Introduction

Big Data Systems

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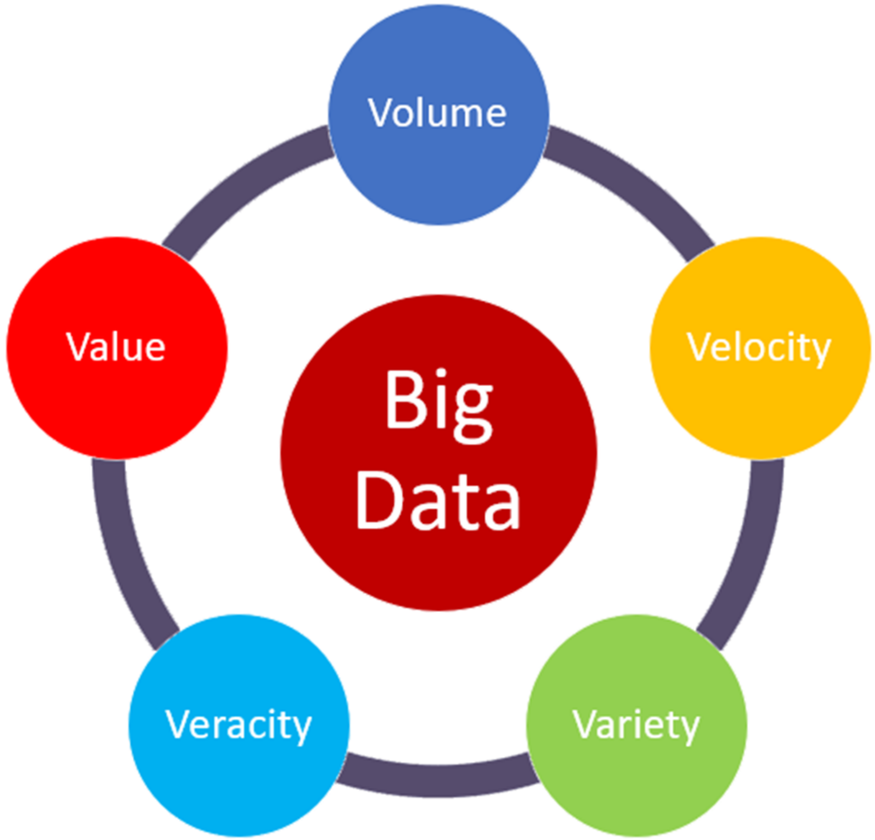
Agenda for today

- 5 V’s of Big Data
- Cloud computing
- Highly available / highly Scalable
- Managed vs Unmanaged services

When data is Big Data?

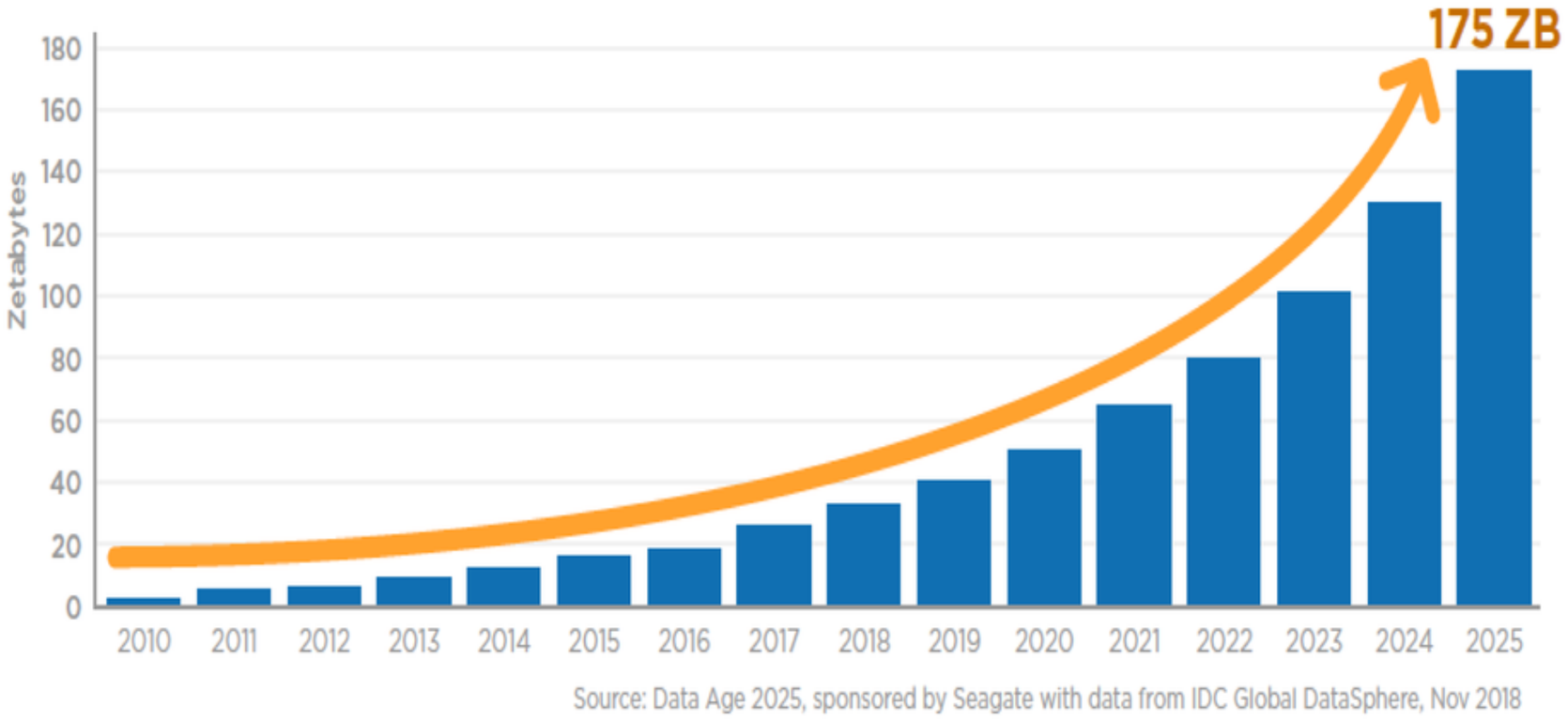
5 V’s of Big Data

- Volume
- Velocity
- Variety
- Veracity
- Value



Volume

- Data is rapidly increasing
  (due to cloud computing, mobile and more)



Value	Metric	
1000	kB	kilobyte
1000^2	MB	megabyte
1000^3	GB	gigabyte
1000^4	TB	terabyte
1000^5	PB	petabyte
1000^6	EB	exabyte
1000^7	ZB	zettabyte
1000^8	YB	yottabyte

Velocity

The speed at which data is generated

- Frequency of data generation (write)
  everything is measured
- Frequency of data processing (read)
  real time experience

Variety

- Structured data
  info, transactions…
- Semi structured data
  logs, sensor data…
- Unstructured data
  images, video, audio…

