Sistemi Operativi e Reti

Virtualization technologies

Facoltà di Scienze Matematiche Fisiche e Naturali

Corso di Laurea Magistrale in Informatica

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What is virtualization

- Virtualization abstracts the underlying physical structure of various technologies. Virtualization, in computing, is the creation of a virtual (rather than actual) version of something, such as a hardware platform, operating system, a storage device or network resources[1]
- Server virtualization[2]
  - Creates multiple isolated environments
  - Allows multiple OS's and workloads to run on the same physical hardware
  - Solves the problem of tight coupling between OS's and hardware

[1] http://en.wikipedia.org/wiki/Virtualization

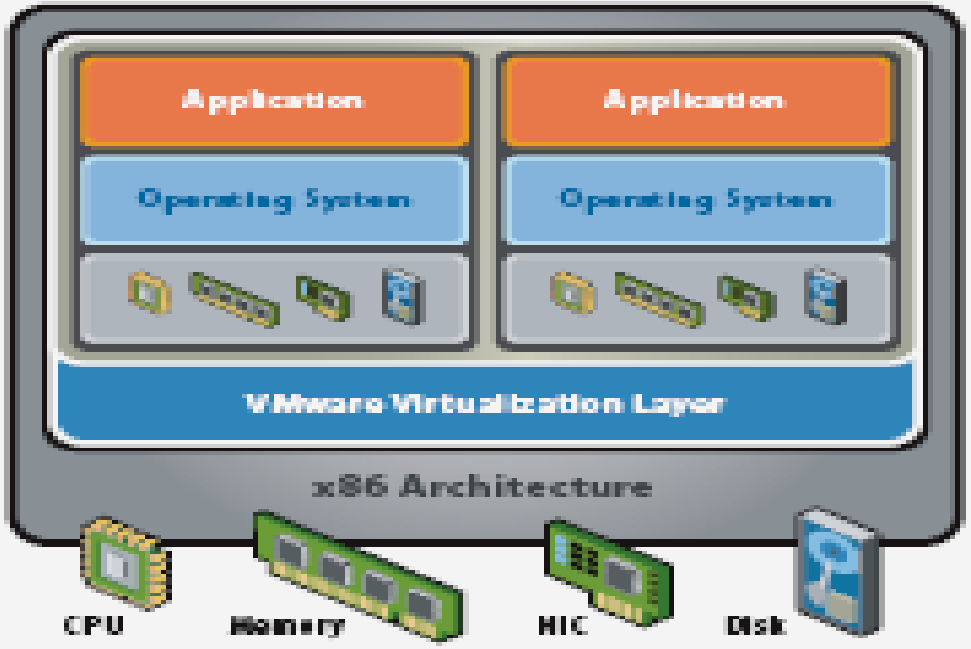
[2] Anil Desai IEEE Computer Society, Austin Chapter April 18th, 2007

The traditional server concept

Before Virtualization:

- Single OS image per machine
- Software and hardware tightly coupled
- Running multiple applications on same machine often creates conflict
- Underutilized resources
- Inflexible and costly infrastructure

The virtual server concept



After Virtualization:

- Hardware-independence of operating system and applications
- Virtual machines can be provisioned to any system
- Can manage OS and application as a single unit by encapsulating them into virtual machines

Virtual Machines

- Virtual machines provide:
  - Hardware independence

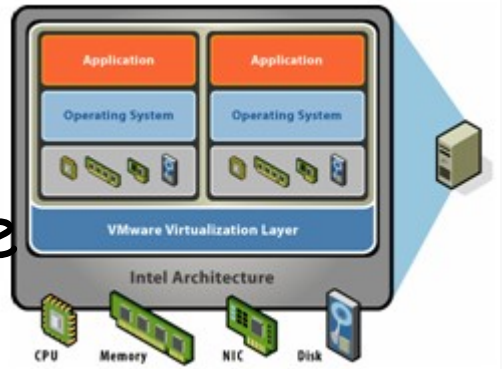
    Guest VM sees the same hardware regardless of the host hardware

