

A Survey of Cloud Simulation Tools

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Course:

Simulation and Modeling Techniques

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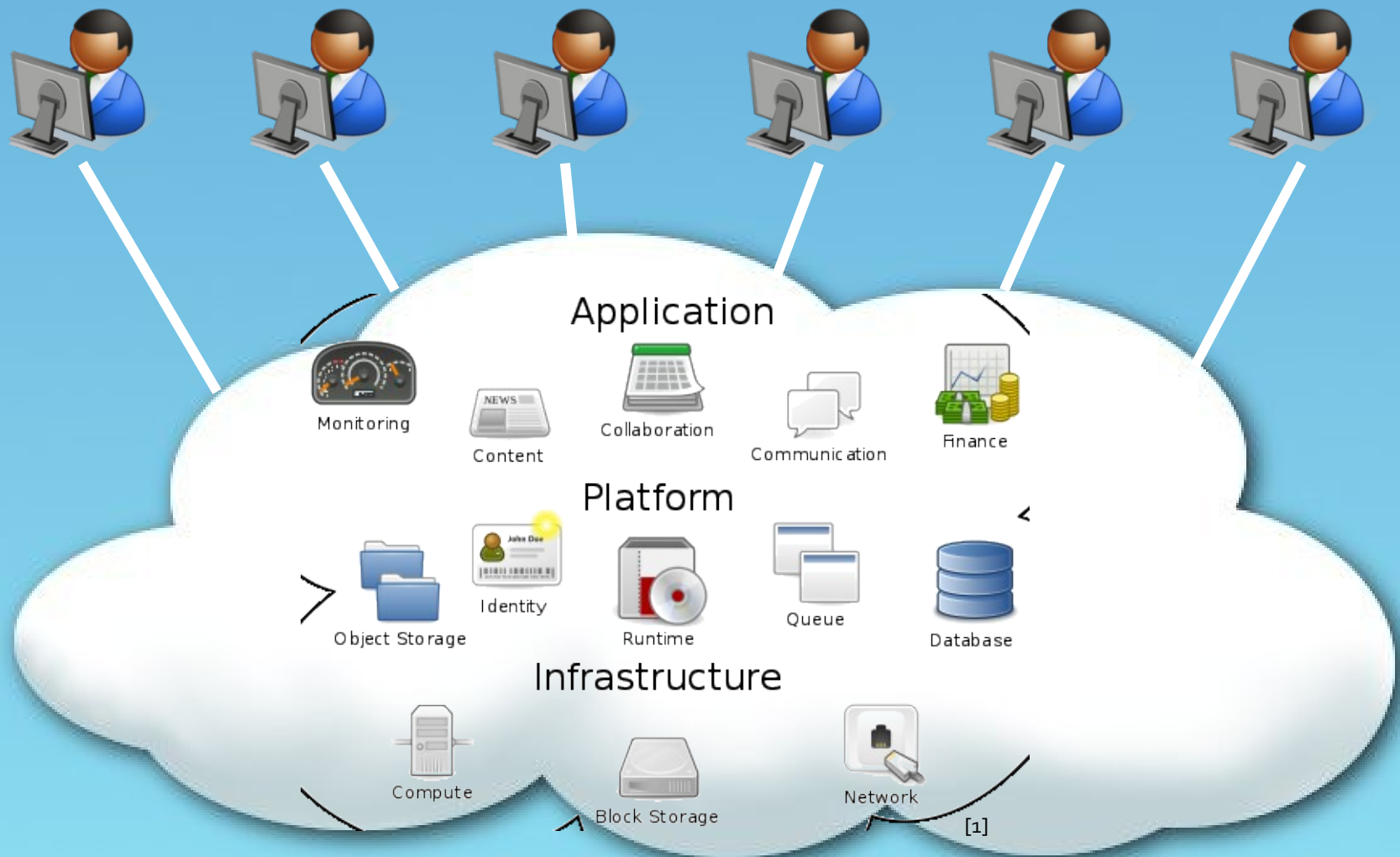
Agenda

- Introduction
- Cloud Simulation Tools
 - Overview
 - Main Features
 - Advantages
 - Disadvantages
 - Recent Developments and its future

Introduction

- What is the cloud?
- Service Models
- Deployment models
- Why we use cloud?
- Challenges

This is the Cloud!



Introduction (cont.)

- Cloud Definition:

- “Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to users as a utility (like the electricity grid) over a network (typically the Internet).” [1]

Service Models

- Cloud is often described as three tiers:
SaaS, PaaS, and IaaS.



