CloudSim: A Toolkit for Modeling and Simulation of Cloud Computing Environments

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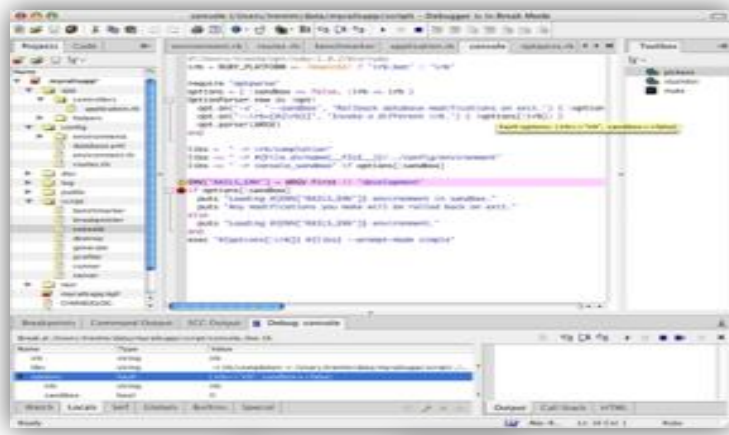
Outline

- *Introduction*
- *Related Work*
- *CloudSim Architecture*
- *CloudSim Modelings*
- *Design and Implementation*
- *CloudSim Steps*
- *Conclusions and Future works*
- *Green Cloud*

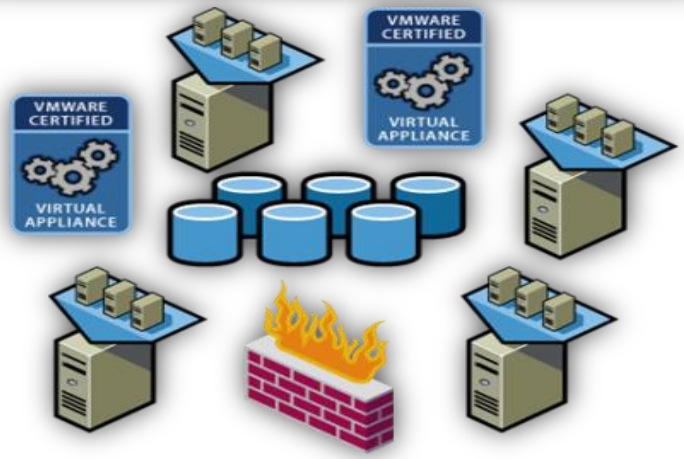
Introduction(1/2):Cloud

- *Cloud computing delivers: XaaS*

- *X :{Software, Platform, Infrastructure }*



✓*So users can access and deploy applications from anywhere in the Internet driven by demand and QoS requirements.*



Introduction(2/2)

Why Simulation?

Cloud Provider Challenges:

- *Maintain Quality of Service*
- *Efficient Resource Utilization*
- *Dynamic Workload*
- *Violation of Service Level Agreement*
- *Difficulties in Testing*

It's not possible to perform benchmarking experiments in repeatable, despensable, and scalable environment using real-world Cloud.

Possible alternative: Simulation Tool

Related Works

Grid simulators:

- *GridSim*
- *SimGrid*
- *OptoSim*
- *GangSim*

But none of them are able to isolate the multi-layer service abstractions(SaaS/PaaS/IaaS), differentiation, and model the virtualized resources required by Cloud.

A holistic software framework for modeling Cloud computing environments and Performance testing application services.

