AGENDA

MONDAY, SEPTEMBER 19, 1977

8:00	COFFEE AND ROLLS	
8:30	WELCOME	SHEL KLEE
9:00	INTRODUCTION AND INSTRUCTION OF THE BOARD	BOB SMITH
9:30	HISTORY AND BUSINESS OVERVIEW OF THE XEROX PROGRAM	HANK HAUGLAND
10:45	LADC ORGANIZATION AND RESPONSIBILITIES	SHEL KLEE
12:00	LUNCH	
1:00	INTRODUCTION TO THE PDR	DICK LITSCHGI
	CP-6 SOFTWARE FACTORY	JOHN CATOZZI

AGENDA

TUESDAY, SEPTEMBER 20, 1977

8:30	CP-6 SYSTEM STRUCTURE OVERVIEW	DOUG HEYING
9:45	PROGRAM-TO-PROGRAM INTERFACE PROGRAM-TO-SYSTEM INTERFACE	DOUG HEYING
10:00	MEMORY MANAGEMENT AND JOB STEP CONTROL	JOHN COLLINS
11:00	CLIMB-PMME, DISPATCHING, FAULTS, EXCEPTIONS	LINDA AVERY
12:15	LUNCH	
1:00	CONNECTIONS	SAM KEYS
2:00	FILE MANAGEMENT	PAT CRISMAN
3:30	USER-TO-SYSTEM INTERFACE	LARRY FELDMAN
4:30	T&D INTERFACE	DAVE MORGAN
4:50	MISCELLANEOUS INTERFACES	DAVE YOX
5:30	SUMMARY	DOUG HEYING

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AGENDA

WEDNESDAY, SPETEMBER 21, 1977

8:30	COMMUNICATIONS – INTRODUCTION	CHUCK MARTIN
	L6 FACTORY	TERRY COX
	COMMUNICATION SOFTWARE	TOM MELTON
10:30	LOS ANGELES DEVELOPED PROCESSORS	WING WONG
	PL-6	RICH HANSON
	BASIC	JIM GRIFFIN
	FORTRAN	JOHN FLINT
	APL	TOM MARTIN
	TEXT AND SUMMARY	WING WONG
12:30	LUNCH	
1:15	PHOENIX DEVELOPED PROCESSORS OVERVIEW	GEORGE MANN
	COBOL 74; PL/I	DUANE DAVIS
	SORT MERGE	JOHN WERTZ
	ASSEMBLER	GEORGE MANN
3:15	LOS ANGELES DEVELOPED PROCESSORS	
	I-D-S/II, IDP/MANAGE	JOHN ROBERTSON
	RPG-II	DOUG CHESTER
4:00	TEST PLAN AND CONVERSION PLAN	HERB GESHWIND
4:30	STAGING AND SCHEDULING - - THE WORK PLAN	DICK LITSCHGI

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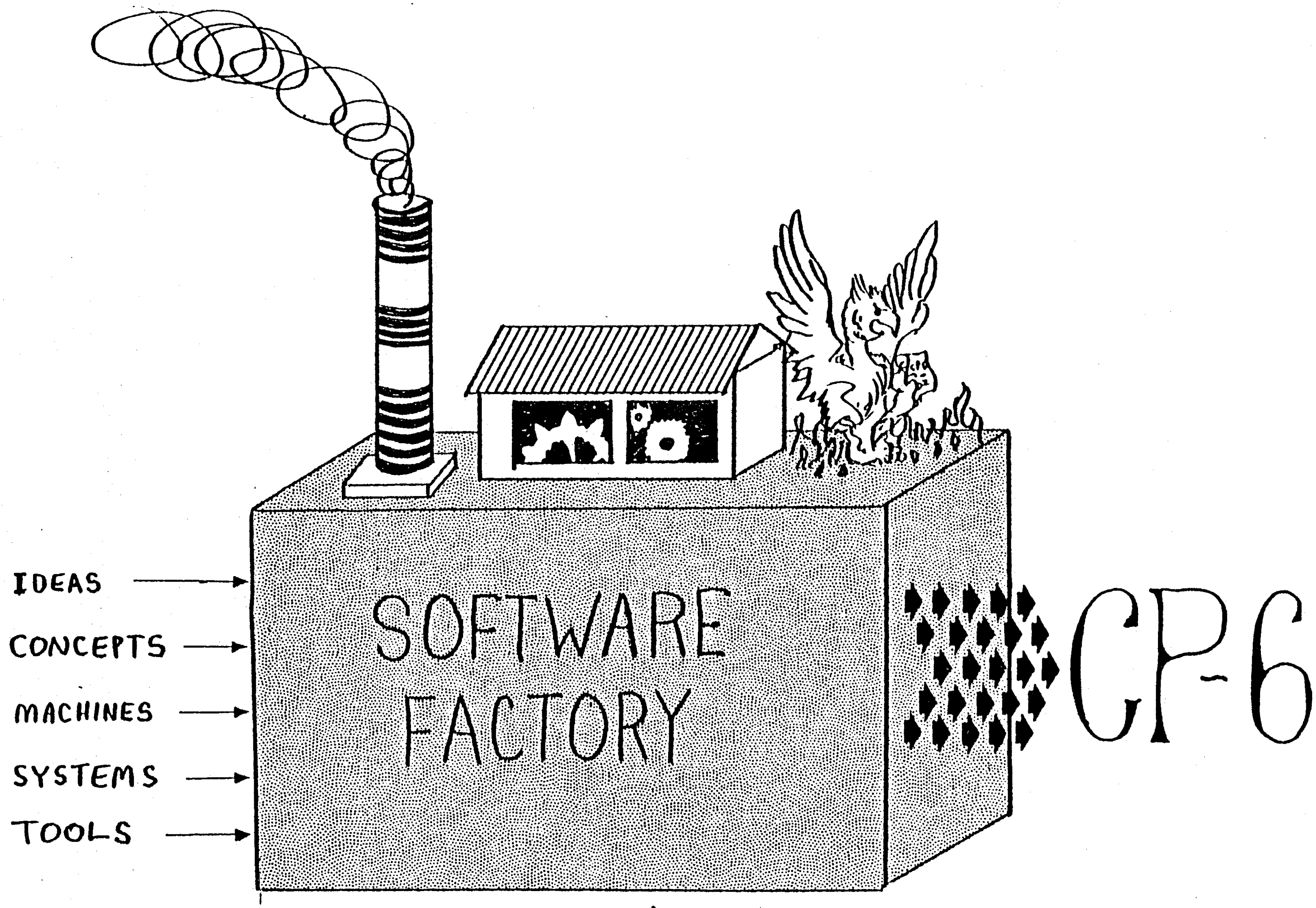
AGENDA

THURSDAY, SEPTEMBER 22, 1977

8:30	LADC SUMMARY – RISKS AND ISSUES	DICK LITSCHGI
9:30	GENERAL QUESTION PERIOD	
–	BOARD DISCUSSION AND RISK DETERMINATION	
12:00	LUNCH	
–	MORE BOARD DISCUSSION	

CP-6


IDEAS
CONCEPTS
MACHINES
SYSTEMS
TOOLS
SOFTWARE FACTORY
CP-6

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SOFTWARE FACTORY

- REQUIREMENTS - WHAT SHOULD IT PROVIDE ?
- HISTORY - HOW WE GOT TO WHERE WE ARE
- SYSTEM IMPLEMENTATION LANGUAGE - WHAT IS PL-6 ?
- COMPONENTS OF THE FACTORY - SOFTWARE TO MAKE SOFTWARE
- USE OF THE FACTORY - HOW IT ALL WORKS TOGETHER
- TRANSPORT OF THE FACTORY TO CP-6 BASE SYSTEM
- EXPERIENCE TO DATE - HOW WELL DOES IT WORK ?

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REQUIREMENTS OF SOFTWARE FACTORY

- LANGUAGES TO SUIT NEEDS OF SYSTEM IMPLEMENTATION
- TOOLS TO PUT PROGRAMS TOGETHER AND ONTO TARGET MACHINE
- DEBUGGING AIDS TO HELP GET CODE WORKING SOONER
- BASE SYSTEM WITH CONVENIENT, CONTROLLED ACCESS and FILE SYSTEM
- SUFFICIENT HARDWARE TO PROVIDE HOME FOR SOFTWARE FACTORY
- EFFICIENT ENVIRONMENT TO PROMOTE PRODUCTIVITY and HELP RETAIN PROGRAMMERS' SANITY

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A LITTLE HISTORY

- PL/1 – TOO MUCH OF A GOOD THING
- MULTICS – NICE TOOLS, WRONG MACHINE
- GCOS – ASSEMBLER, RIGHT MACHINE
- PL-6 – SMALL, CONTROLLABLE
- CP-V – FAMILIAR, AVAILABLE
- BMAP – GMAP ON CP-V

PL-6 THE SYSTEM IMPLEMENTATION LANGUAGE

- PL/1 - LIKE SYNTAX
- BLOCK STRUCTURED
- SIMPLE DATA TYPES
- MINIMAL RUN-TIME ROUTINES
- NO HIDDEN OVERHEAD
- INTERFACES TO SYSTEM SERVICES
- FACILITATES CODING IN NSA ENVIRONMENT
- USES CAPABILITIES OF L66 INSTRUCTION SET

HARDWARE

- DUAL 560 - PRIMARY FACTORY SYSTEM THROUGH 1Q79
- DUAL SIGMA6 - OVERFLOW/BACKUP SYSTEM FOR DUAL 560
- TWO L66's - FOR HANDS ON DEBUGGING THROUGH 3Q78
  - ONE BECOMES FACTORY SYSTEM 4Q78
- TERMINALS - IN OFFICES OF ALL PROGRAMMERS and A FEW TERMINAL ROOMS
- PHOENIX FACTORY SYSTEM - SIGMA 6 and L66 AVAILABLE

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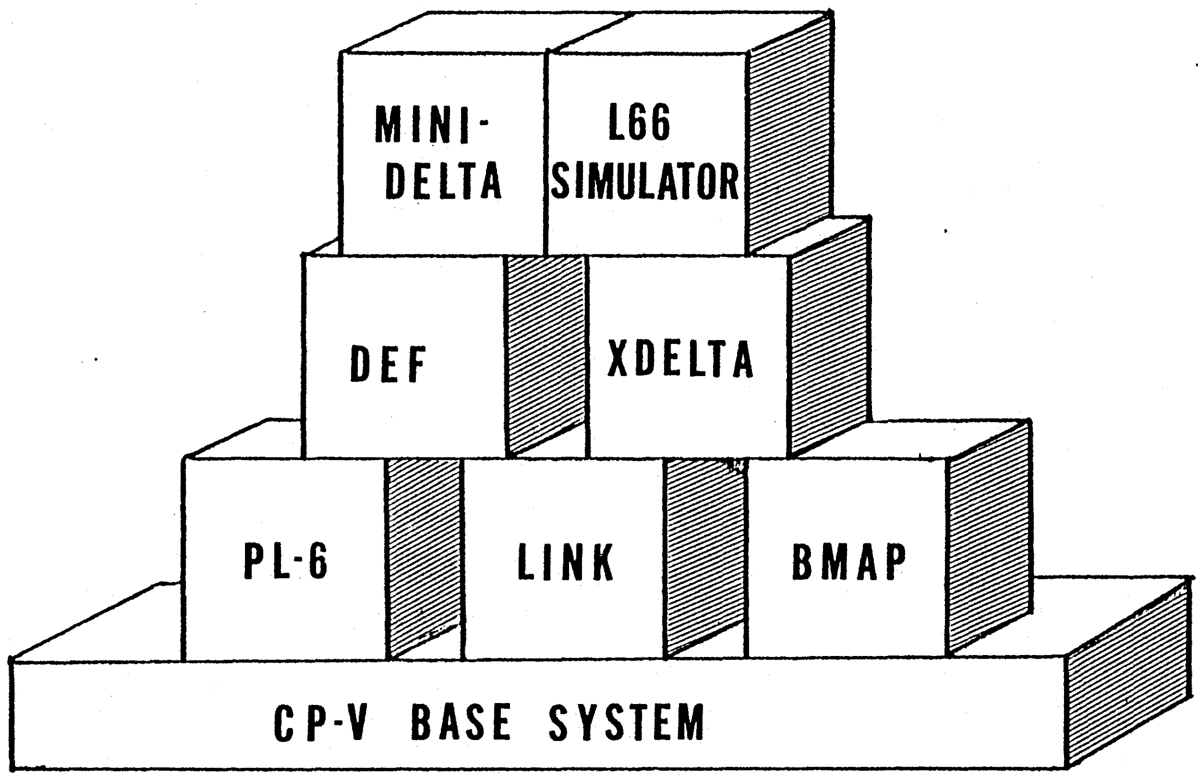
CP-V BASE SYSTEM

- CONTROLLED DEPENDABLE FILE SYSTEM
- EDIT - KNOWN ENTITY
- DEBUGGER - ALLOWS FOR FAST DEVELOPMENT OF BUILDING BLOCKS
- FORTRAN - MOST FACTORY SOFTWARE CODED IN FORTRAN

BUILDING BLOCKS OF THE FACTORY
(SOFTWARE TO BUILD SOFTWARE)



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CP-6 OBJECT LANGUAGE

- DEVELOPED TO SPECIFICALLY FIT CP-6 ENVIRONMENT
- PROVIDES FOR STANDARD CALLING SEQUENCES
- ALLOWS IMPLEMENTATION OF A COMMON DEBUGGER FOR ALL LANGUAGES
- FACTORY FORMAT ACCOMODATES 36-BIT WORD SIZE WITHOUT ALTERING FILE RECORD LAYOUT (2 WORDS = 1 WORD)

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PL-6

- BASED ON PL/H (BASED ON CONTROL FORTRAN)
- CODED IN FORTRAN
- LIVES ON CP-V SYSTEM
- PRODUCES CP-6 OBJECT UNITS WITH DEBUG SCHEMA

BMAP

- L66 ASSEMBLER (WITH NSA, EIS)
- CODED IN FORTRAN
- LIVES ON CP-V
- PRODUCES CP-6 OBJECT UNITS
- GMAP EQUIVALENT WITH EXTENSIONS

LINK

- LINKER WHICH CREATES PROGRAM RUN UNITS FROM OBJECT UNITS
- CREATES ALL EXECUTABLE PROGRAMS (BOOTSTRAP, MONITOR, USER PROGRAMS)
- SUPPORTS DEBUG SCHEMA
- CREATES LOAD MAP OF THE RUN UNIT
- CODED IN FORTRAN
- LIVES ON CP-V SYSTEM
- SUBSET OF CP-6 LINKER FUNCTIONALITY

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L66 SIMULATOR

- PROVIDES CP-6 / L66 SIMULATION ON CP-V
- USES LINK BUILT RUN UNITS FOR INPUT
- INCLUDES ➢ L66 INSTRUCTION SIMULATION (INCLUDING EIS & NSA)
  ➢ INTERACTIVE SYMBOLIC DEBUGGER
  ➢ MINIMAL SYSTEM SERVICES FOR I / O
- ALLOWS CHECKOUT OF CODE BEFORE SYSTEM INTEGRATION
- CODED IN METASYMBOL (CP-V ASSEMBLER)

DEF

- CREATES THE SYSTEM BOOT TAPE (PO TAPE)
- BOOTSTRAP, MINI-DELTA, MONITOR, XDELTA, GHOST1 PROGRAM IMAGES EXTRACTED FROM LINK BUILT RUN UNIT FILES
- MONITOR DEBUG SCHEMA SORTED BY FCG AND WRITTEN TO TAPE
- SYSTEM FILES WRITTEN TO TAPE IN CP-6 TAPE FORMAT (RUN UNIT FILES & CP-V FILES)
- CONVERTS 32-BIT WORD FORMATS TO 36-BIT FORMAT
- CODED IN METASYMBOL

MINI - DELTA

- RUNS ON L66 AS STANDALONE HOST DEBUGGING SYSTEM
- PROVIDES INTERACTIVE DEBUGGING OF CP-6 MONITOR AT SYSTEM CONSOLE
- READS PO TAPE, INITIALIZES MPC'S, SETS UP MONITOR'S RUNNING ENVIRONMENT
- DEBUGGER PROVIDES
  - SYMBOLIC SEGMENT SPECIFICATION
  - ABSOLUTE ADDRESSING WITHIN SEGMENT (ALLOWS SYMBOL DEFINITION)
  - INSTRUCTION BREAKPOINTS (UP TO SEVEN)
  - MEMORY DUMPS TO CONSOLE OR PRINTER
  - DISPLAY AND MODIFICATION OF MEMORY AND REGISTERS
- READS INPUT COMMANDS FROM SYSTEM CONSOLE, PO TAPE, OR CARD READER
- CODED IN BMAP

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XDELTA

- RUNS ON L66 AS STANDALONE HOST DEBUGGING SYSTEM
- POWERFUL INTERACTIVE DEBUGGER - REPLACES MINI-DELTA
- UTILIZES PL-6 GENERATED PROGRAM SCHEMA
- INITIAL VERSION INTERFACES WITH MINI-DELTA
- PROVIDES
  - STATEMENT OR INSTRUCTION MODE SINGLE STEP EXECUTION
  - UNLIMITED BREAKPOINTS (WITH CONDITIONS, ATTACHED COMMANDS)
  - DISPLAYS DATA, INSTRUCTIONS IN SPECIFIABLE FORMAT
  - PERFORMS DISK, TAPE I/O TO FACILITATE FILE SYSTEM CHECKOUT
  - ALLOWS DISPLAY, MODIFICATION OF ALL MEMORY AND REGISTERS
- CODED IN PL-6 (SOME BMAP)
- AVAILABILITY SCHEDULED FOR NOVEMBER 1977

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MISCELLANEOUS TOOLS

- EXTRACT
- DECOMMENT
- DRAW
- XREF

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- (LIST GROWS AS NEEDS ARISE)

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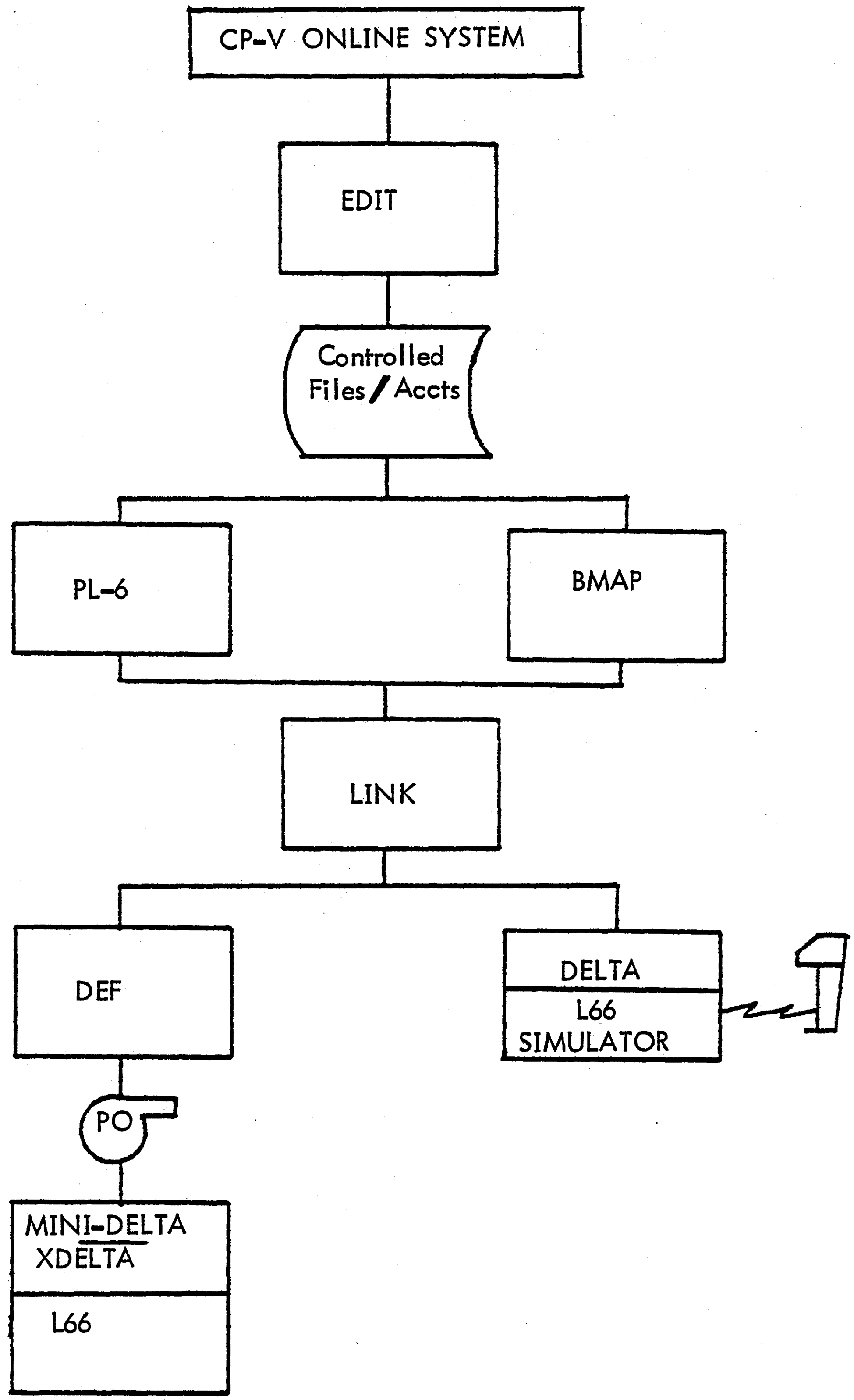
THE FACTORY ON CP-V



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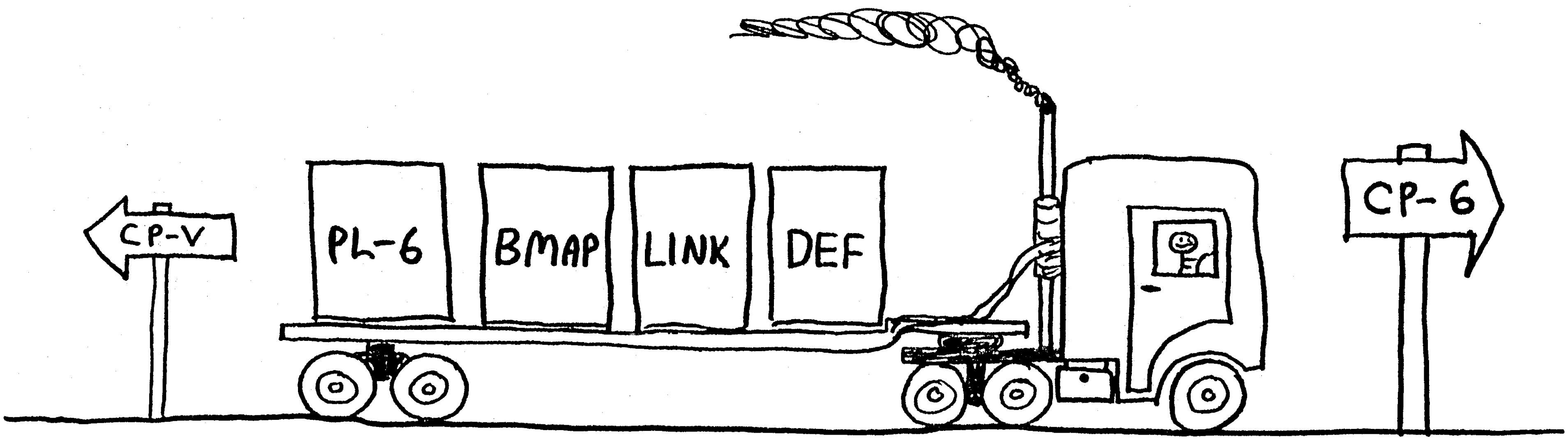
TRANSPORTING FACTORY TO CP-6

- ALL CP-6 FACTORY BUILDING BLOCKS CODED IN EITHER PL-6 OR FORTRAN
- PL-6 BLOCKS ARE CREATED ON CP-V FACTORY
- CP-6 CODEGEN FOR CP-V FORTRAN AVAILABLE JUNE '78
  - RUNS ON CP-V
  - PRODUCES CP-6 OBJECT UNITS
- FORTRAN BLOCKS ARE COMPILED WITH THIS MODIFIED FORTRAN THEN LINKED AND TRANSPORTED JUST AS THE PL-6 BLOCKS



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BLOCKS TO BE RE-CODED IN PL-6

- LINK (FULL IMPLEMENTATION)
- DEF

BLOCKS TO BE CODED IN PL-6

- EDIT
- XDELTA
- DELTA

BLOCKS TO BE MOVED VIA FORTRAN VEHICLE

- PL-6 (MAIN REASON FOR CREATING VEHICLE)
- BMAP (???)

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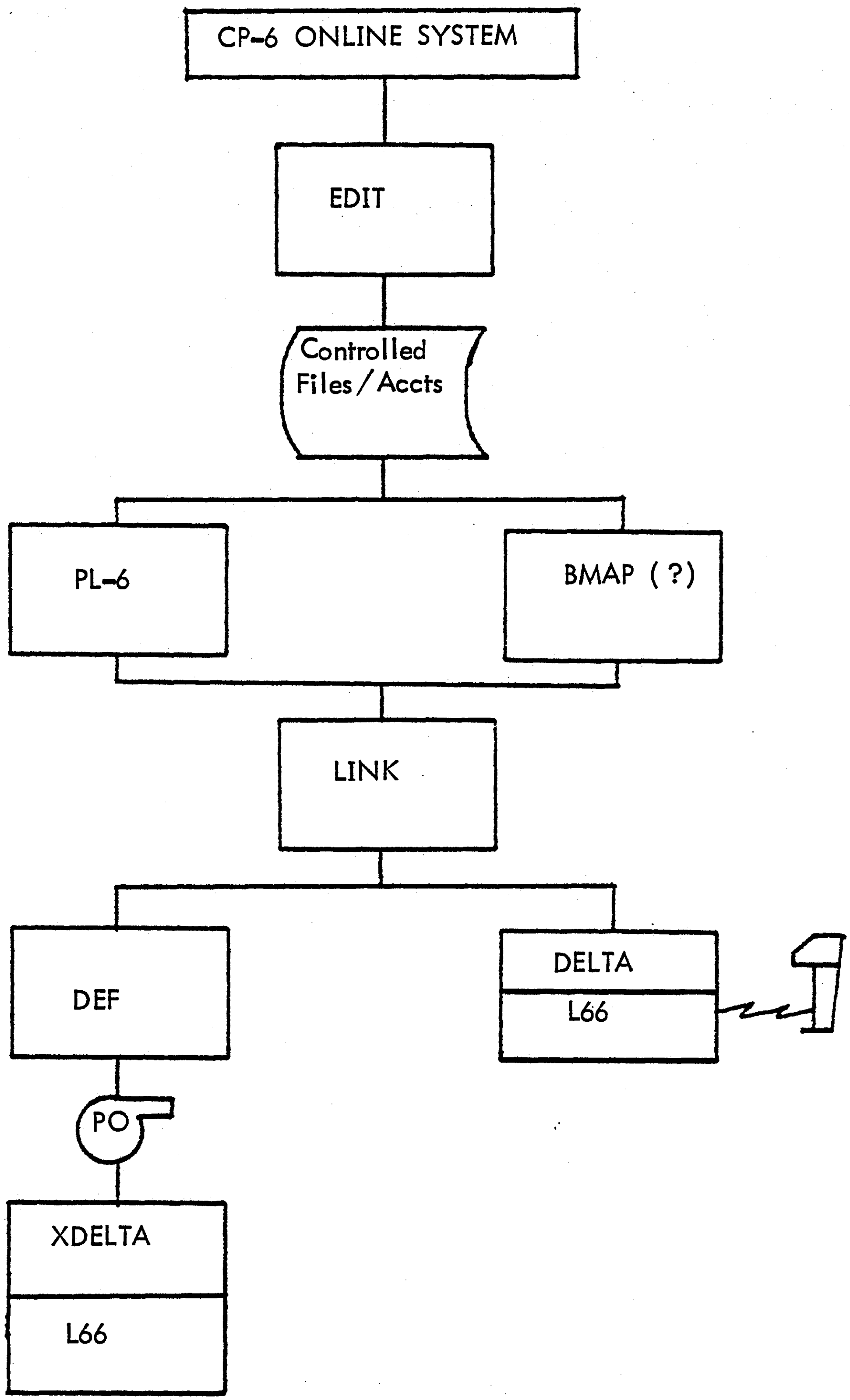
THE FACTORY ON CP-6



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EXPERIENCE TO DATE
(Or How To Lick a Camel)

TWO MAJOR HUMPS –

1. LEARNING INTIMACIES OF NSA ADDRESSING
2. LEARNING TO CODE IN NEW (HIGHER-LEVEL) LANGUAGE

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FACTORY TOOLS AIDED IMMENSELY

- MINI-DELTA – HANDS ON WITH L66 EASY TO SEE WHATS HAPPENING

- SIMULATOR – ABILITY TO SEE CODE WORK

WHERE ITS ALL GOTTEN US

- MINI-DELTA PATH (WITH L66)
  - BOOT PROCESS
  - MEMORY PROCESS
  - SCHEDULER
  - FAULT HANDLER
  - PMME HANDLER (SERVICE DECODER)
  - IOQ-IOS
- SIMULATOR PATH
  - FILE MANAGEMENT
  - SERVICE PROCESSORS
- PL-6 – HOW HAS IT HELPED

ON SCHEDULE AND MOVING FORWARD

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CP - 6

- SYSTEM STRUCTURE
- PROGRAM to PROGRAM INTERFACE
- USER to SYSTEM INTERFACE
- PROGRAM to SYSTEM INTERFACE
- INITIALIZATION, RMA, PERFORMANCE

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CP-6 IS A SYSTEM

- STRONG INTERFACES
- MONITOR, PROCESSORS WORK TOGETHER
- FUNCTIONS NOT DUPLICATED (EFFORT or STORAGE)
- ONENESS OF THE SYSTEM
- FULL PROTECTION
- PL-6 RELATIONSHIP TO SYSTEM

STRENGTH OF CP-6 IS IN ITS INTERFACES

- USER STRUCTURE
- SYSTEM SERVICE INTERFACE
- PROGRAM BINDING INTERFACE
- PROGRAM CALLING INTERFACE
- USER to SYSTEM INTERFACE

SYSTEM SERVICE INTERFACE

- UNIFORM ABSTRACT INTERFACE
- ISOLATES USER PROGRAMS FROM HARDWARE/SYSTEM SOFTWARE
- ENABLES COMPLETE DEVICE INDEPENDENCE
- MAKES FILES INTERCHANGEABLE AMONG LANGUAGES
- CLIMB is EXCELLENT VEHICLE

USER STRUCTURE (DOMAINS)

- USER DOMAIN
- ASL DOMAIN
- COMMAND PROCESSOR DOMAIN
- DEBUGGER DOMAIN
- PLUS MONITOR DOMAIN via PMME

USER DOMAIN

- JOB INFORMATION TABLE (JIT)
- READ ONLY SEGMENT (ROS)
  - Data Control Blocks (DCB)
  - Task Control Block (TCB)
- INSTRUCTION SEGMENT (IS)
- DYNAMIC SEGMENT (DS1 - DS8)

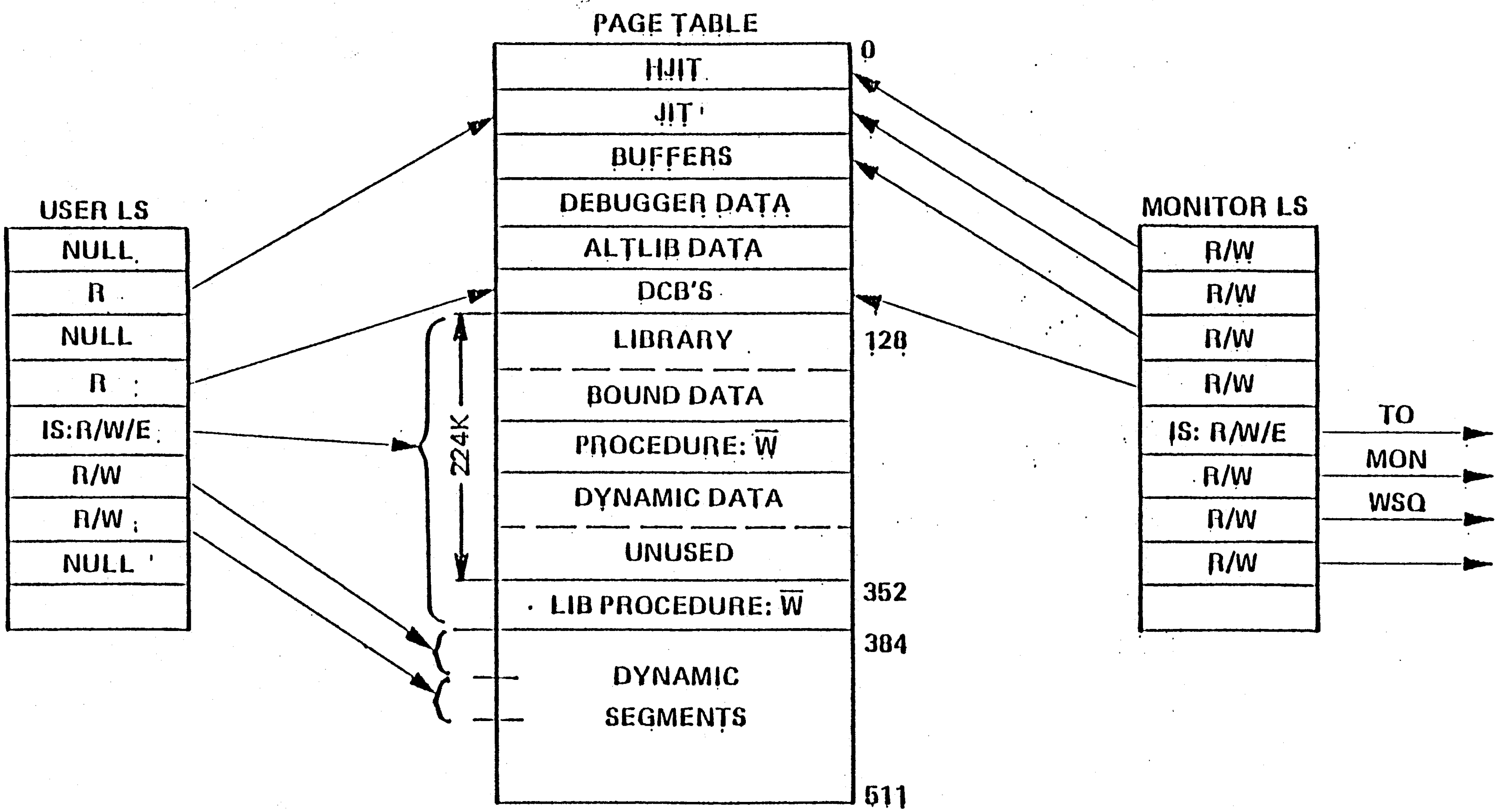
INSTRUCTION SEGMENT

- STATIC DATA
- PROCEDURE and CONSTANTS
- DYNAMIC DATA
- SHARED RUNTIME LIBRARY

USER VIRTUAL SPACE

- 'THE USER' FROM STANDPOINT of MONITOR CONTROL
- CONTAINS ALL 'GLUE' HOLDING IT TOGETHER
  - Page Table
  - Linkage Segments
  - Safe Store Stack
  - Argument/Parameter Segments
- COLLECTS ALL PHYSICAL MEMORY ALLOCATED TO THIS USER
- LOCATES BUT DOES NOT CONTAIN SHARED PROCEDURE
  - Shared Processor
  - Runtime Library

USER VIRTUAL ADDRESS SPACE



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CP-6 MEMORY UTILIZATION

- CP-V BASED ON HIGH SPEED SWAPPER AND NEW INVENTIONS NOT TOLERABLE
- ROTATING MEMORY AND CCD'S CONSIDERED
- EVALUATION OF RAM COST TREND LED TO NOVEMBER '76 DECISION
  - USE 16K RAM IN LIEU OF SWAPPER
  - DECISION IRREVOCABLE WITHOUT SCHEDULE IMPACT
- CURRENT STATUS SHOWS NO SIGNIFICANT CHANGES
  - MUCH TOO LATE FOR ANY SWAPPER DEVELOPMENT
  - PROJECTED MEMORY REQUIREMENTS REMAIN THE SAME
  - 4K CHIP COST TREND BETTER THAN TARGET (BUT NOT A SOLUTION)
  - BUT WILL VOLUMES DEVELOP FOR 16K CHIPS

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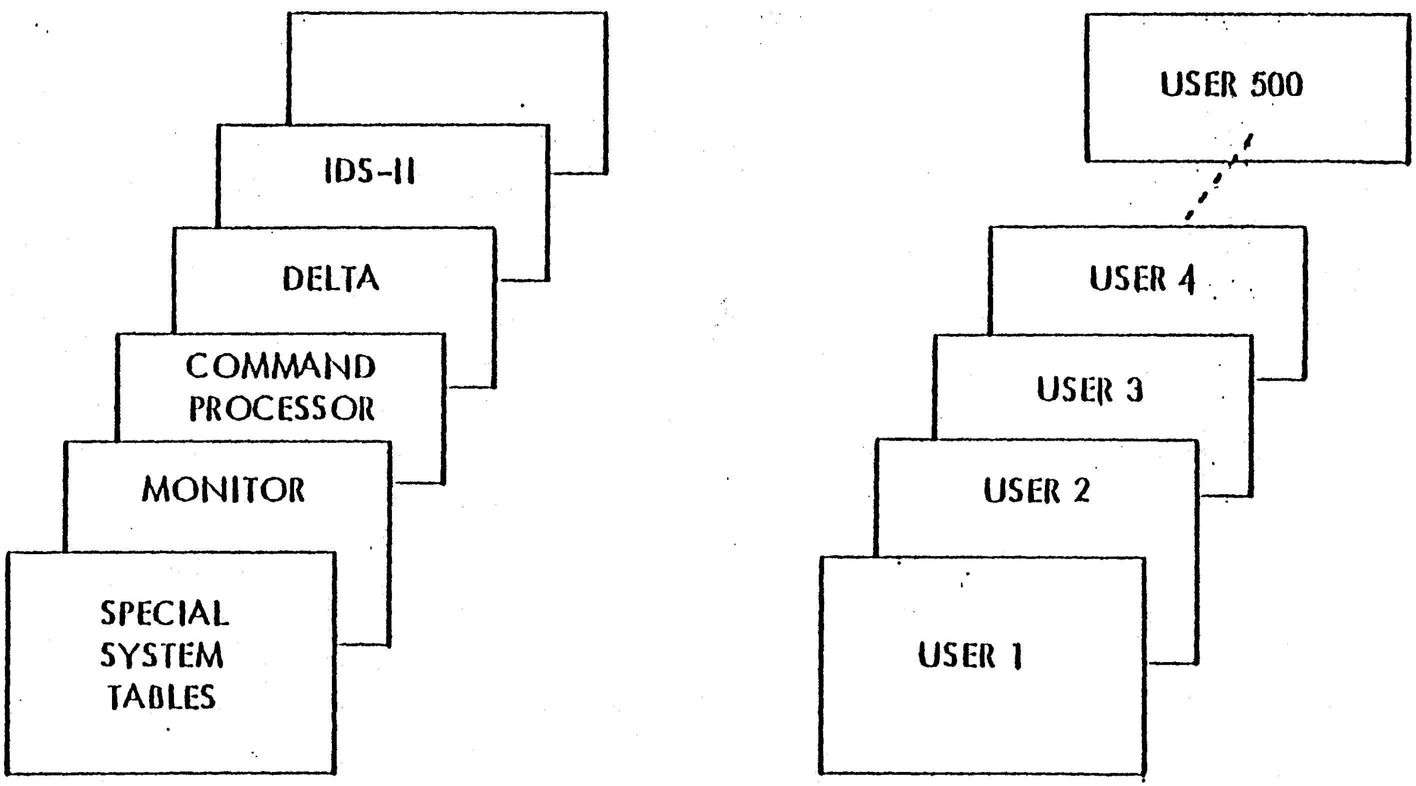
SYSTEM VIRTUAL ADDRESS SPACE



