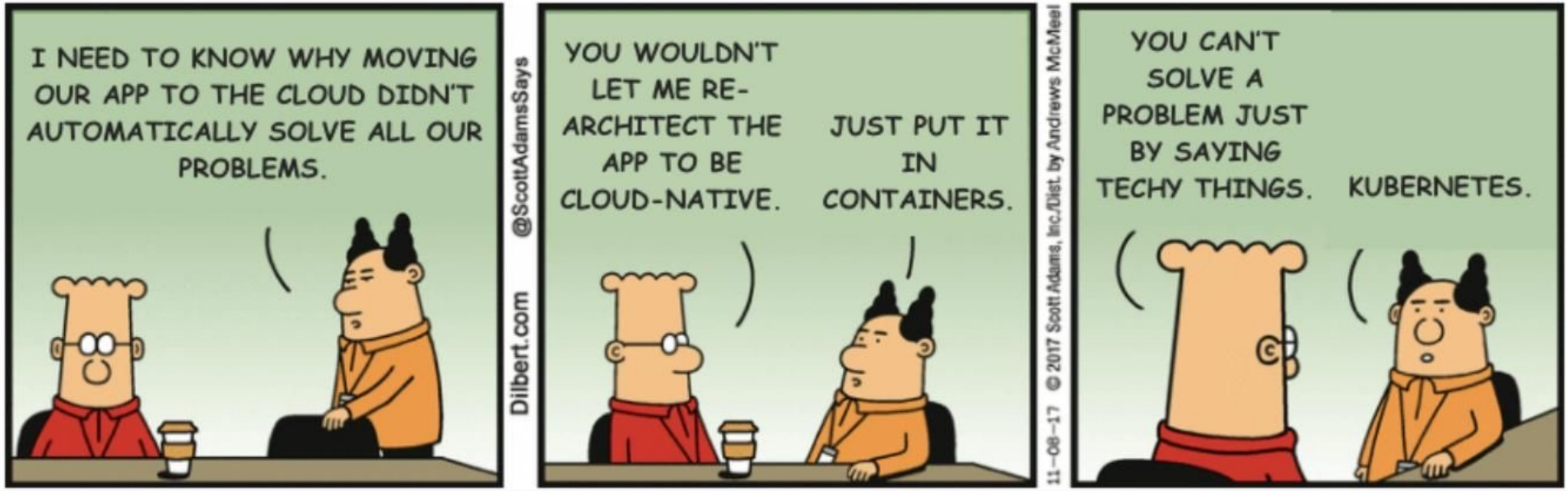
Demystifying Docker, Kubernetes, Rancher, Portainer, containerization, CI/CD pipeline, microservices, etc.


RANCHER
RUNDECK
cilium
kasten
OPENSHIFT
etcd
VERICA
TRILIO
Cockroach DB
NS1.
Kong
MIRANTIS
LINKERD
Pliant
StackRox
HELM
Couchbase
STACKHAWK


I NEED TO KNOW WHY MOVING OUR APP TO THE CLOUD DIDN'T AUTOMATICALLY SOLVE ALL OUR PROBLEMS.
Dilbert.com @ScottAdamsSays
YOU WOULDN'T LET ME RE-ARCHITECT THE APP TO BE CLOUD-NATIVE.
JUST PUT IT IN CONTAINERS.
11-08-17 © 2017 Scott Adams, Inc./Dist. by Andrews McMeel
YOU CAN'T SOLVE A PROBLEM JUST BY SAYING TECHY THINGS.
KUBERNETES.

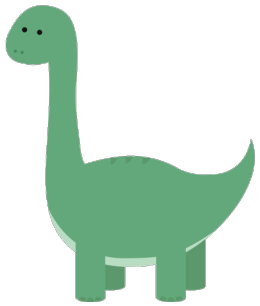
Original Topic Request:

- **Buzzwords:** Docker, Kubernetes, Rancher, Portainer, containerization, CI/CD pipeline, microservices, etc.
  - Why should we care about these things?
  - How are they related to each other (if indeed they are related)?

