



minimesos



The experimentation and testing tool for Apache Mesos

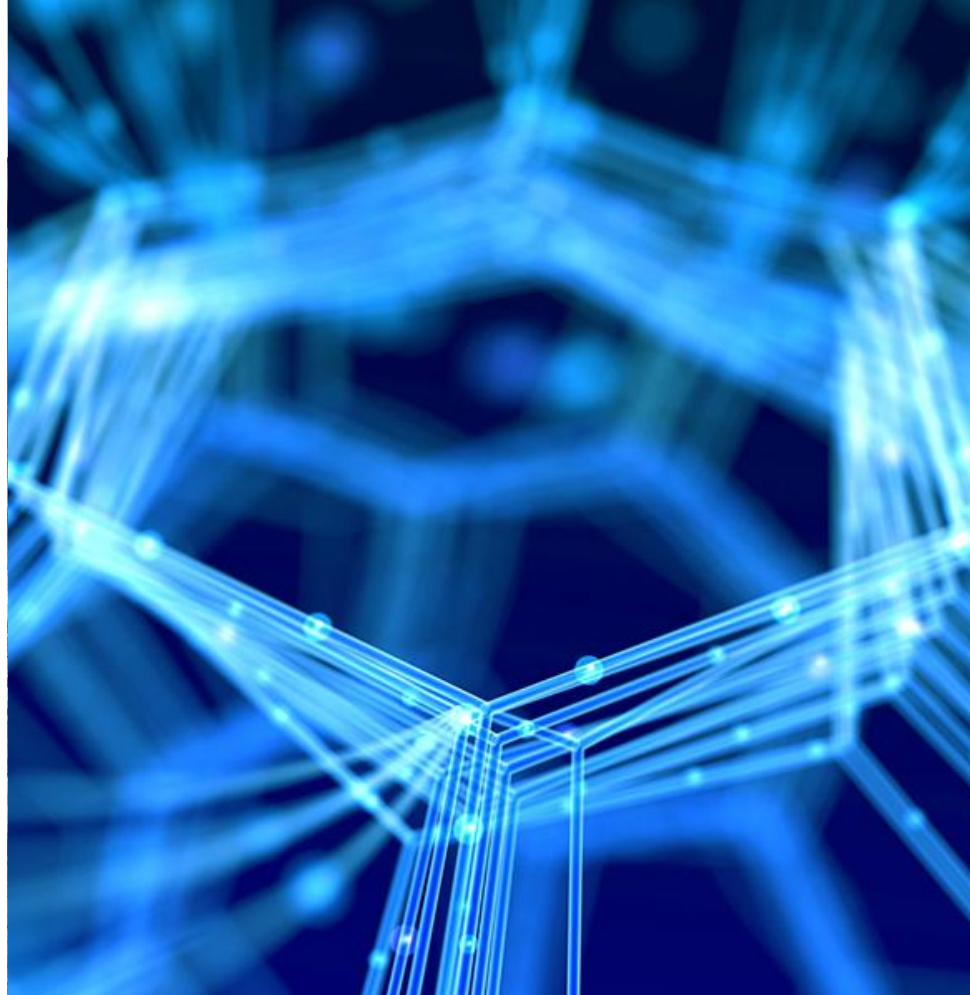
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Container Solutions



NLUUG



Outline

- What is Apache Mesos?
- What is minimesos?
- Demo
- Basic Features
- Design and Implementation
- What's next?



minimesos

Let's discuss on Twitter: #nluug2016

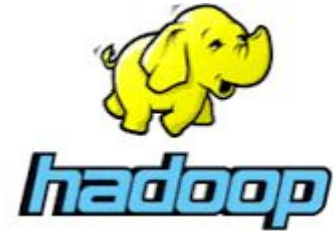
What is Apache Mesos?

- Distributed Systems Kernel
- Program against your datacenter like it's a **single pool of resources**
- Created by Ben Hindman at Berkeley AMP lab
- Top level Apache project since 2013



Why Mesos?