Veracity

The truthfulness or reliability of the data

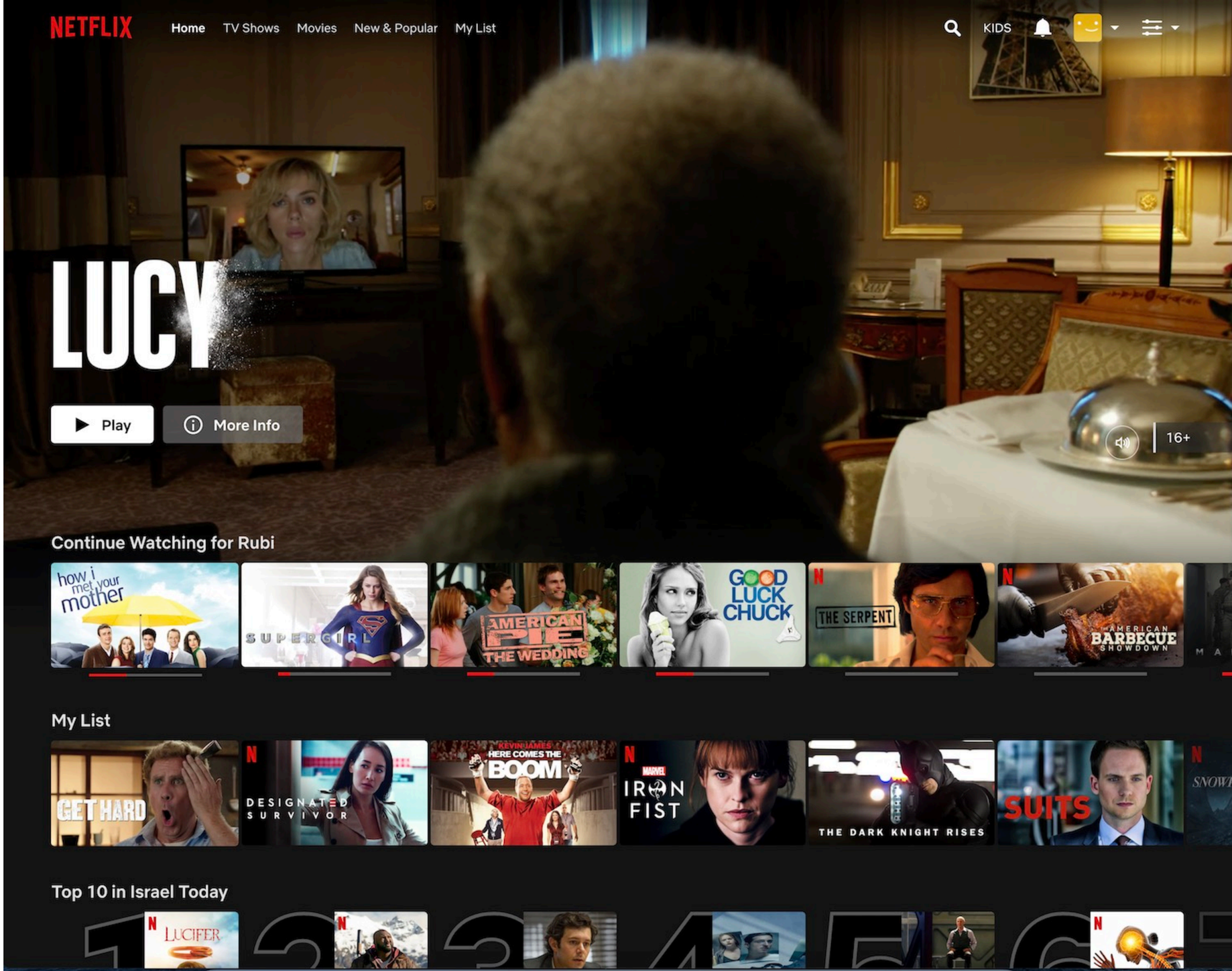
- data quality of captured data can vary greatly
  - bias
  - abnormalities
  - inconsistencies
  - duplication

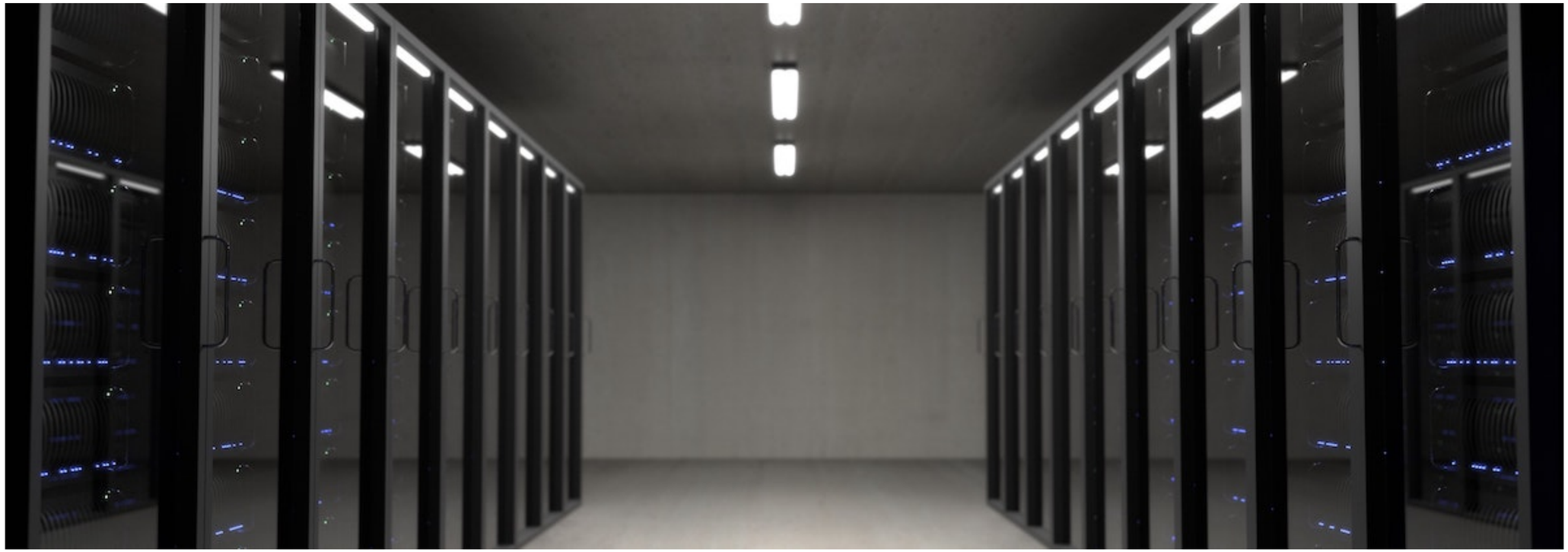
Value

The final result.

