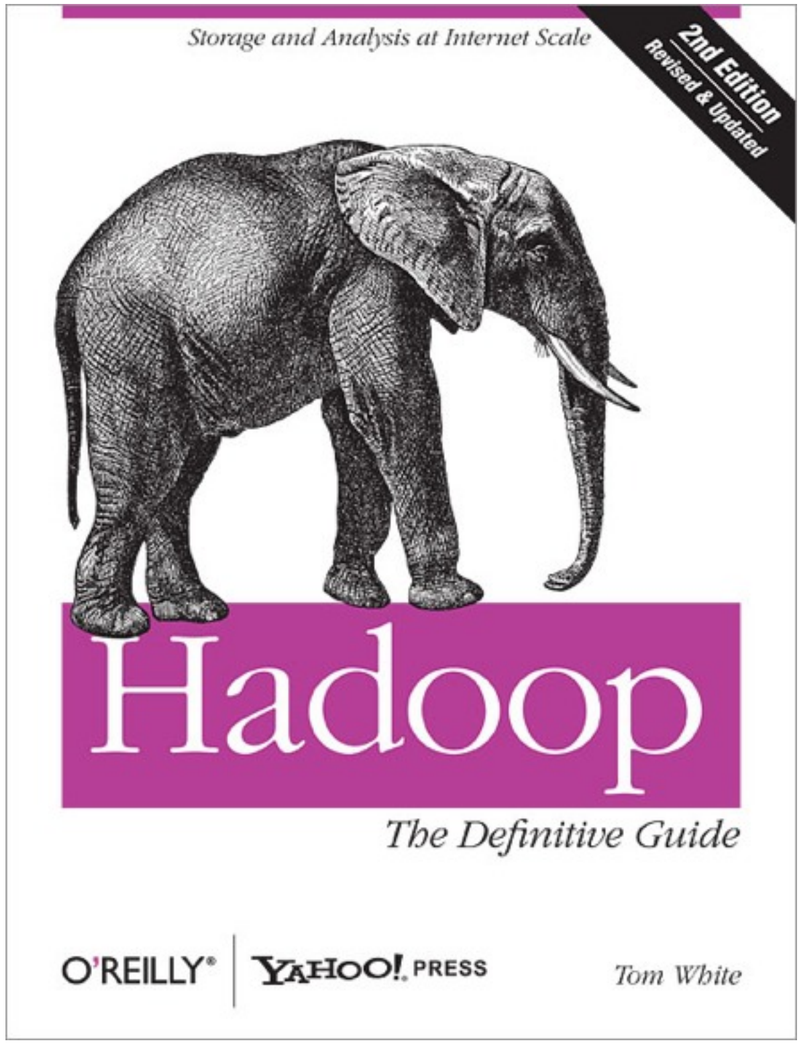
cloudera

Apache Whirr (Incubating)
Open Source Cloud Services

Tom White, Cloudera, @tom_e_white
OSCON Data, Portland, OR
25 July 2011

About me

- Apache Hadoop Committer, PMC Member, Apache Member
- Engineer at Cloudera working on core Hadoop
- Founder of Apache Whirr
- Author of “Hadoop: The Definitive Guide”
  - http://hadoopbook.com



Agenda

- What is Whirr?
- How to use Whirr
- How to write a Whirr Service
- Future work

What is Whirr?

Whirr is an easy way to run services in the cloud

Two aspects

- Make it easy for service writers to “Whirr-enable” their service
- Make it easy for users to consume Whirr services

Whirr in 5 minutes

bit.ly/whirr5

```
% curl http://www.apache.org/dist/incubator/whirr/whirr-0.5.0-
incubating/whirr-0.5.0-incubating.tar.gz | tar zxf -
% cd whirr-0.5.0-incubating
% ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa_whirr

% bin/whirr launch-cluster \
  --config recipes/zookeeper-ec2.properties \
  --private-key-file ~/.ssh/id_rsa_whirr \
  --identity=$AWS_ACCESS_KEY_ID \
  --credential=$AWS_SECRET_ACCESS_KEY

% echo "ruok" | nc $(awk '{print $3}' ~/.whirr/zookeeper/
instances | head -1) 2181; echo
```

