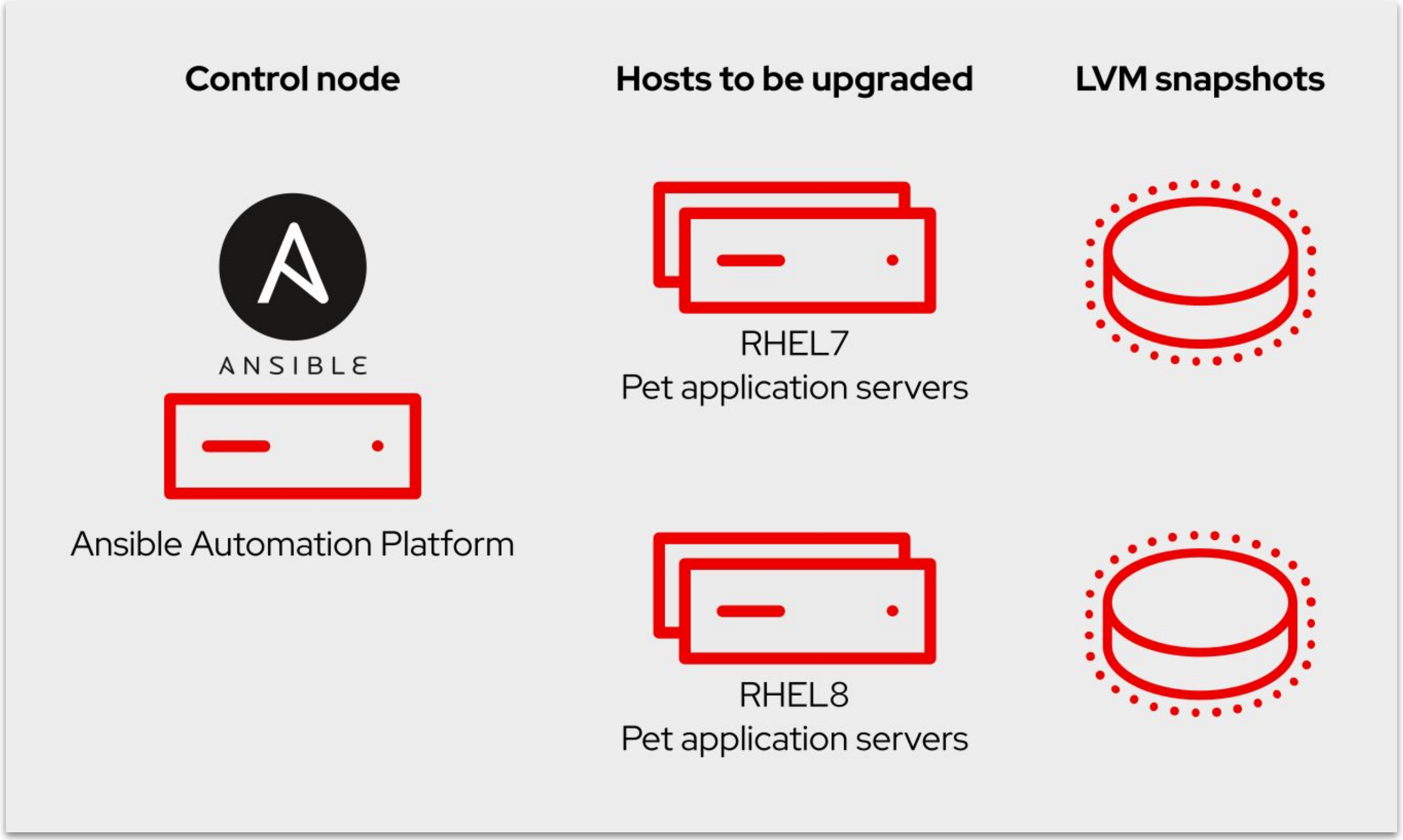
Automate remediations to deal with your standard tools, agents and middleware

Reporting Dashboard

Visualize pre-upgrade results and track progress of upgrades completed across the estate

Workshop Lab Environment

- The workshop lab environment includes a number of RHEL cloud instances
- One instance is dedicated to hosting AAP and launches playbook and workflow jobs
- These jobs perform in-place upgrades on the remaining RHEL "pet app servers"
- The automation uses LVM for the snapshot/rollback capability



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Lab Time - Workshop Lab Environment

Complete exercise 1.1 in your lab environment now

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Section 1
Pre-upgrade Analysis

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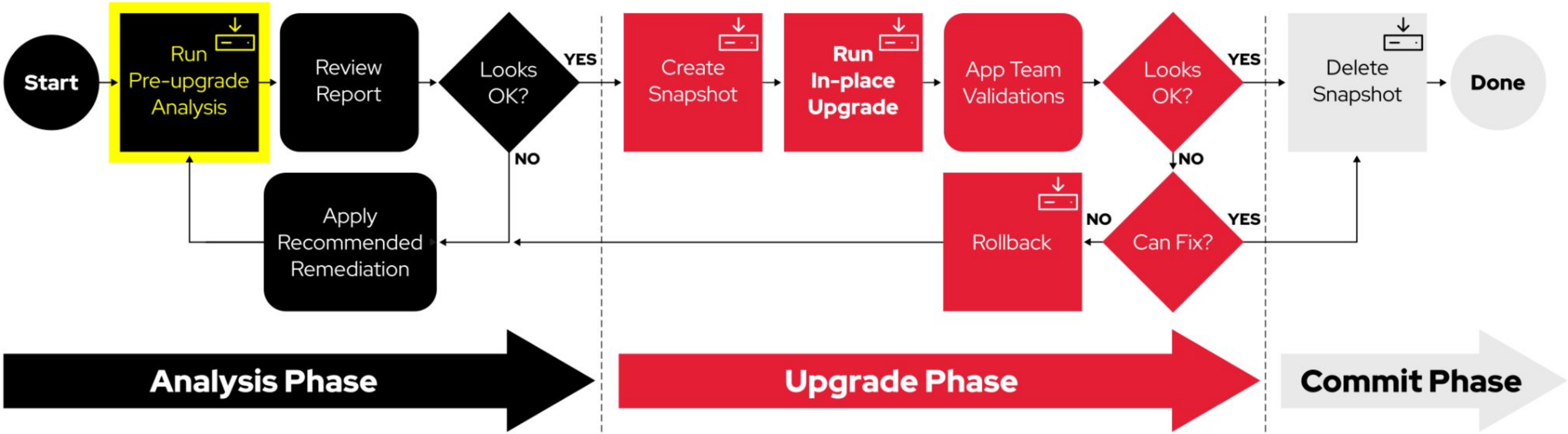
RHEL In-place Upgrade Automation Workflow



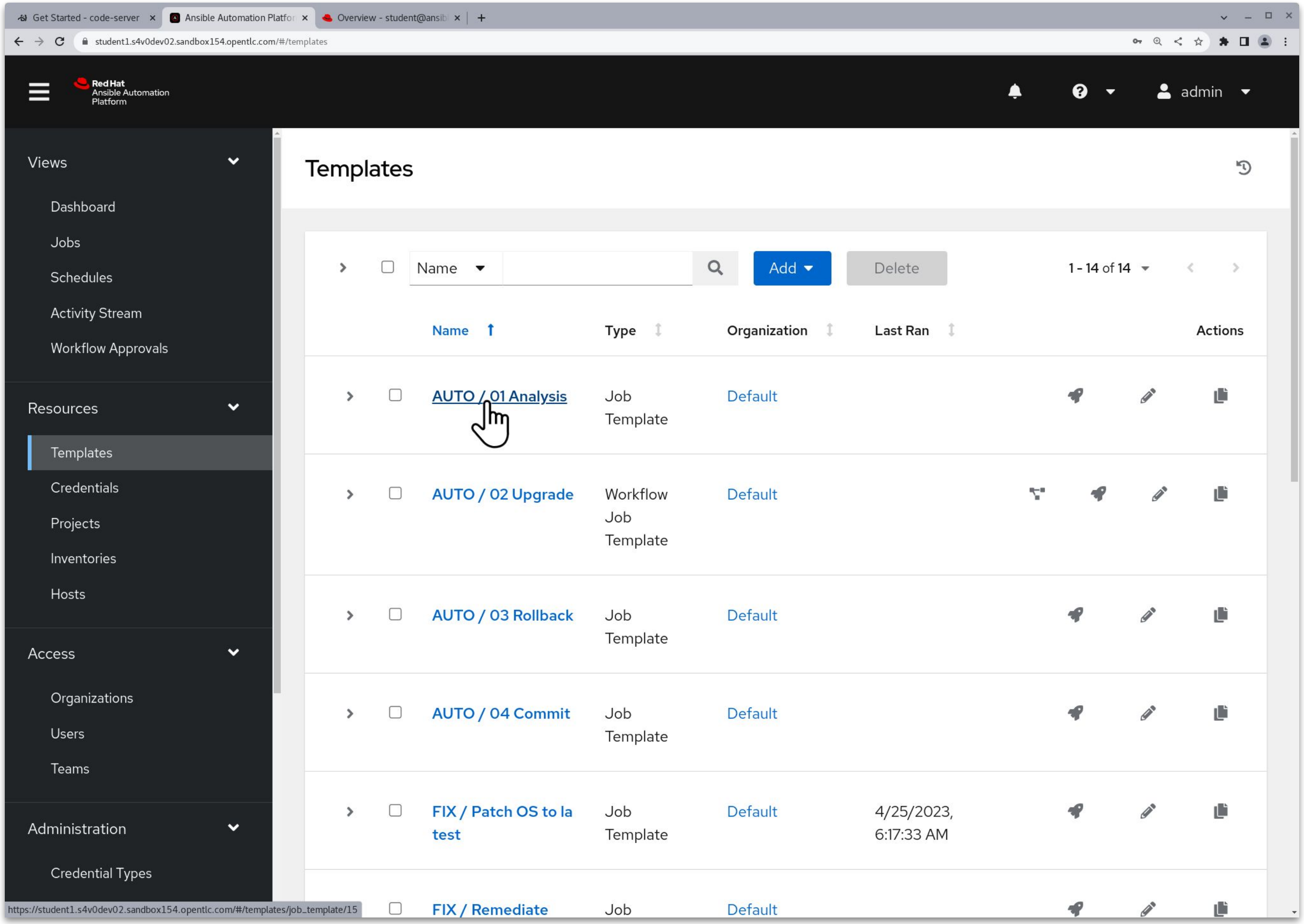
ⓘ Note

The ▤ icon indicates workflow steps that are automated by Ansible playbooks.

