RedFish OS

Do you feel the power?

RedFish OS for Mobile Smart Devices

Executive Summary

RedFish OS has the primary goal of complementing Android rather than replacing it. It can serve for various purposes, such as a flashing tool, firmware supervisor, system configuration manager, IoT fleet manager, B2C support gateway, benign rootkit for security and privacy, and a customizable device for penetration testing, which is the reason for having chosen the name RedFish OS in the first place.

Therefore, RedFish OS is a proof-of-concept demonstrating that Android hardware support, including a custom kernel and firmware blobs, can be utilised to run a traditional GNU/Linux system. This opens up a lot of modding possibilities for every device based on a System-on-Chip (SoC) with Android support.

Before RedFish OS, companies dealing with embedded systems like automotive, smart TV, and set-top box manufacturers had to customise their products for each SoC model and version. They relied on the hope that hardware producers would provide sufficient support, and they were involved in technical activities that were costly and challenging.

For more details, the following presentation is available for evaluation.

Roberto A. Foglietta

RedFish OS for Mobile Smart Devices

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Since May 26th 2023, I have been working on this project presented here below. Before introducing the project, I wish to show some picture and videos.
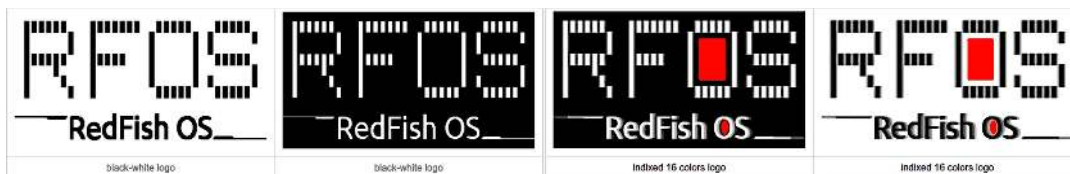
Photos

- Brand & logo: https://lnkd.in/dfP8Cw3z

- Display photos: https://lnkd.in/dumu66wh

Videos

- Multi-OS boot video: https://youtu.be/xT_MR-NgAcU

- Factory reset video: https://youtu.be/EP10Evtl0wo

Because seeing is believing.

As soon as I realised that it was going to be a product, I decided to brand it, giving it a logo that makes it recognisable to everyone and at first sight.

Logo sketches in different formats.

The RedFish OS recovery image running on a Sony Xperia 10 mark 2.

Introduction

The mobile smart devices market is a duopolio dominated by Google Android and Apple iOS, in which Nokia with Maemo before and Microsoft with Surface later failed to remain or to enter.

Despite Android being Open-Source, in practice it is unforkable because it is strictly under the control of Alphabet, the Google's company legal name. As a result, there is almost no variety at the low system level.

However, with time, a large community of modders grown up, and the XDA developers forum is one of the most exemplary cases. The /e/OS with the Murena cloud can be considered another example of successful Android modding.

Even if Android runs with a Linux kernel, there is very few examples of smartphone OS that are comparable with a traditional GNU/Linux system, which runs the internet and the cloud by a near 95% of the share.

In this scenario, every alternative is almost doomed to be a niche for advanced users, modders, and a few other group of people who strongly want to live out-of-the-pack. The recovery images are completely another story: it is a totally unexplored and unleveraged market segment. Hence, here we are!

Opportunity

We like thinking big, but for the moment, it is reasonable to forget about facing the mobile smart device end-user market directly. The potential customers are:

- modders who like to adopt a powerful tool for system administration and development will appreciate a recovery and maintenance boot image that they can use directly and that they contribute to further developing.

- smart mobile device producers like Sony and all other companies that have an Open Devices programme similar to Sony and allow their customers to mod their devices.

- Those smart devices producers will decide to adopt the RedFish OS recovery image as their default first boot image or secondary boot recovery image.

In fact, the RedFish OS boot image can perform a normal boot of any other system, whether it be an Android or something else related to a traditional GNU/Linux system.

