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 platfrom
6.Removed UnUsed packages from OSS packagegroup in RDKB RPI platfrom
7.Removed UnUsed and Duplicate files from RFS in RDKB RPI platfrom
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

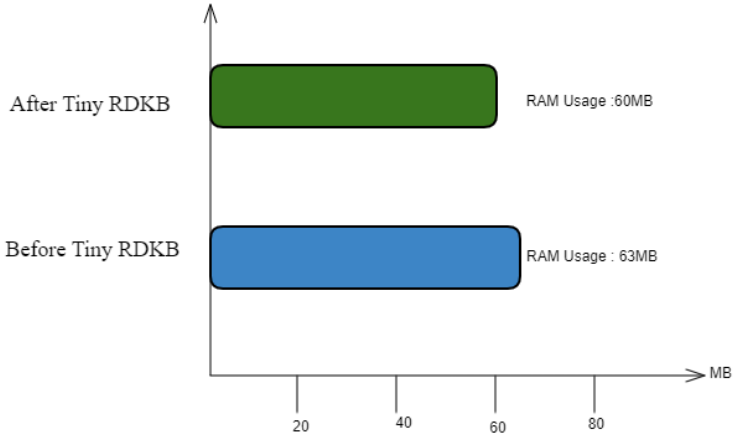
Below are the ways to compare the memories in before and after the Tiny RDKB effort in RPI,

