IITB-Monash Research Academy

Indian Institute of Technology Bombay | MONASH University

An Indian-Australian research partnership

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Project Title:	**Issues with Virtualization in Infrastructure Clouds**	
Project Number	IMURA0203	
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Research Academy Themes:

Highlight which of the Academy's Theme(s) this project will address? 1.
(*Feel free to nominate more than one. For more information, see www.iitbmonash.org)*

1. Advanced computational engineering, simulation and manufacture
2. Infrastructure Engineering

The research problem

Define the problem

There is a growing interest in sustainable design and management of IT systems and infrastructure. Data centers of today house potentially hundreds and thousands of systems with widely varying power and cooling requirements. It is estimated that one data-center housing a few hundred thousand racks requires a dedicated power station to cater to its power and cooling requirements. In essence, data-centers of today are huge behemoths gurgling enormous amounts of electrical power for generating huge amounts of computing cycles and has phenomenal cooling requirements. A typical 1U server can draw up-to 500W of power. When 40 of them are packed into a standard 42U rack the power consumption can be as high as 20KW and produces nearly 70,000 BTU. Further dissipating this heat requires almost 6 tons of cooling per rack. Add to this, the advent of new age computing paradigms – virtualization and cloud computing for example, and adoption of multi-core and multi-processor servers, the amount of power used per square foot is only going to double than what it was 5 years ago.

Cloud computing defines the technologies to share computational infrastructure amongst multiple applications. A common technique employed in clouds is that of virtualization where compute & storage resources from many computers are virtualised and then partitioned into several virtual machines (VMs) each of which execute some set of application processes. However there exist several issues in placing these logical VMs onto a set of physical machines. One could try to optimise the use of physical resources to save power and cooling costs, one could try to wring the maximum efficiency from applications by cleverly collocating VMs that benefit from such collocation policies etc. The "problem" is to investigate such issues in depth and come up with placement strategies for different optimisation criteria.

The work will explore design of cloud brokers using game-theoretic principles and economic frameworks for addressing multiple 'power and cooling' related research issues arising out of adoption of cloud computing and grid technologies within the data-centers. Additionally the cloud brokers need to account for the performance impacts during the cloud migration process. The work will also attempt to explore creation of a simulated data center using above principles and provide a 3-D visualization of the same.

Project aims

Define the aims of the project

One of the goals of such a project is "green" clouds where resources are optimally utilized without sacrificing application performance.