# AZ400-T06: Implementing Application Infrastructure – Course design

## Course Description

This course will cover how to deploy and configure your application infrastructure in devops pipelines. It will cover infrastructure as code and configuration management and what factors need to be considered when automating application and infrastructure deployment and configuration, such as technical Debt and configuration drift and allow you to analyze and design an infrastructure and configuration management strategy for your release pipeline.

It will cover provisioning of azure infrastructure using common Microsoft automation tools such as Azure CLI, PowerShell and ARM templates and the use of Azure SDKs, REST APIs and cloud shell.

It will also cover Azure Deployment models and services using Azure services and products such as App Services, Web app , Service Fabric and provisioning and managing a Managed Kubernetes cluster.

It will also cover 3rd party deployment tool integration with Azure such as Chef, Puppet, Ansible, SaltStack and Terraform and integrating compliance and security in your release pipeline.

It will provide details around analyzing and designing an infrastructure and configuration management strategy

## Audience

This course is intended for experienced IT professionals who wish to learn about implementing application infrastructure and the management and configuration of that infrastructure.

Candidates must be experienced with Microsoft Azure, and have experince deploying and configuring virtual machines and containers, having experience with automation and scripting.

Experience working with release pipelines that allow for continuous integration, continuous testing, continuous delivery, and continuous monitoring and feedback would be an advantage but is not essential.

## Pre-requisities

* Have experience with Microsoft Azure
* Have some experience with virtual machines and containers
* Have some experience with automation and scripting
* Knowledge of general application development and deployment processes.
* Experience working in a software development or operations enviroment with either Windows or Linux would be beneficial but is not essential.

## Learning Objectives

The following are the course learning objectives

* Provide training and prepartion for the exam AS-400: Microsoft Azure DevOps Solutions ([70-538): Implementing Microosft Azure devOps Solutions](https://www.microsoft.com/en-us/learning/exam-70-538.aspx)) and the Functoinal Group Implementing Application Infrastructure within that exam.
* Understand applying Infrastructure and Configuration as code principles
* Learng to deploy and manage infrastructure using Microsoft automation technologies such as ARM templates, PowerShell, Azure CLI,
* Learn deployment models and services available with Azure
* Learn how to deploy and configure a Managed Kubernetes cluster
* Learn how to deploy and configure infrastruture using Chef with Azure
* Learn how to deploy and configure infrastruture using Puppet with Azure
* Learn how to deploy and configure infrastruture using Ansible with Azure
* Learn how to deploy and configure infrastruture using Saltstack with Azure
* Learn how to deploy and configure infrastruture using Terraform with Azure
* Learn how to define and infrasturcture and configuration strategy and appropriate toolset for your release pipeline and applicatin infrastructure.
* Learn how to implement compliance and security in your application infrastructure

### Dev- Notes

* Demos and Labs > Intend to use the [PartsUnlimited](https://github.com/Microsoft/PartsUnlimited/) application and [PartsUnlimitedMRP](https://github.com/Microsoft/PartsUnlimitedMRP/) application at the moment
* Demos and Labs > common scenario across labd and demo will be deploying into azure standalone, or directly from an azure devops release pipeline
* Course maps explicitly to DevOps exam AS-400: Microsoft Azure DevOps Solutions ([70-538): Implementing Microosft Azure devOps Solutions](https://www.microsoft.com/en-us/learning/exam-70-538.aspx))
* Topics > assume a topic is test based unless its explicitly labelled as a video or demo
* Video > the video label is a conceptual video, i.e. just talking and graphics , Video will generally cover the same areas of the topics that follow it, i.e. lead with a video and re-infirce with a topic. Students can consume it as they prefer then also.
* Demo > is a hands on recorded demo.
* Exam Mapping > its difficult to build a course that directly maps to the exam i.e. 1 to one for mopdule and exam Functional group. The flow of a course doesn’t work logically
* Not in Exam >> anythig marked as not in exam could potentially removed wihtout affecting primary course objective to prepare for the cert
* Implement imperative virtual machine configuration management / Configure virtual machines by using centralized configuration management > Azure Automation DSC, Chef
* Covering the design aspects in the exam OD where the individual technologies are covered at lesson and mosuel level

