Notation conventions

McASP – multi-channel audio serial peripheral – full analog of I2S/TDM peripheral, with some additional functionality.

MPU – micro processor unit.

PRU – programmable real-time unit.

SPL – secondary program loader – part of loader that is starting first from MPU ROM and executes some preparation actions (DDR configuration, TFTP of full bootloader).

DDR – double data rate memory.

POE – power over Ethernet.

AGC – automatic gain control.

Hardware

Audio device has in its heart TI Sitara AM3359 processor (here and after – MPU).

Inside this MPU, there are three distinctive devices – one ARM A8 and two real time unit (here and after – MPU). These PRU are used to access digital audio stream from McASP.

Audio device connected to the workplace system by POE. “True” POE will be utilized for this purpose : -48V of power supply will be provided by 4 Ethernet twisted pairs.

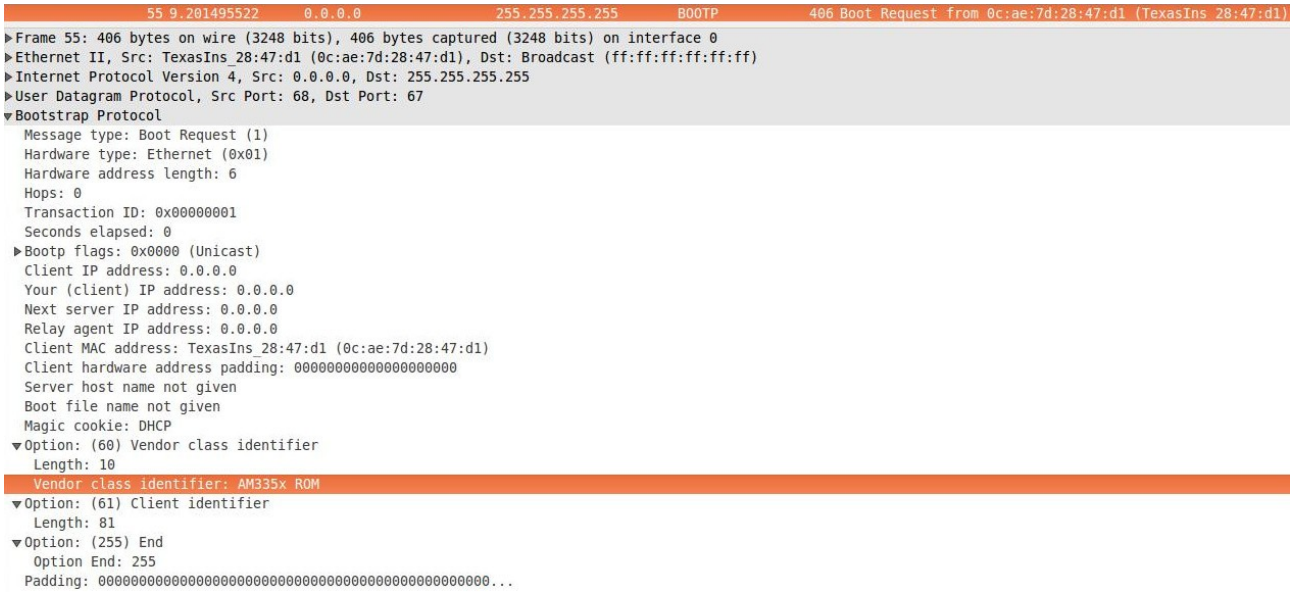
Sound data

Sound data will be send from/to audio devices in RTP packages. Audio devices works with 16kHz/16bit sound internally. 8KHz/8bit data will be re-sampled to accommodate sound device capabilities. Each audio frame will contain 20ms of audio stream data.