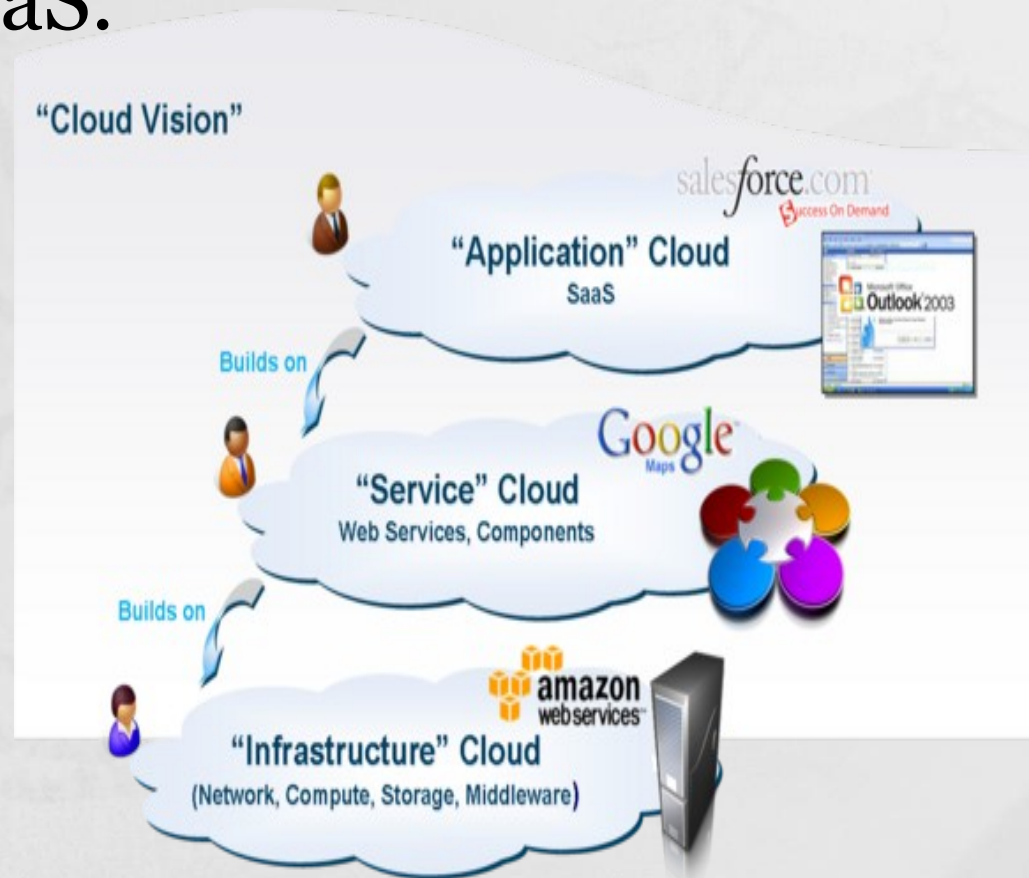
PLATFORM
AS A SERVICE-Build on it



SOFTWARE
AS A SERVICE-Consume it

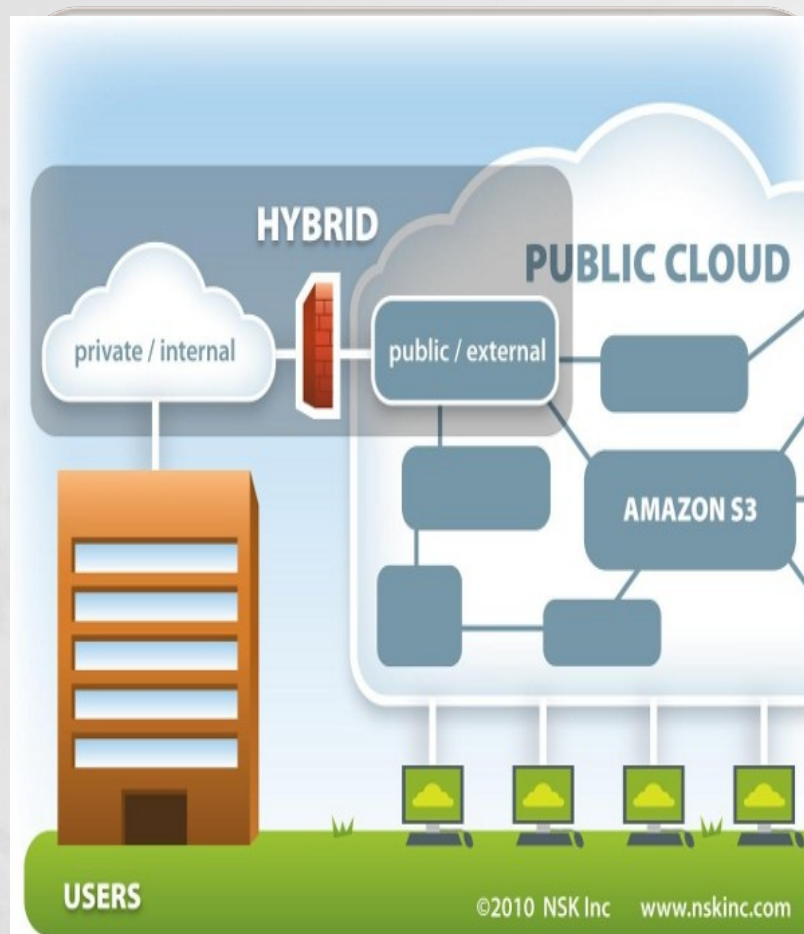


INFRASTRUCTURE
AS A SERVICE-Migrate to it



Deployment models

- Clouds can be classified by its way of administration: Public, Community, Private, and their Hybrid



Benefits

- No Software (SaaS)
- Rapid Implementation
- Automatically Updated
- Adaptability
- Accessibility
- Reduced Cost
- Scalability & Flexibility
- Reliability
- Maintenance

Challenges

- Data security
 - Security is the main problem involves with the cloud computing structure.
- Regulatory and constitutional restrictions
 - In some of countries, Government regulations do not allow personal information and other sensitive information to be physically located outside the state or country
 - In order to meet such requirements, cloud providers need to setup a datacenter or a storage site exclusively within the country to comply with regulations

Cloud Simulation Tools

- CloudSim
- CloudAnalyst
- GreenCloud
- iCanCloud
- MDCSim
- NetworkCloudSim
- VirtualCloud

CloudSim

- Motivation
 - provides a generalized and extensible simulation framework that enables modeling, simulation, and experimentation of emerging Cloud computing infrastructures and application services
- CloudSim is developed in the CLOUDS Laboratory, at the Computer Science and Software Engineering Department of the University of Melbourne.
- CloudSim Toolkit 3.0 released at Jan 13, 2012

CloudSim(cont.)

