Thesis: Cost-Effective and Performance-Preserving Secured Application Management in Cloud Environment

Abstract: Data-intensive science applications in areas such as high-energy and particle physics, bioinformatics, genomics, and healthcare are increasingly using distributed, cloud, and high-performance computing (HPC) resources for computation and storage. In terms of distributed systems, such applications can be presented in terms of: i) the involved data (e.g., sensitive healthcare data requiring HIPAA-compliance) and ii) the different lifecycle stages of processing, transfer, storage the data goes through (i.e., the application workflow which is typically represented as a directed acyclic graph). In most cases, such applications have specialized compute/networking/storage resource (i.e., for performance) and security requirements for both involved data and workflow stages. Hence, more often than not, applications have to rely on remote distributed, cloud, and HPC resources residing outside the boundaries of their home network or data generation site. However, each such remote network or institutional domain has its own resource usage, security, and cost policies or rules that these multi-domain applications must comply with. In this research, we seek to examine the interactions and inter-conflict among application requirements (performance and security) and domain policies and how distributed system management strategies should consider such interactions and inter-conflict towards efficient and effect resource management.

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