esper

Esper Guide

Choose the right hardware for your purpose-built software

Get Started

Start your journey here.

Choosing the right hardware for your for purpose-built software can be overwhelming. The first step is often deciding whether to buy, customize, or build custom. This guide is designed to help you choose which path is right for your needs.

In this guide we'll walk through the key things to consider as you choose your hardware type. If you're using Android hardware, you can deep dive into the key aspects of using GMS and AOSP in the dedicated device space.

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Hardware continuum

Decide whether to buy, commission, or create your dedicated device hardware.

GMS vs AOSP

Understand the key aspects of Android hardware for dedicated use cases.

Hardware continuum

Hardware continuum

Jump to the comparison summary for key deciding factors, dive into a hardware type to learn important trade-offs, or review top-level considerations by concern area. Either way you'll find the information you need to make the right decision for your use case.

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Resources

- Comparison summary
- Additional resources

Hardware types

- Off-the-shelf
- Customizable
- Custom build
- Custom design

Key considerations

- Use case
Cost
Device lifecycle
- Service and support
Engineering capacity
GTM timeline

Comparison summary

HW continuum

	Off-the-shelf	Customizable	Custom build	Custom design
Overview	Includes consumer tablets and smartphones, plus vertical market-specific devices	Leverage an off-the-shelf device and tune it to your particular use case. Tuning can be simple or advanced	Take a common compute platform, like a dev board, and use that as the core of your device	Take a reference design and create the electrical, industrial, and mechanical design for your device
Pros	Lowest price per unit, high inventory available, get the advantages of working with big OEMs (easier procurement, support provided, etc.)	Get the advantages of an off-the-shelf device plus a degree of customization to fit your use case. Less overhead involved than building or designing from scratch	Can leverage an existing designs to start from. Higher degree of customization, but not as intense to execute as a fully custom design	Have full control to design exactly what you want. Great for leading edge or fringe use cases where design isn't readily available
Cons	Beholden to the overall refresh cycle of the industry. May not offer the features you need for your use case	Slower timeline than off-the-shelf. New models could impact modifications you've made. Customization level varies by device	Responsible for working with the device maker around inventory, pricing, and OS load	Most expensive and intense option to execute. Has the longest end-to-end timeline of any option

HW continuum

Off-the-shelf

Commercial, readily available devices from major OEMs.

Includes consumer tablets and smartphones, as well as vertical market specific devices.

For Android hardware, this would be GMS devices. Learn more about GMS hardware here.

Pros

- Lowest price per unit
- Don't have to worry about inventory as you’re working with consumer volumes
- Can procure components more easily as major OEMs typically have a better ability to obtain them
- Leverage service and support from OEMs

Cons

- Beholden to the overall refresh cycle of the industry
- May not offer the features you need for your use case

Key considerations

OS maintenance: Typically, consumer devices are driven by the consumer market, and the security patches may be inadequate for your use case. OEMs that build specialized vertical market devices tend to map the design requirements, ruggedness level, and how they maintain the software to the needs of that vertical. These devices tend to have a premium price compared to consumer devices. Consider whether the cost savings of consumer devices are worth the trade-offs here.

Customizable

Leverage an off-the-shelf device and tune it to your particular use case.

This could be programmable buttons, hidden software that allows changes in OS behavior, or simply taking an off-the-shelf tablet and putting a case around it.

Pros

- Get the advantages of off-the-shelf devices (lower pricing, built-in support, etc.) plus a degree of customization to fit your use case
- Less overhead, time, and effort involved in tuning the device than building or designing one from scratch
- You're not burning the non-recurring engineering (NRE) you would for a custom build or design

Cons

- Slower timeline compared to off-the-shelf devices because of the work associated with light customization, such as selecting, buying, and assembling a case with the particular device. For any physical aspects of the device you're trying to change, you will incur additional time for planing, testing, and operationalizing it.
- Software modifications, like calling a set of APIs or programming a button, require you to track changes to the base device. Vendors will always evolve their technology, which is usually tied to a device model. This means newer models may affect the work you’ve done and create additional overhead.
- Level of customization varies and certain off-the-shelf options may not allow for the degree of tuning you need.

