Distributed Virtualization for Net-Centric Operations Draft

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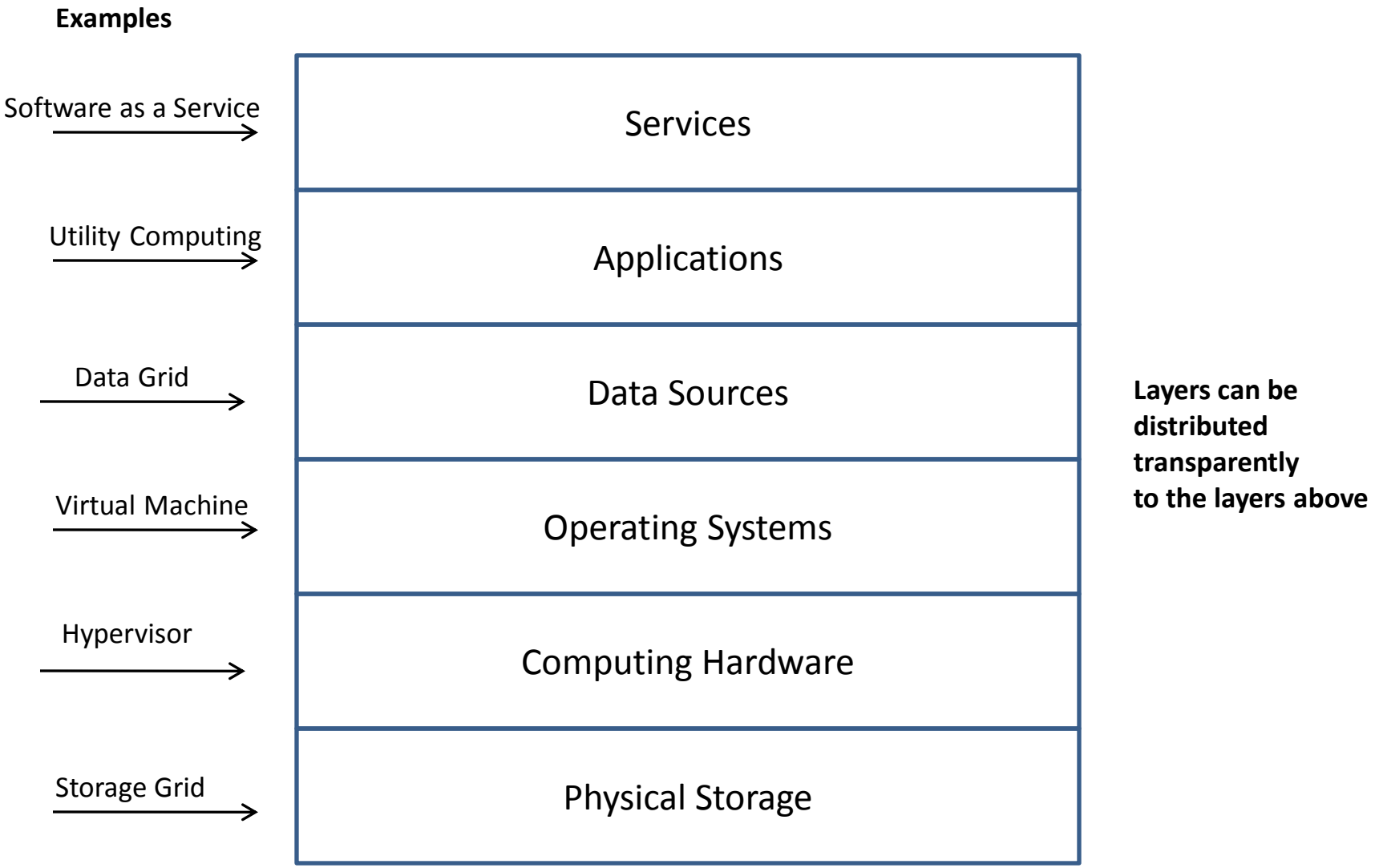
Definitions

Distributed Virtualization is the transparent sharing of distributed resources by multiple clients.

