



CUSTOMIZED ARCH BASED LINUX OPERATING SYSTEM : KAYOS

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Abstract—The millennial era has always been evolved around open-source functionalities and systems. When the conventional world has demanded an easy and safe systems to use, technology aspirants taking a step forward has made their tasks easy by developing several customizable products for them. Especially in computer science, the world has witnessed the focus shift from conventional and two major operating systems to Linux(major open-source contributor) based operating system. Having several distributions available of Linux, Arch is one of the major distributions which is customizable from scratch. While booting, Arch Linux just provides user with a command line, which is not very easy-to-use. So, taking this effort a step ahead this project is aiming to build a baseline operating system which has its own GUI(Graphical User Interface), desktop environment and exquisite customizations. Generally, Linux-based operating systems doesn't have their troubleshooter to counter any problem with any packages or drivers which is quite a big issue for a user. So, solving that demand upfront this project aims to build a troubleshooter. On top of that, to make it easier and more reliable to use, this project provides a user- friendly assistant which has variety of features to offer.

Keywords—Operating System, Arch Linux, Kernel, Troubleshooter, Assistant.

I. INTRODUCTION

A Linux distribution is a collection of software built around the Linux kernel [1] and in many cases, a package management system. A typical Linux distribution includes a Linux kernel [3], GNU tools and libraries, extra software, documentation, a window system, window manager, and a desktop environment, among other things. The majority of the software included is free/open-source software, which is distributed by its maintainers in both generated binaries and source code form, allowing users to change and compile the original source code if desired. There are various distributions of Linux kernel. One of the most popular community-driven distribution is Arch Linux [2]. Since its initial release in 2002, Arch Linux has slowly gained popularity as an independently created and community- maintained x86-64 GNU/Linux distribution. Since 2009, Arch Linux has been a top-10 choice for personal computers, according to distrowatch.com. But from the very beginning Arch Linux has been a command-line driven operating system, which makes it super difficult for common users to understand the interface and the system. So, this project aims to solve this major problem. The Operating System designed and built to handle all these issues is KayOS. Here GUI(Graphical User Interface) [4] over a command line makes it more understandable and easier-to-use. And there are good number of desktop environments available to offer from this version of OS which will provide enough options according to the choice of the user. Afterall, if somehow one manages to enter into the system, tackling with different errors and execution failures makes it even worse. So, there is an introduction of Troubleshooter in this project which handles such things in an optimal way. And to make the operating system more user-friendly this project offers an assistant.

II. RELATED WORK

2.1 Operating System Design

First, Arch Linux is independently developed Linux distribution system which provides the latest stable versions of software in a rolling release model. The default installation is quite minimal base system and is configured by the user only. The official images of Arch Linux are built with Archiso [12] which is a highly customizable tool for building Arch Linux live ISO images. Archiso can be built and implemented with bash scripts. One of the core components of Archiso is mkarchiso command. KayOS is being built on Archiso which is Arch Linux distribution.

Archiso comes with two profiles, releng and baseline.

Releng- To create a monthly official installation ISO [13]

Baseline- It is quite minimal [11] which includes bareminimum packages required to boot the live environment.

While booting up Arch Linux it gives command line interface which is quite peculiar for users to carry out even the basic task. The command line interface while booting up is as shown below: -



```

Arch Linux 5.17.4-arch1-1 (tty1)
archiso login: root (automatic login)

To install Arch Linux follow the installation guide:
https://wiki.archlinux.org/title/Installation_guide

For Wi-Fi, authenticate to the wireless network using the iwctl utility.
For mobile broadband (WWAN) modems, connect with the mmcli utility.
Ethernet, WLAN and WWAN interfaces using DHCP should work automatically.

After connecting to the internet, the installation guide can be accessed
via the convenience script Installation_guide.

root@archiso # _

```

Fig. 1 Live ISO shows command Line Interface

For building the entire ISO, build all the necessary packages and add it to packages .conf for installation. The project uses releng profile for the building of ISO which is done through the below process.

