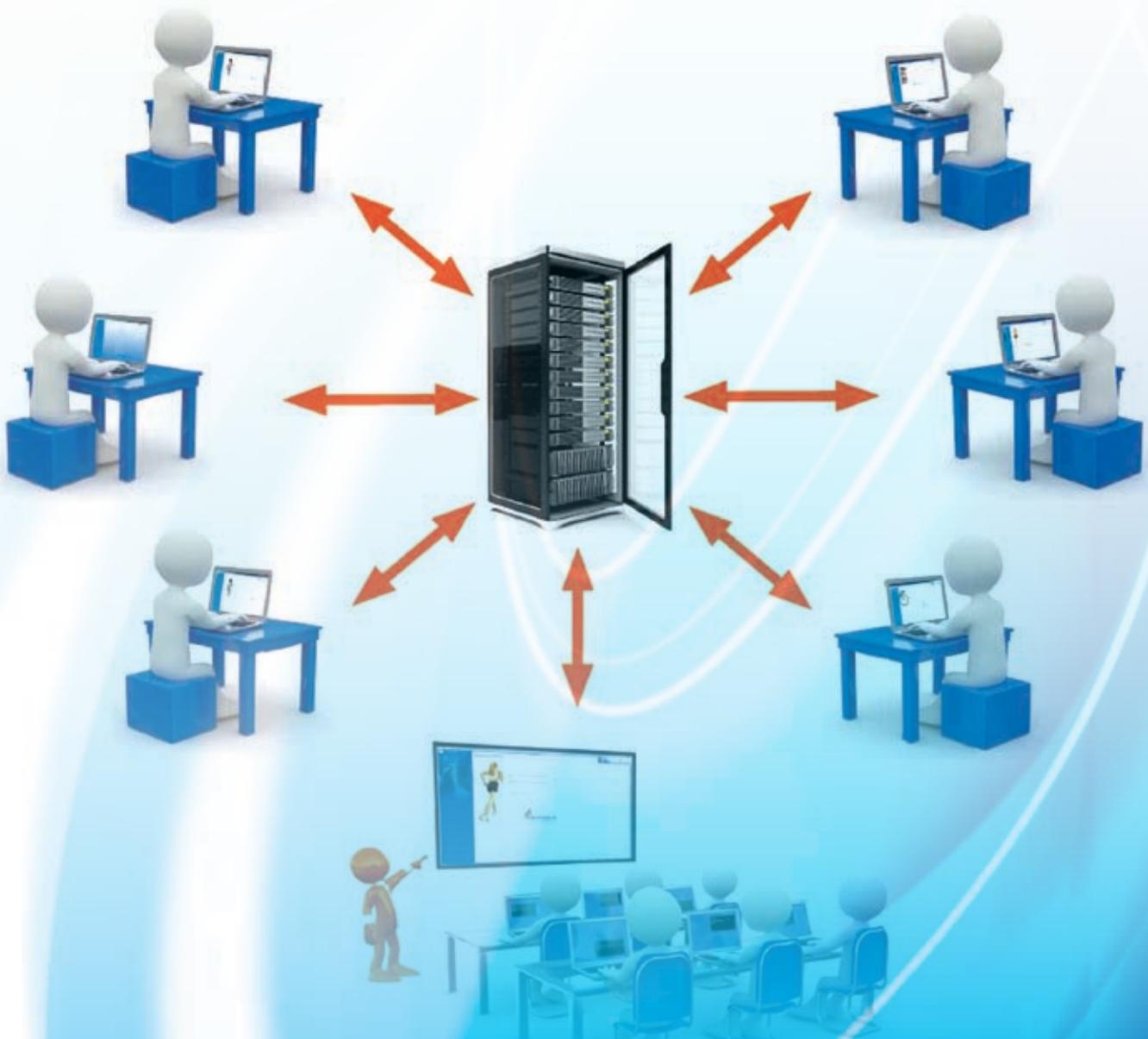




National Computer Board

GUIDELINE on **SERVER CONSOLIDATION** and **VIRTUALISATION**



INTRODUCTION

There is an ever increasing need for both organisations and individuals to consider reducing their Carbon footprint. In this time of recession, organisations worldwide are under pressure to become more efficient by reducing their costs and overheads – it is increasingly clear that reducing energy consumption and increasing the efficiency of organizational processes can and should go hand in hand with environmental initiatives and Carbon emission reductions .

