Evaluation of Energy Consumption for Different VMs Allocation Policies

Your Cloud: Han Chen, Xiaoling Tang, Songjie Cai, Yiliang Tang

Agenda

- Introduction
- Implementation
  - Design
  - Evaluation
  - Workflow
- Demo
- Result
- Conclusion

Introduction

Purpose

- **To evaluate the energy consumption of cloud hosts, we conduct and compare four different VM allocation policies by using the CloudSim.**

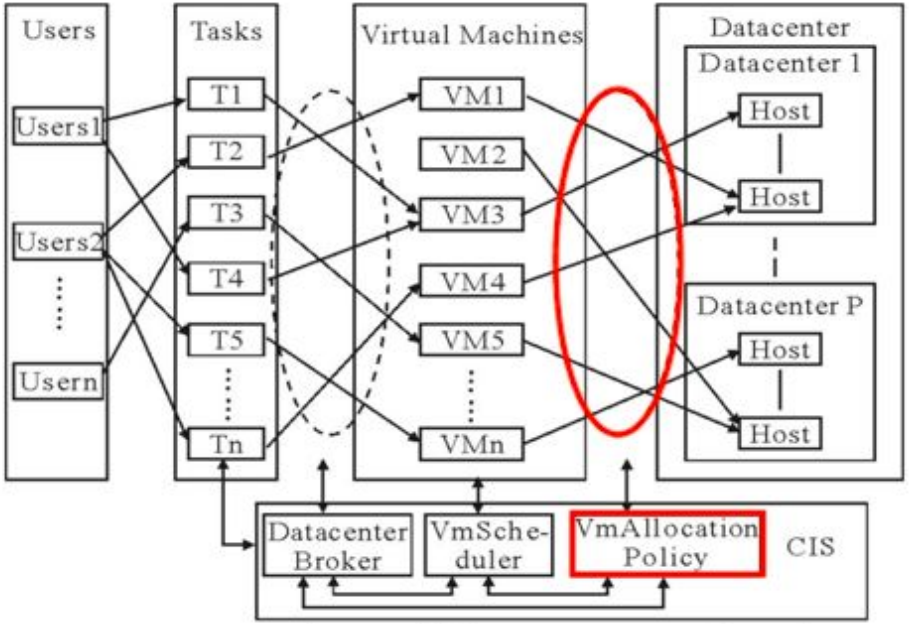
Keywords:

CloudSim - a simulation framework, which is built for simulation of Cloud computing environments.

Introduction - keywords

VM Allocation Policy Applied:

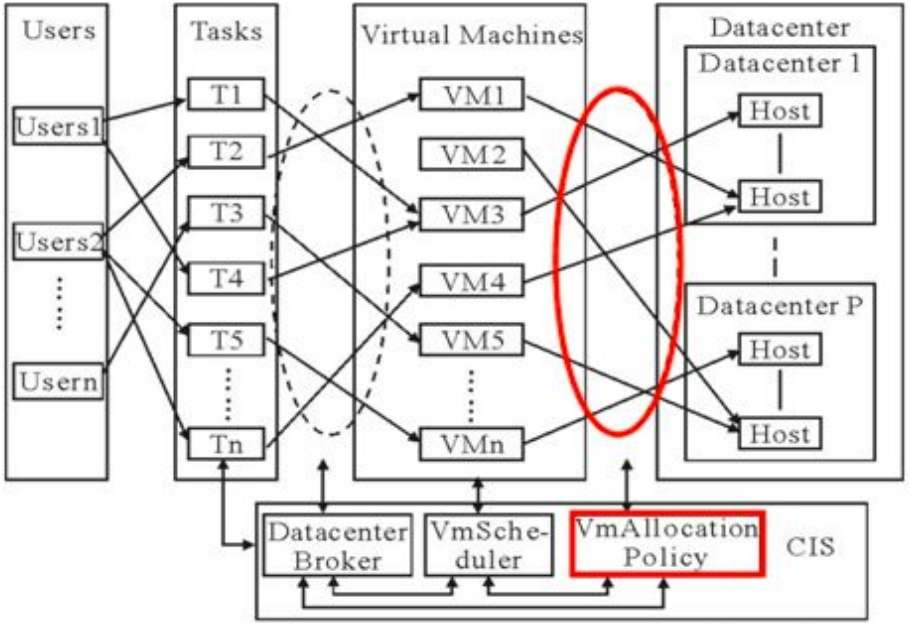
- Round Robin (**RR**)
  - Time-fair load balance
- Single Threshold (**STH**)
  - Configure a upper CPU usage threshold
  - VM migration - SLA violation
  - Energy saving



