

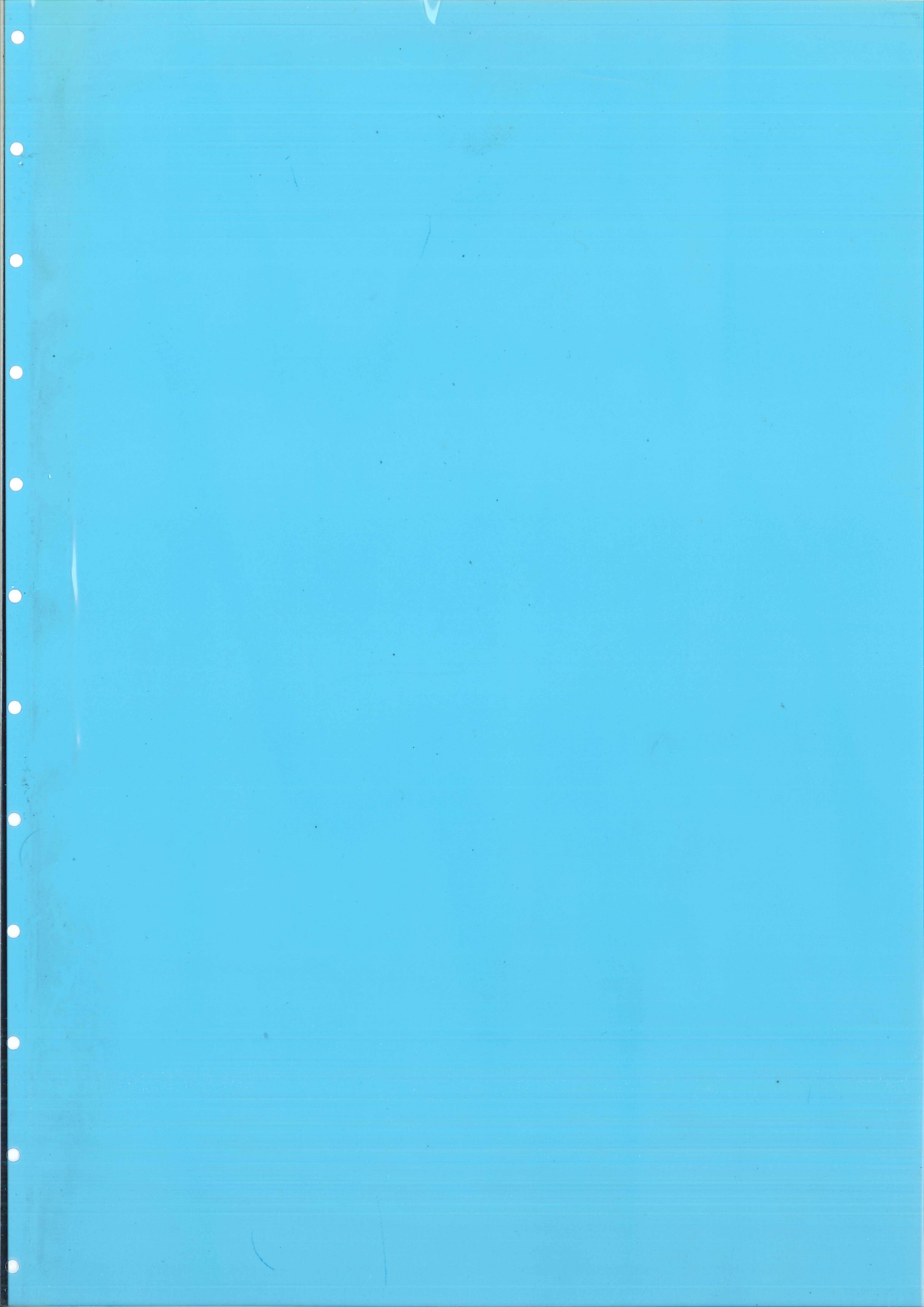


THE UNIVERSITY OF QUEENSLAND

THE PRENTICE CENTRE

19 November 1993

**Capacity Planning
for
Administrative Computing:
Recommendations for 1994**





THE UNIVERSITY OF QUEENSLAND

THE PRENTICE CENTRE

19 November 1993

**Capacity Planning
for
Administrative Computing:
Recommendations for 1994**

Introduction and Recommendations

At the beginning of 1993, the UQADM VAX 6520 system was upgraded by the addition of 256 MB of main memory to make a total of 512 MB of memory. The mass storage system was upgraded by the addition of 8 GB of disk storage, and the backup system was upgraded by the purchase of a cartridge tape stacker unit. A central processing unit upgrade was not considered necessary at that stage.

This upgrade removed the congestion problem on UQADM which was caused by excessive paging and too-few pagefiles, it allowed backups to be made at night, unattended, and it provided mass storage space for several new administrative systems.

This report is the result of a review of the UQADM load, performance, and requirements conducted by Robert Claire, Tony Bell, and Robert Risetto of AIS and Ian Burgess and Mark I. Williams of the Prentice Centre between August and November, 1993.

