IoT Platform Evaluation

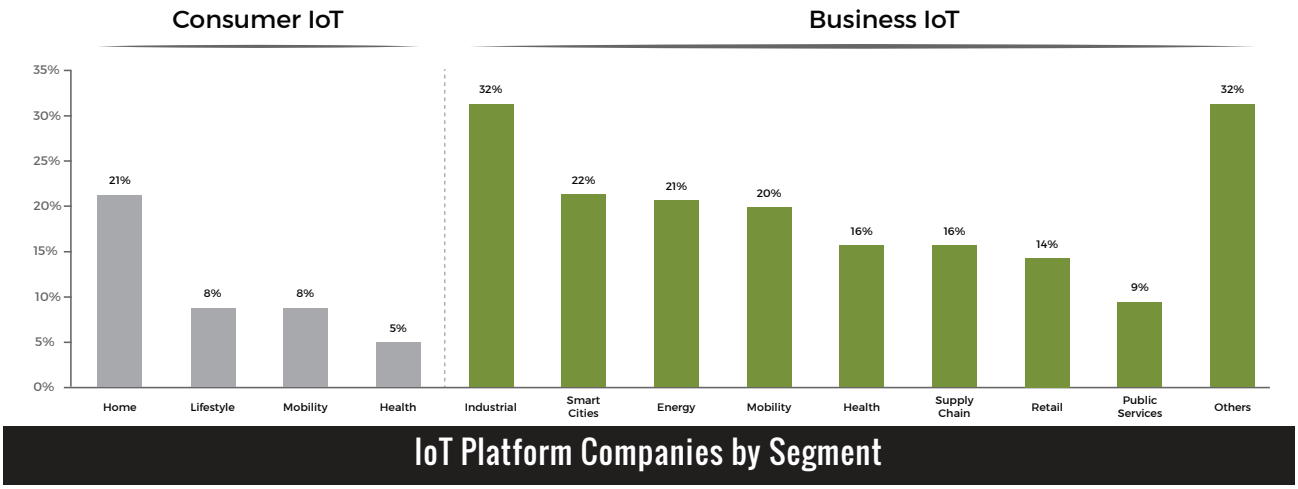
What is the right Analogy?

KELLTON TECH

"The impact and enablement of the Internet of Things (IoT) is not mere business jargon today. As seen in the past two decades of the post-Internet era, IoT has sparked the new age of digital evolution bringing a desirable boom to the most critical sectors. Markedly, IoT has been a success for manufacturing, energy and utility industries, where it has augmented the quest to explore novel ways of doing business. Healthcare, transportation, retail, and connected vehicles are other verticals on the IoT future-scope."

Businesses are rapidly coming to grips with the indomitable potential of IoT in terms of optimizing operational processes, validating predictive maintenance for the smart factories, inventory management, and supply chain management. Undoubtedly, this innovation has chiseled the client experience to better business outcomes. From SME's to enterprises everyone is capitalizing on IoT to gain a competitive business advantage.

As reports from Gartner and Statista suggest—more than 20 billion individual units will be connected on a network by 2020.



IoT Platform Companies by Segment

IoT PLATFORMS

IoT Platforms are seen as the powerhouse in the proliferation of scalable IoT deployments. These platforms frame the complex solution architecture, bringing the real and virtual worlds together on a common network. The IoT Platform market is yet in its native state and can't be overlooked because its landscape is complex, fragmented, and dynamic.

The market size of IoT will continue to grow outrageously in near future, with multiple platforms posing as cub-bearers to this apprehension. Hereby, according to a research organization, IoT Analytics, there are only 7% of IoT platforms with more than $10 million in revenue today.