Introduction - keywords

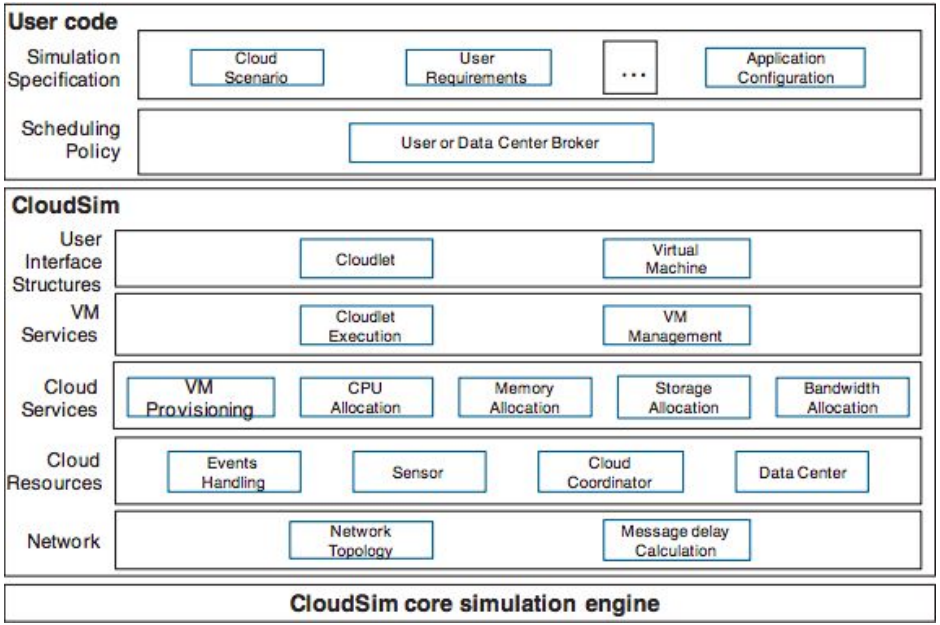
VM Allocation Policy Applied:

- Dynamic voltage and frequency scaling (**DVFS)**
  - The adjustment of power and speed settings on CPU
  - Energy saving
  - Performance maintained
- Non Power Aware (**NPA**)
  - Fully use of CPU
  - High energy cost



Implementation - Design

- **CloudSim**
  - Provides support for modeling and simulation.
  - Manages the instantiation and execution of core entities. (VMs, hosts, data centers)
- **User Code**
  - Exposes configuration related functionalities for hosts, applications, VMs, number of users and their application types, and broker scheduling policies.



CloudSim Layered Architecture

Implementation - Design

Table of VMs

VM Type	MIPS	Cores	Ram	Bandwidth	Storage
0	750	1	512	1000	25000
1	1000	1	512	1000	25000
2	1500	1	1024	1000	25000
3	2000	1	1024	1000	25000

Implementation - Design

Table of Cloudlets

Cloudlet Type	Length (MI)	Input file size (byte)	Output file size (byte)
0	4,000,000	300	300
1	16,000,000	300	300
2	20,000,000	300	300
3	60,000,000	300	300

Implementation - Design

Table of Hosts

Host Type	MIPS	Cores	Ram	Bandwidth	Storage	Max power
0	1500	1	24576	1,000,000	1 TB	80
1	2000	1	24576	1,000,000	1 TB	120
2	2500	2	24576	1,000,000	1 TB	150
3	4200	4	24576	1,000,000	1 TB	130
4	6000	4	24576	1,000,000	1 TB	160

Implementation - Evaluation

Energy Consumption:

- Power model: $$P(u) = k \times P_{max} + (1 - k) \times P_{max} \times u$$

P_{max}: maximum load consumption

k: consumption ration in idle time

u: CPU utilization

$$E = \int_{t_0}^{t} P(u(t))dt$$

Implementation - Evaluation

SLA (Service-Level Agreement) Violation:

- A **service-level agreement** is defined as an official commitment that prevails between a service provider and a client.
- In cloud, SLA is an essential part to ensure maximum availability of services for customers. With a violation of SLA, the provider has to pay penalties.
- Calculate the SLA violation per active host:

