

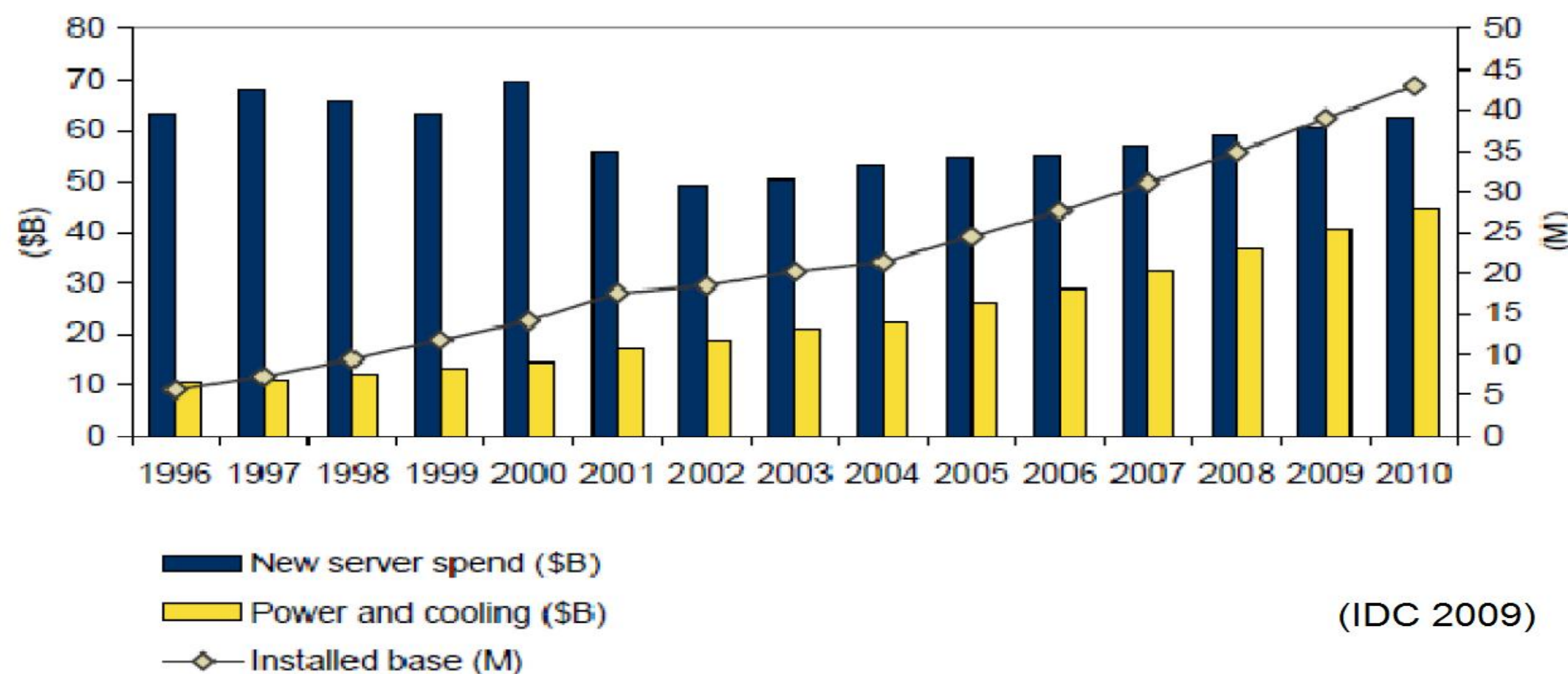
Autonomic Cloud Management System

Farah Fargo, Cihan Tunc, Salim Hariri, Youssif Alnashif, Ali Akoglu

<http://acl.ece.arizona.edu/projects/current/acms/index.html>

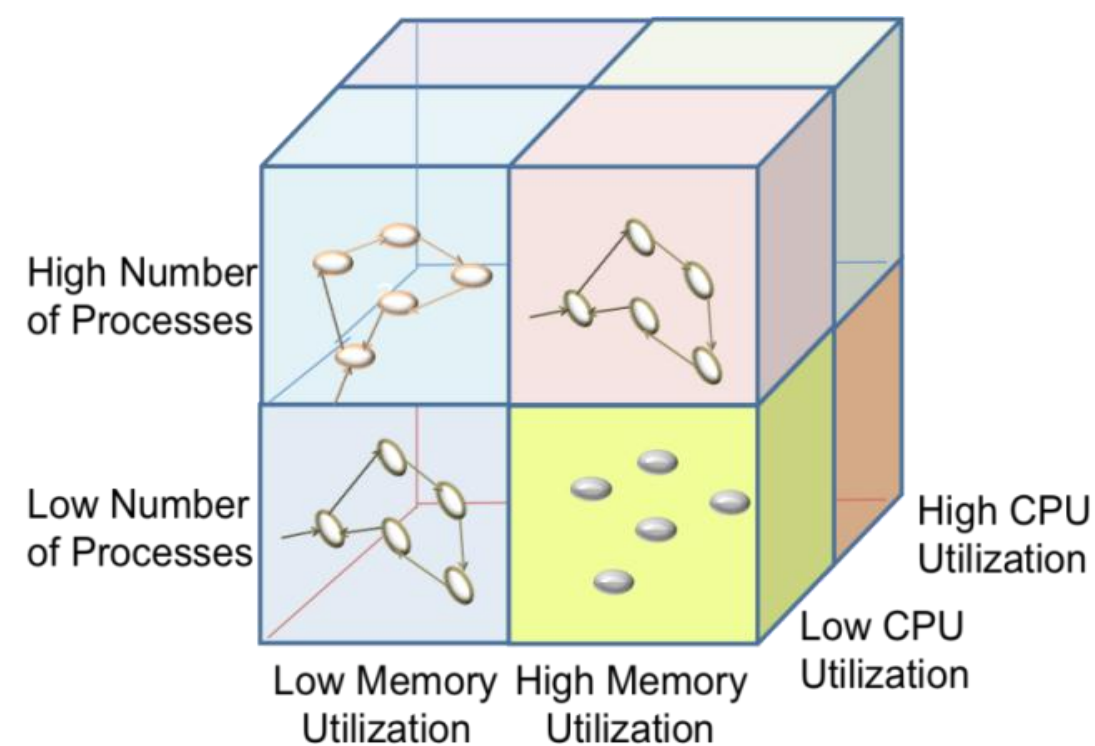
Motivation and Solution

Power management is a big challenge. Power cost during the lifetime of a cloud system can be 2-3 times higher than the investment cost of the system. We present Autonomic Cloud Management System to minimize the power consumption of the system without sacrificing performance of a workload by scaling down/up the virtual machines hardware resources at runtime.



