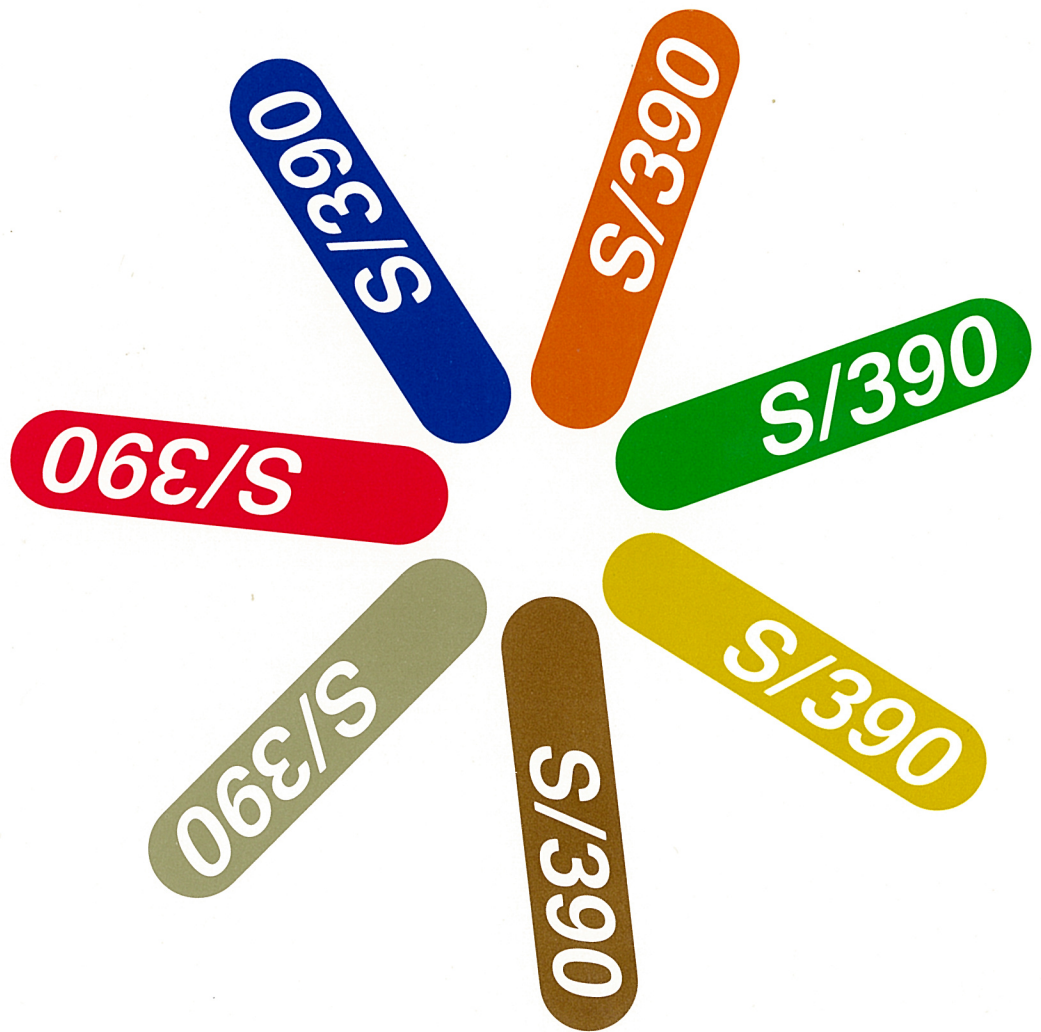


Enterprise System/9000  
Enterprise System/3090

GA22-7123-05

**Processor Resource/Systems Manager  
Planning Guide**





Enterprise System/9000  
Enterprise System/3090

GA22-7123-05

**Processor Resource/Systems Manager  
Planning Guide**

**Sixth Edition (May 1991)**

| This major revision obsoletes and replaces GA22-7123-4.

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## Notices

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ESA/390  
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Integrated Cryptographic Feature  
MVS/ESA  
MVS/SP  
MVS/XA  
Processor Resource/Systems Manager  
PR/SM  
S/370  
S/390  
System/370  
System/390  
VM/ESA  
VM/XA  
VSE/ESA

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## About This Publication

This publication is a guide and reference intended for use by system planners, installation managers, and other technical support personnel who need to plan for the operation of the IBM Enterprise Systems/9000 (IBM ES/9000\*) Processor Complex, the IBM ES/3090-9000T\* Processor Complex, and the ES/3090 Processor Complex E-Models, S-Models, and J-Models in logically partitioned (LPAR) mode.

LPAR mode, provided by the Processor Resource/Systems Manager\* (PR/SM\*), is standard on ES/9000 models and ES/3090-9000T models, and is optional on ES/3090 models (PR/SM publication support for the operation of ES/9000 Models 120, 130, 150, and 170 in LPAR mode to be available at a later date).

This publication is written as a planning guide for readers who are familiar with and understand the characteristics and functions of a selected processor complex model as described in the publications appropriate to that model which are cited in "Reference Publications" on page xiii.

Some features, display frames, and functions are model-dependent, SEC-level dependent, or control-program dependent. For this reason, all of the functions discussed in this publication are not necessarily available on every processor complex model.

The illustrations and examples in this publication describe LPAR mode operation with four logical partitions although as many as seven logical partitions may be defined for some models.

Operation information in this publication is written for installation personnel who need to plan for LPAR mode. System console operators should use the appropriate *Operator Tasks* manual or *Operator Guide* to perform LPAR mode task procedures. Control program operators should refer to the appropriate control program publications for information about control program commands.

### Notes:

1. The terms "processor complex", "processor model", and "processor complex model" when used in this publication, apply only to the ES/9000 Models 190, 210, 260, 320, 440, 480, 330, 340, 500, 580, 620, 720, 820, 860, and 900, the ES/3090-9000T Models 15T, 17T, 18T, 25T, and 28T, and the ES/3090 E-Models, S-Models, and J-Models.
2. The term *basic modes* is used throughout this publication to refer to processor complex modes of operation other than LPAR mode. For ES/3090 models and ES/3090-9000T models, the basic modes of operation are System/370 (S/370) mode and ESA/370 mode. For ES/9000 models, the basic mode of operation is ESA/390 mode. (For ES/9000 models, S/370 mode is available only under LPAR mode).
3. PR/SM also provides support for the VM/XA\* System Product enhancement for Multiple Preferred Guests when the processor complex is operating in ESA/370\* or ESA/390\* mode. This publication provides information about operation in LPAR mode only; for information about Multiple Preferred Guests, see *VM/XA SP Planning*, GC23-0378.



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## What Is Included in this Publication

The information presented in this publication is grouped into five chapters, includes an appendix and a glossary, and is organized as follows:

- **Chapter 1, “Introduction to LPAR Mode Operation,”** describes the prerequisites for establishing and using LPAR mode, the general characteristics and some potential applications for logical partitions, and migration and compatibility considerations for LPAR mode. Information about basic mode performance with PR/SM installed is also included.
- **Chapter 2, “I/O Configuration Planning for LPAR Mode,”** presents considerations and guidelines for use when planning the I/O configuration for LPAR mode, followed by guidelines for coding input/output configuration program (IOCP) specifications required for an LPAR input/output configuration data set (LPAR IOCDs).
- **Chapter 3, “Planning Logical Partitions,”** groups information in three major sections:
  - The section **“Planning Overview”** includes a list of the display frames and the characteristics of logical partitions that can be defined or changed using each display frame, describes when logical partition definitions can be changed, and provides an overview of performance and recovery considerations that apply to logical partition definitions.
  - The section **“Guidelines for Determining Logical Partition Characteristics”** provides guidelines for determining the processor resources to define to a logical partition.
  - The section **“Defining Logical Partitions”** describes the display frames, parameters, and service language commands that can be used to define logical partition characteristics or to change logical partition definitions.  
**Note:** The information presented in this section assumes that decisions about which parameters to specify have been made using the guidelines discussed in the previous section.
- **Chapter 4, “Processor Complex Operation in LPAR Mode”** provides information on operating the system console in LPAR mode, and describes the procedure for initializing the system for LPAR mode.
- **Chapter 5, “Managing Logical Partition Activity”** describes the display frames and the LPAR service language commands that can be used to monitor logical partition activity, provides logical partition performance information, and provides guidelines and suggestions for planning a recovery strategy for LPAR mode of operation.
- **Appendix A, “Architectural Differences in LPAR Mode”** describes observable architectural differences when ES/3090 and ES/3090-9000T Processor Complex models are operating in LPAR mode.
- The **“Glossary of Terms and Abbreviations”** in this publication should be used together with the glossaries in the appropriate reference publications.

---

## Reference Publications

The following publications provide information about the functions and characteristics of the ES/3090 Processor Complex, the ES/3090-9000T Processor Complex, and the ES/9000 Processor Complex.

### **For ES/3090 E-Models**

- *IBM 3090\* Processor Complex: Functional Characteristics, SA22-7121*
- *IBM 3090 Processor Complex: Channel Characteristics and Configuration Guide, SA22-7120*
- *IBM 3090 Processor Complex: Input/Output Configuration Program User's Guide and Reference, SC38-0038*
- *IBM 3090 Processor Complex E-Models: Operator Tasks for the System Console, SC38-0080*
- *IBM 3090 Processor Complex: Recovery Guide, SC38-0051*

### **For ES/3090 S-Models**

- *IBM ES/3090 Processor Complex S-Models: Functional Characteristics and Configuration Guide, SA22-7127*

### **For ES/3090 J-Models and ES/3090-9000T Models**

- *IBM ES/3090 Processor Complex J-Models and 9000T-Models: Functional Characteristics and Configuration Guide, GA22-7135*

### **For ES/3090 S-Models, J-Models, and ES/3090-9000T Models**

- *For ES/3090 models prior to SEC 227574, use IBM ES/3090 Processor Complex: Input/Output Configuration Program User's Guide and Reference, SC38-0066*
- *For ES/3090 models at SEC 227574 or later and for the ES/3090-9000T Models, use IBM Input/Output Configuration Program User's Guide, SC38-0097*
- *IBM ES/3090 Processor Complex: Operator Tasks for the System Console, SC38-0069*
- *IBM ES/3090 Processor Complex: Recovery Guide, SC38-0070*

### **For ES/9000 Processor Complex Models 190, 210, 260, 320, 440, and 480**

- *IBM ES/9000 Models 190, 210, 260, 320, 440, and 480: Introducing the Processor Functional Characteristics, GA23-0380*
- *IBM Input/Output Configuration Program User Guide, SC38-0097*
- *IBM ES/9000 Models 190, 210, 260, 320, 440, and 480 Operating Guide, GA23-0375*
- *IBM ES/9000 Models 190, 210, 260, 320, 440, and 480 Planning for Recovery, GA23-0376*

**For ES/9000 Processor Complex Models 330, 340, 500, 580, 620, and 720**

- *IBM ES/9000 Processor Complex Models 330, 340, 500, 580, 620, and 720: Functional Characteristics and Configuration Guide, GA22-7138*
- *IBM Input/Output Configuration Program User Guide, SC38-0097*
- *IBM ES/9000 Processor Complex: Operators Guide, SC38-0085*
- *IBM ES/9000 Processor Complex: Recovery Guide, SC38-0089*

**For ES/9000 Processor Complex Models 820, 860, and 900**

- *IBM ES/9000 Processor Complex Models 820, 860, and 900: Functional Characteristics and Configuration Guide, GA22-7139*
- *IBM Input/Output Configuration Program User Guide, SC38-0097*
- *IBM ES/9000 Processor Complex: Operators Guide, SC38-0086*
- *IBM ES/9000 Processor Complex: Recovery Guide, SC38-0090*

**For Control Program Publications:** Contact your installation management for information about the versions and release levels of the control programs that are available or planned for LPAR mode operation to ensure that only the publications at the appropriate version and release levels are used.

**For S/370, ESA/370, or ESA/390 Functions:** The following publications provide information about S/370, ESA/370, or ESA/390 functions (these publications are intended principally for use by assembler-language programmers although anyone concerned with the functional details of S/370, ESA/370, or ESA/390 will find them useful):

- *IBM System/370 Principles of Operation, GA22-7000*
- *IBM Enterprise Systems Architecture/370\* Principles of Operation, SA22-7200*
- *IBM Enterprise Systems Architecture/390\* Principles of Operation, SA22-7201*

**For ES Connection Concepts:** The following publication provides an introduction to ES Connection. Although it is intended primarily for those responsible for planning or implementing a system for the interconnection of computer processing, data, and users, it is useful to anyone who needs to understand basic ES Connection concepts.

- *Introducing Enterprise System Connection , GA23-0383*

**For Dynamic Storage Reconfiguration:** The following publication will be useful for anyone who needs to understand the commands, functions, and capabilities of dynamic storage reconfiguration:

- *MVS Guide for Processor Resource/Systems Manager Dynamic Storage Reconfiguration: MVS/System Product JES2 Version 3 and JES3 Version 3, GC28-1365*

**For Automatic Reconfiguration Management (ARF):** The following publication provides an overview of ARF and practical information for implementing and using ARF. The ARF section of this publication is intended primarily for planners and technical support personnel although anyone who needs information about ARF will find this publication useful:

- *MVS/ESA SP Version 4 Implementation Guide, GG24-3628*

**For Dynamic Reconfiguration Management (Dynamic I/O):** The following publication provides information about a dynamic I/O environment. It is intended primarily for system planners and technical support personnel although anyone who needs information about planning MVS applications using dynamic I/O will find this publication useful:

- *MVS/ESA Planning: Dynamic I/O Configuration*, GC28-1674

**For LPAR Management Time:** The following publications provide information about the enhanced RMF Partition Data Report that includes LPAR Management Time reporting. These publications are intended primarily for system programmers although anyone who needs information about RMF reporting, LPAR Management Time, or a partition's effective dispatch time will find these publications useful:

- *MVS/ESA Resources Measurement Facility User's Guide*, GC28-1058.
- *MVS/XA Resources Measurement Facility (RMF) Monitor I and II Reference and User's Guide*, LC28-1556.



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## Summary of Changes

Changes to this edition of the PR/SM Planning Guide have been made to support the topics listed below (editorial changes have been made throughout):

### ***Processor Complex Models Support***

- ES/9000 Processor Complex Model 860

### ***Programming Support***

- PR/SM LPAR Management Time Reporting supported by MVS/ESA SP RMF Version 4 Release 2 and MVS/XA RMF Version 3 Release 5

### ***Logical Partition Characteristics***

- Hardware System Area (HSA) allocations for ES/9000 Models 820, 860, and 900
- Automatic Reconfiguration Facility
- IOCDs values

### ***Operation Considerations***

- Dynamic reconfiguration management (Dynamic I/O)
- VARYCP CPn OFF service language command

### ***Display Frame Updates***

- For the Integrated Cryptographic Feature
  - LPSEC frame (terminology only)
- For ES/9000 Models 820, 860, and 900
  - LPCHNA frame (format only)
  - LPCHND frame (format only)
  - LPCTL frame parameter to set processing weights or to specify a dedicated processor

### ***Managing Logical Partition Activity***

- For MVS/ESA Logical Partitions
  - LPAR Management Time reporting is provided by an enhanced RMF Partition Data Report.



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This chapter describes the prerequisites for establishing and using LPAR mode operation, the characteristics and some potential applications of logical partitions, and migration and compatibility considerations for LPAR mode. Information about basic mode performance with PR/SM installed is also included.

---

## Prerequisites for LPAR Mode Operation

The prerequisites for establishing and using LPAR mode operation are as follows:

- Processor Resource/Systems Manager (PR/SM)
- Programming Compatibility
- Programming Support
  - Control Program Support
  - Input/Output Configuration Program (IOCP) Support
- Hardware Requirements
- Operator Training Requirements

## PR/SM

PR/SM enables logical partitioning of the processor complex, may provide additional byte-multiplexer channel capability, and supports the VM/XA System Product enhancement for Multiple Preferred Guests (see Note 1 in the “About This Publication” on page xi).

When PR/SM is installed, the processor complex (or side of a physically partitioned processor complex) can be initialized for logically partitioned operation.

### Logical Partitioning

PR/SM offers the capability to enable the logical partitioning function of the processor complex. When PR/SM is installed, two or three modes of operation can be enabled: S/370 mode (if offered on the model), ESA/370 mode (if offered on the model, supports 370-XA and ESA/370 operating systems), or ESA/390 mode (if offered on the model, supports 370-XA, ESA/370 and ESA/390 operating systems), and logically partitioned (LPAR) mode.

When the LPAR mode of operation is selected, the operator can define the resources that are to be allocated to each logical partition. Most resources can be reconfigured without requiring a power-on reset. After a S/370, ESA/370, or ESA/390 logical partition is defined and activated, a supported control program can be loaded into that logical partition.

**Note:** S/370 logical partitions can be defined for all processor complex models. ESA logical partitions can be defined for ES/3090 models, ES/3090-9000T models, and ES/9000 models.

Central storage and optional expanded storage are defined to logical partitions before partition activation. When a logical partition is activated, the storage resources are allocated in 1MB contiguous blocks. These allocations are static upon activation for some models, but may be dynamically reconfigured for other models. Sharing of allocated central storage or expanded storage among multiple logical partitions is not allowed.

Individual channel paths may be allocated to each logical partition. A channel path can be allocated only to one logical partition at a time. A device can be shared between logical partitions by using a separate channel path from each logical partition. Channel paths can be reconfigured between logical partitions, and the I/O configuration can be changed dynamically.

Central processors (CPs) can be dedicated to a single logical partition or shared among multiple logical partitions. CPs are allocated to a logical partition when the partition is activated. The use of CP resources shared between logical partitions can be limited and modified by operator commands while the logical partitions are active.

When an optional vector facility or optional Integrated Cryptographic Feature, is installed on a CP it is available for use by all partitions that will perform on that CP. CPs that are dedicated to a logical partition (including associated vector or cryptographic features) are available only to that logical partition.

### **Additional Byte-Multiplexer Channels**

PR/SM provides four additional byte-multiplexer-capable channels for: ES/3090 Models 120E, 150E, 180E, 200E, 300E, 100S, 120S, 150S, 170S, 110J, 120J, 150J, 170J, 180J, 200J, and 300J, and ES/3090-9000T Models 15T, 17T, and 18T, and provides eight additional byte-multiplexer-capable channels (four on each side) for: ES/3090 Models 280E, 400E, 500E, 600E, 250S, 280S, 380S, 400S, 500S, 600S, 250J, 280J, 380J, 400J, 500J, 600J, and the ES/3090-9000T Models 25T, and 28T.

**Note:** Eight byte-multiplexer channels are standard on ES/9000 Models 190, 210, 260, 440, 480, 330, 340, 500, and 580. Sixteen byte-multiplexer channels (eight on a side) are standard on ES/9000 Models 620, 720, 820, 860, and 900. For ES/9000 Models 820, 860, and 900 any parallel channel can be defined to operate in byte-multiplexer mode.

### **S/370 Support**

With PR/SM installed, all processor complexes support S/370 control programs in LPAR mode. This includes all of those models that do not support the S/370 basic mode.

ES Connection Channels cannot be defined or assigned to S/370 logical partitions. Only parallel channels can be defined to S/370 logical partitions.

**S/370 Channel Sets:** PR/SM logical partitions also support S/370 channels in one or, on some models, two channel sets (channel set 0 and channel set 1).

**Note:** For ES/3090 S-Models prior to or at SEC 223770, only one channel set is supported. For other ES/3090 models, two channel sets are supported on some models. See "Programming Support" on page 1-4 for more information.

Each S/370 logical partition activated with two channel sets will decrease by one the total number of logical partitions that can be concurrently activated, except on the ES/9000 Models 820, 860, and 900 where the number of S/370 logical partitions activated with two channel sets does not affect the total number of logical partitions that can be concurrently activated.

## Programming Compatibility

Generally, any control program, including its programming support, that complies with the compatibility requirements for a processor complex operates in a logical partition, with the following exceptions:

- VM/XA SF System Facility and VM/XA System Product Release 1 are not supported in a logical partition.
- VM/XA SP Releases 2 and 2.1 are supported for CMS-intensive production use on some models, and for V=V guest test and development environments only on other models. See "370-XA Control Programs" on page 1-5.

**Note:** PTFs for supported control programs must be applied and can be obtained from the IBM Software Support Center.

When the processor complex is operating in LPAR mode, the CPU IDs presented to logical partitions are different from CPU IDs when operating in one of the basic modes. This may affect the operation of software products that use the CPUID field. See "CPU IDs and CPU Addresses" on page 1-19 for more information.

## Programming Support

This section describes program support for LPAR mode operation. The following control programs are supported in logical partitions.

**Note:** Some characteristics of logical partitions are control-program dependent. Before planning or defining logical partition characteristics, contact your installation management to determine which control programs are in use or planned for LPAR mode operation.

### ESA/390 Control Programs

ESA/390 control programs operate in ESA/390 mode in a logical partition.

- MVS/ESA System Product Version 4 Release 1 and subsequent releases (MVS/ESA\*)

MVS/ESA SP Version 4 Release 1 and Release 2 supports operation on a maximum of six processors, a maximum of 1024MB of central storage, a maximum of 8192MB of expanded storage, the vector facility, the Integrated Cryptographic Feature, ES Connection Channels, and a maximum of 256 channel paths.

MVS/ESA SP Version 4 supports the automatic reconfiguration facility and RMF LPAR Management Reporting. This RMF support for PR/SM is provided by MVS/ESA RMF Version 4 Release 2.

#### Notes:

1. For ES/9000 models using MVS/ESA SP Version 4 Release 1, RMF Version 4 Release 2 or the RMF authorized program analysis report (APAR) OY29112 must be used to obtain RMF I/O activity and configuration information.
2. MVS/ESA SP Version 4 Release 2 supports dynamic reconfiguration management and console integration.

- VM/ESA System Product Version 1 (VM/ESA\*)

VM/ESA supports operation on a maximum of six processors, a maximum of 1024MB of central storage, a maximum of 8192MB of expanded storage, the vector facility, ES Connection Channels, and a maximum of 256 channel paths.

### **ESA/370 Control Programs**

ESA/370 control programs operate in ESA/370 mode or ESA/390 mode in a logical partition.

- MVS/System Product Version 3 Release 1 (MVS/ESA)

MVS/ESA supports operation on a maximum of six processors, a maximum of 1024MB of central storage, a maximum of 8192MB of expanded storage, the vector facility, the Integrated Cryptographic Feature, ES Connection Channels, and a maximum of 256 channel paths.

For MVS/ESA SP Version 3, RMF reporting includes LPAR Management Time. This RMF support for PR/SM is provided by MVS/ESA RMF Version 4 Release 2.

#### **Notes:**

1. For ES/9000 models using MVS/ESA SP Version 3, RMF Version 4 Release 2 or the RMF authorized program analysis report (APAR) OY29112 must be used to obtain RMF I/O activity and configuration information.
2. The Integrated Cryptographic Feature is supported on MVS 3.1.3 if the small programming enhancement (SPE) for the cryptographic feature is applied.

- VSE/System Product Version 1 (VSE/ESA)

VSE/ESA Version 1 supports operation on one processor, a maximum of 384MB of central storage, and a maximum of 256 channel paths.

**Note:** When VSE/ESA 1.1.0 is IPLed for S/370 mode, 16MB of central storage and a maximum of 16 channels in one channel set is supported.

### **370-XA Control Programs**

370-XA control programs operate in ESA/370 mode or in ESA/390 mode in a logical partition.

- MVS/System Product Version 2 Release 2 (MVS/XA\*) and subsequent releases

These releases of MVS/XA support operation on a maximum of six processors, a maximum of 256MB of central storage, a maximum of 2048MB of expanded storage, the vector facility, and a maximum of 128 channel paths.

- VM/XA System Product Release 2 (VM/XA SP) and subsequent release  
VM/XA SP supports operation on a maximum of six processors, a maximum of 512MB of central storage, a maximum of 4096MB of expanded storage, the vector facility, and a maximum of 64 channel paths.

**Notes:**

1. VM/XA System Product Releases 2 and 2.1 are supported for CMS-intensive production use in a logical partition on the following models: 180J, 200J, 280J, 300J, 380J, 400J, 500J, 600J, 15T, 17T, 18T, 25T, and 28T.
2. With RPQ 8P1367, VM/XA SP Releases 2 and 2.1 are supported for CMS-intensive production use in a logical partition on the following models: 180S, 200S, 280S, 300S, 380S, 400S, 500S, and 600S.
3. VM/XA SP and its V=V guests and applications (such as CMS and PROFS) are supported in a logical partition for test and development only on all other ES/3090 models.

- Transaction Processing Facility (TPF) Version 2 Release 4 and subsequent release and TPF Version 3 Release 1

TPF Version 3 Release 1 supports shared processors for one-way (uniprocessor) logical partitions. In all other environments only dedicated processors are supported. TPF Version 3 Release 1 supports ES Connection Channels.

The TPF Enabler RPQ is supported under PR/SM for TPF Version 3 Release 1. TPF releases are supported in environments where other TPF-specific processor RPQs are not required.

**S/370 Control Programs**

S/370 control programs operate in S/370 mode in a logical partition.

- MVS/System Product (MVS/SP\*) Version 1 Release 3.5 and subsequent releases (MVS/370)

MVS/SP Version 1 (MVS/370) supports operation in a S/370 logical partition on a maximum of two processors, a maximum of 64MB of central storage, and a maximum of 16 channels in each channel set.

- VM/System Product Releases 5 and 6 (VM/SP)

VM/SP supports operation in LPAR mode on a maximum of two processors, a maximum of 16MB of central storage, and with a maximum of 16 channels in each channel set.

- VM/System Product High Performance Option Releases 4.2, 5, and 6 (VM/SP HPO)

VM/SP HPO supports operation on a maximum of two processors, a maximum of 64MB of central storage, a maximum of 4096MB of expanded storage, the vector facility, and a maximum of 32 channels in each channel set.

- VSE S/370 Control Programs

The VSE S/370 control programs listed below support operation on one processor, a maximum of 16MB of central storage, and a maximum of 16 channels in one channel set.

- VSE/ESA Version 1 Release 1.1 and subsequent releases when operating in S/370 mode
- VSE/Advanced Functions Version 2 Release 1.1 and subsequent releases (VSE/AF V2)
- VSE/System Package Version 2 Release 1.1 and subsequent releases (VSE/SP V2)
- VSE/System Package Version 3 (VSE/SP V3)
- VSE/Advanced Functions Version 4 (VSE/AF V4)
- VSE/System Package Version 4 (VSE/SP V4)

- TPF Version 2 Release 3

TPF supports shared processors for 1-way (uniprocessor) logical partitions. In all other environments, only dedicated processors are supported.

### **Input/Output Configuration Program (IOCP) Support**

Operation in LPAR mode requires that IOCP IXP Version 2 and subsequent releases, or IOCP IOP Version 3 Level 1 and higher be used to generate an LPAR IOCDS. Only an LPAR IOCDS can be used to perform a power-on reset into LPAR mode.

**Note:** Any PTFs for supported versions of IOCP must be applied and can be obtained from the IBM Software Support Center. The MVS and VM versions of the IOCP IOP versions require specific PTFs that can be obtained from the IBM Software Support Center.

**IOCP IXP Versions::** The IXP version is used to configure ES Connection Channels, and can be used to configure parallel channels for processor complex models supported by Enterprise Systems Connection.

The following IOCP IXP versions are for use on ES/9000 models, ES/3090-9000T models, and on ES/3090 models at SEC 227574 or later.

- IOCP IXP Version 2
- A stand-alone IXP version of IOCP shipped with the processor complex.

**IOCP IOP Versions::** The following IOCP IOP versions are for use on ES/3090 models at an SEC level prior to 227574.

- IOCP IOP Version 3 Level 1 can generate an IOCDS for a maximum of four logical partitions.
- IOCP IOP Version 3 Level 5 can generate an IOCDS with parallel channels only.
- IOCP IOP Version 3 Level 6 can generate an IOCDS with both parallel channels and ES Connection Channels that attach to an ES Connection Converter.
- A stand-alone IOP version is shipped with the processor complex.

## **Hardware Requirements**

Logical partitions operate independently but can share access to I/O devices and processor complex resources. Because channel paths and storage may not be used simultaneously by multiple logical partitions, each **active** logical partition must have sufficient channel paths and storage to meet the particular requirements of that logical partition. Additional central storage, expanded storage, channels paths, consoles, and other I/O devices may be necessary for the planned configuration of logical partitions.

## **Operator Training Requirements**

A general knowledge of IBM ESA/370, ESA/390, and S/370 operations, and operator training on the processor complex is required by operators of the processor complex, LPAR planners, or other customer technical support personnel who operate the processor complex.

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## Logical Partitions

**Note:** This section provides an overview of logical partition characteristics. Some of the characteristics described in this section are model-dependent, SEC-level dependent, or control-program dependent. For this reason, all of the characteristics described below are not necessarily available on all processor complex models.

In LPAR mode, the resources of a processor complex can be distributed among multiple control programs that can run on the same processor complex simultaneously. Each control program has a set of resources called a logical partition.

A logical partition can be defined to include:

- One or more central processors
- Central storage
- One or more channel paths
- Optional expanded storage
- One or more optional vector facilities
- One or two optional Integrated Cryptographic Features

### Characteristics of Logical Partitions

Generally, logical partitions can be defined to have the following characteristics. For more information or details about exceptions to any of the characteristics described below, see "Guidelines for Determining Logical Partition Characteristics" on page 3-10):

- The maximum number of logical partitions that can be defined depends upon the number of logical partitions supported by a processor complex model.
- Logical partitions can operate in S/370, ESA/370, or ESA/390 mode.
- Logical partitions operate independently, except that they can share I/O devices.
- The storage for each logical partition is isolated. Central storage and expanded storage cannot be shared by logical partitions.
- On processor complex models with dynamic storage reconfiguration, a logical partition can release storage or attach storage to its configuration that is released when another logical partition is deactivated.
- Channel paths are assigned to logical partitions. Channel paths may be moved between logical partitions by commands from the system console. If the control program running in the logical partition supports physical channel path reconfiguration, channel paths may be moved among logical partitions by control program commands without disruption to the activity of the control program. A channel path may not be shared by two logical partitions at the same time.



- Logical partitions can be defined to have as many CPs as are configured (SI or PP). The processors may be dedicated to logical partitions or shared by them. Processors dedicated to a logical partition are not available to perform work for other active logical partitions. The resources of shared processors are allocated to active logical partitions as needed, and processor resources can be capped (limited) if required.

A mix of shared and dedicated logical processors can not be defined for a *single* logical partition. The processors for a logical partition are either all dedicated or all shared. However, a mix of *logical partitions* with shared processors and logical partitions with dedicated processors can be defined and activated concurrently.

- Logical partitions may be defined to have the following security-related characteristics: reservation of reconfigurable channel paths for exclusive use (unless overridden by operator action), limitation of authority to read and write any IOCDS in the configuration, limitation of the authority to retrieve CPU utilization values of all of the partitions in the configuration, the limitation of authority to change the I/O configuration dynamically, and the limitation of authority to issue certain control program instructions that affect other logical partitions.
- Logical partitions may be defined to have the following cryptographic characteristics: specification of a crypto-domain index assignment for the logical partition, cryptographic key storage unit assignment, the capability to enable/disable the cryptographic keyboard(s) for a logical partition, the capability to enable/disable the Integrated Cryptographic Feature in special security mode for a logical partition, and the capability to enable/disable the use of the Integrated Cryptographic Feature defined for a logical partition.

Figure 1-1 on page 1-11 shows some of the characteristics that can be defined for a logical partition. Each logical partition can be viewed as a processor unit operating within the real processor unit.

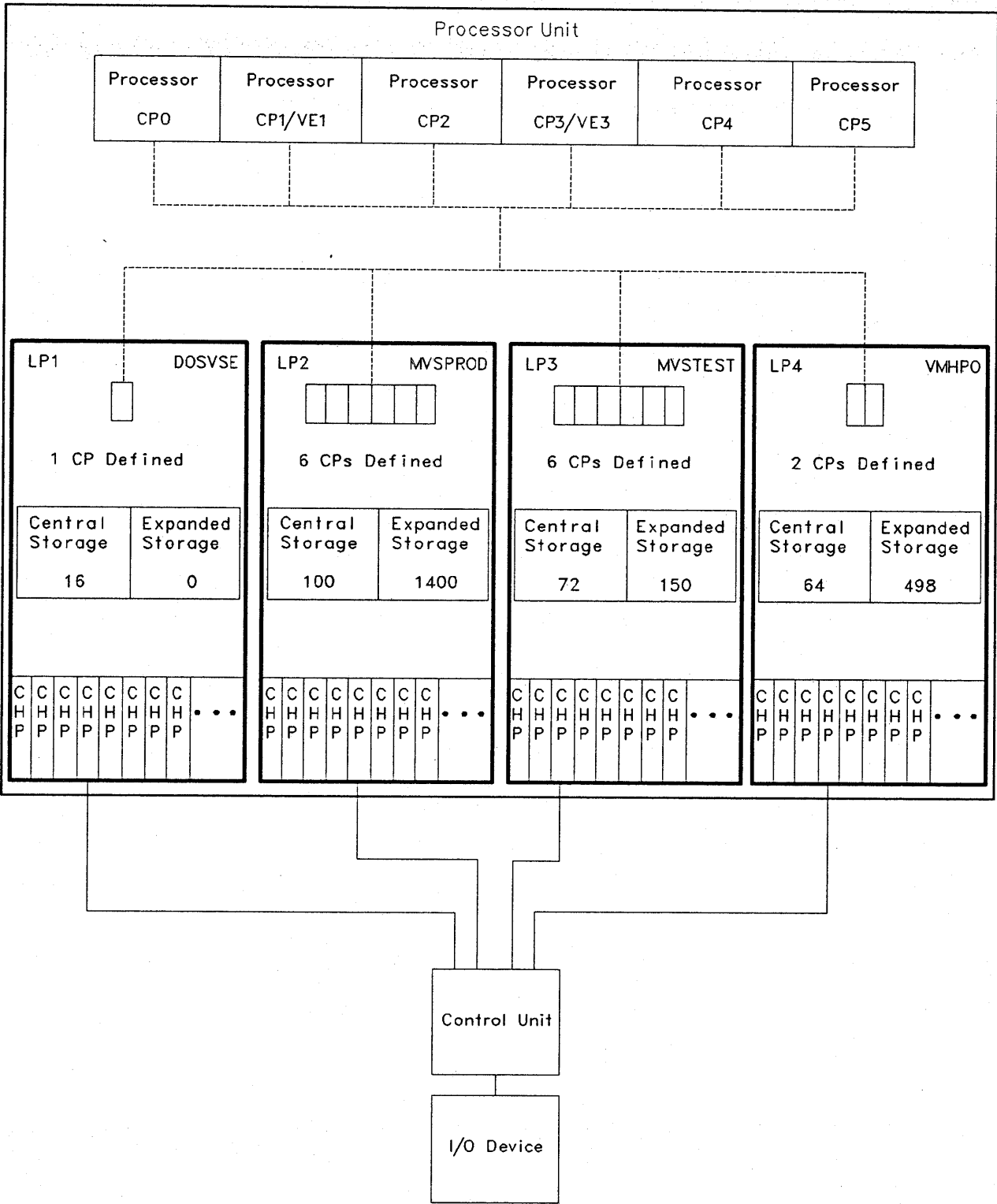


Figure 1-1. Illustration Showing Some Characteristics of Logical Partitions

## Potential Applications

The use of logical partitions allows multiple systems, including the I/O for the systems, to be migrated to a single processor complex while maintaining the I/O performance, recovery, and multipathing capability of each system, and with minimum impact to the system generation procedures.

Logical partitions are suitable for consideration in the following environments:

### **Consolidation**

Multiple production system images can be consolidated onto one processor complex without having to merge them into one image.

### **Migration**

Control programs or applications can be migrated by running the old and new systems or applications in independent logical partitions that are active on the same processor complex at the same time.

### **Production and Test**

Multiple production and test systems can run on the same processor complex at the same time.

### **Extended Recovery Facility (XRF)**

Primary and alternate XRF systems can run on one processor complex. Multiple and alternate XRF systems can run on one processor complex.

### **Communications management configuration (CMC)**

The communications management configuration (CMC) machine, usually run on a separate processor complex, can be run as a logical partition on the same processor complex.

### **Departmental Systems**

Multiple applications can be isolated from one another by running each in a separate logical partition.

### **Constrained Systems**

Those systems that cannot fully use a large system because of storage constraints can alleviate the problem by using logical partitions to define multiple system images on the same processor complex.

### **Diverse Workloads**

Interactive workloads such as the Customer Information Control System (CICS) and time-sharing option (TSO) can be isolated by running each in a separate logical partition.

## Examples of Logical Partition Applications

Figure 1-2 through Figure 1-4 on page 1-14 show examples of how logical partitions on a processor complex can be used to support multiple systems.

Figure 1-2 represents the migration of an MVS/XA and two MVS/370 systems onto a single ES/9000 Processor Complex operating in LPAR mode. These systems, which were running on three separate IBM ES/4381\* Processors, now operate as three logical partitions on a single processor complex. Two logical partitions are each running an MVS/370 system in S/370 mode and one is running an MVS/XA system in ESA/370 mode.

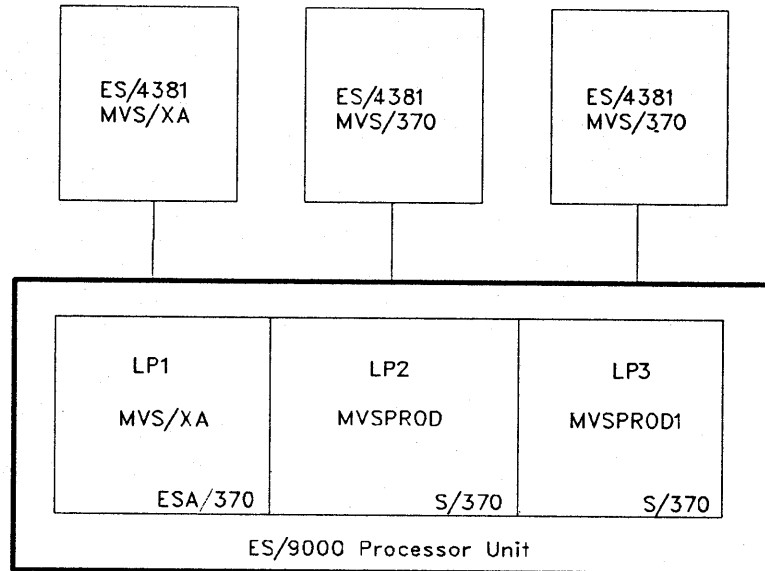


Figure 1-2. Example Representing the Migration of Three MVS Production Systems to Logical Partitions on a Single Processor Complex

Figure 1-3 represents an ES/9000 Processor Complex operating in LPAR mode with four different systems: an MVS production system, an MVS test system, a VM/SP HPO system, and an MVS/ESA system.

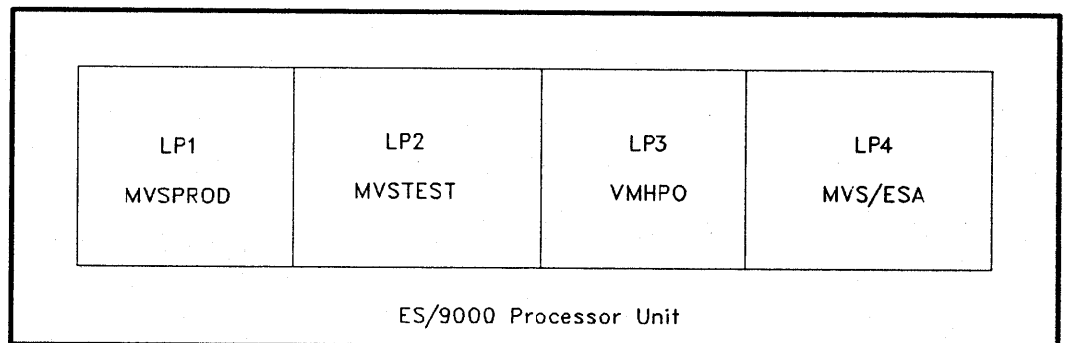
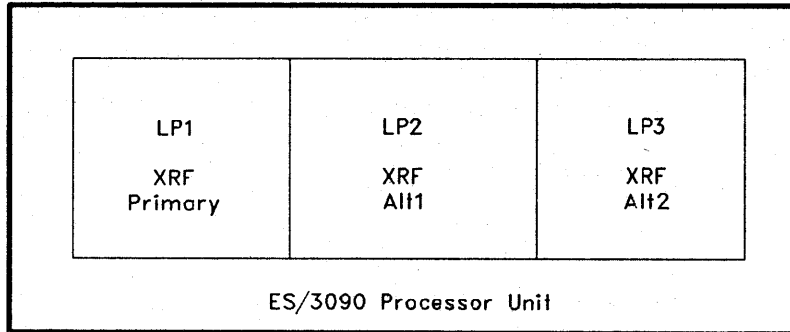


Figure 1-3. Example Representing a Processor Complex Operating in LPAR Mode with Four Different Control Programs

Figure 1-4 represents an ES/3090 Processor Complex in LPAR mode with three logical partitions: an active XRF system, an alternate XRF system, and an alternate for another primary XRF system.



*Figure 1-4. Example Representing LPAR Mode Support for Three XRF Systems on a processor complex*

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## Compatibility and Migration Considerations

This section provides migration and compatibility information for LPAR mode operation.

