

# **Subject: Principles of Virtualisation**

**Module Number: 5.0**

**Module Name: vSphere Solutions to Data Centre Challenges**

# Role of Algorithms in Computing

## Aim:

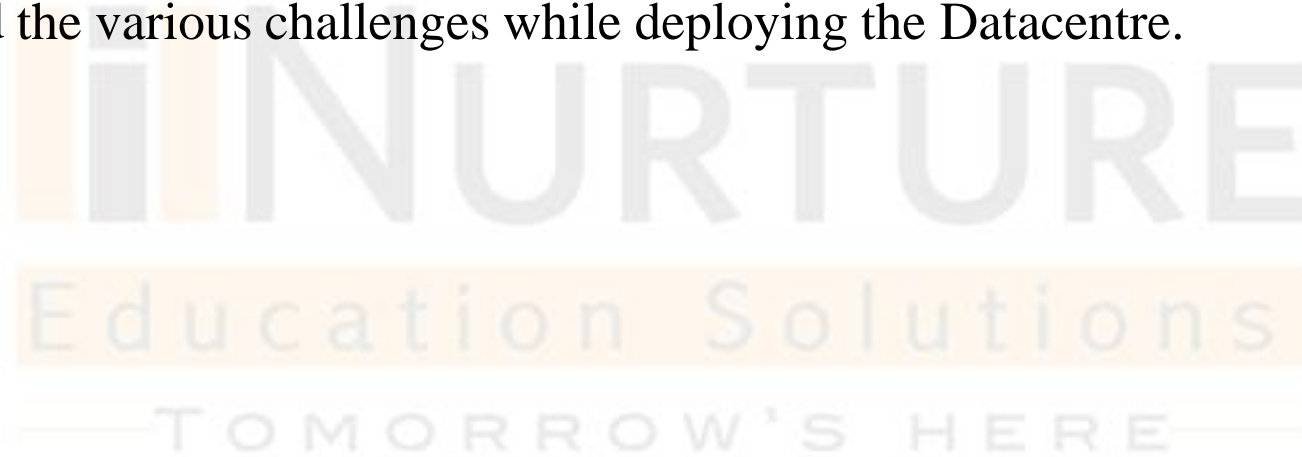
To familiarise students about the Management Challenges, Scalability Issues, and Optimization challenges.



## Objective:

The Objective of this module is to:

- Understand the various challenges while deploying the Datacentre.



## Outcomes:

At the end of this module, you are expected to:

- Evaluate the Scalability challenges
- Remembering the Availability Challenges
- Analyse the Management challenges

## Content

- Seven common virtualization challenges
- Scalability Challenges
- Management challenges
- Change Management
- Optimization Challenges

## Seven Common Virtualization challenges

1. Resource Distribution
2. VM Sprawl
3. Backward Compatibility
4. Performance Monitoring
5. Backup
6. Security
7. Licensing Compliance

## 1. Resource Distribution

- The way virtualization partitions systems can result in varied ways — some might function really well, and others might not provide users access to enough resources to meet their needs. Resource distribution problems often occur in the shift to virtualization and can be fixed by working on capacity planning with your service provider.

## 2. VM Sprawl

- VM sprawl, the unchecked growth of virtual machines in a virtual environment, as any virtualization admin knows can cripple an otherwise healthy environment. It is problematic because its underlying cause often stays hidden until it manifests in resource shortages.
- You should look at how virtual machines will be managed, who will be doing what, and what systems you're going to use. One of the optimal times to develop an overall management plan is when you're in a testing phase, before migration.



## 3. Backward Compatibility

- Using legacy systems can cause problems with newer virtualized software programs.

Compatibility issues can be time-consuming and difficult to solve. A good provider may be able to suggest upgrades and workarounds to ensure that everything functions the way they should.

## 4. Performance Monitoring

- Virtualized systems don't lend themselves to the same kind of performance monitoring as hardware like mainframes and hardware drives do. Try tools like VMmark to create benchmarks that measure performance on virtual networks and to monitor resource usage as well.

## 5. Backup

- In a virtualized environment, there is no actual hard drive on which data and systems can be backed up. This means frequent software updates can make it difficult to access backup at times. Software programs like Windows Server Backup tools can make this process easier and allow backups to be stored in one place for easier tracking and access.

