Dynamic cloud resource allocation for optimized container deployment and distribution

Then...

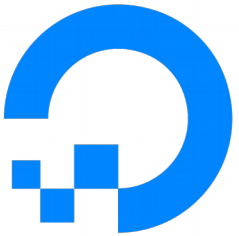
- Dedicated servers
- Big
- Immutable
- Expensive
- Monthly/Annual contracts

Recently...

- Cloud computing
- Small Virtual Machines
- Hourly payments
- Microservices

Additionally...

- Controlling your cloud resources through REST APIs



DigitalOcean

Google Cloud Platform

POSTMAN

Azure

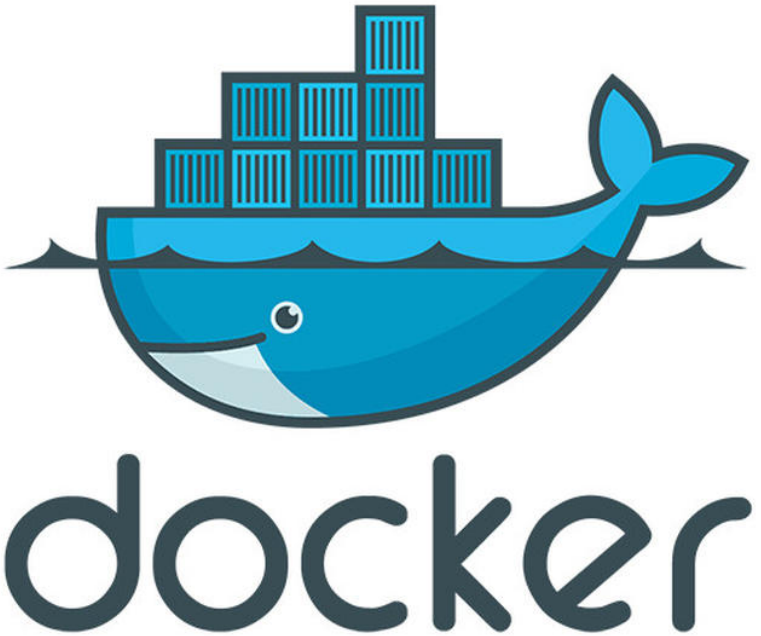
Allocating resources programmatically

- /containers/create

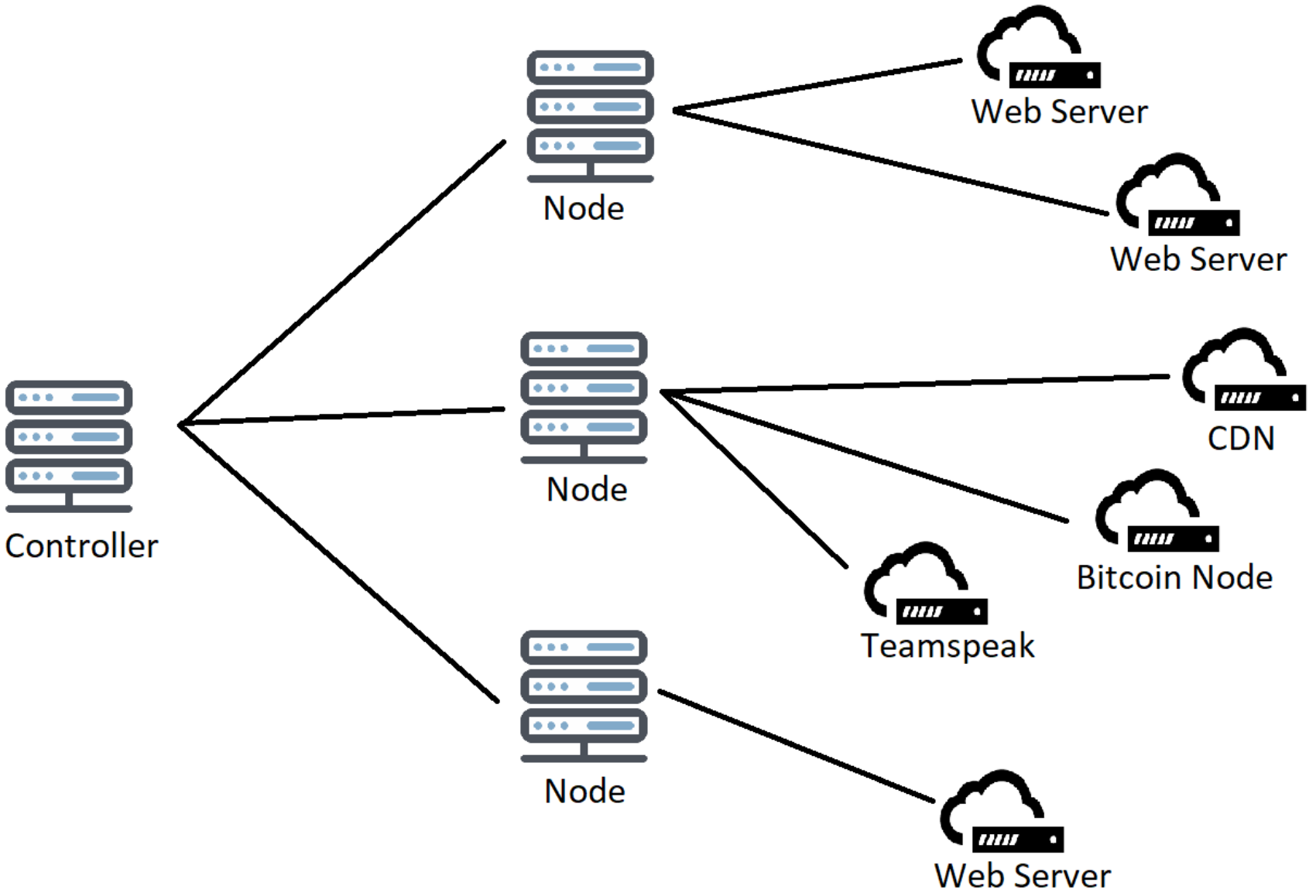
```
{
  "name": "example.com",
  "region": "nyc3",
  "size": "s-1vcpu-1gb",
  "image": "ubuntu-16-04-x64",
  "ssh_keys": [ … ],
  "tags": [
    "web-server"
  ]
}
```

