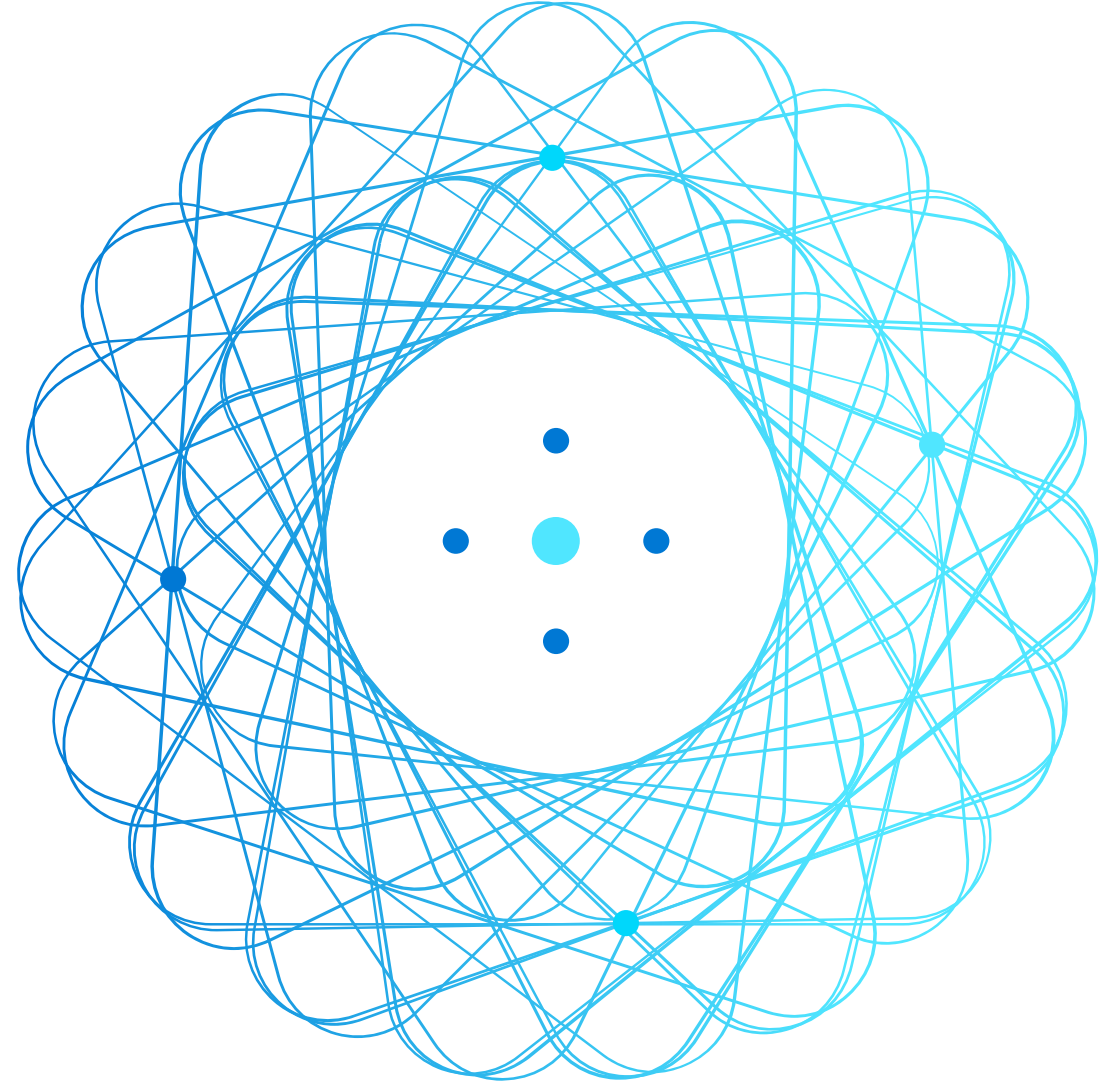


AZ-220T01

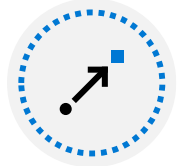
Module 12: Build an IoT Solution with IoT Central



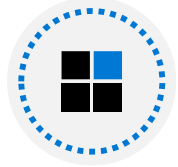
Lesson 1: Learning objectives



Module 12 – Learning objectives



Describe the difference between Azure IoT Central and the Azure IoT PaaS services



Describe the features provided by Azure IoT Central



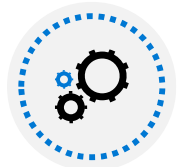
Describe the purpose and components of a Device Template