Run multiple technologies, AKA frameworks, on a single Mesos cluster



Blog post by Phil Winder @ CS blog 

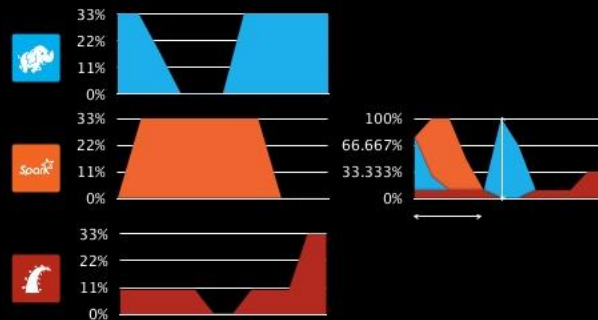
<http://container-solutions.com/reasons-use-apache-mesos-frameworks>

Why Mesos?

This is your typical data center with static partitioned apps



Resource sharing increases throughput and utilization

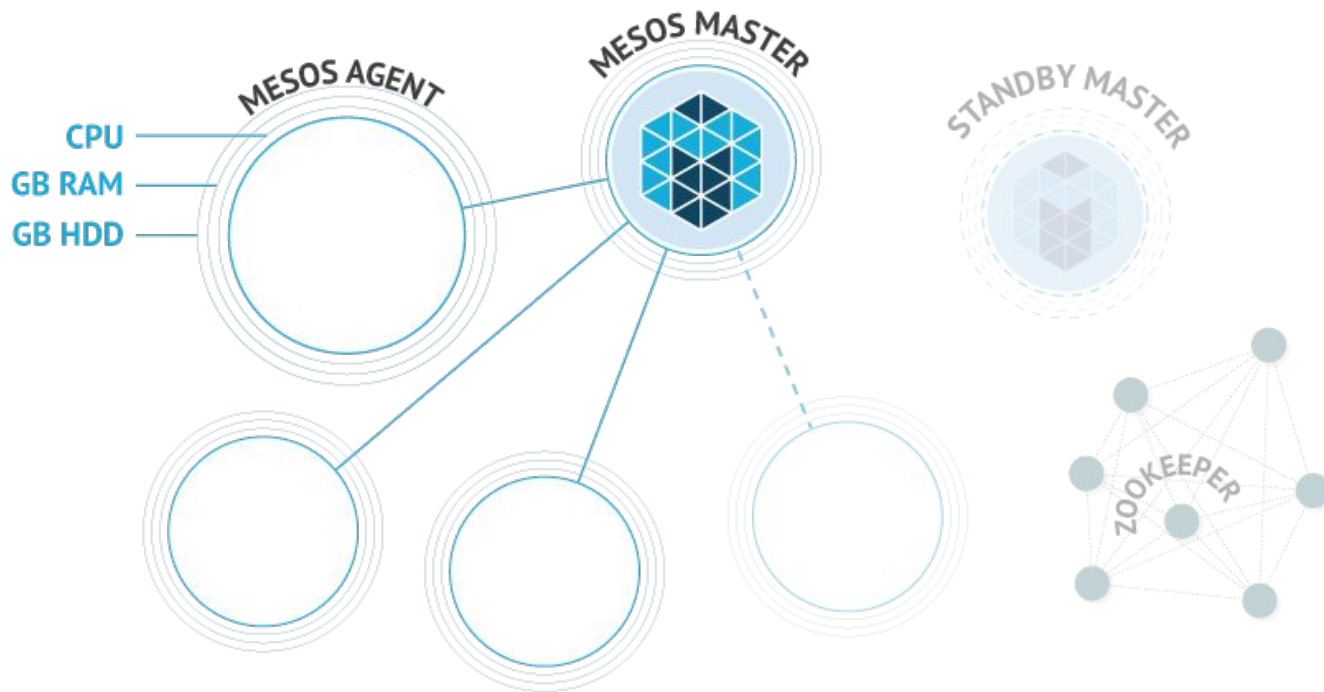


Powered by Mesos

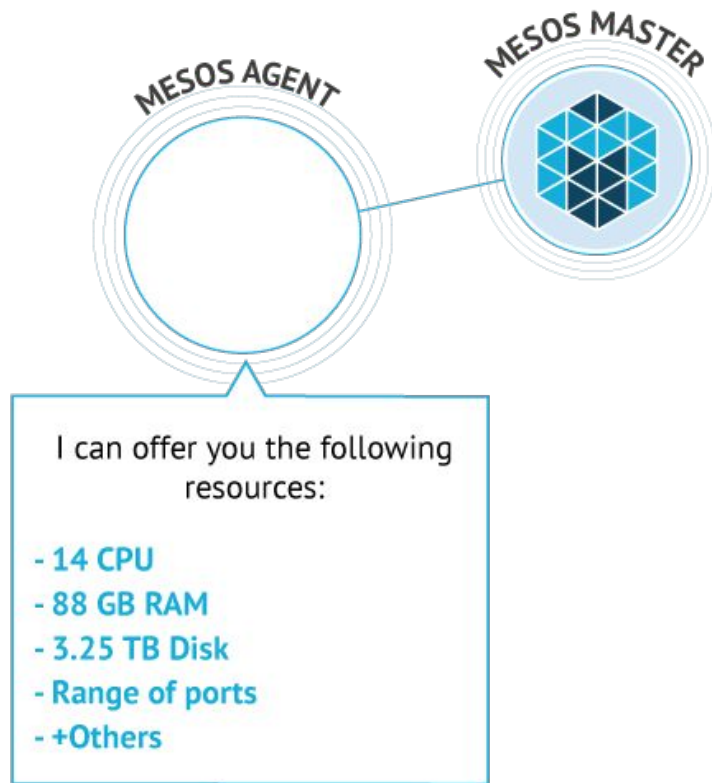


See <http://mesos.apache.org/documentation/latest/powered-by-mesos/>

Mesos Architecture



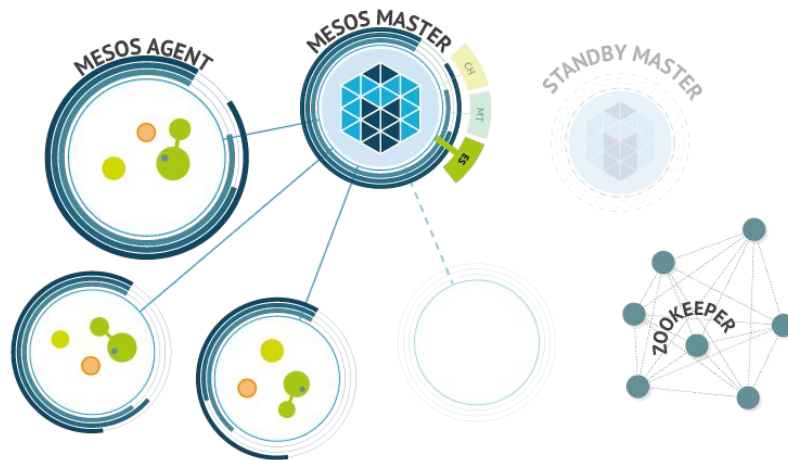
Mesos Resources



Mesos Architecture

Quick run through Mesos architecture and terminology

- Mesos Master
- Mesos Agents
- ZooKeeper
- Frameworks
- Framework Scheduler
- Framework Executors
- Framework Tasks



Tasks

- A task is a process on the cluster with a defined lifecycle
- Examples
 - Running an nginx process
 - Running a Docker container
 - A maintenance task such updating cluster configuration



Mesos Master UI

[http://\\$MASTER:5050](http://$MASTER:5050)

- Frameworks
- Agents
- Offers
- Tasks
- Logs

Mesos Frameworks Slaves Offers dcos-teststack

Cluster: dcos-teststack
Server: 10.0.6.205:5050
Version: 0.28.1
Built: 23 hours ago by
Started: an hour ago
Elected: an hour ago

LOG

Slaves

Activated6
Deactivated0

Tasks

Staging0
Starting0
Running9
Killing0
Finished0
Killed0
Failed0
Lost0

Resources

	CPU	Mem	Disk
Total	24	82.1 GB	208.4 GB
Used	8	24.3 GB	30.0 GB
Offered	0	0 B	0 B
Idle	16	57.8 GB	178.4 GB

Active Tasks

Find...

