Improved Grid Service Discovery with Rough sets

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ABSTRACT
In this paper our basic aim is to present the improved mechanism for the grid service discovery using rough sets with parallel execution of servers. ROSSE is a search engine for grid service discovery. Building on Rough sets theory, ROSSE is novel in its capability to deal with uncertainty of service properties when matching services. This is achieved by dynamically identifying and reducing dependent properties that may be uncertain properties when matching a service query. In this way, ROSSE increases the accuracy in service discovery. Finally, ROSSE is evaluated from the aspects of accuracy and efficiency in discovery of computing services. Improvement in ROSSE model is enhanced by providing the parallel execution of resource requests in order to enhance the Service Discovery.

Keywords
Rough set, Resource manager server, grid service discovery

1. INTRODUCTION
Grid computing is a newly developed technology for complex systems with large-scale resource sharing, wide-area communication, multi-institutional collaboration, etc. The real and specific problem that underlies the Grid concept is coordinated resource sharing and problem solving in dynamic multi-institutional virtual organizations. This is required by a range of collaborative problem solving and resource-brokering strategies [1]. This sharing is highly controlled by resource management system (RMS), with resource providers and consumers defining what are shared, who is allowed to share, and the conditions under which the sharing occurs. With the development of Web service technologies, the computational grid is rapidly evolving into a service-oriented computing infrastructure that facilitates resource sharing and large-scale problem solving over the Internet. The Open Grid Services Architecture (OGSA), promoted by the Open Grid Forum (OGF) [7] as a standard service-oriented architecture (SOA) for grid applications, has facilitated the evolution. It is expected that the Web Service Resource Framework (WSRF) [1] will be acting as an enabling technology to drive this evolution further. The promise of SOA is the enabling of loose coupling, robustness, scalability, extensibility, and interoperability for large-scale grid systems. A service bus building on service-oriented grid middleware technologies such as Globus enables the instantiation of grid services. A grid environment may host a large number of services. Therefore, service discovery becomes an issue of vital importance in utilizing grid facilities. Grid services are implemented as software components, the interfaces of which are used to describe their functional and non-functional properties (attributes). Advertising services in a grid environment means that service-associated properties are registered with a service registry.

Service discovery involves a matching process in which the properties of a service query are matched with that of a service advertisement. In a grid environment, service Publishers may advertise services independently using their predefined properties to describe services. Therefore, uncertainty of service properties exists when matching services. An uncertain property is defined as a service property that is explicitly used by one advertised service but does not appear in another service advertisement that belongs to the same service category. To increase the accuracy of service discovery, a search engine should be able to deal with uncertainty of properties when matching services.
An uncertain property is defined as a service property that is explicitly used by one advertised service but does not appear in another service advertisement that belongs to the same service category. This can be further illustrated using Table 1. For example, property P1, which is explicitly used by service S1 in its advertisement, does not appear in the advertisement of service S2. Similarly, property P3, which is explicitly used by service S2, does not appear in the advertisement of service S1. When services S1 and S2 are matched with a service query using properties P1, P2, P3, and P4, property P1 becomes an uncertain property in matching service S2, and property P3 becomes an uncertain property in matching service S1. Consequently, both S1 and S2 may not be discovered because of the existence of uncertainty of properties even though the two services are relevant to the query. It is worth noting that properties used in service advertisements may have dependencies, e.g., both P1 and P3 may be dependent properties of P2 when describing services S1 and S2, respectively. Both S1 and S2 can be discovered if P1 and P3 (which are uncertain properties in terms of the user query) are dynamically identified and reduced in the matching process. To increase the accuracy of service discovery, a search engine should be able to deal with uncertainty of properties when matching services

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Table 1 Two Service Advertisements with Uncertain Service Properties

Advertised Service	Property	Property	Property	Property
S1	P1	P2		P4
S2		P2	P3	P4

2. ROUGH SETS FOR SERVICE DISCOVERY
A fundamental principle of a Rough sets-based learning system is to discover redundancies and dependencies between the given features of a problem to be classified. The Rough sets theory approaches a given concept using lower and upper approximations.
Let,