The Committee Recommends:

Hire contract application programmers from the Prentice Centre or elsewhere to remove application inefficiencies	\$64000
Purchase 2x 2GB disk drives to replace 800MB drives	\$20000
Purchase Time on UQVAX pending firm specification of VAX/ALPHA upgrade path and better knowledge of hardware/software and capacity requirements for CASMAC systems	(per month) \$7200
and/or	
Upgrade to VAX 7610 (512 MB)	\$230000

CPU Capacity

While the current CPU situation is not critical, the lengthening compute queues on UQADM and growth simulations suggest incipient CPU saturation. On the 3rd of November, a problem with system tuning caused UQADM to become catastrophically congested, with no work being able to be carried out for some time. While the rectification of this tuning fault caused system performance to return to tolerable levels, it illustrates that central processing load is close to the level at which congestion occurs. There is room for at most 5% growth in computing load before UQADM will be saturated most of the time.

There are several options available to alleviate the threat of CPU saturation capacity.

(a) Upgrade UQADM from VAX 6520 to VAX 6530.

Cost: \$55440

The main advantage of this option is that it is cheap.. It gives a 50% increase in the CPU capacity of UQADM, but is adding configuration along a dead-end path. The 6000 series CPUs are now outdated, and can address a maximum of 512 MB of memory. When memory capacity became a problem, there would be no possible solution except to upgrade to the 7000 series CPUs anyway. This option would certainly be a waste of money in the long term, and quite possibly in the short term.

UQVAX becomes even less able to carry the load of UQADM in the event of system failure.

NOT Recommended

(b) Trade-in 6510 and buy a VAX 7610 (6520 becomes UQVAX)

Cost: \$230 000

This option has the advantage of providing an 'ALPHA ready' system. ('ALPHA-ready' means that ~~in that~~ upgrade to an ALPHA platform at some future time is simply a matter of swapping CPUs.) All current peripherals can be moved across except memory, so this option entails the purchase of 7000 series memory as well. This series of CPUs will be able to address up to 3.5GB of memory under VMS 6.0 or later, but under the present version of VMS, 512MB is the limit.

The base price of a 7610 is \$206815. Add to this \$68 568, subtract \$25 000 for the trade-in of the 6510 (\$27 000 for 6520) and the price is \$250 383. However, since this machine would be under warranty in the first 12 months, approximately \$20 000 would be saved on maintenance in the first year, making the actual price about \$230 000. There is a possibility of further saving, which John Peterman of DEC is working on. (See below).

The committee initially recommended that a 768MB system be investigated, but perusal of the systems and options catalogue suggests that this is not a supported configuration, either under VMS 5.5 or VMS 6.0. There is good reason to believe that 512MB of memory would be sufficient for some time, so it is not considered necessary at this stage to purchase 1GB of memory which in any event would not be addressable under the current version of VMS. There are actually 512MB memory modules available, which *should* mean that a 512MB package could be purchased for less than is shown above. However, this option automatically includes an unlimited OpenVMS licence, which raises the price considerably (since UQ purchases its unlimited licence under CSLG). Also, the memory upgrade priced above is purchased at the 20% discount for add-ons rather than the 30% which applies to system purchases. It is recommended that before any purchase is made, strong representations be made that the 512MB system be made available with a 2-user licence as with the 256MB system, which would mean a considerable saving (perhaps as much as \$28 000)

UQADM CPU capacity is increased by 50%

UQVAX CPU and memory is increased by at least 100%, making it a credible backup system.

Recommended

(c) Purchase of Time on UQVAX

Cost: \$7200 per month

The Prentice VAX 6510 (UQVAX) is not heavily loaded during the daytime, when UQADM usage is high. It would be possible to make some smaller, standalone systems such as work-orders, etc. available only on UQVAX. People wishing to use these systems would be forced to login on UQVAX. As an indicator, a limit of 20 administrative users could be allowed on UQVAX for a charge of \$86400 p.a. This would have the effect of reducing the load on UQADM by approximately 10%, which represents about 12 months' growth in CPU usage at current growth rates.

It should be stressed that this option merely postpones the need for more hardware. As such, however, it may have significant benefits, since regardless of when the new hardware is purchased, there is now no longer an upgrade path to the latest equipment - trade-in only is available. Should purchase of new equipment be delayed for 12 months, it is likely that the required capacity will be available at a considerably reduced price.

It is quite likely that, if option (d) is carried out, this option will only need to be exercised for 6 months or less. This option would only need to be exercised when the load on UQADM grows to levels causing congestion.

It should be noted that this particular option does nothing to rectify the current inability of UQVAX to act as more than an emergency stopgap backup for UQADM in case of system failure.

Recommended to be used as required

(d) Tune Applications

Cost: \$64000

There are some administrative systems in which considerable savings in both CPU and memory use could be made by means of rewriting some inefficient sections of code. In one example, the reworking of some student system applications would allow staff who make different types of query to login once instead of four times simultaneously, saving as much as 10MB of memory per user. In other areas, changing some query structures would result in considerable savings of CPU time.

To take advantage of these opportunities will take about 1 person-year of dedicated programming time. The Prentice Applications Development group can supply contract programming services of one senior and one assistant programmer for 6 months for \$

It is recommended that this be done regardless of the choice made between options (b) and (c) above, since this will allow the delaying of hardware upgrades for the life of the current administrative systems.