- Main Features

- support for modeling and simulation of large scale Cloud computing data centers
- virtualized server hosts, with customizable policies for provisioning host resources to virtual machines
- energy-aware computational resources
- data center network topologies and message-passing applications
- support for dynamic insertion of simulation elements, stop and resume of simulation
- support for user-defined policies for allocation of hosts to virtual machines and policies for allocation of host resources to virtual machines

CloudSim(cont.)

- HP and other leading organizations and also many universities around the world are using CloudSim for:
 - Cloud resource provisioning,
 - Energy-efficient management of data center resources,
 - Optimization of cloud computing
 - research activities
- Limitation: No Graphical User Interface (GUI)

CloudSim Architecture

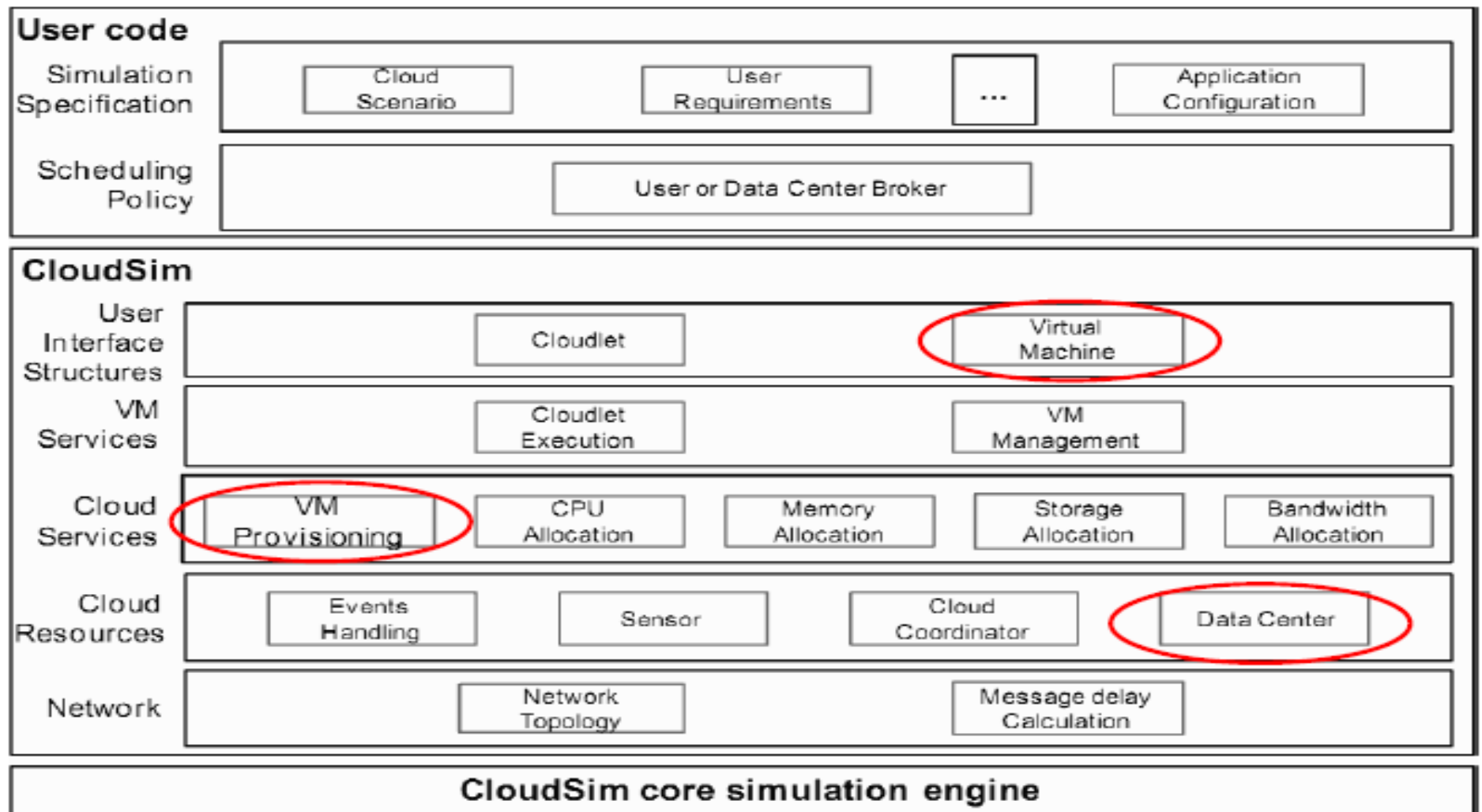


Figure 3. Layered CloudSim architecture.

