

Triple Crown Module Design Document:

Introduction to Azure compute

Module Title: Introduction to Azure compute

Short Abstract:

This module describes the Azure compute service and the options in it and shows how the options can be used.

Long Abstract:

Azure compute provides compute resources that can be flexibly applied by a user to process large amounts of data for tasks like modeling drug effects at a molecular level, mining marketing data, high end video rendering, and analysis of astronomical data gathered from telescopes. The intent of this module is to provide a high level description of the Azure compute service, the options in it, and suggestions about how they can be used to solve the problems a student may encounter in their daily work.

Learning Objectives: After completing this module, the student will be able to:

- Identify options in Azure compute.
- Select one or more compute options that are appropriate for solving their business problems.

Prerequisites:

The student must have working knowledge of networked computers and some notion of cloud computing or an externally driven need to get a high level understanding of it.

Expected Audience:

Audience members may be developers, system administrators, or system architects. Audience members may also be managers and decision makers who direct the activities of developers, admins, and architects.

Design author and SMEs:

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Unit 1: Why use Azure compute?

Motivation (for module):

In business, government, and education we all face the challenge of processing enormous amounts of data. The compute resources for tasks like modeling drug effects at a molecular level, mining marketing data, and high end video rendering can exceed the capabilities of the on-premise resources we have available. Too often, the amount of data varies drastically from week to week or even day to day so it's wasteful to buy, install, and maintain compute resources that then sit idle for weeks or months.

Learning objectives:

By the end of this unit, the student will be able to:

1. Describe the features and benefits of Azure Compute.
2. Describe at a high level the types of problems Azure compute can be used to solve.

Abstract of Learning Content:

Introduce the problem of processing large amounts of data in business, government, and education. Invite the student to imagine themselves in a scenario that involves the processing of large amounts of data. Describe the specific problems that are inherent in the scenario. Propose Azure compute as a source of solutions for the problems.

Motivation:

Imagine that you are an astronomy professor at a small college and it's a new semester. There isn't enough money in your budget to buy the computers needed to process and analyze the petabytes of data gathered last semester. If the data is not processed and analyzed, then you won't be able to present your thesis at an upcoming conference. Worse, the money and effort you and your grad students spent gathering it will be wasted.

Information included:

For the astronomy professor and for you, Azure cloud computing reduces the number of servers a business or organization must purchase and maintain on-premise. Fewer on-premise servers translates into lower cost and less time spent on maintenance.

Azure compute adds even more benefits. You can, for instance, ramp up your computing resources to match the amount of data you need to process and release the resources after it's processed. Azure compute allows you to deploy only the computing resources you need quickly and on demand. Plus, you only pay for what you use so your costs, which are already lower, can be controlled.

Summary:

Azure compute provides the benefits of cloud computing and allows you to match your computing resources to the amount of data you need to process. You can deploy only the computing resources you need quickly and on demand and pay for what you use.

Reference links:

[Find the compute product you need](#)

Unit 2: Defining Azure compute concepts

Learning objectives:

By the end of this unit, the student will be able to:

1. Define virtual machines and explain how they can be used.
2. Define containers and explain how they can be used.
3. Describe serverless computing and explain how it is used.

Abstract of Learning Content:

The concepts of virtual machine, container, and serverless are explained in relation to how they apply to the Azure compute services. The concepts are involved in solving the business problems of the student as exemplified by the astronomy professor in the fictional scenario. A brief description of each of the Azure compute options is provided.

Motivation:

Azure compute options let you process and analyze the vast amounts of data, like the data the professor's team collected, and do it in minutes and hours instead of weeks and months.

