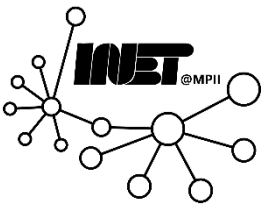
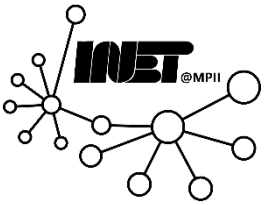
Homework 3

CDNs and Sockets



Assignment Overview

- Learn about CDNs
- Learn about Sockets
- Programming with Sockets



Question 1

A Content Delivery Network (CDN) aims to serve content to clients from ‘nearby’ servers, typically using DNS indirection.

The content of www.godaddy.com is distributed by Akamai, a very popular CDN.

Question 1 (a)

Use dig to obtain the A record of www.godaddy.com.
Perform two queries:

1. On your local DNS resolver and
2. On a public DNS resolver located in Indonesia (https://public-dns.info/nameserver/id.html).

Provide your results (ANSWER SECTION only) in a table

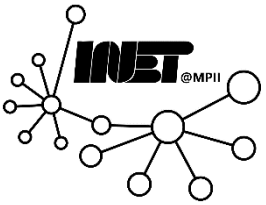
Question 1 (a)

Use dig to obtain the A record of www.godaddy.com.

Perform two queries:

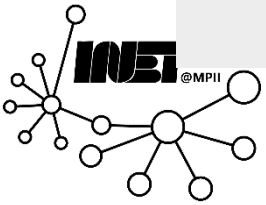
1. On your local DNS resolver and
2. On a public DNS resolver located in Indonesia (https://public-dns.info/nameserver/id.html).

Provide your results (ANSWER SECTION only) in a table



Question 1 (a)

```
1. ~$ dig www.godaddy.com
```



Question 1 (a)

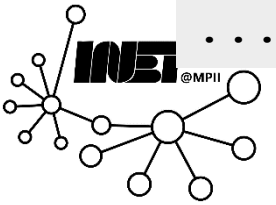
```
1. ~$ dig www.godaddy.com
```

Question 1 (a)

```
~$ dig www.godaddy.com
...
;; ANSWER SECTION:
www.godaddy.com.   300   IN    CNAME wildcard-X
wildcard-X 8519 IN CNAME Y.akamaiedge.net
Y.akamaiedge.net. 20      IN    A     23.57.27.186

;; Query time: 290 msec
;; SERVER: 134.96.7.99#53(134.96.7.99)
;; WHEN: Tue May 02 14:45:26 CEST 2023
;; MSG SIZE  rcvd: 150
...
```

Question 1 (a)

```
~$ dig www.godaddy.com
...
;; ANSWER SECTION:
www.godaddy.com.   300   IN   CNAME wildcard-X
wildcard-X 8519 IN CNAME Y.akamaiedge.net
Y.akamaiedge.net. 20     IN   A     23.57.27.186

;; Query time: 290 msec
;; SERVER: 134.96.7.99#53(134.96.7.99)
;; WHEN: Tue May 02 14:45:26 CEST 2023
;; MSG SIZE  rcvd: 150
...
```



Question 1 (a)

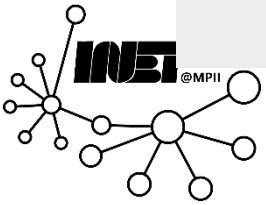
	www.godaddy.com
local	

Question 1 (a)

	www.godaddy.com
local	;; ANSWER SECTION: www.godaddy.com. 300 IN CNAME wildcard-X wildcard-X 8519 IN CNAME Y.akamaiedge.net Y.akamaiedge.net. 20 IN A 23.57.27.186

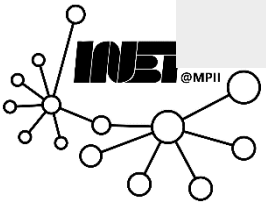
Question 1 (a)

```
1. ~$ dig @103.131.29.78 www.godaddy.com
```



Question 1 (a)

```
1. ~$ dig @103.131.29.78 www.godaddy.com
```



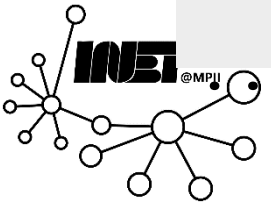
Question 1 (a)

```
~$ dig @103.131.29.78 www.godaddy.com
...
;; ANSWER SECTION:
www.godaddy.com.   275   IN    CNAME wildcard-X
wildcard-X 21575 IN     CNAME Y.akamaiedge.net.
Y.akamaiedge.net. 20    IN    A     23.12.17.70

;; Query time: 218 msec
;; SERVER: 103.131.29.78#53(103.131.29.78)
;; WHEN: Wed May 03 09:33:30 CEST 2023
;; MSG SIZE  rcvd: 147
```

.

Question 1 (a)

```
1. ~$ dig @103.131.29.78 www.godaddy.com
...
2. ;; ANSWER SECTION:
3. www.godaddy.com.   275   IN    CNAME wildcard-X
4. wildcard-X 21575 IN     CNAME Y.akamaiedge.net.
5. Y.akamaiedge.net. 20    IN    A     23.12.17.70

6. ;; Query time: 218 msec
7. ;; SERVER: 103.131.29.78#53(103.131.29.78)
8. ;; WHEN: Wed May 03 09:33:30 CEST 2023
9. ;; MSG SIZE  rcvd: 147
```

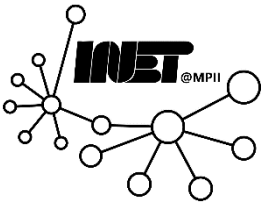


Question 1 (a)

	www.godaddy.com
local	;; ANSWER SECTION: www.godaddy.com. 300 IN CNAME wildcard-X X 8519 IN CNAME Y.akamaiedge.net Y.akamaiedge.net. 20 IN A 23.57.27.186
103.131.29.78	

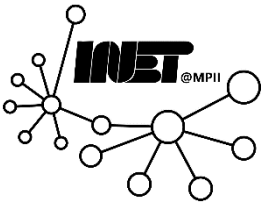
Question 1 (a)

	www.godaddy.com
local	;; ANSWER SECTION: www.godaddy.com. 300 IN CNAME wildcard-X X 8519 IN CNAME Y.akamaiedge.net Y.akamaiedge.net. 20 IN A 23.57.27.186
103.131.29.78	**;; ANSWER SECTION:** **www.godaddy.com. 275 IN CNAME wildcard-X** **wildcard-X 21575 IN CNAME Y.akamaiedge.net.** **Y.akamaiedge.net. 20 IN A 23.12.17.70**



Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

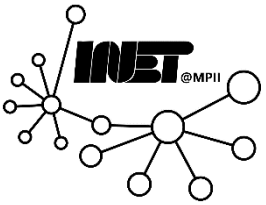


Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?



Question 1 (a)

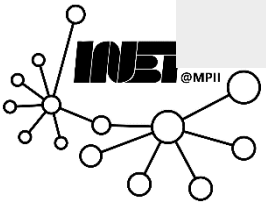
	www.godaddy.com
local	;; ANSWER SECTION: www.godaddy.com. 300 IN CNAME wildcard-X wildcard-X 8519 IN CNAME Y.akamaiedge.net Y.akamaiedge.net. 20 IN A 23.57.27.186
103.131.29.78	;; ANSWER SECTION: www.godaddy.com. 275 IN CNAME wildcard-X wildcard-X 21575 IN CNAME Y.akamaiedge.net. Y.akamaiedge.net. 20 IN A 23.12.17.70

Question 1 (a)

	www.godaddy.com
local	;; ANSWER SECTION: www.godaddy.com. 300 IN CNAME wildcard-X wildcard-X 8519 IN CNAME Y.akamaiedge.net Y.akamaiedge.net. 20 IN A **23.57.27.186**
103.131.29.78	;; ANSWER SECTION: www.godaddy.com. 275 IN CNAME wildcard-X wildcard-X 21575 IN CNAME Y.akamaiedge.net. Y.akamaiedge.net. 20 IN A **23.12.17.70**

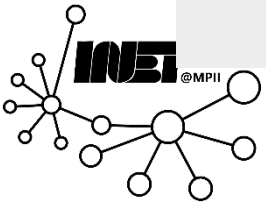
Question 1 (a)

```
1. ~$ ping -c 4 23.57.27.186
```



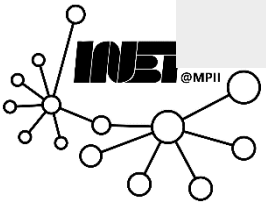
Question 1 (a)

```
1. ~$ ping -c 4 23.57.27.186
2. PING 23.57.27.186 (23.57.27.186): 56 data bytes
3. 64 bytes from 23.57.27.186: icmp_seq=0 ttl=58
   time=117.236 ms
4. 64 bytes from 23.57.27.186: icmp_seq=1 ttl=58
   time=20.274 ms
5. 64 bytes from 23.57.27.186: icmp_seq=2 ttl=58
   time=27.435 ms
6. 64 bytes from 23.57.27.186: icmp_seq=3 ttl=58
   time=45.273 ms
```



