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Background of HarmonyOS

Harmony OS, also known as Hongmeng OS in Chinese, was announced in 2019. Because of the escalating tensions between the United States and China, which were manifested in the form of trade restrictions placed on Huawei by the United States, Huawei decided to create its own operating system after being denied access to important technology, such as Google's Android OS.

The image shows the HarmonyOS logo in white text on a black background. The word "Harmony" is in a sans-serif font, and "OS" is in a larger, bold sans-serif font. A small blue horizontal line is positioned under the letter "O" in "OS".

At the heart of HarmonyOS is its flexibility and wide scale functionality across many different devices. We see that which is typical of traditional operating systems -- that they are designed for very specific device types like smartphones or desktops in contrast HarmonyOS is what we term as a diverse hardware support platform. It includes in its design smartphones, tablets, laptops, smart TV's, wearables and a large array of Internet of Things devices. What makes this cross platform functionality possible is a distributed architecture which in turn enables what we see as smart device communication and cooperation.

For users what we have is a very integrated experience from our distributed design. You can start a task on one device and pick up right where you left off on another. For example a user in the middle of a video conference on a smart phone can very easily switch to a smart TV or laptop which will right away join the conference. This easy transition between devices shows the

operating system's dedication to a consistent and unified user experience which is the same across all types of hardware.

Technologically speaking, in the case of HarmonyOS it has been architected with a microkernel at the core, that which brings to the table some great benefits as compared to the traditional monolithic kernels. What we see here is that one of the main benefits of this architecture is in the area of security. The microkernel in this instance includes only the very base functions like IPC, thread management and basic scheduling, while the other elements run in user space. That which does not go into the microkernel's design are the less critical modules which therefore also do not fall under the protection of the whole system in the event of a failure or security issue. Also the fact that microkernel is a very lean design brings about better use of resources, speedier performance, and also makes for easier maintenance.

Another HarmonyOS' strong point is it's developer friendly environment. We see a large range of programming languages supported by the system which include C, C+, Java, and Kotlin. Also we have a large variety of developers which include all backgrounds contributing to the HarmonyOS ecosystem and in turn creating a wide range of applications. Also it makes the transition of existing applications from other platforms into this new system very easy in particular from Android.

At first Huawei took a practical stand in regards to getting HarmonyOS out there which they did by using elements of the Android Open Source Project (AOSP). That compatibility layer we saw them use made it so many Android apps could run on HarmonyOS devices which in turn made the transition for developers and users a smooth one. The familiar set of Android apps helped to reduce the friction which usually comes with the introduction of a new OS. But that hybrid approach was only a temporary solution.

With the release of HarmonyOS NEXT Huawei took a step out of the box toward full independence. This improved version does away with Android code and goes to a native architecture which is built on HarmonyOS' own microkernel. HarmonyOS NEXT supports only apps which are developed for the HarmonyOS framework which in turn marks a break off from Android and which also strengthens Huawei's idea of a pure and self contained software platform.

In the design of HarmonyOS one of the primary goals was to transform the Internet of Things. We see the system as very modular and scalable which makes it a great fit for use in a wide range of IoT devices. At the heart of what Huawei is trying to achieve is a connected ecosystem of smart devices that will talk to each other and work out solutions without human input. For instance in a HarmonyOS enabled smart home we see lighting which turns on when you approach the door, thermostats that adjust based on your presence, home appliances that inform you of when your laundry is done and security cameras that alert you to any unusual activity. This level of device interaction is made possible by HarmonyOS' distributed communication protocols and unified development platform.

Huawei reports that performance, real time response, and low latency interaction are key elements of HarmonyOS. We see that the OS comes with deterministic latency engines and unified scheduling which in turn guarantee that apps and services react quickly and consistently which is very much the case even when the system is under heavy load. Also this real time feature is of great import for IoT devices and in sectors like health care, transport, and manufacturing.

Beyond in tech innovation HarmonyOS is a play by Huawei to show off the company's resilience and vision for the future. Out of the gate with its own OS Huawei sets out to ride out geopolitical issues but also to be at the forefront of what redefines digital experience. What we see is a company which has a large picture in mind of putting forward a high performance, secure and connected digital ecosystem which in turn will be a match and we hope to see it surpass the features of present day players like Android and iOS.

As at present HarmonyOS is in the midst of growth. We see that Huawei is putting great effort into R&D to put forth new features, expand developer support, and push global adoption. In certain markets which have strong consumer support from Huawei we have seen great success especially in China which has enabled the OS to break into international markets also. That said the success of this expansion is to play on Huawei's ability to attract developers, form partnerships with hardware manufacturers, and to put forward the what is unique about HarmonyOS to the users.

In the end HarmonyOS is put forth as a very forward thinking take on OS design. With its distributed software framework, microkernel architecture and focus on smooth interconnect between devices it is to that which may see us restructure our interaction with tech. As it grows HarmonyOS also stands as a testimony to Huawei's commitment to independent innovation and a player which may bring in a new age of smart device ecosystems. While it is yet to see if it will become a global standard it is without a doubt that we are seeing a key chapter play out in the story of modern OS's.

The Evolution of Harmony Operating System

HarmonyOS is an important part of Huawei's goal to create a flexible and independent operating system. With pressures from global politics and restrictions, Huawei aimed to reduce reliance on external software, especially Google's Android. This drive led to the development of HarmonyOS, which has evolved from focusing on IoT devices to becoming a solid platform for various smart devices.

Initial Launch: HarmonyOS 1.0 (August 2019)

HarmonyOS made its debut in August 2019 at Huawei's developer conference. The first version, HarmonyOS 1.0, launched on the Honor Vision Smart TV, acting as a trial for this new system. It combined features of LiteOS and Linux, allowing Android apps to work through the Android Open Source Project, making it easier for both developers and users to adapt.

The main aim of HarmonyOS 1.0 was to connect IoT devices and smart homes better. It laid the groundwork for Huawei's bigger ecosystem vision, even though it had limited device support at first.

Expansion and Adoption: HarmonyOS 2.0 (June 2021)

In June 2021, HarmonyOS 2.0 arrived, offering major upgrades and support for more devices. Huawei worked on improving the system's ability to manage distributed computing, adding support for smartphones, tablets, smartwatches, and other smart home gadgets.

One cool feature in HarmonyOS 2.0 was the ability to switch tasks easily between devices. For instance, you could start watching a movie on your phone and send it to your smart TV with no hassle. This feature became a highlight of HarmonyOS.

Users responded positively. Just weeks after its launch, millions of devices in China got upgraded to HarmonyOS 2.0. People noticed a boost in performance compared to Huawei's earlier interface, EMUI, and many started viewing HarmonyOS as a real alternative to Android and iOS.

Performance and Integration Enhancements: HarmonyOS 3.0 (July 2022)

Released in July 2022, HarmonyOS 3.0 brought important performance upgrades, better tools for developers, and wider compatibility. The focus was on improving connectivity and making life easier for developers.

A standout feature was the "Super Device" experience, which allowed users to manage multiple devices using a simple drag-and-drop interface. This made it super easy to control tech at home or in the office.

Huawei also introduced new programming tools in HarmonyOS 3.0 to help developers create user interfaces quickly and efficiently. It became simpler to update apps and keep them running smoothly across devices.

Another big change was better support for hardware, including Qualcomm Snapdragon chipsets. This meant more Huawei and Honor devices could use HarmonyOS, expanding its reach.

A Major Milestone: HarmonyOS NEXT (August 2023)

August 2023 saw the launch of HarmonyOS NEXT, a big step forward for the platform. For the first time, it was built on a completely new microkernel that didn't rely on Android at all. This move was significant for Huawei's independence in software.

With HarmonyOS NEXT, apps had to be made specifically for this system, using new development tools. While this was an adjustment for developers used to Android, it gave Huawei the chance to improve performance and security by moving away from older Android features.