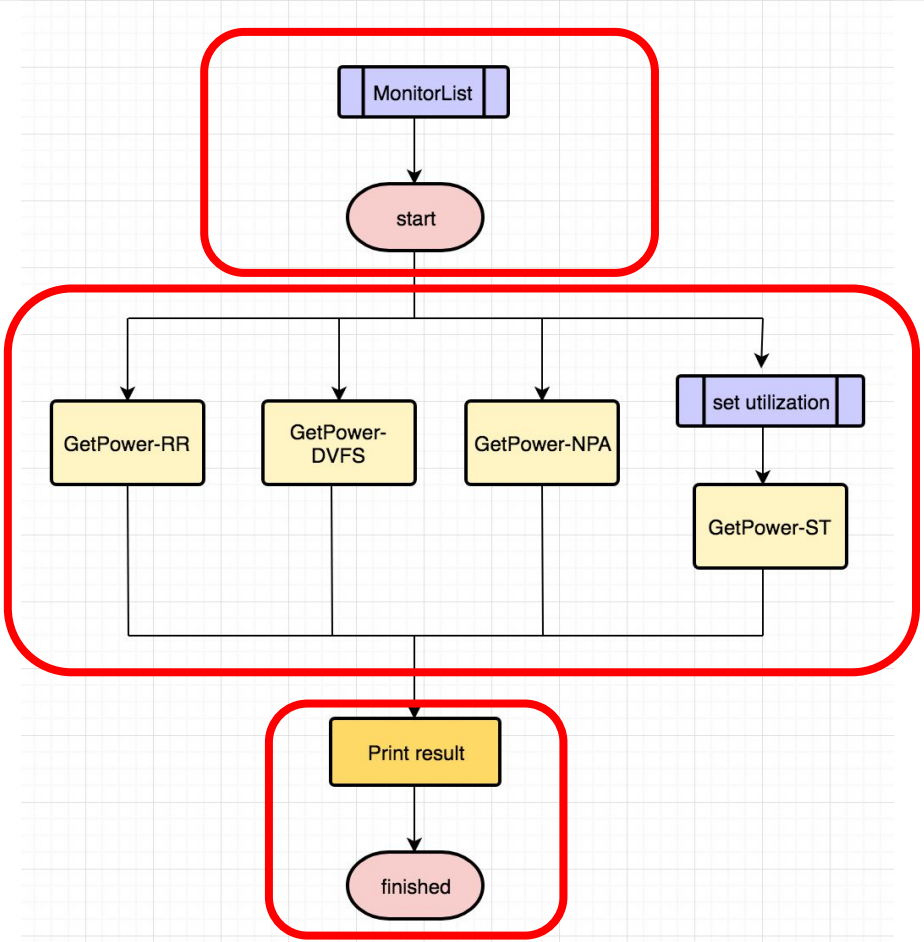
$$\mathrm{SLAV} = \frac{\sum_{j=1}^{M} \int_t [U_{j,r}(t) - U_{j,a}(t)]dt}{\sum_{j=1}^{M} \int_t U_{j,r}(t)dt}$$

