* Course Overview
  + Spinning up multiple containers on a single machine is easy
  + In production environment it may need to span multiple nodes so there is enough capacity
* The Magic of Docker Should W..
  + Some point containers will require more resources than a single machine can handle
  + Spin up containers that can talk to each other across multiple nodes(machines)
  + Swarm mode built into docker engine 1.12 and above
* What Are Some of the Concern..
  + Containers are just process that are running software
    - New way of running software
  + Will run out of resources from a single machine eventually
  + In production environment you will want to have containers over multiple machines
    - Fault tolerance: can lose one machine
  + Dont want to manage each machine individually
  + Docker swarm manage the machines for you
  + Containers will run on top of nodes(machines)
  + Docker swarm will also manage where to place containers based on resource requirements
* What You Should Already Know
  + Getting started with docker on windows
  + Containers and Images: The Big Picture
  + Will need multiple machines(VMs)
* What if a Single Container Isn’t …
  + In production environment you will need to handle alot of requests
  + Can run more containers or optimize api to handle more requests
* Scaling Capacity by Scaling Containers
  + Can add more containers on the same machine if it has enough resources
    - Requests will need to be routed to the containers
  + How to route requests to each of these instances
  + Hot to load balance incoming traffic to spread it out to multiple instance of the application
* What About Balancing Load A..
* What Happens When a Container..
  + What if application dies inside of container
  + Concerns:
  + Scaling Capacity
    - Multiple containers
    - Load balancing
  + Container failure
    - Restart, not good for production
  + Restart, type ‘docker run --rm -d -p [host port]:[container port] --restart=[option] [image]
    - Options are
    - ‘always’
    - ‘no’
    - ‘on-faliure’
    - ‘unless-stopped’
* What Happens When A Node Fails
  + If containers fails when can just restart
  + If node fails, all the containers fails with it
    - Reboot machine
  + In production
    - We will need to bring up capacity somewhere else
    - And then load balance
  + Node Failure
    - Redistribute containers
    - Replace node
    - Placement
    - Node Maintenance
* What About Internal Communication
  + Set environment variable connect to other containers
* User Defined Networks to Con…
  + Bound ports to node, set environment variable to connect to other containers
    - Tricky to scale
    - Shares single address space on the node
    - Loss benefit of network namespace even though we are using containers
  + Custom network
    - Create a virtual network and have containers talk to each other through network
  + Type ‘docker network create -d=bridge [network name]’
    - -d: type of network
    - bridge: network you can use locally to connect containers on a single node
  + Type ‘docker run --rm -d --name customer-api --network [network name] swarmgs/customer’
    - --network: specify which network to use
  + Type ‘docker run --rm -d --name balance-api --network company -p 4000:3000 -e MYWEB\_CUSTOMER\_API=customer-api:3000 swarmgs/balance’
    - Can list container as the MYWEB\_CUSTOMER\_API because the custom networks have service discovery enabled
    - Service discovery is setup based on the name of the containers
    - Resolvable via DNS with container names
    - Will get back ip address specific to container
  + User defined networks comes with embedded DNS server for service discovery
  + Need to attach to the same network
* docker-compose simplifies Co..
  + create network and containers has a lot of commands and can get confusing
  + can do all this with docker-compose
  + need a yml file
    - network is automatically created with docker-compose
  + type ‘docker-compose -f company.yml up -d’
    - -f: specify file
    - up: to run
    - -d: run detach in the background
  + docker-compose creates a network specific to a compose file so that containers are automatically attached to their own private network
    - enables service discovery to talk to each other
  + type ‘docker-compose -f [.yml file] stop [service to stop]’ to stop service
  + type ‘docker-compose -f [.yml file] start [service to start]’ to start service
  + docker-compose can be used with a swarm
* What About Scaling Internal A..
  + Face same issues with application dependencies as with single application
    - Scaling each application
    - Running instances across different nodes
    - Fault tolerance
    - High availability
  + Load balancer for incoming requests
  + Load balancer for internal requests(between containers)
  + Then can scale each component separately
  + Docker swarm makes this simple
    - Build out and schedule work
* Preparing a Single Node to Foll..
  + Launching containers with docker swarm is different then with docker engine via docker run or docker compose
  + Use service to start up a container
  + Service can be used to spawn containers across multiple nodes
  + Need docker v17.03.0-ce-rc1and up
  + Go to about docker to find your version
  + Or type ‘docker version’
  + Enable Experimental field
* Enabling Experimental Features