- i. Find the archiso folder in the file system and put it in any directory.
- ii. Obtain the baseline profile and delete the releng profile.
- iii. Create a build folder for building of installation scripts in the same directory as of archiso folder and a new folder for building of ISO image.
- iv. After that build the basic iso from scratch by using the following command which is: -

```

sudo mkarchiso -v -w /home/kayos/ Desktop/build/ -o /home/kayos/Desktop/out/ /
home/kayos/Desktop/archiso/configs/releng

```

```
root@kali:~# sudo mkarchiso -v -w work/ -o out/ /home/yash/KayOS/Main/releng/
[sudo] password for yash:
[mkarchiso] INFO: Validating options...
[mkarchiso] INFO: Done!
[mkarchiso] INFO: mkarchiso configuration settings
[mkarchiso] INFO: Architecture: x86_64
[mkarchiso] INFO: Working directory: /home/yash/KayOS/Main/releng/work
[mkarchiso] INFO: Installation directory: arch
[mkarchiso] INFO: Build date: 2022-04-24T21:23+0530
[mkarchiso] INFO: Output directory: /home/yash/KayOS/Main/releng/out
[mkarchiso] INFO: Current build mode: iso
[mkarchiso] INFO: Build modes: iso
[mkarchiso] INFO: GPG key: None
[mkarchiso] INFO: GPG signer: None
[mkarchiso] INFO: Code signing certificates: None
[mkarchiso] INFO: Profile: /home/yash/KayOS/Main/releng
[mkarchiso] INFO: Pacman configuration file: /home/yash/KayOS/Main/releng/pacman.conf
[mkarchiso] INFO: Image file name: KayOS-2022.04.24-x86_64.iso
[mkarchiso] INFO: ISO volume label: KayOS_202204
[mkarchiso] INFO: ISO publisher: KayOS
[mkarchiso] INFO: ISO application: kayOS Live/Rescue CD
[mkarchiso] INFO: Boot modes: bios.syslinux.sbr bios.syslinux.eltorito uefi-x64.systemd-boot.esp uefi-x64.systemd-boot.eltorito
[mkarchiso] INFO: Packages File: /home/yash/KayOS/Main/releng/packages.x86_64
[mkarchiso] INFO: Packages: alsa-utils amd-ucode arch-install-scripts archinstall b43-fwcutter base bind-tools britty broadcom-wl htrfs-progs clonezilla cl
bud-init cryptsetup darkhttpd ddrescue dhclient dhcpcd diffutils dmraid dnsaioq dofstools e2fsprogs esk2-shell efibootmgr espeakup ethtool exfatprogs f2fs-tools fatresize fs
archiver gnu-netcat gpart gptfdisk grml-zsh-config grub hdparm intel-ucode ipw2100-fw ipw2200-fw irssi iw lwd jfsutils kitty-terminfo less lftp libfido2 libusb-compat lin
ux linux-atm linux-firmware linux-firmware-marvell livecd-sounds lsscsi lvm2 lynx man-db man-pages mc mdadm memtest86+ mkinitcpio mkinitcpio-archiso mkinitcpio-nfs-utils mode
mmanager atools nano nbd ndisc6 nfs-utils nilfs-utils nmap ntfs-3g nvme-cli openconnect openssh openvpn parted partimage pcsclite ppp pptpclient pv qemu-guest-agent
p refind reflector reiserfsprogs rp-pppoe rsync rxvt-unicode-terminfo screen sdparm sg3 utils smartmontools sof-firmware squashfs-tools sudo syslinux systemd-resolvconf tcpdump
p terminus-font testdisk tmux tm2-tss udfutils usb_modeswitch usbmuxd usbutils vim vnc vrtualbox-guest-utils wireless-regdb wireless_tools wpa_supplicant wvdial xfsprogs x
L2tpd zsh xorg-server xorg-apps lightdm lightdm-gtk-greeter xfce4 xfce4-goodies
[mkarchiso] INFO: Copying custom pacman.conf to work directory...
[mkarchiso] INFO: Using pacman CacheDir: /var/cache/pacman/pkg/
[mkarchiso] INFO: Copying custom airootfs files...
[mkarchiso] WARNING: Cannot change permissions of '/home/yash/KayOS/Main/releng/work/x86_64/airootfs/usr/local/bin/pacman-beep.sh'. The file or directory does not exist.
[mkarchiso] WARNING: Cannot change permissions of '/home/yash/KayOS/Main/releng/work/x86_64/airootfs/etc/ghostow'. The file or directory does not exist.
[mkarchiso] INFO: Done!
[mkarchiso] INFO: Installing packages to '/home/yash/KayOS/Main/releng/work/x86_64/airootfs/'...
=> Creating install root at /home/yash/KayOS/Main/releng/work/x86_64/airootfs
=> Installing packages to /home/yash/KayOS/Main/releng/work/x86_64/airootfs
:: Synchronizing package databases...
core                               158.2 KiB   337 KiB/s 00:00 [#####] 100%
extra                             1699.8 KiB  992 KiB/s 00:02 [#####] 100%
community                         6.6 MiB    4.00 MiB/s 00:02 [#####] 100%
```