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MONITOR DOMAIN

- USER JIT, ROS, HJIT, FILE BUFFERS, TSTACK, PAGE TABLE
- USER PARAMETER SEGMENT
- MONITOR IS
- MONITOR DS's
- REAL MEMORY

MULTIPROCESSING

- USERS RUN STRICTLY in USER CONTEXT - ANY CPU
- MOST MONITOR SERVICES RUN in USER CONTEXT - ANY CPU
- FAULT HANDLER RUNS in USER/CPU CONTEXT - ANY CPU
- SCHEDULER/PHYSICAL I/O+MONITOR SERVICES WHICH USE CPU GLOBAL DATA RUN ON MASTER ONLY

MONITOR MEMORY USAGE

- CPU SPECIFIC (UNIQUE COPIES PER CPU)
  - MONITOR JIT and HJIT
  - Page Table Directory, Page Table, TSTACK
  - STATIC DATA Protected by SOFT DISABLE
- CPU GLOBAL (SAME COPY USED BY ALL CPU's)
  - STATIC DATA
  - REAL (Allocated At Boot Time)
  - DYNAMIC SEGMENTS
  - DYNAMIC REAL (Will be in some Users PT for REF)
  - PROCEDURE and CONSTANTS

ONENESS OF THE SYSTEM

- ONE KIND of JOB
- ONE CPU SCHEDULER
- ONE COMMAND LANGUAGE, DEBUGGER
- ONE FILE MANAGEMENT SYSTEM

PL-6 RELATIONSHIP TO SYSTEM

- LANGUAGE BUILT TO FIT SYSTEM, NOT VICE VERSA
  - Operating System is the Runtime 'Library'
- FACILITIES INCLUDED TO FACILITATE
  - Building the system
  - Using the system
- DOES NOT PROVIDE HIDDEN CONTROL MECHANISMS
- SYSTEM IS NOT PREJUDICED TO ANY LANGUAGE
  - But Provides Facilities Necessary to Implement All

CP-6 IS A SYSTEM

- STRONG INTERFACES
- MONITOR, PROCESSORS WORK TOGETHER
- FUNCTIONS NOT DUPLICATED (EFFORT or STORAGE)
- ONENESS OF THE SYSTEM
- FULL PROTECTION
- PL-6 RELATIONSHIP TO SYSTEM

STRENGTH OF CP-6 IS IN ITS INTERFACES

- USER STRUCTURE
- SYSTEM SERVICE INTERFACE
- PROGRAM BINDING INTERFACE
- PROGRAM CALLING INTERFACE
- USER to SYSTEM INTERFACE

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PROGRAM BINDING INTERFACE

- OBJECT LANGUAGE COMMON FOR ALL LANGUAGES
- DEBUG SCHEMA INCLUDED PERMITTING COMMON DEBUGGER
- ORIENTED TO SHARED PROCEDURE ENVIRONMENT
- PERMITS GENERAL LINK TIME BINDING

FEATURES OF OBJECT LANGUAGE/LINKER

- GENERAL RELOCATION of FIELDS
- COMPLETE DESCRIPTION of VARIABLES/PROCEDURES
- DETECTION of PROCEDURE DEFINITION/CALL MISMATCH
- SYSTEMIC DEFINITIONS SUPPLIED by LINKER
- PERMITS GENERAL LINK TIME BINDING to PROMOTE MODULAR PROGRAMMING
- DESIGNED FOR EASE of GENERATION AND SPEED of LINKING
- LINKER PRODUCES RUN UNIT

FEATURES OF RUN UNIT

- SAME FORMAT USED FOR ALL TYPES PROGRAM
- EXECUTABLE FORM CONTAINING STATIC, PROCEDURE, DCB's and TCB
- IDENTIFIES REQUIRED LIBRARY and ASL
- STANDARD FILE, of course

PROGRAM CALLING INTERFACE

- STANDARD SYSTEM CALLING SEQUENCE
- ACCOMODATES NEEDS of ALL LANGUAGES
- FACILITATES MIXED LANGUAGE PROGRAMS
- DESIGNED FOR EFFICIENT FORMAL INTERFACE
  Among PROGRAMS In a RUN UNIT
- PROMOTES COMMON LIBRARY ROUTINES

CALLING SEQUENCE ATTRIBUTES

- DESIGNED For NSA ENVIRONMENT
- ORIENTED TO PURE PROCEDURE ENVIRONMENT
- CONTAINS INFORMATION USEFUL to DEBUGGER
- INTEGRATED WITH PL/1, PL-6 STACK FRAME MANAGEMENT
- ENCOMPASSES LIBRARY FUNCTION CALL FORMAT

CP-6 MEMORY MANAGEMENT

- PURPOSE
- ORGANIZATION
- OVERVIEW OF VIRTUAL MEMORY STRUCTURE
- DOMAINS – INTERELATIONSHIP OF ADDRESS SPACES
- INTERNAL FUNCTIONS
- PROGRAM INTERFACE

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MEMORY MANAGEMENT IS BUILT IN LEVELS

- PHYSICAL PAGE ALLOCATION
- PAGE TABLE MANIPULATION
- WSQ VIRTUAL PAGE ALLOCATION
- LINKAGE SEGMENT MANIPULATION
- SEGMENT – RELATIVE PAGE ALLOCATION
- ABSTRACTIONS BUILT ON ABOVE CAPABILITIES:
  - DATA SEGMENT ALLOCATION
  - "DYNAMIC" DATA ALLOCATION
  - FILE MANAGEMENT BUFFER ALLOCATION

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USER WSQ

JIT, TSTACK, ACCOUNTING

HJIT, LINKAGE SEGMENTS, SAFESTORE STACK, PARAMETER STACK

FILE (& COOP) BUFFERS

TCB, ECCB, TREE, DCBs

LIBRARY AND USER DATA

USER PROCEDURE

DYNAMIC DATA

SHARED RUN-TIME LIBRARY

INSTRUCTION SEGMENT (256K)

AUTOMATIC DATA, COMMON DATA, USER DATA SEGMENTS

SPECIAL SHARED PROCESSOR DATA SEGMENTS

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USER AND MONITOR VIRTUAL MEMORY LAYOUT

USER WSQ

- JIT, TSTACK, ACCOUNTING
- HJIT, LINKAGE SEGMENTS, SAFESTORE STACK, PARAMETER STACK
- FILE (& COOP) BUFFERS
- TCB, ECCB, TREE, DCBs
- INSTRUCTION SEGMENT (256K):
  - LIBRARY AND USER DATA
  - USER PROCEDURE
  - DYNAMIC DATA
  - SHARED RUN-TIME LIBRARY
- AUTOMATIC DATA, COMMON DATA, USER DATA SEGMENTS
- SPECIAL SHARED PROCESSOR DATA SEGMENTS

MONITOR WSQ

- JIT, TSTACK, ACCOUNTING
- HJIT, LINKAGE SEGMENT , SAFESTORE STACK, PARAMETER STACK
- MONITOR "WINDOW" AREA
- MONITOR INITIALIZATION - TIME TABLES
- INSTRUCTION SEGMENT (256K):
  - MONITOR DATA
  - MONITOR PROCEDURE (All pages marked housekeeping)
- MONITOR DATA SEGMENTS
- RESERVED SPACE (64 pages)

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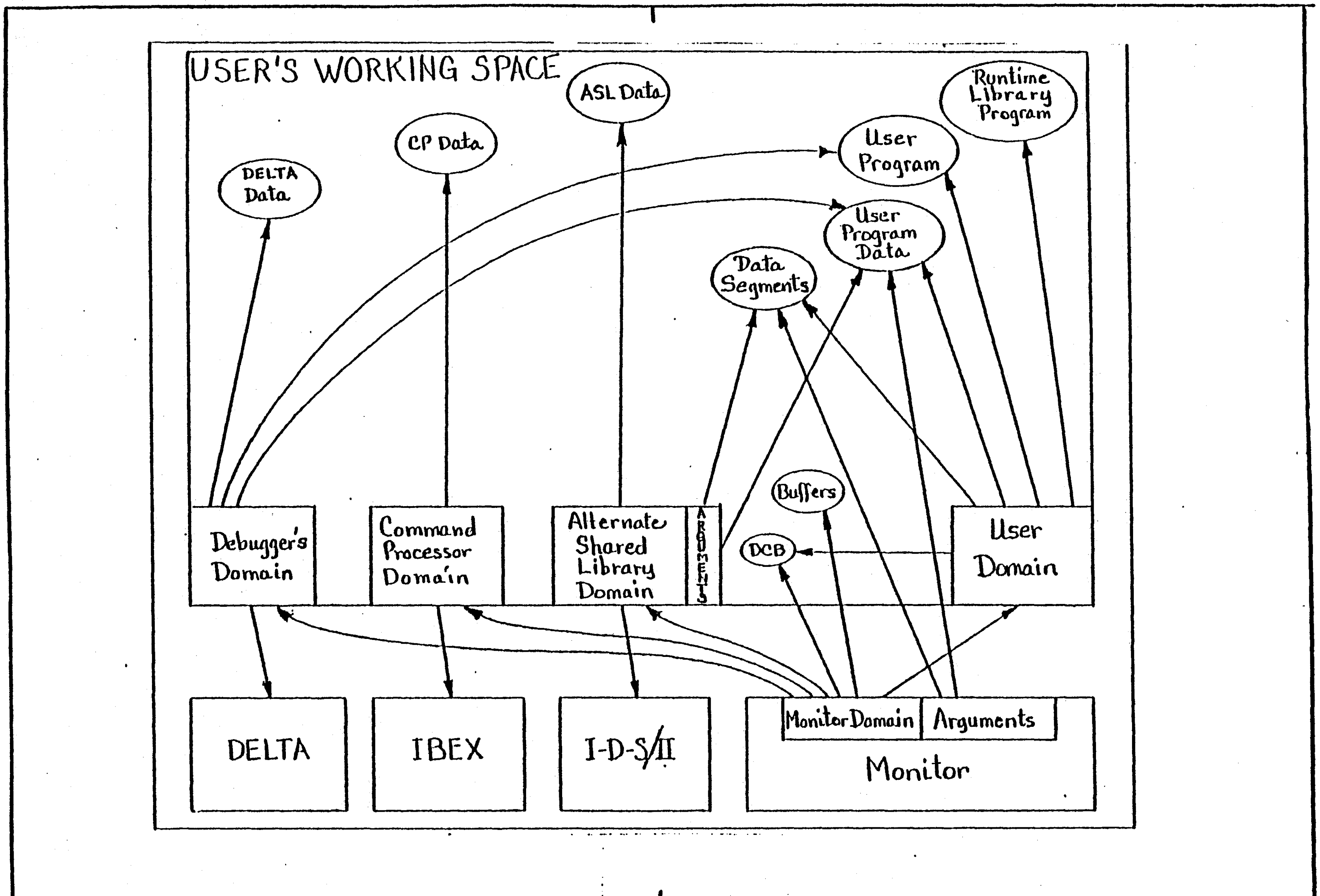
CP-6 DOMAINS OF REFERENCE



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MEMORY MANAGEMENT INTERNAL FUNCTIONS

- GET and RELEASE PHYSICAL PAGE
- GET and RELEASE STOLEN PHYSICAL PAGE
- GET and RELEASE I/O CACHE PAGE

- MAP PHYSICAL PAGE TO VIRTUAL PAGE
- SET ACCESS CONTROL FLAGS FOR VIRTUAL PAGE
- SET SOFTWARE CONTROL FLAGS FOR VIRTUAL PAGE

- GET and RELEASE VIRTUAL PAGE
- CHANGE VIRTUAL MAP
- SET MEMORY PROTECTION
- EXCHANGE I/O CACHE PAGE FOR ONE CURRENTLY IN PAGE TABLE

MORE MM INTERNAL FUNCTIONS

- READ and MODIFY LINKAGE SEGMENT DESCRIPTORS
- GET and RELEASE SEGMENT - RELATIVE PAGES
- GET and RELEASE DATA SEGMENT SPACE
- GET and RELEASE DYNAMIC DATA PAGES
- GET DYNAMIC DATA LIMITS
- GET A FILE MANAGEMENT BUFFER

PROGRAM INTERFACE TO MEMORY MANAGEMENT

- M$GDS - GET DATA SEGMENT SPACE
- M$FDS - FREE DATA SEGMENT SPACE
- M$GDP - GET DYNAMIC DATA PAGES
- M$FDP - FREE DYNAMIC DATA PAGES
- M$GDDL - GET DYNAMIC DATA LIMITS
- M$GVP - GET VIRTUAL PAGE
- M$FVP - FREE VIRTUAL PAGE
- M$STLPP - STEAL PHYSICAL PAGE
- M$RSPP - RELEASE STOLEN PAGE
- M$CVM - CHANGE VIRTUAL MAP
- M$SMPRT - SET MEMORY PROTECTION
- M$SSC - SET SOFTWARE CONTROL FLAGS

CP-6 EXECUTION CONTROL

- CONCEPTS - USERS, PROGRAMS, JOB STEPS, COMMAND PROCESSORS
- PURPOSE
- BASIC FUNCTIONS
- PROGRAM INTERFACE
- EXAMPLE OF JOB STEP CYCLE

CP-6 JOB STEP CONCEPTS

- A USER IS NOT A PROGRAM
- THE INITIAL USER CONSISTS OF A
    - JIT
    - HJIT
    - INITIAL READ-ONLY SEGMENT
- JOB STEP EXTENDS FROM PROGRAM INITIATION TO RUNDOWN
- COMMAND PROCESSOR ALLOWS SPECIFICATION OF JOB STEPS
- ALL USERS HANDLED BY SAME EXECUTION CONTROL ROUTINES

PURPOSE OF EXECUTION CONTROL

- JOB STEP INITIATION
- JOB STEP TERMINATION
- INTRA-JOB STEP FUNCTIONS
  - OVERLAYS
  - LOAD-AND-LINK
  - ASSOCIATE SHARED LIBRARIES, ASL, OR DEBUGGER

EXECUTION CONTROL BASIC FUNCTIONS

- INITIATE OR CONTINUE A JOB STEP
- ASSOCIATE COMMAND PROCESSOR
- ASSOCIATE A SPECIFIED PROGRAM/PROCESSOR
- TERMINATE A PROGRAM-EXIT, ERROR, ABORT
- RUNDOWN A USER - TERMINATE A JOB STEP
- LOAD-AND-LINK TO ANOTHER PROGRAM
- LOAD AN OVERLAY FROM A RUN UNIT
- PROVIDE EXIT CONTROL DISPATCHING

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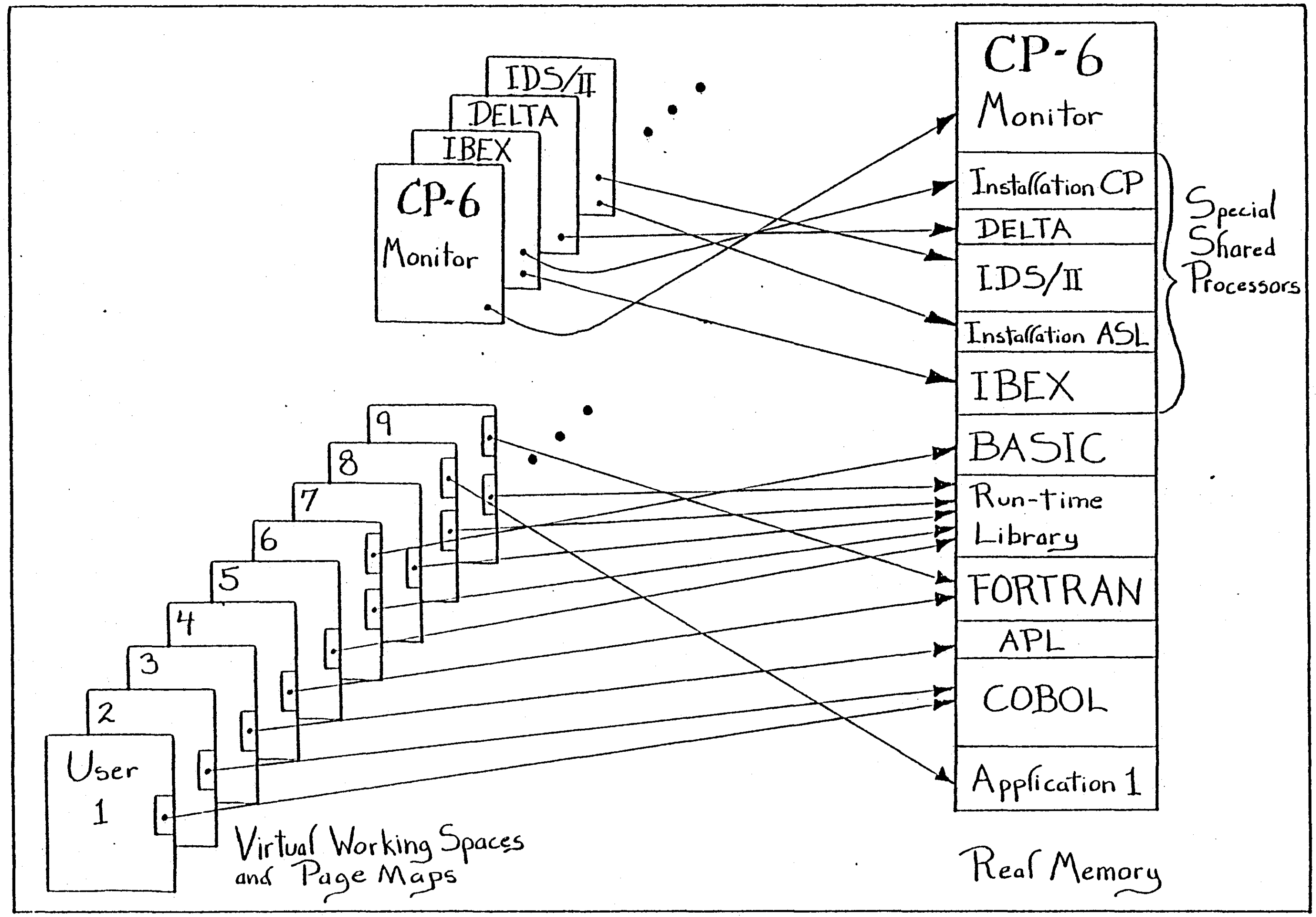
SHARING PROCEDURE

- SHARABILITY DETERMINED AT JOB STEP INITIATION
- SHARED PROCESSOR INITIAL DATA, READ ONLY SEGMENT ALLOCATED TO INDIVIDUAL USER's WSQ
- SHARED PROCESSOR PROCEDURE MAPPED INTO EVERY USER's WSQ
- UNSHARED PROGRAMS READ ENTIRELY INTO MEMORY ALLOCATED TO INDIVIDUAL WSQ's

CP-6 SHARED PROCESSORS



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PROGRAM INTERFACE

- M$CPEXIT - INITIATES NEW JOB STEPS
- M$RUND - TERMINATES A JOB STEP - RUNS DOWN A USER

- M$EXIT - PROGRAM NORMAL EXIT
- M$ERR - PROGRAM ERROR EXIT
- M$XXX - PROGRAM ABORT EXIT

- M$OLAY - BRINGS IN A PROGRAM OVERLAY
- M$LDTRC - TRANSFERS CONTROL TO ANOTHER PROGRAM
- M$LINK - TRANSFERS CONTROL TO ANOTHER PROGRAM, SAVING THE CURRENT PROGRAM STATE FOR LATER RESUMPTION

SAMPLE JOB STEP CYCLE

- NEW USER CREATED and LOGGED ON
- SCHEDULER CALLS CPEXIT TO ASSOCIATE COMMAND PROCESSOR
- COMMAND PROCESSOR ENTERED
- CP is REQUESTED TO RUN A PROGRAM
- CP ISSUES M$CPEXIT TO INITIATE PROGRAM
- EXECUTION CONTROL FETCHES PROGRAM INTO WSQ, CALLS SCHEDULER
- PROGRAM EXECUTES and EVENTUALLY EXITS
- CP IS REENTERED
- CP IS REQUESTED TO RUN ANOTHER PROGRAM
- CP TERMINATES CURRENT JOB STEP VIA M$RUND, INITIATES ANOTHER VIA M$CPEXIT.

PROGRAM TO SYSTEM INTERFACE

- CONTROL PATHS BETWEEN CP-6 DOMAINS
- MONITOR SERVICES INTERFACE
- SCHEDULING (DISPATCHING)
- FAULT and EXCEPTIONAL CONDITION HANDLING

INTER-DOMAIN INTERFACE

- DOMAINS HAVE ESTABLISHED LEVEL OF PRIORITY
  - USER
  - ALTERNATE SHARED LIBRARY
  - DEBUGGER
  - COMMAND PROCESSOR
  - MONITOR
- INWARD CLIMB TO DOMAIN OF HIGHER PRIORITY
  - SAVES ENVIRONMENT
  - OPTIONALLY PREPARES NEW PARAMETERS
  - ESTABLISHES NEW ENVIRONMENT
- OUTWARD CLIMB TO RETURN
  - RESTORES ENVIRONMENT
  - RELINQUISHES CONTROL

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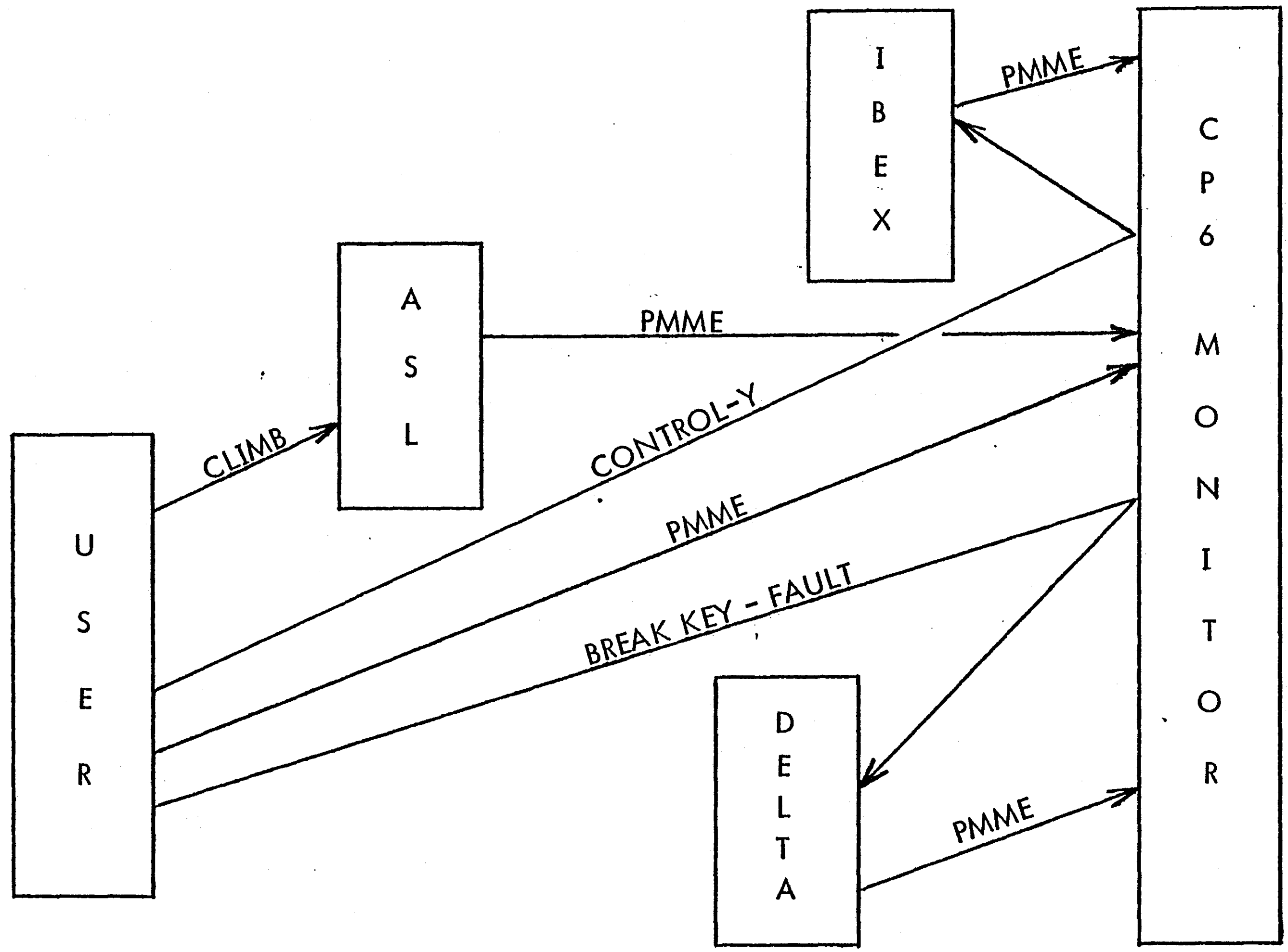

CONTROL PATHS BETWEEN CP-6 DOMAINS

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CP-6 MONITOR SERVICES INTERFACE

- SERVICES AVAILABLE IN ALL LANGUAGES
- SERVICES AVAILABLE TO ALL DOMAINS
- OPERATION IS IDENTICAL FOR BATCH and ON-LINE
- BROAD SPECTRUM of SERVICES AVAILABLE

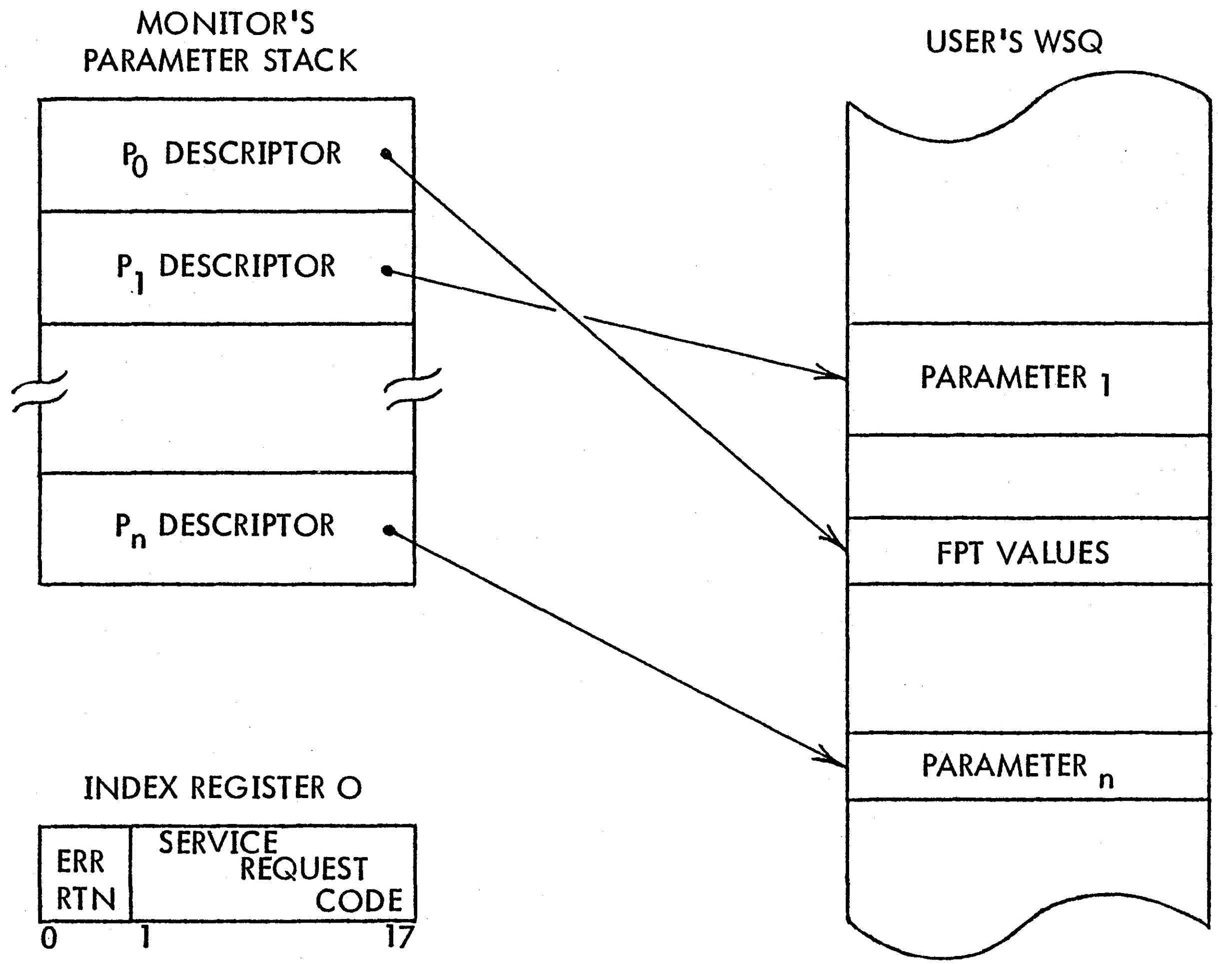
CATAGORIES OF CP-6 MONITOR SERVICES

•	JOB STEP CONTROL	15
•	RUN-TIME SERVICES	25
•	MEMORY MANAGEMENT	15
•	FILE MANAGEMENT/DEVICE I/O	25
•	ON-LINE TERMINAL CONTROL	10
•	DIAGNOSTIC SERVICES	10
•	SPECIAL SHARED PROCESSOR SERVICES	5

CP-6 MONITOR SERVICES REQUEST

- INVOKED VIA PMME FORM of CLIMB
  - SAVE ENVIRONMENT
  - VALIDATES PARAMETER ADDRESSES/SIZE
  - ESTABLISHES MONITOR ENVIRONMENT
- INPUTS ASSOCIATED with EACH REQUEST
  - SERVICE REQUEST CODE
  - ERROR RETURN SPECIFICATION
  - WHERE REQUIRED - USER PARAMETERS
- OUTPUTS SUPPLIED for ERROR ROUTINES
  - COPY of SAFE STORE FRAME
  - SERVICE REQUEST CODE
  - DCB# (IF APPLICABLE)
  - ERROR CODE

MONITOR SIDE OF PMME



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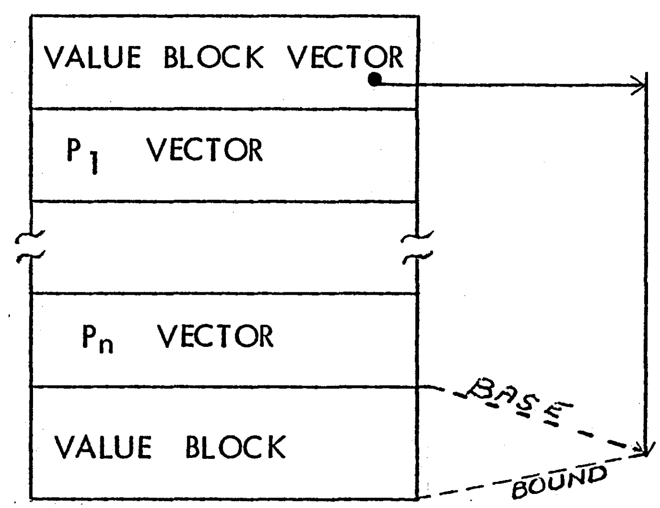
FUNCTIONAL PARAMETER TABLE

- FIXED FORMAT for EACH REQUEST
- SUPPLIES MONITOR with USER SPECIFIC INFORMATION
  - AREAS in USER's MEMORY
  - PRESENCE/ABSENCE of OPTIONAL PARAMETERS
  - VALUES to OVER-RIDE DEFAULTS
- AREAS IN USER MEMORY SPECIFIED AS VECTORS
- ALL VALUES PASSED AS ONE PARAMETER



```
            LDPO      FPT

CLIMB       EA - BIT 0   = ERR RETURN SPECIFICATION
                 BITS 0-17 = SERVICE REQUEST CODE
            SEGID        = PMME
            C            = INWARD CLIMB
                             LOAD XO WITH EA
            E            = 1 - PREPARE PARAMETERS (OR ZERO)
            P            = # of PARAMETERS - 1

TRA         ERROR           (if EA BIT 0 = 1)
```

USER SIDE OF PMME

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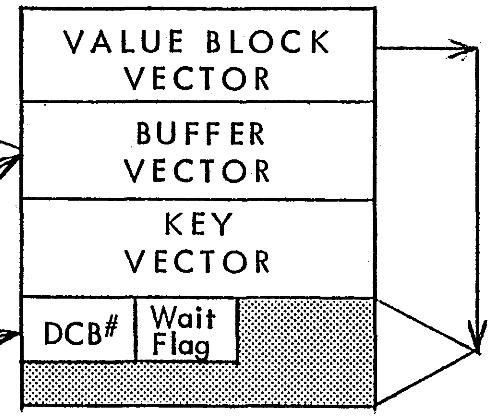
PL-6 EXAMPLE

```
DCL INBUF CHAR (80) STATIC;

% INCLUDE CP-6;

% FPT - READ  (FPTN  =  SIFPT,
               BUF   =  INBUF,
               DCB   =  M$SI);


CALL M$READ (SIFPT) ALTRET (READERR);
    .
    .
    .
READERR:         /*ERROR HANDLER*/
```



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CP-6 SCHEDULER

- STATE QUEUE MAINTENANCE
- QUANTUM TIMING and CONTROL
- EXECUTION SCHEDULING
- ASYCHRONOUS EVENT PROCESSING

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STATE QUEUES

- EXECUTING
- EXECUTABLE

  PRIORITY 1
  PRIORITY 2
  PRIORITY 3
  .
  .
  .
  PRIORITY n

- NON-EXECUTABLE

  I/O WAIT
  SLEEPING
  QUEUED FOR RESOURCE
  TERMINAL INPUTTING
  TERMINAL OUTPUTTING

STATE QUEUE MAINTENANCE

- EVERY JOB in SYSTEM HAS ASSIGNED PRIORITY
- EVERY JOB HAS SINGLE ENTRY in STATE QUEUES
- EXECUTABLE STATE QUEUES HAVE a PRIORITY
- 'EVENTS' CAUSE CHANGE in STATE
  - BLOCKING EVENT MOVES USER to NON-EXECUTABLE STATE
  - UNBLOCKING EVENT MOVES USER TO EXECUTABLE STATE BASED ON PRIORITY ASSOCIATED WITH THE EVENT.
  - EXECUTION SCHEDULER MOVES HIGHEST PRIORITY EXECUTABLE USER TO EXECUTING STATE

EVENTS

I/O IN PROGRESS
I/O COMPLETE

SLEEP
WAKE - UP

NEED MEMORY PAGE
PAGE AVAILABLE

NO DISK SPACE
DISC SPACE AVAILABLE

COMMUNICATIONS INPUT IN PROCESS
COMMUNICATIONS INPUT COMPLETE

BREAK CHARACTER RECEIVED
CONTROL Y RECEIVED
USER ABORTED BY OPERATOR
I/O COMPLETE with EVENT INFO

QUANTUM TIMING

- SYSTEM PARAMETERS

  QUAN - MAXIMUM TIME ALLOWED COMPUTE - BOUND USER

  - USED TO CAUSE TIMER RUNOUT FAULT at QUANTUM END

  QMIN - AMOUNT OF TIME GUARANTEED TO USER

  - USER MAY BE FORCED to RELINQUISH CONTROL to HIGHER PRIORITY USER ONCE QMIN IS REACHED

EXECUTION SCHEDULER

- ENTERED FOLLOWING CLIMB FOR: FAULT
  INTERRUPT
  PMME

- DETERMINE IF JOB ALLOWED TO CONTINUE
  - SUSPEND USER WITH ENVIRONMENT SAVED in SAFE-STORE
  - RELOAD SSR FOR NEW USER

- PROCESS ASYNCHRONOUS EVENTS
  - ENTER COMMAND PROCESSOR
  - ENTER DEBUGGER
  - ENTER USER ASYNCHRONOUS EVENT HANDLER

- RET THROUGH FRAME LAID DOWN BY: FAULT
  INTERRUPT
  PMME

CP-6 FAULT PROCESSING

ACTION TAKEN DEPENDS ON:

- TYPE OF FAULT

  ARITHMETIC
  PROGRAMMED
  PROCEDURE ERRORS
  SYSTEM

- DOMAIN IN CONTROL

- REQUEST FOR CONTROL

CLASSES OF FAULTS

ARITHMETIC

OVERFLOW
DIVIDE CHECK

PROGRAMMED

MASTER MODE ENTRY
DERAIL
FAULT TAG

PROCEDURE ERRORS

MEMORY
COMMAND
LOCKUP
ILLEGAL PROCEDURE
MISSING SEGMENT
MISSING PAGE
SECURITY 2
SAFE STORE
SECURITY 1

SYSTEM

TIMER, RUN-OUT
PARITY
OP NOT COMPLETE
CONNECT
DYNAMIC LINK
MISSING WORKING SPACE
EXECUTE
START UP
SHUT DOWN

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SYSTEM FAULTS

TIME RUN-OUT	-	CALL SCHEDULE
PARITY OP NOT COMPLETE	-	CALL T&D
CONNECT	-	PERFORM COMMANDS IN MAILBOX
DYNAMIC LINK MISSING WORKING SPACE EXECUTE STARTUP SHUTDOWN		CALL RECOVERY

ALL OTHERS

USER IN CONTROL	-	ABORT OR ENTER USER TRAP HANDLER
MONITOR IN CONTROL	-	CALL RECOVERY

EXCEPTIONAL CONDITION PROCESSING

- TYPES OF EXCEPTIONAL CONDITIONS
- ESTABLISHING CONTROL
- EXCEPTIONAL CONDITION ENVIRONMENT
- ENTERING EXCEPTIONAL CONDITION ROUTINES
- EXIT FROM EXCEPTIONAL CONDITION ROUTINES

TYPES OF EXCEPTIONAL CONDITIONS

- FAULTS
- PMME ERRORS
- OPERATOR ABORTS
- LIMITS EXCEEDED
- PROGRAM EXITS AND ABORTS
- TIMER RUN-OUT
- EVENT COMPLETION
- BREAK KEY INTERRUPT

ESTABLISHING CONTROL

- PROGRAM MAY REQUEST CONTROL FOR ANY OR ALL
  - — M$STIMER TIMER RUN-OUT
  - — M$INT CONSOLE INTERRUPT
  - — M$EVENT COMPLETION OF SPECIFIED EVENT
  - — M$TRAP MACHINE TRAPS - 3 CLASSES
    PMME ERRORS/NO ERR RETURN SPECIFIED
  - — M$XCON NORMAL OR ABNORMAL EXIT OF CURRENT PROGRAM
  - — MONITOR SERVICES ERROR RETURN SPECIFICATION
- SEPERATE LEVEL of CONTROL for EACH DOMAIN