Recommended

Disk Channel Upgrade

Cost: \$48783 for each HSC50 (Total: \$97566)

The other area which needs to be considered for upgrade during the course of 1994 is in Disk I/O capacity. This can be provided by upgrading the current HSC50s to HSC95. This would increase the number of disks which could be attached (The HSC50s are approaching capacity) and provide write-through caching.

There is currently space for three new spindles on the HSC50s if a 2 DA channel is purchased at a cost of \$8572 each. If you add to this the option of replacing the two 800MB drives, there is space for 7.4GB of new disk storage, which is adequate for 1994. Whilst some of the disk channels are showing signs of moderate usage, as long as paging activity is kept at current levels, there is little to be gained in performance by making this upgrade at this stage. It is, however, recommended that rather than purchase DA channels in order to add spindles, the HSCs should be upgraded first, since HSC95 channel controllers use higher-density port cards.

Before anything is done in this regard, an investigation should be made into the use of archive systems such as SLS/Archive and optical media jukeboxes.

Recommended for 1995

De-Clustering UQEVE

It is recommended that the current activities leading to the removal of UQEVE from the main cluster be continued. This will reduce the load on the system disks and reduce the proportion of time spent by cluster members in serving Ethernet interrupts.

Mark I. Williams

Senior Engineer

18th November, 1993

(For the Capacity Planning Committee)

Appendix I. Graphs

UQADM CPU Utilisation

The most important point to look at in these graphs is the peak load, excluding batch processing. It can be seen from the graphs that the peak usage has risen from just over 80% in March to just over 90% in November. These two graphs exaggerate growth slightly, since April 14 was a relatively slow day and November 10 relatively heavy.

UQADM Memory Utilization

Both graphs show that UQADM is using all of its memory for almost the whole day. This does not mean that UQADM is about to run into severe memory problems. It does, however, show that all the memory present is making some contribution to the performance of the machine, and hence that a memory upgrade is probably the next thing that will be required.

UQADM Response Time

These graphs are confusing. It would seem that response time for small transactions may be very slightly longer in November than in March, but that the response for large transactions has improved somewhat. It can only be assumed that this is due to different applications being run and not to system performance.

UQVAX CPU and Memory

The last two graphs show that UQVAX has ample CPU and memory resources to support option (c)

