GSMA based Automated Negotiation Model for Grid Scheduling

P. Balakrishnan, S. Thamarai Selvi, G. Rajesh Britto
CARE, Department of Information Technology, Madras Institute of Technology, Anna University
baskrish1977@gmail.com

Abstract

In order to co-ordinate multiple resource providers in grid environment to meet a common objective, support for negotiation is needed to establish a contract between the users and the resource providers that clearly states the QoS required, restrictions on resource utilization and penalties during violation of the objective. In this paper, we propose an architecture called GSMA (Grid SLA Management Architecture) that supports entire operations in SLA lifecycle such as negotiation, creation, monitoring, violation, enforcement and destroy. We propose a deviation based resource ordering algorithm (DRS) and successfully automates the SLA negotiation process with backing up of resource support. The negotiation process is implemented based on WS-Agreement specification. Simulation results against gridway meta scheduler shows improved performance in terms of average SLA creation time, success rate and throughput.

1. Introduction

Grid[1] is a dynamic framework where a number of resource providers seek to share their resources in order to meet a common objective. Since the resources belongs to different administrative domains may have different allocation policies in different VO’s, it is mandatory to express and enforce these policies for proper functioning of these collaborative environments.

2. SLA Management Architecture-GSMA

GSMA (Grid SLA Management Architecture) is an architecture that is capable of negotiate, create, monitor and enforce the resource usage policies. The GSMA architecture shown in Figure 1 provides various components of SLA management system such as SLA Creation Engine, SLA monitoring engine and SLA Enforcement Engine. The life cycle of an SLA starts with SLA creation phase. In this phase, the resources are selected for negotiation[5] based on their deviation value against the parameters specified in the job request that is obtained from deviation based resource scheduling algorithm (DRS). The strength of the DRS is that it can co-allocate resources in the under-satisfied region in addition, it is capable of schedule the resources that are fall in exact and over-satisfied region. Upon successful negotiation using Mutual Agreement Protocol (MAP), SLA is formed in SLA creation phase. The SLA monitoring phase monitors the parameters specified in the guarantee terms [2] of SLA. The SLA violations are notified to the SLA enforcement phase that enforces the SLA against the violation and generates necessary actions.

2.1 Negotiation model

During negotiation (refer to Figure 2), the template generator creates the template and communicates it to the Local Resource Manager (LRM) of the resource provider and get back the bid against this TSLA[3]. Then the negotiation module creates an Agreement bill (tentative SLA) using the collected bids and sends it to each resource providers who submit their individual bid.
against current TSLA. The decision maker of each LRM may either accept or reject this tentative SLA (agreement bill). If it is accepted by all the resource providers, the commit module makes it as a concrete SLA and stored in SLA data base. If not, renegotiation starts by replacing the rejecting LRM with the new one getting from grid meta scheduler.

3. Results and Discussion

In our implementation, we use random access model that generates 100 job requests with different requirements in a random fashion that selects the resources in a random manner from the 12500 resources with different capabilities that are available in database. Also we do the simulation repeatedly over 50 times with various numbers of requests and take average of simulation for plotting the results. The results are shown below. From the Figure 3, we conclude that our DRS shows the match in both direction (i.e +1 and -1) and also the amount of match in each direction is computed. But in Gridway [4], the match is unipolar (i.e 0 to +1) (refer to Figure.4). From Figure 5, we conclude that the throughput of the scheduler get maximized while using DRS based scheduling policy due to the fact that the job requests that are not fulfilled by single cluster (in Gridway) can be completed with the help of negotiation used by DRS thereby increase in throughput.

4. Conclusion and Future Work

In this paper, we have presented an architecture of Grid SLA management, which is a scalable and dynamic approach for creating and managing the SLA’s. Simulation results against Gridway meta scheduler shows improved performance in terms of success rate and throughput.

In our on going research work, we realize each component of GSMA as WSRF compliant grid services that leads to loosely coupled architecture and integrate with the grid meta scheduler.

Acknowledgement

The authors would like to thank the Department of Information Technology, Ministry of Communication and Information Technology of India for their financial support and encouragement in carrying out this research by its sponsored Centre for Advanced Computing Research and Education (CARE).

References