$U_{j,r}(t)$ Total MIPS requested by VMs

$U_{j,a}(t)$ Actual assigned MIPS

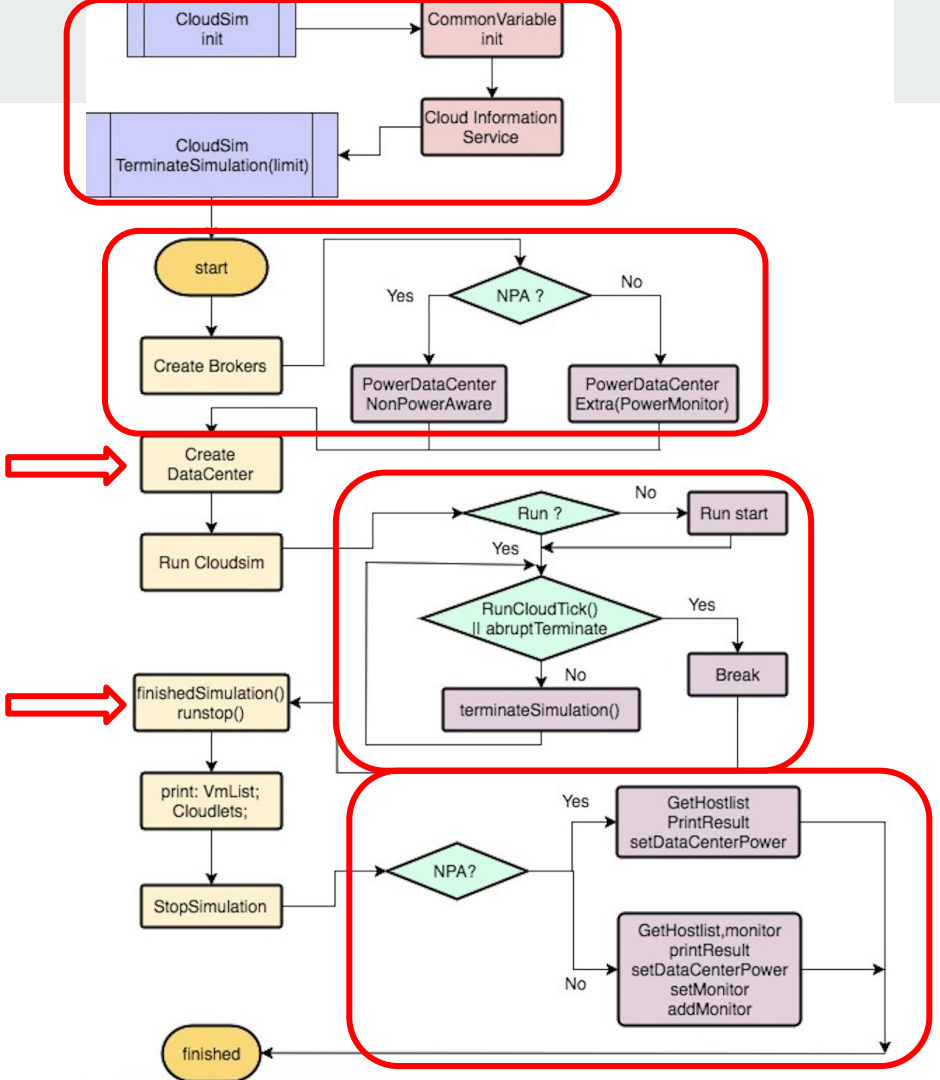
Implementation

- Workflow
- Main Process



Implementation

- Workflow
- GetPower



