Fast Parallel Processing on Workstation Cluster

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1 Introduction

Workstation cluster systems are very attractive for distributed and parallel processing, since it is easy to obtain parallel processing environment. But such as workstation clusters using slow network layer have a problem that can not obtain performances in proportion to number of workstations.

In this paper, we discuss about performance of message passing library such as PVM and MPI, and propose hierarchical broadcast, a technique to to improvement PVM's broadcast. Next we examine some applications on workstation cluster and discuss the performance of workstation cluster. From the result, we discuss about applications running on workstation cluster. Finally, we propose effective parallel processing method on workstation cluster such as shared value system on PVM.

2 Workstation cluster and Massage passing libraly

Recently, many studies and approaches are examined to improve performance of workstation cluster. From hardware improvment, high-speed network layers, such as 100Base-T, FDDI, ATM and Myrinet are deveropped. These hardwares achieves faster workstation cluster's message passing. But, their cost of introduction is high. So we can not use easily.

On the other hand, software approaches are performed to extend existed message passing library, such as PVM and MPI to reduce their overhead on message passing setup time. TPVM and LPVM are proposed this approach. pardi-PVM achieved fast message passing using Adsmith proposed to provide new interfaces to PVM such as distributed shared memory-systems.

These approaches are have some problem, limitation of use, changing of programming interface.

3 Message passing performance on workstation cluster

We measured message passing function's performance such as barrier synchronization, latency, communication speed, and broadcast speed on workstation cluster, to propose effective processing method using workstation cluster constructed standard PVM or MPI, and 10Base-T networks. This measurement is important to analyze bottlenecks on workstation clustr'smessage passing performance.

As the result, we found that PVM's message passing performance are good in case of using TCP connection. MPI is better than PVM about all message passing functions. From these message passing performance, we propose hierarchical broadcast to improve PVM's broadcast speed, and confirmed their effectiveness. And we propose selectable broadcast that improves hierachical broadcast.

4 Performance of Application programs on Workstation Cluster

In this chapter, we examine performance of workstation cluster by running some applications, such as sorting program, N-queen problem and TSP(Traveling Salesman Problem). We found sorting program is unsuitable on workstation cluster because sort program communicate with large data due to increasing message passing time. N-queen problem indicated that if non-communication parallel processing model could load tasks equally, performance will increase linearly. In TSP, we examined and discussed some parallel execution method, such as distributed model, master-slave model, and co-operation model. We gained co-operation model achieves linear performance increase. And we found that TSP is not affected by message passing, so suitable for workstation clusters. As a result, we proposed shared value system to make available shared value using PVM.

5 Conclusion

This paper evaluated workstation cluster performance and discussed their characters. We found workstation cluster using slow network layer such as 10Base-T, are not appropriate to communicat large data. From that's result, we proposed hierarchical broadcast on PVM and confirmed improvement of broad cast performance. We discussed about performance of applications running on workstation cluster. As the result, we gaind that less message passing model and less message data passing model is suitable for workstation cluster. And we proposed and discussed about shared value system which makes shared value system on PVM.

Future research is to improve hierarchical broadcast and implement shared value system proposed in this paper and evaluation their performance.