



September  
2022

IoT & Edge  
Developer Survey  
Report



# Survey Partners

Thank you for sharing the survey with your communities!





# Introduction

## Welcome to the 2022 IoT & Edge Developer Survey Report

The 2022 survey was conducted with the following objectives:

- 1) To gain insights into the IoT & edge computing industry landscape;
- 2) To understand the challenges IoT & edge computing developers are facing; and
- 3) To help identify the opportunities for enterprise IoT & edge computing stakeholders in the IoT & edge computing open source ecosystem.

**Read this report to learn more about the key findings and industry trends for IoT & edge computing stakeholders.**



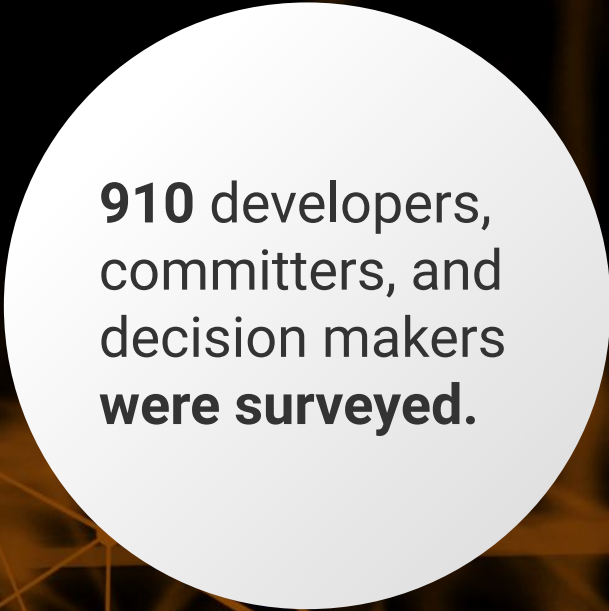
**The 2022  
developer survey  
report provides  
unique insights into  
the IoT & edge  
computing industry  
landscape**



## Methodology

Sponsored by the [Eclipse IoT](#), [Eclipse Edge Native](#), and [Eclipse Sparkplug](#) Working Groups, the 2022 IoT & Edge Developer and Adoption Survey was conducted from April 1 to June 15, 2022.

910 developers, committers, architects and decision makers were surveyed, with participation from across the globe and within a broad range of industries. **69%** of survey participants are both open source committers and users, a **20% Increase** over 2021.



**910** developers, committers, and decision makers were surveyed.



# Executive Summary

- **Java, C and C++** are the most widely used programming languages for **constrained devices**. **Developers indicate that Java is the preferred language** for IoT gateways and edge nodes.
- **MQTT continues to be the most widely used IIoT communication protocol, though there seems to be increased fragmentation.** HTTP/HTTPS and REST show slight decreases in IIoT usage compared to 2021, while alternative communication protocols (TCP/IP, AMQP0.9, In house/proprietary ) have seen noticeable growth.
- **64-bit ARM architectures** are gaining ground with gateway and edge node suppliers.
- **Edge computing is gaining traction in real world applications** as top edge computing workloads all show significant increases in adoption.
- **The IoT Middleware market is still young! AWS IoT (32%), Microsoft Azure IoT (22%), and Google Cloud IoT Platform (17%)** were the top three options. As Google decides to discontinue their IoT middleware race, Middleware market diversification seems to be expanding.
- **Concerns around connectivity are on the rise this year** , making it one of the top 3 challenges developers face, along with security and data collection & analytics.

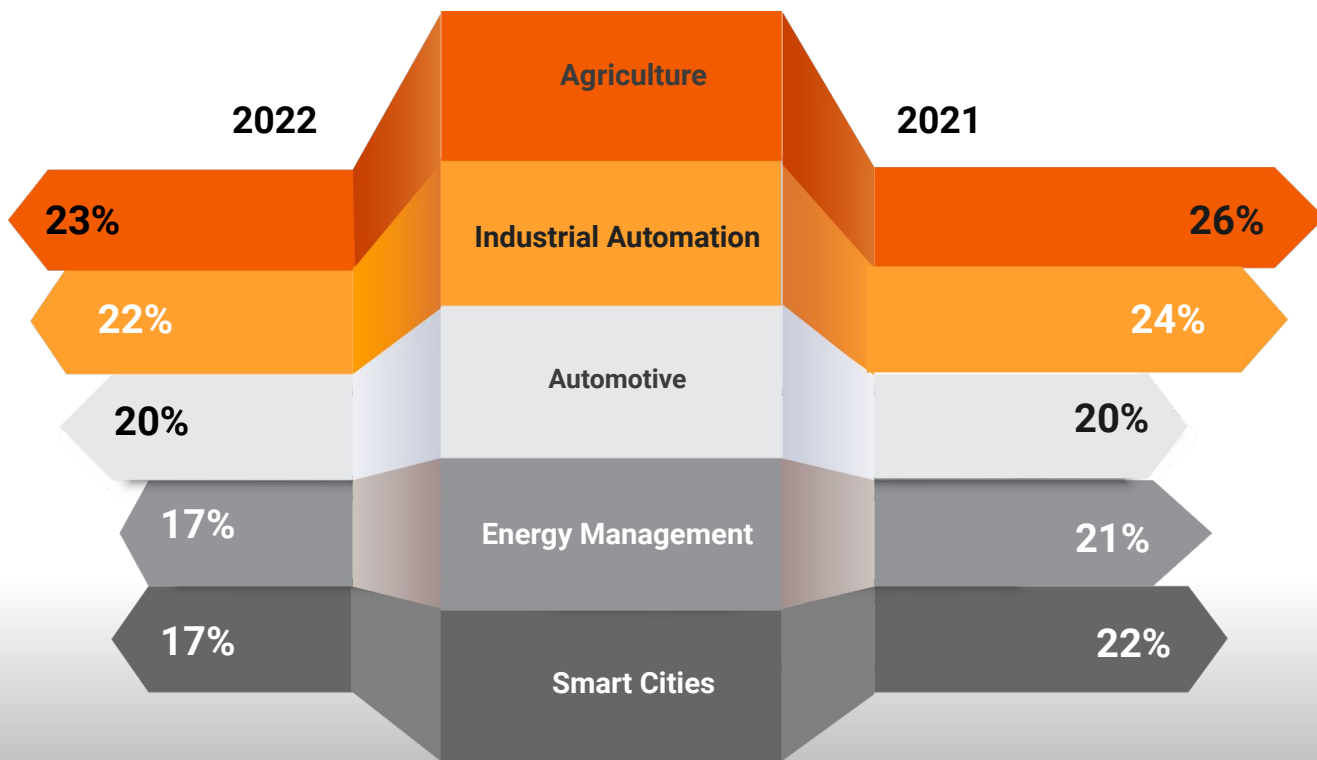


# Executive Summary

- **There is increased public cloud fragmentation and the big three are being challenged. Despite continued dominance, Amazon AWS** with 36% usage (-8% in 2022), **Microsoft Azure** with 18% (-11% in 2022), and **Google Cloud Platform** with 16% (-4% in 2022) have all lost ground in a growing competitive landscape.
- **Agriculture** (23%) has emerged as the leading industry for IIoT and edge computing technology, followed by **industrial automation** (22%) **automotive** (20%) and **energy & smart cities** (17%).
- **Connectivity (47%), data collection & analytics (26%)** and **security(26%)** are the top three concerns for IoT & edge developers in 2022, with connectivity growing by 9% compared to 2021
- **Artificial intelligence (38%)** was the most frequently selected edge computing workload
- **Container images (49%)** are the most frequently selected edge computing artifact
- **Linux** is the most widely used operating systems for constrained devices (43%), as well as for IoT gateways & edge nodes (51%),

# Key Finding 1.1

## Primary Industry Verticals





## Key Finding 1.2

### Agriculture and Industrial Automation Sectors Top Up the Industry Verticals

1

**Agriculture is now the top industry for IIoT and edge computing technology adoption** (at 23%, compared to 26% in 2021). Industrial automation comes in second place (22%) with slight decrease compared to 2021.

