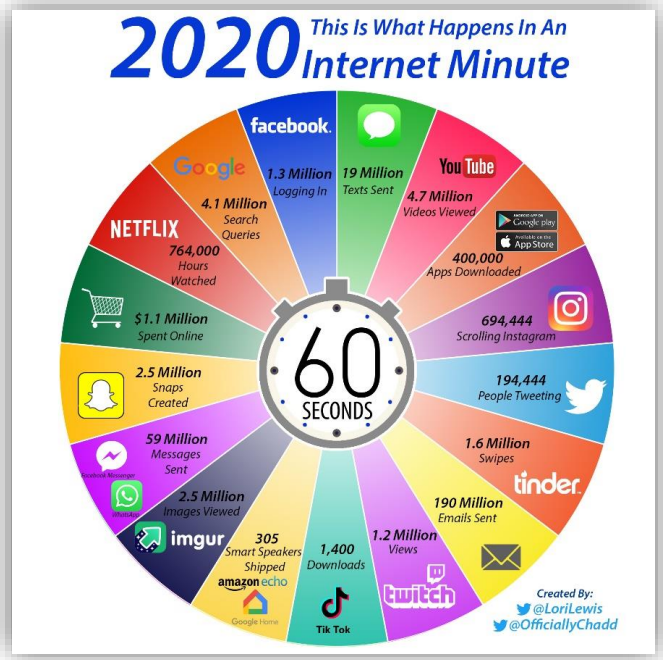
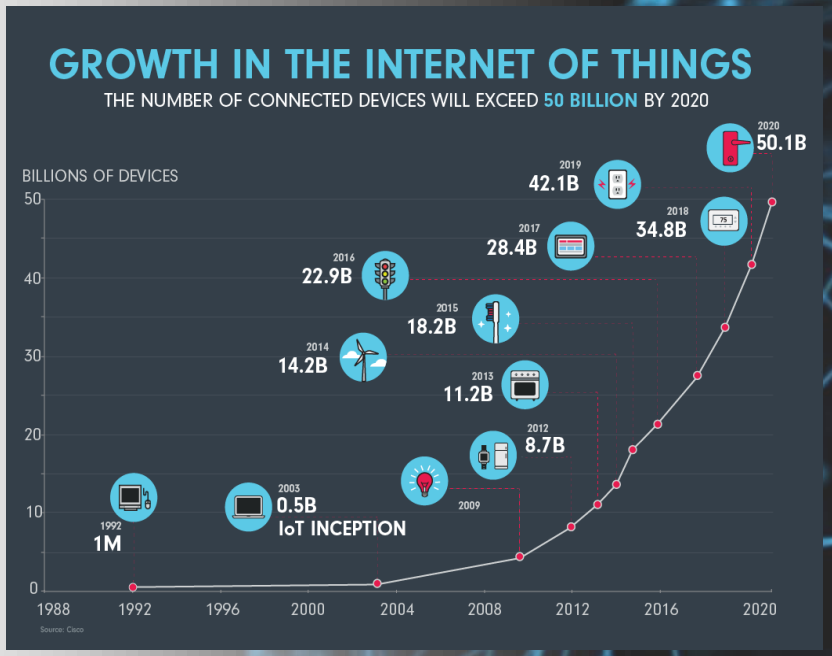
Where Big Data Analytics meets Edge Computing

The Next Big Thing in Big Data: Edge Intelligence

By: Feras Awaysheh, PhD

How Big is our “Data” and Where is it coming from?





Growth and success in one area will promote growth and success in the other area as well!

But still!!