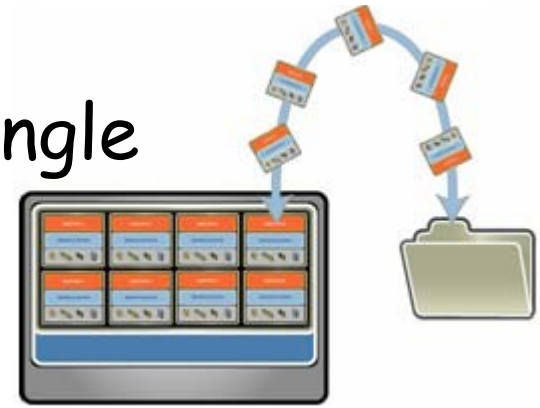
  - Isolation

    VM's operating system is isolated from the host operating system

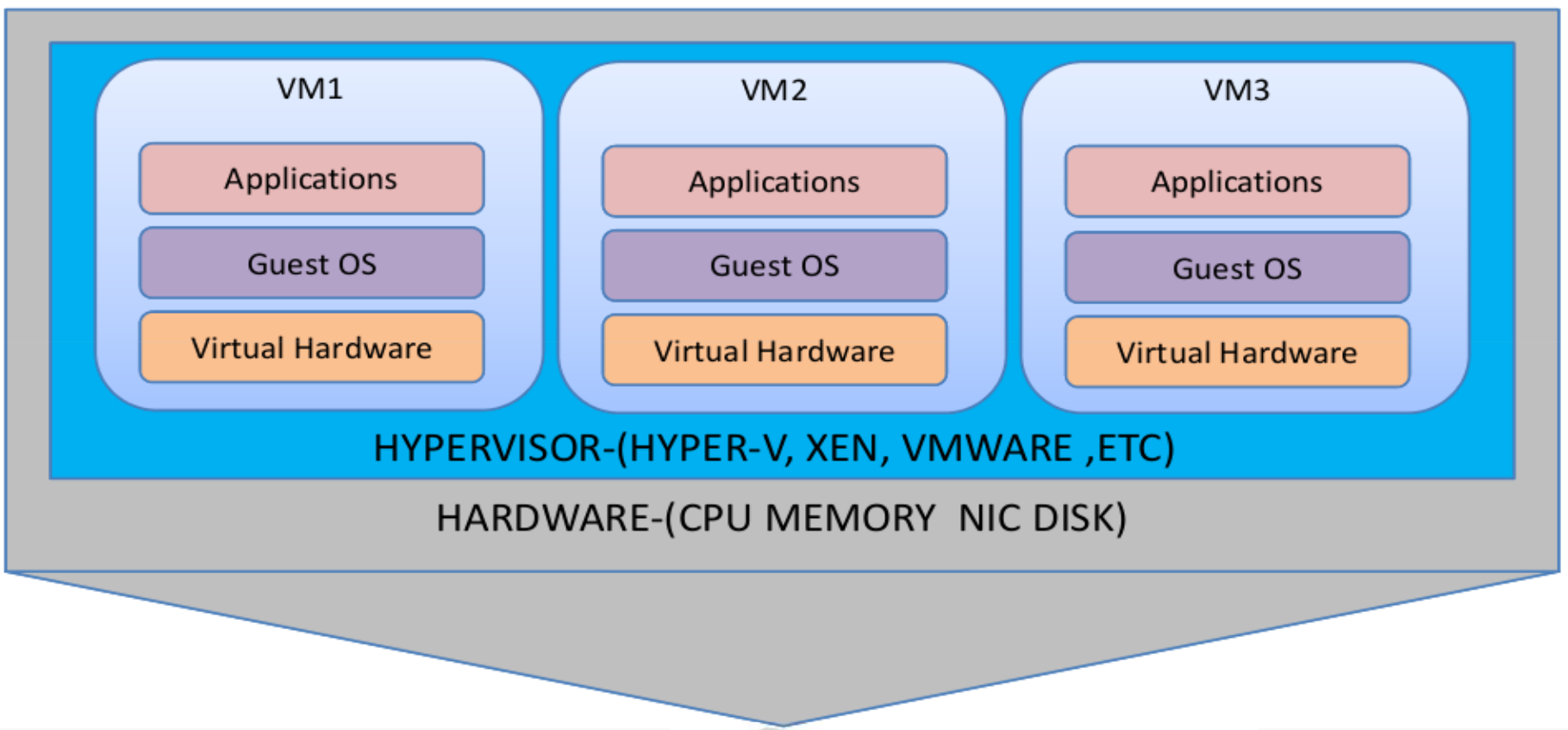
  - Encapsulation

    Entire VM encapsulated into a single file

