

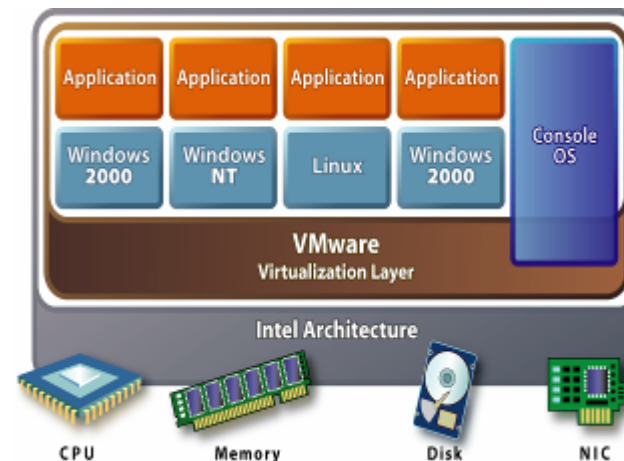


Virtualization with VMware: A Practical Roadmap

Bob Nash
SyCom Technologies

Agenda

- VMware Technology Overview
- Applying Virtualization
 - ▶ Server Consolidation
 - ▶ Disaster Recovery
 - ▶ Development/QA
 - ▶ Desktop Application Access
- Implementation Methodology:
 - ▶ Assess, Plan, Train
 - ▶ Build
 - ▶ Manage
- Success Factors



Technology Overview

Key Features of Virtualization

Partitioning



Run multiple virtual machines simultaneously on a single physical server

Isolation



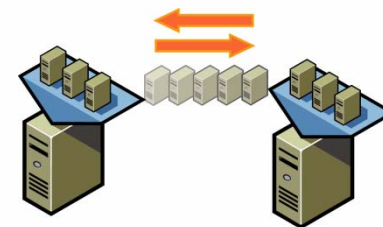
Each virtual machine is isolated from other virtual machines on the same server

Encapsulation



Virtual machines encapsulate entire systems (hardware configuration, operating system, apps) in files

Hardware Independence



Run a virtual machine on any server without modification

VMware Hosted and Native Architectures

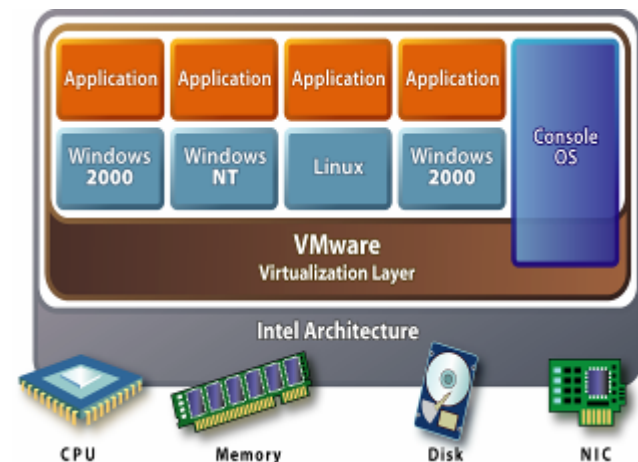
Hosted Architecture

- **Workstation and VMware Server**
- Hardware and I/O compatibility provided by Host OS
- Easily fits into any storage and networking environments

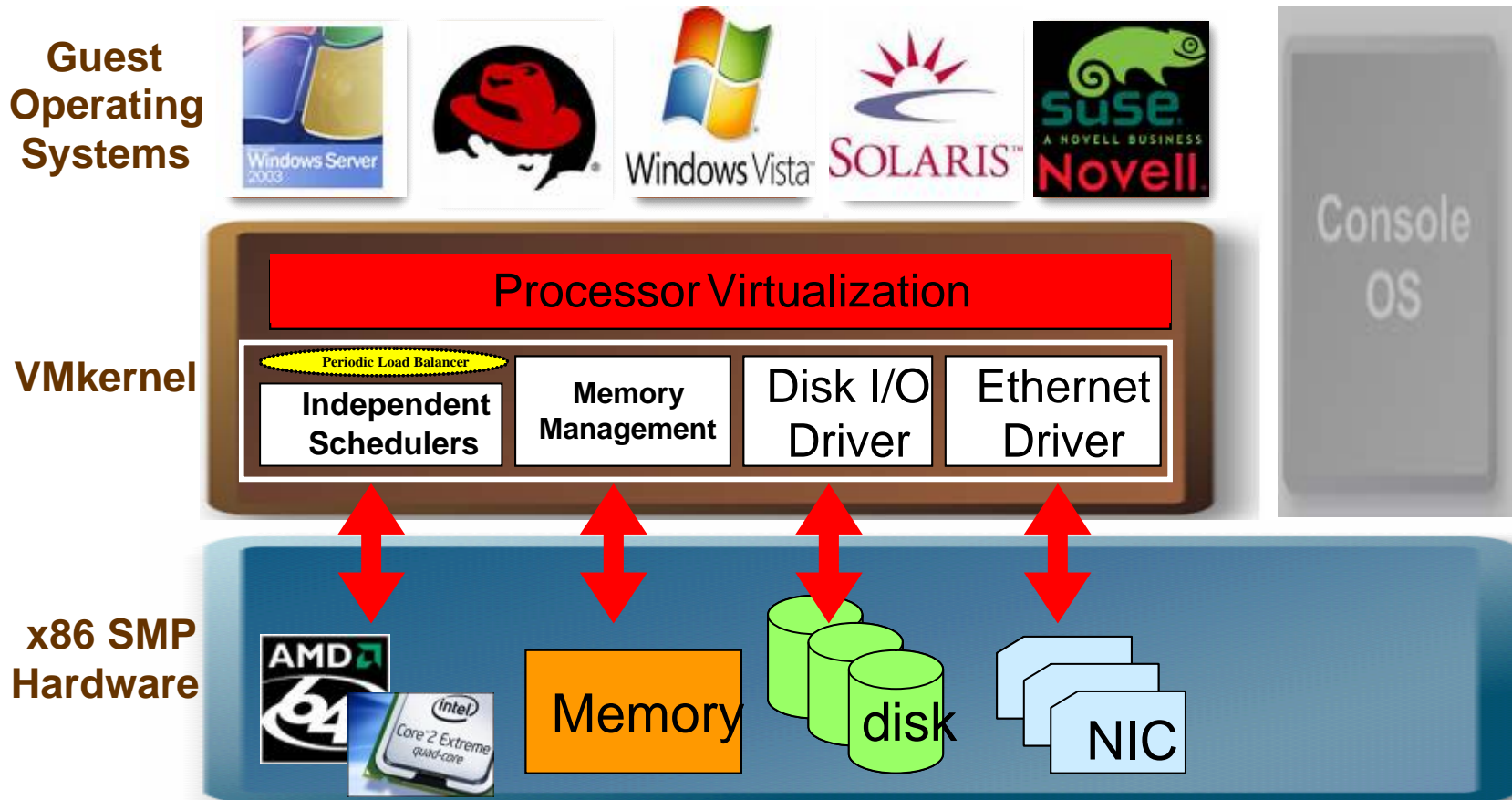


Native Architecture

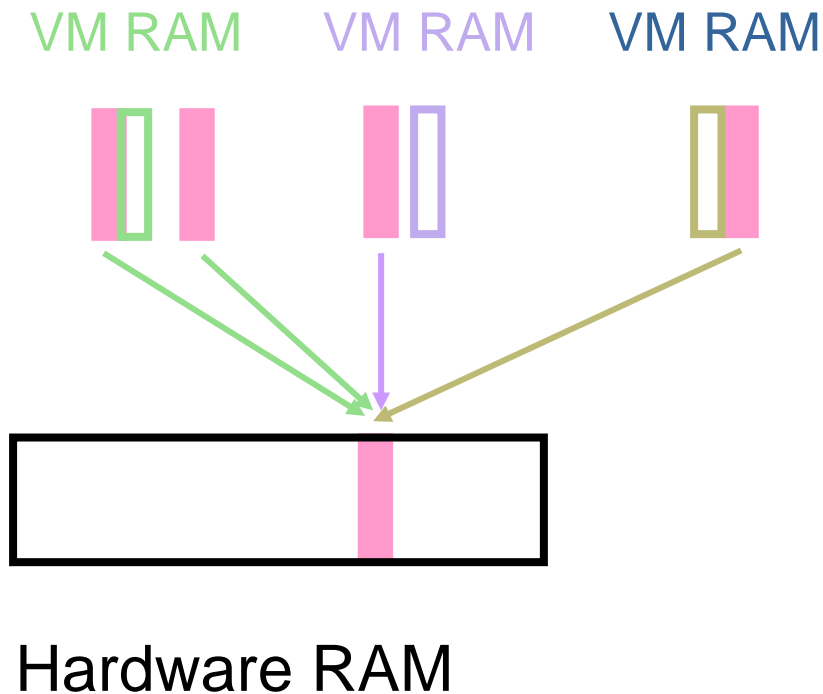
- **ESX Server**
- Runs directly on hardware
- Advanced Resource Management (cpu, memory, disk, network)
- High performance and high throughput
- 4 CPU SMP Capability 16 GB RAM
- Clustering across physical servers



