Build Smarter Products with AWS IoT

IOT IN THE CONNECTED HOME

Introduction

IoT is impacting every industry—but the one area that affects almost everyone's day-to-day is in the home. Connected home products range from voice-controlled lights, to a smart robot that cleans your floors while you're at work, to a WiFi router that can troubleshoot problems for you.

Consumers want a seamless experience in their homes, and IoT is bringing manufacturers of connected home products the capabilities to deliver this back to consumers. All around us, connected home products are expanding in the areas of home automation, security and monitoring, and networking—and manufacturers are racing to release their next innovations.

But with all the hype and promise that IoT brings, device manufacturers still face a number of challenges today. While each strives to differentiate themselves with exciting new customer experiences, features, and services, they have to consider how to build-in secure and reliable connectivity, how to manage connected products throughout their lifecycles, how to analyze the valuable data generated from those connected devices, and how to scale across millions of devices and broad product lines.

CHALLENGES FOR CONNECTED HOME DEVICE MANUFACTURERS

Standing out from the rest

Device manufacturers are facing fierce competition when it comes to selling devices for consumers' homes. It's often hard to differentiate their offerings based on hardware capabilities alone, so they need to add additional value by creating desirable customer experiences, such as enabling their devices to easily connect with each other and be accessible with a simple phone tap or a voice command. Device manufacturers need to consider integrating various smart capabilities into their devices, for example, adding in more sophisticated cloud services on already-connected devices or by building in connectivity from the ground up in new products. They need a full suite of IoT services that can accommodate and scale across all levels of development.

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Scaling across product lines

Many product lines are responsible for choosing their own hardware, like the microcontroller or microprocessor, and end up piecing together software from various vendors or building it themselves. The software and services being used in each business unit end up not being scalable. This creates inconsistencies within the organization that can lead to slow new product development, inability to scale on a single platform, and even security risks down the line with outdated or proprietary systems. Device manufacturers need scalable IoT services that work across their various hardware platforms.

Providing a reliable experience

Reliability of connected devices is a critical need for consumers. For example, a consumer expects an Alexa skill to take an action when they say a command, such as turning a TV on or off. Device manufacturers are looking for a reliable mechanism to connect, communicate with, and manage the millions of devices running across homes. They need a resilient, scalable, and easy to integrate platform that fulfills all their needs, without the heavy lifting or the costs associated with setting up their own technology infrastructure. The need for this platform becomes even more important when building in features like voice control with Alexa, because the device has to be capable of listening for commands and immediately responding by relaying information to and from the cloud.

Maintaining a cloud connection

There are many cases where cloud connectivity will not always be available. In these cases, device manufacturers need to look to local connectivity through a home gateway. This allows connected products to continue to operate as normal when the connection is intermittent or even lost completely. For example, if a burglar cuts the internet in a

home, a home security provider should be able to automate the process of turning on all of the flood-lights outside, sounding the internal alarm, and locking the doors. Beyond external factors, device manufacturers have to worry about latency issues. For example, a home security provider cannot wait for data to make a round trip to the cloud before sending an alert to a water leak, or closing the blinds, and shutting the windows in response to an intruder. Similar to the challenge of building in reliable cloud connectivity, device manufacturers need to consider edge connectivity.

Piecing together security

Lastly, and most importantly, security must be a top priority on the device itself, throughout all connection points, and in the cloud. Device manufacturers need end-to-end encryption and should have the visibility into their entire fleet of connected products to ensure proper security parameters are being met. Many device manufacturers struggle to implement this to its full potential today, which can lead to losing consumer trust.

OPPORTUNITIES IN HOME AUTOMATION

Home automation includes a wide range of connected devices that can be found in the home, everything from white goods like a washer, dryer, oven or refrigerator, media and entertainment products like a TV or speaker system, or to smaller items like a coffee maker, vacuum, thermostat, switches, or light bulbs.

These devices can work alone, by directly connecting to the internet, or together with other devices or hubs for an integrated smart home experience. Consumer experience is critical, with a strong focus on devices being able to quickly connect and achieve an outcome easily.

For example, a consumer who buys a smart coffee maker will want to be able to set it up and get it connected quickly, likely using an app on their smartphone. They also want to be able to take advantage of that connectivity in a simple way, like ordering more coffee from Amazon at the click of a button, or even automatically when a sensor detects that coffee beans are about to run out. These devices can also benefit from using voice services like Alexa for an enhanced customer experience.