Against all expectations, some IoT Platforms can cook the goose. Choosing the right IoT platform to integrate with your business model requires strategic vision, keeping into account their individual features and capabilities. In this whitepaper, we will discuss the qualitative and quantitative propositions of the most popular IoT platforms in detail*:

- AWS IoT Core
- Microsoft Azure IoT
- Google Cloud IoT
- PTC Thingworx
- Software AG Cumulocity

Amazon Web Services (AWS) IoT

AWS is improvising the features of the Internet of Things, with an aim to retain its reputation against the prevalent competition. It is the platform that can handle billions of devices to securely interact, process, and act over the cloud to enable server-less applications.

Unique Perceived Benefits:

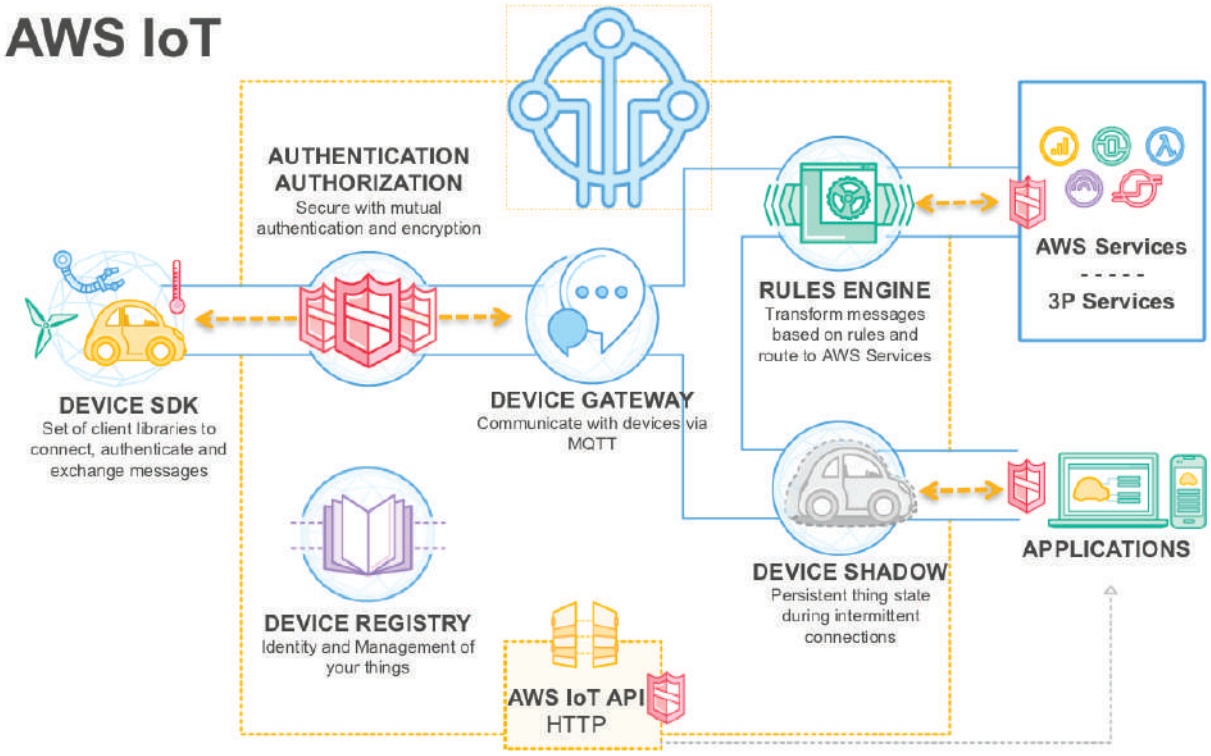
- Scalability: AWS has the broadest and deepest functionality, multi-layered security, and superior integration with AI, proven at a scale
- Ecosystem: AWS IoT is an approach to build applications that can engage with other AWS services such as Amazon Kinesis, AWS Lambda, Amazon S3, Amazon Machine Learning, and Amazon DynamoDB, without any hassle of managing infrastructure
- Key Features: IoT Device SDK, Device Gateway, Message Broker, Authentication and Authorization, and Registry
- IoT Services: FreeRTOS, IoT Greengrass, Core, Device Management, Device Defender, Things Graph, Analytics, SiteWise, and Events
- IoT Solutions: Connected Home, and Industrial IoT
- Security: The messages are securely en-routed through AWS endpoints to other devices even when offline. AWS reckons on Transport Layer Security (TLS) for backend authentication with the full support of mutual authentication by attaching certificates to the device and policies

Setbacks:

- Horizontal Approach: AWS is not customized as per any industry and calls for thorough integration with business processes.
- Features: Besides dull-plain dashboards and graphics, it doesn't allow multi-protocol supports like MQTT, AMQP, CoAP, WebSocket, Node, and others.

