Stable RPM Based Linux Distros for the Raspberry Pi 4

Rexx LA 2021 Online Symposium
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Presentation Overview

- Criteria for Distro Selection
- Candidates Considered and Selected
- Reasons for Distros Selected / Rejected
- CentOS 7 64 Bit - OS & OpenJDK Installation How Tos
- OpenSUSE Leap 15.3 - OS & OpenJDK Installation How Tos
- Alma Linux 8.4 64 Bit - OS & OpenJDK Installation How Tos
- NetRexx v3.09GA Installation
- Open Object Rexx 5.0 Beta Installation
- BSF4ooRexx v641 Installation
- Comparison and Findings for The 3 Distros
- Pros and Cons For Distros
- List of References
- Acknowledgements
- Questions? Comments?
Criteria for Distro Selection

Objectives and Desired Functionality for Install and Use

- **Open Source**
- Take Advantage of the **RPi4 64 Bit Processor** (aarch64 Architecture)
- **Ease of Installation** – Reliability of Installation Process; No Post Install System Freezes
- **GUI Manager Installation Available** – Stability & Speed of the GUI Windows
- **Runs on 4GB Raspberry Pi 4B** without Excessive Wait Time
- **Performance That is Better than Windows 10 Professional**
- **Long-Term Support** (LTS) Life Cycle That is at Least 2 Years
- **Stable Update Process** (No “Bleeding Edge” System Breaks)
- Allows Setup of **Open JDK 8 (1.8) or Oracle JDK8**
- Allows Setup of **NetRexx v3.09GA and Up**
- Allows Setup of **ooRexx 5.0 Beta and BSF4ooRexx v641**
Candidates Considered and Selected

Red Hat Project Family
- Fedora 33 and 34 (aarch64)
- RHEL 8 (aarch64)

CentOS Project Family
- CentOS 7 (aarch64) <=
- CentOS 8 (aarch64)
- Alma Linux 8.4 (aarch64) <=
- Rocky Linux 8 (aarch64)

OpenSUSE Project Family
- Leap v15.2 and 15.3 <=

Oracle Linux Project
- Oracle Linux v7.9 and 8.4
Candidates **Accepted** and Rejected with Reasons

**Red Hat Project Family**
- **Fedora 33 and 34** (aarch64) <= Fedora Releases are Maintained for about a year and a month --
- **RHEL 8** (aarch64) <= Fee for Installation --

**CentOS Project Family**
- **CentOS 7** (aarch64) <= Server with GUI Installation Relatively Easy to Install; End of Life is June 30, 2024 ++
- **CentOS 8** (aarch64) <= Red Hat Shortened End of Life to December 31, 2021 --
- **Alma Linux 8.4** (aarch64) <= Server with GUI Installation Relatively Easy and similar to CentOS 7 Install ++
- **Rocky Linux 8** (aarch64) <= Both an SD Card and USB Drive are required for Standard Installation. --===>Update ... There is now a 3rd Party SD Card Based Install Image

**OpenSUSE Project Family**
- **openSUSE Leap v15.2** and **15.3** <= 15.2 has no Audio Support & Poor Monitor Use --; 15.3 has Audio & Improved Monitor Use; Customizations to Speed Up Startup on the Raspberry Pi SBCs +++

**Oracle Linux Project**
- **Oracle Linux v7.9 and 8.4** (aarch64) <= Unable to Configure GUI; causes System Startup Freeze ---
Navigate to a CentOS 7 Server ARM64 Download Directory

- **Example URL for UC Berkeley Mirror**: https://mirrors.ocf.berkeley.edu/centos-altarch/7.9.2009/isos/aarch64/images/

- For SDHC Card **64 Bit Image** Select The Following Compressed Image File:
  
