Executive summary

> **IoT drives real outcomes today.** Two-thirds of respondents are currently working on IoT projects or will be in the next 18 months

> **AWS, Azure, and GCP are the leading IoT cloud platforms**

> **IoT developers mostly use C, C++, Java, JavaScript, and Python**

> **MQTT is still the dominant communication protocol** leveraged by developers

> **The Eclipse Desktop IDE is the leading IDE** for building IoT applications
Introduction

The objective of this IoT Developer Survey was to gain a better understanding of the requirements, priorities, and perceptions of IoT developer communities. From February 11, 2019 to March 8, 2019, 1,717 individuals participated in an online survey. The survey was heavily promoted on the Eclipse Foundation’s various social media channels, the Eclipse Foundation and Eclipse IoT Working Group websites, as well as on the Eclipse IoT member company websites, social media platforms, and communication streams.
IoT development is expanding at a rapid pace, fueled by the growth of investments in predominantly industrial markets.
The Eclipse IoT Working Group surveyed developers to gain on-the-ground understanding and insights into how IoT solutions are being built.
IoT drives real outcomes

Two thirds of respondents say their organization develops and deploys IoT solutions today or will do so in the next 18 months.

Only 9% answered that their organization has no plans to develop IoT solutions.
Top IoT developer concerns

Security
38%

Connectivity
21%

Data Collection & Analytics
19%

Top three concerns remain the same as last year, with Connectivity moving into second place.

Standards, Performance and Privacy increased in importance.

The Eclipse IoT portfolio is uniquely positioned to address all three developer concerns.
Top developer concerns over time

- Security: 38% in 2018, 38% in 2019
- Connectivity: 21% in 2018, 19% in 2019
- Data collection & analytics: 19% in 2018, 18% in 2019
- Performance: 18% in 2018, 18% in 2019
- Privacy: 18% in 2018, 18% in 2019
- Integration with Hardware: 18% in 2018, 18% in 2019
- Standards: 16% in 2018, 15% in 2019
- ROI: 15% in 2018, 16% in 2019
IoT industry focus.
Key industry focus areas

Top three industries remain the same as last year, with **Automotive**, **Education** and **Building Automation** increasing.

**Platform**

- 34%

**Home Automation**

- 27%

**Industrial Automation**

- 26%

*is breaking the silos between Information Technology (IT) and Operational Technology (OT)*

**Education** had the biggest year on year percentage increase.
Operating systems: A diverse landscape.
The operating system landscape

Aggregating device and edge nodes data and excluding Linux...

**Top Three**

- Windows
- FreeRTOS
- No OS

IoT developers see value in operating systems, which implement **common features** and let them concentrate on their **business outcomes**

Huawei’s **LiteOS** is making inroads (2% to 5%)

Biggest year on year drop: **no OS** (20% to 11%)
Key takeaway

Top device operating systems

dominates constrained devices (along with its Amazon derivation)

Other standouts (75%+) include

- Contiki/Contiki-NG
- MBed OS
- RIOT OS
- Contiki/Contiki-NG
- QNX
Top Edge / Gateway operating systems

Linux dominates
Gateways and
Edge nodes

**Linux**
76% Edge/Gateway

**Windows**
52% Edge/Gateway
Linux distributions

It’s a Debian World...

Debian and derivatives (Raspbian, Ubuntu / Ubuntu Core) were picked by at least a third of respondents.