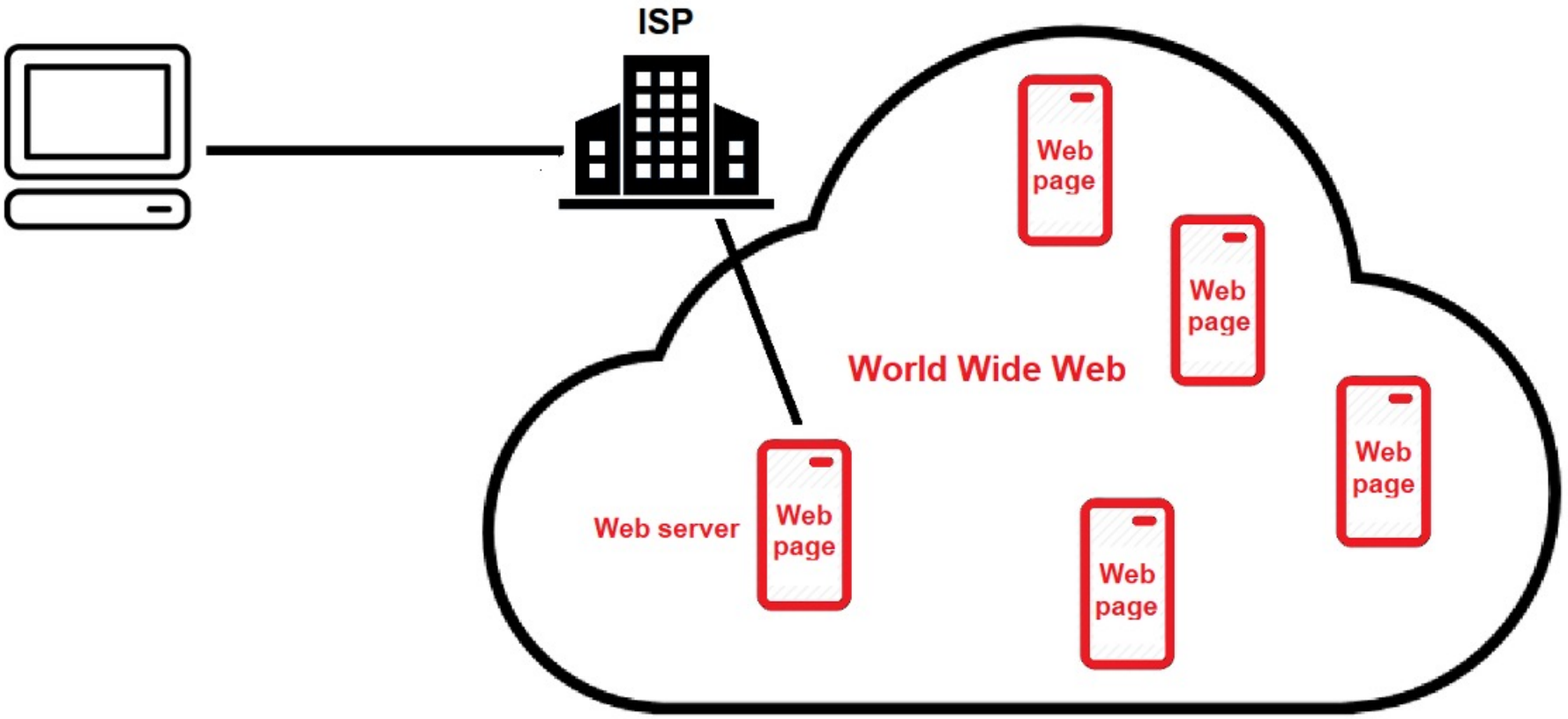
Douglas Adams 3 rules of technology:

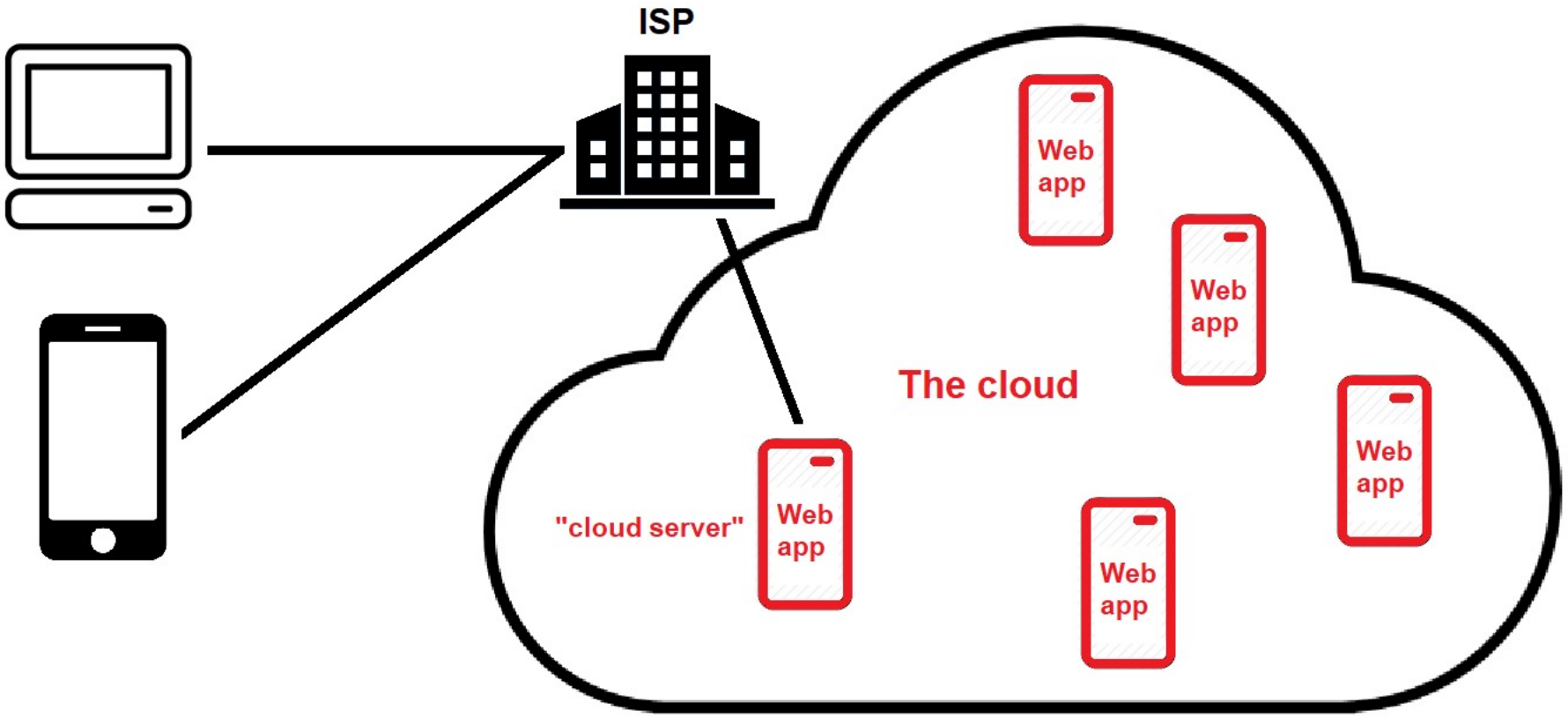
1. Anything that is in the world when you're born is normal and ordinary and is just a natural part of the way the world works.
2. Anything that's invented between when you're fifteen and thirty-five is new and exciting and revolutionary and you can probably get a career in it.
3. Anything invented after you're thirty-five is against the natural order of things.

