Cloud Computing with Microsoft Azure

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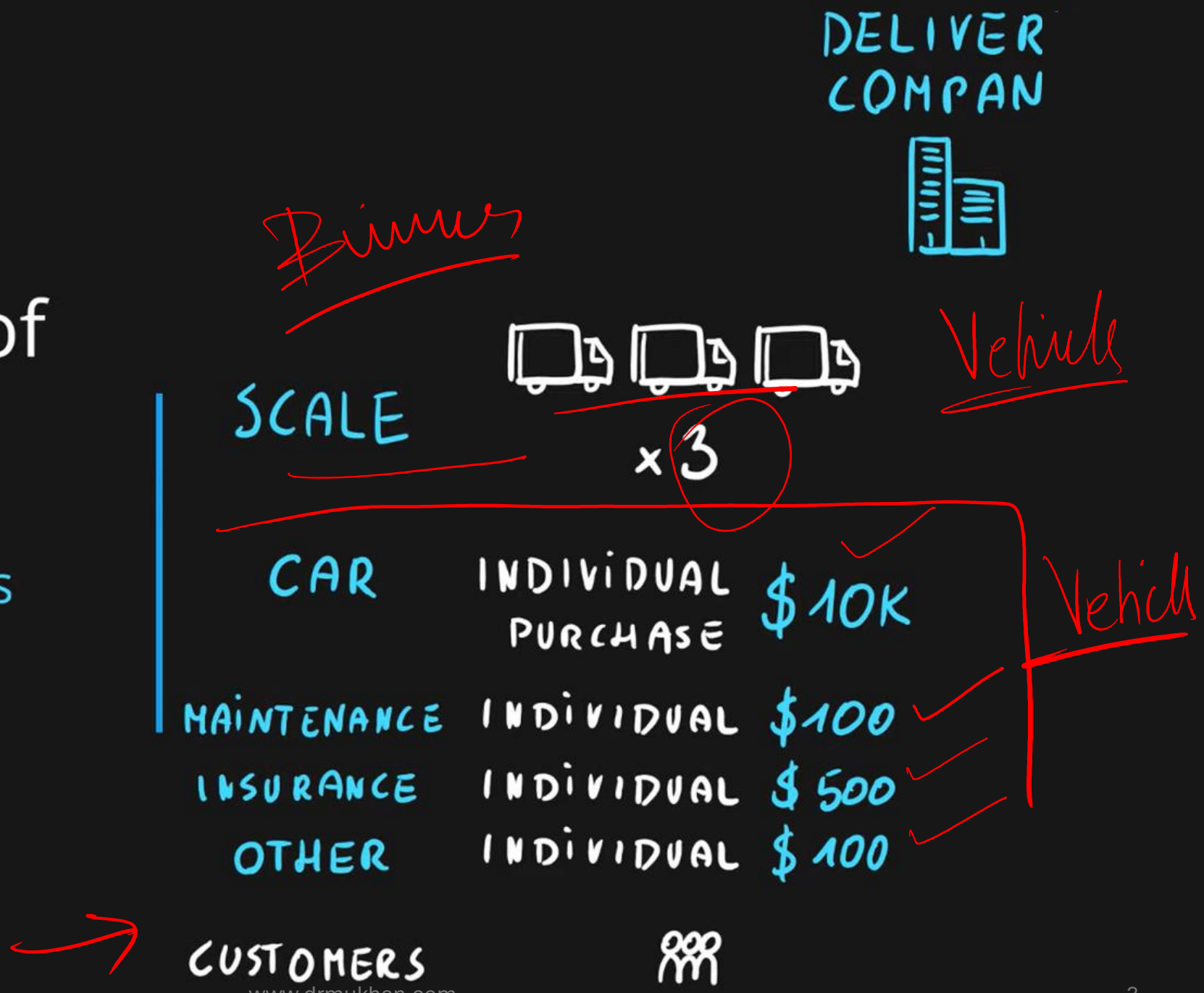
Lecture Objectives

Skills Learned

- Describe the principles of economies of scale
- Describe the differences between
  - Capital Expenditure (CapEx) and
  - Operational Expenditure (OpEx)
- Describe the consumption-based model
- Describe Infrastructure-as-a-Service (IaaS)
- Describe Platform-as-a-Service (PaaS)
- Describe Software-as-a-Service (SaaS)
- Compare and contrast the three different service types

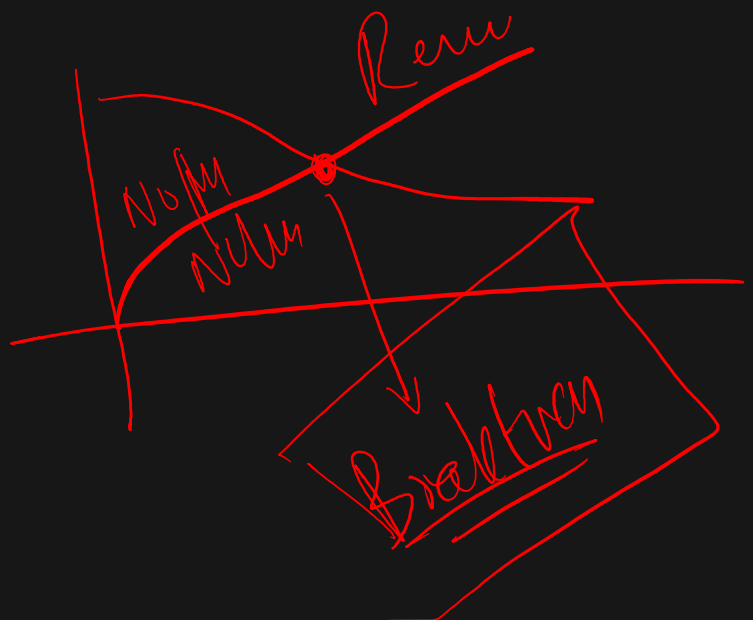
Economies of scale

Key Characteristics



Economies of scale

Key Characteristics

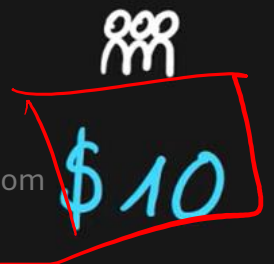


DELIVERY COMPANY

SCALE	 x3	 x300
CAR	INDIVIDUAL PURCHASE $10K	BULK PURCHASE $9k
MAINTENANCE	INDIVIDUAL $100	CONTRACT $90
INSURANCE	INDIVIDUAL $500	BULK PURCHASE $400
OTHER	INDIVIDUAL $100	SHARED $80

CUSTOMERS

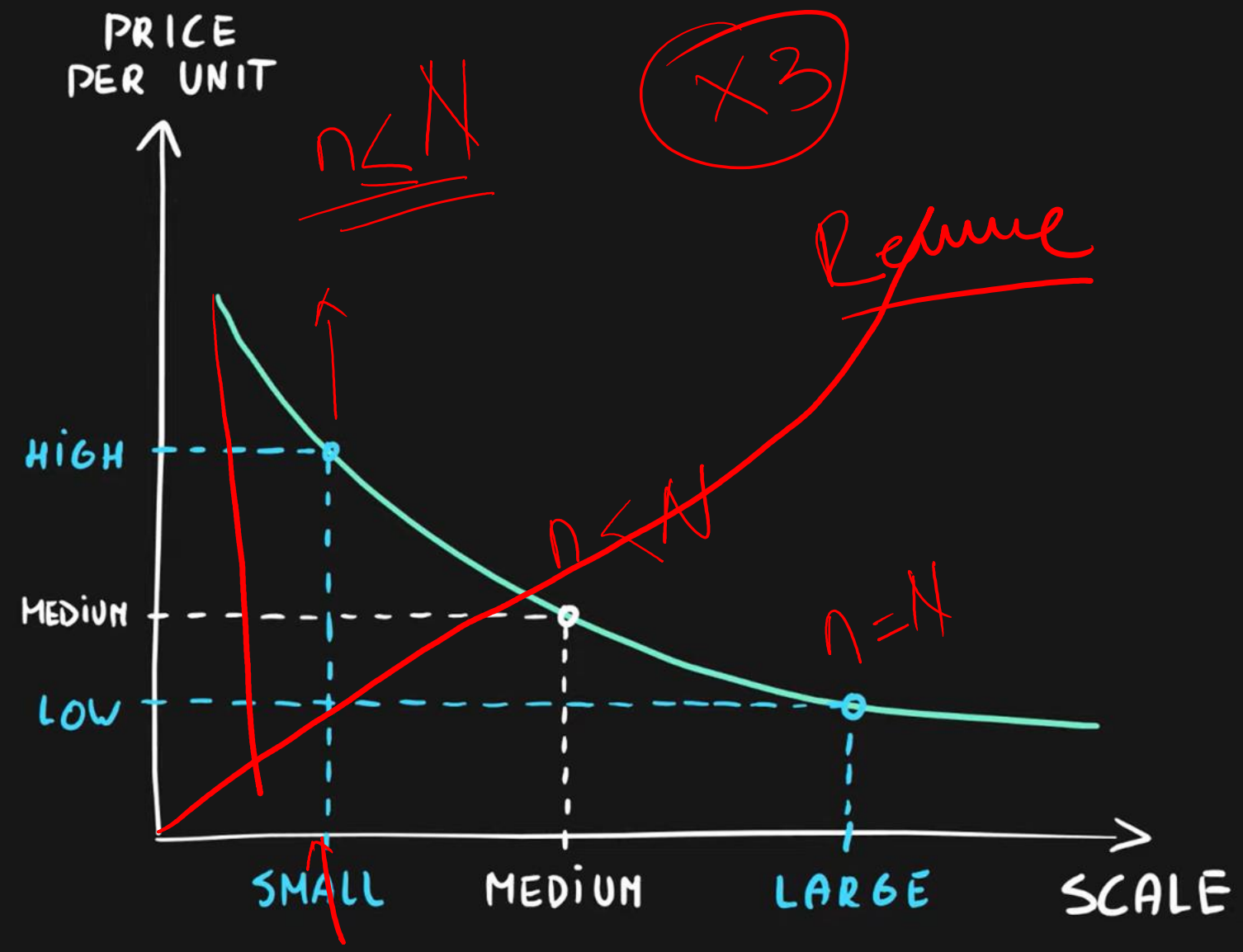
PRICE PER UNIT



Economies of scale

Key Characteristics

- Cost per unit (service) lowers as the size of the company grows



CapEx

Key Characteristics

CapEx

Key Characteristics

- Own infrastructure

CapEx

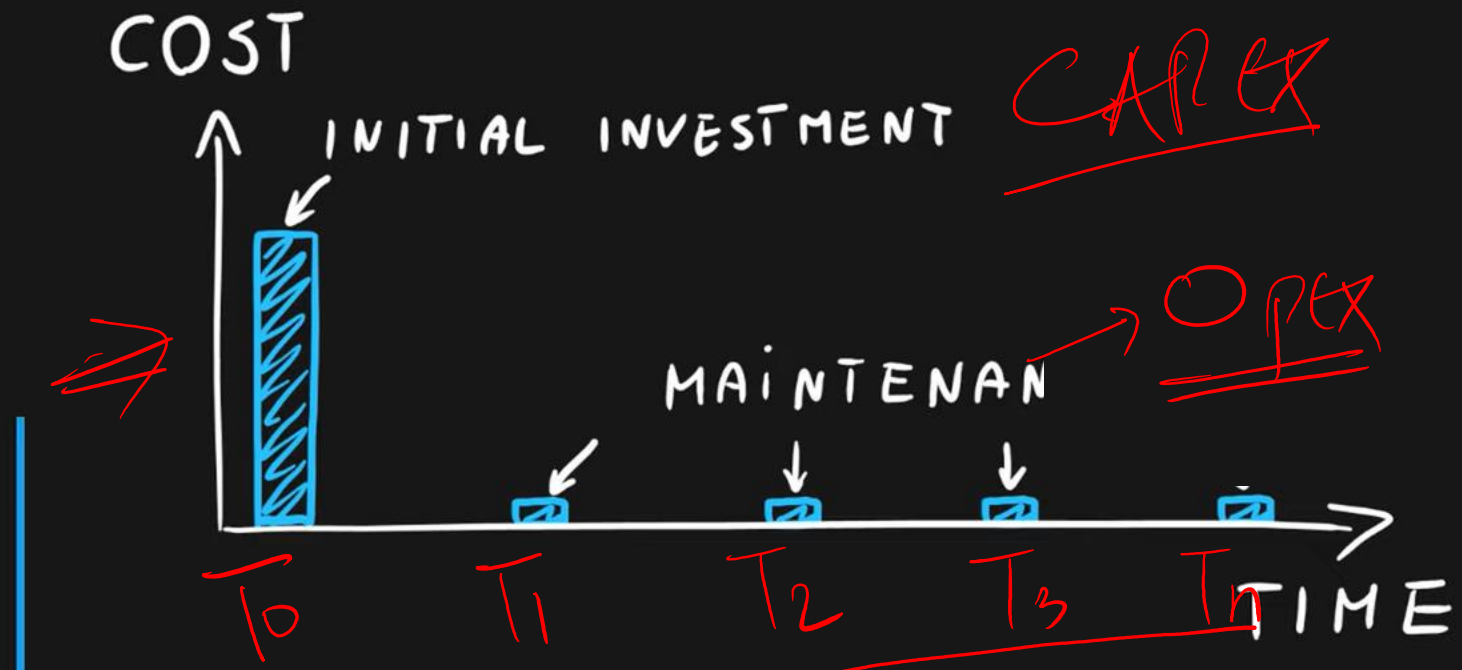
Key Characteristics

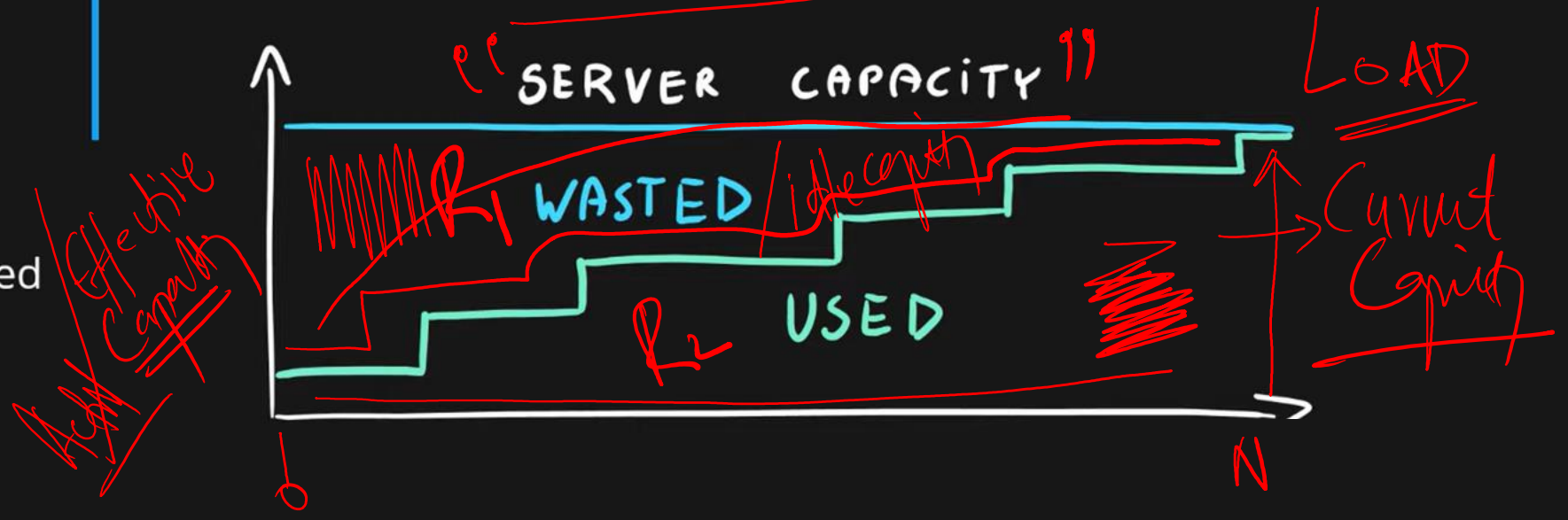
- Own infrastructure
- Big initial investment