Transparent sharing means clients are not directly aware of each other and the underlying physical resources

Virtualization Layers

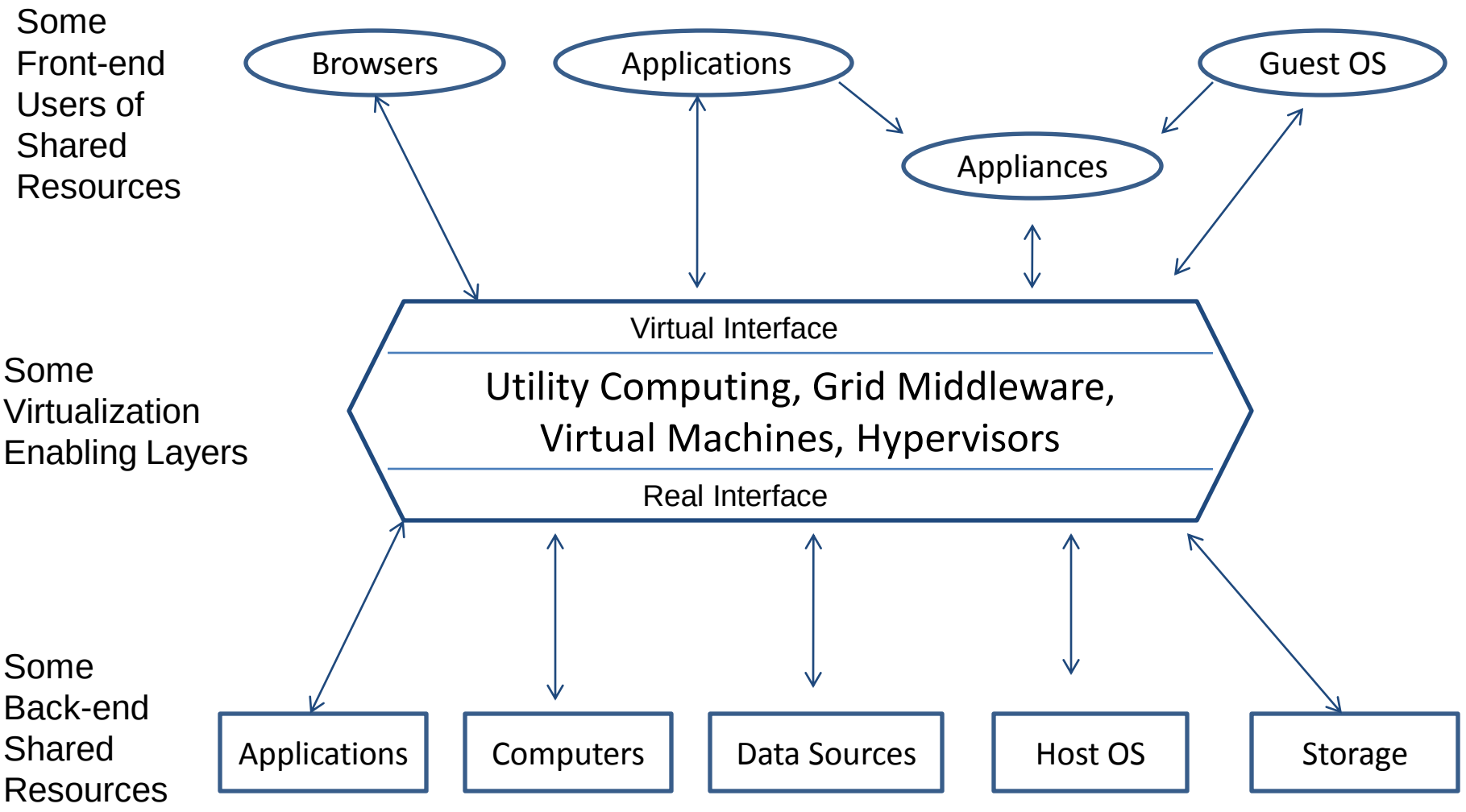
Virtualization enables access at any layer while hiding the layers below



Virtualization Alternatives

- 1. Software as a Service
- 2. Utility Computing
- 3. Computational Grids
- 4. Transaction Grids
- 5. Data Grids
- 6. Storage Grid or Utility
- 7. Application Virtualization
- 8. Virtual Server
- 9. Virtual Machine Monitor (Hypervisor)
- 10. Virtual Appliance

