CCN AS A NETWORK SERVICE CENTER

A. INTRODUCTION

   CCN, the Campus Computing network of UCLA, will shortly be connected
   to the ARPA Network as a host of the "Service Center" type. The
   purpose of this RFC is to describe the hardware and software available
   at CCN and the services we are now planning to provide to other
   Network Hosts.

   These services and their implementation priority were chosen in
   consultation with a particular site (RAND) which plans to use CCN via
   the Network. We would welcome requests and comments from other sites.

B. CCN HARDWARE

   CCN operates an IBM 360/91KK, i.e., a Model 91 CPU with a 4 million
   byte fast memory.

       CPU Speed: Highly program-dependent; 2-6 Mips, with 3 Mips as a
                        useful average. The upper end of this range occurs
                        heavy floating point in the inner loops. The decimal
                        arithmetic operation of a 360 should be avoided as
                        they are executed interpretively by the 91.

       Memory Speed: Memory is interleaved 16 ways and extensively
                        buffered. Effective memory fetch time is 600 ns in
                        lower 2 million bytes, 900 ns in upper 2 million
                        bytes.

       I/O Con-
       figuration   a) 6 2860   Selector Channels
                        b) 1 2870   Multiplexor Channcl (with 16 control
                                       unit RPQ)
                        c) 5 2314   Disk Storage Units (i.e., 40 disk
                                       drives).
                        d) 1 2301   Drum (Systems residence and catalog
                                       only.)
                        e) 5 (245x)   9 track tape drives (80O bpi)
                        f) 3 (240x)   7 tracts tape drives (200/556/800 bpi)
                        g) 1 2291   (Modified 2250 CRT) Operator/
                                       Maintenance Console.

Also on the Multiplexor Channel are:

h) 2 card readers and 4 high speed printers at CCN;

i) Four 40,000 baud interfaces for CCI alphanumeric
   TV display consoles (currently supporting 40
   consoles);

j) Six data communication ports (3 dial @ 2000 baud,
   1 dedicated @ 4800 baud, and 2 dedicated @ 50,000
   baud) for remote batch entry terminals;

k) a Calcomp plotter;

l) an interface for BBS Teleputers (the Culler-Fried
   system);

m) Ten dial ports for 2741 typewriter terminals;
   and finally:

n) the IMP Interface

C. OPERATING SYSTEM

The Model 91 operates under the IBM-supplied MVT version of OS/360,
currently Release 18.6. This system contains a set of modifications
developed at CCN for control of batch job flow. MVT is a realization
of the general process model of multiprogramming, although this fact
is obscured by IBM's terminology. For example, a process is called a
task in MVT, while the fork primitive is called "ATTACH".

D. USER SOFTWARE

1. Processors:

   CCN provides the following user software:

   a) The usual FORTRAN compilers (FORT G. FORT H. WATFOR);

   b) PL/1 (version 5) and PL/C (Cornell's student PL/1);

   c) Assembler G;

   d) IBM Algol F;

   e) IBM Linkage Editor F, and a fast in-core linkage editor written
      at CCN;

        f) Miscellaneous processors, including:

           COBOL, SPI, XP7, META-5, SNOBOL, LISP 1.5, AUTOFLOW SIMSCRIPT
           1.5, MIX (Knuth's student machine), CSMP, GPSS, ECAP, APT, PMS,
           MATLAN, SYMAP, SPSS, and the BMD series}

        g) the IBM file utilities, SORT, and RPG.

   2. Interactive Systems

        a) URSA   Conversational remote job entry system based
                         on alphanumeric display consoles (IBM 2260
                         and CCI CC301 consoles). URSA provides a
                         number of other services, including a "desk
                         calculator", an interactive/interpretive
                         assembler, and on-line utilities for manipu-
                         lation of the OS file system. It also con
                         tains the CCN operator interface to MVT.
                         URSA is not suitable for typewriter interaction
                         because it is designed for "instantaneous" dis
                         play of at least 480 characters at a time.

        b) APL   IBM Program Product version of this well-known
                         interactive system. Currently supports IBM 2741's
                         (Selectric typewriter terminals) only.

        c) OLMS   UCLA implementation of the Culler-Fried system;
                         nearly identical in language to the UCSX On-line
                         System.

        d) TSO   IBM's new general purpose time-sharing subsystem
                         under MVT, to be available at CCS sometime during
                         1971. TSO supports 2741's and Teletypes (and at
                         CCN it will support CCI consoles). TSO is
                         reminiscent of CTSS in its capabilities and
                         command language.