2

The education industry shows a steady effect compared to 2021 at 17% also along with building automation. Both verticals may have been negatively impacted by shifting priorities due to COVID-19 but started to show steady adoption in preparation for a slight increase in the next few years.

3

Automotive (20%) comes in third, developments happening in this industry are massive and promising, its forecasted that this industry shows substantial growth in the next few years.

4

Energy management and smart cities are tied both come in at 17%, a 3% and 5% decrease respectively over 2021.

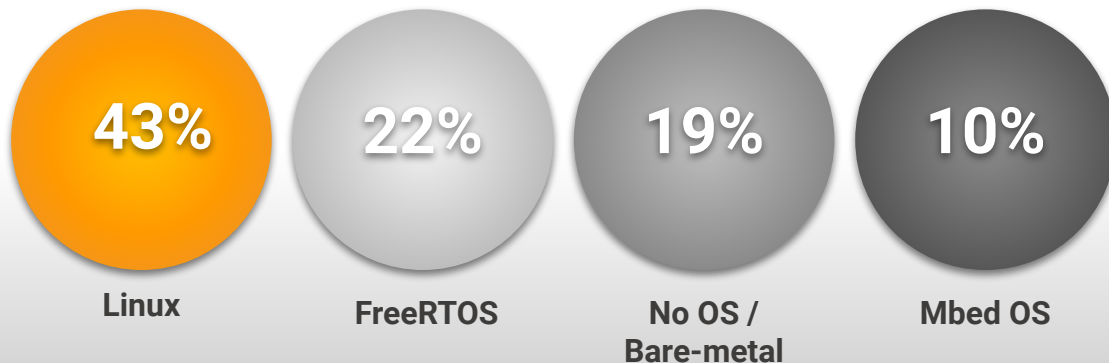


## Key Finding 2

### For Constrained Devices: It's a Linux and FreeRTOS World:

- **Linux** (43%), **FreeRTOS** (22%) and **No OS/Bare-metal** (19%) are the top OS choices for constrained devices
- **Zephyr** shows slight decrease (from 10% in 2021 to 8% in 2022)
- New OSes show promising growth in the next few years such as **Oniro** (3%)

### Top Operating System for Constrained Devices

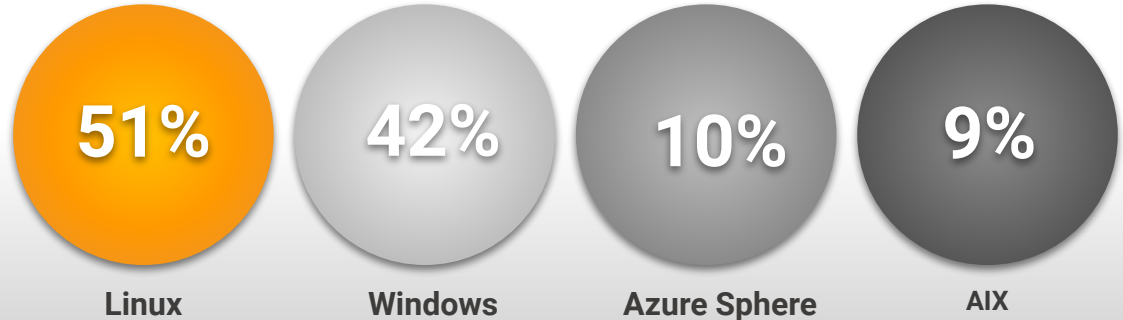


## Key Finding 2.1

### Linux and Windows Dominate IoT Gateways & Edge Nodes OS landscape

Top Operating Systems For IoT Gateways & Edge Nodes

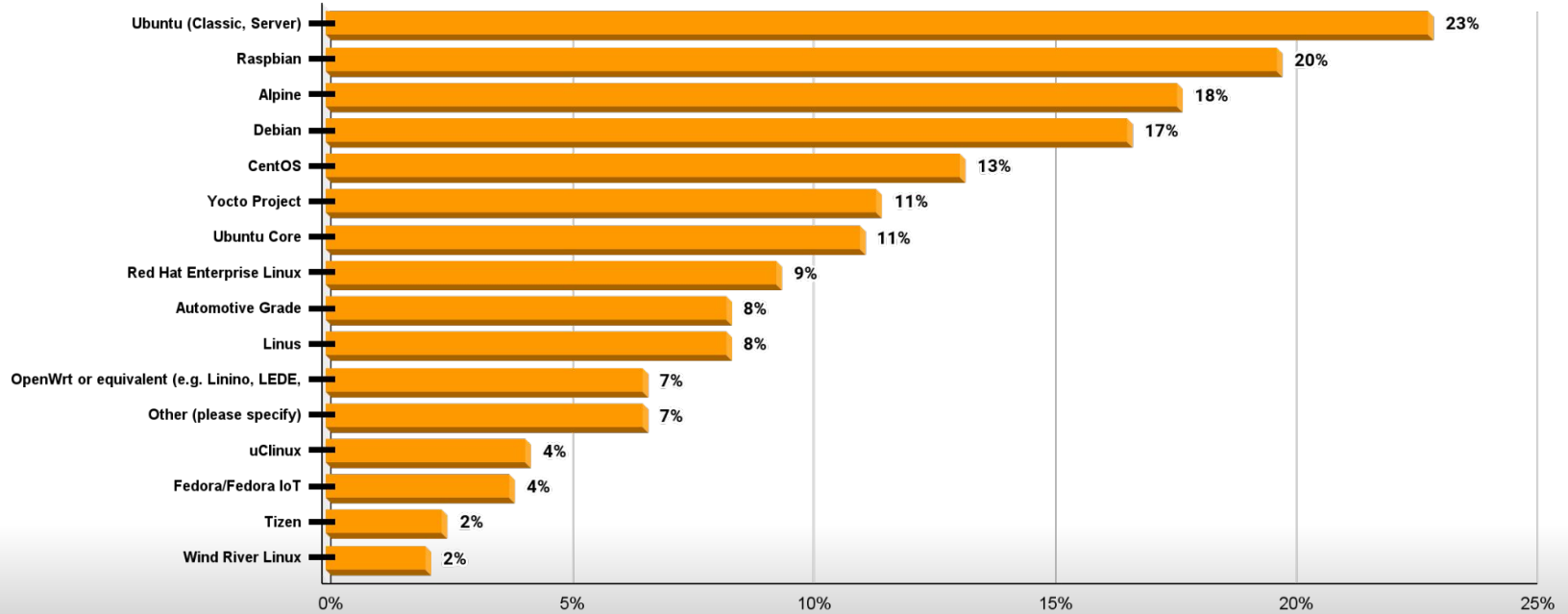
- **Linux** (51%), **Windows** (42%) and **Azure Sphere** (10%) are the top OS choices for IoT gateways and edge nodes
- **AIX** comes in at **9%** for 2022





