



Yocto Project® Runtime Package Management: When, Why and How

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About me

- **10+ years doing embedded Linux**
- **networked audio, sonar and LoRa**
- **MELP3 co-author**
- **home electrification**



Agenda

- **What is runtime package management?**
- **What are the dangers?**
- **What are the benefits?**
- **Adding opkg to an image**
- **Serving ipk package feeds locally**
- **Configuring opkg client on board**



When

Runtime package management

- **Fetch packages from a server**
- **Install packages on the target**
- **Selecting a package manager for your distro**
- **Choices are dnf and opkg**
- **Partial image updates on a per package basis**

Never in production

- **Not robust**
 - **Extract an archive over the filesystem**
 - **Run scripts before and after extraction**
 - **Can result in inconsistent image states**
- **Attack vector**
 - **OpenWRT code-execution bug**
 - **HTTPS not enforced**
 - **downloads.openwrt.org**
 - **Package size vs. SHA256 hash**

Only for development

- **Quick experimentation**
- **Build and serve packages locally**
- **Install packages on demand**
- **Update packages on demand**



Why

Velocity

- **No waiting for image builds**
- **Try before you buy**
- **No full image updates and reboots**
- **Rev packages not images**
- **No scp'ing of binaries**

Familiarity

- **BeagleBone, Jetson, Raspberry Pi**
- **Headless or HDMI**
- **Debian or Ubuntu**
- **apt**
- **Docker**
- **conda-forge**



How

Adding opkg to an image

- **distro layer: meta-mackerel/conf/distro/mackerel.conf**

```
PACKAGE_CLASSES ?= "package_ipk"
```

- **image build: build-rpi/conf/local.conf**

```
#PACKAGE_CLASSES ?= "package_rpm"  
EXTRA_IMAGE_FEATURES ?= "debug-tweaks ssh-server-openssh package-management"  
DISTRO = "mackerel"
```

- **opkg client now on board**

```
root@raspberrypi4-64:~# which opkg  
/usr/bin/opkg
```

Adding packages on demand

- **Build curl package**

```
$ source poky/oe-init-build-env build-rpi  
$ bitbake curl
```

- **Populate package index**

```
$ bitbake package-index
```

Package feeds

- **Navigate to where the package installers are**

```
$ cd build-rpi/tmp-glibc/deploy/ipk
```

- **Package server expects four directories**

```
$ ls  
aarch64  all  Packages  raspberrypi4_64
```

- **So-called *architecture* and *machine* directories**

Serving packages locally

- **Start HTTP package server**

```
$ pwd
/home/frank/build-rpi/tmp-glibc/deploy/ipk

$ ip a
2: wlp59s0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
group default qlen 1000
    link/ether f4:8c:50:80:ed:9b brd ff:ff:ff:ff:ff:ff
    inet 192.168.1.69/24 brd 192.168.1.255 scope global dynamic noprefixroute
wlp59s0

$ sudo python3 -m http.server --bind 192.168.1.69 80
[sudo] password for frank:
Serving HTTP on 192.168.1.69 port 80 (http://192.168.1.69:80/) ...
```

Configuring opkg client

- **SSH into target**

```
$ ssh root@raspberrypi4-64.local
```

- **Edit /etc/opkg/opkg.conf**

```
src/gz all http://192.168.1.69/all
src/gz aarch64 http://192.168.1.69/aarch64
src/gz raspberrypi4_64 http://192.168.1.69/raspberrypi4_64

dest root /
option lists_dir /var/lib/opkg/lists
```


Refreshing available package list

```
root@raspberrypi4-64:~# opkg update
Downloading http://192.168.1.69/all/Packages.gz.
Updated source 'all'.
Downloading http://192.168.1.69/aarch64/Packages.gz.
Updated source 'aarch64'.
Downloading http://192.168.1.69/raspberrypi4_64/Packages.gz.
Updated source 'raspberrypi4_64'.
```

Installing a package

```
root@raspberrypi4-64:~# opkg install curl
Installing libcurl4 (7.69.1) on root
Downloading http://192.168.1.69/aarch64/
libcurl4_7.69.1-r0_aarch64.ipk.
Installing curl (7.69.1) on root
Downloading http://192.168.1.69/aarch64/curl_7.69.1-r0_aarch64.ipk.
Configuring libcurl4.
Configuring curl.
```

```
root@raspberrypi4-64:~# curl
curl: try 'curl --help' for more information
```

```
root@raspberrypi4-64:~# which curl
/usr/bin/curl
```

Updating packages

- **Check for package updates**

```
root@raspberrypi4-64:~# opkg list-upgradable
```

- **Apply them**

```
root@raspberrypi4-64:~# opkg upgrade
```

Connect

MELP3 available at
amazon

<https://packt.live/3tiDDrA>



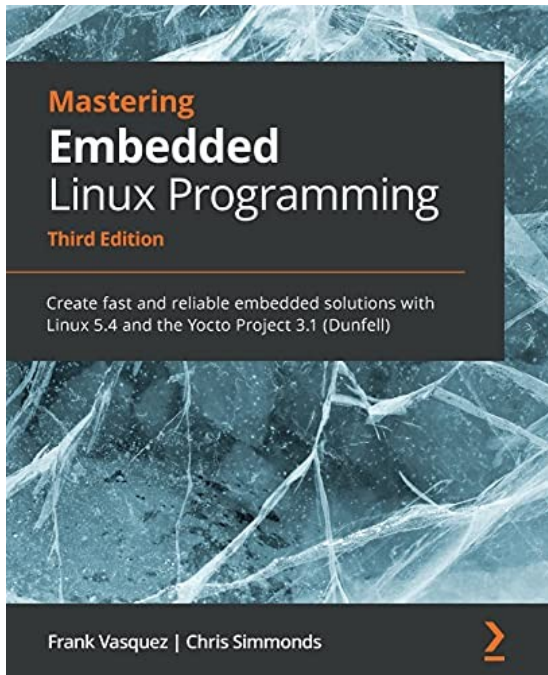
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