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Paper: The Future of Peer-To-Peer Computing [1]
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Summary

In the late 1980s, companies widely accepted client/server models to gain competitive advantages in the declining economy. Most client computers are idle majority of the time. Therefore, in the currently bad economy, companies are seeking again to maintain competitiveness. By maximizing the use of the client computers, peer-to-peer (P2P) model is the best answer to gain that competitive edge. In P2P systems, a computer acts as both the client and server depending on what the most appropriate role is for the computer at that time. P2P has many advantages such as low cost and fast processing. However, there're still problems in large-scale P2P projects. This paper investigates two P2P network examples and discusses solutions to them. These two examples are the Napster Model and Power Server Model. In the Napster Model, the participant's computer sends its local file information to the Napster's central computer. When another participant's computer requests for a target file, the central computer, sends the address of the participants that have the target file, and the request computer will directly establish connection to the computer with the target file. The Power Server Model is quite different from the traditional client-server model where one server serves many clients. In the Power Server Model, many servers work together to serve a client's request. Usually, the requests are very computation-intensive therefore, needing multiple servers to do the processing. These servers are actually, participating computers with the server software installed. They donate free computer time to do the computation for the client.

Critical Comments

Strengths

- P2P approach minimizes the workload on the server and maximizes the overall network performance. It makes more efficient use of client computers by allowing the users to make use of the collective resource in the network.
- P2P is a type of distributed computing. It allows companies to accomplish large computation jobs that they couldn't handle before.
- It is cost effective for any type of users, whether it's an individual user or a large company. It's low in cost and fast in processing.
- P2P Allows file and computer power sharing. Large projects such as cancer research can utilize idle computers of participants to discover drugs for cancer treatments.
- The Power Server Model is very useful for large computation requests. It supports multiple projects and benefits all participants. The participating computer can be both the client and the server; any participant can initiate a project. The best thing about the Power Server Model is that it supports all types of platforms and has security enforcement through the "Security Manager" on the participants' computers.

Weaknesses

- Without the Power Server Model, there are some problems in developing large-scale P2P projects, which includes issues with security, motivation, performance efficiency, and compatibility.
    - Security Issues: The participants must completely trust the organization before downloading the P2P program from the organization. This is because, running P2P programs significantly increases a computer's vulnerability to security breaches such as deleting files and directories, read/write files on the computer, program or command executions, connection to other computers to perform illegal operations. If the participating computer downloads a P2P program from an organization with ill intentions, that organization can use the computer for illegal reasons or harm the computer. It's very difficult to security the participating computer against misuses by the organization. A lot of participants' computers run Microsoft Windows operating system, which

is more vulnerable to security risks. In addition, only big companies such as Intel or the University of Oxford can assure network safety to its participants.

- Motivation Issues: Although individuals can participate in P2P projects, but the number of participants and computation powers are small compared to the most ideal donors for CPU cycles---commercial organizations that have free idle computers outside the business working hours. However, because donors don't receive any benefit from sharing their computer, most commercial organizations don't participate in such P2P projects.

- Performance Efficiency Issues: There is no automatic method for storing and updating the P2P programs on the participants' computers. For example, if the participants want to donate free CPU cycles, their computers must download and install the P2P program each time they donate processing time. Also, it's difficult to upgrade programs on the participating computers or maintain the entire system.

- Compatibility Issues: Some computers have Windows OS, UNIX, or some other operating system. The cancer research project discussed runs only on Windows OS therefore; it can't utilize the many other available computer times on other operating systems. For projects such as SETI that are compatible with different operating systems, cost of maintenance is increased.

- In a Power Server Model, if there are a large number of servers, then maintenance can be very time-consuming if not handled correctly.

Interesting Points

- Enabling technologies can solve some problems with P2P systems. Java solves the compatibility and security management issues. Web services can be used for communication between the participating computers and the central processing computer.
- In the power server model, we can have a single client computer using the computation power of many servers. This is quite different from the traditional client-server model.
- It's difficult to find power servers. We can solve this problem by adding a coordinator to the system. The coordinator maintains the database of power servers and passes IP address of power servers to the users that request for service.

Critical Questions

1. In the Power Server Model, any user can initiate a project. How can we ensure that the project is not intended for bad purposes?
2. Napster has encountered legal problems with its P2P application. If P2P becomes widely used, how would the projects be regulated? Who regulates it? Would the coordinator take up the task of checking the legitimacy of the project?
3. Are there some organizations that the user has to sign up and register the project and have the project validated before starting it?
4. What is needed to build a computing infrastructure to realize the full benefits of P2P applications?

References

[1] Loo, Alfred W. "The Future of Peer-To-Peer Computing." Communications of the ACM, September 2003 Vol. 46(9), pp. 56 – 61. < http://www.sce.umkc.edu/~leeyu/class/CS551-03/cs551.htm>