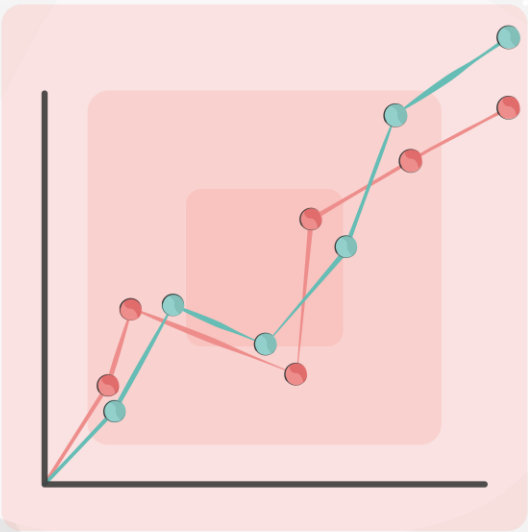
# Level 5 Data Engineer
# Module 5 Topic 1

# Cloud fundamentals



## Welcome to today's webinar.

# The problem to be solved


## A bit of background…

The problem with relatively novel technologies, such as cloud, is that it's tricky, even for seasoned developers, to understand:

- where to focus (providers, implementations, etc.);
- which parts (benefits, aspects) of the technology are overhyped;
- what is actually useful.

To be able to answer any of the above questions, we need to have an understanding of where cloud computing came from and what problems it's positioned to address.



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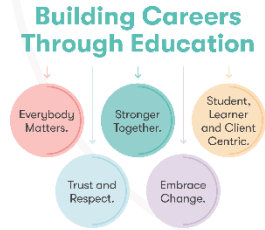
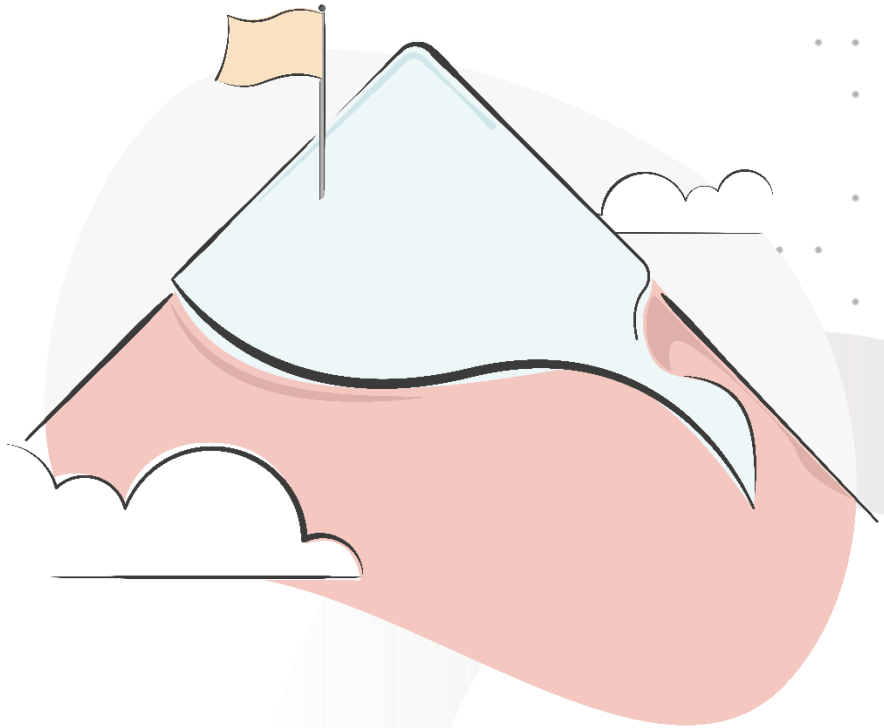
# Session aim and objectives




## This webinar supports the following learning outcomes:

- Recognise key cloud compute types and cost structures.
- Understand the business case for cloud adoption.
- Explore the cloud landscape’s top providers, common utilities, and resources.
- Gain insight into IAM (Identity and Access Management) for secure cloud use.
- Be able to demonstrate your mastery of continuous learning in your EPA professional discussion.



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# Cloud computing

A history and overview…


**Grid computing – solving large problems with multiple machines connected as a "grid" (technical set-up) usually in a way that is single task oriented (job oriented)**

**Utility computing – offering computing resources (storage, computing, printing) as metered and billable items (business model)**

**The concept of cloud computing traces back to 1961 by John McCarthy at MIT: *"computing may someday be organized as a public utility just as the telephone system is a public utility."***

**Cloud computing – draws from the earlier ideas of grid computing and utility computing and extends them in a service-oriented manner, delivered dynamically and on-demand**

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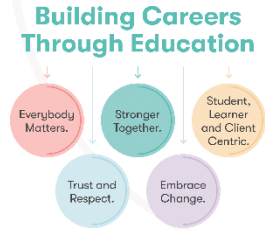
# Cloud computing




A quick timeline…

**1999**

**Salesforce launched**

- **CRM = the product**
- **Cloud = the infrastructure behind the product**
- **Software-as-a-service (SAAS) = how you pay for the product**

**2006**

Amazon Web Services launched

- Cloud infrastructure to make your own products and services
- IAAS = Infrastructure as a Service
- PAAS = Platform as a Service