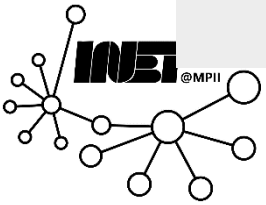
Question 1 (a)

```
1. ~$ ping -c 4 23.57.27.186
2. PING 23.57.27.186 (23.57.27.186): 56 data bytes
3. 64 bytes from 23.57.27.186: icmp_seq=0 ttl=58
   time=117.236 ms
4. 64 bytes from 23.57.27.186: icmp_seq=1 ttl=58
   time=20.274 ms
5. 64 bytes from 23.57.27.186: icmp_seq=2 ttl=58
   time=27.435 ms
6. 64 bytes from 23.57.27.186: icmp_seq=3 ttl=58
   time=45.273 ms
```



Question 1 (a)

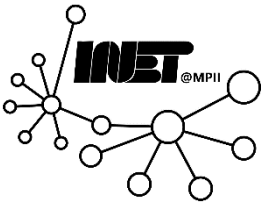
```
1. ~$ ping -c 4 23.12.17.70
2. PING 23.12.17.70 (23.12.17.70): 56 data bytes
3. 64 bytes from 23.12.17.70: icmp_seq=0 ttl=58
   time=205.012 ms
4. 64 bytes from 23.12.17.70: icmp_seq=1 ttl=58
   time=190.867 ms
5. 64 bytes from 23.12.17.70: icmp_seq=2 ttl=58
   time=247.853 ms
6. 64 bytes from 23.12.17.70: icmp_seq=3 ttl=58
   time=805.136 ms
```



Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

Answer:

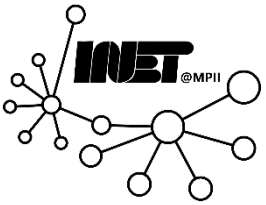


Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

Answer:

The local DNS server has a lower RTT than the Indonesian DNS server.



Question 1 (b)

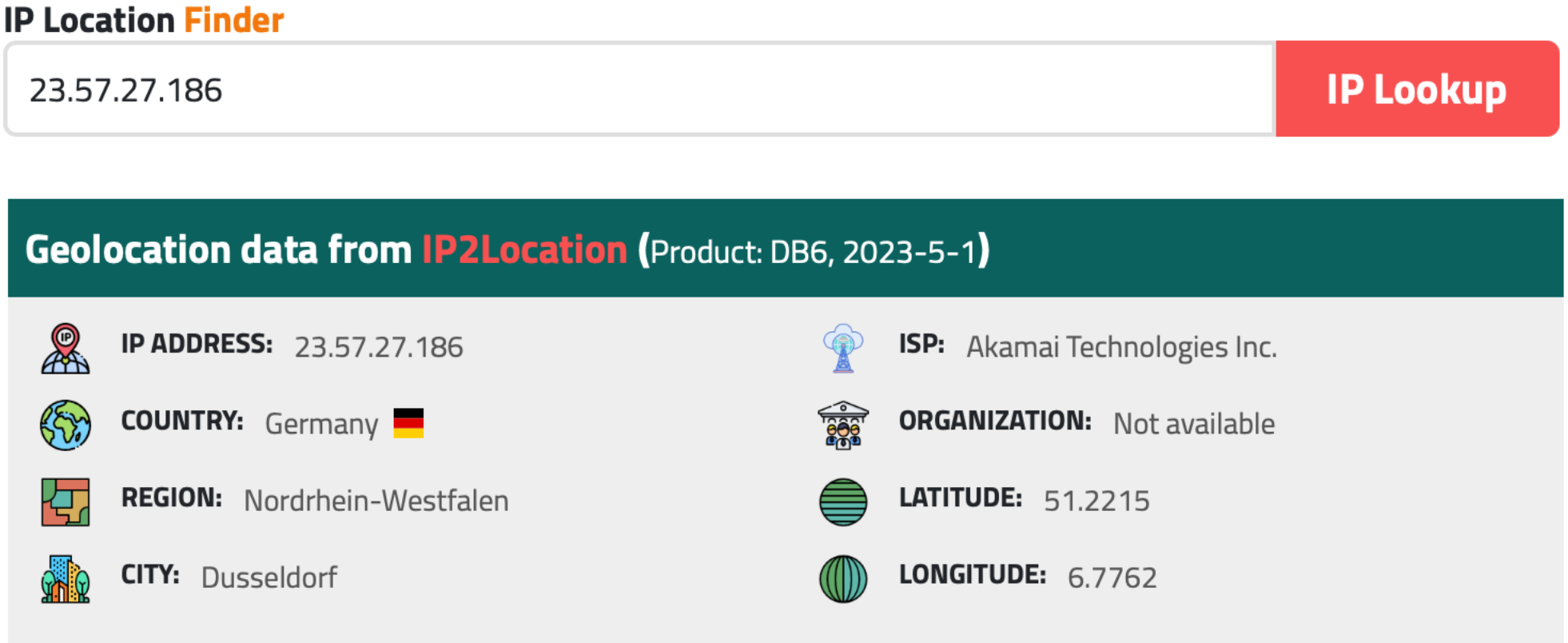
How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

Answer:

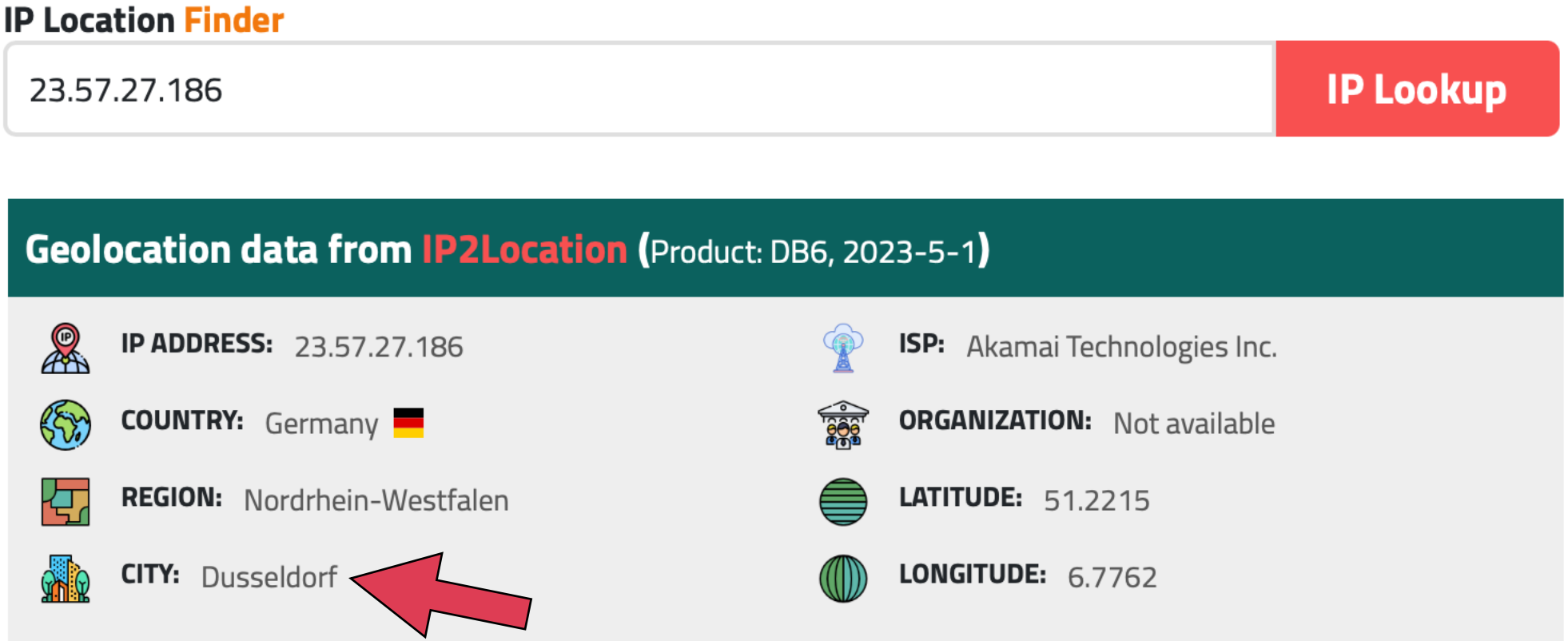
The IP served by the local DNS server has a lower RTT than the IP served by the Indonesian DNS server.

