Containers in Production with Docker, CoreOS, Kubernetes and Apache Stratos

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About Me

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Agenda

- Introduction to Apache Stratos
- Apache Stratos Architecture
- Does Docker Production ready?
- Introduction to CoreOS, Flannel, Kubernetes
- Apache Stratos 4.1 – Containerization and Composition Release
- Apache Stratos with Docker
  - Kubernetes Resources Used by Stratos
- Why Composite Application Support?
- Discuss few Apache Stratos features
- Demo - Docker, Kubernetes with autoscaling

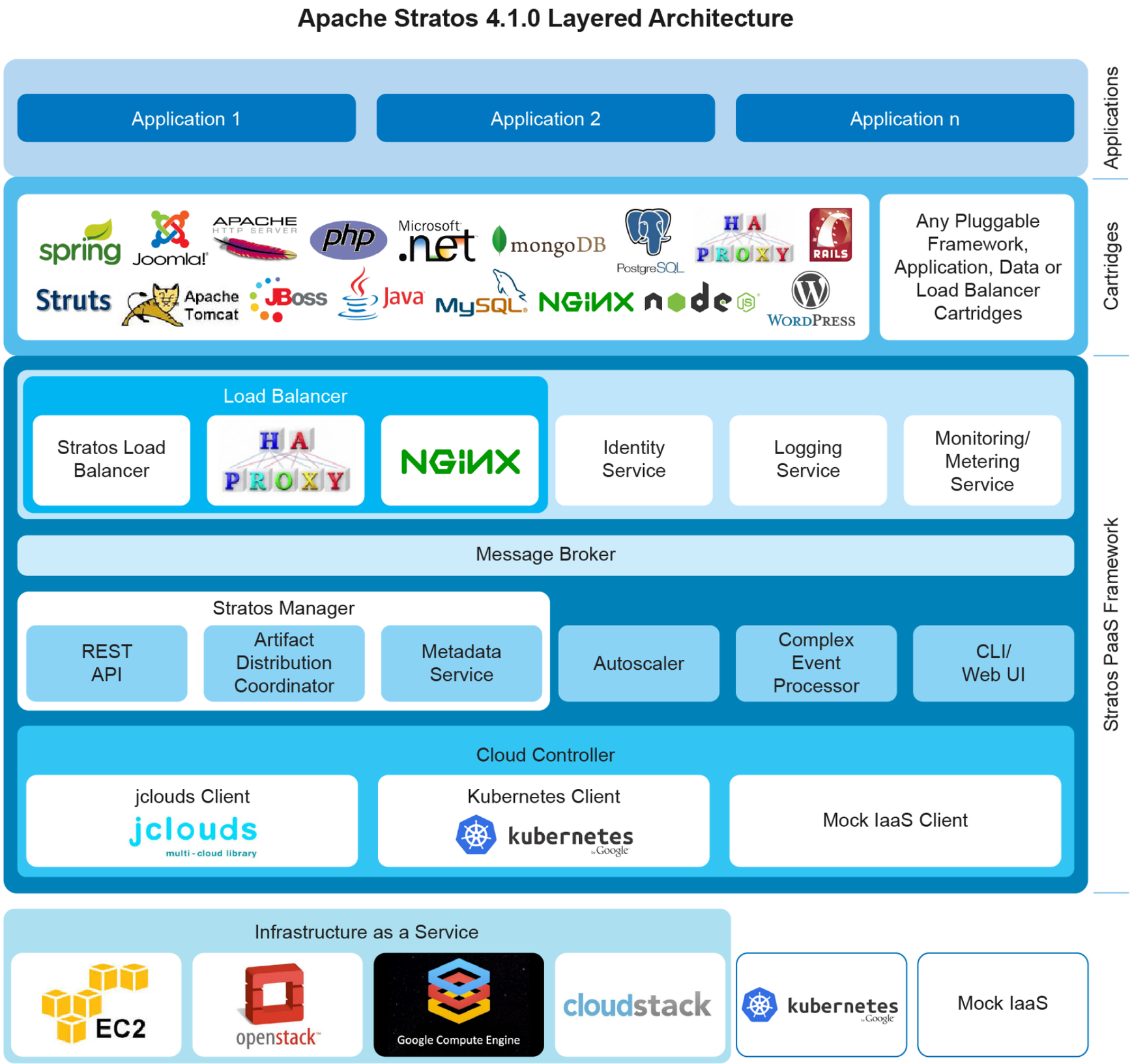
Apache Stratos

- Apache Stratos is a highly-extensible Platform-as-a-Service (PaaS) framework that helps run Apache Tomcat, PHP, and MySQL applications and can be extended to support many more environments on all major cloud infrastructures

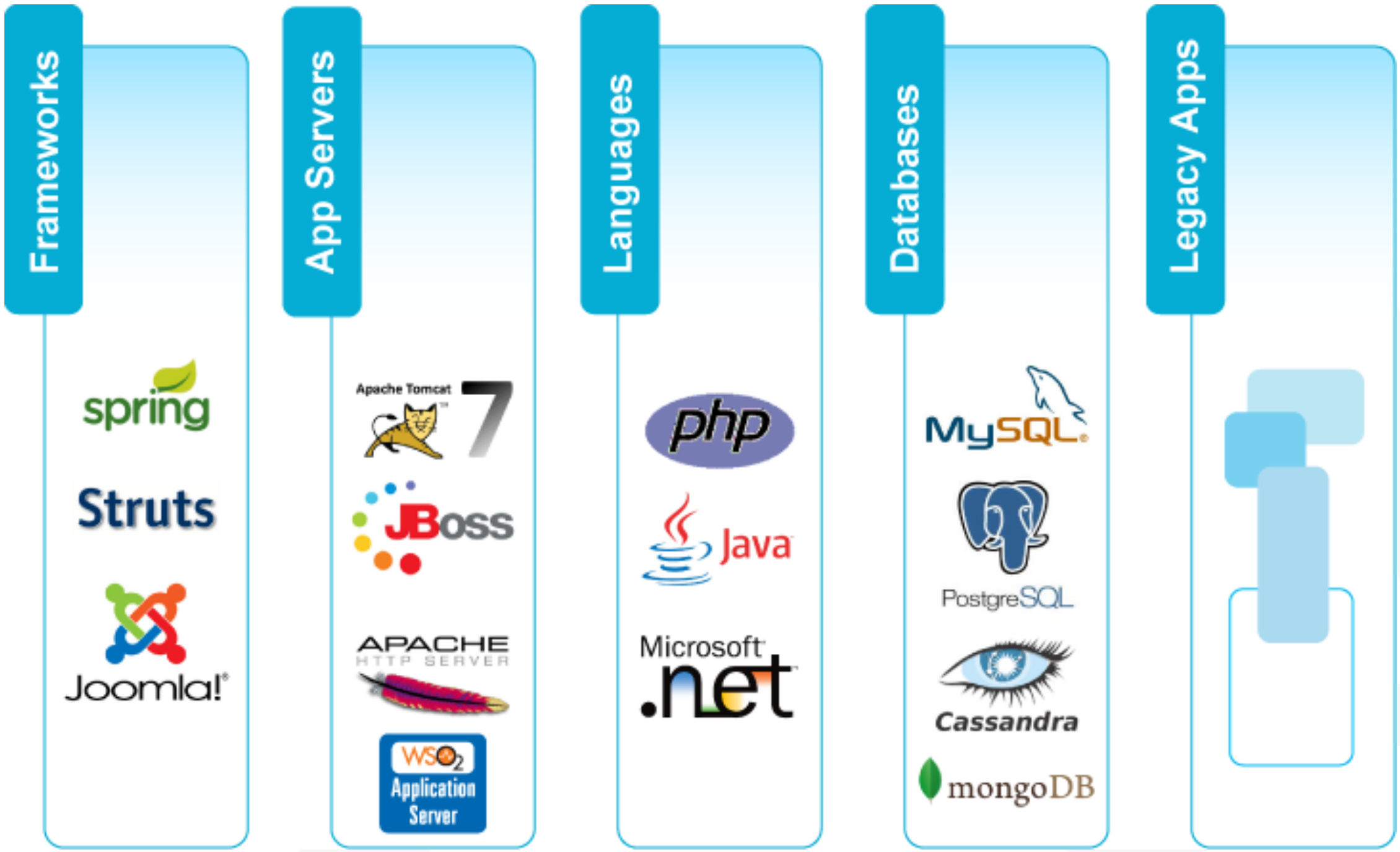
- Stratos initially developed by WSO2 and last year donated to Apache Software Foundation

