Open source software for building a private cloud

Michael J Pan
CEO & co-founder, nephosity

COSCUP
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An introduction

me

- 10+ years working on high performance (distributed, grid, cloud) computing at DreamWorks Animation, NASA JPL, NIH Center for Computational Biology, Compaq
- started nephosity in March 2010

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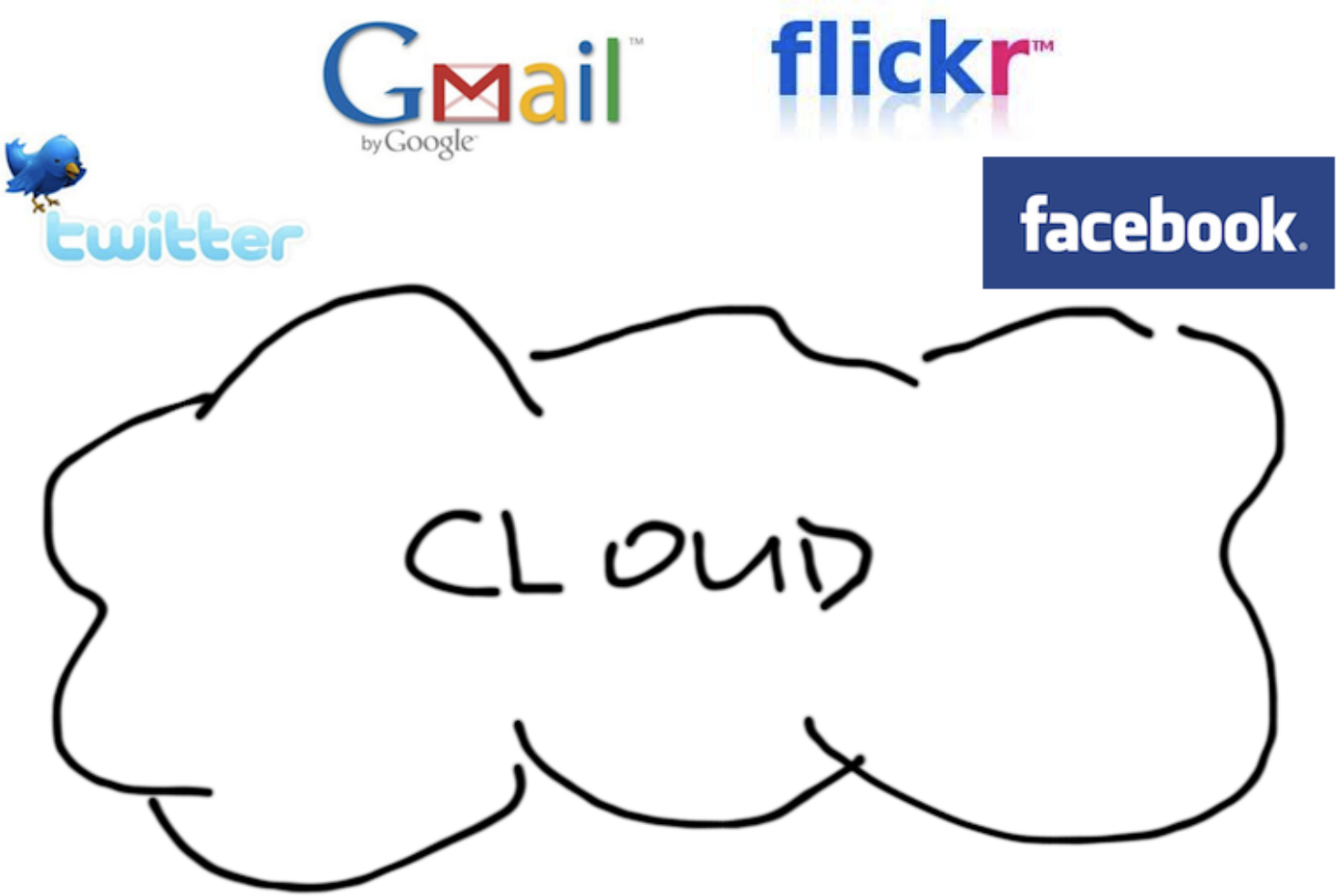
nephosity

- develops cloud computing platform for enterprises
- showcased by STRUCTURE 2010 as one of "10 most promising cloud computing startups of 2010"

What's behind the cloud?



