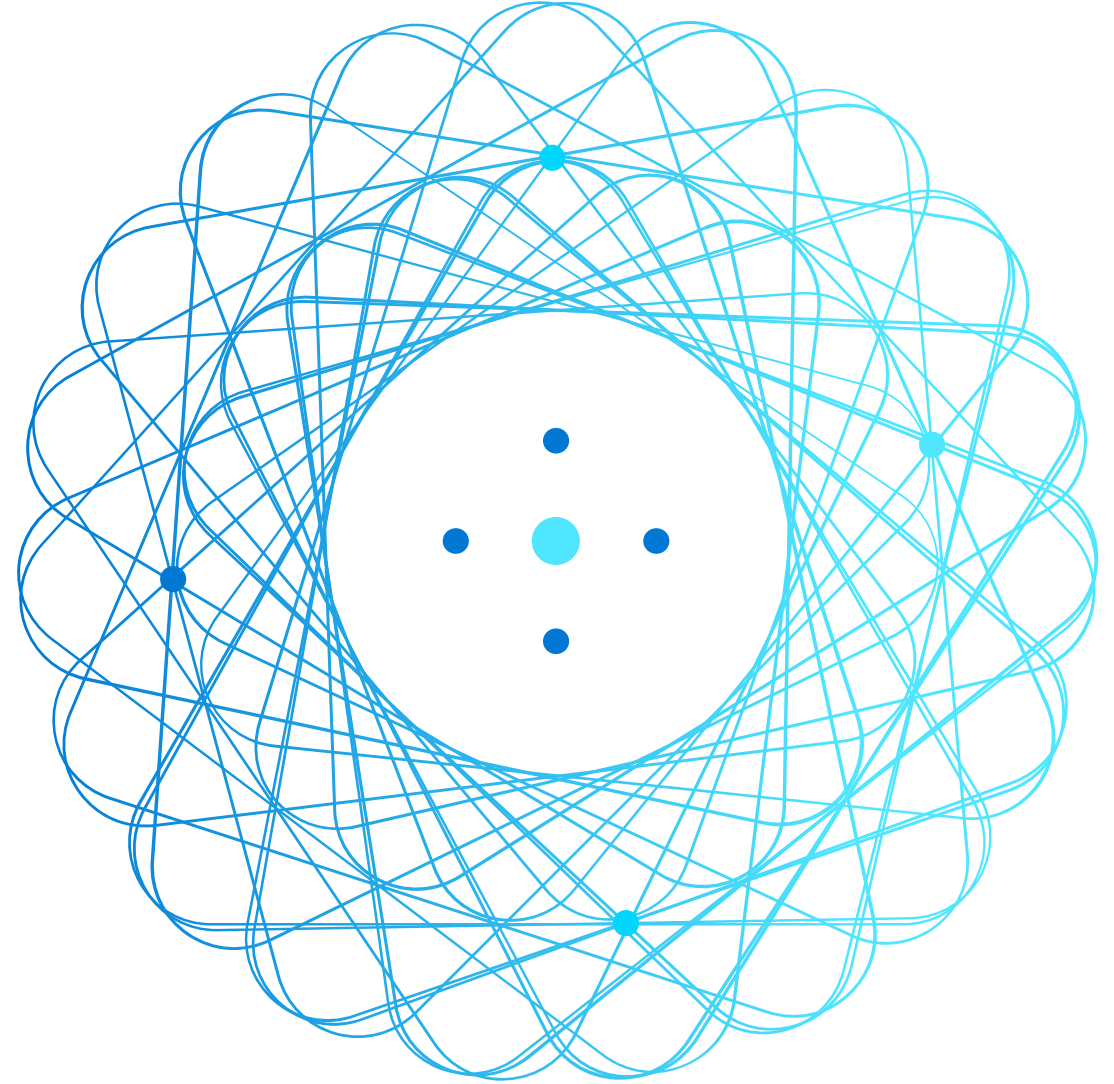


AZ-220T01

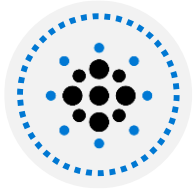
Module 05: Insights and Business Integration



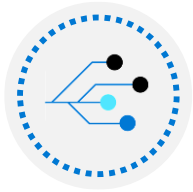
Lesson 1: Learning objectives



Module 5 – Learning objectives



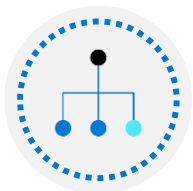
Explain the options for business integration within an IoT solution and how to achieve them



