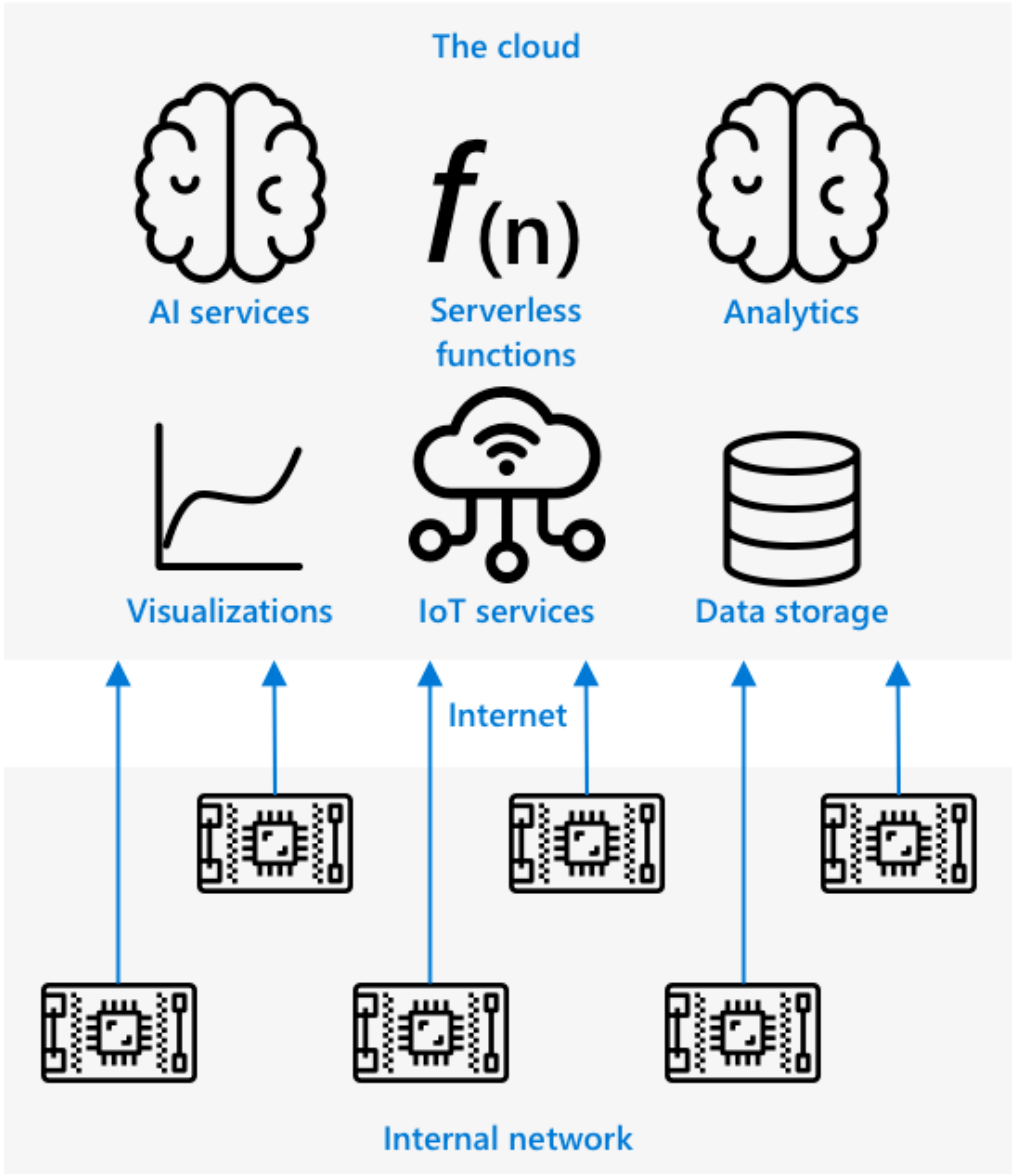
Edge Computing with Azure IoT

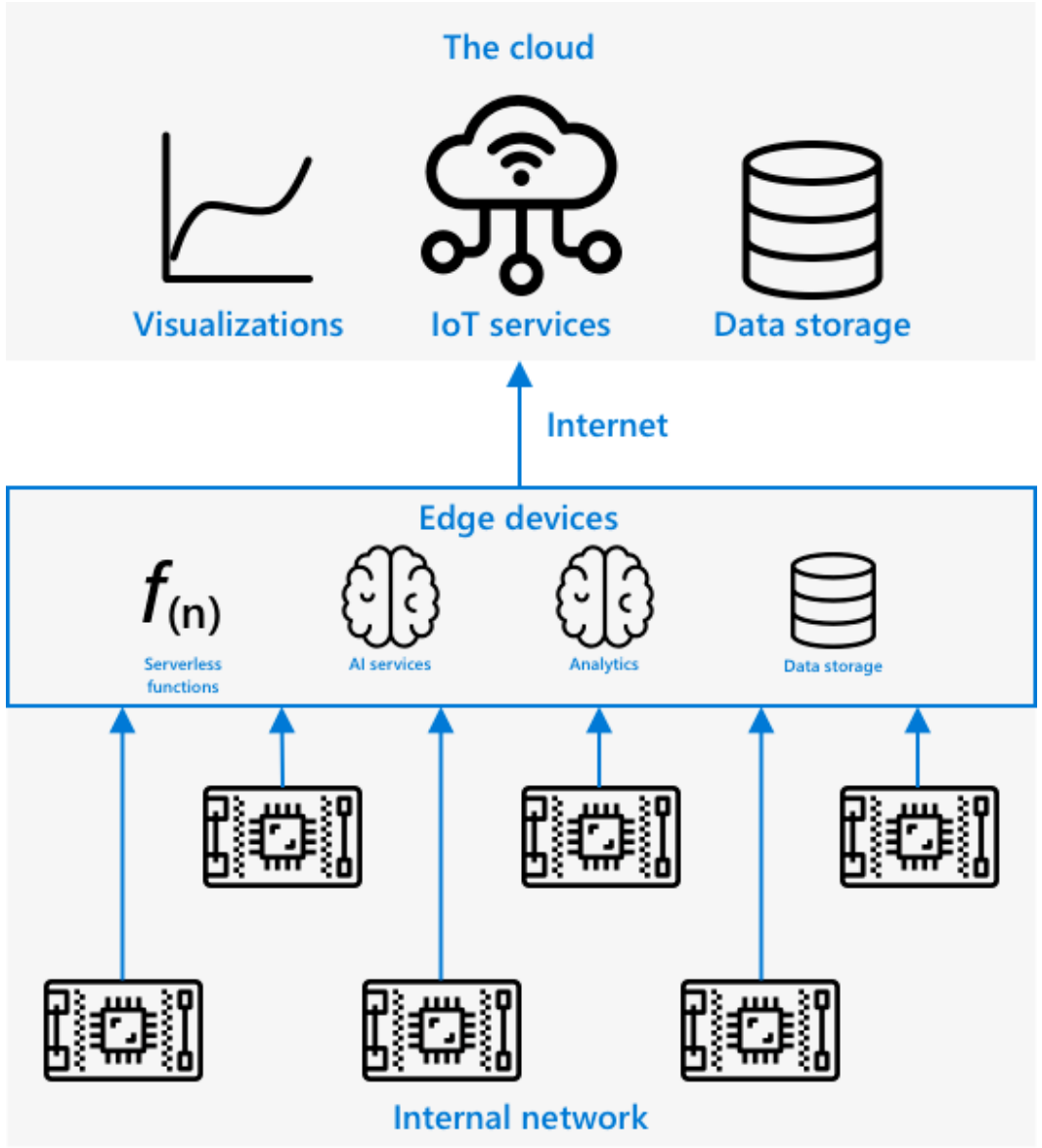
Our work to date

- **Current Model:** Devices gather data and send it to the cloud for analysis.
- **Uses:** AI models, serverless functions.
- **Limitations:** Latency, internet dependency.



