# Cloud-SAFE – Accounting for Cloud Computing

As private and hybrid clouds gain popularity in academia, it is becoming vital to find a way of ensuring that resources are used efficiently to benefit the community. Cloud-SAFE helps provide that way.

What is Cloud computing?

The National Institute of Standards and Technology define Cloud Computing as *"a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction".* In terms of Infrastructure as a Service (IaaS), the three main Open Source technologies are provided by Eucalyptus, OpenNebula and Nimbus.

Academic Clouds in the UK
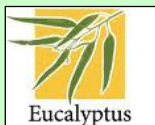
StACC is one of the foremost research clouds in the UK, launched at St. Andrews University in April 2009. StACC is powered by Eucalyptus which is based on the Amazons EC2 interface. Eucalyptus uses x509 certificates for authentication, and accounting information logged and stored.

ALICE (A Large Ion Collider Experiment) is one of the six detector experiments being constructed at the Large Hadron Collider at CERN. ALICE deploys CernVM on a Nimbus cloud as a means of provisioning additional computational resources for the project. Nimbus can turn a compute cluster into an IaaS cloud; and like Eucalyptus and OpenNebula, it supports Amazons EC2 interface.

BonFIRE is a large European funded project starting in June 2010. It aims to provide a test-bed for Future Internet Research and Experimentation (FIRE). It will deploy a distributed heterogeneous private cloud across Europe. It will be build from the OpenNebula tool kit. OpenNebula is compatible with both Amazon EC2 and ElasticHosts. It also supports the Open Grid Forum Open Cloud Computing Interface (OGF OGCI). OpenNebula records accounting information in sqlite and MySQL database.

Challenges – how to track usage?

There are numerous challenges to tracking usage on cloud facilities, as have been covered in a suite of reports from JISC on using the cloud for research (see Further Information below). The primary issue is that Eucalyptus, OpenNebula and Nimbus all record accounting information, but none of them make it accessible.

Any production services, including *'not for profit'* academic services, need to be able to demonstrate the usage of the system - and hence the benefits, of their service - for predefined reporting periods. Without the ability to report on and monitor usage, providers will find it challenging to administer the service and to show how the service benefits the community it serves and so justify its continued funding. Without an integrated and automated reporting mechanism, producing reports or monitoring usage can be prohibitively time consuming. Capacity planning is

Grid
SAFE

another area that is important for administrators, with the need to be able to apply policies in a dynamic fashion on cloud facilities. Finally, in an age of ever increasing power costs and a focus on carbon reduction, understanding usage is a significant consideration for any service.

Accounting data can also be useful to end users but only if a sophisticated access controls are in place to ensure that one user cannot view another user's data. Enabling users to access their usage data empowers them to understand their usage of the infrastructure and inform themselves of when capacity planning by administrators affects the work they are doing.

Cloud-SAFE – an accounting solution for Cloud Computing

Grid-SAFE, developed at EPCC with JISC funding, handles accounting, reporting and usage monitoring for advanced computing facilities. It is a software framework, which comprises a number of modularised components that can be assembled to provide end-to-end High Performance Computing (HPC) or Grid service management. Grid-SAFE supports both the username and password authentication, used in OpenNebula, and X509 certificate authentication, used in Eucalyptus and Nimbus. Grid-SAFE also has rich authorisation facilities built into the reporting system

which can restrict the report which users can view and data use in reports.
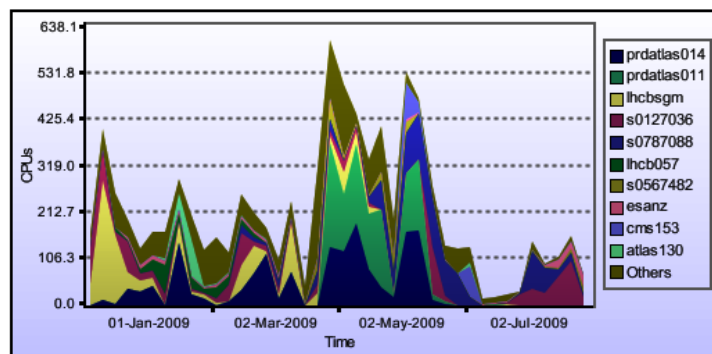
Grid-SAFE is customisable to support Cloud service management, creating **Cloud-SAFE**. Cloud usage records stored in log files or databases are processed - Eucalyptus, OpenNebula and Nimbus all store the required usage information. Parsers then access this data, interfacing to Grid-SAFE's feature-rich accounting and reporting components to allow user, managers and administrators to analyse the usage of their systems for reporting, billing and capacity planning.

Cloud-SAFE will enable service providers to report on the usage of their service and hence show its benefit. Cloud-SAFE will enable the user to understand and tune their usage of the cloud infrastructure. This will make the service more efficiently used and hence more valuable to the communities it serves. Grid-SAFE is available to download from **http://www.epcc.ed.ac.uk/projects/grid-safe**.

Please contact us for further information on how to support accounting on your cloud. gridsafe@epcc.ed.ac.uk

Further information

GridSAFE: http://www.epcc.ed.ac.uk/projects/grid-safe
NIST: http://csrc.nist.gov/groups/SNS/cloud-computing/
JISC Cloud Review:
             http://www.jisc.ac.uk/whatwedo/programmes/researchinfrastructure/
             cloudcomptechreview.aspx
StACC: http://www.cs.st-andrews.ac.uk/stacc
Eucalyptus : http://www.eucalyptus.com/
OpenNebula: http://opennebula.org/
ALICE: http://aliceinfo.cern.ch/Collaboration/
Nimbus: http://www.nimbusproject.org/