- which questions were answered
- hidden insights (machine learning)
- collecting data without use is, well, useless

- Volume
- Velocity
- Variety
- Veracity
- Value

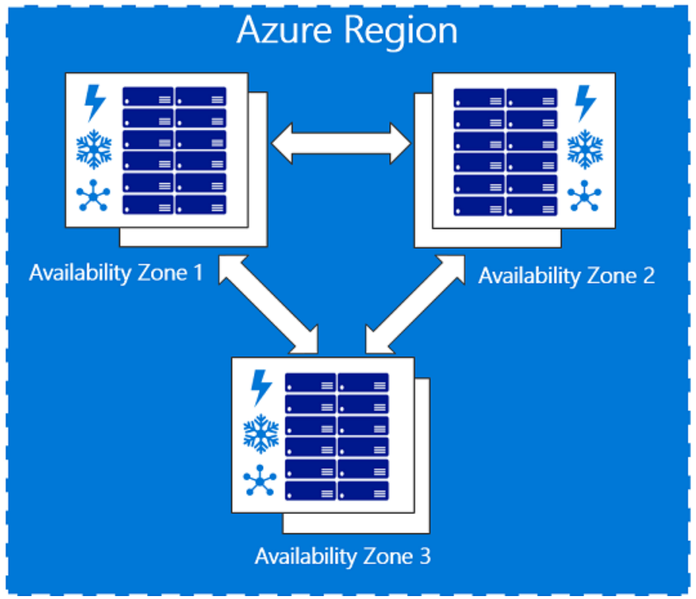




Cloud computing

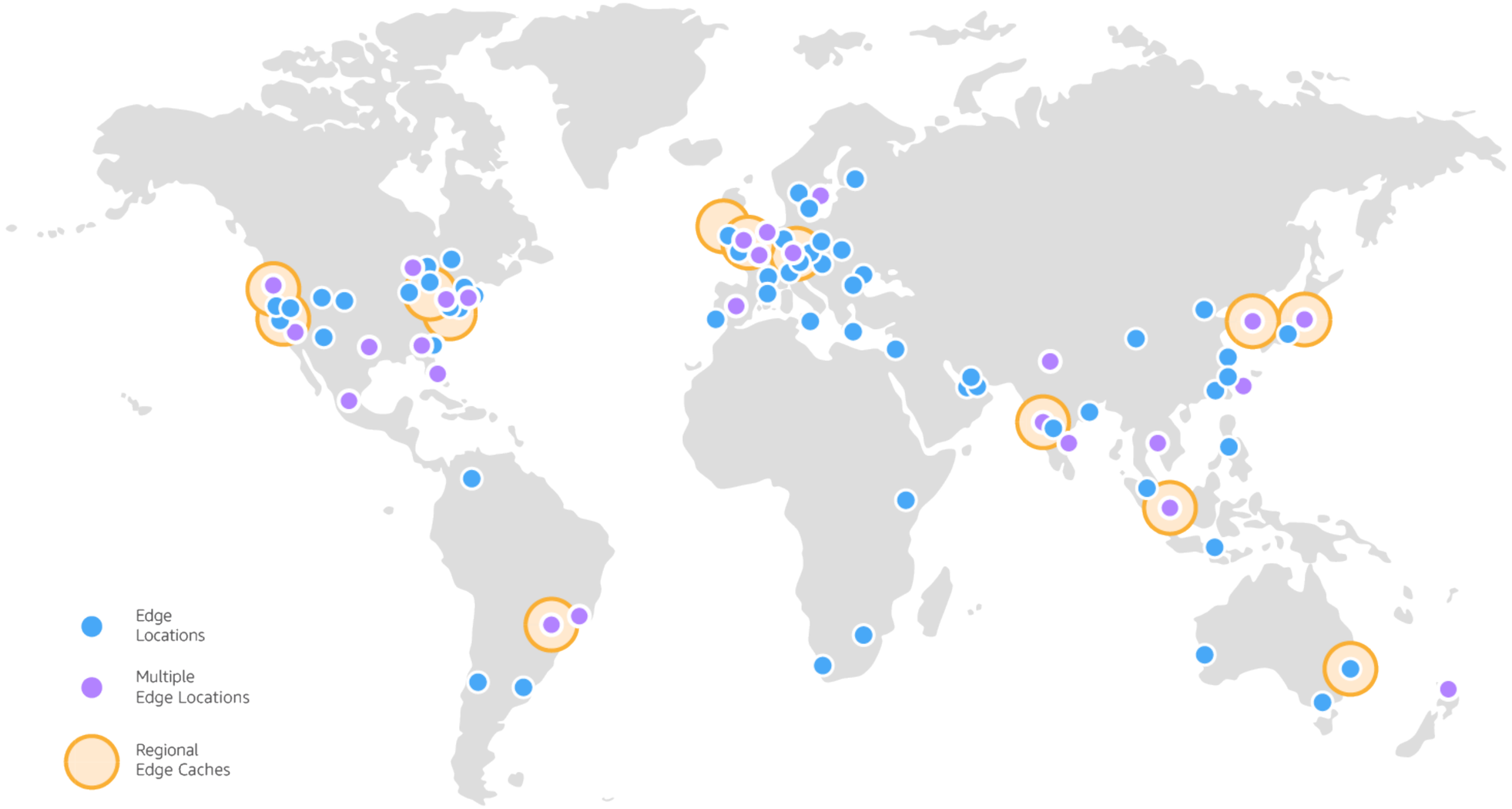
Region / AZ / EL

- Region
  Cluster of data centers in a physical location
- Availability Zone
  a discrete data center with redundant power, networking, and connectivity in a Region
- Edge Location
  access to the network with limited services (usually CDN)



- (Names may vary between cloud providers)

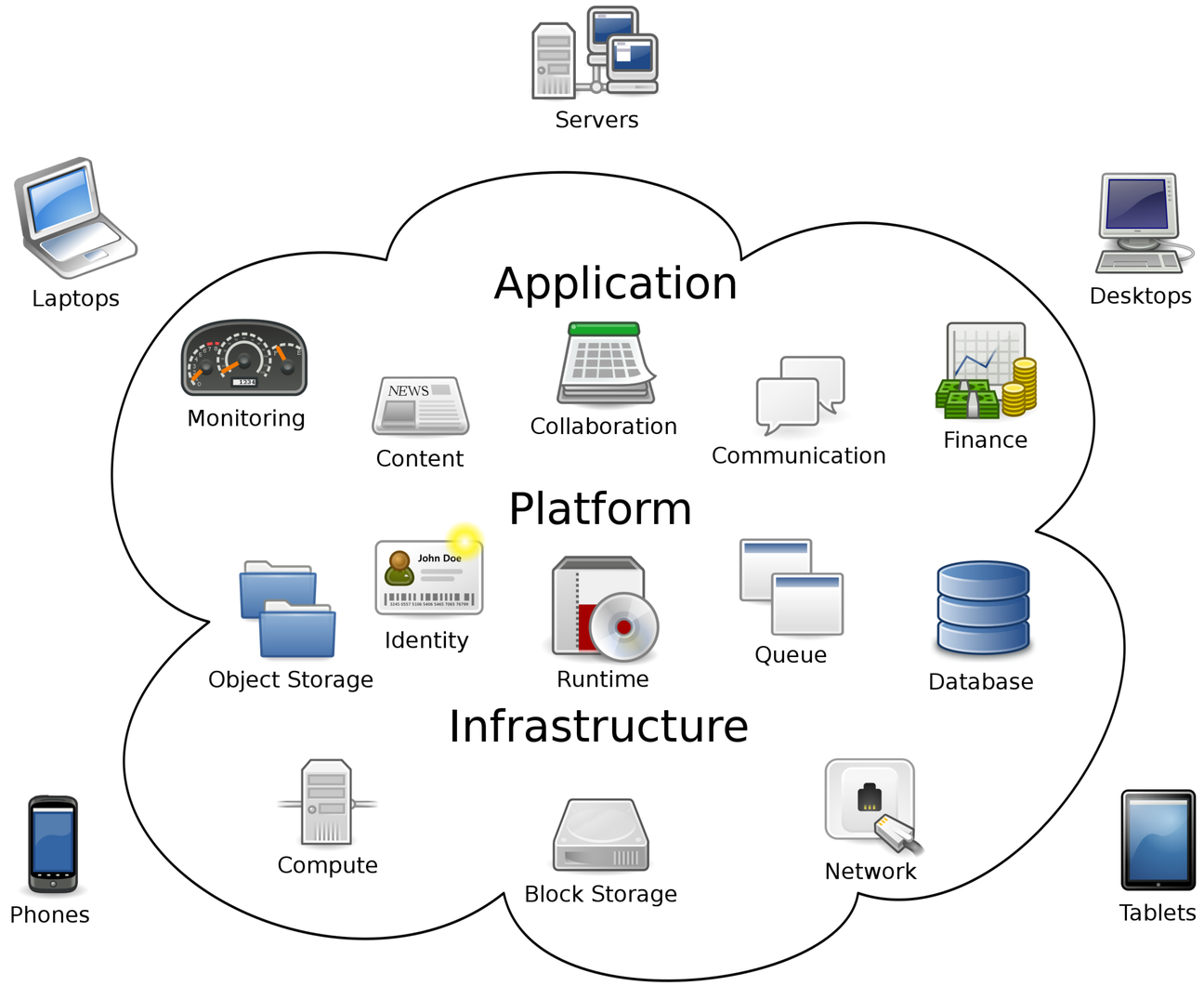
AWS regions (march 2020)



