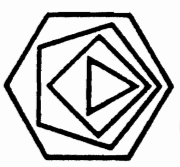
INTERCOMM

for

Systems Programmers



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INTERCOMM FOR SYSTEM PROGRAMMERS

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Release 10.0 -- SM Level 2089 -- 9/15/90

INTERCOMM PUBLICATIONS

GENERAL INFORMATION MANUALS

- Concepts and Facilities
- Planning Guide

APPLICATION PROGRAMMERS MANUALS

- Assembler Language Programmers Guide
- COBOL Programmers Guide
- PL/1 Programmers Guide

SYSTEM PROGRAMMERS MANUALS

- Basic System Macros
- BTAM Terminal Support Guide
- Installation Guide
- Messages and Codes
- Operating Reference Manual
- System Control Commands

CUSTOMER INFORMATION MANUALS

- Customer Education Course Catalog
- Technical Information Bulletins
- User Contributed Program Description

FEATURE IMPLEMENTATION MANUALS

- Autogen Facility
- ASMF Users Guide
- DBMS Users Guide
- Data Entry Installation Guide
- Data Entry Terminal Operators Guide
- Dynamic Data Queuing Facility
- Dynamic File Allocation
- Extended Security System
- File Recovery Users Guide
- Generalized Front End Facility
- Message Mapping Utilities
- Model System Generator
- Multiregion Support Facility
- Page Facility
- Store/Fetch Facility
- SNA Terminal Support Guide
- TCAM Support Users Guide
- Utilities Users Guide

EXTERNAL FEATURES MANUALS

- SNA LU6.2 Support Guide

AUDIENCE:

Intercomm for Systems Programmers is designed for systems programmers responsible for:

- Installing, maintaining and tuning Intercomm
- Supporting applications groups

Experienced Intercomm users should send a representative to this class bi-annually to remain current.

OBJECTIVES:

The primary objective of Intercomm for System Programmers is better Intercomm system support. Students learn basic system architecture for troubleshooting using control block interfaces. Advanced system functions are studied to enhance performance and reliability. Application programming features are reviewed for improved support of application groups.

PREREQUISITES:

Students should have attended the Intercomm Concepts and Facilities class and the Intercomm Application Programming Workshop or have equivalent experience.

A basic knowledge of IBM MVS internals in required, including multitasking and asynchronous processing; interrupt handling; queuing and chaining techniques and control blocks.

At least six months experience with Intercomm system support and maintenance is strictly required.

INTERCOMM FOR SYSTEMS PROGRAMMERS

Table of Contents

1 Introduction and Intercomm Review

1.1 Orientation

1.2 Course Objectives

1.3 Intercomm Architecture

1.4 Intercomm Review

1.5 Messages and Commands

1.6 Installation

1.7 System Startup and Closedown

ORIENTATION AND ADMINISTRATIVE DETAILS

- Pre-requisites
- Student records
- Student Handouts
- Review Course Outline

STUDENT HANDOUTS

Student Materials

Intercomm Manuals

- Intercomm DSECTs
- Operating Reference Manual
- Basic System Macros
- Messages and Codes

INTERCOMM FOR SYSTEMS PROGRAMMERS

1. Introduction and INTERCOMM Review
2. Message Management--Message Collection and Retrieval
3. Execution Management--Dispatcher
4. Resource Management--Manager
5. Data Management--File Handler
6. Application Management--Subsystem Controller
7. TP Network Management--the Front End
8. INTERCOMM in a MVS Environment
9. Multiregion INTERCOMM
10. Link Pack Facility
11. Security/Privacy
12. Database Management Support
13. Contingency Processing: Error Situations, Recovery Options, Logging and Checkpointing
14. ABENDS/SNAPS and Problem Determination Aids
15. Performance Measurement: Tuning and Prediction
16. Supporting Application Groups

BETTER INTERCOMM SYSTEM SUPPORT

Learn: Basic System Architecture
for
Troubleshooting using Control Blocks

Study: Advanced System Functions
for
Performance Enhancement and Tuning

Review: Application Programming Aids
for
Better Support of Applications Groups

BETTER PROBLEM DETERMINATION AND VENDOR INTERFACE

Understand: Basic Architecture,
Installation Procedures,
Documentation
for
Better communication with SEOD,
Better problem descriptions for MSR
reporting

BETTER USE OF SYSTEM AIDS

- Documentation
- Technical Information Bulletins (TIBs)
- User Contributed Library (UCL)
- Annual Maintenance which includes:
  - Problem Reports (MSRs)
  - Experimental SMs
  - System Modifications (SMs)
  - Automated SM Facility (ASMF)
  - New (Revised) Manuals
  - Updates to existing manuals (SPRs)
  - Early Warnings
  - Microfiche
  - XREF Listings (IAIM....)
  - SEOD Support
- User Group
  - Product Enhancement Requests (PERs)
  - Ideas and suggestions from other users
- Funded Development (RPQs)

For each Major Component, the following will be covered:

PURPOSE
- Related Documentation
- Related Features

INSTALLATION REQUIREMENTS
- Globals and SPALIST Parameters
- Function-definition Macros and Tables
- Assemblies and Linkedit
- Files and JCL

INTERFACE STRUCTURE - CONTROL BLOCKS AND DSECTS
- Interface Flow, Entry Points
- Related Modules, Subroutines

FEATURES
- Control Commands
- Status Displays
- Execution Macros
- Tuning & Statistics Reports
- Log Codes
- User Exits

MESSAGES, SNAPS AND ABENDS
- Common Problems

EXERCISE
- Debugging Problems

MAJOR MONITOR FUNCTIONS

Front End (Control Region)

- Network Management

Back End (Satellite Regions)

- Application Program (transaction) Management
- User-written Applications
- Preprogrammed System Applications
- Application Program Service Routines
- System Execution Control
- Message Switching, Queueing and Logging
- Resource Management
- System Facilities (Statistics, Restart/Recovery, etc.)

Further Reference: Concepts and Facilities

Multithreading vs Multitasking

Multitasking--Under operating system control
Interruptable

Multithreading--Under Intercomm Control (Dispatcher)

Dispatcher monitors:

- Threads ready to execute
- Threads "waiting" for a time interval to elapse
- Threads "waiting" for an external event to complete
- Threads "waiting" for an internal event to complete

A MESSAGE THREAD

IS

THE LOGICAL PATH

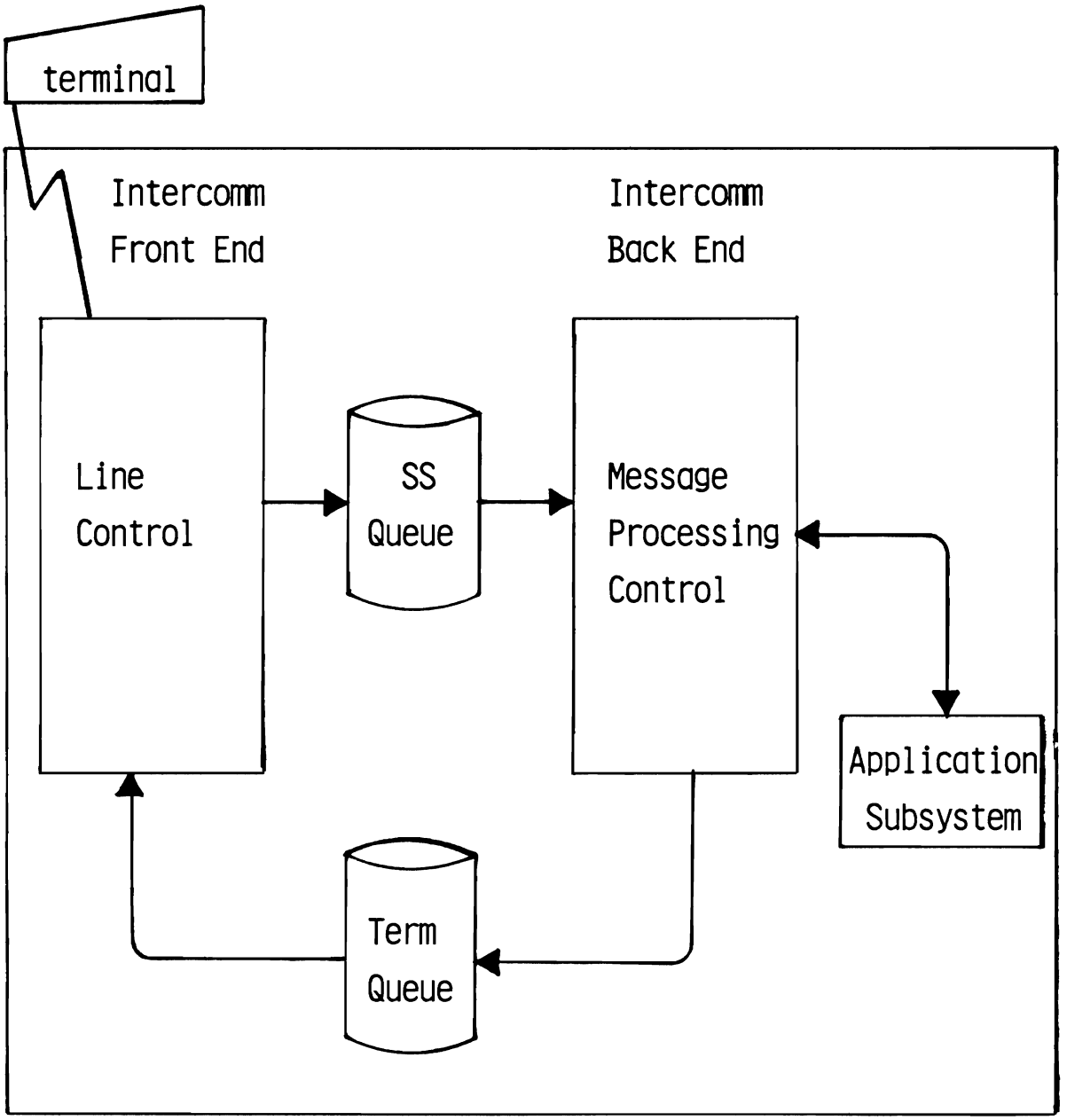
THROUGH 1 SUBSYSTEM

INITIATED BY

ONE MESSAGE.

MESSAGE FLOW OVERVIEW

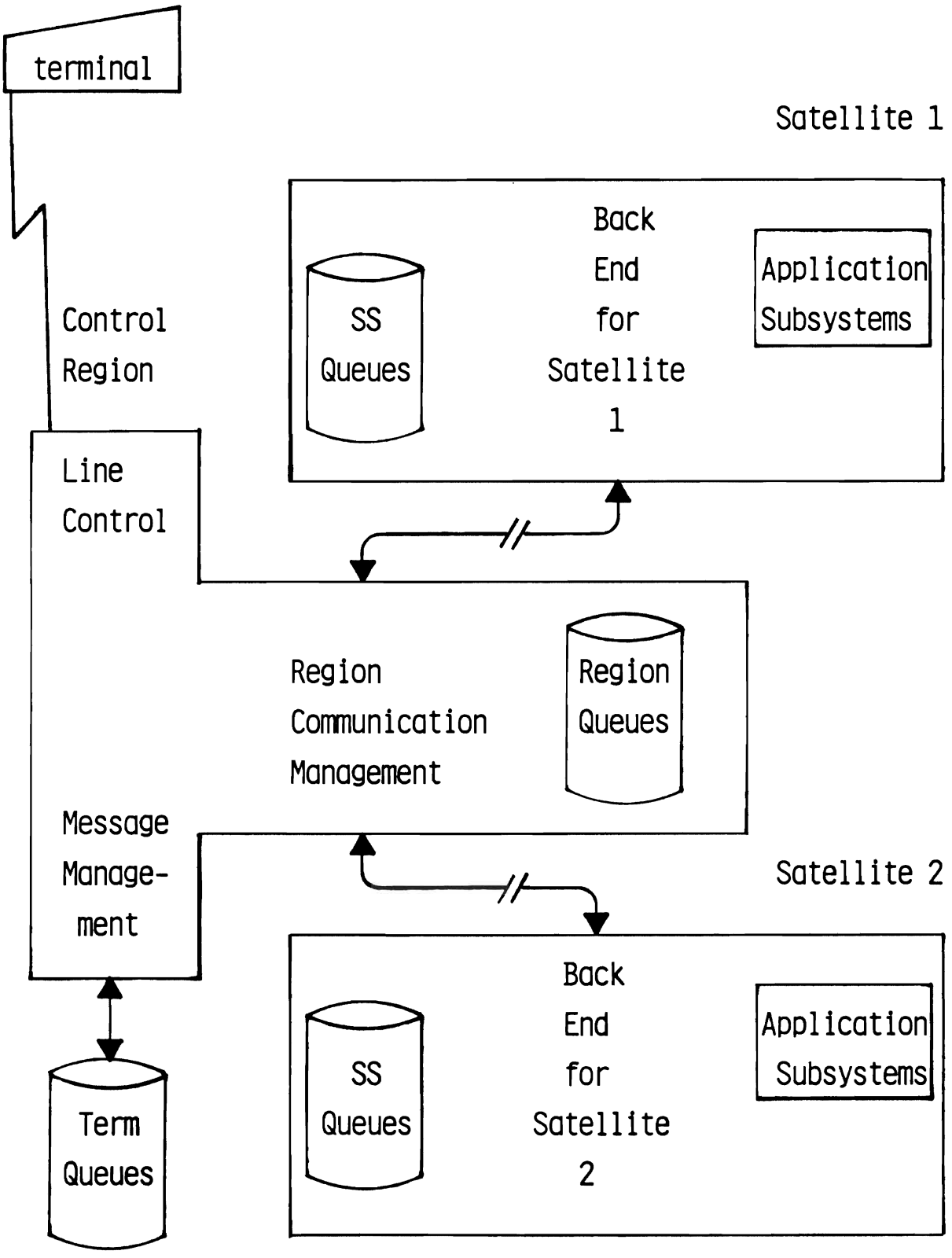
SINGLE REGION INTERCOMM



On-Line System Monitor

SUMMARY OF MESSAGE FLOW

MULTIREGION INTERCOMM



MAJOR INTERCOMM TABLES

Tables which define the Multiregion Environment

- Multiregion Communications Table (MCT)
- Region Descriptor Table (RDT)

Tables which define the Front End

- System Specification

  ENVIRON/SETENV BTSPA VCT

- Transaction Routing (BTVERB)

  Transaction-id Processing program

  Priority Editing

- Network Definition

  LINEGRP VTIDTAB

  BLINE LUNIT

  BTERM LCOMP

  BDEVICE VTCSB

  POLLIST VTLSB

  Terminal Lists (switched) VTLVB

  GFE (TCAM)

  Translate Tables

  AIDGRP AIDDATA

- Queue Specification (SYCTTBL macro)

  BTAMSCTS VTAMSCTS

MAJOR INTERCOMM TABLES (Continued)

Tables which define individual regions (Back End)

- System Specification
  - SPA
  - INTGLOBE/SETGLOBE

- Terminal Specifications
  - STATION
  - DEVICE
  - DVMODIFY
  - BCGROUP

- Program Specification (SYCTTBL)
  - Language
  - Entry Point
  - Queueing
  - Scheduling
  - Residency

- Message Formatting
  - MMU -- Map Definition File
  - EDIT & OUTPUT -- Edit Control Table
    -- Output Format Table

- Storage Resources (ICOMPOOL)

- File Control Specification (IXFDSCTA)

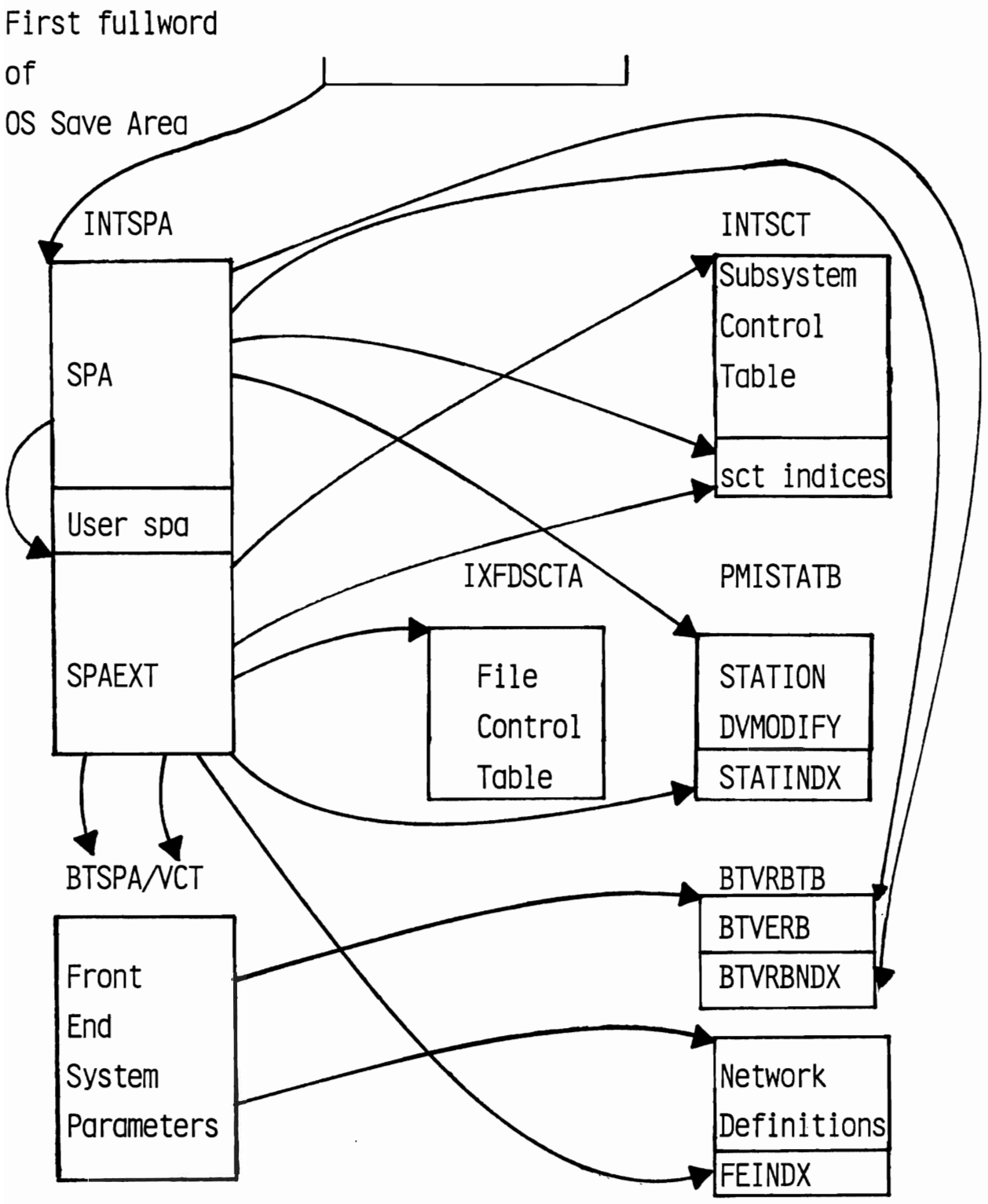
SYSTEM GLOBALS

ENVIRON	&CNTL	Control Terminal Name
	&SEPCHAR	System Separator
	&CLDWAIT	Closedown Message Flush Interval
	&FEPRTY	Front End Execution Priority
	&CONVER	Conversational CRT Control
	&GFE	G.F.E. and/or Extended TCAM Terminals
INTGLOBE	&VSSYSTM	VS Operating System (VS1/MVS)
	&MVS	MVS/370
	&XA	MVS/XA and MVS/ESA
	&BTAM	BTAM/GFE or TCAM Front End
	&VTAM	SNA/VTAM Front End
	&MULTREG	Multiregion Intercomm

Further Reference: BTAM Terminal Support Guide
Operating Reference Manual

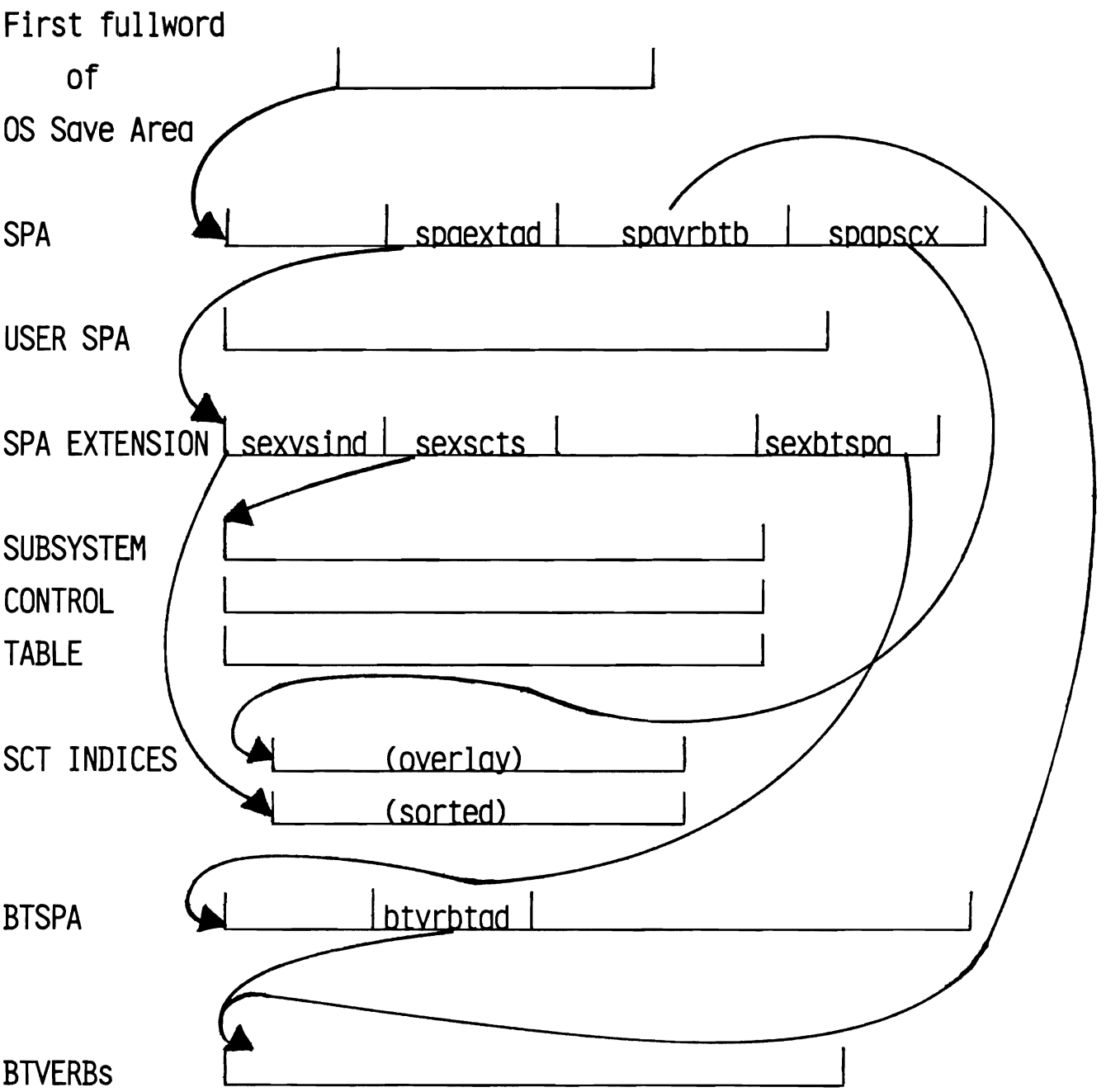
SYSTEM TABLE INTERRELATIONSHIPS

SYSTEM PARAMETER AREA (SPA)



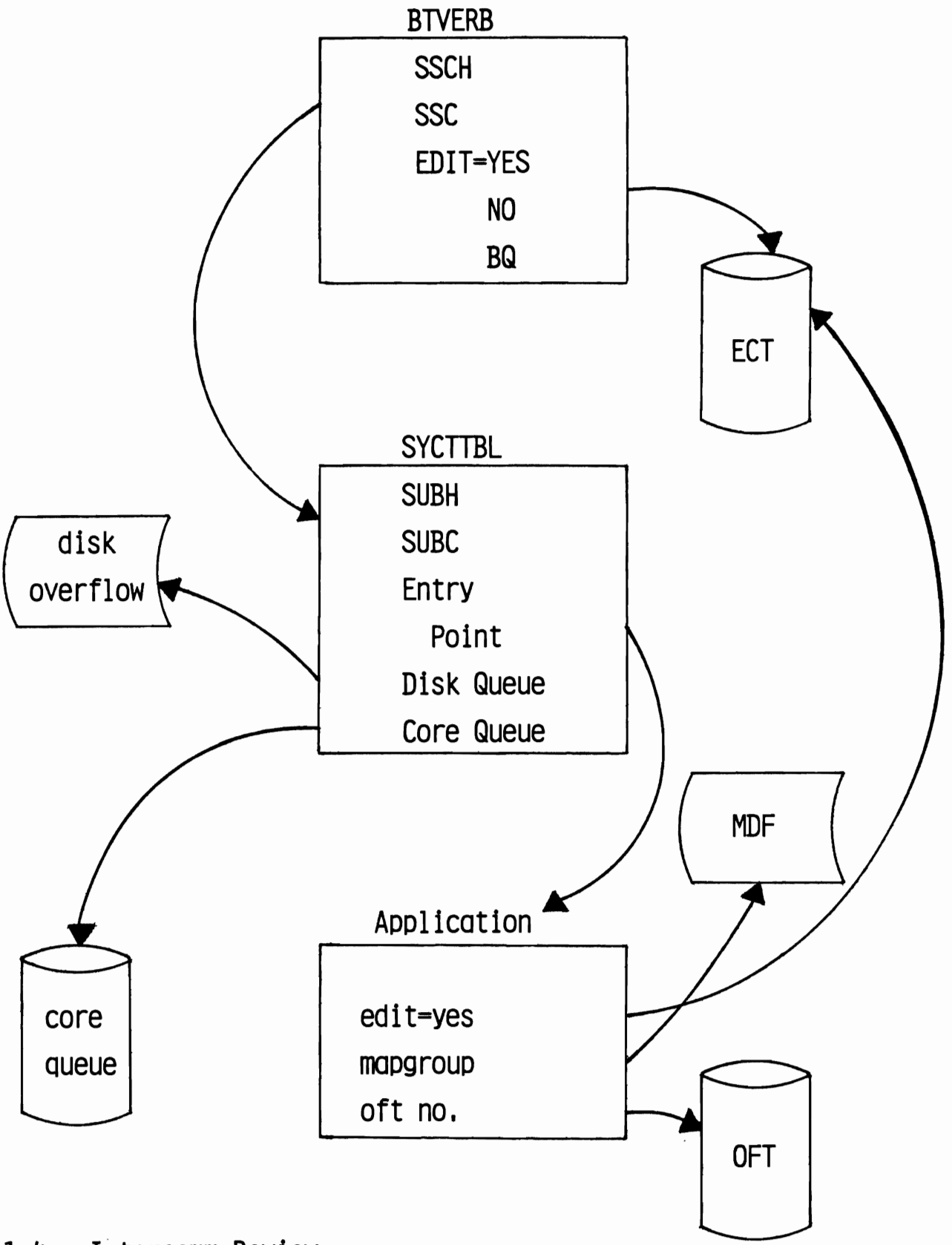
SYSTEM TABLE INTERRELATIONSHIPS

SYSTEM PARAMETER AREA (SPA)



1.4 Intercomm Review

APPLICATION TABLE INTERRELATIONSHIPS



USER-DEFINED TABLES

LISTED BY NAME

INFORMATION GIVEN:

- MACRO's or DC Statements to generate table
- Applicable DSECT's
- Applicable Files
- Brief Description

Further Reference: Operating Reference Manual (Appendix A)

MESSAGES FROM INTERCOMM TO THE OPERATOR

SYSTEM MESSAGES

MESSAGE FORMAT

Message-id - Region-id - Text

JOB/REGION IDENTIFICATION (SEXWTOID):

Jobname -- Single Region Intercomm
CONTROL -- Control Region
Region-id -- Satellite Region (SEXMRID)

MESSAGE IDENTIFIER: iiimmnnnx

iii - Intercomm Message Prefix (SEXWTOPR)
mm - Issuing module/component
nnn - Message number within component
x - Message Type:

I = Informational only - PMIWTO
A = Action Required - PMIWTO
R = Reply Required - PMIWTOR

Further Reference: Messages and Codes

SYSTEM MESSAGES (continued)

SPALIST WTO PARAMETERS

WTOPFX	--	Prefix ID (Default=INT)
FMCSWTO	--	Force System Routing
FPMIWTO	--	Force ICOM Routing
SMCSWTO	--	Suppress System Routing
SPMIWTO	--	Suppress ICOM Routing

USER MESSAGES

Programming Macros: PMIWTO
PMIWTOR
VWTO
VWTOR

User Routing Exit: USRWTO--called by WTOMOD

Further References: Basic System Macros
Messages and Codes

MESSAGES FROM THE OPERATOR TO INTERCOMM

SYSTEM COMMANDS

CONTROL TERMINAL — CPU CONSOLE

ISSUE COMMANDS — WTOR REPLYS

COMMAND RESPONSES

SYSTEM INFORMATION

SYNTAX/PROCESSING ERRORS -- ISSUING TERMINAL

CONTROL TERMINAL COMMAND RESTRICTION

BTVERB verb,SECUR=YES

PRINTED LIST: OUTPUT-- SYSMSG (CPU Console)
SYSPRINT
USERWTO
F2 Log Code
INPUT -- F1 Log Code (USRBTLOG)
SYSMSG (CPU Console)

- STATISTICS/STATUS
- NETWORK CONTROL
- SECURITY CONTROL

  Operator id Terminals

  Transactions/Commands

  Regions Subsystems

- MONITOR CONTROL

  DYNAMIC LOADING

  CLOSEDOWN

  FILES

  SUBSYSTEMS

  QUEUES

  FUNCTIONS

  MULTIREGION

  GPSS

  CORE/TABLE DISPLAYS

SPALIST GPSSEC=FEOVLOG

SSNUM=MAX-GPSS-STRT/STOP-FUNCTIONS

MDELY MAXLOAD

MMNCL STOCORE

Further Reference: System Control Commands

INSTALLATION STANDARDS

LIBRARIES	Source	executable
	SYM....	MOD....
as released		
REL	SYMREL	MODREL
production/ASMF		
LIB	SYMLIB	MODLIB
Tables/User Exits/Mods		
USR	SYMUSR	MODUSR
Experimentals		
XM	SYMXM	MODXM
test		
TEST	SYMTEST	MODTEST

INTERCOMM-SUPPLIED PROCS

ICOMLINK Macro

ICOMGEN Macro

Further References: Installation guide

Basic System Macros

INTERCOMM PROCEDURES

Off-loaded via Installation Job #2 (COPYROX)

ASMOC	Assemble BAL source, create object module
ASMPC	Assemble a BAL source module
ASMPCL	Assemble and linkedit BAL source module
COBUPC	ANSI COBOL source compile
COBUPCL	ANSI COBOL compile, link (NCAL option)
DEFSYM	Generate LOGCHARS language symbols (MMU)
INTASMF	ASMF processing
LIBE	Update a source member
LIBEASM	Update, assemble BAL source
LIBECOBL	ANSI COBOL update, compile and link
LIBELINK	Update, assemble and link BAL module
LKEDP	Linkedit load modules
PLIXPC	Compile PL1--Optimized module
PLIXPCL	Compile, link PL1--Optimized module
PMIPCH	Punch a PDS (source) member (PMIPCH1)
PMIPRT	Print a PDS (source) member (PMIPRT1)
SYMGEN	Generate language dependent symbolic map (MMU)

Further Reference: Installation Guide
Operating Reference Manual

OTHER PROCEDURES AVAILABLE ON SYMREL

ASMPCM	Assemble a macro
COBPC	Compile COBOL-F source module
COBPCL	Compile and linkedit COBOL-F module
COBUPCLD	ANSI COBOL compile and link
COMPRESS	Compress a PDS
COPY	Copy PDS members or compress a PDS
FORTLINK	Compile and link FORTRAN module
LIBCOBDL	Update, compile, link ANSI COBOL
LIBECOB	ANSI COBOL -- update, compile source module
LKEDE	Link object and load modules
LKEDO	Link object modules, create load module
LKEDPL1	Linkedit PL1 modules
LKEDT	Linkedit load modules to MODSCR (test)
OPSCN	Execute OPSCAN -- assembler source scan
PATCH	Patch a load module -- execute IMASPZAP

Further Reference: Operating Reference Manual

UTILITIES/TABLES

BATCHPAK	Intercomm Batch Interface
CHANGER	Produce change deck from two PDS members
CREATEGF	Preformat BDAM data set
DDQPRINT	Print DDQs and/or QIDs
DUMPREST	Print/Dump/Restore Store/Fetch data set
IAIMCOCR	Copy Code Cross-reference Printing
IAIMGOC2	Global Symbols Cross-reference Printing
IAIMMOCR	Macros Cross-reference Printing
IAIMOPCD	Character Strings and Miscellaneous Scans
IAIMXRF1	Csect Sizes, Entry Points, Ext. References, Scan
IAIMXRF2	Print Csect Sizes, etc.
ICOMFEOF	Recover from missing End Of sequential File(log)
KEYCREAT	Preformat keyed BDAM data set
LIBCOMPR	Compare PDS source members
LOADMAPS	Load MMU Map Groups to Store/Fetch data set
LOGANAL	Analyze Log - produce performance statistics
LOGMERGE	Merge 1 to 3 Log files to master Log data set
LOGPRINT	Format and print entire log/selective entries
OPSCAN	Cross-reference Scan BAL op codes
PMIEXLD	Load RCT/VRB/DES/SEC000 data sets
SMS	Table of applied SMs

Further Reference: Operating Reference Manual
ASMF Users Guide

Specification Macros: SMLEVEL - SMS,XMS
SMPROF - ASMFPROF

Control Specifications:

- Macros
- Control Cards
- Execution Parameter Overrides

Load Modules for Execution:

INTASMF	SMS
SMACCEPT	XMS
SMAPPLY	ASMFPROF
SMCOPY	INSORT
SMDELET	LOGIT
SMMAIN	PRTLOG
SMREJECT	PUTSSI
SMSTAT	READD
SMSTOW	

Procedure: INTASMF

Further Reference: ASMF Users Guide

SPALIST MACRO

General System Parameters

```
GENERATION TYPE              A={A}      CSECT
                               {B}      DSECT

                                      {BOTH}
                             ,EXTONLY={YES }
                                      {NO  }

TEST MODE                    ,TSTEND={DUMP  }        999 Abend
                                     {NODUMP}
                                     {NRCD  }

SYSTEM CONTROL:          ,CCNID={CONTROL-TERMINAL-ID}
                                {CNTO1              }

                         ,SEP={SYSTEM-SEPARATOR-CHARACTER}
                              {6B                        }
```

Further Reference: Basic System Macros

START-UP

EXECUTION MODES

STARTUP-- Normal (Previous Execution Ended Normally)

RESTART-- Abnormal (Previous Execution Ended Abnormally or Cancelled)

TEST MODE-- Test Input (Back End Only)

JOB CONTROL

```
//    EXEC INTRCOMM,PARM=STARTUP
                        RESTART
                        RESTRNL
                        TEST
                        TESTR
                        TESTRNL
```

SPA + X'110' = SPAMODE: X'00' - STARTUP
X'04' - RESTART
X'08' - TEST
X'10' - BATCH Processing

Further Reference: Operating Reference Manual

EXECUTION OPTIONS

SETENV GLOBAL &CLDWAIT

MULTIREGION STARTUP -- RDT NUMBER (control region only)
COMMAND -- COMM,START,{ALL }
{REGION-IDs}

SPALIST: CLOSEDOWN --
CLDNLIM={NRCD-TIMEOUT-INTERVAL}
{300 }

After Timeout: CLDTO={DUMP } 125 Abend
{NODUMP} IMCD

LOG CODES: X'9F' -- STARTUP BEGUN
X'AA' -- CLOSEDOWN COMPLETE

COMMANDS:
- NRCD
- IMCD
- ABND

Further References: Operating Reference Manual
System Control Commands

Module Name: STARTUP3, Csects PMISTUP, STUOVLY

Initialize Operating System/CPU Environment

Initialize Intercomm Environment:

- Load Pools, BTVRBTB
- Mode/ESTAE/ESPIE/SYSEVENT
- Open SNAP data set(s)
- CALL Facility startup modules:
  - Link Pack
  - STRT/STOP
  - Store/Fetch
  - Dynamic Linkedit
  - File Handler
  - Subtasking
  - Multiregion
  - DDQ
  - Data Base
  - Front End
  - MMU
  - Security
  - System Statistics
- Log Buffers/Restart/Checkpointing
- Disk Queues - Front End/Back End
- SCT
- Dispatcher Q Entries

Exit to Dispatcher

Further Reference: Operating Reference Manual

STARTUP

Messages to CPU Console/SYSMSG

indicate progress through startup

INTERCOMM VERSION Release-number

STARTING - LAST SM IS SM-number

SPA=SPA-address

User Exits: USERINIT
USRSTART
USRSTRT1

Further Reference: Operating Reference Manual

CLOSEDOWN FUNCTIONS

Closedown Occurs

1. In test mode when all S/S queues are empty.
2. In live mode when NRCD or IMCD is entered.
3. In Satellite Region also if COMM,DOWN,Region-id (NRCD) or COMM,QDOWN,Region-id (IMCD) is entered.

Closedown Processing -- CLOSDWN3 (PMICLDWN Subsystem)

1. Suppress input from Front End, Queue closedown message for each Satellite Region if Multiregion Intercomm.
2. Process all queued messages (NRCD), or complete messages in progress (IMCD).
3. Issue closedown message via USRCLOSE, call closedown user exit - USRCLSE1.
4. Front End transmits all remaining output, then closes down.
5. Close Data Base.
6. Issue last Checkpoint, flush and close Log.
7. Produce final Statistics Reports, and closedown Subsystem/Subroutine Statistics Reports.
8. File Handler Termination, close all Files.

Further References: Operating Reference Manual
System Control Commands
Multiregion Support Facility

2 MESSAGE MANAGEMENT

2.1 Introduction

2.2 Installation Requirements

2.3 Interface: Structure and Processing

2.4 Features

2.5 Messages, Snaps and Abends

2.6 Exercise

MESSAGE MANAGEMENT

MESSAGE COLLECTION AND RETRIEVAL

Purpose: QUEUING

RETRIEVAL

LOGGING

MESSAGE MANAGEMENT

Message Collection and Retrieval

DEFINITION OF TERMS

Queue: A list of items (messages) waiting for service

Queuing Techniques: FIFO
Priority

Queue Storage: Main storage
Disk

Log: A sequential dataset which contains images of messages and checkpoint/restart information.

Logging Options: Single Log/Region Logs
Disk/Tape
By Terminal and/or By Subsystem:
-- Synchronous/Asynchronous
-- Restart
-- No logging

INTERCOMM MESSAGE QUEUES

Region Q

Contains: Messages awaiting interregion transfer

Technique: FIFO

Medium: Main storage; overflow to DDQ

Subsystem "hold" Q

Contains: Messages for subsystems in an inactive region
Messages for 'stopped' subsystems

Technique: FIFO

Medium: DDQ

Subsystem Q

Contains: Messages awaiting processing by the subsystem

Technique: FIFO, Priority

Medium: Main storage and/or BDAM data set

Terminal Q

Contains: Messages awaiting transmission to the terminal

Technique: FIFO, Priority

Medium: Main storage and/or BDAM data set

Message Management--the Main Queueing and Retrieval Routines

In Control Region:

Places, retrieves and logs messages on control region subsystem queues.

Places and logs messages on terminal queues.

Transfers and logs messages for satellite regions.

Receives messages from satellite (batch) regions for:

terminals

transfer to another satellite region

transfer to a control region subsystem.

In a Satellite Region:

Receives messages from control region.

Places, retrieves and logs messages on satellite region subsystem queues.

Transfers messages for terminals or other (non-local) subsystems to control region.

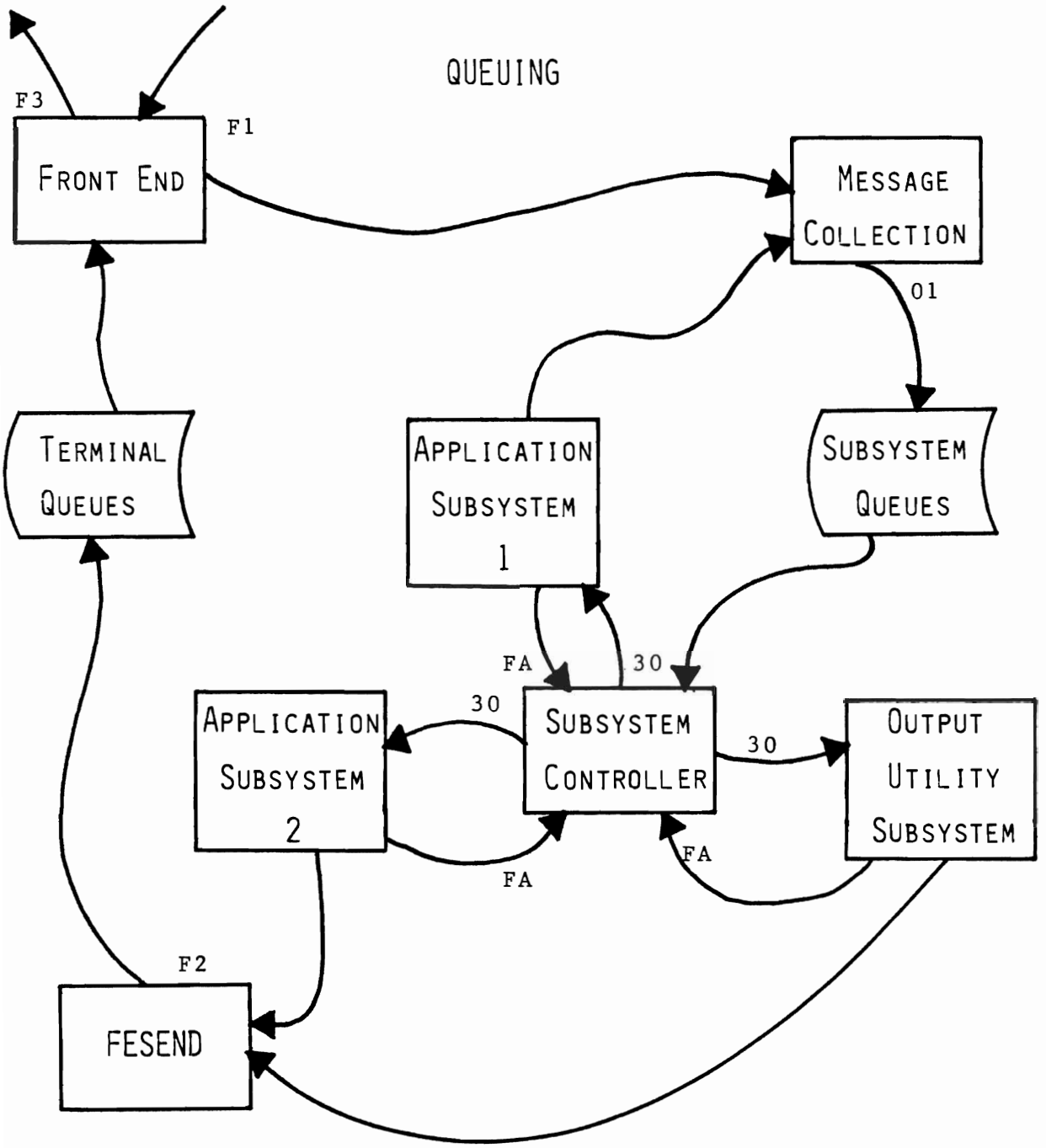
Transfers and logs messages within the satellite region.

In a Single Region Intercomm:

Places, retrieves and logs messages on the Subsystem Queues. The messages might be input messages from terminals or messages being switched between subsystems.

Places and logs messages on terminal queues.

SUMMARY OF MESSAGE FLOW
SINGLE REGION INTERCOMM
LOG CODES

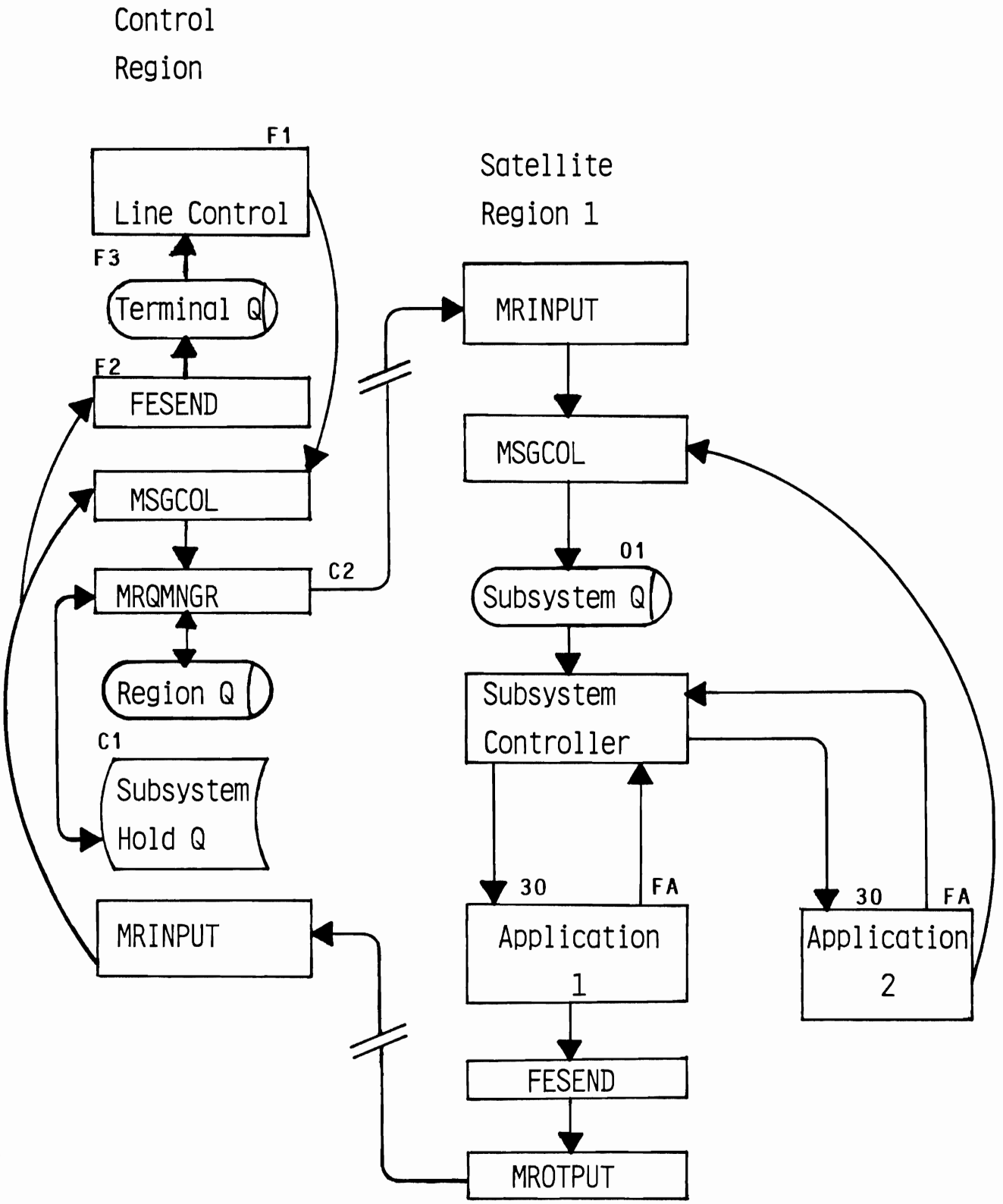


2.1 INTRODUCTION

SUMMARY OF MESSAGE FLOW

MULTIREGION INTERCOMM

Log Codes



FURTHER REFERENCES:

Operating Reference Manual

BTAM Terminal Support Guide

SNA Terminal Support Guide

Dynamic Data Queuing

Multiregion Support Facility

MESSAGE COLLECTION/RETRIEVAL
INSTALLATION CHECKLIST

Global Settings	SETGLOBE	&OUTEXIT	
Definition Macros	SYCTTBL	BTERM	LUNIT
	PCENSCT	BTVERB (HPRTY)	
Assemblies	INTSCT	(BTAMSCTS)	(VTAMSCTS)
Linkedit	Modules	CALCRBN	BLMSGCOL
(automatic)		COBPUT	BMH000
	FESEND	MRINPUT	VTQMOD
	OUT3270	MROTPUT	QUEUEMOD
	OUTDS40	MRQMNGR	PMIRETRV
	Tables	VTAM/BTAMSCTS	INTSCT

Files	DDname	Preformat
STANDARD FRONT END QUEUES	BTAMQ VTAMQ	CREATEGF
STANDARD BACK END QUEUE	PMIQUE	CREATEGF
MRS DDQs	Defined in RDT and DDQDSTBL	CREATEGF

ESTABLISHING THE REGION QUEUES AND SUBSYSTEM HOLD QUEUES

RDT MACROS: REGION BLOCKED=YES/NO (DDQ)
COREQ=number-of-entries
DDNAME=DDQ-data-set-name
QSPACE=number-blocks-per-DDQ-Extent
SUBSYS ALT=alternate-region-id
IFDOWN=QUEUE/FLUSH
QSPACE=number-blocks-per-DDQ-extent

Estimating Space Requirements:

Depends on -- traffic volume
-- satellite region activation

Specifying Main Storage portion: COREQ

At least one per subsystem in satellite region. More than one for heavy traffic subsystems, or when disk overflow processing overhead to be avoided. Use Log Analysis for subsystem activity. See C1/C2/C3 log codes.

Defining disk space: (see also DDQ manual)

Region queues: for overflow at peak periods

Hold Queues: depends whether message can be rejected, or sent to alternate region. If to be held, will be put on REGION'S DDQ data set, or if not specified, that of another region.

Be careful of data set contention in specifying DDQ(s)

ESTABLISHING A TERMINAL QUEUE

Estimating Space Requirements:

Depends on -- CRT processing (one-in, one-out)
-- Multi-page responses (printers)
-- priority queue necessity
-- critical response time

Specifying main storage portion: NUMCL

For CRTs -- at least 2, more if multiple responses.

For printers -- at least 10, more if more pages per report or used by many CRTs for reports.

Control Terminal and CPU console -- at least 20, allow for status/statistics verbs used (STAT, VTST, TALY, etc.).

Defining disk space:

For occasional overflow, or overflow of multi-response messages to hard-copy device.

Depends on -- type of processing (CRT, conversational)
-- volume of responses expected.

Be careful of data set contention for high volume and multi-response terminals (slows down response time).

BLKSIZE=Av-msg-len times (NUMCL+1) -- See F2 log records
-- Use Log Analysis

Maximum number of disk data sets is 63 per VTAM or BTAM.

MACROS USED TO DEFINE TERMINAL QUEUES

Referencing a Terminal Queue

BTVERB	HPRTY=		LUNIT/LCOMP
BTERM	(QNUM=)	Csect: BTAMSCTS	Csect: VTAMSCTS

Defining a Terminal Queue

BTERM/LUNIT generates SYCTTBL TYPE=BTAM/VTAM

DISK QUEUE SPECIFICATIONS

,DFLN = DISK-QUEUE-DDNAME

,PCEN = {PERCENTAGE }
{(PERCENTAGE, HUNDREDTHS)}
{100 }

CORE QUEUE SPECIFICATIONS

,NUMCL=NUMBER-OF-CORE-QUEUE-ENTRIES

,PRYMSGS=NUMBER-OF-PRIORITY-QUEUE-ENTRIES

Max terminals per type with priority Q=255

TERMINAL QUEUES EXAMPLE

```
BTAMSCTS        CSECT
                ENTRY       INTQA,INTQB,BTAMOUTQ
*
INTQA           SYCTTBL     TYPE=BTAM,NUMCL=1
INTQB           SYCTTBL     TYPE=BTAM,NUMCL=1
*
BTAMOUTQ        SYCTTBL     TYPE=BTAM,NUMCL=2,
                            DFLN=BTAMQ,PCEN=5
Q02             SYCTTBL     TYPE=BTAM,NUMCL=2
                            DFLN=BTAMQ,PCEN=10
Q03             SYCTTBL     TYPE=BTAM,NUMCL=2
                            DFLN=BTAMQ,PCEN=5
Q04             SYCTTBL     TYPE=BTAM,NUMCL=2
                            DFLN=BTAMQ,PCEN=10
*
                PMISTOP
*
                PCENSCT
                END
```

Further References: BTAM Terminal Support Guide
SNA Terminal Support Guide
Basic System Macros

ESTABLISHING SUBSYSTEM QUEUES

Estimating Space Requirements - depends on:

-- priority verb specification
-- response time requirements
-- traffic volume (peaks or steady)
-- concurrent processing

Specifying main storage portion: NUMCL

At least 1 or at least the same as MNCL.

More if response time critical--relative to number of verbs associated with the subsystem, and number of terminals entering those verbs, or number of other subsystems which may queue messages for this subsystem. Also depends on concurrent processing.

Priority queueing depends on response time requirements.

Defining disk space - depends on:

-- traffic volume vs. core queues
-- expected traffic volume peaks

BLKSIZE = Av-msg-len times (NUMCL+1)--see 01 log records

Maximum number of disk data sets is 63.

MACROS USED TO DEFINE A SUBSYSTEM QUEUE

```
BTVERB  SSCH=
        SSC=
        HPRTY=

SYCTTBL  TYPE=INT (default)
```

DISK QUEUE SPECIFICATIONS

```
,DFLN = DISK-QUEUE-DDNAME
,PCEN = {PERCENTAGE                }
        {(PERCENTAGE, HUNDREDTHS)}
        {100                       }
```

CORE QUEUE SPECIFICATIONS

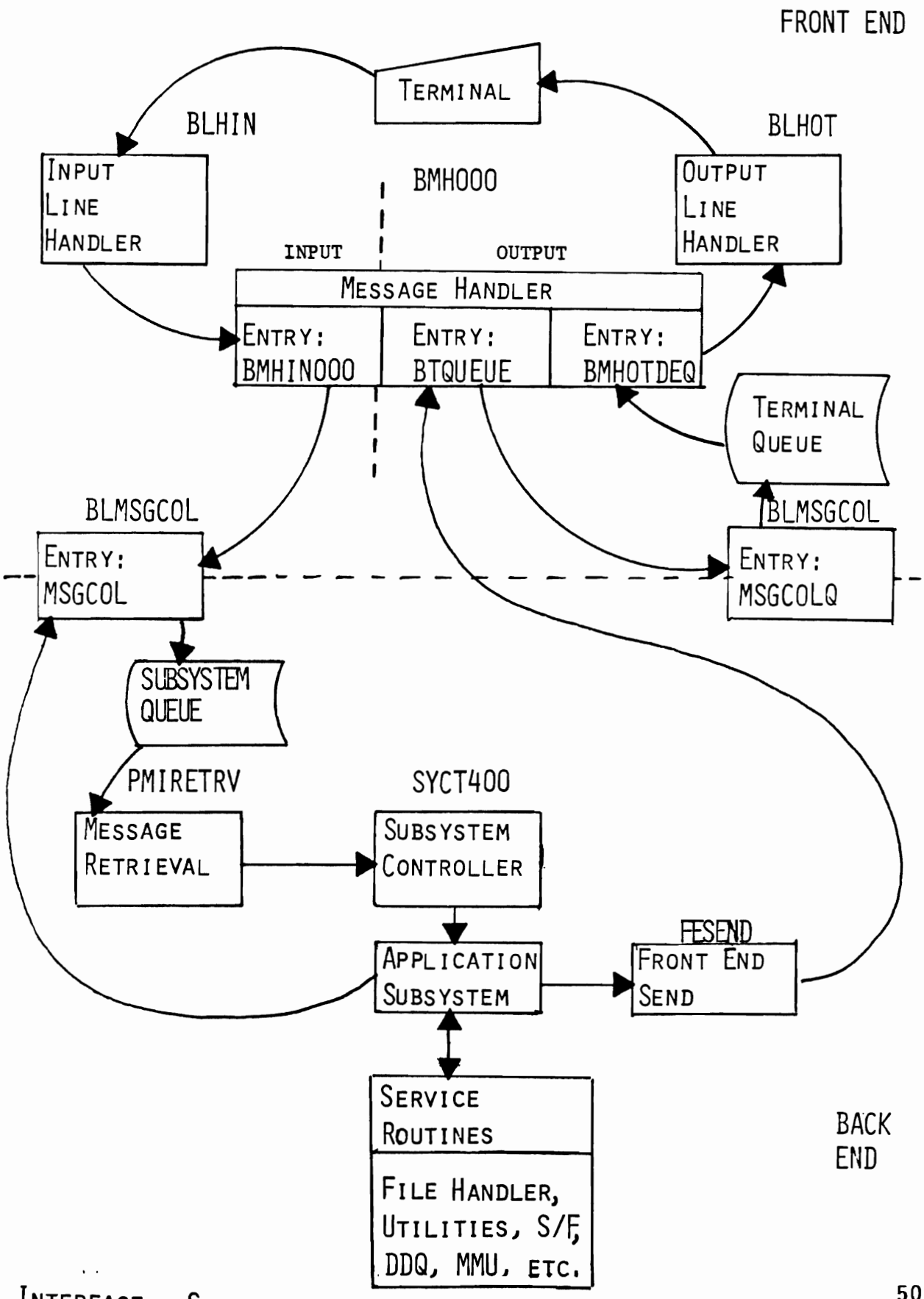
```
,NUMCL=NUMBER-OF-CORE-QUEUE-ENTRIES
,PRYMSGS=NUMBER-OF-PRIORITY-QUEUE-ENTRIES

MNCL=MAXIMUM-CONCURRENT-PROCESSING-THREADS
```

NOTE: Maximum SYCTTBLs with PRYMSGS parameter coded for priority Q=255

Further References: Operating Reference Manual
Basic System Macros

DETAILED MESSAGE FLOW

SINGLE REGION INTERCOMM



MESSAGE COLLECTION

BLMSGCOL -- message queueing routine

Called by: Front End
Subsystems (Intercomm and User)
FESEND
Intercomm System Modules
MRINPUT

Entries: MSGCOL -- for Back End Queueing
MSGCOLQ -- for Front End Queueing

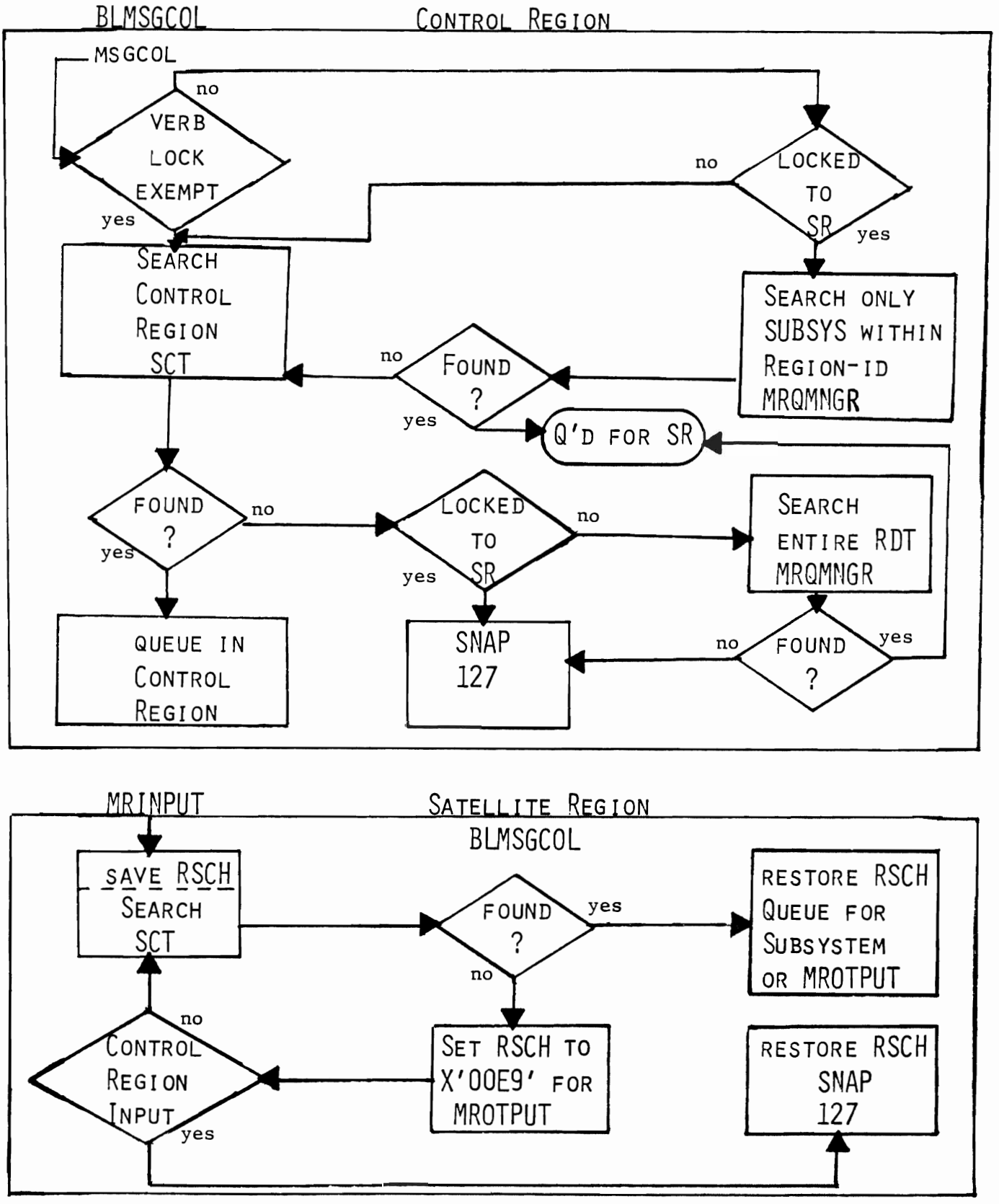
Parameter List:

1. Message Address
   Byte 1 -- Switches
   X'D1' -- Edit Before Queueing
   X'D2' -- Lock exempt verb
   X'D4' -- for Satellite region: passed from control region (from MRINPUT)
2. SPA Address (MSGCOL) -- Subsystem Q or
   BTSPA Address (MSGCOLQ) -- Terminal Q (SPA if VTAM)
3. BTAM/VTAM Queue (SYCTTBL) Address (MSGCOLQ)

BLMSGCOL -- Increments SEX#SATM--count of messages queued for a satellite region

MRINPUT -- increments SEXMRMSI--count of messages received (in CR-from SRs; or in SR-from CR)

MULTIREGION MESSAGE QUEUEING



DETAILED DESCRIPTION:

Back End entry point MSGCOL

1. Move C'2' to MSGHLOG, if the field did not contain C'R', or C'P' (restarted messages).
2. If EDIT=BQ, or in MRS Control Region, skip to step 4.
3. Log the MSG (C'2' changed to X'01' by LOGPUT).
4. Check for valid MSGHQPR, if valid, skip to step 6.
5. Produce SNAP 127, log C'5', WTO.
6. If not Lock Exempt, but in MRS CR and terminal locked to SR, skip to step 9.
7. Find SCT from MSGHDR RSCH, if not found and locked to SR or not MRS, go to step 5. If not SR, go to step 9.
8. In Satellite Region--if found go to step 9, else queue for MROTPUT, unless CR input--if so go to step 5.
9. If EDIT=BQ, call EDIT, if edited message returned, log the MSG (if not MRS CR). If SCT already found, skip to step 11.
10. If MRS, call MRQMNGR to queue for SR. If locked to a region--MRQMNGR searches only RSCH codes for that region, else checks entire RDT using binary search of index. If done, skip to step 16. If queue full go to step 15. If not found, but locked to SR, go to step 7. Else go to step 5 (no WTO).
11. If PRTY Q is present and MSG is PRTY MSG, try to find space on PRTY Q. If space found, queue the MSG and skip to step 13 (MSGCOL) or exit (MSGCOLQ).

12. Queue MSG on normal queue (core, or disk if core full). If no room on disk, go to step 15 (16 if MSGCOLQ).
13. If subsystem not schedulable, return appropriate message to entering terminal. Go to step 15.
14. Post SPACTIVE ECB for Overlay A SCTs, post SCTRECB for resident SCTs.
15. Check saved R.C. If not zero, issue error WTO. Log MSGHDR with C'6' (Qfull) or C'8' (I/O error) if entry=MSGCOL.
16. Free MSG area if error or on DISK Q and return.

Front End entry point MSGCOLQ

1. Set terminal queuing flag.
2. Do steps 11, 12 and 16.

Note: FESEND issues error message if non-zero return code from call to BTQUEUE or VTQUEUE (if VTAM terminal), which called MSGCOLQ.

Assuming you coded on your SYCTTBL/BTERM/LUNIT macro

PRYMSGS=3

The parameter coded will expand to 2 1-byte fields:

SCTPRNDX--the index to this SCTs priority queue (if zero, there is no priority queue).

SCTPRCNT--the current number of messages on the priority queue (if zero, no priority messages queued).

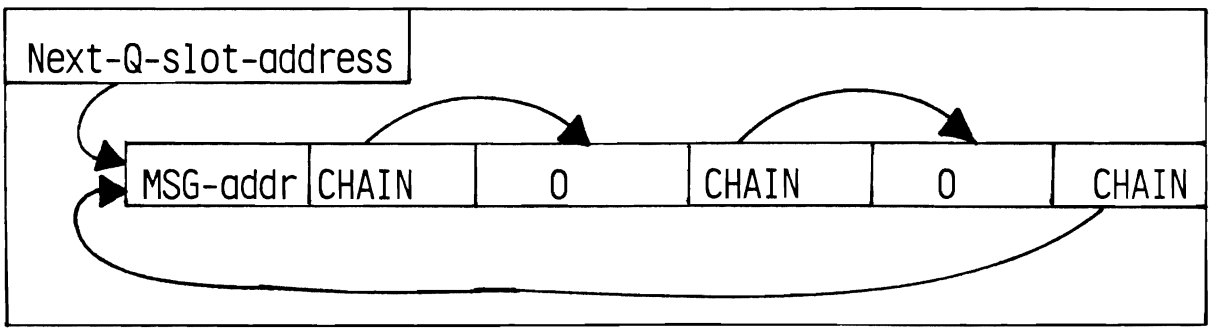
There are 3 base addresses for the priority queues:

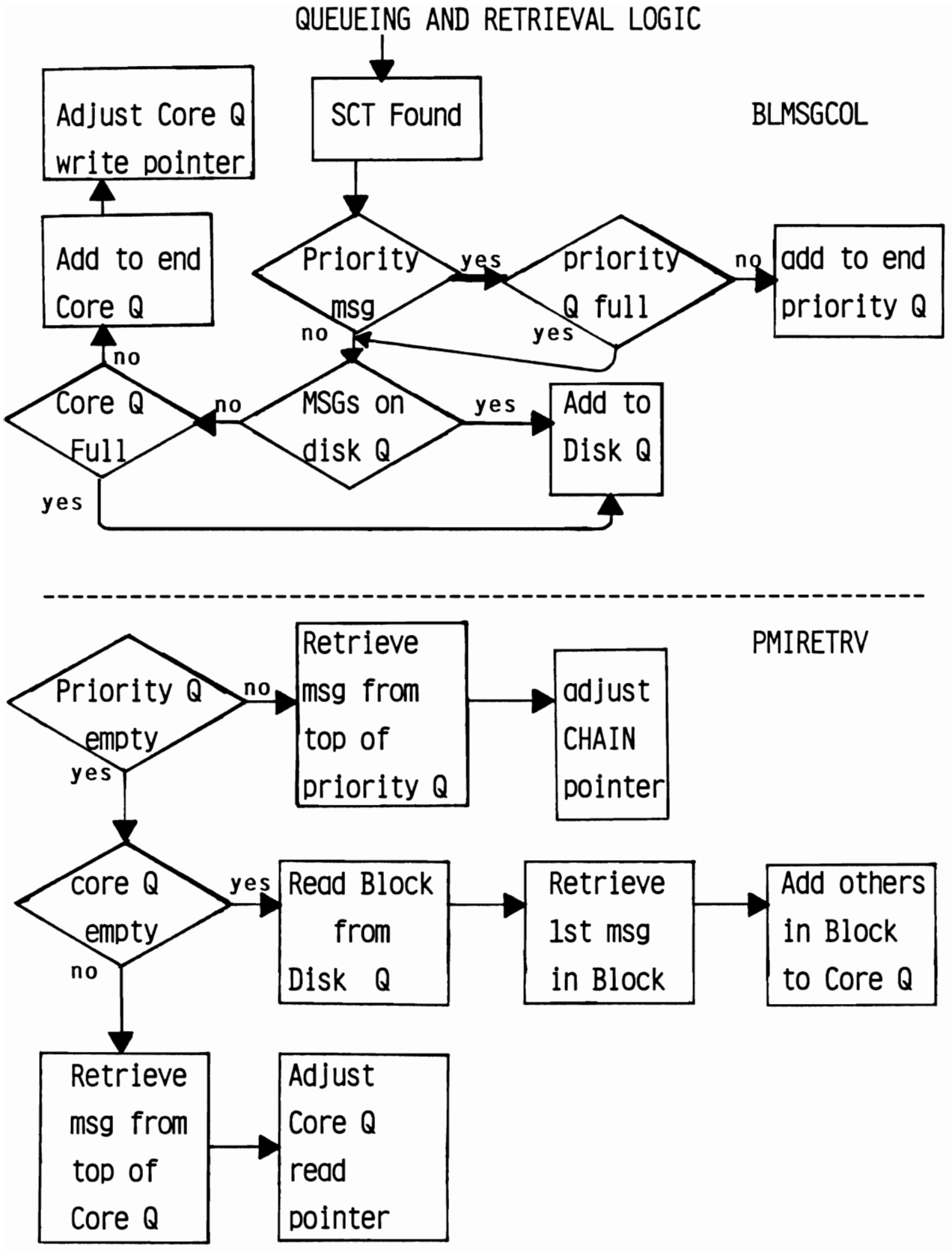
SEXPRNDX--for the Back End SYCTTBLs,

SEXBTNDX--for the BTAM/TCAM Front End BTAMSCTS,

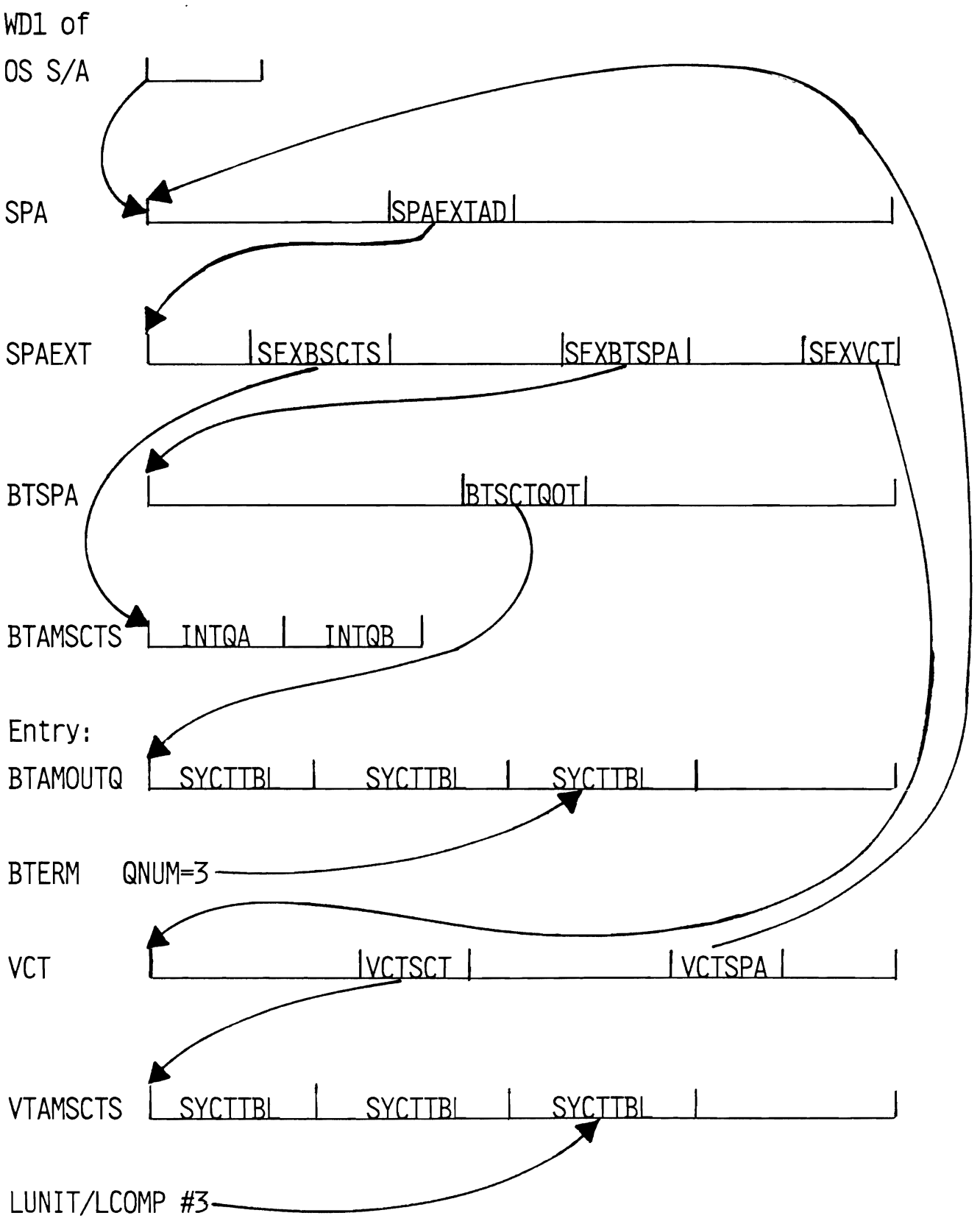
SEXVTNDX--for VTAM Front End VTAMSCTS.