1. Install

bit.ly/whirr5

```
% curl http://www.apache.org/dist/incubator/whirr/whirr-0.5.0-
incubating/whirr-0.5.0-incubating.tar.gz | tar zxf -
% cd whirr-0.5.0-incubating
% ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa_whirr

% bin/whirr launch-cluster \
  --config recipes/zookeeper-ec2.properties \
  --private-key-file ~/.ssh/id_rsa_whirr \
  --identity=$AWS_ACCESS_KEY_ID \
  --credential=$AWS_SECRET_ACCESS_KEY

% echo "ruok" | nc $(awk '{print $3}' ~/.whirr/zookeeper/
instances | head -1) 2181; echo
```

2. Run

bit.ly/whirr5

```
% curl http://www.apache.org/dist/incubator/whirr/whirr-0.5.0-
incubating/whirr-0.5.0-incubating.tar.gz | tar zxf -
% cd whirr-0.5.0-incubating
% ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa_whirr

% bin/whirr launch-cluster \
  --config recipes/zookeeper-ec2.properties \
  --private-key-file ~/.ssh/id_rsa_whirr \
  --identity=$AWS_ACCESS_KEY_ID \
  --credential=$AWS_SECRET_ACCESS_KEY

% echo "ruok" | nc $(awk '{print $3}' ~/.whirr/zookeeper/
instances | head -1) 2181; echo
```

3. Use

bit.ly/whirr5

```
% curl http://www.apache.org/dist/incubator/whirr/whirr-0.5.0-
incubating/whirr-0.5.0-incubating.tar.gz | tar zxf -
% cd whirr-0.5.0-incubating
% ssh-keygen -t rsa -P '' -f ~/.ssh/id_rsa_whirr

% bin/whirr launch-cluster \
  --config recipes/zookeeper-ec2.properties \
  --private-key-file ~/.ssh/id_rsa_whirr \
  --identity=$AWS_ACCESS_KEY_ID \
  --credential=$AWS_SECRET_ACCESS_KEY

% echo "ruok" | nc $(awk '{print $3}' ~/.whirr/zookeeper/
instances | head -1) 2181; echo

imok
```