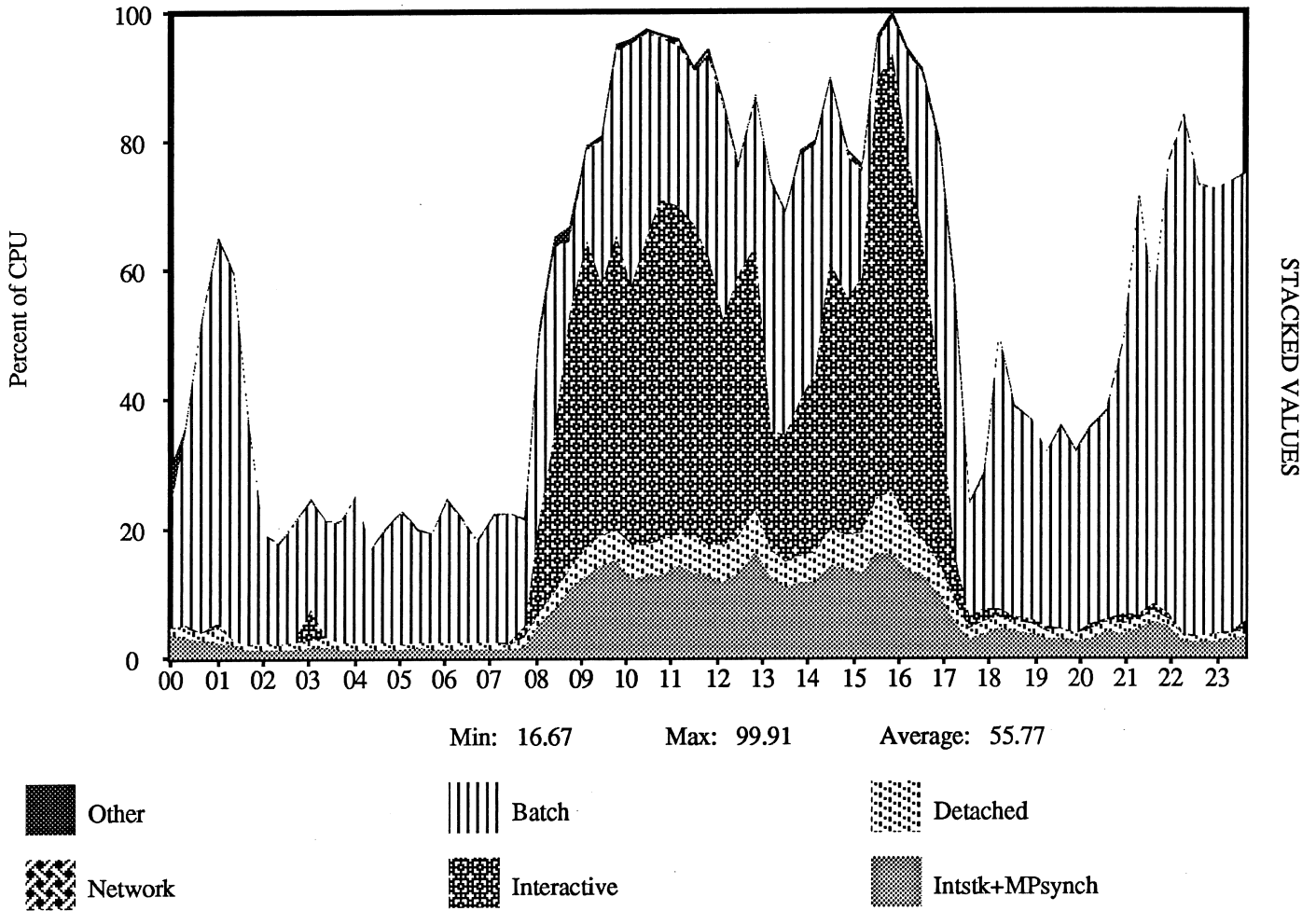
DECps

V1.1

CPU UTILIZATION

Nodes: UQADM

Date: 10-NOV-1993 00:00-23:59 (71 Pts;Each (20:0))



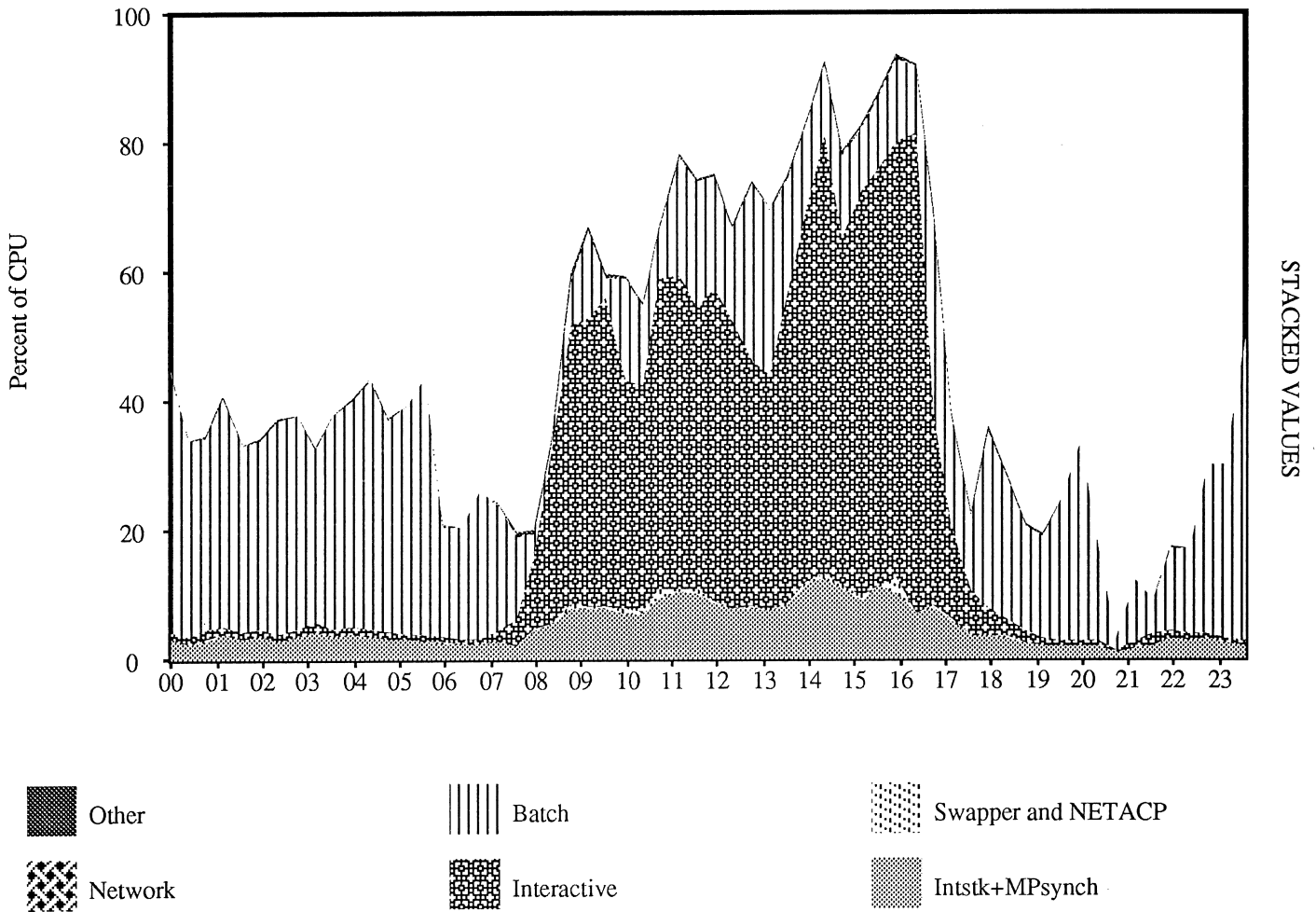
DECps

V1.0

CPU UTILIZATION

Nodes: UQADM

Date: 14-APR-1993 00:00-23:59 (60 Pts Plotted)