ESX Server Architecture



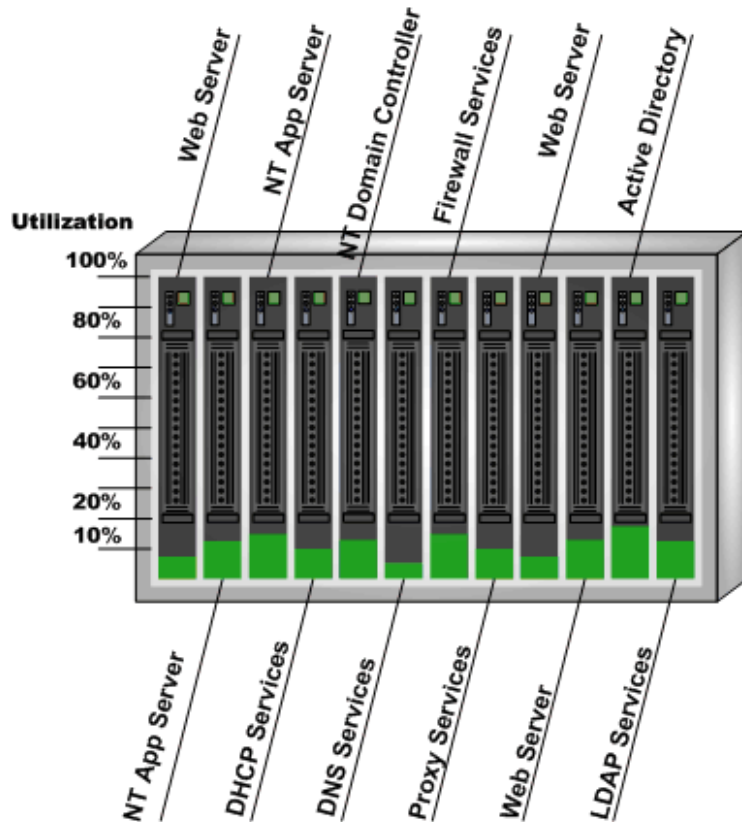
Conservation of Memory



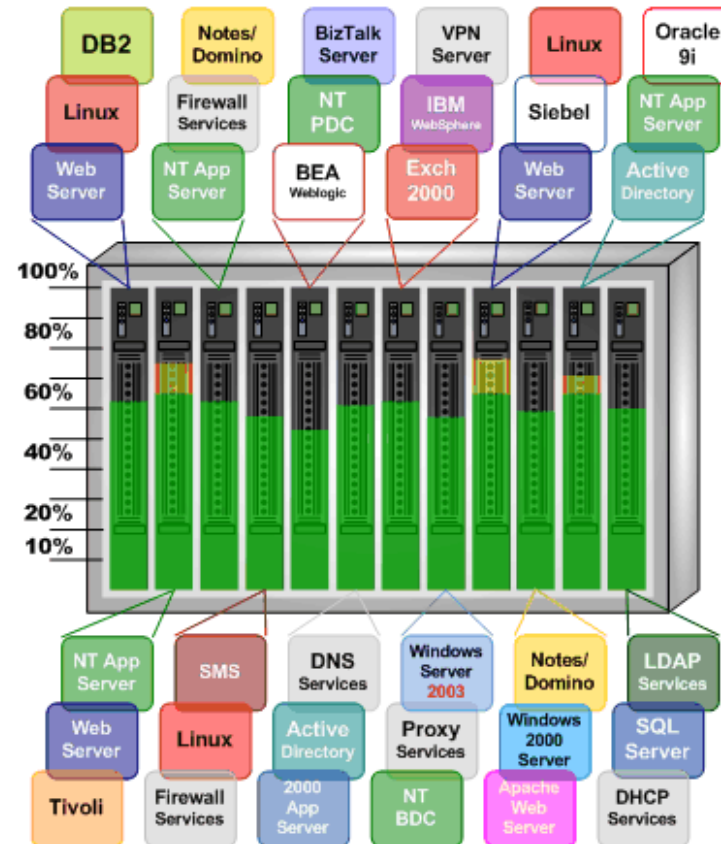
- Multiple VMs
 - Redundant code, data
 - Example: same OS
- Share identical pages
 - Periodic scans
 - Fast match algorithm
 - Example: ~ 30% to 60% shared w/ idle Win2K VMs
- Oversubscribe RAM without swapping

Reduce CPU waste

Blade Servers without VMware VirtualCenter



Blade Servers with VMware VirtualCenter

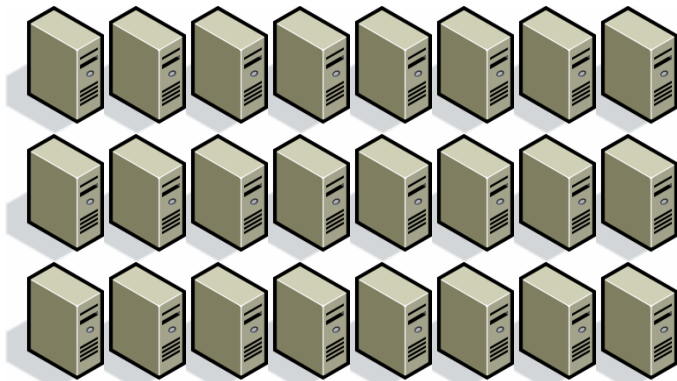


Server, Storage and Network Consolidation

Customer Example

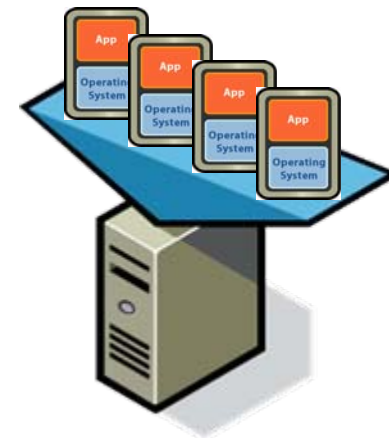
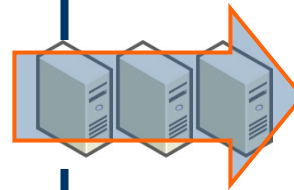
Before

- ▶ 1,000 servers with DASD
- ▶ 200 racks
- ▶ 3000 network cables
- ▶ 400 power whips