This change aimed to set Huawei apart by building a modern software system for smart devices and intelligent environments. They also provided several tools and resources to help developers get on board.

Latest Version: HarmonyOS 4.0 (October 2024)

HarmonyOS 4.0 launched in October 2024, showing Huawei's commitment to keeping things fresh in the operating system game. This version refined modular design, edge computing, and integration with IoT devices.

HarmonyOS 4.0 made further improvements to the microkernel for better efficiency, especially useful for devices like smart sensors. It also added features for processing data locally, which is great for situations that need quick responses.

The update improved support for more hardware platforms, reaching into sectors like automotive and manufacturing. With stronger security measures and better authentication for connected devices, HarmonyOS is shaping up to be a solid platform for smart environments.

The journey of HarmonyOS from a smart TV system to a fully independent platform shows Huawei's aim to lead in the fast-changing tech scene. Each version, from HarmonyOS 1.0 to 4.0, has brought key improvements in connectivity, integration, security, and user experience.

The switch to a new microkernel in HarmonyOS NEXT shows Huawei's desire for independence, while HarmonyOS 4.0 showcases their vision for smart tech ecosystems. With continued investment in research and development, HarmonyOS looks set to make a lasting impact on the future of operating systems.

Motivation for HarmonyOS

Huawei's introduction of HarmonyOS goes beyond just new tech; it's a big shift in strategy for the tech industry as a whole. It started out as a necessity but has become a vital part of Huawei's goal to create a connected and smart digital world. There are a few key reasons why HarmonyOS was developed, from global politics to the limitations of existing systems and the drive for innovation.

1. Dealing with Global Tensions and Technology Independence

The drive to create HarmonyOS mainly came from the trade issues between the U.S. and China, especially after Huawei faced restrictions in 2019. One major impact was losing access to Google Mobile Services, which are crucial for Android devices. Without these services, Huawei struggled to offer smartphones that could compete globally.

This situation pushed Huawei to rethink its reliance on American technology and explore a homegrown option. By developing HarmonyOS, the aim was to ensure their technology was self-reliant and less vulnerable to international politics. This move reflects a larger shift toward tech independence in China and might inspire others to build their own digital systems.

2. Creating a Unified Ecosystem for All Devices

Another big reason for HarmonyOS was Huawei's goal to develop a system that works seamlessly across different devices. Most traditional operating systems only focus on smartphones and tablets and don't always connect well with other devices like TVs or smart gadgets. This fragmentation was seen as a problem, especially with the rise of smart devices in homes and businesses.

HarmonyOS was designed to overcome this issue. It allows various devices—from smartphones to appliances—to work together in one cohesive system. This means you can start a call on your phone and easily switch it to your smart TV or control your home devices from your watch. This kind of integration makes for a smoother experience for users.

3. Emphasizing Performance, Efficiency, and Security

Many traditional operating systems can experience instability and security issues. Huawei recognized these flaws and created HarmonyOS with a microkernel design that prioritizes security and efficiency.

The microkernel focuses on isolating key functions, which helps protect against crashes and security problems. This design also allows for quick performance, which is important, especially in smart devices. Plus, it enables developers to create apps that can work well across different devices, supporting Huawei's broader vision for HarmonyOS.

4. Challenging the Android and iOS Dominance

HarmonyOS aims to break the stronghold that Android and iOS have had on the market for years. With these two controlling most of the smartphone space, it's been tough for new systems to gain traction. Huawei, as a leading hardware maker, saw an opportunity to launch a new operating system that could provide real competition.

By using its large user base and manufacturing capacity, Huawei sees HarmonyOS as a way to shake things up in the market. Its ability to work across devices and support native app development could help it stand out from Android and iOS, not just in China but globally.

5. Focus on Innovation and Future-Readiness

Most importantly, the development of HarmonyOS reflects Huawei's commitment to innovation and leadership in tech. The company has consistently invested in research and development, and HarmonyOS is part of that effort.

Huawei is not treating HarmonyOS as a temporary fix, but as a rethinking of what an operating system can be today. It emphasizes distributing computing, cross-device applications, smart user experiences, and effective integration of IoT devices. HarmonyOS also aims to grow a developer community with support for various programming languages, which will help ensure its long-term success.

The reasons behind HarmonyOS are varied, stemming from both external pressures and internal goals. From tackling global tensions to creating a truly connected digital experience, Huawei is aiming to use HarmonyOS as a key part of its plan for independence and leadership in technology. With its unique features and long-term strategy, HarmonyOS is not just a reaction to challenges but a vision for the future of tech, where security and efficiency are the norm.

Objectives of HarmonyOS

Huawei launched HarmonyOS not just to face political challenges, but to change how we interact with technology. The main idea is to make devices work better together, keep things secure, encourage innovation, and create a more independent digital environment. Each goal reflects Huawei's vision for a connected tech ecosystem.

1. Building Tech Independence

Huawei kicked off HarmonyOS to cut down on reliance on foreign technology. In 2019, the U.S. blocked Huawei from critical parts of Android, especially Google services, affecting their smartphone sales worldwide.

HarmonyOS was built as a stand-alone system, allowing Huawei to keep making and selling devices without needing external software. This move helps them depend less on competitors and gives them greater control over their products, so they can focus on what users really want.

2. Creating a Unified Ecosystem

HarmonyOS wants to address the issue of disconnected digital systems. Regular operating systems like Android and iOS started with phones and then expanded, which often led to inconsistent experiences.

Huawei plans for HarmonyOS to connect phones, tablets, smart TVs, wearables, and IoT devices into one smooth system. This way, you can easily switch a video call from your phone to your smart TV and manage it with your smartwatch. This smooth interaction makes HarmonyOS appealing and practical.

3. Boosting Security and Stability

With the rise in online threats, security and reliability are crucial. HarmonyOS uses a microkernel setup, keeping essential functions separate from the rest.

This design has some perks:

- Lower security risks: Isolated components mean if one part breaks, it doesn't bring down the whole system.
- More reliability: Issues in smaller sections won't crash everything.
- Easier safety checks: A smaller kernel is simpler to secure.

Huawei wants users and developers to trust HarmonyOS as a safe platform for different devices.

4. Improving IoT Connectivity

With smart devices like fridges and sensors becoming common, there's a growing need for operating systems that can manage these gadgets and enable real-time communication.

HarmonyOS is built to meet this need with a lightweight design that works with various IoT devices, no matter their specs. Its communication framework helps devices share data easily.

By focusing on IoT, Huawei positions HarmonyOS as essential for smart homes and cities, allowing devices to work together to save energy and automate tasks without heavily depending on cloud services.

5. Encouraging Tech Innovation

Innovation is a big deal for Huawei. HarmonyOS reflects this by creating a space that promotes new ideas and apps.

It supports:

- Multiple coding languages : Developers can use C, Java, or Kotlin to create apps.
- Cross-device app framework : One app can function on different devices with minimal changes.
- Open toolkits: These help developers access device features easily.

These aspects build a strong developer community, making it easier to create new cross-platform apps.

6. Standing Out in the Market

The smartphone market is mainly ruled by Android and iOS. With HarmonyOS, Huawei wants to not just compete but also stand out with something unique.

By focusing on connectivity and performance, Huawei hopes to make HarmonyOS a distinctive option beyond just smartphones. Features like the Super Device interface and multi-screen collaboration give it a unique touch.

This uniqueness draws in users looking for a smooth experience across devices, helping Huawei stay relevant as tech trends shift.

7. Making User Experience Simple

HarmonyOS is meant to be user-friendly. Knowing that people juggle multiple devices daily, Huawei wants those interactions to be easy.

A key feature is the Super Device interface, which lets users manage all connected devices from one spot. With drag-and-drop options, users can control their devices without hassle.

HarmonyOS also ensures a consistent look and feel across devices, so users don't have to relearn how to use different gadgets, making adaptation easier.