- Ω be a domain ontology,
- U be a set of N advertised services whose properties are defined in Ω,U={s1,s2,s3,…,sN}N>=1,

- P be a set of K properties that describe the N advertised services of the set U,P={p1,p2,…,pk} k>=1;
- PA be a set of M properties that are relevant to the service query Q in terms of Ω PA={pA1,pA2,….,pAM},
- X be a set of Advertised services that are relevant to the services query in terms of Ω.
- $\underline{X}$ be a lower approximation of the set X,
- $\overline{X}$ be an upper approximation of the set X,
- $[x]_{P_A}$ be a set of advertised services that are exclusively defined by the properties of the set PA. x € U.

$$\underline{X} = \{x \in U : [x]_{P_A} \subseteq X\}, \qquad (1)$$

$$\overline{X} = \{x \in U : [x]_{P_A} \cap X \neq \emptyset\}. \qquad (2)$$

Using the size of the set $\underline{X}$ a user can dynamically determine the size of the set $\overline{X}$ that would

maximize user satisfaction in service discovery. The selection of services based on lower and upper approximations.

To present the grid services efficiently and accurate through the rough set grid environment should be prepared with mechanisms mentioned below.

Rough sets theory is a mathematic tool for knowledge discovery in databases. It is based on the concept of an upper and a lower approximation of a set as shown in Figure 1. For a given set *X*, the yellow grids (lighter shading) represent its upper approximation, and the green grids (darker shading) represent its lower approximation.

2.1 Reducing Irrelevant Properties [8]

When searching for a service, a service requestor may use some properties irrelevant to the properties used by a service publisher in terms of domain ontology. These irrelevant properties used by advertised services should be removed before the service matchmaking process is carried out.

2.2 Reducing Dependent Properties [3] [4] [5]

Property reduction is an import concept in Rough Sets. Properties used by an advertised service may have dependencies. Dependent properties are indecisive properties that are dispensable in matching advertised services.

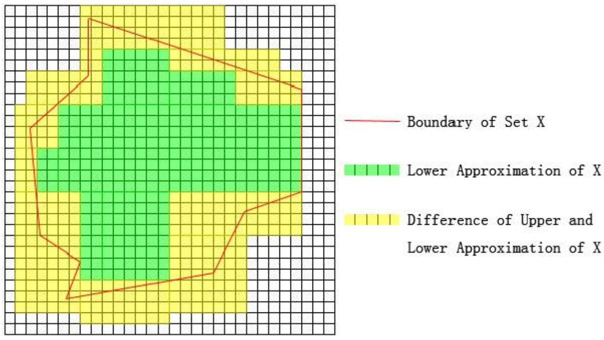

Figure 1: Approximation in rough sets.

2.3 Service Matching and Ranking [6]

Properties are matched and ranked terms of a service request. Fuzzy set theory may use for service matchmaking. The relationships between the properties of advertised services and the properties of service queries are mapped to fuzzy linguistic variables, e.g., exact is mapped to very relevant, and plug-in is mapped to relevant.

2.4 Role of RM Server [2]

A grid service is designed to complete a set of programs under the grid circumstances. The programs may need distributed remote resources. However, they initially do not know the site information of those remote resources in such a large- scale environment, so RMS plays an important role in managing the pool of shared resources, in matchmaking the programs to their requested resources, and in controlling them to access the resources through a wide-area network.

