2. Virtualization technology

Virtualization Status

- Offerings from many companies
  - ✓ e.g. VMware, Microsoft, Sun, ...

- Hardware support
  - ✓ Fits well with the move to 64 bit (very large memories) multi-core (concurrency) processors
  - ✓ Intel VT (Virtualization Technology) provides hardware to support the Virtual Machine Monitor layer

➡ Virtualization is now a well-established technology

Objectives of Virtualization

user

End user

Applications

Web services

Standard Interface(I/O)

Resource transparency

Open API for Service Access

SLA supported Resource Provisioning

Logical Resource

Virt. Layer

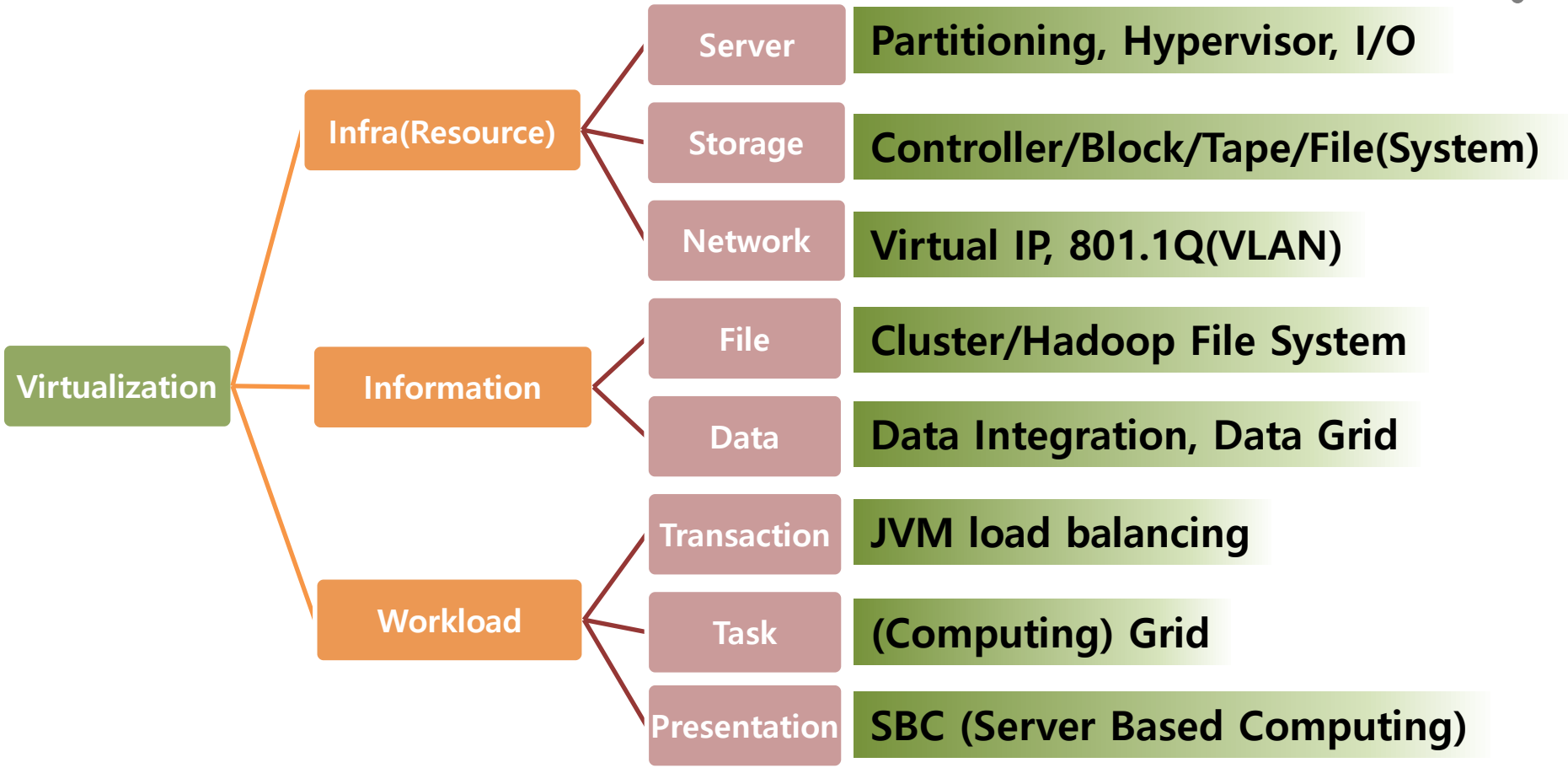
Physical Resource

Server

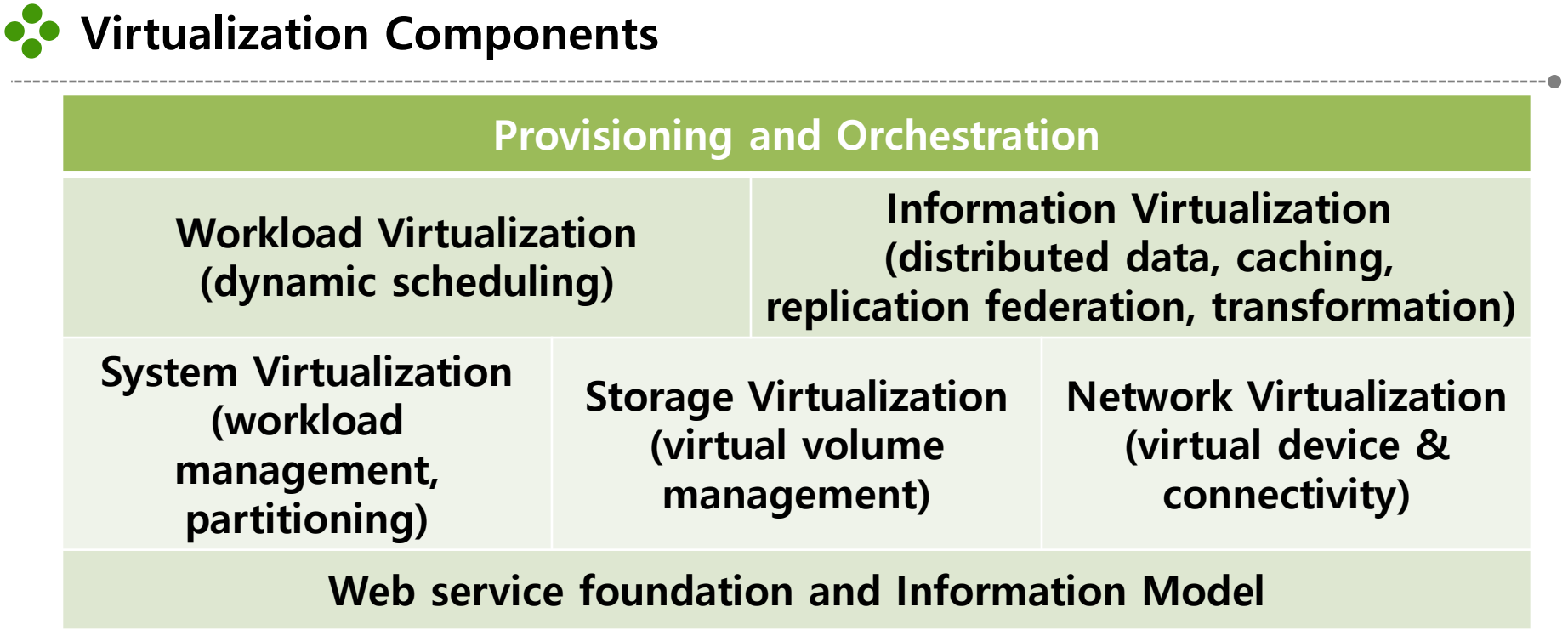
Disk

Network

Scope of Virtualization

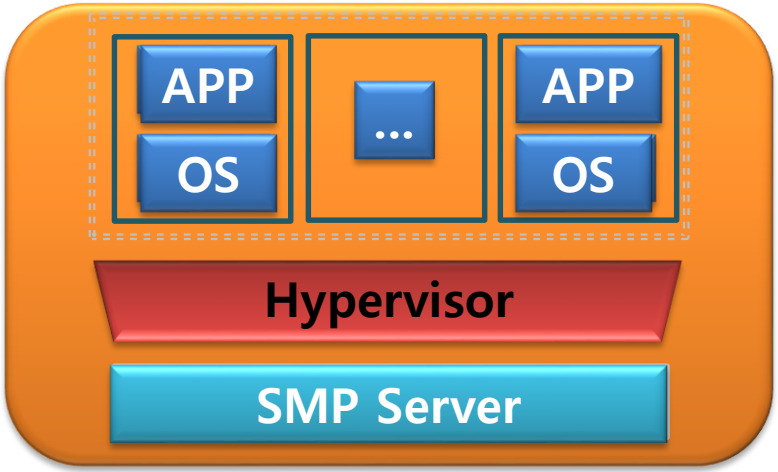