EXCEPTIONAL CONDITION CONTROL BLOCK (ECCB)

- CONTAINS USER SPECIFIED HANDLER ADDRESSES
- SEPARATE ECCB FOR EACH DOMAIN

STIMER	EVENT
BREAK	XCON
PMME	ARITHMETIC
PROGRAMMED	ERROR
CONTROL FLAGS	

Word		
0		ECC
1–63	ENVIRONMENT FROM SAFE STORE STACK	
64	ECC SUB-CODE	
65	EVENT ID	
66	ERROR CODE	
67	NUMBER OF FOLLOWING WORDS	
68 – n	CONDITION SPECIFIC INFORMATION	

ECC:

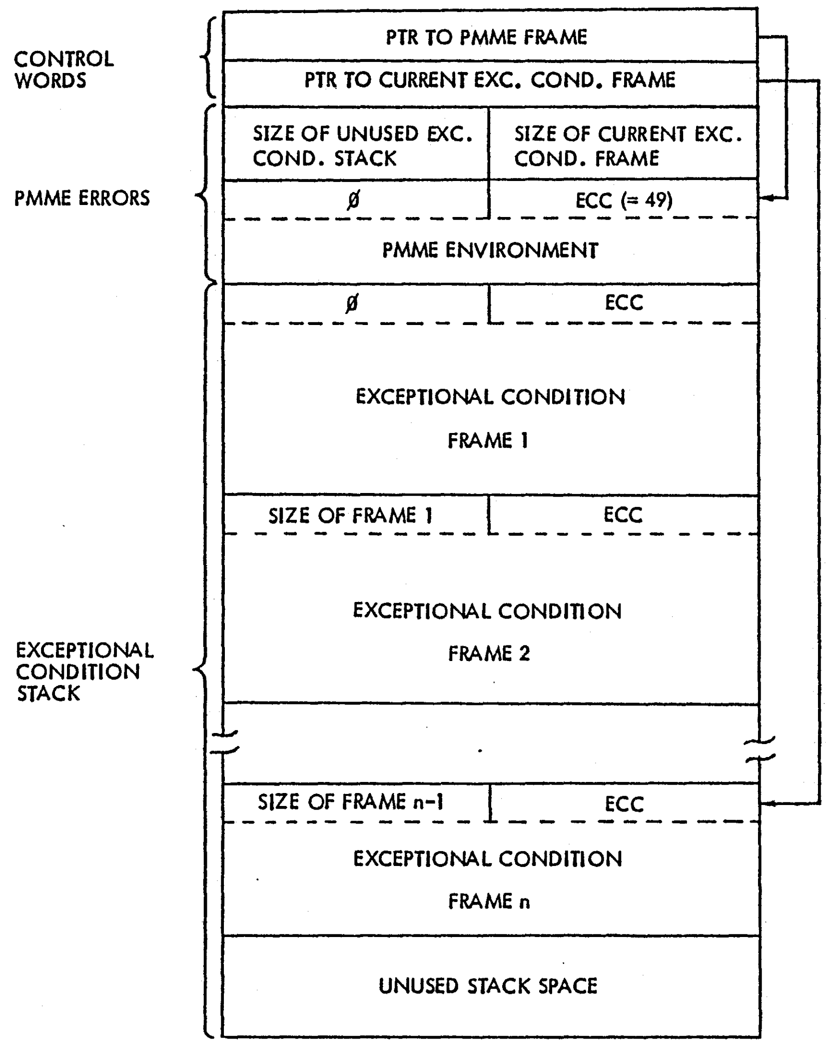
- 0 - TIMER RUNOUT
- 1 - EVENT COMPLETION
- 2 - BREAK
- 3 - XCON
- 4 - BAD PMME/NO ERRRTN
- 5 - ARITHMETIC FAULT
- 6 - PROGRAMMED FAULT
- 7 - PROCEDURE FAULT

99 - PMME ERROR RETURN

EXCEPTIONAL CONDITION ENVIRONMENT

TASK CONTROL BLOCK

- STORAGE FOR RELEVENT INFORMATION
- SINGLE FRAME FOR PMME ERROR RETURNS
- STACKED FRAMES FOR ALL OTHER CONDITIONS
- SEPARATE TCB FOR EACH DOMAIN



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ENTERING EXCEPTIONAL CONDITION HANDLERS

- SYNCHRONOUS EVENTS

  DOES NOT CAUSE CHANGE OF DOMAIN

  SAFE - STORE COPIED TO TCB
  IC IN SAFE-STORE SET TO CONDITION HANDLER
  RET CAUSES HANDLER TO BE ENTERED

- ASYNCHRONOUS EVENTS

  MAY CAUSE CHANGE OF DOMAIN

  — CONDITION FOR EXECUTING DOMAIN
  SAME AS FOR SYNCHRONOUS EVENTS
  — CONDITION FOR DOMAIN WITH HIGHER PRIORITY
  LTRAD TO CONDITION HANDLER
  — CONDITION FOR DOMAIN OF LOWER PRIORITY
  DEFER PROCESSING

EXITING EXCEPTIONAL CONDITION ROUTINE

- MONITOR SERVICE ERROR RETURNS
  - -- NO ACTION is REQUIRED
  - -- M$MERC — MONITOR ERROR HANDLING
  - -- M$RETRY — MODIFY ENVIRONMENT and RETRY PMME
- STACK CONDITION ROUTINES
  - -- M$TRTN — MODIFY ENVIRONMENT and RETURN
  - -- M$CLRSTK — POP STACK FRAME and CONTINUE

CONNECTING USERS TO DEVICES AND FILES

- TO CENTRAL SITE PERIPHERALS
- TO DISK FILES
- TO PVT. VOL. FILES
  - BOTH DEVICE AND FILE
- TO COMMUNICATIONS DEVICES
  - THESE MUST ALSO BE CONNECTED THEMSELVES

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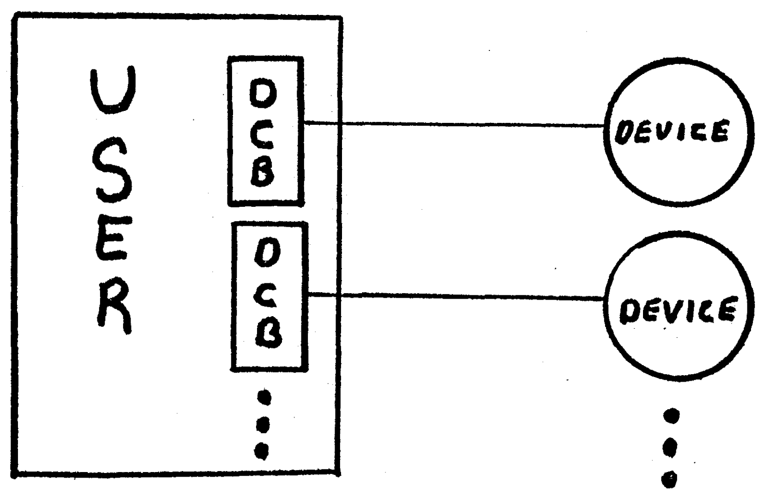
THE DATA CONTROL BLOCK (DCB)

- READ ONLY USER CONTEXT
- EACH USER HAS HIS OWN
- CONNECTION POINT FOR USERS TO DEVICE
- BASIC OPERATIONS: OPEN, READ, WRITE, CONTROL, CLOSE
- OPEN IS THE CONNECTING PROCESS



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TYPES OF ACCESS

- PUBLIC FILE
- PRIVATE DISK FILE
- MANAGED TAPE FILE
- VIRTUAL DEVICE
- WSN/DEVICE
- MASTER T.S. TERMINAL
- COMGROUP

OPEN

- BASIC ELEMENTS SPECIFIED
- ASN: FILE, MANAGED TAPE, DEVICE, COMGROUP, ME
- WSN: SUBSET OF DEVICES
- RN: TYPE OF DEVICE/VIRTUAL DEVICE/OPLABEL
- SER: TAPE OR PRIVATE DISK VOLUME
- N.A.P: IDENTIFIES FILE
- SOME OR ALL MAY BE SPECIFIED ON DCB CREATION OR I SET

STANDARD FILE IDENTIFIER (FID)

RN#SER/N.A.P. @WSN

- ALL FIELDS OPTIONAL
- # SAYS DEVICE
- @ SAYS DEVICE
- / SAYS FILE
- . SAYS FILE
- RESERVED RN'S : MT, LT, DP, DC, CG, OPLABELS

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FID EXAMPLES

PUBLIC FILE	:	A.B.C
PRIVATE DISK FILE	:	DP#1234/A.B.C
MANAGED TAPE FILE		LT#1234/A.B.C
VIRTUAL DEVICE	:	MT01#123
WSN/DEV	:	LP@BOSTON
OPLABEL	:	LP
COMGROUP	:	CG#OSNET
MASTER TERMINAL	:	ME

HISTORICAL PROBLEM :

IS 'ZZ' DEVICE OR FILE?

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FUNCTIONS BETWEEN USER AND DEVICES

- OPLABELS
- WORKSTATIONS
- SYMBIONTS (SPOOLING)
- STREAMS
- RESOURCE MANAGEMENT
- FILE MANAGEMENT
  - CONVERTS FILE COMMANDS TO SENSIBLE I/O TO REAL DEVICE

OPLABELS

- BATCH, ONLINE, GHOST

OPLABEL	BATCH	ONLINE	GHOST
ME	LP01,CR01	UC	OC
SI	CR01	UC	OC
LO	LP01	UC	OC
LP	LP01	LP01	LP01
•			
•			

- ALLOW STANDARD ASSIGNMENT TO "NATURAL" DEVICE FOR MODE
- HEAVILY USED FOR LP, CP, UC IN CP-V AND CP-6 BY PROCESSORS

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WORKSTATIONS

- EVERY USER HAS WORKSTATION OF ORIGIN
- WSN IS SUBGROUP OF ALL DEVICES
- DEVICE TYPE TRANSLATED THROUGH WSN DEFINITION TO PRODUCE REAL DEVICE AND "SYMBIONTNESS"

WSN DEFINITION

LP: SYMBIONT , OTHER ATTRIBUTES
LP01 ON TERMINAL BOSTON

LP02 ON TERMINAL BOSTON

QQ: NON-SYMBIONT, OTHER ATTRIBUTES

ZZ01 ON TERMINAL BIGBOSS

MT: USE CENTRAL SITE DEVICES

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SYMBIONTS

- PROVIDES FILE BUFFERING FOR SLOW U.R. DEVICES
- MANY USERS USING FEW DEVICES
- TALK TO COMMUNICATION DEVICES NOT CONNECTED
- SENSIBLE OUTPUT SCHEDULING
    - FORMS
    - SIZE
    - PRIORITY
- BATCH QUEUE
- NON-CONTROL INPUT FILES

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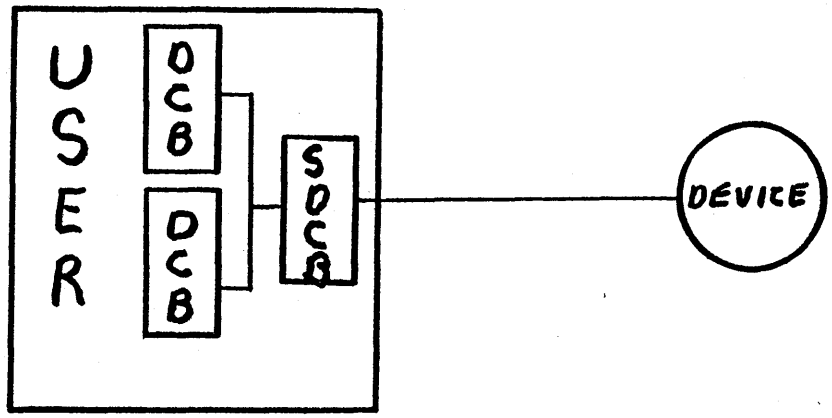
STREAMS



- ALLOW SEVERAL DCBS TO MIX OUTPUT
    - o DIFFERENT OR SAME MLO, MDO
- STREAM IS VIRTUAL DEVICE NAMED VIA LDEV

! LDEV LP02, LPC, ATTRIBUTES

- STREAM DCB IS ASSIGNED TO WSN/DEV
- LP01 IS ALWAYS AUTOMATICALLY THERE - POINTS TO LP@ WSN OF ORIGIN
- ALWAYS SYMBIONT IN 1ST RLSE

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RESOURCE MANAGEMENT

- RESOURCE IS VIRTUAL DEVICE NAMED VIA LIMIT
- I LIMIT MT01, MT, OTHER ATTRIBUTES
- ACTUAL DEVICE IS IN WSN/DEV FORM
- ALWAYS NON-SYMBIONT
- LIMIT PREVENTS CONTINUING UNTIL DESCRIBED REAL DEVICE IS ACQUIRED
- EXCEPTIONS:
  - ONLINE I LIMIT
  - ONLINE TAPES: MT01, MT02

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OPENING TO PUBLIC FILE

- ASN = FILE
- RN = DC
- NAME (.ACCOUNT. PASSWORD)
- SER: USUALLY NOT PRESENT

GOES DIRECTLY TO FILE MANAGEMENT

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OPENING TO PRIVATE VOLUME FILE

- ASN = FILE (DISK) OR MANAGED TAPE (TAPE)
- RN = DPXX(DISK), MTXX, LTXX (TAPE)

  IF 'XX' = '00 - '99' RN IS VIRTUAL DEVICE

  IF 'XX' = ' ' RESOURCE MANAGEMENT PICKS VIRTUAL DEVICE

- SER: USUALLY PRESENT
- NAME(.ACCOUNT. PASSWORD)

GOES TO RESOURCE MANAGEMENT TO GET DEVICE THEN TO FILE MANAGEMENT

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OPENING TO VIRTUAL DEVICE

ASN = DEVICE

RN = VIRTUAL DEVICE (MTxx, LP02)

SER = IS USED FOR TAPES

- THE OPEN IS TO A STREAM IF ONE EXISTS BY THE RN NAME - OTHERWISE TO RESOURCE VIA RESOURCE MANAGEMENT

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OPENING TO WSN/DEVICE

ASN = DEVICE

RN = OPLABEL or DEVICE TYPE ('LP', 'QQ')

SER: IS NOT USED

WSN: MAY BE PRESENT

- IF WSN IS NULL, WORK STATION OF ORIGIN IS APPLIED
- IF OPLABEL, TRANSLATION PRODUCES STREAM
- ASSIGNMENT IS TO SYMBIONT FILE OR RESOURCE BASED ON WSN DEFINITION
- REMEMBER VIRTUAL DEVICES USE THIS METHOD
- SPECIAL DEVICE TYPES: JE, JF

OPENING TO MASTER T.S. TERMINAL

- SPECIAL UC STREAM POINTS TO TERMINAL

  ASN = DEVICE

  RN = 'ME' OR OPLABEL POINTING TO
  UC STREAM

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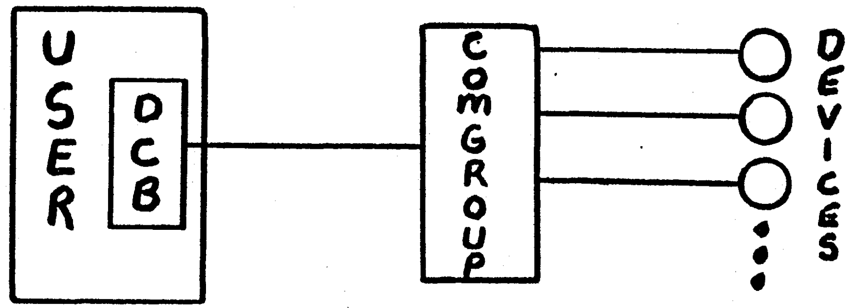
OPENING TO COMGROUP

- ASN = COMGROUP
- SER = COMGROUP NAME



- WAY TO ASSIGN ONE DCB TO MANY DEVICES
- USUALLY COMMUNICATIONS DEVICES
- NEW CONCEPT IN CP-6
  - o USED ONLY BY MONITOR IN 1ST RLSE
  - o WILL BE USED EVENTUALLY FOR T.P.
- SYMBIONTS and KEYIN USE THEM
- ALLOW RAT, RNT, WLS, WNS

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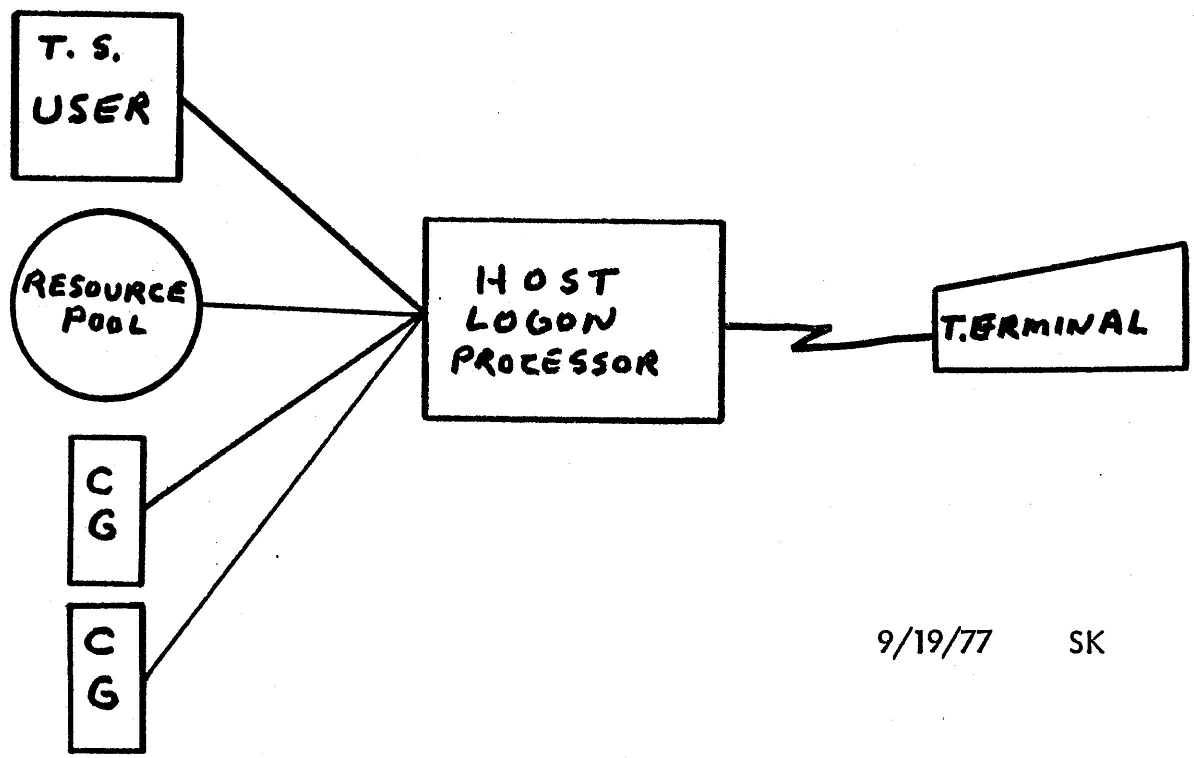
CONNECTING COMMUNICATIONS DEVICES

- ALL CONNECT AND LOGON TO HOST LOGON PROCESSOR
- HLP CONNECTS THEM TO
  1) NEW T.S. USER (T.S. TERMS)
  2) RESOURCE (ODD PERIPHERALS)
  3) COMGROUP (LP, CP, CR, OC, TP)



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CONNECTING USERS TO DEVICES AND FILES

- PUBLIC FILE
- PRIVATE DISK FILE
- MANAGED TAPE FILE
- VIRTUAL DEVICE
- WSN/DEVICE
- MASTER T.S. TERMINAL
- COMGROUP

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FILE MANAGEMENT DEFINITIONS

• GRANULE	UNIT OF ALLOCATION OF DISK STORAGE = 1024 WORDS = 1 MEMORY PAGE
• ACCOUNT	1) LOGICAL GROUPING OF FILES, 2) IDENTIFICATION OF USER FOR LOGON AND FILE ACCESS
• ACCOUNT DIRECTORY	CATALOG OF ACCOUNTS WITHIN THE SYSTEM OR ON A PACK SET
• FILE DIRECTORY	CATALOG OF FILES WITHIN AN ACCOUNT
• FIT	FILE INFORMATION TABLE
• PACK SET	LOGICAL GROUP OF DISK PACKS MAY CONSIST OF ONE OR MORE PACKS. MAY CONTAIN FILES FOR ONE OR MORE ACCOUNTS

FILE ORGANIZATIONS

- SIX DISK FILE ORGANIZATIONS

KEYED	–	EACH RECORD IDENTIFIED BY UNIQUE NAME (KEY) RECORDS STORED IN SORTED ORDER VARIABLE LENGTH RECORDS AND KEYS KEY MAXIMUM LENGTH = 31 CHARACTERS
CONSECUTIVE	–	NO UNIQUE RECORD IDENTIFIERS RECORDS WRITTEN AND READ IN SEQUENTIAL ORDER VARIABLE LENGTH RECORDS
RANDOM	–	NO KNOWN STRUCTURE
RELATIVE	–	NO UNIQUE RECORD IDENTIFIERS OTHER THAN RECORD NUMBER FIXED LENGTH RECORDS
INDEXED	–	RECORD IDENTIFIER IS WITHIN DATA VARIABLE ~~FIXED~~ LENGTH RECORD ~~AND IDENTIFIER (KEY)~~ KEY LENGTH FIXED; MAXIMUM = 255 CHARACTERS
INTEGRATED	–	RANDOM FILE STRUCTURED BY IDS

- EIGHT ANS TAPE FORMATS

ANS	F	–	FIXED LENGTH RECORDS
	D	–	VARIABLE LENGTH WITH DECIMAL CONTROLS
	V	–	VARIABLE LENGTH WITH ASCII CONTROLS
	U	–	UNDEFINED
CP-6	K	–	KEYED (INDEXED)
	C	–	CONSECUTIVE (RELATIVE)
	R	–	RANDOM
	B	–	BLOCKED

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FILE MANAGEMENT SERVICES

- NORMAL SERVICES – OPEN, CLOSE, READ, WRITE, POSITION, DELETE RECORD, DELETE FILE
  AUTOMATIC: BLOCK, DEBLOCK, GRANULE ALLOCATION

- NOT-SO-NORMAL – TEXT DATA COMPRESSION
  WRITE-MORE/READ-LESS (SCATTER I/O)
  SHARE (INPUT, NONE, ALL)
  REWRITE (KEYED, CONSECUTIVE)
  READ/WRITE SEQ OR RANDOM (KEYED)
  AUTOMATIC FILE EXTENSION OR CONCATENATION
  DCB CORRESPONDENCE

- FEATURES – STAR FILES – UNIQUE TEMP FILES
  JOURNAL MODE – (OUTPUT CONSEC)

FILE SECURITY

- GRANULE ACCESS : STAMP
- ACCOUNT ACCESS : READ or CREATE
- FILE ACCESS : MULTIPLE TYPES
- DATA ACCESS : PASSWORD and ENCRYPTION

FILE ACCESS TYPES :

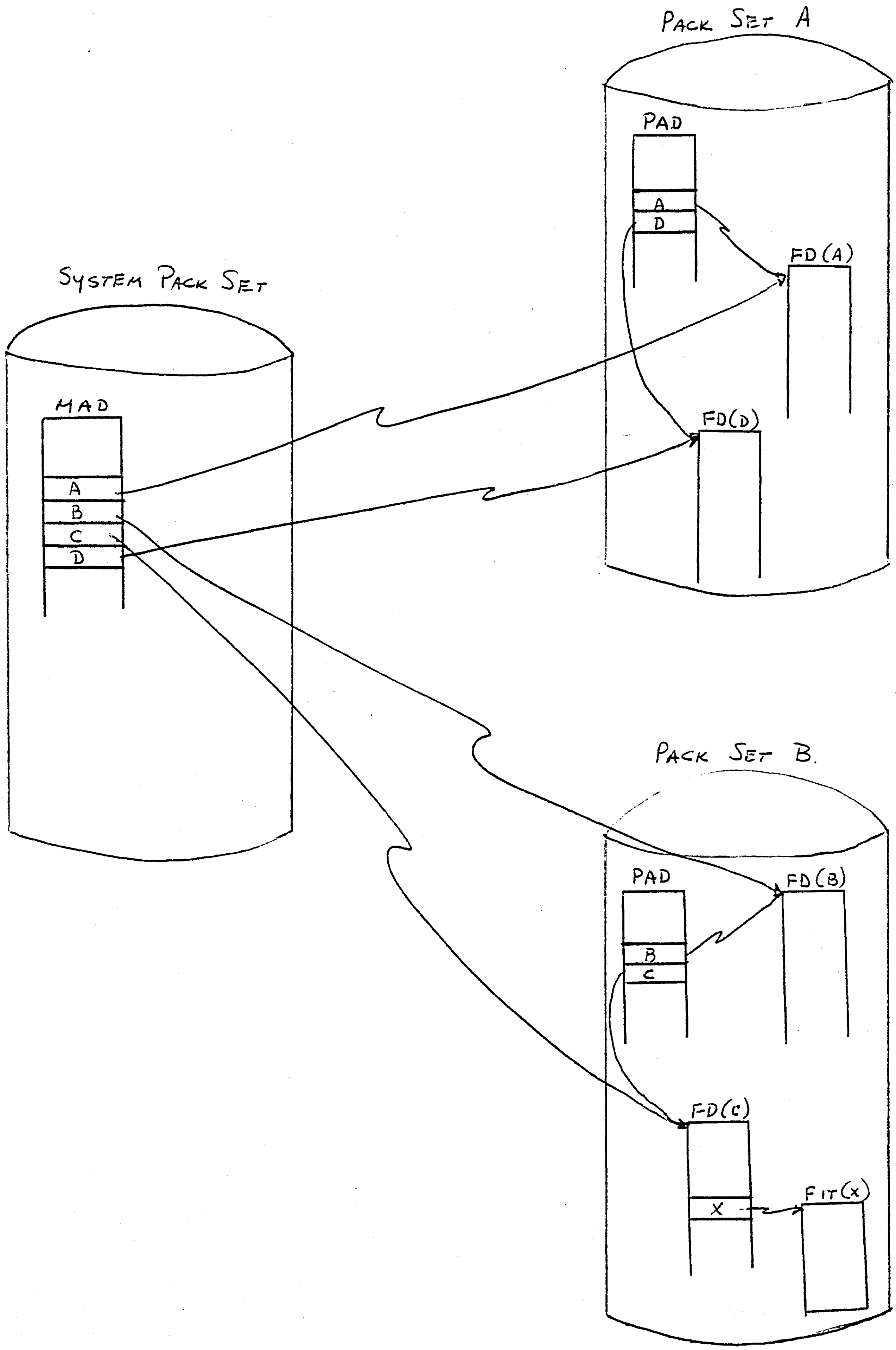
READ
UPDATE
WRITE NEW
DELETE RECORDS
DELETE FILE
LIST
FILE INFORMATION
ACCESS VEHICLE

FILE MANAGEMENT PROCESSORS

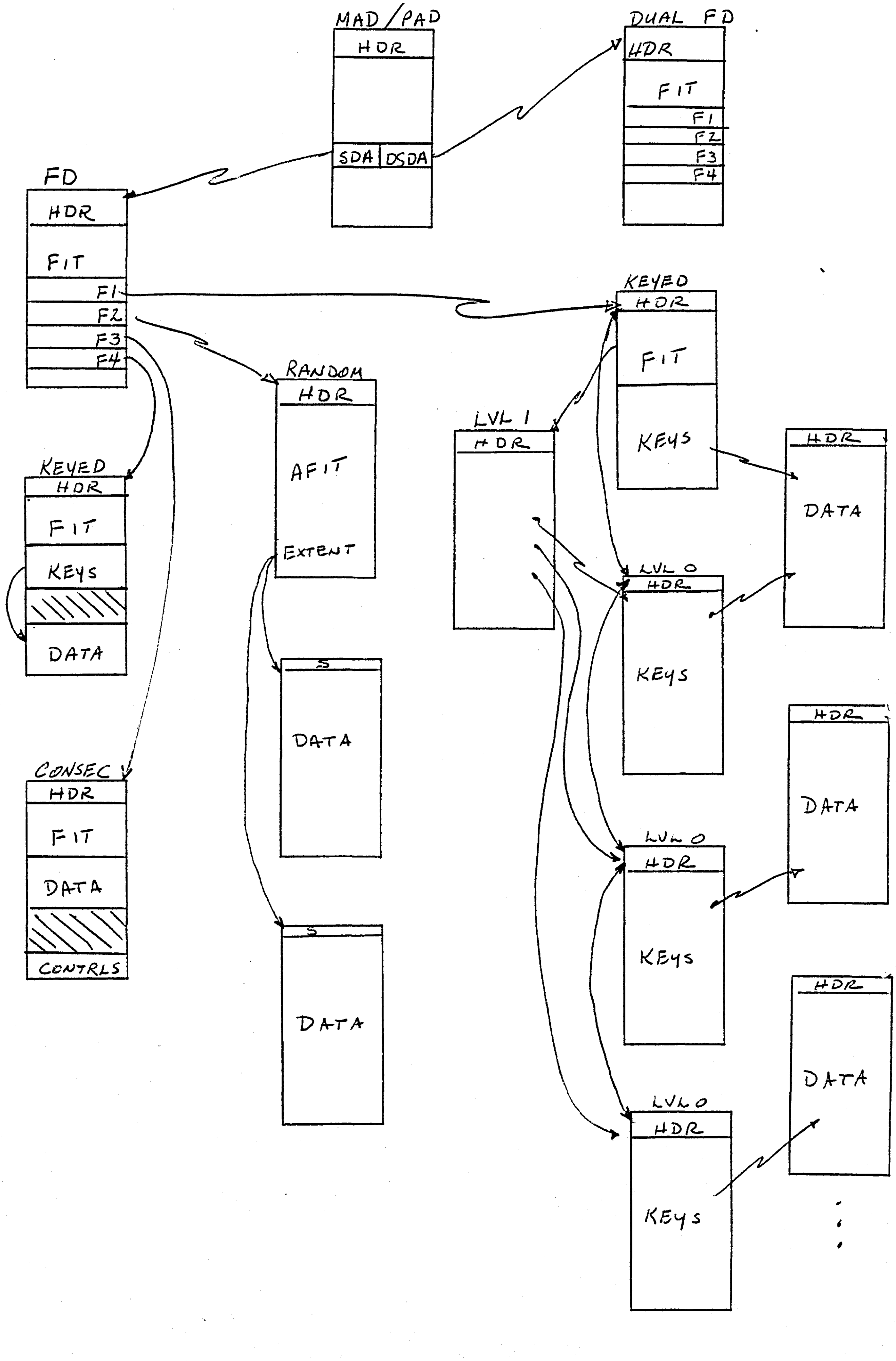
• INITVOL	INITIALIZE PACK SETS
• CAT	CATALOG PACK SETS and THEIR BACKUP MEDIA
• GAC	GRANULE ACCOUNTING
• LABEL	INITIALIZE ANS TAPES
• EFT	BACKUP/RESTORE and STOW/FETCH
• HGPRECON	GRANULE POOL RECONSTRUCTION

INTERNAL FEATURES

• CFU RETENTION	: ACTIVE FILES DO NOT REQUIRE DIRECTORY SEARCH for M$OPEN
• READ-AHEAD, WRITE-AHEAD	: NO DELAY for PHYSICAL I/O
• I/O CACHE (STICKY PAGES)	: SIGNIFICANT GRANULES REMAIN IN MEMORY
• RECOVERY and JOB STEP RUNDOWN	: DEFAULT BUFFER TRUNCATION and FILE CLOSE
• GRANULE STAMP	: NO SCRUB
• COMPRESSED KEYS	: SPACE and ACCESS SAVING
• IDS	: MODIFICATION DATE per GRANULE
• EFT	: BLOCK ACCESS and FILE DESCRIPTORS



SYSTEM PACK SET
MAD
A
B
C
D
PACK SET A
PAD
A
D
FD(A)
FD(D)
PACK SET B.
PAD
B
C
FD(B)
FD(C)
X
FIT(X)


MAD / PAD
HDR
SDA
DSDA
DUAL FD
HDR
FIT
F1
F2
F3
F4
FD
HDR
FIT
F1
F2
F3
F4
KEYED
HDR
FIT
KEYS
DATA
CONSEC
HDR
FIT
DATA
CONTRLS
RANDOM
HDR
AFIT
EXTENT
S
DATA
S
DATA
LVL 1
HDR
KEYED
HDR
FIT
KEYS
LVL 0
HDR
KEYS
LVL 0
HDR
KEYS
LVL 0
HDR
KEYS
HDR
DATA
HDR
DATA
HDR
DATA

2/14/77 PAC

USER'S VIEW OF CP-6

- USER AUTHORIZATION
- COMMON COMMAND LANGUAGE
- IBEX (INTERACTIVE and BATCH EXECUTIVE)
- CP-6 PROCESSORS
- USER SERVICES

USER AUTHORIZATION

- CENTRALIZED CONTROL
- INDIVIDUAL AUTHORIZATION
- SYSTEM DEFAULTS and LIMITS
- BUDGET CHECK
- PRE-SCANNED BATCH JOBS

COMMON COMMAND LANGUAGE

- SIMPLE and COMMON SYNTAX RULES
- STANDARD CALLING SEQUENCE
- UNIVERSAL FILE IDENTIFIER (FID)

STANDARD CALLING SEQUENCE

- !ANSFORT A OVER B, LP; LS, GO, SI
- IMPLICIT DCB ASSIGNMENT
- OPTIONS FOLLOW THE SEMICOLON

IMPLICIT DCB ASSIGNMENT

" ANSFORT A OVER B, LP; LS, GO, SI"

- LINK RELATES POSITION TO ACTUAL DCB
- IBEX RELATES POSITION TO FID
- STEP CONNECTS FID TO ACTUAL DCB
- IBEX PROVIDES POINTER TO OPTIONS

IBEX

- SINGLE REPLACEMENT FOR TEL/CCI
- EXECUTION CONTROL
- COMMAND FILES ("CATALOGUED PROCEDURES")
- FILE MANAGEMENT INTERFACE
- COMMUNICATIONS INTERFACE
- ACCOUNTING

EXECUTION CONTROL

- STEP CONDITION CODE
- COMMAND VARIABLES
- STEP LIMITS and RESOURCE RETURN
- INTERRUPT and CONTINUE
- BUDGET OVERRUN ABORT

EXAMPLE

```
      ⋮
!PROGRAMA.
!STEP IF STEPCC ~= 0, LET A =2
!PROGRAMB.
!STEP IF A ~= 0, GOTO ABC
!PROGRAMC.
      ⋮

!STEP(ABC)
!LIMIT(STEP) LO = 99, TIME = 1
!PROGRAMI.
!STEP IF STEPCC ~= 0, GOTO STEP
      ⋮
```

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COMMAND FILES

- AVAILABLE TO ALL MODES
- NESTING ALLOWED
- STRING AND FIELD SUBSTITUTION

FILE MANAGEMENT INTERFACE

- ASSOCIATE A DCB WITH A FID (!SET)
- ARCHIVE STORAGE QUALIFICATION (!STOW)
- ARCHIVE RETRIEVAL REQUEST (!FETCH)
- STREAM DEFINITION and MANIPULATION

```
!LDEV LP07 LP, FORM = CHECKS, LINES = 9
   :
!ERASE LP07
```

COMMUNICATIONS INTERFACE

- ACCESS TO NETWORK
- TERMINAL PROFILE
- STATISTICS

ACCOUNTING

- BASIC ACCOUNTING
- BUDGET ACCOUNTING
- JOB-STEP ACCOUNTING
- PROPRIETARY PROCESSOR ACCOUNTING
- FORMS ACCOUNTING

CP-6 PROCESSORS

- DELTA
- UTILITY PROCESSORS
- SYSTEM MANAGEMENT PROCESSORS

DELTA

- SINGLE REPLACEMENT FOR 4 CP-V DEBUGGERS
- EXTERNAL TO THE DEBUGGED PROGRAM
- MULTILINGUAL
- EXECUTIVE VERSION IS MONITOR INDEPENDENT

DELTA

- PROGRAM INTERRUPT on SPECIFIED CONDITIONS
- PROCEDURE and DATA MODIFICATION and DISPLAY
- HISTORY TRACE of EXECUTION
- POST-ABORT ASSOCIATION and DEBUGGING

UTILITY PROCESSORS

- EDIT - GENERAL PURPOSE TEXT EDITOR
- PCL - GENERAL PURPOSE FILE MANIPULATOR
- LINK - LINK LOADER
- LEMUR - LIBRARY EDITOR and MAINTENANCE ROUTINE

SYSTEM MANAGEMENT PROCESSORS

- SUPER - INDIVIDUAL USER AUTHORIZATION
- RATES - CHARGE TABLE MAINTENANCE
- CONTROL- SYSTEM PERFORMANCE CONTROL
- DEF - SYSTEM BOOT TAPE CREATION
- ANLZ - SYSTEM CRASH ANALYZER

USER SERVICES

- HELP COMMAND
- STANDARD ERROR HANDLING
- FID DECODER (M$FID)
- GENERAL PURPOSE OUTPUT FORMATTER (M$FORMAT)
- CP-V TO CP-6 JCL CONVERTER
- GENERAL PURPOSE SYNTAX PARSER (M$PARSE)

M$PARSE

- SINGLE PARSING ROUTINE FOR ALL UTILITY PROCESSORS
- POWERFUL TABLE DRIVEN STRUCTURE
- EASILY EXTENDABLE

MISCELLANEOUS TOPICS

- SYSTEM INITIALIZATION and CONFIGURATION CONTROL
- SYSTEM RECOVERY
- PERFORMANCE MONITORING and CONTROL
- ERROR LOGGING and LISTING

SYSTEM INITIALIZATION AND CONFIGURATION CONTROL-I

- GOALS
  - -MINIMIZE CODE SPECIFIC TO SYSTEM BUILD
  - -SIMPLIFY SYSTEM BUILD PROCESS OVER CP-V
  - -BOOT-TIME RECONFIGURATION CAPABILITY
  - -STANDARD SYSTEM, READY TO RUN
    - o SYSTEM PACKAGING
      - -THE MINIMUM SYSTEM
      - -DEFAULT CONTROL PARAMETERS
  - -RELOAD SYSTEM WHEN ADDITIONAL FEATURES REQUIRED
    - o USES STANDARD PROCESSORS

SYSTEM INITIALIZATION AND CONFIGURATION CONTROL-II

- BOOTING THE SYSTEM

    -BOOT ROUTINE (AARDVARK)

    .MINI - I/O
    .MINI - XDELTA (SUBSET OF XDELTA)
    .MPC INITIALIZATION (TAPE, DISK, UNIT RECORD)

    -SYSTEM IMAGE

    -TIGR

    -XDELTA

    -DEBUG SCHEMA

    -GHOST 1

    -PATCHES

    -PROCESSOR PATCHES (GENMDS)

    -CONFIGURATION CONTROL CARDS

    -LABELLED TAPE PORTION

    -PROCESSORS

SYSTEM INITIALIZATION AND CONFIGURATION CONTROL-III

- TIGR - TABLE INITIALIZATION and GENERATION ROUTINE

  -ESTABLISH HARDWARE CONFIGURATION TABLES

  .DCT
  .CIT
  .PPUT
  .ETC.

