Standards and good practices in IoT

Outline

1. IoT overview
2. IoT data transfer standards
3. IoT data transfer formats
4. IoT data storage standards
5. Good practices in IoT
6. Legal considerations
7. IoT standards development

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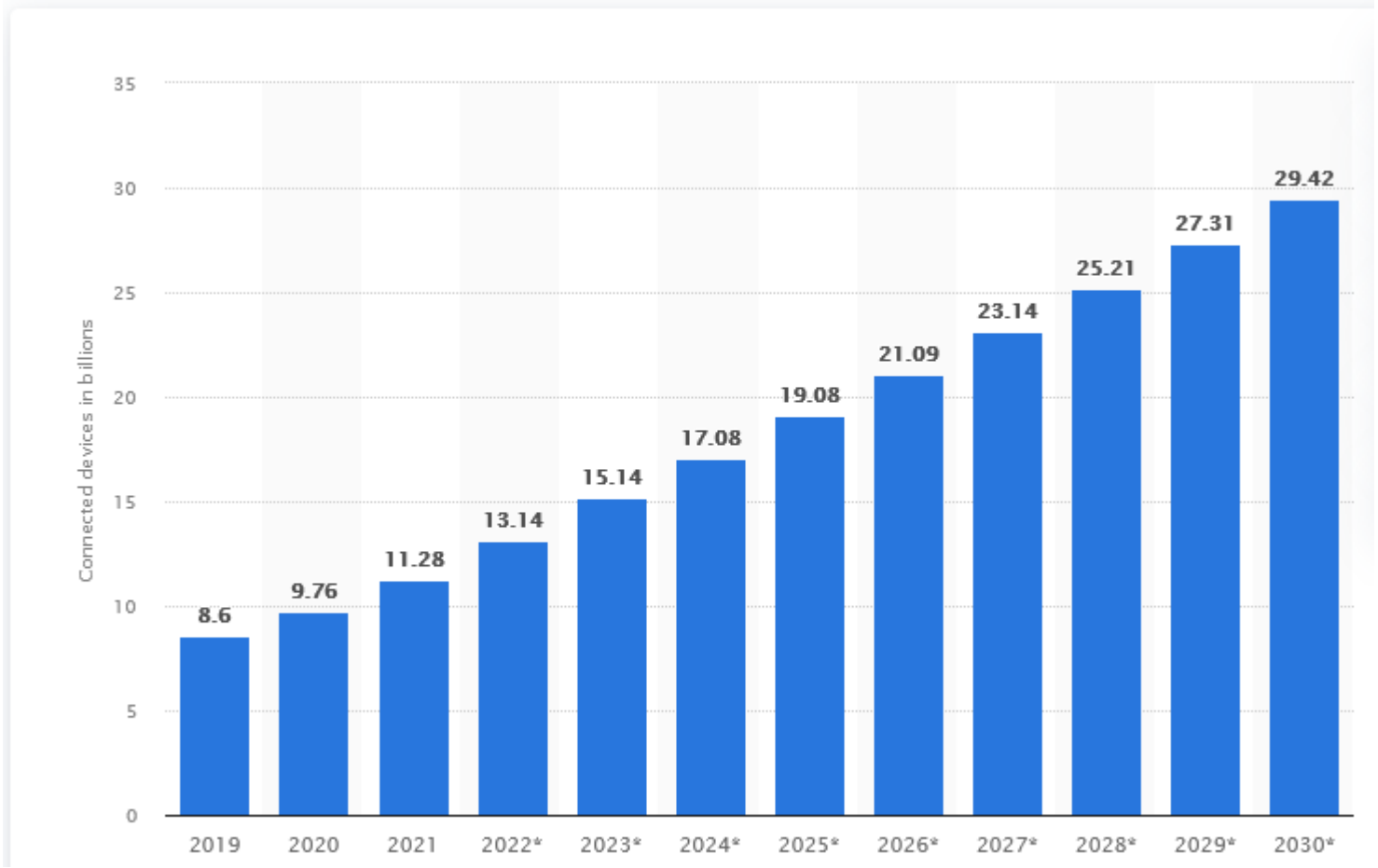
Introduction

http://dlearn.eu

Introduction



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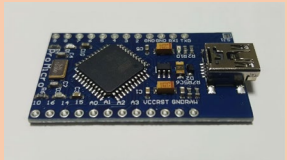
IoT overview