Whilst attention needs to be paid to reducing the footprint from using ICT - various statistics have been produced indicating that the Carbon footprint from data centres is equal to or higher than that from the aircraft industry (reckoned by many to be around 2% of global emissions). ICT is now also identified as a major enabler of carbon footprint reductions that can far exceed the emissions from its use. In a research done by Microsoft, daily power consumption of a typical data centre equals the monthly power consumption of thousands of homes, with a staggering 61 billion kilowatt hours going toward data centre energy consumption.

Data centre managers have two important operating guidelines—operational efficiency



(reducing energy and power requirements and ensuring optimum data centre resource utilization) and applications availability (without sacrificing on application performance). In this context, server consolidation and virtualisation is among one of the most important green information and communication technologies that are being implemented by organisations worldwide.

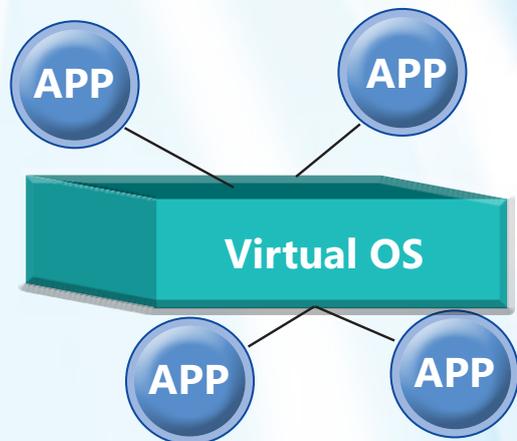
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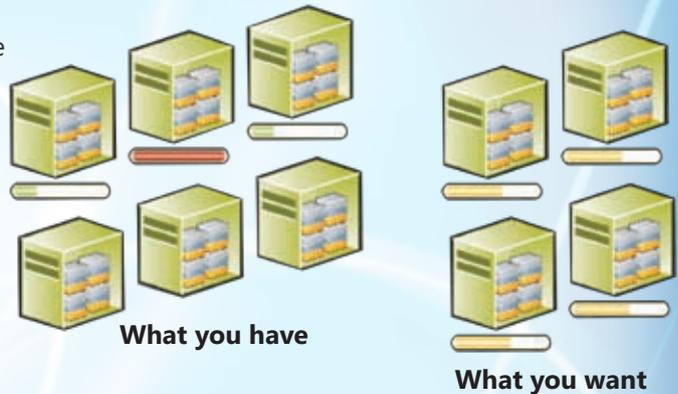


VIRTUALISATION: Virtual operating systems are housed in a giant server with greater power to drive any application to its full potential at any given time

SERVER CONSOLIDATION

What is Server Consolidation?

Server consolidation is an approach to the efficient usage of computer server resources in order to reduce the total number of servers or server locations that an organisation requires. The practice was developed in response to the problem of "server sprawl," a situation in which multiple under-utilized servers take up more space and consume more resources than can be justified by their workload.



Types of Server Consolidation

There are three main levels of server consolidation to consider:

1. **Centralised Consolidation** - Rather than maintaining servers at various branch offices, an organisation moves all servers to a centralised location. This greatly simplifies maintenance duties for IT staff as they can immediately access all systems without travelling. This also simplifies security, backing up data and instituting an extensive failover plan.
2. **Physical Consolidation** - An organisation reduces the total number of servers by merging the workload onto fewer servers. The new setup retains a homogeneous environment in that it is still running on a single platform.
3. **Operational Consolidation** - Also known as **virtualisation** or application consolidation, this approach runs multiple platforms and diverse applications on a single server (or cluster). This technique uses partitioning and virtualisation to run many "virtual servers" on a single machine. This makes efficient use of system resources while minimising upkeep tasks and Total Cost of Ownership (TCO). Although the most complex option, Operational Consolidation can offer the greatest payoff.

Why Consolidate?

Many organisations are turning to server consolidation to reduce infrastructure complexity, improve system availability and save money. With increasingly powerful hardware, including affordable x86-based multi-core servers, organisations can run larger workloads and more applications on fewer servers. Reducing the number of servers has tangible benefits for the data centre as well:

Reduced Staffing Costs - Reduced staffing needs due to efficient operations and improved skill sets.

Less Hardware - Efficient use of hardware minimises investment in hardware & management tools.

Better Software Pricing - Fewer licenses may be required. Having a more consistent environment can provide better discounts due to concentrating on fewer applications purchased in larger quantities.



Minimised Facility Requirements - Less physical space is required for housing IT systems, and power consumption is typically reduced.