Launching the Analysis Job Template

- Job templates are used to launch automation jobs from AAP

- We'll use the Analysis job template to generate pre-upgrade reports for all of the RHEL pet app servers in our lab



Templates

Name	Type	Organization	Last Ran	Actions
AUTO / 01 Analysis	Job Template	Default		
AUTO / 02 Upgrade	Workflow Job Template	Default		
AUTO / 03 Rollback	Job Template	Default		
AUTO / 04 Commit	Job Template	Default		
FIX / Patch OS to la test	Job Template	Default	4/25/2023, 6:17:33 AM	
FIX / Remediate	Job	Default		

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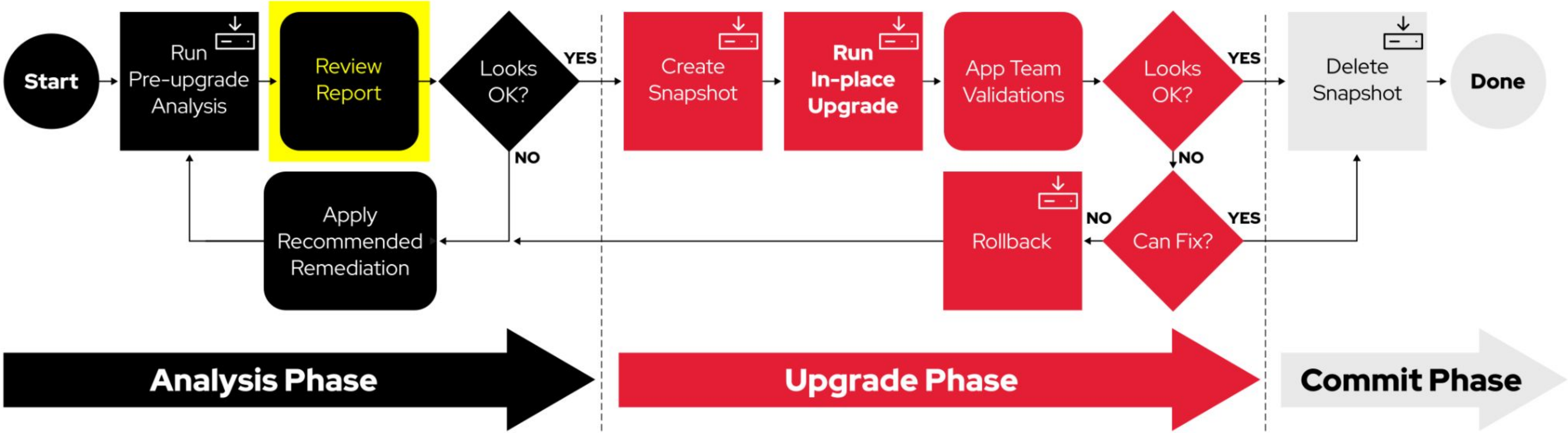
Lab Time - Run Pre-upgrade Jobs

Complete exercise 1.2 in your lab environment now

RHEL In-place Upgrade Automation Workflow

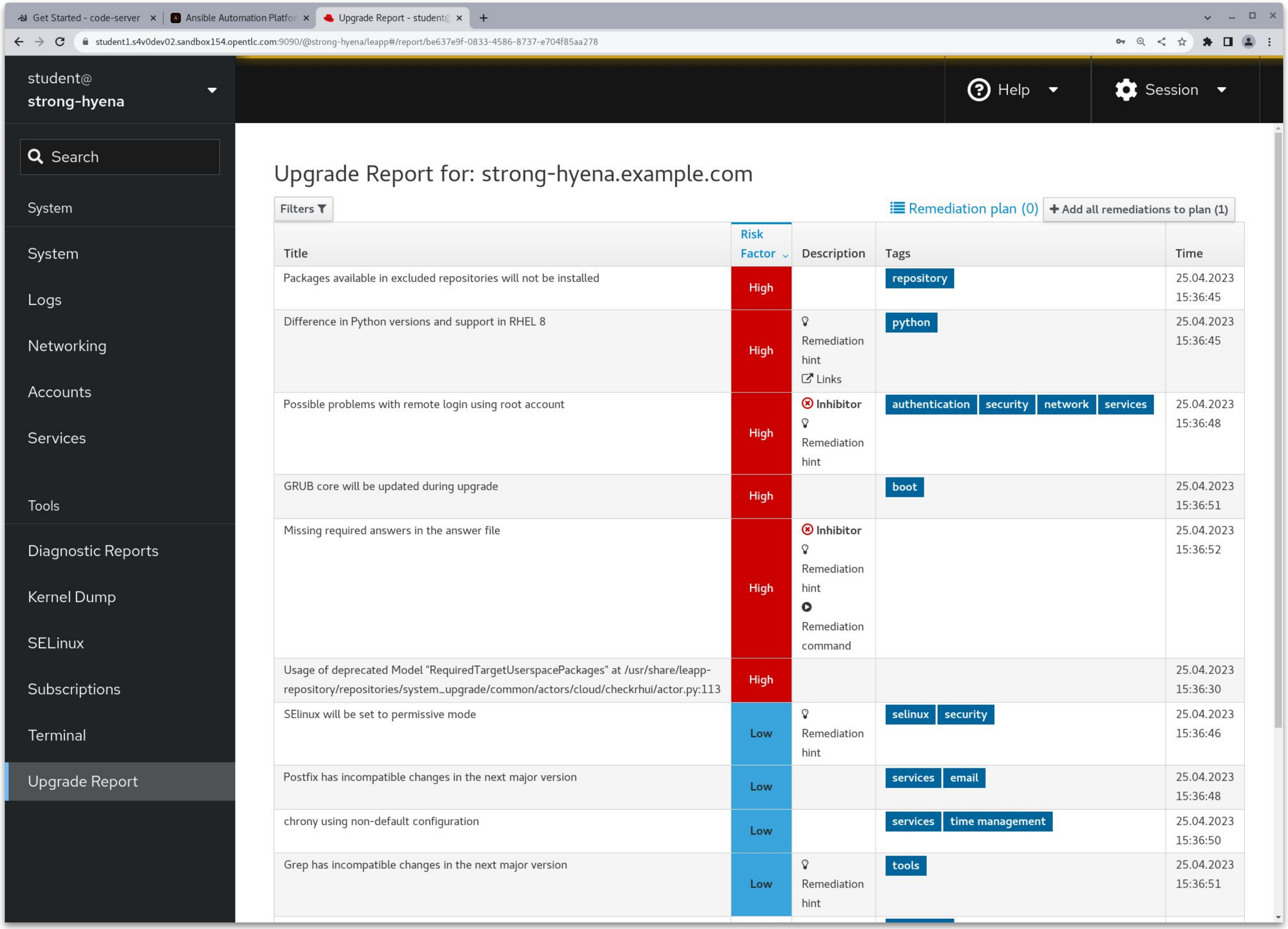


ⓘ Note

The icon indicates workflow steps that are automated by Ansible playbooks.

Example Pre-upgrade Report

- When inhibitor risk findings are reported, the RHEL upgrade is blocked and can't proceed without first resolving the issue.
- Other high risk findings are no big deal as we'll learn at the end of the next exercise.


Get Started - code-server
Ansible Automation Platfor
Upgrade Report - student@
student1.s4v0dev02.sandbox154.opentlc.com:9090/@strong-hyena/leapp#/report/be637e9f-0833-4586-8737-e704f85aa278
student@
strong-hyena
Help
Session
Search
System
System
Logs
Networking
Accounts
Services
Tools
Diagnostic Reports
Kernel Dump
SELinux
Subscriptions
Terminal
Upgrade Report
Filters
Remediation plan (0)
Add all remediations to plan (1)

Upgrade Report for: strong-hyena.example.com

Title	Risk Factor	Description	Tags	Time
Packages available in excluded repositories will not be installed	High		repository	25.04.2023 15:36:45
Difference in Python versions and support in RHEL 8	High	Remediation hint Links	python	25.04.2023 15:36:45
Possible problems with remote login using root account	High	Inhibitor Remediation hint	authentication security network services	25.04.2023 15:36:48
GRUB core will be updated during upgrade	High		boot	25.04.2023 15:36:51
Missing required answers in the answer file	High	Inhibitor Remediation hint Remediation command		25.04.2023 15:36:52
Usage of deprecated Model "RequiredTargetUserspacePackages" at /usr/share/leapp-repository/repositories/system_upgrade/common/actors/cloud/checkrhui/actor.py:113	High			25.04.2023 15:36:30
SElinux will be set to permissive mode	Low	Remediation hint	selinux security	25.04.2023 15:36:46
Postfix has incompatible changes in the next major version	Low		services email	25.04.2023 15:36:48
chrony using non-default configuration	Low		services time management	25.04.2023 15:36:50
Grep has incompatible changes in the next major version	Low	Remediation hint	tools	25.04.2023 15:36:51

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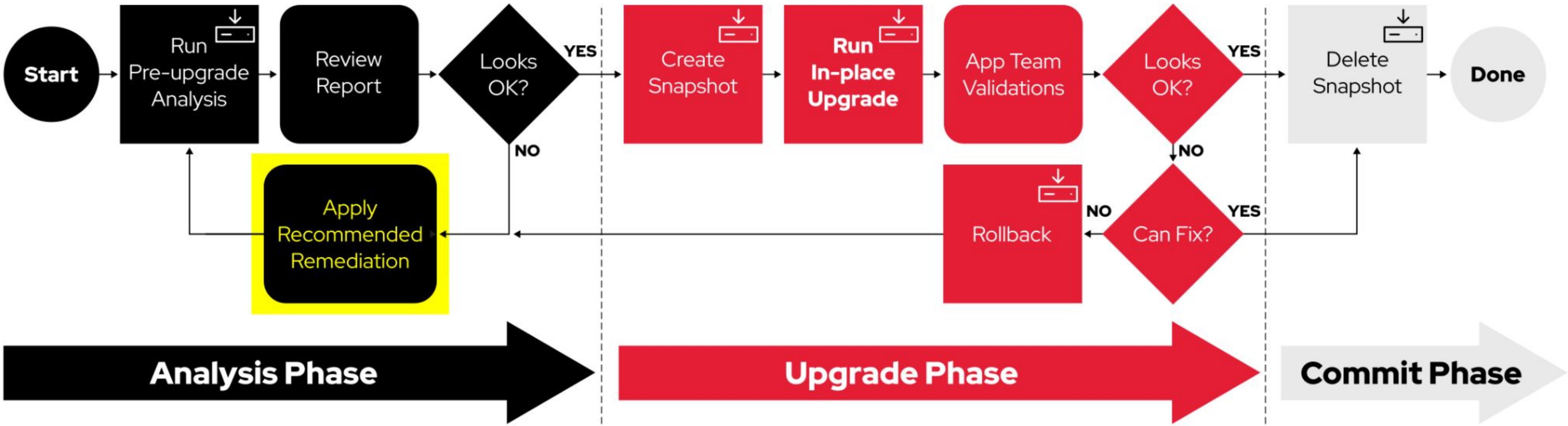
Lab Time - Review Pre-upgrade Reports

Complete exercise 1.3 in your lab environment now

RHEL In-place Upgrade Automation Workflow



ⓘ Note

The icon indicates workflow steps that are automated by Ansible playbooks.

