



**Q-layer** 

# The future is in the management tools

Profoss 22/01/2008

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**Q-layer**





## Agenda

- Introduction
- Virtualization today
  - Server & desktop virtualization
  - Storage virtualization
  - Network virtualization
  - Application virtualization
- Virtualization future
- My management tool wishlist
  - Automation
  - Power reduction
  - Chargeback
  - Licensing reporting
  - Capacity planning
  - Live migration, load balancing & failover
  - Delegation: power to the user with VPDC
- Conclusion

What we need to manage

What the tools need to do



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# Introduction





## Q-layer

- Q-layer provides datacenter virtualization software
  - Translate easy to understand parameters into actual provisioning in datacenter
  
- How ?
  - Orchestration of 3 layers:
    - Servers: all major hypervisors & physical servers
    - Network: VLAN's
    - Storage: Q-Store
  - Storage virtualization: Q-Store & Q-SAN



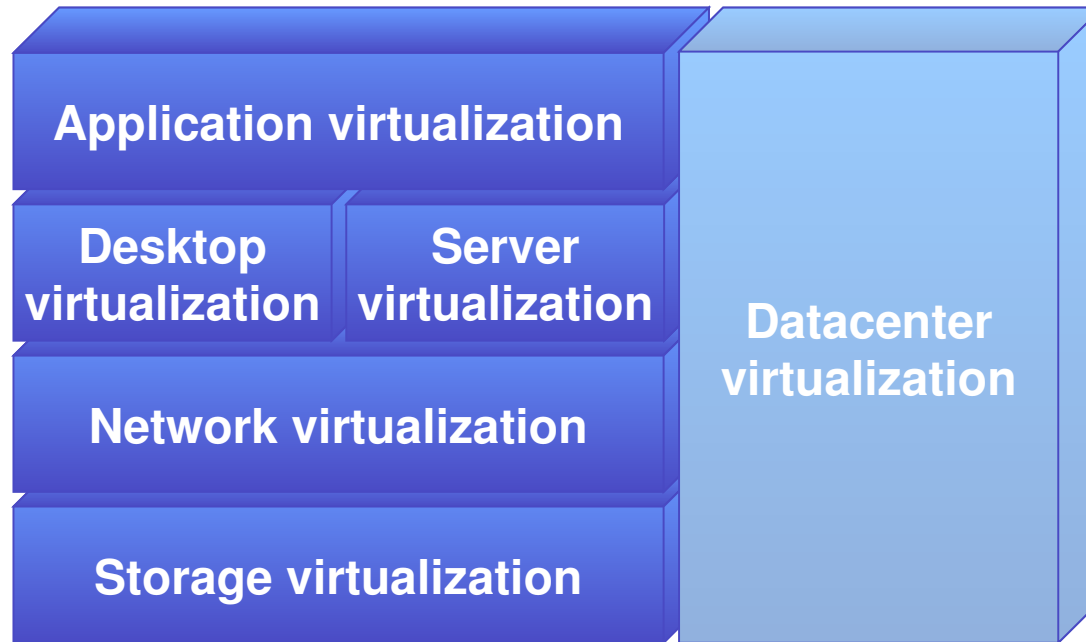
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# Virtualization today





## Virtualization overview





## Server virtualization

- What is it ?
  - Break the direct dependency between OS and hardware
  - Run “guest” operating systems on top of a “host” operating system

- Players

- VMWare
- Xen
- VirtualBox
- Virtuozzo
- KVM (kernel-based virtual machine)
- Microsoft
- ...





## Server virtualization vs. desktop virtualization

### Server virtualization

Specific requirements:

- Disk I/O performance
- Network I/O performance
- CPU, memory overhead
- Support for multiple cores
- Multiple virtual NIC's
- Support for Win 2003, Linux...

### Desktop virtualization

Specific requirements:

- Remote USB support (printers...)
- Support of multiple monitors
- Hibernate VM when not in use
- Connection broker
- Good graphical support
- Support for Win XP, Vista...





