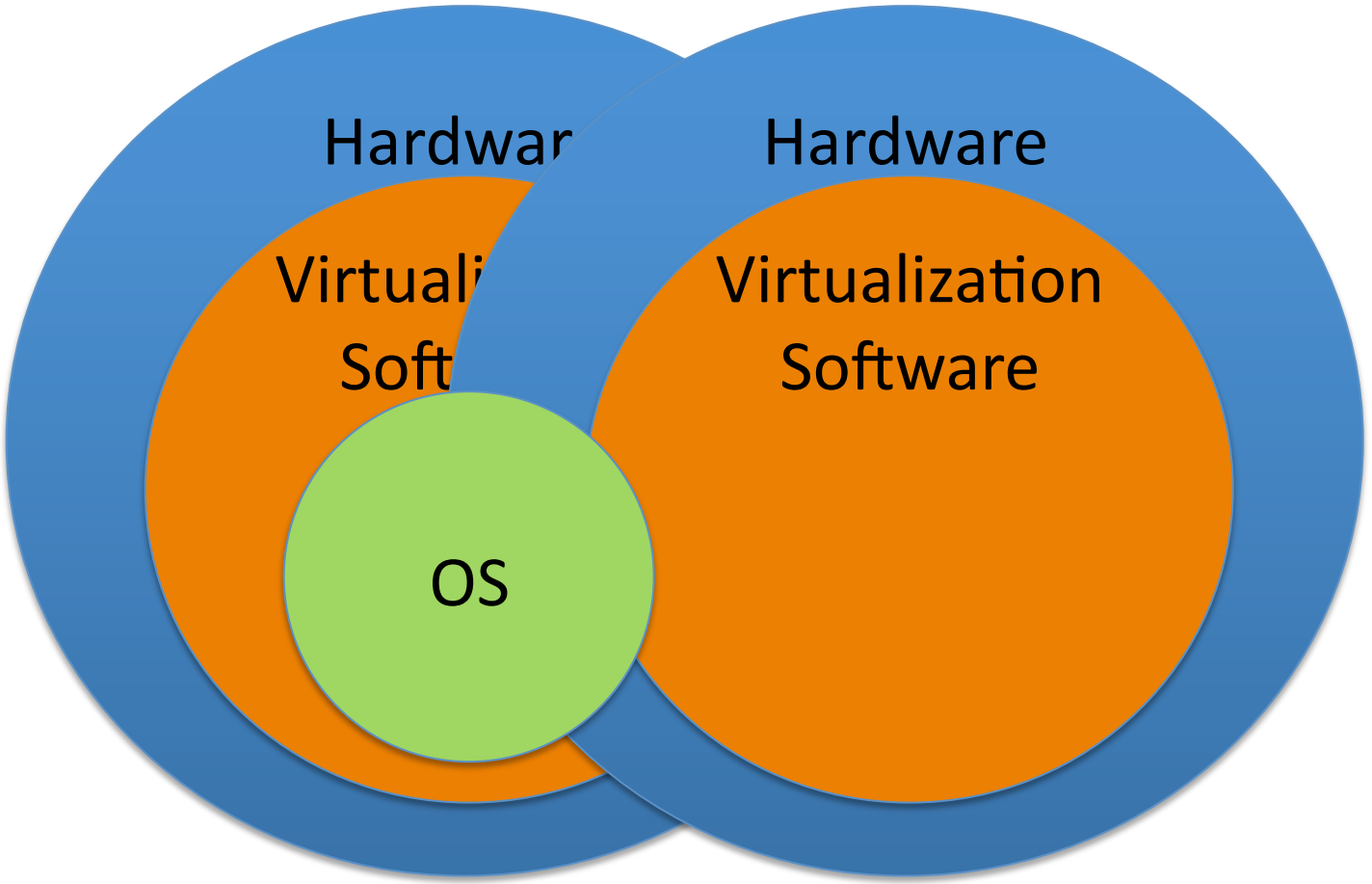
Virtualization in the Data Center

- Virtual Servers
  - How it works
  - Pros
  - Cons
- IPAC's implementation
  - Hardware resource usage and trends
  - Virtualization examples