- After successfully complete the incubating process Stratos now graduated as Top Level Project

Apache Stratos Layered Architecture



Apache Stratos Cartridges



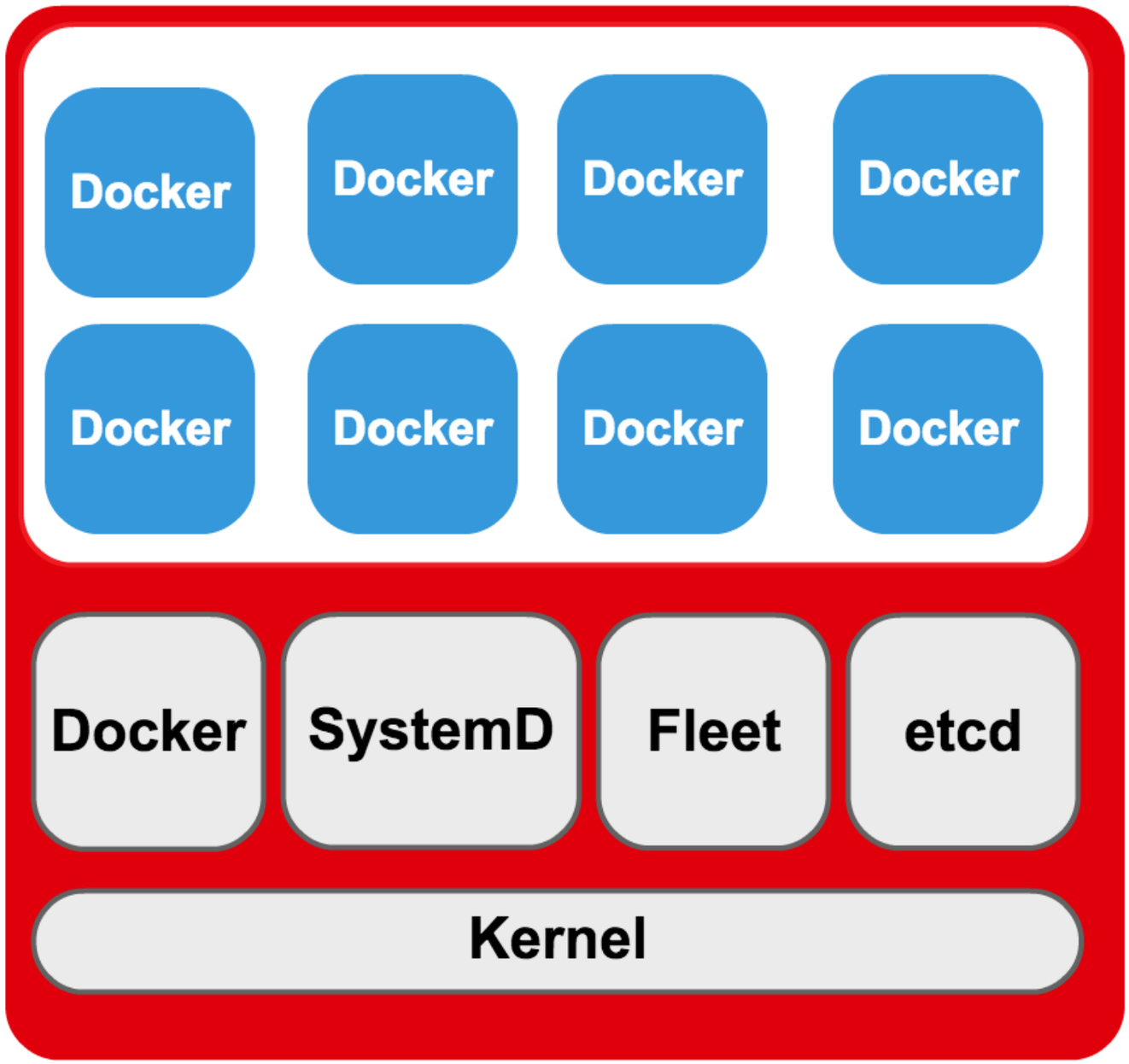
Does Docker Production Ready?

- Docker network?
  - Deploying in Docker host cluster
- Can run enterprise apps in a single docker container?
- Problems of running enterprize appl in multiple docker containers?
  - File System sharing?
  - Network sharing?
  - Process space
  - How to identified an unit?

Apache Stratos 4.1 – Containerization and Composition Release

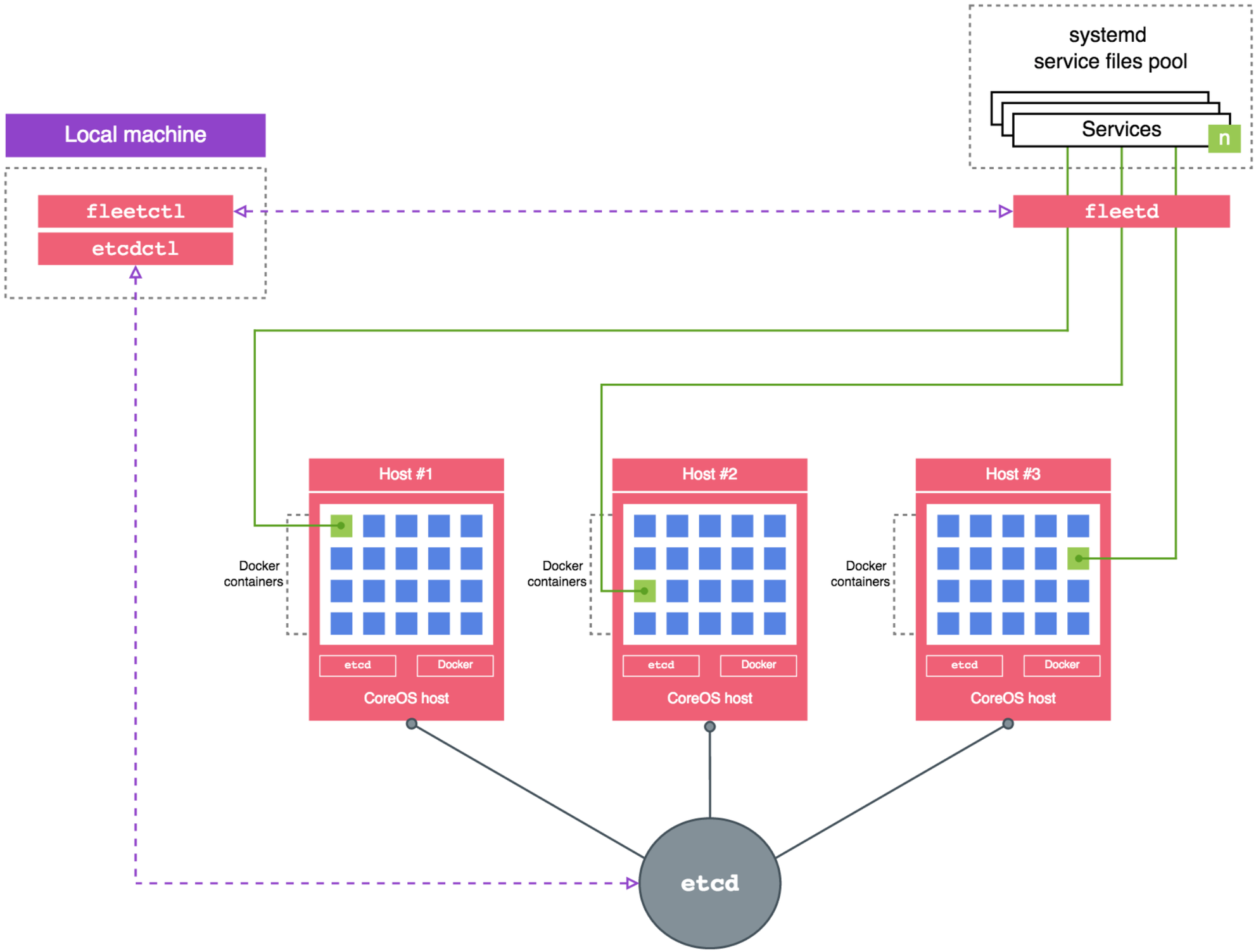
- Application Composition
- Containerization
  - Docker based cartridge support
  - integration with CoreOS
  - integration with Kubernetes
  - integration with flannel
  - integration with discovery service and build in docker registry support