  -ESTABLISH DYNAMIC INSTALLATION DEPENDENT TABLES

  .USER TABLES
  .I/O QUEUE SPACE
  .ETC.

- SYSCON

  -RUN TIME PARTITIONING PROCESSOR

SYSTEM INITIALIZATION AND CONFIGURATION CONTROL - IV

- CONTROL (STANDARD SYSTEM PROCESSOR)

  - SETS INSTALLATION DEPENDENT CONTROL AND DEFAULT PARAMETERS

  - USED TO CHANGE CONTROL/DEFAULT PARAMETERS AS WORK PROFILE CHANGES

  - TYPES OF PARAMETERS

    - NUMBER OF USERS
    - CORE USAGE
    - MULTIPROCESSING CONTROL
    - SCHEDULER CONTROL
    - BATCH STREAM CONTROL
    - I/O ACCELERATOR CONTROL
    - JOB SERVICE LIMITS
    - JOB RESOURCE LIMITS
    - JOB DEFAULTS

RECOVERY

- GOALS
  - -CENTRALIZED SYSTEM ROUTINE (SCREECH)
  - -AUTOMATIC, NO OPERATOR INTERVENTION
    - .INITIATED VIA FAULT OR LOGICAL INCONSISTENCY
  - -FAST, 20 SEC TO 2 MINUTES
  - -MINIMIZE FILE LOSS
- RECOVERY TYPES
  - -ZAP/WARM BOOT
  - -SCREECH
    - .SINGLE USER ABORT
    - .MULTI-USER ABORT
    - .FULL SYSTEM
- POWER FAIL SAFE RECOVERY
  - -NON-VOLATILE MEMORY
  - -MPC STATE
- CREATES DUMP WITH FORMATTED OUTPUT

PERFORMANCE AND CONTROL

- GOALS

    -LIKE CP-V ONLY BETTER

- TOOLS

    -INTERNAL

    o BUILT IN DATA COLLECTION

    -RESPONSE TIMES
    -DEVICE and CHANNEL BUSY TIMES
    -CPU UTILIZATION

    o PERFORMANCE TUNING VARIABLES

    -SCHEDULER CONTROLS

    .QUANTUMS: QMIN,QUAN
    .I/O BLOCK and UNBLOCK LIMITS
    .BASE EXECUTION PRIORITIES:O,B,G
    .I/O TIME ALLOWANCE

    -I/O ACCELERATOR CONTROL

    .READ AHEAD
    .DISASSOCIATED WRITE
    .SEVERAL CACHE TYPES

    -EXTERNAL
    o STATS
    o CALMON
    o SUMMARY

CALMON OUTPUT

**** SUMMARY STATISTICS *

CAL1,1 REPORTS

	CAL COUNT	% OF CALS	CPU TIME	% CAL TIME	% ALL TIME	AVG CPU PER CAL	I/O COUNT	% CAL I/O	AVG I/O PER CAL	AVG#BYTE PER CA
:REW	141	.05	158	.02	0	1.12	0	-	-	693.3
:WEOF	705	.25	976	.10	0	1.38	640	.60	.91	99.4
:DEVICE(PAGE)	572	.20	1,586	.16	.01	2.77	47	.04	.08	371.2
:DEVICE(VFC)	506	.18	248	.03	0	.49	0	-	-	257.3
:SETDCB	17,606	6.28	8,516	.87	.04	.48	0	-	-	917.1
:DEVICE(DRC)	9	0	6	0	0	.67	0	-	-	3,097.7
:DELREC	51	.02	352	.04	0	6.90	3	0	.06	117.6
:MOVE	652	.23	146,736	15.01	.74	225.06	16,065	15.02	24.64	1.19E
:TFILE	26	.01	408	.04	0	15.69	78	.07	3.00	9,377.6
:READ(FILE)	96,007	34.27	211,120	21.60	1.06	2.20	27,100	25.34	.28	519.0
:READ(LBL TAPE)	2,153	.77	4,252	.43	.02	1.97	95	.09	.04	80.6
:READ(DEVICE)	10	0	30	0	0	3.00	10	.01	1.00	
:READ(COC)	3,700	1.32	14,432	1.48	.07	3.90	0	-	-	6.8
:READ(SYMBIONT)	791	.28	2,392	.24	.01	3.02	74	.07	.09	112.5
:WRITE(FILE)	26,706	9.53	55,614	5.69	.28	2.08	4,761	4.45	.18	233.2
:WRITE(LBL TAPE)	27,453	9.80	56,424	5.77	.28	2.06	6,383	5.97	.23	631.7
:WRITE(DEVICE)	10,057	3.59	17,210	1.76	.09	1.71	9,534	8.92	.95	332.5
:WRITE(COC)	8,937	3.19	43,330	4.43	.22	4.85	0	-	-	14.5
:WRITE(SYMBIONT)	30,970	11.05	60,294	6.17	.30	1.95	2,405	2.25	.08	89.9
:TRUNC	66	.02	190	.02	0	2.88	88	.08	1.33	84.0
:OPEN(FILE)	5,136	1.83	70,780	7.24	.36	13.78	5,183	4.85	1.01	4,016.9
:OPEN(LBL TAPE)	1,198	.43	11,904	1.22	.06	9.94	4,788	4.48	4.00	432.4
:OPEN(DEVICE)	59	.02	296	.03	0	5.02	96	.09	1.63	477.0
:OPEN(COC)	176	.06	390	.04	0	2.22	0	-	-	.8
:OPEN(SYMBIONT)	524	.19	1,236	.13	.01	2.36	0	-	-	.2
:OPEN(TSI-FIL)	8,096	2.89	69,976	7.16	.35	8.64	599	.56	.07	5,301.6
:CLOSE(FILE)	4,052	1.45	41,146	4.21	.21	10.15	9,970	9.32	2.46	6,108.5
:CLOSE(LBL TAPE)	1,171	.42	5,566	.57	.03	4.77	8,099	7.57	6.92	327.8
:CLOSE(DEVICE)	736	.26	842	.09	0	1.14	9	.01	.01	1.0
:CLOSE(COC)	232	.08	302	.03	0	1.30	0	-	-	17.4

STATS OUTPUT

```
 STATISTICS ON-LINE
 INTERVAL FROM 14:51 TO 14:55
MINS SINCE STARTUP=   992
NUMBER OF USERS   =    37
NUMBER OF ONLINE  =    26
NUMBER OF BATCH   =     5
NUMBER OF GHOSTS  =     6
90% RESPONSE TIME =  1500

 CPU %          ALL  SNAP   I/O PER MIN    ALL  SNAP
BATCH EXEC     42.6  94.3  SERVICE REQ    2897  9605
BATCH SERV      5.0  16.4  INTERACTIONS     19    29
ONLINE EXEC    14.4  34.2  CHAR IN         265   293
ONLINE SERV     5.2  14.9  CHAR OUT       2414  3572
GHOST EXEC      1.6    .7  TERM WRITES      98   150
GHOST SERV      1.3    .3  I/O ACCESSES    676  1269
MONITOR SERV    8.5  15.7  # TRUNCS          0     0
IDLE           48.3    .0  AIR ATTEMPTS     71    89
SWAP WAIT        .4    .7  AIR HITS         56    35
I/O WAIT        8.6   1.9  SYMBIONT         74    68
I/O&SWP WAIT    1.3  12.1  IN SWAPS         30    99
TOTAL         137.2 191.3  OUT SWAPS        21    67


 SCPU USE %     ALL  SNAP   EVENT RATE/MIN  ALL  SNAP
SCPU #1 EXEC   37.3  91.0  MASTER  CALS    2062  6224
SCPU #1 IDLE   62.1   9.2  SCPU #1 CALS     836  3381
SCPU #1 TOT    99.4 100.2  MASTER  SCHEDS  2135  6417
                           SCPU #1 SCHEDS   751  3176
```

HOW DO WE KNOW WE'LL BE FAST ENOUGH

- ALGORITHMS PROVEN IN CP-V
- USAGE PATTERNS KNOWN
- INTEGRAL PERFORMANCE MONITOR
- HIGH LEVEL LANGUAGE PERMITS SYSTEM WIDE OPTIMIZATION
- USE OF STANDARD BENCHMARKS
- NSA HARDWARE USED FOR CONTEXT SWITCH
- OFFLOADING OF COMMUNICATIONS TO L6 FRONT ENDS

ERROR LOGGING AND LISTING

- GOALS
  - -NEW TOOL COMMON WITH GCOS, TCOS
  - -ONLINE and BATCH OPERATION
  - -DESIGNED BY FED FOR FED
- ERROR TYPES
  - -100 INFORMATIONAL
  - -200 OPERATIONAL
  - -300 HARDWARE ERRORS
  - -400 SOFTWARE ERRORS
- REPORT TYPES
  - -MASS RAW DATA DUMPS
  - -CHRONOLOGICAL LISTING
  - -MEDIA ALERTS
  - -ERROR BY DEVICE/COMMAND
  - -ERROR BY MEDIA ID/UNIT
  - -SUMMARY REPORT
    - .RECOVERY
    - .MPC STATISTICS
    - .EDAC SYNDROME

STRENGTH OF CP-6 IS IN ITS INTERFACES

- USER STRUCTURE
- SYSTEM SERVICE INTERFACE
- PROGRAM BINDING INTERFACE
- PROGRAM CALLING INTERFACE
- USER to SYSTEM INTERFACE

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COMMON/SHARED PARTS OF CP-6

- USER STRUCTURE
- SCHEDULER
- ALL I/O INCLUDING FILE MANAGEMENT
- SHARED PROCESSORS
- SHARED LIBRARIES (RUNTIME AND ALTERNATE)
- COMMAND PROGRAM
- DEBUGGER
- SPECIAL SERVICES (MFID, MPARSE, M$ERRPRT, HELP)

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CP-6

- o PROJECT INTRODUCTION

  -- ORGANIZATION

  -- KEY EVENTS

  -- PROJECT OVERVIEW

  -- ISSUES

- o SOFTWARE FACTORY

  -- IMPLEMENTATION LANGUAGE

  -- PROGRAM TRANSPORTATION

  -- DEBUGGING

  -- SUPPORT TOOLS

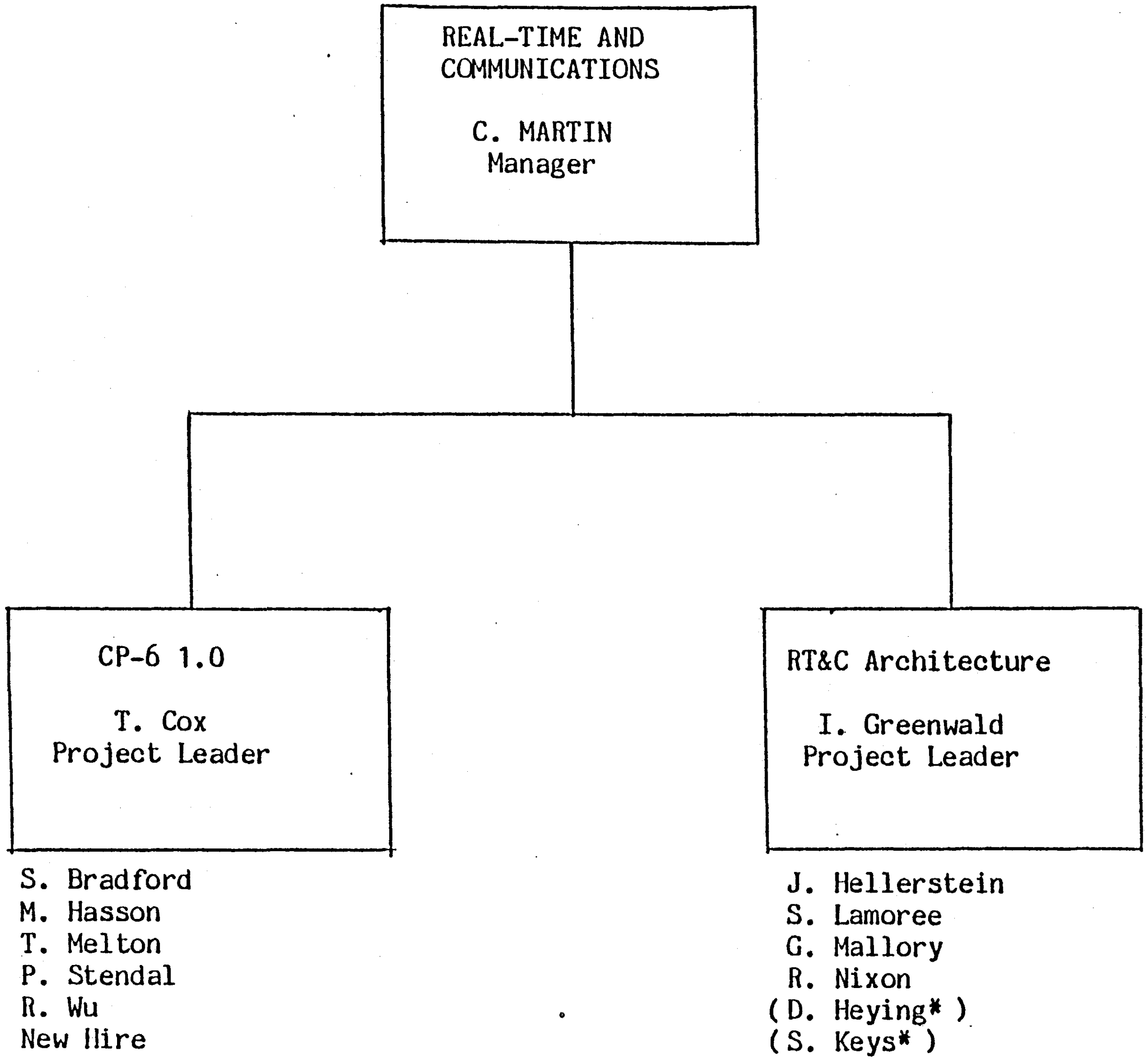
  -- RELEASE SUPPORT

- o RELEASE 1.0

  -- TECHNICAL DESCRIPTION - OVERVIEW

  -- TECHNICAL DESCRIPTION - HARDWARE

  -- TECHNICAL DESCRIPTION - SOFTWARE



* Principal participants from CP-6 OS Section, as required.

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RT&C PROJECT - KEY EVENTS

- o SCHEDULE CONSTRAINTS
- o COUPLER
- o CONTROL FORTRAN AND SIL-6

RT&C PROJECT - SCHEDULE CONSTRAINTS

- LANGUAGE PROCESSOR CHECKOUT
  - -- APPROACH APRIL/MAY, 1978
  - -- PRODUCTIVE JULY, 1978
- SERVICE PROCESSOR CHECKOUT
  - -- BEGIN T/S ENVIRONMENT CHECKOUT JAN/FEB, 1978
  - -- COMPLETE CHECKOUT MARCH/APRIL, 1978
- BASIC T/S CAPABILITY REQUIRED BY JANUARY, 1978

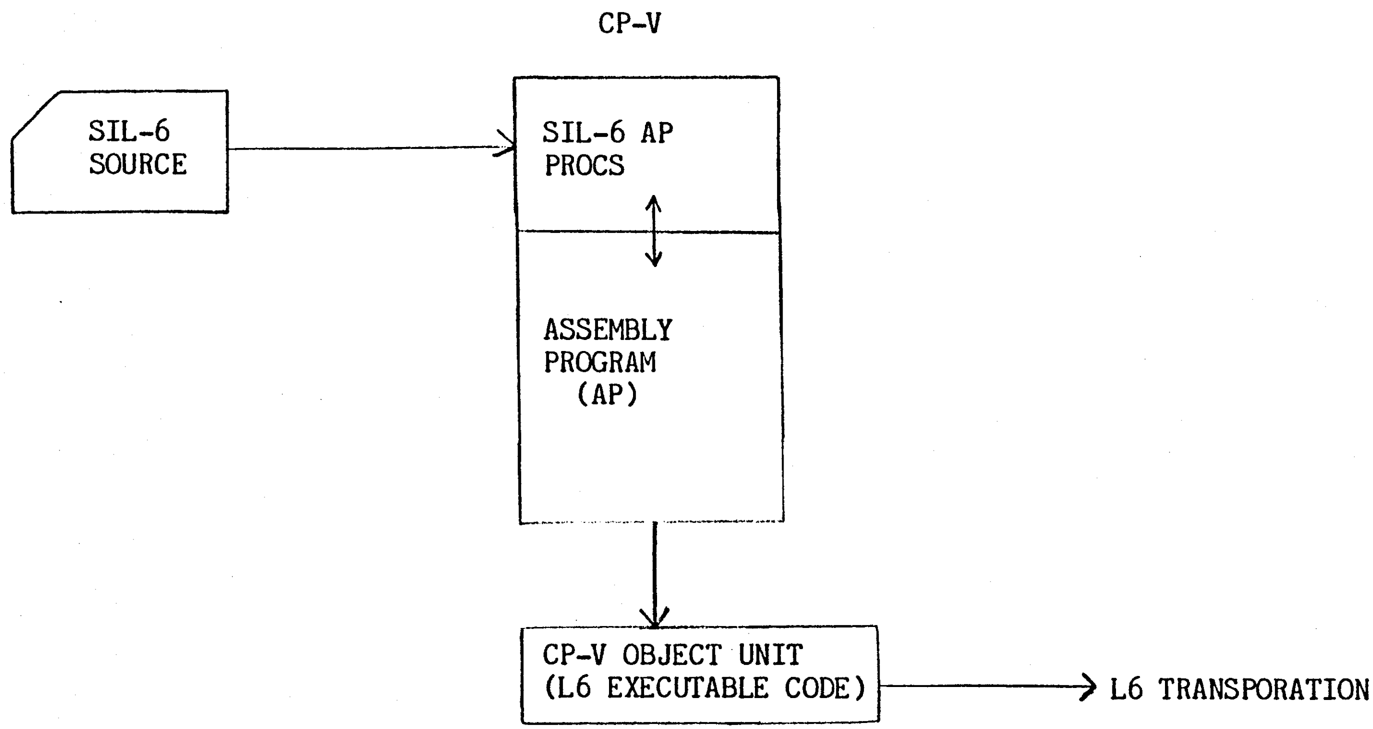
RT&C PROJECT - COUPLER

- 1976 - ASSUMED A COUPLER AVAILABLE BY JULY, 1977.
- MARCH 1977 - COUPLER (PROTOTYPE) COMMITTED 4Q77.
- MAY 1977 - COUPLER COMMITTED TO 746.
- JULY 1977 - COUPLER CDR HELD
- NOVEMBER 1977 - INSTALL COUPLER AT LADC
- DECEMBER 1977 - COUPLER OPERATIONAL AT LADC

RT&C PROJECT - CONTROL FORTRAN AND SIL-6

- 1976 - ASSUMED AVAILABILITY OF CF IN FEBRUARY 1977
- FEBRUARY 1977 - DELIVERY SLIPPED TO MARCH 1977
- APRIL 1977 - CF PDR HELD
- MAY 1977 - CF RESPONSIBILITY MOVED TO BILLERICA
- MAY 1977 - SIL-6 DECISION MADE
- JULY 1977 - WORKING VERSION OF SIL-6 AVAILABLE FOR USE

RT&C PROJECT - SIL-6



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RT&C PROJECT - RELEASE CONTENT

- RELEASE 1.0
  - -- CP-V BASED
  - -- TTY TERMINAL SUPPORT
  - -- IRBT, HASP
  - -- RBT, 2780/3780
  - (-- CP-V SOFTWARE FACTORY)
- RELEASE 2.0
  - -- REAL TIME
  - -- REMOTE CP
  - -- VIP TERMINAL SUPPORT
  - -- CP-6 SOFTWARE FACTORY
  - -- TRANSACTION PROCESSING
- RELEASE 3.0
  - -- 66/85 SUPPORT

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RT&C PROJECT - RELEASE 1.0 STAGING

o A - SYSTEM (805T/S) - JAN 1978

-- INTEGRATED INTO HOST H-SYSTEM

-- SUPPORT FOR DELTA, CP AND USER PROGRAMS

-- TI SUPPORT

-- ECHOPLEX

-- CANNED SALUTATION AND PROMPTS

-- NO ESCAPE SEQUENCES

-- CP-V ACTION FOR CONTROL Y,X AND BREAK AND RUB-OUT

RT&C PROJECT - RELEASE 1.0 STAGING (CONT.)

- B - SYSTEM - JULY 1977
  - INTEGRATED INTO HOST L-SYSTEM
  - T/S FOR LANGUAGE PROCESSOR CHECKOUT
  - TAB STOPS
  - TYPE AHEAD
  - ASCII APL TERMINAL SUPPORT
  - SYMBIONT I/O MODE
  - OC I/O MODE
  - USER PROGRAM ACCESS TO TERMINAL CONTROL ATTRIBUTES
  - MAJORITY OF ESCAPE SEQUENCES

RT&C PROJECT - RELEASE 1.0 STAGING (CONT.)

- o C - SYSTEM
  - -- INTEGRATED INTO HOST O-SYSTEM
  - -- RELEASE 1.0 FUNCTIONALITY
  - -- 2780/3780 AND HASP SUPPORT
  - -- AUTOBAUD
  - -- FULL TAB CAPABILITY
  - -- PAGINATION
  - -- TRANSPARENT I/O
  - -- FULL ESCAPE SEQUENCE CAPABILITY

RT&C PROJECT - ISSUES

- o SNA AND HDNA
- o CP-6 SOFTWARE FACTORY
- o DIAGNOSTICS
- o HOST RESIDENT SYSTEM
- o REAL TIME

RT&C PROJECT - SNA, HDNA ISSUE

- o NOT PART OF ORIGINAL PROJECT STRATEGY - CHANGE OF SCOPE
- o SNA AND IBM CO-RESIDENCY SEEN AS HIGHER PRIORITY BY MARKETING
- o HDNA AS DEFINED IS NOT CONSISTENT WITH CP-6 RESPONSE TIME REQUIREMENTS
- o CONTINUES TO EVOLVE
- o NET RESULT - NOT CONSIDERED IN CP-6/1.0

<u>RT&C PROJECT - CP-6 SOFTWARE FACTORY</u>

- MOVE FROM CP-V TO CP-6
- SIL-6
- DUAL (DYNAMIC UNIVERSAL ASSEMBLY LANGUAGE)
- L6 ASSEMBLER
- L6/PL-6
- BILLERICA SYSTEMS IMPLEMENTATION LANGUAGE
  - PL-6
  - PLH

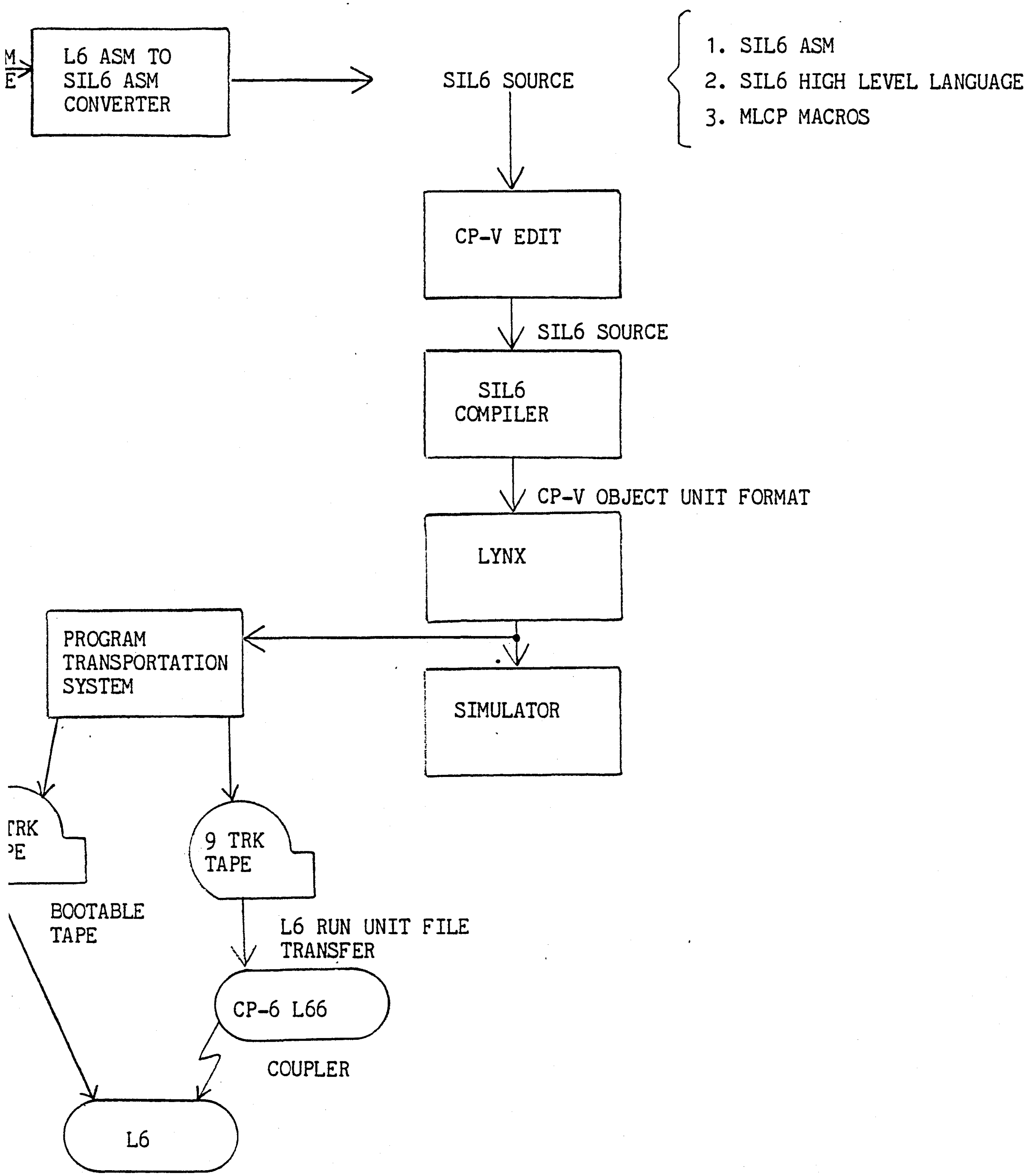
L6 SOFTWARE FACTORY ENVIRONMENTS

1. INITIAL (RELEASE 1.0) CP-6 DEVELOPMENT USING CP-V RESIDENT SOFTWARE FACTORY

2. RELEASE 2 AND 3 DEVELOPMENT USING CP-6 RESIDENT SOFTWARE FACTORY

3. CUSTOMER REAL-TIME DEVELOPMENT (RELEASE 2 AND BEYOND) USING CP-6 RESIDENT FACTORY

CP-V RESIDENT L6 SOFTWARE FACTORY



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SIL6 LANGUAGE

- HIGH LEVEL LANGUAGE
- DATA INDEPENDENCE
- BLOCK PROGRAM STRUCTURES
- ACCESSIBILITY TO L6 REGISTERS
- SYMBOL REF/DEF STACK FOR SYMBOLIC DEBUGGING
- SUPPLEMENTARY ASSEMBLER MNEMONICS FOR TIME-CRITICAL OR HARDWARE RELATED CODE
- MLCP MNEMONICS
- IMPLEMENTATION IN AP-EASY TO EXPAND

SUMMARY OF SIL6 CAPABILITIES

- PROGRAM STRUCTURE COMMANDS
  - LOOP/EXITLOOP/ENDLOOP
  - IF/ELSEIF/OTHERWISE/ENDLOOP
  - DOCASE/CASE/ENDCASE
  - CALL/SUBROUTINE/RETURN
- ITEM DEFINITION FUNCTIONS
  - TYPE - BIT, BYTE, WORD, DOUBLEWORD, POINTER
  - ATTRIBUTES - SIGNED, WRITE PROTECT, DIMENSION, FIELD SPECIFICATION WITHIN A WORD, OFFSET FROM A BASE, FIXED ADDRESS
  - ITEM MAY BE MEMORY LOCATION OR REGISTER
  - LITERAL ADDRESSES AND VALUES

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SUMMARY OF SIL6 CAPABILITIES - CONTINUED

- ITEM MANIPULATION COMMANDS
  - MOVE
  - INCREMENT/DECREMENT
  - SETT/RESET
  - CLEAR
- COMPARISON FUNCTIONS
  - NOT
  - EQUAL/NEQUAL
  - GT/AGT
  - GTE/AGTE
  - LT/ALT
  - LTE/ALTE

SUMMARY OF SIL6 CAPABILITIES - CONTINUED

- COMPUTING FUNCTIONS
  - SUM
  - DIF
  - PRODUCT
  - QUOTIENT
  - MODULO
  - AND
  - OR
  - EOR/XOR
- NON-COMPUTING FUNCTIONS
  - HIGHDIM/LOWDIM
  - ASC
  - MAXOFFSET/MINOFFSET/NEXTOFFSET
  - AMAX/AMIN
  - ADDR

SUMMARY OF SIL6 CAPABILITIES - CONTINUED

- ASSIGNED HARDWARE REFERENCES
  - R1 - R7
  - B1 - B7
  - CARRY/NOCARRY
  - OVERFLOW/NOOVERFLOW
  - IOACK/IONACK
  - LEVEL
  - INHIBIT_LEVEL
- MISCELLANEOUS COMMANDS
  - ENABLE
  - DISABLE/INHIBIT
  - TRIGGER

SUMMARY OF SIL6 CAPABILITIES - CONTINUED

- DECISION TABLE PROCEDURES
  - TABLE
  - TEST(S)
  - RULE
  - ACTION(S)
  - REPEAT
  - RETURN_TRUE
  - RETURN_FALSE
  - ENDTABLE

SUMMARY OF SIL6 CAPABILITIES - CONTINUED

- ASSEMBLY LIST CONTROL
    - PAGE
    - TITLE
    - WARNING
    - LOLIST
    - HEX

- ASSEMBLY CONTROL STATEMENTS
    - DEBUG
    - STARTSIL6
    - STARTASM
    - LABEL
    - ORGG
    - ODDBOUND/EVENBOUND
    - DC
    - RESV
    - ATEXT/ATEXTC

SIL6 EXAMPLE

```
ALPHA       FNAME       WORD,(OFFSET,3),(FIELD,3,7),WP

BETA        FNAME       WORD,(OFFSET,15),(FIELD,1,9),(DIM,1,10)

GAMMA       FNAME       BYTE,(OFFSET,1)

BASE        FNAME       (BREG,1)

INDEX       FNAME       (RREG,2),(FIELD,0,7)
             .
             .
             .
            IF EQUAL (GAMMA(BASE),ALPHA(BASE))

            MOVE ALPHA(BASE),TO,BETA(BASE,INDEX))

            OTHERWISE

            MOVE SUM(ALPHA(BASE),BETA(BASE,INDEX)),TO,GAMMA(BASE)

            INCREMENT INDEX

            ENDIF
```

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SIL6 DECISION TABLE EXAMPLE

```
TESTCASE       TABLE        PASSTEXT,TEXT1,TEST2
               RULE         T,F,T
               ACTIONS      ACTION1,ACTION2,REPEAT
               RULE         F,T,T
               ACTIONS      ACTION2,MOVE(SUM(B3,B4)),TO,B4)
               ENDTABLE
                 .
                 .
                 .
TEST1          SUBROUTINE   NOLOCAL(B4)
               IF           R4
               RETURN_TRUE
               ENDIF
               RETURN_FALSE
               ENDSUB
                 .
                 .
                 .
ACTION2        SUBROUTINE   SAVE(R2,R4)
               MOVE         R5,TO,R4
               ENDSUB
                 .
                 .
                 .
```

DEBUGGING

- SIMULATOR AND L6 DEBUGGER - SUBSET OF CP-6 DELTA FUNCTIONALITY AND COMMAND SYNTAX

    - BREAKPOINTS
    - TRACE
    - STEP
    - MODIFY
    - DISPLAY
    - DUMP
    - SYMBOLIC INPUT

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DEBUGGING - CONTINUED

- BES2 MDUMP
- UPLINE DUMP VIA COUPLER
- DUMP ANALYZER
- MLCP DEBUGGER
- EVENT RECORDING

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SIMULATOR

- HANDLES INTERRUPTS, TRAPS
- L6/36 OR L6/43 INSTRUCTION SET ACCEPTED
- PROVIDES INSTRUCTION TIMING SUMMATION
- I/O INSTRUCTIONS CAUSE DISPLAY OF PERTINENT INFORMATION - NO I/O SIMULATION IS ATTEMPTED
- EXTENSIVE DEBUGGER

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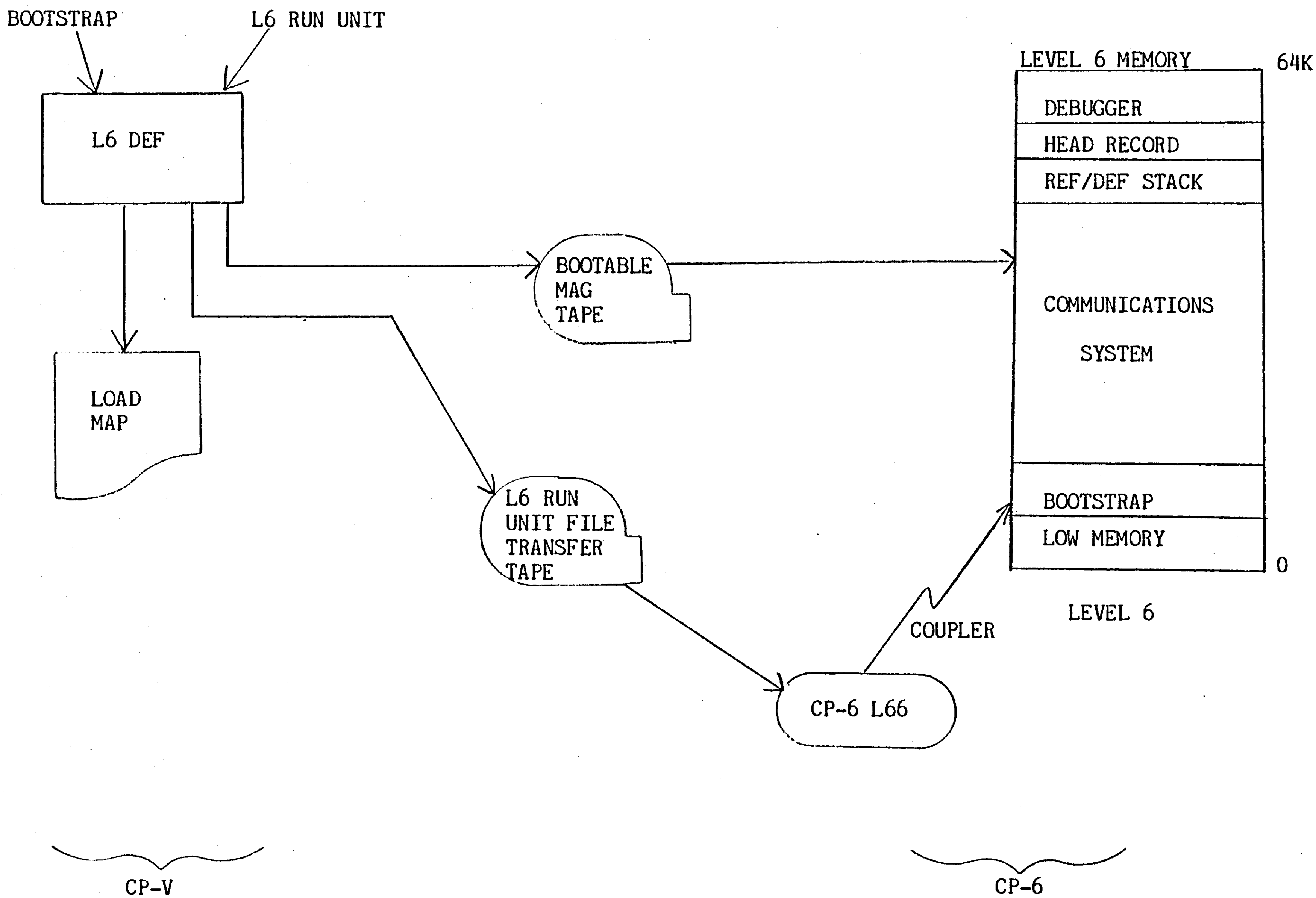
PROGRAM TRANSPORTATION SYSTEM



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SUPPORT TOOLS

- EXTRACT
- DRAW
- L6 ASM TO SIL6 ASM CONVERTER
- GLOBAL XREF

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RELEASE SUPPORT

- PATCHER - WILL PATCH L6 RUN UNIT ON CP-V OR CP-6

- REMOTE DEBUGGER

- UPLINE DUMP VIA COUPLER

- DUMP ANALYZER

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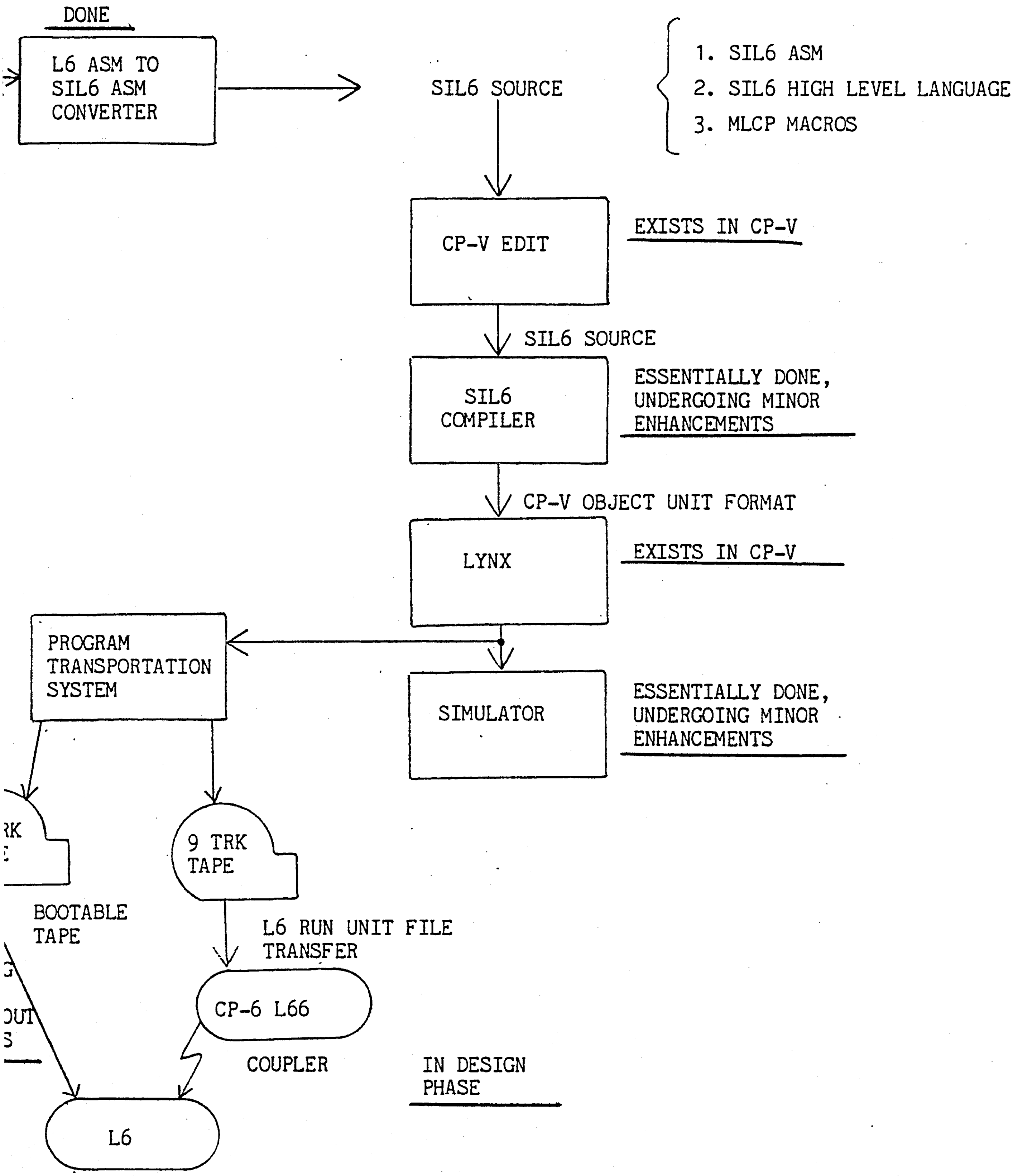
CONVENTIONS AND STANDARDS