CloudSim

Features & Advantages

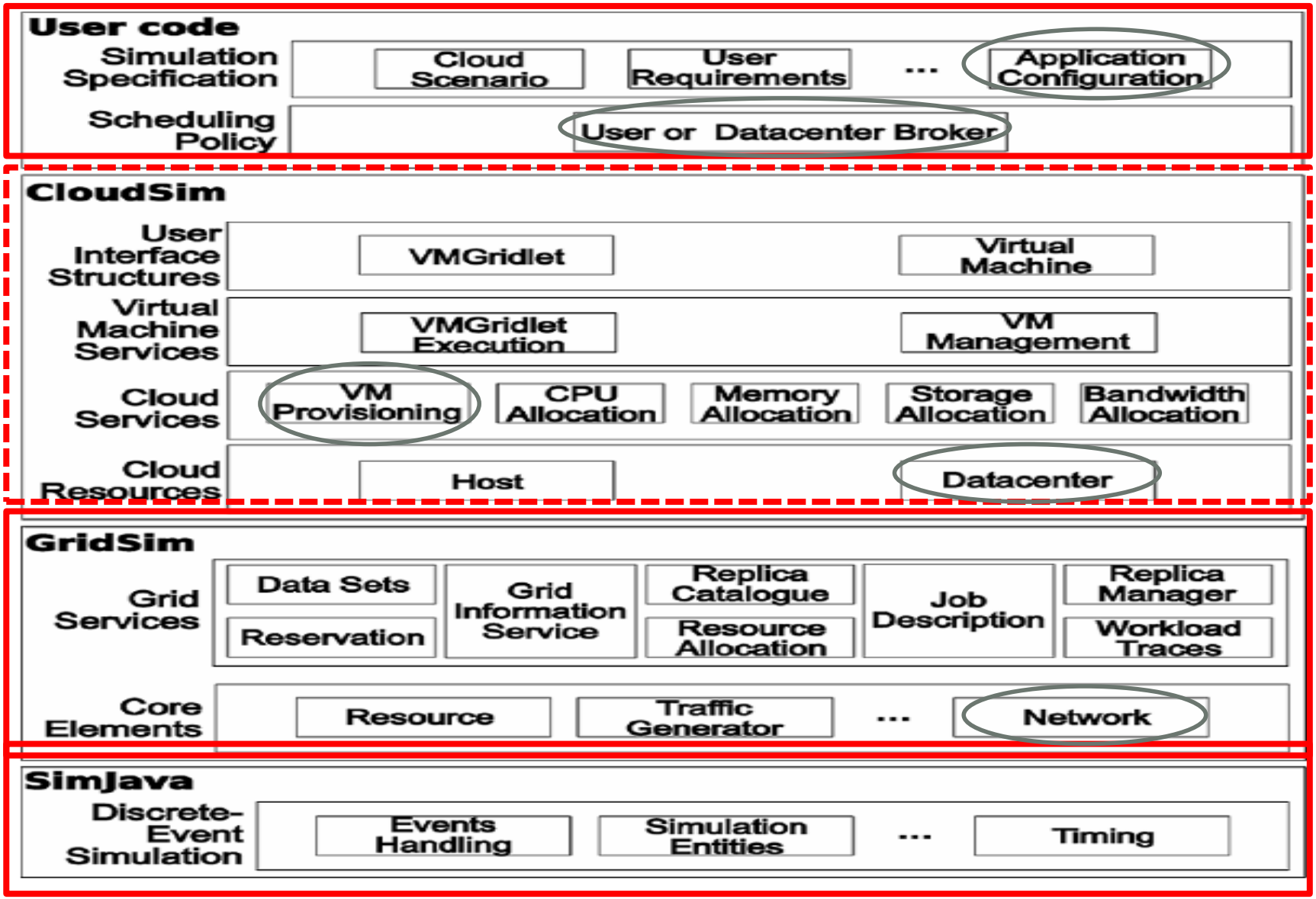
❖ *Features*

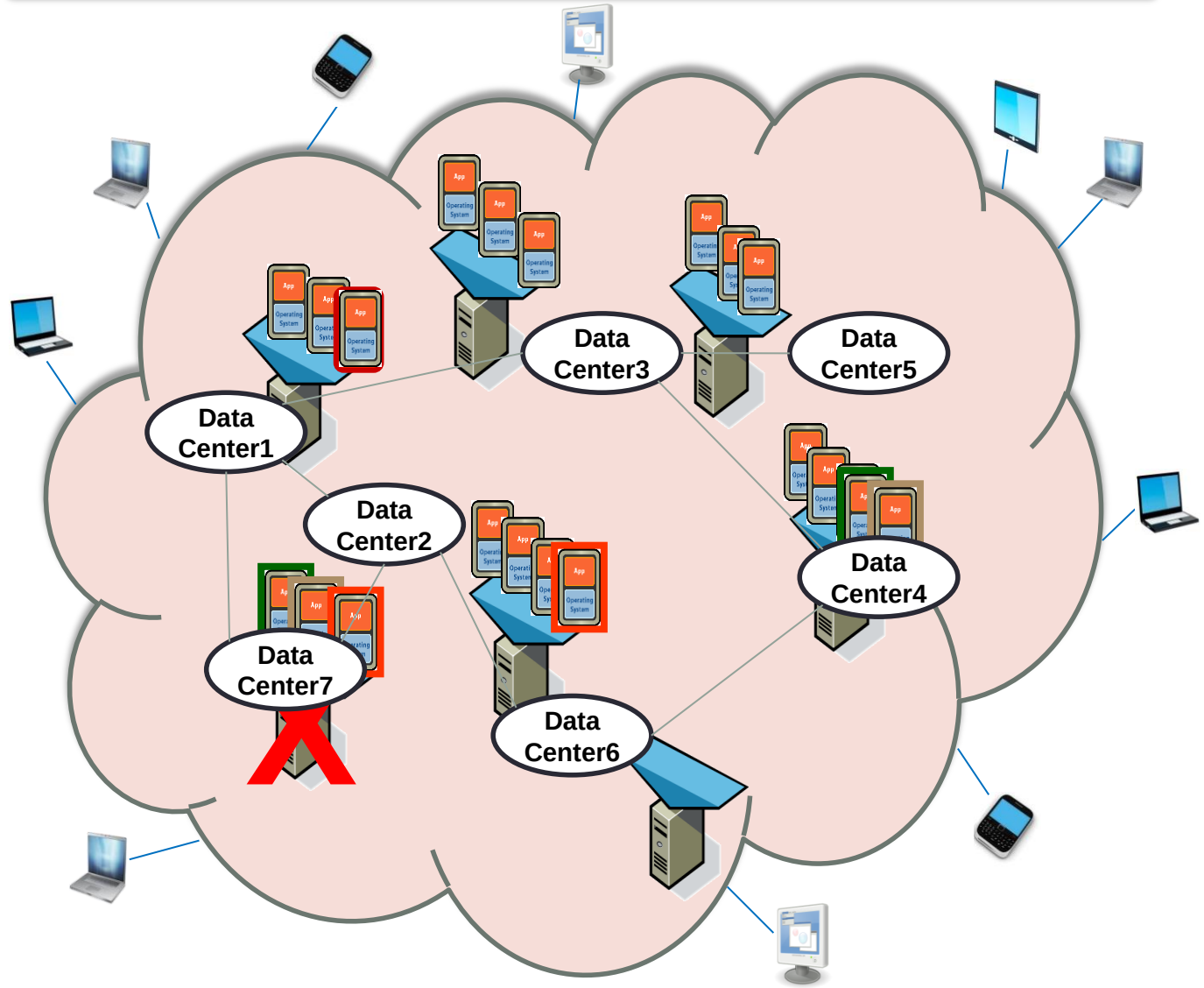
- *Discrete Time Event-Driven*
- *Support modeling and simulation of large scale Cloud computing environments, including data centers*
- *Support simulation of network connections among simulated elements*