## Benefits of server virtualization

- Server consolidation
  - On average, only 15% of server resources is used in a datacenter
  - Using virtualization, utilisation can be increased to 80%, by consolidating servers
- Live migration
- Disaster recovery
- Replication
- Holistic management
- Provisioning of new servers in seconds
- Resize server capacity on the fly
  - Without virtualization, if an application requires more resources (storage, processing power or memory), migration to new hardware is needed, this takes multiple days



## Types of server virtualization

### Full virtualization

- Guest & host kernel are not “aware” of each other
- Unmodified guest OS
- Big overhead for I/O (slower performance)
- Only way to virtualize Windows (MS does not support changes to the HAL)
- Requires CPU with VT instruction set

### Paravirtualization (PV)

- Guest & host kernel “work together” to share resources
- Modified guest OS (modified kernel)
- Not possible for Windows, except for PV drivers for network & storage I/O in guest
- No VT instruction set required on CPU



## Server virtualization checklist

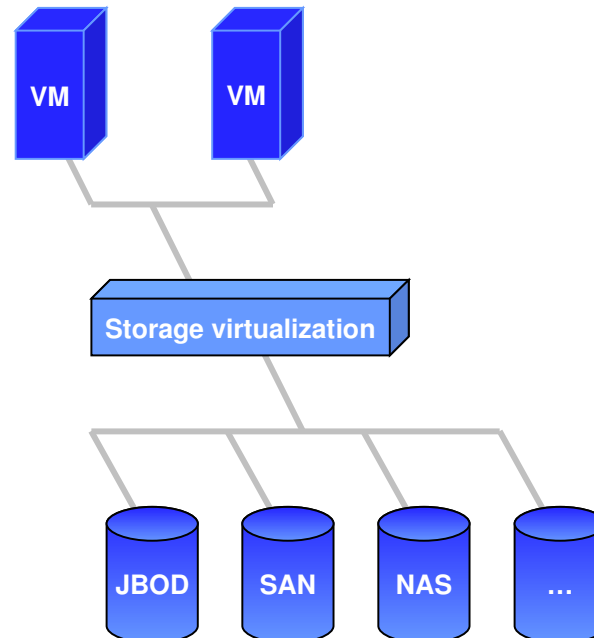
- Supported “host” operating systems ?
- Supported “guest” operating systems ?
- Live migration ?
- Memory ballooning (dynamically change memory VM) ?
- Supported storage layers ?
  - iSCSI (Gigabit Ethernet)
  - Fibre Channel
  - Infiniband
- Full virtualization or paravirtualization ?
- Dedicated or shared resources ?



## Storage virtualization

- What is it ?
  - Consolidate storage
  - Seamless expansion
  - Thin provisioning (sparse volumes)
  - Snapshot

- Players:
  - EMC
  - Netapp
  - Datacore
  - Lefthand
  - Q-layer
  - ...



**EMC<sup>2</sup>**  
where information lives<sup>®</sup>

**NetApp<sup>®</sup>**

**ISILON<sup>®</sup>**  
SYSTEMS

**DataCore<sup>™</sup>**  
SOFTWARE



## Block based versus file based

- File based (NAS)
  - Performance impact
  - Easy to manage
  - File-based management possible on NAS (e.g. file backup, deduplication using CAS = SIS)
  
- Block based (SAN)
  - High performance
  - More complex
  - No file-based management possible on SAN (e.g. file backup)



## Network virtualization

- What is it ?
  - Ability to design network topology in software
  - Single backplane for all I/O
  - VLAN's



- Players
  - Cisco
  - HP
  - Juniper
  - ...





## Application virtualization

- What is it ?
  - Sandbox installed applications
  - Avoid conflicts between applications (e.g. different versions of shared libraries)
  - Avoid conflicts in Windows registry

- Players:

- Microsoft Softgrid (used to be Softricity)
- Altiris
- ...

