

Linux and Android Technical Brief

About this document

Our world-class Wi-Fi and Bluetooth/BLE connectivity solutions are integrated into the Linux and Android open source ecosystems. This document describes the features, modes, and limitations associated with the supported hardware and software.

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Introduction

1 Introduction

The connectivity software solutions for Arm® Cortex®-A class host processors support your product's lifecycle journey from design and part selection through product maintenance. This also includes complex regional radio spectrum regulatory compliance and Wi-Fi Alliance interoperability certifications you need to bring your product to the market faster, cheaper and with less risk.

Table 1 Value Statements for Products Using an Arm Cortex-A Host Processor

Value	Example
Product Characteristics	Battery Life Robust Communications Cost
Product Capabilities	Wi-Fi 4 (802.11n) Wi-Fi 5 (802.11ac) Wi-Fi 6 (802.11ax) Security (WPA3, Enterprise) Multi-radio Coexistence
Time to Market	Software Development Time Testing and Certification Time Predictability
Development Cost	Software Development Effort Code Reuse Solution Completeness
Risk	Product Quality Key Supplier Risk Technology Risk

What's New

2 What's New

This section summarizes the software changes since the last release. Changes to this document since its last revision will be highlighted.

2.1 Q3 2020

This quarter's release is a minor maintenance release which includes the following software changes:

- Software changes to address CVE-2019-15063, CVE-2020-10367, CVE-2020-10368, CVE-2020-10369 and CVE-2020-10370 across the portfolio
- Customers will be pleased to know that we take software quality seriously. As such, we have deployed Gartner's fourth year-in-a-row Leading Magic Quadrant for Application Security Testing: **Synopsis Coverity Static Application Security Testing (SAST)** across the software assets delivered to Linux and Android customers.
- A flexible OTP and MAC programming solution has been built to enable CYW4373 module vendors to use a single SKU in inventory regardless of the interface used (this feature is limited to products using SDIO|PCIe and USB only; PCIe and SDIO are not supported).
- Worldwide regulatory approved radio configurations (FCC, CE, and so on) enable your products to be production ready right out of the box. These configurations lack region-specific power optimizations for Frequency Band, Bandwidth, and Modulation, which will improve the overall performance of your products in each region, but for those of you designing a globally destined product, you now have an out-of-the-box solution to pass worldwide regulatory certifications. See [AN225347](#) for more information.
- Temperature throttling on the CYW4373E. This feature slows the Wi-Fi CPU clock below its base clock speed to prevent the device from reaching maximum temperature conditions. This can maintain your critically connected system while also preventing damage to the surrounding electronics in your package.
- Yocto upgrade to Zeus LTS

2.2 Q2 2020

- Our first Android release for the broad market based on the Google 2019 Android 10 release. This release has been qualified on the NXP iMX8 platform. You can now use the reference package developed on the NXP Android iMX8 platform as a reference design for your product.
- Support for **Yocto Projects**. Yocto is a widely used custom embedded Linux distribution creation tool. The Yocto project provides a flexible set of tools and a space where embedded developers worldwide can share technologies, software stacks, configurations, and best practices to create tailored Linux images for embedded and IoT devices, or anywhere a customized Linux OS is needed. This release allows you to enable the Wi-Fi connectivity software in your Yocto projects, making it easier than ever to get started quickly with the Cypress connectivity software. Bluetooth in Yocto will be released soon.
- Cirrent IoT Network Intelligence (INI) Agent is now provided by default within the connectivity software release. A free 90-day trial is also included. With Cirrent's IoT Network Intelligence, a scalable purpose-built connected-product analytics platform, you can solve customer and product problems faster.
- Zigbee Coexistence for the CYW4345x family. Many customers are using the CYW4345x family along with a third-party Zigbee part. The CYW4345x can now act as the master coexistence engine in your design via the somewhat industry standard 3-wire coexistence interface. This implementation supports only Wi-Fi + Zigbee coexistence. Wi-Fi + BT + Zigbee coexistence is being considered as a future roadmap item.

Coming Soon

3 Coming Soon

This section summarizes features that will be implemented for the A-Class software portfolio in upcoming releases:

- Avoid chip-down designs and complex RF tuning investments by leveraging new CYW4373 and CYW54591 modules from our partner ecosystem, which will assist you in bringing your product to market faster, with less risk and lower cost.
- Wi-Fi + BT + Zigbee coexistence on the CY4354x
- Based on your feedback - Android Improvements: Additional device support, an easier to use out-of-the-box experience (including Bluetooth support), and Android 11.
- Improved support for Wi-Fi mesh routers in today's smart homes. Thanks to Cirrent INI, we have identified several challenges introduced from dense Wi-Fi networks such as beacon loss, collisions, and in some cases, incorrect clock emissions from various third-party access points (APs). We have reproduced, validated, and field-tested changes to our software to gracefully handle these issues with third-party routers, and we are in the process of deploying these changes throughout the wireless portfolio.
- Yocto Dunfell upgrade. Dunfell is the latest LTS release supported by the yocto project. The Bluetooth connectivity software will also soon be preconfigured to further ease your out-of-the-box getting started experiences via Yocto.
- Soon, we will be releasing the Linux and Android software artifacts on GitHub rather than in a tarball format to further ease your use and adoption.
- Our industry-leading dual-mode Bluetooth stack will soon become available as a hosted stack option for your Cortex-A IoT products. We aim to make our Bluetooth stack the "default" stack in our Yocto package to maximize your ease of use and the out-of-the-box experience with our software. In addition to Linux, we are also studying value additions to improve the Google Android Bluetooth stack for your IoT products.

4 Operating System Support



Our connectivity solutions for products using an Arm Cortex-A host processor consist of the following out-of-the-box deliverables:

- Wi-Fi and Bluetooth/BLE combo chips with integrated radios, controller firmware, and an embedded Bluetooth/BLE application stack that is offloaded power and code-size optimized.
- Standardized, pre-integrated device drivers with out-of-the-box support for WPA Supplicant (wpa_supplicant) and Host Access Point Daemon (hostapd).
- Worldwide regulatory approved radio configuration, tunable to your product's targeted regions.
- A tools suite to assist various manufacturing, regulatory, and interoperability requirements.

These software artifacts are supported in two primary ecosystems listed below. New features, fixes, and improvements are released via a quarterly release cadence. All artifacts are validated in our labs using an NXP iMX6, NXP iMX8, or Intel NUC (PCIe) reference platform.