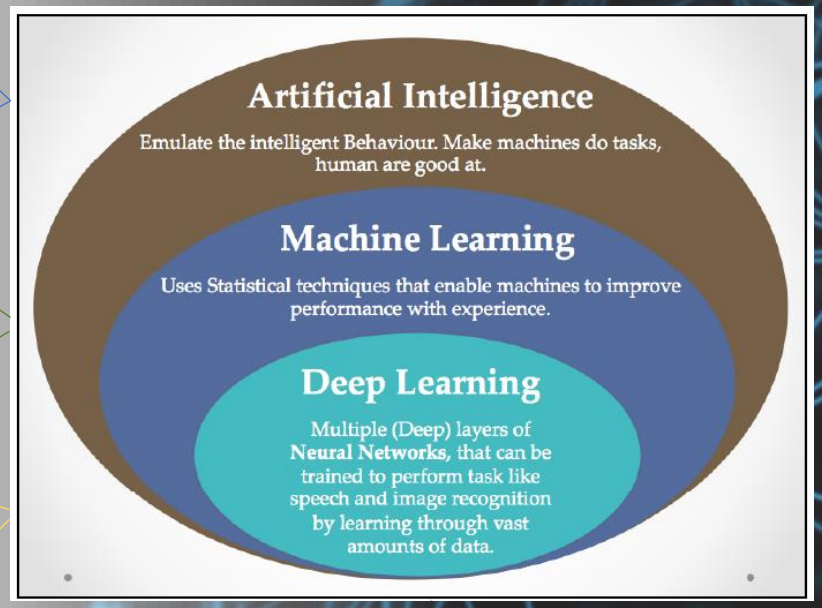
It is a Data Era

Data systems lives and dies by their data

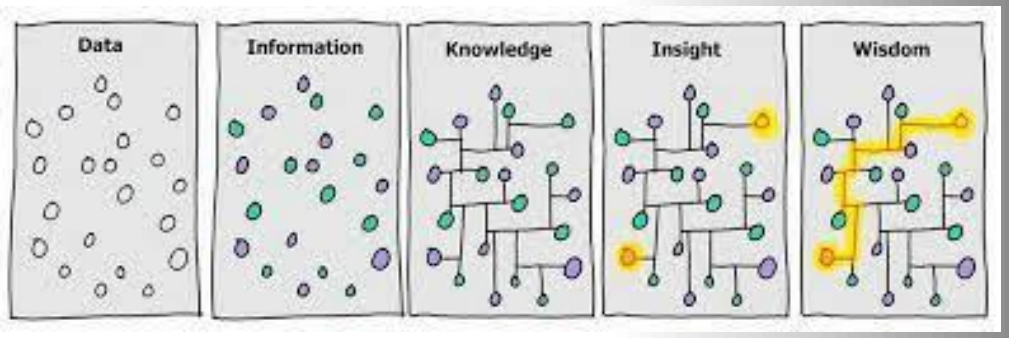
The more data you have the more powerful your data system

Intelligence is a freedom of choice

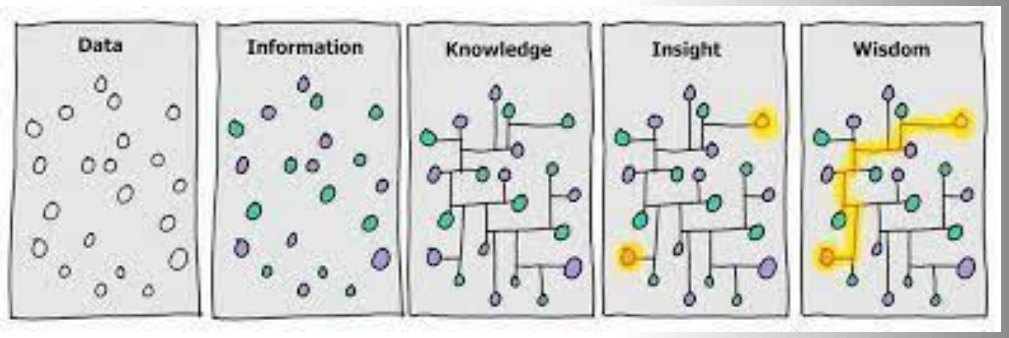
- **Smart Vehicles**
- **Smart Home/city**
- **IIoT**

