EE4500 – Wrap

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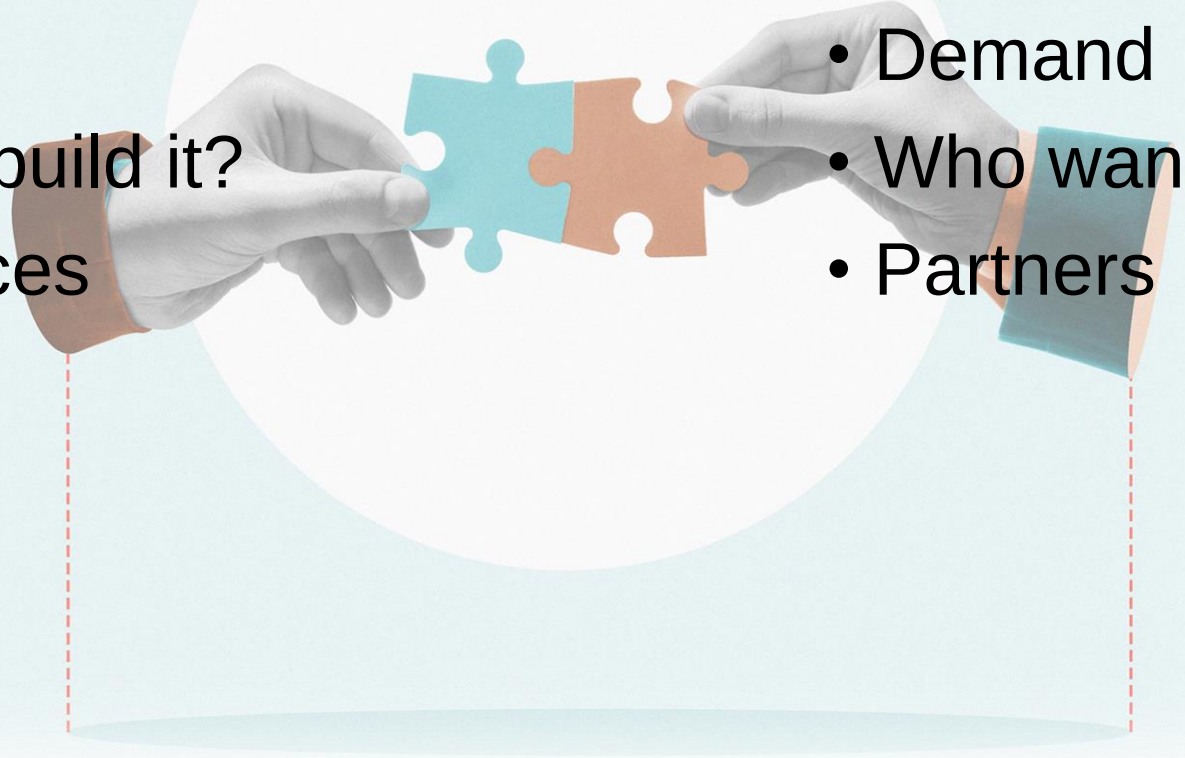
Schedule

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Introduction	AWS Introduction	AWS Global Infrastructure Overview	AWS Compute	AWS Storage	AWS Certification Walhthrough	
RESTful APIs	Cloud concepts overview	AWS Networking and Connectivity		AWS Databases	Subject Wrap	
	LoRaWAN & TTN		Web development			
Business Models (BMC/VP)	Value Proposition Design	Project Review & Feedback	3D Printing	Project Review	Architecture Quiz	
Setup LoRaWAN Gateway	LoRaWAN Node	IoT Database	IoT Dashboard			Presentation

Legend
In-person lectorials
Activities
On-line lectures
Labs

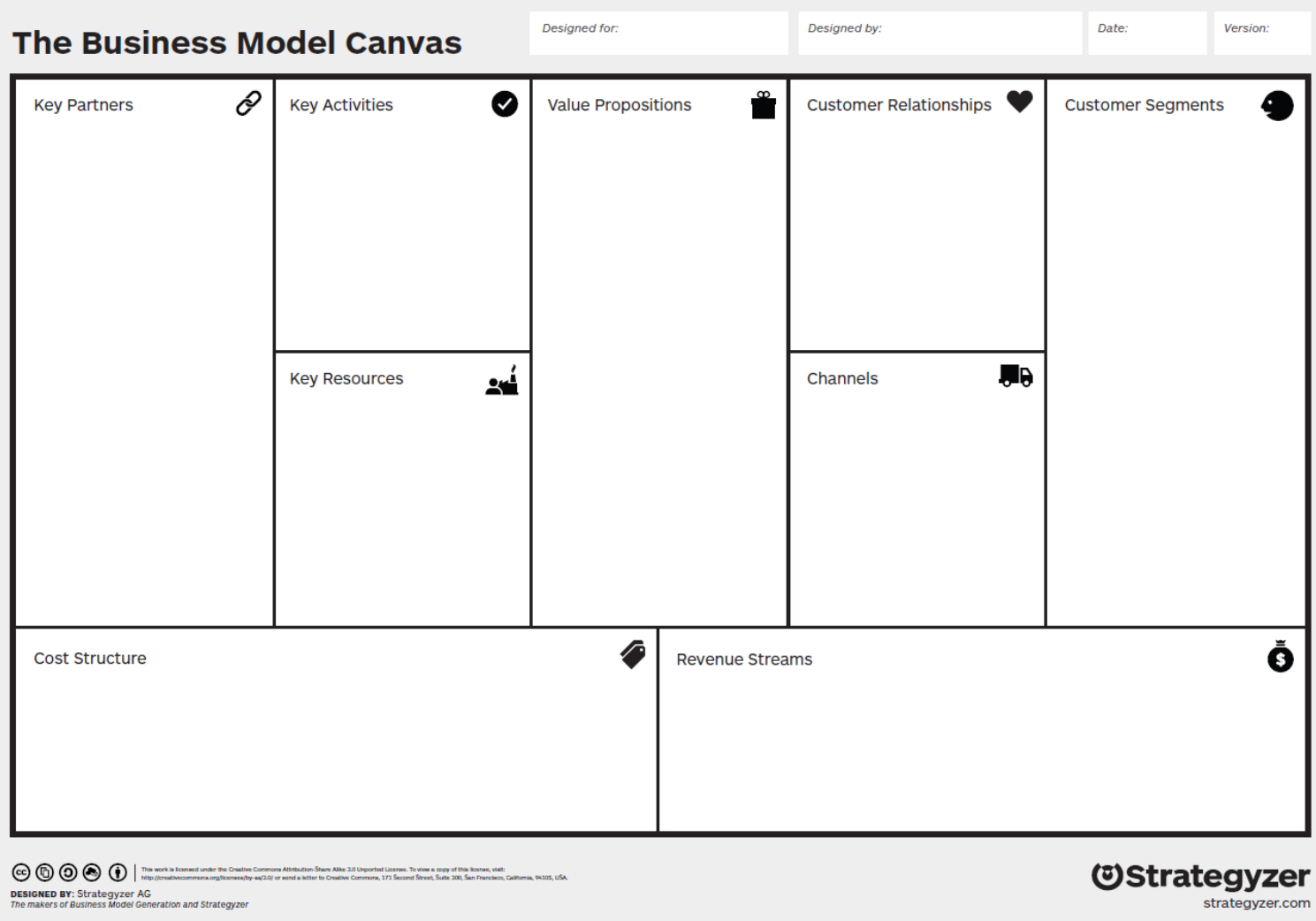
Design project

- Engineering
- Supply
- How to build it?
- Resources



- Economics
- Demand
- Who wants it?
- Partners

Business Model Canvas



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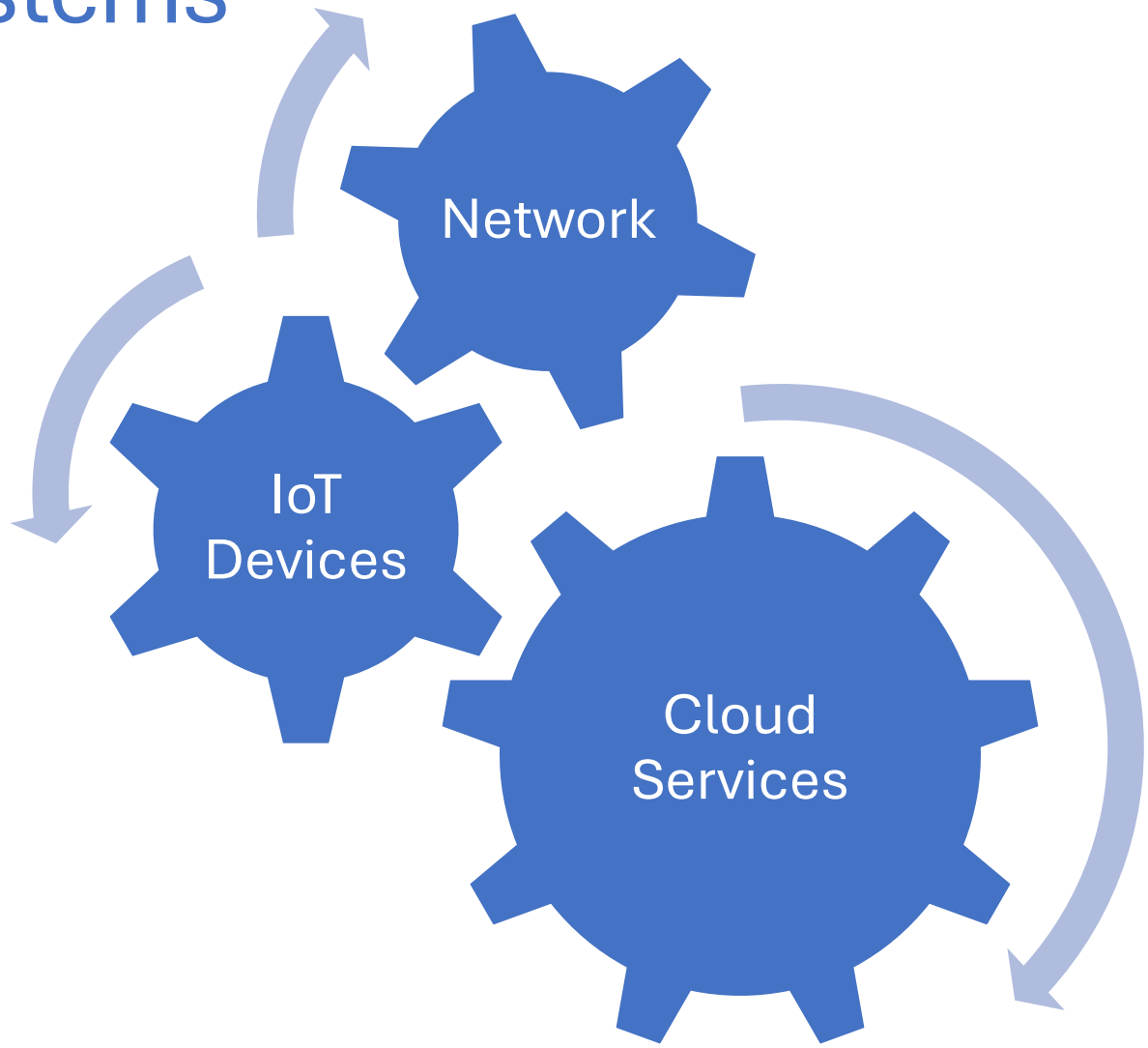
Distributed systems