### Duplicate Device Numbers

When multiple systems are migrated to a processor complex operating in LPAR mode, the combination of systems could include different devices or shared devices with identical device numbers. Each system can operate in a logical partition without changing the device numbers as long as identical device numbers do not occur in the same logical partition.

Duplicate device number conflicts may also occur when the I/O configuration is reconfigured. For example, if a reconfigurable channel path is reassigned to another logical partition and devices attached to the channel path have device numbers that are already assigned in the receiving logical partition to other online channel paths, a conflict results. If IOCP generates an LPAR IOCDs without error, the initial configuration contains no duplicate device number conflicts in a logical partition.

Device number conflicts are also detected during the execution of commands that change the I/O configuration (the CHPID command or a control program configuration command) or during logical partition activation.

### Control Program Function in LPAR Mode

**Note:** Specific program temporary fixes (PTFs) for supported control programs must be applied and can be obtained from the IBM Software Support Center.

A supported control program functions in a logical partition as it does in one of the basic modes, with the following exceptions:

#### ***MVS/ESA and MVS/IXA***

- LPAR mode supports only static (power-on-reset required) physical partitioning (SI to PP) or merging (PP to SI).
- Physical reconfiguration, either offline or online, of processor complex resources (except channel paths) is not supported in LPAR mode. The reconfigurable storage unit (RSU) parameter should be set to 0 when dynamic storage reconfiguration is not available to the processor complex.

When dynamic storage reconfiguration is available, the RSU parameter should be set to the same value that is specified for the CENTRAL RSVD value on the Logical Partition Definition (LPDEF) frame. Central storage, expanded storage, processors, and vectors can be *logically* reconfigured offline or online by means of MVS operator commands in LPAR mode.

**Note:** The term *physical reconfiguration* means to include a resource in or to remove a resource from the physical configuration. This means that from a hardware perspective, the resource is or is not available in the configuration. The term *logical reconfiguration* means that from the perspective of the control program, the resource is or is not available, independent of its status in the physical configuration.

- Reconfiguration, either offline or online, of channel paths by MVS operator commands is supported in LPAR mode. This capability also allows channel paths to be moved among logical partitions using MVS operator commands.

- Preferred paths to a device are not supported in LPAR mode. If the preferred path parameter is specified in an LPAR IOCDs, it is ignored.
- Use of the SHAREDUP keyword on the IODEVICE statement is not recommended in LPAR mode. If used, MVS/XA and MVS/ESA treat the device as a SHARED device.
- Each MVS/ESA or MVS/XA logical partition can run the Resource Measurement Facility (RMF). RMF enhancements for PR/SM allow a single logical partition to record system activities, if allowed by the control performance (CONTROL PRF) data parameter on the Logical Partition Security (LPSEC) frame. This information is contained in the Partition Data Report.

For MVS/ESA SP Version 4 and MVS/ESA SP Version 3, RMF reporting includes LPAR Management Time. This RMF support is provided by MVS/ESA RMF Version 4 Release 2 and MVS/XA RMF Version 3 Release 5 on the following processor models: ES/9000, ES/9000-3090T, and ES/3090 J-Models (180, 200, 280, and above).

**Notes:**

1. To obtain RMF I/O activity and configuration information on ES/9000 models with MVS/ESA Version 4 Release 1 or MVS/ESA Version 3, RMF Version 4 Release 2 or the RMF authorized program analysis report (APAR) OY29112 must be used.
2. System Management Facility (SMF) type 70 records, which are created by RMF running in a logical partition with the appropriate PTF installed, should only be reduced by an RMF postprocessor running on a system (with or without PR/SM) with the appropriate PTF installed. If RMF postprocessing is performed on a different system, the appropriate PTF must also be installed.

If LPAR mode SMF 70 records are processed by RMF without the PTF, two errors occur in the RMF postprocessor:

- A 100% busy condition appears in the CPU Interval Report.
- An OC4 abnormal end occurs if the CPU Duration Report is requested, and that report is not printed.

**Note:** The appropriate PTFs can be obtained from the IBM Software Support Center.

**MVS/370**

- VARY commands issued in a logical partition that is running MVS/370 are executed logically but not physically.
- RMF can run in an MVS/370 logical partition.

However, the RMF enhancements available to MVS/XA and MVS/ESA are not available to MVS/370. An RMF enhancement for channel utilization in MVS/370 logical partitions

Maintenance support for RMF/370 to report CPU utilization accurately for shared logical partitions is provided by APAR OY24796 (available since September, 1989).

- Use of the SHAREDUP keyword on the IODEVICE statement is not recommended in LPAR mode. If used, MVS/370 treats the device as a SHARED device.

**VM/SP and VM/SP HPO:** For channel utilization statistics in VM MONITOR records and the accuracy of the VM/SP and VM/SP HPO Diagnose X'70' accounting interface as described below, corrective service is available (since March, 1989).

**Note:** Information on the updates and corequisite SEC levels for each system can be verified and obtained from the Large Systems Support Center through your service representative. Both hardware and software changes must be implemented.

- VM/SP and VM/SP HPO use the Test Channel (TCH) instruction to determine whether a S/370 channel is busy or not busy at a frequency set by the user for the high-frequency sampling interval of the VM Monitor. Under LPAR mode, whether VM is running in a shared or dedicated partition, the hardware always returns a condition code of 0, which causes the VM Monitor Facility to report in its MONITOR records that the channel was not busy during that measurement interval. This results in the VM MAP Channel Utilization Summary report showing 0% busy for all channels even though the channel I/O counts and rates are accurately reported.

**Note:** For channel utilization statistics in VM MONITOR records when the corrective service is applied, the VM MAP (no change to VM MAP is required) correctly reports channel utilization statistics for VM/SP Release 5, VM/SP Release 6, VM/SP HPO Release 5, and VM/SP HPO Release 6.

- The VM/SP and VM/SP HPO DIAGNOSE X'70' accounting interface does not provide accurate information for shared partitions in LPAR mode. This inaccuracy is caused by this DIAGNOSE instruction relying upon the time-of-day (TOD) clock for its measurements. The DIAGNOSE instruction equates elapsed time with central processing unit (CPU) busy time that is not valid in a shared partition and will give overstated results. The estimation of this overstatement is not predictable or repeatable.

**Note:** For guest programs using DIAGNOSE X'70' to calculate CPU times when the corrective service is applied, CPU times are calculated with the same accuracy as they are for a basic mode. It is recommended that SQL/DS users apply this corrective service before migrating a VM/SP Release 5, VM/SP Release 6, or VM/SP HPO Release 5 system to a shared logical partition.

#### **VM/SP HPO**

- VARY commands issued in a logical partition that is running VM/SP HPO are executed logically but not physically.
- The preferred machine assist (PMA) feature is not supported when VM/SP HPO is running in a logical partition. Users desiring the PMA level of performance should consider running the MVS guest in its own logical partition.

**Note:** The shadow-table-validation function of Virtual Machine Assist (VMA) and the VM Assists for CPU Timer are not available in LPAR mode.



### **VSE**

- VSE using Virtual Address Extension (VAE) should be run in its own logical partition rather than as a guest of VM.

When VSE is run in its own logical partition, VSE using VAE under VM in LPAR mode is more severely degraded than when running under VM in one of the basic modes because the shadow-table-validation function of VMA (Virtual Machine Assist) and the VM Assists for CPU Timer are not available in LPAR mode.

### **EREP**

- Each control program operating in a logical partition has its own environmental recording, editing, and printing (EREP) processing.

## CPU IDs and CPU Addresses

Application packages and software products that are licensed to run under specific CPU identification (CPU ID) information should be checked because they may need to be updated for LPAR mode operation.

CPU ID information is system-generated for each processor in the logical partition (logical processor) during the activation of a logical partition, and consists of a version code for the processor complex model, a CPU identification number that is unique for each logical processor, a model number for the processor unit machine type, and four hexadecimal digits of zeros.

The Store CPU ID (STIDP) instruction stores the CPU ID for each logical processor in storage in the following format (Figure 1-5):

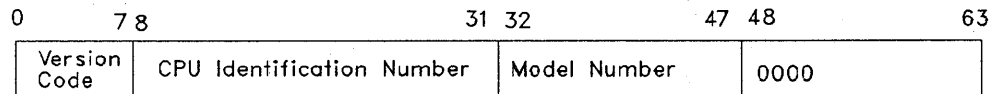
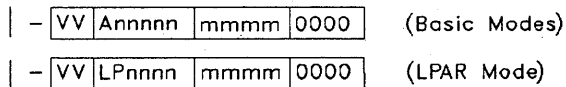


Figure 1-5. Format of the CPU ID for LPAR Mode and the Basic Modes

Figure 1-6 shows the format of the CPU identification number (bits 8 through 31 of the CPU ID format) for the basic modes and LPAR mode.



Legend:

- V Version code digit
- A CPU address for a central processor
- L Logical CPU address for a logical processor
- P Logical partition identifier
- n Digit derived from the serial number
- m Model number digit or character for the processor unit machine type

Figure 1-6. Detailed Format of the CPU ID for LPAR Mode and the Basic Modes

**Note:** For the version codes and CPU addresses for each processor complex model, see to the appropriate *Functional Characteristics* publication cited in the section "Reference Publications" on page xiii.

**CPU ID Fields:** The CPU identification number, with the version code and the model number, permits a unique CPU ID for each logical processor.

- The **version code** is unique for each processor complex model, and is not affected by the operating mode (basic or LPAR) of the processor complex.
- For the basic modes, the **CPU identification number** consists of the CPU address of the central processor and digits derived from the serial number of the processor unit.
- For LPAR mode, the **CPU identification number** for each logical processor (see Figure 1-6 on page 1-19) consists of a one-digit logical CPU address, a one-digit logical partition identifier, and digits derived from the serial number of the processor unit.
  - The **CPU address** for a logical processor is a logical address and not a physical CPU address, although the same CPU address digits that are used for central processors in the basic modes are used for logical processors in LPAR mode.

**Note:** For the Models 280E, 250S, 280S, 250J, 280J, 25T, and 28T, operating in a single-image configuration, the CPU addresses in LPAR mode are 1 and 2, and the CPU addresses in the basic modes are 1 and 3.

Processor addressing *within* each logical partition starts with the lowest CPU address of the CPUs installed in the configuration. For example, in a four-way logical partition defined on a Model 600E in a single-image configuration, the logical CPU addresses are 0, 1, 2, and 3; in a two-way logical partition defined on a physically partitioned Model 600E (side 1), the logical CPU addresses are 3 and 4.

Logical CPU addresses are not affected by the type of processors defined (whether shared or dedicated) for a logical partition.

- The **logical partition identifier** is specified using the Logical Partition Definition (LPDEF) frame after a power-on reset for LPAR mode, and must be unique for each active logical partition in the configuration. When in a physically partitioned configuration, the same logical partition identifier can be used on both sides of the physically partitioned configuration.
- For LPAR mode and the basic modes, the following **model number** (processor unit machine type) should be specified as indicated below.
  - **3090** for ES/3090 and ES/3090-9000T Models.
  - **9121** for ES/9000 Models 190, 210, 260, 320, 440, and 480.
  - **9021** for ES/9000 Models 330, 340, 500, 580, 620, 720, 820, 860, and 900.

**Examples of CPU ID Information:** The following examples show the format and contents of the CPU ID information that is stored by the STIDP instruction for logical processors in active logical partitions.

Figure 1-7 shows the CPU ID information for an ES/3090 Model 400J in a single-image configuration with three active logical partitions.

Partition Name	Logical Partition Identifier	No. of Processors Defined	CPU ID Returned by STIDP
DOSVSE	1	1	43 119999 3090 0000
MVSTEST	2	1	43 129999 3090 0000
MVSPROD	3	4	43 139999 3090 0000 43 239999 3090 0000 43 339999 3090 0000 43 439999 3090 0000

*Figure 1-7. CPU IDs for an ES/3090 Model 400J (Single-Image Configuration)*

Figure 1-8 shows the CPU ID information for an ES/3090 Model 600J in a physically partitioned configuration (side 0) with four active logical partitions.

Partition Name	Logical Partition Identifier	No. of Processors Defined	CPU ID Returned by STIDP
DOSVSE	1	1	63 012345 3090 0000
VMHPO	2	1	63 022345 3090 0000
MVSTEST	3	2	63 032345 3090 0000 63 132345 3090 0000
MVSPROD	4	3	63 042345 3090 0000 63 142345 3090 0000 63 242345 3090 0000

*Figure 1-8. CPU IDs for an ES/3090 Model 600J (Physically Partitioned Configuration, Side 0)*

Figure 1-9 shows the CPU ID information for an ES/3090 Model 600J in a physically partitioned configuration (Side 1) with four active logical partitions.

Partition Name	Logical Partition Identifier	No. of Processors Defined	CPU ID Returned by STIDP
DOSVSE	1	1	63 312345 3090 0000
VMHPO	2	1	63 322345 3090 0000
MVSTEST	3	2	63 332345 3090 0000 63 432345 3090 0000
MVSPROD	4	3	63 342345 3090 0000 63 442345 3090 0000 63 542345 3090 0000

Figure 1-9. CPU IDs for an ES/3090 Model 600J (Physically Partitioned Configuration, Side 1)

**Note:** In a physically partitioned processor complex, identical logical partition identifiers may be used because the CPU addresses make the CPU ID unique.

## HSA Allocation on Processor Complex Models Supporting 24K UCWs

Hardware System Area (HSA) allocation on all processor complex models starts at the top of real storage and extends in a downward direction in increments of 64KB segments until HSA requirements are met. 24K UCWs (subchannels) are supported on ES/9000 models, ES/3090-9000T models, and on ES/3090 Models 180S, 200S, 280S, 300S, 380S, 400S, 500S, 600S, 180J, 200J, 280J, 300J, 380J, 400J, 500J, and 600J. (The ES/3090 E-Models support 4KB UCWs.)

**For Basic Modes:** HSA allocation and expansion on ES/3090 models supporting 24K UCWs for the basic modes is in increments of 64KB segments. HSA allocation for all purposes can be up to 4MB.

**Note:** The amount of central storage available for use by the control program is reduced by an amount equal to the HSA size.

**For LPAR Mode:** Central storage used to meet HSA allocation requirements on processor complex models supporting 24K UCWs for LPAR mode is unavailable for assignment to logical partitions.

- For ES/3090 S-Models at SEC 223765 and SEC 223770, the initial HSA allocation is 4MB. Storage containing additional HSA segments is assignable to logical partitions, but a control program running in a logical partition cannot use storage containing HSA segments.
- For ES/3090 S-Models (Models 180S and up, except Model 250S) at SEC 223775 and later, for the J-Models (Models 180J and up, except Model 250J), and the T-Models the HSA allocation is the same as that for SEC levels prior to SEC 223775, **except** that the area made unavailable for assignment to logical partitions consists of the initial HSA allocation **plus** any 1MB of storage that contains only HSA segments.

- For all processor complex models (except ES/9000 Models 820, 860, and 900):
  - The minimum amount of storage not assignable to logical partitions is 4MB. The maximum amount of storage not assignable to logical partitions is 8MB.

**Note:** A boundary floats between 4MB and 8MB, and is adjusted (in 1MB increments) depending on HSA allocation requirements.

- When HSA allocation for any reason overflows a full megabyte boundary, the amount not assignable to logical partitions is adjusted downward to include the entire megabyte containing only HSA segments as shown in Figure 1-10.

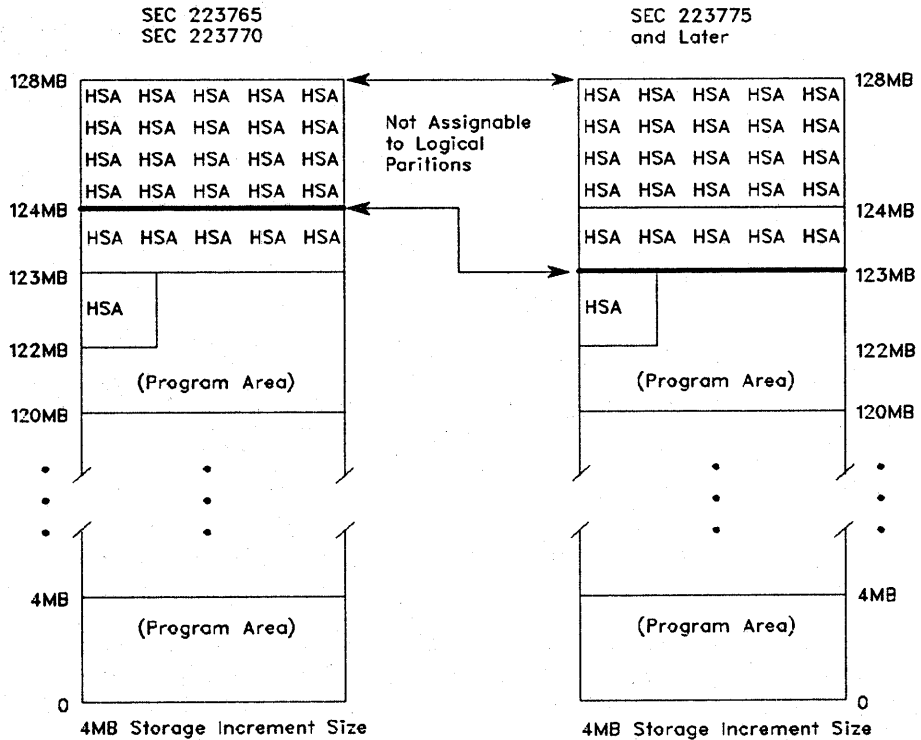


Figure 1-10. Hardware System Area Overflow Beyond 1MB

- For ES/9000 Models 820, 860, and 900, HSA allocation can vary from 12MB to 20MB. The actual amount allocated is a function of the number of active logical partitions, and the number of UCWs and ESCON CHPs specified in the IOCDs.

Logical Partitions	UCWs (Subchannels)		ESCON CHPs	HSA (MB)
1 to 3	up to 12K	and	up to 64 CHPs	12MB
1 to 3	more than 12K	or	more than 64 CHPs	16MB
4 to 5	up to 24K	and	up to 256 CHPs	16MB
6 to 7	up to 12K	and	up to 64 CHPs	16MB
6 to 7	more than 12K	or	more than 64 CHPs	20MB

## TOD Clock Processing in LPAR Mode

The Enable Automatic TOD setting must be enabled for LPAR mode operation (the TOD key on the system console and the TOD service language command are disabled in LPAR mode). The Set Clock (SCK) instruction is always effective in each logical partition and can be used to set a TOD clock value for the logical partition. Setting the TOD clock for one processor in the logical partition sets the TOD clock for all the processors in the logical partition, but does not affect the processors in any other logical partition. The TOD clock value is used for the duration of the logical partition activation, or until a subsequent SCK instruction is executed.

**Note:** The Enable Automatic TOD setting is available in both LPAR and basic modes, but must be enabled for a power-on reset into LPAR mode; it is optional for a power-on reset into one of the basic modes. To ensure that the correct time is set, see the operation considerations and procedures described in the Section, "Activating a Logical Partition" on page 4-19.

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## Basic Mode Performance with PR/SM Installed

A set of MVS/SP 2.2.0 TSO measurements were completed in basic mode on an ES/3090 Model 200E with PR/SM installed and then compared with measurements taken on an ES/3090 Model 200E without PR/SM installed. Measurements were made at 70% and 90% CPU utilization. The resulting internal throughput rates (ITRs) were within 0.2% of each other and the response time varied by less than 3%. These results are considered to be identical because they are within the limits of the expected measurement variation.

For standard MVS workloads not using the Start Interpretive Execution (SIE) instruction, basic mode measurements with or without PR/SM are expected to yield the same results. Minor differences may be detectable with certain performance kernels.

ES/3090 E-Model environments that use SIE may experience some benefit from PR/SM when running in ESA/370 mode. The benefit depends on the frequency of SIE use and is expected to be in the range of 0% to 5%. Environments that use SIE include VM/XA SP1, VM/XA SP2, and VM/XA SF 2.

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This chapter describes the planning considerations and guidelines for use when planning the I/O configuration for LPAR mode, followed by guidelines for coding IOCP specifications required for an LPAR IOCDs.

**Note:** The information in this chapter is intended for use by LPAR mode planners who understand the IOCP configuration and coding requirements that are described in the appropriate *IOCP Users Guide* publication cited in "Reference Publications" on page xiii.

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## Planning Considerations

This section provides information for use when planning the characteristics of the I/O configuration, or determining IOCP requirements, and provides guidelines for setting up the I/O configuration.

### PR/SM Support

PR/SM does not need to be installed to generate an LPAR I/O configuration data set (IOCDs), but PR/SM must be installed to power-on reset into LPAR mode using an LPAR IOCDs.

### Control Program Support

The maximum number of supported devices is limited by the control program. In planning an I/O configuration for LPAR mode, installation management should be aware of the maximum number of devices supported by the control program run in each logical partition. See Table 3-1 on page 3-11.

### Input/Output Configuration Program (IOCP) Support

The IOCP versions discussed in this section provide support for the ES/3090 Processor Complex, the ES/3090-9000T Processor Complex, and the ES/9000 Processor Complex as indicated below.

#### IOCP IXP Versions

The IOCP IXP versions support ESCON Channels and parallel channels.

##### *IXP Version 2 Level 0 and higher:*

- IXP Version 2 is **required** for any I/O configuration on ES/3090 models at SEC 227574 or later, ES/3090-9000T Models, and ES/9000 models.
- As many as seven logical partitions can be defined.

##### *Stand-Alone Version of IOCP*

- A stand-alone version of IOCP is shipped with the processor complex and can be run only when the processor complex is operating in one of the basic modes.
- For control programs other than MVS or VM, only the stand-alone version of IOCP can be used.

**Prior Levels of IOCP:** The IXP version of IOCP is incompatible with IOP (prior levels) versions of IOCP. IXP versions cannot report on IOCDs generated by IOP versions, and IOP versions cannot report on IOCDs generated by IXP versions.

## **IOCP IOP Versions**

The following IOCP IOP versions apply only to ES/3090 models at SEC levels prior to 227574.

### ***IOCP IOP Version 3 Level 1***

- As many as four logical partitions can be defined on ES/3090 E-Models and the Models 100S, 120S, 150S, 170S, 250S, 250S, 120J, 150J, 170J, and 250J. As many as six logical partitions can be defined on all other ES/3090 models.

***IOCP IOP Version 3 Level 1 and higher:*** The following coding specifications are allowed for IOCP IOP Version 3 Level 1 and higher:

- As many as four channel paths can be defined to a device from a logical partition. Device sharing among logical partitions is accomplished by having as many as four channel paths from each logical partition to a device and specifying the device for each logical partition. Keep in mind, however, that IOCP still allows only four channel paths to a logical control unit.
- Four digits can be used for the control unit number; this facilitates the association of logical partitions with control units. See "IOCP Coding Guidelines and Examples" on page 2-15.
- CHPIDs 00-07 (side 0) and 40-47 (side 1) can be defined as byte-multiplexer-capable channel paths.  
**Note:** No validity checking is performed to ensure that the installed hardware is capable of supporting these channel paths as byte multiplexer.
- Twelve IOCDs can be written. Any mix of 12 IOCDs is allowed; they may be all LPAR, all BASC, or any combination of the two. IOCP Version 3 can be run against IOCP input decks prepared for either LPAR mode or one of the basic modes.

### ***IOCP IOP Version 3 Level 2 and Higher***

- As many as four logical partitions can be defined on ES/3090 E-Models and the Models 100S, 120S, 150S, 170S, 250S, 110J, 120J, 150J, 170J, and 250J. As many as seven logical partitions can be defined on all other ES/3090 models.

**Note:** ES/3090 models at SEC 223770 support a maximum of six logical partitions.

### ***Stand-Alone Version of IOCP***

- A stand-alone version of IOCP is shipped with the processor complex and can be run only when the processor complex is operating in one of the basic modes.
- For control programs other than MVS or VM, only the stand-alone version of IOCP can be used.

### ***Prior Levels of IOCP***

- IOCP Version 3 Level 1 and higher can read and report on IOCDs produced by prior levels of IOCP.
- Prior levels of IOCP cannot read and report on IOCDs produced by IOCP Version 3 Level 1 and higher.

## IOCP Basic Mode and LPAR Mode Compatibility

IOCP can be used to generate IOCDs for both basic and LPAR modes. This makes it possible to use the same input decks for either mode. Information specific to either mode is ignored, when necessary, as indicated below.

**Note:** If duplicate device numbers are used to generate an LPAR IOCD, the same IOCP input deck cannot be used to generate an IOCD for one of the basic modes.

- IOCP accepts and checks the syntax of S/370 information when generating an LPAR IOCD, but the channel set definitions and channel addresses are not stored in the IOCD. For LPAR mode, S/370 channel definition is by frame (the LPCHND frame) selection from the system console.
- IOCP accepts and checks the syntax of the IODEVICE PATH= keyword when generating an LPAR IOCD, but the preferred path specification is ignored in the IOCD.

**Note:** Use of the SHAREDUP keyword in the IODEVICE statement is not recommended in LPAR mode. If used, MVS/370, MVS/XA, and MVS/ESA treat the device as a SHARED device.

- IOCP accepts the PARTITION=(name[,REC]) keyword when generating a BASIC IOCD, but the value in the IOCD is ignored.

An LPAR IOCD can be used to perform a power-on reset only into LPAR mode, and a BASIC IOCD can be used to perform a power-on reset only into a basic mode.

## Characteristics of an LPAR Mode IOCD

The definitions for channel paths, control units, and I/O devices are processed by the IOCP and stored in an IOCD. During initialization of the processor complex, the definitions of a selected IOCD are then transferred to the hardware system area (HSA), a working area of central storage. The IOCD is used to define the I/O configuration data required by the processor complex to control I/O requests.

Channel paths in an LPAR IOCD are assigned to logical partitions rather than to a single processor complex. The characteristics of an LPAR IOCD are the following:

- Logical partitions are named in an LPAR IOCD.
- All channel paths defined in IOCP must be assigned to logical partitions in an LPAR IOCD.
- Channel paths in an LPAR IOCD can be specified as reconfigurable, which indicates that the channel path can be moved among multiple logical partitions.
- Device numbers in an LPAR IOCD may be duplicated within a single IOCP input deck, but the device numbers cannot be duplicated within a logical partition. See "IOCP Coding Guidelines and Examples" on page 2-15.

## Maximum Number of Logical Partitions

The number of logical partitions (and logical partition names) are defined in the LPAR IOCDS. The maximum number of logical partitions that can be defined depends on the processor complex model installed and the IOCP version level that is used.

### Notes:

1. Each S/370 logical partition activated with two channel sets will decrease by one the total number of logical partitions that can be concurrently activated, except for the ES/9000 Models 820, 860, and 900 where the number of S/370 logical partitions activated with two channel sets does not affect the total number of logical partitions that can be concurrently activated.
2. See "Determining the Size of the I/O Configuration for LPAR Mode" on page 2-6 before making decisions about the number of logical partitions to define.

**For ES/3090 E-Models:** A maximum of four logical partitions may be defined. In the physically partitioned configuration, a maximum of eight logical partitions is allowed (a maximum of four logical partitions may be defined on each side).

**For ES/3090 S-Models:** The maximum number of logical partitions that may be defined is as follows:

- A maximum of four logical partitions may be defined on Models 100S, 120S, 150S, 170S, and 250S. (In the physically partitioned configuration, as many as four logical partitions may be defined on each side of the Model 250S.)
- A maximum of seven logical partitions may be defined on Models 180S, 200S, 280S, 300S, 380S, 400S, 500S, and 600S. (In the physically partitioned configuration, as many as seven logical partitions may be defined on each side of Models 280S, 380S, 400S, 500S, and 600S.)

**For ES/3090 J-Models and 9000T-Models:** The maximum number of logical partitions that may be defined is as follows:

- A maximum of four logical partitions may be defined on Models 110J, 120J, 150J, 170J, and 250J. (In the physically partitioned configuration, as many as four logical partitions may be defined on each side of the Model 250J.)
- A maximum of seven logical partitions may be defined on Models 180J, 200J, 300J, 280J, 380J, 400J, 500J, 600J, 15T, 17T, and 18T. (In the physically partitioned configuration, as many as seven logical partitions may be defined on each side of Models 280J, 380J, 400J, 500J, 600J, 25T, and 28T.)

**For ES/9000 Models:** A maximum of seven logical partitions may be defined on ES/9000 Models (In the physically partitioned configuration, as many as seven logical partitions may be defined on each side of Models 620, 720, 820, 860, and 900.)

## Determining the Size of the I/O Configuration for LPAR Mode

Before making decisions about the number of logical partitions to define and the number of devices shared between logical partitions, determine the size of the current I/O configuration (number of logical control units and subchannels) by reviewing the I/O Device Report for the current IOCDs. The limits on the number of subchannels and logical control units may constrain the number of channel paths that can be defined as reconfigurable.

If the I/O configuration is constrained because of these limits, use the following guidelines to control the number of logical control units and subchannels that will be generated for an LPAR mode IOCDs:

- Limit the degree of device sharing between logical partitions to that set of devices that must actually be shared.
- Specify the reconfigurable option only for those channel paths that must be specified as reconfigurable; that is, those channel paths that are to be assigned to a S/370 mode logical partition or those channel paths that must be moved among logical partitions.
- Define only those devices that are actually connected to the processor complex.

### Maximum Size of the I/O Configuration for LPAR Mode

The maximum size of the I/O configuration supported by IOCP for LPAR mode is the same as it is for the basic modes, and is determined by the maximum number of supported subchannels, I/O devices, logical control units, physical control units, and byte-multiplexer-capable channels.

#### *For All Processor Complex Models*

- The maximum number of byte-multiplexer-capable channels on a processor complex with PR/SM installed is 16 on multiprocessor models and eight on all other models.

#### *For ES/3090 Models and ES/3090-9000T Models*

- The maximum number of **subchannels** on the ES/3090 E-Models and the ES/3090 Models 100S, 120S, 150S, 170S, 250S, 110J, 120J, 150J, 170J, and 250J is 4096 minus the number of channel paths defined in the IOCP. The maximum number of subchannels on the ES/3090 Models 180S, 200S, 280S, 300S, 380S, 400S, 500S, 600S, 180J, 200J, 280J, 300J, 380J, 400J, 500J, 600J, 15T, 17T, 18T, 25T, and 28T.

**Note:** When IOCP IXP Version 2 is used, the maximum number of subchannels is 24,440 (For ES/3090 models, this applies only to those models at SEC 227574 or later).

- The maximum number of **logical control units** for all ES/3090 E-Models and the ES/3090 Models 100S, 120S, 150S, 170S, 250S, 110J, 120J, 150J, 170J, and 250J is 1024. For ES/3090 Models 180S, 200S, 280S, 300S, 380S, 400S, 500S, 600S, 180J, 200J, 280J, 300J, 380J, 400J, 500J, 600J, 15T, 17T, 18T, 25T, and 28T, the maximum number of logical control units is 2048.

**Note:** When the IXP Version of IOCP is used, the maximum number of logical control units is 2040 (for ES/3090 models, this applies only to those models at SEC 227574 or later).

- The maximum number of **physical control units** for all ES/3090 E-Models is 2304. For ES/3090 Models 100S, 120S, 150S, 170S, and 250S, the maximum

number of physical control units is 2304. For ES/3090 Models 180S, 200S, 280S, 300S, 400S, 500S, 600S, 180J, 200J, 280J, 300J, 380J, 400J, 500J, 600J, 15T, 17T, 18T, 25T, and 28T, the maximum number of physical control units is 6144.

**For ES/9000 Models (Except Models 820, 860, and 900)**

- The maximum number of subchannels is 24,440.
- The maximum number of logical control units is 2040.
- The maximum number of physical control units is 6144.

**For ES/9000 Models 820, 860, and 900**

- The maximum number of subchannels is 24,576.
- The maximum number of logical control units is 3072.
- The maximum number of physical control units is 6144.

**I/O Configuration Size and Central Storage Resources**

Central storage reserved for the HSA cannot be used by logical partitions. Increases in the size of the I/O configuration can decrease the amount of central storage available for use by logical partitions.

For example, on an ES/3090 Model 400J with 128MB of central storage, where the HSA allocation is 78 segments (or 4992KB, 78 x 64KB), the amount of central storage not assignable to a logical partition is 4MB (the HSA partially occupies a 1M-byte storage segment).

If at a later time the I/O configuration is increased to cause the HSA to expand by two 64Kb segments (to 80 segments or 5120Kb), the amount of central storage not assignable to a logical partition is 5MB (4MB *plus* the 1MB that contains HSA segments). Now, only 123MB of central storage is available for assignment to logical partitions (no portion of which contains HSA segments).

For any combination of active logical partitions that used all of the previously available 124MB, at least one of the logical partitions pending activation will fail activation because 123MB of central storage is now available for allocation to logical partitions.

After creating an IOCDs that increases the size of the I/O configuration, ensure that all of the planned combinations of logical partitions can be activated.

**Note:** To determine the amount of central storage available for assignment to logical partitions, display the Logical Partition Definition (LPDEF) frame (for processor complex models with multiple LPDEF frame views, display the LPDEF frame Storage View). If the amount of central storage needed to activate the desired logical partitions is more than the amount of central storage configured, change the necessary logical partition definitions. The total central storage for active logical partitions must be equal to or less than the amount configured.

### **Logical Control Units and Subchannels for an LPAR Mode IOCDS**

Although the maximum size of the I/O configuration is the same for both basic and LPAR modes, an LPAR IOCDS may require more logical control units and subchannels than a similar basic IOCDS.

**Number of Logical Control Units:** For an LPAR IOCDS, the rules governing what constitutes a logical control unit are the same as those for a basic IOCDS. However, for an LPAR IOCDS, the number of logical control units generated depends on the logical partitions assigned to the channel paths within that group of devices and on whether those channel paths are reconfigurable.

For a group of devices, one logical control unit is generated for each reconfigurable channel path within the group. An additional logical control unit is generated for each logical partition associated with the channel paths that are not reconfigurable within the group. Note that the total number of logical control units generated is never more than the number of channel paths within the group.

**Number of Subchannels:** When an IOCDS for one of the basic modes is generated, IOCP generates one subchannel for each I/O device associated with a logical control unit.

When an LPAR IOCDS is generated, the number of subchannels generated for the group of I/O devices associated with a logical control unit depends on the number of logical control units generated for the group of I/O devices. The total number of subchannels generated for the group of I/O devices is the number of I/O devices in the group multiplied by the number of logical control units generated for that group.

## Examples of Logical Control Units and Subchannels

Figure 2-1 through Figure 2-4 show examples of logical control unit and subchannel generation for LPAR mode.

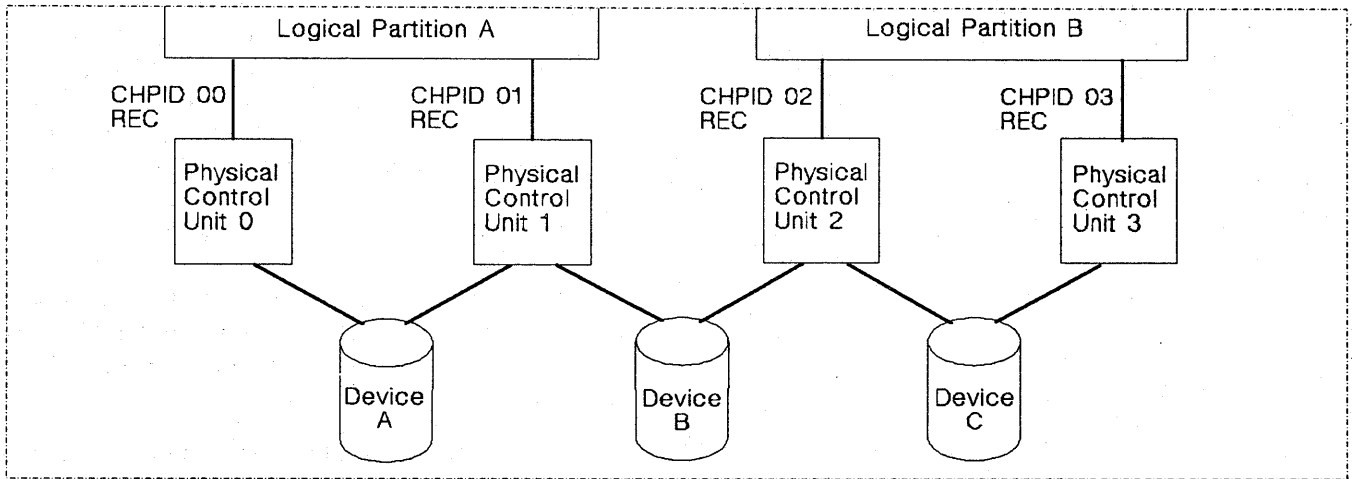


Figure 2-1. Physical Control Units and Channel Paths in LPAR Mode (All Reconfigurable Channel Paths)

**Note:** The I/O configuration used in Figure 2-1 is used for illustration only and may not be representative of any specific I/O configuration.

In Figure 2-1, the total number of logical control units generated is four, one for each reconfigurable (REC) channel path. Because all of the CHPIDs within the group are REC, no additional logical control units are generated. The total number of subchannels generated is 12: the number of logical control units generated (4) multiplied by the number of I/O devices (3) in the group.



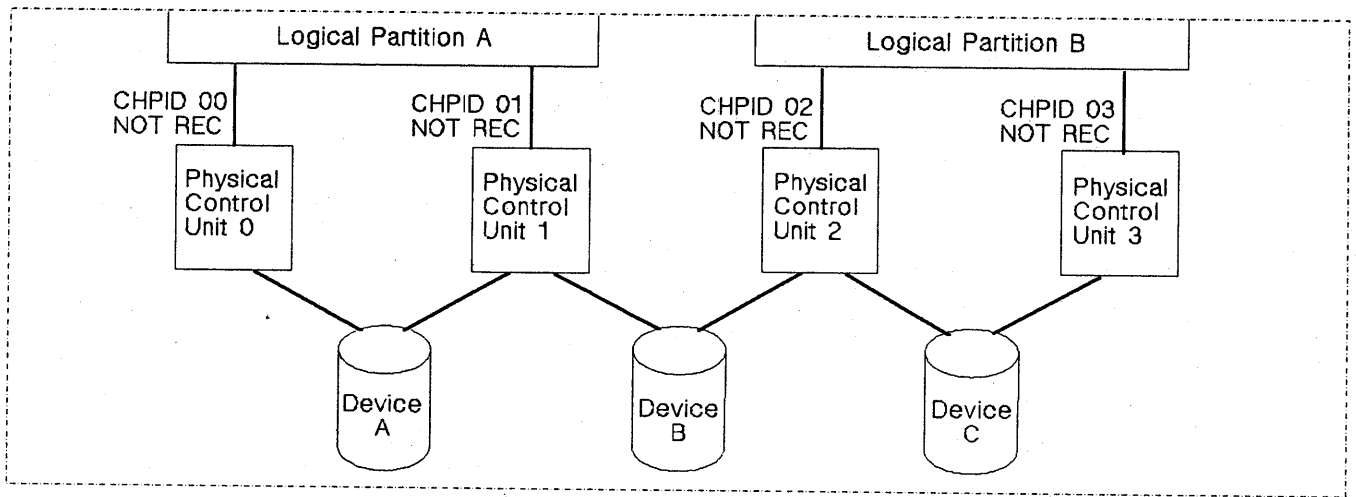


Figure 2-2. Physical Control Units and Channel Paths in LPAR Mode (No Reconfigurable Channel Paths)

**Note:** The I/O configuration used in Figure 2-2 is used for illustration only and may not be representative of any specific I/O configuration.

In Figure 2-2, the total number of logical control units generated is two, one for each logical partition with CHPIDs specified as not reconfigurable. The total number of subchannels generated is 6: the number of logical control units generated (2) multiplied by the number of I/O devices (3) in the group.

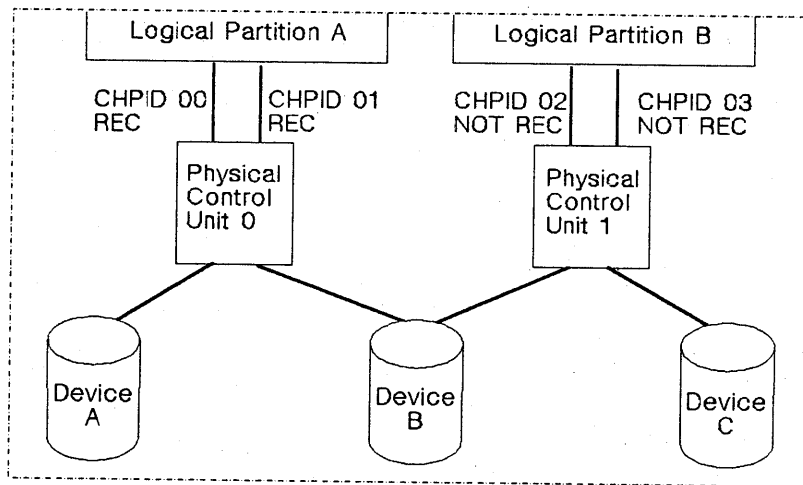
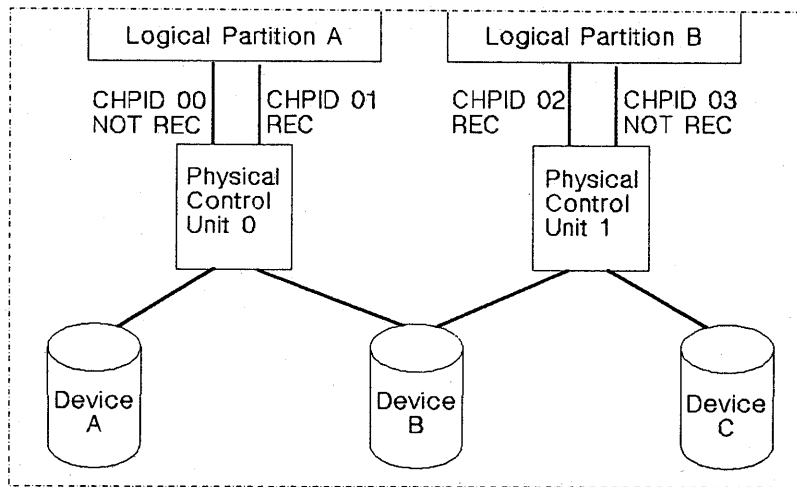


Figure 2-3. Physical Control Units and Channel Paths in LPAR Mode (Reconfigurable Channel Paths in One Logical Partition)

**Note:** The I/O configuration used in Figure 2-3 is used for illustration only and may not be representative of any specific I/O configuration.