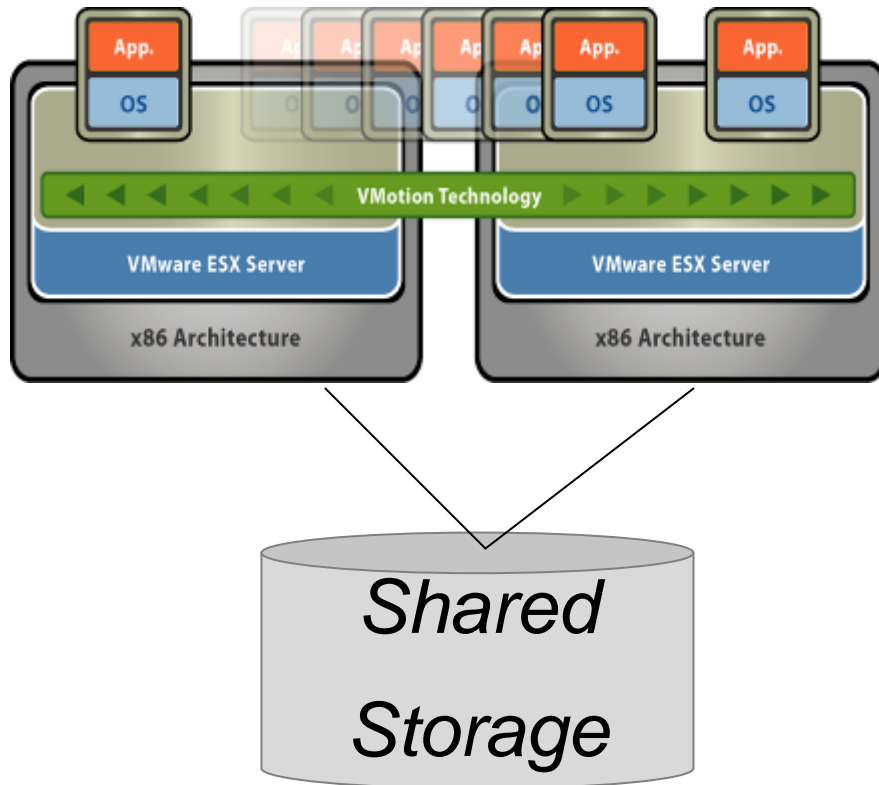
After

- 50 servers with SAN and NAS
- 10 racks
- 300 network cables
- 20 power whips



Live Migration Of Virtual Machines

50% of VMware customers have implemented VMotion



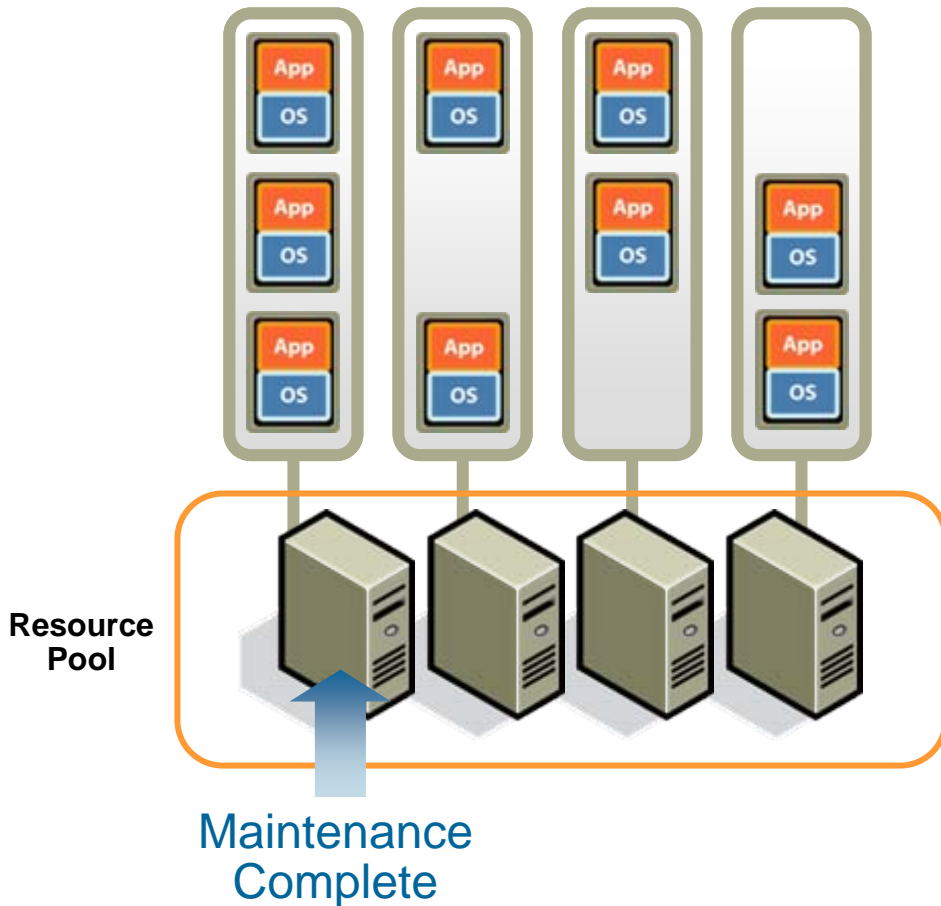
•What is it?

- ▶ Live migration of virtual machines with VMware VMotion

•Customer Impact

- ▶ Zero downtime
- ▶ Continuous service availability
- ▶ Complete transaction integrity
- ▶ Supported on Fibre Channel and iSCSI SAN and NAS

Zero Downtime Maintenance with VMware DRS



- Maintenance mode feature moves virtual machines to alternate hosts in pool
- **No** application outage
- **No** user impact
- **No** server configuration changes
- ***Eliminate planned downtime!***

Datacenter Vision

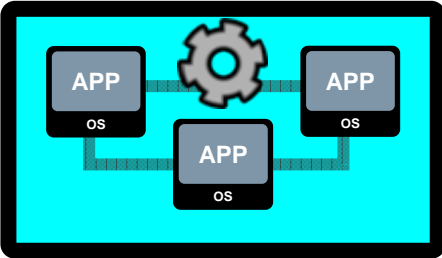


... **Virtual Infrastructure** ...

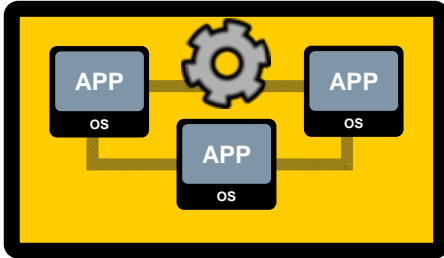


High Availability

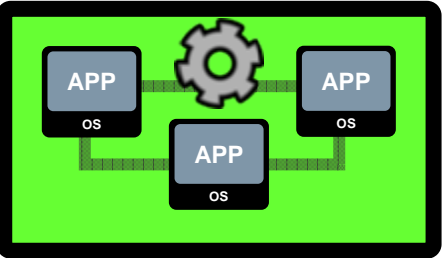
Exchange



CRM



File/Print



... Virtual Infrastructure ...

CPU Pool



Memory Pool



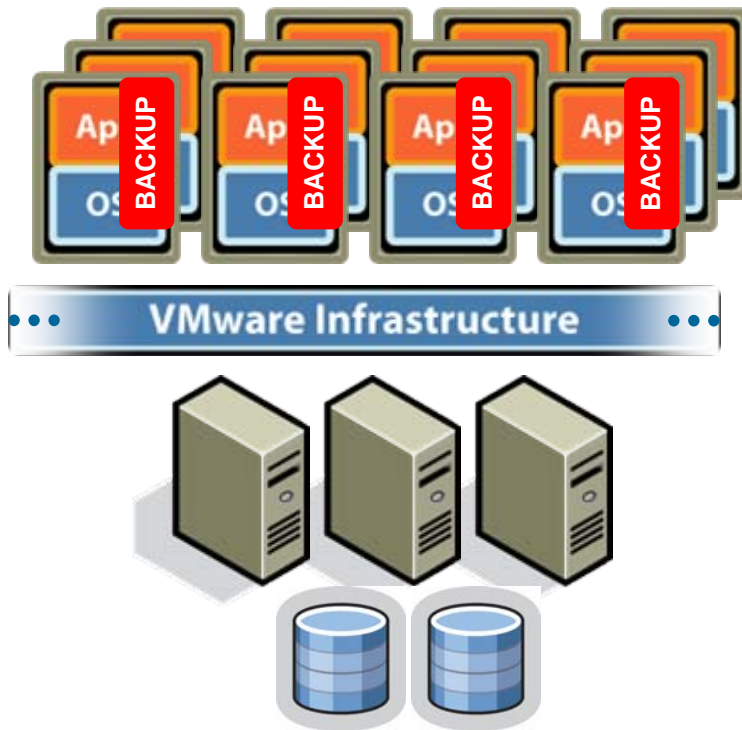
Storage Pool



Interconnect Pool



Backup Anytime



**VMWARE
CONSOLIDATED
BACKUP**

- Decouple backup from production VMs
- 20-40% better resource utilization
- Pre-integrated with 3rd party backup products

Applying Virtualization

Key Enterprise Solutions



Server Consolidation and Containment – Slash capital and operating expenses by using virtualization to consolidate existing servers and contain future datacenter growth



Business Continuity – Increase availability and improve disaster recovery by using virtual infrastructure to slash downtime and implement simpler, cost-effective recovery



