NJIT

Orchestration

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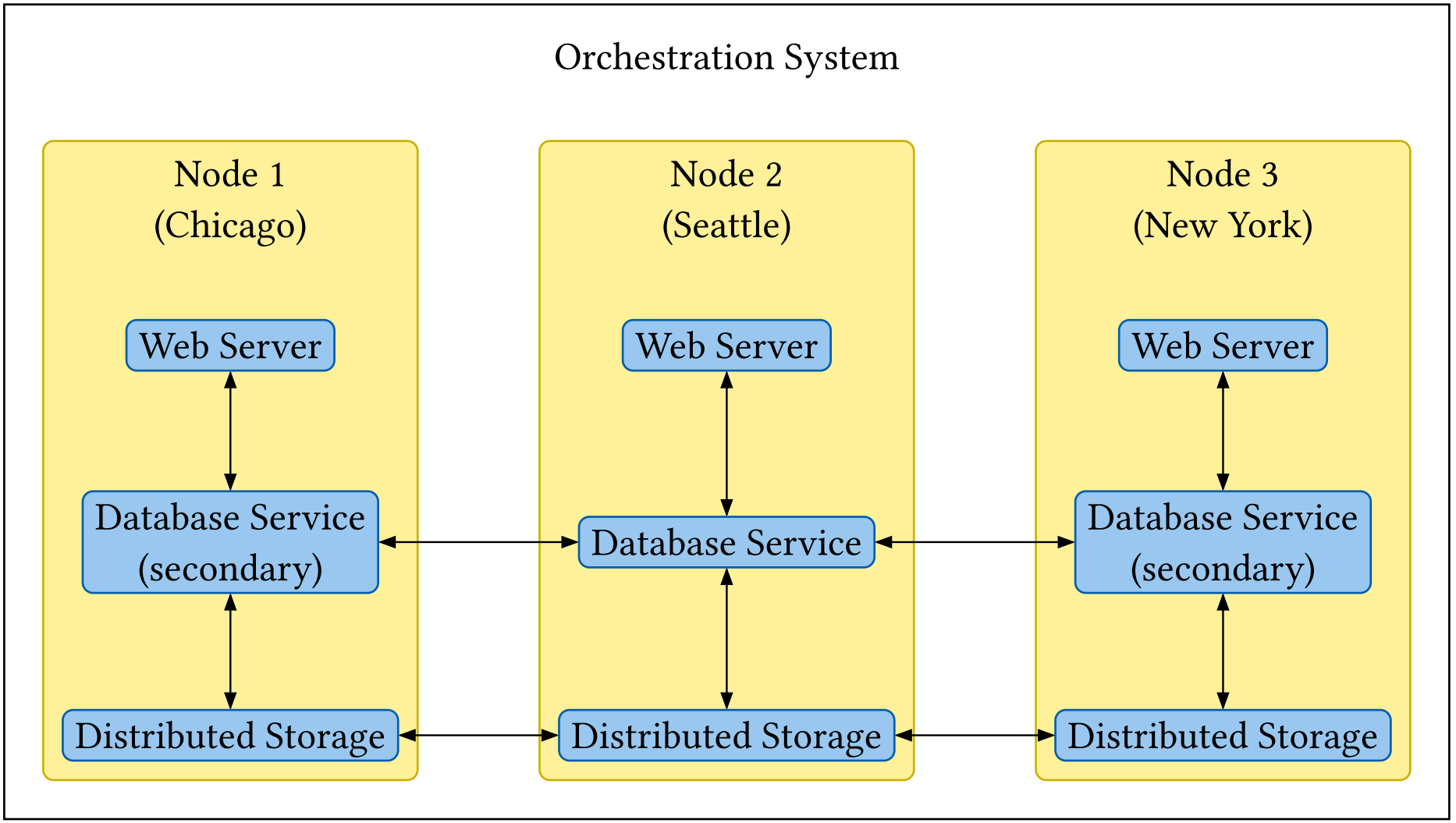
Purpose

