

Tiny RDKB support for RPI Reference Platform

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Reference only(All changes merged to rdk-next and available in all releases)

Introduction

Tiny RDKB is an effort focused on reducing the RFS of mainline RDKB. While there are many different ways are being explored and worked upon for reducing the overall image size, this particular document is aiming at capturing the Tiny RDKB effort .

Major Highlights to be taken in RDKB RPI : Removed the Unused Modules ,XML files ,scripts, systemd files ,configuration files,libraries and binaries /executables from the RDKB RPI RFS. This should be applicable for both Morty and Dunfell builds.

Design

Below are the Overall steps to be taken for Tiny RDKB effort in RPI,

- 1.Remove sound kernel modules
- 2.Removal of unused file COSAXcalibur.XML
- 3.Replace some executables with busybox
- 4.Replace NTPD package with Busybox configuration
- 5.Removed UnUsed packages from ccsp packagegroup in RPI platform
- 6.Removed UnUsed packages from OSS packagegroup in RDKB RPI platform
- 7.Removed UnUsed and Duplicate files from RFS in RDKB RPI platform
- 8.Removed unused driver kernel modules of ath,mediatek,realtek in linux-raspberrypi
- 9.Removed NLS modules from linux-raspberrypi
- 10.Removed unused driver modules of rtc,usb,input in linux-raspberrypi
- 11.Removed Unused kernel driver modules of NF,Xtables,PPS,BT from linux-raspberrypi
- 12.Removed Unused kernel modules of HID and USB from linux-raspberrypi
- 13.Removed Unused kernel modules of DRM,USB_SERIAL,SPEECH,CAN,W1,YAM from linux-raspberrypi
- 14.Added PHP->JST Migration
- 15.Removed Unused packages from util-linux
- 16.Added nodejs package as DISTRO Features for Morty Builds
- 17.Removed Unused files from RFS
- 18.Converted Parental control features kernel modules to in-built modules for reducing the kernel size in RFS.

Comparison of Image Size

S.NO	Yocto Version Builds	Before Tiny RDKB Image Size	After Tiny RDKB Image Size	Difference
1	Morty	380MB	224 MB	156MB
2	Dunfell	80MB(After extract the tar 448MB)	59MB(After extract the tar 306MB)	21MB(142MB)

RDKB RPI Memory Comparison

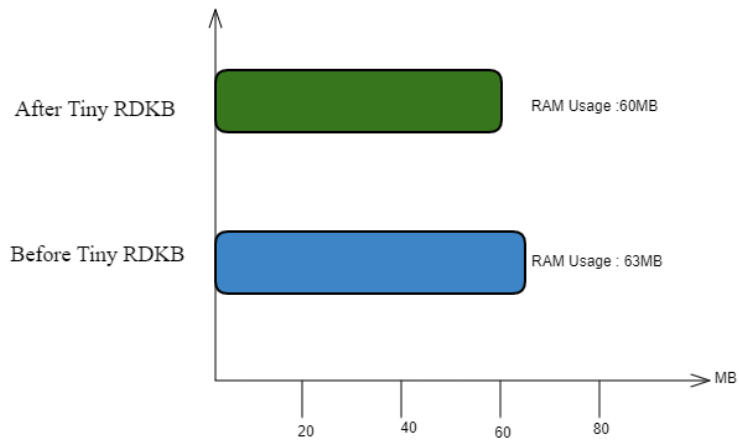
Below are the ways to compare the memories in before and after the Tiny RDKB effort in RPI,