Generic Virtualization



Virtualization Alternatives

Alternative	Shared Resource	Resource Users	Enabling Layer
Software as a Service	Application accessed as Web Services	Web clients paying per use	Multi-tenant architectures
Utility Computing (On Demand, Cloud)	Distributed data center software and hardware	Multiple clients renting resources	Distributed resource and workload managers
Computational Grids	Computers across locations or organizations	Multiple groups sharing computing resources	Grid middleware
Transaction Grids (Fabrics)	Hardware and software within an organization	Enterprise applications	Fabric middleware
Data Grids	Data sources across locations or organizations	Multiple groups creating a shared data capability	Data source resource broker
Storage Grids or Utilities	Storage hardware	Multiple applications and databases	Storage broker
Application Virtualization	Execution environment	Processes	Run-time support
Virtual Server	OS and CPU	Applications running in multiple partitions	Virtual server support
Virtual Machine Monitor	CPU	Multiple OS running on CPU	Hypervisor possibly with CPU support
Virtual Appliance	CPU	Bundled application, OS, database	Application virtualization Packaging and run-time

Horizontal and Vertical Virtualization

- Horizontal Virtualization is virtualization across distributed back-end resources
  - Software as a Service
  - Utility Computing
  - Grids
- Vertical Virtualization is virtualization across architectural layers
  - Virtual Machines
  - Hypervisors
  - Virtual Appliances
- There are a need for additional standards in both horizontal and vertical virtualization
- A key question is the integration of horizontal and vertical virtualization capabilities (e.g. virtual appliances and grids)

Horizontal Virtualization Alternatives

- Software as a service makes applications available in a remote data center through a service-based interfaces available to multiple external organizations
- Utility computing makes resources that are managed by a single organization available to multiple external organizations
- Grid computing combines distributed resources from multiple organizations into a shared resource
  - Computational
  - Transaction
  - Data
  - Storage

1. Software as a Service (SaaS)

- Description – Shared access to applications as remote services by different organizations
- Suppliers
  - Salesforce.com
  - Netsuite
  - Webex
  - http://saas-showplace.com/
- Benefits – Reduced cost for software and infrastructure
- Issues – Security across multiple uses

2. Utility Computing (Cloud)

- Description - Distributed data center resources made available as necessary.
- Suppliers
  - Amazon (Elastic Computing Cloud, Simple Storage Service)
  - IBM Distributed Computing Capacity On Demand
  - Sun Grid Compute Utility
  - HP Managed Capacity
  - Cisco Vframe Server Fabric Virtualization
  - Apache Hadoop
- Benefits – Reduced infrastructure cost
- Issues – Accounting, Resource management

3. Computational Grids

- Definition – Transparent sharing of computational server resources among multiple groups across or within an enterprise
- Suppliers
  - Univa UD
  - Globus Alliance
  - Platform
  - Data Synapse
- Benefits – Reduced cost of infrastructure
- Issues – Cross-organization management

4. Transactional Grids and Utilities

- Definition – Sharing distributed hardware and software platform resources to support high performance transactional applications
- Suppliers
  - Appistry
  - Gigaspaces
  - Paremus
- Benefits – Reduced cost for transactional capabilities
- Issues – Lack of standards

5. Data Grid and Utilities

- Definition – Transparent sharing of data servers among multiple applications across multiple groups or within an enterprise
- Suppliers
  - IBM WebSphere Extended Deployment Data Grid
  - UCSD storage resource broker
- Benefits – Easier access to distributed data
- Issues - Maintenance of metadata and data consistency lities

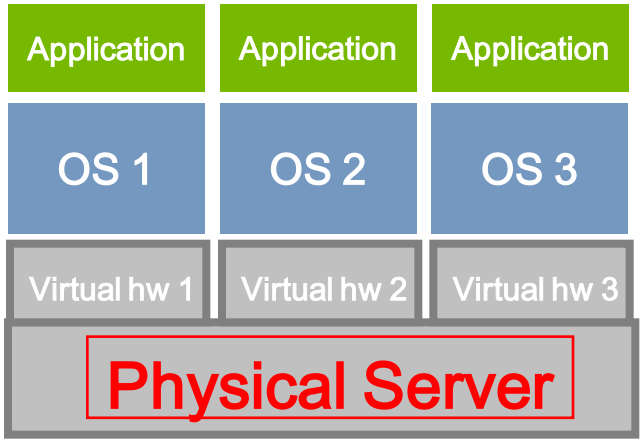
6 Storage Grids and Utilities

- Definition – Transparent sharing of distributed physical storage devices by multiple clients.
- Suppliers
  - Amazon C3 (Storage utility)
  - VMWare Storage Vmotion
- Benefits – Reduced infrastructure costs
- Issues - Performance