Question 1 (b)

Question 1 (b)


IP Location Finder
23.57.27.186
IP Lookup
Geolocation data from IP2Location (Product: DB6, 2023-5-1)
IP ADDRESS: 23.57.27.186
ISP: Akamai Technologies Inc.
COUNTRY: Germany
ORGANIZATION: Not available
REGION: Nordrhein-Westfalen
LATITUDE: 51.2215
CITY: Dusseldorf
LONGITUDE: 6.7762

Question 1 (b)


IP Location Finder
23.57.27.186
IP Lookup
Geolocation data from IP2Location (Product: DB6, 2023-5-1)
IP ADDRESS: 23.57.27.186
ISP: Akamai Technologies Inc.
COUNTRY: Germany
ORGANIZATION: Not available
REGION: Nordrhein-Westfalen
LATITUDE: 51.2215
CITY: Dusseldorf
LONGITUDE: 6.7762

Question 1 (b)

IP Location Finder

23.12.17.70 **IP Lookup**

Geolocation data from IP2Location (Product: DB6, 2023-5-1)

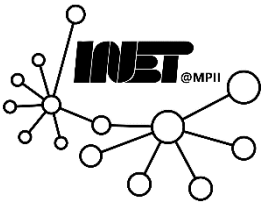
IP ADDRESS: 23.12.17.70	**ISP:** Akamai Technologies Inc.
COUNTRY: Indonesia	**ORGANIZATION:** Not available
REGION: Jakarta Raya	**LATITUDE:** -6.2087
CITY: Jakarta	**LONGITUDE:** 106.8455

Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

Answer:

The IP served by the local DNS server has a lower RTT than the IP served by the Indonesian DNS server.



Question 1 (b)

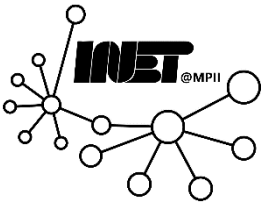
How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

Answer:

The IP served by the local DNS server has a lower RTT than the IP served by the Indonesian DNS server. The resulting IPs are located in Dusseldorf and Jakarta, respectively.

Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

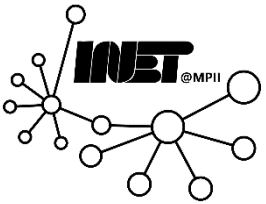


Question 1 (b)

How do RTT and location of the resulting IPs differ? Based on which metric does the CDN chose the appropriate replica?

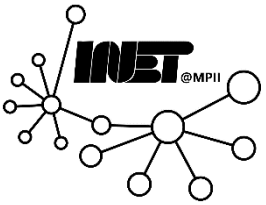
Answer:

- Estimation of physical distance
- Load balancing
- …



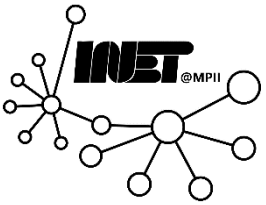
Question 1 (c)

Using the results from above, explain briefly (3-5 sentences) how the CDN uses CNAME to redirect clients to the replica.



Question 1 (c)

Using the results from above, explain briefly (3-5 sentences) how the CDN uses CNAME to redirect clients to the replica.

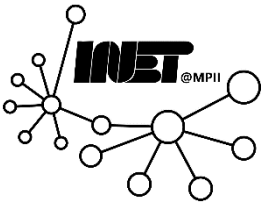


Question 1 (c)

Using the results from above, explain briefly (3-5 sentences) how the CDN uses CNAME to redirect clients to the replica.

Answer:

1. The CDN customer sets a CNAME for their domain to a fixed domain of the CDN.

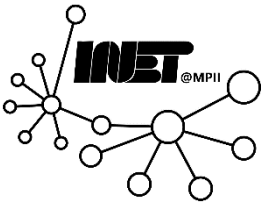


Question 1 (c)

Using the results from above, explain briefly (3-5 sentences) how the CDN uses CNAME to redirect clients to the replica.

Answer:

1. The CDN customer sets a CNAME for their domain to a fixed domain of the CDN.
2. The CNAME of the CDN is associated with a number of IP addresses (i.e., servers in different locations).

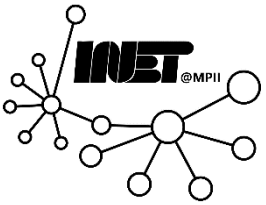


Question 1 (c)

Using the results from above, explain briefly (3-5 sentences) how the CDN uses CNAME to redirect clients to the replica.

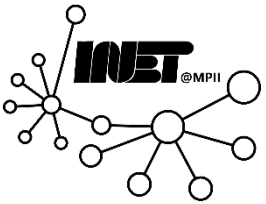
Answer:

1. The CDN customer sets a CNAME for their domain to a fixed domain of the CDN.
2. The CNAME of the CDN is associated with a number of IP addresses (i.e., servers in different locations).
3. CDN chooses the CNAME associated with the closest server to the used DNS resolvers IP address.



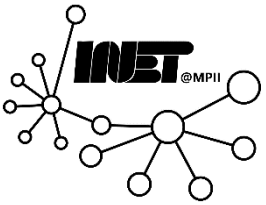
Question 1 (d)

Compare the DNS Time-to-Live (TTL) of the A and CNAME records. How do they differ and why do you think this is the case? Answer this question briefly (3-5 sentences).



Question 1 (d)

Compare the DNS Time-to-Live (TTL) of the A and CNAME records. How do they differ and why do you think this is the case? Answer this question briefly (3-5 sentences).



Question 1 (d)

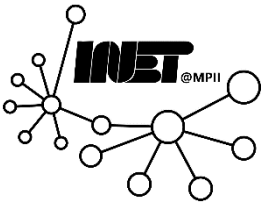
Compare the DNS Time-to-Live (TTL) of the A and CNAME records. How do they differ and why do you think this is the case? Answer this question briefly (3-5 sentences).

Answer:

The TTL of the CNAME records are much larger than that of the A record.

Question 1 (d)

Compare the DNS Time-to-Live (TTL) of the A and CNAME records. How do they differ and why do you think this is the case? Answer this question briefly (3-5 sentences).

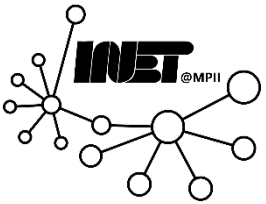


Question 1 (d)

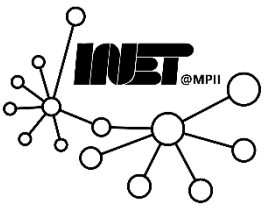
Compare the DNS Time-to-Live (TTL) of the A and CNAME records. How do they differ and why do you think this is the case? Answer this question briefly (3-5 sentences).

Answer:

CNAME redirects are pretty much static and do rarely change, thus they have a long TTL. The A record, in contrast, has a short TTL and allows the CDN to quickly react to changes.

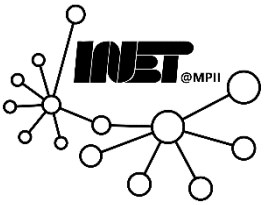


Questions?



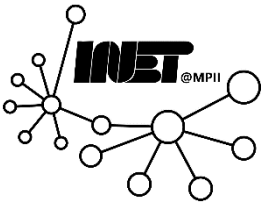
Question 2 (a)

What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?



Question 2 (a)

What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?



Question 2 (a)

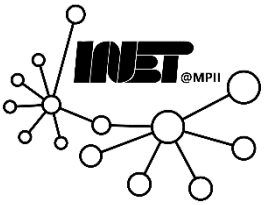
What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?

Answer:

1. Datagram sockets: connectionless (UDP sockets)
2. Stream sockets: connection-oriented (TCP sockets)
3. Web sockets
4. Raw sockets

Question 2 (a)

What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?



Question 2 (a)

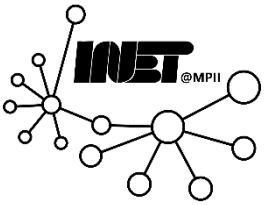
What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?

Answer:

Blocking sockets don't return control to the calling program before result or error appear. Non-blocking sockets do return control immediately to the calling program.

Question 2 (a)

What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?



Question 2 (a)

What types of Internet sockets exist and what are their main differences? What are the differences between blocking and non-blocking sockets? Why would you use one or the other?

Answer:

Blocking sockets are nice to ensure that all data has been received before continuing. Non-blocking sockets are nice if multiple connections must be handled at once.

Question 2 (b)

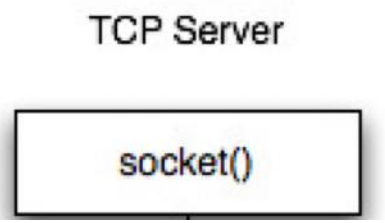
What steps (or function calls) are necessary for an application to establish a connection between a server and a client over a TCP socket? Draw a diagram showing each step.