Virtualization Components



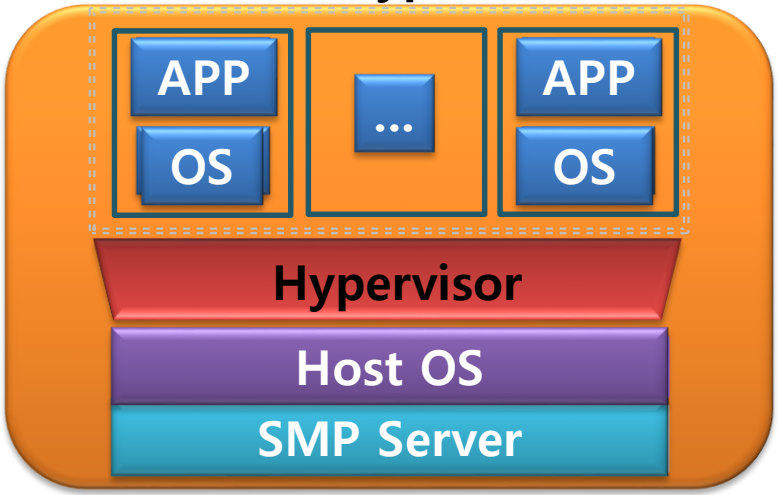
Hypervisor

Bare-Metal Hypervisor



- Hypervisor itself handles all resource management functions
  - System zPR/SM™, z/VM
  - ✓ POWER™ Hypervisor
  - ✓ Vmware ESX Server
  - ✓ Xen Hypervisor
  - ✓

Hosted Hypervisor



- Hypervisor uses HOST OS Functions
  - Vmware Workstation
  - Microsoft Virtual Server
  - ✓ HP Integrity VM
  - ✓ User Mode Linux
  - ✓
  - ✓

Virtualization Scenarios

- Hardware Virtualization
- Software Virtualization
  - ✓ Full Virtualization
  - ✓ Para-Virtualization

Full-Virtualization

- Traditional VMMs provide full-virtualization:
  - ✓ The functionally provided is identical to the underlying physical hardware
  - ✓ The functionality is exposed to the VMs
  - ✓ They allow unmodified guest OSs to execute on the VMs