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

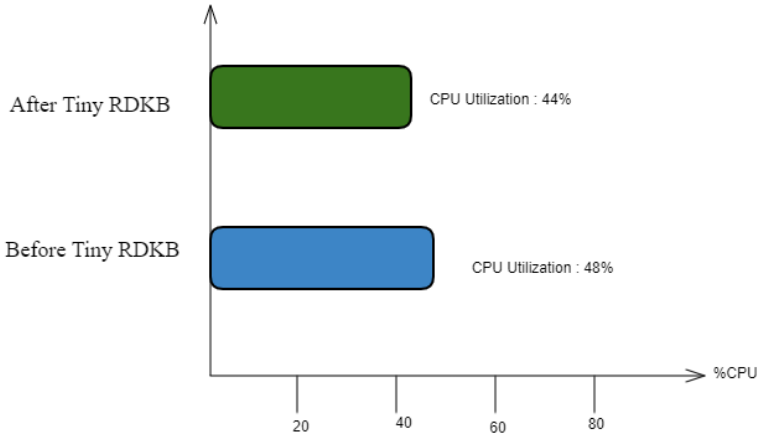
Initial Boot-up

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

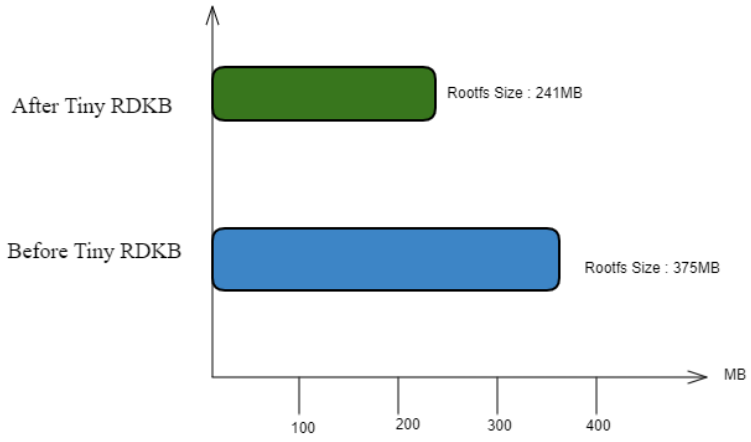
RAM Usage On Initial Boot-up



CPU Utilization On Initial Boot-up



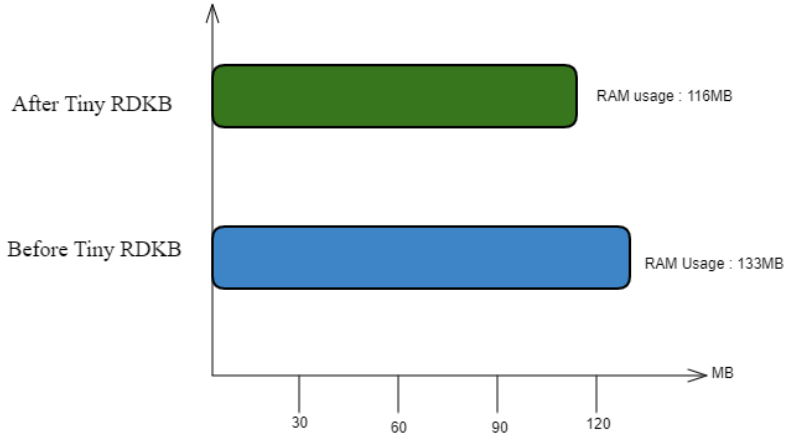
Rootfs Size on Storage Disk On Initial Boot-up



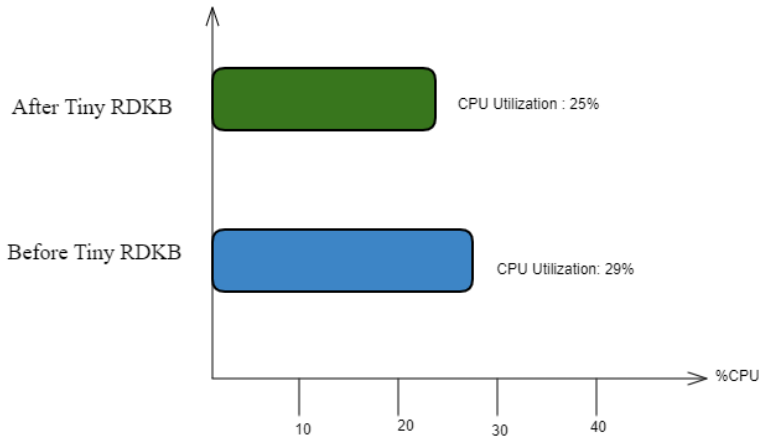
After one hour from Image Boot-up

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

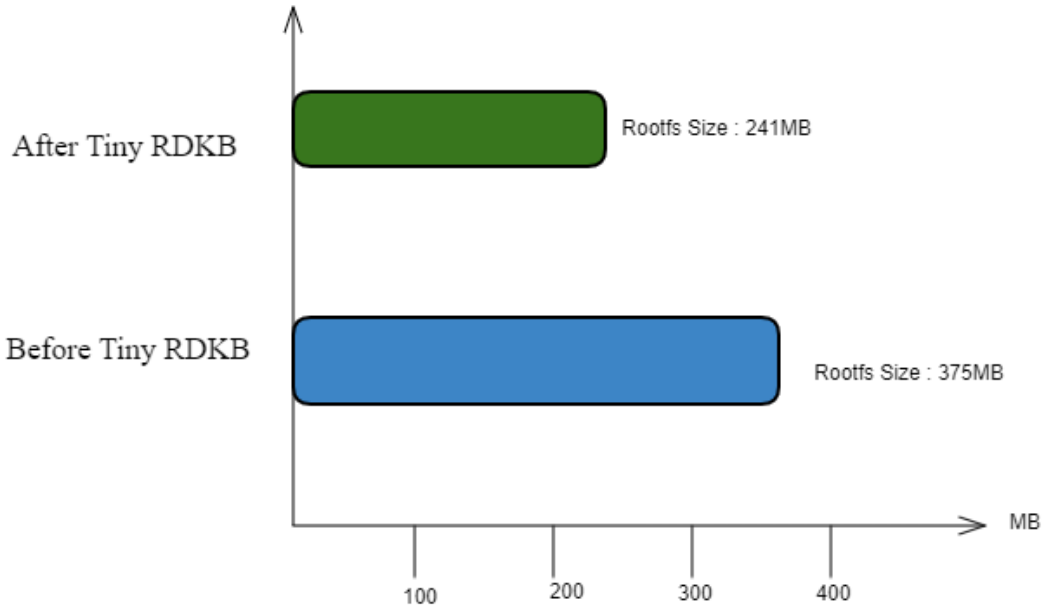
RAM Usage On After One Hour



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