

- **Protocols used during booting a PC:**

→ **Ethereal trace PC-Boot-Trace-clean.ethereal:**

1. **DHCP request (frames 1&2):**

For acquiring an IP address (renewal of IP address, has been previously acquired).

2. **Gratuitous ARP (frames 3-5):**

3 ARP requests for own IP address; purpose: detect double usage of same IP address.

3. **DNS request (frames 8&9):**

Issued by web browser for URL resolution.

4. **TCP connection (frames 10-12):**

Web browser establishes TCP connection(s) to web server for HTML document retrieval.

5. **HTTP transfer (frames 13 ff.):**

Transfer of objects/elements with HTTP protocol.

• Ethereal trace of a booting host (1):

```
1 0.000000 0.0.0.0 -> 255.255.255.255 DHCP DHCP Request - Transaction ID 0xf2401d13
2 0.012786 192.168.1.1 -> 255.255.255.255 DHCP DHCP ACK - Transaction ID 0xf2401d13
3 0.054892 192.168.1.10 -> Broadcast ARP Who has 192.168.1.10? Tell 192.168.1.10
4 0.538444 192.168.1.10 -> Broadcast ARP Who has 192.168.1.10? Tell 192.168.1.10
5 1.539855 192.168.1.10 -> Broadcast ARP Who has 192.168.1.10? Tell 192.168.1.10
6 12.225417 192.168.1.10 -> Broadcast ARP Who has 192.168.1.1? Tell 192.168.1.10
7 12.225659 192.168.1.1 -> 192.168.1.10 ARP 192.168.1.1 is at 00:30:2b:00:06:5e
8 123.614212 192.168.1.10 -> 62.2.17.60 DNS Standard query A www.google.com
9 123.622946 62.2.17.60 -> 192.168.1.10 DNS Standard query response CNAME www.google.akadns.net A 216.239.59.99
10 123.628711 192.168.1.10 -> 216.239.59.99 TCP 1050 > http [SYN] Seq=1344059430 Ack=0 Win=16384 Len=0
11 123.673565 216.239.59.99 -> 192.168.1.10 TCP http > 1050 [SYN, ACK] Seq=2781413272 Ack=1344059431 Win=8190 Len=0
12 123.673734 192.168.1.10 -> 216.239.59.99 TCP 1050 > http [ACK] Seq=1344059431 Ack=2781413273 Win=16616 Len=0
13 123.674157 192.168.1.10 -> 216.239.59.99 HTTP GET / HTTP/1.1
14 123.722845 216.239.59.99 -> 192.168.1.10 TCP http > 1050 [ACK] Seq=2781413273 Ack=1344059666 Win=31624 Len=0
15 123.727333 216.239.59.99 -> 192.168.1.10 HTTP Continuation
16 123.727472 192.168.1.10 -> 216.239.59.99 TCP 1050 > http [ACK] Seq=1344059666 Ack=2781413273 Win=16616 Len=0
17 123.728575 216.239.59.99 -> 192.168.1.10 HTTP HTTP/1.1 302 Found
18 123.728648 216.239.59.99 -> 192.168.1.10 HTTP Continuation
19 123.728720 192.168.1.10 -> 216.239.59.99 TCP 1050 > http [ACK] Seq=1344059666 Ack=2781413898 Win=16616 Len=0
20 123.890928 192.168.1.10 -> 216.239.59.99 TCP 1050 > http [ACK] Seq=1344059666 Ack=2781413918 Win=16596 Len=0
21 124.044624 192.168.1.10 -> 62.2.17.60 DNS Standard query A www.google.ch
22 124.054143 62.2.17.60 -> 192.168.1.10 DNS Standard query response CNAME www.google.akadns.net A 216.239.59.99
23 124.062571 192.168.1.10 -> 216.239.59.99 TCP 1052 > http [SYN] Seq=1344215553 Ack=0 Win=16384 Len=0
24 124.107601 216.239.59.99 -> 192.168.1.10 TCP http > 1052 [SYN, ACK] Seq=3936685089 Ack=1344215554 Win=8190 Len=0
25 124.107746 192.168.1.10 -> 216.239.59.99 TCP 1052 > http [ACK] Seq=1344215554 Ack=3936685090 Win=16616 Len=0
26 124.108208 192.168.1.10 -> 216.239.59.99 HTTP GET /cxfer?c=PREF%3D:TM%3D1067053399:S%3DyNTbXIITC53TDD_r HTTP/1.1
27 124.162190 216.239.59.99 -> 192.168.1.10 TCP http > 1052 [ACK] Seq=3936685090 Ack=1344215840 Win=31624 Len=0
28 124.167207 216.239.59.99 -> 192.168.1.10 HTTP HTTP/1.1 302 Found
29 124.167288 216.239.59.99 -> 192.168.1.10 HTTP Continuation
30 124.167412 192.168.1.10 -> 216.239.59.99 TCP 1052 > http [ACK] Seq=1344215840 Ack=3936685637 Win=16616 Len=0
31 124.591981 192.168.1.10 -> 216.239.59.99 HTTP GET / HTTP/1.1
32 124.637871 216.239.59.99 -> 192.168.1.10 TCP http > 1052 [ACK] Seq=3936685637 Ack=1344216074 Win=31624 Len=0
33 124.644687 216.239.59.99 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
34 124.645262 216.239.59.99 -> 192.168.1.10 HTTP Continuation
```

