Virtually Everything

Understanding Virtualization and What It Means to Your Organization

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Topic Context..

- Virtualization a “hot topic”
- Lot of “Hype”
  - Cacophony of terms
  - Many & overlapping use of terms
  - Lot of Flavors – “managed confusion” ?
- BUT Virtualization rapidly becoming strategic tool
- Tutorial session
  - Baseline definition & concepts
  - Explanation of the various types
  - Benefits
  - Challenges

•Disclaimer: Session not intended to teach you how to implement VMWare on a server or VDI for desktops..

So what is Virtualization?

The $64 question… What does “going virtual” really mean?

- Very broad term - means different things depending on who is using/interpreting it.
- Many definitions - most are correct, adding to the confusion..
- From a well known source..

  " a technique for hiding the physical characteristics of computing resources from the way in which other systems, applications, or end users interact with those resources. This includes making a single physical resource (such as a server, an operating system, an application, or storage device) appear to function as multiple logical resources; or it can include making multiple physical resources (such as storage devices or servers) appear as a single logical resource."

So what is Virtualization?

To put it more simply..

- ***It's a framework for dividing the resources of a computer into multiple execution environments through partitioning, machine simulation or emulation..***
- **Represents *ANY* application where a process is removed from its physical operating environment.**
- **Because of this ambiguity, "virtualization" now applies to any and all parts of an IT infrastructure.**

For purpose of this discussion:

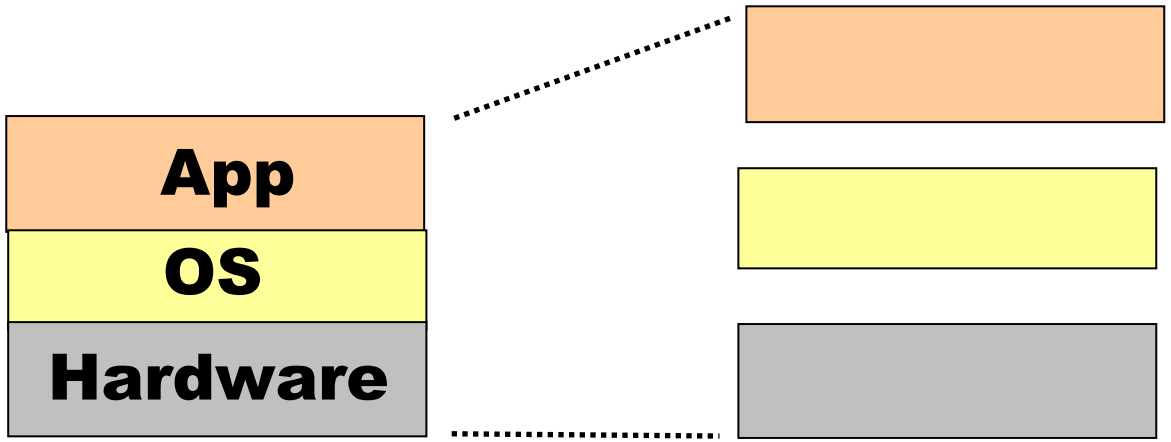
- **Virtualization is technology enabling OS/application workloads, data, networks to be managed independent of host hardware.**
- **Multiple workloads sharing single physical servers.**
- **Workloads migrated among hosts without downtime.**
- **Infrastructure managed as a "pool" of resources**

Some History..

- Virtualization developed decades ago in the mainframe world to prevent wasting available processing capacity and to extend the capability of limited resources.
- Technology creates the appearance of a complete computer and software network, while “uncoupling” the physical hardware from the operating system for greater resource use and flexibility.
- Multiple virtual machines are encapsulated into “files” with various operating systems.
- The “files” run in isolation or “side by side” on the same physical machine.
- Each VM has its own set of virtual hardware upon which an operating system and applications are loaded.

So what is Virtualization?

- In general Virtualization is the separation of a device's functions from its physical elements.
  - "Deconstructs" design affinity of HW, SW, Logical components
  - Technology divides physical resources into "virtual" resources..
  - Ex – server "virtualization" separates computation and I/O from the plastic and metal server