AppFlow

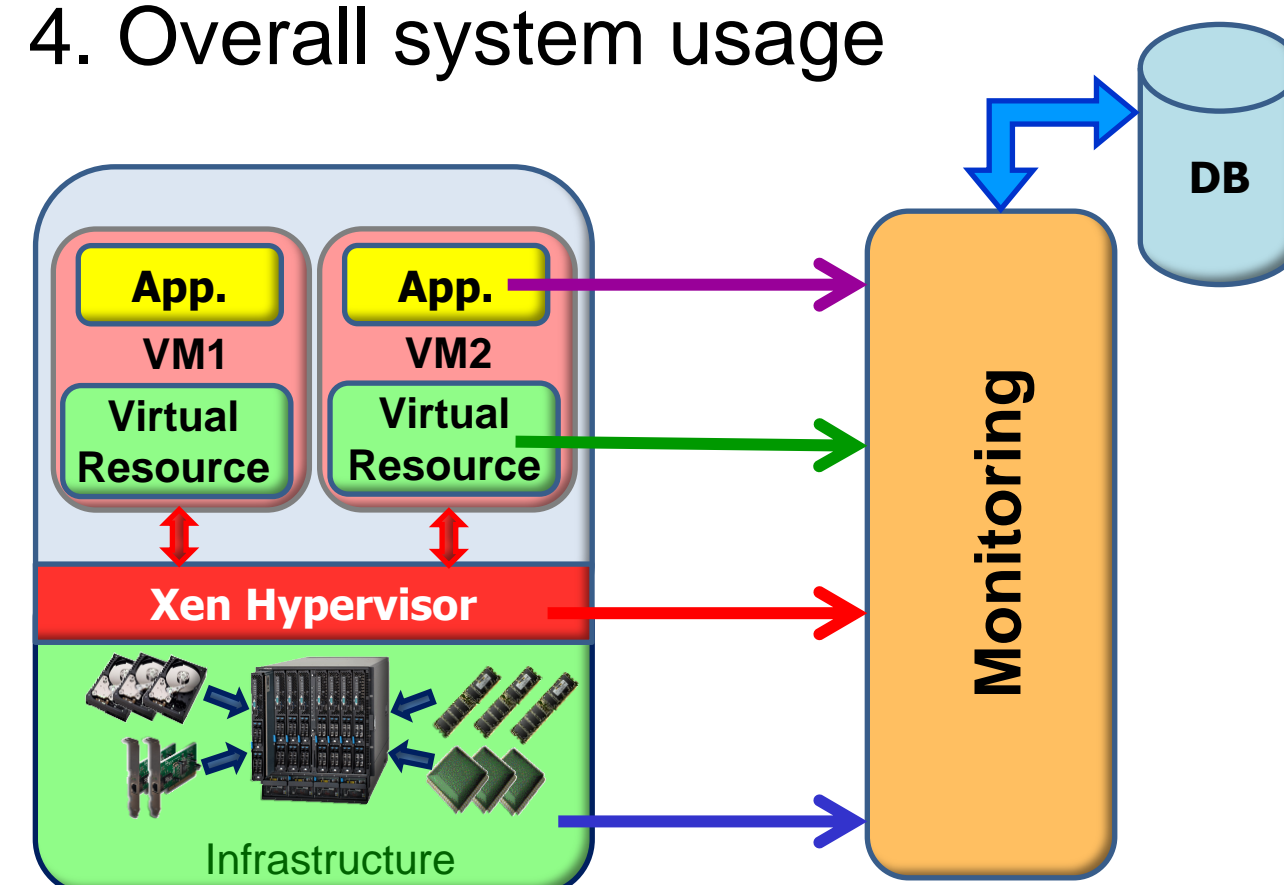
AppFlow is an n-dimensional array (developed in ACL) representing the behavior of a workload during its lifespan. Our approach focuses on the CPU and memory utilization and process numbers to define the behavior of a workload.



