Network Programming

BITS Pilani
Pilani Campus

K Hari Babu
Department of Computer Science & Information Systems

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IPv4 and IPv6 Interoperability

IPv6 Sockets programming

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- New address family: **`AF_INET6`**
- New address data type: **`in6_addr`**
- New address structure: **`sockaddr_in6`**

```
struct in6_addr {
    uint8_t s6_addr[16];
};

struct sockaddr_in6 {
  uint8_t           sin6_len;
  sa_family_t       sin6_family;
  in_port_t         sin6_port;
  uint32_t          sin6_flowinfo;
  struct in6_addr   sin6_addr;
};
```

IPv4-Mapped IPv6 Address

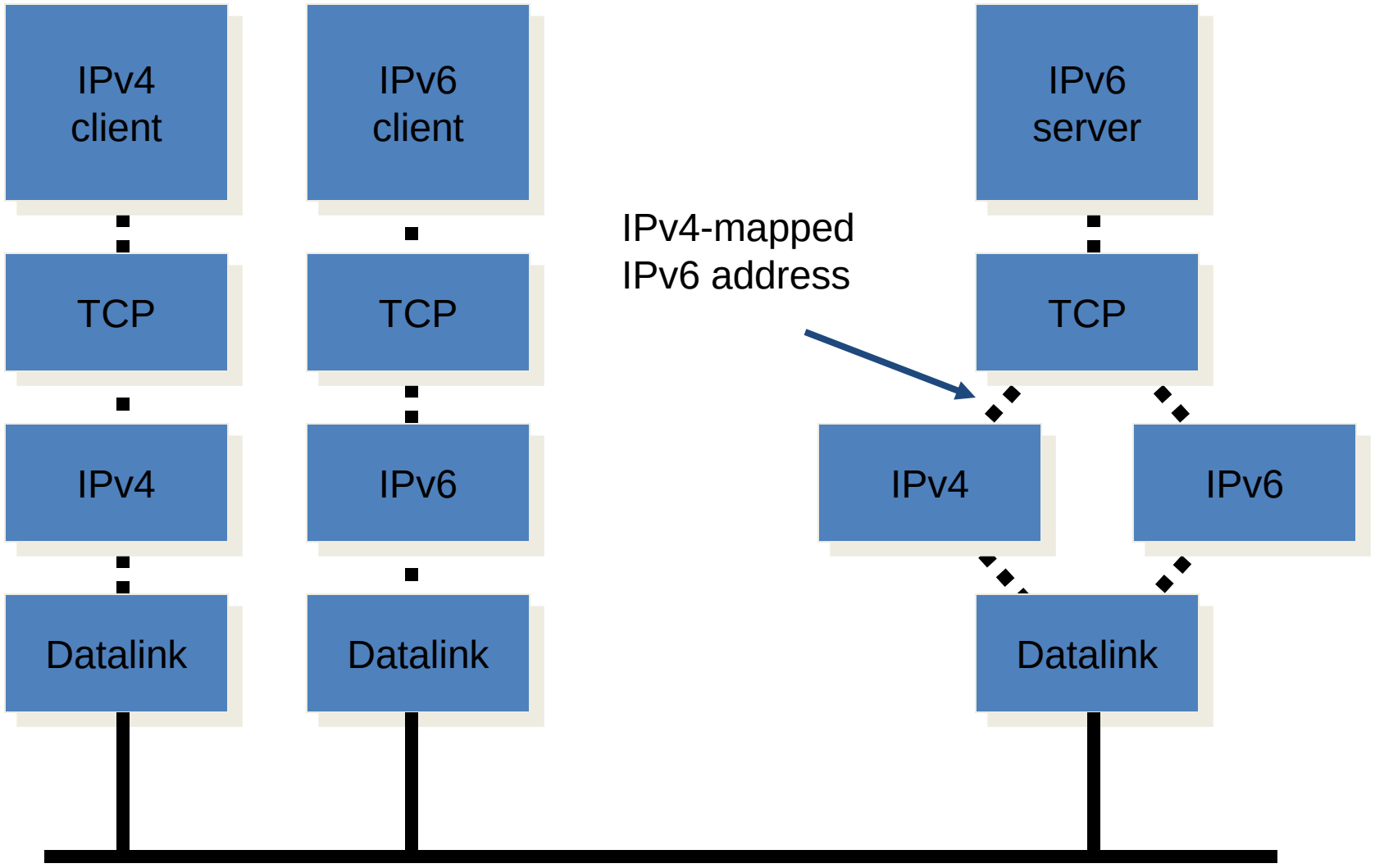
- IPv4-Mapped addresses allow a host that support both IPv4 and IPv6 to communicate with a host that supports only IPv4.
- The IPv6 address is based completely on the IPv4 address.
- 80 bits of 0s followed by 16 bits of ones, followed by a 32 bit IPv4 Address:

0000 . . . 0000	FFFF	IPv4 Address
80 bits	16 bits	32 bits

Dual Stack

- It will be important to create servers that handle both IPv4 and IPv6.
- The work is handled by the O.S. (which contains protocol stacks for both v4 and v6):
  - automatic creation of IPv6 address from an IPv4 client (IPv4-mapped IPv6 address).

Dual Stack


IPv4
client
IPv6
client
IPv6
server
IPv4-mapped
IPv6 address
TCP
TCP
TCP
IPv4
IPv6
IPv4
IPv6
Datalink
Datalink
Datalink

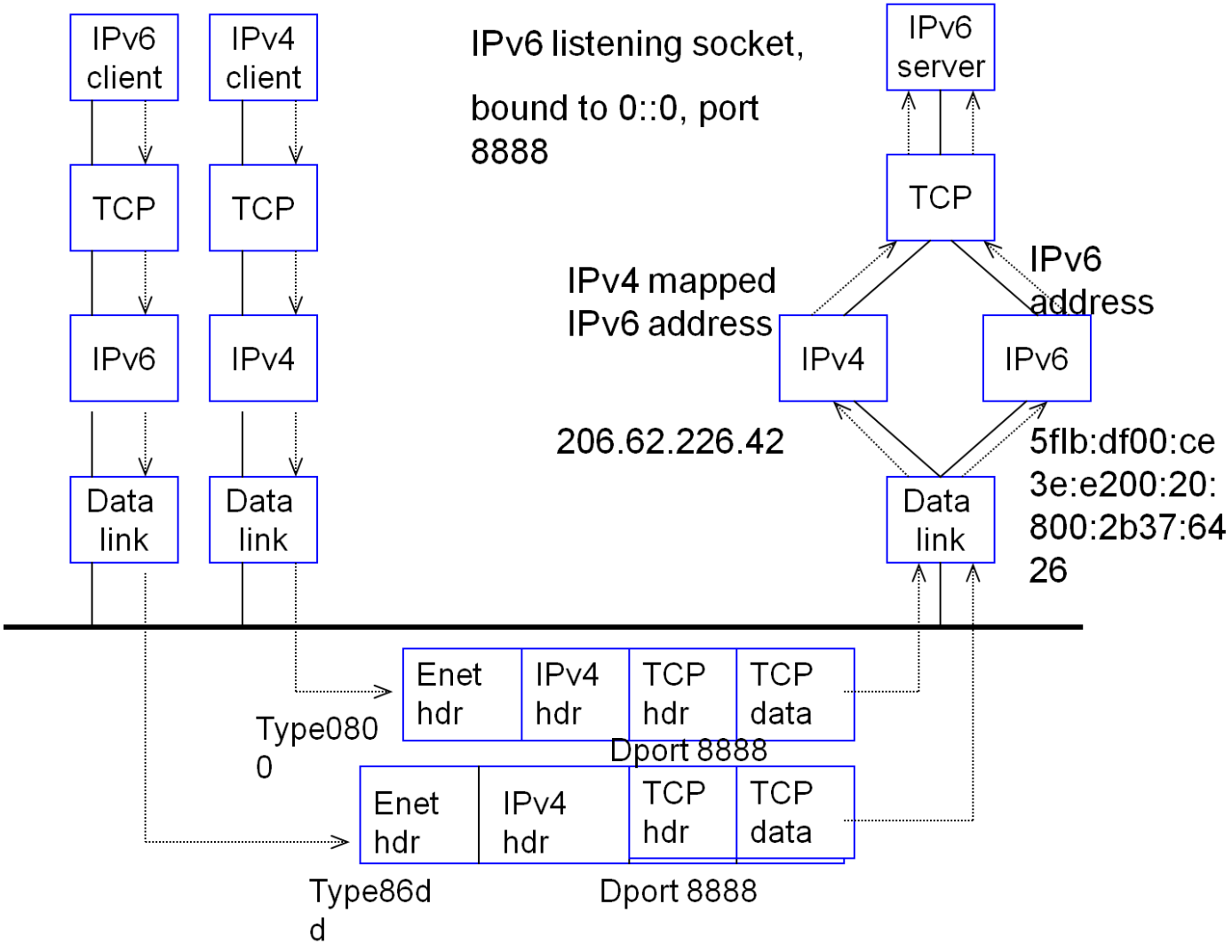
Server and client combination

- Server and client combination
  - IPv4 <=> IPv4(most server and client)
  - IPv4 <=> IPv6
  - IPv6 <=> IPv4
  - IPv6 <=> IPv6
- How IPv4 application and IPv6 application can communicate with each other.
- Host are running dual stacks, both an IPv4 protocol stack and IPv6 protocol stack