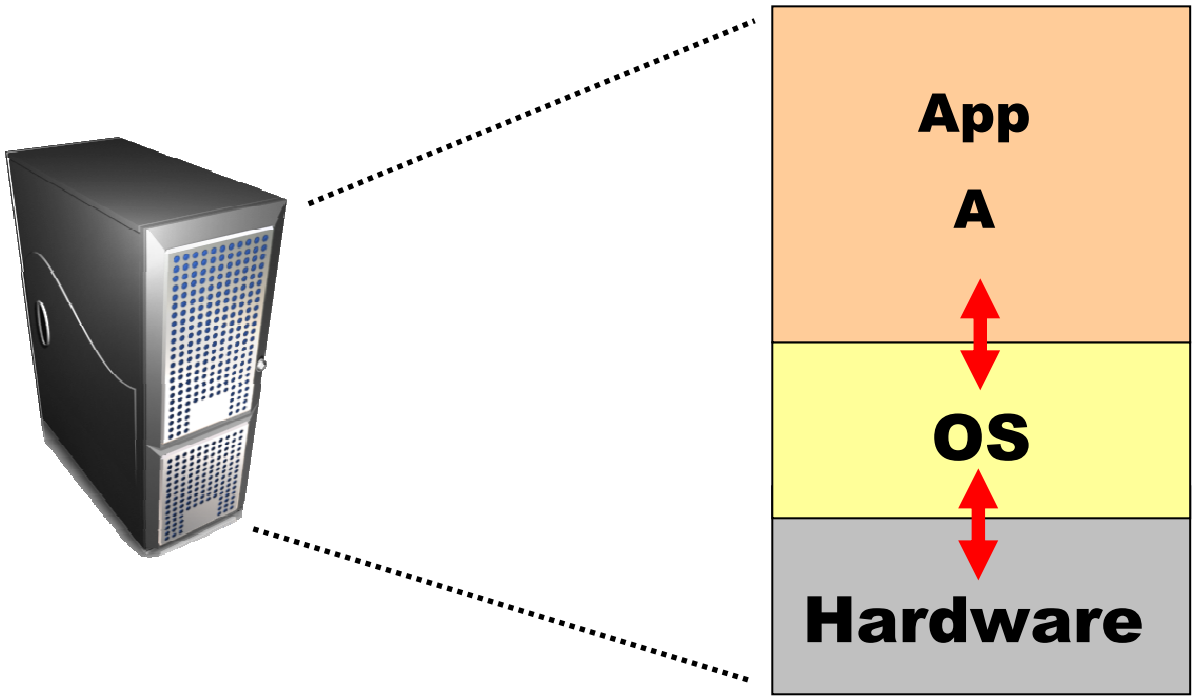


So what's Driving it now?

According to Industry..

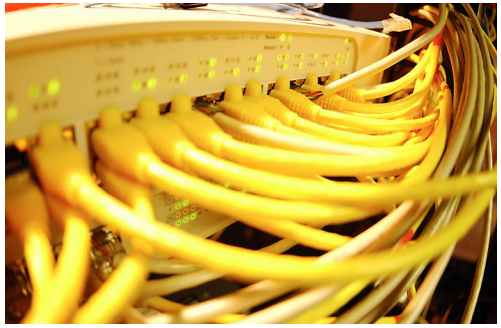
- TCO for servers rose from $98 billion to $250 billion between 1996 and 2006 per IDC.
- Estimated # of servers - 35M (2008) to grow to 45M by 2012.
- Purchase costs for servers has actually remained flat.
- Storage continuing to grow at 25%+ CAGRs
- Rising ownerships costs primarily attributable to:
  - Server, storage and network management
  - Administration costs
  - Energy prices

So what's Driving it now?



- Hardware/OS/Application Affinity
- "Stand Alone" environment
- Tendency to over-provision/under-utilize resource

So what's Driving it now?



- Individual power connections - up to 25% loss in voltage
- HA designs compounded inefficiencies
- Individual NICs added costs & # of switches needed
- Physical footprints added to conditioned space requirements
- Management more complex requiring even greater support effort
- DR expense/complexity

Evolution

- Historical focus on technical infrastructure aspects..
  - "Under the covers" – esoteric awareness
  - Emphasis on:
    - Operational efficiencies
    - Optimizing infrastructure
    - Improving systems management capabilities
  - Understood by those responsible for architecting, configuring or operating infrastructure components
- Focus now shifting to the "value" for applications management..
  - Development/maintenance
  - Testing
  - Quality
  - Deployment/Delivery
  - Addressing unique customer support situations

Evolution

- Two primary approaches:
  - Platform Virtualization
    - Initial form of virtualization
    - Concept not “new” - computational environment been around since the first mainframe systems.
    - Single server hosting one or more “virtual guest machines.”
    - “Server Virtualization” is a flavor of platform
  - Resource Virtualization
    - Virtualization of system resources (ex- storage, network)
    - Accomplished within host server or across multiple servers (using a SAN, for example).
    - EX - blade enclosures/servers employ platform and resource virtualization, sharing storage, network, etc. across physical servers.

Some Types of Virtualization

Hardware - "partition" resources to create isolated environments for OS guests

Platform - separate OS & Apps from platform resources

Operating System – OS allowing multiple isolated user-spaces

Application – separate individual applications from OS

Desktop - remote manipulation of a computer desktop

Portable – executable SW on removable devices

Storage – separate logical storage/data from physical

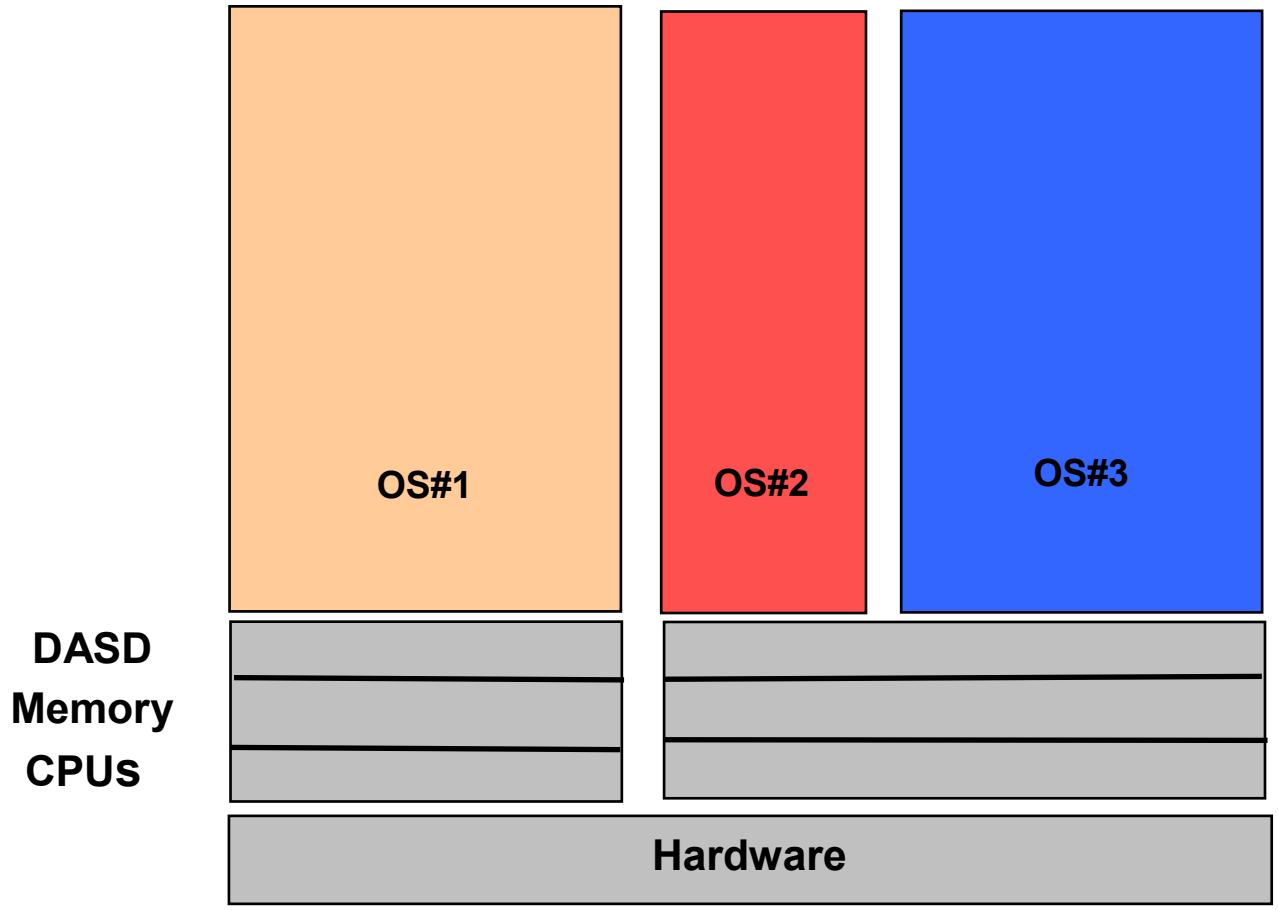
Network - virtualized network addressing across subnets - virtual IP management, segmentation, tables