Automating Remediation of Inhibitor Findings

- Using an Ansible playbook is the best way to automate remediations for inhibitors identified in the pre-upgrade reports.
- The `Configure sshd` task addresses the "Possible problems with remote login using root account" inhibitor.
- The `Remove pam_pkcs11 module` task will update the Leapp answer file to solve our other inhibitor.
- After running the remediation playbook job, we'll generate a fresh pre-upgrade report and see no more inhibitors.

```
- name: Configure sshd
  ansible.builtin.lineinfile:
    path: "/etc/ssh/sshd_config"
    regex: "^(#)?{{ item.key }}"
    line: "{{ item.key }} {{ item.value }}"
    state: present
  loop:
    - {key: "PermitRootLogin", value: "prohibit-password"}
    - {key: "PasswordAuthentication", value: "no"}
  notify:
    - Restart sshd

- name: Remove pam_pkcs11 module
  ansible.builtin.shell: |
    set -o pipefail
    leapp answer --add --section
remove_pam_pkcs11_module_check.confirm=True
  args:
    executable: /bin/bash
```

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Lab Time -
Perform Recommended Remediations

Complete exercise 1.4 in your lab environment now

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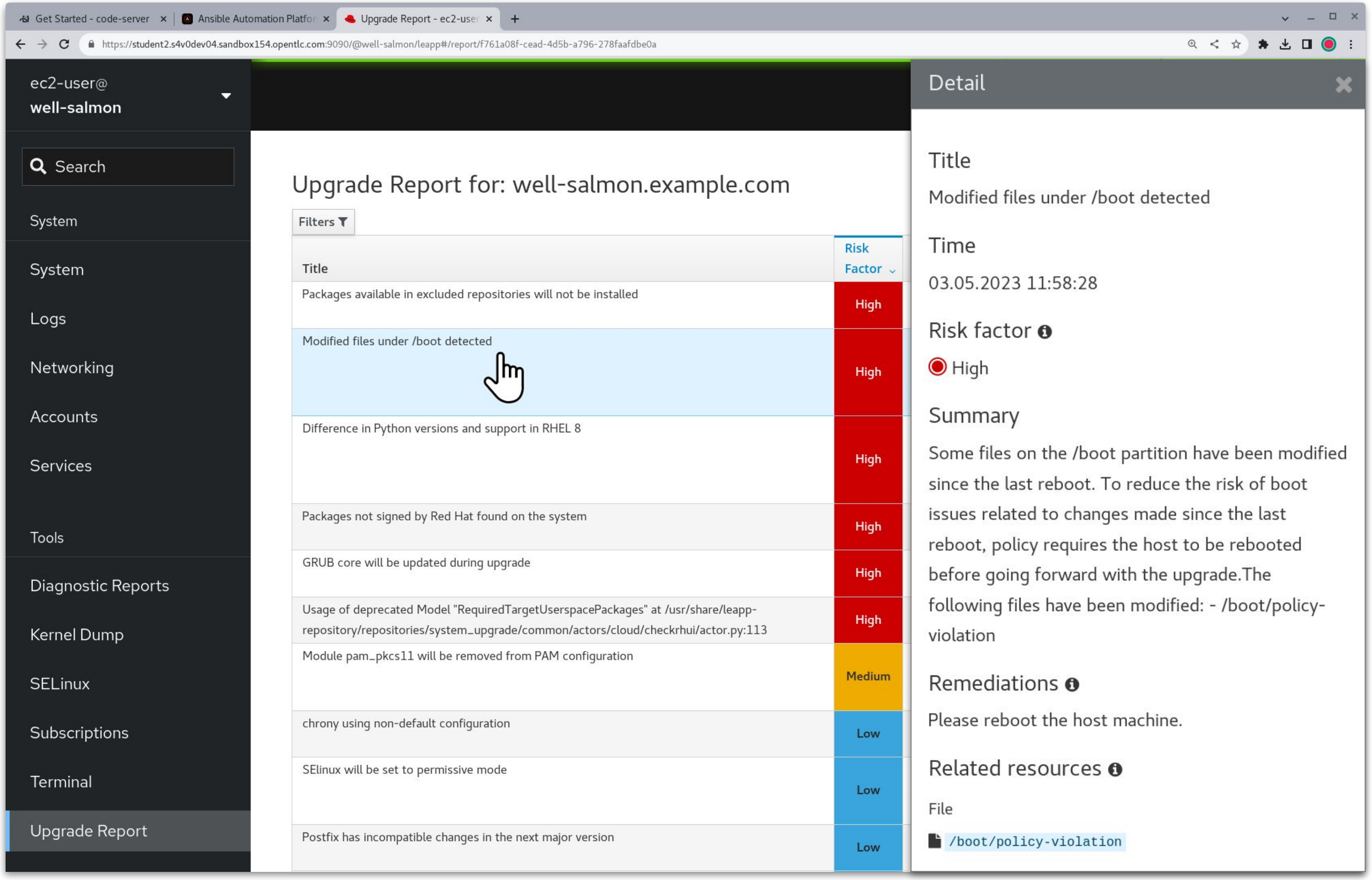
Example Leapp Custom Actor

- A custom actor can implement pre-upgrade checks specific to your enterprise.
- Here we see an inhibitor raised for failed compliance with an imaginary organization's "reboot hygiene" policy.
- Continue to the next exercise to learn more about custom actors and other ways to tailor automation to your needs.


Get Started - code-server
Ansible Automation Platfor
Upgrade Report - ec2-user
https://student2.s4v0dev04.sandbox154.opentlc.com:9090/@well-salmon/leapp#/report/f761a08f-cead-4d5b-a796-278faafdbe0a
ec2-user@
well-salmon
Search
System
System
Logs
Networking
Accounts
Services
Tools
Diagnostic Reports
Kernel Dump
SELinux
Subscriptions
Terminal
Upgrade Report
Filters

Upgrade Report for: well-salmon.example.com

Title	Risk Factor
Packages available in excluded repositories will not be installed	High
Modified files under /boot detected	High
Difference in Python versions and support in RHEL 8	High
Packages not signed by Red Hat found on the system	High
GRUB core will be updated during upgrade	High
Usage of deprecated Model "RequiredTargetUserspacePackages" at /usr/share/leapp-repository/repositories/system_upgrade/common/actors/cloud/checkrhui/actor.py:113	High
Module pam_pkcs11 will be removed from PAM configuration	Medium
chrony using non-default configuration	Low
SElinux will be set to permissive mode	Low
Postfix has incompatible changes in the next major version	Low

Detail

Title

Modified files under /boot detected

Time

03.05.2023 11:58:28

Risk factor

● High

Summary

Some files on the /boot partition have been modified since the last reboot. To reduce the risk of boot issues related to changes made since the last reboot, policy requires the host to be rebooted before going forward with the upgrade.The following files have been modified: - /boot/policy-violation

Remediations

Please reboot the host machine.

Related resources

File

`/boot/policy-violation`

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Lab Time - Custom Modules

Complete exercise 1.5 in your lab environment now

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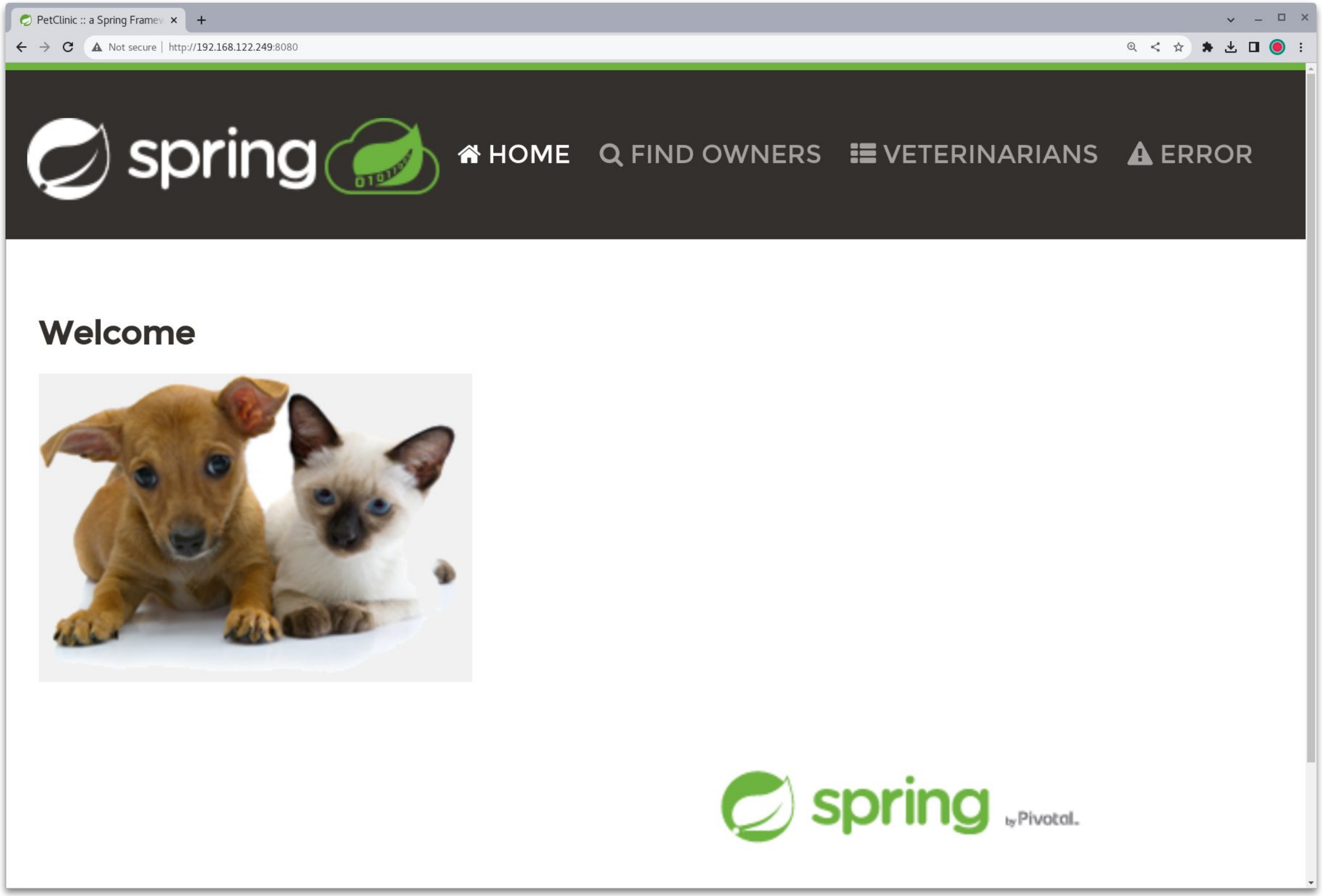
Deploy a Pet Application

- To demonstrate how in-place upgrades and rollbacks might impact business applications, we'll install a sample app.
- The Spring Pet Clinic Sample Application will be installed to use a third-party JDK runtime and a local MariaDB database.
- Will the application lead to more findings on the pre-upgrade report? Will it still function correctly after we perform the RHEL upgrade? Continue to the next exercise to find out!