CloudAnalyst

• Motivation

- A lack of tools that enable developers to evaluate requirements of large-scale Cloud applications in terms of geographic distribution of both computing servers and user workloads.
- Simulate large-scale Cloud applications with the purpose of studying the behavior of such applications under various deployment configurations.

CloudAnalyst (cont.)

- Main Feature

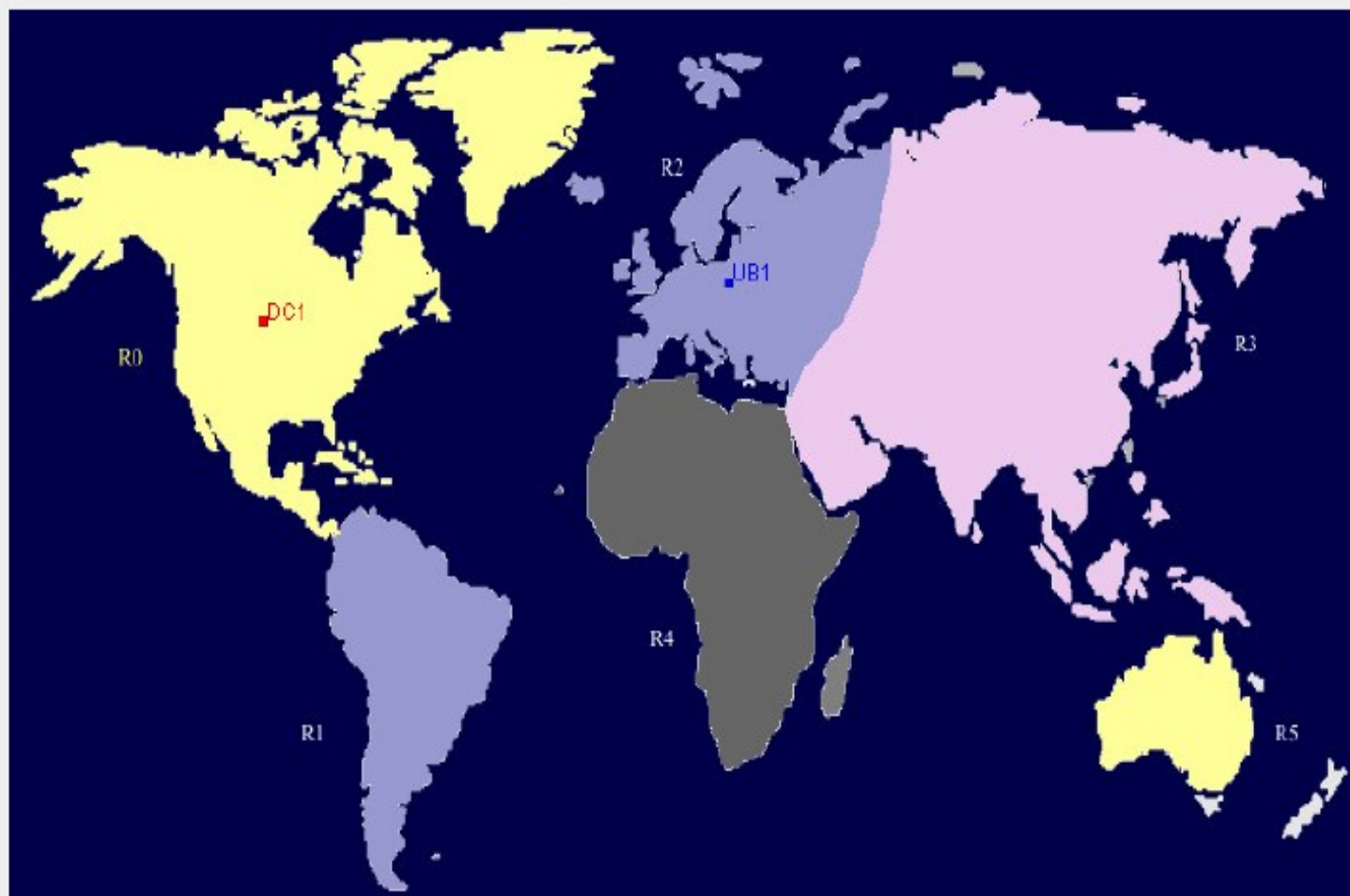
- Easy to use Graphical User Interface (GUI)
- Ability to define a simulation with a high degree of configurability and flexibility
- Repeatability of experiments
- Graphical output
- Use of consolidated technology and ease of Extension (Java Swing)