Question 2 (b)

What steps (or function calls) are necessary for an application to establish a connection between a server and a client over a TCP socket? Draw a diagram showing each step.

Question 2 (b)

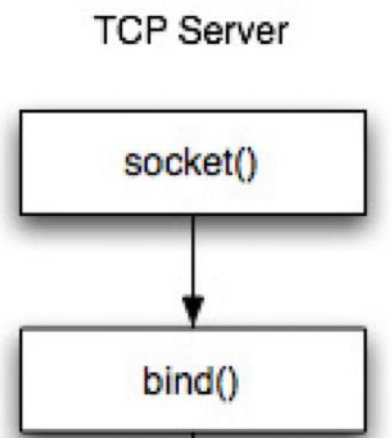
1. Server TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

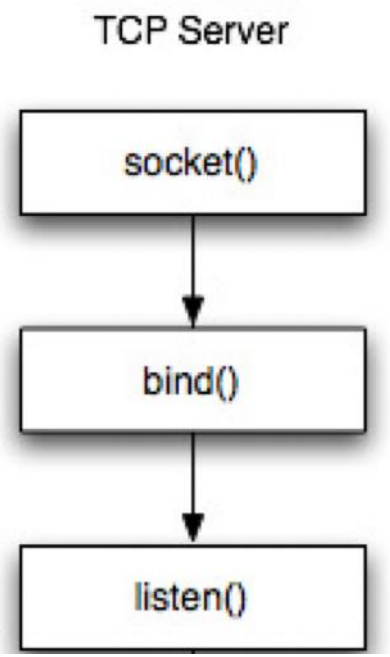
1. Server TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

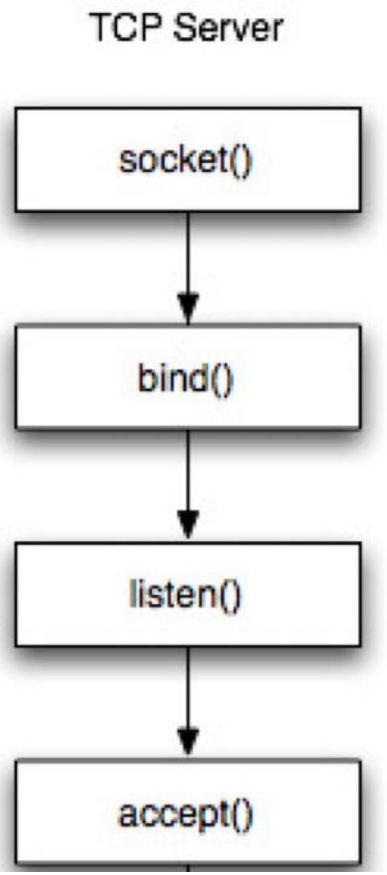
1. Server TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

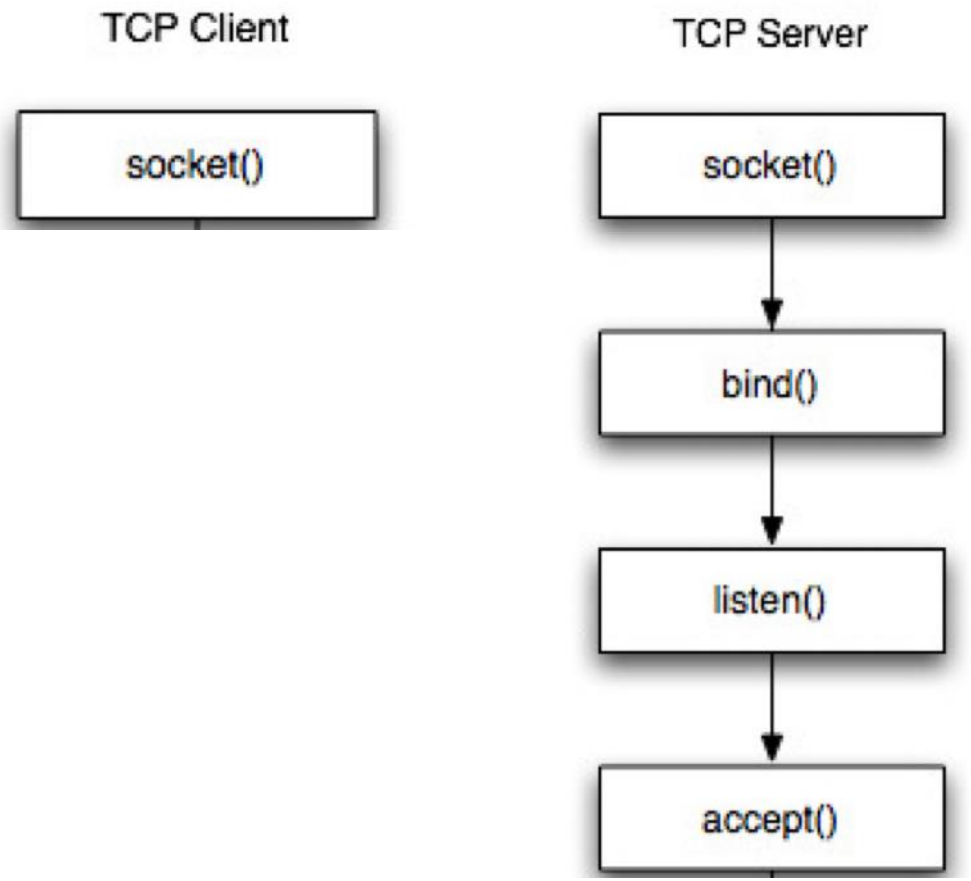
1. Server TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

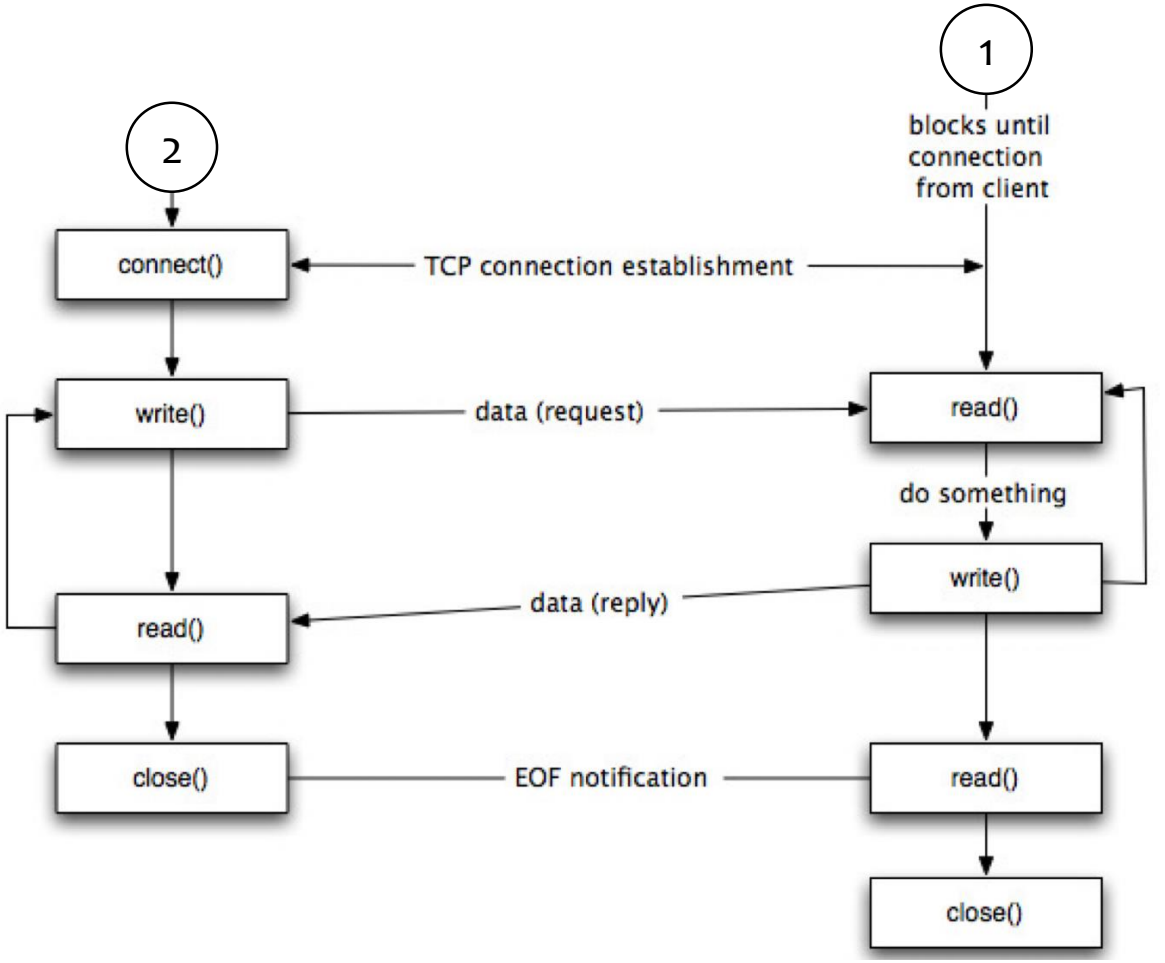
1. Server TCP socket setup
2. Client TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