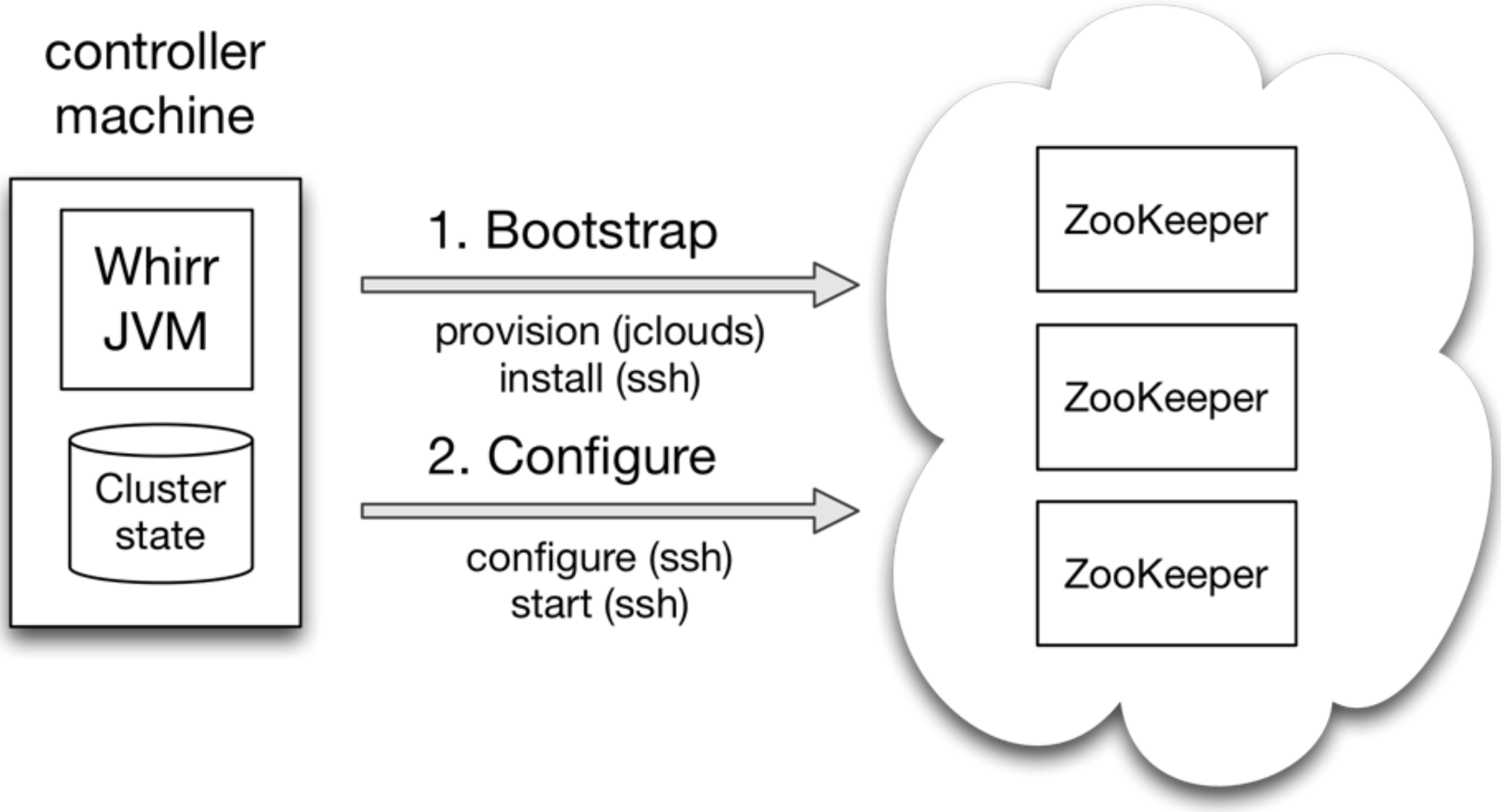
Configuration

- zookeeper-ec2.properties:

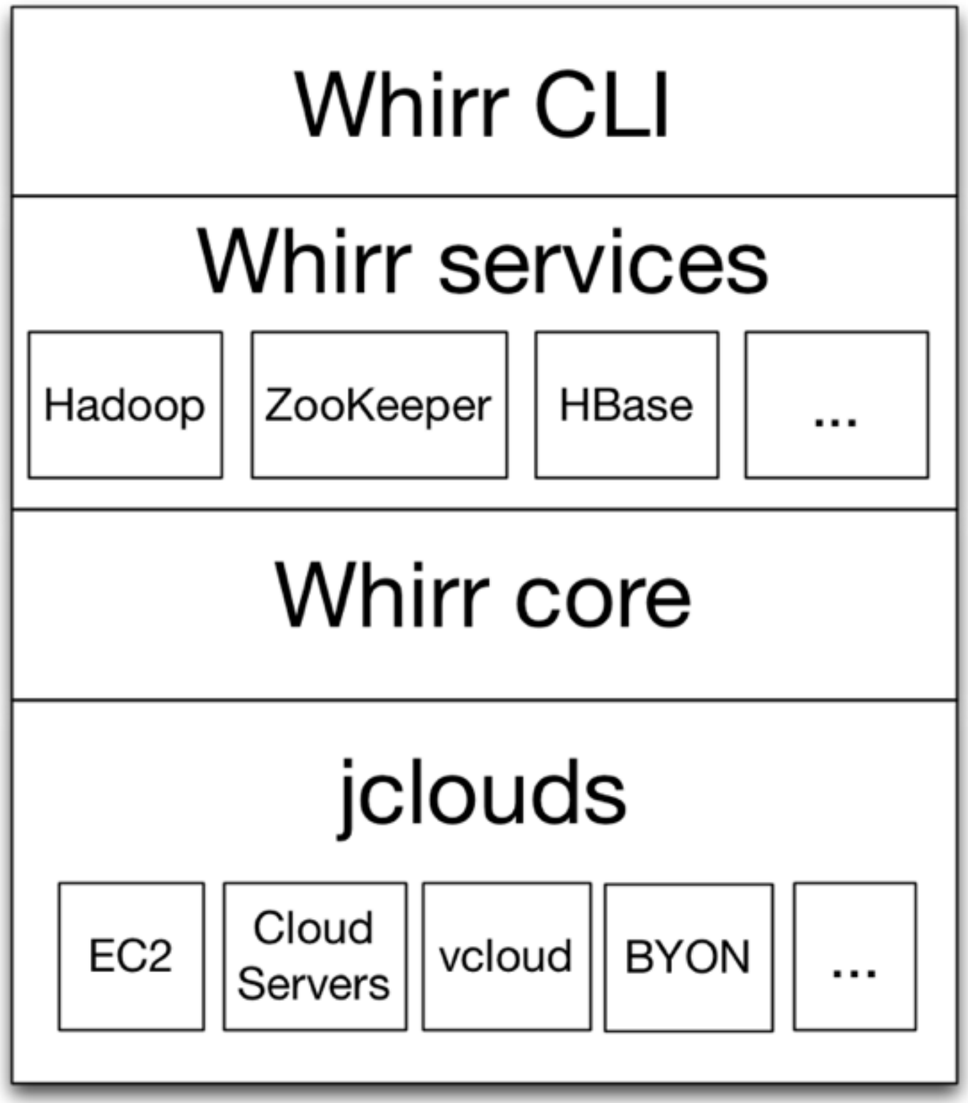
```
whirr.cluster-name=zookeeper
whirr.instance-templates=3 zookeeper

whirr.provider=aws-ec2
whirr.identity=${env:AWS_ACCESS_KEY_ID}
whirr.credential=${env:AWS_SECRET_ACCESS_KEY}
```