Custom build

Take a common compute platform, like a dev board, and use that as the core of your device.

Here you don't have to design the compute. Instead you turn an existing one into a device with your exact specifications.

For Android hardware, this would be AOSP devices. Learn more about AOSP hardware here.

Pros

- Can leverage existing designs while specifying the wrapping around the compute platform and customizing the display
- Get a higher degree of customization, but not intense to execute as a fully custom design

Cons

- More work is often involved. You could go with something fairly finished that you detail around or you can start with a dev board and build it all up yourself
- Responsible for working with the device maker around inventory, pricing, and OS load

Key considerations

OS load: Device makers typically have a base OS image they maintain across all permutations of the device built off their base hardware and OS. You're beholden to them in terms of how they build and maintain that, including over-the-air updates.

For those wanting to own this, Esper can help. Our platform helps smooth out OTA, and with Esper Foundation, can actually do it for you for that particular piece of hardware.

Custom design

Drive the full design of a device by taking a reference design from a semiconductor vendor then creating the electrical, industrial, and mechanical design.

Typically used for higher volume products that justify the engineering cost or higher-priced products with lower per-unit volume where the work effort makes sense.

Pros

- Have full control and freedom to design exactly what you want
- Great for leading edge or fringe use cases where design isn’t readily available anywhere
- Can outsource some aspects of the process, like industrial design or mechanical design, to reduce burden

Cons

- Most expensive and intense option to execute
- Has the longest end-to-end timeline
  Example: If you get a commercial off-the-shelf device with cellular support, they've already covered operator certification and all the regulatory body requirements. For custom design, it's completely on you to do this

Key considerations

Deployment location: It’s crucial to understand your deployment location and the minimum requirements of operating within it. Things like network connectivity or who at the location is unboxing and setting up the device will impact your design.

Considerations

HW continuum

Use case

Define your use case and the associated requirements.

Example
If an off-the-shelf device will suffice and you can accept the operational trade-offs, like cost or refresh cycles, that may be the path for you.

However, for leading edge use cases, you may not find anything out there that fits your needs. If your business model justifies it and you have the engineering spend, custom design is probably the best route.

Cost

Know where and what you’re willing to spend.

Consider things like

- What aspects of your solution are most important to you?
- What is your per-unit price point?
- How much NRE do you want to spend?

Example
If you have to be low on NRE, but you're willing to accept a high per-unit price, custom design most likely won’t work, but custom built could.

Device lifecycle

Determine how long your devices need to be in the market.

Consider things like

- Are you okay with a short duration of your device?
- Will it probably be broken quickly?

Example
If you have a deployment that will churn quickly as you iterate on your business model and user experience, off-the-shelf would be a great option as consumer products typically churn quickly.

Considerations

HW continuum

Service and support

Define how you'll handle service and support.

Example
If you want to outsource service and support, off-the-shelf comes with the advantages of working with bigger OEMs who have sophisticated models for break-fix, returns, allowances, credit, etc.

If you're doing custom design, you're responsible for executing and paying for this. Make sure your spend is on target because otherwise it's wasted time and money.

Engineering capabilities

Consider if you have the capabilities and capacity to execute your project, or if it will require building a new team.

Example
If you already have teams with experience in building Android OS, doing custom work may not be a huge shift.

For those more focused on the business side (understanding the market and your customers) and light on engineering, it may not make sense to take a path requiring high engineering competency.

GTM timeline

Determine your targeted go-to-market timeline.

Example
Off-the-shelf is the quickest way to get to market while custom design will take the longest.

It's possible to take a staged approach. If you want to engage customers to develop or fine tune your use case, you can use an off-the-shelf device to start quickly, then as you get feedback, work on a custom build. This way you create an informed design you know will land well.