Fig. 2 It shows the use of mkarchiso command to build the ISO

The desktop environment that is used in this system is XFCE which is quite simple and aesthetic. The KayOS system is shown below:



Fig . 3 The desktop environment XFCE of the system KayOS

2.2 Troubleshooter

By definition troubleshooter [8] is the process of identifying and resolving different problems occurring in the system. When a computer or program becomes broken, unresponsive, or behaves abnormally, it can be repaired and restored through this troubleshooting process. It is used to keep a system or program in the desired state, particularly when it encounters or exhibits a problem. It's a systematic approach done within one or more phases depending on the complexity of a problem.

Identifying the problem is usually the first stage, followed by devising a solution to address the issue and finally putting that solution into action. However, there may be multiple causes for the problem, necessitating a more involved treatment. A person debugging such a situation could try a variety of alternatives in order to resolve the issue. Troubleshooting can be based on hardware and software depending on the issue a user is facing while operating the system. Some very common problems that a normal user faces in a day-to-day use are like sound issue, driver issue, update issue, backup, device peripheral issue, display issue, account, security etc.

Troubleshooting process steps

- i. Identify the problem in the system.
- ii. Find a probable cause.
- iii. Find a plan to resolve the problem and implement the solution.
- iv. Take full system test and apply preventive measures.

The troubleshooter built for the system is KayOS troubleshooter which has numerous numbers of features for the help of a user.