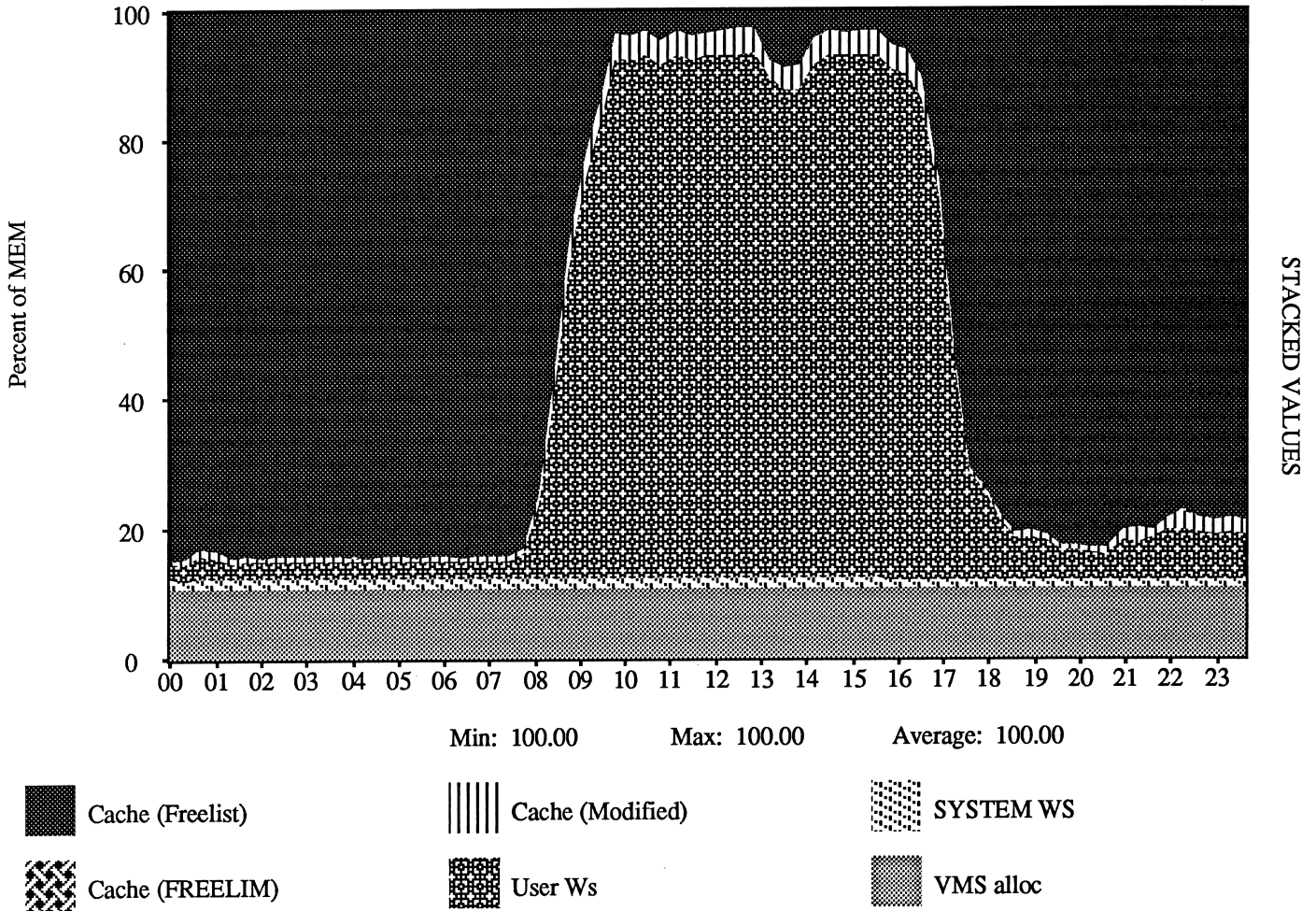
DECps

V1.1

MEMORY UTILIZATION

Nodes: UQADM

Date: 10-NOV-1993 00:00-23:59 (71 Pts;Each (20:0))