1. Latest Google Android Open Source Platform (AOSP) version (with derivative support for Android TV, Wear OS, ...)
 - Current version: Android 10, Kernel version 4.19LTS
2. Latest Long-term Linux kernel release
 - Current version: 5.4LTS

4.1 Kernel Support Policy

For us to service kernel diversity within the IoT market, our kernel support policy embraces the **Backports Project**. The Backports Project is the industry standard practice for enabling older kernels to run newest drivers. Your Arm Cortex-A host provider will define the kernel to be used in your product design via the vendor's *Yocto* recipes or Android SDKs. If the kernel version is not the latest LTS (currently 5.4), you will execute our Backports Project in your development environment to enable the latest and greatest connectivity software (firmware and drivers) in your design.

See [FAQs](#) for Linux kernel software lifecycle information.

Operating System Support

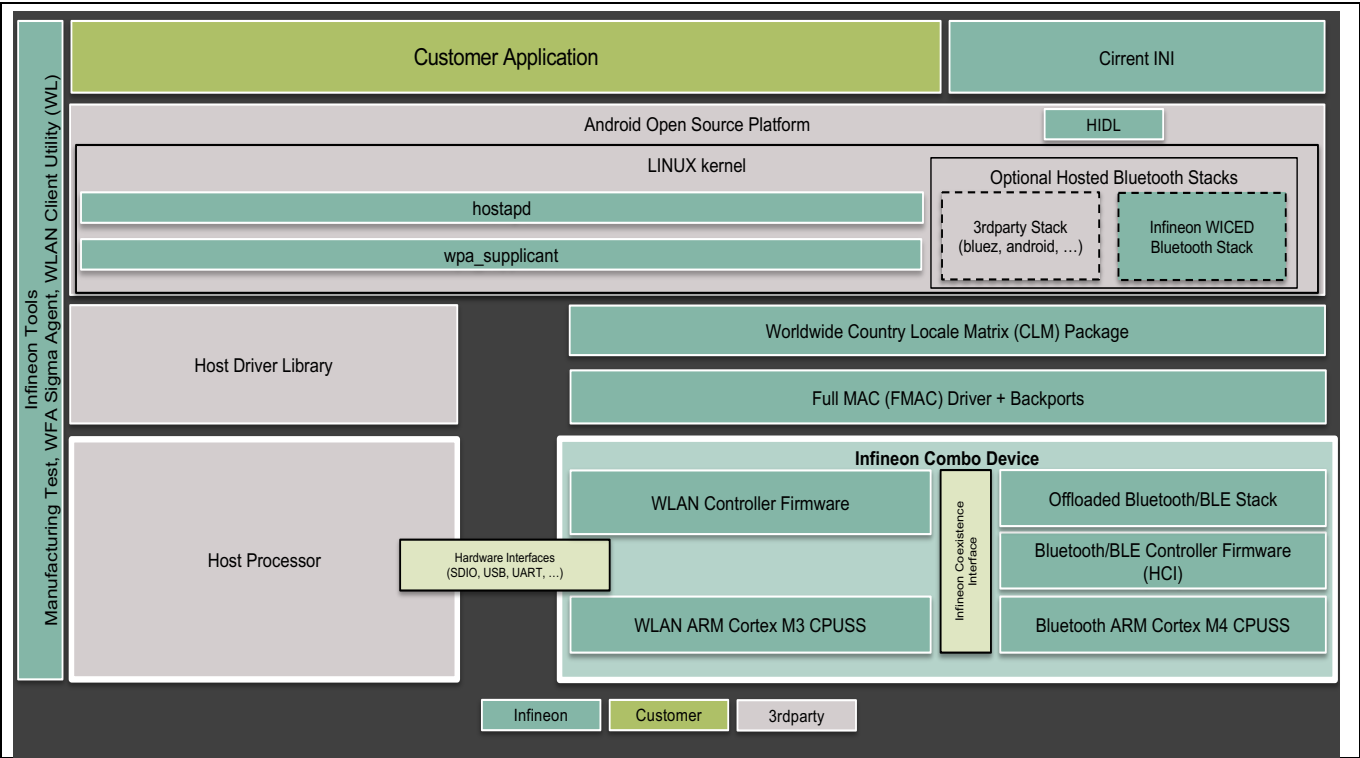


Figure 1 Block Diagram for Cypress Connectivity Paired with Arm Cortex-A Hosts

Commercial Software Lifecycle

5 Commercial Software Lifecycle

All software artifacts are assigned a state in the Software Lifecycle. State assignment will help you plan for your product's lifecycle by ensuring that you select the correct device and software features for your product. State change notifications will be communicated at least two quarters in advance via this technical brief. [Table 2](#) contains a list of Maintenance and EOL devices and software. Software products not listed are considered active.

This section applies to our A-Class commercial software only. Other software segments and businesses such as automotive or M-Class will have independent software lifecycles.

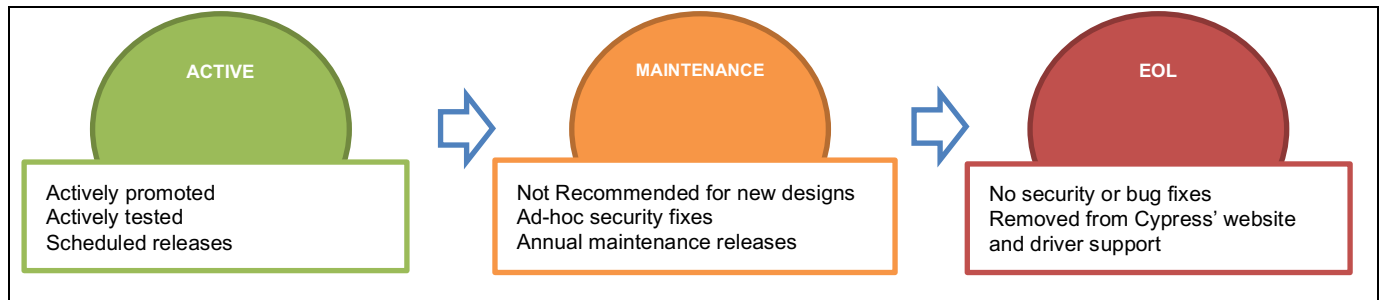


Figure 2 Software Lifecycle

Table 2 Software Lifecycle Change List

Software Artifact	Category	State Transition	Date	Replaced By
88359, 88459 in Commercial Release	Device Refresh	ACTIVE > MAINTENANCE	2020-07-01	5459x
Cypress BSA Bluetooth Stack	Bluetooth Stack	ACTIVE > MAINTENANCE	2021-01-01	Cypress Bluetooth Stack
4343x	Device Refresh	ACTIVE -> MAINTENANCE	TBD	43439x
43455	Device Refresh	ACTIVE -> MAINTENANCE	TBD	4373x
435x	Device Refresh	ACTIVE -> MAINTENANCE	TBD	5459x
431x, 432x, 433x	Device Refresh	ACTIVE -> MAINTENANCE	TBD	43439x

Characteristics of IoT Connectivity Portfolio

6 Characteristics of IoT Connectivity Portfolio

Table 3, each row indicates a product family where several part numbers within the family exist, denoted via the 'x' character such as CYW4343x. For additional information such as product briefs and datasheets, see [Wireless Connectivity](#) and contact your Sales Representative.