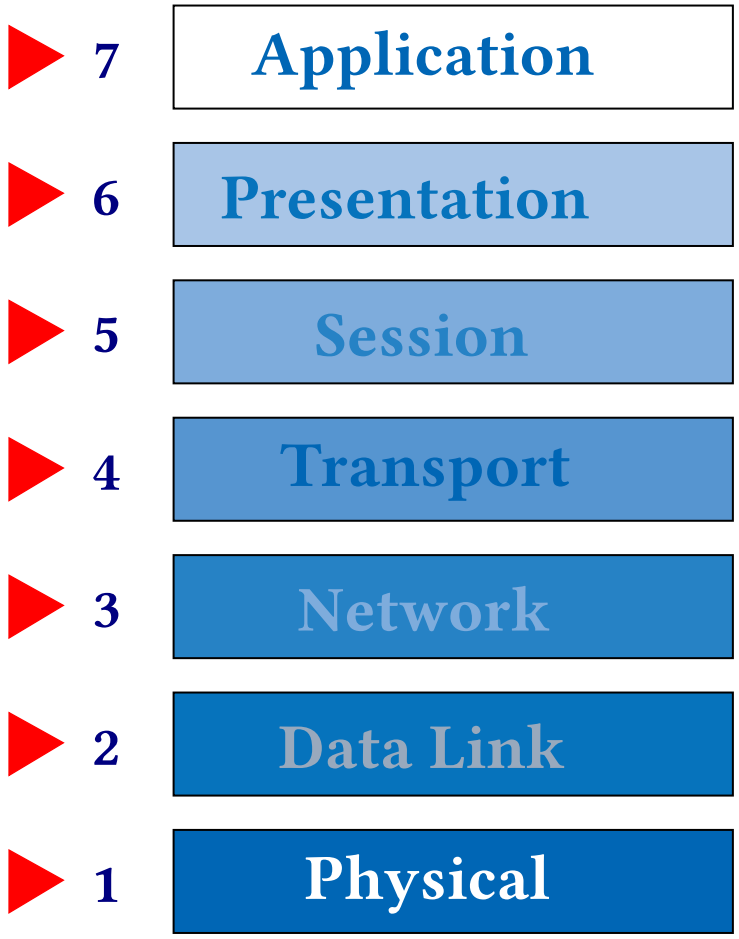
- It is relatively rare to run just one container
- Modern applications are made up of multiple containers working with each other
- Resilient applications are made up of multiple containers running on multiple nodes
- Scalable applications may require containers to be brought up or shut down in response to workload
- Handling monitoring, starting, stopping, and updating containers *is* orchestration.