How Virtualization Works



Smaller foot print in the DC

400 Watts

400 Watts

400 Watts

400 Watts

400 Watts

More efficient use of hardware

10%

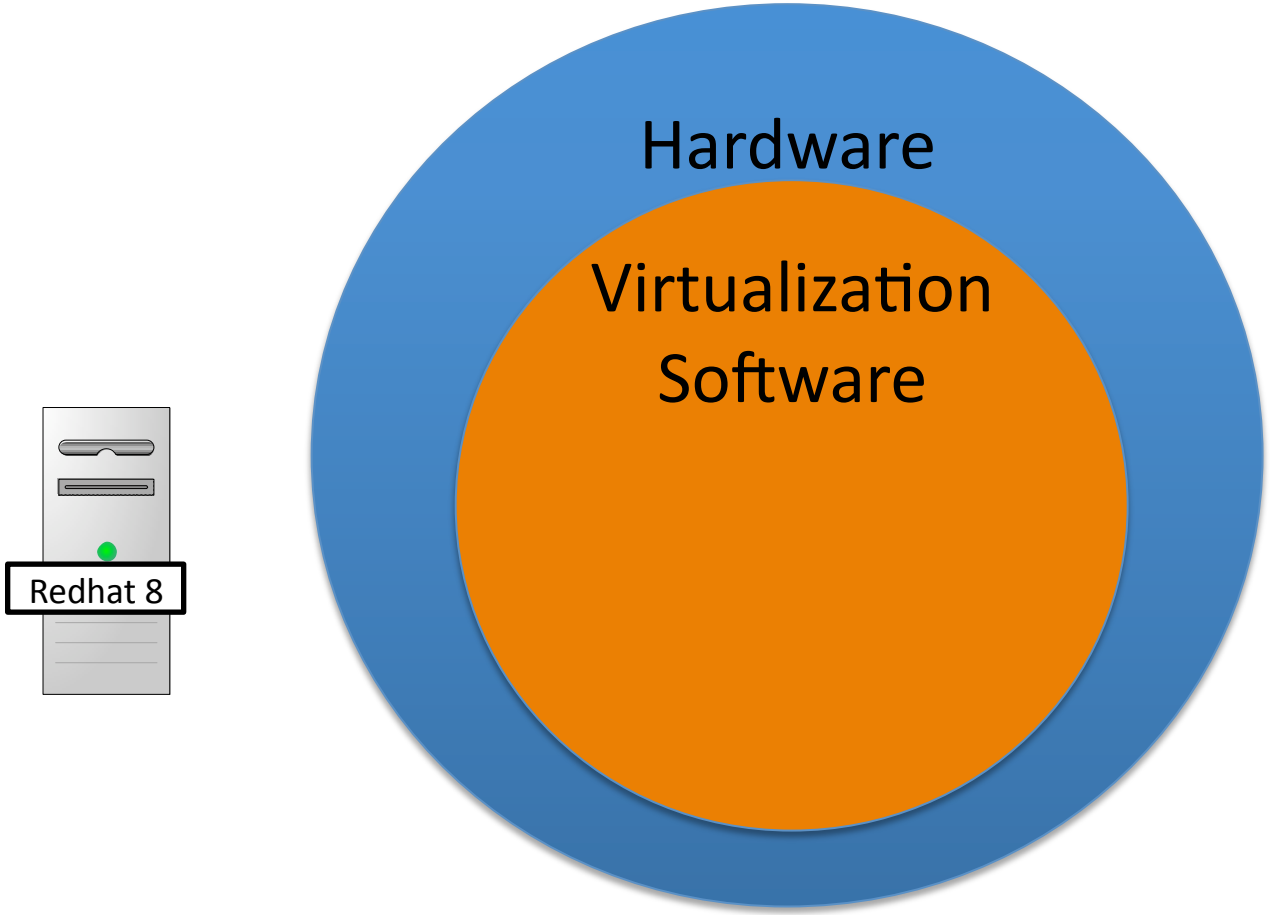
20%

25%

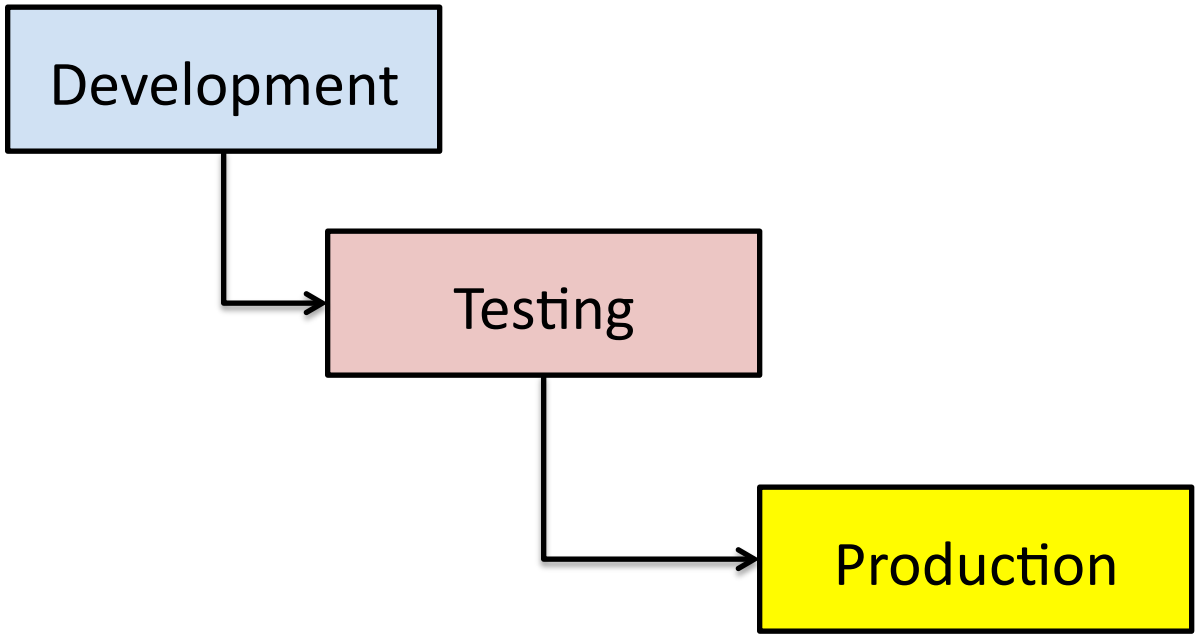
25%