AWS edge locations (march 2020)

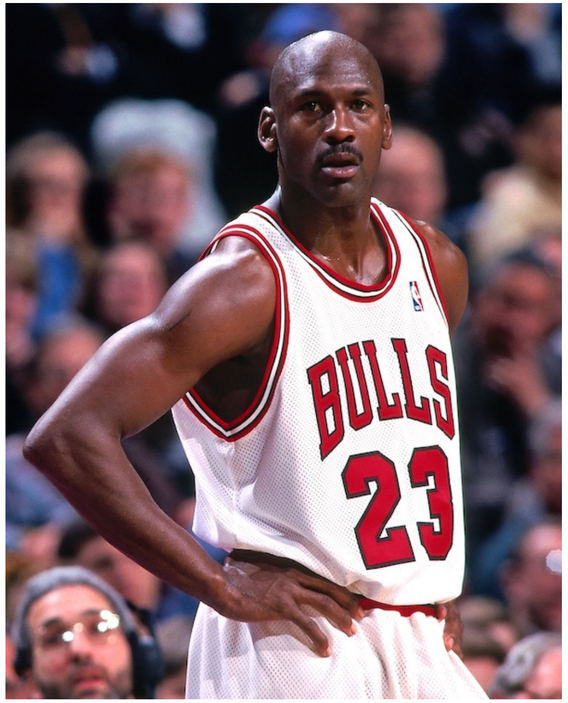
Cloud computing

- SaaS
  software as a service
- PaaS
  platform as a service
- IaaS
  infrastructure as a service



Highly Available / Highly Scalable

Mike orders a a basketball



Once clicked “order"

- Create order
- Check inventory
- Process payment
- Approve order
- Send to warehouse
- …

System error
fire / flood / electricity / hardware malfunction / software update…

Possible outcomes

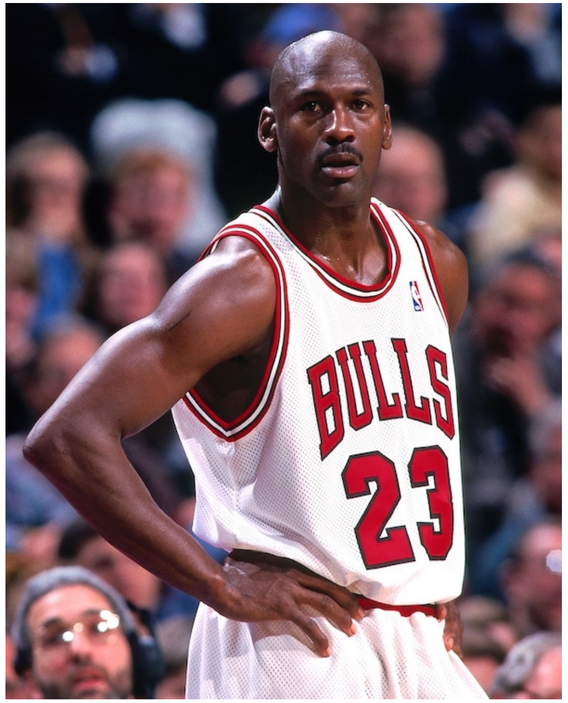
- Service disruption
- Data loss
- Data consistency
- Money lost (direct / reputation)
- A hared problem to solve for Databases
  disaster recovery:
  RTO (Recovery time) / RPO (Recovery point object)

High availability

- “Nines”

Availability	Downtime per day	Downtime per year
90%	2.40 hours	36.53 days
95%	1.20 hours	18.26 days
99%	14.40 minutes	3.65 days
99.9%	1.44 minutes	8.77 hours
99.99%	8.64 seconds	52.60 minutes
99.999%	864.00 milliseconds	5.26 minutes
99.9999%	86.40 milliseconds	31.56 seconds

Mike tweets about a basketball he bought



- Reach millions of users
- Millions of users try to shop the same basketball at the same time