Develop business integration support using Logic Apps and Event Grid



Configure IoT data and connection for Time Series Insights visualizations

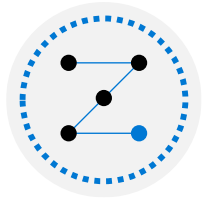


Configure IoT data and connection for Power BI visualizations

Lesson 02: Business integration for IoT solutions



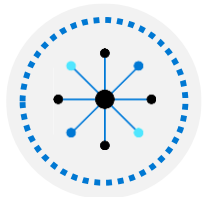
IoT developer role in business integration



Application Backend Processing



Roles Contributing to IoT Solution Implementation



Azure IoT Developer Responsibilities

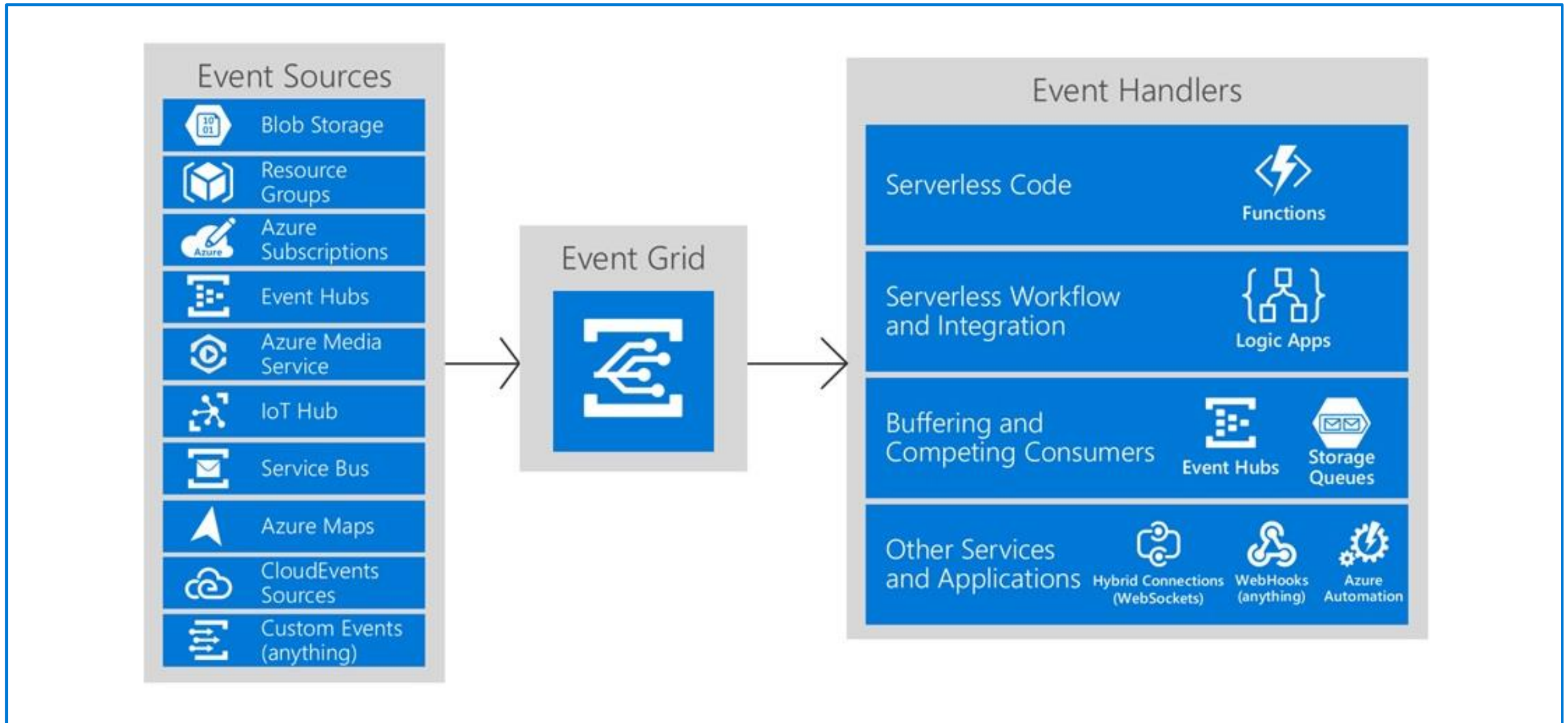
Comparing cloud event and messaging options

