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Processing the Model of the Grid Protocols Stack

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Abstract

In this work, processing the model of the grid protocols stack is the main objective. The development of a software product for the management and administration of computing nodes of the created grid system is underway. The general concept and history of grid computing, their advantages and examples of use are considered. Modern software tools for the implementation of grid systems are analyzed. The most suitable option for work is selected.

Keywords: Grid systems; Protocol; Web concept; Layer; Model

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Introduction

Information technology is developing at an astonishing rate today. Computers are being introduced into all spheres of human activity. And, of course, they are actively used in science, mathematics, physics, chemistry, biology and all these areas require the use of computing power to achieve the best results. Each new study is not complete without processing and calculating a large amount of data. The obvious and familiar solution to this problem for tens of years has been the use of supercomputers. However, even now, this does not always meet the needs of scientists and engineers.

Creation of distributed computing systems is based on grid technology. Currently intensive research is being conducted to create virtual supercomputers-grid systems, which perform the work of supercomputers in the world, but at the same time cheaper. Grid technologies are distributed computing systems created using unused computing resources of computers located within different organizations with the help of global communication technology. Such systems, which solve complex problems and that require large computing and memory resources in the course of fundamental scientific research are created on the basis of computer networks with high-speed communication channels.

The complexity of using computers belonging to different organizations is completely explained. This is because it is very difficult for a single center to involve the resources of computers running different operating systems in solving a complex problem. On the other hand, the independent resources of computers belonging to different organizations are used not on a voluntary basis, but on the basis of traditional market principles. Commercialization of calculations, allows to increase the number of participants in the created Grid-systems. In the market of grid systems services, producers and consumers of computing resources have different goals, use different strategies, different mechanisms of economic regulation of supply and demand.

Computing resources of personal computers of users involved in the creation of grid systems can be used for free and for fee. The sale of unused resources of paid computers creates a new market. The personal computers involved in the grid system send their computing power information to the system's central computer, and the center pays the user accordingly, if it uses a personal computer.

Over the short history of the existence of such systems, many different paradigms have emerged that have gained great weight and general recognition for the implementation of distributed computing, but then disappeared practically under the pressure of newer and more elegant approaches. However, when technology disappears from view, it often reappears under a new name. The result is that basic concepts are constantly mixed with the latest development approaches.

Methodology

In the mid-1990s, there were two main approaches to developing distributed computing systems. On one hand, the concept of the Web was a human-centered distributed information space. On the other hand, distributed object technologies such as Common Object Request Broker Architecture (CORBA) and Distributed Component Object Model (DCOM) primarily focused on creating distributed environments that provide the benefits of accessing network resources by simulating the development and execution of native applications. However, despite the original idea of the Web as a space that allows many Webs to share information, most users have consumed the information without posting anything in return. Meanwhile, the systems of distributed objects grew in terms of opportunities provided, but became increasingly difficult in terms of development and use [1-3].

Immediately after the start of the new millennium, there was an explosion in the development of new methods and middleware for distributed computing systems, including P2P (peer-to-peer) technologies and Grid technology. The use of P2P allowed many users who were previously only consumers of information to participate in content provision. On the other hand, the use of grid technology has made it possible to integrate large data processing and storage complexes, ensuring their availability for various government and scientific users. The concept of grid computing is focused on building an infrastructure that provides "on-demand computing", similar to how we can now access utilities such as electricity.

At the same time, the business world has begun to develop next-generation specifications designed to solve early standards of distributed object technologies through Web services and service-oriented architecture. The merger of the business approach is providing computing resources in the form of services and the concept of grid computing led to the emergence of a new concept called cloud computing in late 2010 [4,5].

The term "Grid" was coined by Jan Foster in early 1998 with the publication of the book "Grid New Computing Infrastructure". Grid, a system that coordinates distributed resources through standard, open, universal protocols and interfaces to provide insignificant quality of service (QoS). Although the basic idea of the grid has not undergone significant changes in the last decade, a comprehensive definition of the grid still does not exist.

The main idea underlying the grid-computing concept is the centralized remote provisioning, required to solve various computational problems. In a sense, the concept of grid-computing reconnects the idea with the concept of the power grid. Also in the grid ideology: we can run any task from any computer or mobile device for computation. Resources for this computation must be automatically provided on remote high-performance servers regardless of the type of our task.

From a more practical perspective, the main task underlying the grid concept is the coordinated distribution of resources and problem solving in a dynamic, multidisciplinary virtual organization. The distribution of resources that network developers are interested in is, not file sharing, but direct access to computers, software, data, and other resources required to co-solve tasks and resource management strategies that arise in industry, science and technology. A virtual organization (SC) is a person or organization united by common rules for mass access to distributed computing resources. Research and development in the grid community is particularly scalable. These technologies include:

• Security solutions that support the management of certificates and security policies by more than one organization during data processing.

• Resource and service management protocols supporting secure remote access to computing and data resources as well as redistribution of various resources.

