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SPW: Scheduling and Positioning of Web-Services

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Abstract: **With the emergent number of Web services, it has become an urgent task to make operative selection from the large number of functionally-equivalent Web service candidates. It is estimated that there would be large number of web services developed, deployed in the internet in next several years. Earlier approaches proposed that two major properties should be taken into consideration that are functional and non-functional (QoS) when user selects services. There are number of different service provider and we have to effectively select the optimal one from web service candidates. In our approach the requests send by the user are scheduled on the basis of priority scheduling. Then by combining the advantages of network coordinate based approach, collaborative filtering and WSP approach, the response time between user and web services can be accurately predicted. Proposed approach provides selection of services on the basis of user priority.**

Keywords
Scheduling and Web Positioning of web service, Simple Regression and Clustering, Network Coordinate

I. INTRODUCTION

Web services are designed as computational components to build service-oriented distributed systems, such as e-commerce, automotive system, multimedia services etc [1]. There has been a huge increase in the scale of distributed network service with the rising demand of service-oriented Architecture (SOA), more and more alternative web services offered by different service providers becomes available over the internet to provide equivalent or similar-function for service user. Since there is rise in the demand of web services and many web services are available, so we have to effectively select the optimal web service for the user. To understand the effective use of services , it is not only sufficient to comprehend the semantics of the Integrated services or find matching for mandatory positioning of services but also to take their Quality of Service (QoS) properties into account for service positioning. A service that does not provide an adequate QoS might be as useless as a service not providing the desired efficient results.

In this paper we focus on response time out of different QoS properties in selected services on the basis of user priority. It is impractical for every user to measure QoS performance of all the web service as there is large number of service candidate on the web. Recently a number of QoS prediction approaches have been proposed [2-5]. A prediction technique in this context can be explained as a methodology that analyzes historical QoS data from previous users of particular services and uses it to predict the QoS that will be experienced by a current user on the particular services [6]. Simple regression and clustering technique is used in this paper for QoS prediction. Network Coordinates Systems (NCS) have been proposed [7]to allow hosts to estimate delays without performing direct measurements and thus, reduce the consumption of network resources. The key idea of an NCS is to model the Internet as a geometric space and characterize the position of any node in the Internet by a position (i.e., a coordinate) in this space. The network distance between any two nodes is then predicted as the geometric distance between their coordinates. Explicit measurements are, therefore, not anymore required. Network coordinate system approach is used to calculate the coordinate. When the users request more than one web service at a time then we first schedule them according to basis of priority scheduling.

Inspired by the success of network coordinate based prediction approaches and to address the process with minimum deadline problem, we propose a QOS based scheduled web service positioning novel framework by combining the advantages of earliest deadline scheduling and network coordinate based approaches. Further we calculate response time for the first web service in the schedule queue as QOS properties.

II. RELATED WORK

A. Priority Scheduling

Scheduling disciplines are algorithms used for distributing resources among parties which instantaneously and asynchronously request them. Priority scheduling can be either preemptive or non-preemptive. A preemptive priority algorithm will preemptive the CPU if the priority of the newly arrival process is higher than the priority of the currently running process. A non-preemptive priority algorithm will simply put the new process at the head of the ready queue. Assign each process a priority. Schedule service with highest priority first. Priority may be determined by user or by some default method. The priority based on memory requirements, time limits, or other resource usage can be determined by this system.

B. Collaborative Filtering

Collaborative Filtering is the process of filtering or estimating items using the opinions of other people. Collaborative filtering systems produce predictions or recommendations for a given user and one or more items. In recent literature, collaborative filtering has been introduced to modified QoS (e.g., response time) prediction for Web services [11] presented the user-based CF algorithm to predict the QoS values with similarity between users. Researcher proposed the item-based CF algorithm based on the similarity between Web services [2]. These two algorithms are denoted as UPCC (user-based CF with PCC coefficient) and IPCC (item-based CF with PCC coefficient) respectively. A hybrid CF approach, UIPCC [2], was also given by combing UPCC and IPCC approaches.

C. Network Coordinate System

The network coordinate system is proposed in [12] to estimate the network distances, i.e., round trip time (RTT), between pairwise Internet hosts. Triangulated heuristic and global network positioning (GNP) are two widely employed approaches among various network coordinate systems, due to their simplicity and generality.

