Chapter XV
Service Discovery with Rough Sets

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ABSTRACT

The computational grid is rapidly evolving into a service-oriented computing infrastructure that facilitates resource sharing and large-scale problem solving over the Internet. Service discovery becomes an issue of vital importance in utilizing grid facilities. This chapter presents ROSSE, a Rough sets based search engine for grid service discovery. Building on Rough sets theory, ROSSE is novel in its capability to deal with uncertainty of properties when matching services. Services with WSDL interfaces or OWL-S interfaces can be registered with ROSSE and then be discovered.

INTRODUCTION

The past few years have witnessed the rapid development of grid computing, a computing paradigm that can be employed to utilise various resources on the Internet. The evolution of grid computing can be divided into the following stages:

- **Parallel computing** is targeted at high performance computing using parallel computers of which each has multiple processors. A parallel library such as MPI (Message Passing Interface, http://www-unix.mcs.anl.gov/mpi/) or PVM (Parallel Virtual Machine, http://www.csm.ornl.gov/pvm/)
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can be used to make multiple processors of a supercomputer work together to achieve high performance. Parallel computing environment focuses on high performance and utilize dedicated resources.

- **Cluster computing** is a computing paradigm that couples inexpensive personal computers in a LAN to utilise resources. Most cluster computing environments employ a master-slave mode with one master node and multiple working nodes. Compared with parallel computing environments, a cluster is cheap to deploy, and the capacity of resources can increase dynamically. Unlike parallel computing environments, resources in a cluster environment can be non-dedicated, and can be effectively shared. Software technologies such as Condor (http://www.cs.wisc.edu/condor/), PBS (Portable Batch System, http://www.openpbs.org/), LSF (Load Sharing Facility, http://www.platform.com/Products/Platform.LSF.Family/), Sun Grid Engine (http://www.sun.com/software/gridware/) can be used to build a cluster computing environment.

- **Meta-computing** is a computing paradigm that can be used to build a large scale computing environment on top of cluster computing environments and parallel computing environments. A meta-computing environment is characterised by coupling heterogeneous resources which may spread across organizational boundaries. Globus (http://www.globus.org) and Legion (http://legion.virginia.edu/) are two representative middleware technologies for developing meta-computing systems.


Standards are needed to make grid systems interoperable. Building on Web services technologies (Curbera et al., 2002), the global grid forum (now is open grid forum, http://www.ogf.org) promotes Open Grid Services Architecture (OGSA) (Foster et al., 2002) as a standard service-oriented architecture (SOA) for the next generation of grid systems. In the context of OGSA, it is envisioned that various physical resources such as processors/CPUs, disk storage, network links, instrumentation and visualisation devices as well as applications and software libraries would be exposed as services. Discovering services of interest from a large grid environment becomes an issue of vital importance in utilizing grid facilities. This article introduces ROSSE (Li et al., 2006; Yu et al., 2006), a Rough sets (Pawlak, 1982) based search engine for service discovery in the grid infrastructure.

**BACKGROUND**

Grid services are implemented as software components, the interfaces of which are used to describe their functional and non-functional properties (attributes). Publishing (advertising) services in a grid environment means that service-associated properties are registered with a service registry. Service discovery involves a process of matching service properties of a user query with that of a service advertisement.
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