**2010**

Other major cloud providers launch

**2012**

Google computing engine launches

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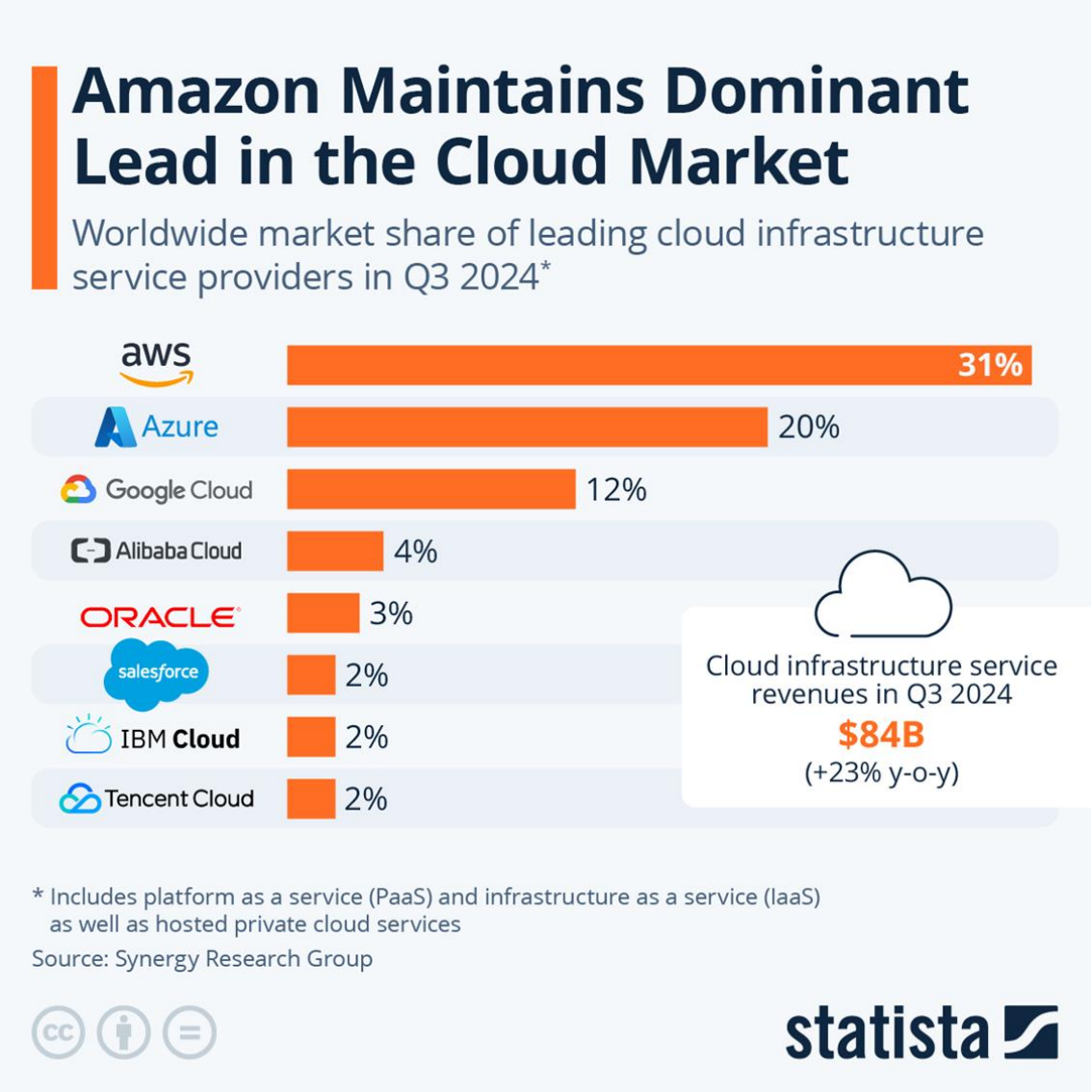
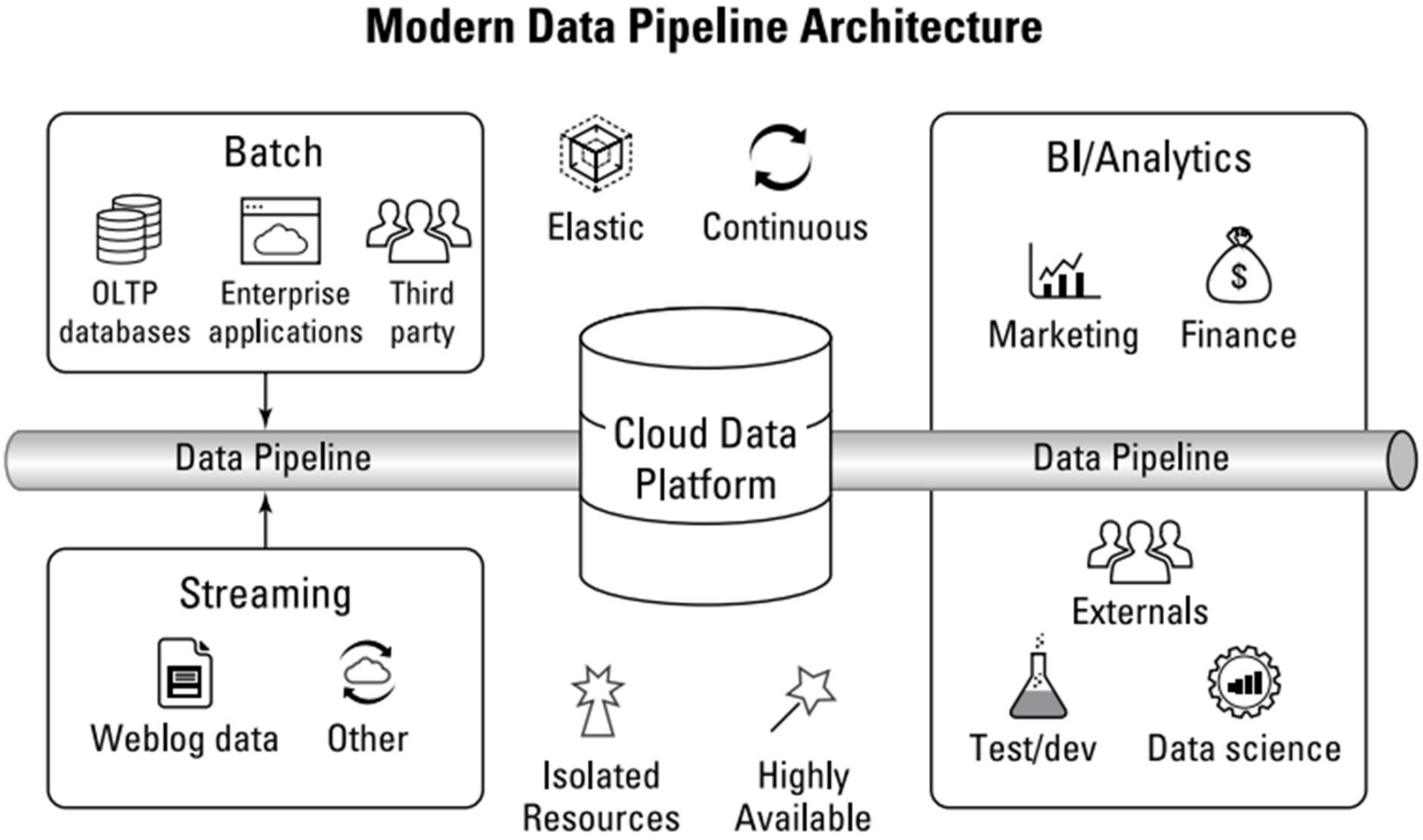
# Cloud computing