  **CentOS-Userland-7-aarch64-generic-Minimal-2009-sda.raw.xz**

Flash the Image to a SDHC Card

- Use a Utility such as **Balena Etcher** or **Raspberry Pi Imager** to Flash The Image to a SDHC Card (Recommendation use a Good Quality Card with at Least 64GB Capacity)
CentOS 7 64 Bit - OS Installation How To - II

Insert SDHC Card into the RPi4 and Initial Boot Steps

- **Enter Credentials -- User:** root **Password:** centos
- To change root password from OS Prompt
  
  `# passwd`

- To Add a New User Id:
  
  `# useradd USERNAME -G wheel -p PASSWORD`

- To Apply System Updates logged in as root
  
  `# yum update -y`

- To Apply System Updates logged in as a super user
  
  `$ sudo yum update -y`
GUI Desktop Setup for CentOS 7

- To List Install Groups
  
  # yum grouplist

- To Add the GNOME Desktop GUI:
  
  # sudo yum groupinstall "GNOME Desktop"

- Reboot The RPi4 Workstation and Login

- The KDE Desktop is Also Available but Does Require More Overhead and is slower Performance versus GNOME
OpenJDK 1.8 Setup for CentOS 7

- To Search for OpenJDK Packages:

  # yum search openjdk

- To OpenJDK Version 1.8:

  $ sudo yum install openjdk-1.8

- **Set $JAVA_HOME and $PATH Environments** in .bashrc (local to User Id logged in)

  - Use a Text Editor such as nano, SciTE, jedit, nedit or gedit
  - Add the Followining to .bashrc:

    ```bash
    export JAVA_HOME=/usr/lib64/jvm/java-1.8.0
    export PATH=$JAVA_HOME/bin:$PATH
    ```

- To Test Environment Settings:

  $ javac -version
Navitate to a openSUSE Leap 15.3 Download Directory

- Example URL for Xfce Image File Download:
  http://download.opensuse.org/distribution/leap/15.3/appliances/openSUSE-Leap-15.3-ARM-XFCE-raspberrypi.aarch64.raw.xz

- Download Images also exist for the Following Desktop GUIs:
  JeOS, E20, LxQt, KDE and X11

Flash the Image to a SDHC Card

- Use a Utility such as Balena Etcher or Raspberry Pi Imager to Flash The Image to a SDHC Card (Recommendation use a Good Quality Card with at Least 64GB Capacity)
OpenSUSE Leap 15.3 64 Bit - OS Installation
How To - II

Insert SDHC Card into the RPi4 and Initial Boot Steps

- **Enter Credentials -- User**: root **Password**: linux
- Follow The Sets for the openSUSE Setup Wizard (This GUI wizard covers more setup features than CentOS 7 and Alma Linux 8.4)

To Apply System Updates logged in as root

```bash
# zypper update  (Answer “y” to prompt)
```

- To Apply System Updates logged in as a super user

```bash
$ sudo zypper update
```

- Wiki Reference for openSUSE Installation on the Raspberry Pi 4:
  
  **URL**: https://en.opensuse.org/HCL:Raspberry_Pi4
OpenJDK 1.8 Setup for openSUSE Leap 15.3

- To Search for OpenJDK Packages:
  
  # zypper se openjdk

- To OpenJDK Version 1.8:

  $ sudo zypper install openjdk-1.8

- Set $JAVA_HOME and $PATH Environments in .bashrc (local to User Id logged in)

  - Use a Text Editor such as nano, SciTE, jedit, nedit or gedit
  - Add the Following to ~/.bashrc File:

    export JAVA_HOME=/usr/lib64/jvm/java-1.8.0-openjdk-1.8.0
    export PATH=$JAVA_HOME/bin:$PATH

- To Test Environment Settings:

  $ javac -version
Navigate to a AlmaLinuxServer aarch64 Download Directory

- Download the Minimal Server Image Customized for the RPi4:
  
  https://repo.almalinux.org/rpi/images/AlmaLinux-8-aarch64-RaspberryPI-Minimal-4-sda.raw.xz