  - ✓ This might result in some performance degradation

- E.g., *VMWare* provides full virtualization

Para-Virtualization

- Other types of VMMs provide para-virtualization:
  - ✓ They provide a virtual hardware abstraction that is *similar, but not identical* to the real hardware
  - ✓ They modify the guest OS to cooperate with the VMM
  - ✓ They result in lower overhead leading to better performance
  - ✓ E.g., *Xen* provides both para-virtualization as well as full-virtualization

Core Technology

The Hypervisor: HW Virtualization

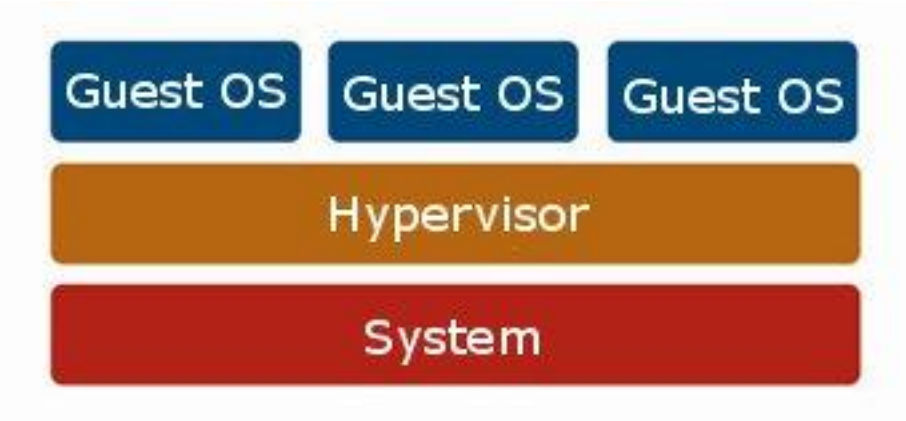
- ✓ A computing layer which allows multiple operating systems to run on a host computer at the same time
- ✓ Originally developed in the 1970s as part of the IBM S/360
- ✓ Many modern day variants from different developers