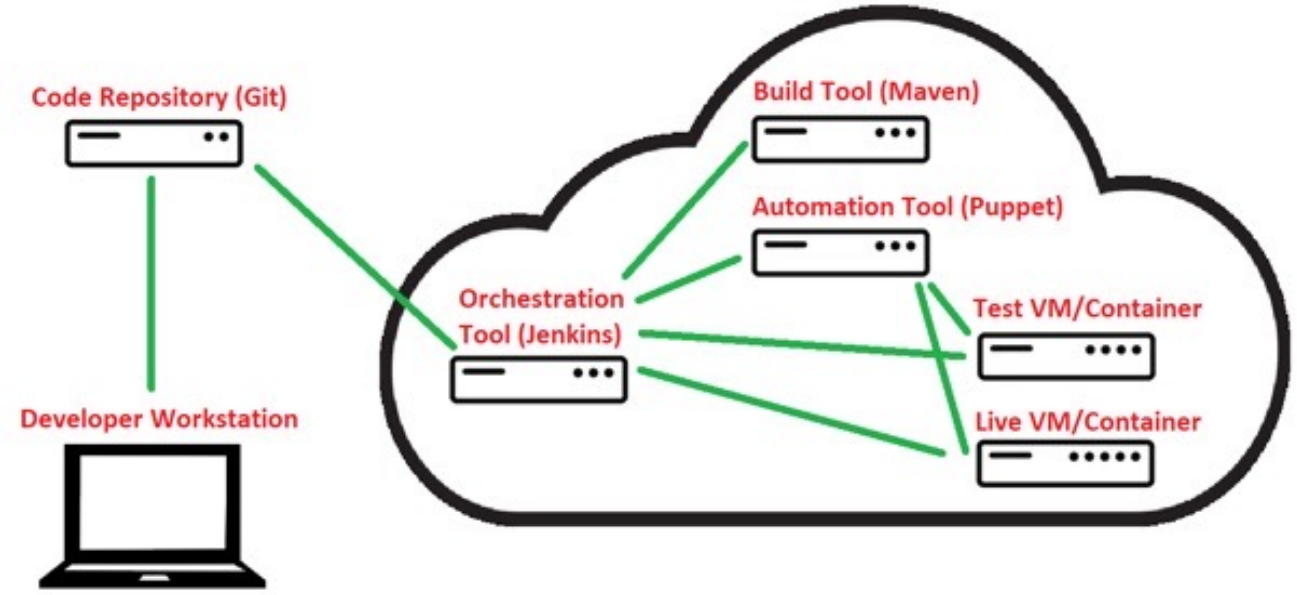
Why I follow this stuff?