❖ *Advantages*

- *Time effectiveness*
- *Flexibility and applicability*
- *Test policies in repeatable and controllable environment*
- *Tune system bottlenecks before deploying on real clouds*

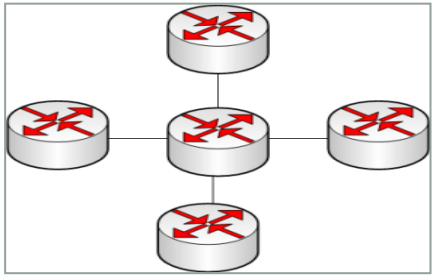
Layered CloudSim Architecture(1/7)

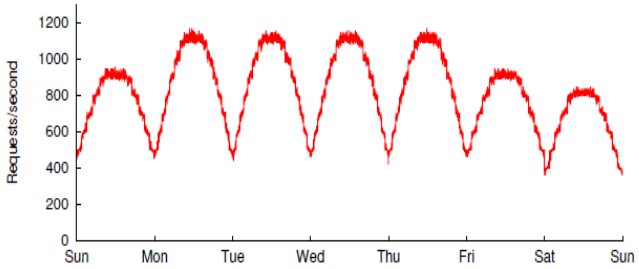


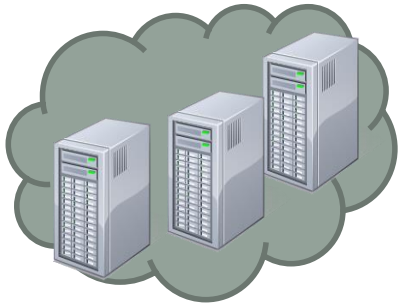

Data Center1
Data Center2
Data Center3
Data Center4
Data Center5
Data Center6
Data Center7

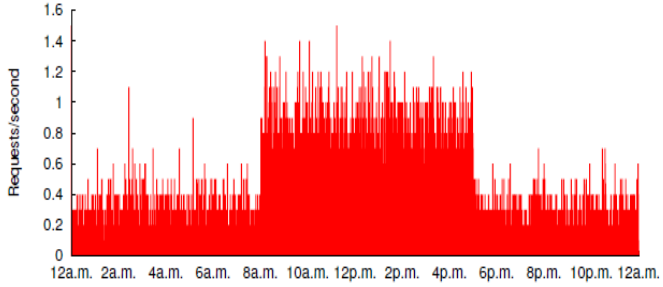
Modeling in Cloudsim (1/5)

- *Modeling DataCenter*
- *Modeling VM Allocation*
- *Modeling Network Behavior*
- *Modeling Dynamic Workloads*
- *Modeling Power Consumption*