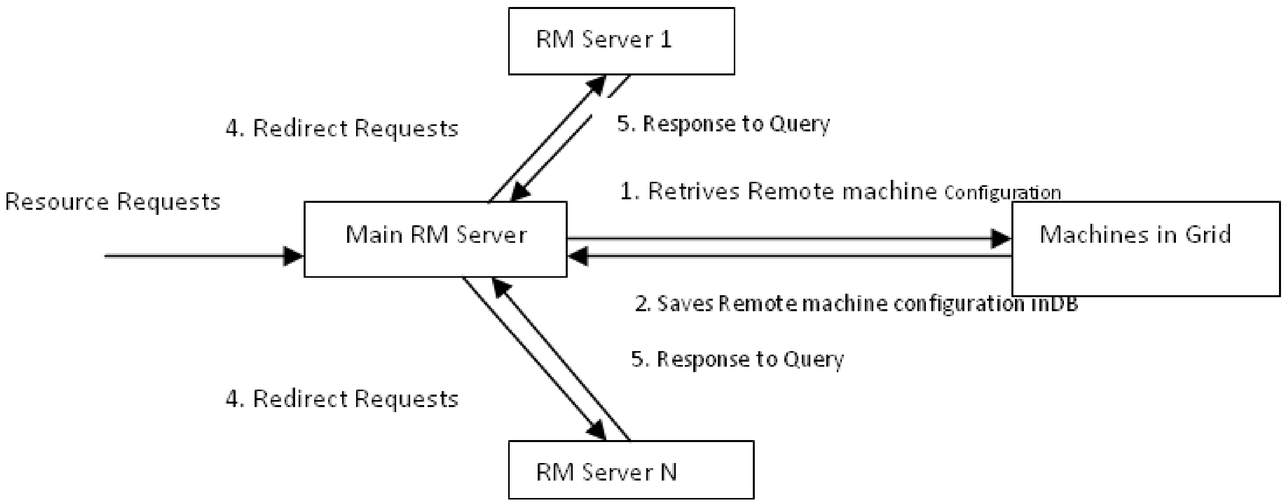

Fig 2.Parallel RM servers handling request

3. HANDLING SERVICE REQUESTS WITH PARALLEL RM

Fig 2 shows the model. Multiple service requests can be executed in parallel fashion on multiple RM servers.The focus is on improvement of ROSSE model by providing the parallel execution of resource requests in order to enhance the Service Discovery. We are developing a wrapper for some basic interfaces that provide detailed information about a system. The class allows the use of the current security context or a specified name and path to access either a remote or a local machine. Once connected, the class is then populating the values from the machine. This gives us an easy way of accessing the information without having worry about the calls to each of the interfaces and it stores all the information. In this module we use rough set based match making algorithm to find out the required service. This is the one of important portion of this project. By select the profile and system id the matching will occur as shown in Figure.3. Here, focus is on concurrent execution of the multiple service requests, so that service discovery process may improve as well as satisfaction among users. There are homogeneous RM (Resource Management) servers serving in parallel to user request. Query requests from multiple users may execute parallel on RM servers. Hence, this ultimately reduces the time for service discovery.

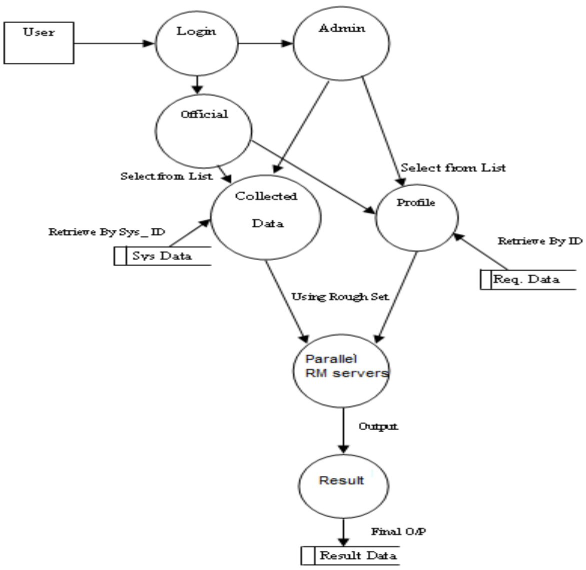

Fig.3. Schematic of Data Matching

4. CONCLUSION

In this paper, we have presented ROSSE, a search engine for discovery of grid services. ROSSE builds on the Rough sets theory to dynamically reduce uncertain properties when matching services. In this way, ROSSE increases the accuracy of service discovery. To maximize user satisfaction in service discovery, ROSSE dynamically determines the set of services that will be presented to users based on the lower and upper approximations of relevant services. Improvement in ROSSE model is enhanced by providing the parallel execution of resource requests in order to enhance the Service Discovery and it reduces service discovery time.

5. REFERENCES

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