Topics

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RESTful APIs

- Representational State Transfer
- Application Programming Interface
- Underpins the Internet and the Cloud
- Allows disparate platforms to cooperate
  - OS
  - Language
  - Location
- Postman

Bezos Mandate

1. All teams will henceforth expose their data and functionality through service interfaces.
2. Teams must communicate with each other through these interfaces.
3. There will be no other form of interprocess communication allowed: no direct linking, no direct reads of another team's data store, no shared-memory model, no back-doors whatsoever. The only communication allowed is via service interface calls over the network.
4. It doesn't matter what technology they use. HTTP, Corba, Pubsub, custom protocols — doesn't matter.
5. All service interfaces, without exception, must be designed from the ground up to be externalizable. That is to say, the team must plan and design to be able to expose the interface to developers in the outside world. No exceptions.
6. Anyone who doesn't do this will be fired.
7. Thank you; have a nice day!

AWS Introduction

- Cloud concepts
- Cloud economics
- Infrastructure
- Security

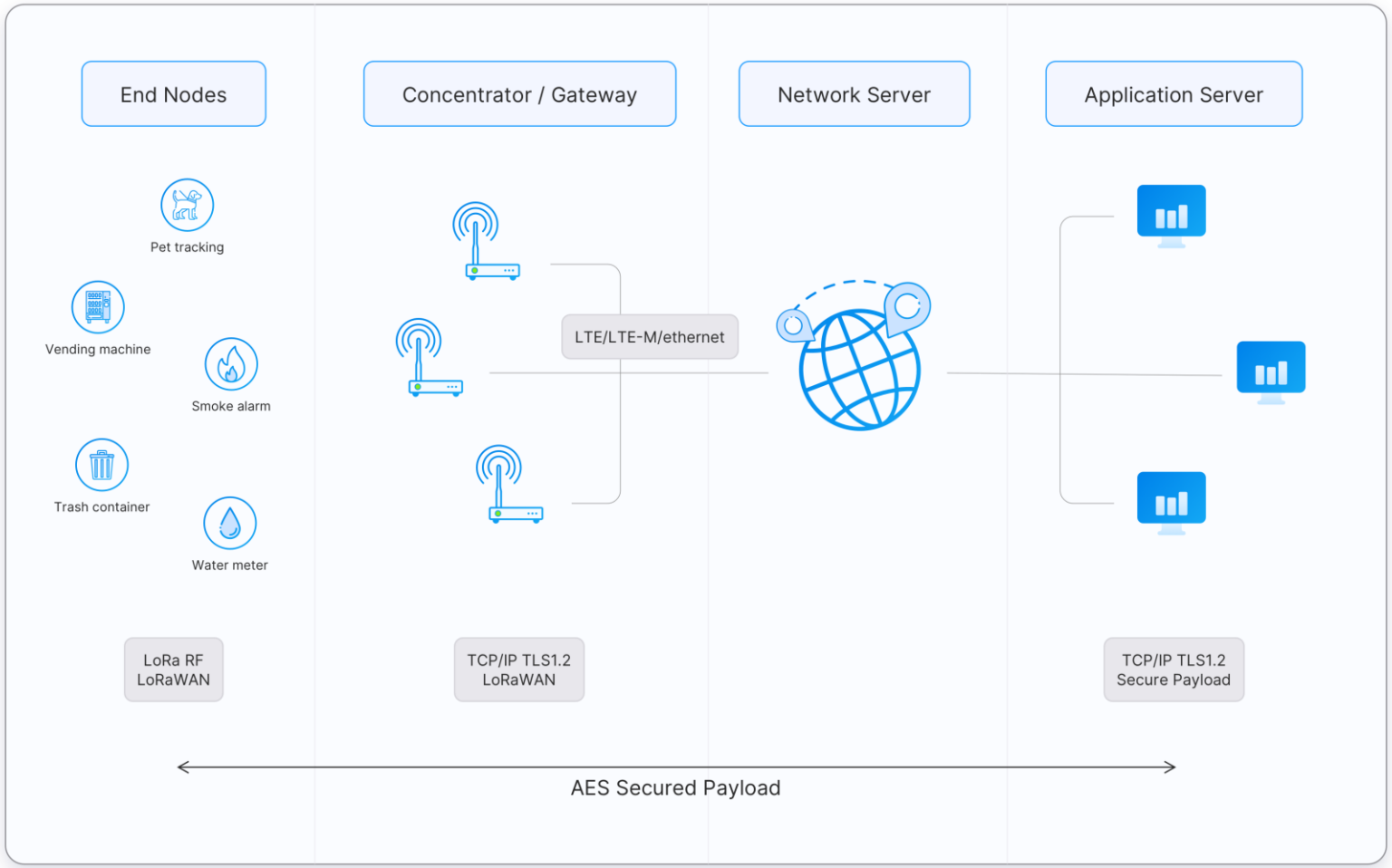
AWS Components

- Compute
- Storage
- Databases
- Scaling and deployment

LoRaWAN

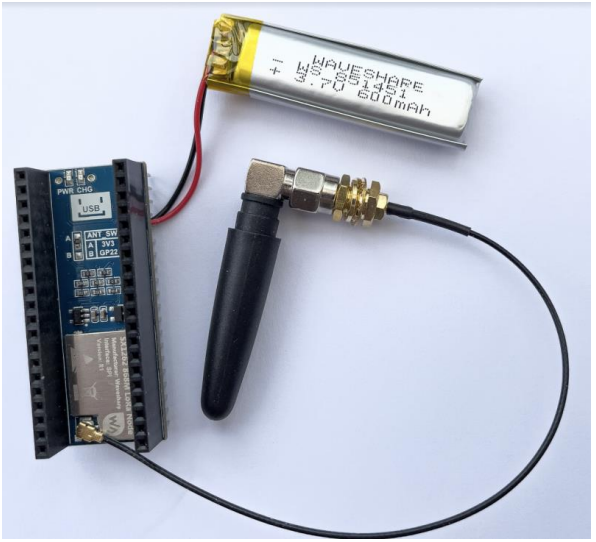
- Long Range Wide Area Network (LoRaWAN)
- Designed for IoT applications
- Architecture
  - End Devices
  - Gateways
  - Network Server
  - Application Server

LoRaWAN Architecture



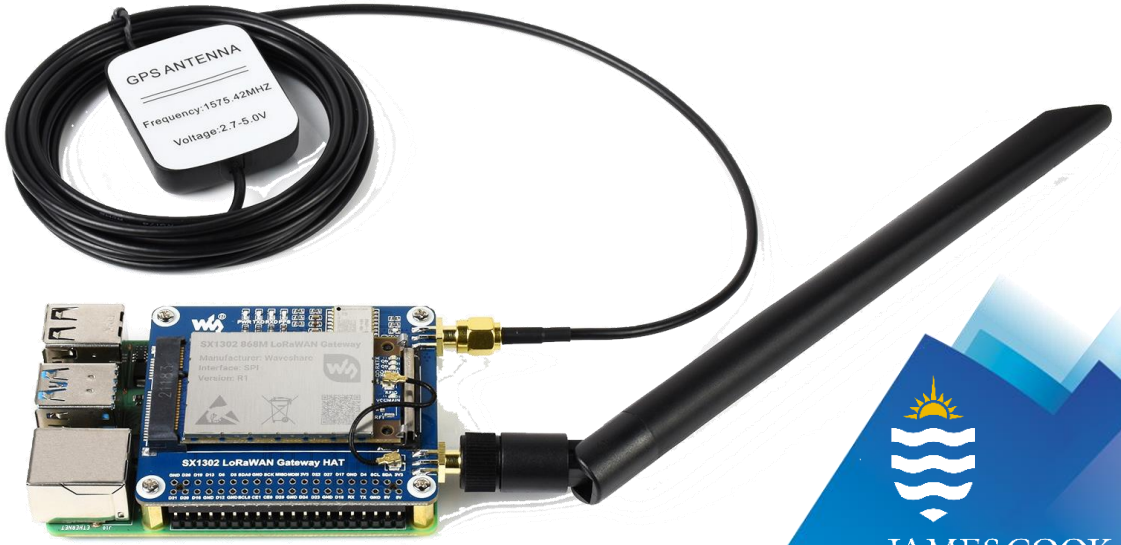
End Devices

- Sensors or actuators
- Communicate with gateways
- Low power and long battery life