Edge Computing

- Edge computing processes IoT data as close as possible to where it is generated, reducing dependence on the cloud.
- **Key Concept:** Moves some cloud services to local networks.
  Example: Running AI models on edge devices (e.g., fruit ripeness analysis). IoT devices connecting to.

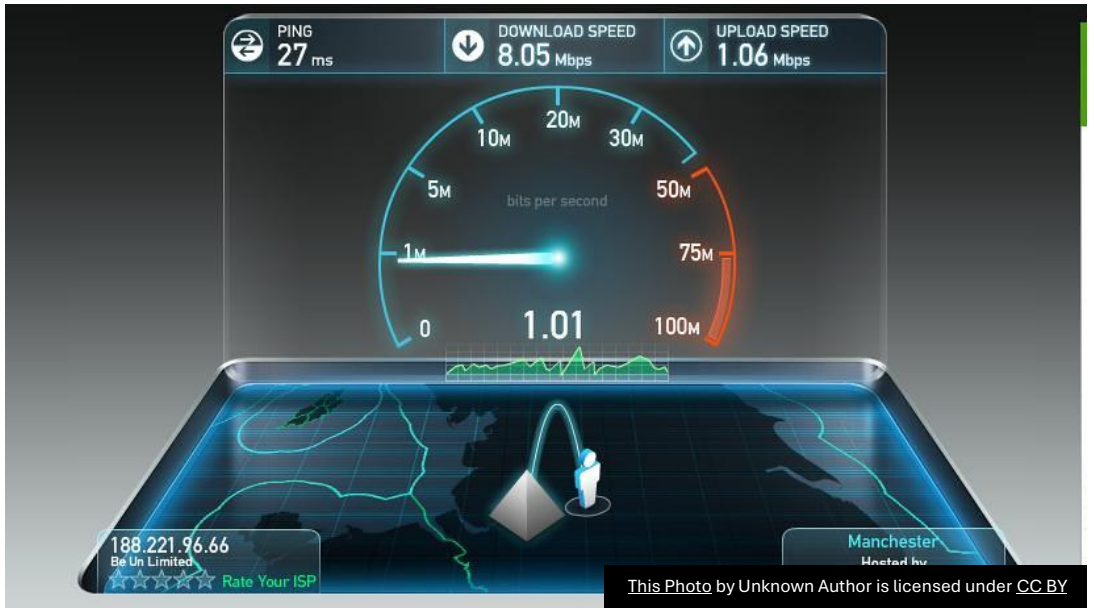


Edge Computing - Benefits

- **Speed:** Faster processing, reduced internet congestion.
- **Remote Accessibility:** Works in low/no connectivity areas.
- **Lower Costs:** Reduces cloud service usage.
- **Privacy & Security:** Keeps sensitive data local.
- **Handling Insecure Devices:** Acts as a secure gateway.
- **Supports Incompatible Devices:** Works as an IoT Hub gateway.

Edge Computing - Speed

- Faster network speeds on internal networks.
- Reduces latency caused by long-distance cloud communication.
- **Example:** Optical cables allow fast travel but crossing the Atlantic adds delay (~28ms).



