

AZ-220T00 Microsoft Azure IoT Developer

Course Summary

Description

This course provides students with the skills and knowledge required to successfully create and maintain the cloud and edge portions of an Azure IoT solution. The course includes full coverage of the core Azure IoT services such as IoT Hub, Device Provisioning Services, Azure Stream Analytics, Time Series Insights, and more. In addition to the focus on Azure PaaS services, the course includes sections on IoT Edge, device management, monitoring and troubleshooting, security concerns, Azure Digital Twins, and Azure IoT Central.

Objectives

At the end of this course, students will be able to:

- Examine the architecture of an IoT solution
- Examine the components of an IoT solution
- Explore the Azure portal
- Explore Azure IoT services
- Examine IoT Hub properties
- Examine IoT device lifecycle concepts
- Examine the IoT developer tools
- Explore device configuration and communication
- Examine Device Provisioning Service terms and concepts
- Examine Device Provisioning Service coding tools and access
- Examine device provisioning lifecycle tasks
- Explore individual enrollment tasks
- Explore group enrollment tasks
- Examine IoT Hub message routing
- Consider message processing options and constraints
- Get started with cloud storage for IoT
- Examine Azure Stream Analytics and Azure Functions
- Explore message processing tasks
- Examine business integration for IoT solutions
- Examine Azure Time Series Insights
- Examine data visualizations with Power BI
- Explore Event Grid integration
- Explore Time Series Insights integration
- Examine the Azure IoT Edge environment
- Examine IoT Edge device deployment
- Examine IoT Edge gateway device configuration
- Explore IoT Edge module deployment
- Explore IoT Edge gateway configuration
- Examine IoT Edge module development
- Examine offline and local storage capabilities
- Explore custom module development for IoT Edge
- Explore IoT Edge offline support
- Examine device management concepts and methods
- Examine device management tools
- Examine approaches to device management at scale
- Explore device management with device twins and direct methods
- Explore IoT Hub automatic device management
- Examine Azure IoT solution monitoring and logging
- Troubleshoot device connections and communication
- Explore IoT Hub monitoring
- Examine security fundamentals for IoT
- Examine Microsoft Defender for Cloud and Microsoft Defender for IoT
- Examine Microsoft Defender for IoT security agents
- Explore Microsoft Defender for IoT implementation
- Examine the components of an Azure Digital Twins solution
- Examine the Azure Digital Twins solution development tools and processes
- Monitor and troubleshoot ADT
- Explore Azure Digital Twins implementation
- Intro to IoT Central
- Create and manage Device Templates
- Manage devices in Azure IoT Central
- Configure business integration

AZ-220T00 Microsoft Azure IoT Developer

Course Summary (cont'd)

Topics

- Examine the architecture of an IoT solution
- Examine the components of an IoT solution
- Explore the Azure portal
- Explore Azure IoT services
- Examine IoT Hub properties
- Examine IoT device lifecycle concepts
- Examine the IoT developer tools
- Explore device configuration and communication
- Examine Device Provisioning Service terms and concepts
- Examine Device Provisioning Service coding tools and access
- Examine device provisioning lifecycle tasks
- Explore individual enrollment tasks
- Explore group enrollment tasks
- Examine IoT Hub message routing
- Consider message processing options and constraints
- Get started with cloud storage for IoT
- Examine Azure Stream Analytics and Azure Functions
- Explore message processing tasks
- Examine business integration for IoT solutions
- Examine Azure Time Series Insights
- Examine data visualizations with Power BI
- Explore Event Grid integration
- Explore Time Series Insights integration
- Examine the Azure IoT Edge environment
- Examine IoT Edge device deployment
- Examine IoT Edge gateway device configuration
- Explore IoT Edge module deployment
- Explore IoT Edge gateway configuration
- Examine IoT Edge module development
- Examine offline and local storage capabilities
- Explore custom module development for IoT Edge
- Explore IoT Edge offline support
- Examine device management concepts and methods
- Examine device management tools
- Examine approaches to device management at scale
- Explore device management with device twins and direct methods
- Explore IoT Hub automatic device management
- Examine Azure IoT solution monitoring and logging
- Troubleshoot device connections and communication
- Explore IoT Hub monitoring
- Examine security fundamentals for IoT
- Examine Microsoft Defender for Cloud and Microsoft Defender for IoT
- Examine Microsoft Defender for IoT security agents
- Explore Microsoft Defender for IoT implementation
- Examine the components of an Azure Digital Twins solution
- Examine the Azure Digital Twins solution development tools and processes
- Monitor and troubleshoot ADT
- Explore Azure Digital Twins implementation
- Intro to IoT Central
- Create and manage Device Templates
- Manage devices in Azure IoT Central
- Configure business integration

