Network Performance in a Large Environment

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1 Introduction

We have 5000 users who are under-graduate students, i.e., beginners. Our system consists of 207 × X-terminal, 8 × EL92M400/2CPU, and one CS6400(60MHz)/28CPU. We started the Internet services since April 1995. Here we show our network performance and its problems that we have experienced since installing Internetwork environment in our system.

2 E-mail

We have already started e-mail service since Oct. 1994 for the purpose of exchanging reports. It makes paperless education possible. After connecting e-mail with Internet, students enjoy communication with pen-pals via Internet. We made a secondary mail server in the same domain, which works as a "vacation" program when stopping CS6400 for maintenance.

3 WWW/gopher

We run our CS6400 as a WWW server, `http://www.students.chiba-u.ac.jp/`. The WWW data are mostly written in Japanese, which contain teachers' notebooks, students' home page. Our WWW server is linked to our university-wide class information system and of course outside servers. Each course provides WWW data as a text of the class and information on its schedule. Although we have a large screen in the classroom which displays a teacher's terminal window, the room is too large for students sitting at the end of the room to see the characters in the screen in detail. Students use "Mosaic", a WWW browser, to watch the data from their terminal at any place in the classroom and at any time so that they can learn at their own pace, i.e., during doing home-work as well as during the class. As for linking to remote servers, we were concerned about network traffic and the CPU power of the remote servers because the number of simultaneous accesses to the remote server would be up to 100. We made a test of accessing to a popular remote server (Sun-IPX/64MB). Then we

found the load average of the remote server became greater than 10 for 100 simultaneous access counts. Therefore we concluded that it is necessary to install a proxy server.

4 Our WWW history

Before describing what is currently working for WWW in our system, we here show our installation history related with WWW. We note that students directly use EL92 (UNICOS 8.0) as a X-client host, and the superserver CS6400 plays a WWW server, where WWW data are located, and that we want to hide CS6400 from students because OS Solaris 2.3-2.4 cannot strictly control user's resources. One of bottle-necks to install WWW system was browser's facility to show Japanese characters.

At first we installed Mosaic-J, a WWW browser controlling Japanese characters, on CS6400 at November 1994 and started test classes. Students use the browser by a remote shell from EL92 to CS6400. This style is not beautiful and it is somewhat dangerous because some of processes related with the browser are not terminated.

At second, we installed Mosaic-J on EL92s with help of CRI and CRJ. We found "bind" problem on EL92s, described in the next section. Problems of network traffic and high load on remote server still remained.

Finally we installed a proxy server on CS6400. It works well together with Mosaic-J on EL92 and currently there is not any problems in our WWW system.

5 BIND problem

We were annoyed about UNICOS's "bind" facility when installing Mosaic-J on EL92 without a proxy server. Every application program chooses either "DNS" or "`/etc/hosts`". The choice is done by an environment variable `HOSTLOOKUP`. If an application runs with `HOSTLOOKUP=named`, it accesses Domain Name Server to get host information, otherwise it looks at `/etc/hosts`. Under UNICOS, it is impossible to choose both with some priority meaning that an application program looks at /etc/hosts first and if not found in the table then it uses DNS.

We avoid such a complex configuration since hostname analysis is carried out by a Proxy server on CS6400.

6 Proxy server

A Proxy server mediates communications between servers and clients. We made installation of a software "delegate" developed by Yutaka Sato (Electrotechnical Laboratory, Japan). Our usage of the Proxy server is as follows. When one accesses to a remote server, a WWW browser on EL92 connects with CS6400's Proxy server which can communicate with remote servers listening to DNS as a "proxy", so the "bind" problem is avoided. Then if data are found in cache, the data are read from cache, otherwise data are transferred from the remote server and are stored in cache. The cache data are kept during a day. This usage saves network traffic and CPU power of remote WWW servers. We find the load average of the remote server down to almost zero. When one accesses to the local server, CS6400, the cache is not used. One

of the reasons why we do not use cache for the local access, teachers often prepare their text data just before their classes. With the Proxy server, we find there is no problem on CS6400 even for simultaneous access count = 100.