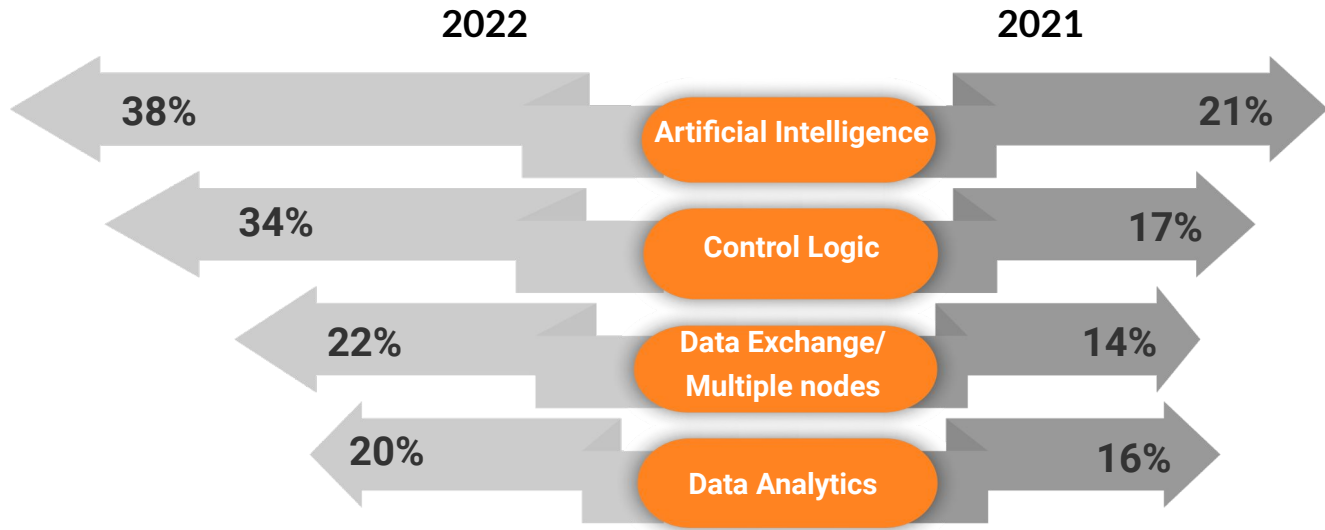
## Key Finding 2.2

# Linux Distributions Employed in IoT Solutions



# Key Finding 3

## Top Edge Computing Workloads

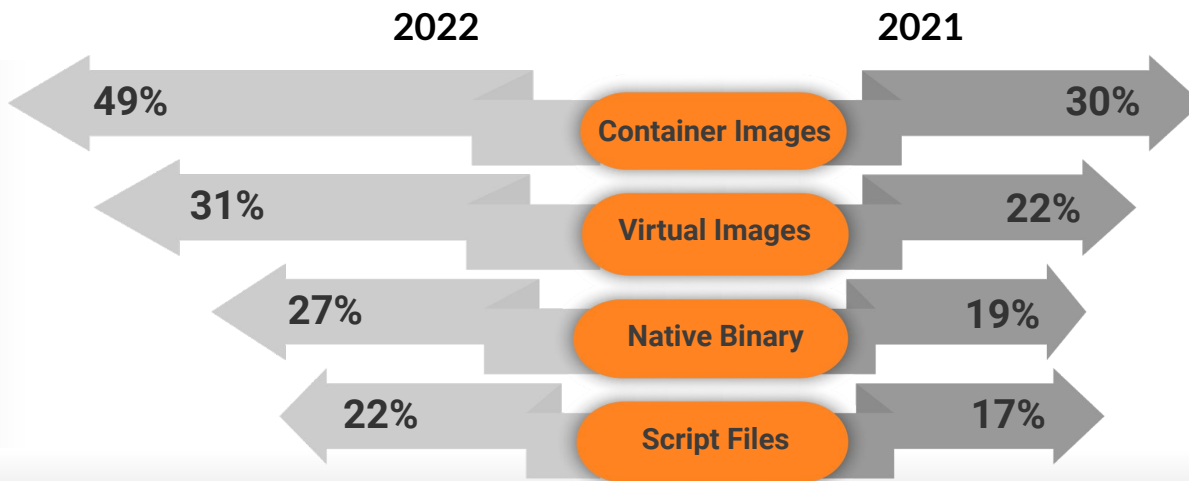


Edge Computing are gaining ground as all workloads respectively increased Y-on-Y. **Artificial intelligence** (38%) is the most common workload for edge gateways /edge nodes. **Control logic, data exchange between multiple nodes, and data analytics** round out the top 4 edge computing workload.

# Key Finding 4

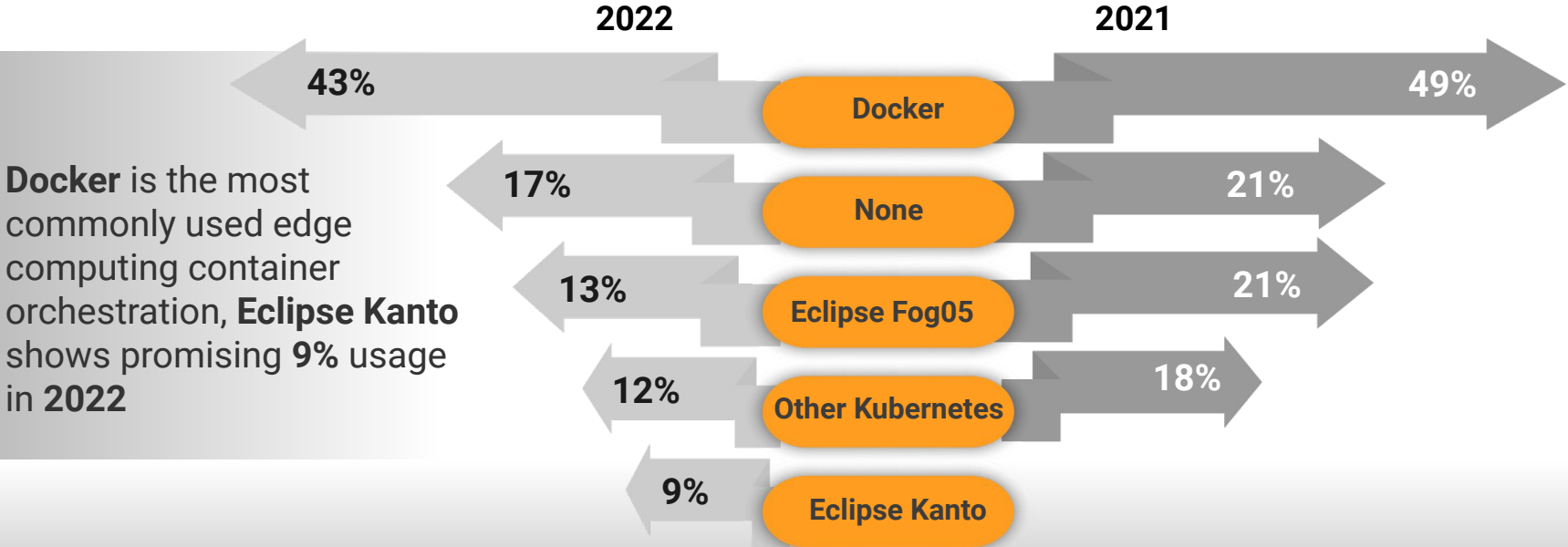
## Top Edge Computing Artifacts Deployed for IoT Solutions