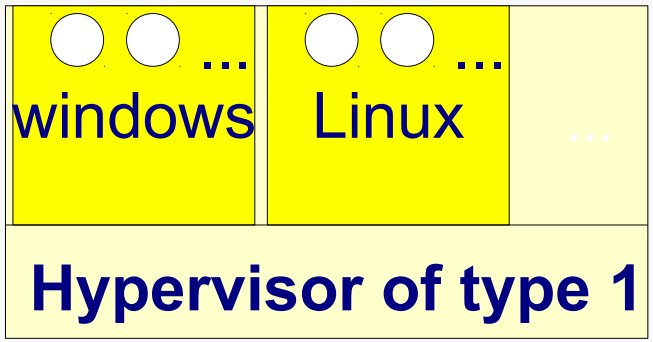




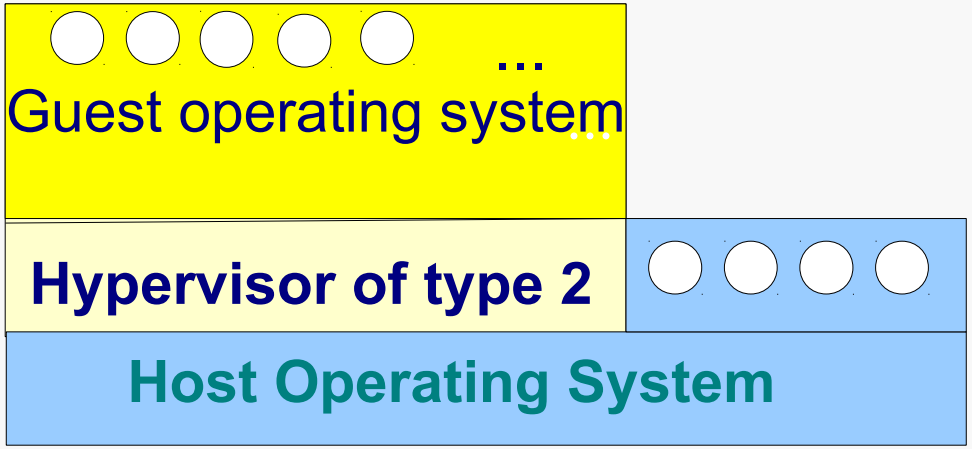
Virtual Machine



Hypervisor di tipo 1 e 2



Solo programma eseguito in modalità Kernel: supporta molteplici copie dell'hardware reale