## 6. Security

- Virtual systems could be vulnerable when users don't keep them secure and apply best practices for passwords or downloads. Security then becomes a problem for virtualization, but the isolation of each VM by the system can mitigate security risks and prevent systems from getting breached or compromised.
- Unlike some tech solutions, virtualization is not really a “set it and forget it” type of solution. You will need to manage it from the start, if you want to be able to get the most out of your systems. This includes ensuring resources are being allocated properly, machines are created and shut down properly, apps and systems are updated, and more.

## 7. Licensing Compliance

- Using existing licensed software in a virtual environment can lead to compliance issues, if more VMs are created than the company is licensed to use the software on. It's important to keep track of how licensed software is being used and to be sure compliance is maintained as the virtual environment grows.

## Scalability Challenges

- We learned that there are three main ways to measure the scalability of a system, which refer to the three dimensions of scalability: size scalability, geographical scalability, and administrative scalability. As a quick refresher, these three dimensions effectively ensure that, as the number of users and resources grows, as the physical distance between resources grows, and as the administrative overhead of a system changes in size, the system itself should not slow down or become less performant as a result.

## Challenges:- Application Footprint

- There are two known factors IT faces today when managing apps: First, the number being used in your company is increasing, and second, you no longer own all of them. With easy SaaS availability and distributed budgets, any team can sign up for and start using a new app without ever involving IT. While non-IT folks see this as a new dawn, we know that the moment that app is slow, they're going to blame you for it. If you're not keeping up with what's on the network, you're bound to run into the network blame game.

## Performance and Reliability

- Apps rarely go down. Maybe once or twice a year do your major application providers have unscheduled downtime, and if it happens during off hours, it can be a non-event. The issue facing enterprise employees today is slow applications. Apps can get a bad reputation on your sales floor or limit your marketing team because of performance and reliability issues.



## Identity Access Management

- Legacy systems having number of problems when coupled with modern applications and performance demands can be costly to maintain and difficult to manage across a corporate infrastructure. This is why companies like Okta, Ping Identity, and OneLogin have seen success lately by approaching the solution through SSO and SaaS offerings. IAM is easy, when your company has 50 employee across two locations, but when you're supporting 500 employees in 20 locations, the processes used to provision apps need to be optimized. You can't rely on ad-hoc work or scripts anymore, but need to evolve to use more sophisticated solutions.

## Hybrid Cloud Support

- Today's enterprise infrastructure is a blend of legacy infrastructure you own and new infrastructure in the cloud. Depending on your company's particular journey, the balance may tip to either side, but increasingly it's the providers who own devices and links. Scalability is key, but sacrificing visibility and control of these devices means IT needs to identify new solutions and methods to monitor and alert on the performance of their network and applications. Doing this with smaller centralized teams is also becoming the norm, since there aren't as many physical devices to manage.

## Cost Pressures

- As IT teams shift their planning towards a distributed cloud-based model, they aren't always getting enough money to support that. Plus, there's pressure across the board to reduce costs, and pressure for IT to prove its value by having a positive effect on the business's bottom line. IT has to be more efficient with spending while increasing performance and reliability. This has a huge effect on what's possible for scalability, as the market changes constantly. Adding more seats to a SaaS subscription may be easy, but it's not cheap. The complexity of SaaS pricing and licensing can also bring confusion and unwelcomed billing surprises when IT makes changes or additions.

## Management Challenges

1. Storage Management
2. Enterprise Monitoring
3. Capacity Planning
4. Change Management
5. Business View



## Storage Management

- Storage is the most critical and valuable resource in a virtual environment as it serves as the persistent foundation for the virtual machines running on a host, because storage can make or break a virtual environment. Having a properly architected and well-performing storage system is paramount. Storage is typically also the most costly part of your virtual environment as well. Because of all these factors, you need to ensure that your storage operates at peak efficiency without bottlenecks and that you do not needlessly waste space. Managing your storage resources is a constant challenge - not only do you need to ensure that they perform well, you also need to ensure you have sufficient capacity for your virtual machines.