**Container images** are the most commonly used edge computing artifacts for both edge gateways and edge servers.



# Key Finding 4.1

## Top Edge Computing Container Orchestrations Used for IoT Solutions

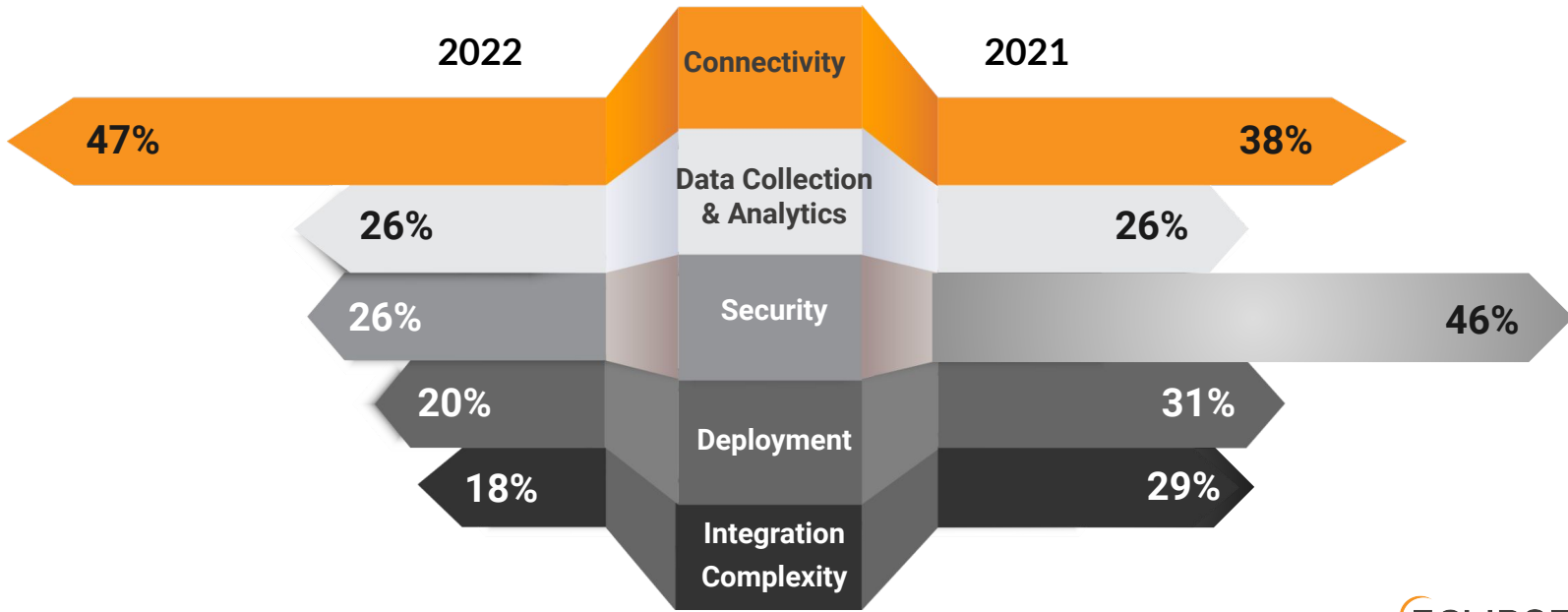


**Docker** is the most commonly used edge computing container orchestration, **Eclipse Kanto** shows promising **9%** usage in **2022**

# Key Finding 5

## Concerns around connectivity are on the rise!

### IoT & Edge Computing Developer Concerns





## Key Finding 5.1

### Top Edge Computing Artifacts Deployed for IoT Solutions

- **Connectivity** 47% (38% in 2021), **data collection & analytics** 26% (26% in 2021) and **security** 26% (46% in 2021) continue to be the top three developer concerns in 2021.
- **An increase in connectivity** concerns underscores the lack of computational capacity for efficient built-in security.
- Security still resembles major concern despite the percentage drop (from 46% in 2021)
- A decrease in deployment-related concerns (from 31% to 20% in 2022) indicates that less solutions are moving past the PoC phase and developers are focusing more on successful solutions rollout to assure overall better user experience.
- Concerns around **integration complexity** have also decreased (by 11% compared to 2021). As the number of deployments increase, developers see less complexity in the need for additional integrations with complementary technologies and systems.



## Key Finding 6

### Programming Languages: All The Usual Suspects



**C (25%)** is number one for **constrained devices**



**C (38%), C++ (33%)** comes in 2nd and 3rd place for constrained devices



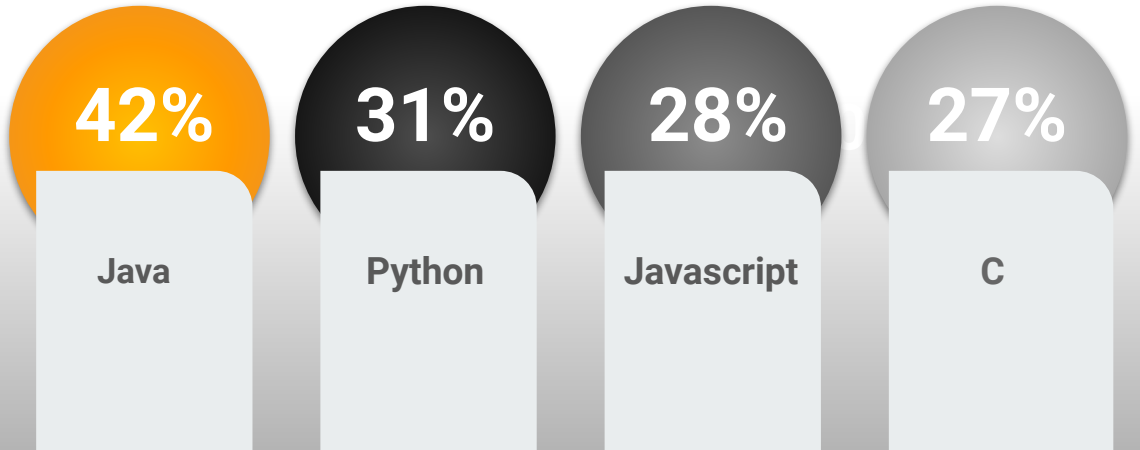
**Python** come in 4th place with **(27%)** for constrained devices