Better Service - With fewer applications and versions to support, IT staff will be more knowledgeable and handle help desk calls more efficiently.

Reduced Complexity - A simplified infrastructure provides better performance and more stability.

Improved Scalability - A simplified network also provides a more flexible system that can grow as your needs evolve.

Easier Disaster Recovery - Fewer systems are easier to maintain, backup and restore.

Steps for server consolidation planning

1. **Begin by researching** - Having solid understanding of the different consolidation techniques and technologies will help you pinpoint the approach that best meets your needs.
2. **Set operational and financial goals** - Identify exactly what you hope to accomplish in terms of scope, performance and costs before you begin designing the system.
3. **Create a schedule** - To minimise disruption to everyday business and IT operations, set a timeline with defined benchmarks. Be sure to build in some extra time to accommodate inevitable project setbacks.
4. **Put it in writing** - A document describing project goals, system design details, integration specifics, server management responsibilities and other key points will help stay on track.
5. **Build support** - As with any major IT project, getting buy-in from stakeholders is essential for a successful consolidation initiative. Make sure business users understand the benefits, and any pitfalls of virtualisation.

Four things to consider when looking at server consolidation:



- (a) Hardware
- (b) Redundancy
- (c) Operating system
- (d) Maximising efficiency

The purpose of server consolidation is to decrease the number of individual servers and maximize available resources. Make an inventory list of all your servers, operating system, software installed, versions and their primary function and user group. If possible, review the total traffic load, peak times and overall user demand.

DID YOU KNOW?

- ☛ Energy-related costs account for approximately 12 percent of overall data centre expenditure and are the fastest rising cost in the data centre, according to **Gartner**. It is also mentioned by **Gartner** that data centre power, cooling and energy supply, and cost problems are likely to worsen during the next few years as organisations grow their technology infrastructure as they emerge from a recessionary period.
- ☛ IT energy costs are increasing by 16% every year, according to a report by McKinsey & Company and the Uptime Institute.
- ☛ A Stanford University report published in 2011, entitled 'Growth in Data Centre Electricity Use 2005 to 2010', estimated that the amount of electricity consumed by data centres worldwide grew by 56% between 2005 and 2010.
- ☛ Rapid improvements in server performance and density management software, and network bandwidth have made server consolidation a viable consideration for most IT environments. Faced with an ever-increasing demand to provide services, organisations can pursue consolidation as a way of gaining greater control over their IT resources, leading to efficiency gains and a more consistent level of service.

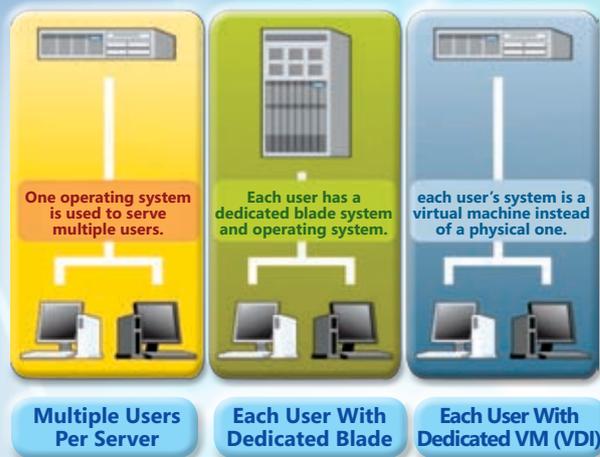
VIRTUALISATION

What is Virtualisation?



Virtualisation is one of the most promising technologies for improving the energy efficiency of data processing and data centres. It replaces physical computers with software applications that stimulate computers. Because it is possible to deploy multiple virtualised computers on a single physical machine, virtualisation enables the consolidation of physical servers and helps optimise energy consumption. Virtualisation is categorised into four types, namely:

1. Desktop Virtualisation
2. Server Virtualisation
3. Storage Virtualisation
4. Network Virtualisation



Desktop Virtualisation

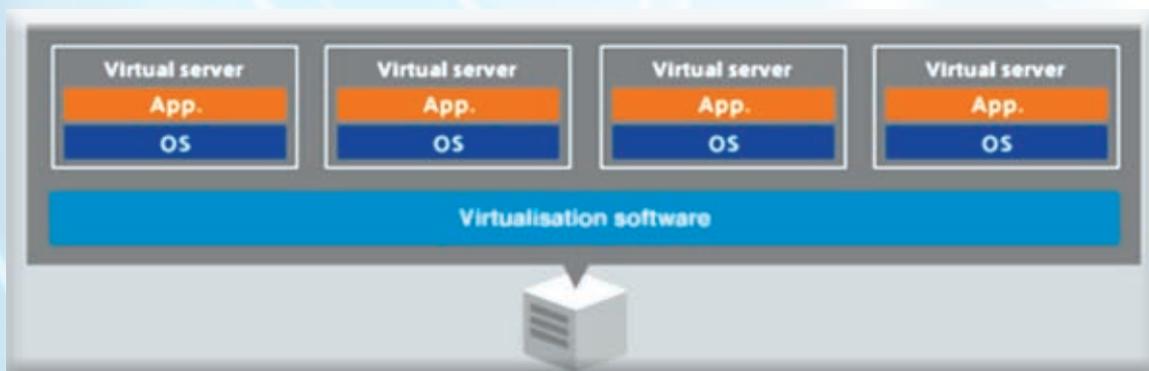
Desktop Virtualisation is defined as a virtualisation technology that is used to separate a computer desktop environment from the physical computer. Desktop virtualisation is considered a type of client-server computing model because the virtualised desktop is stored on a centralised, or remote, server and not the physical machine being virtualised. Desktop virtualisation "virtualises desktop computers" and these virtual desktop environments are

"served" to users on the network. Users interact with a virtual desktop in the same way that a physical desktop is accessed and used. Desktop virtualisation offers advantages over computers operating as individual units as each virtual desktop will not require its own hardware, operating system and software. Another benefit of desktop virtualisation is that it lets you remotely log in to access your desktop from any location.

Common Types of Virtual Desktops: VDI (Virtual Desktop Infrastructure or Interface) is a popular method of desktop virtualisation. This type of desktop virtualisation uses the server computing model, as the desktop virtualisation in this scenario is enabled through hardware and software. VDI hosts the desktop environment in a virtual machine (VM) that runs on a centralised or remote server.

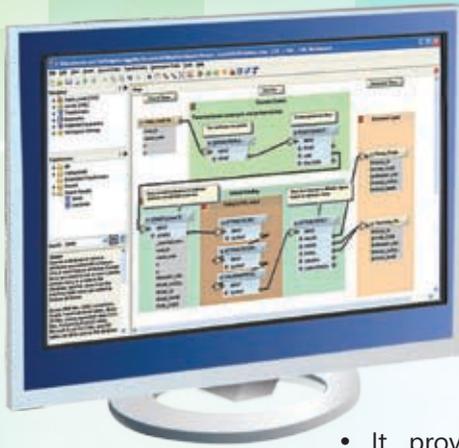
Server Virtualisation

Server Virtualisation is a technology for partitioning one physical server into multiple virtual servers. Each of these virtual servers can run its own operating system and applications, and perform as if it is an individual server. This makes it possible, for example, to complete development using various operating systems on one physical server or to consolidate servers used by multiple business divisions.



Why use Server Virtualisation?

- It conserves space through **consolidation**. It is common practice to dedicate each server to a single application. If several applications only use a small amount of processing power, the administrator can consolidate several machines into one server running multiple virtual environments



- It provides a way for companies to practice **redundancy** without purchasing additional hardware. Redundancy refers to running the same application on multiple servers. It's a safety measure - if a server fails, another server running the same application can take its place.
- Virtual servers offer programmers isolated, independent systems in which they can test new applications or operating systems. Rather than buying a dedicated physical machine, the network administrator can create a virtual server on an existing machine. Because each virtual server is independent in relation to all the other servers, programmers can run software without worrying about affecting other applications.
- An emerging trend in server virtualisation is called **migration**. Migration refers to moving a server environment from one place to another. With the right hardware and software, it's possible to move a virtual server from one physical machine in a network to another.

Three kinds of Server Virtualisation - There are three ways to create virtual servers: **full virtualisation**, **para-virtualisation** and **OS-level virtualisation**. They all share a few common traits. The physical server is called the **host**. The virtual servers are called **guests**. The virtual servers behave like physical machines. Each system uses a different approach to allocate physical server resources to virtual server needs.