What is CoreOS?

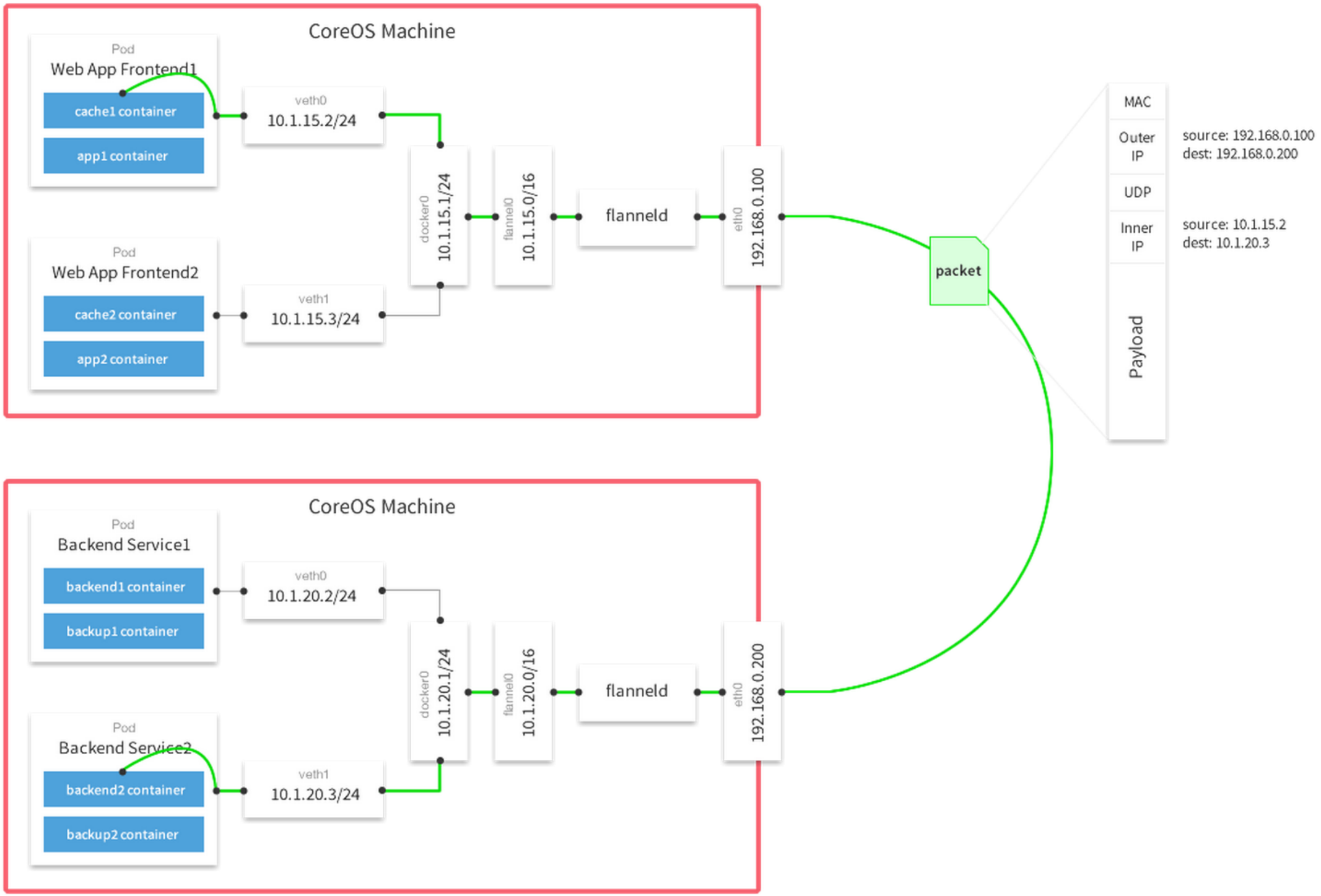


CoreOS Host

CoreOS Cluster



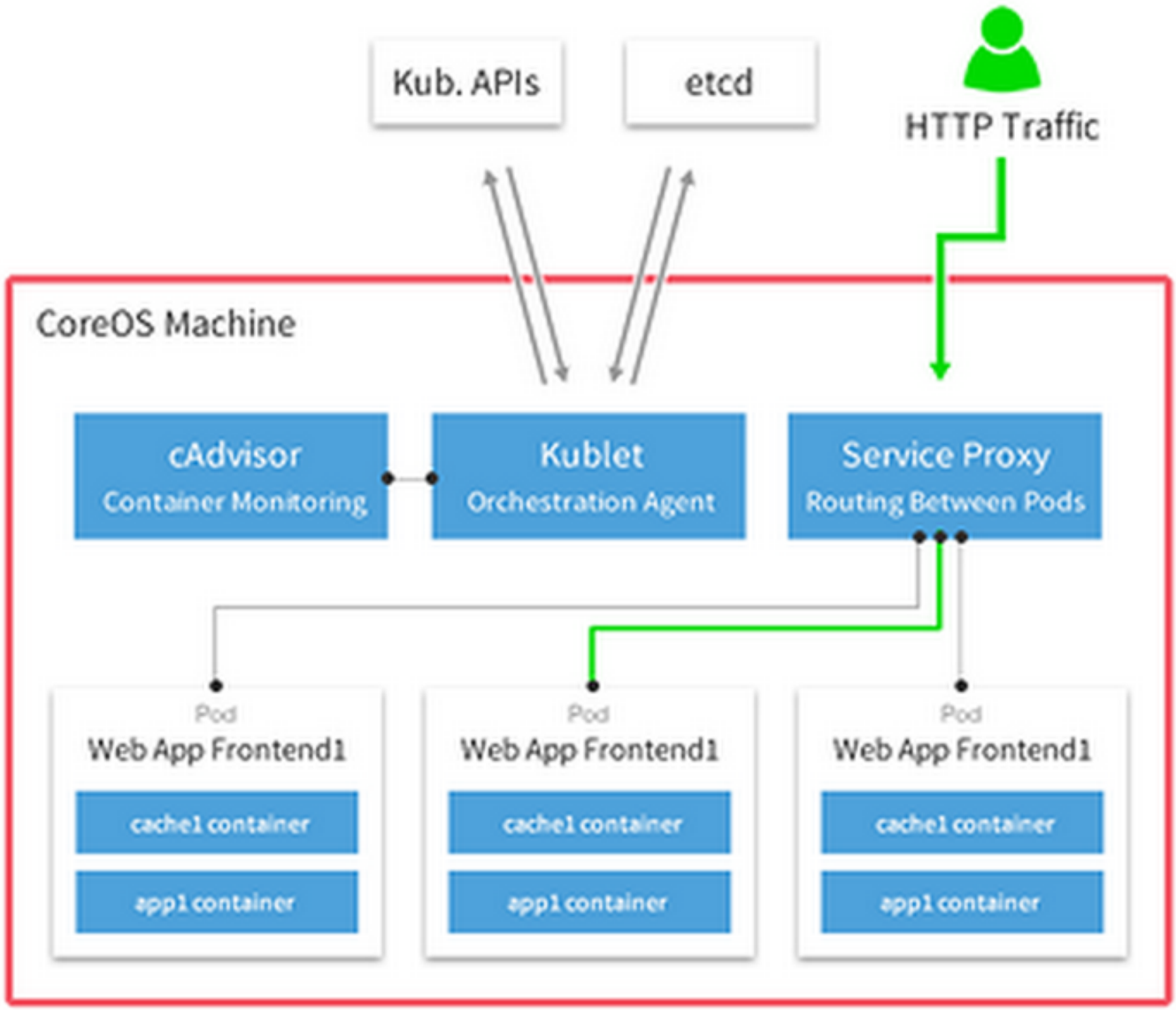
What is Flannel?