Microsoft®  
SoftGrid





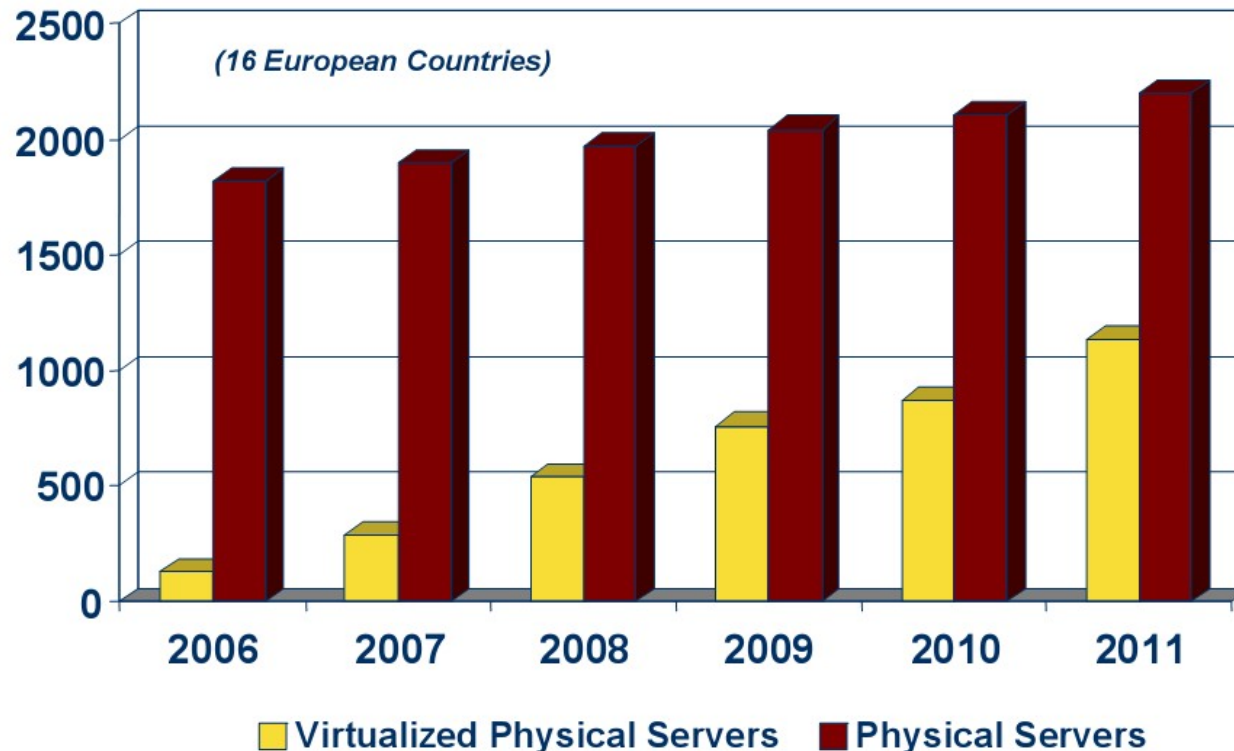
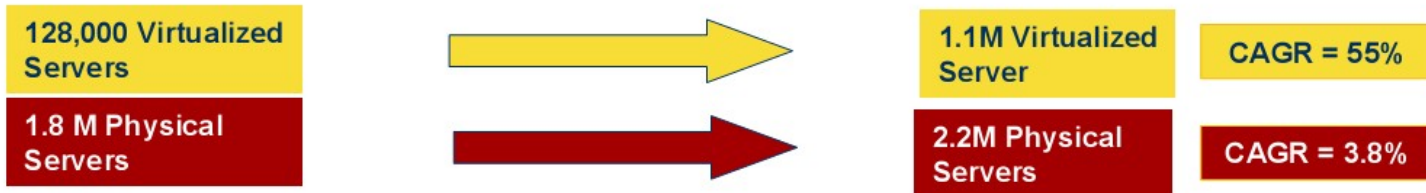
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# Virtualization future

