Grid Meta-Broker Architecture: Requirements of an Interoperable Grid Resource Brokering Service

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The Grid was originally proposed as a global computational infrastructure to solve grand-challenge, computational intensive problems that cannot be handled within reasonable time even with state of the art supercomputers and computer clusters [1]. Grids can be realized relatively easily by building a uniform middleware layer, on top of the hardware and software resources, the programming concept of such distributed systems is not obvious. To enhance the manageability of grid resources and users Virtual Organizations were founded. This kind of grouping started an isolation process in grid development, too. Interoperability among these "islands" will play an important role in grid research.

As resource management is a key component of grid middlewares, many solutions have been developed. After examining the existing resource brokers we created a taxonomy, which helps identifying the relevant properties of these brokers. Utilizing the existing, widely used and reliable resource brokers and managing interoperability among them could be new point of view in resource management. This paper introduces an abstract architecture of a Meta-Broker that enables the users to access resources of different grids through their own brokers. Designing such architecture the following guidelines are essential: As standards play an important role of today's grid development, the interfaces must provide standard access. The architecture must be "plug-in based" - the components should be easily extended by all means. The main components of the system: the *Converter* is responsible for translating the user requests to the language of the appropriate broker that the Meta-Broker wants to invoke; the *Information System* stores the properties of the reachable brokers and historical data of the previous submissions; the *Matchmaker* selects the proper broker for a user request; the *Submitter* communicates with the connected brokers, invokes them with a job request and collects the results. The job description contains the user request, and the Information System provides the broker information needed for the Meta-Broker to decide where to submit the job. The interconnected brokers' tasks are to perform the actual job submissions; to find the best resource within their scopes, i.e. the VOs they have access to. The Meta-Broker only needs to communicate with them. In this sense meta-brokering stands for brokering over resource brokers instead of resources.

Some related works also deal with interoperability: The Grid Interoperability Project [2] has some results on resource brokering between Unicore [4] and Globus [5] Grids. The goal of their work was to create a semantic matching of the resource descriptions, but their ontological mappings specialize only in these two middlewares. The Gridbus Grid Service Broker [3] is designed for computational and data-grid applications and supports all Globus middlewares and Unicore in experimental phase. Both solutions aim at accessing resources from different grids, but their architecture stays on the level of direct resource brokering.

Grid portals give a user friendly access to grid resources and other grid services. Using a Web-based portal, the user can submit a job easily, regardless of location. The P-GRADE Portal [6] is a workflow-oriented, multi-grid portal that provides all the functions needed for job submission. P-GRADE portal is already connected to different grids and brokers. Integrating the Meta-Broker to this portal provides the next step supporting interoperability in grids.

The introduced meta-brokering approach opens a new way for interoperability support. The design and the abstract architecture of the Grid Meta-Broker follow the latest results and standards in grid computing. This architecture enables a higher level brokering called meta-brokering by utilizing resource brokers for different middlewares. This service can act as a bridge among the separated "islands" of the current grids, therefore it enables more beneficial resource utilization and collaboration.

References

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