Market leaders…



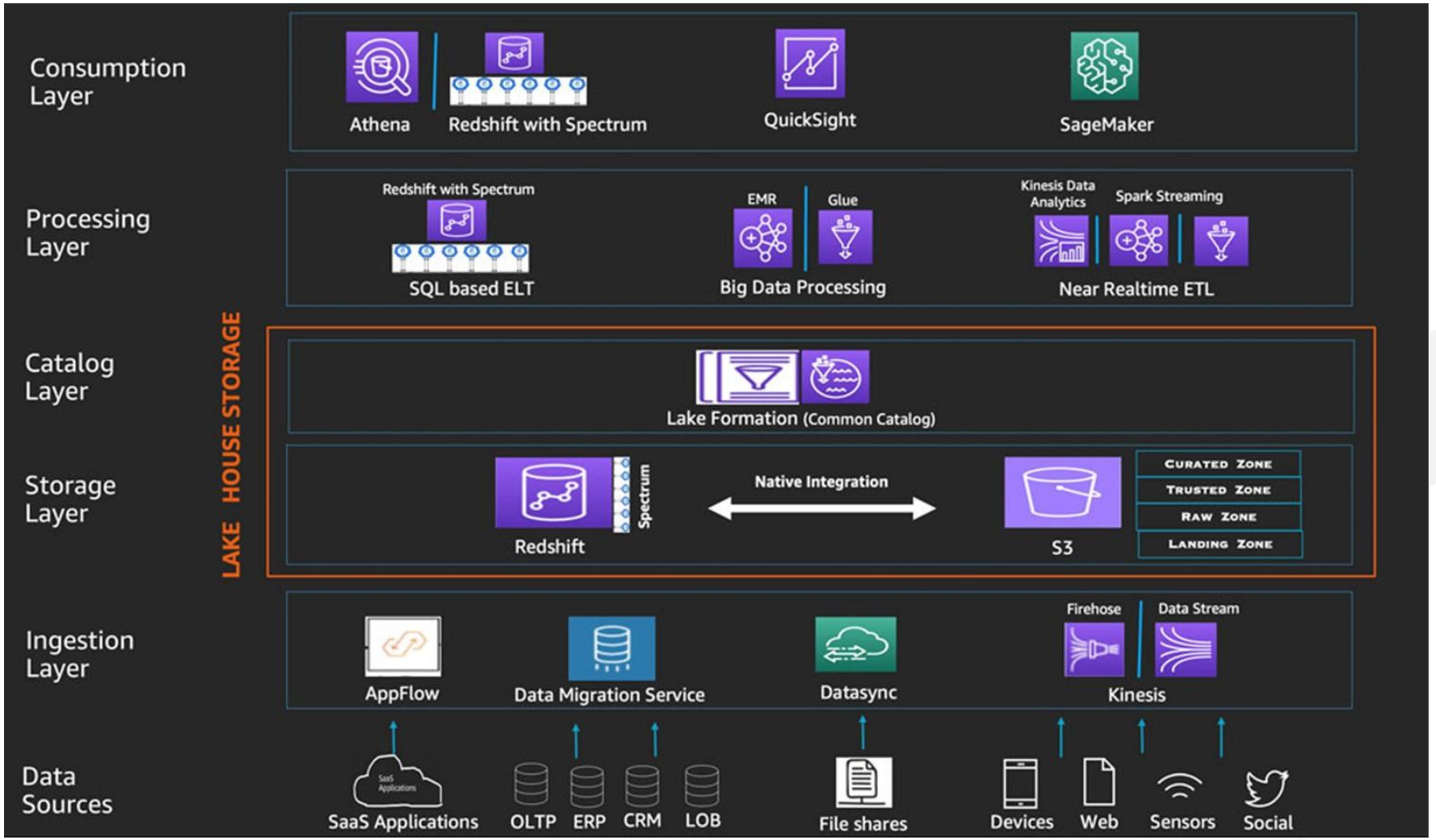
# Cloud computing

Modern data pipeline architecture…



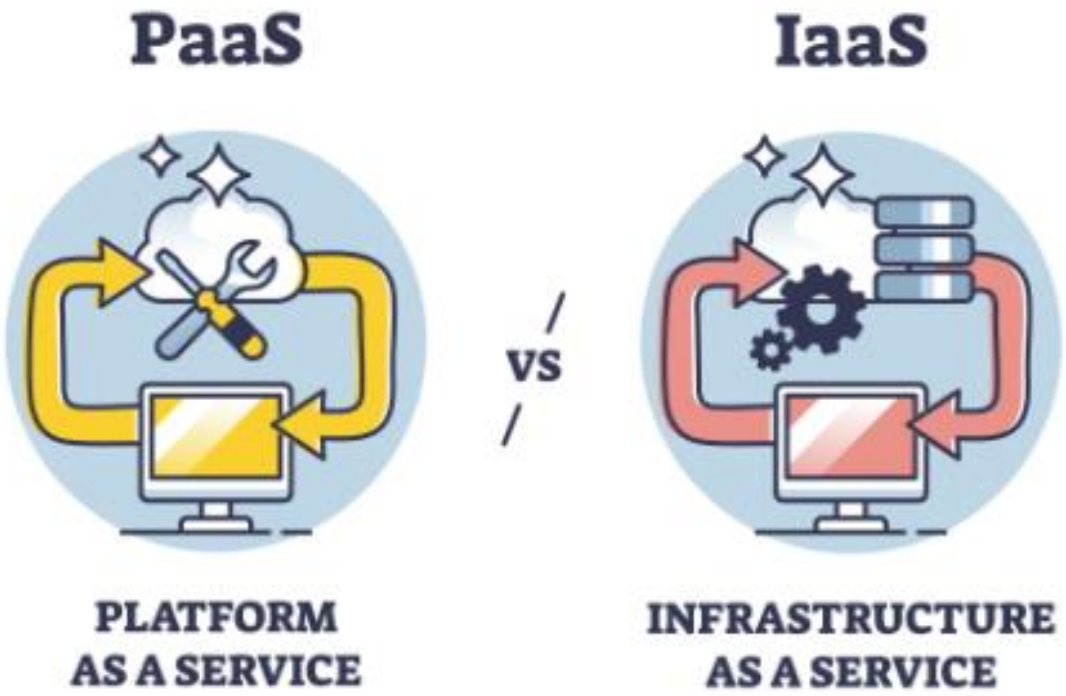
# Cloud computing

Lakehouse storage…



# Cloud computing

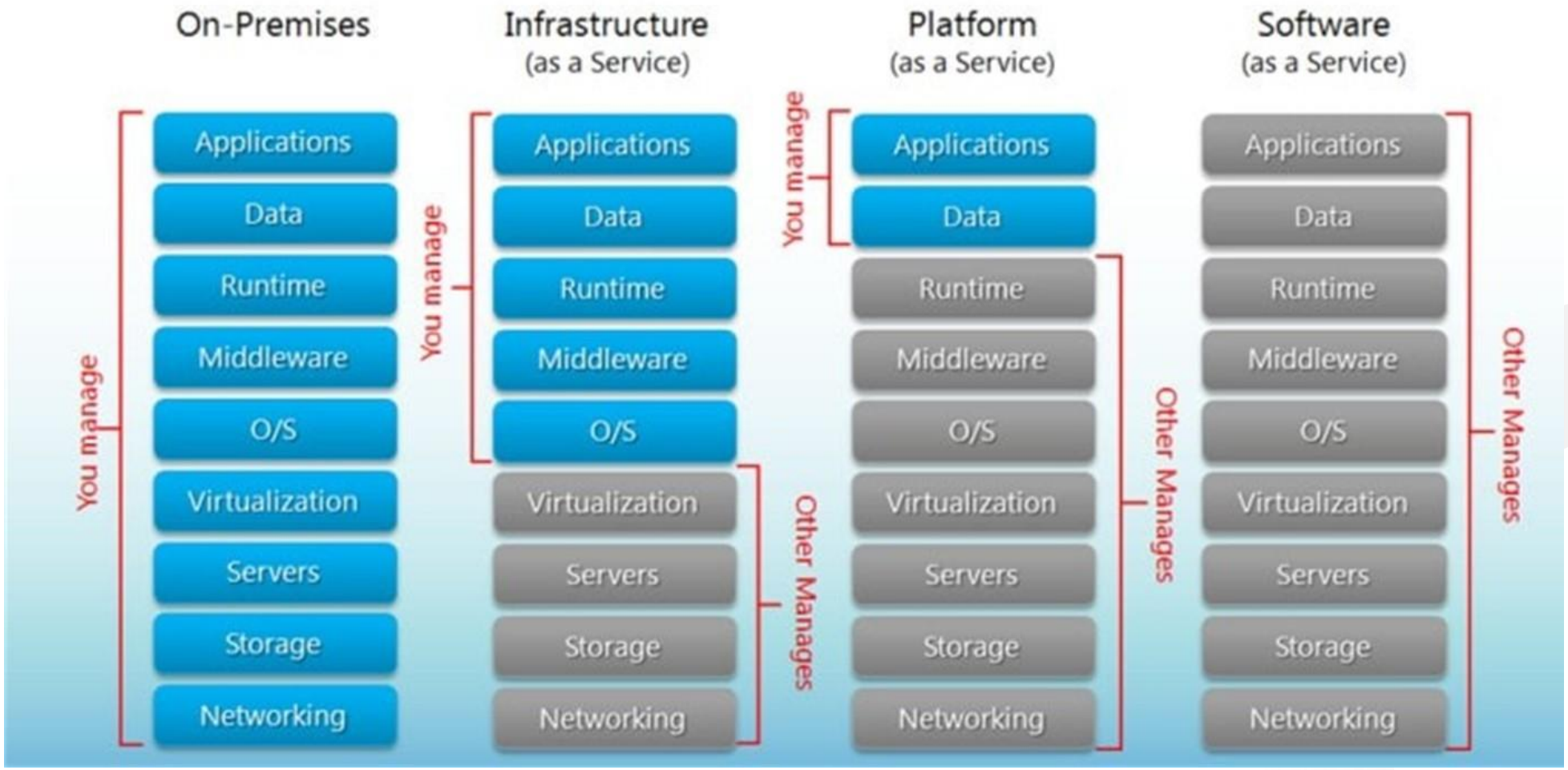
IAAS vs PAAS – the biggest difference…




| IaaS | PaaS |
| --- | --- |