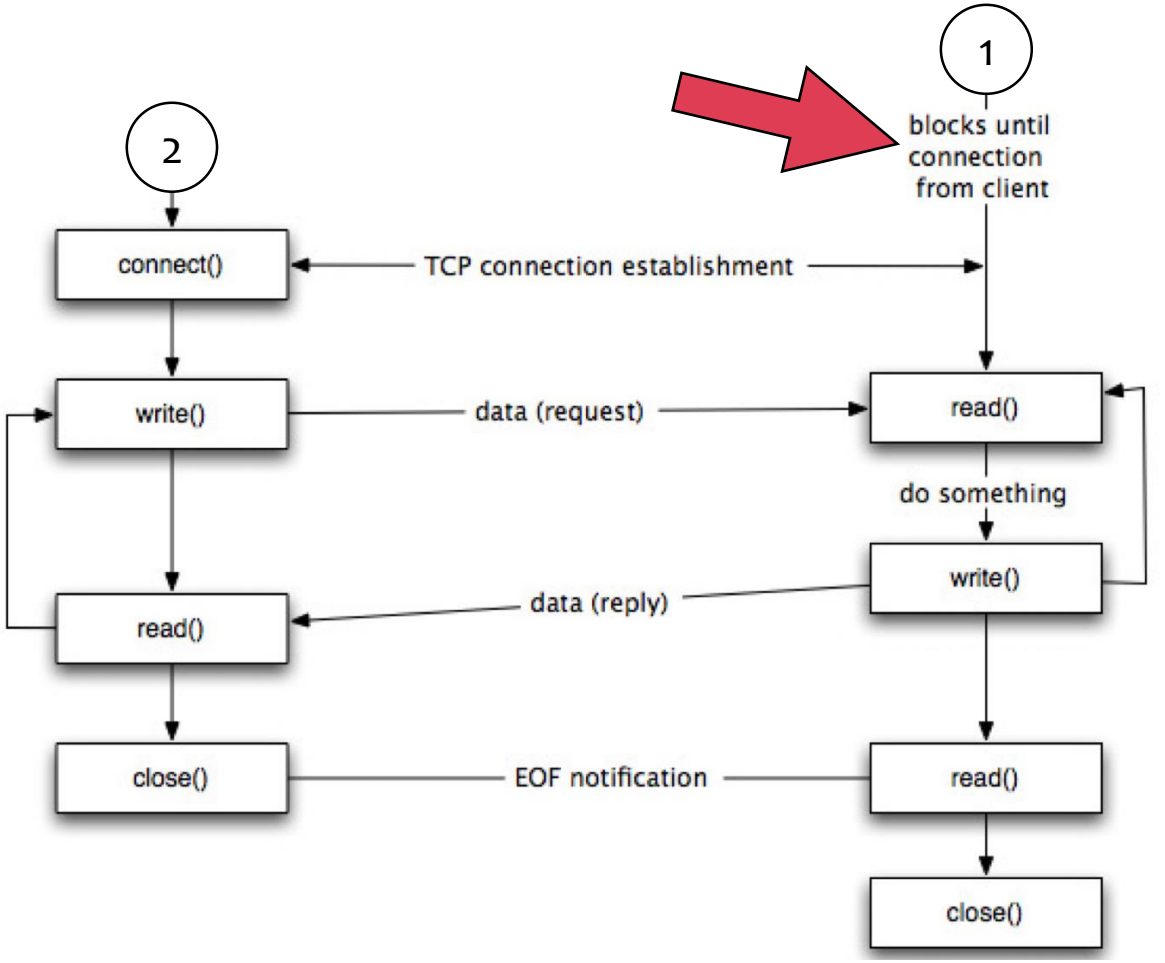
1. Server TCP socket setup
2. Client TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

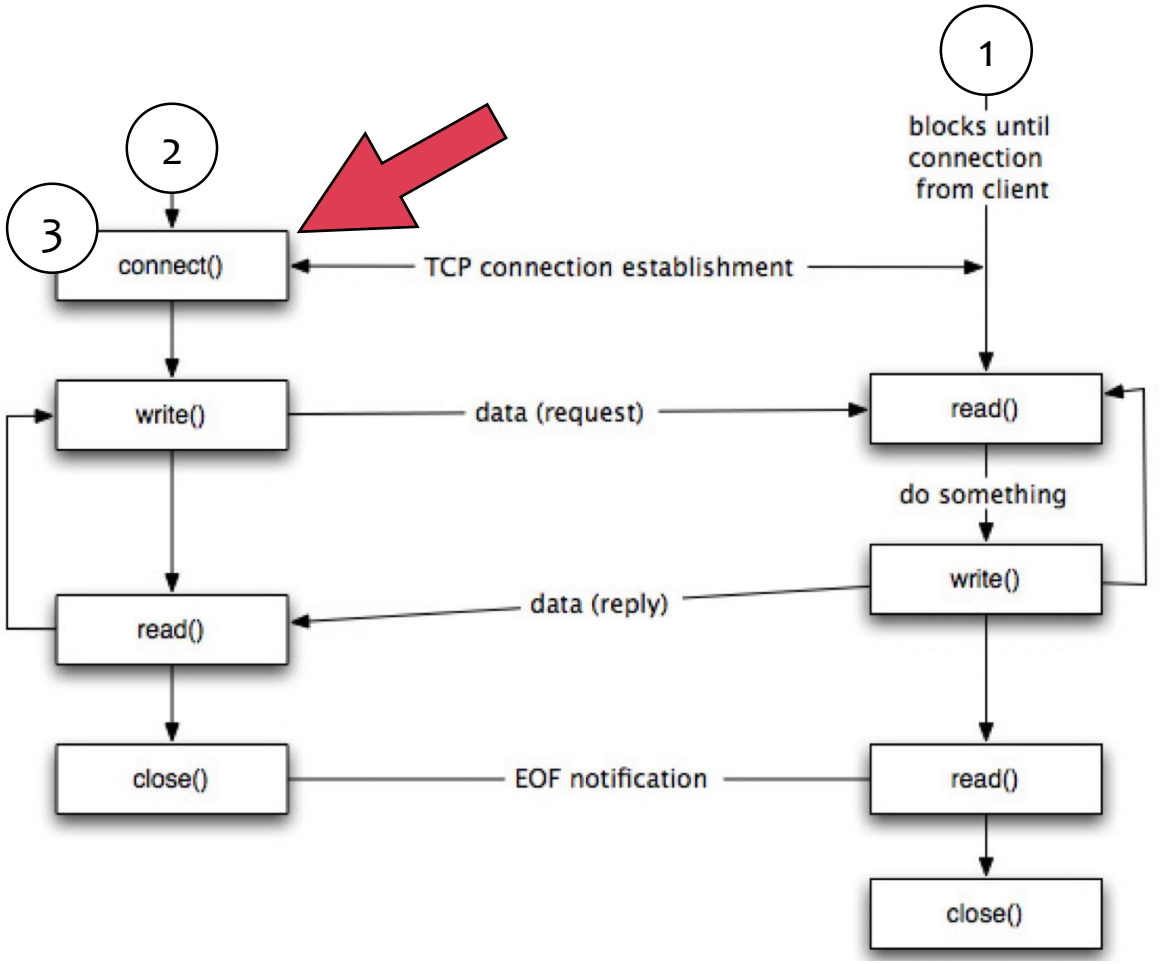
1. Server TCP socket setup
2. Client TCP socket setup