CapEx

Key Characteristics

- Own infrastructure
- Big initial investment
- Lots of maintenance required
  - Support staff
  - Power & networking
  - Hardware failures
  - others

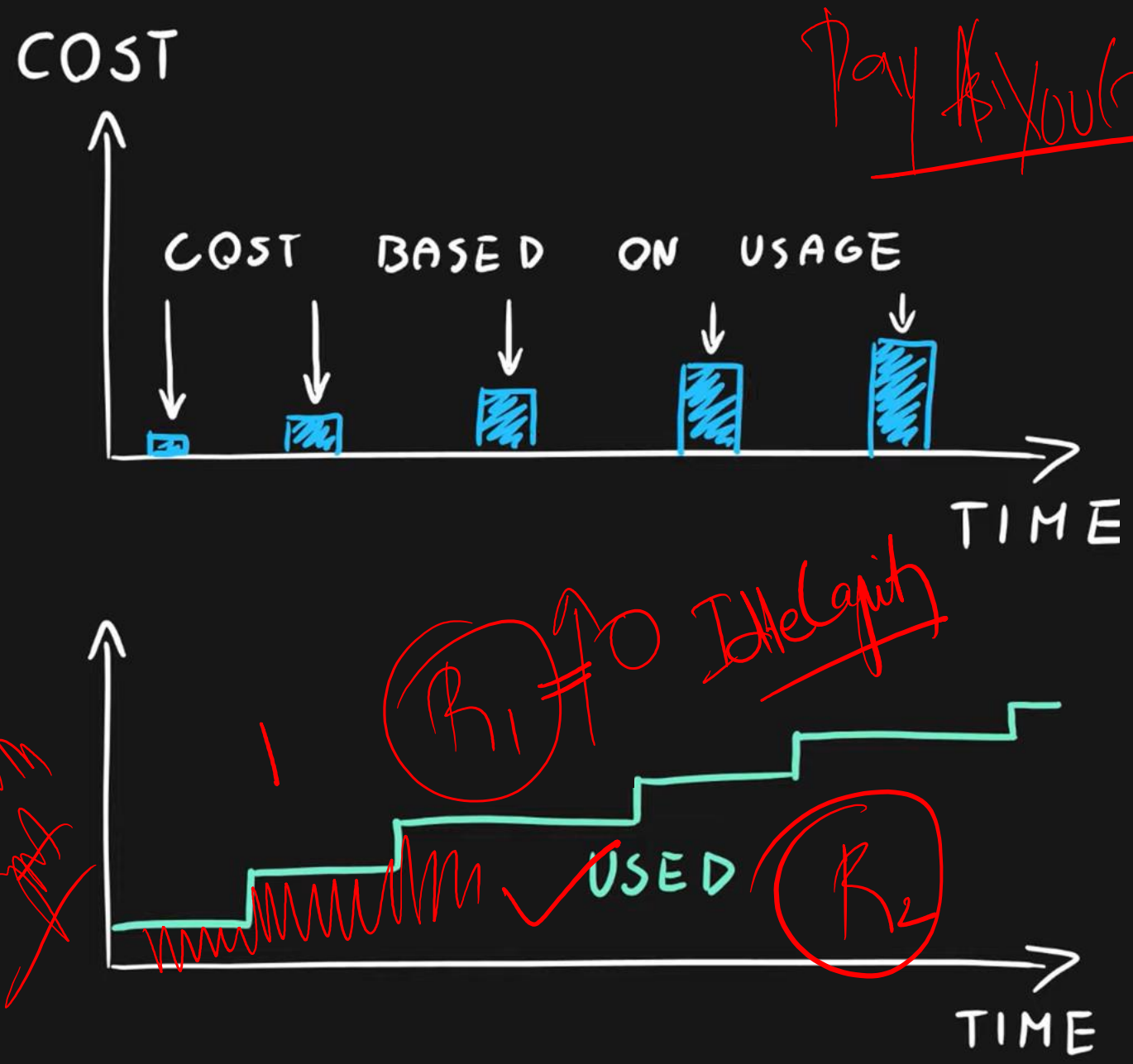




OpEx

Key Characteristics

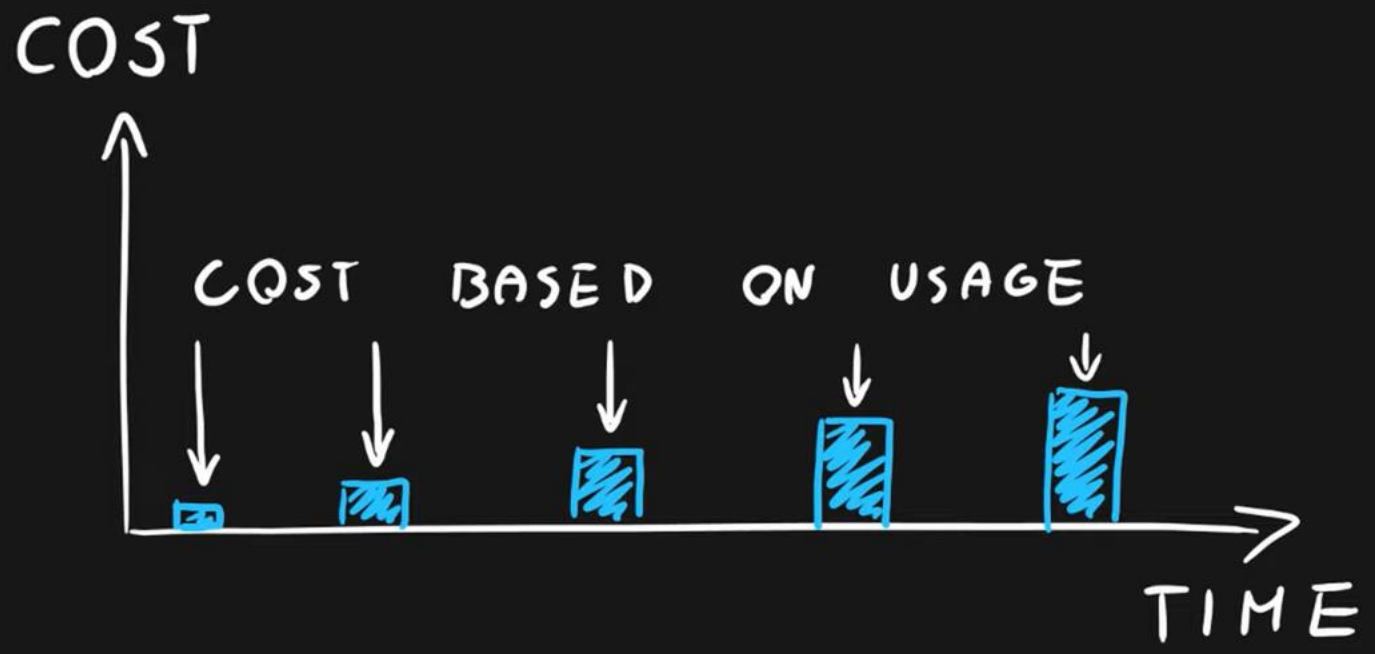
- Rent infrastructure

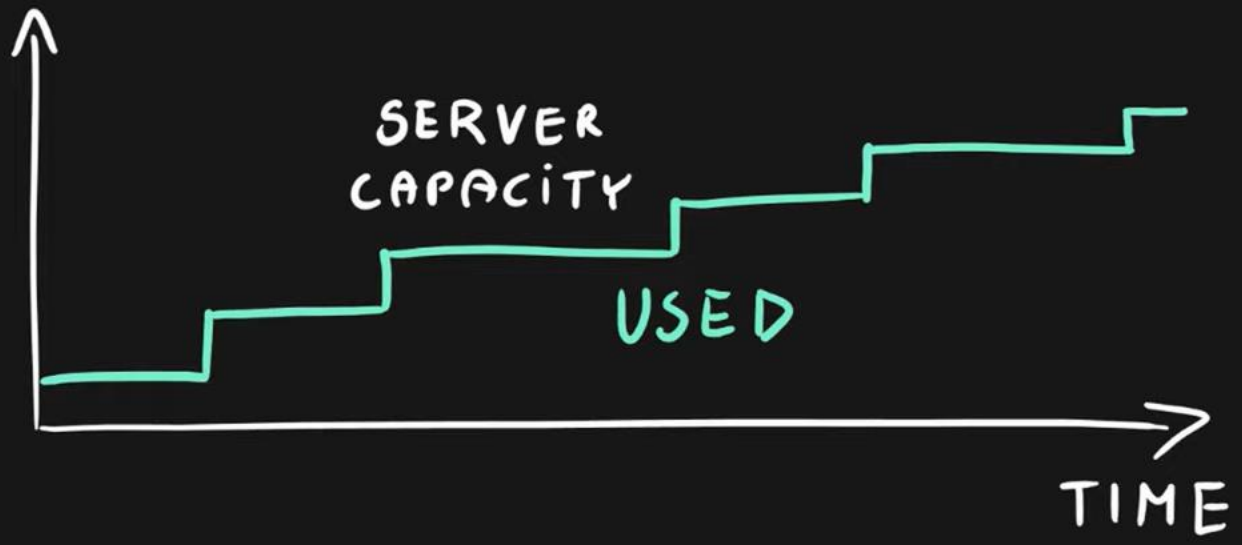


OpEx

Key Characteristics

- Rent infrastructure
- No initial investment, pay for what you use

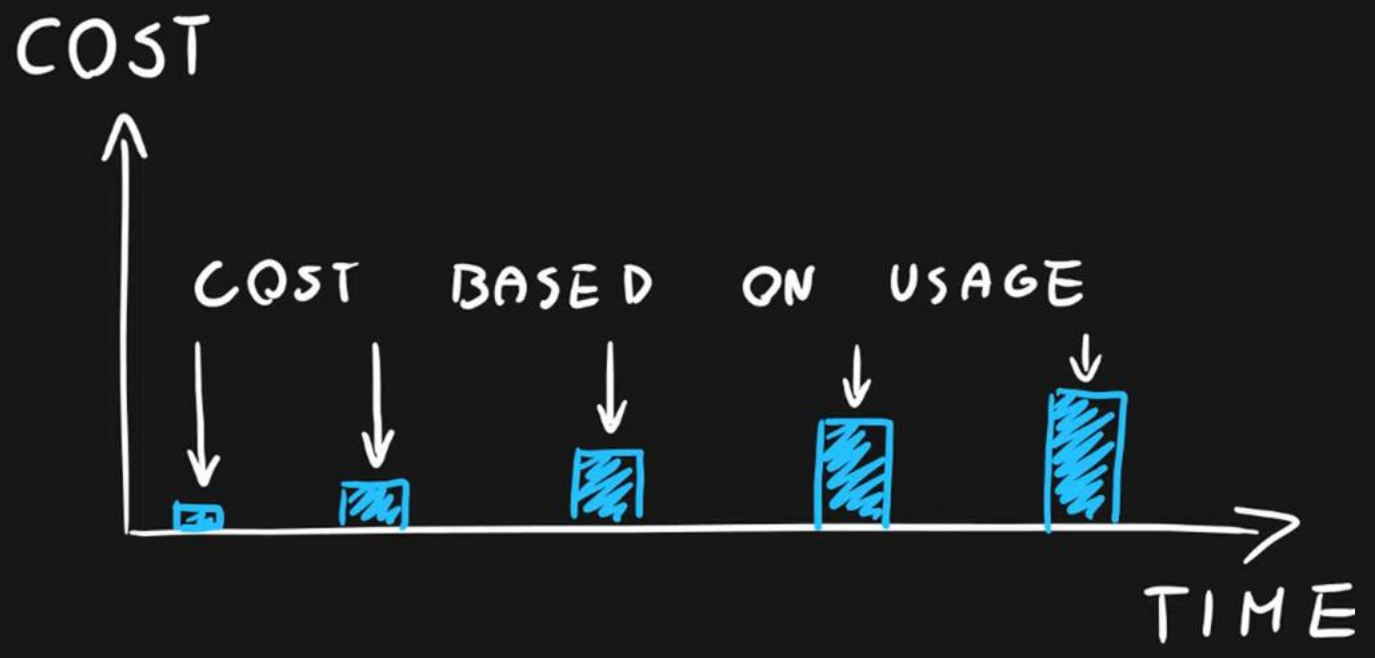


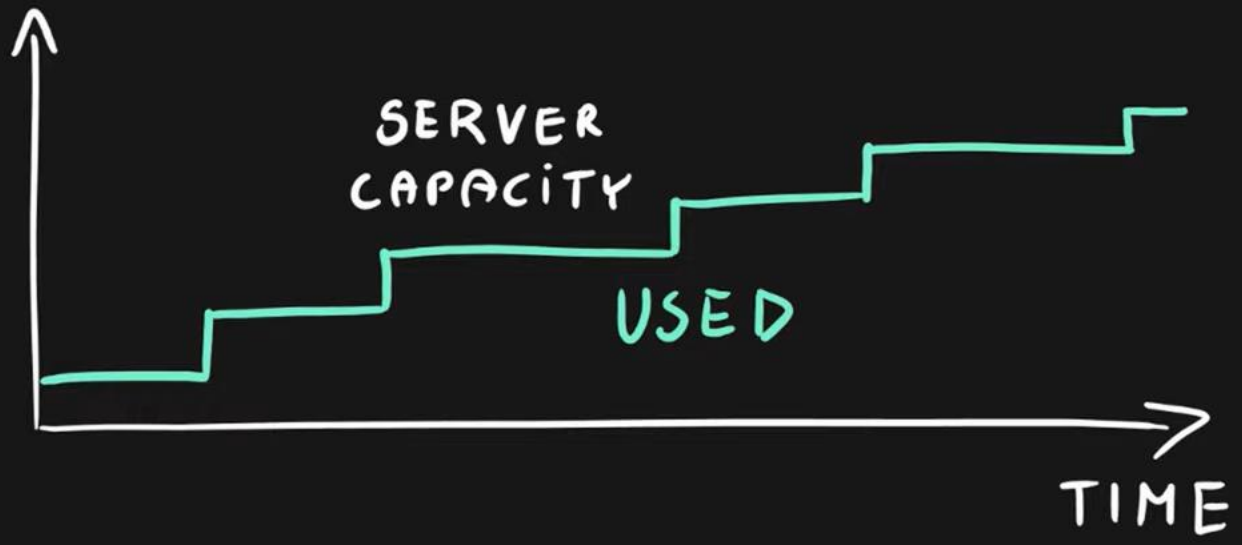


OpEx

Key Characteristics

- Rent infrastructure
- No initial investment, pay for what you use
- Minimal maintenance
  - Operations team