Triangulated Heuristic [12] services a kind of relative coordinates based on the triangle inequality. A fixed set of landmarks are deployed in the network as locations. Then each ordinary host is apportioned an n-tuple relative coordinate, composed of the network distances between the ordinary host and the landmarks. Given the relative coordinate of each host, we can obtain the upper bound U and the lower bound L of the network distance between two hosts by triangle inequality. The network distance can be expected by the convex combination of U and L (e.g. U+L 2). It is stated in [12] that taking the upper bound U as the network distance prediction result can achieve better performance. The triangulated heuristic approach is broadly used in online shortest path distance calculation in large graphs.

GNP [12] is a emblematic landmark-based network coordinate system, which embed the Internet hosts into an Euclidean space for network distance approximation. After locating the coordinate of each host, the network distance between two Internet hosts can be well approximated by the corresponding Euclidean distance. Figure 1 depicts a network coordinate system prototype. As we can see from the figure, the five Internet hosts can be embedded into a 2-dimensional Euclidean space by assigning each host a coordinate, and then the original network distances can obtain good estimation results using the corresponding Euclidean distances.

In this paper we use GNP (global network positioning). First we embed hosts into a Euclidean system and after that we calculate the coordinate of each host. When we have calculated the coordinate of hosts, we can easily calculate the distance between them by using Euclidean formula that is used to calculate Euclidean distance.

Example host A (x, y) Host B (a ,b) ; distance between them can be calculated by the formula

$$\sqrt{(x-a)^2+(y-b)^2}$$

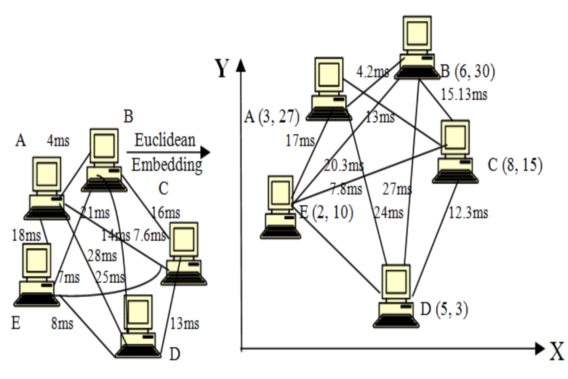

Figure 1 Network Coordinate System prototype

D. *Web Service Positioning Approach*

This approach proposed a web service positioning framework to make response time prediction for web services.

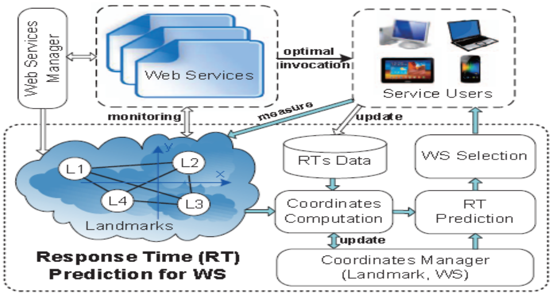

Figure 2 WSP Framework [11]

In this framework, a small number of landmarks are deployed in the internet to construct the network coordinate system. This approach follows network coordinate based and CF- based approaches [11].The experimental results show that the earlier proposed WSP approach solves the data sparsity problem of CF-based approaches and significantly enhances the prediction accuracy.

III. SCHEDULING AND POSITIONING OF WEBSERVICES (SPW) FRAMEWORK

We proposed a novel approach of web service positioning using earliest deadline scheduling in web services and calculating its response time. Our SPW framework combines the advantages of network coordinate based, simple regression and clustering approaches in priority scheduled queue.

The response time is calculated using WSP based QOS algorithm [11] which includes Offline coordinate updating and online web services selection.

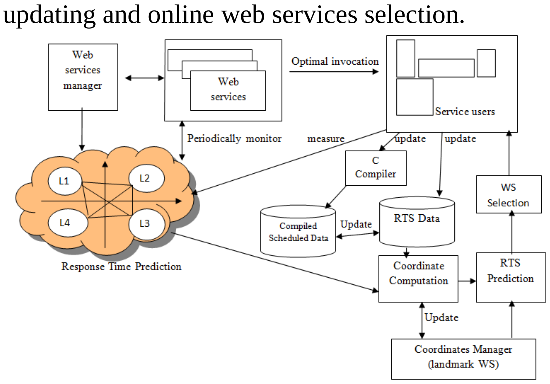

Figure 3 SPW Framework

Figure 3 depicts the framework of QOS based schedules web service positioning. The proposed novel approach will follow the following steps shown in figure 4.

After web services are scheduled in a queue using earliest deadline first scheduling, the WSP based QOS prediction algorithm [11] is followed in data gathered through simple regression and clustering method.