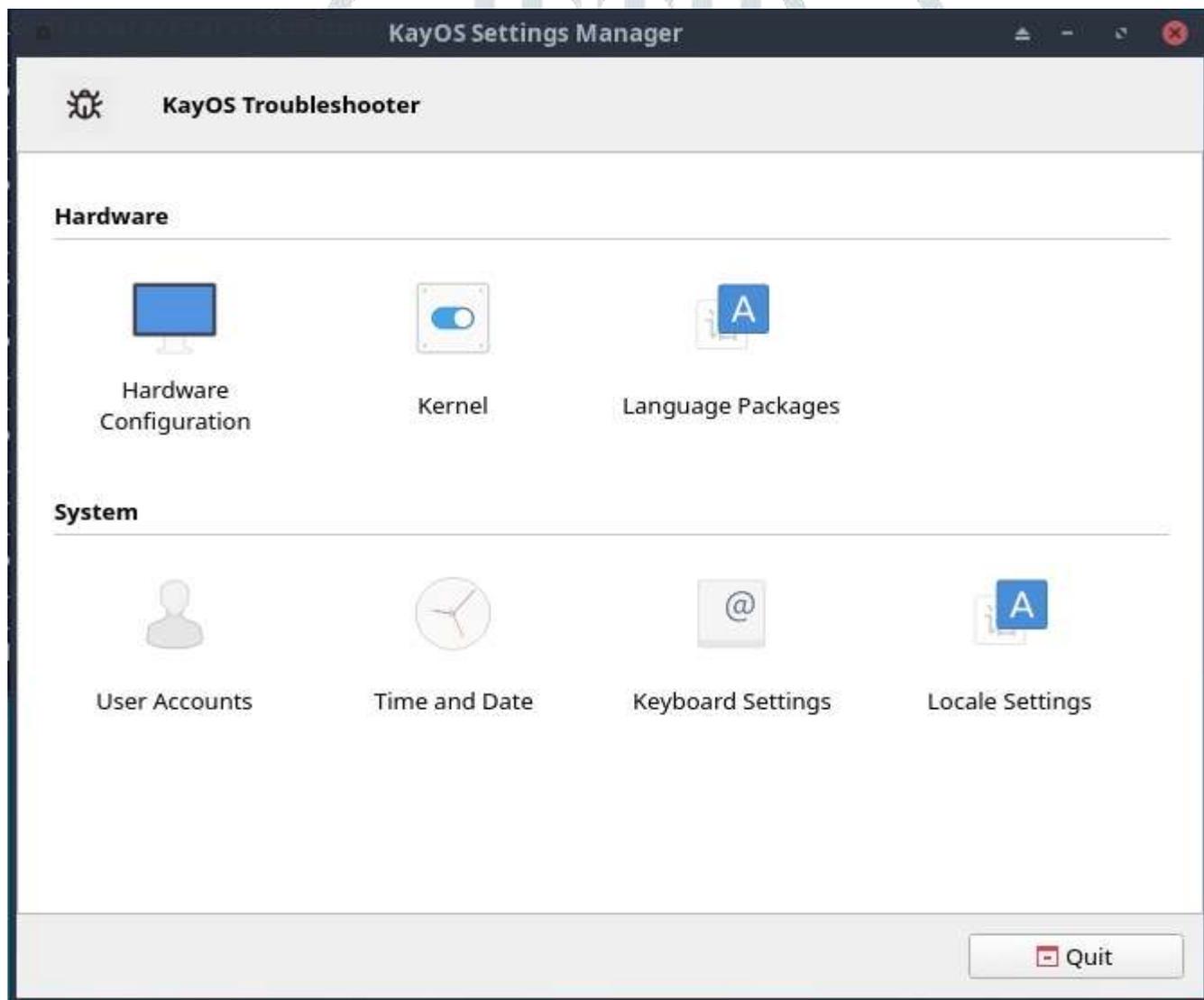


Fig . 4 KayOS Troubleshooter

2.3 Assistant

Generally, Linux operating systems don't have any assistant [10] for users. But with introducing an assistant it provides users an ease of access. Assistant does the work of cluttering an entire iota of programs in a single place which is quite helpful as everything is there in just one click away. Assistant helps user to pick drivers, change desktop environment, change grub themes and many more useful functions. It also provides users to update mirrors of the system and choose terminal of their wish.

The assistant built for this system is KayOS assistant and comes with exquisite built-in features for users.