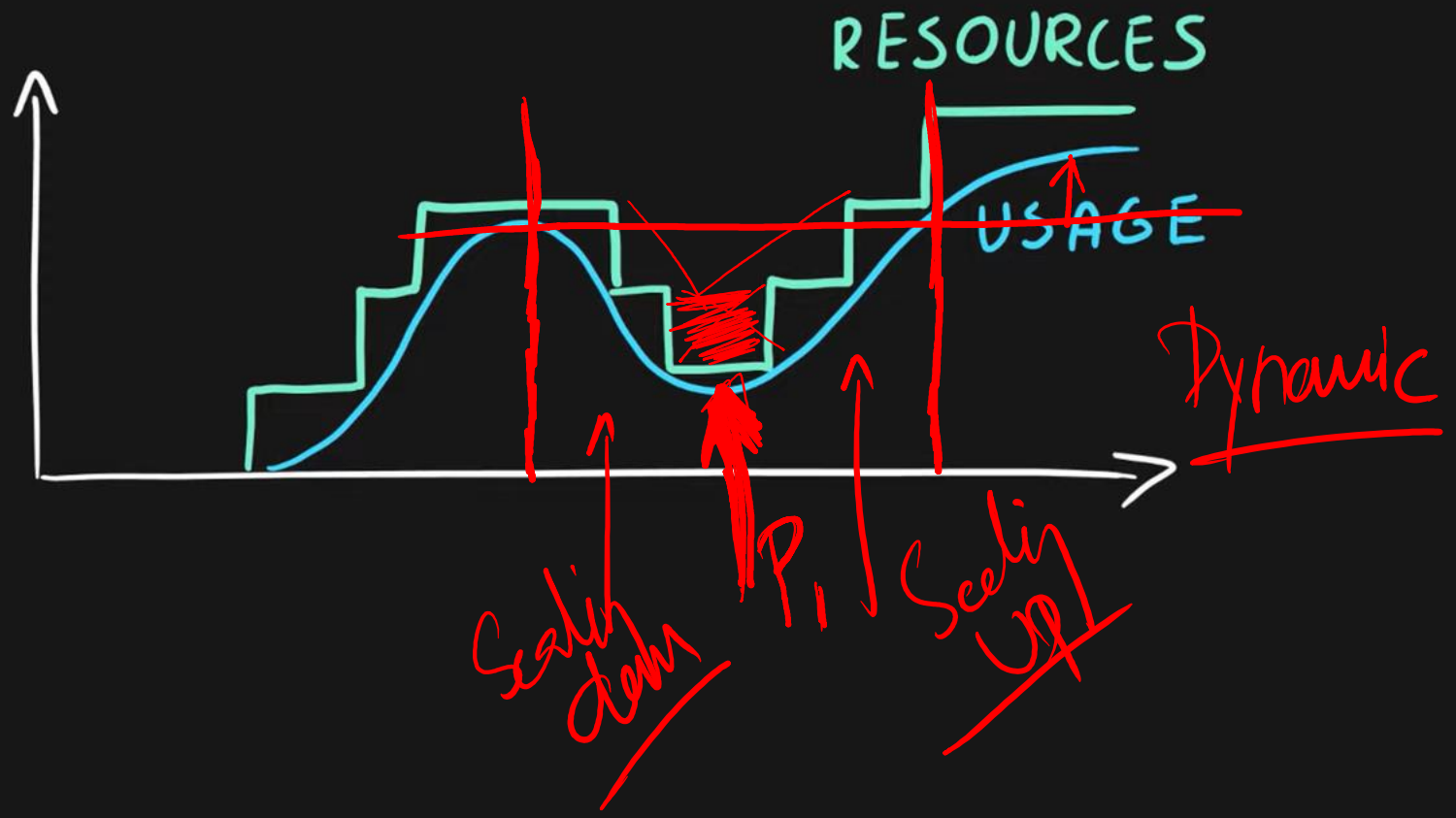
CapEx vs. OpEx

Differences

	CapEx	OpEx
Up front cost	Significant	None
Ongoing cost	Low	Based on usage
Tax Deduction	Over time	Same year
Early Termination	No	Anytime
Maintenance	Significant	Low
Value over time	Lowers	No change

Consumption-based Model

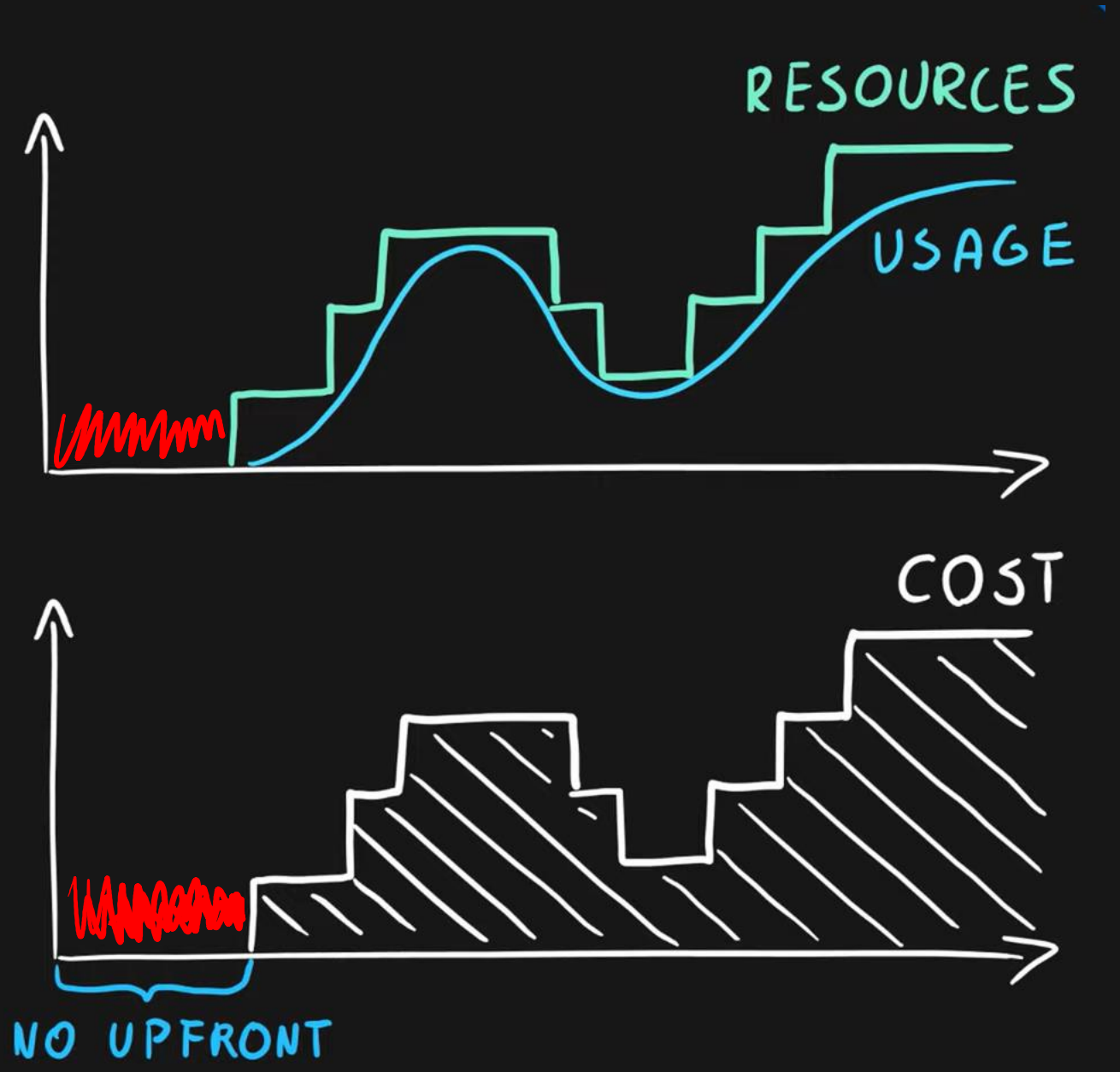
Key Characteristics



Consumption-based Model

Key Characteristics

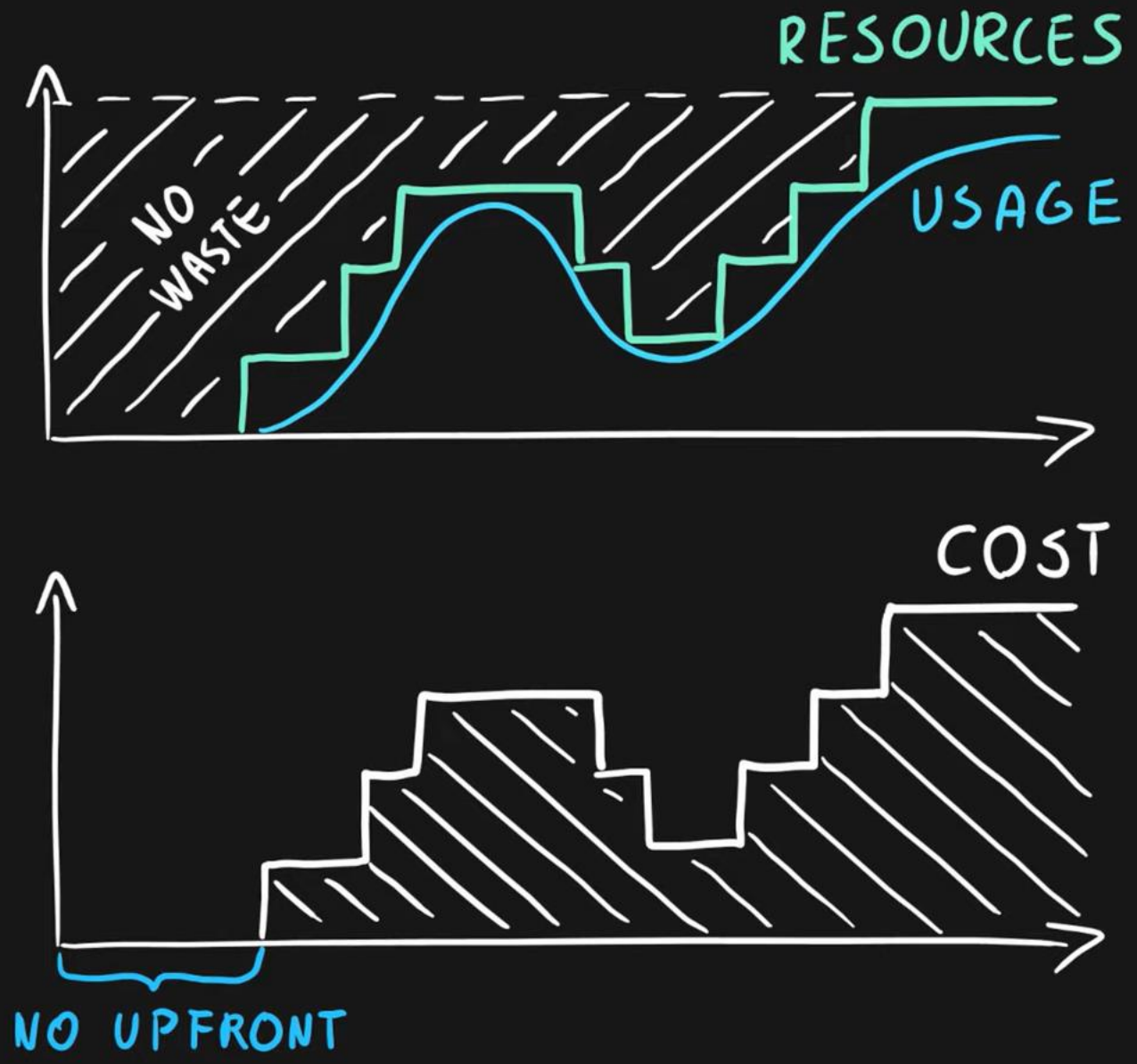
- No upfront costs



Consumption-based Model

Key Characteristics

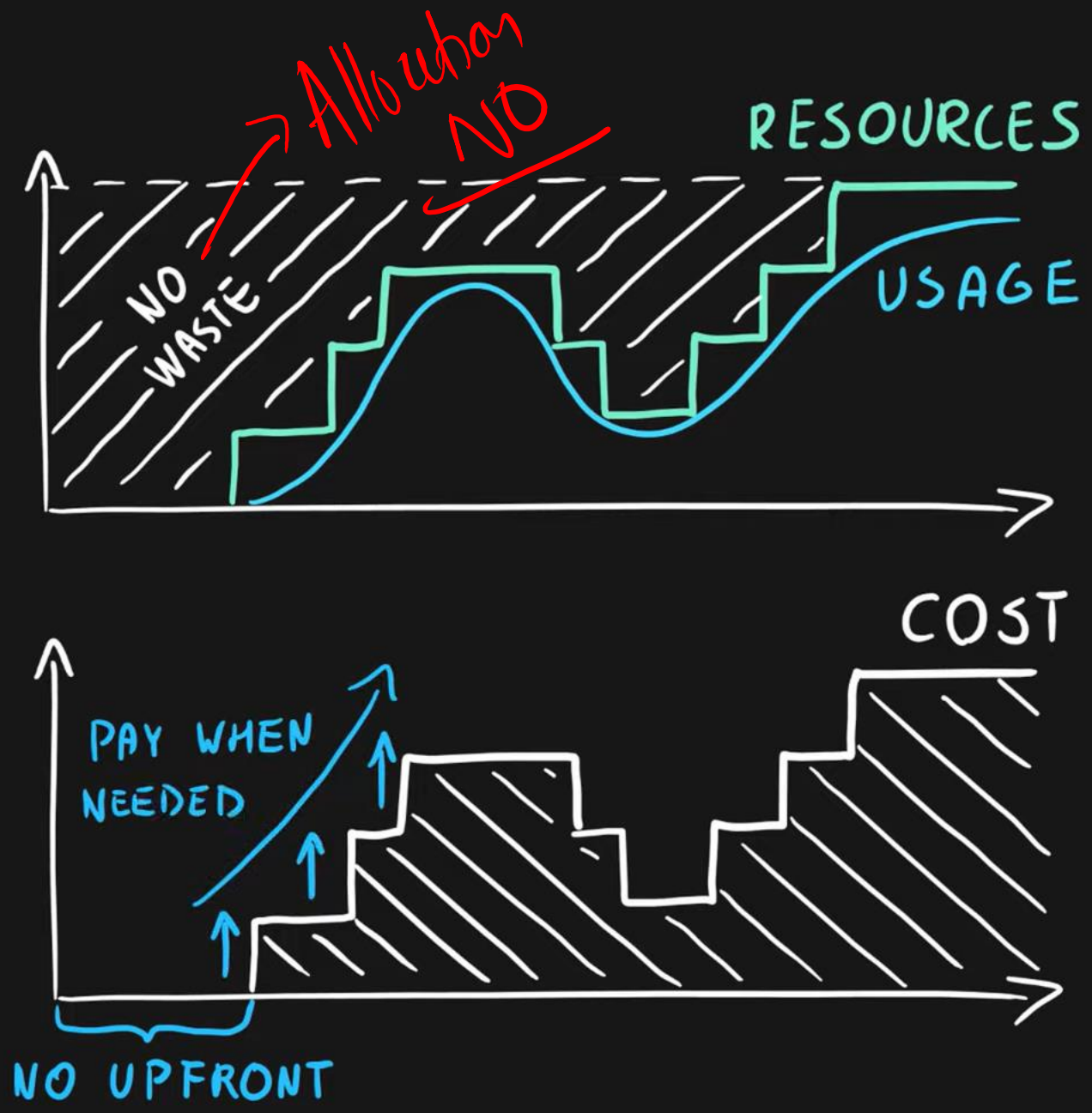
- No upfront costs
- No wasted resources