*This article touches upon a few of the platforms and is not an exhaustive list.

AWS Workflow:



Bottom Line:

AWS is here, undoubtedly, for a long haul, and that is a decisive reason for many businesses and leaders. It comes along with a set of package libraries to speed-up the integration.

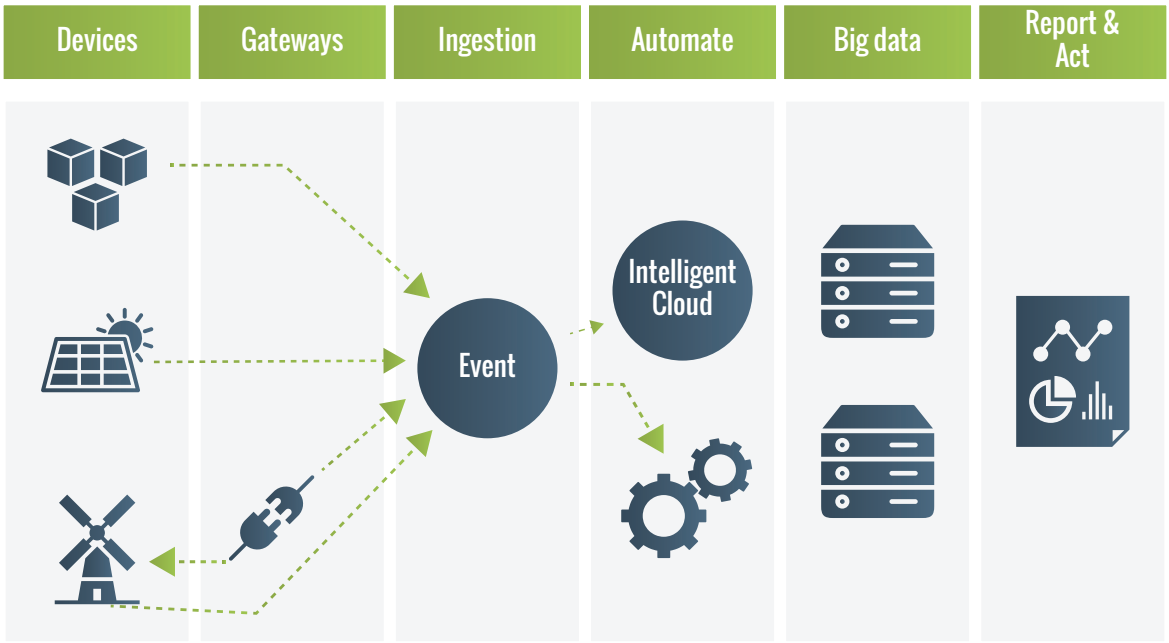
Microsoft Azure IoT

Microsoft talks about the components of IoT solution in terms of Things, Data, Insights, and Action. Its Azure IoT Hub is a comprehensive collection of fully hosted and Microsoft-managed Software-as-a-Service (SaaS) solutions for distinct Platform-as-a-Service (PaaS) offerings. Rooting from bidirectional communications between millions of IoT devices, Azure lays the intelligent edge by streamlining end-to-end IoT applications with open-source SDKs and other protocols.