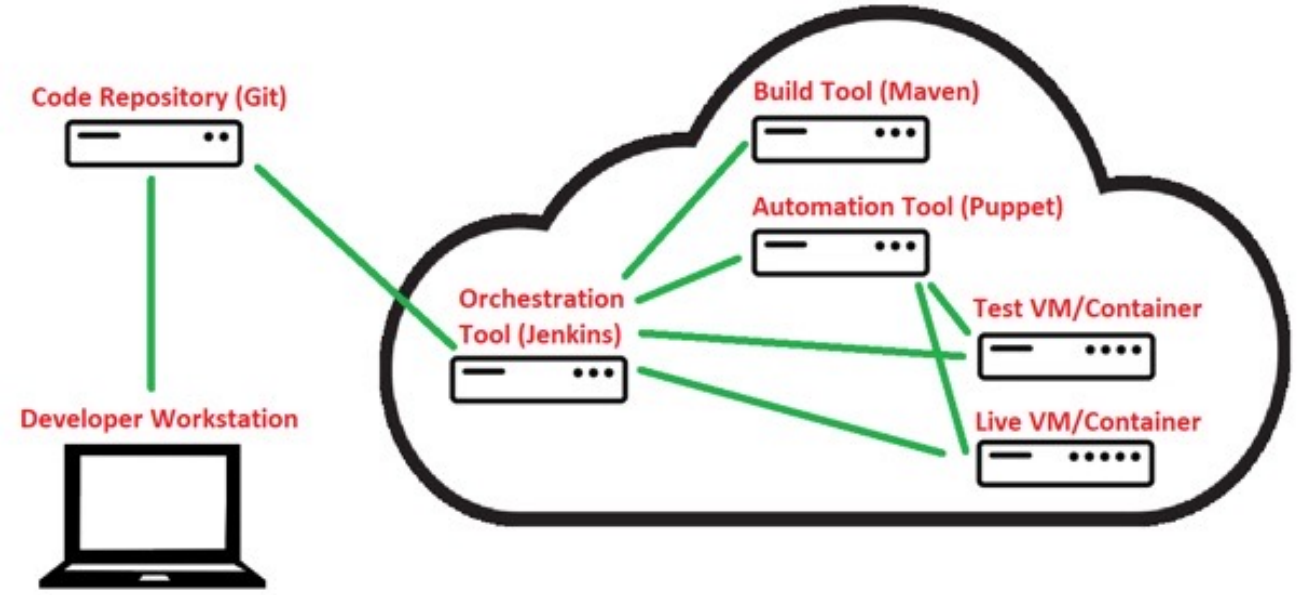
- I'm a UNIX sysadmin & developer
- The cloud native landscape feels natural & fun
  - UNIX philosophy → microservices
  - NIS & NFS → IaC & cloud
  - .cfg/.rc → .json/.yaml
  - Makefiles → Makefiles
  - UNIX → Linux (& BSD)


ISP
Web page
Web page
World Wide Web
Web page
Web server
Web page
Web page

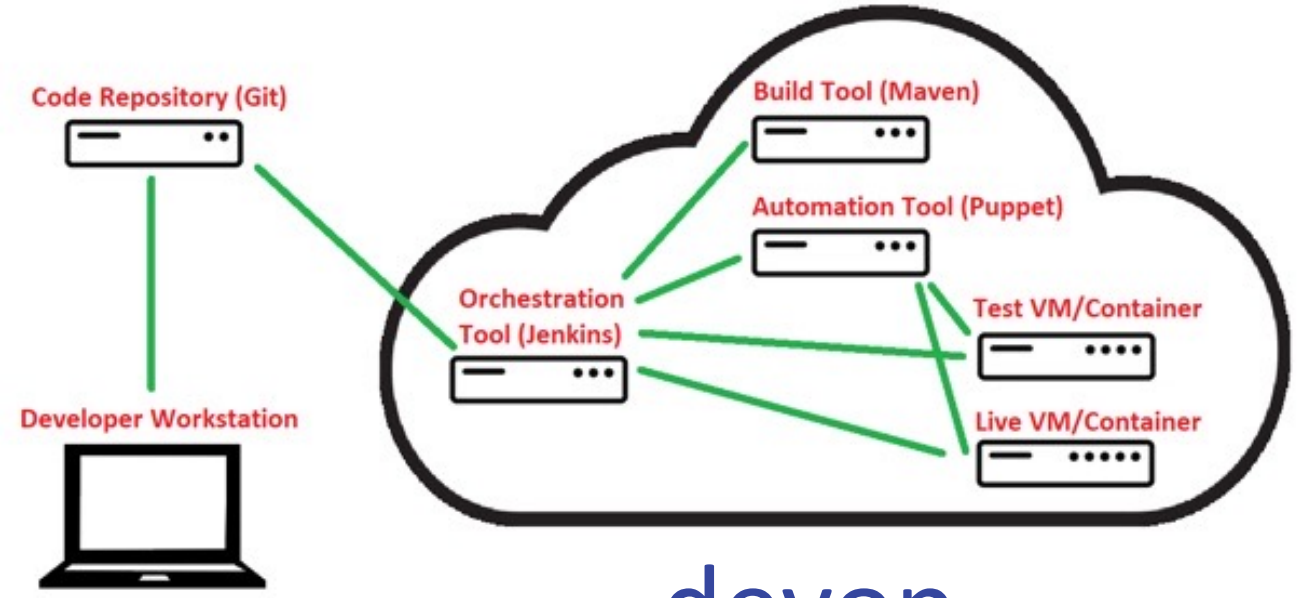

ISP
Web app
Web app
The cloud
Web app
"cloud server"
Web app
Web app


Code Repository (Git)
Developer Workstation
Build Tool (Maven)
Automation Tool (Puppet)
Orchestration
Tool (Jenkins)
Test VM/Container
Live VM/Container

CI CD (orchestrate, automate, IaC, EIEIO, etc.)