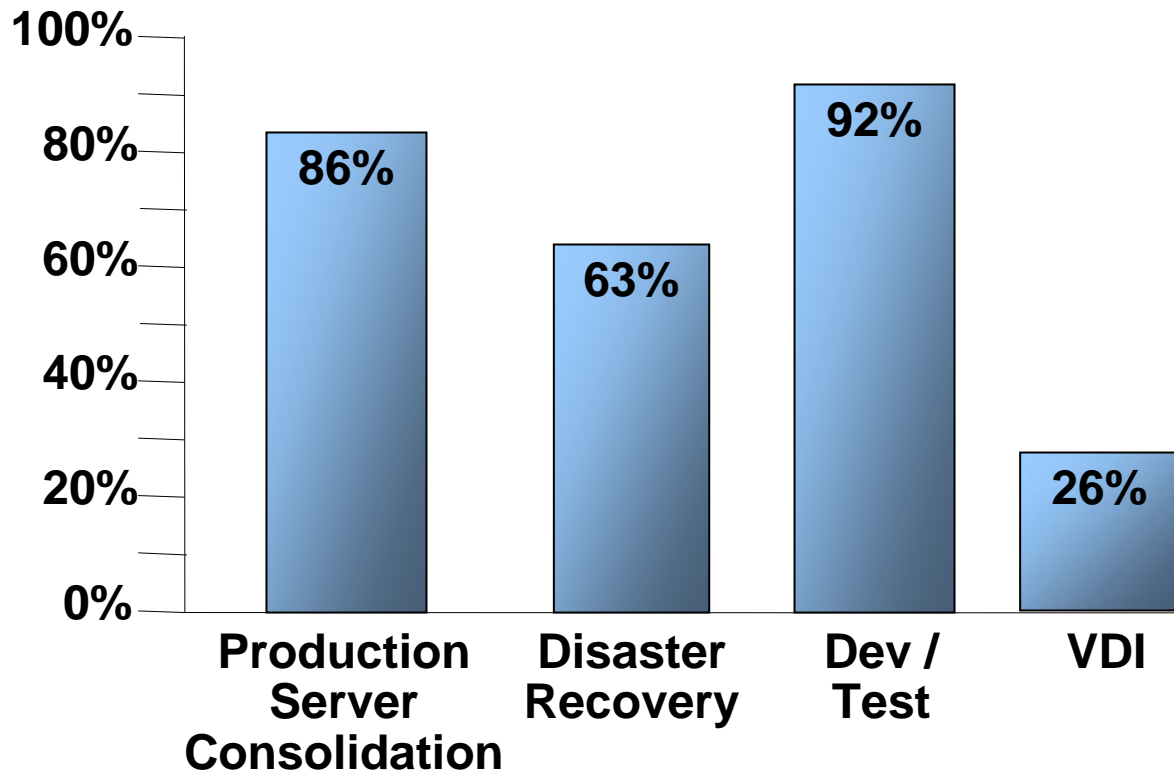
Development and Test – Rapidly provision and re-provision test and development servers; store libraries of pre-configured test machines



Desktop Manageability & Security – Provide secure, managed desktop environments on any PC or thin client to ensure safe, managed access to enterprise resources

Solutions Deployed by VMware

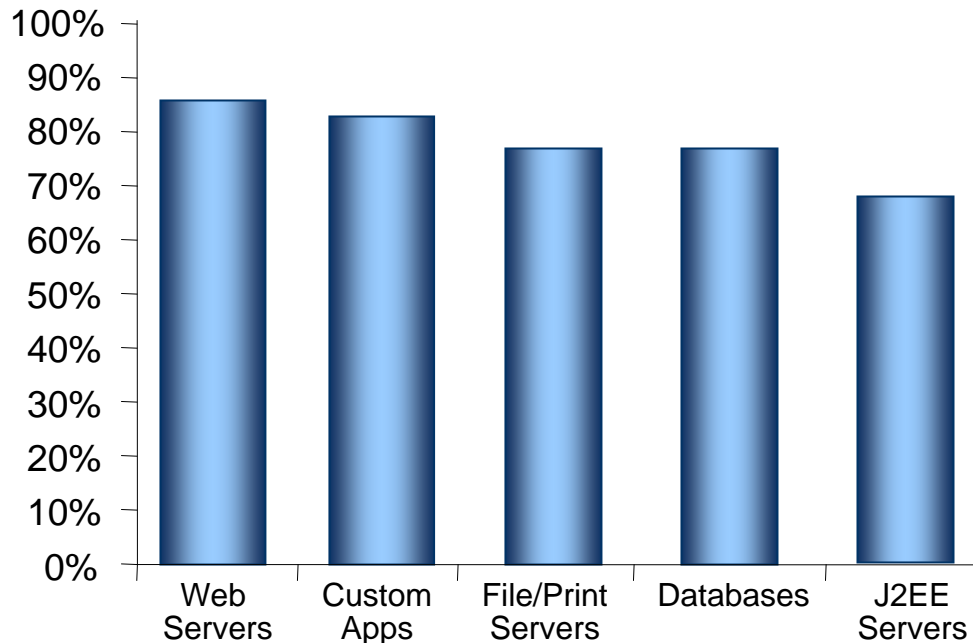
Customer Survey: How is VMware Software Used



Virtualization is Running Enterprise Workloads

Customers are using virtualization throughout their environment

Customer workloads deployed in ESX Server



- **>20,000 enterprise accounts**
- **>90% of VMware customers are running VMware in production**
- **>25% of VMware customers standardize on virtual infrastructure**

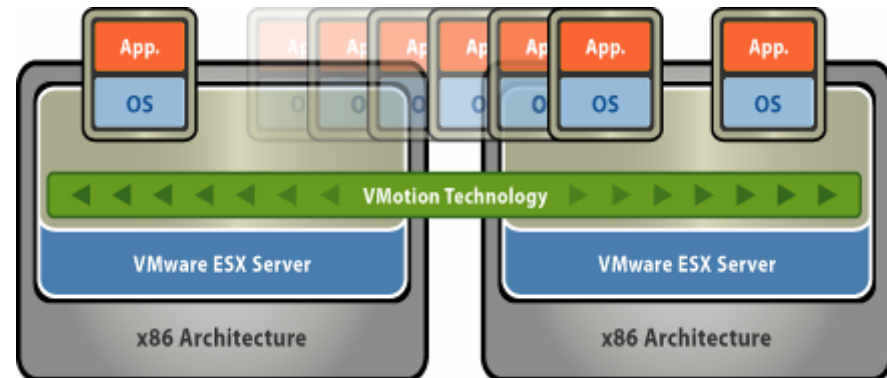
Sources:

King-Brown 2005 market research study (What stage of adoption is your company in with regards to VMware?)

VMworld 2004 & 2005 customer survey (Are you running the following applications in a virtual machine?)

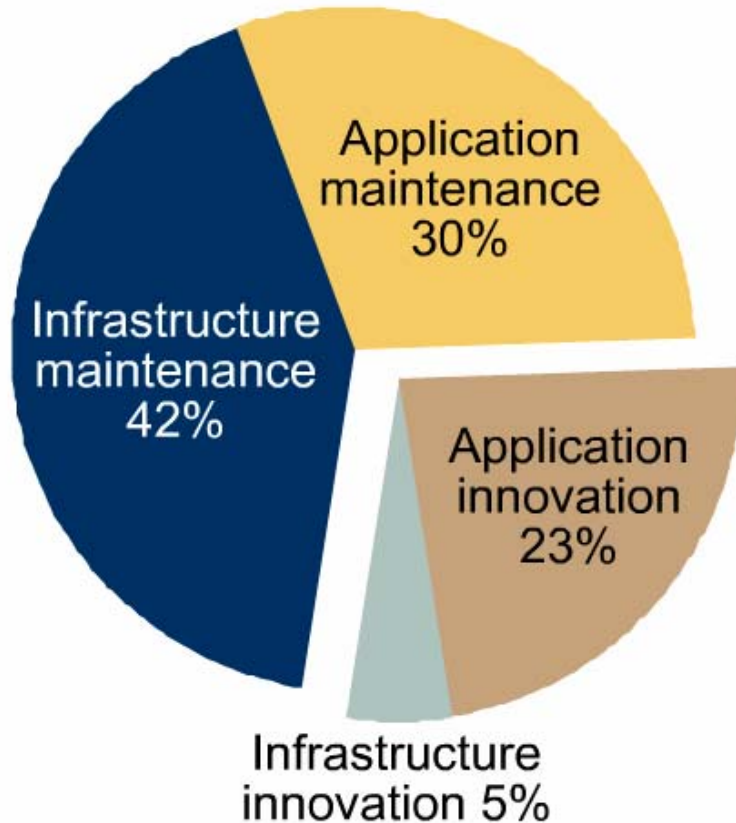
Key Benefits of Server Consolidation & Containment with Virtual Infrastructure

- **Dramatically reduce costs**
 - ▶ Cut hardware costs by 30-50%
 - ▶ Cut operations costs by 30-70%
- Enhance manageability
 - Streamline and automate operational tasks
 - Manage growing datacenter with existing resources
- Increase responsiveness
 - Respond faster to business needs
 - Provision servers in minutes
- Increase flexibility
 - Pool computing resources
 - Enable dynamic workload management