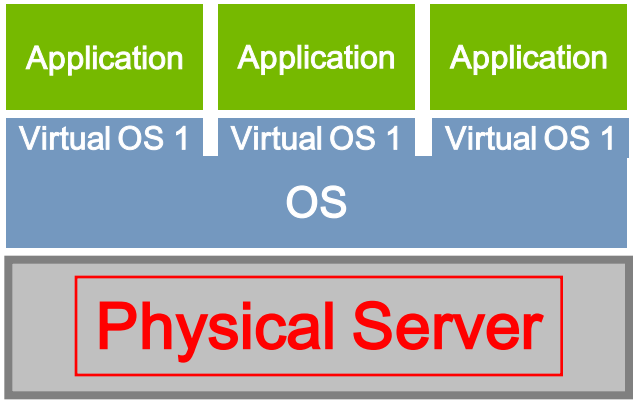
Vertical Virtualization Alternatives

- Type 1 Virtual Machine Monitor - Hypervisor running directly on top of a CPU providing an environment for guest operating systems
- Type 2 Virtual Machine Monitor - Hypervisor running on top of a host operating system providing an environment for guest operating systems
- Application Virtualization - Controlled environment for running applications
- Virtual Appliance - Pre-configured bundling of application and operating system capabilities into a module that can run on a virtual machine. Provides a means of rapidly deploying applications using OVF standard.

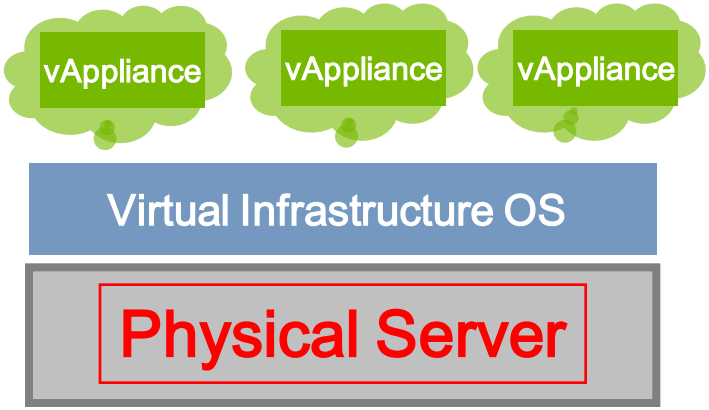
Vertical Virtualization Alternatives Diagrams



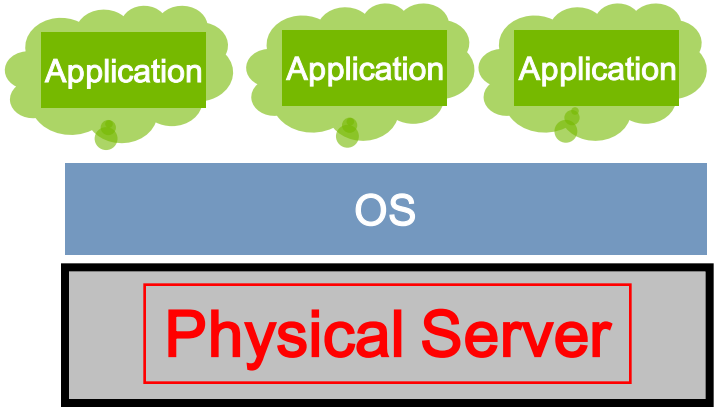
HW Virtualization (today)



OS Virtualization



HW Virtualization (tomorrow)



Application Virtualization

From http://it20.info/files/3/documentation/entry54.asp

7. Virtual Machine Monitor within Host OS

- Definition – Virtual machine capabilities built on top of a specific operating system. Can be used to partition resources or to host guest operating systems.
- Suppliers
  - VMWare Virtual Machine Server
  - Microsoft Virtual Server (Viridian)
  - SWSoft Virtuozzo
  - Sun Solaris Container
  - IBM Virtual I/O Server
- Benefits – Better utilization for resources
- Issues - Performance