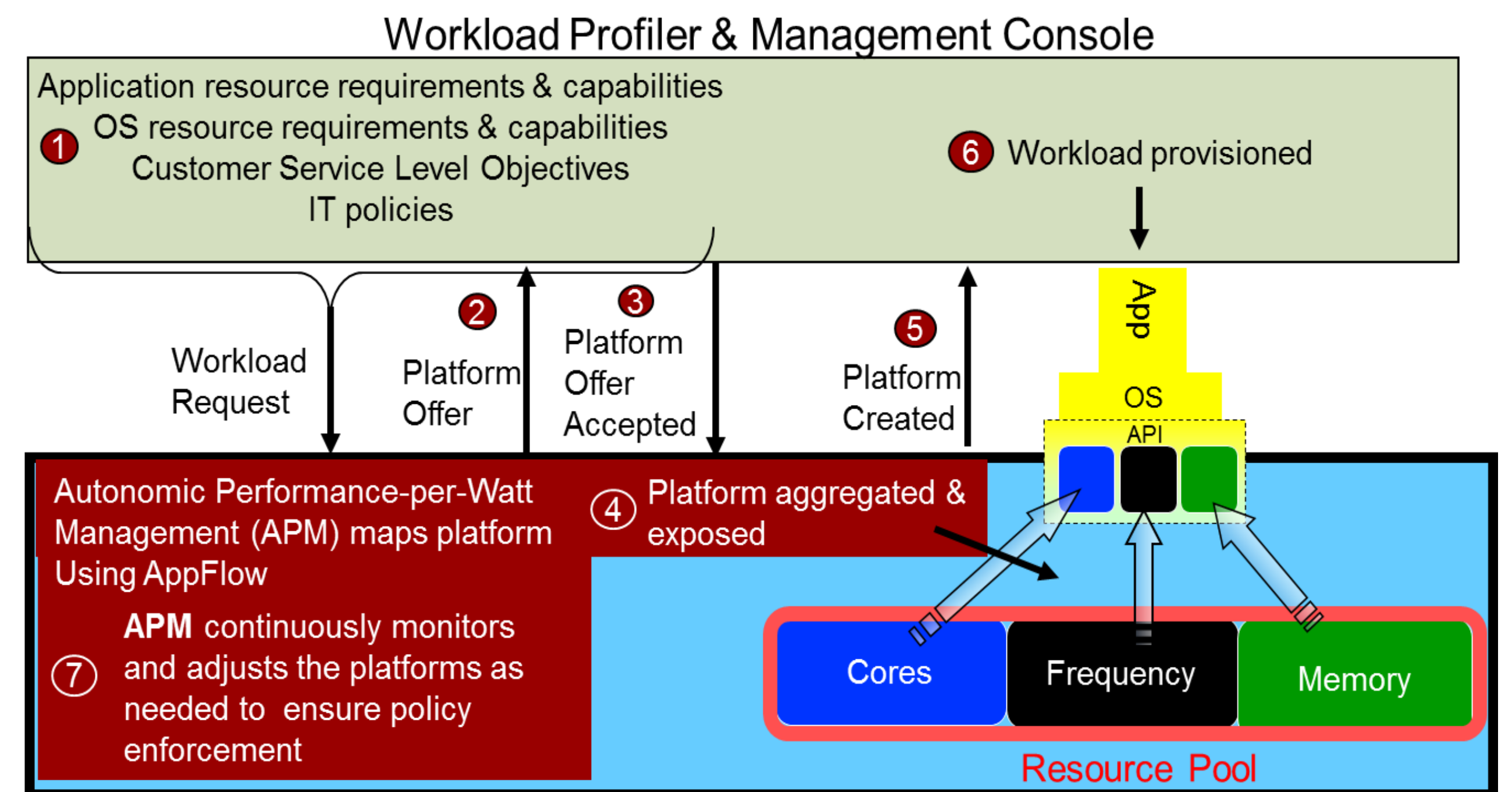
Monitoring

We monitor the system from different perspectives and store in a database :