Memory - RAM resources virtualized into shared pools

Hardware Virtualization

- Partitions computer's resources into separate/isolated VM's
  - Simulates multiple machines within one physical computer.
  - Enables multiple copies of same/different OSs
  - Isolates applications from interfering with each other.
- Hardware resources "reconfigured" into independent segments
  - Segments managed as separate, individual components.
  - Several ways to configure:
    - Pre-allocation – dedicated resources
      - Good choice for specific tasks – ex high CPU users
      - Downside is artificial resource shortages if underutilized
    - Dynamic – shared resources
      - Allows complete hardware management/control
      - Downside limitation to control of dominating process

Hardware Virtualization

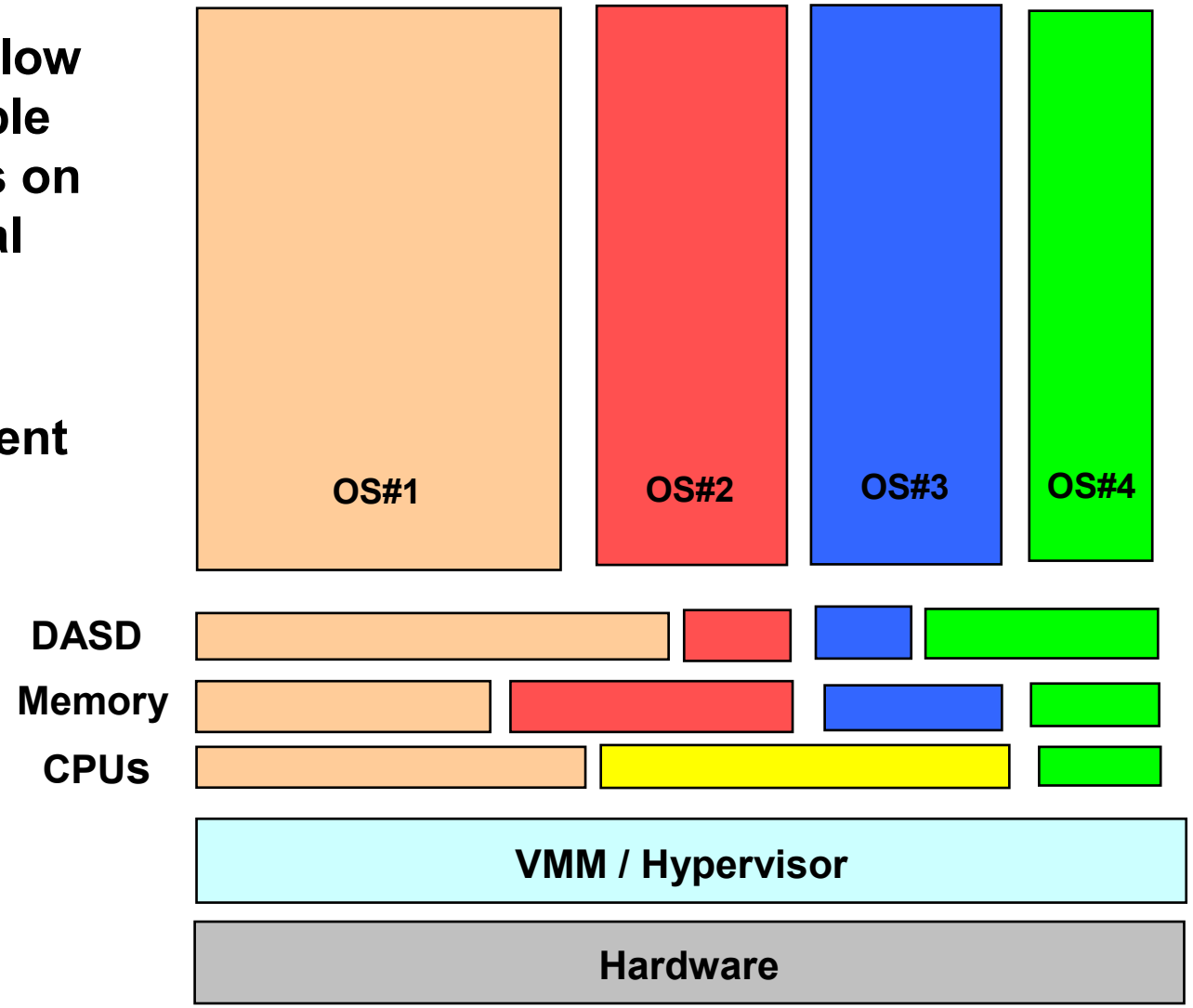


Platform

- Division of hardware physical resources “virtualized” as separate computers each with it’s own operating system.