### Areas not covered –

* Template Integration with Visual Studio
* SaltStack

Course Duration and Length

* # of modules – 8 modules (1 intro / 5 content / 1 exam and 1 course end which contains course summary and post course survey)
* # of lessons – approx. 46 (includes intros / summaries /surveys)
* # of topics (excluding video and demo topics) – approx. 82
  + Assuming takes 2 mins to read each item => approx 164 mins (2 hours 45 mins to read topics)
* # of video – approx 37
  + Asuming approx 3 mins to view each video => approx 111 mins (1 Hours 51 mins video content)
* # of demos – approx 18
  + Asuming approx 4 mins to view each video => approx 72 mins (1 Hours 30 mins video content)
* # of Labs = approx 5
  + Assuming 60 mins per lab => 300 mins = > 5 Hours
* number of questions
  + end of module = 50
  + end of course = 20
  + total = > assume 2 mins per question = > 140 mins = 2 hours 20 mins to answer all questions
* **Estimated Course Duration Total = topics + video + demos+ questions =787 mins => approx 13 Hours 10 mins**

## Exam Course is mapping To : AS-400: Microsoft Azure DevOps Solutions

**Implement Application Infrastructure (15-20%)**

**Design an infrastructure and configuration management strategy**

Analyze existing and future hosting infrastructure

Analyze existing Infrastructure as Code technologies

Design a strategy for managing technical debt on templates

Design a strategy for using transient infrastructure for parts of a delivery lifecycle

Design a strategy to mitigate infrastructure state drift

**Implement Infrastructure as Code**

Create nested resource templates

Manage secrets in resource templates

Provision Azure resources

Recommend an Infrastructure as Code (IaC) strategy

Recommend appropriate technologies for configuration management

**Manage Azure Kubernetes Service infrastructure**

Provision Azure Kubernetes Service (e.g. using ARM templates, CLI)

Create deployment file for publishing to Azure Kubernetes Service (e.g. kubectl, Helm)