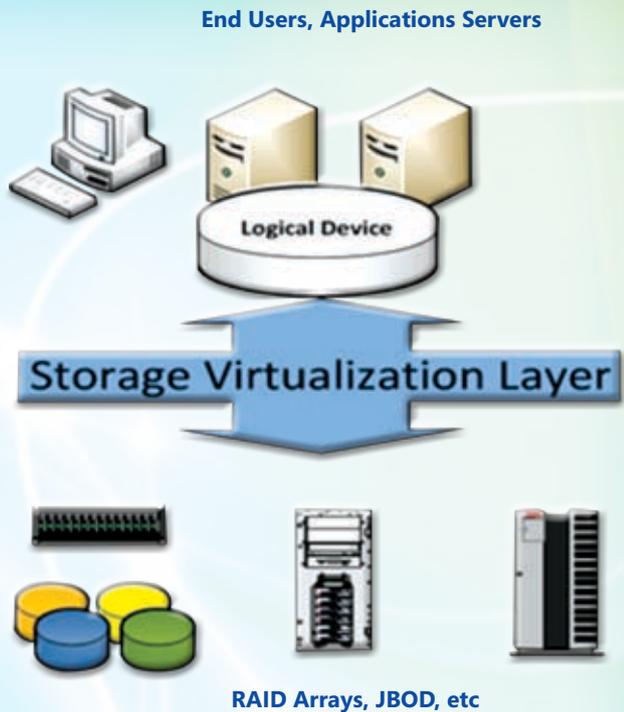
Full virtualisation uses a special kind of software called a **hypervisor**. The hypervisor interacts directly with the physical server's CPU and disk space. It serves as a **platform** for the virtual servers' operating systems. The hypervisor keeps each virtual server completely independent and unaware of the other virtual servers running on the physical machine. Each guest server runs on its own OS -- you can even have one guest running on Linux and another on Windows. The hypervisor monitors the physical server's resources. As virtual servers run applications, the hypervisor relays resources from the physical machine to the appropriate virtual server.

The **para-virtualisation** approach is a little different. Unlike the full virtualisation technique, the guest servers in a para-virtualisation system are aware of one another. A para-virtualisation hypervisor doesn't need as much processing power to manage the guest operating systems, because each OS is already aware of the demands the other operating systems are placing on the physical server.

An **OS-level virtualisation** approach doesn't use a hypervisor at all. Instead, the virtualisation capability is part of the host OS, which performs all the functions of a fully virtualised hypervisor. The biggest limitation of this approach is that all the guest servers must run the same OS.

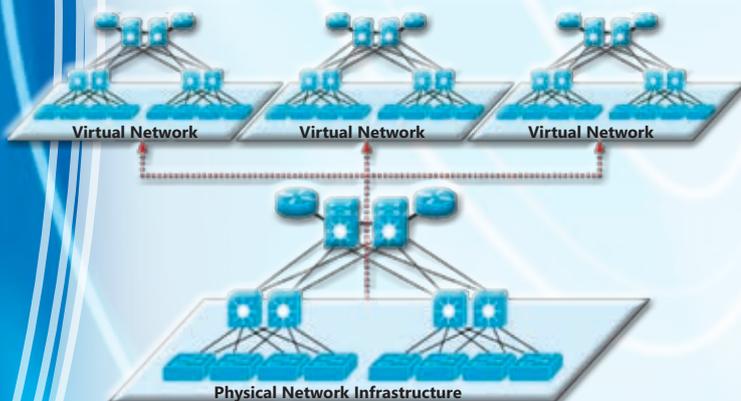
Storage Virtualisation

Storage virtualisation creates a layer of abstraction between the operating system and the physical disks used for data storage. Storage virtualisation is the pooling of physical storage from multiple network storage devices into what appears to be a single storage device that is managed from a central console. This is also a great way to monitor resources, as you can then see exactly how much you have left at a given time. The creation of logical space allows a virtualisation platform to present storage volumes that can be created and changed with little regard for the underlying disks. Storage area networks (SANs) are a common type of storage virtualisation. Storage management is centralised whereby administrator can allocate storage from a central place and view all available storage from a single interface.



The most immediate benefit of storage virtualisation is increased utilisation of the available capacity, thus reducing wasted storage space. With virtualised storage, data migrations can be seamless and even automated. By simply changing the mapping scheme, virtualisation can move the location of data without disrupting disk I/O, allowing for efficient and non-disruptive data movement.

Network Virtualisation



Network virtualisation is the process of combining hardware and software network resources and network functionality into a single, software-based administrative entity, a *virtual network*.

Network virtualisation is categorised as follows:

- *external*, combining many networks, or parts of networks, into a virtual unit,
- *internal*, providing network-like functionality to the software containers on a single system.

The aim of network virtualisation is to improve a network's overall performance and enhance its security.

Network virtualisation is intended to optimize network speed, reliability, flexibility, scalability, and security. Network virtualisation is said to be especially effective in networks that experience sudden, large, and unforeseen surges in usage.