Flash the Image to a SDHC Card

- Use a Utility such as Balena Etcher or Raspberry Pi Imager to Flash The Image to a SDHC Card (Recommendation use a Good Quality Card with at Least 64GB Capacity)
Insert SDHC Card into the RPi4 and Initial Boot Steps

- **Enter Credentials -- User**: root **Password**: almalinux
- To change root password from OS Prompt
  
  ```
  # passwd
  ```
- To Add a New User Id:
  
  ```
  # useradd USERNAME -G wheel -p PASSWORD
  ```
- To Apply System Updates logged in as root
  
  ```
  # dnf update -y
  ```
- To Apply System Updates logged in as a super user
  
  ```
  $ sudo dnf update -y
  ```
Resize the Root Partition to Use Available Space on SDHC Card Steps

- **Execute parted as root** (# Prompt on Shell):
  
  ```shell
  parted
  ```

- Run print free to get partition list and sizes including free space. The root file system will exist on the 3\(^{rd}\) partition: `devmmcblk0p3`
  
  ```shell
  print free
  ```

- **Resize the 3\(^{rd}\) Partition to Use All Free Space**
  
  ```shell
  resizepart 3
  ```

- For The **End** Prompt Enter the Size of Your SDHC Card in GB. For Example, a 64GB Card: `64GB`

- Save The Changes
  
  ```shell
  quit
  ```

- **Resize The File System 3\(^{rd}\) Partition**
  
  ```shell
  # resize2fs /dev/mmcblk0p3
  ```

- Verify Available Used and Free Space
  
  ```shell
  # df -h
  ```
OpenJDK 1.8 Setup for Alma Linux 8

- To Search for OpenJDK Packages:
  
  `# dnf search openjdk`

- To OpenJDK Version 1.8:
  
  `$ sudo dnf install openjdk-1.8`

- **Set $JAVA_HOME and $PATH Environments** in .bashrc (local to User Id logged in)

  - Use a Text Editor such as nano, SciTE, jedit, nedit or gedit
  - Add the Following to .bashrc:

    ```
    export JAVA_HOME=/usr/lib/jvm/java-1.8.0-openjdk-1.8.0.302.b08-0.el8_4.aarch64
    export PATH=$JAVA_HOME/bin:$PATH
    ```

- To Test Environment Settings:
  
  `$ javac -version`
NetRexx v3.09GA Installation

Download the Zip Archive from URL:
- http://www.netrexx.org/downloads.nsp

Create a netrexx subdirectory off the /opt Path
- $ cd /opt
- $ sudo mkdir netrexx

Copy to the Distros ‘/opt/netrexx’ directory:
- $ sudo cp $HOME/Downloads/NetRexx3.09GA.zip /opt/netrexx

Unzip The Archive
- $ sudo unzip NetRexx3.09GA.zip

Copy The lib and runlib Jar File to OpenJDK8 Extension Library
- $ sudo cp ./lib/*.jar $JAVA_HOME/jre/lib/ext
- $ sudo cp ./runlib/*.jar $JAVA_HOME/jre/lib/ext
Install The Following Packages with Dependencies Using Distro Command Line Package Tool

- CentOS 7
  $ sudo yum install cmake
  $ sudo yum install subversion
  $ sudo yum install g++

- openSUSE Leap 15.3
  $ sudo zypper install cmake
  $ sudo zypper install subversion
  $ sudo zypper install gcc-c++

- AlmaLinux 8.4
  $ sudo dnf install cmake
  $ sudo dnf install subversion
  $ sudo dnf install g++
Open A Terminal Command Shell And Run The Following To Build & Install the ooRexx 5.0 Beta

- **All 3 Distros**

  `$ cd $HOME`
  `$ mkdir oorexx`
  `$ cd oorexx`
  `$mkdir build`
  `$ cd build`
  `$ svn checkout svn://svn.code.sf.net/p/oorexx/code-0/main/trunk oorexx-code-0`
  `$ cd oorexx-code-0`
  `$ cmake .`
  `$ sudo make install`

