Virtually Everything
Understanding Virtualization and What It Means to Your Organization

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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.
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.
- Purchase costs for servers has actually remained flat.
- Storage continuing to grow at 25%+ CAGRs
- Rising ownership 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

OS#1
DASD
Memory
CPUs
Hardware

OS#2

OS#3
Platform

- Division of hardware physical resources “virtualized” as separate computers each with its 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 execute 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 with 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
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 you 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 you 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?
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 ????