Week 2

Artificial Intelligence Program

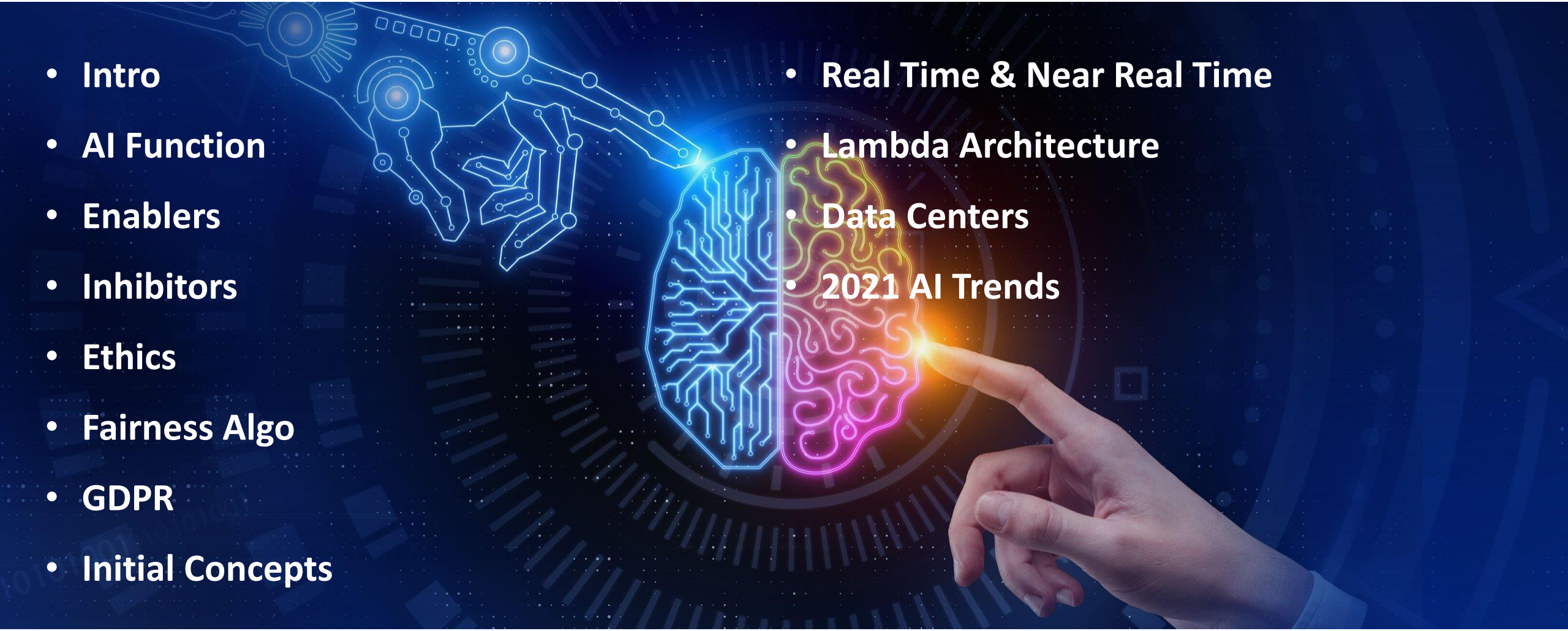
Infrastructure and Architecture

> Agenda // Program

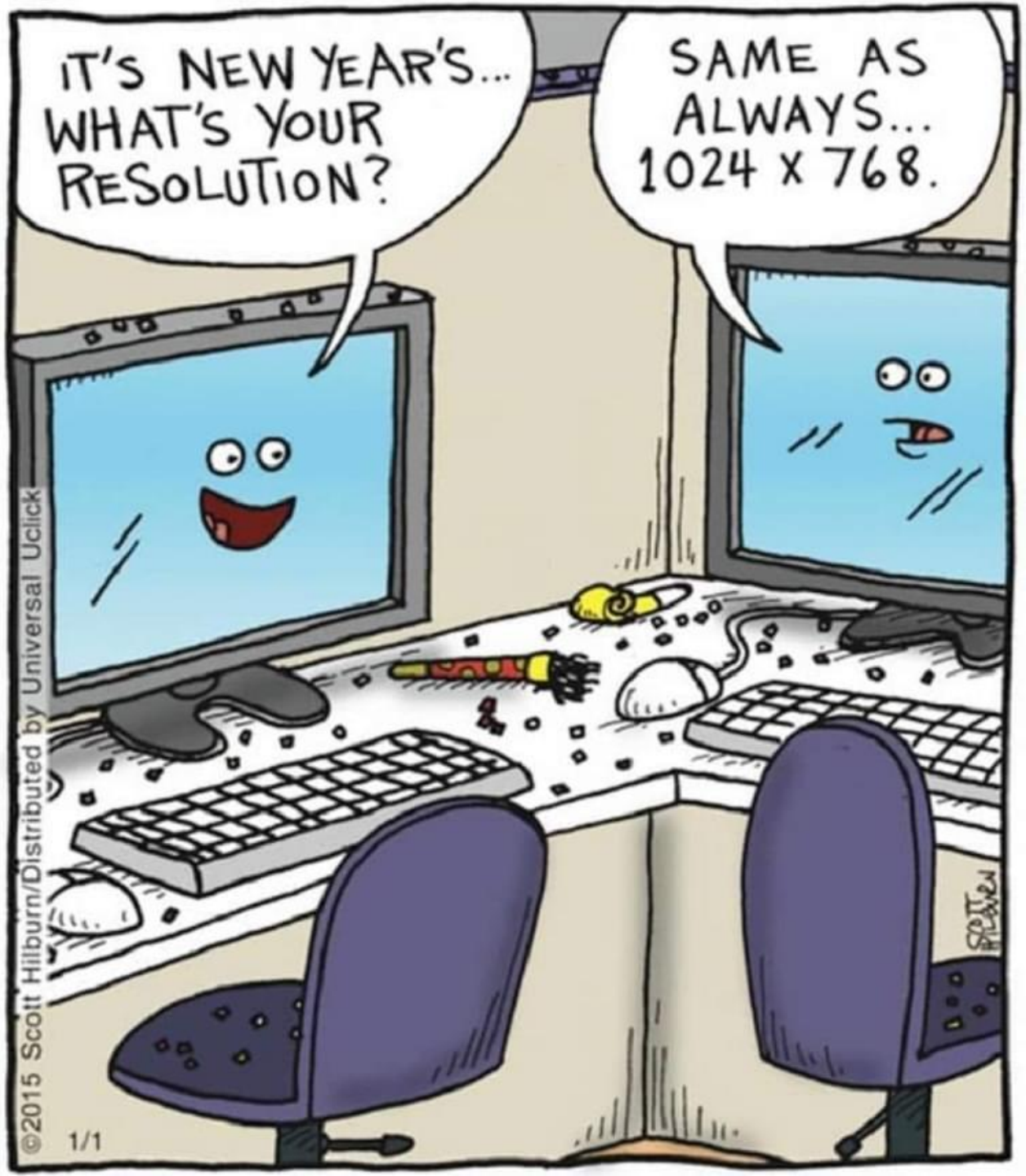
Assignments [60%]
EXAMS [40%]

WEEK	SUBJECT	ASSIGNMENT / TO BE DELIVERED	DATES
2	Intro / AI Function / Enablers		Sep 13
3	Infra and Architecture / On-prem vs. Cloud / CSPs	C 1	Sep 20
4	Data Pipeline / Processes / Framework / AutoML	#1 Image Classifier **[5%]**	Sep 27
5	Data Pipeline / Processes / Framework / AutoML	C 2	Oct 4
6	More Data / SSIS / ADF / Data Quality	#2 Machine Learning Studio **[10%]**	Oct 11
7	Azure services – Intro **EXAM 1 [20%]**	C 3	Oct 18
8	**READING WEEK**	**NO CLASSES**	**Oct 25**
9	Azure services – Cognitive Services 1	41	Nov 1
10	Azure services – Cognitive Services 2	#3 Draw your own Architecture (in class) **[5%]** 42	Nov 8
11	Azure services – Cognitive Services 3	43	Nov 15
12	Azure services – Cognitive Services 4	#4 Azure pipeline // Sentiment Analysis **[20%]** 44	Nov 22
13	AWS Academy – Cloud Foundations		Nov 29
14	AWS Academy – Machine Learning	#5 AWS Academy – Cloud Foundations **[10%]**	Dec 6
15	Enterprise Architecture **EXAM 2 [20%]**	#6 AWS Academy – Machine Learning **[10%]**	Dec 13

> Agenda



- Intro
- AI Function
- Enablers
- Inhibitors
- Ethics
- Fairness Algo
- GDPR
- Initial Concepts
- Real Time & Near Real Time
- Lambda Architecture
- Data Centers
- 2021 AI Trends


IT'S NEW YEAR'S... WHAT'S YOUR RESOLUTION?
SAME AS ALWAYS... 1024 x 768.
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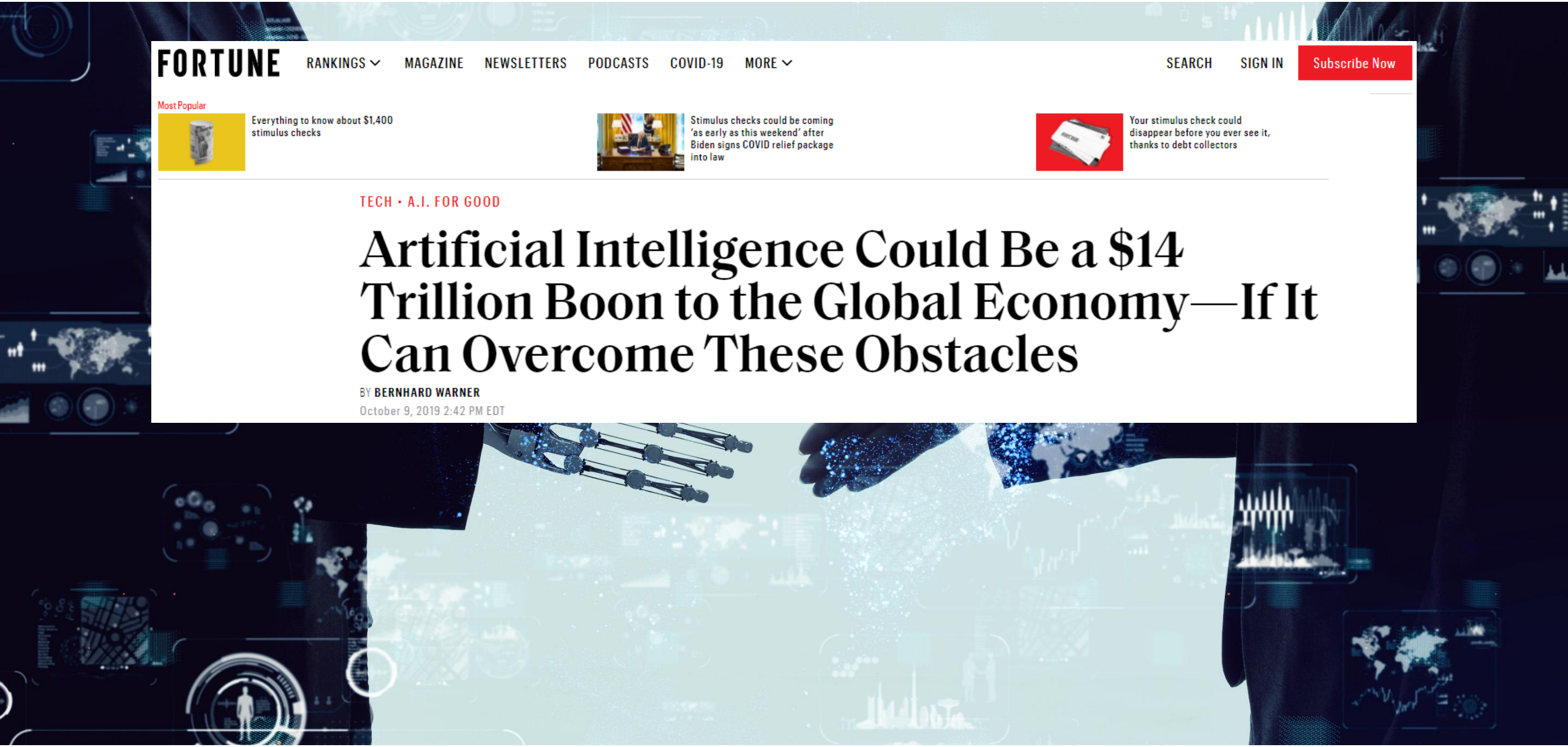
AI

Before we start…



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Your stimulus check could disappear before you ever see it, thanks to debt collectors

