

No.	Time	DPort	SPort	Source	Destination	Protocol	Length	Info
1	0.000000000	8080	38928	127.0.0.1	127.0.0.1	TCP	80	38928 → 8080 [SYN] Seq=0
2	0.000012330	38928	8080	127.0.0.1	127.0.0.1	TCP	88	8080 → 38928 [SYN, ACK]
3	0.000024049	8080	38928	127.0.0.1	127.0.0.1	TCP	147	38928 → 8080 [PSH, ACK]
4	0.000030070	38928	8080	127.0.0.1	127.0.0.1	TCP	88	8080 → 38928 [ACK] Seq=1

▶ Frame 1: 80 bytes on wire (640 bits), 80 bytes captured (640 bits) on interface 0

▶ Linux cooked capture

▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1

▼ Transmission Control Protocol, Src Port: 38928, Dst Port: 8080, Seq: 0, Len: 0

Source Port: 38928

Destination Port: 8080

[Stream index: 0]

[TCP Segment Len: 0]

Sequence number: 0 (relative sequence number)

Acknowledgment number: 0

1011 .... = Header Length: 44 bytes (11)

▶ Flags: 0x002 (SYN)

Window size value: 43690

[Calculated window size: 43690]

Checksum: 0xfe34 [unverified]

[Checksum Status: Unverified]

Urgent pointer: 0

▼ Options: (24 bytes), Maximum segment size, SACK permitted, Timestamps, No-Operation (NOP), Window scale, TCP Fast Open, No-Operation

▶ TCP Option - Maximum segment size: 65495 bytes

▶ TCP Option - SACK permitted

▶ TCP Option - Timestamps: TSval 910043647, TSecr 0

▶ TCP Option - No-Operation (NOP)

▶ TCP Option - Window scale: 7 (multiply by 128)

▼ TCP Option - TCP Fast Open

Kind: TCP Fast Open Cookie (34)

Length: 2

Fast Open Cookie Request

▶ TCP Option - No-Operation (NOP)

▶ TCP Option - No-Operation (NOP)

1	0.000000000	8080	38928	127.0.0.1	127.0.0.1	TCP	80	38928 → 8080 [SYN] Seq=
2	0.000012330	38928	8080	127.0.0.1	127.0.0.1	TCP	88	8080 → 38928 [SYN, ACK]
3	0.000024049	8080	38928	127.0.0.1	127.0.0.1	TCP	147	38928 → 8080 [PSH, ACK]
4	0.000035768	38928	8080	127.0.0.1	127.0.0.1	TCP	206	8080 → 38928 [ACK] Seq=

- ▶ Frame 2: 88 bytes on wire (704 bits), 88 bytes captured (704 bits) on interface 0
- ▶ Linux cooked capture
- ▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1
- ▼ Transmission Control Protocol, Src Port: 8080, Dst Port: 38928, Seq: 0, Ack: 1, Len: 0

- Source Port: 8080
- Destination Port: 38928
- [Stream index: 0]
- [TCP Segment Len: 0]
- Sequence number: 0 (relative sequence number)
- Acknowledgment number: 1 (relative ack number)
- 1101 .... = Header Length: 52 bytes (13)

- ▶ Flags: 0x012 (SYN, ACK)

- Window size value: 43690
- [Calculated window size: 43690]
- Checksum: 0xfe3c [unverified]
- [Checksum Status: Unverified]
- Urgent pointer: 0

- ▼ Options: (32 bytes), Maximum segment size, SACK permitted, Timestamps, No-Operation (NOP), Window scale, TCP Fast Open, No-Op

- ▶ TCP Option - Maximum segment size: 65495 bytes
- ▶ TCP Option - SACK permitted
- ▶ TCP Option - Timestamps: TSval 910043647, TSecr 910043647
- ▶ TCP Option - No-Operation (NOP)
- ▶ TCP Option - Window scale: 7 (multiply by 128)

- ▼ TCP Option - TCP Fast Open
  - Kind: TCP Fast Open Cookie (34)
  - Length: 10
  - Fast Open Cookie: 1cf521655382fb70

- ▶ TCP Option - No-Operation (NOP)
- ▶ TCP Option - No-Operation (NOP)

- ▶ [SEQ/ACK analysis]

No.	Time	DPort	SPort	Source	Destination	Protocol	Length	Info
1	0.000000000	8080	38928	127.0.0.1	127.0.0.1	TCP	80	38928 → 8080 [SYN] Seq=0
2	0.000012330	38928	8080	127.0.0.1	127.0.0.1	TCP	88	8080 → 38928 [SYN, ACK]
3	0.000024049	8080	38928	127.0.0.1	127.0.0.1	TCP	147	38928 → 8080 [PSH, ACK]

▶ Frame 3: 147 bytes on wire (1176 bits), 147 bytes captured (1176 bits) on interface 0

▶ Linux cooked capture

▶ Internet Protocol Version 4, Src: 127.0.0.1, Dst: 127.0.0.1

▼ Transmission Control Protocol, Src Port: 38928, Dst Port: 8080, Seq: 1, Ack: 1, Len: 79

Source Port: 38928

Destination Port: 8080

[Stream index: 0]

[TCP Segment Len: 79]

Sequence number: 1 (relative sequence number)

[Next sequence number: 80 (relative sequence number)]

Acknowledgment number: 1 (relative ack number)