When the mobile smart device is connected to an USB port with a data link active -- not a charger but a laptop or PC -- the normal boot is postponed, and it enters the recovery and maintenance mode, offering a variety of services and tools:

- a telnet menu by which the advanced user is guided into pre-determined actions;
- an http interface that can be controlled by a common browser on the laptop;
- a ssh connection to access a command-line terminal for extreme modding.

Obviously, like any Open-Source system, it allows to install as many tools as available for GNU/Linux distributions like CentOS, Fedora or Debian and Ubuntu which provide pre-compiled packages for the smart device CPU architecture, usually aarch64, arm7hl and i486, which cover a almost all of the mobile smart devices on the market.

Hardware support

Out in the world, there is a large plethora of smart devices that can potentially run with a GNU/Linux distribution-like system but instead, because of a lack of hardware support, can run only an Android system.
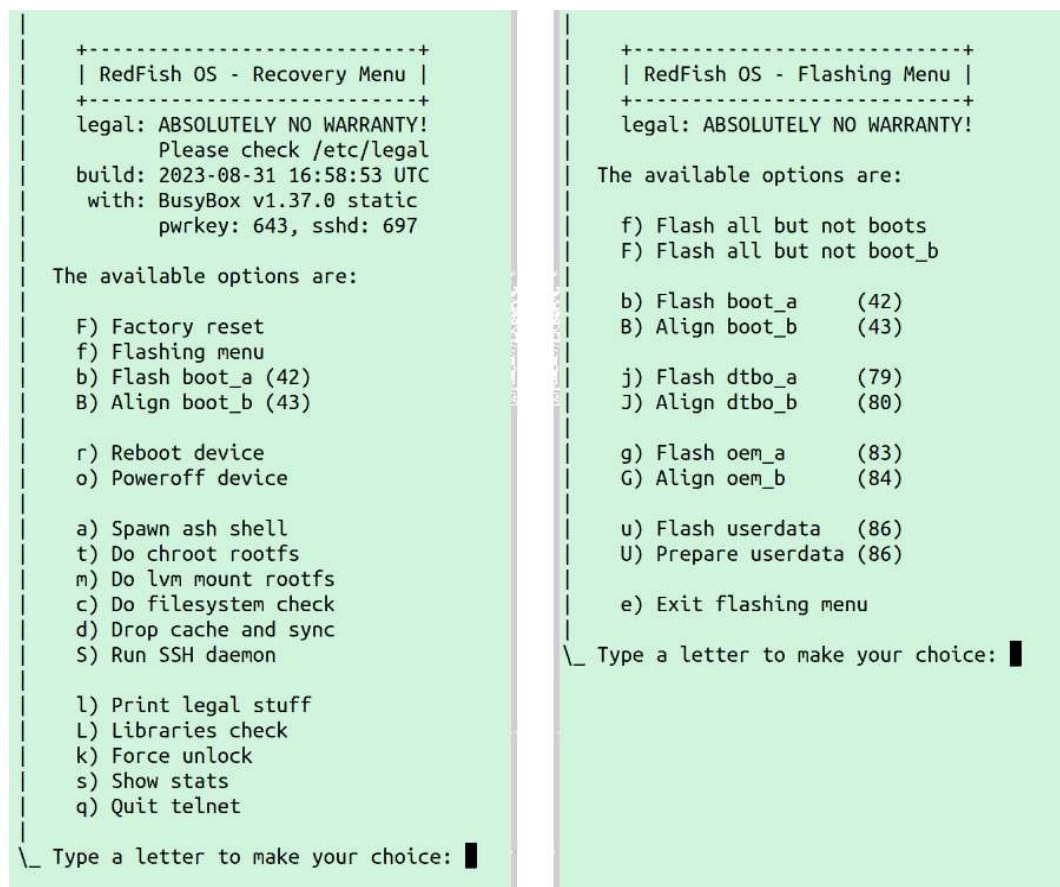
The RedFish OS is a proof-of-concept that shows that the Android hardware support -- a custom kernel plus firmware blobs -- can be leveraged to run a traditional GNU/Linux system. This expands the modding to every device that is based on a SoC hardware board for which some kind of Android support is available.