The Hypervisor

- Conceptual diagram of typical server configuration without virtualization

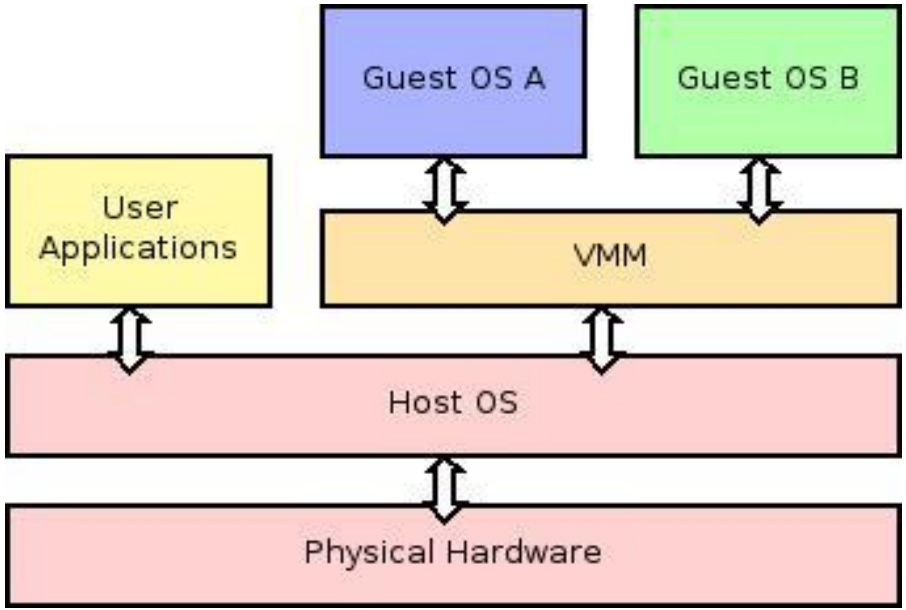
The Hypervisor

- The role of the Hypervisor in supporting Guest Operating Systems on a single machine



Software Virtualization (example)

- VMware Server (GSX)



http://openlab-mu-internal.web.cern.ch/openlab-mu-internal/openlab-II_Projects/Platform_Competence_Centre/Virtualization/Virtualization.asp

2. Marketplace offerings

Marketplace Offerings

Freely Available

- ✓ OpenVZ (Open Source)
- ✓ VMWare Server (GSX)
- ✓ Xen 3.0 (Open Source)

Commercial

- ✓ Virtuozzo
- ✓ VMWare ESX
- ✓ Xen Enterprise
- ✓ Microsoft Virtual Server
- ✓ Virtual Iron

OpenVZ

- Maintained by SWsoft, Inc (http://www.swsoft.com/)
  - ✓ Branch from their commercial Virtuozzo product
- Supports 64-Bit Guest Operating Systems
- Linux only, Open Source Product
- $ - Free
- http://openvz.org/

VMWare Server (formerly GSX)

- Maintained by VMWare (http://www.vmware.com/)
  - ✓ Est. 1999 - More mature than many competitors
- Supports 64-Bit Guest Operating Systems
- Some limitations for clustering and HA imposed by vendor
- Windows and Linux Host/Guest OS Support
- $ - Free

http://www.vmware.com/products/gsx/

http://www.vmware.com/products/server_comp.html

Xen 3.0

- Available from Xen Source (http://www.xensource.com)
- In association with University of Cambridge (http://www.cl.cam.ac.uk/Research/SRG/netos/xen/)
- Support for 64-Bit and 32-way machines
- Supports IntelVT
- Linux support only, Windows expected later this year
- Open Source Product – One of the most actively maintained projects in the open source community
- $ - Free