- Developed on mainframes
  - CP-40, IBM 360/40, CP-67, IBM 360/67, VM/370, OS/VS1
  - Extended to midrange, servers
- Logical partitioning performed on the hardware layer
- LPARs managed by Hypervisors (e.g. Virtual Machine Monitors)
- Hypervisors – HW platform virtualization software that enables multiple OS to excute concurrently on host computer
- Hypervisors - system software products or HW features
- LPARS can share physical resources (CPUs, DASD, memory).
  - Partitioning options vary by processor class/vendors
  - CPUs may be dedicated or shared between separate LPARs.
  - LPARs may access memory from a common memory

Platform - Logical Partitioning

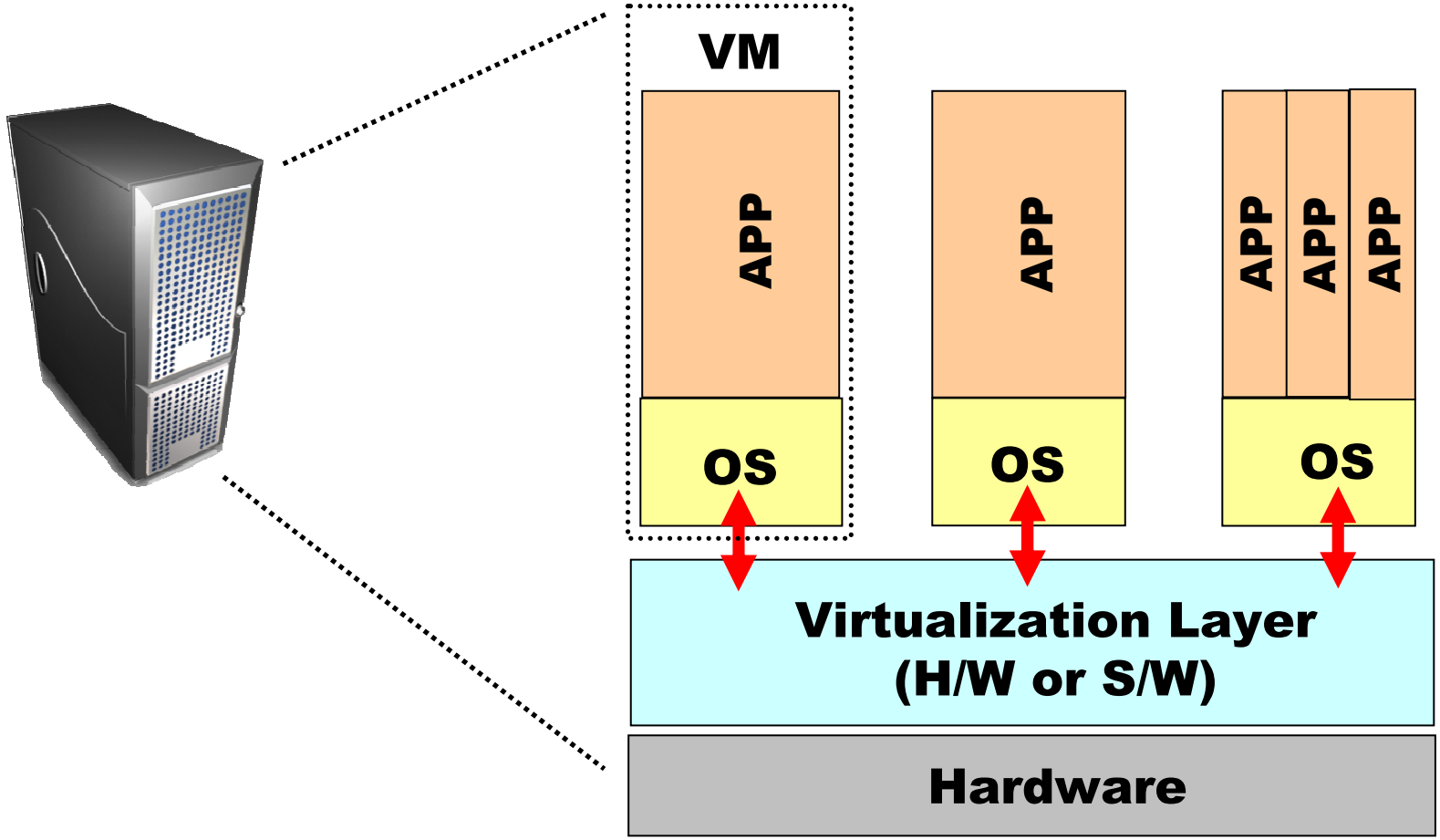
- LPARs safely allow combining multiple OS environments on the same physical system
- Lower costs
- Faster deployment
- Secure environments



So what is Server Virtualization?