| Gives administrators more control over operating systems | Gives consumers more flexibility and ease of use |

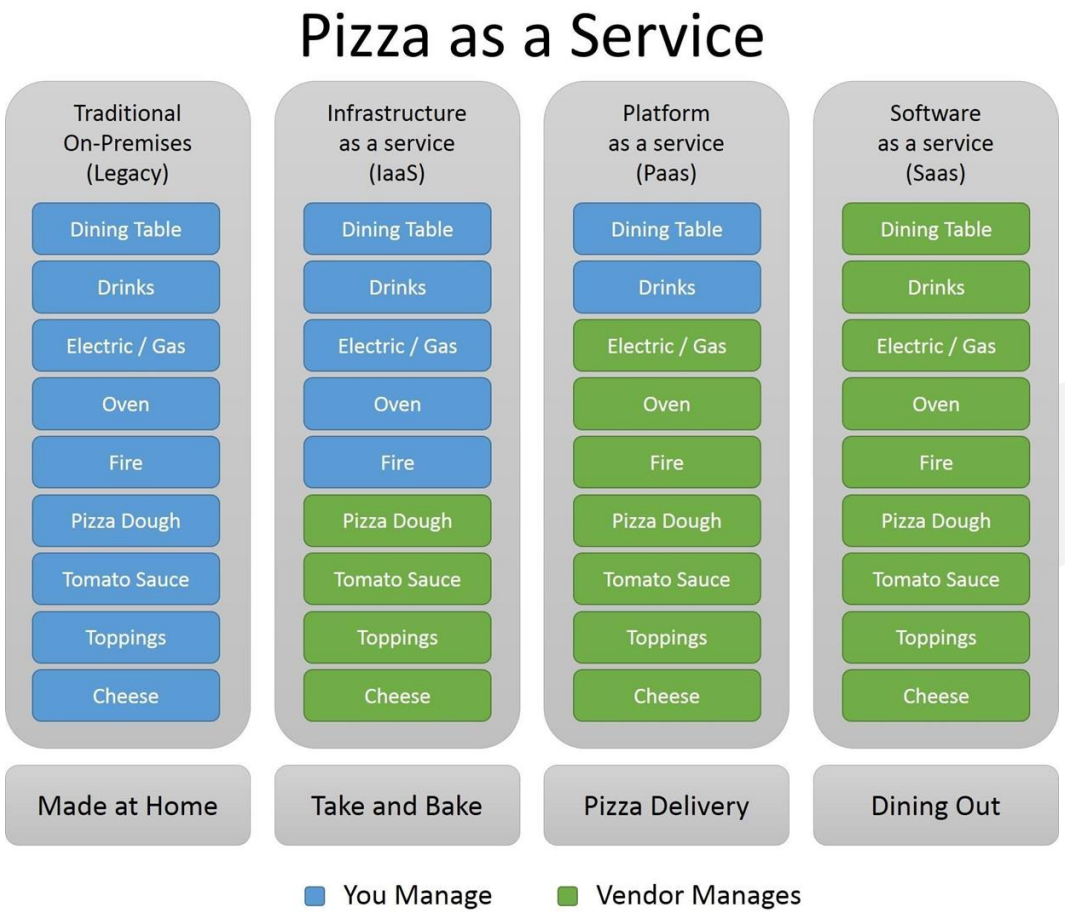
# Cloud computing

Service offerings…



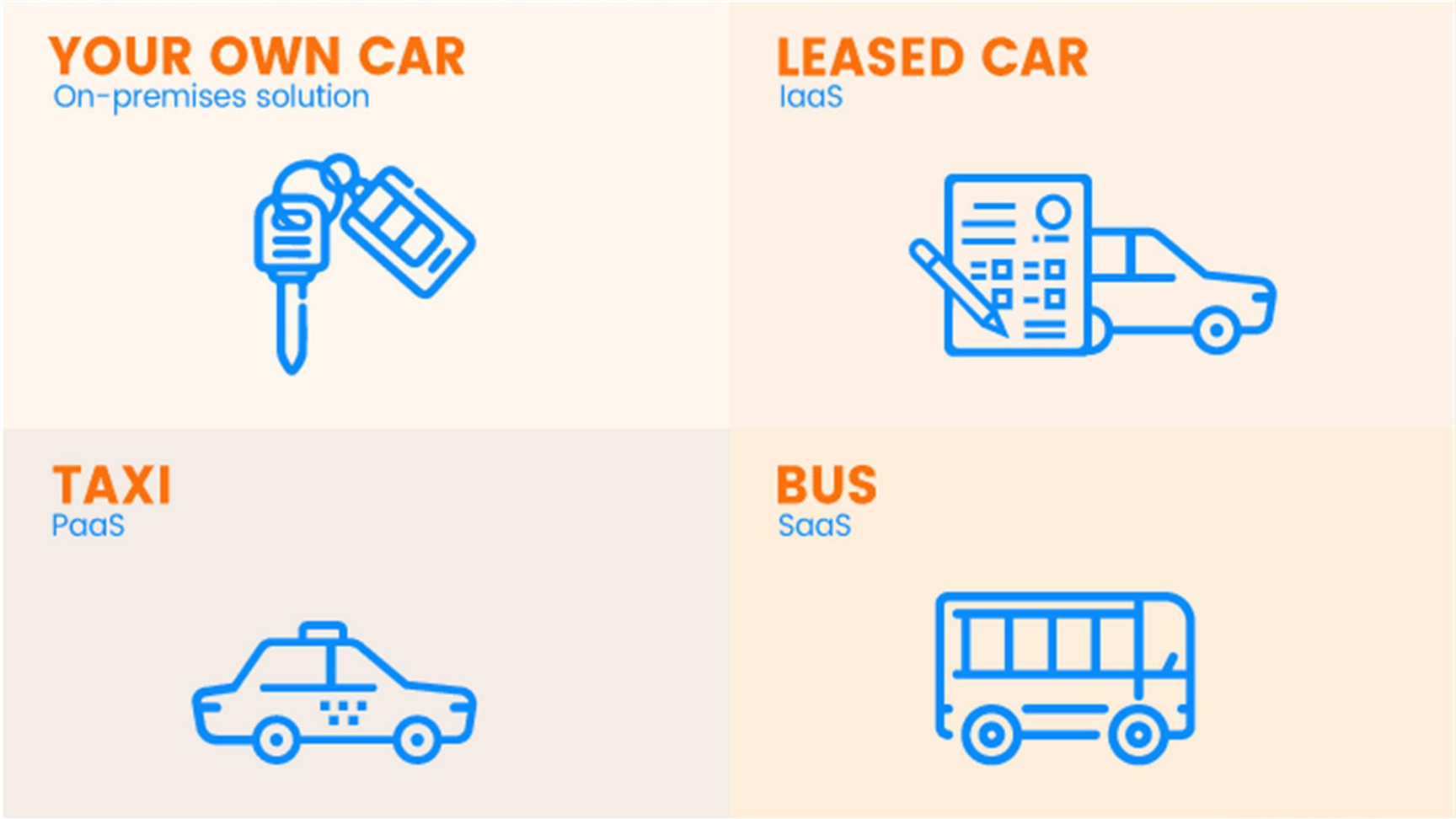
# Cloud computing

## Pizza as a service…



# Cloud computing

Service offerings…



# Scaling

What is it…?