8. Virtual Machine Monitor (Hypervisor) on CPU

- Definition - Virtual machine capabilities built on top of a CPU not requiring a host operating system
- Suppliers
  - VMWare ESX Server
  - XenSource (Citrix)
  - IBM Advanced Power Virtualization
  - Virtual Iron
- Benefits – Better utilization of resources
- Issues - Functionality

9. Application Virtualization

- Definition - Platform (CPU, OS) independent environment for running applications
- Suppliers
  - Java Virtual Machine
  - Microsoft CLR
  - Microsoft SoftGrid
- Benefits - Portability
- Issues – Performance

10. Virtual Appliances

- Definition - Pre-configured bundling of application and operating system capabilities into a module that can run on a virtual machine. Provides a means of rapidly deploying applications for utility computing using OVF standard
- Suppliers
  - VMWare Virtual Appliance
  - Amazon Machine Images
  - rPath rBuilder and Appliance Platform
- Benefits - Ease of deployment
- Issues – Managing evolving interdependencies across multiple appliances and physical environments

Transparent Virtual Component Migration

- Definition – Ability to move virtual machines and virtual appliances across physical machines while maintaining continuous operations
- Suppliers
  - VMWare VMotion
  - IBM Live Partition and Live Application Mobility
  - Microsoft SoftGrid
  - Citrix Ardence Desktop and Provisioning Server for Data Centers
- Benefits - High availability
- Issues – Migration across heterogeneous platforms

Distributed Virtualization = Horizontal + Vertical

- This combination enables the secure rapid deployment of applications in a distributed heterogeneous environment for net-centric operations
- It will be necessary to create standard representations to support the configuration of a network of virtual appliances and machines to enable utility computing and grids
- Distributed Management Task Force's (DMTF) Open Virtual Machine Format (OVF) provides a portable standard for describing virtual appliances
- OVF is an open, secure, portable, efficient and extensible format for the packaging and distribution of virtual machines and appliances
- The next few years will see extensive development of distributed virtualization architectures

Backup Slides:
Gartner 14 Delivery Models for IT

From: http://www.baselinemag.com/article2/0,1540,2213439,00.asp

"Virtualization technologies can improve IT resource utilization and increase flexibility. However, by themselves, virtualization technologies are simply infrastructure improvement enablers. With the addition of automation technologies—with service-level, policy-based active management—resource efficiency can improve dramatically, flexibility can become automatic based on requirements and services can be managed holistically, ensuring high levels of resiliency"

Source: Gartner -- Presented at Gartner Symposium/ITxpo Oct. 12 in Orlando.

Gartner Alternative Strategies (1)

- **Software as a Service (SaaS):** software that is owned, delivered and managed remotely by a provider.
- **Web platforms:** Web 2.0 applications that take advantage of service-oriented architecture to access multiple kinds of services through the Web.
- **Community source:** shares elements from the open-source community, but is its own trend in that users coordinate the work of user IT organizations that have common requirements to solve business problems.
- **Software streaming:** solutions that do not use persistent storage to cache applications and data.
- **Software-based "appliances" (SBAs):** separate application and operating system logic from the underlying hardware.
- **User-owned devices:** devices owned and managed by employees responsible for providing technology to complete job-related tasks
- **Remote management services:** outsourced operations and management capabilities offered over a networked infrastructure.

Gartner Alternative Strategies (2)

- **Business process utilities (BPUs):** outsourced business process services based on standardized processes and a unified, one-to-many platform.
- **Infrastructure utilities (IUs):** shared IT infrastructure architectures offered on-demand and priced-on-service usage.
- **Storage as a Service:** storage capacity offered on a usage basis.
- **Grid computing:** a collection of computing resources with multiple owners coordinated to address a common problem.
- **Communications as a Service (CaaS):** a multiyear, annuity-based offering that bundles vendor-owned, managed and co-located communication applications with connectivity and IT services.
- **Utility computing**: the use of server virtualization, dynamic provisioning and dynamic workload management to provide transparent services to users.
- **Capacity on demand**: the availability of inactive components—processors, memory and input/output adapters—in systems that can be activated rapidly.