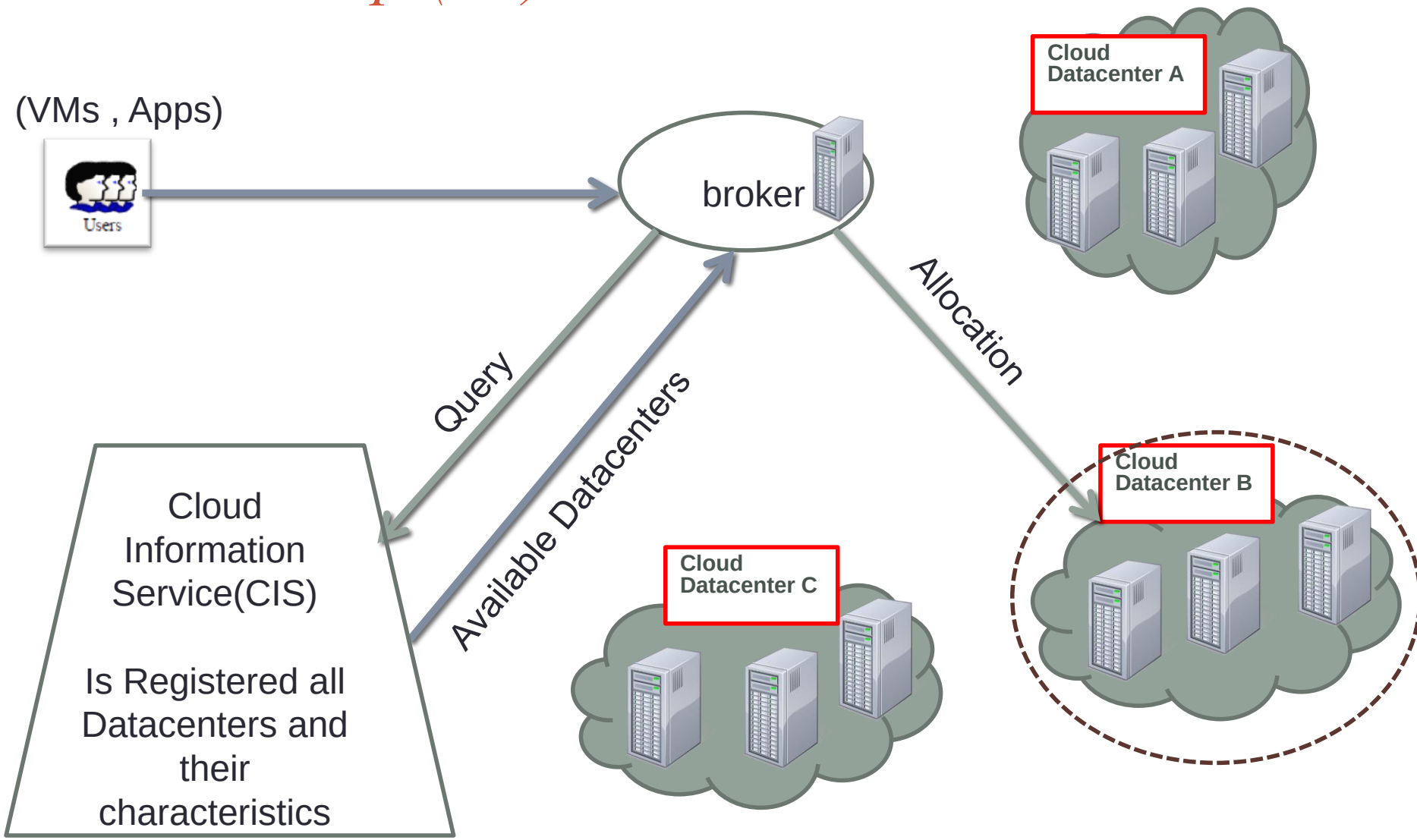




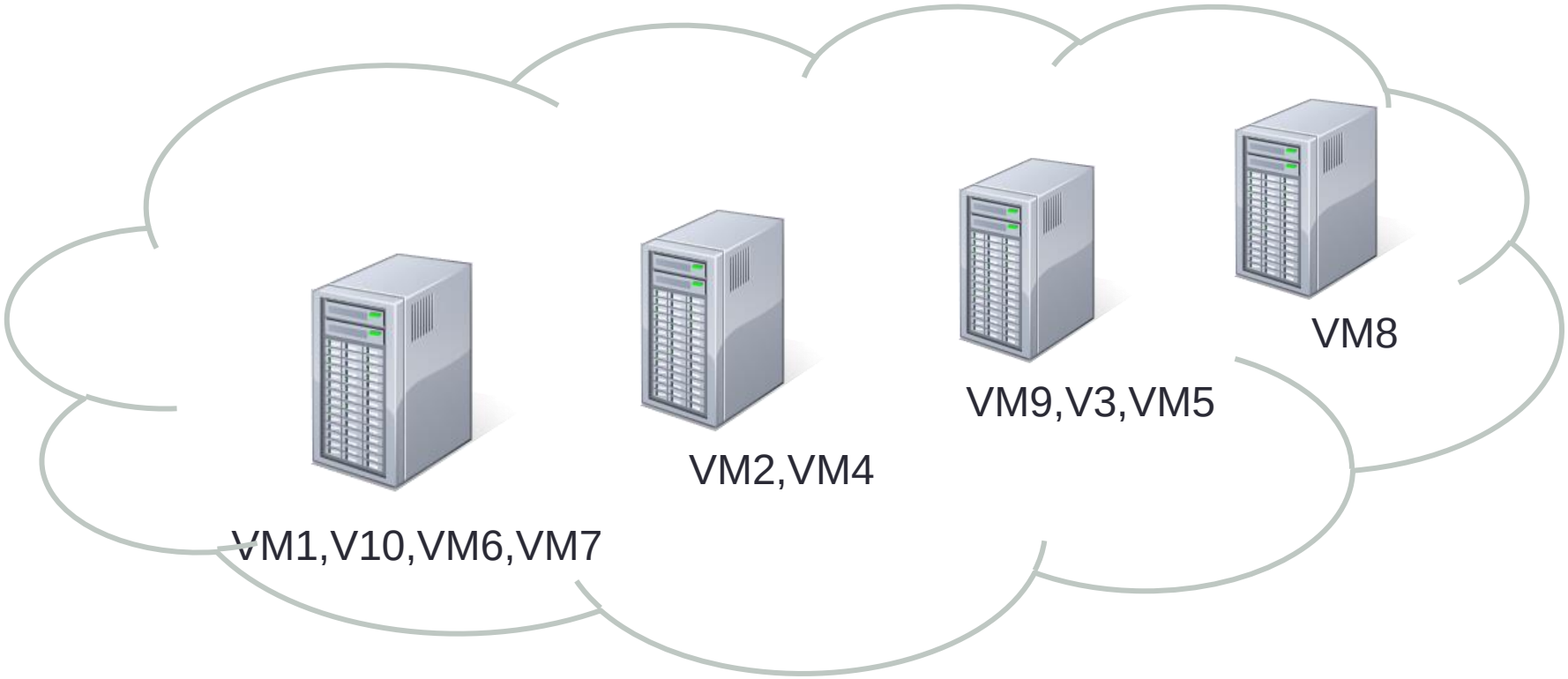




CloudSim Steps(1/2)