Requirement	Simple queuing	Eventing and PubSub	Big data streaming	Enterprise messaging
Product	Queue storage	Event Grid	Event Hubs	Service Bus
Supported advantages	<ul style="list-style-type: none"> • Communication within an app • Individual message • Queue semantics/polling buffer • Simple and easy to use • Pay as you go 	<ul style="list-style-type: none"> • Communication between apps/orgs • Individual message • Push semantics • Filtering and routing • Pay as you go • Fan out 	<ul style="list-style-type: none"> • Many messages in a Stream (think in MBs) • Ease of use and operation • Low cost • Fan in • Strict ordering • Works with other tools 	<ul style="list-style-type: none"> • Instantaneous consistency • Strict ordering • Java Messaging Service • Non-repudiation and security • Geo-replication and availability • Rich features (such as deduplication and scheduling)
Weaknesses	<ul style="list-style-type: none"> • Ordering of messaging • Instantaneous consistency 	<ul style="list-style-type: none"> • Ordering of messaging • Instantaneous consistency 	<ul style="list-style-type: none"> • Server-side cursor • Only once 	<ul style="list-style-type: none"> • Cost • Simplicity
Type	Serverless	Serverless	Big data	Enterprise

Azure event and messaging services

Service	Purpose	Type	When to use
Event Grid	Reactive programming	Event distribution (discrete)	React to status changes
Event Hubs	Big data pipeline	Event streaming (series)	Telemetry and distributed data streaming
Service Bus	High-value enterprise messaging	Message	Order processing and financial transactions
Azure Storage Queues	Simple, reliable, persistent messaging within and between services	Message	Very large message stores (over 80 GB), unreliable consumers

Business integration with Event Grid

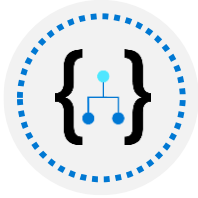


Message routing or Event Grid integration?

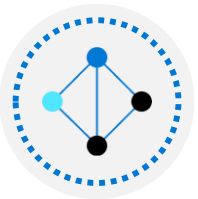
IoT Hub Message Routing and IoT Hub Event Grid integration have some Conceptual Overlaps... but they are Targeting Different Use Cases...

Decision Point	IoT Hub	Event Grid
Data type	Telemetry data, potentially with enhancement	Filtered unenhanced telemetry data and device lifecycle events
Next step endpoint	Limited number built-in with support for some connectors	Azure Functions, Logic Apps (next slide), Storage Accounts, Service Bus queues, webhooks
Ordering	Ordering maintained	Ordering not guaranteed

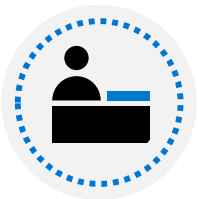
Introduction to Azure Logic Apps



How Logic Apps work – a *trigger* from a *connector* launches a business *workflow* to process data

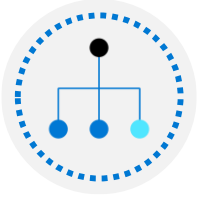


Why to use Logic Apps – a visual designer with codeless implementation and dozens of connectors (including to IoT Hub) make it easy to do sophisticated workflows



Same platform as Power Automate (Microsoft Flow)

Connectors for Azure Logic Apps

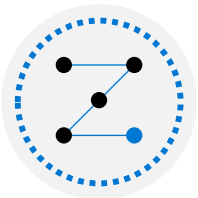


Connectors can be *built-in, managed, or custom*:

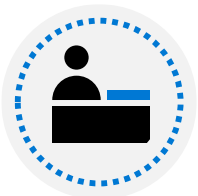
Built-in connectors are core functionality such as calling a web site and receiving a reply

Managed connectors are Microsoft extensions to Logic Apps to talk to many different external systems

Custom connectors are your own code (these are not covered in this course, they are in the AZ-204 course)

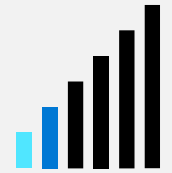


All connectors have *actions*, which are directly mapped to code running in the connector