ID	Name	State	Started ▼	Host	
broker-2-2e84123b-c356-4ae6-b31c-833cdbbabbdb	broker-2	RUNNING	just now	10.0.3.13	Sandbox
broker-1-34061e42-9086-4c4a-97f9-e0ad31f3dcf8	broker-1	RUNNING	just now	10.0.3.17	Sandbox
broker-0-83b819d5-d2e0-45ca-96b0-0e85439b2a69	broker-0	RUNNING	just now	10.0.3.15	Sandbox
node-2_68c4bad1-250a-4905-b6d2-9acc988a0bc3	node-2	RUNNING	21 minutes ago	10.0.3.17	Sandbox
node-1_5838aa96-80b2-4e4a-bd8c-9d52c8a7149a	node-1	RUNNING	22 minutes ago	10.0.3.16	Sandbox
node-0_fb7e324c-74ad-4be9-b3c7-b79ecf10036f	node-0	RUNNING	23 minutes ago	10.0.3.15	Sandbox
cassandra.17a63a99-06c6-11e6-b185-82f2b01f3fb3	cassandra	RUNNING	23 minutes ago	10.0.3.17	Sandbox
spark.1b1aa0da-06c6-11e6-b185-82f2b01f3fb3	spark	RUNNING	23 minutes ago	10.0.3.15	Sandbox
kafka.11ebb4e8-06c6-11e6-b185-82f2b01f3fb3	kafka	RUNNING	24 minutes ago	10.0.3.17	Sandbox

Completed Tasks

ID Name State Started ▼ Stopped Host

No completed tasks.

11

container-solutions.com | @containersoluti

ContainerSolutions

Mesos Task Sandbox

Directory with task-specific resources

- Mesos Fetcher downloads resources before task starts
- Configuration files
- Binaries
- `stdout` and `stderr` logs

<http://mesos.apache.org/documentation/latest/fetcher>
<http://mesos.apache.org/documentation/latest/sandbox>

Mesos Frameworks Slaves Offers						
Master / Slave / Browse						
/ tmp / mesos / slaves / 20150528-071451-1325795380-5050-1132-S2 / frameworks / 20150528-084538-561580084-505 / 00f75243-2796-461c-828e-c044f318f3fc						
mode	nlink	uid	gid	size	mtime	
drwxr-xr-x	8	root	root	4 KB	May 28 11:57	gridgain-community-fabric-1.0.6
-rw-r--r--	1	root	root	55 MB	May 28 11:57	gridgain-community-fabric-1.0.6.zip Download
-rw-r--r--	1	root	root	2 KB	May 28 11:57	ignite-default-config.xml Download
-rw-r--r--	1	root	root	17 KB	May 15 17:14	ignite-log4j-1.0.4-SNAPSHOT-sources.jar Download
-rw-r--r--	1	root	root	23 KB	May 15 17:14	ignite-log4j-1.0.4-SNAPSHOT.jar Download
-rw-r--r--	1	root	root	27 KB	May 28 11:57	ignite-mesos-1.1.0-SNAPSHOT.jar Download
-rw-r--r--	1	root	root	35 KB	May 28 11:57	libs.zip Download
-rw-r--r--	1	root	root	3 KB	May 28 11:57	stderr Download
-rw-r--r--	1	root	root	636 KB	May 28 11:57	stdout Download

Mesos State

- Cluster-wide available at [http://\\$MASTER:5050/state.json](http://$MASTER:5050/state.json)

```
{  
  "cluster": "testcluster",  
  "git_sha": "2dd7f7ee115fe00b8e098b0a10762a4fa8f4600f",  
  "leader": "master@172.17.0.4:5050",  
  // ... SNIP ...  
}
```

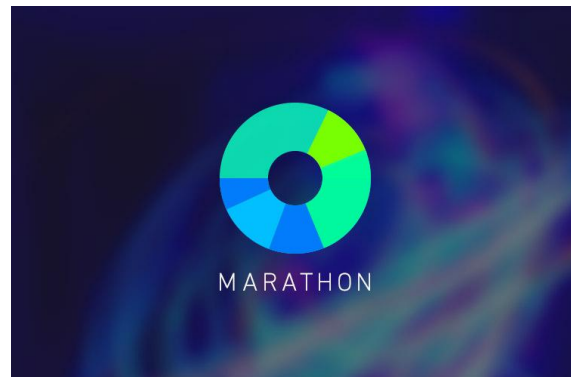
- Agent info available at [http://\\$AGENT:5051/state.json](http://$AGENT:5051/state.json)

```
{  
  // ... SNIP ...  
  "hostname": "172.17.0.5",  
  "git_tag": "0.25.0",  
  "master_hostname": "172.17.0.4",  
  "attributes": {},  
  "id": "4adbc43c-20c4-4a5e-bebf-99c0c4d20f8c-S0"  
}
```