In Figure 2-3, the total number of logical control units generated is three, one for each reconfigurable CHPID (2) and an additional logical control unit for the logical partition (B) that has CHPIDs specified as not reconfigurable. The total number of subchannels is 9: the number of logical control units generated (3) multiplied by the number of I/O devices (3) in the group.



**Figure 2-4. Physical Control Units and Channel Paths in LPAR Mode (Reconfigurable Channel Paths in Two Logical Partitions)**

**Note:** The I/O configuration used in Figure 2-4 is used for illustration only and may not be representative of any specific I/O configuration.

In Figure 2-4, the total number of logical control units generated is four, one for each CHPID specified as reconfigurable (2) and one for each logical partition that has CHPIDs specified as not reconfigurable (2). The total number of subchannels generated is 12: the number of logical control units generated (4) multiplied by the number of I/O devices (3) in the group.

## Guidelines for Setting Up the I/O Configuration

The following are guidelines to be followed when setting up an I/O configuration to operate in LPAR mode.

### Uniprocessor, Dyadic, Triadic, and Physically Partitioned Multiprocessor Models

- Determine the number of logical partitions.
- Determine the byte-multiplexer-capable channel path requirement for the partitions.  
**Note:** Eight byte-multiplexer-capable channel paths are available (on each side in the multiprocessor models).
- Determine if any channel paths may be moved among logical partitions or will be assigned to S/370 logical partitions. If so, these channel paths must be defined as reconfigurable in the IOCP CHPID macroinstruction.
- Determine the total number of channel paths to be defined to each logical partition (including the byte-multiplexer-capable channel paths). Where possible, assign a channel element of four channel paths to a logical partition. Try to avoid having a channel element span logical partitions. This isolates a channel element failure to a single partition. This may not be possible when assigning byte-multiplexer-capable channel paths to logical partitions.
- Within each logical partition, configure primary and backup paths from separate channel elements; otherwise, follow the configuration guidelines in the appropriate *Recovery Guide*.

### Single-Image Multiprocessor Models

When planning configurations to run in LPAR mode on the multiprocessor models in single-image (SI) configuration, additional thought must be given to configuration decisions that allow critical applications to run on either side should the processor complex be reconfigured to a physically partitioned (PP) configuration.

- Determine the number of logical partitions.
- Determine the byte-multiplexer-capable channel path requirement for the logical partitions. Sixteen byte-multiplexer-capable channel paths are available, eight on each side.
- Determine if any channel paths may be moved among logical partitions or will be assigned to S/370 logical partitions. If so, these channel paths must be defined as reconfigurable in the IOCP CHPID macroinstruction.
- Decide which critical applications must run in a backup configuration.
- Determine the total number of channel paths (including the byte-multiplexer-capable channel paths) necessary for the critical applications to run in a PP configuration.
  - It is important to keep in mind that if two paths to critical devices are necessary for the application to run with acceptable performance, then four total paths have to be configured (two from side 0 and two from side 1).
  - After the backup I/O configuration has been determined, mirror the I/O configuration for the other side. This allows the critical applications to access I/O devices from either side of the processor complex in a PP configuration.

The remaining channel paths determine if additional logical partitions can be active in both an SI configuration and a backup configuration. Keep in mind that while channel paths may be available, other logical partition resources (processors, vectors, main storage, and expanded storage) may not be available in sufficient quantity to support both the critical applications and the additional active logical partitions.

- Where possible, assign channel paths to a logical partition by channel element. This isolates a channel element failure to a single logical partition. This may not be possible when assigning byte-multiplexer-capable channel paths to logical partitions.
- Within each logical partition, configure primary and backup paths from separate channel elements (both across and within the sides of the processor complex).
- To avoid confusion, three separate IOCDs capable of operating in LPAR mode should be created to support SI and PP configurations:
  - One for the SI configuration
  - One for each side in a PP configuration

## Recovery Considerations

In planning for recovery in LPAR mode, consider the following guidelines for the I/O configuration:

- Ensure that at least one BASIC IOCD is written so that a power-on reset into one of the basic modes can be performed.
- Assign channel paths to logical partitions as described in the section "Guidelines for Setting Up the I/O Configuration" on page 2-12.
- Review the recoverability characteristics of the I/O configuration described in the section "Shared Devices" on page 2-15.

---

## IOCP Coding Specifications for LPAR Mode

IOCP can be used to generate IOCDSs for LPAR mode and the basic modes, but only an LPAR IOCDS can be used to perform a power-on reset into LPAR mode.

**Note:** If duplicate device numbers are used to generate an LPAR IOCDS, the same IOCP input deck cannot be used to generate an IOCDS for one of the basic modes.

## IOCP Invocation Parameters

IOCP parameters that allow the specification of an LPAR IOCDS or a BASIC IOCDS:

**MVS** LPAR={YES|NO} is a keyword for the PARM field of the EXEC statement. The default is LPAR=NO.

**VM** LPAR and NOLPAR are parameters in the IOCP command. The default is NOLPAR.

**Stand-Alone** The stand-alone BUILD IOCDS and WRITE IOCDS frames provide a field for the LPAR parameter. The default is NO.

**Note:** No IOCP control program version is available for control programs other than MVS and VM. If either the MVS or VM version of IOCP is not available to generate an LPAR IOCDS, the stand-alone version must be used. The stand-alone version can be used only when the processor complex is operating in a basic mode.

## IOCP Macroinstructions

The LPAR IOCP can generate a BASIC IOCDS from existing IOCP input decks. For an LPAR IOCDS, however, each channel path must be assigned to a logical partition by adding the following keyword in all CHPID macroinstructions:

PARTITION=(name[,REC]) field of the CHPID macroinstruction specifies a 1- to 8-character logical partition name. This identifies the name of the logical partition to which the channel path is assigned. Logical partition names may be any combination of alphanumeric and national characters (0 through 9, A through Z, \$, #, @) and must begin with an alphabetic or national character. A maximum of four (IOCP Version 3 Levels 1 and 2), six (IOCP Version 3 Level 1), or seven (IOCP Version 3 Level 2 and higher) unique names is allowed for each IOCDS. If REC is specified, this channel path is reconfigurable and can be moved among multiple logical partitions.

IOCP accepts and checks the syntax of S/370 information when generating an LPAR IOCDS, but the channel set definitions and channel addresses are not stored in the IOCDS. For LPAR mode, S/370 channel definition is by frame selection from the system console.

### Notes:

1. If the channel path is assigned to a logical partition that operates in S/370 mode, the channel path must be reconfigurable. For LPAR mode, S/370 channel addresses are assigned to physical channel paths using frame selections at the system console. See "Defining S/370 Channels" on page 3-53.
2. ES Connection channels can not be defined or assigned to S/370 logical partitions.

3. The words PART=ALL, PART=PHYSICAL, SYSTEM, and PRIMnnnn (where nnnn are digits) are keywords reserved by IOCP and cannot be used as the names of logical partitions.

The CHPID PARTITION=(name[,REC]) information is used to determine which channel paths are assigned to each logical partition, which devices and control units are shared between logical partitions, and which channel paths are reconfigurable.

For devices shared across logical partitions, IOCP generates a separate sub-channel for each sharing logical partition. In addition, if channel paths are reconfigurable, IOCP may create additional subchannels and logical control units. The IOCP Device Report for an LPAR IOCDS includes the totals of generated logical control units and subchannels.

The limits on the number of subchannels and logical control units may constrain the number of channel paths that can be defined as reconfigurable.

## IOCP Coding Guidelines and Examples

When coding an IOCP input deck for LPAR mode, the following specifications are allowed:

- Duplicate device numbers can be specified within a single IOCP input deck, if device numbers are not duplicated within a logical partition.
- Four channel paths from each logical partition can be assigned to a device. Device sharing among logical partitions is accomplished by having multiple channel paths from each logical partition to a device.

The following sections illustrate IOCP coding for LPAR IOCDSs when shared devices and duplicate device numbers are specified.

### Shared Devices

Generally, the coding of an IOCP input deck for an LPAR IOCDS should view I/O devices from a logical partition perspective. The following examples illustrate this concept by showing the physical connectivity of an I/O configuration for multiple logical partitions, the view of this configuration from a logical partition perspective, and the IOCP coding for the same configuration.

**Shared Devices Using Parallel Channels:** Figure 2-5 on page 2-16 shows an example of an I/O configuration for LPAR mode with a device shared by each of the four logical partitions. In this representation of a shared device, each logical partition views device 190 as part of its own I/O configuration. Notice the recoverability characteristics of this configuration: each logical partition has two channel paths to the shared device, each attached to a different storage director.

Figure 2-6 on page 2-16 shows this configuration from the perspective of each logical partition. Note that this logical representation has the same recoverability characteristics as does the physical connectivity: each logical partition has two channel paths to the shared device, each attached to a different storage director. Figure 2-7 on page 2-17 shows the IOCP macroinstructions for this configuration.

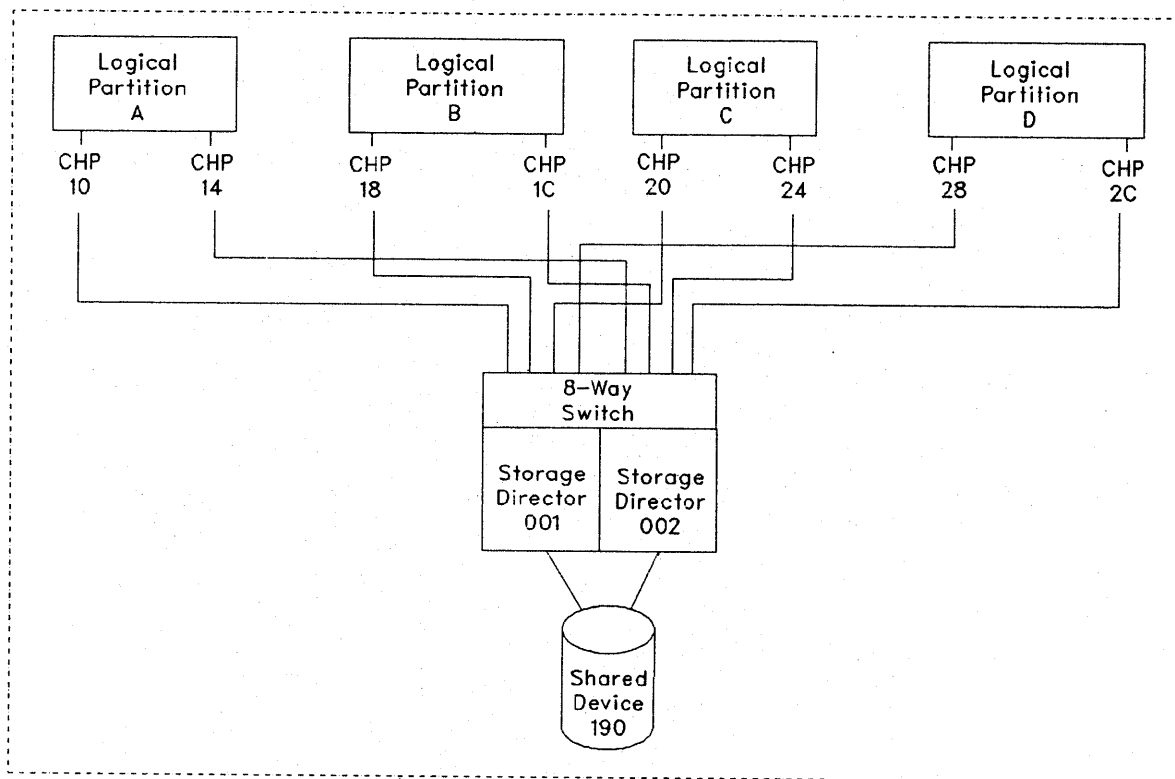


Figure 2-5. Physical Connectivity of Shared Device 190 for LPAR Mode (Parallel Channels)

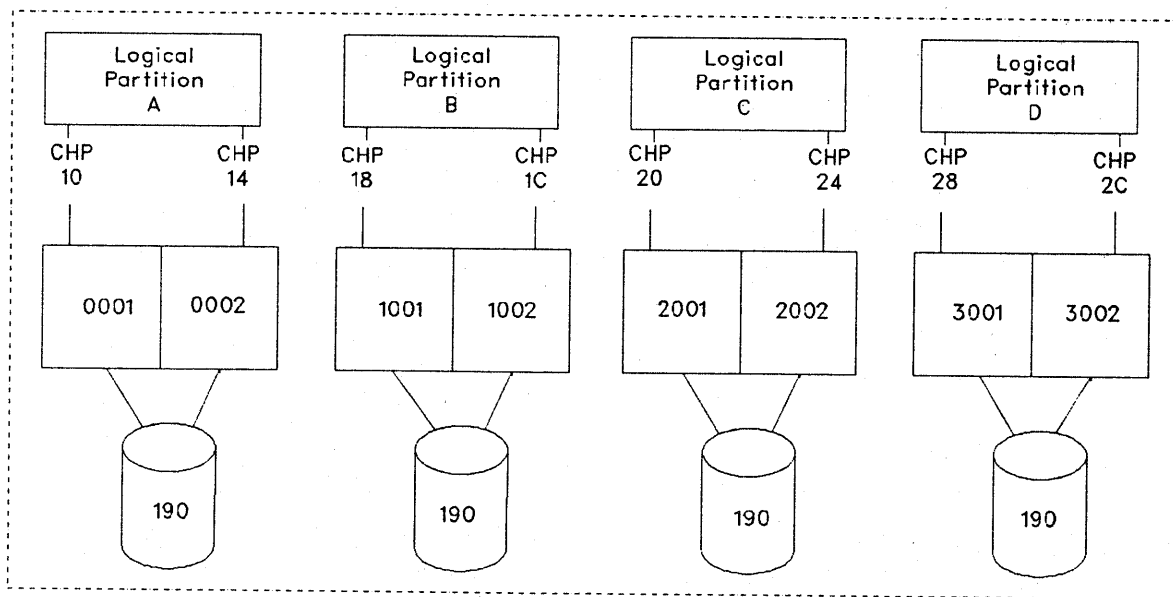


Figure 2-6. Logical View of Shared Device 190 for LPAR Mode (Parallel Channels)

```
CHPID PATH=((10),(14)),PARTITION=(A), . . .
CNTLUNIT CUNUMBR=0001,PATH=(10),UNITADD=(90) . . .
CNTLUNIT CUNUMBR=0002,PATH=(14),UNITADD=(90) . . .
IODEVICE ADDRESS=(190),CUNUMBR=(0001,0002),UNITADD=00. . .
```

```
CHPID PATH=((18),(1C)),PARTITION=(B), . . .
CNTLUNIT CUNUMBR=1001,PATH=(18),UNITADD=(90), . . .
CNTLUNIT CUNUMBR=1002,PATH=(1C),UNITADD=(90), . . .
IODEVICE ADDRESS=(190),CUNUMBR=(1001,1002),UNITADD=00. . .
```

```
CHPID PATH=((20),(24)),PARTITION=(C), . . .
CNTLUNIT CUNUMBR=2001,PATH=(20),UNITADD=(90), . . .
CNTLUNIT CUNUMBR=2002,PATH=(24),UNITADD=(90), . . .
IODEVICE ADDRESS=(190),CUNUMBR=(2001,2002),UNITADD=00. . .
```

```
CHPID PATH=((28),(2C)),PARTITION=(D), . . .
CNTLUNIT CUNUMBR=3001,PATH=(28),UNITADD=(90), . . .
CNTLUNIT CUNUMBR=3002,PATH=(2C),UNITADD=(90), . . .
IODEVICE ADDRESS=(190),CUNUMBR=(3001,3002),UNITADD=00. . .
```

Figure 2-7. LPAR Mode Coding Example with Shared Device 190 (Parallel Channels)

**Note:** The IOCP macroinstructions in Figure 2-7 are used for illustration only and may not be representative of specific I/O configurations.

**Shared Devices Using ESCON Channels:** Figure 2-8 on page 2-18 shows an example of an I/O configuration with ESCON Channels for LPAR mode with a device shared by each of the four logical partitions. In this representation of a shared device, each logical partition views device 190 as part of its own I/O configuration. Notice the recoverability characteristics of this configuration: each logical partition has two ESCON channel paths to the shared device. Each channel path is attached to an ESCON Director.

**Notes:**

1. An ESCON Director supports the attachment of ES Connection Channels which can be configured only to ESA/370 or ESA/390 logical partitions.
2. For ES Connection concepts, see the publication, *Introducing Enterprise System Connection*, cited in "Reference Publications" on page xiii.

Figure 2-9 on page 2-18 shows this configuration from the perspective of each logical partition. Figure 2-10 on page 2-18 shows the IOCP macroinstructions for this configuration.

Recoverability can be enhanced by using two switches in the configuration and connecting one channel path from each logical partition to each switch.



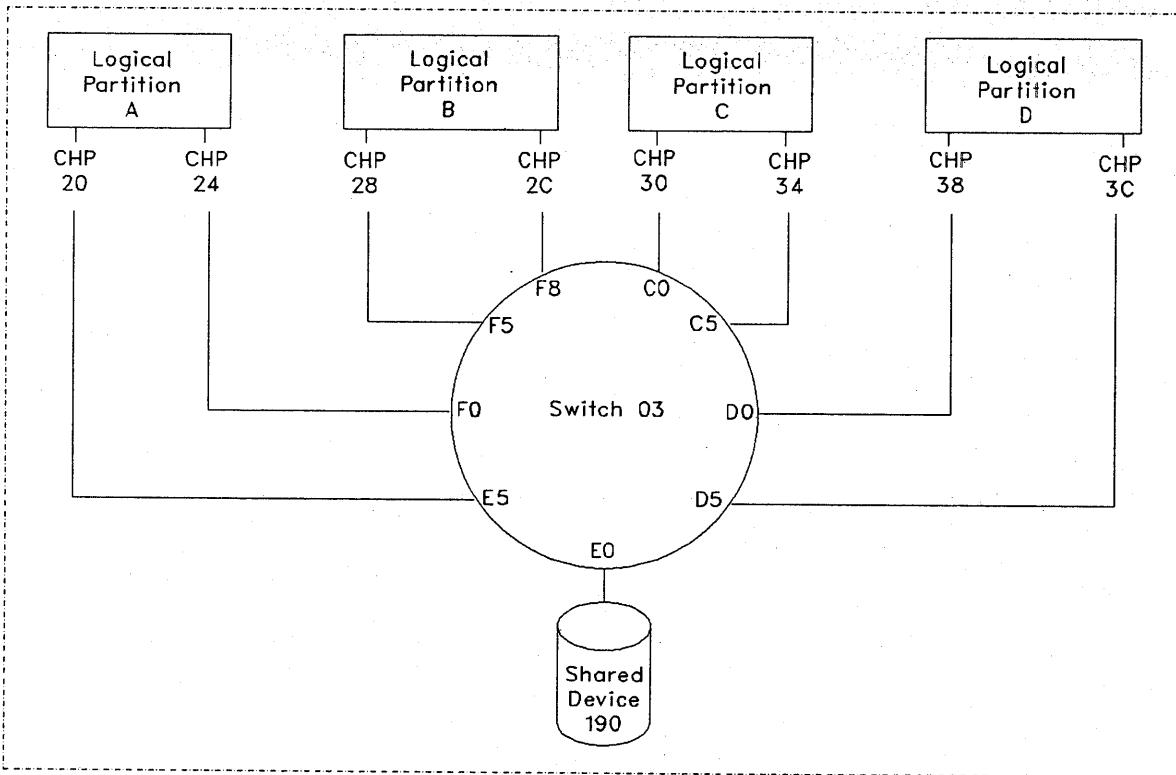


Figure 2-8. Physical Connectivity of Shared Device 190 for LPAR Mode (ES Connection Channels)

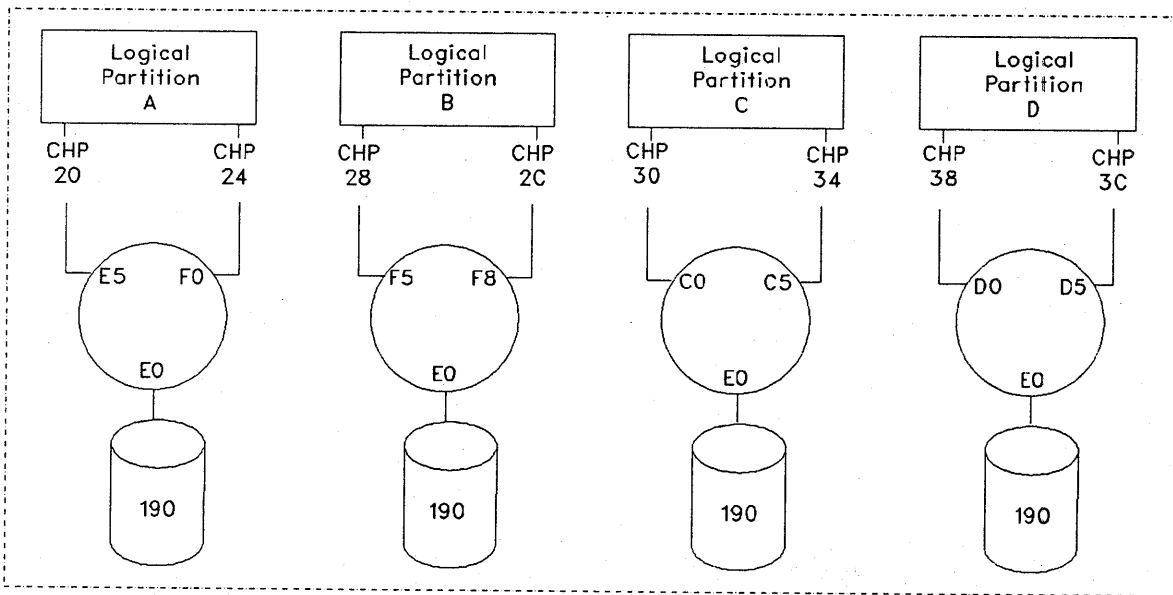


Figure 2-9. Logical View of Shared Device 190 for LPAR Mode (ES Connection Channels)

```
CHPID PATH=((20),(24)),TYPE=S,PARTITION=(A),SWITCH=03, . . .
CNTLUNIT CUNUMBR=000,PATH=(20,24),UNITADD=((90)),UNIT=XXXX,LINK=(E0,E0) . . .
IODEVICE ADDRESS=(190),CUNUMBR=0000,UNIT=XXXX . . .
```

```
CHPID PATH=((28),(2C)),TYPE=S,PARTITION=(B),SWITCH=03, . . .
CNTLUNIT CUNUMBR=100,PATH=(28,2C),UNITADD=((90)),UNIT=XXXX,LINK=(E0,E0) . . .
IODEVICE ADDRESS=(190),CUNUMBR=1000,UNIT=XXXX . . .
```

```
CHPID PATH=((30),(34)),TYPE=S,PARTITION=(C),SWITCH=03, . . .
CNTLUNIT CUNUMBR=200,PATH=(30,34),UNITADD=((90)),UNIT=XXXX,LINK=(E0,E0) . . .
IODEVICE ADDRESS=(190),CUNUMBR=2000,UNIT=XXXX . . .
```

```
CHPID PATH=((38),(3C)),TYPE=S,PARTITION=(D),SWITCH=03, . . .
CNTLUNIT CUNUMBR=300,PATH=(38,3C),UNITADD=((90)),UNIT=XXXX,LINK=(E0,E0) . . .
IODEVICE ADDRESS=(190),CUNUMBR=3000,UNIT=XXXX . . .
```

*Figure 2-10. LPAR Mode Coding Example with Shared Device 190 (ES Connection Channels)*

**Note:** The IOCP macroinstructions in Figure 2-10 on page 2-18 are used for illustration only and may not be representative of specific I/O configurations.

### **Duplicate Device Numbers**

Figure 2-11 on page 2-20 illustrates an LPAR mode configuration in which duplicate device numbers are used to represent a console (110) and a printer (00E) within each of four logical partitions. Figure 2-12 on page 2-20 illustrates the IOCP coding for this configuration. The IOCP coding in this example groups the input statements by logical partition to illustrate the concept that IOCP coding for LPAR mode should view I/O devices from a logical partition perspective.

Eight IODEVICE macroinstructions are used, one for each console and one for each printer that has a duplicate device number. Device numbers 110 and 00E occur four times each; however, they are not duplicated within a logical partition. When coding an IOCP input deck for LPAR mode, remember that the unique device number rule that applies for basic IOCDs also applies for logical partitions in an LPAR IOCDs. The IOCP input deck containing duplicate device numbers cannot be used to generate an IOCDs for one of the basic modes.

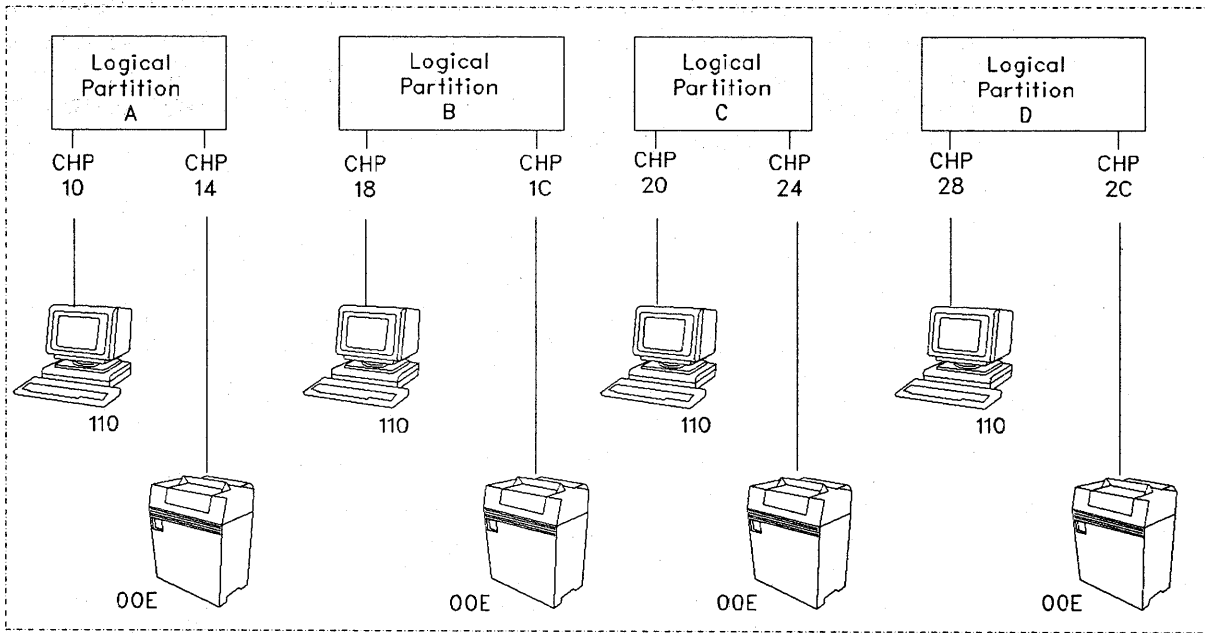


Figure 2-11. PRISM Configuration with Duplicate Device Numbers

```

CHPID PATH=((10),(14)),PARTITION=(A), . . .
CNTLUNIT CUNUMBR=0011,PATH=(10),UNITADD=(10), . . .
CNTLUNIT CUNUMBR=0012,PATH=(14),UNITADD=(0E), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0011), . . .
IODEVICE ADDRESS=(00E),CUNUMBR=(0012), . . .

CHPID PATH=((18),(1C)),PARTITION=(B), . . .
CNTLUNIT CUNUMBR=0013,PATH=(18),UNITADD=(10), . . .
CNTLUNIT CUNUMBR=0014,PATH=(1C),UNITADD=(0E), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0013), . . .
IODEVICE ADDRESS=(00E),CUNUMBR=(0014), . . .

CHPID PATH=((20),(24)),PARTITION=(C), . . .
CNTLUNIT CUNUMBR=0015,PATH=(20),UNITADD=(10), . . .
CNTLUNIT CUNUMBR=0016,PATH=(24),UNITADD=(0E), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0015), . . .
IODEVICE ADDRESS=(00E),CUNUMBR=(0016), . . .

CHPID PATH=((28),(2C)),PARTITION=(D), . . .
CNTLUNIT CUNUMBR=0017,PATH=(28),UNITADD=(10), . . .
CNTLUNIT CUNUMBR=0018,PATH=(2C),UNITADD=(0E), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0017), . . .
IODEVICE ADDRESS=(00E),CUNUMBR=(0018), . . .

```

Figure 2-12. IOCP Coding Example for Duplicate Device Numbers

**Note:** The IOCP coding in Figure 2-12 is used for illustration only and may not be representative of specific I/O configurations.

Figure 2-13 shows another example of a logical partition configuration in which the device number for a console (110) is duplicated for all four logical partitions. Figure 2-14 shows the IOCP coding for this configuration. Four IODEVICE and four CNTLUNIT macroinstructions are used, one each for the console within each logical partition that has a duplicate device number.

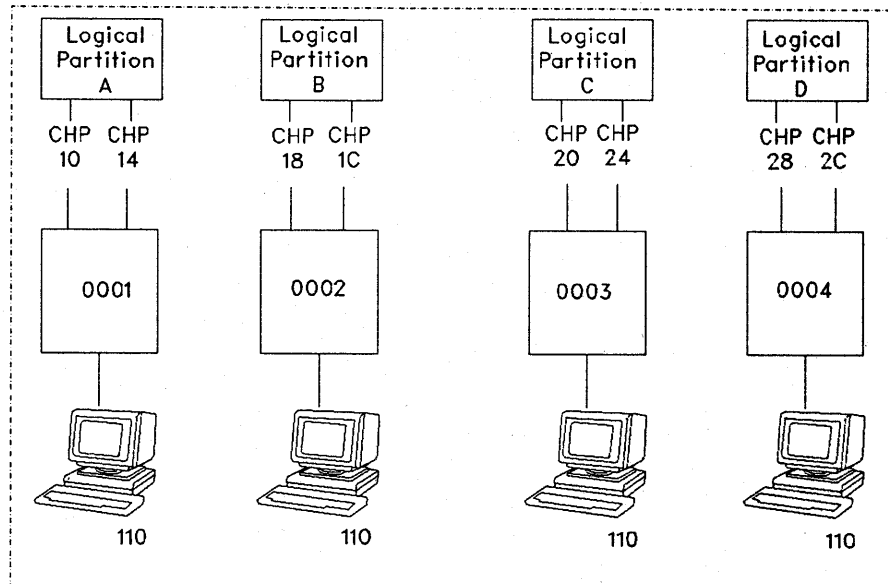


Figure 2-13. Duplicate Device Numbers for Console

```
CHPID PATH=((10),(14)),PARTITION=(A), . . .
CNTLUNIT CUNUMBR=0001,PATH=(10,14),UNITADD=(10), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0001), . . .
```

```
CHPID PATH=((18),(1C)),PARTITION=(B), . . .
CNTLUNIT CUNUMBR=0002,PATH=(18,1C),UNITADD=(10), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0002), . . .
```

```
CHPID PATH=((20),(24)),PARTITION=(C), . . .
CNTLUNIT CUNUMBR=0003,PATH=(20,24),UNITADD=(10), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0003), . . .
```

```
CHPID PATH=((28),(2C)),PARTITION=(D), . . .
CNTLUNIT CUNUMBR=0004,PATH=(28,2C),UNITADD=(10), . . .
IODEVICE ADDRESS=(110),CUNUMBR=(0004), . . .
```

Figure 2-14. Example of IOCP Coding for Duplicate Device Numbers

**Note:** The IOCP coding in Figure 2-14 is used for illustration only and may not be representative of specific I/O configurations.

## **Duplicate Device Number Conflicts**

IOCP generates an LPAR mode IOCDS that allows duplicate device numbers if the duplicate device numbers do not occur in the same logical partition. LPAR mode thereby allows systems using different logical partitions to be integrated into a processor complex without changing device numbers.

LPAR mode requires a unique device number for each device within a logical partition. If IOCP completes without error, the initial configuration contains no duplicate device number conflicts within a logical partition.

Conflicts may occur when the I/O configuration is redefined. If a reconfigurable channel path is reassigned to another logical partition and devices attached to the channel path have device numbers that are already assigned in the receiving logical partition to other online channel paths, a conflict results. The conflicts are detected during the execution of commands that change the I/O configuration (the CHPID command or a control program configuration command) or during logical partition activation.

The operator is informed of device number conflicts by means of one or more messages on line 22 of the system console that identify a device, several devices, or a range of devices in conflict. The identified device cannot be accessed while a conflict exists. Two types of conflict are possible: conflicts between device numbers for the same device (a shared device) or between device numbers for different devices (nonshared devices).

### ***Examples of Duplicate Device Number Conflicts***

Figure 2-15 provides two examples of duplicate device number conflict. As indicated, both examples use identical IOCP macroinstructions. Channel path 04 is reassigned from MVSPROD to MVSTEST in each example. This creates a duplicate device number conflict regarding device number 180 because a device numbered 180 already exists on the original channel path 10. If such conflicts occur, the operator must know what configuration is desired.

**Shared Device** In the example on the left, the duplicate device numbers refer to the same device from different logical partitions (a new path to the same device has been moved to MVSTEST). This may result in a performance problem because the control program in logical partition MVSTEST may not access the device from the desired channel path.

**Nonshared Device** In the example on the right, the duplicate device numbers refer to a different device from each logical partition (a new device has been moved to MVSTEST). This may result in a data integrity problem because the control program in logical partition MVSTEST may not access the correct device from channel path 04.

## Resolving Duplicate Device Number Conflicts

Consider the following options (A, B, and C) when planning the I/O configuration and the reconfigurability of channel paths. The operator, after consulting with installation management, must resolve duplicate device number conflicts by performing one of the following:

- A Use the original channel path.** If the receiving logical partition does not need a new path to a shared device or does not need the new (nonshared) device, the operator should take no action. The conflict is resolved by using only the *original* path (shared device) or the *original* device. (Access is still allowed to any nonconflicting devices on the reassigned channel path.)

In Figure 2-15, MVSTEST can access device 180 only through channel path 10 if the operator takes no action in response to the conflict message.

- B Deconfigure the original channel path and use the reassigned channel path.** If the logical partition must have the reassigned channel path to a shared device or access to a new (nonshared) device, the conflict is resolved by substituting the reassigned channel path for the original channel path. Perform the following steps:

1. Configure offline the original channel path (CHP 10 in Figure 2-15).
2. Configure offline and then online the reassigned channel path (CHP 04 in Figure 2-15).
3. If necessary or appropriate, configure online the original channel path (CHP 10 in Figure 2-15). Another conflict message is issued because a new conflict has been created. The operator then ignores this conflict as described in option A. (Access is still allowed to any nonconflicting devices on the original channel path.)

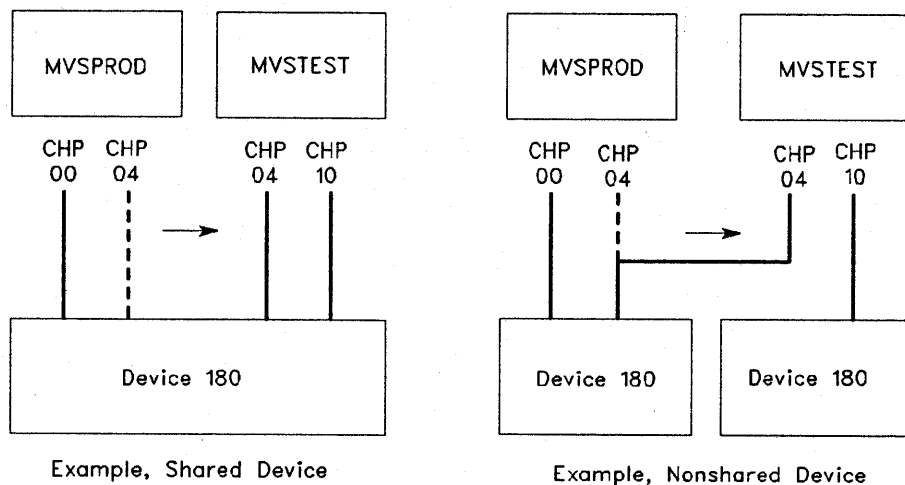
In Figure 2-15, MVSTEST can access device 180 only through channel path 04 if the operator performs the preceding steps in response to the conflict message.

- C Change the IOCDs.** If the logical partition must have access to all devices over the original channel path **and** the reassigned channel path (shared devices), or to a new device **and** the original device (nonshared devices), the operator must perform **one** of the following steps:

1. Select an existing LPAR IOCDs that reflects the desired configuration and perform a power-on reset. Or,
2. Change the current LPAR IOCDs to provide unique device numbers to the conflicting devices and perform a power-on reset. Or,
3. Generate a new LPAR IOCDs that provides unique device numbers to the conflicting devices and perform a power-on reset.

In Figure 2-15 (shared device), MVSTEST can access device 180 through CHP 04 and CHP 10 if CHP 04 is defined to MVSTEST in the IOCDs.

In Figure 2-15 (nonshared device), MVSTEST can access either device 180 (nonshared device) if one or both of the devices are assigned a new device number in the IOCDs.



```

CHPID PATH=((00,04)),PARTITION=(MVSPROD,REC)
CNTLUNIT CUNUMBR=0001,PATH=(00,04),UNITADD=80
IODEVICE ADDRESS=180,CUNUMBR=0001

```

```

CHPID PATH=((10)),PARTITION=(MVSTEST)
CNTLUNIT CUNUMBR=0002,PATH=(10),UNITADD=80
IODEVICE ADDRESS=180,CUNUMBR=0002

```

**Figure 2-15. Examples of Duplicate Device Number Conflicts**

**Note:** Logical Partition Activation Logical partitions may fail to activate because of device number conflicts: if the receiving logical partition was deactivated when a channel path is reassigned, or if the receiving logical partition is deactivated after a channel path is reassigned.

Such a failure to activate may be the result of having used option A or B. If a logical partition fails to activate, option B or C must be used to resolve the conflict and to activate the logical partition.

**Note:** Option C provides a permanent resolution to a device number conflict.

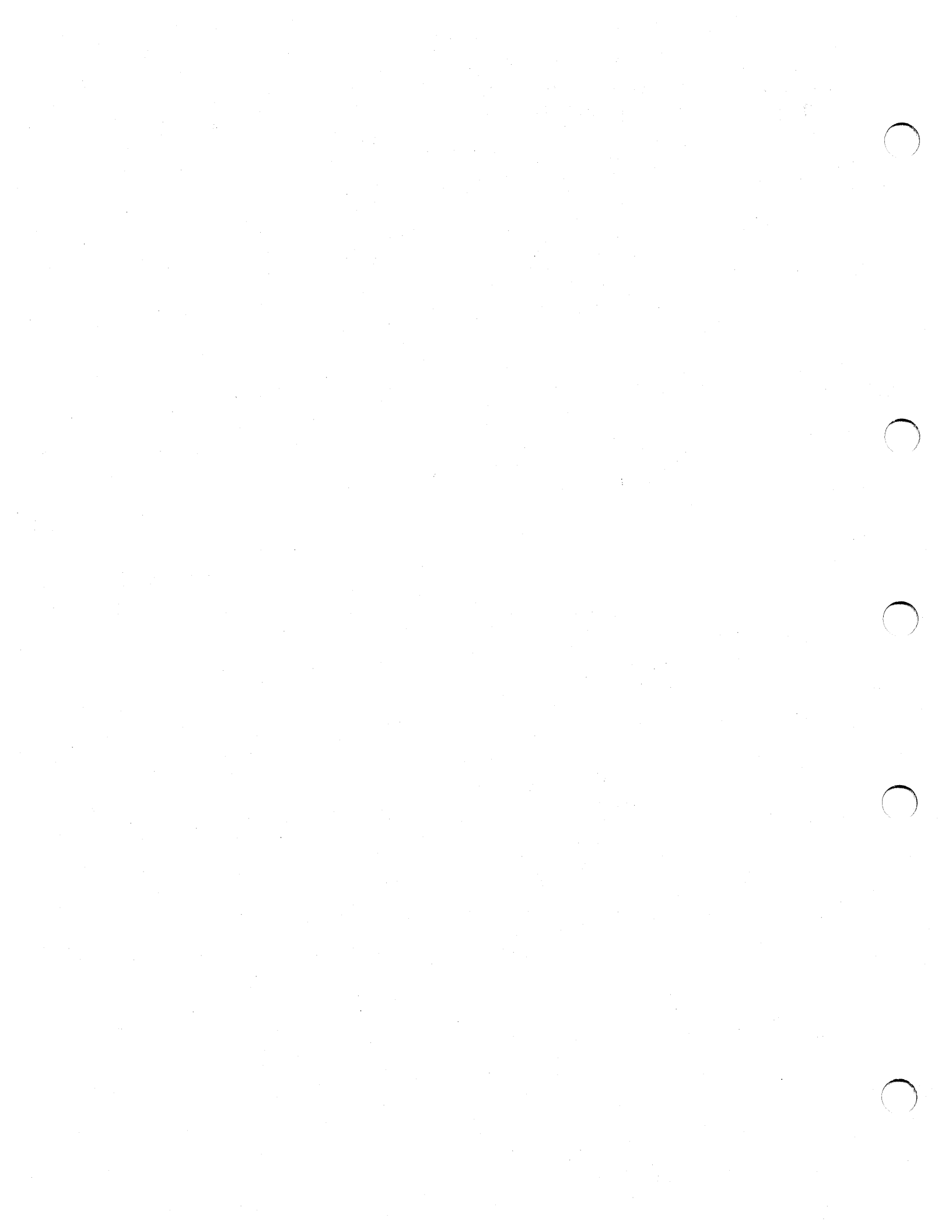
In Figure 2-15, if MVSTEST is not active when CHP 04 is reassigned, or MVSTEST is deactivated and then activated after CHP 04 is reassigned, MVSTEST does not activate until the conflict over device 180 is resolved. If the operator resolves the conflict by using option B, the operator must establish the correct configuration by configuring offline one of the channel paths (CHP 04 or CHP 10), and configuring offline and then online the other channel path. After activation, the operator may, if necessary, configure online the first channel path (ignoring the resulting conflict message).