What did it do?



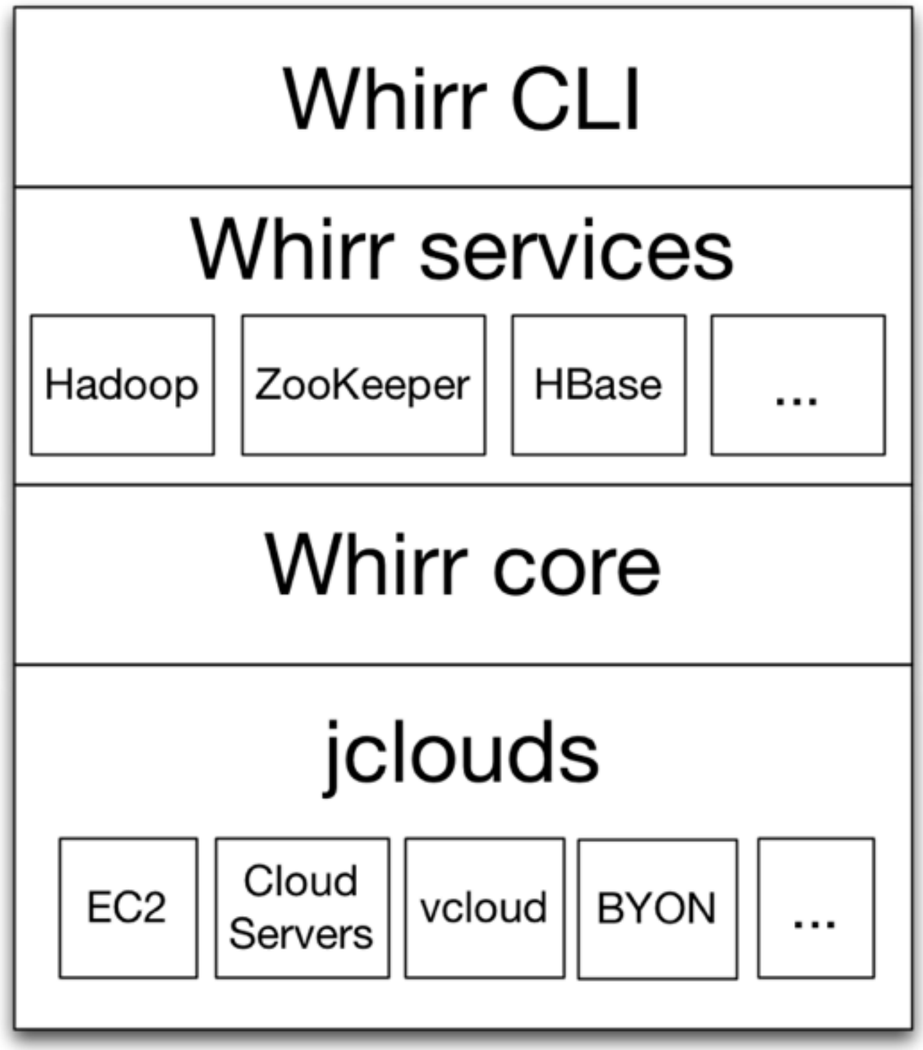
The Big Picture



jclouds is awesome

- ComputeService API for managing machines
  - Uniform API across ~20 providers
- BlobStore API for using key-value stores
  - Uniform API across ~10 providers
- Optionally use provider-specific APIs to use non-portable features
  - E.g. EC2 spot pricing
- Emphasis on testing and performance
- Vibrant, responsive community