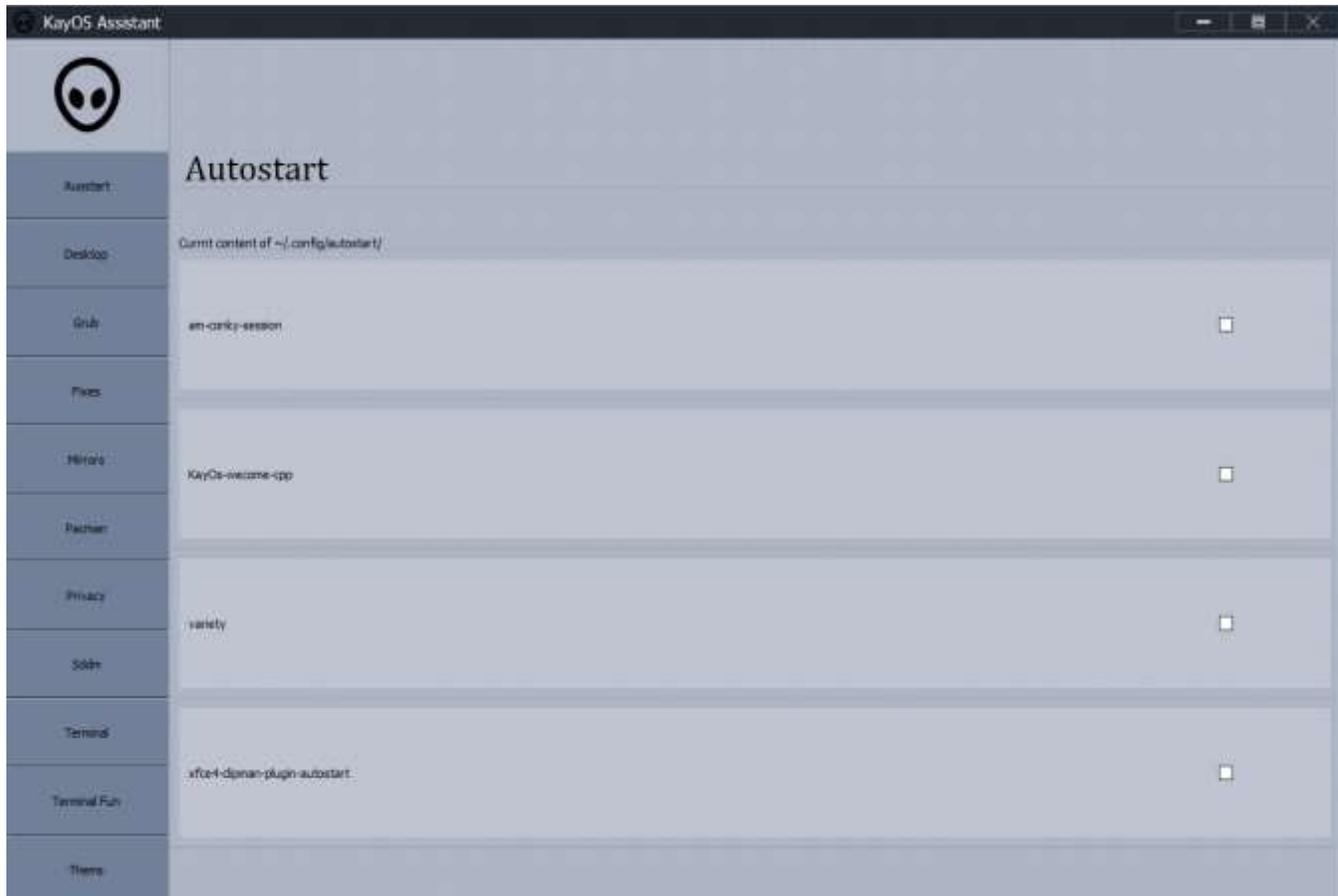


Fig . 5 KayOS Assistant

2.4 Package Management System

KayOS is based on Arch Linux which has its own package management system called pacman [9], which is also the command line utility which is going to manage the packages. It is straightforward and reliable package manager which includes everything a user required to get started.

The pacman packages have .pkg.tar.xz extension.

It is built on ABS(Arch Build System) which allows user to tweak any official package or even develop their own package from the third-party sources. The packages can be configured using a PKGBUILD(a shell script) package description that can be compiled from source and built into a package that can be installed using pacman. The main advantage Arch Linux distribution gives over other distribution is its user repository which is also known as AUR [14](Arch User Repository). It is a community driven repository [7] which allows user to get PKGBUILDS which allow user to compile a package from source and install it via pacman. The AUR was established to assist organize and disseminate new community packages as well as to speed up the admission of popular packages into the community repository.