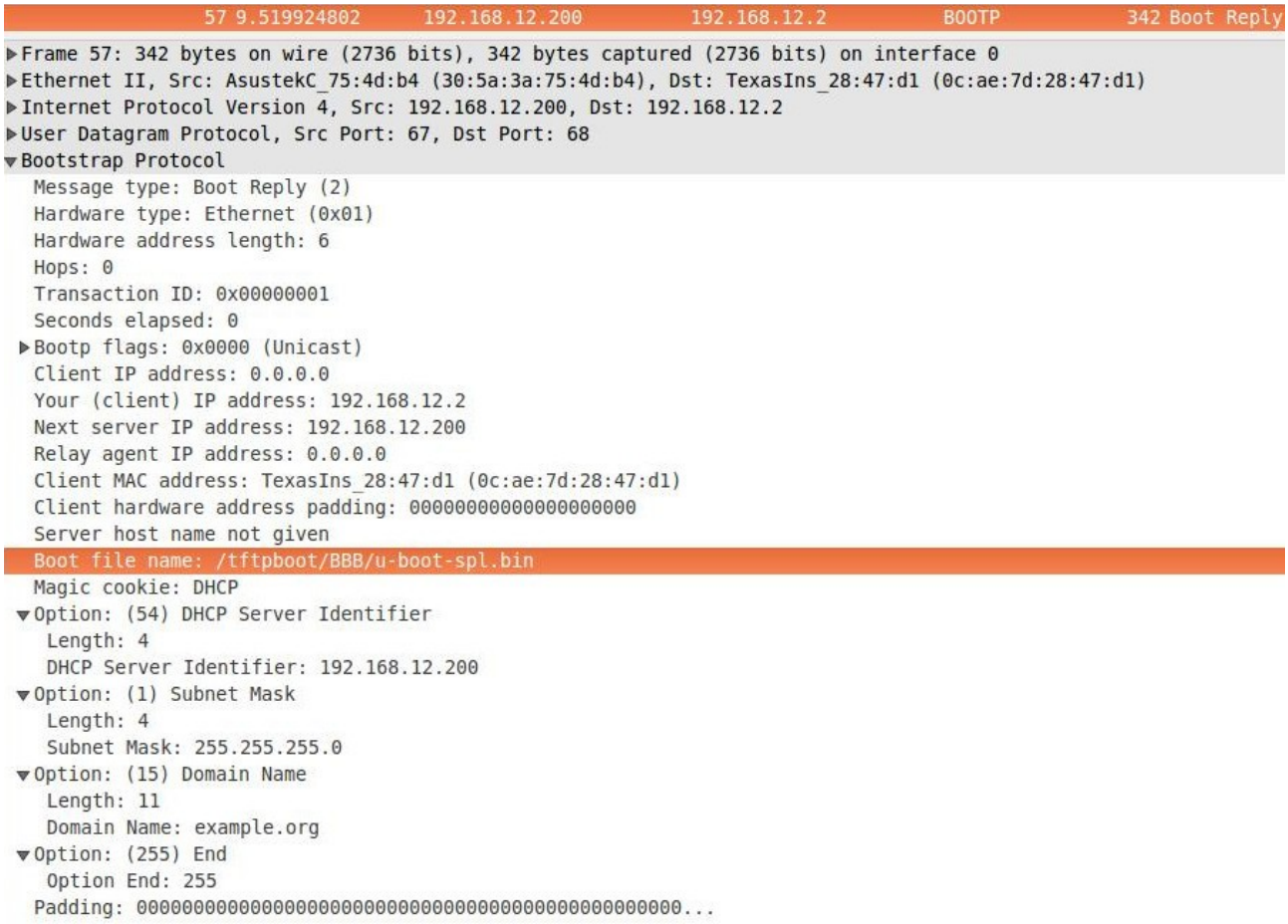
Audio device boot mechanism

Some Sitara devices, and AM3359 of such type, support boot from Ethernet. Exchange mechanism looks like :

1) MPU sends BOOTP package with vendor class identifier:



2) In response for this message DHCP server provides free IP address and says what file should be downloaded:



It is necessary to add next lines in file 'dhcpd.conf' to support such mechanism:

```
allow booting;
allow bootp;
ddns-update-style  none;
default-lease-time 600;
max-lease-time     7200;
server-name        "working place";
subnet 192.168.???.0 netmask 255.255.255.0
{
  interface             ????;
  next-server           192.168.???.???;
  server-identifier     192.168.???.???;
  option subnet-mask    255.255.255.0;
  pool
  {
    range dynamic-bootp 192.168.???.??? 192.168.???.???;
    allow unknown clients;
  }#pool
  if substring (option vendor-class-identifier, 0, 10)    = "AM335x ROM"
  {
    #filename "/tftpboot/???/u-boot-spl.bin";  #xinetd
    filename "/???/u-boot-spl.bin";            #tftp-server
  } #AM335x ROM
  elsif substring (option vendor-class-identifier, 0, 17) = "AM335x U-Boot SPL"
  {
    #filename "/tftpboot/???/u-boot.img";      #xinetd
    filename "/???/u-boot.img";                #tftp-server
  } #AM335x U-Boot SPL
  elsif substring (option vendor-class-identifier, 0, 13) = "AM335x U-Boot"
  {
    #filename "/tftpboot/???/zImage";          #xinetd
    filename "/???/zImage";                    #tftp-server
  }#AM335x U-Boot
}#subnet
```

Example configuration files for Fedora are provided by the designer of this system.

3) After MPU downloads its SPL, it executes it.

As it seen from picture above SPL downloads what full loader (Das U-Boot currently).

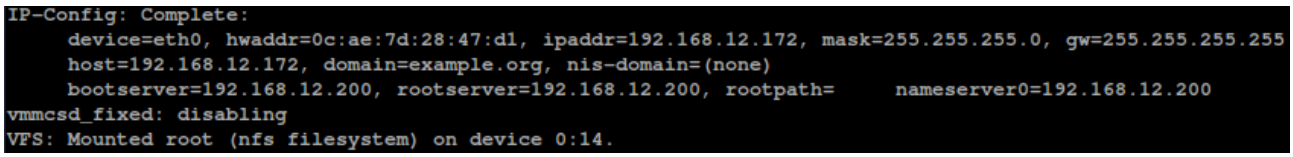
After full loader is downloaded into the DDR, it is executing:

```
U-Boot 2019.01-rc3 (Mar 28 2019 - 12:30:57 +0300)

CPU  : AM335X-GP rev 2.1
Model: TI AM335x BeagleBone Black
DRAM:  512 MiB
MMC:
In:    serial@44e09000
Out:   serial@44e09000
Err:   serial@44e09000
<ethaddr> not set. Validating first E-fuse MAC
Net:   mac_lo = 535751 mac_hi = 6793251961
cpsw
Press SPACE to abort autoboot in 2 seconds
```

4) Loader will download kernel and device tree blob (here and after - DTB) and executes kernel. DTB will be passed to kernel's main in its arguments.

5) Kernel will try to mount root FS from NFS:



Start up

After audio device have made all necessary hardware configuration, it sends Protobuf message to the DHCP server with it's (audio-device) capabilities. After reception of such message appropriate class will be created by the workplace's communication matrix application.

=== Should be tested ===

Backward compatibility

To avoid cluster-fuck with Yakutsk project, some intermediate version of the proposed system will be presented. This system will support USB connection (signal and power supply), but Sitara will replace AVR. The purpose of such trick is to represent digital automatic gain control (here and after AGC) in exchange of analogue one, that is presently used.

=== Near feature ===