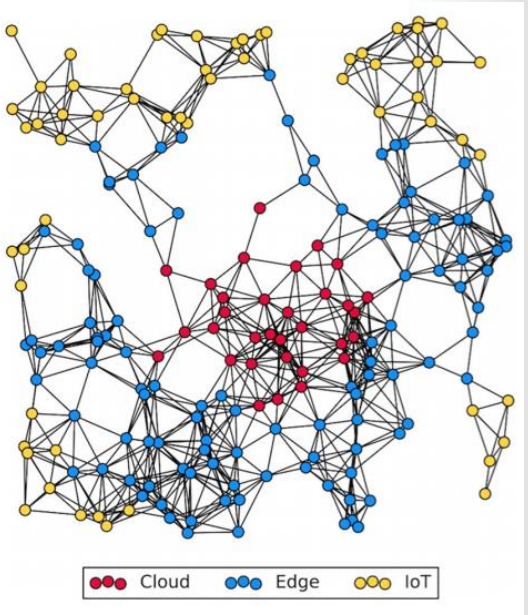


The art of Data



The art of Data

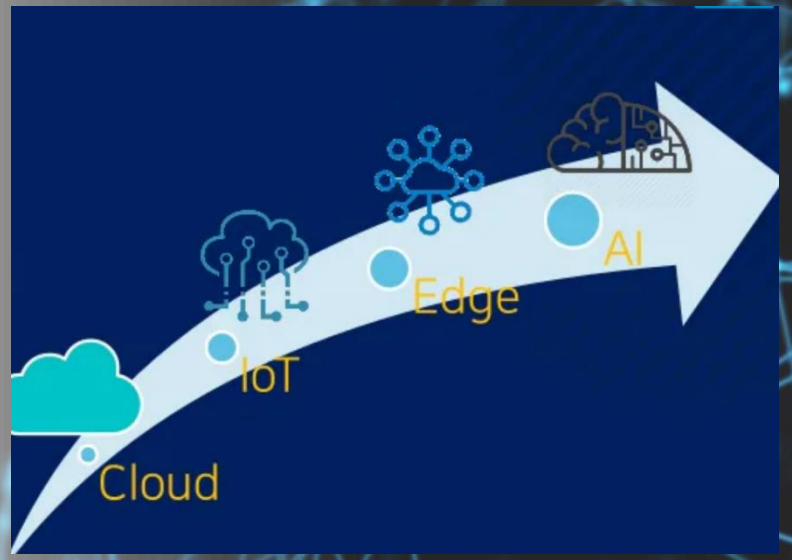




Edge Computing

The goal: Unleash services (Data Analytics) to the network Edge

- Connect everything and everyone at anytime
- Highly dependent on fast & smart analytics
- People will become less involved in decision-making over time → **AI era!**
- Up to 40% of IoT applications would rely on local data analytics (Edge/Fog/IoT) [1]
- satisfy the requirements of time-critical applications, e.g., autonomous driving,
- Keep data movement to a minimum, i.e., privacy