Sensors
Actuators

renke

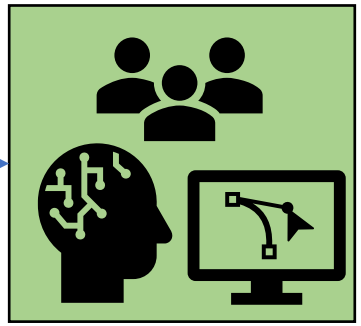
IoT device



All3dp

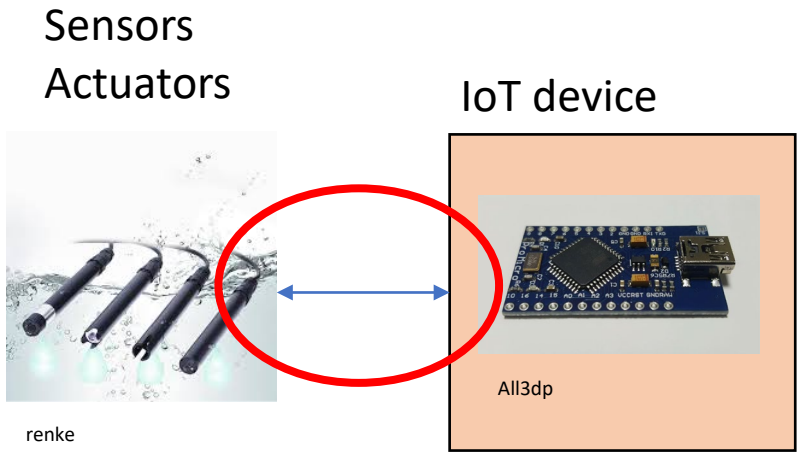
Database
Data handler

Users
ML



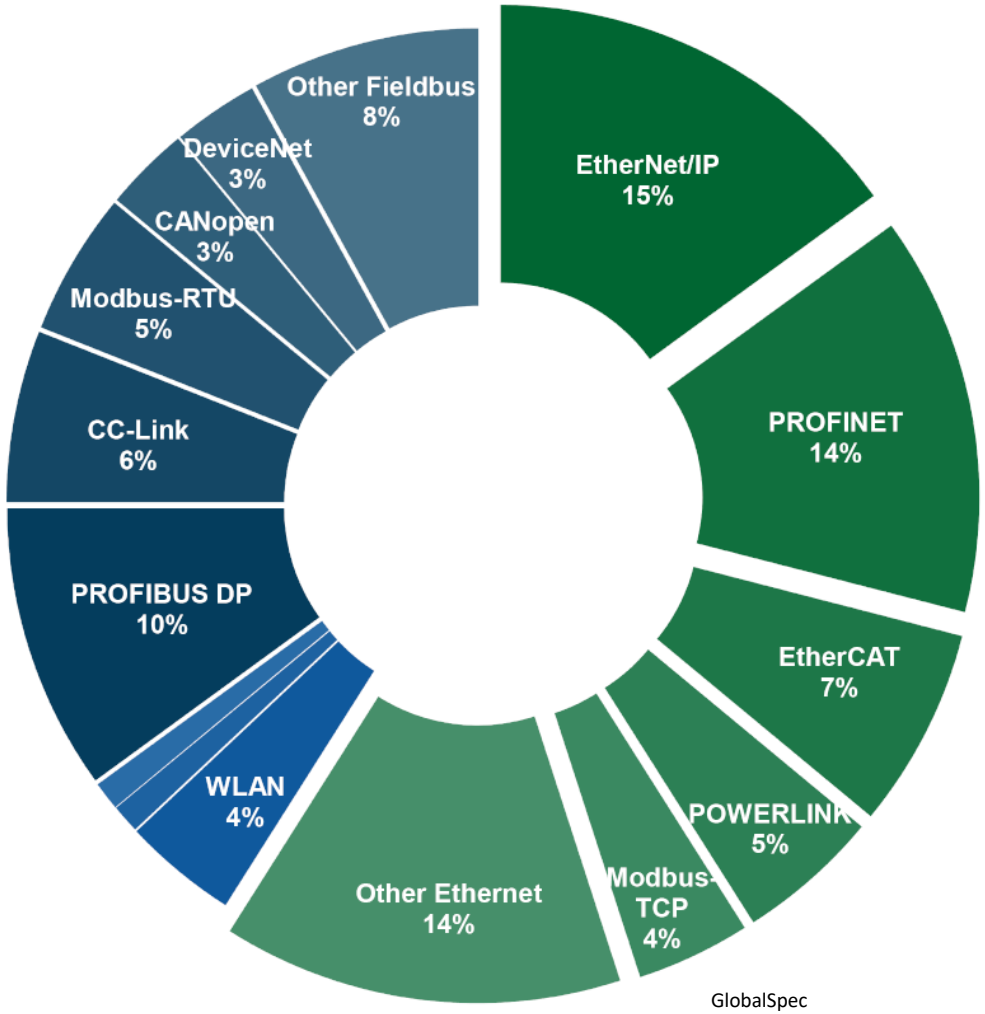
IoT data transfer standards (sensor/actuator)