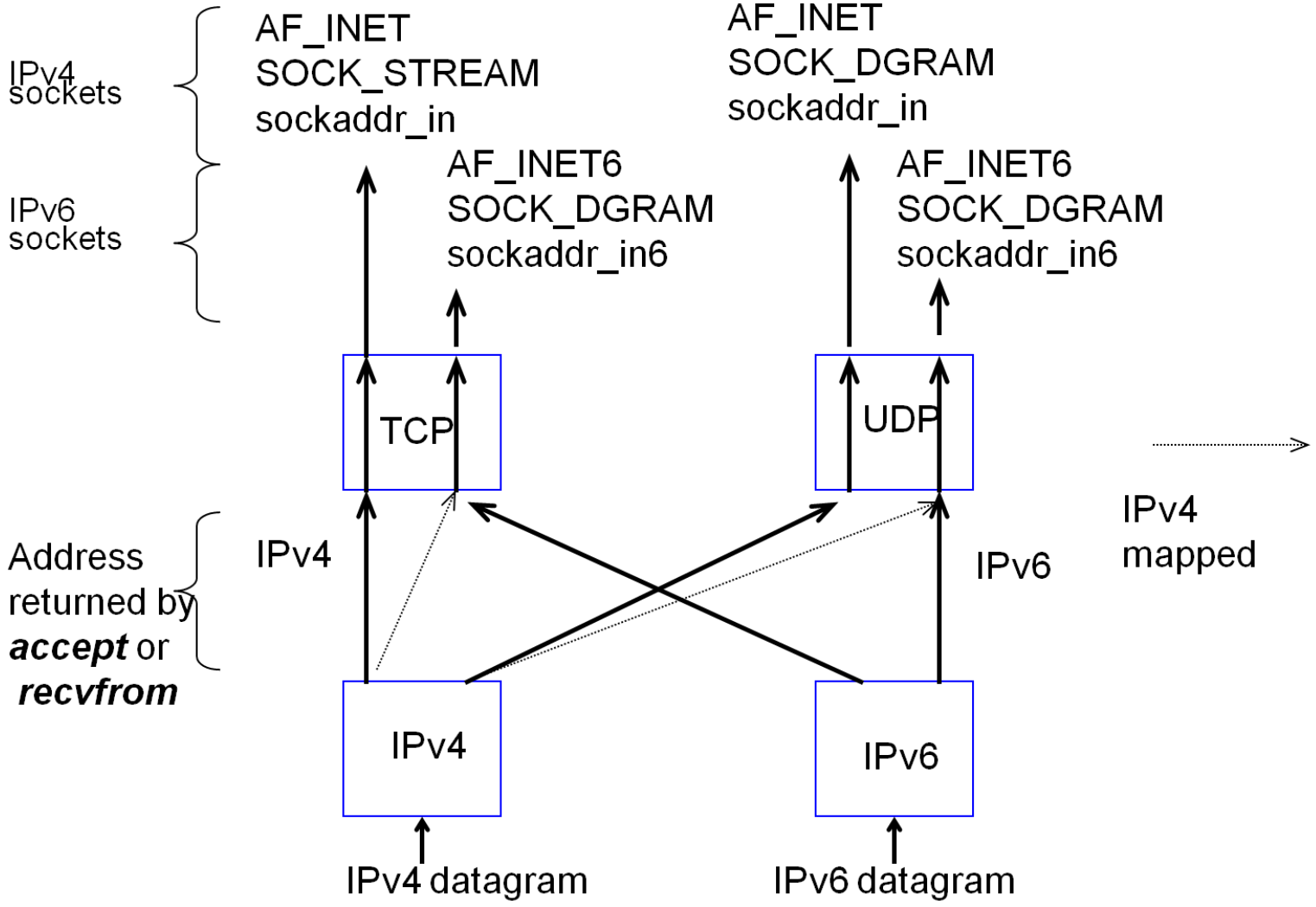
IPv4 Client , IPv6 Server

- IPv6 dual stack server can handle both IPv4 and IPv6 clients.
- This is done using IPv4-mapped IPv6 address
- server create an IPv6 listening socket that is bound to the IPv6 wildcard address