8. Planning for the Future

Finally, HarmonyOS is built for both now and later. Huawei recognizes that tech changes fast, and systems have to keep up.

HarmonyOS is designed to be scalable and easy to update, ready for:

- Edge computing : Processing data closer to where it comes from.
- AI features : Adding smart features like voice recognition.
- Component updates : Allowing updates without major changes.

Huawei's ongoing investment in research ensures HarmonyOS can adjust to new technologies. It's not just a system for phones or TVs; it aims to be a long-lasting platform for tech growth.

The goals of HarmonyOS show Huawei's vision for the future of technology. From seeking independence and security to making user experiences smooth and promoting IoT innovation, Huawei is building a platform ready for a swift-changing digital world.

HarmonyOS isn't just a quick fix; it's a forward-thinking choice for a smarter, safer, and more connected digital landscape. As it grows, HarmonyOS aims to change the way users, devices, and data interact, getting Huawei closer to its goal of a connected future.

Requirements of HarmonyOS

Hardware requirements

HarmonyOS is all about being flexible and efficient. One of its standout features is that it doesn't require much hardware to function. This means it can run on a wide range of devices, from simple gadgets to high-end smartphones and tablets. Huawei aims to create an operating system that connects all sorts of digital devices.

The system uses a lightweight microkernel that allows it to perform well even on devices with fewer resources. Here's a quick rundown of the hardware needs for running HarmonyOS on different devices.

1. Low RAM Requirements

One impressive thing about HarmonyOS is its minimal RAM requirements, which sets it apart from many other systems. It can run on devices with as little as 128KB of RAM.

This low memory requirement comes from:

- Microkernel design : HarmonyOS has a small core that only includes the essential system services.
- Modular components : It installs only what's necessary, which reduces extra memory use.
- Resource management: The system allocates resources based on the device's capabilities and current needs.

Because of this, HarmonyOS is great for devices like smart home sensors, fitness trackers, and industrial monitors. In contrast, systems like Android typically need much more RAM.

2. CPU Compatibility

HarmonyOS supports a range of processor types, including:

- ARM : Common in mobile devices like smartphones and tablets.
- x86-64 : Found in computers, laptops, and high-performance systems.
- RISC-V : A newer open-source architecture gaining popularity for its flexibility and cost-effectiveness.

This wide compatibility means HarmonyOS can be used in smart TVs, industrial systems, and more, giving manufacturers confidence that their devices will work smoothly.

3. Storage Needs

HarmonyOS is also designed to be efficient with storage, running on devices with as little as 4MB for basic setups. The amount required can vary based on the features used.

Some of the ways HarmonyOS saves storage include:

- Decoupled components : Only essential parts are installed.
- File compression : It reduces file sizes when possible.
- Incremental updates : Only changed parts are updated, saving space.

This efficiency makes it suitable for smart meters, medical devices, and low-storage home appliances. While higher-end devices may need more space, it's still less than what other operating systems often require.

4. Peripheral Compatibility

A key feature of HarmonyOS is how well it connects with various hardware. It works with all sorts of peripherals like sensors, cameras, and communication modules, making it versatile for many applications.

HarmonyOS supports:

- Sensors : Such as temperature and GPS sensors.
- Actuators : Like motors and LED indicators.
- Input/Output devices : Including screens, keypads, and speakers.
- Connectivity : Options for Wi-Fi, Bluetooth, and cellular connections.

This extensive support allows HarmonyOS to be used in areas like smart cities, healthcare, and industrial settings.

5. IoT and Edge Computing Focus

HarmonyOS is designed with IoT and edge computing in mind, allowing devices to operate independently, process data locally, and communicate quickly.

Some features include:

- Task scheduling : Devices can share tasks based on resources.
- Fast communication : Quick methods for real-time data sharing.
- On-device processing : It can handle tasks right on the device, making it faster and more reliable.

These features make HarmonyOS a great choice for smart homes, retail, and agricultural technology.

HarmonyOS supports Huawei's vision of a smart digital ecosystem. With low RAM and storage needs, a broad range of CPU compatibility, and extensive peripheral support, it's suitable for many devices. Its focus on edge computing helps it remain efficient and secure, making it more than just another mobile operating system. As technology continues to develop, HarmonyOS can adapt, ensuring smooth and intelligent use across different devices..

Software requirements

Huawei's HarmonyOS takes a fresh approach to operating systems, working well across all kinds of smart devices. It goes beyond what you normally see in systems like Android or Linux. Let's break down what makes up HarmonyOS.

Microkernel Design

HarmonyOS uses a microkernel structure, which is different from the usual setup in many operating systems.

- What It Is and Why It's Important

In a microkernel, only the key functions, like communication between processes and managing memory, run in the kernel itself. Everything else operates separately, which helps keep the system stable.

- Benefits

- Security : Keeping services separate helps avoid crashes or attacks.
- Stability : If one part goes down, the whole system stays up.
- Scalability : It can run on everything from small devices to powerful ones.
- Real-Time Processing : It's great for time-sensitive tasks, making it useful in robotics.

- Verification

Huawei has made sure the microkernel works reliably through formal checks, important for safety in fields like healthcare and aviation.

Programming Language Support

To attract developers, HarmonyOS supports various programming languages.

- Supported Languages

- C/C++: Great for low-level programming and hardware tasks.
- JavaScript: Good for app interfaces and basic applications, allowing for compatibility across devices.
- ArkTS (Ark TypeScript): A new language from Huawei for reactive programming.
- Java : Kept for compatibility with older Android apps.

- Ark Compiler

HarmonyOS includes the Ark Compiler, which speeds up app performance and offers more flexibility during development.

Compatibility and App Support

HarmonyOS started off compatible with Android to make it easier for developers and users to transition.

- Initial Android Compatibility

It was based on the Android Open Source Project, making it simple to run most Android apps with minor tweaks.

- Shift to HarmonyOS NEXT

With HarmonyOS 3.x, it began to step away from Android. The 2023 version of HarmonyOS NEXT is fully its own, encouraging apps developed with ArkTS and native APIs.

- Distributed App Model

Apps can function across various devices, allowing users to start on one device and continue on another seamlessly.

Layered System Architecture

HarmonyOS uses a multi-layered setup for organization and flexibility.

1. Kernel Layer : Handles key system functions and hardware access.
2. System Service Layer: Manages services like connectivity and media playback.
3. Framework Layer: Provides APIs for developers.
4. Application Layer : Hosts user apps and ensures a consistent experience across devices.

This design keeps HarmonyOS flexible and easy to update.

Lightweight Hardware Compatibility

HarmonyOS is made to be lightweight, which is important for modern devices.

- Resource Efficiency
 - Minimal RAM Needed: Can run on just 128 KB of RAM.
 - Low Storage Needs: Core parts take up little space.
 - CPU Compatibility: Works on various hardware setups.
- Use Case :Think smart home devices, wearables, and industrial systems.

Update and Maintenance Mechanism

To keep devices working well, HarmonyOS has a solid update system.

- Over-the-Air (OTA) Updates :These updates are secure and don't require much from users.
- Granular Updates :Instead of big updates, HarmonyOS can update smaller components, saving bandwidth and energy, which is crucial for IoT.
- Developer Benefits : Thanks to the HarmonyOS SDK, developers can handle updates without interrupting the whole system.

HarmonyOS is designed with the future in mind, showing Huawei's goal of creating a flexible operating system for many devices. With its microkernel structure, organized layers, and support for various programming languages, it aims for safety and adaptability. Understanding

these software needs will help developers build connected systems and contribute to creating a smarter ecosystem.

Download and Installation steps of HarmonyOS

Installing HarmonyOS on a supported Huawei device is a straightforward process, but it involves a few critical steps to ensure success. Since HarmonyOS only functions on Huawei-branded hardware, this guide will walk you through everything you need to know—without the use of images—to help you confidently install the operating system on a compatible device. Whether you're transitioning from EMUI or updating to a newer HarmonyOS version, these instructions will guide you through every step.

