ESP RainMaker® Product Brief

Version: 1.0

rainmaker.espressif.com

Catalog

Overview

ESP RainMaker® is a private IoT cloud platform that you can deploy in your own AWS account, giving you full control over data and feature customizations. ESP RainMaker is built on AWS Server-less architecture and leverages AWS-managed services to offer resource scalability, pay-as-you-go pricing, and low maintenance.

ESP RainMaker is a complete solution that you can use to readily build your connected products without any development and maintenance efforts. However, with your differentiated business requirements, you can also utilize ESP RainMaker as a foundational platform to fully customize the functionality with its open-source device SDK, mobile apps and voice assistants, device management dashboard, and open-architecture cloud backend. This way you can build your own IoT platform without requiring to reinvent the wheel.

Key Value Proposition

Improve Time-To-Market
Simplify connected device development, eliminating the need for significant upfront investments in both software and hardware.

Complete Control
With ESP RainMaker deployed in customers' own AWS accounts, customers have full control over end user and device data, as well as customization.

Pay-As-You-Grow Pricing
Our high flexibility enables customers to pay as their business expands, avoiding the burden of expenses related to idle resources. It eliminates the need for provisioning and managing servers, allowing you to focus solely on your business logic and delivering value to your customers.

Facilitating Innovation
ESP RainMaker provides all the required and undifferentiated yet critical functionality for connected devices allowing customers to focus on their key differentiators. Furthermore, open-source SDKs & components, phone apps, voice assistant skills, device dashboard, and open-API cloud backend allow you to easily build custom solutions.

Key Design Considerations

Manageability
Traditionally, having your own IoT platform also means having the burden of managing the cloud infrastructure with the DevOps team.However, ESP RainMaker utilizes AWS Server-less architecture and has been carefully designed to relieve you from the responsibility of actively managing the cloud backend. Server-less services automatically scale up or down based on the demand, ensuring that your application can handle any amount of traffic without manual intervention.

Scalability
ESP RainMaker is meticulously designed and tested to handle a vast number of devices and users. Server-less services are designed to be highly available and fault-tolerant. They automatically handle tasks like load balancing, scaling, and fault recovery, ensuring that your application remains available even in the event of failures.

Security
ESP RainMaker uses all the standard security infrastructure for the security of devices and users. No custom security schemes and unnecessary privilege escalations are used in the design.

Cost
ESP RainMaker optimizes cost-effectiveness by thoughtfully selecting AWS-managed services and their intercommunication, ensuring the lowest possible cost of operation.

Extensibility
The ESP RainMaker platform is purposefully designed with pluggability and extensibility in mind. The API is open and all the common customizations within the cloud backend are well addressed. It seamlessly integrates with other AWS services, such as databases, storage, and analytics services. This allows you to build complex and scalable applications by utilizing the full range of AWS services, unlocking endless possibilities for your solution.

Key Features

End-User Features

- Network Configuration
- Device Control (Local & Remote)
- Schedules & Automation
- Matter protocol support
- User Management
- Sharing (device, group & home)
- Grouping (device group, room, home & mesh)
- Voice Assistant Integrations (HomeKit, Alexa, GVA)

OEM Features

- Admin RBAC
- Device Diagnostics
- Business Intelligence
- OTA Upgrades
- Fleet Management
- OTA Firmware Signing

In addition, ESP RainMaker provides complete support for the custom development of Matter-compatible accessories using ESP RainMaker device SDK enabled with Matter.

Details of ESP RainMaker

Components

Device Firmware SDK

The Device Firmware SDK is open-source software that supports all Espressif System-on-Chips (SoCs). It is written in the C programming language and encompasses a comprehensive set of functionalities. These include network provisioning, connection management, both local and remote control, scheduling, scene management, Over-The-Air (OTA) upgrades, and diagnostics. In addition to the SDK, we offer production-ready application examples.

Phone Apps

ESP RainMaker provides native phone applications for both iOS (developed in Swift) and Android (developed in Java). Additionally, we offer a hybrid phone application, Nova Home, developed using HTML and CSS. These phone applications are readily accessible on popular App Stores for trial use and are available for full-scale development and customization with complete source code provided. Our phone applications encompass a wide range of smart home functionalities, including network provisioning, local and remote device control, device sharing, group management, scheduling & automation trigger, scene creation.