Information included:

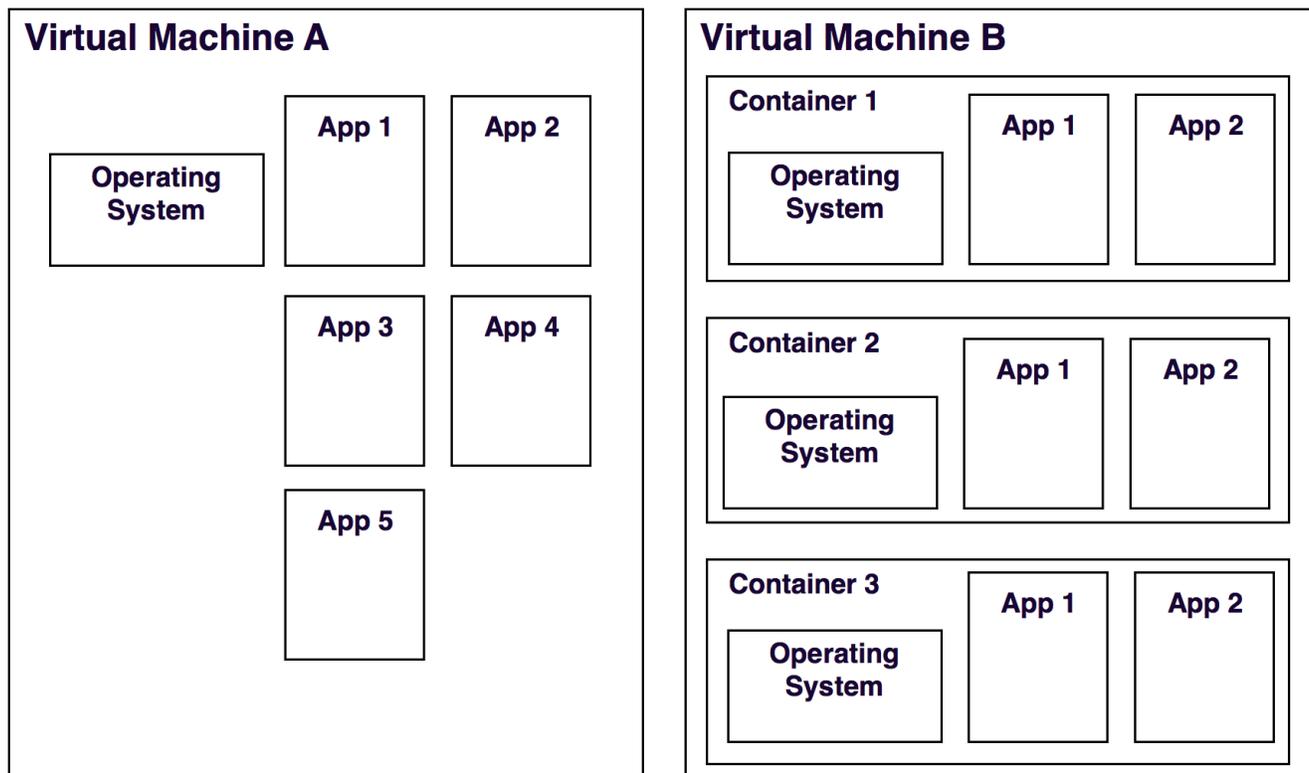
Azure compute options are based on the concept of the virtual machine. Though certain Azure compute options take care of generating and managing virtual machines, having some knowledge of them and related concepts will enable making informed decisions when choosing the options that fit your business needs.

Virtual Machines

A **virtual machine (VM)** is a software emulation of a physical computer. Because VMs exist as software, dozens, hundreds, or thousands of Azure VMs can be generated in minutes or even seconds and then deleted when you don't need them anymore. With the low-cost, per-minute billing in Azure compute, you only pay for the compute resources you use and only for as long as you are using them. Plus, there are lots of ways to

configure the VMs to fit your needs.

The diagram below shows two examples of how virtual machines can be configured. There are many variations on these types of configurations. Virtual Machine A is an example of a VM with its operating system and instances of multiple different applications. The application instances could also be of the same application, for example, 100 instances of App 3.



Containers

A concept related to Azure VMs that makes them even more efficient is containerization. Similar to the way a VM emulates a single computer, a **container** emulates a single operating environment, which includes the operating system and applications and perhaps other software.

In the diagram above, Virtual Machine B is an example of a VM that has containers. In containers 1 through 3, each has its own instance of an operating system and instances of apps. The operating system and apps can be different from container to container.