TECH • A.I. FOR GOOD

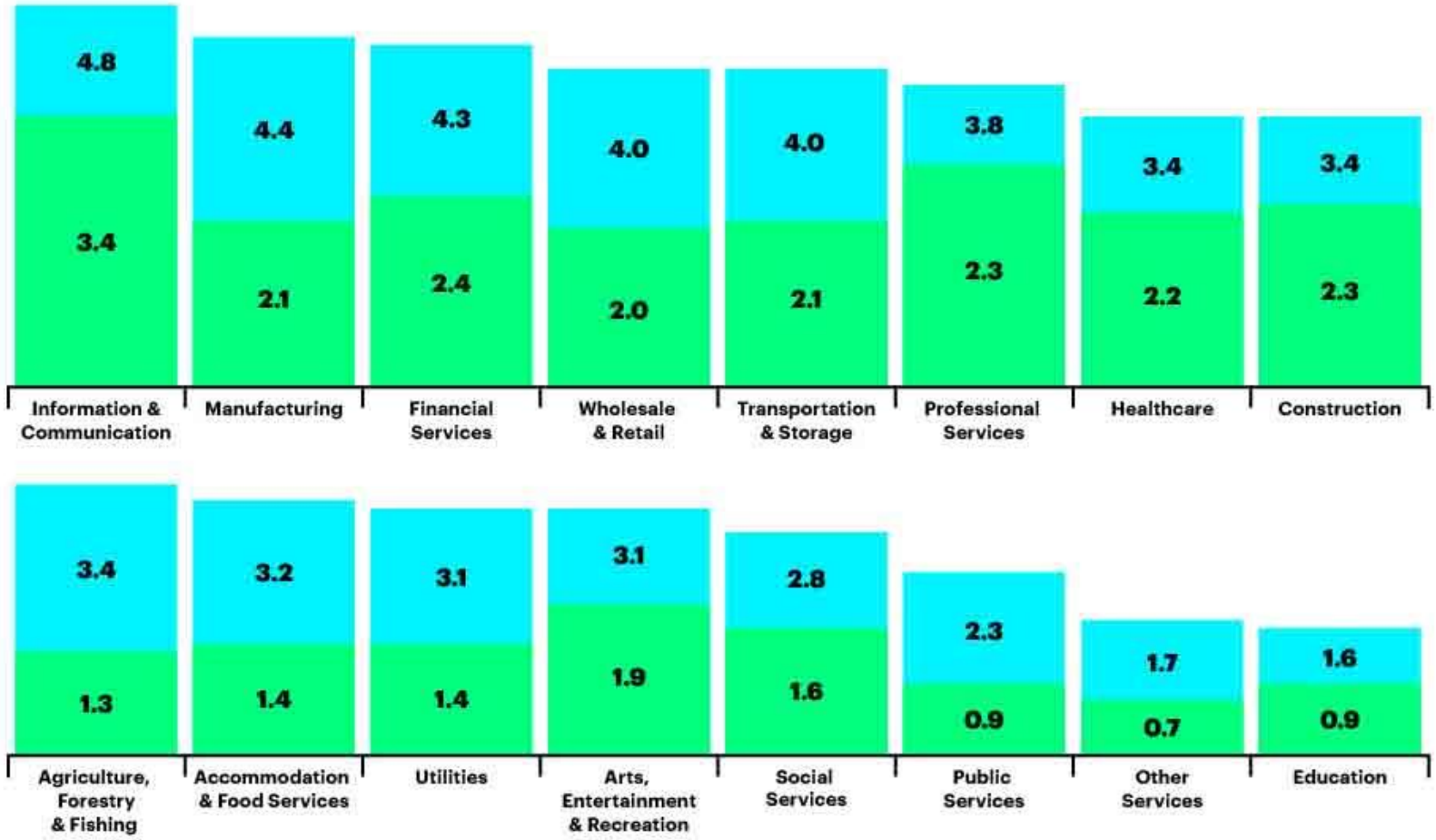
Artificial Intelligence Could Be a $14 Trillion Boon to the Global Economy—If It Can Overcome These Obstacles

BY **BERNHARD WARNER**

October 9, 2019 2:42 PM EDT

accenture

The impact of AI on industry growth



NEWS RELEASE

ACCENTURE REPORT: ARTIFICIAL INTELLIGENCE HAS POTENTIAL TO INCREASE CORPORATE PROFITABILITY IN 16 INDUSTRIES AN AVERAGE OF 38 PERCENT BY 2035

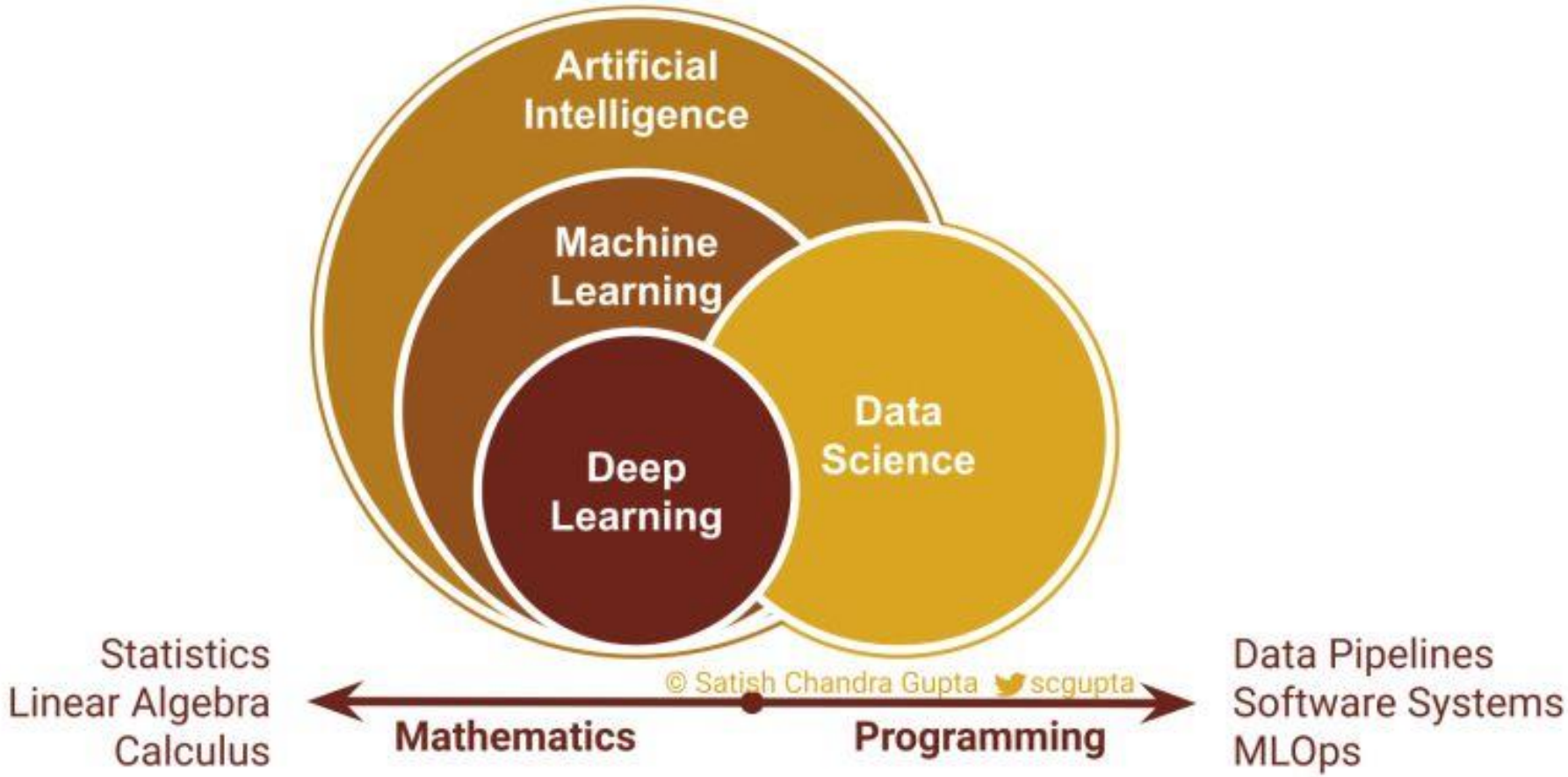
Georgian

https://www.accenture.com/ca-en/company-news-release-ai-research-corporate-profitability

AI

Function

> Where we are?

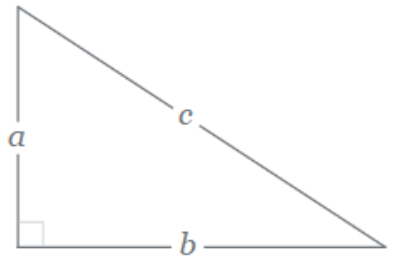

Artificial Intelligence
Machine Learning
Deep Learning
Data Science
Statistics
Linear Algebra
Calculus
© Satish Chandra Gupta scgupta
Mathematics
Programming
Data Pipelines
Software Systems
MLOps

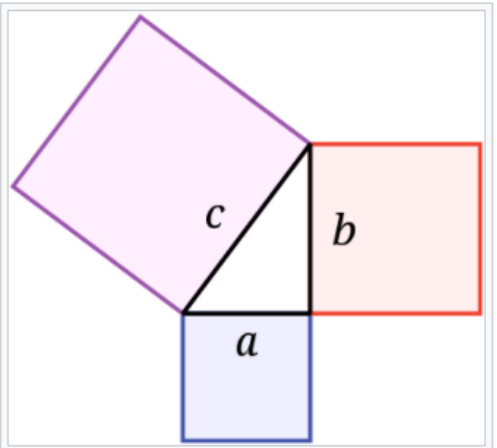
> Enablers | AI Function

$$c = \sqrt{a^2 + b^2}$$

a Leg — Enter value

b Leg — Enter value





Pythagorean theorem
The sum of the areas of the two squares on the legs (a and b) equals the area of the square on the hypotenuse (c).

17 Equations That Changed the World
by Ian Stewart

1.	**Pythagoras's Theorem**	$a^2 + b^2 = c^2$	Pythagoras,530 BC
2.	**Logarithms**	$\log xy = \log x + \log y$	John Napier, 1610
3.	**Calculus**	$\frac{\mathrm{d}f}{\mathrm{d}t} = \lim_{h\to 0} = \frac{f(t+h) - f(t)}{h}$	Newton, 1668
4.	**Law of Gravity**	$F = G\frac{m_1 m_2}{r^2}$	Newton, 1687
5.	**The Square Root of Minus One**	$i^2 = -1$	Euler, 1750
6.	**Euler's Formula for Polyhedra**	$V - E + F = 2$	Euler, 1751
7.	**Normal Distribution**	$\Phi(x) = \frac{1}{\sqrt{2\pi\rho}} e^{\frac{(x-\mu)^2}{2\rho^2}}$	C.F. Gauss, 1810
8.	**Wave Equation**	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	J. d'Almbert, 1746
9.	**Fourier Transform**	$f(\omega) = \int_{\infty}^{\infty} f(x) e^{-2\pi i x \omega} \mathrm{d}x$	J. Fourier, 1822
10.	**Navier-Stokes Equation**	$\rho\left(\frac{\partial \mathbf{v}}{\partial t} + \mathbf{v}\cdot\nabla\mathbf{v}\right) = -\nabla p + \nabla\cdot\mathbf{T} + \mathbf{f}$	C. Navier, G. Stokes, 1845
11.	**Maxwell's Equations**	$\nabla\cdot\mathbf{E} = 0$ $\quad \nabla\cdot\mathbf{H} = 0$ $\nabla\times\mathbf{E} = -\frac{1}{c}\frac{\partial \mathbf{H}}{\partial t}$ $\quad \nabla\times\mathbf{H} = \frac{1}{c}\frac{\partial E}{\partial t}$	J.C. Maxwell, 1865
12.	**Second Law of Thermodynamics**	$\mathrm{d}S \geq 0$	L. Boltzmann, 1874
13.	**Relativity**	$E = mc^2$	Einstein, 1905
14.	**Schrodinger's Equation**	$ih\frac{\partial}{\partial t}\Psi = H\Psi$	E. Schrodinger, 1927
15.	**Information Theory**	$H = -\sum p(x)\log p(x)$	C. Shannon, 1949
16.	**Chaos Theory**	$x_{t+1} = kx_t(1 - x_t)$	Robert May, 1975
17.	**Black-Scholes Equation**	$\frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS\frac{\partial V}{\partial S} + \frac{\partial V}{\partial t} - rV = 0$	F. Black, M. Scholes, 1990

> Enablers | AI Function

$$(S+D)^{AI} = BV$$

Situation, Data

Artificial Intelligence

Enablers and Inhibitors

Business Value

Enablers:

en·a·bler

/iˈnāblər,eˈnāblər/

noun

plural noun: **enablers**

a person or thing that makes something possible.
"the people who run these workshops are crime enablers"

- a person who encourages or enables negative or self-destructive behavior in another.
  "being an enabler to an addict does more harm than good"

Inhibitors:

in·hib·i·tor

/inˈhibədər/

noun

plural noun: **inhibitors**

a thing which inhibits someone or something.