System error

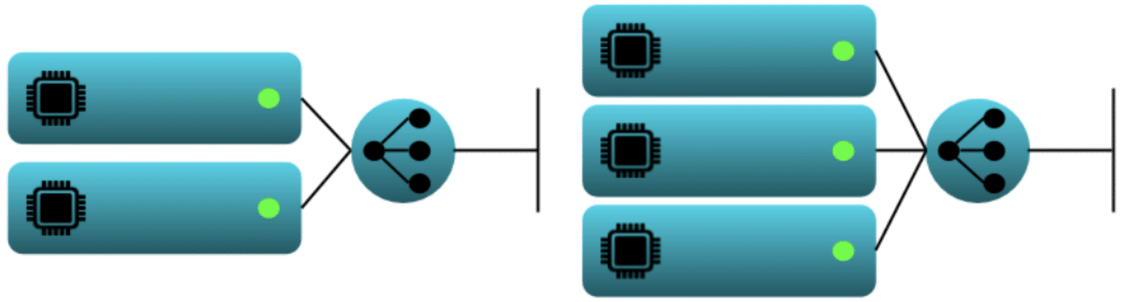
Too many requests

High scalability

- Scale up vs scale out
- Commodity computing
- Stateless

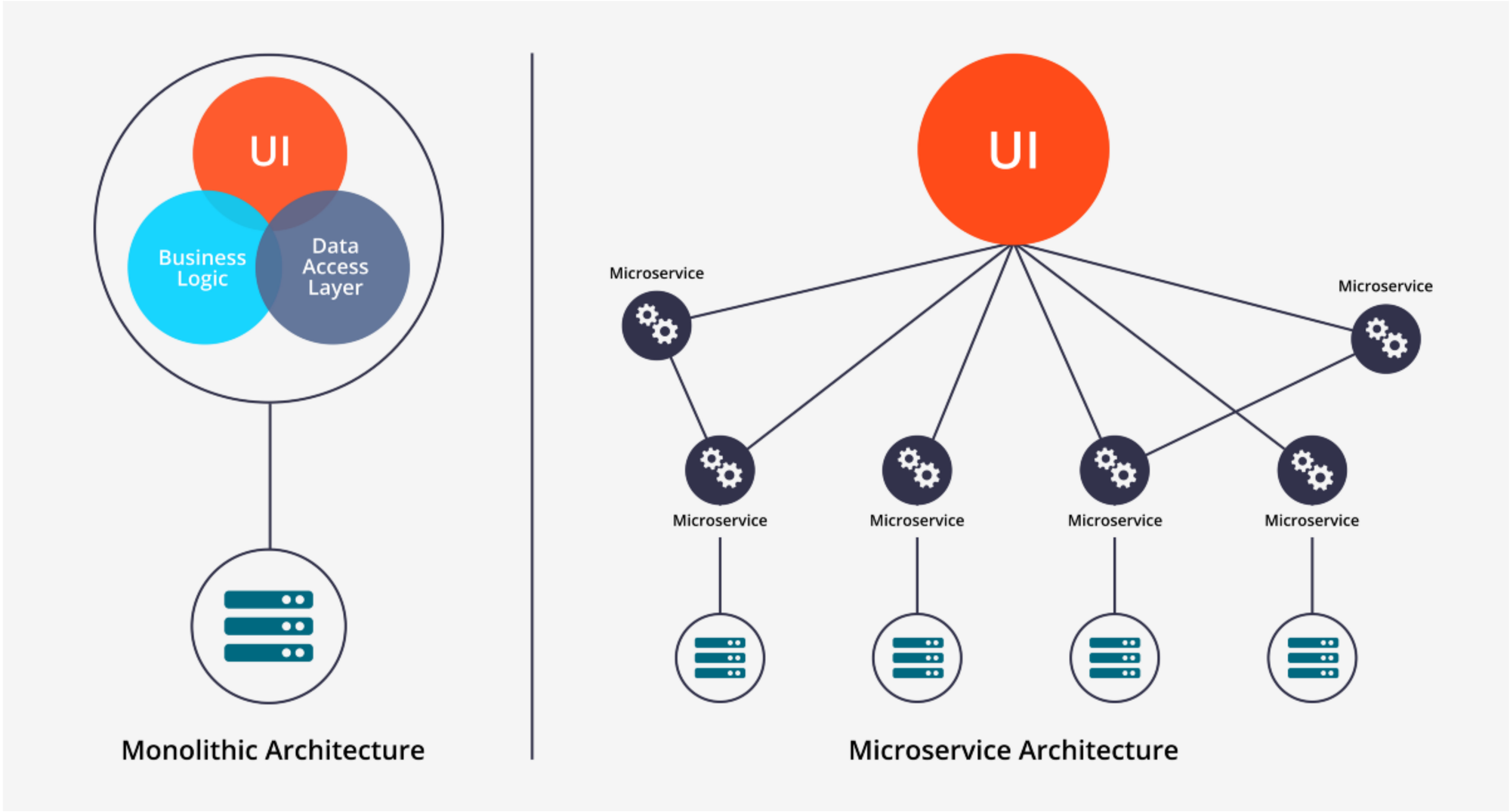
  amazon’s shopping cart is stateless?
- Microservices
- Sharding