- Connection between sensors/actuators is often wired, but wireless technologies can also be used.
- Will mostly be dependent on the sensor/actuator supplier



IoT data transfer standards (sensor/actuator)

- Ethernet/IP
- PROFINET
- Modbus
- TDI
- Serial
- Ethernet



GlobalSpec

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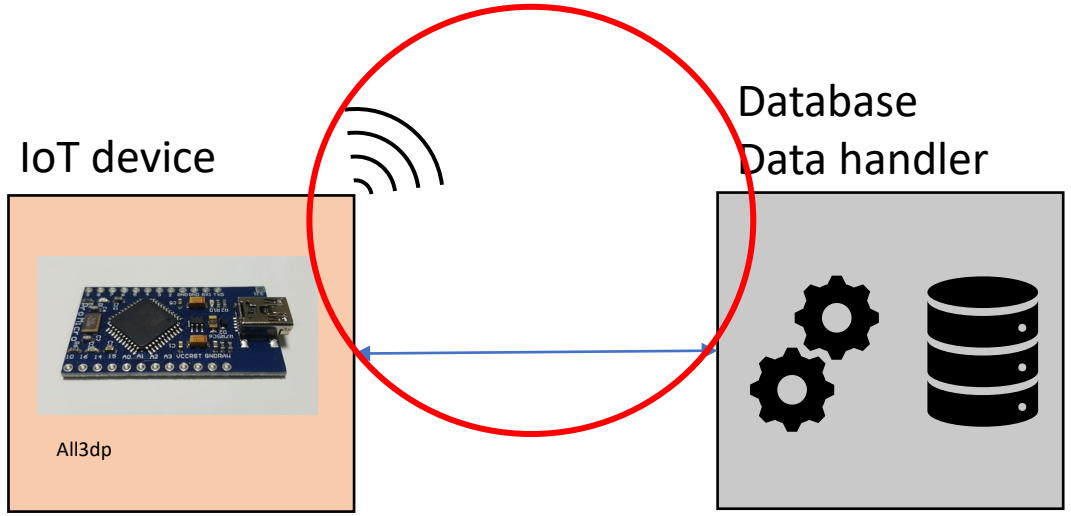
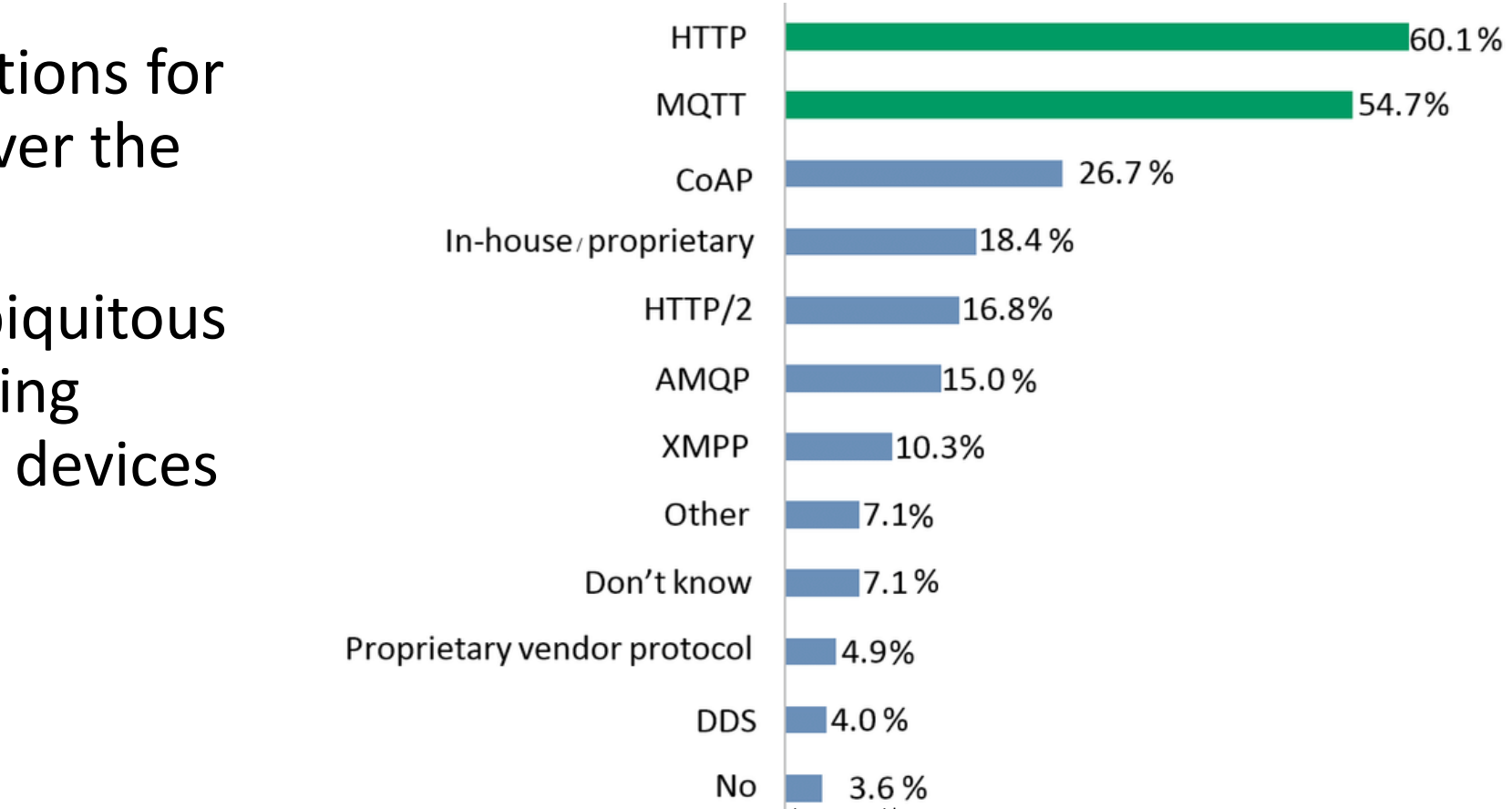
IoT data transfer standards