Create and publish a Device Template

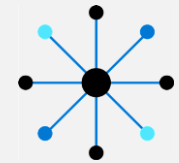


Manage devices using rules and notifications



Manage devices at scale using jobs

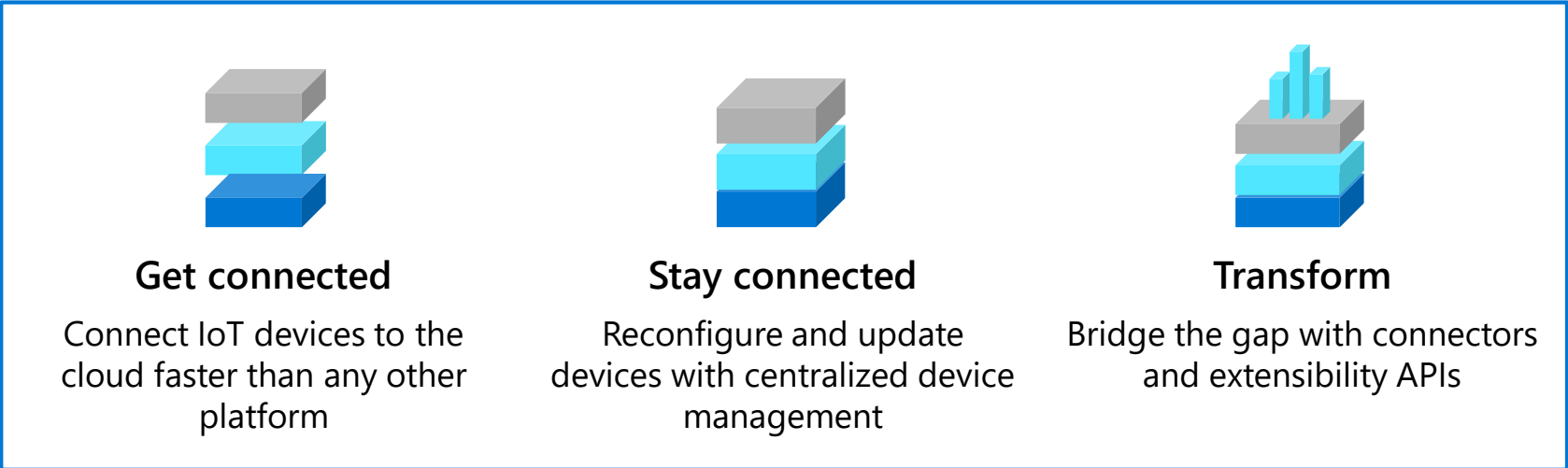
Lesson 2: Introduction to IoT Central



Azure IoT Central

A fully managed IoT app platform that reduces the burden of building and maintaining IoT solutions

- ✓ Highly secure
- ✓ Enterprise-grade
- ✓ Predictable pricing
- ✓ Industry-focused



Existing solution builders

A collection of logos for existing solution builders, arranged in two rows:

- Row 1: MESHSYSTEMS™, cradlepoint (Connect Beyond), sage greenlife, flex, C.H. ROBINSON, umec
- Row 2: FOOTMARKS, Kroger, jda., Starbucks, BOSCH, QUEST (BORN TO ENGINEER)