**Java, C, C++, Python, and JavaScript** dominate the IoT & edge space, as they do in the rest of the IT market.

## Key Finding 6.1

### Programming Languages: All The Usual Suspects

**Java, Python, Javascript** and **C** dominate as programming languages for the IoT gateways & edge nodes in 2022 .

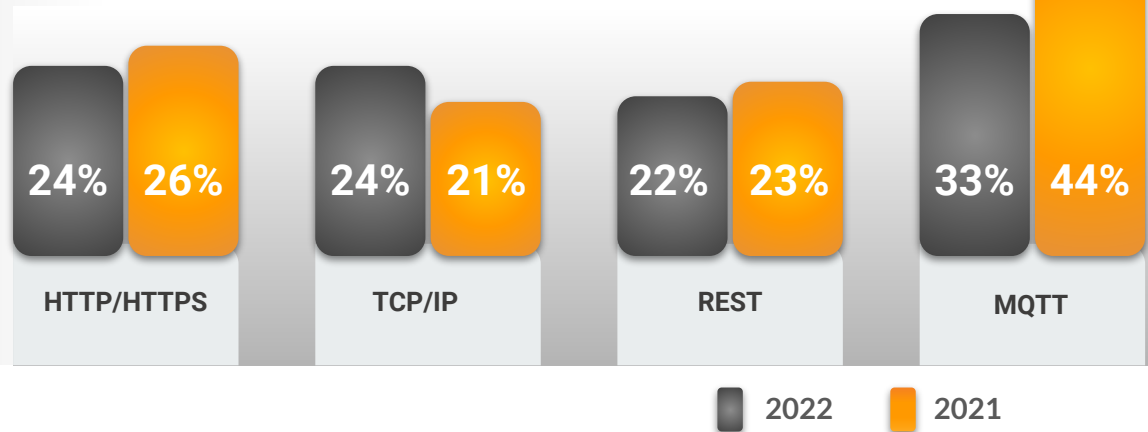


## Key Finding 7

- MQTT still leads communication protocols in 2022 despite -11% drop compared to 2021
- Slight decrease in HTTP/HTTPS (-2%) and REST (-1%) communication protocols in 2022 compared to 2021
- 3% increase in TCP/IP in 2022 compared to 2021 (21%)

**MQTT continues to be the most widely used IIoT communication protocol, though there seems to be increased fragmentation.**

### Preferred IIoT Communication Protocols



## Key Finding 8

### Most Used Connectivity Technologies



WiFi  
**36%**



Ethernet  
**29%**



Cellular  
(LTE, 4G, 5G, etc)  
**22%**



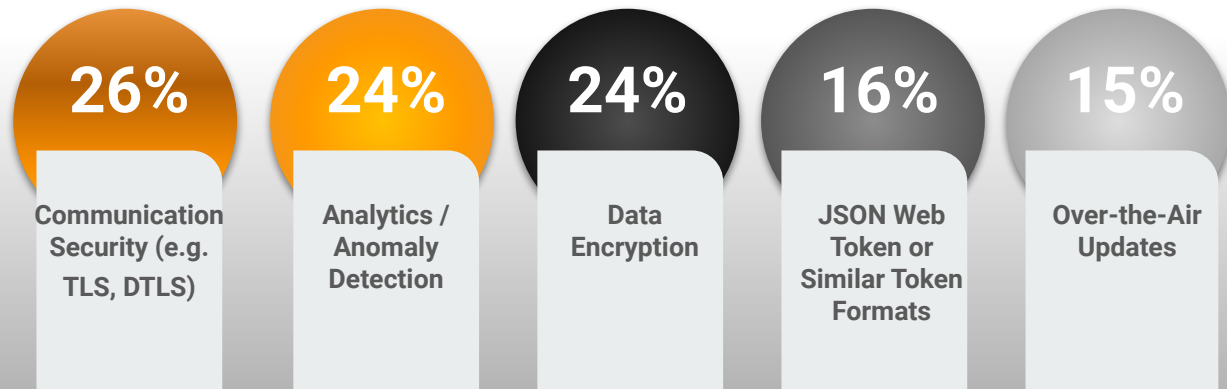
Bluetooth/Bluetooth  
Smart  
**20%**

Top Connectivity Technologies Being Used are WiFi 36% (45% in 2021), Ethernet 29% (40% in 2021) Cellular (LTE, 4G, 5G, etc) 22% (30% in 2021) and Bluetooth/Bluetooth Smart 20% (20% in 2021).

## Key Finding 9

### Most Favored Security-Related Technologies

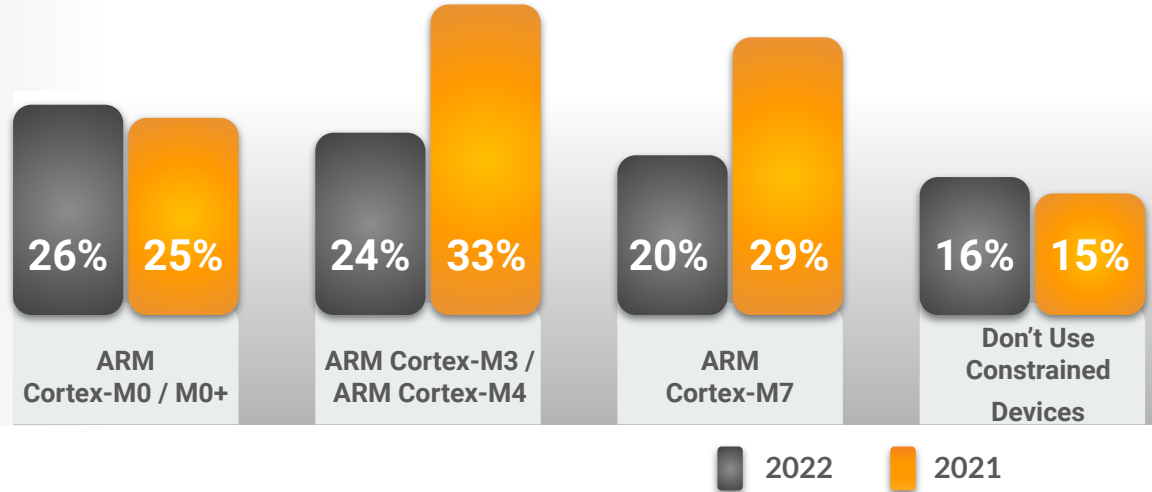
**Communication security (e.g TLS, DTLS) (26%), analytics/anomaly detection (24%), data encryption (24%)** are the most used security related technologies in IoT/edge solutions, **JSON web token (16%)** and **OTA updates (15%)** follows the top 3 mentioned above.