IPv4 Client , IPv6 Server



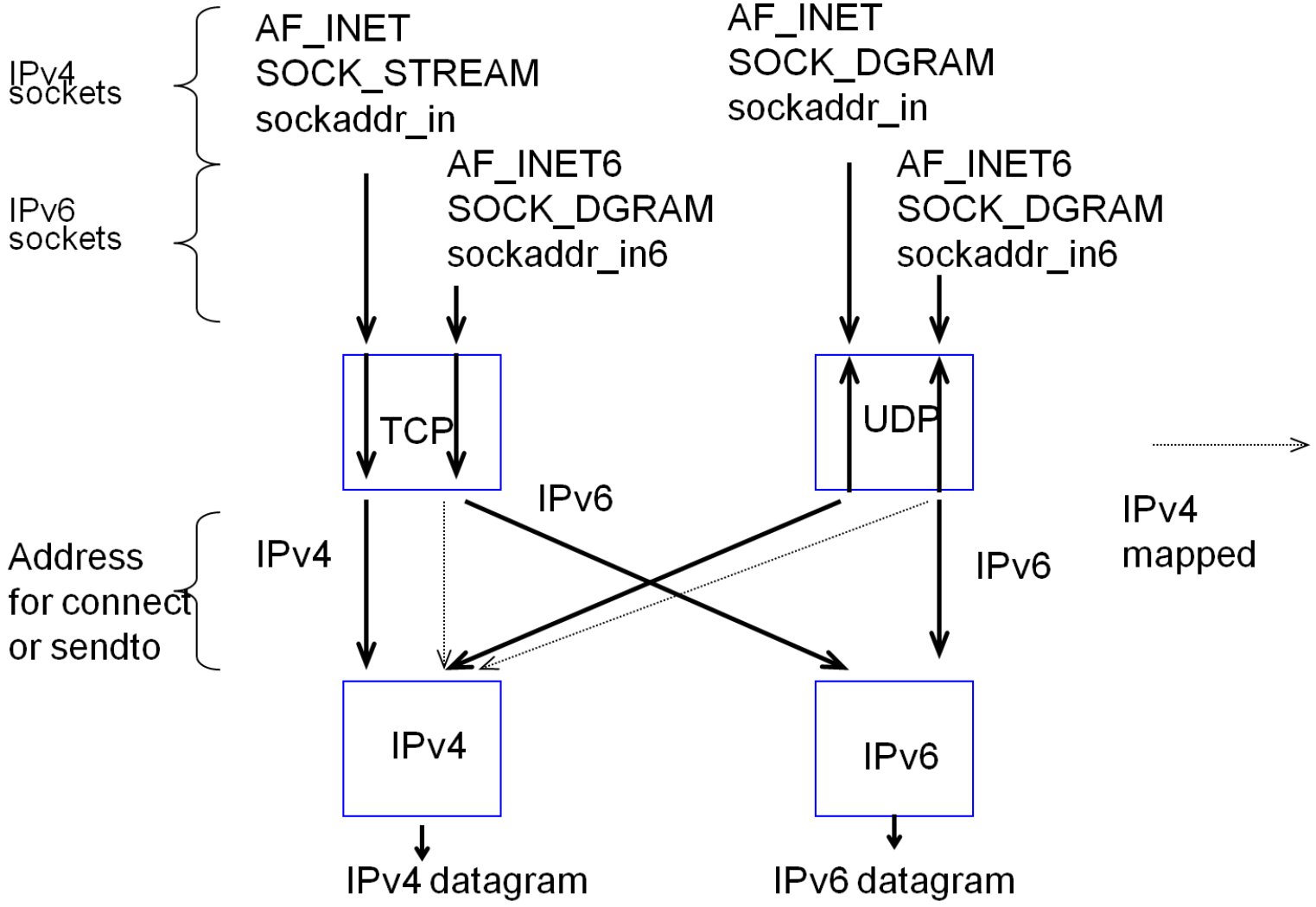
IPv4 Client , IPv6 Server



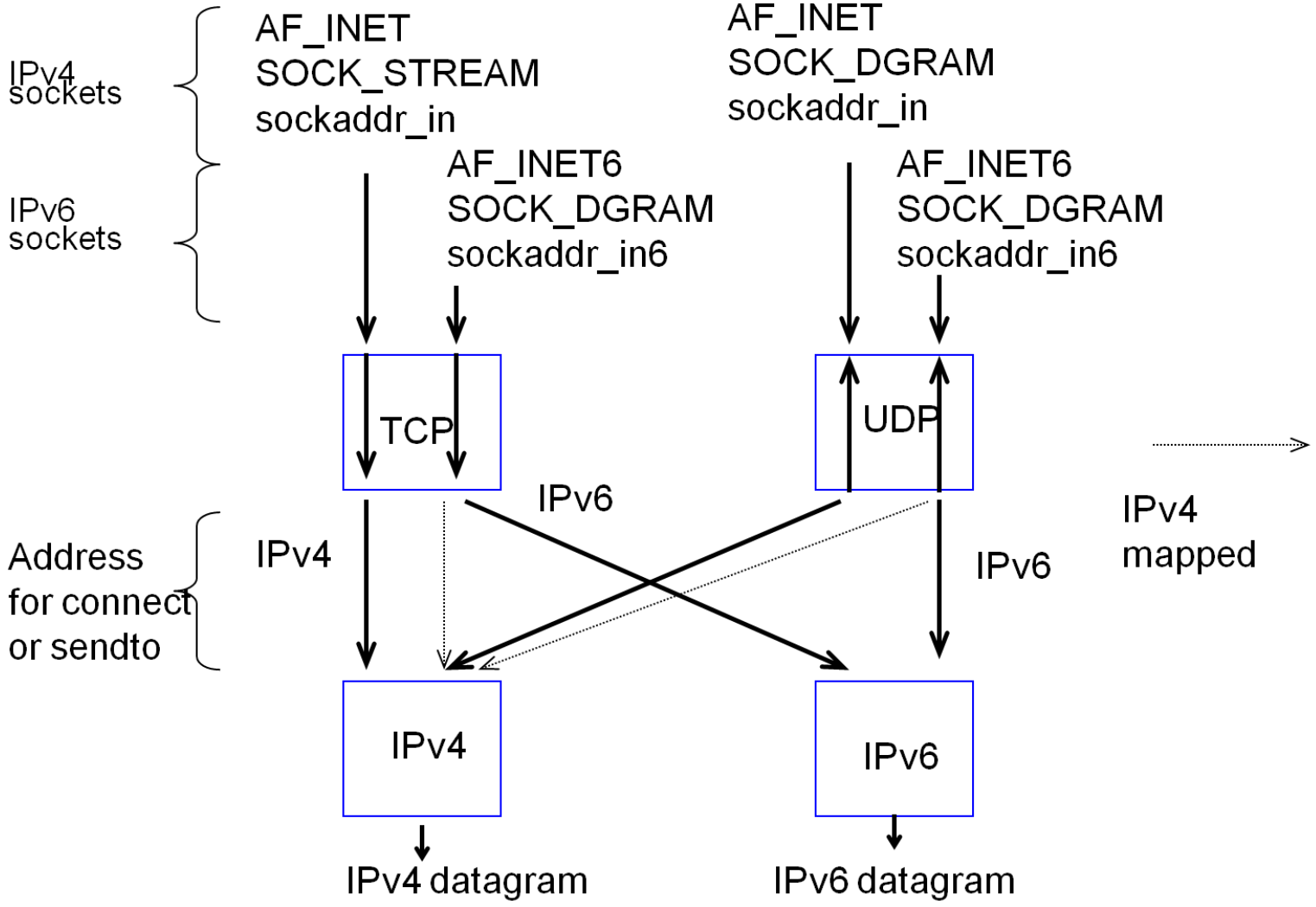
IPv6 client, IPv4 server

- IPv4 server start on an IPv4 only host and create an IPv4 listening socket
- IPv6 client start, call ***gethostbyname. IPv4 mapped IPv6 address is returned.***
- Using IPv4 datagram

IPv6 client, IPv4 server



IPv6 client, IPv4 server



Summary of Interoperability

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	IPv4 Server IPv4-only host	IPv6 Server IPv6-only host	IPv4 Server Dual stack	IPv6 Server Dual stack
IPv4 client, IPv4 only host	IPv4	No	IPv4	IPv4
IPv6 client, IPv6 only host	No	IPv6	No	IPv6
IPv4 client, dual stack host	IPv4	No	IPv4	IPv4
IPv6 client, dual stack host	IPv4	IPv6	No*	IPv6

Acknowledgements

Q&A

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Thank You