VMWare ESX Server

- Maintained by VMWare (http://www.vmware.com/)
- Supports 64-Bit Guest Operating Systems
- Advanced clustering and high availability features
- Windows and Linux Guest OS Support
- Advance management tools
- Low-overhead Hypervisor base installation
- Packages ranging from $10-$25k and beyond
- http://www.vmware.com/products/esx/

Virtual Server Enterprise Edition

- By Microsoft
- Support for 64-bit and 32-way machines
- Linux and Windows support for Guest OS's
- $ - Licensing varies. One listing found for $594.29 - $1,069.58, not including extra Windows licenses for Guest OS's

Next Steps at ITE

- Complete testing and functionality assessments
- Finalize architecture plans
- Proceed with recommendations for implementation

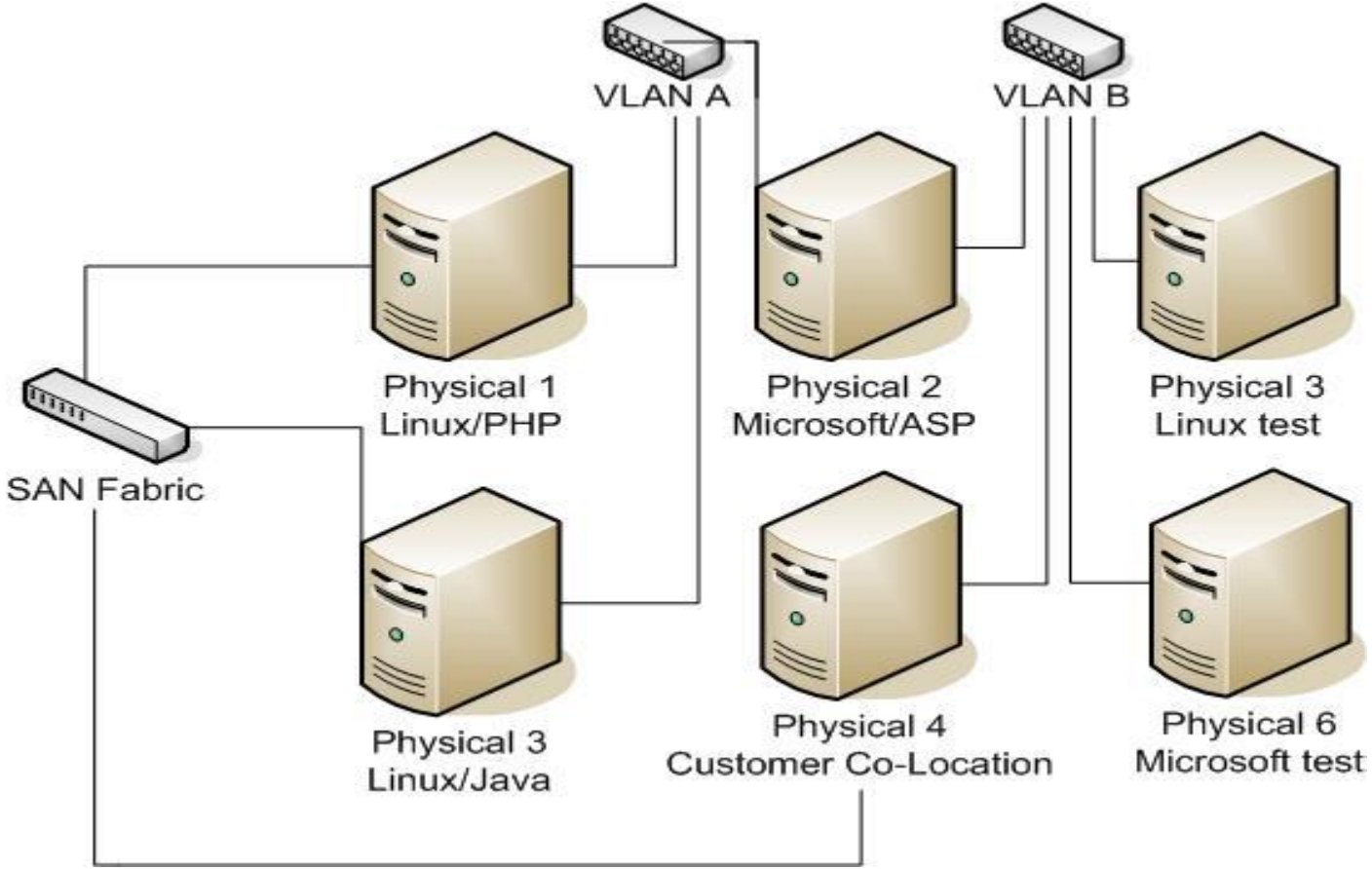
ITE Web Services Test Plan

- Installation and configuration
  - ✓ OpenVZ
  - ✓ VMWare
  - ✓ Xen
- To date, we have installations running OpenVZ and Xen for testing purposes

