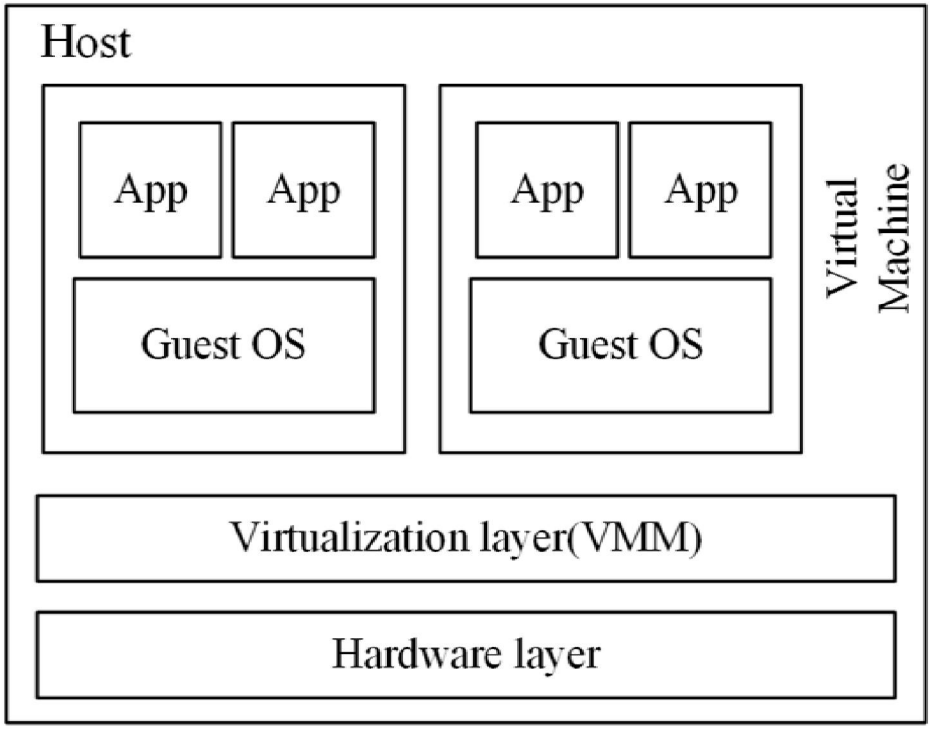
Cloud Computing Simulation tools

Components of Cloud Computing

Host: Server that **accepts connections from clients** who request a service function.

A cloud host is a server that provides services to customers via **multiple connected servers** that comprise a cloud.

A virtual machine is an **emulated computer system** created using software.



Simulation Tools

What is Simulation?

Without creating an actual structure we see the results by modeling a dummy structure having same parameters.

Why Simulation is Required?

Cloud computing requires a large amount of infrastructure and huge amount of money is required for it.

To know the feasibility of cloud for a particular application we simulate it.

Cloud Computing Simulation Softwares/Tools

Open Source Cloud Computing Simulators

- GreenCloud
  - Simulation environment for **energy-aware** cloud computing data centres.
  - Modelling of the **energy consumed by the data centre's** IT equipment
- iCanCloud
  - Simulation platform supports the simulation of **large storage networks**
  - Predicting the trade-offs between cost and performance of a given set of applications executed in specific hardware.

- EMUSIM
  - Integrated Emulation and Simulation(EMUSIM).
  - **Combines emulation and Simulation** (CloudSim) to enable more accurate models
- GroudSim
  - Designed for **scientific applications** on grid and cloud environments.
- DCSim (Data Centre Simulation)
  - Framework for performing **high-end experiments on data centre** management techniques
- CloudAnalyst
  - **GUI based simulator** derived on the bases of CloudSim
  - Evaluation of social network tools according to the **geographical distribution of users and data centres**.

CloudSim Tool

CloudSim is a simulation toolkit that supports the **modeling and simulation of the core functionality of cloud**.

Developed in the CLOUDS Laboratory, at the Computer Science and Software Engineering Department of the University of Melbourne.

Provides environment to

- Test application services in a **repeatable** and **controllable** environment.
- Tune the **system bottlenecks** before deploying apps in an actual cloud.
- Experiment with **different workload mix** and resource performance scenarios.

Features

- Large scale Cloud computing data centers
- Virtualized server hosts, with customizable policies for provisioning host resources to virtual machines
- Application containers
- Energy-aware computational resources
- Data center network topologies and message-passing applications
- Dynamic insertion of simulation elements, stop and resume of simulation
- User-defined policies for allocation of hosts to virtual machines and policies for allocation of host resources to virtual machines

Limitations

- Not Suitable for real-time applications, security algorithms, platform implementations, etc
- No Graphical User Interface (GUI) is available

Frequently used for

- Load Balancing of resources and tasks
- Task scheduling and its migrations
- Optimizing the Virtual machine allocation and placement policies
- Energy-aware Consolidations or Migrations of virtual machines
- Optimizing schemes for Network latencies for various cloud scenarios

Versions of CloudSim

- CloudSim 1.0 beta
- CloudSim 2.X
  - CloudSim 2.0
  - CloudSim 2.1
  - CloudSim 2.1.1
- CloudSim 3.X
  - CloudSim 3.0.1
  - CloudSim 3.0.2
  - CloudSim 3.0.3
- CloudSim 4.0
- CloudSim 5.0 (Latest release)

Versions of CloudSim

CloudSim 1.0 to CloudSim 2.0 : New Simulation Core, Improvement In Schedulers

CloudSim 2.X to CloudSim 3.0 : New Vm Scheduler, New Datacenter Network Model, New Vm Allocation And Selection Policies Etc.

CloudSim 3.X to CloudSim 4.0 : Added support for Container virtualization, Bugfixes

CloudSim 4.0 to CloudSim 5.0 : VM extensions with performance monitoring, Work with other simulation models such as Software-defined Networks (SDN) / Service Function Chaining (SFC).

Other Related Tools

Cloudsim 3.x.x became base for many other tools

- CloudSimEx
  - Set of **extensions** for the CloudSim simulator
    - Web session modeling, Better logging utilities, Utilities for generating CSV files for statistical analysis, Automatic id generation, Utilities for running multiple experiments in parallel, MapReduce simulation.
- EdgeCloudSim
  - Simulation environment **specific to Edge Computing** scenarios
    - Experiments that considers both computational and networking resources
- WorkflowSim
  - Support of workflow preparation and execution
    - With an implementation of a stack of workflow parser, workflow engine and job scheduler.

- CloudReports
  - Graphic tool that **simulates distributed computing environments** based on the Cloud Computing paradigm
- CloudAnalyst
  - Evaluation of social networks tools according to **geographic distribution of users** and data centers.
- iFogSim
  - Enables modelling and **simulation of Fog computing** environments.
  - Evaluation of resource management and scheduling policies across edge and cloud resources under different scenarios

Classes of CloudSim

Datacenter

Models the **core infrastructure-level services**, that will consist set of Hosts which is responsible for managing VMs during their life cycle.

Host

Physical computing node in a Cloud with processing capabilities, memory, storage and scheduling policy for allocating processing cores to Virtual Machines

VM

Models a Virtual Machine. Host can simultaneously instantiate multiple VMs and allocate cores based on processor sharing policies(Space shared, Time shared).