Table 3 **Product families**

Family	WI-FI					Bluetooth/BLE				Operating Temperature
	MAC	Interfaces	Bands	Security	AES256	Version	Interfaces	BT4.x	BT5.x	
CYW4343x datasheet	802.11 b/g/n low power	SDIO 2.0 SPI	2.4 GHz	WPA2/ (WPA3 STA only)	-	5.1	UART PCM I2S	<ul style="list-style-type: none"> Nudging and interlaced scan Low-duty cycle directed ADV BLE Scatternet BLE Secure Connections 	Errata Only	-30° to +70°C
CYW43012 datasheet	802.11 a/b/g/n/ac ultra-low power beamformee	SDIO 3.0	2.4/5.0GHz	WPA2/WPA3 EAP-TLS** EAP-TTLS** PEAP**	-	5.0	UART PCM I2S	<ul style="list-style-type: none"> Nudging and interlaced scan Low duty cycle directed ADV BLE Scatternet BLE Secure Connections DPLE BLE Privacy 	2Mbps BLE (Symmetric-mode only) SAM BLE Channel Selection Algo #2 High duty cycle non connectable ADV High output power CSA5	-20° to +70°C

Characteristics of IoT Connectivity Portfolio

Family	Wi-Fi					Bluetooth/BLE				Operating Temperature
	MAC	Interfaces	Bands	Security	AES256	Version	Interfaces	BT4.x	BT5.x	
CYW4373x 4373 datasheets 4373E datasheet	802.11 a/b/g/n/ac beamformee	UART USB SDIO 3.0	2.4/5.0GHz	WPA2/WPA3	-	5.0	UART USB PCM	<ul style="list-style-type: none"> • Nudging and interlaced scan • Low duty cycle directed ADV • BLE Scatternet • BLE Secure Connections • DPLE • BLE Privacy 	Errata Only	-40° to +85°C
CYW43455 datasheet	802.11 a/b/g/n/ac beamformee	UART SDIO 3.0	2.4/5.0GHz	WPA2/WPA3 EAP-TLS ¹ EAP-TTLS ¹ PEAP ¹	-	5.0	UART PCM I2S	<ul style="list-style-type: none"> • Nudging and interlaced scan • Low duty cycle directed ADV • BLE Scatternet • BLE Secure Connections • DPLE 	Errata Only	-20° to +75°C

1. Validated on Free Radius Enterprise servers.

Characteristics of IoT Connectivity Portfolio

Family	WI-FI					Bluetooth/BLE				Operating Temperature
	MAC	Interfaces	Bands	Security	AES256	Version	Interfaces	BT4.x	BT5.x	
CYW5459x datasheet coming soon	802.11 a/b/g/n/ac 2x2 MIMO RSDB ac/n beamforming	UART PCIe	2.4/5.0GHz	WPA2/WPA3	-	5.0	UART PCM I2S	<ul style="list-style-type: none"> • Nudging and interlaced scan • Low duty cycle directed ADV • BLE Scatternet • BLE Secure Connections • DPLE • BLE Privacy 	<ul style="list-style-type: none"> • 2Mbps BLE • BLE Long Range • SAM • BLE Channel Selection Algo #2 • ADV Extensions • High duty cycle non-connectable ADV • High output power CSA5 • AoA/AoD 	-40° to +85°C
CYW4354 datasheet	802.11 a/b/g/n/ac 2x2 MIMO ac beamformee	SDIO 3.0	2.4/5.0GHz	WPA2	-	5.1	UART USB2.0 PCM I2S	<ul style="list-style-type: none"> • Nudging and interlaced scan • Low duty cycle directed ADV • BLE Scatternet 	Errata Only	-30° to 85°C
CYW4356 datasheet	802.11 a/b/g/n/ac 2x2 MIMO ac beamforming	PCIe SDIO	2.4/5.0GHz	WPA2	-	5.0	UART USB2.0 PCM I2S	<ul style="list-style-type: none"> • Nudging and interlaced scan • Low duty cycle directed ADV • BLE Scatternet 	Errata Only	-30° to +75°C

Characteristics of IoT Connectivity Portfolio

Family	Wi-Fi					Bluetooth/BLE				Operating Temperature
	MAC	Interfaces	Bands	Security	AES256	Version	Interfaces	BT4.x	BT5.x	
CYW5557x datasheet coming soon ¹	802.11/a/b/g/n/ac/ax 2x2 MIMO beam	PCIe 3.0 SDIO 3.0	2.4/5.0GHz	WPA2/WPA3 AES and TKIP hardware WLAN boot image validation	yes	5.2	UART TCPWM 2x I3C 2x SCB	<ul style="list-style-type: none"> • Nudging and interlaced scan • Low duty cycle directed ADV • BLE Scatternet • BLE Secure Connections • DPLE • BLE Privacy 	<ul style="list-style-type: none"> • Trust-Zone M33 BT CPUSS • High Accuracy Data Measurement (HADM) • 2Mbps BLE • BLE Long Range • SAM • BLE Channel Selection Algo #2 • High duty cycle non-connectable ADV • High output power CSA5 • AoA/AoD • BLE Isochronous Channels • BLE Mesh • eSCO • AFH • Multiple A2DP profile support 	coming soon

¹ Engineering Samples available Q3 2020 (date subject to change) - Contact your Sales Representative for more information

Partner Modules, Ecosystems, and Kits

Avoid chip-down designs and complex RF tuning by leveraging the our partner network. This network provides several modules powered by our silicon. These platforms are developed, tested, and supported by the our partners who implement the RF settings, testing, interfaces, and pin configurations. These modules accelerate your time to market by avoiding complex RF tuning and certifications processes. Our A-Class software gives you the flexibility to use any combination of these modules, kits, and ecosystems in your product. See [Partners](#) for more information on our partner network solutions.