programma eseguito in modalità utente ed “intrepreta” le istruzioni macchina

Intel Virtualization Technology **AMD Secure Virtual Machine**

Benefits of virtualization

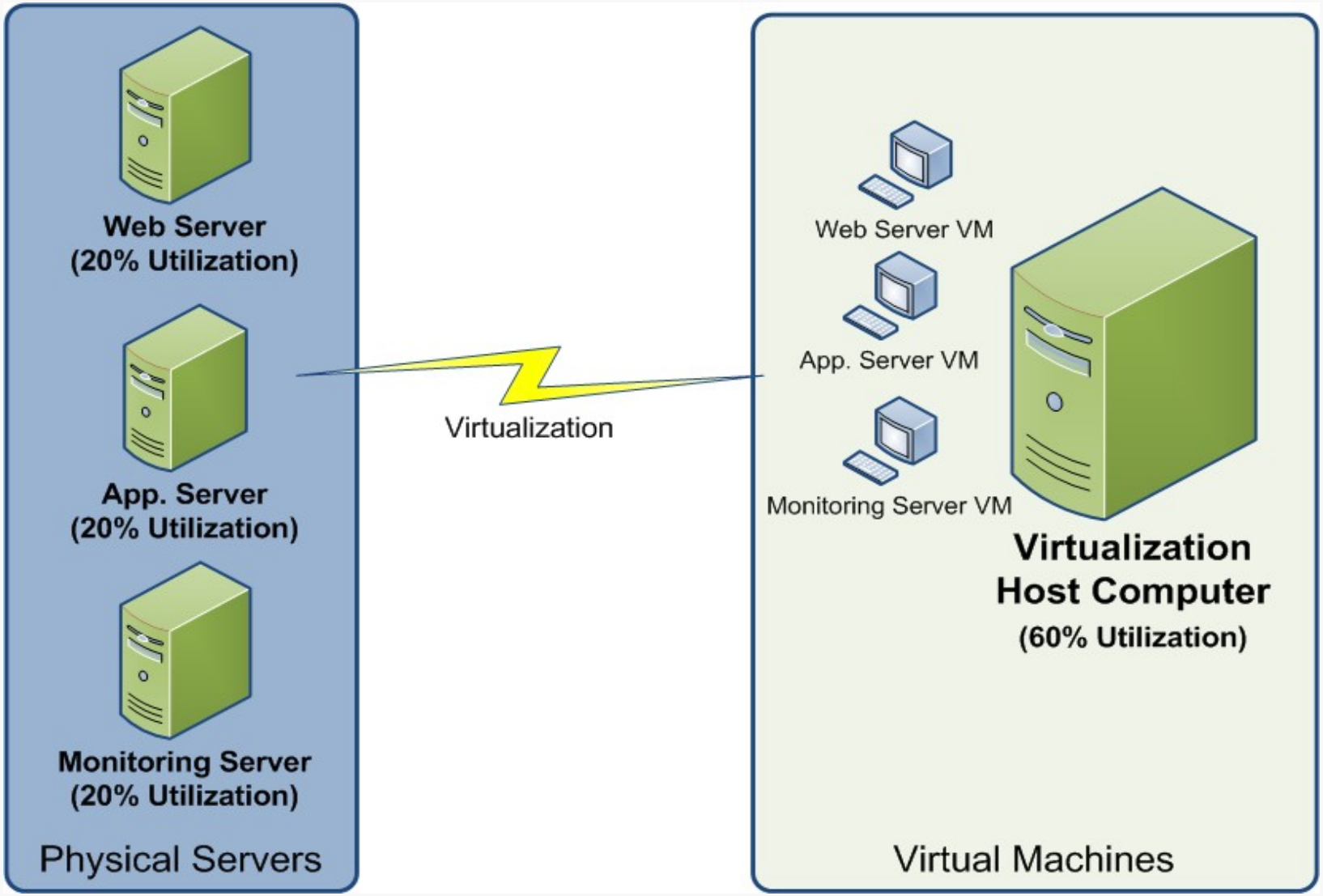
- Simplified administration
- Hardware independence/portability
- Increased hardware utilization
- Server consolidation
- Decreased provisioning times

- Software Development
- Testing / Quality Assurance
- Product evaluations / demonstrations
- Training
- Disaster Recovery

