Batch Computing Facility based on PC (BCFpc)

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Abstract.

It is discussed the Linux PC cluster prototype at Petersburg Nuclear Physics Institute (Russia). It was enumerated the reasons why such a type of computing installation is profitable now and will be more attractive in nearest future for centralized general purpose computing in scientific applications.

INTRODUCTION

Last year (1997) we were faced the problem to upgrade centralized general purpose computing facility at HEP Division at PNPI. In looking for appropriate decision we took into account several hardware platforms, namely: Intel Pentium II as most wide spread microprocessor and DEC Alpha as most powerful microprocessor in a range of last years. For some comparison please see fig.1.

The figure 1 shows that two microprocessor lines have almost same power: the close frequency the close power. That means we have to consider other microprocessor features. A binary program size for DEC Alpha is 1.5-3 times more than same binary program for Pentium due to RISC structure of Alpha microprocessor. At the same time Pentium II is not able yet to be used by 64 bit operating systems.

Finally we discussed the fact that many (if not most) universities and research centres are spending the efforts to realize inexpensive computing installations based on PC in various research centres.

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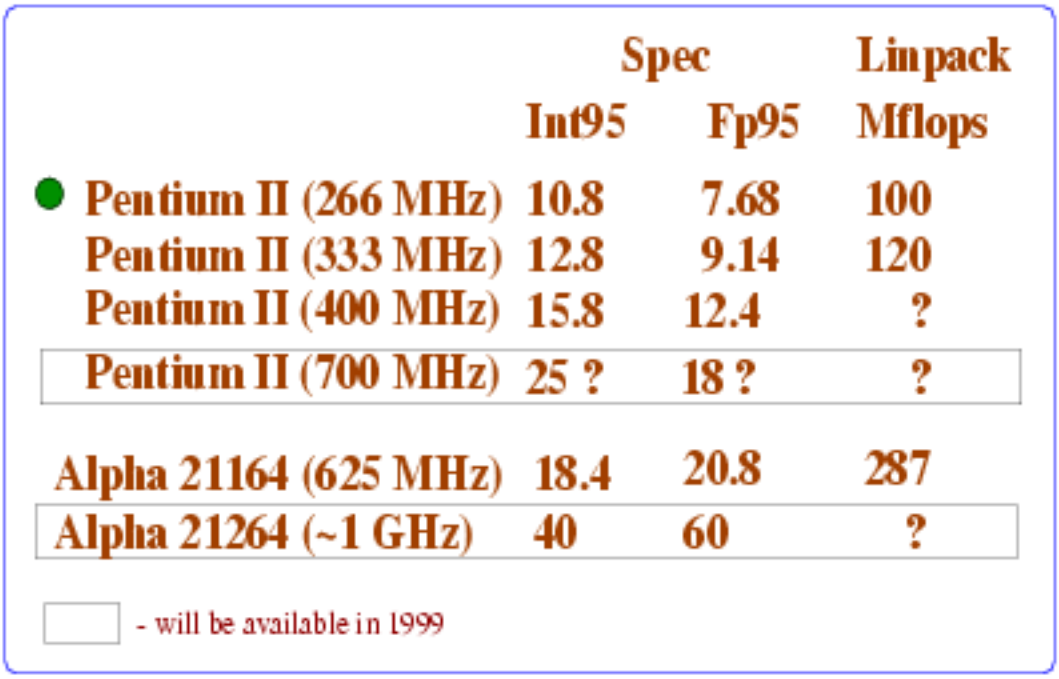

FIGURE 1. Some comparison for microprocessors.

PC CLUSTER PROTOTYPE

The proposal has been prepared in November 1997. Actual hardware delivering was taken place in January-February 1998. In a result we have realized the experimental computing structure *cluster prototype*. The cluster became available to the users about the middle of February 1998. The cluster consists of three machines based on Pentium II/266MHz. The total computing power is about 300 Mflops. The cluster scheme is seen at fig.2. For more details someone might see [1].

This computing cluster is appeared to users as single computer. A user may submit the interactive or not interactive job(s) with the batch system CODINE [2]. We found out that CODINE is stable system which required only an manager-hour to understand and start up the system. Seemingly DQS was earlier predecessor of CODINE. Probably several minutes are enough for users to begin to use the batch system. Actually an user can start short debug job outside the batch system. However in that case when the consumed processor time exceeds 10 minutes our cron script will kill such the job and send to an user the mail with advice how to submit long jobs.