Consumption-based Model

Key Characteristics

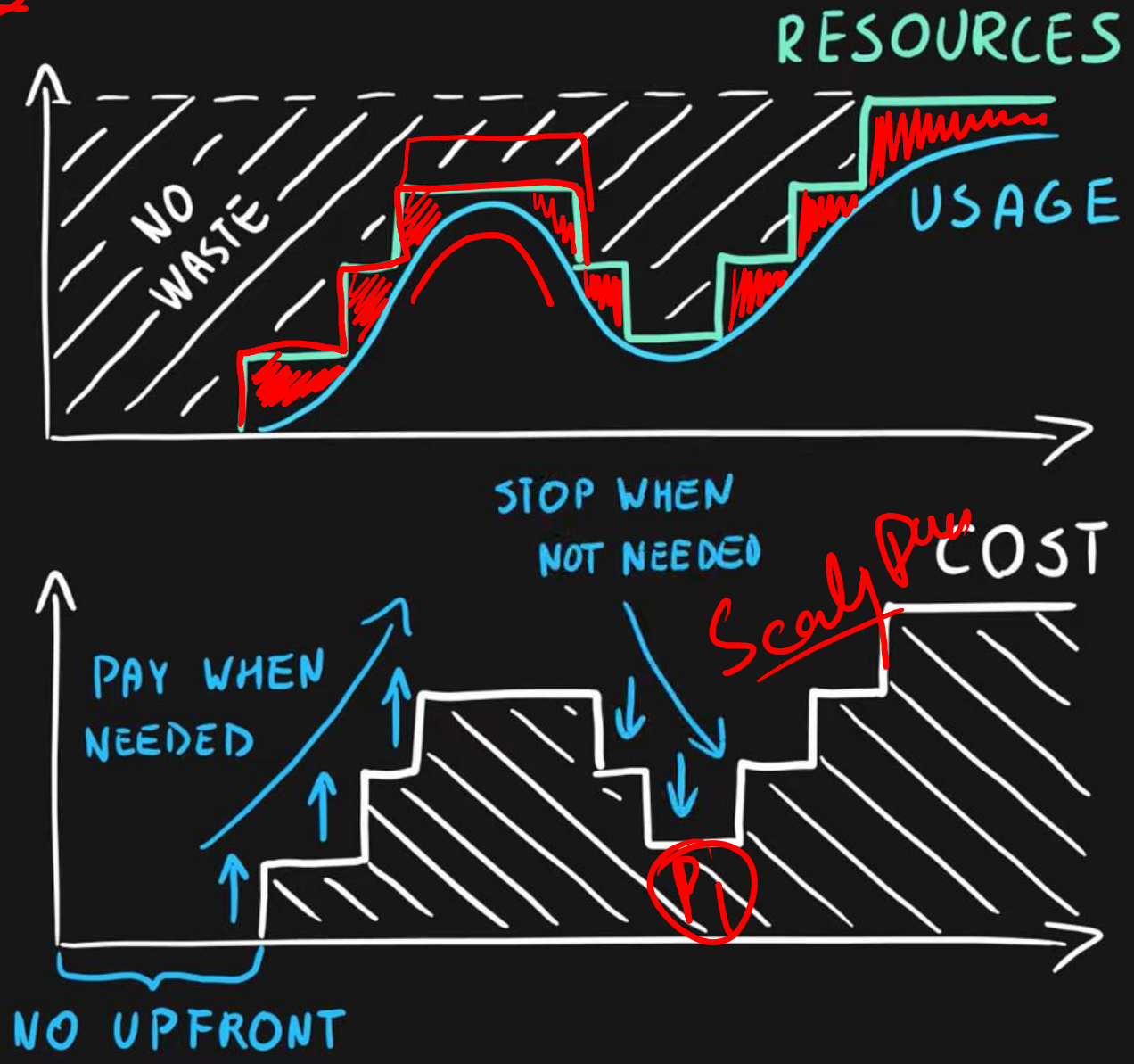
- No upfront costs
- No wasted resources
- Pay for additional resources when needed



Consumption-based Model

Key Characteristics

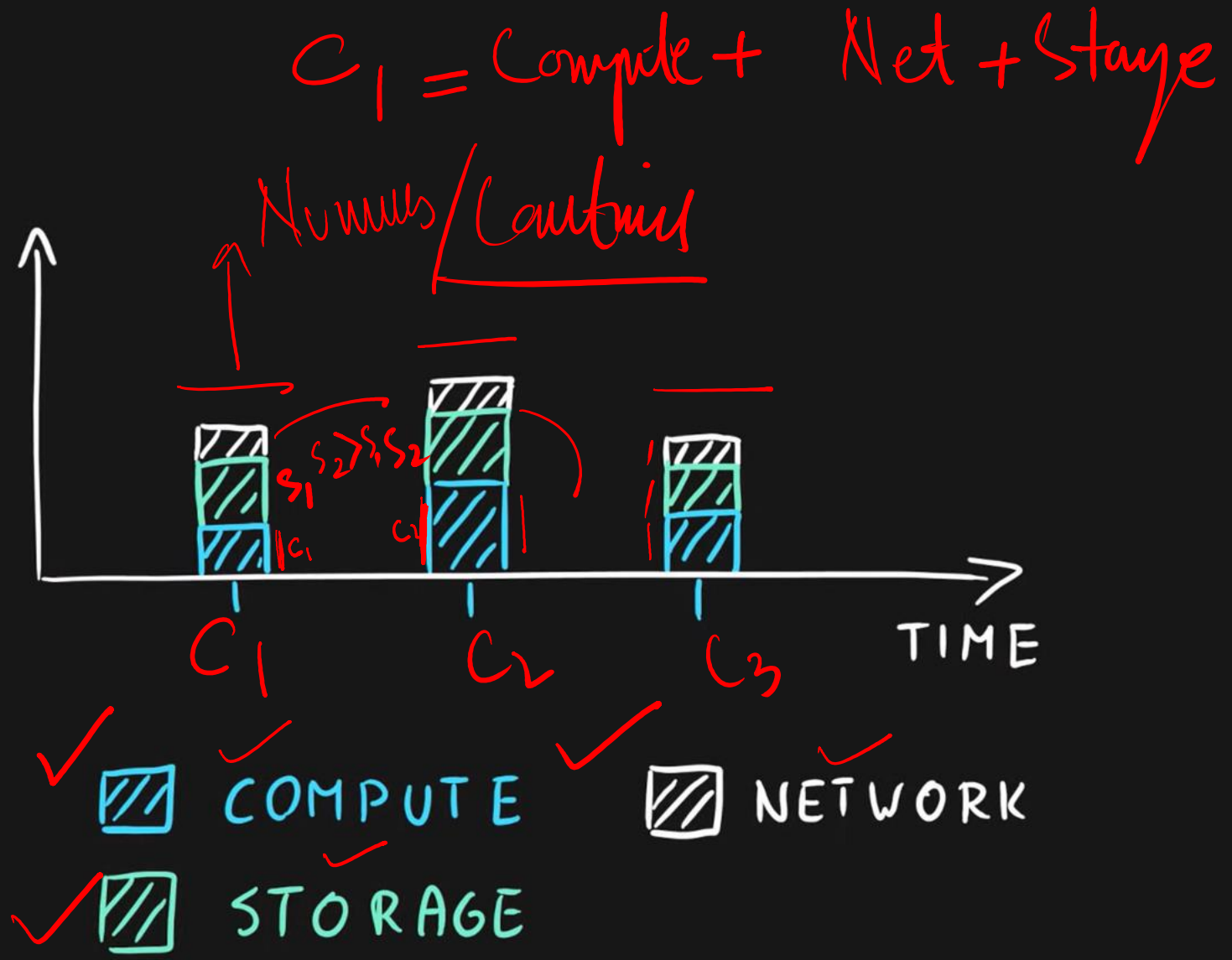
- No upfront costs
- No wasted resources
- Pay for additional resources when needed
- Stop paying at any time