Some partners such as [Murata](#) have also established proprietary ecosystems and complete hardware development kits. These environments often include a default preconfigured Arm Cortex-A host processor with an m.2 based connectivity expansion slot. This enables rapid evaluation and prototyping of the our connectivity portfolio through swappable m.2 connectivity expansion cards.

We also have several software development partners such as [EmbedUR](#) and [Rhonda Software](#) . These software design centers hold expertise on our software portfolio and are available to customize and integrate the software beyond our initial software offering.

7 Connectivity Software Solutions for the IoT

When selecting a connectivity supplier for your IoT product, it is critical to understand the supplier's software portfolio. Software is where the connectivity features defined by the Wi-Fi Alliance (WFA) or Bluetooth Special Interest Group (BTSIG) are implemented. Not all features defined by these working groups will be applicable to your product.

Our solutions are used across a variety of applications. The following tables map the most common Arm Cortex-A host processor applications to connectivity characteristics enabled by the our silicon and software portfolio.

7.1 IEEE, BT SIG and Wi-Fi Alliance Programs

Table 4 highlights the IEEE, BT SIG and Wi-Fi Alliance programs which are used ubiquitously across nearly every IoT Wi-Fi product regardless of the target application.

Table 4 Application-independent IEEE/Wi-Fi Alliance Programs

Category	Supported IEEE/Wi-Fi Alliance Program
Connectivity	802.11a/b/g/n/ac/ax
Access	Wi-Fi Easy Connect (DPP) Wi-Fi Protected Setup (WPS)
Security	Wi-Fi Enhanced Open WPA2 and WPA3 Protected Management Frames (PMF)
Optimizations	Wi-Fi Data Elements Power Saving Features

Table 4 highlights the IEEE, BT SIG, and Wi-Fi Alliance programs most commonly used in specific application segments. **Table 4** maps our silicon and software to specific applications, highlighting our best-in-class connectivity portfolio for your application. The AOSP has over 100 additional overlapping or unique connectivity requirements spanning **Wi-Fi and Bluetooth/BLE**. The column titled "Android Connectivity" describes the most common Android requirements and organizes them by application.

Connectivity Software Solutions for the IoT

Table 5 Application-Specific IEEE/Wi-Fi Alliance Programs

Application	Connectivity Characteristics	Cypress Product Family	Common Application Specific IEEE/WFA/BT SIG Programs		Frequent Android Connectivity Features	Frequent Coexistence Modes
			IEEE/WFA Programs	BT Programs		
Enterprise/ Industrial (POS, VoIP) High End Advanced Market	Low power Robustness Critical connectivity Security Voice	CYW54591	Voice-Enterprise Voice-Personal Wi-Fi Location 802.11mc (FTM/RTT) 802.11k/v/r 802.11h (DFS/TPC) Enterprise Security (EAP-TLS, PEAP)	Google HCI 2 Mbps BLE BLE Long Range BLE Channel Selection Algo #2 High-duty cycle non-connectable adv High output power CSA5 AoA/AoD BLE Privacy BLE Mesh	A2DP Offload HFP Audio Gateway Google HCI	Hybrid or Parallel

Connectivity Software Solutions for the IoT

Application	Connectivity Characteristics	Cypress Product Family	Common Application Specific IEEE/WFA/BT SIG Programs		Frequent Android Connectivity Features	Frequent Coexistence Modes
			IEEE/WFA Programs	BT Programs		
Enterprise/Industrial (POS, VoIP) High Volume Consumer Market	Low power Robustness Critical connectivity Security Voice	CYW4345x CYW4373x	Wi-Fi Optimized Connectivity Wi-Fi TimeSync Wi-Fi Multimedia (WMM) WMM-Admission Control WMM-Power Save Temperature Throttling Enterprise Security (EAP-TLS, PEAP)	2Mbps BLE BLE Long Range BLE Channel Selection Algo #2 High duty cycle non connectable adv High output power CSA5 BLE Mesh	PTS, ACTS, CTS Validation Suite STA/AP Concurrency P2P/NAN MAC Randomization GSCAN/PNO	Time Division Multiplex
Healthcare/Medical	Low power Security Critical connectivity	CYW4343x CYW4345x CYW43012	Wi-Fi Location 802.11mc (FTM/RTT) 802.11k/v/r 802.11h (DFS/TPC) Wi-Fi Optimized Connectivity Wi-Fi TimeSync Enterprise Security (EAP-TLS, PEAP)	Google HCI BR/EDR Secure Connections BLE Privacy 2Mbps BLE BLE Long Range BLE Channel Selection Algo #2 Low duty cycle directed ADV BLE Secure Connections BLE Privacy 1.2	Google HCI PTS, ACTS, CTS Validation Suite MAC Randomization GSCAN/PNO	Time Division Multiplex

Connectivity Software Solutions for the IoT

Application	Connectivity Characteristics	Cypress Product Family	Common Application Specific IEEE/WFA/BT SIG Programs		Frequent Android Connectivity Features	Frequent Coexistence Modes
			IEEE/WFA Programs	BT Programs		
Home Automation	Low power RF Coexistence Security Usability	CYW4354x CYW4343x CYW4345x CYW4373x CYW43012	Wi-Fi Aware Wi-Fi Location 802.11mc (FTM/RTT) Wi-Fi EasyMesh Wi-Fi Direct (P2P)	Nudging and interlaced scan Low duty cycle directed ADV BLE Scatternet BLE Secure Connections BLE Mesh	Google HCI PTS, ACTS, CTS Validation Suite P2P/NAN MAC Randomization GSCAN/PNO	Time Division Multiplex
IP Cameras	Low power Security High performance	CYW43012 CYW4343x	Wi-Fi Location 802.11mc (FTM/RTT) 802.11h (DFS/TPC) Wi-Fi TimeSync Wi-Fi Multimedia (WMM) WMM-Admission Control WMM-Power Save Enterprise Security (EAP-TLS, PEAP)	Nudging and interlaced scan Low duty cycle directed ADV BLE Secure Connections BLE Privacy	Google HCI PTS, ACTS, CTS Validation Suite MAC Randomization GSCAN/PNO	Time Division Multiplex