- RAM usage
- CPU Utilization
- Rootfs size on Storage Disk

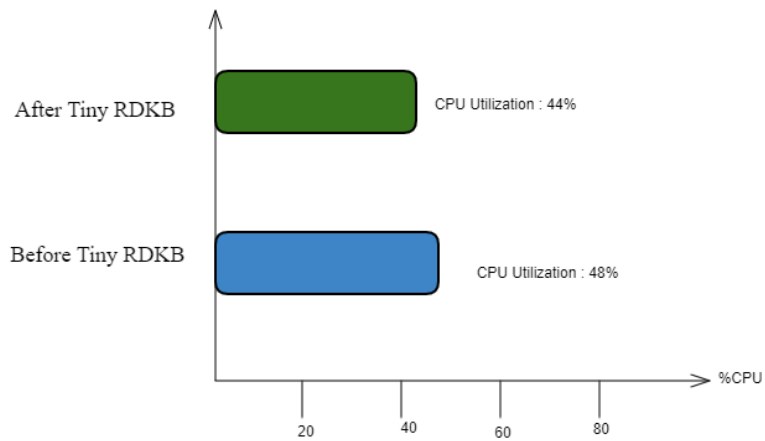
Initial Boot-up

This below analysis are immediately taken while the fresh image is boot-up,

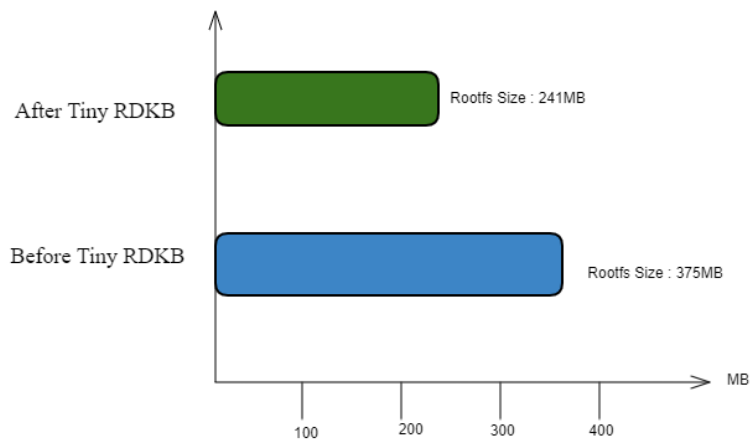
RAM Usage On Initial Boot-up



CPU Utilization On Initial Boot-up



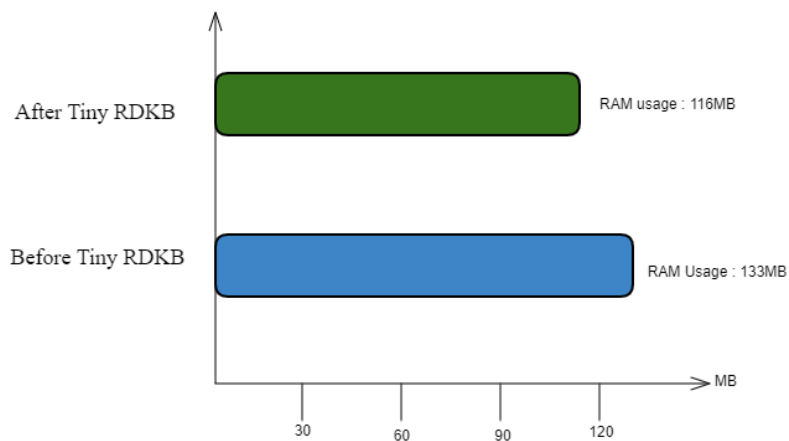
Rootfs Size on Storage Disk On Initial Boot-up