It Gets Complicated



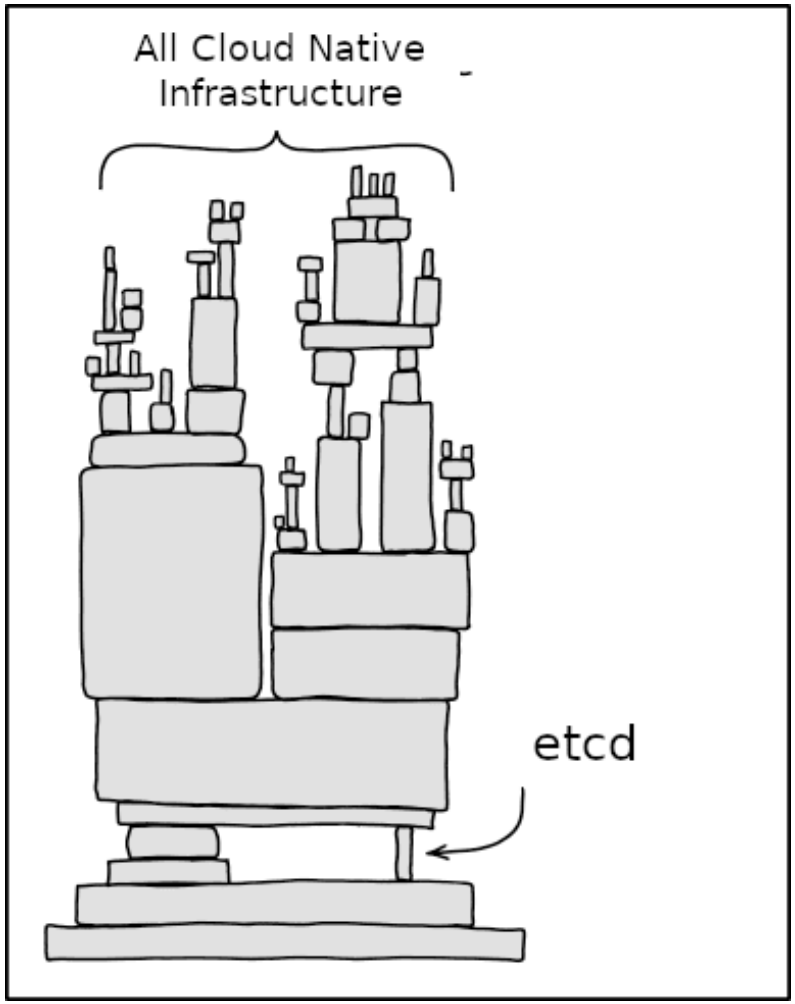
Networking

- Containers need to be able to talk to each other on a *virtual* network
- This network may or may not traverse *real* networks
- This network may or may not traverse nodes
- Docker supports many network types but it's still not typically used in production.
- Isolation is a security feature, but use common sense



osi model is in the public domain

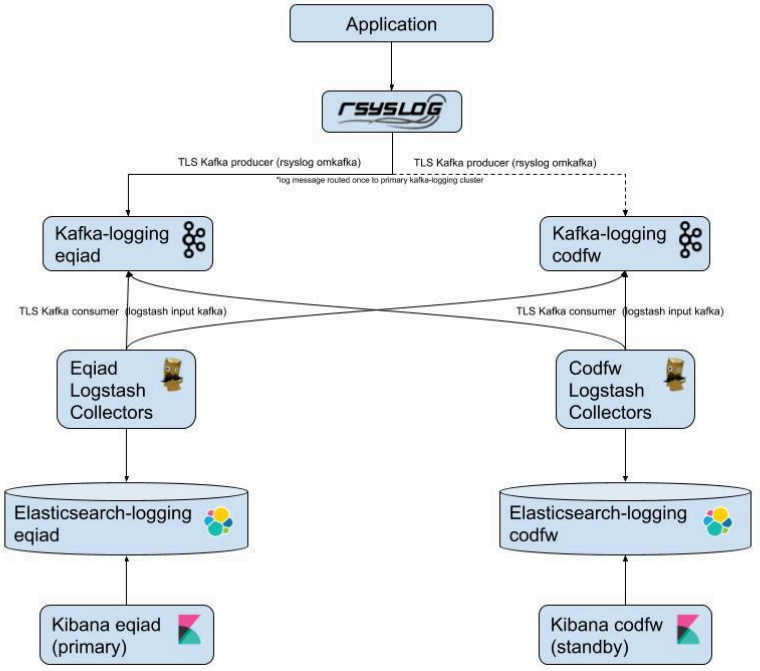
Service Discovery



- Containers need to be able to find each other
- This can be handled with services: etcd , consul , k8s
- This can be handled through DNS: Docker Compose

Logging

- Logs from all of the containers need to be aggregated
- This is trending towards being one of the jobs of the orchestration system: k8s , Docker (Compose / Swarm)
- You can (and maybe should) still do this externally! Things like rsyslog and logstash still work.



What options are out there?

Docker Compose

- Uses a `docker-compose.yml` file to describe multiple services
- Allows for many of the Docker options you are familiar with

Docker Swarm

- Extends the Docker Compose syntax to allow replication and running on multiple nodes

Kubernetes (k8s)

- *Very popular*
- Uses its own syntax for container orchestration
- Can use multiple container runtimes (docker, containerd, etc.)