- **Verify The Version Build of ooRexx**

  `$ rexx -V`
Install the ooRexx 5.0 Beta Issue on Alma Linux 8.4

- Verify The Version Build of ooRexx Using sudo
  
  $ sudo rexx -V

- Alma Linux is unable to locate the `rexx` and `rxqueue` binaries utilized by the BSF4ooRexx Linux Install Shell Scripts

  - Workaround:
    
    Create Symbolic Link pointing ooRexx binaries in `/usr/local/bin` to `/usr/bin` (omitting the single quotes below)
    
    $ sudo ln -s `/usr/local/bin/rexx` `/usr/bin/rexx`
    $ sudo ln -s `/usr/local/bin/rxqueue` `/usr/bin/rxqueue`

- All Distros
  
  If rexx -V fails to find the ooRexx binary ... consider refresing the Shared Object Library cashe

  $ sudo ldconfig
Navigate to the Following URL for BSF4ooRexx Download:

Download the BSF4ooRexx Install Zip Archive:
- BSF4ooRexx_install_v641-20210807-beta.zip
- Open A Bash Shell; Unzip The Archive

Copy Folder bsf4oorexx to a Directory of Your Choosing
- For Example:
  $ cp $HOME/Downloads/<bsf-version-folder>/bsf4orexx $HOME

Change to the install/linux subdirectory; Run The Install Shell
$ cd $HOME/bsf4oorexx/install/linux
$ sudo sh ./install.sh
Default Installation Will Reside in Directory:
- /opt/BSF4ooRexx

Copy Jar File to Java JRE Extensions Library:
- sudo cp bsf*.jar $JAVA_HOME/jre/lib/ext

Refresh The Shared Object Load Library Cache:
- sudo ldconfig

Run The Classic Rexx Sample Program:
GetJavaSystemProperties.rxj

$ cd /opt/BSF4ooRexx
$ sh ./rexxj2.sh ./samples/classicRexxSamples/GetJavaSystemProperties.rxj
Comparing the 3 Distros

**Best Desktop GUI:**
- openSUSE Leap 15.3 Xfce
  - Fastest Performance
  - Make Optimum Use of Display
  - Best User Experience on a Small Screen Display

**Best Performance:**
- 1st: CentOS 7
  - 2nd: Alma Linux
  - 3rd: openSUSE

**Fastest Bootup:**
- 1st: Alma Linux
  - 2nd: CentOS 7
  - 3rd: openSUSE

**Closest to CentOS Standard:**
- 1st: CentOS 7
  - 2nd: Alma Linux
  - 3rd: openSUSE
- openSUSE deviates from certain Red Hat conventions more than the other 2 distros
Findings for the 3 Distros

OpenJDK 1.8:
- RPM Packages with Dependencies are Available for All 3 Distros

User Libraries:
- **Alma Linux** – References to ‘/usr/local/lib64’ and ‘/usr/local/lib’ needed to be added for Software to Find The Shared Object Libraries for ooRexx and BSF4ooRexx

OoRexx Binaries:
- **Alma Linux** – Running sudo to ooRexx executables in ‘/usr/local/bin’ resulted in a Not Found Condition. Added Symbolic Link of `rexx` and `rxqueue` binaries to ‘/usr/bin’

RPI Userland Utilites:
- Unavailable for all 3 Distros; Unable to Install on openSUSE Leap 15.2 and 15.3
- Can Be Installed on CentOS 7 and Alma Linux 8
Pros and Cons – CentOS 7

CentOS7

+ Pros
  - Closest to Red Hat Enterprise Linux Convention
  - Boots Quickly
  - 2nd Best Repository of Available Packages
  - LTS Support Through End of June 2024