Multiple containers can run on one VM so you can run your astronomy software in multiple containers on multiple VMs. That will vastly speed up the processing and analysis you all need to do before the end of the semester.

As you can see by comparing the two VMs, a big bonus of using containers is that you can run more

applications in one VM. That means you can run fewer VMs which further reduces the cost of getting your astronomical data processed. Another plus is that containers are more portable. Once apps are in a container, it's possible to copy the container to other environments without changing anything in the apps or in the container.

Not all apps can be containerized, but many can. It helps if the apps are already designed to be used in the cloud. It also helps if an app is already a single binary or a JAR file. If the stateful tiers of your applications can be factored out, they may be able to be containerized. Many third party apps are already available in a containerized form.

Container orchestration

Generating and managing containers can be done when you configure a VM. It is possible to automate these tasks and is probably the best way to go if you need a large number of containers in many VMs. Automating the generation and management of containers and their interactions is referred to as **orchestration**. Popular container orchestrators include Kubernetes, DC/OS, and Docker Swarm. With or without orchestration, containers are especially useful in agile delivery environments.

Microservices

Microservice-based architectures can also benefit from using containers. A **microservice-based architecture** supports single-function modules with well-defined interfaces and operations. This makes it easy to quickly deploy and run the modules.

Serverless computing

Azure compute allows you to choose a high degree of control in configuring and managing the VMs or you can choose to have less work and responsibility by going serverless. **Serverless** computing goes one step beyond VMs and containers by abstracting servers, infrastructure, and operating systems. Plus, serverless options react to events that are triggered by usage. That way, your team can spend their time writing their software instead of managing servers.

These are concepts to keep in mind as you investigate the Azure compute options to select the ones that will help you process and analyze your astronomical data.

Summary:

Virtual machines, containers, and serverless apps are used in Azure compute services to provide low cost, powerful, efficient computing resources.

Reference links:

[What is a virtual machine?](#)

[Azure containers](#)

[The promise of serverless computing](#)

Unit 3: Selecting compute options

Learning objectives:

By the end of this unit, the student will be able to:

1. Describe the Azure compute options and at least one of the benefits of each.
2. Select one or more Azure compute options that can be used to solve their business problems.

Abstract of Learning Content:

Each of the Azure compute options is briefly described and the benefits of each are explained. Guidance about how to select compute options for specific tasks is provided.

Motivation:

To get the most out of Azure compute, it helps to select the right options for the work you're doing. Use the guide below to get started investigating the options so you can select the ones that fulfill your business needs.

Information included:

There are multiple characteristics to consider when selecting Azure compute options. The characteristics of cost and control are common to most business needs. While important, cost depends on details that you may not be able to determine at first. Whereas, the degree of control you require can usually be assessed at the outset. Or, you may frame the issue as the degree of automation you need or prefer.

Certain compute options provide more automation so you don't need to manage them as much. Others involve more direct control so you can optimize them for your work. So, we'll start with the options that provide the most automation and work towards the options that are not as automated but allow the most refined control.

Certain business needs may require control that involves features you or your staff may need to learn to use. You can still get your work done because Azure compute options make it easy for you to get started and, if you need to, gradually learn what you need to take on more control.

Automating functions and services

If you want to spend your time on developing code that is optimized for your work or business instead of provisioning and maintaining servers, the **Functions** option is a good choice. You get a fully managed compute platform with high reliability and security that scales on demand.

You may have applications your staff, or a third party vendor, already developed. All you need is to quickly generate multiple instances of cloud apps for web and mobile deployment while avoiding provisioning and maintaining servers. For this case, use **App Service**. It's a fully managed platform that runs and scales your applications effortlessly on Windows or Linux. It performs infrastructure maintenance, load balancing, and more.

Controlling virtual machines

If you want or need to choose the language, workload, and operating system that runs on the VMs you deploy, the **Virtual Machines** option may be a good choice. It allows you to provision and configure Linux and Windows virtual machines.

