

CS 39006: Computer Networks Laboratory

Raw Sockets in POSIX Network programming

Department of Computer Science
and Engineering



INDIAN INSTITUTE OF TECHNOLOGY
KHARAGPUR

Abhijnan Chakraborty
abhijnan@cse.iitkgp.ac.in

Sandip Chakraborty
sandipc@cse.iitkgp.ac.in



What Are Raw Sockets?

- A raw socket allows direct sending and receiving of IP packets without transport-layer encapsulation (e.g., TCP or UDP).
- Used when:
 - You want to implement custom protocols.
 - You need fine-grained control over packet structure.
 - You're working on network monitoring or security tools.

Key Characteristics

- Bypass the OS transport layer
- Requires root privileges
- Can be used to build or inspect packets manually
- Access to IP headers and payloads

Raw Socket Use Cases

- Writing custom protocols (e.g., your own discovery or telemetry protocol)
- Packet sniffing
- Penetration testing tools
- Network testing and simulation

POSIX Raw Socket API

```
int sock = socket(AF_INET, SOCK_RAW, protocol);
```

- AF_INET: IPv4
- SOCK_RAW: Raw socket type
- protocol: e.g., IPPROTO_TCP, IPPROTO_RAW, or a custom protocol number

POSIX Raw Socket API

```
int sock = socket(AF_INET, SOCK_RAW, protocol);
```

- AF_INET: IPv4
- SOCK_RAW: Raw socket type
- protocol: e.g., IPPROTO_TCP, IPPROTO_RAW, or a custom protocol number

- Optionally, you can pass the option to set the IP header manually

```
int opt = 1;
```

```
setsockopt(sock, IPPROTO_IP, IP_HDRINCL, &opt, sizeof(opt));
```

Simple Example (Send IP Packet)

```
int sock = socket(AF_INET, SOCK_RAW, IPPROTO_RAW);
```

```
char packet[1024];
```

```
struct iphdr *ip = (struct iphdr *)packet;
```

```
strcpy(packet + sizeof(struct iphdr), "Hello!");
```

```
ip->version = 4;
```

```
ip->ihl = 5;
```

```
ip->ttl = 64;
```

```
ip->protocol = 253; // Custom protocol
```

```
ip->saddr = inet_addr("192.168.1.10");
```

```
ip->daddr = inet_addr("192.168.1.20");
```

Simple Example (Send IP Packet)

```
struct sockaddr_in dst;  
dst.sin_family = AF_INET;  
dst.sin_addr.s_addr = ip->daddr;  
  
sendto(sock, packet, sizeof(struct iphdr) + strlen("Hello!"), 0,  
       (struct sockaddr *)&dst, sizeof(dst));
```


Receiving with Raw Sockets

```
int sock = socket(AF_INET, SOCK_RAW, 253); // Custom protocol

char buffer[2048];
struct sockaddr_in src;
socklen_t len = sizeof(src);

int bytes = recvfrom(sock, buffer, sizeof(buffer), 0,
                    (struct sockaddr *)&src, &len);

struct iphdr *ip = (struct iphdr *)buffer;
char *payload = buffer + ip->ihl * 4;

printf("Received: %s\n", payload);
```

Receiving with Raw Sockets

```
int sock = socket(AF_INET, SOCK_RAW, 253); // Custom protocol
```

```
char buffer[2048];
```

```
struct sockaddr_in src;
```

```
socklen_t len = sizeof(src);
```

```
int bytes = recvfrom(sock, buffer, sizeof(buffer), 0,  
                    (struct sockaddr *)&src, &len);
```

```
struct iphdr *ip = (struct iphdr *)buffer;
```

```
char *payload = buffer + ip->ihl * 4;
```

```
printf("Received: %s\n", payload);
```



Why multiply by 4?

Some Useful Tips

- Understand the IP header structure (RFC 791)
- Always validate buffer sizes
- Use virtual machines or isolated networks for testing