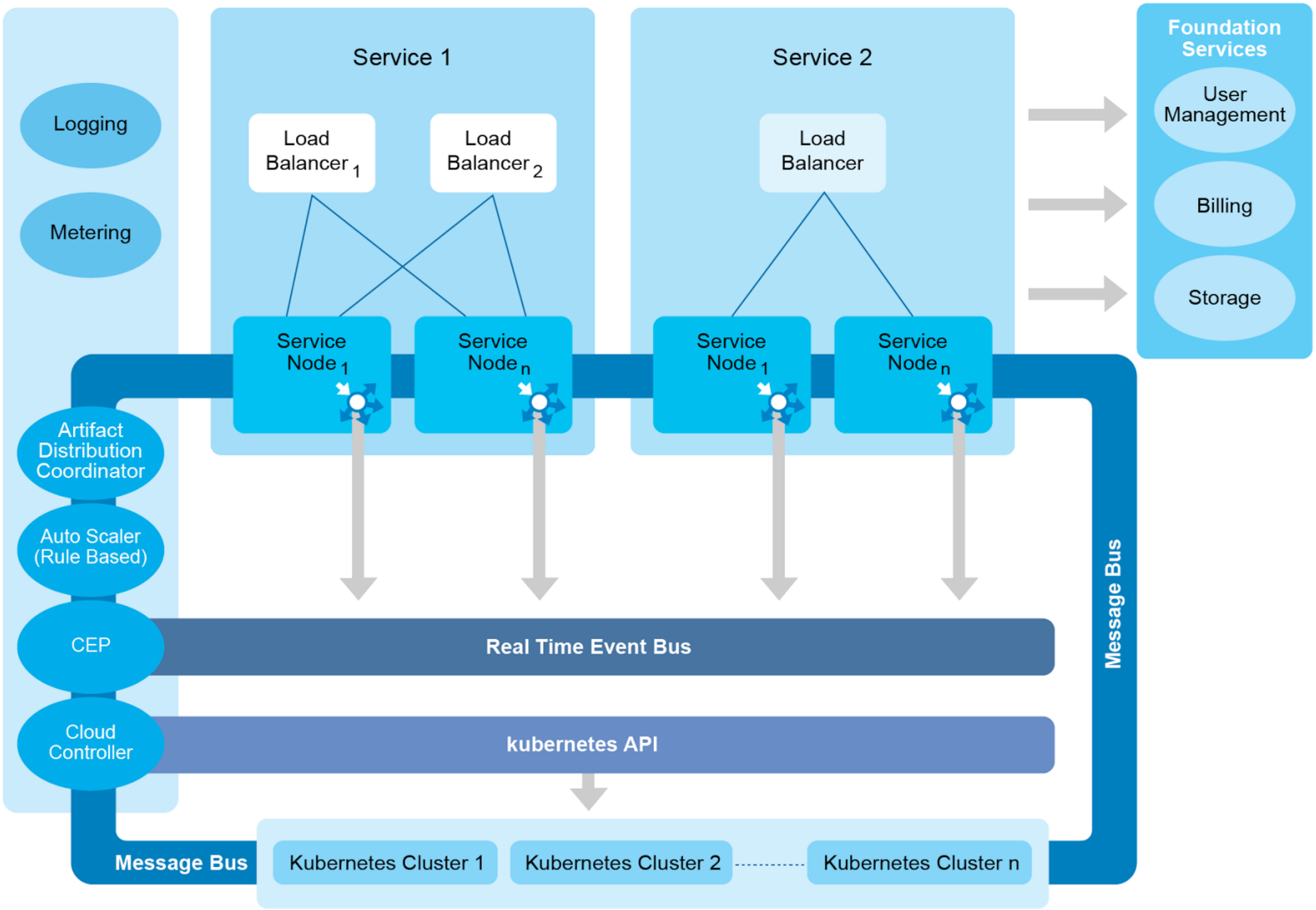
What is Kubernetes?

- Kubernetes is a platform for hosting Docker containers in a clustered environment with multiple Docker hosts
- Provides container grouping, load balancing, auto-healing, manual scaling features ...etc
- Project was started by Google
- Contributors == Google, CodeOS, Redhat, Mesosphere, Microsoft, HP, IBM, VMWare, Pivotal, SaltStack, etc

