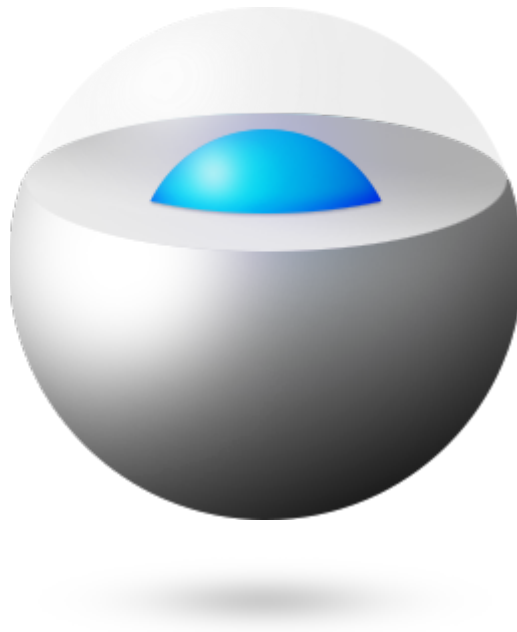


PlayStation 2 HDD Decryption Helper

PS2HDDH is a set of tools used primarily to mount all partitions of the hard drive and various operations related to it (such as formatting). In addition, USB and MC features are also present; but the main media is and will remain internal mass storage, eg. HDD (it does not matter whether the media is actually HDD or SHDD/HHD, SSD, eMMC, etc.).

The term “decryption” might be misleading, because the HDDs used in the **SCPH-******* and **DTL-H-****** models **have never been encrypted**. This is different from the **DESR-****** models, whose drives are encrypted. Support for those drives will be added in the future. Right now, we don't know the key needed to generate the encryption key, so it's not possible to modify the disk's logical structure outside of the console. I chose to keep the term “toolkit” to match the names of similar tools (like **PS3HDDH**, **PS4HDDH**, etc.). ;)



Environment Preparation

The supported operating system is **Linux**. Because of the packaging and repositories, only distros from the **Debian** family are supported (such as **Ubuntu**, **Mint**, etc.). As my favorite distro is **Mint**, everything is catered, tested, and customized for this particular distro. Due to the fact that many people do not use "penguin" on a daily basis, but rather for example a bootable USB in live mode, my priority is to keep PS2HDH compatible on the latest version of Mint in live mode.

Some of the "toolkit" functionality will not work fully on **WSL** (Windows 10/11). For macOS and FreeBSD, same problems – due to differences in system architecture and lack of some software. If you plan to fully virtualize Linux (e.g. via **VirtualBox**, **VMWare**, **QEMU**), make sure the virtual machine has access to physical devices (hard drive, etc.).

1. Unpack the *.tar.xz package in your home directory, so that you get the "ps2" folder. This is also the default path used in all scripts.

If you want the "toolkit" to be in a different location, you need to change the line from in each script:

```
TOOLKIT_PATH="${HOME}/ps2"
```

i.e. to:

```
TOOLKIT_PATH="/media/OS/test"
```

Don't add a slash at the end of the path!

2. Run the script "**Tools Installer.sh**" and install all the required programs, libraries etc. Some apps will be automatically compiled from the downloaded sources.

Remember to review the entire log at the end for any errors.

3. From now on you can use any of the scripts fitting the purpose for which you need. ;) In the following text you will find detailed descriptions of all options from all scripts.

Scripts

*.sh scripts, interpreted by Bash. I tried to stick to POSIX and Bash itself, so the other shells are probably also supported.

Tools Installer

This script is used to automatically install and eventually compile programs missing from the system. It should be run right after unpacking the "toolkit" and is a one-time action.