- a substance which slows down or prevents a particular chemical reaction or other process or which reduces the activity of a particular reactant, catalyst, or enzyme.
- GENETICS
  a gene whose presence prevents the expression of some other gene at a different locus.

> Enablers | AI Function

$$(S+D)^{AI} = BV$$

Situation, Data

Artificial Intelligence

Enablers and Inhibitors

Business Value

Enablers:

- People
- Tools
- Infra
- Process

Inhibitors:

- Transparency
- Explain ability
- Ethics

> Enablers | People

Data Scientist

Machine Learning Engineer

Data Engineer
Data Analyst

AI (S+D) = BV

Business Analyst
Data Analyst
Business side professional

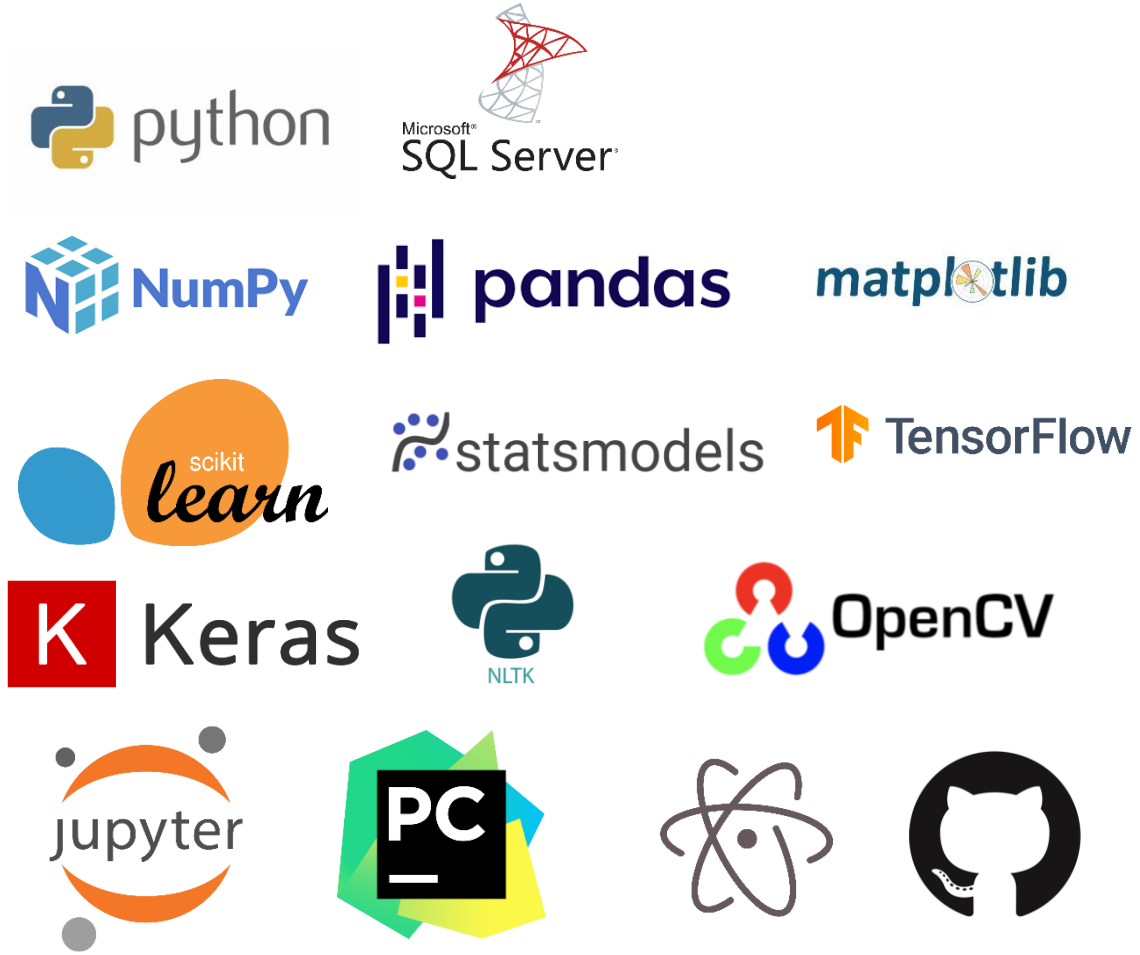
Business Analyst
Business side professional

Machine Learning Engineer
Developers
Software Engineers

> Enablers | AI Tools

OPEN SOURCE !

- **Programming Languages: Python, SQL**
- **Libraries: numpy, pandas, matplotlib, statsmodels**
- **ML-Libs: scikit-learn, tensorflow, keras**
- **NLP: NLTK**
- **Computer Vision: OpenCV**
- **Integrated Development Environment (IDE): Jupyter Notebook, Kite, Atom, PyCharm …**
- **Collaboration: GitHub**



> Inhibitors | AI Function

Key Considerations

As machine learning algorithms are used in more and more products and services, there are some serious factors must be considered when addressing AI, particularly in the context of people's trust in the Internet.

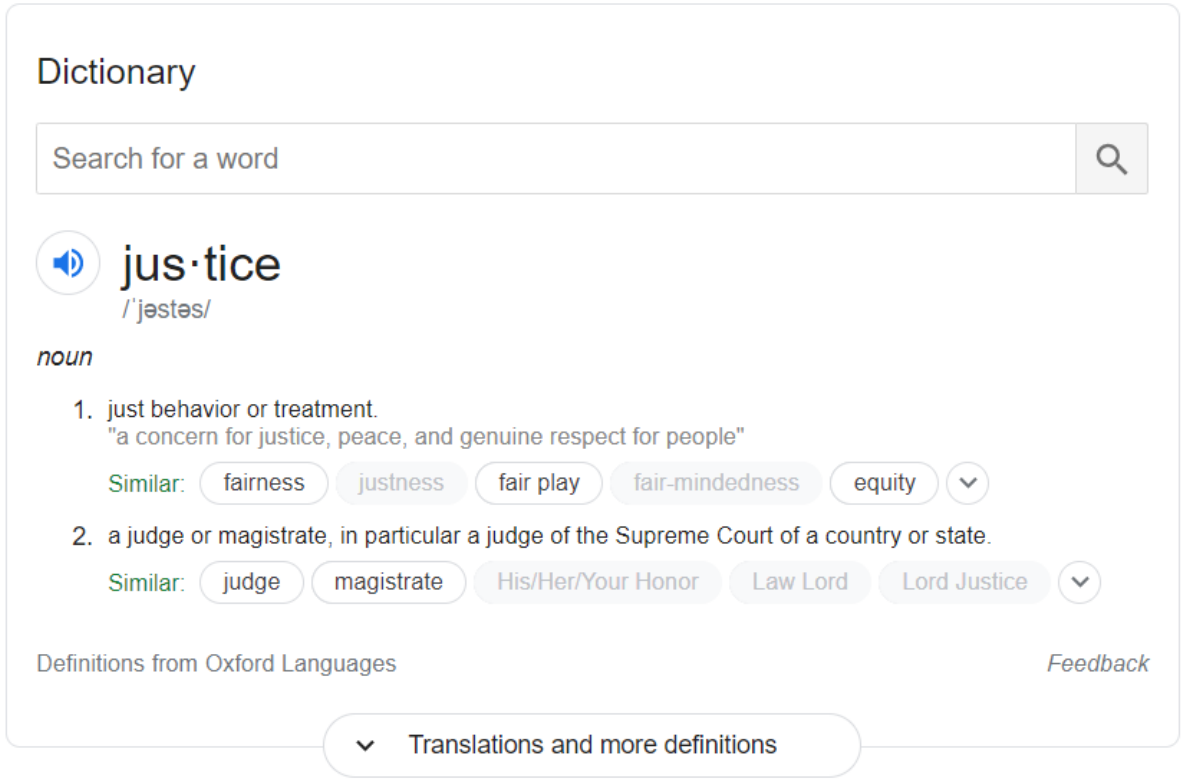
- **Socio-economic impacts**. The new functions and services of AI are expected to have significant socio-economic impacts. The ability of machines to exhibit advanced cognitive skills to process natural language, to learn, to plan and to perceive, makes it possible for new tasks to be performed by intelligent systems, sometimes with more success than humans. New applications of AI could open up exciting opportunities for more effective medical care, safer industries and services, and boost productivity on a massive scale.
- **Transparency, bias and accountability**. AI-made decisions can have serious impacts in people's lives. AI may discriminate against some individuals or make errors due to biased training data. How a decision is made by AI is often hard to understand, making problems of bias harder to solve and ensuring accountability much more difficult.

> Inhibitors | AI Function

- **New uses for data**. Machine learning algorithms have proved efficient in analyzing and identifying patterns in large amounts of data, commonly referred to as "Big Data". Big Data is used to train learning algorithms to increase their performance. This generates an increasing demand for data, encouraging data collection and raising risks of oversharing of information at the expense of user privacy.
- **Security and safety**. Advancements in AI and its use will also create new security and safety challenges. These include unpredictable and harmful behavior of the AI agent, but also adversarial learning by malicious actors.
- **Ethics**. AI may make choices that could be deemed unethical, yet also be a logical outcome of the algorithm, emphasizing the importance to build in ethical considerations into AI systems and algorithms.
- **New ecosystems**. Like the impact of mobile Internet, AI makes new applications, services, and new means of interacting with the network possible. For example, through speech and smart agents, which may create new challenges to how open or accessible the Internet becomes.

> Inhibitors | AI Function | Ethics

Justice, in its broadest sense, is the principle that people receive that which they deserve, with the interpretation of what then constitutes "deserving" being impacted upon by numerous fields, with many differing viewpoints and perspectives, including the concepts of moral correctness based on ethics, rationality, law, religion, equity and fairness.



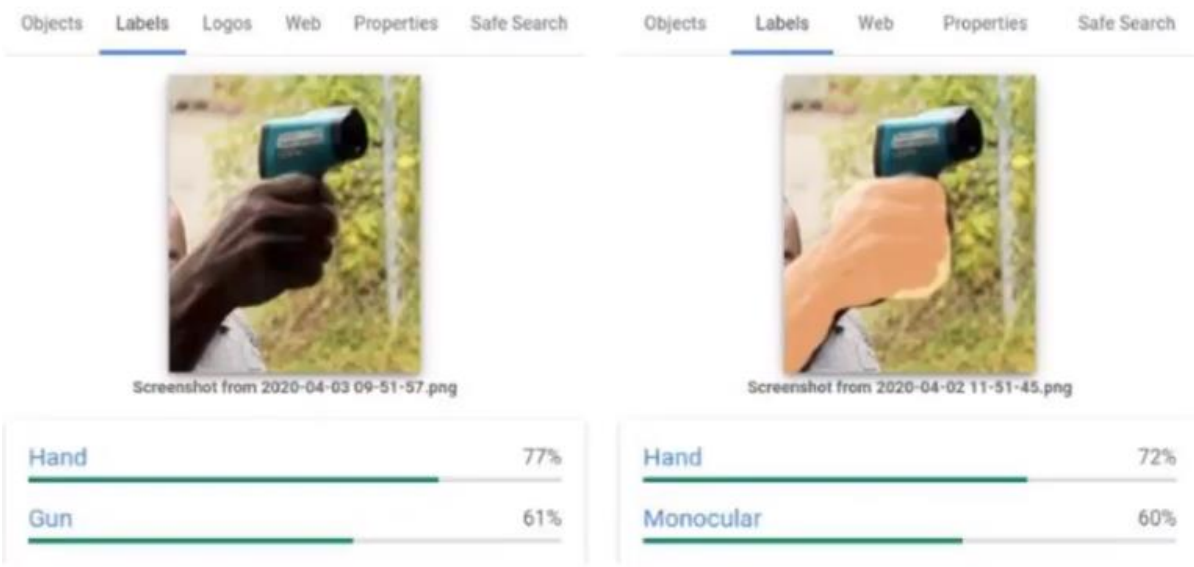
https://en.wikipedia.org/wiki/Justice


SHARE PRICE
PROFITS
REPUTATION
INTEGRITY
LOYALTY
TRUST
BRAND
PRIVACY
DO WE REALLY NEED THIS?
SLANE
SLANE CARTOON.COM

Ethical AI is a collective and personal effort

> Inhibitors | AI Function | Ethics | Fairness Algo

- Confidence
- Responsibility
- Understanding
- GDPR
- Quality
- Governance
- Risks