Figure 2-16 provides an example of IOCP coding that removes duplicate device number conflicts for shared devices.

```
CHPID PATH=((00,04)),PARTITION=(MVSPROD,REC)
CHPID PATH=(10),PARTITION=(MVSTEST)
CNTLUNIT CUNUMBR=0001,PATH=(00,04),UNITADD=80
CNTLUNIT CUNUMBR=0002,PATH=(10),UNITADD=80
IODEVICE ADDRESS=180,CUNUMBR=(0001,0002)
```

*Figure 2-16. Example of IOCP Coding for Shared Devices to Remove Duplicate Device Number Conflict*





---

## Chapter 3. Planning Logical Partitions

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This chapter provides a planning overview for defining logical partitions, discusses the guidelines for determining logical partition characteristics, and describes the operator controls that can be used to specify logical partition definition parameters.

**Notes:**

1. Some features, functions, and display frames are model-dependent and SEC-level dependent. For this reason, all of the functions discussed in this chapter are not necessarily available on every processor complex model.
2. The display frames in this chapter illustrate LPAR mode operation with four logical partitions although as many as seven logical partitions may be defined for some processor complex models.

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## Planning Overview

This section provides a summary of the characteristics of logical partitions that can be defined, describes when logical partition definitions can be changed, and provides an overview of performance and recovery considerations that apply to logical partition definitions.

## Defining Logical Partitions

During IOCP execution, the names of the logical partitions are specified and channel paths are assigned to the logical partitions. After a power-on reset for LPAR mode, the Logical Partition Definition (LPDEF) frame is displayed, LPDEF frame parameters can be defined or changed, and other display frames can be invoked.

**Note:** For those processor complex models without dynamic storage reconfiguration, a single LPDEF frame is displayed. On models with dynamic storage reconfiguration, the LPDEF frame (Summary View) is displayed.

**Invoking and Exiting Display Frames:** To invoke a display frame, enter **F fname**, where *fname* is the frame name. Frame names (such as LPDEF, LPSEC, LPCTL) are displayed in the upper right-hand corner of the display frame, as shown in the illustrations in this section, and are used throughout this publication as a convenient reference to display frames.

To exit from a display frame, press the **End** key.

**Logical Partition Definition Frame (Single LPDEF Frame):** The following logical partition characteristics can be defined using the single LPDEF frame:

- Logical partition identifier (ID)
- Architectural mode (MODE)
- Favored logical partition (F)
- Central and expanded storage assignments (STG MB)
- Number of central processors (CP)
- Number of vector facilities (VE)
- Automatic IPL information (AUTO IPL)
  - Whether automatic IPL is active (A)
  - Automatic IPL device address (AUTO IPL ADDR)
  - Optional IPL load parameters (AUTO IPL PARM)

**Logical Partition Definition Frame (Multiple LPDEF Frame Views):** Any of the following LPDEF frame views can be selected and used to define logical partition characteristics as indicated below.

**Note:** The Summary View (C1) is the default view that is displayed whenever the LPDEF frame is invoked; this display-only frame provides a status summary for the logical partitions.

- Description View (C2)
  - Logical partition identifier (ID)
  - Architectural mode (MODE)
- Storage View (C3)
  - Amount of initial central storage, CENTRAL INIT (MB)
  - Amount of reserved central storage, CENTRAL RSVD (MB)
  - Central storage origin, CENTRAL ORIG (MB)
  - Amount of initial expanded storage, EXPANDED INIT (MB)
  - Amount of reserved expanded storage, EXPANDED RSVD (MB)
  - Expanded storage origin, EXPANDED ORIG (MB)
- Processor View (C4)
  - Number of central processors (CPs)
  - Number of central processors with a vector facility (VEs)
  - Number of central processors with an Integrated Cryptographic Feature
- Auto IPL View (C5)
  - Whether automatic IPL is active (A)
  - Automatic IPL device address (AUTO IPL ADDR)
  - Optional IPL load parameters (AUTO IPL PARM)

- One Partition View (C6)

The following characteristics for an individual logical partition can be defined using this view:

- Logical partition identifier (ID)
- Architectural mode (Mode)
- Amount of initial central storage (CS Initial)
- Amount of reserved central storage (CS Rsvd)
- Central storage origin (CS Origin)
- Amount of initial expanded storage (ES Initial)
- Amount of reserved expanded storage (ES Rsvd)
- Expanded storage origin (ES Origin)
- Number of central processors (CPs)
- Number of central processors with a vector facility (VEs)
- Number of central processors with a cryptographic feature (CTs)
- Whether automatic IPL is active (Auto IPL)
- Automatic IPL device address (IPL Addr)
- Optional IPL load parameters (IPL Parm)

**Logical Partition Controls (LPCTL) Frame:** The following logical partition characteristics can be specified using the LPCTL frame.

**Note:** At certain SEC levels, some of the values displayed on this frame are associated with an IOCDS. See “Changing Logical Partition Definitions” on page 3-7

- Processing weight or the specification of dedicated processors
- Processor resource capping
- Processor running time interval
- Wait completion setting

**Logical Partition Security (LPSEC) Frame:** The following security-related controls can be specified for a logical partition using the LPSEC frame:

- Reservation of reconfigurable channel paths (ISO)
- I/O configuration control authority (CONTROL IOC)
- Global performance data control authority (CONTROL PRF)
- Cross partition control authority (CONTROL XLP)
- Cryptographic key storage unit (ICRF KSU)
- Cryptographic key entry (ICRF KE)
- Cryptographic special security mode (ICRF SPC)
- Enable the Integrated Cryptographic Feature (ICRF ENA)
- Update crypto-domain index (CDX)

## Changing Logical Partition Definitions

### *Parameters that can be changed when the IOCDs is changed*

- The names and number of logical partitions are specified using IOCP macro-instructions, and can be changed only by creating a new IOCDs.
- The following parameters can be specified on the LPCTL frame and can be changed at any time, but the displayed values are associated with an IOCDs. The displayed values are not retained if the IOCDs is rewritten to change the number of logical partitions or logical partition names.

- Processing weight

**Note:** The logical partition must be deactivated to dedicate processors to a logical partition, or to change from dedicated to shared processors.

- Processor resource capping
- Processor running time interval
- Wait completion setting

**Note:** For some ES/9000 SEC levels, processing weights and processing resource capping values are associated with logical partition definitions and not with an IOCDs. These values are retained as long as the associated logical partition name is specified in an IOCDs.

### *Parameters that can be changed only when the logical partition is deactivated:*

Use the following frames to change the parameters below only when the logical partition is deactivated. See “Deactivating a Logical Partition” on page 4-22.

- Use the LPDEF frame (or the appropriate LPDEF frame view) to change:
  - Logical partition identifier
  - Mode of the logical partition

#### **Notes:**

1. If planning to change an ESA/370 or ESA/390 mode logical partition to a S/370 mode logical partition, the channel paths on the LPCHND frame may be prepared before deactivating the ESA/370 or ESA/390 logical partition.
2. ES Connection Channels cannot be assigned to S/370 logical partitions (only parallel channels can be assigned to S/370 logical partitions).

- Central and expanded storage assignments

Before changing storage assignments for logical partitions, display the Logical Partition Storage Assignments (LPSMAP) frame (see Figure 5-1 on page 5-3 or Figure 5-2 on page 5-4) to determine how processor storage is currently defined for the logical partitions.

- Quantity of central processors
- Quantity of vector facilities
- Quantity of Integrated Cryptographic Features
- Automatic IPL data (without dynamic storage reconfiguration)



- Use the LPSEC frame to change:
  - The cryptographic key storage unit value
  - The cryptographic crypto-domain index
- Use the LPCTL frame to change:
  - Processing Weights
  - Whether processors are dedicated to a logical partition

**Note:** If the processors for a previously capped logical partition are changed from dedicated processors back to shared processors, the last-used capping value for that logical partition is restored.
- Use the LPCHND frame to change:
  - S/370 channel definitions for a S/370 logical partition
  - S/390 channel definitions for ESA/390 and ESA/370 logical partitions.

**Parameters that can be changed at any time:** The following frames can be used to change the logical parameters below at any time:

- Use the LPDEF frame to change:
  - Automatic IPL data (with dynamic storage reconfiguration)
- Use the LPSEC frame to change:
  - Reservation of reconfigurable channel paths
  - I/O configuration control authority
  - Global performance data control authority
  - Cross-partition control authority
  - Whether the cryptographic key entry is enabled
  - Whether the cryptographic features are to run in special security mode
  - Whether the logical partition can use the cryptographic feature
- Use the LPCTL frame to change:
  - Processing weight
  - Processor running time interval
  - Processor resource capping
- Use the LPCHND frame to change:
  - CHPID values for ESA/370 or ESA/390 logical partitions

If an ESA/370 or ESA/390 logical partition is to be redefined to be a S/370 logical partition, LPCHND changes may be made at any time while the logical partition is operating in ESA/370 or ESA/390 mode because the changes have no effect until the ESA/370 or ESA/390 logical partition is defined as a S/370 logical partition.

**Note:** ES Connection Channels cannot be assigned to S/370 logical partitions.

## Performance Considerations

The performance of a logical partition is controlled by the following:

- The number of logical processors online
- Whether processors are dedicated to or are shared by the logical partition
- The processing weight assigned to each logical partition
- The processor running time interval

The total number of logical processors across all active logical partitions is one of the factors used to determine the dynamic dispatch interval. See "Processor Running Time for Shared Processors" on page 3-23.

**Note:** The effective dispatch time for MVS/ESA logical partitions can be determined using RMF Partition Data Reports that report on LPAR Management time. For more information about this RMF reporting enhancement see "RMF LPAR Management Time Reporting" on page 5-12.

The greater the number of active logical processors relative to the number of physical processors configured, the smaller the dispatch interval.

**Dedicated and Shared Processors:** Logical partitions may have processors dedicated to them, or they may share processors with other active logical partitions. Because the use of dedicated or shared processors in a logical partition affects performance in several ways, the characteristics, limitations, and advantages of each should be carefully studied.

**ITR Performance:** The best ITR performance is achieved with dedicated logical partitions. To achieve optimal ITR performance in sharing logical partitions, keep the total number of logical processors online to a minimum. This reduces both software and hardware overhead.

A logical partition designated as favored gains a small ITR benefit with respect to other logical partitions. All logical partitions perform as favored on ES/3090 models (ES/3090 S-Models require RPQ 8P1367).

**Capped Logical Partitions:** It is recommended that logical partitions be defined as capped logical partitions only when needed to support planned requirements. When a capped partition does not obtain needed CPU resources, because it has reached its cap, activity for that logical partition is similar to a system in basic mode that is running out of CPU resources. Response time elongation may occur in system loads which operate at their cap. For this reason, interactive response times may suffer when there is a mix of interactive and CPU-intensive work in the same capped logical partition.

Asymmetric configurations, such as S/370 attached processor configurations, or configurations with fewer vector facilities than logical processors, should avoid the use of capping because one logical processor may reach its cap more quickly and impede the progress of other logical processors within the same logical partition.

## Recovery Considerations

Resources should be defined for logical partitions so that any hardware failure has a minimal impact on any logical partition that must remain active.

For example, the failure of a physical processor causes the temporary loss of any logical processor that was dispatched on the physical processor. The logical partition owning that logical processor may continue operating if it was running on a logical partition with at least two processors dispatched on different physical processors, and if the control program that is active in the logical partition can recover from processor failures.

---

## Guidelines for Determining Logical Partition Characteristics

The information in this section is provided to help in the process of determining the type and amount of processor complex resources to define for each logical partition.

Although it is not possible to define more resources for a *single* logical partition than are physically installed, the total amount of resources that can be defined for *all* logical partitions may exceed the configured resources.

Individual logical partition definitions are checked against the total resources installed when the logical partition is defined. The actual allocation of these resources takes place only when the logical partition is activated. This LPAR mode design characteristic allows considerable flexibility when defining and activating logical partitions.

## Control Program Support

Table 3-1 on page 3-11 summarizes the characteristics of the control programs that can be supported in a logical partition. See the Section, "Programming Support" on page 1-4 for more information.

### Notes:

1. Some characteristics of logical partitions are control-program dependent. For this reason, contact your installation management to determine which control programs are in use or planned for LPAR mode operations before planning or defining logical partition characteristics.
2. TPF supports shared processors for one-way (uniprocessor) logical partitions on uniprocessor or on multiprocessor models. In all other environments, TPF supports only dedicated processors.

Table 3-1. Control Program Support for a Logical Partition

Control Program	Mode of Operation	Max No. of CPs	Max Central Storage (in MB)	Max Expanded Storage (in MB)	Vector Facility	ICRF Feature	Max. No. of Channels or Channel Paths	Channel Set Address
MVS/ESA SP 4	ESA/390	6	1024	8192	Yes	Yes*	256	N/A
MVS/ESA SP 3.1.0	ESA/370	6	1024	8192	Yes	Yes*	256	N/A
MVS/SP 2.2	ESA/370	6	256	2048	Yes	No	128	N/A
MVS/SP 1.3.5	S/370	2	64	N/A	No	No	16 per chan set	0, 1
VM/ESA	ESA/390	6	1024	8192	Yes	No	256	N/A
VM/XA SP R2***	ESA/370	6	512	4096	Yes	No	128	N/A
VM/SP	S/370	2	16	N/A	No	No	16 per chan set	0, 1
VM/SP HPO	S/370	2	64	4096	Yes	No	32 per chan set	0, 1
VSE/ESA	ESA/370	1	384	N/A	No	No	256	N/A
VSE	S/370	1	16	N/A	No	No	16	0
TPF V2 R3	S/370	1	16	N/A	No	No	16	0
TPF V2 R4	ESA/370	6	512	N/A	No	No	128	N/A
TPF V3 R1	ESA/370	6	512	N/A	No	No	128	N/A

Legend:

- \* For MVS 3.1.3 if the small programming enhancement (SPE) for the ICRF is applied. There is no ICRF support for MVS 3.1.0.
- \*\* If the small programming enhancement (SPE) for vector support has been applied.
- \*\*\* Supported for CMS-intensive production use on ES/9000 Models 330, 340, 500, 580, 620, 720, 820, 860, and 900, on ES/3090 Models 180J, 200J, 280J, 300J, 380J, 400J, 500J, and 600J, and on ES/3090-9000T Models 15T, 17T, 18T, 25T, and 28T, and also on Models 180S, 200S, 280S, 300S, 380S, 400S, 500S, and 600S if RPQ 8P1367 is installed. On all other ES/9000 Models and ES/3090 Models, VM/XA SP R2 is supported for V=V guest test and development only.
- N/A Not applicable.

## IOCDs Requirements

An LPAR IOCDs must be created using IOCP. The number and names of the logical partitions must be specified in an LPAR IOCDs.

An LPAR IOCDs must be selected during initialization of the processor complex. After a power-on reset for LPAR mode (PR/SM must be installed), logical partition definitions can be specified.

## Logical Partition Identifier

The logical partition identifier (ID) is used as the fourth hexadecimal digit of the operand stored by the Store CPU ID instruction for each processor in the logical partition. Valid identifiers for logical partitions are '0'X through 'F'X. The logical partition identifier must be unique for each active logical partition, or for each side of a physically partitioned configuration.

## Mode of Operation

The mode of the logical partition is processor-model dependent and can be S/370, ESA/370, or ESA/390. S/370 mode is available under LPAR mode on all processor complex models, ESA/370 mode is available on ES/3090 models, and ESA/390 mode is available on ES/9000 models.

The mode of the logical partition must support the mode of the control program loaded into that logical partition. S/370 logical partitions support S/370 control programs. ESA/370 logical partitions support ESA/370 and 370-XA control programs, and ESA/390 logical partitions support ESA/390, ESA/370, and 370-XA control programs.

## Storage Configurations

The definition of central storage and expanded storage to the logical partition depends on the size of the I/O configuration, the storage limits of the control program loaded into the logical partition and on the storage requirements of the applications running in the logical partition.

### Storage Resources for Logical Partitions

Standard capacity-planning procedures should be used to assess processor storage requirements for the planned logical partition configuration.

The following storage definitions apply to logical partitions:

- Configured = defined. The total amount of configured storage is the same as the total amount of defined storage. This condition is optimal if all logical partitions are to be activated at the same time.
- Configured > defined. The total amount of configured storage is greater than the total amount of defined storage. This condition leaves storage that is not being used, even if all logical partitions are activated at the same time.
- Configured < defined. The total amount of defined storage is greater than the total amount of configured storage. This condition may be correct and optimal if all logical partitions are never activated at the same time.

For models with dynamic storage reconfiguration, a logical partition when appropriately defined can dynamically attach storage to its configuration that is released when another logical partition is deactivated.

## Storage Assignments and Storage Allocation

Central (main) storage is allocated to a logical partition in a contiguous block. 1MB increments should be specified. Expanded storage is allocated to a logical partition in a contiguous block. 1MB increments should be specified. Central storage and expanded storage allocated to a logical partition is not shared by other logical partitions.

### ***For Processor Models without Dynamic Storage Reconfiguration:***

- Central storage for the favored logical partition begins at physical storage location 0 and is allocated from the bottom up. The remaining central storage assignments for logical partitions are allocated from the top down in activation order. Expanded storage for all logical partitions is allocated from the bottom up in activation order.
- When reallocating storage among logical partitions, the logical partitions must be contiguous in the storage that is to be reallocated. For example, in Figure 5-1 on page 5-3, storage may be reallocated between logical partitions MVSPROD and MVSTEST, or between logical partitions MVSTEST and VMHPO, or among all three. However, storage may not be reallocated between logical partitions MVSPROD and VMHPO because the storage boundaries are not contiguous.

***For Processor Models with Dynamic Storage Reconfiguration:*** Dynamic storage reconfiguration is supported in ESA/370 and ESA/390 logical partitions running MVS/ESA and MVS/SP 2.0 and subsequent releases (dynamic storage reconfiguration is not supported in S/370 logical partitions), and provides the capability of changing the storage allocated to a logical partition while the partition is active.

If dynamic storage reconfiguration is installed, ESA/370 and ESA/390 logical partitions may have reserved amounts of central storage and expanded storage. This storage can become available to the partition if no other active logical partition has this reserved storage online. Reserved central storage and reserved expanded storage may be made available to the logical partition by commands from the system console.

**Note:** If the control program in the logical partition supports physical storage reconfiguration, the reserved storage may be made available to the logical partition by MVS commands, without disrupting control program activity.

The same planning and operation considerations that apply to storage reconfiguration in the basic modes apply to dynamic storage reconfiguration under LPAR mode (the MVS RSU parameter must be set to allow reconfiguration, and all reconfiguration is initiated through MVS operator commands issued from the operator console).

- **Dynamic storage reconfiguration**

Dynamic storage reconfiguration provides logical partition definitions that allow a logical partition to attach storage to its configuration when another logical partition releases its storage after deactivation and to detach storage from its configuration while MVS remains active. Storage detached from a logical partition can be used to activate another logical partition. See the section "LPDEF Frame (Storage View)" on page 3-38 for the storage parameters that can be specified.

**Note:** MVS CONFIG commands are used to configure reserved central storage and expanded storage online and offline (see the appropriate *MVS Commands* publication). For detailed information about initialization and tuning, and recovery, refer to the appropriate MVS publications.

- **Initial Central Storage and Initial Expanded Storage**

The initial amount of central storage and the initial amount of expanded storage represent the amounts of storage allocated to a logical partition when it is activated.

Initial expanded storage is reconfigurable (can be configured offline or online by the control program) **only** if the logical partition has no reserved expanded storage defined, and an expanded storage origin is specified for the logical partition.

The initial amount of expanded storage can be zero when the reserved expanded storage is nonzero.

- **Reserved Central Storage and Reserved Expanded Storage**

**Note:** Only ESA/370 or ESA/390 logical partitions can have nonzero amounts for this parameter. A S/370 logical partition may not have reserved storage amounts.

The reserved amounts of central storage and the reserved amount of expanded storage define the additional amounts of storage that can become available to a logical partition when no other activated logical partition has this reserved storage online. Reserved storage amounts are always offline after partition activation.

**For reserved central storage:** if all of the reserved central storage is not available, any available reserved central storage can be configured online.

**For reserved expanded storage:** all of the reserved expanded storage must be available to configure any reserved expanded storage online.

If a reserved storage amount is specified for a logical partition, then an origin must be specified or the definition will not be allowed. Only logical partitions that specify a central storage origin can be allocated storage within the reserved central storage defined for another logical partition. Only logical partitions that specify a reserved expanded storage origin can be allocated storage within the reserved expanded storage for another logical partition.

Central reserved storage is contiguous to and above the initial amount of central storage. When a zero is specified for central reserved storage, it indicates that the central storage size is fixed at the initial size for the duration of the activation.

Expanded reserved storage is contiguous to and above the initial amount of expanded storage.

### – Central Storage Origins and Expanded Storage Origins

The origin for central storage defines the starting megabyte where the central storage begins for the logical partition. If enough central storage is not available to satisfy the INIT request starting at this origin, logical partition activation will fail.

The origin for expanded storage defines the starting megabyte where the expanded storage begins for the logical partition. If enough expanded storage is not available to satisfy the INIT request starting at this origin, logical partition activation will fail. If there is no initial amount of expanded storage defined, the reserved amount of expanded storage starts at this origin.

There must also be enough contiguous central storage and enough contiguous expanded storage to fit the reserved amounts, but the reserved amounts can be in use by other logical partitions (that specified origins for storage) at the time this logical partition is activated.

The storage origin parameter is required if a nonzero amount of reserved storage is specified. If an origin is not specified, the initial amounts of storage specified will be allocated wherever there is sufficient space available. Storage that is part of reserved storage for another activated logical partition is **not** available for any logical partitions that do not specify an origin.

For both central storage and expanded storage, the specification of the origin parameter provides the only way to overlap storage definitions. For example, the reserved storage definition for one logical partition can overlap an initial storage definition of another logical partition when the origin parameter is specified for both logical partitions.

### • Recommendations for Storage Map Planning with Dynamic Storage Reconfiguration

Planning storage maps as described below will help avoid storage fragmentation and remove dependencies on the order of activation of logical partitions.

**Note:** For more information and examples of storage map planning, see the *MVS Guide for PR/SM Dynamic Storage Reconfiguration* cited in "About This Publication" on page xi.

- It is recommended that the central storage origin and the expanded storage origin be defined for each logical partition on a processor complex using dynamic storage reconfiguration even if only one logical partition is using dynamic storage reconfiguration.
- The reserved central storage for a logical partition cannot contain any hardware system area (HSA). This means that the topmost megabyte of configured central storage may not be available for use in a logical partition's reserved central storage. This megabyte of storage can be assigned to the initial central storage for a logical partition.
- The capability to define storage origins provides maximum flexibility for planning storage configurations and avoids confusion when planning the system storage layouts. This capability provides an easy means of controlling where logical partitions are allocated and can be used to define adjacent or overlapping logical partitions without having to rely on the order of activation.



- It is possible to define expanded storage to logical partitions in such a way that many logical partitions use the same expanded storage (one partition at a time). If this is desired, no more than **one** logical partition should have this expanded storage defined as its **initial** expanded storage (instead, define it as **reserved** expanded storage).

**Note:** Failure to observe this convention may inhibit automatic activation of logical partitions.

- It is recommended that all logical partitions that require an origin be mapped from the bottom up (that is, start with OMB and build upward). When both central and expanded storage require origins, it is further recommended that the storage be mapped in the same order for both central and expanded storage. If no origin is specified for a logical partition, the system assigns the storage to the logical partition using a top-down-first-fit algorithm for both central and expanded storage.

- **Operation Considerations for Dynamic Storage Reconfiguration**

- Whenever a load clear or system reset clear is performed on a logical partition, LPAR mode forces the reserved central storage element offline.

The reserved expanded storage element will remain online if it was already online from the prior IPL. This allows MVS to flag the reserved storage element as reconfigurable, to allow it to be later deconfigured from the logical partition.

**Note:** If MVS is IPLed using a load clear or system reset clear immediately after the logical partition is activated, both the reserved central storage element and the reserved expanded storage element are forced offline.

- Whenever MVS is re-IPLed in a logical partition that has a reserved storage element, a load clear should be performed to force the reserved storage element offline.
- When a standalone dump is to be performed on a logical partition, perform a load (not a load clear) on that logical partition to retain the reserved storage element online.
- It is recommended that the SYSCTL frame be used to re-IPL a logical partition or to perform a dump because the SYSCTL performs a load clear when re-IPLing, and performs a load when loading the dump program.

**For Processor Models with the Automatic Reconfiguration Facility:** ARF consists of two systems: the primary system which runs the application, and the backup system which provides backup if the primary system fails. ARF allows workload redistribution from the failed primary system to the backup system without operator intervention. ARF uses dynamic storage reconfiguration to allow the backup logical partition to acquire the storage resources previously owned by the primary logical partition.

ARF is supported on ES/9000 Models 190 and above, and ES/3090 J-Models 180J and above (at SEC 228574 and beyond). ARF requires that both the primary partition and the backup partition operate with MVS/ESA SP Version 4. For detailed information about ARF, use the *MVS Implementation Guide* cited in "Reference Publications" on page xiii.

## ES/3090 HSA Allocation and Storage for Logical Partitions

When the ES/3090 Processor Complex is operating in LPAR mode, the size of the HSA is at least 2MB for the Models 120E, 150E, 100S, 120S, 150S, 170S, 250S, 110J, 120J, 150J, 170J, and 250J, and at least 4MB for other models. If the HSA allocation expands, the amount of central storage available for use by the logical partition decreases.

**Note:** For more information, see the sections "HSA Allocation on Processor Complex Models Supporting 24K UCWs" on page 1-22 and "I/O Configuration Size and Central Storage Resources" on page 2-7.

### Power-On Reset in LPAR Mode at SEC 223775 and Later

The size of the HSA in LPAR mode at SEC 223775 (available April, 1989) may increase for the ES/3090 models supporting 24K UCWs. Therefore, the amount of configured storage available for logical partition activation may be smaller at SEC 223775 and later than it was at prior SEC levels (even if the HSA at SEC 223775 does not increase, the amount of configured storage available for logical partition activation may decrease).

This change can affect two customer groups:

- Customers installing SEC 223775 on ES/3090 Models 180S, 200S, 280S, 300S, 380S, 400S, 500S, and 600S with PR/SM installed.
- Customers upgrading from an ES/3090 E-Model, or 100S, 120S, 150S, 170S, 250S, 110J, 120J, 150J, 170J, or 250J, with PR/SM installed to any one of the following ES/3090 S-Models with SEC 223775 installed: 180S, 200S, 280S, 300S, 380S, 400S, 500S, or 600; to any of the following ES/3090 J-Models or ES/3090-9000T Models: 180J, 200J, 280J, 300J, 400J, 500J, 600J, 15T, 17T, 18T, 25T, or 28T.

The following procedure is recommended in two situations:

- The first time an LPAR IOCDS used at prior SEC levels is selected to perform a power-on reset on a system with SEC 223775 installed.
- After a power-on reset with any LPAR IOCDS that has been changed.

**Recommended Procedure:** Check the LPDEF frame. If the amount of central (main) storage needed to activate the desired logical partitions is more than the amount of central storage configured, change the necessary logical partition definitions. The total central storage for active logical partitions must be equal to or less than the amount configured.

## Number of Processors

The processors defined to a logical partition are called logical processors. The total number of logical processors for **all** logical partitions may be greater than the number of physical processors installed. Processors can be dedicated to logical partitions or shared by logical partitions (*sharing* logical partitions).

The number of processors defined for a logical partition represents the number of logical processors on which the control program will dispatch work, and is determined by several factors as described below.

**Maximum Number of Processors:** The maximum number of processors that can be defined depends on the following:

- The number of processors that are available

The maximum number of logical processors available for definition in a single logical partition is limited to the number of physical processors installed.

### Notes:

1. When a logical partition is activated, the number of central processors defined to a logical partition must be equal to or less than the number of physically installed central processors, minus the number of central processors that are dedicated to activated partitions.
2. If logical partitions are activated on one side of a processor complex in PP configuration, the maximum is the number of processors installed on the side that is run in LPAR mode.
3. Logical partitions for an SI configuration can be defined when the processor complex is operating in a PP configuration in LPAR mode.

- The number of processors that are supported by the required control program

Some control programs support only one or two processors and other control programs can support as many as six processors. The number of processors defined for a logical partition should not exceed the number supported by the control program used for that logical partition.

**Number of Processors Defined and Workload Requirements:** The number of logical processors defined also depends on the workload requirements and the ability of the control program or application program to effectively use multiple logical processors.

- The number of processors required to meet the peak demands of the logical partition

When a sharing logical partition is activated, it should be assigned enough processors to meet its peak demands and any immediate growth requirements.

**Note:** Too few processors could limit the number of potential transactions, and too many active logical processors could affect performance. An alternative to defining the minimum number of processors is to define extra processors and, after activation and IPL, configure them offline until needed.

For a logical partition that uses dedicated processors, the number of processors required to meet peak demand should be determined as in one of the basic modes.

- The number of processors shared by a logical partition

The physical processors used by a sharing logical partition can be limited by the number of processors defined to it. For example, on a six-way processor complex operating in the SI configuration, a two-way logical partition could never get more than a third of the processor resources.

On most machines, there are many possible configurations. For example, if a two-way processor complex is to be used by three sharing logical partitions, configuration options include all two-way logical partitions, all one-way logical partitions, or a mix of one-way and two-way logical partitions.

Three two-way logical partitions should only be considered if all logical partitions have peak demands exceeding the capacity of a uniprocessor. In this instance, the average requirements during peak periods should be examined carefully to ensure that the total does not exceed the capacity of the processor complex.

Three 1-way (uniprocessor) logical partitions are optimal for ITR performance and should be used if no logical partition has peaks exceeding half of the capacity of a 2-way processor complex.

## Dedicated Processors

A logical partition may have processors dedicated to it. When a logical partition that uses dedicated processors is activated, a physical processor is assigned to each defined logical processor. The logical partition then has exclusive use of its physical processors.

The physical processors that belong to a logical partition that uses dedicated processors are always available for its use, but the capacity that is not used cannot be used by other logical partitions.

***Suitable Workloads for Dedicated Processors:*** Workloads best suited for logical partitions that use dedicated processors are those that maintain a fairly even external throughput rate (ETR) while using most of the capacity of the logical partition. Logical partitions with timing dependencies may require dedicated processors.

The installation goals for a logical partition that uses dedicated processors should be similar to the goals of the processor complex in one of the basic modes. For example, if the goal is an average processor utilization rate of 70%-85%, then the same goal should be used for a logical partition that uses dedicated processors.

## Shared Processors

Logical partitions may share processors with other logical partitions. A shared logical partition does not have exclusive use of the physical processors. There is no correspondence between the logical processors in a sharing logical partition and the physical processors on which the logical processors are dispatched (except on a uniprocessor or when a vector facility is required). A logical processor can be dispatched on any physical processor and, on successive dispatches, the logical processor may be dispatched on different physical processors.

The number of processors available for use by sharing logical partitions is determined by adding the number of processors already assigned to active, dedicated logical partitions and subtracting that sum from the total number of physical processors available. The number of physical processors available is the total number installed or the total number on a side in PP configuration.

The total of all logical processors for all sharing logical partitions may be larger than the number of physical processors serving the sharing logical partitions. For example, if four logical partitions are active on a six-way processor complex and each logical partition is defined to have four processors, the total number of online logical processors is 16.

***Suitable Workloads for Shared Processors:*** Workloads best suited for sharing logical partitions are those that have a widely fluctuating ETR or would not fit well into the capacity of a dedicated logical partition. If a workload can use only a small portion of the capacity of a dedicated logical partition, redefine the logical partition to use shared processors to free the available capacity for use by other logical partitions.

A workload with a widely fluctuating ETR would experience peaks and valleys in its processor-utilization curve. Such fluctuations may occur over extremely short periods of time (minutes or seconds). This type of workload could take advantage of the time- and event-driven dispatching available with LPAR mode. With event-driven dispatching, a sharing logical partition receives the resources required as needed and leaves the capacity free for other logical partitions when not needed. See "Wait Completion for Shared Processors" on page 3-24.

When combining workloads on a processor complex by means of logical partitions, examine their average and peak requirements carefully. If the workloads fluctuate over very short intervals, the total capacity of the system must meet the sum of the average requirements for each workload. If processor utilization fluctuates over longer periods, and the peak utilization periods for these workloads occurs simultaneously, then the total capacity of the logical partitions must meet the sum of the peak requirements for each workload.

Sharing logical partitions that use event-driven dispatching are better able to maintain high transaction rates with fluctuating demand while being responsive. However, the ITR for a sharing logical partition is lower than the ITR for a dedicated logical partition.

The capability to limit CPU usage for any or all logical partitions with shared processors is provided by the PR/SM capping function. The capping function enhances LPAR workload balancing controls for environments with a requirement that the CPU resources for a logical partition be limited. Capped logical partitions are recommended for use when CPU resources must be limited for

business reasons (in accordance with a contract), or when the impact that one logical partition can have on other logical partitions needs to be limited.

### Processing Weights for Shared Processors

**Note:** A logical partition with dedicated processors is not affected by processing weights.

Processing weights are used to specify the portion of the shared processor resources allocated to a logical partition. Although PR/SM always manages sharing logical partitions according to the specified processing weights, there are times when a logical partition will receive either more or less than its processing share, or not more than its processing share:

- A logical partition will receive more than its processing share when there is excess processor capacity, provided it has work to do and other logical partitions are not using their share.
- A logical partition will receive less than its processing share when its workload demand drops below the capacity specified by its weight.
- A logical partition will not receive more than its processing share when the processing resources for that logical partition are capped.

The recommended procedure is to specify processing weights to satisfy the peak requirements of the logical partitions.

**The Use of Processing Weights:** Processing weights can range from 1 to 999 (weights of less than 2% difference are not considered significant) and are used as follows:

- The processing weights for all active, sharing logical partitions are added together. This total is considered to be 100% of the processing resource available to shared processors. For example, the total processing weights for the logical partitions shown in Figure 3-11 on page 3-46 is 1,300.
- The share of processing resources for each logical partition is calculated by dividing the processing weight for each sharing logical partition by the total processing weight. For example, at peak CP utilization levels, the dispatcher allocates shared processing resources to each of the logical partitions in Figure 3-11 on page 3-46 as follows:

DOSVSE	300/1300 = 23.1%
MVSTEST	100/1300 = 7.7%
VMHPO	900/1300 = 69.2%

- The share of processing resource for each logical processor is calculated by dividing the share for each logical partition by the number of logical processors in the logical partition. For the logical partitions shown in Figure 3-11 on page 3-46, the share for each logical processor is as follows:

DOSVSE	23.1/1 CP = 23.1%
MVSTEST	7.7/6 CPs = 1.3%
VMHPO	69.2/2 CPs = 34.6%

These percentages are used to determine preemption priority for I/O interruptions. A lower priority logical processor may be preempted when an I/O interruption is pending for a higher priority logical processor when the following occurs:

- The higher priority logical processor is further behind in its share, or

- The higher priority logical processor is not as far ahead of its share as the lower priority logical processor.

For example, the lower priority logical partition is receiving 15% more than its processing share, and the higher priority logical partition is receiving 10% more than its processing share.

**Note:** As long as there is excess processor capacity, processing weights have no effect on the processor resources consumed. Weights affect processing when the number of logical processors that need processing time is greater than the number of physical processors available.

**The Effects of Processing Weights:** Several implications are derived from the rules described above. First, every time a sharing logical partition is activated, the share of all other active logical partitions changes. This happens because the total of the processing weights has changed. Configuring a logical processor offline from a logical partition reduces the total share of the partition. When a logical processor is varied offline, the other logical processors in the partition retain their previous share, so the total weight for the partition is reduced. The share belonging to the offline logical processor is contended for by all the remaining logical processors of all sharing partitions.

Because the processing share of logical partitions may vary, the actual utilization reported by monitors such as RMF may be different from the weights. In systems at less than 100% utilization, some logical partitions could receive greater than their share if other logical partitions are not using their share. The number of processors defined also affects the maximum resource allocated to that logical partition. For example, a logical partition defined to have two processors on a 3-way processor complex can never be allocated more than 67% of the processor resources no matter what its processing weight.

### **Capping Processing Weights for Shared Processors**

The PR/SM capping function provides the capability of limiting CPU resource usage for one or more logical partitions. The *relative* processing weight of a logical partition is its capping value.

A capped partition running at its cap does not have access to the CPU resources that are not utilized by other partitions. However, CPU resources that are not used by a capped logical partition can be used by other partitions. Equitable distribution of CPU resources is maintained.

Capping values can be dynamically adjusted. The capping function may be turned on and off, and provides the capability of specifying capping for individual partitions without a re-IPL of the partition. The specification of CAPPED=YES (on the LPCTL frame) turns the capping function on, and enforcement takes effect immediately.

A partition's relative weight is divided by the number of logical CPs defined for the partition to give the share for each logical CP. The goal of the LPAR dispatcher is to give each logical CP its share of the total relative weight. Capping is done on a per logical CP basis.

A logical partition's share of CPU resources is determined by its weight (as indicated on the LPCTL frame). The combined processing weights for all active logical partitions are considered to be 100% of the available shared CPU resources. The activating and deactivating of logical partitions changes the amount of CPU resources available to logical partitions, making the percentage

of CPU resources requested for each active logical partition a relative one, and not a fixed percentage of CPU resources.

**Maintaining the Same Relative Percentages of CPU Resources:** To maintain the same *relative* percentage of CPU resources requested for a capped logical partition, processing weights should be readjusted immediately prior to, or immediately after, the activation or deactivation of a logical partition.

Processing weight values for use when specific logical partitions are activated or deactivated should be calculated in advance, and be readily available. Otherwise, it is recommended that a convenient method be developed for changing the processing weight values to readjust relative shares after a logical partition is activated or deactivated.

For example, if the sum of the weights of the active partitions totals 100, then the sum of the relative weights of the active partitions also totals 100. This provides an easy means for adjusting weights upon the activation or deactivation of logical partitions. Another good approach to maintaining the desired share for a capped partition is to also readjust the processing weights for logical partitions with the capping function turned off, as shown in Figure 3-1 for the logical partition MVSTEST.

Four Partitions Active				Three Partitions Active			
LP Name	Status	Weight	Capped	LP Name	Status	Weight	Capped
DOSVSE	A	30	No	DOSVSE	D	--	--
MVSPROD	A	40	No	MVSPROD	A	64	No
MVSTEST	A	20	Yes	MVSTEST	A	20	Yes
VMHPO	A	10	No	VMHPO	A	16	No

Figure 3-1. Example of Maintaining the Relative Weight of a Capped Logical Partition

When the sum of all the relative weights is maintained at 100, it is easy to recalculate weights when a partition is deactivated. After deactivating DOSVSE, the weight for MVSPROD can be changed to 64, and the weight for VMHPO can be changed to 16 to maintain the same relative weight of 20 for MVSTEST, the capped logical partition.

### Processor Running Time for Shared Processors

The processor running time is the length of continuous time (determined by the dispatch interval) allowed for the dispatch of a logical processor. Processor running time can be dynamically determined, or it can be set to a value using the LPCTL frame. The logical processors that belong to all logical partitions that share processors are assigned the same run-time value.

The default value is dynamically calculated and changes when the number of active, scheduled logical processors changes.