HDD Formatter

The script is used to format the internal memory. Depending on the selected option, it will perform different ways:

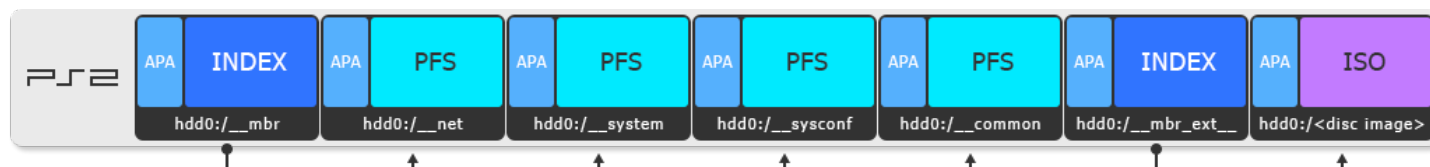
APA

Native environment for the **internal** hard drive, supported by all programs. The array format used is for **LBA48** (maximum media size: **2TiB**). **LBA28** (max **128GiB**) is not supported. Disks larger than 2TiB (~2.2TB) must be limited to a maximum of this size, e.g. by setting an AMAC, **DCO** or **HPA** zone, by i.e. **hdparm** app.



APA-EXT

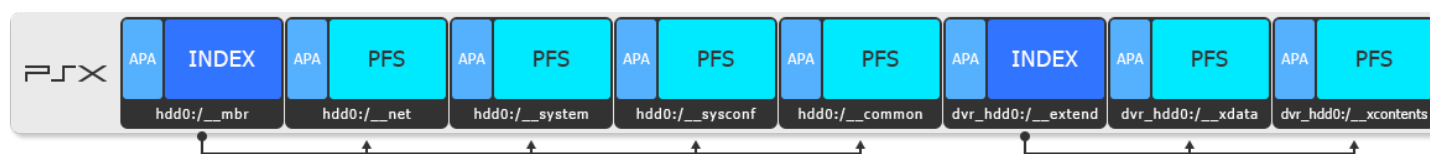
Native environment for the **internal** hard drive, but split into two areas. The first up to **128GiB** covers "**__mbr**" (APA LBA28/48). The second from 128GiB up to **2TiB** (LBA48) covers "**__mbr_ext**". The first being an index for full compatibility with all programs, while the second is seen by dedicated applications used to write and run games for PS2.



PS2HDH does not support formatting to APA-EXT. All scripts that are used work only if APA is recognized in the first area, thus completely ignoring the second area (and can overwrite it!). The only PC programs that will see all partitions are **IsoBuster** and **WinHiIP**.

APA-DVR

Native environment for the **internal** hard drive in **DESR-**** models**, but split into two areas. The first up to **40GiB** covers "**__mbr**" (APA LBA28/48). The second from 40GiB up to **2TiB** (LBA48) covers "**__extend**". The first being an index for full compatibility with all programs, while the second is seen by the console's dashboard and used for updates and recording footage. **The entire drive is encrypted in a way that is not currently fully known. PS2HDH does not support APA-DVR at all.**



APA-JAIL

A hybrid environment for the **internal** hard drive.



The simplest way to eliminate the limitations of APA is to stop using it altogether. However, doing so also removes the ability to boot software (like Free HD Boot, HDD OSD, and PSBBN) directly from the hard drive, and it breaks compatibility with all existing software written for the PS2 (such as unofficial LaunchELF). So, if you want to maintain full compatibility with both the PS2 firmware and homebrew applications, it's crucial to preserve the logical structure they recognize. Since PC environments (Windows, Linux, and macOS) only support MBR and GPT – and treat APA as unallocated space – you'll need to find a way to combine them. And that's exactly what APA-Jail is – a mix of two different and incompatible environments. The existing PS2 software, will not see content from the PC world and vice versa.

The original design was to put exFAT at the same address in both APA and MBR/GPT, so that the same file system could be accessed in two different logical structures. However, due to APA's limitations on partition size and disk size, plus a lack of interest among developers with modifying the libraries that support the internal hard drive, the idea evolved into the form described in the following pages.

RECOVERY Partition

Any attempt to tamper with the partition table whether on PS2 or PC, in most cases, will end up corrupting both. Therefore, regardless of the type of APA-Jail, a **recovery partition** is created, which is always at the same addresses. In case the user inadvertently adds a partition, deletes or renames any of them – which is tantamount to corrupting APA-Jail – it is possible to restore the APA and MBR/GPT, thus repairing the environment.