To find the messages, take SCTPRNDX, subtract 1 and multiply by 4 (SLL 2 bits). Add the result to the respective base address. This result will point you to the address of the slot with the first valid message on the priority queue. MSGCOL goes down chain looking for first empty (0) MSG-addr slot. When finds CHAIN pointer and Next-Q-slot-address are =, priority Q is full. Retriever moves CHAIN to Next-Q-slot-address and sets MSG-addr to 0 (to keep FIFO Q).

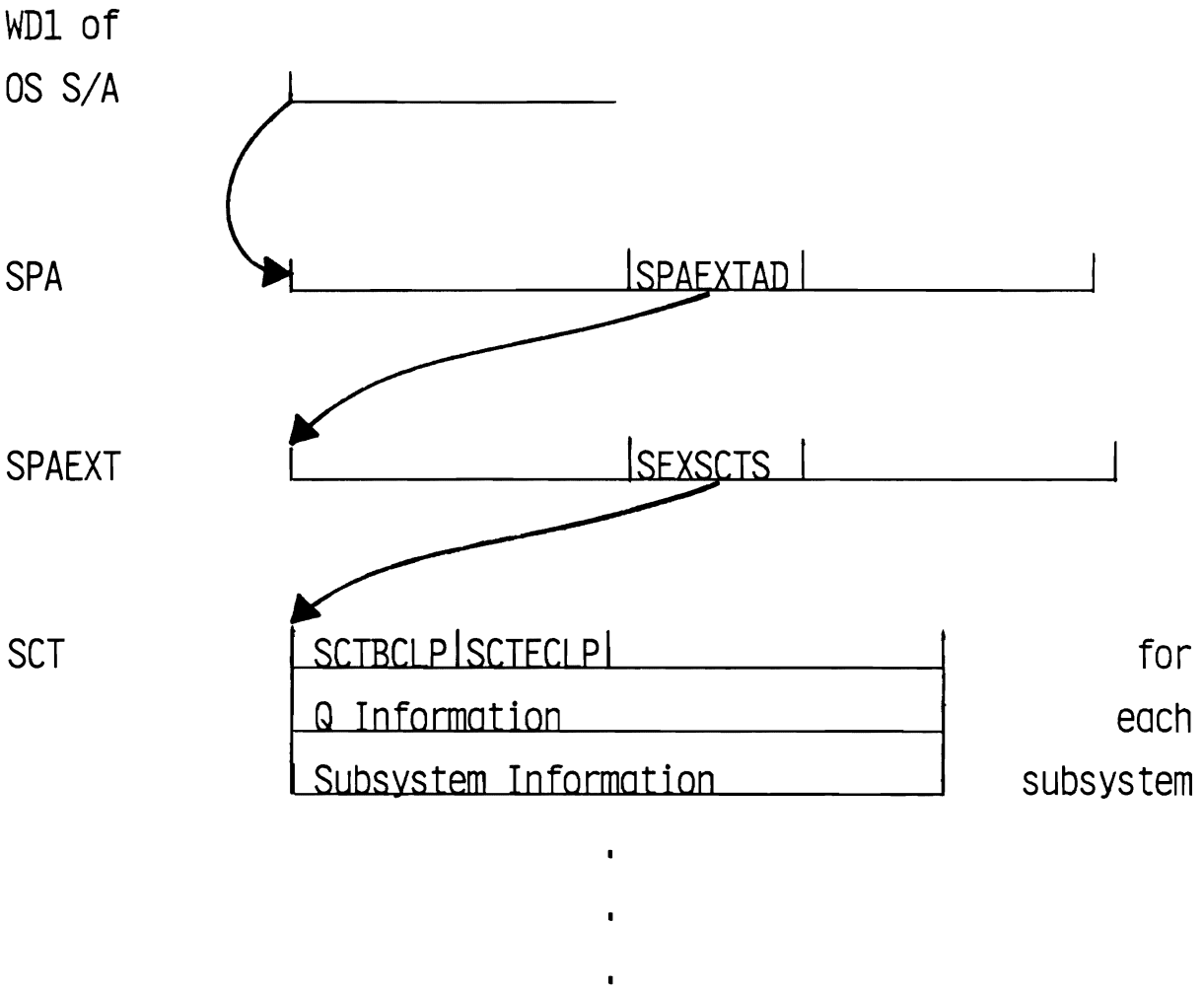



QUEUEING AND RETRIEVAL LOGIC
BLMSGCOL
Adjust Core Q write pointer
SCT Found
Add to end Core Q
Priority msg
yes
priority Q full
no
add to end priority Q
no
yes
no
Core Q Full
no
MSGs on disk Q
yes
Add to Disk Q
yes
PMIRETRV
Priority Q empty
no
Retrieve msg from top of priority Q
adjust CHAIN pointer
yes
core Q empty
yes
Read Block from Disk Q
Retrieve 1st msg in Block
Add others in Block to Core Q
no
Retrieve msg from top of Core Q
Adjust Core Q read pointer

STRUCTURE OF TERMINAL QUEUES



STRUCTURE OF SUBSYSTEM QUEUES



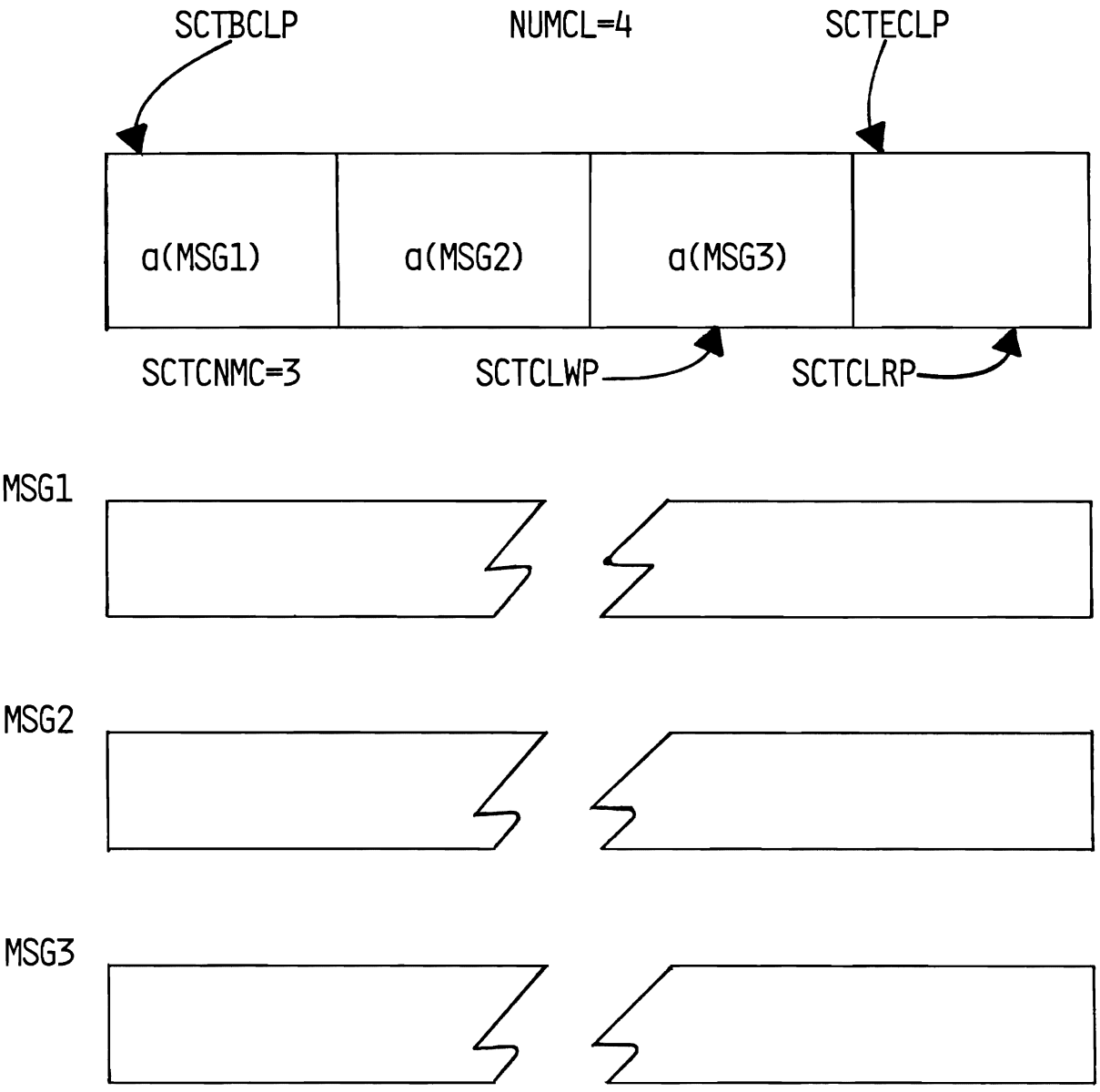
Dsects:
- SPA -- SPALIST
- SPAEXT -- SPALIST (EXTONLY)
- SCT -- SCTLISTC

ENTRY label for first SYCTTBL in SCT: SCT$STRT

SYCTTBL

Core Queues

(Main Storage Portion--Wraparound)



If SCTCNMC not 0 and SCTCLRP=0 -- no messages read (dequeued) since messages put on Q. SCTCLRP set to zero by MSGCOL when puts first message in core Q (in slot pointed to by SCTBCLP).

Multiregion: --- Satellite Region and Subsystem Hold Queues

- vvvv$FLUSH
- vvvv$FLUSH$SS
- vvvv$STOP
- vvvv$STOP$SS
- vvvv$START
- vvvv$START$SS

Single (Control) Region: --- Terminal Queues Only

- FLSH
- RLSE
- QHLD
- QRLS

All Regions: --- Subsystem Queues Only

- SSFL

Further Reference: System Control Commands

Multiregion: ---

- vvvv$STATUS$

Single Region: ---

- TALY$BE(subsystem-code)
- TALY$FE(tid)
- TALY$NQ/FQ

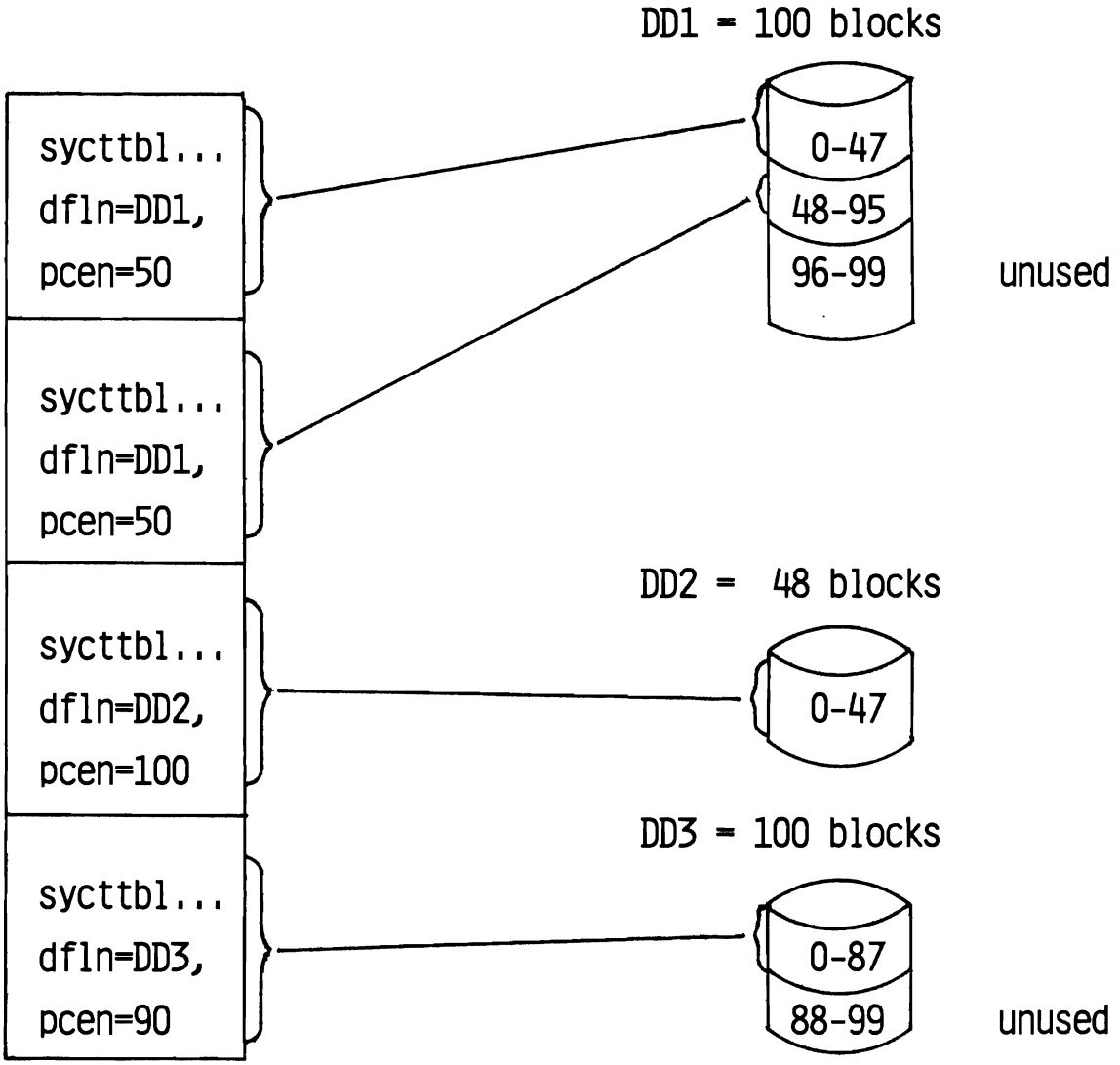
TUNING and STATISTICS: System Tuning Statistics
SAM
Log Analysis

DSECTS: SCTLISTC -- BLMSGCOL, PMIRETRV, VTQMOD
RDTSECTS -- MRQMNGR
MSGQWRK -- BLMSGCOL
MSGHDRC -- all
SPALIST -- all
PTRDSECT -- BTAM/TCAM Front End
BTSPA -- all Front End
PVRBTBLE -- all Front End
VCT -- VTAM Front End

User Exits: INQEXIT (BMH000) Input Message - BTAM/TCAM
INQUEUE (VTRECVE) Input Message - VTAM
USROTEDT (FESEND) Output Message - All
OTQUEUE (VTQMOD) Output Message - VTAM
USRBTLOG (BTSEARCH, VTRECVE, VTO1MOD) Log F1-input

STARTUP ALLOCATION OF QUEUE SPACE

Executed by CALCRBN



ROUNDS DOWN TO MULTIPLE (minimum) of 8

OVERALLOCATION RESULTS IN ABEND 44

NOTE: NUMFILES in CALCRBN set to 189 to allow for maximum of 63 Disk Q Data Sets per type (BTAM,VTAM and/or subsystem queues).

Subsystem not found in SCT

-- BTVERB coding defines SSCH and SSC combination that is not defined for any subsystem in the SCT (Single Region Intercomm).

-- MSGHDR RSCH/RSC code for message to be transferred from one subsystem to another is not defined for any subsystem in the SCT (program error) for a Single Region Intercomm.

-- MSGHDR RSCH/RSC code does not match any SUBH/SUBC code for a subsystem in SCT, nor for any defined via SUBSYS macro in RDT (Multiregion Intercomm -- Control Region).

-- RSCH/RSC code does not match any SUBH/SUBC code for a subsystem in the Satellite Region SCT when passed directly from Control Region (Multiregion Intercomm -- Satellite Region).

Closedown Subsystem Code not X'00', C'J'

-- Must be so defined for PMICLDWN in SCT for both Control (single region) Intercomm and all Satellite region SCTs. Do not code a SUBSYS macro for J.

-- Must be so defined for NRCD/IMCD BTVERB entries.

MROTPUT Subsystem Code not X'00, C'Z'

-- Must be so defined in each Satellite Region SCT. Do not put this subsystem in Control Region SCT, nor define any SUBSYS macro for this subsystem. There is also no corresponding BTVERB entry.

FESEND -- SNAP 53

Accompanies message MG600I:

FESEND ... MSG LOST,RC=nn,TID=...,MMN=...

RC=

4	Queue full
8	No storage
12	Disk Q I/O error
16	Invalid tid
20	Invalid VMI or Front End verb syntax error
24	Should Not Occur error (with msg. MG602I)
28	VTAM OTQUEUE user exit discarded message (snap/error msg. suppressed)
32-36	LU6.2 processing problem

Solution: find F2 log record from MMN number

PMIRETRV -- SNAP 115

SYCTTBL -- invalid message queuing counter

R11 in Registers at Entry to Snap = SYCTTBL

Exercise

MESSAGE COLLECTION/RETRIEVER

CSECT	ADDRESS
SPA	_____
SCT	_____

For subsystem U, find:

1. The SCT address: _____

2. How many messages queued in core? _____

   on disk? _____

3. The address of the core queue: _____

   Maximum messages in core queue: _____

4. The address of the last message added to the core queue:

   _____

5. The address of the last message retrieved from the core queue:_____

3 EXECUTION MANAGEMENT--Dispatcher

3.1 Introduction

3.2 Installation Requirements

3.3 Interface: Structure and Processing

3.4 Features

3.5 Messages, Snaps and Abends

EXECUTION MANAGEMENT
PURPOSE OF DISPATCHER

Distributes CPU cycles amongst Intercomm "tasks."

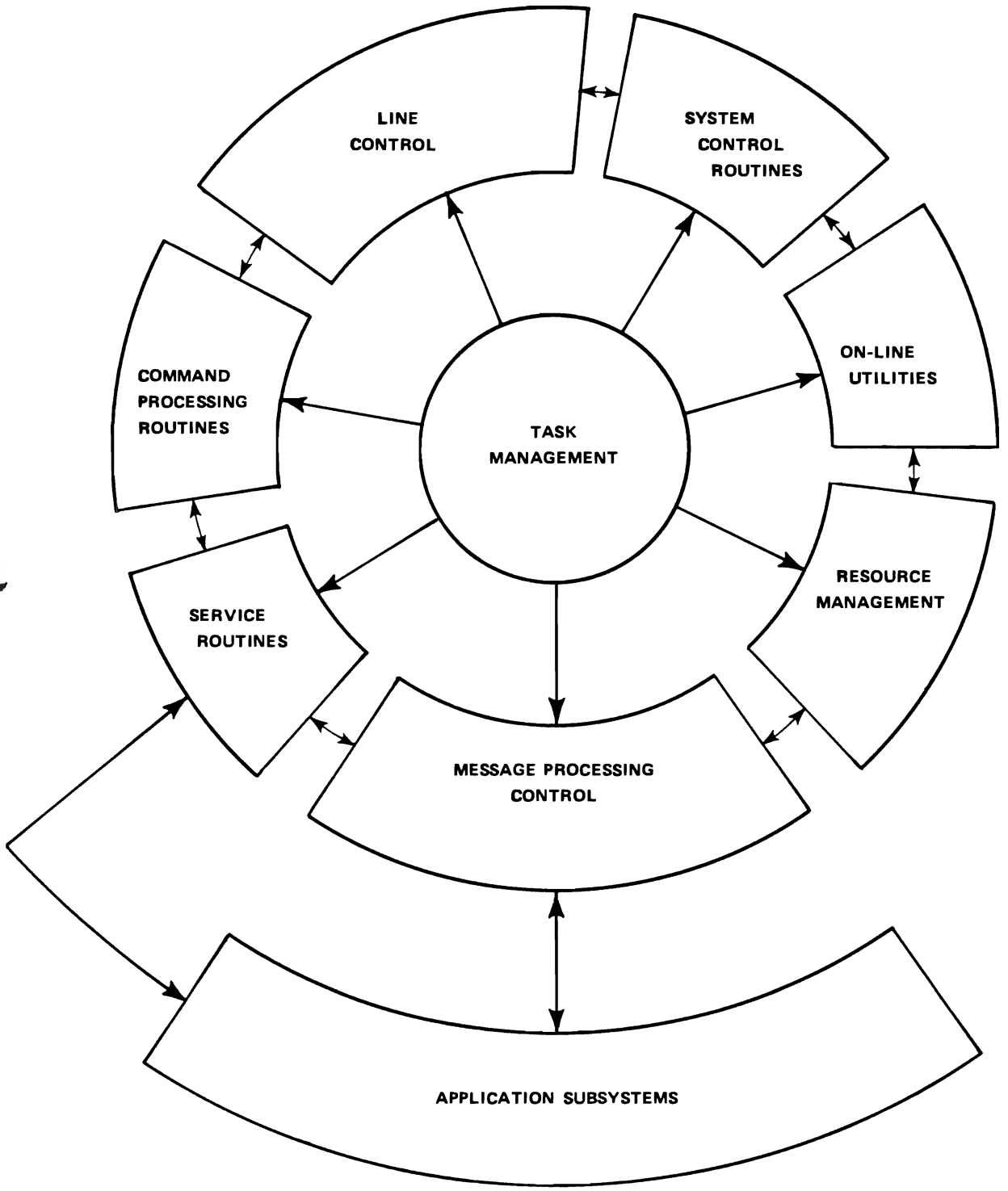
There is one dispatcher in each Intercomm region.

- CPU Time Distribution--asynchronous processing
  --priority scheduling
- Timer Management--time-dependent processing
- Event (WAIT) Management--ECB posting
- Loop detection--subsystem CPU control

Further Reference: Operating Reference Manual

MAJOR INTERCOMM COMPONENTS

SYSTEM INTERFACE



3.1 INTRODUCTION

DISPATCHER
DEFINITION OF TERMS

Work Queue Table: Contains pointers to each dispatcher queue.

Dispatcher Queues: There are four types of dispatcher queues. Each is made up of Work Queue Elements.

Execute Queue: The Work Queue Elements on an Execute Queue represent tasks awaiting execution ('ready-to-go'). There are four execute queues representing the priorities 0 (high) through 3 (low). These queues are FIFO queues.

Event Queue: WQEs on an Event Queue represent tasks awaiting event completion. There are two types of event queues. One (EVENT) is for external (posted by MVS) ECBs and internal (posted by Intercomm) ECBs. The second (IPOST) is a pseudo-queue (not chained) for internal ECBs created with the INTRNL=IPOST option.

Timer Queue: WQEs on the Timer Queue represents tasks awaiting expiration of a timer interval.

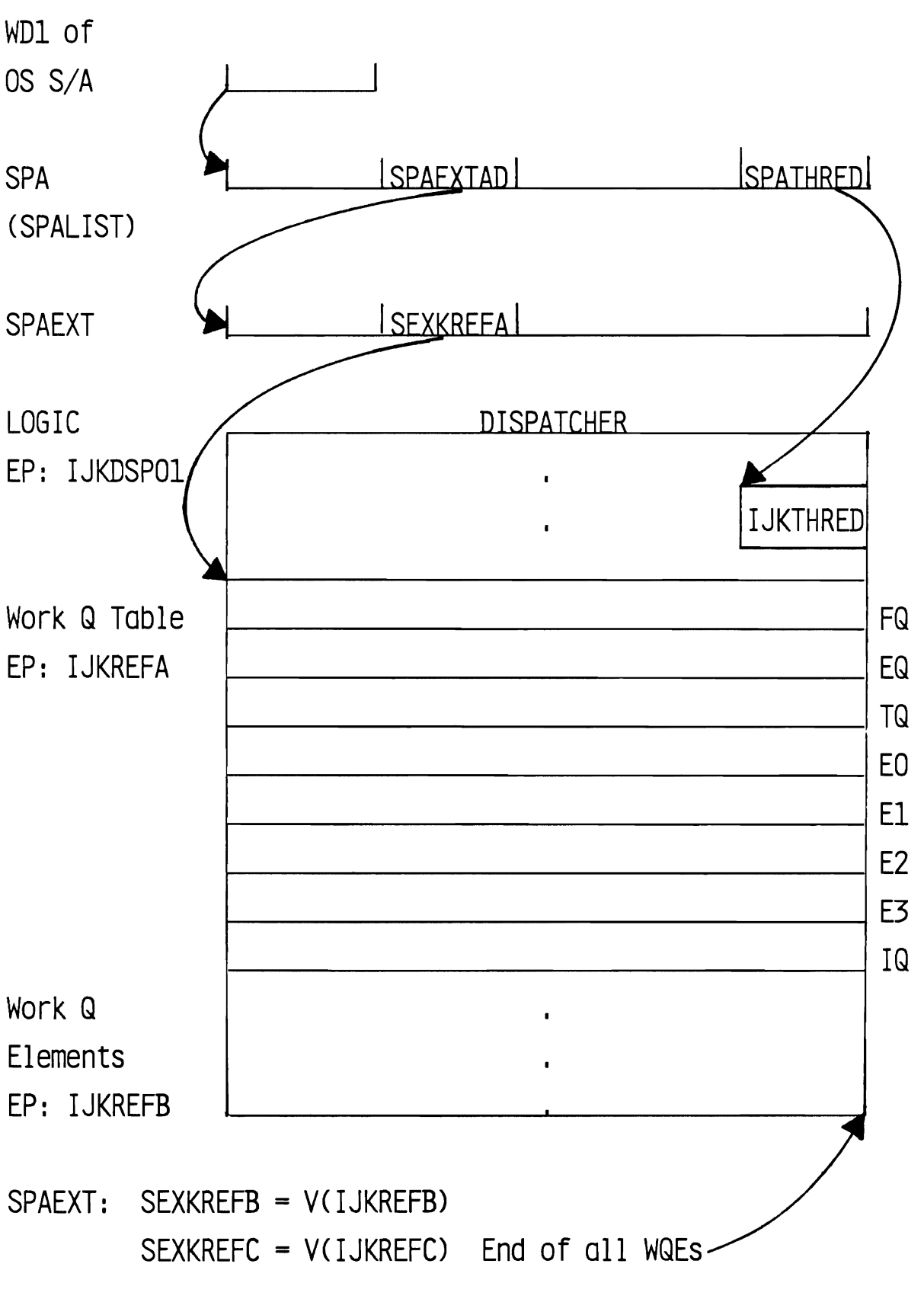
Free Queue: WQEs on the Free Queue are awaiting assignment to one of the other queues.

3.1 Introduction

DISPATCHER INSTALLATION CHECKLIST

Globals--SETGLOBE	&NUMWQES	released as 120
Assemblies	IJKDSP01	
Linkedit	Automatic	
	Modules	IJKDSP01
		IJKTLOOP
		IJKDELAY
		IJKPRINT
		IJKTRACE
		IJKCESD
		IJKWHOIT
		TALLY
		RPT00043
		TRAP
		STAERTRY
		SYSCNTL
Data Sets	SYSPRINT	
	(for IJKPRINT)	
	LPSPALIB	

CONTROL BLOCK STRUCTURE



THE WORK QUEUE TABLE--12 BYTES PER ENTRY

	0	4	8	A
FQ	A(first FQE)	A(last FQE)	Current # FQEs	MIN available
EQ	A(first EQE)	A(last EQE)	Current # EQEs	MAX used
TQ	A(first TQE)	A(last TQE)	Current # TQEs	MAX used
EQ0	A(first XQE)	A(last XQE)	Current # XQEs	MAX used
EQ1	A(first XQE)	A(last XQE)	Current # XQEs	MAX used
EQ2	A(first XQE)	A(last XQE)	Current # XQEs	MAX used
EQ3	A(first XQE)	A(last XQE)	Current # XQEs	MAX used
IQ	N.A.	N.A.	Current # IQEs	MAX used

NOTE: The Work Queue is empty if the A(first WQE) and the A(last WQE) both point to its Work Queue Table entry.

NOTE: The Free Queue halfword--MIN available--is a negative value. If zero--901 abend. N.A. in first two words of IPOST Q=not applicable.

WORK QUEUE ELEMENT (WQE) -- 4 FULLWORDS

00	01	04	05	08	09	0C
S T A T U S	Chain Field Next WQE in same list	P O R V T L Y Y	ECB or Real Time	T N H U R M E B A E D R	"Branch-to" address	PARAMETER Often R13 (returned via R1)

Priority -- 2 bits 00=highest (0)--11=lowest (3)

Overlay -- remaining 6 bits (0=resident or dynamic loaded)

STATUS: cumulative--62=dispatched, was on timer, execute Qs.

80 - Cancelled (on Free Q)

40 - Dispatched (on Free Q) (last=most recently dispatched)

20 - On an execute queue

10 - unused

08 - Internal ECB will be posted via INTRNL=IPOST

04 - Internal ECB (on event queue: indicated via INTRNL=YES)

02 - On timer queue

01 - On Event queue (External ECBs followed by Internal ECBs)

NOTE: WQE is at end of the chain if chain field points back to WQT
05=Internal ECB on Event Q, 09=IPOST WQE

DSECT: WQEDSECT Total number WQEs = &NUMWQES

DISPATCHER EXERCISE

ENTRY	ADDRESS
IJKREFA	_____
IJKREFB	_____
IJKREFC	_____

1. Describe the last thread given control:

   WQE Location: _____

   Status Byte: _____

   Thread Number: _____

   Priority/Overlay: _____

   Entry Point: _____

   Parameter: _____

   ECB/Time: _____

   What was its history?

2. For the first task on the Event Queue:

   WQE location: _____

   ECB Address: _____

   Task Entry Point: _____

   When will this task gain control? _____

   _____

   _____

(continued)

DISPATCHER EXERCISE (continued)

3. What was the minimum number of WQEs available during this execution? _____

4. What would be the next task given control?_____

_____

_____

_____

_____

5. What is the current thread number?_____

EXECUTION PRIORITY

FRONT END SETENV GLOBAL -- &FEPRTY (BTAM/TCAM only)
released as 2

BACK END SYCTTBL macro -- PRTY =
default is 0

CHANGE DYNAMICALLY

BACK END ONLY -- via DISPATCH macro (current thread only)
-- via PRTY or FTUN/SSUP commands

IPOST QUEUE WQES

WQE address placed in ECB being waited upon via DISPATCH or INTWAIT request

When posted (via INTPOST), WQE chained immediately to appropriate Execution Queue. The Event Queue is not affected.

DISPATCHER PROCESSING

SCHEDULING A TASK VIA THE INTERCOMM DISPATCHER

Dispatch Macro -- Provides to the DISPATCHER:

1. Entry point to receive control when ready to execute.
2. A parameter list address to be passed to entry point.
3. ECB address -- Posted on event completion, or
   Interval--time for delaying further execution.
4. Are we creating an additional task for later control (no EXIT), or do we just want this task to wait (EXIT).
5. Gives control to Intercomm Dispatcher.

The Dispatcher:

1. Builds a table entry (WQE).
2. Puts on proper queue (fills in chain address).
   TIME ECB(WAIT) READY(EXEC)
3. Sees if you want to queue yourself as a new task for later control (EXIT parameter or INTWAIT used).
   NO -- Return control to caller.
   YES -- Give control to next ready to go task:
4. If no tasks on any Execute Q, then reorganizes queues, e.g., if ECB is posted, take off Event queue and put on Execute queue for associated priority. If STIMER expired--requeue expired delays--reissue STIMER.
5. Just before giving control to next ready task, return its WQE to free Q.
6. If no tasks to execute (after reorganization), WAIT for external ECB to be posted or current STIMER to expire.

Register Usage

- Upon entry to dispatched routine

  R0 -- address of WQE (now on Free Queue)
  R1 -- parameter passed to dispatched routine
  R13 -- address of save area provided by dispatcher
  R14 -- return address in dispatcher
  R15 -- address of dispatched routine

- After DISPATCH macro with no exit

  R1 -- address of WQE created

NOTE: Created WQE address must be saved for later cancellation if thread waiting for only one of several events (timed delays) to complete.

Field Labels via Literals

- IJKTHRED -- current thread number
- IJKFLAGS -- status bytes
  X'20' = system in WAIT status
- ECBLIST -- pointer to list of ECB addresses when in WAIT status: starts in second word (STIMER ECB)
- IJKREFA -- Work Queue Table followed by WQEs

DISPATCHER ROUTINES

IJKDSP01: Main Dispatcher Logic Module--Also WQT/WQEs

IJKTLOOP: Subsystem Loop Timeout Processing

IJKDELAY: Request Temporary Timed Delay for Program Execution

IJKTRACE: Format Dispatcher Queues for Printing (118/122/126 snaps)

IJKPRINT: Print a line on SYSPRINT (without losing control) -- required if IJKTRACE used/included

IJKCESD: Format CSECT/ENTRY table at startup

IJKWHOIT: Find Csect name, subsystem name/codes, etc.

DISPATCHER ENTRY

IJKTHRED: Active thread number in low-order byte of fullword: if zero--system thread is active (pointed to by SPATHRED). Set by the Subsystem Controller/Dispatcher.

Further Reference: Operating Reference Manual

DISPATCHER RELATED ROUTINES

IJKDELAY:

REQUEST TIME DELAY
100 MILLISECOND (AVERAGE)
ENTRY ON TIMER QUEUE
TIME-SLICING
PARALLEL PATHS (TESTING)
ACTIVATE: CALL DIRECTLY FROM SUBSYSTEM
(NO PARAMETERS)
POINTER: SEXDELAY

IJKTLOOP:

DETECT CLOSED LOOP
SUBTASKED
30 SECOND INTERVALS
SNAP 121
ABEND 909
DEACTIVATE: CALL IJKTSTOP
STOP$TLOOP
REACTIVATE: CALL IJKTLOOP
STRT$TLOOP

DISPATCHER RELATED ROUTINES

IJKTRACE:

FORMATTED DISPLAY OF WQE QUEUES

FLAGS: C-CANCELLED

D-DISPATCHED (GIVEN CONTROL)

E-ON EXECUTION QUEUE

P-IPOST ECB

I-INTERNAL ECB

T-ON TIMER QUEUE

W-EXTERNAL ECB

CALLED BY: SPIESNAP (SNAP 126)

RMPURGE

SYCT400 (SNAP 118)

STAEEXIT (SNAP 122)

USER--(CALL IJKTRACE)

IJKPRINT:

IN-LINE WRITE (NO OVERLAP)

CALL IJKPRINT

REGISTER 1 = ADDRESS OF ADDRESS OF PRINT LINE:

VARIABLE-LENGTH RECORD (RDW)

ASA PRINT CONTROL CHARACTER

MAXIMUM PRINT-LINE-LENGTH=132

DISPATCHER

APPLICATION PROGRAMMING MACROS

DISPATCH

INTWAIT

INTPOST

Further Reference: Basic System Macros
Assembler Language Programmers Guide
(also execution/programming techniques)

COMMANDS

- TALY$SU
- TALY$DS
- SCTL

Further Reference: System Control Commands

DISPATCHER PROCESSING REQUEST ENTRIES
(IJKDSP01)

Entry	Processing	POINTER
IJKCNC	cancel existing WQE, return	SPAKCNC
IJKCNCX	cancel existing WQE, exit	SPAKCNCX
IJKDSP	place WQE on execute Q, return	SEXKDSP
IJKDSPX	place WQE on execute Q, exit	SEXKDSPX
IJKINT	place (INTWAIT) WQE on timer Q, return	SPAKINT
IJKINTX	place (INTWAIT) WQE on timer Q, exit	SPAKINTX
IJKPOST	INTPOST internal/IPOST event WQE, return	SEXPOST
IJKPOSTX	INTPOST internal/IPOST event WQE, exit	SEXPOSTX
IJKRETX	terminate control (exit)	SPAKRETX
IJKWAIT	place (INTWAIT) WQE on event Q, return	SEXKWAIT
IJKWAITX	place (INTWAIT) WQE on event Q, exit	SEXKWAIX

Further Reference: Basic System Macros

DISPATCHER ABENDS

900 Dispatcher was given control, but no tasks to be dispatched on any Execute Queue, no events or timed delays awaiting completion. ABEND can occur at start-up if a program check occurs prior to end of start-up.

901 WQE needed, but Free Queue is empty. Occurs if more outstanding requests are made than there are free task elements (as may occur in an erroneous system loop).

NOTE: If a loop not in progress--increase the &NUMWQES global setting in SETGLOBE, reassemble IJKDSP01, and relinkedit Intercomm before restarting Intercomm.

Monitor Free WQEs remaining via TALY$SU command.

909 A task element on the timer list is identified as belonging to the closed-loop detection module (IJKTLOOP) and the 30-second time interval has expired--this indicates that a closed loop, or operating system supervision of activity has occurred. To recover, both STAEEXIT and STAERTRY must be in linkedit. A SNAP 121 is produced.

Further Reference: Messages and Codes

4 RESOURCE MANAGEMENT--Manager

4.1 Introduction

4.2 Resource Audit and Purge

4.3 Storage Management

PURPOSE OF RESOURCE MANAGEMENT

Control All Resources Except CPU Time

Resource Audit and Purge: Subsystem clean-up

- -- Storage (Core pools/Subpools)
- -- OS/VS Datasets
- -- DDQs
- -- Dynamically Loaded Subroutines
- -- Control Requests -- ENQUEUE/DEQUEUE
- -- WQEs under subsystem thread

Storage Resources: Avoid GETMAIN/FREEMAIN (interruptible)

- -- Storage Cushion
- -- Core Pools
- -- Core Use Monitoring/Statistics

Further Reference: Operating Reference Manual

AUDITING

CSECT	ENTRY	Processing
RMFNQ	RMFON	Files RCBs
	RMFOFF	
	RMNQON	ENQ/DEQ RCBs
	RMNQOFF	
	RMDQON	DDQ RCBs
	RMDQOFF	
	RMDYON	Dynamic Subroutines RCBs
	RMDYOFF	
RSMGMNT	RCBTABLE	RCB Table address
	RELOCATE	Relocate RCBs

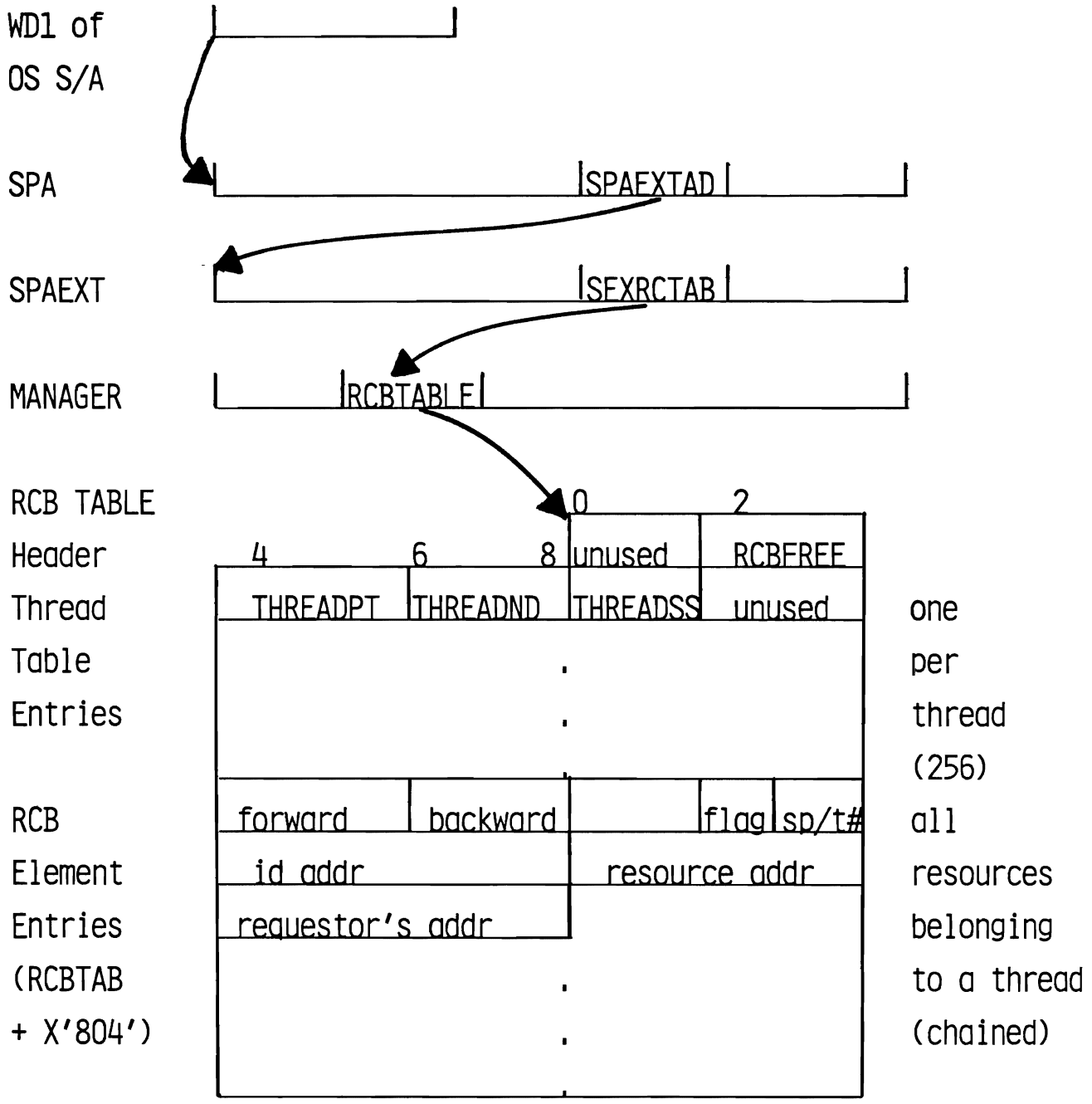
STORAGE

CSECT	ENTRY	Processing
RSMGMNT	STORAGEM	STORAGE
	STORFRED	STORFREE
	RMSTATS	Core Use Statistics Areas
	CUSHION	Cushion Area Address
RMPC	RMPASS	PASS
	RMCATCH	CATCH

RESOURCE MANAGER--AUDIT AND PURGE

Installation Checklist

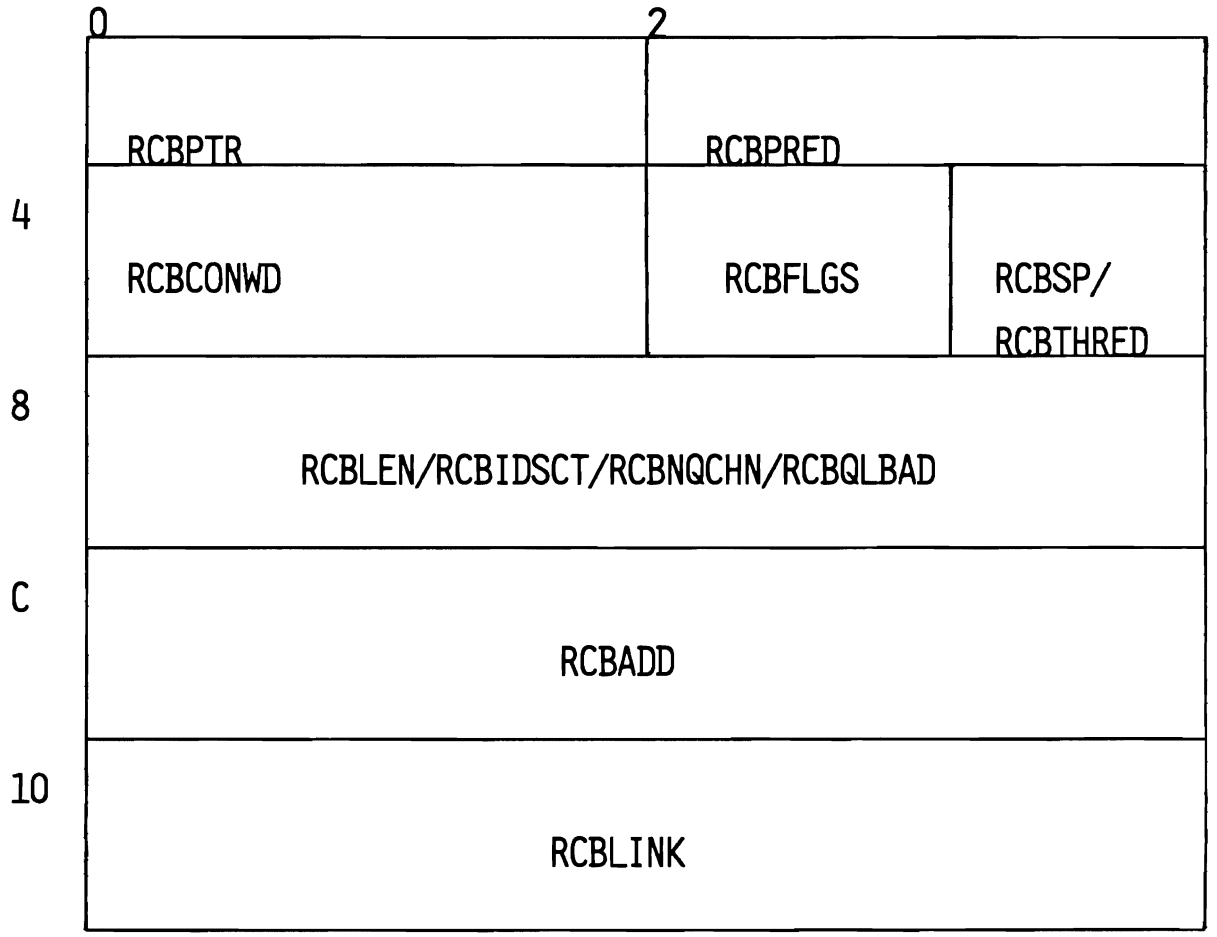
Globals	SETGLOBE	&RM
SPALIST	RCBSINT	
	RCBSADD	
Assemblies	MANAGER	
	IXFHND01	
Linkedit	Automatic	
	Modules	MANAGER
		RMPURGE
		TDUMP
		RMNADISA
		FDITCB
		PMINQDEQ



DSECT: RMDSECTS

FORMULAS: A(RCBTABLE)+4+(T#*8)=THREADPT-address
A(RCBTABLE)+(THREADPT*4)=thread's-1st-RCB-address

RCB ELEMENT--20 BYTES



FLAGS:
- 80 -- Dynamic Loaded Subroutine
- 40 -- DDQ
- 20 -- Part of Core Pool was freed
- 10 -- Storage
- 08 -- System NQ
- 04 -- File
- 02 -- User NQ
- 01 -- Core Pool Block

NOTE: X'11' = Intercomm Core Pool Storage
X'00' = RCB on Free RCBs Q

RESOURCE AUDIT EXERCISE

ENTRY	ADDRESS
RCBTABLE	_____
IJKTHRED	_____

1. What is the current thread number? _____
2. For the current thread, find:
   First RCB Address _____
   Last RCB Address _____
   Subsystem Code _____

3. Describe the most recently acquired resource for the current thread:
   What type of resource? _____
   Address of resource _____
   Requestor's address _____

PROCESSING--SUBSYSTEM TERMINATES NORMALLY

Before calling a subsystem--

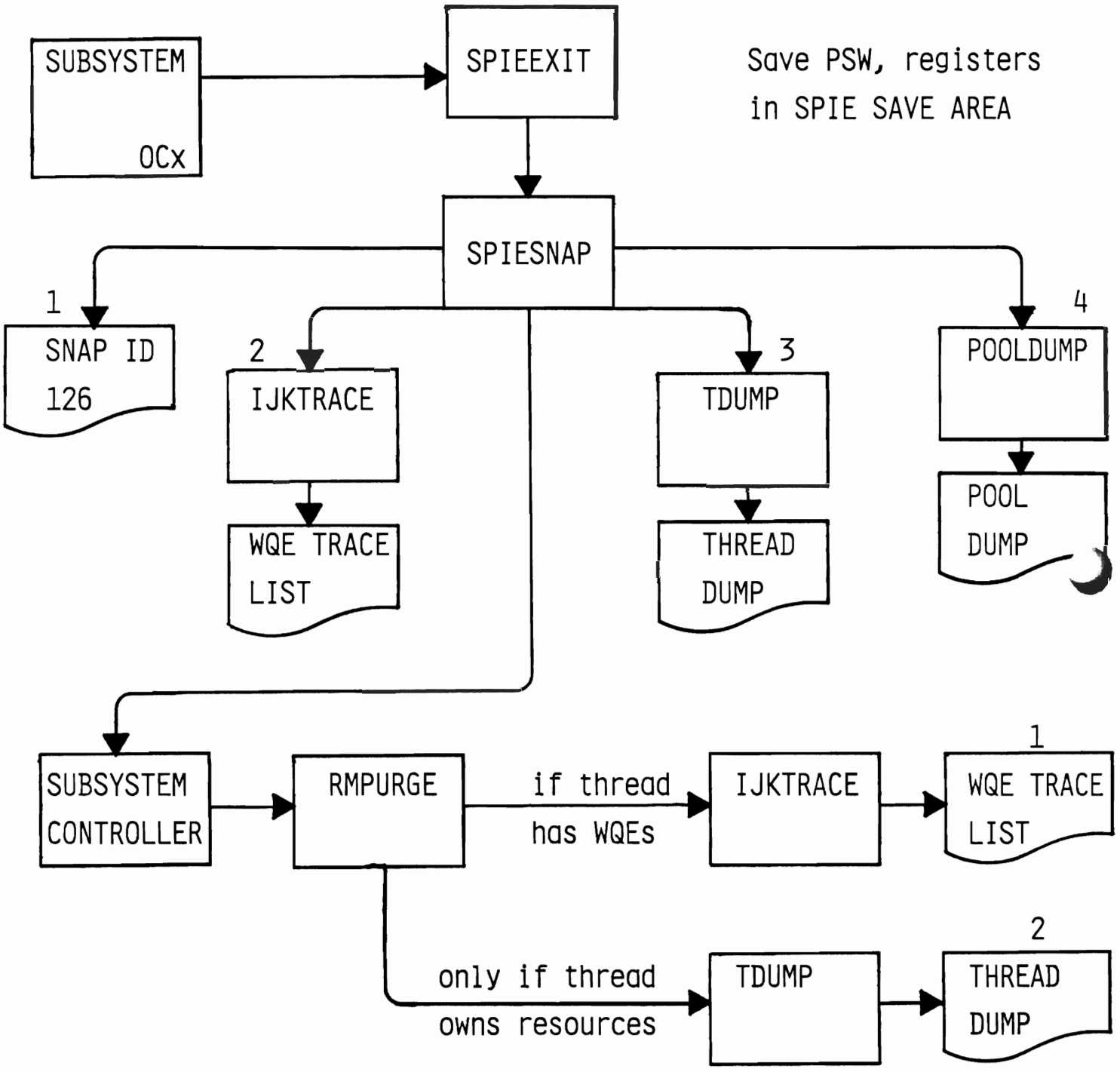
Before a message is passed to a subsystem, the Subsystem Controller will assign a thread number and insert it into MSGHDR - used for 30 and FA logging.

Upon subsystem return--

When the subsystem returns to the Subsystem Controller, the Subsystem Controller calls RMPURGE. RMPURGE checks for any unreleased RCB (traced using thread number), and if any found for this thread, RMPURGE calls TDUMP to produce a thread dump. RMPURGE then releases all outstanding resources belonging to the thread (including outstanding WQEs). Subsystem Controller then resets current thread number (in IJKTHRED) to zero.

PROCESSING--SUBSYSTEM TERMINATES ABNORMALLY

SUBSYSTEM PROGRAM CHECK



NOTE: if Thread 0, after steps 1-4, SPIESNAP exits to Dispatcher

PURGE PROCESSING--SUBSYSTEM TIMES OUT

Controlled by: SYCTTBL--TCTV=

SNAP: 118

PROCESSING: RMPURGE via Dispatcher TQE (from SS Controller)
called by PURGE entry in SS Controller

Register Assistance: SPIE SAVE AREA

R2 -- Message Header in SS Controller Save Area

R11 -- SYCTTBL of subsystem

R12 -- SPA

R13 -- SS Controller's Save Area (SCNLIDS Dsect)

FIND: Current Thread Number (IJKTHRED or SCNTHRED)
Active (not on Free Q) WQEs--same thread number

If none: DISPATCH EXIT without another DISPATCH for
WAIT/TIME/EXEC Q

If more than one: What will occur first?

Timer--time out entry point
time interval greater than TCTV

Event--who will post ECB:
external--File/DB I/O hung
internal--enqueue lock out
will poster get control

Possible Causes: TCTV value too small vs. subsystem PRTY and
I/O needs. Device contention.
Front End may be monopolizing CPU.

To see associated WQEs printout, IJKTRACE must be in Linkedit
(called by SYCTRL if Snap 118 issued, and/or by RMPURGE).

Thread Dump: thread is SMLOG owner - also see status line.

RESOURCE CONTROL MACROS

INTENQ/INTDEQ

DISABLE/ENABLE

COMMANDS

- TALY$SU — RCB Table Relocation, Cushion Status
- SCTL$TDUMP — 1/all threads to terminal or SMLOG
- FILE$ddname$DEALL — SMLOG or SYSPRINT

Further Reference: Basic System Macros
Operating Reference Manual
System Control Commands

Purpose: Control resource access
Control resource usage concurrency
Limit contention for frequently used resources
Control resource usage duration

Installation:

SPALIST	NQTIM
SYCTTBL	RESOURC
RESOURCE	ID
	MAXUSE
Linkedit	PMINQDEQ

Programming macros:

INTENQ
INTDEQ

Identifier: 1-44 character logical name (Default=16)

DSECT: NQDSECTS -- work area
ELMDSECT

Statistics: SAM -- ENQS

Time Out: Enqueue time expired--Snap 114

4.2 Resource Audit and Purge

Processing: RMNADISA

Purpose: Temporarily suspend/prevent subsystem purge.
Used when I/O must complete: e.g. Subsystem
CALLs MSGCOL and disk queueing required.
Also for dynamic subroutine load.

```
ENABLE   [SPAEXT=(r)]
  or
DISABLE
```

If SPAEXT=(r): address preloaded, USING not required,
otherwise VCON will be generated.

RMPURGE: issues EVENT--RMEVENT entry in RMNADISA; test
outstanding DISABLE, wait for TCTV time, if no
ENABLE, do not purge thread (core).

User Exit: IOEXIT - called by (CALLIF) RMNADISA (after wait)
--called for Subsystem Timeout (Snap 118)
when an outstanding DISABLE for a selected file
--parameter - address of SYCTTBL in R1
--no return code checking
--may be used to issue a message (PMIWTO)
when subsystem hung on file/DB I/O

TALY$DA -- thread status - all assigned thread numbers

STORAGE CUSHION

Purpose: Prevent (GETMAIN) ABEND when no Subpool core available.

Installation Checklist

Global	SETGLOBE	&RM
SPALIST	CUSHION	
	CUSHTM	
Assemblies	MANAGER	
	IXFHNDO1	

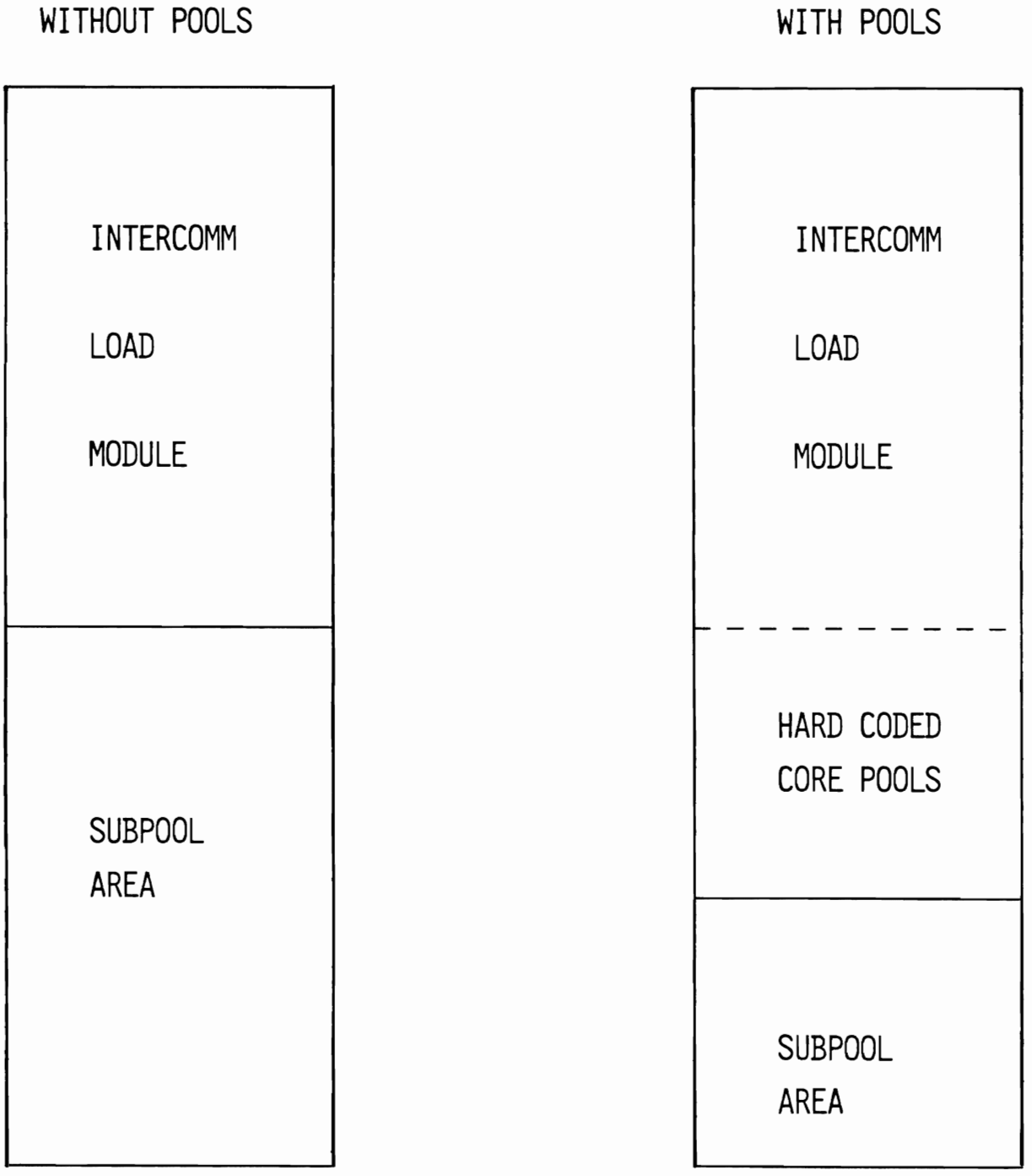
MANAGER Entry: CUSHION -- if 0 = SPALIST -- CUSHION = 0
if negative = released
if positive = cushion address

Monitoring Cushion Use: SPAHOLD = 'F0' -- Cushion Acquired
'F1' -- Cushion Released
GETCUSH -- reacquire Cushion
SSPOLL -- suppress terminal input until cushion reacquired
LOWCORE -- flush S/F strings, loaded subroutines

ABEND: 1111 -- Cushion Released and no core for RCBTABLE

CORE POOLS

Intercomm Region



RESOURCE MANAGER -- STORAGE MANAGEMENT

Installation Checklist

Globals	&RM	Core Pool Release Auditing
	&RMPOOLS	Core Pools Support
	&RMSTATS	Global Core Use Statistics
	&RMACCT	Detail Core Use Statistics
	&RMINTEG	Core Pool integrity checking
SPALIST	COREACC	TRACETM
	RMSTIM	TIMS
Assemblies	MANAGER	
Generation	ICOMPOOL	
Macros	COREACCT	
Dataset	SMLOG	SYSOUT=A
Linkedit	Automatic	
	Modules	MANAGER
		RMTRACE
		POOLSTRT (optional)
		POOLDUMP (optional)
		SSPOLL (optional)
		TRAP (optional)
	Tables	NEWPOOLS/ICPOOLnn

STORAGE CUSHION

Purpose: Prevent (GETMAIN) ABEND when no Subpool core available.

Installation Checklist

Global	SETGLOBE	&RM
SPALIST	CUSHION	
	CUSHTM	
Assemblies	MANAGER	
	IXFHNDO1	

MANAGER Entry: CUSHION -- if 0 = SPALIST -- CUSHION = 0
if negative = released
if positive = cushion address

Monitoring Cushion Use: SPAHOLD = 'F0' -- Cushion Acquired
'F1' -- Cushion Released
GETCUSH -- reacquire Cushion
SSPOLL -- suppress terminal input until cushion reacquired
LOWCORE -- flush S/F strings, loaded subroutines

ABEND: 1111 -- Cushion Released and no core for RCBTABLE

SAMPLE CORE POOLS -- NEWPOOLS

```
ICOMINX     CSECT
            ICOMPOOL    LEN=32,NUMBER=2
            ICOMPOOL    LEN=64,NUMBER=2,LOWLIM=50
            ICOMPOOL    LEN=96,NUMBER=6
            END
```

Maximum ICOMPOOL definitions: 255

Maximum LEN = 256K - 8 bytes

	NAME	SPAEXT	DISPLACEMENT
CSECTS:	POOLACCT	SEXPOOLA	+370
	ICOMINX	SEXICMNX	+334
	ICOMCHN	SEXICMCH	+348
	ICOMPOOL	SEXICMPL	+38C
	POOLEND	SEXPOOLN	+358
	POOLCONS	SEXPOOLC	+3A8
ENTRY:	HILIM	SEXHILIM	+378
	POOLREGS	SEXPOOLR	+3A4

For MVS ordering: in above CSECT order

DSECT: RMDSECTS (BLOKCON, ACCTAB, STATSECT, POOLACC)

CSECTS IN ICOMPOOL GENERATION

ICOMINX

- String of 1-byte entries per 8 bytes in ICOMPOOLs range (largest size specified rounded up to doubleword boundary).

- The nth byte represents requests for 8n-7 to 8n bytes of storage:

  N=(STORAGE-LEN-REQUESTED+7) divided by 8

- If the byte is zero, a GETMAIN must be done.

- If the byte is non-zero, it has an index (I) to ICOMCHN

  (STORAGE-LEN-REQUESTED+7)/8=N+A(ICOMINX)->I

ICOMCHN

- Pool block addresses for each ICOMPOOL--first word is the address of ICOMPOOL followed by:

- for each size pool block defined, two words:

  -- the address of the first block of that size.
  -- the address of the first available block of that size or zero (if all in use).

- Formula: 8*(I-1)+A(ICOMCHN)+8->first available block pointer where I=Index from ICOMINX

ICOMPOOL

- Actual pool blocks defined via ICOMPOOL macros.

- Unused pool blocks (or unused low-order portions) are Initialized to X'BB' - easy way to find pools area in a dump.

- Each pool block starts with 8-byte (2 word) header:

pool block not in use

- Free list chain pointer to next free pool block, or zero (fullword)

- Offset from start of ICOMCHN to head of free list for this size pool (halfword)

- Length of this pool block in doublewords (halfword)

pool block in use

- Number of doublewords used (halfword)

- Index/4 to RCB for this block: same format as index in RCB Table (halfword)
  4(Index)+A(RCBTABLE)=RCB

- Offset from start of ICOMCHN to head of free list for this size pool (halfword)

- Length of this pool block in doublewords (halfword)

CSECTS IN ICOMPOOL GENERATION (continued)

POOLACCT

- Used to accumulate Pool Use Detail Statistics
- For each ICOMPOOL, four words:
  - -- number of requests that fit pool
  - -- number of pool failures
  - -- amount allocated
  - -- number of free blocks

POOLCONS

- total size of ICOMPOOLs exclusive of headers (fullword)

ENTRY HILIM

-- size of largest ICOMPOOL

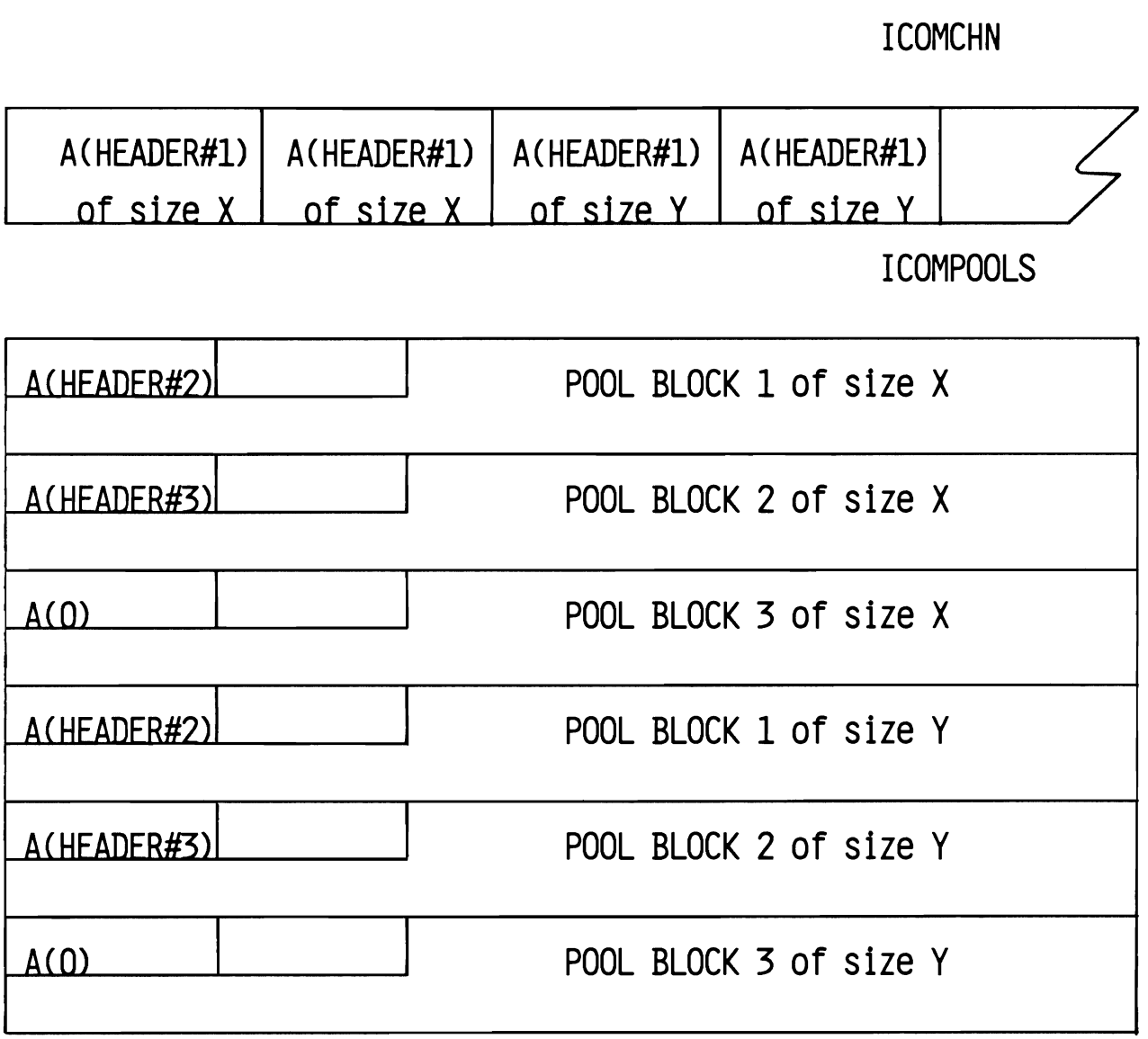
ENTRY POOLREGS

-- constants for pool use statistics accounting
  - fullword of '8'
  - address of last pool block header chain
  - address of first pool block header chain

POOLEND

- Defines end of all pools (fullword X'FF')

POOL HEADER CHAINING AT STARTUP



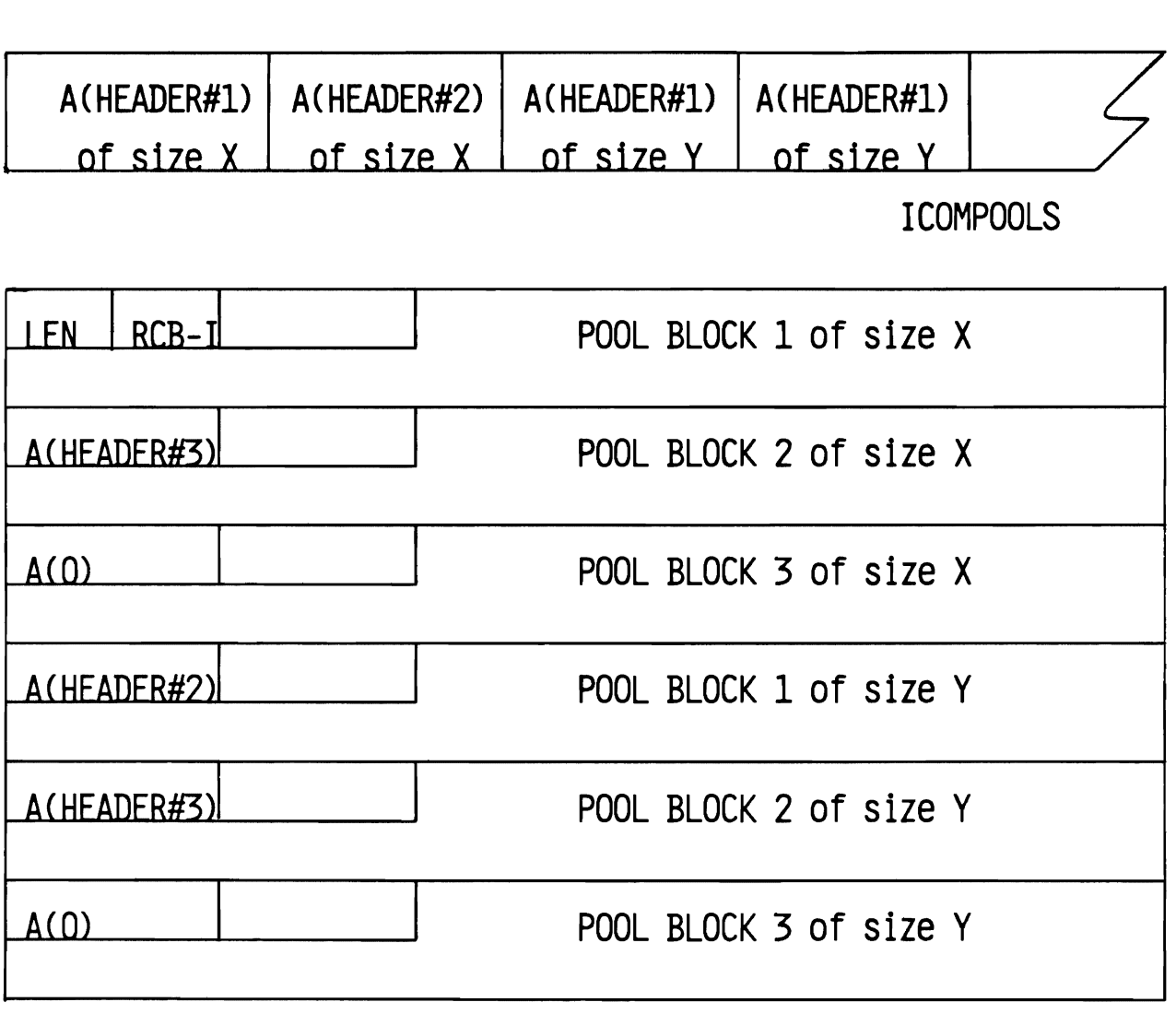
Pool Blocks grouped in ascending order by size
(from ICOMPOOL macros)

Each Pool Block has 8-byte header.