Motivation

Scenario

- You are (or your company is) developing a SaaS
- You require elastic compute resources

So you want to deploy in the cloud, but...

- Public clouds do not satisfy your (security, performance, etc.) requirements
- You want to use open source components in your cloud

What's available to you?

Why not Amazon EC2 (or some other public cloud?)

EC2 (more specifically, dynamic provisioning[1] capabilities provided by EC2) is only one part of the equation

- Core is dynamic provisioning capabilities
- EC2 is not open source.

You need a machine image to run on EC2– what software (OS + platform) to install on the image? What are the (open source) alternatives for dynamic provisioning?

[1] the ability to start up and tear-down compute resources on-demand

What about Hadoop?

Hadoop is also only part of the equation

- Hadoop-core provides map-reduce functionality
- HDFS provides data management functionality

How do you control Hadoop jobs? What alternatives to Hadoop are there?

Cloud computing stack

- Infrastructure
  - Hypervisor / machine image
  - Dynamic provisioning
  - Operating system
- Platform
  - Data management
  - Map-reduce
  - Workflow management
  - Messaging
- Cluster management
  - Configuration
  - Analytics

Disclaimer

- Will discuss only open source offerings that have been **released**
- Will present what's available, not how to adopt/implement them
- Lists may be incomplete
- You will see some badly hand drawn graphics

Infrastructure

- Hypervisor / Virtual machine
- Dynamic provisioning
- Operating system

Hypervisor / Virtual machine

- Hardware virtualization
- Allows multiple virtual machines to run on a single physical machine

Hypervisor / Virtual machine

- QEMU (virtualizer)
- KVM
- Xen
- VirtualBox (Desktop only)

Dynamic provisioning

de/allocate compute resources on demand

- You get compute resources when you want them
- Compute resources are reclaimed when you release them

Dynamic provisioning

Open source software

- Eucalyptus
- OpenNebula / Haizea
- Condor (via VM universe)
- TCloud Elaster (not yet released)

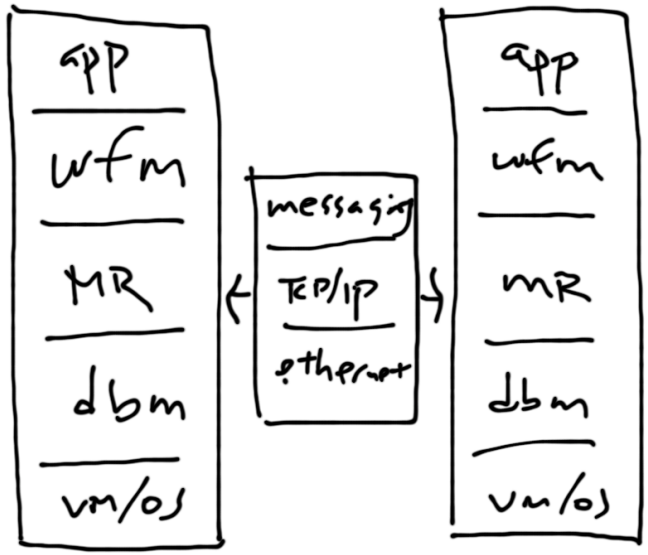
Operating system

- The interface between your software and the underlying hardware
- In cloud computing, operating systems are stored as machine images
- Images are distributed to local storage on-demand
- Loaded into memory and booted into the hypervisor by the dynamic provisioner

Operating system

- Various Linux distributions
  - Ubuntu
  - SUSE
  - Fedora
  - CentOS
- BSD (on VirtualBox)

Platform



- Data management
- Map reduce
- Workflow management
- Messaging

Data management

- Distribute your data across your network
- Replicate your data across your network
- Optimize retrieval to improve computation time
- Optimize storage requirements