HarmonyOS is not compatible with non-Huawei devices.

The process requires a stable internet connection.

It's important to back up your data to prevent loss.

Step 1 – Check Device Compatibility

Why This Step Is Important:

HarmonyOS doesn't support all Huawei devices, especially older models. Attempting to install it on an unsupported device could fail or cause system instability.

How to Check Compatibility:

Using the “My Huawei” App:

Open the AppGallery and download or update the My Huawei app.

Launch the app and navigate to the HarmonyOS section.

The app will automatically check your device's compatibility and notify you if an update is available.

Using the Official Huawei Website:

Visit <https://consumer.huawei.com>.

Search for the HarmonyOS supported device list.

Look for your device model to confirm compatibility.

If your device is listed, proceed to the next step.

Step 2 – Update the "My Huawei" App and Create a Huawei ID

Update the App:

Before anything else, ensure you have the latest version of the “My Huawei” app. You can update it via:

Huawei AppGallery → Search "My Huawei" → Tap "Update".

Create a Huawei ID (if you don't have one):

Launch the My Huawei app.

Select “Sign Up”.

Enter:

Your full name.

A valid phone number or email address.

A strong password (must meet Huawei's security standards).

You will receive a verification code via SMS or email. Enter this to confirm your account.

Once verified, your Huawei ID is ready for use. This ID is essential for accessing updates and downloading HarmonyOS.

Step 3 – Navigate to HarmonyOS and Download

Begin the Download Process:

Once signed in with your Huawei ID:

Open the My Huawei app.

Navigate to the HarmonyOS Update Section.

Choose the correct HarmonyOS version based on your device model.

Tap “Download” and ensure you are connected to Wi-Fi to avoid mobile data charges.

Wait for the download to complete. This may take several minutes depending on your internet speed and device.

Step 4 – Back Up Your Data

Why Backup Is important :

Installing a new operating system might wipe or corrupt personal data. To prevent any data loss:

How to Back Up:

Using Huawei Cloud:

Go to Settings > Huawei ID > Cloud.

Turn on Cloud Backup.

Select the data types (photos, contacts, app data) to back up.

Tap “Back Up Now”.

Using External Storage:

Connect your device to a PC or use a USB OTG with external storage.

Copy important files manually (DCIM, Documents, Downloads, etc.).

Backup Apps:

You may use apps like HiSuite (Huawei’s PC software) to back up your entire device. Once the backup is completed and confirmed, move to installation.

Step 5 – Install HarmonyOS

Installing the OS:

Go to your device’s Settings > System & Updates > Software Update.

If the HarmonyOS package has been downloaded successfully, you will see a “Install” option.

Tap Install and follow on-screen instructions.

Your phone will:

Verify the update.

Restart and enter installation mode.

Complete the process automatically (do not interrupt or force shutdown).

The device will reboot into HarmonyOS once the installation is complete.

Installation time varies between 10–30 minutes.

Step 6 – Post-Installation Verification

Verify the Update:

After your device restarts:

Go to Settings > About Phone.

Check the Software Version—it should say HarmonyOS with the installed version number.

Things to Do After Installation:

Restore your backed-up data.

Explore new features like Super Device, Service Widgets, or Smart Task Center.

Check for any minor updates under System > Software Update.

Troubleshooting:

If HarmonyOS doesn't appear or the installation fails:

Reboot the device and retry.

Ensure the device is supported.

Contact Huawei Support via the Support App or official website.

Issues(Problem faced)

Getting HarmonyOS on a Windows PC can be tricky. It's mainly meant for Huawei devices, so some folks try to use emulators like DevEco Studio. This isn't always straightforward, and you might run into some software issues or restrictions.

The followings are common problems we may face and some simple solutions. Whether we're a developer or just curious, it's good to know what to expect before diving in.

Compatibility and Emulation Tools

Since HarmonyOS is built for Huawei gadgets, it won't run on a standard Windows machine easily. You'll need to use something like DevEco Studio to simulate HarmonyOS.

Here are some common issues:

- Problems getting DevEco Studio installed or running.
- The emulator might crash or freeze.
- No device profiles for uncommon screen sizes.

Why does this happen?

- DevEco Studio requires decent hardware.
- Older PCs or unsupported Windows versions can struggle.

What can we do?

- Check that your setup meets the HarmonyOS IDE requirements and download the latest version.
- Enable virtualization in your BIOS so the emulator works properly.

Developer Account and Verification Issues

To make the most of DevEco Studio, you'll need a Huawei Developer Account. This involves:

- Sharing some personal info.
- Verifying your identity with an official ID, like a passport.
- Waiting for Huawei to approve your application.

Common hiccups include:

- Applications getting denied for missing information.
- Long waits for approval.
- Restrictions based on your location.

To make things easier:

- Double-check your registration info.
- Use clear identification documents.
- If it takes more than 3–5 business days, reach out to Huawei Support.

High System Requirements

Running HarmonyOS on Windows demands a lot from your system. If your PC isn't powerful enough, you might experience slowdowns or trouble starting the emulator.

Here's what you need at a minimum:

- RAM: 8GB (or 16GB for better performance).
- Storage: At least 100GB of free space.
- Processor: Intel i5 or better with virtualization support.

Common problems include:

- The emulator fails to load.
- It runs slowly.
- Frequent crashes.

Suggestions:

- Consider upgrading your RAM or using an SSD for faster storage.
- Close other apps while using DevEco Studio.
- Ensure virtualization is enabled in BIOS.

Limited Documentation and Debugging Help

Right now, HarmonyOS doesn't have as much support as Android or iOS. This means:

- There aren't enough official documents for non-Huawei developers.
- Few community tutorials or guides available.
- No official support for Windows installation.

Why is this an issue?

- Users might have a hard time fixing problems.
- No clear way to troubleshoot issues.
- Developers could waste time figuring things out.

What can we do?

- Use this guide along with other reliable sources.
- Check out video tutorials or projects by HarmonyOS developers on GitHub.
- Think about creating your own guide to help others.

Regional Restrictions and Internet Issues

Some HarmonyOS tools may not be accessible depending on where you are, and you could face internet issues during installation or syncing.

Common problems include:

- Download links not working in specific regions.
- Connection problems with DevEco Studio.
- Interruptions during SDK downloads.

How to deal with these:

- Try using a trustworthy VPN to change your location.
- Adjust your proxy settings in DevEco Studio.
- Make sure your firewall or antivirus isn't blocking anything important.

Solutions Summary and Community Support

If you get stuck, sharing your experiences can be really helpful. The Huawei developer community can be a great resource.

Also:

- Keep an eye on your Developer Account info and ask for help when needed.
- Ensure your hardware meets the requirements and that virtualization is on.
- Join community forums like the Huawei Developer Forum or check relevant Discord and Reddit groups.
- Look for other emulators if DevEco Studio isn't working for you.

Stay tuned for updates from Huawei that could improve compatibility. Following these tips can help you get HarmonyOS installed and running on your PC.

Filesystem Support

HarmonyOS, made by Huawei, is built for IoT, mobile gadgets, and other small devices. A key feature is its filesystem support. The filesystem you pick affects data safety, speed, and compatibility with devices. HarmonyOS mainly supports exFAT, which is user-friendly and works well across different platforms.

In this article, we'll look at the filesystem support in HarmonyOS, focusing on exFAT and comparing it with other filesystems like FAT32, NTFS, ext4, Btrfs, ZFS, HFS+, and APFS.

exFAT, created by Microsoft, is awesome for flash storage and removable drives. It offers some clear benefits over FAT32:

- File Size Limit : exFAT can handle files as big as 16 exabytes, while FAT32 tops out at 4GB.
- Cross-Platform Support : It works well on Windows, macOS, Linux (with drivers), and Android.
- Great for Flash Memory : exFAT is optimized for USBs, SD cards, and SSDs.