At linkedit header chained to next header in range or 0 if last in range.

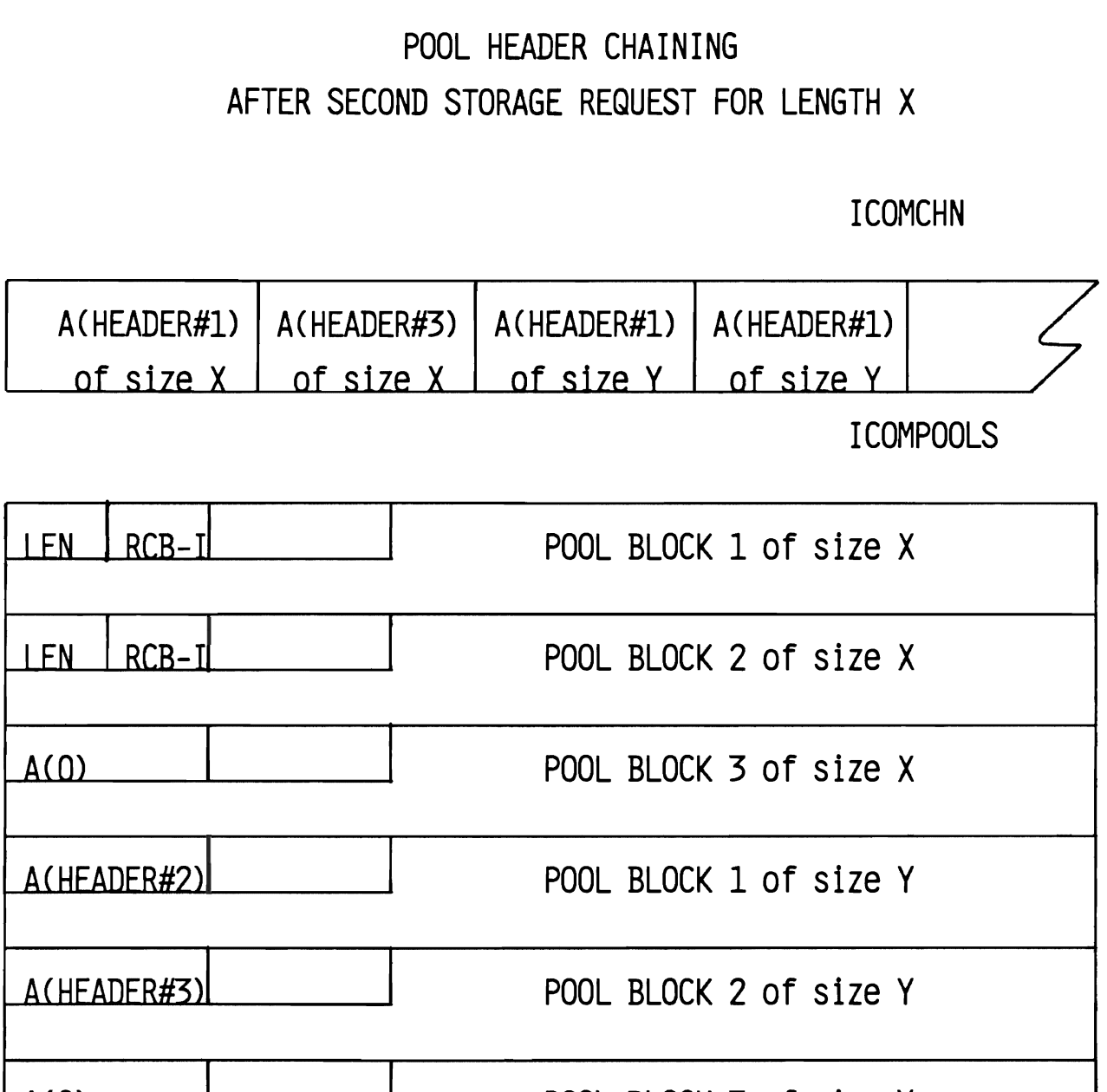
POOL HEADER CHAINING

AFTER FIRST STORAGE REQUEST FOR LENGTH X



POOL HEADER CHAINING

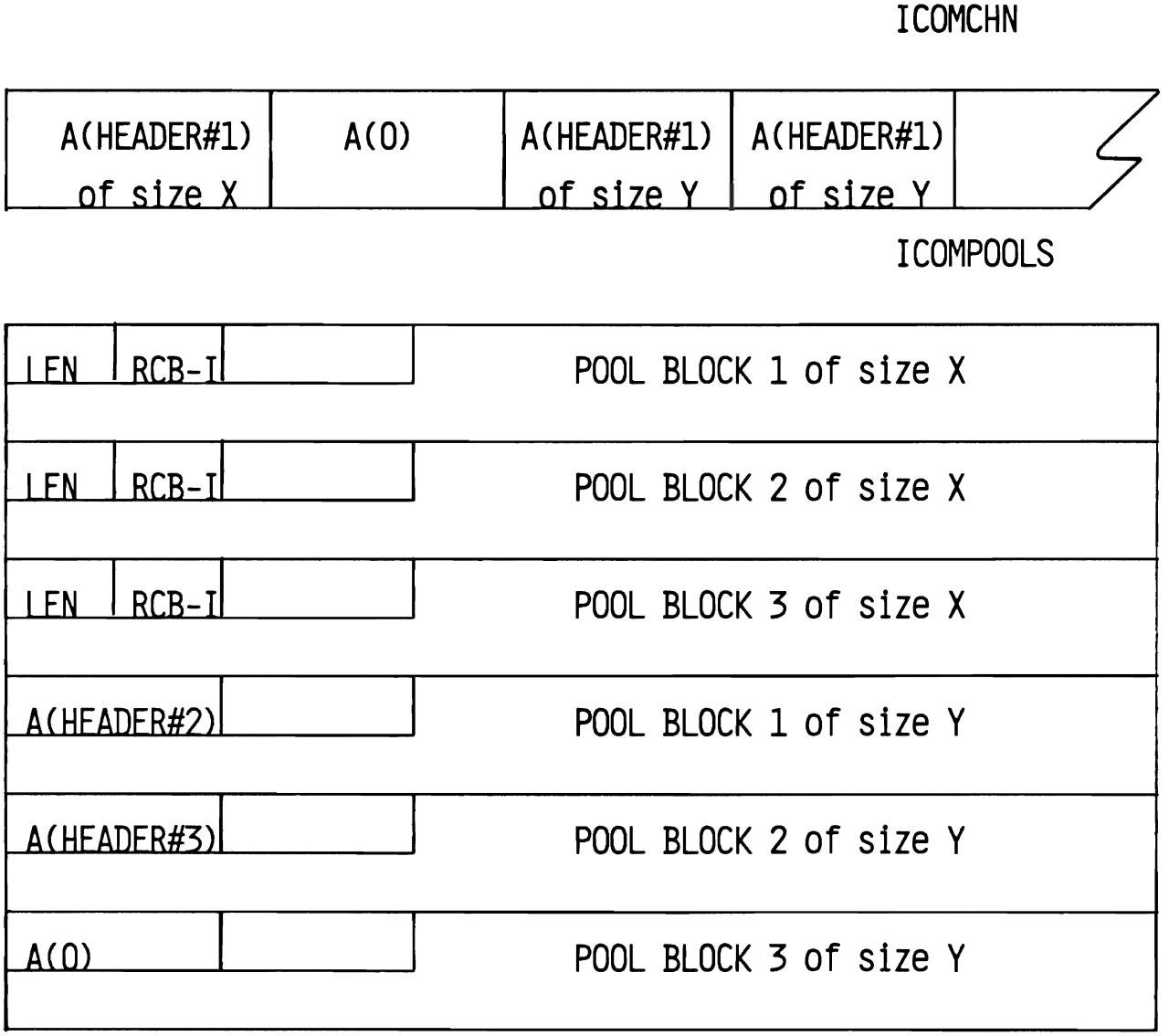
AFTER SECOND STORAGE REQUEST FOR LENGTH X



POOL HEADER CHAINING

AFTER THIRD STORAGE REQUEST FOR LENGTH X

WHEN NO INTERVINING STORFREE REQUESTS WITHIN SIZE X



POOL HEADER CHAINING

AFTER STORFREE FOR SECOND OF THREE AREAS OF SIZE X

ICOMCHN

A(HEADER#1) of size X	A(HEADER#2) of size X	A(HEADER#1) of size Y	A(HEADER#1) of size Y	

ICOMPOOLS

LEN	RCB-I		POOL BLOCK 1 of size X
A(0)			POOL BLOCK 2 of size X
LEN	RCB-I		POOL BLOCK 3 of size X
A(HEADER#2)			POOL BLOCK 1 of size Y
A(HEADER#3)			POOL BLOCK 2 of size Y
A(0)			POOL BLOCK 3 of size Y

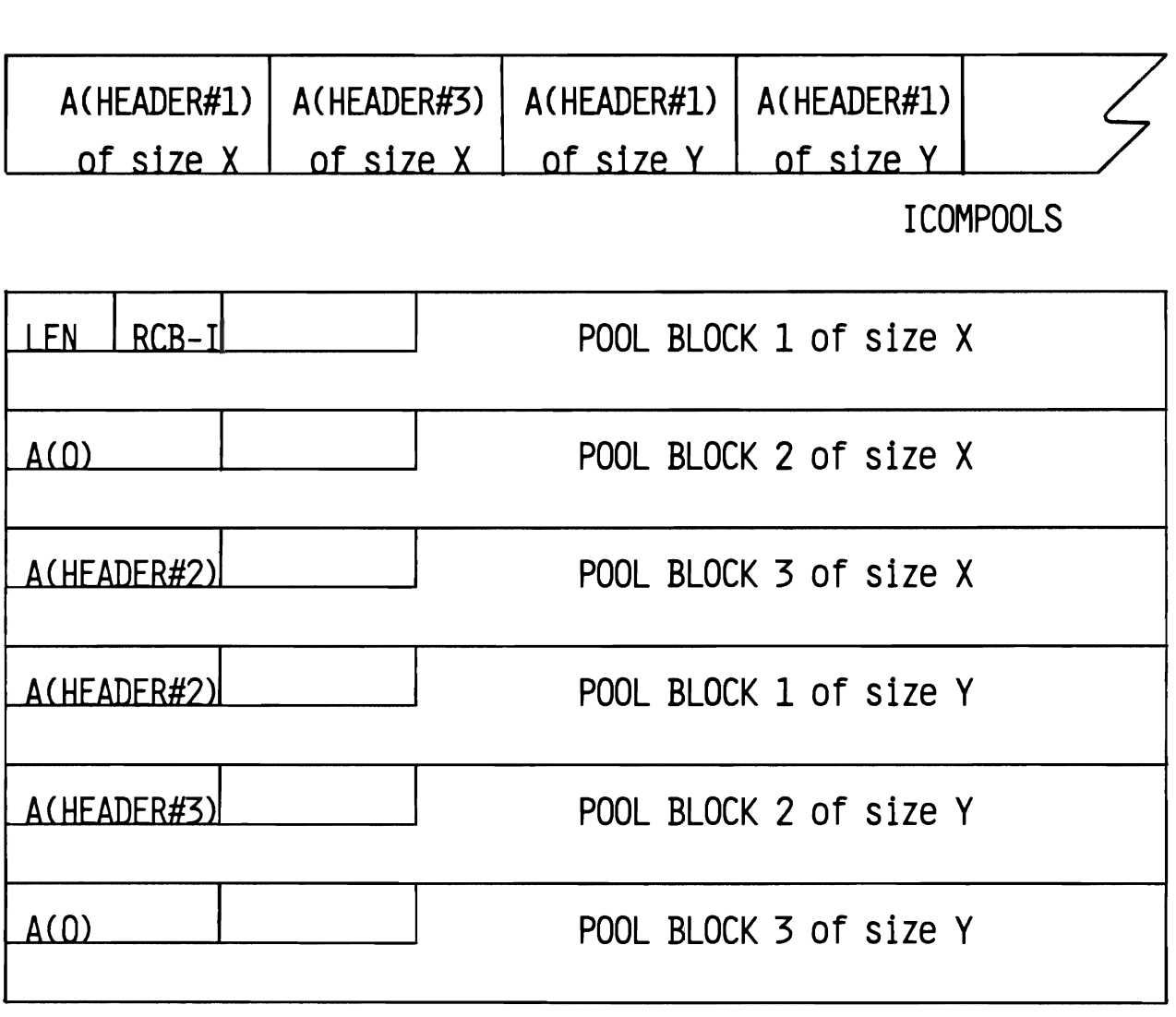
NOTE: A(HEADER#2) stored in ICOMCHN after 'NEXT' pointer moved to header of pool block being freed.

In this case, 'NEXT' pointer was A(0) because all pool blocks of size X were in use. A(0) now in HEADER#2.

POOL HEADER CHAINING

AFTER STORFREE FOR THIRD OF THREE AREAS OF SIZE X

(SECOND AREA WAS FREED EARLIER)



NOTE: After STORFREE, ICOMCHN points to HEADER#3 of size X, and HEADER#3 of size X points to HEADER#2 of size X which is the end of the Free Chain (for size X).

STORAGE MANAGEMENT EXERCISE

Address ICOMINX _____

Address ICOMCHN _____

Using ICOMINX/ICOMCHN indexing,
Allocate 2 blocks of core from ICOMPOOLS

Sizes: 278 bytes, 735 bytes.

APPLICATION INTERFACE

Macros: STORAGE/STORFREE
PASS/CATCH
LINKAGE/RTNLINK
SUBLINK

Statistics: SAM -- HIGHSTOR/STORAGES

Further Reference: Basic System Macros
Assembler Language Programmers Guide

PROGRAM CHECKS - MANAGER

Csect RSMGMNT

Example: SOC4 on L R1,BLOKPTR instruction

Cause: Bad Pool Block Header chain address

Snap 126: SPIE SAVE AREA -- find R4 - has
Blanks (X'40') or X'BB' or Alpha data

Cause: Owner of previous pool block moves data over next header (may also destroy next pool)

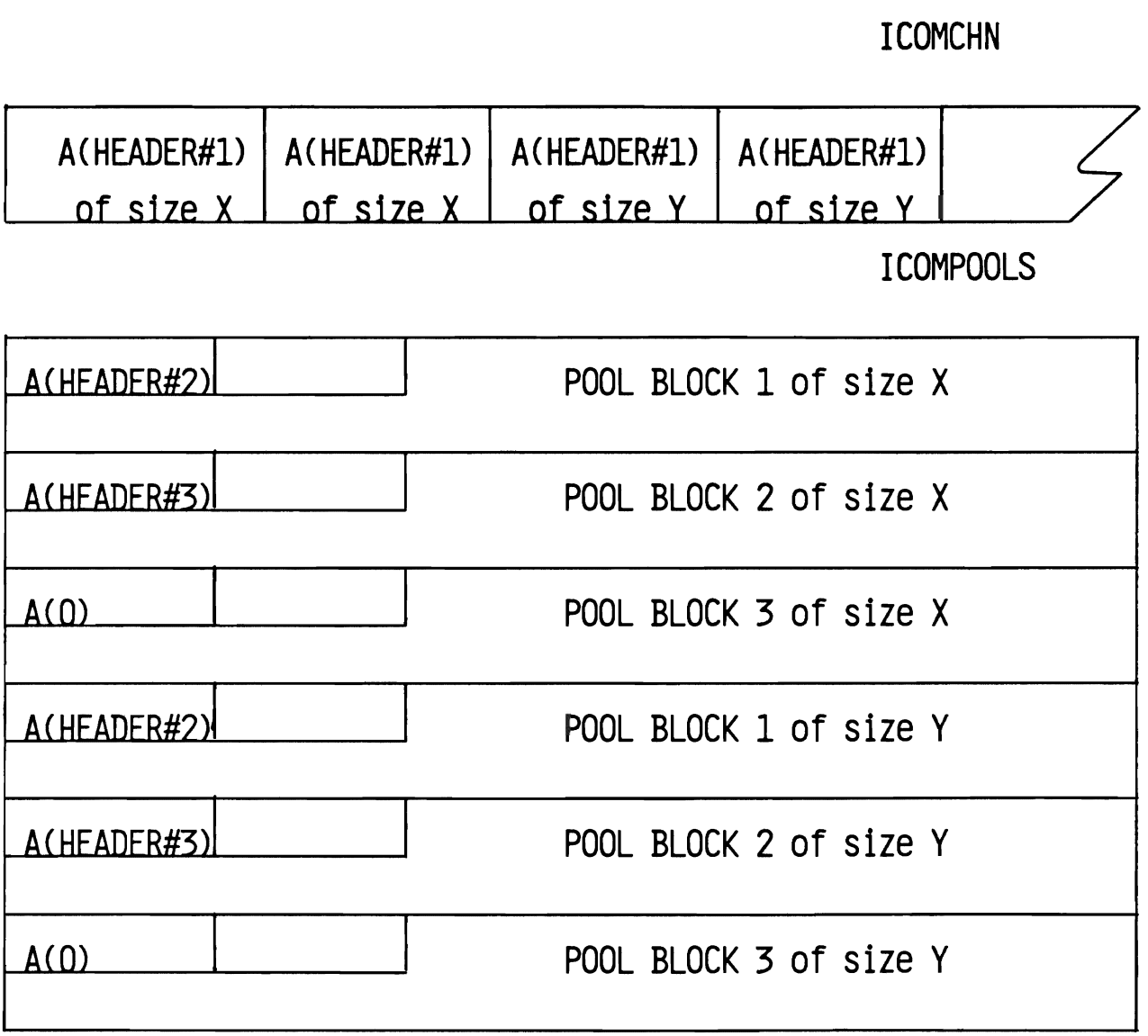
Occurs if:
1) data added to input message area
2) data moved beyond allocated save/work (DWS) area
3) DWS size (SYCTTBL macro GET) not increased after program change

SPALIST/SYCTTBL macros: DWSCHK=YES will trap 2 and 3 for COBOL, controlled by STRT/STOP (SPALIST), FTUN/SSUP (SYCTTBL)

If bad header for block in use - ISK

May cause recursive ISK when RMPURGE issues STORFREE

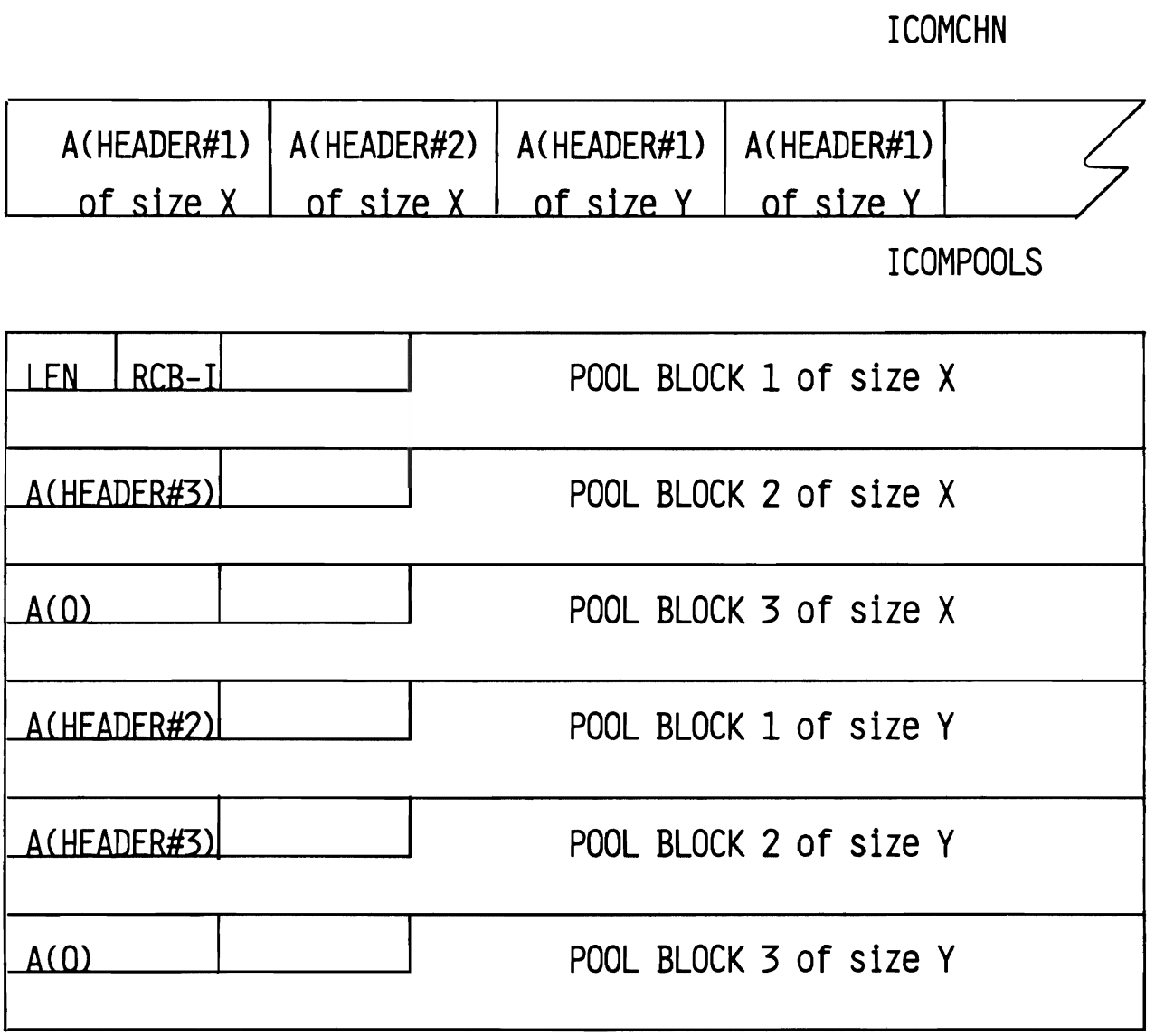
POOL HEADER CHAINING AT STARTUP



POOL HEADER CHAINING

AFTER FIRST STORAGE REQUEST FOR LENGTH X

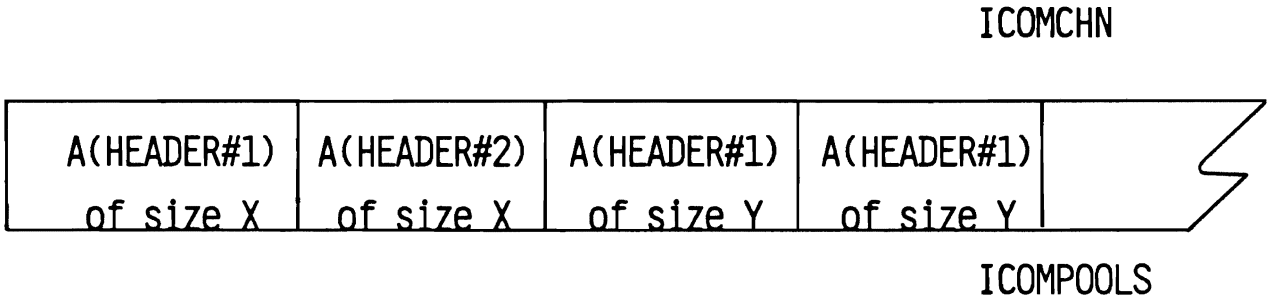
(BY USER 'A')

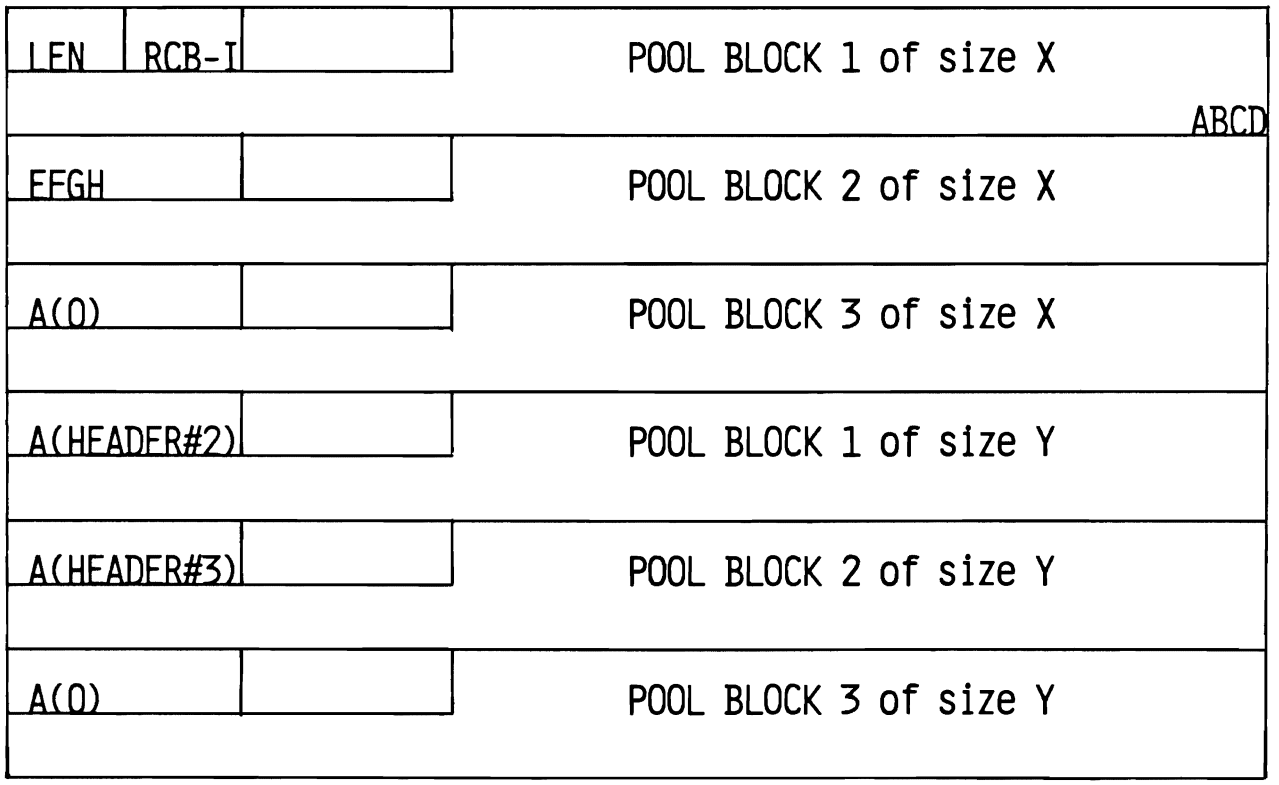


POOL HEADER CHAINING

AFTER USER 'A' HAS OVERLAID HEADER#2

OF POOL#2 OF SIZE X

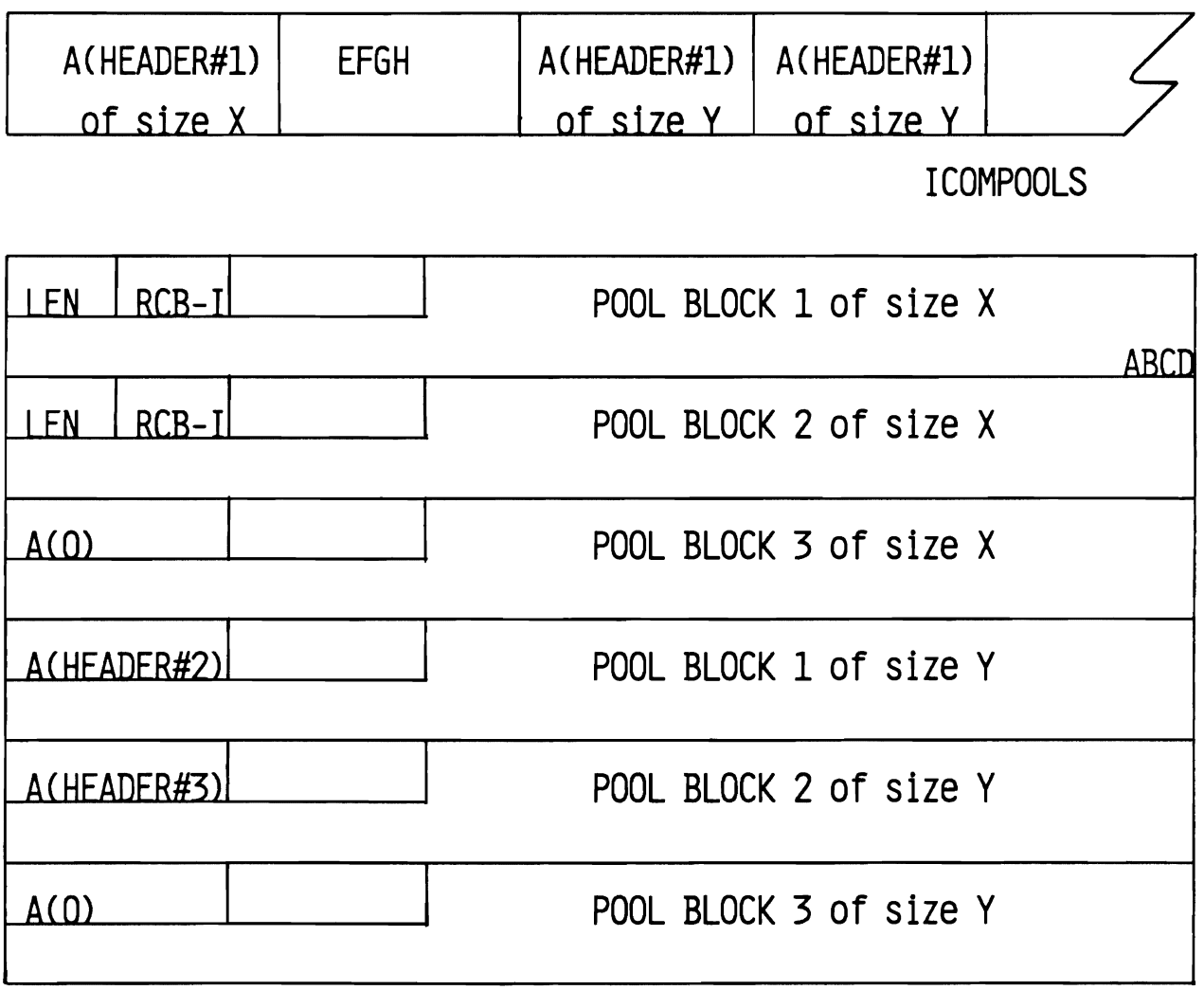




POOL HEADER CHAINING

AFTER SECOND STORAGE REQUEST FOR LENGTH X

(BY USER 'B')



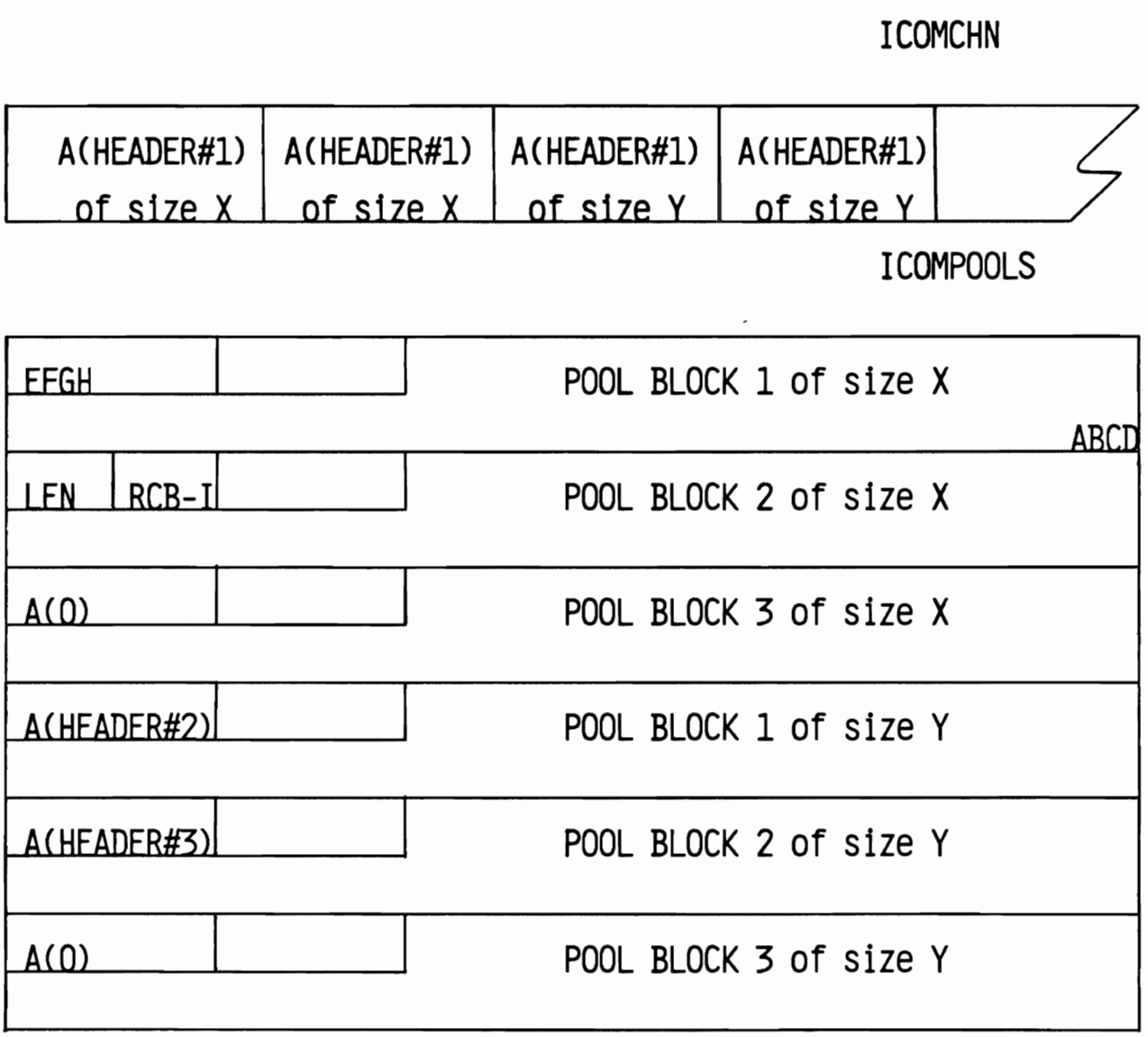
NOTE: Destroyed pointer from HEADER#2 of size X moved to ICOMCHN

SOC4 occurs if third storage request for length X (by user 'C') before STORFREE for areas owned by user 'A' and user 'B'

POOL HEADER CHAINING

AFTER STORFREE ISSUED BY USER 'A'

(FIRST REQUESTER OF LENGTH X)



NOTE: Destroyed pointer from ICOMCHN moved to HEADER#1, ICOMCHN points to HEADER#1 as first available area of size X.

Chain is a 'Push-down Stack' -- access to bad pointer can occur minutes/hours later, usually at peak processing time.

In SOC4 - R2 in SPIE SAVE AREA points into ICOMCHN
SEXICMCH contains ICOMCHN address
First word in ICOMCHN is ICOMPOOL address
(end of ICOMCHN)

If R2 is good, it points to a free pool chain pointer
Previous word in ICOMCHN is A(Header#1)

Look at Header#1:

1) If good header, use 4th (last) halfword value times 8 + A(Header+8)=A(next-header)
2) Compare A(next-header) to word following free-chain-pointer in ICOMCHN which is A(Header#1) for next pool size (0 if at end).
   If A(next-header)=next A(Header#1), go to 3.
   If A(next-header) lower than next A(Header#1), go to 1.
   If A(next-header) higher than next A(Header#1), then block length in current header is bad; this header originally had bad chain pointer, go to 4.
3) If all headers look good, then bad address in R4 = free pool chain address in ICOMCHN.
4) Try to match data in R4 to data at end of previous (each) block. If matching block in use, use POOLDUMP or Thread Dump to find owner. Owner may not be guilty if area reused.

TRAP

Checks all pool headers and chaining on every call to Resource Management, Dispatcher, COBREENT by trapping associated entry point. Has Trace Table of last 256 calls.

ABEND 1369

Controlled by: STRT/STOP commands
-- set OFF at startup

Further Reference: Messages and Codes

RMINTEG

Global: &RMINTEG requires &RM SETB 1

Assemble: MANAGER

Checks pool headers, chaining, pool data.
More processing overhead than TRAP.

Controlled by: STRT/STOP commands
-- set OFF at startup

Further Reference: Operating Reference Manual

SPECIFYING CORE-USE DETAIL STATISTICS

In Pools module: COREACCT macro (before ICOMINX CSECT)

```
COREACCT    [(range1,...,rangen)]
            ,FROM=start-value
            ,TO=end-value
            ,BY=increment
```

Recommended:

```
COREACCT    ,FROM=64,TO=4096,BY=64
```

When Pools are tuned--save overhead by:

set &RMACCT to 0 (reassemble MANAGER)

or

Omit RMTRACE from linkedit

or

Specify larger increments for COREACCT

or

SPALIST macro: specify COREACC=NO

or

STOP$RMSTAT stops statistics printing

Further Reference: Operating Reference Manual
Basic System Macros

5 DATA MANAGEMENT--File Handler

5.1 Introduction

5.2 Installation

5.3 Interface: Structure and Processing

5.4 Features

5.5 Messages, Snaps and Abends

DATA MANAGEMENT
FILE HANDLER

- I/O UNDER MONITOR CONTROL
  -- "read only," "duplexing," etc. at monitor level

- OVERLAP WITH APPLICATION PROCESSING
  -- allows multithreading

- I/O ERROR ANALYSIS
  -- errors trapped by monitor: program not terminated

- CENTRALIZED OPEN AND CLOSE
  -- Program independent
     OPEN--startup or first access
     CLOSE--close down or program request

- CENTRALIZED OS/VS CONTROL BLOCKS saves storage

- EXCLUSIVE CONTROL
  -- for data integrity; prevents concurrent updates

- SIMPLIFIED APPLICATION PROGRAMS
  -- Restart/Recovery is external to application

- STATISTICS

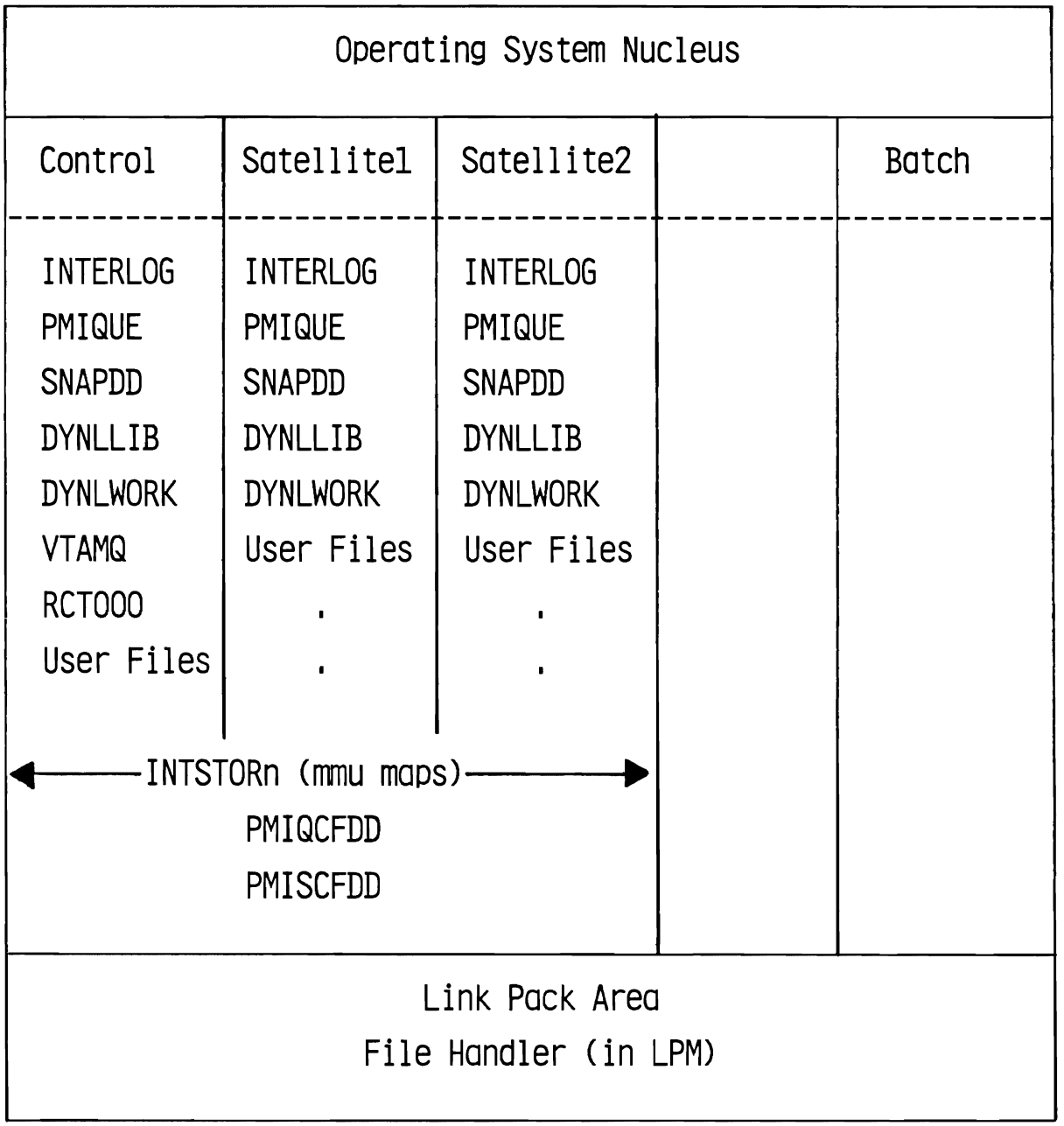
- EXTERNAL CONTROL via FILE command

FILE HANDLER AND MRS--DATA MANAGEMENT ACROSS REGIONS

FILES -- Region Dedicated

-- Shared across regions

Exclusive Control -- within a Region only



SUPPORTED ACCESS METHODS

- BDAM--Fixed and Variable
  --by RBN or KEY
- BISAM--Fixed and Variable
- QISAM*
- ISAM/VSAM Compability
- VSAM--Entry-sequenced, Key-Sequenced, RRDS
- BSAM
- QSAM
- IAM--ISAM replacement

* QISAM via BISAM option

Further References: Operating Reference Manual
Programmers Guides

FILE HANDLER INSTALLATION CHECKLIST

Globals	&ISAM	
	&VSAM	(requires &VSSYSTM)
	&VSISAM	(requires &VSAM)
	&IAM	(requires &ISAM)
SPALIST	TASKNUM	(subtasked I/O)
	BLDVRP	(VSAM LSR Pools)
Assemblies	IXFHND00	also if using link pack:
	IXFHND01	LPINTFC
	IXFFAR	LPSPA
Generation Macros:	IXFDSCTA	
ICOMLINK	DSCT=	IXFDSCTn

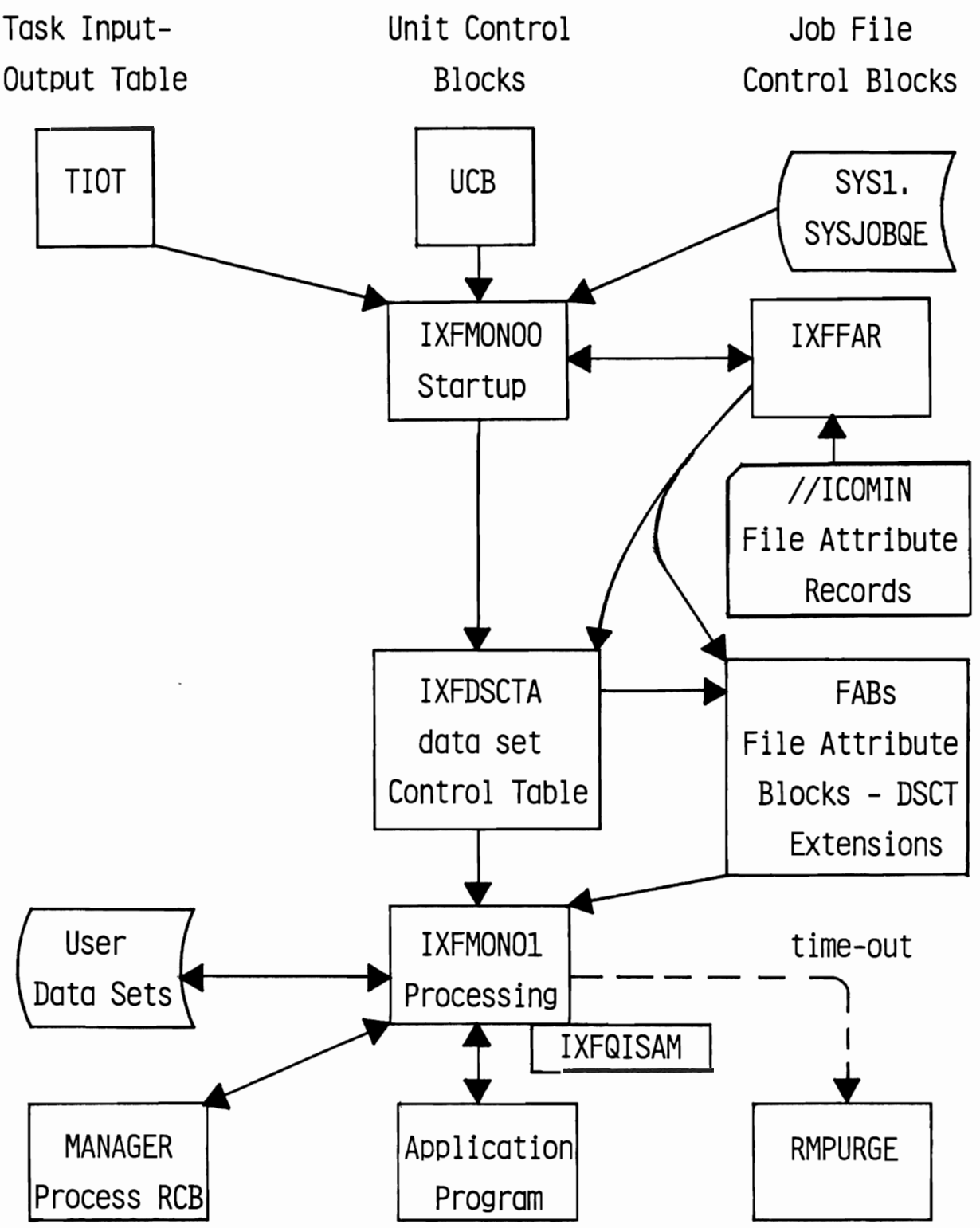
Linkedit	Modules	IXFHND00	IXFB37
		IXFHND01	IXFRPT01
		IXFFAR	IXFVSCRS
		IXFQISAM	
		ICOMTASK (subtasked I/O)	

Dsect: IXFDSECT--File Handler Work Area
VRPDSECT--VSAM LSR Pools Build Area

FILE HANDLER COMPONENTS

Member Name	Description	CSECT Name
IXFDSCTn	Data Set Control Table	IXFDSCTA
IXFHND00	Initialization Processing	IXFMON00
	Termination Processing	IXFMON09
IXFFAR	FAR Processing Module	IXFFAR
IXFHND01	Resident Processing Module	IXFMON01
	Common Subroutines	IXFSUBS
	Issues Error Messages, ISK	IXFABWTO
IXFQISAM	QISAM/BISAM Module	IXFQISAM
IXFB37	SAM Disk File Flip/Flop	IXFB37
IXFRPT01	File Handler Statistics	IXFRPT01
IXFVSCRS	VSAM X-Region File Control	IXFVSCRS

PROCESSING OVERVIEW



Note: JFCBs are in SWA under MVS

DATA SET CONTROL TABLE

The Data Set Control Table contains one entry for each file. It is built dynamically at startup, but space must be reserved.

IXFDSCTA Macro

```
(symbol)    IXFDSCTA    CSECT=
                        MAXFILE=
                        OPTIONS=
```

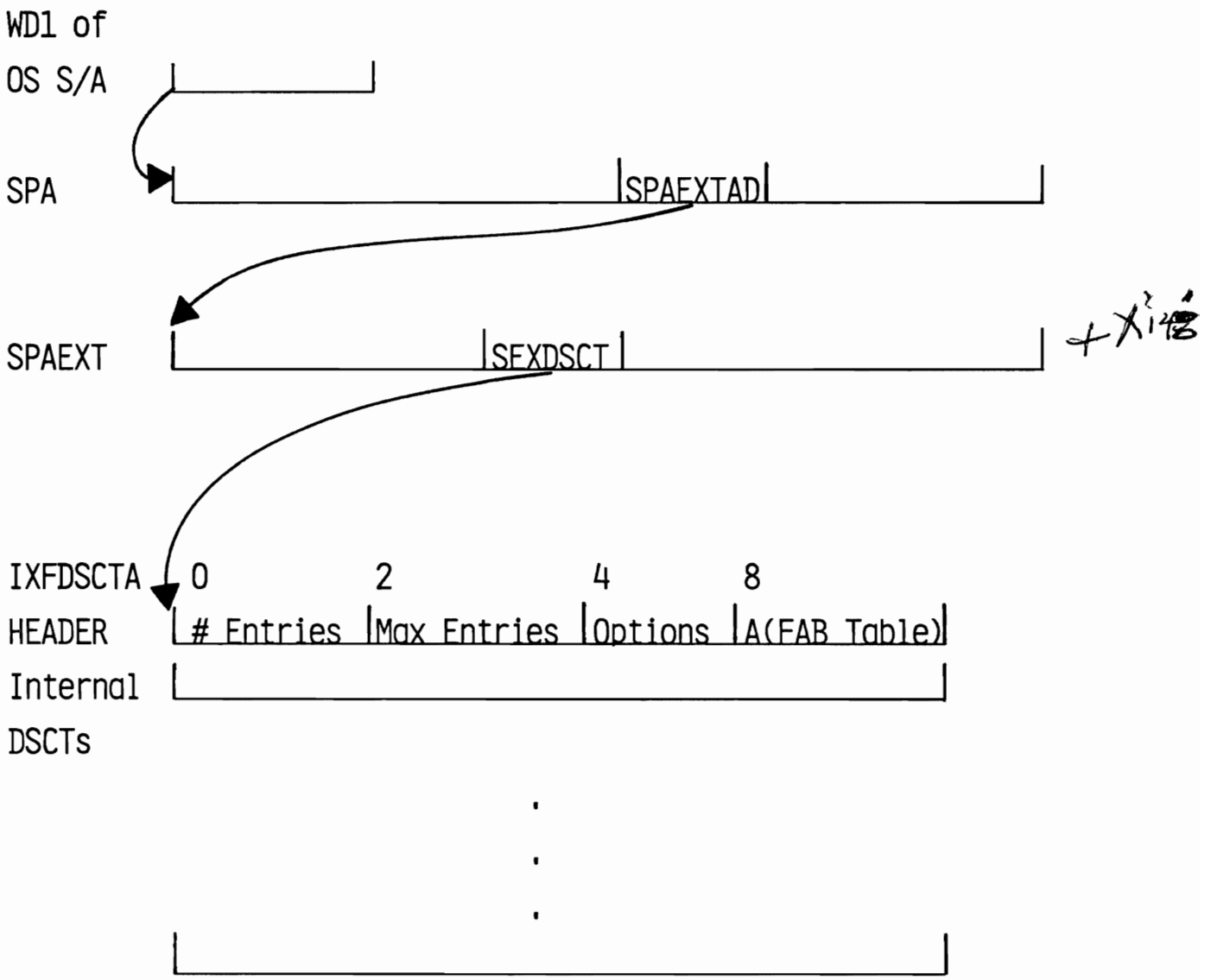
Packaged IXFDSCTA Macros (MODREL)

Member Name	Maxfiles
IXFHND01	20
IXFDSCT1	50
IXFDSCT2	100
IXFDSCT3	200

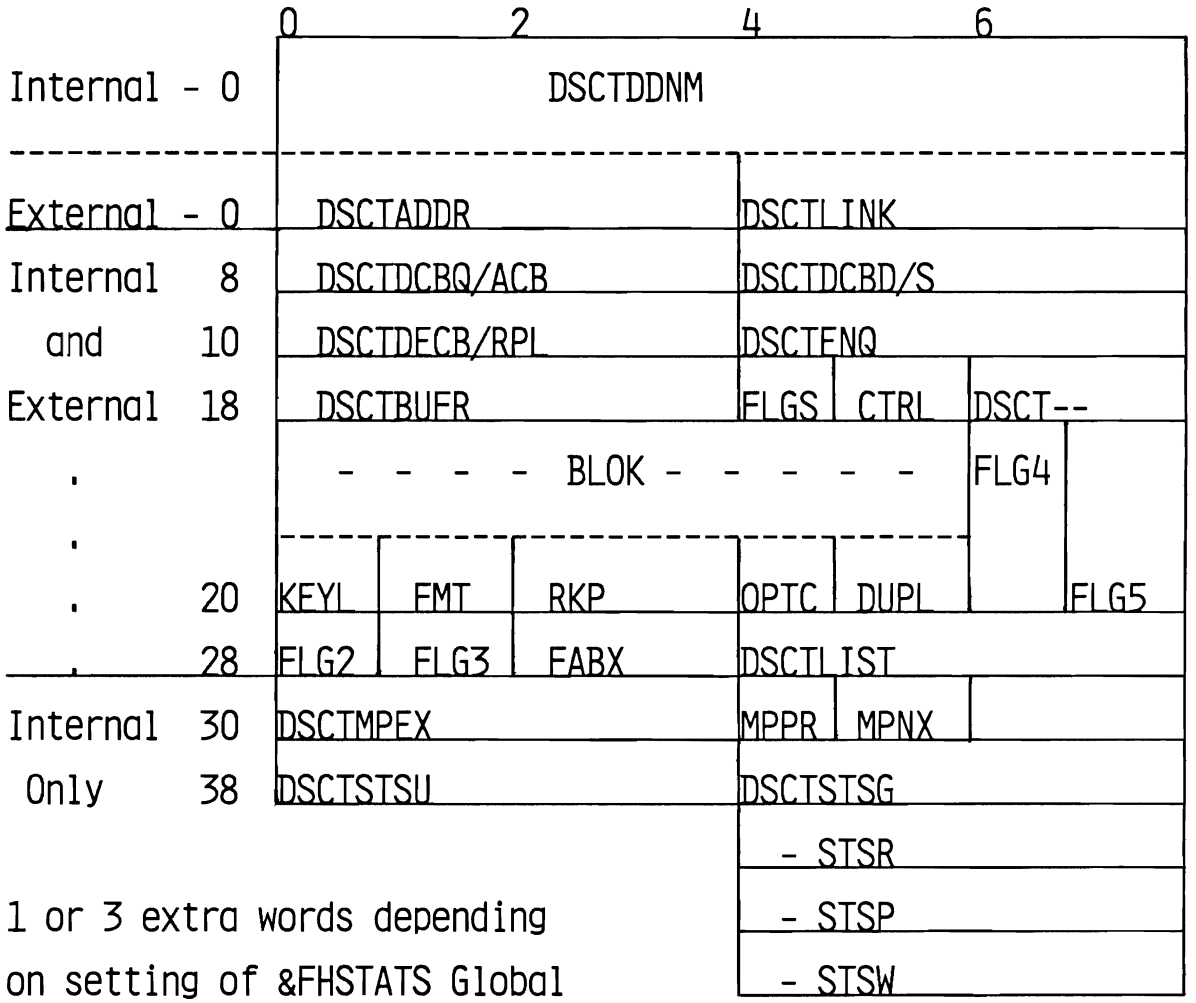
```
ICOMLINK        DSCT= IXFDSCT1
                      IXFDSCT2
                      IXFDSCT3
```

DSECT: IXFDSCTA

LOCATING THE DSCT



DSCT FORMAT



DSCTADDR | A(internal-dsct) |

X'00' not active
X'3F' selected
X'FF' I/O in progress
X'1F' file reversal

DSCTLINK = A(previous extdsct)
0 if first in chain

DSCTDCBQ | A(DCB/ACB) |

DSCTDCBD high order bit on = open DCB/ACB

DSCTLIST = A(latest extdsct) (back chain) Internal only

Dsect: IXFDSCTA

FILE HANDLER EXERCISE

CSECT	ADDRESS
IXFDSCTA	_____

From the DSCT, find:

1. Which files have been accessed? _____

   _____

   _____

2. Of those accessed, how many are currently selected? _____

3. What is the address of the most recent external DSCT for INTERLOG? _____

4. How many outstanding SELECTs for INTERLOG? _____

   _____

5. From the first EXTDSCT for INTERLOG, find:

   status: _____

   what was the last function issued: _____

   _____

FILE OPEN/CLOSE

- Program Independent
- OPEN -- Start-up (FAR option)
  -- First Access
- CLOSE -- Close-down
  -- Program Request (RELEASE)
- Terminal Command -- FILE

SELECT

- Verify File Availability
- Initialize External DSCT (chain to Internal)
- Create RCB (call RMFON in MANAGER)

RELEASE

- Free Dynamic Buffers
- Update Internal DSCT Status (unchain External)
- Delete RCB (call RMFOFF in MANAGER)
- Issue VSAM ENDREQ

	EXTDSCT	FHCW	AREA	KEY	BLOCK-ID
SELECT	R	R	R	--	--
RELEASE	R	R	--	--	--
GET	R	R	R	I OR U	--
PUT	R	R	R	U	--
GETV	R	R	R	I	D OR E
PUTV	R	R	R	I	D OR E
READ	R	R	R	DI OR U	D
WRITE	R	R	R	DI OR U	D
RELEX	R	R	--	--	--

R -- REQUIRED
I -- OPTIONAL FOR ISAM OR KEY-SEQUENCED VSAM
U -- REQUIRED FOR BSAM OR QSAM WITH RECFM=U
D -- OPTIONAL FOR KEYED BDAM OR KEY-SEQUENCED VSAM
DI -- REQUIRED FOR KEYED BDAM
E -- REQUIRED FOR ENTRY-SEQUENCED VSAM (RBA)
-- -- INVALID PARAMETER

NOTES: CONCURRENT QISAM GETS RESULT IN MULTIPLE DCBS OPENED (DUE TO SETL), EACH CLOSED VIA PROGRAM CALL TO RELEASE (EXCEPT ORIGINAL DCB OPENED AT START-UP).
AREA USED FOR --DDNAME FOR SELECT
--RECORD AREA FOR I/O REQUESTS

LOCATE SERVICE ROUTINE

```
CALL LOCATE,(WORKAREA,*
                FHCW,
                DSCTFLD,
                DCBFLD,
                DECBFLD,
                IOBFLD),
                VL, MF = (E,LISTAREA)

*  ADDRESS OF DDNAME FOR
     "PUBLIC" DCB , OR
   ADDRESS OF EXTDSCT FOR
    "PRIVATE" DCB
```

VSAM FILE: ACB instead of DCB address
RPL instead of DECB address
omit IOBFLD

SHAREABLE SEQUENTIAL DATA SETS

SHAREABLE IF:

- -- Disposition is OLD or SHR (READ only)
  - --can be repositioned if not tape
- -- DCB address is in internal DSCT
- -- DCB not closed via RELEASE

NOT SHAREABLE IF:

- -- On magnetic tape
- -- Disposition is NEW or MOD (write only)
  - --(unless interleaving of output records immaterial)

CHARACTERISTICS:

- -- Select Status Code = 1
- -- Operations Performed in Order Requested
- -- No Repositioning - if tape
- -- No Intermixing of Queued and Basic Methods

BISAM DYNAMIC BUFFERING

- BUFNO IGNORED (all basic access methods)
- BUFFER OBTAINED AT FIRST ACCESS
- FREED AT RELEASE (if more than 1 outstanding for file)
- UPPER LIMIT ON CONCURRENCY IS NCP (DCB parameter)

EXCLUSIVE CONTROL

- VSAM - CONTROL INTERVAL LEVEL
- QISAM - DATA SET LEVEL
- BISAM - PHYSICAL RECORD
- BDAM - RECORD BLOCK
- TIME-OUT: 2 MINUTES AT RECORD LEVEL
  10 MINUTES AT DATA SET LEVEL
  (VALUE SET IN IXFHND01)
- REQUESTED BY -- CALLER
  -- C'X'in second byte of FHCW

DATA SET LABEL INFORMATION

DSORG*
RECFM
BLKSIZE
LRECL
KEYLEN
RKP
OPTCD
LIMCT* (if applicable)

* MUST BE ON DD CARD

Except
Data Sets (Data Base) JCL following a
//PMISTOP DD DUMMY
will not be processed via internal DSCT

VSAM

--AMP=(AMORG) required
--if fixed-length: AMP=(AMORG,'RECFM=F')

SEQUENTIAL, MULTI-VOLUME FILES

--code SUL on LABEL parameter to prevent 118 timeouts between volume mounts

FILE ATTRIBUTE RECORDS
(FABs)

- READ ONLY (input only)
- OPEN AT START-UP
- UPDATE ONLY (ISAM)
- IN-CORE INDEX (ISAM)
- ALIAS
- INTERNAL EXCLUSIVE CONTROL (BDAM)
- LOCK IF I/O ERROR
- n-PLEXED SEQUENTIAL OUTPUT
- B37 (SAM)
- WRITEOVER (SAM, VSAM ESDS)
- LSR (VSAM)
- VSAMCRS (VSAM)
- DSN (VSAM)

DSECT: FRDSECTS Data Set: ICOMIN
Processing: IXFFAR - at start-up

FAB Table Base Address: See IXFDSCTA Header

Additional FAR specifications--File Recovery Facility

Further Reference: Operating Reference Manual
File Recovery

SPECIAL CONSIDERATIONS

ACCESS METHODS -- refer to Operating Reference Manual and Vendor Documentation

- IAM -- Innovation Data Processing

NOTE: ISAM and IAM may be used in same region. I/O modules for IAM are provided by the vendor.