Scaling up from two to three CPUs

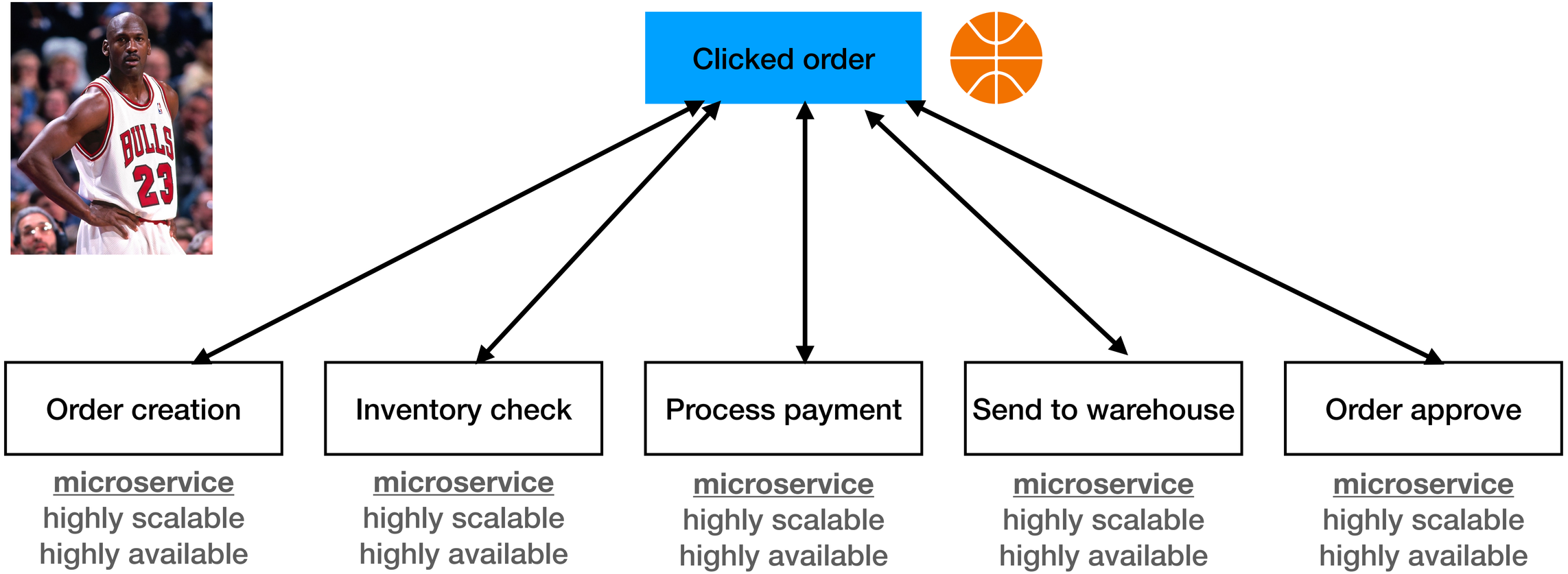


Scaling out from two to three CPUs

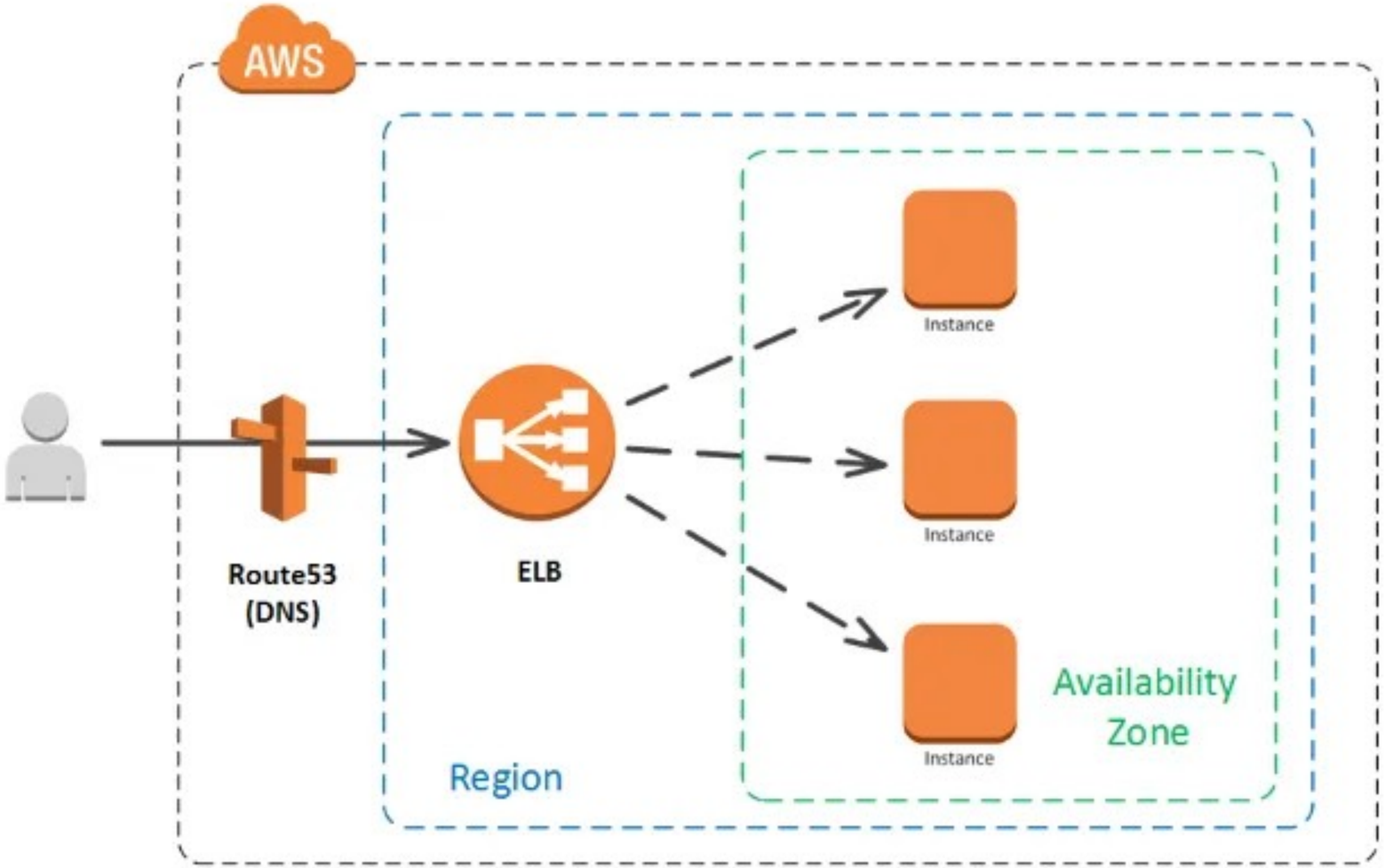
Microservices



Ordering a basketball

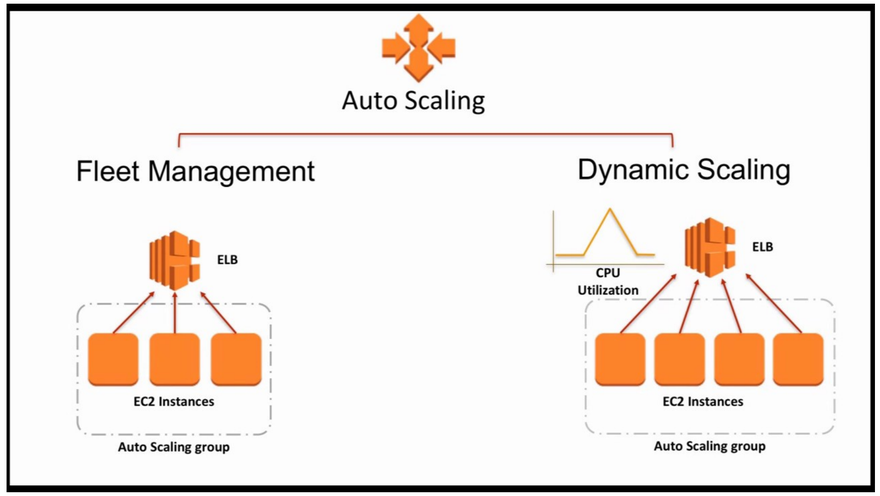


Load balancer



Auto scaling

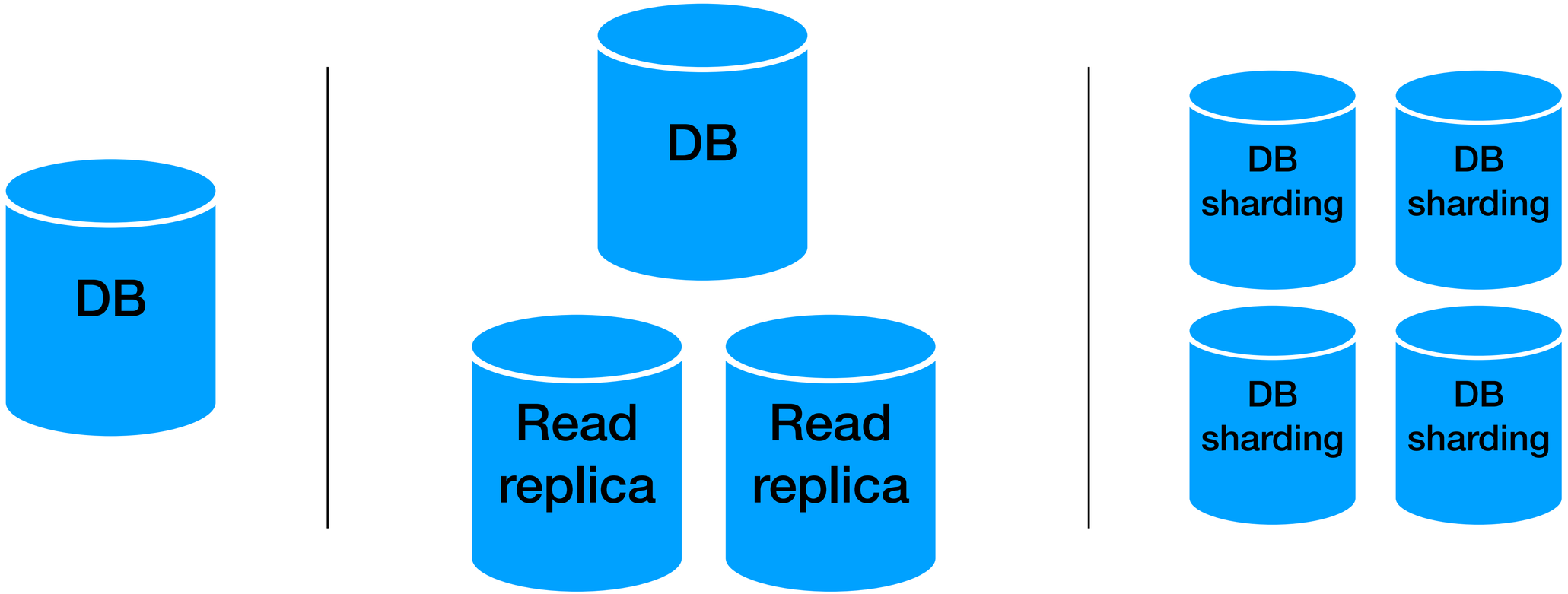
- When threshold occurs (hits / traffic / CPU…), create a new instance with the same logic and add to the load balancer
- When threshold drops, remove the from the load balancer and terminate the instance
- Usually requires stateless logic
  can Cassandra work with auto scale?



