CloudStack and Big Data

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Google trends

- Cloud computing trending down, while “Big Data” is booming. Virtualization remains “constant.”
BigData on the Trigger

- Cloud Computing Going down to the “through of Disillusionment”
- “Big Data” on the Technology Trigger

<table>
<thead>
<tr>
<th>Technology Trigger</th>
<th>Peak of Inflated Expectations</th>
<th>Trough of Disillusionment</th>
<th>Slope of Enlightenment</th>
<th>Plateau of Productivity</th>
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<tbody>
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<td>Years to mainstream adoption:</td>
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<tr>
<td>• less than 2 years</td>
<td>• 2 to 5 years</td>
<td>• 5 to 10 years</td>
<td>• more than 10 years</td>
<td>• obsolete before plateau</td>
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• Big Data
What is Big Data?

• Large scale datasets
  – From scientific instruments
  – From Web apps logs
  – From Health records...

• Complex datasets
  – Not necessarily large.
  – E.g Unstructured data
  – E.g Natural Language
  – E.g IBM Watson
A natural evolution

- From traditional file systems and databases
- To large scale object store and nosql movement designed to handle massive scale and concurrency
While BigData is often associated with HDFS, Map-Reduce is the algorithm used to parallelize data processing.

- BigData ≠ Map-Reduce ≠ HDFS
- Map-reduce is a way to express embarrassingly parallel work easily.
- You can do Map-Reduce without HDFS.
- E.g Basho map-reduce on riackCS
• CloudStack
How about IaaS?
IaaS is really:

• **A Data Center Orchestrator**
  – Data storage
  – Data movement
  – Data processing

• **That can:**
  – Handle failures
  – Support large scale
  – Be programmed
What is CloudStack?

• Open source Infrastructure as a Service (IaaS) solution.
• “Programmable” Data Center orchestrator
• Hypervisor agnostic (with addition of bare metal provisioning)
• Support scalable storage (Ceph, RIAK CS…)
• Support complex enterprise networking (e.g. Firewall, load
A bit of History

- Original company VMOPs (2008)
  - Founded by Sheng Liang former lead dev on JVM
- Open source (GPLv3) as CloudStack
- Acquired by Citrix (July 2011)
- Relicensed under ASL v2 April 3, 2012
- Accepted as Apache Incubating Project April 16, 2012
- First Apache (ACS 4.0) released November 2012
- Top Level Project Since March 2013
Why ASF?

• Open Sourced CloudStack to:
  – Build a community
  – Facilitate the building of an ecosystem
  – Faster time to market

• ASF highly recognized OSS foundation.
• ASF clear processes
• Individual contributions, companies have no standing
Monthly Contributors

![Graph showing the count of individual contributors over time. The graph distinguishes between users and developers.]

- Users
- Developers
Multiple Contributors

**Sungard:** Announced last week that 6 developers were joining the Apache project.

**Schuberg Philis:** Big contribution in building/packaging and Nicira support.

**Go Daddy:** Maven building.

**Caringo:** Support for own object store.

**Basho:** Support for RiakCS.
• The Apache Software Foundation
We consider ourselves not simply a group of projects sharing a server, but rather a community of developers and users.

The Apache Software Foundation provides support for the Apache community of open-source software projects, which provide software products for the public good.

The Apache projects are defined by collaborative consensus based processes, an open, pragmatic software license and a desire to create high quality software that leads the way in its field.
• 35 projects in incubation:
  – 11 Hadoop related (including Apache provisionr)
  – ~30% Big Data related
  – +jclouds

• 116 top level projects:
  – ~14 cloud or bigdata +10%
  – Deltacloud, Libcloud, Whirr
  – Hadoop, couchdb, cassandra
  – Bigtop, accumulo, lucene, UIMA
Hadoop Ecosystem

• Complex ecosystem to perform data processing on big-data

• Software components can be managed in VMs via CloudStack
• BigData and CloudStack
CloudStack and BigData

• Apache CloudStack is a data center orchestrator

• BigData solutions as **storage backends** for image catalogue and large scale instance storage.

• BigData solutions as **workloads** to CloudStack based clouds.
Storage

• **Primary Storage:**
  – Anything that can be mounted on the node of a cluster.
  – Cluster LVM, iSCSI, NFS, Ceph
  – Holds disk images of running VMs and user block stores.