Edge Intelligence came into being

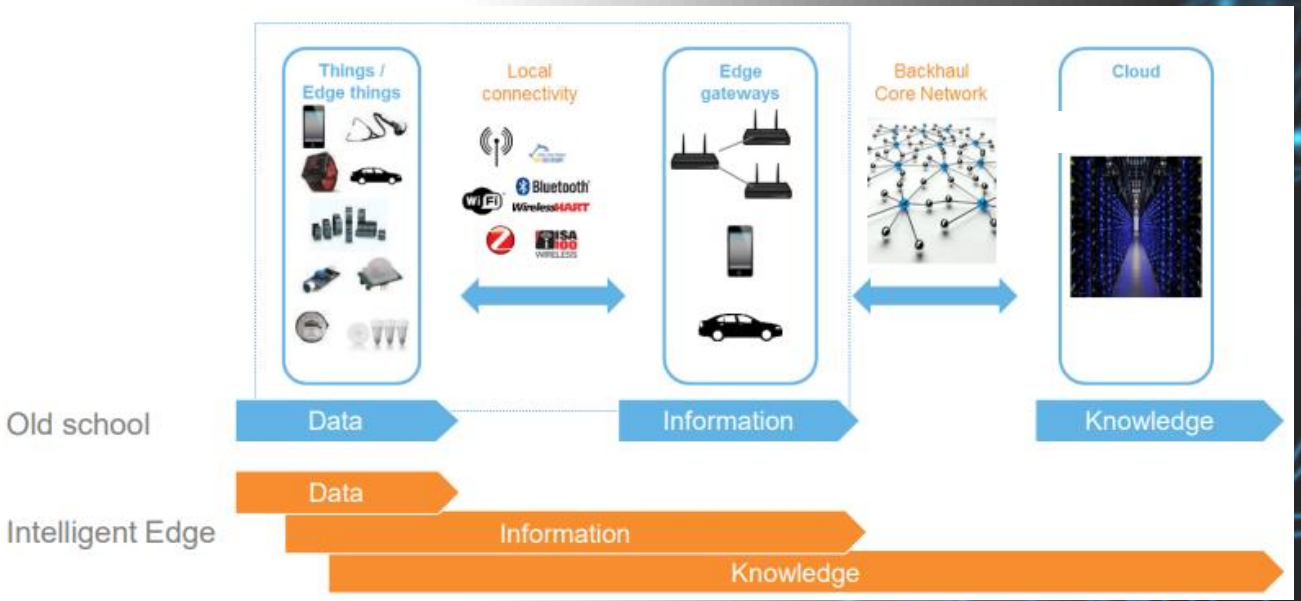
Edge Intelligence

Definition:

A set of connected systems and devices for data collection, caching, processing, and analysis proximity to where data is captured based on artificial intelligence [1].

- *It is about making decisions, in the right place and right time in time.*

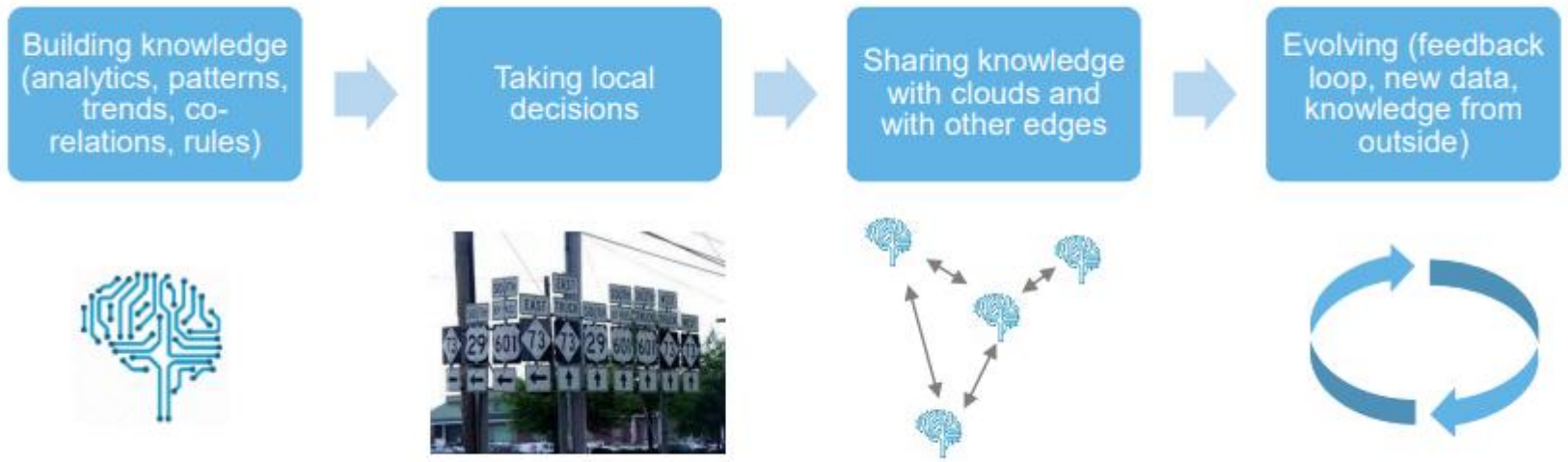
Edge Intelligence



Because we can! Not enough:

- Proximity to the source of data
- Lower latency - speedup of decision making time
- Reduced global bandwidth
- Local context, local security
- Ownership of data, privacy protection

Handling Data at the Edge



Although recently emerged, spanning the period from 2011 to now, this field of research has shown explosive growth over the past five years.