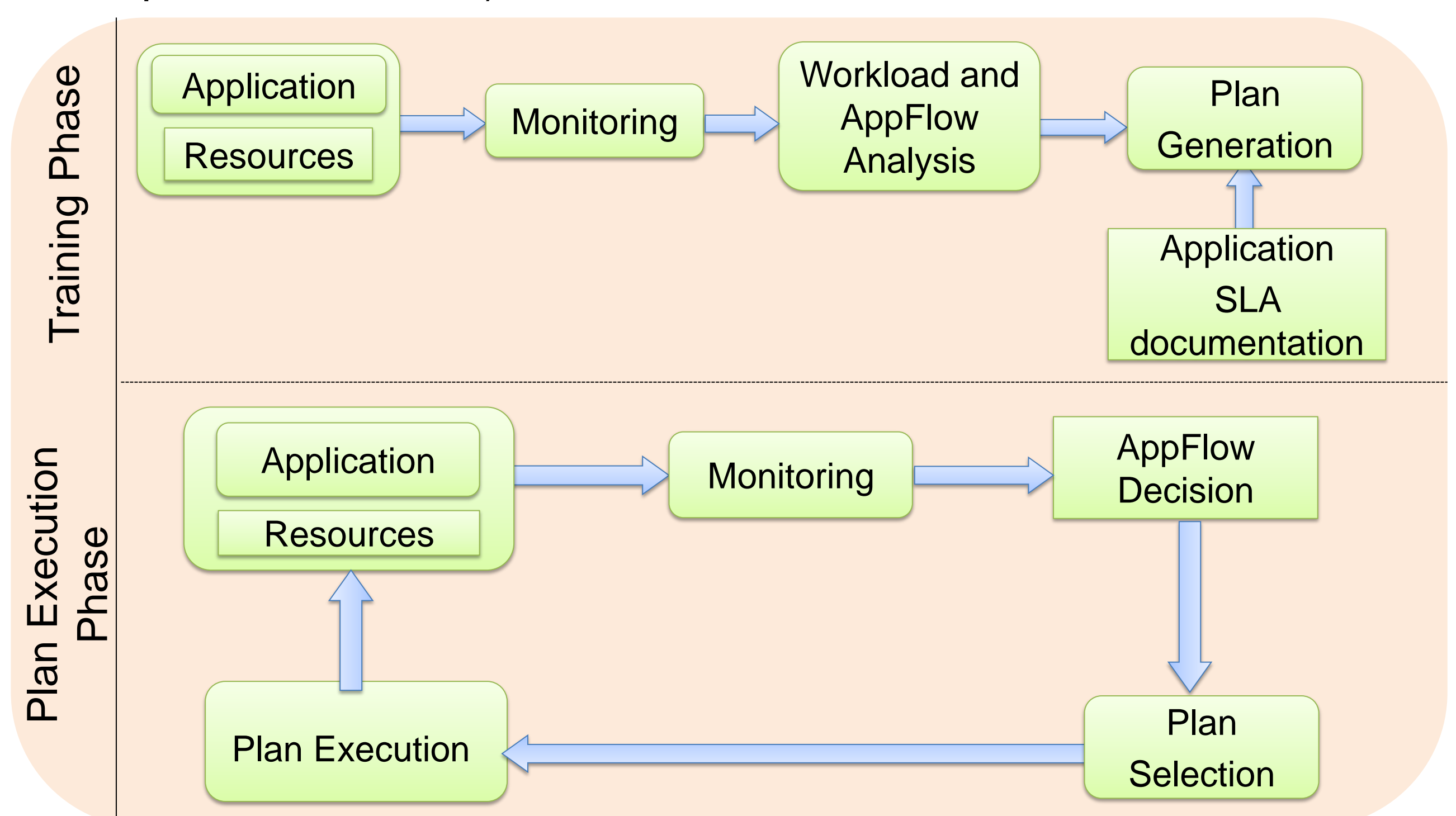
1. VM resource utilization
2. Application resource usage
3. Hypervisor perspective
4. Overall system usage