Before RedFish OS, every automotive company, smart TV, and setup box company which were dealing with embedded systems aiming to run a GNU/Linux system on one of those SoCs, they needed to customise their product for each SoC model and version, hoping that the hardware producer would support them enough in this expensive, highly technical and skilled task.

System maintenance

The RedFish OS image in recovery mode allows you to flash any device partition using standard network tools like netcat. Therefore, any software that can deal with network sockets can leverage these features:

1. connect a smart device to the laptop via a standard USB cable;
2. start a web browser or any other custom app or script based on standard tools;
3. perform a wide variety of system administration tasks in a free or guided mode.

```
|
|    +----------------------------+
|    | RedFish OS - Recovery Menu |
|    +----------------------------+
|    legal: ABSOLUTELY NO WARRANTY!
|           Please check /etc/legal
|    build: 2023-08-31 16:58:53 UTC
|     with: BusyBox v1.37.0 static
|           pwrkey: 643, sshd: 697
|
|    The available options are:
|
|    F) Factory reset
|    f) Flashing menu
|    b) Flash boot_a (42)
|    B) Align boot_b (43)
|
|    r) Reboot device
|    o) Poweroff device
|
|    a) Spawn ash shell
|    t) Do chroot rootfs
|    m) Do lvm mount rootfs
|    c) Do filesystem check
|    d) Drop cache and sync
|    S) Run SSH daemon
|
|    l) Print legal stuff
|    L) Libraries check
|    k) Force unlock
|    s) Show stats
|    q) Quit telnet
|
\_ Type a letter to make your choice: █
```

```
|
|    +----------------------------+
|    | RedFish OS - Flashing Menu |
|    +----------------------------+
|    legal: ABSOLUTELY NO WARRANTY!
|
|    The available options are:
|
|    f) Flash all but not boots
|    F) Flash all but not boot_b
|
|    b) Flash boot_a      (42)
|    B) Align boot_b      (43)
|
|    j) Flash dtbo_a      (79)
|    J) Align dtbo_b      (80)
|
|    g) Flash oem_a       (83)
|    G) Align oem_b       (84)
|
|    u) Flash userdata    (86)
|    U) Prepare userdata (86)
|
|    e) Exit flashing menu
|
\_ Type a letter to make your choice: █
```

RedFish OS telnet menu screenshots (examples)

Conclusion

The RedFish OS recovery image reached, on 24th August 2023, the levels of quality and scalability targeted for setting the main route for the entire RedFish OS. Learn more here below:

- Features, facts and stats: https://lnkd.in/d_eYvZrX

RedFish OS main goal is not to replace Android but to complement it. In fact, it can be adopted as a flashing tool, a supervising firmware, a system configuration manager, an IoT fleet manager, a B2C support gateway, a benign rootkit for security and privacy, and a mobile customizable device for penetration testing, which is why I chose the name RedFish OS in the first place.

Inspired by the Lord of the Rings main citation –– *One Ring to rule them all, One Ring to find them, One Ring to bring them all and in the darkness bind them* –– I forged the following motto:

RedFish OS, do you feel the power?

Equipped with hot-plug support and USB host-mode, both supported by the hardware and by the standard kernel, this motto is something more than a mere commercial spot.

About me

I am working on UNIX systems since 2000 and delivering products based on GNU/Linux embedded systems since 2002. I worked for a great variety of companies: large, middle and small sized in many different market sectors mainly as consultant or free-lance. I worked within large teams and in a solo or tandem high-performers.

My education is quite an unique composition: high-school degree in electronics, university bachelor in physic with a thesis in cybernetics (neural networks), a university master degree in Open-Source technologies with a thesis in real-time networking systems, a business school master in technological innovation executive management.

Therefore, I have been also educated about business administration, team organisation and project planning models, sales, marketing, patenting, licensing, copyright and copyleft law.

Contacts

For opportunities or more information, feel free to contact me by e-mail or by phone during office hours in central European time zone or to schedule a video conference.

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