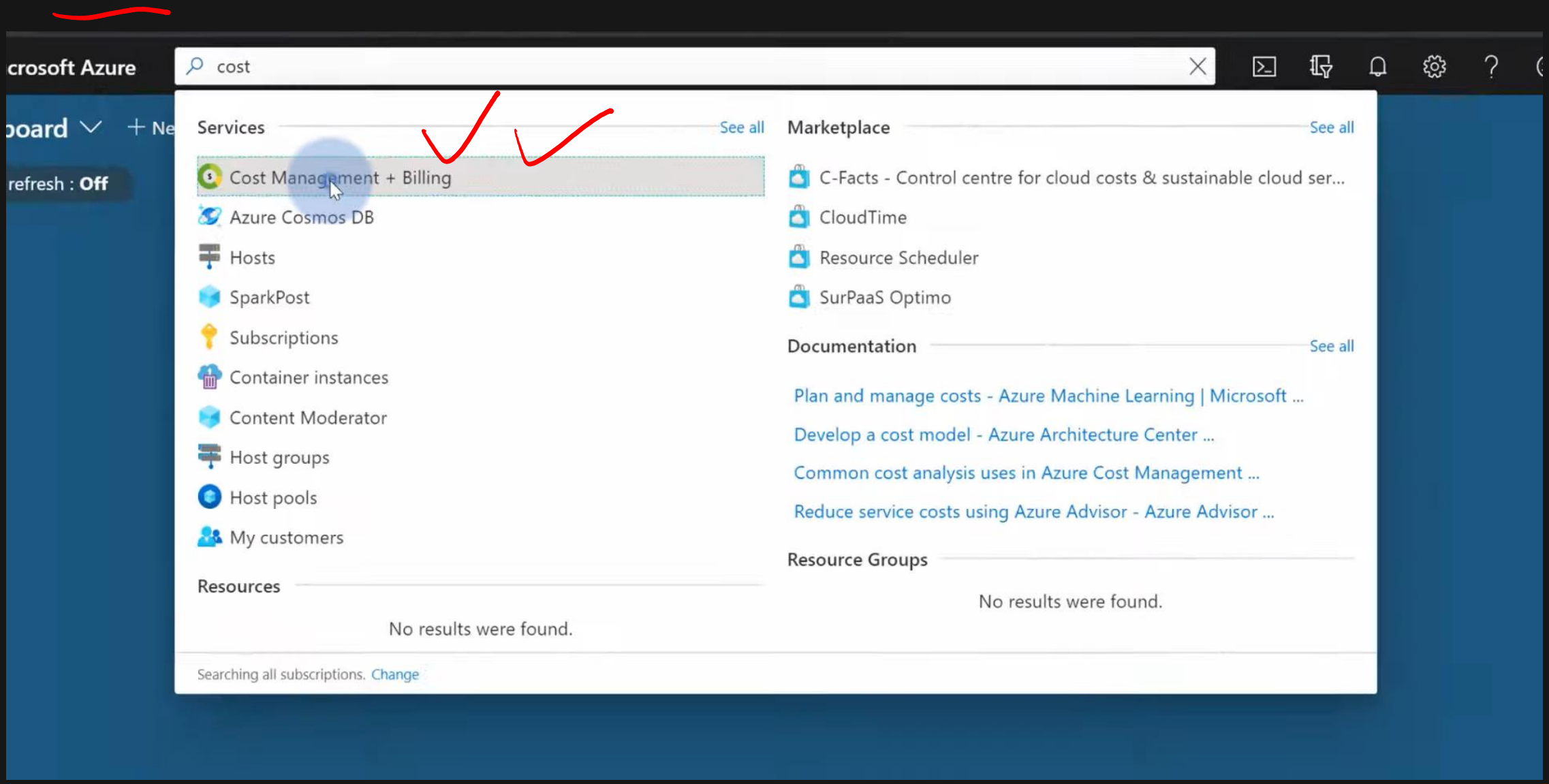


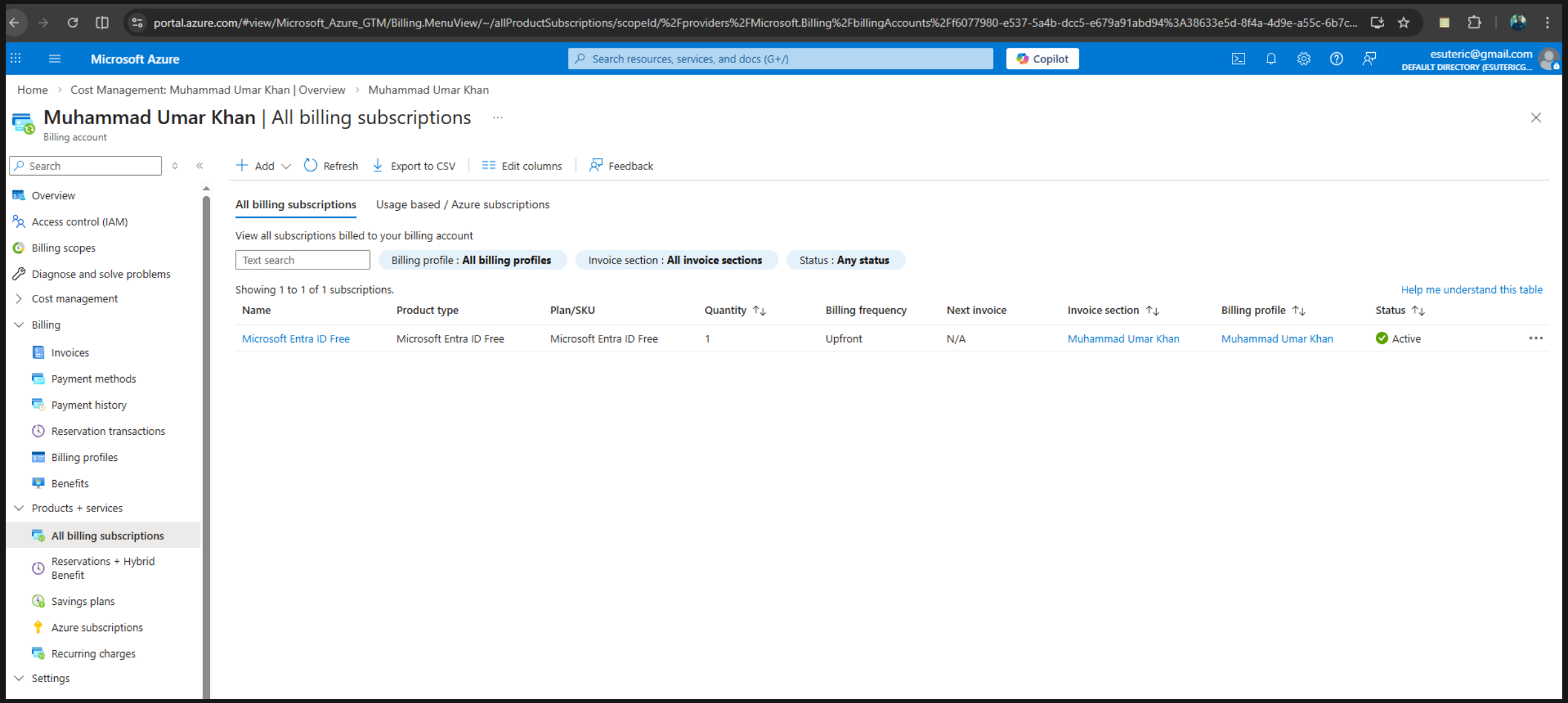
Consumption-based Model

Key Characteristics

- Multiple pricing components per service
- Very granular usage measurement




crosoft Azure
cost
Services
See all
Cost Management + Billing
Azure Cosmos DB
Hosts
SparkPost
Subscriptions
Container instances
Content Moderator
Host groups
Host pools
My customers
Resources
No results were found.
Marketplace
See all
C-Facts - Control centre for cloud costs & sustainable cloud ser...
CloudTime
Resource Scheduler
SurPaaS Optimo
Documentation
See all
Plan and manage costs - Azure Machine Learning | Microsoft ...
Develop a cost model - Azure Architecture Center ...
Common cost analysis uses in Azure Cost Management ...
Reduce service costs using Azure Advisor - Azure Advisor ...
Resource Groups
No results were found.
Searching all subscriptions. Change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Microsoft Azure
Search resources, services, and docs (G+/)
Copilot
esuteric@gmail.com
DEFAULT DIRECTORY (ESUTERICG...
Home
Cost Management: Muhammad Umar Khan | Overview
Muhammad Umar Khan
Muhammad Umar Khan | All billing subscriptions
Billing account
Search
Overview
Access control (IAM)
Billing scopes
Diagnose and solve problems
Cost management
Billing
Invoices
Payment methods
Payment history
Reservation transactions
Billing profiles
Benefits
Products + services
All billing subscriptions
Reservations + Hybrid Benefit
Savings plans
Azure subscriptions
Recurring charges
Settings
Add
Refresh
Export to CSV
Edit columns
Feedback
All billing subscriptions
Usage based / Azure subscriptions
View all subscriptions billed to your billing account
Text search
Billing profile : All billing profiles
Invoice section : All invoice sections
Status : Any status
Showing 1 to 1 of 1 subscriptions.
Help me understand this table
Name
Product type
Plan/SKU
Quantity
Billing frequency
Next invoice
Invoice section
Billing profile
Status
Microsoft Entra ID Free
Microsoft Entra ID Free
Microsoft Entra ID Free
1
Upfront
N/A
Muhammad Umar Khan
Muhammad Umar Khan
Active

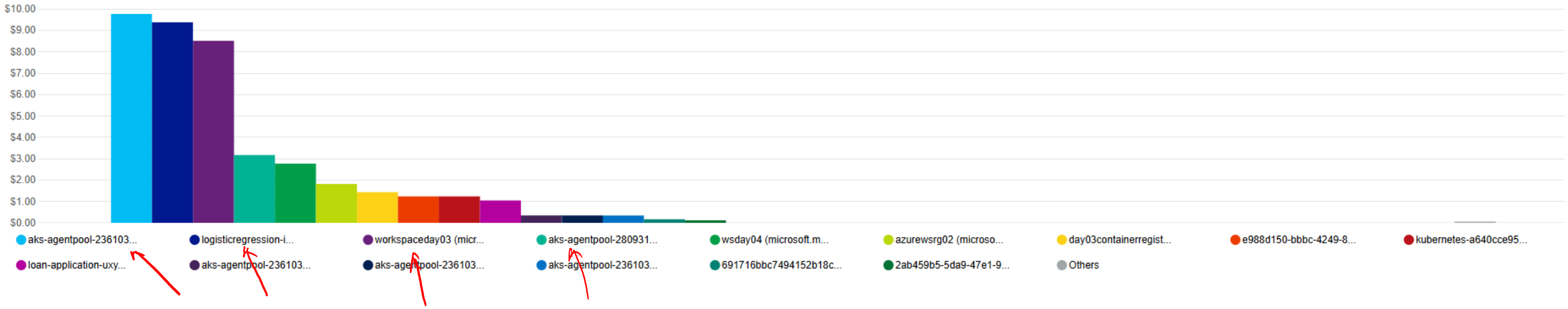
Cost analysis

Save | Save as | Delete view | Share | Subscribe | Refresh | Download | Cost by resource | Configure billing profile | Feedback | Try preview | Help

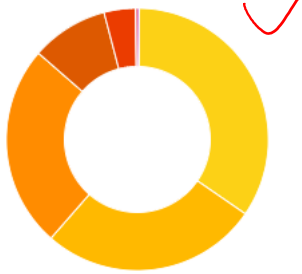
Scope : Muhammad Umar Khan | VIEW * G096153183 | May 2025 | InvoiceId : G096153183 | Add filter

ACTUAL COST (USD) **$41.80** | FORECAST UNAVAILABLE -- | BUDGET: NONE --

Group by: Resource | Granularity: None | Column (grouped)

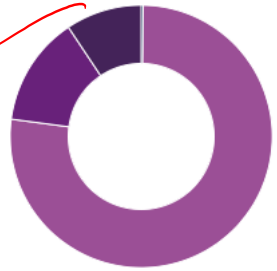


Service name



Virtual Machines $14.46
Storage $11.23
Container Instances $10.43
Virtual Network $3.97
Container Registry $1.61

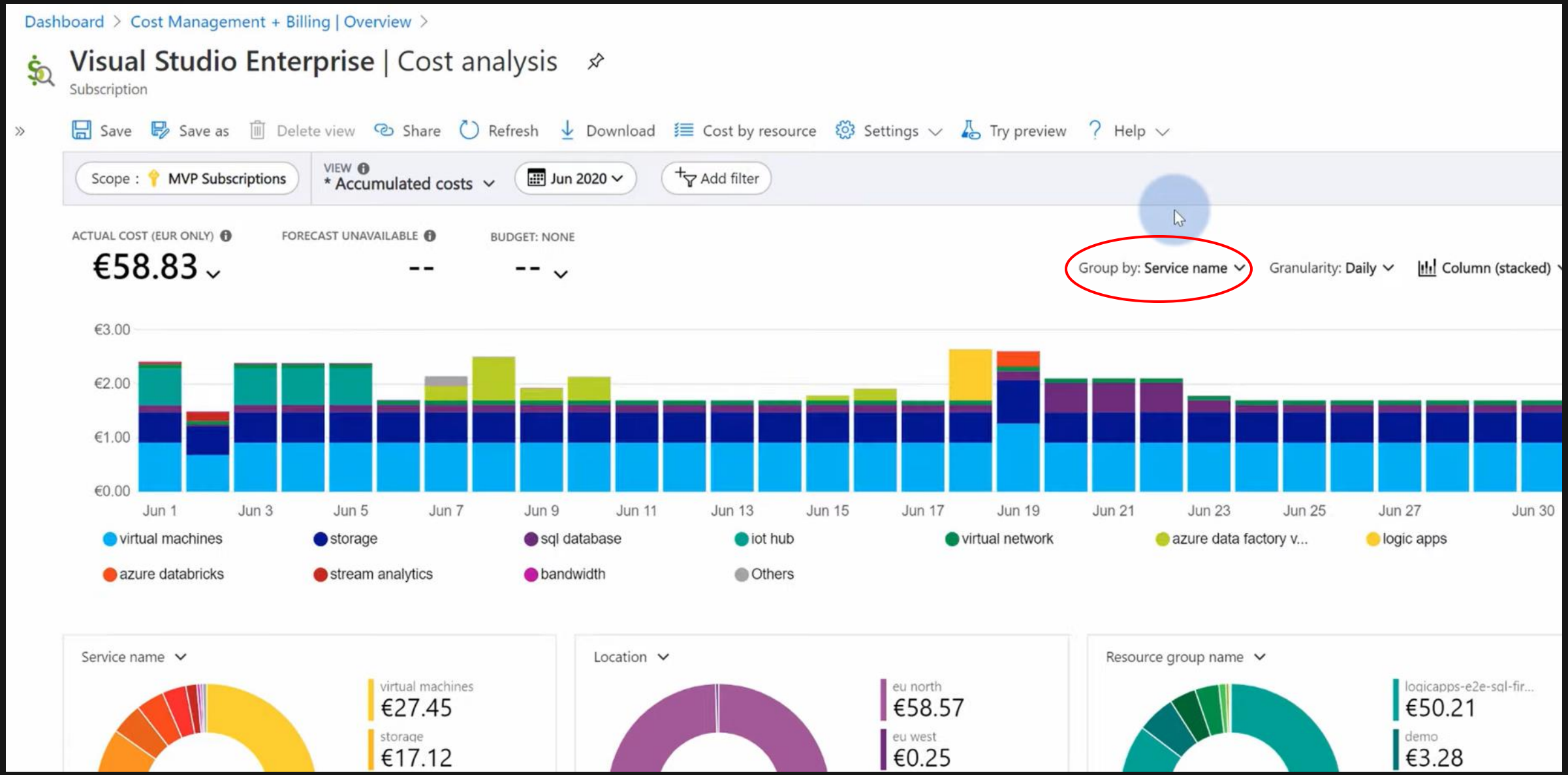
Location



ap east $32.23
us east $5.65
us east 2 $4.02
No resource location $-0.11

Resource group name

azurerg01 $19.34
mc_day04rg_loan-ap... $11.06
mc_azurerg01_aks-d... $5.65
day04rg $4.02
azurewsda02 $1.82