Virtualization features

Virtualization scenarios

Server consolidation



Virtualization Key solutions / Use cases

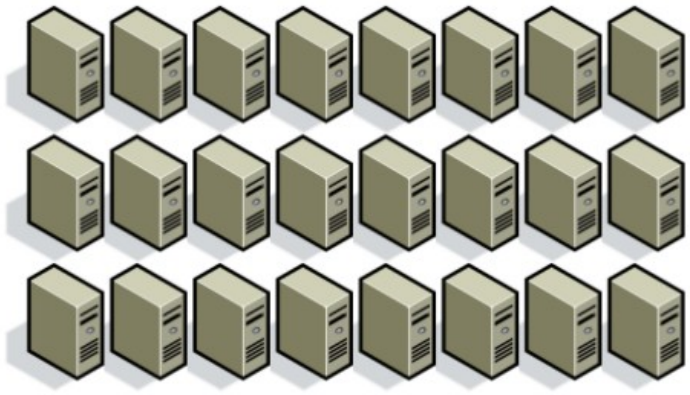
- Server Consolidation and Containment – Eliminate server sprawl by deploying systems into virtual machines
- Infrastructure Provisioning – Reduce the time for provisioning new infrastructure to minutes with sophisticated automation capabilities.
- Business Continuity – Reduce the cost and complexity of business continuity by encapsulating entire systems files that can be replicated and restored onto any target server
- Test and Development – Rapidly provision and re-provision test and development servers; store libraries of pre-configured test machines
- Enterprise Desktop – Secure unmanaged PCs. Alternatively, provide standardized enterprise desktop environments hosted on servers.
- Legacy Application Re-hosting – Migrate legacy operating systems and software applications to virtual machines running on new hardware for better reliability

Top 3 economic reasons for virtualization

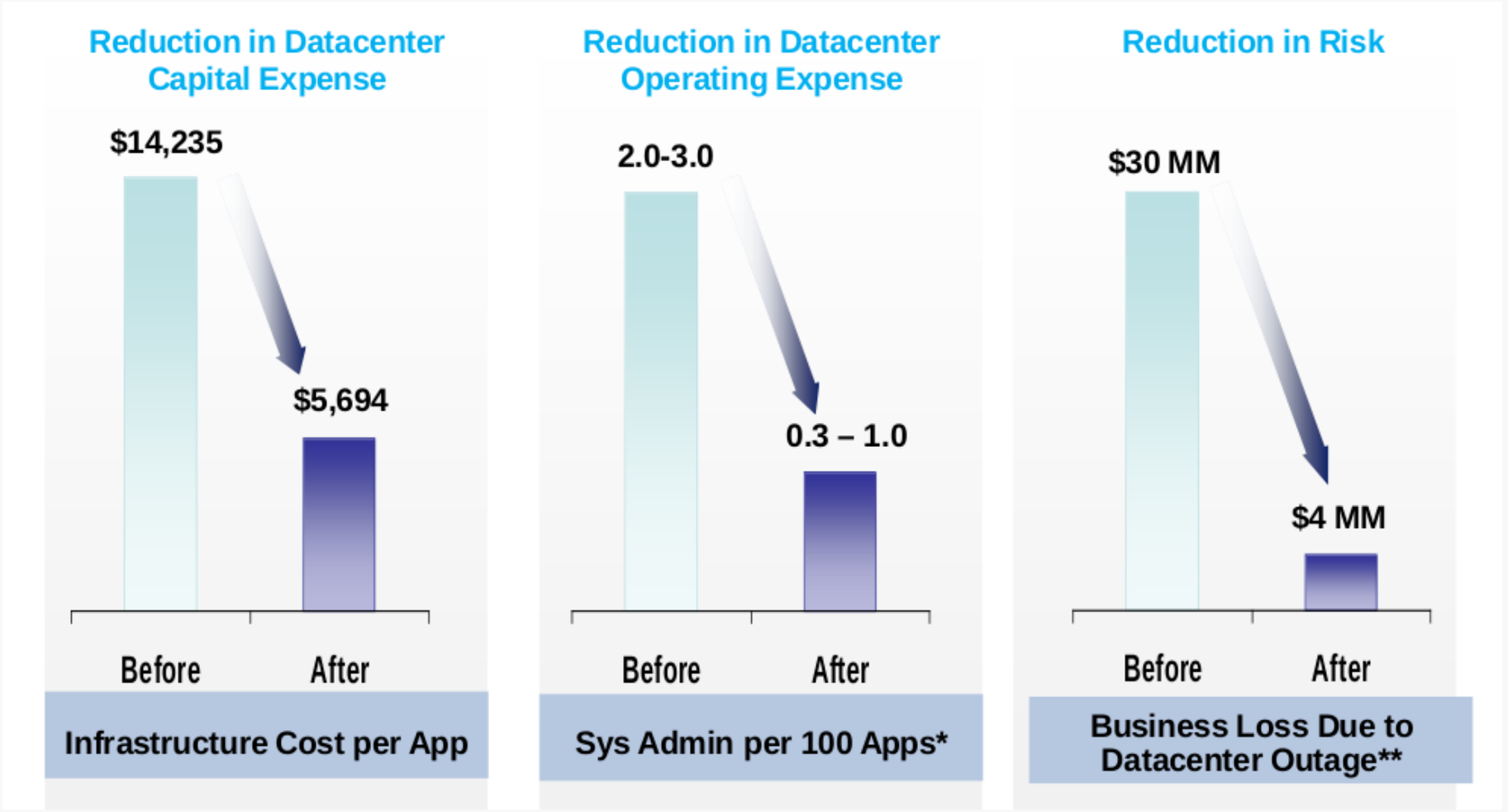
1. Reduce Physical Infrastructure Cost
2. Reduce Datacenter Operating Cost (e.g. Power & Cooling)
3. Minimize Lost Revenue Due to Downtime