• Ethereal trace of a booting host (2):

```
35 124.645710 216.239.59.99 -> 192.168.1.10 HTTP Continuation
36 124.645774 192.168.1.10 -> 216.239.59.99 TCP 1052 > http [ACK] Seq=1344216074 Ack=3936686709 Win=16616 Len=0
37 124.693619 216.239.59.99 -> 192.168.1.10 HTTP Continuation
38 124.693790 192.168.1.10 -> 216.239.59.99 TCP 1052 > http [ACK] Seq=1344216074 Ack=3936687613 Win=16616 Len=0
39 149.332357 192.168.1.10 -> 62.2.17.60 DNS Standard query A www.fhzh.ch
40 149.340866 62.2.17.60 -> 192.168.1.10 DNS Standard query response CNAME bart.isz.ch A 193.5.54.112
41 149.347847 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [SYN] Seq=1350574464 Ack=0 Win=16384 Len=0
42 149.364909 193.5.54.112 -> 192.168.1.10 TCP http > 1055 [SYN, ACK] Seq=3936147583 Ack=1350574465 Win=1460 Len=0
43 149.365081 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350574465 Ack=3936147584 Win=17280 Len=0
44 149.365637 192.168.1.10 -> 193.5.54.112 HTTP GET / HTTP/1.1
45 149.388325 193.5.54.112 -> 192.168.1.10 TCP http > 1055 [ACK] Seq=3936147584 Ack=1350574827 Win=2920 Len=0
46 149.415071 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
47 149.526775 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350574827 Ack=3936149024 Win=17280 Len=0
48 149.559832 193.5.54.112 -> 192.168.1.10 HTTP Continuation
49 149.563077 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [SYN] Seq=1350676619 Ack=0 Win=16384 Len=0
50 149.565540 193.5.54.112 -> 192.168.1.10 HTTP Continuation
51 149.565664 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350574827 Ack=3936151904 Win=17280 Len=0
52 149.579138 193.5.54.112 -> 192.168.1.10 TCP http > 1056 [SYN, ACK] Seq=3936290634 Ack=1350676620 Win=1460 Len=0
53 149.579265 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350676620 Ack=3936290635 Win=17280 Len=0
54 149.579660 192.168.1.10 -> 193.5.54.112 HTTP GET /basestyles.css HTTP/1.1
55 149.602502 193.5.54.112 -> 192.168.1.10 TCP http > 1056 [ACK] Seq=3936290635 Ack=1350676896 Win=2920 Len=0
56 149.627396 193.5.54.112 -> 192.168.1.10 HTTP Continuation
57 149.627565 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350574827 Ack=3936151904 Win=17280 Len=0
58 149.657592 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
59 149.659625 193.5.54.112 -> 192.168.1.10 HTTP Continuation
60 149.659813 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350574827 Ack=3936154784 Win=17280 Len=0
61 149.690512 193.5.54.112 -> 192.168.1.10 HTTP Continuation
62 149.690692 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350574827 Ack=3936155778 Win=16286 Len=0
63 149.827154 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350676896 Ack=3936292075 Win=17280 Len=0
64 149.918926 193.5.54.112 -> 192.168.1.10 HTTP Continuation
65 149.929273 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/logos/logo_mitglied.gif HTTP/1.1
66 149.929581 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/schule/unsereschule_out.gif HTTP/1.1
67 149.949314 193.5.54.112 -> 192.168.1.10 TCP http > 1055 [ACK] Seq=3936155778 Ack=1350575130 Win=2920 Len=0
68 149.965630 193.5.54.112 -> 192.168.1.10 TCP http > 1056 [ACK] Seq=3936292134 Ack=1350677203 Win=2920 Len=0
```