Develop a scaling plan

**Implement infrastructure compliance and security**

Implement compliance and security scanning

Prevent drift by using configuration management tools

Set up an automated pipeline to inspect security and compliance

## Detailed Course Outline

1. **Module 1 - Course Introduction**
   1. Lesson 1 – Welcome
      * Topic 1 - Video: Welcome
   2. Lesson 2- Course Overview
      * Topic 1 - Video: About This Course
      * Topic 2 - About This Cours (Description/Audience/Lrn Objs/Pre-reqs)
      * Topic 3 - Course Syllabus (module and lessons level outline)
      * Topic 4 - Course Components (text / video / end of mod Qs/
      * Topic 5 - Grading
      * Topic 6 - Meet the Authors
   3. Lesson 3 - Labs Overview
      * Topic 1 - placeholder
   4. Lesson 4- Pre-Course Survey
      * Topic 1 - Pre-Course Survey
2. **Module 2 – Infrastructure and Configuration Azure Tools**
   1. Lesson 1 - Learning Objectives
      * Topic 1 – Learning Objectives
   2. Lesson 2 - Infrastructure as Code and Configuration Management
      * Topic 1: Video: Environment Deployment - Topic 2 below
      * Topic 2 – Environment Deployment – what is IaC, definitions, table of manual vs automated IaC
      * Topic 3 – Video: Environment Configuration – topic 4 below
      * Topic 4 – Environment Configuration – what is Config as Code – definition, table of manual config vs config as code.
      * Topic 5 – Video: Architecting Automation – (Topics 6, 7, 8 and 9)
      * Topic 6 – Modularization – architect automation to allow re-use.
      * Topic 7 - Imperative Vs Declarative - definition and apoproaches, - idempotence
      * Topic 8 - Technical Debt - Design a strategy for managing technical debt on templates - e.g., ARM templates being updated for new API versions
      * Topic 6 - Configuration Drift - Design a strategy to mitigate infrastructure state drift i.e. redeploy iac scripts to avoid being affected by breaking changes, security aspect to this
      * Topic 7 – Database as Code – definition, commonscenarios – really a call out to not forget it, and a refeence out.
   3. Lesson 3 - Create Azure Resources by using Azure CLI
      * Topic 1 – Demo: Using Azure CLI to eploy to Azure
      * Topic 2 – Using Azure ClI
   4. Lesson 4 - Create Azure Resources by using Azure PowerShell – inlcuding powershell core
      * Topic 1 – Demo: Using Powershell to deploy to Azure
      * Topic 2 - Using Powershell to deploy to Azure
      * Topic 3 – PowerShell Core
   5. Lesson 5 - Create Azure Resources by using ARM templates
      * Topic 1 – Demo: Creating and Using modular ARM Templates
      * Topic 2 – Modularising Templates - Create reusable resource templates - modular, parameterized, outputs, variables
      * Topic 3 – Nested Templates - Create nested resource templates - output results to be consumed in between nested templates
      * Topic 4 – Secrets in Templates - Manage secrets in resource templates
      * Topic 5 - Configure virtual machines by using the Azure Custom Script Extension
   6. Lesson 6 - Additional Automation Tools
      * Topic1 – Demo: Azure SDKs
      * Topic 2 - Azure SDKs,
      * Topic 3 – Demo: REST APIs
      * Topic 4 - Azure REST APIs,
      * Topic 5 – Demo: Cloud Shell
      * Topic 6 - Azure Cloud Shell
      * Topic 7 – Package Management – high level definition, and some common forms i.e. npm, apt, yum, chocolatey, NuGet
   7. Lesson 7 - Version Control
      * Topic 1 – Video: Version control with Azure
      * Topic 2 – General Principles - overview, use cases, benefits,
      * Topic 3 - Centralized Vs Decentralised
      * Topic 4 – Git with Azure
      * Topic 5 - TFVC with Azure
      * Topic 6 – Additional VCS tools Integration with Azure i.e. Atlassian and BitBucket, high level
   8. Lesson 8 - Labs
      * Lab Overview
      * Lab Steps – Hands On to deploy to Azure using ARM tenplates – will be IaaS deployment, single short lab. (max 1 hour)
   9. Lesson 9 - Module 2 Review Questions
      * Module 2 Review Questions
   10. Lesson 10 - Module 2 Summary–
       * Module 2 Summary
3. **Module 3 - Azure Deployment models and Services**
   1. Lesson 1 - Learning Objectives
      1. Topic 1 – Learning Objectives
   2. Lesson 2 - Deployment Models and Options
      * Topic 1 – Video: Models and Options (topics 2, 3, 4, 5)
      * Topic 2 - Physical Infrastructure – Azure Stack, pros and cons, usage scenarios
      * Topic 3 - IaaS – brief recap on definition, use cases - examples, pros and cons in devops
      * Topic 4 - PaaS – brief recap on definition, use cases, pros and cons
      * Topic 5 - Serverless – brief recap on definition, use cases, pros and cons