Server, storage and Network consolidation

Before	After
1,000 servers with DASD	50 servers with SAN and NAS
200 racks	10 racks
3000 network cables	300 network cables
400 power whips	20 power whips

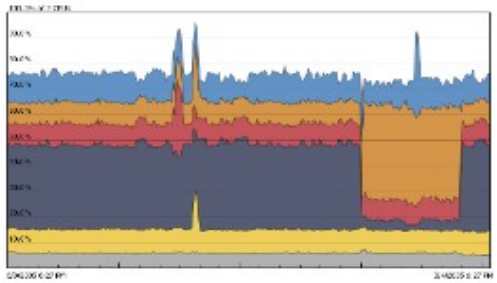


Virtualization advantages

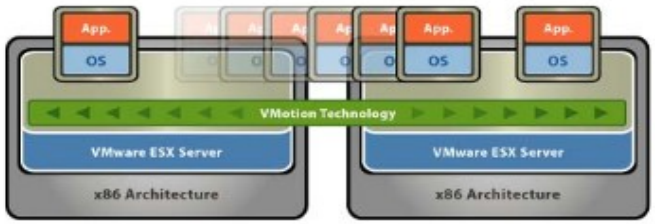


Source: IDC and VMWare

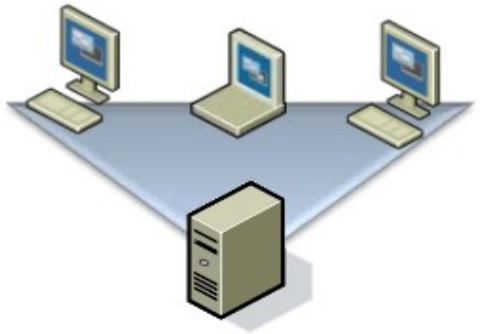
Virtualization reduces energy consumtion



- Highest consolidation rates on most secure and reliable virtualization platform
- Safely improve utilization rates
- **80% energy reduction**