Dashboard > Cost Management + Billing | Overview >
Visual Studio Enterprise | Cost analysis
Subscription
Save
Save as
Delete view
Share
Refresh
Download
Cost by resource
Settings
Try preview
Help
Scope : MVP Subscriptions
VIEW
* Accumulated costs
Jun 2020
Add filter
ACTUAL COST (EUR ONLY)
€58.83
FORECAST UNAVAILABLE
--
BUDGET: NONE
--
Group by: Service name
Granularity: Daily
Column (stacked)
€3.00
€2.00
€1.00
€0.00
Jun 1
Jun 3
Jun 5
Jun 7
Jun 9
Jun 11
Jun 13
Jun 15
Jun 17
Jun 19
Jun 21
Jun 23
Jun 25
Jun 27
Jun 30
virtual machines
storage
sql database
iot hub
virtual network
azure data factory v...
logic apps
azure databricks
stream analytics
bandwidth
Others
Service name
virtual machines
€27.45
storage
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Location
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eu west
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Resource group name
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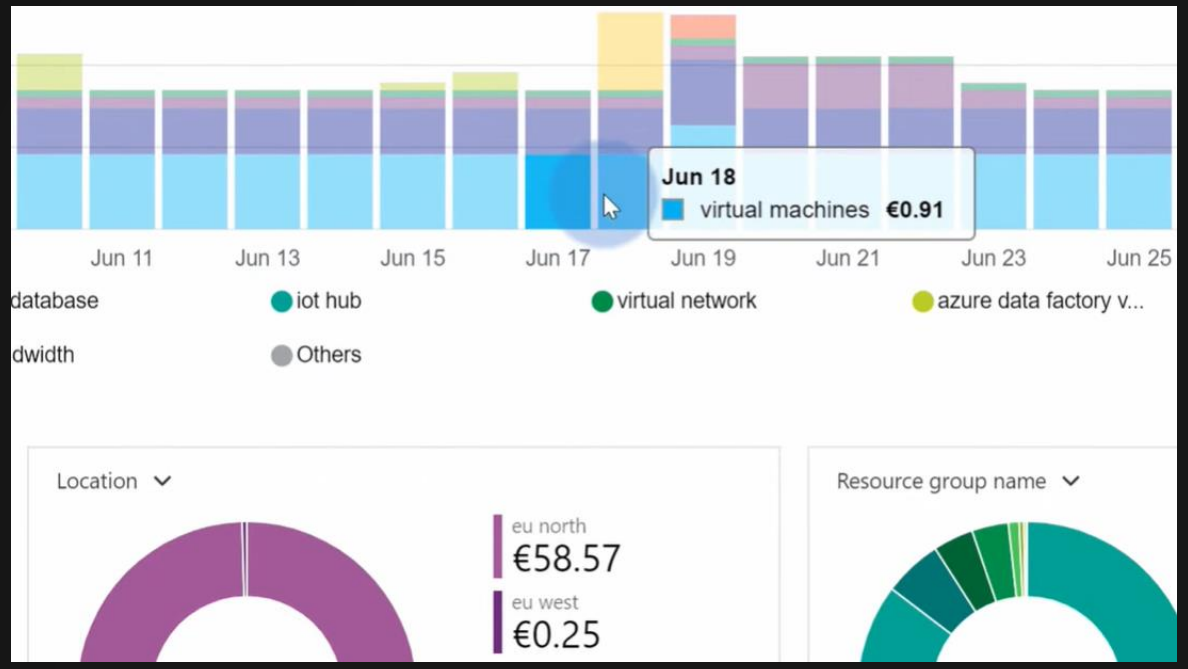
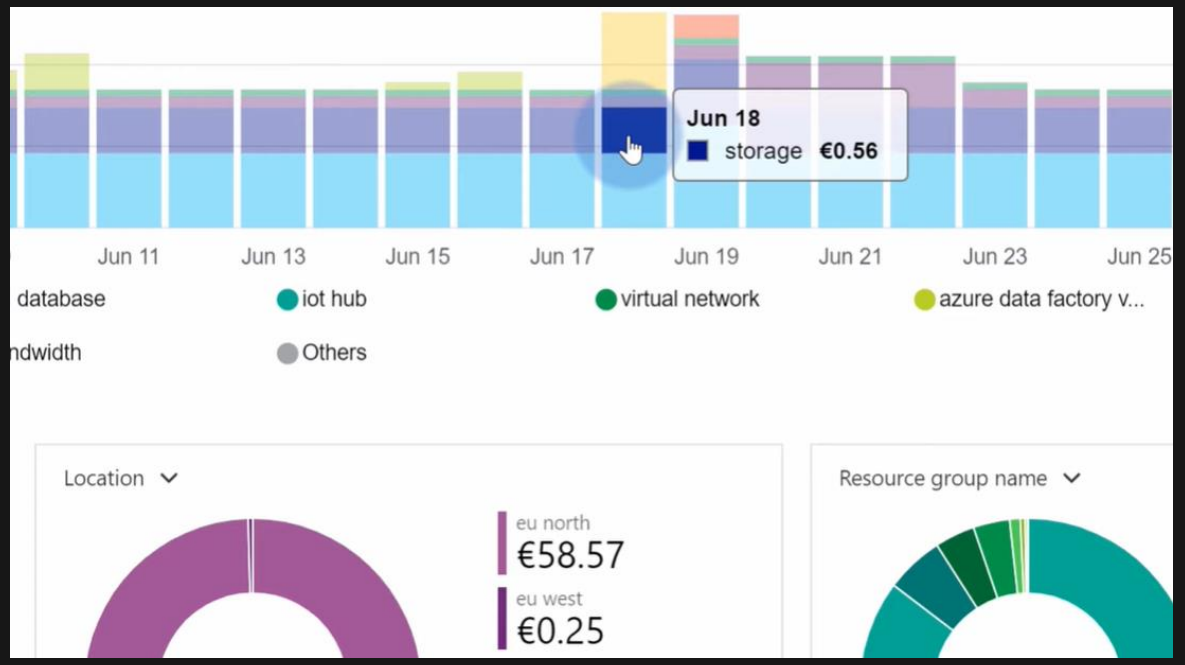
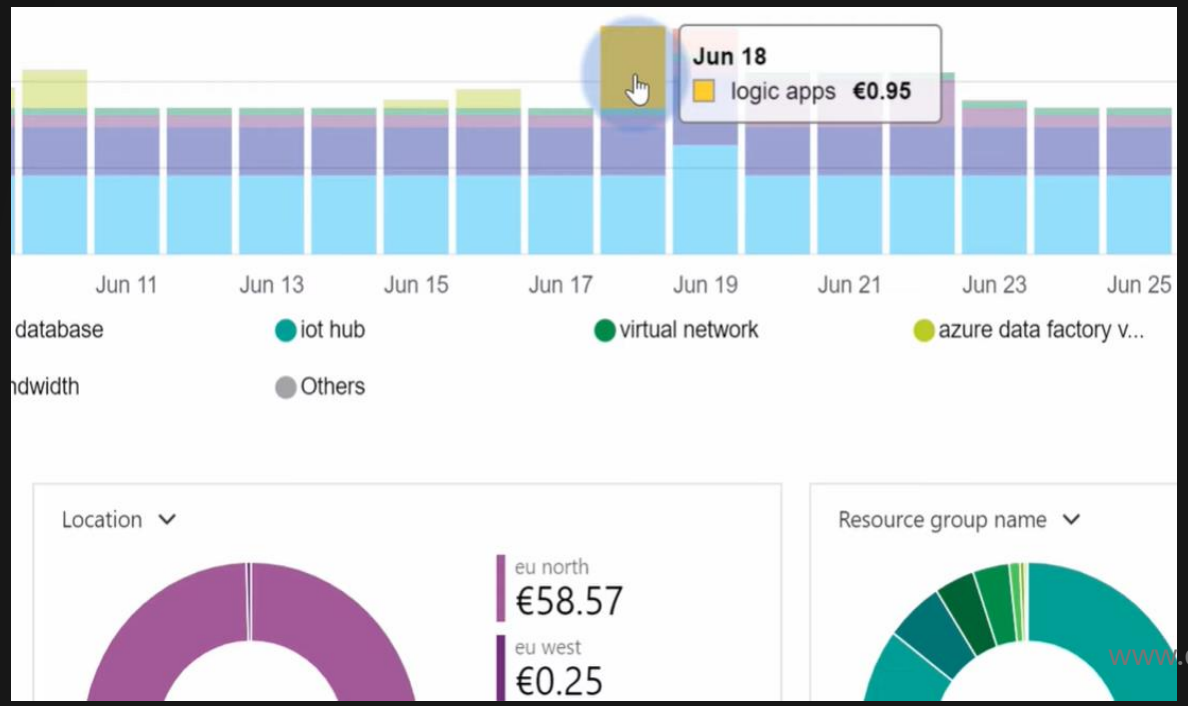
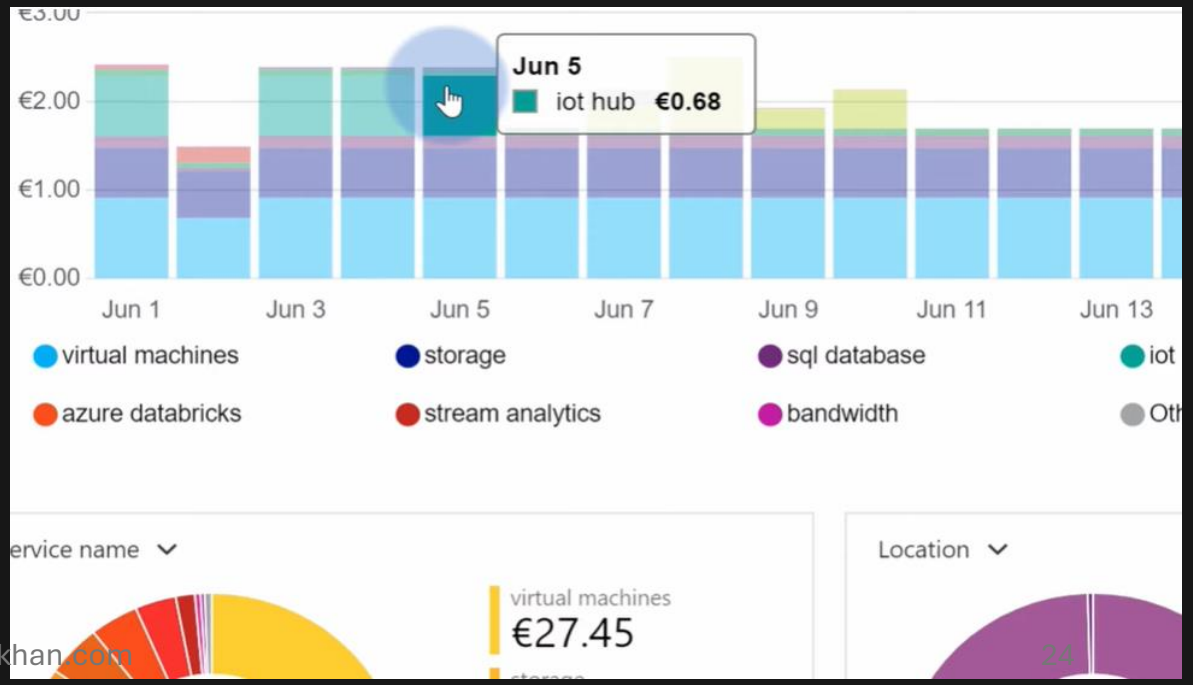
demo
€3.28









(i) Cloud Service models

(ii) Cost management

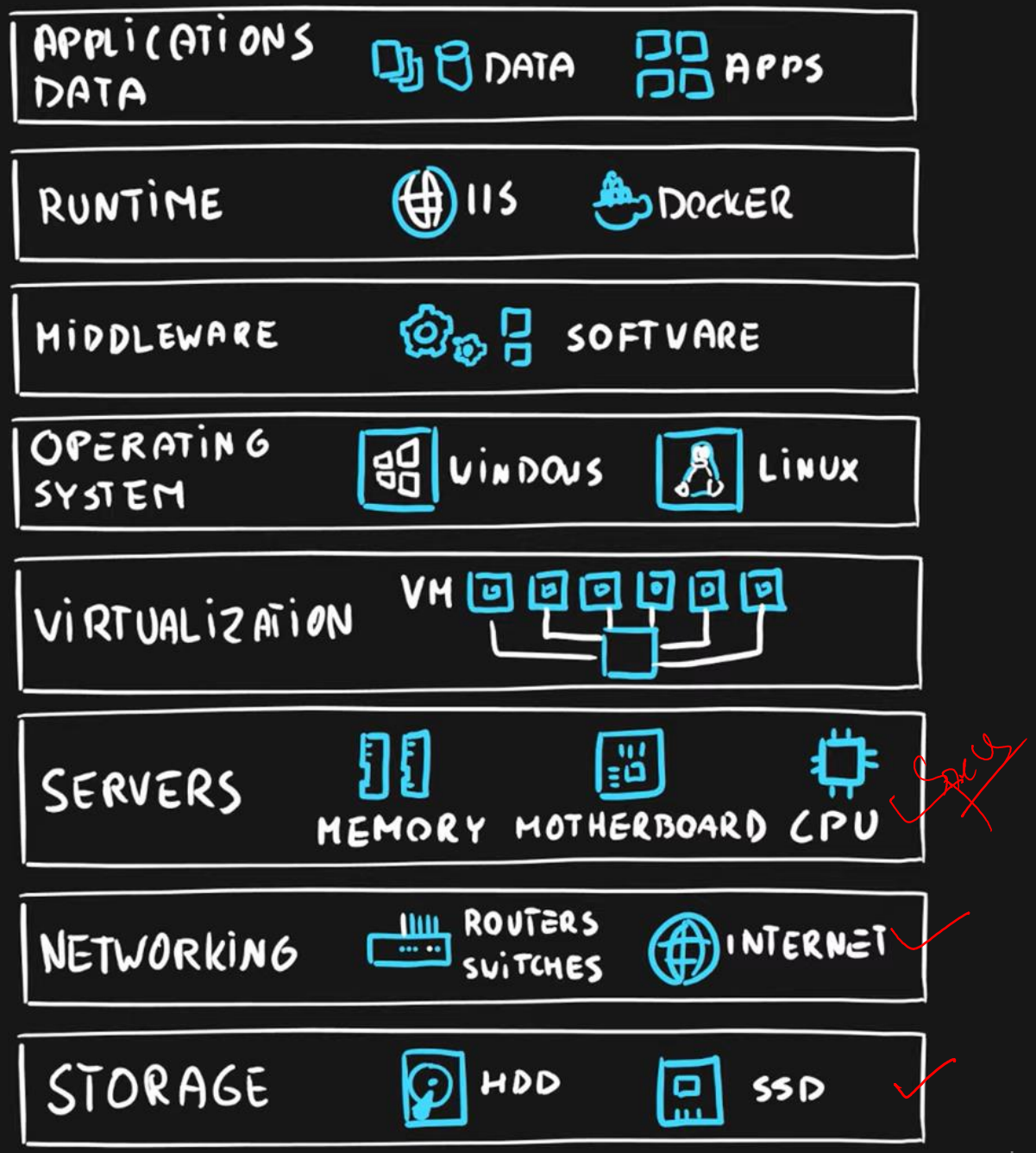
(iii) Basic Services

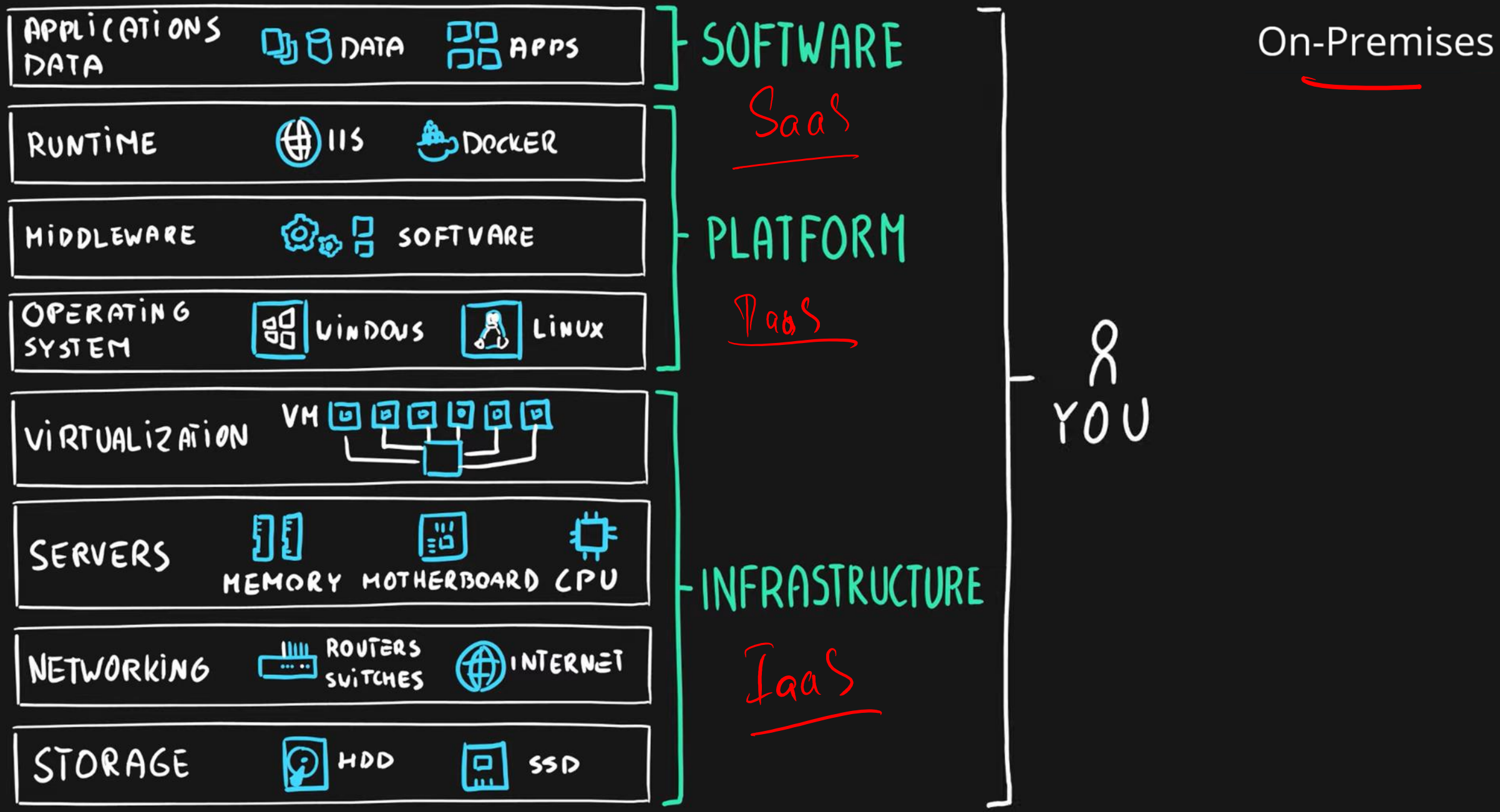
Microsoft Az-900 Question:

(1) B2B | Provider Side

Consider yourself a startup, how you will go with the Cloud to start your own service model for your customers?