Edge Computing – Remote Locations

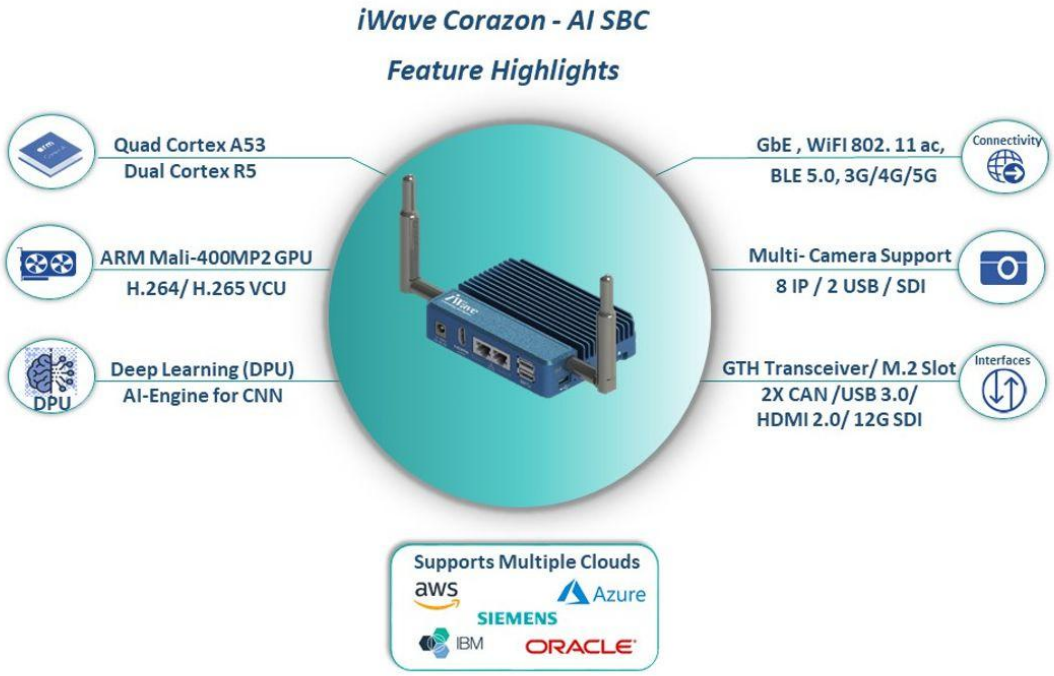
- Edge computing works in low-connectivity areas.
- Useful in humanitarian crises or developing regions.
- **Example:** Local data processing in disaster zones.

Edge Computing - Costs

- **Reduces cloud processing and storage expenses.**
- **Affordable AI accelerators (e.g., Jetson Nano).**
- **Example:** AI workloads running on inexpensive local devices.

Edge Computing: Privacy

- **Sensitive data remains on local networks.**
- **Prevents data leaks by reducing cloud storage.**
- **Example:** Medical data, security footage(iWave Corazon).