Docker

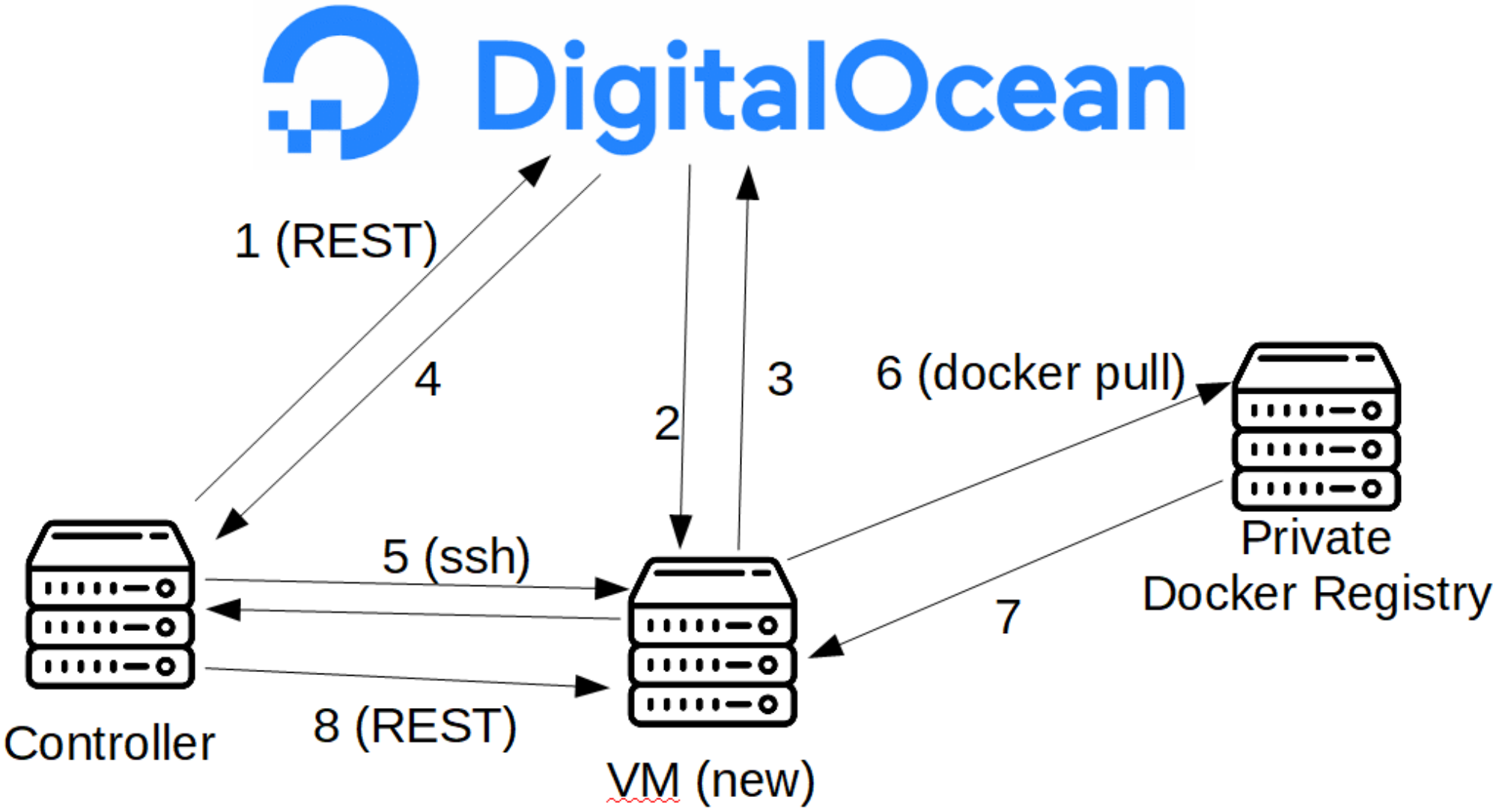
- Packing services into images
- Dependency-free
- Portability
- Isolation



