AWS vs. AZURE

for your IoT project

Witekio

AN AVNET COMPANY

HOW TO CHOOSE FOR YOUR IOT PROJECT?

Cloud computing options for IoT projects have proliferated in recent years. Where once a single default choice – AWS – dominated the landscape, today competitors from some of the biggest technology firms on Earth have risen to the challenge and snatched market share from Amazon. Offers from Google, Alibaba, Oracle, Microsoft, and a plethora of smaller cloud providers now present IoT device owners with a choice. But it's a choice that is not always easy to make.

While Amazon has lost market share to the newcomers, it remains the market leader. Microsoft's cloud offer, Azure, is in a clear second place, and between them they control more than 50% of the global cloud computing market. Both companies offer robust and mature IoT cloud solutions and often match each other feature-for-feature. As a result, choosing between the cloud platforms is more difficult than ever.

At Witekio we regularly work with clients that have a preference for AWS or Azure and our engineering team is experienced at architecting software and provisioning devices on both platforms. However, sometimes clients arrive at Witekio without a clear preference for either AWS or Azure and seek our guidance on how to make that choice. This white paper aims to provide that guidance and help IoT device managers to choose the cloud platform that best suits their needs and use case.

WHY USE THE CLOUD FOR YOUR IOT PROJECT?

Before coming to the question 'AWS or Azure' it's worth exploring what makes the cloud such a popular option for IoT projects. Already many IoT projects are planned with public cloud architectures from the outset. Others eschew the cloud and prefer to keep everything in house on private servers. Finally, there are those who might be convinced to deploy their devices to the cloud if only they could be convinced that making the shift is worthwhile.

At Witekio, we have transitioned clients from their own servers to the cloud and, in doing so, we've identified eight factors that help make the cloud the preferred option for IoT project managers.

PART 1

8 *factors* to consider when evaluating a Cloud-based solution for your IoT project

- **Device Provisioning and Management:** Deploying, provisioning, and managing devices is far simpler and often more cost effective using a public cloud option than doing the same work from servers owned by the device owner or manager.

- **OTA Updates:** Updating firmware, software, and applications over the air (OTA) is a fact of life for every IoT project. Pushing those updates at scale using the computing resources of the cloud is easier and faster than relying on more limited in-house machines.

- **Device Monitoring:** 24/7 global device monitoring exacts a resource cost and many IoT projects cannot justify the costs of local monitoring in different regions. Cloud giants with datacenters geolocated around the world make local monitoring accessible to all.

- **Telemetry and Device Communications:** Bandwidth limitations are a thing of the past when your project has evolved to the cloud. Every device can communicate with the cloud or with each other without ever overloading your in-house machines.

- **Data Processing and Visualization:** Cloud computing platforms come equipped with the data processing and analytics tools to provide more and better information about your devices and how they are used. Visualizations from this data come standard, no developers required.

- **Data Storage and Lifecycle Management:** Public cloud platforms offer essentially unlimited data storage capacity and expanding your storage takes no more than a click.

- **Develop and Deploy Machine Learning:** The R&D investment in machine learning can be significant and the computing resources required to deploy a machine learning solution at scale can be pricy, too. In the cloud not only are the computing resources cheaper and available on-demand, and platforms also offer some machine learning components and products pre-integrated, right off the shelf.

- **Web Applications:** The web applications associated with a device often represent a large slice of the post-deployment computing power and spend. By deploying in the cloud, you can leverage scalability to support, expand and add features to your web application incrementally.

In a single sentence, the cloud offers IoT projects advantages in terms of scalability, data mobility, security, up-time, and cost effectiveness.

Then the question remains: which cloud platform to use?

UNDERSTANDING THE CLOUD COMPUTING MARKET:

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PART 2

An overview

The global cloud computing market consists of a clear market leader, a handful of other major players, and several niche actors specialized in either regional or sectorial service provision.

Canalys, a technology and innovation research firm, publishes regular research on the state of the cloud computing market. In their late 2020 report on the state of the market, Canalys concluded that while the market remains heavily weighted towards Amazon, the market had shifted significantly. With a growth rate still above 40% for the industry as a whole, the leading cloud providers were:

1. **Amazon AWS** with 32% market share
2. **Microsoft Azure** with 19%
3. **Google Cloud** with 7%
4. **Alibaba Cloud** with 6%

Other cloud providers include Oracle, IBM and its recent acquisition RedHat, and Tencent.