Subtasked GETs -- refer to Operating Reference Manual

- Specify SPALIST TASKNUM=
- Include ICOMTASK

User-supplied DCBs: refer to Operating Reference Manual

Using the File Handler in a Batch Environment: refer to the Operating Reference Manual

ICOMFEOF--off-line EOF recovery for SAM file after:
head crash
CPU crash
--data set on disk or tape
--special use for INTERLOG, TOTAL Logs

DYNAMIC FILE ALLOCATION

Access Methods supported: SAM, VSAM (Access only)

File Handler Service Routines (instead of SELECT):

- ALLOCATE
- ACCESS

Installation:

Assemble	IXFDYNAM	
ICOMLINK	DFA	
Linkedit	Module	IXFDYNAM
Data Sets	IXFnnnnn	
Control Block:	DFACB	
DSECT:	DDSASECT	

Further reference: Dynamic File Allocation

File Control--GPSS Subsystem--IXFCTRL, IXFDYALC

- FILE
  - LOCK/UNLOCK
  - FEOV
  - CLOSE/CLOSE$LOCK
  - ALTER$READONLY/WRITES/WRITEOVER
  - STAT
  - DYNAMIC ALLOC/DEALLOC

Statistics Display--IXFRPT01 Subsystem--Entry IXFRPTIQ

- FHST
- FHST$ddname
- FHST$LSR

--Information displayed depends on SETGLOBE Global:

```
&FHSTATS  SETA 2     SELECT ACCESS
               3     SELECT INPUT OUTPUT
               5     SELECT GET PUT READ WRITE (VSAM LSR)
```

Interval Control Global: &RPTINTV (assemble STARTUP3)

ICOMLINK FILSTAT=YES Modules

Linkedit:
- IXFRPT01
- RPT00046
- RPT00047

Data Set: STATFILE (Optional) Disk (CREATEGF)

Further Reference: Operating Reference Manual
System Control Commands

FILE STATISTICS

During Intercomm Execution:

FILE HANDLER STATISTICS--same as Terminal display--all files

--At interval defined by &RPTINTV

--At Close-down--final summary (including LSR stats)

--Spooled to SYSPRINT

--Cumulative

Off-Line:

SAM

- OPENS/CLOSES
- SETLS/QISAMG/QISAMP
- BISAMR/BISAMW/BISAMWKN
- BDAMR/BDAMW
- BSAMR/BSAMW
- QSAMG/QSAMP
- VSAMG/VSAMP/VSAMPT/VSAME
- SELECTS/RELEASES
- ALLOCS/ACCESSES
- by message # within subsystem code

Further Reference: Operating Reference Manual

FILE HANDLER REGISTER USAGE

R2 -- Dynamic (External) DSCT

R8 -- Internal DSCT

R12 -- Base Register of Called ENTRY

R11 -- Base Registers of 'Common Code'
R3 -- (after RELEX Entry)

R4 -- # of parameters

R5 -- CALLER's I/O AREA

R6 -- DCB/ACB

R7 -- DECB/RPL

See Also: Messages and Codes
for ISK conditions and associated registers

CONSIDERATIONS AFFECTING--

- RESPONSE TIME
- SUBSYSTEM TIME-OUTS
- CONVERSATIONAL TIME-OUTS

Disk Pack--

Data Set Contention:

-- User Files
-- DYNLLIB
-- INTERLOG (if on disk)
-- MVS PAGE Data Sets
-- Store/Fetch Files
-- DDQ Data Sets, particularly if used for Multi-Region
-- Overflow Disk Q Data Sets
-- RCTOOO (if Output Utility heavily used)
-- SNAPDD (if SPINOFF used)
-- JES Spool Data Sets
-- Cross-system RESERVE

6 APPLICATION PROGRAM MANAGEMENT--Subsystem Controller

6.1 Introduction

6.2 Installation Requirements

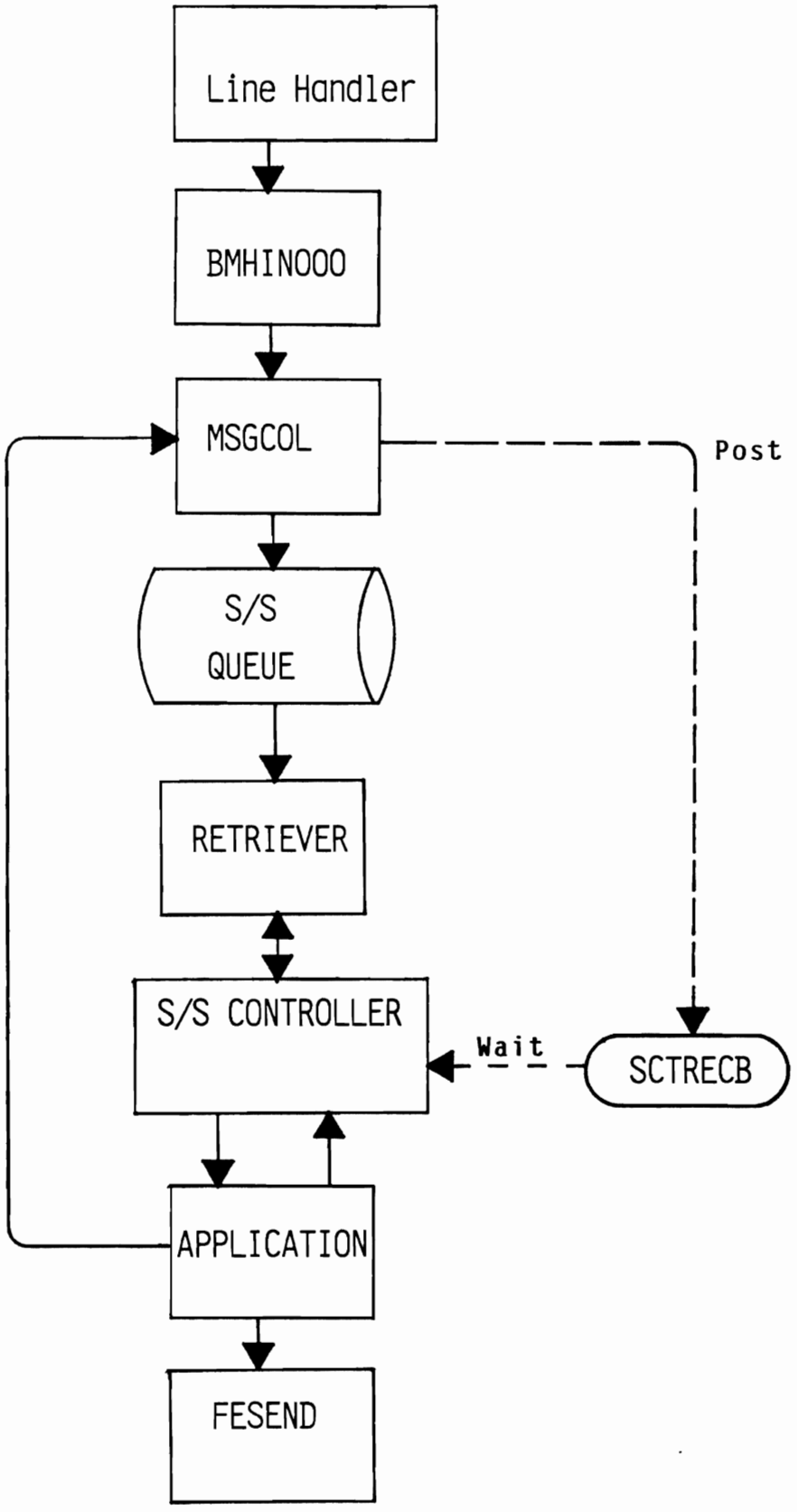
6.3 Interface: Structure and Processing

6.4 Features

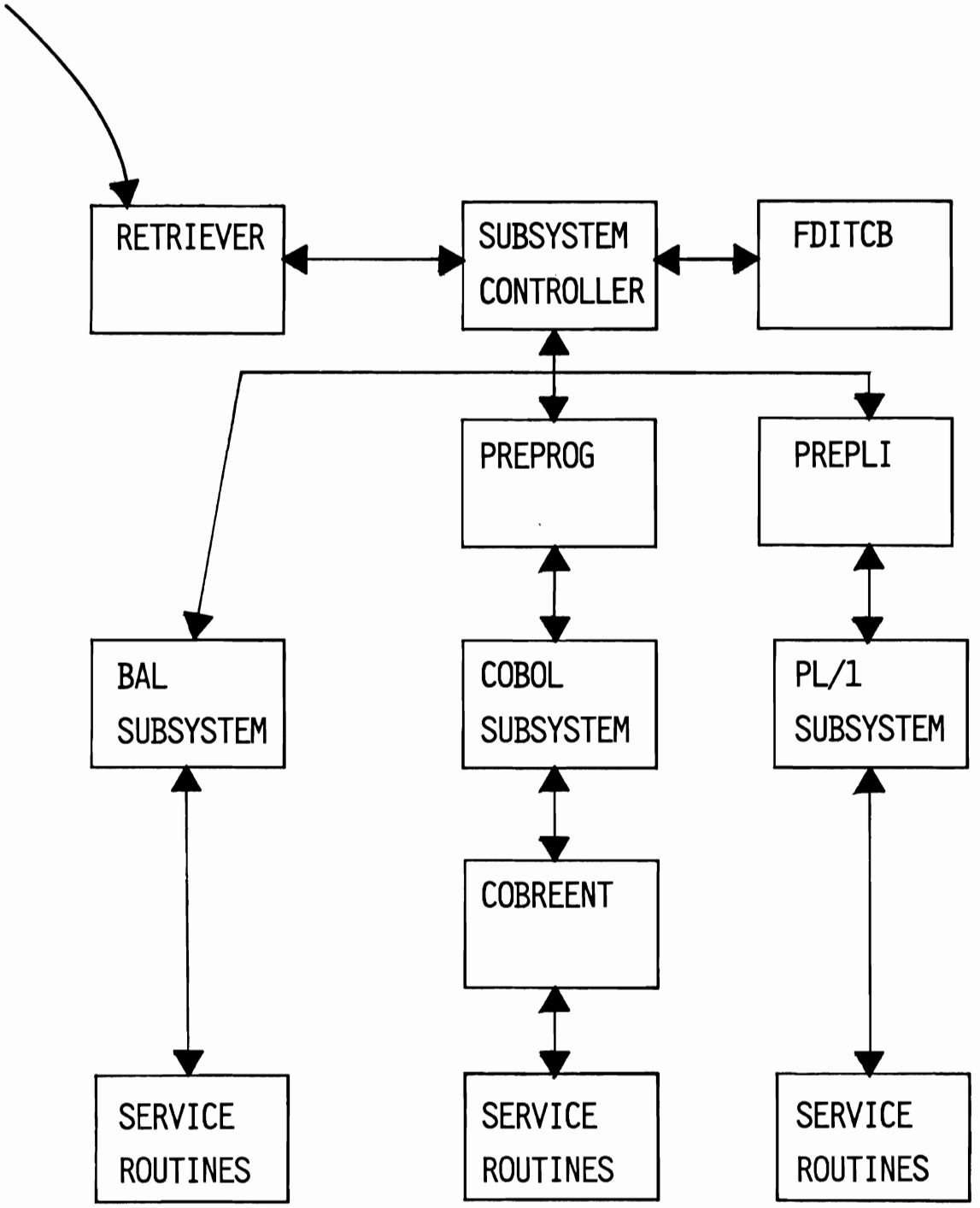
6.5 Messages, Snaps and Abends

6.6 Debugging Worksheet

FRONT END/BACK END COMMUNICATION



SUBSYSTEM CONTROLLER--OVERVIEW



SUBSYSTEM CONTROLLER

- Scheduling/Termination
  - -- Message Driven
  - -- Concurrency Processing
  - -- Time Out Initialization/Cleanup

- Locates a Subsystem
  - -- Resident
  - -- Overlay/Execution Group
  - -- Dynamically Loaded

- Status Logging - Log Code
  - -- Started 30
  - -- Completed
    - successful FA
    - error FD
    - flushed FD
    - failed security check FE

- Statistics
  - -- Message Totals: Valid/Invalid
  - -- Peak Processing

SUBSYSTEM CONTROLLER
INSTALLATION CHECKLIST

Globals	None		
SPALIST	ASYNLDR (Overlay only)		DWSCHK
	CNTDT	"	INDUMP
	ECB	"	MAXLOAD
	SWIN	"	TASKNUM
Generation Macros	RESOURCE		GENINDEX
	SYCTTBL		PCENSCT
Assemblies	None		
Linkedit	ICOMLINK		ASYNCH
			OVLYSTR
			TRANS
	Modules	SYCT400	ICOMTASK
		FDITCB	ASYNCH
		PMICANC	PMIOVLAY
		CKLINK	LOADOVLY
		SSRPT	
	Tables	INTSCT	INTSPA
User Exit:	USRCANC (released as PMICANC)		RPT0008/9
DSECTS:	SCNLIDS, SCTLISTC, RESRC		

DEFINING SUBSYSTEMS TO INTERCOMM

All subsystems are defined to Intercomm by an entry in the Subsystem Control Table, generated by the SYCTTBL macro. There is one entry per subsystem defining the following:

- Subsystem Locality
  - Dynamically Loadable (LOADNAM, BLDL, REUSE)
  - Resident (OVLY=0)
  - Overlay/VS Execution Group (OVLY/EXGRP)

- Subsystem Characteristics
  - Subsystem Code (SUBH, SUBC)
  - Entry Point (SBSP) if not loadable
  - Language (LANG, PL1LNK)
  - Core Requirements (GET/FREE, SPAC)

- Processing Specifications
  - Scheduling (MNCL, ECB, SCHED, THRSH, RESOURC)
  - Queueing
    - (Core: NUMCL, PRYMSGS)
    - (Disk: DFLN, PCEN)
    - (Auxiliary: AUXS)
  - Execution Priority (PRTY)
  - Files (BACKOUT, DBASE)
  - Features (DWSCHK, SAM)

DEFINING SUBSYSTEMS TO INTERCOMM (continued)

- Control Parameters
  - Timeout (TCTV)
  - Snaps (SNAP, INDUMP)
  - VTAM response type (SRESP)
  - Cancellation Criteria (CANC, REJECT, IMCDFL)
  - Security (SOSO, TISE, SECU)
  - Restart/Recovery (LOG, LSYNCH, RESTART, RVFILE, CNVREST, SEGREST)

- RESOURCE macro
  - -- overrides total MNCL across the group of subsystems with same value for RESOURC
  - -- control max threads access to: file, data base, function
  - -- control max threads producing printed reports: reduce DDQ access/contention

Table: INTSCT (single region Intercomm)
CRSCT, SR1SCT, SR2SCT (Multiregion)

SCT INDICES

SCT Binary Search Index--

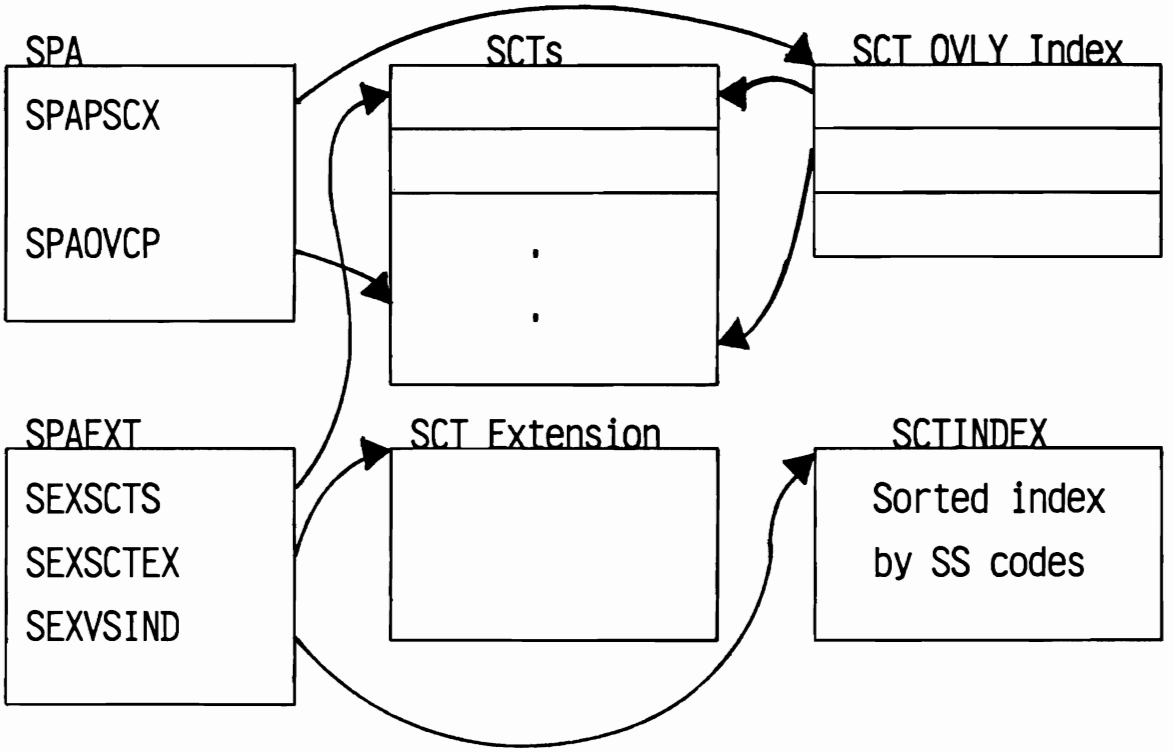
Used for Finding an entry by Subsystem code in the Subsystem Control Table. (CSECT is SCTINDX)

SCT Overlay Index--

Used for scheduling work for resident subsystems and overlay groups: (ENTRY SCXESCX, SCXFSOG1)

```
SCXESCX   DC   A(SCXFRSS or last-ovly-index)
SCXFRSS   DC   A(first-resident-SCT)
SCXLRSS   DC   A(last-resident-SCT)
*
SCXFSOG1  DC   A(first-ovly-SCT or 1)
          DC   A(last-ovly-SCT-same-group or 0)
          DC   AL1(ovly/exgrp-number or 0)
          DC   AL3(0)
          .
          .       if more ovly/exgrp numbers
          .
```

Generated by: GENINDEX macro



Plus within SCTEXT -

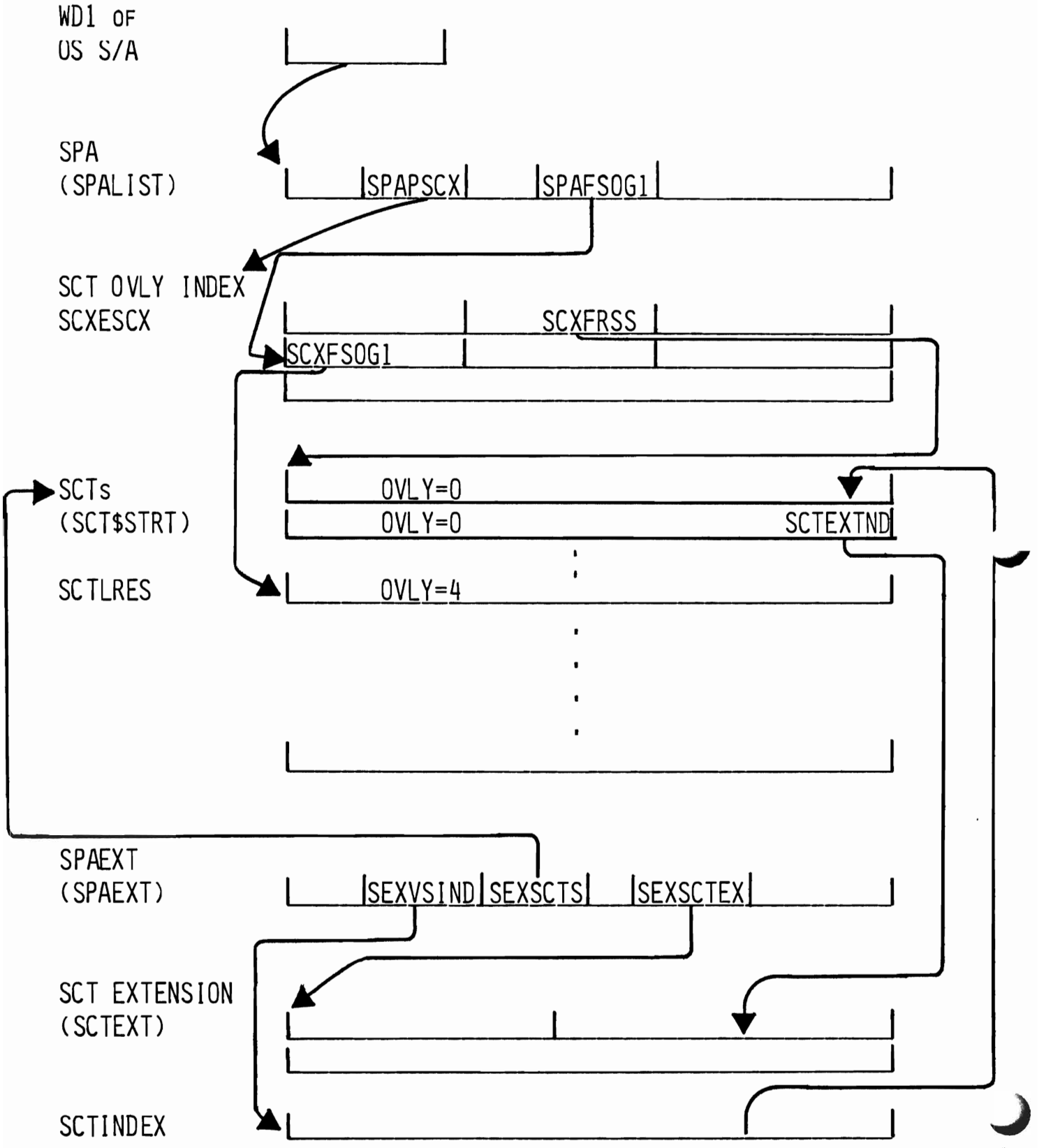
LOAD QUEUE: chain of SCT Extensions for dynamically loaded subsystems waiting to be loaded.

DELETE QUEUE: chain of SCTEXTs eligible for deletion

--forced delete status:
  timed-out or program check
  reload requested (LOAD command)
  low-core condition (CUSHION released)
  not reentrant or reusable

--optional delete status:
  no messages queued
  not schedulable (DELY command)
  MAXLOAD reached (below 16mg line)

DSECTS: SPALIST,SCTLISTC

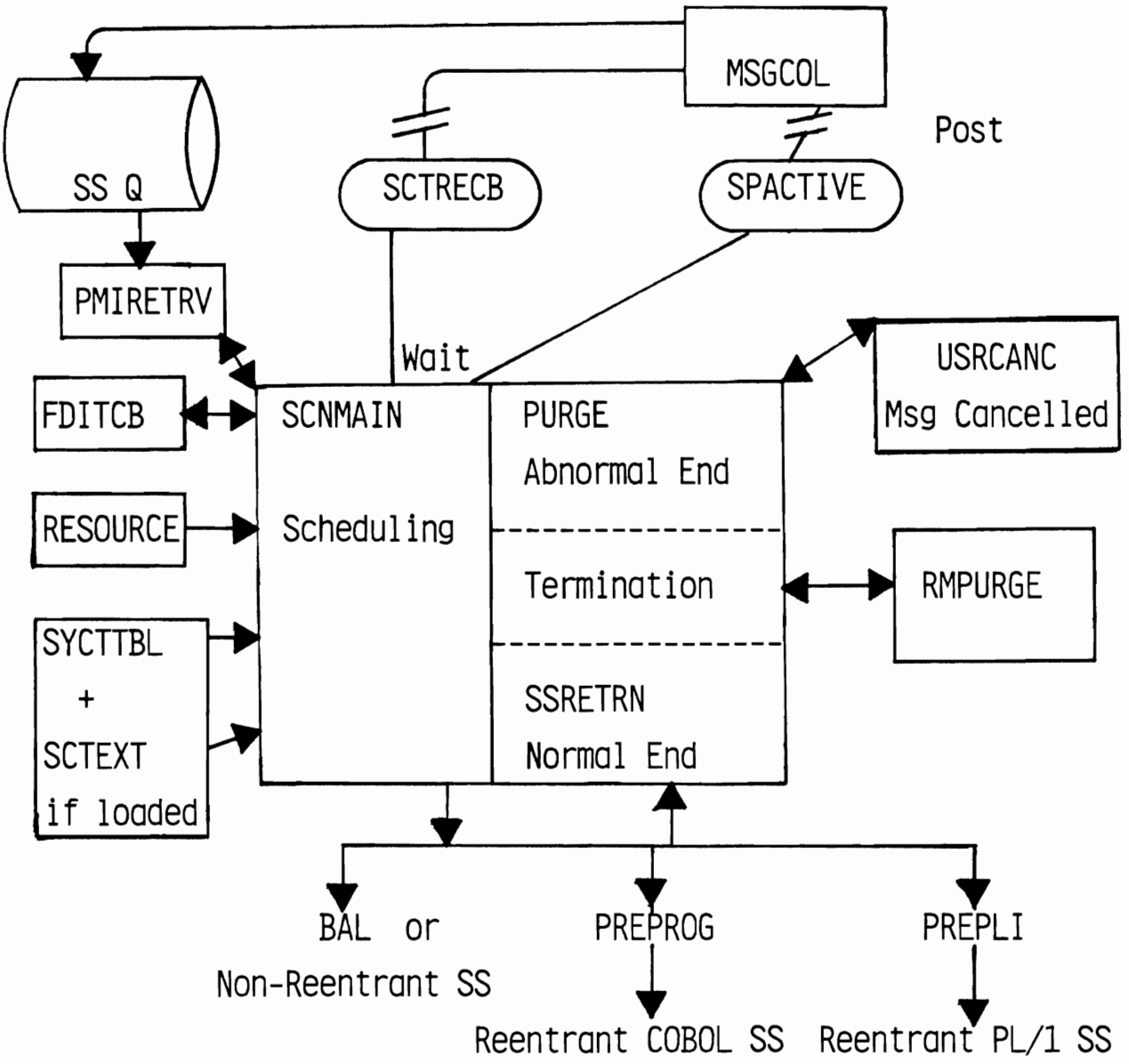

WD1 OF
OS S/A
SPA
(SPALIST)
SPAPSCX
SPAFSOG1
SCT OVLY INDEX
SCXESCX
SCXFRSS
SCXFSOG1
SCTs
(SCT$STRT)
OVLY=0
OVLY=0
SCTEXTND
SCTLRES
OVLY=4
SPAEXT
(SPAEXT)
SEXVSIND
SEXSCTS
SEXSCTEX
SCT EXTENSION
(SCTEXT)
SCTINDEX

PROCESSING OVERVIEW

Member Name: SYCT400

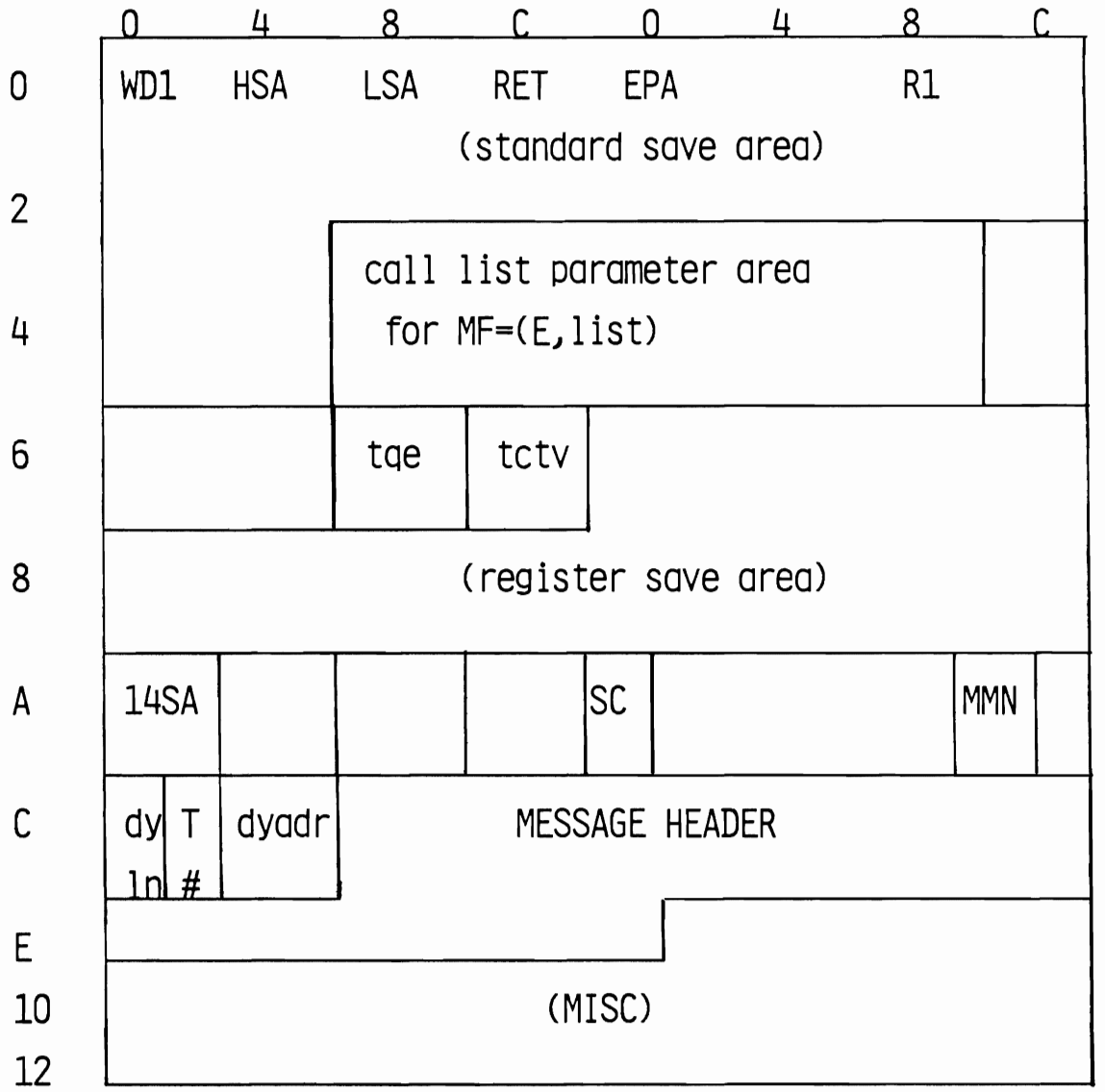
CSECT Name: SYCTRL

Entry Points: SCNMAIN PURGE SSRETRN



Further Reference: Operating Reference Manual

SUBSYSTEM CONTROLLER SAVE AREA



+68 SCNTQE, SCNTCTV: Timer Queue Element, Value

+A0 SCN14SA: Register 14 Save Area - Return point

+C0 SCNDYLEN: Dynamic Workspace Length

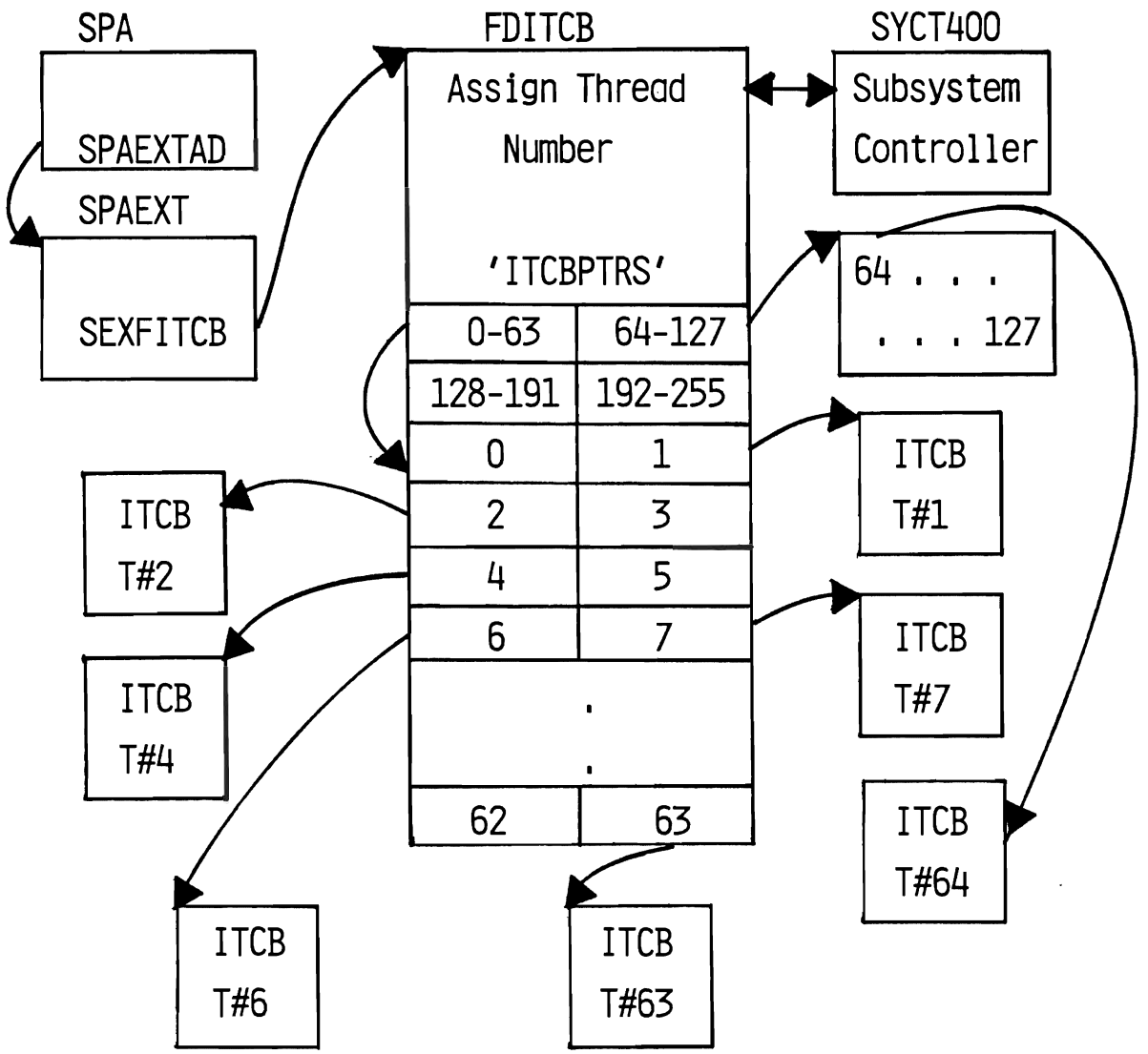
+C2 SCNTHRED: Assigned Thread #

+C4 SCNDYADR: Dynamic Workspace Address

+C8 Message Header--used for logging and control

Dsect: SCNLIDS

INTERCOMM THREAD CONTROL BLOCK



Formula: T# divided by 64 = I

I * 4 = Vector-table-address in ITCBPTRS

Vector-table-address + (remainder * 4) = ITCB-address

If ITCB-address = 0 -- thread not allocated

Dsect: ITCB (generated by INTTCB macro)

-- Subsystem Controller S/A address

-- SCT (SYCTTBL) address, etc.

6.3 Interface: Structure and Processing

THREAD CONTROL BLOCK MACRO

Find an ITCB

INTTCB (no operands)--generates ITCB Dsect

INTTCB OPT=S or OPT=T,THREAD={address}
{(r) }

Returns:

--address of currently active/requested ITCB in R1

--if Register 1 = 0, then system thread executing
or no ITCB assigned for requested thread number.

Further Reference: Basic System Macros

THREAD STATUS TABLE

NAME--TSTATAB - Entry in SYCTRL Csect of SYCT400
- pointed to by SEXTSTAT

SIZE--256 bytes - 1 per possible thread (0 to 255)
- X'00' = thread not active (unused)
- X'01' = thread in use (assigned)
- X'11' = thread being purged
- X'15' = thread is hung

Assigned/Released by Subsystem Controller

Referenced by: PMISNAP1, RMPURGE, TDUMP, SYSCNTL, TALLY

Command: TALY$DA

QUIZ

Debugging Using the ITCB

Current Thread Number _____

FDITCB Address _____

'ITCBPTRS' Address _____

Current Thread Vector Table Entry Address _____

ITCB address for current thread _____

Any other ITCBs allocated?

Address	Thread#	Status

SUBSYSTEM CONTROLLER--FEATURES

DYNAMIC LOADED SUBSYSTEMS

DYNAMIC LINKEDIT

DYNAMIC LOADED SUBROUTINES

TIME ZONE PROCESSING

COMMANDS

STATISTICS

SUBSYSTEM SAVE AREA CHAINING

DYNAMICALLY LOADED SUBSYSTEMS
DYNAMIC LINKEDIT

Installation Checklist

Globals		None		
SPALIST		MAXLOAD=		
Macros		SYCTTBL	OVLY=0	LOADNAM=
				BLDL=
				REUSE=
ICOMLINK		DYNLOAD=	DYNLINK=	
Linkedit:	Modules	ASYNCLDR		ICOMDYNL
		DELOAD		
		LOADSCT		
		SWMODE		
On STEPLIB			ICOMCESD	ICOMVCON
Data Sets		DYNLWORK		Disk
		DYNLPRNT		SYSOUT
		DYNLLIB		Disk

Dsects: DYNDSECT, ASYDSECT

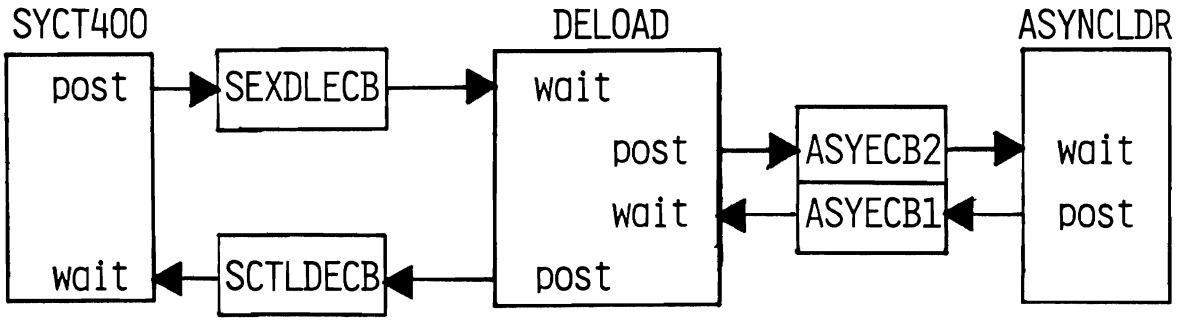
Further Reference: Operating Reference Manual

6.4 Features

DESCRIPTION OF DELOAD

DELOAD monitors all loading activity for loaded subsystems. DELOAD is invoked by the Subsystem Controller and in turn invokes the asynchronous loader, ASYNCLDR.

Communication between SCNMAIN and DELOAD is established via an ECB in the SPA Extension called SEXDLECB. The ECB is posted by SCNMAIN when a subsystem is put on the load or delete queues. The actual LOAD and DELETE macros are processed in the Asynchronous Loader: ASYNCLDR, an attached (at startup) subtask, running with a priority 1 higher than the mother task, INTERCOMM. ASYNCLDR and DELOAD communicate via a pair of ECBs contained within DELOAD. ASYECB2 is posted by DELOAD, to indicate to ASYNCLDR the need to load or delete a module. ASYECB1 is posted by ASYNCLDR to indicate to DELOAD that the request for load or delete was completed. When posted that load/delete is successful, DELOAD then loads/deletes the subsystem under the mother task so it will be in/deleted from INTERCOMM's CDE (except if non-reusable). For a load request, DELOAD then posts subsystem's SCTLDECB.



INTERCOMM DYNAMIC LINKEDIT

LOAD MODULE	SIZE	UNRESOLVED EXTERNAL SYMBOL DICTIONARY REFERENCES
SQCOBOLA	(001388)	ALL LABELS ARE RESOLVED
SQASMA	(000C70)	ALL LABELS ARE RESOLVED
SQPL1	(000D18)	PLITABS PLIXOPT IBMBPOPT PLIXHD IBMBEATA PLIFLOW PLICOUNT DBINT IBMBSXCA IBMBSXCB IBMBSIST SYSPINT
APWTESTC	(001D18)	ALL LABELS ARE RESOLVED
FHTESTL	(0006F0)	ALL LABELS ARE RESOLVED
SNBKL1	(000630)	ALL LABELS ARE RESOLVED
SNBKL2	(0006D8)	SCTEND SCTRES SCTBCLPJ PMITIMTB KEYTABLE VSSCTIND
CONV1L	(0004D0)	SCTEND SCTRES SCTBCLPJ PMITIMTB
TESTRLSE	(000480)	ALL LABELS ARE RESOLVED
SQCOBOLB	(000618)	ALL LABELS ARE RESOLVED
SQASMB	(0006E8)	ALL LABELS ARE RESOLVED

DYNAMICALLY LOADED SUBROUTINES

Definition Macro: SUBMODS DSECT: DYNDSECT
Table: REENTSBS COBOL Copy List: ICOMSBS

Program Interface:	BAL	MODCNTRL macro
	COBOL	COBREENT
	PL/1	PMIPL1

Processing: DYNLLOAD receives control via MODCNTRL:
loads subroutine (ICOMLOAD)
links to it, returns to caller
schedules subroutine deletion (ICOMDEL)

PMIDLOAD entries ICOMLOAD, ICOMDEL
interface to ASYNCLDR

Closedown Report -- loaded subroutines only: SUBRPT

Linkedit	ICOMLINK	DYNLOAD=
		DYNLINK=
Modules	same as for loaded subsystems plus	
REENTSBS	PMIDLOAD	DYNLLOAD

Data Sets: DYNLLIB ~~DYNLWORK~~ DYNLPRNT

Further Reference: Operating Reference Manual
Basic System Macros
Programmers Guides

TIME ZONE PROCESSING

Purpose: Specify Clock-dependent Subsystem Processing

Activated via: TRIGGER

SS Time Table: PMITIMTB

Definition Macro: TMZONE SCHT=time-of-day
PGID=lo-order-SS-code
PGIH=hi-order-SS-code
TCTV=sycttbl-TCTV-override
PVMI=msg-hdr-VMI-code
TMZC=request-identifier

Dsect: TIMETBL

Further Reference: Operating Reference Manual
Basic System Macros

Dynamic Loaded Subsystems/Subroutines--LOADSCT Subsystem

- LOAD (also change MAXLOAD, GET/SPAC)

Subsystem Control--FINTUNER Subsystem

- SPAC
- PRTY
- TCTV
- MNCL
- BEGN
- DELY
- SSFL

Dynamic Update SYCTTBL--DYNSSUP Subsystem

- FTUN
- SSUP

Status Display--GPSS Subsystem - TALLY (RPT00043)

- TALY$SU
- TALY$BE
- TALY$DA

Multiregion Control--MRCONSS Subsystem

- vvvv$STATUS$SS
- vvvv$FLUSH$SS
- vvvv$START$SS
- vvvv$STOP$SS

Further Reference: System Control Commands

STATISTICS

SAM -- Details/Totals by Subsystem

STS -- # BE Messages Processed
    -- # Overlay Loads
    -- # Dynamic SS Loads
    -- # Dynamic Subroutine Loads

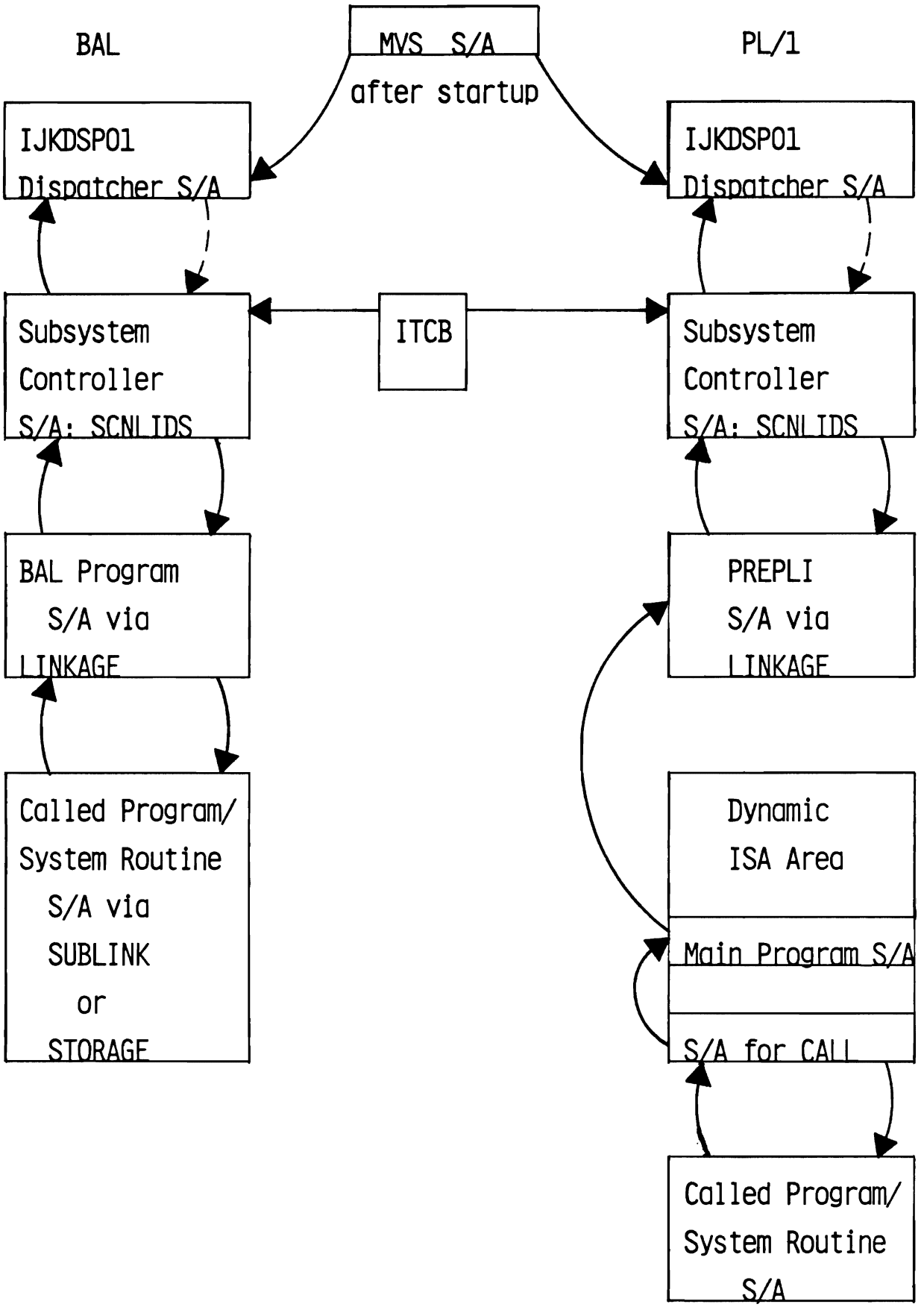
STATUS LOGGING: Queued
                Started
                Completed
                Cancelled/flushed

LOGPRINT: -- Date
          -- Time
          -- SSC
          -- Log code

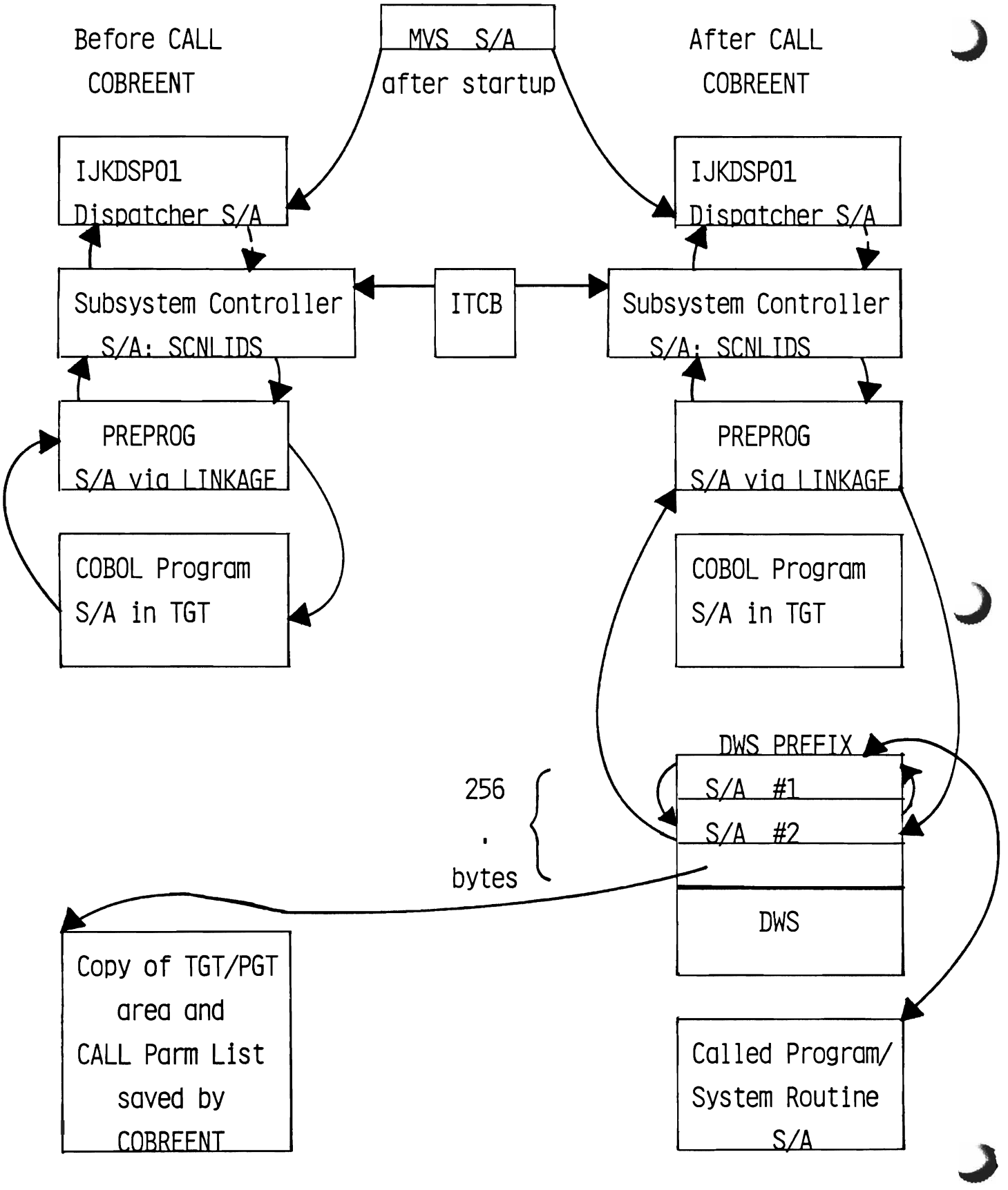
LOG ANALYSIS: Peak Activity - Traffic
              Response Time
              Message Totals -- Valid
                             -- Error

Closedown Activity Reports: SSRPT
                            SUBRPT

SUBSYSTEM SAVE AREA CHAINING



SUBSYSTEM SAVE AREA CHAINING -- COBOL



COMMON PROGRAM CHECKS AND PROBABLE CAUSES

0C1 Branch to data area
Referencing a module not linkedited with Intercomm
Referencing a module missing from LPSPA link
ISK issued by System Program (XA, ESA)

0C2 I/O error (from File Handler)
ISK issued by System program (MVS/370)

0C4 Referencing an area outside your program/storage
Modifying a program linked as RENT

0C5 Invalid data address
Referencing an area outside your program

0C6 Incorrect boundary alignment
In BAL -- odd numbered register specified 1st when even- odd pair required

0C7 Data field not initialized correctly
Packed Decimal data has an invalid sign
Incorrect index caused invalid data to be referenced

Further Reference: Messages and Codes

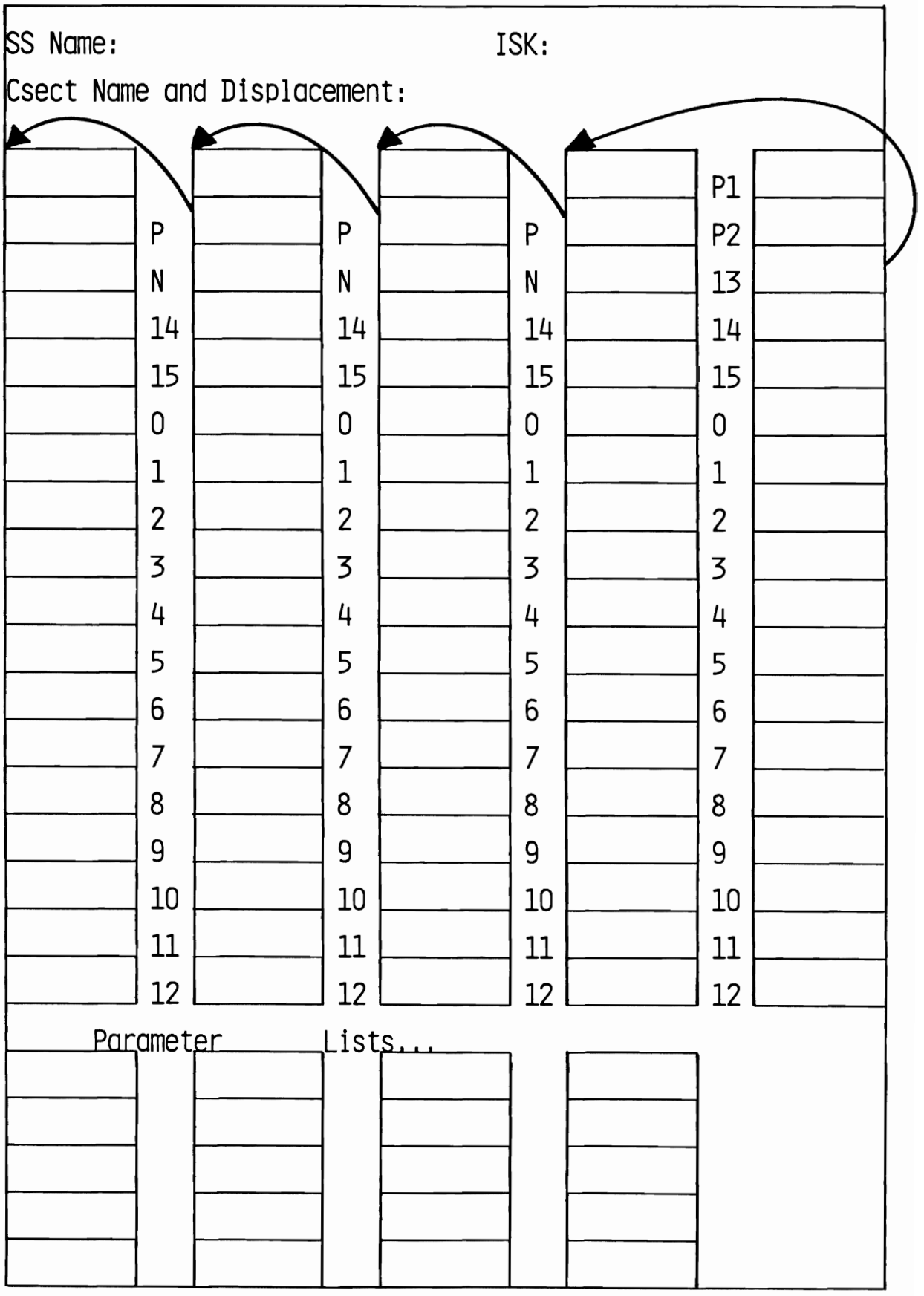
SNAPS: 114 -- Enqueue Time-out
118 -- Subsystem Time-out (TCTV exceeded)
126 -- Program Check - SPIEEXIT
-- 'SPIE SAVE AREA', PSW, Registers 13-12
--Slow Snap - at beginning
--Fast Snap - find literal
Subsystem Controller Save Area
--find via ITCB

Each snap type has informative message.

Message Cancelled Processing - PMICANC
Entry: USRCANC
May be replaced by user-coded routine
Called when: Time-out
Program Check
Subsystem Return Code = 4/8
Message flushed via SSFL
CANC=STOP in effect

Further Reference: Messages and Codes

SNAP 126 WORKSHEET FROM SPIE SAVE AREA PSW, REGS



7 TP NETWORK MANAGEMENT - The Front End

7.1 Introduction

7.2 Installation - BTAM

7.3 Interface: Structure and Processing - BTAM

7.4 Features - BTAM

7.5 Messages, Snaps and Abends - BTAM

7.6 VTAM - Introduction

7.7 VTAM Installation

7.8 VTAM Interface: Structure and Processing

7.9 VTAM Features

7.10 VTAM Messages, Snaps and Abends

TP NETWORK MANAGEMENT

THE FRONT END

ACCESS METHODS SUPPORTED

- BTAM
- TCAM
- SNA/VTAM
- Others via GFE

INSTALLATION TP MANAGEMENT RESPONSIBILITIES

- System Facilities
  - -- Hardware
  - -- Software (Access Methods, etc.)
- Standards
- Intercomm Table Maintenance

INTERCOMM FRONT END FACILITIES

- Network Management
- Transaction Routing
- Message Header Construction
- Control Commands

DEFINITION OF TERMS

Terminal--teleprocessing message transmission/reception device (CRT, Printer, Card/Tape Reader, Remote CPU/Mini, etc.)

Local--device connected directly to CPU--'in house'.

Remote--device connection via Communications Controller, Modems, Telephone Lines to external location/city: switched/leased.

Communications Controller--interprets software requests into hardware action on the line--37xx, Comten, Memorex, etc.

Leased--continuous connection between CC and terminal, controlled from CPU under Intercomm.

Switched--broken connection completed via dialing on telephone line: --to terminal from CC
--from terminal to CC

Auto-Call--switched line--terminal may be called (automatically).

Auto-Answer--switched line--CC automatically answers a call from a terminal.

Protocol Converters--convert non-stanard to standard (3270) protocol.

UCB--Unit Control Block-Defines channel to BTAM--device type, etc.

Point-to-Point--leased line--only one terminal permanently connected to line.

Multipoint--leased line--multiple terminals connected to the line via one terminal control unit.

Multidrop--leased line--multiple terminals connected to the line via multiple control units.

Polling--required for multipoint/multidrop lines--selects device for read request via:

-- Control Unit--General Poll
-- Individual terminal--Specific Poll

Addressing--to write a message to a specific terminal on a multipoint/multidrop line, it must first be addressed--confirm terminal available to receive a message.

Asynchronous--simple line communication (Start/Stop). No parity-checking (garbled data). Text sent in a continuous stream until end-of-message (unbuffered).

Binary Synchronous--complex line communication. Parity checking (error recovery). Text received (by CPU) in segments of device I/O buffer length (3270 CRT=256).
Hand-shaking line protocol--confirmation.

SDLC--Synchronous Data Link Control (VTAM only)

Line Protocol--channel programs and control characters necessary for terminal/CPU communication: STX/ESC, EOB, ETX, EOT, etc.

Data Link Control--additional control characters:
- ESC sequences--e.g., Dataspeed 40/1, 2
- Write commands--3270
- Device Selection--Punch/Printer, etc.--3275
- Terminal Turnaround--receive/transmit
- Idles, Backspace

Modem--Hardware box (Data Set) between: -- CC and line
-- line and terminal

- verifies line connection established (carrier)
- verifies transmission can be initiated
- controls transmission speed
  - -- bits per second--BAUD rate
  - -- characters per second
    - -- Baud rate divided by 10 (approximate)
    - -- Asynch = 10-4800, Bisync = 240-up
- controls transmission direction
  - -- half/duplex--unidirectional at a time
  - -- full/duplex--both directions--same time
    (not supported by BTAM)

Translate Table--Transmission code translation

7.1 Introduction

Line Group--group of lines controlled via one DCB
must be same transmission type (Asynch/Bisync)
if Bisync--same transmission code: ASCII, EBCDIC, BCD, etc.
same transmission speed not required (except modem compatibility)

Line--one continuous telephone line connection: CC-terminal, controlled over one channel from CPU

Terminal List--leased-polling list
open: each device (CU) selected (by CPU) once until end of list reached; if nothing to read--control returned to line handler.
wrap: continuous polling--wrap around from end-of-list to beginning until somthing to read.
auto: list sent to CC--initiates poll--CPU not involved until end-of-list.
autowrap: list sent to CC--wraps around until something to read--then interrupts CPU: most efficient

Terminal List--switched
Answering List:
Asynch--terminal-id request 'message'
Bisync--list of terminal-ids--checked by BTAM
Call List:
Asynch--'ready-to-receive' indication from CPU

TP NETWORK MANAGEMENT OVERVIEW

LINE CONTROL

- Establish Connection/Ready-to-receive
- Transmit data
- Acknowledge receipt
- Terminate Connection/Line Turnaround

DEVICE MANAGEMENT

- Mode of Operation
- Configuration
- I/O Media

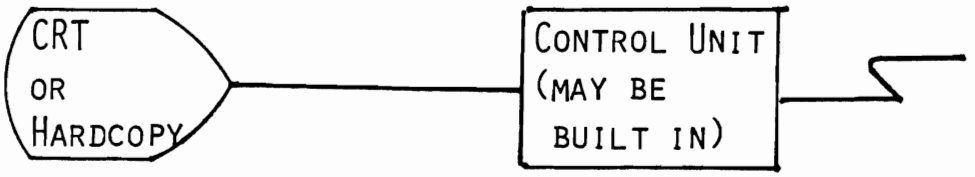
I/O MEDIA

Human Input	Answer-Back & Display	Document Transmission
Typewriter	Typewriter	Paper Tape
Keyboard	Display	Cards
Telephone Dial	Audio	Magnetic Tape
	Printer	Remote CPUs
Special	Plotter	Mini-computers
- keyboard	.	(distributed processing)
- buttons	.	Data Collection Devices
- levers	.	Optical Scanner
- dials		Microfilm
- light pen		.
- badge reader		.
.		.
.		
.		

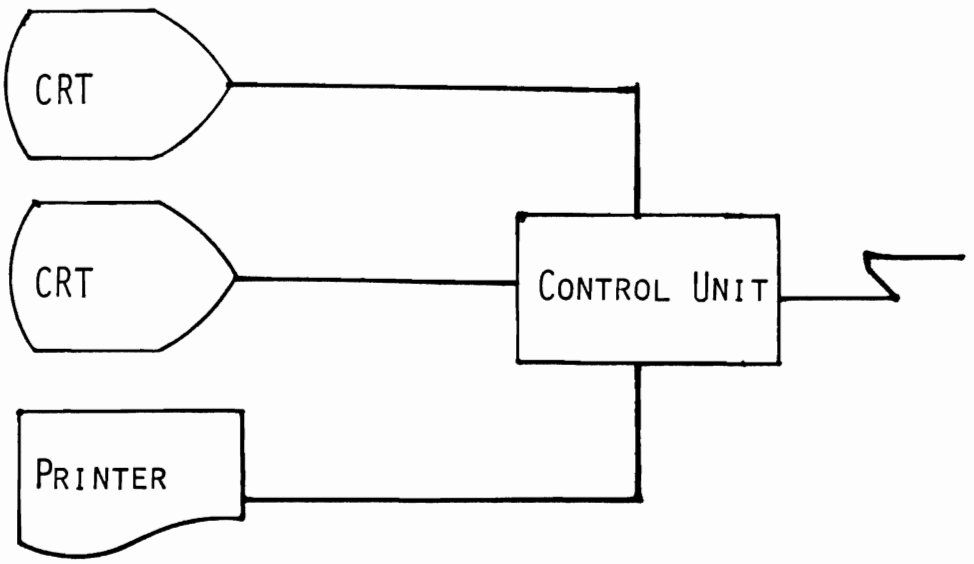
7.1 Introduction

LINE CONTROL CONFIGURATION

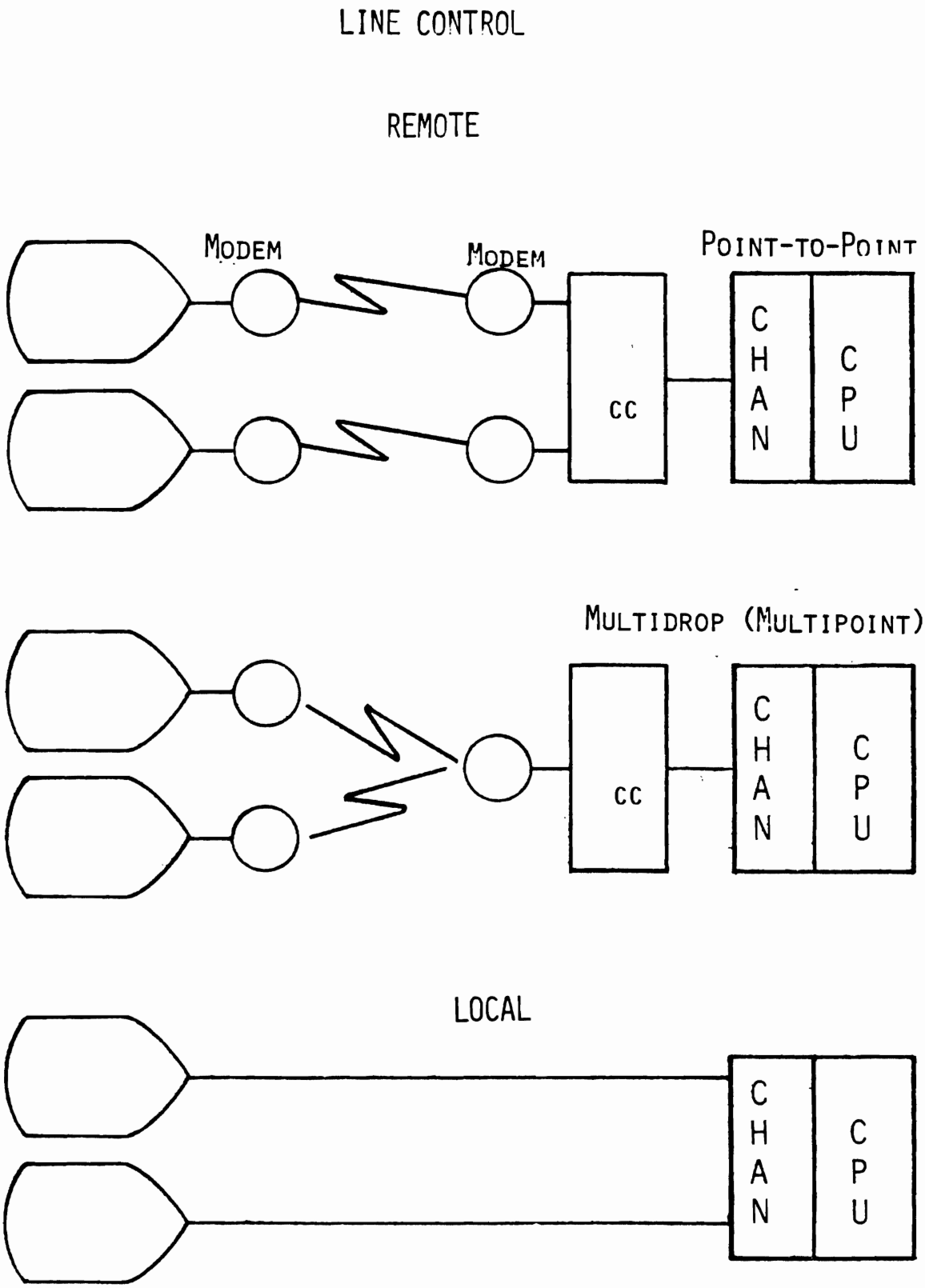
POINT-TO-POINT (LEASED/SWITCHED)

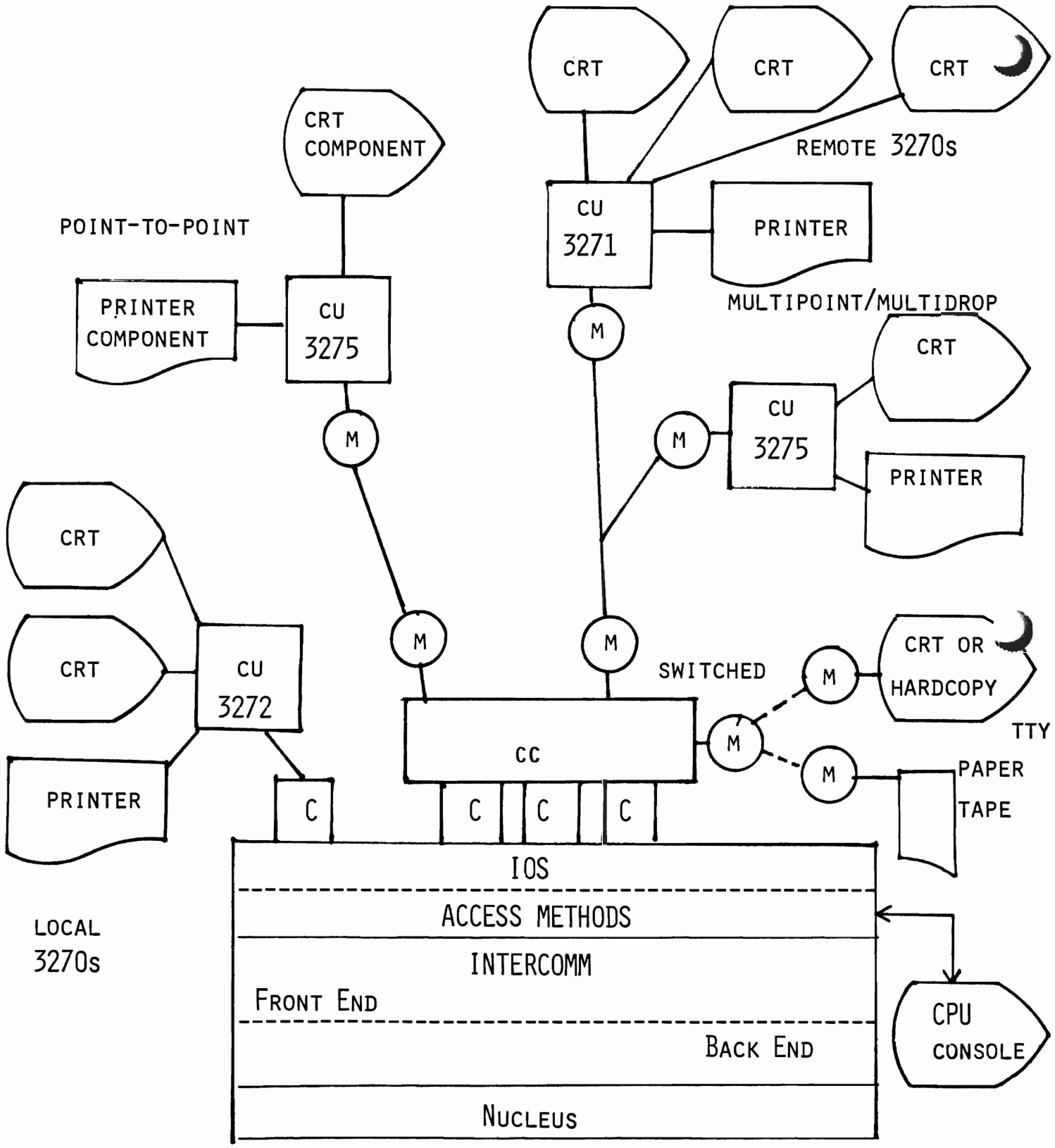


MULTIPOINT (LEASED)



7.1 INTRODUCTION


LINE CONTROL
REMOTE
MODEM
MODEM
POINT-TO-POINT
CC
CHAN
CPU
MULTIDROP (MULTIPOINT)
CC
CHAN
CPU
LOCAL
CHAN
CPU


TP NETWORK COMPONENTS
CRT
CRT
CRT
REMOTE 3270s
CRT COMPONENT
POINT-TO-POINT
CU 3271
PRINTER
MULTIPOINT/MULTIDROP
PRINTER COMPONENT
CU 3275
M
CRT
CU 3275
PRINTER
CRT
CRT
CU 3272
PRINTER
SWITCHED
CRT OR HARDCOPY
TTY
CC
PAPER TAPE
C
C
C
C
IOS
ACCESS METHODS
INTERCOMM
FRONT END
BACK END
NUCLEUS
LOCAL 3270s
CPU CONSOLE

FRONT END SPECIFICATION

GLOBALS--specify Environmental/Hardware Characteristics
--SETENV, SETGLOBE (&BTAM SETB 1)

TABLES--DEFINE OPERATING CHARACTERISTICS

- Verb Table (BTVERB) - BTVRBTB
- Network Definition Table
  --Network Configuration
    LINEGRP (DCB)
    BLINE (DECB)
    BTERM
  --Device Table (BDEVICE)
  --Terminal-id Table (Switched)
    DFTRMLST
  --Polling List Table (Leased)
    POLLIST
  --Translate Table (ASMTRTAB)
  --AID Processing Table
    AIDGRP
    AIDDATA

--DEFINE TERMINAL QUEUES--BTAMSCTS (SYCTTBL)

--DEFINE BACK END TABLES

- Station Table - PMISTATB
- Device Table - PMIDEVTB
- Broadcast Groups - PMIBROAD

THE FRONT END -- BTAM
Installation Checklist

Globals	SETENV	SETGLOBE	
SPALIST	CCNID	Control Terminal	
	SEP	System Separator	
Definition			
Macros	BTVERB	DFTRMLST	
	LINEGRP	LERB	
	BLINE	ASMTRTAB	
	BTERM		
	BDEVICE	STATION	
	AIDGRP	DEVICE	
	AIDDATA	DVMODIFY	
	POLLIST	BCGROUP	
Assemblies	See List		
Linkedit	Automatic	Modules	(see list)
	Tables	BTVRBTB	PMISTATB
		FENETWRK	PMIDEVTB
		(BTAMSCTS)	PMIBROAD
Data Sets	BTAMQ	Overflow Disk Q	
JCL	LINEGRP DDNAME	UNIT=channel-address	
Dsects:	PVRBTBLE,LGDSECT,PLNDSECT,DIALTBL,PTRDSECT,		
	PEXTABLE,DEVTABL,BTAMWORK,BTSPA,AIDSECTS		

INTERCOMM FRONT END -- MODULES

Conditional Assemblies

BDIAL	*	FECMD	
BLHIN		FEMSG	
BLHOT		FEWHOI	
BLHTRACE		GFEINTFC	*
BMH000		IGG019MP	*
BSCDIAL	*	INTVRB00	
BSCLEASE	*	LOPENMOD	*
BSEGMOD	*	OUTDS40	*
BSTAT2		OUT3270	*
BTAMLINE		PMIBTSTR	
BTSEARCH		PMIEXTRM	
BTVERIFY		QUEUEMOD	
CNT01MOD	*	SIMTTY	*
COPYSS	*	TPUMSG	
ERRSTATS	*	USRBTLOG	*
ERRSTMSG	*	USRER129	*

* - IF FEATURE IS USED IN FRONT END ENVIRONMENT

Always reassemble: BLHIN, BLHOT, BTAMLINE, TPUMSG, BMH000, BTSEARCH

Further Reference: BTAM Terminal Support Users Guide

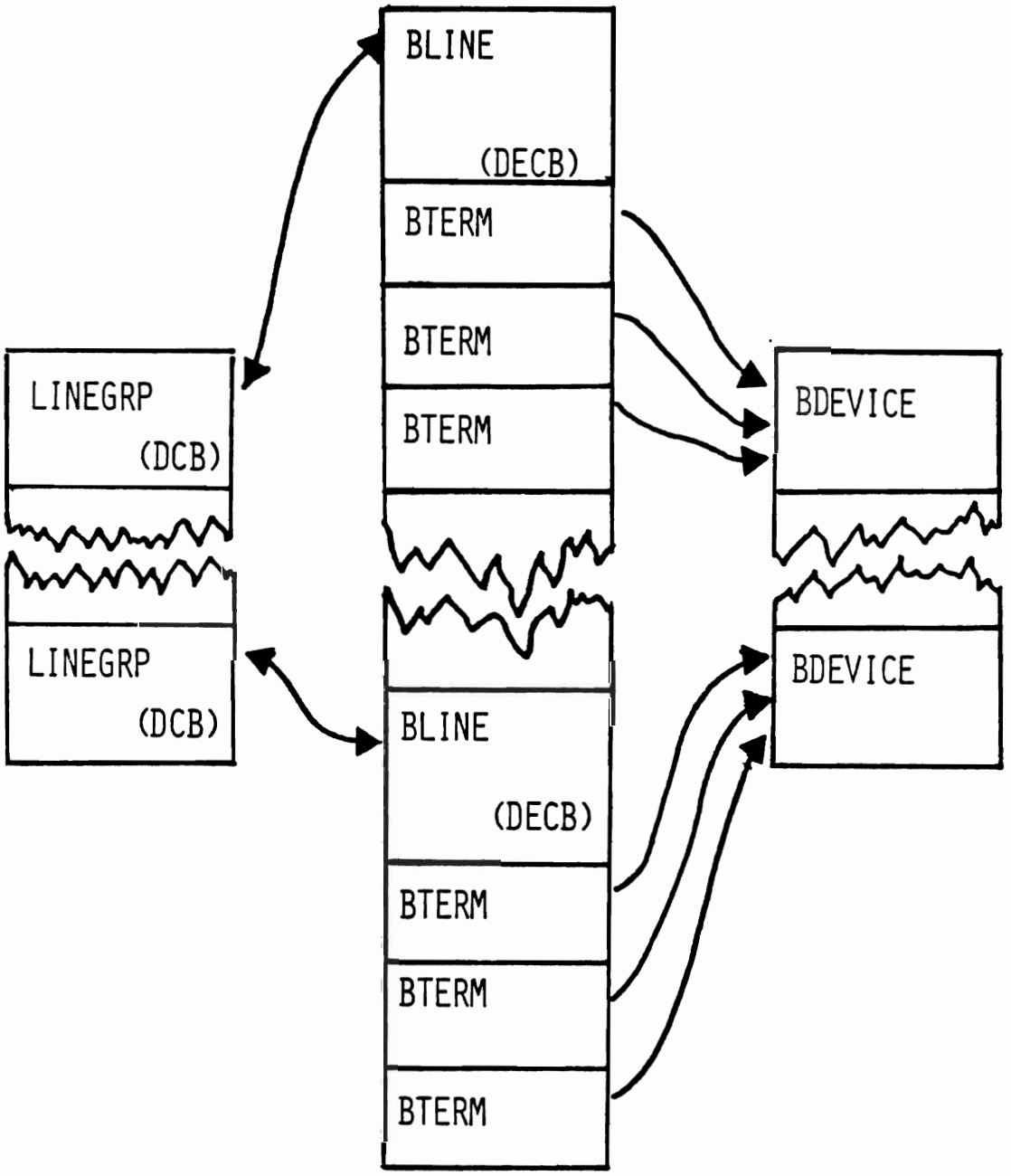
Turn "on" SETENV	- New Terminal Type
Conditional Assemblies	- For Changed Globals
LINEGRP	- New Line or Group of Lines
BLINE	- New Line
BTERM	- New Terminal
BDEVICE	- As Necessary
POLLIST	.
ASMTRTAB	.
AIDGRP	.
AIDDATA	.
Reassemble Network Table	
BTAMSCTS	- New Queue (if not on BTERM)
CREATEGF	- Format (new) Disk Queue
STATION	- New Terminal
DEVICE	- As Necessary
BROADCAST TABLE	.
JCL	- Concatenation Sequence for Line must match BLINE Sequence

FRONT END -- BACK END TABLE RELATIONSHIPS

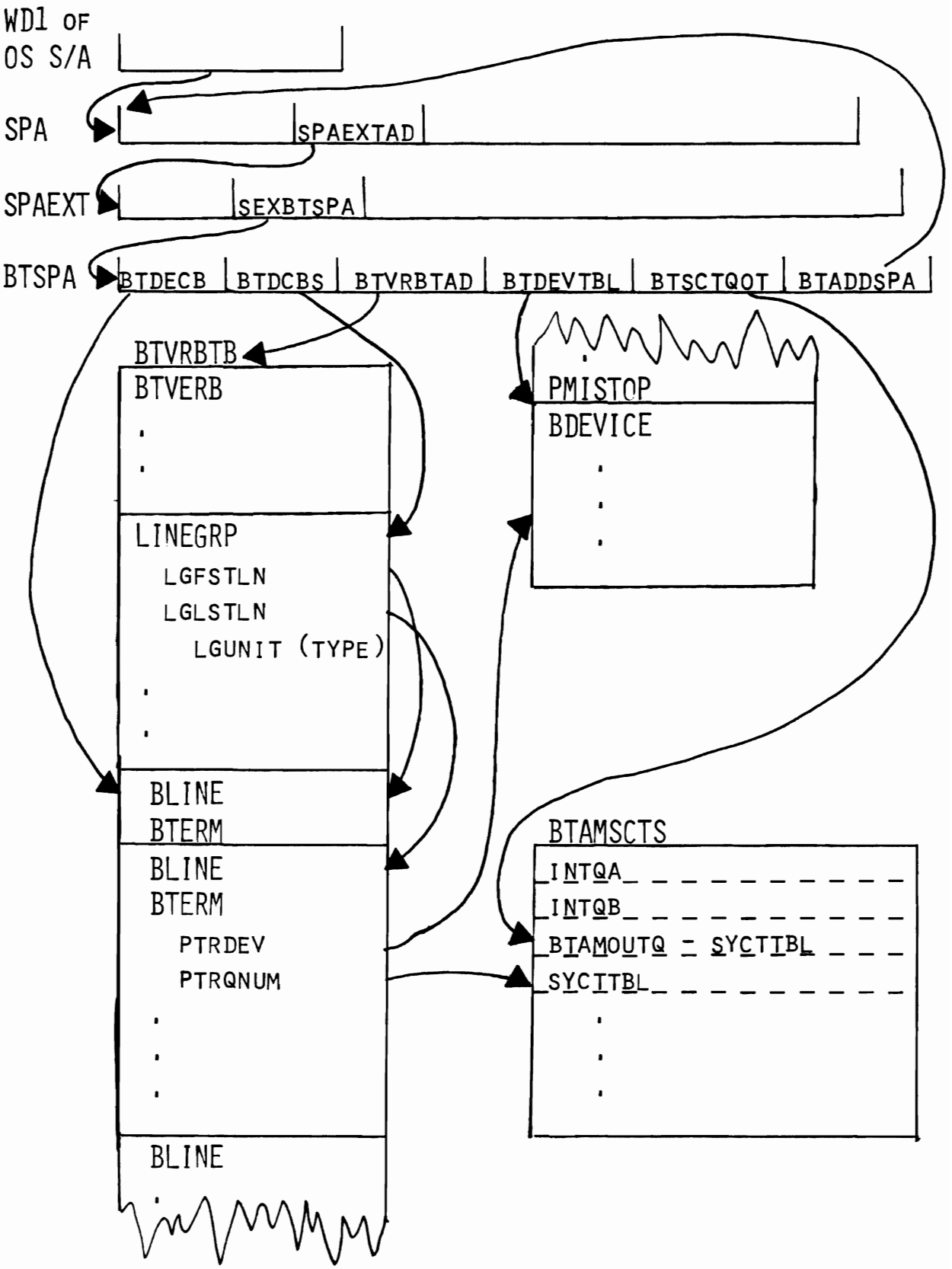
TP Interface Editing/Formatting Interface