(2) B2C | Client Side


APPLICATIONS DATA
DATA
APPS
RUNTIME
IIS
DOCKER
MIDDLEWARE
SOFTWARE
OPERATING SYSTEM
WINDOWS
LINUX
VIRTUALIZATION
VM
SERVERS
MEMORY
MOTHERBOARD
CPU
NETWORKING
ROUTERS
SWITCHES
INTERNET
STORAGE
HDD
SSD


APPLICATIONS DATA
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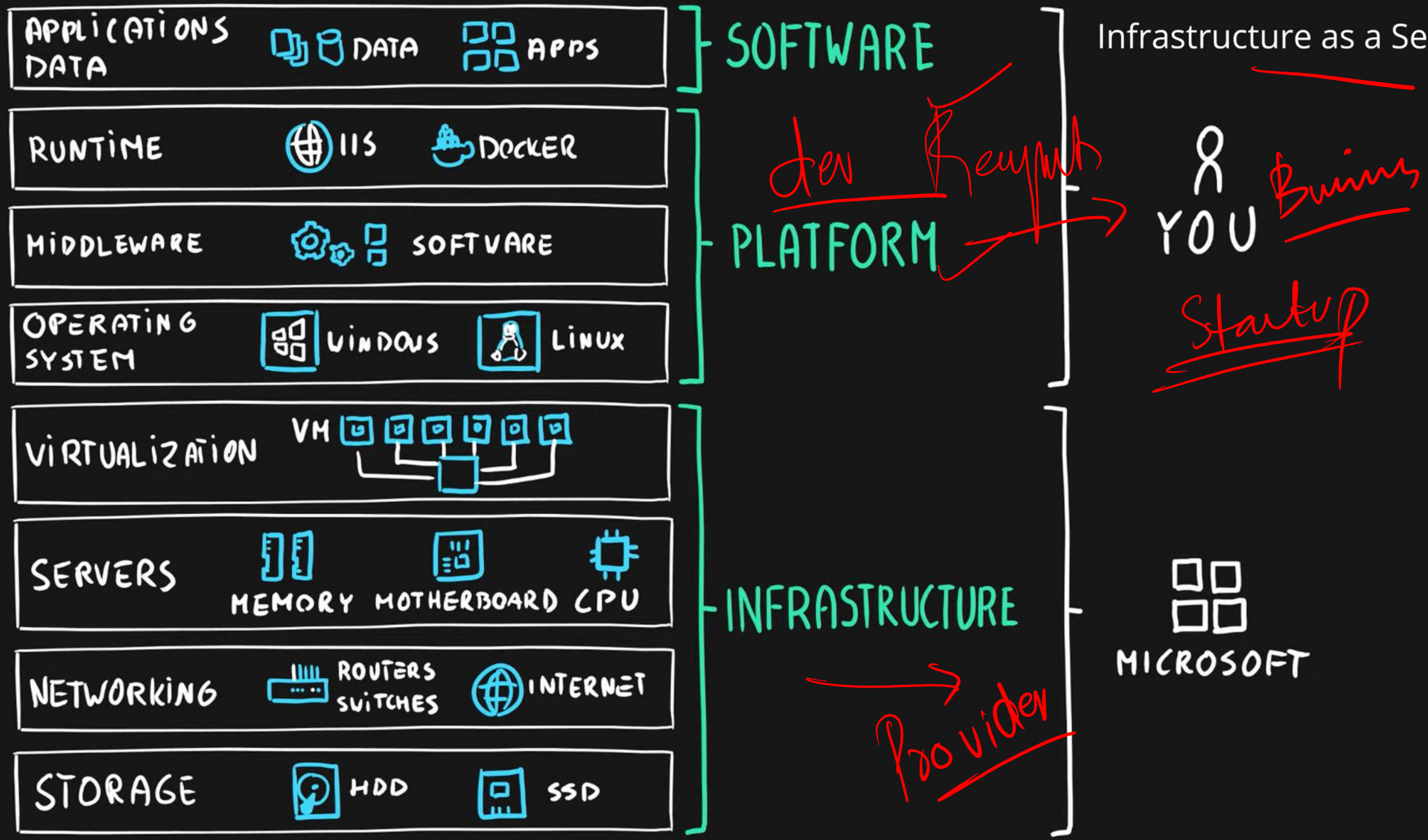
SWITCHES
INTERNET
STORAGE
HDD
SSD
INFRASTRUCTURE
IaaS
&
YOU
On-Premises

On-Premises

Key Characteristics

Ownership

- Cloud provider manages nothing
- You manage everything
  - Infrastructure – networking, hardware & virtualization
  - Platform – operating system, middleware, runtime
  - Software – data & applications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NETWORKING
ROUTERS
SWITCHES
INTERNET
STORAGE
HDD
SSD
INFRASTRUCTURE
Infrastructure as a Service (IaaS)
YOU
MICROSOFT

Infrastructure as a Service (IaaS)

Key Characteristics

Ownership

- Cloud provider manages infrastructure
  - Infrastructure – networking, hardware & virtualization
- You manage platform & software
  - Platform – operating system, middleware, runtime
  - Software – data & applications

Infrastructure as a Service (IaaS)

Key Characteristics

Ownership

- Cloud provider manages infrastructure
  - Infrastructure – networking, hardware & virtualization
- You manage platform & software
  - Platform – operating system, middleware, runtime
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Use cases

- Migration of workloads
- Test & development
- Storage, backups and recovery

Infrastructure as a Service (IaaS)

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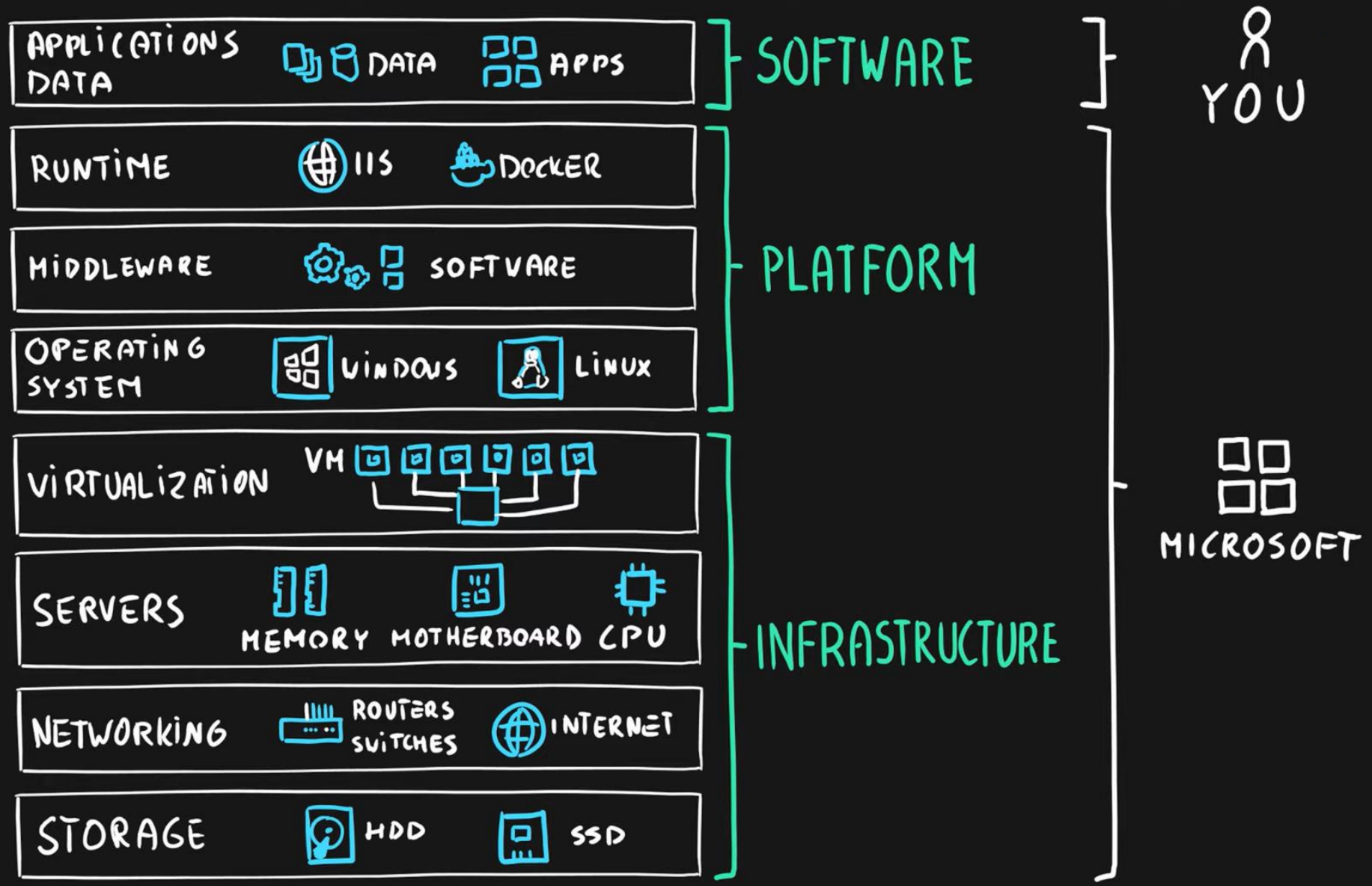
Platform as a Service (PaaS)



Platform as a Service (PaaS)

Key Characteristics

Ownership

- Cloud provider manages infrastructure & platform
  - Infrastructure – networking, hardware & virtualization
  - Platform – operating system, middleware, runtime
- You manage software
  - Software – data & applications

Platform as a Service (PaaS)

Key Characteristics

Ownership

- Cloud provider manages infrastructure & platform
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  - Platform – operating system, middleware, runtime
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  - Software – data & applications

Use cases

- Development framework
- Analytics & business intelligence

Platform as a Service (PaaS)

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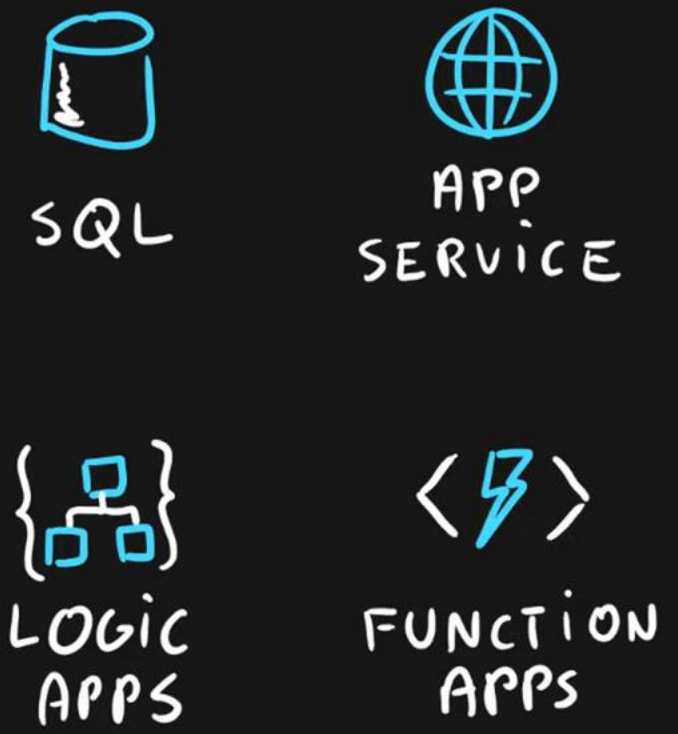
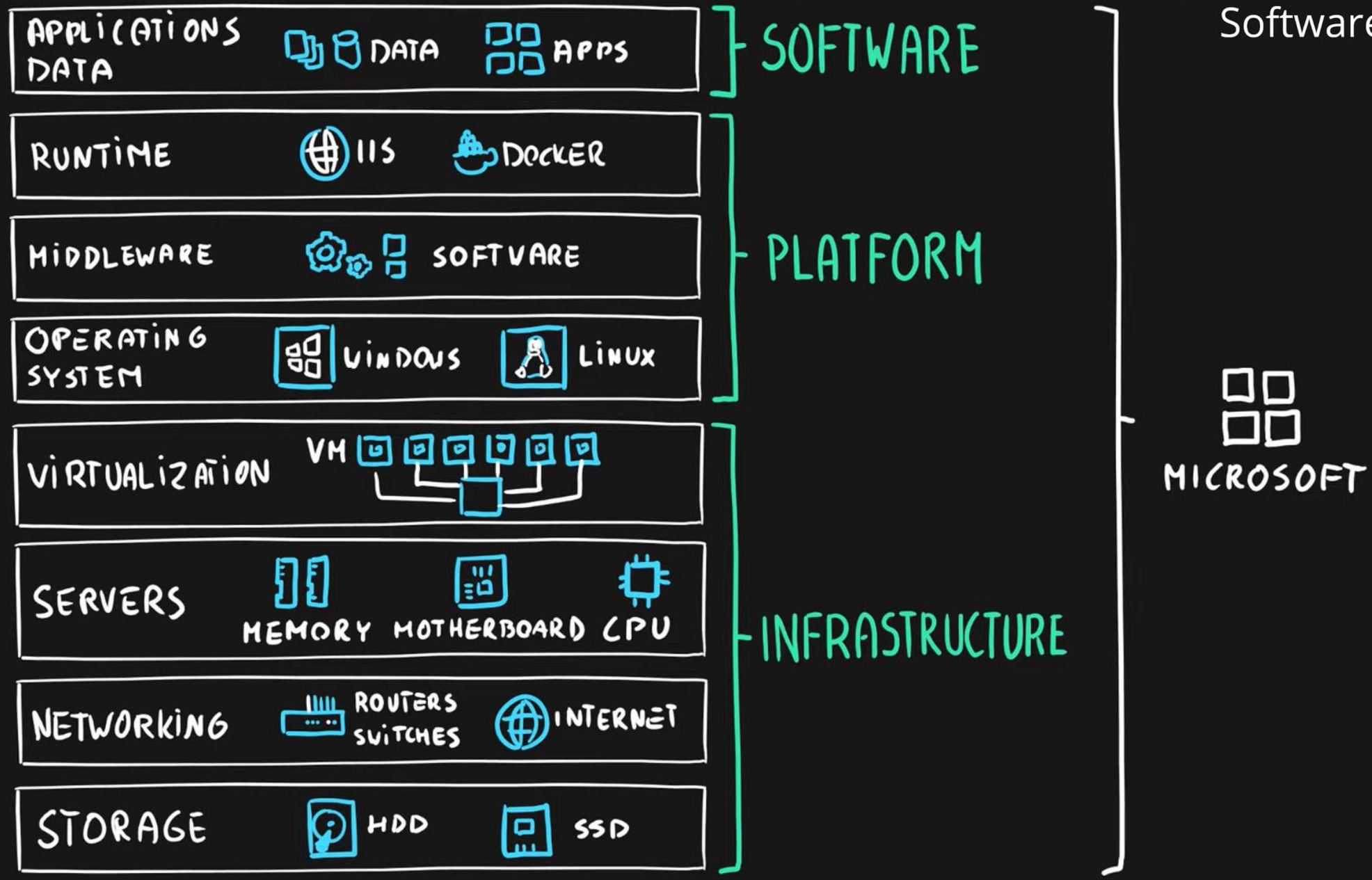