Connectivity Software Solutions for the IoT

Application	Connectivity Characteristics	Cypress Product Family	Common Application Specific IEEE/WFA/BT SIG Programs		Frequent Android Connectivity Features	Frequent Coexistence Modes
			IEEE/WFA Programs	BT Programs		
Printer	Robustness Security Usability	CYW4343x CYW4345x CYW4373x	Wi-Fi Aware 802.11h (DFS/TPC) Tunneled Direct Link Setup (TDLS) Wi-Fi Direct (P2P)	Nudging and interlaced scan BLE Secure Connections BLE Privacy	Google HCI PTS, ACTS, CTS Validation Suite P2P/NAN MAC Randomization GSCAN/PNO	Time Division Multiplex
IoT Media	Robustness Usability	CYW5459x CYW4373x CYW4345x	Wi-Fi Aware 802.11h (DFS/TPC) Tunneled Direct Link Setup (TDLS) Wi-Fi TimeSync Wi-Fi Multimedia (WMM) WMM-Admission Control WMM-Power Save	Nudging and interlaced scan BLE Secure Connections BLE Privacy	Google HCI PTS, ACTS, CTS Validation Suite GSCAN/PNO	Time Division Multiplex

Connectivity Software Solutions for the IoT

Application	Connectivity Characteristics	Cypress Product Family	Common Application Specific IEEE/WFA/BT SIG Programs		Frequent Android Connectivity Features	Frequent Coexistence Modes
			IEEE/WFA Programs	BT Programs		
Smart Audio/Speakers	High performance Multimedia RF Coexistence Usability	CYW5459x CYW4373x CYW4345x	Wi-Fi Location 802.11mc (FTM/RTT) 802.11h (DFS/TPC) Wi-Fi TimeSync Wi-Fi Multimedia (WMM) WMM-Admission Control WMM-Power Save	2Mbps BLE BR/EDR Secure Connections BLE Privacy BLE Long Range BLE Channel Selection Algo #2	A2DP Offload HFP Audio Gateway Google HCI PTS, ACTS, CTS Validation Suite STA/AP Concurrency GSCAN/PNO	Time Division Multiplex
Wearables	Low power Security RF Coexistence	CYW43012	Wi-Fi Location 802.11mc (FTM/RTT) 802.11h (DFS/TPC) Wi-Fi Aware	Google HCI BR/EDR Secure Connections BLE Privacy 2Mbps BLE BLE Long Range BLE Channel Selection Algo #2	A2DP Offload HFP Audio Gateway Google HCI PTS, ACTS, CTS Validation Suite STA/AP Concurrency P2P/NAN MAC Randomization GSCAN/PNO	Time Division Multiplex

Connectivity Software Solutions for the IoT

Application	Connectivity Characteristics	Cypress Product Family	Common Application Specific IEEE/WFA/BT SIG Programs		Frequent Android Connectivity Features	Frequent Coexistence Modes
			IEEE/WFA Programs	BT Programs		
Video Gaming	Robustness High performance	CYW4356x CYW5459x	Wi-Fi Location 802.11mc (FTM/RTT) Wi-Fi Aware Tunneled Direct Link Setup (TDLS) Wi-Fi TimeSync Wi-Fi Multimedia (WMM) WMM-Admission Control WMM-Power Save	2Mbps BLE BLE Long Range SAM BLE Channel Selection Algo #2 High duty cycle non connectable adv High output power CSA5 AoA/AoD MFE	A2DP Offload HFP Audio Gateway Google HCI PTS, ACTS, CTS Validation Suite STA/AP Concurrency P2P/NAN MAC Randomization GSCAN/PNO	Time Division Multiplex

7.2 Wi-Fi Firmware Offloads and Soft Access Point Clients

Each Wi-Fi part contains an Arm core that implements the Media Access Control (MAC) layer. The software running on these cores implement several A-Class host offloads, which improve the power and performance of your applications by enabling the system to stay in a low-power state for longer durations. Note the values in the **Table 6** may change over time we add or remove Wi-Fi features in the device software.

Soft AP allows you to establish a wireless network with your device, which can then be used by your Wi-Fi enabled devices to access the internet. In other words, when Soft AP is enabled, your device becomes an access point that can be used by other devices to access the internet.

Table 6 Wi-Fi Offload and Soft Access Point Support

Functions	Description	Parts	Limitations
Soft Access Point (SoftAP) Clients	Enable your device to become an AP, which can be used by other devices to access the Internet.	CYW43012	8
		CYW4373x	4
		CYW5459x	13
		CYW4345x	8
Preferred Network Offloads (PNO)	Monitor/join Wi-Fi networks automatically when screens are OFF, and devices are in suspended. WPA-Personal security negotiation and roaming is supported.	CYW4343x	64
		CYW5459x	64
		CYW4345x	8
TCP Keepalive	Prevent APs from timing out an IoT device's network connection because of inactivity	CYW4343x	1
		CYW43012	1
		CYW5459x	1
		CYW4345x	1
		CYW4354x	1
Packet Filtering	Customizable network layer interrupt management to keep your devices in a lower state for a longer period	CYW43012	1
		CYW4373x	1
		CYW5459x	22
		CYW4345x	22
Address Resolution Protocol (ARP) Offloads	OSI Layer-2 packet processing	CYW43012	1
		CYW5459x	0 (disabled)
		CYW4345x	1

Connectivity Software Solutions for the IoT

7.3 Wi-Fi Alliance Pre-Certification Testing

To introduce your product to the market, it must have a Wi-Fi CERTIFIED™ certification. These certifications can be a difficult, time consuming, and high-risk. We help facilitate obtaining a certification by executing the following Wi-Fi CERTIFIED test plans prior to each software release. Our Wi-Fi CERTIFIED lab uses an NXP iMX6 Arm®Cortex®-A and Intel NUC (BRIX) host processors, and we make the Wi-Fi Alliance Sigma Agent available to any customer or third-party who needs it.

- Wi-Fi CERTIFIED n: 2.4 and 5 GHz bands
- Wi-Fi CERTIFIED ac: 5 GHz band
- Wi-Fi Direct®
- Wi-Fi Protected Setup™
- Wi-Fi EasyConnect
- WMM® (Wi-Fi Multimedia (WMM)™)
- Wi-Fi CERTIFIED Legacy 802.11a/b/g: 2.4 GHz band

7.4 Wi-Fi Host Driver

Our FullMAC (FMAC) Wi-Fi host driver is written specifically for Linux. As such, it has fewer files and fewer layers than competing driver architectures. With FMAC and the backports package, Cypress has simplified your software integration.