1000 .... = Header Length: 32 bytes (8)

▶ Flags: 0x018 (PSH, ACK)

Window size value: 342

[Calculated window size: 43776]

[Window size scaling factor: 128]

Checksum: 0xfe77 [unverified]

[Checksum Status: Unverified]

Urgent pointer: 0

▼ Options: (12 bytes), No-Operation (NOP), No-Operation (NOP), Timestamps

▶ TCP Option - No-Operation (NOP)

▶ TCP Option - No-Operation (NOP)

▶ TCP Option - Timestamps: TSval 910043647, TSecr 910043647

▶ [SEQ/ACK analysis]

TCP payload (79 bytes)

```

0000  00 00 03 04 00 06 00 00 00 00 00 00 00 08 00  .....
0010  45 00 00 83 57 52 40 00 40 06 e5 20 7f 00 00 01  E...WR@. @..
0020  7f 00 00 01 98 10 1f 90 2b 53 55 37 82 77 43 42  .... +SU7.wCB
0030  80 18 01 56 fe 77 00 00 01 01 08 0a 36 3e 29 ff  ...V.w...6>).
0040  36 3e 29 ff 43 41 4c 43 55 4c 41 54 45 20 4d 41  6>).CALC ULATE MA
0050  54 48 2f 31 2e 31 0a 4f 70 65 72 61 6e 64 31 3a  TH/1.1.0 perand1:
0060  20 31 0a 4f 70 65 72 61 74 6f 72 3a 20 2b 0a 4f  1.0perator: +.0
0070  70 65 72 61 6e 64 32 3a 20 31 0a 43 6f 6e 6e 65  perand2: 1.Conne
0080  63 74 69 6f 6e 3a 20 4b 65 65 70 2d 41 6c 69 76  ction: K eep-Aliv
0090  65 0a 0a  e..

```

No.	Time	DPort	SPort	Source	Destination	Protocol	Length	Info
1	0.000000000	8080	38932	127.0.0.1	127.0.0.1	TCP	167	38932 → 8080 [SYN]
2	0.000014142	38932	8080	127.0.0.1	127.0.0.1	TCP	76	8080 → 38932 [SYN]
3	0.000023764	8080	38932	127.0.0.1	127.0.0.1	TCP	68	38932 → 8080 [ACK]

Source Port: 38932  
Destination Port: 8080  
[Stream index: 0]  
[TCP Segment Len: 79]  
Sequence number: 0 (relative sequence number)  
[Next sequence number: 80 (relative sequence number)]  
Acknowledgment number: 0  
1101 .... = Header Length: 52 bytes (13)

▶ **Flags: 0x002 (SYN)**

Window size value: 43690  
[Calculated window size: 43690]  
Checksum: 0xfe8b [unverified]  
[Checksum Status: Unverified]  
Urgent pointer: 0

▼ **Options: (32 bytes), Maximum segment size, SACK permitted, Timestamps, No-Operation (NOP), Window scale, TCP Fast Open, N**

- ▶ TCP Option - Maximum segment size: 65495 bytes
- ▶ TCP Option - SACK permitted
- ▶ TCP Option - Timestamps: TSval 910286776, TSecr 0
- ▶ TCP Option - No-Operation (NOP)
- ▶ TCP Option - Window scale: 7 (multiply by 128)

▼ **TCP Option - TCP Fast Open**

Kind: TCP Fast Open Cookie (34)  
Length: 10

▶ **Fast Open Cookie: 1cf521655382fb70**

- ▶ TCP Option - No-Operation (NOP)
- ▶ TCP Option - No-Operation (NOP)

▶ [SEQ/ACK analysis]

**TCP payload (79 bytes)**

0000	00 00 03 04 00 06 00 00 00 00 00 00 00 00 08 00	.....
0010	45 00 00 97 59 24 40 00 40 06 e3 3a 7f 00 00 01	E...YS@. @.:...
0020	7f 00 00 01 98 14 1f 90 cb 3b b6 f1 00 00 00 00	.....;.....
0030	d0 02 aa aa fe 8b 00 00 02 04 ff d7 04 02 08 0a	....."
0040	36 41 df b8 00 00 00 00 01 03 03 07 22 0a 1c f5	6A....."
0050	21 65 53 82 fb 70 01 01 43 41 4c 43 55 4c 41 54	!eS..p.. CALCULAT
0060	45 20 4d 41 54 48 2f 31 2e 31 0a 4f 70 65 72 61	E MATH/1 .1.Opera
0070	6e 64 31 3a 20 31 0a 4f 70 65 72 61 74 6f 72 3a	nd1: 1.0 perator:
0080	20 2b 0a 4f 70 65 72 61 6e 64 32 3a 20 31 0a 43	+ .Opera nd2: 1.C
0090	6f 6e 6e 65 63 74 69 6f 6e 3a 20 4b 65 65 70 2d	onnectio n: Keep-
00a0	41 6c 69 76 65 0a 0a	Alive..

# Code

server

```
#include <netinet/tcp.h>
```

```
// fast open  
int qlen = 5;  
setsockopt(socketfd, SOL_TCP, TCP_FASTOPEN, &qlen, sizeof(qlen));
```

client

```
sendto(socketfd, pBuf, strlen(pBuf), MSG_FASTOPEN,  
       (struct sockaddr *) &sAddr, sizeof(struct sockaddr_in));
```

then send()/recv() normally