For smartphones, tablets, and smart TVs running HarmonyOS, exFAT provides a nice balance of ease of use and speed, making file transfers between systems simple.

Why We Skip FAT32 ?

HarmonyOS's Decision Against FAT32

While FAT32 is widely compatible, it has some major downsides that make it less appealing these days:

- File Size Limit : It can't handle files larger than 4GB.
- Partition Size Limit : The maximum is 8TB.
- No Recovery Option : If something goes wrong, you can't recover the data.

Since users often need to work with large files like 4K videos and backups, HarmonyOS goes with exFAT to avoid these issues and keep things straightforward.

Why We Don't Use ext4 and Btrfs ?

ext4 and Btrfs are popular in the Linux world for features like journaling and snapshots. But HarmonyOS skips them because it aims to keep things simple, especially for everyday devices instead of complex systems.

HarmonyOS isn't just a regular Linux version. Its lightweight design means it doesn't support complicated filesystems like ext4 or Btrfs, which are better for desktops and servers.

No NTFS Support

NTFS is the default for Windows and has features like file permissions and recovery. But HarmonyOS doesn't support NTFS natively due to licensing issues and a focus on keeping things simple for mobile and IoT users.

To access NTFS drives, you'll need to use third-party apps or tools, making it easy for those who want compatibility without the fuss.

No Apple Filesystem Support

HarmonyOS doesn't support HFS+ and APFS, which are made for Apple devices. These filesystems have features just for Apple, but HarmonyOS operates independently.

For transferring files to and from HarmonyOS and Apple devices, users can use exFAT drives, which are compatible with both.

No Advanced Enterprise Filesystems

ZFS is known for its data protection and management mostly in server environments, along with other systems like XFS or ReiserFS. However, since HarmonyOS isn't aimed at enterprise storage, using these filesystems would complicate things for most users.

Summary of Filesystem Support in HarmonyOS

Filesystem	Supported	Notes
exFAT	Yes	Best for external and removable storage.
FAT32	No	Outdated; replaced by exFAT for larger files.
ext4	No	Common in Linux but not in HarmonyOS.
Btrfs	No	Too complicated for HarmonyOS.
NTFS	No	Requires third-party tools for access.
HFS+	No	Only for Apple devices; not supported.
APFS	No	Exclusive to Apple.
ZFS	No	Not needed for HarmonyOS users.

HarmonyOS focuses on being simple, fast, and user-friendly. That's why exFAT is the best choice for file storage and sharing.

What's Next for Filesystem Support?

As HarmonyOS continues to develop, it might consider adding support for more filesystems, like read-only NTFS or optional ext4 for specific devices.

For now, exFAT is the main option for HarmonyOS users who need to share files. It works well with Android, Windows, macOS, and Linux, making it a solid choice for all digital needs.

HarmonyOS aims to be practical and easy to use. While it may not have support for some advanced filesystems, it offers good compatibility and user-friendly options with exFAT.

Advantage and Disadvantages of HarmonyOS

Advantages

HarmonyOS offers several advantages that make it a compelling operating system for modern devices. Here are some key benefits:

1. Smooth Device Integration

One of the standout features of HarmonyOS is how well it connects different devices. It's built to bring together smart gadgets like smartphones, tablets, smart TVs, smartwatches, and IoT appliances so they can work together seamlessly.

This isn't just about sharing data. HarmonyOS lets you control and operate devices interchangeably. For instance, you can start watching a video on your phone and switch it to your smart TV without missing a beat. Or, you can take calls that come through your smartwatch on a smart speaker. This kind of connection makes everything easier and creates a more user-friendly digital experience.

For developers, HarmonyOS allows them to make apps that can run on multiple device types without needing to write separate code for each one. This cuts down development time and makes the user experience smooth across different platforms.

2. Smart Device Architecture

HarmonyOS is one of the first operating systems that really embraces a distributed system architecture. This means that many connected devices can act like one big device, sharing tasks and services among themselves.

So, for example, you could edit a document on your tablet while using your laptop's processing power. Or, you could start a video call on your phone and use the better camera and microphone on your smart TV and speaker. This makes users more productive, especially in homes and offices where several devices are often in play. It also helps use hardware resources better, so no one device is left doing all the heavy lifting while others sit idle.

The Super Device feature in HarmonyOS shows this off nicely, letting users easily connect compatible devices with a simple drag-and-drop method.

3. Better Performance and Security

HarmonyOS is designed for high performance with minimal lag, which is really important for the interactivity we expect from modern devices. It has an engine that smartly manages how tasks are prioritized, allowing apps to launch quickly and touch responses to feel smooth, even when many tasks are happening at once.

Plus, it helps devices save battery life by managing resources intelligently. It looks at how the system is behaving and adjusts memory, CPU usage, and internet bandwidth to give priority to the apps that really need it. This keeps things running quickly while also being easy on battery life, which is especially helpful for wearables and mobile gadgets.

4. Security with a Microkernel Approach

HarmonyOS is also designed with security in mind, using a microkernel architecture that keeps the most important system components separate. Only the essential functions stay in the kernel, while less critical parts operate in user space.

This setup has several benefits. It minimizes the chance that a flaw in a non-essential service could take down the whole system. A smaller kernel also means fewer vulnerabilities, and Huawei uses mathematical models to verify that the microkernel works correctly, making it a solid choice for keeping devices secure—especially those that handle sensitive information like banking or smart home controls.

5. Open Source and Developer-Friendly

Unlike many other mobile operating systems, HarmonyOS is open-source under the OpenHarmony project. This openness helps both individual developers and businesses in different ways.

For developers, they can create apps that can run on phones, TVs, and IoT devices using the same distributed APIs. Manufacturers can adjust the OS to better fit specialized hardware or specific business needs. Plus, developers have access to the core system features and can improve performance across the board.

To make things easier, Huawei provides tools like DevEco Studio, which is a user-friendly environment for app development. It supports programming in Java, C/C++, and JS, so developers with various skills can join in.

This open approach fosters community contributions and quick innovation, which is vital for HarmonyOS to stand out and compete with established platforms like Android and iOS.

Disadvantages

1. Fewer Apps and Developer Issues

One of the biggest concerns with HarmonyOS is that it has way fewer apps compared to Android and iOS. The Huawei AppGallery just can't compete with the choices available on the Google Play Store or Apple App Store.

This causes some problems for users:

- Some popular apps might not be there or could have limited features.
- App updates can be slow or inconsistent across different platforms.
- Users may have to look for third-party apps or install them manually, which can lead to security risks.

For developers, getting their apps to run on HarmonyOS can be tricky. They often need to tweak or completely rebuild their Android apps to fit Huawei's system. Even though Huawei offers some tools and guides to help with this, it can still be a lot of work, especially for smaller developers.

Until more people start using HarmonyOS, many developers may hold back on making versions of their apps for this platform, slowing its growth.

2. Compatibility Issues with Other Services and Devices

HarmonyOS wants to work smoothly across devices, but it still has trouble with compatibility, especially with apps and services designed for Android and iOS.

For example:

- Apps that depend on Google Mobile Services won't work on HarmonyOS.
- Some Android apps might not run properly due to coding differences.
- Smart home devices from brands like Google Nest or Amazon Alexa might not connect well with HarmonyOS gadgets.

Certain hardware that requires specific software might not function well, or at all, with HarmonyOS. While Huawei is working on these issues, there's still a long way to go. This means users who like to mix and match different services might find HarmonyOS a bit limiting.

3. Dependence on Huawei Devices Limits Appeal

HarmonyOS is primarily designed for Huawei devices like smartphones, wearables, TVs, and smart home products. There's an open-source version called OpenHarmony for other brands, but it hasn't really taken off outside of Huawei devices.