While it is evident that Amazon maintains a clear lead in the cloud market, that lead is shrinking. In fact, in 2017 and 2018 Gartner reported that Amazon's share of the market was hovering around 50%. Microsoft, Google, Alibaba and others have helped cut a market dominating position to one that is simply market leading.

What about the cloud computing market for IoT?

In broad terms, the cloud computing market for IoT mirrors the cloud market generally. Indeed, in recent Zdnet surveys Amazon's AWS and Microsoft's Azure are ranked ahead of their rivals consistently:

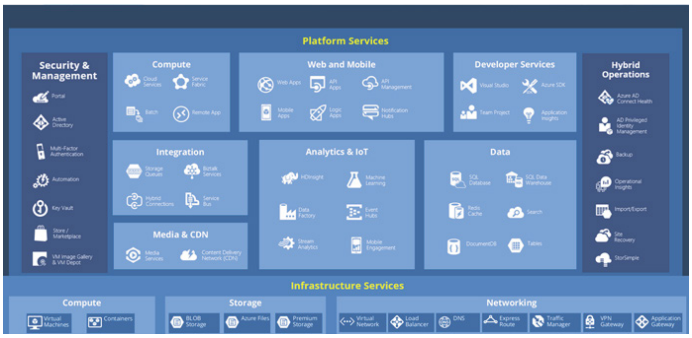
2017	2018	2019	2020
AWS	AWS	AWS	AWS
AZURE	AZURE	AZURE	AZURE
GCP	GCP	GCP	GCP
IBM	IBM	IBM	IBM
ORACLE	ORACLE	ORACLE	ORACLE

Other IoT cloud providers compete for projects outside of the major platforms. These IoT players include platforms like Avnet's IoTConnect and their Solutions Suite, and open-source toolkits like ThingsBoard.

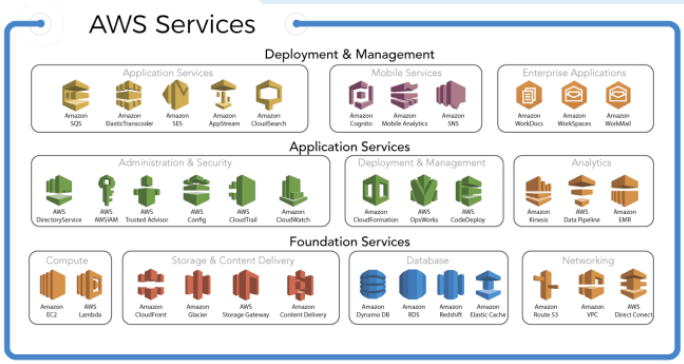
Yet AWS and Azure remain near-default options for many developers with some even demonstrating strong preferences for one or the other. In truth, though, both Amazon and Microsoft offer fully-featured cloud offerings with close feature-for-feature alignment. There are, however, some areas where the two differ, and depending on the specifics of your IoT project, there could be good reason to choose one over the other.

LET'S COMPARE AMAZON AWS AND MICROSOFT AZURE

Even a quick review of the services provided by AWS and Azure reveals that there are many areas where the two offer similar options. Whether it is in broad areas such as Web and Mobile? Developer Services, or Computing Infrastructure, or something as targeted as content delivery (Azure CDN and Amazon Content Delivery) or caching (Azure Reds Cache and Amazon Elastic Cache), Azure and Amazon mostly match each other feature-for-feature.



Yet there are some areas where the subtle differences between the two are important enough to allow an IoT device project manager to make a choice. At Witekio, we start with three areas when advising our clients which cloud computing platform to choose and, indeed, when making that same choice ourselves.



The three key areas are:

1. Authentication and Authorization
2. Device Provisioning
3. Cost Optimization

AWS or Azure?
Authentication and Authorization

Authentication and authorization in the cloud is about answering two simple questions:

- Who are you?
- What are you allowed to do?

The cloud provider needs to ensure that the IoT device that is seeking to connect to the server is allowed to do so. Both the AWS and Azure platforms have different authentication and authorization mechanisms, though there are best practice similarities.