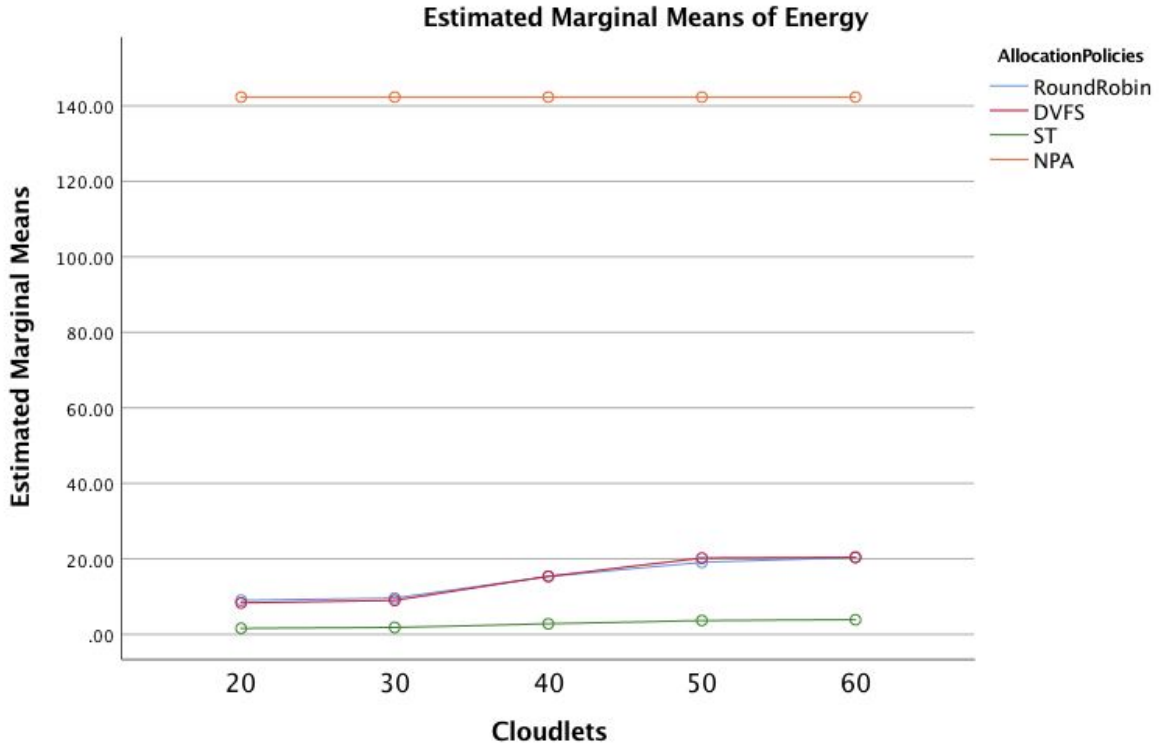
Demo

Result

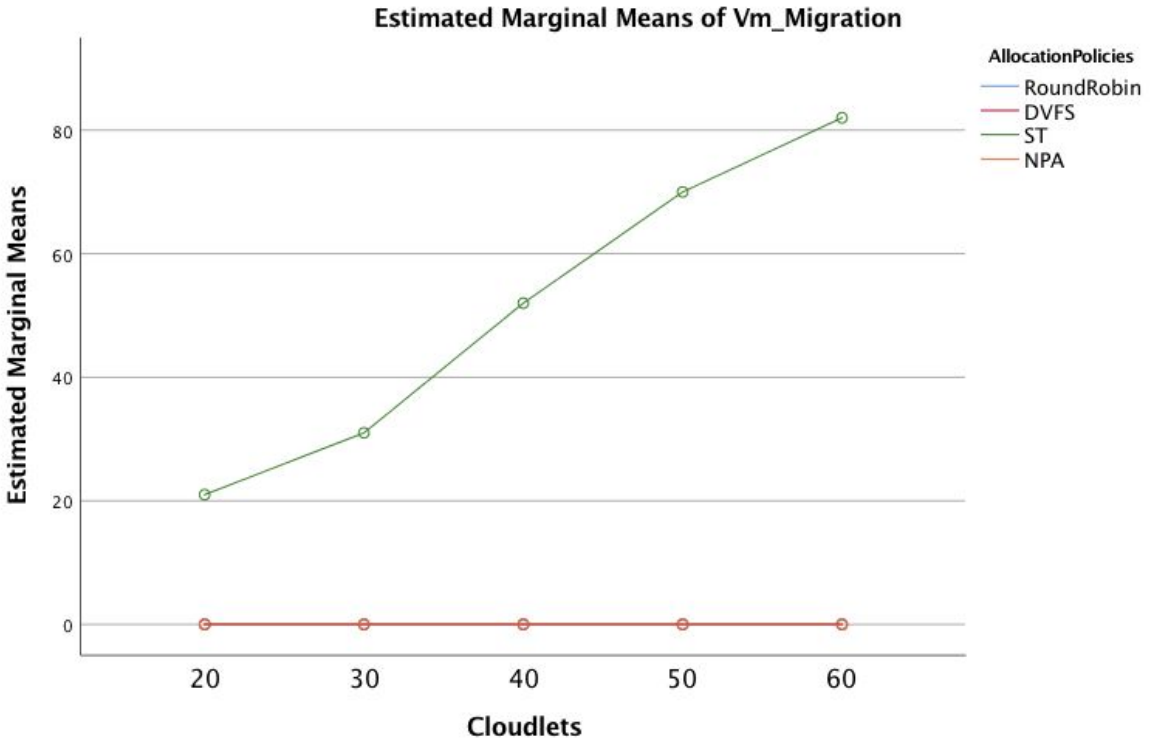
Energy consumption

Bases on

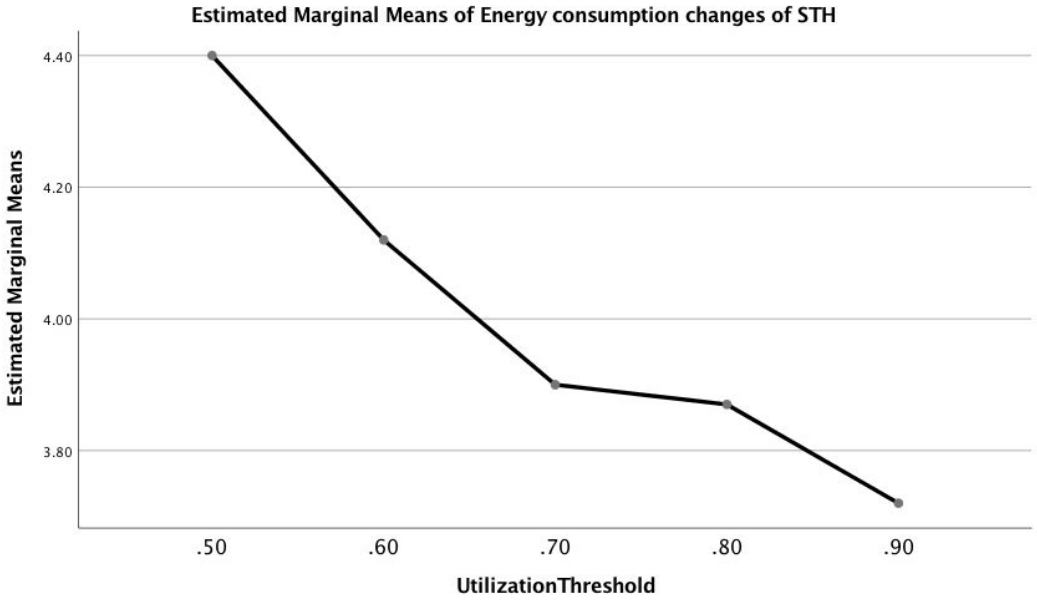
Different cloudlets