Front End	Table Type	Back End
BTVTBTB --BTVERB	Verbs	PMIVERBS --VERB
--LINEGRP	Network	---
--BLINE		---
		PMISTATB
--BTERM		--STATION
		--DVMODIFY
		PMIDEVTB
--BDEVICE		--DEVICE

NETWORK CONFIGURATION TABLE AND DEVICE TABLE



FRONT END CONTROL BLOCKS -- POINTERS



LINE HANDLER BTAM MACRO REQUESTS

- READ INITIAL
  --POLL-LEASED
  --WAIT FOR CALL-SWITCHED
    --FIND TERMINAL WITH CORRESPONDING ID
    --SET LINE/TERMINAL CONNECTED

- WRITE INITIAL
  --ADDRESS TERMINAL--LEASED
  --CALL TERMINAL--SWITCHED
    --SET TERMINAL CONNECTED

- READ CONTINUE
  --READ A MESSAGE--ASYNCHRONOUS
  --READ A SEGMENT--BISYNC
    --ACCUMULATE SEGMENTS UNTIL EXT/EOT
      (FORCED FOR 3270 CRT)
    --QUEUE EACH SEGMENT AS A MESSAGE

- WRITE CONTINUE
  --WRITE A MESSAGE--ALL

- WRITE DISCONNECT
  --DISCONNECT SWITCHED LINE/TERMINAL

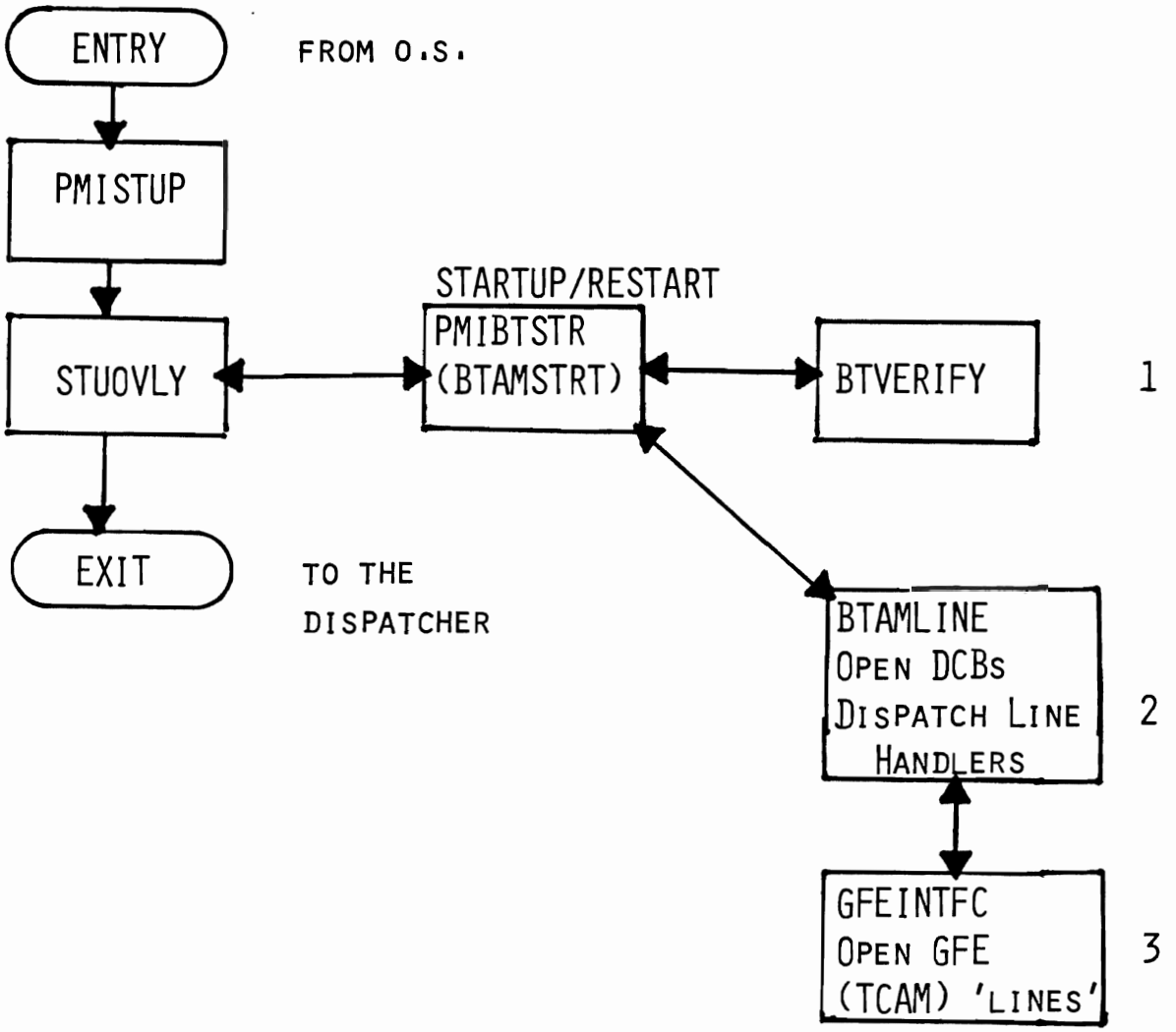
- LOPEN
  --RECONDITION LINE (DISABLE/ENABLE)

- RESETPL
  --HALT POLLING (LEASED)
  --HALT OUTSTANDING READ INITIAL (SWITCHED)

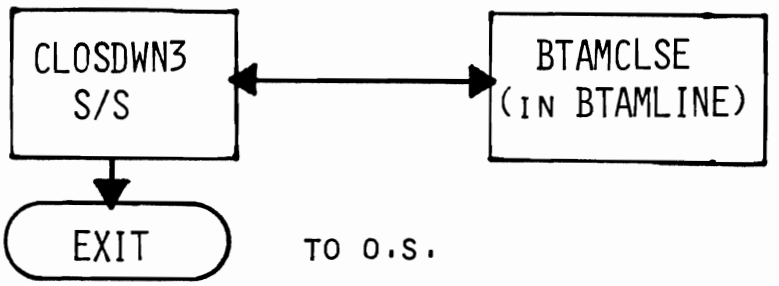
- REQBUF/RELBUF
  --REQUEST/RELEASE BUFFER FROM/TO BUFFER POOL

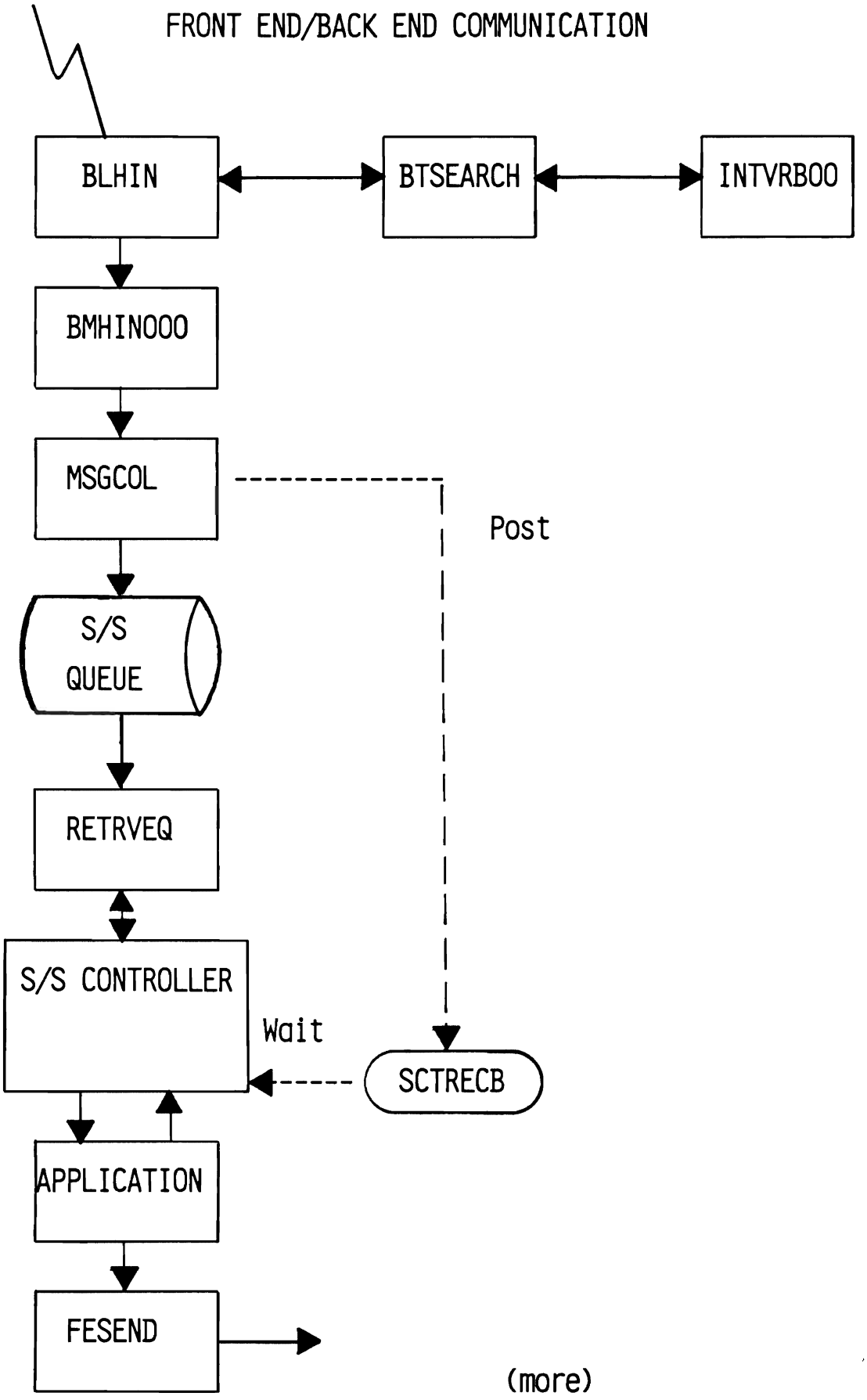
- CHGNTRY
  --REQUEST CHANGE POLLING LIST (ADD/REMOVE)

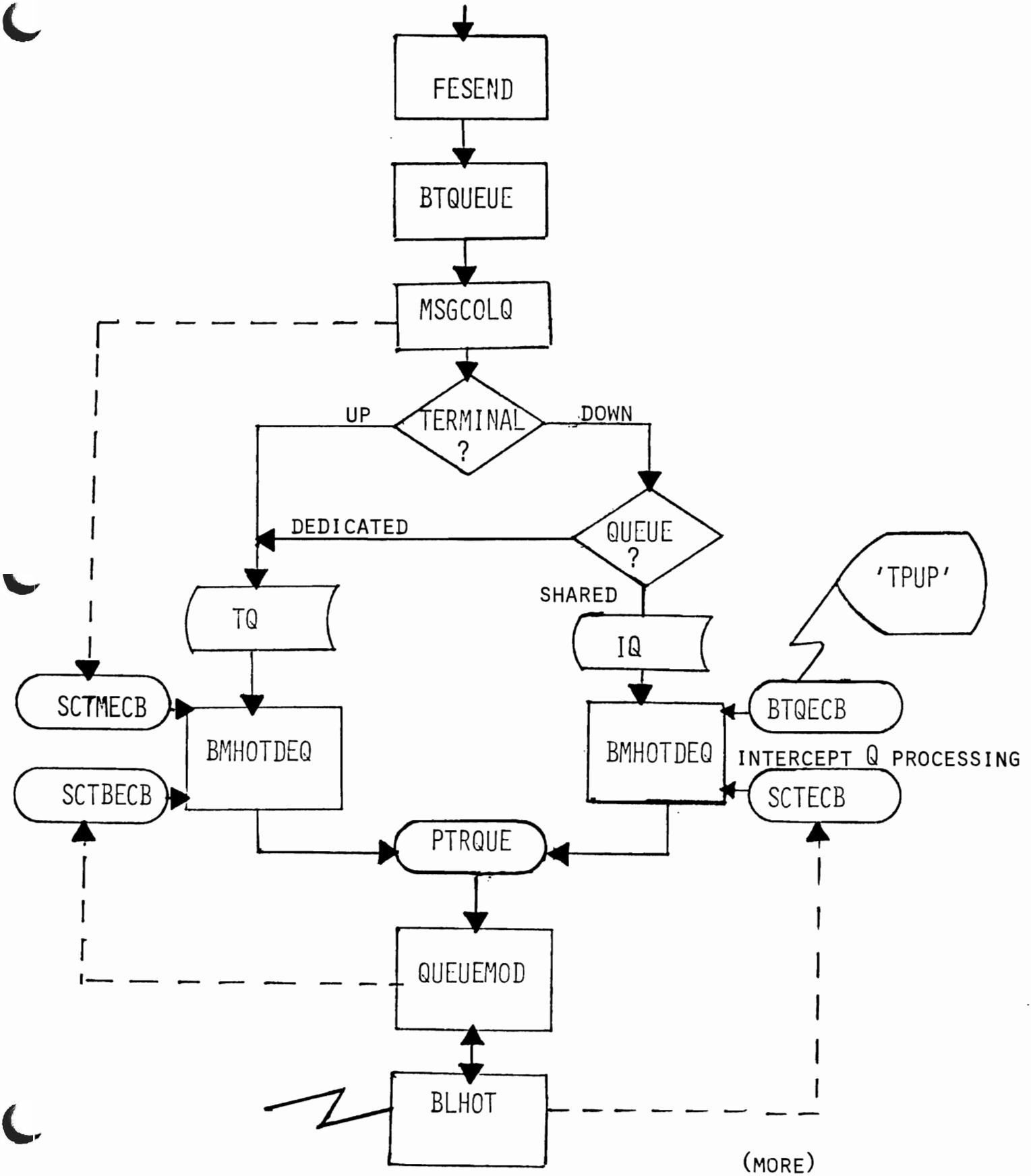
START UP

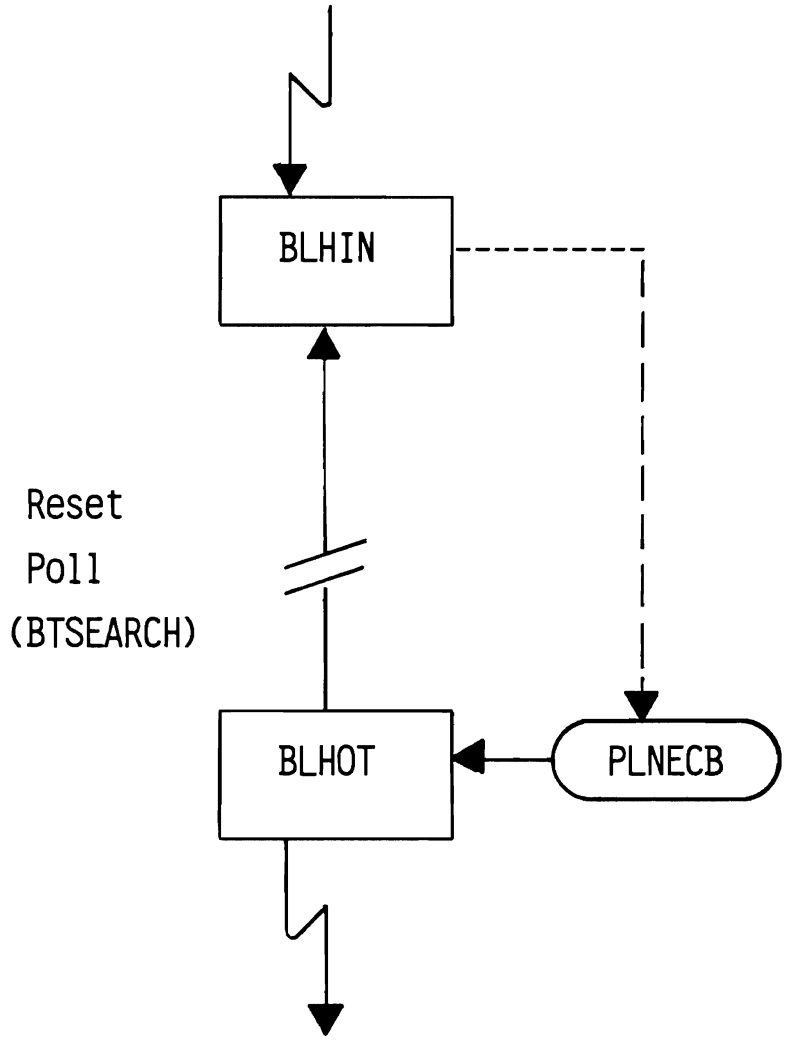


CLOSE DOWN




FRONT END/BACK END COMMUNICATION
BLHIN
BTSEARCH
INTVRBOO
BMHINOOO
MSGCOL
Post
S/S
QUEUE
RETRVEQ
S/S CONTROLLER
Wait
SCTRECB
APPLICATION
FESEND
(more)


FESEND
BTQUEUE
MSGCOLQ
UP
TERMINAL ?
DOWN
DEDICATED
QUEUE ?
SHARED
'TPUP'
TQ
IQ
SCTMECB
BMHOTDEQ
BMHOTDEQ
BTQECB
INTERCEPT Q PROCESSING
SCTBECB
SCTECB
PTRQUE
QUEUEMOD
BLHOT
(MORE)



Output has priority over input.

Read always outstanding when nothing can be written (leased).

Terminal disconnected when nothing to read or write (switched).

INPUT MESSAGES

FORMAT:

VERB$TEXT.....@

WHERE: $ = SYSTEM SEPARATOR

@ = EOT, ETC.

VERB:

1 to 4 characters on input

short verbs are padded (right) with Xs

to 4-character length

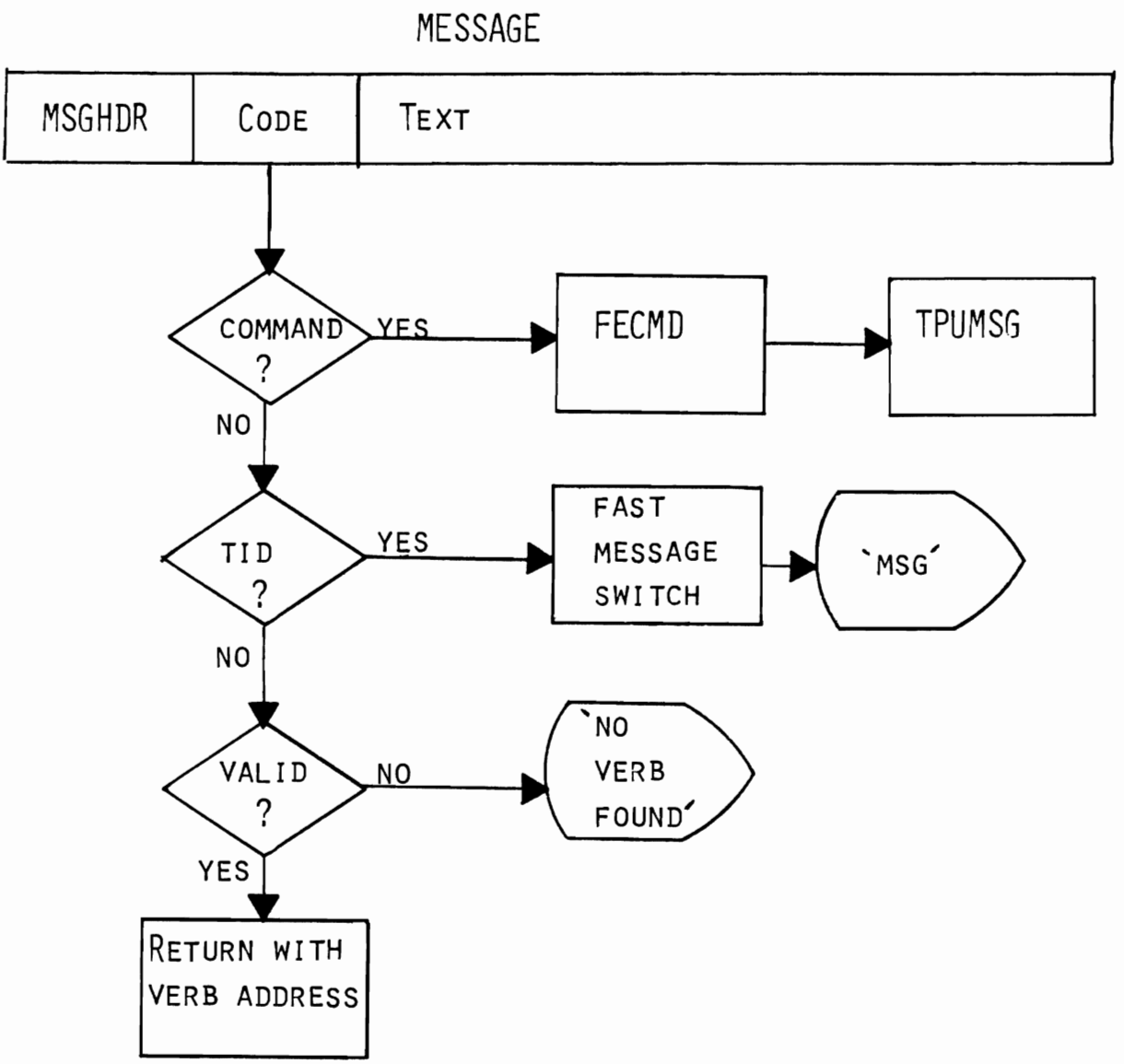
TRANSACTION ROUTING

- Transaction code
  - --Processing Subsystem
  - --Multiregion Queue
- Front End Command
- Fast Message Switch

TRANSACTION PROCESSOR

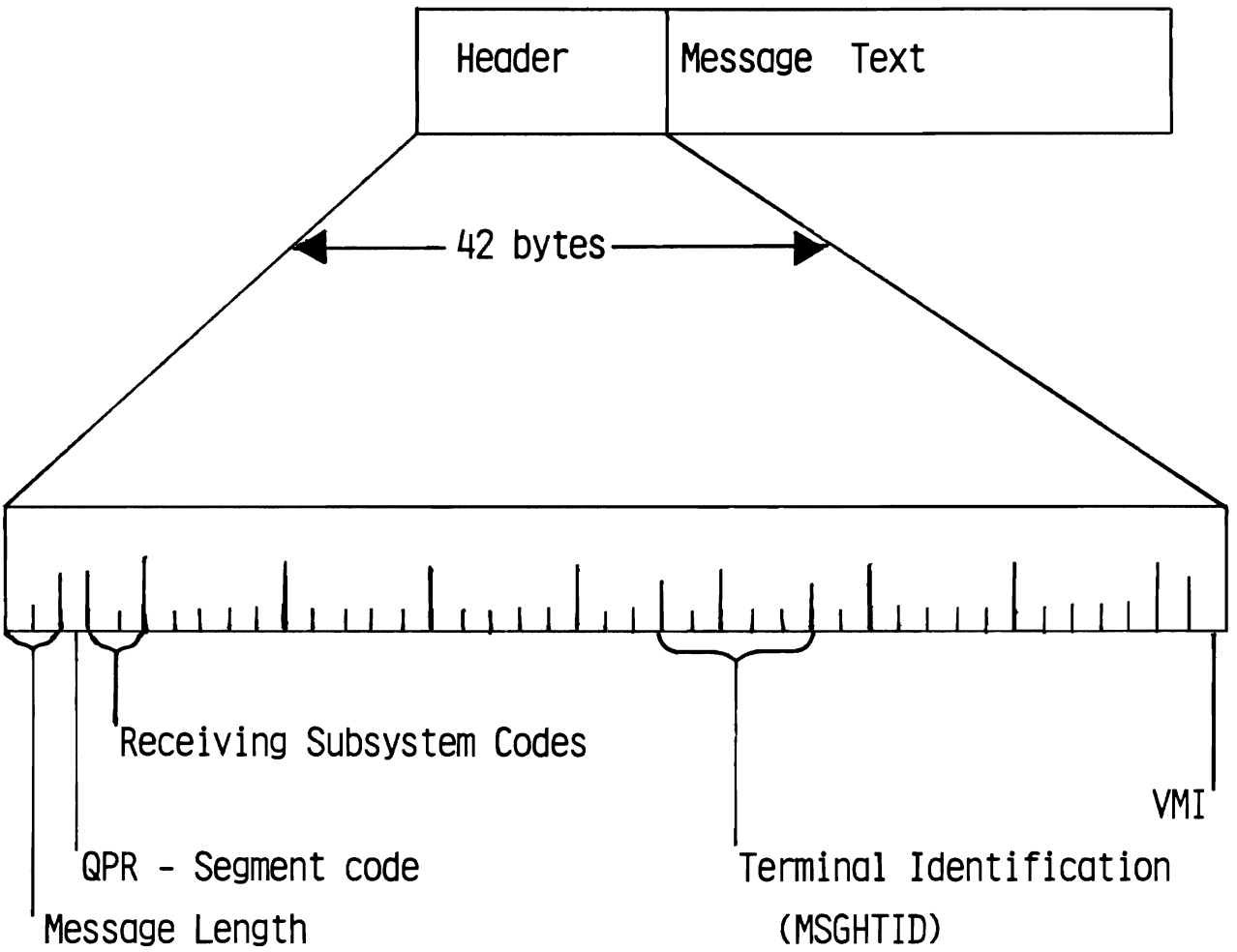
BTSEARCH

CALLED FROM SRCHVRB ENTRY IN BLHIN



MESSAGE HEADER CONSTRUCTION

Completed by SRCHVRB in BLHIN



VMI = FF if no editing required (BTVERB EDIT=NO)
00 if editing needed (BTVERB EDIT=YES)
01-FE if edited (BTVERB EDIT=BQ)

QUIZ

1. How would one quickly find the Front End Tables by a scan of the Dump? _____

2. Address of the first Line Group _____

3. What type of Line Group is it? _____

4. Address of its first line? _____

5. Address of its last line? _____

6. How many lines in the group? _____

7. How many terminals are associated with the first line? _____

RESPONSE TIME CONSIDERATIONS

- General Poll vs. Specific Poll
- Polling List Type--Open/Wrap/Auto
- Dedicated vs. Shared Queues
- Core Queueing vs. Disk
- Priority Queueing
- Front End Priority vs. Subsystem Priority
- Logging -- YES/NO, ASYNCH/SYNCH, RESTART
- Number of Terminals vs. Number of Lines
- Message Length
- Core Pools Tuning--Message Areas, Work Areas
- Hardware Problems--Efficiency
- Line Speed
- Software Error Recovery
  --CC, CPU, Intercomm

CPU CONSOLE AS A TERMINAL

- Intercomm Communication
- Use as Control Terminal for TCAM
- Processing: CNTO1MOD

CONTROL TERMINAL

- System Control and Command Responses
- Secured Information/Requests
- Error Reporting

FAST MESSAGE SWITCHING

- Tid$Text.....@

SCREEN MANAGEMENT

- Function Keys
  - -- AID Processing
  - -- 3270 Header Interpolation
- Device Timing Considerations
  - -- CRT Processing
  - -- RLSE Command

SEGMENTED INPUT MANAGEMENT

Further Reference: BTAM Terminal Support Guide

CONVERSATIONAL SUPPORT

- Requires SETENV--&CONVER SETB 1

- Conversational Mode
  - -- BTERM CONV=YES
  - -- BTVERB CONV=time-out interval

- Conversational Time-out--Error Message
  - -- Subsystem delayed?
  - -- Subsystem hung?
  - -- Subsystem Program check?
    (SNAP processing delay)
  - -- Enough time allowed?
    BTVERB CONV=

- RLSE Command--delayed message

ALTERNATE TERMINAL

- Automatic Assignment--BTERM ALT=

- Manual Assignment--TDWN ATDname

If no alternate terminal is specified, messages are held until flushed or destination terminal is available.

AUTOMATIC TPUP

- After I/O Errors cause terminal down

- Maximum I/O Errors before TDWN:
  -- BDEVICE -- MAXERR

- BTERM AUTOUP=YES
  BDEVICE UPINTV=interval

LINE CONTROL CHARACTERS

INSERTION/DELETION

BDEVICE -- EXTCHR
STCHAR
CTCHAR
LAST
ENDCHAR

ASYNCH LINE FEATURES

- Idles
- Back Space

PRINTER BUFFER-EMPTY CONTROL

BDEVICE -- CHPS

ALTERNATE BUFFER PROCESSING

BDEVICE ALTBUF=size
DVMODIFY ALTBUF=YES,BUFFRSZ=size[,LINESZ=nn]

3270 Write Command = EWA (X'7E') supported by:
MMU--MAPEND MCW option
--MAPGROUP macro COMMAND=
Output Utility--REPORT ALTBUF=YES

- BTDN/BTUP
- STLG/SPLG
- STLN/SPLN
- TPUP/TDWN
- STPL/SPPL
- SECF/SECN
- WHOI/WHOU
- LOCK/UNLK
- LOKR/ULKR
- RLSE
- FLSH
- QHLD/QRLS
- SNBK/SWCH
- COPY
- LTRC
- SCTL$DSPCH${BTSPA }
  {TID=name}

STATISTICS

ONLINE COMMANDS

- STAT
- STAT$ERR
- TALY$SU
- TALY$FE[(tid)]
- TALY$FQ/FN/BD/BU/FD/FU

REPORTS

- SAM -- MESSAGES
  -- FECLS
  -- FEOTPUT

- STS -- # FE MSGS PROCESSED
  -- # FE DISK Q BLOCK WRITES
  -- current BMN number

- LOGPRINT

- LOG ANALYSIS
  -- Response Time
  -- Traffic

Further Reference: System Control Commands
Operating Reference Manual

USER EXITS

- USRBTLOG (sample provided)
- USRXIN
- USRECRY (sample provided)
- INQEXIT
- USRTDWN
- USRTPUP
- COPYEXIT (sample provided)
- USRBSCEX
- USRER129 (sample provided)
- USROTEDT

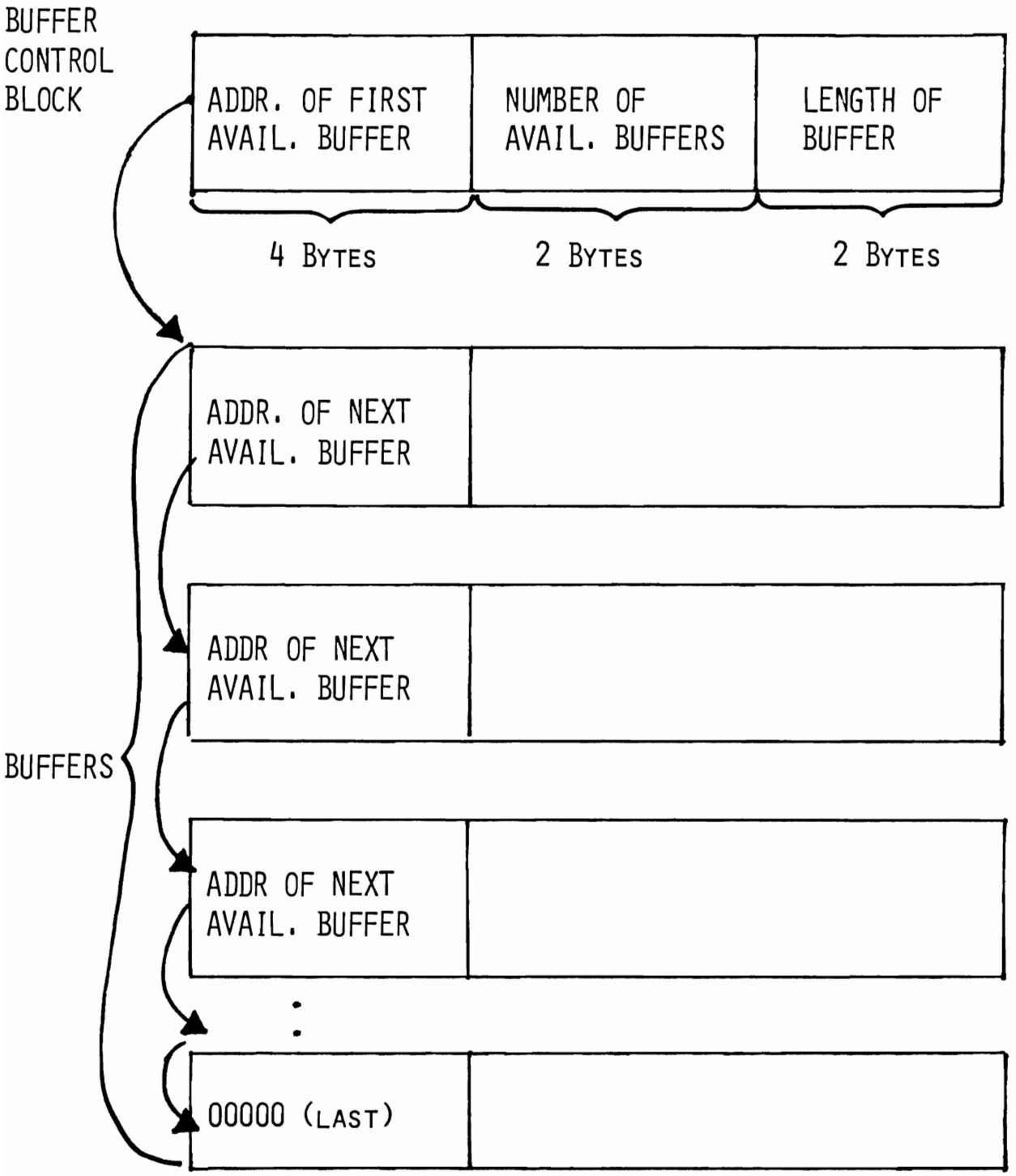
Further Reference: BTAM Terminal Support Guide
Operating Reference Manual

BLHIN/BLHOT REGISTER USAGE

NAME	USAGE
R0	Variable
R1	Variable
R2	Variable
R3	Second Base
R4	Current Message
R5	Current BDEVICE
R6	BTSPA (First Base)
R7	Variable
R8	Variable (DCB)
R9	Variable
R10/RA	Current BTERM
R11/RB	Current BLINE
R12/RC	Variable (DCB--Line Group)
R13/RD	Save Area
R14/RE	Variable
R15/RF	Variable (Current BDEVICE)

BDIAL -- Base Registers -- 5, 12

FORMAT OF BTAM BUFFER POOL



INPUT/OUTPUT BLOCK (IOB)

00	FLAG 1 (NOTE)	FLAG 2	SENS0	SENS1
04	COMPLETION CODE	ADDR. OF ECB (TO VERIFY RIGHT IOB)		
08	IOBFLAG3	CSW, BYTES 1-3 (POINTER TO NEXT CCW)		
0C	CSW, BYTES 4-7			
10	SIO COND CODE	ADDR. OF START OF (LOGICAL) CHANNEL PROGRAMS		
14	RESERVED	ADDRESS OF DCB		
	CHANNEL PROGRAM (CCWs)			

NOTE: FLAG 1=C2 FOR 7F COMPLETION
C6 FOR 41 COMPLETION

EVENT CONTROL BLOCK (ECB)

7F	I/O completed successfully
41	I/O error occured
48	RESETPL caused neg. resp. to read
80	Waiting on I/O completion

Also Check Dispatcher Entries - WAIT/TIME/EXEC Q's

WQE: CHAIN ECB/TIME E.P PARM
(usually BLINE addr.)

DEBUGGING EXAMPLE
Terminal No Longer Polled

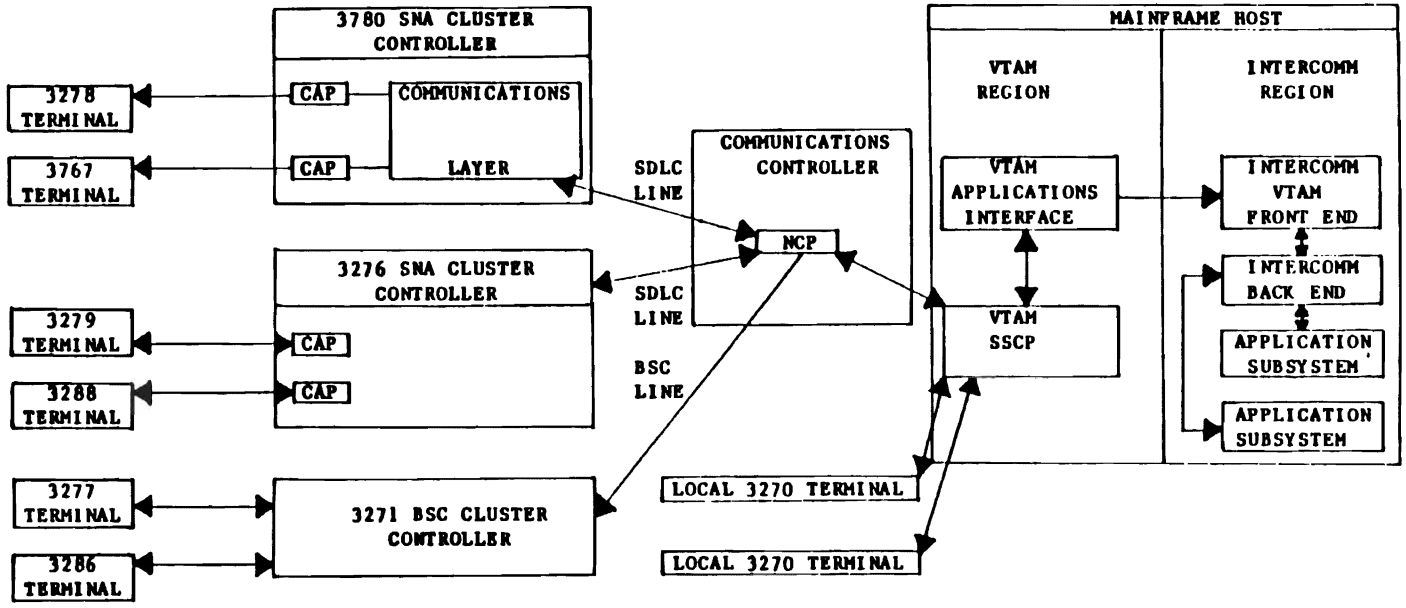
1. What is the status of the DCB?
   Check DCBOFLGS.

2. What is the status of the Line?
   EEEE in DECSDECB=DCB closed
   Check PLNSW--PLNACT, etc.
   Check Dispatcher Queues

3. What is the status of the terminal?
   Check PTRSW--PTRACT, etc.
   Active in the polling list-PLNPOLL?

4. What happened during last I/O?
   Find IOB for the line.
   Check channel program.

5. What is the line handler for that line doing?
   Check PLNSW.
   Check Dispatcher Queues.



TERMINALS: Device to communicate with outside world, for example, CRT and Keyboard, Printer.
Examples: 3604, 3618 (3600 System)
3277, 3767 (3790 System)
327x, 328x (BSC/SNA 3270 System)

SNA CLUSTER CONTROLLER: Special purpose small computer that executes user-written application programs that communicate with terminals, perform local processing of data, and communicate with application programs in S/370. May also be microcoded, having no user code (for example, 3276)
Examples: 3601, 3791, 3270 system.

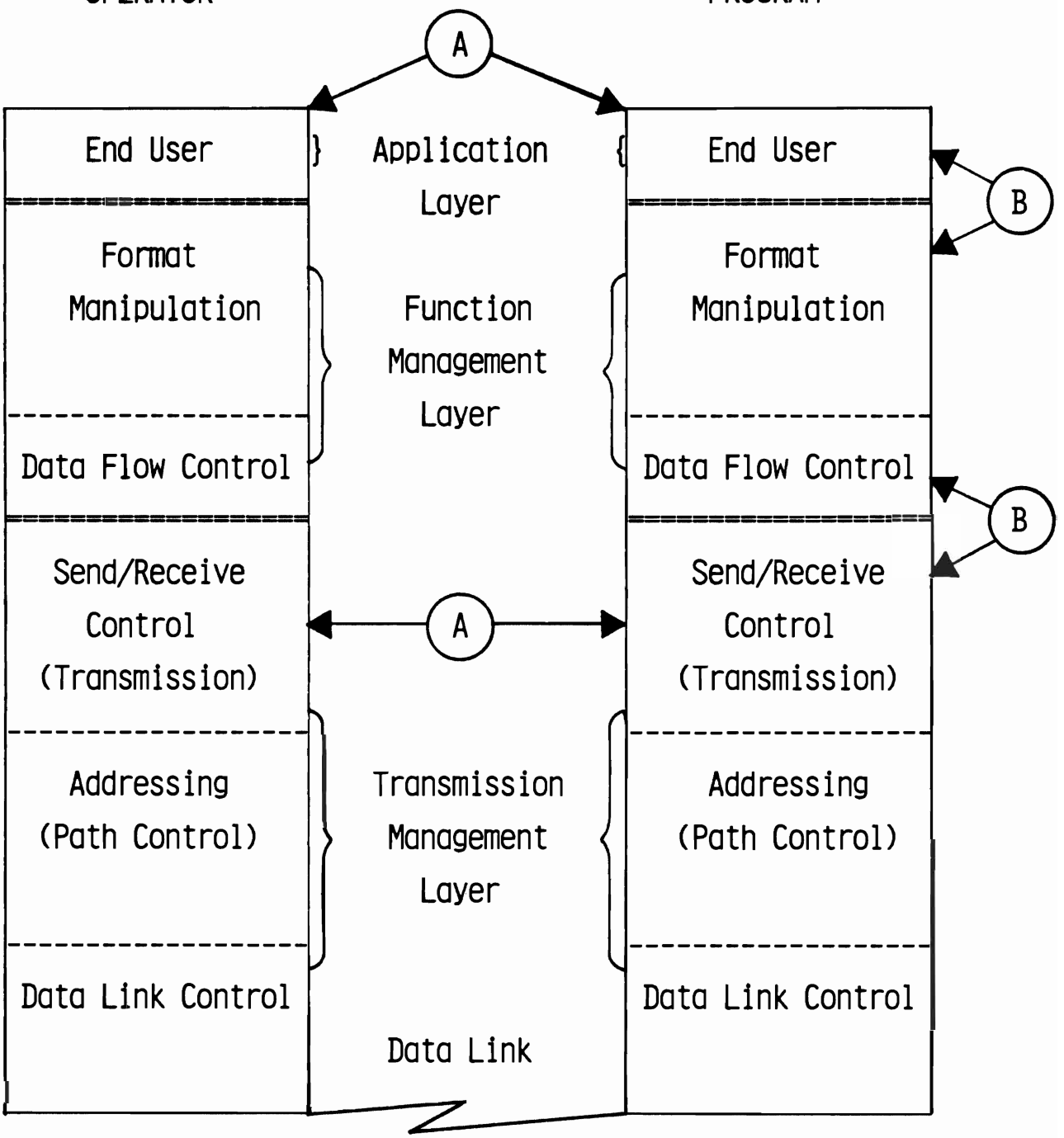
COMMUNICATIONS CONTROLLER: Telecommunications computer that executes the Network Control Program (NCP) to manage lines between SNA controllers and VTAM.

MAINFRAME HOST: Host computer executing MVS with region/address spaces for:

VTAM: Virtual Telecommunications Access Method (VTAM) allocates network resources and routes data through network and to application systems.

INTERCOMM: Intercomm application system utilizes system routines to schedule Intercomm subsystems when input is received from SNA controller programs and sends output from these subsystems back to the SNA controller programs. User-written Intercomm subsystems process the input, access the data base, and create the output.

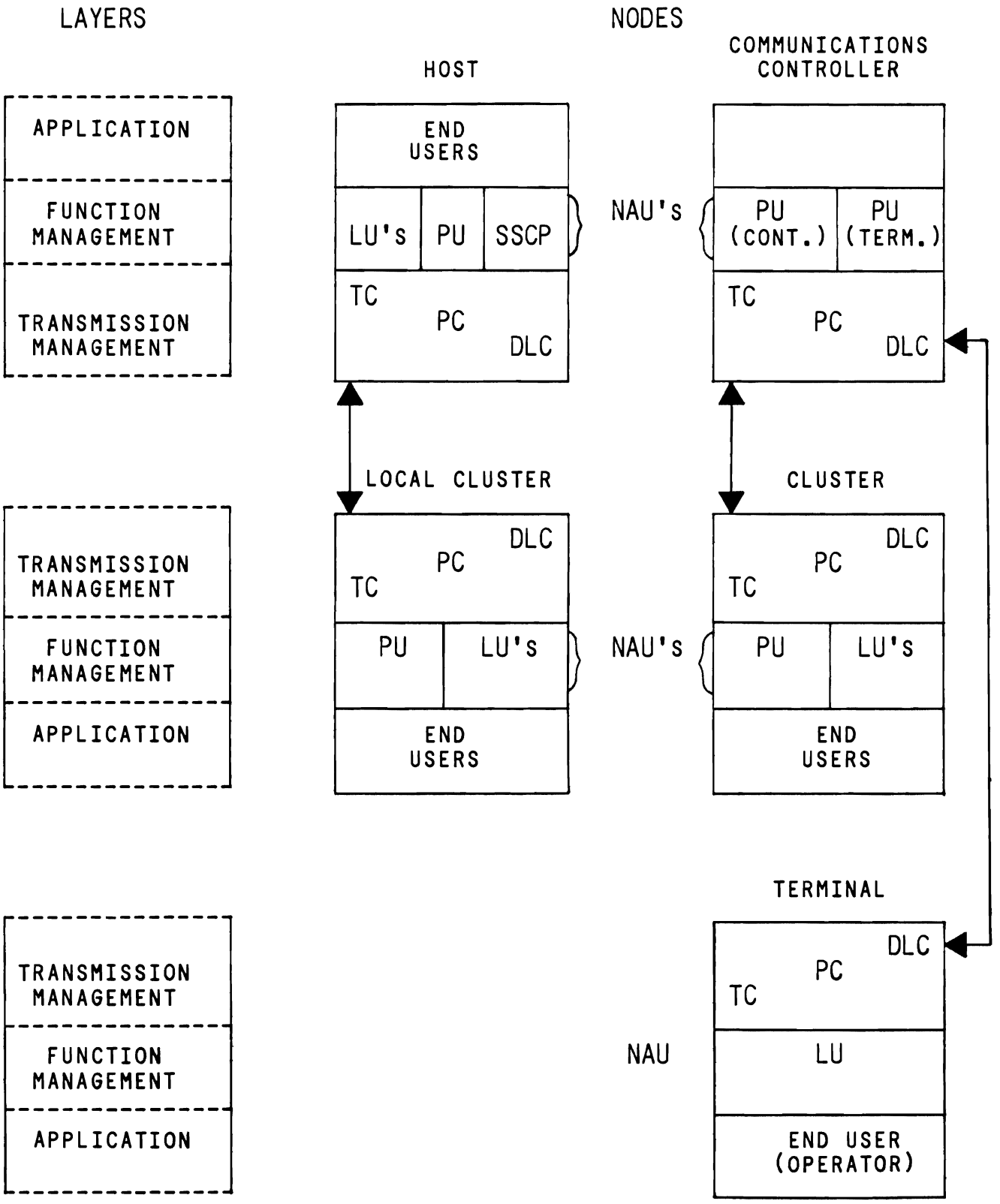
SNA -- ARCHITECTURAL LAYERS



A -- PEER LAYER COMMUNICATION

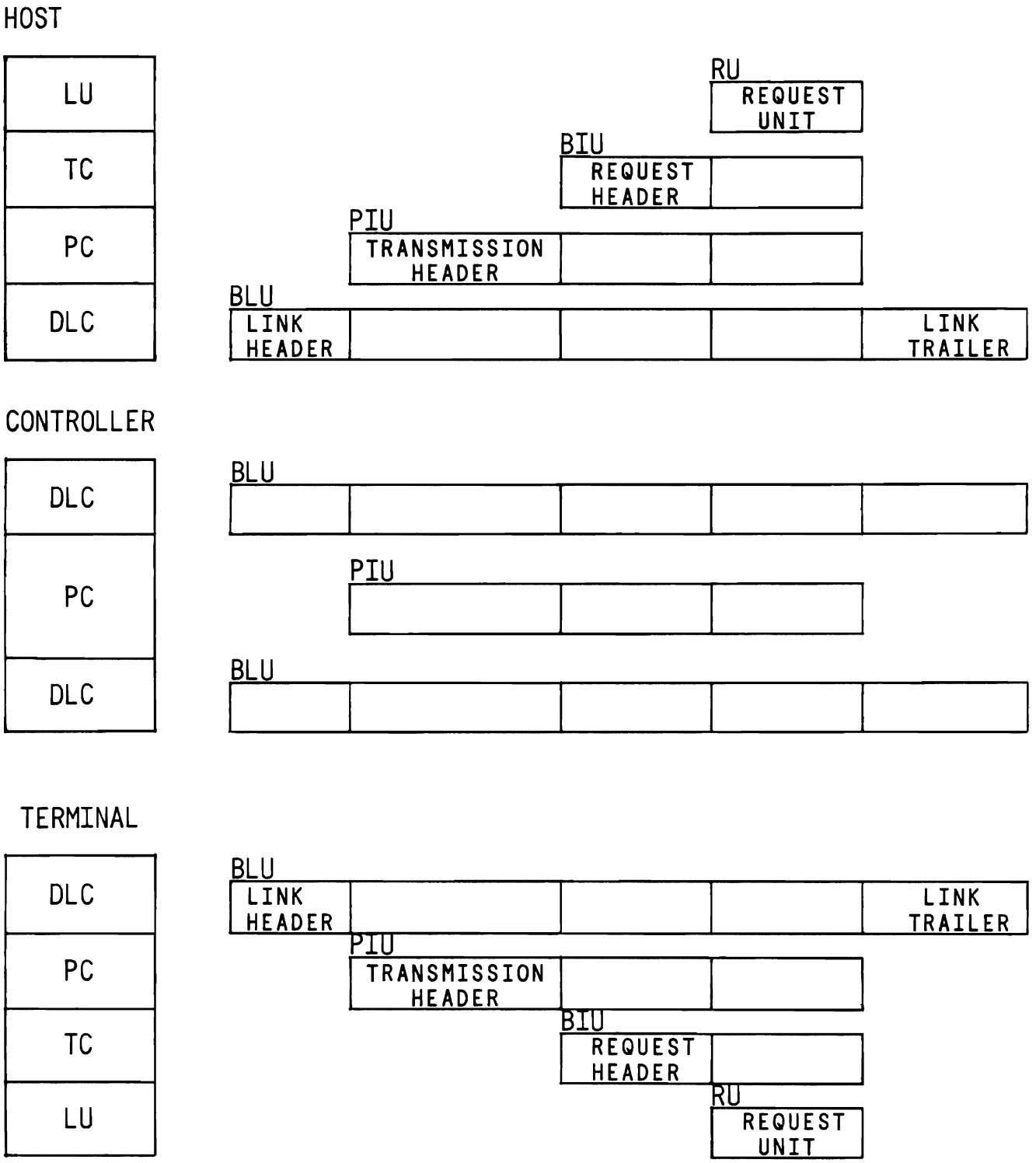
B -- ADJACENT LAYER COMMUNICATION

NODE STRUCTURE AND COMPONENTS

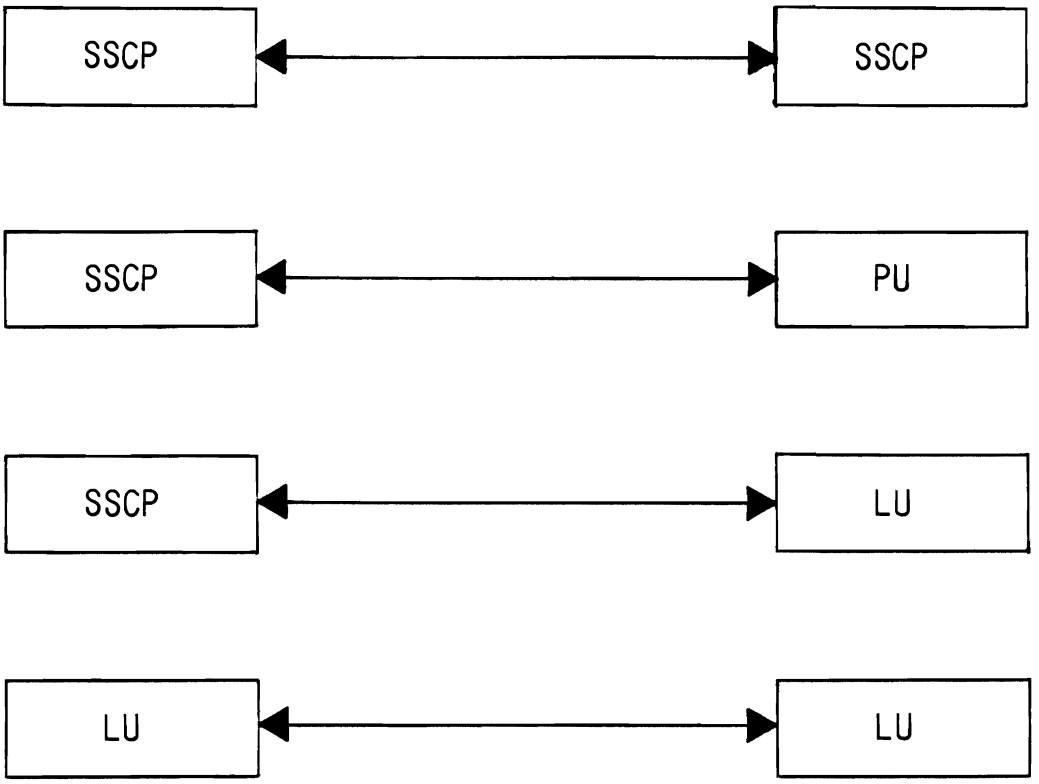


NAU = NETWORK ADDRESSABLE UNIT

INFORMATION FLOW -- ORIGIN TO DESTINATION



SESSION TYPES



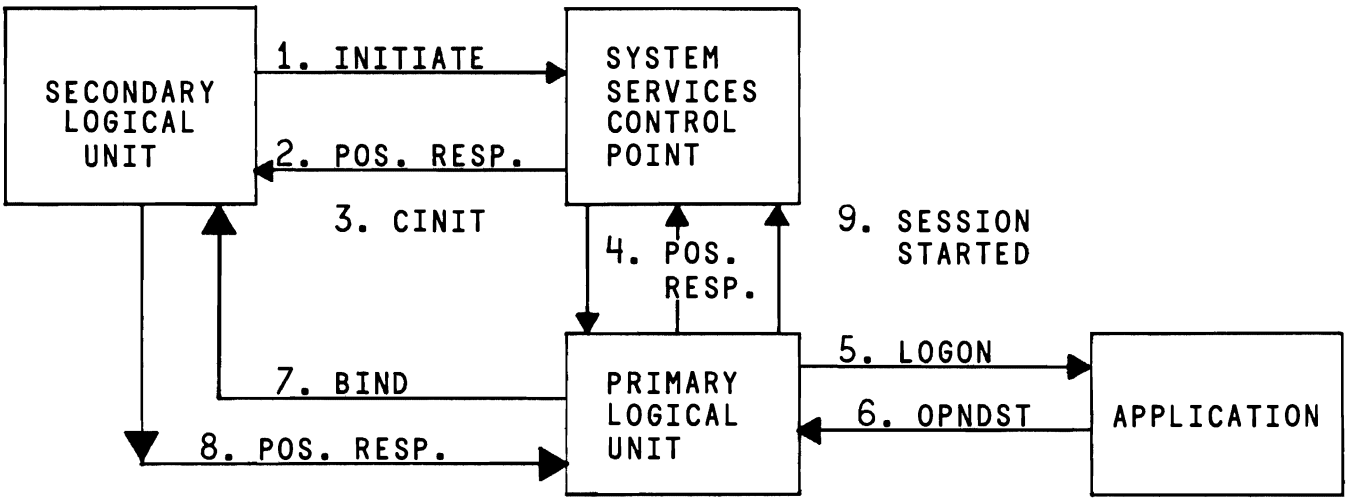
SSCP = System Services Control Point

PU = Physical Unit

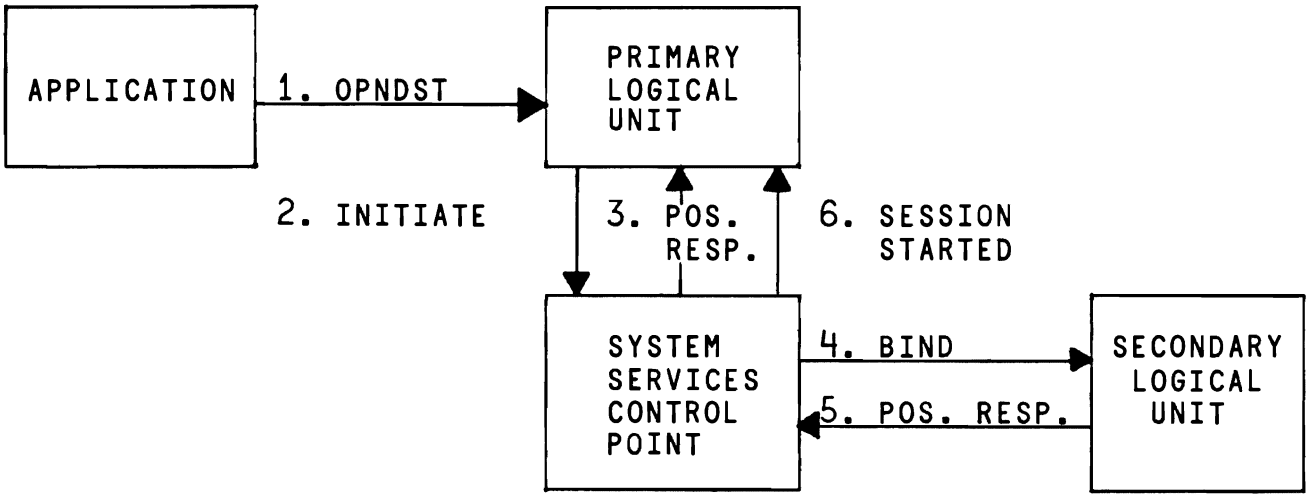
LU = Logical Unit

SESSION INITIATION

A. REQUEST BY SECONDARY



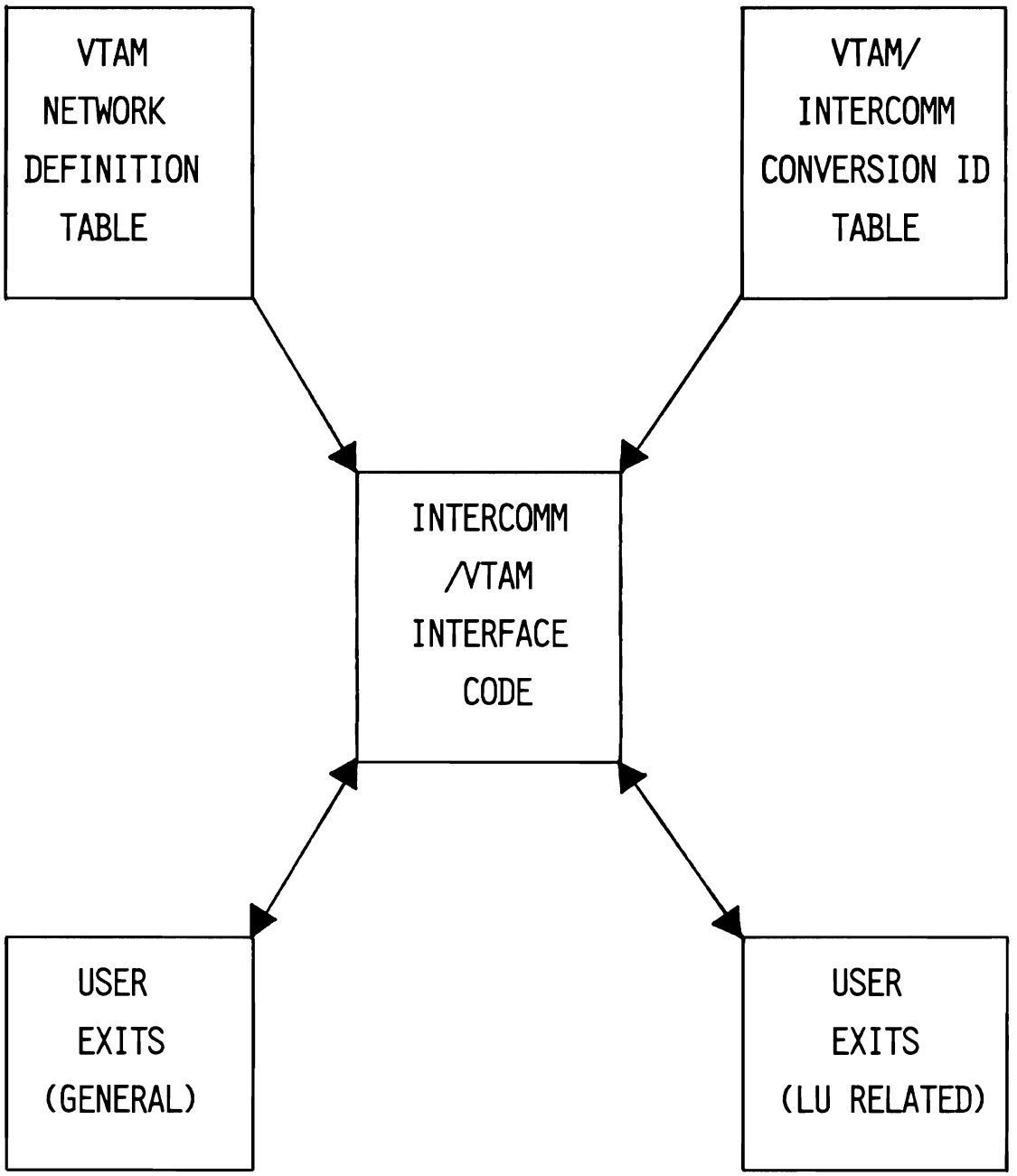
B. REQUEST BY PRIMARY



LOGICAL UNIT COMMUNICATION

- CHAINING
- BRACKETING
- QUIESCING
- CONTROL MODE
- PACING
- DEFINITE/EXCEPTION RESPONSES
- NORMAL/EXPEDITED FLOW

THE INTERCOMM -- VTAM FRONT END



```
         VCT     ......,SEQNO=BTAM,ULVB=LVB1
         LUNIT   ......,LSB=LSB1,CSB=CSB1,              X
                 NUMCL=nn,DFLN=aaaaaaaa,PCEN=nn,        X
                 VTID=vtamname
         LUNIT   ......,LSB=...,VTID=....
         LCOMP   ......,CSB=...,NUMCL=nn, etc.
         LCOMP   ......,CSB=...,NUMCL=nn, etc.
         LUNIT   ......,LSB=LSBCPU
         PMISTOP
         PCENSCT
LSB1     VTLSB   ......,ULVB=LVB2,TRSTBL=LOWTOUP
LSBCPU   VTLSB   LUTYPE=SYSCON
          .
          .
CSB1     VTCSB   ......,AIDGRP=1
          .
          .
LVB1     VTLVB   ......
LVB2     VTLVB   ......
          .
LOWTOUP  COPY    TRAN3270
         PMISTOP
         AIDGRP 1,.....
         AIDDATA
          .
         END
```

GLOBALS--specify Environmental Characteristics

--SETGLOBE (&VTAM SETB 1)

TABLES--DEFINE OPERATING CHARACTERISTICS

- Verb Table (BTVERB) - BTVRBTB
- Network Definition Table

--Network Configuration

VTAM Control Table (VCT)

LUNIT

LCOMP

--Network Specifications

Logical Unit Specification Block -- LSB

Component Specification Block -- CSB

--User Exit Vectors

Logical Unit -- LVB

--Terminal-id Table (VTIDTABL)

VTIDTAB (generate from LUNIT VTID=)

--Translate Table (ASMTRTAB) (TRAN3270)

--AID Processing Table

AIDGRP, AIDDATA

--DEFINE TERMINAL QUEUES--VTAMSCTS (SYCTTBL)-Automatic

--DEFINE BACK END TABLES

- Station Table - PMISTATB
- Device Table - PMIDEVTB
- Broadcast Groups - PMIBROAD

THE FRONT END -- VTAM

Installation Checklist

Globals	SETGLOBE	&VTAM	
SPALIST	CCNID	Control Terminal	
	SEP	System Separator	
Definition			
Macros	BTVERB	AIDGRP	
	VCT	AIDDATA	
	LUNIT	PMISTOP	
	LCOMP		
	VTLSB	STATION	
	VTLVB	DEVICE	
	VTCSB	DVMODIFY	
	(VTIDTAB)	BCGROUP	
Assemblies	(see list)		
Linkedit	ICOMLINK	VTAM=	
	Modules	(see list)	
	Tables	BTVRBTB	PMISTATB
		FENETWRK	PMIDEVTB
		(VTIDTABL)	PMIBROAD
Data Sets	VTAMQ	Overflow Disk Q	
JCL	None		

Dsects: PVRBTBLE, VCT, LUDSECTS (LUB, LUC, LSB, CSB),
AIDSECTS, VTBUFFER, VRT, VXQCB

INTERCOMM FRONT END -- MODULES

VTRECVE		VTERRMOD	
VTSEND		VTLUCMD	
VTAMSTAT		VTSQRSYN	
VTRESP		VTVREERR	
VTEXITS		VTAUTOUP	*
VTLUSCAN		VTQMOD	
VTO1MOD	*		
VTCDM1	*	OUT3270	*
VTCDM2	*	CLOSDWN3	
VTCDM6	*	BLHSTRC	
VTLUDM2	*	FECMD	
VTLUDM6	*	FEMSG	
VTSTART		FEWHOI	
VTTRACEV	*	INTVRBOO	
VTURLRX1	*	PMIEXTRM	
VTUROTX1	*	SYSCNTL	
VTURSDX1	*	TALLY	

* - IF FEATURE IS USED IN FRONT END ENVIRONMENT

VTAMSCTS--automatically generated

VTIDTABL--if not automatically generated and not in Network Table

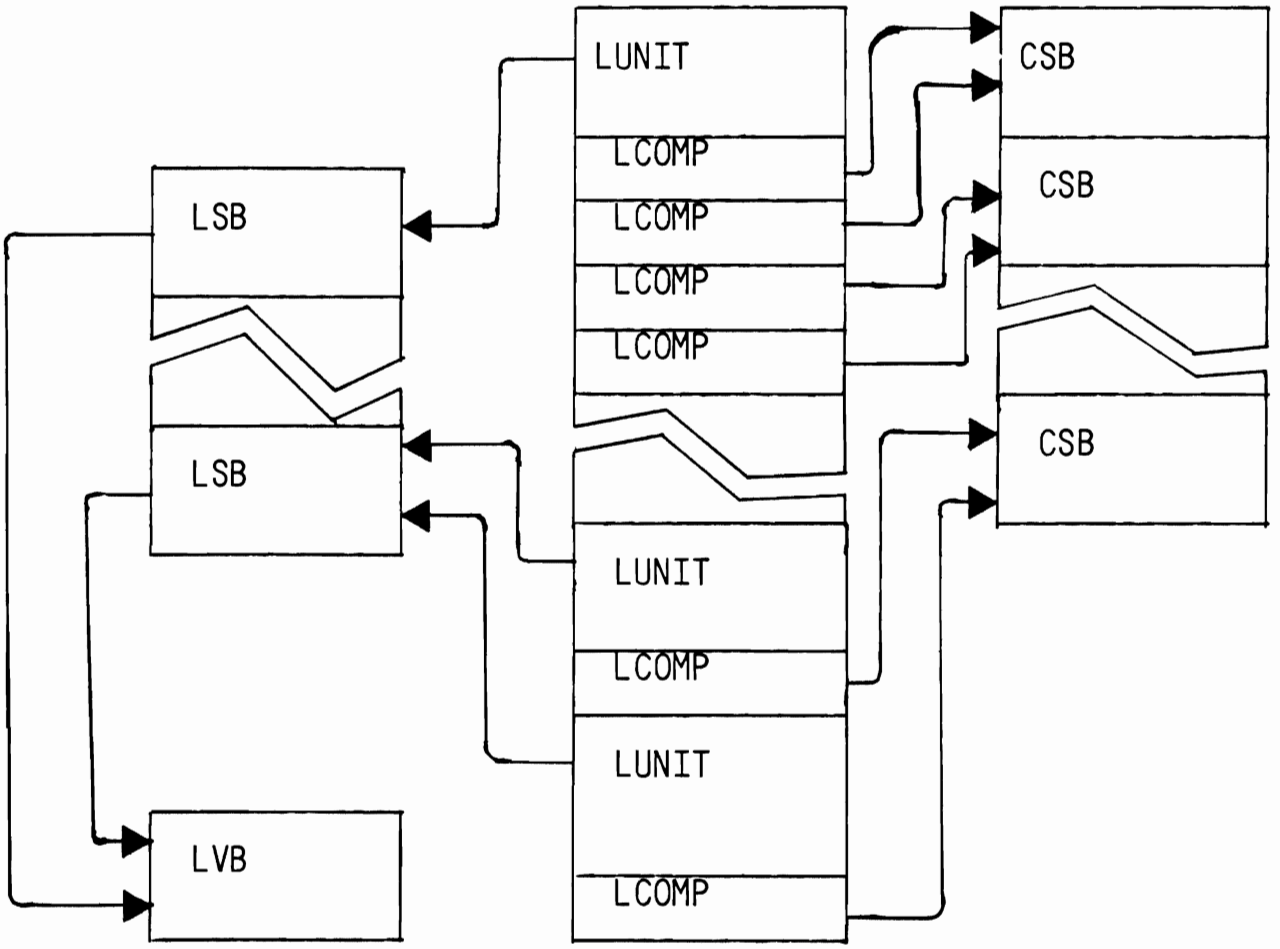
AIDTABLE--if not in Network Table

Include Module(s) in the Linkedit	- New Logical Unit Type(s)
LUNIT	- New Logical Unit
(LCOMP	- New Component(s))
VTLSB	- New Logical Unit Type
VTCSB	- New Characteristics
(VTLVB)	
(VTIDTAB)	
ASMTRTAB	- Translate Table as needed
AIDGRP	- If Type = 3270
AIDDATA	
Reassemble Network Table	
CREATEGF	- Format (new) Disk Queue
STATION	- New Terminal
DEVICE	- as necessary
DVMODIFY	- as necessary
BCGROUP	- Broadcast Group