Configure
Simulation

Define Internet
Characteristics

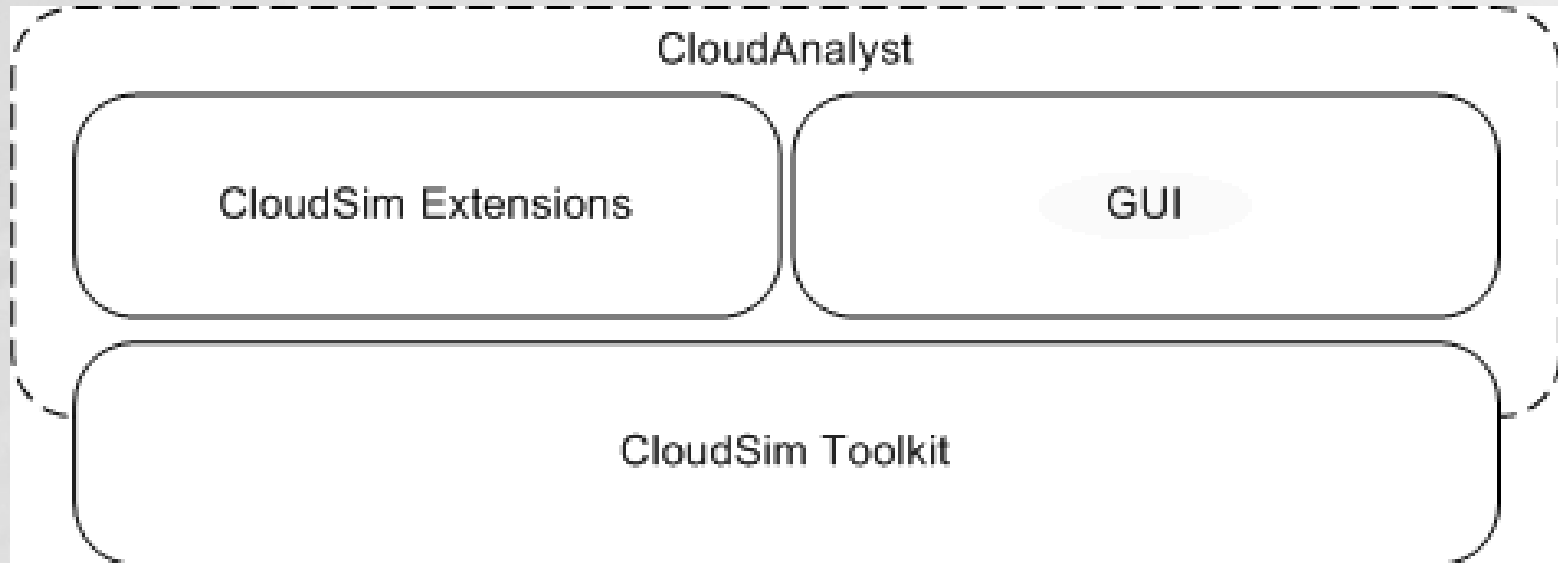
Run Simulation

Exit



Show Region Boundaries

CloudAnalyst architecture



CloudAnalyst can be used to model and evaluate a real world problem through a case study of a social networking application deployed on the cloud.

GreenCloud

- Motivation

- The lack of detailed simulators on the market was the motivation to develop GreenCloud that allows researchers to observe, interact and measure cloud performance.
- GreenCloud is a sophisticated open source cloud computing simulator
- Greencloud as been elaborated in the context of the GreenIT project.

GreenCloud

• Main Feature

- There also was no provisioning for observing clouds for their energy-efficiency
- Simulation environment for energy-aware cloud computing data centers.
- GreenCloud is an extension of the well-known NS2 network simulator.
- Focused primarily on the communications within a cloud, i.e., all of the communication processes are simulated on packet level.