BIAS – In the data because it is in the people

DISTORTION – Common attribute in the data

> Inhibitors | AI Function | Ethics | Fairness Algo

Doctor = men

Woman = Housekeeper

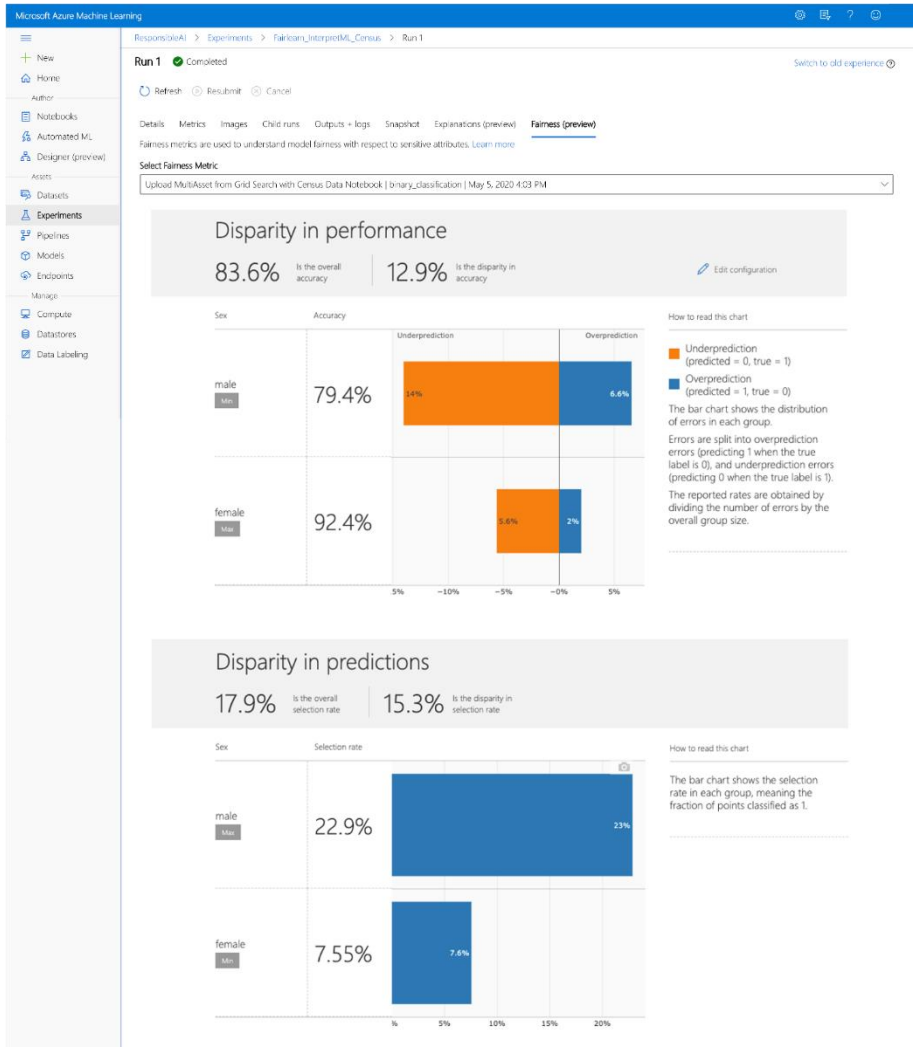
> Inhibitors | AI Function | Ethics | Fairness Algo

Fairlearn Python

(OPEN SOURCE)

Algorithm and Dashboard

Fairlearn



https://www.mckinsey.it/idee/why-diversity-matters

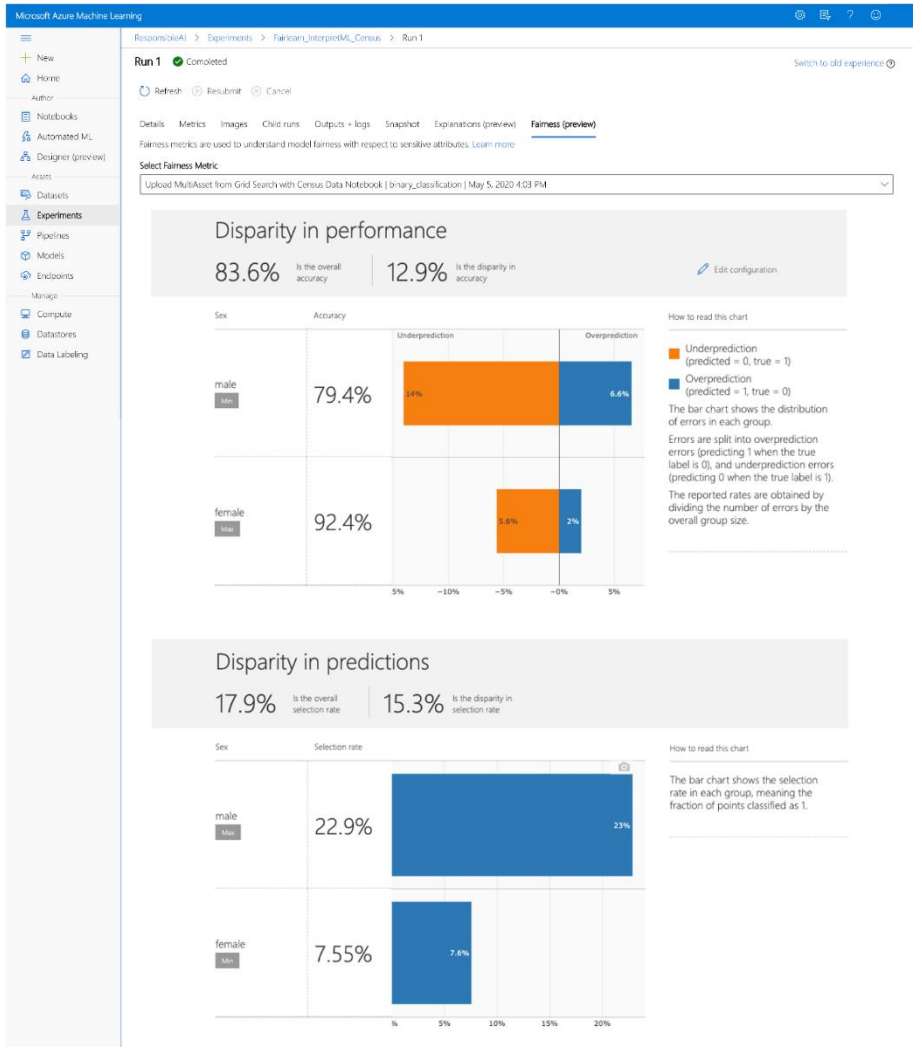
EXAM

> Inhibitors | AI Function | Ethics | Fairness Algo

- **Assessing fairness:** Fairlearn contains a FairlearnDashboard component and a set of metrics that help you measure the fairness of your model.

- **Mitigating unfairness:** Alongside the metrics, and dashboard, there's a set of algorithms in fairlearn to help mitigate unfair behavior in models. You can, for example, use a postprocessing algorithm to improve existing models. But there are also a couple of algorithms that help you improve the model during training.

- Reduction and prep processing

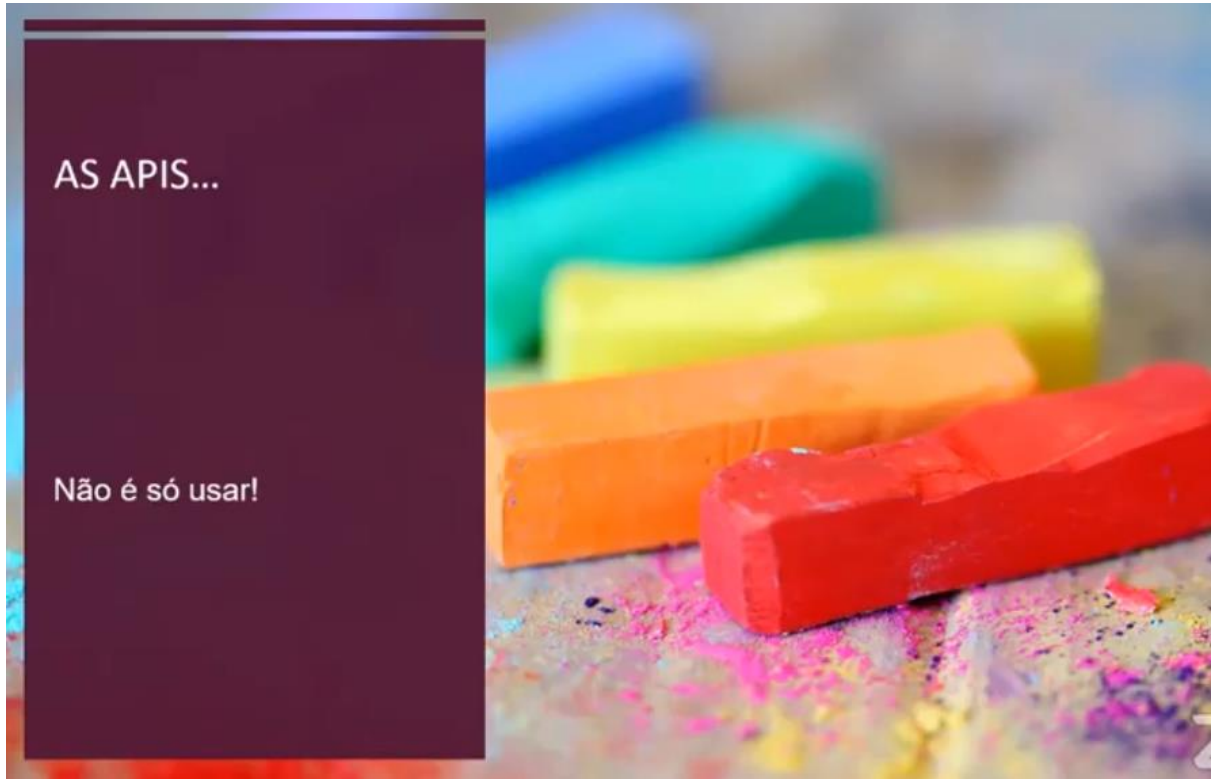


https://medium.com/microsoftazure/fairlearn-the-secret-to-teaching-your-models-to-play-fair-1dfe8a42ed9f

> Inhibitors | AI Function | Ethics | Fairness Algo

TRENDS

- **Understand the ML models**
  - No more black boxes
- **Protect data and people**
  - Using people data
  - GDPR
  - Ethics
  - Transparency
- **Control the ML process end-to-end**
  - Governance
  - Version



https://medium.com/microsoftazure/fairlearn-the-secret-to-teaching-your-models-to-play-fair-1dfe8a42ed9f

> Inhibitors | AI Function | Ethics

Challenges

- **Social**
- **Economy**

The data cannot reproduce a social distortion.

Evaluate, measure and understand your data and possible issues reproducing inadequate behaviors.

> Inhibitors | AI Function | Responsible AI

Fairness
https://www.microsoft.com/en-us/videoplayer/embed/RE4vqfa?postJsllMsg=true

Reliability & Safety
https://www.microsoft.com/en-us/videoplayer/embed/RE4vvIl?postJsllMsg=true

Privacy & Security
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Inclusiveness
https://www.microsoft.com/en-us/videoplayer/embed/RE4vl9v?postJsllMsg=true

Transparency
https://www.microsoft.com/en-us/videoplayer/embed/RE4vqfb?postJsllMsg=true

Accountability
https://www.microsoft.com/en-us/videoplayer/embed/RE4vvIk?postJsllMsg=true

- Human Values
- Ecosystem
- Emotions
- Context
- Morals
- Generations
- Society Culture

How to reduce the Ethical Dilemma?

> It is not only about Ethics… It is about power…

Gianluca Mauro · 1st
Artificial Intelligence coach - Turned people at €1B+ companies into AI leaders - Author of Zero t...
3h ·

The Italian antitrust fined Google for $100M over Google Play's abuse of dominance. Here's what happened:

The Italian utility giant Enel Group built an app to locate its EV charging stations. The Android Auto functionality of the app has been rejected by Google for non disclosed "security concerns while driving". The antitrust claim is that Google is abusing its position of power to push people to use Google Maps instead.

🤔 Here's why I think this is interesting:

Not only Enel is a giant, it was also a public body until 1999. Can you imagine the power they have over the government to fight for their right to compete?

How many small businesses have suffered similar behaviours, without the power to fight back?

Interested to know if you have any other stories.