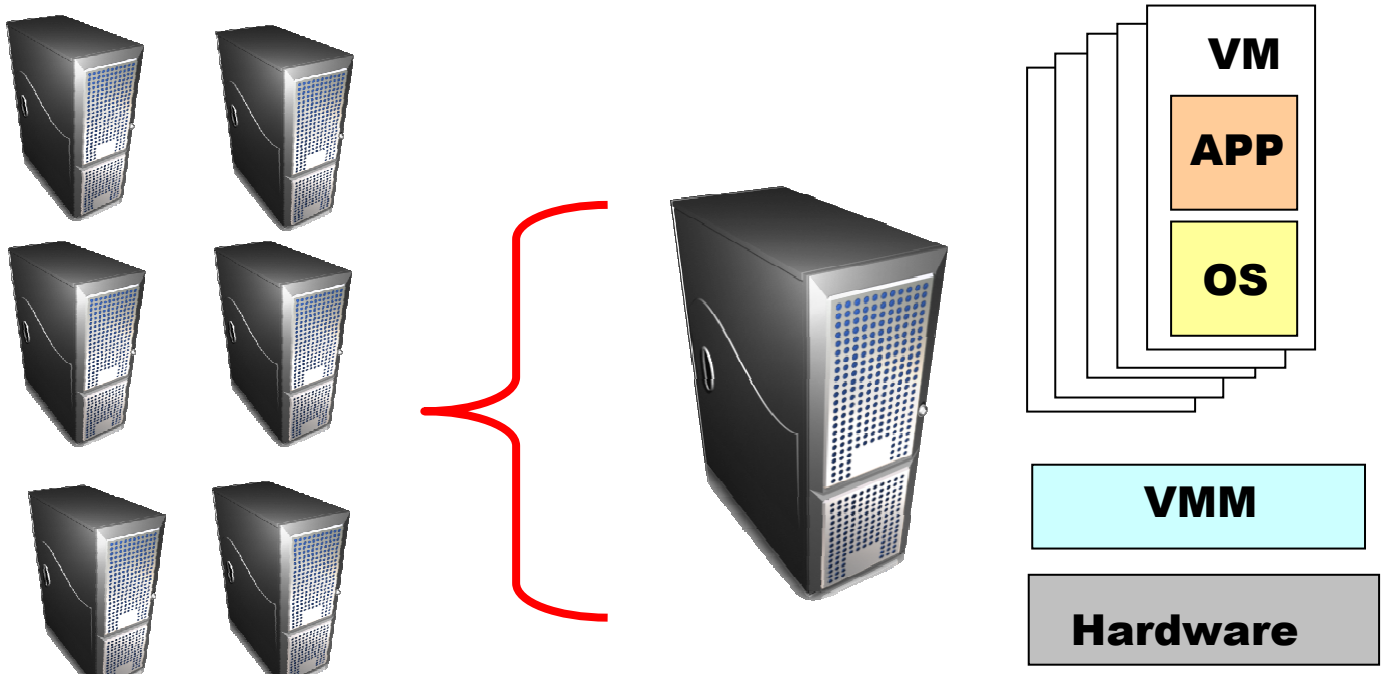
- Server virtualization variation on platform virtualization
- Most prevalent form of virtualization today – most “press”
- Well known S/W & H/W vendors have offerings
- “Masks” server resources (including the number and identity of individual physical servers, processors, and operating systems) from server users.
- Efficiencies targeted toward hardware costs, co-location fees, rack space, power, cable management, and more.
- Virtual Machines (VMs) full implementations of standard operating systems executing simultaneously on the same physical hardware.
- Virtual Machine Managers (VMMs also known as Hypervisors) control each VM individually for services

Server Virtualization



- Virtualization “layer” enables multiple OS/APP images

Server System Rationalization



- Reduced Power/Cooling
- Simpler Network Connectivity
- Smaller Footprint
- Reduced Support
- Improved Recovery

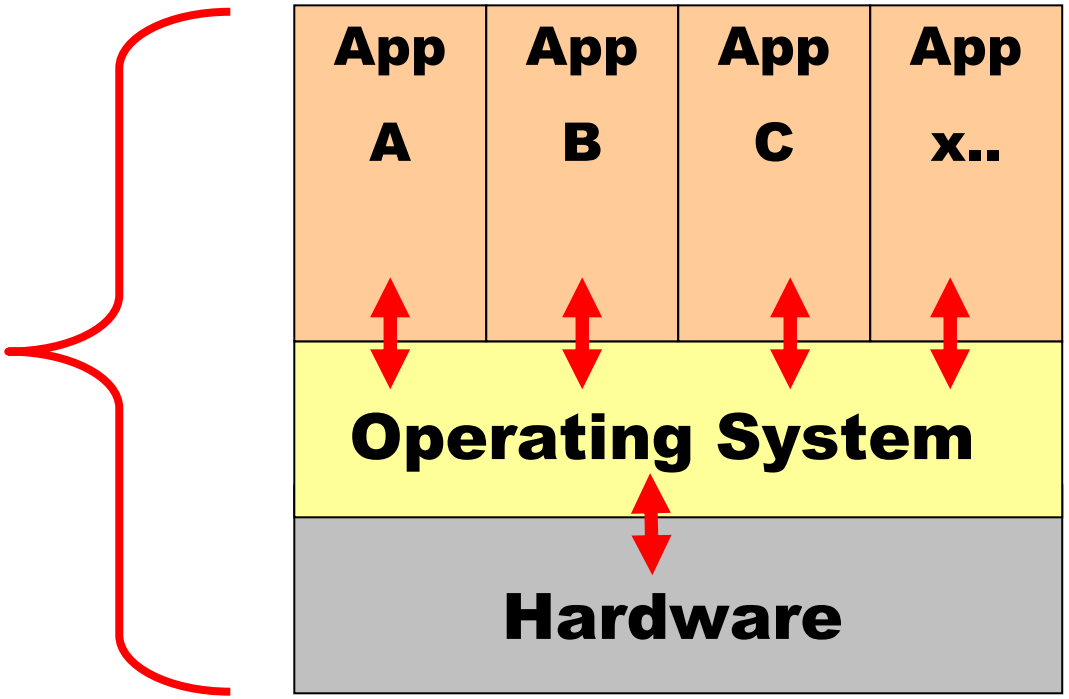
So what are the Benefits?

- Reduced need for separate dedicated physical servers
- Reduced DC space requirements
- Reduced power/cooling costs – “Green”
- Protection - Lowers the cost/complexity of disaster recovery.
- Deployment - speeds up the deployment of new server-based applications.
- Lessens “vendor lock-in” with server vendors.
- Agility – Rapidly address changes in workload demand
- Concurrently support old/new applications
- New versions of an OS/application can be deployed without purchasing new hardware.
- Stability - Application conflicts can be mitigated thru isolation
- Fault tolerance - Isolation enhances troubleshooting efforts.
- Security- Isolated VM’s limit risk exposures

So what is Application Virtualization?