Both AWS and Azure authentication processes rely on X.509 certificate chains and TLS handshakes for secure access to the cloud. For device authorization, these certificates are tied to device identities which are each granted permissions to take certain actions inside the cloud. While there are some minor differences between the two cloud platforms in their respective workflows, the end result is the same: secure, authenticated, and authorized access to the cloud platform.

To authenticate and authorize cloud and IoT developers, AWS and Azure both have multi-factor authentication, and Azure Active Directory with Azure Role-Based Access Control (RBAC) is roughly equivalent to AWS's Identity and Access Management (IAM).

For multi-account scenarios, AWS allows you to control security policies, role management, and management groups in a single service called AWS Organizations. Microsoft Azure, on the other hand, has a more granular approach with separate components for Azure Subscription Management, Azure Policy, and Azure Management Groups.

In short, both AWS and Azure offer best in class authentication and authorization. If you need to prototype your IoT devices before using X.509 certificates, Azure does give you built in tools to work with symmetric keys.

AWS or Azure?
Device Provisioning

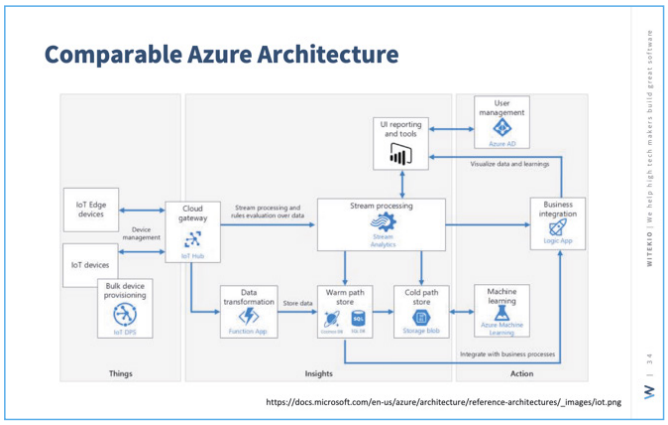
As you might expect, both AWS and Azure are capable of device provisioning and management. However, unlike the small differences between the two services in authentication and authorization, there are some marked differences between the two cloud platforms on this score.

AWS and Azure have multiple options for provisioning and managing IoT devices. Yet there are clear differences between the two platforms in terms of the tools that they offer developers to do these tasks.

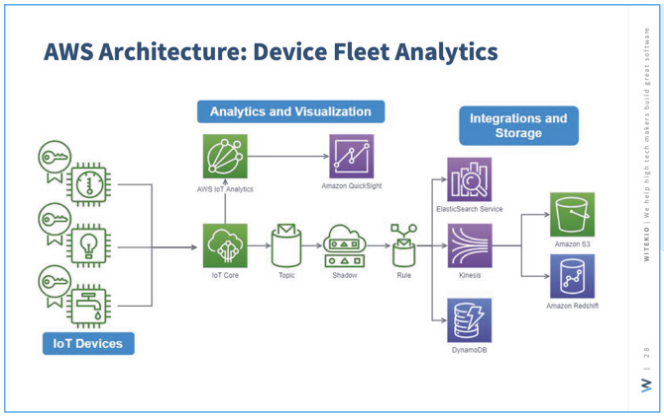
Both Azure and AWS have a user-friendly interfaces to straightforwardly provision, manage, and monitor IoT devices.

Azure, though, provides a Device Provisioning Service (DPS) for enterprise level projects which is a plus for provisioning devices on a larger scale. It's this scalability and the option of a managed service for enterprise customers that set Azure up as a preferred option for large IoT Deployments.

AWS does have options to handle more automated deployments, however it requires a little more custom integration with other services like AWS Lambda.



Choosing between the two, then, might really be an assessment of the scale of the deployment and provisioning of your IoT devices. Smaller projects and in-house development teams confident and capable of working in the cloud? Go with either platform. Projects that will benefit from a managed service like DPS? Go with Azure.



AWS or Azure?
Cost Optimization

Cloud computing is essentially outsourcing your physical infrastructure to another company, in this case either Amazon or Microsoft. While there are certainly top-line cost savings to not investing in the purchase, maintenance, and expansion of a server farm (indeed, this is the argument for cloud computing from the outset) there is no such thing as a free cloud computing lunch. If a close eye is not paid to the costs of your cloud computing, things can get real expensive real fast.