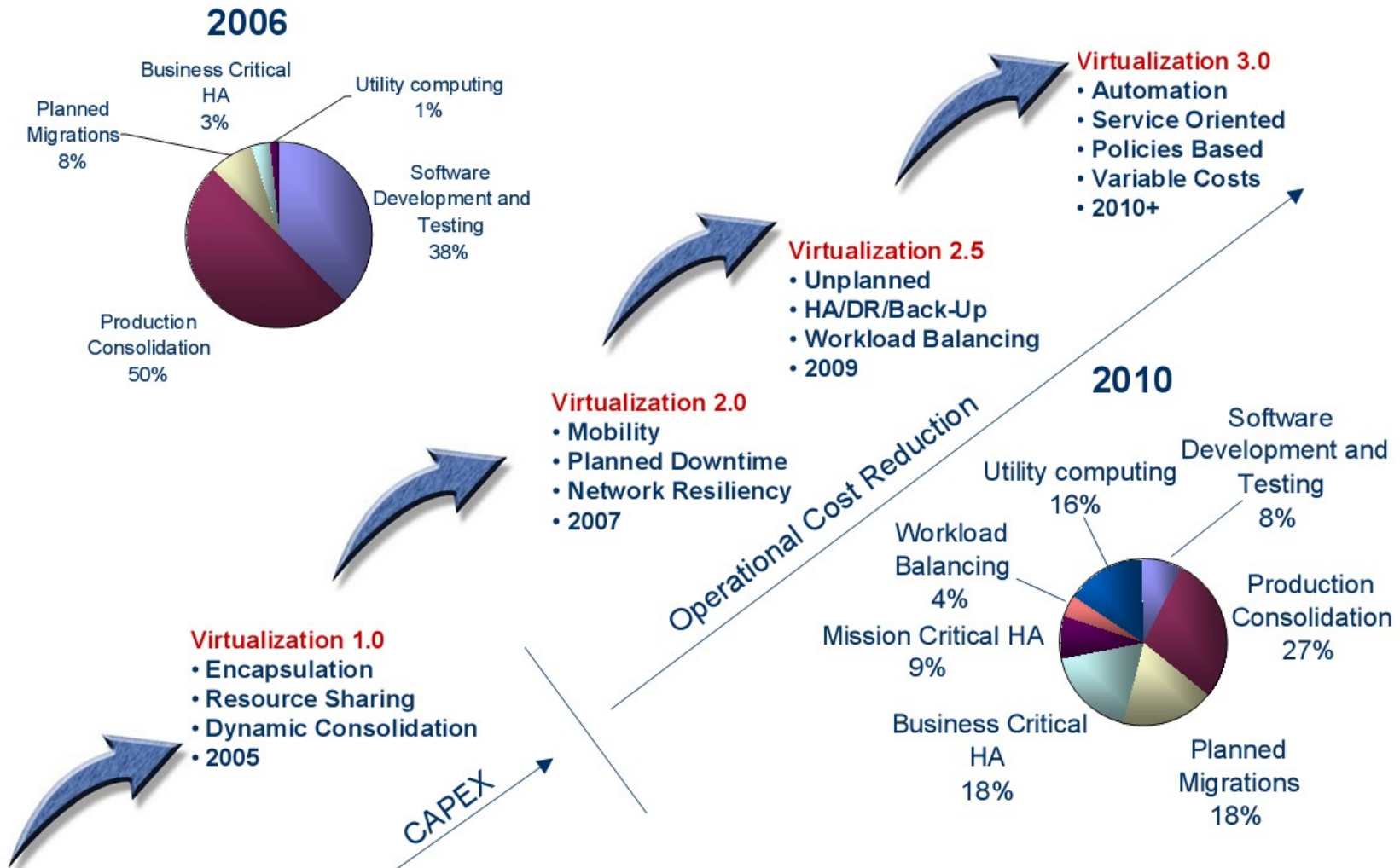




# Western Europe Virtualized Server Unit Shipment Forecast, 2006-2011



# The Next Virtualization Milestones





# Infrastructure maturity model

Gartner

	<b>Basic</b> <i>Uncoordinated infrastructure</i>	<b>Standardized</b> <i>Standard resources, configurations</i>	<b>Rationalized</b> <i>Consolidate to fewer</i>	<b>Virtualized</b> <i>Infrastructure resources pooled</i>	<b>Service-Based</b> <i>Services managed holistically</i>	<b>Policy/Value-Based</b> <i>Dynamic optimization to meet SLAs</i>
<b>Objective</b>	<i>React</i>	<i>Reduce complexity</i>	<i>Economies of scale</i>	<i>Flexibility, reduce costs</i>	<i>Service-level delivery</i>	<i>Business agility</i>
<b>Ability to Change</b>	Months to weeks	Weeks	Weeks to days	Weeks to minutes	Minutes	Minutes to seconds
<b>Pricing Scheme</b>	None, ad hoc	Fixed costs	Reduced, fixed costs	Fixed shared costs	Variable usage costs	Variable business costs
<b>Business Interface</b>	No SLAs	Class-of-service SLAs	Class-of-service SLAs	Flexible SLAs	End-to-end SLAs	Business SLAs
<b>Resource Use</b>	Unknown	Known	Rationalized	Shared pools	Service-based pools	Policy-based sharing
<b>Organization</b>	None	Central control	Consolidated	Pooled ownership	Service-oriented	Business-oriented
<b>IT Management Processes</b>	<b>Chaotic – Reactive</b> Ad hoc	<b>Reactive – Proactive</b> Life cycle management	<b>Proactive</b> Mature problem mgmt.	<b>Proactive</b> Prediction, dynamic capacity	<b>Service</b> End-to-end service management	<b>Value</b> Policy management