PetClinic :: a Spring Framev
Not secure | http://192.168.122.249:8080
spring
HOME
FIND OWNERS
VETERINARIANS
ERROR
Welcome
spring by Pivotal.

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Lab Time - Deploy a Pet App

Complete exercise 1.6 in your lab environment now

Section 2
RHEL In-place Upgrade

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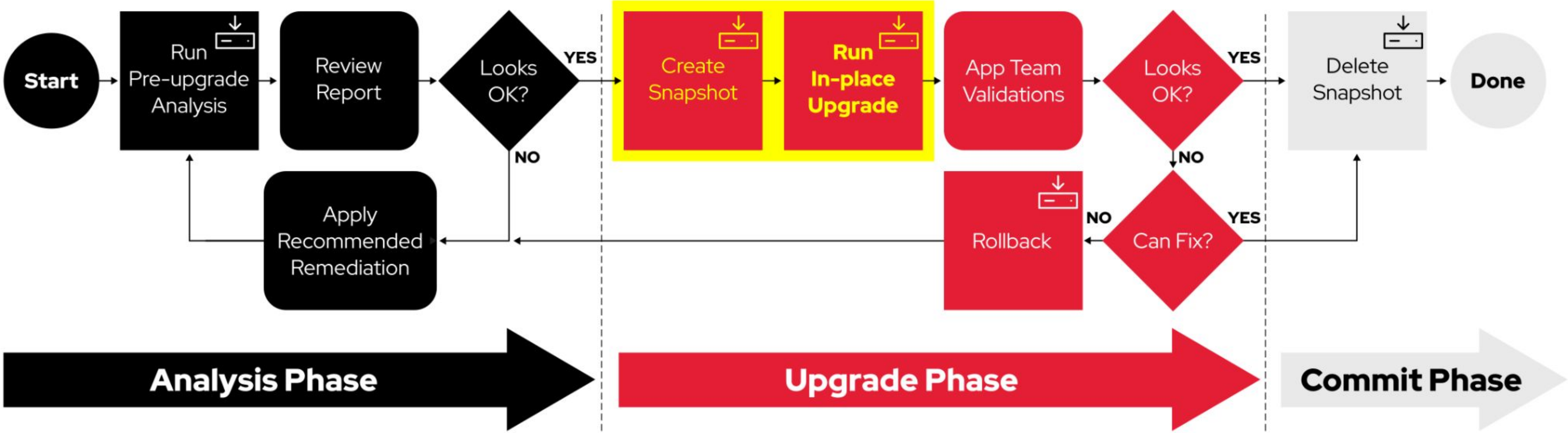
RHEL In-place Upgrade Automation Workflow

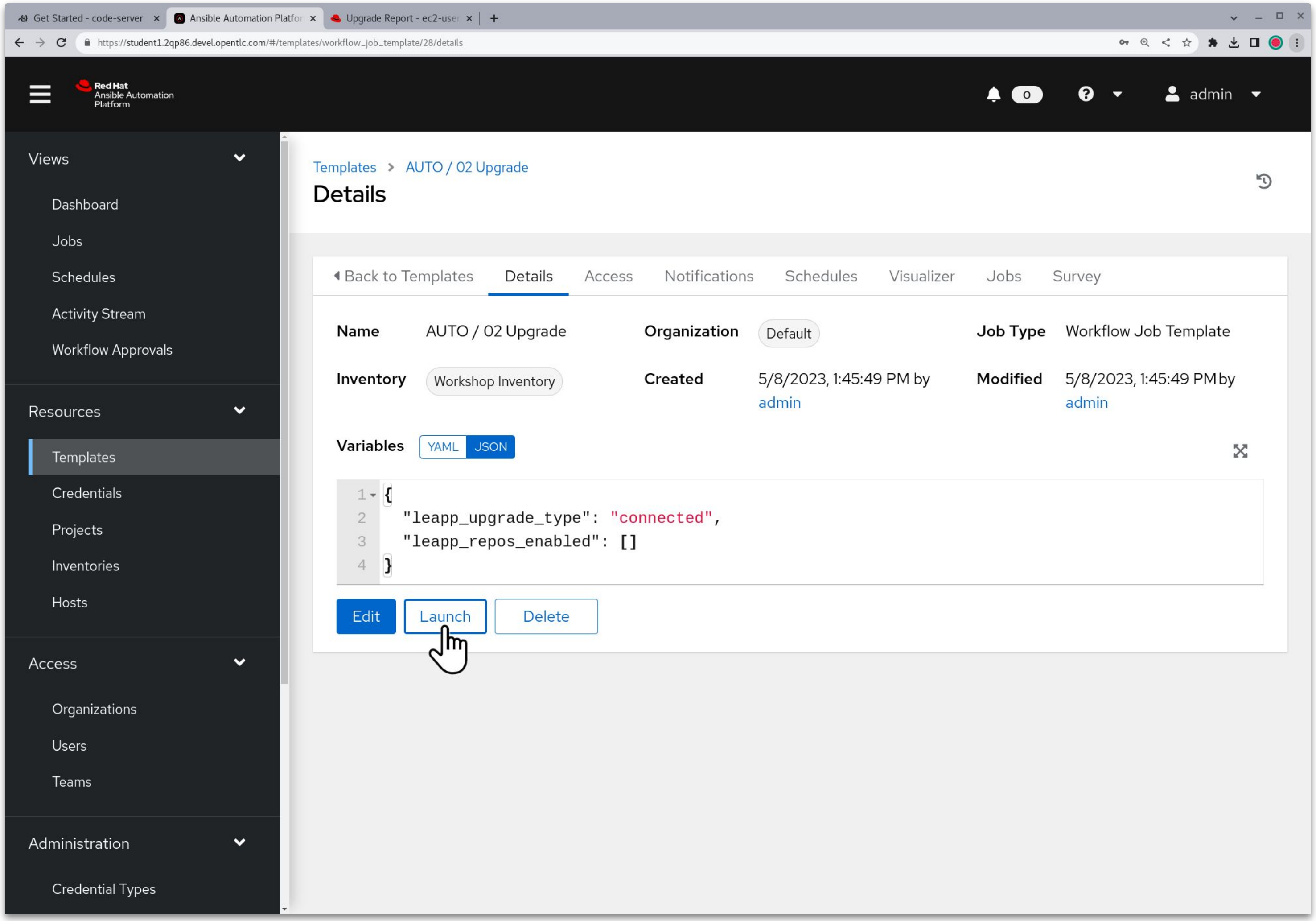


ⓘ Note

The icon indicates workflow steps that are automated by Ansible playbooks.

Launching the Upgrade Workflow Job Template

- A workflow job template in AAP is used to run the snapshot and upgrade playbooks back-to-back in a single job.
- This job will take about 20 minutes to finish the upgrades on all the RHEL hosts in our lab. While we are waiting, we'll read up to learn more about how Leapp works.



Details

Name: AUTO / 02 Upgrade
Organization: Default
Job Type: Workflow Job Template
Inventory: Workshop Inventory
Created: 5/8/2023, 1:45:49 PM by admin
Modified: 5/8/2023, 1:45:49 PM by admin

Variables

```
{
  "leapp_upgrade_type": "connected",
  "leapp_repos_enabled": []
}
```

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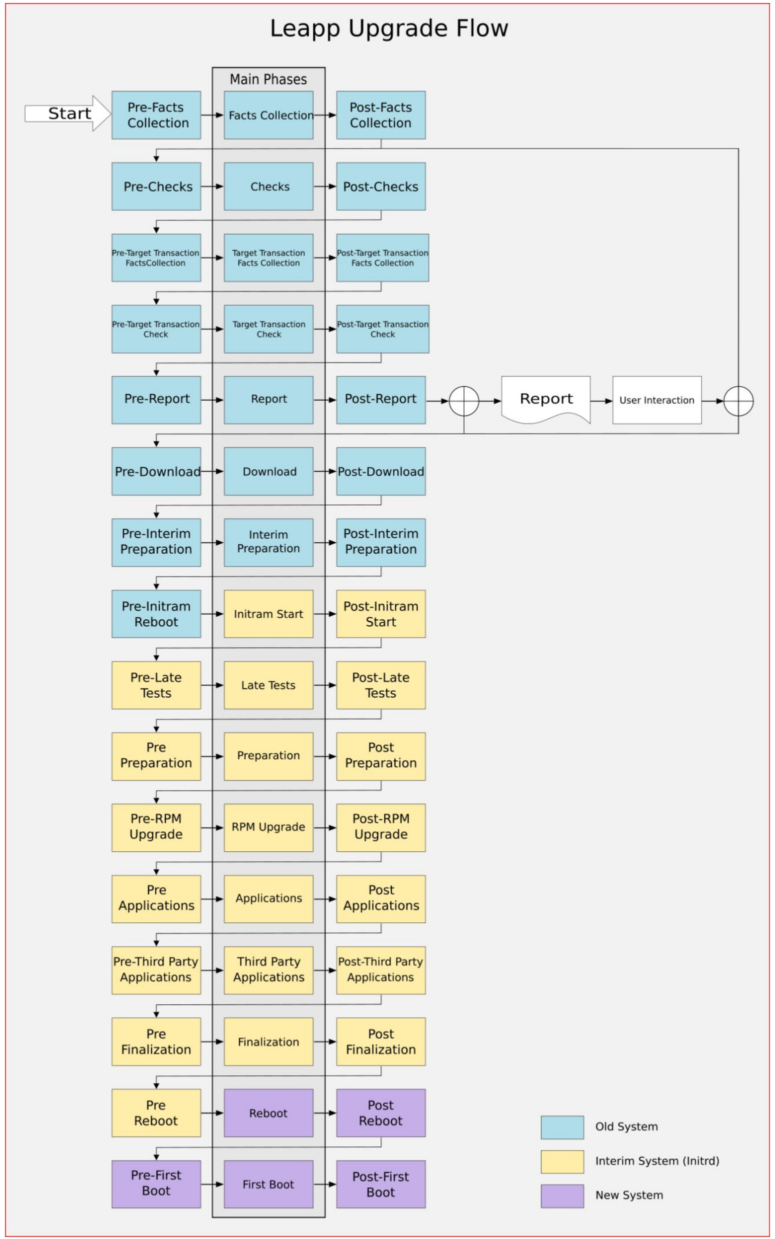
Lab Time - Run OS Upgrade Jobs