## Storage Management Contd..

- One of the biggest challenges with virtual disks lies in managing VM snapshots and thin disks. Thin disks allows for over-provisioning of storage resources as virtual disks start with a minimum of space and grow as needed as disk blocks are written to them by the guest OS. Virtual machine snapshots can be a nuisance because they are often forgotten and slowly consume space on your data stores. Thus, snapshots and thin disks present a double threat to your storage resources as they consume growing amounts of disk space and put your datastores at risk for running out of space. Having your datastores run out of space is a situation you want to avoid at all costs, as it can result in all your VMs being suspended and data corruption within the VMs.

## Storage Management Contd..

There are also many factors that can impact storage performance and cause I/O bottlenecks such as:

Disk alignment

- Multi-pathing
- Improper configuration and settings
- Excessive I/O
- Improper architecture/design
- Too many snapshots

## Business View

- Virtual environments produce unique challenges that you typically do not encounter in physical server environments. When you virtualize, you have many servers and applications all running on the same physical hardware which causes your hosts to become melting pots of virtual machines. The virtual machines that can run on a host (also known as density) is increasing at a rapid pace due to the latest advancement in server and storage hardware. Even the smallest of hosts these days can easily hold dozens of virtual machines. This can present a problem when VMs with different functions and from different departments and business groups get lumped together on the same host, making chargeback and reporting a challenge.



Instead of using the categorization objects built into virtualization, such as datacenters, clusters, resource pools and hosts, you can organize your VMs in more useful ways that align with your business structure or other characteristics, such as:

- Service level agreements (SLAs)
- Departments (sales, marketing, R&D, IT)
- Company or business unit
- Geographic location
- Server role (database, email, web, authentication)
- Operating system (Windows versions, Linux Distros)

- You can do this using the basic VM folders that are built into vCenter Server, but setting them up and maintaining them can be very time-consuming. Additionally, VM folders are only one dimensional. You can also use custom attributes, but they are a pain to maintain as well. Veeam ONE, on the other hand, provides an automated, flexible and dynamic way to group the many objects in your virtual environment within different categories. While you can do this manually, using the standard VM folders, Veeam ONE automates the categorization process for you based on pre-defined rules. It also allows for the editing of attributes either individually or in mass and is a huge time saver compared to using standard VM folders. Organization in a virtual environment is very important, and Veeam ONE allows you to easily categorize the objects in your virtual environment with minimal effort.

## Change Management

- Managing the changes that occur within the data center is a necessary and critical task that must be done to ensure that you have a record of all the changes to your environment. While this is an important function for any data center, it is especially important for virtual environments because of their architecture. Virtualization is all about the sharing of common infrastructure components and resources between many virtual machines. Because of this type of architecture, seemingly innocent and minor changes that are made can have really big impacts in a virtual environment. In addition, changes that are made can have ripple effects across all the hosts and have large scale consequences. An example of this is a change made to a virtual Distributed Switch (vDS), where the configuration is shared across many hosts.

## Change Management

- If a change is made to the network configuration that causes a problem, it would apply to all your hosts that use the vDS and it could cause a large number of VMs to lose all network connectivity. This applies to shared storage as well - hosts in a virtual environment all share common storage arrays and if a change is made to a storage array that causes a problem, it could impact all the hosts that have VMs running on that storage array. The bottom line is you have to be extremely careful when making any changes in a virtual environment.

## Change Management

- There are many reasons companies implement change management procedures within their data centers, and one particularly beneficial practice is to ensure every change is documented, so that a history of all changes is maintained. This is especially useful when problems occur in your environment and you need to troubleshoot their cause. When problems occur, the inevitable first question is “it’s been working fine all this time, what changed?”. Change tracking can play a big role in troubleshooting when you can go back and see exactly what changed.

## Change Management

Some of the key statistics in each resource area are listed below:-

- **CPU Ready** — A VM statistic is the amount of time in milliseconds that is spent waiting for a CPU to become available. High CPU Ready times can indicate a CPU bottleneck or too many vSMP VMs on a host.
- **Mem Swapped** — A VM/Host statistic which is the amount of memory that is being swapped to from a VMs virtual disk swap file by the Vmkernel is measured in kilobytes. A large number here represents a problem with lack of physical host memory and is a clear indication that performance is suffering as a result.