The default running time is determined using the formula:

$$\frac{25 \text{ milliseconds} \cdot (\text{number of physical shared CPs})}{(\text{total number of logical CPs not in stopped state for all sharing partitions})}$$

The default value is used whenever the Dynamically Determined (B1) selection is made on the LPCTL frame. The run-time value may change whenever a logical partition is activated or deactivated and when a logical processor stops or starts (for instance, when a logical processor is configured online or offline). The default processor running time is limited to the range of 12.5 to 25 milliseconds.

The logical processor might not use all of its run time because it goes into a wait state. With event-driven dispatching, when a logical processor goes into a wait state, the physical processor is reassigned to another logical processor ready to do work. When a logical processor does not go into a wait state during its run time, it loses the physical processor when it reaches the end of its run time. Therefore, a logical partition with processor-bound work cannot permanently take control of the physical processors.

The run-time value may be set from the LPCTL frame by selecting Set Running Time. Generally, it is recommended that the processor running time be dynamically determined. The recommended procedure is to start by using the default processor running time. That value should be acceptable when all sharing logical partitions have similar proportions of interactive work; for example, two logical partitions each running 40% to 70% of interactive work.

Adjustments to the run-time value may be necessary when one sharing logical partition contains a large proportion of processor-bound work and the other sharing logical partitions contain only short, interactive transactions. Degraded response time in one logical partition may indicate that the run-time value should be reduced to decrease the length of continuous time given to processor-bound work. The run-time value should be decreased by approximately 10% several times over several days while monitoring performance carefully. The processing weights should also be adjusted to favor the interactive logical partition. See "Processing Weights for Shared Processors" on page 3-21.

### **Wait Completion for Shared Processors**

Shared processor resources can be divided on either an event-driven basis or a time-driven basis. When the resource is divided on an event-driven basis, switching between users is done as the result of some event, such as a wait or an interruption. When the resource is divided on a time-driven basis, switching is done after a predetermined interval of time. The resource is given to a user for a fixed interval and then given to another user for a subsequent fixed interval.

LPAR mode can use either of these methods to divide processor resources between sharing logical partitions. The method is selected by setting Wait Completion to either Yes or No (the Wait Completion entry field is displayed after selecting Set Running Time on the LPCTL frame). Wait Completion = No (the default) requests event-driven dispatching. LPAR mode event-driven dispatching also has an element of time-driven dispatching because the processor running time limits the time a logical processor can be continuously dispatched. Wait Completion = Yes turns off event-driven dispatching and causes shared processor resources to be distributed on the basis of time intervals and

according to the weights specified. The Wait Completion setting does not affect logical partitions that use dedicated processors.

Event-driven dispatching has two advantages that are of special interest. The first advantage is a flexibility that allows the system to better meet the peak transaction rates of a logical partition. With Wait Completion = No, the event-driven dispatcher has the flexibility to manage processor resources to compensate for fluctuations in demand among the logical partitions instead of distributing processor resources in a rigid, predetermined manner.

The second advantage is improved responsiveness over time-driven scheduling through I/O interruption and wait detection. With event-driven dispatching, the time that one logical processor spends in a wait state can be made available to other logical processors.

Wait Completion = Yes disables event-driven dispatching. All logical processors are given an entire dispatch interval, even if they have no work to perform and even if they spend that time in a wait state. When Wait Completion = Yes, logical partitions are considered to be busy for 100% of their running time. Therefore, processing weights are always in effect.

Generally, response time is much better when Wait Completion = No is specified and ITR is slightly better when Wait Completion = Yes is specified. Wait Completion = No is recommended because improved responsiveness and the ability to use wait time more than compensates for a small decrease in ITR.

## Number of Vector Facilities

The number of vector facilities defined to the logical partition depends on the number of vector facilities installed and on whether the applications running in the logical partition require vector processing.

The number of vector facilities defined for a logical partition cannot exceed:

- The number of vector facilities installed
- The number of processors in the configuration
- The number of processors defined to the logical partition
- The number of processors defined to the logical partition minus the number of processors with the cryptographic feature.

**Note:** A vector facility and an Integrated Cryptographic Feature cannot be installed on the same processor.

A vector facility installed on a processor is available to all the logical partitions that are dispatched on that processor.

Vector facilities can be shared among logical partitions, but when a vector facility is associated with a processor that is dedicated to a logical partition, the vector facility is not available to other logical partitions.

## Number of Integrated Cryptographic Features

The number of Integrated Cryptographic Features defined to the logical partition depends on the number of cryptographic features installed (one or two, one on each side) and on whether the applications running in the logical partition require a cryptographic feature.

The number of cryptographic features defined for a logical partition cannot exceed:

- The number of cryptographic features installed
- The number of processors in the configuration with the cryptographic feature

**Note:** Two Integrated Cryptographic Features can be defined to a logical partition when a cryptographic feature is installed on both sides of a processor complex and the processor complex is operating in single-image configuration.

- The number of processors defined to the logical partition
- The number of processors defined to the logical partition minus the number of vector facilities defined to a logical partition.

**Note:** A vector facility and a cryptographic feature cannot be installed on the same processor.

A cryptographic feature installed on a processor is available to all the logical partitions that are dispatched on that processor.

Cryptographic features can be shared among logical partitions, but when a cryptographic feature is associated with a processor that is dedicated to a logical partition, the cryptographic feature is not available to other logical partitions.

## Security-Related Controls

Security-related controls for a logical partition can be defined on all processor complex models except ES/3090 E-Models.

**Logical Partition Isolation:** This control reserves reconfigurable channel paths for the exclusive use of a logical partition. Channel paths assigned to an isolated logical partition are not available to other logical partitions and remain reserved for that logical partition when they are deconfigured (configured offline).

**Note:** The only way to release a channel path from an isolated logical partition is by using the RELEASE parameter of the CHPID service language command.

**I/O Configuration Control Authority:** This control can limit the capability of the logical partition to read or write any IOCDS in the configuration. Logical partitions with control authority for the I/O configuration data can read and write any IOCDS (created using an IOP version of IOCP) in the configuration, read a modified IOCDS without an intervening power-on reset (normally, this is accomplished by running IOCP under MVS or VM in the logical partition), and can change the I/O configuration dynamically.

- **For IOCDSs created using an IOP version of IOCP,** all logical partitions can read the active IOCDS, but without control authority for the I/O configuration the read active returns only the information for the logical partition from which the read active was done. The read active function is not supported on IOCDSs (IXP versions) that support ES Connection Channels.

- **Dynamic Reconfiguration Management (Dynamic I/O)**, available with MVS/SP Version 4 Release 2 and subsequent releases, provides the capability of changing the currently active I/O configuration. With dynamic I/O, channel paths, control units, and devices of the currently active I/O configuration can be added, deleted, or modified without requiring a power on reset and an IPL for the change to take effect. Changes made to the currently active I/O configuration can be saved, and the IOCDS that reflects these changes can be written at a later time.

For detailed information about changing the I/O configuration dynamically, refer to the dynamic I/O publication cited in "Reference Publications" on page xiii and the appropriate *MVS Commands* publications.

- **Dynamic I/O Planning and Operation Considerations:**

**Note:** Guidelines for planning and operating in a dynamic I/O environment are detailed in the appropriate MVS publications. The planning and operation considerations described in this section are additional guidelines that apply to a dynamic I/O environment under LPAR mode.

Careful planning will avoid confusion when moving CHPIDs, and eliminate duplicate device situations should a backout be required when a power on reset is performed.

1. Prepare for a backout situation

Before changing the currently active I/O configuration, prepare for a possible backout situation. Record the current CHPID assignments and the planned I/O changes.

To record the CHPID assignments: perform Print Screens or LOGFRAME from the system console while viewing the LPCHNA frame.

It is important to prepare for a backout situation. A backout situation occurs when changes are made to the I/O configuration but the changes are not saved prior to performing a power on reset. If the changes are not saved, the CHPID assignments prior to the first dynamic I/O change will take effect.

In addition CHPID assignments after a backout will also reflect any changes made by service language commands or control program commands.

2. Avoid CHPID reconfigurations concurrent with dynamic-I/O changes

CHPID service language commands and system control program commands should not be used to cause a CHPID to be moved from one logical partition to another while dynamic I/O changes are being made. It is recommended that these commands be used only after the dynamic I/O changes have been saved.

**Note:** These commands change logical partition ownership of a channel path and should not be used to cause a CHPID to be moved from one logical partition to another. These commands can be used to configure or deconfigure channel paths to or from a logical partition during dynamic I/O changes.

**Global Performance Data Control Authority:** This control can limit the capability of a logical partition to view CPU activity data for other logical partitions. Logical partitions with control authority for global performance data can view CPU utilization data and Input/Output Processor (IOP) busy data for all of the logical partitions in the configuration.

A logical partition without control authority for the performance data can view only the CPU utilization data for that logical partition.

**Cross-Partition Control Authority:** This control can limit the capability of the logical partition to issue certain control program instructions that affect other logical partitions. Logical partitions with cross-partition control authority can issue instructions to perform a system reset of another logical partition, deactivate any other logical partition, and provide support for the automatic reconfiguration facility.

The automatic reconfiguration facility permits a backup logical partition to deactivate a primary logical partition if a problem is detected in the primary logical partition. The backup logical partition can then configure online, storage resources that become available when the primary logical partition is deactivated.

**Cryptographic Characteristics:** The following characteristics of the Integrated Cryptographic Feature can be specified for a logical partition.

- **The cryptographic key storage unit** for use by a logical partition must be specified to activate a logical partition when a cryptographic feature is defined to a logical partition. The cryptographic key storage unit on side 0, side 1, or on both sides can be specified for use by a logical partition.
- **The cryptographic key entry enable** indicates which logical partition can read data from the cryptographic key-entry unit. When the key-entry unit is enabled, only one logical partition can communicate with it at a time.
- **Cryptographic special security mode** indicates if the cryptographic features for a logical partition can run in the special security mode. Multiple logical partitions can run in the special security mode concurrently.
- **Enabling the Integrated Cryptographic Feature** for use by a logical partition can be specified for each logical partition for which a cryptographic feature has been defined.

**Note:** Multiple logical partitions can be enabled to use the cryptographic feature concurrently.

When a logical partition is not enabled to use the cryptographic feature, it can not use the cryptographic features that have been defined to that logical partition.

- **crypto-domain index** for use by a logical partition must be specified to activate a logical partition when a cryptographic feature is defined to a logical partition. It can be a value from 0 to 6 inclusive.

## Assigning Channel Paths to a Logical Partition

Channel paths are defined in the IOCDs. Channel paths that are specified as reconfigurable may be moved among logical partitions and can be assigned to S/370 channels using the LPCHND frame.

Channel paths that are specified for a logical partition as not reconfigurable are dedicated to that logical partition.

### Channel Paths for ESA/370 and ESA/390 Logical Partitions

Channel paths assigned in the IOCDs to ESA/370 or ESA/390 logical partitions can be specified as reconfigurable or specified as not reconfigurable.

### Channel Paths for S/370 Logical Partitions

- For LPAR mode, S/370 channels are defined **only** through the LPCHND frame.
- Only parallel channels can be defined for S/370 logical partitions. ES Connection Channels can not be defined for a S/370 logical partition.
- S/370 channel information specified in the IOCP is ignored.

If the mode of the logical partition is S/370, the S/370 channel information must be specified on the LPCHND frame before the logical partition is activated.

- If the channel path is to be assigned to a S/370 logical partition, the channel path must be specified as reconfigurable in the IOCDs.
- A CHPID may be defined to a channel set and channel address in more than one logical partition at the same time. This allows CHPIDs to be moved among S/370 logical partitions.
- The number of S/370 channels that can be defined is limited by the channel restrictions of the control program loaded into a logical partition.

For example, VM/SP and MVS/370 each support 16 channels in each channel set. VM/SP HPO supports up to 32 channels in each channel set. VSE supports 16 channels in one channel set.

**Note:** For MVS/370 and VM, defining two channel sets is of benefit only if they are run in a logical partition with two logical processors.

## Automatic IPL for a Logical Partition

Use the LPDEF frame to define automatic IPL information if the control program is to be loaded automatically each time the logical partition is activated.

**For S/370 logical partitions:** During automatic IPL, a device attached to channel set 0 is used.

**For MVS/SP Versions 3 and 4, and MVS/SP Version 2 Release 2:** Specify parameter (PARM) information if desired. Byte 2 and byte 3 of the PARM field are used to select an IOCONFIG member of this IPL if the default (00) is not desired.

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## Defining Logical Partitions

This section describes the display frames, parameters, and service language commands that can be used to define logical partition characteristics or to change logical partition definitions.

### Notes:

1. The information in this section assumes that decisions about which processor resources to define to logical partitions and which parameters to specify are made using the information under "Guidelines for Determining Logical Partition Characteristics" on page 3-10.
2. Some features, functions, and display frames are model dependent and SEC-level dependent. For this reason, all of the logical partition characteristics, display frames, or functions described in this section are not necessarily available on every processor complex model.

Logical partition definitions are saved across a power-on reset and are used during each power-on reset into LPAR mode. Some logical partition definitions can be changed only when the logical partition is deactivated; other definitions can be changed at any time. For more information, see "Changing Logical Partition Definitions" on page 3-7.

After a power-on reset into LPAR mode, the LPDEF frame is displayed and LPDEF frame parameters can be defined or changed, and other display frames can be invoked.

## Defining Logical Partitions (Using the Single LPDEF Frame)

The Logical Partition Definition (LPDEF) frame is used to define a logical partition, change a logical partition definition, activate a logical partition, or deactivate a logical partition that is specified by the currently active IOCDs.

### Operation Considerations (Single LPDEF Frame)

**Note:** The identifier (ID) of the logical partition should not be changed unless directed to do so by installation management. This field is used by the Store CPU ID instruction for each processor in the logical partition.

1. At the system console, enter **F LPDEF** to display the Logical Partition Definition (LPDEF) frame.
2. If necessary, shut down the control program in the selected logical partition, and deactivate that logical partition.
3. Use **Ax** (where **x** is the A-selection number of the logical partition to be defined) and **B3** (Update) to define the characteristics of the logical partitions.

After the **Ax B3** selection is made, the information for the selected logical partition is displayed in the middle of the LPDEF frame where the definition information can be entered. After the definition information is entered, the system prompts for an **X1** entry to confirm the definition. The logical partition can then be activated.

### Logical Partition Definition Parameters (Single LPDEF Frame)

The parameters of a logical partition definition are represented by the entry fields on the Logical Partition Definition (LPDEF) frame (Figure 3-2).

Logical Partition Definition											dd mmm yy	hh:mm:ss
											(LPDEF)	
IOCDs: A0/LPARPROD												
A= PARTITION	S	ID	MODE	F	--STG	MB--	--NUMBER	OF--	---	AUTO	IPL-----	
1. DOSVSE	A	F	370	N	MAIN	EXP	CP	VE	CHPS	A	ADDR	PARM
2. MVSPROD	A	1	ESA	N	16	0	1	0	16	N	0250	
3. MVSTEST	A	5	ESA	N	100	1400	6	2	44	Y	0150	
4. VMHPO	A	A	370	N	72	150	6	1	44	Y	0400	120
					64	498	2	1	24	N	0300	
B= ACTION												
1. Activate					252	2048	...	Defined				
2. Deactivate					252	2048	...	Activated				
3. Update					252	2048	...	Configured				
COMMAND ==>												
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating												
A:A MODE											SI	

Figure 3-2. Logical Partition Definition (LPDEF) Frame

**LPDEF Parameters:** The logical partition definition parameters described below can be defined using the single LPDEF frame.

- The names (PARTITION) for the logical partitions are the names specified in the active IOCDs. This information is display only and can be changed only by changing the active IOCDs.
- The status (S) of the logical partitions can be one of the following:
  - A indicates that the logical partition is active.
  - D indicates that the logical partition has been deactivated.
  - P indicates that activation for the logical partition is pending. The P indicator is shown at the end of a power-on reset and indicates that the logical partition may be activated automatically.

The status information for the logical partitions is display only. The status of a logical partition can be changed with a B1 (Activate) or B2 (Deactivate) selection.

- The identifier (ID) of the logical partition is used as the fourth hexadecimal digit of the operand stored by the Store CPU ID instruction for each processor in the logical partition. Valid identifiers for logical partitions are '0'X through 'F'X. The logical partition identifier must be unique for each active logical partition, or for each side of a physically partitioned configuration.
- The mode (MODE) in which the logical partition is to operate, S/370 or ESA/370.



- The favored (F) logical partition is the logical partition whose main storage starts at physical storage location 0. Only one logical partition can be favored. Specify Y or N.

The favored logical partition is the first logical partition to be activated, if the requirements for automatic activation are met. See "Automatic Activation" on page 4-19.

#### **Storage Parameters**

- Main storage (STG MB MAIN) is allocated to a logical partition in a contiguous block. Specify the size in 1MB increments. The main storage allocated to a logical partition is not shared by the other logical partitions.
- Expanded storage (STG MB EXP) is allocated to a logical partition in a contiguous block. Specify the size in 1MB increments. The expanded storage allocated to a logical partition is not shared by the other logical partitions.

**Note:** For VM/SP HPO, the recommended procedure is to define expanded storage in 4MB increments.

#### **Processor Parameters**

- The number of processors (NUMBER OF CP) for the logical partition. The number of processors defined to a logical partition cannot exceed the number of physical processors installed.
- The number of vector facilities (NUMBER OF VE) cannot exceed the number of vector facilities installed, and the number of processors defined to that logical partition.

#### **Channel Paths**

- Channel paths (NUMBER OF CHPS) indicates the number of channel paths currently assigned to the logical partition. Channel paths are assigned to logical partitions during the IOCP process. This information is display only.

#### **Automatic IPL Information**

- Automatic IPL (AUTO IPL) information for the logical partition specifies the target load unit and any optional parameters for loading a control program automatically on each activation of the logical partition.

**Note:** S/370 logical partitions use a device attached to channel set 0 when performing an automatic IPL.

#### **Storage Resources**

- The **Defined** storage field is a display-only field and displays the total megabytes of central storage and expanded storage defined.
- The **Activated** storage field is a display-only field and displays the total megabytes of central storage and expanded storage allocated for all the currently activated logical partitions.
- The **Configured** storage field shows the amount of storage that is available for the logical partitions (for this side only if in physically partitioned configuration, or for the entire processor complex if in single-image configuration).

## Defining Logical Partitions (Using Multiple LPDEF Frame Views)

The Logical Partition Definition (LPDEF) frame is used to define a logical partition, change a logical partition definition, activate a logical partition, or deactivate a logical partition that is specified by the currently active IOCDS.

### Operation Considerations (Multiple LPDEF Frame Views)

**Note:** The identifier (ID) of the logical partition should not be changed unless directed to do so by installation management. This field is used by the Store CPU ID instruction for each processor in the logical partition.

1. At the system console, enter **F LPDEF** to display the Logical Partition Definition (LPDEF) frame. The Summary View is displayed.
2. If necessary, shut down the control program in the selected logical partition, and deactivate that logical partition.
3. Select the appropriate View (Cn, where n is the view-selection number), the logical partition (Ax, where x is the A-selection number), and Update mode (B3, Update) to define or change the desired parameters.

After the definition information is entered, the system prompts for an X1 entry to confirm the definition. The logical partition can then be activated.

## Logical Partition Definition Parameters (Multiple LPDEF Frame Views)

The LPDEF frame with multiple views is represented by several frames (called views) that display logical groups of parameters and display-only fields for a logical partition, and provide an update mode for changing some definition parameters.

```

                                Logical Partition Definition
                                dd mmm yy  hh:mm:ss
                                (LPDEF)
IOCDs: A0/LPARPROD

A= PARTITION  S  ID MODE L/U MSG SUM CHPS
1. DOSVSE    A  F 370 L . . 16
2. MVSPROD   A  1 ESA L . . 44
3. MVSTEST   A  5 ESA L . . 44
4. VMHPO     A  A 370 L . . 24

B= ACTION
1. Activate
2. Deactivate
3. Update

C= VIEW
-> 1. Summary
   2. Description
   3. Storage
   4. Processor
   5. Auto IPL
   6. One Partition

COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating
-----
A:A MODE      SI
```

Figure 3-3. Logical Partition Definition (LPDEF) Frame (Summary View)

### LPDEF Frame (Summary View)

The Summary View (Figure 3-3) of the LPDEF frame is the default view whenever the LPDEF frame is invoked, and provides a display-only status summary for the logical partitions.

**LPDEF Frame Views:** The following views (VIEW) of the LPDEF frame can also be selected from any other LPDEF frame view:

- The Summary (C1) view provides quick access to a status summary for the logical partitions.
- The Description (C2) view is used to display or change the definitions for the identifier (ID) and the architectural mode (MODE) for the logical partitions.
- The Storage (C3) view is used to display or change storage definitions for the logical partitions. Storage is totaled and displayed for all partitions when this view is selected.
- The Processor (C4) view is used to display or change the processor definitions for the logical partitions.

- The Auto IPL (C5) view is used to display or change automatic IPL definitions for the partitions.
- The One Partition (C6) view is used to display and change all of the parameters (displayed on C2 through C5) for a single partition that can be changed using the LPDEF frame.

**ACTION Parameters:** The following actions (ACTION) can be selected from any LPDEF frame view and performed on the resources specified by A = Partition and C = VIEW.

- Activate (B1) is used to activate the specified physical and logical resources. The activation will not complete unless all physical resources specified are available.
- Deactivate (B2) is used to release any physical resources that are allocated to the logical partition.
- Update (B3) is used to change and save a definition for a logical partition. A prompt is issued and a confirmation is required to save a definition.

**LPDEF Parameters:** The logical partition definition parameters described below are also displayed on each view of the LPDEF frame:

- The name (IOCDs) of the active I/O configuration data set is displayed if a name has been assigned.
- The names (PARTITION) for the logical partitions are the names specified in the active IOCDs. This information is display only and can be changed only by changing the active IOCDs.
- The status (S) of the logical partitions is a display-only field and can be one of the following:
  - A indicates that the logical partition is activated.
  - D indicates that the logical partition is deactivated.
  - P indicates that automatic activation for the logical partition is pending, and is displayed only during the automatic activation sequence (D is displayed for partitions that are not to be activated automatically).

The status information for the logical partitions is display only. The status of a logical partition can be changed with a B1 (Activate) or B2 (Deactivate) selection.

The following logical partition definition parameters that are displayed on the Summary view may be displayed on other views or be changed as indicated below.

- The identifier (ID) of the logical partition is used as the fourth hexadecimal digit of the operand stored by the Store CPU ID instruction for each logical processor in the logical partition, and can also be displayed and updated using the C2 or C6 selections. Valid identifiers for logical partitions are '0'X through 'F'X. The logical partition identifier must be unique for each active logical partition, or for each side of a physically partitioned configuration.
- The mode (MODE) in which the logical partition is operating, either S/370 or ESA/370 mode, can also be displayed and updated using the C2 or C6 selections.

- The lock/unlock (L/U) status for the operator controls in each partition is displayed only on the Summary view, and can be changed by using the LOCKLP/UNLOCKLP service language commands.
- Messages (MSG) for the logical partition are indicated by one of the following characters:
  - S indicates that system control program messages are pending that can be handled using the SCPMSG frame.
  - O indicates that messages are pending that can be handled using the OPRMSG frame.
  - \* indicates that messages are pending that can be handled using the SCPMSG frame and the OPRMSG frame.
  - . (a period) indicates there are no messages pending.
- Summary (SUM) Logical CP status field indicates the global logical CP status.
  - X indicates that there is at least one CP in the logical partition that is in the check-stop state.
  - T indicates that the logical partition is in test mode.
  - \* indicates that the logical partition is in test mode and that there is at least one CP in the logical partition that is in the check-stop state.
  - . (a period) indicates that no CPs in the logical partition are in the check-stop state, and the logical partition is not in test mode.
- The number of channel paths (CHPs) that are allocated to the logical partition as defined by the active IOCDs. These channel paths are defined to logical partitions during the IOCP process, and cannot be specified or changed using the LPDEF frames.

This display-only field shows any previous reconfiguration using CHPID or control program channel reconfiguration commands.

**Updating Parameters Using the Multiple LPDEF Frame Views:** Each LPDEF frame view (except the Summary view that is display only) provides an update-mode view that displays the current definitions for logical partitions, the parameters that can be updated using that view, and input fields for entering the new values. Update mode formats vary according to the LPAR frame view selected. The capability to change views during an update is provided, but the selection of other logical partitions or the activation or deactivation of logical partitions is not permitted while updating an LPDEF parameter.

**Note:** Logical partition definitions defined using the LPDEF frame can be changed only when the selected partition is deactivated, except for the automatic IPL definitions (C5) that can be changed at any time. These logical partition definitions are saved across a power-on reset, and are used automatically during each power-on reset for LPAR mode.

## LPDEF Frame (Description View)

```

                                                    dd mmm yy hh:mm:ss
                                                    (LPDEF)
Logical Partition Definition
IOCDS: A0/LPARPROD

A= PARTITION  S  ID MODE
1. DOSVSE    A  F 370
2. MVSPROD   A  1 ESA
3. MVSTEST   A  5 ESA
4. VMHPO     A  A 370

B= ACTION
1. Activate
2. Deactivate
3. Update

C= VIEW
1. Summary
-> 2. Description
3. Storage
4. Processor
5. Auto IPL
6. One Partition

COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating
-----
A:A MODE      SI
```

Figure 3-4. Logical Partition Definition (LPDEF) Frame (Description View)

The Description view (Figure 3-4) of the LPDEF frame displays the definitions for the logical partition identifier (ID) and the operating mode (MODE) for the logical partitions, and provides an update mode to change these parameters for each logical partition.

## LPDEF Frame (Storage View)

```

                                Logical Partition Definition
                                dd mmm yy hh:mm:ss
                                (LPDEF)
IOCDs: A0/LPARPROD

A= PARTITION S  --CENTRAL (MB)-- --EXPANDED (MB)-
1. DOSVSE  A   16    0   236    0    0
2. MVSPROD A  100    0   136  1400    0   648
3. MVSTEST A   72    0    64   148    0   500
4. VMHPO   A   64    0    0    500    0    0

B= ACTION
1. Activate
2. Deactivate
3. Update

C= VIEW
1. Summary
2. Description
-> 3. Storage
4. Processor
5. Auto IPL
6. One Partition

-----CS Total----- -----ES Total-----
Defined:                252                2048
Assigned:               252                2048
Configured:             252                2048

COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating

-----
A:A MODE   SI

```

Figure 3-5. Logical Partition Definition (LPDEF) Frame (Storage View)

The Storage view (Figure 3-5) of the LPDEF frame displays the central and expanded storage parameters, totals the storage for all logical partitions when displayed, and provides an update mode to change these parameters for each logical partition.

### Central Storage Parameters:

- The amount of initial central storage, CENTRAL INIT (MB), shown is the amount of requested central storage that is allocated to the logical partition when it is activated.

#### Notes:

1. Central storage is allocated to a logical partition in a contiguous block. Specify the size in 1MB increments. The central storage allocated to a logical partition is not shared by other logical partitions.
  2. The amount of central storage available is the total amount of central storage installed minus that allocated to active logical partitions and the storage occupied by the hardware system area (HSA). Any megabyte that is wholly occupied by HSA is removed from the storage that can be assigned to a logical partition.
- The amount of reserved central storage, CENTRAL RSVD (MB), shown is the amount of additional central (main) storage requested for the logical partition. The reserved storage space must be contiguous to and above the initial amount of central storage, and becomes available to the logical partition when another logical partition is not activated for the same storage.

- 0 indicates that the central storage size for the logical partition is fixed at the initial size for the duration of the activation.
- A nonzero amount requires that the origin for the logical partition's central storage be specified. Only logical partitions that specify a central storage origin can be allocated storage within the reserved storage of another logical partition.
- The central storage origin, CENTRAL ORIG (MB), defines the origin of the central storage for the logical partitions. When a logical partition is activated, it is allocated at the origin specified by this field.
  - An origin can be specified whether or not CENTRAL RSVD (MB) is specified.
  - If an origin is not specified, the INIT amount of central storage will be allocated wherever there is sufficient space available. If enough central storage is not available to satisfy the INIT request starting at the specified origin, the activation for the partition will fail.

**Expanded Storage Parameters:**

- The amount of initial expanded storage, EXPANDED INIT (MB), shown is the amount of requested expanded storage that is allocated to the logical partition when it is activated.

**Notes:**

1. Expanded storage is allocated to a logical partition in a contiguous block. Specify the size in 1MB increments. The initial expanded storage allocated to a logical partition is not shared by the other logical partitions.
  2. For VM/SP HPO, the recommended procedure is to define expanded storage in 4MB increments.
- The amount of reserved expanded storage, EXPANDED RSVD (MB), shown is the amount of additional expanded storage requested for the logical partition. The reserved storage space must be contiguous to and above the initial amount of expanded storage, and becomes available to the logical partition when another logical partition is not activated for the same storage.
    - 0 indicates that the expanded storage size for the logical partition is fixed at the initial size for the duration of the activation.
    - A nonzero amount requires that the origin for the logical partition's expanded storage be specified. Only logical partitions that specify an expanded storage origin can be allocated storage within the reserved storage of another logical partition.
  - The expanded storage origin, EXPANDED ORIG (MB), defines the origin of the expanded storage for the logical partitions. When a logical partition is activated, it is allocated at the origin specified by this field.
    - An origin can be specified whether or not EXPANDED RSVD (MB) is specified.
    - If an origin is not specified, the INIT amount of expanded storage will be allocated wherever there is sufficient space available. If enough expanded storage is not available to satisfy the INIT request starting at the origin specified here, the activation for the logical partition will fail.



**Storage Resources:**

- The **Defined** storage field is a display-only field and displays the total megabytes of central storage and expanded storage defined.
- The **Assigned** storage field is a display-only field and displays the total megabytes of central storage and expanded storage allocated for all the currently activated logical partitions.
- The **Configured** storage field shows the amount of storage that is available for the logical partitions (for this side only if in physically partitioned configuration, or for the entire processor complex if in single-image configuration).

**LPDEF Frame (Storage View in Update Mode)**

```

                                dd mm yy hh:mm:ss
                                (LPDEF)
IOCDS: A0/LPARPROD
                                Logical Partition Definition
                                --CENTRAL (MB)-- --EXPANDED (MB)--
A= PARTITION S INIT RSVD ORIG INIT RSVD ORIG B= ACTION
-> 1. DOSVSE A 16 0 236 0 0 1. Activate
    New Value => 16 0 236 0 0 2. Deactivate
2. MVSPROD A 100 0 136 1400 0 648 -> 3. Update
3. MVSTEST A 72 0 64 148 0 500
4. VMHPO A 64 0 0 500 0 0
                                C= VIEW
                                1. Summary
                                2. Description
                                -> 3. Storage
                                4. Processor
                                5. Auto IPL
                                6. One Partition

                                -----CS Total----- -----ES Total-----
Defined: 252 2048
Assigned: 252 2048
Configured: 252 2048

COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating

A:A MODE SI
    
```

Figure 3-6. Logical Partition Definition (LPDEF) Frame (Storage View in Update Mode)

The Storage view (Figure 3-6) of the LPDEF frame in update mode displays the central and expanded storage parameters that can be defined or changed for a selected logical partition, and provides input fields for entering new values.

This view indicates that the logical partition DOSVSE has been selected for update. The current values and the input fields are displayed below the selected logical partition.

## LPDEF Frame (Processor View)

```

                                dd mmm yy  hh:mm:ss
                                (LPDEF)
                                Logical Partition Definition
IOCDS: A0/LPARPROD
                                --PROCESSOR--
A= PARTITION  S  DED CPs VEs CTs
1. DOSVSE    A  N   1  0  1
2. MVSPROD   A  N   6  2  2
3. MVSTEST   A  N   6  1  0
4. VMHPO     A  N   2  1  1

B= ACTION
1. Activate
2. Deactivate
3. Update

C= VIEW
1. Summary
2. Description
3. Storage
-> 4. Processor
5. Auto IPL
6. One Partition

COMMAND ==>
SYSTEM 1 MVSPROD  0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating
-----
A:A MODE      SI

```

Figure 3-7. Logical Partition Definition (LPDEF) Frame (Processor View)

The Processor view (Figure 3-7) of the LPDEF frame displays the processor definitions for the logical partitions, and provides an update mode to change these definitions for each logical partition, except for the dedicated processors indicator that is a display-only field.

### Processor Parameters:

- If the processors for a logical partition are dedicated to that partition (DED), Y is shown. An N indicates the logical partition uses shared processors.
- Note:** To dedicate a central processor for a logical partition, use the Logical Partition Controls (LPCTL) frame.
- The number of central processors (CPs) defined to a logical partition cannot exceed the total number of physical processors installed (or installed on a side if physically partitioned).
  - The number of central processors with a vector facility (VEs) that can be defined to a logical partition cannot exceed the number of vector facilities installed, and the number of processors defined to that logical partition.
  - The number of central processors with an Integrated Cryptographic Feature (CTs) that can be defined to a logical partition cannot exceed the number of processors defined to that logical partition, and the number of cryptographic features (one or two) installed (or installed on a side if physically partitioned).

## LPDEF Frame (Auto IPL View)

```

                                dd mm yy  hh:mm:ss
                                (LPDEF)
IOCDs: A0/LPARPROD
                                Logical Partition Definition
                                --- AUTO IPL ----
A= PARTITION  S A ADDR PARM
1. DOSVSE     A N 0250 _____
2. MVSPROD   A Y 0150 _____
3. MVSTEST   A Y 0400 120 _____
4. VMHPO     A N 0300 _____

B= ACTION
1. Activate
2. Deactivate
3. Update

C= VIEW
1. Summary
2. Description
3. Storage
4. Processor
-> 5. Auto IPL
6. One Partition

COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating

-----
A:A MODE  SI

```

Figure 3-8. Logical Partition Definition (LPDEF) Frame (Auto IPL View)

The Auto IPL view (Figure 3-8) of the LPDEF frame displays automatic IPL information for the logical partitions, and provides an update mode to change the IPL definitions for each logical partition (unlike other definitions for logical partitions, the automatic IPL parameters can be changed at any time).

### Automatic IPL Parameters:

- The **A** field indicates whether an automatic IPL is active for the logical partition. A **Y** indicates yes and an **N** indicates no.
- The automatic IPL device address (**ADDR**) specifies the target load unit. A hexadecimal value may be entered in this field.
- Optional IPL load parameters (**PARM**) may be specified for loading a control program on each activation of the logical partition. A 1- to 8-character load parameter may be entered.

**Note:** For S/370 logical partitions, a device attached to channel set 0 is used when performing an automatic IPL.

## LPDEF Frame (One Partition View)

```

                                dd mmm yy hh:mm:ss
                                (LPDEF)
Logical Partition Definition
IOCDs: A0/LPARPROD
+--MVSPROD ---Current-----+
A= PARTITION S | ID = 1 | B= ACTION
1. DOSVSE D | Mode = ESA | 1. Activate
-> 2. MVSPROD D | CS Initial= 100 | 2. Deactivate
3. MVSTEST D | CS Rsvd = 0 | 3. Update
4. VMHPO D | CS Origin = 136 |
| ES Initial= 1400 | C= VIEW
| ES Rsvd = 0 | 1. Summary
| ES Origin = 0 | 2. Description
| CPs = 6 | 3. Storage
| VEs = 2 | 4. Processor
| CTs = 2 | 5. Auto IPL
| Auto IPL = Y | -> 6. One Partition
| IPL Addr = 0150 |
| IPL Parm = - |
+-----+
COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating
-----
A:A MODE SI

```

Figure 3-9. Logical Partition Definition (LPDEF) Frame (One Partition View)

**Note:** For more information on the parameters shown on the One Partition view, refer to the appropriate LPDEF frame view descriptions.

The One Partition view (Figure 3-9) of the LPDEF frame displays all of the definitions for a logical partition that can be updated using the LPDEF frame, and provides an update mode to change these definitions for each logical partition.

This view requires an Ax entry to change the logical partition being displayed. The activation or deactivation of other logical partitions is permitted while this view is displayed.

## LPDEF Frame (One Partition View in Update Mode)

```

                                dd mmm yy  hh:mm:ss
                                (LPDEF)
IOCDs: A0/LPARPROD
                                Logical Partition Definition
A= PARTITION S +-MVSPROD ---Current--New-----+
1. DOSVSE   D | ID           =      1  1      | B= ACTION
-> 2. MVSPROD D | Mode          =     ESA  ESA      | 1. Activate
3. MVSTEST  D | CS Initial=    100 100_   | 2. Deactivate
4. VMHPO    D | CS Rsvd     =      0  0_     | -> 3. Update
           D | CS Origin  =    136 136_   |
           D | ES Initial=   1400 1400  | C= VIEW
           D | ES Rsvd    =      0  0_     | 1. Summary
           D | ES Origin  =      0  0_     | 2. Description
           D | CPs         =      6  6_     | 3. Storage
           D | VEs        =      2  2_     | 4. Processor
           D | CTs         =      2  2_     | 5. Auto IPL
           D | Auto IPL   =      Y  Y_     | -> 6. One Partition
           D | IPL Addr  =    0150 0150  |
           D | IPL Parm  =                |
           D +-----+
COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating
-----
A:A MODE      SI

```

Figure 3-10. Logical Partition Definition (LPDEF) Frame (One Partition View in Update Mode)

**Note:** For more information on the parameters shown on the One Partition view, refer to the appropriate LPDEF frame view descriptions.

The One Partition view (Figure 3-10) of the LPDEF frame in update mode displays all of the parameters that can be defined or changed for a selected logical partition, and provides input fields for entering new values.

This view indicates that the logical partition MVSPROD has been selected for update. The current values and the input fields for entering new data are displayed for the selected logical partition.

## Defining Processing Weight and Processor Running Time

Processing weights, running time, and resource capping are specified using parameters on the Logical Partition Controls (LPCTL) frame.

### Operation Considerations

**LPCTL Values and Changes to the IOCDS:** Information on the LPCTL frame (processing weights, dedicated indication, capping) are written to the processor controller DASD and are associated with an IOCDS, not with logical partition definitions. The implications of this are:

- LPCTL frame settings and values can be lost when updating the I/O configuration and rewriting the IOCDS.
- If the names and number of logical partitions in the **new** IOCP configuration are the **same** as those previously defined in the target IOCDS (for example, A0, B0, and so forth), then the LPCTL frame values **last** associated with the target IOCDS will be used. These values **may or may not** be the same as the values and settings associated with the currently active IOCDS.
- If the names **or** the number of logical partitions changes, or if the target IOCDS has not been used to initialize LPAR mode (and thus no LPCTL values are associated with this IOCDS), the weight values for each logical partition will default to 10, and the settings for dedicated or capped logical partitions are lost.

### Notes:

1. If an updated IOCDS is used after a power-on reset, the LPCTL settings should be checked to ensure that they are correct.
2. If a logical partition is changed from dedicated to shared, the last-used capping value for the logical partition is restored.
3. For some ES/9000 SEC levels, processing weights and processing resource capping values are associated with logical partition definitions and not with an IOCDS. These values are retained as long as the associated logical partition name is specified in an IOCDS. Processor running time and wait completion values continue to be associated with an IOCDS.

**Setting LPCTL Frame Parameters:** The following procedure can be used to set the values on the LPCTL frame. See Figure 3-11 on page 3-46.

1. At the system console, enter **F LPCTL** to display the Logical Partition Controls frame.
2. Check the status of the logical partitions in the Status field: active (A), deactivated (D). If processors are to be dedicated to a logical partition, the status must be deactivated (D).
3. In the Weight field, enter one of the following for each logical partition (as necessary):
  - Values between 001 and 999 (decimal) can be used to set the weights for a logical partition (the default value is 010).
  - **DED** to cause the central processors that are allocated to a logical partition to be dedicated when the logical partition is activated.

**Note:** To make this specification, the logical partition must be deactivated. To release (undedicate) dedicated central processors, the logical partition must be deactivated before the weight field can be changed.

## Logical Partition Controls Parameters (LPCTL Frame)

**Note:** For ES/9000 Models 820, 860, and 900 use the LPCTL frame shown in Figure 3-12 on page 3-47.

```

                                     Logical Partition Controls
                                     dd mm yy hh:mm:ss
                                     (LPCTL)

IOCDs: A0/LPARPROD

A= Processing Weights
->1= Set Weights (1-999 Or D For Dedicated)
    LP Name  Status  Weight  Capped
    DOSVSE   A       300    NO
    MVSPROD  A       DED
    MVSTEST  A       100    YES
    VMHPO    A       900    NO

B= Processor Running Time
  1. Dynamically Determined
->2. Set Running Time
    Time (Dec): 015 (Milliseconds)
    Wait Completion: N (Y/N)

COMMAND ==>
```

Figure 3-11. Logical Partition Controls (LPCTL) Frame

**Capping Function:** To cap the processor resources for a logical partition, enter YES in the Capped field. The default is NO.

**Note:** The capping function does not apply to logical partitions with dedicated processors (the Capped field for dedicated processors is blank).

### Processor Running Time

- The default is B1, Dynamically Determined; this allows the dynamic calculation of the length of central processor time dispatched.
- The Set Running Time (B2) selection can be used to manually set the length of central processor time dispatched. Values from 001 through 100 (decimal) milliseconds can be specified.
- The Wait Completion field is displayed after selecting Set Running Time (B2) with a Y/N field.

If Wait Completion is N, the default, event-driven dispatching is requested. If Wait Completion is Y, event-driven dispatching is turned off, causing shared processor resources to be distributed on the basis of time intervals according to the weights specified.