Amazon's AWS IoT Core offers pay-per-request and pay-per-feature pricing. This means it is possible to optimize your spend on the IoT platform by switching off features that are not strictly necessary for your specific IoT deployment. As well, it is possible to take actions such as reducing connectivity, reducing message size, and bundling data to cut costs further. By paying close attention to the metering charges and optimizing messages to suit, you'll be able to save money while still taking full advantage of the Amazon cloud.

Microsoft Azure, on the other hand, starts with selecting the tier of the Azure IoT Hub that's required. Choosing between Basic and Standard depends entirely on the scale and requirements of your deployment, in particular whether there is a need for bidirectional communication between your devices and their cloud-side servers. Optimizing costs on Azure means tuning the number and type of the IoT Hub units you deploy, setting up auto-scaling for the Hub, and then tuning individual applications to cut the computing time and power required.

Choosing between the two once again comes down to the specific of your projects. **If per-request pricing works best and communication between your device and the cloud can be minimized in scale and size, then AWS might be the best option. If a more fully featured offer is required and you're deploying at enterprise scale, Azure might be the better choice.**

	AMAZON AWS	MICROSOFT AZURE
AUTHENTICATION & AUTHORIZATION	★★★★★	★★★★★
DEVICE PROVISIONING	★★★★★	★★★★★
COST OPTIMIZATION	★★★★★	★★★★

Now that we've established a conceptual overview of the AWS and Azure platforms, let's take a closer look at some examples of how we at Witekio have worked with them.

#1

Case Study #1:
Connected Crane

A team of Witekio engineers choose Microsoft Azure to develop a connected crane.

Technologies:

- Microsoft Windows 10 IoT Core
- Avnet's IoTConnect
- NXP i.MX8 (MaaxBoard MX8M electronic board)
- **Microsoft Azure**

The Witekio team had worked with a client, Manitowoc, that was active in the crane industry. The team sought to leverage this experience to build a working, physical model of a crane with remote monitoring of the device in the cloud – specifically, the Microsoft Azure cloud.

Development

Working in IoTConnect was a challenge. At the time the environment was still under development and didn't have extensive technical documentation to support us. Fortunately, though, the team at Softweb, the publisher behind the solution based on Azure IoT technology, was willing and able to step in and help if and developers found themselves stuck. Working on the MaaxBoard and porting it to Windows 10 IoT Core was also a challenge as such porting is not yet commercialized.

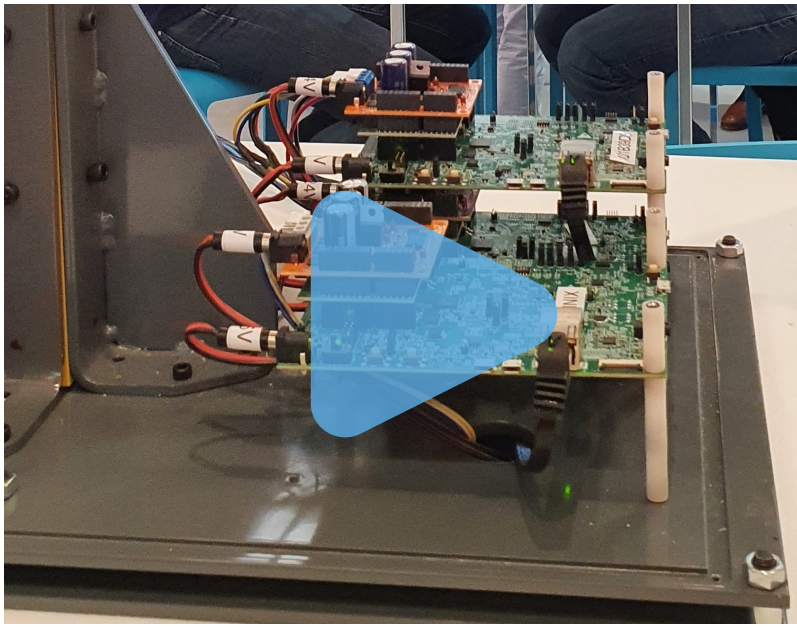
The modified Wii Nunchuk controller selected for the crane isn't standard fare for the MaaxBoard but, with an electronic extension board, the team made it work and developed a hardware abstraction layer for the Wii Nunchuk to access.