• **Secondary Storage:**
  – Available across the zone
  – Holds snapshots and templates (image repo)
  – Can use multiple object stores (Gluster, Ceph, riackCS, Swift, Caringo)
“Big Data” solutions can be used as secondary storage (OpenStack swift, Caringo, CephFS, Gluster FS, RiackCS…).

- Used to deploy a large scale storage backend to manage user images, and user data volumes.
- Primary intent is not to use it inside the VMs for data processing.
CloudStack and Baremetal

• CS supports baremetal provisioning.
• This opens the door to multiple scenarios for Big-Data store, Clouds
  – Provision Hadoop cluster on baremetal
  – Operate “Hybrid” cloud: part Hypervisor for VM provisioning, part baremetal for data store.
  – Reconfigure entire cloud on-demand
“Traditional” CS deployment

- Farm of hypervisors, separate secondary storage to store VM images and data volumes.
“Bare Metal” Hybrid deployment

- Set of hypervisors, stand-alone secondary storage, bare metal cluster with specialized hardware or software.
- Access Big-Data store from VM guests
“Bare metal” cluster as secondary storage

• Use bare-metal provisioning to manage larges-scale secondary storage
“Pure” Big-Data store

- Use CS as a traditional data center provisioning system and build a Big-Data store on-demand
Combinations

• CloudStack offers the possibility to switch between these modes on-demand

• **An elastic reconfigurable cloud**

• Just be careful not to override your data ☝
Big Data as a Workload to the Cloud tools and demo...
Apache Whirr

- Big Data Provisioning tool
- Deploys Hadoop, cdh, Hbase, Yarn, etc in the Cloud
- Use jclouds
- Works with multiple cloud providers including CloudStack
jClouds

- Under Incubation at the Apache Software Foundation (ASF)
- Wrapper to multiple cloud providers
Whirr

Configuration

```text
whirr.cluster-name=myhadoopcluster
whirr.instance-templates=1 hadoop-jobtracker+hadoop-namenode,1 hadoop-datanode+hadoop-tasktracker
whirr.provider=cloudstack
whirr.private-key-file=${sys:user.home}/.ssh/id_rsa
whirr.public-key-file=${sys:user.home}/.ssh/id_rsa.pub
whirr.env.repo=cdh4
whirr.hadoop.install-function=install_cdh_hadoop
whirr.hadoop.configure-function=configure_cdh_hadoop
whirr.hardware-id=b6cd1ff5-3a2f-4e9d-a4d1-8988c1191fe8
whirr.endpoint=https://api.exoscale.ch/compute
whirr.image-id=1d16c78d-268f-47d0-be0c-b80d31e765d2

whirr.identity=<your access key>
whirr.credential=<your secret key>
```
• Demo ?
Other tools

• Brooklyn

Whirr Hadoop Cluster

• Apache Provisionr incubating
Others: Pallet

- Clojure based provisioning tool
- Provisions Hadoop clusters in the cloud.
- Equivalent to Whirr but in clojure
CloStack

- Clojure client for CloudStack
- Uses native CloudStack API
- Developed by @pyr at exoscale.ch, a CloudStack based public cloud providers
Storm is a free and open source distributed realtime computation system. Storm makes it easy to reliably process unbounded streams of data, doing for realtime processing what Hadoop did for batch processing. Storm is simple, can be used with any programming language, and is a lot of fun to use!

Storm has many use cases: realtime analysis, continuous computation, distributed RPC, etc. One benchmark clocked it at over a million tuples per second. It is scalable, fault-tolerant, guaranteed processed, and is easy to set up and operate.
On-Going Big-Data development

• Hadoop being an Apache project written in Java, there is great potential synergy between CloudStack and Hadoop:

  e.g Develop Elastic Map-Reduce mechanisms to provide map-reduce processing in CS backed by HDFS. Implementation of AWS EMR API.

• Integration of Basho map-reduce (coming in 4.2 release)
• ASF is a mentoring organization for GSoC

• CloudStack has several proposals under consideration
  – Improved CloudStack support in Apache Whirr and Provisionr
  – Integration of Apache Mesos with CloudStack
Info

• Apache Top Level project
• http://www.cloudstack.org
• #cloudstack on irc.freenode.net
• @cloudstack on Twitter
• http://www.slideshare.net/cloudstack
• http://cloudstack.apache.org/mailing-lists.html

Welcoming contributions and feedback, Join the fun!