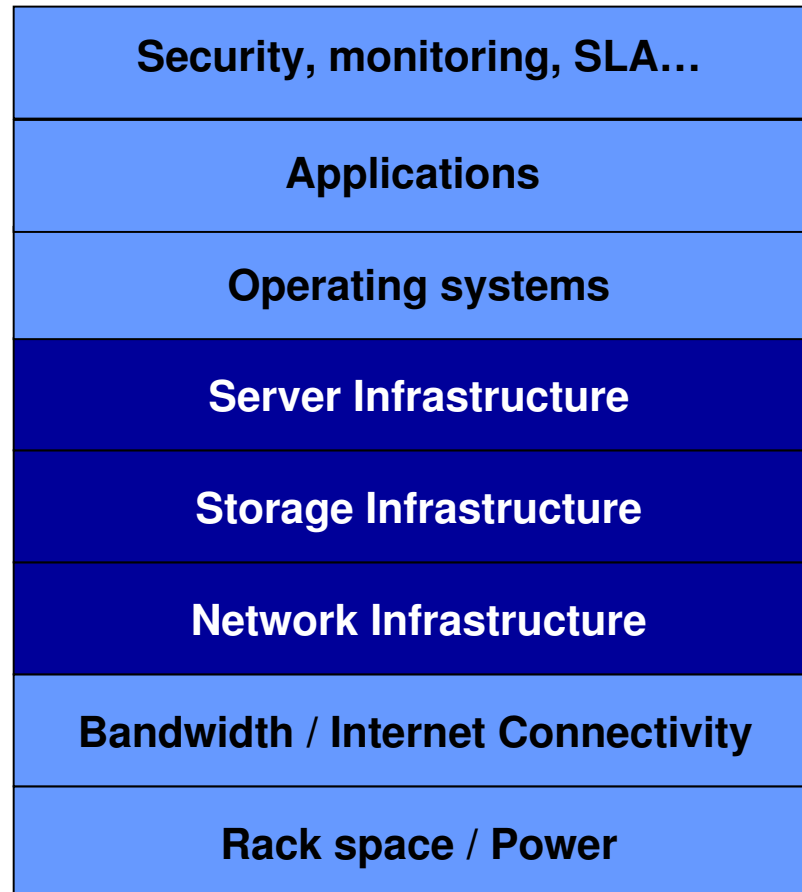
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# My management tool wishlist





## Manage the whole stack





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# Automation





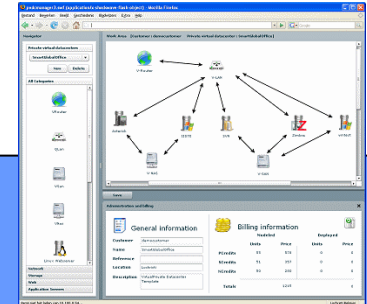
## Automation

- Full automation comprises:
  - Server provisioning
  - Network provisioning (VLAN's, IP's...)
  - Storage provisioning
  - Configuration of firewall, monitoring, backup...
  - Billing
- Benefits:
  - Full online sales possible
  - No human errors
  - Instant availability for customer
  - Reduce TCO