This focus brings some challenges:

- Users who prefer brands like Samsung or Xiaomi won't find HarmonyOS on their devices.
- Developers might be less keen on creating apps for an OS that isn't widely adopted.
- Schools or businesses looking for a variety of devices may bypass HarmonyOS for more options.

Relying on Huawei also brings political issues, especially with trade restrictions and the brand's limited presence in some Western markets. These factors make it tougher for HarmonyOS to expand internationally.

4. Tough Competition in a Crowded Market

HarmonyOS enters a busy market where Android and iOS hold over 95% of the share. Breaking into this space isn't easy for either users or developers.

User adoption is slowed by:

- Comfort with the operating systems they're already used to.
- Concerns about switching, like losing bought apps or having to figure out a new interface.
- Little awareness of HarmonyOS outside of the Asia-Pacific region.

While HarmonyOS has attracted some users in China thanks to Huawei, making progress elsewhere will be challenging without building trust and showing a commitment to future support. There will need to be a significant focus on education, marketing, and partnerships.

5. Concerns About Long-Term Support and Stability

Unlike well-established platforms like Android and iOS, which are supported by big companies, HarmonyOS is still fairly new. This raises valid questions about its long-term support, update policies, and compatibility with older devices.

Key questions include:

- Will older devices continue to get updates when new HarmonyOS versions come out?
- How committed is Huawei to expanding globally if it doesn't gain more market share?
- Can the platform remain stable if Huawei encounters supply chain issues or regulatory hurdles?

If Huawei decides to shift its focus or faces outside pressures, it could hurt the HarmonyOS ecosystem. For both developers and users, uncertainties about the platform's future can be a big barrier to adoption.

In contrast, Android and iOS offer predictable updates and solid support plans. HarmonyOS will need to build a similar reputation over time to gain the trust of both developers and users.

Conclusion

Huawei's goal of building a smooth, networked ecosystem has propelled HarmonyOS to prominence in the operating system market. Its history and development demonstrate how it evolved from an Android substitute to a fully functional operating system with cross-device compatibility. The need for a unified platform that improves user experience across smartphones, tablets, smart TVs, and Internet of Things devices is what inspired HarmonyOS.

Efficiency, security, and interoperability are the main goals of HarmonyOS, which makes sure that consumers may have a seamless experience on a variety of devices. It is a robust yet user-friendly system for users within the Huawei ecosystem because its hardware and software specifications are tailored for Huawei devices. The installation steps are straightforward, but users may encounter issues such as compatibility challenges or difficulties in downloading and installing the OS.

Huawei offers remedies including software upgrades, troubleshooting manuals, and assistance for third-party apps to deal with these issues. Users can easily transfer huge files thanks to the filesystem support, especially exFAT, which guarantees compatibility with external storage devices. Although HarmonyOS has several benefits, such as enhanced security, performance, and cross-device compatibility, it also has drawbacks, including a small app store and difficulties gaining traction in the market.

All things considered, HarmonyOS is a daring move in the direction of a more cohesive digital experience. It is a viable option in the operating system industry, despite its ongoing evolution, thanks to its advantages in security, efficiency, and device connectivity. HarmonyOS has the potential to become a commonly used platform for contemporary computing as use increases and more developers join its ecosystem.

Future outlook/recommendation

Huawei's HarmonyOS is showing a lot of potential as it keeps evolving. With the new HarmonyOS NEXT on the way, it seems like Huawei really wants to compete in the operating system space. This update promises better device connectivity, improved security, and enhanced performance, helping it go toe-to-toe with Android and iOS in certain areas.

The main aim of HarmonyOS is to provide a seamless experience across different smart devices like smartphones, tablets, smartwatches, TVs, and home gadgets. The way it's set up allows devices to work together smoothly. For example, you could start something on your phone and easily switch to your tablet or TV. This kind of collaboration is likely to be a big selling point as Huawei pushes HarmonyOS into a wider market.

While HarmonyOS has made notable strides, there are a few things Huawei could do to strengthen its position and expand globally:

1. Grow the App Ecosystem:

The number of apps on HarmonyOS is still a bit lacking. Even though Huawei has invested in supporting developers and its AppGallery, it doesn't match the variety found on Android and iOS. To change this, Huawei could:

- Encourage developers to create apps specifically for HarmonyOS.
- Offer tools for adapting Android apps to work on HarmonyOS.
- Collaborate with major app providers to ensure access to key services like banking and social media. Having a good variety of apps is essential for keeping users satisfied, especially outside of China.

2. Boost Global Reach:

HarmonyOS has made some headway in China, but expanding internationally has been a challenge due to political issues and app compatibility concerns. To enter new markets, Huawei should:

- Team up with international tech companies.

- Improve HarmonyOS's compatibility with non-Huawei devices and allow better third-party integrations.

- Focus marketing efforts on areas more open to new tech, such as Southeast Asia, Africa, and Latin America.

Building trust is key, so being transparent about privacy and data handling will help attract international users.

3. Focus on Business Users:

There's a big chance for HarmonyOS in the business space, which it hasn't fully explored yet. Many companies are looking for reliable, secure, and customizable operating systems. HarmonyOS could:

- Use its microkernel security model for enhanced protection against security threats.

- Develop features that cater to businesses, like remote management and secure communication options.

- Create cloud services that enhance collaboration and productivity, including office tools and safe document sharing.

Targeting this market could not only increase HarmonyOS's user base but also provide reliable revenue for Huawei.

4. Keep User Trust with Regular Updates:

Regular updates, security patches, and performance enhancements are vital for any operating system's long-term success. To maintain user trust in HarmonyOS, Huawei should:

- Stick to a consistent update schedule, especially for crucial security updates.

- Offer long-term support for enterprise users and ensure devices remain compatible over time.

- Engage with the community to promote feedback from developers.

A clear, regular update plan will help Huawei build a reputation as a trustworthy tech company, which is essential for user confidence.

In short, HarmonyOS is on the verge of broader acceptance, supported by innovation and a user-friendly design. To truly achieve its potential, Huawei needs to make thoughtful moves—especially in boosting its app offerings, gaining global presence, appealing to business customers, and ensuring reliable updates. If Huawei continues to focus on these areas, HarmonyOS could be more than just another option to Android; it could be a leader in the next generation of connected devices.

Virtualization

Virtualization in Modern Operating Systems

These days, virtualization is a big deal in computing. It lets us create virtual versions of things like hardware, operating systems, storage, and networks on just one machine. This means we can run several virtual machines (VMs) together, sharing the same hardware. It makes everything more flexible, efficient, and cost-effective.

Virtualization is about making a virtual version of something—whether that's hardware, storage, or network resources. For operating systems, it's what allows multiple systems to run on a single machine at the same time. This is handled by a hypervisor, which manages how resources are shared among the different virtual environments.

With virtualization, we get:

- Better use of resources: Making the most out of the available hardware.
- Isolation: Each virtual environment operates separately, which helps with security and stability.
- Flexibility: It's easier to manage applications across different setups.

Types of Virtualization

There are various kinds of virtualization, each serving its own purpose:

1. Hardware Virtualization

This lets multiple VMs run on a single physical machine, thanks to a hypervisor. Each VM functions like an independent computer with its own OS and applications. It is better in use of hardware, simpler server management, and easier to scale.

Examples : VMware ESXi, Microsoft Hyper-V.

2. Operating System Virtualization

This runs several isolated instances, known as containers, on one OS kernel. Containers share the host OS but maintain separate environments for apps. Less overhead than full VMs, faster to set up and scale, and better resource use. Examples, Docker, Linux Containers (LXC).

3. Network Virtualization

This creates multiple virtual networks from the underlying physical network, allowing them to work independently. It is used for Better scalability, improved security through isolation, and easier network management. Example: Software-Defined Networking (SDN), Virtual LANs (VLANs).

4. Storage Virtualization

This merges different physical storage devices into one system, making management easier. It has better recovery options ,Better use of storage and simplified data management.

Examples :Storage Area Networks (SAN), Network-Attached Storage (NAS).