• Ethereal trace of a booting host (3):

```
69 149.966541 193.5.54.112 -> 192.168.1.10 HTTP Continuation
70 149.966704 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350575130 Ack=3936155778 Win=16286 Len=0
71 150.039877 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
72 150.040054 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350575130 Ack=3936157439 Win=17280 Len=0
73 150.079662 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/sitemap/sitemap_out.gif HTTP/1.1
74 150.090146 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
75 150.094920 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/impressum/impressum_out.gif HTTP/1.1
76 150.134013 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
77 150.138852 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/home/hochschule.gif HTTP/1.1
78 150.182032 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
79 150.206349 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/home/spacer_vorne.gif HTTP/1.1
80 150.234410 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
81 150.239389 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/home/sb_technik.gif HTTP/1.1
82 150.273854 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
83 150.279214 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/home/spacer_unterhochschule.gif HTTP/1.1
84 150.367583 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
85 150.401651 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
86 150.405968 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/logos/logo_twv.gif HTTP/1.1
87 150.500282 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
88 150.528133 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350576031 Ack=3936160253 Win=17280 Len=0
89 150.544635 193.5.54.112 -> 192.168.1.10 HTTP Continuation
90 150.549145 192.168.1.10 -> 193.5.54.112 HTTP GET /images/navigation/home/balken_links_neutral.gif HTTP/1.1
91 150.576008 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
92 150.580003 192.168.1.10 -> 193.5.54.112 HTTP GET /images/helper/spacer.gif HTTP/1.1
93 150.616820 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
94 150.621841 192.168.1.10 -> 193.5.54.112 HTTP GET /images/homepage/haende.jpg HTTP/1.1
95 150.628249 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350678420 Ack=3936296200 Win=17280 Len=0
96 150.662779 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
97 150.736096 193.5.54.112 -> 192.168.1.10 HTTP Continuation
98 150.742058 192.168.1.10 -> 193.5.54.112 HTTP GET /images/homepage/allein.jpg HTTP/1.1
99 150.827335 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
100 150.828554 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350576914 Ack=3936162534 Win=17280 Len=0
101 150.888835 193.5.54.112 -> 192.168.1.10 HTTP Continuation
102 150.888966 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350576914 Ack=3936162534 Win=17280 Len=0
```

• Ethereal trace of a booting host (4):

```
103 150.919809 193.5.54.112 -> 192.168.1.10 HTTP Continuation
104 150.919957 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350576914 Ack=3936165414 Win=17280 Len=0
105 150.922331 193.5.54.112 -> 192.168.1.10 HTTP Continuation
106 150.928691 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350678708 Ack=3936298848 Win=17280 Len=0
107 150.930934 192.168.1.10 -> 193.5.54.112 HTTP GET /images/homepage/zwei.jpg HTTP/1.1
108 150.983430 193.5.54.112 -> 192.168.1.10 HTTP Continuation
109 150.983582 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350678708 Ack=3936298848 Win=17280 Len=0
110 151.007688 193.5.54.112 -> 192.168.1.10 HTTP Continuation
111 151.007821 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350678708 Ack=3936298848 Win=17280 Len=0
112 151.017440 193.5.54.112 -> 192.168.1.10 HTTP Continuation
113 151.017564 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350678708 Ack=3936301728 Win=17280 Len=0
114 151.076644 193.5.54.112 -> 192.168.1.10 HTTP Continuation
115 151.076838 192.168.1.10 -> 193.5.54.112 TCP 1056 > http [ACK] Seq=1350678708 Ack=3936304056 Win=17280 Len=0
116 151.099358 193.5.54.112 -> 192.168.1.10 HTTP HTTP/1.1 200 OK
117 151.101066 193.5.54.112 -> 192.168.1.10 TCP http > 1055 [ACK] Seq=3936167383 Ack=1350577200 Win=2920 Len=0
118 151.229116 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350577200 Ack=3936167383 Win=17280 Len=0
119 151.291381 193.5.54.112 -> 192.168.1.10 HTTP Continuation
120 151.291488 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350577200 Ack=3936167383 Win=17280 Len=0
121 151.328297 193.5.54.112 -> 192.168.1.10 HTTP Continuation
122 151.328456 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350577200 Ack=3936170263 Win=17280 Len=0
123 151.386317 193.5.54.112 -> 192.168.1.10 HTTP Continuation
124 151.389716 193.5.54.112 -> 192.168.1.10 HTTP Continuation
125 151.389880 192.168.1.10 -> 193.5.54.112 TCP 1055 > http [ACK] Seq=1350577200 Ack=3936171725 Win=17280 Len=0
```