

Improving Business Outcomes with IoT

WHITE PAPER

Imagine being able to know the state of every “*thing*” across your enterprise. What would you do with that knowledge?

The Internet of Things (IoT) is rapidly gaining steam because the first wave of applications and workloads is delivering tangible financial and operational value for enterprises and a positive experience for consumers. Industrial manufacturing, connected homes and buildings, connected vehicles, retail and healthcare are just the tip of the IoT iceberg—with more to come.

Not surprisingly, it's easy to be impressed by the numbers presented in market research about the size and growth of IoT. Billions of connected devices. Trillions of dollars in economic value. Millions of developers building software for connected devices.

But behind the numbers is the real story—the ability to get invaluable data from a broad array of things connected to the cloud. This “from the edge to the cloud” phenomenon of creating things, collecting

data, analyzing data and acting on new insights is reshaping the landscape of what we can do with technology to achieve business benefits.

Organizations are deploying more IoT devices and using them to support mission-critical use cases—everything from municipal water supply purification system monitoring to robotic manufacturing processes. These rapidly expanding implementations are driven by the need to collect and analyze data from a wide swath of devices. Increasingly, this is happening in the public cloud, where enterprises can take advantage of economic, operational, security and scalability advantages offered by that platform, without having to manage complex infrastructure.



Custom Media

This paper looks at some of the software and services available to enterprises looking to build IoT applications that collect, process, analyze and act on data generated by connected devices.

Speed Development of IoT Applications

As Wi-Fi and peer-to-peer networks become ubiquitous, and as operating systems and software are available to run on microcontrollers and other devices, it is now possible to connect devices to each other, to enterprise networks and to a wide range of cloud services. Devices as complex as robotics-controlled manufacturing conveyor belts or as simple as a light bulb now can take intelligent actions locally and connect to the cloud for data storage, high-compute operations and analytics. However, it takes a lot of heavy lifting especially in places with intermittent connectivity.

Fortunately, new software and services are rapidly coming to market that allow developers to run models built and trained in the cloud on devices so they can take timely, local actions. These services allow developers to send device data to the cloud where it can be stored, shared, managed and analyzed. Once the data is in the cloud, machine learning models can be developed. Machine learning uses statistical algorithms that can learn from existing data, a process called training, in order to make decisions about new data, a process called inference. During training, patterns and relationships in the data are identified to build a model for decision making. This model allows a system to then make intelligent decisions about data it hasn't encountered before. Training machine learning models requires massive computing resources, so it is a natural fit for the cloud. But, inference typically takes a lot less computing power and is often done in real time when new data is available. So, getting inference results with very low latency is important to making sure your IoT applications can respond quickly to local events.



IoT applications help you understand the state of every *thing* so you can solve business problems. IoT helps you grow revenue by unlocking IoT data and improving operational efficiencies. Business outcomes include new service and business models, products that get better with time, better relationships with customers, intelligent decision making, and instilling a data driven discipline in your organization. Organizations are looking to connect more types of devices to the cloud, derive insights from the data those devices generate and use those insights to take business action.

Best-in-Class IoT Services Provide:

- Edge-to-cloud capabilities that allow diverse devices to act and respond locally based on machine learning models.
- Rich development tools for IoT developers, including software developer kits for a range of devices, support for open source tools, device management, messaging and connectivity.
- Human interfaces to query, control and work with devices.
- Security services built in to help you meet compliance regulations.
- Cloud services that scale to support billions of devices and make it easy to manage diverse device fleets.

- The ability to build and train machine learning models in the cloud, and to deploy and run them locally on connected devices.
- The ability to create custom software in the cloud and deploy to connected devices so they can perform intelligent actions without cloud connectivity.
- Tools to build machine learning models for your fleet.

Use cases for IoT in industrial, consumer and commercial environments

Today there are three very large and well-developed market environments for IoT use cases:

- **Industrial IoT**, which is a potentially massive market opportunity because of the ability to use IoT to improve everything from manufacturing yields and safety rates.
- **Consumer IoT**, allowing everyday items such as cars, household appliances, and home security systems to be accessed, controlled and monitored by a range of mobile devices from notebooks and tablets to smartphones and wearables.
- **Commercial IoT**, such as automotive telematics, third-party logistics merchandise tracking, inventory control and replenishment, retail loss prevention and agricultural resource management.

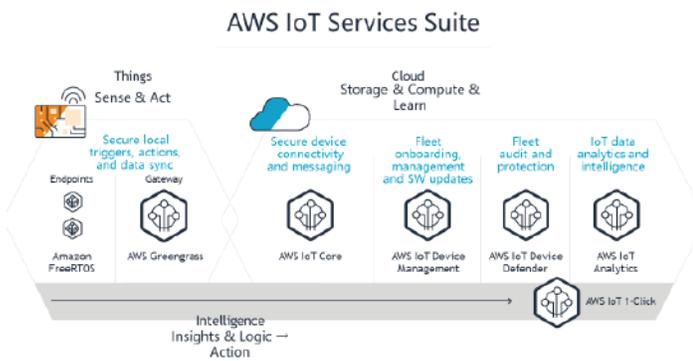
Use Case	Key Capabilities	Business Outcomes
Industrial Manufacturing	Predictive maintenance; remove asset monitoring; predictive quality	Quick identification of machine or assembly line faults and better-quality products
Connected Home/Building	Home/building automation; home/building and security monitoring; home/building network management	Personal security; cost management; fault identification and solutions
Connected Vehicles	Local computing within vehicles; event rules; voice interaction	Improved maintenance, safety and reliability
Retail	Facial recognition for preferred customers	Improved shopper experience
Healthcare	Wearables for patient monitoring; medical device monitoring	Faster identification and resolution of medical issues; improved analytics for better decision-making; personalized patient care

As IoT use cases become apparent and the ability to connect more and increasingly diverse devices expands dramatically, developers and business decision makers have found that managing those connected devices is a big challenge. For many organizations, it requires a big step up in Capex investment to fund extended IT infrastructure. In fact, research indicates that organizations deploying IoT need to fund increases in storage capacity, network edge equipment and server infrastructure “in order to help manage the IoT data storm.”¹

¹ “Voice of the Enterprise: Internet of Things, IoT—Workloads and Key Projects—Quarterly Advisory Report,” 451 Research, September 2017



How AWS makes IoT applications a reality



Instead of devoting financial and manpower resources to building, managing and securing IT infrastructure, organizations team with AWS to handle the processing, analytics, storage and machine learning that make IoT applications hum. Already, a wide range of organizations are using AWS public cloud services and tools to build, deploy and run transformative IoT applications.

AWS IoT Services offer capabilities to help in the creation and rollout of IoT applications, including:

- [AWS Greengrass](#)—Secure Local Triggers, Actions and Data Sync
- [Amazon FreeRTOS](#)—IoT Operating System for Microcontrollers
- [AWS IoT 1-Click](#)—Easily Trigger Actions in the Cloud
- [AWS IoT Core](#)—Secure Device Connectivity and Messaging
- [AWS IoT Device Management](#)—Fleet Onboarding, Management and Software Updates
- [AWS IoT Device Defender](#)—Fleet Audit and Protection
- [AWS IoT Analytics](#)—IoT Data Analytics and Intelligence

Conclusion

By unlocking IoT data, AWS IoT helps enterprises improve operational efficiency and generate net new revenue streams. New service and business models, products that adapt to changing conditions and “improve” over time based on new data, improved customer experiences, enhanced workforce productivity and building a data-driven organizational culture are just some of the business benefits that derive from AWS IoT software and services.

To get started with the Internet of Things on AWS, please visit <https://aws.amazon.com/iot/>