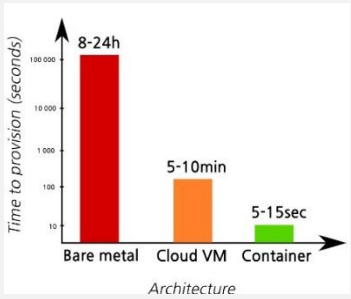
Associated Technologies

- NFV: accelerate service deployment for network operators and reduce cost by separating functions of the infrastructure
- SDN: dynamic and programmatically efficient network configuration
- Both fields market share > 70 Billion by 2025

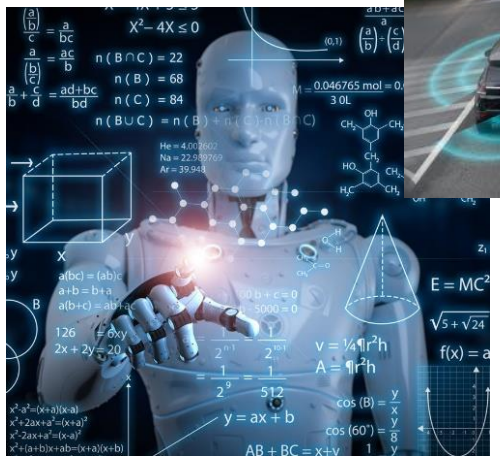
- Communication efficiency
- Global 5G Stand-alone infrastructure market will exceed $94B by 2025
- B5G will be a boon for neutral host providers as well as micro-operator service providers

docker

- Lightweight virtualization run jobs inside Linux containers
- Easy to deploy with an open-source project
- Resource capping and isolation, workloads don’t interfere with operational applications