**Horizontal = adding more machines (to solve bigger problems)**

***In the world of cloud, we don't really think of machines, but rather instance types with vCPUs***

**Vertical =adding more resources to each machine (to also solve bigger problems)**

***<u>if you can go horizontal, just go horizontal:</u>***

*Redundancy: if one server/app fail, the other still runs and you hopefully have a load balancer upfront that can reroute the traffic waiting for a new instance to come up*
*More bandwidth: Network could be your bottleneck rather than system resources*

# Migrating to the cloud


According to AWS…

- Infrastructure (TCO) cost saving
- Reduction in unplanned downtime
- Optimising access for different regions
- Optimising infrastructure management


- **Source:** https://aws.amazon.com/free/migration/

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# Cloud computing


More benefits…

- **Immediate availability -** Additional resources can be added or removed on demand.
- **Scalability -** As the need for greater or lesser capacity changes overtime, it is simpler in a cloud-based environment to make those adjustments.
- **Round-the-clock availability -** As cloud-based resources are typically housed in massive data centres, personnel are on duty 24 hours a day, 7 days a week, 365 days a year to respond to any issues.
- **Resiliency -** Cloud computing provides sustainability for disaster recovery and business continuity.
- **Regulations -** Cloud providers have the expertise necessary to stay on top of changing regulations.

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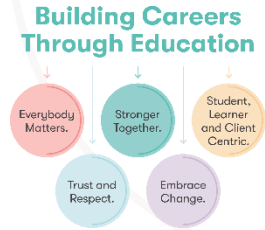
# Cloud computing




## Drawbacks of the cloud…

- **Vendor lock-in -** make apps portable and aligned with open standards
- **Ever increasing complexity**

"It's supposed to be about efficiency, simplicity, and value for money, but it's not working out that way.

Our teams are growing and getting overwhelmed with complex CI/CD pipelines and IAM policy tweaks.

Meanwhile, our AWS bills are 10 times higher than our old on-prem costs, and staff costs have also increased."

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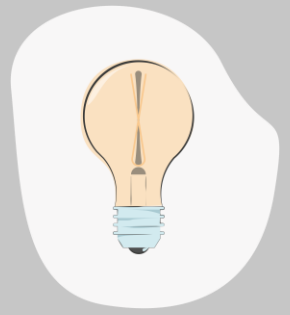
# Cloud computing

## What is the cloud actually used for…?

| For start-ups | For established corporations |
| --- | --- |
| Rapid prototyping | Predictable pricing, good for projects with precise budget constraints |
| Accelerated time to market | Reduce capital expenditure and recruitment costs, good when these are constrained |



"**For both:** Virtually unlimited scalability, good when you're experiencing very fast growth or your demand fluctuates."

# Migration


## Considerations…

Moving all your on-prem servers to the cloud may not be necessary if they're managed well.

"Lift and shift", i.e. making copies of applications as VMs to be deployed in the cloud is also very costly and not necessarily justified.

Cloud only becomes a cost saving when you change your model to take advantage of cloud native features.

- SaaS offering
- Micro-services
- Automation

Etc…

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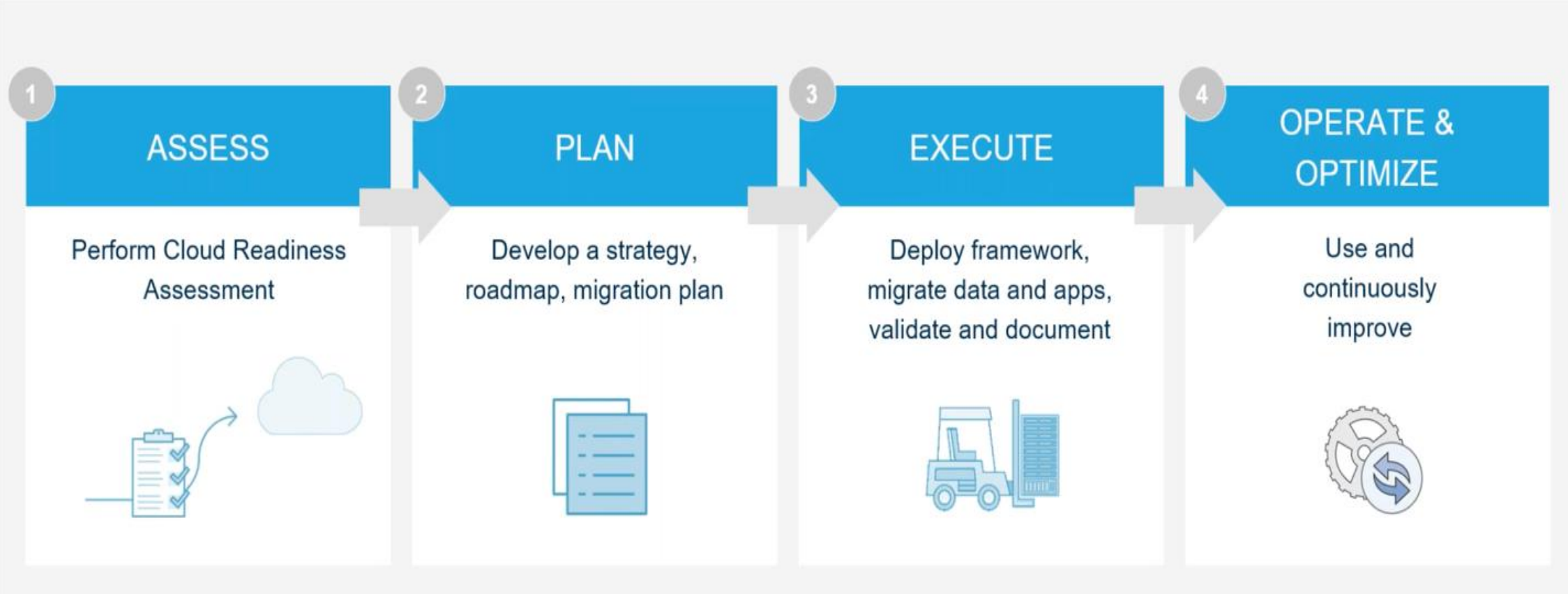
# Migration

The high level…



# ‘Developing for the Cloud’

## What does it mean…?


We could mean different things, either:

- Creating applications that are natively served on the cloud
- OR Creating applications that have only their data hosted in the cloud

We could also mean different modes of development:

- Full-Stack
- OR Front-End only
- OR Back-End only.