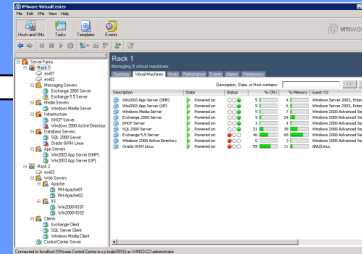


## Levels of abstraction

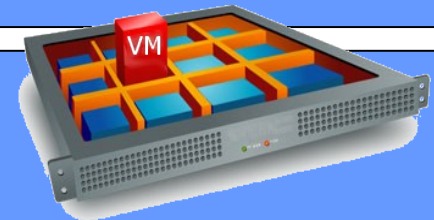
**Datacenter virtualization**



**Management tools across environments:  
VMWare VirtualCenter...**



**Virtual servers:  
VMWare ESX, XenSource, VirtualBox...**



**Hardware**



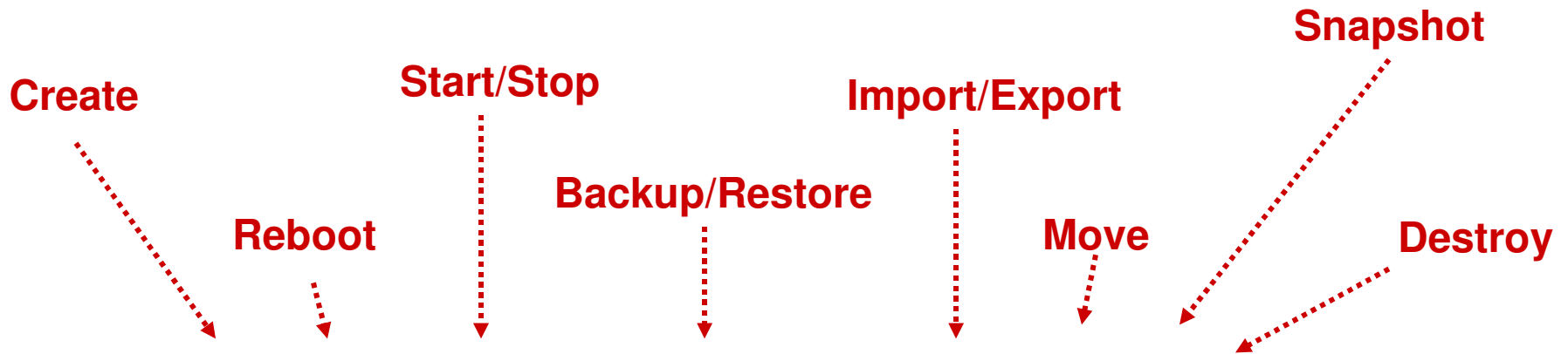


## What is datacenter virtualization ?

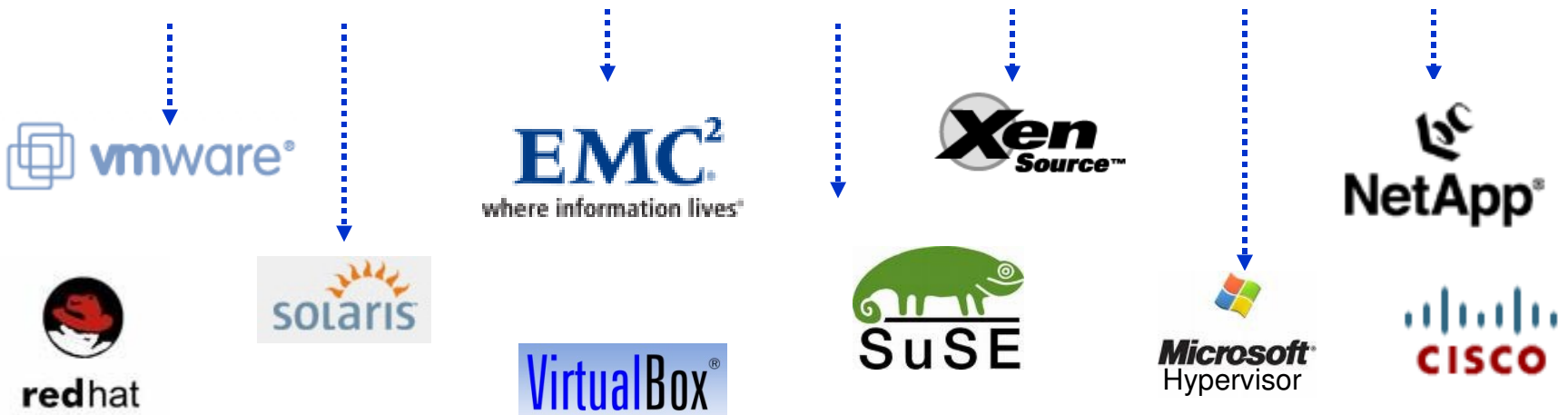
- Uniform management of one or more datacenters
  - Support for all hypervisors
  - Support for physical (non virtual) servers
- Full automation
  - Automated provisioning of servers
  - Automated network configuration
  - Automated storage provisioning
  - “Lights off” in the datacenter
- Translate a complex environment to easy to understand parameters



## Uniform management



### Datacenter Virtualization





## Components of “datacenter virtualization”

- Server, network and storage virtualization
- Workflow engine
- Policy engine
- Agent framework
- A datacenter model



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# Power reduction





## Power consumption facts

- In 2009, energy costs will emerge as the second-highest operating cost in 70% of worldwide data center facilities
- Servers account for 40% of the data center's overall power consumption. Storage isn't far behind, taking 37% of the overall power