OPPORTUNITIES IN HOME SECURITY AND MONITORING

Innovative products in the home security and monitoring market include devices such as connected door locks, video doorbells, security cameras, or emergency lighting systems, and monitoring systems such as water leak detectors, energy management systems, and connected thermostats.

Consumers expect that their smart cameras and audio sensors will automatically detect threats, then take action, and send alerts to their smart phones. Such devices need to run with low latency and compute data locally as each round trip to the cloud could cost valuable time in detecting threats.

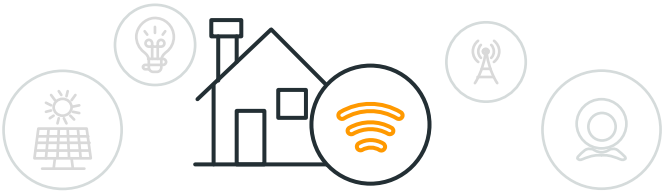
Additionally, devices in the security and monitoring market need to be able to operate locally, so that they can act even when external WiFi connection has been tampered with or lost.

For example, a lighting system or HVAC system will continue to operate when WiFi connectivity is down.

OPPORTUNITIES IN HOME NETWORKING

Network operators and cable providers are looking for new ways in which they can help consumers quickly discover, troubleshoot, and fix their home network issues including WiFi and Cable TV connectivity. In the past, network operators have been limited with the potential of computing capabilities within those devices.

However, with edge computing, they can add new functionality to enhance the overall customer experience.



For example, IoT-enabled set-top boxes can automatically log network diagnostics and send the data to the customer service center proactively, and in turn they can send a message to the customer to alert when a problem is detected. This level of transparency allows customers to monitor and troubleshoot the network health themselves, through a mobile application.

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AWS provides a suite of IoT services, spanning the edge to the cloud, to provide the capability to overcome the challenges and take advantage of connected home opportunities.

STARTING AT THE EDGE, ON THE DEVICE ITSELF, AWS IOT PROVIDES:

Built-in connectivity for microcontrollers

You can cut back on development time with Amazon FreeRTOS, an IoT operating system for microcontrollers which provides connectivity libraries in a tiny memory footprint and is based on the familiar FreeRTOS kernel. With a broad and growing set of qualified hardware, you can easily scale across product lines, and build in connectivity to AWS cloud services such as AWS IoT Core, or local connectivity to an edge device running AWS Greengrass.

Device security

AWS IoT services provide end-to-end encryption for connected devices. On the device, Amazon FreeRTOS provides a PKCS#11 interface for key management, making it easy for developers to manage keys. Amazon FreeRTOS also provides code signing during over-the-air (OTA) updates so that your code is secure before and after deployment. Plus, both Amazon FreeRTOS and AWS Greengrass authenticate and encrypt device data for both local and cloud communications, so that data is never exchanged between devices and the cloud without proven identity.

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> AWS IoT offers leading-edge security capabilities. Messages are encrypted, and the broker adds another level of security—and in general, the policy-based security is a huge advantage of AWS. If one of our devices goes rogue, we don't have to reissue certificates. We can just shut off the policy to that device. It's very simple and effective.
>
> *Franz Garsombke*
> *CTO and Co-Founder, Rachio*

Local communication

AWS Greengrass devices can act locally on the data they generate so they can respond quickly to local events, while still using the cloud for management, analytics, and durable storage. This cuts down on the time and cost it takes for data to make a round trip to the cloud. Devices running Amazon FreeRTOS can easily connect to devices running AWS Greengrass, allowing for near real time local communication.

Offline communication

AWS Greengrass enables connected devices to operate with intermittent connectivity to the cloud. Once the device reconnects, Greengrass synchronizes the data on the device with AWS IoT Core, providing seamless functionality regardless of connectivity.

Machine learning inference

Machine learning inference on AWS Greengrass gives you the ability to train ML models in the cloud and deploy them on the device for inference—where there is an abundance of data and the inference model can run without a direct cloud connection.

Over-the-air (OTA) updates

Devices running AWS Greengrass and Amazon FreeRTOS can be updated over-the-air, so that you can easily deploy security updates, bug fixes, and new feature updates to smart devices in the field.

