



Distributed systems and web technologies

Bioinformatics BSc

University Autònoma of Barcelona

A. Espinosa 16/09/24

Objectives

- Methodologies for web application development and distributed data analysis in cloud computing environments.
- Introduction to web applications structure, frameworks and cloud services related.
- Focus on current tools for web application building using cloud computing services

Content blocks

Block 1: Web Programming

Web Applications & technologies. Fundamental protocols, APIs and languages for web applications. Design of web applications based on the Model-View-Controller pattern
Frameworks and tools for web application development

Block 2: Distributed systems and cloud computing

Introduction to distributed systems and cloud computing
Introduction to data management in cloud computing context

Block 3: Distributed data processing applications

Introduction to distributed data processing
Data analysis practice with Spark framework

Assessment and grades

- The success in meeting the course learning objectives will be measured by theoretical exams and practical exercises. There will be one theoretical exam (TExam) consisting of short questions and it is compulsory.
- There will be 3 lab deliverables, and each of them will be assessed individually. Laboratories will be done in two-member teams that will be defined the first day of class and will remain for the whole term.
- The final grade will be computed as: $\text{TExam} * 0.5 + 0.5 * \text{Lab}$
- Only those students with a grade equal or higher than 5.0 will pass the subject.

Re-assessment

- Only the students that have not passed the theoretical exam after the evaluation can take a final theoretical exam in January.
- The grade obtained at the new exam will substitute the grade of the previous failed exam during the trimester and will be used to calculate the final grade according to the rules and percentages reported above.
- The maximum grade that can be obtained in this examination is 5.

Class scheduling

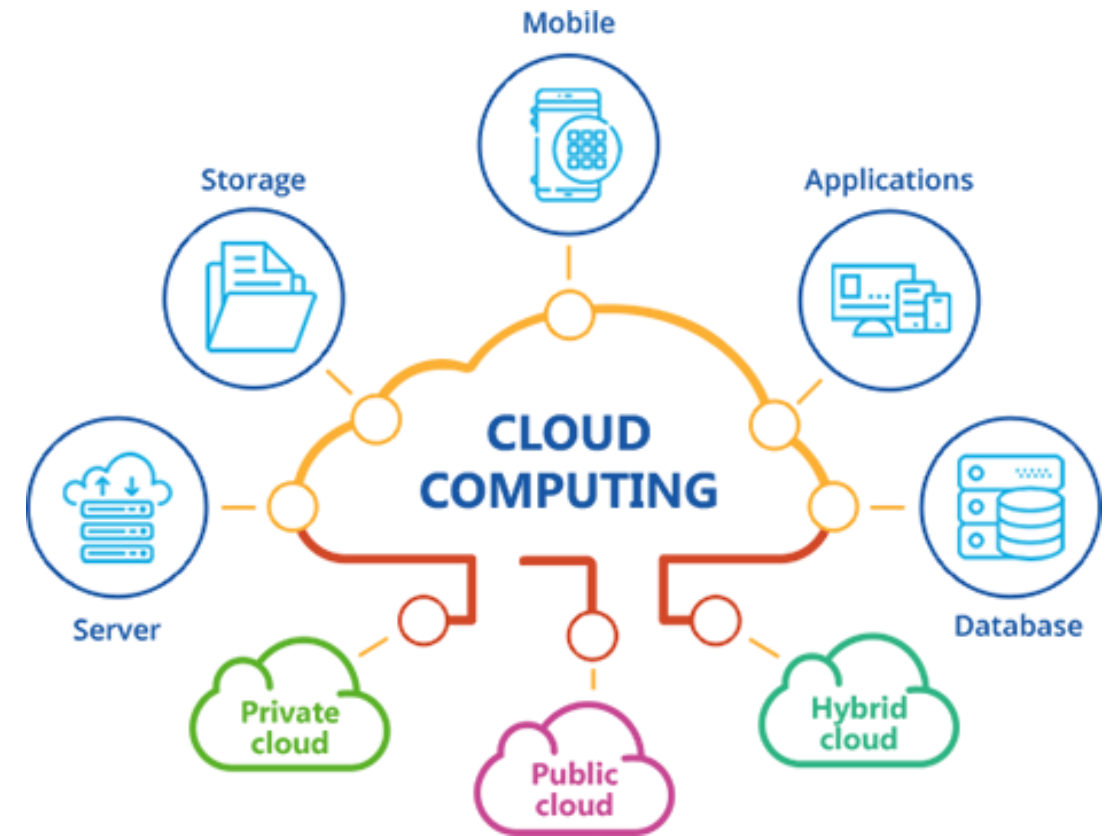
Distributed systems and Web Technologies					
Week		Mondays 11:30-13:30		Fridays 11:30 - 13:30	
		Date	Topic	Date	Topic
1	16-sept	16-sept	Introduction to cloud computing	20-sept	Web applications
2	23-sept	23-sept	no class	27-sept	Web applications
3	30-sept	30-sept	Django Azure	4-oct	Django AWS
4	7-oct	7-oct	Django lab	11-oct	Django lab
5	14-oct	14-oct	In-memory DB	18-oct	Redis tutorial
6	21-oct	21-oct	Redis lab	25-oct	Redis lab
7	28-oct	28-oct	Data analytics introduction	1-nov	no class
8	4-nov	4-nov	Spark intro	8-nov	Spark tutorial
9	11-nov	11-nov	Data analytics	15-nov	Spark lab
10	18-nov	18-nov	Spark lab	22-nov	Spark lab
15	11-dic	11-dic	exam		