- CP-6 COMPATIBLE
- DOCUMENTATION STANDARDS
- NAMING CONVENTIONS AND FUNCTIONAL CODE GROUPS
- CODING STANDARDS
- CONTROLLED DEVELOPMENT ACCOUNTS

9/14/77 TC

CP-V RESIDENT L6 SOFTWARE FACTORY



9/14/77 TC

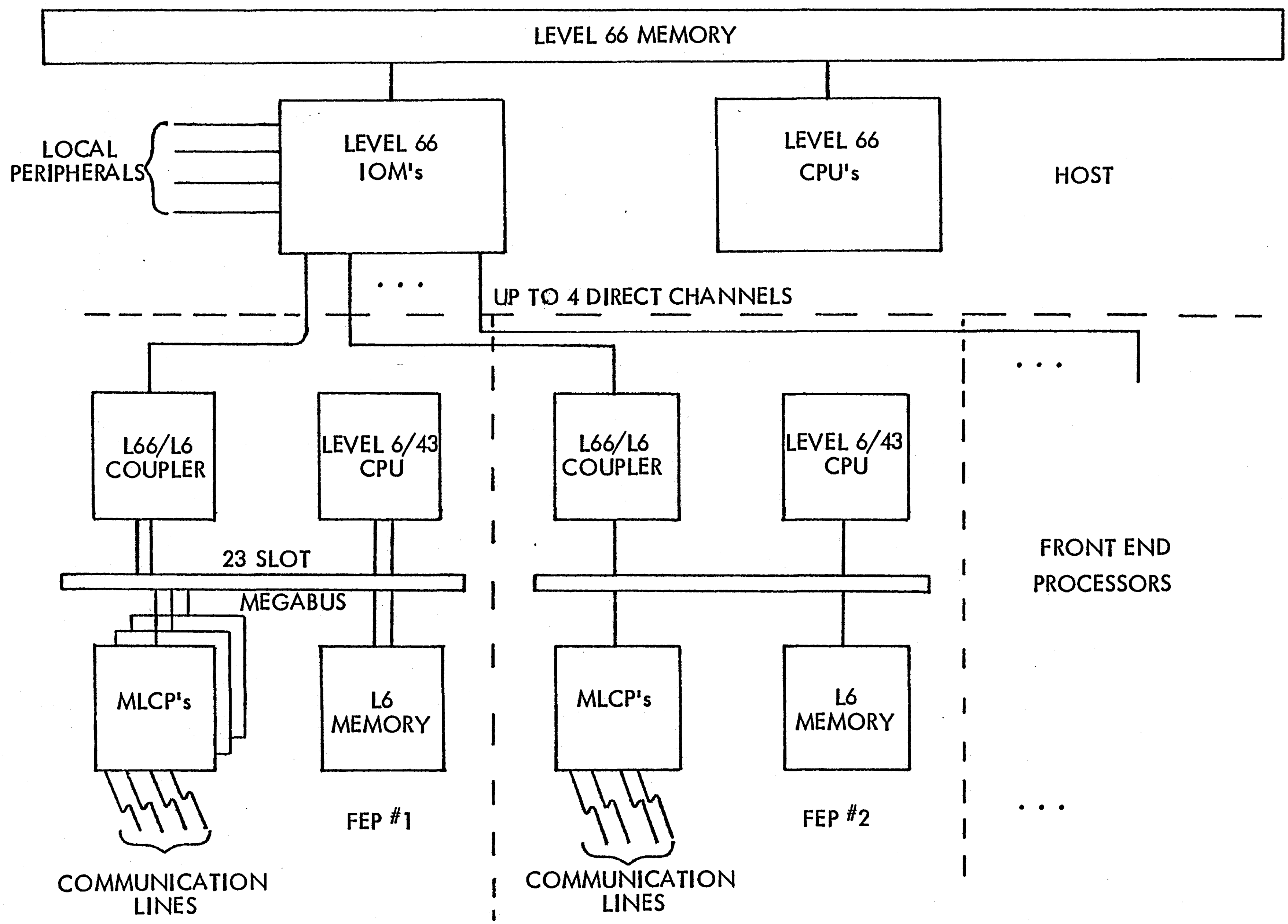
CP-6 COMMUNICATIONS - RELEASE 1.0

- o FUNCTIONALITY
- o HARDWARE
  - o OVERVIEW
  - o L66/L6 COUPLER
  - o LEVEL 6 MLCP
- o LEVEL 6 SOFTWARE DESIGN
  - o OVERVIEW
  - o NUCLEUS
  - o FRONT END INTERFACE
  - o COC HANDLER
  - o RBT/IRBT HANDLER
- o LEVEL 66 SOFTWARE

COMMUNICATIONS SOFTWARE REQUIREMENTS – RELEASE 1

- OFFLOAD PROCESSING FROM THE L66
- USE LEVEL 6/43
- CP-V STYLE TERMINAL SUPPORT
    - TTY COMPATIBLE TERMINALS
    - 2780/3780 COMPATIBLE RBTS
    - HASP COMPATIBLE IRBTS
    - CUSTOM DEVICES (TRANSPARENT I/O)
- HOST TO HOST COMMUNICATION (CP-6 TO CP-6, CP-6 TO CP-5)
- ESTABLISH A BASE FOR FUTURE RELEASES

CP-6 HARDWARE ENVIRONMENT - COMMUNICATIONS VIEW



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L66/L6 COUPLER HARDWARE

- HOST INITIATED BOOT LOAD
- BYTE ORIENTED ASCII MODE; 1 MEGABYTE TRANSFER
- BINARY MODE; 500 KB TRANSFER
- LEVEL 6 INITIATED I/O WITH COMMAND CHAINING

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MLCP HARDWARE CAPABILITIES

- GENERAL CAPABILITIES
  - PROGRAMMABLE
  - EIGHT RECEIVE/TRANSMIT CHANNEL PAIRS
  - CONTROL CHARACTER AND END-OF-MESSAGE DETECTION
  - L6 COMMAND CHAINING CAPABILITY
- ASYNCHRONOUS LINE SUPPORT (COC)
  - PROGRAMMABLE LINE SPEED AND CHARACTER FORMAT (AUTOBAUD)
  - SPEEDS UP TO 19.2K BITS/SEC
- SYNCHRONOUS LINE SUPPORT
  - AUTOMATIC CYCLIC REDUNDANCY CHECK
  - SPEEDS UP TO 72K BITS/SEC

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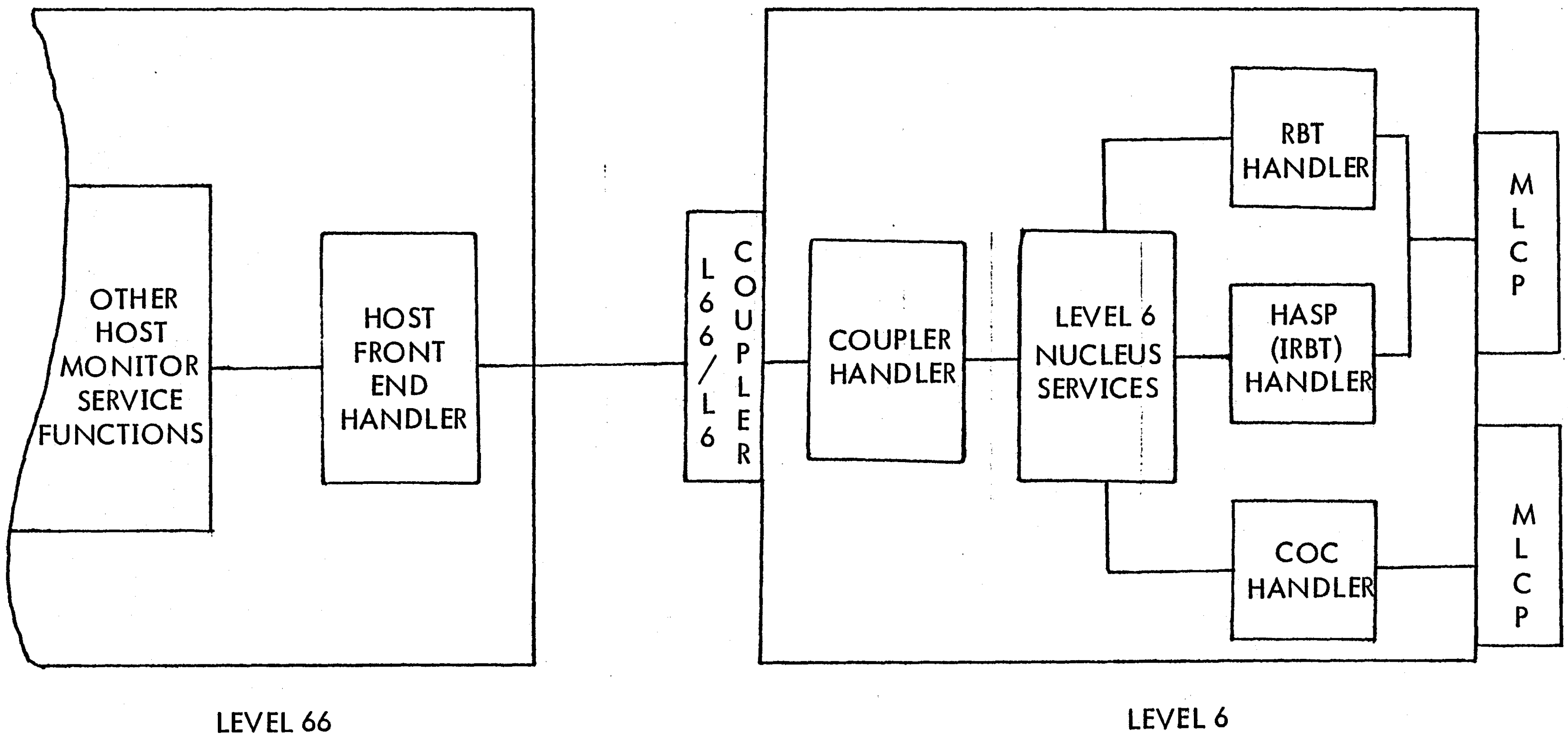
LEVEL 6 SOFTWARE STRUCTURE FOR RELEASE 1



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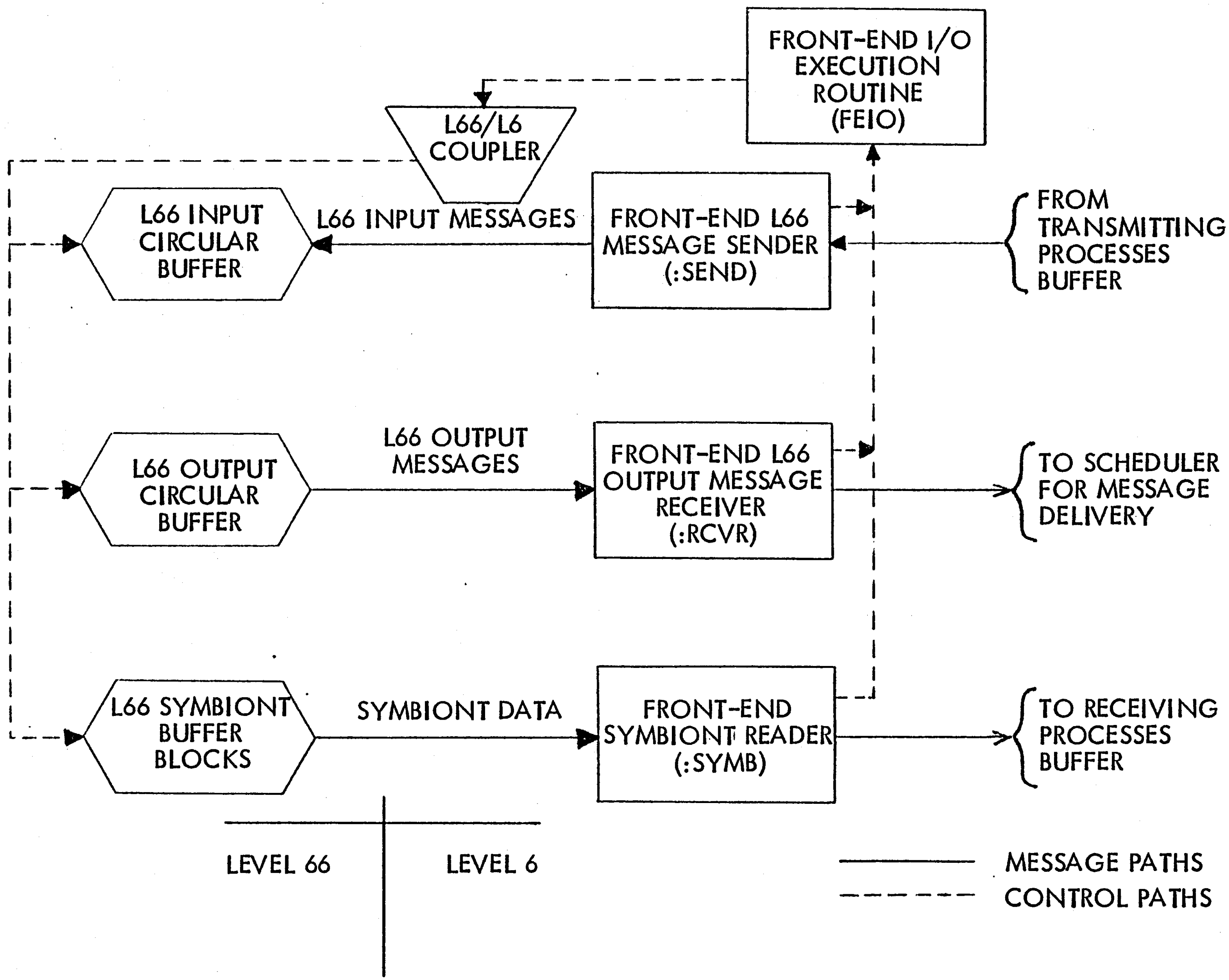
LEVEL 6 NUCLEUS SERVICES

- CLOCK SERVICES
- MEMORY ALLOCATOR
- SCHEDULER
  - WAKE-UP
  - GENERAL SERVICE
  - LOGICAL PATH SERVICE
  - MESSAGE SERVICE
- ADMINISTRATIVE SERVICES
  - LOGICAL PATH CONNECTION, DISCONNECTION
  - ERROR LOGGING
  - CONFIGURATION CONTROL

L6 FRONT END INTERFACE STRUCTURE AND MESSAGE FLOW



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CP-6 LEVEL 6 COC HANDLER CAPABILITIES

- TYPE AHEAD
- TERMINAL TYPES AND TIMING ALGORITHMS
- TRANSPARENT I/O
- PAGINATION
- INPUT EDITING AND CONVERSION
- TABULATION CONTROL
- TERMINAL COUPLING
- TERMINAL TAPE INPUT

COC USER CONTEXT MAINTAINED IN THE LEVEL 6

- INPUT PROMPTS
- TAB STOPS
- ACTIVATION SET
- TERMINAL TYPE, AND TRANSLATION
- TIMING ALGORITHM
- MODES OF OPERATION IN EFFECT
- IMAGE OF PREVIOUS INPUT RECORD FOR RECALL

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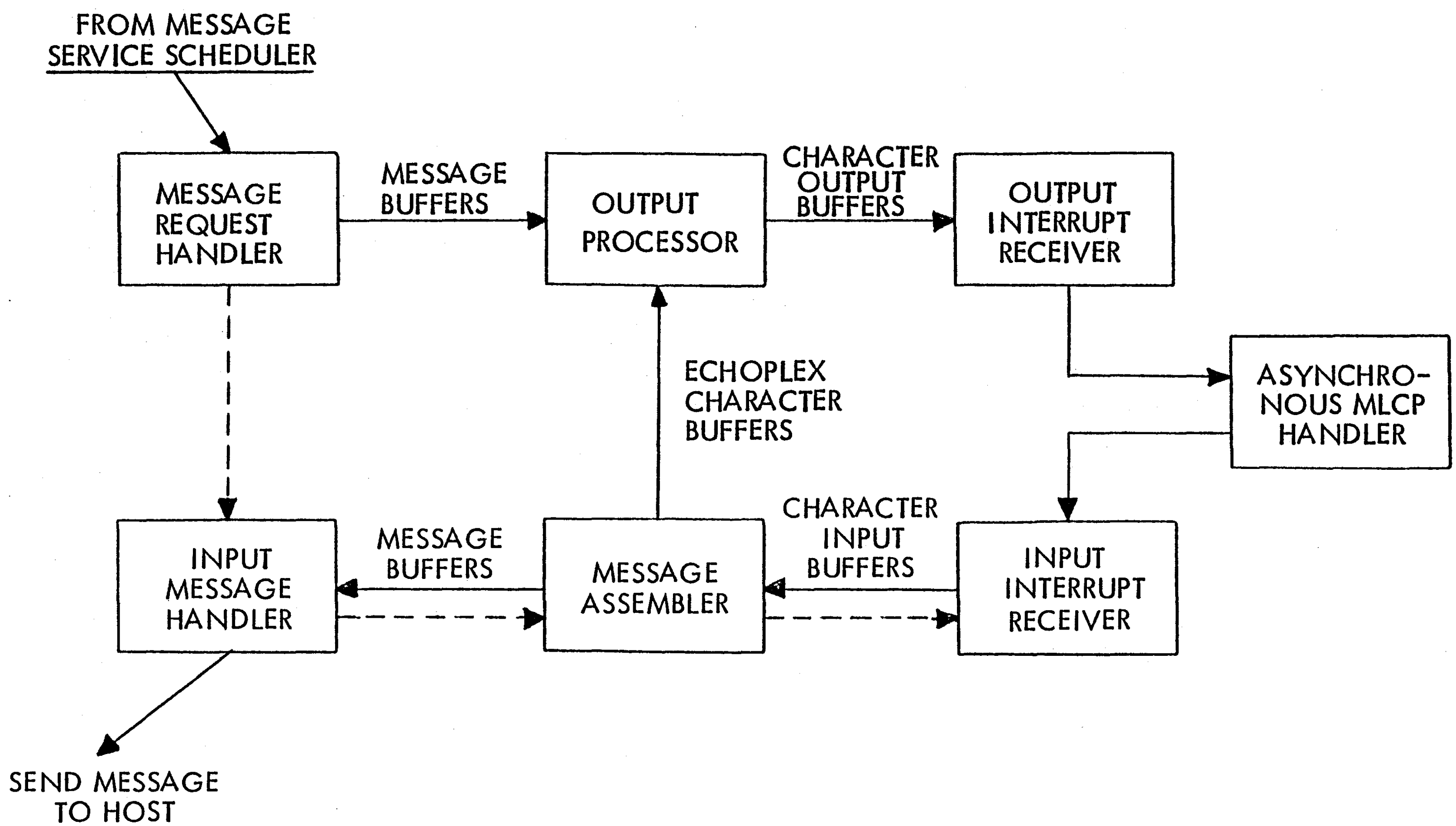
CP-6 LEVEL 6 COC HANDLER STRUCTURE



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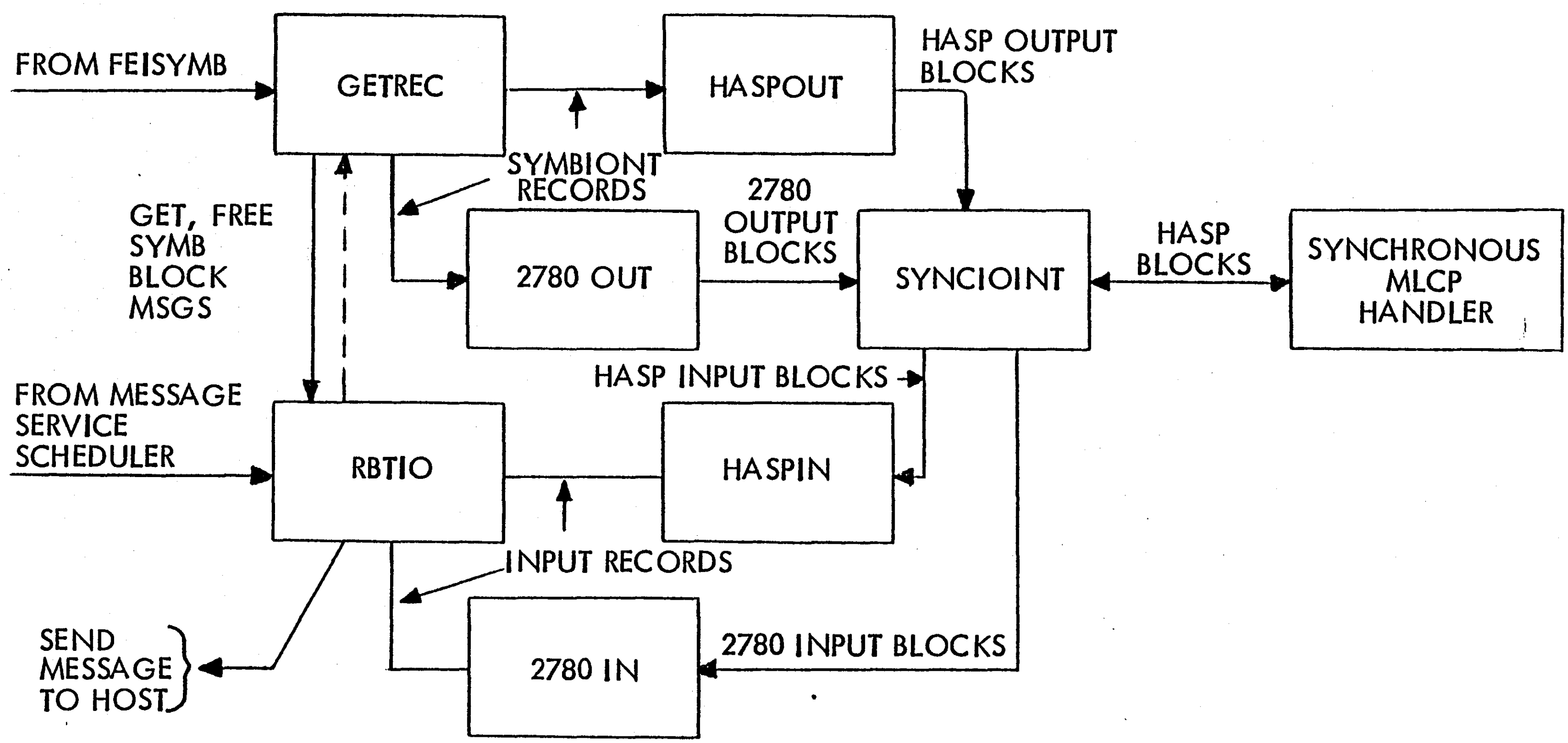
CP-6 REMOTE BATCH CAPABILITIES

- SUBMIT JOBS, RECEIVE RESULTS, AND TRANSMIT FILES
- 2780/3780 AND HASP-MULTILEAVING PROTOCOL SUPPORT
- HOST TO HOST COMMUNICATION
    - MASTER OR SLAVE OVER EACH CONNECTION
- WORKSTATION CONCEPT
    - CP-6 HOST SUPPLIES CHARACTERICS DURING CONNECTIONS
    - WIDE RANGE OF DEVICES CAN BE SUPPORTED
- LOGICAL PATH TO HOST FOR EACH ACTIVE DEVICE
- REMOTE OPERATOR COMMANDS
    - DEVICE AND FILE CONTROL
    - OBTAIN STATUS
    - COMMUNICATION WITH HOST OPERATOR

CP-6 LEVEL 6 RBT/IRBT HANDLER STRUCTURE



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HOST RESIDENT COMMUNICATIONS SUPPORT

- ADMINISTRATIVE SERVICES
- INITIALIZATION AND RECOVERY
- LEVEL 6 CRASH SUPPORT
- WORKSTATION DEFINITION
- HOST LOGON
- COMMUNICATION RELATED I/O FUNCTIONS
    - L66 COUPLER HANDLER
    - INTERFACE TO READ/WRITE COMMANDS
    - INTERFACE TO LOGICAL CONNECTIONS (OPEN)
    - PROGRAM CONTROL OF TERMINAL MODES

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CP-6 LANGUAGE PROCESSORS

(DEVELOPED AT LADC)

- PL-6
- BASIC
- ANS FORTRAN
- APL
- TEXT

CP-6 LANGUAGE PROCESSORS

HIGHLIGHTS

FUNCTIONALITY $\geq$ CP-V LANGUAGES

COMPATIBILITY WITH ANS

COMPATIBILITY WITH H.I.S UNIFICATION

COMMON RUN-TIME LIBRARY FOR APL, BASIC, FORTRAN

SHARED PROCESSORS

PL-6 OVERVIEW

- o LANGUAGE REQUIREMENTS
- o COMPILER HISTORY
- o COMPILER DESIGN

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- o LANGUAGE DEFINITION

- o CODE GENERATION

- o EFFICIENT USE OF HARDWARE

- o EFFICIENT ACCESS TO MONITOR SERVICES

LANGUAGE DEFINITIONS	PL-6	PL-1
ADDRESS RESOLUTION	COMPILATION	COMPILATION/RUNTIME
ASYNCRONOUS EVENT PROCESSING	USER CONTROLLED	ON CONDITION CHAIN IN AUTOMATIC
AUTO ALLOCATION STRATEGY	USER CONTROLLED	NO CONTROL

EFFICIENCY FEATURES	PL-6	PL-1
DEDICATED POINTER REGISTER	ASSUME CLAUSE	NONE
REGISTERS PRESERVED ACROSS CALLS	PRESERVED CLAUSE	SAVES ALL REGISTERS
REGISTER HISTORY CONTROL ON BASED ASSIGNMENTS	REMEMBERS REGISTER HISTORY SPOIL CLAUSE	FORGETS HISTORY

STRING FACILITY	EIS INSTRUCTION	ALTRET FUNCTION
CONCAT/INSERT	MLR	TRUNCATION
XLATE	MVT	TRUNCATION
INDEX	NONE	NOT FOUND
INDEX1/INDEX1R	SCM/SCMR	NOT FOUND
INDEX2/INDEX2R	SCD/SCDR	NOT FOUND
SEARCH/SEARCHR	TCT/TCTR	NOT FOUND
BINCHAR/BINXCHAR	BTD	--
CHARBIN/XCHARBIN	DTB	--
EDITSTR	MVE	--
EDITCHAR/	MVNE	--

a/a/-- DH

MACRO DEFINITIONS

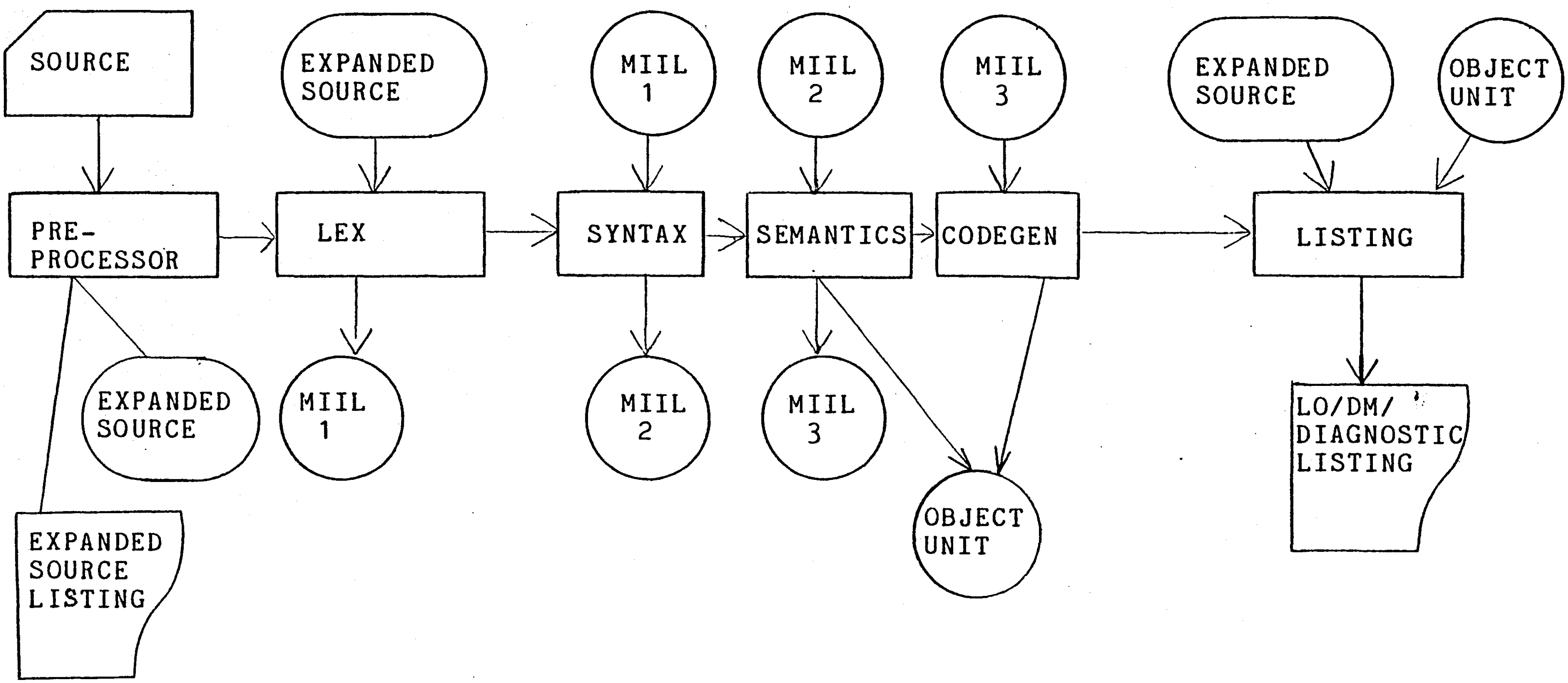
ENTRY DEFINITIONS

VECTOR/SIZEV FUNCTIONS

EXAMPLE:

```
%MAC FPT_TRUNC (FPTN=FPT=TRUNC, STCLAS=STATIC,DCB=NIL);
      DCL 1 FPT STCLASS DALIGNED,
             2 P,
                    3 V_ BIT(72) DALIGNED INIT(VECTOR(FPTN.V)),
             2 V DALIGNED,
                    3 DCB# UBIN(18) UNAL INIT(DCBNUM(DCB));
%MEND;
DCL M$TRUNC ENTRY(1) CONV(1, 14) ALTRET;
%FPT_TRUNC (DCB=M$SI);
CALL M$TRUNC(FPT_TRUNC) ALTRET(ERROR);
```

PL-6 EXECUTION/INPUT-OUTPUT FLOW



9/a/nn RH

PL-6 OVERLAY STRUCTURE

- ROOT (1.5K)
  - CONTROL CARD (0.5K)
  - PRE-PROCESSOR (18K)
  - OBJECT CODE ROUTINES (19K)
    - LEX/SYNTAX (12K)
    - SEMANTICS (32K)
    - CODE GENERATION (37K)
  - LISTINGS (16K)

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BASIC

- SHORT REVIEW OF BASIC LANGUAGE FEATURES
- DESIGN GOALS
- DESIGN TECHNIQUES
- DESIGN OVERVIEW
- WHERE ARE WE NOW?

BASIC DESIGN GOALS

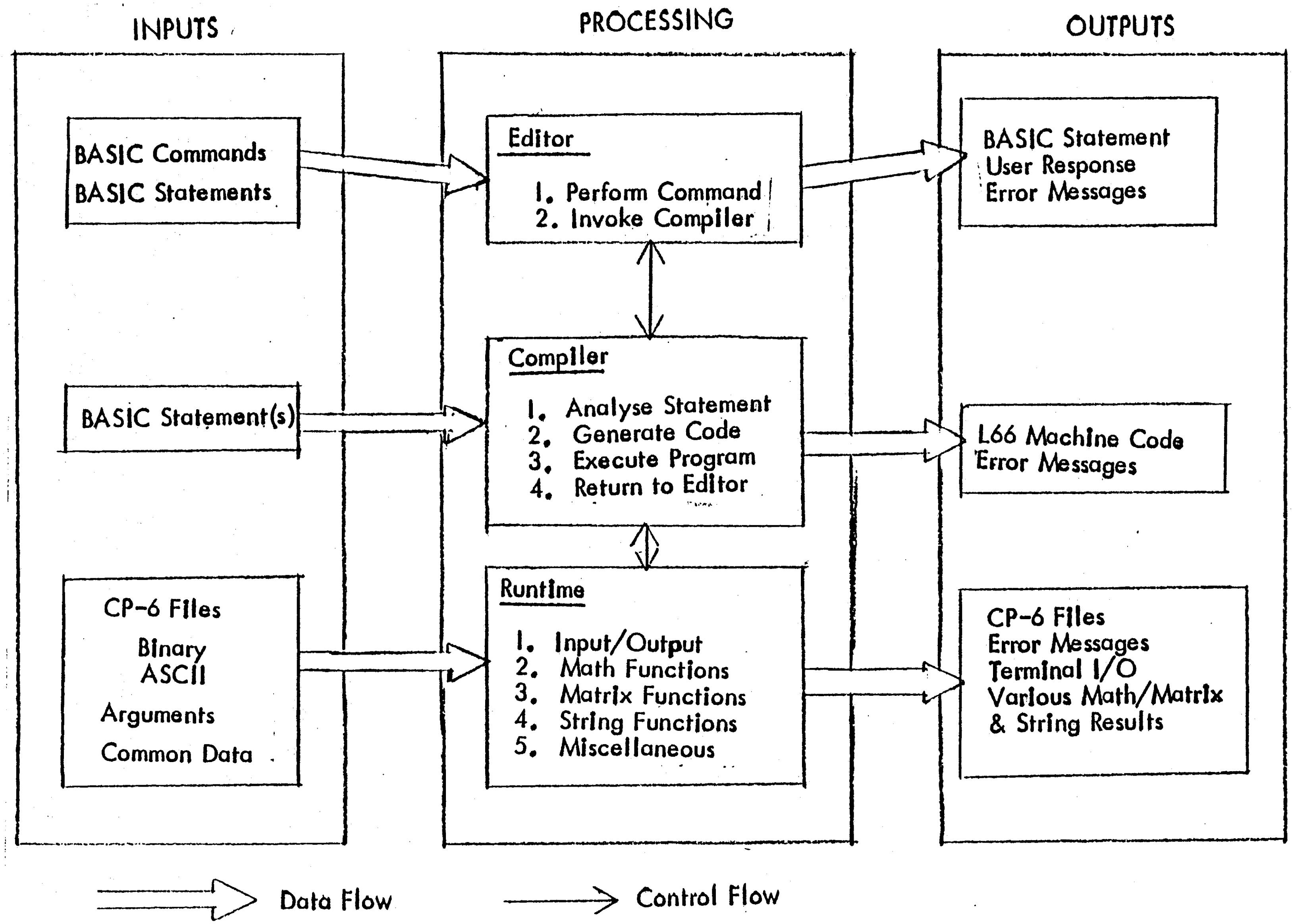
- RELIABILITY
- MAINTAINABILITY
- EXTENDIBILITY

BASIC DESIGN TECHNIQUES

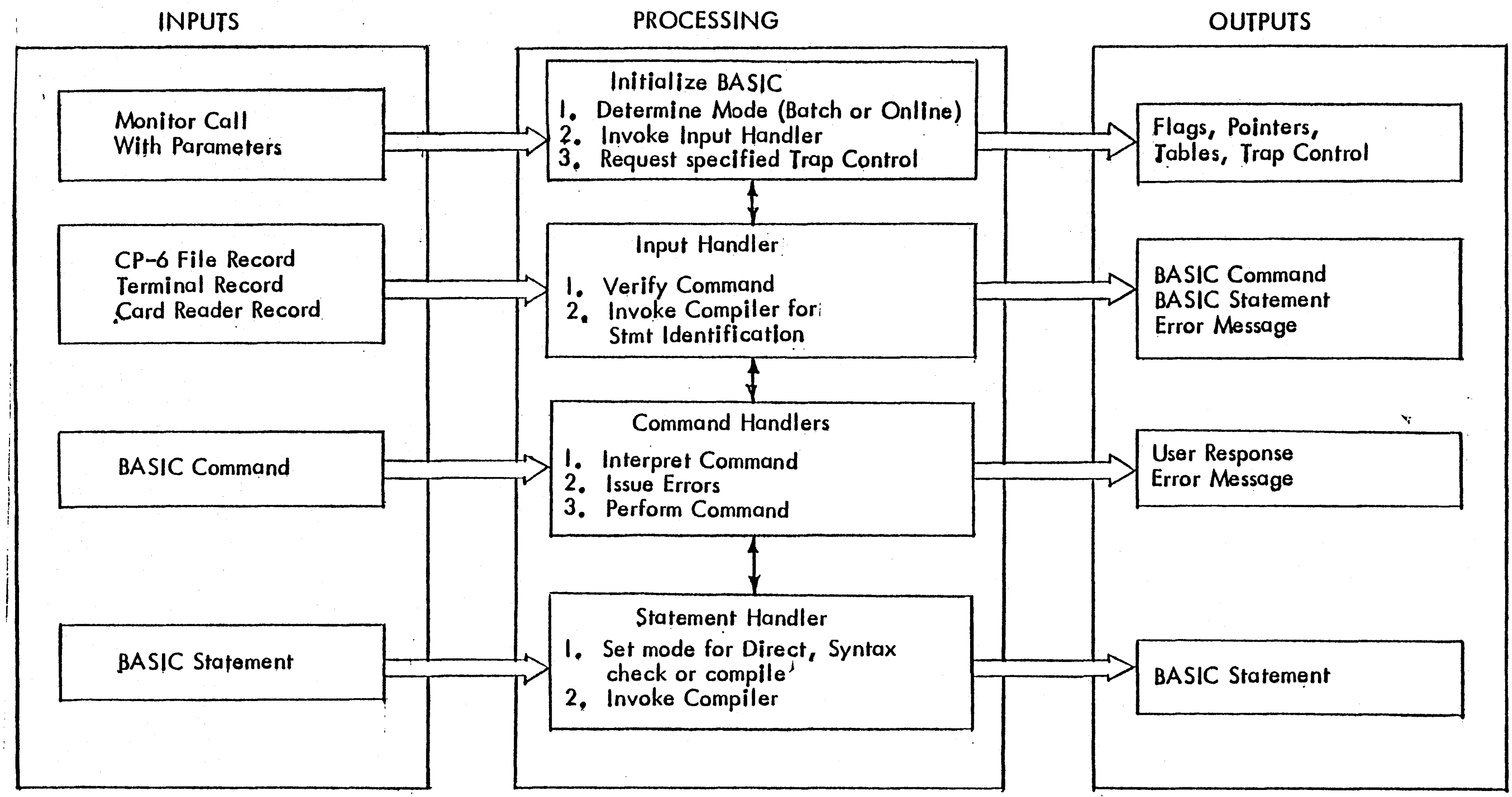
- TOP-DOWN DESIGN
- FUNCTIONAL FLOWS-FLOWCHARTS
- MODULARITY
- STRUCTURE

BASIC PROCESSOR DESIGN OVERVIEW

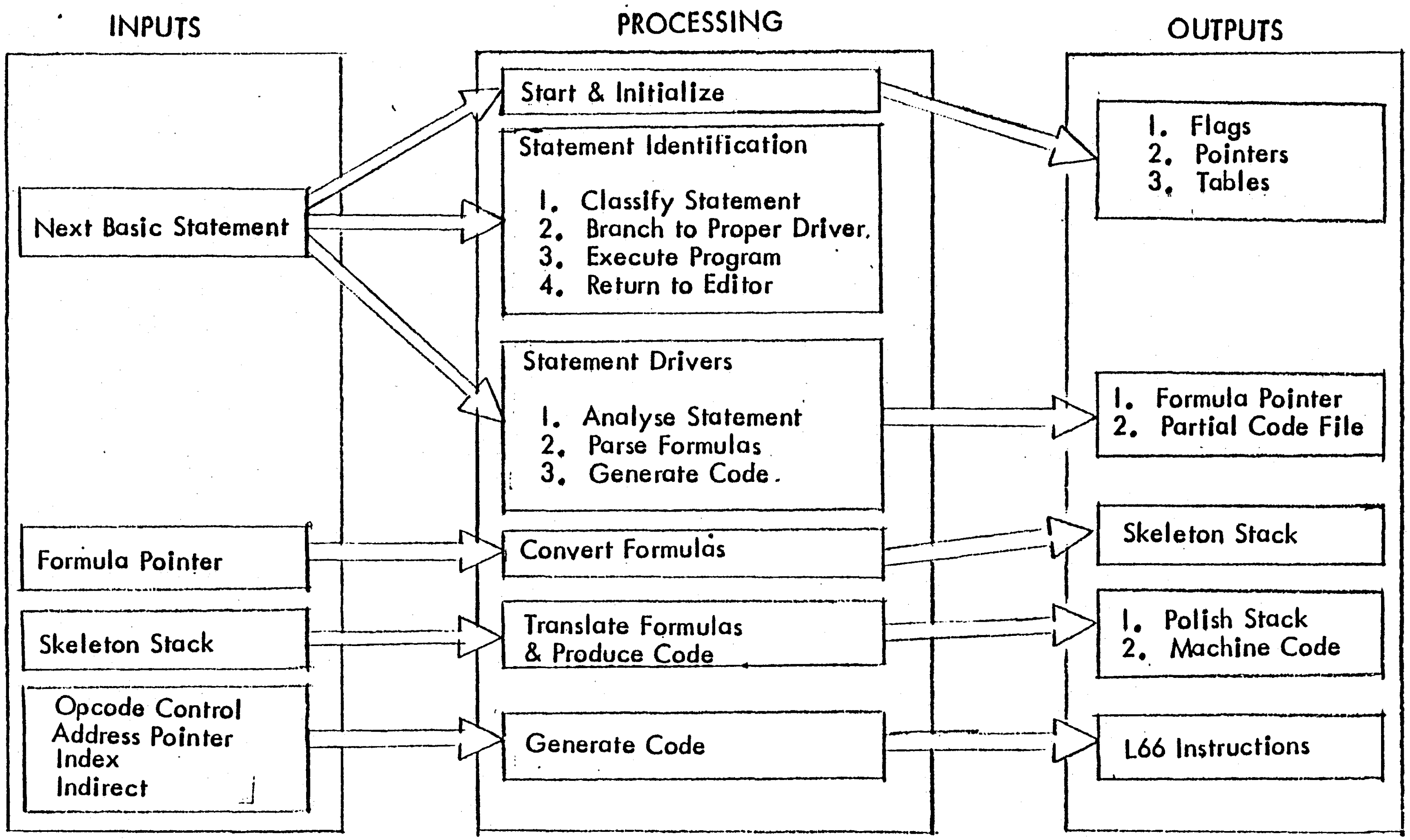
- o THREE MAJOR MODULES
  - EDITOR
  - COMPILER
  - RUNTIME
- o THREE MINOR MODULES
  - GENERAL UTILITIES
  - MEMORY MANAGEMENT
  - CP-6 INTERFACE