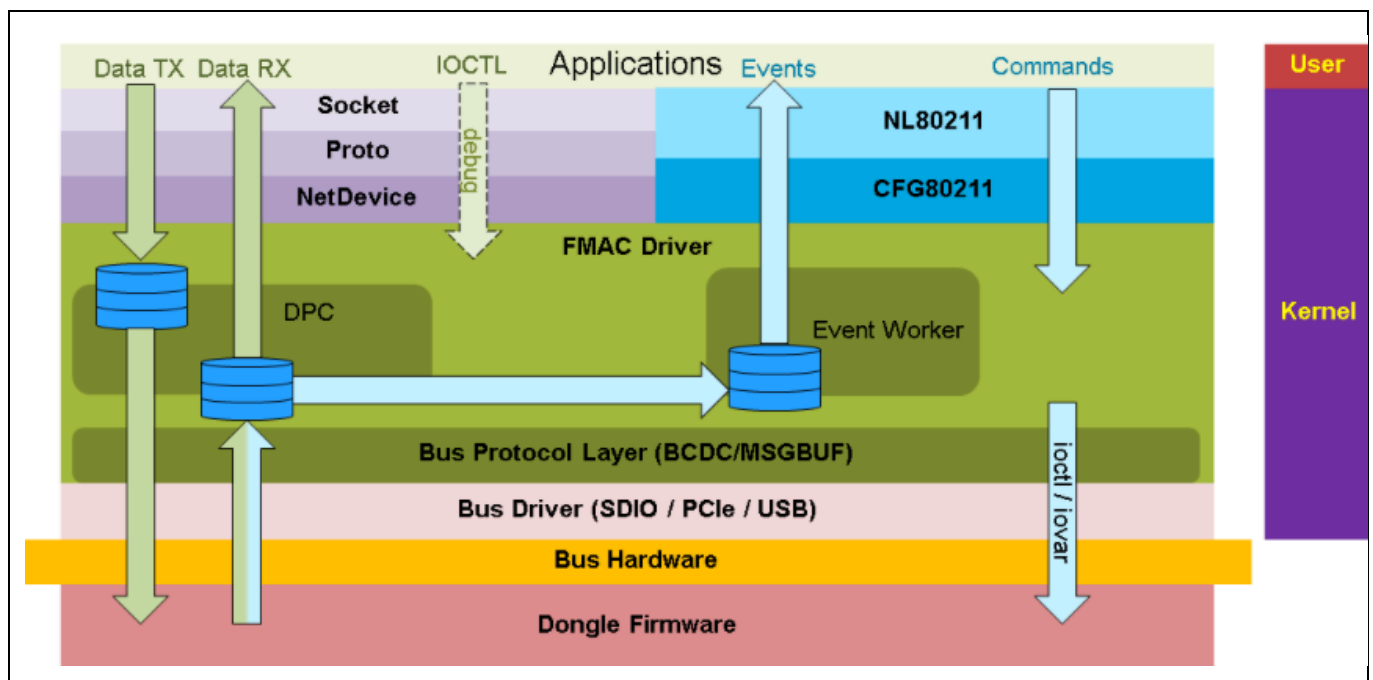


Figure 3 FMAC Block Diagram

7.5 Wi-Fi and Bluetooth Coexistence

Our combo chips support three proprietary coexistence modes via the internal Generalized Coexistence Interface (GCI). GCI is a wide and fast internal bus for bi-directional, real-time traffic/packet information sharing between the Wi-Fi and Bluetooth subsystems within the Cypress combo chips. The three modes supported in the [Table 7](#).

Table 7 Internal GCI Coexistence Modes

Mode	Characteristics	BT/BLE Wi-Fi Tx/Rx Concurrency		
Time Division Multiplexing (TDM) (Mode 1)	For shared front ends or there is low antenna isolation (< 25 dB) Tx/Rx concurrency not supported Airtime is shared. BT is ON, or Wi-Fi is ON but not both. Variety of MAC and software capabilities are supported (traffic throttle, buffering)	Not Applicable		
		BT/BLE	Wi-Fi	Supported
Hybrid (Mode 5)	For separate front ends with medium antenna isolation (25-35 dB) Performance depends on antenna isolation Critical Wi-Fi frames are allowed during BT Tx/Rx BT does not compete with the Wi-Fi channel	Tx	Tx	✗
		Tx	Rx	✓
		Rx	Tx	✗
		Rx	Rx	✓
Parallel (Mode 4)	For separate front ends with high antenna isolation (> 35 dB) Enables all simultaneous traffic Concurrency performance depends on antenna isolation	Tx	Tx	✓
		Tx	Rx	✓
		Rx	Tx	✓
		Rx	Rx	✓

Time Division Multiplex is enabled by default on all our combo parts, while Hybrid and Parallel are currently supported on the high-end enterprise parts, such as the CYW54591. Contact your sales representative to learn more about Hybrid or Parallel modes.

Multiple combo chips can be linked together through a proprietary 2-wire external interface called Serial Enhanced Coexistence Interface (SECI). SECI uses the UART core, often referred to as GCI UART, to transmit 64-bit coexistence data between WLAN and BT subsystems. This industry leading solution has higher throughput than competitive solutions (such as 3-wire and 4-wire coexistence). See the blog post [Overview of SECI](#).

We also understand that your product may need coexistence support for third-party radios and protocols such as Zigbee and Thread. We provide a common 3-wire interface that most other vendors support. This simple 3-wire interface uses GPIOs, but it cannot support complex signaling. [AN214852](#) discusses the collaborative coexistence interface between our parts-to-our parts and our parts-to-third-party parts, including the required NVRAM settings to enable and configure them.

The BT SIG has defined their own 2-wire interface (called WCI2), which is used to provide BT/BLE coexistence with non-Cypress parts where SECI is not available. This interface has been adopted by LTE companies. Contact your sales representative to learn more about our WCI2 coexistence interface.

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7.6 Bluetooth Stack

Your Arm Cortex-A host development environment most likely already contains one or more Bluetooth stacks (BSA, BlueZ, Android, etc.). While Cypress' Bluetooth controllers are compatible with any Bluetooth stack via Cypress's Bluetooth Host Controller Interface (HCI), you should be aware of the advantages when using Cypress' Bluetooth Stack for your family of IoT products.