Azure IoT Central



Get Connected

Connect IoT devices to the cloud faster than with any other platform

Device connectivity and management

Edge support

Device Modeling

End to End Security



Stay Connected

Reconfigure and update devices with centralized device management

Telemetry ingestion and command & control

Dashboards, visualization & insights

Monitoring rules & triggered actions

User roles and permissions



Transform

Bridge the gap with connectors and extensibility APIs

Industry-focused Application Templates

White Labeling

Multitenancy

Extensibility & Customization IoT Central public APIs

Azure IoT Central

Tier options



App templates for Industry Verticals



White labeling your SaaS – your brand



Azure IoT Edge support






API support



IoT Plug and Play support

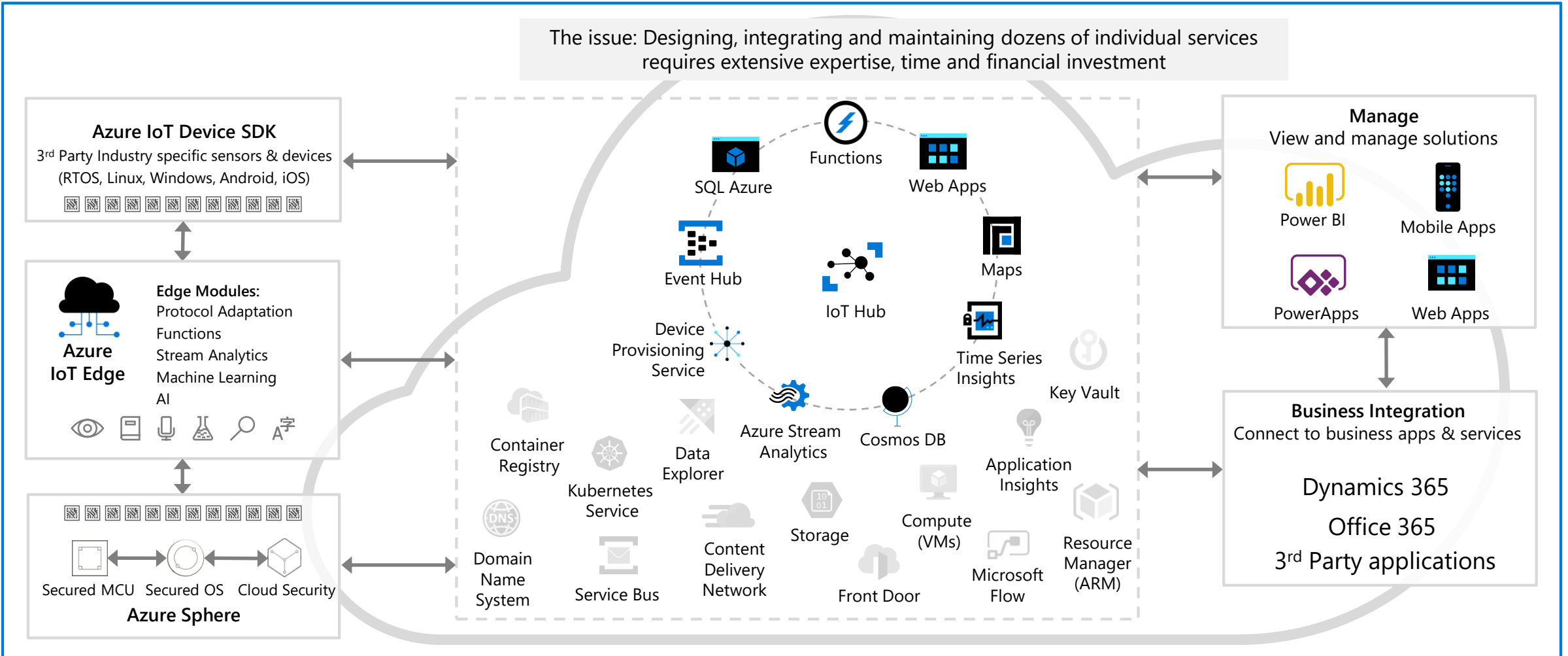


New 2-tiered pricing model

<p>First 2 devices included (tiered message rates apply)</p>  <p>free</p>	<p>Tier 1</p> <p>5,000 messages/month/device</p>  <p>additional devices: \$0.40 (USD) ea.</p>	<p>Tier 2</p> <p>30,000 messages/month/device</p>  <p>additional devices: \$0.70 (USD) ea.</p>
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Your options for building IoT solutions

1. Build from the ground up

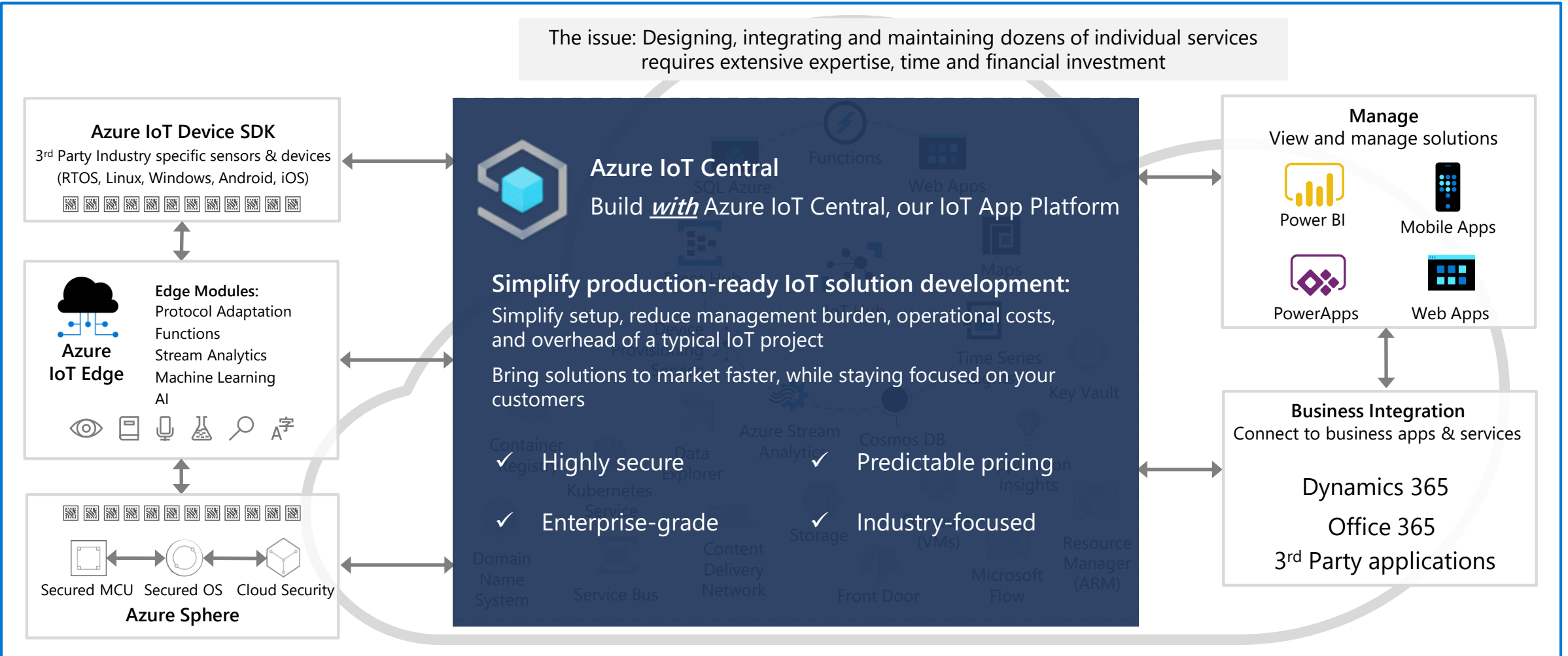


Azure Security Center for IoT

- Integrated view for [CISO & SecOps personas](#) to review enterprise security posture, including IoT solutions
- Holistic view of IoT solution security posture for [DevOps and IoT solution managers](#) to review and manage day to day security status

