（様式２）

学位論文の概要及び要旨

氏　名　　　　川戸　聡也

題　　　目　 A Study of Building a Distributed System using Idle Resources
（遊休資源を利用した分散システムの構築に関する研究）

学位論文の概要及び要旨

In this thesis, we discuss the problems, solutions, and specific applications of building distributed systems using idle computing resources (hereinafter referred to as "idle resources") in order to effectively utilize them.

Computers have computing resources such as CPU and storage, and are used for a variety of purposes such as office work. There are computers that operate normally but are discarded due to equipment upgrades, etc. (hereafter referred to as "used-computers"). Their computers have their resources such as CPU and storage and so on, that is idle resources. However, we cannot make use of their computers anymore even though they have their idle resource. In order to make effective use of these idle resources of used-computers, we propose a distributed storage system using their resources as storage. We design and implement a system that automatically builds used-computers as distributed storage in order to use them with low labor. In addition, we operate the distributed storage system in a real environment as a backup storage for online storage and mail systems. However, if more used-computers are used to ensure capacity, power consumption will increase and the cost performance will become worse. In addition, the problem of securing a place for installation also arises. Therefore, we turn our attention to computers, which are used for office work and other purposes (hereinafter referred to as "using-computers").

Even though using-computers are used for their purposes to operate stable and continuous works, they have surplus capacity over their intended use since recent computers have enough power for office works. These surplus resources are potentially idle resources, and

computers in use also have idle resources. Therefore, we propose to combine the idle resources of used-computers and using-computers to form a distributed storage system. A using-computer has its original use such as office work. Therefore, when idle resources of the using-computer are used, they cannot be dedicated to distributed storage, which is a problem that cannot be conveniently controlled. They may not always be running. They may start and stop depending on the situation of their original use. In addition, their timing and frequency are not fixed. It is necessary to deal with the instability of this state. There are also problems such as the fluctuating amount of idle resources and ensuring security. Of these issues, we focus on the instability of state using-computers. Using-computers are not always available as a system because joining and leaving cannot be controlled. Therefore, the data to be stored into using-computers for load balancing and redundancy should be temporary. Thus, we suppose the original data exists in external of using-computers. For example, the original data can be placed on a used-computer. This will allow the system to continue in a situation where all using-computers leave the system. Here, a using-computer leaving can be divided into two types: one is that have enough time to process leaving operation such as a planned shutdown; and another one is that do not have an afford to process it, such as a normal network shutdown. If there is enough time, leaving node can declare its leaving to other nodes and move the files in its possession. However, if there is not enough time, other nodes need to detect leaving and process files held by leaving nodes. Therefore, we propose a process based on the declarations at the leaving node and the availability of moving files in its possession.

As a practical application of using idle resources, we propose an e-Learning system. This system is designed to distribute the load by storing and distributing content to the computers that use it. When the load on the system increases due to an increase in the number of client accesses, the system makes use of idle resources of using-computer for the load balancing. When the load decreases, using-computers are removed from the system. In this way, high scalability can be achieved inexpensively. We also propose a content delivery network (CDN) using using-computers as another use case. By building a cache server, which is a component of a CDN, on the internal network and delivering content from there, the amount of external data communication can be reduced. This will lead to a reduction in data communication charges on the shared network. Moreover, this can be achieved inexpensively by building the cache server using used and in-use computers.