	Byte:	LBA Address:	Length:
Type-A/B/C	2151677952 + 512	LBA: 4202497	124MiB
Type-A2/B2/C2	137438953472 + 512	LBA: 268435457	32MiB
Type-A3/B3/C3	1099511627776 + 512	LBA: 2147483649	32MiB

Due to the fact that **Open PS2 Loader** automatically creates a "+OPL" partition if it does not find one, the script adds it in the role of backward compatibility and protection against APA-Jail corruption. OPL versions 1.1.0 and later, look for the "**conf_hdd.cfg**" file at startup, which contains the path to the resource partition, so the script creates this file as well.

HDD OSD and 2TiB+ disks

Browser 2.00, the so-called HDD OSD will not work properly on a disk exceeding 1TiB in size. Therefore, the user must limit the size of the media by creating an HPA area (at least for the time of formatting to APA). Later, the HPA can be removed and conversion to APA-Jail *2 or *3 can be performed.

The situation is similar with a disk larger than 2TiB (2TB is less than 2TiB, and it is this unit that manufacturers use when designating capacity). Formatting to APA (including all types of APA-Jail), will fail if the larger media was not previously limited by HPA. Only then you can remove the HPA and convert the drive to APA-Jail *3.

Not every controller supports all the necessary ata commands for HPA manipulation. As well, many Linux distributions automatically remove the HPA just after detecting it...

Type-A

Mixed **APA with MBR** (do not confuse **Master Boot Record** with "`__mbr`" partition, which has nothing to do with it).

PS2: all basic APA partitions are created, plus additionally "`hdd0:/__recovery`" and "`hdd0:/+OPL`". The remaining free space (RAW) is and must remain unused, otherwise you will overwrite the data on the partition with exFAT (that is, the one on the PC side).

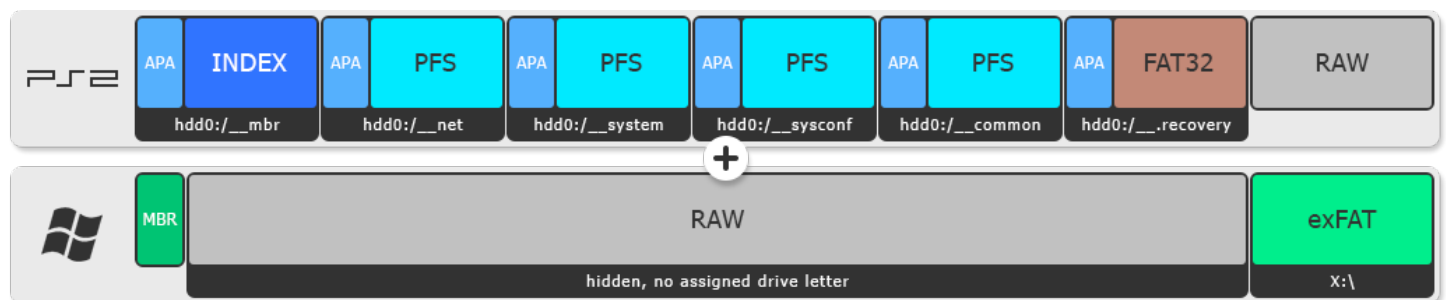
PC: The hidden partition (ID 17) RAW (without a file system, because from the point of view of, for example Windows, APA is a collection of random data) covers the area occupied by the PS2 environment. The exFAT partition takes up all the remaining space.

Advantages:

- backward compatibility with most PS2 software
- ability to auto-boot from disk (e.g. Free HDBoot)
- copying games for PS2 without the need for dedicated programs