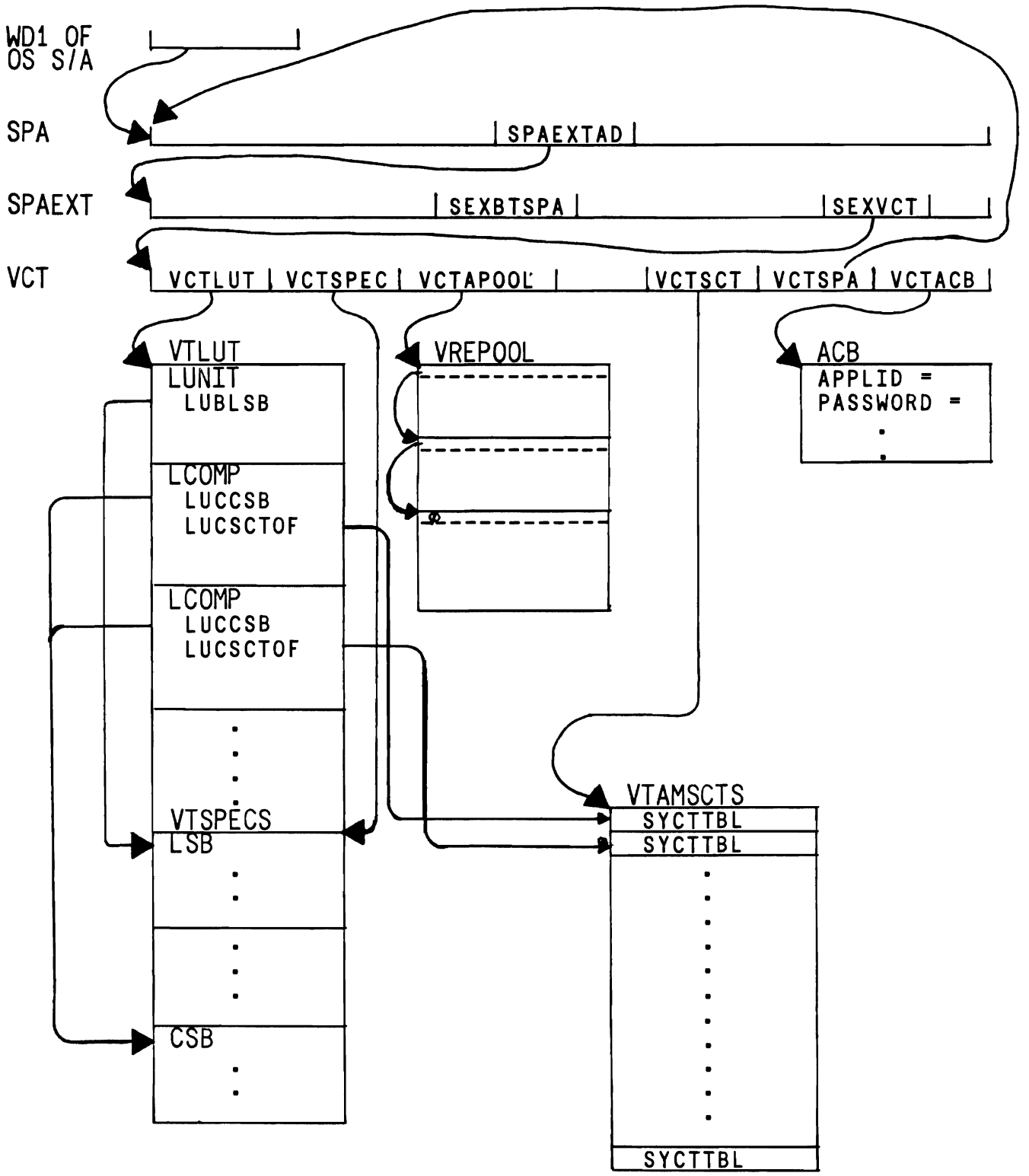
FRONT END -- BACK END TABLE RELATIONSHIPS

TABLE TYPE	FRONT END		BACK END
	BTAM	VTAM	
VERBS (transaction codes)	BTVRBTB --BTVERB	BTVRBTB --BTVERB	PMIVERBS --VERB
NETWORK	FENETWRK (BTVRBTB)	FENETWRK (BTVRBTB)	---
	--LINEGRP	---	---
	--BLINE	--LUNIT --VTLSB	---
			PMISTATB
	--BTERM	--LCOMP	--STATION --DVMODIFY
			PMIDEVTB
	--BDEVICE	--VTCSB	--DEVICE

NETWORK CONFIGURATION TABLE RELATIONSHIPS



FRONT END CONTROL BLOCKS -- POINTERS



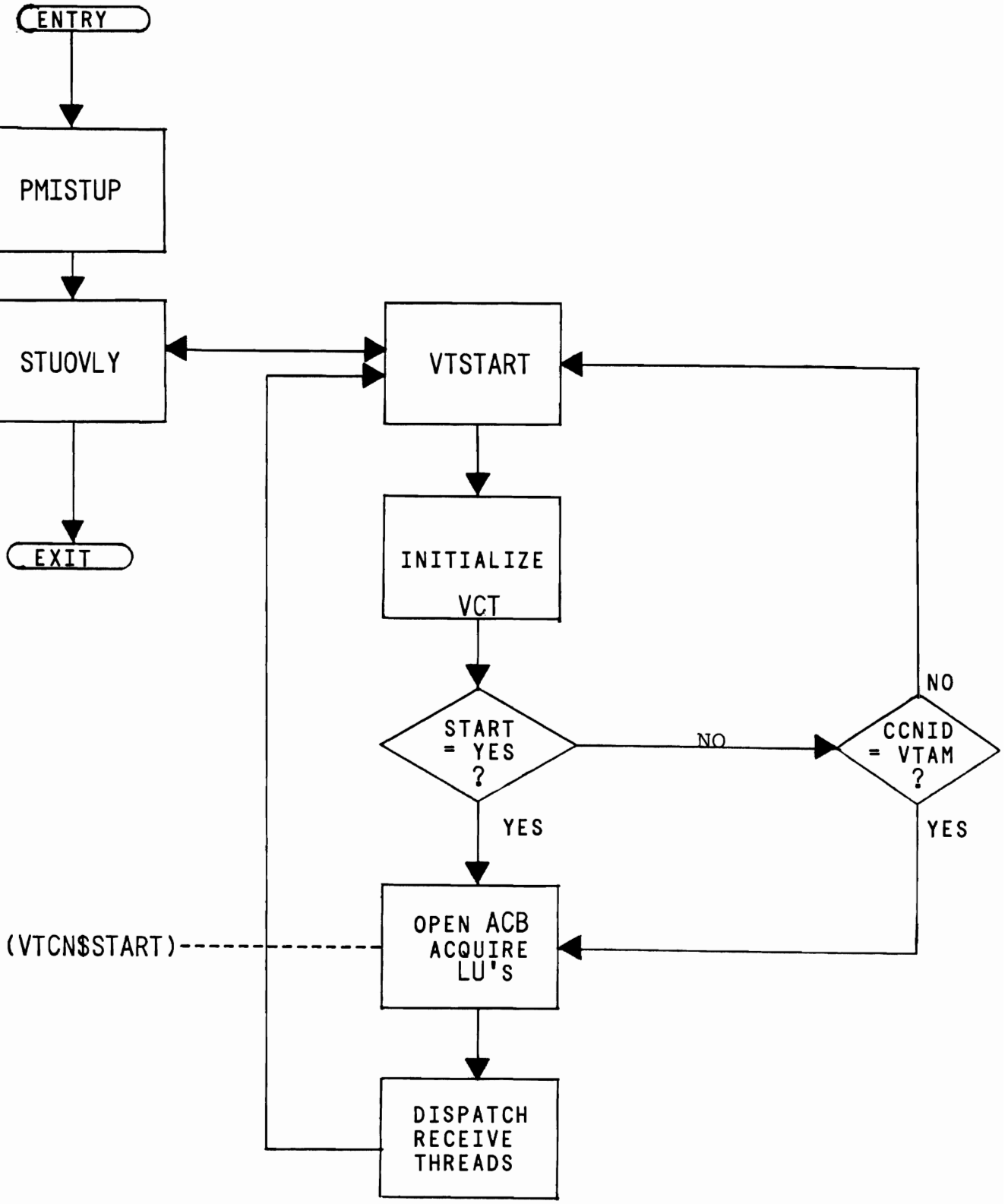
VTAM REQUESTS -- CONTROL BLOCKS/MACROS

CONTROL BLOCKS

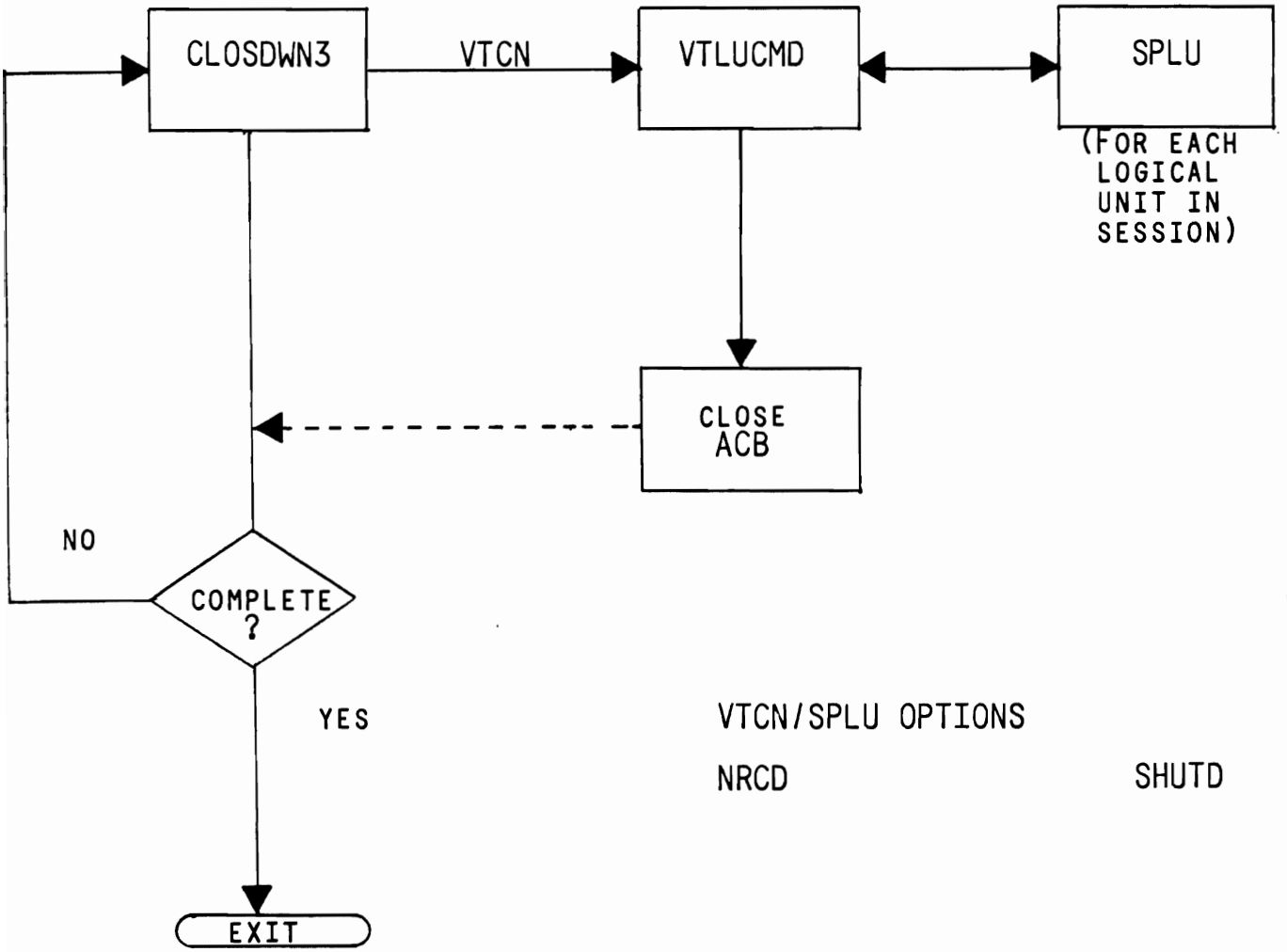
ACB	--	Access Method Control Block
EXLST	--	Exit List
NIB	--	Node Initiation Block
RPL	--	Request Parameter List

MACROS

GENCB	MODCB	SHOWCB	TESTCB
SEND	RECEIVE	CHECK	
SESSIONC	RESETSR		
OPEN	CLOSE	OPNDST	CSLDST
SETLOGON	SIMLOGON	INQUIRE	
OPNSEC	REQSESS	TERMSESS	
SENDCMD	RCVCMD		

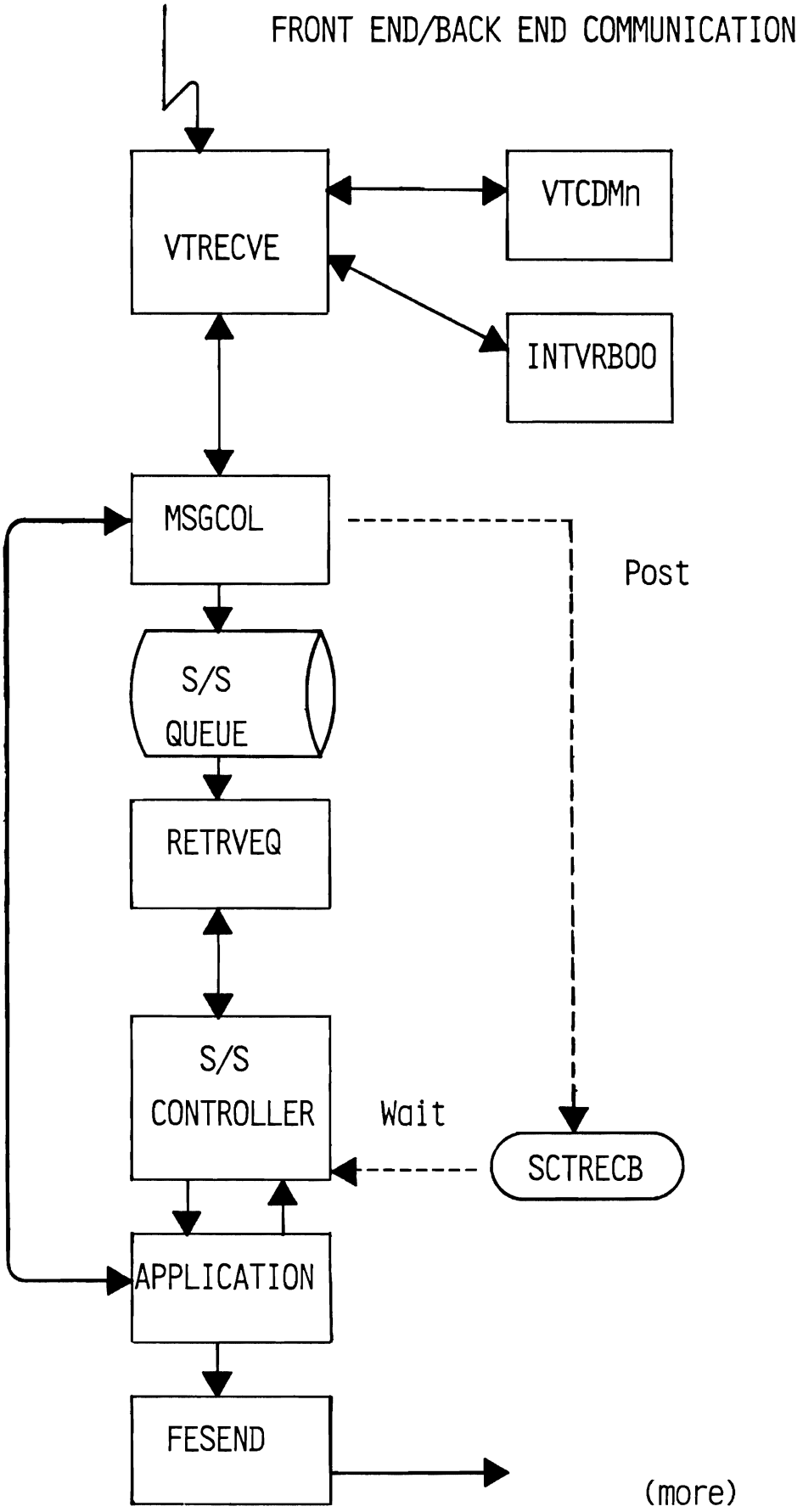

ENTRY
PMISTUP
STUOVLY
EXIT
VTSTART
INITIALIZE VCT
START = YES ?
NO
CCNID = VTAM ?
NO
YES
YES
(VTCN$START)
OPEN ACB ACQUIRE LU'S
DISPATCH RECEIVE THREADS

CLOSEDOWN



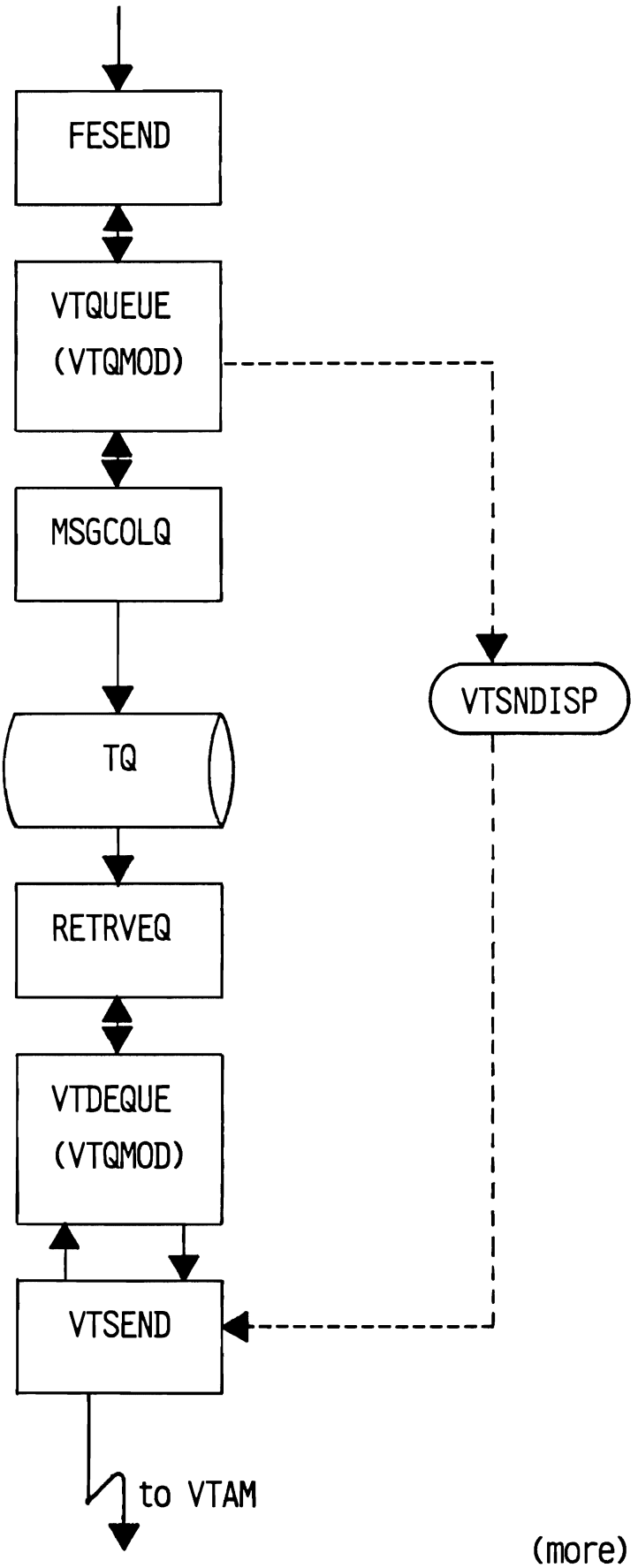
VTCN/SPLU OPTIONS

NRCD	SHUTD
IMCD (NRCD TIMEOUT)	HALT



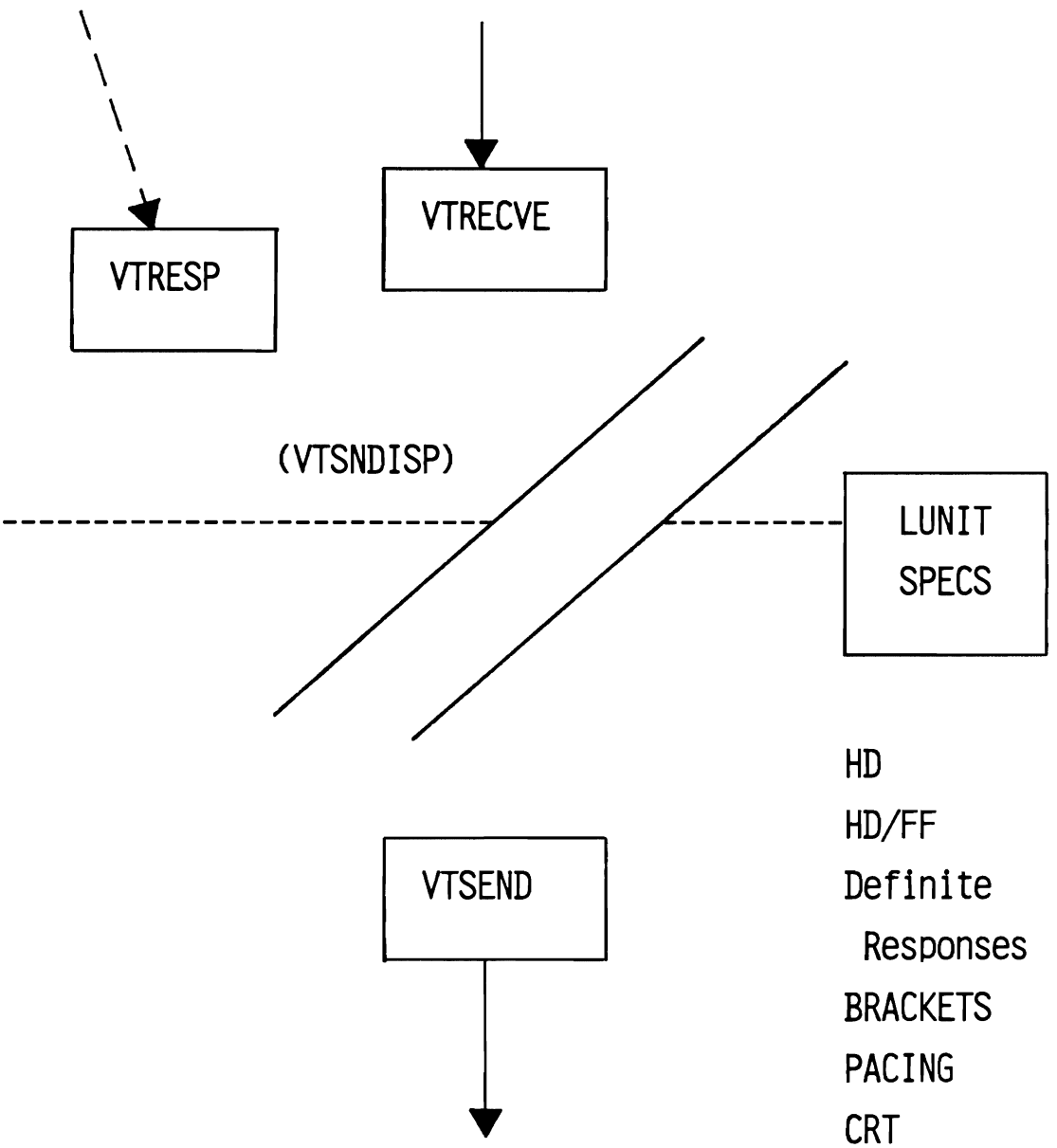
7.8 VTAM Interface: Structure and Processing

FRONT END -- BACK END COMMUNICATION



(more)

FRONT END -- BACK END COMMUNICATION



INPUT MESSAGES

FORMAT:

VERB$TEXT.....@

WHERE: $ = SYSTEM SEPARATOR

@ = ETB (X'26')

(inserted by VTAM Front End for compatability with existing common routines)

VERB:

1 to 4 characters on input

short verbs are padded (right) with Xs to 4-character length

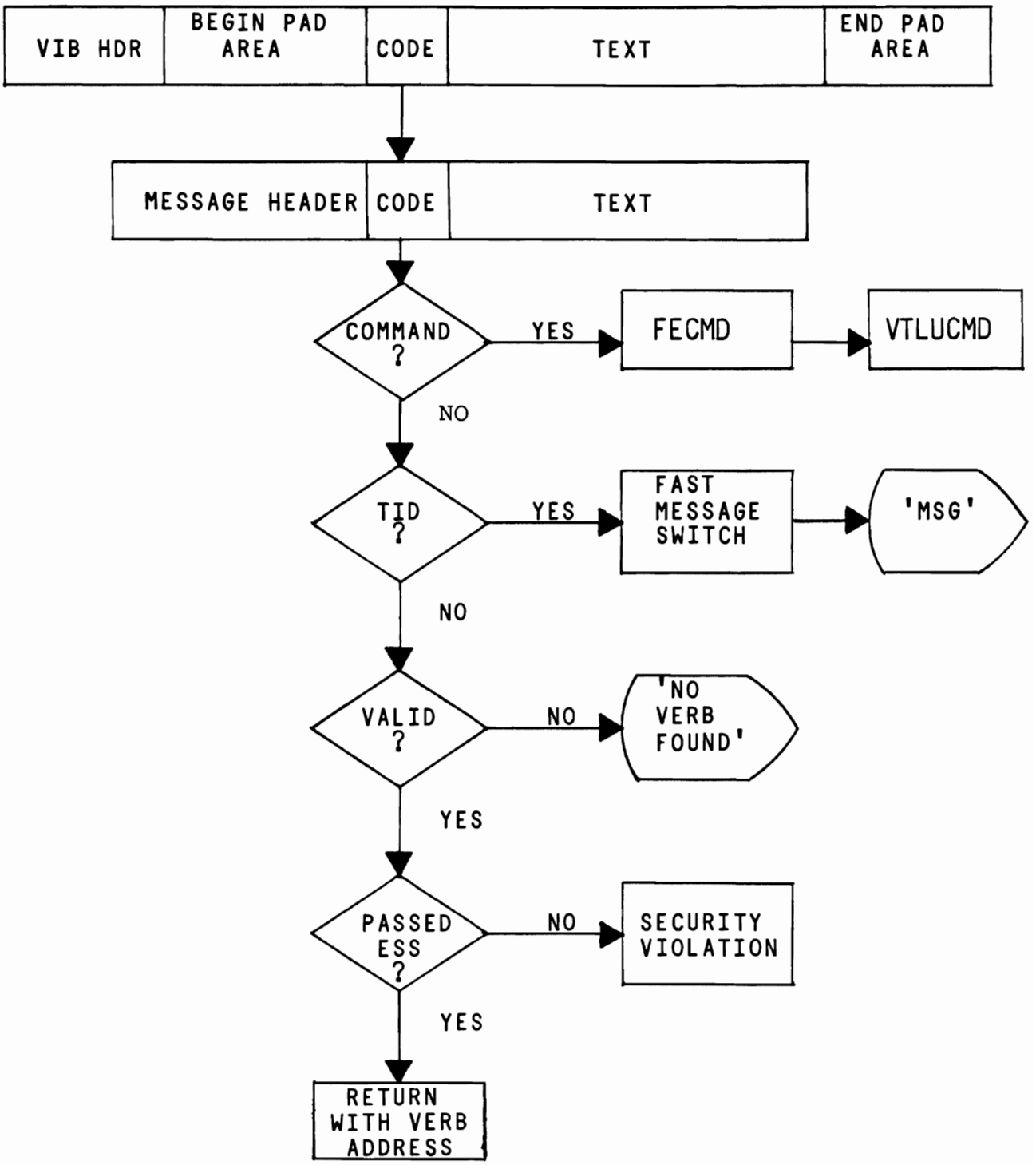
TRANSACTION ROUTING

- Transaction code
  - --Processing Subsystem
  - --Multiregion Queue
- Front End Command
- Fast Message Switch

TRANSACTION PROCESSOR

RCVVERB (INTVRB00)

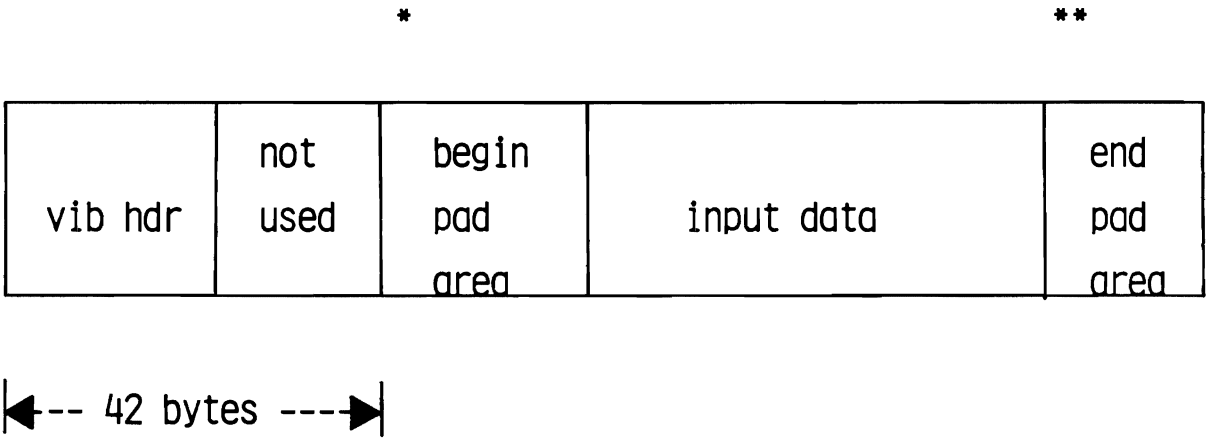
CALLED FROM RCVINPUT ENTRY IN VTRECVE AND/OR
VTVERB ENTRY IN CDM (VTCDM2)



MESSAGE HEADER CONSTRUCTION

VIB -- VTAM Input Buffer

VIB Header -- Information re input data, verb, LU, etc.



* Locked Verb
AIDDATA Processing

** ETB Character (X'26')

Dsect: VTBUFFER

VSB -- VTAM Send Buffer (Output Message)

RESPONSE TIME CONSIDERATIONS

- Definite vs. Exception Responses (VTLSB SRESP=)
- Maximum Concurrent Sessions (VCT SNMAX=)
- Number of 'RECEIVE' Threads
  - -- Responses (VCT RCVRSP=)
  - -- New Input (VCT RCVNO=)
- Core Queueing vs. Disk
- Priority Queueing
- Logging -- YES/NO
  - -- ASYNCH/SYNCH
  - -- RESTART
- Message Length (REQUEST UNIT Sizes)
  - -- VTLSB SNDBUFL= (LU-type dependent)
  - -- VCT RCANYLN=
- Core Pools Tuning--VIB, VSB, VRE's etc.
- Software Error Recovery
  - --CC (NCP)
  - --CPU (VTAM)
  - --Intercomm

CPU CONSOLE AS A TERMINAL

- Intercomm Communication
- Define in BTAM or VTAM Network (but not both)
- Global forcing and suppression of route codes
- Processing: VT01MOD

CONTROL TERMINAL

- System Control and Command Responses
- Secured Information/Requests
- Error Reporting
- Either a BTAM or VTAM Terminal

FAST MESSAGE SWITCHING

- Tid$Text.....@

SCREEN MANAGEMENT

- Function Keys
  - -- AID Processing
  - -- 3270 Header Interpolation
- Device Timing Considerations
  - -- CRT Processing
  - -- RLSE Command

Further Reference: SNA Terminal Support Guide

CONVERSATIONAL SUPPORT

- Conversational Mode
  - -- LUNIT/LCOMP CONV=YES
  - -- BTVERB CONV=time-out interval

- Conversational Time-out--Error Message
  - -- Subsystem delayed?
  - -- Subsystem hung?
  - -- Subsystem Program check?
    (SNAP processing delay)
  - -- Enough time allowed?
    BTVERB CONV=

- RLSE Command--delayed message

ALTERNATE BUFFER PROCESSING

- Alternate column/line size must be defined in VTAM region

- Sizes acquired by Intercomm at LOGON-stored in LUC

- DVMODIFY ALTBUF=YES,BUFFRSZ=size[,LINESZ-nn]

3270 Write Command = EWA (X'7E') supported - same as BTAM

ALTERNATE TERMINAL

- Automatic Assignment--LUNIT/LCOMP ALT=
- Manual Assignment--SPLU ATDname/VT-id
- Not recommended for shared printers, dial-in devices

If no alternate terminal is specified, messages are held until flushed or destination LU is available.

AUTOMATIC SESSION RE-INITIATION

- OPNDST Failure
- Session Lost
- SIMLOGON Failed
- Exception Response
- LUNIT ACQ=YES,UPINTV=time
- SPLU...DEACT cancels autoup processing
- Processing: VTAUTOUP

AUTOMATIC VTAM RESTART

- If ACB Open Failed at Startup
- After VTAM Region Failure (TPEND Exit)
- After VTAM Front End Closed due to unrecoverable error
- VCT VTUPINV=time
- Processing: VTAUTOUP

- VTCN
- RSLU
- STLU/SPLU
- BRDN/BRUP
- VTDN/VTUP
- SECF/SECN
- WHOI/WHOU
- LOCK/UNLK
- LOKR/ULKR
- RLSE
- FLSH
- QHLD/QRLS
- SNBK/SWCH
- COPY
- LTRC
- SCTL$DSPCH${VCT }
  {TID=name}

STATISTICS

ONLINE COMMANDS

- VTST
- TALY$SU
- TALY$FE[(tid)]
- TALY$FQ/FN/FD/FU/VS/VN/VI/FI

REPORTS

- SAM -- MESSAGES
  -- FECLS
  -- FEOTPUT

- STS -- # FE MSGS PROCESSED
  -- # FE DISK Q BLOCK WRITES
  -- current BMN number

- LOGPRINT

- LOG ANALYSIS
  -- Response Time
  -- Traffic

Further Reference: System Control Commands
Operating Reference Manual

USER EXITS

GENERAL

- COPYEXIT* -- same as for BTAM
- USRBTLOG* -- same as for BTAM
- USROTEDT -- same as for BTAM
- VTUSLGNX -- validate LOGON before 'OPNDST'
- VTUSVSDX -- shutdown to be processed
- VTUSRLRX -- RELREQ received from VTAM

LOGICAL UNIT RELATED (VTLVB for logical unit)

- INQUEUE
- OTQUEUE
- OUTSEG
- LOGON
- SHUTD
- HALT (see LUCUR*)
- LUS
- SIGNAL
- RCVEXCD
- SNDABT
- SNDEXR
- SNDNRM

SHARED PRINTER SUPPORT

- VTURLRX1*
- VTUROTX1*
- VTURSDX1*

* Supplied on SYMREL

Further Reference: SNA Terminal Support Guide

MACROS FOR USER EXIT CODING

- EXTERM
- VTIDCONV
- VTREGUSE USING=(MSG,LUB,LUC,VCT,CSB,LSB)
- VTGETCB CSB/LSB=(r)[,LUC/LUB={(r)}][,VCT={(r)}]
  {YES} {YES}
- QCOUNT

Further Reference: SNA Terminal Support Guide
Basic System Macros

VTAM -- REGISTER USAGE

NAME	USAGE
R0	Variable, Work
R1	Variable, Work
R2	Link, Work
R3	Second Base
R4	Current Message (VIB/VSB)
R5	CSB, Return Addr Stack Ptr. Third Base (VTLUCMD)
R6	VCT
R7	Work
R8	VRE (RPL)
R9	LSB, Work
R10/RA	LUC, NIB (if in LOGON Processing)
R11/RB	LUB
R12/RC	First Base
R13/RD	Save/Work Area
R14/RE	Variable (Link), Work
R15/RF	Variable (Address), Work

VTCN COMMAND

- SHUTD
- HALT
- HALT$QUICK
- START
  --$APPLID=name
  --$PASSWD=code
- TRCON/TRCOF
- SNMAX$nnnnn
- CLSON/CLSOF${TRC$SNP$WTO}
  {ALL }
  (may be keyed after SHUTD/HALT)
- SNPON/SNPOF

VCT MACRO

ERROR PROCESSING OPTIONS

- TRACE=([EWTO],[ETRC][,NTRC])

- CONTROL={YES} Do not use Q option to acquire control LU
  {ASK} Issue WTOR if cannot acquire control LU or alternate control LU if primary not available

- CLOSE=([NOTRACE],[NOSNAP][,NOWTO])

- FULLSNAP={NO }
  {YES}

- VTUPINV=autoup-interval in minutes (to 255)

- SHUTDTL=shutdown/halt time limit in seconds (to 32767)

- MXSDTHD=max shutdown/CLSDST threads (to 32767)
  should not be more than 200 to prevent PMINQDEQ ISK

8 INTERCOMM IN A MVS ENVIRONMENT

MVS VOCABULARY

Page

EPS

Page Fault

Page Loading

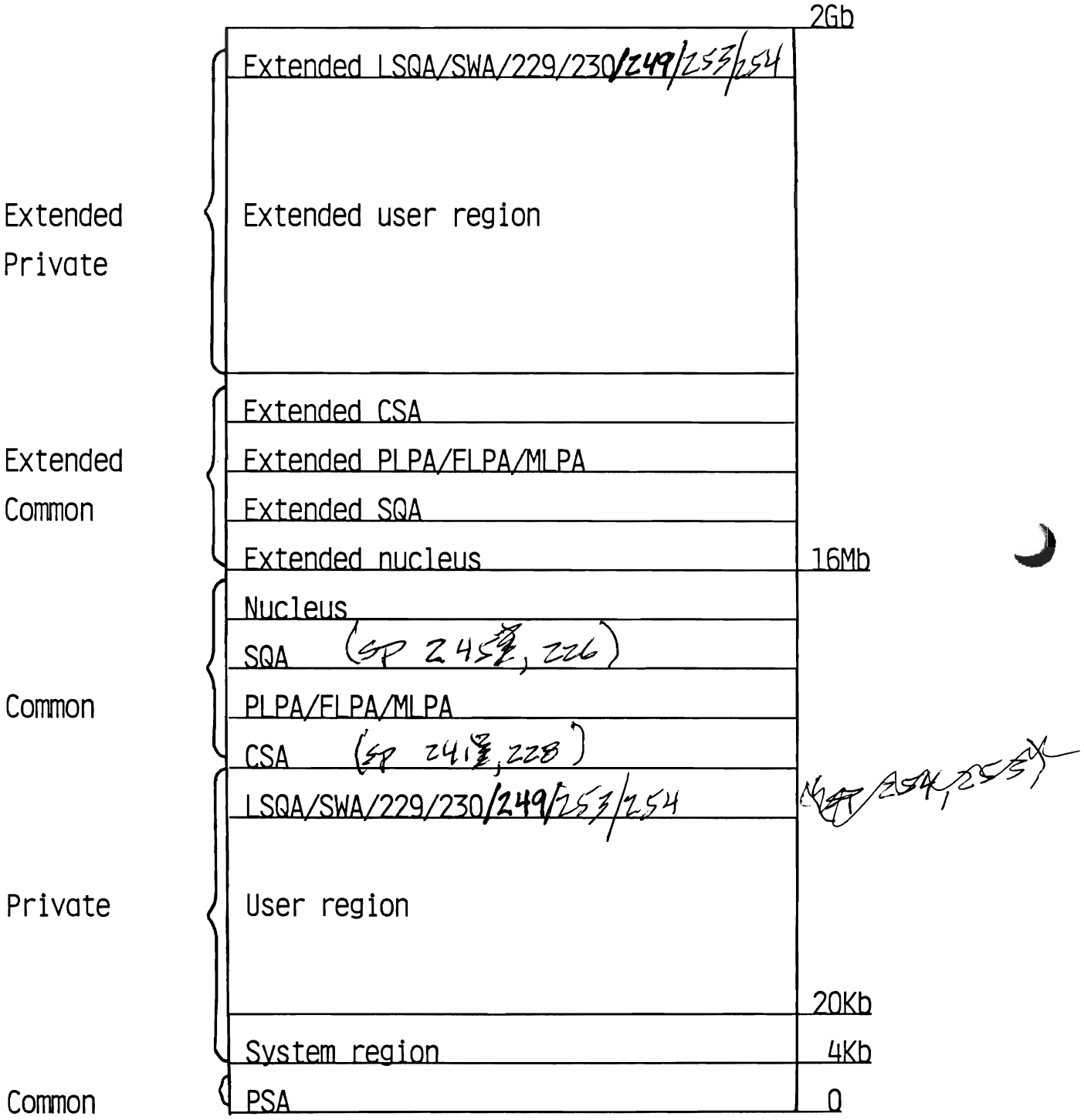
Page Fixing

INTERCOMM AND A MVS ENVIRONMENT

- MVS/370, MVS/XA, MVS/ESA
- Page Faults
- Nature of On-Line Programs
- Linkedit Ordering
- Subsystem Page Modularity

Further Reference: Operating Reference Manual

8.1 Introduction


2Gb
Extended LSQA/SWA/229/230/249/253/254
Extended user region
Extended Private
Extended CSA
Extended PLPA/FLPA/MLPA
Extended SQA
Extended nucleus
Extended Common
16Mb
Nucleus
SQA
PLPA/FLPA/MLPA
CSA
Common
LSQA/SWA/229/230/249/253/254
User region
Private
20Kb
System region
4Kb
PSA
0
Common

SETGLOBE: &MVS
&XA
&MRSVC
&IISVC
&VTAM
&VSAM

IBM Macros: SPLEVEL

Assemblies: See Installation Guide

Linkedit Special Modules SWMODE
LOADPAGE
PMIPGLD

Add ORDER statements

Intercomm Restrictions:
--do not put in Program Properties Table
--will not execute Authorized

Further References: Operating Reference Manual
Installation Guide

Page Preloading (MVS/370 only)
XASWITCH Macro

Virtual Storage Constraint Relief
- --subsystem loading above 16M line
- --subroutine loading above 16M line
- --VSAM LSR buffer pools above 16M line

STAEEXIT -- ESTAE processing under MVS

SPIEEXIT -- ESPIE processing under XA, ESA

Virtual Execution Groups

VSAM
- Standard Support in File Handler
- VSAM Recovery
- ISAM/VSAM Compatability

SNA/VTAM

Intercomm must execute non-swappable
- --SYSEVENT issued by STARTUP3 (requires MRSVC or IISVC)

Further Reference: Operating Reference Manual

LOADING ABOVE 16M LINE

Supported for: subsystems/subroutines

if

REENTRANT or PSUEDO-REENTRANT

Requires: parameters passed to 24-Amode routines (Intercomm/User) be in 24-Amode DWS including constants--map name, ddname, etc.

Unaffected by: SPALIST MAXLOAD

remains loaded unless program check or time-out or LOAD command issued

Program Linkedit: AMODE=31,RMODE=ANY

RENT (REUS if COBOL)

NCAL

If BAL or PL/1--link with INTLOAD

Linkedit: Module SWMODE

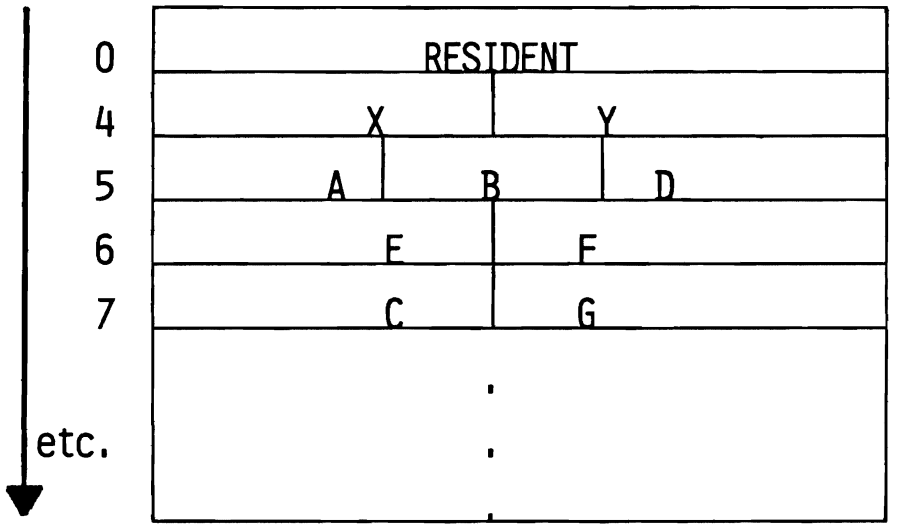
Command: TALY$DA

Statistics: System Tuning Statistics

Closedown Reports

Further Reference: Operating Reference Manual

Programmers Guides



FEW PAGE FAULTS

```
ORDER   X(P),Y
ORDER   A(P),B,D
ORDER   E(P),F
  .
  .
```

Implementation: SYCTTBL EXGRP=n,ECB=NO
SPALIST SWIN/ECB

EXGRP subsystems are resident but processed as though in an OVLY group:

--all messages queued for subsystems in one EXGRP processed until Q empty, or MNCL messages processed for each SS.

--next group executes if any messages on Q.

CANCEL RECOMMENDATIONS

STAEEXIT: Issues Snap ID=122 (except Operator Cancel)
WQE Trace, Thread Dump
Calls Multiregion Closedown (MRSTAE)
Calls IISVC to free protected core

USE

PMIDEBUG (see Messages and Codes)

REPLY

CANCEL (user Abend Code=32)

to Cancel Intercomm when
IMCD/NRCD ineffective

ALLOWS

Log Buffer Flushing
Closing Files
DB Closedown (DBSTAE)
ESS Closedown (if MRSVC)

AVOID CANCEL INTERCOMM (122/222) UNDER MVS
(due to IBM ESTAE/SETRP restrictions)
BECAUSE FILES NOT CLOSED (VSAM)
LOG BUFFERS NOT FLUSHED

9 MULTIREGION INTERCOMM

9.1 Introduction

9.2 Installation

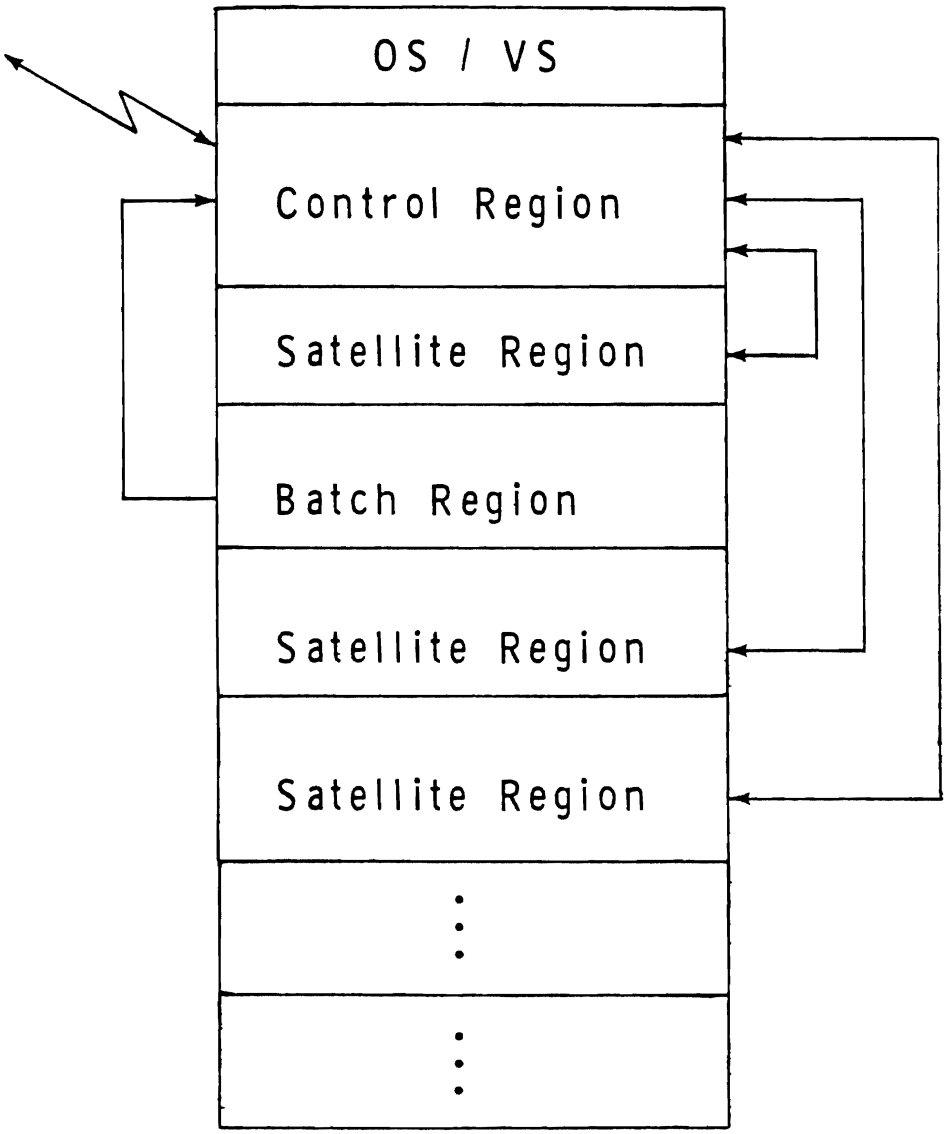
9.3 Interface: Structure and Processing

9.4 Features

MULTIREGION USES

- Separate On-line Test from Production Region(s)
  - --core integrity
- Separate Data Management
  - --user files (file recovery)
  - --Data Bases
- Separate Logging
  - --message restart
  - --accounting
  - --Log Analysis
- Independent Start-up and Close-down for
  - --recovery procedures
  - --subsystem testing/enhancement
  - --table maintenance
- Storage Conservation
  - --Front End only in Control Region
  - --Link Pack Facility
- Subsystem Grouping by
  - --file usage/Data Base access
  - --Response time criteria/application group
- Batch/On-line Communications

MESSAGE FLOW OVERVIEW



CONTROL REGION

- MESSAGE TRAFFIC CONTROL
  - -- REGION DESCRIPTOR TABLE ASSOCIATES SUBSYSTEMS WITH REGION
  - -- REGION QUEUES AND SUBSYSTEM HOLD QUEUE
  - -- LOCAL SUBSYSTEM QUEUES
  - -- TERMINAL QUEUES

- CONTENTS
  - -- FRONT END
  - -- BACK END
  - -- UTILITIES
  - -- SYSTEM CONTROL SUBSYSTEMS
  - -- USER SUBSYSTEMS

- RESPONSE TIME

SATELLITE REGIONS

- CONTENTS
  - -- BACK END
  - -- USER SUBSYSTEMS
  - -- MRS INPUT/OUTPUT INTERFACE
- INDEPENDENT START UP/CLOSEDOWN
- INDEPENDENT LOGGING
- INDEPENDENT RESTART/RECOVERY

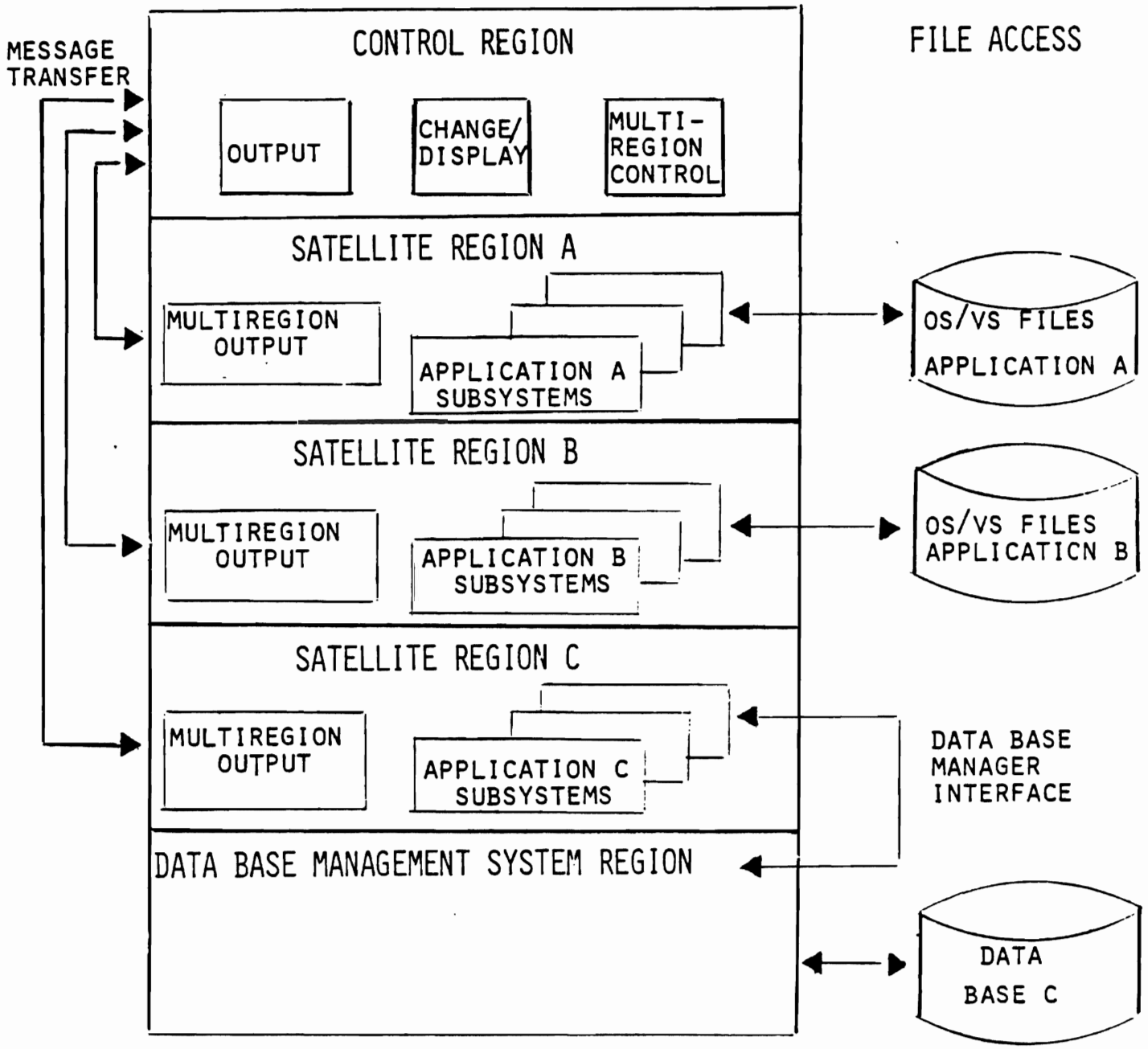
A batch program can send a message to the Intercomm Control Region:

- To request that certain online programs be quiesced because of batch processing (DELY Command) or to dynamically deallocate a file (FILE Command).

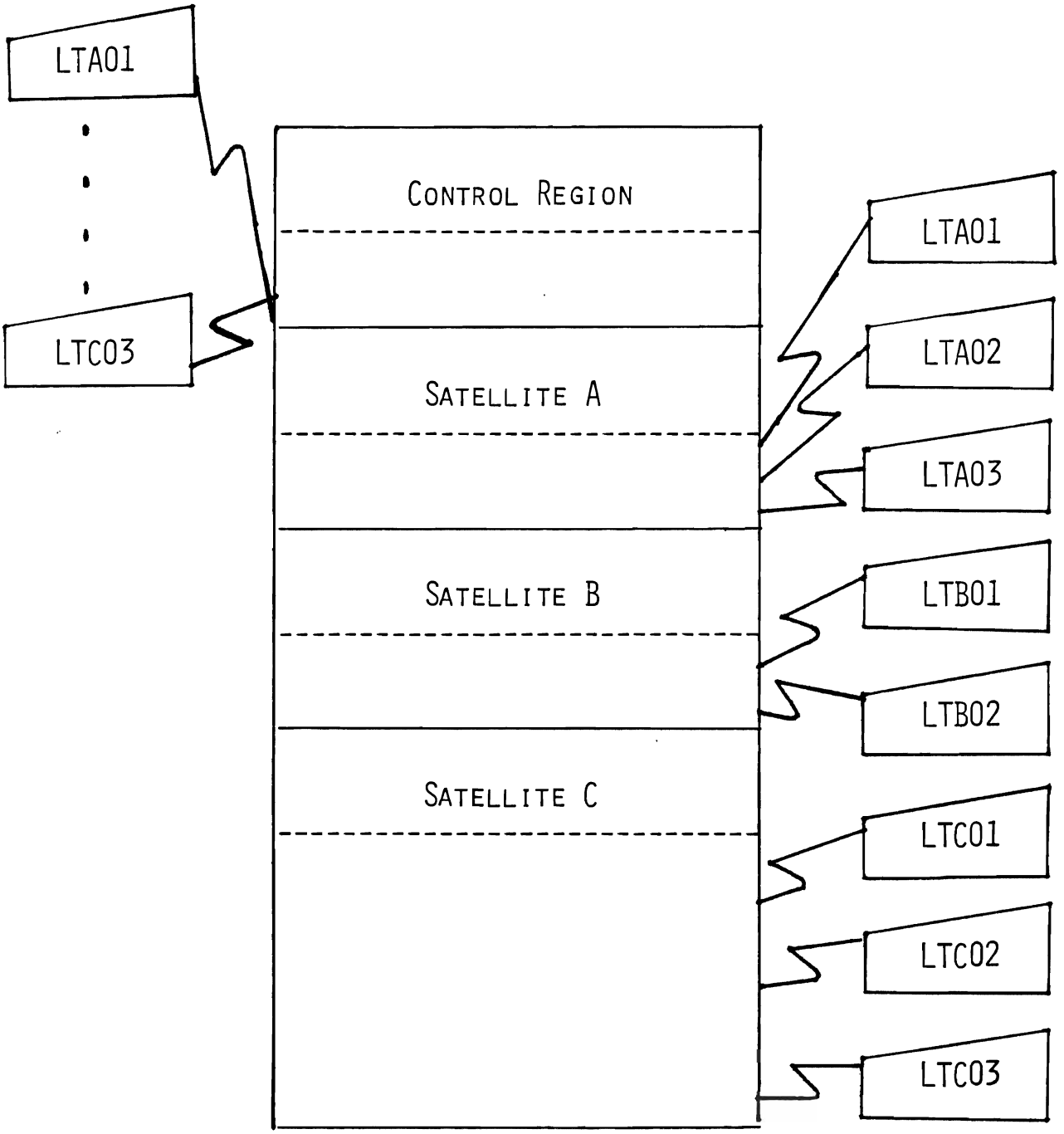
- To notify a user subsystem that a DDQ is complete and can now be processed online.

- To notify a user subsystem that file creation/update is complete and can now be reallocated (FILE Command) and/or to reactivate online programs (BEGN Command).

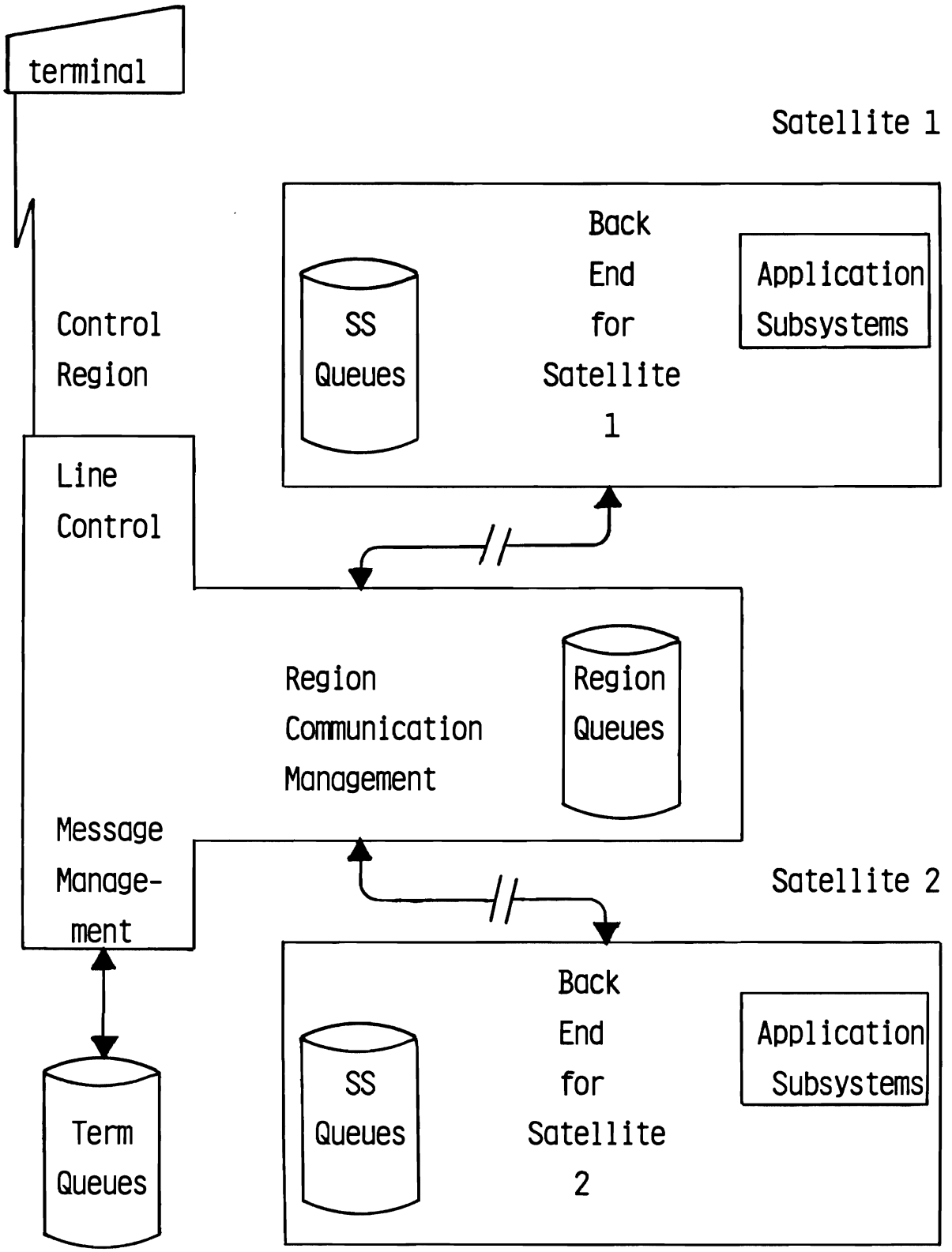
FILE AND DATABASE ACCESS



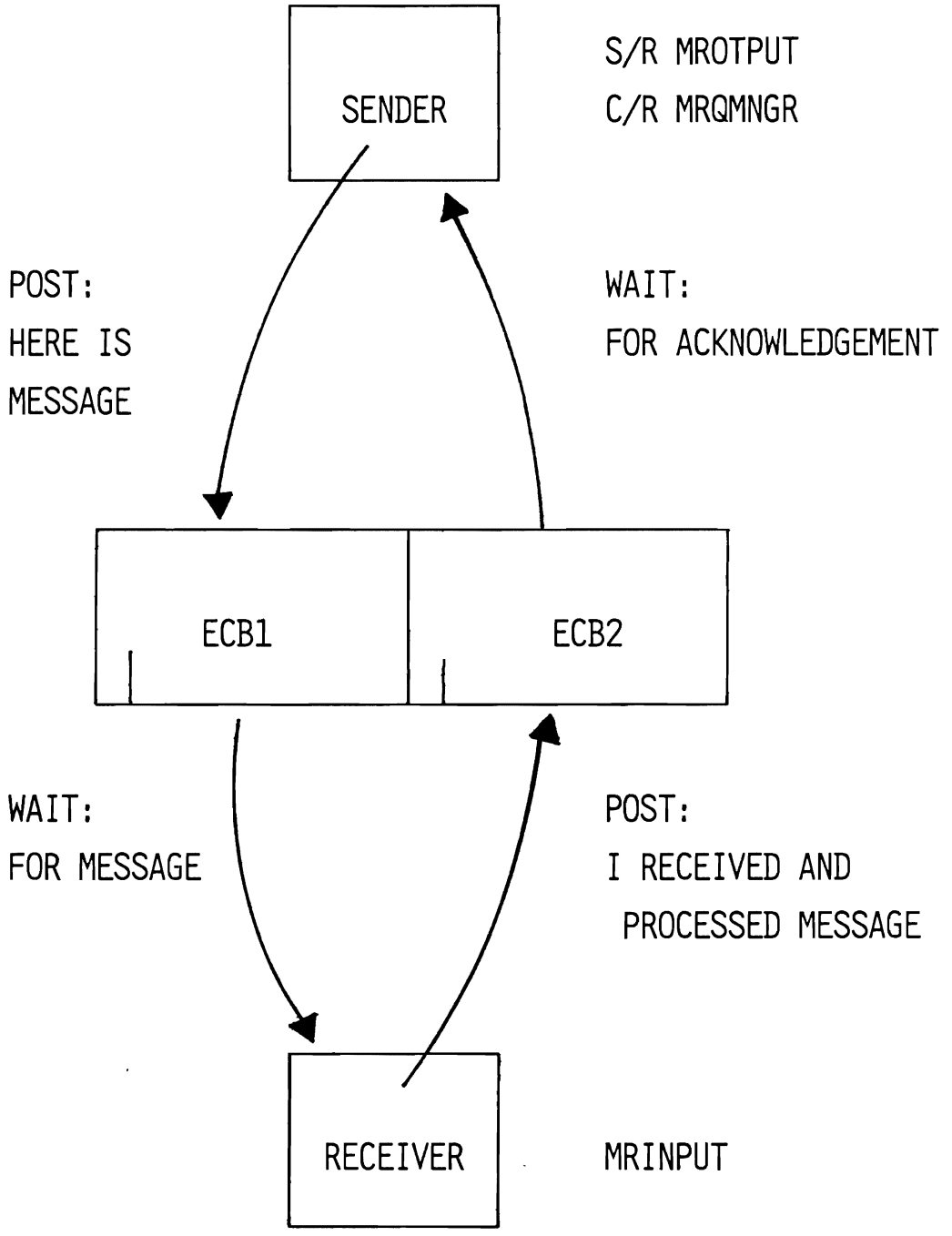
TERMINAL ACCESS (WITH RAP)



IN REALITY "LOOKS LIKE"


terminal
Satellite 1
Back
End
for
Satellite
1
SS
Queues
Application
Subsystems
Control
Region
Line
Control
Region
Communication
Management
Region
Queues
Message
Manage-
ment
Satellite 2
Back
End
for
Satellite
2
SS
Queues
Application
Subsystems
Term
Queues

INTERREGION COMMUNICATION CHANNEL
in MRMCT



GLOBALS	SETGLOBE	&MULTREG
		&MRSVC
		&IISVC
SPALIST	MRCNTL	MR1LOG
	MRCSALN	MRAUTO
	MRID	
Assemblies	INTSTS	MRINTER
	FECMD	MRSTAE
	FESEND	MRINPUT
	FEWHOI	MRCSAMOD
	INTSPA	MRPURGE
	IGCICOM	MRQMNGR
	IJKDSP01	MROTPUT
		MRBATCH
		MRLOGIN
		MRLOGOT
Generation Macros	REGCOM	
	REGION	
	SUBSYS	
	MRPASWRD	
	GENRDT	
Tables	MRMCT	PMIRDTOO

MULTIREGION INSTALLATION CHECKLIST (continued)

Linkedit	ICOMLINK	MULTREG=
	Modules	MRINTER
		MRINPUT
		MRSTAE
		MRPURGE
		MRCSAMOD
		MRQMNGR (CR only)
		MRCONSS (CR only)
		MRLOGIN (CR only)
		MRLOGOT (SR only)
		MROTPUT (SR only)
		MRMOD (RAP only)
		MRBATCH (BR only)

User Exits: MRSECUR1 MRSECUR2 MRQMONX

Operating System Preparation: IGCICOM (MRSVC) or
IGCICSVC (IISVC)
MRMCT (LPA)
PMIRDTnn (dynamic)

Additional Preparation: DDQ environment

Data Sets: DDQs Region Queues, Subsystem Hold Queue

Further Reference: Multiregion Support Facility
Dynamic Data Queuing Facility
Operating Reference Manual

GENERATE MULTIREGION COMMUNICATIONS TABLE
MRMCT

Prototype:

```
      (symbol)        REGCOM            RGNID={Region-id}
                                                {BATCH}
```

Example:

```
                      REGCOM            RGNID=SATELIT1
                      REGCOM            RGNID=SATELIT2
                        .
                        .
                        .
                      REGCOM            RGNID=BATCH
                      END
```

Place in: Link Pack Area (resident, Reentrant)
(must be FLPA or MLPA with NOPROT option)

PARM.LKED='RENT'

DSECT: MCTDSECT

Notes: Control Region not defined
CONTROL may not be a region-id
Only one Batch Region may be defined
(RGNID=BATCH)

GENERATE THE REGION DESCRIPTOR TABLE (RDT)
PMIRDTnn

The RDT associates subsystems with regions and is generated using the REGION and SUBSYS macros.

```
(symbol)  REGION        Region-Identifier
                       ,STOP={YES}
                             {NO}
                       ,XSATREG={NO}
                                {YES}

                        LOGGING

                       ,LOG={NO}
                            {YES}

                        QUEUEING

                       ,COREQ={Messages-Queued-In Core}
                              {4}
                       ,DDNAME=DDname-of-DDQ
                       ,BLOCKED={NO}
                                {YES}
                       ,QSPACE={Size-of-DDQ-Extent}
                               {8}
                       ,CSALEN={Interregion-CSA-Buffer}
                               {1024}
```

```
(symbol)  SUBSYS     Ssch,Ssc

                     SATELLITE INACTIVE

                    ,ALT=Alternate-Satellite-Region-ID
                    ,IFDOWN={FLUSH}
                            {QUEUE}
                    ,QSPACE={Size-of-DDQ-Extent}
                            {8}
                    ,STOP={YES}
                          {NO}

                     RESTART

                    ,LOG={NO}
                         {YES}
                    ,LSYNCH={YES}
                            {NO}
                    ,RESTART={NO}
                             {YES}
```

Maximum SUBSYS macros in the RDT = 1000

To use more: Increase values for all globals in FEMACGBL

EXAMPLE OF REGION DESCRIPTOR TABLE

```
PMIRDTnn  CSECT
          REGION        SATELIT1,...
          SUBSYS        1,A,...
          SUBSYS        1,B,...
          .
          .
          .
          REGION        SATELIT2,...
          SUBSYS        2,A,...
          SUBSYS        2,B,...
          .
          .
          .
          GENRDT                    (Must be Final Macro)
          END
```

Add SUBSYS macros for Intercomm command subsystems
No SUBSYS macros for CLOSDWN3 (J), MROTPUT (Z),
PMIOUTPT (U,V,N), MRCONSS (K), ESS (E), or FEWHOI
Multiple RDTs may be defined--different MRS configurations
Each RDT--PMIRDTnn (nn must be unique)
That used depends on CPU Console WTOR reply of 'nn'
PMIRDTnn tables must be loaded to STEPLIB

DSECT: RDTSECTS

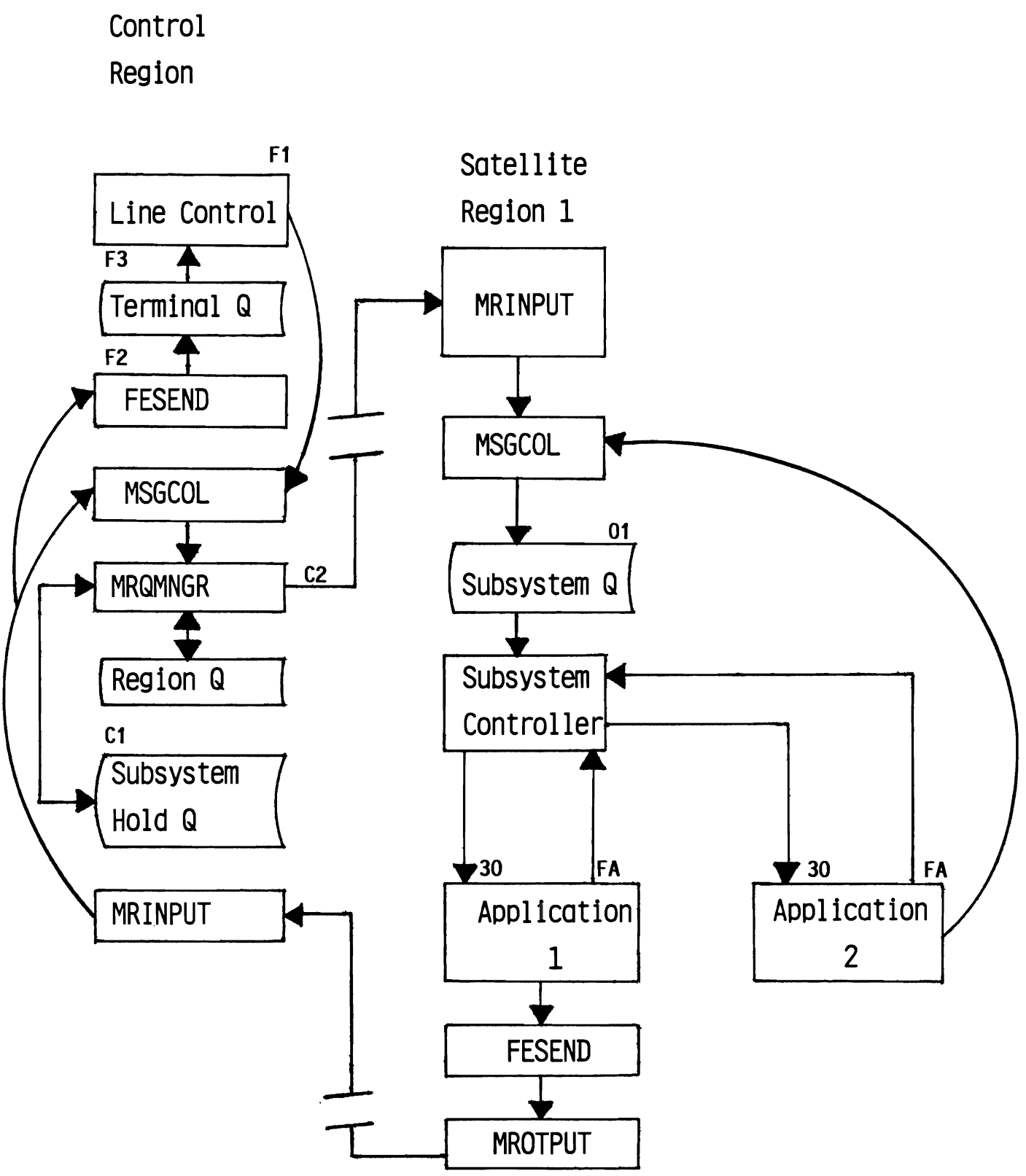
REGION ASSOCIATED PROCESSING

RDT DEFINITION

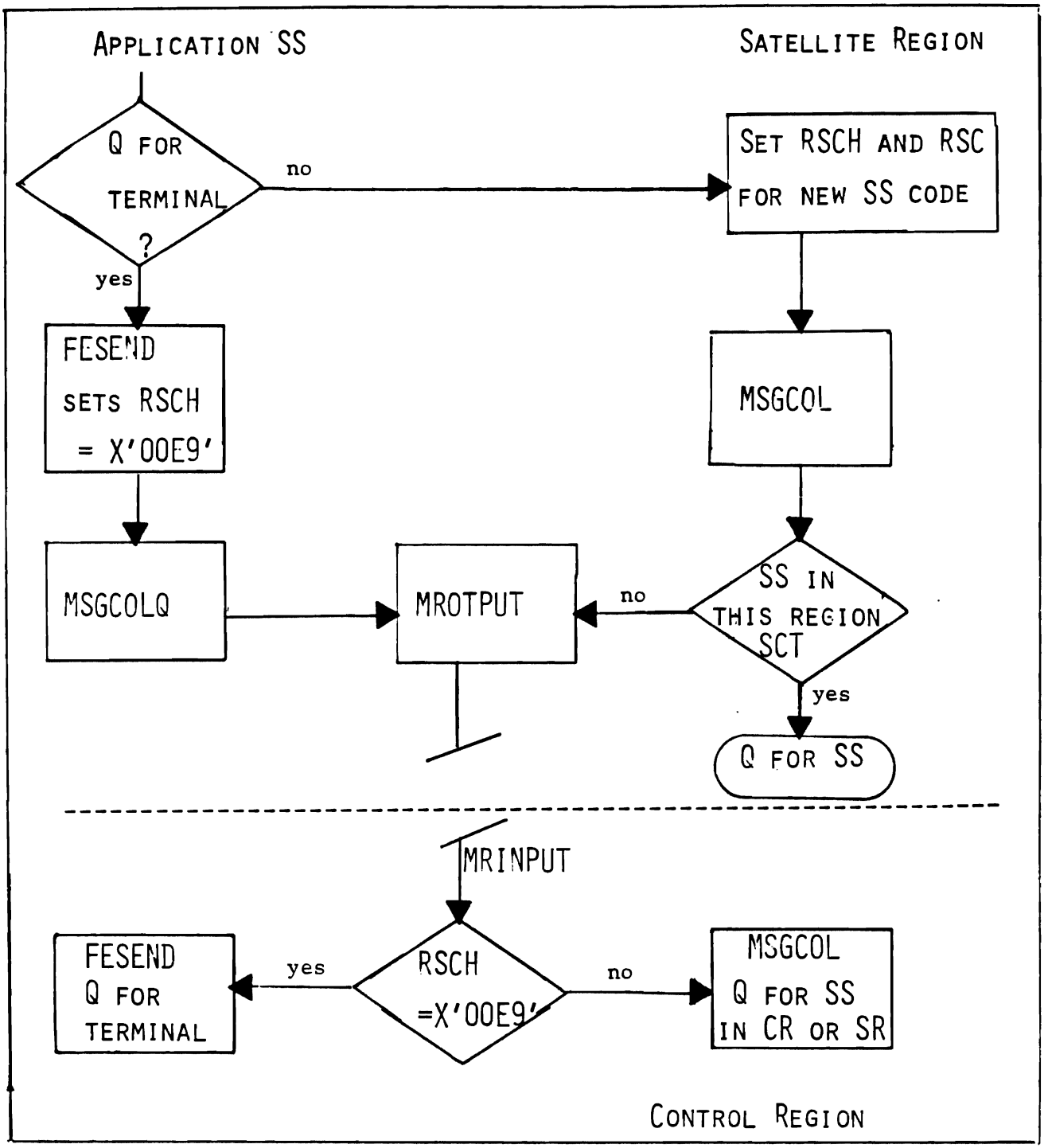
```
PMIRDTnn  CSECT
          REGION        SR1...
          SUBSYS        1,A,...
          SUBSYS        1,B,...
          .
          .
          .
          REGION        SR2...
          SUBSYS        2,A,...
          SUBSYS        2,B,...
          .
          .
          .
          MRPASWRD      P=ABCD1234,R=SR1
          MRPASWRD      P=WXYZ6789,R=SR2
          .
          .
          .
          GENRDT                    (Must be Final Macro)
          END


          BTERM/LUNIT   ...,MRPASSW=ABCD1234

          DSECT:  MPWDSECT
```

REGION INTERFACE PROCESSING

Log Codes

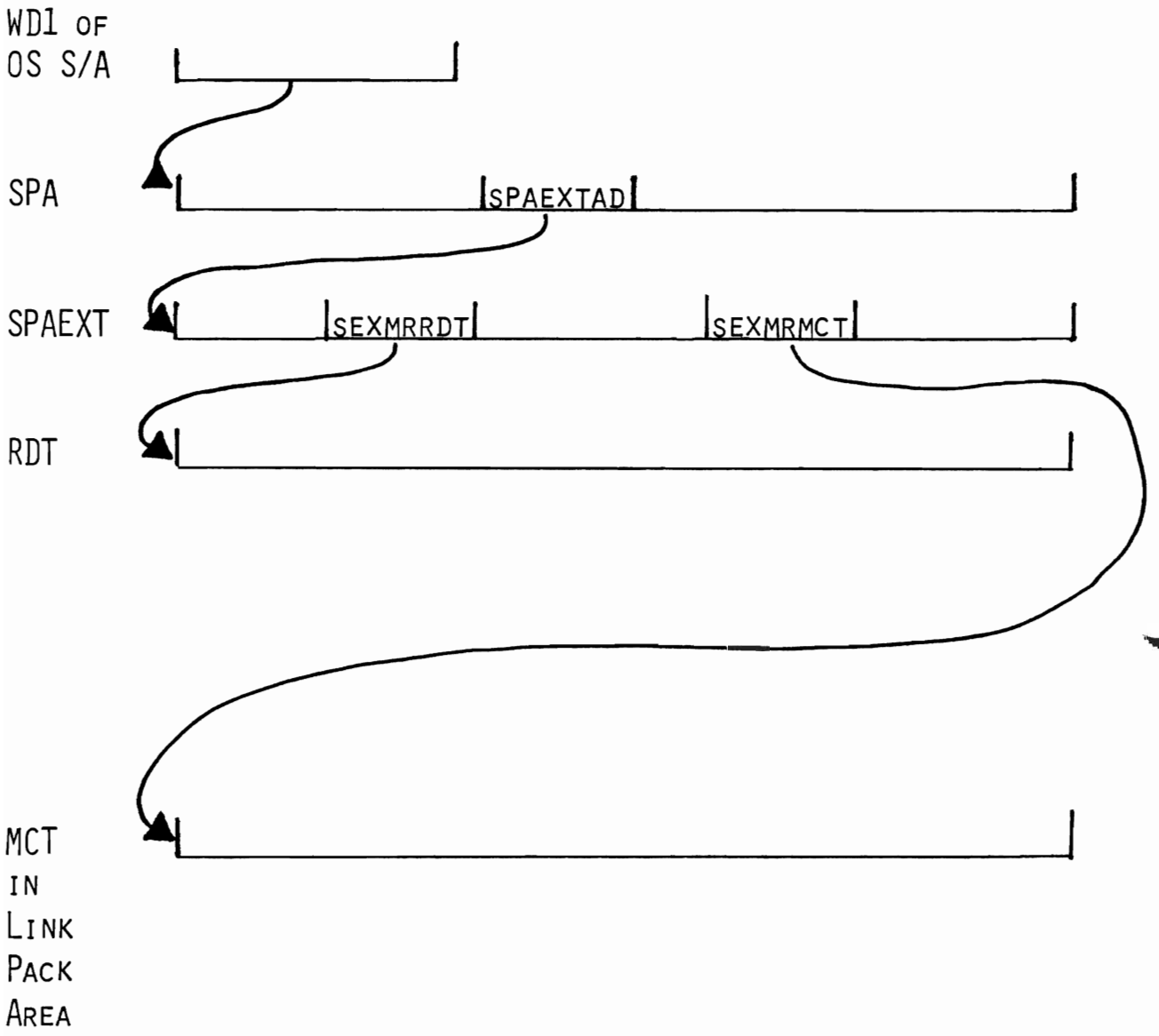


INTER-REGION MESSAGE SWITCHING



NOTE: IF TERMINAL LOCKED TO A SR, A MESSAGE CANNOT BE QUEUED FOR A SUBSYSTEM IN ANOTHER SR, IT CAN ONLY BE QUEUED FOR A CR SUBSYSTEM.