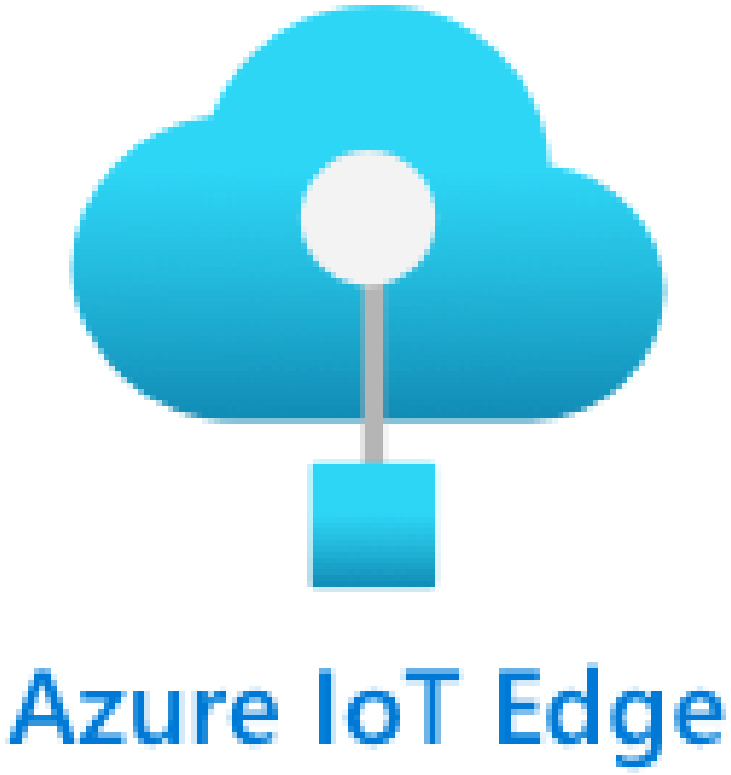


Edge – Insecure/incompatible devices

- **Can Act as a secure gateway for vulnerable/dodgy devices**
- **Connects devices with limited connectivity options (e.g., Bluetooth-only).**
- **Example:** IoT Edge acting as an intermediary.

Edge Computing - Challenges

- **Scaling & Flexibility:** Manual setup required for more devices.
- **Reliability:** Cloud has redundancy; edge requires local investment.
- **Maintenance:** Cloud providers handle updates, edge devices can require manual maintenance(can be mitigated with “over-the-air” depoys.)



Azure IoT Edge Overview

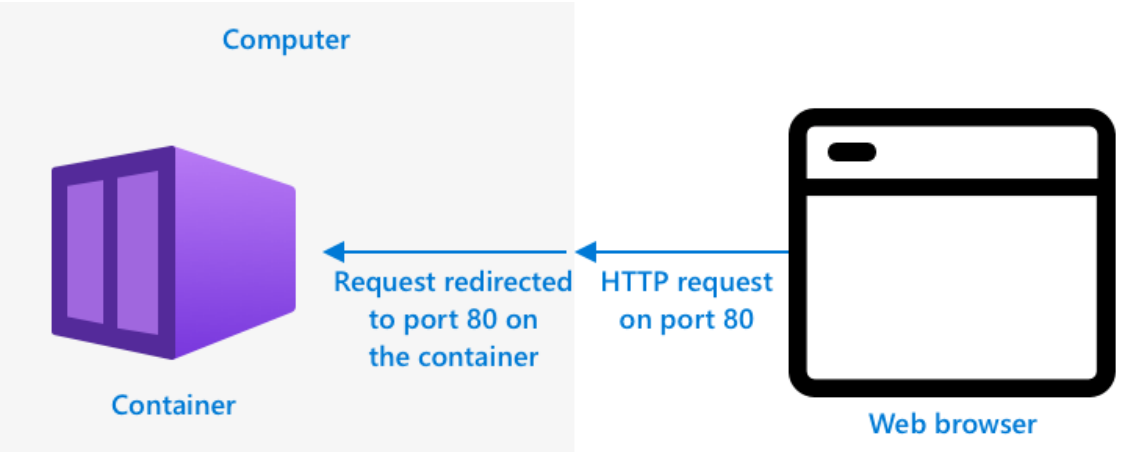
- **Service for managing edge workloads.**
- **Deploy and manage from the cloud.**
- **Example:** Train an AI model in the cloud, deploy it to an edge device

How IoT Edge Works

- **Uses Modules:** Software components deployed to edge devices.
- **Built-in Modules:** edgeAgent, edgeHub for IoT Hub communication.
- **Example:** Deploy an image classifier to an edge device.

Containers in IoT Edge

- **Runs workloads in isolated containers.**
- **Containers work like virtual machines but lighter.**
- **Example:** AI model deployed in a container.



Lab Example- Custom Vision

- **Deploy image classifiers as containers.**
- **Access local models using REST API.**
- **Example:** Custom Vision model running on an edge device instead of cloud.

Lab Example – Building Edge Container

1. Downloaded your classifier model
2. Build into a container
3. Push to a container registry on Azure
4. IoT Edge downloads the container from the registry and push it to the device

The container registry you will use for this lesson is Azure Container Registry