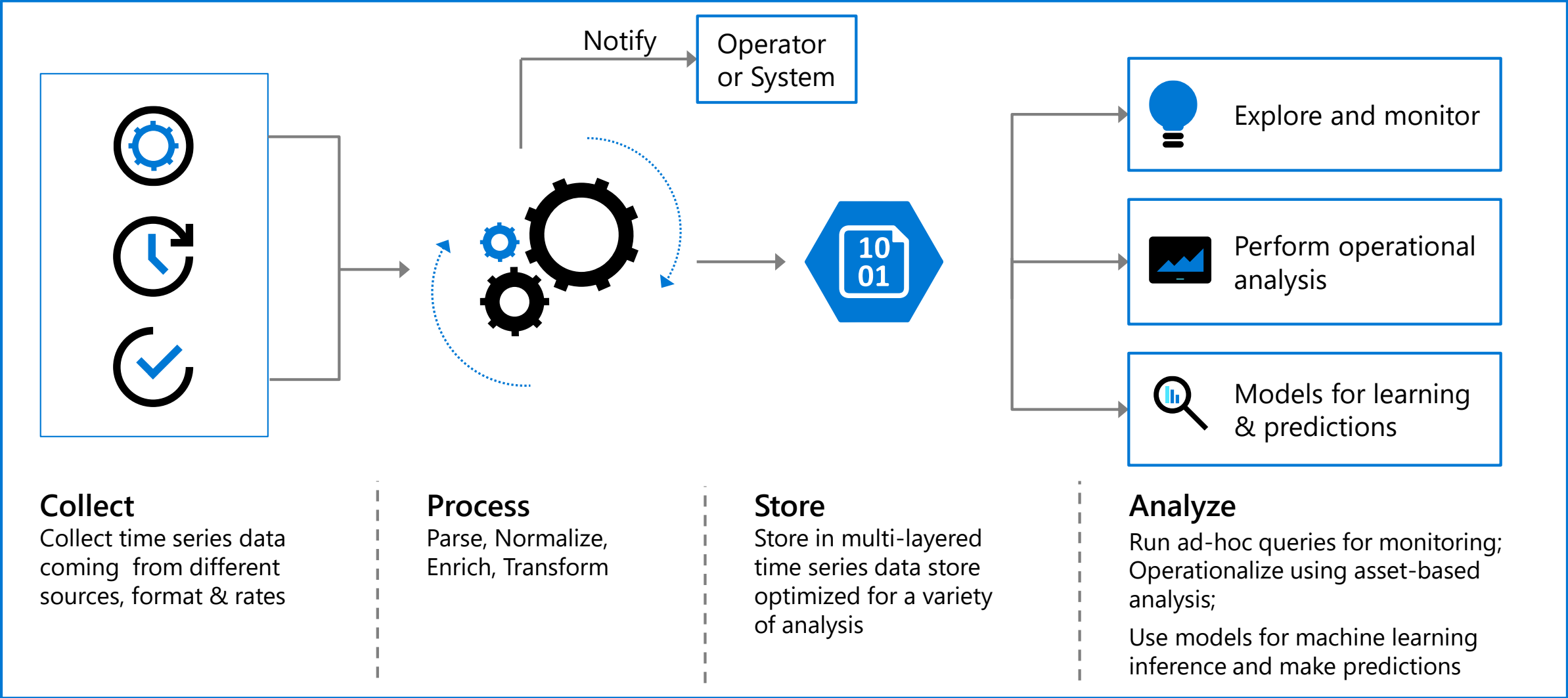


Connectors optionally support triggers, allowing them to be used to start a workflow

Lesson 3: Data visualization with Time Series Insights



What is Azure Time Series Insights?



Why use Azure Time Series Insights?

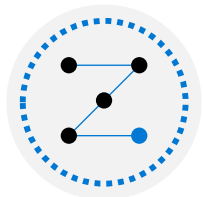


Time Series Insights gives a business the ability to examine historical data over long periods of time, including:

Discovery of data

Trending of data over time

Anomaly detection over time with basic machine learning



TSI manages the details of storage with configurable retention and throttling:

S1 covers 30 GB or 30 million events

S2 covers 300 GB or 300 million events

Configure the TSI environment: Basics

Create Time Series Insights environment

Microsoft

[Basics](#) [Event Source](#) [Review + Create](#)

Create a Time Series Insights environment that you'll use to explore and query time series data. [Learn more](#)

ENVIRONMENT DETAILS

Choose the subscription that will house your new environment. Use resource groups to organize and manage resources in that subscription. Note that these details can't be edited after they're saved.