GreenCloud Architecture

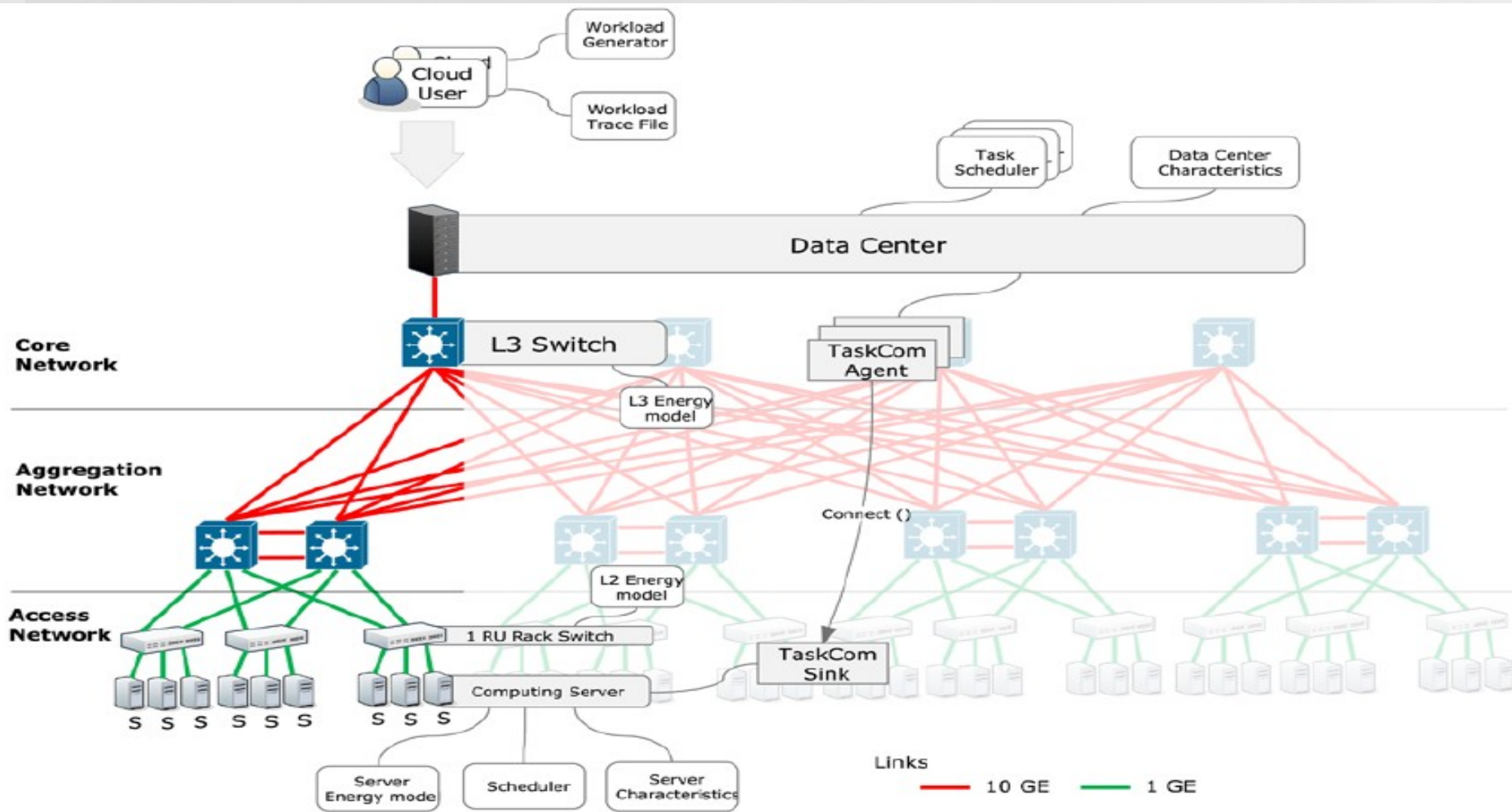


Fig. 4 Architecture of the GreenCloud simulation environment

Table 1 Comparison of cloud computing simulators

Parameter	GreenCloud	CloudSim	MDCSim
Platform	Ns2	SimJava	CSIM
Language/Script	C++/OTcl	Java	C++/Java
Availability	Open source	Open source	Commercial
Simulation time	Tens of minutes	Seconds	Seconds
Graphical support	Limited (Network animator)	Limited (CloudAnalyst)	None
Application models	Computation, Data transfer, and Exec. deadline	Computation, Data transfer	Computation
Communication models	Full	Limited	Limited
Support of TCP/IP	Full	None	None
Physical models	Available using plug in	None	None
Energy models	Precise (servers + network)	None	Rough (servers only)
Power saving modes	DVFS, DNS, and both	None	None

iCanCloud

- Motivation
 - model and simulate cloud computing systems
 - predict the trade-offs between cost and performance of a given set of applications executed in a specific hardware, and then provide to users useful information about such costs
 - simulating instance types provided by Amazon, so models of these are included in the simulation framework
- Developed by a research group (ARCOS) at Universidad Carlos III de Madrid, Spain

iCanCloud (cont.)

- Main Feature

- Both existing and non-existing cloud computing architectures can be modeled and simulated
- A flexible cloud hypervisor module
- Customizable VMs can be used to quickly simulate uni-core/multi-core systems.
- provides a user-friendly GUI to ease the generation and customization of large distributed models.
- provides a POSIX-based API and an adapted MPI library for modeling and simulating applications.
- New components can be added to the repository of iCanCloud to increase the functionality