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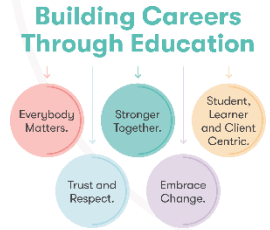
# Discussion




## Infoworld article

https://www.infoworld.com/article/3639050/complexity-is-killing-software-developers.html

'The growing complexity of modern software systems is slowly killing software developers'

- Do you agree / disagree?
- What is meant by 'essential vs. accidental complexity'?

**Submit your responses to the chat!**

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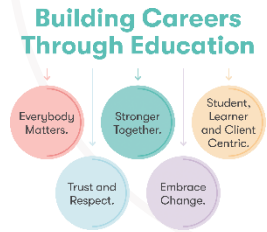
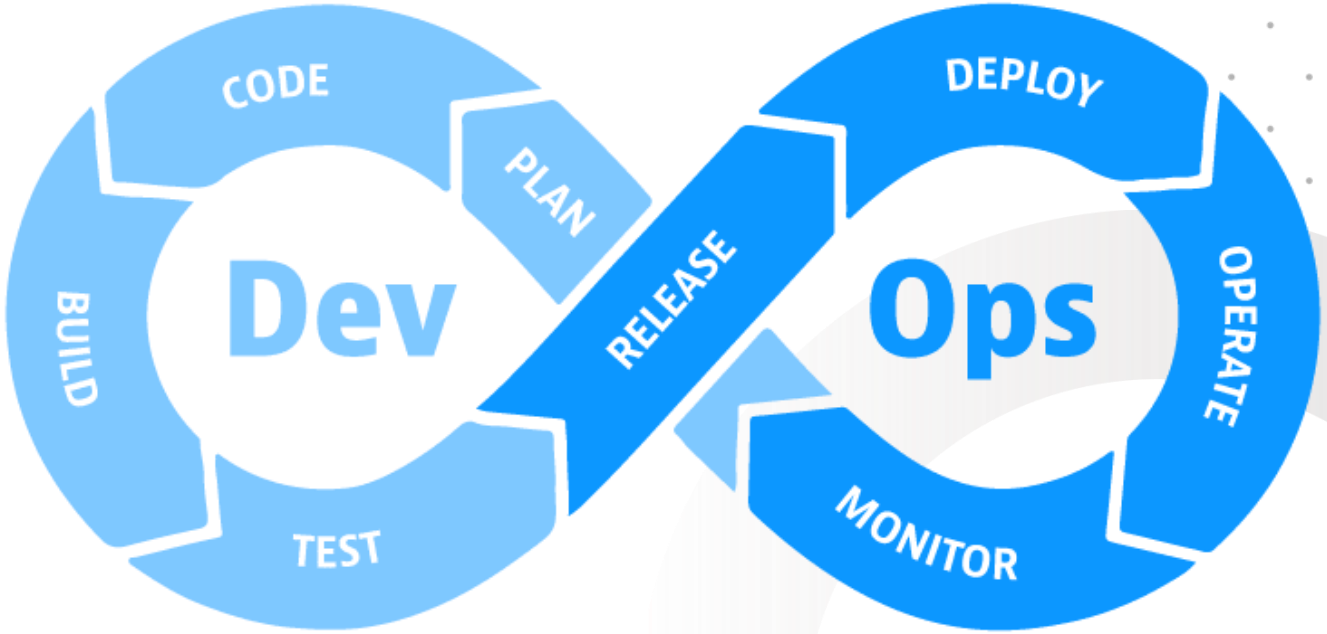
# DEVOPS




What does it mean…?

- Simplify dev team workflows.
- Enable seamless, hands-off deployments.
- Use version control.
- Automate builds on commits.
- Use automation tools.
- Perform unit and integration tests.
- Manage environment configs.
- Store build artifacts.
- Monitor reliability and security.

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# Four key principles of cloud-native deployment


## Microservices

A microservices architecture is an application development approach in which a large application is built as a suite of modular components or services

## Containerization

Containers are a type of software that can virtually package and isolate applications for deployment

## Continuous delivery

Continuous delivery is a software delivery approach in which development teams produce and test code in short but continuous cycles

## DevOps

DevOps is a method-ology that promotes better communication and collaboration between development and operations teams