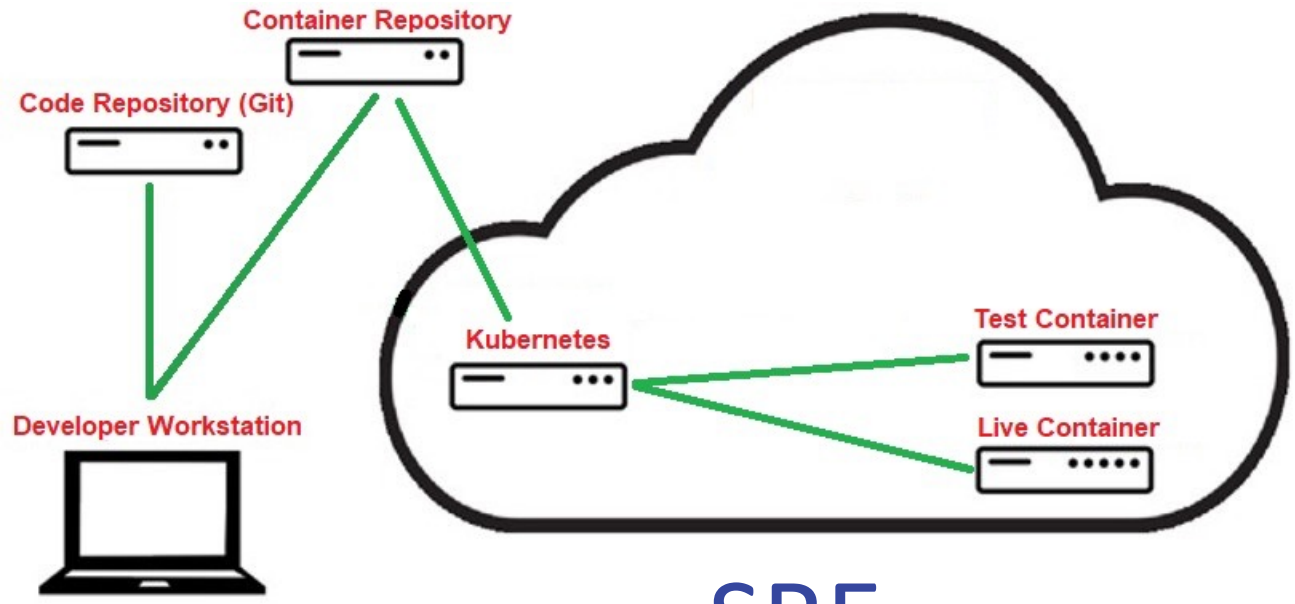


CI CD (orchestrate, automate, IaC, EIEIO, etc.)



devop

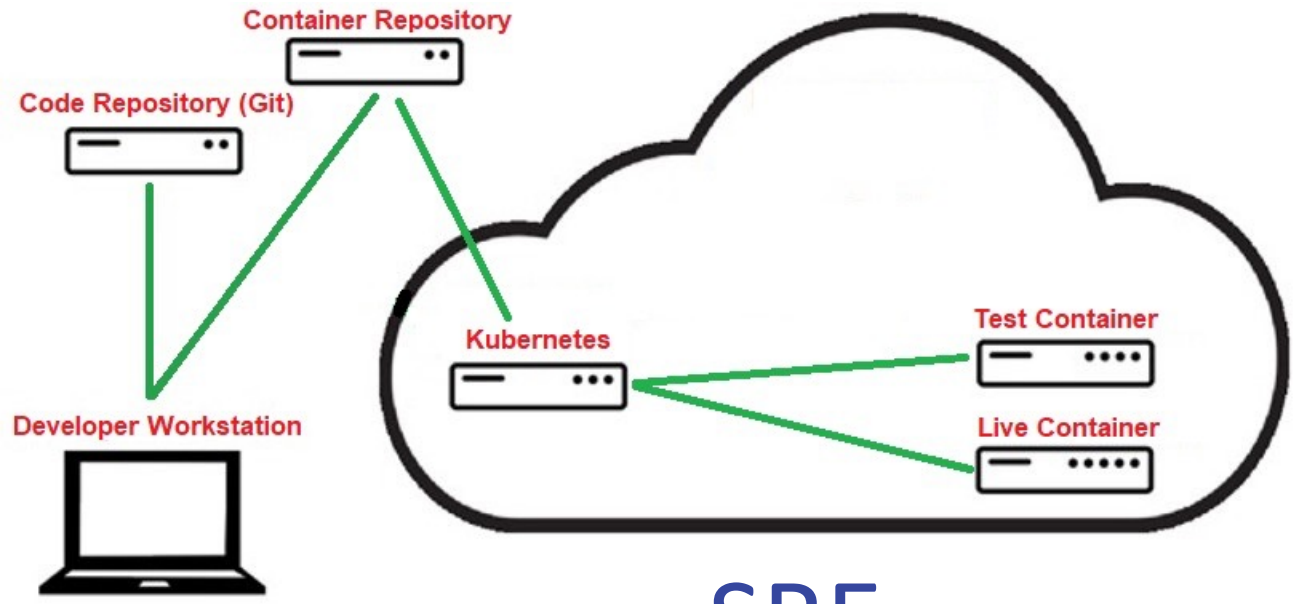
CI CD (orchestrate, automate, IaC, EIEIO, etc.)