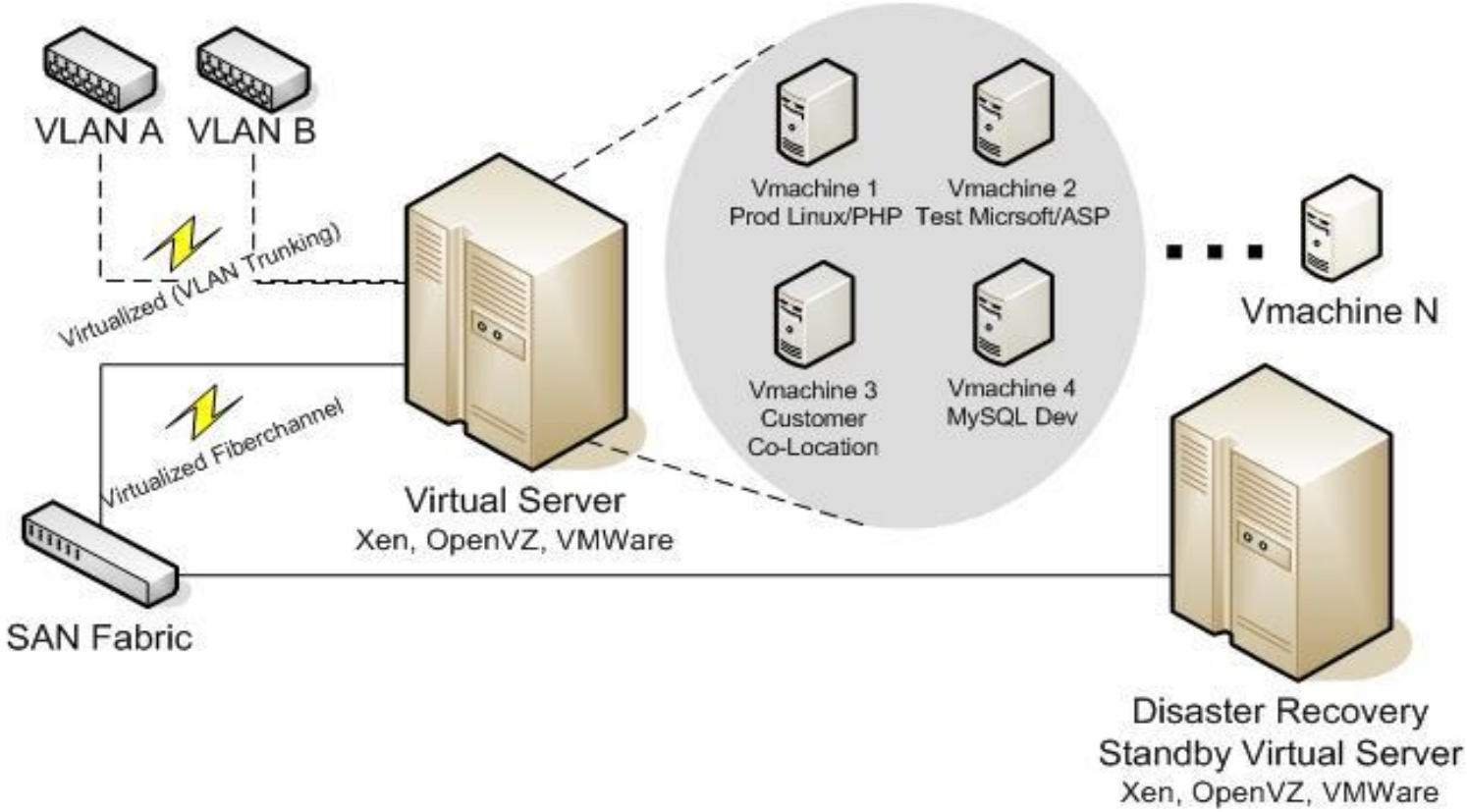
ITE Web Services Test Plan

- Ability to start/stop partitions
- Ability to copy and replicate partitions
- Assess functionality of required software installations (Apache, JBoss, PHP, etc)
- Performance testing – hdparm, Apache JMeter, etc