Marathon

Meta-framework for deploying long running services and Docker containers

- Automatic restart
- Scaling
- Healthchecks
- Placement Constraints
- API
- Created by Mesosphere



Mesos Elasticsearch

Framework for running Elasticsearch on Mesos

- Automatic restart
- Horizontal Scaling
- Web UI



mesos/**elasticsearch**

The **Cloud Native Computing Foundation** has donated cluster resources for testing the framework at scale!

<https://github.com/cncf/cluster/issues/13>

What is minimesos?



From UNIX to internet services, and back!



What is minimesos?

- Experimentation and testing tool for Apache Mesos
- Instant Mesos cluster on your laptop
- CLI and Java API
- Runs in Docker
- Sponsored by

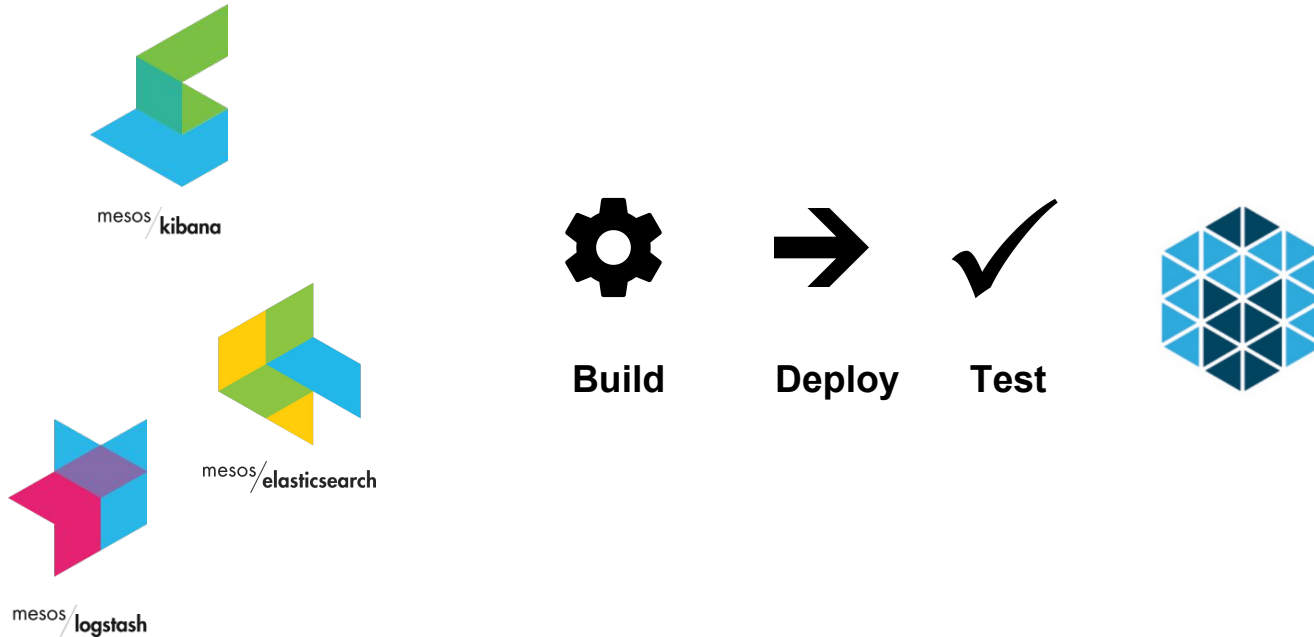


The story behind minimesos

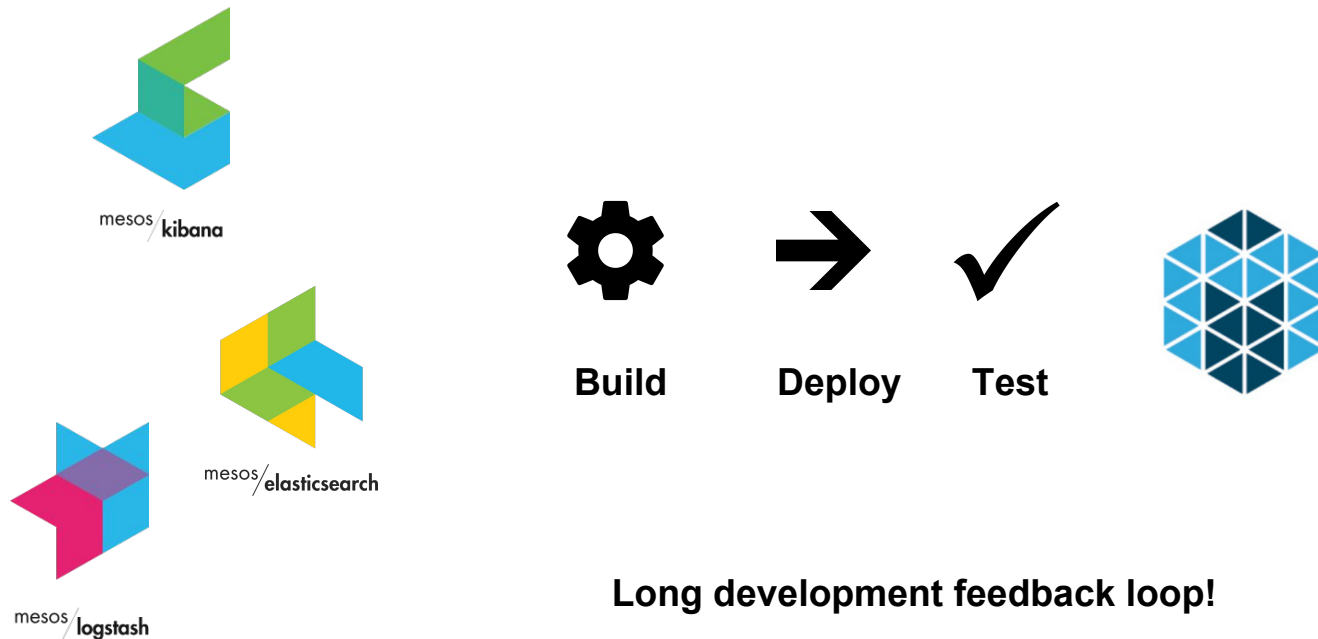
- CS contributed to the Mesos ELK stack sponsored by
- Developing & testing distributed systems is hard...



Mesos framework development



Mesos framework development



Mesos framework development



Basic Features



minimesos CLI

- **Initialize** minimesosFile

```
$ minimesos init
```

- **Start the cluster**

```
$ minimesos up
```

```
Minimesos cluster is running: 2329145689
```

```
...
```



minimesos CLI

- Print tasks

```
$ minimesos ps
```