SRE

devop

CI CD (orchestrate, automate, IaC, EIEIO, etc.)



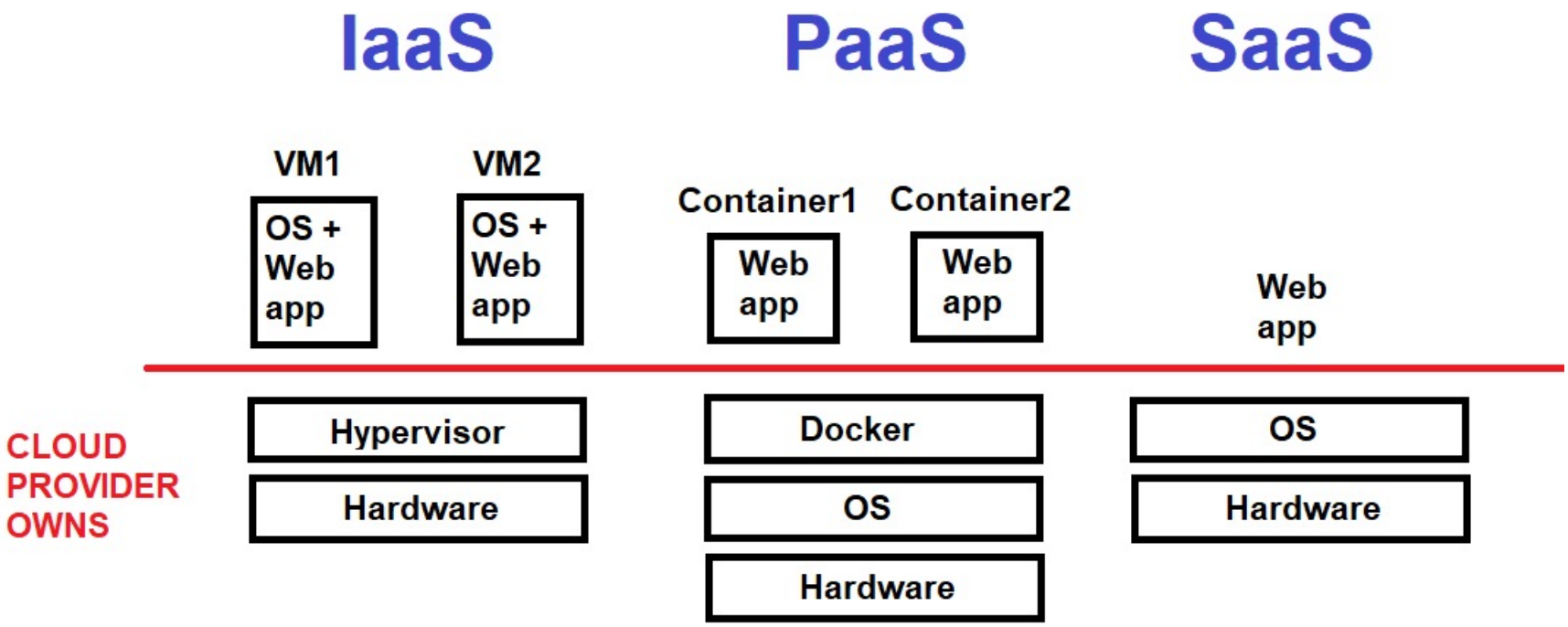
SRE

devop

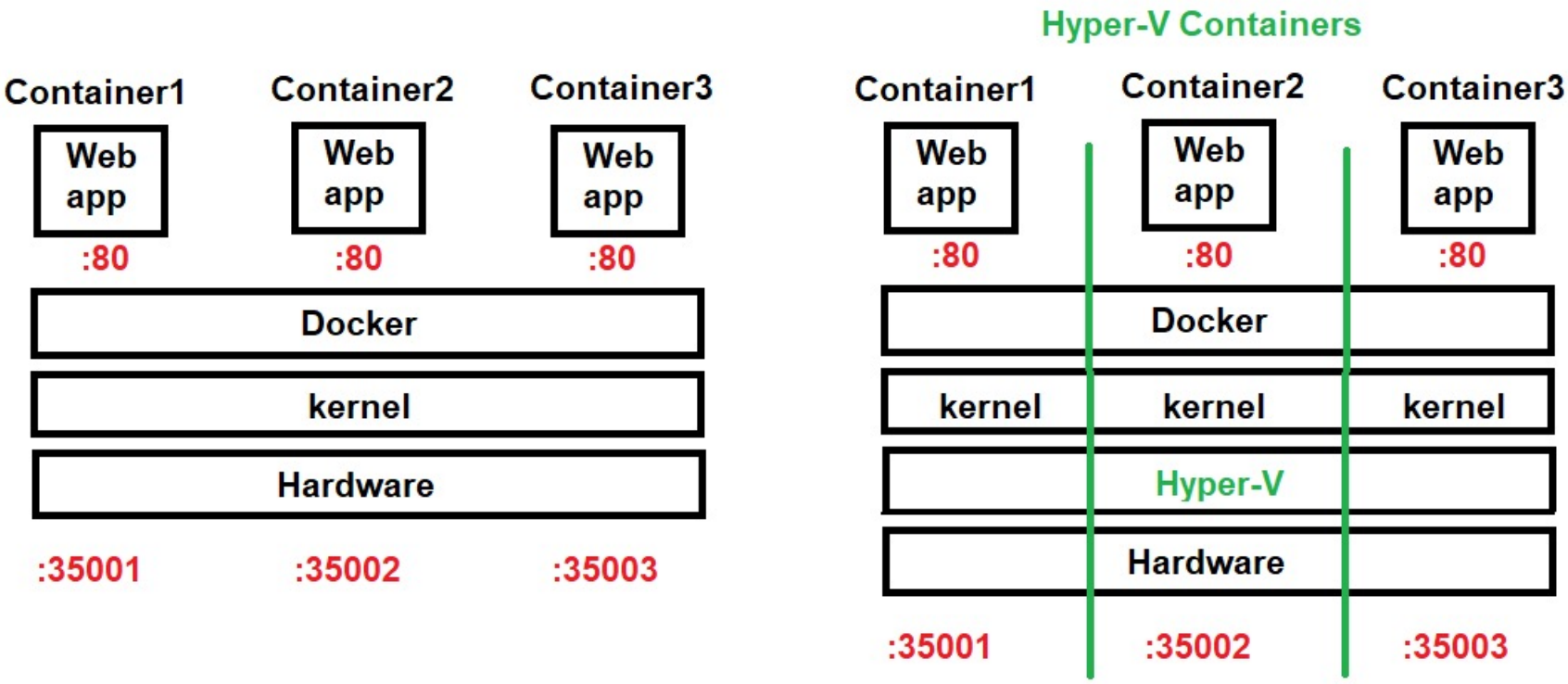
Gitops?