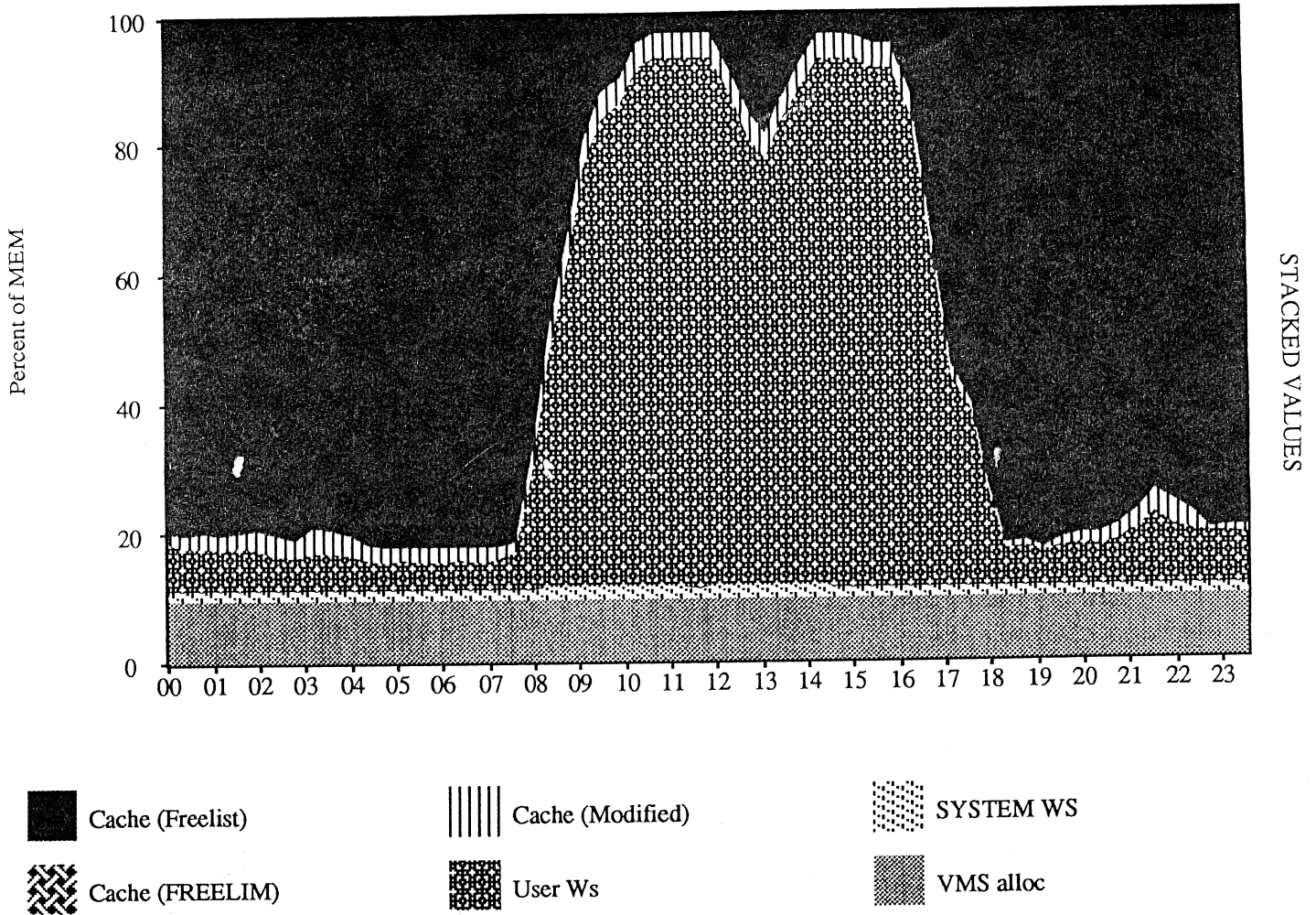
DECps

MEMORY UTILIZATION

V1.0

Node: UQADM

Date: 10-MAR-1993 00:00-23:58 (60 Pts Plotted)