AZ-220T00 Microsoft Azure IoT Developer

Course Summary (cont'd)

Audience

An Azure IoT Developer is responsible for the implementation and the coding required to create and maintain the cloud and edge portion of an IoT solution. In addition to configuring and maintaining devices by using Azure IoT services and other Microsoft tools, the IoT Developer also sets up the physical devices and is responsible for maintaining the devices throughout the life cycle. The IoT Developer implements designs for IoT solutions, including device topology, connectivity, debugging and security. For Edge device scenarios, the IoT Developer also deploys compute/containers and configures device networking, which could include various edge gateway implementations. The IoT Developer implements designs for solutions to manage data pipelines, including monitoring and data transformation as it relates to IoT. The IoT Developer works with data engineers and other stakeholders to ensure successful business integration. IoT Developers should have a good understanding of Azure services, including data storage options, data analysis, data processing, and the Azure IoT PaaS versus SaaS options. IoT Developers should have basic programming skills in at least one Azure-supported language, including C#, Node.js, C, Python, or Java.

Prerequisites

To be successful in this course, learners should have the following:

- **Cloud Solution Awareness:** Students should have experience using the Azure Portal and a basic understanding of PaaS, SaaS, and IaaS implementations.
- **Software Development Experience:** Software development experience is a prerequisite for this course, but no specific software language is required, and the experience does not need to be at a professional level.
- **Data Processing Experience:** General understanding of data storage and data processing is a recommended but not required.

Duration

Four days

AZ-220T00 Microsoft Azure IoT Developer

Course Outline

- I. Examine the architecture of an IoT solution*
 - A. Describe the subsystems of an IoT solution architecture and the cross-cutting concerns that overlay the architecture.
 - B. Describe the data workflows between device and cloud and between cloud services.
- II. Examine the components of an IoT solution*
 - A. Describe the device hardware and cloud service components of an IoT solution.
 - B. Describe the device software options and Azure IoT technologies that are available to you.
- III. Explore the Azure portal*
 - A. Describe the features of the Azure portal.
 - B. Demonstrate your ability to configure and use the Azure portal toolbar, navigation menu, and dashboard.
- IV. Explore Azure IoT services*
 - A. Describe features of the Azure IoT Hub and Device Provisioning Service resources.
 - B. Explain Azure resource naming requirements.
 - C. Create and examine Azure IoT Hub and Device Provisioning Service resources in the Azure portal.
- V. Examine IoT Hub properties*
 - A. Describe the service tiers available for IoT Hub.
 - B. Describe the IoT Hub endpoints that are available for communication with other resources.
 - C. Describe the security features that IoT Hub uses to help protect your solution.
- VI. Examine IoT device lifecycle concepts*
 - A. Describe the IoT device lifecycle terms and device type classifications.
 - B. Describe the concept of device twins and how devices twins can be used to monitor devices.
 - C. Describe the conditions under which devices may need to be retired.
- VII. Examine the IoT developer tools*
 - A. Describe the developer tool options.
 - B. Describe the Azure IoT SDKs for devices and services.
 - C. Describe the Visual Studio Code, Azure CLI, and Cloud Shell coding environments.
- VIII. Explore device configuration and communication*
 - A. Describe the types of device communication and the device communication protocols.
 - B. Register a device with IoT Hub, and then configure and test device-to-cloud communication with IoT Hub.
- IX. Examine Device Provisioning Service terms and concepts*
 - A. Describe the phases of device provisioning.
 - B. Describe the concepts and features of Device Provisioning Service deployments.
 - C. Describe device enrollment concepts and attestation methods.
 - D. Describe the processes for device provisioning and auto-provisioning.
- X. Examine Device Provisioning Service coding tools and access*
 - A. Describe the Azure CLI support for the Device Provisioning Service.
 - B. Describe the SDKs associated with the Device Provisioning Service.
 - C. Describe user permissions and how to control access to DPS.
- XI. Examine device provisioning lifecycle tasks*
 - A. Describe the device enrollment tools and processes.
 - B. Describe how to configure and use certificates within the provisioning lifecycle.
 - C. Describe the deprovisioning and disenrollment processes.
 - D. Describe how to provision for multi-tenancy scenarios.