Michael Bell, VP at Gartner

- All power consumed requires at least the same amount in cooling



## Power reduction: DC instead of AC



**A-Server “Datacenter in a rack”**



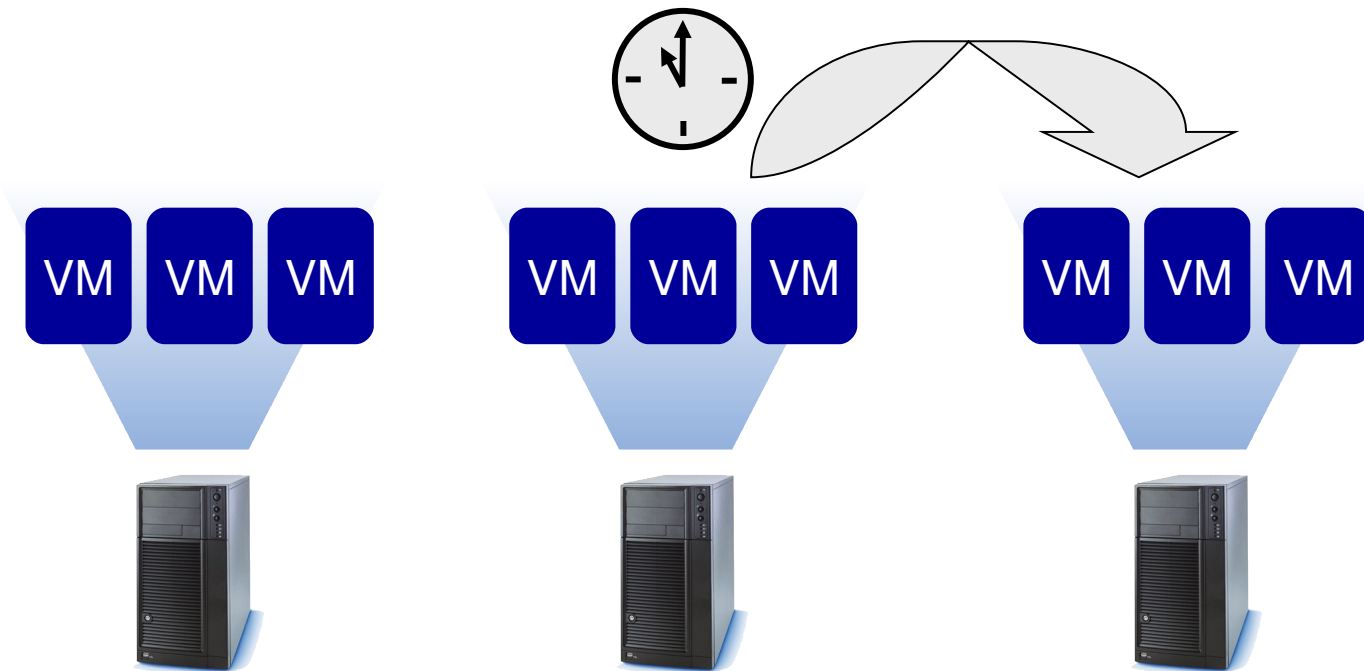
## Storage and power reduction

Energy tradeoffs	
<i>Tradeoff</i>	<i>Implication</i>
<b>Energy efficiency vs. performance</b>	More spindles boost performance but use more energy
<b>Density vs. cooling efficiency</b>	Cooling efficiency requires less density but wastes rack and floor space
<b>High vs. low disk speed</b>	Faster disks increase performance but burn more energy
<b>Online vs. offline (tape-based) data</b>	Online data is much more readily available but burns more energy
<b>Energy vs. capacity</b>	Small form-factor disks use less energy but require more spindles to achieve high capacity



## Software to reduce power

- Optimized capacity planning
- Consolidate VM's at night to less physical servers







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# License reporting





## Licensing of operating systems

- Choosing the right hypervisor may depend on licensing policies
- Example: Redhat Enterprise is free for all VM's (guests) running on a Redhad Enterprise host
- Same to be expected from Microsoft SPLA and others
- You cannot rely on just one hypervisor to support all projects or customers



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# Chargeback





## Chargeback

- Virtual environment is every changing
- Not easy to keep track of usage for billing
  
- Solution: concept of “credits”
  - Processing credits
    - combines CPU & memory usage
  - Network credits
    - Bandwidth
    - Firewall usage
    - ...
  - Storage credits
    - 3 levels of performance: archive, normal, ultra fast