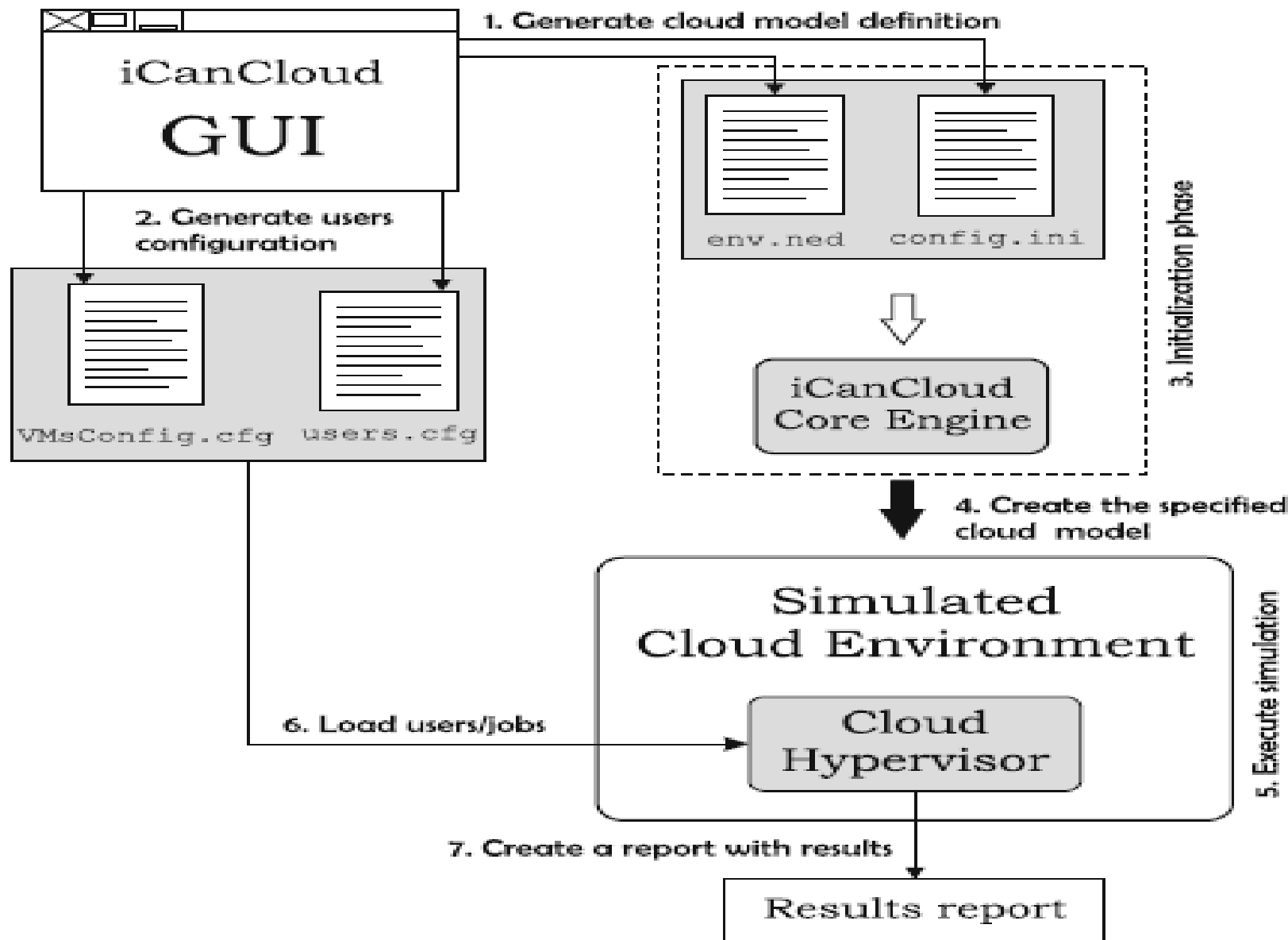


Fig. 6 iCanCloud configuration process

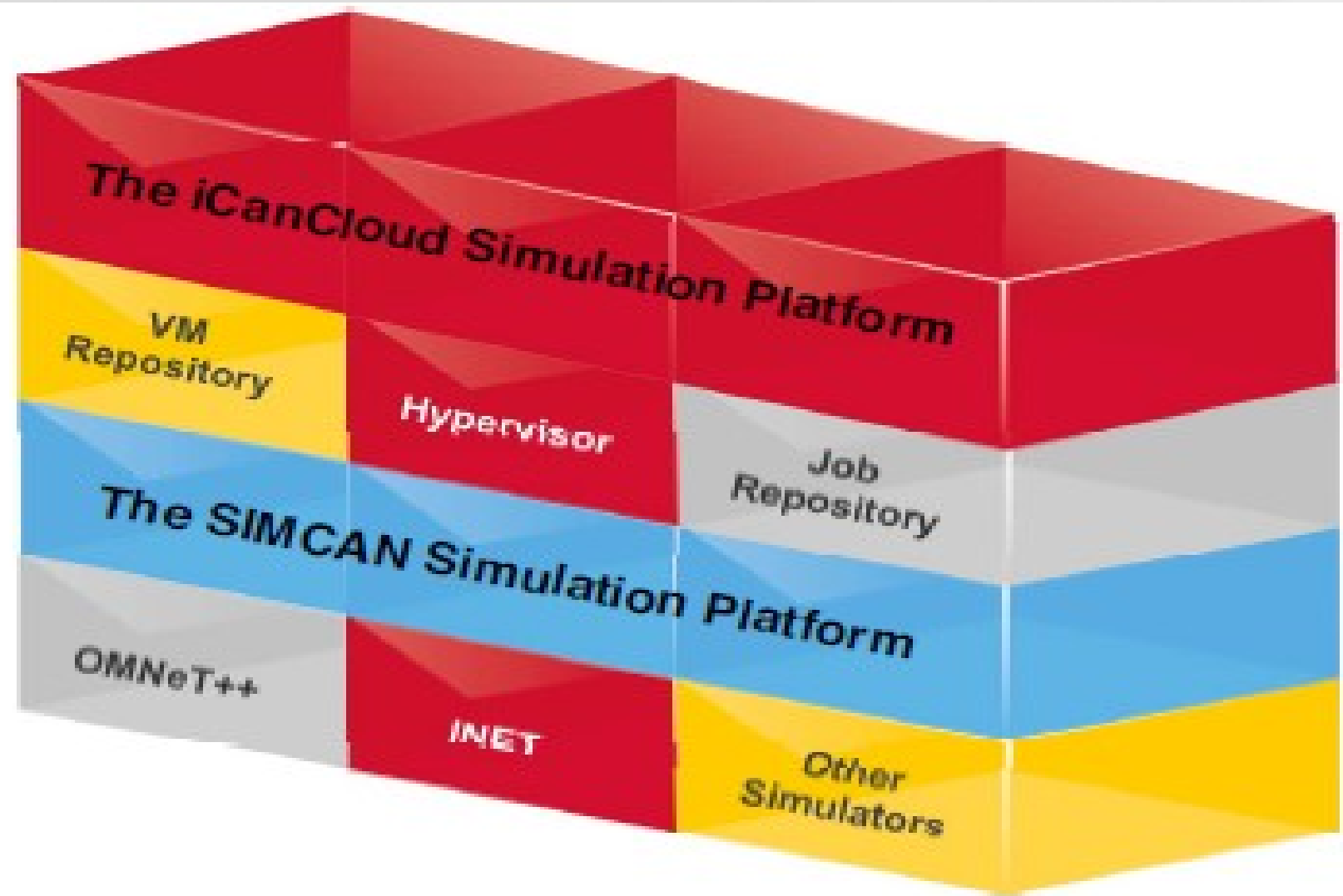


Fig. 1. Basic layered architecture of iCanCloud.