Unique Perceived Benefits:

- Multiple clouds to device communication options: One-way messaging, file transfer, and request-reply method
- Utility: As a completely hosted platform, it can pose as an agile Infrastructure-as-a-Service (IaaS) solution or specialized Platform-as-a-Service (PaaS) offering
  a) PaaS Offerings: IoT Solution Accelerators is a collection of pre-configured solutions that enable and accelerate the development of custom IoT architecture. Modeling the physical environment Azure Digital Twins service allows contextual IoT solutions for users using space intelligence graph and domain-specific object models
  b) SaaS: IoT Central is a simplified solution to connect, monitor and manage your IoT solutions at scale. It requires no cloud expertise for initial setup
- Key Features: Fancy dashboards pipeline support for Device Management, Native Active Directory (AD) support with token-based access for simple legacy integration
- Communication: Supports HTTPS, MQTT, and AMQP, barring HTTP in the absence of a custom gateway between the device and Azure IoT Hub.
- Security: Azure IoT Hub relies on TLS protocol for encrypted communication and data confidentiality. It follows access protocol and credentials to specify the list of permissions, ensuring security for all services and devices and enabling control over a specific list of actions

Azure Workflow:



Setbacks:

- Third-party Protocol: Azure IoT Hub uses third-party tools like MQTT spy, MQTT.fx to display the information received
- On-premise connectivity: It may fall weak in edge and on-premise device connectivity

Bottom Line:

Azure IoT Solution is an unparalleled choice for its strong analytics capabilities over the cloud.

Google Cloud IoT

Google Cloud IoT Platform is a complete set of tools that securely connect, manage and ingest data from dispersed (on- and of- the premise) devices and services. Overarching the perks of lightweight, simple, secure, robust, scalable, and fully-managed cloud services Google Cloud IoT stems an integrated software stack for robust computing.

Unique Perceived Benefits:

- Beacon Technology: Eddystone is an open source beacon technology from Google that provisions easy BLE advertisement for any device without any high-tech perquisites
- Integration of serverless components: Integrants of the platform such as Cloud Functions, Dataflow, Dataproc, and BigQuery- Google Cloud Engine (GCE) allows different storage classes for each necessity, fast boot times, flexible networking, and the promise of no/low contention for resources
- Support and Analytics: A robust suite of APIs complement the scalable device management layer to capture data for downstream analytics. IoT Cloud uses Google BigQuery for Ad-hoc (aggregate and query) analysis and Cloud Machine Learning Engine-for Advanced Analytics (Predictive Maintenance, remaining useful life (RUL), and anomaly detection)
- Features: Google IoT Core facilitates easy deployment options for multiple data stream, or rather data management. Besides, it offers fancy dashboards in Google Data Studio, access to Neural Networks and ease of customization
- Communication: Supports HTTP, high-velocity data ingestion, and stores per-device security credentials. M2M messages are shared via MQTT or REST endpoints and delivered through other services using Pub/Sub topics