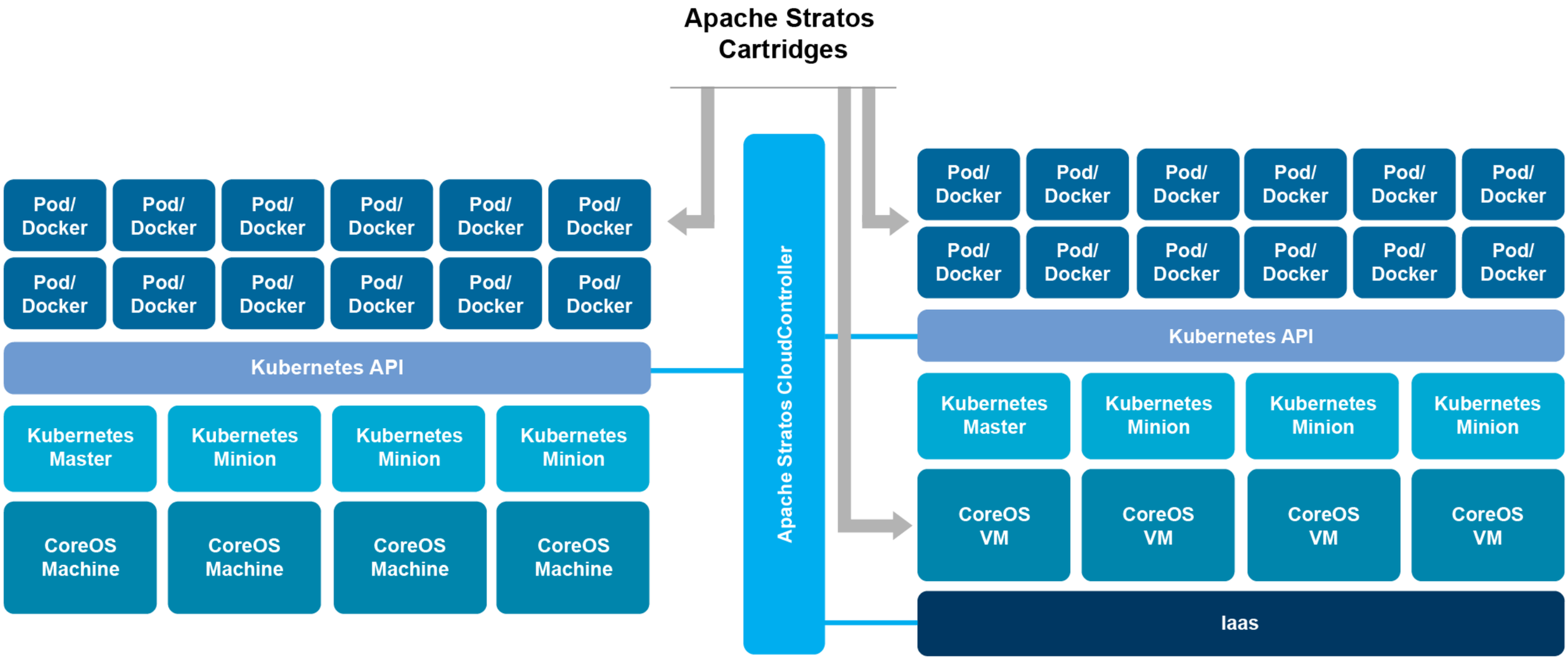
Kubernetes with CoreOS



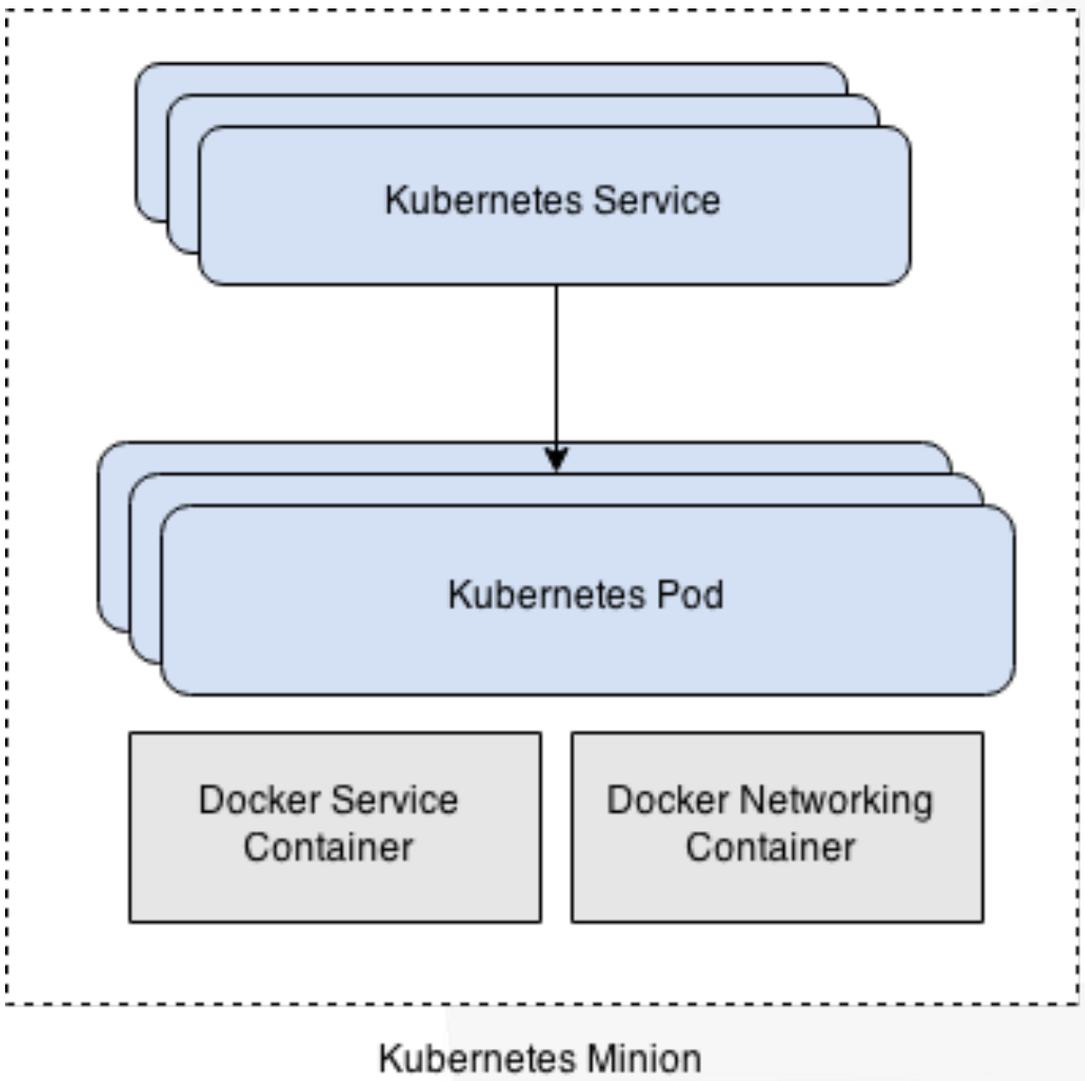
Apache Stratos L1 Architecture for Docker based Cartridges



Stratos Architecture with Docker Support



Kubernetes Resources Used by Stratos



- A Kubernetes Service is created for each transport/port mapping defined in the cartridge.
- Kubernetes Service is a load balancing service for Pods.
- A Kubernetes Pod is created for each member in a cluster.
- A Kubernetes Pod is a group of Docker containers.
- Kubernetes creates a separate Docker container for networking.

Why Composite Application Support?

- Real world application are complex and required multiple heterogeneous service runtimes (Cartridges) to host the application
- These Cartridges may have dependencies to each other
  - startup order
  - dependency ratio
  - dependent scaling
  - termination behaviors
  - data sharing
- Capable of creating Cartridge group and it provide more flexibility to handle group behaviours such as group scaling, load balancing..etc
- Capable of creating blueprint of an application runtime by using simple structured json payload