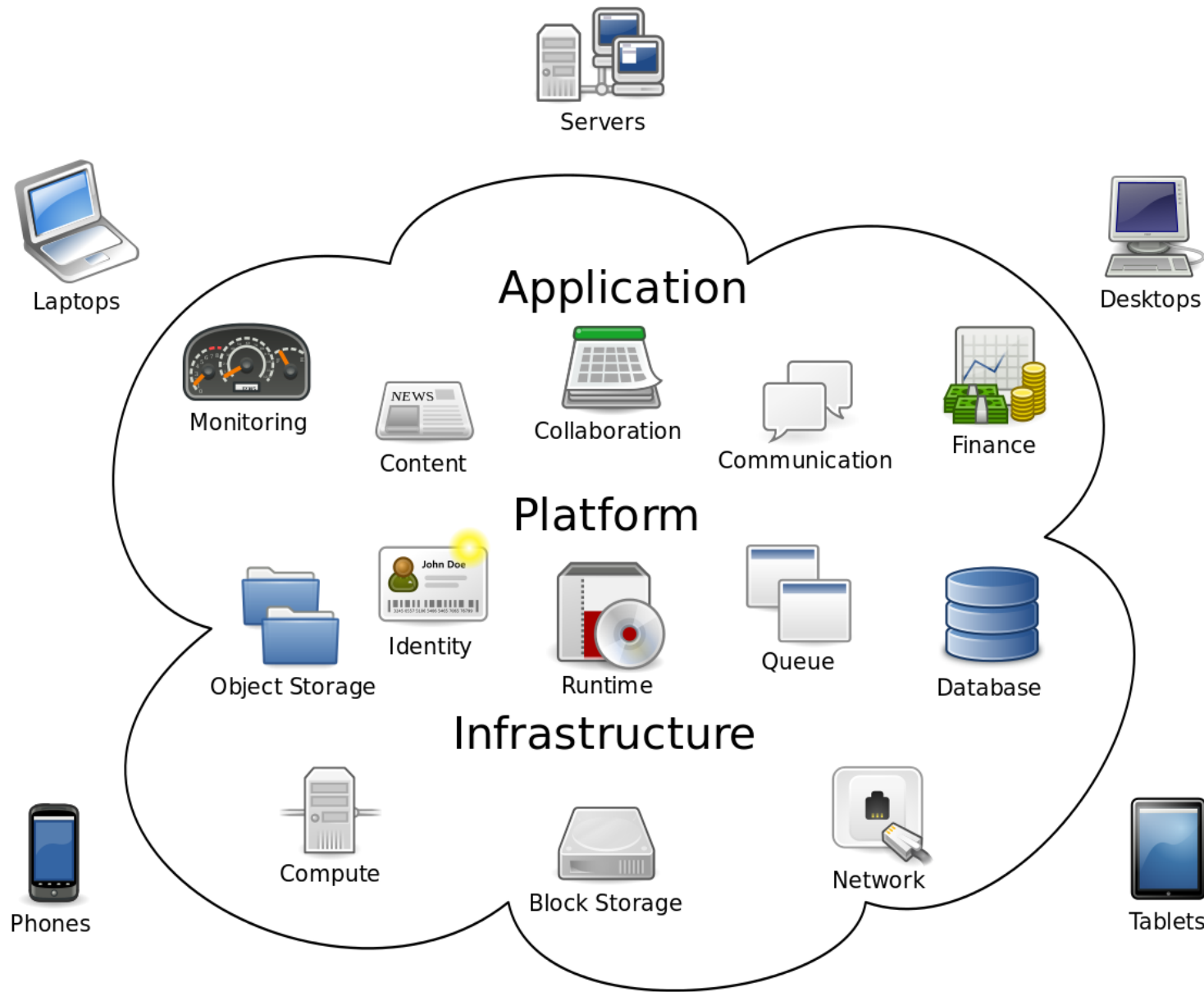
Introducing Cloud Computing

Cloud Services

Cloud computing

- On-demand availability of computer system resources
- Especially data storage and computing power
- Without direct active management by the user





Cloud
computing
services

Cloud computing

Amazon web services

AWS Services

Deployment & Management

Application Services



Amazon
SQS



Amazon
ElasticTranscoder



Amazon
SES



Amazon
AppStream



Amazon
CloudSearch

Mobile Services



Amazon
Cognito



Amazon
Mobile Analytics



Amazon
SNS

Enterprise Applications



Amazon
WorkDocs



Amazon
WorkSpaces



Amazon
WorkMail

Application Services

Administration & Security



AWS
DirectoryService



AWS
IAM



AWS
Trusted Advisor



AWS
Config



AWS
CloudTrail



Amazon
CloudWatch

Deployment & Management



Amazon
CloudFormation



AWS
OpsWorks



AWS
CodeDeploy

Analytics



Amazon
Kinesis



AWS
Data Pipeline



Amazon
EMR

Foundation Services

Compute



Amazon
EC2



AWS
Lambda

Storage & Content Delivery



Amazon
CloudFront



Amazon
Glacier



Amazon
S3



Amazon
EBS

Database



Amazon
DynamoDB



Amazon
RDS



Amazon
Redshift



Amazon
Elastic Cache

Networking



Amazon
Route 53



Amazon
VPC



AWS
Direct Connect

AWS foundational services

Applications



Virtual desktops



Collaboration and sharing

Platform Services

Databases

Relational

NoSQL

Caching

Analytics

Cluster computing

Real-time

Data warehouse

Data workflows

Application services

Queuing

Orchestration

App Streaming

Transcoding

Email

Search

Deployment and management

Containers

DevOps tools

Resource templates

Usage tracking

Monitoring and logs

Mobile Services

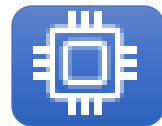
Identity

Sync

Mobile Analytics

Notifications

Foundation Services



Compute (virtual, automatic scaling, and load balancing)



Networking



Storage (object, block, and archive)

Infrastructure

Regions

Availability Zones














Edge locations

The AWS ML Stack

Broadest and most complete set of Machine Learning capabilities


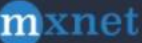





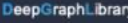
AI SERVICES

VISION	SPEECH		TEXT			SEARCH	CHATBOTS	PERSONALIZATION	FORECASTING	FRAUD	DEVELOPMENT	CONTACT CENTERS
												
Amazon Rekognition	Amazon Polly	Amazon Transcribe <small>+Medical</small>	Amazon Comprehend <small>+Medical</small>	Amazon Translate	Amazon Textract	Amazon Kendra	Amazon Lex	Amazon Personalize	Amazon Forecast	Amazon Fraud Detector	Amazon CodeGuru	Contact Lens <small>For Amazon Connect</small>

ML SERVICES

 Amazon SageMaker <div>SageMaker notebook instance</div>	Ground Truth	ML Marketplace	SageMaker Studio IDE						Neo	Augmented AI
			Built-in algorithms	Notebooks	Experiments	Model training & tuning	Debugger	Autopilot	Model hosting	Model Monitor

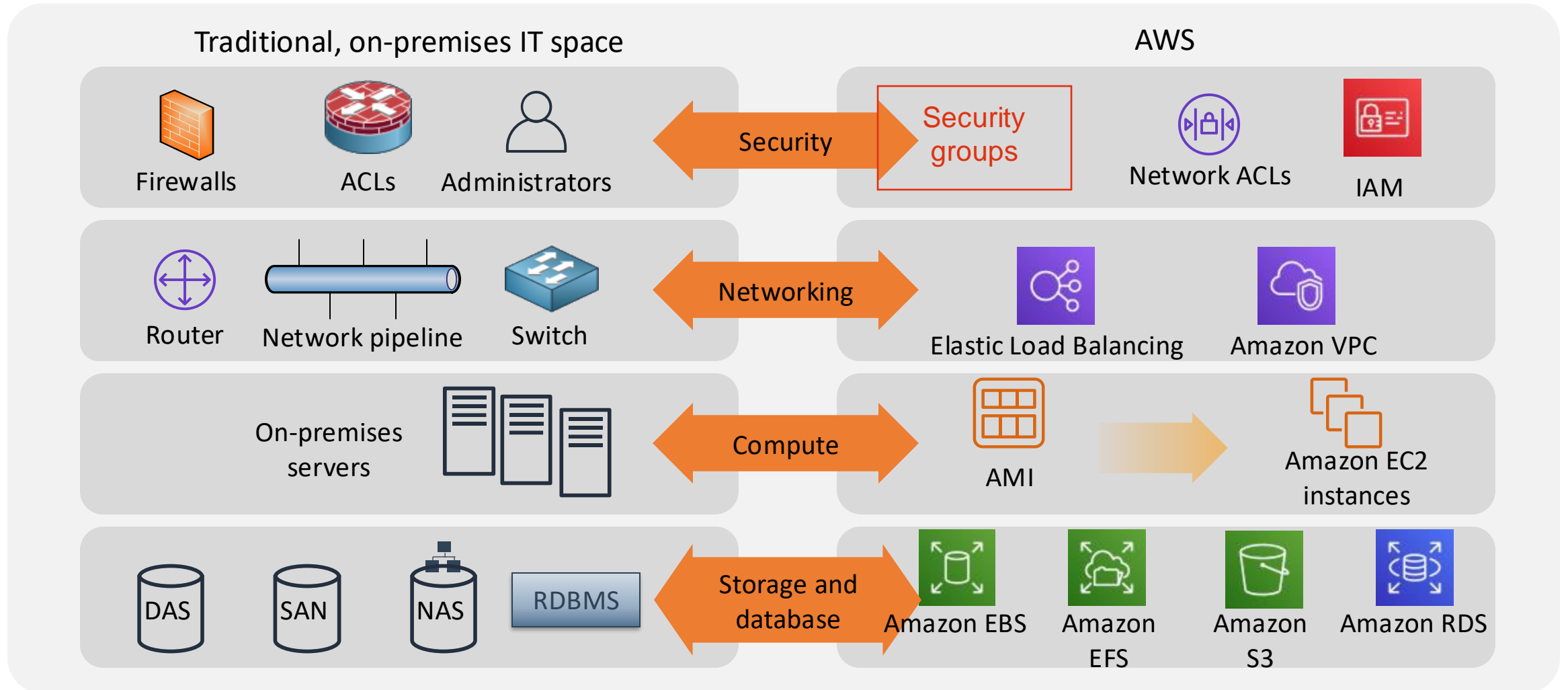
ML FRAMEWORKS & INFRASTRUCTURE

 TensorFlow	 mxnet	 GLUON	 Keras	Deep Learning AMIs & Containers	GPUs & CPUs	Elastic Inference	Inferentia	FPGA
 PYTORCH	 fastai	 MxNet	 DeepGraphLibrary					