# Key Finding 10

- While ARM continues to dominate, ARM Cortex-M0 / M0+ usage has show slight increase **25% in 2021 to 26% in 2022**
- ARM Cortex-M3 / M4 usage shows drop in 2022 from **33% in 2021 compared to 24%**
- ARM Cortex-M7 usage has dropped 9% since 2021

## Hardware Architecture Usage for IoT Constrained Devices

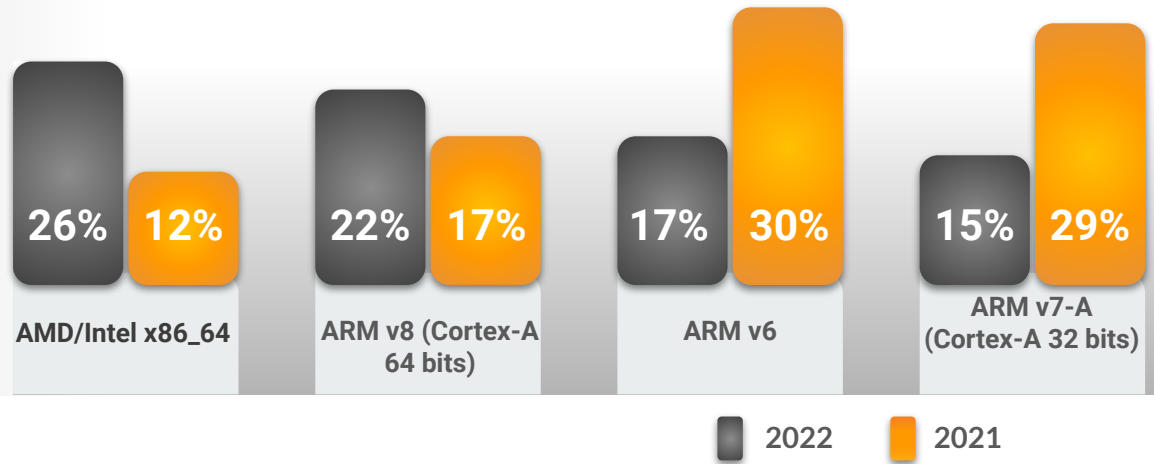


# Key Finding 11

## 64-bit ARM architectures are gaining ground with gateway and edge node suppliers.

- **AMD/Intel x86-64** usage shows a significant growth in 2022 (14% increase from 2021)
- **ARM v8** usage shows also an increase by 5% in 2022
- **ARM v6 & ARM v7-A (Cortex-A 32 bits)**-shows significant drop in 2022

Hardware Architecture Usage for IoT/Edge Gateways and Edge Nodes



## Key Finding 12

### Types of IoT Data/Information Stored In Database/Datastore

**Device information (36%), time series data (26%), contextual data (26%)** are the types of IoT/data/information stored in a database/datastore.



**Device Information**



**Time Series Data**

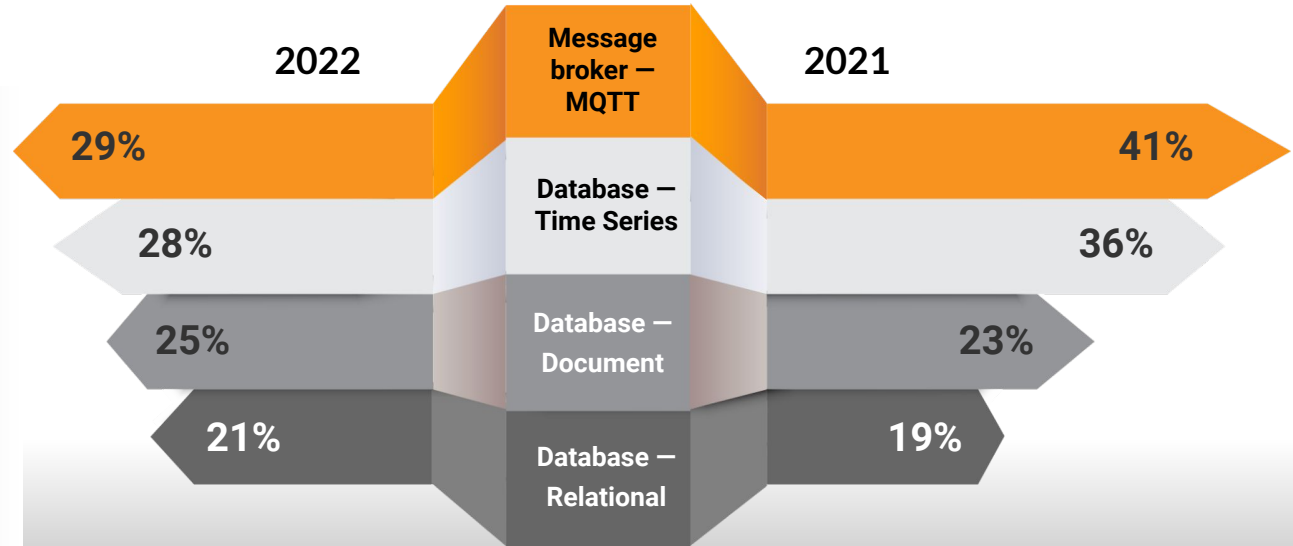


**Contextual Data (e.g. adding location or geospatial context to device, sensor, etc.)**



# Key Finding 13

## Most Common Technologies Used In Messaging Infrastructure

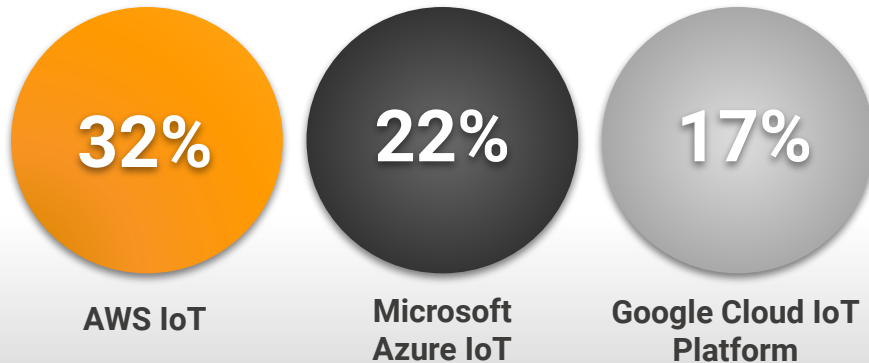


Message broker-MQTT still the most commonly used technology in messaging infrastructure in 2022.

## Key Finding 14

- IoT Middleware is dominated by **AWS IoT** (32%, -5% in 2021), **Microsoft Azure IoT** (22%, -5% in 2021), and **Google Cloud IoT Platform** (17%, -5% in 2021)
- Percentage drop of Google **foreshadowed their decision to discontinue** Google Cloud IoT platform
- The market is also seeing a rise of other middleware options: (Bosch IoT suite (11%), IBM Watson IoT platform (10%), cumulocity (10%).
- The diversity in responses indicates that this technology segment is still young and competitive.

### IoT Middleware: The Race Is Still Young

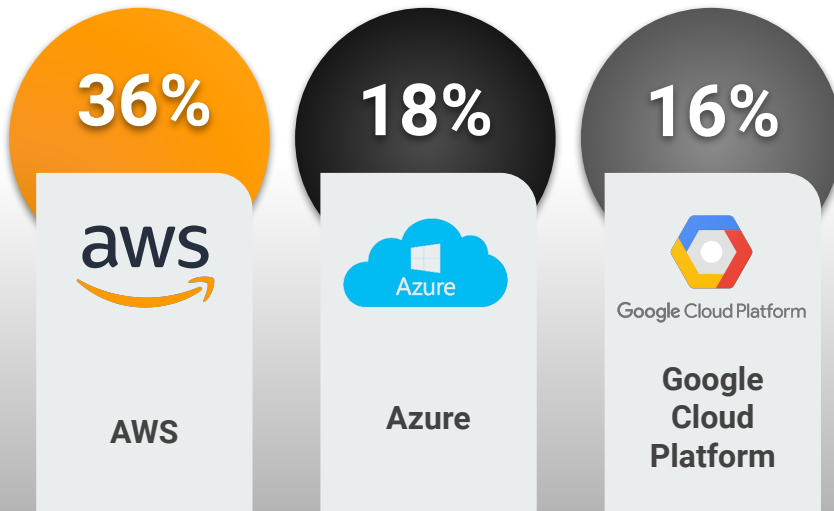


## Key Finding 15

### Public Cloud and IoT: The Big Three Continue to Rule

**Amazon AWS** with **36%** (-8% in 2021), **Microsoft Azure** with **18%** (-11% in 2021), and **Google Cloud Platform** with **16%** (-4% in 2021) continue their dominance of public IoT and cloud platforms.