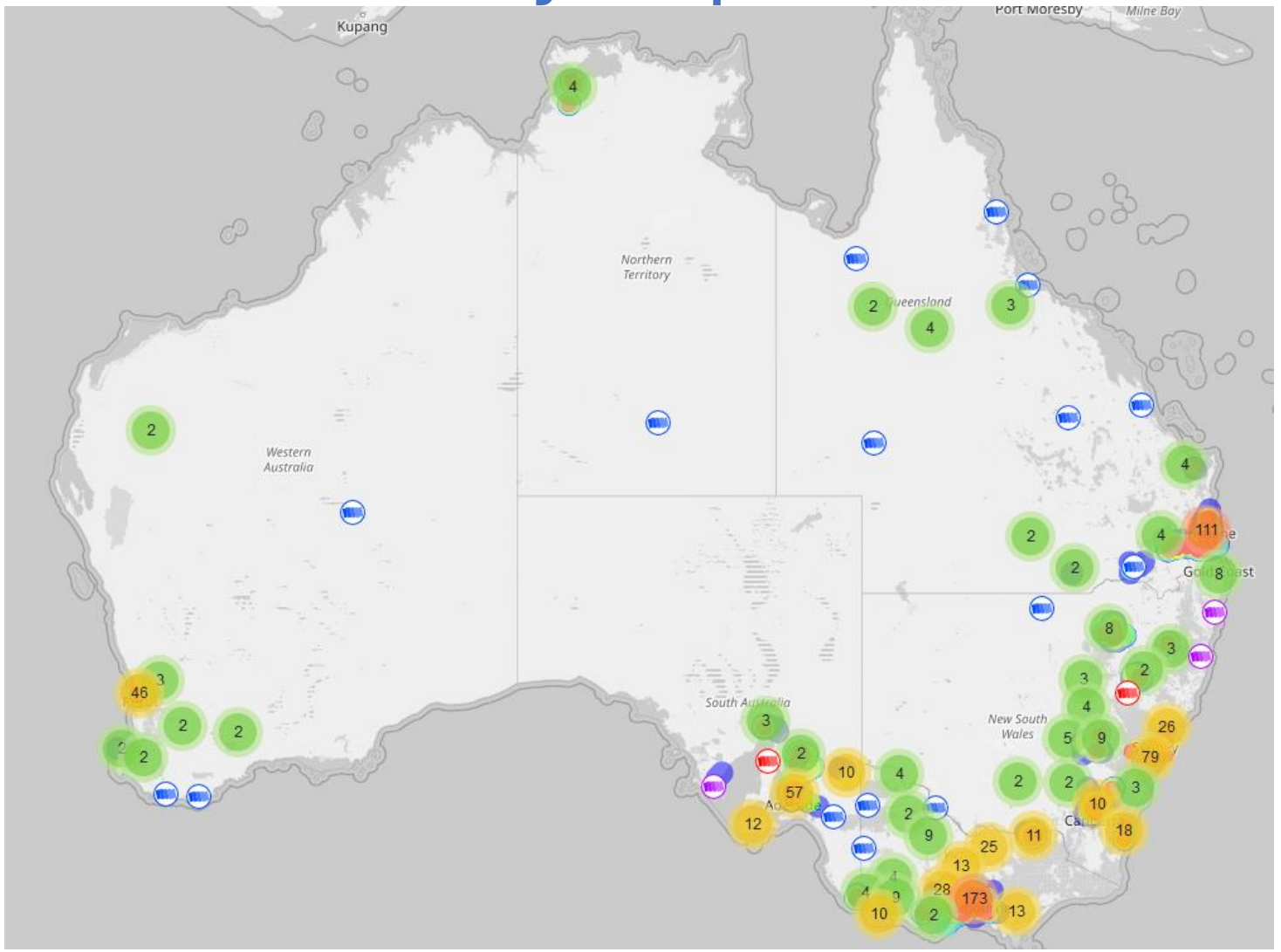


Gateways

- Act as a bridge between end devices and network server
- Forward data from end devices to network server



TTN Australian Gateway Map



TTN Coverage @ 16-Jul-2024 (ttnmapper.org)

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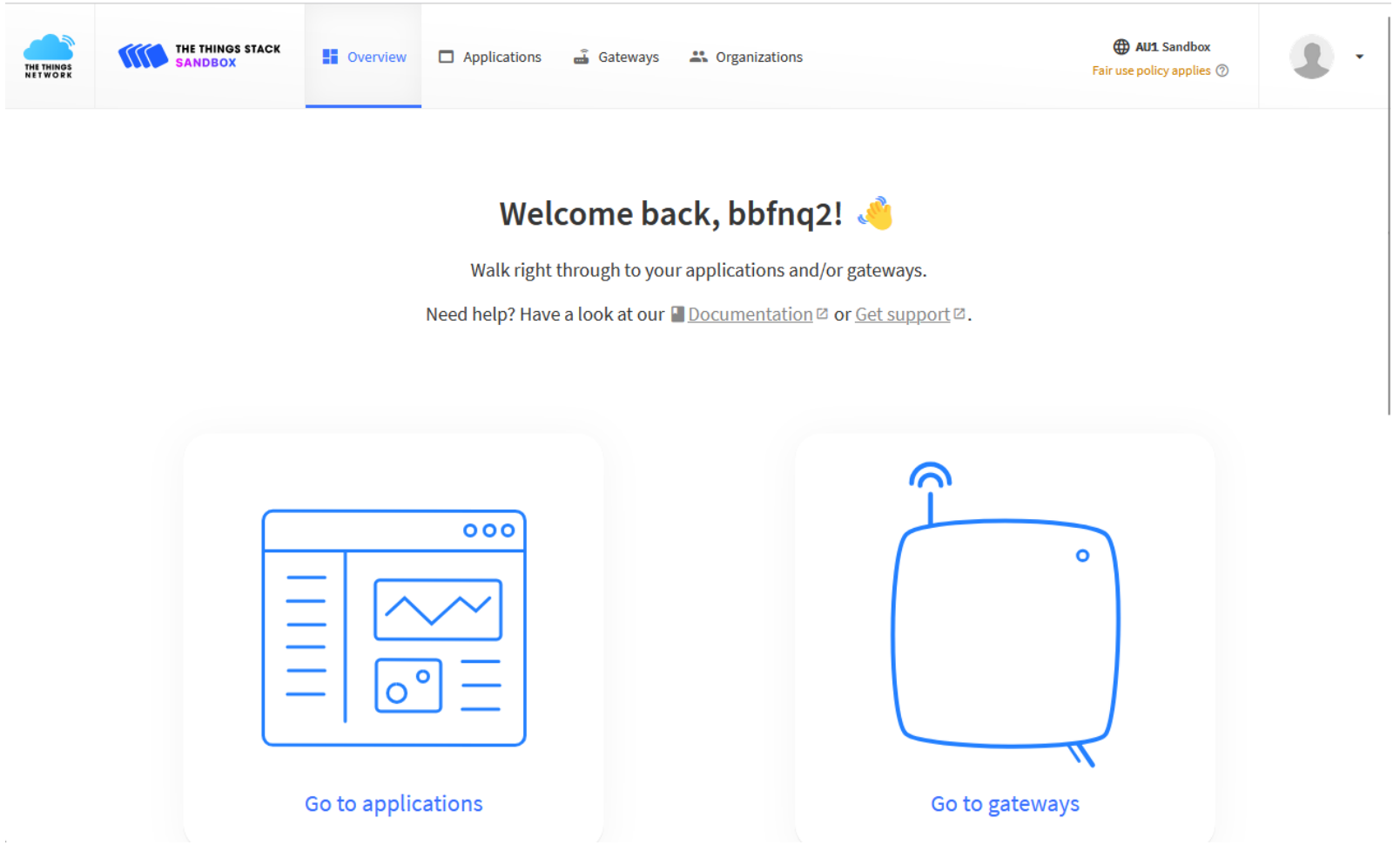
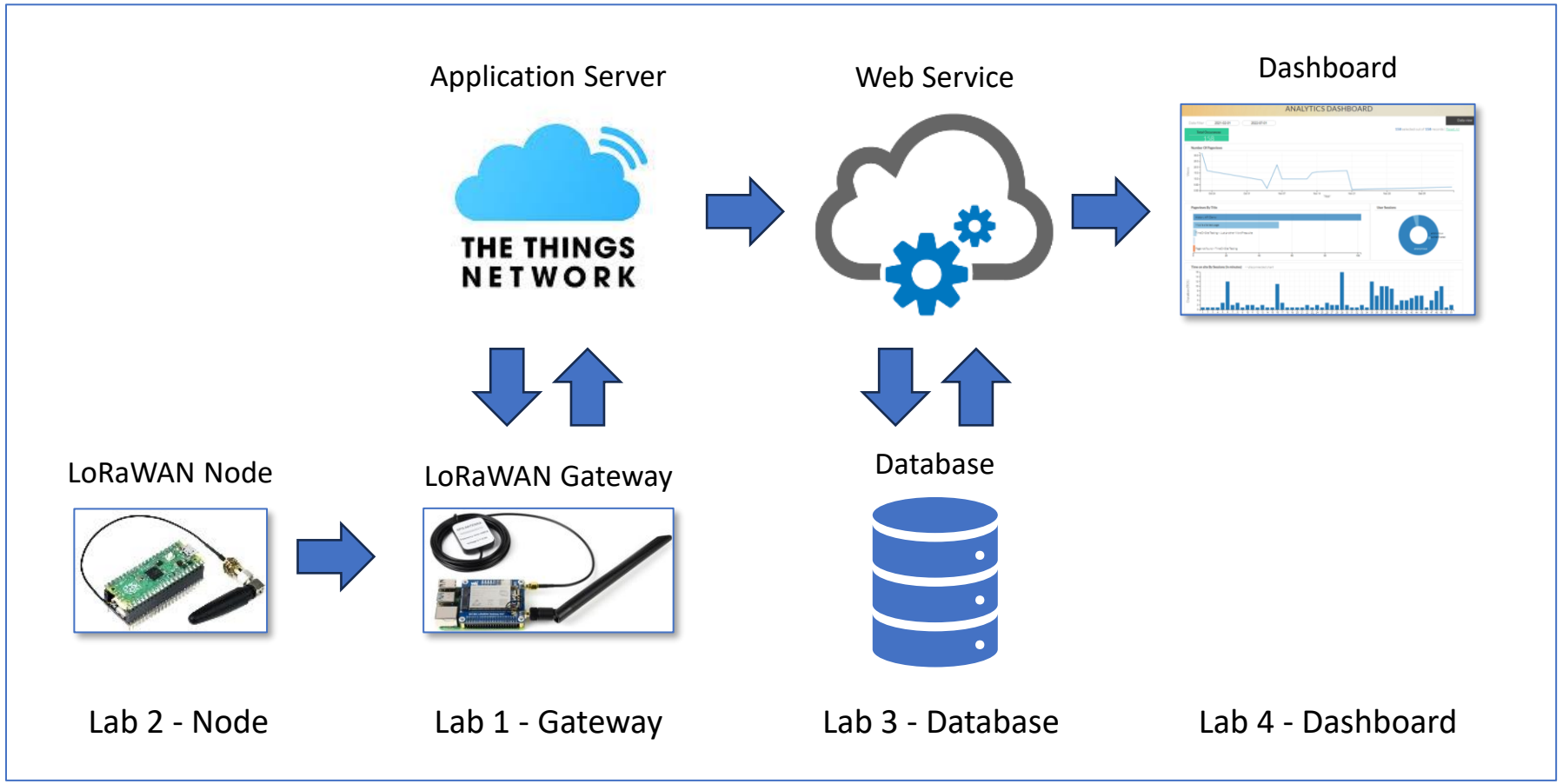
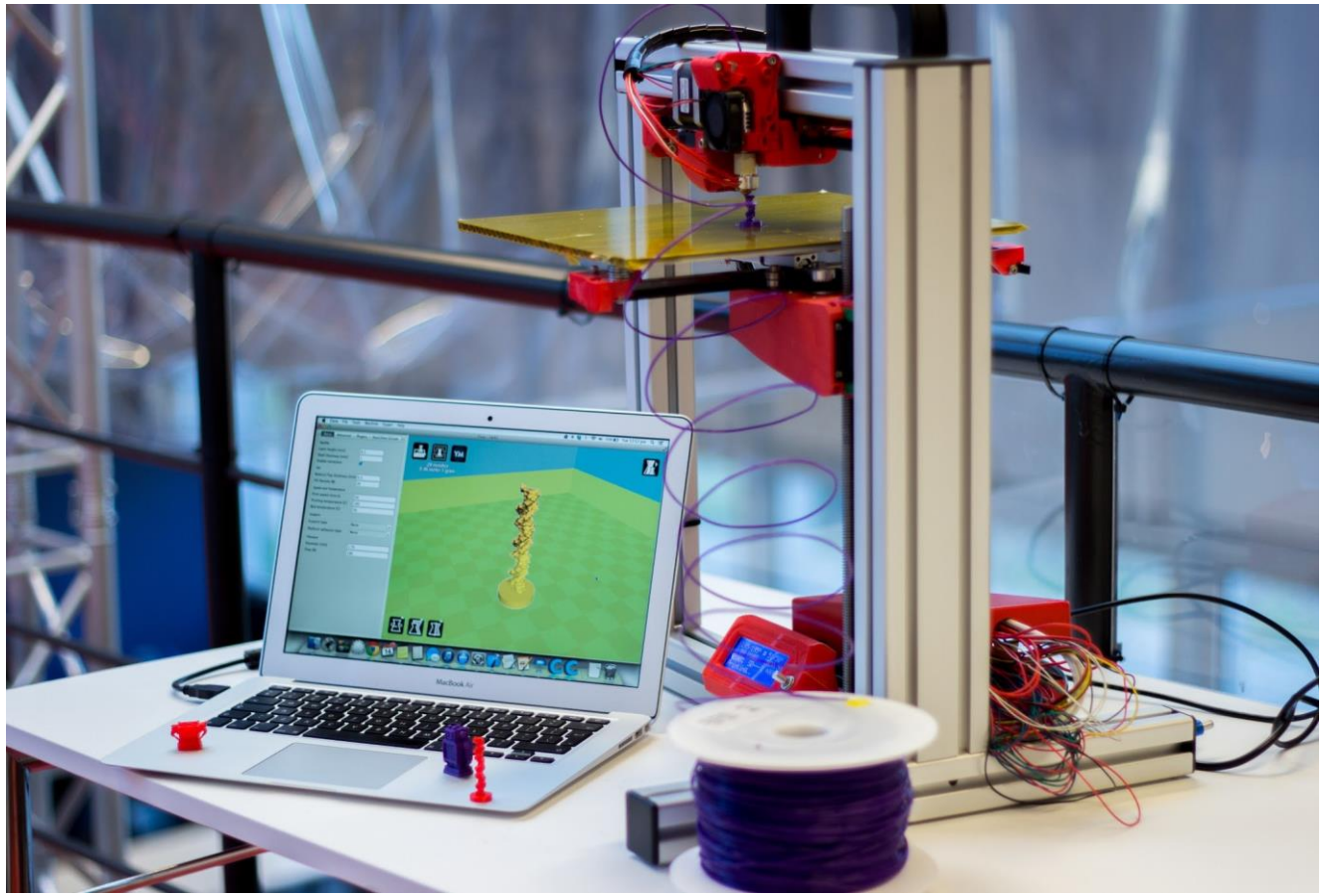
Console