GMS vs AOSP

GMS vs AOSP

Jump to the cheat sheet for key deciding factors or deep dive into each consideration for more context. Either way you'll find advice from leading Android hardware experts so you can choose your hardware confidently.

Click on the tile to jump to that slide or use the navigation bar to continue on.

Overviews

- Android hardware types 101
- Selection cheat sheet

Considerations

- App and hardware compatibility
- Hardware design
- OS maintenance
- Vendor and supplier relationships

Resources

- Esper's advice
- Additional resources

Android hardware types 101

GMS

Google Mobile Services

- Off-the-shelf hardware built on top of AOSP on Google
- Delivers capabilities for consumer and enterprise markets
- Includes apps, Play Store, and developer services

AOSP

Android Open Source Project

- Built and maintained by Google
- Provides ability to build a custom device off of Android
- Offers a subset of capabilities that are available on GMS

Selection cheat sheet

	GMS	AOSP
Use when you…	• Can work within GMS rules and regulations • Can satisfy your use case with an off-the-shelf device • Are starting out in dedicated devices or beginning to build your fleet • Want a quick, simple, and risk free process	• Have a distinct design vision that doesn't fit the rules of GMS • Must fulfill specific use case requirements • Need hardware available for the long term • Want to set the pace of your OS updates or freeze on a specific OS version
As long as you don't mind…	• Little control of OS and security updates • Risk of breakage from Google pushed updates • Using a GMS based OS • Switching hardware models frequently (avg. every 1-2 years)	• Building custom apps • More logistical complexity and project risks • Allocating additional resources, budget, and timeline to customization project • Negotiating and committing to detailed terms with vendors and/or suppliers

Our advice? Don't be afraid of a mixed fleet. Start with GMS and use AOSP as needed for complex or specific use cases. Choose the device type that will best satisfy your use case and, most importantly, create a seamless customer experience. More details.

App and hardware compatibility

GMS vs AOSP

GMS

GMS apps often require a GMS based OS

While you can access a wide range on apps on the Google Play Store, the apps created by GMS app devs and ISVs are often only compatible with a GMS device and can't be freely moved to an AOSP device.

Leveraging mirror sites as a workaround can be risky

Mirror sites can make apps available for any device type, but may lack the required licensing.

The Esper difference

You can control which apps from Google Play Store are available to your device fleet for download with the Managed Google Play Store. Esper offers access to this special aspect of the Google Play Store meant for managed devices.

AOSP

AOSP requires building custom apps

AOSP devices don't support Google Play apps (with the exception of a few outliers) and you won't be able to use GMS APIs with your AOSP devices.

Benefit of custom apps is fine grained control

Building your own app or working with an ISV to build one gives you fine-grained control over how you install, update, and track the status of the app.

The Esper difference

Esper provides easy-to-use tools, like our Android Studio and CI/CD pipelines, so you can create and roll out apps seamlessly.

We can work with ISVs to discuss your GMS app dependencies and the trade-offs of making an AOSP version with your end-customer experience in mind.

Hardware design

GMS

Design limited to off-the-shelf options

No ability to customize device design (unless you want to do the GMS certification process yourself). This works well if your use case can be satisfied by a standard tablet or smartphone design.

Availability based on consumer & enterprise markets

Off-the-shelf hardware will average 1-2 years before you need to switch it out. This can impact certain use cases, such as clinical trials where you need to lock in a device model and an OS for years.

The Esper difference

Esper can help you find the right stock Android device. As the Esper platform is hardware agnostic, we look for the best device to match your needs, regardless of device maker.

AOSP

Get complete design control

Build any device you want (no restrictions on display, screen, UX, buttons, etc.) based off of extensive code Google provides. Can purchase AOSP devices from vendors such as Honeywell or Zebra.