Cloud Backend

The ESP RainMaker cloud backend is provided in the form of AWS “Server-less Application Repositories” (SAR) and implements policies, service orchestration, and functional implementation. Devices communicate with the backend using the MQTT over TLS protocol, adhering to publicly defined payload formats. Phone applications, voice assistant skills, device management dashboards, and third-party integrations utilize REST APIs and push notifications for interaction. These APIs are publicly documented. The ESP RainMaker backend is designed to be data model agnostic and offers a custom plugin interface for processing all incoming events and data. While the ESP RainMaker backend is implemented in the Go programming language, customizations can be made using any AWS-supported language. The backend can be customized in the following ways:

Extensible AWS Services
Customers have the freedom to extend AWS services within the same account to develop their own applications. ESP RainMaker will never interfere with or appropriates any of these services for its own use.

OAUTH2 Interface
ESP RainMaker provides an OAUTH2 interface for external services, enabling custom authenticators to be utilized via the OAUTH2 interface offered by those services.

Data and Event Accessibility
ESP RainMaker facilitates easy access to its data and events for further processing:

- The ESP RainMaker web API is openly accessible for third-party integrations, fostering a collaborative ecosystem.
- The webhook interface empowers users to extract events and data, offering the flexibility to implement additional processing either within the same AWS account or in a different one.

Comprehensive Database Documentation
To support direct access to databases, ESP RainMaker provides comprehensive documentation of all internal database schemas, ensuring transparency and ease of use.

Device Management Dashboard

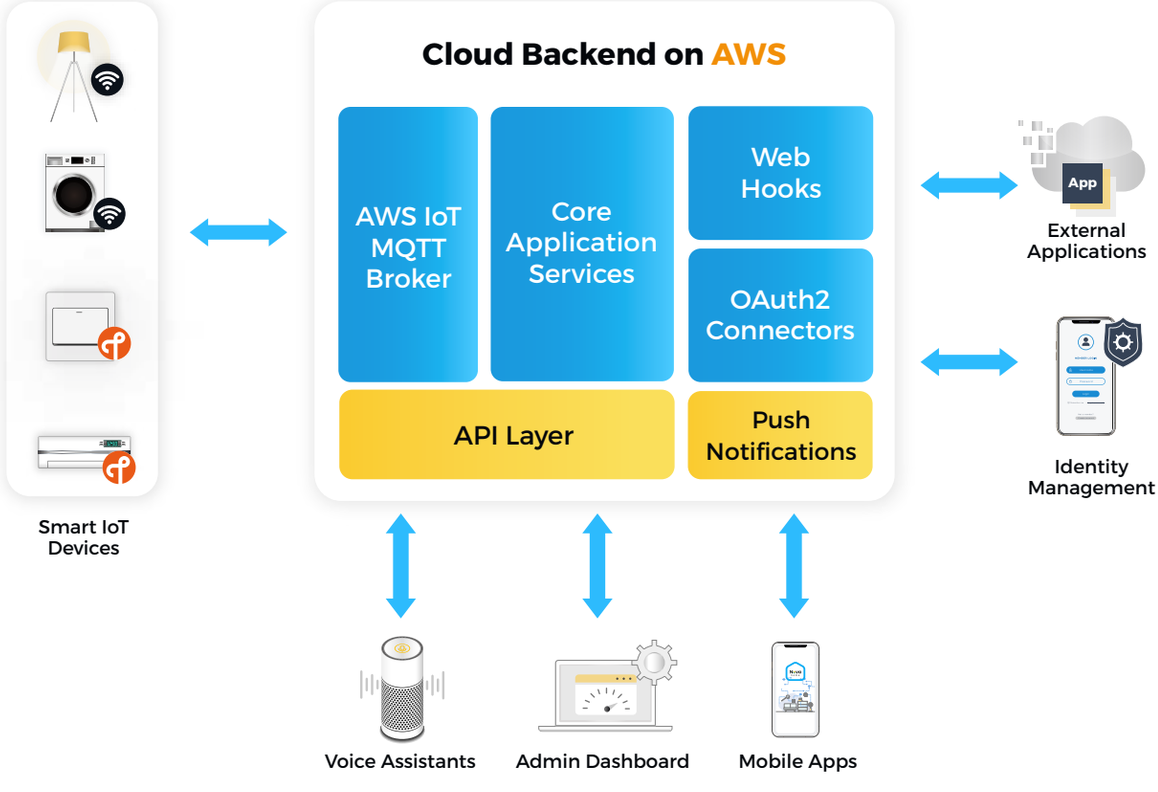
The device management dashboard offers essential functionalities, including business insights, device diagnostics, device management, and Over-The-Air (OTA) updates. It is crafted using a combination of HTML, CSS, and JavaScript (JS), providing a solid foundation. Moreover, it is highly adaptable, allowing for further customization to address specific business needs.