Your options for building IoT solutions

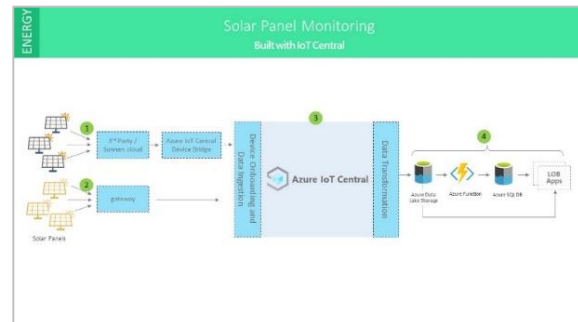
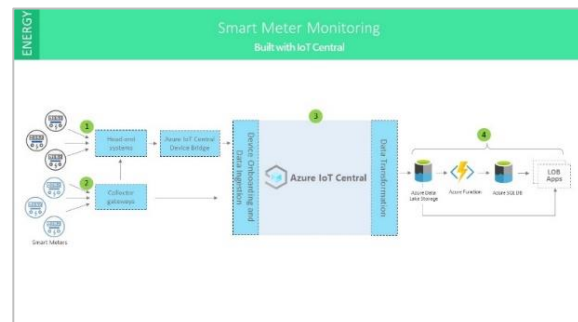
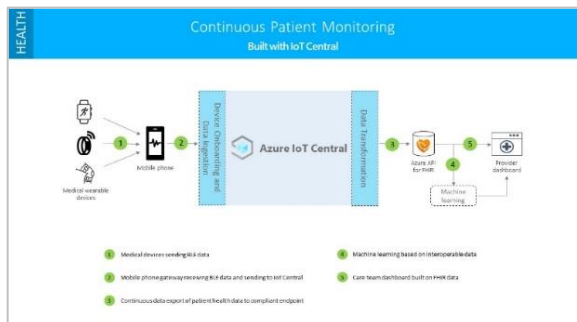
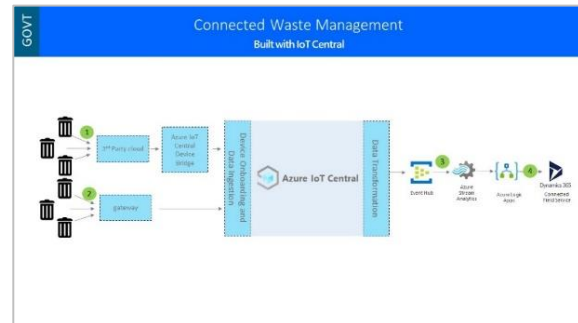
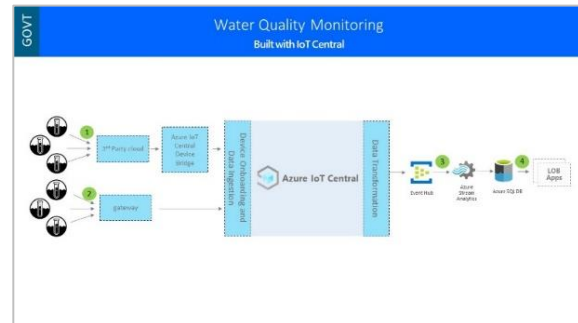
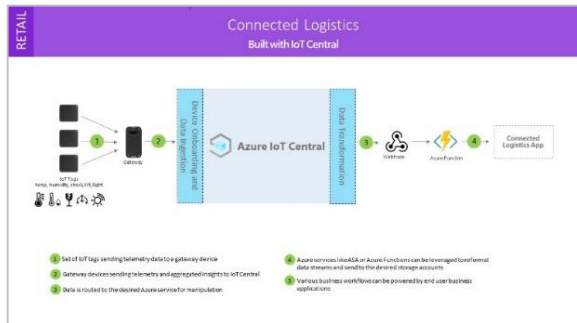
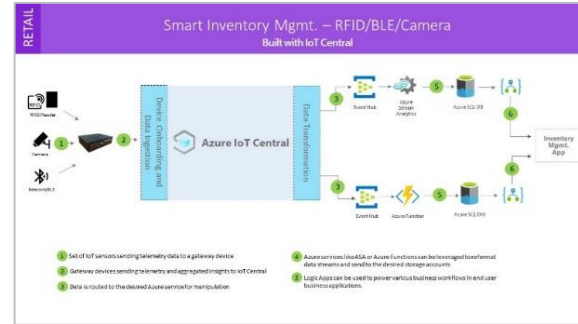
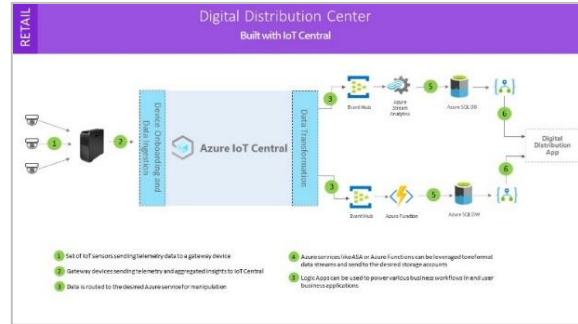
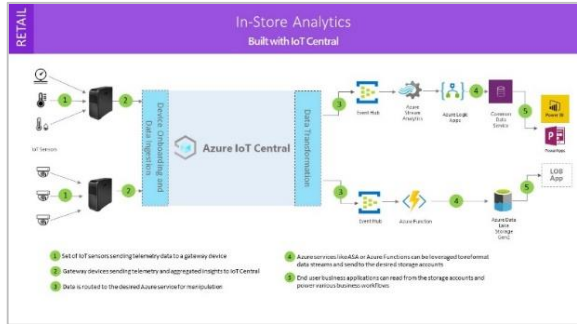
2. Build with a fully managed IoT app platform