EE4500 Labs – The big picture



3D Printing



Certification

Embedded Surveys

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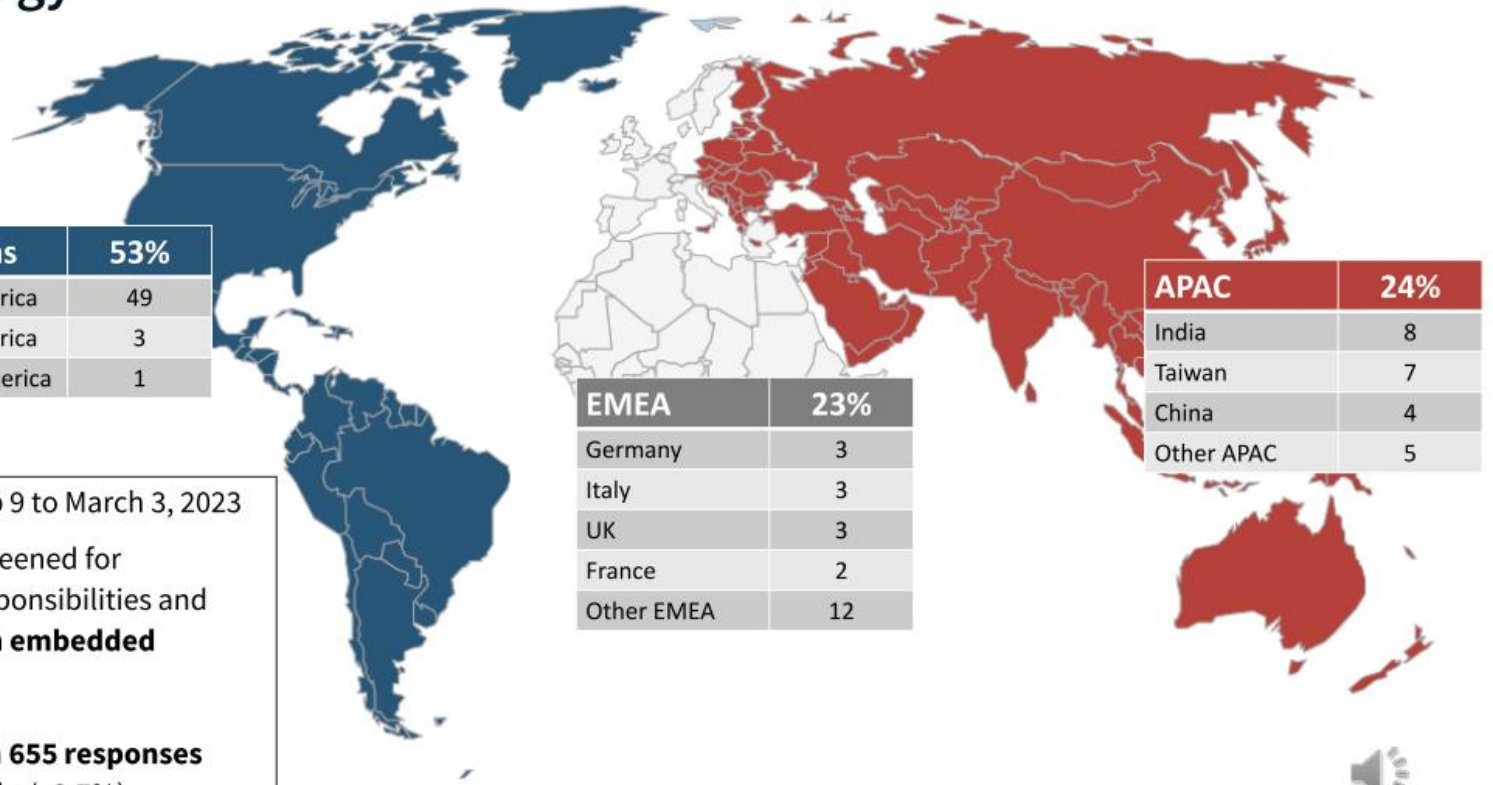
Sources

Methodology

Online survey



Americas	53%
North America	49
South America	3
Central America	1

EMEA	23%
Germany	3
Italy	3
UK	3
France	2
Other EMEA	12

APAC	24%
India	8
Taiwan	7
China	4
Other APAC	5

- **Field Dates**: Feb 9 to March 3, 2023
- Respondents screened for **engineering** responsibilities and **experience with embedded applications**
- Results based on **655 responses** (confidence level +/- 3.7%)

Total Respondents

embedded survey

S3. In which region of the world do you reside?