Allocation Policies: Enough Capacity, Ram, Storage, Bandwidth



Scheduling Policies: Sharing of Host mips between VMs

- *Space Shared*
- *Time Shared*

Datacenter Modeling

- *Number of Hosts, VMs and Cloudlets (tasks)*
  - *Host(mips, ram, storage, bandwidth)*
  - *Datacenter(arch, os, vmm, hostlist, cost mem/bw/storage)*
- *VM*
  - *MIPS, pesNumber(no. of cpu), Ram(MB), BW(MB/s)*
- *Cloudlet*
  - *Length (MI), pesNumber, input Size, output Size*

Simulation Setup

- *1 datacenter*
- *1 dual-core host, each core's mips: 1000*
- *2 vm, mips:1000*
- *4 cloudlets, length: 1000mips*
- *core1 deal with two cloudlets(t1 and t2), and core2 deal with the other two cloudlets (t3 and t4)*

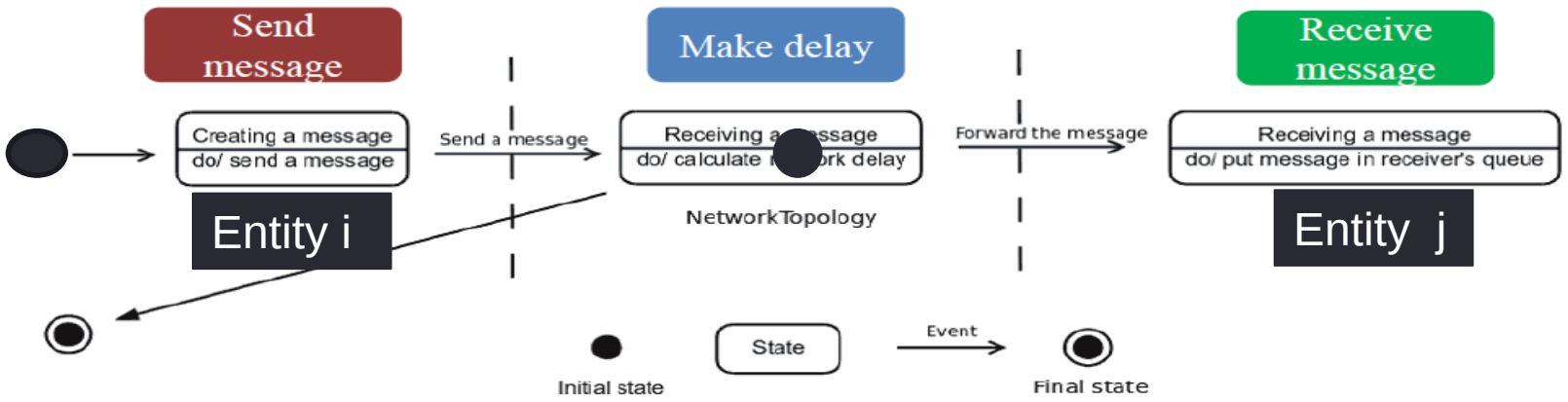
Cloudlet ID	STATUS	Datacenter ID	VM ID	Time	Start Time	Finish Time
0	SUCCESS	2	0	2	0.1	2.1
2	SUCCESS	2	0	2	0.1	2.1
1	SUCCESS	2	1	2	0.1	2.1
3	SUCCESS	2	1	2	0.1	2.1
	*****Datacenter: Datacenter_0*****					
		User id	Debt			
		3	2051.2			