User's shows noticeable growth in using Kubernetes (14%) and other on-premises cloud (14%) in 2022

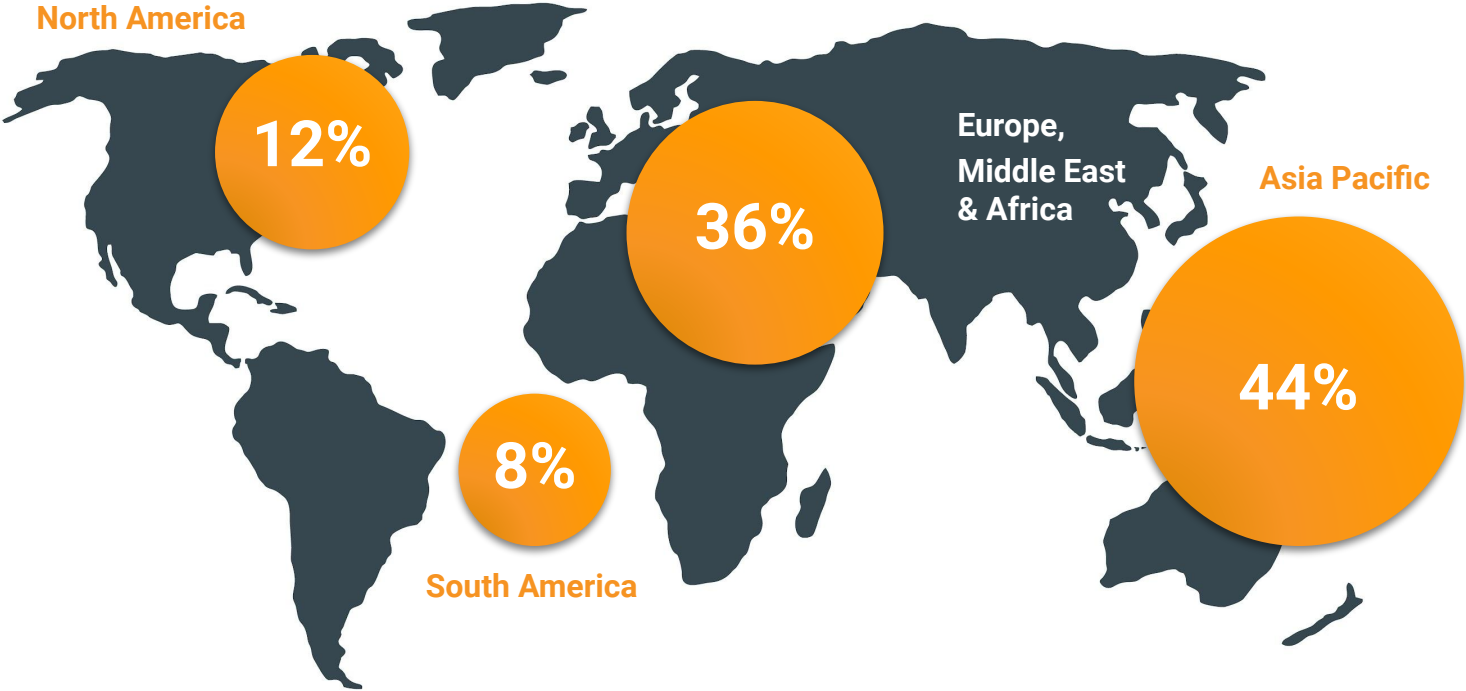




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**Demographics**

# Regions

## In Which Region Are You Located?



# Roles

## What Best Describes Your Role?



Developer



Executive



Engineering/R&D Management



Other



IT Management



Engineer/R&D (Hardware)