ASPENCORE | 2

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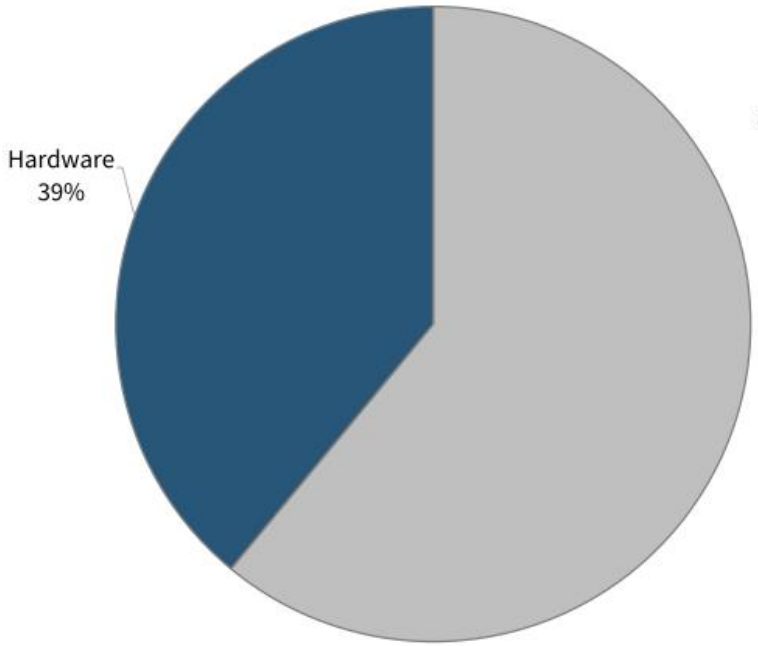
Embedded Development

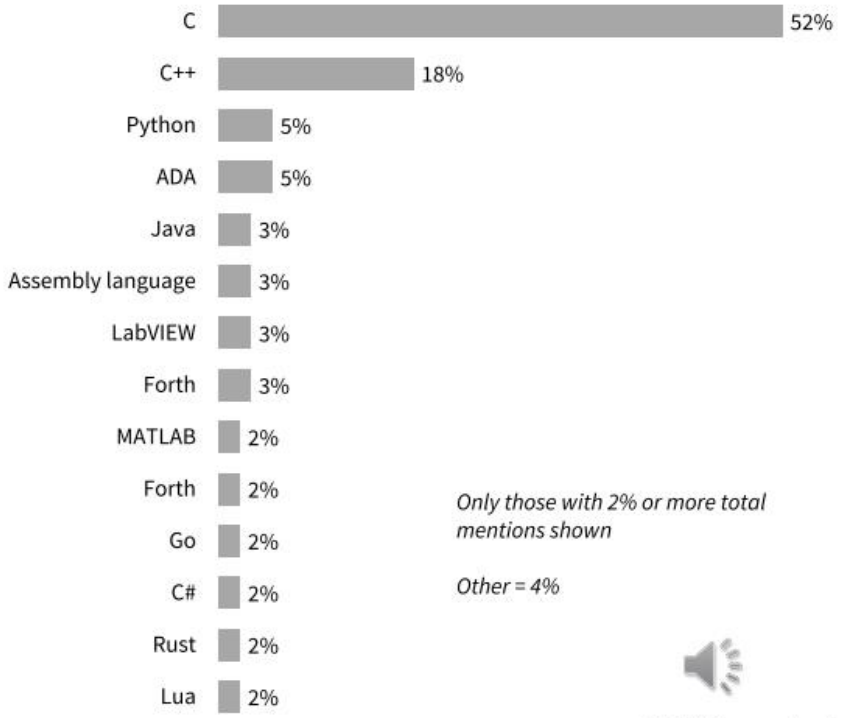
- Languages and Operating systems
- Working styles
- Technologies

Languages

Software development requires more cycle time

"C" dominates other languages for embedded software programming





Only those with 2% or more total mentions shown

Other = 4%

Total Respondents

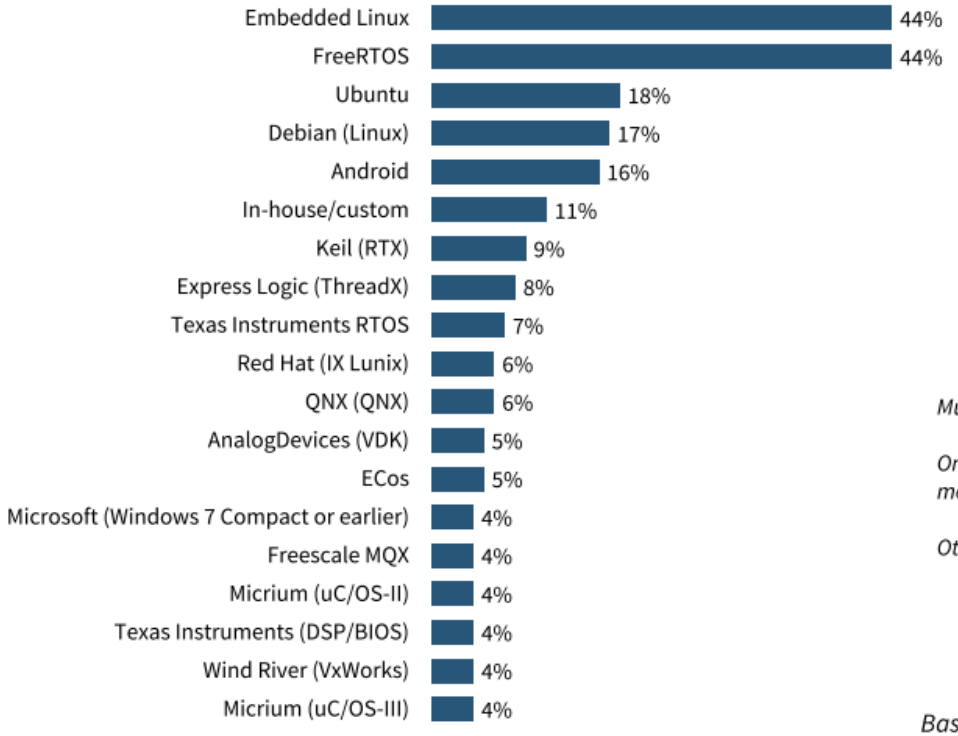
embedded survey

10. What is your development team's ratio of total resources (including time/dollars/manpower) spent on software vs. hardware for your embedded projects?
16. My current embedded project is programmed mostly in:

Operating System

Most popular embedded OSs – Embedded Linux, FreeRTOS and Ubuntu

Top 3 OSs are especially popular in APAC, while Embedded Linux is used more in the Americas



Multiple responses allowed

Only those with 4% or more total mentions shown

Other = 7%

Base = Those who will use an OS (566)

embedded survey

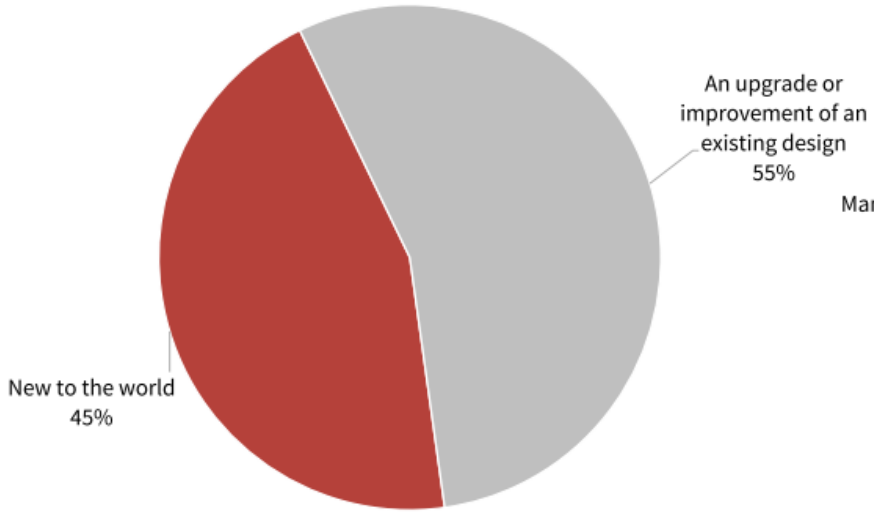
35. Please select the operating systems you are currently using or considering using in the next 12 months for a commercial product development project. *(Only include non-RTOS operating systems that you embed into your projects.)*

New vs Old

Most embedded projects involve incremental upgrades to existing designs

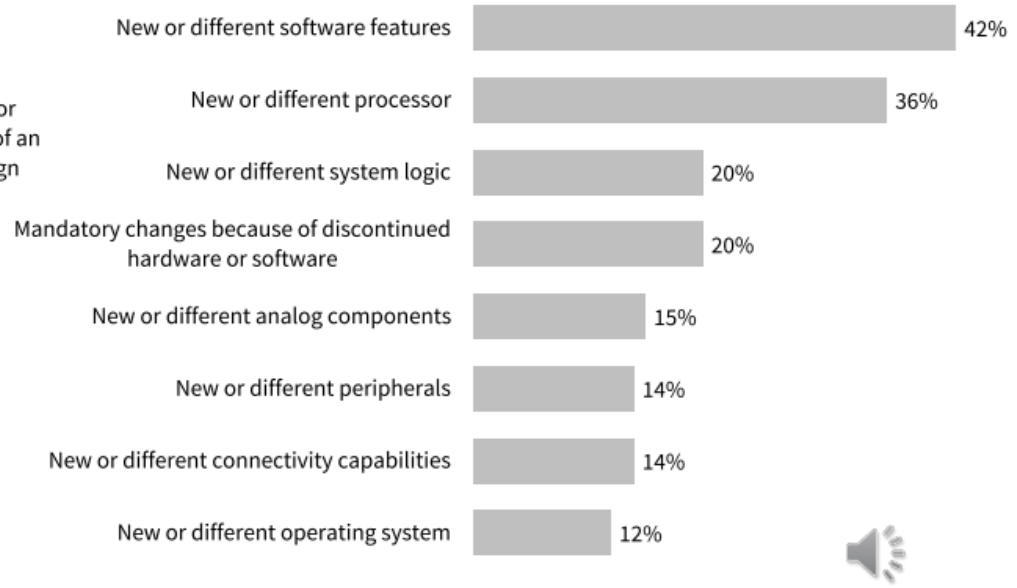
Improvements including additional software features and/or better MPUs/MCUs (particularly by larger OEMs)

Current Embedded Project Is...