2.5 Maintenance

As KayOS is based on Arch Linux distribution there is necessity to manage applications and perform updates. The duties of managing programmes and upgrading them are done through command line in KayOS. Pacman does the task efficiently.

Various commands for managing applications and the system are as follows: -

To install [9] any application –

```
$ pacman -S git (For installation of git)
```

To remove it, use this command –

```
$ pacman -R git
```

For making regular updates, the command is like

```
$ pacman-Syu
```

or we can use

```
$ update
```

To get the idea of the disk storage, use the command-

```
$ duf
```

To know the version of any package, use command –

```
$ sudo pacman -Q archiso (to know the version of archiso).
```

```

17 ~ /K/M/releng
ls
drwxr-xr-x - yash 20 Apr 19:41  airootfs
drwxr-xr-x - yash 18 Apr 23:23  efiboot
drwxr-xr-x - yash 24 Apr 21:51  out
drwxr-xr-x - yash 18 Apr 23:23  syslinux
drwxr-xr-x - yash 24 Apr 21:52  work
.rw-r--r-- 26 yash 18 Apr 23:23  bootstrap_packages.x86_64
.rw-r--r-- 1.3k yash 20 Apr 19:24  packages.x86_64
.rw-r--r-- 3.0k yash 18 Apr 23:23  pacman.conf
.rw-r--r-- 945 yash 20 Apr 21:33  profiledef.sh
18 ~ /K/M/releng
ls airootfs/
drwxr-xr-x - yash 24 Apr 20:06  etc
drwxr-xr-x - yash 20 Apr 19:41  home
drwxr-xr-x - yash 24 Apr 20:49  root
drwxr-xr-x - yash 20 Apr 20:08  usr
19 ~ /K/M/releng

```

Fig . 6 Build/Base structure of the system

Some long-term duties are required such as updating the keyring or mirrorlist and also recommended to perform updates on daily basis as there maybe changes that maybe necessitate it.

If any of the packages are installed from the AUR, there are several tools that can be used such as yaourt, pacaucrower. They are unofficial apps which can be used to have more control in the process.

2.6 Pros and Cons

Pros-

- It comes with a great package manager and ABSand AUR.
- It is fully customizable which gives user a load of options to make the system look exquisite.
- By introducing troubleshooter, it is going to be a boon for users to get the issue solved.
- Assistant is a great tool which will be in action in this system and would provide users with lot of options to manage their system in an easier way.

Cons-

- No commercial support.
- Since it is based on Arch Linux which has a rolling release so there is a bit of instability.
- Users should have brief idea about terminal.

III. FUTURE ASPECTS

The open source has come a long way. It's been 20 years since Arch Linux rolled out for the first time. It's arguably the most widely known rolling-release distribution so far. A lot of new features have been developed for this environment by the developers over the years. Still there are many opportunities left for exploration and development. Especially for open source the end limit is always infinite. Some easy-to-approach development aspects are as follows :

3.1 Voice Assistant

Voice assistant is one of the basic IoT(Internet of Things) devices that found in almost everywhere these days. It would be a huge milestone to develop a feature in this OS which will integrate voice assistants.

3.2 Smart Devices

Headings, or heads, are organizational devices that guide the reader through your paper. There are two types: component heads and text heads.

3.3 Better Navigation Features

Finding indexes of folder is a time taking job, since it can be tedious this process can be made smoother with the help of better indexing algorithm which can be implementing in this environment.

3.4 Better Collaboration

Distributed Operating systems like Linux and Unix have already come a long way, but since this environment follow through the features of arch Linux, OS distribution can be promoted to ensure better collaboration.

Majorly all the features that require machine learning and artificial intelligence to develop more tools to make our daily lives better are still unexplored.

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