Next up was the development of an application in UWP for Windows 10 IoT Core for the management of the Nunchuk, data generation, and uploading that data to the IoTConnect cloud on Azure. Of course, the team also had to develop the graphical elements, too.

Deployment

The connected crane software was first demonstrated by Witekio at CES in Las Vegas, and later a fully functional, 3D printed model crane driven by that software was on display at the 2020 SIDO event in France.

The Project In Action



Why Microsoft Azure?

We could easily integrate the traditional authentication, authorization, and provisioning components of Azure's IoT offering. In addition, had this project required a streamlined way to manage device software updates, we could have leveraged the Device Update Center.

This makes perfect sense for those who want to control the full lifecycle of a device and need to maintain the full software image on the device in question. Alternatively, If you are working with devices that you only manage portions of the software (such as on-device applications, but not the underlying software) then there are other options.

#2

Case Study #2:
Chocolate Security System

A Witekio Engineer chooses Amazon's AWS to develop a basic chocolate protection sensor.

Technologies:
- Raspberry Pi Device
- PIR Sensor
- **Amazon AWS**

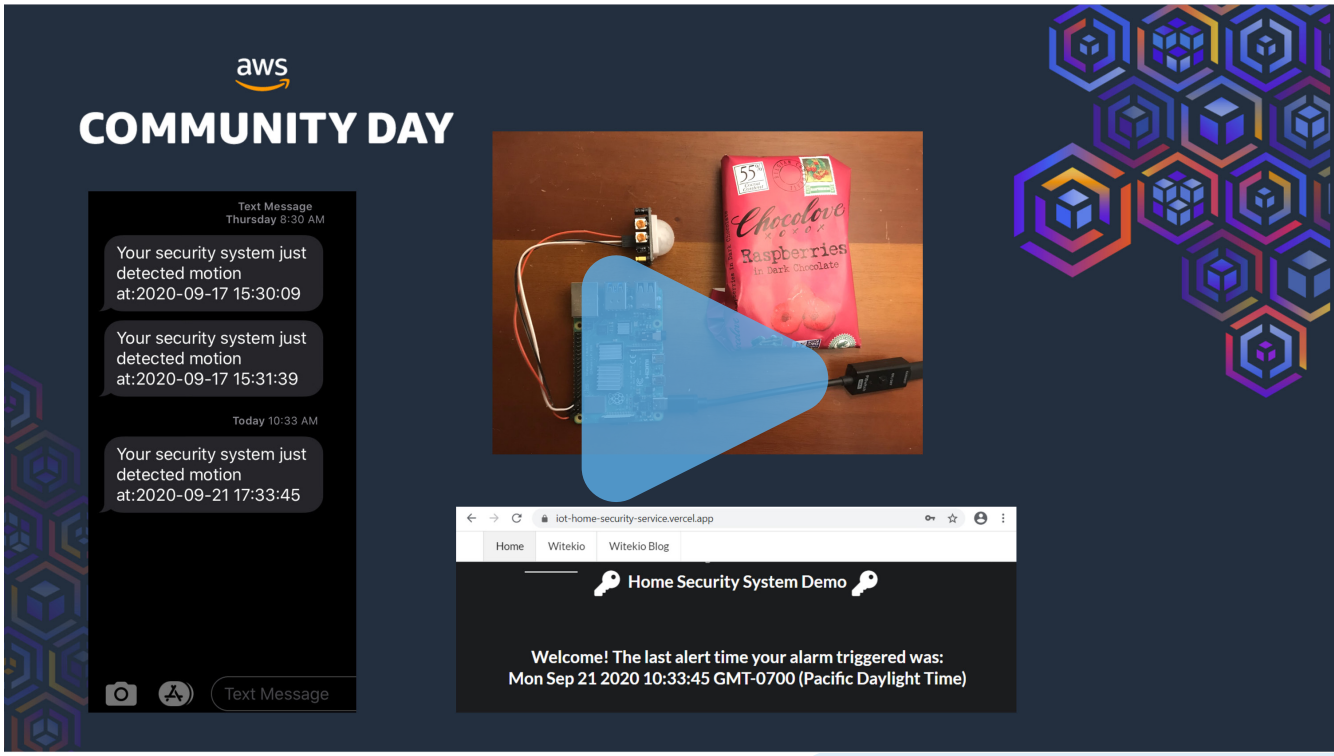
As a development project, a Witekio engineer combined a basic IoT sensor with a low-powered computing device, connected the device to the Amazon AWS cloud, and used it to monitor a particularly tasty stash of chocolate. A lighthearted project but with some serious cloud architecture packed in.