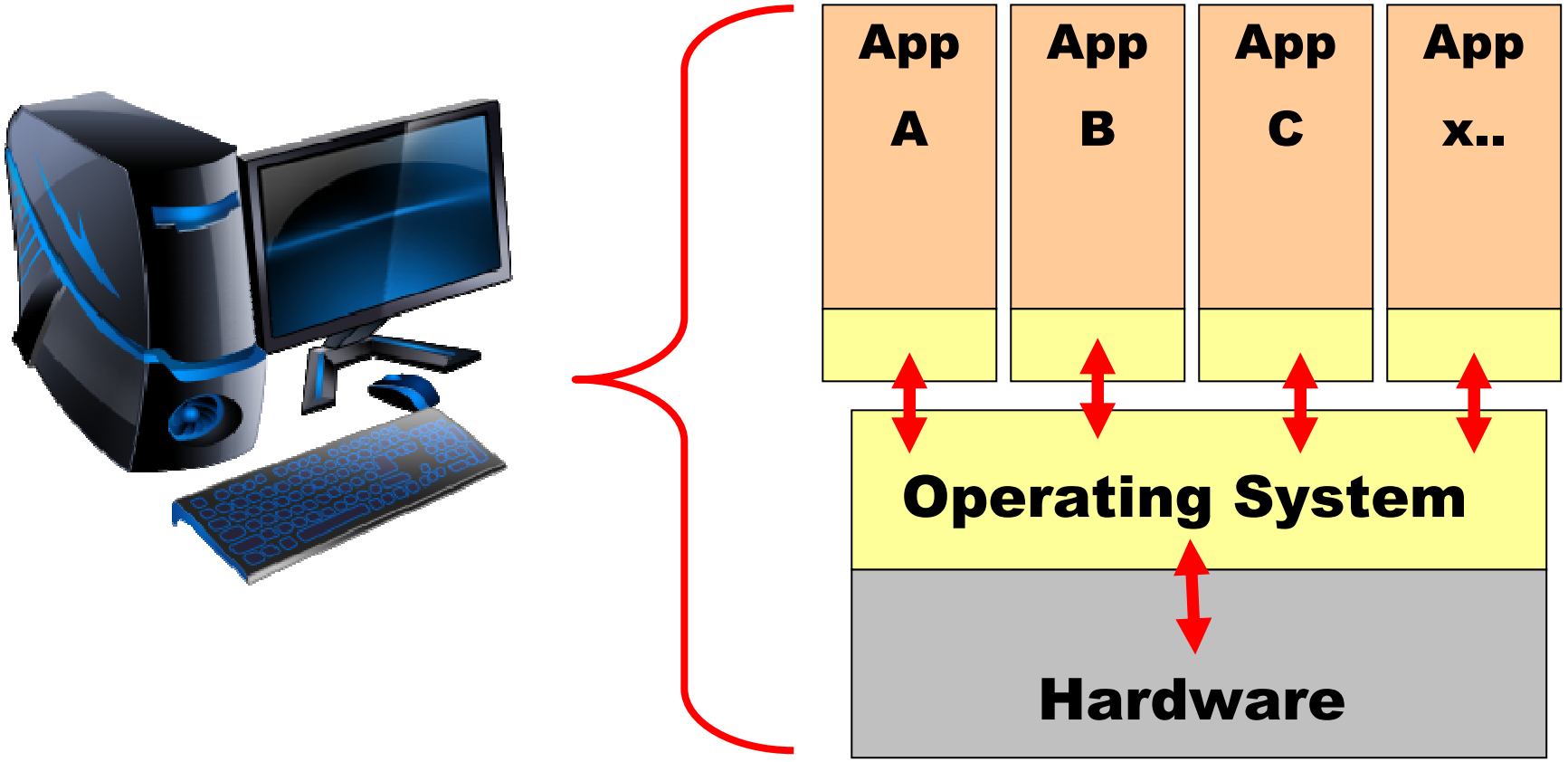
- Technologies that improve portability, manageability and compatibility of Applications.
- Relatively new – next opportunity to leverage virtualization.
- Encapsulates application from the OS/other apps
  - Packaged w/registry keys, DLLs, libraries as MSI or EXE file without changes to underlying OS.
  - Entire application & virtual OS delivered as a single file
  - Deployed in user mode (no administrative rights).
  - No device drivers/registry changes required
  - Application executes without directly interfacing with the original operating system
  - Can stream applications from a shared network drive with no server/client software to install.

Standard Desktop



- “Thick” configuration – local loads
- Hardware/OS/Applications “Tightly” Coupled
- OS manages App Resources (Registry, DLLs, etc)