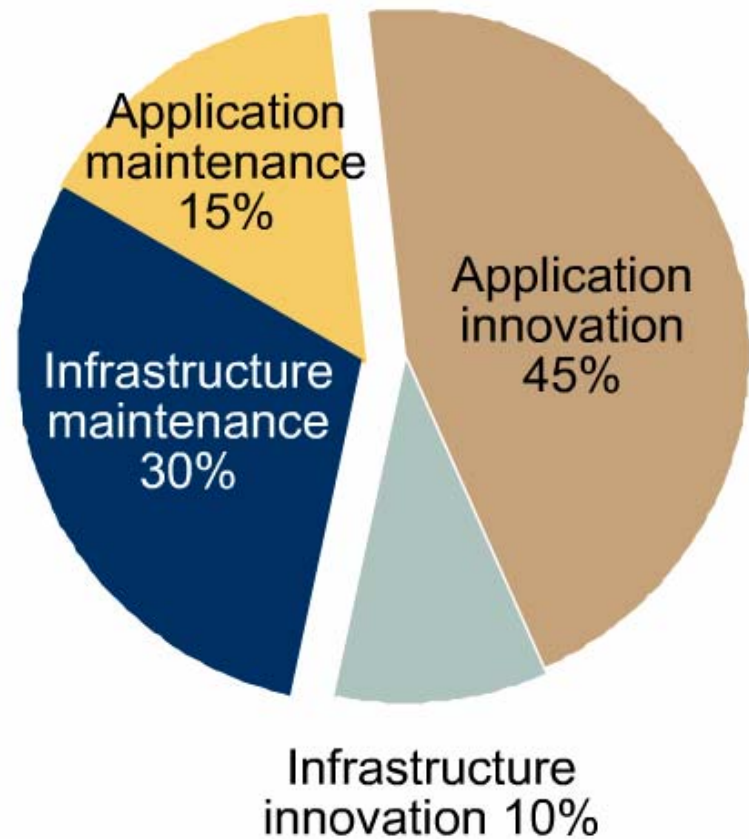


Moving from Maintenance to Innovation

Current IT

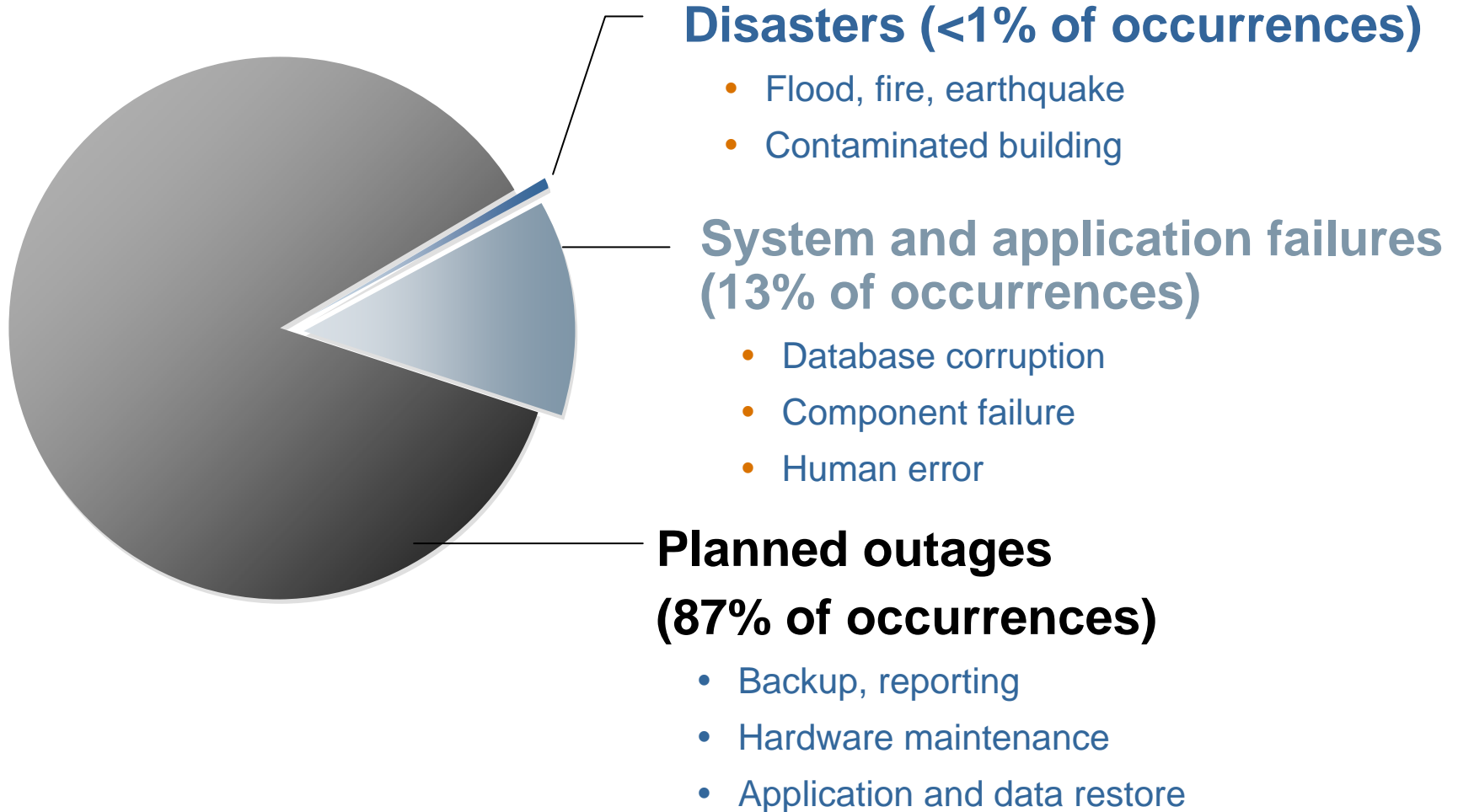


Future IT



Why Focus on Availability and Recovery?

Substantial number of outages due to failures and disasters



Disasters (<1% of occurrences)

- Flood, fire, earthquake
- Contaminated building

System and application failures (13% of occurrences)

- Database corruption
- Component failure
- Human error

Planned outages (87% of occurrences)

- Backup, reporting
- Hardware maintenance
- Application and data restore

Solution: Business Continuity with Virtual Infrastructure

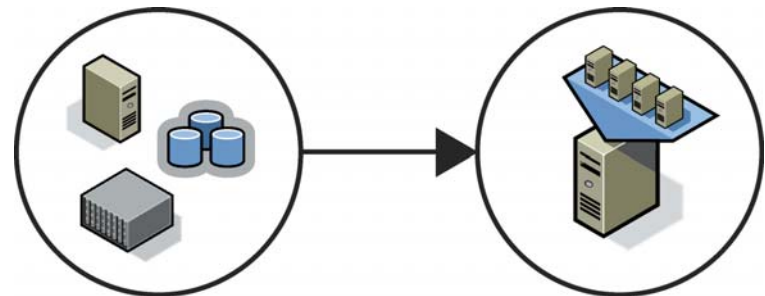
High Availability

- **Goal:** Reduce planned and unplanned downtime
- **Components:**
 - ▶ Redundancy features
 - ▶ Clustering capabilities
 - ▶ Zero-downtime maintenance



Disaster recovery

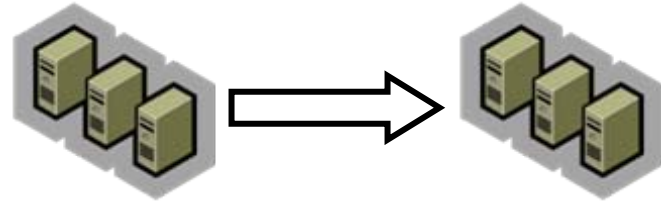
- **Goal:** Restore critical applications as quickly and reliably as possible
- **Components:**
 - Ability to leverage replication technologies
 - Rapid, hardware-independent recovery



Options for Disaster Recovery

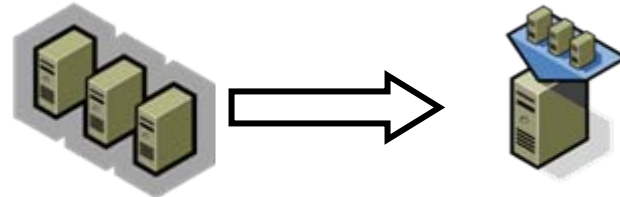
- Physical to Physical

- ▶ Today's scenario without Virtual Infrastructure
- ▶ Requires identical DR site



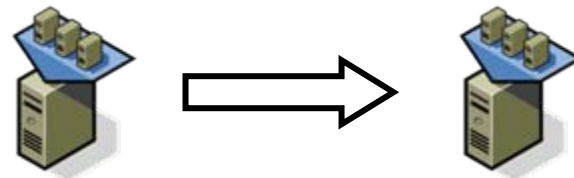
- Physical to Virtual

- Reduces cost, improves time to recovery, and increases flexibility



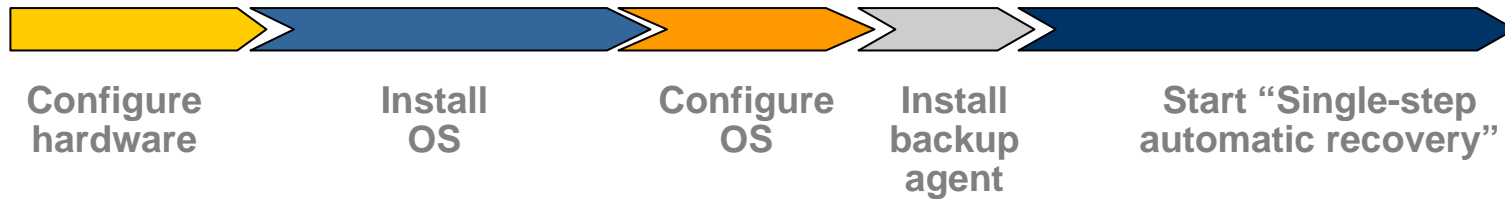
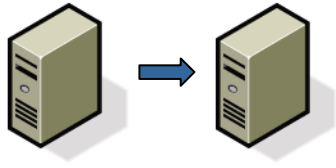
- Virtual to Virtual