- Data must reach a data storage and processing server
- Usually done through wireless technologies due to convenience and cost



IoT data transfer standards (protocols)

- There are many options for transferring data over the internet.
- Http is the most ubiquitous while MQTT is gaining popularity with IoT devices



steves-internet-guide

Khalid Aloufi

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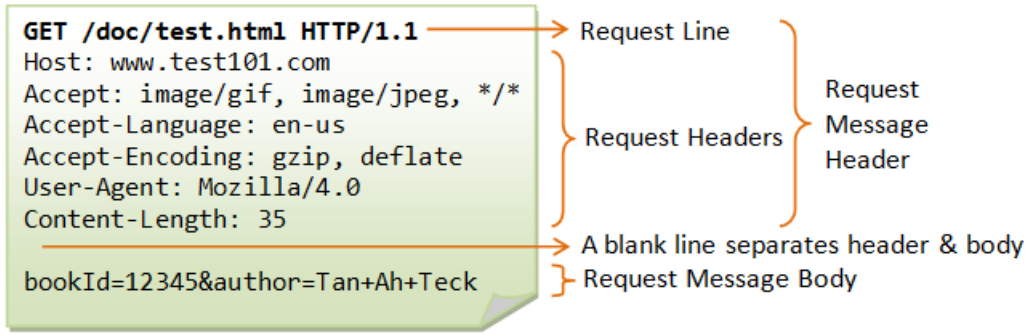
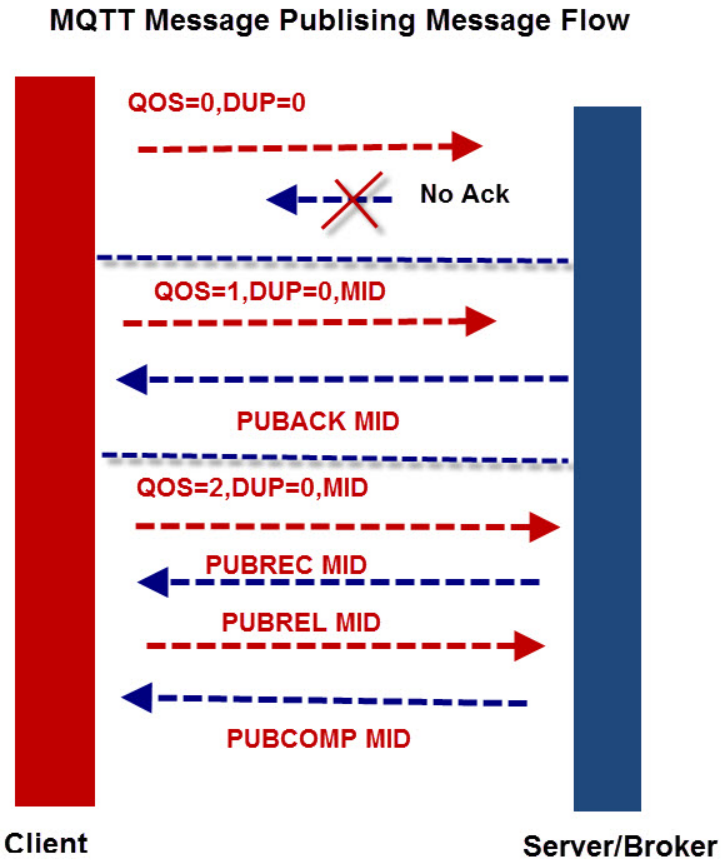
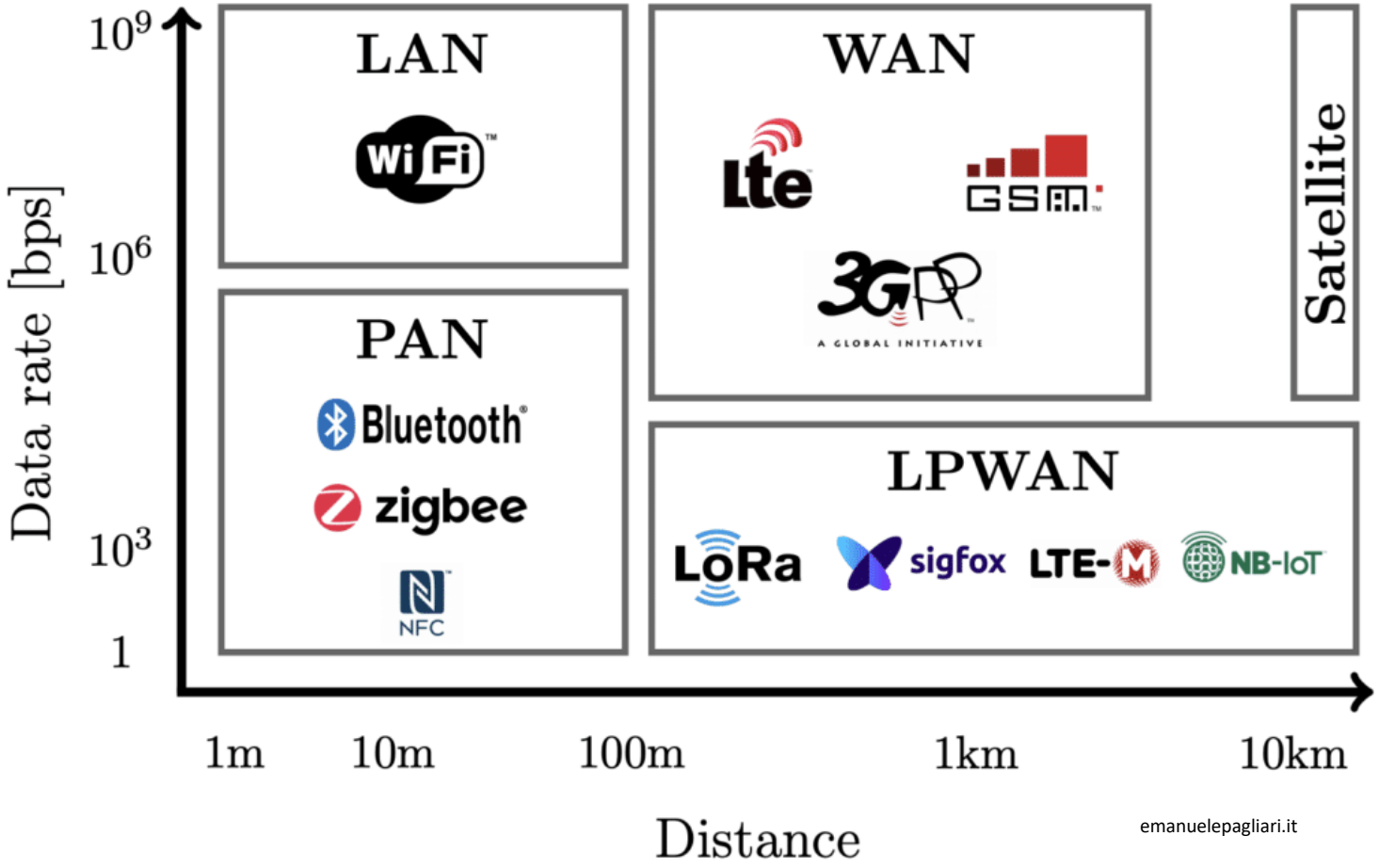
IoT data transfer standards (protocols)