Azure Security Center for IoT

- Integrated view for [CISO & SecOps personas](#) to review enterprise security posture, including IoT solutions
- Holistic view of IoT solution security posture for [DevOps and IoT solution managers](#) to review and manage day to day security status

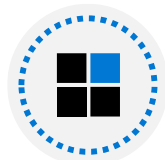
Industry application templates



Connecting devices



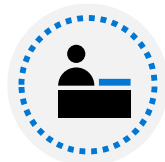
Connect a single device



Connect devices at scale using SAS



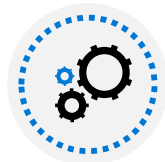
Connect devices at scale using X.509 certificates



Connect without registering devices



Individual enrollment-based device connectivity

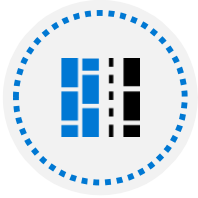


Device status

Lesson 3: Create and manage device templates



Introduction to device templates



Device templates – blueprints for a device:

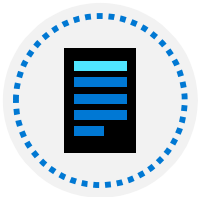
Device capability model – telemetry, properties, and commands for the device

Cloud properties – IoT Central properties not shared with the device

Customizations – allow overriding some of the capability model for an individual device such as property names

Rules – monitoring workflows and actions (more in a later lesson)

Dashboards and flows – visual display and configuration (more in a later lesson)



Options for creating a device template:

Create a device template from the device catalog

Create a device template from scratch



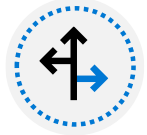
Manage a device template:

Templates can be renamed or deleted

Device template example: A connected fan



Sends temperature telemetry



Sends location property



Sends fan motor error events



Sends fan operating state



Provides a writeable fan speed property



Provides a command to restart the device



Gives you an overall view of the device via a dashboard

Create a device Capability Model

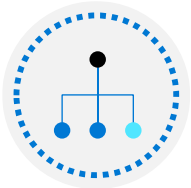


Approaches for Creating a Capability Model:

From scratch

Import from a JSON file such as from Visual Studio Code

Import from the device catalog



Manage a Capability Model:

Add interfaces to the model – A reusable collection of capabilities

Edit model metadata such as its name

Delete the model

Add cloud properties to a Device Template

Field	Description
Display Name	The display name for the cloud property value used on dashboards and forms
Name	The name of the cloud property. IoT Central generates a value for this field from the display name, but you can choose your own value if necessary
Semantic Type	The semantic type of the property, such as temperature, state, or event. The choice of semantic type determines which of the following fields are available
Schema	The cloud property data type, such as double, string, or vector. The available choices are determined by the semantic type

Add customizations to a Device Template



Use customizations to modify a capability:

Display name and unit

Default chart color

Initial, minimum, and maximum values



Generate default views for visualization:

Commands – Lists the device commands with a dispatch option

Overview – Device telemetry in charts and metric values

About – Device properties

Add dashboards to a Device Template



Dashboards – Enable operators to visualize devices



Includes charts and metrics



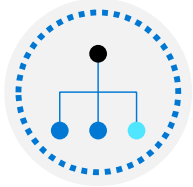
Configure preview device – Option in the dashboard editor that allows viewing a running version of the dashboard, with data from:

Nothing (no data)

