```c
#include <stdio.h>
#include <time.h>
#include <pcap.h>
#include <netinet/in.h>
#include <netinet/if_ether.h>
#include <stdlib.h>
#include <netinet/if_ether.h>
#include <netinet/in.h>
#include <netinet/ip.h>
#include <netinet/tcp.h>
#include <netinet/udp.h>

void packetCallback(u_char *args, const struct pcap_pkthdr *header, const u_char *packet);

int main(int argc, char **argv) {
        char *device;
        char error_buffer[PCAP_ERRBUF_SIZE];

        pcap_t *handle;
        int packet_count = 25;
        int packet_timeout = 10000;

        if(argc == 2) {
                handle = pcap_open_offline(argv[1], error_buffer);
                if(handle == NULL) {
                        printf("error opening file: %s\n",error_buffer);
                        exit(1);
                }
        } else {
                device = pcap_lookupdev(error_buffer);
                if(device == NULL) {
                        printf("Can't find device: %s\n", error_buffer);
                        exit(1);
                }

                handle = pcap_open_live(device, BUFSIZ, 0, packet_timeout, error_buffer);
                if(handle == NULL) {
                        printf("can't open device: %s\n", error_buffer);
                        exit(1);
                }
        }

        pcap_loop(handle, packet_count, packetCallback, NULL);
        pcap_close(handle);
}

void processIP(const u_char *packet) {
        struct iphdr *ip;

        u_char *payload;
        char *addr;
        unsigned int len;

        ip = (struct iphdr*) packet;
        if(ip->version != 4) {
                printf("not version 4\n");
                return;
        }

        len = ip->ihl * 4;
        printf("header length: %d\n", len);
        payload = (unsigned char*)packet+len;

        if(ip->protocol == IPPROTO_TCP) {
                printf("TCP packet\n");
                // call the TCP procedure here
        }

```

```c
 69             if(ip->protocol == IPPROTO_UDP) {
 70                     printf("UDP packet\n");
 71                     // call the UDP procedure here
 72             }
 73
 74             addr = (char*) &(ip->saddr);
 75             printf("\tsource: %hhu.%hhu.%hhu.%hhu\n",addr[0], addr[1],addr[2], addr[3]);
 76             addr = (char*) &(ip->daddr);
 77             printf("\tdestination: %hhu.%hhu.%hhu.%hhu\n",addr[0], addr[1],addr[2], addr[3]);
 78
 79             printf("Time alive: %d\n", ip->ttl);
 80             printf("ID: %d\n", ntohs(ip->id));
 81
 82             int reserved = (ip->frag_off & IP_RF);
 83             if (reserved != 0) printf("'Reserved' fragment flag is %d\n", reserved);
 84             else printf("'Reserve' fragment flag not found.\n");
 85
 86             int dont = (ip->frag_off & IP_DF);
 87             if (dont != 0) printf("'Dont' fragment flag is %d\n", dont);
 88             else printf("'Dont' fragment flag not found.\n");
 89
 90             int more = (ip->frag_off & IP_MF);
 91             if (more != 0) printf("'More' fragment flag is %d\n", more);
 92             else printf("'More' fragment flag not found.\n");
 93 }
 94
 95 void packetCallback(u_char *args, const struct pcap_pkthdr *header, const u_char *packet) {
 96             struct ether_header *eptr;
 97             short type;
 98             char* addr;
 99
100             printf("time: %s", ctime((const time_t*) &header->ts.tv_sec));
101             eptr = (struct ether_header*) packet;
102
103             addr = (char*) &(eptr->ether_shost);
104             printf("\tsource: %hhu.%hhu.%hhu.%hhu\n",addr[0], addr[1],addr[2], addr[3]);
105             addr = (char*) &(eptr->ether_dhost);
106             printf("\tdestination: %hhu.%hhu.%hhu.%hhu\n",addr[0], addr[1],addr[2], addr[3]);
107
108             type = ntohs(eptr->ether_type);
109             if(type == ETHERTYPE_IP) {
110                     printf("IP packet\n");
111                     processIP(packet+14);
112             }
113
114             if(type == ETHERTYPE_ARP) {
115                     printf("arp packet\n");
116             }
117
118             printf("\n");
119 }
```

```
1  CFLAGS = -Wall -w -g
2
3  lab10: lab9.o
4          cc -o lab9 lab9.o -lpcap
5
6  clean :
7          rm lab9.o lab9
```

```
time: Mon Oct  4 16:16:02 2004
        source: 128.11.152.59
        destination: 190.98.216.125
IP packet
header length: 20
UDP packet
        source: 131.243.208.144
        destination: 128.3.26.57
Time alive: 253
ID: 49208
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.


time: Mon Oct  4 16:16:02 2004
        source: 190.98.216.125
        destination: 128.11.152.59
IP packet
header length: 20
UDP packet
        source: 128.3.26.57
        destination: 131.243.208.144
Time alive: 64
ID: 12868
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.


time: Mon Oct  4 16:16:02 2004
        source: 128.11.152.59
        destination: 190.98.216.125
IP packet
header length: 20
```