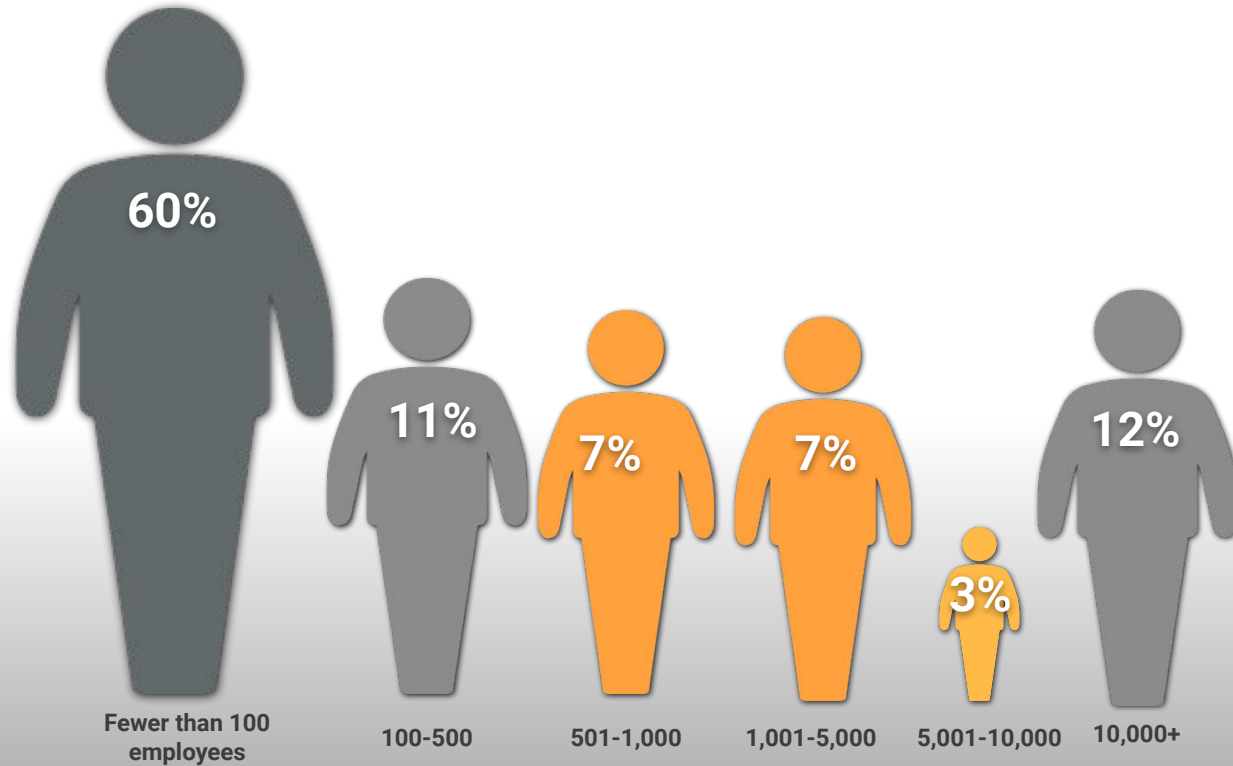
Product Manager



Marketing/Sales/Business Development

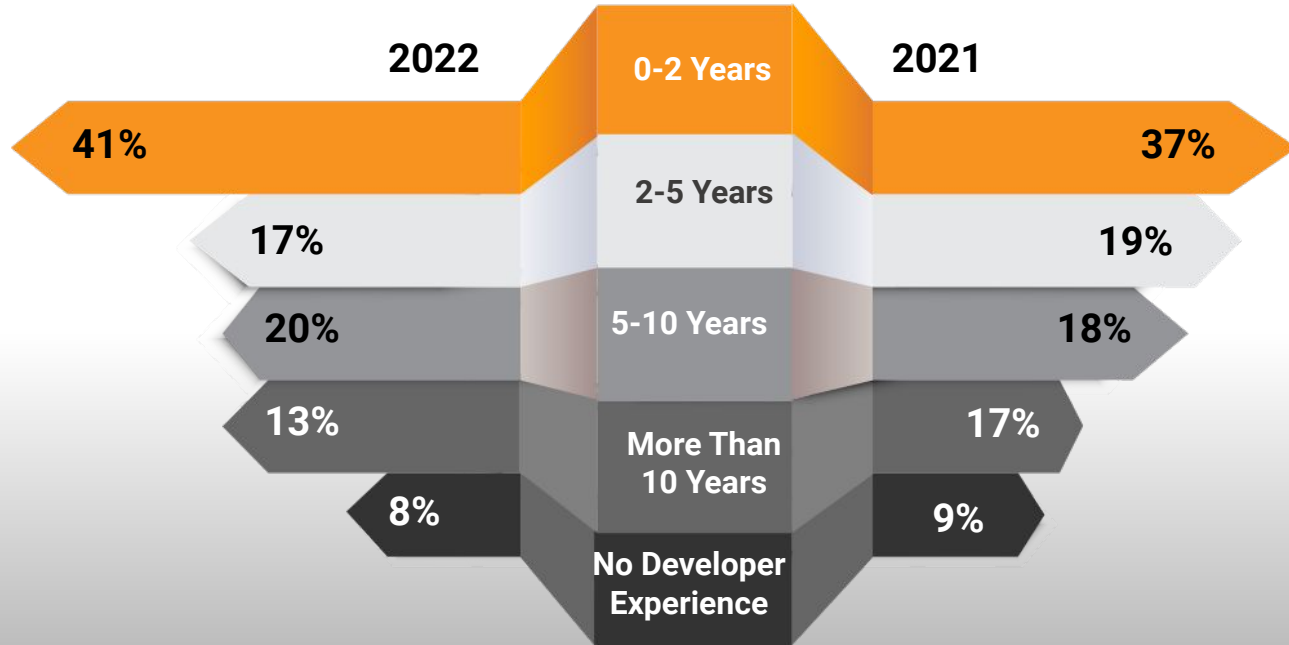
# Employees

## How Large is the Organization You Work For?



# Experience

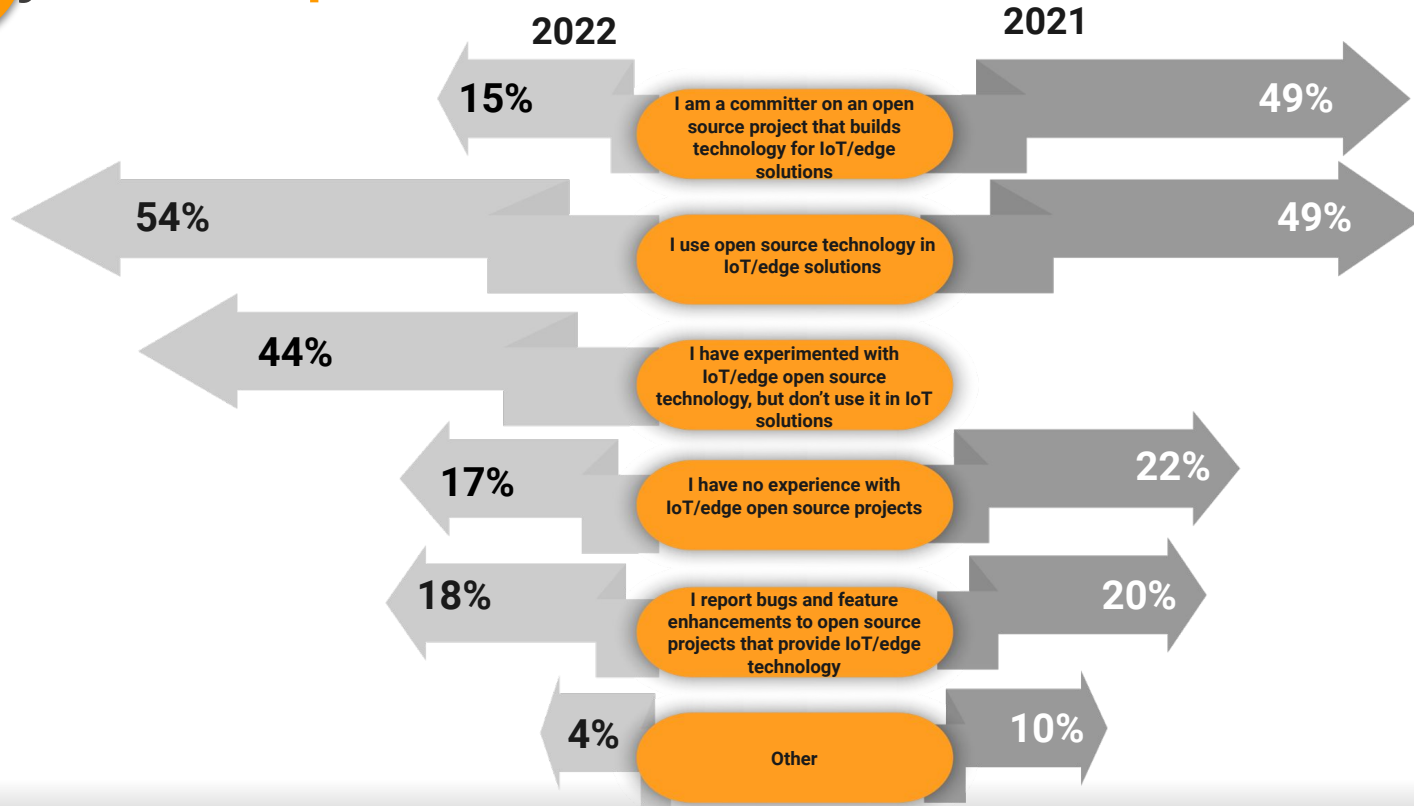
## How Much Experience Do You Have Developing IoT/Edge Solutions?







# Project Participation



# Thank You!

To receive exclusive access to detailed industry research findings,  
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