80%

Preserve legacy applications



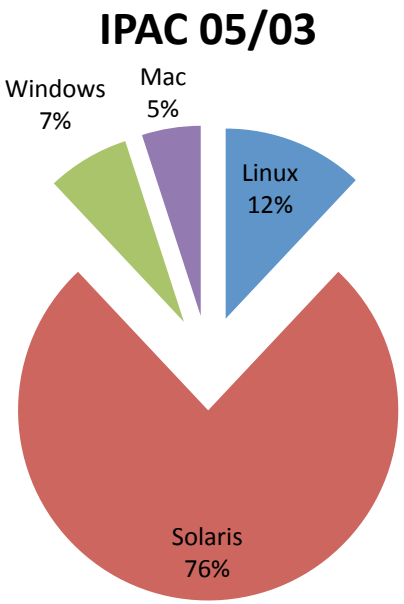
Develop, Test, and Deploy

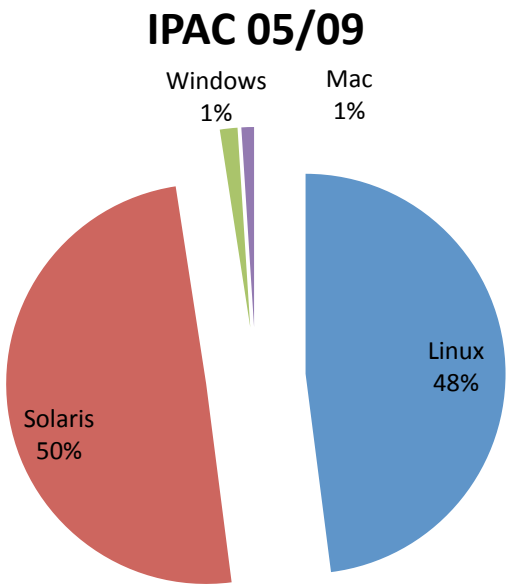


Cons

- Too many virtual servers can crash the physical server
- Shared I/O may lead to bottlenecks