## Change Management

- **Disk GAVG** — A host statistic is the average amount of time in milliseconds (latency) that it takes to process a SCSI command issued by the guest OS. GAVG is the sum of latency in the VMkernel (KAVG) and latency in the storage device (DAVG). High disk latency can really slow down VMs. In general, GAVG should be below 20ms.
- **Disk Commands** — A VM/Host statistic which is the number of SCSI commands that have been issued. Disk commands show the number of I/O operations per second (IOPS) that are occurring. For VMs, this is the command to the disk target that the VM is located on. For hosts, this is the commands to all the disk targets. This is a good general disk statistic that shows how much disk activity is happening in the environment.

## Capacity Planning

- With traditional physical server environments, capacity planning is fairly easy and straightforward as each server is an individual entity much like a single house. If you need more capacity, you just upgrade your existing servers or buy more servers. Trying to plan for capacity requirements in a virtual environment is much more difficult and complicated as you have a lot of shared infrastructure components that all work together as a whole unit, much like a city. Therefore, a balance of resources is critical in a virtual environment.



## Capacity Planning

- If resources are not balanced on a host, it can lead to wasted resources that cannot be used. For example, if a host runs out of physical memory, it limits the number of VMs that can run on that host despite having plenty of other resources available to it. Trying to keep your resources balanced isn't all that simple; you need to look at historical resource trends and usage to determine where that balancing point is.

## Enterprise Management

- Every data center typically has many separate management silos for all the various technologies, products and applications that reside within it. Trying to manage all these silos can be particularly challenging, and using multiple tools to manage multiple systems can result in multiple headaches. Every layer in the computing stack (hardware, OS, virtualization, applications) is often managed with a separate application, and even within each layer, there are often multiple management tools. Having fewer panes of glass to look through makes management much easier.

## Optimization Challenges

There are three phases in optimization:-

Phase One- Configuration

Phase two- Performance

Phase Three- Capacity Optimization

## Phase One: Assess Configuration Health

Configuration data is collected immediately after setup and configuration, so you can run the vSphere Optimization Assessment Configuration report on the very first day. This will help you identify and correct inconsistent cluster, host and VM settings as well as give you visibility into HA, DR, Admission Control VMware Tools and security settings. You'll also have a clearer view of your compute and storage distribution.

1. Highlight the Configuration Report and select the Run Template icon.
2. Select the object you want to report against, then select OK. You may want to start at an object level of a smaller environment and work your way up as you get a feel for the data in the report.
3. Select the generated reports tab. It may take a few minutes for the report to complete. You can select refresh to update the status. Select the PDF export option. You may also wish to look at the CSV option, but these reports were designed for PDF.

## Phase Two-Identity Performance Bottleneck

After the vSphere Optimization Assessment has been collecting data for five to seven days, the performance report will surface problem alerts and help you identify bottlenecks.

1. Select your Performance Report and then the Run Template icon.
2. Again, select a smaller environment to run the report against, while you are learning your way around.
3. Select the Generated Reports tab. As before, the report may take a few minutes to complete depending on the size of the environment. When it's complete, select the PDF export.
4. We recommend looking at:
  - Patterns of high Workload: Correlate this with the Stress Badge in the UI, which indicates high Workload patterns and opportunities to distribute workload.
  - Problem Alerts (under Health): Get recommendations on how to resolve problems.

## Phase Three-Optimize Capacity

After the vSphere Optimization Assessment has been collecting data for 21 days, you can run the Capacity Assessment Report.

1. Select your Capacity Assessment Report and then the Run Template icon.
2. Again, select a smaller environment to run the report against, while you learn your way around.
3. Select the Generated Reports tab, then select the PDF export once the report has been completed.

## Upgrading Issues

Most common issues that might occur during a vCenter Server upgrade to version 6.7, that contains host profiles.

For issues occurring during a vCenter Server upgrade or ESXi upgrade, see troubleshooting a vSphere Upgrade.

If upgrading vCenter server 6.0 or 6.5, containing host profiles with version earlier than 6.0, results with a failure. See KB 52932.

For error, there is no suitable host in the inventory as reference host for the profile host Profile. The profile does not have any associated reference host, see KB 2150534.

If an error occurs when you import a host profile to an empty vCenter server inventory, see vSphere Host Profiles for Reference Host is unavailable.

## Upgrading Issues

- If a host profile compliance check fails for NFS datastore, see vSphere Host Profiles for Host Profile without NFS Datastore.
- If compliance check fails with an error for the UserVars.ESXiVPsDisabledProtocols option, when an ESXi host upgraded to version 6.7 is attached to a host profile with version 6.0, see VMware vSphere 6.7 Release Notes.