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Similarities between AWS and traditional IT



Main Cloud Providers

- Amazon Web Services (AWS)
- Microsoft Azure Cloud
- Google Cloud

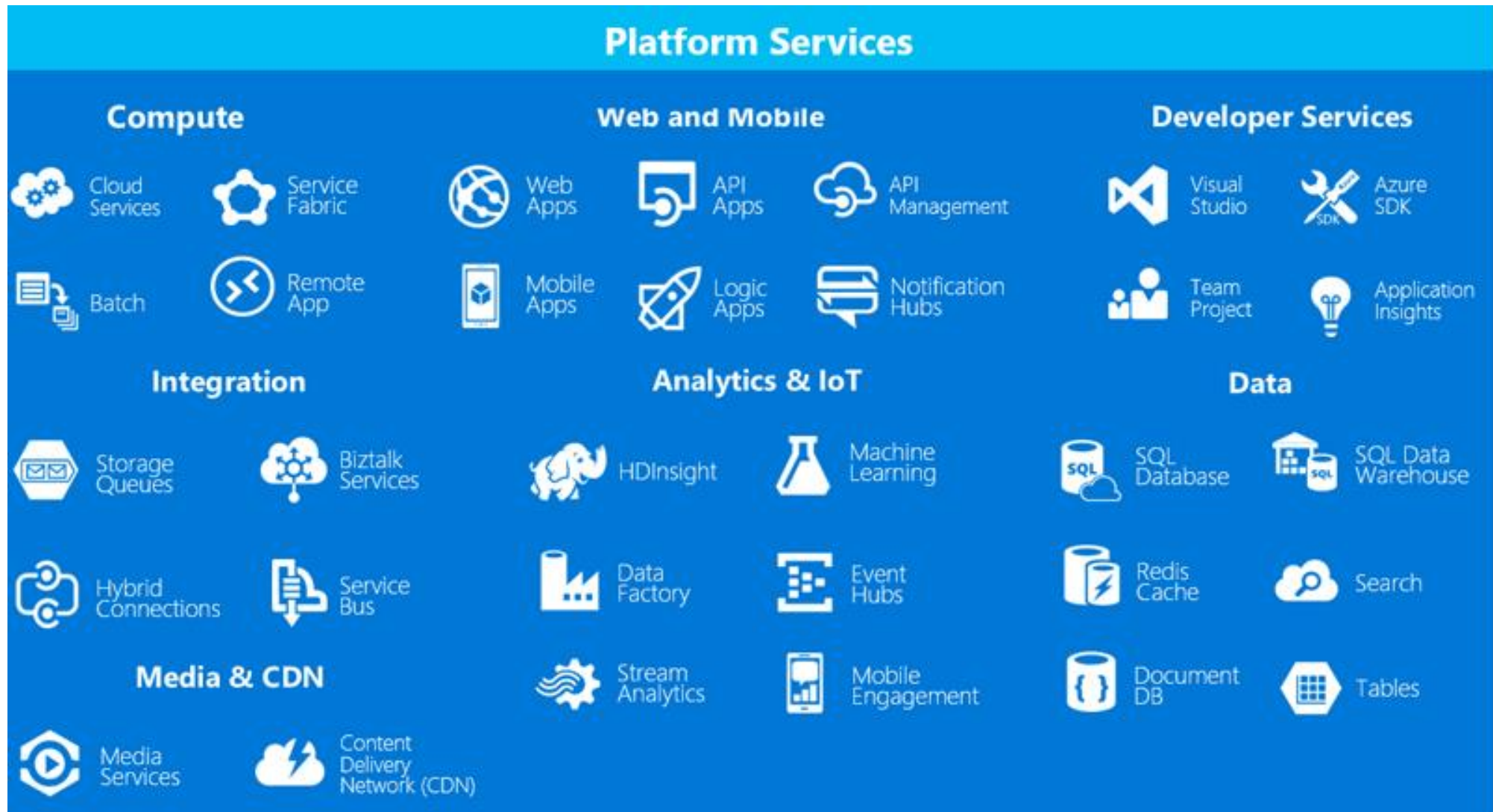


Google Cloud



Microsoft
Azure

Microsoft Azure web services

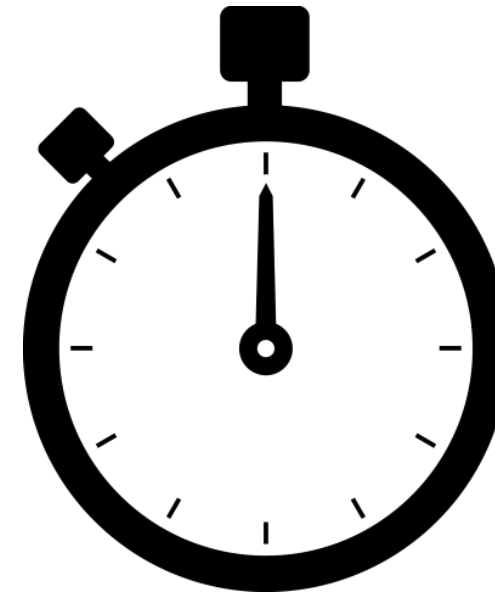


Advantages of cloud computing

Trade capital expense for variable expense



Data center investment
based on forecast

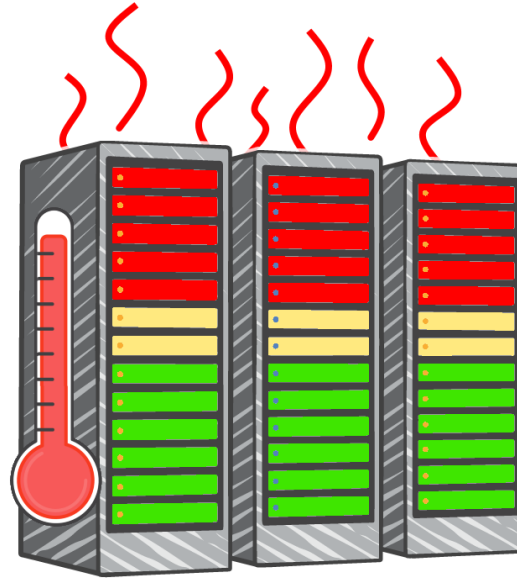


Pay only for the amount
you consume

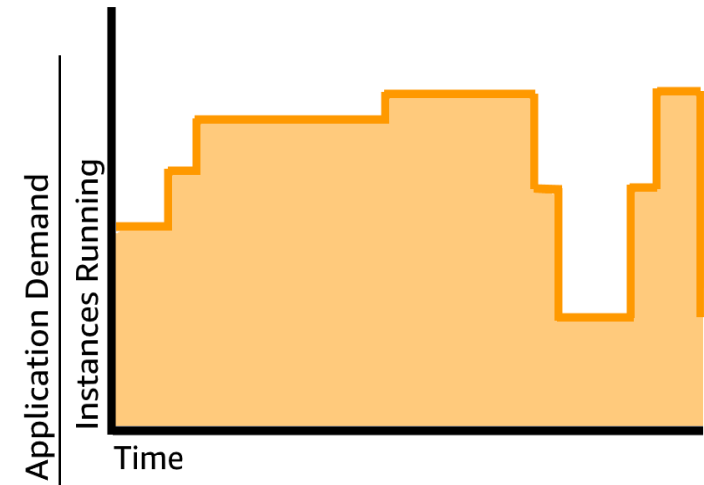
Stop guessing capacity



Overestimated
server capacity



Underestimated
server capacity



Scaling on demand

Increase speed and agility

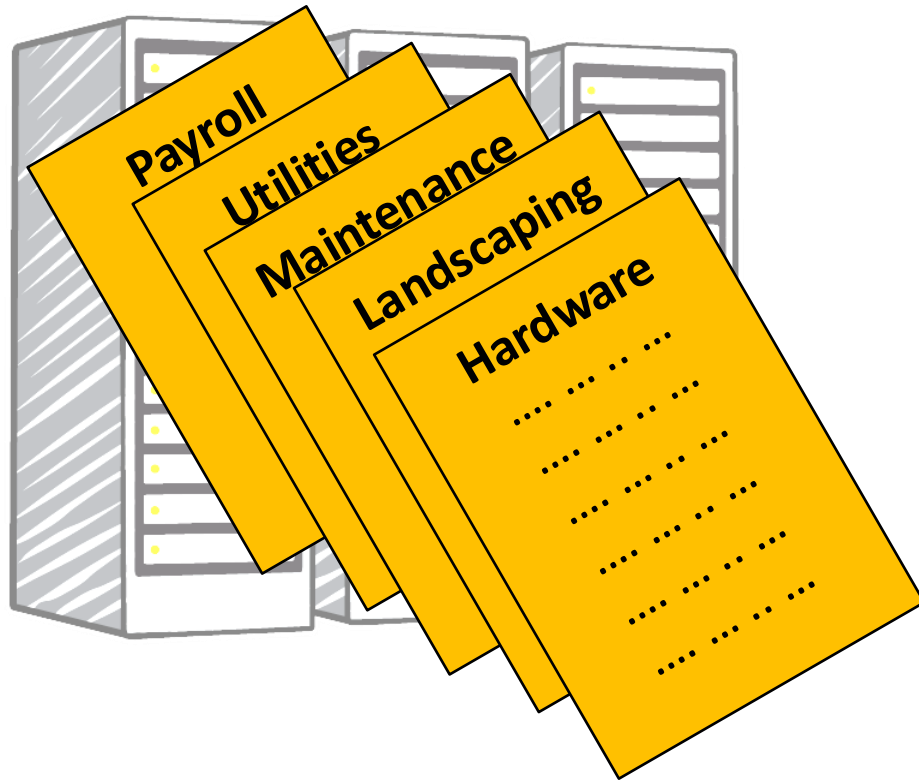


Weeks between wanting
resources and having resources

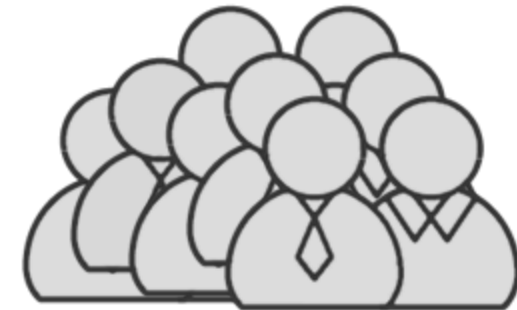
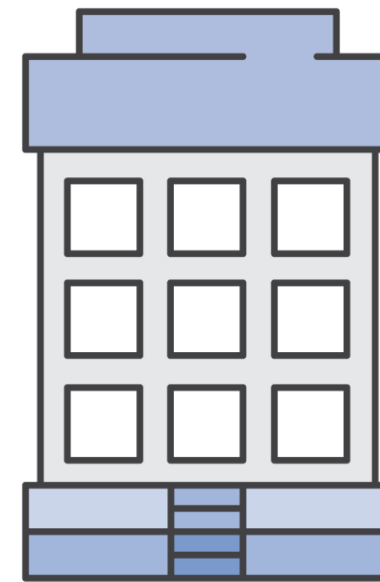
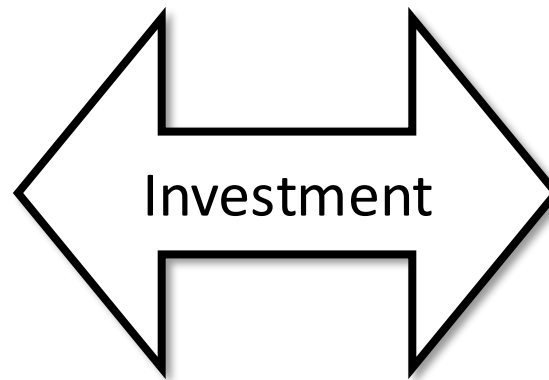