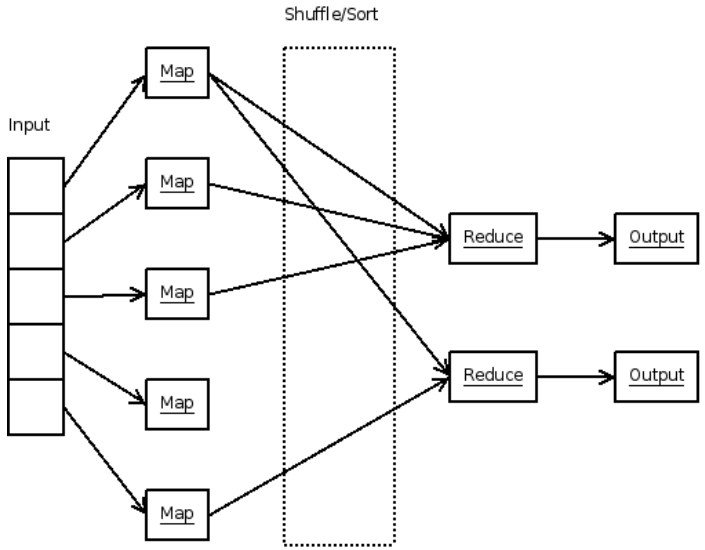
Data management considerations

- SQL vs. NoSQL
- Replication degree
- small file vs. BLOB storage
- Consistency
- Centralized vs. decentralized
- Access patterns

Data management

- HDFS (Hadoop)
- SphereFS (UIC)
- DDFS (Nokia)
- Cassandra (Facebook / Apache)
- MongoDB
- CouchDB (Apache)
- MySQL (Oracle)
- PostgreSQL
- Ceph (DreamHost), release as part of Linux v2.6.34

Map reduce



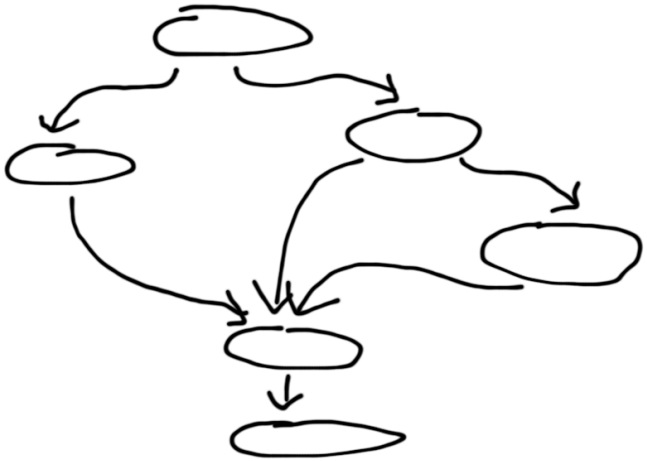
- Split and parallelize a task into many parts
- Combine the results of the split tasks for a final result

Map reduce

Open source offerings

- Hadoop (Yahoo)
- Sphere (UIC)
- Disco (Nokia)

Workflow management



- design
- specification
- coordinated execution

of compute tasks

Workflow management

Open source offerings

- Oozie (Yahoo)
- Pig (Hadoop / Apache)
- Cascading (Concurrent)
- Azkaban (LinkedIn)
- pomsets (nephosity)