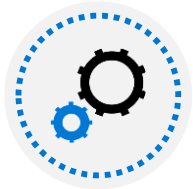
A test device

A production device

Add forms to a Device Template



Forms – Enable operators to manage a device

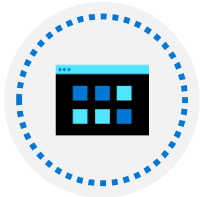


Includes properties and editors for properties

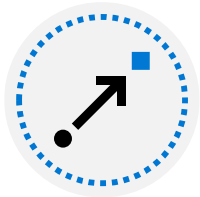
Version a Device Template



Add customizations to the device template without versioning – As long as the interface is consistent

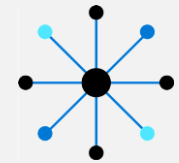


Versioning a Device Template



Migrate a device across device template versions

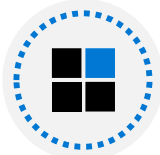
Lesson 4: Manage devices in Azure IoT Central



Manage your devices



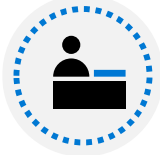
View Your devices



Add a device



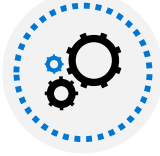
Import devices



Export devices



Delete a device



Change a property

Introduction to device groups



Device group – Collection of devices based on device properties



Can be displayed on a dashboard in a grid or on a map



Can be displayed in a customizable list view within the group



Analytics – Tool to perform aggregation of telemetry data across a device group

Manage devices at scale using Jobs



Jobs – Allow changing settings or properties or running commands across a collection of devices in a device set



Can be started and stopped on demand



Can be copied to make new templates

Lesson 5: Business integration and data analysis



What are rules?

Rules – Serve as a customizable response tool that trigger actions on actively monitored events from connected devices



Actions can be:

Email

Webhooks

Azure Monitor Action Groups

Configuring rules

1. Select Target Devices

2. Use multiple conditions

3. Use aggregate windowing

4. Use rules with IoT Edge modules

Target devices

Select the device template your rule will use. If you need to narrow the rule's scope, add filters.

Device template *

Refrigerator

Property * Operator * Value *

Manufactured State Equals Washington

+ Filter

Configuring rules

1. Select Target Devices

2. Use multiple conditions

3. Use aggregate windowing

4. Use rules with IoT Edge modules

▼ **Conditions**

Conditions define when your rule is triggered. Aggregation is optional—use it to cluster your data and trigger rules based on a time window.

Telemetry *	Operator *	Value *	
Temperature ▼	Is greater than ▼	90 × ▼	×
Humidity ▼	Is less than ▼	10 × ▼	×