## LPCTL Frame (ES/9000 Models 820, 860, and 900)

**Note:** This frame applies only to the ES/9000 Models 820, 860, and 900. For other models, use the LPCTL frame shown in Figure 3-11 on page 3-46.

```

                                     dd mm yy hh:mm:ss
                                     (LPCTL)

Logical Partition Controls

IOCDs: A0/LPARPROD

---Weights---
A= Partition S Value Capped      B= Processor Running Time
  1. DOSVSE  A  300   NO          1. Dynamically Determined
  2. MVSPROD A  DED    -          -> 2. Set Running Time
  3. MVSTEST A  100   YES         Time (Dec): 030 (Milliseconds)
  4. VMHPO   A  900   NO          Wait Completion: N (Y/N)

C= Partition Controls
  1. Set Processing Weights
    (1-999 or D for Dedicated)

COMMAND ==>
```

Figure 3-12. LPCTL Frame (ES/9000 Models 820, 860, and 900)

**Capping Function:** To cap the processor resources for a logical partition, enter YES in the Capped field. The default is NO.

**Note:** The capping function does not apply to logical partitions with dedicated processors (the Capped field for dedicated processors is blank).

### Processor Running Time

- The default is B1, Dynamically Determined; this allows the dynamic calculation of the length of central processor time dispatched.
- The Set Running Time (B2) selection can be used to manually set the length of central processor time dispatched. Values from 001 through 100 (decimal) milliseconds can be specified.
- The Wait Completion field is displayed after selecting Set Running Time (B2) with a Y/N field.

If Wait Completion is N, the default, event-driven dispatching is requested. If Wait Completion is Y, event-driven dispatching is turned off, causing shared processor resources to be distributed on the basis of time intervals according to the weights specified.

**Partition Controls:** Use this selection (C1) to enable the update function for the processing weights (Value and Capped) for all logical partitions. To save the changes, enter X1 on the command line.



## Defining Security-Related Controls

Security-related control parameters and cryptographic parameters for logical partitions can be displayed and specified using the Logical Partition Security (LPSEC) frame.

**Note:** The ICRF parameters are displayed on the LPSEC frame only if the IBM Integrated Cryptographic Feature is installed on the processor complex.

### Operation Considerations

When changing the I/O configuration in a dynamic I/O environment, follow the planning and operation guidelines under "Security-Related Controls" on page 3-26.

The only way to release a channel path from an isolated logical partition is by using the RELEASE parameter of the CHPID service language command.

If a channel path is configured offline while the logical partition is isolated and remains offline when the logical partition is changed from being an isolated partition, the channel paths must be configured offline again using the CHPID service language command.

### Logical Partition Security Parameters (LPSEC Frame)

```

                                dd mmm yy  hh:mm:ss
                                (LPSEC)

                                Logical Partition Security
IOCDs: A0/LPARPROD

--CONTROL-- ----ICRF-----
A= PARTITION  S ISO IOC PRF XLP KSU KE SPC ENA CDX B= UPDATE
1. DOSVSE    A N  Y  Y  Y  B  Y  N  Y  0    1. Isolate
2. MVSPROD   A N  Y  Y  N  0  N  Y  Y  1    2. Control
3. MVSTEST   A N  Y  Y  N  1  N  Y  Y  3    3. ICRF
4. VMHPO     A N  Y  Y  N  0  N  N  Y  4    4. CDX

                                C=  RESET CONTROLS
                                1. To ALL N

                                Legend:
                                N = No/No Control
                                Y = Yes

COMMAND ==>
SYSTEM 1 MVSPROD  0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating

                                A:A MODE      SI
  
```

Figure 3-13. Logical Partition Security (LPSEC) Frame

The LPSEC frame (Figure 3-13) displays security-related control parameters and cryptographic parameters for the logical partitions, and provides update functions to change these parameters.

**Updating Isolation, Control, and Cryptographic Parameters:** The ISO, CONTROL, and the ICRF parameters can be changed at any time using the update parameters displayed on this frame, except for the cryptographic crypto-domain index and the cryptographic storage unit parameters that can be changed only when the logical partition is deactivated.

**Notes:**

1. For LPSEC frame parameters that can be changed at any time, the changes take effect immediately, are saved, and are used automatically during each power-on reset for LPAR mode.
2. For cryptographic parameters that can be changed at any time, at least one cryptographic feature must be defined to a logical partition (CT must be non-zero on the LPDEF frame) to update the parameter.

**Update Parameters:** The following update (UPDATE) functions can be selected from the LPSEC frame and performed on the logical partition specified by A = PARTITION. A prompt is issued and a confirmation is required to change a value.

- Isolate (B1) is used to change the isolation value (ISO) for a logical partition.
- Control (B2) is used to change the control authority for the I/O configuration data (CONTROL IOC) and for the CPU (CONTROL PRF) utilization data.
- Crypto (B3) is used to change the cryptographic parameters for a logical partition.

**Reset Controls:** Use RESET CONTROLS (C1) to reset the CONTROL IOC, CONTROL PRF, and the CONTROL XLP values to N for all logical partitions in the configuration. Confirmation is required to perform this reset; a prompt will be issued.

**Logical Partition Isolation Parameters:** The isolation parameters for a logical partition can be specified as follows:

- Logical partition isolation (ISO) reserves reconfigurable channel paths for the exclusive use of the logical partition. N is the default for this field. This parameter can be changed at any time.
  - N indicates that the logical partition is not isolated.
  - Y indicates that the logical partition is isolated.

**Logical Partition Control Parameters:** The control parameters for a logical partition can be specified as follows:

- The I/O configuration control (CONTROL IOC) parameter can limit the capability of the logical partition to read or write any IOCDS in the configuration. Y is the default for this field. This parameter can be changed at any time.
  - N indicates that the logical partition does not have control authority for the I/O configuration.

**Note:** For IOCDSs created using an IOP versions of IOCP, all logical partitions can read the active IOCDS. A read active returns only the information for the logical partition from which the read active was done. The read active function is not supported for IOCDSs (IXP versions) that support ES Connection Channels.

- Y indicates that the logical partition has control authority for the I/O configuration.

Logical partitions with control authority for the I/O configuration data can read and write any IOCDS in the configuration, read a modified IOCDS without an intervening power-on reset, and change the I/O configuration dynamically.

- The global performance data control (CONTROL PRF) parameter can limit the capability of the logical partition to view CPU performance data. Y is the default for this field. This parameter can be updated at any time.

- N indicates that the logical partition does not have control authority for the performance data.

A logical partition without control authority for the performance data can view the CPU utilization data only for that logical partition.

- Y indicates that the logical partition has control authority for the CPU utilization data.

Logical partitions with control authority for the performance data can view the CPU utilization data and the Input/Output Processor (IOP) data for all of the logical partitions in the configuration.

- The cross-partition control (CONTROL XLP) parameter can limit the capability of the logical partition to issue certain control program instructions that affect other logical partitions. N is the default for this field. This parameter can be updated at any time.

- N indicates that the logical partition does not have cross-partition control authority.

A logical partition without cross-partition control authority cannot issue control program commands that affect other logical partitions.

- Y indicates that the logical partition has cross-partition control authority.

Logical partitions with cross-partition control authority can issue certain control program instructions to other logical partitions to perform a system reset of another logical partition, to deactivate a logical partition, or to provide support for the automatic reconfiguration facility.

**Logical Partition Cryptographic Parameters:** The cryptographic (ICRF) parameters for a logical partition are displayed only if the IBM Integrated Cryptographic Feature is installed on the processor complex.

- The cryptographic key storage unit (ICRF KSU) value indicates the cryptographic storage to use for the logical partition. There is no default for this value.

The logical partition must be deactivated to change this value. This field must be specified to activate a logical partition when a cryptographic feature is defined to the logical partition.

- 0 indicates that the cryptographic storage unit on Side 0 of the processor complex can be used for the logical partition.
- 1 indicates that the cryptographic storage unit on Side 1 of the processor complex can be used for the logical partition.
- B indicates that the cryptographic storage unit on Side 0 or Side 1 of the processor complex can be used for the logical partition.

- The cryptographic key-entry (ICRF KE) enable specifies whether the cryptographic keyboards are enabled for the logical partition. This value may be changed at any time.
  - Y indicates the keyboards are enabled for the logical partition.
  - N indicates the keyboards are not enabled for the logical partition, and is the default for this parameter.

Only one logical partition can have the keyboards enabled at a time, and only that selected logical partition can read the data from the keyboard.

Though this value may be changed at any time, if the logical partition is activated the partition must have a cryptographic feature defined to the logical partition to change the value. Changes take effect immediately for activated logical partitions, or at the next activation of the partition if the partition is currently deactivated.

- The cryptographic special security mode (ICRF SPC) specifies if the cryptographic features for the logical partition are to run in special security mode. This parameter can be changed at any time.
  - Y indicates that the cryptographic features for the logical partition are running in special security mode.
  - N indicates that the cryptographic features for the logical partition are not running in special security mode, and is the default value.

Multiple logical partitions can run in special security mode concurrently.

- ICRF ENA specifies if the logical partition can use the Integrated Cryptographic Feature.
  - Y indicates that the logical partition can use the defined ICRFs.
  - N indicates that the logical partition cannot use the defined ICRFs and is the default for this field.

Multiple logical partitions can be enabled to use their defined cryptographic features concurrently.

The crypto-domain index (CDX) used by the logical partition for any cryptographic feature can be a value from 0 through 6. This field has no default value.

The logical partition must be deactivated to change this value. This field must be specified to activate a logical partition when a cryptographic feature is defined to the logical partition.

## LPSEC Frame (Update Mode)

```

dd mmm yy hh:mm:ss
(LogSEC)

Logical Partition Security
IOCDs: A0/LPARPROD

--CONTROL-- ----ICRF-----
A= PARTITION S ISO IOC PRF XLP KSU KE SPC ENA CDX B= UPDATE
1. DOSVSE A N Y Y Y B Y N Y 0 1. Isolate
2. MVSPROD A N Y Y N 0 N Y Y 1 2. Control
3. MVSTEST A N Y Y N 1 N Y Y 3 3. ICRF
4. VMHPO A N Y Y N 0 N N Y 4 4. CDX

C= RESET CONTROLS
1. To ALL N

Partition: MVSTEST
IOC => Y
PRF => Y
XLP => N

Legend:
N = No/No Control
Y = Yes

COMMAND ==>
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating

-----
A:A MODE SI

```

Figure 3-14. Logical Partition Security (LPSEC) Frame (Update Mode)

The LPSEC frame (Figure 3-14) in update mode displays the security-related control parameters and cryptographic parameters that can be defined or changed for a selected logical partition.

The name of the logical partition selected for update is displayed (Partition: MVSTEST), and the parameters selected for update are displayed immediately below. The current values are displayed in the fields where the new values can be entered.

**Note:** The ICRF parameters are displayed on the LPSEC frame only if the IBM Integrated Cryptographic Feature is installed on the processor complex.

## Defining S/370 Channels

**Note:** ES Connection Channels can not be defined for a S/370 logical partition. Only parallel channels can be assigned to a S/370 logical partition.

Channel paths assigned to S/370 logical partitions must be reconfigurable and must be defined as S/370 channels on the Logical Partition S/370 Channel Definition (LPCHND) frame.

**Operation Considerations:** For LPAR mode, S/370 channel definition is through the LPCHND frame only. S/370 channel information specified in the IOCP is ignored.

- If an active S/370 logical partition is selected on the LPCHND frame, the display is read only.
- S/370 logical partitions must be deactivated before channel paths can be redefined.
- The same channel path can be specified in more than one S/370 logical partition definition. This allows the channel path to be reconfigured. Each logical partition may use a different channel number.
- LPCHND changes may be made to an ESA/370 logical partition at any time because the changes have no effect until the ESA/370 logical partition is defined as a S/370 logical partition.

**Note:** If planning to change an ESA/370 mode logical partition to a S/370 mode logical partition, the channel paths on the LPCHND frame may be prepared before deactivating the ESA/370 logical partition.

### **Procedure for Defining Channel Paths for a S/370 Logical Partition**

1. At the system console, enter **F LPCHND** to display the Logical Partition S/370 Channel Definition frame. See Figure 3-15 on page 3-54.

**Note:** On the LPCHND frame, the *selected partition* refers to the logical partition selected in the A= PARTITION field, *not* the target logical partition named on the status line.

2. Enter **Ax**, where x is the number of the desired S/370 logical partition. Highlighted CHPIDs indicate all channel paths that are assigned to logical partitions other than the selected logical partition.
3. Enter **B2** to display the reconfigurable channel paths that are available to the selected logical partition.
4. If the selected logical partition is active, shut down the control program and deactivate the partition. See "Deactivating a Logical Partition" on page 4-22.
5. Enter **B1**. Underscored update fields are displayed below the CHPID fields. Update the necessary fields and press Enter. Enter **X1** to confirm the entry or enter **B1** to cancel the entry. The definitions are written on the processor controller DASD.
6. Activate the logical partition. See "Activating a Logical Partition" on page 4-19.
7. IPL the control program.

### S/370 Channel Definition Parameters (S/370 LPCHND Frame)

**Note:** For ES/9000 Models 820, 860, and 900 use the S/390 LPCHND frame shown in Figure 3-16 on page 3-55.

```

20 May 88 18:27:34
Logical Partition S/370 Channel Definition (LPCHND)
IOCDS: A4/DDDDDDDD -----CS0-----
Channel 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
CHPID(hex) 26 00 01 1D 1E 1F 21 13 2C 07 04 30 31 32 33 34
                0C 0D 5A 1E 1F
Channel 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
CHPID(hex) 35 36 37

CHPIDs not assigned to selected Partition are highlighted
A= PARTITION      B= ACTION
1. MVSPROD        -> 1. Update S/370 Channel assignments for Channel set 0
->2. MVS2          -> 2. Display reconfigurable CHPIDs for the Partition
3. TSO            3. Select Channel set 1
4. VMHPO

Byte :00 01 04 05 40 41 44 45
Block: 02 03 06 07 08 09 0A 0B 0C 0D 0E 0F
      :10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
      :20 21 22 23 24 25 26 2A 2B 2C
      :30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F

COMMAND ==>
SYSTEM05 FRED                                P. PSW

```

Figure 3-15. LPCHND Frame (ES/9000 Models 820, 860, and 900)

The Logical Partition S/370 Channel Definition (LPCHND) frame (Figure 3-15) is used to define or change S/370 channel information for S/370 logical partitions.

**Note:** ES Connection Channels can not be defined for a S/370 logical partition. Only parallel channels can be defined for a S/370 logical partition.

#### LPCHND Fields

- The Channel field displays channel set 0 in hexadecimal.
- The CHPID(hex): field contains the CHPID values defined to each of a maximum of 32 channels for each channel set in the S/370 logical partition. The CHPID value consists of two hexadecimal digits under the corresponding channel address.
- The Ax B2 selection (where x is the number of a specified partition) displays the reconfigurable CHPIDs that are assigned to this logical partition. Any CHPID defined to the logical partition may be specified under one, and only one, channel address.

The Ax B3 selection is used, when necessary, to select the desired channel set. The CSx/CPx field on line 3 of the LPCHND frame identifies the current channel set displayed and the processor to which the channel set is currently connected.

### S/390 LPCHND Frame (ES/9000 Models 820, 860, and 900)

**Note:** This frame applies only to ES/9000 Models 820, 860, and 900. For other models use the S/370 LPCHND frame shown in Figure 3-15 on page 3-54.

```

                                          29 Aug 88 18:27:34
Logical Partition S/370 Channel Assignments (LPCHND)
IOCDS: A4/DDDDDDDD -----CS0-----
A= PARTITION
  1. MVSPROD
-> 2. MVS2
  3. TSO
  4. VMHPO
Channel 00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
CHIPID 26 00 01 1D 1E 1F 21 13 2C 07 04 30 31 32 33 34
          0C 0D 5A
Channel 10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
CHIPID 35 36 37
-----
CHIPIDs not assigned to selected Partition are highlighted

B= ACTION
-> 1. Update S/370 Channel assignments for Channel set 0
   2. Select Channel set 1

Reconfigurable CHPIDs for the selected Partition(1 of 4)
Byte  :00 01 04 05 40 41 44 45
Block :    02 03          06 07 08 09 0A 0B 0C 0D 0E 0F
       :10 11 12 13 14 15 16 17 18 19 1A 1B 1C 1D 1E 1F
       :20 21 22 23 24 25 26          2A 2B 2C
       :30 31 32 33 34 35 36 37 38 39 3A 3B 3C 3D 3E 3F

COMMAND ==>
SYSTEM05 FRED
        A A MODE
                                P. PSW
```

Figure 3-16. S/390 LPCHND Frame (ES/9000 Models 820, 860, and 900)

The Logical Partition S/390 Channel Assignments (LPCHND) frame (Figure 3-16) is used to define or change S/370 channel information for S/390 logical partitions.

**Note:** ES Connection Channels can not be defined for a S/370 logical partition. Only parallel channels can be defined for a S/370 logical partition.

#### LPCHND Fields

- The Channel field displays channel set 0 in hexadecimal.
- The CHPID(hex): field contains the CHPID values defined to each of a maximum of 32 channels for each channel set in the S/370 logical partition. The CHPID value consists of two hexadecimal digits under the corresponding channel address.
- The Ax B2 selection is used, when necessary, to select the desired channel set. The CSx/CPx field on line 3 of the LPCHND frame identifies the current channel set displayed and the processor to which the channel set is currently connected.
- The Reconfigurable CHPIDs assigned to the selected logical partition are displayed. Byte multiplex CHPIDs and BLOCK multiplex CHPIDs are shown.



## Reconfiguring Channel Paths for a Logical Partition

Channel paths (CHPID) that are indicated as reconfigurable can be moved among logical partitions using one of the following procedures:

- Moving Channel Paths from an MVS System
- Moving Channel Paths Using Service Language Commands

**Note:** ES Connection Channels can not be defined or assigned to a S/370 logical partition. Only parallel channels can be assigned to a S/370 logical partition.

### Logical Partition Channel Path Assignments (LPCHNA Frame)

**Note:** For ES/9000 Models 820, 860, and 900, use the LPCHNA frame shown in Figure 3-18 on page 5-7.

```

                                                    dd mmm yy  hh:mm:ss
                    Logical Partition Channel Assignments (1 of 2)      (LPCHNA)

IOCDs: B1/BBBBBBBB

CHPID              = 0000 0000 0000 0000 1111 1111 1111 1111  PARTITION
                   0123 4567 89AB CDEF 0123 4567 89AB CDEF  1 = MVSTSO
                                                           2 = IMSPROD
PARTITION #        = 1111 2222 3333 4444 1111 2222 3333 4444  3 = VMCMS
RECONFIGURABLE     = RRRR .... RRRR RRRR RRRR .... RRRR RRRR  4 = DOSVSE

CHPID              = 2222 2222 2222 2222 3333 3333 3333 3333
                   0123 4567 89AB CDEF 0123 4567 89AB CDEF

PARTITION #        = 1111 2222 3333 4444 1111 2222 3333 4444
RECONFIGURABLE     = RRRR .... RRRR RRRR RRRR .... RRRR RRRR

LEGEND
R = YES
. = NO
* = NOT DEFINED

COMMAND ==>

```

Figure 3-17. Logical Partition Channel Assignments (LPCHNA) Frame

The Logical Partition Channel Assignments frame (Figure 3-17) indicates the channel paths that are assigned to each logical partition and indicates whether or not the channel path is reconfigurable. See the appropriate *Operator Tasks* manual for more information about this display-only frame.

## LPCHNA Frame (ES/9000 Models 820, 860, 900)

**Note:** This frame applies only to the ES/9000 Models 820, 860, and 900. For other models, use the LPCHNA frame shown in Figure 3-17 on page 3-56

Logical Partition Channel Assignments (1 of 2) (LPCHNA)																07 Apr 89 01:29:13			
IOCDs: A4/DDDDDDDD																			
CHPID	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	PARTITION	CHPS	
PARTITION	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	1 = MVSPROD	20	
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	2 = MVS2	20	
																	3 = TSO	20	
CHPID	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	4 = VMHPO	36	
PARTITION	5	5	5	5	6	6	6	6	7	7	7	7	1	1	1	1			
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
CHPID	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F			
PARTITION	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5			
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
CHPID	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F			
PARTITION	6	6	6	6	7	7	7	7	1	1	1	1	2	2	2	2			
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
LEGEND R = Yes . = No * = Not Defined																			
COMMAND ==>																			
SYSTEM05	ONLINE	0	..	1	..	2	..	3	..	4	..	5	..					PSW0	OPERATING
A:A MODE																			

Figure 3-18. LPCHNA Frame (ES/9000 Models 820, 860, and 900).

The Logical Partition Channel Assignments frame (Figure 3-18 on page 5-7) indicates the channel paths that are assigned to each logical partition and indicates whether or not the channel path is reconfigurable. See the appropriate *Operator Tasks* manual for more information about this display-only frame.

### Moving Channel Paths from an MVS System

1. At the system console, enter **F LPCHNA** to display the Logical Partition Channel Assignments frame. See Figure 3-17 on page 3-56.

If an R is indicated in the RECONFIGURABLE field for the desired CHPID, the channel path may be reallocated to another logical partition.

#### Notes:

- a. For MVS/370, the operator must use the VARY command for the following steps.
- b. The only way to release a channel path from an isolated logical partition is by using the RELEASE parameter of the CHPID service language command.
- c. If a channel path is configured offline while the logical partition is isolated and remains offline when the logical partition is changed from being an isolated partition, the channel paths must be configured offline again using the CHPID service language command.

2. Enter (from the operator console from which the CHPID is to be taken offline) **CF CHP(nn),OFFLINE**, where nn is the number of the desired CHPID.
3. Enter (from the operator console from which the CHPID is to be put online) **CF CHP(nn),ONLINE**, where nn is the number of the desired CHPID.

**Note:** If the receiving logical partition is not MVS, use the appropriate control program command to bring the CHPID online to the receiving logical partition. If the control program in the receiving logical partition does not support physical channel path reconfiguration:

- a. At the system console, enter **SETLP yyyy**, where yyyy is the name of the receiving logical partition.
- b. Enter **CHPID nn ON**, where nn is the number of the desired CHPID.

### **Moving Channel Paths Using Service Language Commands**

1. At the system console, enter **F LPCHNA** to display the Logical Partition Channel Assignments frame. See Figure 3-17 on page 3-56.

If an R is indicated in the RECONFIGURABLE field for the desired CHPID, the channel path may be reallocated to another logical partition.

**Notes:**

- a. The only way to release a channel path from an isolated logical partition is by using the **RELEASE** parameter of the CHPID service language command.
  - b. If a channel path is configured offline while the logical partition is isolated and remains offline when the logical partition is changed from being an isolated partition, the channel paths must be configured offline again using the CHPID service language command.
2. Enter **SETLP xxxxxxx**, where xxxxxxx is the name of the logical partition from which the channel path is to be taken.
  3. Enter **CHPID nn OFF**, where nn is the number of the desired CHPID.
  4. Enter **SETLP yyyyyyy**, where yyyyyyy is the name of the logical partition to which the channel path is to be assigned.
  5. Enter **CHPID nn ON**, where nn is the number of the desired CHPID.

---

## Chapter 4. Processor Complex Operation in LPAR Mode

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This chapter provides information on operating the system console in LPAR mode, and describes the procedures for initializing the system for LPAR mode.

---

## Operation Considerations for the System Console

Before **any** system console procedures are performed, ensure that the first two recommendations described below are followed.

**Performing System Console Procedures With the Control Program Active:**

**Warning:** An active control program does not prevent hardware configuration changes from the system console. To keep the logical configuration (maintained by MVS) identical to the physical configuration (maintained by the processor controller), do not change the hardware configuration from the system console when the control program is active.

**Performing System Console Procedures for a Logical Partition:** In LPAR mode, it is extremely important that all procedures be performed in the desired logical partition. Failure to do so may disrupt one or all logical partitions.

### SETLP Command

In LPAR mode, it is possible to enter commands or make frame selections that are not intended for the logical partition to which they are directed (the target logical partition was not set or the wrong target logical partition was set). It is also possible to enter commands or make frame selections that are disruptive to all logical partitions (for example, power-on reset).

LPAR mode provides two ways for the operator to ensure that the desired logical partition is the target logical partition. Before performing any procedure at the system console, perform one of the following:

- Always use the **SETLP** command to select the correct logical partition before performing any other procedure from the system console.

Enter **SETLP xxxxxx**, where xxxxxx is the name of the desired logical partition. Or,

Look at the status line, identify the selected logical partition, and enter the SETLP command if necessary. Or,

- Always use the **LOCKLP** and the **UNLOCKLP** commands (to prevent potentially disruptive functions from being issued to the wrong logical partition) before performing any other procedure from the system console.

**Console Integration:** For processor complex models with console integration, the system console can be used to support both control program functions and hardware functions (see Note 5 in "About This Publication" on page xi).

**For processor complex models with dynamic storage reconfiguration, ensure that the recommendations described below are followed.**

**Operation Considerations for Dynamic Storage Reconfiguration:** It is recommended that the SYSCTL frame be used to re-IPL a logical partition or to perform a dump (SYSCTL frame functions perform a LOAD CLEAR when re-IPLing, and a LOAD when loading the dump program).

**Note:** A SYSTEM RESET CLEAR or a LOAD CLEAR forces the reserved storage element offline (this allows MVS to flag it as reconfigurable to be later deconfigured from the logical partition). When a standalone dump is to be performed on a logical partition, a LOAD (not a LOAD CLEAR) on that logical partition retains the reserved storage element online.

## LPAR Mode Operator Tasks

Instructions for performing the following operator tasks are provided in the section "LPAR Mode Operation" on page 4-14.

**Note:** For more information about these tasks or to perform additional LPAR mode operator task procedures, see the appropriate processor complex *Operator Tasks* publication for the system console.

- Enabling Automatic TOD (time-of-day) setting
- Initializing LPAR mode operation
- Selecting an LPAR IOCDS
- Performing a power-on reset
- Defining logical partitions
- Changing logical partition definitions
- Activating a logical partition
- Canceling an automatic activation
- Performing an IPL on a logical partition
- Idling a logical partition
- Deactivating a logical partition
- Locking and unlocking logical partitions
- Releasing LPAR mode operation

## System Console Functions Not Available in LPAR Mode

The following system console function is not available in LPAR mode.

- Instruction Address Trace

The following function keys are not available in LPAR mode:

- IStep
- TOD

The following display frames are not available in LPAR mode:

- SCE Address Compare (ADRSC)
- Alter/Display VE (ALTVE)

The following service language commands are not available in LPAR mode:

- IOCP
- ISTEP
- SETIAR
- SYSIML
- TOD

---

## System Console Operation in LPAR Mode

System console operation in LPAR mode is similar to system console operation in the basic modes. When the processor complex is operating in LPAR mode, the normal system console configuration is required for each logical partition.

Figure 4-1 illustrates the function of the system console in LPAR mode.

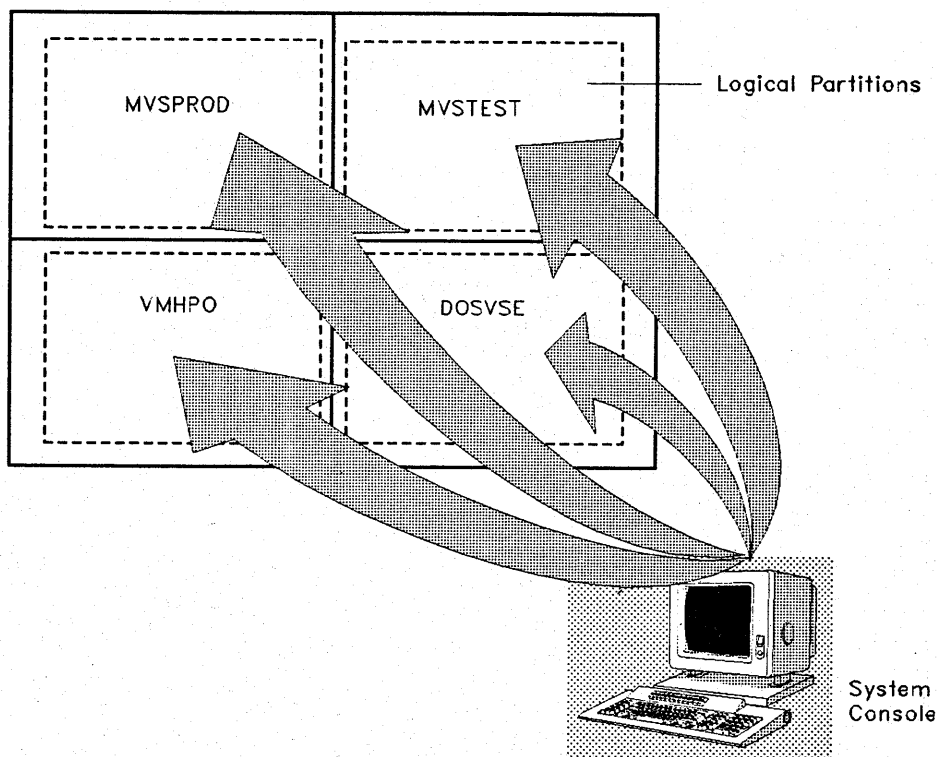


Figure 4-1. Function of the System Console in LPAR Mode

Like the basic modes, the system console in LPAR mode controls the processor complex hardware by means of a set of function keys, display frame selections, and service language commands.

**Note:** The operation of the control program running in a logical partition is controlled by a console that is attached to a channel path assigned to that logical partition, and requires the normal operator console configuration for each logical partition.

In LPAR mode, some of the display frames, service language commands, and function keys apply to a target logical partition and others apply to the entire processor complex.

The service language command SETLP allows the operator to designate the target logical partition before performing any function that applies to a target logical partition. The name of the target logical partition is displayed on the status line.

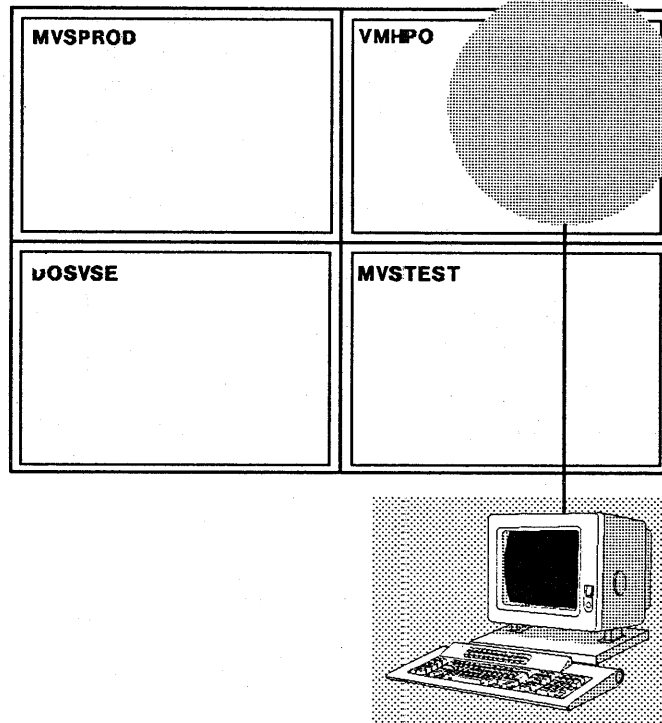


Figure 4-2. SETLP VMHPO Makes VMHPO the Target Logical Partition

Figure 4-2 shows the use of the SETLP command to set the target logical partition. In this example, the SETLP VMHPO command is issued from the system console to make VMHPO the target logical partition.

## Service Language Commands for LPAR Mode

A set of service language commands is provided for the following activities:

### Activating a Logical Partition

Logical partitions can be activated when needed. Partition activation is performed with a selection from the LPDEF frame or with the ACTLP service language command.

**ACTLP IMSPROD** activates the logical partition named IMSPROD.

If a partition name is not specified, the target logical partition is the default.

### Deactivating a Logical Partition

Partition deactivation is performed with a selection from the LPDEF frame or with the DEACTLP service language command.



**DEACTLP IMSPROD** deactivates the logical partition named IMSPROD.

If a partition name is not specified, the target logical partition is the default.

#### **Setting the Target Logical Partition**

When the processor complex is operating in LPAR mode, the operator may select one logical partition to be the target logical partition. The target logical partition is that logical partition to which partition-sensitive functions (function keys, display frames, and service language commands) apply. The target logical partition is designated by the SETLP service language command.

**SETLP IMSPROD** makes the logical partition named IMSPROD the target logical partition.

If SETLP is not used to change the target logical partition, the default target logical partition is the last valid logical partition named with the SETLP command and is indicated on the CP status line.

If SETLP is issued without a partition name, a list of logical partitions for this IOCDs is displayed.

#### **Varying a Central Processor Online**

Physical processors that are being used for shared or dedicated logical processors can be varied online after concurrent central processor maintenance.

A physical processor can be varied online at any time and is immediately available for use by shared logical processors. A dedicated logical processor can use a physical processor that has been varied online after the logical partition has been reactivated.

**VARYCP CPn ON** varies physical central processor n online after concurrent central processor maintenance.

**Note:** See the appropriate *Recovery Guide* for the MVS procedures that are required when using this command.

#### **Varying a Central Processor Offline**

Physical processors that are being used for shared or dedicated logical processors can be varied offline for concurrent central processor maintenance.

A physical processor can be varied offline at any time if used by shared logical processors. A physical processor dedicated to a logical processor should be varied offline after the logical partition has been deactivated.

**VARYCP CPn OFF** varies physical central processor n offline for concurrent central processor maintenance.

**Note:** See the appropriate *Recovery Guide* for the MVS procedures that are required when using this command.

#### **Locking a Logical Partition**

Active logical partitions can be locked when needed. The LOCKLP service language command can be issued to prevent the following potentially disruptive commands from being issued to the wrong logical partition: LOAD, LOAD CLEAR, RESTART, START, SYSRESET, SYSRESET CLEAR, STOP, INTERRUPT.

If LOCKLP is issued without a partition name, a list of locked logical partitions is written to the console log.

**LOCKLP IMSPROD** locks the logical partition named IMSPROD.

**Unlocking a Logical Partition**

Active logical partitions can be unlocked when needed to allow operator functions for the logical partition.

**UNLOCKLP IMSPROD** unlocks the logical partition named IMSPROD.

UNLOCKLP also allows an ALL parameter. If UNLOCKLP is issued without a partition name, a list of unlocked logical partitions is written to the console log.

## Operator Controls for a Target Logical Partition

The target logical partition is that logical partition to which partition-sensitive functions (function keys, display frame selections, and service language commands) apply.

**Note:** If a function key, display frame, or service language command is not partition sensitive, its function in LPAR mode is the same as it is in one of the basic modes.

For example, in LPAR mode the Operator Controls (OPRCTL) frame is partition sensitive. If four logical partitions were active, any one of four OPRCTL frames might be displayed in response to the F OPRCTL command, depending on the current target logical partition. In Figure 4-3, all logical partitions are active. MVSTEST is the target logical partition.

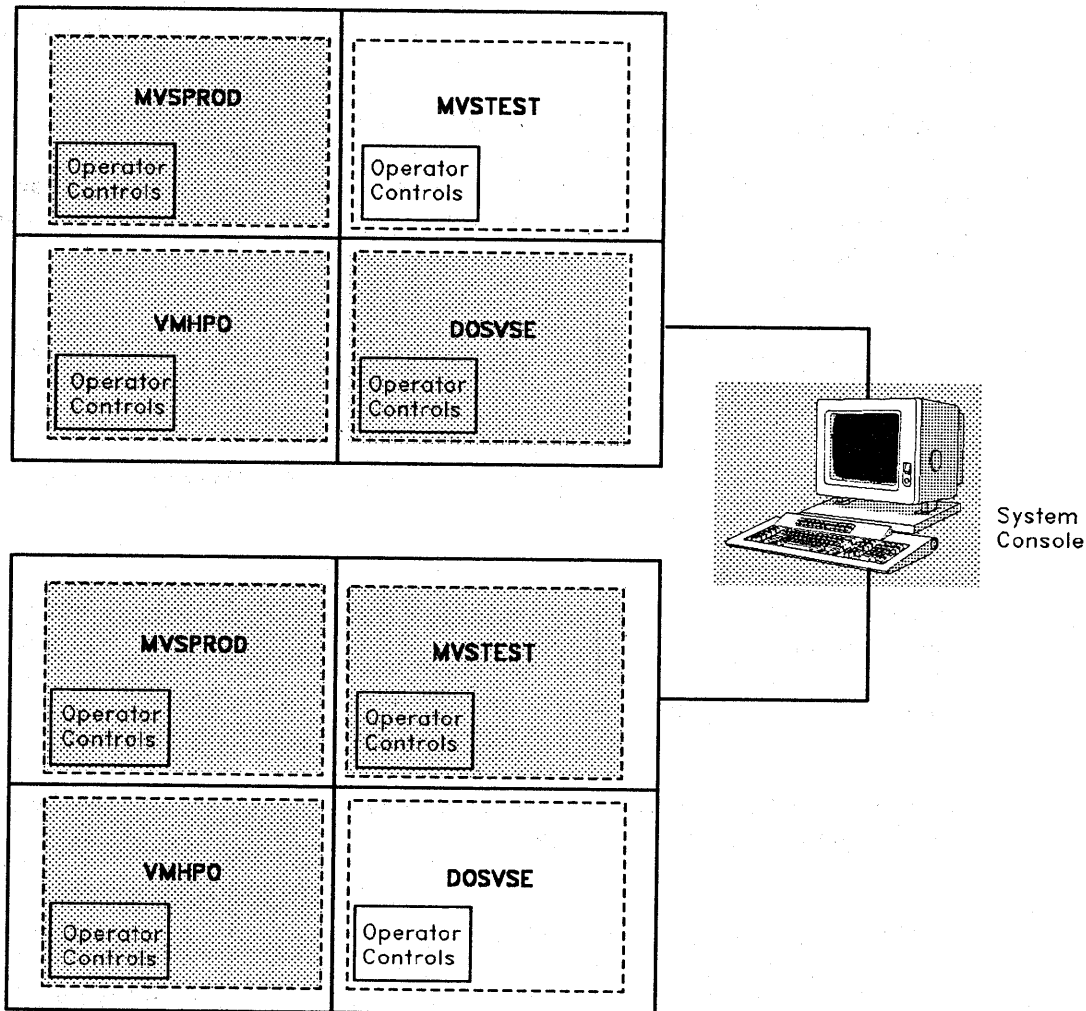


Figure 4-3. Examples Showing Active and Target Logical Partitions

The OPRCTL frame for logical partition MVSTEST would be displayed in response to the F OPRCTL command. However, if the operator made DOSVSE the target logical partition by issuing the SETLP DOSVSE command, the OPRCTL frame for logical partition DOSVSE would be displayed.

### **Partition-Sensitive System Console Function Keys**

The following console function keys apply to the target logical partition when the processor complex is operating in LPAR mode and when the target logical partition is active.

- Irpt** makes pending an external interruption at the target logical processor in the target logical partition.
- Rstrt** makes pending a restart interruption at the target logical processor in the target logical partition.
- Start** starts all stopped logical processors in the target logical partition.
- Stop** stops all logical processors in the target logical partition.

### **Partition-Sensitive Display Frames**

The following display frames apply to the target logical partition when the processor complex is operating in LPAR mode and when the target logical partition is active.

An **Alter/Display CP (ALTCP)** frame for LPAR mode provides alter or display functions for a specified processor in the target logical partition. Storage, storage key, registers, and PSW on this frame refer to facilities of the specified processor in the target logical partition. Equivalent service language commands apply to the target logical partition.

The **CP Address Compare (ADRCP)** frame provides address compare functions for a specified processor in the target logical partition.

The **I/O Problem Determination (IOPD)** frames display I/O information for the target logical partition.

An **Operator Controls (OPRCTL)** frame for LPAR mode is available to perform operator functions for a target logical partition: IPL (load or load clear), restart, system reset, store status, and system reset clear. Equivalent service language commands apply to the target logical partition.

The **SCP Manual Control (SYSCTL)** frame is available to perform operator functions for an MVS target logical partition.

The **SCP Message Facility (SCPMSG)** frame permits the control program operating in a logical partition to communicate with the operator by means of the system console when the normal path is not available. The SCPMSG frame alerts the operator by an audible alarm and displays a priority message that specifies the logical partition that requires attention.

## Partition-Sensitive Service Language Commands

The following service language commands apply to the target logical partition when the processor complex is operating in LPAR mode and when the target logical partition is active.

Use the SETLP service language command to set the target logical partition. See "Operator Controls for a Target Logical Partition" on page 4-8.

<b>ALTSYSF</b>	alters facilities of a specified logical processor in the target logical partition; does not support the vector facility.
<b>CHPID</b>	supports channel path reconfiguration among logical partitions if the control program is not active or does not support channel path reconfiguration.
<b>DISSYSF</b>	displays facilities of a specified logical processor in the target logical partition; does not support the vector facility.
<b>IRPT</b>	makes pending an external interruption at a specified logical processor in the target logical partition.
<b>LOAD</b>	performs load functions for a specified logical processor in the target logical partition.
<b>PSW</b>	displays the program status word (PSW) for a specified logical processor in the target logical partition.
<b>RESTART</b>	makes pending a restart interruption at a specified logical processor in the target logical partition.
<b>START</b>	starts a specified logical processor in the target logical partition. If no processor is specified, START starts all logical processors in the target logical partition.
<b>STOP</b>	stops a specified logical processor in the target logical partition. If no processor is specified, STOP stops all logical processors in the target logical partition.
<b>STORSTAT</b>	stores the status of a specified logical processor in the target logical partition.
<b>SYSRESET</b>	performs a system reset in the target logical partition only.

