Logical Partition (LPAR)

LPARs operate independently!
iSeries Partition Characteristics

• Each partition has its own:
  – Operating system
  – License Internal Code (LIC) for i5/OS or Open Firmware for AIX 5L and Linux
  – Console
  – Load source disk or boot resources
  – ASPs and memory pools
  – And others expected in a standalone operating system environment:
    • Problem logs
    • Data (libraries, objects, filesystems)
    • Performance characteristics
    • Language feature codes
    • Network identity
    • Date and time
I/O is assigned to partitions by allocating individual slots.
Benefits of Using Partitions

• Capacity management
  – Flexibility to allocate resources

• Consolidation
  – Consolidate hardware, floor space, software licenses, support contracts, in-house support/operations
  – Efficient use of resources

• Application isolation
  – Separate workloads
  – Guaranteed resources
  – Data integrity

• Merge production and test environments
  – Share same hardware

• Ability to have virtual Ethernet and virtual I/O devices
Virtual Resources
IBM Virtualization Engine

- Enterprise-wide integration
  - Cross-LPAR system technologies
  - Cross-platform system services

- Flexibility and scalability
  - Dynamic LPAR (CPU, memory, I/O)
  - Virtual I/O
  - Automatic CPU balancing
  - Capacity on Demand
Shared Processor
Understanding Shared Processors

To understand Processing Units – there are four main concepts

1. One single processor is equivalent to 1.00 Processing Units, 2 Processors = 2.00 Processing Units, etc. 0.5 processing units is NOT same as half a processor.

2. Shared processor pool. A processor must live in the shared processor pool (now the default) to become Processing units.

3. Virtual Processor – how many processors do you want the partition to be able to use (run jobs/threads on) simultaneously. It’s also the number of processors that the operating system thinks it has to use.
10 Milliseconds Time Slice

4. The iSeries processors run on 10 ms time slices

Each Processor use is allocated within a 10 ms Cycle

- A partition’s use of a processor is limited to its allocation during each 10 ms cycle.
- For example, 80% of a processor (.80 Processing Units) yields up to 8 ms of processing time out of this 10 ms time slice. It also yields .8 X CPW rating of the processor.
- Every 10 ms this cycle repeats itself.
How Does a Job Get Into the Processor?

• For a job to run it has to get its data from DISK into memory, into cache, and finally into the processor.

• Slowest - disk

• Fastest - cache

• Even if the data is already in memory it has to be loaded into cache to run – this takes time.
Example of Two Partitions Sharing a Processor ("capped")

Partition **dog** jobs **a,b,c** allocated .6 Processing Units

Partition **cat** jobs **1,2,3** allocated .4 Processing Units
Potential Shared Processor Penalty

• There is a potential for a performance penalty (from 0 to 10%) when using shared processors, due to:
  – Increasing the possibility that jobs won’t complete, and
  – Having to be redispacht and potentially reload cache, and
  – Increasing the chance of a cache miss

• Reduce the chance for processor and memory affinity

• The POWER Hypervisor overhead of:
  – Managing multiple processors
  – Tracking each partitions use of its allotted milliseconds
  – Managing time slices from multiple partitions

• All of the above are affected by how you allocate your virtual processors – next couple of foils
Desired Minimum/Maximum Processing Units

- How about 0.2 Processing Units
- Minimum of 0.1
- Maximum of 2.00
- Select Advanced
Capped Partitions

- First time through we select Capped
- You can’t have less than .10 processing units per virtual processor
- I’ll allocate two virtuals for my .2 PUs
- What’s a virtual processor?
Introduction to Virtual Processors

For every 10 milliseconds of wall clock time each processor in the shared pool is capable of 10 milliseconds of processing time

• If you give Partition x .5 processing units it could use (up to) 5 milliseconds of processing time – capped. (more on capped soon)

• But you have ABSOLUTELY no control over which processors your jobs/threads run on

• All you CAN control is how many of the processors in the pool, your jobs/threads do run on (potentially) simultaneously, via Virtual Processors

= 80 milliseconds
P1 1.5 processing unit default of 2 virtual processors – max of 15 milliseconds – capped. Each job potentially could get 7.5 milliseconds (15/2 = 7.5)

P2 1.5 processing unit but using 6 virtual processors – max of 15 milliseconds – capped. But if all 6 Jobs ran at same time each may get no more than 2.5 milliseconds per job. (15/6 = 2.5)
Uncapped - Introduction

• As of IBM eServer i5/OS, and POWER5-based servers, it is now possible, by using the uncapped mode, to use more milliseconds than are allocated to a partition.