Complete exercise 2.1 in your lab environment now

Leapp Framework Overview

- Keep in mind that the Leapp framework is responsible only for upgrading the RHEL OS packages. Additional tasks required for upgrading your standard agents, tools, middleware, etc., need to be included in the upgrade playbooks you develop to deal with the specific requirements of your organization's environment.
- The Leapp framework performs the RHEL in-place upgrade by following a sequence of phases as shown in this flowchart found in the Leapp developer docs. The phases of the RHEL in-place upgrade are implemented in modules known as Leapp actors.
- Phases under the Old System group run under the existing RHEL installed version. The Interim System phases starts when the host reboots to an upgrade environment under which the network and other services are not started. It is at this time that all RHEL packages are upgraded. Once all the packages are upgraded, another reboot brings the host up under the new RHEL major version and the FirstBoot phase starts. This final phase runs a few post-upgrade actors that require network access and then the upgrade is done.



https://leapp.readthedocs.io/en/latest/inplace-upgrade-workflow.html

Different Snapshot Options Compared

Snapshot type	Works with	Benefits	Drawbacks
LVM	▸ Bare metal ▸ On-prem VMs ▸ Cloud*	▸ No external API access required ▸ Scope can be just OS or everything	▸ Free space required in volume group ▸ Snapshots can run out of space if not sized correctly ▸ Automation must backup and restore /boot separately
VMware	▸ On-prem VMs (ESX)	▸ Simple and reliable ▸ Scope includes everything	▸ Doesn't support bare metal, etc. ▸ Using VMware snapshot for over 3 days is discouraged ▸ Getting API access can be difficult ▸ No free space in datastores because of overcommitment ▸ Everything scope might be too much
Amazon EBS	▸ Amazon EC2	▸ Simple and reliable ▸ Unlimited storage capacity ▸ Scope can be just OS or everything	▸ Only works on AWS
Break Mirror	▸ Bare metal	▸ Alternative to LVM for servers with hardware RAID	▸ Significant development and testing effort required ▸ RAID and Redfish API standards vary across different vendors and hardware models
ReaR	▸ Bare metal ▸ On-prem VMs	▸ Method of last resort if no snapshot options will work	▸ Not really a snapshot, but does offer boot ISO full recovery capability

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Lab Time - Let’s Talk About Snapshots

Complete exercise 2.2 in your lab environment now

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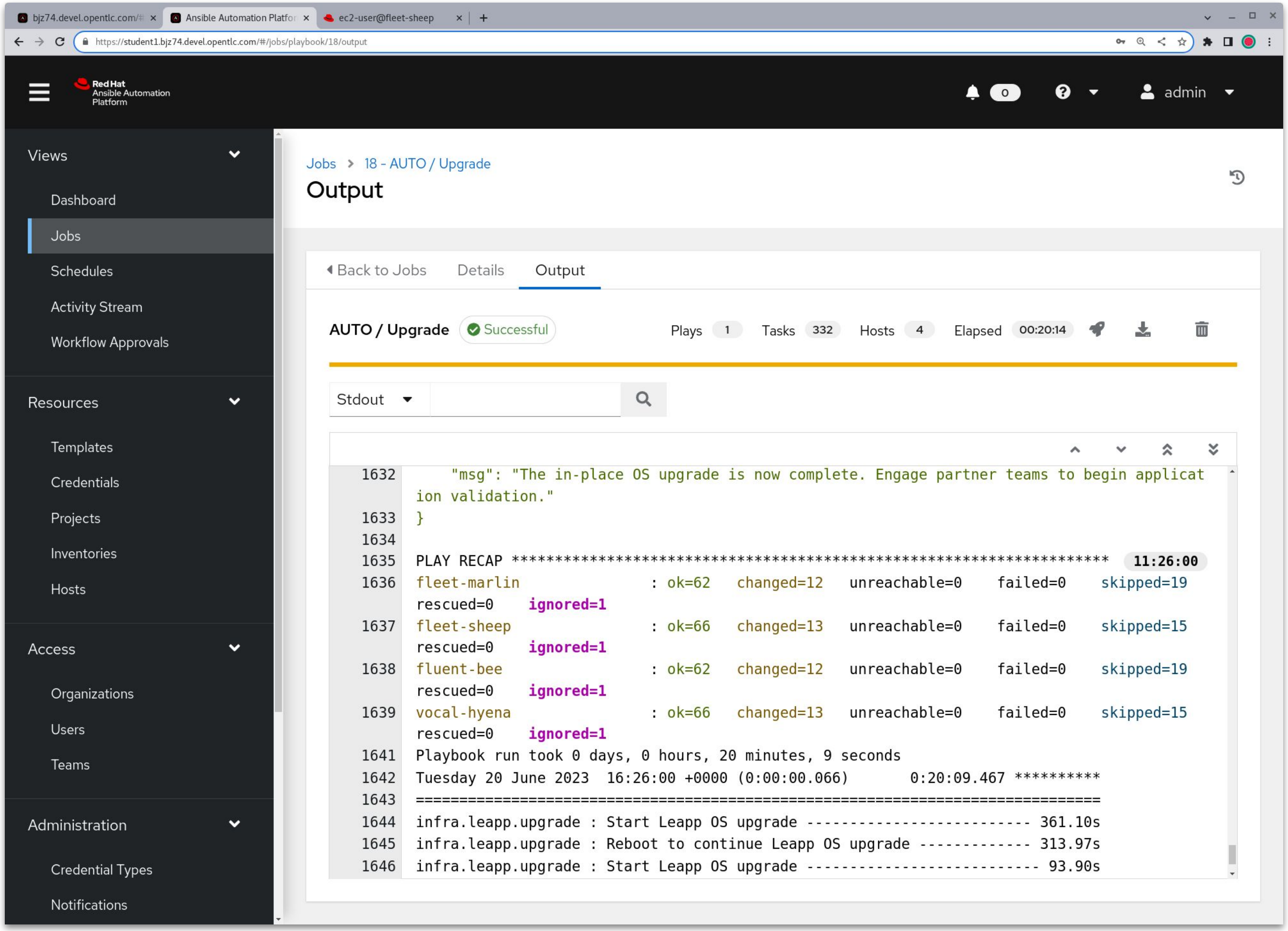
Checking Upgrade Job Log Output

- After the upgrade playbook job finishes, review the play recap in the log output.
- All hosts should show failed=0 indicating that the upgrades are completed.
- The application teams can now start their validation and acceptance testing.

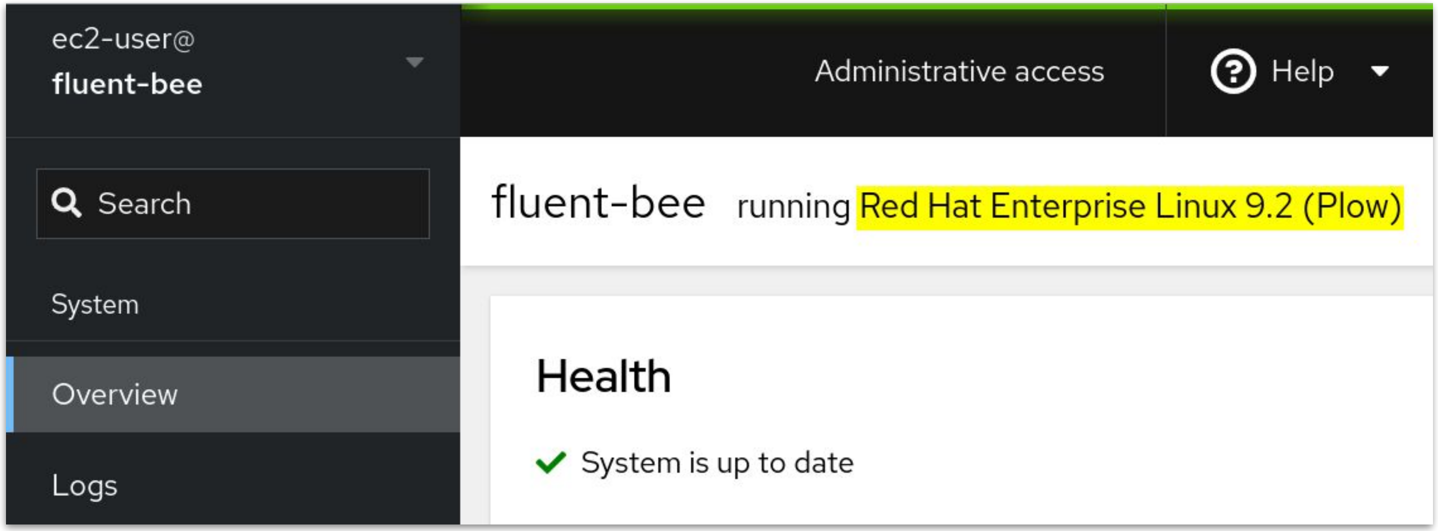


```
    "msg": "The in-place OS upgrade is now complete. Engage partner teams to begin applicat
ion validation."
}

PLAY RECAP *********************************************************************** 11:26:00
fleet-marlin               : ok=62   changed=12   unreachable=0    failed=0    skipped=19
rescued=0    ignored=1
fleet-sheep                : ok=66   changed=13   unreachable=0    failed=0    skipped=15
rescued=0    ignored=1
fluent-bee                 : ok=62   changed=12   unreachable=0    failed=0    skipped=19
rescued=0    ignored=1
vocal-hyena                : ok=66   changed=13   unreachable=0    failed=0    skipped=15
rescued=0    ignored=1
Playbook run took 0 days, 0 hours, 20 minutes, 9 seconds
Tuesday 20 June 2023  16:26:00 +0000 (0:00:00.066)       0:20:09.467 **********
===============================================================================
infra.leapp.upgrade : Start Leapp OS upgrade ------------------------- 361.10s
infra.leapp.upgrade : Reboot to continue Leapp OS upgrade ------------ 313.97s
infra.leapp.upgrade : Start Leapp OS upgrade ------------------------- 93.90s
```

Checking the RHEL and Kernel Versions

- You can refresh the RHEL Web Console system overview page to show the upgraded RHEL version.