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

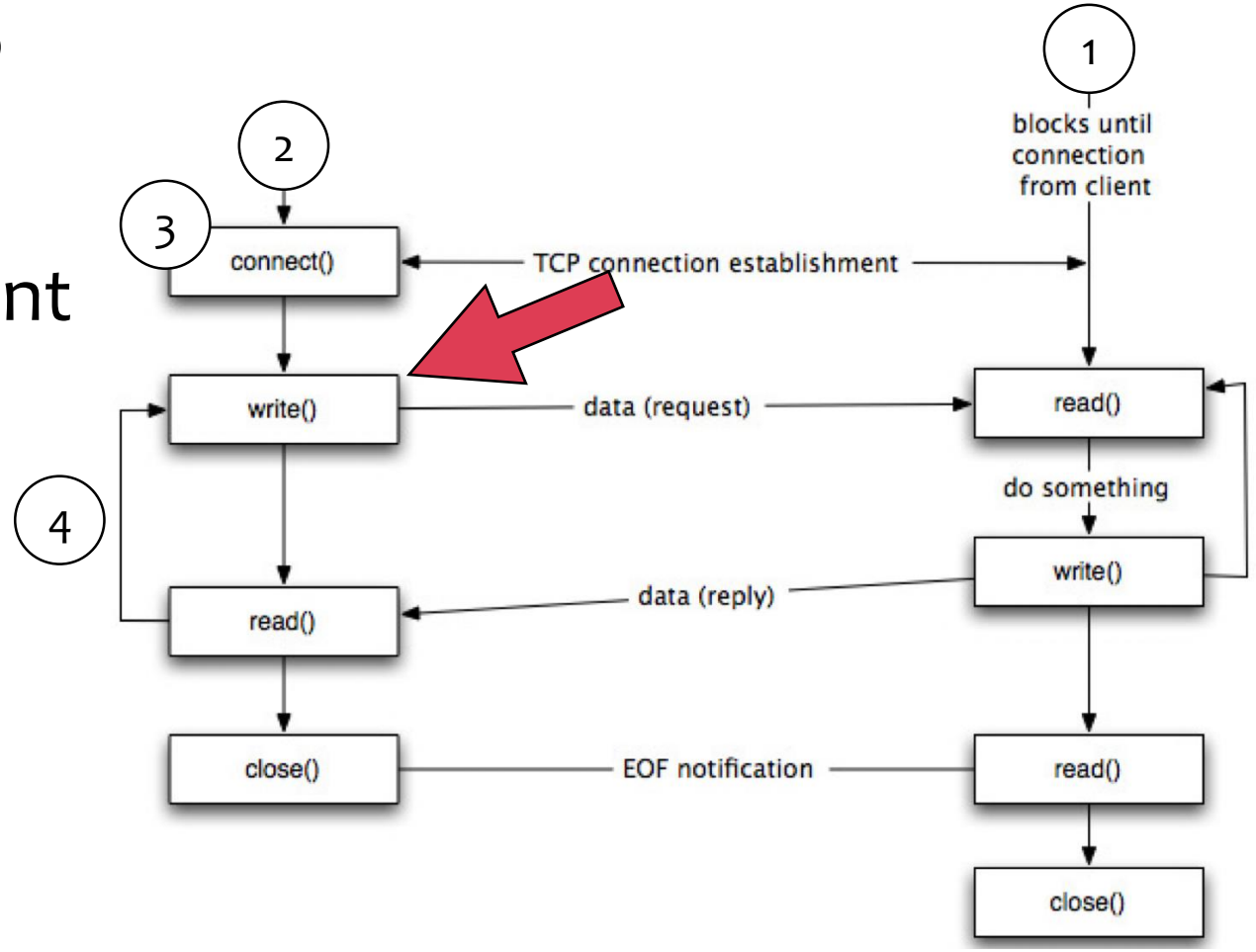
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

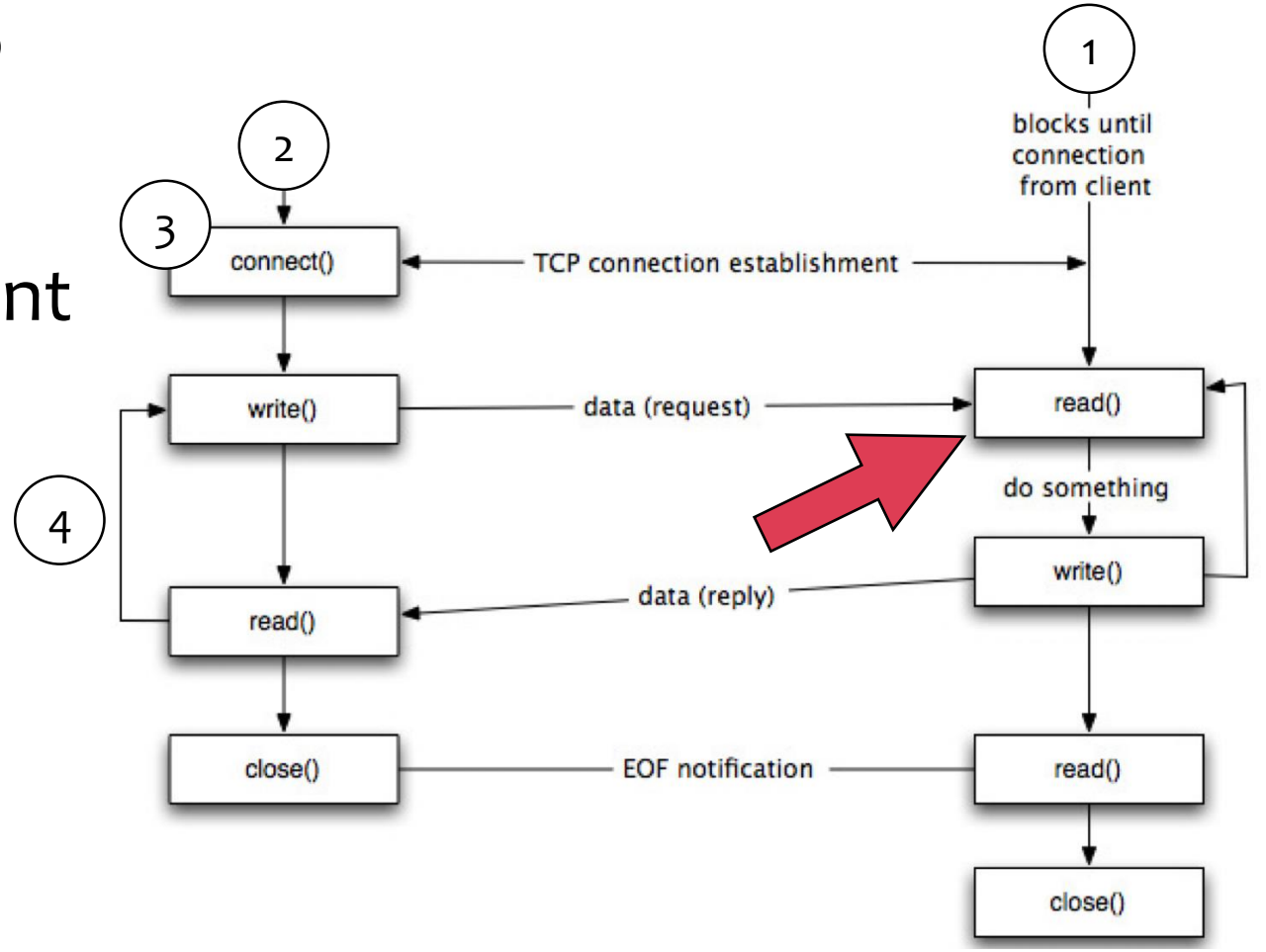
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