IoT data transfer standards (hardware)



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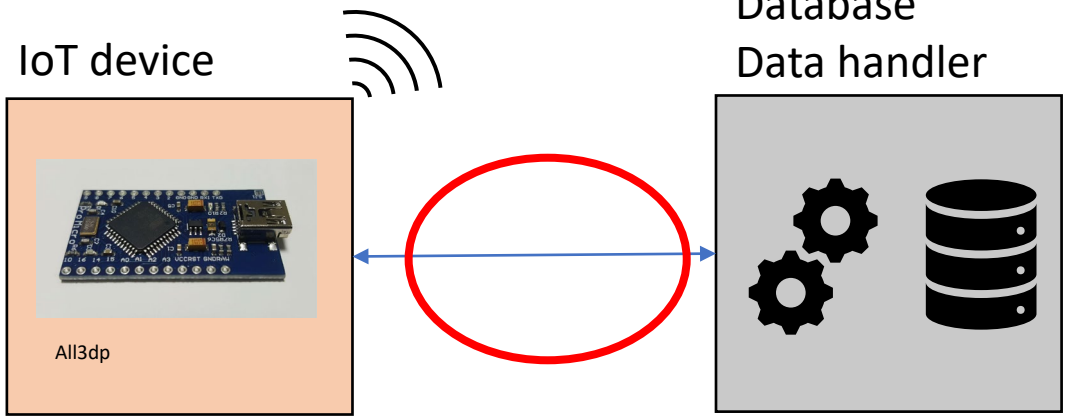
IoT data transfer formats

- Sensor data needs to be converted to a format that can be easily transmitted and processed
- High focus on formats that are RESTFUL (can be understood completely in transit)



IoT data transfer formats

XML	JSON	YAML

<Servers>
<Server>
<name>Server1</name>
<owner>John</owner>
<created>123456</created>
<status>active</status>
</Server>
</Servers>
	{
	Servers: [
	{
	name: Server1,
	owner: John,
	created: 123456,
	status: active
	}
	]
	}
		Servers:
		- name: Server1
		owner: John
		created: 123456
		status: active

jsonfile.org

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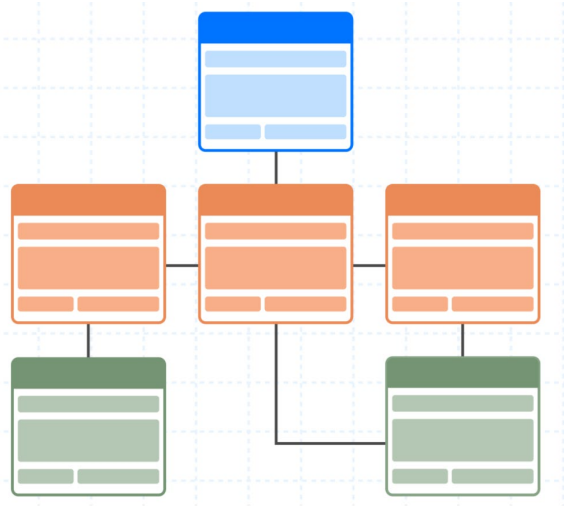
IoT data storage standards

- Multiple database solutions exist
- Tradeoffs between speed/throughput, ease of use and storage use



