IoT Data Storage

Using Azure

Structured vs. Unstructured Data

- **Structured Data**
  - Well-defined, rigid structure
  - Maps to tables with relationships
  - Example: Person's details (name, DOB, address)
- Semi-Structured Data
  - Flexible, but has some structure
  - Maps to documents or key-value pairs
  - Example: JSON object with person's details (name, DOB, address, optional fields)
- **Unstructured Data**
  - No rigid structure
  - Can change frequently
  - Example: Documents, spreadsheets, IoT data
- **IoT data is typically unstructured data.**

Structured data	Semi-structured data	Unstructured data
Databases	XML / JSON data	Audio
	Email	Video
	Web pages	Image data
		Natural language
		Documents

IoT Data Examples

Farm Vehicles

GPS data to ensure tractors work on correct fields

Delivery Trucks

GPS, speed, acceleration data for safety

Driver identity and hours for compliance

Refrigerated Trucks

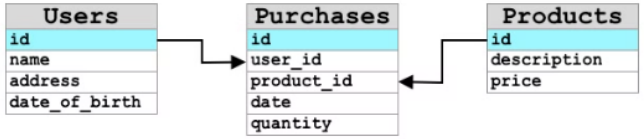
Temperature monitoring to prevent food spoilage and regulations

This data changes constantly. IoT services must process this unstructured data effectively.

SQL vs NoSQL storage

SQL Databases

Rigid schema with tables and columns

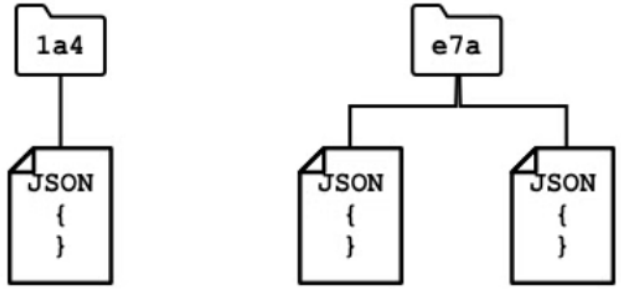


Relational structure between tables

Examples: SQL Server, MySQL, PostgreSQL

NoSQL Databases

Flexible schema for unstructured data



Document-based storage using JSON

Examples: Azure CosmosDB, MongoDB, CouchDB

Best For IoT

NoSQL databases handle varying data structures

New fields can be added without database changes

Hot, Warm, and Cold Data Paths

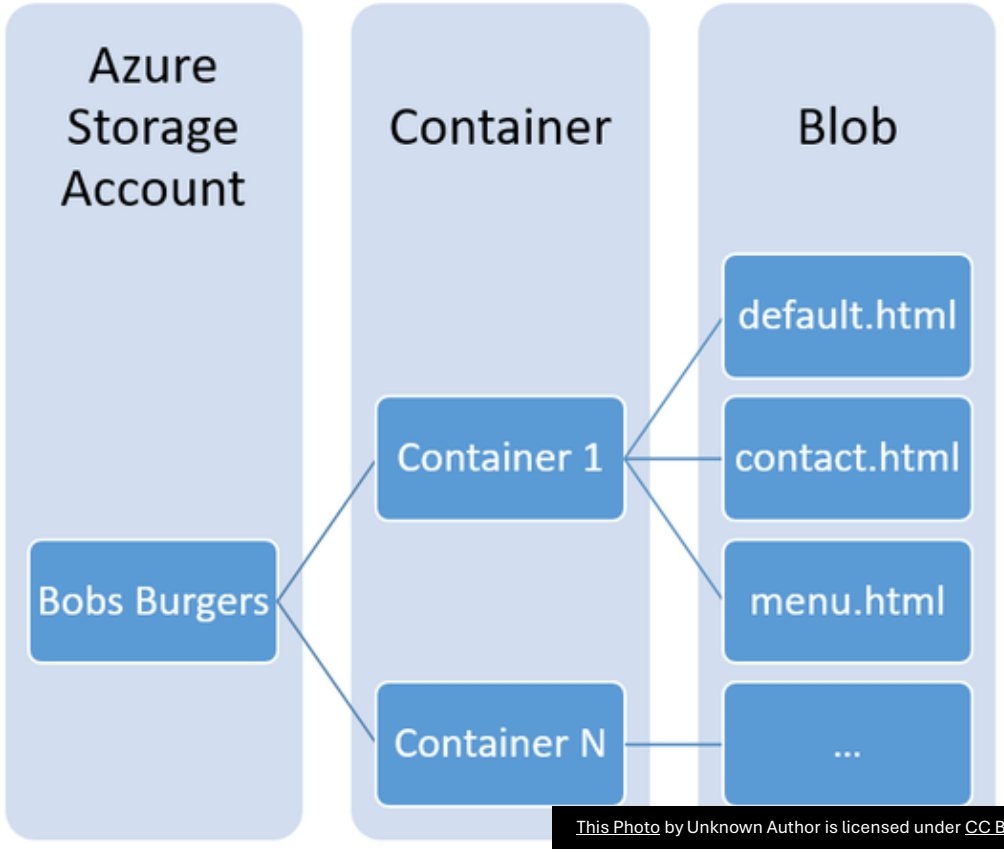
- Data that flows from an IoT device to the cloud is not always processed in real time.
- Some data needs real time processing, other data can be processed a short time later, and other data can be processed much later.
- The flow of data to different services that process the data at different times is referred to hot, warm and cold paths.

Azure Storage Account

- Azure provide a variety of storage solutions
- General purpose Storage accounts provide a unified platform for all Azure Storage services.
- **Blobs** are ideal for storing unstructured data like text, images, and media files.
- **Tables** store structured/semi structured NoSQL data in the cloud, offering a key-attribute data store.
- **Queues** provide a reliable messaging solution for asynchronous communication between application components.

Blob Storage

- **Binary Large Objects**
  - Store any unstructured data, from JSON to images
- **Organised in Containers**
  - Named “buckets” with folders and subfolders
- **Scalable**
  - Useful for varying IoT data structures



Other Options...

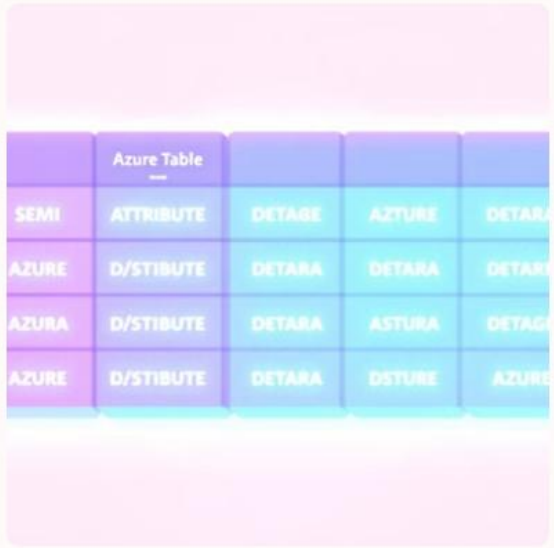


Table Storage

NoSQL database for semi-structured data in tables with unique keys

Queue Storage

Store 64KB messages in queues for later processing

File Storage

Cloud-based file storage using standard protocols