

### 3.7.1. Systems with U-Boot firmware

As already mentioned before, there is unfortunately no standard for system firmware on ARM systems. Even the behaviour of different systems which use nominally the same firmware can be quite different. This results from the fact that a large part of the devices using the ARM architecture are embedded systems, for which the manufacturers usually build heavily customized firmware versions and include device-specific patches. Unfortunately the manufacturers often do not submit their changes and extensions back to the mainline firmware developers, so their changes are not integrated into newer versions of the original firmware.

As a result even newly sold systems often use a firmware that is based on a years-old manufacturer-modified version of a firmware whose mainline codebase has evolved a lot further in the meantime and offers additional features or shows different behaviour in certain aspects. In addition to that, the naming of onboard devices is not consistent between different manufacturer-modified versions of the same firmware, therefore it is nearly impossible to provide usable product-independent instructions for ARM-based systems.

#### 3.7.1.1. Setting the ethernet MAC address in U-Boot

The MAC address of every ethernet interface should normally be globally unique, and it technically has to be unique within its ethernet broadcast domain. To achieve this, the manufacturer usually allocates a block of MAC addresses from a centrally-administered pool (for which a fee has to be paid) and preconfigures one of these addresses on each item sold.

In the case of development boards, sometimes the manufacturer wants to avoid paying these fees and therefore provides no globally unique addresses. In these cases the users themselves have to define MAC addresses for their systems. When no MAC address is defined for an ethernet interface, some network drivers generate a random MAC address that can change on every boot, and if this happens, network access would be possible even when the user has not manually set an address, but e.g. assigning semi-static IP addresses by DHCP based on the MAC address of the requesting client would obviously not work reliably.

To avoid conflicts with existing officially-assigned MAC addresses, there is an address pool which is reserved for so-called “locally administered” addresses. It is defined by the value of two specific bits in the first byte of the address (the article “MAC address” in the English language Wikipedia gives a good explanation). In practice this means that e.g. any address starting with hexadecimal `ca` (such as `ca:ff:ee:12:34:56`) can be used as a locally administered address.

On systems using U-Boot as system firmware, the ethernet MAC address is placed in the “ethaddr” environment variable. It can be checked at the U-Boot command prompt with the command “`printenv ethaddr`” and can be set with the command “`setenv ethaddr ca:ff:ee:12:34:56`”. After setting the value, the command “`saveenv`” makes the assignment permanent.

#### 3.7.1.2. Kernel/Initrd/Device-Tree relocation issues in U-Boot

On some systems with older U-Boot versions there can be problems with properly relocating the Linux kernel, the initial ramdisk and the device-tree blob in memory during the boot process. In this case, U-Boot shows the message “Starting kernel ...”, but the system freezes afterwards without further output. These issues have been solved with newer U-Boot versions from v2014.07 onwards.

If the system has originally used a U-Boot version older than v2014.07 and has been upgraded to a newer version later, the problem might still occur even after upgrading U-Boot. Upgrading U-Boot usually does not modify the existing U-Boot environment variables and the fix requires an additional environment variable (`bootm_size`) to be set, which U-Boot does automatically only on fresh installa-