This dashboard offers the flexibility to define various administrator roles, each tailored to specific responsibilities. It empowers administrators to create custom dashboards and subsets, catering to the distinct requirements of different roles within the organization.

Voice Assistant Skills

ESP RainMaker offers open-source voice assistant skills compatible with both Alexa and Google Voice Assistant. These skills are standard and certified, designed to seamlessly integrate with a wide range of common smart home devices.

What sets these skills apart is their adaptability; they can be easily customized using the provided source code. This flexibility empowers users to tailor the voice assistant skills to suit their specific requirements.



Matter Readiness

ESP RainMaker offers robust support for the Matter protocol in several key ways:

Phone App Capabilities
ESP RainMaker's phone apps are equipped to utilize the Matter protocol-defined network provisioning and Matter protocol-based local control. This means that ESP RainMaker phone apps can seamlessly commission any Matter-compliant device.

PKI Infrastructure Support
As part of the Matter Fabric support, ESP RainMaker's cloud backend and phone apps also include the necessary Public Key Infrastructure (PKI) infrastructure. This infrastructure enables the issuance of fabric-specific device certificates to devices that are being commissioned.

Creating Matter Ecosystems
ESP RainMaker phone apps and the cloud backend provide a fully functional implementation of a Matter fabric. This empowers users to establish their own Matter ecosystem. Within this ecosystem, Matter-commissioned devices in a user's context are synchronized across multiple phone applications and Matter controller devices, all within the same user context.

ESP Insights

Empowering Firmware Analysis

ESP Insights, seamlessly integrated into RainMaker, is a powerful device monitoring solution that offers developers the ability to remotely analyze their firmware, providing rich insights into its execution. This tool serves as a valuable resource for identifying issues and bottlenecks, ultimately saving valuable engineering time and accelerating firmware development.

What Customers Can Achieve with ESP Insights

Crash Analysis
Investigate register dumps and backtraces when the firmware encounters crashes, allowing for a deep understanding of the root causes.

Custom Event Integration
Enhance the timeline by adding custom events to highlight specific occurrences of interest.

Device Timeline Monitoring
Track important events on a device timeline, providing a comprehensive view of device behavior.

Firmware Metric Monitoring
Monitor custom firmware metrics, such as motor temperature, over a timeline to assess performance and trends.

Log Observation
Gain visibility into critical logs and errors generated by the firmware during its execution.

Variable Inspection
Inspect the real-time values of select variables of interest.

ESP Insight fully leverages the ESP RainMaker platform for device authentication and cloud transport. It is offered as part of the ESP RainMaker ecosystem, providing an optional service to further enhance quality of firmware development, product maintenance and data analysis.

Security

Secure Hardware and Firmware

Espressif SoCs and modules are equipped with a robust array of security functionalities spanning multiple levels, designed to meet the stringent requirements of IoT scenarios. These features include secure boot mechanisms and flash encryption, addressing the need for data protection.

To bolster security further, Espressif has introduced unique innovations, exemplified by the 'digital signature peripheral' system embedded in our modules. This system plays a pivotal role in safeguarding device identities.

The firmware layers atop these foundational security measures, implementing additional protective features such as secure and verified Over-The-Air (OTA) upgrades, anti-rollback support, and mutual authentication based on TLS 1.2 with the cloud. This multi-layered approach ensures comprehensive security.

It's worth noting that all Espressif modules have earned AWS qualification, making them compatible with FreeRTOS and AWS IoT Core. This qualification underscores our commitment to delivering secure and reliable IoT solutions.