The Big Picture



The Whirr Community

- Apache Whirr is currently undergoing Incubation at the Apache Software Foundation
- Over 1 year old
- 5 releases
- People: 10 committers (6 orgs), more contributors and users
- The Whirr community shares recipes
  - Cloud best practice (e.g. good images, hardware types)
  - Service configuration

4. Don’t forget to shutdown!

bit.ly/whirr5

```
% bin/whirr destroy-cluster --config recipes/zookeeper-
ec2.properties
```

How to use Whirr

Using Whirr from Java

```
Configuration conf = new PropertiesConfiguration(
    "recipes/zookeeper-ec2.properties"); //1
ClusterSpec spec = new ClusterSpec(conf); //2
ClusterController cc = new ClusterController(); //3
Cluster cluster = cc.launchCluster(spec); //4

String hosts = ZooKeeperCluster.getHosts(cluster); //5
ZooKeeper zookeeper = new ZooKeeper(hosts, ...); //6
// interact with ZooKeeper cluster

cc.destroyCluster(spec); //7
```

A Lifecycle API

- Very simple API
  - `ClusterController`
    - `Cluster launchCluster(ClusterSpec spec)`
    - `void destroyCluster(ClusterSpec spec)`
    - `Set<Instance> getInstances(ClusterSpec spec)`
- Whirr is not dependent on service libraries (e.g. ZooKeeper)
  - Version independent

Whirr is very customizable

- Version
  - Specify the version (e.g. `whirr.hadoop.version`)
  - Or the tarball to install (e.g. `whirr.hadoop.tarball.url`)
  - Dev workflow:
    - Build tarball – e.g. Hadoop with a patch you want to test
  - Start a cluster that uses this tarball specified as a file:// URI
  - Whirr will push tarball to a blob store and then download onto cloud instances

Customizing services

- Configuration
  - Set service properties
  - E.g. `hadoop-common.fs.trash.interval=1440`
    - Sets `fs.trash.interval` in the Hadoop cluster configuration
    - Whirr will generate the service configuration file for the cluster
- Customize nodes
  - E.g. install extra software on nodes simply by editing scripts

Characteristics of Whirr Clusters

- Short lived clusters with a small number of users
- Testing, manual or automated (e.g. Jenkins)
- Evaluation of services
- Ad hoc data exploration
  - Example: data POC
    - Load data from e.g. S3 into temporary cluster (Hadoop, HBase) for analysis
- Reproducibility
  - A way to share analysis. Can share datasets easily already, but Whirr makes it easy to reproduce results.

Whirr Use Cases

- Cloudera
  - Provides Whirr in CDH to make it easy to try out Hadoop
- Omixon
  - Uses Whirr to run human exome analysis
  - Regular job uses 10 machines
  - 80 gigabases exome pipeline runs in 4 hours
- Outerthought
  - Will use Whirr to do Lily cluster installs
  - Lily combines HBase and Solr to provide large-scale storage with indexing and search
- https://cwiki.apache.org/confluence/display/WHIRR/Powered+By