Software as a Service (SaaS)



Software as a Service (SaaS)

Key Characteristics

Ownership

- Cloud provider manages infrastructure, platform & software
  - Infrastructure – networking, hardware & virtualization
  - Platform – operating system, middleware, runtime
  - Software – data & applications
- You manage nothing

Software as a Service (SaaS)

Key Characteristics

Ownership

- Cloud provider manages infrastructure, platform & software
  - Infrastructure – networking, hardware & virtualization
  - Platform – operating system, middleware, runtime
  - Software – data & applications
- You manage nothing

Use cases

- Buying of-the-shell applications

Software as a Service (SaaS)

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  - Software – data & applications
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Use cases

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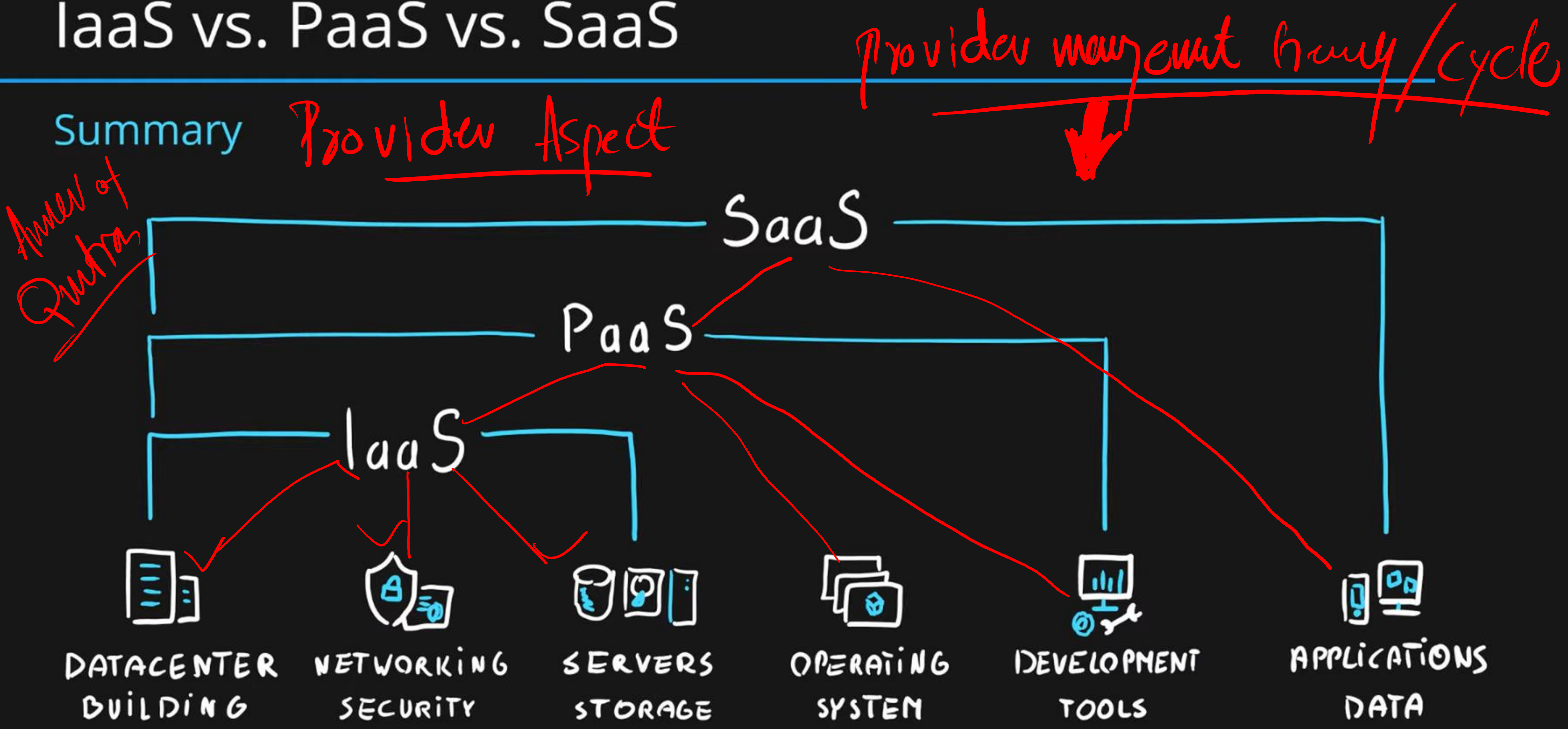
IaaS vs. PaaS vs. SaaS

Summary



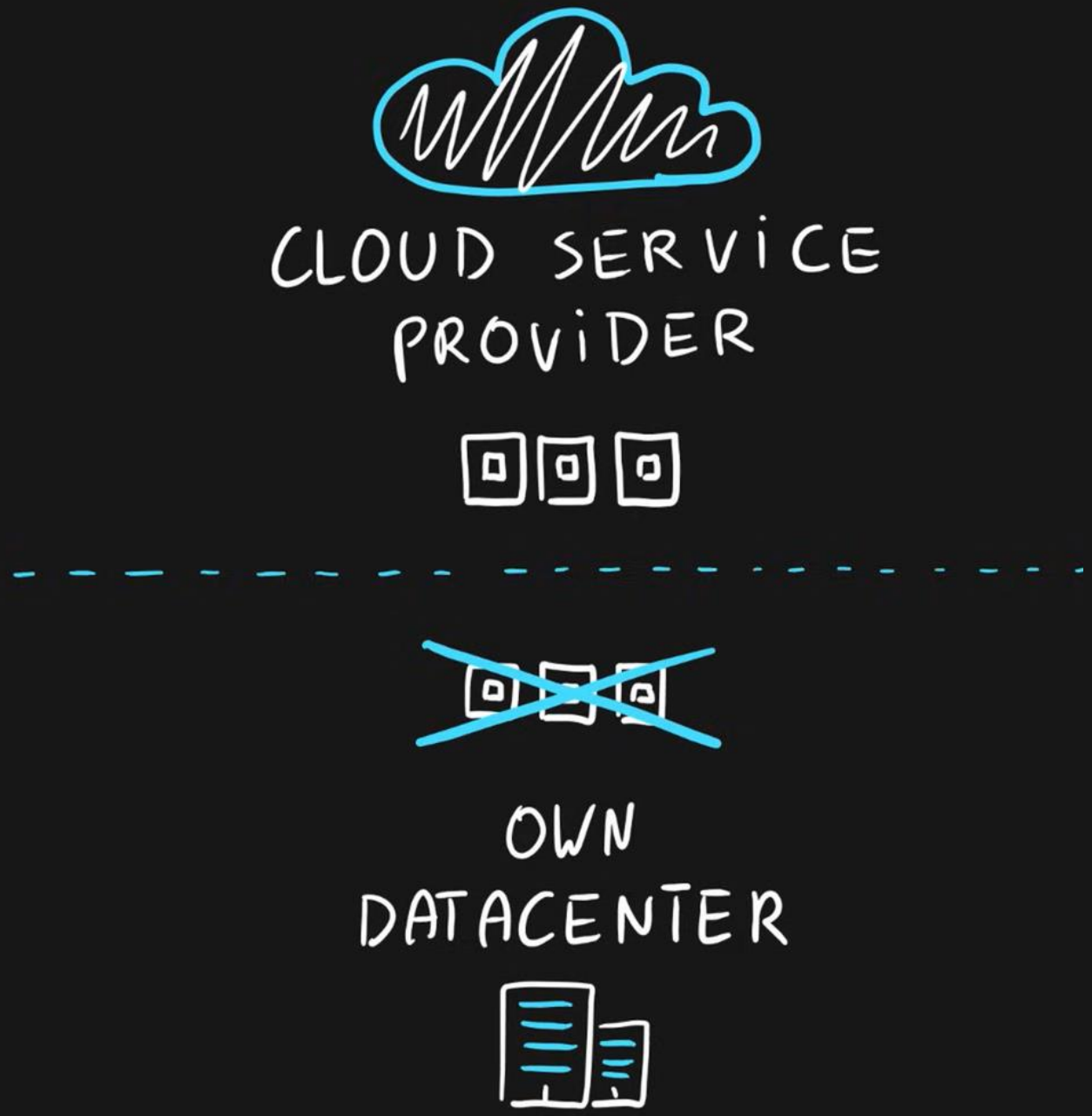
Public Cloud

Key Characteristics

Public Cloud

Key Characteristics

- Everything runs on cloud provider hardware
- No local hardware
- Some services share hardware with other customers



Public Cloud

Advantages and Disadvantages

Advantages	Disadvantages
No CapEx	Security & Compliance
High availability & Agility	Ownership
Pay as you go pricing	Specific scenarios with unique business req.
No hardware maintenance	
No deep technical skills required	

Private Cloud

Key Characteristics

- Everything runs on your own datacenter
- Self-service should be provided
- You maintain the hardware

Private Cloud

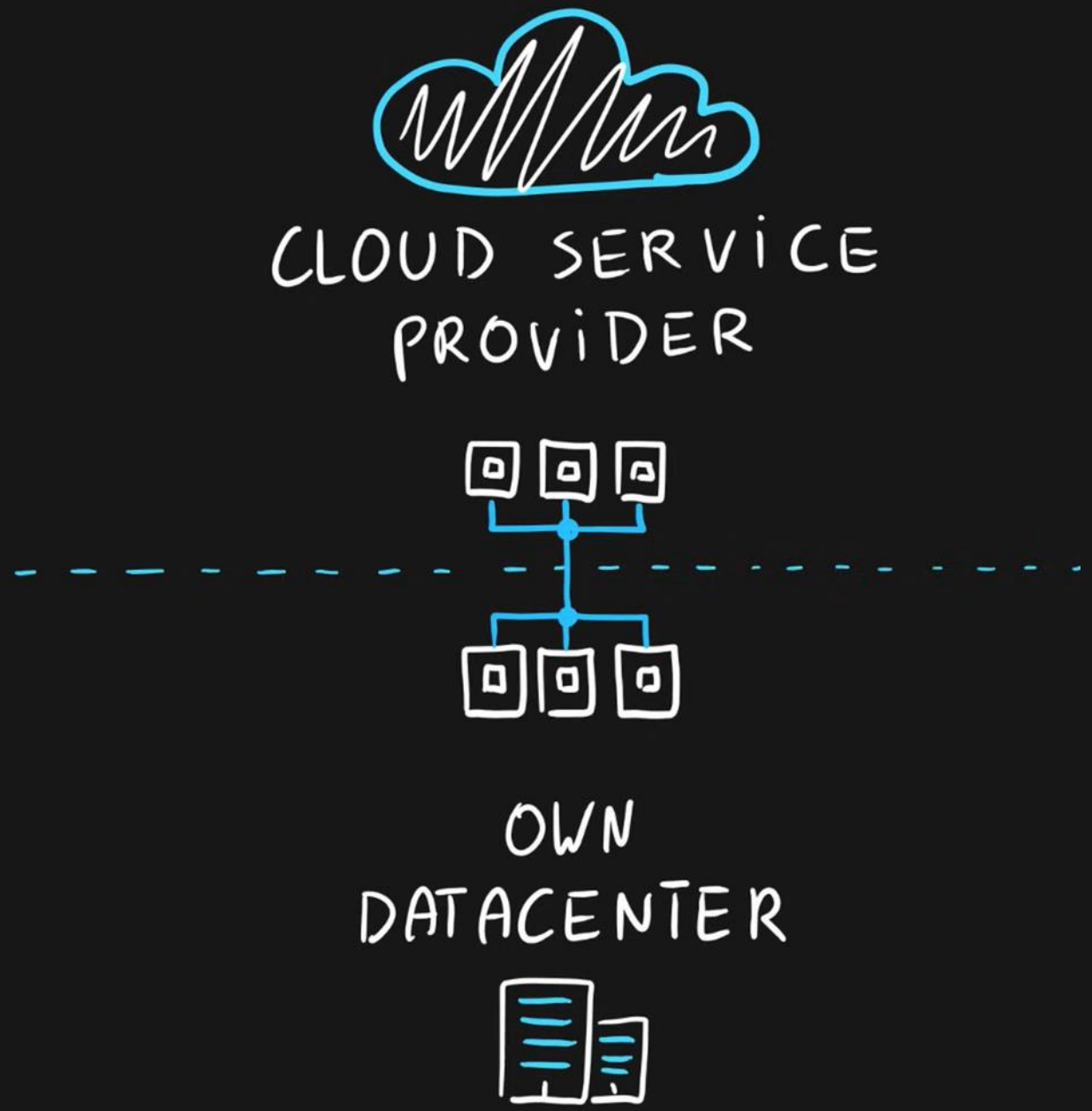
Advantages and Disadvantages

Advantages	Disadvantages
Can support any scenario	Initial CapEx
Control over security	Limited Agility
Can meet any security & compliance requirements	IT skills & expertise are mandatory

Hybrid Cloud

Key Characteristics

- Combines public & private clouds
- Great flexibility



Hybrid Cloud

Advantages and Disadvantages

Advantages	Disadvantages
Great flexibility	Can be more expensive
Run legacy apps in private cloud	Complicated to manage
Utilize existing infrastructure	IT skills & expertise are mandatory
Meet any security requirements	

THANK YOU!