AZ-220T00 Microsoft Azure IoT Developer

Course Outline (cont'd)

XII. Explore individual enrollment tasks

- A. Create a new individual enrollment in DPS that uses Symmetric Key attestation and specifies an initial Device Twin State for the device.
- B. Configure a simulated device using the autogenerated keys for device attestation, verify that device connects successfully with IoT hub, and recognize the code used to initialize the device using device twin properties.
- C. Complete a deprovisioning process that securely removes the device from your solution by both disenrolling and deregistering the device.

XIII. Explore group enrollment tasks

- A. Generate an X.509 root CA Certificate using OpenSSL within the Azure Cloud Shell, and then use the root certificate to configure a group enrollment within the Device Provisioning Service.
- B. Generate a device certificate and use it to provision a device to IoT hub.
- C. Use code to access to the device twin properties and perform initial configuration of the device.
- D. Deprovision an individual device from the enrollment group and then deprovision the entire group enrollment.

XIV. Examine IoT Hub message routing

- A. Describe message processing concepts.
- B. Describe the Azure IoT common message format and features of IoT Hub message routing.
- C. Describe the built-in and custom endpoints that can be used with IoT Hub message routing.
- D. Describe the message routing query syntax.

XV. Consider message processing options and constraints

- A. Describe IoT Hub message routing with Event Grid integration.
- B. Describe IoT Hub message enrichment.
- C. Describe the IoT Hub messaging quotas and throttling limits.

XVI. Get started with cloud storage for IoT

- A. Describe the lambda architecture for data storage.
- B. Describe Azure storage options commonly implemented with IoT solutions.
- C. Describe the features provided by specific Azure storage options.

XVII. Examine Azure Stream Analytics and Azure Functions

- A. Describe Azure Stream Analytics concepts, use cases, and guidelines.
- B. Describe Azure Stream Analytics input types and configuration requirements.
- C. Describe the Azure Stream Analytics query syntax for simple and complex queries.
- D. Describe how Azure Stream Analytics handles time data and the available windowing functions.
- E. Describe Azure Stream Analytics output options and the capabilities provided by Azure functions.

XVIII. Explore message processing tasks

- A. Connect a simulated device to Azure IoT Hub and verify that IoT Hub is receiving telemetry.
- B. Configure an Azure IoT Hub message route that outputs selected message data to Azure Blob storage.
- C. Configure an Azure Stream Analytics job that analyzes message data and routes the selected information to Azure Blob storage.

XIX. Examine business integration for IoT solutions

- A. Describe business contributor responsibilities and the Azure services that enable downstream workflows.
- B. Describe Azure Event Grid integration within an IoT solution.
- C. Describe the purpose and capabilities of Azure Logic Apps.

XX. Examine Azure Time Series Insights

- A. Describe the use cases and benefits of Azure Time Series Insights.
- B. Describe Time Series Insights resource configuration.
- C. Describe Time Series Insights integration with IoT Hub.