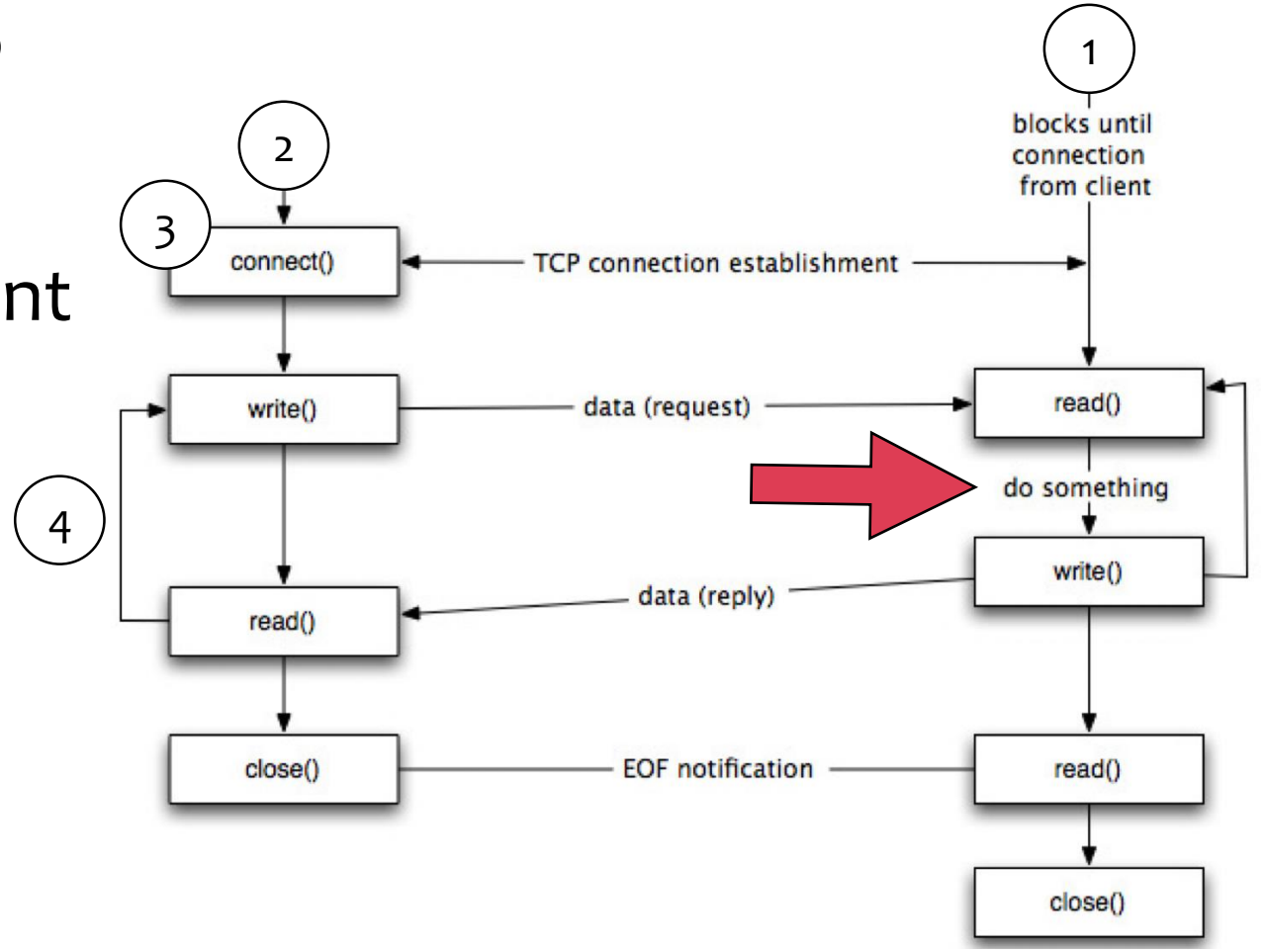
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

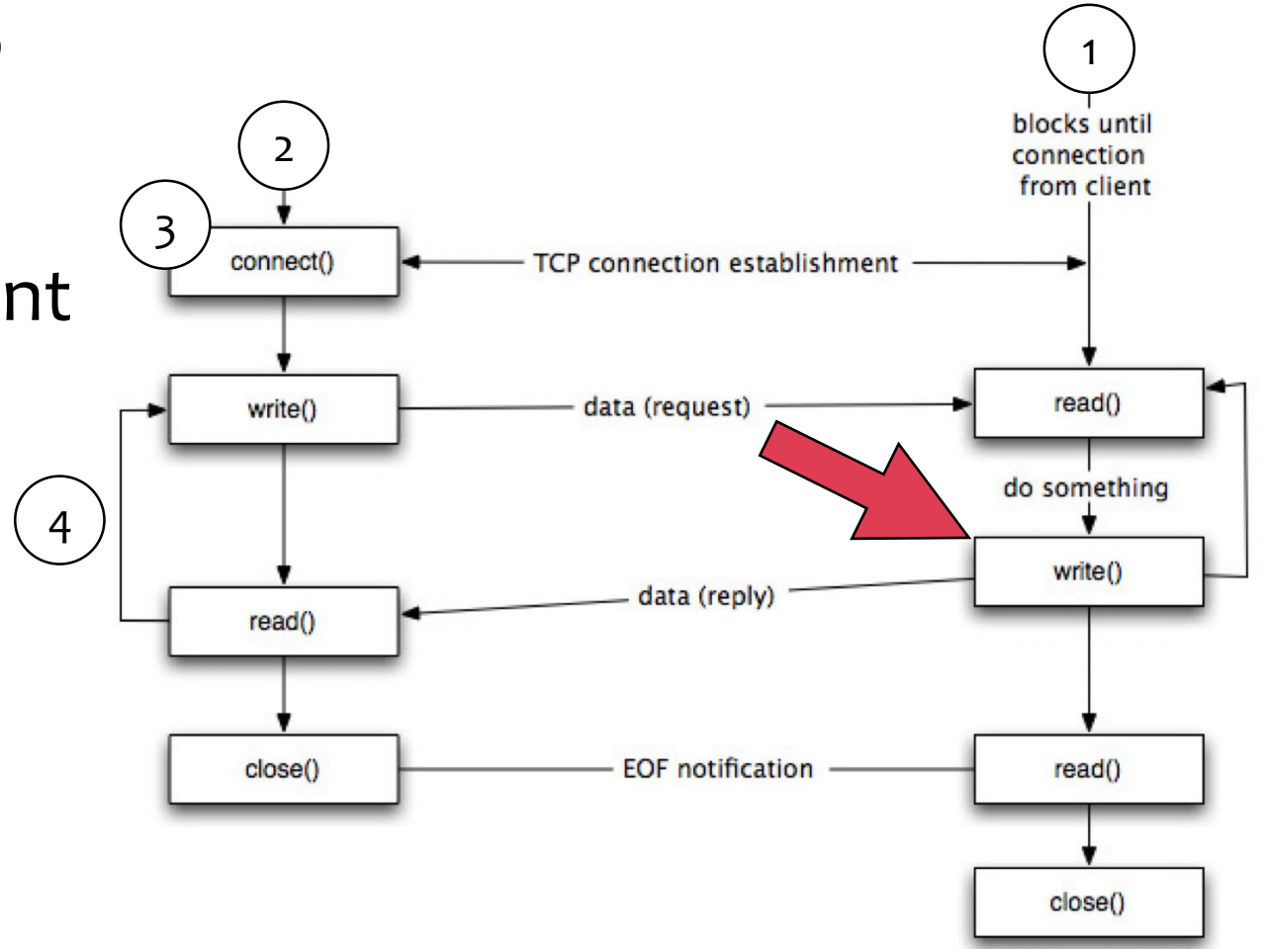
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

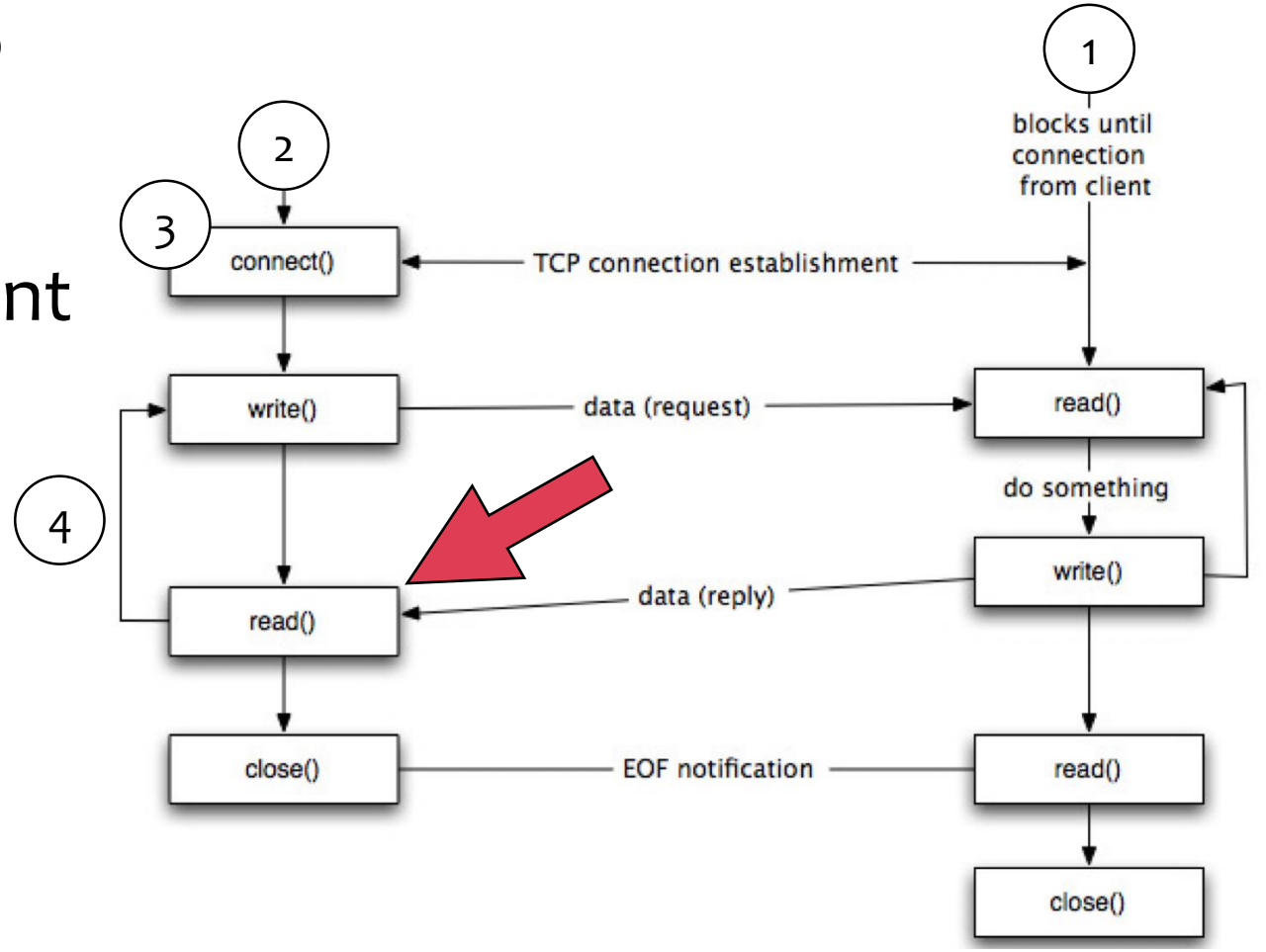
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