Minutes between wanting
resources and having resources

Stop spending money on running and maintaining data centers

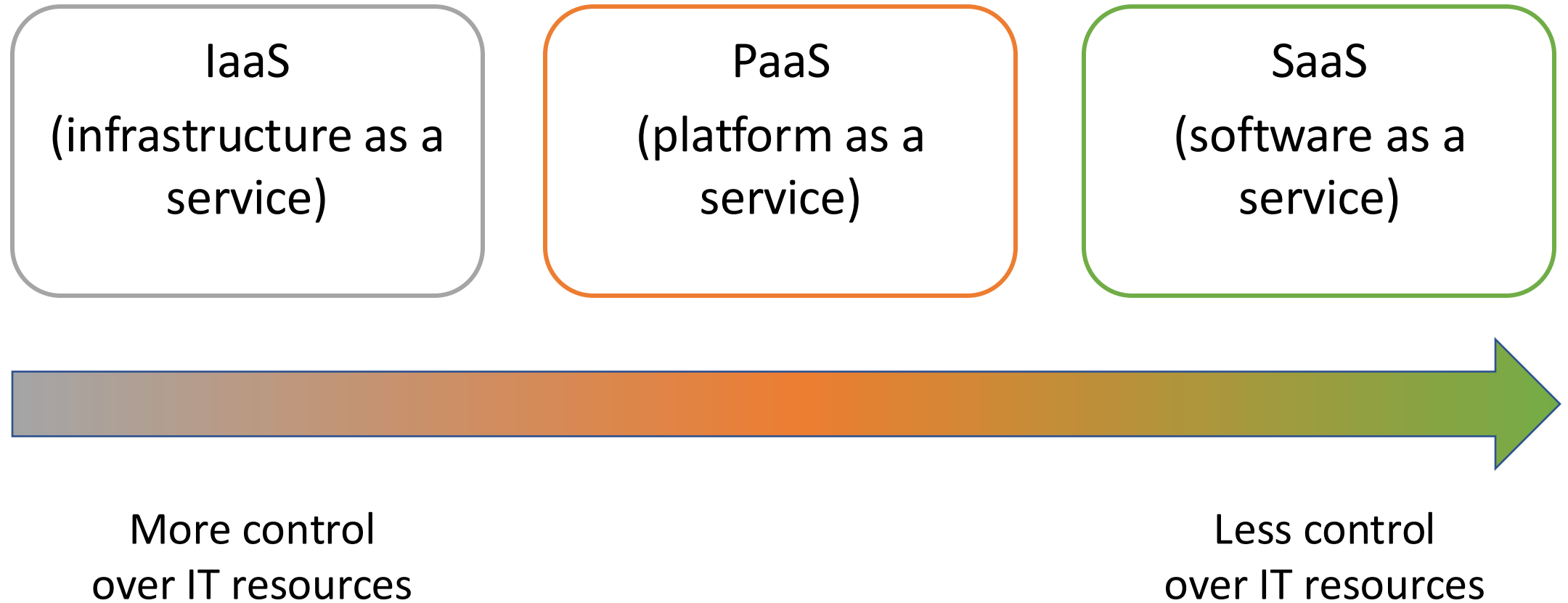


Running data centers