Network Modeling

- *Latency Matrix*

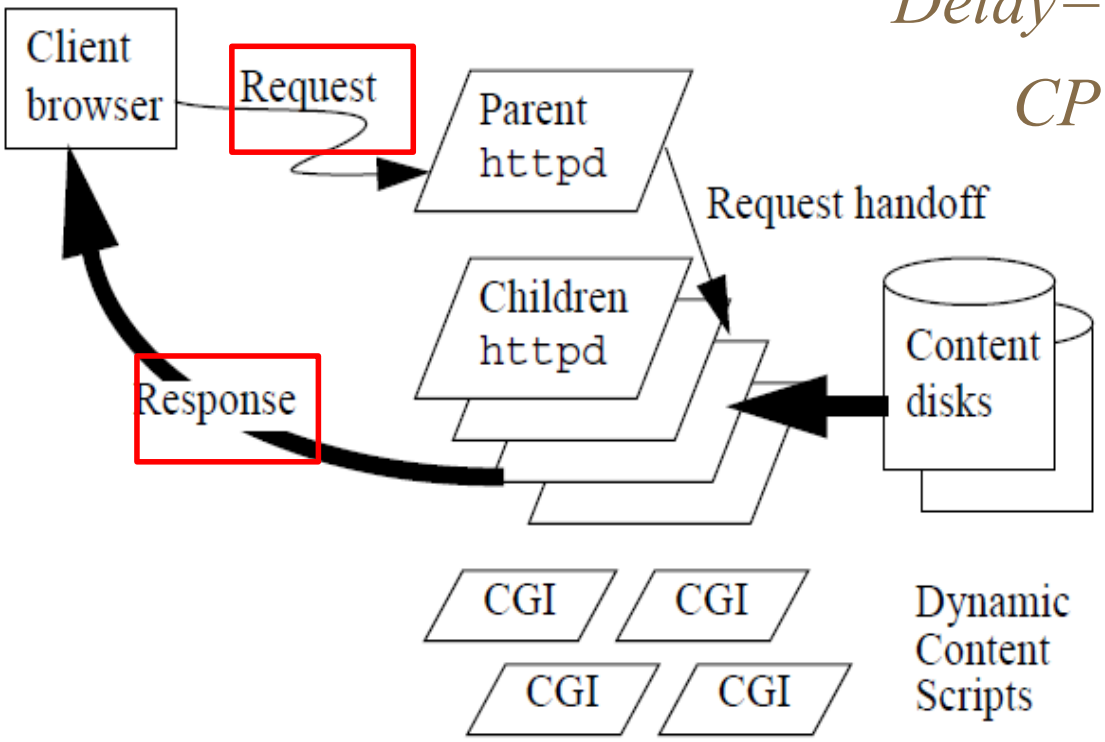
$$\begin{bmatrix} 0 & 40 & 120 & 80 & 200 \\ 40 & 0 & 60 & 100 & 100 \\ 120 & 60 & 0 & 90 & 40 \\ 80 & 100 & 90 & 0 & 70 \\ 200 & 100 & 40 & 70 & 0 \end{bmatrix}$$