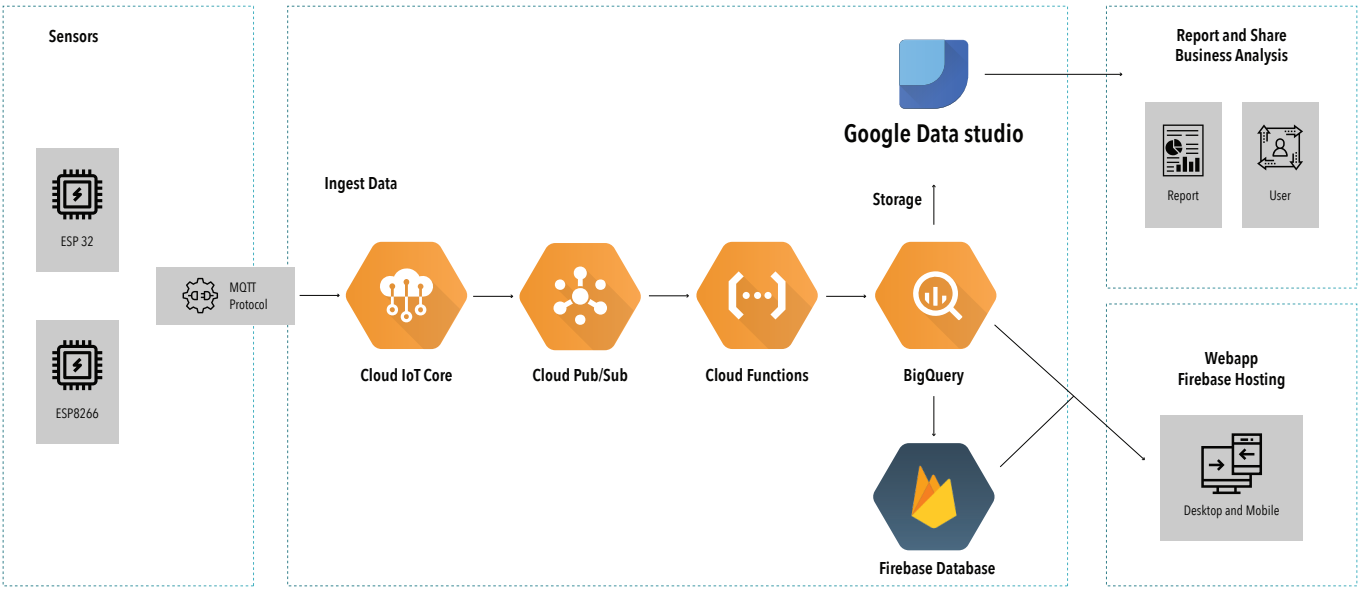
Setbacks:

- Throttle Limit: Connection may drop in case of more than one update per second.
- There is a lot of scope for Google to diversify its product range and improve UI support.

Bottom Line:

Since Google deploys its own products, Cloud IoT Platform will see fast-paced improvements in the near future for best-in-time scalability, efficiency, and reliability.

Google Cloud IoT Workflow:



PTC Thingworx

Purpose-built for industrial environments, PTC ThingWorx is a machine to machine (M2M) IoT Platform providing smart, connected and seamless IoT solution. It is an end-to-end technology platform that reflects the principles of functionality, flexibility, and agility. ThingWorx modeling is powerful in expression and simple to explain.

Unique Perceived Benefits:

- Features: Multiple yet simple connectivity options, easy configuration, and device management besides other application development tools, analytics, and AR.
- Analytics: It aggregates data from production controllers and drills down to details for quick monitoring of abnormality.
- Support: With MQTT Interface ThingWorx Foundation allows integration with other Kelpware Tools and libraries. The components like ThingWorx Analytics, ThingWorx Studio, and ThingWorx Industrial Connectivity allow comprehensive, feature-rich, fast time-to-insight IoT solutions.
- Strong mashup builder and unrivaled set of interface solutions.

Setbacks:

- Complicated system which is difficult to use with the limitation of install edge program on a custom platform such as Windows CE
- Basic standard time series and trend tools can use third-party applications.

Bottom Line:

Having high rapport for its multi-stream data, PTC Thingworx beckons highly-scalable application scenarios. Albeit, it does not compare well with large, complex logic and architecture at the edge.

Software AG Cumulocity

Accelerating IoT adoption, Cumulocity is a device management, data visualization, and application enablement platform for enterprises. Cumulocity as a platform is an open source, telco-grade, and independent solution to bring your remote assets to the cloud.