Selecting Virtualisation Software

Compatibility: Virtualisation software should be compatible with your company's hardware and with your organisation's operating systems and other third-party management tools

Scalability: One of virtualisation's benefits is its ability to grow, or retract, as needed. It's important that your virtualisation software enables and empowers your organisation's current and future business plans.

Performance: The software should provide strong performance on both host and guest machines.

Cost: Consider the return on investment (ROI) your company can anticipate, based on the software's features and capabilities. Consider the type of licensing agreements

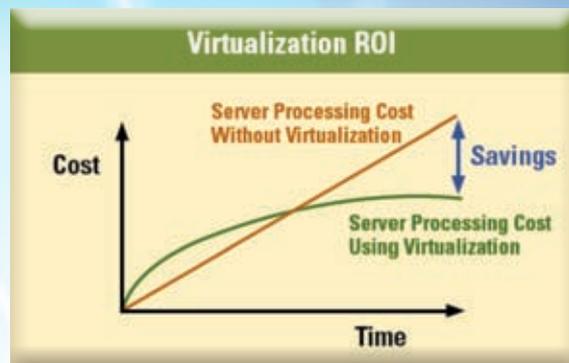
Centralisation: Choose software that includes centralised deployment and management, to help reduce the costs and time associated with these tasks.

Ease of Installation: It is recommended that companies select virtualisation platforms that include an easy installation process, wizards, and/or a simplified VM creation processes.

High Availability: It's vital that employees can access the virtual environment whenever and wherever they need it. Avoiding costly downtime is a goal all companies strive to attain. High availability is, therefore, a critical component of any organisation's virtualisation solution.

Security: Built-in security features—such as password-protection, strong authentication, and guest isolation—are designed to help protect the corporate network, data and data centre. These features complement a company's other security initiatives.

Support: Whether it's through a partner, solution provider, or directly from the vendor, ensure you can receive prompt and thorough support as needed. Check for availability of additional tools such as capacity-planning tools.



Virtualisation and Cloud Computing

Cloud Computing is one of the most popular topic in the ICT sector today. Cloud computing means integrated, dynamic infrastructures that deliver IT as a service either internally (private cloud) or externally (public cloud). It is important to understand the trade-offs among Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS), and between public and private clouds. Imagine the possibilities for your organisation if you could continue to build your virtualised environment into a fully automated service-oriented infrastructure of pooled resources (server, storage, and network) that enables you to easily deliver IT Services to your internal users.

Cloud computing takes virtualisation a stage further; the hardware used to deliver the virtualised instances is not owned by the client, but by a third-party provider, and the instances are accessed over the internet. The principal difference between virtualisation and cloud computing is the move from capital expenditure to operational expenditure: the cloud provider takes the risk of buying the hardware and the client pays for a service as an operational expense.

Virtualisation Issues and Benefits

Issues during Virtualisation

Subpar performance: Virtualising may lead to decreased user productivity if virtual servers fail to perform as they did prior to being virtualised. To avoid this situation proper capacity planning and testing are important by virtualising the server in an isolated lab environment.

Virtual Server Sprawl: An organisation may deploy so many virtual servers that it end up with more server hardware than it had before it decided to consolidate its servers. This completely undermined its stated goal of reducing hardware costs.

Underestimating the Required Number of Hosts: Part of the capacity planning process involves determining how many host servers are going to be required. There are some types of virtual servers that simply should not be grouped together. For example, placing all domain controllers (DCs) on a single host. If that host failed, there would be no DCs remaining on the network. Another example is the setting up of a virtual failover cluster on the same host.

Multiple Eggs into a Single Basket: A server failure in a non-virtualised data centre is inconvenient, but not typically catastrophic. The failure of a host server in a virtual data centre can be catastrophic because the failure of a single host can mean the unavailability of multiple virtual servers.

Benefits of Virtualisation

Virtualisation enables business partners to provide more comprehensive solutions to new and existing customers. It allows users to run multiple applications and operating systems on the same computer so you can optimise your IT investments, infrastructure and resources.

Customer Benefits - Cost savings and IT staff productivity reduce

- Hardware expenses through consolidation and improved utilisation
- System administration and maintenance expenses via simplified server configuration and deployment
- Power, cooling energy, and real estate costs

Improve

- Desktop management and administration
- System manageability and responsiveness
- System availability and scalability

Business Partner Benefits - Potential higher billings and reduced cost

- Ability to focus on higher billable rate services
- Ease of installation