How to write a Whirr Service

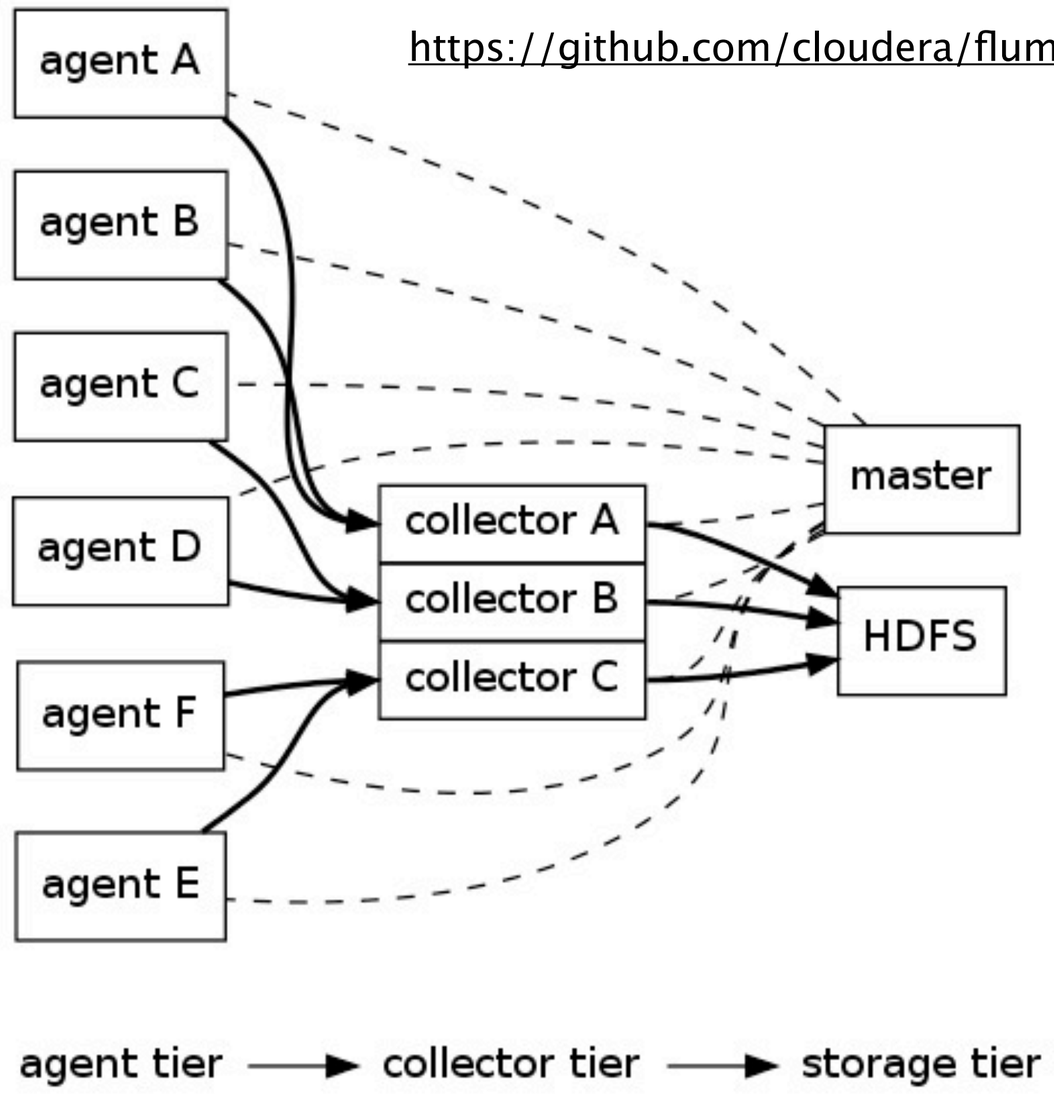
Steps in writing a Whirr service

- 1. Identify service roles
- 2. Write a ClusterActionHandler for each role
- 3. Write scripts that run on cloud nodes
- 4. Package and install
- 5. Run

1. Identify service roles

- Flume, a service for collecting and moving large amounts of data
- Flume Master
  - The head node, for coordination
  - Whirr role name: `flumedemo-master`
- Flume Node
  - Runs agents (generate logs) or collectors (aggregate logs)
  - Whirr role name: `flumedemo-node`

https://github.com/cloudera/flume



2. Write a ClusterActionHandler for each role

```
public class FlumeNodeHandler extends ClusterActionHandlerSupport {

  public static final String ROLE = "flumedemo-node";

  @Override public String getRole() { return ROLE; }

  @Override
  protected void beforeBootstrap(ClusterActionEvent event) throws IOException,
      InterruptedException {
    addStatement(event, call("install_java"));
    addStatement(event, call("install_flumedemo"));
  }

  // more ...
}
```