One differentiated aspect of the Cypress Bluetooth Stack is its ability for the stack to be "offloaded", running in "embedded mode" on the connectivity device. In these scenarios, your Bluetooth application is programmed via the Cypress **ModusToolbox BTSDK**. Your application executes in the Cypress combo device's Arm Cortex M4+ – not in the Arm Cortex A host. This offloaded stack configuration is interesting for power constrained, time sensitive applications or where Bluetooth application code reuse across your product families is important. For example, one product may be resource constrained and wish to use the offloaded version of the Cypress Bluetooth Stack (embedded mode), while other high performance products may not have system constraints and may wish to run the Cypress Bluetooth Stack on the Arm Cortex A host directly (hosted mode). Regardless of your implementation, your Cypress Bluetooth Stack application code (a proprietary IP library, perhaps) is portable across your portfolio of products! Please contact your Cypress sales representative for more information about Cypress' Offloaded BT Stack (embedded mode).

For those of you wishing to leverage the Cypress Bluetooth Stack in a hosted configuration, as a BlueZ or Android alternative, you will have to wait a few more months while our software engineering teams cook up the best, portable solution for your IoT applications. In the meantime, the **Table 8** will give you an idea of the functions that are available in the current version of our Bluetooth Stack.

Table 8 BT/BLE Stack Comparison

Subsystem	Features	Bluetooth Stack	BlueZ	Android10
BR/EDR	a2dp	1.3	1.3	1.2
	avrcp	1.6	1.5	1.4
	di	1.3	1.3	-
	ftp	*a	1.1	-
	hdp	-	1.0	1.1
	hfp	1.7	1.6	1.7
	hid	1.1	1.0	1.0
	hsp	1.2	-	1.2
	map	1.2 (MAP client)	1.0	1.2
	opp	1.2 (OPP server)	1.1	1.2
	pan	*b	1.0	
	pbap	1.2 (PBAP client)	1.1	1.2
	sap	-	-	1.1
	spp	1.2	1.1	1.2
	BIP/BPP	-	-	-
	Wireless Audio Sync (WASS)	yes	-	-
	USB support	-	-	-

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Subsystem	Features	Bluetooth Stack	BlueZ	Android10
	Shared SDIO support	-	-	-
	Multi SCO/ SCO relay support	-	-	-
	Dynamic PCM/I2S settings switch	-	-	-
	SCO over HCI support	-	-	-
	A2DP codec support (AAC and APTX)	-	-	-
	A2DP SCMS-T support	-	-	-
	A2DP bitrate user control	-	-	-
	AVRCP cover ART support	-	-	-
	OBEX over L2CAP	-	-	-
	Snooping	-	-	-
BLE	Mesh	yes	Yes (limited)	-
	HoGP	1.0	1.0	-
	cscp	-	1.0	-
	htp	-	1.0	-
	pxp	-	1.0	-
	TiP	-	1.0	-
	ANP/ANS	1.0	-	-
	BAP/BAS	1.0	-	-
	HRP/HRS	1.0	-	-
	FMP	1.0	-	-
	IAS	1.0	-	-
	ESP/ESS	1.0	-	-
	Dual Mode LE Central/Peripheral	Yes	-	yes
	LE Connection-Oriented Channels	Yes	-	-
	LE Peripheral Mode	yes	-	yes
	32-bit UUIDs	yes	-	yes
	data packet extensions	5.0	-	5.0
Security	br/edr secure connections	5.0	-	5.0
	le privacy	5.0	-	5.0
	le secure connections	5.0	-	5.0

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Subsystem	Features	Bluetooth Stack	BlueZ	Android10
Apple	HomeKit	yes	-	no
	iAP2	yes	-	-
	AMS/ANCS	yes	-	-
	iBeacon	yes	-	-
Amazon	Alexa Music Accessories (AMA)	yes	-	?
Google	Google Fast Pair	yes	-	yes
	Google HCI Requirements	yes	-	yes
	Eddystone beacon	yes	-	yes
BT 5.2	BT 5.2/ LE ISOC	yes	-	-
	BT 5.2 /EATT	yes	yes	-
	BT 5.2 /GAWG profiles	yes	-	-
Stack features	mode	hosted and offloaded	hosted	hosted
	Dual mode (LE+BREDR stack)	yes	yes	yes
	LE only stack	yes	-	-
	size	100/200 kb	-	-
	port	PSoC, Linux, embedded	Linux	Android
	BT SIG Listing	BT 5.1 (5.2 planned)	BT 5.0	BT 5.0

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7.7 Cirrent IoT Network Intelligence (INI) Service

We provide customers with an IoT Network Intelligence service that enables insights about your product operation in the field after it has been deployed. The agent collects and characterizes parameters about the networks in which your products are deployed such as ISP, Routers, device versions, link stability, signal strength, and geographic locations. The Cirrent cloud platform then provides an easy-to-use interface for your support teams to solve your customers’ problems faster by easily detecting trends and running reports.