CentOS & Fedora / Fedora IoT came in second place, with a strong showing by Yocto
Non-Linux operating systems over time

<table>
<thead>
<tr>
<th>Operating System</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>20%</td>
<td>19%</td>
</tr>
<tr>
<td>FreeRTOS</td>
<td>19%</td>
<td>11%</td>
</tr>
<tr>
<td>No OS / Bare-metal</td>
<td>11%</td>
<td>6%</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>MBed OS</td>
<td>6%</td>
<td>5%</td>
</tr>
<tr>
<td>Contiki</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>TinyOS</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>RIOT OS</td>
<td>5%</td>
<td>3%</td>
</tr>
<tr>
<td>QNX</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>VxWorks</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Zephyr</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Huawei LiteOS</td>
<td>5%</td>
<td>5%</td>
</tr>
</tbody>
</table>
Key hardware architectures.
Constrained devices

The top three CPU architectures for constrained devices used by respondents are ARM-based, with significant use of niche 8-bit, 16-bit and 32-bit MCUs.
Key takeaway

Hardware architectures used for IoT gateways

Use gateways and edge nodes with **ARM Variants**

- 70%

Use gateways and edge nodes with **Intel x86 and x86_64 CPUs**

- 42%

**ARM and Intel Dominate**
Top security technologies.
Top 3 security technologies

- Communication Security: 38%
- Data Encryption: 38%
- JSON Web Token (or equivalent): 26%

Top three remain the same as last year, with Virtualization starting to play a stronger role in IoT security.
Key IoT cloud platforms.
### Top 3 IoT cloud platforms

<table>
<thead>
<tr>
<th>Platform</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>AWS</td>
<td>34%</td>
</tr>
<tr>
<td>Azure</td>
<td>23%</td>
</tr>
<tr>
<td>GCP</td>
<td>20%</td>
</tr>
</tbody>
</table>

Top three remain the same as last year, this reflects the wider Cloud market share.

*Public Cloud seems to be making gains at the expense of private Cloud and on-premise deployments of Openstack, Kubernetes and Cloud Foundry.*
Programming languages and communication protocols.
### Key takeaway

#### Top programming languages

<table>
<thead>
<tr>
<th>Constrained devices</th>
<th>Gateways and edge nodes</th>
<th>IoT Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>Java</td>
<td>Java</td>
</tr>
<tr>
<td>C++</td>
<td>Python</td>
<td>Javascript</td>
</tr>
<tr>
<td>Java</td>
<td>C++</td>
<td>Python</td>
</tr>
<tr>
<td>Javascript</td>
<td>C</td>
<td>PHP</td>
</tr>
</tbody>
</table>

C dominates constrained devices. Java leads on Edge/Gateway and for Cloud applications.
Top 3 communication protocols

Almost 50% of participants use HTTP (likely for RESTful web services) with MQTT strongest of the IoT-specific protocols.

- **HTTP**: 49%
- **MQTT**: 42%
- **Websockets**: 26%

Websockets and HTTP/2 are also strong (around 25%) with CoAP usage significantly lower at 15%.
Connectivity
Top 3 connectivity protocols

TCP/IP, WiFi and Ethernet dominate usage with Satellite and Thread more than doubling year over year.

TCP/IP: 54.1%
WiFi: 48.2%
Ethernet: 41.1%

Usage of specialized connectivity solutions (LPWA, Zigbee, 6LoWPAN, Z-Wave, Satellite) hovers between 8 and 15% each.
Eclipse is the leading IoT IDE.
Top 3 IDEs or text editors

45% of respondents use the Eclipse Desktop IDE and close to 10% also use Eclipse Che, the Eclipse Cloud IDE.

Other top choices are Visual Studio Code (32%) and Notepad++ (26%). Visual Studio Code’s year on year surge is remarkable (23% to 32%).
Eclipse is perceived as the most influential IoT organization.
Most influential IoT organizations

The Eclipse Foundation, the Apache Software Foundation and the Linux Foundation deemed the three most important organizations for IoT.

Eclipse Foundation 57%
Apache Software Foundation 52%
Linux Foundation 43%
80% of respondents are active in IoT

Key takeaway

- 40% Develop IoT solutions at work
- 10% Develop in their spare time
- 20% Learn in their spare time
- 10% Research IoT solutions
To stay updated on open source IoT innovation, subscribe to the Eclipse IoT newsletter or connect with us at: @EclipseIoT
Thank you!