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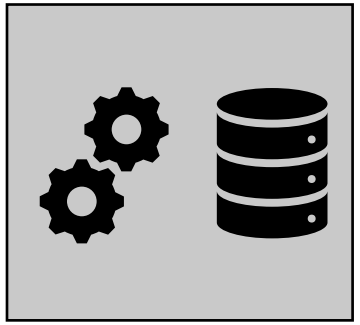
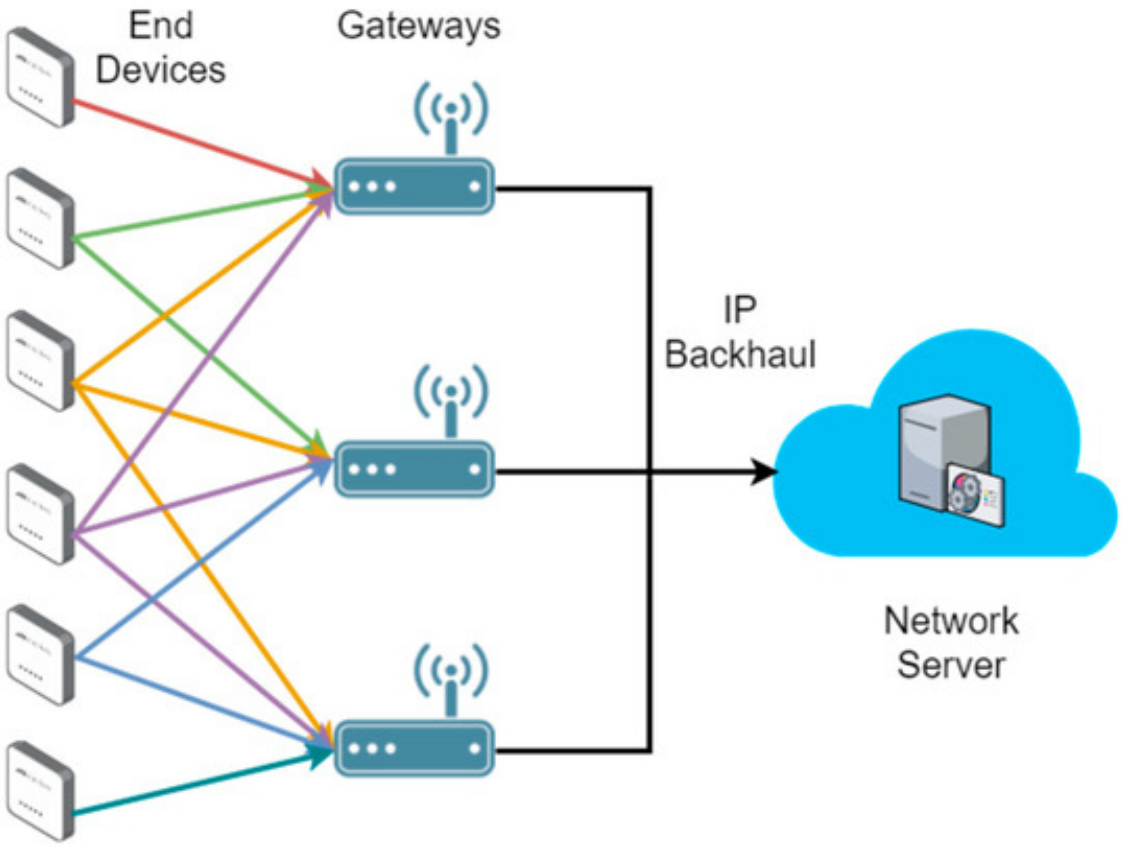
Database
Data handler