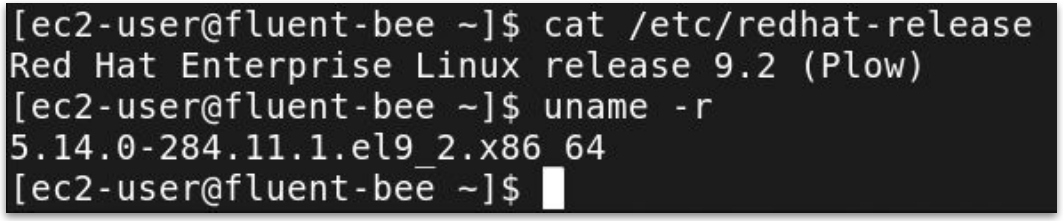


fluent-bee running Red Hat Enterprise Linux 9.2 (Plow)

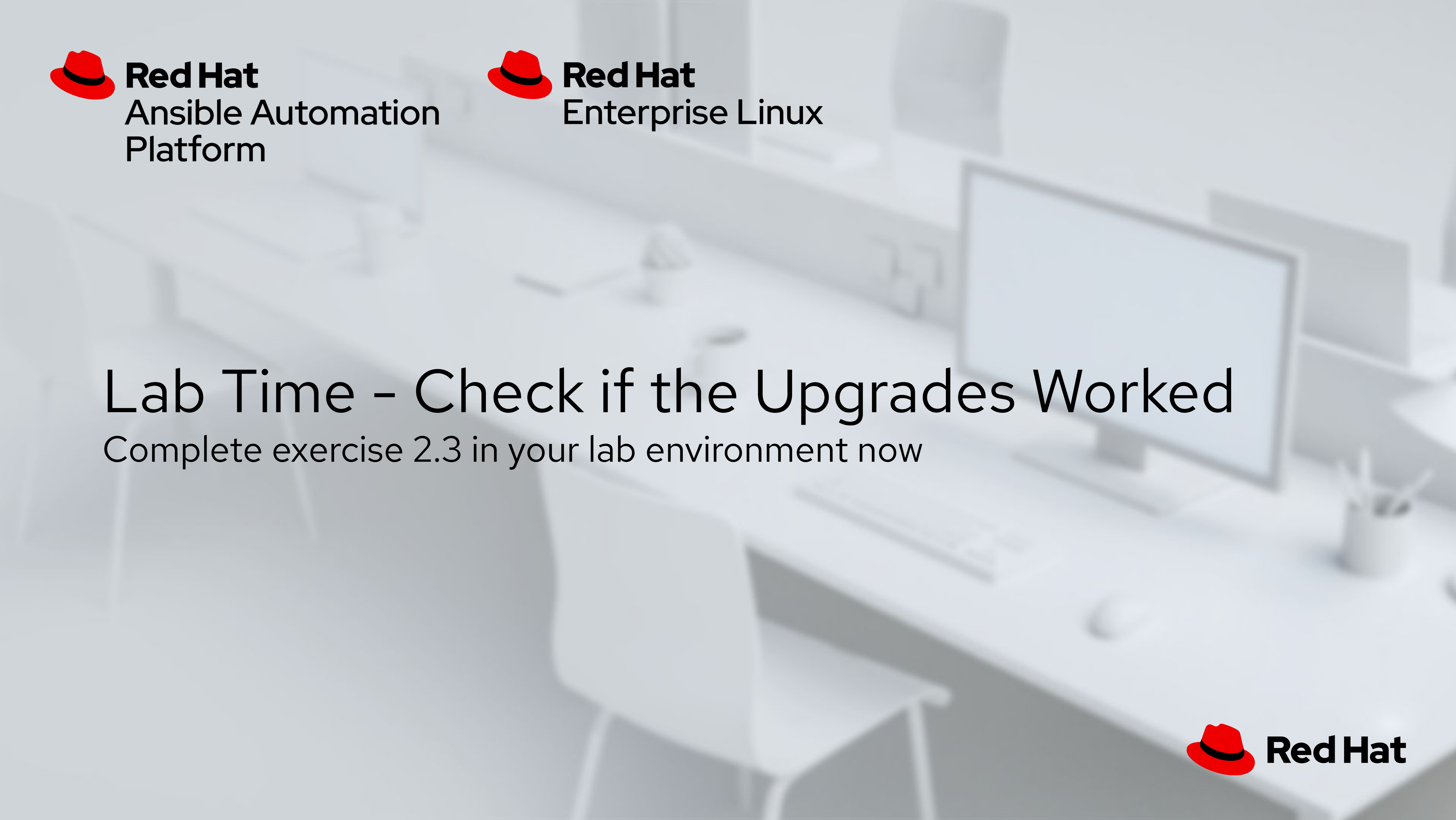
Health

✓ System is up to date

- If you prefer the shell prompt, try these commands:
  `cat /etc/redhat-release`
  `uname -r`



```
[ec2-user@fluent-bee ~]$ cat /etc/redhat-release
Red Hat Enterprise Linux release 9.2 (Plow)
[ec2-user@fluent-bee ~]$ uname -r
5.14.0-284.11.1.el9_2.x86_64
[ec2-user@fluent-bee ~]$ 
```



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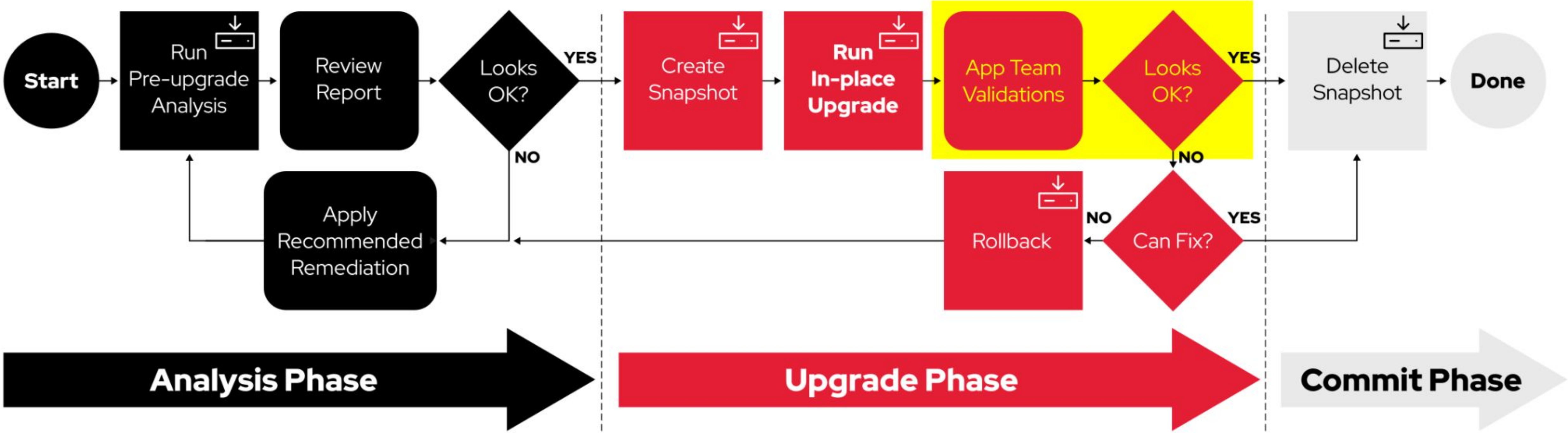
Lab Time - Check if the Upgrades Worked

Complete exercise 2.3 in your lab environment now

RHEL In-place Upgrade Automation Workflow



ⓘ Note

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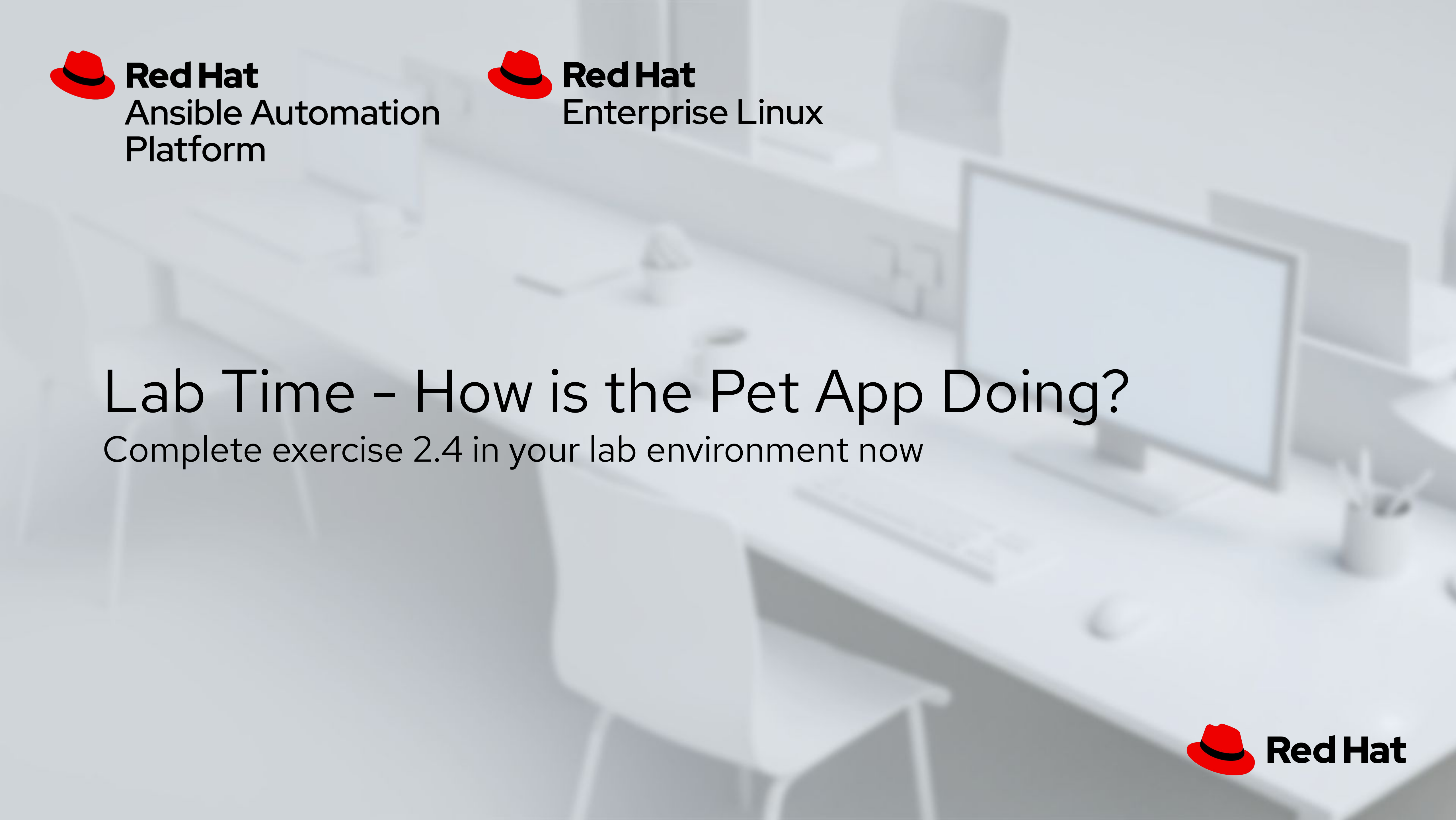