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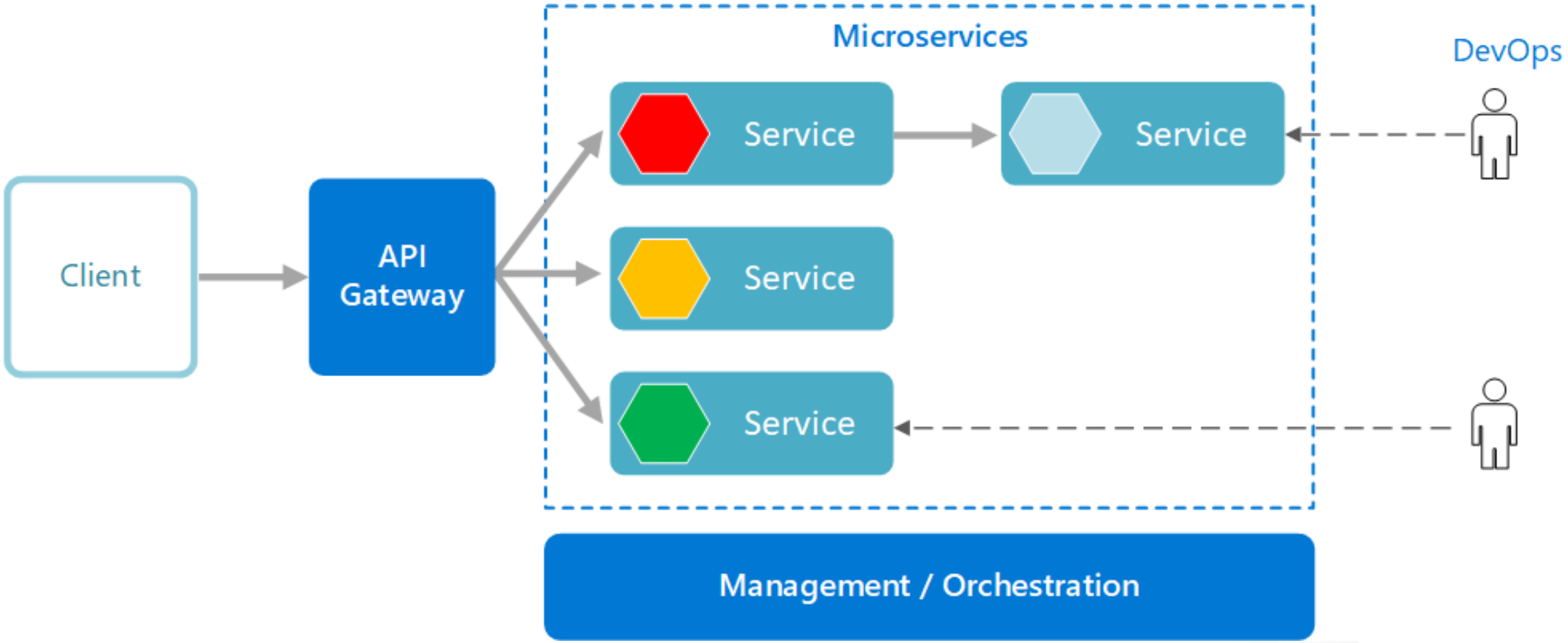
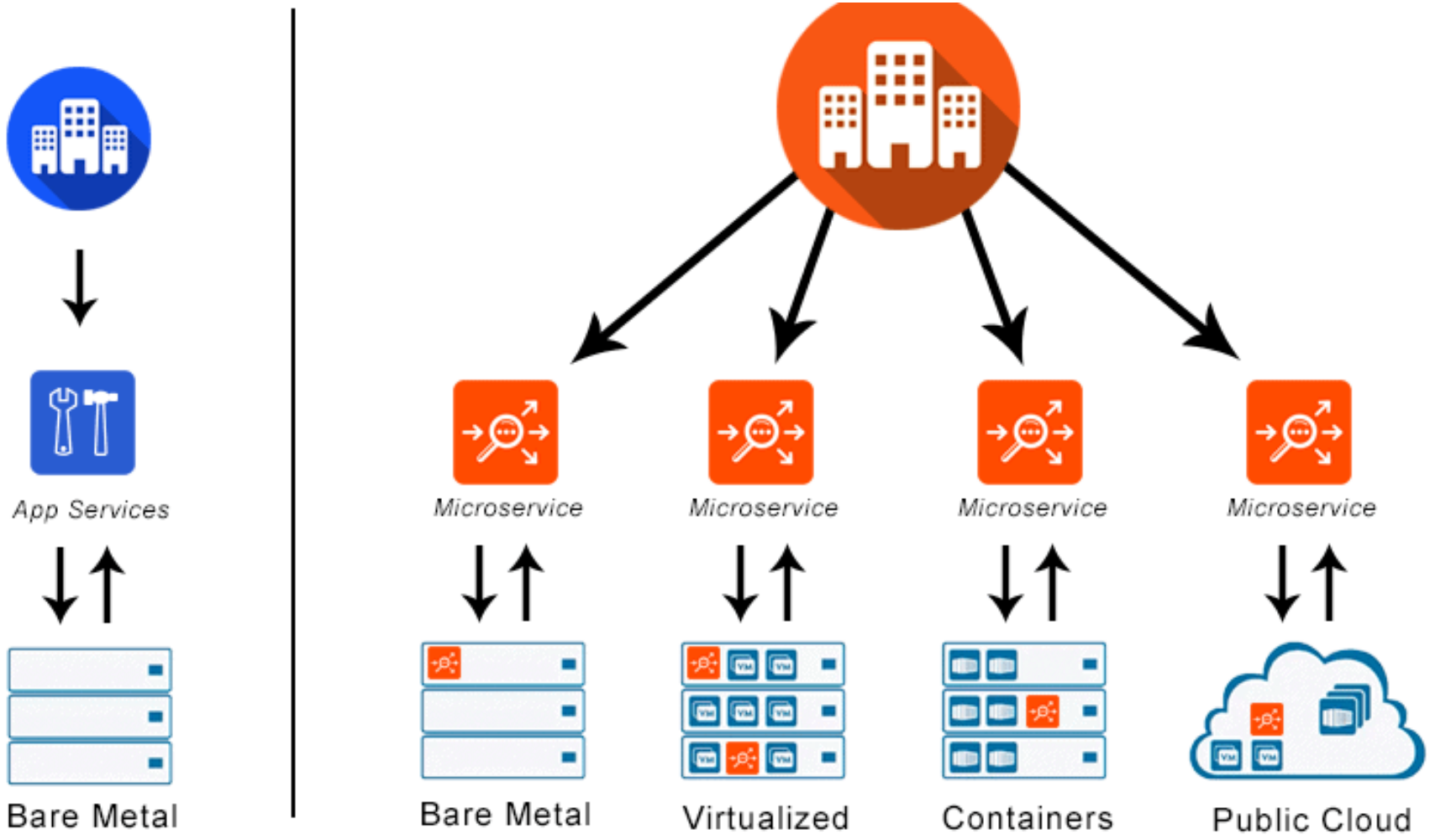
# Microservices

## Management / orchestration



# Microservices

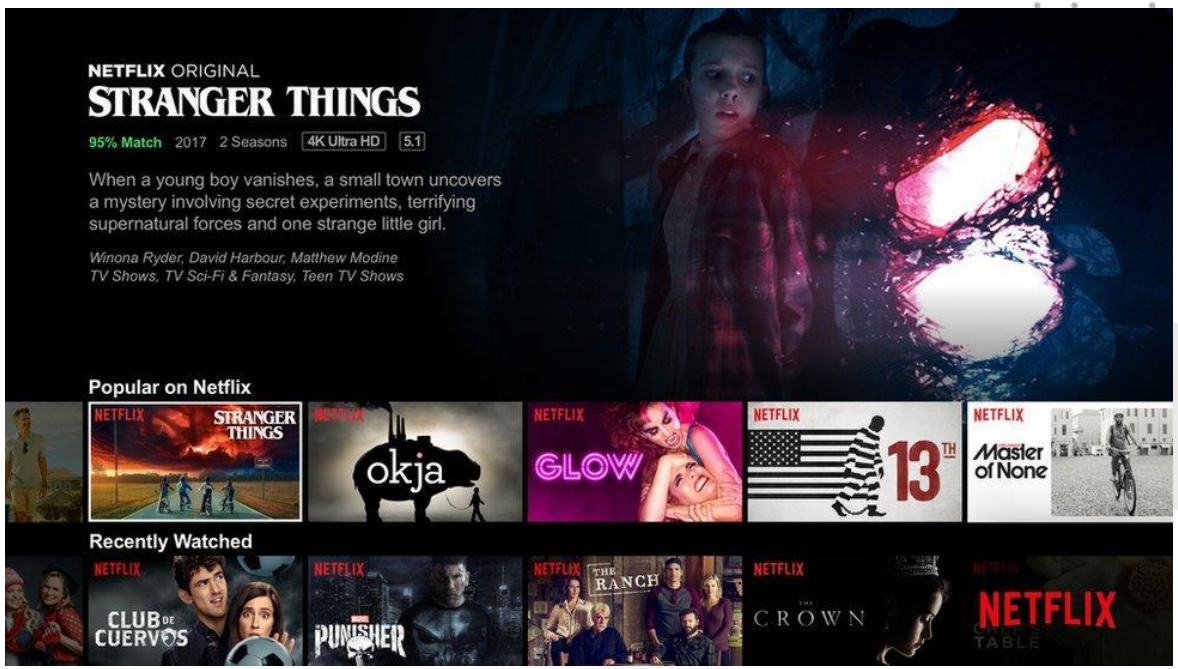
## Management / orchestration



# Migration

Considerations…


- Started as DVD-by-mail, shifted to streaming.
- Managed massive data loads.
- Ensured high availability and minimal buffering.
- Migrated to AWS.
- Used cloud scalability.
- Implemented microservices.
- Achieved global reach.
- Scaled infrastructure to cut costs.
- Focused on core strengths.
- Showcased cloud computing's benefits.

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# Walkthrough

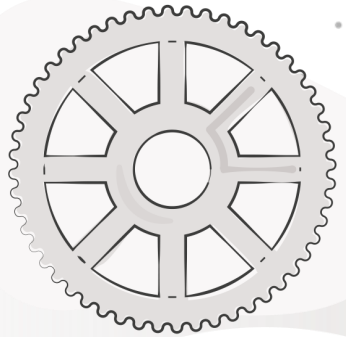
## Master IAM

Set up a student trial account in Azure

**Exercise Overview: Master IAM by s**ecurely managing access to a storage account.

**Tasks:**

- Create a resource group and a storage account.
- Set up a service principal (application identity).
- Assign appropriate roles to the service principal.
- Emphasise the importance of selecting the correct role (e.g., 'Storage Blob Data Contributor').