- Greatest flexibility, lowest cost, best time to recovery

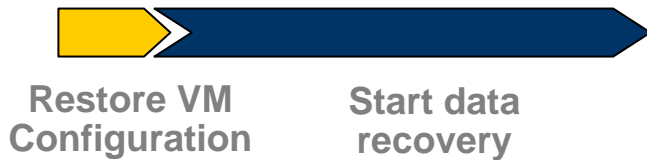
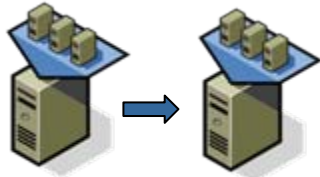


Example Comparison of Recovery

Physical to Physical Recovery



Virtual to Virtual Recovery



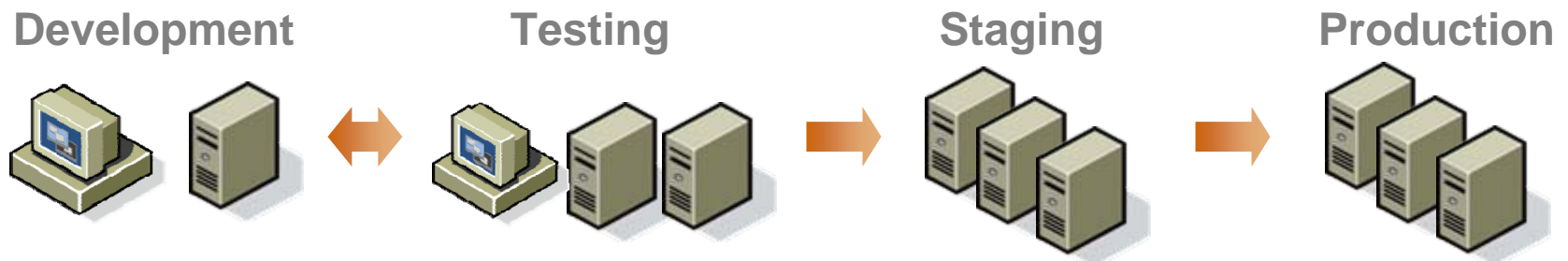
Customer Example:

- 40+ hours for physical to physical recovery
- < 4 hours for virtual to virtual recovery

Development and Testing Challenges

What organizations demand of development and testing groups:

- Timely completion of projects
- High quality
- Ability to control and reduce costs

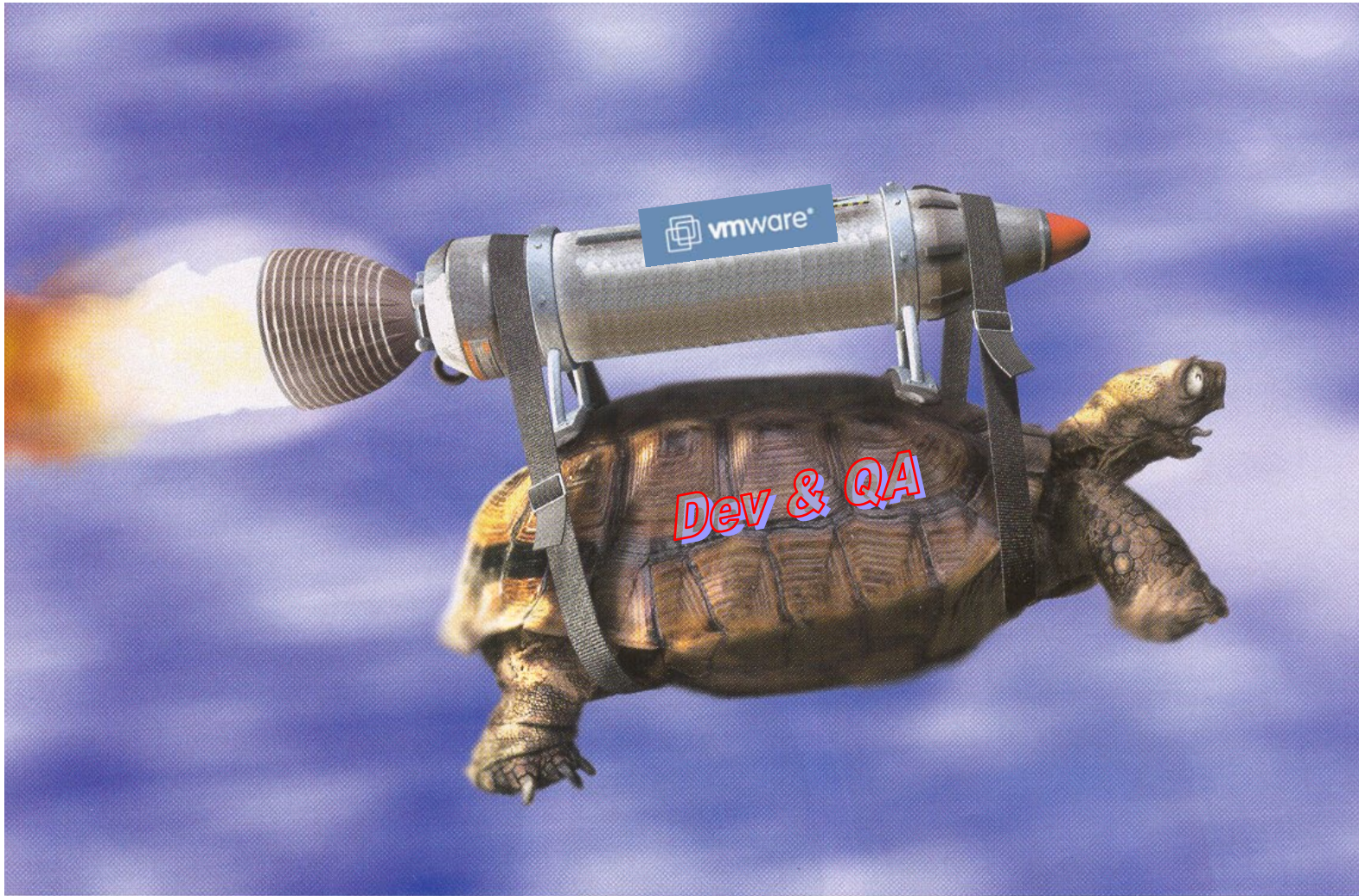


The harsh reality:

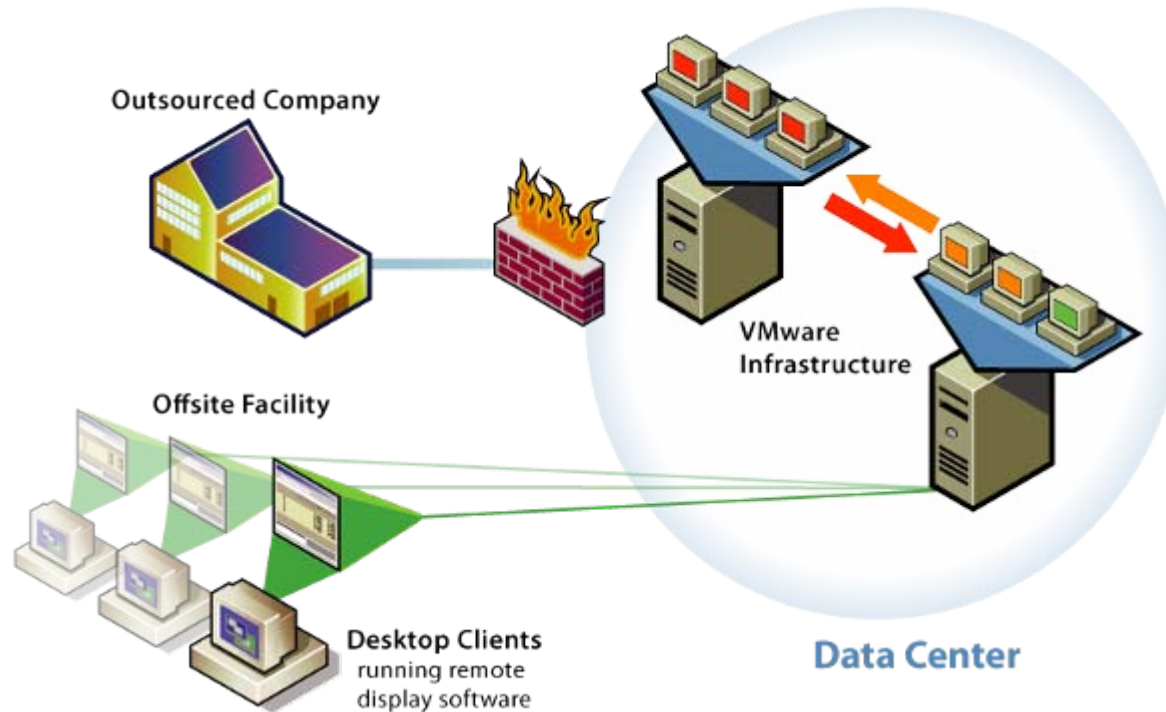
- Only 16% of software projects completed on-time and on-budget*
- Average budget overrun is 189%*
- Average time overrun is 220%*