IoT data storage standards

IoT load balancers

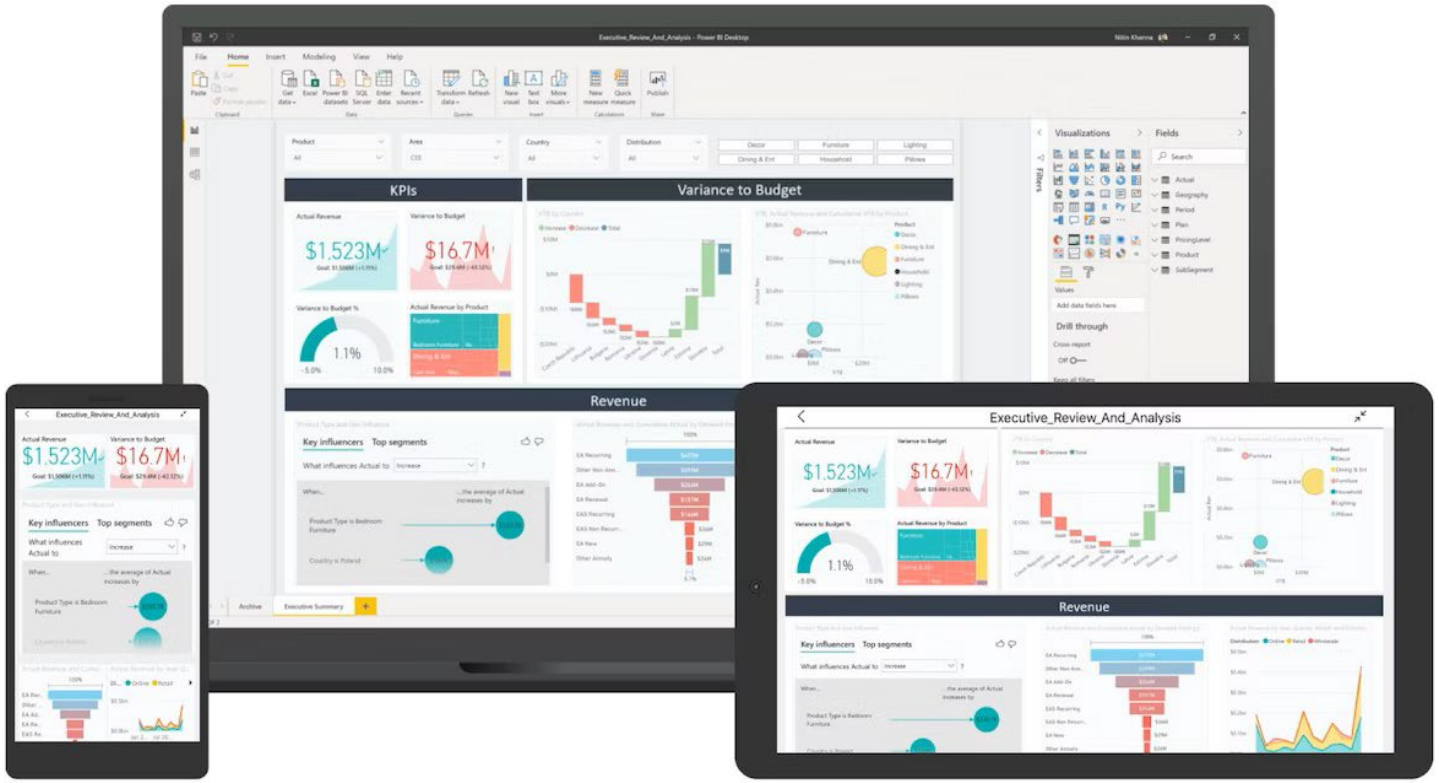


Cesar .A Gomez et al

IoT data brokers and load balancing

Visualization tools

- PowerBI
- Grafana
- Kibana
- Tableu
- Thingsboard



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Good practices in IoT

- Use the right tool for the job
  - Efficient protocols can be time consuming to set up
  - Premature optimization increases time to deployment

Good practices in IoT

- Predict scaling in advance
  - Running out of storage space or data handling capacity can be catastrophic
  - Horizontal vs vertical

Arbor

Good practices in IoT

- Outsourcing can simplify implementation and operation
  - Cloud services allows for quick implementation and worry free (almost) operation and scaling handling
  - Can be costly for larger operations

Getty Images

Good practices in IoT

- Cyber security is a challenge as IoT systems consists of many layers and protocols.
  - Monitoring
  - Action plans
  - Backups

Trend Micro

Legal considerations in IoT (Wireless communication)

- Radio communication is highly regulated in most countries. As IoT devices are dependent on this, you must ensure you follow local laws.
- Most suppliers of wireless communication will have documentation explaining their use areas

International Telecommunication Union

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Legal considerations in IoT (Privacy)

- IoT devices can collect data that can be considered sensitive and personal.
- Most regions have laws that regulates this, EU's GDPR is one of them.

https://gdpr-info.eu/

Legal considerations in IoT (Security)

- IoT networks consists of multiple technologies and are often outside of your control. These are vulnerable to cyber security threats and there are regulations in some regions that govern this.

  EU Cyber Security Directive (Directive 2016/1148)
  US Internet of Things Cybersecurity Improvement Act 2020

- More is coming

IoT standards development

- There is no single entity responsible for the development of IoT standards. Organizations usually take responsibility for developing these standards, but request feedback from experts and users in the field.
- This process is often done through documents called RFC (return for comment) where proposals of new standards or changes to existing ones can be discussed.

Thank you for your attention

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