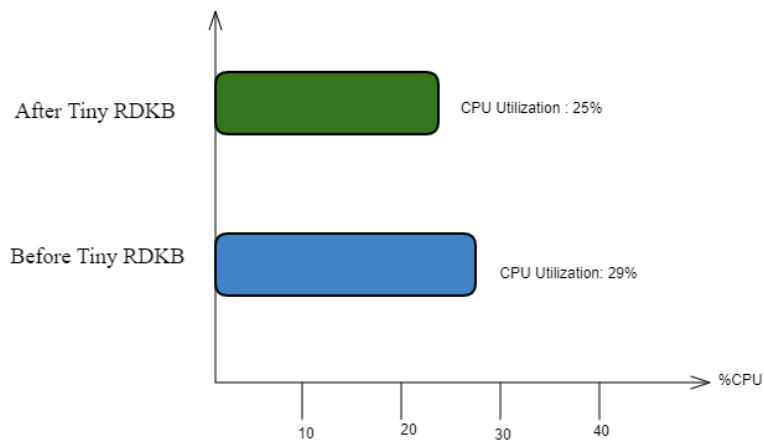
After one hour from Image Boot-up

The below analysis are taken one hour after form the fresh image boot-up,

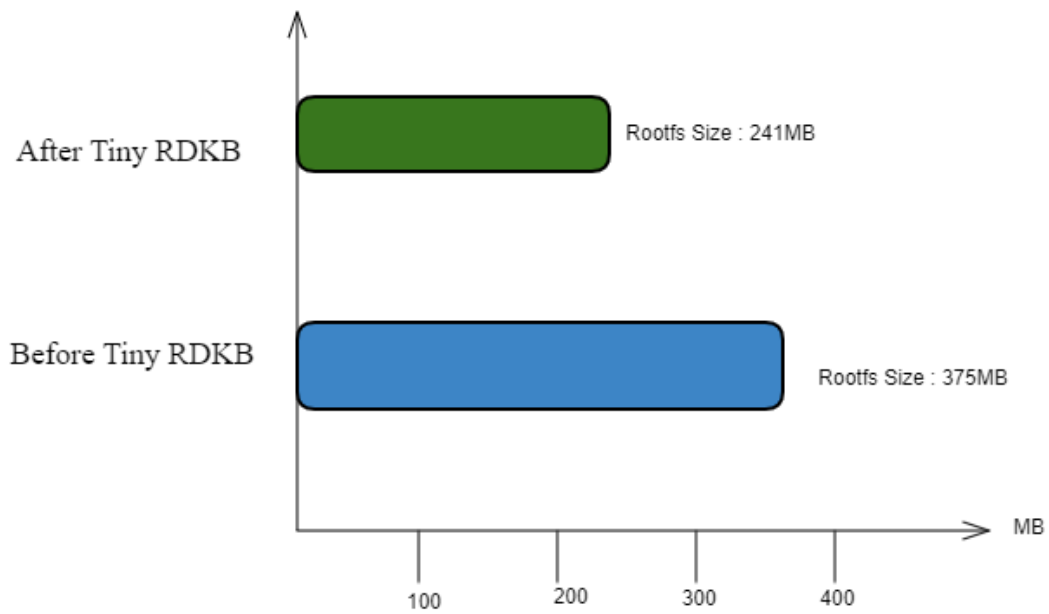
RAM Usage On After One Hour



CPU Utilization On After One hour



Rootfs Size on Storage Disk On After One hour



Linux Commands for Memory Usage

Below linux commands are used to find the memory usage of RAM, CPU Utilization and Rootfs Size.

S.NO	Memory Usages	Linux Commands
1	RAM Usage	free -m
2	CPU Utilization	iostat / top
3	Rootfs Size	df -h

Initial Boot-up - Sample Output from fresh image

Before Tiny RDKB

RAM Usage

```
root@RaspberryPi-Gateway:~# free -m
```

	total	used	free	shared	buff/cache	available
Mem:	924	63	827	4	39	842
Swap:	0	0	0			

After Tiny RDKB

RAM Usage

```
root@RaspberryPi-Gateway:~# free -m
              total        used         free       shared    buff/cache   available
Mem:           603          60          503           4           36          518
Swap:           0           0           0
```

Before Tiny RDKB

CPU Utilization

```
root@RaspberryPi-Gateway:~# iostat
Linux 5.4.72-v7 (RaspberryPi-Gateway)          12/09/20          _armv7l_          (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           19.17    0.02   26.86    0.41    2.50   53.46

Device:            tps    Blk_read/s    Blk_wrtn/s    Blk_read    Blk_wrtn
mmcblk0             14.02         508.65         43.97       95683       8271
mmcblk0p1            0.38           3.88           0.01         729         1
mmcblk0p2           13.39         493.68         43.96       92866       8270

root@RaspberryPi-Gateway:~#
```

After Tiny RDKB

CPU Utilization

```
root@RaspberryPi-Gateway:~# iostat
Linux 5.4.72-v7 (RaspberryPi-Gateway)          03/29/21          _armv7l_          (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           17.72    0.02   24.32    1.94    0.00   53.98

Device:            tps    Blk_read/s    Blk_wrtn/s    Blk_read    Blk_wrtn
mmcblk0             20.85         723.65         73.56       79435       8075
mmcblk0p1            0.58           6.66           0.01         731         1
mmcblk0p2           19.83         697.97         73.55       76616       8074
```

After Tiny RDKB

Rootfs Size On Storage Disk

```
root@RaspberryPi-Gateway:~# df -h
Filesystem      Size      Used Available Use% Mounted on
/dev/root        241.6M    139.5M     85.6M   62% /
devtmpfs         173.0M         0    173.0M    0% /dev
tmpfs            301.5M     4.0K    301.5M    0% /dev/shm
tmpfs            301.5M    21.4M    280.1M    7% /run
tmpfs            301.5M         0    301.5M    0% /sys/fs/cgroup
tmpfs            301.5M     2.5M    299.1M    1% /tmp
tmpfs            301.5M    328.0K    301.2M    0% /var/volatile
/dev/mmcblk0p1   50.8M    29.2M     21.6M   58% /boot
tmpfs            60.3M         0     60.3M    0% /run/user/0
root@RaspberryPi-Gateway:~#
```