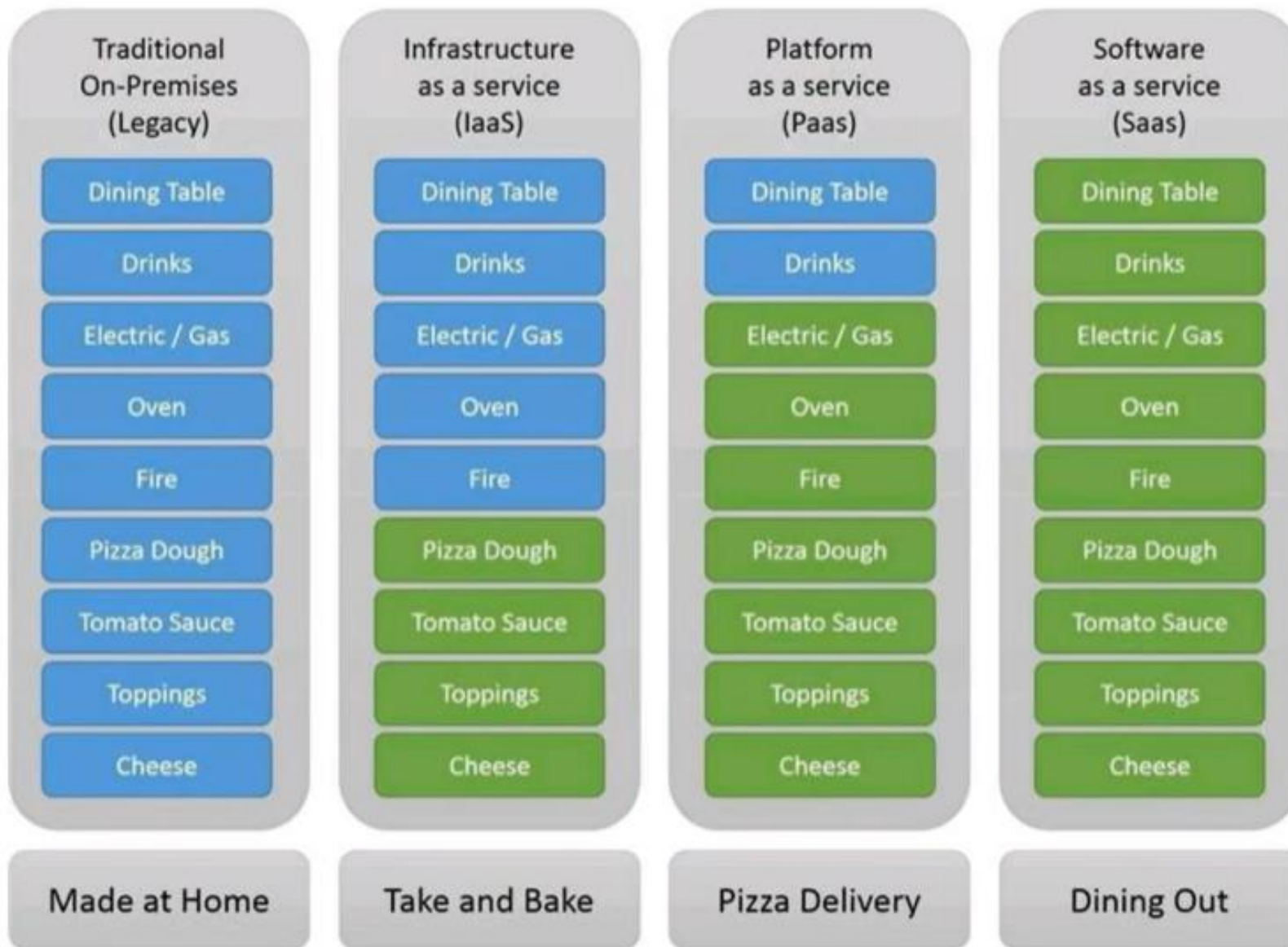


Business and customers

Cloud service models

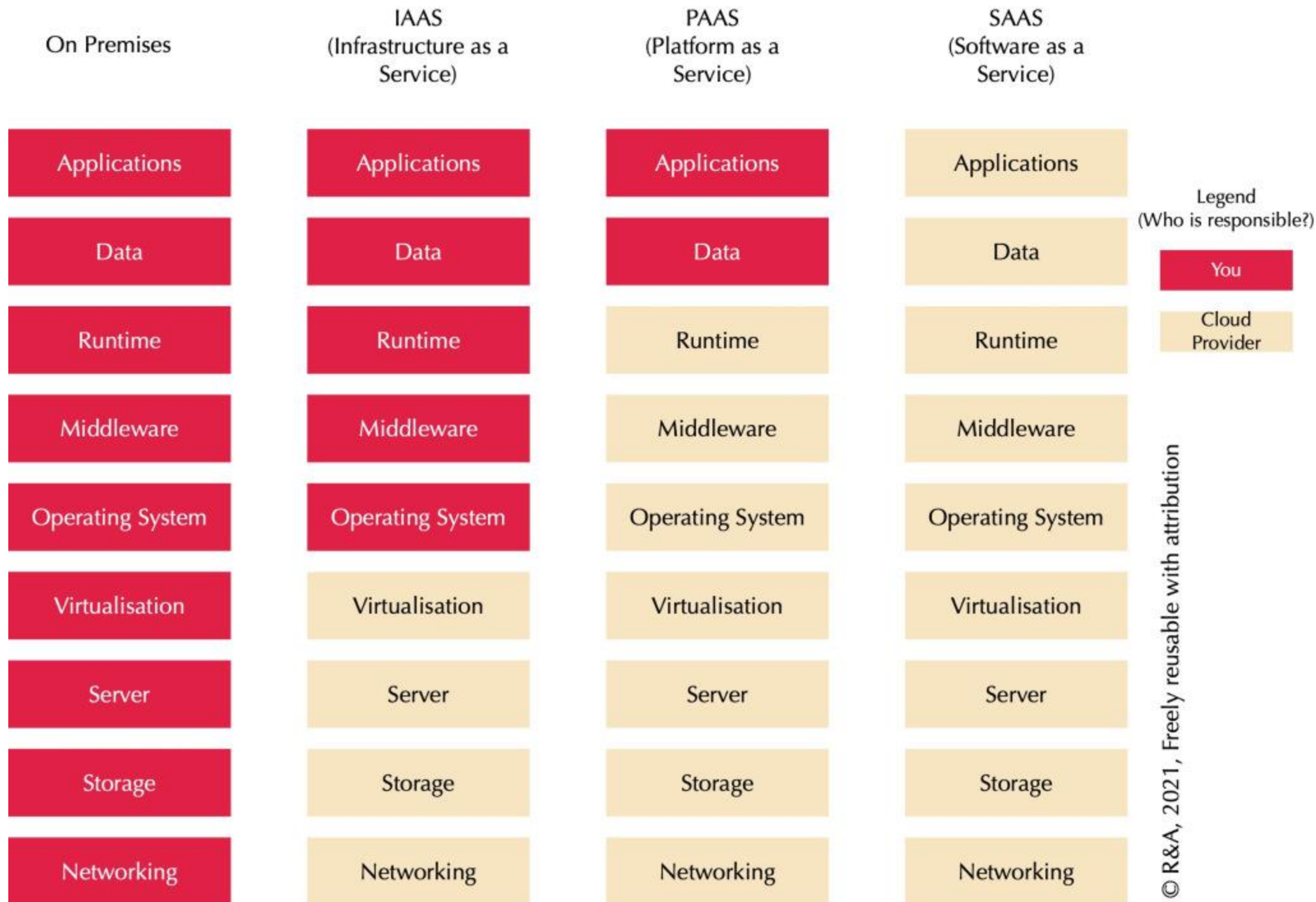


Pizza as a Service



■ You Manage

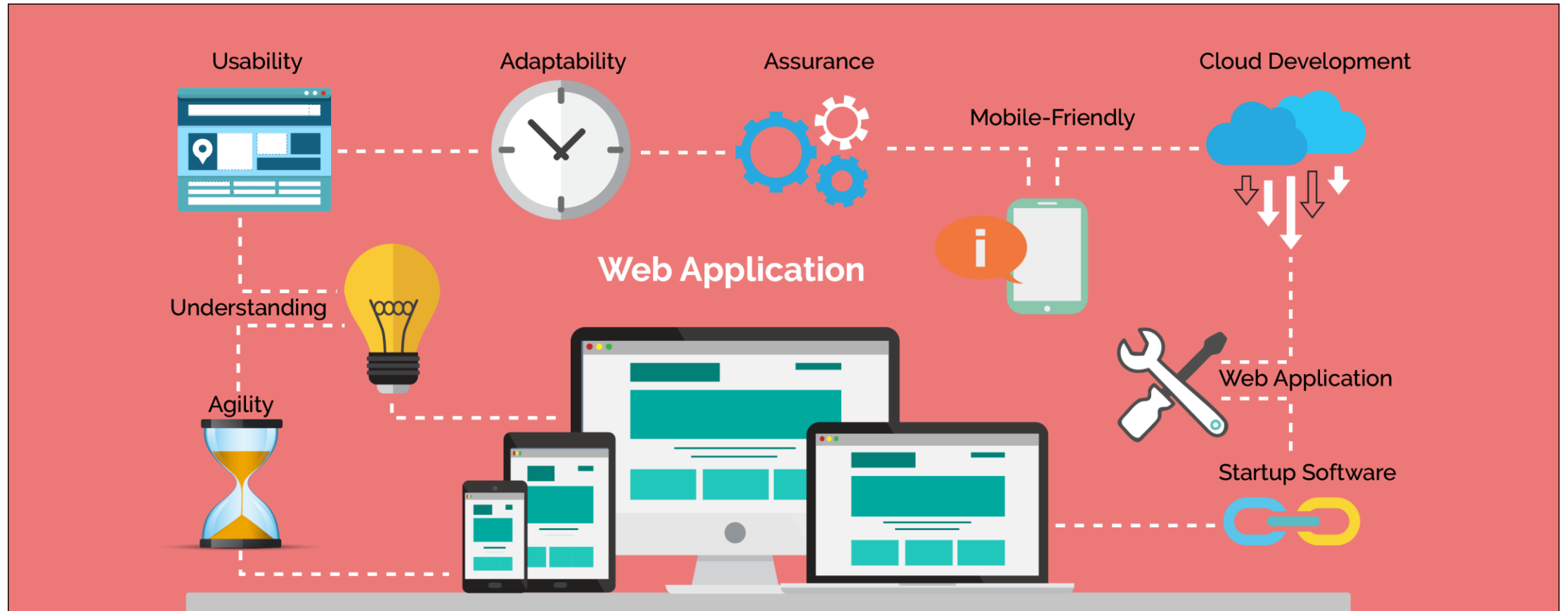