Cartridge Group

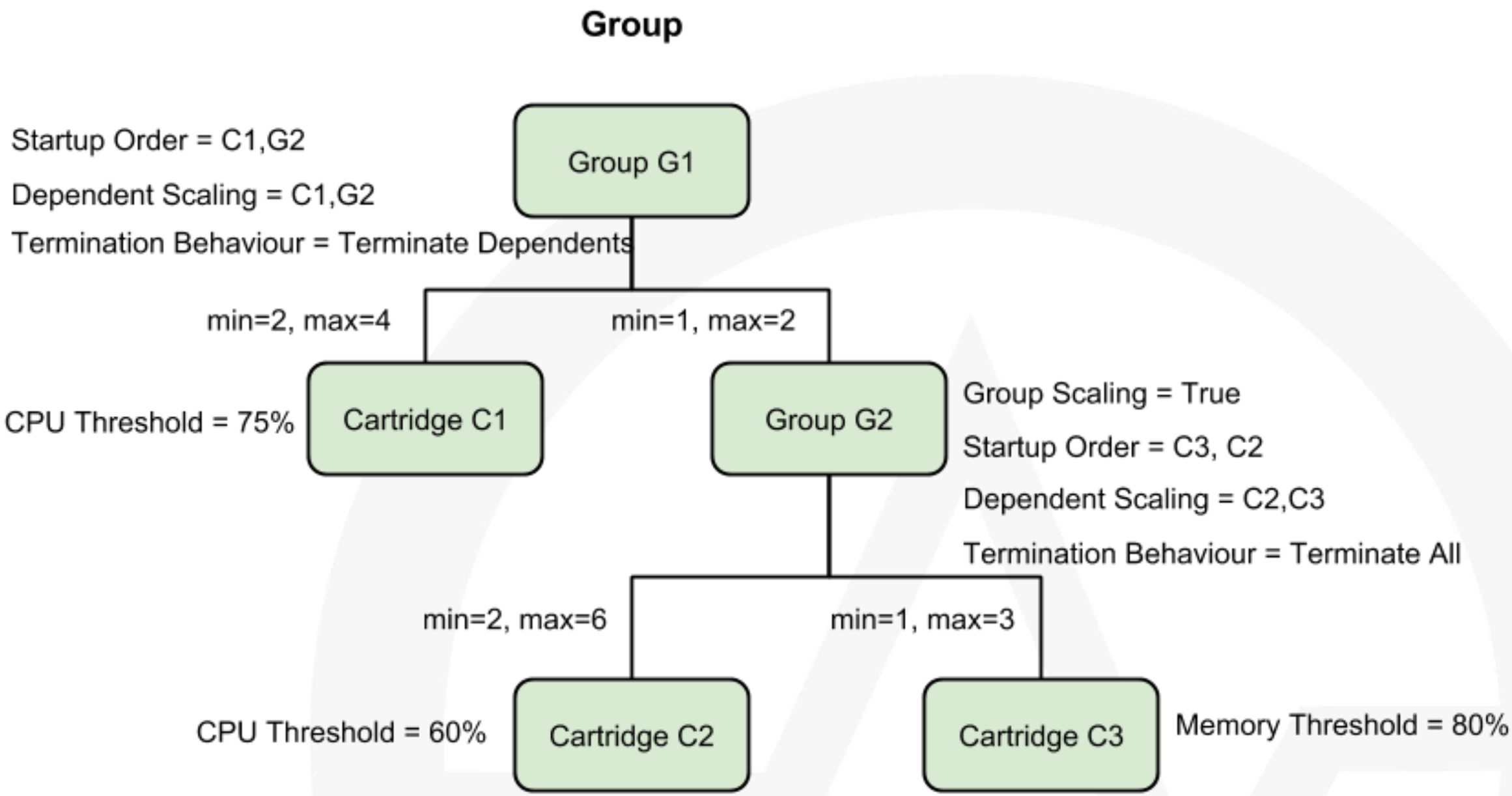


diagram - 01

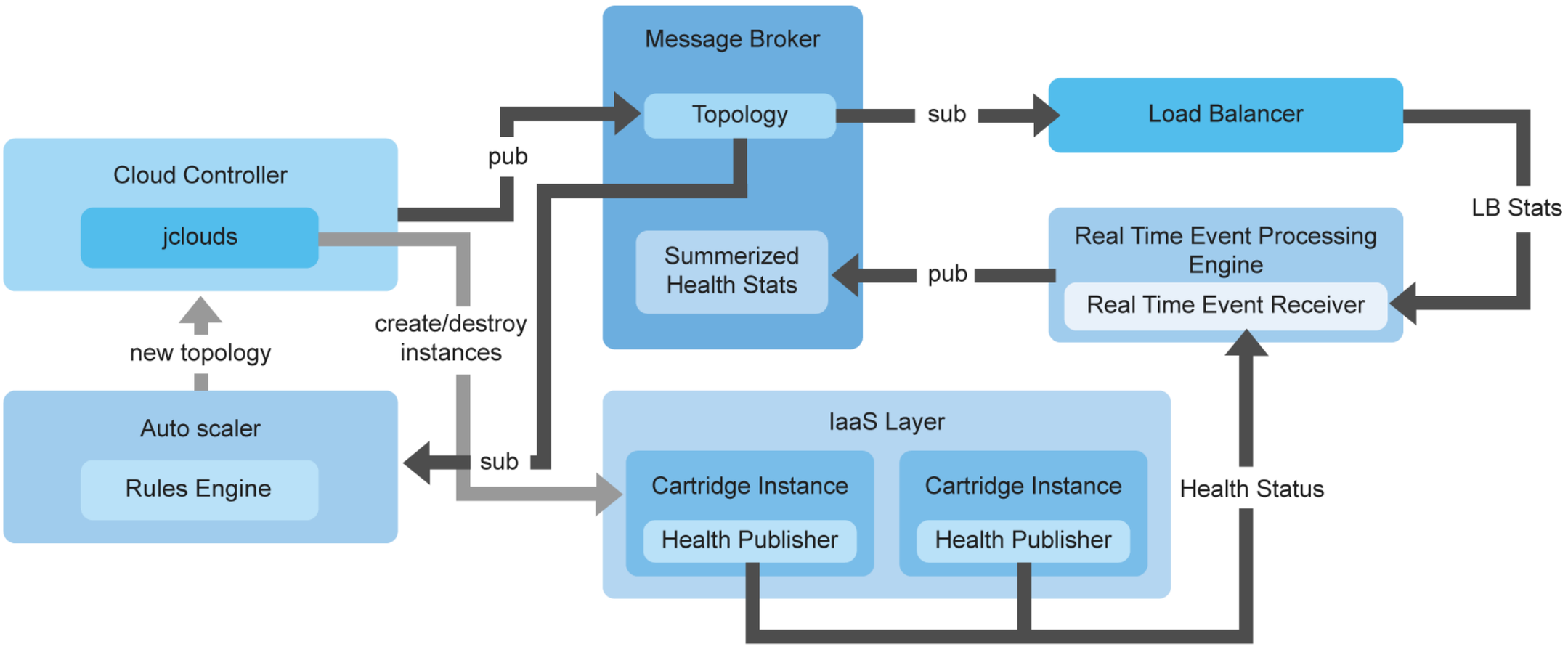
Sample Group Definition

```
{
    "name": "group2",
    "isGroupScalingEnabled": "true",
    "cartridges": [
        "c2", "c3"
    ],
    "dependencies": {
        "startupOrders": [
            "cartridge.c3,cartridge.c2"
        ],
        "scalingDependants": [
            "cartridge.c3, cartridge.c2"
        ],
        "terminationBehaviour": "terminate-all"
    }
}
```

Multi-factored Auto Scaling

What is it?

- Scaling algorithm can use multiple factors. such as
  - Load average of the instance
  - Memory consumption of the instance
  - In-flight request count in LB



Multi-factored Auto Scaling...

- Capable of predicting future load
  - Real time analysis of current load status using CEP integration
  - Predict immediate future load based on CEP resulting streams
  - Predicting equation $s=ut + ½ at^2$
  - s=predicted load, u=first derivative of current average load, t=time interval , a=second derivative of current load

Why should one care?

- Maximise resource utilization
- Easy to do capacity planning
- Dynamic load based resource provisioning
- Optimizing across multiple clouds

Scalable and Dynamic Load Balancing

How Scalable it is?

- In theory infinite
  - horizontal scaling
  - limited by resource (instance capacity) availability