• An uncapped partition can use excess pool Processing Units.

• But even an uncapped partition could still be limited by setting the number of virtual processors too low. The number of processors it can use simultaneously is still limited by the number of virtual processors assigned.

• As of Power5 it’s also possible to allocate more virtual processors than there are processors in the pool, since the actual number of processors in the pool is a ‘floating’ number. However, you still cannot allocate less than 1 ms (.10 PUs) per processor per job (virtual processor). For example, .5 PUs and 6 virtuals is a dog that doesn’t hunt. 5 (milliseconds)/6 (jobs) < 1 milliseconds per job.
Uncapped - Configuring

- This time we deal with uncapped
- You can’t have any less than .10 processing units per virtual processor
- Allocate two virtuals for my .2 PUs
- Select OK
Virtual Processors (Limited) – Uncapped

P1 1.5 processing unit default of 2 virtual processors – max of 20 milliseconds – uncapped because you are limited to only use 2 Processors simultaneously

P2 1.5 processing unit 6 virtual processors – max of 60 milliseconds – uncapped
Example of Two Partitions Sharing a Processor ("uncapped")

Partition **dog** jobs **a,b,c** allocated .6 Processing Units

Partition **cat** jobs **1,2,3** allocated .4 Processing Units
iSeries “uncapped shared pool” with CoD

- Ressources can be requested by any partition
- Unused resources can be released
- Priorities can be assigned
- Unused resources CPUs/MEM will automatically be used to solve failures in a running operating environment
Virtual Processors (Unlimited) - Uncapped

P2 1.5 processing unit with 15 Virtual Processors (maximum allowed) gives Partition – potentially – ALL 80 milliseconds of Processing time – for every 10 physical milliseconds BUT only as long as the other shared processor partitions DON’T have jobs ready to run!
Floating Processors

• You have eight processors on your system. Seven are in the pool and one partition uses a dedicated processor.

• Dedicated partitions can allow its processors to be used for uncapped capacity (returned to the shared pool) when the partition is powered off, or a processor is removed from the partition. This is the default.
Dedicated or Shared / Capped or Uncapped?

- The best performance may well be achieved by using dedicated processors. However, dedicated processors cannot utilize excess capacity.

- For both capped and uncapped partitions, setting the virtual processor number too high may degrade performance.

- Shared uncapped allows use of excess capacity of the processors in the shared pool. Setting virtual processors too low limits the amount of excess you can use. Setting too high may negatively impact performance.

- Also be aware for uncapped partitions the operating system sees the number of desired virtual processors as equal to the number of physical processors, you need an OS license (i5/OS, Linux and AIX 5L) for the lesser of the number of virtual processors or the number of processors in the shared pool.

- So what could be recommended? The right answer depends on workload.
LINUX and AIX Integration
AIX 5L and Linux in LPAR on eServer i5

- Mission-critical UNIX/Linux on eServer i5
  - 64-bit or 32-bit AIX 5L and 64-bit Linux kernel running on POWER5
  - Consolidate i5/OS and AIX/Linux storage
  - Utilizes IBM Virtualization Engine

- POWER5 LPAR Enhancements
  - Micro-partitioning
  - Up to 254 LPARs
  - Automatic CPU balancing
  - Virtual SCSI and Ethernet

- Across eServer i5 and p5
  - AIX 5L 5.3: Up to 10 LPARs/processor, virtual I/O

- Common Linux distributions for eServer i5 and p5
  - " RHEL 3 AS QU3 from Red Hat, Inc.
  - " SLES 9 from Novell, Inc. (SUSE part of Novell)

- Enterprise Edition (depends on model)
  - Extra Processor Activated
  - Service and Education Voucher
Create a New Partition

PARTITION IDENTIFIER AND NAME ............ 2 Linux1

NUMBER OF AVAILABLE SYSTEM PROCESSORS .... 1
NUMBER OF PARTITION PROCESSORS ............ 1
MINIMUM / MAXIMUM NUMBER OF PROCESSORS .... 1 / 1
USE SHARED PROCESSOR POOL .................. 1 1=YES, 2=NO
  SHARED PROCESSOR POOL UNITS ............... 10
MINIMUM / MAXIMUM PROCESSOR POOL UNITS .... 10 / 1 00
UNCAPPED PROCESSING .......................... 1 1=YES, 2=NO
  UNCAPPED PROCESSING WEIGHT ................. 128 0, 64, 128, 255
SIZE OF AVAILABLE MEMORY (MB) .............. 1024
SIZE OF PARTITION MEMORY (MB) ............... 256
MINIMUM / MAXIMUM SIZE OF MEMORY (MB) .... 128  / 512
ENABLE WORKLOAD MANAGEMENT ................. 1 1=YES, 2=NO
VIRTUAL ETHERNET IDENTIFIERS (1=YES, 2=NO)
  1  2  3  4
  1  2  2  2