      * Topic 6 – Video: Containera vs Virtual machines (topic 7 below)
      * Topic 7 - Containers Vs Virtual machines
      * Topic 8 – Hybrid and Multi-Cloud Environments
   3. Lesson 3 - Azure Infrastructure-as-a-Service (IaaS) Services
      * Topic s 1: Video: Azure Virtual Machines and DevOps
      * Topic 2 – Azure Virtual Machines - services and specifics available within Azure VMs that tie into devops,vmss, analytics, windows and linux skus, security and compliance in Azure etc
      * Topic 3 – Video: Azure Container Instances
      * Topic 4 – Azure Container Instances - again services and specifics relevant to DevOps i.e. agliilty, container groups, Az Container Registry integration, orchestrators etc
   4. Lesson 4 - Azure Automation with DevOps
      * Topic 1 – Video: Azure Automation and DevOps
      * Topic 2 –Azure Automation - definition, services within AA, use cases
      * Topic 3 - Video: Runbooks with Azure Automation (Tpoic 4 below)
      * Topic 4 – Runbooks – definition, types, python, graphical, powershell, use cases, Hybrid runbook workers, provision to AWS, Asset types
      * Topic 5 – Demo: Provision Azure VMs using AA PowerShell Runbook (based around PU or PU MRP app)
      * Topic 6 – Video: - Workflows with Azure Automation
      * Topic 7 – Workflowswith Azure Automation – definition, types powershell, graphical, when to use, how to use, config and implementation points, parallel processing, inline Scripts etc
      * Topic 8 – Demo: Provision Azure VMs using Az Auto Workflow (based around PU or PU MRP app)
   5. Lesson 5 - Desired State Configuration (DSC)
      * Topic 1 – Video: Desired State Configuration (DSC) -
      * Topic 2 - Desired State Configuration (DSC) – what it is, how it works, characteristics etc
      * Topic 3 – Video: DSC Coponents and DevOps (topics 3 and 4)
      * Topic 4 – DSC Components
      * Topic 5 - DSC with DevOps
      * Topic 6 – Video: Azure Automation DSC (Topic 7 below)
      * Topic 7 - Azure Automation DSC – includig managing AWS VMs call out.
      * Topic 8 – Demo: Managing Azure IaaS with Azure Automation DSC
      * Topic 9 – Version control and Azure Automation – GitHub, AZ DevOps git, TFVC
   6. Lesson 6 - Azure Platform-as-a-Service (PaaS) services –
      * Topic 1 – Video: Web Apps (topic 2)
      * Topic 2 – Web Apps – overview, definitions, use cases, characteristics
      * Topic 3 – Demo: Web App deployment
      * Topic 4 – Video: Web Apps for Containers
      * Topic 5 – Web Apps for Containers – as per topic 2 above
      * Topic 6 – Demo: Web App for Containers deployment
      * Topic 7 – Video: DevTest Labs
      * Topic 8 – DevTest Labs – overview, usage scenarios, Integration into CI/CD pipelines, where they fit inot the devops pipeline, functionality, VM auto shutdown, etc
      * Topic 9 – Video: Additional Azure PaaS Services (topic
      * Topic 10 - Additional Azure PaaS Services – i.e. Mobile Apps, API apps, Logic Apps, Functions, and as per topic 2 above, just at a higher leverl
   7. Lesson 7 - Azure Service Fabric –
      * Topic 1 – Video: Microservices
      * Topic 2- Microservices
      * Topic 3 – Video: Azure Service Fabric Overview
      * Topic 4 - Azure Service Fabric Overview
   8. Lesson 8 - Labs
      * Lab Overview
      * Lab Steps – Azure Automation - IaaS or PaaS deployment (agai max 1 hour) / maybe devtest labs ….
   9. Lesson 9 - Module 3 Review Questions
      * Module 3 Review Questions
   10. Lesson 10 - Module 3 Summary
       * Topic 1 - Video: – Module 3 Summary
       * Topic 2 - Module 3 Summary
4. **Module 4 - Create and Manage Kubernetes Service Infrastructure**
   1. Lesson 1 - Learning Objectives
      * Learning Objectives
   2. Lesson 2 - Azure Kubernetes Service
      * Topic 1 – Video: Azure Kubernetes Service (AKS) Overview - (topic 2)
      * Topic 2 – Azure Kubernetes Service (AKS) Overview – what it is, key characteristics, distributed systems, orchstration, etc
      * Tpoic 3 - Video: AKS Components – (topic 4)
      * Topic 4 - AKS Components - pods, nodes, docker integration
      * Topic 5 – Demo: Deploy Cluster to AKS – templatization and yaml, json files involved. (topics 6 and 7 hands on)
      * Topic 6 - Deploying Cluster to AKS - Create a resource provisioning template for AKS – (e.g. using ARM templates, CLI)
      * Topic 7 - Create deployment file for publishing to AKS – cinfiug files - YAML, JSON, with kubectl, minikube local dev system, Helm
      * Topic 8 - Scaling with AKS - Develop a scaling plan
   3. Lesson 3 - Labs
      * Lab Overview
      * Lab Steps – Deploy and Scale AKS Cluster
   4. Lesson 4 - Module Review Questions
      * Module Review Quuestions