For running consistently available instances of the same app, or sets of apps, on similarly configured VMs, use the **Virtual Machine Scale Sets** option. It automatically generates thousands of identical VMs loaded with your application in minutes so your users never have to wait. And, since you don't have to pre-provision virtual machines, you use only the compute resources your application needs at any time.

There may be situations in which you need raw computing power or perhaps even supercomputer level compute power. The **Batch** option provides cloud-scale job scheduling and compute management with the ability to scale to tens, hundreds, or thousands of VMs. You can even specify VMs with supercomputer capabilities.

Controlling containers

For more control of the containers that run on the VMs you deploy, use the **Container Instances** option. You can run containers without managing servers. It's even possible to containerize your apps and run the containers with a single command.

It may be the case that you need to control a large number of containers and the interactions between them. If you or members of your staff are comfortable with using Kubernetes container orchestration consider the **Azure Kubernetes Service (AKS)** option. It is way to simplify and automate the management, deployment, and operations of Kubernetes orchestration.

Widely distributed services

It is possible to get wide distribution along with automation. The **Cloud Services** option allows you go generate highly available, massively-scalable cloud applications and APIs with the click of a button. Scale from 1 to 1000

in minutes. Once your application is deployed, provisioning, load balancing, health monitoring are taken care of automatically.

There is often a need, especially in large organizations, to operate always-on, scalable, distributed apps. In that case, consider the **Service Fabric** option. With it, you can develop microservices and orchestrate containers to deliver highly available and durable services at cloud-scale. It automatically assesses the available infrastructure and resource needs of applications, enabling automatic scale, rolling upgrades, and self-healing. It handles the hard distributed systems problems such as reliability, scalability, management, and latency for you.

Summary:

The ocean of compute power that Azure compute options provides is wide and deep. To help you navigate it, use the reference links below.

Reference links:

[Find the compute product you need](#)

[Decision tree for Azure compute services](#)

Unit 4: Knowledge Check

Learning objectives:

By the end of this unit, the student will be able to:

1. Know how to search online to find the a specific compute option.
2. Know what information to look for in pages about a specific compute option.

Abstract of Learning Content:

To help the student remember what they've learned, they are presented with a few multiple choice questions that touch on the more important pieces of information regarding Azure compute options.

Motivation:

To help you remember what you've learned, read the two scenarios involving the astronomy team. Read each scenario and answer the question for it. You may refer to the compute decision tree in the previous unit.

For internal reference, the correct answers are indicated with bold text.

Information included:

This unit is a knowledge check. The **Knowledge check objectives** are:

The **Preferred testing style** is: The testing style is scenario based. A scenario is described and the student is asked to pick the correct Azure compute option from a list of three compute options.

Scenario 1

Imagine that your astronomy team is small and that, while the members of your team are top notch astronomers and computer programmers, they have only a rudimentary understanding of server and web administration. Which of the following options should you choose?

1. Azure Kubernetes Service (AKS)
2. Service Fabric
3. **App Service**

Scenario 2

Imagine that your astronomy team has come up against certain astronomical calculations that are taking hours and even days to complete. Which of the following options should you choose?

1. Cloud Services
2. **Azure Batch**
3. Container Instances

Summary:

There are many details to sort through when selecting a compute option that works for you. We hope that you've learned what details matter to your work.

Unit 5: Summary

In this module you've learned that:

- virtual machines (VMs) provide a flexible way for you to get the computing resources you need only when you need them and pay only for as much as you use.
- containers can be used to run multiple instances of applications while making more efficient use of VMs.
- serverless apps can be run without you having to be concerned with compute infrastructure.

- the multiple compute options available can be used to fulfill your specific compute resources needs.

To find out more about Azure compute options, visit the following pages.

Reference links (module):

[Overview of Azure compute options](#)

[Find the compute product you need](#)

[Decision tree for Azure compute services](#)

[Choose the right Azure hosting option](#)

[What Is Microsoft Azure – A Complete Guide, from 5Nine](#)

[Quickstart for PowerShell in Azure Cloud Shell](#)

[Media Services - on Demand Streaming](#)