INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Large systems and cloud computing paradigm have emerged as a promising computing platform of recent time. These systems attracted users from various domains, and their applications are getting deployed for several benefits, such as reliability, scalability, elasticity, pay-as-you-go pricing model, etc. These applications are often of real-time nature and require a significant amount of computing resources. With the usages of the computing resources, the energy consumption also increases, and the high energy consumption of the large systems has become a serious concern. A reduction in the energy consumption for the large systems yields not only monetary benefits to the service providers, but also yields performance and environmental benefits as a whole. Hence, designing energy-efficient scheduling strategies for the real-time applications on the large systems becomes essential.

The first work of the thesis devises a coarse-grained thread-based power consumption model which exploits the power consumption pattern of the recent multi-threaded processors and then proposes three energy-efficient scheduling policies. Experimental results show significant improvement compared to the baselines. The second work of the thesis considers a utilization-based power consumption model for a heterogeneous virtualized cloud system where the utilization of a host can be divided in three ranges and then proposes scheduling technique based on that. The proposed scheduling technique reduces energy consumption by almost 24% w.r.t. the state-of-art policy. As the cloud providers often offer VMs with discrete compute capacities and sizes, which leads to discrete host utilization, the third work of the thesis considers scheduling a set of real-time tasks on a virtualized cloud system which offers Vms with discrete compute capacities. The problem is divided into four sub-problems based on the characteristics of the tasks and solutions are proposed for each sub-problem. The fourth work of the thesis considers scheduling of online scientific workflows on the virtualized cloud system where a scientific workflow is taken as a chain of multi-VM tasks. series of scheduling approaches are proposed considering several options and restrictions on migration, allocation of Vms, and slack distribution. Experimental results show that the proposed scheduling policy under non-splittable VM allocation category consumes a similar amount of energy as the baseline policy but with a much lesser number of migrations. For the splittable VM allocation category, the proposed policies achieve energy reduction of almost 60% as compared to the state-of-art policy.