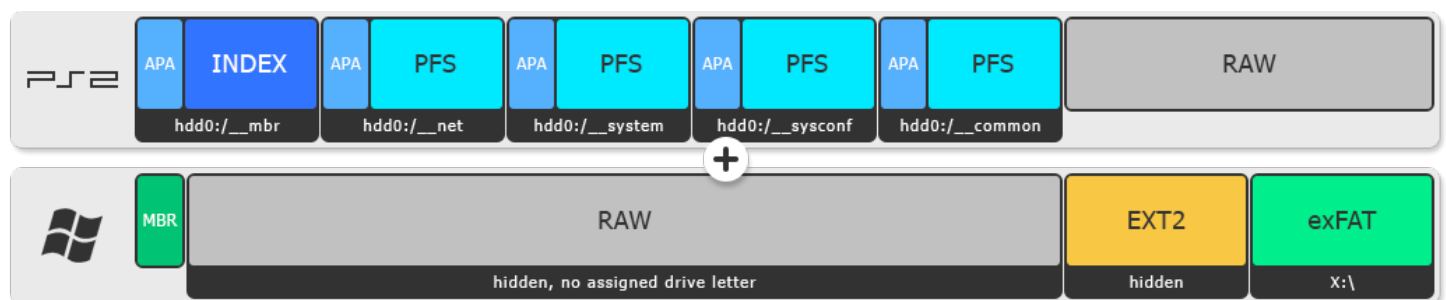
Disadvantages:

- no ability to add partitions and defragment the APA chain
- no ability to add, delete or edit any partitions on the MBR
- disk size must not exceed 2TiB (~2.2TB)



Type-A2/A3

A2 differs from its predecessor in that it is created from an already existing APA environment. The recovery partition is not created in APA space, but in the MBR, just behind the first 128GiB (A2) or 1TiB (A3). Therefore, the user cannot cross this barrier on the APA side, nor can the conversion from APA to APA-Jail take place on a disk with APA partitions above 128GiB/1TiB (the script does not check this).



Type-B

Mixed **APA** with **GPT** (complete).

PS2: all basic APA partitions are created, plus additionally "`hdd0:/__recovery`" and "`hdd0:/+OPL`". The remaining free space (RAW) is and must remain unused, otherwise you will damage the APA (due to the lack of APA journal).

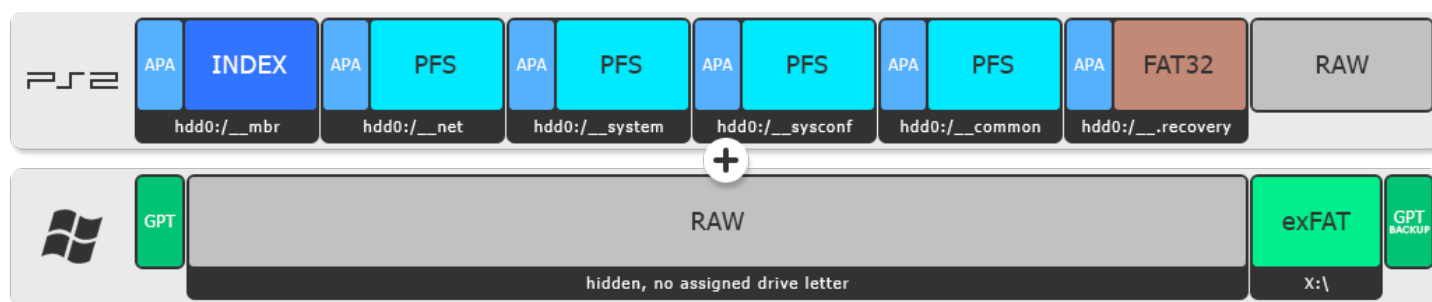
PC: the hidden partition (ID ED00, Hidden flag) RAW ("PS2 Protection Area") covers the area occupied by the PS2 environment. The exFAT partition occupies all the remaining space minus the last 1MiB occupied by the GPT copy.

Advantages:

- backward compatibility with most PS2 software
- ability to auto-boot from disk (e.g. Free HDBoot)
- copying games for PS2 without the need for dedicated programs
- maximum disk size is 8ZiB (~9.44ZB)
- maximum exFAT partition size is 512TiB (~563TB)