Hardware will be available for the long term

Utilize hardware for the long term as its availability isn't dictated by the consumer or enterprise markets. Availability will instead be determined by your ODM or supplier.

The Esper difference

As we have our own AOSP version of Android, we can offer deep insight into firmware and hardware design. We often collaborate on device strategy, analysis, and final design decisions to help support our customers.

OS maintenance

GMS

Little control over updates

Delivery of updates is up to the device maker. For GMS, you'll give control to Google which is mainly focused on controlling for security.

Unexpected updates present risk

Updates pushed by Google bring risk of unexpected app or device breakage. You'll need a plan for mitigating these situations quickly. Proprietary extensions offered by vendors can stop some firmware updates (standard patches not included) to devices.

The Esper difference

Esper enables you to deploy and update your app at will. With our DevOps pipeline automations you can roll out app updates in hours instead of weeks or months.

AOSP

Full control of OS and security maintenance

Decide how and when to push OS and security updates to your devices. Great if you're looking to set the pace of your OS updates or freeze on a specific OS version.

Ownership can bring risk and require additional cost

You are fully accountable for building and pushing out updates, and building an update engine into the OS you're shipping your device with. This may require extra time, budget, and/or resources.

The Esper difference

Esper offers support for Lenovo, Samsung, and Bluebird extensions that allow you to stop certain, non-standard firmware updates.

Vendor and supplier relationships

GMS vs AOSP

GMS

Low-risk, simple process when buying off-the-shelf

Buying off-the-shelf has few unknowns. You can buy standard offerings, see device maker track records, and negotiate cost based on volume up front. You'll also get standard services and support from Google.

The Esper difference

We partner with a select set of leading device makers to offer our Esper Validated Android Devices. These devices span common use cases of purpose-built device fleets. For those needing the firmware, device, and tailored app load to work seamlessly, we offer Esper Enhanced Hardware which runs Esper Foundation for Android.

AOSP

Requires working with ODMs to custom build

Working with ODMs will require negotiating or commissioning your design. This can be a complex, lengthy process depending on your relationship.

Negotiations will determine your experience

You'll need to decide and negotiate terms with your vendor/supplier such as who will build the OS updates and how breakage will be handled. You'll be locked into whatever contract terms you sign.

The Esper difference

We know Android devices at every level and have seen many deployments. Our in-house experts can provide an analysis of your device design and management strategy.

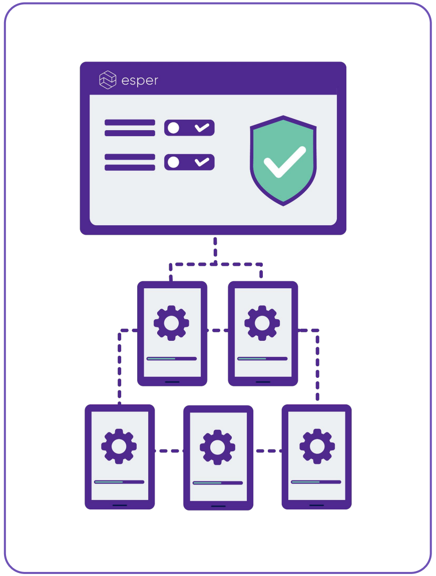
Esper’s advice?

Don’t let a mixed fleet scare you!

Through Esper you aren't committed to either AOSP or GMS hardware. You can choose whichever one suits your needs. Use GMS as an economical, off-the-shelf option for a subset of your use cases and AOSP for more specialized and/or complex ones.

Esper can help you mix and match which applications you target for each hardware type. And with Esper Foundation for Android you can apply our modern DevOps approach to device management and operations across both AOSP and GMS hardware.

Need more help?



Learn more about Esper

We've helped many leading organizations modernize their business, from those struggling with legacy devices to those dealing with the limitations of traditional MDMs.

Learn more about how we can help you build agility into the ways you deploy, manage, update, and secure your fleet of devices and the software it runs on.

Visit our website or connect with an in-house expert.