   5. Lesson 5 - Module 4 Summary
      * Topic 1 - Video: – Module 4 Summary
      * Topic 2 - Module 4 Summary
5. **Module 5 - Third Party and Open Soruce Tools available with Azure**
   1. Lesson 1 - Learning Objectives
      * Learning Objectives
   2. Lesson 2 - Chef
      * Topic 1 – Video: What is Chef?
      * Topic 2 - What is Chef?
      * Topic 3 - How does Chef work with Azure
      * Topic 4 - Usage Scenarios - Configure virtual machines by using centralized configuration management, Chef, Chef DSC
      * Topic 5 – Security with Chef – Chef Inspec
      * Topic 6 - Demo: Deploy and configure and app to Azure using Puppet
   3. Lesson 3 - Puppet
      * Topic 1 – Video: What is Puppet
      * Topic 2 - How does Puppet work with Azure
      * Topic 3 - Usage Scenarios
      * Topic 4 - Demo: Deploy and configure and app to Azure using Puppet
   4. Lesson 4 - Ansible
      * Topic 1 – Video: What is Ansible
      * Topic 2 - How does Ansible work with Azure
      * Topic 3 - Usage Scenarios
      * Topic 4 - Demo: Deploy and configure and app to Azure using Ansible
   5. Lesson 5 - Cloud init
      * Topic 1 – Video: What is cloud init
      * Topic 2 - How does cloud init work with Azure
      * Topic 3 - Usage Scenarios - Configure Linux machines > using cloud init
      * Topic 4 - Demo: Configure Linux VMs on Azure using cloud init
   6. Lesson 6 - Terraform
      * Topic 1 – Video: What is Terraform
      * Topic 2 - How does Terraform work with Azure
      * Topic 3 - Usage Scenarios
      * Topic 4 - Demo: Provision Resources in Azure usig Terraform
   7. Lesson 7 - Labs
      * Lab Overview
      * Lab Steps – Provision and configure an App in Azure Using X .
   8. Lesson 8 - Module Review Question
      * Module Review Quuestions
   9. Lesson 9 - Module 4 Summary
      * Topic 1 - Video: – Module 5 Summary
      * Topic 2 - Module 5 Summary
6. **Module 6 - Implement Compliance and Security in your infrastructure**
   1. Lesson 1 - Security and Compliance Principles with DevOps
      * Topic 1 – Video: Rugged DevOps and DevSecOps (topic 2 below)
      * Topic 2 – Rugged DevOps and DevSecOps DevOps – including content based around this - <https://msdn.microsoft.com/en-us/magazine/mt790188.aspx>
      * Topic 3 – Configuration Drift - preventing Configuration drift affecting compliance using , PowerShell DSC, Azure Automation DSC, Chef DSC
      * Topic 4 – Video: Scanning Code in DevOps Pipelines (topics 5 and 6 below)
      * Topic 5 - AzDevOps Pipeline extension Integration – scannig tools to integrate into CI/CD pipeines, when and where to use
      * Topic 6 – Whitesource - Using Whitesource in AzDevOps pipeline – identifying open source, containers, images and other oss components, clould also mention hyper-v containers in this context and Azure Container registry integration as trusted source.
      * Topic 7 - Pipeline Compliance Checks - Create templates to perform automated compliance checksin your pipeline - Azure Policy, PowerShell DSC, Chef's InSpec, Azure Automation DSC, Azure SDK
      * Topic 8 - Additional Pipeline Security considerations - pipeline permissions access, integrate with Az AD i.e. MFA etc, stick to using your pipelines to pull down existing infrastructure, encrypt data in transit and at rest, monitoring in production, use of PaaS services for patch management etc securing infrastructure, firewalls etc
   2. Lesson 2 - Azure Security Center –
      * Topic 1 – Video: Azure Security Center ( topic 2 below )
      * Topic 2 - Azure Security Center – what it is how it integrates inot CI/CD pipelines in Azure DevOps
      * Topic 3 - Security Policies - definition, create and apply.
      * Topic 4 –Threat Assessment and Alerts – integration stratgey around threat assessment and tools, process.
      * Topic 5 – Azure Advisor Integration – how Sec Center integartes with advisor
      * Topic 6 – Key Vault usage – general guidance on it, not an ideal fit here, but just a mentin for awareness…
      * Topic 5 - Demo: Azure Security Center
   3. Lesson 3 - Labs
      * Lab Overview
      * Lab Steps – Integrate a scanning extension or tool into an Az devOps pipeline/ Security Center (max 1 hour)
   4. Lesson 4 - Review Question
      * Module Review Quuestions
   5. Lesson 5 - Module 6 Summary
      * Topic 1 - Video: – Module 6 Summary
      * Topic 2 - Module 6 Summary
7. **Module 7 – Final Exam**
   1. Lesson 1 - Graded Final Exam
      * Topic 1 - Course Final Exam
8. **Module 8 – Course End**
   1. Lesson 1 - Course Complete
      * Topic 1 – Video: Course Summary and Thank You
   2. Lesson 2 - Post – Course Survey
      * Topic 1 - Post Course Survey