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Lab Time - How is the Pet App Doing?

Complete exercise 2.4 in your lab environment now

Section 3
Rolling Back

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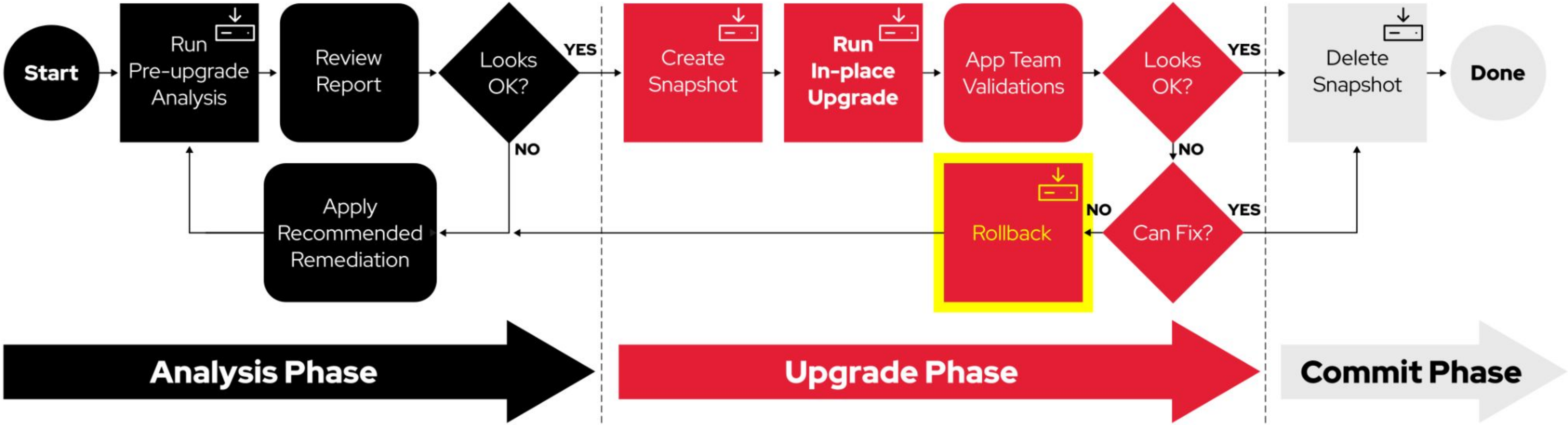
RHEL In-place Upgrade Automation Workflow



Note

The icon indicates workflow steps that are automated by Ansible playbooks.

Simulate a Failed Upgrade or Application Impact

- To help demonstrate the effectiveness of rolling back, we're going to intentionally mess up one of our upgraded hosts.

- What if the RHEL upgrade had caused our temurin-17-jdk 3rd-party JDK runtime package to be removed because of unresolvable dependencies? Our pet app requires the JDK runtime to function. Without it, our application will be broken. We can simulate this by manually removing the package like this:

```
sudo dnf -y remove temurin-17-jdk
```

youngthousands from usa, CC BY 2.0

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Lab Time - Trash the Instance

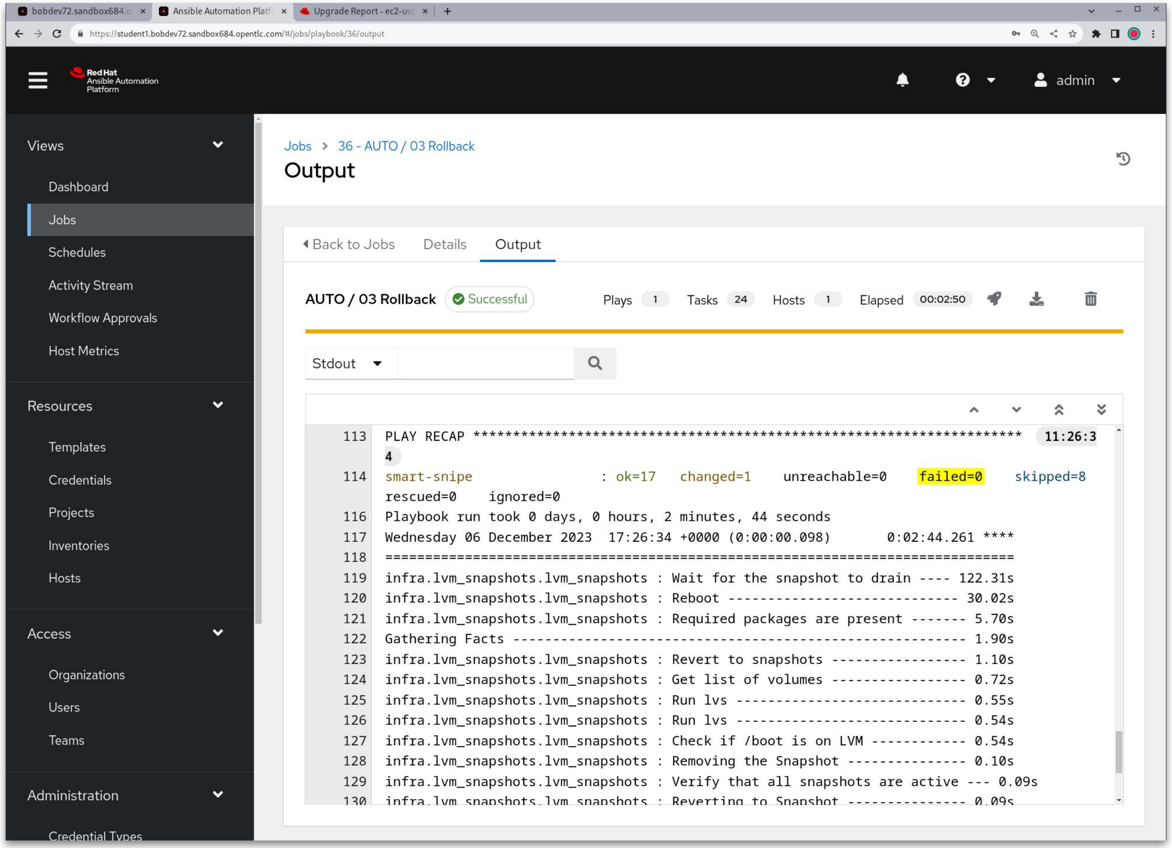
Complete exercise 3.1 in your lab environment now

Rolling Back the Upgrade

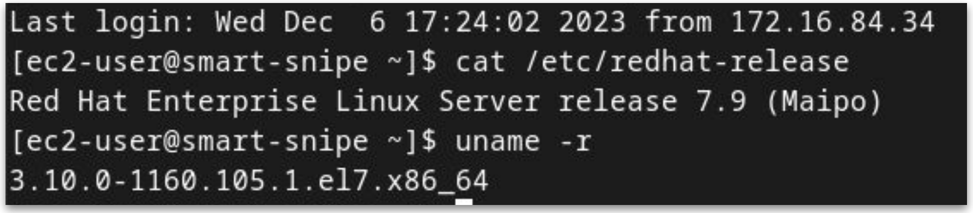
- The rollback playbook uses the snapshots that were automatically created by the upgrade workflow job and reverts an instance back to its previous state.

- This job completed in just under 3 minutes!

- After rolling back, we see the RHEL and kernel versions are the same as before we upgraded.



```
PLAY RECAP ************************************************************************  11:26:34
smart-snipe                : ok=17   changed=1    unreachable=0    failed=0    skipped=8
rescued=0    ignored=0
Playbook run took 0 days, 0 hours, 2 minutes, 44 seconds
Wednesday 06 December 2023  17:26:34 +0000 (0:00:00.098)       0:02:44.261 ****
===============================================================================
infra.lvm_snapshots.lvm_snapshots : Wait for the snapshot to drain ---- 122.31s
infra.lvm_snapshots.lvm_snapshots : Reboot ---------------------------- 30.02s
infra.lvm_snapshots.lvm_snapshots : Required packages are present ------- 5.70s
Gathering Facts --------------------------------------------------------- 1.90s
infra.lvm_snapshots.lvm_snapshots : Revert to snapshots ----------------- 1.10s
infra.lvm_snapshots.lvm_snapshots : Get list of volumes ----------------- 0.72s
infra.lvm_snapshots.lvm_snapshots : Run lvs ----------------------------- 0.55s
infra.lvm_snapshots.lvm_snapshots : Run lvs ----------------------------- 0.54s
infra.lvm_snapshots.lvm_snapshots : Check if /boot is on LVM ------------ 0.54s
infra.lvm_snapshots.lvm_snapshots : Removing the Snapshot --------------- 0.10s
infra.lvm_snapshots.lvm_snapshots : Verify that all snapshots are active --- 0.09s
infra.lvm_snapshots.lvm_snapshots : Reverting to Snapshot --------------- 0.09s
```



```
Last login: Wed Dec  6 17:24:02 2023 from 172.16.84.34
[ec2-user@smart-snipe ~]$ cat /etc/redhat-release
Red Hat Enterprise Linux Server release 7.9 (Maipo)
[ec2-user@smart-snipe ~]$ uname -r
3.10.0-1160.105.1.el7.x86_64
```

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Lab Time - Run Rollback Job

Complete exercise 3.2 in your lab environment now

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Is Everything Working Again?