Development
The Witekio engineer combined some basic hardware and software elements with AWS cloud services to build a basic image sensing device to 'protect' a valuable chocolate bar. After connecting the PIR sensor to the Raspberry Pi Device, the engineer deployed a cloud architecture to enable the monitoring and alert functionality of the device.

Five broad elements were combined on AWS: first, a web portal for the end user using Vercel and Amazon Cognito Authentication; second, a DynamoDB database and a Lambda Function for the HTTP APIs; third, the IoT Core; fourth, the SMS notification service via AWS's SNS; and fifth, a Shadow to enable communication with the Raspberry Pi.

Deployment
While the chocolate guard device is a trivial example of a IoT device and an associated cloud deployment, the AWS architecture successfully mimicked more advanced industrial IoT monitoring devices.

The Project In Action



Why Amazon AWS?

While either AWS or Azure could easily connect the Raspberry Pi Device to the cloud, AWS had the infrastructure and tooling to easily spin up a web portal granting end-users authenticated access to the device. In this case, Amazon Cognito acts as an end-user authentication system that can scale to massive numbers of users.

Additionally, the selected AWS services are highly scalable and tie cost directly to utilization with pay-per-request style pricing. Meaning, that you don't pay for idle server time and instead pay for compute directly proportional to how much utility your customers are getting out of the service.

Both AWS and Azure allow event-driven actions from Device Twin/Device Shadow updates, but we found the AWS tooling more robust and easier to integrate.

BOX 1 : How to connect your Raspberry Pi to AWS IoT?

Want to explore the cloud with a simple, quick-to-mount project? We've developed a step-by-step guide to launching a basic IoT project on the AWS cloud. All you'll need to get started are a Raspberry Pi and Freenove kit, a USB keyboard and mouse, a monitor with an HMDI port, and an AWS account.

Witekio Cloud Architect Fernando Medina Corey walks you through the process of connecting the Raspberry Pi to the cloud and preparing the ground for a proof of concept cloud computing project.

Get the free guide here:

https://urlz.fr/fyD4

BOX 2 : How to connect a MaaxBoard to Azure IoT

Connecting a board to Azure is straightforward, especially with a step-by-step guide! We've developed a walkthrough process to launch an IoT project on Azure and all you'll need to get started is an Avnet MaaxBoard, a USB keyboard and mouse, a couple of cables, an SD card and reader, and a basic development hardware kit.

Witekio Cloud Architect Fernando Medina Corey walks you through the process of connecting the MaaxBoard to the Azure cloud. In no time at all you'll be exploring the possibilities of the Microsoft Azure cloud environment!

Get the free guide here:

https://urlz.fr/fyD6

ABOUT WITEKIO

At Witekio, success starts with our core beliefs.

We believe that software is at the heart of all technology. Software has always been important, but it is becoming more essential every day as new devices emerge and the IoT expands.

We believe that the invisible code – the code that supports the entire system – is vital to the operation, security, and market perception of a device or system. Getting it right is non negotiable.

We believe that the best system designs emerge from creative thinking. Calling legacy systems into question and thinking outside of the box are key steps towards building systems that deliver.

And we believe that low-cost code can never contribute to the excellence or longevity of a product or system. Cutting corners is a short-term tactic and can only lead to long-term loss.

Over more than 15 years Witekio has helped deliver thousands of the world's most innovative IoT and embedded software projects. Every project is different, but every project is managed and delivered in line with the beliefs and values that define **'the Witekio Way'**.

Our commitment to high-quality code and stable, scalable, and efficient software is unwavering. We choose to work with companies that believe, like we do, that success for products and systems that you do see is built on what you don't see: the code that drives the system, powers a platform, and provides the basis for an ecosystem.

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