MULTIREGION CONTROL BLOCKS



- Link Pack Facility should be used
- Checkpoint file (CHEKPTFL) must be unique to each region
- Separate Logging (and LOGDISK and RESTRTLG) required if any of the following used at RESTART:
  - -- Message Restart
  - -- File Recovery
  - -- Checkpoint Restoration
- SPINOFF Snap data set (SNAPDD) must be unique
- Fast Snap Facility data set (FASTSNAP) must be unique
- Back-out-on-the-Fly THREDLOG DDQ should be unique
- DYNLLIB and DYNLWORK--unique if dynamic linkedit used
- DDQs for Multiregion queues in CR should not be shared
- Intercomm System commands requiring subsystem processing--Control Region Only--unless RAP used, or verb-replacement router subsystem coded for Satellite Region:
  - -- STRT/STOP
  - -- TALY (TALY$FE cannot be used in a SR)
  - -- FILE, FHST (STATFILE must be unique)
  - -- LOAD, SCTL
  - -- LMAP/MMUC (INTSTORn for maps should be unique)
  - -- FTUN/SSUP (requires MMU)
  - -- MNCL/BEGN/DELY/SPAC/PRTY/TCTV/SSFL
  - -- PAGE/SAVE (data sets must be unique)
- VRB000 and RCT000 files may be shared or unique
- Subsystem Disk Q data sets must be unique

Application Programs run unmodified.

Without RAP: the following must be unique across all Regions: --VERBS (transaction codes)
--Subsystem Codes

With RAP:
-- the following must be unique within a region only: Subsystem Codes
-- Each verb only one entry in BTVRBTB--processed in region to which terminal locked if SS code defined for that region, else in Control Region
-- Unlocked terminal--Control Region only

Recommendations:
Output Utility processing should be in CR only--reduces contention for RCT000 file, and increases response time.

If EDIT=BQ, editing done in CR (add macros to CR PMIVERBS). If EDIT=YES, editing in processing region--specify in local PMIVERBS.

NRCD/IMCD subsystem defined in CR and each SR SCT (Code=J), but not in RDT.

MROTPUT subsystem defined in each Satellite Region SCT only (Code=Z), not in RDT. (No associated verb)

DDQs may be used across Regions as long as Keys are unique.

Store/Fetch files must be unique to each region. Also MMU maps file if LMAP used.

COMMAND OPTION	FUNCTION
DOWN	NRCD all or selected Regions.
QDOWN	IMCD all or selected Regions.
FLUSH	Flush Subsystem Hold and Region Queues for all or selected Regions or subsystems.
STOP	Stop input to all or selected Regions or subsystems.
START	Allow input to all or selected Regions or subsystems.
STATUS$ALL	Display processing status of all regions.
STATUS$SS	Display specified subsystem status.
STATUS$RS	Display SS status within Region.
STATUS$FE	Display status of terminals locked to all or selected Regions.
SEND	Broadcast message to all terminals locked to specified region.

MULTIREGION CONTROL COMMANDS (continued)

```
symbol    SYCTTBL SUBC=K,SBSP=MRCONSS,LANG=NBAL,MNCL=1,
                  RESTART=NO, (recommended)
                  ---- OTHER PARAMETERS AS REQUIRED
                       FOR COMPLETE DEFINITION


symbol    BTVERB  VERB=COMM,SSC=K,
                  SECUR=YES       (recommended)


          INCLUDE MRCONSS
```

REGION ASSOCIATED PROCESSING (RAP)

- Provides Automatic Terminal Lock to Satellite Region (terminal may also be locked to a specific subsystem within that region via verb locking)
- Provides Region-associated Security
- Obviates unique Verb/SS/Region association
- Subsystem codes only unique within Region's SCT
- Guarantees Region-associated File/Data Base access
- Provides charge back accounting within subsystem
- Allows Test Region for Production Subsystem enhancements
- Allows Test Region for Replacement Subsystems (e.g., converting from Edit/Output to MMU)
- Allow Intercomm Command Subsystem processing duplication (e.g., LOAD, FHST, GPSS, Fine Tuner)

Note: Message Switching to a Subsystem in another Satellite Region not allowed.

LOKR$password[$(tid,tid,...)]
ULKR$password[$(tid,tid,...)]

If unlocked--only access Control Region Subsystems
when MRPASSW defined for terminal

Refer also: Message Collection

Implementation: BTVERB VERB=LOKR[,SECUR=YES]
BTVERB VERB=ULKR[,SECUR=YES]
BTERM/LUNIT MRPASSW=region-id
INCLUDE MRMOD in Control Region only

User Exit: USRQMONX called by MRQMNGR
use to determine receiving region when
RAP not used/not in effect
(sample provided)

NOTE: Multiregion Control Commands for one or more SS codes require P=password specification as second parameter.

10 LINK PACK FACILITY

10.1 Introduction

10.2 Installation

10.3 Interface: Structure and Processing

10.4 Features

LINK PACK FACILITY

- SHARE COMMON INTERCOMM ROUTINES

- SHARE COMMON USER ROUTINES

  -- By Production/Test/Batch Regions
     (Single Region Intercomm)
  -- By Control/Satellite/Batch Regions
     (Multiregion Intercomm)

- Reduces Page Faults under MVS

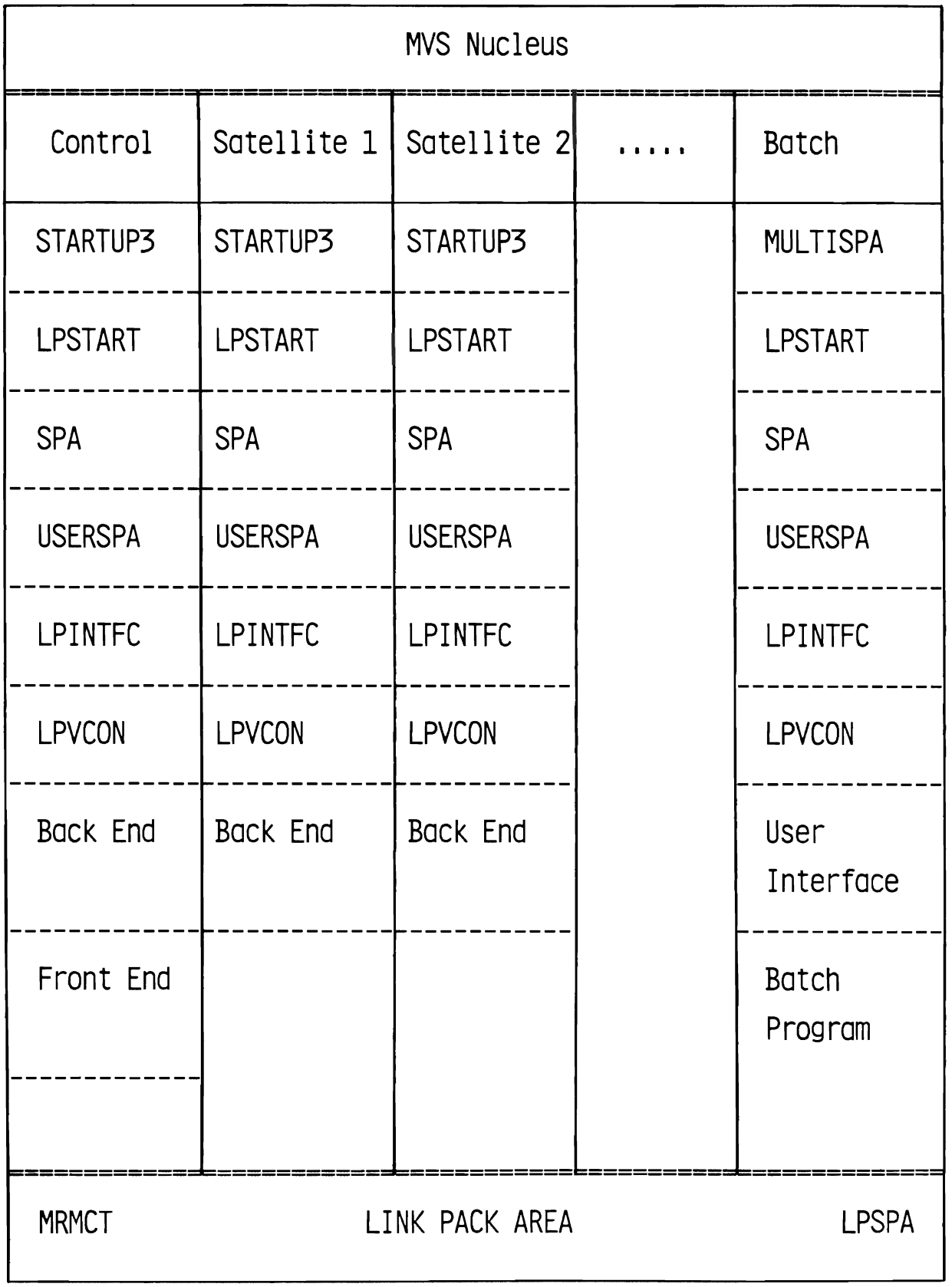
- Reduces Ordering under MVS

Advantages: reduce core required by region.
reduce number of linkedits after applying SMs.
Experimental SMs for Link Pack modules--only one link.

Disadvantages: All regions executing Intercomm modules should be at same SM level and use same features (Global Settings).
User Routines must be reentrant.

Further Reference: Operating Reference Manual

10.1 Introduction


MVS Nucleus
Control
Satellite 1
Satellite 2
.....
Batch
STARTUP3
STARTUP3
STARTUP3
MULTISPA
LPSTART
LPSTART
LPSTART
LPSTART
SPA
SPA
SPA
SPA
USERSPA
USERSPA
USERSPA
USERSPA
LPINTFC
LPINTFC
LPINTFC
LPINTFC
LPVCON
LPVCON
LPVCON
LPVCON
Back End
Back End
Back End
User Interface
Front End
Batch Program
MRMCT
LINK PACK AREA
LPSPA

1. Prepare the Operating System

2. Prepare the Link Pack Area (LPM),
   Create and Link the Intercomm Link Pack Module (LPSPA).

```
LPENTRY
   .            User Routines
LPENTRY
LPSPA           Intercomm Routines
END
```

   Link resultant module with Intercomm/User LP modules.
   All modules must be pre-linked as RENT.

3. Prepare the Intercomm Region (IR),
   Create and Link the Link Pack Interface Module (LPINTFC).

```
LPINTFC          Intercomm Routines
LPVCON
   .            User Routines (same order as LPENTRYs)
LPVCON
END
```

4. Re-link Intercomm (CONTROL/SATELLITE/BATCH/TEST)

   INCLUDE LPSTART,LPINTFC   All Regions

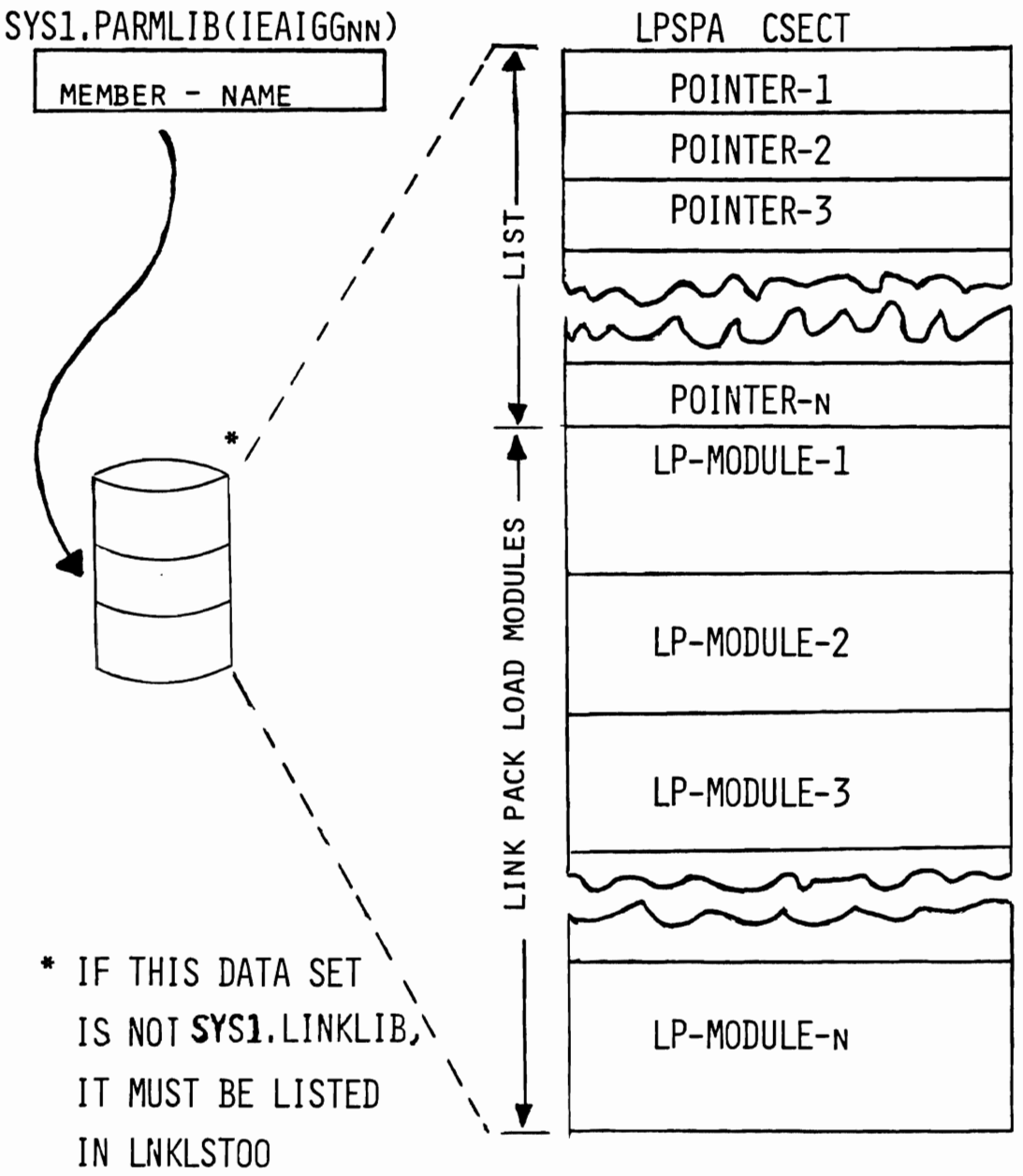
LINK PACK FACILITY COMPONENTS AND PROCESSING

		Residency
LPSTART	At startup, initializes SPALIST VCONS with real (in LINK PACK) addresses.	IRs
LPINTFC	There is a pseudo entry point for each link pack-eligible module in LPINTFC. At execution time, LPINTFC resolves the reference to the pseudo entry point into the real location in the link pack. The LPINTFC macro generates pseudo entry points for Intercomm link pack modules; the LPVCON macro generates pseudo entry points for user link pack modules.	IRs
LPSPA	Contains Intercomm and user Link Pack routines. The LPSPA macro is for Intercomm routines, the LPENTRY macro is for user routines.	Link Pack

LINK PACK FACILITY COMPONENTS AND PROCESSING (CONTINUED)

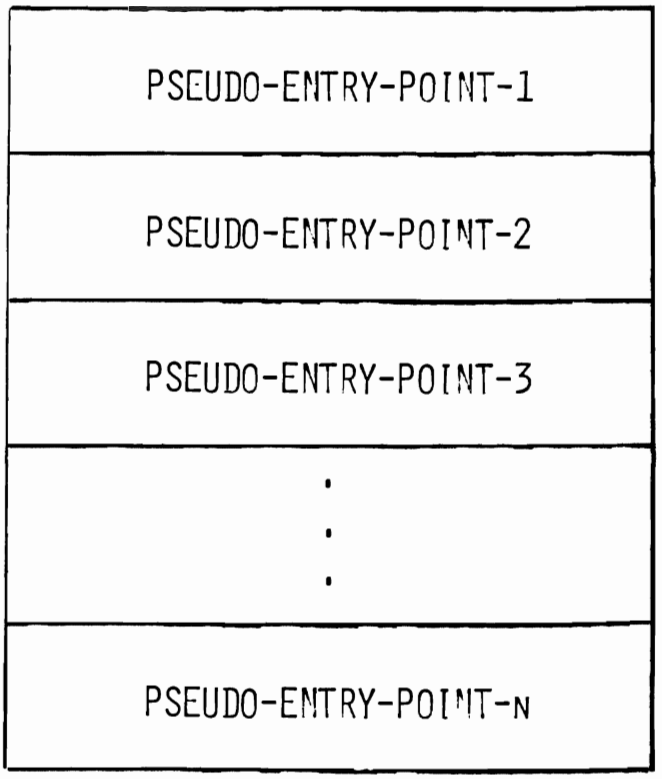
		RESIDENCY
MULTISPA	AT STARTUP, PLACES A(SPA) IN FIRST WORD OF OS SAVE AREA (DONE BY STARTUP3 IN IR)	BR ONLY

LINK PACK LOAD MODULE



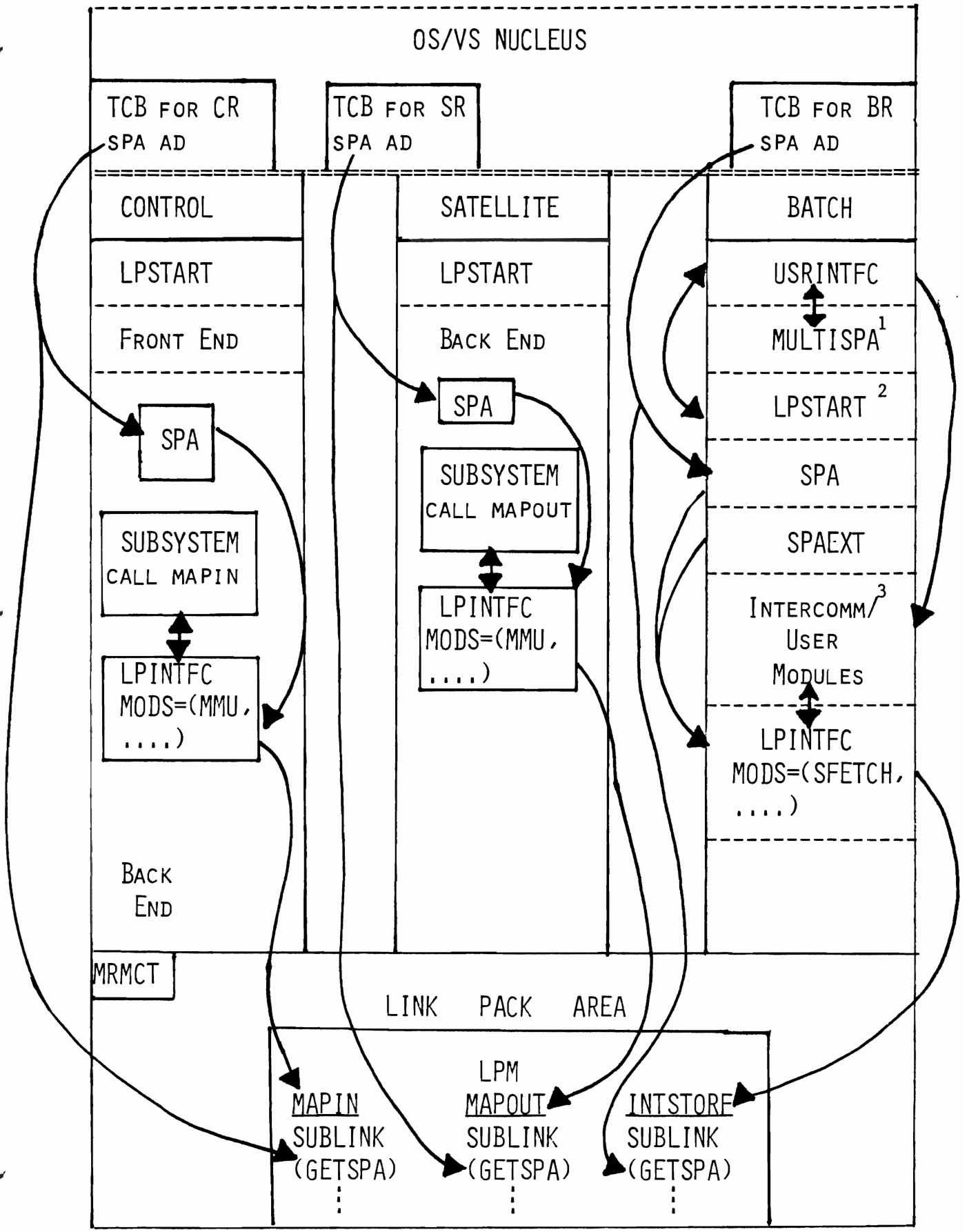
UNDER MVS: LINK LPSPA TO SYS1.LPALIB
IPL WITH CLPA OPTION

LINK PACK INTERFACE MODULE (IR)




```
MSGCOL   EQU   *,              PSEUDO ENTRY POINT
         ENTRY MSGCOL
         USING MSGCOL,15       POINT TO PSEUDO ENTRY POINT
         L     15,=V(SPA)      VCON OF SPA OR SPA EXTENSION
         USING SPALIST,15      15 POINTS TO THAT NOW.
         L     15,SPAPMCR      GET ACTUAL ENTRY POINT.
         BR    15              BRANCH TO IT.
```

IR/LPM INTERFACE OVERVIEW



INTERCOMM REGION MODULES:

- COBOL, PL/1 SUBSYSTEMS:
  -- Standard Processing
     (link pack interface is transparent)

- BAL SUBSYSTEM/SUBROUTINE
  -- Called LPM routines (system and user-coded) are accessed using standard form:
     CALL MAPIN,(.....),VL,MF=(E,listaddr)
     (LPINTFC will resolve LPM address and transfer CALL to LPM routine)
  -- Macro-requested routine (in LPM) --
     address may be preloaded from:
     SPA SPAEXT USERSPA
  -- Called user-coded subroutines in LPM--
     must be defined in LPINTFC via LPVCON

Further Reference: Operating Reference Manual

LINK PACK MODULES:

- REENTRANT BAL SUBSYSTEM or SUBROUTINE:
  - -- Subsystem: Use LINKAGE macro -- TEST=NO,SPA=(r)
    do not code DSECT=PRM
  - -- Subroutines: Use SUBLINK macro -- SPA=(r)
  - -- Use RTNLINK macro -- SPA address acquired via GETSPA macro
  - -- Save SPA address in dynamic working storage or use GETSPA macro to reacquire SPA address
  - -- Use SPA=(r) when appropriate on Intercomm macros
  - -- Use LINK=(r) when appropriate on Intercomm macros
  - -- Load addresses in R15 of all Intercomm routines from SPA or SPAEXT, use CALL (15),parameters
  - -- Do not CALL any (sub)routines not addressable via SPA, SPAEXT, USERSPA or local linkedit (LPM)
  - -- Dynamically loaded subroutines may not be used.

BATCH PROCESSING:

- Link with MULTISPA, LPSTART, LPINTFC
- Needs user-interface program to call MULTISPA, LPSTART, batch program

Further Reference: Operating Reference Manual
Basic System Macros

11 SECURITY/PRIVACY

11.1 Introduction

11.2 Basic Security

11.3 Extended Security System (ESS)

SECURITY/PRIVACY

- COMMON SENSE PROCEDURES
- PHYSICAL SECURITY
- SOFTWARE SECURITY
  - LIMITING ACCESS TO SYSTEM RESOURCES
  - AUDITING USE OF SYSTEM RESOURCES

LIMITING ACCESS TO SYSTEM RESOURCES

- CONTROL TERMINAL
- MULTIREGION--GENERAL
- MULTIREGION-RAP
- FARS
- BASIC SECURITY (STATIC)
  - OPERATOR
  - TERMINAL (STATION)
  - VERB
  - SUBSYSTEM
  - USER EXITS (SIGN-ON, SIGN-OFF, SUBSYSTEM)
- EXTENDED SECURITY SYSTEM (DYNAMIC)
  - OPERATOR
  - TERMINAL
  - VERB
  - REGION
  - SUBSYSTEM
  - FILES
  - USER FUNCTIONS
  - TIME
  - NUMBER OF SIGNONS
  - PASSWORD
  - USER EXITS/FACILITIES

11.1 INTRODUCTION

BASIC SECURITY
Installation Checklist

Globals	None		
SPALIST	SGNTIME	TRANSEC	
	SONOFF	USERSEC	
Definition Macro:	SYCTTBL	SECU	TISE
		SOSO	
Generation Macros:	STATION	UNIVER	AUTOFF
		VERBS	MAXSIGN
		CONTIN	OPER
	GENSEC		RBN
	SECVERBS		TIME
Linkedit	ICOMLINK	SECUR=YES	
	Modules	PMIAUTOF	SECURE00
		PMIHEADR	SECURE01
		PMISIGN	SECURE02
	Tables	PMISTATB	SECURITY
Data Set:	SEC000	Disk	
User Exits:	USRSGNON	USRSGNOF	

SIGN-ON/SIGN-OFF

- Optional from terminal to terminal
- Specify via list of Operator-ids
  (MAX=50 per terminal)
- Operator must sign-on to terminal if list defined
- Operator only sign on to one terminal at a time
- Only one operator may be signed on at a terminal
- Automatic sign-off may be specified from terminal to terminal--time-limit (in minutes):
  --global--via SPALIST--SGNTIME
  --local--via STATION--TIME
- Maximum number of sign-on attempts
- Operator-id lists may be:
  --core-resident (GENSEC OPER=CORE)
  --disk-resident on SECOOO (OPER=DISK)
- Global control at start-up--SPALIST SONOFF parameter

Operator Commands: SIGNONoperator-id
SIGN$OFF

System Control Commands: ASGN/DSGN (global control)

Code: BTVERBs for ASGN/DSGN
SYCTTBL for PMISIGN

Table: PMISTATB Dsect: STALIST

TRANSACTION

- Optional from terminal to terminal
- Specify via list of transation codes (VERBS=)
- Independent of sign-on/sign-off
- Limits verbs that may be entered at terminal
  (MAX=51 per terminal)
- All possible verbs for all possible terminals must be specified via SECVERBS
  (those not specified available to all)
- Global control at start-up--SPALIST TRANSEC

System Control Commands: AVRB/DVRB (global control)
SWOF/SWON (specific control)

Code: BTVERBs for AVRB/DVRB, SWOF/SWON
SYCTTBL for PMISIGN or at least one SYCTTBL in the region must have TISE=YES

Tables generated internally:

PMISECTB Dsect: SECTB
SECURVRB (list of secured verbs)

USER EXIT CONTROL

- Global for Sign-on/Sign-off via USRSGNON, USRSGNOF
  -- use for statistics gathering (ON/OFF)
  -- use for additional checks (ON)

- Specific for Transaction via SYCTTBL SECU=n
  -- use in-addition-to/instead-of Intercomm sign-on and/or transaction security
  -- SECU provides index to SECURITY table list of user routine VCONs
  -- called by SS Controller before message passed to subsystem
  -- return code indicates message processing or cancellation
  -- Global Control via SPALIST USERSEC parameter
  -- SECURITY table must be coded
  -- may be coded for Control and/or Satellite Region Subsystems

Table: SECURITY

Further Reference: Operating Reference Manual
Basic System Macros

GENERATE THE STATION/SECURITY TABLES

PMISTATB

```
GENSEC                                  (required)
SECVERBS        VERBS=                  (optional)
   .
SECVERBS        VERBS=
STATION         TERM=aaann,             OPER=
                                        VERBS=
                                        CONTIN=
STATION         TERM=
   .
   .
STATION         TERM=
PMISTOP
DVMODIFY                                (if needed)
   .
DVMODIFY
END
```

Note: VERBS (SECVERBS) should be coded in multiples of eight. Round out with dummy verbs.

2 CSECTS generated via STATION: PMISECTB, PMISTATB

1 CSECT generated via SECVERBS: SECURVRB

EXTENDED SECURITY SYSTEM

- Dynamically created
- Dynamically maintainable
- Comprehensive access control
- Highly secure itself
- Compatible with MRS philosophy

ESS TERMINOLOGY

- Security Tree
  - -- Global Managers
  - -- Group Managers
  - -- End Users
- Security Resources
  - -- Operator IDs (passwords)
  - -- Regions
  - -- Verbs
  - -- Subsystems
  - -- Files
  - -- Terminals
  - -- User Functions
- Security Attributes
  - -- Commands Allowed
  - -- Time: Time of Day
    Expiration Date
    Idle Timeout Interval
- Default Attribute List
- Command Language
- User Exits: Statistics
  Additional Validation/Cleanup
  Interface to RACF, ACF/2, etc.
- Audit Trail
- Exempt Terminal List (printers, control terminal)

ESS COMMAND OPTIONS

Base Command-SECU:

- ADD/DELETE
- ATTACH/DETACH*
- DISPLAY*
- EDITNEWS
- EXCLUDE/INCLUDE
- FORCE*
- MODIFY*
- SEND
- SIGNON/SIGNOFF

* Group-name or generic-user-id may be used for global processing/display of multiple accounts

ESS ATTRIBUTES

- ACCOUNT
- ADD
- AID(nnn)
- ATTACH
- CONTROL
- DELETE
- DETACH
- DISPLAY
- EDITNEWS
- EXEMPT
- EXPDT(yyddd)
- FILES
- FORCE
- FUNC-INV
- FUNCTION
- GLOBAL
- GROUP(group-name)
- INHIBMSG
- INTVL(hhmm)
- LOCK(verb)
- MANAGER
- MAXUSERS
- MODIFY
- NOPSWD
- PASSWORD
- PSWDEXP(nnn)
- QUETO(hhcc)
- REGIONS
- REGN-INV
- SEENEWS
- SEND
- SIGNON
- START(hhmm)
- STOP(hhmm)
- SUBSYS
- S/S-INV
- TERM-INV
- TERMS
- USERS
- VERB-INV
- VERBS

- User Exit--USRSEC00
  - -- Receives control whenever any ESS log record is created (audit trail)

- User Exit--USRPRMPT
  - -- Suppress sign-on message at startup

- User Exit--SECUEXIT (sample provided)
  - -- Receives control when a user account is added or deleted, at sign-on and sign-off, and when an ESS session times out
  - -- Could be used to enforce standardized user-ids, prevent unauthorized deletion
  - -- Cleanup processing at sign-off, time-out
  - -- Generate internal SPLU if sign-on id=LOGOFF

- Subroutine--SECUSER (code supplied)
  - -- Invoked by subsystems
  - -- Returns active user-id

- SECTEST Macro
  - -- Tests authority of current user to use a logical user function

- VTAM HALT Exit--LUCUR (sample provided)
  - -- Sign off user when LU session disconnected

ESS INSTALLATION PROCEDURE

1. Install Intercomm Multiregion SVC (MRSVC) or
   Integrity SVC (IISVC)

2. Establish SECURITY Data Set (SECFILE Utility)

3. Prepare Link Pack (SECVECT generated by SVECT macro)

4. Define BTVERB for SECU, SYCTTBL for $$$$SECU

5. Intercomm Assemblies, Linkedit

6. Use Command Language to Establish and Maintain the
   Security Environemnt

Modules: INTSEC00 (CR and all SRs)
INTVRB00 (CR only)
INTSEC02 (CR only - loaded at ESS startup)
RPT00049 (CR only)
$$$$SECU (CR only - dummy ESS subsystem)
SECFILE (utility-init/expand SECURITY data set)
SECUPRNT (Batch SECURITY file print program)

Further Reference: Extended Security System

12 DATABASE INTERFACES

12.1 Introduction

12.2 DBMS Support-- General Requirements

12.3 Installation

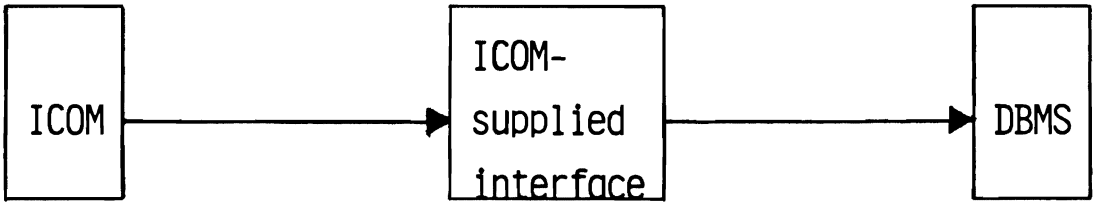
12.4 Interface Routines

INTERCOMM SUPPORTED DATABASE MANAGEMENT SYSTEMS

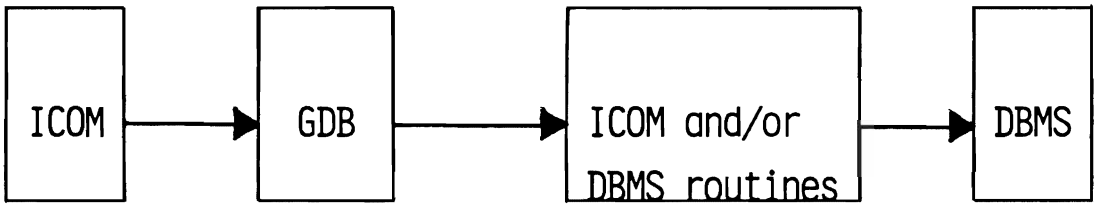
PRODUCT	VENDOR
Adabas	Software AG of North America, Inc
IDMS	Computer Associates
DL/I (IMS DB)	IBM Corporation
Model 204	Computer Corporation of America
System 2000	MRI Systems Corporation
TOTAL	Cincom Systems, Inc.

Others through Generalized Database Interface (GDB)

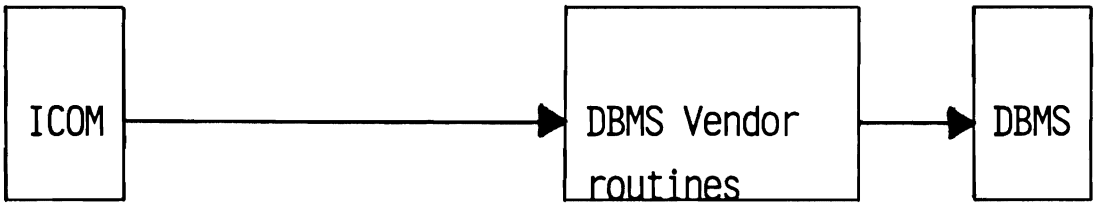
- Customized DBMS Interface (DL/I, TOTAL)



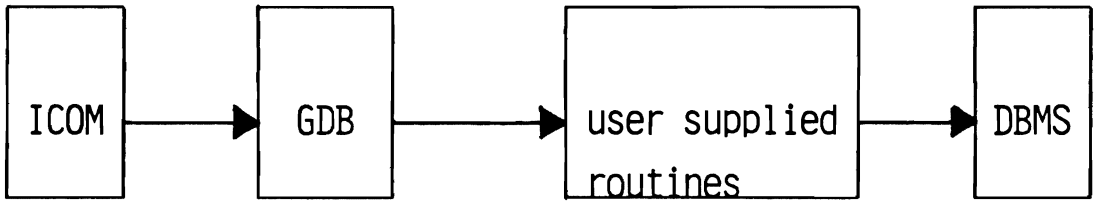
- DBMS Interface using GDB (MODEL 204)



- DBMS Interface from Vendor (IDMS, ADABAS, S2K)



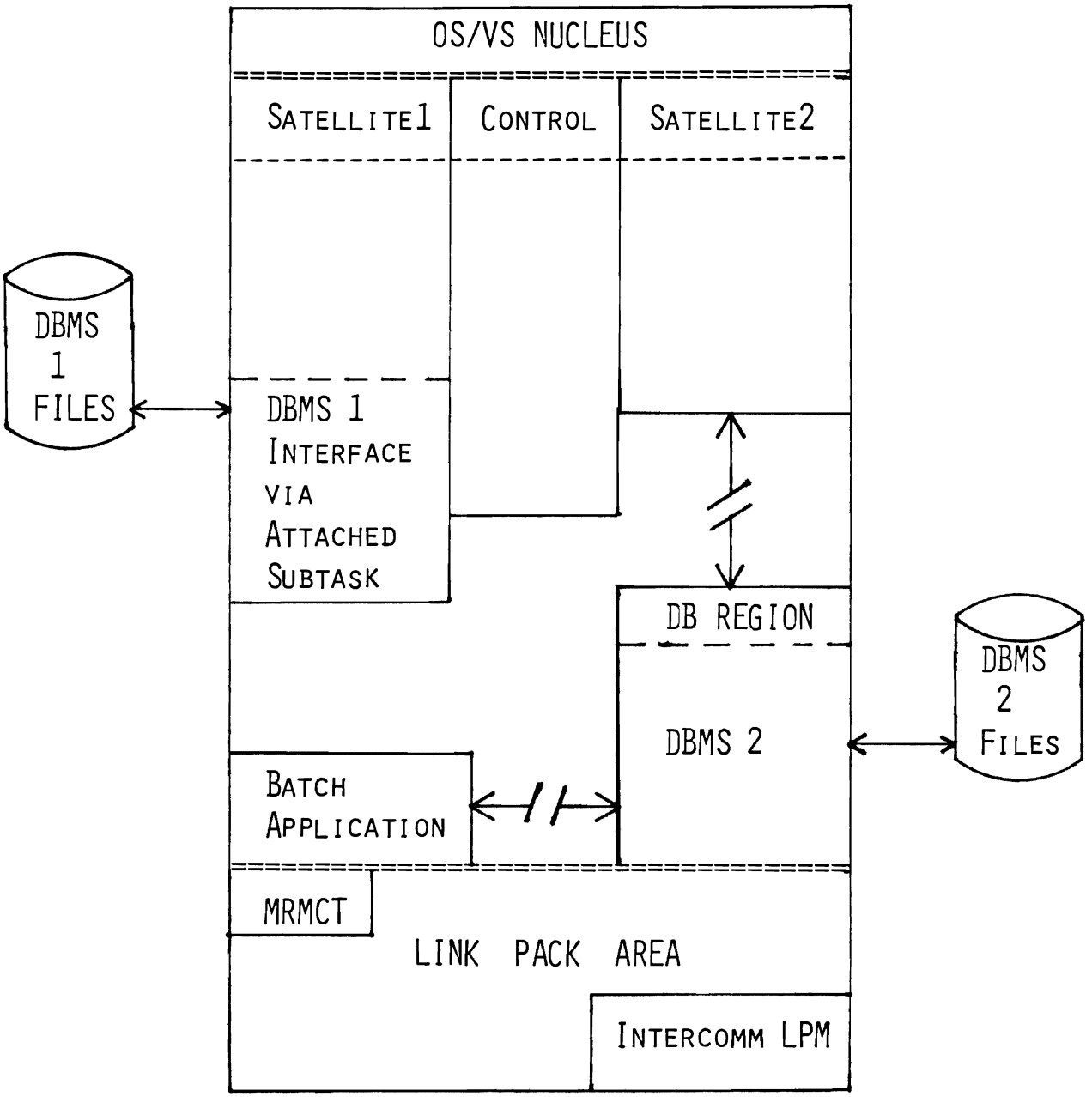
- User-supplied support for "foreign" DBMS, (i.e, user-coded exits in GDB).



Further Reference: Data Base Management System Users Guide

12.1 Introduction

INTERCOMM/DBMS MULTIREGION ENVIRONMENT



EXECUTION PROCEDURES

INTERCOMM COLD START --

DBMS ACTIVE -- NORMAL INITIALIZATION

DBMS INACTIVE -- QUIESCE DBMS SUBSYSTEM AND ALLOW OTHER SUBSYSTEMS TO EXECUTE, OR
ABEND INTERCOMM, OR
RETRY DBMS STARTUP

INTERCOMM WARM START -- AS ABOVE

COORDINATED RESTART --

INTERCOMM ABENDED -- TERMINATE ACTIVE DBMS BATCH JOBS
EXECUTE DBMS BACKOUT PROCEDURES
RESTART INTERCOMM
RESTART BATCH JOBS

DATABASE ABENDED -- TERMINATE INTERCOMM
TERMINATE DBMS BATCH JOBS
EXECUTE DBMS BACKOUT PROCEDURES
RESTART DBMS
RESTART INTERCOMM
RESTART BATCH JOBS

- DBMS I/O
  Usually takes longer than standard OS/VS I/O.

- Coordinated Checkpointing (optional)
  No one program should do excessive I/O--it will delay checkpointing.

- Minimizing DB contention
  Use RESOURCE macro, OVERLAY or EXECUTION Groups.

Some recommended techniques--

- Perform updates last
  Speeds checkpointing
  Speeds Restart/Recovery

- Set Subsystem Controller return code to indicate R/R requirements (optional)
  -- 64 (X'40')--Never Restart Message
  -- 68 (X'44')--Restart Message if processed since last checkpoint

DBMS Support--General Requirements

Globals	&TOTDESC, etc.	TOTAL
SPALIST	CHKPTLIM	
	TCHP	
	GENSW	
SYCTTBL	DBASE={DB }	
	{UDB}	
Assemblies	INTSPA	INTSCT
ICOMLINK	DBLIBR=	CHKRES=
	DBASE=	
Linkedit	DBCHKDSP	LOGPROC
	GDBSTUP	CHECKPT3
	DBRSTRT	CHCKPTSS
	AUTORCVR	RESTORE3
	User/Vendor modules	
Datasets	CHEKPTFL	
	(GDBWKFL)	
SYS1.SVCLIB	Interface SVC	

INTERCOMM ROUTINES		
	GDBSTUP	Initialization and Continuation of
	DBCHKDSP	Interregion Checkpoint
	CHECKPT3	Checkpoint Processing
	RESTORE3	Checkpoint Restart
	CHCKPTSS	Quiesce of Subsystem Database Activity
	DBRSTRT	Message Restart Processing
	LOGPROC	
	AUTORCVR	
DB EXITS		
	DBSTART	Database Initialization at Startup
	DBCLOSE	Database Termination at Closedown
	DBINT	Database Request Processing
	DBRELEX	Subsystem DBMS Resource Purging (SYCT400)
	DBPURGE	(RMPURGE)
	DBSTAE	ABEND Processing
	DBCKPREP	Database Checkpoint Processing
	DBCHKCOM	

13 ERROR SITUATIONS: Logging, Checkpointing and Restart/Recovery

ERROR SITUATIONS

Hardware:

- Central Processor
- Main Storage
- Communications Network
- Peripheral Devices

Software:

- Operating System
- Access Methods
- Data Base Software
- Intercomm Nucleus
- Intercomm/User Subsystems

Error Situation	Detection	Recovery
Network Failures	Error Retry	Put down LU, terminal/line
Device Failures (Access Methods)	Error Retry	Error return codes
DBMS Failure	Notify DB Region & Control Operator	Quiesce online subsystems
Intercomm nucleus	ESTAE Exit	SNAP 122
Program ISK	ESPIE/SPIE Exit	SNAP 126
Subsystems		
Program check	ESPIE/SPIE Exit	SNAP 126
Program loop	IJKTLOOP	SNAP 121
Core clobber	RMINTEG/TRAP	ABEND 1114/1369
	DWSCHK (ISK)	SNAP 126
Failure to release resources	RM Audit & Purge	Thread Dump WQE Trace
Time out-TCTV	SYCT400	SNAP 118
-Enqueue	PMINQDEQ	SNAP 114

13.1 Introduction

DESIGNING FOR RESTART/RECOVERY

What is important?

- Continuous performance
  - Subsystem control/quiesce
- Prevention of long periods of down time
  - Checkpoint restarting
- Database integrity
  - Database backout/restoration
- OS/VS File Integrity
  - On-line record recovery
  - File record restoration at restart
  - Batch recovery/update from backup file
- Recovering messages in progress
  - Message restart
- Prevention of terminal operator idle time
  - Network control/quiesce

Note: All restart/recovery options incur overhead, but are tuneable.

13.1 Introduction

INTERCOMM RESTART/RECOVERY PROVISIONS

INTERCOMM LOG

MESSAGE RESTART

CHECKPOINT RESTART

FILE RECOVERY

DATA BASE RECOVERY

CONTROL COMMANDS

Further Reference: Operating Reference Manual
File Recovery Users Guide
System Control Commands
Data Base Management System Users Guide

13.1 Introduction

MODES OF SYSTEM INITIALIZATION

- Cold Start - no message/checkpoint restart
  no file/Data Base recovery
  --Parm=STARTUP

- Warm Start - restart/recovery optional
  --Parm=RESTART
  --Parm=RESTRNL

RESTRNL - Restart without previous log:

--allows preserving semi-permanent DDQs
--allows preserving semi-permanent S/F strings
--no message/checkpoint restart
--no file recovery

RESTART - If previous log available, and Restart modules included:

--allows full message restart
--allows checkpoint restart
--allows file recovery
--allows Data Base recovery

LOGGING OVERVIEW

Purpose--

- Restart/Recovery
- Performance Statistics
- Charge-back Accounting
- Debugging

Log Residency--

- Tape
- Disk

Writing log records--

- Synchronous
- Asynchronous

Further Reference: Operating Reference Manual

LOGGING OVERVIEW -- LOG ENTRIES

Message Processing Entries-

- F1: Message received (optional)
- C1: Message Qd for SR
- C2: Message passed to SR
- C3: Message for SR lost or flushed
- 01: Message Qd on SS Q
- 30: Message passed to SS
- FA: Message completed by SS
- FB-FE: Cancelled SS message
- F2: Message Qd on TQ
- F3: Message transmitted
- F5-F8: VTAM DDQ output message status

File Recovery Entries- 80-8E: Before Images
90-9E: After Images

User Entries- 41-6F: User-specified Text

Checkpoint/Restart Entries-

- 8F: File Recovery checkpoint record
- 00: Checkpoint record
- FF: Message Accounting record

ESS Entry- C9: Signon/off processing (audit trail)

MRS Entry- C0: Satellite Region started

LOGGING OPTIONS WITH MRS

- Single Log
- Separate Log per Region

LOGGING OPTIONS WITHIN A REGION

- Front End - by Terminal
- Back End - by Subsystem
- Within Subsystem - by User log codes
- File - for restart/recovery
- Checkpointing (checkpoint time)

LOG UTILITIES

- LOGPRINT
- LOGANAL
- LOGMERGE

FAR options	B37	WRITEOVER
SPALIST	GPSSEC	LGBLK
	MR1LOG	LGNUM
Definition Macros	BTERM/LUNIT	LOG=
		LSYNCH=
	SYCTTBL	LOG=
		LSYNCH=
	REGION	LOG=
	SUBSYS	LOG=
		LSYNCH=
		IFDOWN=
		STOP=
Assemblies	INTSPA	INTSCT
	PMIRDTOO	Network Table
Linkedit	LOGPUT	IXFB37
Automatic	MSGAC	IXFFAR
Data Set	INTERLOG	Tape
	(RECFM=VB)	Disk
Dsect: MSGHDRC		
User Exits:	USERLOGE	USERB37E

LOGGING BUFFERS CALCULATIONS

Number (LGNUM) and Average Size (LGBLK) depend on:

- Log Writing Type
  - --Synchronous
  - --Asynchronous
- Average Output Message Size
- If File Recovery Log Entries created
  - --at least half the size of maximum record plus message header
  - --depends on frequency and total volume

If mostly Synchronous:

--Use average message size for buffer size

--Or use average record size if also file recovery entries created (whichever is larger)

--Use more buffers

If mostly Asynchronous:

--Use larger buffer size to accomodate several average size messages or larger file recovery records

--Use fewer buffers

See also System Tuning Statistics Printout:

Logging and Buffer-wait Statistics

Note: SPALIST SEXLGBUF is address of log buffers

INTERLOG DCB=LRECL=maximum-log-buffer-size-required

NCP=same as LGNUM

LOG ENTRY SEQUENCE

BMN	MMN	RSC	SSC	LOGCODE	H/T

USING OUTPUT UTILITY

100	101	AB		01	HT
100	101	AB		30	H
100	102	U	AB	01	HT
100	101	AB		FA	H
100	102	U	AB	30	H
100	103		U	F2	HT
100	102	U	AB	FA	H
100	103		U	F3	H

USING MESSAGE MAPPING UTILITY

200	201	AB		01	HT
200	201	AB		30	H
200	202		AB	F2	HT
200	201	AB		FA	H
200	202		AB	F3	H

Name	Log Code	Description
SPAMSNM	01,F2,C1	B.E. seq. no. (MMN)
SPANMIP	01	queued for Subsystems (total)
SPANMOW	01	queued for Overlay Subsystems
SPANMOP	30	passed to Overlay A Subsystems
SPATNMP	FA	total processed
SPACANC	--	total cancelled
SPACIOE	FD	cancelled--I/O error, Timeout, Program Check
SPACISC	FB	cancelled--invalid SS code
SPACNQS	FC	cancelled--no queue space
SPAINVMG	--	rejected by restart
SEXLGRSB	02,03	total restarted messages - B.E.
SEXLGMMN	--	starting MMN after Restart
SEXLGRSF	F2	total restarted messages - F.E.
SEXLOMMN	--	MSGAC completed count
SEXBMN#	--	highest BMN received by SR
SEXMRMSI	--	total received via MRINPUT
SEXMRMSO	--	total transferred via MROTPUT
SEX#SATM	C1	queued for SRs by CR
SEX#BUFW	--	count of Buffer Waits by LOGPUT
BTAMSEQ	01	F.E. seq. no. (BMN) in BTSPA
SEX#FMSG	F2	total queued for F.E.

Statistics: SAM, STS

LOGGED MESSAGES ONLY (LOG=YES)

IF REQUESTED BY:

- TERMINAL
  --Output Transmission requeued - F2

- SUBSYSTEM (after file/checkpoint recovery)
  --Incompleted messages reprocessed - 01/30
  --Cancelled messages restarted - FB/FC/FD
  --Completed messages checked for
    Data Base/File recovery - FA

- MULTIREGION -- as applicable
  --Region Qs recreated - C1

AUTOMATED RESTART (eliminates EXEC PARM=STARTUP/RESTART)

- STRTUPSW Data Set (BDAM file)
  --Restart needed status
  --Restart time (TOTAL DB only)

- Created/maintained by AUTORSET Utility
  --Dsect: STUSWRCD

- Updated on-line by AUTORCVR
  --Set by startup
  --Reset by closedown

MESSAGE RESTART
LOG CODES

9F -- INTERCOMM STARTED

FF -- MESSAGE ACCOUNTING RECORD

A0 -- MESSAGE RESTART BEGUN

F2 -- OUTPUT TRANSMISSION MESSAGES REQUEUED

02 -- UNCOMPLETED/CANCELLED MESSAGES RESTARTED (C'R')

03 -- COMPLETED MESSAGES RESTARTED (C'P')

A1 -- MESSAGE RESTART FINISHED

READ-BACK-POINT-IN-TIME

based on
LAST MESSAGE ACCOUNTING RECORD:
HIGHEST COMPLETED MESSAGE MMN

which is based on
LOG/RESTART OPTIONS SPECIFIED FOR
TERMINAL/SUBSYSTEM/REGION

MESSAGE ACCOUNTING RECORD

LOGPUT CALLs MSGAC
MESSAGE COMPLETED TRACKING

Type	Start	End	According To
Terminal	F2	F3	RESTART=YES
	F2	F2	RESTART=IFPOSBL
	F2	F2	RESTART=NO
Subsystem	01	FA	RESTART=YES
	01	30	RESTART=IFPOSBL
	01	01	RESTART=NO
Multiregion (CR)	C1	C2	RESTART=YES
	C1	C1	RESTART=NO

When a sequence of 255 messages (MMN) completed,
SEXLOMMN reset to new completed count
READ-BACK-POINT-IN-TIME Record Written
by MSGAC - Log Code = X'FF'
Contains: MMN - highest message sequence # completed
Next Sequential MMN assigned - every log record with
01 F2 C1

RESTART PARAMETER

- BTERM/LUNIT
- SYCTTBL
- SUBSYS

=YES (default) Requires LOG=YES
LSYNCH=YES (if critical)

Use only if:

-- File Recovery critical
-- Data Base Recovery critical
-- Checkpointing data affected
-- Remote CPU or tape data collection input stream can be resumed
-- Output transmission recovery critical

May result in no MSGAC record

-- Particularly if no transmission recovery for down terminal
-- May couse read-back of entire log

=IFPOSBL Requires LOG=YES

Use if:

-- File or Data Base Recovery needed

-- Recently queued transmission data must be sent

All incompleted messages logged after last MSGAC record are restarted (if RESTART not=NO)

Applies only to BTERM/LUNIT and SYCTTBL macros

=NO (LOG=NO/YES)

Use for:

-- Inquiry subsystems

-- When terminal is used in conversational mode

-- When last update can be checked at terminal before being reentered

-- When printer output can be recreated

-- When all remote CPU input can be retransmitted

-- When no checkpointing

-- When using file recovery for reversal processing only

Further Reference: Operating Reference Manual
Basic System Macros
SNA Terminal Support Guide

13.3 Message Restart

Installation Checklist (requires logging installation):

Definition	BTERM/LUNIT	RESTART=
Macros	SYCTTBL	RESTART=
		SEGREST=
		CNVREST=
	REGION	LOG=YES
	SUBSYS	STOP=NO
		IFDOWN=QUEUE
		RESTART=
Assemblies	PMIRDTOO	INTSCT
	Network Table	
Linkedit	ICOMLINK	CHKRES=YES
	Modules	LOGPROC
	AUTORCVR	READBACK
	REQONDDQ	INTDBLOK
	DBRSTRT	RESTORE3
Data Sets	RESTRTLG	Previous Log(s)
	LOGDISK	Disk (work file)
	INTERLOG	New Log
	STRTUPSW	Startup/Restart status
User Exits	USRESTRT	called by LOGPROC
	USRSEREX	called by REQONDDQ

CHECKPOINT AREAS

STATION Table (PMISTATB)
FILE Table (PMIFILET)
SPA (message counters, MMN)
SCT (SS codes, message counters)
TIME Table (PMITIMTB)
User-specified Area

CHECKPOINT TIME Log Record -- INTERLOG - code=X'00'
CHECKPOINT File -- CHEKPTFL

- 5 logical segments maximum--each big enough for all areas
- Wraparound--when 5th segment written - 6th will overlay 1st.
- Segment availability controlled by SPALIST GENSW - bit settings
- When I/O error in a segment - bit set on
- When less than 2 segments - checkpointing stopped.

Further Reference: Operating Reference Manual
Basic System Macros

Installation Requirements (requires logging installation):

SPALIST	GENSW	CKUSER	
	CKPTLIM	CKUSL	
	TCHP		
Definition	SYCTTBL	for CHCKPTSS	
Macros	SYCTTBL	DBASE= (data base)	
		RVFILE=	
Assemblies	INTSPA	INTSCT	
Linkedit	ICOMLINK	CHKRES=YES	
	Modules	CHECKPT3	LOGPROC
		AUTORCVR	INTDBLOK
		RESTORE3	READBACK
	Data Base	DBCHKDSP	CHCKPTSS
	Checkpointing	DBRSTRT	PURGEQ
Reports used by	Checkpointing	RPT00040	RPT00044
Data Sets	INTERLOG	Tape/Disk	
	RESTRTLG	Previous Log(s)	
	LOGDISK	Disk (work file)	
	CHEKPTFL	Disk	

Dsects: CHKPTDST, LOGCHK

User Exit USRCHKPT - called by CHECKPT3 after writing checkpoint records

CHECKPOINTING SUBSYSTEM

CHCKPTSS

```
SYCTTBL    SBSP=CHCKPTSS
           SUBC=Q
           LANG=NBAL
           PRTY=0
           OVLY=0
           NUMCL=1
           MNCL=1
           RESTART=NO
           LSYNCH=YES
           TCTV=n
```

NOTE: TCTV should be at least 300

Dispatched on Time Interval specified with SPALIST TCHP parameter.

Purpose: Quiesce INTERCOMM Subsystems for Checkpoint Recording if SYCTTBL RVFILE=YES or DBASE=UDB

Further Reference: Operating Reference Manual

FILE RECOVERY FACILITY

- ON-LINE PROCESSING
- ON-LINE RESTART
- OFF-LINE RECREATE
- BACKOUT-ON-THE-FLY

FILE ACTIVITY LOGGING

INTERLOG

LOG CODES: 80-8E - Before Images
90-9E - After Images
8F - File Recovery Checkpoint Record

Supported Access Methods: ISAM, BDAM, VSAM

Further Reference: File Recovery Users Guide

Installation Checklist (requires logging and checkpointing):

Definition Macro:	SYCTTBL	RVFILE=YES DBASE=
Assemblies		INTSCT
Linkedit	ICOMLINK Modules	FILEREC=YES all logging, etc. IXFFAR IXFLOG IXFCHKPT
Data Sets	INTERLOG ICOMIN CHEKPTFL	Tape/Disk FAR cards Disk
FAR Specifications:	REVERSE= CHECKPOINT= DELETE= CHECK= RECREATE	applicable files

Dsect: FRDSECTS (FABs)

FILE RECOVERY - ON-LINE RESTART

BEFORE MESSAGE RESTART
BEFORE NEW MESSAGE INPUT

Installation Checklist -
Requires Logging & Checkpointing & Message Restart, and:

Linkedit	ICOMLINK	FILEREC=YES
	MODULES	all previous, and
		IXFRVRSE
		IXFSNAPL (optional)
Data Sets	INTERLOG	New Log
	RESTRTLG	Previous Log(s)
	LOGDISK	disk (work file)
	CHEKPTFL	disk (previous file)
	FRLOG	SYSOUT (optional)
		IXFSNAPL output
	ICOMIN	FAR cards

File Recovery processing executes in conjunction with checkpointing.

FILE RECOVERY - OFF-LINE RECREATE

APPLY AFTER-IMAGES OFF-LINE

ALLOWS ON-LINE RESTART TO BE STARTUP BYPASSING LOG RESTART

Linkedit	IXFCREAT	IXFFAR
	IXFHND00	IXFSNAPL
	IXFHND01	BATCHPAK
Data Sets:	ICOMIN	FAR cards
	FRLOG	SYSOUT (optional)
	AFTERIM	Log (with after-images)
	User data sets to be recovered	

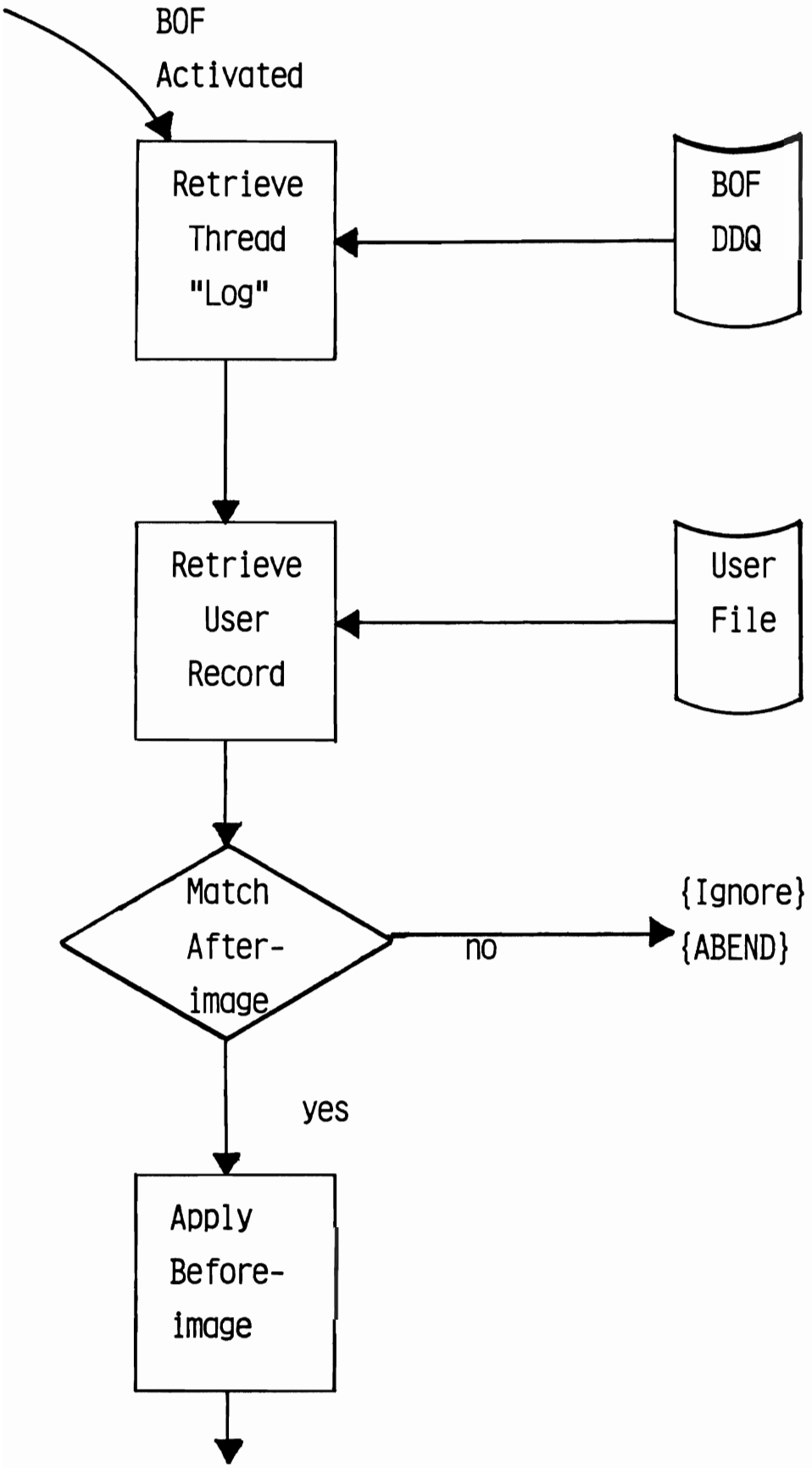
FAR Specification: DDname,RECREATE

Further Reference: File Recovery Users Guide

BACKOUT-ON-THE-FLY

- Dynamic File Reversal-invoked if subsystem:
  - -- OCx or Timeout
  - -- Return Code is 912
- DDQ Maintained Per Thread
- "Logging" before-images and after-images on THREDLOG DDQ data set

BOF -- OVERVIEW



BOF IMPLEMENTATION

- Requires File Recovery, DDQ installation
- Define THREADLOG DDQ Data Set, QCF File
- Specify BACKOUT=YES on SYCTTBL (reassemble SCTs)
- Specify REVERSE={YES } in FARs
  {CRITICAL}
- Linkedit - all previous modules, and
  ICOMLINK: BACKOUT=YES

  - MODULES: INTCRQ
    INTPRQ
    IXFVERF1
    TRVRSE

NOTE: BACKOUT=YES on ICOMLINK forces FILEREC=YES

Further Reference: File Recovery Users Guide
Dynamic Data Queuing Facility

Network Control--

- STLU/SPLU - start/stop VTAM logical unit activity
- RSLU/VTCN - resequence/change VTAM status
- STLG/SPLG - start/stop line group (DCB)
- STLN/SPLN - start/stop line activity
- TPUP/TDWN - start/stop terminal activity
- STPL/SPPL - start/stop leased line polling, VTAM input

Data Set Control--

- FILE - change file status, open/close a file

System Activity Control--

- STOP/STRT - deactivate/activate system or user function
- SCTL - core/table display, TDUMP, WQE trace

Multiregion Control--

- COMM,... - Satellite Region/subsystem/queue control
- LOKR/ULKR - lock/unlock a terminal to a region (RAP)

Queue Control (Front End)--

- QHLD/QRLS - hold/release terminal output queue

Subsystem Control/Quiesce--

- MNCL/PRTY - change subsystem concurrency limit, priorty
- BEGN/DELY - initiate/quiesce subsystem processing
- LOAD - load an updated/corrected subsystem/subroutine

14 ABENDS, SNAPS AND PROBLEM DETERMINATION AIDS

14.1 INTRODUCTION

Error conditions--recoverable and non-recoverable. Program checks in subsystems. Intentional program checks. MVS ABENDS. Abends/Snaps due to control terminal or CPU console operator requests.