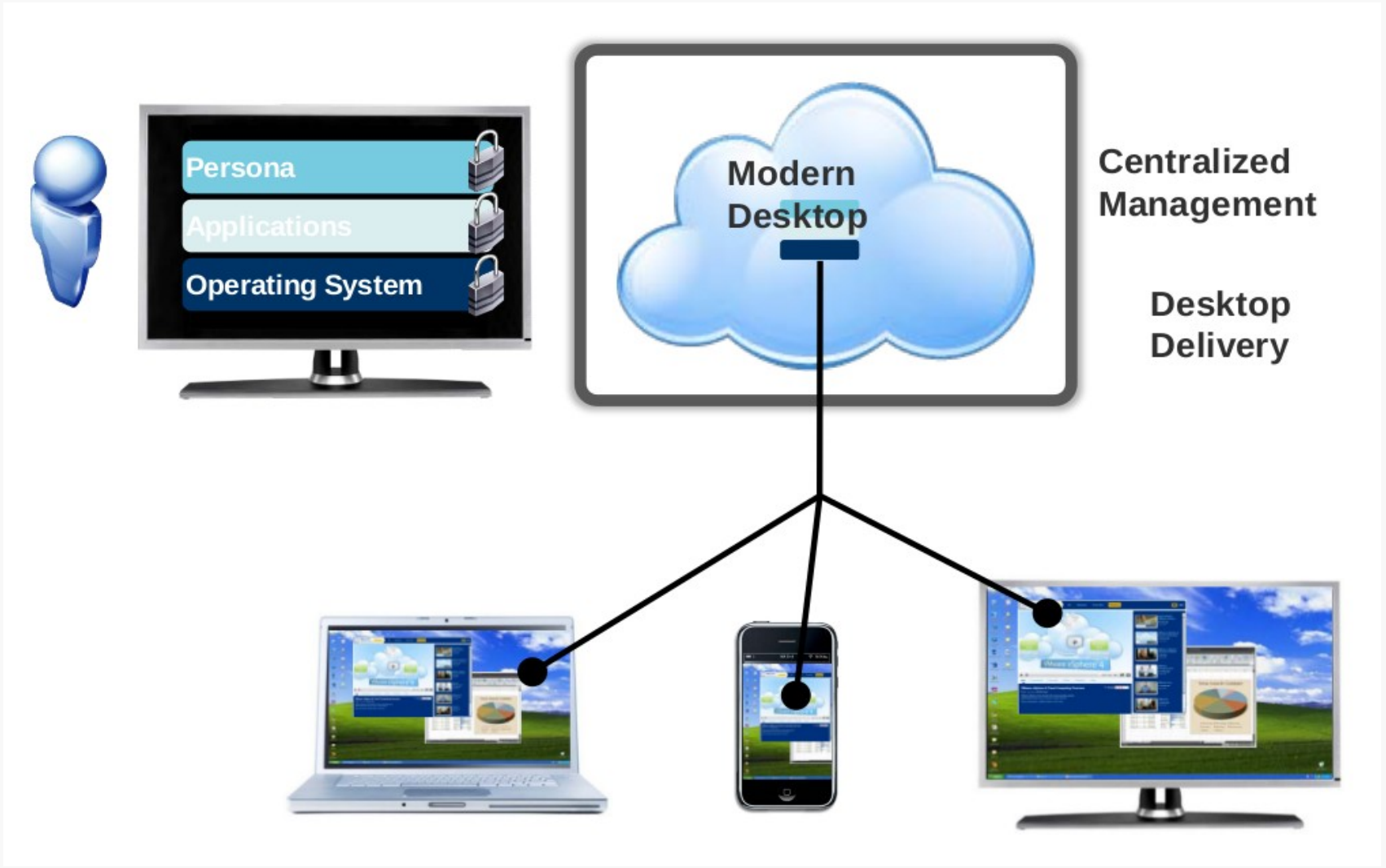


- Dynamic server and storage migration
- Power off unneeded servers in real-time
- Migrate storage dynamically
- **25% energy reduction**