ACM Architecture

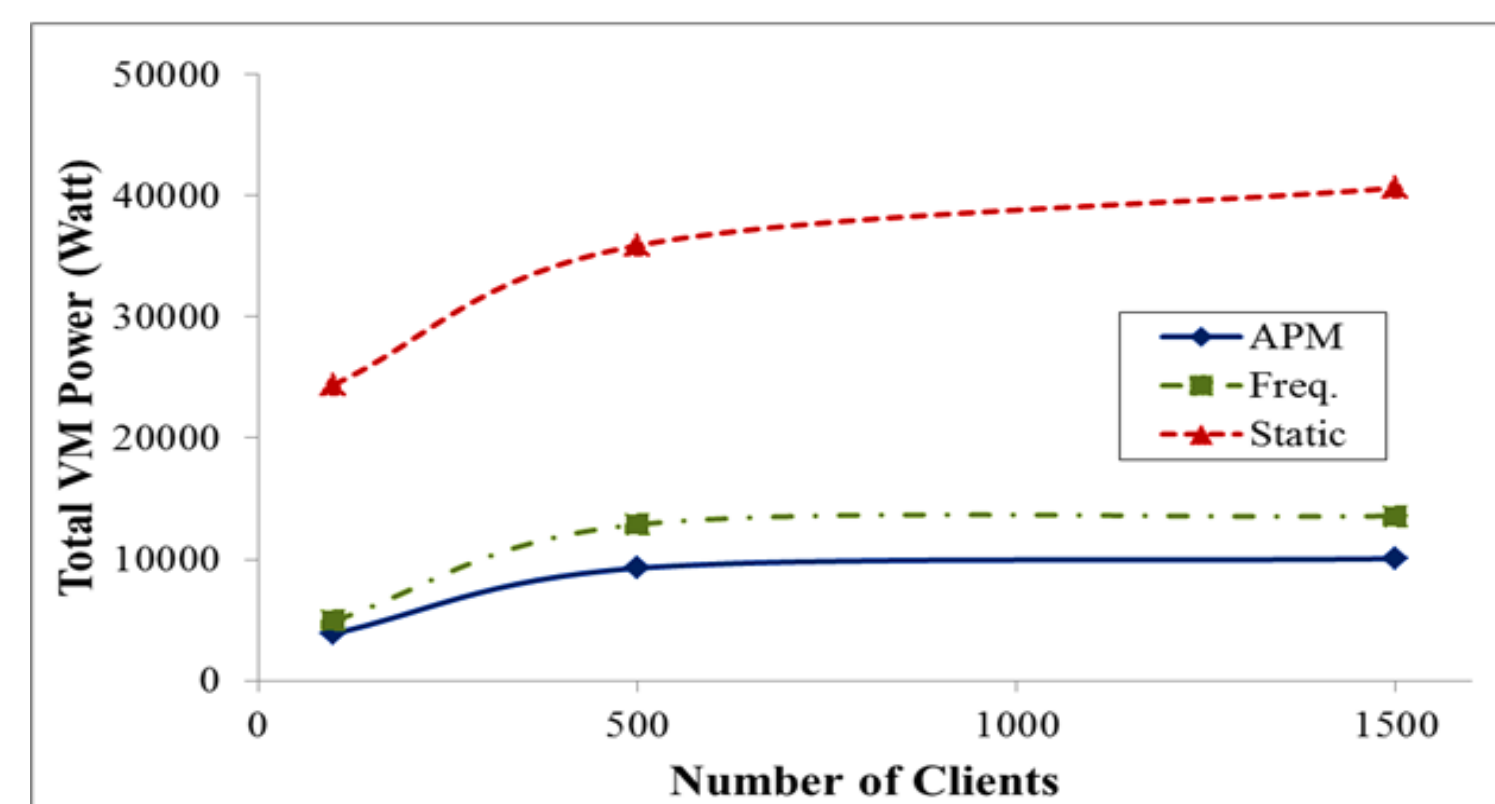


Our approach contains two parts. Offline training phase (different workloads are analyzed and plans are generated) and Runtime Plan Execution phase (plans are executed to reduce power consumption without performance loss).