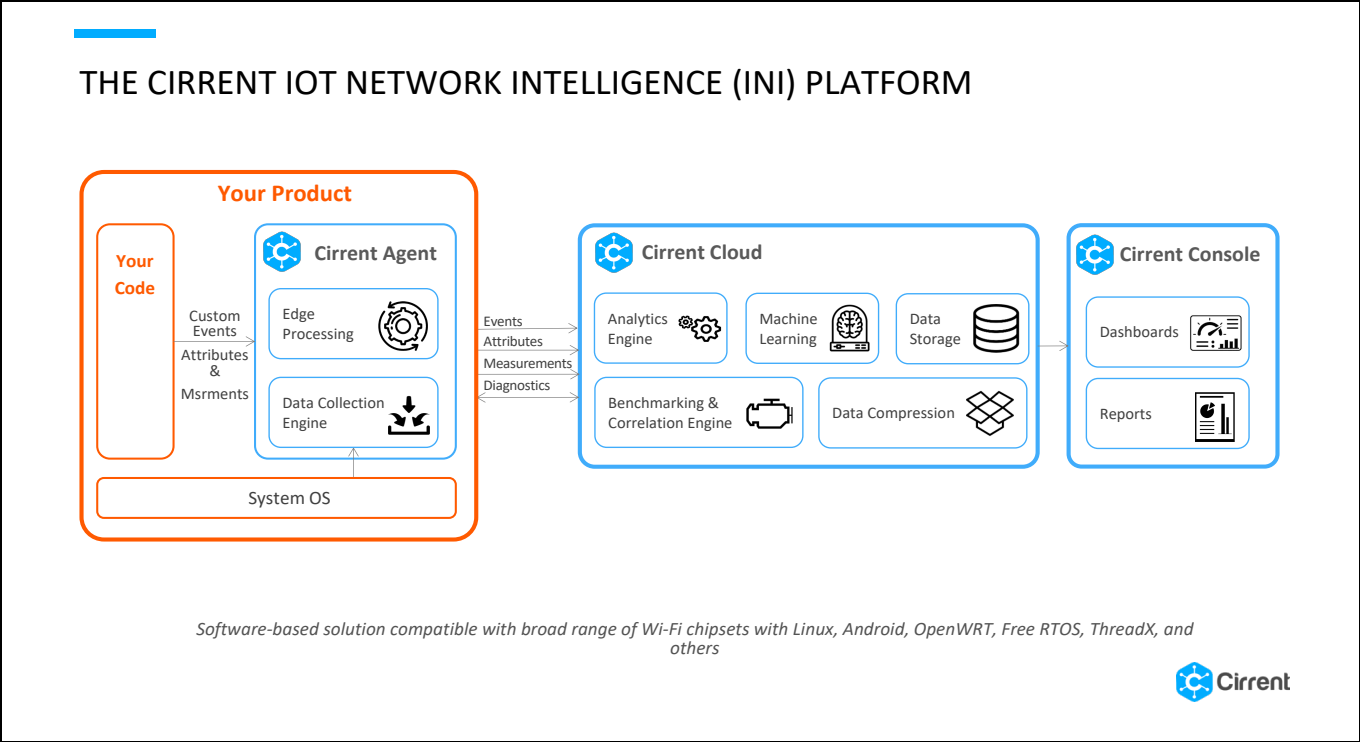


Figure 4 Cirrent INI Block Diagram

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7.8 Tools Package (Regulatory and Manufacturing Test)

We also provide the following tools that will help bring your product to market easier and with less risk.

Table 9 Tools Package

Category	Tool	Purpose	Documentation
Regulatory	CLM	Wi-Fi regulatory compliance process and steps required to submit a regulatory configuration to us. This application note provides the background on various Wi-Fi requirements and technical details as it pertains for regulatory certification.	AN225347
Wi-Fi Development Tools	NVRAM, OTP	Develop NVRAM and OTP, a crucial part of your product development phase.	AN214808
	WL	Describes the commands available in the WI-FI Client Utility application (WL). These commands are used with our Manufacturing Test application firmware used to configure your device on a factory product line. Contact your Cypress sales team for access to the WL and the corresponding Manufacturing Test Firmware.	002-23156
Bluetooth HCI	CyBlueTool	A tool for testing and debugging our Bluetooth devices. CyBlueTool connects to the Bluetooth devices at HCI protocol layer and currently supports HCI UART and HCI USB transport interfaces and allows you to send BT HCI commands and receive BT HCI events from the BT controller	DOC-15585 DOC-16475 DOC-19558
	BTSpy	Tracing utility to collect HCI traces and BT snoop logs	readme.md
	wmbt	Bluetooth Manufacturing tool	readme.md
	Ecdsa256	Elliptic curve digital signature algorithm	-
Cypress Bluetooth Stack Applications	BLE Hello Sensor	A peer application for Android and Windows used to validate that your embedded design is operational over BLE with a simple and extensible Hello World program	-
	BLE Over-the-Air	Upgrade peer application for Android, iOS, and Windows	readme.txt
	BL Mesh	A peer application to assist with your BLE mesh design	-

Release Notifications and Release Vehicles

8 Release Notifications and Release Vehicles

The **Community** is the primary release vehicle for the our connectivity software. Each release is posted on this website with a tarball containing a set of patches that can be applied to your development environment as described below. We recommend using these tarballs (or the new Yocto packages) as the primary vehicle to upgrade or integrate our connectivity software into your A-Class development environment.

Table 10 Description of Released Software Artifacts

Tarball	Description
Backports	Enables old kernels to run latest drivers. Backports project documentation is available at https://backports.wiki.kernel.org/index.php/Main_Page
Devicetree	Out-of-the box NXP iMX6SX + Murata Wi-Fi/BT EVKs integration
Firmware	Device software delivered in binary form
Hostap	Patch files that enable the Cypress connectivity within the hostapd application
Patch	Patch files that enable the FullMAC driver

After the release is posted on the community, we begin the kernel.org upstreaming process where these artifacts are merged into the kernel.org repositories. This process is orthogonal to our release process and may take one or two additional months to complete, depending on what is happening within the open source community. Changes contributed by the open source community are always cherry-picked and made available in Cypress's next released version of software posted to the Community.

Technical Support

9 Technical Support

To find answers to questions while using the features and platforms mentioned in this document, we have an **Active Professional Community** managed by our engineers. These forums are staffed by our engineers to assist you with issues that you encounter while using our solutions. For support on items not already listed in the document, you may also contact one of our **Ecosystem Partners**.

Upon request, your C Sales representative may establish a program in our CRM tool to ease collaboration and support.

Software Licensing

10 Software Licensing

Software in the A-Class segment follows two licensing standards: **ISC** for application and device driver software for which we release full source code to and the **Binary License** for device software that we release in binary form and is free to be used or distributed on our devices only. Device software is scanned regularly for open source license identifiers and fingerprints. Given these two types of software and the licensing mechanisms we provide you can rest assured safety and compliance for your products.

For formal Cypress FOSS disclosures, see <https://www.cypress.com/documentation/software-and-drivers/free-and-open-source-software-download-page>.

Release History

11 Release History

We are committed to a regular cadence of software releases. **Table 11** illustrates this commitment by highlighting the releases over recent years.

Table 11 Release History

Release Date	Operating System	URL
2020-09-30	Android	https://community.cypress.com/docs/DOC-21492
	Linux	https://community.cypress.com/docs/DOC-21490
2020-06-25	Android	https://community.cypress.com/docs/DOC-20842
	Linux	https://community.cypress.com/docs/DOC-20044
2020-04-02	Linux	https://community.cypress.com/docs/DOC-19375
2020-01-15	Linux	https://community.cypress.com/docs/DOC-19000
2019-10-31	Linux	https://community.cypress.com/docs/DOC-17441
2018-09-28	Linux	https://community.cypress.com/docs/DOC-15932
2018-07-16	Linux	https://community.cypress.com/docs/DOC-15330
2018-03-21	Linux	https://community.cypress.com/docs/DOC-14837
2018-02-05	Linux	https://community.cypress.com/docs/DOC-14597

Revision History

Revision History

Document version	Date of release	Description of changes
**	2020-06-28	Q2 2020 - Initial version
*A	2020-09-30	Q3 2020 - Update

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