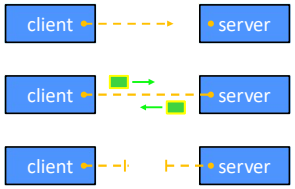
Stream Sockets

- Typically used for client-server communications
  - Client: An application that establishes a connection to a server
  - Server: An application that receives connections from clients
  - Can also be used for other forms of communication like peer-to-peer

1) Establish connection:
2) Communicate:
3) Close connection:

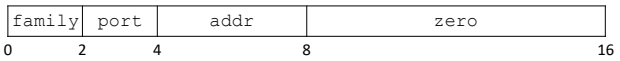


IPv4 Address Structures

```
// IPv4 4-byte address
struct in_addr {
  uint32_t s_addr;            // Address in network byte order
};

// An IPv4-specific address structure
struct sockaddr_in {
  sa_family_t    sin_family;  // Address family: AF_INET
  in_port_t      sin_port;    // Port in network byte order
  struct in_addr sin_addr;    // IPv4 address
  unsigned char  sin_zero[8]; // Pad out to 16 bytes
};
```

`struct sockaddr_in`:



Resolving DNS Names

- The POSIX way is to use **`getaddrinfo()`**
  - A complicated system call found in `#include <netdb.h>`
  - ```
    int getaddrinfo(const char* hostname,
                    const char* service,
                    const struct addrinfo* hints,
                    struct addrinfo** res);
    ```
    - Tell **`getaddrinfo()`** which host and port you want resolved
      - String representation for host: DNS name or IP address
    - Set up a "`hints`" structure with constraints you want respected
    - **`getaddrinfo()`** gives you a list of results packed into an "`addrinfo`" structure/linked list
      - Returns `0` on success; returns *negative number* on failure
    - Free the `struct addrinfo` later using **`freeaddrinfo()`**

DNS Lookup Procedure

```
struct addrinfo {
  int      ai_flags;          // additional flags
  int      ai_family;         // AF_INET, AF_INET6, AF_UNSPEC
  int      ai_socktype;       // SOCK_STREAM, SOCK_DGRAM, 0
  int      ai_protocol;       // IPPROTO_TCP, IPPROTO_UDP, 0
  size_t   ai_addrlen;        // length of socket addr in bytes
  struct sockaddr* ai_addr;   // pointer to socket addr
  char*    ai_canonname;      // canonical name
  struct addrinfo* ai_next;   // can form a linked list
};
```

1) Create a `struct addrinfo hints`
2) Zero out `hints` for "defaults"
3) Set specific fields of `hints` as desired
4) Call **`getaddrinfo()`** using `&hints`
5) Resulting linked list `res` will have all fields appropriately set

- See dnsresolve.cc
```