Total Respondents

Improvements for Upgrade

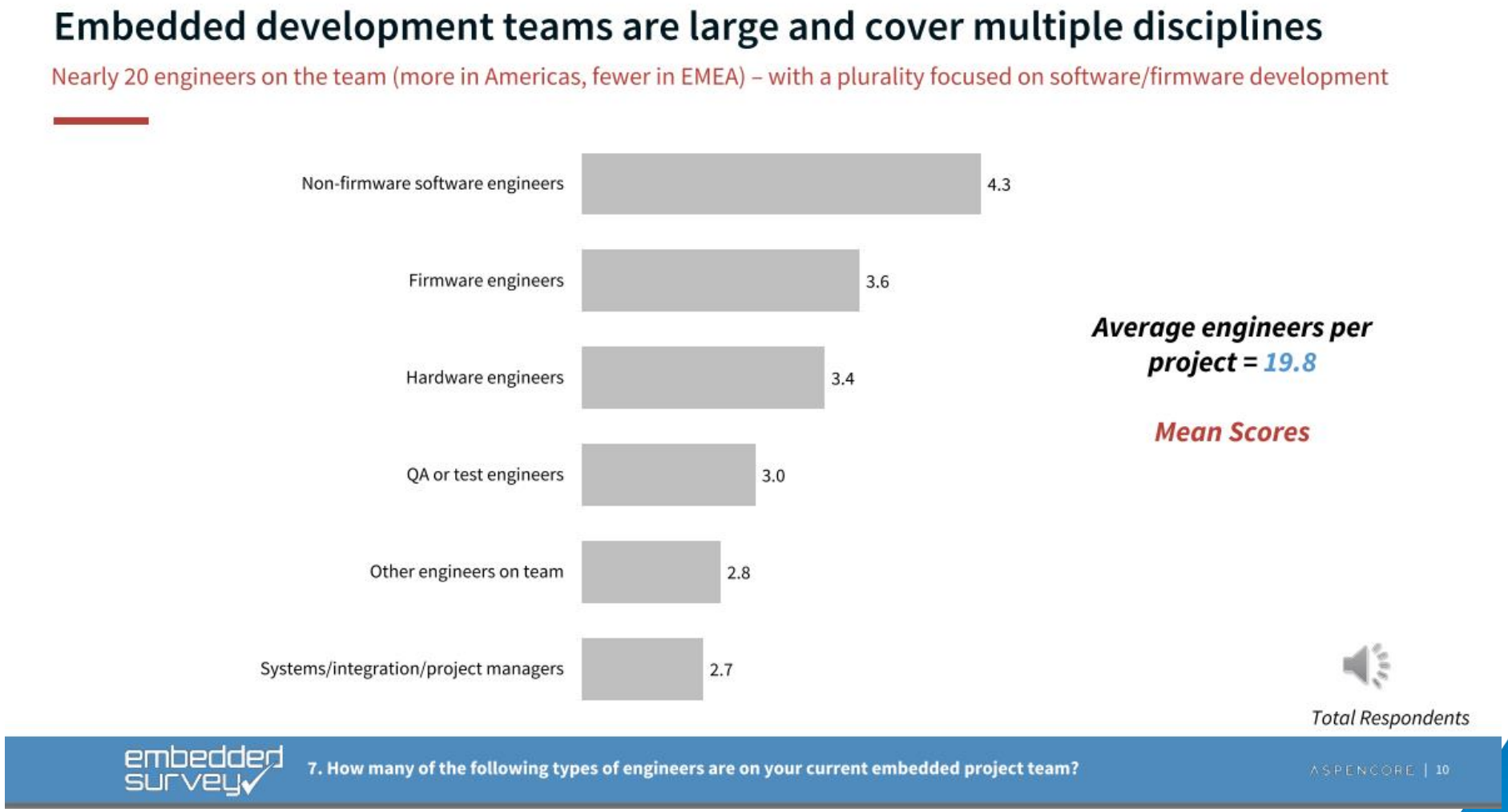


Base = Those upgrading existing design (362)

embedded survey

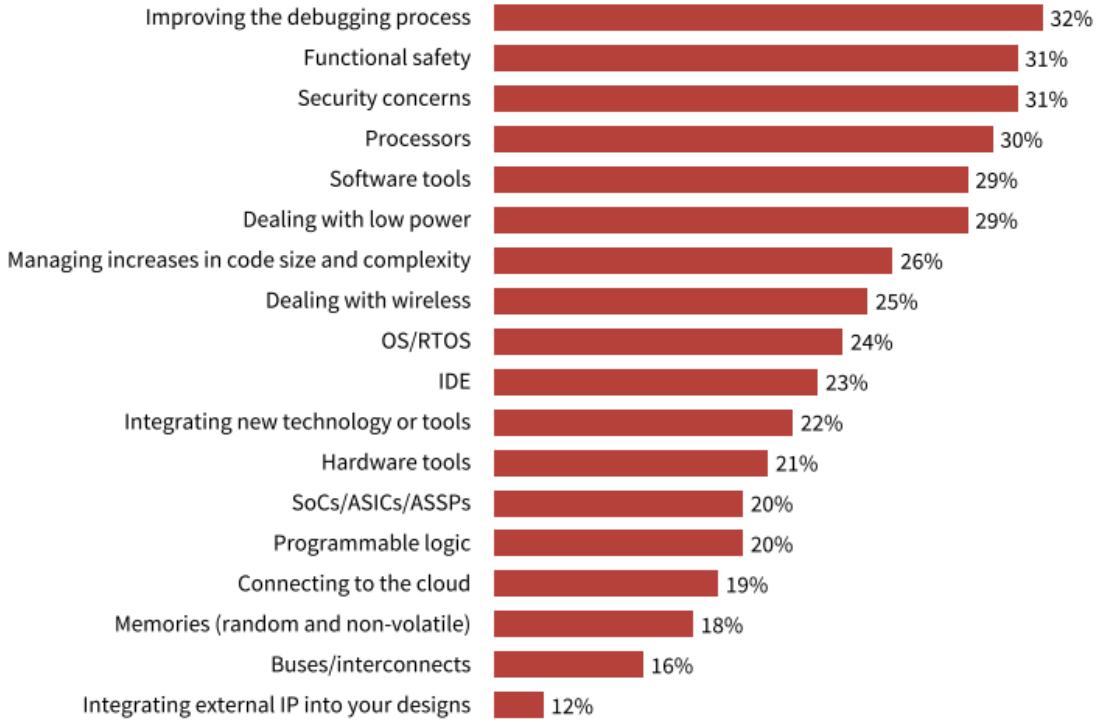
1. My current embedded project is:
2. Which two improvements were the main reasons for the upgrade?

Teams



Design Challenges

Better debugging and SW tools, improved safety and security and power join processor selection as most critical design challenges



APAC design teams are especially concerned about nearly all these issues

'Very Important' Summary

Total Respondents

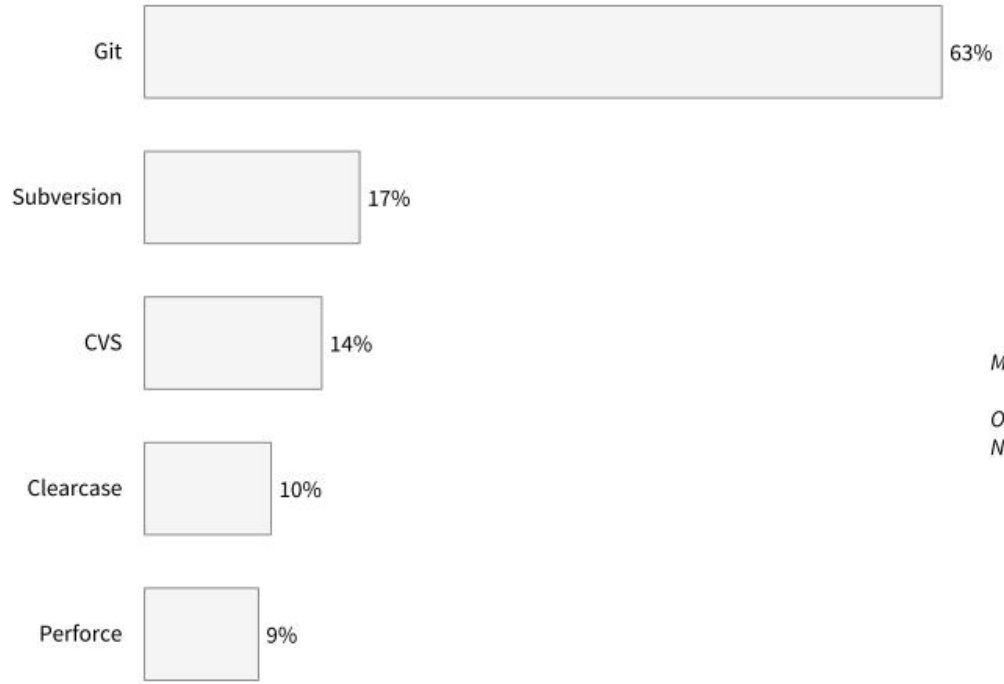
embedded survey

20. Thinking about next year, how important will the following technology challenges be regarding future embedded designs?