Master/Slave model



Node Initialization



Now what?

Cloud resources and service deployment can now be programmatically controlled and automated.

- High-level optimization

Resource Utilization

- Bin packing problem

Given a set of bins $S_1, S_2 \ldots$ with the same size V and a list of n items with sizes $a_1, \ldots, a_n$ to pack, find an integer number of bins B and a B-partition $S_1 \cup \cdots \cup S_B$ of the set $\{1, \ldots, n\}$ such that $\sum_{i \in S_k} a_i \leq V$ for all $k = 1, \ldots, B$. A solution is *optimal* if it has minimal B. The B-value for an optimal solution is denoted **OPT** below. A possible Integer Linear Programming formulation of the problem is:

minimize $B = \sum_{i=1}^{n} y_i$

subject to $B \geq 1$,

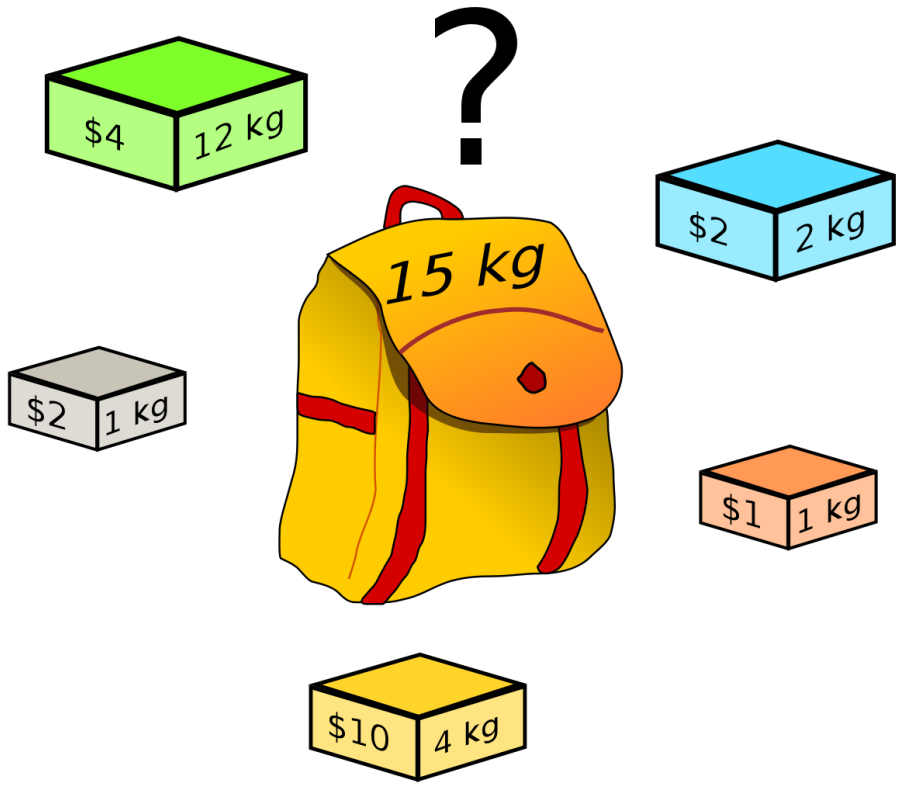
$$\sum_{j=1}^{n} a_j x_{ij} \leq V y_i, \forall i \in \{1, \ldots, n\}$$

$$\sum_{i=1}^{n} x_{ij} = 1, \qquad \forall j \in \{1, \ldots, n\}$$

$$y_i \in \{0, 1\}, \qquad \forall i \in \{1, \ldots, n\}$$

$$x_{ij} \in \{0, 1\}, \qquad \forall i \in \{1, \ldots, n\} \, \forall j \in \{1, \ldots, n\}$$

where $y_i = 1$ if bin i is used and $x_{ij} = 1$ if item j is put into bin i.[5]



Optimizing Allocation

- Allocating new reosurces

  => size?

- We should predict what we'll need space for in the immediate future

  => linear regression