- Print cluster info

```
$ minimesos info
```

- Print state

```
$ minimesos state
```

- Installing an app on Marathon

```
$ minimesos install --marathonFile apps/app.json
```



minimesosFile

- Cluster-wide properties

```
minimesos {  
    clusterName = "test"  
    loggingLevel = "INFO"  
    mapAgentSandboxVolume = true  
    mesosVersion = "1.0.0"  
    timeout = 60  
    ...  
}
```



minimesosFile

- Configure agent resources and other processes

```
agent {  
  resources {  
    cpu {  
      role = "*"   
      value = 2  
    }  
    disk {  
      role = "*"   
      value = 20000  
    }  
    ...  
  }  
}
```



minimesos Java API

@ClassRule

```
public static final MesosClusterTestRule RULE = MesosClusterTestRule.fromFile("src/test/resources/configFiles/minimesosFile-mesosClusterTest");
```

```
public static MesosCluster CLUSTER = RULE.getMesosCluster();
```

@Test

```
public void mesosClusterCanBeStarted() throws Exception {
```

```
    MesosMaster master = CLUSTER.getMaster();
```

```
    JSONObject stateInfo = master.getStateInfoJSON();
```

```
    assertEquals(3, stateInfo.getInt("activated_slaves"));
```

```
}
```



Weave Scope

- Visualize containers
- Launched via Marathon
on startup in `minimesosFile`
- Runs at <http://localhost:4040>