Delay time from entity i to entity j

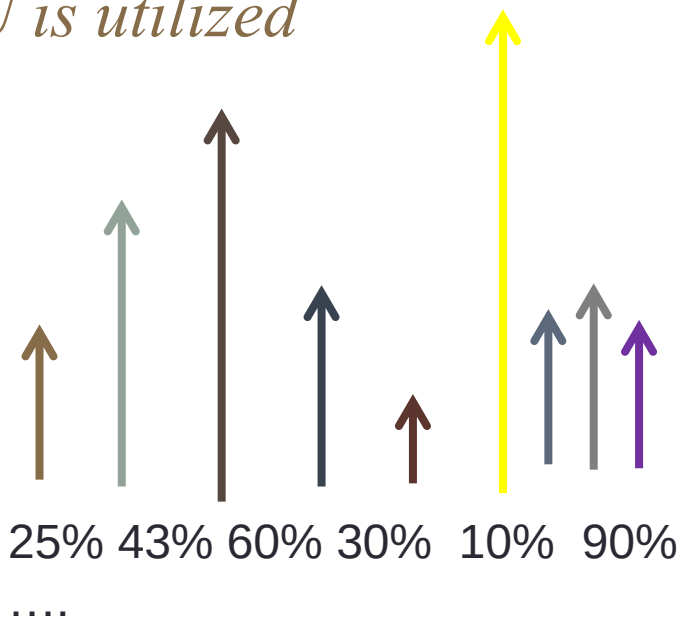


Dynamic Workload Modeling

- *The Strategy is to Vary VM Utilization!*

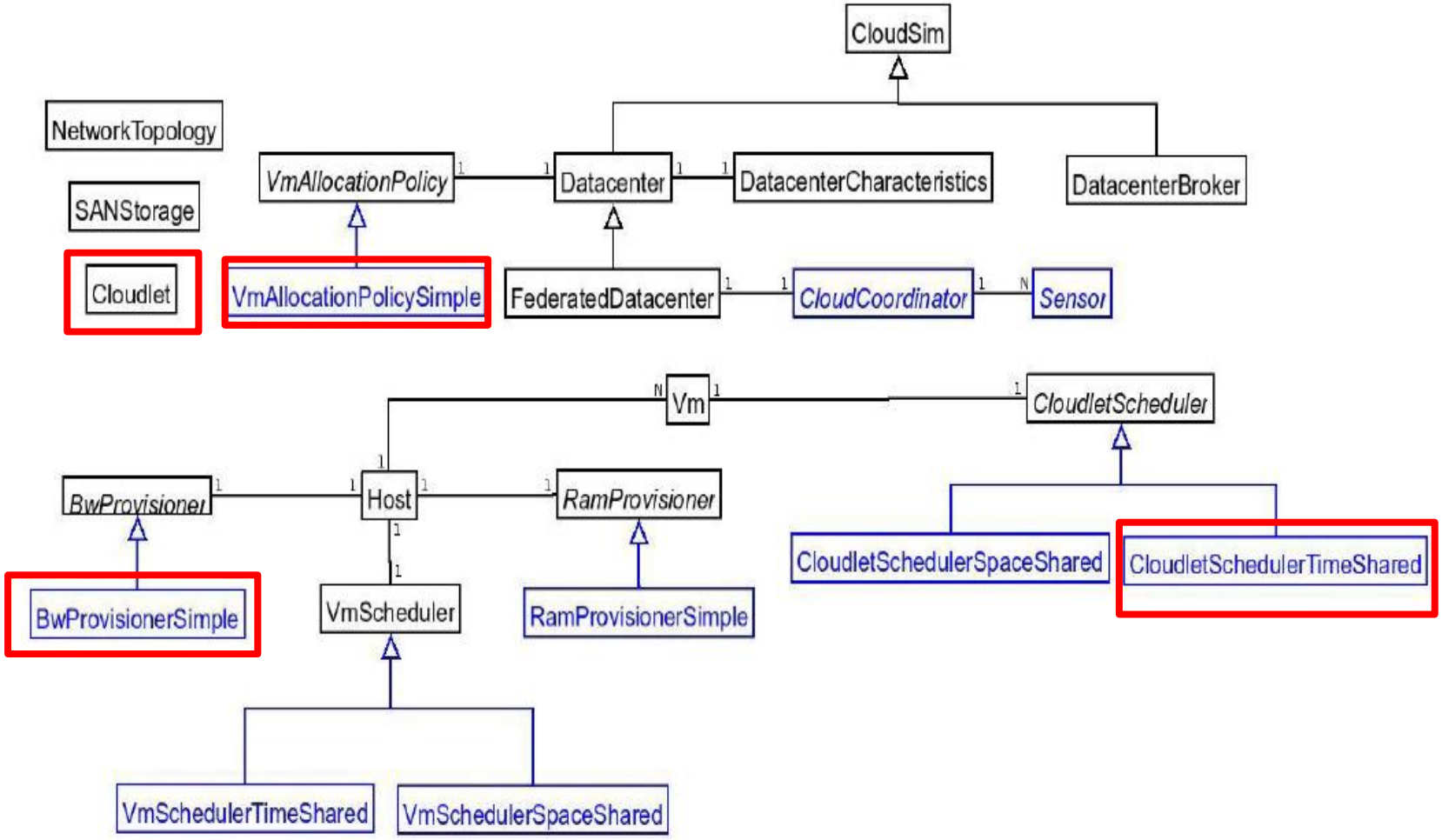


Delay= not all the time, CPU is utilized



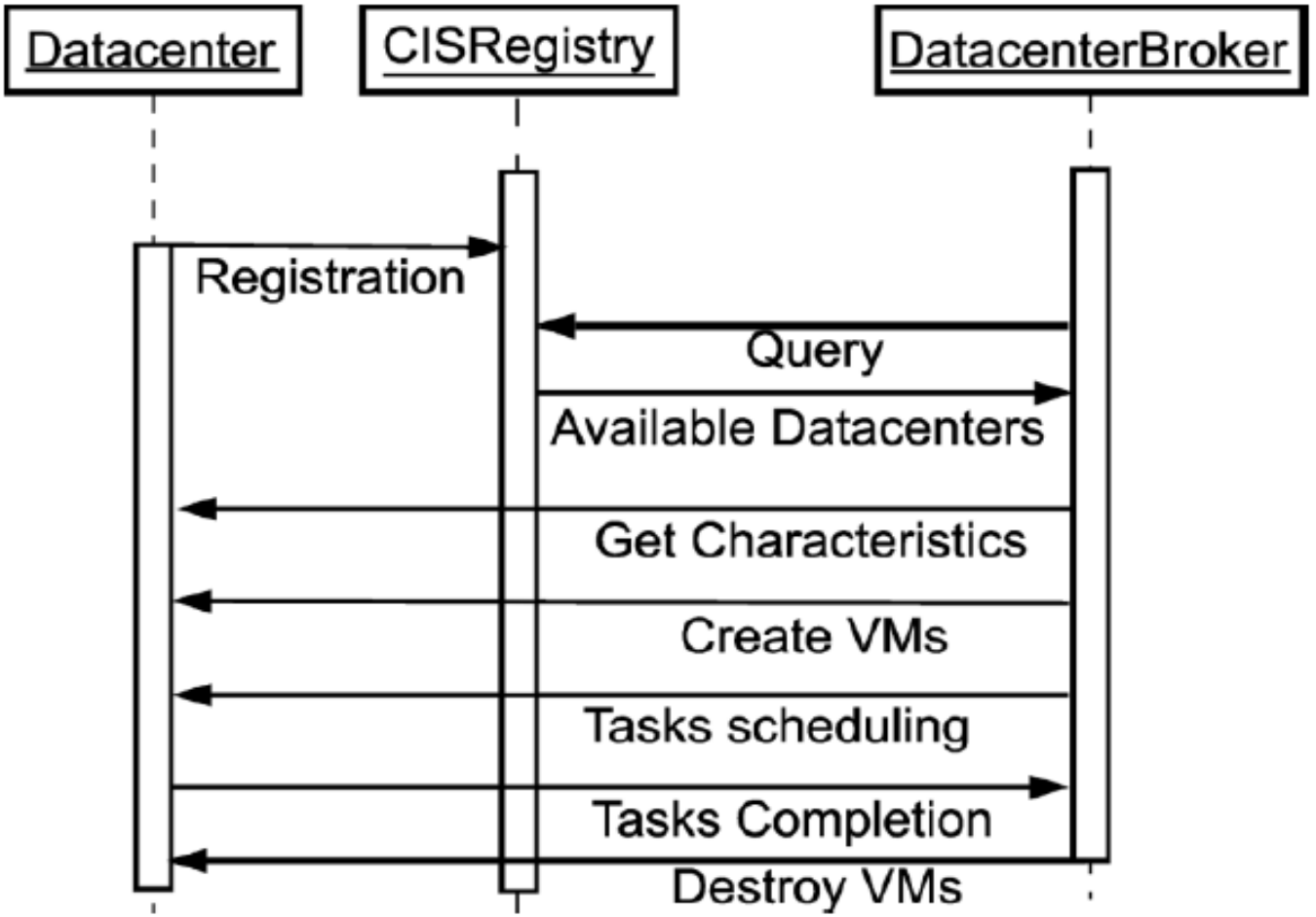
Design and Implementation(1/2)