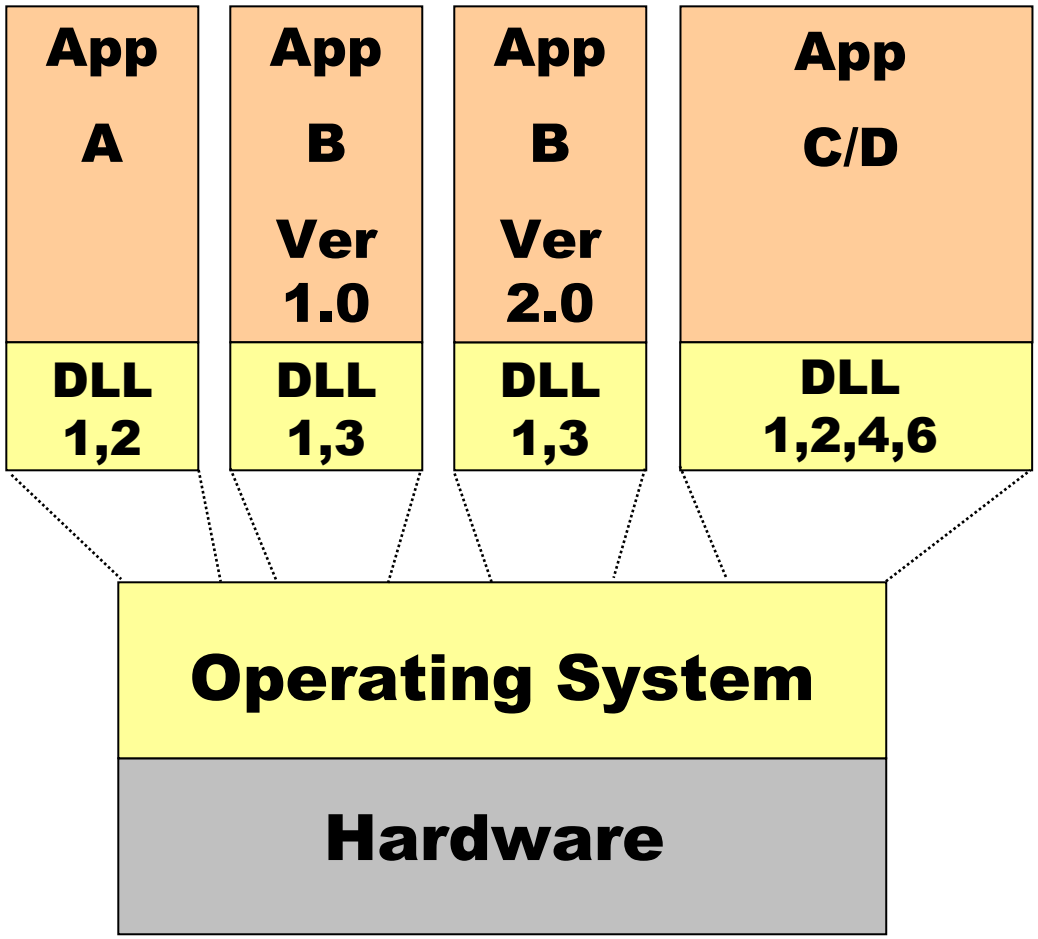
Application Virtualization



• Applications “encapsulated” with own copy OS resources required to execute

Application Virtualization

- Isolates Applications from OS & each other
- Resolves Conflict / Compatibility Issues
- Supports Versioning & Migrations
- Reduce Testing Time
- Must combine Apps with run time dependencies
- App size limitation
- New packaging / distribution required



❖Added Bonus – Can also "mix" with traditional APP loads

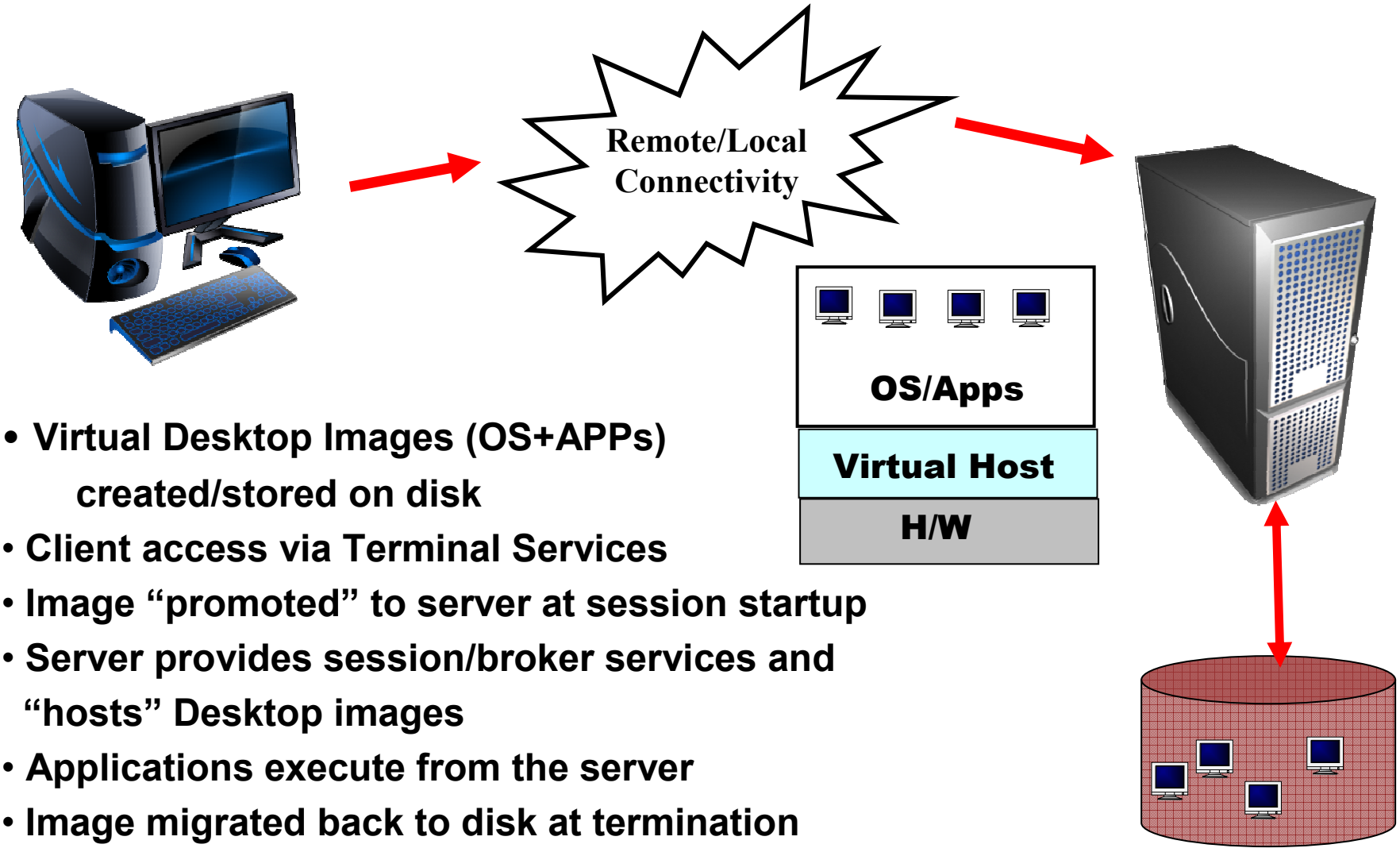
So what are the benefits?