14.2 SYSTEM SNAPS

Subsystem Programming Problems.
Intentional Program Checks.
Program Looping.
Format of SPIE and STAE save areas.
Snap 114 debugging.
Indicative Dumps.

14.3 SPINOFF SNAPS

14.4 FAST SNAPS

14.5 PROBLEM DETERMINATION AIDS

PMISNAP Macro.
Core Pool Integrity Checking.
TRAP.
DWS Integrity Checking.
Programming Aids.
PMIDEBUG.
Line Trace Facility.

ERROR CONDITIONS--RECOVERABLE AND NON-RECOVERABLE

- Program checks within application subsystems

  If SPIEEXIT and SPIESNAP included, Intercomm does not ABEND, but rather takes a SNAP 126.

- Intentional Program Checks

  Program check is due to a logical error in an Intercomm or application program. The PSW points to an ISK in an Intercomm module. SNAP produced.

- Unrecoverable (e.g. hardware) errors cause Intercomm region to ABEND.

  STAEEXIT, if included, ensures proper dataset close procedures. Produces SNAP 122.

- Unrecoverable (e.g. operating system software) error due to access method, GETMAIN/FREEMAIN, etc. problems.

  Again STAEEXIT processing ensures proper shutdown procedures. Produces SNAP 122.

- STAEEXIT CLEANUP PROCESSING COMPLETED message produced if log buffers flushed, data sets closed, etc.

- Snaps/Abends/Cancellation at CPU Console/Control Terminal request.

  Operator issues:

  -- GPSS command - SNAP or ABND
     ABND closes associated Region only.
     If Multiregion, SNAP provides optional snap areas for associated Region only.
  -- IMCD or NRCD with SNAP or ABEND option
     closes control and all Satellite Regions.
     SNAP/ABEND 120 produced.
  -- 'CONTIN' reply to PMIDEBUG WTOR provides a region SNAP, no close-down and resets Dispatcher Timer. SNAP ID=32 produced.

- System Abends due to CPU operator cancellation.

  Intercomm is "hung" and will not respond to any closedown command attempts. To be avoided if at all possible.

Further Reference: Operating Reference Manual
Basic System Macros
System Control Commands
Messages and Codes

See also: MRS Facility - Satellite Region close-down commands from Control Region

- Intercomm assigns a SNAP-ID as documented in Messages and Codes, Chapter 5.

- Certain "famous" SNAPs are eligible for the INDICATIVE DUMP option, these are:
  SNAP 114--Enqueued resource time out
  --Thread Dump (if TDUMP in linkedit)
  --WQEs Trace (if IJKTRACE in linkedit)
  SNAP 118--subsystem time out (SYCTTBL-if SNAP=YES)
  --WQEs TRACE (if SNAP 118 issued)
  SNAP 126--OCx abends - Subsystem Program Checks
  --Thread Dump, WQEs TRACE
  --ICOMPOOL Dump (if POOLDUMP in link)

Installation:		
SPALIST	STUSPIE	INDUMP
Data Set	SNAPDD	SYSOUT
LINKEDIT	Modules	PMISNAP1
Automatic		SPIEEXIT
		SPIESNAP
	IJKCESD	STAEEXIT
	IJKWHOIT	STAETASK
User Exits:	SNAPEXIT	called by PMISNAP1
	SPSNEXIT	called by SPIESNAP

INTENTIONAL PROGRAM CHECKS/SNAPs 126, etc.

- Subsystem request is invalid (e.g., invalid parameter list)
  - -- PSW points to ISK instruction in an Intercomm service routine.
  - -- Module name and operands if ISK identifies the problem. See Messages and Codes, Chapter 4.

- Logical error within Intercomm system modules or subsystems.
  - -- Snap ID or ISK identifies Intercomm system problem. See Messages and Codes, Chapter 5.

PROGRAM LOOPING

Trapped by IJKTLOOP - ABEND 909
SNAP 121

Recovery: STAERTRY

Linkedit: ICOMLINK LOOPTIM=YES

Control Command: STRT/STOP TLOOP

Further Reference: Operating Reference Manual
System Control Commands
Messages and Codes

FORMAT OF SPIE SAVE AREA - SNAP 126

Formatted by SPIEEXIT

'SPIE SAVE AREA', 8-byte PSW, Registers 13-12

-- Slow Snap - at beginning of Region Dump

-- Indicative Dump - first area snapped

-- Fast Snap - find SPIE SAVE AREA literal

FORMAT OF STAE SAVE AREA - SNAP 122

Formatted by STAEEXIT

'STAE WORK AREA' - same as OS format:

Fullword - Abend Code: if byte 1=X'80'-dump requested

Bits 8-19: system abend code

Bits 20-31: user abend code

Fullword - binary zeros or same as previous word

2 8-byte PSWs (system, user)

Registers 0-15

-- Slow Snap - at beginning of Region Dump

-- Fast Snap -

-- look for literal, or

-- linkedit - STAEWORK entry point, or

-- 'PSW AT ENTRY TO SNAP'

points to STAEEXIT code - find literal

NOTE: if user abend code - translate to decimal.

ENQUEUE/DEQUEUE
Time Out

Processing -- PMINQDEQ
SNAP -- 114

On WQE Trace find:
IJKREFA -- Free Queue Table (WQT)
Last FQE -- Enqueue owner (status=62)
Parm Field -- Address of Enqueue Element in first 3 bytes

Use ELMDSECT to find: Resource ID
Caller's Return Address

Find All WQEs -- same thread number
TQEs -- check Timer/Event Queues

Or see TDUMP - RCB for NQ(OWNER)

I/O Device -- Hung?
Time Delay -- Too Long?

If no WQE/TQE -- program executed DISPATCH EXIT without an INTDEQ

Further Reference: Messages and Codes

INDICATIVE DUMPS

- Advantages
  - -- Speeds debugging time
  - -- Reduces disk space and paper usage

- SNAP-IDs 114, 118, and 126 are eligible
  - -- Except when in thread 0

- Areas dumped
  - -- Spie Save Area - 126 - failing program regs
    - 118 - SYCT400 regs
  - -- Program Check, TCTV or ENQ Time-out message
  - -- Neighborhood of failing instruction - 126 only
  - -- Resource Manager Save Area (RMSAVE)
  - -- SPA, USERSPA, SPAEXT
  - -- ITCB, SYCTTBL
  - -- SS Controller S/A, SS parm list, input message
  - -- Subsystem (COBOL/non-reentrant), SCTEXT
  - -- Dynamically loaded subroutines (if any)
  - -- Thread resources (core, files accessed, etc.)

- GPSS command STRT/STOP INDUMP/INDALL/IND114-118-126

Installation	SPALIST	INDUMP
	SYCTTBL	INDUMP

Program Request: PMISNAP ...,INDUMP=YES
(honored only if global INDUMP option is on)

Further Reference: Operating Reference Manual
14.2 System SNAPs

SPINOFF SNAPS

- Advantage--SNAPs can be printed ("spun off") during the course of Intercomm execution, rather than at Intercomm closedown. Particularly useful for debugging and reloading Dynamically Loaded Subsystems/Subroutines.

- Operation

  -- SNAPs are written to the SNAPDD dataset on disk

  -- When the total accumulated SNAP output reaches the number of pages specified by the SNAPPGS parameter of the SPALIST macro, SNAPDD is closed.

  -- SNAPDD is renamed dynamically and message MP010A is issued: 'A SNAP DATA SET HAS BEEN CREATED NAMED XXXX----XXXX ON VOLUME ZZZZZZ.'

  -- The dataset XXXX----XXXX can now be printed using IEBGENER.

  -- New space is dynamically allocated on volume ZZZZZZ to hold subsequent SNAPs.

  -- If reallocation cannot be done, subsequent snaps spooled to NEWSNAP if in JCL.

SPINOFF SNAPS (continued)

Installation Checklist

SPALIST	SNAPPGS	
Linkedit	Automatic	
	Modules	SPINOFF
Datasets	SNAPDD	disk
	NEWSNAP	SYSOUT=A

if SNAPDD is SYSOUT, code
FREE=CLOSE to have snaps spun off

USER EXIT: SPINEXIT
--can be used to generate internal Job to print completed SNAPDD data set.

Further Reference: Operating Reference Manual

FAST SNAPS

- Advantage-depending on region size and supervisor in use, fast snaps can save up to 90% elapsed time.
- Requested by PMISNAP FAST=YES.
- Automatic for SNAPs 114, 118, 126 if INDUMP off.
- If user-requested, standard (Slow Snap) parameters must also be defined for PMISNAP macro.
- Printed via IBM Utility--AMDPRDMP.

Installation Checklist

Prerequisites:

- MRSVC or IISVC
- SPINOFF SNAP Facility

Assemblies:	PMISNAP1	STARTUP3
Dataset	FASTSNAP	disk

Further Reference: Operating Reference Manual

PMISNAP MACRO

DCB-address Default: PMISNAP in PMISNAP1
DDNAME = SNAPDD

If FAST=YES: FASTSNAP DCB in PMISNAP1
DDNAME = FASTSNAP

Further Reference: Basic System Macros

CORE POOL INTEGRITY CHECKING -- RMINTEG

Refer to Chapter 4: STORAGE MANAGEMENT

TRAP FACILITY

Refer to Chapter 4: STORAGE MANAGEMENT

User-coded additional Entry Point trapping macro: TRAP

User Exit: USRTRAP

Further Reference: Operating Reference Manual
Messages and Codes

DWS INTEGRITY CHECKING

- Detects storage destruction by reentrant COBOL subsytems and subroutines.
- A pad area is added to DWS when it is allocated; inspected on each call to COBREENT.
- If pad area is not intact, a diagnostic message and a SNAP 126 are issued (ISK 1,0).
- Message -- 'COBOL DWS AREA TOO SMALL S/S=cccc'
- Should be used in test environment only due to processing overhead.

Installation

SPALIST	DWSCHK=	
SYCTTBL	GET=	{must be
	FREE=	{equal
	LANG=RCOB	
	DWSCHK=YES (default is NO)	

Command Control:
- STRT/STOP DWSCHK (global)
- FTUN/SSUP (specific SYCTTBL)

Further Reference: COBOL Programmers Guide

- Call IJKTRACE--print Dispatcher Qs (WQEs)

- Call TDUMP--print thread resources (RCBs)
  --current thread # only or all threads

- Call POOLDUMP--print ICOMPOOLS

- INTTCB Macro--ITCB for current thread #

- MMU Snaps--Symbolic Map Area (MAPIN/MAPOUT)

- DWSSNAP-- snap parts/all of COBOL DWS or PL/1 DSA to
  --SNAPDD (ID=87)
  --on-line printer
  --input message terminal (partial data only)

- SCTL command
  --internally generate to snap Save/Work areas
  to input message terminal/on-line printer
  --on-line display of table areas, addresses
  --locate Csect name from address,
  address from name
  --generate WQE trace, thread dump
  --display core

Further Reference: Operating Reference Manual
System Control Commands

Installation

ICOMLINK DEBUG=YES
Module PMIDEBUG

Issues CPU Console WTOR:
IF INTERCOMM STUCK REPLY CANCEL OR CONTIN

Do not reply at Startup!

Use to take region Snapshot if Intercomm problems:
Reply: CONTIN
Result: SNAP 32, then WTOR reissued

Use to cancel Intercomm instead of CPU cancel:
Reply: CANCEL
Result: ABEND 032

Caution: indescriminate use of CONTIN reply in a Production system will cause delays up to several minutes in response time. Intercomm quiesced until SNAP completes. Delay time depends on region size and whether Fast Snap in use.

Further Reference: Messages and Codes, Chapter 6.

LINE TRACE FACILITY

- Writes short SNAPs to SNAPDD data set at the completion of each Front End I/O operation.

- Useful in diagnosing Front End problems, when using almost-but-not-quite plug-to-plug compatible devices.

- Activated/deactivated using LTRC command.

- Areas Snapped - BTAM:
  - -- DCB, IOB
  - -- DECB/BLINE and all associated BTERMs
  - -- Buffer Area (input) or
    Message Area (output)
  - -- BTAMWORK save/work area of line handler
  - -- Line Handler Registers
    R10 -- BTERM R11 -- BLINE

- Areas Snapped - VTAM:
  - -- LUNIT (LUB) and associated LCOMPs (LUCs)
  - -- VRE (8-byte prefix and VTAM RPL)
  - -- input buffer or output message area

- SNAP IDs -- see Messages and Codes for BTAM
  ID=26 -- VTAM Front End Trace

Further Reference: Messages and Codes
System Control Commands

```
JOB INTT001X         STEP GO              TIME 133708   DATE 90286    ID = 100    CPUID = 068109515890   PAGE 00000001

PSW AT ENTRY TO SNAP   078D0E00 00037FE6        ILC 2   INTC 0033


REGS AT ENTRY TO SNAP

     FLTR 0-6      0000000000000000      0000000000000000            0000000000000000      0000000000000000

     REGS 0-7      00045850   8E037F98   8E0144D2   00015018         FFFFFFFD   0000DAE4   00014018   FFFFFFFD
     REGS 8-15     0000099F   8E01432E   0000CE04   0000CDAC         FFFFFFFD   00045838   4E01E16E   4E037F6E


-STORAGE

0000C7A0          00384000 0000CDAC 0000CDAC    F3F2F7D3 0000C7A4 00000001 04101000   *    .. .........327L..G.........*
0000C7C0 00000001 0000FF00 00000000 D4D4E4F3    F2F7F040 FF011896 02000000 00644080   *............MMU3270 .......... .*

0001E1C0 E3C8C9E2 40C1D9C5 C140D5D6 E340C1D7    D7D3C9C3 C1C2D3C5 40E3D640 D3C9D5C5   *THIS AREA NOT APPLICABLE TO LINE*
0001E1E0 40E3D9C1 C3C54040                                                            * TRACE                           *

0000CDA0                              7F6C1D78    0001099F 0000C7A4 00060EC8 00000995   *             ..........G....H....*
0000CDC0 00000000 00010000 00000000 00000000    00000003 00000000 00000000 00000000   *................................*
0000CDE0 00000000 00000000 0000F458 0000012C    0000012C 0000012C 7F000000 0080C000   *...........4....................*
0000CE00 00080000 E3C2D9D6 C4000000 00000087    00000000 00000000 00000000 8080002A   *....TBROD.....................*
0000CE20 00000100 00000040 00000006 00130000    40404040 E4E2E2D9 F1000000 00000087   *....... ........    USSR1.....*
0000CE40 00044D88 00000000 00000000 8080024D    00000200 00000046 00000006 00140000   *................................*
0000CE60 40404040 D7C1E4D3 F1000000 00000087    00000000 00000000 00000000 80800023   *    PAUL1.....................*
0000CE80 00000300 00000047 00000006 00150000    40404040 E3C5E2E3 F1000000 00000087   *.............    TEST1.....*
0000CEA0 00000000 00000000 00000000 8080001F    00000400 00000045 00000006 00160000   *................................*
0000CEC0 40404040 E3C5E2E3 F2000000 00000087    00000000 00000000 00000000 808000B0   *    TEST2.....................*
0000CEE0 00000500 00000047 00000006 00170000    40404040 E3C5E2E3 F3000000 00000087   *.............    TEST3.....*
0000CF00 00000000 00000000 00000000 8080001F    00000600 00000045 00000006 00180000   *................................*
0000CF20 40404040 C3E5C8F0 F1000000 00000087    00000000 00000000 00000000 80800032   *    CVH01.....................*
0000CF40 00000700 00000047 00000006 00190000    40404040 E3C5E2E3 D7000000 00000087   *.............    TESTP.....*
0000CF60 00000000 00000000 00000000 808002A7    00000800 00000040 0000000C 001A0000   *.............................. .....*
0000CF80 40404040 7F6C1D78                                                            *    ....                         *

00060EC0                    7D4040E3 C1D3E868    C6C50000 00000000 00000000 00000000   *         .  TALY.FE.............*
00060EE0 00000000 00000000 00000000 00000000    00000000 00000000 00000000 00000000   *................................*
      LINES 00060F00-00061840  SAME AS ABOVE
00061860 00000000 00000000                                                            *........                         *

00045820                                                      00000000 0002E0A4       *                          .....*
00045840 6E015982 0001DFB8 000000E0 AE015954    0000C7A4 0000C7DC 0001E1C0 0001E1E7   *.................G...G.....X*
00045860 0000CDAC 0000CF84 00060EC8 00061867    00045838 80045918 0000CDAC FFFFFFFD   *............H...................*
00045880 00000000 01000000 000458A0 000009A0    00000000 00000000 00000000 00000000   *................................*
000458A0 00060EC8 00080000 00000000 00000000    00000000 00000000 00000000 00000000   *...H............................*
000458C0 00000000 00000000 00000000 00000000    00000000 00000000 00000000 00000000   *................................*
      LINE 000458E0  SAME AS ABOVE
00045900 09A00000 00000000 00000000 00000000    00000000 00000000 000466B0            *............................    *
```

```
JOB OASTEST2          STEP CICSTAP1        TIME 081315   DATE 88274    ID = 026    CPUID = 212711953090   PAGE 00000001

PSW AT ENTRY TO SNAP   078D0000 000075E2        ILC 2   INTC 0033

REGS AT ENTRY TO SNAP

     FLTR 0-6      0000000000000000      0000000000000000              0000000000000000      0000000000000000

     REGS 0-7      0005338C   800075C8   00000000   00000000           000532C8   701C9202   0010B000   00000600
     REGS 8-15     003AC808   0013F9F4   001354D8   00135498           701CA466   001CA530   501CA50A   400075BE

-STORAGE

00135480                                                                D3E4C201 01010080   *                       LUB.....*
001354A0 010000D0 00000004 000400B6 18E0C040    0080E000 0101FD88 00000000 100080B8   *.............. ................*
001354C0 F0100000 01000000 00000000 06000000    00000000 00000000 C8E8F3F5 C1000000   *0.......................HY35A...*
001354E0 00000100 000000C8 00000000 FC000000    00000300 05440000 00000000 C0000000   *.......H.....................*
00135500 00000000 00000000 40404040 00185018    50000000 00000000 D3E4C201            *........    ............LUB.    *

003AC800                   00135498 00000000    00202270 501C90FC 00000000 00000000   *        ......................*
003AC820 20041000 84800000 0010B168 00000000    0005338C 010000D0 28800000 00000000   *................................*
003AC840 00000028 00000000 10309450 00000000    80800005 40000000 00000000 00000000   *..................... ...........*
003AC860 00000000 00000000 00000000 00135498    80008012 00000000 00000000 00000000   *................................*
003AC880 003AC358                                                                     *..C.                           *

00053380                             F5C71140    40F0F87A F1F37AF1 F540D6C1 E2C6C3F0   *            5G.  08.13.15 OASFC0*
000533A0 F0F2C940 D5D640D6 E4E3D7E4 E340D8E4    C5E4C5C4 00000000                     *02I NO OUTPUT QUEUED....       *
```

15 PERFORMANCE: STATISTICS, TUNING and PREDICTION

15.1 Introduction

15.2 Measurement

15.3 Tuning

15.4 Performance Prediction

FACTORS WHICH INFLUENCE PERFORMANCE

Hardware Factors

- Terminals and Lines
- CPU
- Main Storage Allocation
- I/O Devices

Software Factors

- Operating System
- Monitor
- Subsystems -- Design and Code
- Activity in Batch and Data Base Regions

Human Factors

- Peak Periods
- Operations Staff
- Terminal Operators

All of these factors change from day to day. Thus, tuning is an ongoing process.

SELECTIVE LOG PRINTING AND LOG ANALYSIS

Selectively printing INTERLOG using LOGPRINT--

- DATE
- TIME
- TERM
- BMN
- MMN
- SSC
- LOG CODE
- FILE

Log Analysis

- Traffic Histograms
  - -- Terminal
  - -- Subsystem
  - -- Verb
  - -- Total Run
- Response Time
  - -- Region
  - -- Terminal
  - -- Subsystem
  - -- Verb
  - -- Total Run
- Date
- Time
- Selected Sorted Output

Further Reference: Operating Reference Manual

FILE HANDLER STATISTICS

File Handler Statistics are accumulated for each OS/VS dataset processed by Intercomm, and periodically printed on SYSPRINT. A final summary is produced at closedown.

The following statistics are gathered for each file--

- Number of SELECTS
- Number of accesses
- Total number of accesses if broken down by INPUT, OUTPUT or detailed by READ, WRITE, GET, PUT
- Average accesses per SELECT

If VSAM LSR Pools used, then per buffer size--

- REQ REJ--because not enough buffers
- BFRFND--record in buffer-no read needed
- BUFRDS--reads to bring in CIs

Plus for whole pool--STRNO EX and STRMAX

Commands:

- FHST: display statistics for one or all files
  display LSR pool statistics

- FILE$STAT: display current status of a specific file - type, selects, FAR options used, DISP

Further Reference: Operating Reference Manual
System Control Commands

SYSTEM TUNING STATISTICS (STS)

Accumulates system-wide service usage information at user-specified intervals. Reports on:

- Current BMN and MMN numbers
- Count of Dispatcher inactivity WAITs
- Message processing and Overflow Disk Queueing
- Multiregion message traffic
- INTERLOG I/O
- Dynamic/Overlay Subsystem/Subroutine Loading
- Store/Fetch activity
- Subsystem and loaded subroutine activity - at closedown only

INSTALLATION CHECKLIST

SPALIST	STSTIME	
Linkedit	INCLUDE	INTSTS
Automatic		SUBRPT
		SSRPT
Dataset	STSLOG	SYSOUT

Further Reference: Operating Reference Manual

Accumulates resource usage information for each message processed by a subsystem, for example:

- Total CPU time
- Storage usage
- Overlay and subroutine loads
- File Handler requests
- Dynamic File Allocation requests
- Store/Fetch requests
- MMU requests
- DDQ requests
- Output messages created, for terminals or other subsystems
- 1-10 User-defined categories and function exits (for Data Base activity, etc.)
    --USRBK01-10
    --USRFN01-10

Statistics are recorded on INTERLOG on the Subsystem thread's FA log record.

--Message Header and SAM data, no text.

Commands:

- STRT/STOP SAM (global control)
- FTUN/SSUP (specific subsystem)

SYSTEM ACCOUNTING AND MEASUREMENT
INSTALLATION CHECKLIST

Definition Macro:	MAPACCT	
Programming Macro:	USRTRACK	
Specification Macro:	SYCTTBL	SAM=
Linkedit	ICOMLINK	SAM=YES
	Modules	SAMSECT TRACKMOD
	Table	SAMTABLE
User Function Exits:	USRSAMnn	
Dataset	INTERLOG	
Dsect:	SAMCB	

Further Reference: Operating Reference Manual
Basic System Macros

15.2 Measurement

```
MAPACCT         ('bucket-name1',bucket,bucket),
                ('bucket-name2',bucket)


SAMTABLE        CSECT
                MAPACCT ('BDAM READS',BDAMR),
                        ('CPU TIME',CPUTIME)'
                        ('STORAGES',STORAGES)'
                END


                APPLICATION PROGRAMMING MACRO

USRTRACK        {BUCKTNO=}
                {FUNCNO=}
                [,SPA=(r)]
```

Further Reference: Basic System Macros
Operating Reference Manual

Executed off-line against INTERLOG presorted by

--subsystem codes

--terminal-ids

Linkedit: SAMREPT, SAMRPTIO,
SAMTABLE (from corresponding on-line system)

CONTROLLING EXECUTION OF SAM REPORT

PARM	TOTALS	MAJOR CONTROL
SUBO	BY SUBSYSTEM CODE	SS CODE
SUBO,DTL	BY SUBSYSTEM CODE, WITH DETAILS	SS CODE
SUBT	BY TERMINAL, WITHIN SUBSYSTEM CODE	SS CODE
SUBT,DTL	BY TERMINAL, WITHIN SUBSYSTEM CODE, WITH DETAILS	SS CODE
TRMO	BY TERMINAL	TERMINAL-ID
TRMO,DTL	BY TERMINAL, WITH DETAILS	TERMINAL-ID
TRMS	BY SUBSYSTEM CODE WITHIN TERMINAL	TERMINAL-ID
TRMS,DTL	BY SUBSYSTEM CODE WITHIN TERMINAL, WITH DETAILS	TERMINAL-ID

Further Reference: Operating Reference Manual

CORE USE STATISTICS

Three sets of core use statistics can be accumulated with the RMTRACE routine. Statistics are computed and printed at intervals.

Global Statistics -- STORAGE and STORFREE request results
-- RCB table relocation count

Core Pool Statistics -- breakdown of STORAGE requests into user-defined size ranges (COREACCT macro)

Pool Use Statistics -- measure the effects of different choices of pools (ICOMPOOL macros)

An example was given earlier for RESOURCE MANAGEMENT

Further Reference: Operating Reference Manual

ONLINE SYSTEM STATUS/STATISTICS REPORT -- TALY

TALY dynamically generates a display of information on:

- General Resource Utilization -- TALY$SU
- Status of Dispatcher Queues -- TALY$DS
- Message Traffic by some/all subsystems --
  TALY$BE/NQ/MU/NC/NS/NP/B*/NG
- Message traffic for a specific subsystem --
  TALY$BE(ssch$ssc)
- Front End message traffic --
  TALY$FE/FQ/FN/FD/FU/BD/BU/VS/VN/VI/FI
- Front End traffic for a specific terminal --
  TALY$FE(tid)
- Current Thread Activity -- TALY$DA

TALY$RH resets the thread high count to current count

On each display -- time display generated, region-id

GPSS subroutine: TALLY uses RPT00043

Further Reference: System Control Commands
15.2 Measurement

VTST command displays VTAM-name, tid-name, flag bytes, active/connected status, locked-to verb, locked-to region-id for:

- Entering (no option) or specific (LU/VTname) terminal
- All VTAM LUs (ALL)
- All connected LUs (CONN)
- All disconnected LUs (NCONN)
- All LUs being acquired (SIM)
- All connected LUs with pending RELREQ (REL)
- All LU6.2 session LUs (ALU6)
- Sense data (SENSE sub-option)

Or totals only of number connected, max allowed,
LOGONs and SIMLOGONs queued (TOT).

Requires VTAMSTAT and RPT00045 in (CR only) link (automatic).

- TALY command gives total line for VTAM LU displays with:
  - Current sessions count
  - High sessions count
  - Maximum sessions allowed

- VTCN$SNMAX$nnnnn - use to change max session count.

Further Reference: System Control Commands

STAT command -- requires BSTAT2 and RPT00045
Linkedit-automatic (CR only) if &BTAM SETB 1 in SETGLOBE

BTAM NETWORK ERROR STATISTICS DISPLAY

STAT$ERR displays the accumulated I/O error count for:

- One Line
- All Lines
- One Terminal

NOTE: Requires ERRSTAT=YES coded on each

- BLINE
- BTERM

to be displayed.

ERRSTATS must also be included in the linkedit.

Further Reference: System Control Commands

ON-LINE MULTIREGION STATUS DISPLAY

COMM$STATUS (Control Region only) displays the status of:

- All Satellite Regions
- One or more specific Regions
- All Subsystems in all Satellite Regions
- All Subsystems in one or more specific Regions
- One or more specific Subsystems
- All terminals locked to one or more specific Regions

Region requests display the following:

- STATUS--Active/Stopped
- CAUSE--if stopped
- MESSAGES--# queued (core/DDQ)

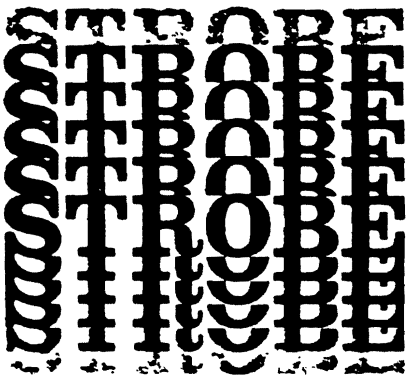
Subsystem requests display the following:

- REGION--region or regions containing SS code
- STATUS--Active/Stopped
- QUEUES--if DDQ defined (YES/NO) (Hold or Region)
- MESSAGES--# queued (core/DDQ)

Terminal request displays the following:

- Region name, status (top line only)
- Terminal name, status (of LUC if VTAM)

Further Reference: Multiregion Support Facility
System Control Commands



PERFORMANCE MEASUREMENT

STROBE/INTERCOMM
...to maintain the high throughput and fast response time of your INTERCOMM online operation.

STROBE/INTERCOMM

The STROBE/ INTERCOMM feature is a complete program performance measurement tool. It is directed at the INTERCOMM online system and the application programs within it. Concise summaries of both program usage and dataset usage point out the areas deserving review.

Those areas can be examined on additional reports which show where the computer resources are used in meaningful detail. Execution time is attributed to *the source statements within the application programs*. Data base activity is reported by cylinder. This meaningful detail is readily used by the application programmer or data base specialist to maintain the peak efficiency of the system.

STROBE measurement is accomplished by low-volume sampling. The activation of a measurement session is controlled by the user. Through a terminal, he or she invokes a Sample Control program which initiates and terminates the STROBE measurement session. Measurement can be continuous or can be focused on peak time intervals.

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STROBE/INTERCOMM SUBSYSTEM SUMMARY

The Program Section Usage Summary below shows the execution time used by each program within each application subsystem. The program RESVSTAT of subsystem RS appears as a big consumer of CPU cycles (15.36% of the total).

** PROGRAM SECTION USAGE SUMMARY **

MODULE NAME	SECTION NAME	SECTION SIZE	EXEC. TIME PERCENT SOLO	EXEC. TIME PERCENT TOTAL	EXEC. TIME HISTOGRAM UNIT = 0.50 PERCENT .00 5.00 10.00 15.00 20.00
.IBM	.IOCS		7.01	19.04	.*************************************
.IBM	.SVC		13.05	18.12	.***********************************
.INTERCM	.INTERCM		13.01	19.56	.**************************************
AB ICOMM	.INTERCM		.69	3.99	.*******
AB ICOMM	PAYINVCM	7584	2.14	4.76	.********
AB ICOMM	PAYECVCM	608	.79	4.01	.*******
AB ICOMM	PAYREPLY	8146	.12	1.01	.*
AB ICOMM	PAYUPDT	24286	.01	.01	.
AB ICOMM	PAYZ001	7484	2.22	4.90	.*********
AD ICOMM	.INTERCM		.38	.07	.
AD ICOMM	RCBATCH	6223	.41	2.02	.***
KA ICOMM	.INTERCM		.07	.43	.
KA ITEST	BTESTRCM	240	.07	.15	.
KA ITEST	CTEST	723	.22	.56	.*
RS ICOMM	.INTERCM		3.10	5.41	.**********
RS ICOMM	RESVCHG	10276	.27	.36	.
RS ICOMM	RESVNEW	1280	.08	.03	.
RS ICOMM	RESVSTAT	3056	12.50	15.36	.******************************
RS ICOMM	RESVTZ	4092	.12	.18	.
			------	-----	
PROGRAM ICOMM	TOTALS		55.00	99.99	

Each entry with a non-zero value on this report is expanded in a subsequent section to show the whereabouts of the activity within the section. For IOCS, SVC and INTERCOMM activity which supports the entire online operation, the identifying module names and SVC numbers are listed with their execution time percentages.

The summary entry for .INTERCM within a named application subsystem shows the CPU time in INTERCOMM control sections in direct support of the named application. In the expanded report it appears as follows.

MODULE - RS ICOMM

SECTION - .INTERCM

LINE NUMBER	PROCEDURE NAME	STARTING LOCATION	INTERVAL LENGTH	EXEC. TIME PERCENT SOLO	EXEC. TIME PERCENT TOTAL	EXEC. TIME HISTOGRAM UNIT = 0.05 PERCENT .00 .50 1.00 1.50 2.00
	IXFLOG			.36	.36	.******
	IXFMON01			1.78	1.81	.************************************
	IXFSUFS			.03	.33	.*****
	MSGCOLS			.36	.36	.******
	PMIEXTRM			.09	.09	.**
	PMILINK2			.09	.24	.*****
	PMIMODEQ			.09	.79	.***************
	PMIOUTPT			.74	1.79	.***********************************
				-----	-----	
SECTION	.INTERCM TOTALS			3.54	5.77	

While the application programmer cannot alter the coding within such support routines, he sometimes can reduce the frequency of use or perhaps substitute an alternative technique which is more efficient for his needs. Execution time in SVC and IOCS modules and INTERCOMM overhead routines is shown in a similar fashion.

STROBE/INTERCOMM DETAILED REPORTS

The activity within each application program is detailed in the STROBE Program Module Usage Report.

** PROGRAM MODULE USAGE REPORT **

MODULE - RS ICORM

SECTION - RESVSTAT   SOURCE LANGUAGE - ANS COBOL VS

LINE NUMBER	PROCEDURE NAME	STARTING LOCATION	INTERVAL LENGTH	EXEC. TIME PERCENT SOLO	EXEC. TIME PERCENT TOTAL	EXEC. TIME HISTOGRAM UNIT - 0.30 PERCENT .00 3.00 6.00 9.00 12.00
	INIT1 CODE	000000	156	.00	.00	.
	DATA DIVISION	00009C	1926	.00	.00	.
302	ESTABLISH-POINTERS	000A22	234	.00	.00	-.
328	PARSE-REQT	00090C	120	.00	.00	.
332	MOVE	000984	58	.04	1.30	.****
341	CALL	0009BE	82	.30	.30	.*
350	MOVE	000A10	112	.00	.00	-.
371	TESTFIELDS	000A82	60	.10	.33	.*
375	MOVE	000ABC	42	.00	.03	.
381	SEARCH-FLGT	000AE6	420	.00	.00	-.
417	GET-NEXT	000C8A	48	.33	.36	.*
422	CONTIN-SEARCH	000CBA	54	9.90	11.67	.**************************************
429	BUILD-MSG	000CF0	110	.32	.52	.**
434	WRITE-AND-RETRY	000D5E	50	.54	.78	.**
442	CALL	000D90	32	.09	.12	.
453	GOOD-END	000DB0	16	.00	.03	.
455	RETURN-NORMALLY	000DC0	24	.00	.06	.
458	ABORT-IT	000DD8	30	.00	.00	.
				-----	-----	
SECTION RESVSTAT TOTALS				12.50	15.36	

In this case a Strobe Indexer program has been used to obtain the Cobol source program line numbers and paragraph names so that activity can be attributed directly by source program statement. Here STROBE shows that the paragraph CONTIN-SEARCH accounts for almost all the CPU time spent in the application program. Obviously the programmer's performance improvement efforts should be focused on this paragraph.

Activity can be related to source program statements for Cobol, PL/I, Fortran and Assembler languages. For other languages or if the optional indexing is not used, the execution activity is shown by location.

STROBE/INTERCOMM DATA BASE REPORTING

The I/O Facility Utilization Summary lists devices used by device type, unit assignment, volume and file. The percentage of run time that the device is busy is shown as well as the percent solo or non-overlapped time. This report helps to reveal device contention.

A Direct Access Utilization Report shows this job's use of direct access devices, broken down by device, file name, and cylinder. Utilization figures include disk arm movement time as well as data transfer time. This report will often suggest changes in the allocation of permanent files on a particular volume, as well as changes in the assignment of temporary files from unit to unit to increase channel utilization and overlap.

STROBE/INTERCOMM CONTROL FACILITIES

Sample Control

The acquisition of application program samples is controlled by the user at a terminal serviced by a Sampling Control program. By issuing commands to STROBE through the Sampling Control program, the terminal operator can start sampling, stop sampling, or switch to a new sample set, freeing the current sample set to be used to produce a Program Performance Profile.

Selective Sampling

Activity during certain periods of the day may be of great interest; activity of periods of no interest should be excluded from performance measurement and reporting. Issuing a start command causes STROBE to begin sampling (fig. 1). A suspend command causes sampling to be stopped, without closing the current sample set. Sampling is resumed when a start command is again issued, and the samples are appended to the current sample set. A stop command causes sampling to cease and a message to be issued to the operator announcing the release of the sample set. At his convenience, the user may then initiate a job to produce the Program Performance Profile.

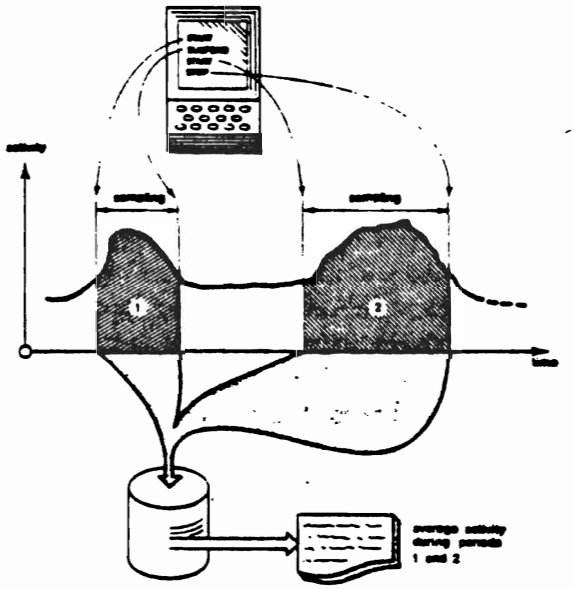


Figure 1 Selective sampling

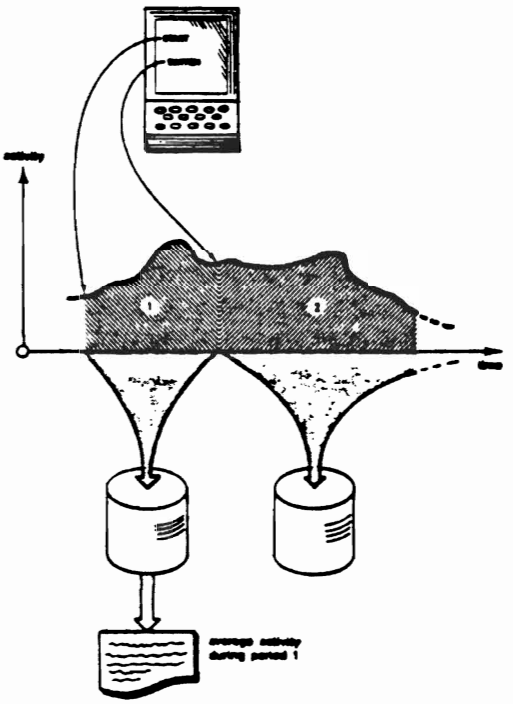


Figure 2 Sample set switching

Sample Set Switching

Continuous measurement of an online system may be desired, with periodic performance reports that can be produced without interrupting performance measurement. A Program Performance Profile may be produced from a sample set while sampling continues (fig. 2). This is accomplished by first using a switch command. This command causes one sample data set to be closed and an alternate to be opened, and a message to be issued to the operator announcing the release of the first sample set. A Program Performance Profile may then be produced from the released sample set while samples continue to be collected in the alternate data set.

SYSTEM TUNING

- Response Time--Measure of Individual Messages
- Throughput--Measure of Total System Performance

PURPOSE OF TUNING

- Bring Activity Into Balance
- Trade-Offs
  - -- Priority
  - -- Facility/Service Routine Usage
  - -- User Requirements
  - -- Resources

LINKEDIT ORDERING

- Reduces Page Faults, MVS Paging
- Guidelines--See Operating Reference Manual

Subsystem Program Logic

- Judicious use of exclusive control
- Use small, single purpose subsystems
- Consider thread subtasking

Subsystem Residency

- Resident subsystems
- Dynamically loaded subsystems
- Overlay Region A
- Execution groups

Limiting Concurrency

- MNCL
- RESOURC

Execution Priority

- SYCTTBL PRTY parameter

Logging

- YES/NO
- Asynchronous/Synchronous
- Restart

Avoiding SNAP Delays

- FASTSNAP
- Indicative Dumps
- SYCTTBL SNAP parameter

Time-Delay Processing

- Verb Table
  --EDIT, HPRTY, etc.
- Terminal Queues
  --core vs. disk
- Network Table
  --CRT and/or CONV processing
  --Message segmenting
  --Terminals per line - BTAM
- Polling List Table - BTAM
  --General vs. Specific
  --Open/Auto/Wrap
- Execution Priority - BTAM/TCAM
  --SETENV - &FEPRTY
- Printer output spooling via DDQ Facility
  --Reduces queuing
  --Reduces core usage
  --Adds file I/O overhead
- Logging - YES/NO
  --Asynchronous/Synchronous
  --Restart

NOTE: The order of verbs in the Verb Table is unimportant (binary search performed on the verb index).

Further Reference: BTAM Terminal Support Users Guide
SNA Terminal Support Guide

SUBPOOL SPACE AND SCHEDULING CRITERIA

- Core management to reduce MVS GETMAIN/FREEMAIN processing
  - -- Core Use Statistics
  - -- COREACCT macro
  - -- Keep pools tuned

- "Count of maximum usage" (TALY$MU)
  Number of times MNCL messages processed concurrently

- Avoiding fragmentation
  - -- OPEN frequently used files at startup
  - -- VSAM files - use LSR Pools (buffer pools)
  - -- Avoid "partial frees"

- SPALIST parameters
  - -- MMNCL (SCTL command)
  - -- MDELY (SCTL command)
  - -- TASKNUM (reassemble INTSPA)
  - -- MAXLOAD (LOAD command)
  - -- STOCORE (SCTL command)

- Other SYCTTBL parameters
  - -- NUMCL
  - -- PRYMSGS
  - -- DFLN, PCEN
  - -- See Chapter 2 - Message Management

OTHER CONSIDERATIONS

- Data set/Pack placement
  - -- Program Libraries (DYNLLIB)
  - -- Queues (PMIQUE, BTAMQ, DDQs, etc.)
  - -- Store/Fetch Files (MMU, User)
  - -- Page Facility data sets
  - -- INTERLOG
  - -- SNAP disk data sets
  - -- User Files/DBMS Files
  - -- MVS Page data sets
  - -- JES spool packs
  - -- JCL - list in decreasing order of # of SELECTs

- User Files
  - -- Blocking factor (block size/CI size)
    decrease if frequent updating
  - -- VSAM files -
    If reading sequentially - do not use GETV for update until specific record found
    If update via path and base - use DSN FAR option

- Utility Tables -- from RCT000, VRB000, SEC000
  - -- Make frequently used entries core resident

- Multiregion
  - -- Large in-core queues
  - -- 4K minimum CSA size for inter-region message transfer

GPSS STRT/STOP COMMANDS

Allows User to dynamically Start/Stop

- Core Pools Integrity Checking/TRAP
- Indicative Dump Processing
- Printing Resource Management Statistics
- Logging Options
  - -- All
  - -- Back End
  - -- Front End
  - -- File Recovery
- SAM Statistics Gathering
- Program Loop Checking
- COBOL DWS Overflow Checking
- User Functions (by number)

SPALIST SSNUM parameter

Programming Macros:

- SSSTART
- SSSTOP
- SSTEST

Further Reference: System Control Commands
Basic System Macros

For a BTAM/TCAM/VTAM Terminal:

- FLSH--one/some/all queued messages
  TPUname or VTvtam-id
- RLSE--release next message queued for CRT
- QHLD--stop transmission of queued output
  TPUname or VTvtam-id
- QRLS--allow transmission of queued output
  TPUname or VTvtam-id
- TDWN--ATDname - reroute down BTAM/TCAM terminal output
- SPLU--ATDname/vtam-id - reroute down LU output

For a Subsystem:

- SSFL--flush one/some/all queued messages
- MNCL--change processing concurrency

Further Reference: System Control Commands

Allow altering access status of a data set:

- LOCK--prevent I/O operations (SELECT)
- UNLOCK--allow I/O operations
- FEOV--force end of volume
  (see also SPALIST - GPSSEC)
- CLOSE--temporarily close a file
  (next access reopens it)
- CLOSE$LOCK--permanently close a file
  (until UNLOCKed)
- ALTER--processing options
  (READONLY/WRITES/WRITEOVER)
- DEALL--deallocate a file (change SYSOUT class)
- ALLOC--reallocate previously deallocated file
- CANCEL--incompleted LOCK/CLOSE/ALTER/DEALL
  (allows resumption of subsystem activity)

Further Reference: System Control Commands

To Dynamically Tune Subsystem Characteristcs:

- BEGN
- DELY
- MNCL
- PRTY
- SPAC
- TCTV

Processed by FINTUNER subsystem.
Uses RPT00009, RPT00010, RPT00022, RPT00029.

To Dynamically Alter Subsystem Processing:

- FTUN
- SSUP

Processed by DYNSSUP subsystem.
Uses MMU to generate/edit displays (Maps coded in program).

BTVERB and SYCTTBL coding provided.
Linkedit-automatic.

Further Reference: System Control Commands

MMU CONTROL COMMANDS

- LMAP--reload a Map Group
  requires load library data set concatenated
  to STEPLIB (DISP=SHR)

- MMUC--display Map template, printer maps
  delete in-core copy of Map Group
  display last assembly date/time

PAGE FACILITY CONTROL COMMANDS

- SAVE--save a response group of pages
  (not recommended)

- PAGE$REPORT-list saved response groups
  TC--terminate (delete) current response
  TH--delete all responses except first
  TL--delete only the last response
  TA--delete all response groups

MULTIREGION CONTROL COMMANDS

- NRCD/IMCD$RCONTROL--bring down only CR
- COMM$DOWN/QDOWN$rrrrrrrr--NRCD/IMCD specific SR

Further Reference: System Control Commands
15.3 Tuning

INTERCOMM QUIESCE

Before Stop CPU - After Start CPU

WTOR Replys: ICOMHALT ICOMSTART

- Puts Region in 'HARDWAIT' status
- Prevents Subsystem Timeouts
  (Timer WQEs adjusted)
- Processing - PMIHARDW (include in linkedit)

NOTE: To re-IPL CCU (Communications Control Unit)

1. SPLG--all line groups (close DCBs) and/or
   VTCN$HALT[$QUICK]--close VTAM Front End
2. Re-IPL--37xx, etc.
3. STLG--all line groups (open DCBs) and/or
   VTCN$START--restart VTAM Front End

Further Reference: Messages and Codes
System Control Commands

15.3 Tuning

PERFORMANCE PREDICTION

- LOGINPUT
- BTAM TERMINAL SIMULATION

Allows an INTERLOG created in a previous Intercomm execution to be used as input to a subsequent execution. Arrival rates of messages can be adjusted to perform volume testing. Only 01 log records are used.

Log input and "live" input can be mixed.

Also useful for regression and message peak testing.

Can be used in Test Mode (one input message required).

Can be used to update a backup version of a user file or DBMS.

User modification to select only desired 01 log records.

Cannot be used with security installed in "live" system.

LOG INPUT

Installation Checklist

Globals	SETGLOBE	&LGINRTD &LOGINTM &GENTERM
SPALIST	LOGINDO	
Definition Macro	STATION	&GENTERM tid
Assemblies	INTSPA LOGINPUT	
Table	PMISTATB	
Linkedit	Modules	LOGINPUT
Dataset	LOGINPUT	Previous Log

Further Reference: Operating Reference Manual

BTAM TERMINAL SIMULATION

- Define VTAM 3270s as local BTAM 3270s
- LIVE and SIMULATED line groups can be mixed
- Define standard BTAM lines in Network Table
- Terminals on simulated lines require individual input Data Sets -- DDname = Terminal-id
- SIMCARDS input data set gives terminal-id, input message frequency rate for each BTAM terminal to simulate
- I/O requests trapped by BTAMSIM (include in BTAM link)
- SIM3270 formats 3270 input/output (include in link)
  - -- SYSOUT data set for each simulated terminal
- Network/System control commands can be used
- Input Message creation utility
  - -- CREATSIM (also 3270 CRTs - SBA sequences)
- Can also be used in Batch Mode
  - -- requires BTAM Front End in linkedit

Further Reference: Operating Reference Manual

16 APPLICATION PROGRAM SUPPORT

16.1 Introduction

16.2 Application Services

16.3 Additional Services

APPLICATION PROGRAM SUPPORT

System Manager(s) Responsibility

- Liason
  - Vendor
  - Application Groups
- Initial Test Mode
- Production Sysgen and Maintenance
- Maintenance of System Libraries and Tables
- System Tuning
- Expansion Coordination
- System Restart and Backup Procedures

Application Programmer Responsibilities

- Maintenance of Existing Programs
- Coding and Testing of New Applications
- Table Specifications
- Implementation Coordination with System Manager

16.1 Introduction

DESIGN

Design of New Applications

- Features
- Files
- Network Considerations
- Coordination
- Reentrancy
- Restart/Recovery
- Priority
- Security
- Residency
- Region Location

Unique Indentifiers

- Tables:
  - Verb
  - Subsystem Codes
  - Entry Points/Member Names
  - Subroutine names (REENTSBS)
  - Mapgroup (MMU)
  - Report Number (Output)
  - Region (MRS-SUBSYS)

- Data:
  - Data Set Name
  - DDname
  - Store/Fetch Key
  - DDQ Indentifier
  - FAR Specifications

TESTING

- Test Mode (Back End only)

- Terminal Simulation
  - -- Batch Mode
  - -- Online

- Single Region Online Test System
  - -- Dynamically Loaded Subsystems
  - -- Dynamically Loaded Subroutines

- Multiregion Test Satellite Region
  - -- Dynamically Loaded Subsystems
  - -- Dynamically Loaded Subroutines

- Core Clobbering Control
  - -- RMINTEG/TRAP
  - -- DWSCHK

- Program Path Tracing
  - -- User Log Entries
  - -- DWSSNAP/SCTL command/snaps
  - -- TDUMP (program thread only)
  - -- IJKTRACE

Further Reference: Operating Reference Manual
Programmers Guides

16.1 Introduction

- Control Commands
- Messages
  - -- Logging/Restart
  - -- Switching and Queuing
  - -- Terminal Locking (Verb/Region)
  - -- Conversational mode
- Dispatcher
  - -- IJKDELAY
  - -- IJKPRINT
  - -- IJKWHOIT
- Resources
  - -- Concurrency Control
  - -- Storage Management
  - -- TDUMP
- File Handler
  - -- Data Base Interface
  - -- DFA
  - -- BOF
  - -- File Recovery
- USERSPA
- Dynamic Load (Subsystem/Subroutine)
  - -- above 16M line (XA, ESA)
- In-core Table Sort - INTSORT
- Link Pack Routines
- Security
- Checkpointing
- Snaps--Core Display, Indicative Dumps

APPLICATION SERVICES
VIA
BAL MACROS/SUBROUTINES

- STORAGE/STORFREE
- PASS/CATCH
- INTENQ/INTDEQ
- DISPATCH/INTWAIT/INTPOST
- MODCNTRL (SUBMODS)
- PMIWTO/PMIWTOR/VWTO/VWTOR
- USRTRACK (MAPACCT)
  - -- SAM Statistics
- PMISNAP
- START/STOP FUNCTIONS
  - -- SSTEST
  - -- SSSTART
  - -- SSSTOP
- SUBTASK
- INTTIME/GETDATE
- EXTERM
- LAYOUT
- SSCONV

Further Reference: Basic System Macros
Assembler Language Programmers Guide

GENERALIZED SUBTASKING

- Subtask Pool Defined Via SPALIST
  - -- TASKNUM parameter
  - -- General/Special Subtasks

- Intercomm use:
  - -- Dynamic File Allocation - IXFDYNAM
  - -- FILE Command - DEALL/ALLOC - IXFDYALC
  - -- File Handler - IXFHND01
    - GET, SETL, ESETL

- Subsystem Use via SUBTASK Macro

- Processing: ICOMTASK

Further Reference: Operating Reference Manual
Basic System Macros
Assembler Language Programmers Guide

ADDITIONAL BAL PROGRAMMING MACROS

CALLIF
CALLOVLY
CONVERT
DDNFIND
DISABLE
ENABLE
ENTER
EXMVE
EXSS
EXTERM
EXTRT
GETSPA
HEXCON
INTTCB
LINKAGE
QCOUNT
REGA
REGS
ROUND
RTNLINK
SUBLINK
XASWITCH

DSECT Generation

BTSPA
DVMODIFY DSECT=YES
IXFDSCTA
INTTCB
MSGHDR
SECTB
SPALIST
STALIST
VCT SECT=D

Inner Macro Parameter Checking

CHKA1
CHKA2
CHKA3
CHKA4
CHKDE
CHKHE
CHKREG
CHKRG
CHKRQ
CHKYN

Further Reference: Basic System Macros
Assembler Language Programmers Guide

- MMU
- AUTOGEN
- PAGE
- EDIT & OUTPUT
- FORMGEN
- STORE/FETCH
- DDQ
- FECMs
- CONVERSE
- GETSEG
- PMIDATER
- Binary Table Search - BINSRCH
- SECTEST macro (ESS)
- SECUSER (ESS)

Further Reference: Programmers Guides
Extended Security System

User Exits: PREPROGI, PREPROGE
Add to COBOL Subsystem Parm List,
clean up added user areas on exit.
Called by PREPROG (RMPURGE)

Further Reference: Operating Reference Manual

SERVICE ROUTINES -- MESSAGE EDITING/FORMATTING

- Message Mapping Utilities (MMU)
- AUTOGEN
- PAGE
- EDIT and OUTPUT
- CHANGE/DISPLAY
- FORMGEN

REQUIRED BACK END TERMINAL TABLES

- PMISTATB -- STATION
  -- PMISTOP
  -- DVMODIFY
- PMIDEVTB -- DEVICE
- PMIBROAD (optional) -- BCGROUP

Dsects: STALIST, DEVLISTC, BRODSECT, DVMODIFY(DSECT=YES)

User Exit: USRSTSCH (sample provided - see description in code)
Convert real tid-name to generic STATION entry;
cannot be used for CRTs if security in use.
Called by PMIEXTRM (EXTERM macro).

Editing:	Positional
	Keyword
	Fixed-length
	Relative-positional
Formatting:	Initial Screen Menu Only
	Symbolic Data Only
	Menu and Data Combined
Output:	Page Overflow
	Segmenting to Device Buffer Size
Message Routing:	Return to Caller
	Pass to FESEND
	Put on PAGE Data Set
	Create a DDQ, queue FECM
Map Loading:	LOADMAPS Utility
Control Commands:	MMUC, LMAP
Statistics:	SAM
Dsects:	MMUVT, MCBDSECT, MDCAREA, MMUDSECT, MMUICDST, MMUNFDST, MMUDDMWK

Further Reference: Message Mapping Utilities

Advantages:

- Involves end-user in online system design at an early stage

- Relieves application programmers of coding MMU map-definition macros

Limitations:

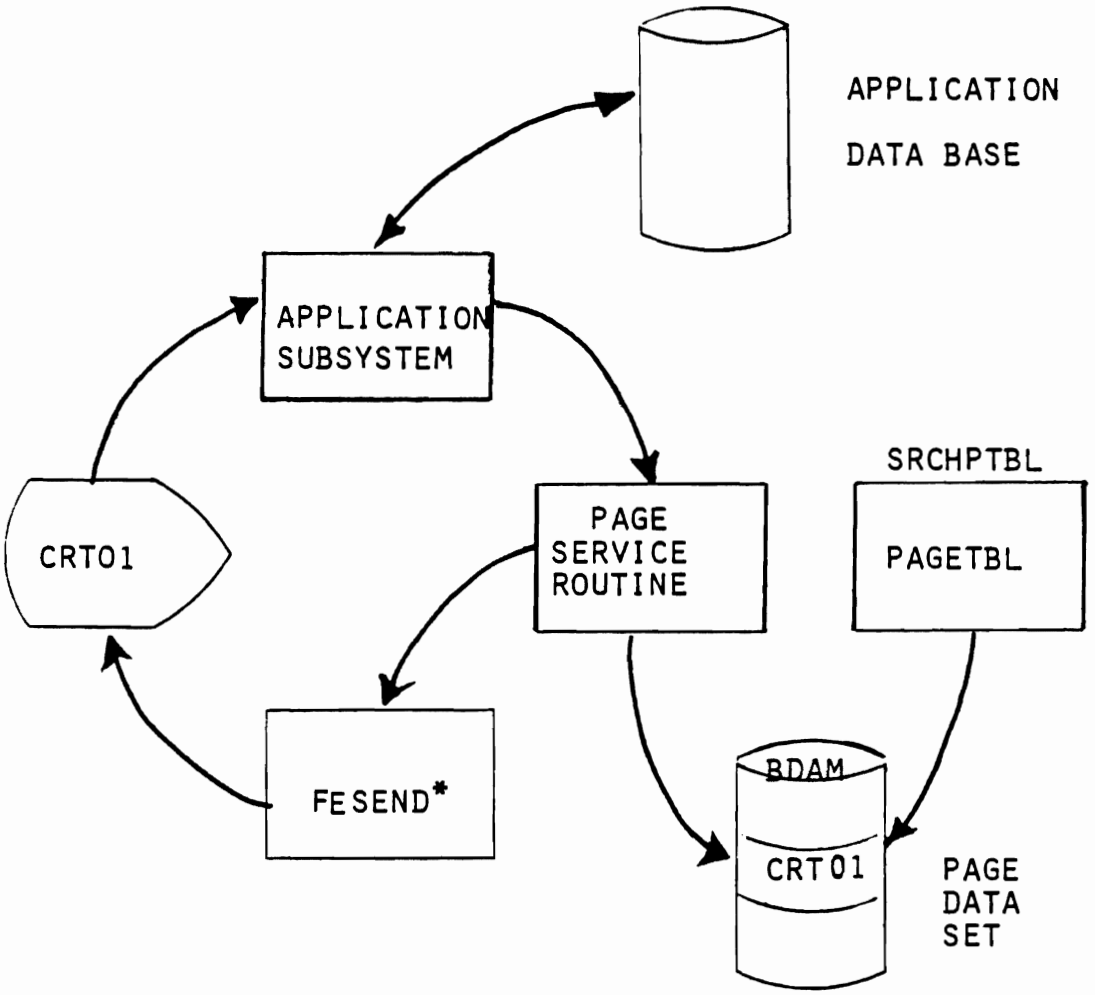
- Devices--3270 CRT
  --Dataspeed 40/1,2 CRTs
- Maps Entire Screen
- No Structured Segments
- No Repetive Fields/Segments
- RELPOS is always relative (to zero) positional
- No VERB/AID/CURSOR field types

Command: AGEN

Dsects: ISGFIT, ISGDATA

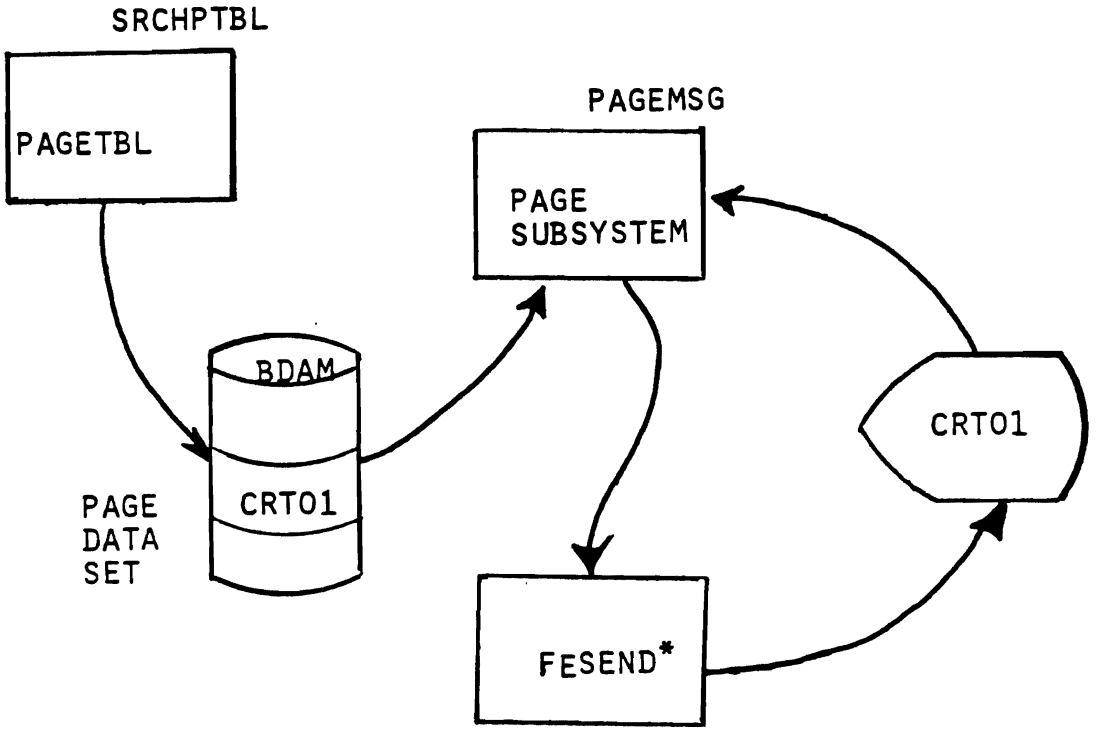
Further Reference: Autogen Faciltiy

PAGE SERVICE ROUTINE



* OR OUTPUT OR CHANGE/DISPLAY

PAGE SUBSYSTEM



* OR OUTPUT OR CHANGE/DISPLAY

PAGE COMMANDS

PAGE,N,n
P,n
S,n
C
L

SAVE

PAGE,REPORT
TC
TH
TA
TL

Dsects: PGEDSECT, RQEDSECT

User Exit: USRPAGEX (sample provided)
Control adding pages to Page data set.
Called by PAGE service routine.

Further Reference: PAGE Facility
System Control Commands

PAGE AND MULTIREGION

Without RAP--

All subsystems using PAGE (including via MMU) must be in the same Region (SR or CR). Unless Different verbs/SS codes used (use EDIT=YES on BTVERB macros and define in local PMIVERBS). In this case Page Data Sets and Page Tables must be unique to the region.

With RAP--

May be used in several regions. PAGE Subsystem must be defined in each, but PAGE/SAVE verbs in Control Region PMIVERBS only (EDIT=BQ in BTVERBs). Data Sets must be unique to each region. Can use universal Page Table.

Further Reference: Multiregion Support Facility

PAGE AND MMU

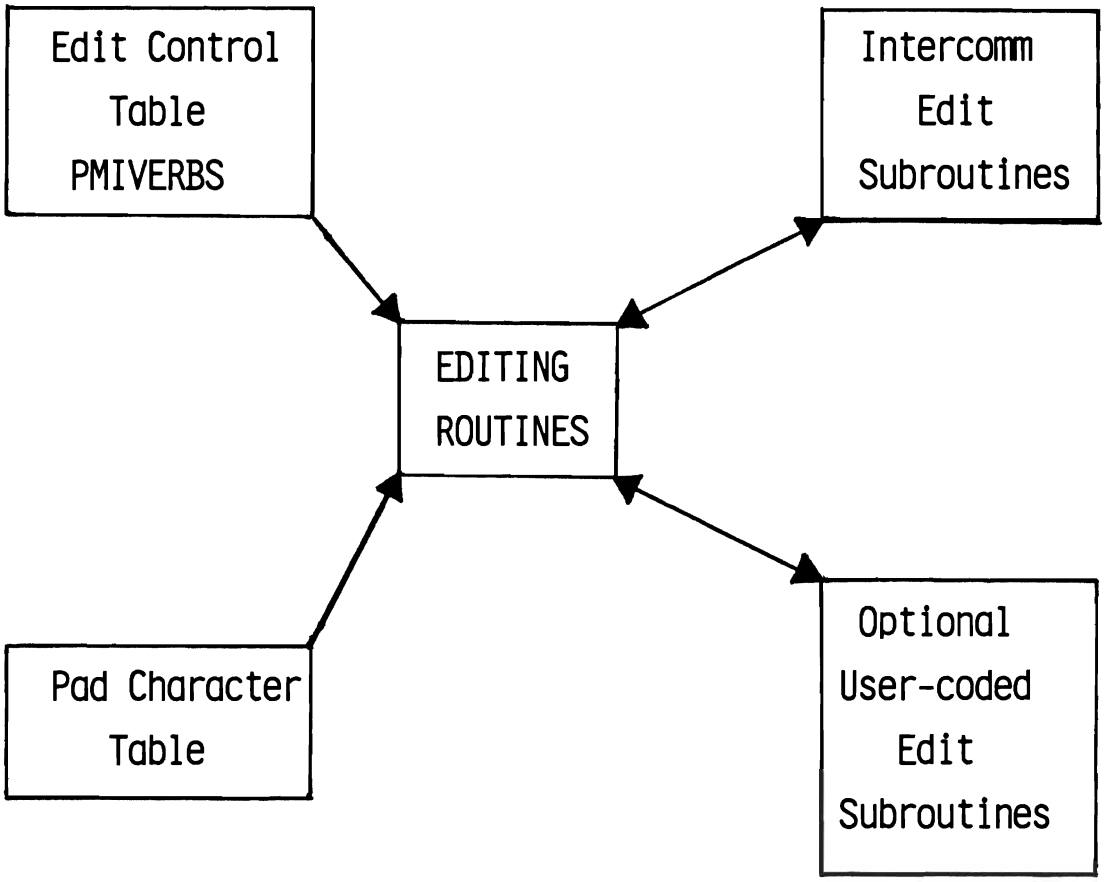
MAPEND Option--C'P' in byte 2 of the MCW

All pages (messages) built by MAPEND and sent to Page Data Set defined for the associated terminal in Page Table. First page sent to terminal. Applies to CRT (input/output) devices only.

Install PAGE Facility as though subsystem were calling it, rather than MMU. Retrieve pages at terminal in the same manner as though subsystem had created them directly.

Further Reference: Message Mapping Utilities

EDIT is invoked after a message is passed to a subsystem or before a message is queued for a subsystem (Satellite Region).



BAL Programming Interfaces: EDITCTRL, PMIFINDB, PMIDLTDB

Dsect: VERBTBL

Further Reference: Utilities Users Guide
Operating Reference Manual
Assembler Language Programmers Guide

OUTPUT UTILITY

Operates as an Intercomm subsystem - PMIOUTPT.
Creates a terminal dependent message.

INPUT--Message Data Stream, Item Codes, Length
OFTs (RPTnnnnn)
PMISTATB/PMIDEVTB

Processing:

1. If VMI=57, do steps 3 and 6 only.
2. Locate OFT in PMIRCNTB or on RCT000.
3. Verify destination terminal.
4. Get storage for message formatting.
5. Format output message using OFT and data from input message. Segment message depending on buffer size.
6. Pass output message(s) to Front End
   (FESEND: Entry Point--PMIOTPUT)

OUTPUT--Queued Messages(s)

User Exits: USROTEDT - output message modification (FESEND)
USROUTCK - bypass Output processing/queuing

Dsects: ALTREPRT, RCTLISTC, REPTABLE

Further Reference: Utilities Users Guide

FORMGEN

Request Format Display from OFT

Verb(s): User-defined (fgen)

Processing: FORMGEN Subsystem

Table: FORMTBLE

Further Reference: System Control Commands
Utilities Users Guide

DATA PRESERVATION/MANIPULATION

- STATISTICS GATHERING
- INTER-REGION COMMUNICATION
- INTER-SUBSYSTEM COMMUNICATION
- SUBSYSTEM-TERMINAL COMMUNICATION

VIA

STORE/FETCH

DDQ

FECM

Store/Fetch Applications

- Modular Programming
- Conversational Control
- Short Term Storage
- Long Term Storage
- Batch/Online Communication
- Inter-Subsystem Communication

Store/Fetch Data Strings

Key--1-48 bytes

Unique by user design

Do not use DATA, ISYS

Data--Less than 32K

Store/Fetch Required For:

- MMU
- Autogen
- Data Entry

Data Sets: INTSTORn (0-9)--Keyed BDAM

Preformat: KEYCREAT Utility

Further Reference: Store/Fetch Facility

TYPE	AVAILABILITY	STORAGE
TRANSIENT	UNTIL CLOSEDOWN OR ABEND	CORE OR DISK
SEMIPERMANENT	ACROSS RESTART	DISK
PERMANENT	UNTIL EXPLICIT UNSTORE	DISK

Transient Strings should not be specified for File Recovery.

File Recovery logging occurs when string written to disk.

Low Core condition causes Transient Strings to be flushed to disk.

At startup, File Recovery occurs before Store/Fetch Initialization

Backout-on-the-fly can recover all except:

-- Transient strings created with 'keep-in-core' option.
-- Transient strings updated or replaced with a 'keep/hold in core' option.

Off-Line Dump/Restore/Print Utility: SFDMPRST (DUMPREST)

Statistics: SAM, STS

Dsects: SFCOREDS, SFTABLE

DDQ Applications

- Message or data switching between subsystems
- Temporary Storage
- Batch/Online Communication
- MRS Queueing
- Segmented messages input
- Data Collection and Statistics Gathering
- Backout-on-the-Fly

DDQs

- Preformatted BDAM Files
- Data or messages
- Identified by QID

Services Routines: QBUILD, QOPEN, QCLOSE,
QREAD, QWRITE

Statistics: SAM

Print Utility: DDQPRT (DDQPRINT)

Dsects: DDQSECTS

Further Reference: Dynamic Data Queuing Facility

DYNAMIC DATA QUEUE TYPES

- Transient:
  - -- pass to another subsystem
  - -- temporary storage
  - -- single retrieval
- Semi-permanent:
  - -- pass or reuse
  - -- freed at startup
  - -- kept over restart
- Permanent:
  - -- exists until explicitly freed

DDQ PROCESSING OPTIONS

- Creation:
  - -- Tail
  - -- Head
- Access:
  - -- Sequential
  - -- Relative Block
  - -- Relative Record
  - -- Update
- Disposition:
  - -- Save
  - -- Pass
  - -- Free

FRONT END CONTROL MESSAGES

- Front End Data Queuing (DDQ)
- Front End Feedback Messages
- Front End Queue (Message) Release

Processing: FECMMOD

Dsect: FECMDSEC

Further Reference: Programmers Guides

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What are your objectives in taking this course?

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INSTRUCTOR(S) NAME _____

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2. Did you meet these prerequisites? Yes ____ No ____ NA ____

B. OBJECTIVES

1. Were they clearly stated at the beginning of the class? Yes ____ No ____
2. Did the course meet its objectives? Yes ____ No ____
   If not, why? _____

C. CRITIQUE

1. In general, how do you rate the class?
   Excellent ____ Very Good ____ Good ____ Fair ____ Poor ____
2. What was the strongest element of the course?
3. What was the weakest element of the course?
4. How would you improve the course?
5. Additional comments. (Use other side if necessary.)

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