Version Control

Git is the most widely used version control software

Git and Subversion are especially popular in EMEA



Multiple responses allowed

Other = 3%
None of the above = 14%

Total Respondents

embedded survey

65. Which of the following Version Control software systems do you currently use?

Internet of Things

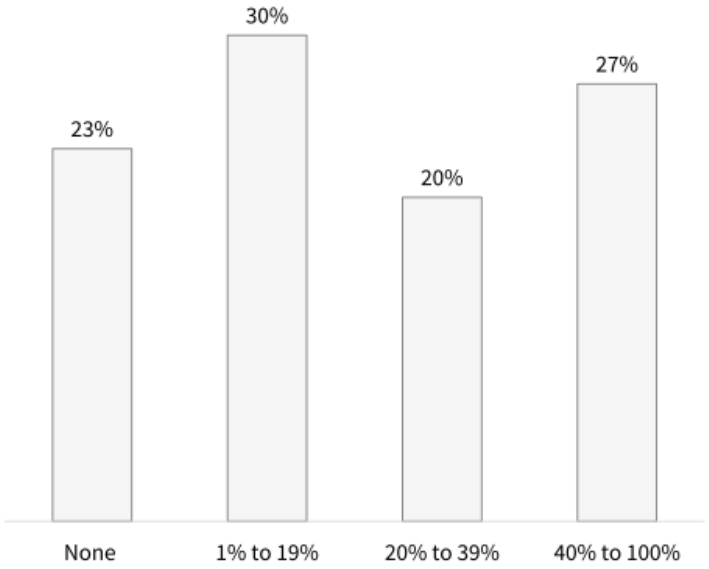
Internet of Things (IoT) continues to attract attention

Nearly one-third of embedded design is devoted wholly or partially to IoT, most for sensor-driven, industrial or mobile communications applications

Projects devoted to IoT

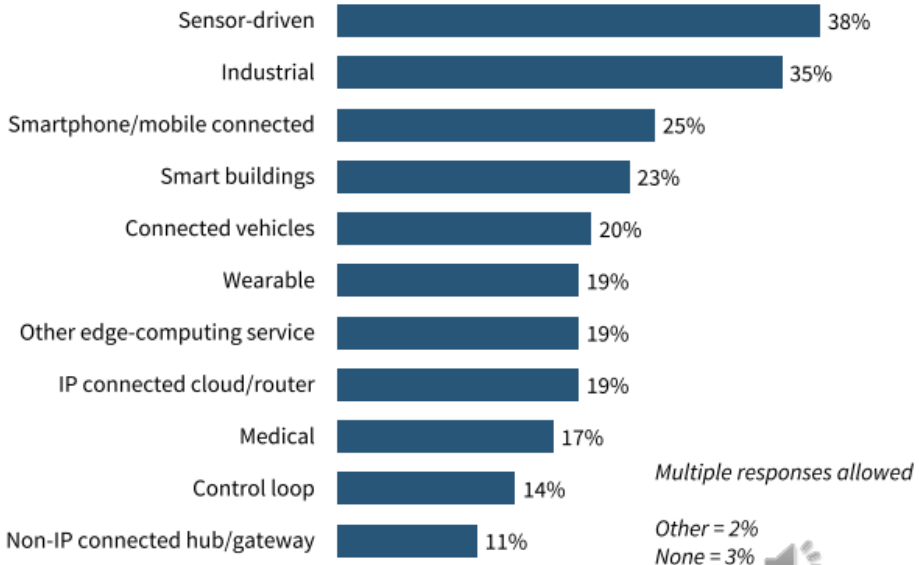
Mean = 29% of projects

2019 = 21% of projects



Total Respondents

Types of Applications for IoT



Multiple responses allowed

Other = 2%
None = 3%

Base = Those primary devoted to IoT applications (870)

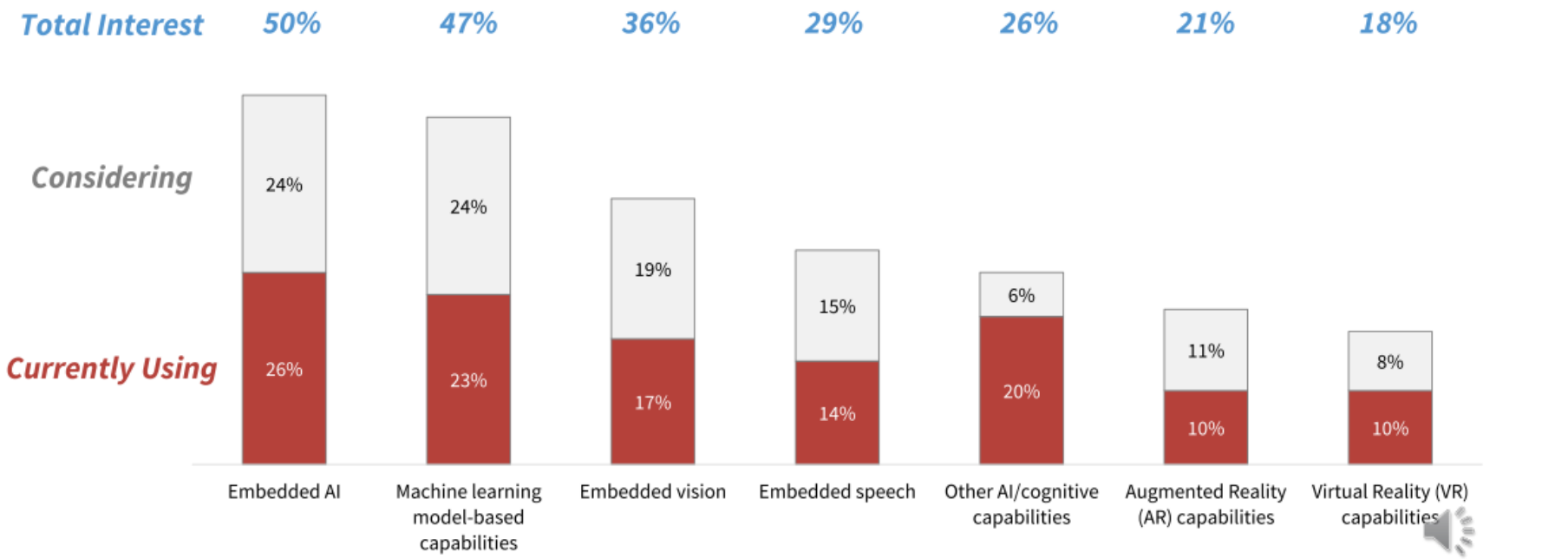
embedded survey

24. In the coming year, approximately what percentage of your projects will be primarily devoted to Internet of Things (IoT) applications or devices?
25. If you are developing Internet of Things (IoT) applications, please indicate the types of applications.

Advanced Technologies

Embedded development makes use of advanced technology capabilities

Embedded AI and machine learning attract the most attention, followed by embedded vision and speech capabilities



Total Respondents

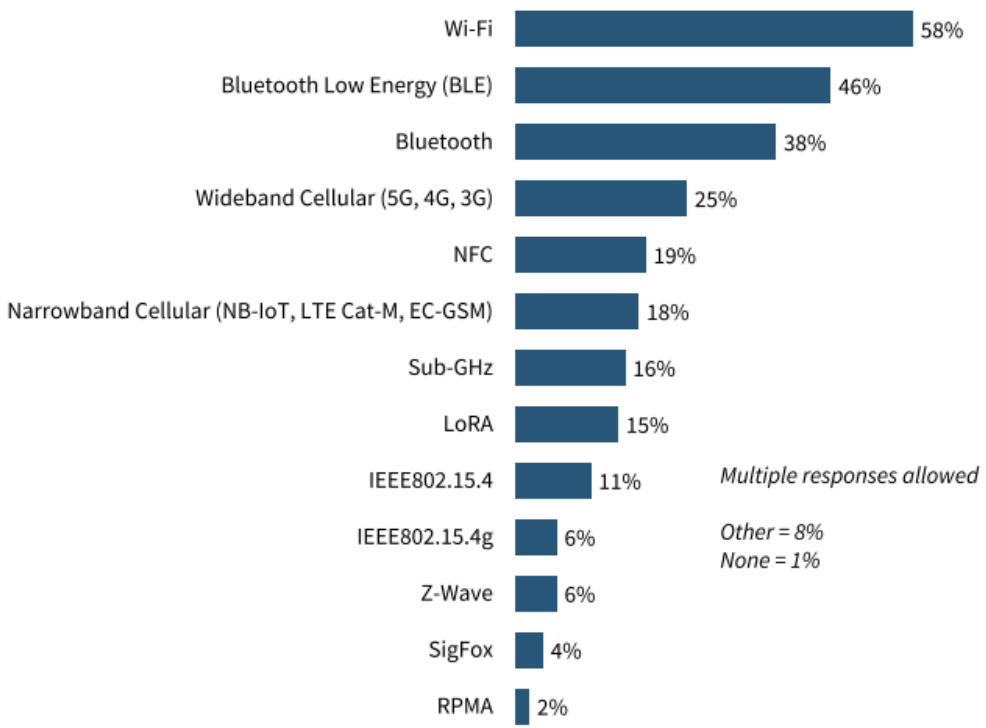
embedded survey

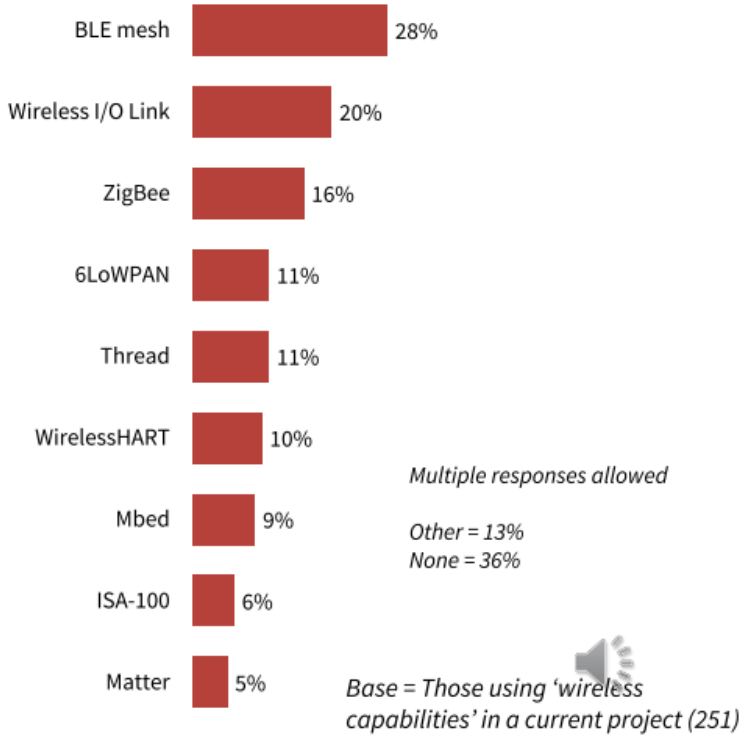
27. Which of the following advanced technologies are you currently using in your embedded systems?
28. Which of the following advanced technologies are you considering using in your future embedded systems?