 E. REMOTE JOB SERVICE

      The RJS ("remote Job service") subsystem, was written by CCN to
   support remote batch terminals communicating over dial and leased
   lines. A remote batch terminal consists of a set of unit record
   devices (one or more card readers, printers, and punches) driven
   either by a hardwired controller or by a small CPU (e.g., IBM Model 20
   or 1130). A remote RJS user enters OS/360 jobs, complete with JCL,
   into the remote reader; the jobs are spooled into the operating system
   and run in their turn, and the printed and/or punched output is

returned to the remote terminal from which the jobs originated (unless
the user or operator re-routes the output). The remote terminal may
also include a console typewriter to be used by the remote operator to
receive and send messages and to exert control over his terminal.

F. FAST BATCH SUBSYSTEM

     CCN has written a fast batch subsystem called QUICKRUN to provide
"instant" turnaround for small, simple batch jobs which are common in
a university computing center. QUICKRUN accepts a very simple job
control language ("QCL") without much of the generality of OS/360 JCL.

     QUICKRUN is really a batch job control subsystem which itself runs
essentially as a job within MVT. Because of its lack of generality,
the QUICKRUN subsystem creates much less system overhead than normal
OS batch; this is reflected in lower cost per job in QUICKRUN.

     QUICKRUN is available at remote batch terminals through RJS as
well as through a self-service card reader at CCN.

G. SPECIAL CONSIDERATIONS

   1. Core Memory for Batch Jobs

     CCN can easily run batch jobs requiring up to 3 million bytes,
     although jobs over 600K bytes will normally not run during prime
     time.

   2. Disk Space

     CCN provides extensive on-line disk space for permanent files. The
     resident disk pack configuration includes:

     220 M bytes (8 packs) of user source programs, for use through
     URSA.

     170 M bytes (6 packs) of user object and load modules ("binary
     decks") and other files.

     100 M bytes of limited-time storage (n days, where n is published
     number satisfying 7<= n < 0)

     This space is charged for, at about 5s per kilobyte per month.

     In the future, we plan to significantly extend this on-line space
     by implementing a tertiary storage system using magnetic tapes.
     In addition, a batch job may always request that the user's own
     disk pack be mounted, thus allowing very large private collections

of files.

3. Rates

Batch charges are based upon t(CPU time), I(number of I/O requests
), and R(core memory region size). The current rate schedule may be
obtained from:

        Mr. Kenneth Tom
        User Relations Supervisor
        UCLA
        Campus Computing Network
        Math Sciences Addition
        Los Angeles, California 90024

Generally speaking, the CCN Model 91 cost is very attractive for
compute-bound, heavy floating-point calculations, particularly
where large regions are required. For most other jobs, the CCN
machine is competitive with other cost-recovery computing centers
which operate without special subsidy.

G. SERVICE TO NETWORK

        CCN currently plans to provide RJS, URSA, and (eventually)
TSO service to the Network. Each of these will have its own third-
level protocol. In addition, there will be a "transparent" third
level protocol to allow a user-written program running in batch or
TSO at CCN to converse directly with the Network.

        The third-level protocols, in the order in which we plan to
implement them, are as follows:

        1. NETRJS

           NETRJS is the name of the third level protocol by which a
           user process in a remote host will simulate a remote batch
           terminal connected to CCN's RJS system. Thus, NETRJS will
           allow a user to submit complete batch jobs to the 360/91
           and receive their print and punch output streams back over
           the Network. NETRJS has been specified in RFC #88 and
           implementation is targeted for March, 1971.

        2. NETCRT

           This protocol will allow a Network user to simulate an
           (idealized) CCI alphanumeric display console and use CCN's
           URSA system (and eventually TS0). An initial version of
           NETCRT will be circulated shortly as an RFC.

        3. NETTRANS

           This is the "transparent" protocol allowing a user process
           at CCN to talk over the Network. It has not yet been
           specified.

        4. NETTYPE

           This protocol will allow a real or simulated 2741 to use
           TS0 (and perhaps APL) via the Network.

H. REFERENCES

   1. "IBM System/360 Model 91 Functional Characteristics". IBM Form A22-6907.

   2. "An Implementation of MVT". CCN Technical Report TR-1 (August, 169).

   3. For more information, see CCN Users' Manual.

   4. "APL/360 Primer". IBM Form GH20-0689.

   5. "Planning for TS0". IBM Form GC28-6698.

   6. "Remote Job Service". CCN Technical Report TR-2 (undated).

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