devsecops?


IT WORKS ON MY MACHINE
THEN WE'LL SHIP YOUR MACHINE
AND THAT IS HOW DOCKER WAS BORN
imgflip.com


IaaS
PaaS
SaaS
VM1
VM2
OS + Web app
OS + Web app
Container1
Container2
Web app
Web app
Web app
CLOUD PROVIDER OWNS
Hypervisor
Hardware
Docker
OS
Hardware
OS
Hardware


UNIX


Container1
Container2
Container3
Web app
Web app
Web app
:80
:80
:80
Docker
kernel
Hardware
:35001
:35002
:35003
Hyper-V Containers
Container1
Container2
Container3
Web app
Web app
Web app
:80
:80
:80
Docker
kernel
kernel
kernel
Hyper-V
Hardware
:35001
:35002
:35003

Containers and why are they good

- OS virtualization (=BSD jails)
  - **namespace** (restrict what container sees using syscalls)
  - **cgroups** (limits resources container uses)
  - **chroot** (sets / to the container image) – also /proc

- Liz Rice Containers from Scratch:
  - **https://www.youtube.com/watch?v=8fi7uSYlOdc**

- Use underlying Linux kernel + container runtime
  - Except Hyper-V containers & LCOW which provide a separate kernel for each container

Containers and why are they good

- Easier to develop/evolve **microservices**
  - UNIX philosophy at work
  - Containers can be combined to create larger services
  - Containers can be scaled (unevenly too)
  - Just makes sense (comp sci is all about containers nowadays)
  - Can be used to add virtualized apps to an existing on-prem system or cloud VM

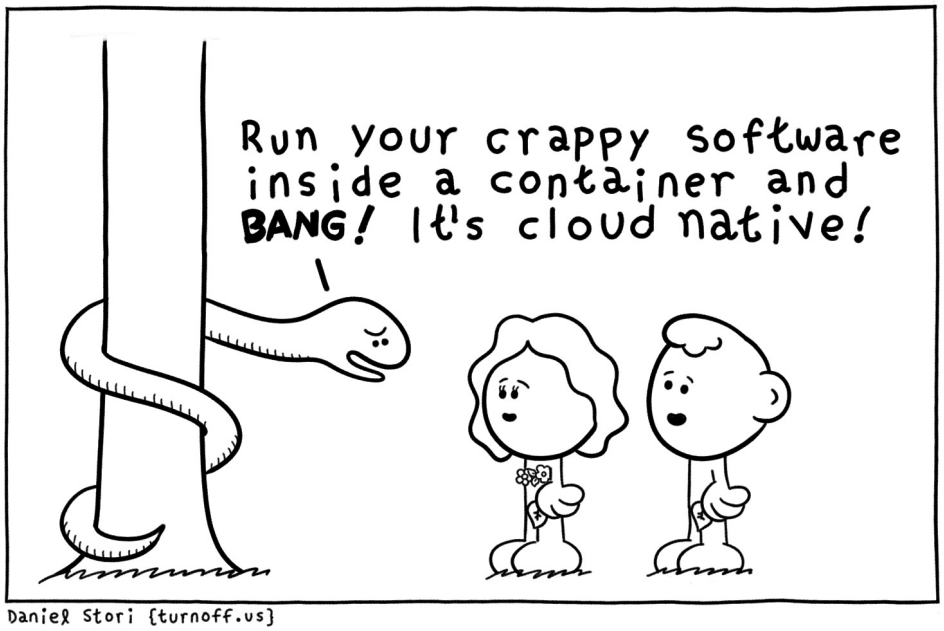
- Want to learn Docker?
  - Docker Desktop comes with great tutorial (macOS run a Linux VM, Windows uses WSL2)
  - Can also try: **https://labs.play-with-docker.com/**