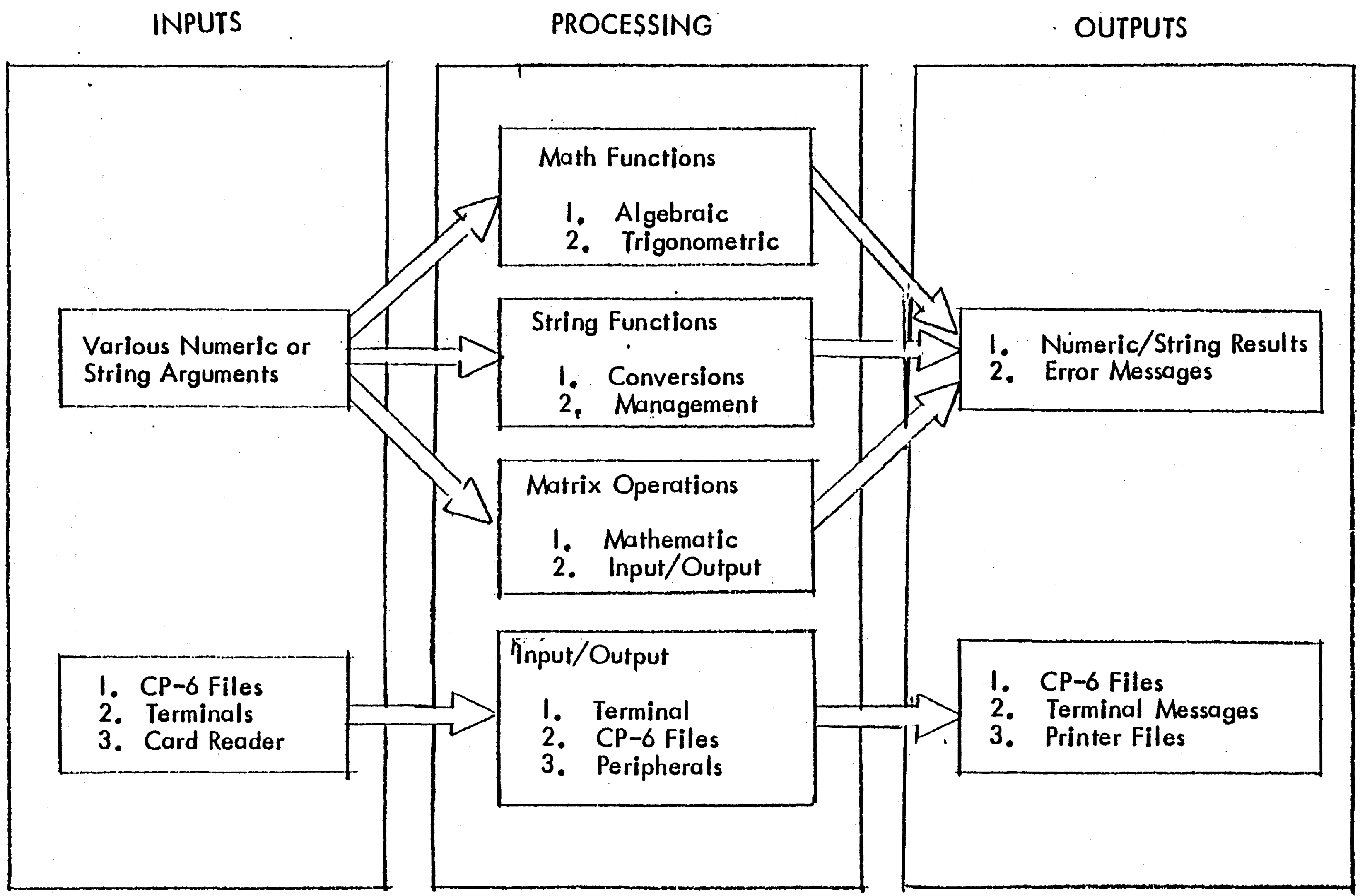
BASIC MAJOR MODULES - HIPO



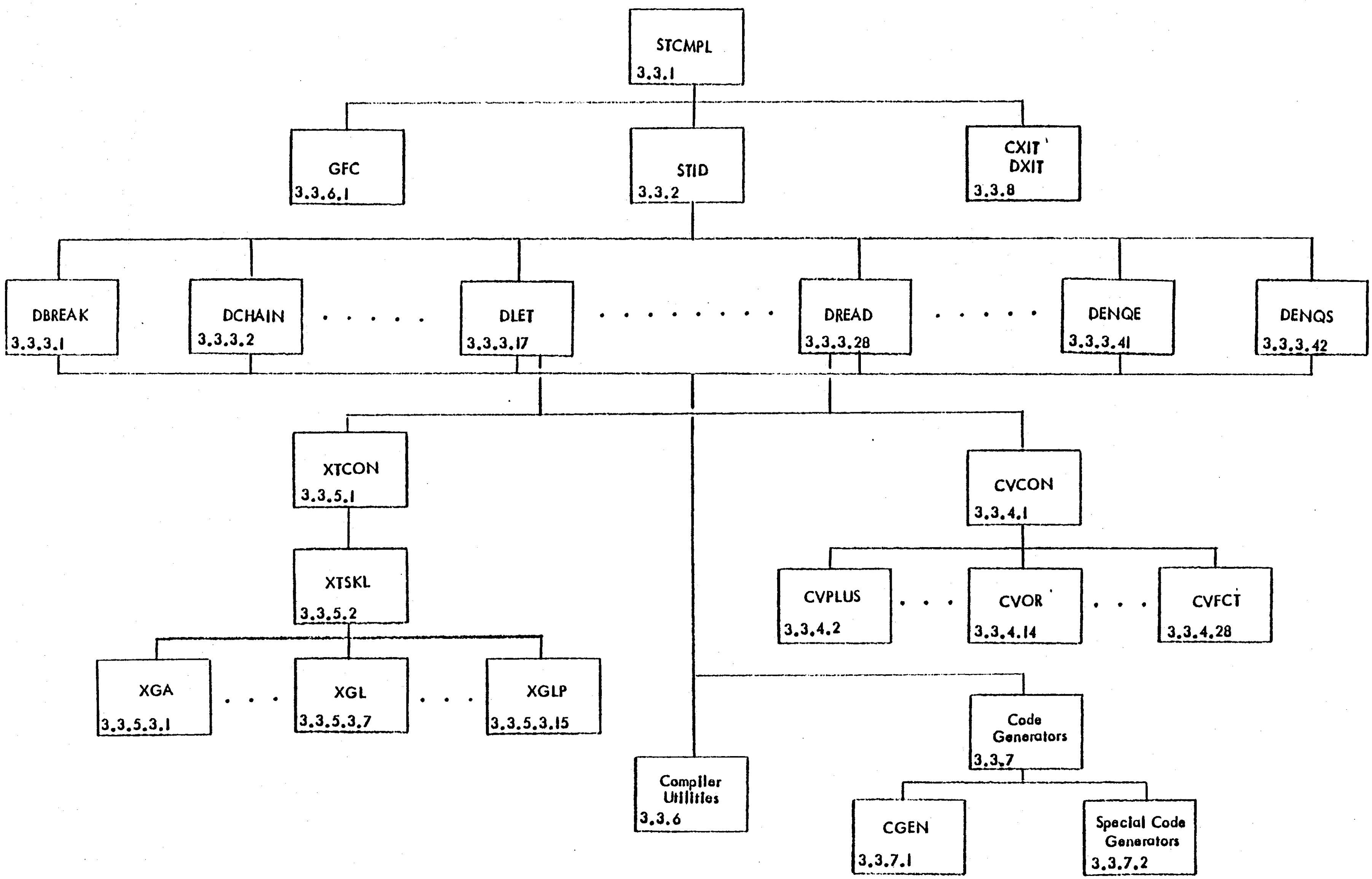
BASIC EDITOR - HIPO



BASIC COMPILER - HIPO



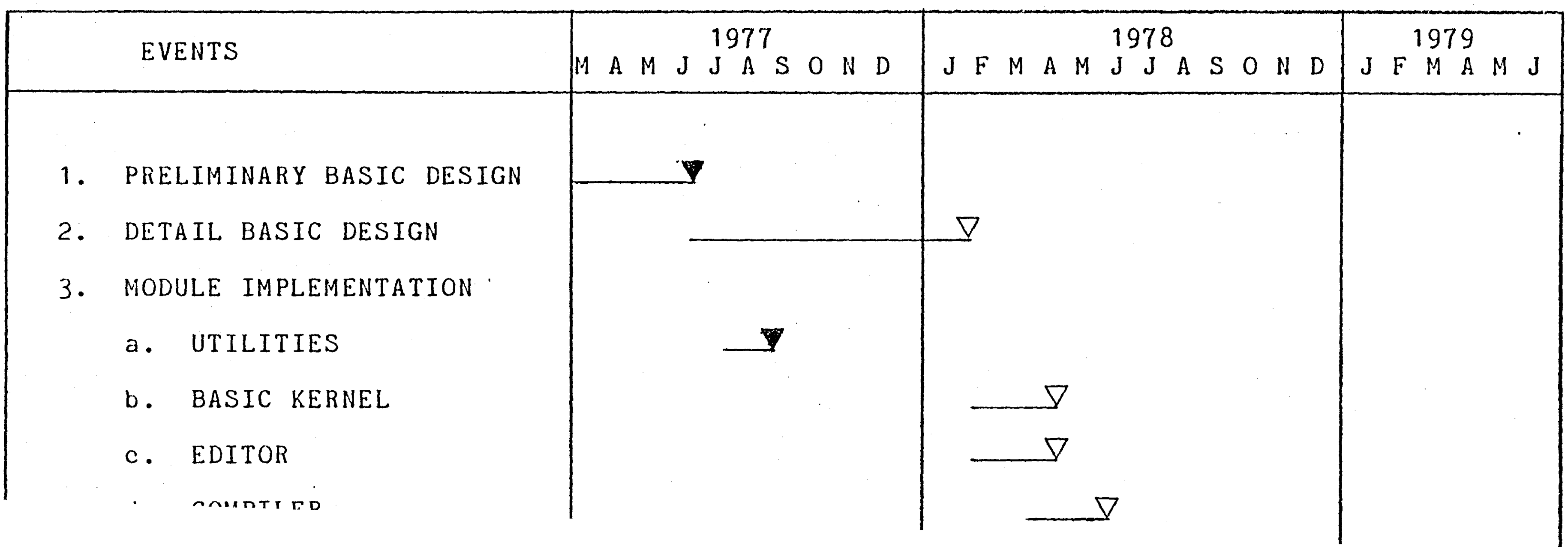
BASIC RUNTIME - HIPO



BASIC COMPILER - FUNCTIONAL HIERARCHY

WHERE ARE WE NOW?

- o EPS-1 RELEASED
- o PRELIMINARY DESIGN COMPLETE
- o DETAIL DESIGN ON SCHEDULE NEAR 20% COMPLETE
- o ONE MINOR MODULE CODED/CHECKED OUT


EVENTS
1977
M A M J J A S O N D
1978
J F M A M J J A S O N D
1979
J F M A M J
1. PRELIMINARY BASIC DESIGN
2. DETAIL BASIC DESIGN
3. MODULE IMPLEMENTATION
a. UTILITIES
b. BASIC KERNEL
c. EDITOR

ANS FORTRAN FOR CP-6

LANGUAGE FEATURES

- 77 ANS FORTRAN LANGUAGE
- IBM FORTRAN LANGUAGE EXTENSIONS
- XEROX CP-V ANS FORTRAN EXTENSIONS

IBM FORTRAN LANGUAGE EXTENSIONS

- DIRECT ACCESS I/O
  - DEFINE FILE STATEMENT
  - FIND STATEMENT
  - INDEXED READS AND WRITES
- NAMELIST DRIVEN I/O
  - NAMELIST STATEMENT (WITH N/L NAMES)
  - READS AND WRITES WITH NAMELIST NAMES
- ALTERNATE RETURNS FROM SUBPROGRAMS

XEROX CP-V ANS FORTRAN LANGUAGE EXTENSIONS

- ABNORMAL STATEMENT
- CONSTANT STATEMENT
- DOUBLE COMPLEX DATA TYPE
- GLOBAL STATEMENT
- INCLUDE STATEMENT
- INPUT STATEMENT
  - FREE FORM
  - WITH LIST
- NAMELIST STATEMENT
  - WITHOUT ID LIST
  - WITH ID LIST, WITHOUT N/L NAMES
- NORMAL STATEMENT
- OUTPUT STATEMENT
- PARAMETER STATEMENT (INIVAC FORM)
- READ/WRITE DISK STATEMENTS
- VIRTUAL STATEMENT
- ENCODE STATEMENT
- DECODE STATEMENT

ANS FORTRAN COMPILER DESCRIPTION

- o DESIGN BASED OF CP-V ANS FORTRAN
  - SIMILAR LANGUAGE SET
  - BLOCK OPTIMIZATION
  - BASIC DESIGN IS TRANSPORTABLE
  - FAMILIARITY OF DESIGN
- o MULTIPASS COMPILER
- o OVERLAYED PROCESSOR

OVERLAY STRUCTURE OF THE

CP-6 ANS FORTRAN COMPILER

ROOT
PROGRAM CONTROL

- SYNTAX ANALYSIS - SOURCE EDITOR
- DECLARATION PROCESS - ALLOCATION PROCESSING
- SEMANTIC ANALYSIS AND PLEX TREE BUILDING
- OPTIMIZATION - TRANSLATION
- CODE GENERATION PHASE
- LOAD AND GO CODE EXECUTION

COMPILER OPTIMIZATION

- BLOCK OPTIMIZATION
  - CONGRUENT SUBSCRIPTS EXPRESSIONS
  - CONGRUENT ARITHMETIC EXPRESSIONS
  - ALTERNATE RECOGNITION
    - VARIABLES KNOWN AS EXPRESSIONS
    - VARIABLES KNOWN AS CONSTANTS
    - EXPRESSIONS KNOWN AS VARIABLES
  - COMPILE TIME CONSTANT ARITHMETIC
    - ADD, SUB, MULTIPLE, DIVIDE, EXPONENTIATION
  - CONGRUENT ADDRESS REGISTER USAGE

COMPILER OPTIMIZATION (CONT.)

o ALTERNATE RECOGNITION

- VARIABLES KNOWN AS EXPRESSIONS

  ASSOCIATION OF A VARIABLE WITH AN EXPRESSION:

```
A = B*C
  .
  .
  .
D = A  [.:,D=RESULT OF B*C]
```

- VARIABLES KNOWN AS CONSTANTS

  ASSOCIATION OF A VARIABLE WITH A CONSTANT AT COMPILE TIME:

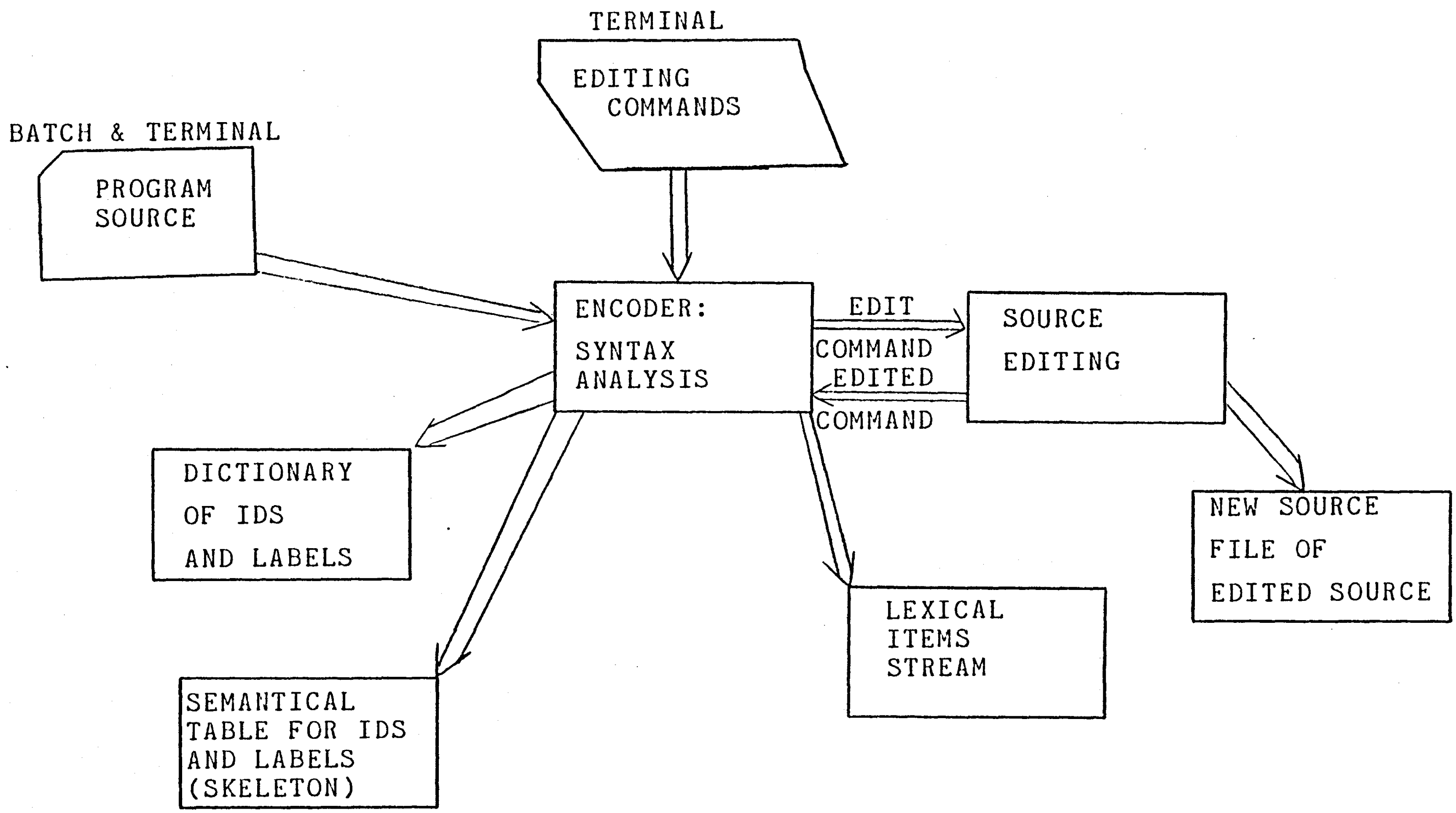
```
A = 10.0
  .
  .
  .
D = A*4  [.:,D=40.0]
```

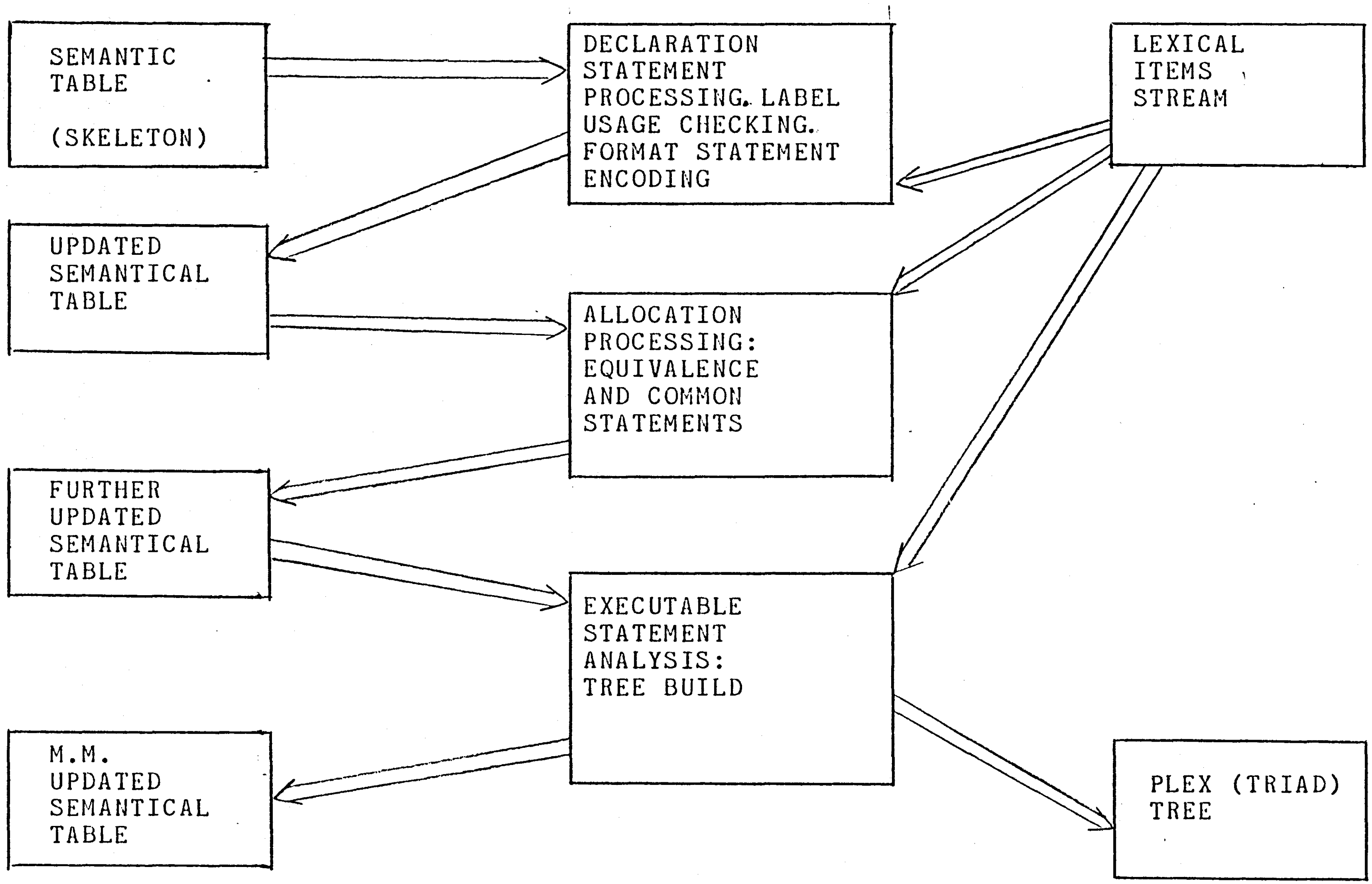
- EXPRESSIONS KNOWN AS VARIABLES

  ASSOCIATION OF AN EXPRESSION WITH A VARIABLE:

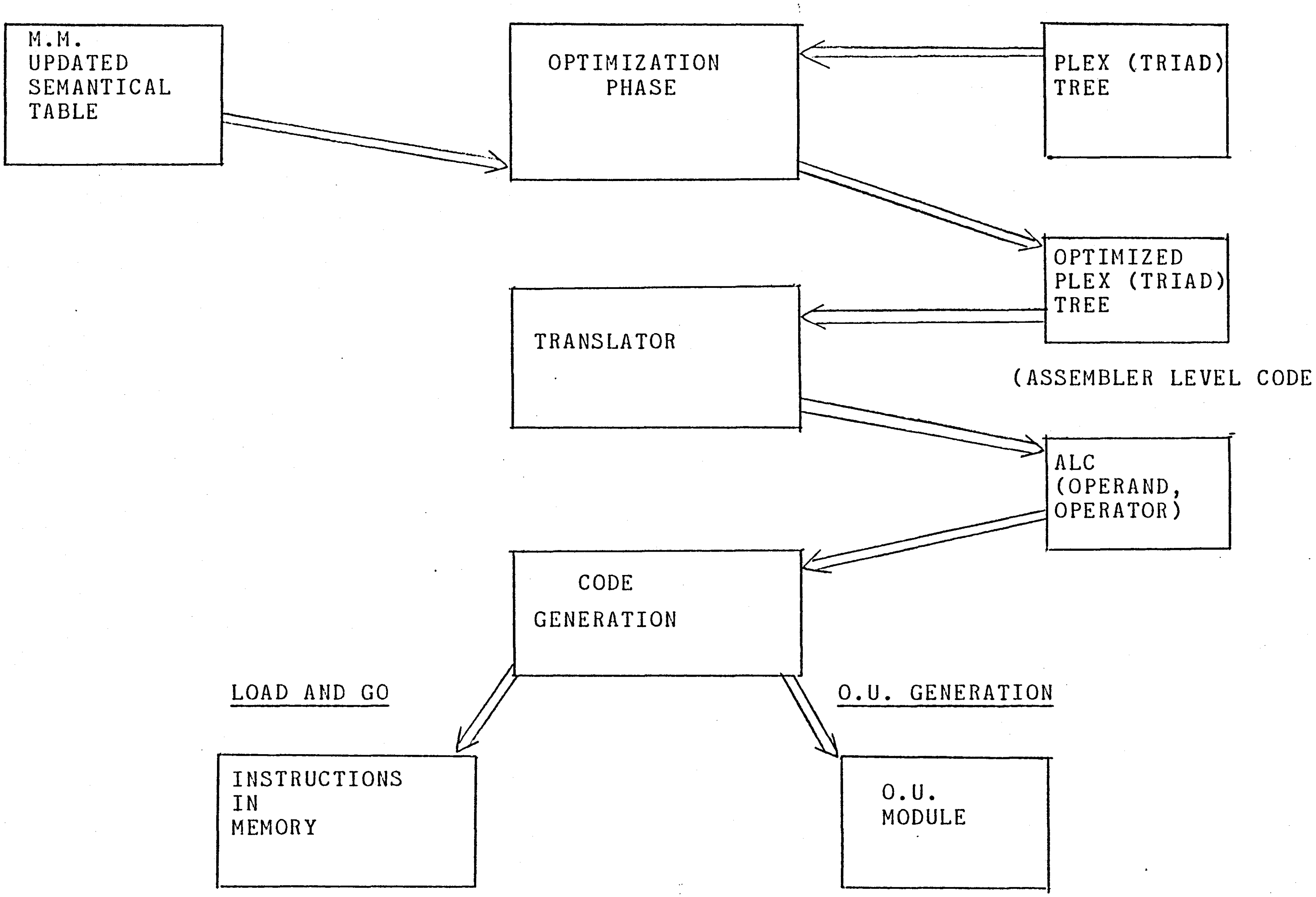
```
A = B*C
  .
  .
  .
D = B*C [.:,D=A]
```

FRONT END PROCESSOR




SEMANTIC TABLE (SKELETON)
DECLARATION STATEMENT PROCESSING. LABEL USAGE CHECKING. FORMAT STATEMENT ENCODING
LEXICAL ITEMS STREAM
UPDATED SEMANTICAL TABLE
ALLOCATION PROCESSING: EQUIVALENCE AND COMMON STATEMENTS
FURTHER UPDATED SEMANTICAL TABLE
EXECUTABLE STATEMENT ANALYSIS: TREE BUILD
M.M. UPDATED SEMANTICAL TABLE
PLEX (TRIAD) TREE

CODE GENERATION PROCESSING



COMPETITIVE ADVANTAGES OF CP-6 APL

1. A rich set of functions exceeding those of competitive products.

2. An environment which admits expansion easily.

3. Relatively efficient operations on large data aggregates.

4. Workspace capacity significantly greater than that of competitive products.

DIFFERENCES BETWEEN CP-V APL & CP-6 APL

1. Hardware differences

2. Implementation vehicle differences

3. Operating system differences

4. New features

5. Delayed features

ROOT 30000

- INIT 500
- FUNCS 5500
- FILE 6200
- CMDS 6400
- DEF 5500
- MAT 2600
- SPROG 6200

Name	Includes
ROOT	Principal monitor interface, input, output, workspace management, codestringer, codestring executor, operator execution drivers
INIT	Processor initialization
FUNCS	Certain function evaluators, formatted output
FILE	File I/O and shared variables
CMDS	All commands
DEF	Function definition & error reporting
MAT	The domino operator
SPROG	System programmer functions: workspace management, text editing, and canonical representation

Sizes above are in 36 bit words and have a tolerance of ±20%, for procedure only.

WORKSPACE DATA

STATIC DATA -	3 pages in the ROOT and 1 page in most overlays
AUTOMATIC DATA -	1 page
DYNAMIC SEGMENT 1 -	The symbol table and the data blocks
DYNAMIC SEGMENT 2 -	The execution stack

INTERNALLY PERCEIVED RISKS

1. THE IMPLEMENTATION VEHICLE, PL6

2. THE CHECKOUT ENVIRONMENT AND LIMITED CHECKOUT TIME

3. PERSONNEL

Competitive Advantages of CP-6 APL

I. A rich set of functions exceeding those of many competitive products.

A. File I/O, blind I/O

1) The full CP-6 file system facilities are available to the APL user. This includes shared update as well as enqueue/dequeue to control access in the shared mode.

2) Both translated and untranslated(blind) I/O is provided.

B. Several unique commands are provided

1))SEAL allows the installation to provide proprietary APL functions for execution only. Also, individual functions in a workspace may be locked to likewise prevent inspection of the algorithm.

2))OBSERVE provides the ability to inspect the evaluations undertaken for execution of any line in the minutest detail.

3))CATCH allows the user to intercept all assignments to a particular variable to facilitate debugging.

C. System commands may be executed via the unary epsilon operator.

D. Sidetracking of errors and breaks is provided.

E. The system programmer functions

1) Canonical representation to change function definition to and from text.

2) Workspace management to investigate attributes of workspace constituents.

3) Text editing to provide text index, search and replacement and comparison.

II. An environment which admits expansion easily.

A. Both batch and on-line operations are accomodated.

B. A very flexible terminal interface mechanism admits considerable variety.

1) Files are included.

2) Terminals without APL characters are accomodated.

C. The PL6 software factory has several beneficial aspects.

1) Listings can contain much more documentary content.

2) The language promotes the use of "structured" constructs.

D. The modularization of the CP-6 APL product will separate data, procedure and monitor interface.

E. The commentary in the source for the processor will contain all the information to produce the technical and data base manuals via an automated process.

Competitive Advantages of CP-6 APL - Contd.

III. Relatively efficient operations on large data aggregates.

A. Code is "compiled" for inner loops.

B. Use is made of the common library at all radix translation and elementary function evaluation times.

C. Codestring is used to facilitate execution.

IV. Workspace capacity is significantly greater than that of the competition.

A. A large virtual memory is provided with little operating system preemption.

B. Multiple segment dynamic memory will be utilized.

C. Typically CP-6 APL will provide 256K bytes vs. 32K bytes.

D. CP-6 APL will provide overflow symbol table processing beyond the "hashed" symbol table capacity.

Differences between CP-V APL & CP-6 APL

It should be empasized that the CP-V APL design is, to a large extent, being copied over into the APL processor for CP-6. CP-V APL is a field-proven, highly competitive product. However, there are differences which should be exposed during review.

I. Differences caused by change of hardware
 A. Word and byte size, but fortunately 36>32 and 9>8.
 B. Floating point range is reduced which may require scaling of some processes.
 C. The instruction set and the CPU organization are quite different.
  1) The compiled code for interpretation of operators is new.
  2) The use of PL6 minimizes much of this effect.
 D. Traps are different.

II. Differences caused by change of primary implementation vehicle.
 A. The "structured" and documentary effects have been reviewed earlier.
 B. PL6 generated code will be far from that which would be generated to provide minimum procedure residency as was the intent in the CP-V product.
 C. The abilty to produce technical documentation in an automated manner was mentioned earlier.
 D. As an empasis note, all of the above noted differences tend to promote maintainability.

III. Differences caused by change of operating system.
 A. Some additional effects of hardware change are reflected in the operating system interface.
  1) Exceptional conditions vary.
  2) NSA hardware is different from the Sigma map.
  3) File granule size is different.
 B. Many of the facilities of CP-6 expand upon those which had been in CP-V.
  1) File open
  2) File attributes
  3) "Privilege"
 C. Dynamic memory management is particularly different.

IV. New features have been added to CP-6 APL.
   A. Distinguished names
      1) Had been available as I-BEAM and T-BAR functions.
      2) Must be made capable of localization.
   B. Shared variables are a new CP-6 APL facility which will be provided by utilizing field-proven CP-V facilities.
      1) Shared update files
      2) Enqueue and dequeue

V. Delayed features - Two features of the CP-V APL processor have been eliminated from the initial release of the CP-6 product.
   A. Graphics functions
   B. The interface to the data base manager, IDS-II.

Processor Structure

I. ROOT
   A. Principal monitor interfaces
      1) Memory management
      2) SI, LO, DO management
      3) Exceptional condition handlers
   B. Input
      1) Mnemonic translation
      2) Visual fidelity
   C. Output
      1) Mnemonic translation
      2) Line formation
   D. Workspace management
      1) Symbol table
      2) Data blocks
      3) Execution stack
   E. Command recognition
      1) Initial processing of commands
      2) Root interface to error processes
   F. Codestring
      1) Translate to/from codestring
      2) Codestring execution
   G. Operator execution drivers
      1) Simple operators
      2) Mixed and composite operators
      3) Index processes
      4) Intrinsic functions

II. INIT - Once per user processor invocation processes.

III. FUNCS
   A. Certain function evaluators
   B. Formatted output

Processor Structure - Contd.

IV. FILE
   A. File and transparent I/O
   B. Shared variables

V. CMDS - All commands starting with)

VI. FUNDEF
   A. Function definition
   B. Error management

VII. MAT - Matrix inversion

VIII. SPROG - System programmer functions; namely, canonical representation, workspace management, and text editing.

Workspace Data

I. Static data - 3 pages for the ROOT and 1 page in several overlays. This is the main internal working space for the workspace containing the fixed size data which is, in general, not displayable.

II. Automatic data - 1 page is required for certain local data which is temporary in nature.

III. Dynamic segment 1
- A. Most of the displayable and copyable fixed length workspace data.
- B. The symbol table.
- C. The data blocks.

IV. Dynamic segment 2
- A. The fixed length state control data.
- B. The execution stack.

Internally Perceived Risks

I. The implementation vehicle, PL6
  A. Effects on processor and workspace size.
  B. Effects on speed of various processes.

II. Personnel - It is an exceptional circumstance which could cause this to be surfaced as a risk, but the health of the only team member from the original CP-V team is of concern.

III. Checkout
  A. The novelty of CP6 is bound to cause problems, not the least of which is concern about timely availability.
  B. The current schedule does not admit sufficient time between earliest assumed availabilty of checkout hardware/software and delivery time to accomodate even the most optimistic checkout schedule.