F3=EXIT  F12=CANCEL
Lab Preparation
Lab Exercise Unit 13 Overview

• Use WebSM to remotely connect to the HMC
• Create a partition and a partition profile for Linux
• Create virtual adapters on the Linux partition and the i5/OS partition
• Install SUSE Linux Enterprise Server 9 from an image catalog
• Set up network communications through virtual Ethernet
• Optionally, install Platform Enablement Library
Using WebSM

- Connect to a Windows 2003 server on an IXS via Remote Desktop Connection
- From the remote desktop, start WebSM and log in to the HMC
Create a Partition

- Create a logical partition and the required partition profile using WebSM

![Create Logical Partition Wizard]

This wizard helps you create a new logical partition and a default profile for it. You can use the partition properties or profile properties to make changes after you complete this wizard.

Ensure you have your logical partition planning information before you use this wizard. You may also find it helpful to be familiar with logical partition concepts. Click Help for more information.

To create a partition, complete the following information:

System name: Server-9406-550-SN65DAA3E Uni
Partition ID: 7
Partition name: UniLab13_Linux

Partition environment:
- AIX or Linux
- i5/OS
- Virtual I/O server
Adding SCSI Adapter via DLPAR

- Create a virtual SCSI client adapter via the partition creation wizard
- Create a virtual SCSI server adapter via Dynamic LPAR on the i5/OS partition – Does not require any restart
Installing Linux from Virtual Media (1)

- Linux CDs are loaded into an image catalog in i5/OS
- Virtual CD/DVD optical drive used for installation

![Image Catalog Entries]

```
Work with Image Catalog Entries

Image Catalog . . . . . . : SUSE_SLES
Image Catalog Status . . . : Not ready
Virtual optical device . . . :
Directory . . . . . . . . . : /imagecatalog/sles9

Type options, press Enter.
1=Add  2=Change  4=Remove  6=Mount  8=Load  9=Unload
10=Initialize volume  12=Work with volume

Opt Index Status Image File Name
-- *AVAIL
--  1 Mounted SU90.001
--  2 Loaded SU90.C01
--  3 Loaded SU90.C02
--  4 Loaded SU90.C03
--  5 Loaded SU90.C04
```

F3=Exit  F5=Refresh  F6=Load image catalog  F7=Verify image catalog
F8=Reorder by index  F12=Cancel  F24=More keys
Installing Linux from Virtual Media (3)

- Creating Network Server Description (NWSD) and network Server Storage (NWSSTG)
- Set one-time boot parameter for installation

<table>
<thead>
<tr>
<th>Network server description</th>
<th>SLES9A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option</td>
<td>*BASIC</td>
</tr>
<tr>
<td>IPL source</td>
<td>*NWSSTG</td>
</tr>
<tr>
<td>IPL stream file</td>
<td>*NONE</td>
</tr>
<tr>
<td>IPL parameters</td>
<td>root=/dev/sda3</td>
</tr>
<tr>
<td>Power control</td>
<td>*YES</td>
</tr>
<tr>
<td>Text</td>
<td>Linux Server Thomas</td>
</tr>
</tbody>
</table>
Installing Linux from Virtual Media (2)

- Console session started from WebSM (virtual terminal)
- Installation from console

What type of terminal do you have?

1) VT100
2) VT102
3) VT220
4) X Terminal Emulator (xterm)
5) X Terminal Emulator (xterm-vt220)
6) X Terminal Emulator (xterm-sun)
7) screen session
8) Linux VGA or Framebuffer Console
9) Other

Type the number of your choice and press Return: _
Setting up IP Networking (1)

- Virtual Ethernet adapter created via partition creation wizard
- Virtual Ethernet adapter for i5/OS added via DLPAR
- External access to Linux partition through i5/OS partition

172.17.17.54 translated to 10.20.20.2
Setting up IP Networking (2)

- Communications to a partition that is only reachable via virtual Ethernet can be achieved by:
  - Using Network Address Translation (used in this lab)
  - Transparent Subnetting (a.k.a Proxy ARP)
  - IP Routing
  - Virtual I/O Server with Shared Ethernet adapter
Installing the Platform Enablement Library (optional)

- To enable full Linux integration in a hosting i5/OS environment, additional software needs to be installed under Linux
- Enables full shutdown support for Linux when NWSD is varied off