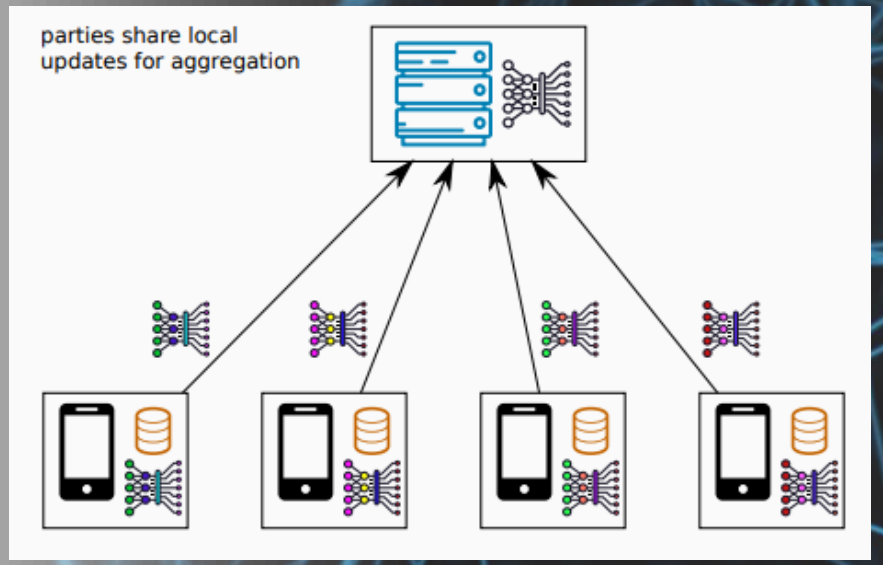


EI Applications



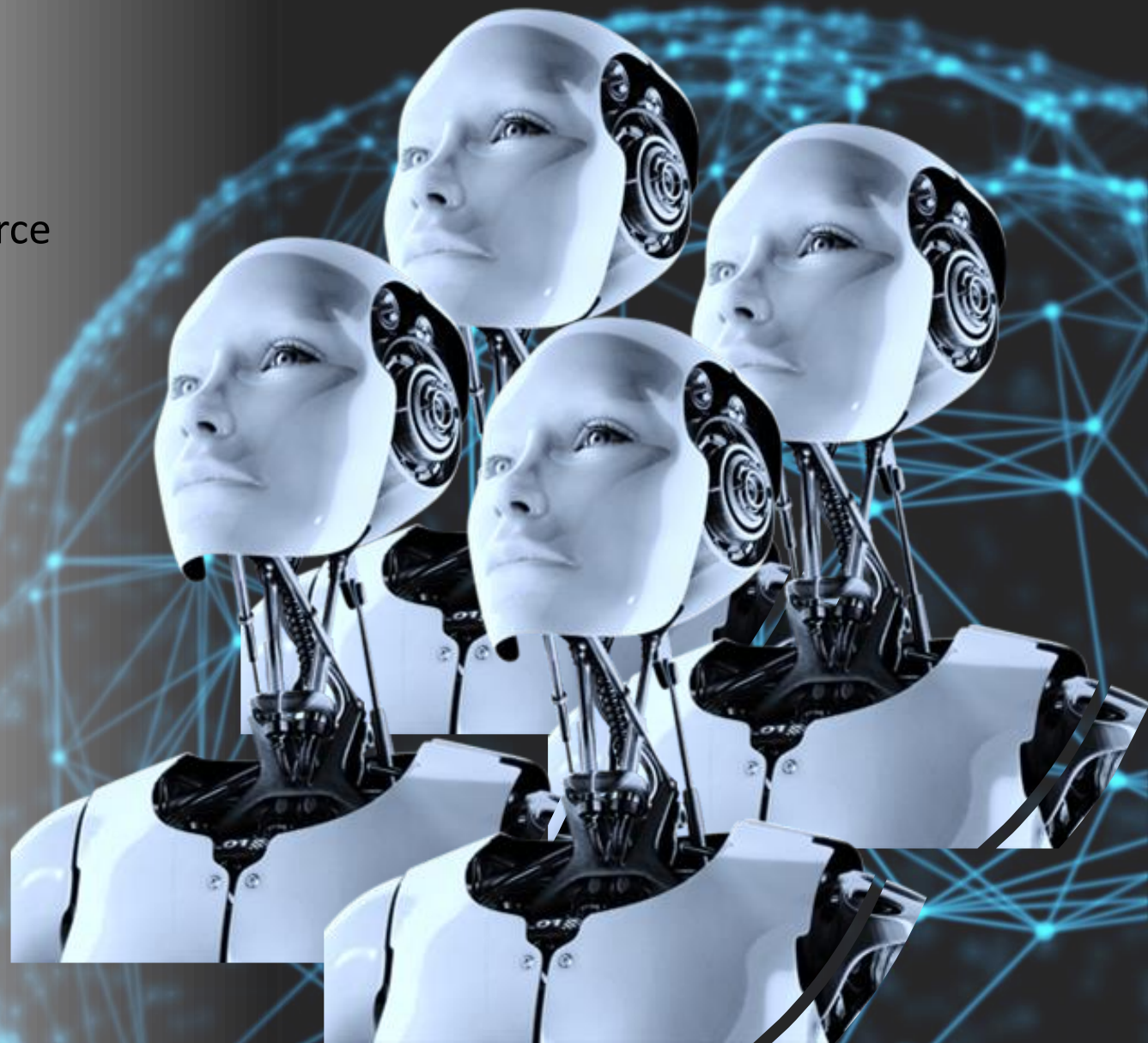
Federated Learning: a star is born

- FL enables multiple actors to build a common, robust, and distributed ML model without sharing data,
- Thus allowing to address critical issues such as data privacy, data security, data access rights and access to heterogeneous data.
- A recent trend in data analytics



Wrap up

- Data processing and analysis close to the source is critical,
- Especially when privacy, time or transmission matters
- AI is key to handle, classify and analyze big flows of data
- Decentralize is the next big thing in big data
- The benefits of edge intelligence are obvious,
- It paves the way for the last mile of AI and to provide high-efficient intelligent services and lessens the dependency on a central cloud



Thank you for you listening!

Happy to have your questions

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References

[1] **Awaysheh**, Feras M., et al. "Big Data Resource Management & Networks: Taxonomy, Survey, and Future Directions." IEEE Communications Surveys & Tutorials (2021).

[2] Kebande, Victor, F. **Awaysheh** et al. "Active Machine Learning Adversarial Attack Detection in the User Feedback Process." IEEE Access 9 (2021): 36908-36923..

[3] **Awaysheh**, Feras M., et al. "Security by Design for Big Data Frameworks Over Cloud Computing." IEEE Transactions on Engineering Management (2021).

[4] **Awaysheh**, F. et. Al. (2020). TrustE-VC: Trustworthy evaluation framework for industrial connected vehicles in the cloud. IEEE Transactions on Industrial Informatics, 16(9), 6203-6213.

[5] **Awaysheh**, Feras, et al. "Big data security frameworks meet the intelligent transportation systems trust challenges." 2019 18th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/13th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE). IEEE, 2019.

[6] **Awaysheh**, Feras. From the Cloud to the Edge Towards a Distributed and Light Weight Secure Big Data Pipelines for IoT Applications. CRC book chapter (In press).

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