> To achieve a seamless smart-home experience in which the home, and the smart devices within it, responds to our daily needs autonomously, two things must happen," says Kehoe. "First, the burden of programming devices must be removed from the consumer. And second, the home needs to understand itself: what the layout of the home is, the location and purposed of each room, and where the home's various smart devices are located.
>
> *Ben Kehoe*
> *Cloud Robotics Research Scientist at iRobot*

IN THE CLOUD, AWS IOT PROVIDES A FULL SUITE OF SERVICE INCLUDING AWS IOT CORE, AWS IOT DEVICE MANAGEMENT, AWS IOT DEVICE DEFENDER, AND AWS IOT ANALYTICS

Reliable and persistent communication

AWS IoT Core allows you to easily connect devices to the cloud and to other devices. AWS IoT Core supports HTTP, WebSockets, and MQTT, a lightweight communication protocol specifically designed to tolerate intermittent connections, minimize the code footprint on devices, and reduce network bandwidth requirements. AWS IoT Core also allows you to program your devices to keep them "listening" for long durations, allowing for reliable response from voice activated commands through Alexa.

Responsiveness

AWS IoT provides scalable, low latent, bi-directional communication from device to cloud. AWS IoT Core is present in 11 regions worldwide, allowing you a global footprint and minimal downtime.

> Customers are demanding easier ways to interact with a growing number of products and technologies throughout the home—Cloud connectivity provides Roomba customers with even more convenience and control, so they can use their phones to manage their Roomba, wherever and whenever it's convenient... The AWS Cloud offered an essential combination of scalability, global availability and breadth of services.
>
> *Ben Kehoe*
> *Cloud Robotics Research Scientist at iRobot*

Device management

With AWS IoT Device Management, you can onboard, organize, and monitor your devices, creating a real-time, searchable fleet index of all of your connected devices. You can also push bug fixes and firmware updates over-the-air with a few clicks. Plus, the device certificates for routers and set-top boxes managed with AWS IoT Device Management will never expire.

> The market for smart devices in the home is flourishing, and AWS IoT services are helping us be part of that development by supporting our Rotimatic flatbread-making robot… We're able to understand our customers better. We can gather data on usage patterns and gauge feedback and satisfaction levels. We can also distinguish the favorite recipe on our Rotimatics. With this kind of information, we can evolve our product with updates—right down to new recipes we send out to the device—that we know will add value to our customers.
>
> *Rishi Israni*
> *Co-founder and CEO, Zimplistic*

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Anomaly detection

AWS IoT Device Defender detects anomalies in device behavior that may indicate a compromised device by monitoring incoming device data and comparing that against your device's expected behavior, which you can define.

Device insights

With AWS IoT Analytics, customers can always keep track of error logs, troubleshoot remotely, perform predictive maintenance with machine learning, and gain valuable customer insights to identify upsell opportunities.

> Our research and development group is getting information about how our top-of-the-line products are functioning that was impossible to gather before. We have insights into not only how the product is functioning, but also how people are using the product. For example, we gather statistics about motor speed, errors, voltages, and so on, which tell us how well our air-treatment units are operating in the field. We also collect information about users' interactions with our mobile application in order to improve that offering.
>
> *Everette Binger*
> *Chief IoT Solutions Architect, Amway*

Low total cost of ownership

AWS IoT Core allows customers to quickly implement our cloud services, enabling a faster time-to-market and eliminating the need to build expensive, custom in-house infrastructure to manage device connectivity at scale.

Time-to-market is everything for us," says Franz Garsombke, chief technology officer and co-founder of Rachio. "But we're a startup, and we wanted to get our product out there rapidly without investing a lot in our own hardware resources to make that happen. We didn't want to spend all our time maintaining the underlying technology, whether that be device connectivity or servers. For companies wanting to get into the IoT space, tools like AWS IoT enable a faster time-to-market and eliminate the need to spend months and months and hundreds of thousands of dollars building a solution yourself—using AWS, we were able to get our product to market 40% faster than we could if we had to build a highly available infrastructure with load balancing.

Franz Garsombke
CTO and Co-founder, Rachio

LEARN MORE ABOUT AWS IOT

At AWS, our mission is to make sure that you can know the state of every thing, of all your devices, and that you can reason on top of that data, so you can solve business problems.

EDGE-BASED SOFTWARE »

Amazon FreeRTOS
IoT Operating System for Microcontrollers
https://aws.amazon.com/freertos/

AWS Greengrass
Secure Local Triggers, Actions, and Data Sync
https://aws.amazon.com/greengrass/

CLOUD-BASED SERVICES »

AWS IoT Core
Secure Device Connectivity and Messaging
https://aws.amazon.com/iot-core/

AWS IoT Device Management
Fleet Onboarding, Management,
and Software Updates
https://aws.amazon.com/iot-device-management/

AWS IoT Device Defender
Fleet Audit and Protection
https://aws.amazon.com/iot-device-defender/

AWS IoT Analytics
IoT Data Analytics and Intelligence
https://aws.amazon.com/iot-analytics/