UDP packet
        source: 196.138.108.120
        destination: 128.3.26.57
Time alive: 51
ID: 25184
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:03 2004
        source: 190.98.216.125
        destination: 128.11.152.59
IP packet
header length: 20
UDP packet
        source: 128.3.26.57
        destination: 128.3.97.204
Time alive: 64
ID: 16477
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:03 2004
        source: 190.98.216.170
        destination: 128.11.152.59
IP packet
header length: 20
UDP packet
        source: 128.3.26.152
        destination: 128.3.99.102
Time alive: 64
ID: 20865

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:03 2004

        source: 128.11.152.59

        destination: 28.214.7.52

IP packet

header length: 20

UDP packet

        source: 128.3.97.204

        destination: 128.3.26.133

Time alive: 62

ID: 7177

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:04 2004

        source: 128.11.152.59

        destination: 190.98.216.125

IP packet

header length: 20

UDP packet

        source: 128.3.97.11

        destination: 128.3.26.57

Time alive: 62

ID: 64408

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:04 2004

```
        source: 190.98.216.125
        destination: 128.11.152.59
IP packet
header length: 20
UDP packet
        source: 128.3.26.57
        destination: 128.3.97.11
Time alive: 64
ID: 13685
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.


time: Mon Oct  4 16:16:04 2004
        source: 128.11.152.59
        destination: 190.98.216.218
IP packet
header length: 20
UDP packet
        source: 192.41.222.40
        destination: 128.3.26.181
Time alive: 59
ID: 46963
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.


time: Mon Oct  4 16:16:04 2004
        source: 128.11.152.59
        destination: 194.223.224.130
IP packet
header length: 20
UDP packet
```

```
        source: 128.3.96.230
        destination: 128.3.26.255
Time alive: 62
ID: 26541
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.


time: Mon Oct  4 16:16:04 2004
        source: 194.223.224.130
        destination: 128.11.152.59
IP packet
header length: 20
UDP packet
        source: 128.3.26.255
        destination: 128.3.96.230
Time alive: 30
ID: 4691
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.


time: Mon Oct  4 16:16:05 2004
        source: 128.11.152.59
        destination: 190.98.216.218
IP packet
header length: 20
UDP packet
        source: 192.41.222.40
        destination: 128.3.26.181
Time alive: 59
ID: 46966
'Reserve' fragment flag not found.
```

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:05 2004
        source: 128.11.152.59
        destination: 190.98.216.218
IP packet
header length: 20
UDP packet
        source: 192.41.222.40
        destination: 128.3.26.181
Time alive: 59
ID: 46969
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:05 2004
        source: 190.98.216.125
        destination: 128.11.152.59
IP packet
header length: 20
UDP packet
        source: 128.3.26.57
        destination: 128.55.222.16
Time alive: 64
ID: 22789
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:05 2004
        source: 128.11.152.59

destination: 190.98.216.125
IP packet
header length: 20
UDP packet
             source: 131.243.208.184
             destination: 128.3.26.57
Time alive: 253
ID: 15077
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:05 2004
             source: 190.98.216.125
             destination: 128.11.152.59
IP packet
header length: 20
UDP packet
             source: 128.3.26.57
             destination: 131.243.208.184
Time alive: 64
ID: 25642
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:05 2004
             source: 128.11.152.59
             destination: 190.98.216.218
IP packet
header length: 20
UDP packet
             source: 192.41.222.40

destination: 128.3.26.181

Time alive: 59

ID: 46972

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:06 2004

        source: 128.11.152.59

        destination: 190.98.216.218

IP packet

header length: 20

UDP packet

        source: 192.41.222.40

        destination: 128.3.26.181

Time alive: 59

ID: 46975

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:06 2004

        source: 128.11.152.59

        destination: 190.98.216.172

IP packet

header length: 20

TCP packet

        source: 32.138.48.97

        destination: 128.3.26.249

Time alive: 109

ID: 27716

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:06 2004
        source: 190.98.216.172
        destination: 128.11.152.59
IP packet
header length: 20
TCP packet
        source: 128.3.26.249
        destination: 32.138.48.97
Time alive: 64
ID: 7986
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:07 2004
        source: 128.11.152.59
        destination: 190.98.216.172
IP packet
header length: 20
TCP packet
        source: 32.138.48.97
        destination: 128.3.26.249
Time alive: 109
ID: 28484
'Reserve' fragment flag not found.
'Dont' fragment flag not found.
'More' fragment flag not found.

time: Mon Oct 4 16:16:07 2004
        source: 190.98.216.172
        destination: 128.11.152.59

IP packet

header length: 20

UDP packet

        source: 128.3.26.249

        destination: 128.3.99.102

Time alive: 64

ID: 58896

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:07 2004

        source: 128.11.152.59

        destination: 190.98.216.170

IP packet

header length: 20

UDP packet

        source: 128.3.99.54

        destination: 128.3.26.152

Time alive: 62

ID: 53340

'Reserve' fragment flag not found.

'Dont' fragment flag not found.

'More' fragment flag not found.

time: Mon Oct 4 16:16:08 2004

        source: 194.223.224.140

        destination: 169.113.29.159

time: Mon Oct 4 16:16:08 2004

        source: 194.223.224.140

        destination: 169.113.29.0