

## Modified Gridway

Gridway has been suitably modified to enhance the Trust mechanism. The Trust which we exploit has been fully described in the document “Final\_journal\_trust”. The following section deals with the Trust formula which we have used to compute Trust and the later section description about the changes we made in the Gridway source file to adapt the Trust Mechanism. This mechanism helps the Gridway in identifying the suitable resources based on the Trust.

### Section 1: Trust Formula

The Trust of a Resource provider is computed by the following equation

$$T(r_i) = \alpha |f_H(r_i, n)| + \beta |f_P(r_i, t_s)| \quad \text{---(1)}$$

Where  $\alpha$  and  $\beta$  are the two weights with respect to the functions. We have used  $\alpha = \beta = 1$ , for testing purpose and the weights can be adjusted as per the application.

#### *Computation of Resource provider past behavior ( $f_H(r_i, n)$ )*

The function  $f_H(r_i, n)$  is determined by the product of Availability  $A_v(r_i)$  and the Success Rate  $S_v(r_i)$ .

$$A_v(r_i) = \begin{cases} \frac{\sum_{j=1}^n A_j}{n} & \text{if } n < C_r, j \geq 1 \\ \frac{\sum_{j=n-C_r}^n A_j}{n} & \text{if } n > C_r, j \geq 1 \end{cases} \quad \text{----- (2)}$$

If the Resource is available during the time of Scheduling, the value  $A_j$  is ‘1’ and if it is not reachable the value of  $A_j$  is ‘0’.

The value of  $S_v(r_i)$  of a resource provider  $r_i$  can be expressed as follows,

$$S_r(r_i) = \begin{cases} \frac{\sum_{k=1}^m S_k}{m} & \text{if } m < C_r, k \geq 1 \\ \frac{\sum_{k=m-C_r}^m S_k}{m} & \text{if } m > C_r, k \geq 1 \end{cases} \quad \text{---- (3)}$$

The values n and m are the positive integers ranging from 1. If the Resource provider  $r_i$  executes a job successfully, then the value of  $S_k$  is '1' and if the job is failed during the execution of a Resource provider  $r_i$ , then the value of  $S_k$  is '0'.

The value obtained through the function  $f_H(r_i, n)$  represents the past behavior of the Resource provider ( $r_i$ ) with respect to a Resource Broker (RB).

\*\*\*Note : (i) The availability and success Rate of all the Resource providers have been updated regularly after the completion of each job.

(ii) For averaging we have used the simple averaging scheme over 100 iterations which is represented by the constant  $C_r$

### **Computation of fulfillment Belief ( $f_P(r_i, t_s)$ )**

We introduce the function fulfillment belief ( $f_P(r_i, t_s)$ ), to determine the best suitability of resources which satisfies the job requirements. The function  $f_P(r_i, t_s)$  computes the current Resource's capability with respect to System and network information which as expressed in the form of CPU (GHz), Bandwidth (Mbps) and Latency (ms). This function finds the product of the Network bandwidth, latency and the CPU unit as follows,

$$f_P(r_i, t_s) = \left( \frac{Cr_i}{CMax + C_1} * \frac{Nr_i}{NMax + C_2} * \frac{LMin}{Lr_i + C_3} \right) \quad \text{---- (4)}$$

In this equation (4)  $CMax$  and  $NMax$  can be computed using the following functions

$$CMax = f_{\max}(Cr_i) \quad \text{Where } i = 1.. N \quad \text{---- (5)}$$

$$NMax = f_{\max}(Nr_i) \quad \text{Where } i = 1.. N \quad \text{---- (6)}$$

$$LMin = f_{\min}(Lr_i) \quad \text{Where } i = 1 .. N \quad \text{---- (7)}$$

The 'N' in the equation (5), (6) and (7) represents the total number of Resources considered at the time of the scheduling and the function  $f_{\max}(Cr_i)$  computes the maximum value of the CPU among the Resources selected in terms of the unit MHz. Similarly the function  $f_{\max}(Nr_i)$  computes the maximum value of the Network bandwidth in terms of the unit MBps, from the list

of Resource providers selected. The function  $f_{\min}(Lr_i)$  represents the Minimum latency of the Resource provider selected. The main significance of these three functions is to make a comparative analysis among the Resource provider's list and to select the best one. Thus the function  $f_p(r_i, t_s)$  computes the present system's capability of a Resource provider ( $r_i$ ).

## Section 2 : Code altered in Gridway source

We have installed gridway of version 5.2.2 in our lab and incorporated Trust Model in this version. The changes we made in the source code are as follows

- i) File Location : Gridway\_directory/src/rm/gw\_rm\_host\_match.c  
This file has been suitably modified to compute the Trust of a Resource provider using the formula which we have described in the previous section.
- ii) File Location : Gridway\_directory/src/host/gw\_host\_attr\_parser.l  
This file has been suitably modified to compute the availability and the success Rate of a Resource provider from the Database oracle 10g.
- iii) File Location: Gridway\_directory/gwd.conf  
This file is modified by introducing a new variable known as TRUST\_VALUE which determines the adopted mechanism for scheduling. In order to follow a Trust based scheduling, the TRUST\_VALUE is made as value '1'.

Note :

\*Database: We have used Oracle 10g for storing the Trust metrics of Resource providers. The tables which we have used for the Trust computation is provided by the DB.sql file. We represent the DB.sql file as follows

```
CREATE TABLE USER_DETAILS (FNAME VARCHAR2(30), PANNO
VARCHAR2(12), USR_ID VARCHAR2(10), PWD VARCHAR2(10), REPWD
VARCHAR2(10), PHNO VARCHAR2(15), ADDRESS VARCHAR2(25), EMAIL
VARCHAR2(25));
CREATE TABLE RESOURCE_DETAILS (RES_NAME VARCHAR2(45), RES_ID
VARCHAR2(25), RES_PASSWORD VARCHAR2(25), RES_ADDRESS
VARCHAR2(200), RES_EMAIL VARCHAR2(25), RES_NO
VARCHAR2(25), RES_TYPE VARCHAR2(25), RES_SECLEVEL
VARCHAR2(25), RES_NOOFNODES VARCHAR2(15), BANDWIDTH
VARCHAR2(20));
CREATE TABLE TRUST (HOSTNAME VARCHAR2(50), TRUSTVALUE
VARCHAR2(25));
CREATE TABLE AFFORDABILITY (SNO NUMBER(10), RES_ID
VARCHAR2(25), RES_NAME VARCHAR2(45), AFFORDABILITY
```

```
NUMBER(10));  
CREATE TABLE SUCCESSRATE (SNO NUMBER(10),RES_ID  
VARCHAR2(25),RES_NAME VARCHAR2(45),SUCCESSRATE NUMBER(10));
```

**Steps to use Table which we have described:**

```
Copy the DB.sql file into /home/oracle directory  
Login in oracle sql  
SQL> @/home/oracle/DBTables.sql
```

**Monitoring Tools used:**

\*Network information: We have installed NWS for acquiring the Network information viz, Bandwidth, Latency.

\*Ganglia : We have installed Ganglia for monitoring the CPU and Memory Information.

**Directory Specification:**

\*Log Directory : the directory named “gw\_logs” have been created in the location “/tmp” and the permission to this directoy has been made to the user who own gridway.