- After rolling back, repeat the observations we made on our host after the upgrade with the expectation that everything is back as it was before the upgrade.
- Look for any app data you added or modified after the upgrade and you will find that all those changes are preserved.
- What does this tell us about the snapshot scope implemented by our rollback playbook?
- In the next exercise, we will assess our state after rolling back and consider next steps.

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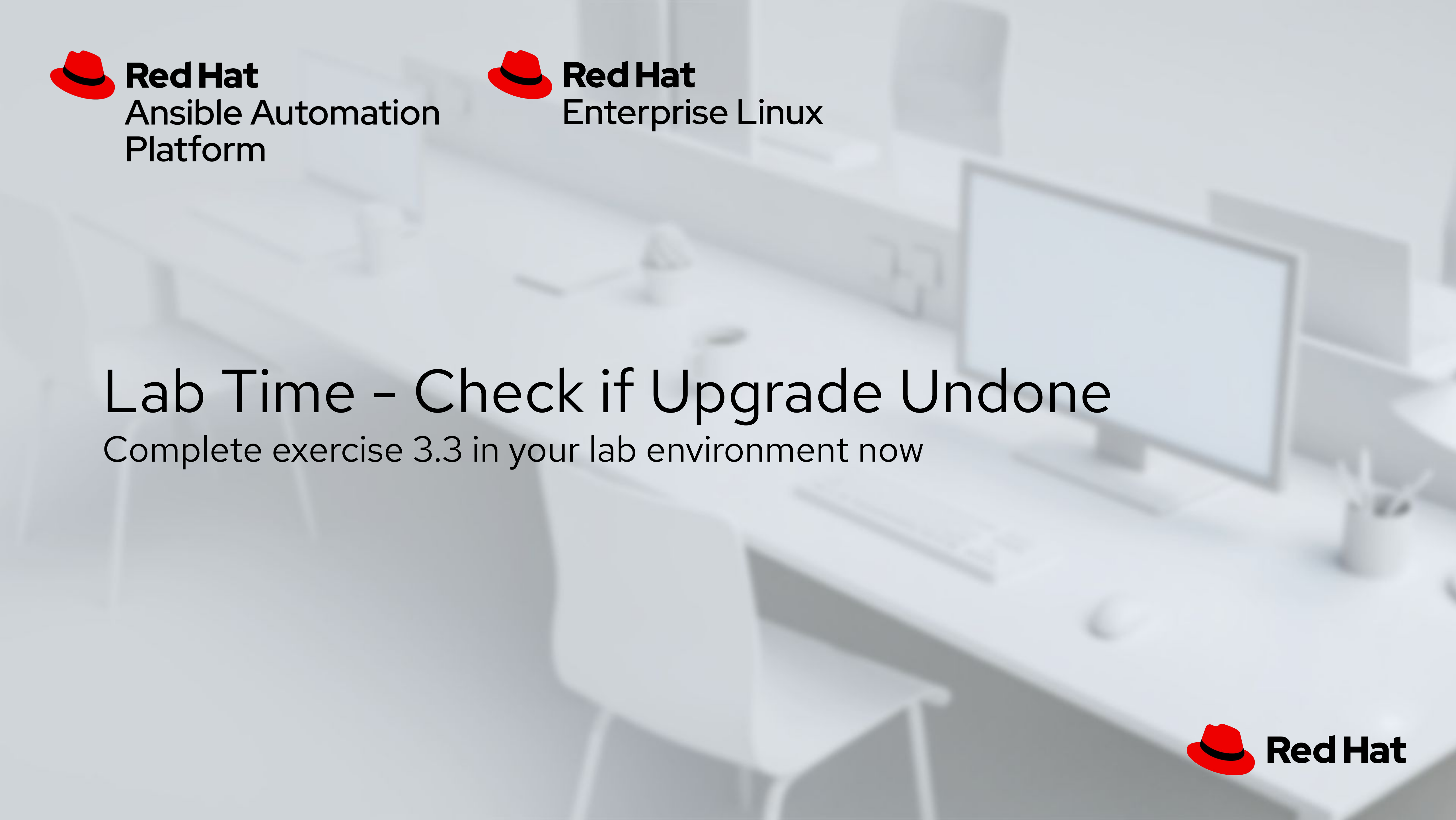

Lab Time - Check if Upgrade Undone

Complete exercise 3.3 in your lab environment now

Congratulations!

- You have reached the end of the workshop. You are now armed with the knowledge needed to start developing an automation solution to help your organization manage RHEL upgrades at scale.
- The workshop lab environment is now yours to play with. Dream up your own ideas for additional learning and experimentation. Remember you can upgrade and roll back as often as you like. Rinse and repeat!

McElspeth

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Lab Time - Rinse and Repeat

Complete exercise 3.4 in your lab environment now

Checkout the Code

- All of the Ansible roles and playbooks used in this workshop are maintained in open source repositories.
- Take some time to review the code and get engaged with the communities supporting these resources.

- github.com/redhat-cop/infra.leapp

  The `infra.leapp` collection provides the Ansible role that generates the pre-upgrade reports and another that is used to perform the RHEL upgrades. This collection uses the Leapp framework for upgrades from RHEL 7 and later, but also supports upgrading from RHEL 6 using the older Red Hat Upgrade Tool. The collection is published on Ansible Galaxy here and also available from Ansible Automation Hub validated content here. If you are planning to do RHEL in-place upgrades for your organization, these roles will help you quickly roll out proof-of-concept automation and start upgrading.

- github.com/swapdisk/infra.lvm_snapshots

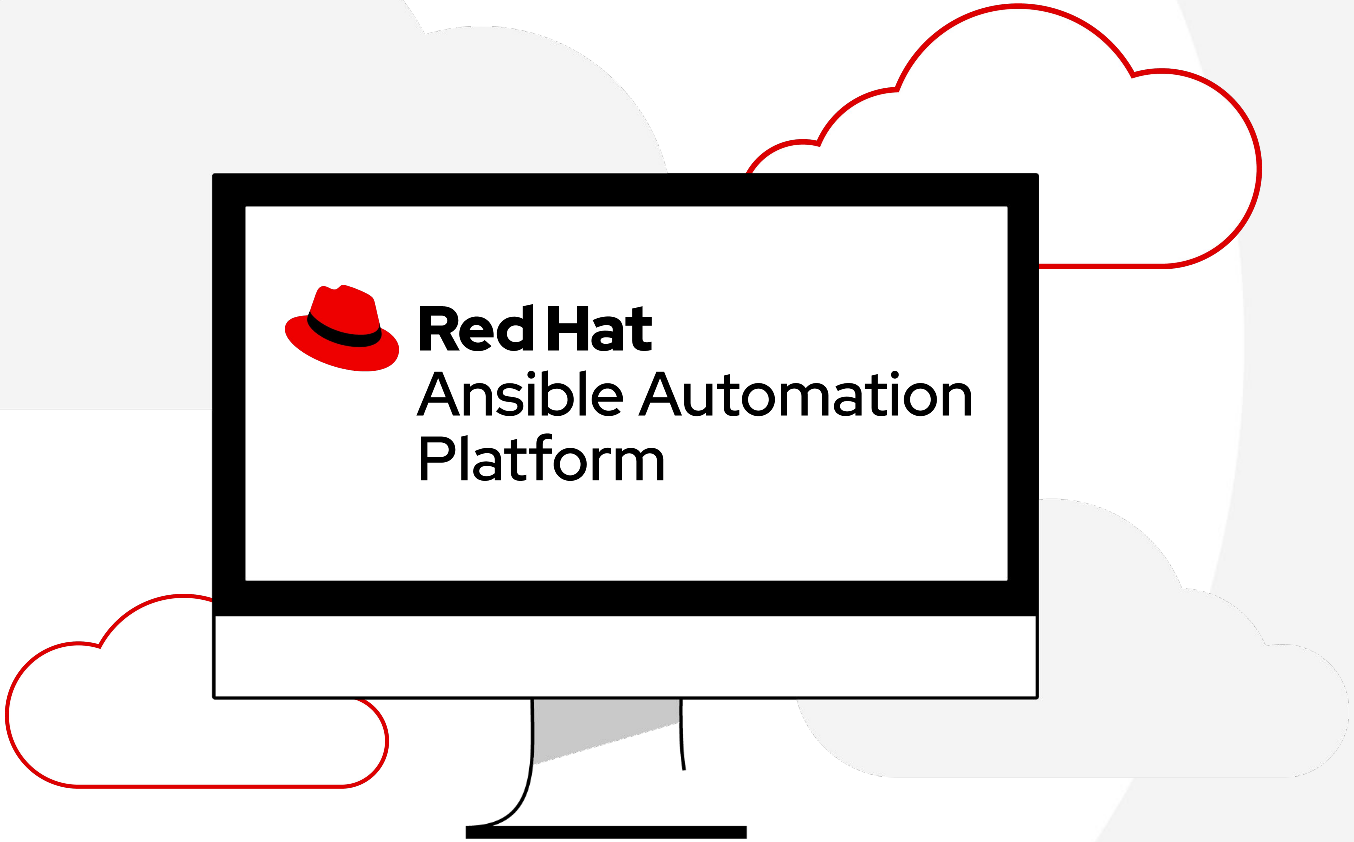
  Here you will find work in progress on a new Ansible role for managing snapshot sets using LVM. The collection also includes roles that can be used to shrink LVM logical volumes to free up volume group space for snapshots and another that makes it possible to increase the size of /boot partitions.

- github.com/oamg/leapp-supplements

  Leapp Supplements is a repository of example Leapp custom actors. The CheckRebootHygiene actor that was demonstrated in the optional Custom Pre-upgrade Checks exercise is maintained here. There is also a Makefile and RPM spec file that can be used to build packages for installing your Leapp custom actors..

- github.com/redhat-partner-tech/leapp-project

  This is where you will find all of the AAP job templates and Ansible playbooks included in the workshop. You can also explore the infrastructure as code (IaC) magic that is used to provision the workshop lab environment.



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