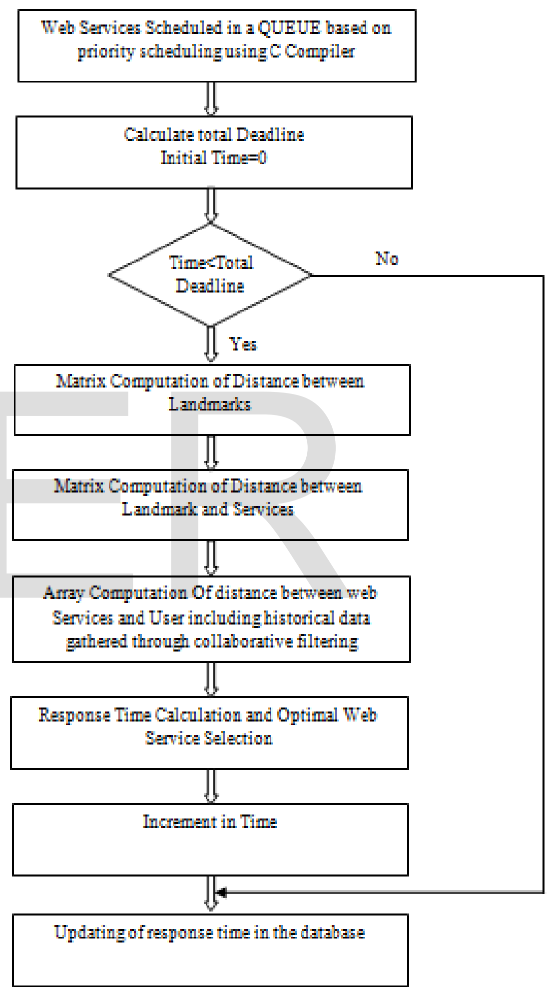

Figure 4 Flowchart depicting the working of SPW

1. *Matrix Computation Of Distance Between Landmark*

For n-dimensional Euclidean space, there should be at least n+1Landmarks. Problem that arises is that how landmarks should be deployed. We are using spectral clustering based approach [15] in this paper, m landmarks denoted by $L_{\varnothing}=\{ L_I , I = 1,2 \ldots m\}$ are deployed in the internet. Ping message is used to measure distance between landmarks and then transmitted to central node.

- *m*m landmarks distance matrix*

$$LD=\begin{vmatrix} 0 & d(l_1,l_2) & \ldots & d(l_1,l_m) \\ d(l_2,l_1) & 0 & \ldots & d(l_2,l_m) \\ \ldots & \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots & \ldots \\ d(l_m,l_1) & d(l_m,l_2) & \ldots & 0 \end{vmatrix} \longrightarrow 1$$

Where entry $d(l_a, l_b)$ define the distance between landmarks l_a and l_b. matrix is to be assume symmetric along diagonal. Then we embed m landmarks' into an n-dimensional Euclidean space R^n and then each landmark obtain coordinate in Euclidean space denoted as $x^k_{la} = (x^1_{la},\ x^2_{la} ,.. x^n_{la})$ where x^k_{la} Ɛ R, 1<=K<=n

Function is define as the sum of error square i.e.

$$F_{l_e}(x_{l1}, \ldots x_{lm}) = \sum_{k=1}^{m} [\, d'(l_a , l_b)-d(l_a , l_b)]^2 \quad \text{----------2}$$

l_a,l_b ƐL_e,a>b

$$d'(l_a , l_b) = \| x_{la}-x_{lb} \|_2 = \sqrt{\sum (x^k_{la}- x^k_{la})^2} \quad \text{---------------3}$$

Regularization term is added to address unknown response time between users and web services.

$$F'_{L_e}(x_{l1}, \ldots x_{lm}, \mu_L) = \sum_{l_a,l_b \in L_e, a>b} [\, d'(l_a , l_b)-d(l_a , l_b)]^2 + \mu_L \sum_{k=1}^{n} \|x_{lk}\|^2_2 \quad \text{---4}$$

Simplex downhill algorithm [10] is used to solve minimization problem. Landmark should keep updated periodically to track the changes of network condition [11].

2. Matrix Computation Of Distance Between Landmark And Services

A small number of landmarks monitor the available web services by periodically invoking them[11]. Assume there are z available web services denoted by W={wi,i=1,2,…z}

Then m*z matrix is computed which include network distance between m landmarks and z web services.

$$LS=\begin{vmatrix} d(l_1,w_1) & d(l_1,w_2) & \ldots & d(l_1,w_z) \\ d(l_2,w_1) & d(l_2,w_2) & \ldots & d(l_2,w_z) \\ . & . & \ldots & . \\ . & . & \ldots & . \\ d(l_m,w_1) & d(l_m,w_2) & \ldots & d(l_m,w_z) \end{vmatrix} \longrightarrow 5$$

Where entry d(la,wb) define the distance between landmarks la and web service wb. It is then transmitted to the central node.