#google #antitrust #enelx

Antitrust, multa da 100 milioni di euro a Google: "Ha limitato un'applicazione di Enel X"

di Aldo Fontanarosa

GDPR

General Data Protection Regulation

> GDPR

GDPR stands for **General Data Protection Regulation** also referred to as Regulation (EU) 2016/679.

GDPR was approved by the European parliament in April 2016. After a two-year transition period, GDPR will be in force for all organisations that handle the data of EU residents from the 25th of May 2018.

Under GDPR, the definition of personal data has been much simplified to **'any information relating to an identified or identifiable person.'**

> GDPR

The GDPR states that EU citizens have several rights regarding their personal data:

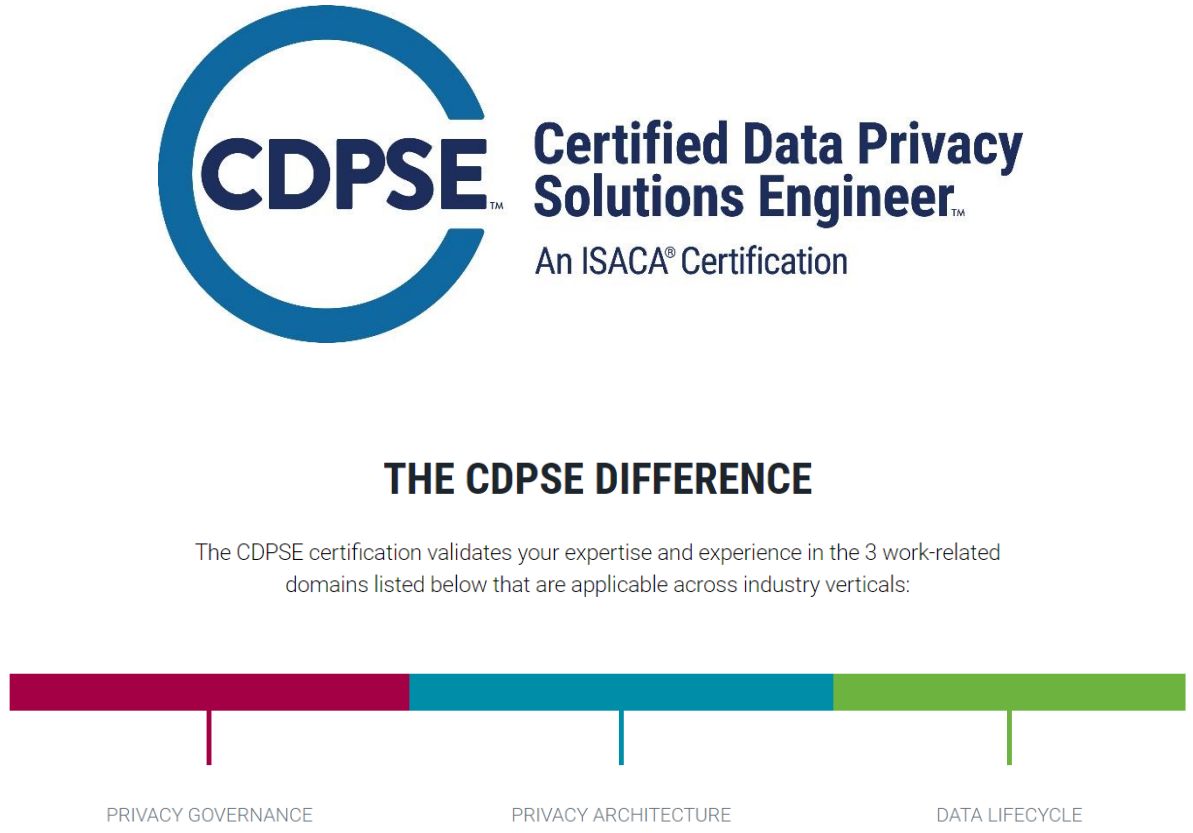
1. The right to breach notification.
Organizations must provide citizens or customers notice within 72 hours if any data leak has occurred that potentially involves their personal information.

2. The right to access.
Upon request, any government or business group must be prepared to provide a copy of all known personal information held by that organisation and the purpose behind the collection of said information.

3. The right to be forgotten.
Any person can request data erasure and organizations must comply as soon as possible if there are no implications to “the public interest in the availability of the data”.

4. The right to data portability.
Any personal information must be shared in a format that is easily understood and easily consumed.

5. Privacy by design.
This implies that organizations that plan to collect personal information will need to invest in robust security and recordkeeping practices.



https://youtu.be/acijNEErf-c

> Cambridge Analytica

The New York Times

Brexit | Britain and E.U. Reach Deal | 5 Things to Know | Post-Brexit Trade Deal | Already Out of Date?

Cambridge Analytica and Facebook: The Scandal and the Fallout So Far

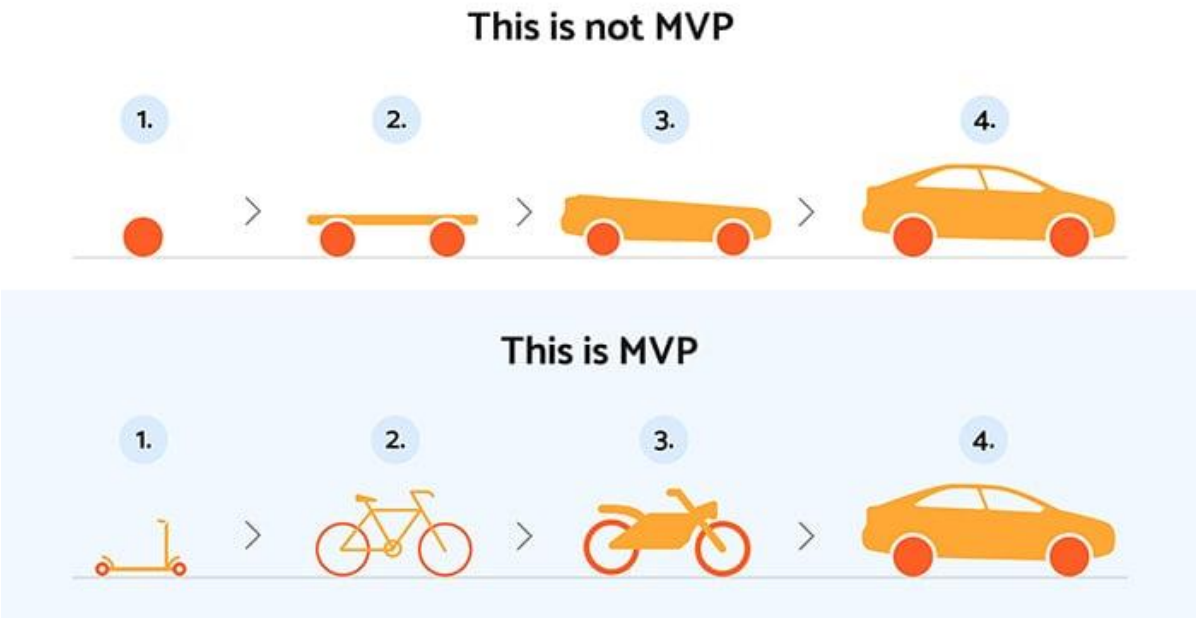
Revelations that digital consultants to the Trump campaign misused the data of millions of Facebook users set off a furor on both sides of the Atlantic. This is how The Times covered it.

Georgian

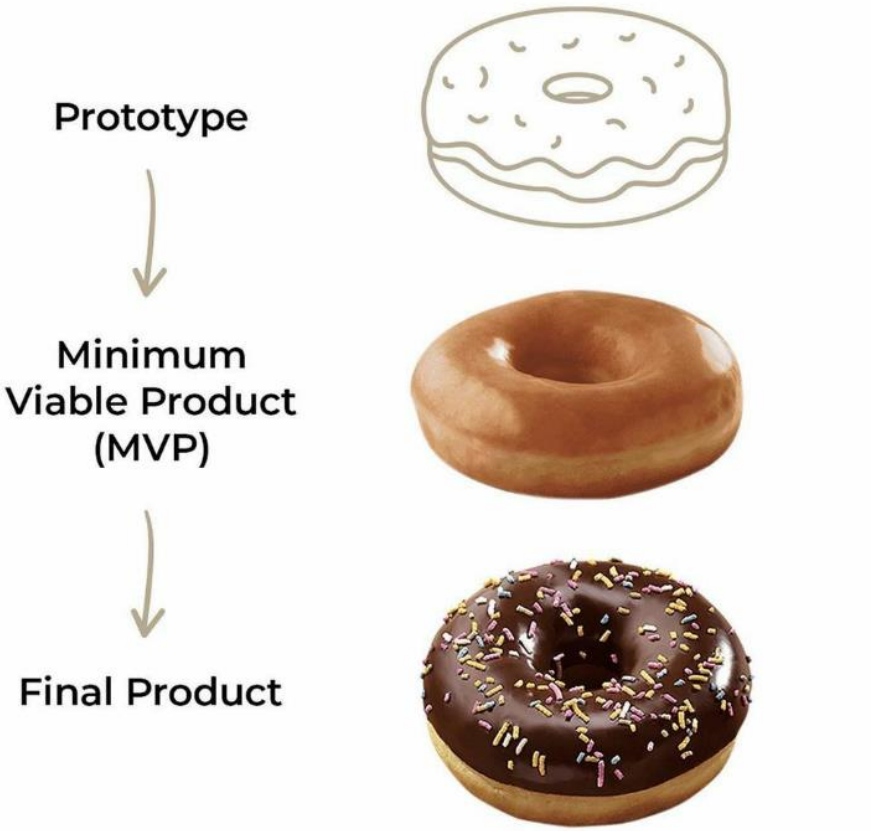
https://www.nytimes.com/2018/04/04/us/politics/cambridge-analytica-scandal-fallout.html

> Initial Concepts

Minimum Viable Product (MVP)

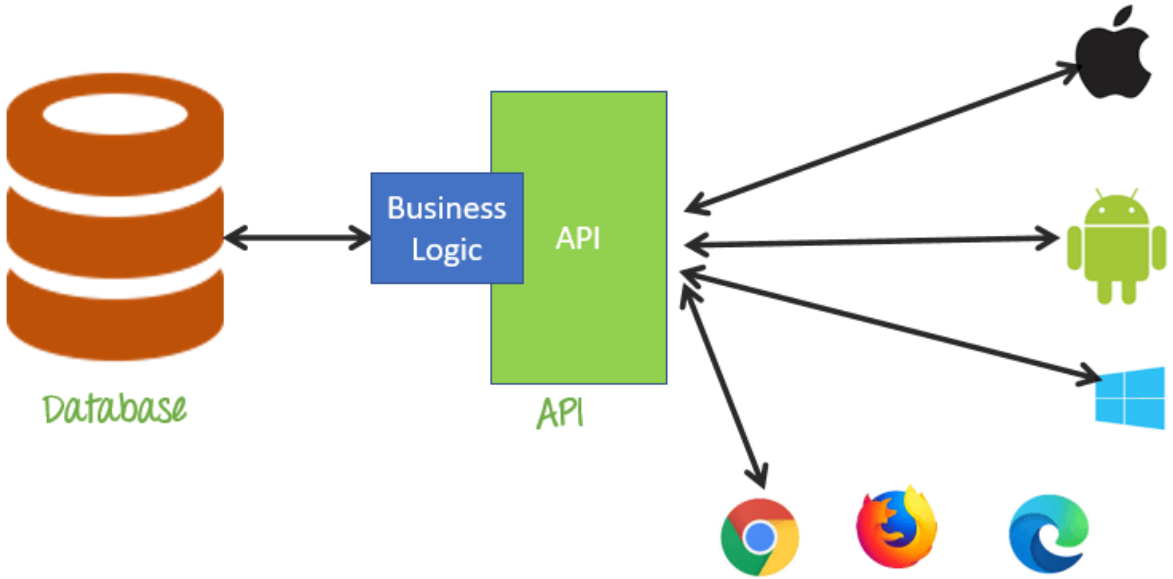


Minimum Viable Product (MVP)



> Initial Concepts

Application Programming Interface (API) – An application programming interface (API) is an interface that allows the user to access information from another service and integrate this service into their own application. Through a set of defined requests, the asking application is allowed to access limited pieces of the called upon application's functionality. APIs are used to share limited functionality between programs.
One example of an API is the Facebook share button on this page.



Cloud Backup – Cloud backup is the process of backing up data to a remote, cloud-based server.