Demo



minimesos online demo

- Try out minimesos in a browser. Powered by @teamkatacoda
- Go to <https://minimesos.org/try>
- **NOTE** does not work with ad-blockers




minimesos installation

- `curl -sSL https://minimesos.org/install | sh`
- Initial pull of Docker images may take a few minutes
- For more info see <http://www.minimesos.org>



minimesos demo

- See  [containersolutions/nluug-2016-minimesos](https://github.com/containersolutions/nluug-2016-minimesos)
- The `minimesosFile` contains a reference to `es.json` Marathon file
- Deploys on startup



Design & Implementation



Mesos implementation

- Written in C++
- Based on Actor model via libprocess library
- Internal communication is done via Google protocol buffers

Blog post by Frank Scholten @ CS blog


<http://container-solutions.com/how-protocol-buffers-are-used-in-mesos-framework-development>

- Resource isolation via cgroups
- Many components are pluggable
- UI written in Angular



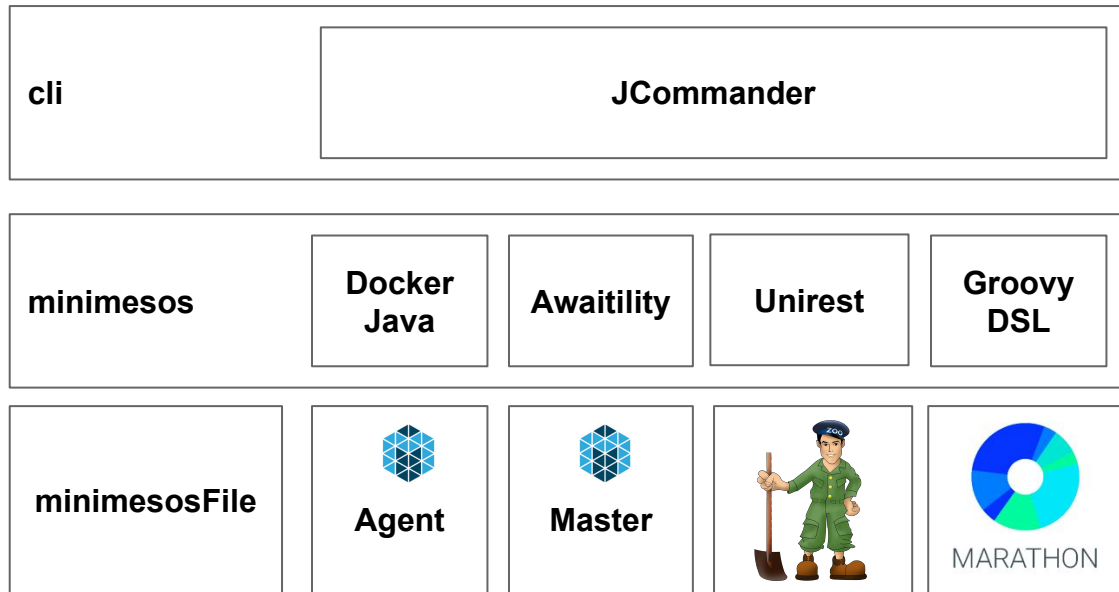
minimesos design and implementation

- minimesos follows the Vagrant workflow of **up** and **destroy**
- A mash-up of Open Source Software

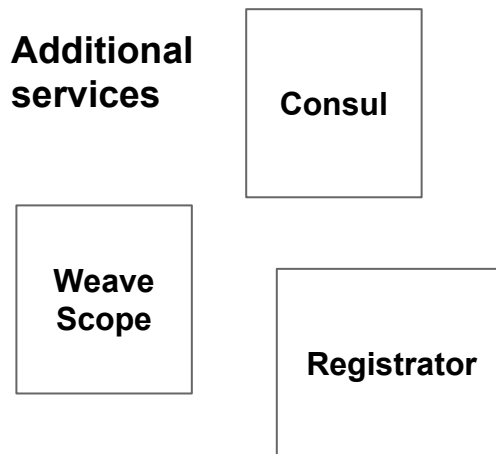
- 
minimesos = Apache Mesos + Docker + Java + Groovy

minimesos architecture

Linux box or Docker Machine VM



Additional services



Limitations

- **Networking**

- Executors do not use Agent ports. Different network interface!
- 'Mesos Agents not routable' (from Marathon UI)