Nomad

- Simpler than k8s
- Works with both VMs and containers

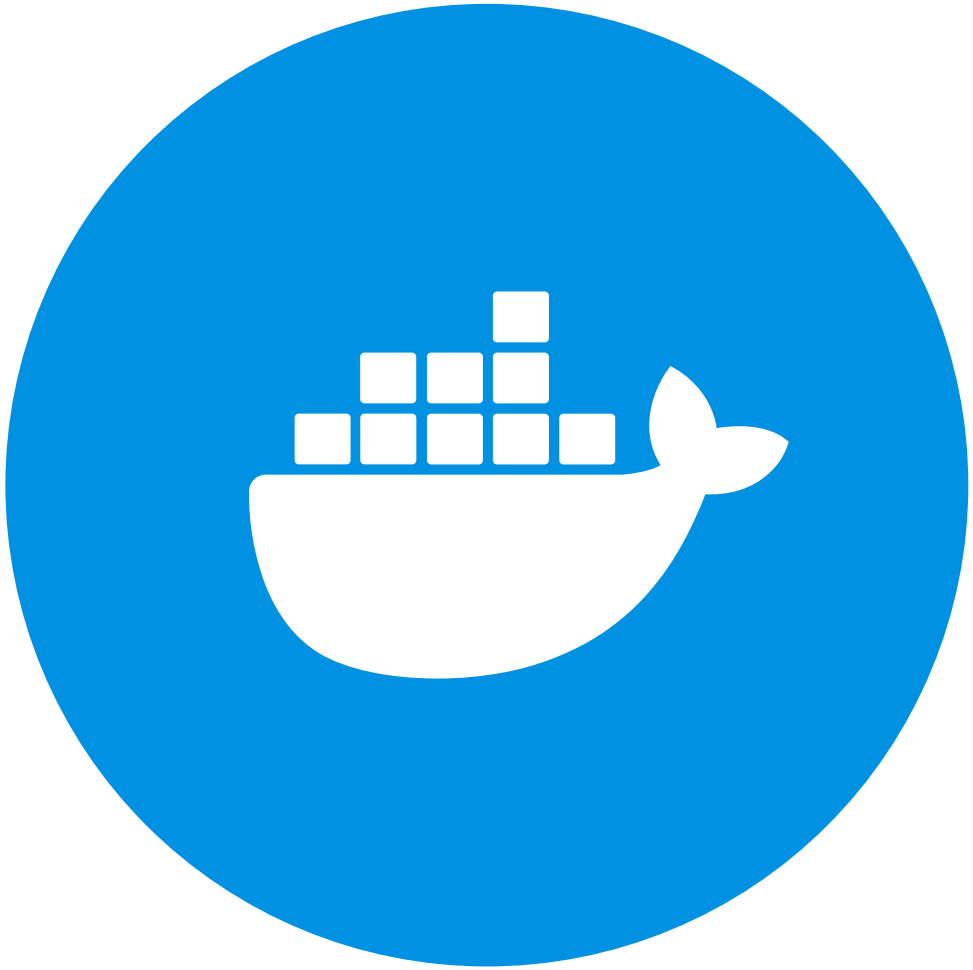
Docker Compose Example

```
---
version '3'

volumes:
  web_data: external: true

services:
  app:
    image: nginx:alpine
    ports:
      - 80:80
    volumes:
      - web_data:/usr/share/nginx/html:ro
  app2:
    image: nginx:alpine
    ports:
      - 8080:80
    volumes:
      - web_data:/usr/share/nginx/html:ro
  app3:
    build: ./app3
----
```

Docker Compose Tips / Resources



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- It's YAML, watch your whitespace
- Get started with Docker Compose
- Compose file version 3 reference
- Docker Compose expects a `docker-compose.yml` in the working directory
- Commands start with `docker-compose` and are similar to docker: `build`, `run`, `exec`, `up`, `down`
- If you change a Dockerfile, don't forget to rebuild!
- Use multiple consoles to make seeing what's going on easier

Nomad Example

```
job "pytechco-web" {
  type = "service"
  group "ptc-web" {
    count = 1
    network {
      port "web" {
        static = 5000
      }
    }
    service {
      name     = "ptc-web-svc"
      port     = "web"
      provider = "nomad"
    }
    task "ptc-web-task" {
      driver = "docker"
      config {
        image = "ghcr.io/hashicorp-education/learn-nomad-getting-started/ptc-web:1.0"
        ports = ["web"]
      }
    }
  }
}
```

Hashicorp Nomad

- Works with multiple container runtimes and VMs
- Uses Hashicorp Configuration Language (HCL) and domain specific language
- Simpler the k8s
- More configurable that Docker Swarm
- Free open source version with paid enterprise and managed service offerings

Hashicorp Nomad Logo is used under fair use