- Cons
  - Install of GNOME Desktop Does Not Use The Full Display Screen
  - Slow Speed of Software Updates
  - GUI Software Updater is lacking in some of the Functionality of Other Install Facilities Such As Synaptic, For Example
  - Limited Desktop GUI Installs: GNOME and KDE
Pros and Cons – openSUSE Leap 15.3

openSUSE

+ **Pros**
  - Slickest Desktop that is Already Built into the Install Image
  - Boots Quickly
  - Best Repository of Available Packages
  - Several Choices for Desktop GUI

- **Cons**
  - Deviates from Red Hat Enterprise Linux Convention
  - Slow Speed of Software Updates
  - R Pi Userland Utilities Could Not Be Installed
  - Earliest End of Life Support Date: End of November 2022
Pros and Cons – Alma Linux 8

Alma Linux 8

+ **Pros**
- Close to Red Hat Enterprise Linux Convention
- Boots Quickly
- Quick Speed of Software Updates
- Best LTS Support Through At Least 2029

- **Cons**
- Install of GNOME Desktop Does Not Use The Full Display Screen
- Worst Repository of Available Packages
- GUI Software Updater is lacking in some of the Functionality of Other Install Facilities Such As Synaptic, For Example
- Limited Desktop GUI Installs: GNOME and KDE
- Least Stable – Some Bugs due to the Very Recent Implementation
# List of References - CentOS 7

## CentOS 7 Installation Resources

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</tr>
<tr>
<td>Make Tech Easier – How to Install CentOS on a Raspberry Pi by John Perkins</td>
<td><a href="https://www.maketecheasier.com/install-centos-on-raspberry-pi/">https://www.maketecheasier.com/install-centos-on-raspberry-pi/</a></td>
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<tr>
<td>Open Logic – The Long-Term Outlook for CentOS 7 Support</td>
<td><a href="https://www.openlogic.com/blog/long-term-outlook-centos-7-support">https://www.openlogic.com/blog/long-term-outlook-centos-7-support</a></td>
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# OpenSUSE Raspberry Pi Installation Resources

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</tr>
<tr>
<td>GitHub – Alma Linux / Raspberry Pi4</td>
<td><a href="https://github.com/AlmaLinux/raspberry-pi/">https://github.com/AlmaLinux/raspberry-pi/</a></td>
</tr>
<tr>
<td>ASCII Cinema – How to Install and Configure Alma Linux on Raspberry Pi?</td>
<td><a href="https://asciinema.org/a/423618">https://asciinema.org/a/423618</a></td>
</tr>
<tr>
<td>You Tube Video – GNOME Desktop on Raspberry Pi</td>
<td><a href="https://www.youtube.com/watch?v=HbPRKJrYFbQ">https://www.youtube.com/watch?v=HbPRKJrYFbQ</a></td>
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## List of References - Miscellaneous

### Various Resources Pertaining to Rpi Userland and Linux

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<td>Download Mirror of Rpi Userland Utilities</td>
<td><a href="https://github.com/raspberrypi/userland.git">https://github.com/raspberrypi/userland.git</a></td>
</tr>
<tr>
<td>GitHub – Rpi Userland Project – Source code for ARM side libraries for interfacing to Raspberry Pi GPU.</td>
<td><a href="https://github.com/raspberrypi/userland">https://github.com/raspberrypi/userland</a></td>
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</tbody>
</table>
Acknowledgements

Special Thanks to Rexx LA Members ...

Mr. Rene` Jansen – For Providing Subversion Checkout and Build Information for the ooRexx 5.0 Beta on Linux

Dr. Rony Flatscher – For Providing Subversion and Build Information for the BSF4ooRexx Source Code Build and Maintenance

Special Thanks to Linux Contributor ...

Mr. Pablo Greco – For His Efforts in Providing Raspberry Pi Images for both the CentOS and Alma Linux Linux Projects

Background Info on Pablo:

https://www.redhat.com/sysadmin/users/pablo-greco
End of Presentation

Image of Raspberry Pi 4B SBC

Questions?
Comments?