Environment name * ⓘ

Subscription * ⓘ

Resource group * ⓘ
[Create new](#)

Location * ⓘ

PRICING

Choose a pricing tier. If you aren't sure which tier to choose, [visit our pricing page](#) to learn more.

Tier * ⓘ

Capacity ⓘ

Ingress rate:	Scalable based on usage needs. View current limits.
Storage capacity:	Subject to Azure Storage limits.
Estimated cost:	Varies depending on usage. View metered pricing information.

Configure the TSI environment: Storage

TIME SERIES ID

i Time Series ID acts as a partition key for your data and as a primary key for your time series model. It is important that you specify the appropriate Time Series ID during environment creation, since you can't change it later.

* Property name ⓘ

STORAGE CONFIGURATION

Configure a cold store for long term durable storage with pay-as-you-go pricing. Optionally, enable a warm store if you need faster and unlimited queries over the most recent data. [Learn more](#)

Cold store

Creates a new Azure Storage resource in the subscription and region you've chosen for the TSI environment. You will incur data storage and transaction charges for the data that Time Series Insights reads and writes to this storage resource. [Learn more](#)

Storage account name * ⓘ

Storage account replication * ⓘ

Warm store

Creates a warm store for the TSI environment optimized for higher query performance and unlimited queries. The warm store can be removed from the environment at a later time. By selecting "Yes", you will incur data storage costs. [Learn more](#)

Enable warm store * ⓘ

 Yes No

Data retention time (in days) ⓘ

[Review + create](#) [Next: Event Source >](#) [Download a template for automation](#)

Configure the TSI environment: Event source

The screenshot shows the 'Create Time Series Insights environment' configuration page in the Microsoft Azure portal, specifically the 'Event Source' tab. The breadcrumb trail is 'Home > New > Create Time Series Insights environment'. The page title is 'Create Time Series Insights environment' with the Microsoft logo. Below the title are tabs for 'Basics', 'Event Source' (which is selected), and 'Review + Create'. A descriptive paragraph states: 'An event source is the IoT Hub or Event Hub that feeds data into your Time Series Insights environment. [Learn more.](#)'

The 'EVENT SOURCE DETAILS' section contains the following fields:

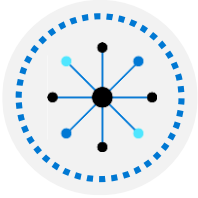
- 'Create an event source?' with a toggle set to 'Yes'.
- 'Name' with the value 'myReader' and a green checkmark.
- 'Source type' with the value 'IoT Hub'.
- 'Select a hub' with the value 'Select existing'.
- 'Subscription' with the value '<My Subscription>'.
- 'IoT Hub name' with the value 'iothub-vdtdo'.
- 'IoT Hub access policy name' with the value 'iothubowner'.

The 'CONSUMER GROUP' section features an information icon and a note: 'This consumer group should be used exclusively for this event source as there can be only one active reader from a given consumer group at a time.' Below this is a dropdown for 'IoT Hub consumer group' with the value 'tsigroup' and a 'New' button.

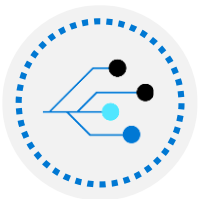
The 'TIMESTAMP' section includes a descriptive paragraph: 'Create an event source timestamp property name. If you don't enter a value, we'll use the message enqueued time from the event source. [Learn more.](#)' and a text input field for 'Property name' containing 'Timestamp property name'.

At the bottom, there are three buttons: 'Review + create' (highlighted with a red box), '« Previous: Basics', and 'Download a template for automation'.