+ Condition

Time aggregation

Off

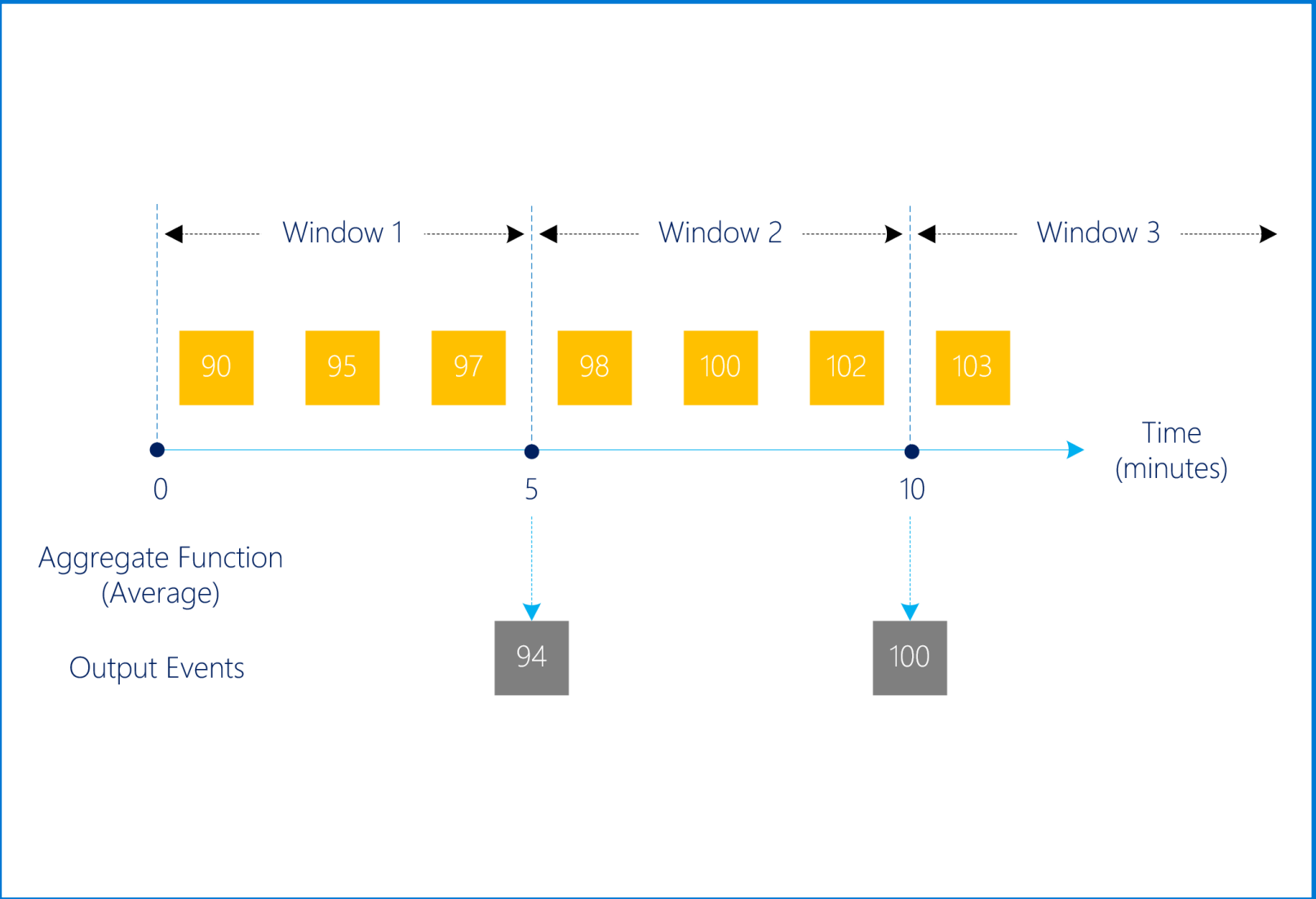
Configuring rules

1. Select Target Devices

2. Use multiple conditions

3. Use aggregate windowing

4. Use rules with IoT Edge modules



Configuring rules

1. Select Target Devices

2. Use multiple conditions

3. Use aggregate windowing

4. Use rules with IoT Edge modules

A restriction applies to rules that are applied to IoT Edge modules. Rules on telemetry from different modules aren't evaluated as valid rules. Take the following as an example. The first condition of the rule is on a temperature telemetry from Module A. The second condition of the rule is on a humidity telemetry on Module B. Since the two conditions are from different modules, this is an invalid set of conditions. The rule isn't valid and will throw an error on trying to save the rule

Create a rule and set up notifications

- 1** Name the rule
- 2** Optionally, filter the devices the rule applies to
- 3** Configure the Rule Conditions
- 4** Configure actions (email, Webhooks, Azure Monitor Action Groups)

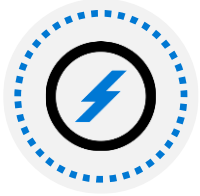
Manage rules for devices:

Delete

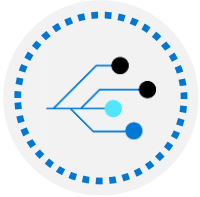
Enable or Disable globally

Enable or Disable for a specific device through the rule filter

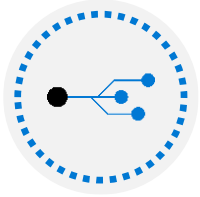
Continuous data export



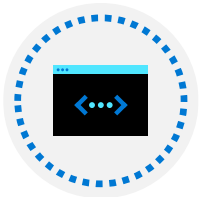
Continuous data export – the ability to send ongoing streams of data (telemetry, device property changes, device template changes) to Event Hubs, Service Bus, or Blob Storage in JSON format



Useful for warm path scenarios such as Azure Stream Analytics, Azure Logic Apps, or Azure Function-based transformations



Useful for cold path scenarios such as training Azure Machine Learning or long-term trend analysis



Includes full message data



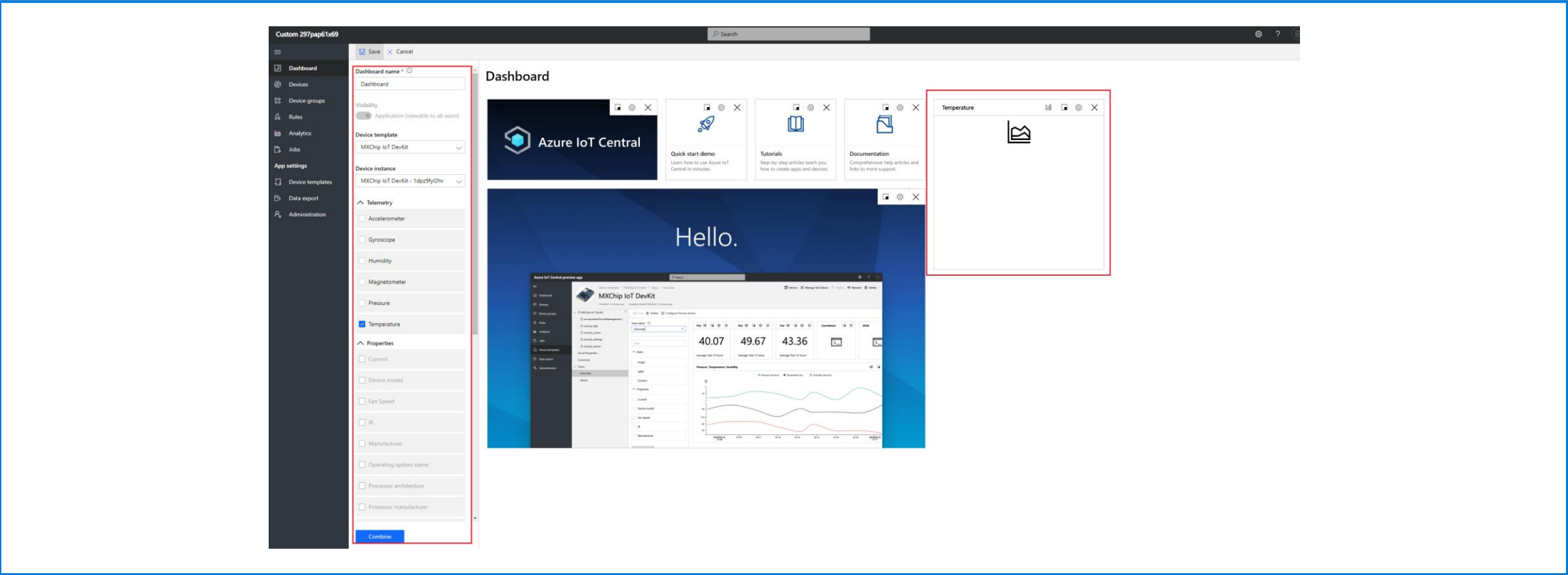
Near-real time for Event Hubs and Service Bus, once per minute for Blob Storage