Before Tiny RDKB

Rootfs Size On Storage Disk

```
root@RaspberryPi-Gateway:~# df -h
Filesystem      Size      Used Available Use% Mounted on
/dev/root        375.7M    217.2M    135.1M   62% /
devtmpfs         333.7M         0    333.7M    0% /dev
tmpfs            462.2M     4.0K    462.2M    0% /dev/shm
tmpfs            462.2M    25.5M    436.7M    6% /run
tmpfs            462.2M         0    462.2M    0% /sys/fs/cgroup
tmpfs            462.2M     2.9M    459.3M    1% /tmp
tmpfs            462.2M    512.0K    461.7M    0% /var/volatile
/dev/mmcblk0p1   48.5M    27.4M     21.0M   57% /boot
root@RaspberryPi-Gateway:~#
```

One Hour after from Image Boot-up - Sample Output

Before Tiny RDKB

RAM Usage

```
root@RaspberryPi-Gateway:~# free -m
              total        used         free       shared    buff/cache   available
Mem:           924          133           712           24         78          750
Swap:            0             0             0
root@RaspberryPi-Gateway:~#
```

After Tiny RDKB

RAM Usage

```
root@RaspberryPi-Gateway:~# free -m
              total        used         free       shared    buff/cache   available
Mem:           603          116           337           99         149          371
Swap:            0             0             0
```

Before Tiny RDKB

CPU Utilization

```
root@RaspberryPi-Gateway:~# iostat
Linux 5.4.72-v7 (RaspberryPi-Gateway)          03/29/21          _armv7l_          (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           4.63    0.01  24.77   0.09    0.00   71.50

Device:            tps    Blk_read/s    Blk_wrtn/s    Blk_read    Blk_wrtn
mmcblk0             3.44         91.07         15.14       96231       15997
mmcblk0p1            0.07          0.69          0.00         729         1
mmcblk0p2            3.33         88.41         15.14      93414      15996
```

After Tiny RDKB

CPU Utilization

```
root@RaspberryPi-Gateway:~# iostat
Linux 5.4.72-v7 (RaspberryPi-Gateway)          03/29/21          _armv7l_          (4 CPU)

avg-cpu:  %user   %nice %system %iowait  %steal   %idle
           4.02    0.01  21.68   0.03    0.00   74.26

Device:            tps    Blk_read/s    Blk_wrtn/s    Blk_read    Blk_wrtn
mmcblk0             1.33          8.31         10.54       81599      103441
mmcblk0p1            0.01          0.07          0.00         731         1
mmcblk0p2            1.32          8.03         10.54       78780      103440
```

Before Tiny RDKB

Rootfs Size on Storage Disk

```
root@RaspberryPi-Gateway:~# df -h
Filesystem      Size      Used Available Use% Mounted on
/dev/root        375.7M    216.1M    136.1M   61% /
devtmpfs         333.7M         0     333.7M    0% /dev
tmpfs            462.2M     4.0K    462.2M    0% /dev/shm
tmpfs            462.2M     9.5M    452.7M    2% /run
tmpfs            462.2M         0     462.2M    0% /sys/fs/cgroup
tmpfs            462.2M     2.8M    459.4M    1% /tmp
tmpfs            462.2M    280.0K    461.9M    0% /var/volatile
/dev/mmcblk0p1   48.5M     27.4M     21.0M   57% /boot
```

After Tiny RDKB

Rootfs Size on Storage Disk

```
root@RaspberryPi-Gateway:~# df -h
Filesystem      Size      Used Available Use% Mounted on
/dev/root        241.6M    139.5M     85.6M   62% /
devtmpfs         173.0M         0     173.0M    0% /dev
tmpfs            301.5M     4.0K    301.5M    0% /dev/shm
tmpfs            301.5M    21.4M    280.1M    7% /run
tmpfs            301.5M         0     301.5M    0% /sys/fs/cgroup
tmpfs            301.5M     2.5M    299.1M    1% /tmp
tmpfs            301.5M    328.0K    301.2M    0% /var/volatile
/dev/mmcblk0p1   50.8M     29.2M     21.6M   58% /boot
tmpfs            60.3M         0     60.3M    0% /run/user/0
```

Limitation

"rbus" and "runit" Integration also part of Tiny RDKB effort but still those changes are not available in stable2 branch.
we will integrated in RPI once those changes are successfully merged in stable2.

References

Jira

[REFPLTB-916](#) - Getting issue details...

STATUS

Gerrit Links

<https://code.rdkcentral.com/r/q/REFPLTB-916>