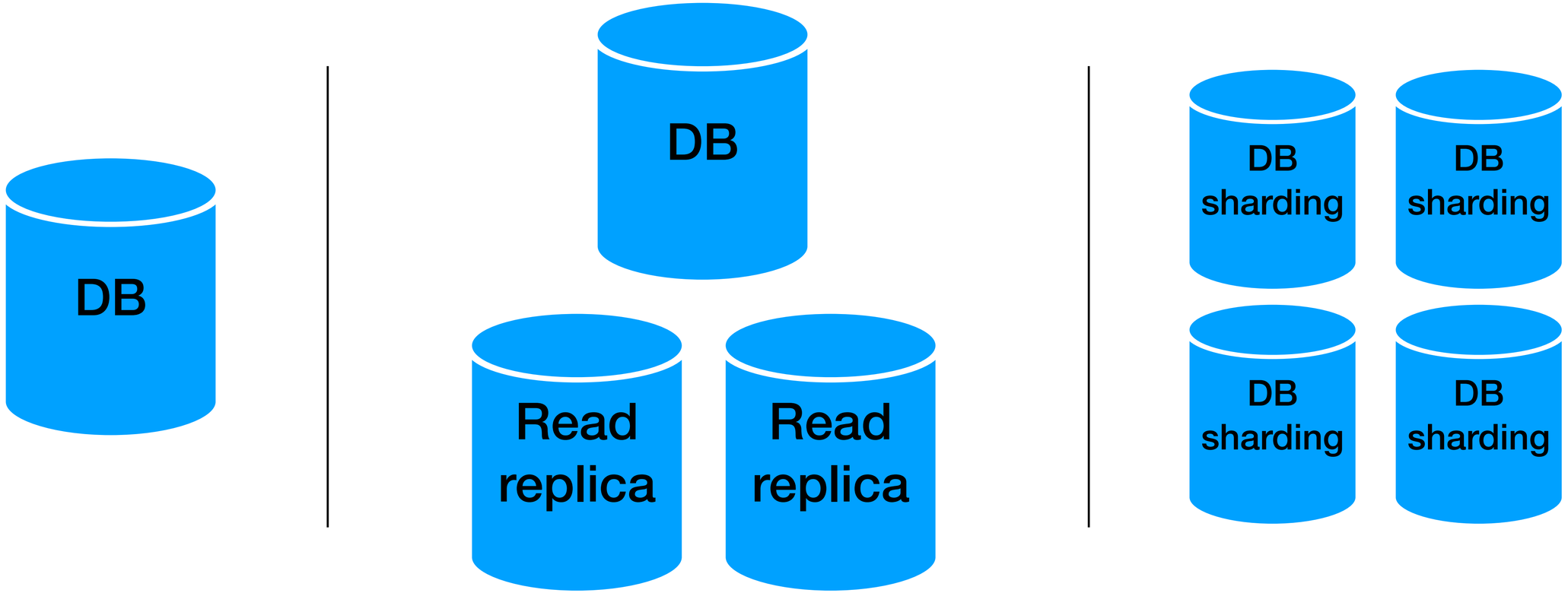
Auto scaling - compute + storage?

- Some applications use both compute and storage (databases)
- Stateless?
- What happens when we scale down?