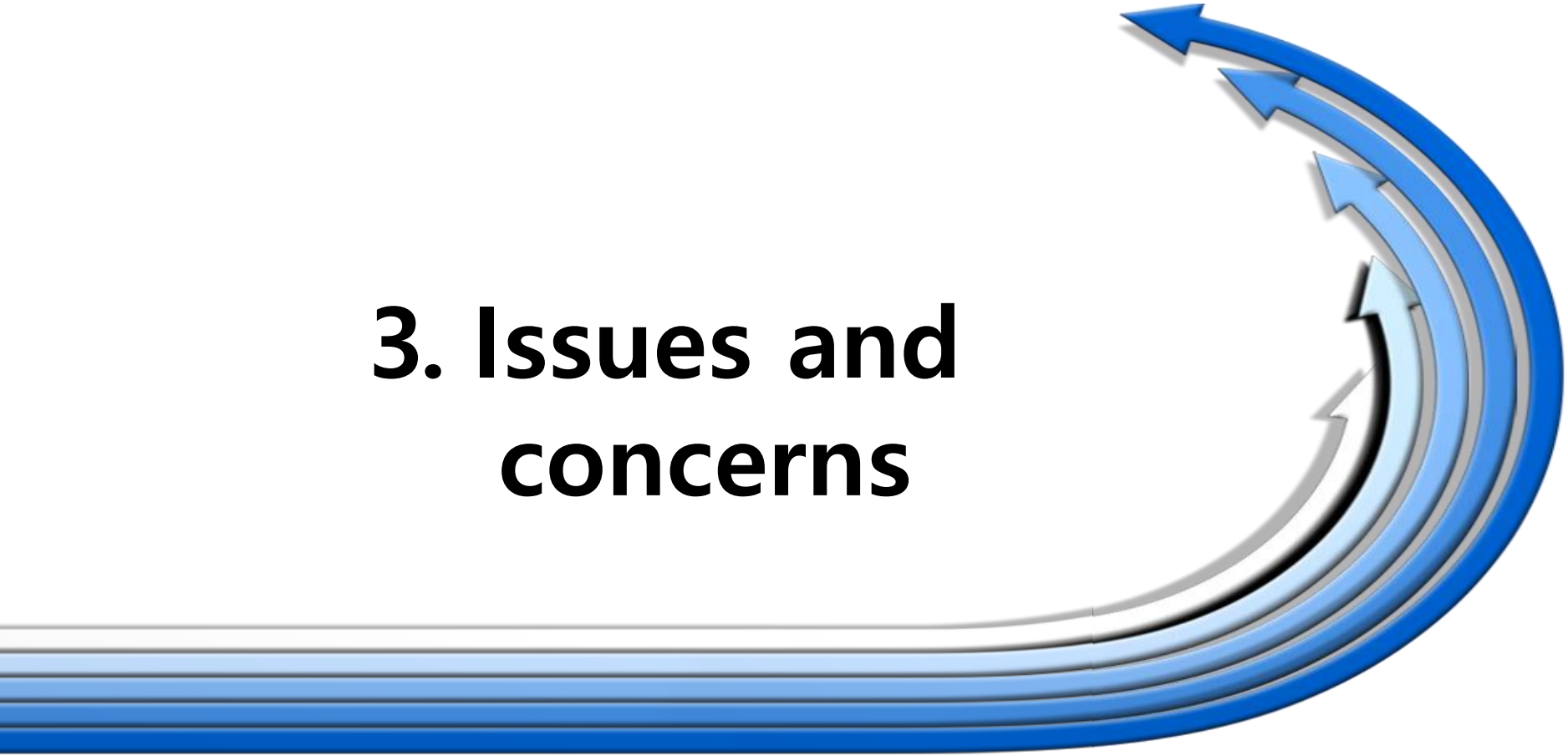
Current Architecture



Virtualized Architecture



3. Issues and concerns



Issues and concerns

- Supportability of Microsoft Server products running as Guest Operating Systems on a non-certified virtualization engine

- Managing load on virtualized systems can be more art than science