Handlers can interact...

```
public class FlumeNodeHandler extends ClusterActionHandlerSupport {

  // continued ...

  @Override
  protected void beforeConfigure(ClusterActionEvent event) throws IOException,
      InterruptedException {
    // firewall ingress authorization omitted

    Cluster cluster = event.getCluster();
    Instance master = cluster.getInstanceMatching(role(FlumeMasterHandler.ROLE));
    String masterAddress = master.getPrivateAddress().getHostAddress();
    addStatement(event, call("configure_flumedemo_node", masterAddress));
  }
}
```

3. Write scripts that run on cloud nodes

- install_java is built in
- Other functions are specified in individual files

```
function install_flumedemo() {
  curl -O http://cloud.github.com/downloads/cloudera/flume/flume-0.9.3.tar.gz
  tar -C /usr/local/ -zxf flume-0.9.3.tar.gz
  echo "export FLUME_CONF_DIR=/usr/local/flume-0.9.3/conf" >> /etc/profile
}
```

You can run as many scripts as you want

- This script takes an argument to specify the master

```
function configure_flumedemo_node() {
  MASTER_HOST=$1
  cat > /usr/local/flume-0.9.3/conf/flume-site.xml <<EOF
<?xml version="1.0"?>
<?xml-stylesheet type="text/xsl"  href="configuration.xsl"?>
<configuration>
  <property>
    <name>flume.master.servers</name>
    <value>$MASTER_HOST</value>
  </property>
</configuration>
EOF
  FLUME_CONF_DIR=/usr/local/flume-0.9.3/conf \
    nohup /usr/local/flume-0.9.3/bin/flume node > /var/log/flume.log 2>&1 &
}
```

4. Package and install

- Each service is a self-contained JAR:

```
functions/configure_flumedemo_master.sh
functions/configure_flumedemo_node.sh
functions/install_flumedemo.sh
META-INF/services/org.apache.whirr.service.ClusterActionHandler
org/apache/whirr/service/example/FlumeMasterHandler.class
org/apache/whirr/service/example/FlumeNodeHandler.class
```

- Discovered using java.util.ServiceLoader facility
  - META-INF/services/org.apache.whirr.service.ClusterActionHandler:

```
org.apache.whirr.service.example.FlumeMasterHandler
org.apache.whirr.service.example.FlumeNodeHandler
```

- Place JAR in Whirr's lib directory

5. Run

- Create a cluster spec file

```
whirr.cluster-name=flumedemo
whirr.instance-templates=1 flumedemo-master,1 flumedemo-node
whirr.provider=aws-ec2
whirr.identity=${env:AWS_ACCESS_KEY_ID}
whirr.credential=${env:AWS_SECRET_ACCESS_KEY}
```

- Then launch from the CLI

```
% whirr launch-cluster --config flumedemo.properties
```

- or Java

```
Configuration conf = new PropertiesConfiguration("flumedemo.properties");
ClusterSpec spec = new ClusterSpec(conf);
ClusterController cc = new ClusterController();
Cluster cluster = cc.launchCluster(spec);
// interact with Flume cluster
cc.destroyCluster(spec);
```

Orchestration

- Instance templates are acted on independently in parallel
- Bootstrap phase
  - start 1 instance for the `flumedemo-master` role and run its bootstrap script
  - start 1 instance for the `flumedemo-node` role and run its bootstrap script
- Configure phase
  - run the configure script on the `flumedemo-master` instance
  - run the configure script on the `flumedemo-node` instance
- Note there is a barrier between the two phases, so nodes can get the master address in the configure phase

Future Work

Challenges

- Complexity
- Degrees of freedom

  #clouds × #OS × #hardware ×
  #images × #locations × = a big number!
  #services × #configs

  - Known good configurations, recipes
  - Regular automated testing
  - Move common patterns into core
- Debugging – what to do when the service hasn't come up?
  - Logs

What's next?

- Add more services
  - Use Bigtop – packaging and testing for the Hadoop ecosystem
    - http://incubator.apache.org/projects/bigtop.html
- Support more cloud providers
- Support for configuration management systems like Puppet and Chef

- https://cwiki.apache.org/confluence/display/WHIRR/RoadMap

Questions

- Find out more at
  - http://incubator.apache.org/whirr
  - https://github.com/tomwhite/whirr-service-example
- IRC: #whirr on freenode
- Twitter: @tom_e_white