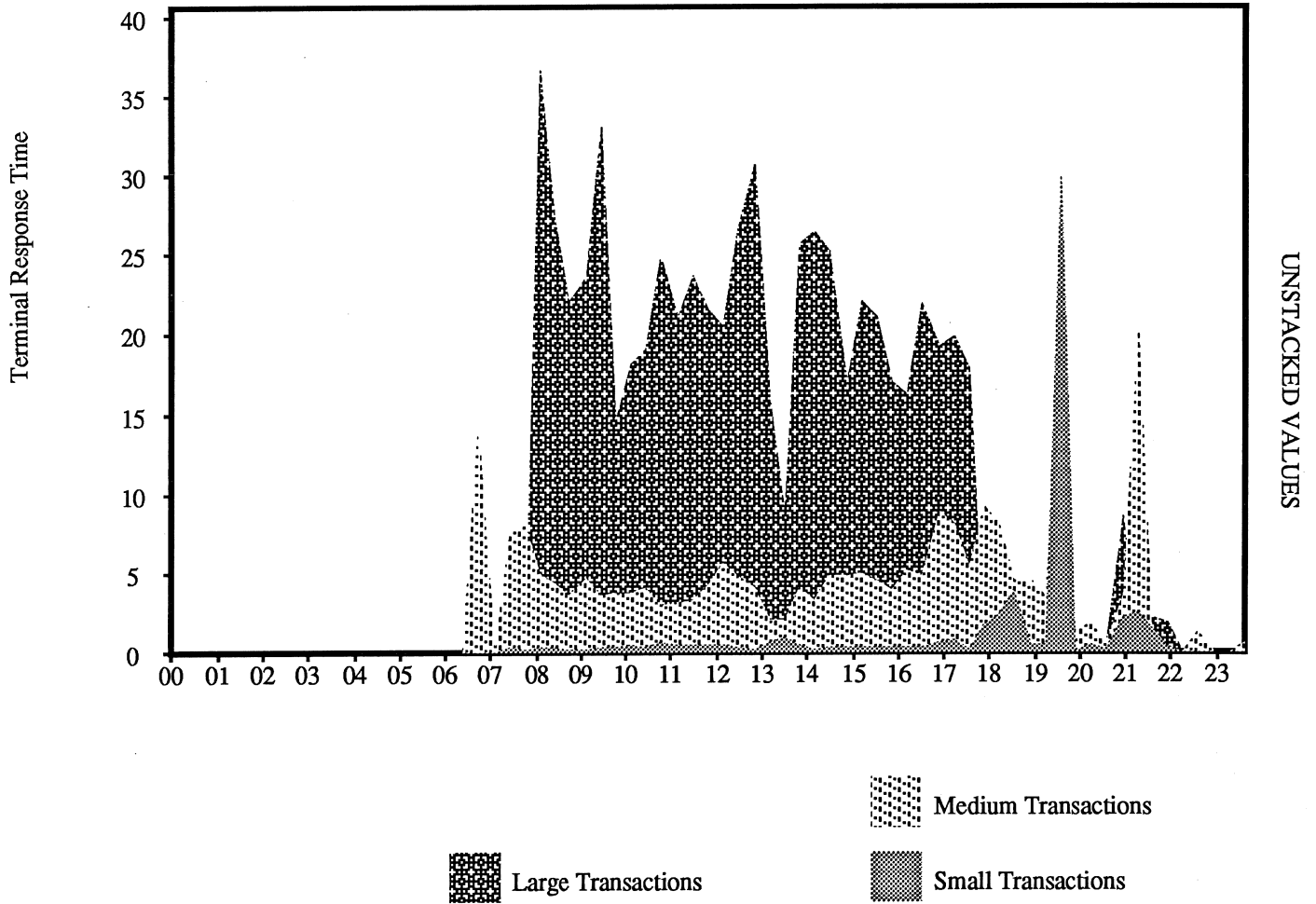
DECps

V1.1

RESPONSE TIME

Nodes: UQADM

Date: 10-NOV-1993 00:00-23:59 (71 Pts;Each (20:0))