- Eliminates application conflicts & regression issues
- Faster application development cycles
- Deliver/deploy applications w/less disruption and cost
- Improved software distribution integrity – no “mods” to local OS
- Portability – executable from portable storage devices
- Version/Upgrade integrity
    - Apps can execute side by side
    - Isolation from problematic apps
    - Removals don’t touch Registry, DLLs, etc..
    - New versions execute at next application launch.
- Dynamically provision desktops in real time.
- Reduced TCO through centralization/simplification of desktop management across the lifecycle.

So what is Desktop Virtualization?

- Separation of Desktop environment from the physical machine through a client/server model.
- Virtual Desktop Infrastructure (VDI) is the model enabling desktop virtualization - HW & SW to support the virtualized environment.
- "Virtualized" desktops stored on remote server instead local client
- Applications and data executed from server
- Desktop virtualization is encapsulation delivering either:
  - Access to an entire information system environment
  - The environment itself to a remote client device.
- VMs allow subscribers to maintain individualized desktops on a single, centrally located computer or server.

Virtual Desktop Infrastructure - VDI



- Virtual Desktop Images (OS+APPs) created/stored on disk
- Client access via Terminal Services
- Image "promoted" to server at session startup
- Server provides session/broker services and "hosts" Desktop images
- Applications execute from the server
- Image migrated back to disk at termination

So what are the benefits?

- Consolidate multiple development and test workstations onto fewer physical systems
- Ease in creation of desktop images to support growth, versioning, testing, QA
- Images can be easily shared to support customer testing
- Improved desktop management and reduced support costs
- Support model for off-campus – remote offices, mobile, telecommuters, off-shore, etc.
- Enhanced security and control over corporate resources and sensitive information

So what capabilities can I use for my application development or support purposes?

- Support legacy applications
- Permanently mitigate application conflicts
- Securely isolate “untrusted” applications
- Create isolated environments for Internet downloads
- New options for support of remote customers
- Enhance software distribution - deploy w/less disruption
- Exploit portability/streaming capabilities for mobile customers
- Create application suite “appliances” on their own VMs
- Leverage version/upgrade flexibility – “side by side” acceptance, cutover, back-out, near-time upgrades
- Enhance QA & customer testing experience and results
- Consider VMs for research, piloting, prototyping exercises
- Leverage VMs for fault isolation, debugging, performance testing

Current Marketplace Thoughts..

- Lot of activity in both server and desktop marketplace
  - Plethora of announcements and fast moving..
  - Needed capabilities becoming available - failure, migration
  - Most significant enhancements will be in hypervisor and operating system functions for Server Virtualization.
  - But it's not free..
- Price/Cost comparisons muddled:
  - Features, options, management capabilities, etc..
  - Acquisition price differentials are closing..
  - Startup costs/initial price tags daunting..
  - What features do <u>you</u> care about? willing to pay for?
  - Cost "reality" lies in real-world deployments – how far are you willing to push virtualization & tradeoffs?
  - Need to consider recovery risk (ex - how to recover 35 VMs?)

Key Question - What problem(s) are <u>you</u> trying to solve?

Some Practical Considerations..

- Costs can influence unrealistic density rates to achieve ROI.
- Density magnifies outage “impact” with hardware failures
- Requires new staff skills – breadth across I/F & process-centric.
- Can’t virtualize everything – also “mix” & compatibility
- Don’t let virtual “sprawl” replace server “sprawl”
- Beware exceptions - new silos or "pods" due to restrictions by CPU family, application environment, etc..
- Provisioning agility can create compliance exposures.
- Balance performance with capacity planning / exploitation
- Vendor marketplace – “Battles” make choices difficult.
- Limited standardization - Vendors are addressing.
- Market acceptance – SW/support ecosystems not fully mature
- Culture & Credibility - previous hype inhibited adoption rates – need to address skepticism to effectively manage change.

Some Practical Considerations..

And Don't forget about Software Licensing and Pricing..

- **Traditional models don't fit – Location, device, capacity**
- **Contracts don't typically address "virtual" implications**
- **Technology "independence" an issue**
- **Challenges Price/Value paradigms**
- **Vendors determining how to handle..**
  - **Revenue streams..**
  - **Audits – true-ups/downs**
  - **Controllability**
  - **Measurability**
- **Expect to re-negotiate**
- **New language to address usage, rights, price, compliance**
- **Pays to understand your per/user, per/device, per/transaction, per/business event, etc.. Metrics**
- **Consumption based?**

Closing thoughts..

Virtualization is a strategic tool now !

- **Not a question of "IF" but "WHEN"..**
- **Technology critical to evolution of real-time infrastructure:**
  - **Policy-based, services-oriented, automated shared infrastructure and operations.**
  - **Centralized admin, scalability, workload mgt**
  - **Autonomic – self-managing based on activity**
- **Technology can deliver solid benefits today..**
  - **Greater flexibility, scalability & simplified administration**
  - **Reduced operating costs – servers, power/cooling**
  - **Lower cost/complexity for disaster recovery**
  - **Speed deployment of new applications**
  - **Lessened vendor dependence**
  - **Improved organizational agility to meet rapid changes in workload demands.**

Virtualization

QUESTIONS ???