DKT 797xx series, DHCP/TFTP boot options

Rev.:1.0 – Aug 8, 2015

Introduction

The DKT platform is provisioned per default via DHCP/TFTP method (alternative methods are available, e.g. via TR-069 – as an option). Communication between the device and the DHCP server is possible using standard DHCP options, which allows the networking specific parameters to be shared. This document described the individual options supported by the device.

Booting Procedure

The standard boot procedure is outlined below.
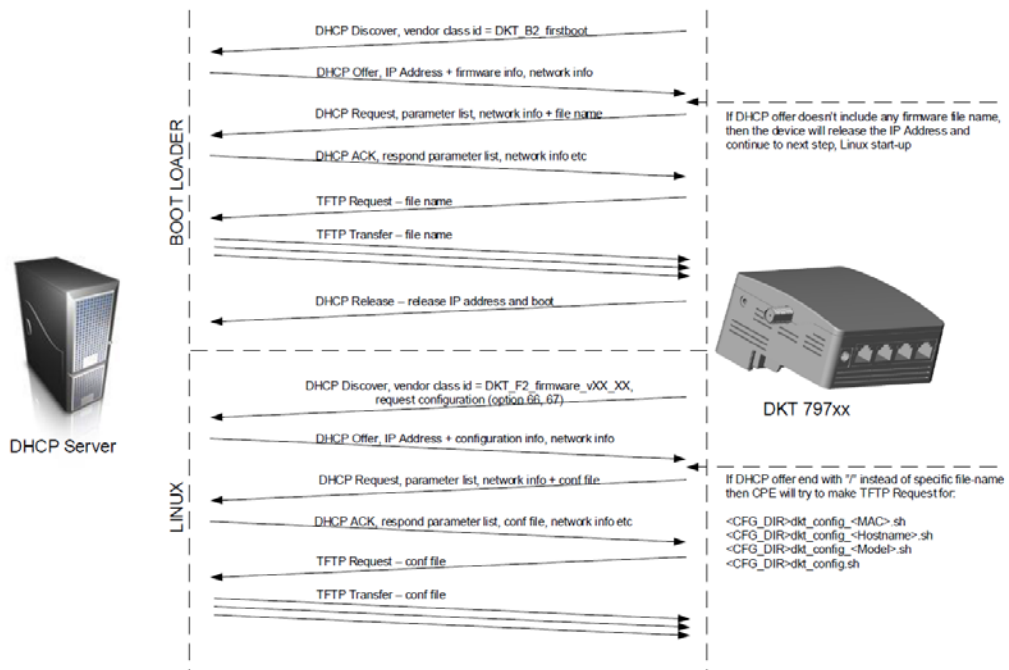
The booting procedure consists of two parts, a boot loader part and a Linux part.

Boot loader part: The primary task of the boot loader procedure is to bring the device to the network, get an IP address and net mask from the DHCP Server. Secondary task is to obtain information about an eventual firmware upgrade. If no firmware upgrade is necessary (DHCP Server communicates this via DHCP Option 66/67), then the device will jump to the second stage, and starting up the Linux OS system. The DKT device will during its boot loader initial DHCP DISCOVER request the following parameters via DHCP option 55 from the DHCP Server (all parameters should be responded to by the DHCP Server, in order to ensure proper boot procedure):
DHCP Options in boot loader procedure: 1 (Subnet Mask), 3 (Router)

Linux firmware part: IP address is released as the last step of the boot loader part, so a new DHCP DISCOVER – DHCP OFFER – DHCP REQUEST – DHCP ACK procedure will take place, so primary task of the firmware load procedure is again to bring the device onto the network, asking for an IP address, sub net mask, default gateway, TFTP Server information etc. Secondary part is to let the DHCP Server offer a specific configuration file for the device. The DKT device will during its Linux firmware load initial DHCP DISCOVER request the following parameters via DHCP option 55 from the DHCP Server (all parameters should be responded to by the DHCP Server, in order to ensure proper boot procedure):
DHCP Options in Linux firmware load procedure: 1 (Subnet Mask), 3 (Router), 6 (Domain Name Server), 12 (Host Name), 43 (Vendor-Specific Information), 54 (DHCP Server Identifier), 66 (TFTP Server name) and 67 (Boot file name, used for configuration scripts – not to be confused with firmware file name obtained via BOOTP flag `boot file name`)

DHCP Options supported

Besides the standard DHCP Options supported, in order to bring the device onto the network, DKT has developed specific implementation in order to communicate between DHCP Server and the device. This is order to identify the unit, and to configure the unit to some extent.

DHCP Option 43:

The DHCP Option 43 is used to communicate in both directions, so DKT device can inform the DHCP Server, and the DHCP Server can inform the DKT device.