IPAC OS Demography





* servers only

IPAC OS Trends

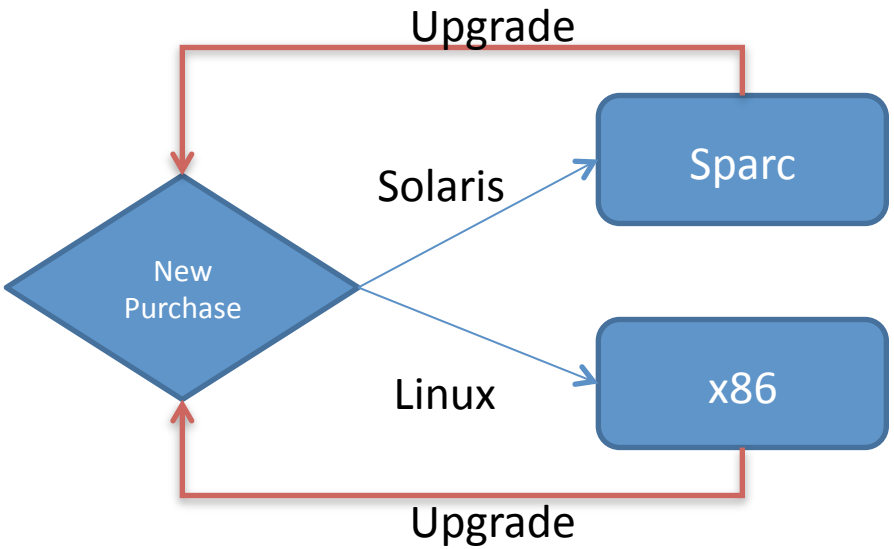
Desktop
Sun to Mac

File Server
Solaris Sparc to Solaris x86

Common Services (Web)
Solaris to Linux

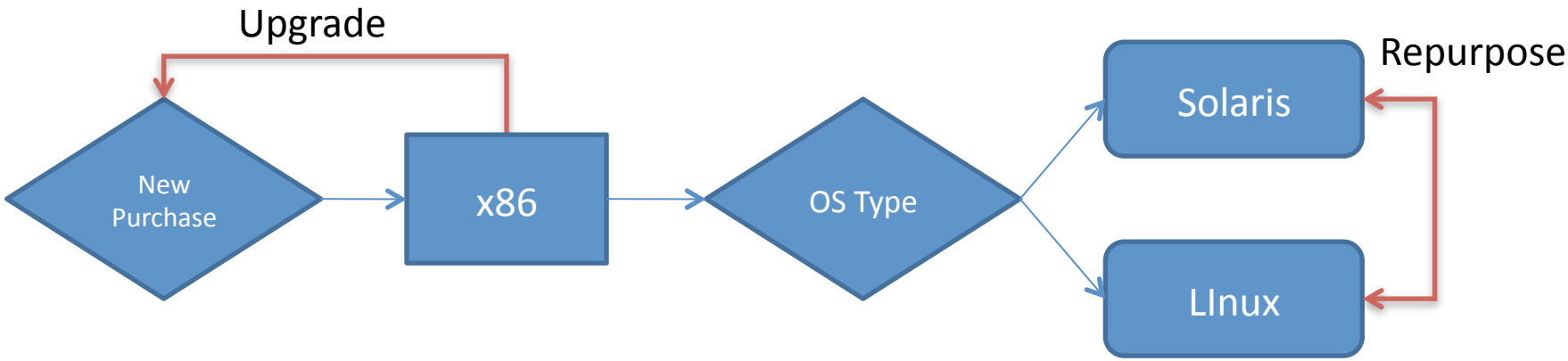
Old Purchasing Model

Buy hardware to fit the Operating System
Must choose OS at purchase time
Changing software may require new purchase



New x86 Purchasing Model

Buy hardware to fit the computing requirements
Choose software later
Repurpose HW if desired



Consolidation with Virtualization

Reliability	$R_{\text{RAIDSET}} = \prod_{i=1}^{n} R_{\text{HDD}_i}$ MTBF(sata) = 600,000 T = 5 yrs (43800 hrs) R = e^(-t/MTBF) R(sata) = 0.93 R(service) = (0.93)^4 = 0.56	$R_{\text{array}} = \prod_{i=1}^{\#\ of\ RAID\ sets} (2R_{\text{HDD}} - R_{\text{HDD}}^2)$ MTBF(sas) = 1,200,000 T = 5 yrs (43800 hrs) R = e^(-t/MTBF) R(sas) = 0.96 R(service) = (2)(0.96) – (0.96)^2 = 0.99
Performance	4x400Mhz = 1.6Ghz	4x2.6Ghz = 10Ghz
Heat Dissipation	4 x 153.54 = 614.16 BTU/hr 363.65 BTU/Ghz	1500 BTU/hr 150 BTU/Ghz
Power Comsumption	4x50 = 200 W 125 W/Ghz	450 W 45 W/Ghz
Rack Space	4 U	2 U

*straw man comparison

VM technologies at IPAC

- Xen – Open Source, supported on Linux
- Zones – Software Partition, on Solaris
- Logical Domains – Hardware Partitioning, supported on Sparc servers
- VMWare – Multi-OS capable, common on desktops, experimental on servers
- Parallels – being phased out for VMWare

Oracle Server Build

Real Example: Project X wanted a test Oracle server deployed same-day
Challenge: No hardware , little time

Tradition

The VM way

Outcome: Server functional in 8 hrs

Java App Server Dev to Ops

Real Example: Project Y wanted to move the Java App from a Dev environment Ops
Challenge: Minimize work for Project Y and ISG