■ Vendor Manages



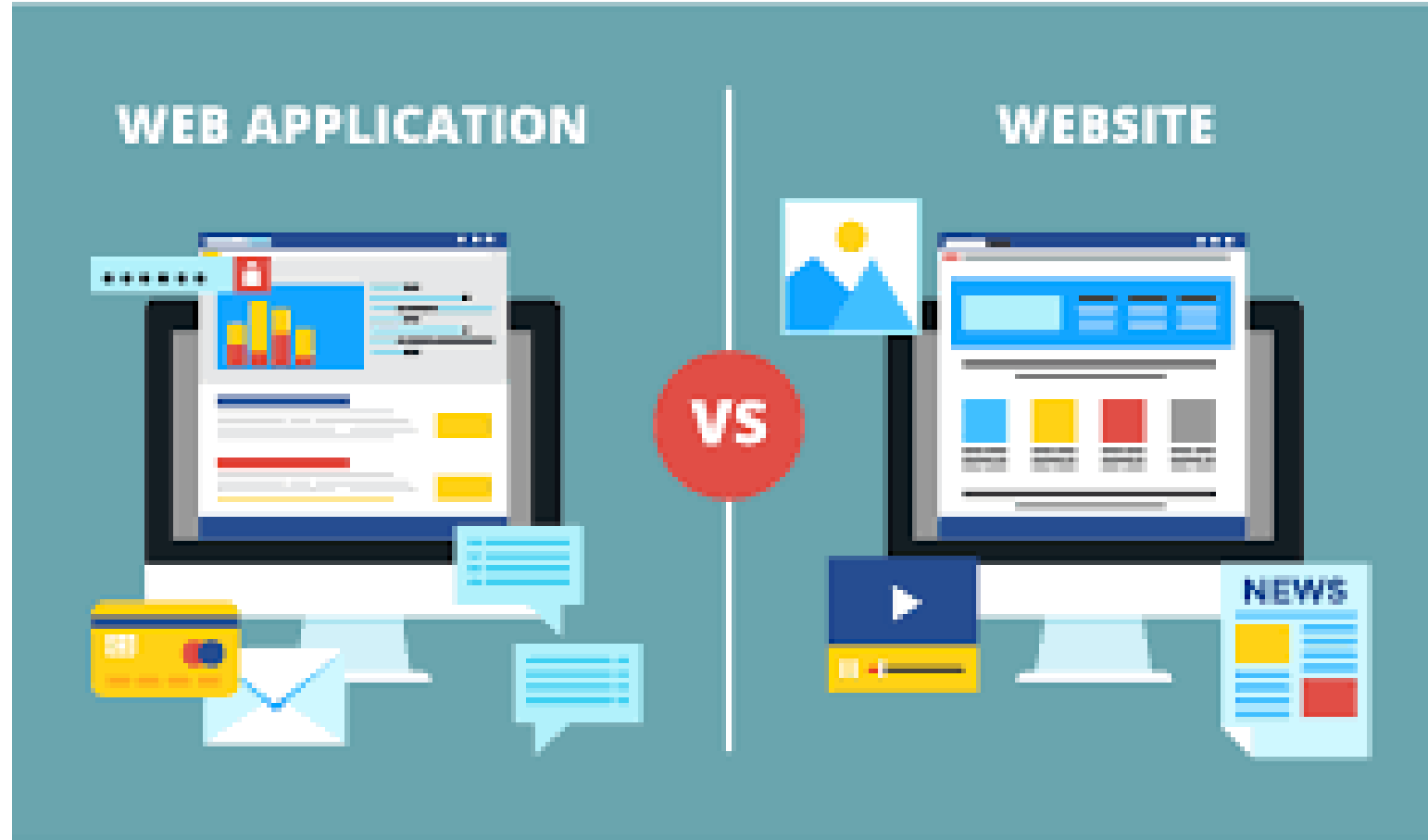
Creating Cloud Services

Web Development

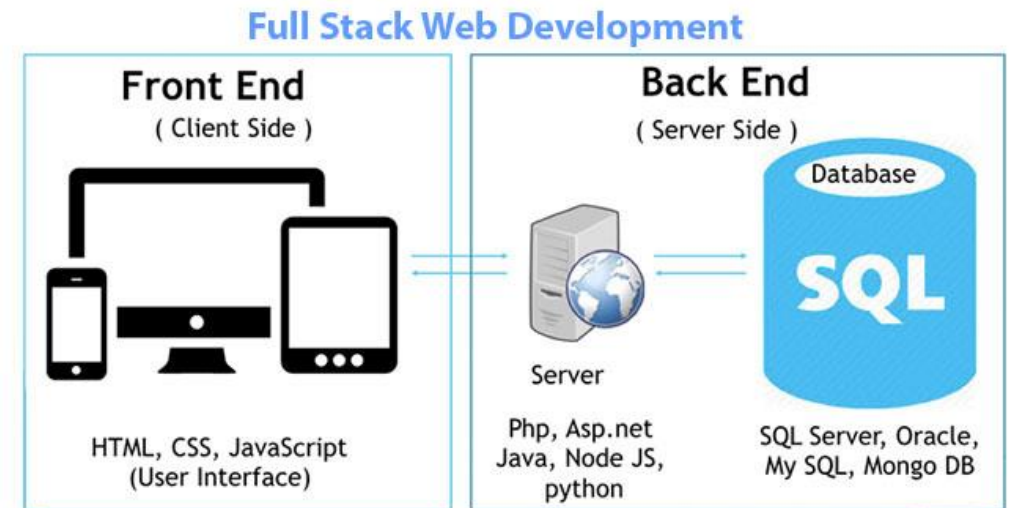
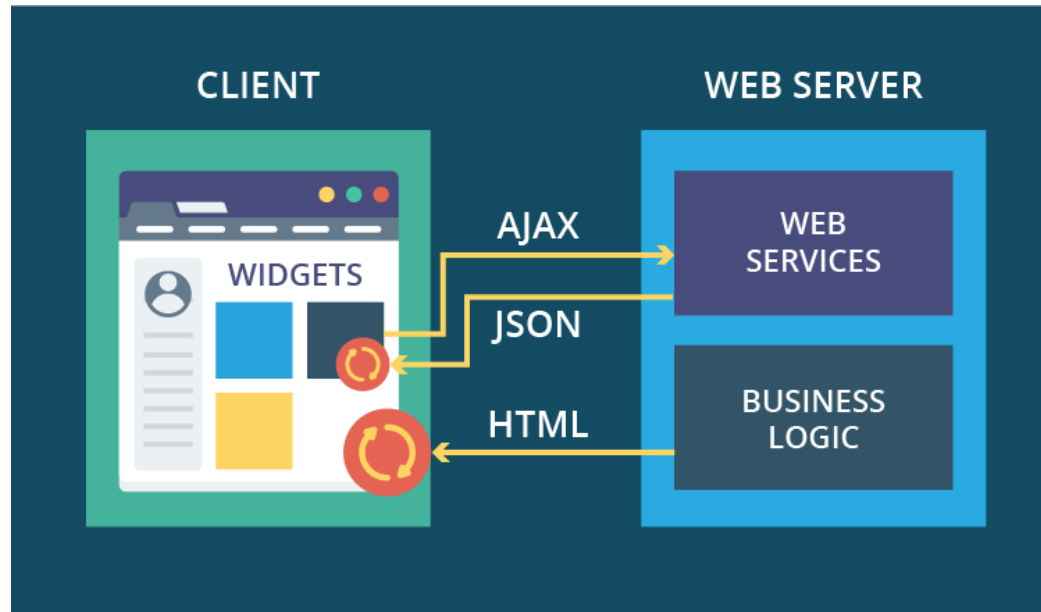
Web applications