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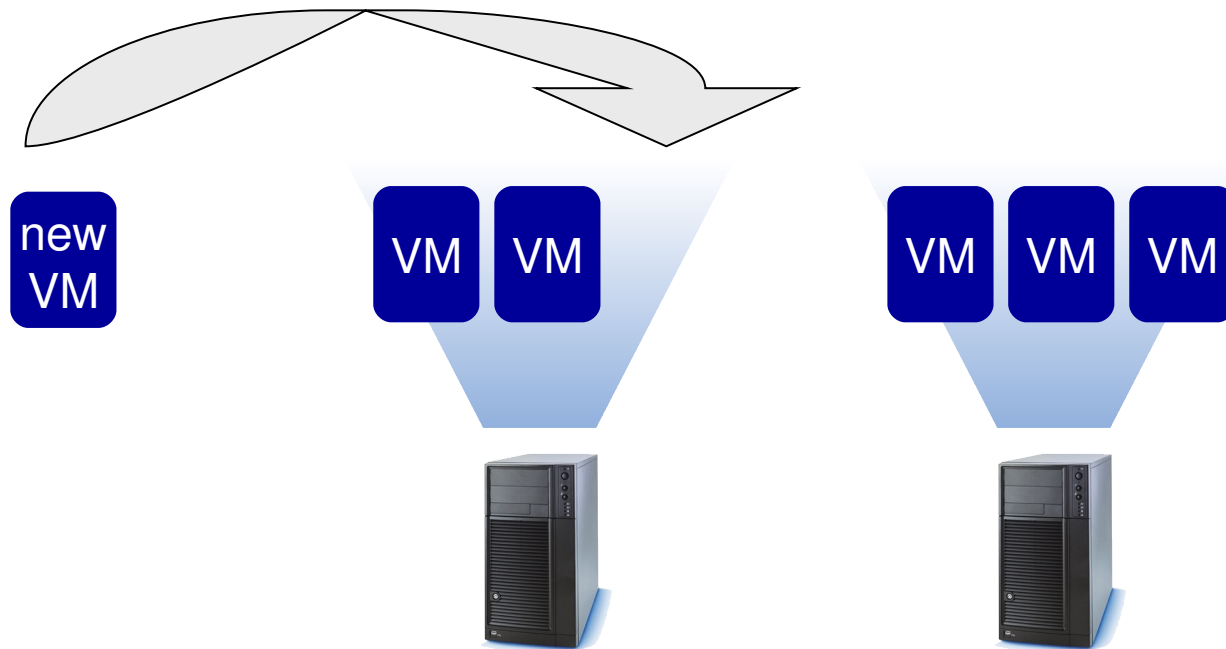
# Capacity planning





## Capacity planning

- Select optimal physical server for new VM
- Support for multiple “tiers”, e.g. test & live environment
- Ability to change business logic
- Reporting on available resources





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# Live migration, load balancing & failover





## Live migration, load balancing & failover

- Live migration: tool for planned maintenance
- Load balancing: automatically move VM's if load on physical server too high
- Failover: boot VM on other physical server when server dies





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# Virtual private datacenter





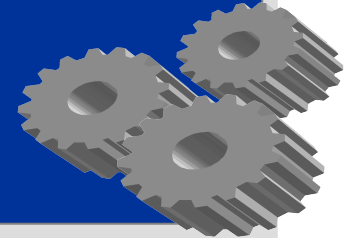
## Self-service provisioning

### Resource description

- Operating system: Windows, Linux, NAS...
- Processing capacity: 1 Ghz, 2 Ghz, 4 Ghz...
- Memory capacity: 500 MB, 1 GB, 2 GB...
- Storage capacity: 100 GB, 1TB, 10 TB...
- Storage performance: normal, fast, ultrafast...
- Redundancy level: single, raid, HA...



### Datacenter virtualization



Enterprise  
business unit  
manager



Service provider  
end-customer



## Demo

pydcmanager3.swf (application/x-shockwave-flash-object) - Mozilla Firefox

Bestand Beveiligen Beeld Geschiedenis Bladvoters Extra Help

Work Area [Customer: democustomer Private virtual datacenter: SmartGlobalOffice]

Navigator

Private virtual datacenters

SmartGlobalOffice

New Delete

All Categories

- VRouter
- QLan
- VSan
- VMac
- Linux Webserver

Network

Storage

Web

Application Servers

V-Router

V-LAN

Asterisk

11570

V-NAS

V-SAN

Zimbra

wintest

Save

Administration and billing

General information

Customer: democustomer

Name: SmartGlobalOffice

Reference:

Location: Lodwisti

Description: VirtualPrivate Datacenter Template

Billing information

	Modeled		Deployed	
	Units	Price	Units	Price
PCredits	55	570	0	0
SCredits	91	357	0	0
NCredits	50	280	0	0
<b>Totals</b>		<b>1215</b>		<b>0</b>

Bezig met het laden van 10.100.0.54...

Lochrsti Belgium



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# Conclusion





## Conclusion

- Hypervisors are commodity
  - Choose the right hypervisor for each server or project
  - There will be licensing impact
  - You will need multiple hypervisors
  - Avoid “lock-in”
- Every layer is equally important
  - Virtualize servers, but also storage and network
  - Automation is the key to scalability
  - Automation allows for better uptime and reduces TCO !
- Model the datacenter
  - Keep track of all resources
  - You can no longer “follow the network cable” or count the servers in your rack !



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## Thank you !

Questions or remarks ?  
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