Initiated by DKT device

The device will communicate its boot loader revision and general capabilities via DHCP Option 43.

At the boot loader procedure, the main purpose it to tell its current boot loader revision, and board ID information/architecture

The option 43 field is formatted by type-length-value fields as specified below:

Type 'a' <board architecture> Type 'v' <bootloader version> Type 'b' <board ID - revision>

The type field is defined by the ASCII value of the letters a, v and b.

```
Example:
 Architecture "f2"
 Version      "0507"
 Board ID-ver "f-0"

 Hexadecimal:
  61:03:46:32:00:76:05:30:35:30:37:00:62:03:66:2d:30
 ASCII with binary length fields:
  'a' 3  'F2'  0 'v' 5      '0507'  0 'b' 3     'f-0'
```

At the Linux firmware load procedure, the main purpose it to tell the device capabilities, including HW specific information.

In other words, the DHCP option 43 field of the Linux DHCP request is used to indicate the optional features of the system. The option 43 string may be extended in the future with more TLV fields (Type, Length, Value).

The features are listed with ASCII characters. If more than one feature is present in the system, then the feature strings are separated by commas.

The format of the Linux DHCP option 43 field is specified below:

'm' (hex 0x76) <length> <Value> <Value> <Value> ....

```
Example for 79742:
m<len>catv,4,managed p<len>0
```

Initiated by the DHCP Server

The device can be configured with a fixed URL for ACS connectivity (requires special firmware branch), or can obtain its information via DHCP option 43, as outlined in the below DHCP server example.

```
# Encapsulate option space in vendor option (43)
    vendor-option-space              tr069;
    option tr069.acs-server-url      "http://192.168.10.10:7547/";
    option tr069.provisioning-code   "special-code";
    option tr069.retry-min-wait      "5";
    option tr069.retry-interval-multipl "2000";
```

The device will, if DHCP option 43 parameters are received at boot, automatically start the TR-069 application and make a register towards the ACS.

DHCP Option 60:

Initiated by DKT device

The DKT device is able to communicate its boot loader/firmware revision to the network by using DHCP option 60, according to RFC 3925. The DHCP protocol for IPv4, RFC 2131, defines options that allow a client to indicate its vendor type (option 60), and the DHCP client and server to exchange vendor-specific information (option 43).

The vendor class identifier has the format as follows:

```
Bootloader:
  DKT_F2_Boot_vXX
Linux:
  DKT_F2_Firmware_vXX
```

It is possible to use this information to decide if firmware upgrade is necessary, and DHCP Server can offer a file to fetch via BOOTP flag `boot file name` during the boot loader process.

DHCP Option 66/67:

Initiated by DHCP Server

U-boot issues a DHCP request, and use the file name (DHCP option 67 - if any) returned by the DHCP response. The filename is used in a TFTP request to the indicated server IP address (DHCP option 66).

If filename ends on '/' then it is used as directory and appended the file name from the list:

1. dkt_boot_upgrade_<MAC>.img
2. dkt_boot_upgrade.img
3. dkt_firmware_upgrade_<MAC>.img
4. dkt_firmware_upgrade.img

```
NOTE: It has shown that a URL is interpreted as a directory.
We have seen a support issue with this line in DHCP server configuration
  filename "tftp://172.17.17.100/dkt_fw2_flashdisk_04_25.img" ;
- resulted in TFTP requests for these files:
  //172.17.17.100/dkt_firmware_upgrade.img
  //172.17.17.100/dkt_boot_upgrade_00199f94049c.img
  //172.17.17.100/dkt_boot_upgrade.img
  //172.17.17.100/dkt_firmware_upgrade_00199f94049c.img
```

DHCP Option 125:

Initiated by DHCP Server (from firmware revision 05_05 and later)
DHCP option 125 is defined in RFC 3925. This option can be used to
configure the CPE for VLAN, in order to define a static VLAN for
management (notice, default is native VLAN).
The option-data field use TLV-format just like the DHCP options
Type 1 is used for VLAN VID, ASCII number. For example VID=50 (here shown
as hexadecimal numbers):

```
   01 02 35 30
```

DKT's enterprise number is 27304 (6aa8 in hexadecimal number). The entire
DHCP option 125 field could then be like (for VID=50):

```
   7d 09  00 00 6a a8  04  01 02 35 30
```

The first time the option 125 is seen, a VLAN configuration file is written to
flash and the system is rebooted. The following startup will use the
configuration file before network is set up.
If VID=0, then the configuration file is removed, and VLAN is NOT setup.

```
configuration example with ISC DHCP server:

## Option 125: Disable VLAN
#      option vivso
#        00:00:6a:a8:
#        03:
#        01:01:30;

# Option 125: Enable VLAN 4089
      option vivso
        00:00:6a:a8:
        06:
        01:04:34:30:38:39;
```