• Information request protocols and services that enable the configuration and monitoring of the status of resources, organizations and services.

• Data processing services that enable searching and transferring data sets between storage systems and applications.

Figure 1 shows the levels of the Grid protocols stack and this structure looks like the OSI (Open Systems Interconnection Reference Model) network model.

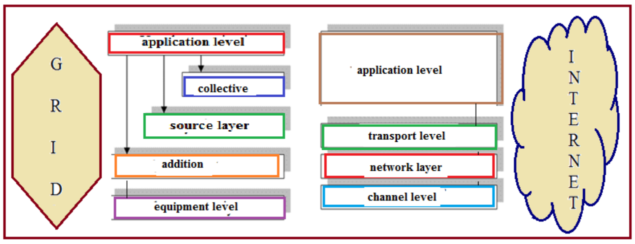

Figure 1: Model showing the levels of the grid protocols stack.

Results and Discussion

The following grid architecture levels are distinguished:

Basic level (Fabric)

Basic level (Fabric) includes computers, storage devices, networks, sensors, etc. Here, services that provide direct access to processor capacities, memory resources, information resources, network resources and distributed *via* grid protocols are defined.

Connectivity

Connectivity defines communication and authentication protocols that provide data transfer between basic level resources. The link level of the grid is based on the Transmission Control Protocol (TCP)/Internet Protocol (IP) protocol stack: Internet (IP, Internet Control Message Protocol (ICMP)), transport protocols (TCP, User Datagram Protocol (UDP)), application protocols (Domain Name System (DNS), Open Source Robotics Foundation, Inc. (OSRF)).

Resource level

Resource level implements protocols for interacting with relative value scale (RVS) resources and their management. These protocols provide the following functions:

• Coordination of resource use security policies

• Source initiation procedure

• Monitoring the status of the resource

• Source control

• Resource use accounting

Collective level

Collective level is responsible for the global integration of various resource sets and may include directory services, joint resource allocation, planning and resource allocation services, resource monitoring and diagnostic services, data replication services.

Application level (Applications)

Application level (Applications) includes tools for working with user applications. They can use resources found in the lower layers of the grid architecture.

Grid Standards are:

The key to developing grid applications is standardization, which allows you to organize the search, use, deployment and monitoring of the various components that make up a single virtual system, even if they are provided by various service providers or managed by various organizations. At the beginning of 2001, several projects presented various methods for implementing grid computing. But they all agreed on one thing: a service-oriented model was proposed to provide flexible, transparent and reliable access to computing resources [6-8].

Technologies used to create distributed computing systems are shown in **Table 1**.

Table 1: Technologies used to create distributed computing systems.

Utility computing	Distributed computing	Cluster computing	Grid computing
Utility Computing is based on the principle of distribution of resources of one computer (multi-terminal processing systems) among users.	Distributed computing is independent modules of the program means, performing on two or more computers. In this case, interconnection is carried out through a network.	Great with the help of local network technologies use in solving complex problems that require computing and memory resources numerous computing nodes located and located within an organization (microprocessor, computer, etc.) is a computing system created by a combination.	Complex with the help of communication technology numerous used in problem solving and located in various organizations created by a combination of computing nodes (server, computer, etc.) is a distributed computing system

In 2001, web application technology was chosen as the basis for establishing a standard for network application architecture. The developed Grid architecture standard is called Open Grid Services Architecture (OGSA). It is based on the concept of a network service. A network service supports the provision of complete information about the current state of a (potentially temporary) instance of a service, as well as the possibility of reliable and secure execution, lifetime management, sending notification of changes in the status of a service instance, managing resource access policies, managing access certificates. The network service supports the following standard interfaces:

• Search-Network applications need mechanisms to search for available services and determine their characteristics.

• Dynamic service creation-The ability to dynamically create and manage services is one of OGSA's core principles that require services to create new services.

• Life time management-A distributed system should provide the ability to destroy an instance of the network service.

• Notification-To make the network application work, the sets of network services must be able to inform each other about changes in their state asynchronously.

The joint efforts of the network community and organizations to improve web service standards have led to the definition of standards that meet network requirements. The proposed WSRF (Web Service Resource Framework) standard defines universal mechanisms for defining, viewing, and managing the state of a remote resource critical to a network [9].

Conclusion

Currently, there are two systems that provide infrastructure for the development of grid systems in accordance with OGSA standards implemented through WSRF: Globus Toolkit and Uniform Interface to Computing Resources (UNICORE).

Globus system-This is a project of developing and providing infrastructure for network computing. The development of this project falls on 1997 and its development continues today.

The purpose of its creation is to enable applications to run as a single virtual machine with distributed heterogeneous computing resources. The main focus of this project is to compute Grid systems. Grid computing system means a hardware and software resources infrastructure that provides reliable and full-scale access to high-performance computing systems regardless of the geographical location of users or resources.

The general structure of the Global Grid is defined as a stack of protocols. In this model, each level is designed to solve a narrow circle.

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