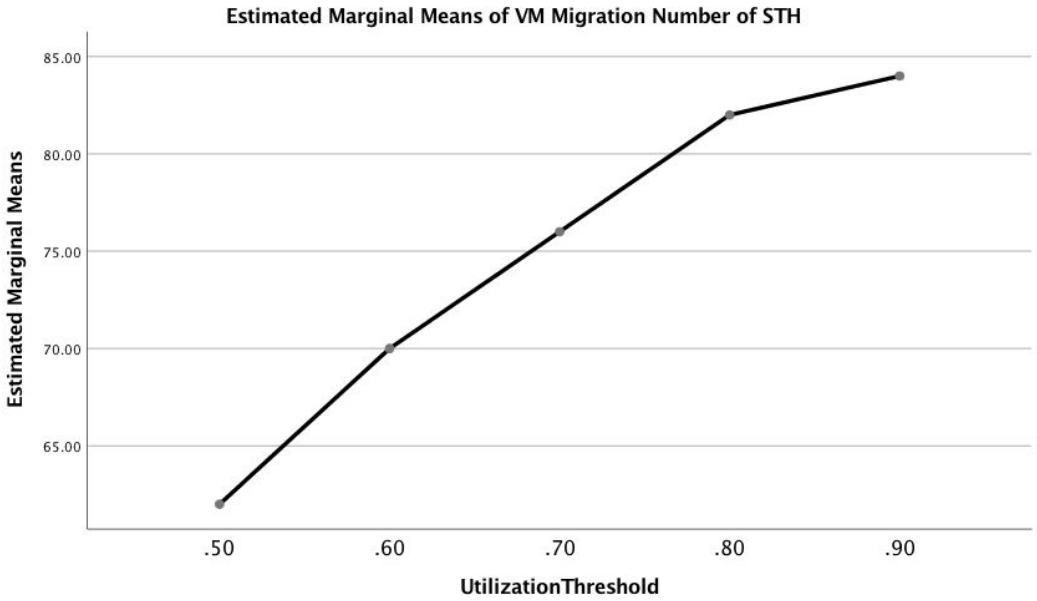
Result


Estimated Marginal Means of Vm_Migration
AllocationPolicies
RoundRobin
DVFS
ST
NPA
Estimated Marginal Means
0
20
40
60
80
20
30
40
50
60
Cloudlets