Cloud Computing – Cloud computing is the delivery of information technology services over a network, usually the internet. In the cloud computing model, infrastructure, data, and software are hosted by the vendor and delivered to the user as a service, much like a utility company would deliver water or electricity.

https://solutionsreview.com/cloud-platforms/glossary/

EXAM

> Initial Concepts

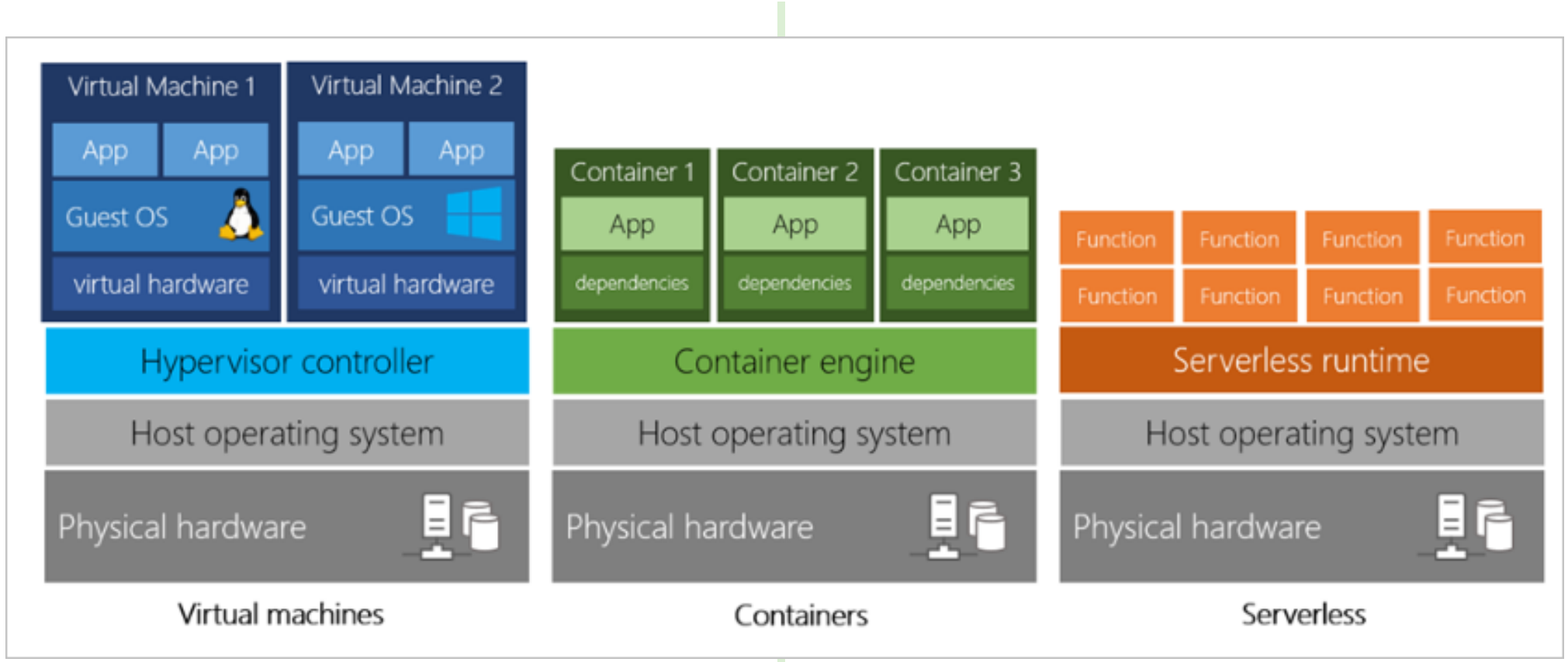
Virtual machine (VM) is an emulation of a computer just like your desktop or laptop you're using now. Each VM includes an operating system and hardware that appears to the user like a physical computer running Microsoft Windows or other operating systems such as Linux. You can then install whatever software you need to do the tasks you want to run in the cloud.
The difference is that you don't have to buy the hardware or install the operating system (OS). The cloud provider runs your virtual machine on a physical server in one of their datacenters, often sharing that server with other isolated and secure VMs. With the cloud, you can have a VM ready to go in minutes and at a cost less than a physical computer.

Containers provide a consistent, isolated execution environment for applications. They're like VMs, except they don't require a guest operating system. Instead, the application and all its dependencies are packaged into a container, and then an environment is used to execute the app. This configuration allows the container to start up in just a few seconds, because there's no OS to boot and initialize. You only need the app to launch.

Serverless computing lets you run application code without creating, configuring, or maintaining a server. The idea is that your application is broken into separate functions that run when triggered by some action. This configuration is ideal for automated tasks.
For example, you can build a serverless process that automatically sends an email confirmation after a customer makes an online purchase.
The serverless model differs from VMs and containers in that you only pay for the processing time used by each function as it executes. VMs and containers have costs while they're running, even if the applications on them are idle. The serverless architecture doesn't work for every application, but when the app logic can be separated into independent units, you can test and update the units separately, and launch them in microseconds, making this approach the fastest option for redeployment.

EXAM

> Initial Concepts



https://solutionsreview.com/cloud-platforms/glossary/

> Initial Concepts

Cloud Migration – Cloud migration is the process of transferring all of or a piece of a company's data, applications, and services from on-premise to the cloud.

Cloud Native – Applications developed specifically for cloud platforms.

Cloud Service Provider (CSP) – A Cloud Service Provider (CSP) is a company that offers a cloud computing service, such as PaaS, IaaS, or SaaS, to individuals or other businesses.

Cloud Storage – Cloud storage is a model of computer storage in which data is stored in facilities (often multiple facilities) managed by a hosting company (cloud service provider) and is accessed remotely by the user via a network.

Customer Relationship Management (CRM) – Customer Relationship Management (CRM) applications allow a business to manage relationships with current and future customers by providing the business with tools to manage sales, customer service, and technical support roles. SaaS CRM applications, such as Salesforce.com, are very popular.

Data Migration – The process of moving data between two or more storage systems, data formats, warehouses or servers.

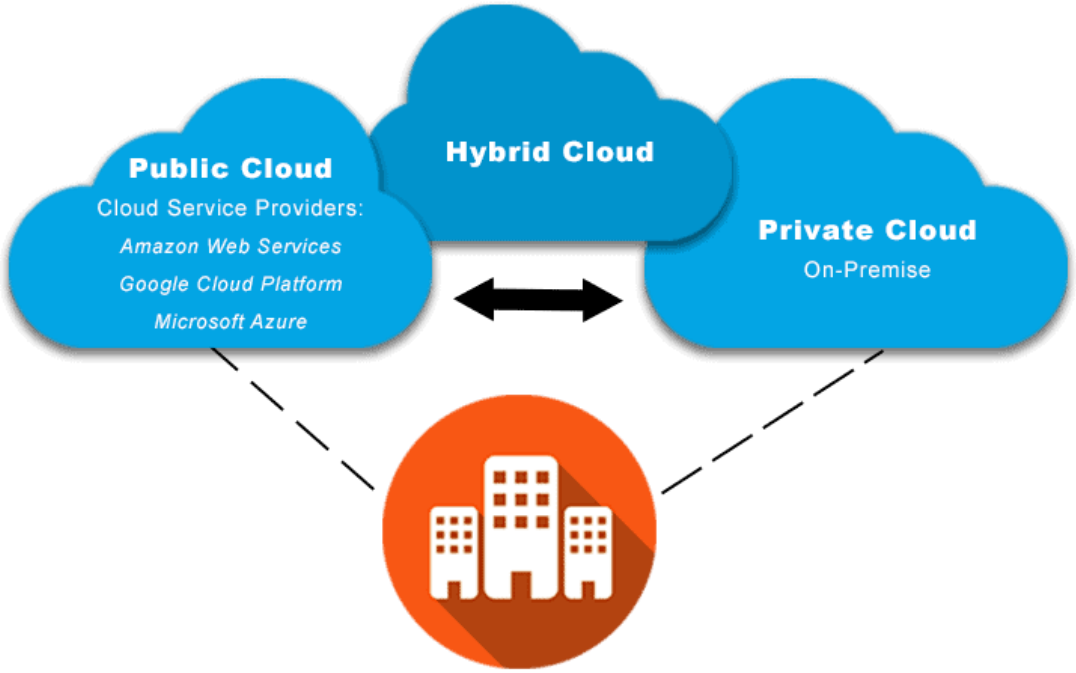
DevOps – An amalgamation of "development" and "operations," DevOps is the combination of tasks performed by an organization's applications development and systems operations teams. The DevOps software development method emphasizes collaboration, communication and integration between developers and other IT personnel with the goal of streamlining software development and quality assurance.

> Initial Concepts

Enterprise Application – An enterprise application is an application (or software) that is intended for large scale use by a (large) business.

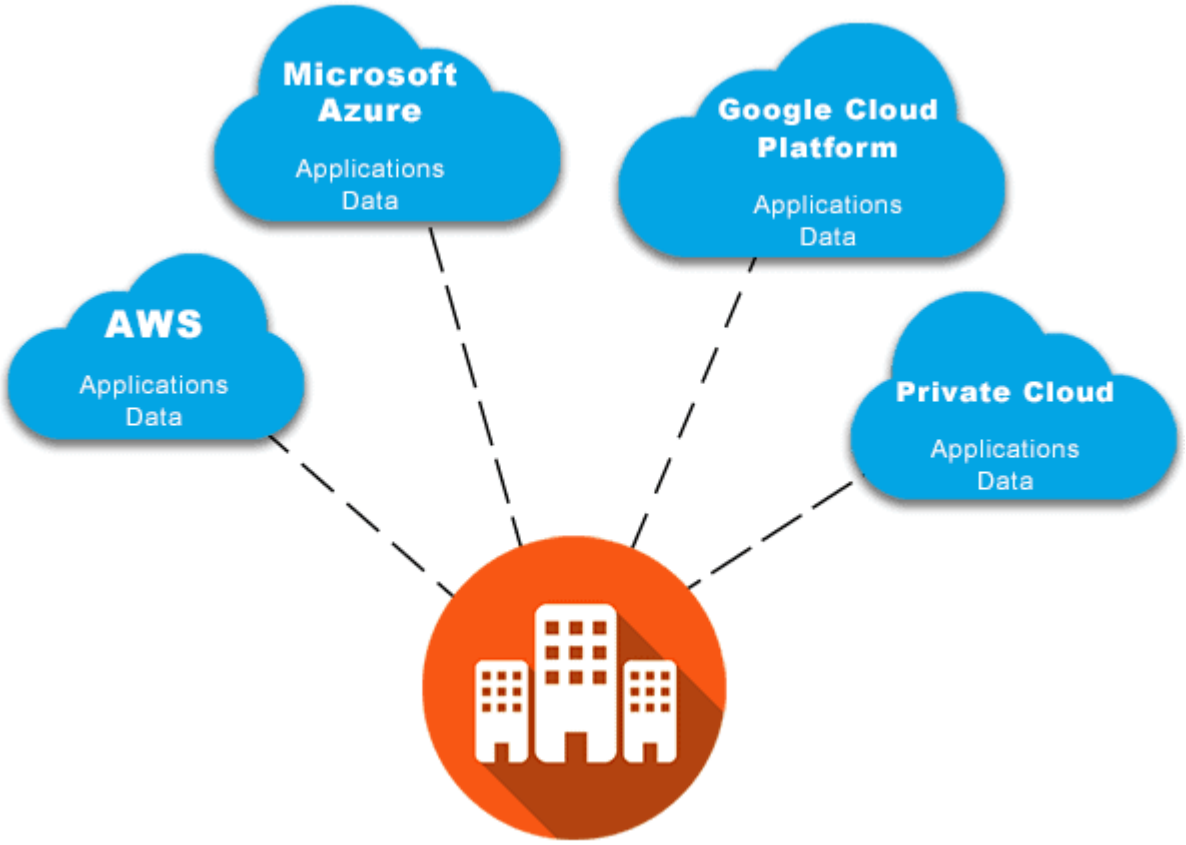
Hybrid Cloud – A hybrid cloud is a cloud computing environment that is comprised of a mix of private cloud, public cloud, and on-premises solutions. In a hybrid cloud, private and public cloud infrastructures remain distinct from one another but are bound together by technology that allows data and services portability between them.

Integrated Development environment (IDE) – An integrated development environment (IDE) is an application that provides a programming environment for developers. An IDE typically includes a code editor, automation tools, and a debugger.



https://solutionsreview.com/cloud-platforms/glossary/

> Initial Concepts



Load Balancing – The process of distributing computing workloads across multiple resources, such as servers. In cloud computing, a load balancer acts as a reverse proxy and distributes application traffic to multiple servers in order to prevent any single application server from becoming a point of failure.

Multi-Cloud – A multi-cloud strategy is the concurrent use of separate cloud service providers for different infrastructure, platform, or software needs. A multi-cloud approach can help prevent vendor lock-in and may help an enterprise deal with diverse workloads and partners.