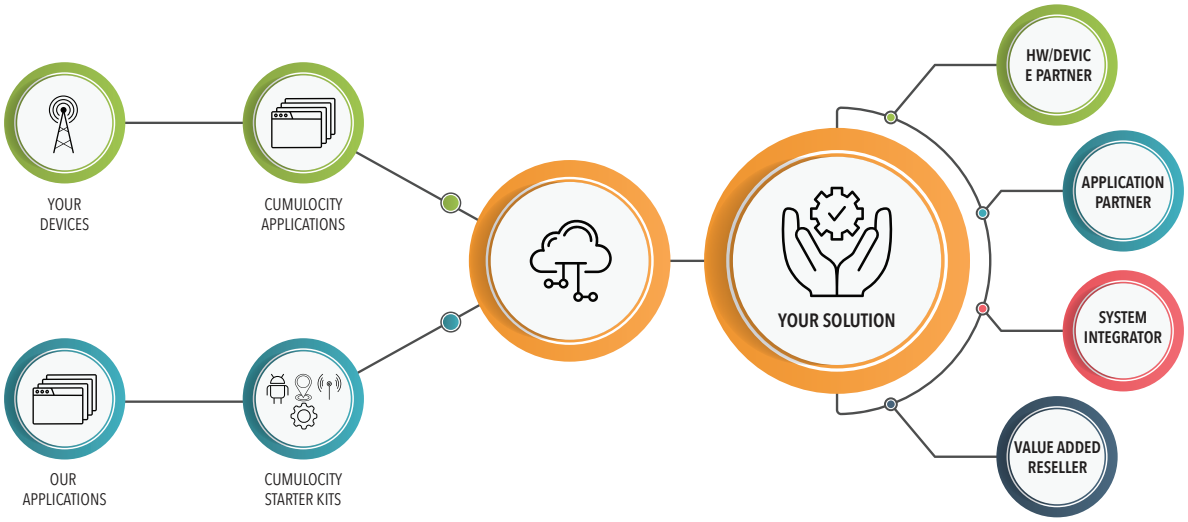
Unique Perceived Benefits:

- Device Connectivity: Plug & Play with pre-integrated devices and gateways over any IP network without VPN. It has Cloud Fieldbus for web based end to end integration that allows remote data aggregation and management. Cumulocity supports MQTT, REST, LWM2M, Tracker, SNMP, SmartREST protocols
- Device Management: Web-based device management, data visualization, and remote control functionality. Cumulocity prefers credentials per individual device to provision small & large deployment scenarios alongwith auto-registration, asset management, real-time alarms in an integrated workflows
- Analytics & Data: Built-in IoT/IIoT domain data models for extended, descriptive & predictive analytics, designed for high throughput & low latency, with small HW footprint. Fancy mashup dashboards with SCADA visualization IIoT Cockpit & Digital Twins are incredible
- Integration and APIs: It can be easily tailored via publicly documented APIs and the open UI framework. Optimal for the cloud, on-premise or as a hybrid Cumulocity supports all relevant security standards like OAuth, SAML, Kerberos plus custom APIs. Cumulocity can also host HTML5 applications
- Process Automation & Application Development: Certified hardware kits and software libraries to connect remote assets into the cloud. As a distinct feature of

Setback

- Though there are no drawbacks of Cumulocity observed so far but it is advisable to take some technology consultation to visualize and optimize the implementation roadmap.

Software AG Cumulocity Workflow:



Bottom Line:

Cumulocity is one platform for your all devices, all networks, all verticals, and all use cases with exquisite customization capabilities for white-labelling, legacy integration for cloud and edge connectivity.

What Matters while Choosing an IoT Platform?

Some of the important factors that are required while choosing an IoT platform are:

The feature comparison table below provides a birds-eye view of each platform based on the above-mentioned factors.