3. Array Computation Of Service User Coordinate

Our QSWSP provide optimal web service selection to any web service requester. In the starting, the user measures the network distance between him and the landmarks using ping message. The result is transmitted to the central node for coordinate computation.

$D_{userl} = [d(su,l_1) \quad d(su,l_2) \quad \ldots \quad d(su, l_m)]$. Where entry $d(su,l_a)$ define the distance between landmarks l_a and service user su.

{$d(su,w_b)$, su Ɛ S} is the available historical data between service user and web services. S is the web service set which include available historical data. To obtain the coordinate of the service user (x_{su})

$$F_{su} (x_{su} , \mu_{su}) = \sum_{l_a \in L_e} [\, d'(su ,l_a) - d(su, l_a)]^2 + \sum_{w_a \in S} [\, d'(su, w_a) - d(su , w_a)]^2 + \mu_{su} \|x_{su}\|^2_2 \quad \text{-------------------------6}$$

Where entry $d'(su ,l_a)$ define the distance between landmarks l_a and service user su.

Where entry $d'(su ,w_a)$ define the predicted response time value between web service w_a in S and service user su.

4. Response Time Calculation and Optimal Web Service Selection

Now we calculated the Euclidean distance between coordinates of service user and web services which is equal to the response time.

$d'(su ,w_a) = \|x_{su} - x_{wa}\|_2$, w_a Ɛ S, w_a Ɛ S_a, means set of web services with unknown response time[11].

IV. EXPERIMENT

Experiment conducted on basis of WSP approach[11] but before this web services are scheduled priority wise using C Compiler.

START
STEP 1: Print "How many web-services are you going to request at a time"
STEP 2: Read n
STEP 3: Print "Enter web-services and its priority (priority should be at first location)"
STEP 4: set I = 0
STEP 5: Repeat step 6-7 until i<n
STEP 6: Read webpri [i]
STEP 7: i++
STEP 8: set i= 0
STEP 9: Repeat step 10-14 until i<n
STEP 10: set j = i+ 1
STEP 11: Repeat step 12-13 until j< n
STEP 12: [Arranging them in order]
If * (webpri [i] + 0) > * (webpri [j] + 0) then
Strcpy (t, webpri[i], strcpy (webpri [i], webpri[i].
Strcpy (webpri[j], t)
STEP 13: j++
STEP 14: i++
STEP 15: Print " web-services according to their priority are"
STEP 16: set i= 0
STEP 17: Repeat step 18-19 until i<n
STEP 18: Print webpri [i]
STEP 19: i++

STOP

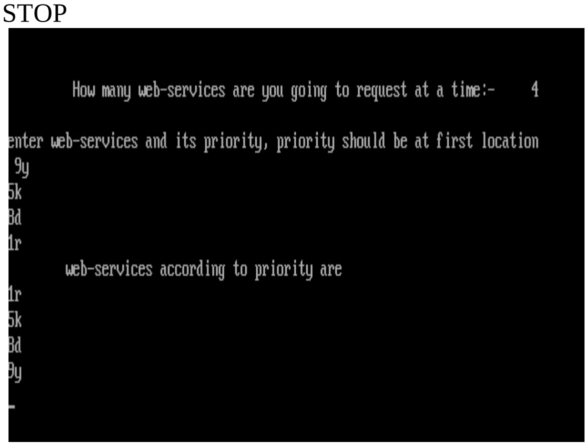

Figure 5 Web services scheduled using Priority queue

Figure 5 depicts the compiled priority scheduled data. This paper, collected data used in WSP approach [11] a QoS dataset for experiment, comprising the response times between 200 users (PlanetLab nodes) and 1,597 Web services, together with the network distances between the 200 distributed nodes, for our SPW approach. And response time is calculated using QOS based algorithm[11].

The advantage of this proposed approach over WSP is that it provides selection of services on the basis of user priority.

V. CONCLUSION AND FUTURE WORK

In this paper we propose a novel approach for QOS based scheduling method for web service positioning when there are number of request at a time .By combining the advantage in network coordinates based approaches priority scheduling and collaborative filtering, our SPW is constructed to support response time prediction for service users. It can also serve users without available of historical data .In this paper using scheduling technique we only focused on response time. In future we will extend SPW model to be implemented using various experiments to other QoS properties. We will further study to improve the working of SPW using different data mining techniques.

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