TSI connection to IoT Hub



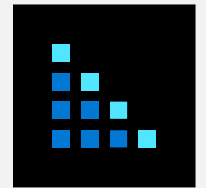
Create an IoT Hub Consumer Group for TSI



Create a TSI Event Source for IoT Hub

The screenshot displays the Azure IoT Hub portal interface for configuring built-in endpoints. The left-hand navigation pane shows the 'Built-in endpoints' option selected under the 'Settings' section, highlighted with a red box and a yellow callout '1'. The main content area shows the configuration for the 'Events' endpoint, which is highlighted with a red box and a yellow callout '2'. Under the 'Consumer Groups' section, a dropdown menu is open, showing the selected group 'Contoso-TSI-GA-IoT-Hub-Consumer-Group' and the option 'Create new consumer group', both highlighted with a red box and a yellow callout '3'. The 'Events' endpoint configuration includes details such as Partitions (4), Event Hub-compatible name (contoso-tsi-ga-iot-hub), and Event Hub-compatible endpoint (sb://iothub-ns-contoso-ts-2507284-cfa30622ff.servicebus.windows.net/SharedAccessKeyName=iothubowner;SharedAccessKey=...). The 'Retain for' setting is set to 1 Day, and the 'Default TTL' is set to 1 Hour.

Lesson 4: Data visualization with Power BI



What is Power BI?

Power BI is used to:

Connect
to data

Transform and
clean data

Create visuals

Create reports

Share reports

Connect to Azure IoT data sources

Azure SQL Database

Azure Data Lake Storage Gen2 (Beta)

Azure SQL Data Warehouse

Azure Data Lake Storage Gen1

Azure Analysis Services database

Azure HDInsight (HDFS)