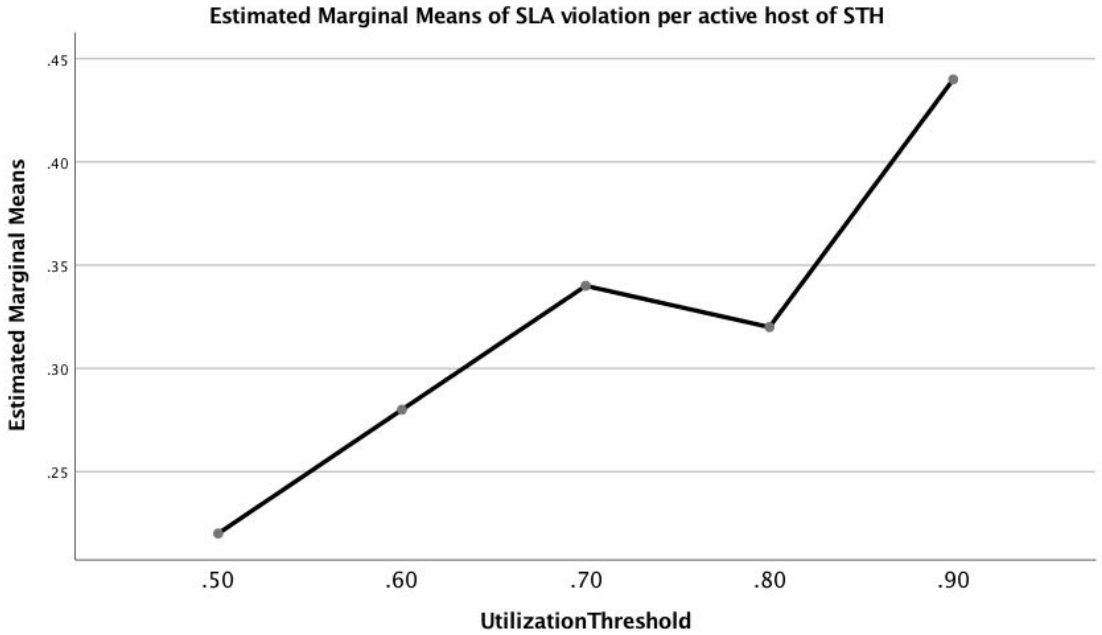
Result


Estimated Marginal Means of Energy consumption changes of STH
Estimated Marginal Means
4.40
4.20
4.00
3.80
.50
.60
.70
.80
.90
UtilizationThreshold

Result


Estimated Marginal Means of VM Migration Number of STH
Estimated Marginal Means
85.00
80.00
75.00
70.00
65.00
.50
.60
.70
.80
.90
UtilizationThreshold

Result


Estimated Marginal Means of SLA violation per active host of STH
Estimated Marginal Means
.45
.40
.35
.30
.25
.50
.60
.70
.80
.90
UtilizationThreshold

Conclusion

- CloudSim architecture, simulation mechanism
- Design and implementation of four different VM allocation algorithms
- Test Result and conclusion

References

- Rajeshkannan, R., and M. Aramudhan. “Comparative Study of Load Balancing Algorithms in Cloud Computing Environment.” Indian Journal of Science and Technology, vol. 9, no. 20, 2016, doi:10.17485/ijst/2016/v9i20/85866.
- Beloglazov, Anton, and Rajkumar Buyya. “Energy Efficient Resource Management in Virtualized Cloud Data Centers.” 2010 10th IEEE/ACM International Conference on Cluster, Cloud and Grid Computing, 2010, doi:10.1109/ccgrid.2010.46.
- Mohammed, Maysoon A., et al. “Queueing theory study of round robin versus priority dynamic quantum time round robin scheduling algorithms.” *2015 4th International Conference on Software Engineering and Computer Systems (ICSECS)*, 2015, doi:10.1109/icsecs.2015.7333108.
- Balogh, Tomáš, et al. “Performance of Round Robin-Based Queue Scheduling Algorithms.” *2010 Third International Conference on Communication Theory, Reliability, and Quality of Service*, 2010, doi:10.1109/ctrq.2010.34.
- Patil, Shital, et al. “Performance improvement in cloud computing through dynamic task scheduling algorithm.” *2015 1st International Conference on Next Generation Computing Technologies (NGCT)*, 2015, doi:10.1109/ngct.2015.7375090.
- Jaspreet Kaur, “Comparison of load balancing algorithm in a Cloud”, International Journal of Engineering Research and Applications (IJERA), vol. 2, Issue 3, May- June 2012, pp. 1169- 1173.
- B. Santosh Kumar1 and Dr. Latha Parthiban2 , “An Implementation of Load Balancing Policy for Virtual Machines Associated with a Data Centre”, International Journal of Computer Science & Engineering Technology (IJCSET), volume 5 no. 03, March 2014, pp. 253- 261.

Thank You!