Traditional

The VM way

Outcome: Delivered 2 Ops replicas of Dev server same day

How to Manage VMs

Abstraction with Bit-Buckets: Each server is a bucket of resources CPU, Memory, Disk
Eliminate cutesy names and dedicated roles for the hardware

xen1
- CPU (4)
- MEM (8G)
- Disks (50G)

xen2
- CPU (8)
- MEM (16G)
- Disk (1T)

xen3
- CPU (16)
- MEM (32G)
- Disk (2T)

My App Needs
- CPU 8
- MEM 8G
- Disk 50G

VM Resource Math

Filling the Bit Bucket
Adding My App to a VM server reduces the VM resource and increases utilization

xen3

- CPU (16) 100%
- MEM (32G) 100%
- Disks (2T) 100%

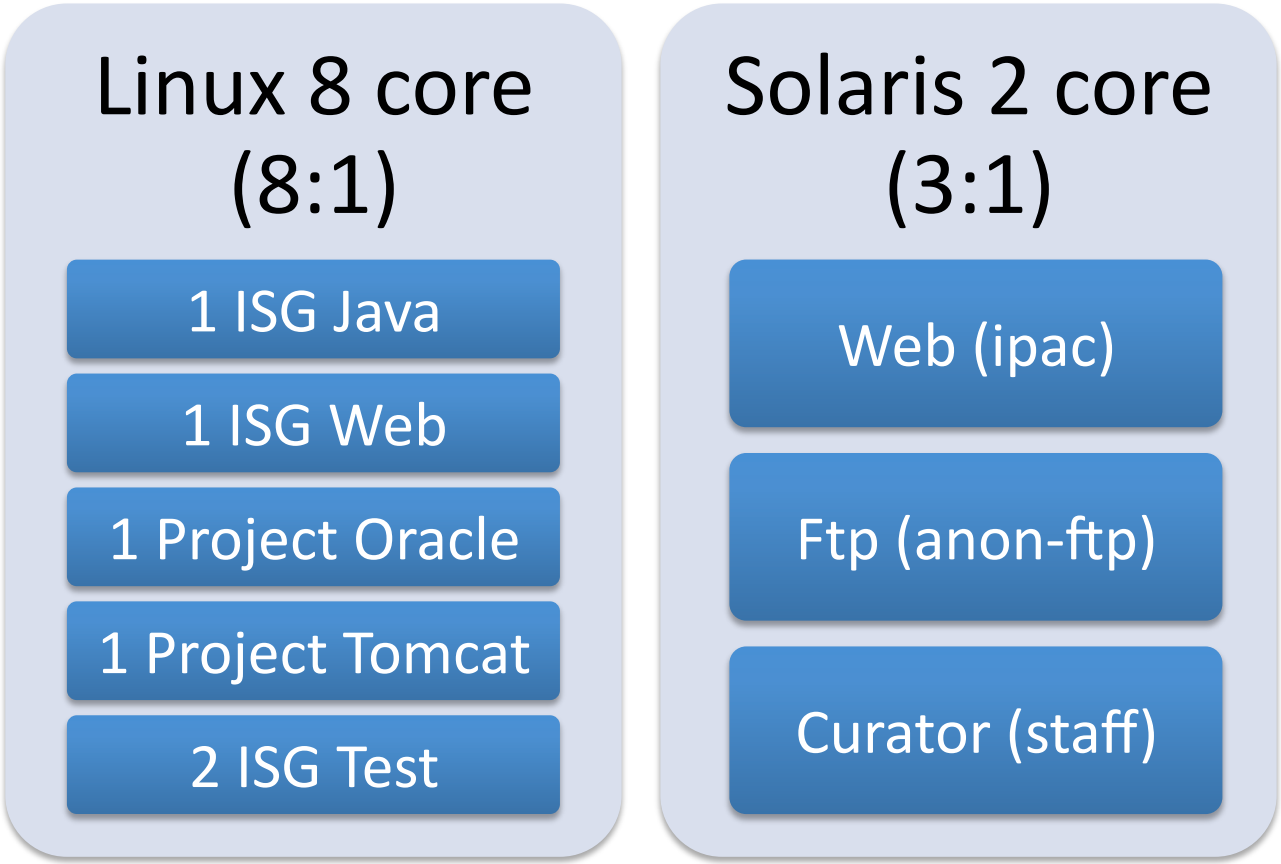
My App

- CPU (8)
- MEM (8G)
- Disk (50G)

xen3

- CPU (8) 50%
- MEM (24G) 50%
- Disk (1.9T) 99%

Virtualization In Use



IPAC-wide: 32 servers supporting 60 VMs

Virtualization ratio 2:1 – 2 OS running on each CPU core

Summary

- Virtualization is efficient and cost-effective
- I/O performance is a challenge
- Consider going virtual when buying HW/ building servers
- Benefits usually outweighs the costs