Configure a dashboard

Add Tiles

Edit Tiles

Tile Types



Analyze your device data

Understanding the Analytics UI:



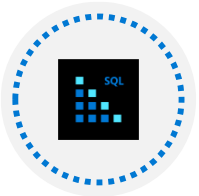
You select the devices, the telemetry values, and the aggregation methods



You select the analysis duration and interval size within the duration

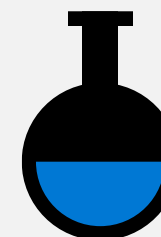


You can choose to display data on a line chart

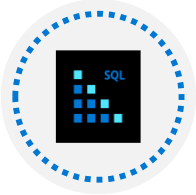


You can split data by device properties to change the data display or aggregation buckets (can even be set to "Device Id" for per-device viewing)

Lesson 6: Module labs



Module 12 labs



Lab 20: Build an IoT Solution with IoT Central

You will create an Azure IoT Central custom app, using the IoT Central portal

You will create a device template for a custom device, using the IoT Central portal

You will create a simulated device app to represent a refrigerated truck

You will define delivery routes using Azure Maps

You will monitor and command the refrigerated truck from an IoT Central dashboard

Lesson 7: Module 12 review questions



Module review: Question 12.1



What are the two categories of Azure IoT Central application template?

Answer A:

Standard and Custom.

Answer B:

Custom and Industry focused.

Answer C:

Default and Custom.

Module review: Question 12.2



Which of the following choices accurately describes Azure IoT Central?

Answer A:

Azure IoT Central is a helper service for IoT Hub that enables zero-touch, just-in-time provisioning to the right IoT hub without requiring human intervention.

Answer B:

Azure IoT Central is an IoT app platform that reduces the resources required to develop, manage, and maintain an IoT solution.

Answer C:

Azure IoT Central is a simple dashboard for reviewing Azure Monitor logs.

Module review: Question 12.3

The device model section of a device template is made up of one or more interfaces.



Which of the following choices describes the items that can be added to an interface?

Answer A:

Capabilities that define either telemetry or property capability types.

Answer B:

Capabilities that define telemetry, property, or command capability types.

Answer C:

Capabilities that define the authentication, telemetry, or property capability types.

Module review: Question 12.4

A developer needs to create a device template in Azure IoT Central.



What are the four components of a device template?

Answer A:

Device capability model, Cloud properties, Views, and Customizations.

Answer B:

Device connectivity model, Cloud properties, Views, and Customizations.

Answer C:

Device capability model, Cloud properties, Views, and Controls.

Module review: Question 12.5



What are the three phases of an IoT Central job?

Answer A:

Pending, running, and completed

Answer B:

Scheduled, running, and successful

Answer C:

Failed, running, and successful

Module review: Question 12.6



In IoT Central, what file type is used to perform a bulk import of devices?

Answer A:

A JSON file

Answer B:

A CSV file

Answer C:

An XML file

Module review: Question 12.7



What is the purpose of a Dashboard within an Azure IoT Central solution?

Answer A:

The Dashboard is the home page for IoT Central that enables you to create your IoT Central app.

Answer B:

The Dashboard is the page displayed by your IoT Central app, your app's URL.

Answer C:

The Dashboard is the IoT Central page that exposes marketplace items that you can add to your solution.

Module review: Question 12.8



Which of the following choices accurately describes how are rules used within an IoT Central application?

Answer A:

Rules in IoT Central perform a set of actions that will be applied equally to all devices in your solution and ensure consistent behavior the full fleet of devices.

Answer B:

Rules in IoT Central allow you to further refine what actions are performed when a Filter is specified.

Answer C:

Rules in IoT Central serve as a customizable response tool that trigger on actively monitored events from connected devices.