5. Application Virtualization

This allows applications to run in isolated settings without being installed directly on the host OS.

- Benefits : Easier to deploy apps, fewer conflicts, and better security.
- Examples : Citrix Virtual Apps, Microsoft App-V.

Why Virtualization is Important ?

Virtualization is important today for a few reasons:

1. Cost Savings

With many virtual environments on one machine, companies can save on hardware and maintenance costs.

2. Better Security

Each virtual environment is separate, so problems in one don't impact the others, helping prevent security issues.

3. Easy Disaster Recovery

VMs can be quickly backed up, duplicated, and restored, making recovery simple.

4. Simplified Testing and Development

Developers can test apps in different environments without messing up the main system, speeding up the process.

5. Scalability and Flexibility

Businesses can easily adjust resources based on their needs.

How Virtualization Works

Virtualization has a few key components:

1. Hypervisors

These are software layers that allow multiple operating systems to share one hardware host.

- Type 1 (Bare-Metal) Hypervisors: Run directly on the hardware (e.g., VMware ESXi, Microsoft Hyper-V).

- Type 2 (Hosted) Hypervisors: Run on an existing OS (e.g., VMware Workstation, Oracle VirtualBox).

2. Resource Allocation

The hypervisor controls how physical resources like CPU and memory are shared among VMs for the best performance.

3. Virtual Machines

Each VM acts like a complete system with its own OS, independent of others on the same host.

4. Containers

These are lightweight formats that hold applications along with their required parts, sharing the host OS but keeping their environments apart. Examples : Docker, Kubernetes.

5. Virtual Networks and Storage

Virtualization also applies to networks and storage, allowing the creation of manageable virtual networks and storage pools

Over all, Virtualization has changed computing making it more flexible, efficient, and scalable. By separating physical resources, it allows for the setup of environments suited for different needs, from testing to production. As technology advances, virtualization will continue to play a key role in modern operating systems.

System call Implementation

Implementing system calls is a key component of operating system design that allows user applications to safely and effectively communicate with hardware and system resources.

System calls are crucial for how operating systems work. They act as a link between user apps and the operating system, allowing programs to request help for specific tasks safely. Here's why they matter:

1. Safe Access to Hardware

User programs shouldn't connect with hardware directly since it can lead to crashes or security risks. System calls manage how software interacts with hardware, making sure:

- Only allowed actions take place.
- Requests get checked before they're carried out.
- Resource access follows the system's rules.

2. Simplifying Programming

System calls make it easier for programmers by providing simple ways to use complex system functions. Instead of dealing with all the technical details, developers can use straightforward commands for things like:

- Managing files (open, read, write)
- Handling memory (malloc, mmap)
- Controlling processes (fork, exec)

3. Improving Security

Security is essential for operating systems. System calls act as checkpoints, ensuring that the app asking for something has the right permissions. For instance, if someone tries to access another user's process, the system stops it. This keeps everything running smoothly.

4. Making Code More Portable

System calls set a standard for how applications interact with system resources, which helps make code more portable. Developers can write their code using these calls, and it should work on different systems with minimal changes, as long as the setups are similar.

5. Managing Errors

System calls provide clear ways to report errors. This lets developers deal with issues like missing files or permission problems directly in their applications.

6. Handling Resources

System calls help manage resources like CPU time and memory efficiently. They allow processes to communicate and handle signals, letting multiple processes run at the same time without causing problems.

Creating the Kill() System Call in HarmonyOS :

Making a custom system call like Kill() in HarmonyOS involves getting into the kernel and understanding the system. It's mainly for Huawei devices, and HarmonyOS comes with development tools like DevEco Studio. There are some limits for developers without Huawei hardware.

Since HarmonyOS is specific to certain devices, I couldn't install and test it myself. Huawei keeps it exclusive, and while you can try to emulate it through DevEco Studio, I ran into some issues:

- The installation stalled and showed errors.
- Warnings about potential data loss were a bit concerning.

But here's how to set up a Kill() system call.

Step 1: Set Up Your Environment

- Download the HarmonyOS SDK from Huawei's developer site.
- Install DevEco Studio.
- Make sure you have all necessary system tools (Java JDK, CMake, GN, etc.).
- Set up the HarmonyOS toolchain and libraries.

Step 2: Define the System Call

- Find the header file with system call definitions (like syscalls.h).
- Add the Kill() definition:

```
int sys_kill(pid_t pid, int signal);
```

- Define the parameters:
 - pid: the process ID you want to target.
 - signal: the type of signal, like SIGTERM or SIGKILL.

Step 3: Implement the System Call

- Go to the kernel source folder (kernel/syscalls).
- Write the logic in a new file, like kill.c:

```
int sys_kill(pid_t pid, int signal) {  
    struct process *target = find_process_by_pid(pid);  
    if (!target) return -ESRCH;  
    return send_signal(target, signal);  
}
```

- Make sure there are checks for whether the process exists and if the signal is valid.

Step 4: Register the System Call

- Give the Kill() call a unique number in the system call table (syscall_table.c).

“

```
[SYS_KILL] = sys_kill,
```

“

- Update any relevant definitions or macros to include SYS_KILL.

Step 5: Update User Libraries

- Create a wrapper in the libc layer so user applications can call Kill() easily:

```
int kill(pid_t pid, int sig) {  
    return syscall(SYS_KILL, pid, sig);  
}
```

- Add necessary declarations in header files (signal.h).
- Compile and link the updated library with user applications.

Step 6: Compile and Build

- Rebuild the kernel:

“

```
make kernel
```

“

- Make sure the build includes the new syscall files.
- Deploy the kernel using make install or your chosen method.
- Fix any compilation errors or conflicts as they arise.

Step 7: Test the System Call

- Write test applications to use the Kill() syscall.

```
#include <signal.h>

int main() {

    kill(1234, SIGTERM);

    return 0;

}
```

- Test for:
 - Non-existent processes.
 - Unauthorized PIDs.
 - Successful signal delivery.
- Use debugging tools to see how the kernel acts.

Step 8: Document the System Call

- Purpose: Allows one process to send signals to another.
- Parameters:
 - pid: ID of the target process.
 - signal: the type of signal to send.
- Return Values: 0 for success, -1 for error.