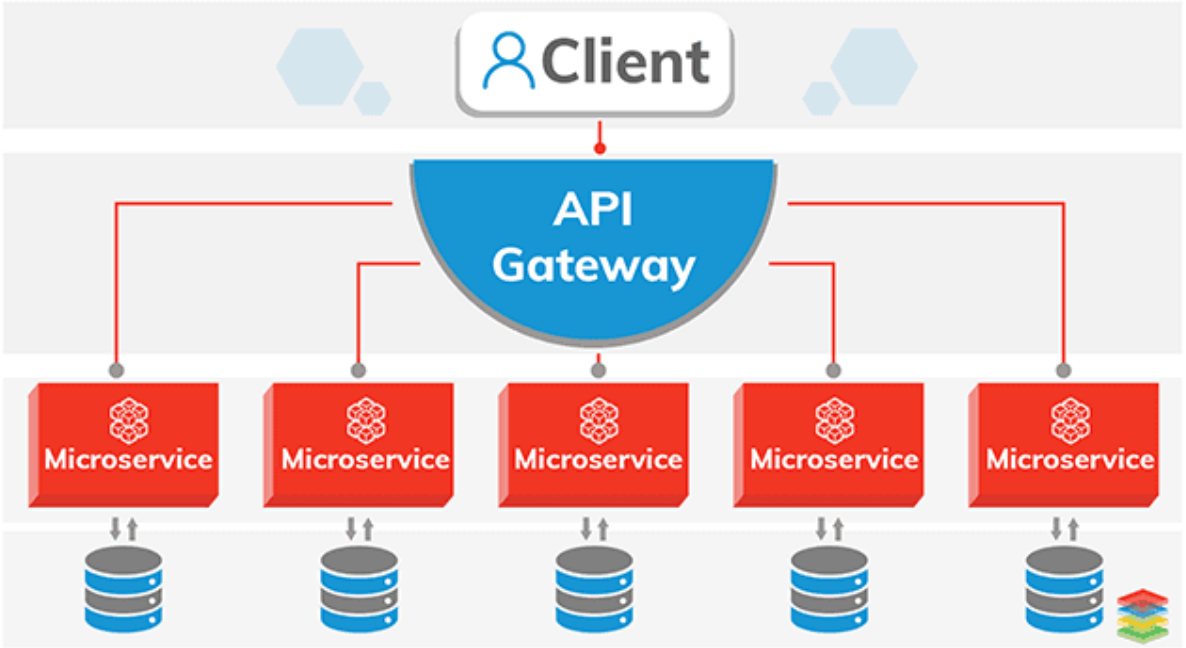
However, a multi-cloud approach can complicate many processes, such as security and governance, and a Cloud management platform is recommended for this approach.

https://solutionsreview.com/cloud-platforms/glossary/

> Initial Concepts

Microservices – or microservice architecture is a way of designing applications in which complex applications are built out of a suite of small, independently deployable services. These ‘microservices’ run their own processes and communicate with one another using lightweight mechanisms such as language-agnostic APIs.

Microservices are independently deployable and scalable and can even be written in different languages.



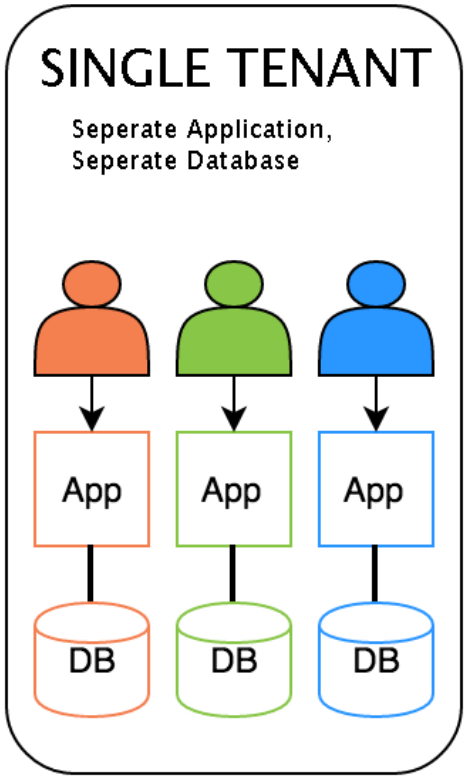
> Initial Concepts

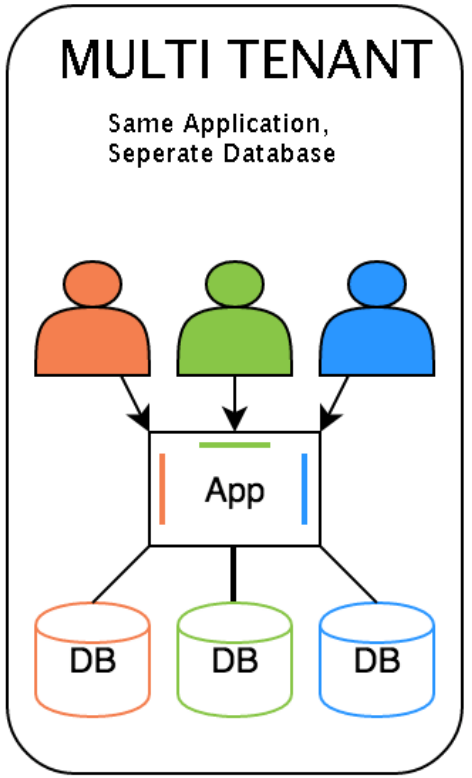
Multi-Tenancy – Multi-Tenancy is a mode of operation for software in which multiple instances of one or many applications run in a shared environment. In a cloud computing model, pooled physical and virtual resources are dynamically assigned and reassigned to tenants according to consumer demand.

Private Cloud – A private cloud is a cloud infrastructure that is provisioned for use by a single organization comprised of multiple users. A private cloud cab managed and operated by the organization, a third party, or some combination of them, and it can exist on or off premises.

Public Cloud – A public cloud is a cloud infrastructure that is hosted by cloud services provider and is made available to the public via the internet.

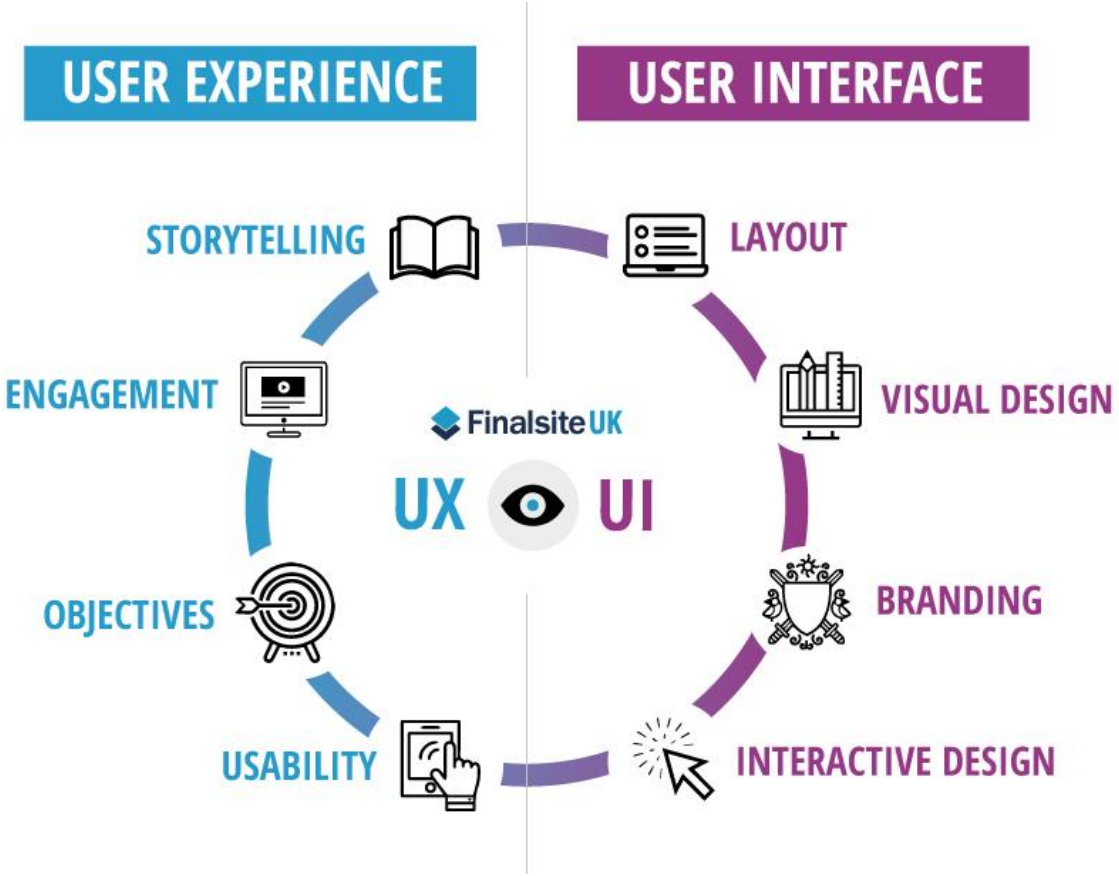
Scalability – Scalability is the ability of a process, system, or framework to handle a growing workload. In other words, a scalable system is adaptable to increasing demands.
The ability to scale on demand is one of the biggest advantages of cloud computing.





https://solutionsreview.com/cloud-platforms/glossary/

> Initial Concepts



Service Level Agreement (SLA) – A service level agreement (SLA) is a contractual agreement between a customer and a cloud service provider (CSP) which defines the level of service, availability and performance guaranteed by the CSP.

User Interface (UI) – User interface (UI) is the way that the user and computer system interact.

User Experience (UX) –The nature of a user's interaction with and perception of a system.

Vertical Cloud – A vertical cloud is a cloud computing solutions that is built or optimized for a specific business vertical such as manufacturing, financial services, or healthcare.

https://solutionsreview.com/cloud-platforms/glossary/

Latency

EXAM

> Latency

https://youtu.be/H6E5wT9je6A

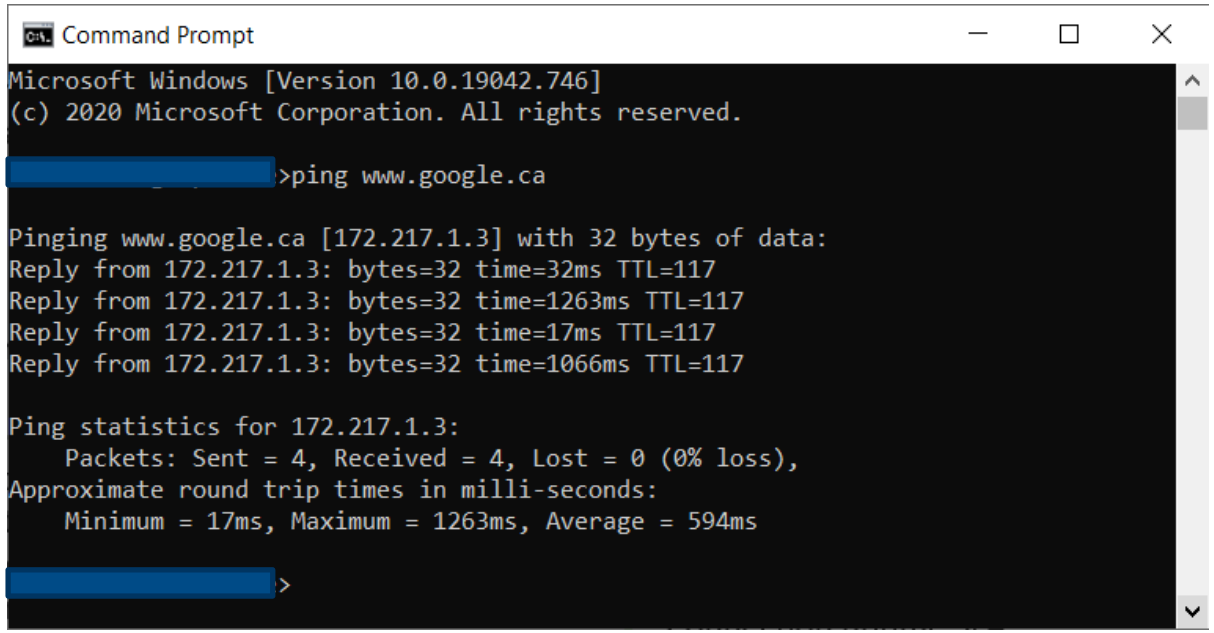
Latency is the delay between a user's action and a web application's response to that action, often referred to in networking terms as the total round-trip time it takes for a data packet to travel.

Key Takeaways

Latency is the time it takes for a data packet to travel from the sender to the receiver and back to the sender.

High latency can bottleneck a network, reducing its performance.

You can make your web applications less latent by using a CDN and a private network backbone to transfer data.



Here you can see the result of pinging www.google.ca.