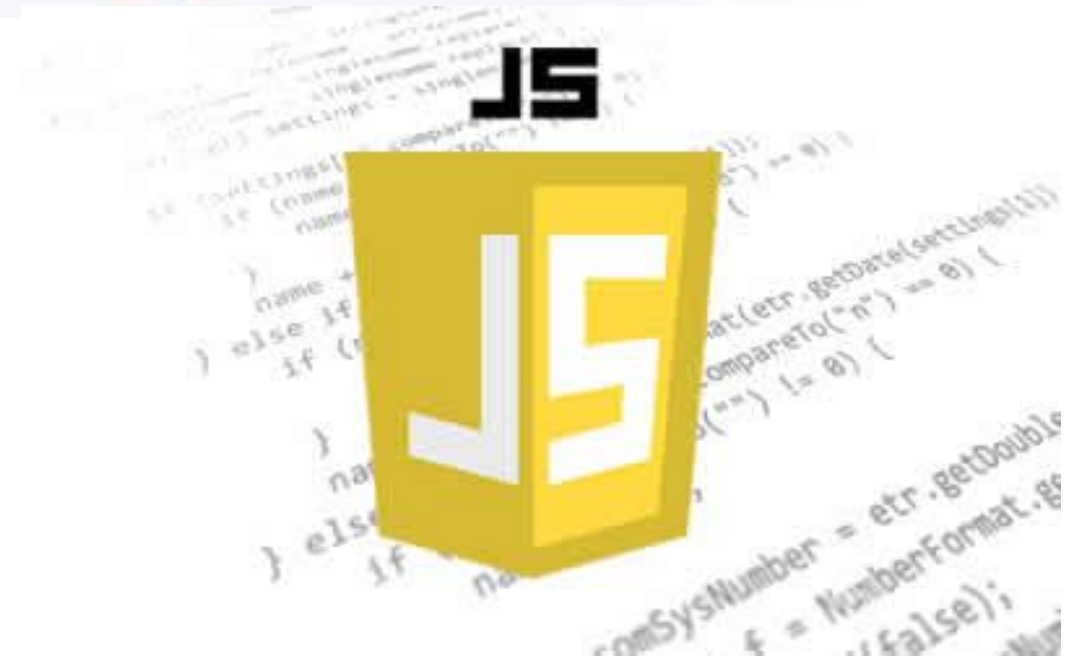
Web App vs. Web Page



Web development



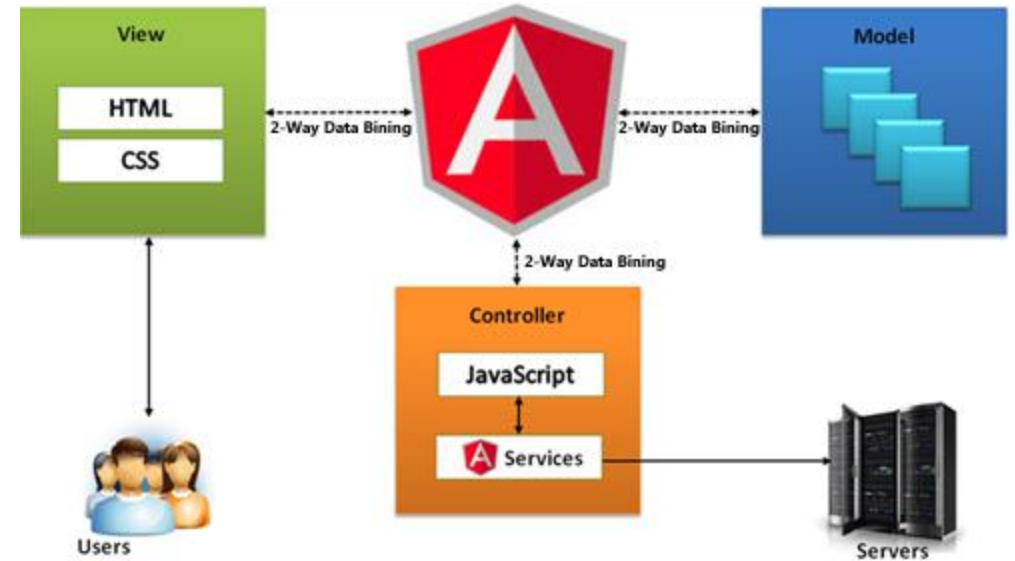
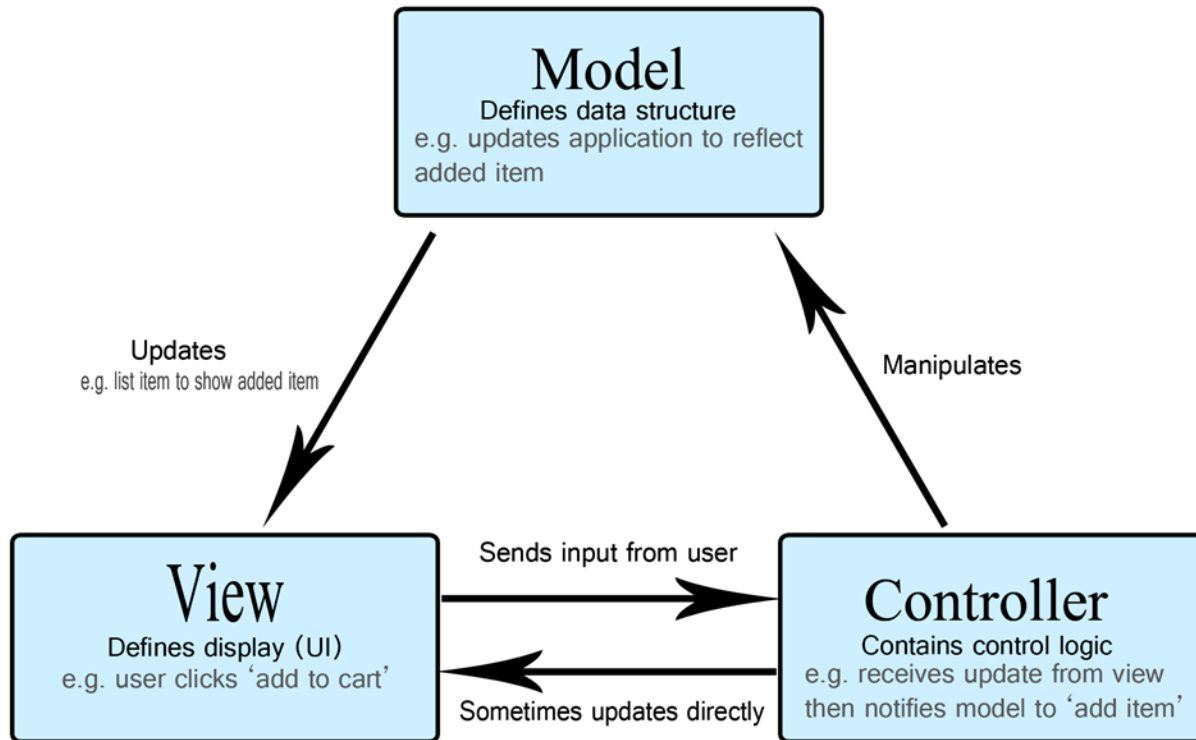
Web development: Front-end