CloudSim Class Design Diagram



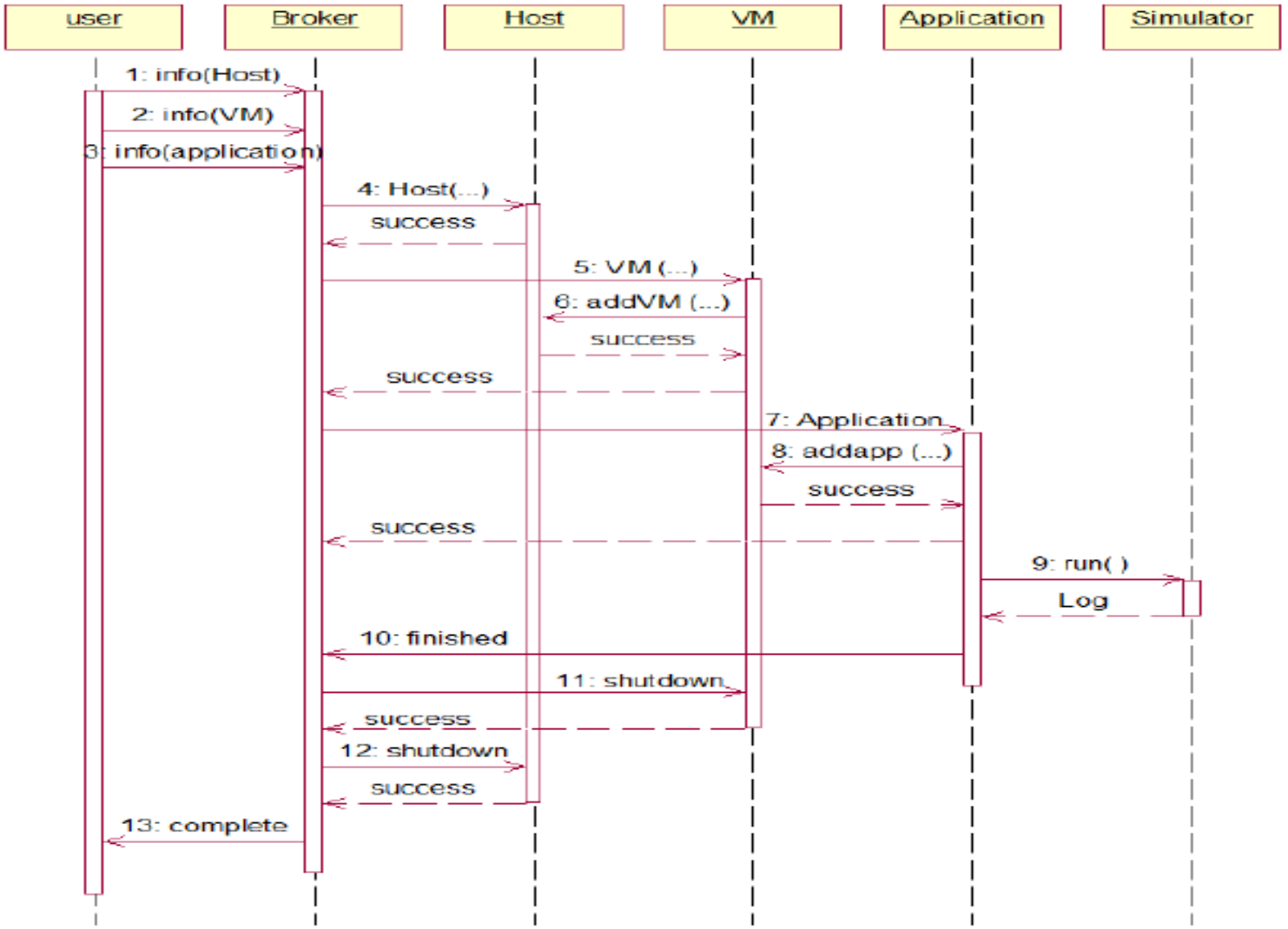
Design and Implementation(2/2)

Simulation Data Flow



DESIGN AND IMPLEMENTATION(3/4)

CLOUDSIM SEQUENCE DIAGRAM



Conclusion

- *Time effectiveness*
- *Flexibility and applicability*
- *Test services in repeatable and controllable environment*
- *Tune system bottlenecks before deploying on real clouds*
- *Experiment with different workload mix*

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- R. Buyya, A. Beloglazov, J. Abawajy, Energy-Efficient Management of Data Center Resources for Cloud Computing: A Vision, Architectural Elements, and Open Challenges, Proceedings of the 2010 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA2010), Las Vegas, USA, July 12-15, 2010.

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