Features	Google Cloud IOT	ThingWorx	Microsoft Azure	AWS	Cumulocity
Scalability	✓	✓	✓	✓	✓
Availability (24*7)	✓	✓	✓	✓	✓
Security & Privacy	✓	✓	✓	✓	✓
Plug and Play	✓	✓	✓	✓	✓
Real time Data	✓	✓	✓	✓	✓
Storage of Data	✓	✓	✓	✓	✓
Provision of Support	✓	✓	✓	✓	✓
Developer Friendly	★★★★★	★★★	★★★★★	★★★	★★★★★
Solution Type	IaaS/PaaS	PaaS	PaaS/SaaS	IaaS	PaaS
Protocols	HTTP,MQTT	HTTP, MQTT, WebSockets	MQTT, AMQP, XMPP, CoAP, DDS, WebSockets	HTTP, MQTT, WebSockets	HTTPS, MQTT and AMQP
Certified Hardware	Beaglebone, Raspberry Pi, Arduino Series, ARM, Intel	Raspberry Pi, Arduino Series, Intel, Texas Instruments	Intel, Raspberry Pi2, Freescale, Texas Instruments	Broadcom, Marvell, Renesas, Texas Instruments, Microchip, Intel	Beaglebone,Raspberry Pi, Arduino Series, Intel, Texas Instruments
SDK/Language	C, Python, Java, NodeJS	Java, .NET, C, C#	.Net and UWP, Java, C, NodeJS	Java, C, NodeJS	Java, C, Python, C#, NodeJS
Connection	Easy Configuration	Medium configuration	Easy Configuration	Easy Configuration	Easy Configuration
Pricing	Based on the data volume. First 250 MB is free after that the rates are tiered based on monthly data	Subscription based model. Public pricing information is unavailable	Paying for IoT Hub unit related to number of devices and messages per days.	Based on four components: connectivity, messaging, device shadow usages and rules engine.	Based on the number of devices, API calls/month and Storage size. Divided into small, medium and large
Integration	REST API	REST API	REST API	REST API	REST API
Time To Market	★★★★	★★★★★	★★★★	★★★★	★★★★★
Dashboard	Stackdriver	ThingWorx SQUEAL	Web Portal	AWS IOT Dashboard	Cockpit

Pricing Models

Different IoT system developers provide different pricing models. In most cases, an open source platform can be used for free. Below are the most common pricing models for IoT:

- Pay per node/year
- Pay per active device
- Pay per message
- Pay for premium features (optional)
- Pay for support (optional)

Pricing Summary:

In the jinx of quickly doing the business, decision maker's need to keep an eagle's eye on pricing scenarios and their on scale influences. More often it is the below mentioned scenarios in absolute or muddle. Being in the state of conscious awareness about the pricing metrics is what will keep the scepticism off your digital transformation curve.

To make a seamless decision the pricing summary table below delves into build-platforms based on three different scenarios.

Scenario 1: Large number of devices; Small message size
Scenario 2: Large message size; Limited number of devices
Scenario 3: More frequent messages; Smaller message size

Build vs. Buy:

IoT implementations rely heavily on the needs of the business, whether they want a solution to be built from scratch or buy an off-the-shelf product.

Platforms such as Thingworx and Cumulocity offer more buyable solutions as opposed to Amazon web services, Azure, Google IoT, and more, which provide platforms to build the product from the scratch. Both build vs buy options have their pros and cons as analyzed below.

BUY	
Pros	**Cons**
Vendor is competent in providing IoT solutions provides managed services and regular updates	Software upgrade may not be of use all the time
Solution is tried and tested	Certain features may not benefit you
Saves a lot of time due to faster deployment and thus, realization of value is quicker	May bill for features that you may not use
Less engagement of developers required as compared to build solutions	Level of customization may be capped
Lower risk, challenges, and only upfront cost for implementation	

BUILD	
Pros	**Cons**
Customize the platform as per the customers requirement	Extensive expertise and capabilities required to build a scalable and secure product
Maintenance of the developed product	Longer implementation cycle, continuous development and maintenance costs
No upfront cost (except for hosting)	Regular upgrades, Higher risks, challenges, and costs
Development team knows how to handle the product better	May take months to build and realize value
	Controlling disparate data sources can be a complex task

About the Author

Abhishek Vinod Singh is the Head of Digital Transformation at Kellton Tech and an instrumental force and thought leader in defining companies operations, integration after merger, sales and marketing strategy and goals. Globe-trotter in the true sense of the word, he has traveled the length and breadth of the USA, Asia, Europe, Latin America and the Middle East, thus benefiting from profound exposure to the business mindsets and work culture of both developed and emerging markets.

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