MULTICS ENVIRONMENT

- Configuration Independent

- I/O not Necessary For on-line Storage

- Large Virtual Memory

- PL/I Support

- Library... Supervisor Entries Environment Interfaces

- Administrative Controls
0. Actual Hardware

Diagram:

- CPU
- MEM
- MEM
- MEM
- DRUM DISC
1. Virtual Machine

VIRTUAL CPU 1

VIRTUAL MEMORY 1

VIRTUAL CPU 2

VIRTUAL MEMORY 2

VIRTUAL CPU n

VIRTUAL MEMORY n

ADDRESSING: GET 1376

ADDRESS IN VIRTUAL MEMORY

MULTIPLE VIRTUAL MACHINES (NO SHARING OF VIRTUAL MEMORY)
1.5 Sharing of Memory Segments

VCPUs

VMEMs

1 per user

1 or more per user

Addressing: Get 3,1376 memory segment (word) in segment
2 Segmented Memory with Maps

ADDRESS MAPS

SEGMENT # ➔ PHYSICAL ADDRESS IN REAL MEMORY
3. Symbolically Addressed File System (Usual Approach)
4. Multics Virtual Memory

VIRTUAL CPU 1
ADDRESS MAP 1

VIRTUAL CPU 2
ADDRESS MAP 2

FILE = SEGMENT
ADDEM: PROCEDURE;
DECLARE
  SUM      FIXED,
  I        FIXED,
  C$(1000) FIXED   EXTERNAL;

SUM = 0;
DO I = 1 TO 1000;
  SUM = SUM + C$(I);
END;
RETURN (SUM);

END ADDEM;
ADDITIONAL IDEAS:

- CATALOG HIERARCHY

- ONE PROCESS PER USER
  - VIRTUAL CPU
  - ADDRESS MAP

- MANY (>1000) SEGMENTS PER PROCESS

- ADDRESS MAP DYNAMICALLY CONSTRUCTED BY USER PROCESS

- BOTH PROCEDURES AND DATA ARE STORED IN SEGMENTS
Techniques Used

- Demand Paging
- Multiprogramming
- Time Allotment
- High Performance Drum
- Segmentation Hardware
Administrative Controls

- Accounting
- Quotas
- Periodic Reports
- Access
- Login Sequence and System Interface
- Limited Service
- Anonymous Users
- Decentralized Administration
ACCOUNTING
- BY SHIFT
- CPU TIME
- CONSOLE TIME
- (MEMORY USAGE)
- DISK STORAGE
- SYSTEM SERVICES
  PRINT/READ/PUNCH
  TRANSLATE

- BY SYSTEM GROUP INDIVIDUAL } REPORTS