As an operating platform we use RedHat version 5.0, Linux kernel version 2.0.33 patch 18, g77 0.5.21, gcc 2.7.2.3.f.1; libraries: libc.so.6, GNU, and CERNlib (*paw++* and *root* are also in operation). User directories and several common libraries are located on central PC and exported via NFS to peripheral PCs. Users are registered with utility `control-panel` on main PC. Just after registration the

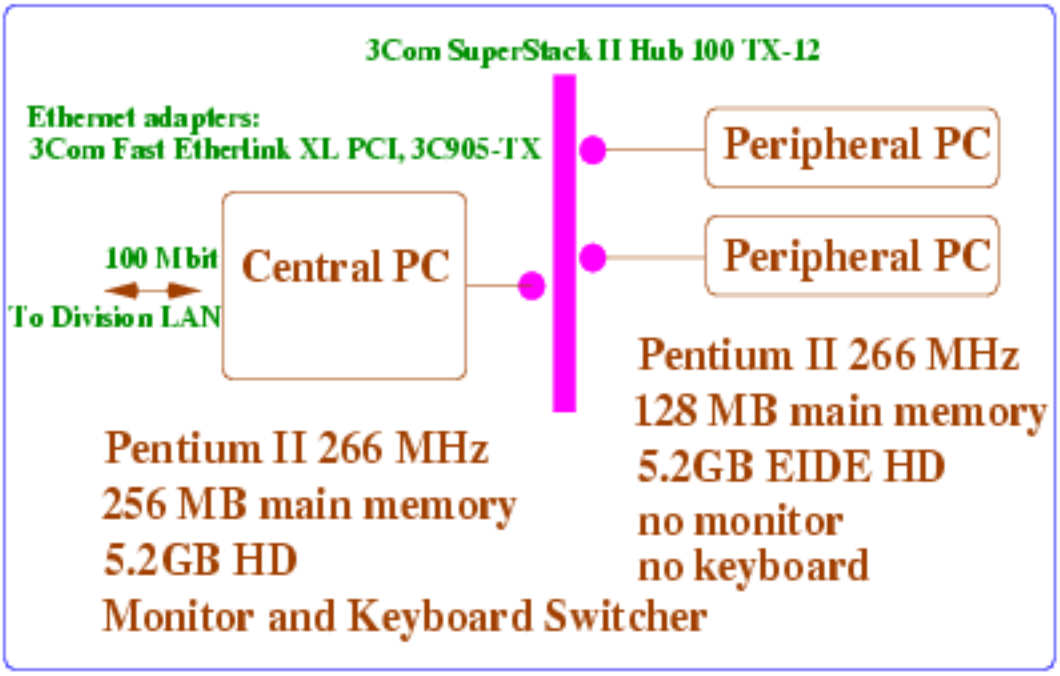

FIGURE 2. BCFpc scheme.

required files (*passwd*, *shadow*, etc) are copied to peripheral PCs in order to make uniform password environment. For security reason BCFpc is out of direct Internet access. To copy a file *to* or *from* Internet an user can do such a copy through some different centralized computer server at the institute.

BCFpc is equipped with separate Smart UPS which in turn is connected to main PC over serial link. The daemon "apcupsd" is used as UPS software. Main PC is configured as *master* and others - as *slave*.

In October of 1998 the cluster has more than 30 user accounts. About 6-8 users are using the farm every day. Actually the cluster is very stable: in October of 1998 it has uptime more than 114 days (more than three months). Last system restart was connected to kind of technical software and hardware upgrade. The cost/performance ratio is about $30/Mflops. Main purpose for the computing with the cluster (and most of the jobs) is HEP simulation and related computation.

TO SAVE AN INVESTMENT IN THE FUTURE

Everybody knows that computing power per a microprocessor chip is doubled every 15-18 months. That means the question does come in mind how to save an investment and human efforts into computing installation like relatively large PC cluster. Together with the computing cluster we suggested the procedure to upgrade the computing power with the time. It might be done in two ways:

- to add another node(s);
- to replace one or several existing nodes by more powerful nodes; old replaced nodes might be used as the desktop machines.

In other words with such a computing structure we have ready to use procedure how to keep the computing power up to date with minimum investment.

We plan to increase the computing power up to 10 GFlops and to add the tape drive DLT 7000.

CONCLUSION

We expect that such a kind of centralized computing installations will be most popular in following several years as a general purpose computing platform (PC farm + Linux) for scientific applications.

Moreover, it is not surprising an idea to integrate several such a computing clusters in several institutes over Internet together by means CODINE or other distributed batch system in order to sum the computing power to solve some challenging computing problem. We believe that enough security level might be realized relatively cheap.

REFERENCES

1. *Batch Computing Facility based on pcs (BCFpc)* `http://www.pnpi.spb.ru/pcfarm/`.
2. *COmputing in DIstributed Network Environment (CODINE)* `http://www.genias.de/products/codine/description.html`.