CP-6 TEXT

SHARED PROCESSOR UNDER CP-6

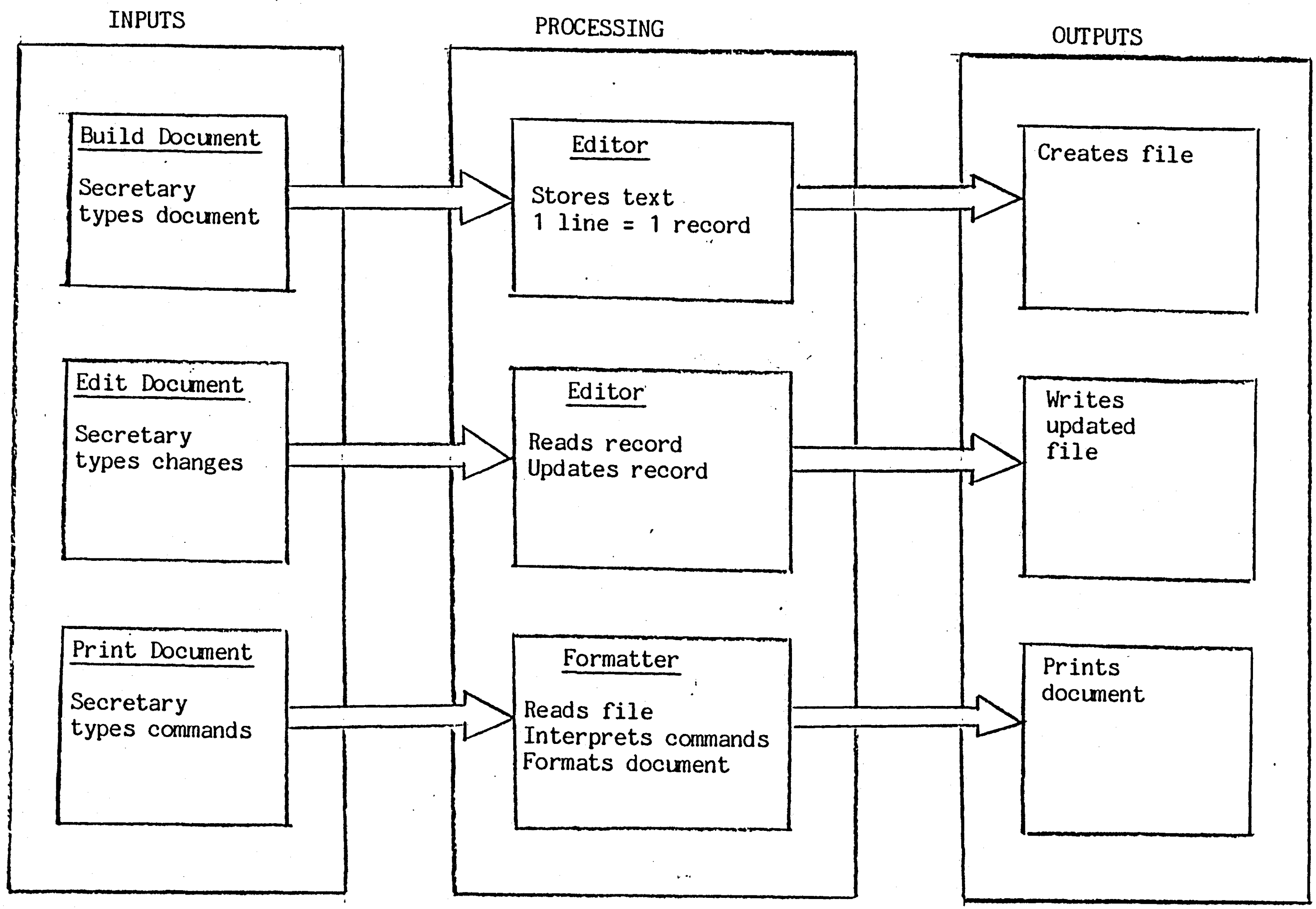
FAST DOCUMENT CREATION

AUTOMATIC FORMATTING CAPABILITIES

NAME-AND-ADDRESS FILES

ON-LINE AND BATCH OPERATION

CP-6 TEXT



INPUTS
PROCESSING
OUTPUTS
Build Document
Secretary types document
Editor
Stores text
1 line = 1 record
Creates file
Edit Document
Secretary types changes
Editor
Reads record
Updates record
Writes updated file
Print Document
Secretary types commands
Formatter
Reads file
Interprets commands
Formats document
Prints document

CP-6 LANGUAGE PROCESSORS

SUMMARY

DESIGN PHASE - EXCELLENT VISIBILITY

- o BUILDING UPON PROVEN CP-V DESIGN

CODING PHASE - HIGH CONFIDENCE

CHECKOUT PHASE - LOTS OF EXPOSURE

CP-6 LANGUAGE PROCESSORS

RISKS

CONCURRENT DEVELOPMENT OF OPERATING SYSTEM

- DEBUGGING - WHERE IS ERROR?
- CONTENTION FOR COMPUTER TIME

COMPUTER RESOURCES

- ADEQUATE COMPUTER TIME
- SUFFICIENT TERMINALS

PL-6 PERFORMANCE

- SIZE
- SPEED

STAFFING

CP-6 PRELIMINARY DESIGN REVIEW
PHOENIX SUPPLIED SOFTWARE

- PRODUCTS
  - COBOL-74
  - SORT/MERGE
- IMPLEMENTATION TOOLS
  - PL/I
  - GMAP6
- TOPICS
  - PRODUCT STRUCTURE
  - COMPATIBILITY
  - PERFORMANCE
  - TESTING
  - SCHEDULE
  - MAINTENANCE STRATEGY

PRODUCT STRUCTURE

- BASE DESIGN
  - EXISTING GCOS PRODUCTS
- DEVELOPMENT STRATEGY
  - MAXIMIZE COMMON SOURCE BASE
  - ISOLATE HOST SYSTEM INTERFACES
  - ADAPT TO CP-6 I/O
- EXCEPTION - SORT/MERGE
  - MAJOR REDEVELOPMENT
  - PERFORMANCE SENSITIVITY
  - INTIMATE USE OF MONITOR SERVICES

COMPATIBILITY

- WITH CP-V
  - MAXIMIZE CONSISTENT WITH OVERALL CP-6 GOALS
- WITH GCOS
  - HIGHLY DESIRABLE TO FACILITATE:
    - COMMON PROCESSORS - COSTS
    - ULTIMATE MIGRATION
- WITH IBM
  - NOT ADDRESSED IN WORK LEADING TO RELEASE 1

PERFORMANCE

- EXPECTATIONS
  - EXISTING DESIGN
  - EXISTING BASE PROCESSOR

- EXCEPTIONS
  - MONITOR I/O
  - COMMON I/O ADAPTATION
  - PURE PROCEDURE

TESTING

- BY DEVELOPMENT SHOP LEADING TO INITIAL RELEASE AS OPPOSED TO CURRENT GCOS PRACTICE OF USING SEPARATE AND FORMALIZED TEST ORGANIZATION

MAINTENANCE STRATEGY

- CP-6 FIELD SUPPORT GROUP
  - SCREEN STARS
  - RESPONSE DATABASE
  - INTERFACES WITH THE FIELD AND THE DEVELOPMENT GROUPS
- PHOENIX DEVELOPMENT GROUP
  - INTERFACES WITH CP-6 FIELD SUPPORT GROUP
  - COMMON PROCESSOR FIXES TESTED ON GCOS
  - HOST INTERFACE FIXES TESTED ON CP-6

CP-6 PRELIMINARY DESIGN REVIEW

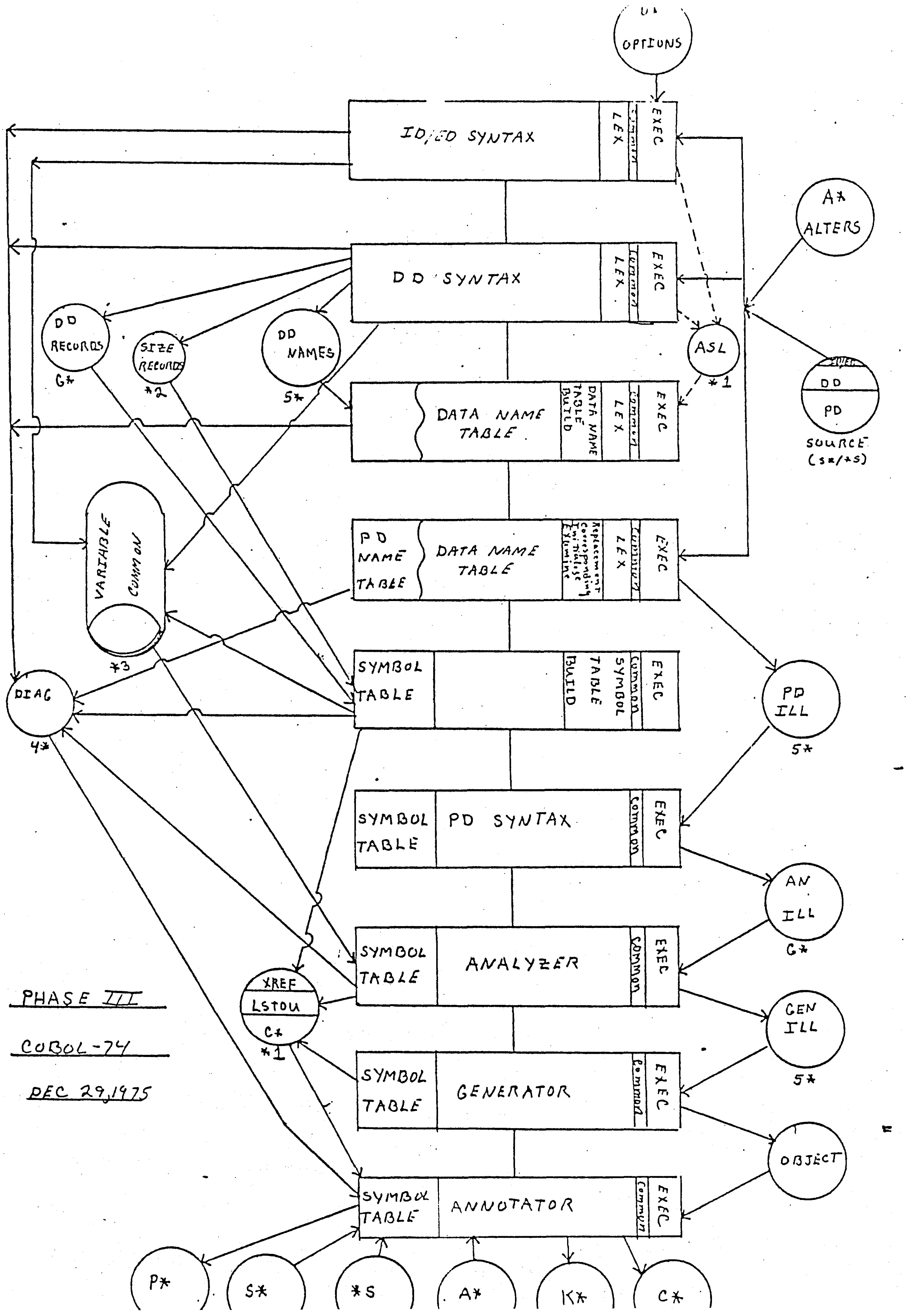
COBOL-74

- STRUCTURE
- COMPATIBILITY
  - CP-5
  - GCOS-III
- PERFORMANCE
- TESTING
- SCHEDULE & MILESTONES
- MAINTENANCE STRATEGY

PL/I

- STRUCTURE
- SCHEDULE

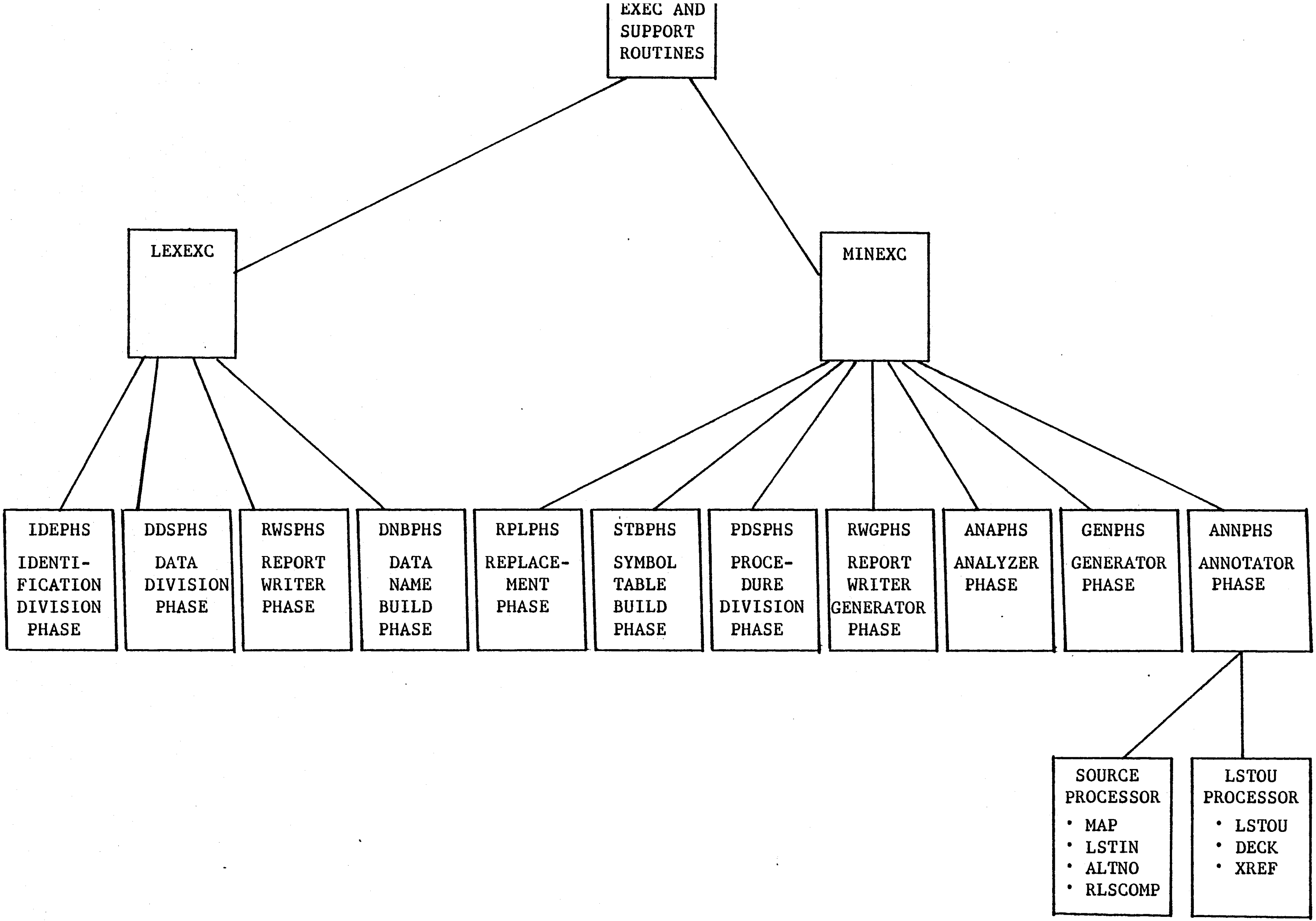
S T R U C T U R E



PHASE III

COBOL-74

DEC 29,1975


EXEC AND SUPPORT ROUTINES
LEXEXC
MINEXC
IDEPHS IDENTIFICATION DIVISION PHASE
DDSPHS DATA DIVISION PHASE
RWSPHS REPORT WRITER PHASE
DNBPHS DATA NAME BUILD PHASE
RPLPHS REPLACEMENT PHASE
STBPHS SYMBOL TABLE BUILD PHASE
PDSPHS PROCEDURE DIVISION PHASE
RWGPHS REPORT WRITER GENERATOR PHASE
ANAPHS ANALYZER PHASE
GENPHS GENERATOR PHASE
ANNPHS ANNOTATOR PHASE
SOURCE PROCESSOR
• MAP
• LSTIN
• ALTNO
• RLSCOMP
LSTOU PROCESSOR
• LSTOU
• DECK
• XREF

COBOL-74 COMPILER EXECUTIVE

- CONTROLS FLOW OF COMPILER FROM PHASE TO PHASE
- PROVIDES ABORT RECOVERY AND WRAP-UP
- PROVIDES I/O INTERFACE WITH CP-6
- PROVIDES CP-6 MONITOR INTERFACES
- PROVIDES OTHER MISCELLANEOUS SUPPORT FUNCTIONS

COBOL-74 GENERATOR PHASE

TRANSLATION OF INTERNAL LANGUAGE LIST (ILL) AND EXPRESSION TRIAD TABLE (ETT) ITEMS INTO OBJECT CODE.

- INPUT
  - INTERMEDIATE FILE: ILL FROM ANALYZER
  - CORE RESIDENT TABLES: ETT, ST, LTS, SYSSM, ETC.
- OUTPUT
  - CP-6 OBJECT FILE
  - *1 FILE (LSTOU INFORMATION)

COBOL-74 ANNOTATOR

- PRODUCES SOURCE LISTING OF COBOL COMPILER
- PRODUCES SYMBOLIC LISTING OF GENERATED OBJECT CODE
- PRODUCES SYMBOL CROSS REFERENCE REPORT
- PRODUCES STORAGE MAP
- PRODUCES OBJECT DEBUG SCHEMA
- PRODUCES COMPILER STATISTICS

COMPATIBILITY

- CP-5
  - FLOATING POINT DATA TYPES
  - MULTIPLE ENTRY POINTS
  - LABEL PROCESSING USE PROCEDURES
  - RUNTIME OPTIONS
  - 30 CHARACTER ID-NAMES
- GCOS-III
  - INCORPORATION OF CP-5 ENHANCEMENTS
  - SINGLE COMPILER SOURCE

PERFORMANCE

- COMPILER
  - SIZE 42K BASE
  - SPEED 3000 LPM
  - NOT SHARED

- OBJECT
  - EFFICIENCY
  - SIZE
  - SHAREABLE

LANGUAGE FEATURE TESTING

- USE EXISTING TEST PROCEDURES
- TEST IN LEVEL 66 ENVIRONMENT

CP-6 OBJECT TESTING

- USE EXISTING TEST PROGRAMS
- COMPILE ON LEVEL 66; EXECUTE ON CP-6
- REQUIRES EXTENSIVE MODIFICATION OF TEST PROCEDURES

COMPILER TESTING

- USE EXISTING TEST PROGRAMS, TRANSPORTED TO CP-6 IN SOURCE FORM
- USE EXISTING (SELF-CHECKING) TEST PROCEDURES MODIFIED TO EXECUTE ON CP-6

SCHEDULE & MILESTONES

	DATE START	COMPLETE
• FUNCTIONAL ENHANCEMENTS	732	834
FLOATING POINT DATA TYPE		
MULTIPLE ENTRY POINTS		
LABEL PROCESSING USE PROCEDURES		
• CP-6 OBJECT I/O	733	827
• CP-6 RUNTIME LIBRARY	733	826
• CP-6 OBJECT UNIT	730	830
• DEBUG SCHEMA	728	832
• COMPILE TIME MODIFICATIONS	730	830
• COMPILER INTEGRATION	826	839
• SYSTEM TEST	840	913

MAINTENANCE STRATEGY

INTERFACE - LADC

- RESPONSES/VERIFICATION
- TESTING ON GCOS-III (LANGUAGE)
- TESTING ON CP-6
- CORRECTIONS ISSUED

OBJECTIVE - SINGLE COMPILER SOURCE

- CP-6 I/O INTERFACE
- CP-6 MONITOR INTERFACE
- CP-6 SORT INTERFACE
- CP-6 IDS-II INTERFACE
- CP-6 OBJECT UNITS
- CP-6 RUNTIME LIBRARY
- CP-6 DEBUG SCHEMA

PL/I

- IMPLEMENTATION LANGUAGE (SUBSET)
    - COBOL-74
    - IDS-II
- CROSS COMPILER ON GCOS-III
- EXPORT FACILITY TO CP-6 (OBJECT)
- PL/I RUNTIME ON CP-6

PL/I STRUCTURE

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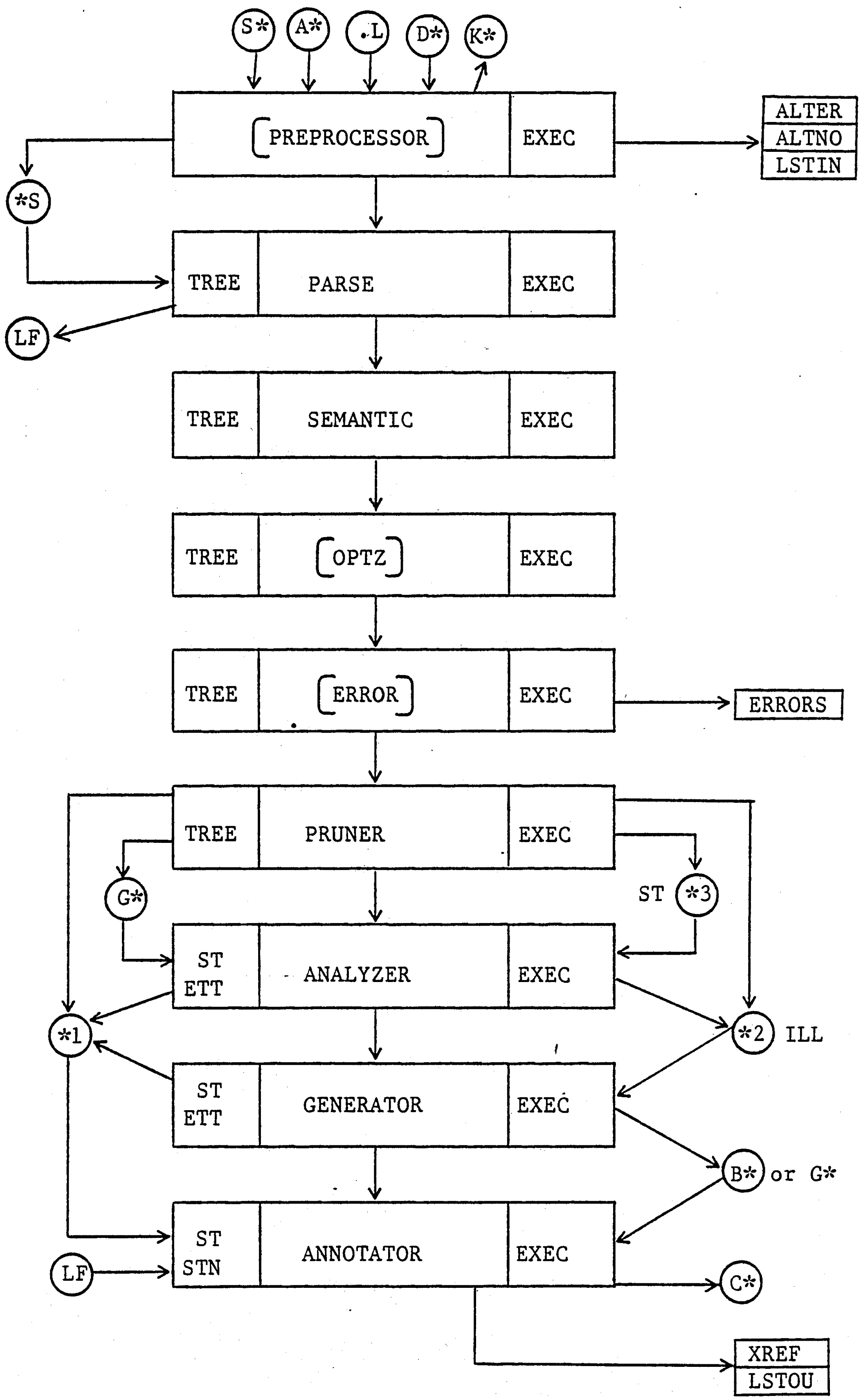
PL2.0



S*
A*
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PREPROCESSOR
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PRUNER
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ANALYZER
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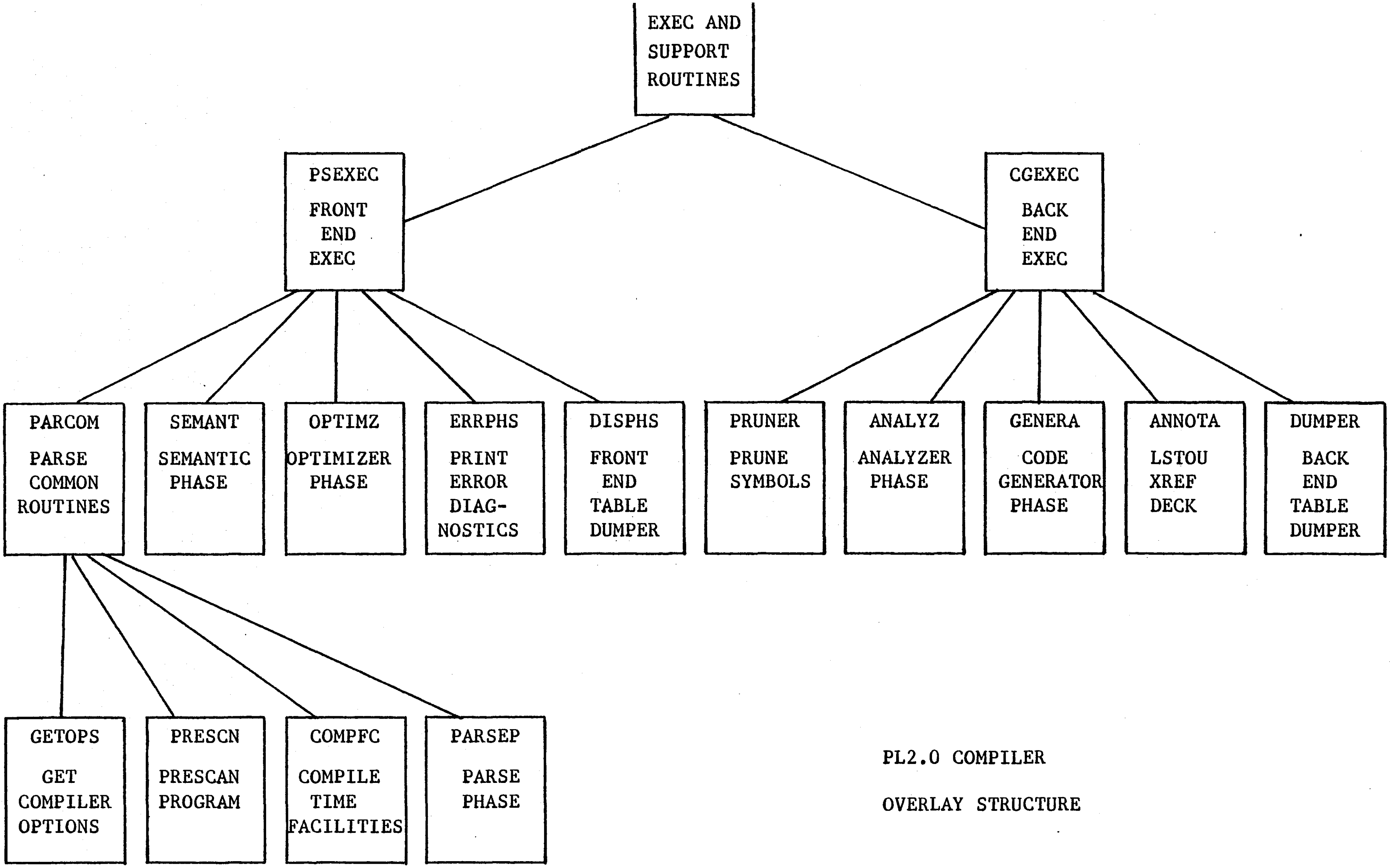
XREF
LSTOU



PL2.0 COMPILER

OVERLAY STRUCTURE

PL/I SCHEDULE

GCOS-III PL/I

- CURRENT STATUS

  RECOMPILED COBOL-74
  RECOMPILING ITSELF

- FIELD TEST — FW744
- PRODUCT PL/I — FW752

CP-6 PL/I CROSS COMPILER

- IMPLEMENTATION — FW747-FW831
- SYSTEM TEST — FW832-FW843
- AVAILABILITY (COBOL-74) — FW835
- TWO ADDITIONAL PEOPLE — FW826

CP-6 PL/I COMPILER

- AVAILABLE — FW852

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CP-6 PRELIMINARY DESIGN REVIEW

SORT/MERGE

- PRODUCT STRUCTURE
- CP-V COMPATIBILITY
- PERFORMANCE
- TESTING
- SCHEUDLE
- MAINTENANCE STRATEGY

JAW
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SORT/MERGE PRODUCT STRUCTURE

- USES BOTH CP-V AND GCOS III ALGORITHMS
  - REPLACEMENT/SELECTION SORT TOURNAMENT
  - BOTH POLYPHASE AND STANDBY TAPE SORT
  - MINIMUM TREE DISK SORT
- USES CP-6 MONITOR FOR INPUT/OUTPUT
- IMPLEMENTED IN COMBINATION OF PL/6 AND ASSEMBLY LANGUAGE
- IMPLEMENTATION AND DOCUMENTATION VIA CP-6 SOFTWARE FACTORY ON CP-V

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SORT/MERGE PRODUCT STRUCTURE

- COMBINATION OF
  - LINKABLE SUBROUTINES
  - SHARED SUBROUTINE LIBRARY MODULES

- LINKABLE SUBROUTINES
  - COBOL-74/SORT INTERFACE
  - COBOL-74/MERGE INTERFACE
  - SORT FREESTANDING DRIVER
  - MERGE FREESTANDING DRIVER

- SHARED SUBROUTINE LIBRARY MODULES
  - PARAMETER VALIDATION
  - KEY COMPARISON COMPILER
  - SORT TOURNAMENT DRIVER
  - SORT COLLATION DRIVER
  - SORT COLLATION INPUT ROUTINE
  - SORT COLLATION OUTPUT ROUTINE
  - SORT STRING DISTRIBUTION MANAGER
  - SORT STRING COMBINATION MANAGER
  - MERGE COLLATION DRIVER

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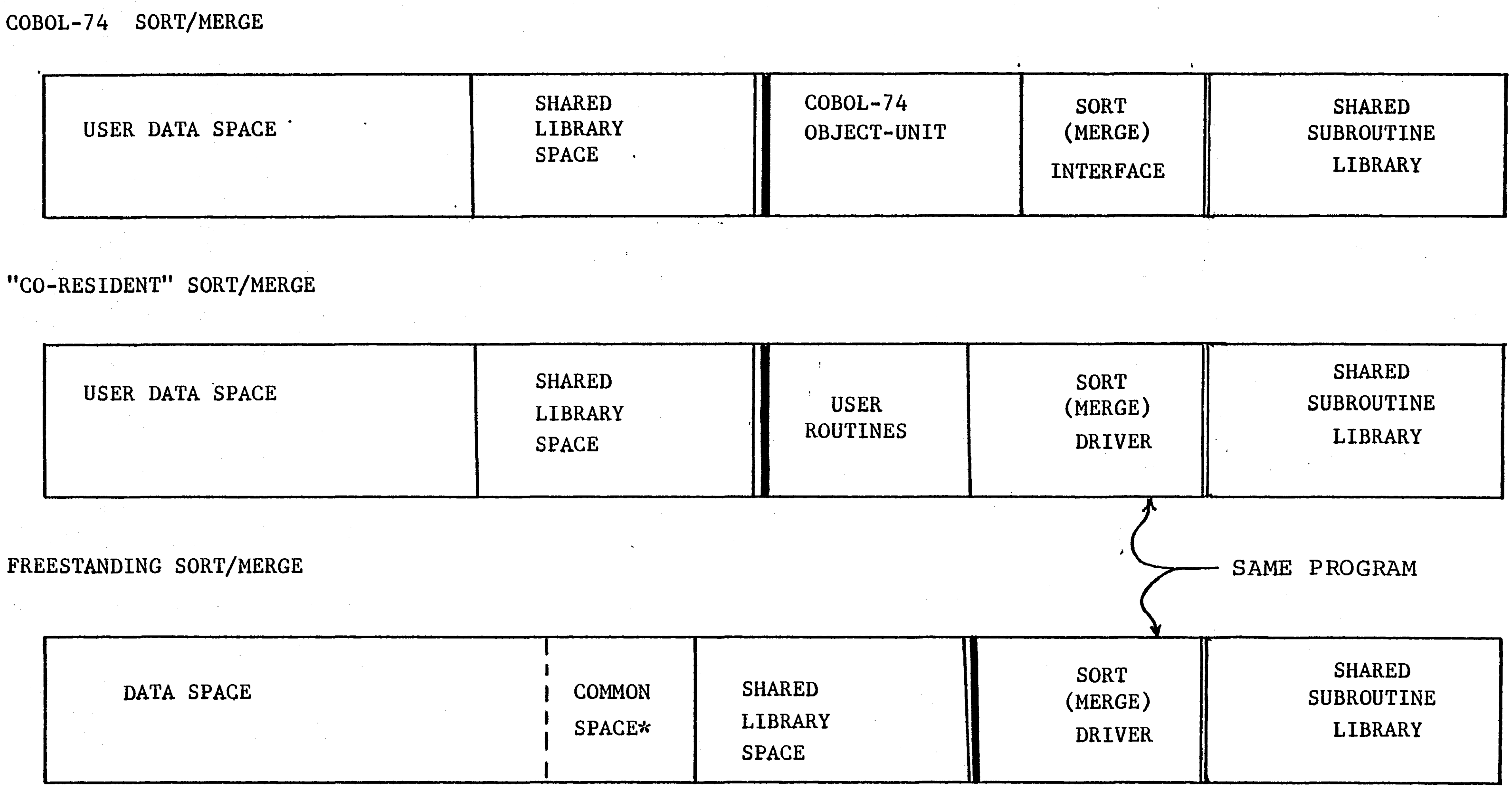

*WHEN INVOKED VIA M$LINK

SORT/MERGE COMPATIBILITY

- HIGH CP-V COMPATIBILITY IN
  - KEY DESCRIPTION AND TRANSLATION
  - RECORD DESCRIPTION
  - FILE POSITIONING
  - USER OWN-CODE INTERFACES

- FULL COMPATIBILITY WITH COBOL-74

- WILL EXECUTE IN EITHER BATCH OR TIMESHARING MODE

- FULL COMPATIBILITY WITH ANS FORMAT TAPES AND ALL CP-6 FILE TYPES

- DIFFERS FROM CP-V IN
  - BLOCK DIRECTIVE DELETED IN FAVOR OF LABEL INFORMATION
  - LIMIT DIRECTIVE MODIFIED
  - NEW DATA TYPES ADDED FOR COBOL-74

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SORT/MERGE PERFORMANCE

- GOALS
  - PERFORMANCE EQUIVALENT TO GCOS III
  - DISK SORT SPACE NOT TO EXCEED 1.2 X INPUT FILE SIZE
- FINAL PERFORMANCE HIGHLY DEPENDENT ON MONITOR I/O PERFORMANCE

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SORT/MERGE TESTING

- PLAN TO USE SORT/MERGE SYSTEM AS OPERATING SYSTEM TEST VEHICLE

- PLAN EXTENDED UNIT AND SYSTEM TESTING TO REFINE PERFORMANCE

- PLAN EXTENDED COBOL-74 SORT/MERGE TESTING VIA FEDERAL AUDIT ROUTINES

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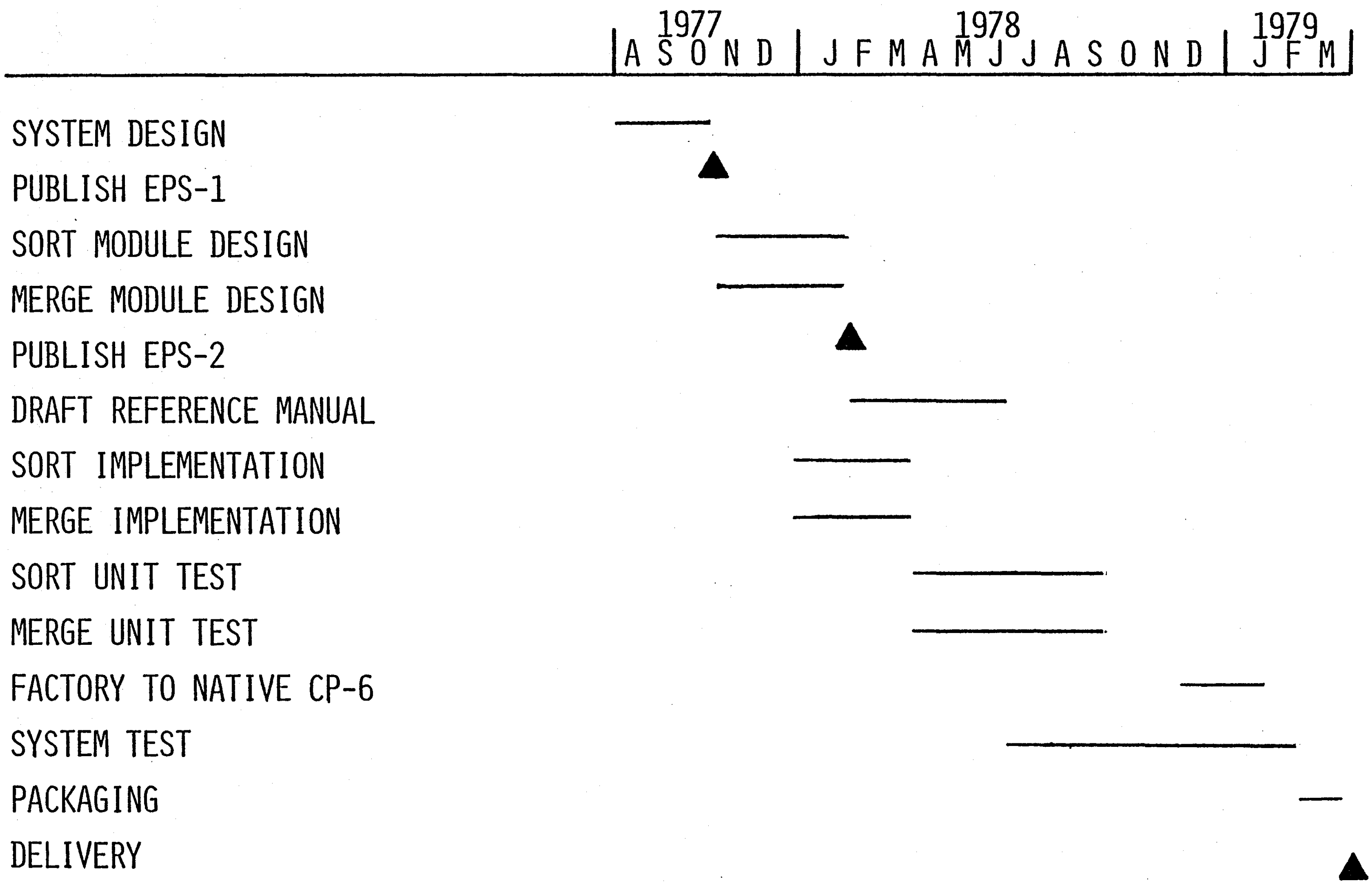
SORT/MERGE SCHEDULE



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SORT/MERGE MAINTENANCE STRATEGY

- MAINTAINED ON CP-6 SYSTEM

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CP-6 PRELIMINARY DESIGN REVIEW