**Submit your responses to the chat!**

# I am live walkthrough

## Infoworld article


**Scenario:** Your company wants to launch an online learning platform quickly.

**Considerations**

- **Time to Market:** Need rapid deployment to stay ahead of competitors.
- **Control:** Moderate control over the environment is acceptable.
- **Expertise:** Limited in-house IT resources for infrastructure management.

**Discussion Activity:**

**Task:** Decide which compute model (IaaS, PaaS, or SaaS) best suits this project.

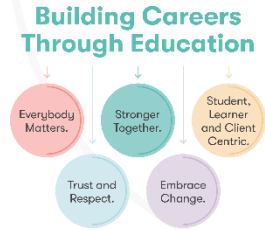
**Group Discussion:**

- Evaluate the pros and cons of each model in this context.
- Consider factors like scalability, cost, and maintenance.

**Demo:** https://azure.microsoft.com/en-gb/pricing/calculator/

**Submit your responses to the chat!**

# Activity




- See file L5DE M5T1 Activity
- Also available in the Hub

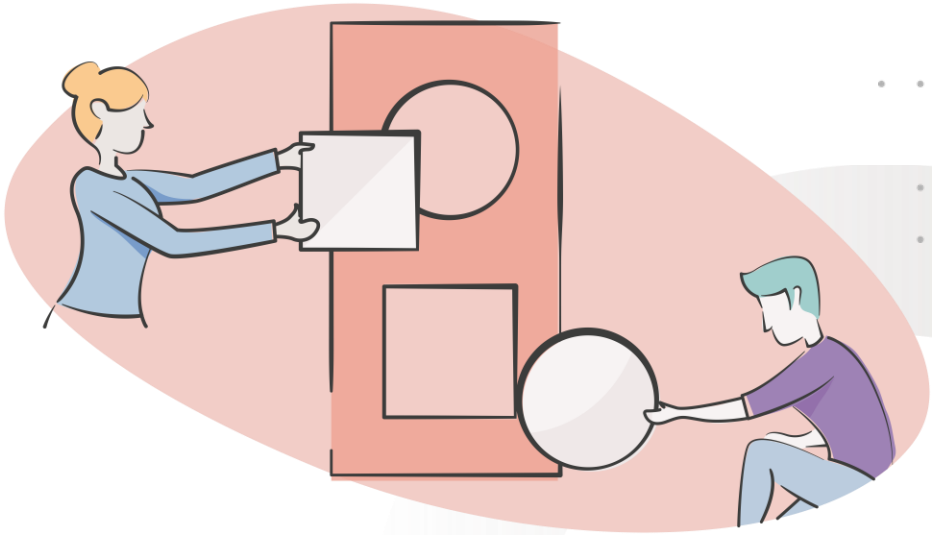
**Individual Activity**

In Topic 1, you have covered TCP/IP – Transmission Control Protocol/Internet Protocol.

A common transport layer protocol that underpins the Internet is **UDP**, or the *User Datagram Protocol*.

Using your own research skills, learn about UDP and answer the following questions:

1. What does it mean that UDP is a connectionless protocol?
2. What is the use of checksums in UDP?
3. What are port numbers and how does UDP use them?
4. Draw a UDP datagram in Microsoft Paint, Visio, or any other drawing software.
5. Compare and contrast UDP and TCP on at least five different criteria.



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# Group discussion

## Your experience of cloud services

- **First Impressions:** What are your initial thoughts on using cloud services?
- **Challenges Faced:** Any difficulties or surprises encountered?
- **Applications**: How do you envision using cloud technologies in your projects?

**Submit your responses to the chat!**

# Addressing common cloud misconceptions


Let's unpack them…

## Misconception 1: Cloud Is Not Secure

- **Reality:** Cloud providers offer advanced security measures.
- **Explanation:** Security is a shared responsibility; proper configurations are essential.

## Misconception 2: Cloud Is Always Cheaper

- **Reality:** Costs can increase without proper management.
- **Explanation:** Requires monitoring and optimisation to realise savings.

## Misconception 3: Moving to Cloud Means Losing Control

- **Reality:** Offers different levels of control depending on the service model.
- **Explanation:** IaaS provides significant control; even PaaS and SaaS offer configuration options.

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# Key Learning Summary


**The key takeaways from this session are as follows:**

- The transformative power of cloud computing illustrated by Netflix.
- Understanding and selecting appropriate compute models.
- Importance of calculating ROI for informed decision-making.
- Leveraging hyperscalers and edge computing for advanced solutions.
- Navigating cloud services and implementing robust IAM practices.

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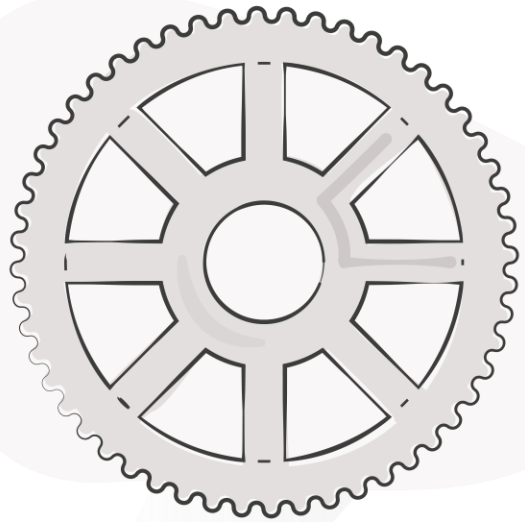
# Post-webinar tasks


Apply…

- Apply for the Azure student trial and explore services.
- Practice setting up resources and configuring IAM.
- Consider starting a cloud project to apply what you've learned.
- Community Engagement: Join forums like Stack Overflow, Reddit's r/AZURE.



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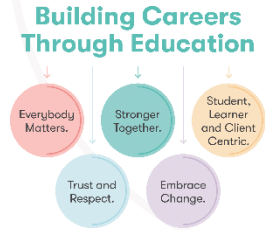
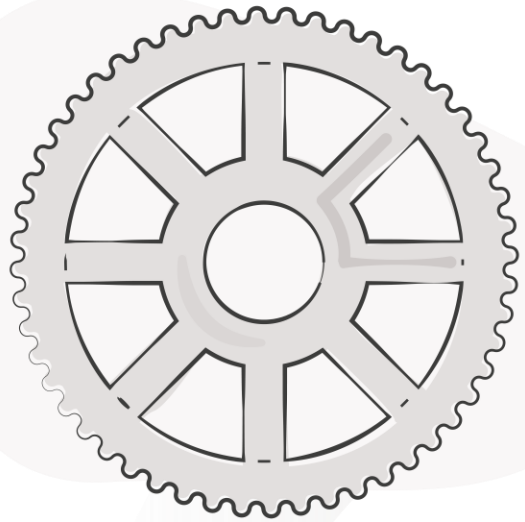
# Post-webinar tasks

Apply…




- Continue activities ideas for the learning journal from the pre-learning
- **Extend Task 1:** Write a report evaluating the ROI of a proposed cloud project
- **Extend Task 2:** Create an IAM architecture diagram illustrating service account usage



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# Thank you

## Do you have any questions, comments, or feedback?