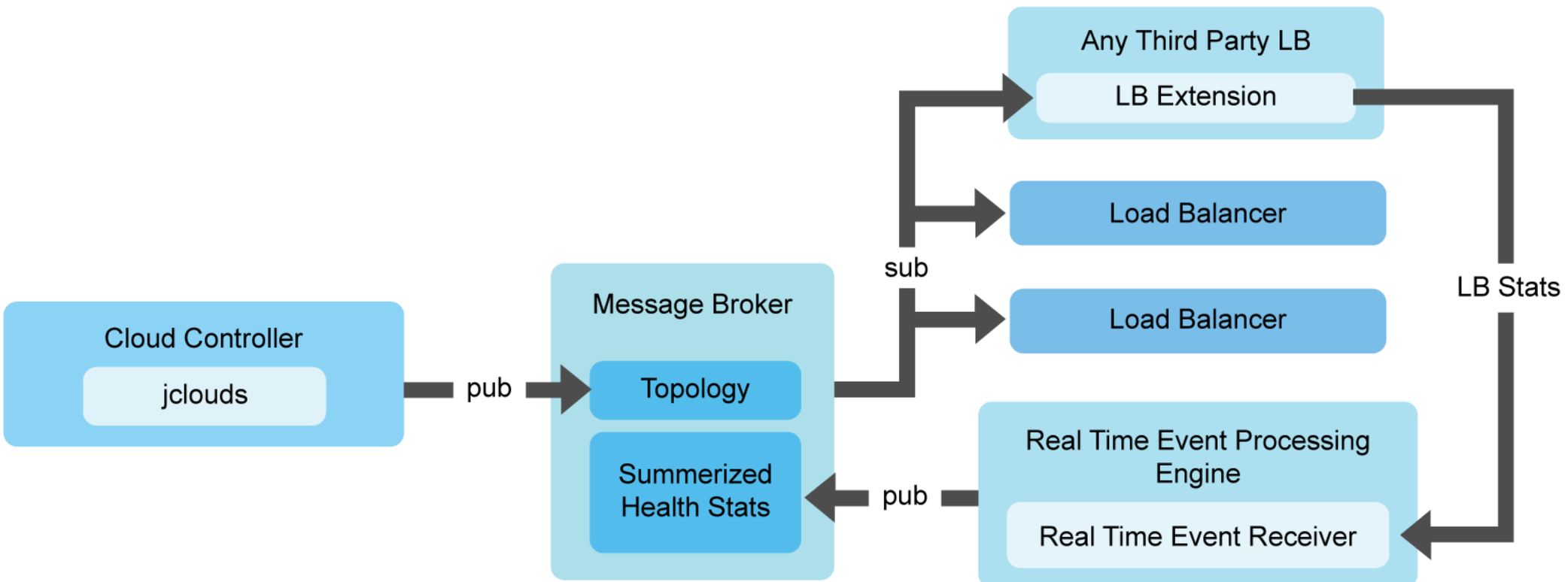
How Dynamic it is?

- Load Balancers are spawned dynamically
  - LB too is a cartridge
- In case of multi-cloud, multi-region, LB can scale per cloud/region
- Per service cluster LB

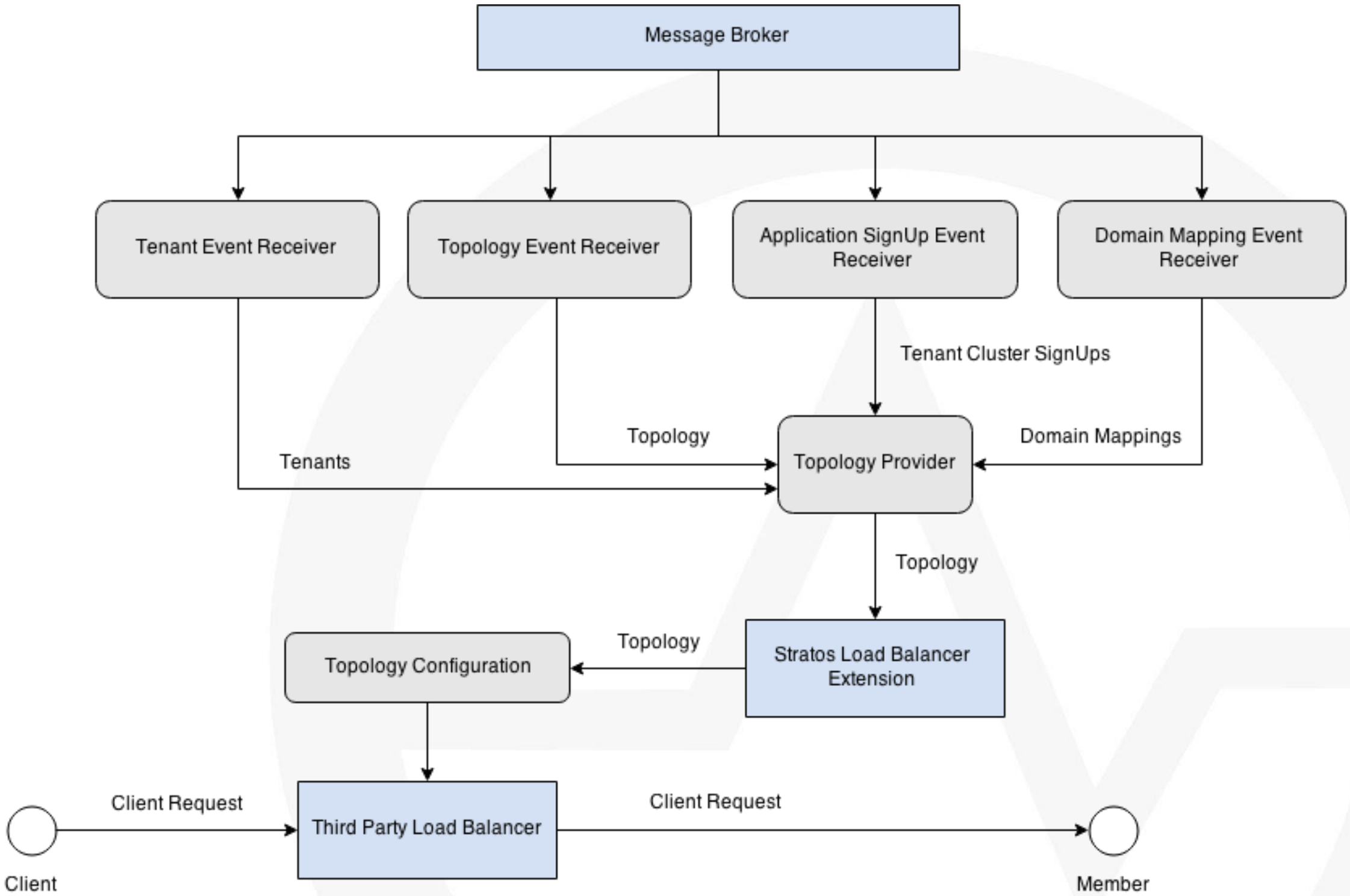
Scalable and Dynamic Load Balancing..

What is unique about Stratos

- Cartridge based LB model
- Can bring any third-party LB
  - HAProxy, nginx, AWS ELB
  - As easy as plugging into LB extension API



Stratos Load Balancer Extension Architecture



Smart Policies

What are the smart policies?

- Auto scaling
- Deployment

Auto scaling policy

- Define thresholds values pertaining scale up/down decision
- Auto Scaler refer this policy
- Defined by DevOps

Deployment policy

- Defined how and where to spawn cartridge instances
- Defined min and max instances in a selected service cluster
- Defined by DevOps based on deployment patterns