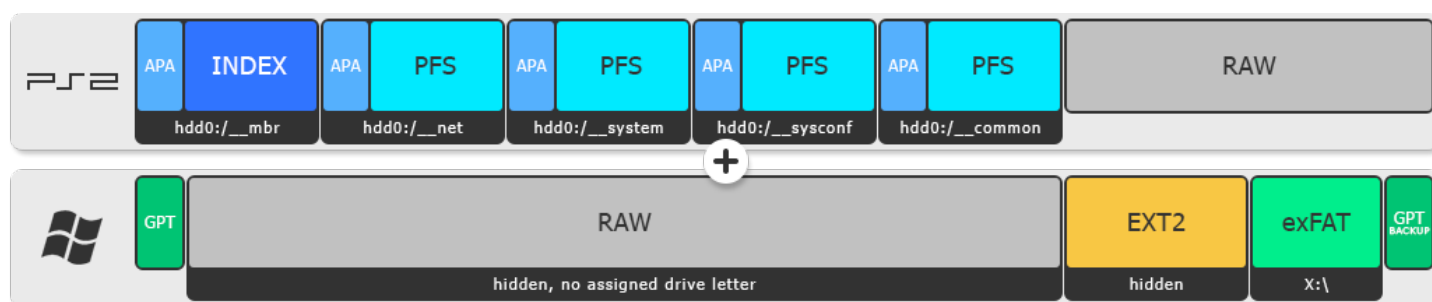
Disadvantages:

- no ability to add, delete and edit any partitions, APA chain defragmentation
- no ability to add, delete and edit any partitions on GPT



Type-B2/B3

B2 differs from its predecessor in that it is created from an already existing APA environment. The recovery partition is not created in APA space, but in the GPT, just behind the first 128GiB (A2) or 1TiB (A3). Therefore, the user cannot cross this barrier on the APA side, nor can the conversion from APA to APA-Jail take place on a disk with APA partitions above 128GiB/1TiB (the script does not check this).



Type-C

Mixed **APA with GPT (GPT backup only)**. Type-C has proven to be too problematic to use on modern Windows and Linux, so the toolkit currently does not offer its creation.

PS2: all basic APA partitions are created, plus additionally "`hdd0:/__recovery`" and "`hdd0:/+OPL`". The remaining free space (RAW) is and must remain unused, otherwise you will overwrite the data on the partition with exFAT (that is, the one on the PC side) and perhaps also the GPT copy.

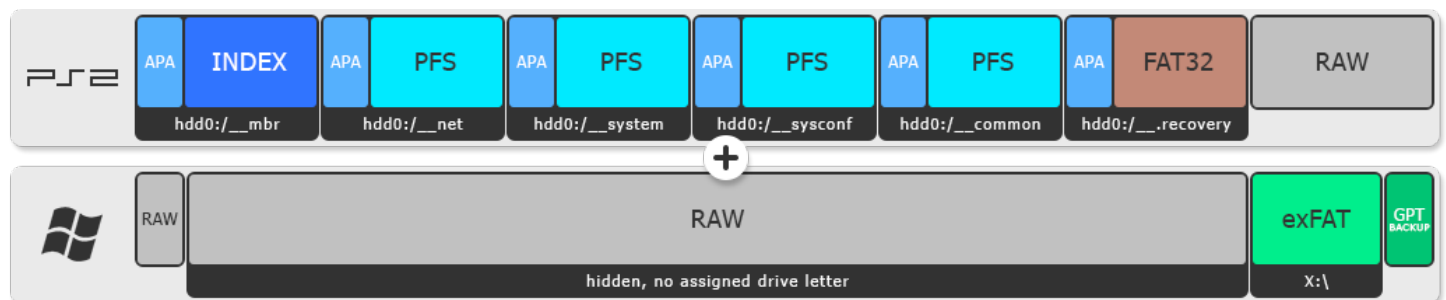
PC: The hidden partition (ID ED00, Hidden flag) RAW ("PS2 Protection Area") covers the area occupied by the PS2 environment. The exFAT partition occupies all the remaining space minus the last 1MiB occupied by the GPT copy.