Wireless

Over one-third of embedded designs incorporate wireless capabilities

Wi-Fi and Bluetooth are the most used interfaces and Bluetooth Low Energy mesh the most popular protocol





embedded survey

4. What wireless interfaces does your current project include?
5. What wireless protocols/stacks does your current project include?

Jobs

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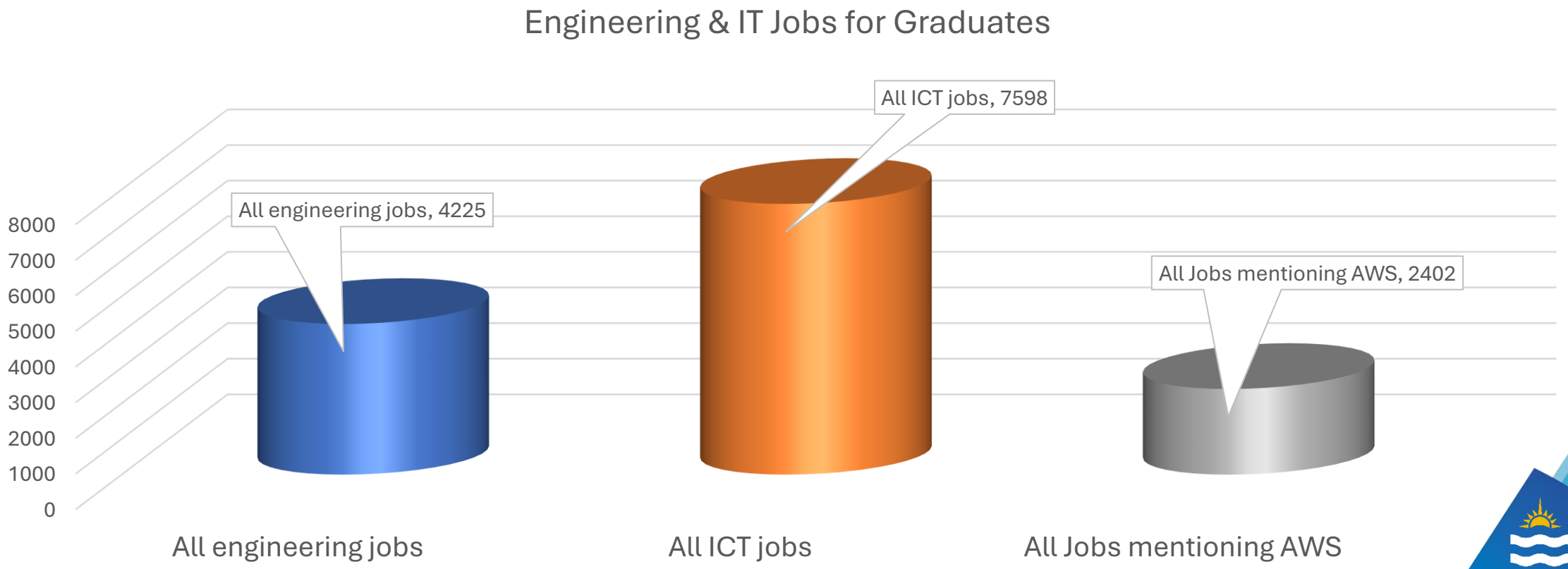
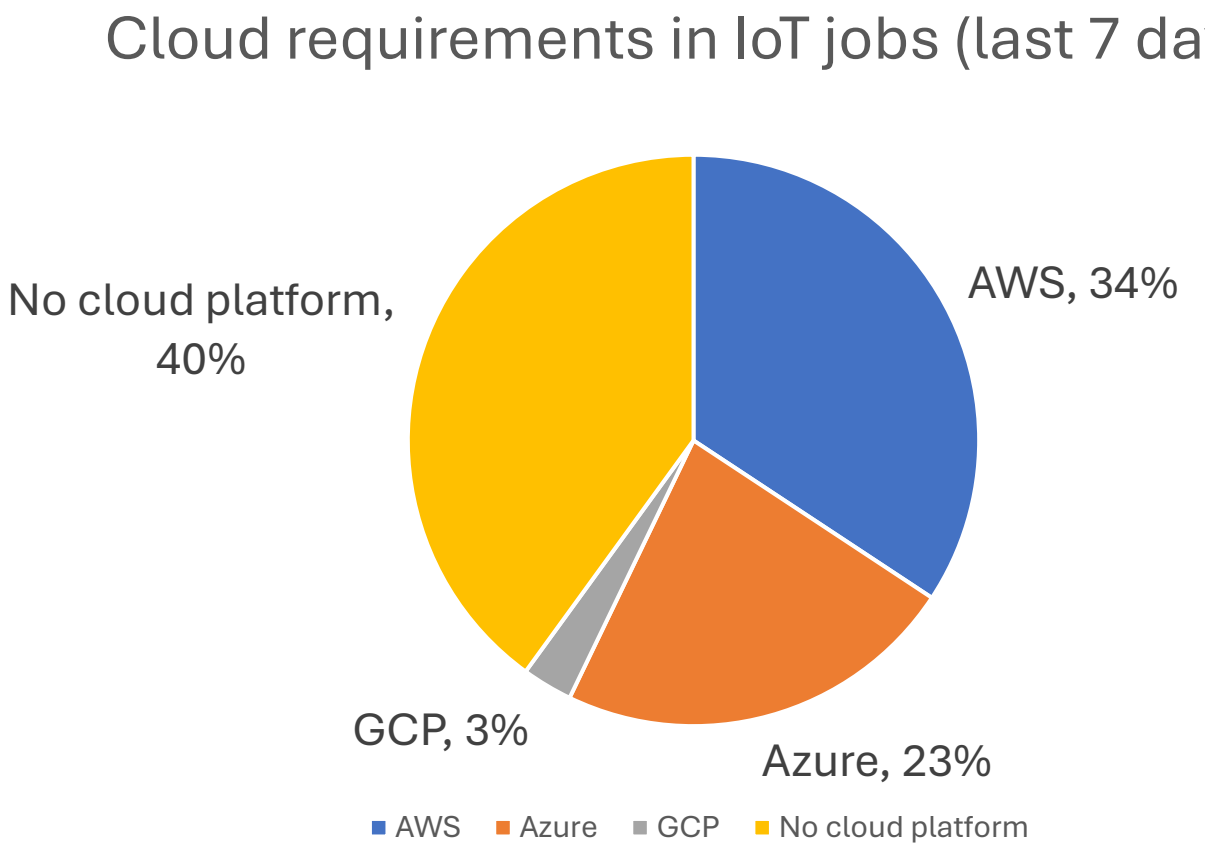
Jobs in the Cloud

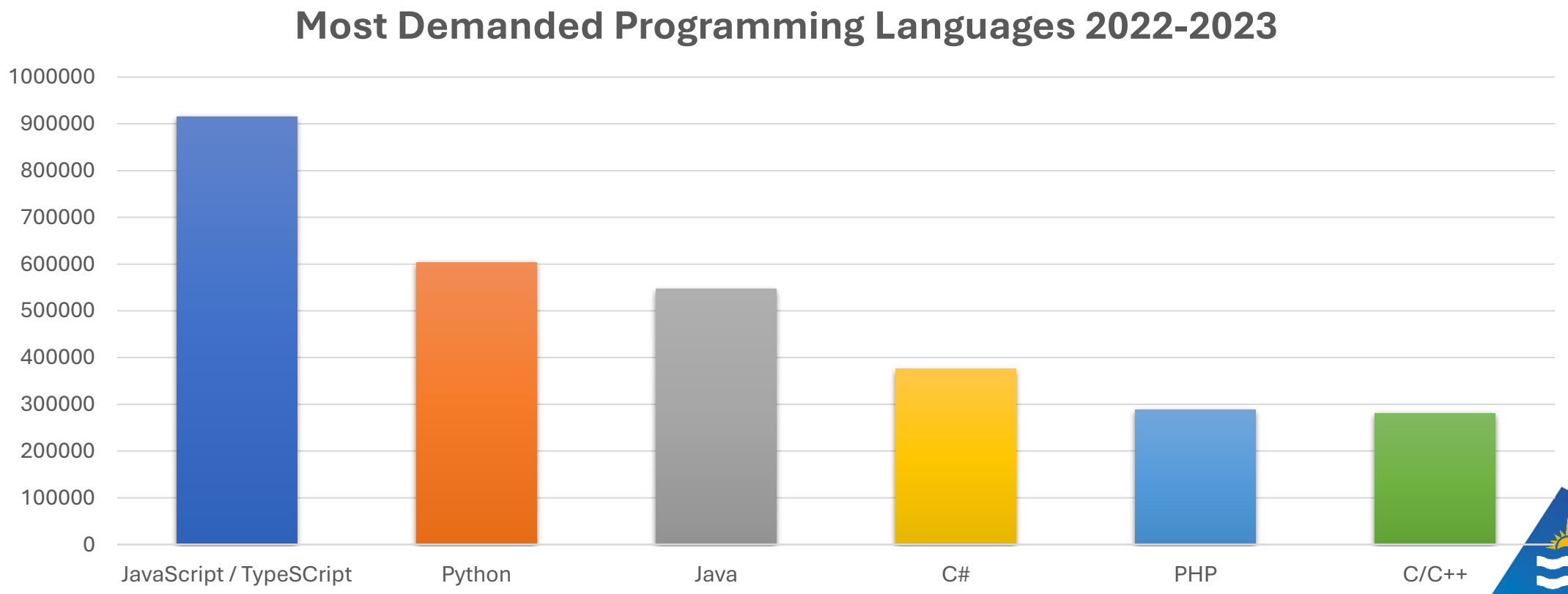


https://www.seek.com.au 9-Oct-24

IoT & Embedded Jobs



Programming Languages in Demand - Overall



Next - Project Presentation: Wednesday Week 7
Report: Week 7

Thank you

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