* Source: *The Standish Group*

Speed Provisioning: Complete Projects Faster



Extend Virtual Infrastructure to end-user desktops: VDI



- > Resource pools
- > Scalability and performance
- > Desktop licensing

NEW

PARTNERS



Businesses Benefits of VDI

Hard Cost Avoidance



Extend Desktop Refresh Cycle

Mitigate Business Risks



Disaster Recovery
Data Security

Reduce Labor



Estimated: PC = \$6700, Thin =
\$2500

Faster Time to Market



Reduce the Deployment time of
new applications

Implementation Methodology

Planning your Virtual Infrastructure

•Phase I - Planning

- Decide between “strategic technology” or “just a project”
- Get the right people and training
- Gather inventory and performance data for current environment
- Choose early win scenarios
- Identify virtualization candidates
- Perform capacity planning to match applications with VMs and physical hosts
- Define hardware infrastructure
 - Servers
 - Storage
 - Networking

Planning your Virtual Infrastructure

- **Consider building an “Adaptive Infrastructure”**
 - Simple
 - Standard
 - Integrated
 - Modular
- **Treat virtualization as an architectural decision**
- **Many benefits result for “free”**
 - Consolidation
 - Ease of control and management
 - Robust availability
 - Flexible business continuity options



Planning your Virtual Infrastructure

- **Solve three problems at once**

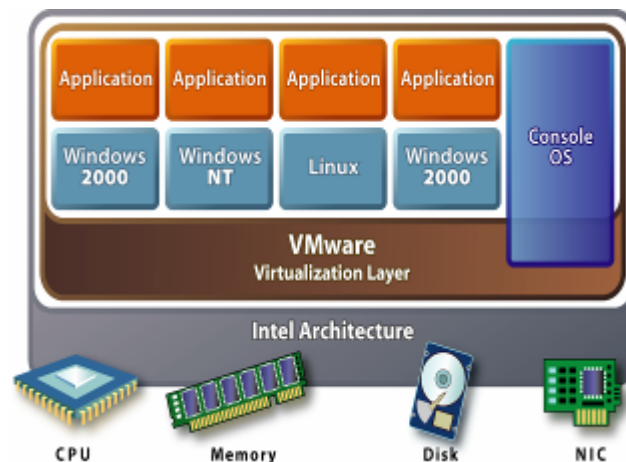
- Streamline operations and provisioning
- Provide high availability
- Improve disaster recovery and business continuity

- **Centralize data on the SAN**

- **Simplify by using only one OS**

- **Replicate data to DR site**

- Production and development span both sites
- DR plan is constantly “in use”



Planning your Virtual Infrastructure

•Design strategically, deploy tactically

- Look for early ROI
- Do a low risk visible pilot or POC

•Form a **SWAT** team early

- Get some training and inject some experience
- Document methodologies
- Align with business goals
- Ensure high quality design
- Perform acceptance testing
- Rapidly address remediation issues

•Mature into a center of excellence



Virtualization Assessment

VMware Virtualization Assessment

Objective – Identify server consolidation candidates and potential savings

Resources – 1 VMware Certified Professional and VMware Service Bureau assistance

Duration – approximately 6 weeks, including a minimum 30 day sample period to capture typical and peak usage

Data Collection

- Leverages VMware Capacity Planner
- 30-day data collection period
- Metrics include server inventory, operating system inventory, server CPU utilization, and memory load

Data Analysis and Recommendations

- Interviews with key stakeholders
- Analysis of server CPU and RAM utilization
- Identification of potentially obsolete servers
- Development of three server consolidation scenarios
- Creation of ROI and TCO models based on direct costs for hardware, facilities, and personnel

Deliverables

- Virtualization assessment report
- TCO and ROI models
- Server inventory and performance data summary
- Formal presentation of findings

Analysis of Current State and Projected Financial Impact

Building your Virtual Infrastructure

•Phase II – Deployment and Migration

- Build servers, storage and networking
- Install ESX and VI3 components
- Deploy P2V tools and begin migration to VMs
- Test resulting VMs for functionality and performance
- Test management tools, backup systems
- Test VMotion, DRS and HA

Building your Virtual Infrastructure

- **Use uni-processor VMs w/ single-threaded apps**

- Supports up to 4 virtual processors per VM
- Don't impose SMP overhead when its not needed

- **Plan VirtualCenter users and groups**

- Gets user list from AD
- Decide who needs what role
- Use individual logins for audit

- **Leverage vSwitches**

- Connect VMs to multiple vSwitches
- Use internal-only connections
- Enhance security with VLANs
- Isolate the service console on it's own VLAN



Building your Virtual Infrastructure

- **Implement the SAN to support virtualization**

- Do virtualization first, then design SAN
- Some VMs will never need attach to the SAN

- **Use ISO images instead of CD-ROMS**

- Rip CD to ISO-9660 file system
- Faster to access
- Can be mounted through Remote Console
- Don't take the place of templates
- Remember that you are responsible for compliance with OS and application vendor licensing

Creating your Virtual Infrastructure

•Implement Consolidated Backup

- Removes backup load from ESX host
- Eliminates the backup window
- Removes backup traffic from the LAN
- Eliminates need to run backup agents in VMs

•Limitations

- If you do a file-level backup, you can't backup and restore the VM as a whole
- If you do a VM-level backup, you can't backup and restore individual files
- Must restore to running VM with agent
- Supports file-level backup of Windows only
- Supports incremental backup of Windows only

Using your Virtual Infrastructure

•Phase III – Operations

- Deploy tools for monitoring both physical servers and virtual machines
- Implement a vulnerability and patch management solution
- Update your provisioning processes
- Take advantage of snapshots and disk-to-disk backup
- Monitor end user experience and SLA metrics
- Understand the “rhythm” of your datacenter

Using your Virtual Infrastructure

•Create templates and clone them

- Build a library of master images
- Templates include:
 - Service packs and patches
 - VMware tools
 - Management and backup agents
 - Anti-virus
 - Applications
- Copy virtual disks and build VMs around the copies
 - You may have to reset certain system attributes
- Test clones thoroughly
 - Some apps stop when the NetBios name changes
 - Some stop if the MAC address changes

Using your Virtual Infrastructure

•Leverage tools

- Use Insight Manager or similar for physical servers
- Use MOM or similar for VMs
- You'll still need patch management
- DRS can automatically initiate VMotion, start with manual
- Enforce SLAs using Resource Pools