Advantages:

- backward compatibility with most PS2 software
- ability to auto-boot from disk (e.g. Free HDBoot)
- copying games for PS2 without the need for dedicated programs
- maximum disk size is 8ZiB (~9.44ZB)
- maximum exFAT partition size is 512TiB (~563TB)

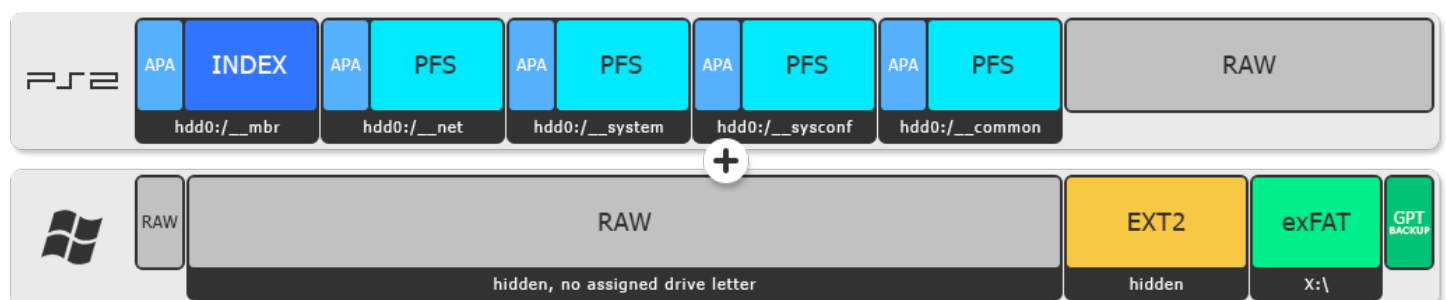
Disadvantages:

- no ability to add partitions and defragment the APA chain
- no ability to add, delete and edit any partitions on GPT



Type-C2/C3

C2 differs from its predecessor in that it is created from an already existing APA environment. The recovery partition is not created in APA space, but in the GPT, just behind the first 128GiB (A2) or 1TiB (A3). Therefore, the user cannot cross this barrier on the APA side, nor can the conversion from APA to APA-Jail take place on a disk with APA partitions above 128GiB/1TiB (the script does not check this).



GPT

Standard PC environment. The PlayStation 2 is unable to automatically boot anything from such a formatted drive because the PS2 firmware lacks GPT and exFAT support.

The only program that supports exFAT on GPT from the internal hard drive currently is [OPL GD](#).

Advantages:

- easy editing of the environment with any PC program
- copying games for PS2 without the need for dedicated programs
- maximum disk size is 8ZiB (~9.44ZB)
- maximum exFAT partition size is 512TiB (~563TB)
- possibility to use several partitions

Disadvantages:

- no possibility to auto-boot from disk (e.g. Free HDBoot)
- lack of compatibility with almost all programs for PS2



exFAT

Standard PC environment. The PlayStation 2 is unable to automatically boot anything from such a formatted drive because the PS2 firmware lacks exFAT support.

The only program that supports exFAT on GPT from the internal hard drive currently is [OPL GD](#).

Advantages:

- easy editing of the environment with any PC program
- copying games for PS2 without the need for dedicated programs
- maximum disk size is 512TiB (~563TB)

Disadvantages:

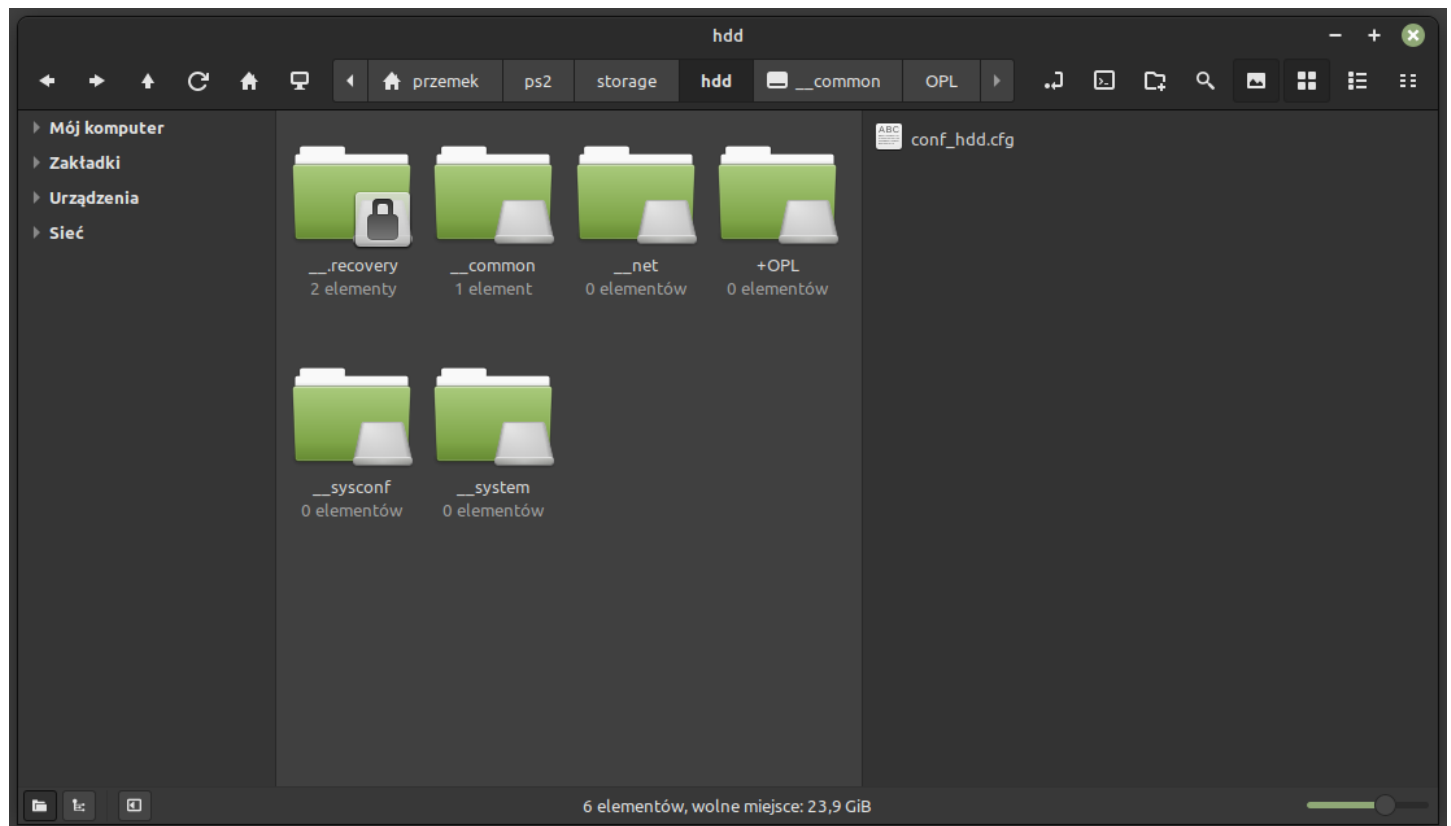
- no possibility to auto-boot from disk (e.g. Free HDBoot)
- lack of compatibility with almost all programs for PS2



HDD Mounter

The script is used to automatically mount all popular **APA** or **APA-Jail** partitions with **PFS**, **EXT2**, **RFS** and **FAT32** file systems.

All mounted partitions can be managed with any file manager ("[\\${TOOLKIT_PATH}/storage/hdd/](#)"). **Partitions with EXT2, RFS and FAT32 require root privileges.**



HDD Unmounter

The script is used to automatically unmount mounted **APA** or **APA-Jail** partitions and remove the mappers.

HDD Tasker

The script is used for special operations on the internal hard drive:

Check Disk Condition

Read S.M.A.R.T. parameters (also stored in "[\\${TOOLKIT_PATH}/logs/](#)"), from which you can assess the health of the disk.

Perform Secure Erase

Overwrite all sectors with zeros (safe for SSD as well).

Unformat Disk

Overwrite the first 128MiB and the last 1MiB of the disk with zeros.

Change Maximum Disk Size

Create an **HPA** (Host Protected Area) to reduce the disk size. This is useful when the media is too large for software to handle. Pre-defined sizes include **128GiB**, **1TiB** and **2TiB**, but you can also set any custom maximum LBA value.