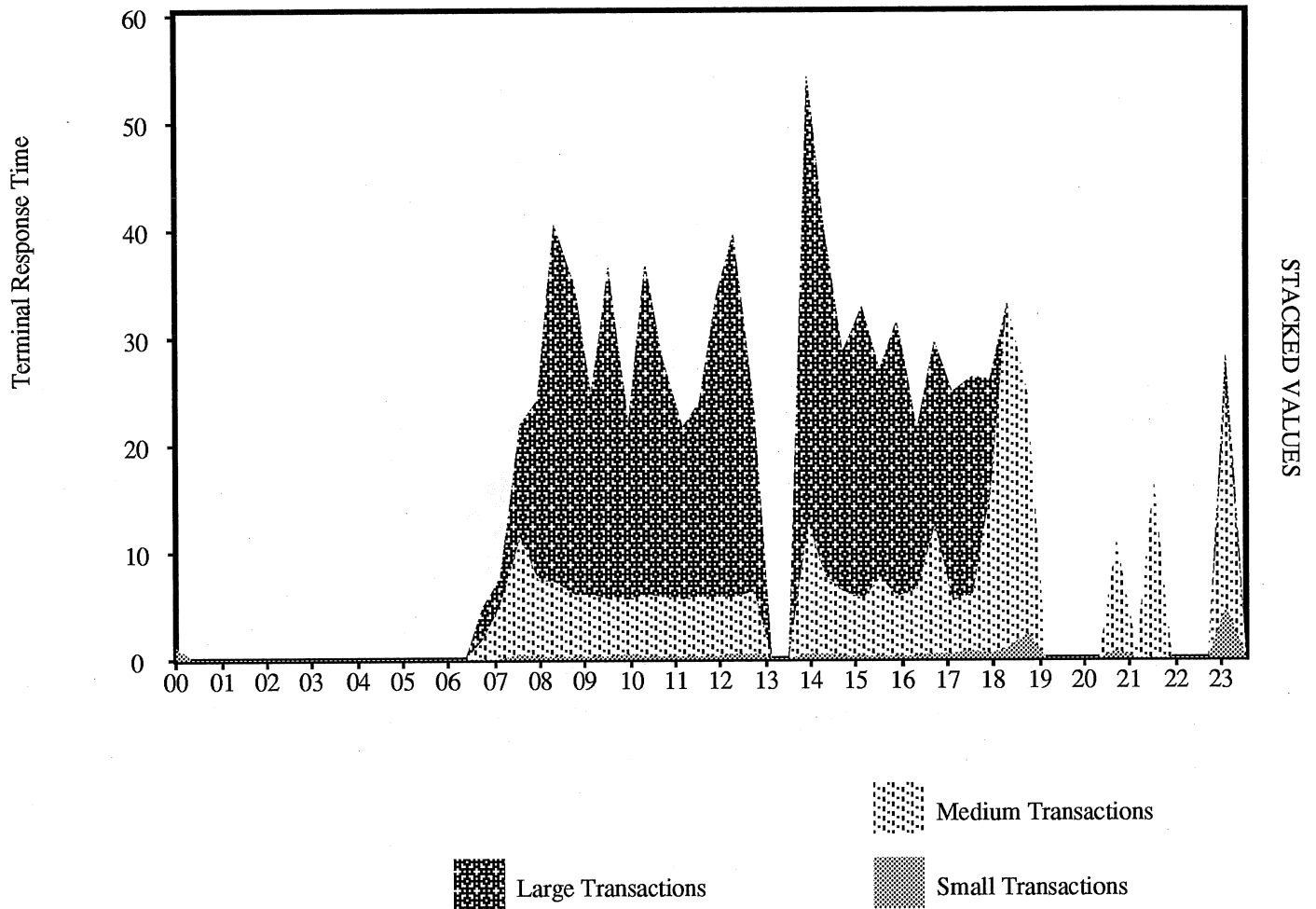
DECps

RESPONSE TIME

V1.0

Node: UQADM

Date: 3-MAR-1993 00:00-23:58 (60 Pts Plotted)



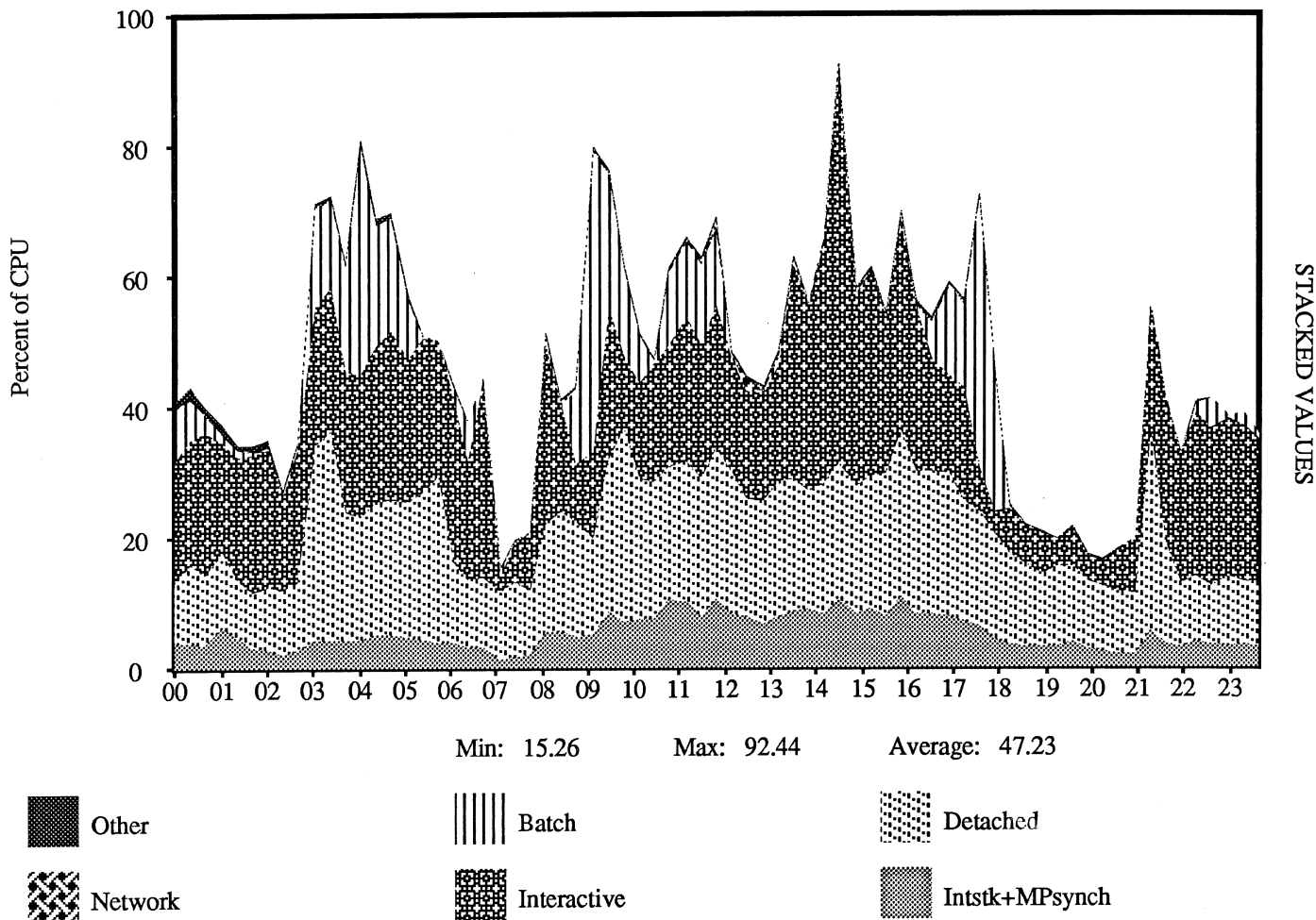
DECps

V1.1

CPU UTILIZATION

Nodes: UQVAX

Date: 17-NOV-1993 00:00-23:59 (71 Pts;Each (20:0))



DECps

V1.1

MEMORY UTILIZATION

Nodes: UQVAX

Date: 17-NOV-1993 00:00-23:59 (71 Pts;Each (20:0))