## Processor Complex Status Line in LPAR Mode

When the processor complex is operating in LPAR mode, the processor complex status line (line 24) displays the status of the target logical partition:

System Token	Target Partition Name	Processors Defined to This Partition	Logical Processor Status	PSW
SYSTEM05	IMSPROD	0 .. 1 .. 2 ..	L. P.	PSWn Operating

### System Token

The system token displays the system name. The system name is defined on the System Definition (SYSDEF) frame.

### Target Partition Name

The target logical partition name is designated by the SETLP service language command. If no target logical partition is designated, the default is the first target logical partition shown on the LPDEF frame.

### Processors Defined to This Partition

The logical processors that are defined to this logical partition are shown.

### Logical Processor Status

The status of the processors defined to this logical partition are

**L** is the global logical processor status that indicates whether the logical processors are in check-stop or test state.

**P** is the global physical processor status that indicates whether the physical processors are in check-stop, clock-stop, or test state.

**Note:** More information about the status of the physical processors is available on the CP Status (CPSTAT) frame. See Figure 4-7 on page 4-13.

### PSW

**PSWn** identifies the program status word for the specified processor, which may be the target logical processor designated on the OPRCTL or SYSCTL frame, or by the PSW service language command.

### Examples of the Processor Status Line (Line 24)

**Power-On Reset Required:** If a console controls the configuration and a power-on reset is required, the status line displays the system name and "-----" for the name of the target logical partition (Figure 4-4).

```
COMMAND ==>
SYSTEM02 ----- PSW
-----
A:A MODE SI
```

Figure 4-4. Status Line, Power-On Reset Required

**Power-On Reset Complete (Target Logical Partition Not Active):** If a console controls the configuration and if a power-on reset is in progress or is complete, but the target logical partition is not active, the status line displays the system name and the name of the target logical partition (Figure 4-5).

```
COMMAND ==>
SYSTEM02 VMCMS P. PSW
-----
A:A MODE SI
```

Figure 4-5. Status Line, Power-On Reset Complete and Logical Partition Not Active

**Power-On Reset Complete (Target Logical Partition Active):** If a console controls the configuration, if the power-on reset is complete, and if the target logical partition is active, the status line displays the system name, the name of the target logical partition, and the identifier for each logical central processor assigned to the partition (Figure 4-6).

```
COMMAND ==>
SYSTEM02 MVSTS0 0 MW 1 MW 2 MW 3 MW 4 MW 5 MW L. P. PSWn hhhhhhhhhhhhhhh
-----
A:A MODE SI
```

Figure 4-6. Status Line, Power-On Reset Complete and Logical Partition Active

## Processor Status in LPAR Mode

```
CP Status                                     dd mmm yy hh:mm:ss
                                           (CPSTAT)

---- STATE ----  PHYSICAL CP
0 1 2
X Checkstopped  . 1 .
C Clockstopped  . . .

T Test          . . .

Press 'REFRESH' to update this frame.
COMMAND ==>
```

Figure 4-7. CP Status (CPSTAT) Frame

The CP Status (CPSTAT) frame (Figure 4-7) displays the status of the physical processors for the processor complex. It shows that CP1 is in a check-stop state and CP0 and CP2 are performing normal operations.



---

## LPAR Mode Operation

This section provides procedures for initializing LPAR mode, and for logical partition definition, activation, and operation.

### Initializing LPAR Mode

Use the following procedure to initialize LPAR mode operation.

**Note:** This procedure assumes that an LPAR IOCDS as described in the section, "IOCP Macroinstructions" on page 2-14, can be selected from the IOCDSM frame (Figure 4-10 on page 4-17).

**Operation Considerations:** Check the battery-operated clock (BOC) for the correct time before a power-on reset into LPAR mode, and to reset the BOC if necessary.

When the Enable Automatic TOD setting is selected (using the SYSDEF frame), the TOD clock is set from the BOC in the processor controller during a power-on reset. The TOD does not have to be set by the operator unless required.

To ensure that the correct time is set, use the following procedure:

1. Set the BOC to local time.
2. Set Zone offset (selection B2 on the SYSDEF frame) to adjust local time to offset from Greenwich mean time (GMT).

The Zone offset on the SYSDEF frame has to reflect the correct deviation of local time from GMT. For example, for Eastern standard time (EST), the Zone offset would be set to 5 hours and the Zone direction would be set to West. When EST changes to Eastern daylight saving time (EDT), the Zone offset would be set to 4 hours and the Zone direction would remain West.

If the correct offset and direction are entered, the TOD clock is set to GMT during power-on reset. GMT is calculated by adding the offset to the local time or by subtracting the offset from the local time.

The SYSDEF frame includes an Enable Automatic TOD setting (B2) selection (Figure 4-8). The B2 selection is required for a power-on reset into LPAR mode.

1. Use the System Definition (SYSDEF) frame to enable the automatic time-of-day (TOD) clock setting at a power-on reset.

```

                                dd mmm yy 19:47:07
                                (SYSDEF)

System Definition

MACHINE TYPE:                    D= ACTION FOLLOWING POWER ON RESET
SERIAL NUMBER:                    1. New Frame Name(A/N) :_____
SYSTEM EC LEVEL:                  2. Load Information(Hex) :
VERSION ID:                        MODE      370 or  ESA/370 tm or
                                    370TPF   ESA/370/TPF tm

A= CONFIGURATION (Forces POR Required)  Load Addr: ____  ____
  1. Maximum Installed                Parameter: _____
                                       Target CP:  _   _

B= CLOCKS (B1 forces PC Warm Start)    (Above not used with LPAR POR)
  1. Set Date : ____ day              I/O Pwr Seq Delay: __:__
    Time : ____
  2. Enable Automatic TOD Setting      Automatic Load: Not Active
    Zone offset : __ (hh:mm)  -> 1. Initiate by PA Only
    Zone direction: ____ (East/West)  2. Initiate by PA or RSF

C= SYSTEM NAME                      F= RECOVERY ACTIONS
  1. Set Name : _____          -> 1. I/O Interface Reset
                                       2. Set Recovery Time: ____

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COMMAND ==>
SYSTEM 1  0  ....  1  ....  2  ....  3  ....  4  ....  5  ....  PSW0 Operating

-----
A:A MODE      SI
  
```

Figure 4-8. System Definition (SYSDEF) Frame

**Note:** The SYSDEF frame I/O Pwr Seq Delay parameter is used to define the wait interval (plus 10 seconds) between the display of the LPDEF frame after power-on reset for LPAR mode and the start of automatic activation and automatic IPL.

2. Use the Configuration (CONFIG) frame to select LPAR mode.

The CONFIG frame includes a CP MODE (B5) selection, LPAR (Figure 4-9). Initialization of LPAR mode is a mode selection that requires a power-on reset.

```

                                DD MM YY hh:mm:ss
                                (CONFIG)

Configuration
POWER ON RESET                CURRENT CONFIGURATION                ACTIVE IOCDS
  Required                    Physically Partitioned                B1/AAAAAAAA

A= ACTION                      D= PROCESSORS                    F= CENTRAL STORAGE
 1. Release                    x1. CP1                          x0. PMA0
 2. Power on reset              x2. CP2                          x1. PMA1
 3. Maximum Installed           -> 3. CP3                        -> 2. PMA2  On: 32 MB
 4. Select IOCDS Mgmt.         -> 4. CP4                        -> 3. PMA3  On: 28 MB

B= CP MODE                      E= VECTORS                          G= EXPANDED STORAGE
 1. 370                          x1. VE1                          x0. ESA0
 2. ESA/370 tm                  x2. VE2                          -> 2. ESA2  On: 96 MB
 3. Not Used                    -> 3. VE3                          -> 3. ESA3  On: 128 MB
 4. Not Used                    -> 4. VE4
-> 5. LPAR

C= I/O TRACE                    ---- CHPID STATUS ----
 1. Type(hex):_____          Online: 32 Offline: 16
   Units:___

ESA/370 is a trademark (tm) of the IBM Corporation.
COMMAND ==>
  
```

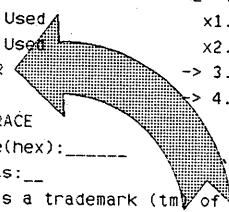


Figure 4-9. Configuration (CONFIG) Frame

3. Use the IOCDSTM frame to select an LPAR IOCDs (Figure 4-10).

The IOCDSTM frame includes a Type column that indicates whether the IOCDs is a BASC or LPAR IOCDs.

```

DD MM YY hh:mm:ss
                                (IOCDSTM)

                                IOCDS Management

POWER ON RESET                    CURRENT CONFIGURATION          ACTIVE IOCDS
Required                          Physically Partitioned          B1

                                I/O CONFIGURATION DATA SETS ----
A= ACTION                          I-IOCDS  Name      Type      Status      Timestamp
1. Select                          x1.  A0    12345678 BASC      Write Protect 87.120 12:13:14
-> 2. Write Protect                 x2.  A1    AAAAAAAA LPAR      Write Protect 87.012 00:10:00
3. Release Write                   x3.  A2                                Not Valid
   Protect                          x4.  A3    CCCCCCCC BASC      Write Protect 87.265 23:59:56
4. Select Config                   x5.  A4                                Not Valid
   Frame                            x6.  A5    CCCCCCCC BASC      Write Protect 87.265 23:59:56
                                   7.  B0    12345678 BASC                                87.128 12:13:13
                                   -> 8.  B1    AAAAAAAA LPAR      Write Protect 87.012 00:10:02
                                   x9.  B2                                Not Valid
                                   10. B3    CCCCCCCC BASC      Write Protect 87.265 23:59:51
                                   x11. B4                                Not Valid
                                   12. B5    CCCCCCCC BASC      Write Protect 87.265 23:59:51

COMMAND ==>

```

Figure 4-10. IOCDs Management (IOCDSTM) Frame

4. Perform a power-on reset using the Configuration (CONFIG) frame (Figure 4-9 on page 4-16).

## Defining Logical Partitions

After a power-on reset for LPAR mode is complete, the Logical Partition Definition (LPDEF) frame (the single LPDEF frame or the Summary View frame) is displayed.

The **S (status)** field on the LPDEF frame displays a **P (pending)** for all logical partitions that are to be activated automatically. The automatic activation of previously defined and activated logical partitions proceeds when the requirements described in the section "Automatic Activation" on page 4-19 are met. If automatic IPL was defined for a logical partition, it occurs after the activation of a logical partition has completed.

```

                                Logical Partition Definition
                                dd mmm yy  hh:mm:ss
                                (LPDEF)
IOCDs: A0/LPARPROD

A= PARTITION  S  ID MODE  F  --STG MB--  --NUMBER OF--  ---AUTO  IPL-----
                A  F 370  N   16     0    1  0  16    N  0250  _____
1. DOSVSE     A  1  ESA  N   100  1400  6  2  44    Y  0150  _____
2. MVSPROD    A  5  ESA  N    72   150   6  1  44    Y  0400  120 _____
3. MVSTEST    A  A 370  N    64   498   2  1  24    N  0300  _____
4. VMHPO      A  A 370  N

B= ACTION
1. Activate           252  2048  ... Defined
2. Deactivate         252  2048  ... Activated
3. Update             252  2048  ... Configured

COMMAND ==>

```

Figure 4-11. Logical Partition Definition (LPDEF) Frame (Showing the Single LPDEF Frame)

**Note:** After the LPDEF frame is displayed, there is a wait interval during which automatic activation and automatic IPL can be canceled. To cancel the automatic activation of logical partitions, press Enter, Reset, and Cncl, in that order. Any activation in progress is completed and any logical partition pending activation remains deactivated.

Use the appropriate sections in Chapter 3, "Planning Logical Partitions" on page 3-1 to define logical partition characteristics.

## Changing Logical Partition Definitions

**Note:** This section assumes that logical partitions have been defined using the appropriate sections in Chapter 3, "Planning Logical Partitions" on page 3-1, and that LPAR mode is initialized.

Use the following procedure to change logical partition definitions:

1. Use the section, "Changing Logical Partition Definitions" on page 3-7 to determine if the logical partition must be deactivated to change the desired definition parameter, and to determine which frame to display.
2. At the system console, enter **F fname**, where fname is frame name, to display the desired frame.
3. If necessary, shut down the control program in the desired logical partition and deactivate the logical partition.
4. Use the appropriate section indicated in Chapter 3, "Planning Logical Partitions" on page 3-1 to change logical partition definitions.

**Note:** If required, use the appropriate *Operator Tasks* publication to perform the procedures to change logical partition definitions.

## Activating a Logical Partition

After the resources for a logical partition are defined, the activation of a logical partition can be performed. During activation, main storage and expanded storage of the partition are cleared, the channels are reset, and the resources that have been defined for the logical partition are allocated to the logical partition.

**Note:** Activation of a logical partition will fail if the resources defined for that logical partition are not available for allocation.

After activation, an IPL of the appropriate control program can be performed in each logical partition. Logical partitions may be activated and IPLed manually or automatically.

### Automatic Activation

Automatic activation of logical partitions occurs immediately after a power-on reset if the following requirements are met:

- The active IOCDs has not changed since it was last active.

Automatic activation does not occur the first time that the IOCDs is selected after it is written. If the active IOCDs has not been rewritten, automatic activation is allowed.

- Logical partition definitions have not changed since the selected IOCDs was last active.

Automatic activation does not occur if the definitions are not made or if the definitions have been changed since the active IOCDs was used.

- The logical partition was active or idle during the previous power-on reset with the active IOCDs.

Automatic activation requires that logical partitions have the status of pending, and does not occur if logical partitions are deactivated before the configuration is released.

**Note:** The status (S) field on the LPDEF frame indicates whether a logical partition is active (A), deactivated (D), or pending (P).

- The hardware configuration (SI or PP) has not changed since the active IOCDs was last active.

Automatic activation does not occur if the configuration of a multiprocessor model has changed.

- Power-on reset into LPAR mode is performed.

Automatic activation does not occur if LPAR mode is initialized by the LPAR service language command.

**Note:** Logical partitions may fail to activate because of device number conflicts (see "Duplicate Device Number Conflicts" on page 2-22). Automatic activation also does not occur when the microprogram detects a failure, performs an LPAR logout, and initializes LPAR mode.

If the above requirements are met, a message indicates that automatic activation of logical partitions has started. If no action is taken to cancel the automatic activation, logical partition activation proceeds in the following order:

- Favored logical partition  
If a logical partition is defined (using the single LPDEF frame) as favored (F), it is activated first.
- Logical partitions requesting dedicated processors
- Remainder of the logical partitions in alphabetic order by name

### Canceling an Automatic Activation

After the message indicates that automatic activation of logical partitions has started, automatic activation can be canceled within a 10-second interval after the message appears.

To cancel the automatic activation of logical partitions, press Enter, Reset, and Cncl, in that order. Any activation in progress completes and any logical partition pending activation remains deactivated.

### Manual Activation

Logical partitions can be activated manually using the LPDEF frame or the ACTLP service language command:

- Use the LPDEF frame to activate several logical partitions at one time.

For example, enter **F LPDEF** to display the Logical Partition Definition frame (Figure 4-12), then Enter **An B1**, where n is the number of the logical partition to be activated.

If **A1 A2 A3 A4 B1** is entered, all of the logical partitions shown in Figure 4-12 are activated in the order in which they are entered.

**Note:** If several logical partitions are selected for activation at the same time and a problem is encountered during the activation of one of the logical partitions, the command fails and the remaining logical partitions (in the selected sequence for activation) must be activated individually using the ACTLP service language command.

- The ACTLP service language command can be used to activate individual logical partitions.

## Automatic and Manual IPL

Automatic IPL of a logical partition occurs immediately following the activation of a logical partition if the appropriate automatic IPL information has been specified on the LPDEF frame.

If the automatic IPL parameter (A) indicates N for a logical partition, the logical partition must be IPLed manually. Use the OPRCTL frame to perform a manual IPL.

Logical Partition Definition											dd mmm yy hh:mm:ss (LPDEF)		
IOCD5: A0/LPARPROD													
A=	PARTITION	S	ID	MODE	F	MAIN	EXP	CP	VE	CHPS	A	ADDR	IPL-----
1.	DOSVSE	A	F	370	N	16	0	1	0	16	N	0250	_____
2.	MVSPROD	A	I	ESA	N	100	1400	6	2	44	Y	0150	_____
3.	MVSTEST	A	5	ESA	N	72	150	6	1	44	Y	0400	120_____
4.	VMHPO	A	A	370	N	64	498	2	1	24	N	0300	_____
B= ACTION													
1.	Activate					252	2048						... Defined
2.	Deactivate					252	2048						... Activated
3.	Update					252	2048						... Configured
COMMAND ==>													

Figure 4-12. Logical Partition Definition (LPDEF) Frame (Showing the Single LPDEF Frame)

### Notes:

1. On the LPDEF frame, an IPL device must be specified (AUTO IPL ADDR field) for a logical partition, and it must be indicated (AUTO IPL A field, Y) that the logical partition is to receive an automatic IPL.
2. The automatic IPL of S/370 logical partitions uses a device attached to channel set 0.



## Idling a Logical Partition

To idle a logical partition, perform an orderly shutdown of the control program in the logical partition, but leave the logical partition activated.

When a logical partition is idled (not deactivated) and the configuration is released (power-on reset is required), the status of an idled logical partition changes to *pending (P)*, and it can be activated automatically.

For the process of shutting down the system (for example, prior to giving the system to the service representative for maintenance), it is advisable to idle the partitions rather than to deactivate them to allow automatic activation to occur on a subsequent power-on reset into LPAR mode.

## Deactivating a Logical Partition

A logical partition may be deactivated at any time using the LPDEF frame or the service language command DEACTLP. Use the LPDEF frame to deactivate several logical partitions at one time.

**Note:** Deactivation of a logical partition is required for making some changes to logical partition definitions. For information about definition changes that require a deactivated logical partition, see "Changing Logical Partition Definitions" on page 3-7.

When a logical partition is deactivated, it releases any dedicated processors and storage allocations for the logical partition, and resets the channel paths (CHPs), which are left configured to the logical partition.

After a logical partition is deactivated, it can be left intact (but not active) or the resources that were released during deactivation can be allocated to other logical partitions.

**Note:** A dedicated processor released during deactivation is no longer dedicated and is available to other logical partitions. The same is true for a vector facility associated with a dedicated processor.

As a safeguard against deactivating the wrong logical partition, the logical processors must be in a stopped state before deactivation proceeds.

If any of the logical processors are not in a stopped state, a message is displayed and a confirmation is required before the logical partitions can be deactivated.

**Note:** The confirmation requirement gives an operator the opportunity to cancel the deactivation, to shut down the control program and then proceed, or to proceed with the deactivation if a shutdown of the control program is not applicable.

It is not necessary or advisable to deactivate all the logical partitions to perform a system shutdown. Idling the partitions (an orderly shutdown of software running in the logical partitions) is advisable. If the partitions are deactivated, automatic activation does not occur on a subsequent power-on reset into LPAR mode.

### **To deactivate logical partitions:**

1. First, perform an orderly shutdown of the control program, and then use the LPDEF frame or the DEACTLP service language command to perform the deactivation.
2. Use the LPDEF frame to deactivate several or all logical partitions at the same time.

Enter **F LPDEF** to display the Logical Partition Definition frame. See Figure 4-12 on page 4-21.

Then enter **Ax B2**, where x is the number of the logical partition to be deactivated. For example, if all of the logical partitions listed on the LPDEF frame are active, enter **A1 A2 A3 A4 B2** to deactivate all of the logical partitions shown in Figure 4-11.

**Note:** The logical partitions are deactivated from the LPDEF frame in numeric sequence (A1, A2, A3, and so forth), and not necessarily the order in which they are entered.

3. The DEACTLP service language command may be used to deactivate an individual logical partition.

## **Locking and Unlocking Logical Partitions**

Potentially disruptive commands can be prevented from being issued to the wrong logical partition by using the LOCKLP service language command.

When the LOCKLP command is issued to a specified logical partition, the following functions are not allowed:

- LOAD
- LOAD CLEAR
- RESTART
- START
- SYSRESET
- SYSRESET CLEAR
- STOP
- INTERRUPT

To use the LOCKLP service language command, enter LOCKLP lpname (where lpname is the name of the logical partition to be locked), or LOCKLP ALL to lock all logical partitions.

### **Notes:**

1. The UNLOCKLP service language command is used to unlock locked logical partitions. The UNLOCKLP command also allows an ALL parameter.
2. The LOCK/UNLOCK status of logical partitions is saved across a power-on reset.
3. LOCKLP and UNLOCKLP allow an automatic IPL following activation of a logical partition.
4. If the LOCKLP or UNLOCKLP service language command is used without a logical partition name, the locked or unlocked status of the logical partitions is written to the console log.

## Releasing LPAR Mode

To release LPAR mode:

1. Perform an orderly shutdown of all the application programs and the control program in the active logical partitions.
2. Enter **F CONFIG** to display the Configuration frame. See Figure 4-13.
3. Enter **A1**. When prompted, enter **X1** to release the configuration and to release LPAR mode.

```

                                dd mm yy  hh:mm:ss
                                (CONFIG)

Configuration

POWER ON RESET                CURRENT CONFIGURATION        ACTIVE IOCDS
Required                      Physically Partitioned      B1/BBBBBBBB

A= ACTION                      D= PROCESSORS                F= CENTRAL STORAGE
 1. Release                    x1. CP1                      x0. PMA0
 2. Power on reset             x2. CP2                      x1. PMA1
 3. Maximum Installed          -> 3. CP3                    -> 2. PMA2  On: 32 MB
 4. Select IOCDS Mgmt.        -> 4. CP4                    -> 3. PMA3  On: 28 MB

B= CP MODE                      E= VECTORS                    G= EXPANDED STORAGE
 1. 370                        x1. VE1                      x0. ESA0
 2. ESA/370 tm                 x2. VE2                      x1. ESA1
 3. Not Used                   -> 3. VE3                    -> 2. ESA2  On: 96 MB
 4. Not Used                   -> 4. VE4                    -> 3. ESA3  On: 128 MB
-> 5. LPAR
C= I/O TRACE
 1. Type(hex): _____
   Units: _____
ESA/370 is a trademark tm of the IBM Corporation.
COMMAND ==>

```

Figure 4-13. Configuration (CONFIG) Frame

---

## Chapter 5. Managing Logical Partition Activity

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This chapter describes the display frames and the LPAR service language commands that can be used to monitor logical partition activity, provides logical partition performance information, and provides guidelines and suggestions for planning a recovery strategy for LPAR mode operation.

---

## Monitoring Logical Partition Activity

In addition to the LPDEF, the LPCTL, and the LPSEC frames, the following frames and service language commands are provided to monitor the operation of logical partitions:

- Logical Partition Storage Assignment (LPSMAP) frame
- Logical Partition Channel Assignments (LPCHNA) frame
- System Activity Display (SAD) frames

For information about defining and displaying LPAR mode SAD frames, see the section "System Activity Display (SAD) for Logical Partitions" on page 5-8.

**Note:** The display frames included in this section illustrate some of the characteristics of logical partitions that can be defined and displayed using SAD frames. These frames are not intended for use as a tool to analyze the relationships among the displayed fields. For more information about the use of SAD frames, see the appropriate *Operator Tasks* manual.

- The Log Logical Partition (LOGLP) service language command can be used to obtain a log of LPAR data for one or all logical partitions.
- The LPAR mode (LPAR) service language command can be used to obtain a log of LPAR mode data.

### Logical Partition Storage Assignments (LPSMAP Frame)

The Logical Partition Storage Assignment (LPSMAP) frame displays the storage assignments for each active logical partition. The LPSMAP frame indicates how processor storage (central storage and expanded storage) is defined to the active logical partitions, and can be used to determine the total amount of central or expanded storage available to allocate to logical partitions.

- For processor complex models without dynamic storage reconfiguration, see Figure 5-1 on page 5-3.
- For processor complex models with dynamic storage reconfiguration, see Figure 5-2 on page 5-4.

**Note:** From the control program perspective, the storage for a logical partition is origin-zero based, regardless of its physical address assignment.

## LPSMAP Fields (Without Dynamic Storage Reconfiguration)

The Logical Partition Storage Assignment (LPSMAP) frame is a display-only frame. The storage assignments displayed in Figure 5-1 below can be updated using the LPDEF frame (the single LPDEF frame).

Logical Partition Storage Assignment					dd mmm yy hh:mm:ss . (LPSMAP)
IOCDs: A0/LPARPROD					
ACTIVE PARTITION	---MAIN STORAGE-- ORIGIN	SIZE	---EXPANDED STORAGE-- ORIGIN	SIZE	
DOSVSE	236MB	16MB	--	0MB	
MVSPROD	136MB	100MB	0MB	1400MB	
MVSTEST	64MB	72MB	1400MB	150MB	
VMHPO	0MB	64MB	1550MB	498MB	
Available		0MB		0MB	
COMMAND ==>					

Figure 5-1. Logical Partition Storage Assignment (LPSMAP) Frame (Without Dynamic Storage Reconfiguration)

The IOCDs field displays the name of the currently active IOCDs.

The ACTIVE PARTITION field shows the names of all activated partitions that are defined by the currently active IOCDs. Logical partitions that are not activated are not displayed on this frame.

**Note:** The partitions shown in this example have been activated in alphabetic order by name with no favored partition.

Central (main) storage for a favored logical partition begins at physical storage location 0 and is allocated from the bottom up. The remainder of main storage assignments for logical partitions is allocated from the top down in order of activation. Expanded storage is allocated from the bottom up in order of activation. The active logical partitions appear in descending order of their starting addresses (origins) in central storage.

The LPSMAP fields provide the following information for central (main) and expanded storage:

- The ORIGIN is the physical starting address (in MB) at which storage for the logical partition begins.
- The SIZE is the total amount of storage (in MB) that is allocated to the logical partition.

## LPSMAP Fields (With Dynamic Storage Reconfiguration)

The Logical Partition Storage Assignment (LPSMAP) frame is a display-only frame. Storage assignments for logical partitions displayed in Figure 5-2 below can be updated using the LPDEF frame (Storage View).

Logical Partition Storage Assignment											dd mm yy	hh:mm:ss
											(LPSMAP)	
IOCDs: A0/LPARPROD												
ACTIVE	----CENTRAL STORAGE (MB)----					----EXPANDED STORAGE (MB)----						
PARTITION	ORIG	INIT	CURR	MAX	GAP	ORIG	INIT	CURR	MAX	GAP		
DOSVSE	236	16	16	16	0	--	0	0	0	0		
MVSPROD	136	100	100	100	0	0	1400	1400	1400	0		
MVSTEST	64	72	72	72	0	1400	150	150	150	0		
VMHPO	0	64	64	64	0	1550	598	598	598	0		
Available					0					0		
COMMAND ==>												
SYSTEM 1 MVSPROD 0 .. 1 .. 2 .. 3 .. 4 .. 5 .. L. P. PSW0 Operating												
-----												
A:A MODE SI												

Figure 5-2. Logical Partition Storage Assignment (LPSMAP) Frame (With Dynamic Storage Reconfiguration)

The IOCDs field displays the name of the currently active IOCDs.

The ACTIVE PARTITION field shows the names of all activated partitions that are defined by the currently active IOCDs. Logical partitions that are not activated are not displayed on this frame.

The activated logical partitions appear in descending order of their starting addresses (origins) in central storage.

The following storage parameters are displayed on the LPSMAP (Figure 5-2) frame in megabytes (MB).

### Central Storage Parameters:

- The CENTRAL STORAGE ORIG (MB) field shows the absolute starting address where the central (main) storage extent of the logical partition begins.
- The CENTRAL STORAGE INIT (MB) field shows the amount of central storage that was specified as the initial storage amount on the LPDEF frame.
- The CENTRAL STORAGE CURR (MB) field shows the amount of central storage that is currently allocated to the logical partition.

This amount includes the initial central storage value and may include all or part of the amount specified as reserved central storage on the LPDEF frame.

- The CENTRAL STORAGE MAX (MB) field shows the maximum amount of central storage that can be allocated to the logical partition without deactivating, redefining, and then activating the logical partition.

This amount is the sum of the initial and reserved central storage fields that are specified on the LPDEF frame.

- The CENTRAL STORAGE GAP (MB) field shows the amount of available central storage from the ending address of the logical partition (ORIG plus CURR) to the starting address of the central storage extent for the next active logical partition.

If there are no active logical partitions with central storage allocated above the logical partition, this field shows the remaining amount of available central storage from the ending address of the logical partition to the top of central storage.

Any available central storage starting at origin 0 is included in the available CENTRAL STORAGE only.

- Available CENTRAL STORAGE shows the total amount of central storage available but not yet assigned and online to any active logical partition.

#### ***Expanded Storage Parameters:***

- The EXPANDED STORAGE ORIG (MB) field shows the absolute starting address where the expanded storage extent of the logical partition begins.
- The EXPANDED STORAGE INIT (MB) field shows the amount of expanded storage that was specified as the initial expanded storage amount on the LPDEF frame.
- The EXPANDED STORAGE CURR (MB) field shows the amount of expanded storage that is currently allocated to the logical partition.

This amount includes all or none of the initial expanded storage value, and all or none of the reserved expanded storage specified on the LPDEF frame.

- The EXPANDED STORAGE MAX (MB) field shows the maximum amount of expanded storage that can be allocated to the logical partition without deactivating, redefining, and then activating the logical partition.

This amount is the sum of the initial and reserved expanded storage fields that are specified on the LPDEF frame.

- The EXPANDED STORAGE GAP (MB) field shows the amount of available expanded storage from the ending address of the logical partition (ORIG plus CURR) to the starting address of the expanded storage extent for the next active logical partition.

If there are no active logical partitions with expanded storage allocated above the logical partition, this field shows the remaining amount of available expanded storage from the ending address of the logical partition to the top of expanded storage.

Any available expanded storage starting at origin 0 is included in the available EXPANDED STORAGE only.

- Available EXPANDED STORAGE shows the total amount of expanded storage available but not yet assigned and online to any active logical partition.



## Channel Path Assignments (LPCHNA Frame)

**Note:** For ES/9000 Models 820, 860, and 900 use the LPCHNA frame shown in Figure 3-18 on page 5-7.

The Logical Partition Channel Assignments (LPCHNA) frames (Figure 5-3 and Figure 3-18 on page 5-7) indicate the channel path that is assigned to each logical partition and indicates whether or not the channel path is reconfigurable.

**Operation Considerations:** Each time a power-on reset into LPAR mode is performed from the same IOCDs, channel paths are assigned to logical partitions as they were the last time this IOCDs was active. Channel paths are assigned to logical partitions according to IOCP definition only in the following instances:

- On the first power-on reset with this IOCDs
- If channel paths in the IOCDs have not been reconfigured
- If reconfigured channel paths are reconfigured again to the original logical partition
- If none of the channel paths in the IOCDs are defined as reconfigurable.

In these instances, the data displayed on the LPCHNA frame reflects the channel assignments specified in IOCP; otherwise, the frame displays the current channel assignments for logical partitions.

```

                                DD MMM YY  hh:mm:ss
                                (LPCHNA)
Logical Partition Channel Assignments(1 of 2)

IOCDs: B1/BBBBBBBB

CHPID          = 0000 0000 0000 0000 1111 1111 1111 1111  PARTITION
                0123 4567 89AB CDEF 0123 4567 89AB CDEF  1 = DOSVSE
PARTITION #    = 1111 2222 3333 4444 1111 2222 3333 4444  2 = HVSPROD
RECONFIGURABLE = RRRR .... RRRR RRRR RRRR .... RRRR RRRR  3 = HVSTEST
                                                         4 = VMHPO

CHPID          = 2222 2222 2222 2222 3333 3333 3333 3333
                0123 4567 89AB CDEF 0123 4567 89AB CDEF
PARTITION #    = 1111 2222 3333 4444 1111 2222 3333 4444  LEGEND
RECONFIGURABLE = RRRR .... RRRR RRRR RRRR .... RRRR RRRR  R = YES
                                                         . = NO
                                                         * = NOT DEFINED

COMMAND ==>

```

Figure 5-3. Logical Partition Channel Assignments (LPCHNA) Frame

**LPCHNA Fields:** The RECONFIGURABLE field indicates whether the channel path is available for reconfiguration: R if reconfigurable, . (period) if not reconfigurable, and \* (asterisk) if the channel path is not defined in the IOCDs.

**Note:** When a channel path has been reconfigured, it is dedicated to the new logical partition unless it is reconfigured again. Reconfiguration is saved across a power-on reset.

## LPCHNA Frame (ES/9000 Models 820, 860, and 900)

**Note:** This frame applies only to ES/9000 Models 820, 860, and 900. For other models use the LPCHNA frame shown in Figure 5-3 on page 5-6.

Logical Partition Channel Assignments (1 of 2) (LPCHNA)																07 Apr 89 01:29:13			
IOCDs: A4/DDDDDDDD																			
CHPID	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	PARTITION	CHPS	
PARTITION	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	1 = MVSPROD	20	
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	2 = MVS2	20	
																	3 = TSO	20	
CHPID	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	4 = VMHPO	36	
PARTITION	5	5	5	5	6	6	6	6	7	7	7	7	7	1	1	1			
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
CHPID	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F			
PARTITION	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5			
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
CHPID	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F			
PARTITION	6	6	6	6	7	7	7	7	1	1	1	1	2	2	2	2			
RECONFIG	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R			
LEGEND R = Yes . = No * = Not Defined																			
COMMAND ==>																			
SYSTEM05	ONLINE	0	..	1	..	2	..	3	..	4	..	5	..					PSW0	OPERATING
A:A MODE																			

Figure 5-4. LPCHNA Frame (ES/9000 Models 820, 860, and 900)

**LPCHNA Fields:** The RECONFIGURABLE field indicates whether the channel path is available for reconfiguration: R if reconfigurable, . (period) if not reconfigurable, and \* (asterisk) if the channel path is not defined in the IOCDs.

**Note:** When a channel path has been reconfigured, it is dedicated to the new logical partition unless it is reconfigured again. Reconfiguration is saved across a power-on reset.

## System Activity Display (SAD) for Logical Partitions

When PR/SM is installed, new SAD definition capabilities are provided. The following SAD capabilities are provided for LPAR mode:

- A one-line display summarizing the activity of a logical partition, indicating supervisor state activity, problem state activity, or both. An indication of 100% busy indicates that the logical partition is using its full weight of resources as specified on the LPCTL frame. An indication of more than 100% busy indicates that the logical partition is receiving more than its share of resources as specified by the weights on the LPCTL frame.
- One or more lines of display for a dedicated logical partition, each line reflecting the activity of a logical processor within the logical partition. The display can indicate supervisor state activity, problem state activity, or both, and may be qualified by key or by key exclusion.
- Display of high-usage or low-usage CHPIDs for one or more logical partitions.

### Defining LPAR Mode System Activity Display (SAD) Frames

The Define System Activity Display (SAD-00) frame has a field under the B= LINE ELEMENT selection group title:

Activity display for: \_\_\_\_\_

The values that may be filled into this entry field are PHYSICAL if the B-, C-, and D-selections for a given A-selection are to represent physical hardware data, or a logical partition name if the display line currently being defined is to display logical partition data. See Figure 5-5.

SAD: 9	04 Dec 89 15:04:14
Define System Activity Display (SAD)-00	
A= LINE NO.	B= LINE ELEMENT
1. C1	Activity display for: PHYSICAL
2. C2	1. CP(Hex): _
3. C3	2. CP(Hex): _ Key(Hex): _
4. C4	3. CP(Hex): _ Ex Key(Hex): _ State: _ (S/P/B)
5. C5	4. CH(Hex):ESA CHPID: _ 370 Set: _ No. _
6. C6	5. CH List: _ (HI/LO) ; Thru line(Dec): _
7. C7	6. Blank Line
8. Grid	7. Grid
9. CP1	8. Summary
10. CP2	E= REFRESH RATE
11. High Usage	-> 1. Seconds(Dec): 3_
12. CH List	F= SAD ID INFORMATION
13. CH List	-> 1. SAD Name(A/N):
14. CH List	LPAR SAD Frame _____
15. CH List	2. Save as No.(Dec): 9_
16. CH List	3. Review SAD List
17. CH List	D= THRESHOLD
18. CH List	1. >(Dec): _
	2. <(Dec): _
	-> 3. None
	G= EXECUTE SAD
	1. Number(Dec): _
COMMAND ==>	

Figure 5-5. Define System Activity Display (SAD-00) Frame

If logical partition data is desired, the following rules apply:

- The 1- to 8-character logical partition name must be entered in the new entry field under the B-selection group title.
- If the logical partition is activated as a sharing logical partition, a logical partition Summary (B8) line may be requested.
- If the logical partition is activated as a dedicated logical partition, more flexibility exists in the display of logical partition data. A summary logical partition display on a single line may be requested, or logical CP data may be requested, with a single display line representing the activity of a single logical central processor within the logical partition.
- High-usage or low-usage channels for more than one logical partition may be selected by changing the logical partition name in the entry field and by selecting the B5 item again.

### Example of a SAD Display for Logical Partitions

The following is an example of a SAD display that may be defined. Figure 5-6 is a display for all logical partitions, followed by a display showing physical activity for all central processors, on the same frame. Note that specific storage protection keys can be displayed for dedicated logical partitions. At the bottom of the display are system-wide, high-usage CHPIDs.

```

                                04 Dec 89 15:01:57
System Activity Display - LPAR SAD Frame      (SAD 9)
Prob=* Supv=@  0---1---2---3---4---5---6---7---8---9---10
C1
C2          @@@@
             PARTITION C3      NOT ACTIVE
C4
C5          *****@@@@@@@@@@
             PARTITION C6      NOT ACTIVE
             PARTITION C7      NOT ACTIVE
             0---1---2---3---4---5---6---7---8---9---10
CP1         *@@@@@
CP2         *@@@@@
High Usage  0---1---2---3---4---5---6---7---8---9---10
CHPID 01 C2 @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
CHPID 07 C5 @
CHPID 06 C2 @@@@@@@@
CHPID 1B C2 @@@@@@@@@@
CHPID 2D C5 @@@
CHPID 1C C5 @@
CHPID 3F C5

COMMAND ==>

```

Figure 5-6. SAD Display of Logical Partition and Physical Processor Activity Activity

## Logical Partition Log Data

The Log Logical Partition (LOGLP) service language command can be invoked from either the system console or the service console (when the console owns the operating partition) to obtain a log of LPAR data for one or all logical partitions. Note that the LPAR data for a logical partition can be logged whether a logical partition is locked or unlocked.

To obtain the best LPAR data for problem determination, no processors in the logical partition specified should be active. If a log of LPAR data for **all** logical partitions is requested, no processors should be active in any logical partition.

### LOGLP Service Language Command

**Operation Considerations:** If a logical partition name is specified, no processors in the logical partition should be active. If one or more processors in the logical partition are active, the global stop function should be invoked to attempt to stop all the processors. The global stop function is available either through the STOP command or the Stop function key when the specified logical partition is the target logical partition.

If ALL is specified, no processors should be active in any logical partition. If one or more processors in a logical partition are active, the global stop function should be invoked to attempt to stop all the processors. This function should be attempted for all active logical partitions.

LOGLP		lpname
		ALL

#### **Mandatory Parameters:**

**lpname/ALL** When a logical partition name is specified, the LPAR data for that logical partition is logged. When ALL is specified, the LPAR data for all logical partitions is logged. If entered, the logical partition name must specify the name of a valid, active logical partition. Note that LPAR operation continues while the log of LPAR data is taken.

**Optional Parameters:** None.

## LPAR Mode Log Data

**Note:** When the LPAR mode command is issued, it is disruptive to the activity in all active logical partitions.

The LPAR mode (LPAR) service language command can be invoked from either the system console or the service console (when the console owns the operating partition) to obtain a log of LPAR mode data or to reinitialize LPAR mode. Using this service language command, the following functions may be performed:

- A log of LPAR mode data may be obtained
- LPAR mode may be reinitialized
- The configuration may be released; that is, the system is put in a Power-on-Reset Required state.

### LPAR Mode Service Language Command

**Operation Considerations:** When this service language command is invoked with the LOG parameter, the store status function will be performed to save the status of all the processors.

Any LPAR restart accomplished through this service language command will not be included in the LPAR threshold calculations.

The Cncl key is effective only if the LOG parameter has been specified. When the Cncl key request is recognized, LPAR logging ends and no further processing of the LPAR service language command request is performed. All processors in the configuration are left in the stopped state.

When LPAR mode is reinitialized through this service language command, automatic activation of logical partitions is not performed. All logical partitions must be activated manually.

LPAR		RESTART	LOG
		-----	-----
		RELEASE	NOLOG

#### **Mandatory Parameters**

**RESTART/RELEASE** The RESTART parameter should be used to reinitialize LPAR mode. With the RESTART parameter, a system reset clear is performed during LPAR reinitialization. The RELEASE parameter should be used when the system mode will be changed to one of the basic modes. With the RELEASE parameter, the system is placed in a Power-on-Reset Required state.

**LOG/NOLOG** The LOG parameter should be used to obtain a log of LPAR mode data. The NOLOG parameter should be used only when no log of LPAR mode data is required.

**Optional Parameters:** None.

## Logical Partition Performance

**Note:** Contact your IBM service representative assistance in planning LPAR-mode configuration capacity requirements for logical processors.