AZ-220T00 Microsoft Azure IoT Developer

Course Outline (cont'd)

XXI. Examine data visualizations with Power BI

- Describe Power BI options and capabilities.
- Describe Power BI data connections.
- Describe Power BI data visualization options.

XXII. Explore Event Grid integration

- Create a Logic App that sends an email.
- Configure an IoT Hub Event Subscription that triggers the Logic App when a device is created.

XXIII. Explore Time Series Insights integration

- Create an Azure Time Series Insights (TSI) environment.
- Connect to IoT Hub with Time Series Insights (TSI).
- View time series data using the Time Series Insights (TSI) Explorer.

XXIV. Examine the Azure IoT Edge environment

- Describe the features and capabilities of Azure IoT Edge.
- Describe the IoT Edge runtime and modules.
- Describe IoT Edge security and certificates.

XXV. Examine IoT Edge device deployment

- Describe Azure IoT Edge deployment concepts.
- Describe the IoT Edge deployment manifest.
- Describe pre-deployment considerations.

XXVI. Examine IoT Edge gateway device configuration

- Describe the IoT Edge device gateway patterns.
- Describe how to authenticate the devices that are connected to a gateway device.
- Describe the configuration of a transparent gateway device.

XXVII. Explore IoT Edge module deployment

- Deploy an Azure IoT Edge enabled Linux VM.
- Create an IoT Edge device identity in IoT Hub using Azure CLI.
- Connect the IoT Edge device to IoT Hub.

- Deploy an IoT Edge module that acts as a temperature sensor.
- Deploy Azure Stream Analytics module that analyzes temperature data on the IoT Edge device.

XXVIII. Explore IoT Edge gateway configuration

- Deploy an Azure IoT Edge Enabled Linux VM as an IoT Edge Device.
- Configure the IoT Edge device as a transparent gateway and connect it to IoT Hub.
- Configure the IoT Edge gateway device for communication with downstream IoT devices.
- Create a downstream IoT device and configure its connection to the gateway device.

XXIX. Examine IoT Edge module development

- Describe the Azure IoT Edge runtime support for custom code development.
- Describe the IoT Edge coding tools.
- Describe IoT Edge coding and debugging processes.

XXX. Examine offline and local storage capabilities

- Describe the extended offline capabilities.
- Describe local storage using Azure Blob storage.
- Describe module access to local storage.

XXXI. Explore custom module development for IoT Edge

- Configure the IoT Edge code development environment and container registry.
- Create and debug a custom IoT Edge module.
- Publish the module to the Azure Container Registry and prepare for deployment.

XXXII. Explore IoT Edge offline support

- Create an IoT Edge gateway device and a child IoT device.
- Configure communication between the IoT Edge gateway and child device.
- Configure the IoT Edge Gateway device Time-to-Live and Message Store.
- Test the device connectivity and offline support.

AZ-220T00 Microsoft Azure IoT Developer

Course Outline (cont'd)

XXXIII. Examine device management concepts and methods

- A. Describe device management concepts.
- B. Describe the device management patterns.
- C. Describe device configuration options using device twins and direct methods.

XXXIV. Examine device management tools

- A. Describe the device management tools and approaches.
- B. Describe device management using the IoT extension for Azure CLI.
- C. Describe device management using the Azure IoT tools for VS Code.

XXXV. Examine approaches to device management at scale

- A. Describe how to use IoT Hub jobs for device management.
- B. Describe IoT Hub automatic device management.
- C. Describe device management best practices.

XXXVI. Explore device management with device twins and direct methods

- A. Create a back-end service app that listens for device telemetry.
- B. Implement a direct method that communicates settings to an IoT device.
- C. Implement device twin functionality that manages IoT device properties.

XXXVII. Explore IoT Hub automatic device management

- A. Write code for a simulated device that will implement a firmware update.
- B. Test the firmware update process on a single device using Azure IoT Hub automatic device management.