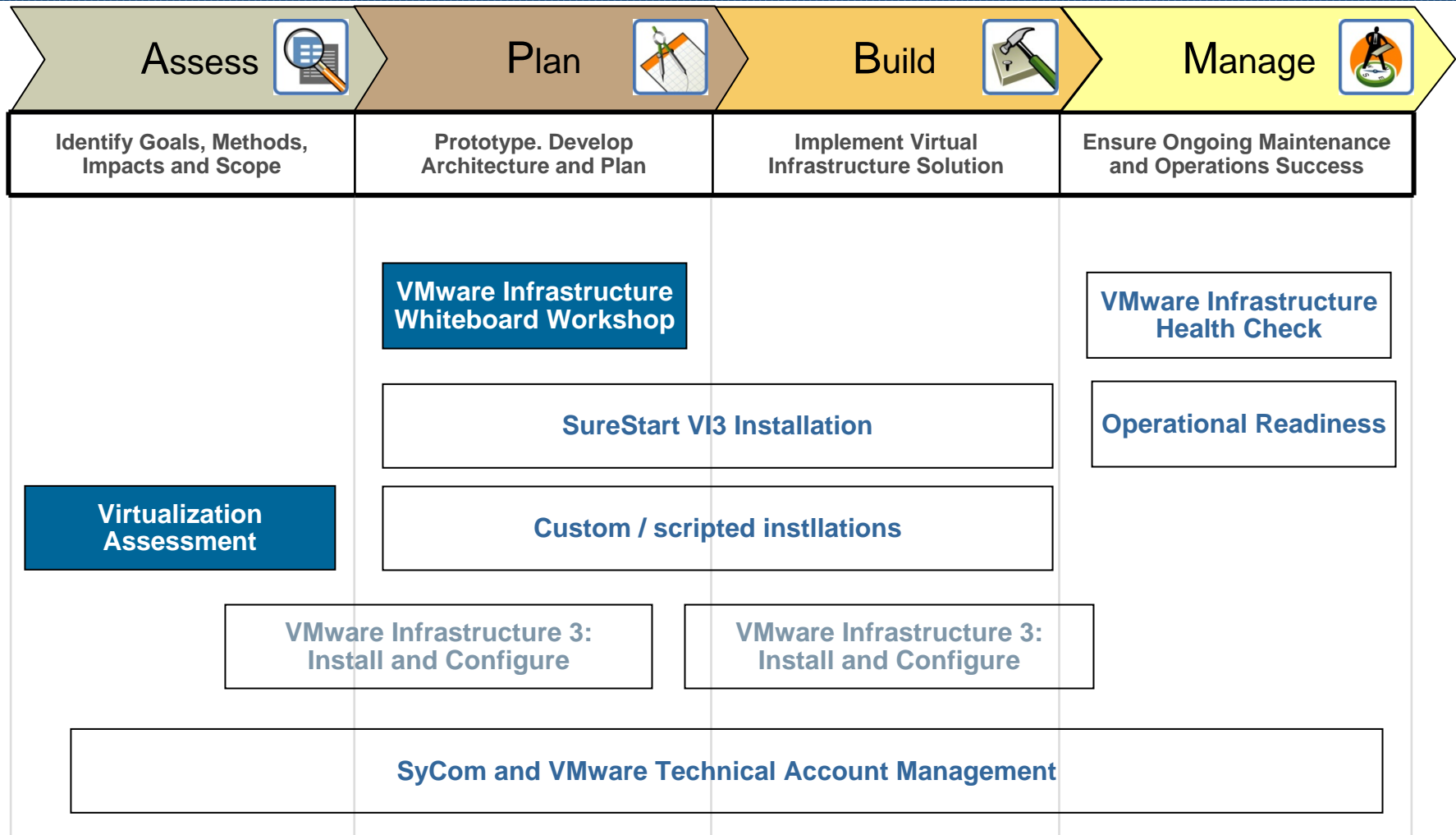
•Get regular input from non-IT users

- Especially key stakeholders

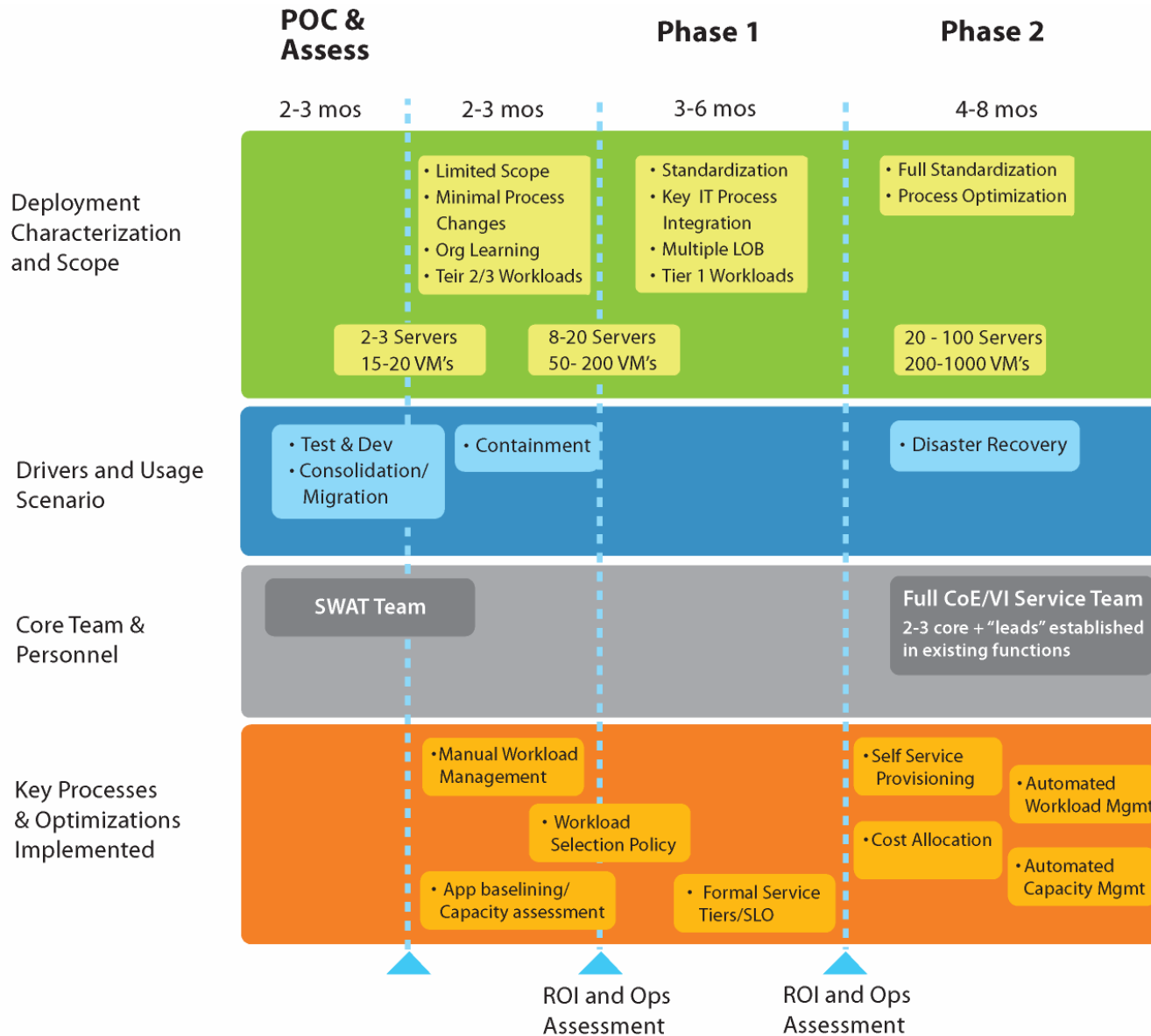
•Use performance data to understand where, when and how much performance is needed

- Adjust Resource Pools as required

Virtual Infrastructure LifeCycle



Virtual Infrastructure Timeline



Success Factors

Success Factors

- **Assessment of your current environment is critical**

- Can be manual, but really should be the result of a formal, automated process

- **Consider tiered infrastructure**

- Top tier applications get lots of horsepower and disk IO
- Lower tiers get less expensive hardware and storage

- **There is no silver bullet for operations**

- If backup is broken now, virtualization alone won't fix it
- You'll need to update your provisioning methodology
- Consistency and accuracy are vital to DRS and VMotion

Success Factors

•Build many small servers

- Greater flexibility in distributing workloads
- Potential increased exposure to server outages
- Increased cost of blade infrastructure
- Benefit of consistent (identical) physical hardware, especially suitable for HA and DRS environments

•Build a few large servers

- Reduce costs by sharing infrastructure resources
- Spend savings on high availability features
- Considered the lowest cost per VM
- You may already have the hardware
- Inconsistent hardware may be a limitation
- Most consider three servers as the minimum

Success Factors

- **Install latest version of VMware tools in each guest**
 - Updates the BusLogic driver with optimizations
 - Make sure you upgrade tools as you upgrade ESX
- **Disconnect unused, unnecessary ports on both hosts and guests**
 - COM ports
 - LPT ports
 - Floppy drives
 - CD-ROM drives
 - USB adapters

Success Factors

- **Use as few virtual CPUs as possible**

- Don't waste virtual SMP if your app is single-threaded

- **Make sure hyperthreading is enabled**

- The CPU may support it, but the BIOS may not

- **Use less than 896MB of guest memory on Linux VMs**

- Memory mapping algorithm changes above this level

- **Multiple network adapters from a single vSwitches to the physical network form a NIC team**

- Can increase performance by distributing traffic
- Provide passive failover

Success Factors

- **Make sure you connect VMs on the same host to the same vSwitch**

- If not, traffic must go through the network IO systems to the wire

- **Some guest network drivers limit bandwidth due to buffer constraints**

- Increase receive, reduce transmit or both
- Default in vmxnet is 100, max is 128

Success Factors

- **Keep some machines available for V2P**
 - You may have to prove a problem can be reproduced outside of VMware
- **Don't underestimate iSCSI performance**
 - On a separate physical network it may be adequate
- **Default management database is MSDE**
 - Size limit of 2GB
 - Configuration changes, not raw number of servers increases size



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