Smart Policies

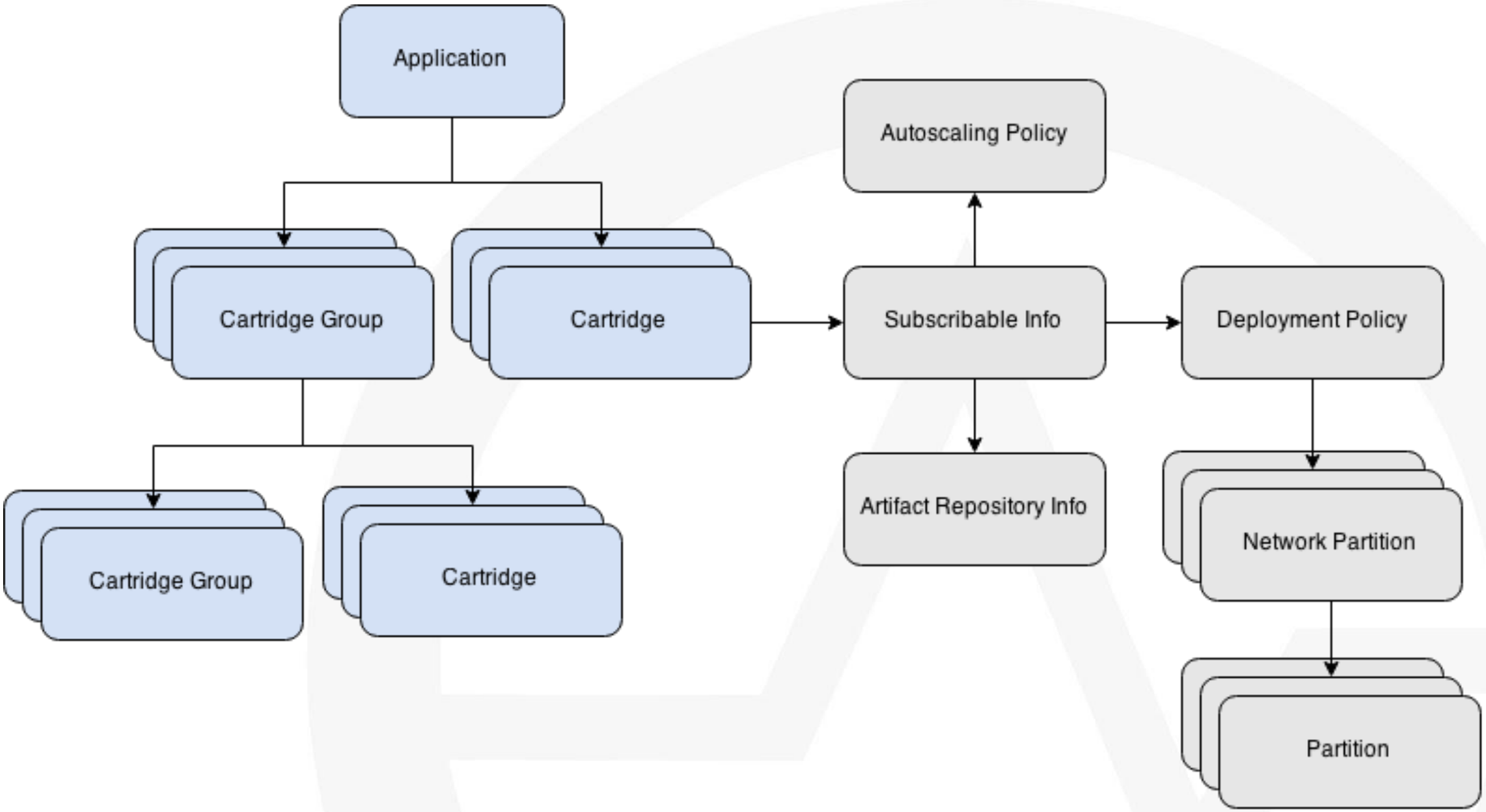
Why should one care?

- Can provide cloud SLA

What are the advantages?

- Make DevOps life easy
  - help keep to SLA
- Make SaaS app delivery life easy
  - do not have to worry about availability in application layer

Composite Application Model and Policy Model



Cloud Bursting

What is it?

- Expanding/provisioning application into another cloud to handle peak load.

Why Should one care?

- Resource peak time can be off-loaded to third party clouds/resources

What is unique about it?

- Can off-load to any cloud
  - Private, Public and Hybrid
- Whole application can replicated into bursting cloud with all configuration
- Can migrate application into another cloud without downtime

Logging, Metering and Monitoring

What details are?

- Instance up/down time
- Each and every instances health status
  - application health, load average, memory consumption
- Application logs

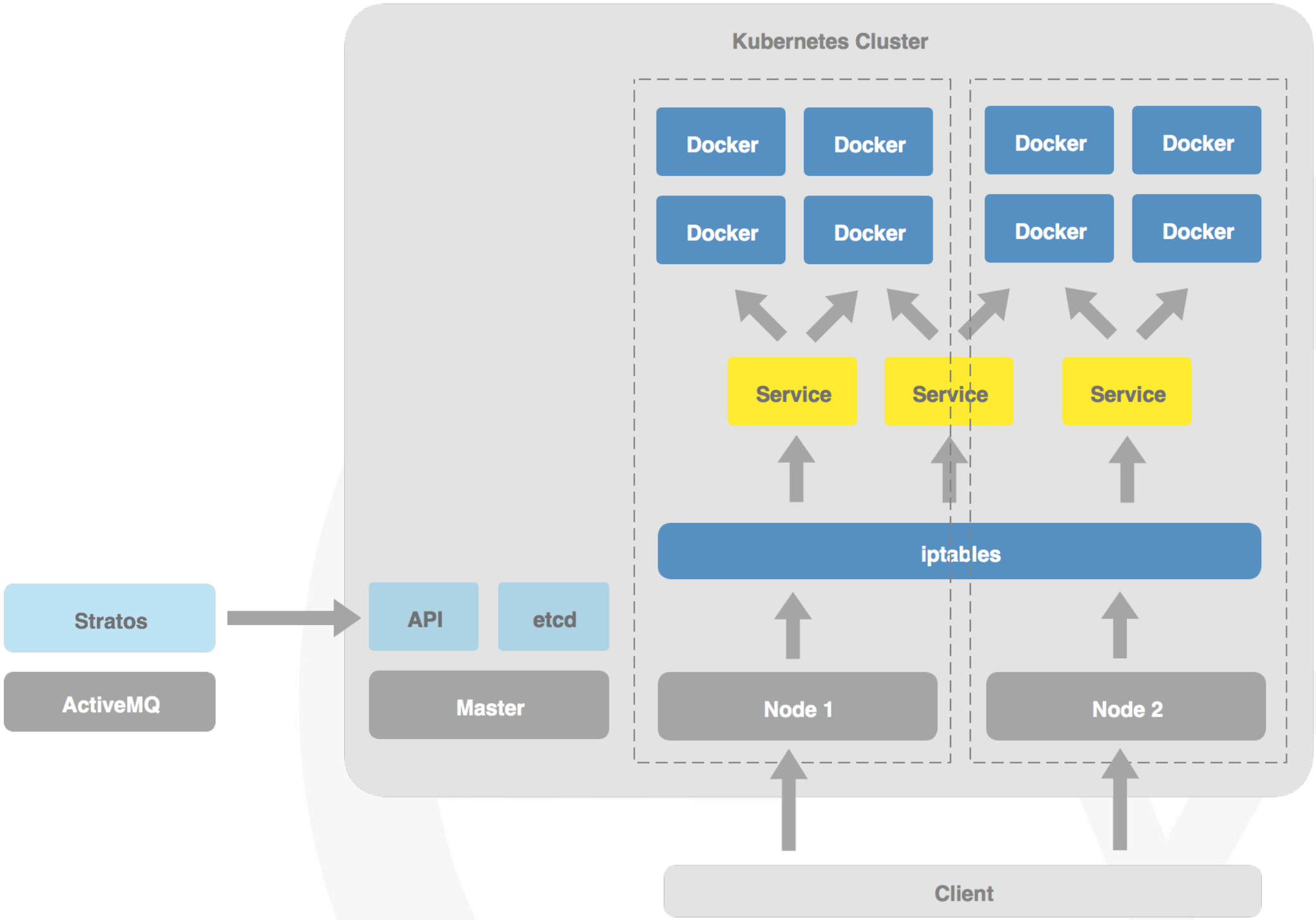
Why should one care?

- Centralize view for all logging, metering and monitoring

What are the advantages?

- DevOps life easy
  - centralized log viewer
  - centralized dashboard
- Easy to throttling

Demo - Docker, Kubernetes with autoscaling



More Information !

- http://stratos.apache.org
- http://lakmalsview.blogspot.com/2013/12/sneak-peek-into-apache-stratos.html
- https://cwiki.apache.org/confluence/display/STRATOS/
- https://github.com/coreos/flannel
- https://www.youtube.com/watch?v=tsk0pWf4ipw

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