XXXVIII. Examine Azure IoT solution monitoring and logging

- A. Describe Azure Monitor support.
- B. Describe IoT Hub metrics and resource logs.
- C. Describe IoT device connection state monitoring and lifecycle events.
- D. Describe IoT Hub service limits and their impact on monitoring.

XXXIX. Troubleshoot device connections and communication

- A. Describe device connection best practices.
- B. Describe the device communication troubleshooting guide.

XL. Explore IoT Hub monitoring

- A. Enable IoT Hub diagnostics logs and metrics.
- B. Configure alerts for IoT Hub metrics.
- C. Trigger alerts and verify records in the diagnostics log.

XLI. Examine security fundamentals for IoT

- A. Describe security recommendations.
- B. Describe the IoT security infrastructure and security-in-depth strategy.
- C. Describe threat modeling and mitigation techniques.

XLII. Examine Microsoft Defender for Cloud and Microsoft Defender for IoT

- A. Describe Microsoft Defender for Cloud concepts.
- B. Describe Microsoft Defender for IoT options and features of the agent-based implementation.
- C. Describe IoT Hub security alerts and custom alert implementations.

XLIII. Examine Microsoft Defender for IoT security agents

- A. Describe Microsoft Defender for IoT security agent options.
- B. Describe security agent authentication methods.
- C. Describe built-in security agent alerts.
- D. Describe security recommendations for Microsoft Defender for IoT and devices.

XLIV. Explore Microsoft Defender for IoT implementation

- A. Enable Microsoft Defender for IoT and create a security module twin.
- B. Install a security agent on a device.
- C. Create and trigger a custom alert.
- D. Review the alert in Microsoft Defender for IoT.

AZ-220T00 Microsoft Azure IoT Developer

Course Outline (cont'd)

XLV. Examine the components of an Azure Digital Twins solution

- A. Describe the components of an Azure Digital Twins solution.
- B. Describe Azure Digital Twins models and the Digital Twins Definition Language.
- C. Describe digital twins and graph construction.

XLVI. Examine the Azure Digital Twins solution development tools and processes

- A. Describe Azure Digital Twins service configuration.
- B. Describe the Azure Digital Twins APIs and associated developer tools.
- C. Describe the Azure Digital Twins SDKs and associated developer tools.
- D. Describe how to manage and query graph components.
- E. Describe how to implement Azure Digital Twins data inputs and outputs.

XLVII. Monitor and troubleshoot ADT

- A. Describe the Azure Digital Twins metrics.
- B. Describe the Azure Digital Twins diagnostics settings, logs, and alerts.
- C. Describe Azure Resource Health support for Azure Digital Twins.

XLVIII. Explore Azure Digital Twins implementation

- A. Build an Azure Digital Twins graph using digital twin instances.
- B. Implement graph interaction that includes queries and digital twin property updates.
- C. Ingest IoT device messages by using an Azure function.
- D. Configure Azure Digital Twins routes and endpoints to publish telemetry to Time Series Insights using Azure Functions and Event Grid.

XLIX. Intro to IoT Central

- A. Describe the components and capabilities of Azure IoT Central.
- B. Describe the Azure IoT Central architecture.
- C. Describe the industry support and device security provided by Azure IoT Central.

L. Create and manage Device Templates

- A. Describe the features and components of a Device Template.
- B. Describe the component sections of a Device Template.
- C. Describe how to version a Device Template.

LI. Manage devices in Azure IoT Central

- A. Describe the Azure IoT Central UI tools for device management.
- B. Describe device management with device groups.
- C. Describe device management at scale using jobs.

LII. Configure business integration

- A. Describe the configuration of Rules in Azure IoT Central.
- B. Describe how to configure a rule with condition-based actions.
- C. Describe the Azure IoT Central Dashboard page for administrators.
- D. Describe the Azure IoT Central data analytics UI.