Cloud Backend Security

ESP RainMaker places paramount importance on backend security, employing a range of techniques to fortify its defenses:

User Authentication
Our cloud backend leverages Amazon Cognito for both user and API authentication, adhering to industry standards for secure access control.

Device Security
AWS IoT Device Defender is deployed to safeguard against rogue behavior originating from the device side, preserving the integrity of our cloud infrastructure.

IAM Policies
To ensure the utmost security, we implement strict and fine-grained IAM (Identity and Access Management) policies. These policies grant access only to authorized users or devices, ensuring that cloud resources are accessed solely by those with legitimate permissions.

DDoS Protection
Our backend is shielded from Distributed Denial of Service (DDoS) attacks by the robust AWS WAF (Web Application Firewall). This safeguard prevents disruptive attacks on our REST API gateway.

In addition to these security measures, customers have the transparency to inspect API configurations in the AWS Console's API Gateway. This visibility empowers customers to review the specific API services implemented within their AWS account.

Furthermore, we extend an open invitation to our customers and trusted security companies for Joint Code Reviews of ESP RainMaker. This collaborative approach allows customers or their chosen security experts to conduct thorough code reviews, ensuring the highest level of security and confidence.

Compliance

ESP RainMaker has successfully undergone both the AWS Foundational Technical Review and the Well-Architected Review. Our platform is meticulously designed with security at its core, offering a robust set of security features to safeguard your IoT ecosystem. These features include secure boot mechanisms, encrypted firmware upgrades, and secure communications facilitated by TLS (Transport Layer Security).
One of the key strengths of ESP RainMaker lies in its utilization of AWS standard managed service components such as AWS API Gateway, AWS IoT, and AWS S3. These services have been rigorously developed and tested for both reliability and security. They adhere to industry best practices, ensuring compliance with recognized standards such as ISO 27001 and ISO 27018.
AWS's unwavering commitment to security and reliability is further evidenced by their comprehensive suite of security measures, including certificate-based mutual authentication, IAM (Identity and Access Management), Cognito, WAF (Web Application Firewall), and Device Defender. These services align with industry standards and underscore AWS's dedication to providing a secure and dependable foundation for your IoT solution.

Data Privacy

ESP RainMaker stands apart from other SAAS (Software as a Service) platforms by offering unparalleled transparency and business independence. We firmly uphold the principle that only the account owner or authorized personnel should have access to resources and data.
To elaborate, ESP RainMaker employs Amazon Cognito for end-user management, ensuring secure, password-protected access to devices and services that users are authorized to utilize. This versatile system allows developers to define custom user attributes and seamlessly integrate with external identity providers, including social login, SAML, and OIDC (OpenID Connect). Cognito empowers developers by enabling the issuance of temporary credentials to end-users for a limited timeframe, revoking access once their session concludes. This approach guarantees that resource access is confined to authorized individuals, preventing unauthorized entry to sensitive information.
Moreover, ESP RainMaker takes data protection to heart by diligently adhering to GDPR (General Data Protection Regulation) compliance requirements. We've proactively developed essential features within the product to align with GDPR standards. To validate our compliance, Espressif has collaborated with an external testing and certification laboratory, TUV Rheinland, to undergo a thorough GDPR review. Your data privacy and security are our top priorities.

Additional Espressif Services

Pre-provisioned Modules

Espressif can provide modules that are pre-provisioned with X.509 private keys and certificates. The private key is generated on the module and never leaves it. ESP32's Secure Boot, Flash Encryption, and Digital Signature Peripheral features provide and secure storage scheme for the device's private key. Modules are delivered along with a software manifest containing device certificates. Espressif also provides a tool to register the certificates in the AWS account used for ESP RainMaker. This simplifies Customers' manufacturing significantly.

Recently, with Matter readiness on ESP RainMaker, the pre-provisioned module are available for both Matter and RainMaker with single DAC.

Pre-programmed Modules

Customers can provide their firmware and other binaries to Espressif and Espressif can also program these artifacts in the modules to further simplify manufacturing lines. Secure boot and flash encryption too can be enabled in the Espressif factory.

Software Customization Service

Espressif can provide technical consulting service with provision of SDK or reference solution. When necessary, Espressif would also offer customization service for firmware, phone apps, cloud backend, and voice assistant skills customizations based on customer requests.