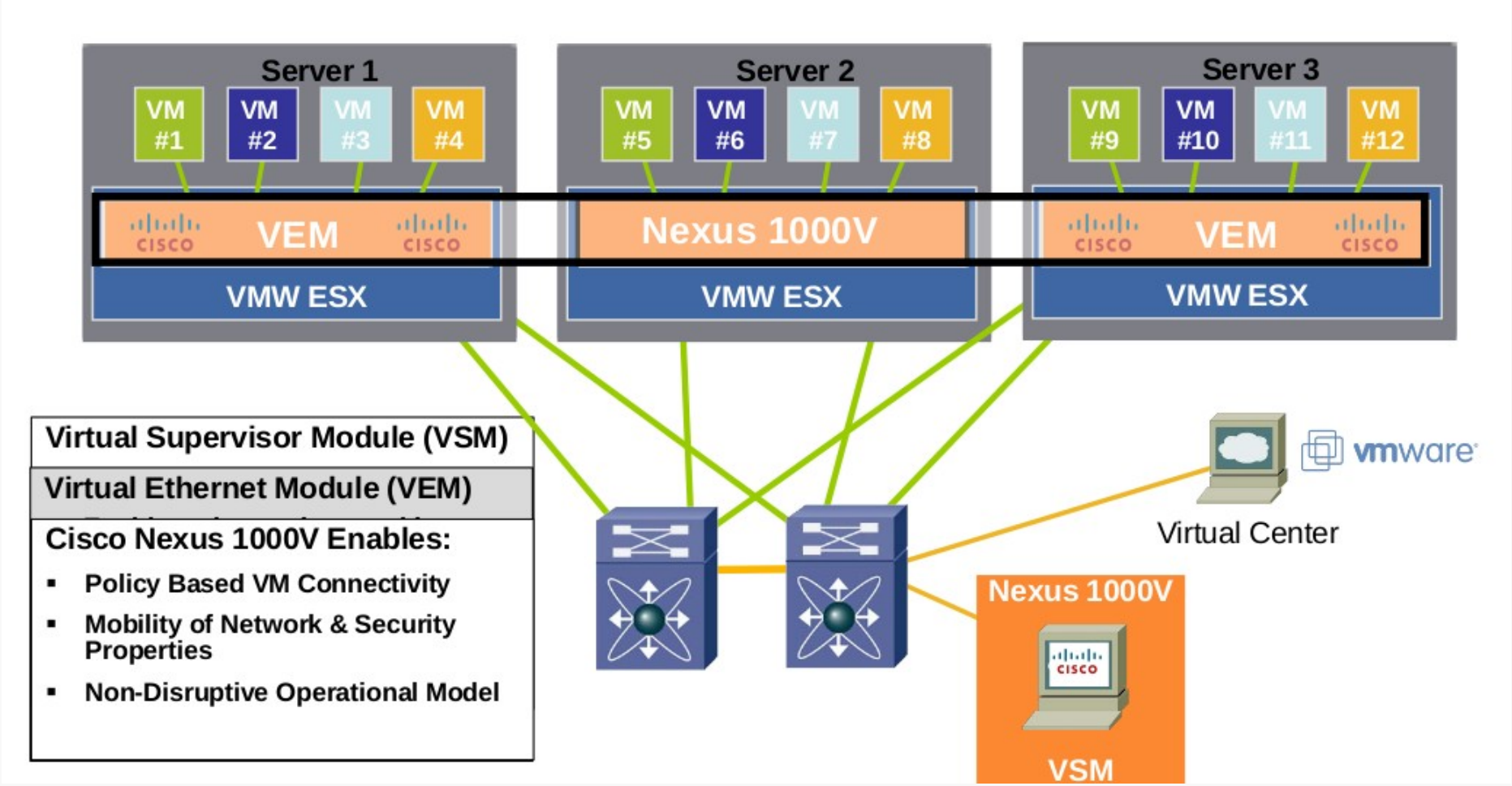


- Host desktop PCs in the datacenter
- Use thin clients, double refresh cycle
- Reduce storage for similar desktop images
- **70% energy reduction**

Modernizing the desktop: Virtual Desktop Infrastructure



Virtual Distributed Network Switch



System virtualization: present state

- Data center and desktop computing successfully use virtualization to
  - Better utilize computing capacity
  - Balance computing load
  - Manage complexity and parallelism
  - Improve security by isolation
- Mobile and embedded computing currently lag behind since
  - Most hypervisors only support the x86 platform
  - Most hypervisors require large memories
  - Most hypervisors have poor real-time support
  - Most hypervisors are inefficient with microkernel Oss
  - Full-virtualization is not available. Operating system source code needs to be available and must be modified
  - Suitable open source-code hypervisors are not available