Messaging

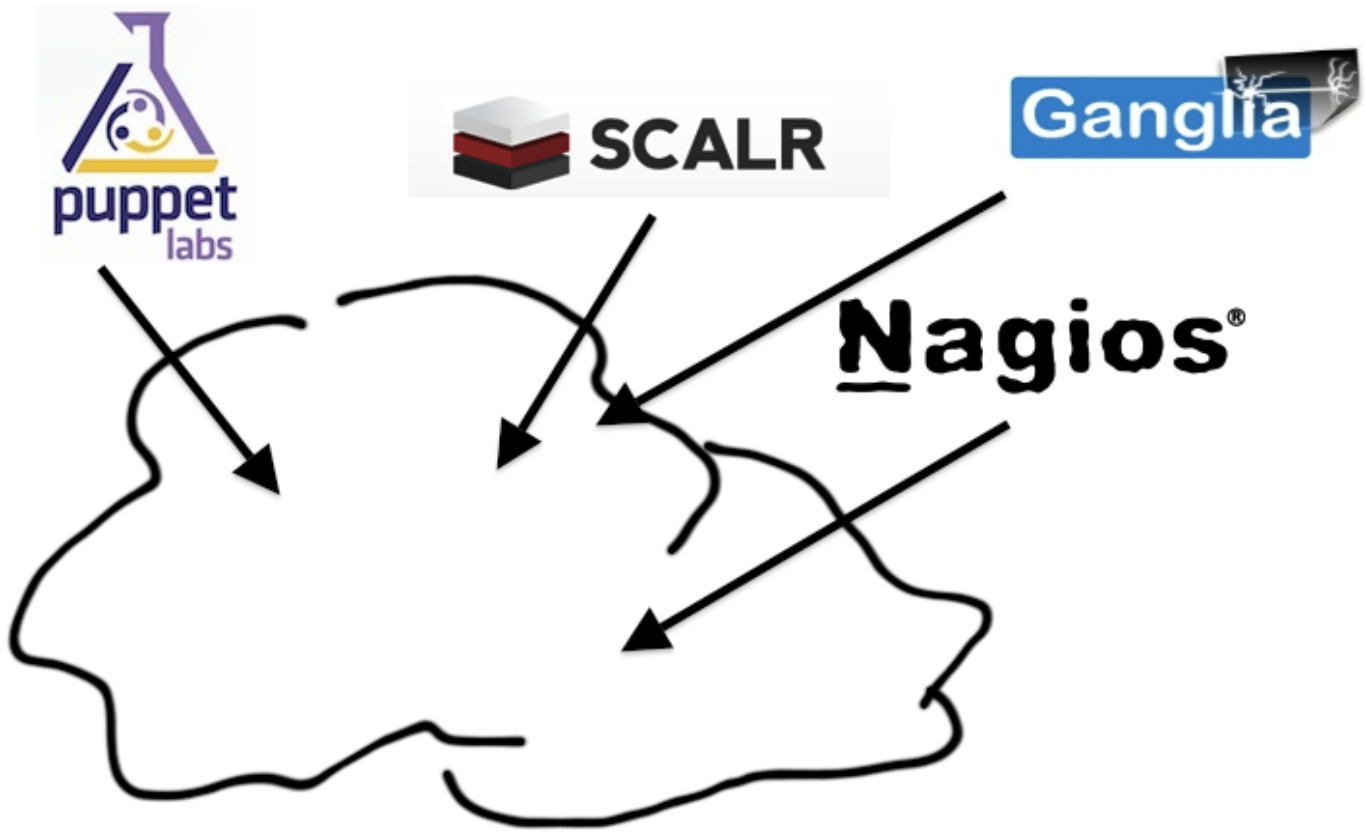
- Unified framework for your application and all components to communicate with each other
- Above the network hardware and network protocol layer
- Your application handles only discrete messages

Messaging

Open source offerings

- qpid (Apache)
- RabbitMQ (SpringSource / VMWare)
- ZeroMQ (iMatix)

Cluster management



Configuration management

- Configuration of your running cloud instances
- Software upgrades
- Dynamic configuration that cannot be stored onto OS images
- Relaxes storage constraints vs. using OS images

Configuration

Open source offerings

- Chef (Opscode)
- Puppet
- StarCluster (MIT)

Analytics

- Collection and visualization of the status of your cloud
  - Compute load
  - Network usage
- Dynamic load balancing and scaling of your cloud
  - Start new instances
  - Tear down existing instances

Analytics

Open source offerings

- Graphite (Orbitz)
- Scalr
- Nagios
- Ganglia

Questions?

For more info:
Michael Pan
mjpan@nephosity.com