Azure Blob Storage

Azure HDInsight Spark

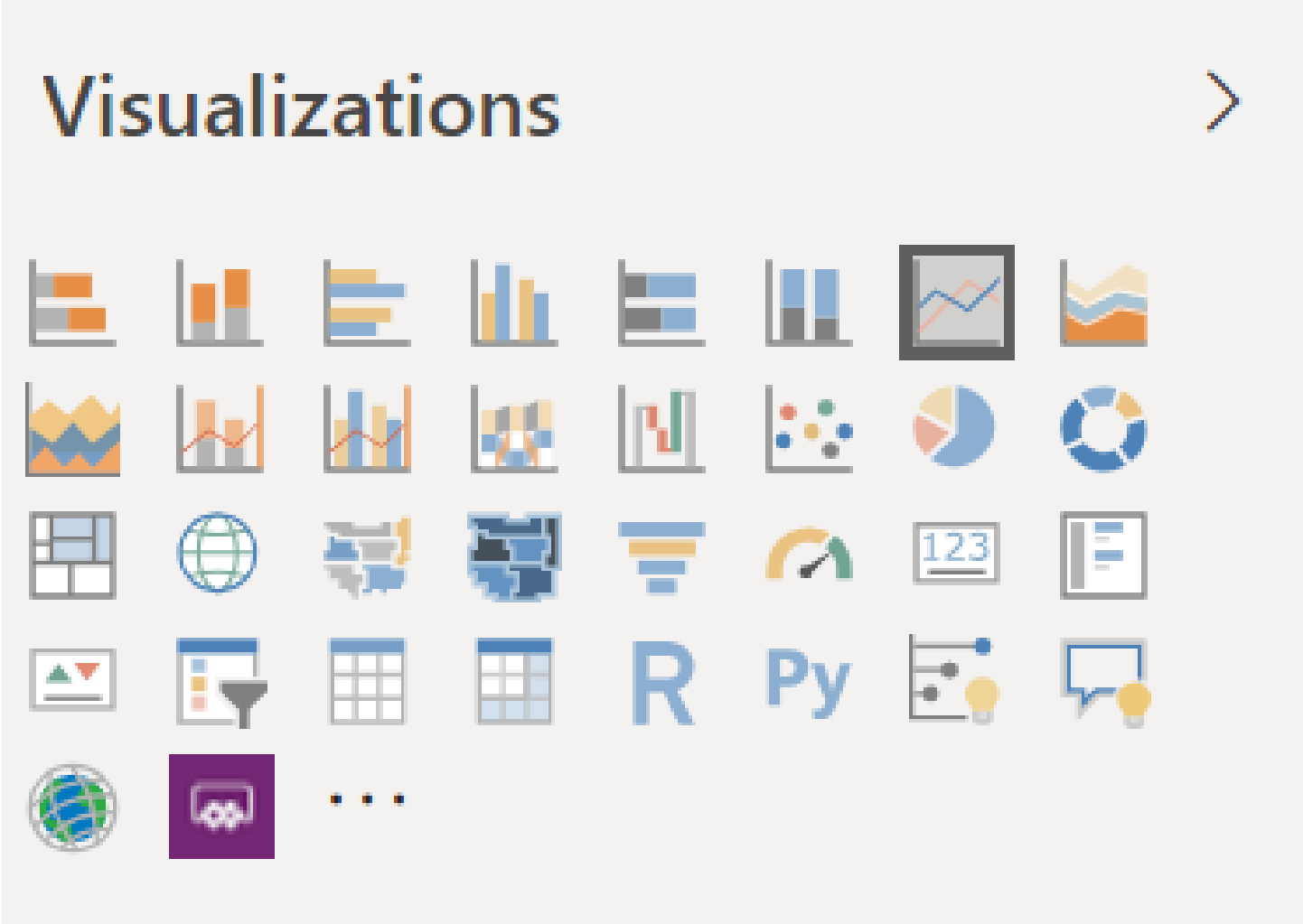
Azure Table Storage

HDInsight Interactive Query

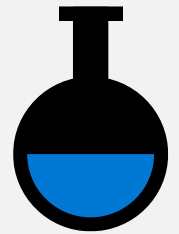
Azure Cosmos DB

Azure Data Explorer (Kusto)

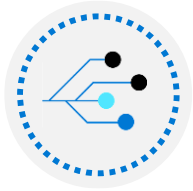
Data Visualization in Power BI



Lesson 5: Module labs



Module 5 Labs



Lab 9: Integrate IoT Hub with event grid

You will create a Logic App that sends an email

You will configure an Azure IoT Hub Event Subscription

You will create new devices to trigger the Logic App



Lab 10: Explore and analyze time stamped data with Time Series Insights

You will create an Azure Time Series Insights (TSI) environment

You will connect to IoT Hub with Time Series Insights (TSI)

You will view time series data using the Time Series Insights (TSI) Explorer

Lesson 06: Module 5 review questions



Module review: Question 5.1



Which of the following event types occurs when a device is registered to an IoT hub?

Answer A:

DeviceConnected

Answer B:

DeviceCreated

Answer C:

DeviceTelemetry

Module review: Question 5.2



When delivering series event information from IoT hub to downstream services, what service should you use?

Answer A:
Event Grid

Answer B:
Event Hubs

Answer C:
Service Bus

Module review: Question 5.3



In order for Time Series Insights to reliably read data from IoT Hub, what must be configured in IoT Hub?

Answer A:

An event source

Answer B:

A shared access policy

Answer C:

A consumer group

Module review: Question 5.4



What are four key jobs of Azure Time Series Insights?

Answer A:

Data ingestion, data queries, data storage, and data verification.

Answer B:

Data ingestion, data queries, data visualization, and data application.

Answer C:

Data ingestion, data queries, data storage, and data visualization.

Module review: Question 5.5



What does the term "visualization" refer to in Power BI?

Answer A:

A data chart or graph

Answer B:

The UI shell that is used to connect to data, construct a report, and share results.

Answer C:

A report that includes data charts and graphs.

Module review: Question 5.6



What is the primary purpose of Power BI?

Answer A:

To visualize data, develop insights, and share reports.

Answer B:

To archive data that will be used for machine learning analysis.

Answer C:

To transform IoT hub data before it is read into Time Series Insights.

Module review: Question 5.7



Which of the following answers describes how a Logic App works?

Answer A:

A Logic App is started by a trigger, which fires when a specific event happens or when certain criteria is met.

Answer B:

A Logic App is started by an event, which is generated programmatically by an app or service.

Answer C:

A Logic App is started by an event, which fires when an app or user issues a command.

Module review: Question 5.8



Which of the following answers is a valid reason to use Event Grid in your solution?

Answer A:

Unlimited free access.

Answer B:

Built-in data backup and retrieval.

Answer C:

Built-in and Custom Events.

Module review: Question 5.9



Which of the following is required to connect TSI to IoT Hub?

Answer A:

Use IoT Hub to create a custom endpoint that will be used exclusively by TSI.

Answer B:

Use IoT Hub to create a dedicated consumer group that will be used exclusively by TSI.

Answer C:

Use IoT Hub to create a consumer group that will be used by all downstream consumer services.

Module review: Question 5.10



What is the purpose of the Time Series Insights Explorer?

Answer A:

To examine potential event sources when configuring the Time Series Insights environment.

Answer B:

To view time series data.

Answer C:

To simulate the data for an IoT hub consumer group in a test environment.