Scaling databases



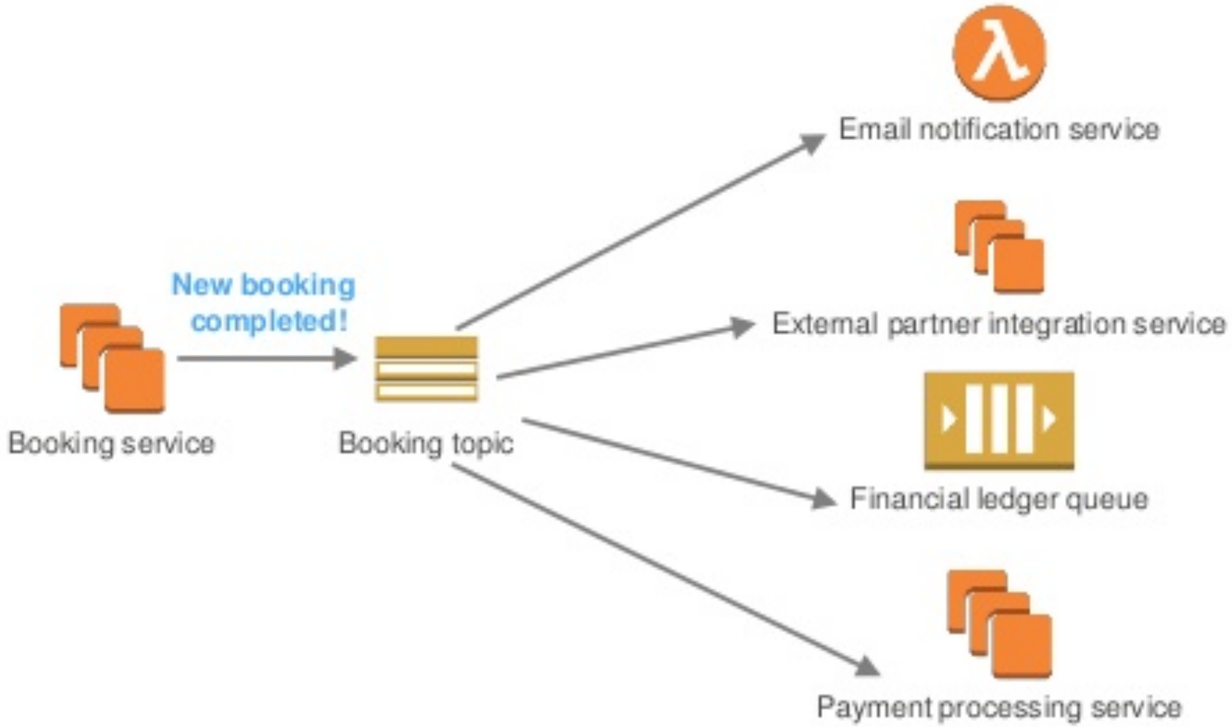
Scaling databases



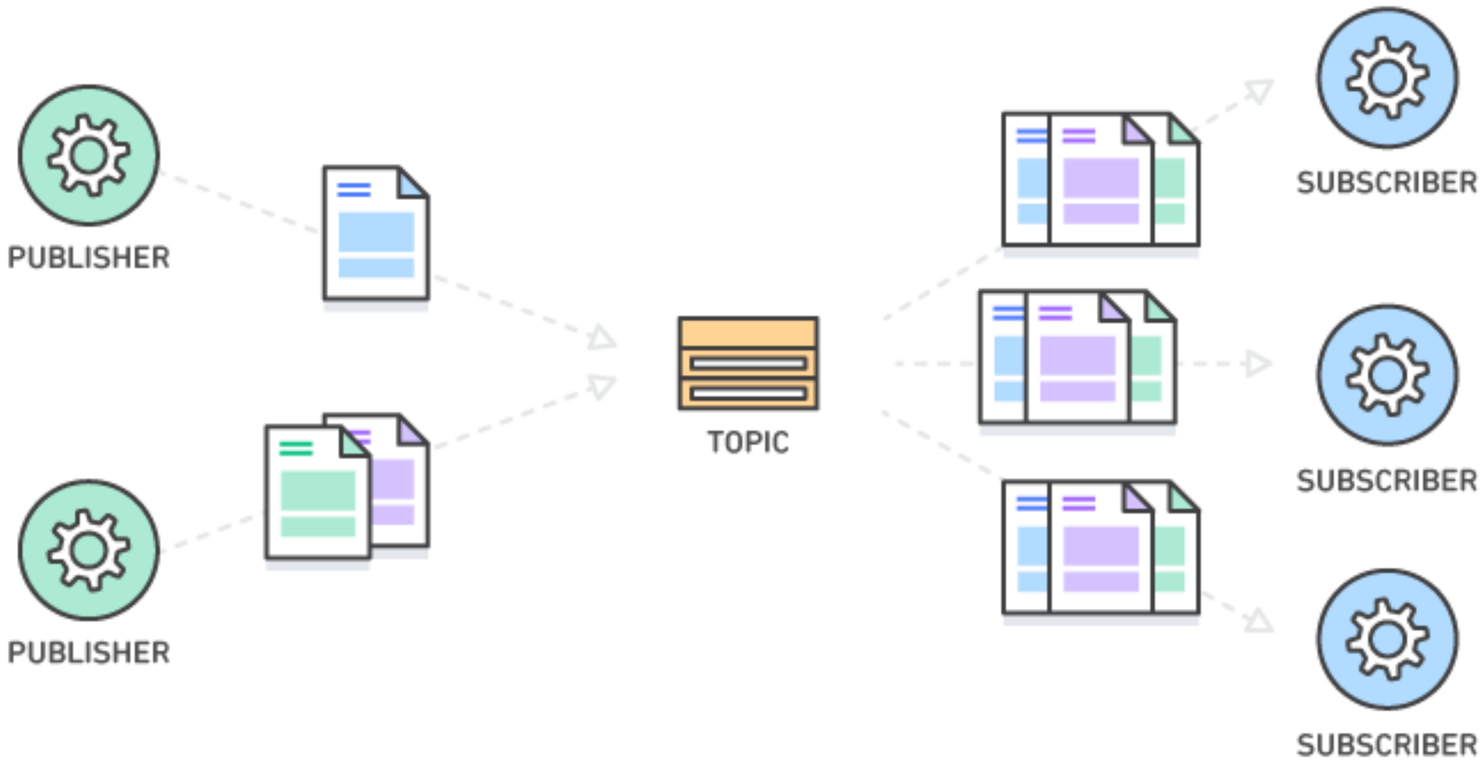
Warning - we will talk about this a lot :)

Decoupling + event based services

- autonomous and unaware of each other services



Pub sub


PUBLISHER
PUBLISHER
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SUBSCRIBER

Managed vs Unmanaged services

Unmanaged service

You are responsible for everything!

- Choosing CPUs, storage, network…
- Installing OS, Java, core software, dependencies…
- Patches, updates
- Security
- Backup
- Monitoring
- Availability

Unmanaged service (2)

Requires different skills

- System
- DevOps
- …

Managed service

- All the stuff we talked about before are managed for you out of the box
- Hardware utilization
- Focus on stuff that really matters for you
- Cost?

Managed service cons

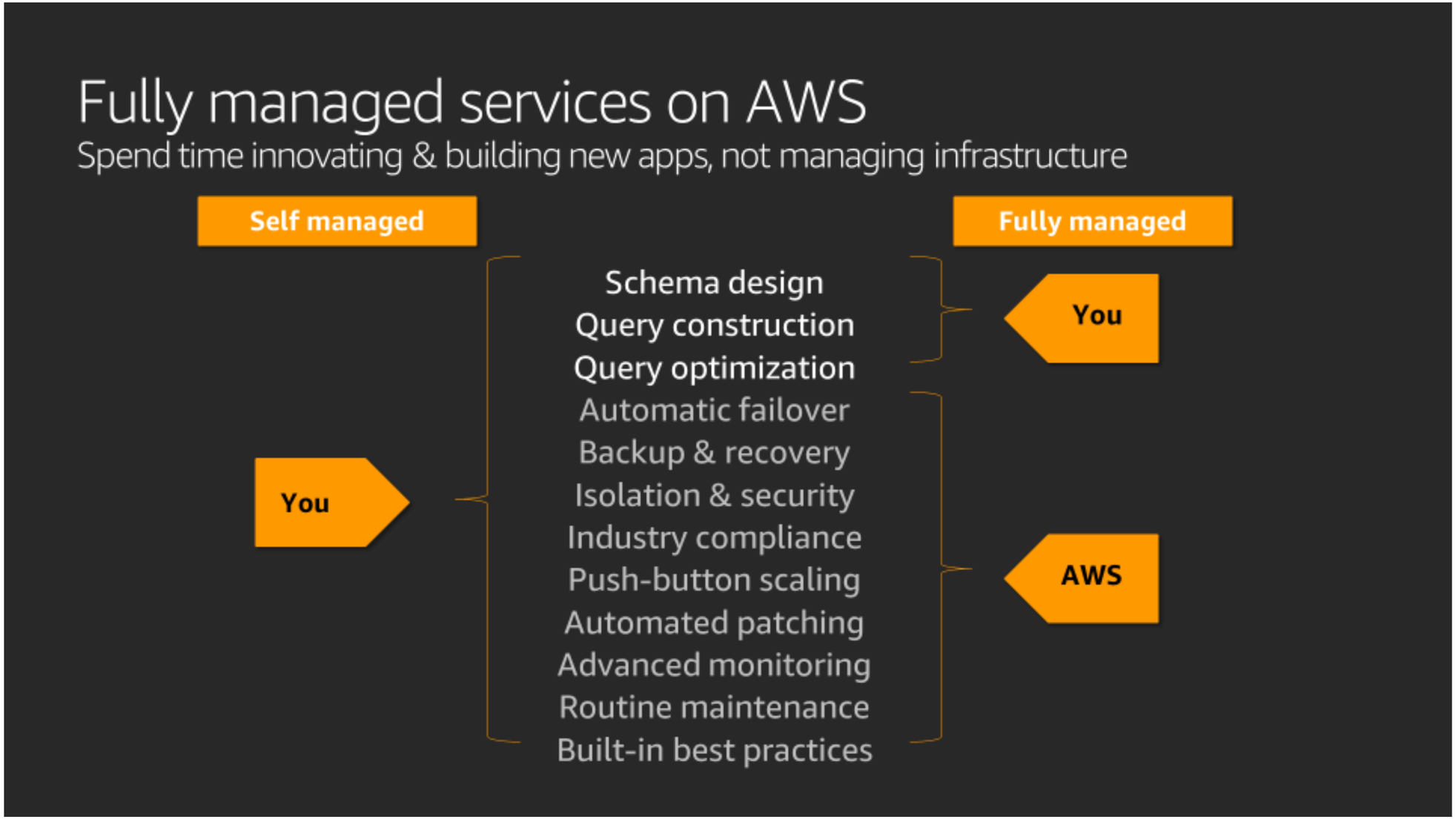
- **Cloud locked in**
- Slightly limited functionality
- Works only in the cloud
- Cost?
  (cheaper to go unmanaged on large scale, but a lot of headaches)

In practice

- Some will be managed and some not
  VMs
  load balancers
  network stuff
  …

- **To go managed or unmanaged with databases is a good question**

Managed vs Unmanaged Databases



But how managed service work?

- It is just someone else's software…

- Do we need to understand how it works behind the scenes?

For databases, YES!

Big Data databases

- Managed big data databases are built on, well, big data databases
- **Data modeling is crucial.**
  (with bad modeling, nothing will work)

To model data correctly,
we need to understand the technology
(it is not just reading the API docs)