GMAP6

- PROCESSOR STRUCTURE
- COMPATIBILITY
- PERFORMANCE
- TESTING
- SCHEDULE
- MAINTENANCE STRATEGY

GAM
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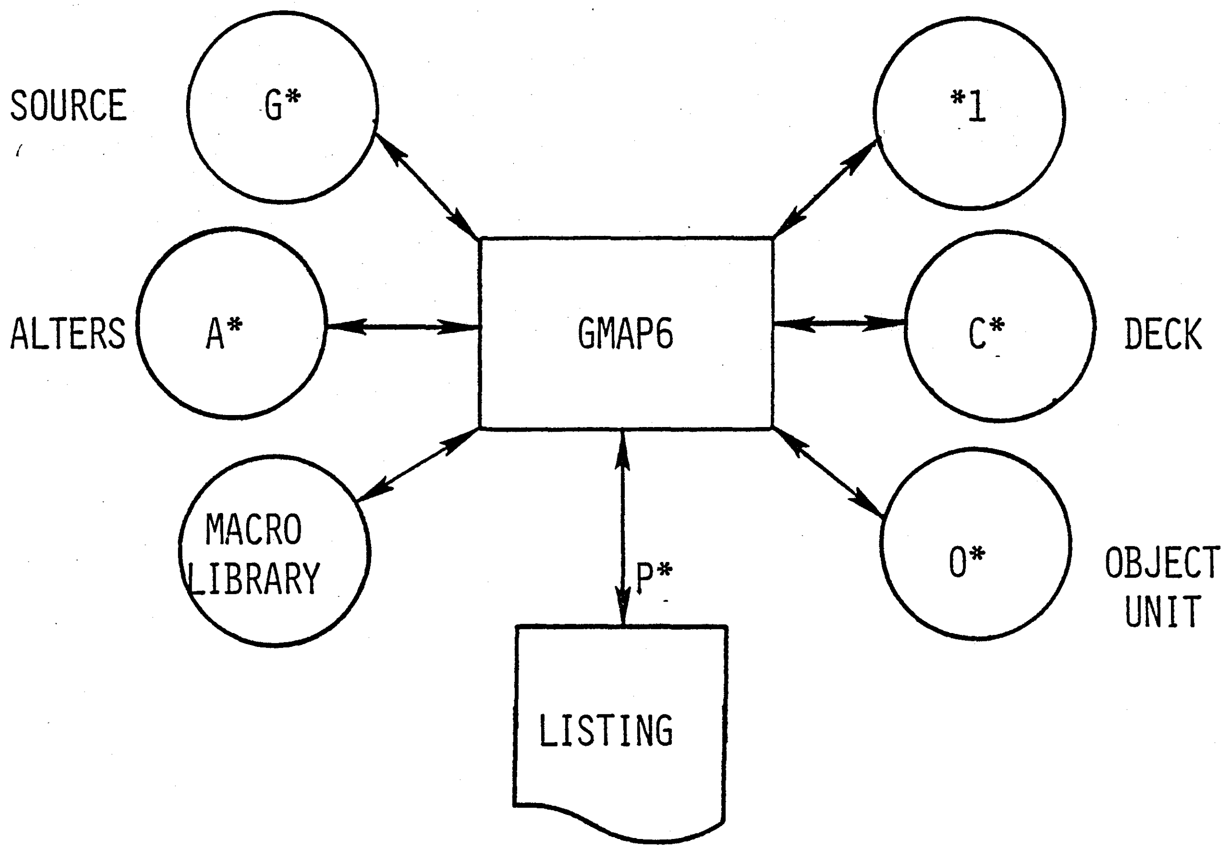

GMAP6 STRUCTURE

FILE UTILIZATION

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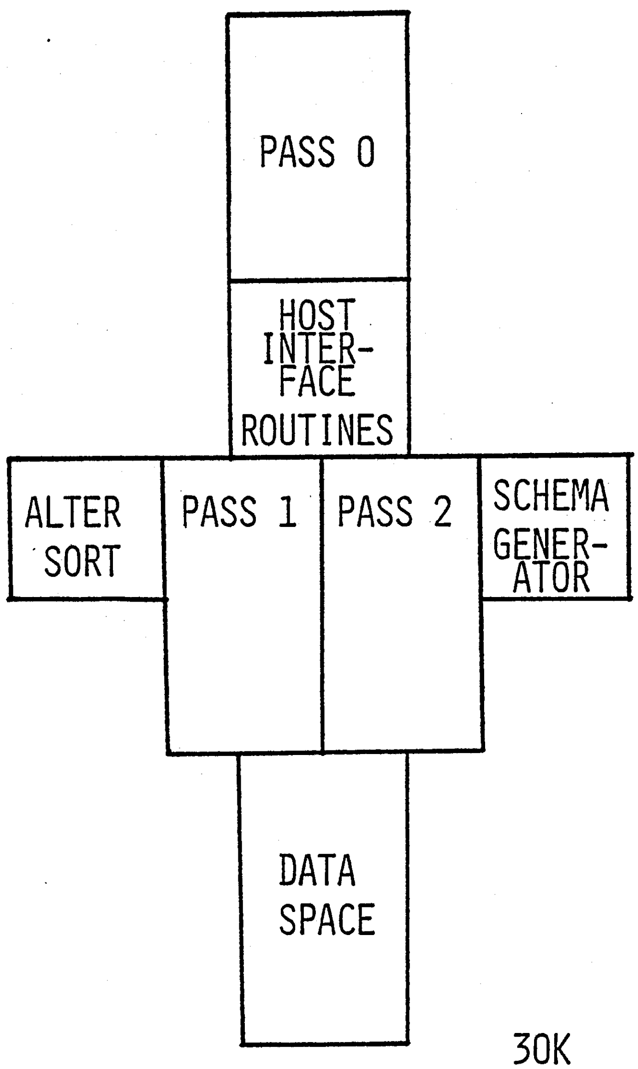
GMAP6 STRUCTURE

STORAGE UTILIZATION



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GMAP6 COMPATIBILITY

- GCOS66
    - COMMON PROCESSOR/COMMON LANGUAGE
    - SYSTEM PERSONALITY MACROS DIFFER
    - ALTER MECHANISM MAY DIFFER
    - LOGICALLY SIMILAR OBJECT UNITS
- CP-V
    - NONE
- GCOS-III
    - LARGELY COMMON LANGUAGE
    - GMAP6 ADDS SECTION/SEGMENT VISIBILITY
    - SOME DIFFERENCES IN PSEUDO-INSTRUCTIONS
    - DIFFERENT OBJECT OUTPUT FORMATS

GMAP6 PERFORMANCE

- TARGET IS PARITY WITH GCOS EXECUTION OF GMAP AND APPROXIMATELY SAME CORE REQUIREMENTS.
- GMAP ON GCOS VARIES (DEPENDING ON MACRO USE) FROM 5000 - 20000 SOURCE STATEMENTS PER MINUTE OF PROCESSOR TIME ON A 66/80.
- ACTUAL PERFORMANCE MAY VARY FROM THIS TARGET AS A FUNCTION OF CP-6 I/O. HOWEVER, NO PERFORMANCE PROBLEMS ENVISIONED AT THIS TIME.
- GMAP6 IS NOT SHARED IN RELEASE 1.

GMAP6 TESTING

- IMPLEMENTATION VERSIONS
  - LIMITED SPECIFIC TESTING FOR NEW FEATURES
  - LIMITED GENERAL TESTING
  - ACTUAL USE IN DEVELOPMENT OF CP-6 AND LANGUAGE SYSTEM SUPPORT ROUTINES

- FINAL VERSION
  - SELF ASSEMBLED
  - LIMITED GENERAL TESTING
  - ACTUAL USE IN ASSEMBLY OF ALL SYSTEM TEST VERSIONS OF CP-6 AND ITS PRODUCT SOFTWARE

GMAP6
DEVELOPMENT SCHEDULE
MILESTONES

- PHASE 1 FW 748
  - PROVIDE SECTION DECLARATION
  - SYMDEF/SYMREF ENHANCEMENTS
  - PROVIDE FOR SYSTEM MACRO SUBSTITUTION
  - PRODUCE EXPORT OBJECT UNIT
  - RUN UNDER GCOS III
  - INTERNAL RELEASE ONLY
- PHASE 2 FW 813
  - PRODUCE PROGRAM SCHEMA
  - ENHANCED RELOCATION FLEXIBILITY
  - STILL RUNS UNDER GCOS III
  - STILL PRODUCES EXPORT OBJECT UNIT
  - INTERNAL RELEASE ONLY
- BEGIN NATIVE TEST FW 826
  - RUNS UNDER CP6
  - NO OBJECT UNIT OUTPUT
  - TEST VEHICLE ONLY
- BEGIN SYSTEM TEST FW 839
  - MERGE GMAP66 (ADF2V) FEATURES
  - COMMON PROCESSOR WITH GCOS66
  - CAPABLE OF ASSEMBLING SELF
  - PRODUCES CP6 OBJECT UNIT
- SHIP FW 913

GAM

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GMAP6
MAINTENANCE STRATEGY

- COMMON PROCESSOR WITH GMAP66
  - SINGLE SOURCE BASE
  - SINGLE PROJECT TEAM
- SPECIALIZED HOST SYSTEM INTERFACE
  - ISOLATES CP-6 INTERFACES
- PROCESSOR PACKAGING
  - INITIALLY DELIVERED AS EXPORT OBJECT UNITS TO BE CONVERTED AND LINKED ON CP-6 FOR SYSTEM TEST
  - FINAL PRODUCT DELIVERED AS CP-6 OBJECT UNITS

GAM
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CP-6 PRELIMINARY DESIGN REVIEW
PHOENIX SUPPLIED SOFTWARE

- SUMMARY
  - BASED ON EXISTING PRODUCTS
  - MAXIMIZE COMMON SOURCE
  - HIGH DEGREE OF COMPATIBILITY WITH CORRESPONDING GCOS PRODUCTS
  - PERFORMANCE TARGET - PARITY WITH GCOS

I-D-S/II FOR CP-6

- A CODASYL STRUCTURED DATA BASE SYSTEM
- TRANSLATORS CONVERT DDL AND DMCL → SCHEMA
- TRANSLATORS CONVERT DDL → SUBSCHEMA
- GCOS III I-D-S/II PLUS
    - INCREASED SECURITY
    - FIXED 1024 WORD PAGE SIZE
    - SHARED DBCS PROCEDURE (ASL)
    - MULTI-LANGUAGE INTERFACE
    - IMPORTANT EDMS FEATURES
    - ON-LINE TRANSLATION OF DDL, DMCL

I-D-S/II

MOTIVATING FACTORS

- NEW HARDWARE
  - NSA, WORKSPACES, ASL
  - SHARED PROCEDURE IN DBCS
- CP-6 AND GCOS-III SYSTEM DIFFERENCES
  - CONCURRENT ACCESS CONTROL
  - BUFFER MANAGEMENT
  - JOURNALING
  - FILE I/O
  - COMMAND LANGUAGE
- XEROX PARC
  - NEW (OLD) FEATURES

I-D-S/II

MAJOR EDMS & I-D-S/II DIFFERENCES

- NO IDS INDEXED RECORD SET RELATIONSHIPS
- NO IDS LOGICAL RESTRUCTURING PACKAGE
- DIFFERENT DATA TYPES

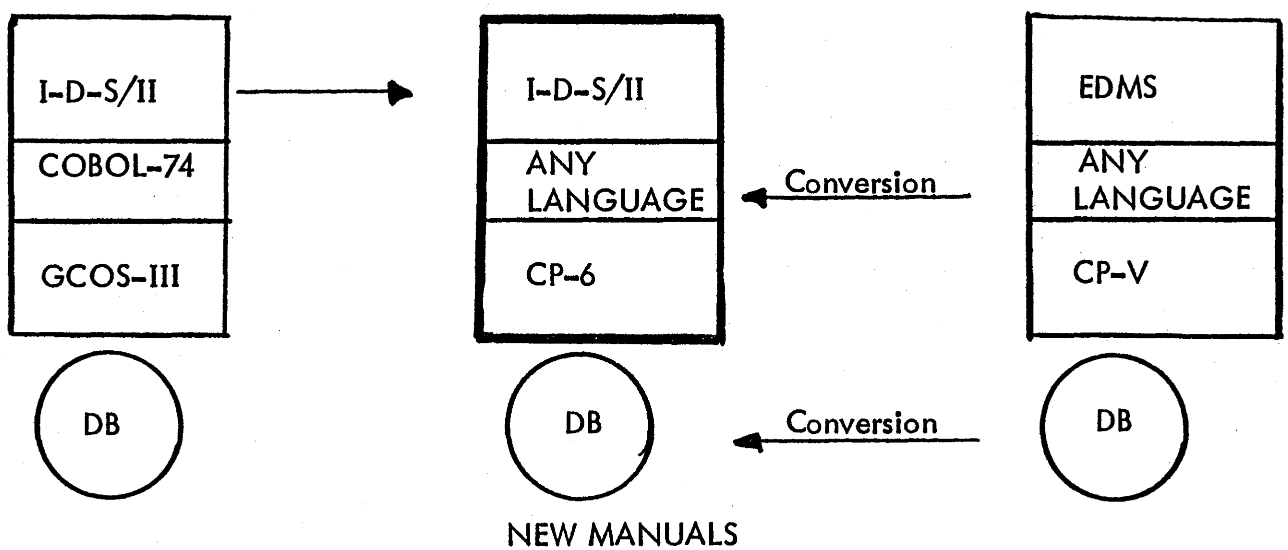
I-D-S/II

NEW FEATURES FOR XEROX PARC

- RUN TIME TRACE
- RUN TIME STATISTICS
- MULTI LANGUAGE INTERFACE
- CHECKSUM OF INTEGRATED FILE PAGES
- ENCRYPTION OF INTEGRATED FILE PAGES
- ENCRYPTION OF COMMON JOURNAL

I-D-S/II

RESOLVING DIFFERENCES



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I-D-S/II

- PRODUCT DELIVERED TO US AS A GCOS III RELEASE

- STRUCTURE

-	DBCS	16,000 Lines	GMAP
-	DBACS	32,000 Lines	PL/1
-	UTILITIES	12,000 Lines	GMAP

- DROPPING
  - INTERACTIVE I-D-S/II
  - PHYSICAL RESTRUCTURING UTILITY
  - DELETE UTILITY

JR 9/19/77

I-D-S/II PERFORMANCE

- 64 μ SEC FOR EACH DBCS CLIMB
- SOME COMPUTE FOR COBOL-74 OIL SLICK
- EXPECT PERFORMANCE TO BE THE SAME AS GCOS III AND EDMS.
- CP-6 WILL HAVE SHARED DBCS PROCEDURE AND SHARED TRANSLATORS AND UTILITIES

I-D-S/II MAINTENANCE

- EACH NEW GCOS III I-D-S/II RELEASE WILL BE A PROBLEM TO BE CONSIDERED INDIVIDUALLY.
- ERRORS AND CUSTOMER PROBLEMS WILL BE SCANNED BEFORE ASKING FOR PHOENIX SUPPORT.
- ALL FIXES FROM PHOENIX WILL REQUIRE REVIEW BEFORE INSTALLATION.

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I-D-S/II

TESTING AND VERIFICATION

- PHOENIX 4J TESTS
- CP-6 FUNCTION TESTS

I-D-S/II

DEPENDENCIES

I-D-S/II DB3.0	OCT	77
ASSEMBLER	DEC	77
CP-6	APR	78
PL/1 FOR CP-6	SEP	78
COBOL FOR CP-6	DEC	78
DELIVERY	APR	79

TWO PERSONS AT PRESENT, ONE OPENING

IDP FOR CP-6

- INTERACTIVE DATA BASE QUERY LANGUAGE
- TOPOLOGY ANALYSIS
- RETRIEVAL OF SEQUENTIAL DATA FILES
- AUTOMATIC OR SPECIFIED REPORT FORMAT
- REASONABLY SMALL (EST 15,000 LINES OF PL-6)

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IDP STRUCTURE

- COMMAND MODULE
- VALIDATION MODULE
- RETRIEVAL MODULE
- DICTIONARY MODULE
- TOPOLOGY MODULE
- REPORT MODULE

RPG-II RUN TIME

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IDP FLOW

- USER ENTERS IDP STATEMENTS OR RUNS A FILE OF IDP STATEMENTS FILLING IN BLANKS
- IDP ANALYZES TOPOLOGY
- IDP GENERATES PROGRAM IN MEMORY AND EXECUTES WITH RUN TIME LIBRARY

IDP

- PERFORMANCE - SAME AS IDP IN CP-V
- MAINTENANCE - ENTIRELY AT LADC
- TESTING - CP-V REGRESSION TESTS PLUS NEW TESTS
- DEPENDENCIES - CP-6, I-D-S/II, SORT
- SCHEDULE - 2Q79
- PRESENTLY ONE PERSON, ONE OPENING

RPGII FOR CP-6

- COMMERCIAL DATA PROCESSING

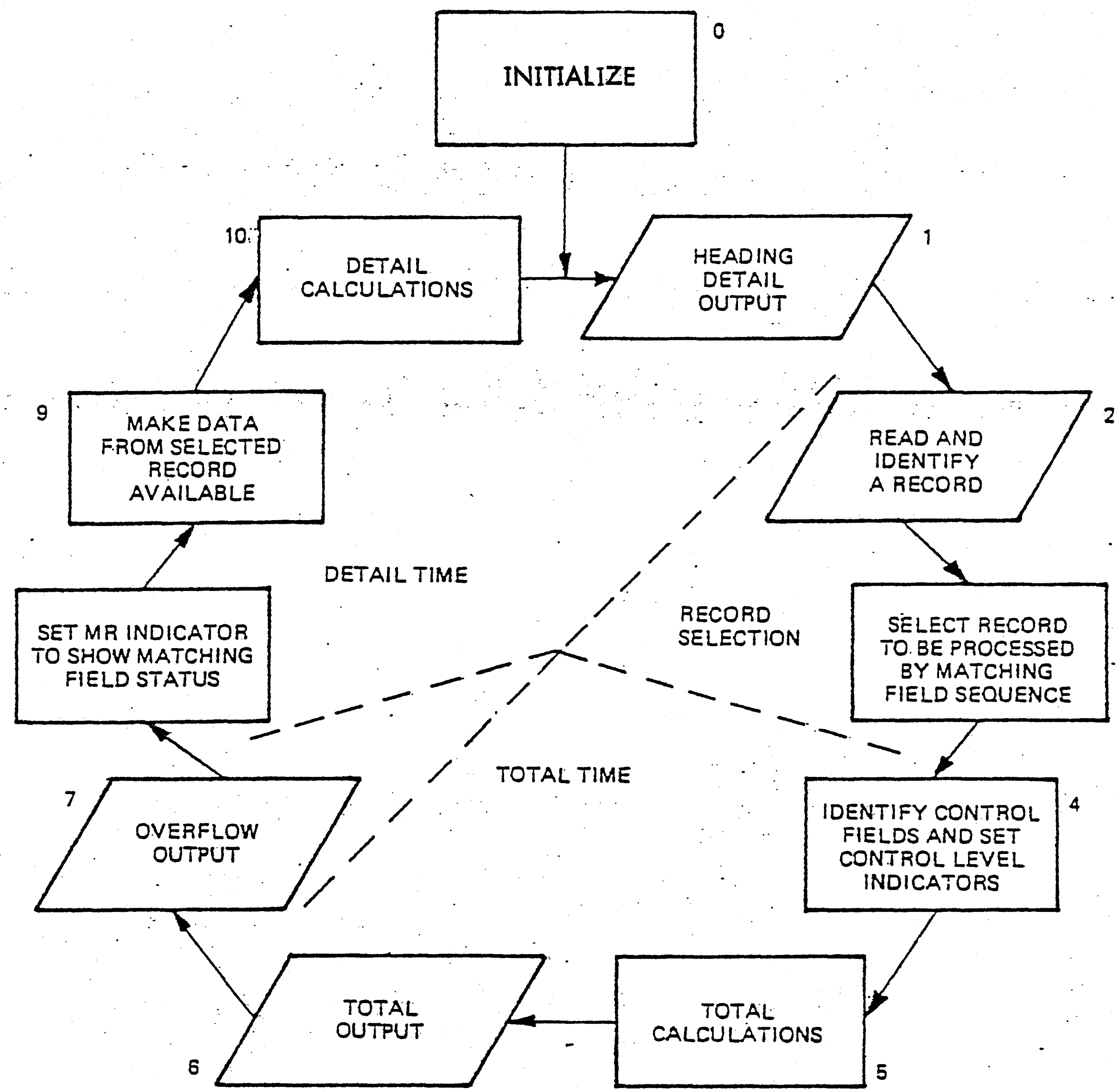
- PROGRAM PHASES

  COMPILATION
  EXECUTION

- COMPATIBILITY

LANGUAGE ELEMENTS

- FILE PROCESSING
- FORMS CONTROL
- OUTPUT EDITING
- OPERATIONS CODES
- FIXED SPECIFICATION FORMS
- FIXED PROGRAM LOGIC


INITIALIZE
0
DETAIL CALCULATIONS
10
HEADING DETAIL OUTPUT
1
READ AND IDENTIFY A RECORD
2
SELECT RECORD TO BE PROCESSED BY MATCHING FIELD SEQUENCE
3
IDENTIFY CONTROL FIELDS AND SET CONTROL LEVEL INDICATORS
4
TOTAL CALCULATIONS
5
TOTAL OUTPUT
6
OVERFLOW OUTPUT
7
SET MR INDICATOR TO SHOW MATCHING FIELD STATUS
8
MAKE DATA FROM SELECTED RECORD AVAILABLE
9
DETAIL TIME
RECORD SELECTION
TOTAL TIME

CP-V RPG VS. CP-6 RPGII

- COMPLETE SUBSET
- RELATIVE I/O
- LOOK AHEAD
- SPREAD CARD/PLACE
- ARRAYS/TABLES
- OPERATION CODE EXTENSIONS

OVERALL STRUCTURE

- 530 DESIGN

  MOM (MACRO OPERATION MACHINE)
  INTERPRET
  RUN-TIME

- COMPILATION PHASES

  FILE AND EXTENSION PROCESSOR
  INPUT PROCESSOR
  CALCULATIONS PROCESSOR
  OUTPUT PROCESSOR
  FINALIZE PROCESSOR

- PERFORMANCE

- SIZE

- SPEED

TESTING AND VERIFICATION

- EXISTING TESTS
- OUTSIDE VENDOR

DEPENDENCIES AND SCHEDULE

- CP-6
- PL-6 STRING FUNCTIONS
- ASSEMBLER
- RELEASE
- RECRUIT

SOFTWARE TEST AND RELEASE CONTROL

HONEYWELL

- TESTING, ANALYSIS AND RELEASE DECISION BY ENGINEERING MANAGEMENT
- COMPREHENSIVE TESTING OF FUNCTION, PERFORMANCE, IMPROPER USE
- STABILITY DETERMINED BY EXPOSURE TO LADC USERS
- SPECIFIC INDIVIDUAL ASSIGNED AS RELEASE MANAGER
- RELEASE DECISION BY MANAGER, LADC

9/19/77 IPR/SK

- EXTERNAL LOAD GENERATOR (QUESTA SYSTEM)
- HARDWARE MONITOR
- TIME-SHARING USER SIMULATOR

- PROVIDES SUPPORT TO THE DEVELOPMENT STAFF AND RELEASE MANAGER
  - DEVELOPS TEST TOOLS AND TECHNIQUES
  - PROVIDES MEASUREMENT AND ANALYSIS SUPPORT
  - LIBRARIAN TO PROVIDE ORGANIZED, DOCUMENTED TEST DATA AND HISTORY

- TEST GROUP ESTABLISHED
  - STAFFING IN PROCESS NOW
  - TOOL BUILDING IN PROCESS NOW
  - ACTIVE MEASUREMENT BEGINS IN EARLY 1978, 1 YEAR BEFORE RELEASE

CP-V TO CP-6 CONVERSION

- PRINCIPAL ORIENTATION TO CONVERSION WHILE CP-V SYSTEM IN PLACE, BUT CAN BE DONE ON CP-6
- WILL NOT CONVERT MACHINE LANGUAGE PROGRAMS
- WILL CONVERT BULK OF:
  - -- HIGH LEVEL SOURCE PROGRAMS
  - -- DATA FILES WITH KNOWN DATA TYPES
- TAPE IS PRIMARY MEDIUM OF CONVERSION
- SPECIFIC CONVERTERS DEVELOPED BY EACH DEVELOPMENT GROUP

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HIGH LEVEL SOURCE PROGRAMS

- CP-6 ANS FORTRAN COMPATIBLE WITH CP-V ANS FORTRAN
- COBOL USES CAPS AND PROGRAMS REQUIRE SOME MANUAL ASSISTANCE
- APL CONVERTER GENERATES APL SOURCE FROM WORKSPACES
- BASIC CONVERTER CONVERTS ALL STATEMENTS WHICH HAVE SAME SEMANTICS IN ANS BASIC
- EDMS SCHEMA CONVERSION TO IDS DATA DEFINITION LANGUAGE

8/31/77 DH

FILE CONVERSION METHODS:

- ALL CHARACTER FILES TRANSPORTABLE VIA ANS TAPE (UNLESS KEYED FILES)
  - -- CP-V CAN WRITE ASCII, CP-6 CAN READ EBCDIC
- OTHER FILES USE ONE OF TWO METHODS:
  - -- DATA CONVERSION PACKAGE, CP-6 TAPE WRITE PACKAGE ON CP-V
  - -- CP-V TAPE READ PACKAGE, DATA CONVERSION PACKAGE ON CP-6

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CP-6 MAJOR MILEPOSTS

• Transition to Honeywell	July	1976
• Begin CP-6 Architecture Phase	July	1976
• Level 66A Installation	November	1976
• Begin CP-6 Detail Design and Implementation Phase	January	1977
• A-System First L66 Code	February	1977
• B-System Software Factory	May	1977
• C-System PL-6	July	1977
• Level 66B Installation	September	1977
• Complete CP-6 Architecture Phase	September	1977
• F-System - File Management	November	1977
• H-System - Time Sharing	February	1978

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CP-6 MAJOR MILEPOSTS (continued)

• Four Million Words on L66B	February	1978
• Second CP L66B	March	1978
• K-System - Batch	June	1978
• Language Processors	July	1978
• Demonstration (K-System)	August	1978
• First Release Implementation Complete	October	1978
• In-House ALPHA Test	November	1978
• In-House Beta Test	January	1979
• Customer Benchmark	March	1979
• Final System Build (S-System)	May	1979
• Controlled Field Release	June	1979

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CP-6 PROGRESS TO DATE

DESIGN REVIEW -

- 40 Documents
- Over 2100 pages

SOURCE

- In Checkout

16,000 (PL-6) 6,000 (Assembler) D-System

SOURCE

- Awaiting Checkout (Estimate)

26,500 . (PL-6) 12,000 (Assembler)

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CP-6 PROGRESS TO DATE

A-SYSTEM	Checkout Bootstrap Environment
	Mini I/O
	Mini DELTA
	Mini Boot
	Used GCOS GMAP - ABS LOAD
	Used NSA (WSQO)
B-SYSTEM	Software Factory Test
	BMAP
	LINK
	DEF
	Established Monitor Environment (WSQ1)
C-SYSTEM	PL-6 Test
	Unit Test
	Memory Management
	CPU Scheduler
	Service Decoder
	Fault Handler
D-SYSTEM	Stabilize C-System
	Basis for Parallel Checkout and Integration

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Δ AARDVARK
MINI-DELTA
MINI-I/O

Δ BISON
FACTORY LINK
FACTORY DEF
INITIAL

Δ COYOTE
MM
SCHED
SERVICE DECODER
FAULT HANDLER
PL-6 MODULES

Δ DINGO
TEST DRIVERS
STABLE SYSTEM

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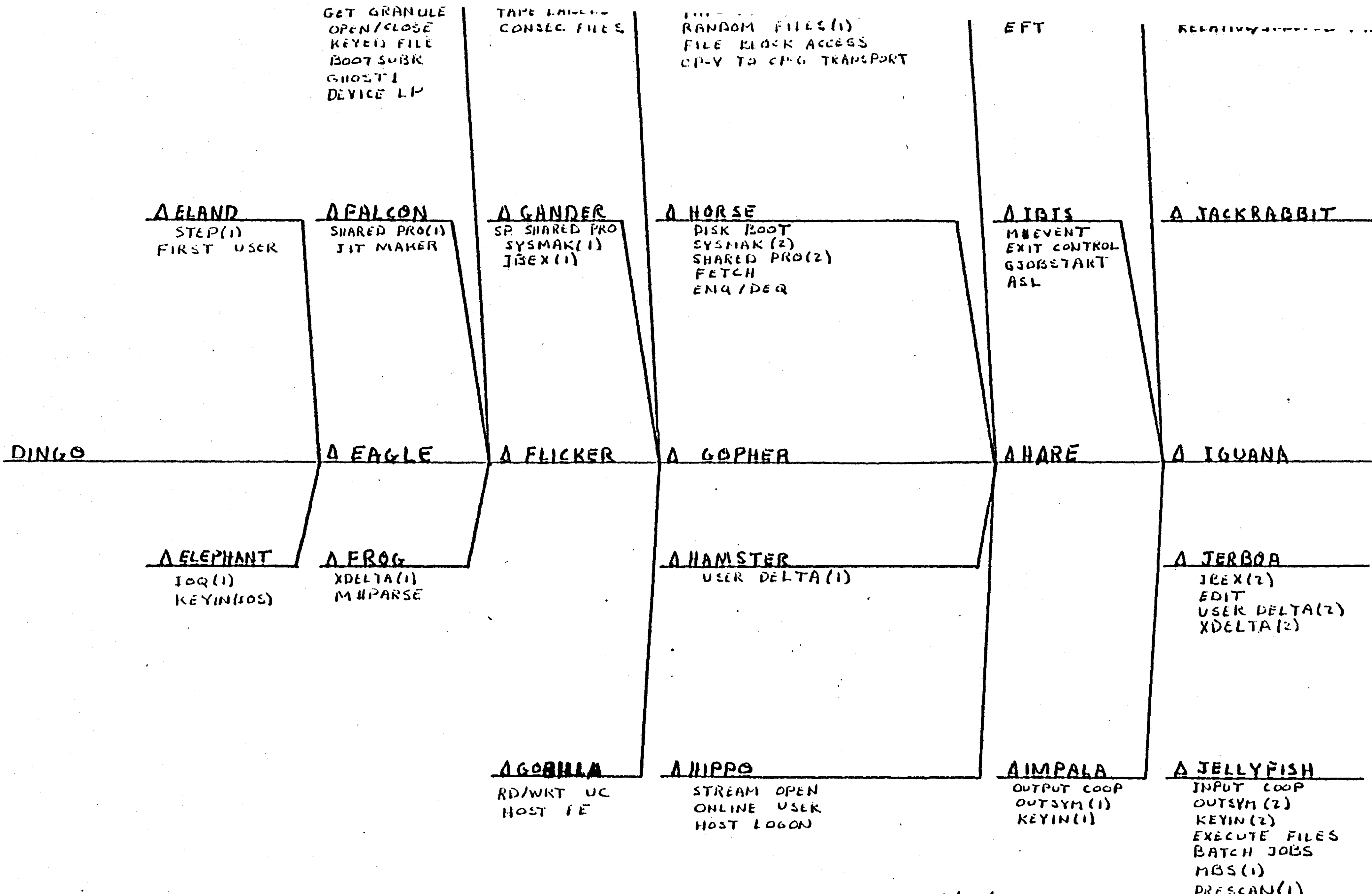
GET GRANULE
OPEN/CLOSE
KEYED FILE
BOOT SUBR
GHOST1
DEVICE LP
CONSEC FILES
RANDOM FILES(1)
FILE BLOCK ACCESS
CP-V TO CP-6 TRANSPORT
EFT
Δ ELAND
STEP(1)
FIRST USER
Δ FALCON
SHARED PRO(1)
JIT MAKER
Δ GANDER
SP SHARED PRO
SYSMAK(1)
JBEX(1)
Δ HORSE
DISK BOOT
SYSMAK (2)
SHARED PRO(2)
FETCH
ENQ/DEQ
Δ IBIS
M#EVENT
EXIT CONTROL
GJOBSTART
ASL
Δ JACKRABBIT
DINGO
Δ EAGLE
Δ FLICKER
Δ GOPHER
Δ HARE
Δ IGUANA
Δ ELEPHANT
IOQ(1)
KEYIN(IOS)
Δ FROG
XDELTA(1)
M#PARSE
Δ HAMSTER
USER DELTA(1)
Δ JERBOA
JBEX(2)
EDIT
USER DELTA(2)
XDELTA(2)
Δ GORILLA
RD/WRT UC
HOST FE
Δ HIPPO
STREAM OPEN
ONLINE USER
HOST LOGON
Δ IMPALA
OUTPUT COOP
OUTSYM(1)
KEYIN(1)
Δ JELLYFISH
INPUT COOP
OUTSYM (2)
KEYIN (2)
EXECUTE FILES
BATCH JOBS
MBS(1)
PRESCAN(1)

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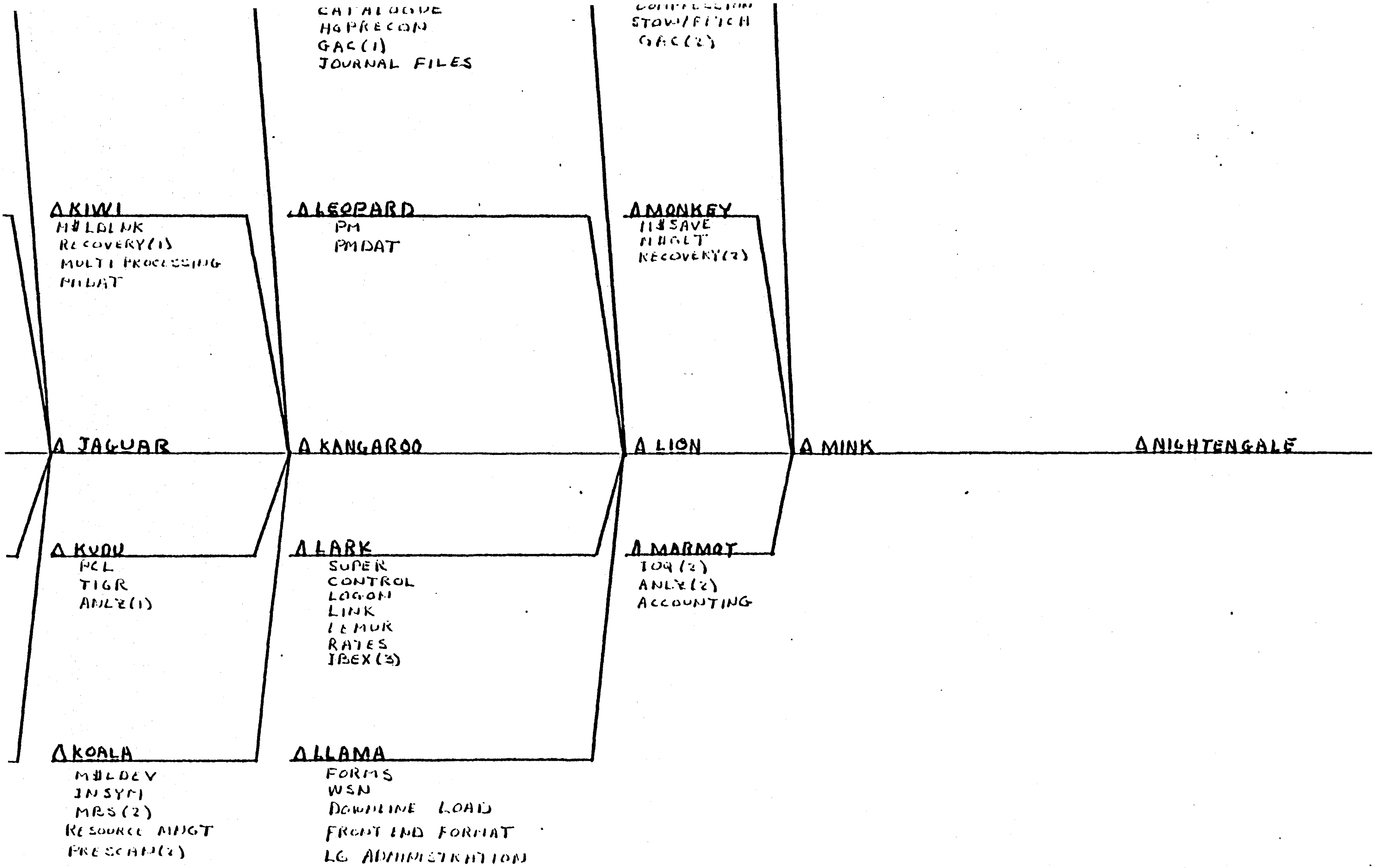
HGPRECON
GAC(1)
JOURNAL FILES
STOW/FETCH
GAC(2)
ΔKIWI
M#LDLNK
RECOVERY(1)
MULTI PROCESSING
PMDAT
ΔLEOPARD
PM
PMDAT
ΔMONKEY
M#SAVE
RECOVERY(2)
ΔJAGUAR
ΔKANGAROO
ΔLION
ΔMINK
ΔNIGHTENGALE
ΔKUDU
PCL
TIGR
ANLZ(1)
ΔLARK
SUPER
CONTROL
LOGON
LINK
LEMUR
RATES
IBEX(3)
ΔMARMOT
TOQ(2)
ANLZ(2)
ACCOUNTING
ΔKOALA
M#LDEV
INSYM
MBS(2)
RESOURCE MNGT
PRESCAN(2)
ΔLLAMA
FORMS
WSN
DOWNLINE LOAD
FRONT END FORMAT
LG ADMINISTRATION

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Δ OCELOT Δ PUMA Δ QUAIL Δ RABBIT Δ SQUIRREL

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- PL-6 to Date
  - No (serious) Code Generator Bugs
- CP-6 Code in PL-6
  - Straight Forward Checkout
    - L66 Hands-on
    - L66 Simulator
- Good Trend
- Too Soon To Tell

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NSA PROBLEM RESOLUTION

- CP-6 - Dependent upon NSA
- CP-6 / NSA Problem Definition
  - L. Krasny (LADC)/R. Mynatt (Phx) - Change Request
- Two Sets of NSA Boards
  - In Hardware Engineering for LADC
- Approved Change Request (C.O.)
  - Install on System P1 (redwire).
  - Install on LADC Boards (Betty McCulley-Phx).
- FED (R. Fawcett) Tests and Sends Boards to LADC (P. Germain).
- NSA T&D (P. Drown)/Phx Sends Tape to LADC (H. Geshwind).
- LADC FED (E. Steinhauer) Coordinates with PHX FED (R. Fawcett).

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NSA PROBLEM RESOLUTION (Continued)

What's Missing ?

- Single Control Point
  - Hardware Changes
  - T & D
- Installation and Checkout Expertise For <u>New Hardware</u> at LADC

SOLUTION

- New Product Test Engineering
  - Coordination
  - Installation

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CP-6 PROBLEMS AND ISSUES

- Test and Diagnostics
  - TOLTS   Interface to CP-6
  - HEALS   FED Errorlog Spec
- CP-V Drain on Management and Programmer Resources
- Software Factory - Dual 560
  - Production for CP-6
  - Test for CP-V

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CP-V	E01	October	1977

- MPC Disks
- Sigma 5 MAP Support (F00)
- Multi - Account Private Packs (F00)
- Multi - Processing Performance Improvement
- 300 SIDRs Closed (CK-97s)

CP-V		December	1977

- Dual Sigma 6/7
- Sigma 6/7 to 256K (with MOS)

CP-V	F00	March	1978

- MPC Tape
- MOS Memory (Single bit error logging)
- 300 SIDRs

CP-V	F01	----