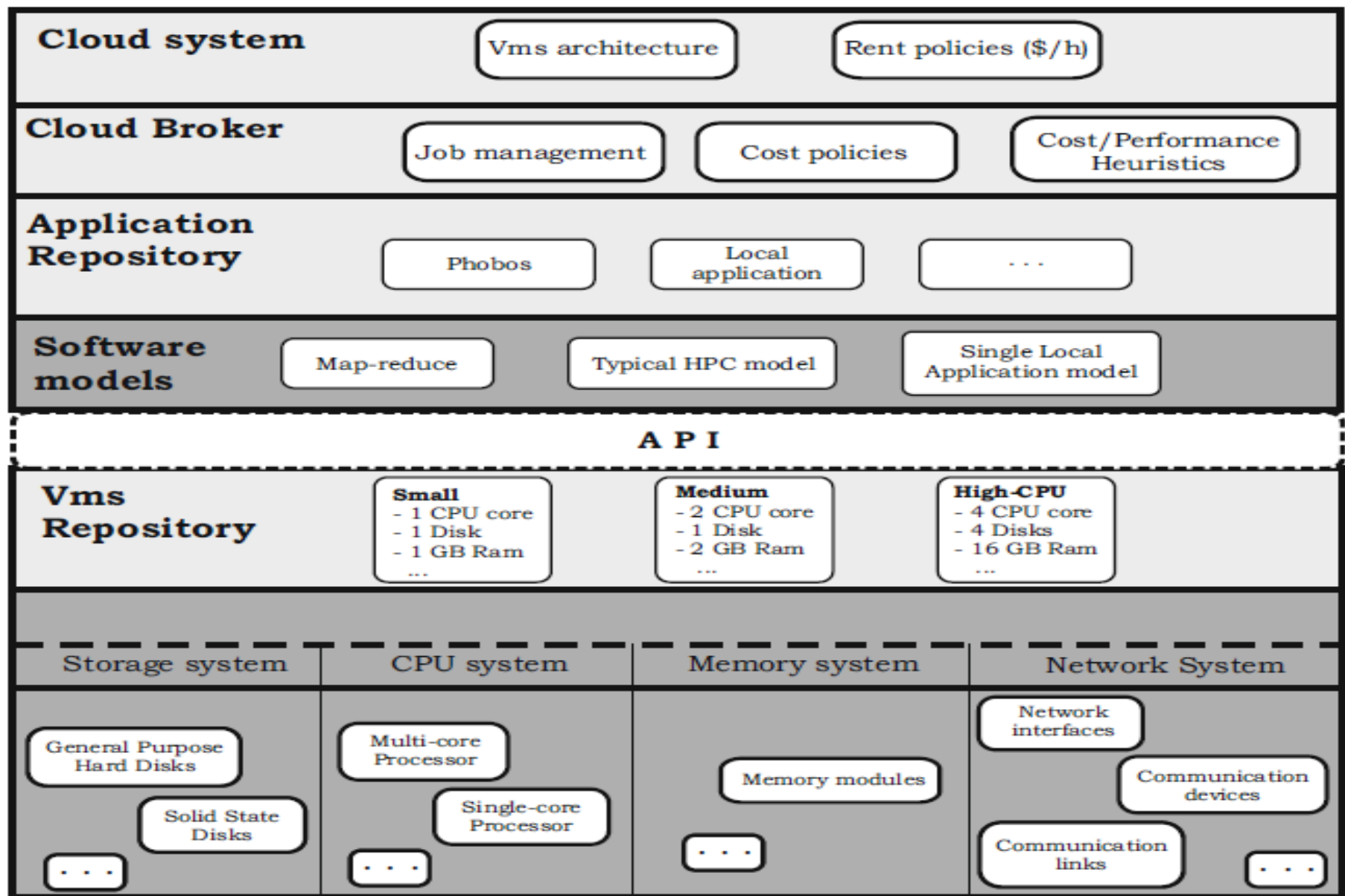


Fig. 1. Basic layered schema of iCanCloud architecture

Table 1 Summary of cloud simulators

Parameter	CloudSim	MDCSim	GreenCloud	iCanCloud
Platform	–	CSIM	NS2	OMNET, MPI
Language	Java	C++/Java	C++/OTcl	C++
Availability	Open source	Commercial	Open source	Open source
Graphical support	Limited (through CloudAnalyst [36])	None	Limited (through Nam [30])	Full
Communication models	Limited	Limited	Full	Full
Physical models	None	None	Available using plugin	Full
Models for public cloud providers	None	None	None	Amazon
Support for parallel experiments	No	No	No	WiP
Support for power consumption modeling	Limited	Yes	Yes	WiP

Conclusion

- We offer a general overview on the current development status of cloud simulator for the people who are not familiar with this topic
- We introduced four typical cloud simulators: CloudSim, CloudAnalyst, GreenCloud and iCanCloud
- According to our discussion, iCanCloud and GreenCloud performs better than other simulator.

Thank you 😊