The statistics show that the average time it takes for a roundtrip between the given PC and Google's network is 594ms.

https://blog.stackpath.com/latency/

EXAM

> Latency | How to reduce latency?

https://youtu.be/H6E5wT9je6A

Azure provides some resources to reduce latency for Virtual Machines as listed below

- Accelerated networking
- Receive Side Scaling
- Proximity Placement Groups

https://azure.microsoft.com/en-ca/resources/videos/azure-friday-how-to-reduce-inter-vm-latency-with-proximity-placement-groups/

Near Real Time & RT

Real-time analytics

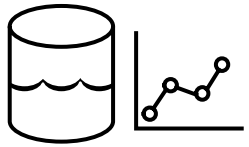
Deals with streams of data that are captured in real-time and processed with minimal latency to generate real-time (or near-real-time) reports or automated responses.

Modern data warehousing

"We want to integrate all our data—including Big Data—with our data warehouse"

Advanced analytics

"We're trying to predict when our customers churn"



Real-time analytics

"We're trying to get insights from our devices in real-time"

Streaming Use Cases

Retail

CONSUMER ENGAGEMENT

Real-time Pricing Optimization

- Demand-Elasticity
- Personal Pricing Schemes
- Promotion events
- Multi-channel engagement

Financial

RISK AND REVENUE MANAGEMENT

Risk and Fraud, Threat Detection

- Real-time anomaly detection
- Card Monitoring and Fraud Detection
- Risk Aggregation

Oil/Gas & Energy

GRID OPS, ASSET OPTIMIZATION

Industrial IoT

- Preventive Maintenance
- Smart Grids and Microgrids
- Asset performance as a Service
- UAV image analysis

Security

ACTIONABLE THREAT INTELLIGENCE

Security Intelligence

- Real-time firewall, network, and auth log correlation
- Anomaly detection
- Security context, enrichment
- Security Orchestration

Healthcare

SENSOR DATA

IoT DEVICE ANALYTICS

- Aggregation of streaming events
- Predictive Maintenance
- Anomaly Detection

Advertising

RECOMMENDATION ENGINE

Next Best and Personalized Offers

- Right product, promotion, at right time
- Real time Ad bidding platform
- Personalized Ad Targeting

Media Entertainment

CONSUMER ENGAGEMENT ANALYSIS

Sentiment Analysis

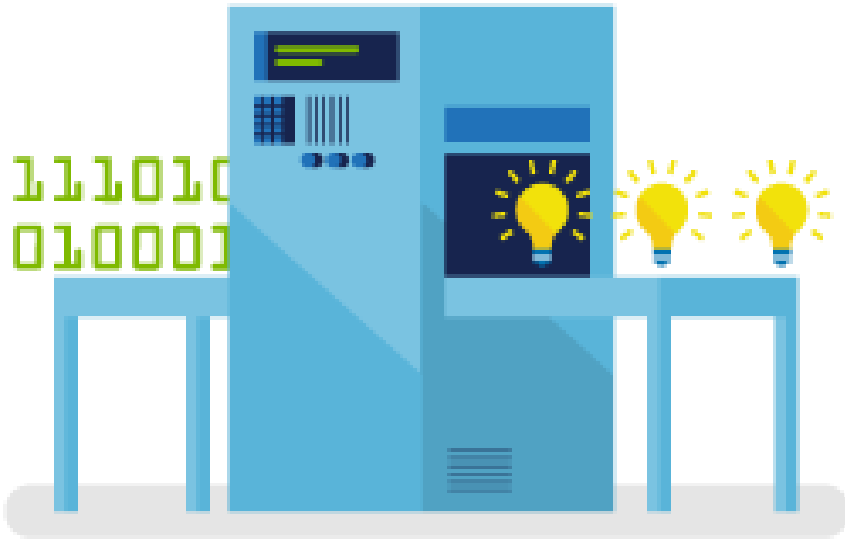
- Demand-Elasticity
- Social Network Analysis
- Promotion events
- Multi-channel Attribution

And Much More!

Unlocking Real-time Insights

Time to Insight is Critical

Reducing decision latency can unlock business value



Insights are Perishable

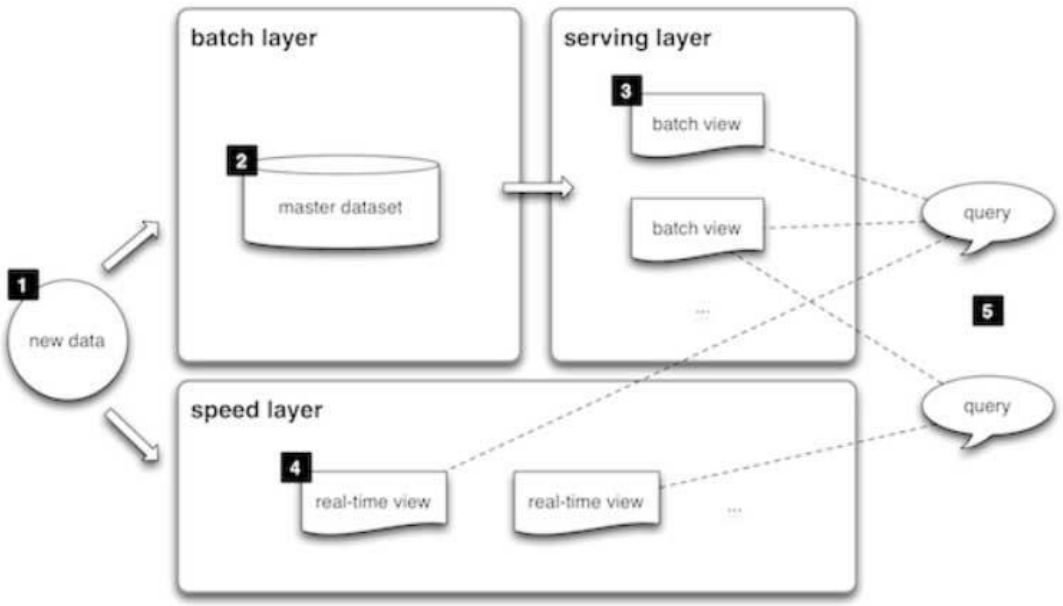
Window of opportunity for insights to be actionable

Ask Questions to Data in Motion

Can’t wait for data to get to rest before running computation

EXAM

> Lambda Architecture



Lambda architecture is a way of processing massive quantities of data that provides access to batch-processing and stream-processing methods with a hybrid approach.

Lambda architecture is used to solve the problem of computing arbitrary functions. The lambda architecture itself is composed of 3 layers:

- Batch Layer
- Serving Layer
- Speed Layer (Stream Layer)

https://databricks.com/glossary/lambda-architecture#

EXAM

> Lambda Architecture

Batch Layer

New data comes continuously, as a feed to the data system. It gets fed to the batch layer and the speed layer simultaneously. It looks at all the data at once and eventually corrects the data in the stream layer. Here we can find lots of ETL and a traditional data warehouse. This layer is built using a predefined schedule, usually once or twice a day. The batch layer has two very important functions:

- To manage the master dataset
- To pre-compute the batch views.

Serving Layer

The outputs from the batch layer in the form of batch views and those coming from the speed layer in the form of near real-time views get forwarded to the serving. This layer indexes the batch views so that they can be queried in low-latency on an ad-hoc basis.

Speed Layer (Stream Layer)

This layer handles the data that are not already delivered in the batch view due to the latency of the batch layer. In addition, it only deals with recent data in order to provide a complete view of the data to the user by creating real-time views.

https://databricks.com/glossary/lambda-architecture#

EXAM

> Lambda Architecture | Benefits

https://youtu.be/FePv0lro0z8

Benefits of lambda architectures

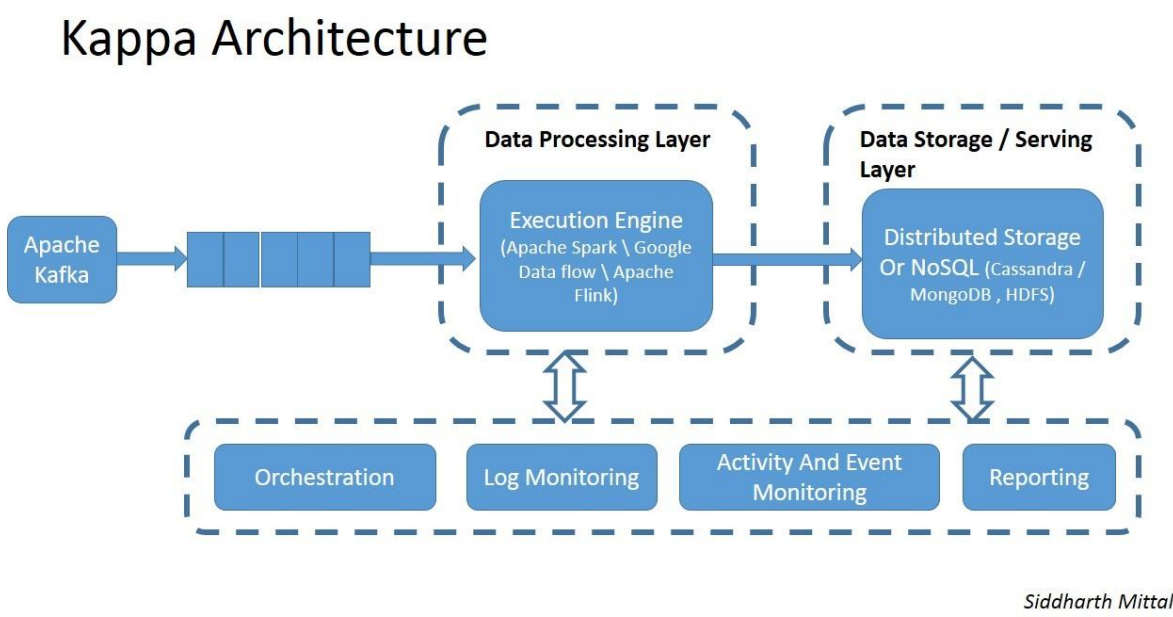
Here are the main benefits of lambda architectures:
No Server Management – you do not have to install, maintain, or administer any software.
Flexible Scaling – your application can be either automatically scaled or scaled by the adjustment of its capacity
Automated High Availability – refers to the fact that serverless applications have already built-in availability and faults tolerance. It represents a guarantee that all requests will get a response about whether they were successful or not.
Business Agility – React in real-time to changing business/market scenarios

Challenges with lambda architectures

Complexity – lambda architectures can be highly complex. Administrators must typically maintain two separate code bases for batch and streaming layers, which can make debugging difficult.

https://databricks.com/glossary/lambda-architecture#

> Kappa Architecture



Kappa Architecture is a simplification of Lambda Architecture. A Kappa Architecture system is like a Lambda Architecture system with the **batch processing system** removed. To replace batch processing, data is simply fed through the streaming system quickly.

Kappa Architecture revolutionizes database migrations and reorganizations: just delete your serving layer database and populate a new copy from the canonical store! Since there is no batch processing layer, only one set of code needs to be maintained.

https://databricks.com/glossary/lambda-architecture#

Data Centers

> Data Centers

Microsoft - The foundation to the cloud:

Building the world’s computer with Microsoft Datacenters
https://youtu.be/9nLD7bc5O1g

Why Microsoft Has Underwater Data Centers
https://youtu.be/LmfvUiJ6tB8

Google Data Center

https://youtu.be/kd33UVZhnAA

Switch

Inside The World's Largest Data Center
https://youtu.be/g7JaN3rTK2A

> 2021 Trends…

MLOps Will Become Even More Critical

Teams Will Need to Infuse Agility Amidst a Post-Pandemic Environment

Companies Are Implementing True Self-Service Analytics Initiatives (and Will Continue to)

Cloud Architecture as the New Normal

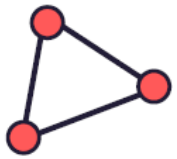
Organizations Will Shift From "What Is Responsible AI?" to "How Can We Implement Responsible AI?"

Democratized Data Quality Will Play a Key Role in Data 4.0

The Continued Rise of Edge Computing (and Why It Matters to the Enterprise)

Diversity, Equity, and Inclusion (DEI) Will Take the Spotlight for Organizations in Pursuit of AI

> 2021 Trends | Conclusions



Commitment to the democratization of data throughout the enterprise (and, in turn, tools that are responsible, governable, and free of unintended bias)

Streamlined implementation and processes (automating and reusing whenever possible)

Having a centralized repository for all data efforts, accelerating insight extraction

Continuing to bridge technical and domain expertise, in order to rally the entire organization around the common goal of faster data-driven insights

Inserting agility and elasticity to easily monitor and adjust models as needed in times of economic flux

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END OF DAY 2