<https://github.com/ContainerSolutions/minimesos/issues/401>

- **Isolation**

- minimesos containers write files as `root` on host instead of `$USER`
- 'Failures to write from containers to host'

<https://github.com/ContainerSolutions/minimesos/issues/426>

Creating a Mesos cluster



- Install Mesos Master, Mesos Agents and create a Zookeeper ensemble
- Provision a cluster with our Terraform module

<https://github.com/ContainerSolutions/terraform-mesos>



Blog post by Jaroslav Holub @ CS blog



<http://container-solutions.com/how-to-set-up-mesos-on-google-cloud-with-terraform>

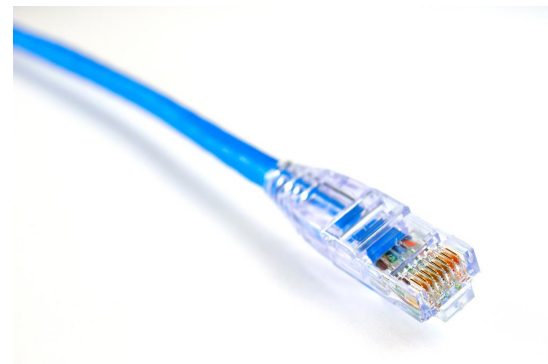
- Use minimesos! ;-)



What's Next?

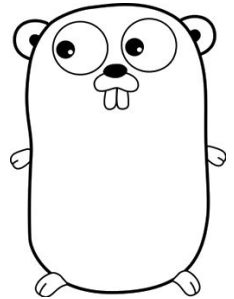
IP per task

- Each task gets its own IP and `veth` device
- Use standard ports for services
- No more port conflicts!
- How? With the Container Networking Interface



Container Networking Interface (CNI)

- Container Networking standardization effort started by CoreOS
- Used by Apache Mesos, Kubernetes, rkt and more.
- CNI plugins for Weave, Project Calico, Contiv and more
- Written in golang
- <https://github.com/containernetworking/cni>



Setting up CNI in Apache Mesos

- Configure Mesos Agent
 - `--network_cni_config_dir=/var/lib/mesos/cni/config`
 - `--network_cni_plugins_dir=/var/lib/mesos/cni/plugins`
- Create configuration files and install plugins
- Configure task's *NetworkInfo*
- See <https://github.com/ContainerSolutions/minimesos/issues/420>



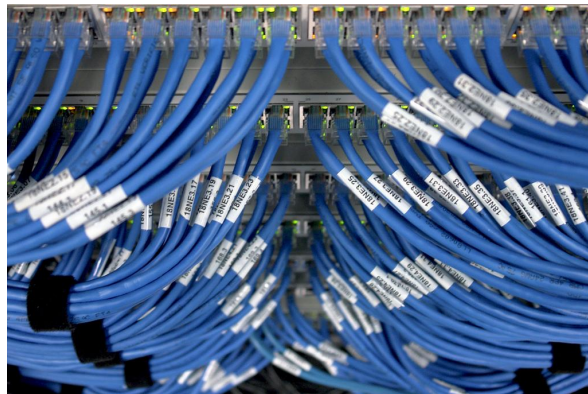
mDNS Service Discovery

- Each task gets its own DNS name
- `$ wget master.cluster.local:5050`
- Publish DNS record to Avahi or Bonjour
- See github.com/ContainerSolutions/minimesos/issues/257



Evaluating networking technologies

- L2 technologies
 - bridge + CNI host-local plugin
 - Ubuntu fan networking
 - Weave Net
- L3 technologies
 - gobgpd
 - Project Calico

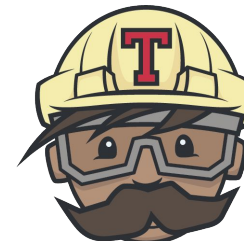


- **Do you have expertise on these topics? Let's talk later!**

How to contribute to minimesos



- Found a bug or issue? Let us know
- PRs are appreciated!
- Your PR is auto built by Travis CI



Let's stay in touch!

GitHub  **containersolutions/minimesos**



<https://minimesos.org>



<https://www.container-solutions.com>



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Thank you!