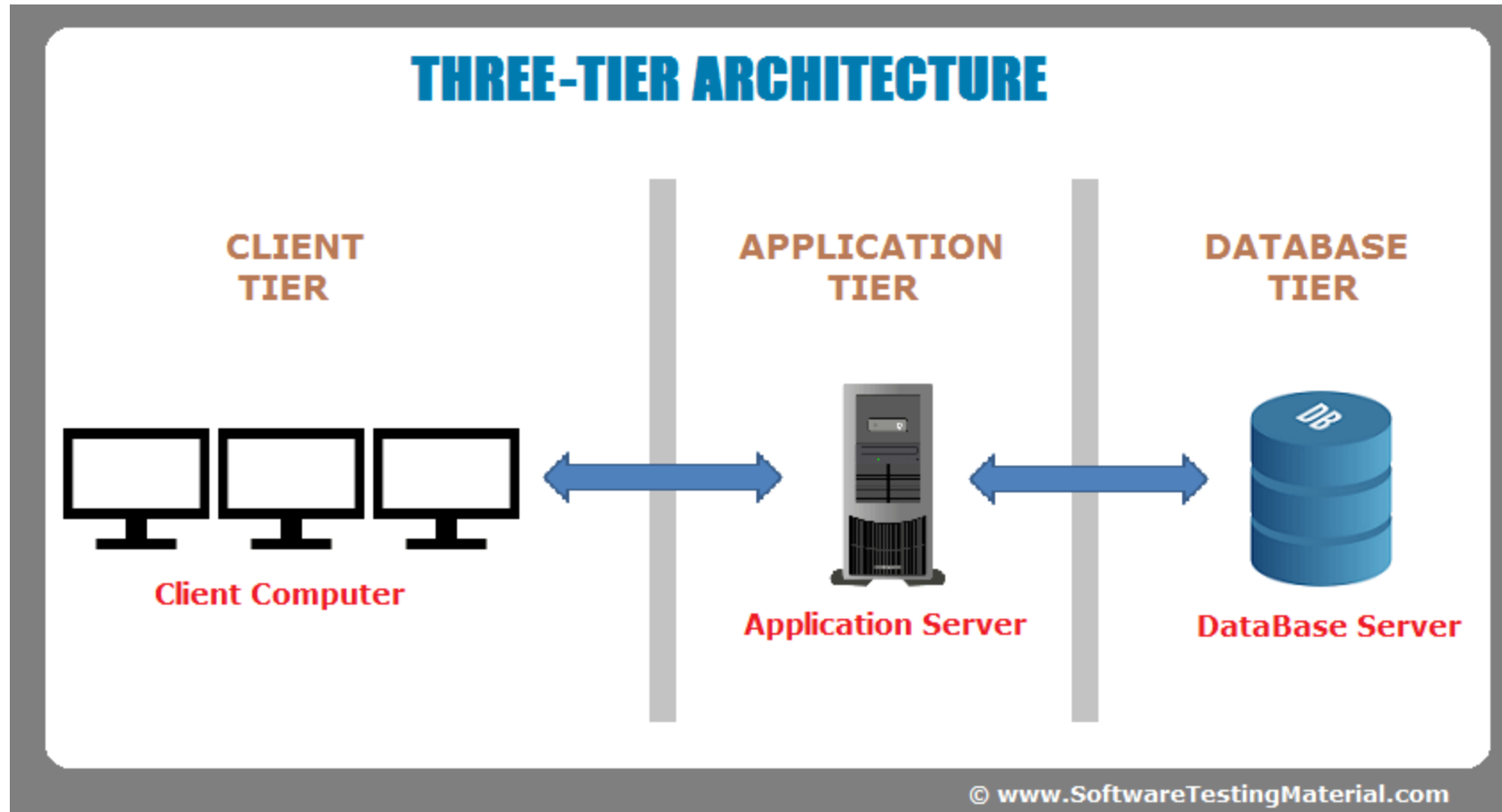
Web development: Back-end



Model View Controller (MVC)

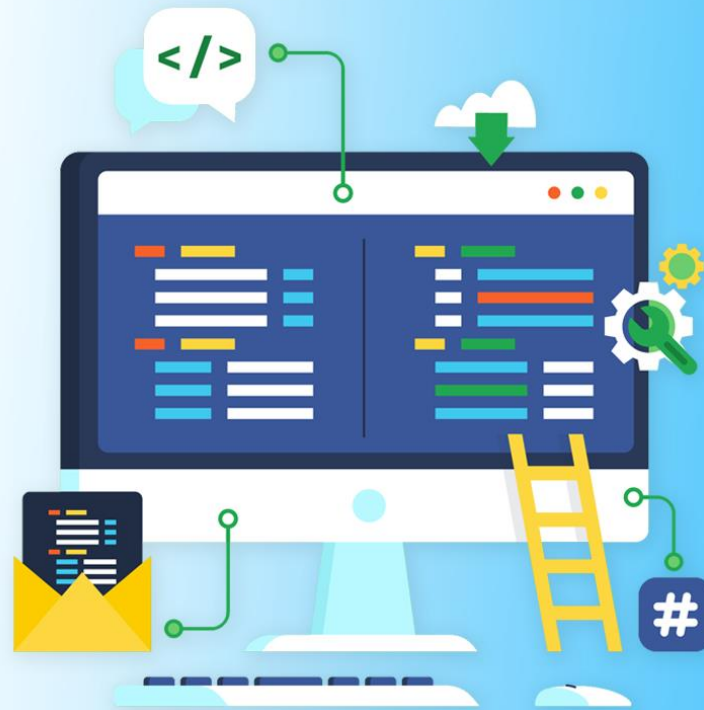
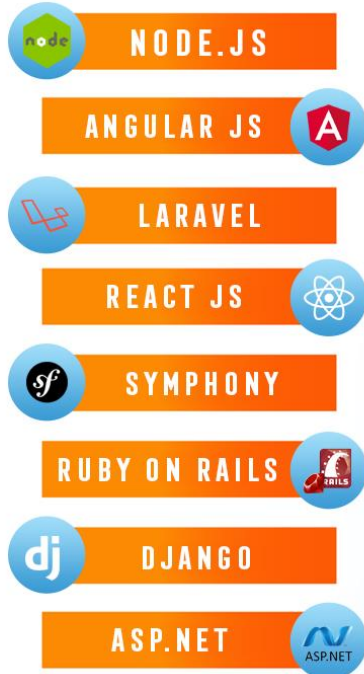


Three Tier Architecture



Web Development Frameworks

TOP **WEB DEVELOPMENT** FRAMEWORKS



Using appropriate framework is essential for a developer because it saves an important time and efforts for building an app