## Summary

In this module, we have learnt different aspects of VMware challenges. There are lots of issues, which we have to understand while we deploy VMware. Datacentre is vulnerable entity, so it is better to protect it and find out all the loop holes of the data centre.

In this module, we have studied about management challenges, optimization, and storage challenges.

## Self Assessment Question

1. Which of the following dvPort binding types have been removed in vSphere 5?
  - a. Dynamic Binding
  - b. Ephemeral Binding
  - c. Static Binding

**Answer:- Dynamic Binding**

## Self Assessment Question

2. Your boss has asked you to setup 4 ESXi hosts to evaluate the new vSphere 5 release, which is the recommended install method to use in this situation?
- a. Interactive Installation
  - b. Scripted Installation
  - c. vSphere Auto Deploy Installation
  - d. Upgrade via VMware Update Manager

**Answer: Interactive Installation**

## Self Assessment Question

3. Your colleague has accidentally allocated more vRAM than your company is licensed for. What will happen to your virtual machines?
- a. All VMs will be powered Off
  - b. New VMs can not be powered On
  - c. VMware will be notified
  - d. Nothing will happen

**Answer: New VMs can not be powered On**

## Self Assessment Question

4. In an HA cluster after an initial election process, host are either:

- a. Primary or Secondary
- b. Master or Slave
- c. King or Queen
- d. Live or Standby

**Answer: Master or Slave**

## Self Assessment Question

5. It is possible to store vMotion virtual machines that have snapshots.

a. True

b. False

**Ans: True**

## Assignment

1. What are the factors that affect Storage Management?
2. Why optimization is important in Virtualized environment?
3. What are the management issues in VMware?
4. How do we take backup of servers?

# Role of Algorithms in Computing

## Document Link

Topic	URL	Notes
Availability Challenges	<a href="https://www.computerweekly.com/feature/VMware-five-biggest-challenges-of-server-virtualisation">https://www.computerweekly.com/feature/VMware-five-biggest-challenges-of-server-virtualisation</a>	This link discusses the challenges of VMware availability.
Scalability Challenges	<a href="http://pages.cs.wisc.edu/~remzi/Courses/838/Spring2013/Papers/p95-sundararajan.pdf">http://pages.cs.wisc.edu/~remzi/Courses/838/Spring2013/Papers/p95-sundararajan.pdf</a>	This link explains why scalable environment is vulnerable and needs focus.
Management Challenges	<a href="https://www.eginnovations.com/blog/top-5-monitoring-challenges-vmware-environments/">https://www.eginnovations.com/blog/top-5-monitoring-challenges-vmware-environments/</a>	This link talks about top-5 performance monitoring challenges in VMware environments.



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## Video Link

Topic	URL	Notes
What is Virtualization	<a href="https://youtu.be/_6CkdCiJDNs">https://youtu.be/_6CkdCiJDNs</a>	This link provides the basics of Vmware.
Describe software defined data centre.	<a href="https://youtu.be/uSa5v2qZmHk">https://youtu.be/uSa5v2qZmHk</a>	This link explains how SDDC Works.
Distributed Virtual Switch	<a href="https://youtu.be/c_DBlvJs4T4">https://youtu.be/c_DBlvJs4T4</a>	This link explains the parts of networking.

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## E- Book Link

Ebook name	Chapter	Page No.	Notes	URL
vSphere Virtual Machine Administration	1-8	47-223	<a href="https://docs.vmware.com/en/VMware-vSphere/6.0/vsphere-esxi-vcenter-server-601-virtual-machine-admin-guide.pdf">https://docs.vmware.com/en/VMware-vSphere/6.0/vsphere-esxi-vcenter-server-601-virtual-machine-admin-guide.pdf</a>	This link provides the details of vSphere Virtual Machine Administration.
Vmware vsphere 6.0 with vcentre server	4-5	31-178	<a href="https://www.esxlab.com/pdfs/VMware%20vSphere%206.0%20with%20ESXi%20and%20vCenter%20-%20Sample.pdf">https://www.esxlab.com/pdfs/VMware%20vSphere%206.0%20with%20ESXi%20and%20vCenter%20-%20Sample.pdf</a>	This link provides the details of Vmware vsphere 6.0 with vcentre server.