Example Usage:

```
if (kill(4567, SIGKILL) == -1) {

    perror(Kill failed);

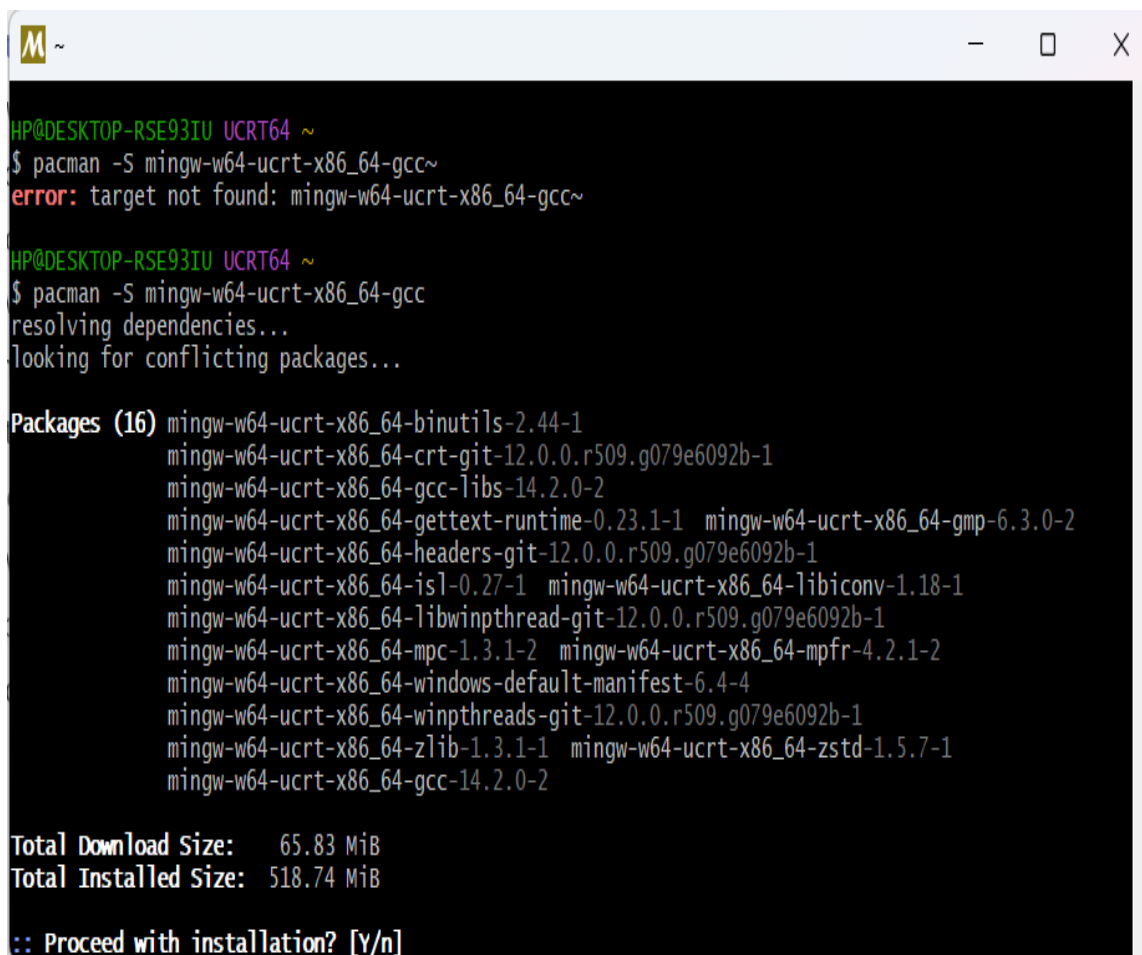
}
```

```
}
```

Include this syscall in HarmonyOS developer docs for better understanding.

System calls are essential for operating systems, ensuring secure and efficient interactions between applications and hardware. Although accessing HarmonyOS can be tricky, following these steps to create a Kill() system call gives insight into system-level development and its challenges.

Although HarmonyOS does not currently have a windows pc version available for general use, it can be accessed through emulators like DevEco but may not work completely. So I tried to download, install and do system call implementation through DevEco but it stopped me by halting half way of installing DevEco. The following are snipped pictures of installing and systemcalling DevEco until it stopped working:

A terminal window with a title bar showing a yellow 'M' icon and a tilde '~'. The terminal text shows a failed pacman command, followed by a successful command that lists 16 packages to be installed, their total download and installed sizes, and a prompt to proceed with installation.

```
HP@DESKTOP-RSE93IU UCRT64 ~  
$ pacman -S mingw-w64-ucrt-x86_64-gcc~  
error: target not found: mingw-w64-ucrt-x86_64-gcc~  
  
HP@DESKTOP-RSE93IU UCRT64 ~  
$ pacman -S mingw-w64-ucrt-x86_64-gcc  
resolving dependencies...  
looking for conflicting packages...  
  
Packages (16) mingw-w64-ucrt-x86_64-binutils-2.44-1  
mingw-w64-ucrt-x86_64-crt-git-12.0.0.r509.g079e6092b-1  
mingw-w64-ucrt-x86_64-gcc-libs-14.2.0-2  
mingw-w64-ucrt-x86_64-gettext-runtime-0.23.1-1 mingw-w64-ucrt-x86_64-gmp-6.3.0-2  
mingw-w64-ucrt-x86_64-headers-git-12.0.0.r509.g079e6092b-1  
mingw-w64-ucrt-x86_64-isl-0.27-1 mingw-w64-ucrt-x86_64-libiconv-1.18-1  
mingw-w64-ucrt-x86_64-libwinpthread-git-12.0.0.r509.g079e6092b-1  
mingw-w64-ucrt-x86_64-mpc-1.3.1-2 mingw-w64-ucrt-x86_64-mpfr-4.2.1-2  
mingw-w64-ucrt-x86_64-windows-default-manifest-6.4-4  
mingw-w64-ucrt-x86_64-winpthread-git-12.0.0.r509.g079e6092b-1  
mingw-w64-ucrt-x86_64-zlib-1.3.1-1 mingw-w64-ucrt-x86_64-zstd-1.5.7-1  
mingw-w64-ucrt-x86_64-gcc-14.2.0-2  
  
Total Download Size: 65.83 MiB  
Total Installed Size: 518.74 MiB  
  
:: Proceed with installation? [Y/n]
```



```
M ~ - □ X
mingw-w64-ucrt-x86_64-libwinpthread-git-12.0.0.r509.g079e6092b-1
mingw-w64-ucrt-x86_64-mpc-1.3.1-2 mingw-w64-ucrt-x86_64-mpfr-4.2.1-2
mingw-w64-ucrt-x86_64-windows-default-manifest-6.4-4
mingw-w64-ucrt-x86_64-winpthread-git-12.0.0.r509.g079e6092b-1
mingw-w64-ucrt-x86_64-zlib-1.3.1-1 mingw-w64-ucrt-x86_64-zstd-1.5.7-1
mingw-w64-ucrt-x86_64-gcc-14.2.0-2

Total Download Size: 65.83 MiB
Total Installed Size: 518.74 MiB

:: Proceed with installation? [Y/n] y
:: Retrieving packages...
mingw-w64-ucrt-x86_64-binu... 6.0 MiB 236 KiB/s 00:26 [#####] 100%
mingw-w64-ucrt-x86_64-head... 6.3 MiB 214 KiB/s 00:30 [#####] 100%
mingw-w64-ucrt-x86_64-gcc-... 1022.7 KiB 202 KiB/s 00:05 [#####] 100%
mingw-w64-ucrt-x86_64-isl-... 1453.5 KiB 43.1 KiB/s 00:34 [#####] 100%
mingw-w64-ucrt-x86_64-zstd... 642.3 KiB 81.8 KiB/s 00:08 [#####] 100%
mingw-w64-ucrt-x86_64-libi... 725.4 KiB 44.6 KiB/s 00:16 [#####] 100%
mingw-w64-ucrt-x86_64-mpfr... 535.7 KiB 74.9 KiB/s 00:07 [#####] 100%
mingw-w64-ucrt-x86_64-mpc-... 128.3 KiB 238 KiB/s 00:01 [#####] 100%
mingw-w64-ucrt-x86_64-gmp-... 430.1 KiB 190 KiB/s 00:00 [#####-----] 74%
mingw-w64-ucrt-x86_64-gcc-... 10.3 MiB 484 KiB/s 01:10 [#####-----] 23%
mingw-w64-ucrt-x86_64-gett... 111.9 KiB 34.2 KiB/s 00:05 [#####-----] 35%
mingw-w64-ucrt-x86_64-crt-... 3.1 MiB 101 KiB/s 00:14 [#####-----] 68%
mingw-w64-ucrt-x86_64-zlib-1.3.1-1-anyMiB 270 KiB/s 02:16 [#####-----] 45%
Total ( 8/16) 30.7 MiB 855 KiB/s 00:42 [#####-----] 46%
```

```
HP@DESKTOP-RSE93IU UCRT64 ~
```

```
$ gcc --version
```

```
gcc.exe (Rev2, Built by MSYS2 project) 13.2.0
```

```
gcc.exe (Rev2, Built by MSYS2 project) 14.2.0
```

```
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```

```
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warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.
```

```
-bash: syntax error near unexpected token `Rev2,'
```

```
HP@DESKTOP-RSE93IU UCRT64 ~
```

```
$ |
```

Reference

<https://www.harmonyos.com/en/>

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