7 Network News

Network traffic by NNTP is the highest degree of traffic in our LAN, as seen in Fig. 1. The data are taken from a packet flow analyzer "Interman" at Information Processing Center, Chiba University but not at the domain of our education system and the figure is drawn by SPSS. We are waiting for a new release of proxy server "delegate". The software would make it possible to store news articles in cache as well as conversion of NNTP into HTTP. It is now in development by Y.Sato. Its installation on CS6400 is one of our near-future tasks.

8 NFS problem ?

We wonder processing speed of network is too faster than that of IO in Solaris 2.4.

In our 8 EL92s and CS6400 system, user's password is changed using NFS and CRON as follows. Our new command "passwd" writes user's password information in a file mounted by NFS. At every host, system CRON changes user's password according to the NFS file. After installing Solaris 2.4 we often face a trouble that user's password is not changed correctly at some hosts. We had not faced such a trouble during Solaris 2.3. Therefore we assume that this NFS trouble is related with up-grading Solaris (2.3 → 2.4).

9 NFS mismatch

We find an EL(UNICOS-8)'s command "`du -k`" tells 2 times wrong size of files in NFS on CS6400(Solaris 2.4) because of difference in file unit size between each OS. In order to let users know correct size we must have made a script of

$$\text{actual size} = \frac{\text{du } -\text{k}}{2} \qquad \text{for EL92.}$$

Fortunately we do not take "account" for user's disk space. However this discrepancy would cause quite a big trouble at the "accounting" site. Thus we recommend to make coincidence between them in NFS internally.

10 Telnet/Ftp restriction

We are trying to make "fire wall", restriction of telnet/ftp connection from outside, to avoid cracker's job. A possible way to make it is to do it either (A) on Router or (B) by TCPD on CS6400. The Router in our system is CISCO4000 (version 9.x). We hear it is impossible to make different restriction for each different protocol in this version. For example, our WWW might become unaccessible from outside if we make fire-all on Router in the current version. We tested only access-log by "`tcp_wrappers`", a TCPD gateway software, during this summer vacation, when only a small number of users log-in, and then we found it did not take high load on CS6400. Therefore now we are choosing the latter (B). However this must be determined after more tests. Is CPU/IO traffic using TCPD tolerable for a large number of user's accesses ? Or should our Router be up-grade ? If there is a good idea, please let us know. Address : `yamasita@tanpopo.ipc.chiba-u.ac.jp`.

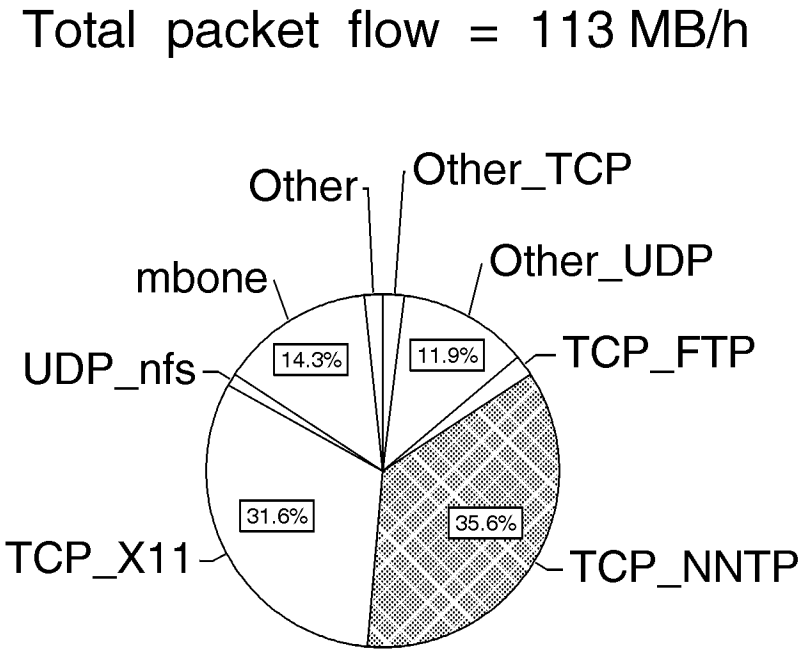

Figure 1: Network traffic