The performance of logical partitions is a function of the operating systems and the workloads, the configuration of the partitions, the configuration of the processor complex model, and the performance tuning parameters.

### RMF LPAR Management Time Reporting

Enhanced RMF processor utilization reporting includes LPAR Management Time on the Partition Data Report. RMF provides information about all shared logical processors that remain active for the duration of the reporting interval. RMF can also be run on a single partition if additional information is required.

There are two types of LPAR management time reporting: time spent managing the partition, and time spent managing the physical configuration. With LPAR Management Time reporting, the time used to manage a logical partition can be separated from the time used by the workload in a logical partition.

### LPAR Management Time

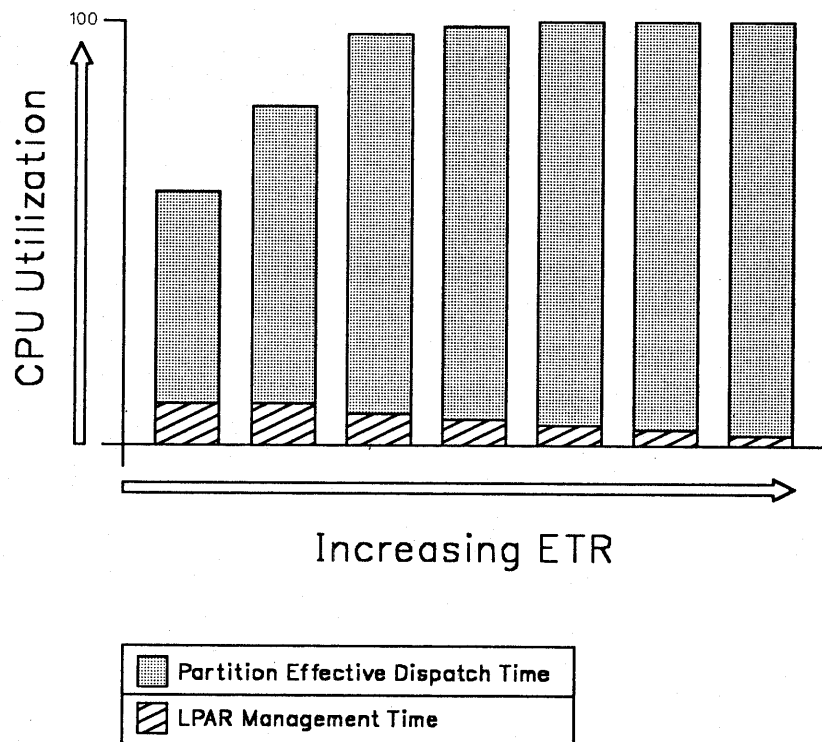


Figure 5-7. Graph Showing ETR Increasing with CPU Utilization

Figure 5-7 is an example of how information from the enhanced RMF LPAR Management Time reports can be used. This example shows the LPAR Management Time and the partition effective dispatch time for each logical partition. As CPU utilization increases, LPAR management time decreases, and the external throughput rate (ETR) increases.

Using the enhanced RMF report, CPU-utilization calculations can be based on a partition's effective dispatch time. The effective dispatch time can be determined by excluding LPAR Management Time from the time that a physical CPU is assigned to a logical processor.

**Note:** RMF support for LPAR Management Time reporting is available only on ES/9000 models, ES/9000-3090T models, and ES/3090 J-Models (180, 200, 280, and above) using MVS/ESA SP Version 4 or MVS/ESA Version 3 Release 5, and RMF Version 4 Release 2 and RMF Version 3 Release 5 respectively. For more information about RMF support, the RMF Partition Data Report, and LPAR Management Time see the *RMF User's Guide* cited in "Reference Publications" on page xiii.

## Dedicated and Shared Processors

Logical processor configurations (when large single-image processing is not required), with each partition having fewer logical processors than there are physical processors, may have a higher ITR than the same system in one of the basic modes. This can occur because each partition has fewer N-way effects.

Listed below are some examples of laboratory workload measurements for the ES/3090 E-Models using PR/SM with MVS/SP 2.2 workloads.

### Dedicated Processors

- Two dedicated 1-way partitions running CICS on a Model 200E showed an ITR ratio of 99% of the ITR of the same Model 200E in basic mode.
- Two dedicated 3-way partitions running IMS on a Model 600E showed an ITR ratio of 110% of the ITR of the same Model 600E in basic mode. Each of these partitions achieved an ITR ratio of 83% of a Model 300E.
- Two dedicated 1-way and two dedicated 2-way partitions running IMS on a Model 600E showed an ITR ratio of 125% of the ITR of the same Model 600E in basic mode.

Generally, dedicated processor partitions require fewer processing resources. That is, the ITR of dedicated partitions is higher than that of identically defined shared processor partitions.

### Shared Processors

- Four shared 2-way partitions running IMS on a Model 200E showed an ITR ratio of 86% of the ITR of the same Model 200E in basic mode.
- Four shared 1-way partitions running IMS on a Model 200E showed an ITR ratio of 95% of the ITR of the same Model 200E in basic mode.
- Two shared 2-way and two shared 3-way partitions running IMS on a Model 600E showed an ITR ratio of 102% of the ITR of the same Model 600E in basic mode.

Generally, the capability in LPAR mode to recognize central processor resources that are not used and to balance workloads may result in an improved ETR with logical partitions with shared processors. In particular, for workloads that exhibit fluctuations in processing demands, the consolidation of several systems as sharing partitions of a processor complex may improve responsiveness and increase ETR.



For logical partitions with shared processors, a major factor in performance is the ratio of logical processors to physical processors. For example, an ES/3090 Model 300J with six one-way partitions and one 3-way partition (a total of 9 logical processors) will have better ITR than the same system with seven 3-way partitions (21 logical processors). Other factors (though of less importance) are the maximum number of logical processors defined for any or all logical partitions in the configuration, the number of logical partitions, and the workload.

## **Start Interpretive Execution (SIE) Performance**

PR/SM implementation uses processor complex hardware mechanisms that are also used to implement the SIE facility when operating in ESA/370 or ESA/390 mode. Therefore, if SIE is executed in a logical partition, SIE performance is reduced relative to operation in ESA/370 or ESA/390 mode. The performance reduction depends on the frequency of SIE invocation and should be evaluated for each application. On models that support operation of VM/XA SP for CMS-intensive production use in a logical partition, the design of the hardware has significantly improved the performance of the SIE instruction when used to dispatch pageable guests in LPAR mode.

## **Channel Balancing in a S/370 Mode Logical Partition**

Special tuning for channels when operating a logical partition in S/370 mode should be considered. The Test Channel (TCH) instruction does not return condition code 2 in LPAR mode. Therefore, channel balancing algorithms that use TCH to determine if a channel is working in burst mode will find the channel claimed to be available even when it is active. To compensate for this, special tuning may be necessary.

With MVS/SP 1.3.5, a channel balancing algorithm may be selected using the IECIOSxx member of SYS1.PARMLIB. This member will select the order in which alternative paths to a device are chosen. It is recommended that the channel balancing algorithm Rotate be selected for MVS/SP 1.3.5 environments.

With VM/SP HPO, devices using the same pair of channels may need to be generated so that half the devices use the low channel as their primary channel with the high channel as the alternative, and the remainder of the devices use the high channel as their primary channel. It is also recommended that half the devices on a control unit be generated with the low channel as the primary channel with the remainder having the high channel as their primary channel.

This work should be done during the LPAR mode planning stage. Particular attention should be given to swap volumes and highly used data base volumes.

## **VM/SP and VM/SP HPO Performance Considerations**

When VM/SP or VM/SP HPO is run in a logical partition with dedicated processors, the following variables are consistent with how they are reported in S/370 mode.

When VM/SP or VM/SP HPO is run in a logical partition with shared processors, certain key Virtual Machine Monitor Analysis Program (VMMAP) variables are no longer consistent with how they are reported in S/370 mode. The key variables are:

- TOTCPU, SYSTCPU, APTCPU
- CPCPU, SYSCCPU, APCCPU

- IDLE, SYSIDLE, APIDLE
- IOWAIT, SYSIOWAIT, APOWAIT, PAGEWAIT, SYSPGWAIT, APPGWAIT
- TVRATIO

Even at high utilizations where VM is the dominant partition on a shared processor, it is difficult to predict how much they will deviate from one of the basic modes. However, the TOTCPU and CPCPU times can be easily estimated from either the accounting records or the VMMAP User Resource Summary report because that information is correct under all conditions in LPAR mode.

### **TOTCPU and CPCPU TIMES Calculations Using VMMAP**

To calculate TOTCPU and CPCPU times using VMMAP:

- Divide the sum of all the TOTAL CPU TIMES (which appears at the bottom of the VMMAP User Resource Summary report) by the ELAPSED TIME (which appears in the upper right hand corner of the same report) and multiply by 100. This gives the TOTCPU value without accounting for any uncaptured time.
- To include the uncaptured time to get a more accurate estimation of CPU utilization, divide the number calculated in the previous step by the system's capture ratio. This is typically between 92% to 95% for UP-generated systems and between 90% and 94% for AP-generated systems. If there are any basic mode VMMAPs for the current workload, that capture ratio should be used.

**Response Time Variables:** For measurement of internal response time, the VMMAP variables TRIVRESP and Q1SEC are understated but the amount of their understatement cannot be predicted under varying shared processor loads. An alternative measure (called XRT) can be used as a more reliable measurement for system responsiveness. This can be computed from VMMAPs run for VM systems in shared partitions:

$$\text{XRT} = \text{ACTIVE} / (\text{Q1VOLDROPS} + \text{Q2VOLDROPS})$$

**Channel Utilization:** VM/SP and VM/SP HPO sample I/O control blocks at the high-frequency sampling interval to collect information on device and control unit activity. Therefore, the VMMAP reports reflecting DASD device and controller activity are equivalent in accuracy to reports generated for VM systems running in S/370 mode.

### **TOTCPU and CPCPU TIMES Calculation Using Accounting Records**

To calculate TOTCPU and CPCPU times using accounting records:

- Add all of the TTIMES from type 01 accounting records, including the SYSTEM virtual machine type 01 accounting record. Divide this total by the elapsed time during which the accounting records were collected and multiply by 100. This gives the estimated total CPU utilization value for the VM system without accounting for any uncaptured time.
- To include the uncaptured time to get a more accurate estimation of CPU utilization (that is, closer to the real TOTCPU value), divide the number calculated in the previous step by the capture ratio for the system. This is typically between 92% to 95% for UP-generated systems and between 90% and 94% for AP-generated systems. If there are any basic mode VMMAPs for the current workload, that capture ratio should be used.

**VM/SP and VM/SP HPO Accounting Records:** VM/SP and VM/SP HPO type 01, 02, 03, 04, 05, 06, and 08 accounting records generated in logical partitions, whether shared or dedicated, are equivalent in accuracy to the records generated by VM systems operating in S/370 mode. Type C0 accounting records are user defined and their accuracy will depend on what information is collected and how it is collected.

### **TVRATIO Calculation**

From either of these two methods for calculating TOTCPU, the TVRATIO for the VM system can be calculated. Divide the estimated total CPU utilization value by the VIRTCPU (or SYSVCPU value for an AP-generated system) value reported in VM MAP.

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## **Recovery Strategy in LPAR Mode**

Recovery planning for LPAR mode requires that the appropriate planners and technical support personnel understand the recovery strategy for the basic modes and for LPAR mode as described in the appropriate *Recovery Guide*, and the relationship between LPAR mode and logical partitions.

In planning for recovery in LPAR mode, consider the following guidelines:

- Recovery in LPAR mode is considered successful if a logical partition is able to perform useful work and critical application programs remain operational (even if one or more logical partitions are disabled) after a failure occurs. Recoverability depends on the extent and location of a failure and the ability of the control program to handle the failure.
- Develop a recovery strategy for the specific installation that addresses the specific hardware and applications of that installation. For example, if a failure occurs that might disrupt multiple logical partitions or a critical logical partition, the operator should be able to determine what must remain active and what can be deactivated, and to perform the appropriate recovery procedures.
- The operator should follow established local procedures for reporting problems and for performing recovery procedures. It is recommended that recovery procedures be ranked from least to most disruptive. The operator should know what procedures to follow if any or all logical partitions do not respond to the recovery actions directed to it.
- Assign channel paths to logical partitions as described in the guidelines under "Guidelines for Setting Up the I/O Configuration" on page 2-12.

**Note:** ES Connection Channels can not be defined or assigned to S/370 logical partitions. Only parallel channels can be defined to S/370 logical partitions.

- Define resources to logical partitions so that any hardware failure has a minimal impact on any logical partition that must remain active.

For example, the failure of a physical processor causes the temporary loss of the logical processor that was dispatched on the physical processor. The logical partition owning that logical processor may continue running if it was running on a logical partition with at least two processors and if the control program can recover from a processor failure.

- Idled logical partitions may enable faster recovery than deactivated logical partitions because idled logical partitions have a status of pending, which is required for automatic activation.
- Ensure that at least one basic mode IOCDS (BASC IOCDS) is generated to allow a power-on reset into one of the basic modes if required.

**Operation Considerations:** If an individual logical partition is affected, the following recovery actions (ranked from least to most disruptive) should be considered when planning recovery procedures.

- If an affected logical partition continues to operate with a problem, allow it to do so.
- If the control program in a logical partition remains active but processing is interrupted, consider the applicability of a restart or IPL.
- Enter the LOGLP command for the affected logical partition. See “Logical Partition Log Data” on page 5-10. When the logout is complete, perform a stand-alone dump and IPL the control program.
- Enter the LOGLP command for the affected logical partition. See “Logical Partition Log Data” on page 5-10. When the logout is complete, perform a stand-alone dump. Deactivate the logical partition, activate the logical partition, and IPL the control program.
- Enter the LOGLP command for the affected logical partition. See “Logical Partition Log Data” on page 5-10. When the logout is complete, perform a stand-alone dump. Deactivate the logical partition, redefine it to exclude the hardware that failed, activate the logical partition, and IPL the (SC).
- Perform an orderly shutdown of the (SC) in an affected logical partition. If the logical partition is not critical, allow the other logical partitions to continue.

If all logical partitions are affected, or if a critical logical partition is affected and did not respond to the recovery actions directed only to it, the following recovery actions (also ranked from least to most disruptive) should be considered when planning recovery procedures.

- Perform an orderly shutdown of all the control programs. Initialize LPAR mode by entering the LPAR command (see “LPAR Mode Log Data” on page 5-11). Activate the logical partitions and IPL the control programs.
- Perform an orderly shutdown of all the control programs. Perform the most appropriate recovery action (for example, in response to a hardware failure) as in one of the basic modes of operation. Perform a power-on reset into LPAR mode.
- For a single-image configuration, perform static partitioning (SI-to-PP reconfiguration) to continue processing on the operational side of the processor complex.
- If a power-on reset fails to initialize LPAR mode, perform a power-on reset into one of the basic modes to attempt a recovery in basic mode. IPL the most critical control program.

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## Appendix A. Architectural Differences in LPAR Mode

**Note:** The differences described in this section apply only to the ES/3090 and ES/3090-9000T models.

When an ES/3090 or ES/3090-9000T Processor Complex is operating in LPAR mode, the following differences from the *IBM System/370 Principles of Operation* and the *IBM Enterprise Systems Architecture/370 Principles of Operation* are observable. These differences should rarely, if ever, affect normal operation.

### **Address-Limit Checking Not Implemented (ESA/370 Mode)**

If a Start Subchannel instruction designates an operation-request block in which the address-limit bit is 1, an operand exception is recognized, and the operation is suppressed. The Store Subchannel instruction stores 0's in the limit-mode field of the subchannel-information block regardless of the limit mode specified by the Modify Subchannel instruction.

### **No Interruption Priority by I/O-Interruption Subclass (ESA/370 Mode)**

I/O interruptions are not necessarily recognized in the order of interruption-subclass numbers.

### **Delay of I/O Interruption (System/370 Mode)**

The following applies only when bit 12 of the current PSW indicates basic-control (BC) mode. If some, but not all, channels in the range 0 through 5 are disabled, one of the disabled channels has a pending interruption, and that channel becomes enabled, then the interruption may be delayed until the wait state is entered.

### **First CSW in a Channel Program May Be TIC (System/370 Mode)**

If the first channel command word (CCW) in a System/370 channel program specifies the Transfer in Channel (TIC) command, a program check is not necessarily recognized.

### **No I/O Measurement Information (System/370 Mode)**

The I/O measurement byte at real location 185 is always stored as 0's.

### **Test I/O to a Channel-to-Channel Adapter (System/370 Mode)**

For any IBM channel-to-channel adapter that provides extended mode, sense bits 1 and 7 may be reset by Test I/O.

If an IBM 3088 Multisystem Communication Unit has pending sense data and contains an end-of-file condition, Test I/O may cause the end-of-file condition to be cleared.

### **Unpredictable CCW Address in CSW (System/370 Mode)**

In the following instances, the CCW-address field of the channel status word (CSW) contains an unpredictable value.

- Start I/O Fast Release or Resume I/O is followed by Halt Device or Halt I/O, halting the operation before it is initiated at the device. The deferred condition code is 1 or 3.
- Resume I/O is issued for a suspended channel program, resulting in a deferred condition code of 1 or 3.
- Start I/O Fast Release is followed by Clear I/O, clearing the operation before it is initiated at the device.

### **Condition Codes for Test Channel (System/370 Mode)**

Test Channel sets condition code 0 (channel available) unless the channel is not operational, in which instance condition code 3 is set. Test Channel never causes a subsequent channel-available interruption.

### **I/O-Busy Conditions (System/370 Mode)**

During the execution of an I/O instruction:

- A busy channel, control unit, or device is reported as a device-busy condition.
- A busy subchannel is always the result of activity on the addressed device.

### **Halt Device and Halt I/O Differences (System/370 Mode)**

Halt I/O will not halt a device other than the addressed device.

Halt I/O and Halt Device may complete with condition code 1 and store a CSW with zero status before the addressed device is signaled to halt.

Halt I/O and Halt Device may cause the addressed device to be signaled to halt even if, at the time the instruction is executed, the channel is working in burst mode with a device other than the one addressed and the subchannel is available or has an interruption pending.

### **Signal Processor (System/370 and ESA/370 Modes)**

The external-call-signal-processor order may remain pending at the addressed CPU for as long as 256 microseconds even though the addressed CPU is enabled for external interruptions.

### **Ancillary Report (System/370 and ESA/370 Modes)**

A new indication, ancillary report, is provided. The ancillary-report bit, when 1, indicates that a malfunction has occurred that has been previously recognized or that has affected the activity of multiple facilities. When the malfunction affects the activity of multiple facilities, an ancillary-report condition may be recognized for all the affected facilities except one. For example, a machine-check-interruption condition could be reflected to several logical processors, but only one of the processors would have the ancillary-report bit set to 0.

Recognition of an ancillary-report condition may not be provided for all malfunctions.

An ancillary-report bit exists in the following places:

- Bit 44 of the machine-check-interruption code (System/370 and ESA/370 modes).

This bit is meaningful for all conditions indicated by the machine-check-interruption code or the external-damage code.

- Bit 26 of the limited channel logout (System/370 mode).

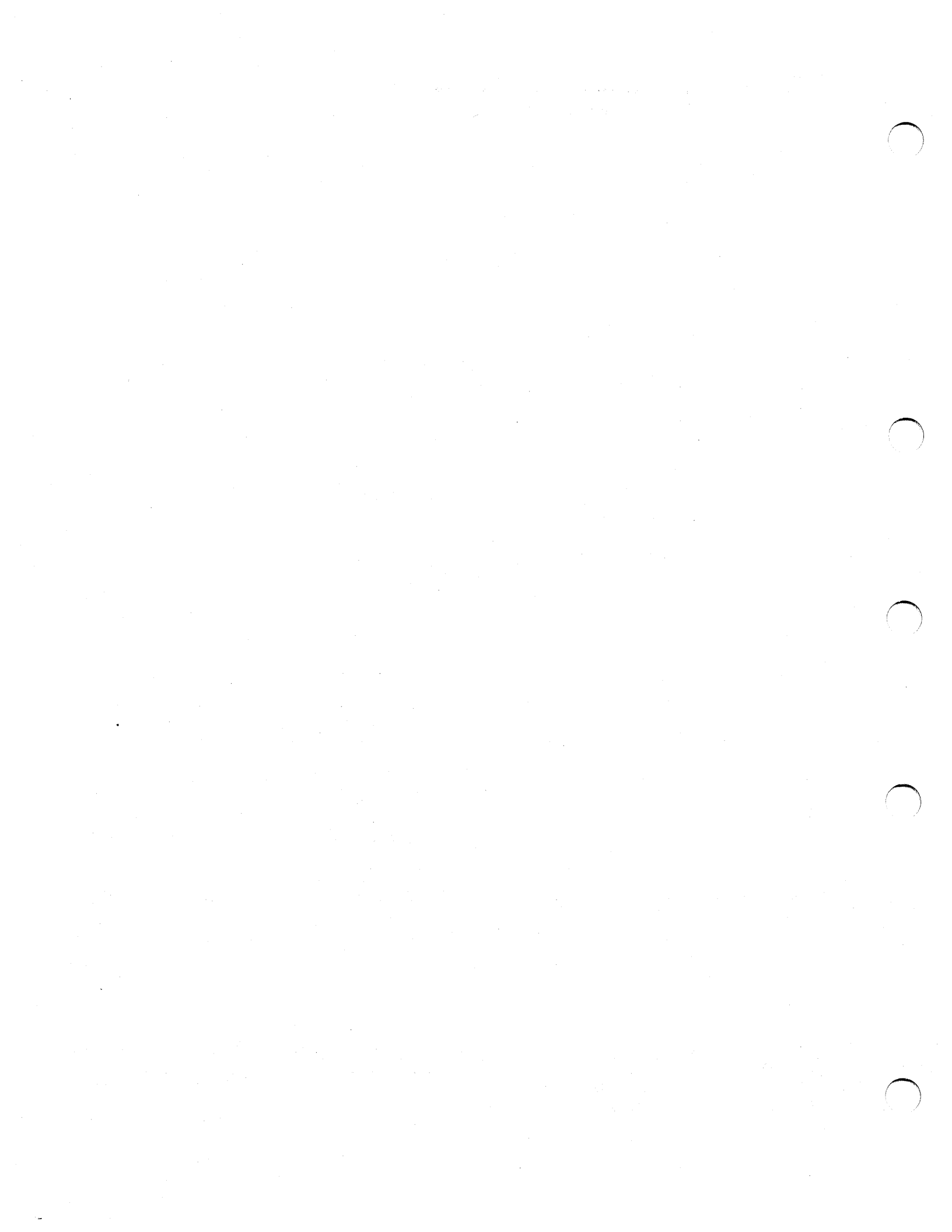
This bit is meaningful when the channel status indicates channel-control check, channel-data check, or interface-control check.

- Bit 16 of the subchannel logout (ESA/370 mode).

This bit is meaningful when channel-control check, channel-data check, or interface-control check is indicated in bits 12 through 14 of word 2 of the subchannel status word (SCSW).

- Bit 8 of the channel-report word (ESA/370 mode).  
This bit is meaningful for all channel reports.





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## Glossary of Terms and Abbreviations

See the *IBM Dictionary of Computing*, SC20-1699, or the Index for terms that do not appear in this glossary. Also see the glossaries of reference publications (listed in the Preface).

### A

**absolute address.** An address after translation and prefixing, but before configuration. See *logical address*, *physical address*, *real address*, and *virtual address*.

**activate.** In LPAR mode only, when the operator activates a logical partition, a SYSRESET is performed in the logical partition and the hardware defined to the logical partition is assigned to it. When activation is complete, an IPL of the SCP is automatically performed or the operator performs an IPL of the SCP in the logical partition. Contrast with *deactivate*.

**active subchannel (SCH).** Resides in the channel subsystem because the control information it contains is necessary for the current operation. An active subchannel may reside in I/O processor (IOP) or channel (CHN) local working storage. An active subchannel is always locked. An active subchannel is always busy or interruption pending. See *inactive subchannel* and *busy subchannel*.

**addr.** Address.

**address.** An identification of a storage location or an I/O device.

**APAR.** Authorized program analysis report.

### B

**basic modes.** Any central processor mode that is available on the Configuration (CONFIG) frame, *except for LPAR mode*. For all models of the processor complex, when PR/SM is not installed (or is installed, but is not operating in LPAR mode), the processor complex is in a basic mode. Contrast with *LPAR mode*.

**BC.** Basic control mode.

**BOC.** Battery-operated clock.

**bot.** Bottom.

**busy subchannel (SCH).** The state of a busy subchannel is either active or inactive. When active, a busy subchannel is always locked. When inactive, a busy subchannel indicates that an I/O operation is pending, is in process, or is between commands in a

multiplex operation. See *active subchannel* and *inactive subchannel*.

### C

**CCW.** Channel command word.

**CE.** Channel end.

**central processor.** The hardware that controls and performs program execution in the processor unit.

**central storage.** Storage that includes both main storage (programs and data) and the hardware system area (not addressable by programming). Available to the channel subsystem and all central processors.

**CH.** Channel.

**ch.** Channel.

**chan.** Channel.

**channel (CHN).** In the channel subsystem, each channel controls an I/O interface between the channel control element and the attached control units.

**channel adapter (CHAD).** An adapter that prioritizes and stages data between the channels and the channel control element. Each channel adapter attaches four channels to the secondary data stager.

**channel address.** The 8 leftmost bits of a System/370 I/O address that identify the channel in System/370 mode. See *device address* and *I/O address*.

**channel element (CHE).** An element in the channel subsystem that consists of four channels and a channel adapter.

**channel path (CHP).** A connection between a central processor and a control unit along which signals and data can be sent to perform I/O requests. Analogous to *channel*.

**channel path identifier (CHPID).** A two-digit hexadecimal number that identifies a channel path.

**channel set.** A group of channels that are assigned to a specific central processor in the processor complex. Channel sets apply only when the processor complex is operating in System/370 mode.

**check stop.** The state that occurs when an error makes it impossible or undesirable to continue the operation in progress.

**CHE.** Identifier for a channel element, as in CHE04.

**CHP.** Channel path.

**CHPID.** Channel path identifier.

**CICS.** Customer Information Control System.

**CMS.** Conversational monitor system.

**cncl.** Cancel.

**config.** (1) Configure.

**console.** A logical device that is used for communication between the user and the system. See *display station, monitor consoles, operator console, programming support console, service console, system console.*

**CP.** (1) Central processor (as in CP1, CP2).

**CP.** Central processor.

**CPU.** Central processing unit.

**critical.** Necessary for continued operation. See also *system resource.*

**CS.** (1) Central storage. (2) Channel set.

**CSW.** Channel status word.

## D

**DASD.** Direct access storage device.

**deactivate.** In LPAR mode only, when the operator deactivates a logical partition, the hardware assigned to the logical partition is released and may be re-assigned to other logical partitions. The operator should first shut down the system control program, if active and if possible. Deactivation and reactivation of a logical partition may provide a reset of the logical partition. Contrast with *activate.*

**DEC.** Double-bit error correction.

**dec.** (1) Decimal.

**deconfigure.** To take offline a system resource by any means (usually by means of the system control program or the Configuration frame). Contrast with *deselect.*

**def.** (1) Definition.

**degraded.** (1) A mode of operation in which the system continues to do useful work, but without some resources of the processor unit. (2) A mode of operation in the processor controller in which the processor controller continues to operate, but without a backup side or without a backup DASD string.

**deselect.** To take offline the processor unit hardware by means of the Configuration frame. Contrast with *deconfigure.*

**device address.** The 8 rightmost bits of a System/370 I/O address that identify a particular I/O device and a control unit on the designated channel in System/370 mode. See *channel address* and *I/O address.*

**device number.** Four hexadecimal digits that uniquely identify an I/O device in 370-XA or ESA/370 mode.

**display.** A physical device that may be assigned as a console. Contrast with *console.*

**display station.** A physical device that can be used as multiple logical consoles. See *console.*

## E

**element.** A major part of a component (for example, the buffer control element) or a major part of the processor complex (for example, the system control element).

**EREP.** Environmental recording, editing, and printing program.

**error.** Any deviation from normal operation. Errors are automatically corrected by the hardware and Licensed Internal Code. The operator is seldom aware that an error has occurred or is only notified that an error occurred after automatic correction is complete. Uncorrected errors are failures.

**ES.** Expanded storage.

**ESA/390.** Enterprise Systems Architecture/390.

**est.** Estimate.

**ETR.** External throughput rate.

**expanded storage.** Optional integrated high-speed storage that transfers 4KB pages to and from central storage.

## F

**facility.** Hardware and software that provide useful capabilities (as in an operator facility or a maintenance service facility).

**failure.** An uncorrected error. Failures are either recoverable or not recoverable by the software or the operator. The operator is always notified when failures occur. The processor complex is generally recovered from a failure by means of a hardware reconfiguration. If reconfiguration is not possible, recovery requires a repair of the failed hardware.

**FAR.** Fetch address register.

**FCC.** Federal Communications Commission.

## G

**G.** Giga; 1 000 000 000 (1 billion).

**giga (G).** Billion.

**GMT.** Greenwich mean time.

**guest.** In interpretive execution mode, the interpreted or virtual machine as opposed to the real machine (the host).

## H

**h..** Hexadecimal digit (for example x'hh')

**hardware system area (HSA).** A logical area of central storage that is used to store Licensed Internal Code and control information (not addressable by application programs).

**hex.** Hexadecimal.

**HPO.** High performance option.

**HSA.** Hardware system area (of central storage).

## I

**ICRF..** Integrated Cryptographic Feature.

**I/O.** Input/output.

**I/O address.** In System/370 mode, a 16-bit address that consists of two parts: the 8 bits of the leftmost part constitute the channel address, and the 8 bits of the rightmost part constitute the device address.

**I/O configuration.** The collection of channel paths, control units, and I/O devices that attaches to the processor complex.

**I/O configuration data set (IOCDs).** The data set, located in the disk files that are associated with the processor controller, that contains the I/O configuration definition.

**I/O configuration program (IOCP).** A program that defines for the central processors all of the I/O devices and all of the available channel paths.

**I/O processor (IOP).** The processor in the channel control element that detects, initializes, and ends all channel subsystem operations.

**ID.** (1) Identifier. (2) Identification.

**IF.** (1) Interface. (2) Instruction fetch.

**IMS.** Information Management System.

**in.** Inch.

**inactive subchannel (SCH).** Resides outside the channel subsystem because the control information it contains is not necessary for a current operation in the channel subsystem. An inactive subchannel may be busy, even if it is unlocked. An inactive subchannel may be busy, not busy, or interruption pending. See *active subchannel* and *busy subchannel*.

**init.** (1) Initial. (2) Initiate. (3) Initialize. (4) Initialization. (5) Initialized.

**initialization.** To set counters, switches, addresses, latches, or storage contents to 0 or to other starting values at the beginning of, or at the prescribed points in, a computer program or process.

**ins.** (1) Insert. (2) Insertion.

**IOCDs.** I/O configuration data set.

**IOCDsM.** I/O configuration data set management.

**IOCP.** I/O configuration program.

**IOP.** I/O processor.

**IOPD.** I/O problem determination.

**IPL.** Initial program load.

**irpt.** (1) Interrupt (verb). (2) Interruption (noun or adjective).

**ITR.** Internal throughput rate.

## L

**limited channel logout (LCL).** An error record containing detailed information about an error affecting an I/O operation. The limited channel logout is stored in the system area of central storage. This logout may not be available on all channels and may or may not be stored along with the fixed logout when a failure occurs.

**logical address.** The address found in the instruction address portion of the program status word (PSW). If translation is off, the logical address is the real address. If translation is on, the logical address is the virtual address. See *absolute address*, *physical address*, *real address*, and *virtual address*.

**logical control unit (LCU).** In ESA/370 or ESA/390 mode, a group of contiguous words in the hardware system area that provides all of the information necessary to control I/O operations through a group of paths that are defined in the IOCDs. Logical control

units represent to the channel subsystem a set of control units that attach common I/O devices. Whenever an I/O device attaches to more than one control unit, a logical control unit is created during IOCP execution.

**logical partition.** In LPAR mode, a subset of the processor unit hardware that is defined to support the operation of a system control program.

**logical processor.** In LPAR mode, central processor resources defined to operate in a logical partition like a physical central processor.

**logout.** Log data that has been collected, formatted, and recorded.

**LP.** Logical partition.

**LPAR mode.** Logically partitioned mode. The central processor mode that is available on the Configuration (CONFIG) frame when PR/SM is installed. LPAR mode allows the operator to allocate the hardware resources of the processor unit among several *logical partitions*.

## M

**M.** Mega; 1 000 000 (1 million).

**main storage.** A logical entity that represents the program addressable portion of central storage. See *central storage*.

**max.** Maximum.

**MB.** Megabyte; 1 048 576 bytes.

**mega (M).** Million.

**megabyte.** 1 048 576 bytes.

**merge.** In the multiprocessor models, to reconfigure the processor complex from the physically partitioned (PP) configuration to the single-image (SI) configuration.

**microsecond ( $\mu$ s).** One millionth of a second.

**mm.** Millimeter.

**monitor consoles.** Optional logical displays that are used to monitor the service or system consoles. Each monitor console can be assigned to any of the physical displays attached to the processor controller.

**msg.** Message.

**multiprocessor.** A processor complex that can be operated in physically partitioned configuration as two processor complexes.

**MVS.** Multiple virtual storage.

**MVS/ESA.** MVS/ESA SP Version 3 and Version 4.

**MVS/SP.** Multiple Virtual Storage/System Product.

**MVS/XA.** Multiple Virtual Storage/Extended Architecture.

**MVS/370.** MVS/SP Version 1.

## O

**offline.** Pertains to system resources with which the processor unit has no direct communication or control.

**online.** Pertains to system resources with which the processor unit has direct communication or control.

**operating system.** Same meaning as *control program*.

**operator console.** A required display that is attached to the processor unit to provide communication with the control program.

**parm.** Parameter.

**partition, logical.** See *logical partition*.

**partition, target logical.** See *target logical partition*.

**PER.** Program event recording.

**physical address.** The absolute address after configuration (the final address). See *absolute address*, *logical address*, *real address*, and *virtual address*.

**physically partitioned (PP) configuration.** The processor complex is configured so that it operates like two processor complex models. The A-side of the processor controller controls side 0 of the processor complex, and the B-side of the processor controller controls side 1 of the processor complex.

**port.** An access point for data entry or exit. A port connects a device, usually a display, to the display/printer adapter in the processor controller.

**PP.** Physically partitioned configuration.

**PR/SM.** Processor Resource/Systems Manager.

**prob.** Problem.

**problem state.** The central processor is executing instructions for application programs. Contrast with *supervisor state*.

**processor complex.** A configuration comprising the:

- Processor unit
- Processor controller
- System display

- Service support display
- Power and coolant distribution unit
- Power unit.

**processor controller (PCE).** Provides support and diagnostic functions for the central processors. The processor controller communicates with the processor unit by means of the logic support adapter and the logic support stations, and with the power and coolant subsystems by means of the power/thermal adapter and the power/thermal stations.

**processor storage.** The storage available to the central processors (central storage and, if installed, expanded storage).

**processor unit.** The processor unit for the processor complex includes the following:

- Central processor
  - One or more central processors, depending on the model. A vector facility, if installed, is associated with each central processor.
- Processor storage
  - A combination of central storage and expanded storage (if installed).
- Channel subsystem
  - One or two channel control elements (CCEs), depending on the model. The physical configuration for a channel subsystem varies according to the number of channel elements installed.
- System control element.

**programming support console.** Logical device used as a data bank access console. The programming support console can be assigned to any of the physical displays attached to the processor controller.

**PSW.** Program status word.

**PTF.** (1) Program temporary fix.

**pwr.** Power.

## R

**real address.** An address before prefixing, such as found in the instruction address portion of the channel status word (CSW). If translation is off, the logical address is the real address. See *absolute address*, *logical address*, *physical address*, and *virtual address*.

**recovery.** To maintain or regain system operation after a failure occurs. Generally, to recover from a failure is to identify the failed hardware, to deconfigure the failed hardware, and to continue or restart processing.

**request for price quotation (RPQ).** A procedure for requesting nonstandard modifications.

**RMF.** Resource Measurement Facility (MVS/ESA term).

**RPQ.** Request for price quotation.

**RSU.** Reconfigurable storage unit (MVS term).

## S

**SAD.** System activity display.

**SCE.** System control element.

**SCK.** Set Clock instruction.

**SCP.** System control program. Same meaning as *operating system*.

**SCSW.** Subchannel status word.

**SEC.** System engineering change.

**seq.** Sequence.

**service console.** Logical device used by service personnel to maintain the processor complex and to isolate failing FRUs. The service console can be assigned to any of the physical displays attached to the processor controller.

**shutdown (of the system control program).** The operator should, in an orderly manner when possible, go to the operator console, and stop all application programs and the system control program (SCP). After shutting down the SCP, the operator should be able to execute a SYSRESET command without causing a disruption.

**SI.** (1) Single-image configuration.

**side.** (1) The multiprocessor models have a processor complex with two sides, called side 0 and side 1. (2) The processor controller has two sides, called the A-side and the B-side.

**SIE.** Start Interpretive Execution instruction.

**single-image (SI) configuration.** The processor complex is configured so that it operates like one processor complex. The A-side or B-side of the processor controller controls the processor complex while the remaining side serves as a backup. All functional elements can be activated. See *physically partitioned (PP) configuration*.

**SLC.** (1) Service language command.

**SMF.** System Management Facility (MVS/ESA term).

**SP.** System product.

**Start Interpretive Execution (SIE) instruction.** An ESA/370 and ESA/390 instruction used to emulate I/O operations for operating systems that do not use ESA/370 or ESA/390 instructions. Using the Start Interpretive Execution instruction, I/O instructions are translated into ESA/370 or ESA/390 mode I/O operations.

**stg.** Storage.

**STIDP.** Store CPU ID instruction.

**STOP.** Stop Clocks command.

**storage.** Includes both central and expanded storage (programs and data) and the hardware system area (not addressable by programming). Available to the channel subsystem (CSS), the vector element (VE), and the central processor (CP).

**storage element.** MVS/ESA term for storage hardware. Same meaning as *storage array*.

**storage key.** A control field associated with a defined block of storage that protects that block of storage from unauthorized access and change.

**subchannel (SCH).** In ESA/370 mode, a group of contiguous words in the hardware system area that provides all of the information necessary to initiate, control, and complete an I/O operation.

**sum.** Summary.

**supervisor state.** The central processor is executing instructions for the system control program. Contrast with *problem state*.

**SYSIML.** System initial machine load.

**system.** Comprises the processor complex and all attached and configured I/O and communication devices.

**system area (SA).** Concept describing a logical area of central storage used to store Licensed Internal Code and control information (not addressable by application programs).

**system console.** A logical device used for the operation and control of hardware functions (for example, IPL, alter/display, and reconfiguration). The system console can be assigned to any of the physical displays attached to the processor controller.

**system control element (SCE).** Handles the transfer of data and control information associated with storage requests between the elements of the processor complex.

**system control program (SCP).** System control program and operating system are generic terms for MVS/ESA. Same meaning as *operating system*.

**system resource.** Processor unit hardware, I/O device, channel path, software program, or other component that contributes to the ability of the system to perform useful work. If the system resource is *critical*, useful work on the system cannot continue if the resource is offline or not operational.

## T

**target logical partition.** In LPAR mode, the *target* logical partition is the logical partition that is identified on the status line and is determined by the SETLP service language command. The target logical partition is the current or immediate logical partition, the logical partition that the operator is working with or looking at.

**TCH.** Test Channel instruction.

**TIC.** Transfer in Channel command.

**TO.** Time-out.

**TOD.** Time of day (clock in the processor unit)

**TPF.** Transaction processing facility.

**TSO.** Time-sharing option.

## U

**UCW.** Unit Control Word. Same meaning as subchannel.

**uniprocessor.** A processor complex that physically contains only one central processor.

## V

**V.** Virtual (as in  $V=R$ ).

**V=V.** Virtual equals virtual.

**VE.** Identifier for a vector facility, as in VE1.

**virtual address.** A symbolic address naming the relative location of data. See *absolute address*, *logical address*, *physical address*, and *real address*.

**VM/SP.** Virtual Machine/System Product.

**VM/SP HPO.** Virtual Machine/System Product High Performance Option.

**VM/XA.** Virtual Machine/Extended Architecture.

**VM/XA SF.** Virtual Machine/Extended Architecture Systems Facility.

**VM/XA SP.** Virtual Machine/Extended Architecture System Product.

**VMA.** Virtual machine assist.

**VOL.** Beginning-of-volume label.

**vol.** Volume.

**VSE.** Virtual storage extended.

## **W**

**wait.** A central processor condition in which instructions are never executed because an error has occurred or the central processor is waiting for something to happen.

## **X**

**X.** (1) Index. (2) Hexadecimal (as in X'5F').

**x.** (1) Symbol for unknown value or character.  
(2) Symbol for variable alphanumeric.

## **3**

**370-XA.** System/370 extended architecture.





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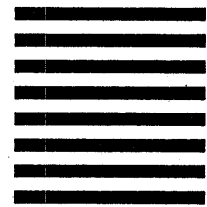
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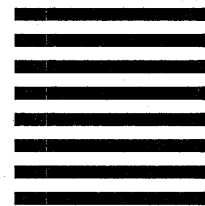
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