Backup Or Restore APA Index

Creates or restores a copy of the "__mbr" partition. **APA** supported only. With **APA-EXT** only the first index, **APA-DVR** is completely unsupported due to encryption.

Optionally, restores the logical structure of **APA-Jail** from the recovery partition (if, of course, it still exists and its contents have remained intact since the drive was formatted or converted to APA-Jail).

Fix APA Checksum

Fixes the "__mbr" checksum.

Manipulate Bootstrap

Allows you to inject, copy or remove the bootstrap to/from "__mbr".

*Bootstrap is a boot program (encrypted and signed *.elf – the *.xin) that runs by a function in the firmware called OSD Update at console startup. It is the bootstrap that initializes the hardware and starts, for example, FHDB, PSBBL, HDD OSD, PSBBN etc.*

HDD Keygen

A script to read the **HDD ID** from the original Sony disk for PlayStation 2 (from SA/DFA) and extract a key unique to each individual disk.

USB-SIO Formatter

The script is used to format the external memory. Depending on the selected option, in different ways:

FAT32 on MBR

Ancient environment, but supported by all programs.

Limitations:

- maximum file size on **FAT32** is equal to **3.99**GiB
- maximum media size for **MBR** is equal to **2**TiB

EXT2 on MBR

An environment supported only by E2OPL.

exFAT or exFAT on MBR/GPT

The exFAT environment on MBR supports **OPL 1.2.0 and later**, XEB+, PSBBL and several other modern homebrews. exFAT on GPT or without partition table supports **OPL GD** only.

MCFS

Memory card environment for PlayStation 2. Original **PS3 Memory Card Adaptor (CECHZM1)** required for formatting.

USB-SIO Tasker

The script is used for special operations on external memory:

Check USB/MX4SIO Fake Size

Allows you to check whether the declared memory size is true.

Create All Directories Used By Homebrew Apps

Creates all necessary folders on, for example, a flash drive.

HDD Exploiter

A script used to put basic homebrew programs and exploits on disk. The official release of PS2HDH, although it includes the above script, does not include "ps2/apps/exploits/".

The missing files needed for installation (see script's code for details):

- few utility programs
- unofficial LaunchELF for DEV2
- SoftDEV2 (unofficial LaunchELF and Open PS2 Loader)
- MBRBoot (unofficial LaunchELF kHn)
- Free HDBoot (versions 1.953, 1.965 and 1.966)
- HDD OSD (standalone or for FHDB)
- PlayStation 2 Basic Bootloader

Known BUGs

To prepare the disk with APA (and therefore also to create APAJ-A and B), the PFS Shell program is used. For unknown reasons, there are times when it crashes during formatting, and thus the script never completes all the other required steps. If the process gets stuck at:

```
pfs version 0000 driver start.  
#
```

Then disconnect the drive or reboot the computer and try again. The cause of the problem is unknown, although it is probably related to USB-connected memory (so for the moment, PATA/SATA via USB and SDXC cards are not recommended). If possible, always use PATA or SATA directly plugged into the motherboard or controller on PCIe.

FAQ

The most frequently asked questions.

Q: "Are you the author of the methods, tools, etc.?"

A: Of course NOT. I am a humble graphic designer and IT specialist. I am definitely neither a programmer, nor a reverse engineer, nor even a Linux master hidden in a basement somewhere. Think of me as Prometheus bringing you fire. Just remember not to get burned by it. ;)

Q: "Can I use toolkit to write pirated copies of games?"

A: No...

Q: "Can I use WSL2?"

A: No.

Special Thanks

- For **all** involved in the development of the so-called homebrew scene, all developers of all programs, libraries, sdk etc.
- For **all** the developers of *HDL Dump*, *PFS Shell* and *PFS Fuse* (including **AkuHak**, **UYJulian**).
- For **Pinky** for writing *APA Partition Header Checksumer* for me, and **Bucanero** for Linux port.
- For **Bucanero** for an app unpacking *.psu.
- For **CosmicScale**, **Khat17**, **nuno6573**, **Ripto** and **Haker120** (**a_youkai_of_love**) for QA testing.
- For **Ripto** and **Khat17** for translating the readme and scripts into English.