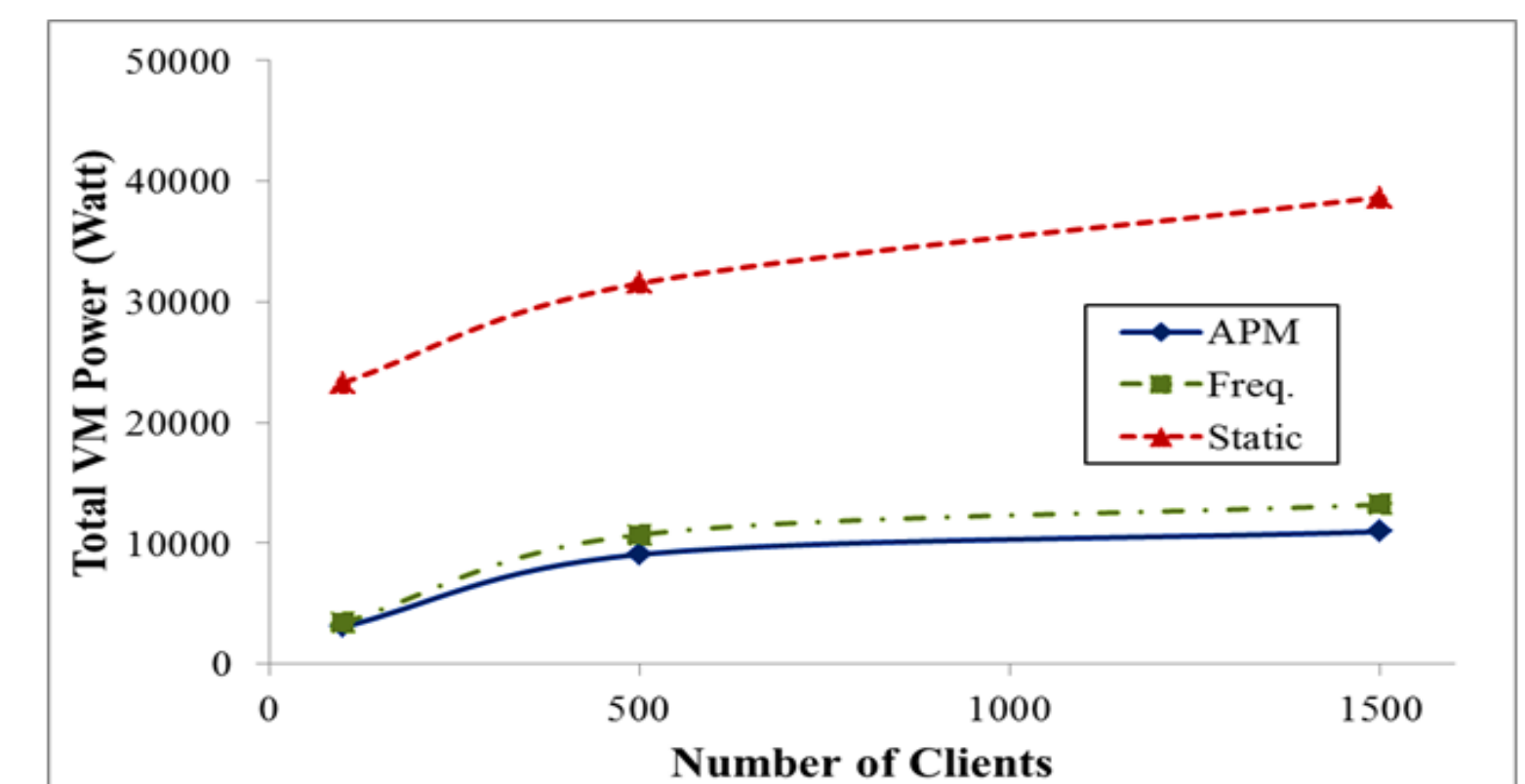


Experimental Results and Conclusion

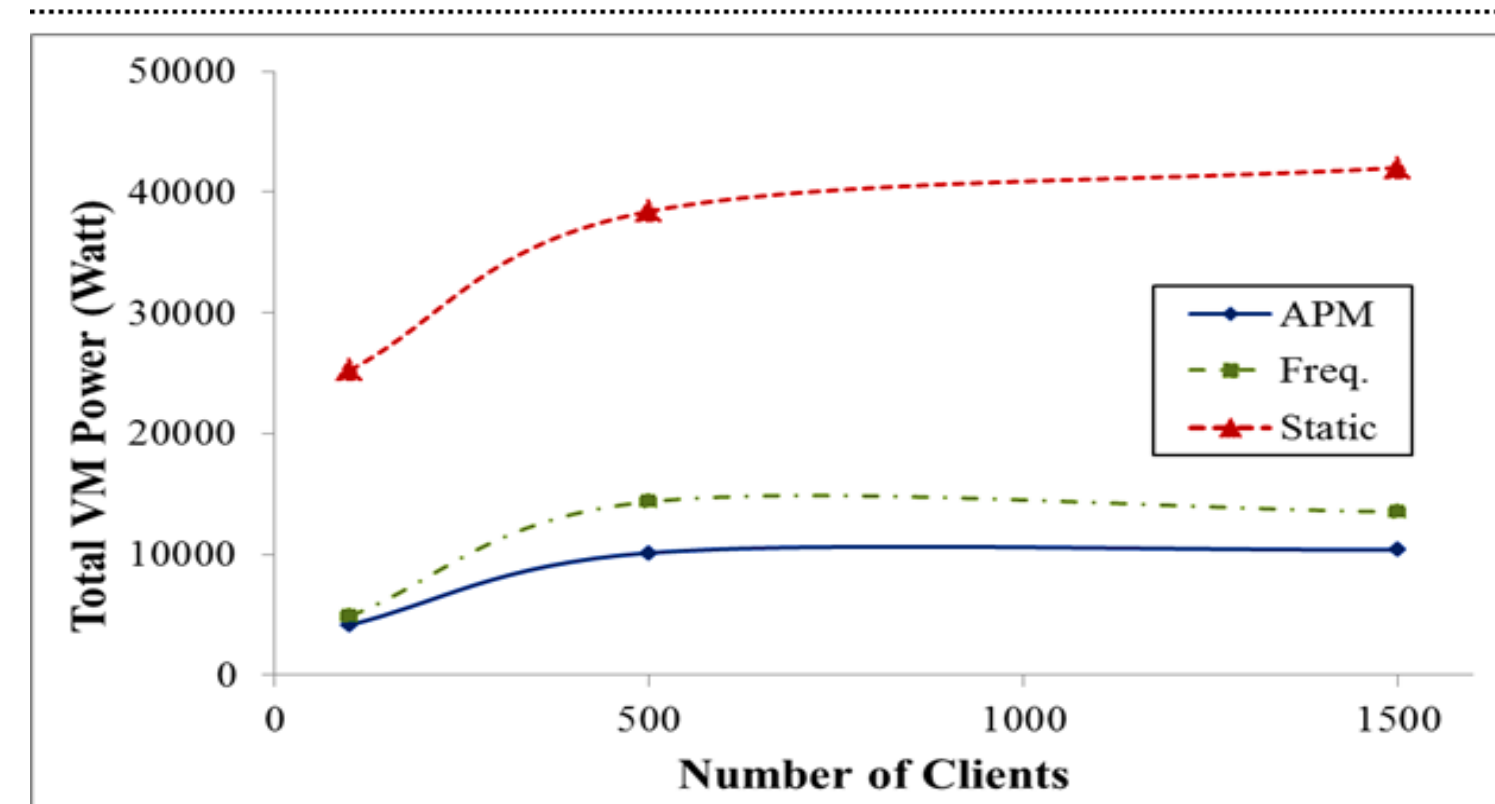
- IBM HS22 blade server as private cloud consist of 3 blades are used with Xen hypervisor
- RUBiS is used as benchmark which has been built by modeling eBay behavior.
- Web Server and Database Server are separated to different VMs on one blade
- Other 2 blades are used to create client behavior, up to 1500 clients
- For the comparison, both static behavior and frequency scaling have been used.



Browse only RUBiS power cons.



Default RUBiS power cons.



Random RUBiS power cons.

Power Reduction and Time overhead

	#Clients	Time Overhead (%)		Total VM Power Reduction (%)		APM Reduction over Freq. (%)
		Freq.	APM	Freq.	APM	
Browse	100	-0.09	-0.09	79.76	84.13	21.61
	500	0.08	-0.25	64.15	74.18	27.98
	1500	0.17	0.83	66.59	75.27	25.96
Default	100	-0.09	-0.09	85.27	86.81	10.43
	500	-0.42	0.25	66.01	71.23	15.36
	1500	-0.25	0.17	65.85	71.65	16.97
Random	100	-0.17	0.00	80.64	83.59	15.22
	500	-0.25	0.67	62.62	73.67	29.57
	1500	-0.08	0.83	67.85	75.31	23.18