Containers and why are they good

- Container runtimes:
  - **LXC** (LXD is just LXC's REST tool) – sysadmins/proxmox
  - **Docker** = LXC + portable deployment (1 object with multiple containerized apps) + versioning + component/library reuse (index.docker.io)
  - **Podman** (daemonless Docker)
  - **CRI-O** (made for Kubernetes)
  - **containerd (CRI-compliant)**

Containers and why are they good

- **Kubernetes** natively supports CRI-O/containerd (Docker with a shim, but that is deprecated)
- Developers typically use Docker, Podman to create **OCI-compliant** container images that work on any container runtime (**cloud native**)



When it comes to orchestrators

Kubernetes/K8S

- Is NOT hard
- You must put on your dev mindset at first
  - Microservice scaling is a developer-first thing!
  - K8S provides a common API for implementing containers and managing resources (pods, deployments, services, etc.)
- Start small
  - Docker Desktop, minikube, kind, Rancher Desktop (k3s), microk8s
- Sweat equity
- Later, you must put on your sysadmin mindset
  - Networking, security, authentication, storage

Cloud Native: The Series

- 2011: **Jenkins** was king
  - Nothing was simple, and devops meant devops
- 2012: ???
- 2013: **Docker** is the new kid on the block
- 2014: New orchestrators
  - **Rancher** was the hot new startup (managed Docker containers)
  - Jenkins bought by Cloudbees and put on maintenance?
  - **Docker Swarm** & **K8S**

Cloud Native: The Series

- 2015: Things get formal
  - Docker starts **Open Container Initiative (OCI)** → containerd (OCI-compliant)
  - **Cloud-native Computing Foundation (CNCF)**
  - **OpenShift** gains traction after it adopts Docker & K8S
  - **Microsoft** announces Docker support in upcoming Server 2016/10 builds
- 2016: K8S ~ IBM PC of the cloud world


I'M SURE HE BROKE UP WITH ME BECAUSE I'M UGLY
OH NO DON'T SAY THAT !
ARTBYJULIET
YOU'RE BEAUTIFUL
HE BROKE UP BECAUSE YOU WOULDN'T SHUT UP ABOUT KUBERNETES

Cloud Native: The Series

- 2017: K8S Gold rush
  - People start making management & reporting tools (e.g. **Portainer**)
  - The big PaaS providers got in on it (**hyperscalers**)
  - Docker gets much more attention
  - Big push towards promoting container/microservice-focused **development** (start of **evangelism**)

Cloud Native: The Series

- 2018: Everyone and their mother pivots to support K8S (**Jenkins X**, **Rancher**)
  - Shift to the other areas of cloud native landscape (security, auth, storage, DBs, etc.)
  - Docker gets freakin' huge (and stable)
  - Dev evangelism supreme (Kelsey Hightower)
  - Role separation: SRE vs devops

Cloud Native: The Series

- 2019: pick your area(s)
  - Make K8S easier? Manage K8S clusters?
  - Do K8S differently? Rancher K3S (edge)
  - Security must be worth $$ (saturated quickly)
  - **GitHub ecosystem** started to mature (including workflow)
  - **Tooling** is really really good (developer-driven)
  - Docker monetization? Docker-EE sold to Mirantis.

Cloud Native: The Series

- 2020:
  - Developers know what they're doing.
  - SREs make $150k US (we need to figure out a product that will reduce the # of them needed)
  - Gold rush: Make K8S cheaper to maintain
  - SuSE buys Rancher (to keep up with the Red Hats)
- 2021:
  - This infrastructure stuff is never gonna be easy. SREs are necessary. We've got to find our niche (pick something small that others aren't doing and run with it).
  - Umm….. What's your workflow like? Tell us and we'll send you a free mug.
  - Docker Desktop isn't free for big companies


CNCF Cloud Native Landscape
Overwhelmed? Please see the CNCF Trail Map. That and the interactive landscape are at l.cncf.io
Database
Streaming & Messaging
Application Definition & Image Build
Continuous Integration & Delivery
Platform
Observability and Analysis
Monitoring
Logging
Tracing
Chaos Engineering
Serverless
Scheduling & Orchestration
Coordination & Service Discovery
Remote Procedure Call
Service Mesh
Cloud Native Network
Cloud Native Storage
Key Management
Service Proxy
Kubernetes Training Partner
Certified Kubernetes - Distribution
Certified Kubernetes - Hosted
Cert Cert Kubernetes - Installer
PaaS/Container Service
etcd
gRPC
envoy
linkerd
spiffe
fluentd
ZTE

How do I keep up with this stuff?

- Attend as many online events/presentations as you can
  - SuSEcon
  - Red Hat Summit
  - CloudNativeCon
  - AllDayDevops
  - and many more...
- HackerNews