Cost of Operation

ESP RainMaker uses AWS-managed services and all of these services carry their own pay-as-you-go pricing. ESP RainMaker customers typically pay their own AWS bill based on the actual consumption of the resources. This provides the customers with almost linear scalability of the operational cost proportionate typically to the number of devices and number of users. The cost of operation also depends on messaging between devices and cloud, phone apps and cloud and voice assistant skills invocation. Espressif provides a cost calculation sheet that models the cost for a given use-case and provides a ballpark, yet detailed cost analysis.

AWS Bill

The AWS bill is sent directly to customers' AWS accounts on a monthly basis, and customers manage their own payments. The cost of an IoT device is notably dependent on firmware development. ESP RainMaker, which extensively utilizes AWS managed services, provides a predictable, transparent, and stable cost structure.

Importantly, AWS service costs have demonstrated a consistent trend of decreasing over time, with no history of price increases. This stability sets AWS apart from other SAAS services that may experience price fluctuations and unpredictability.

The actual cost may vary based on factors such as connected nodes, registered users, user behavior, and firmware usage. Espressif offers a dedicated cost estimation tool that provides a ballpark estimate for customers to calculate their expenses. ESP RainMaker customers have access to this tool to facilitate their cost calculations.

Furthermore, Espressif remains committed to ongoing cost optimization efforts, ensuring that our customers benefit from the most cost-effective solutions.

Pricing Model of ESP RainMaker Service

The cost structure of ESP RainMaker consists of Entry Fee (One-time) and subscription fee. To acquire for more details about the price information, please approach our business development team.

Subscription Model

Under our subscription model, Espressif charges an annual maintenance fee based on the number of a customer's valid devices at the conclusion of each calendar year. The cost of AWS services is managed directly by our customers.

Espressif takes on several key functions and responsibilities to support our valued customers:

Cloud Maintenance
Espressif is committed to ensuring the stable operation of our customers' cloud backends. We provide debugging assistance to address any issues that may arise during the operational stage, safeguarding the uninterrupted flow of their business.

Cloud Iteration
Our team periodically performs maintenance and updates, ensuring that our customers benefit from new feature releases and enhancements. This ongoing support helps keep their systems up-to-date and competitive.

Consulting & FAQ
We offer comprehensive consulting services and frequently asked questions (FAQ) support to facilitate our customers' development work. Our aim is to empower them with the knowledge and guidance they need to succeed in their projects.

Company Introduction

Espressif Systems (688018.SH) is a public multinational, fabless semiconductor company established in 2008, with offices in China, the Czech Republic, India, Singapore and Brazil. We have a passionate team of engineers and scientists from all over the world, focused on developing cutting-edge wireless communication, low-power, AIoT solutions. We have created the popular ESP8266, ESP32, ESP32-S, ESP32-C and ESP32-H series of chips, modules and development boards. By leveraging wireless computing, we provide green, versatile and cost-effective chipsets. We are committed to offering solutions that are secure, robust and power-efficient. At the same time, by open-sourcing our technology and solutions, we aim to enable developers to use Espressif's solutions globally and build their own smart-connected devices.

Global Support & Policy

Espressif is a global enterprise that maintains an open and neutral position, respecting and attaching great importance to diverse customer and partner relationships. Our goal is to ensure the secure and stable operation of our customers' businesses by delivering high-quality technical services.

ESP RainMaker establishes a global team with a rich tapestry of cultures, spanning India, Singapore, and China. Our international presence empowers us to deliver IoT solutions on a global scale. Our diverse workforce brings an array of perspectives to the table, enhancing our ability to design and implement IoT solutions tailored to the unique needs and preferences of customers worldwide.

Our team's profound understanding of technology, data security & compliance from chipsets to cloud and software stands as a cornerstone of our service. Given that IoT solutions often involve intricate technology stacks, data security considerations, and compliance standards, our technical proficiency equips us to guide customers through these complexities effectively.

We take pride in our unwavering commitment to customer support, ensuring that our clients benefit from robust technical assistance. In the dynamic world of IoT, where troubleshooting, updates, and system maintenance are paramount, ESP RainMaker is your steadfast partner for success.

If you are interested in understanding more about ESP RainMaker and Espressif products, please contact us at espressif.com/sales.