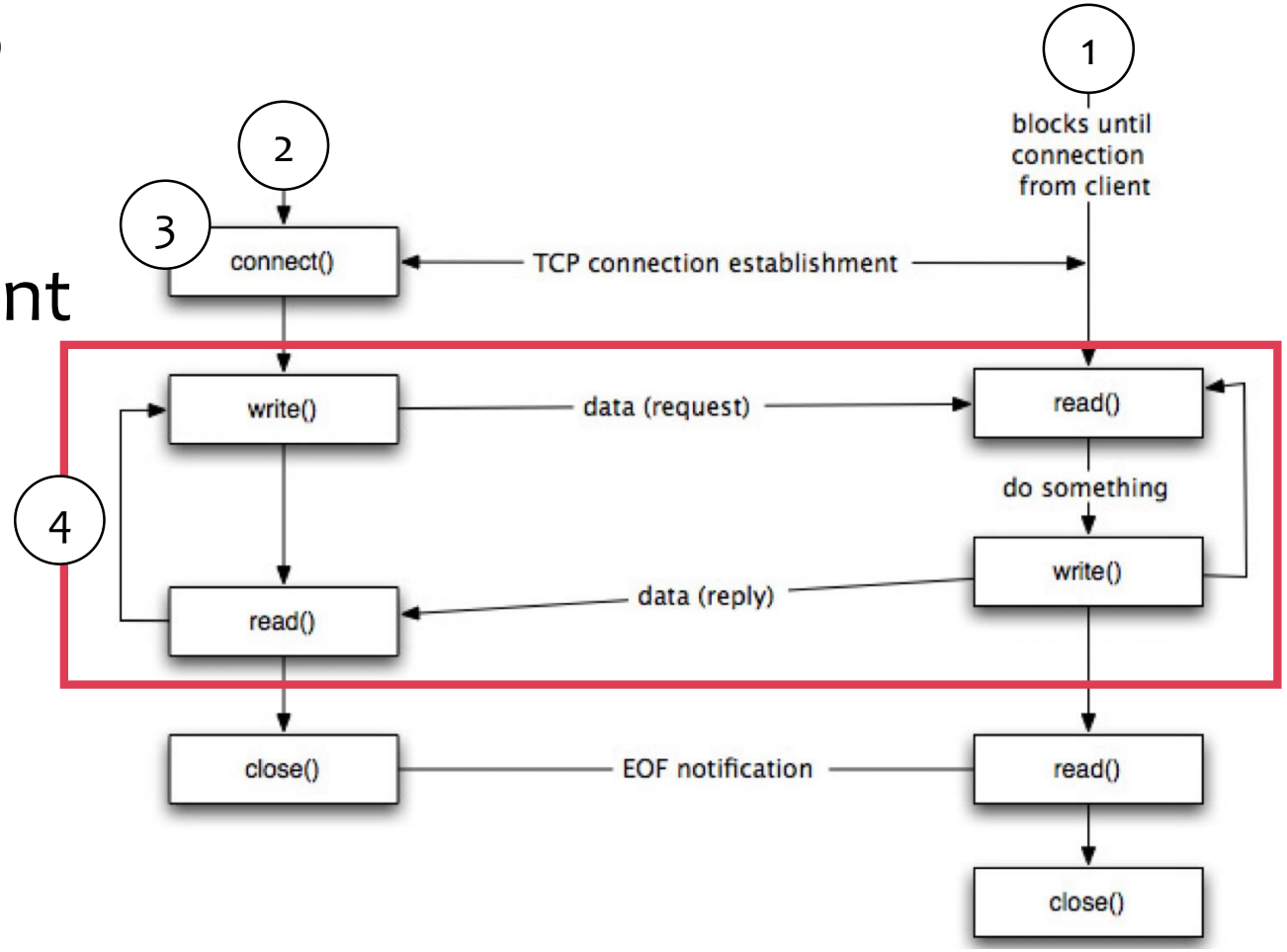
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

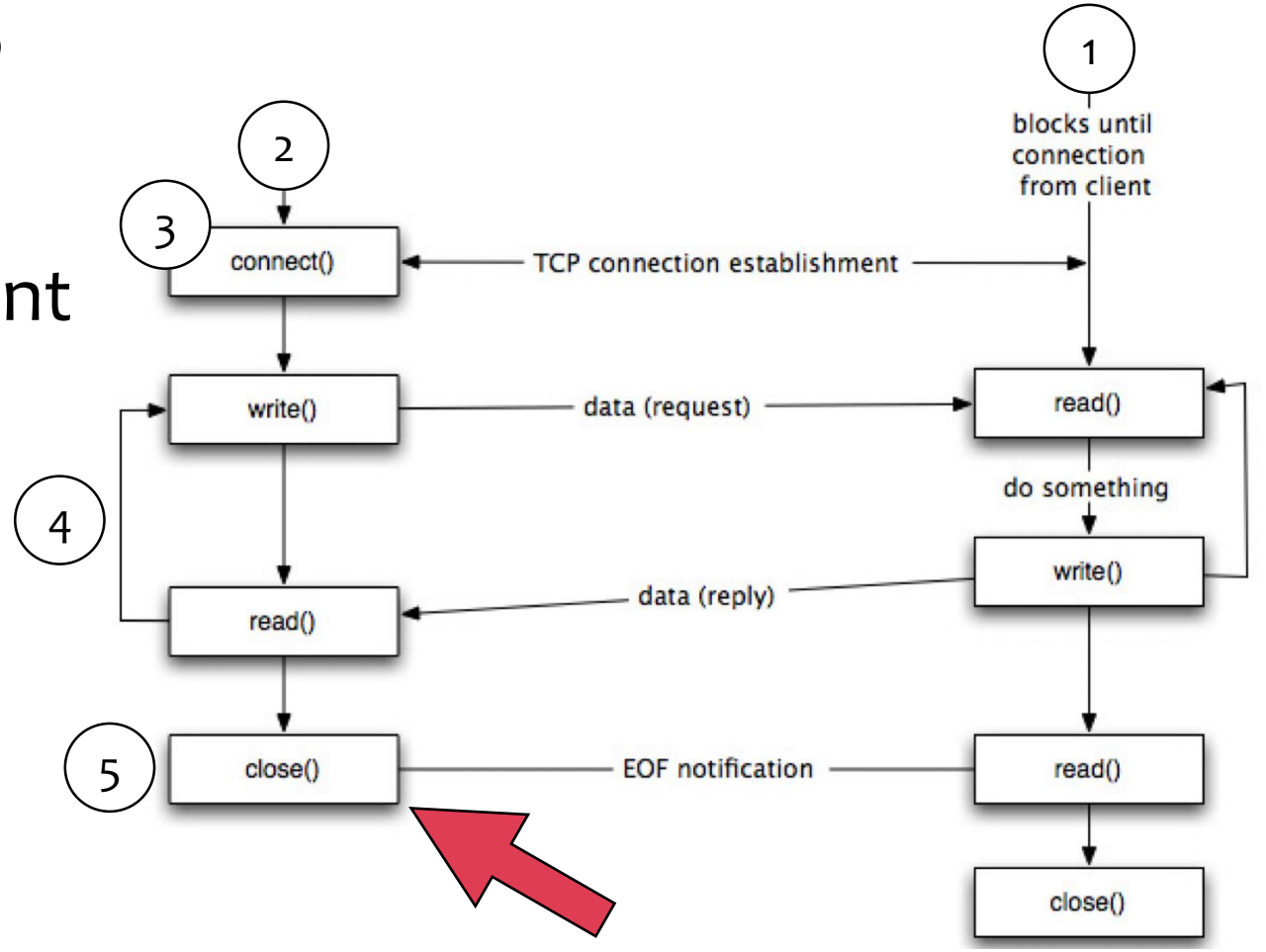
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

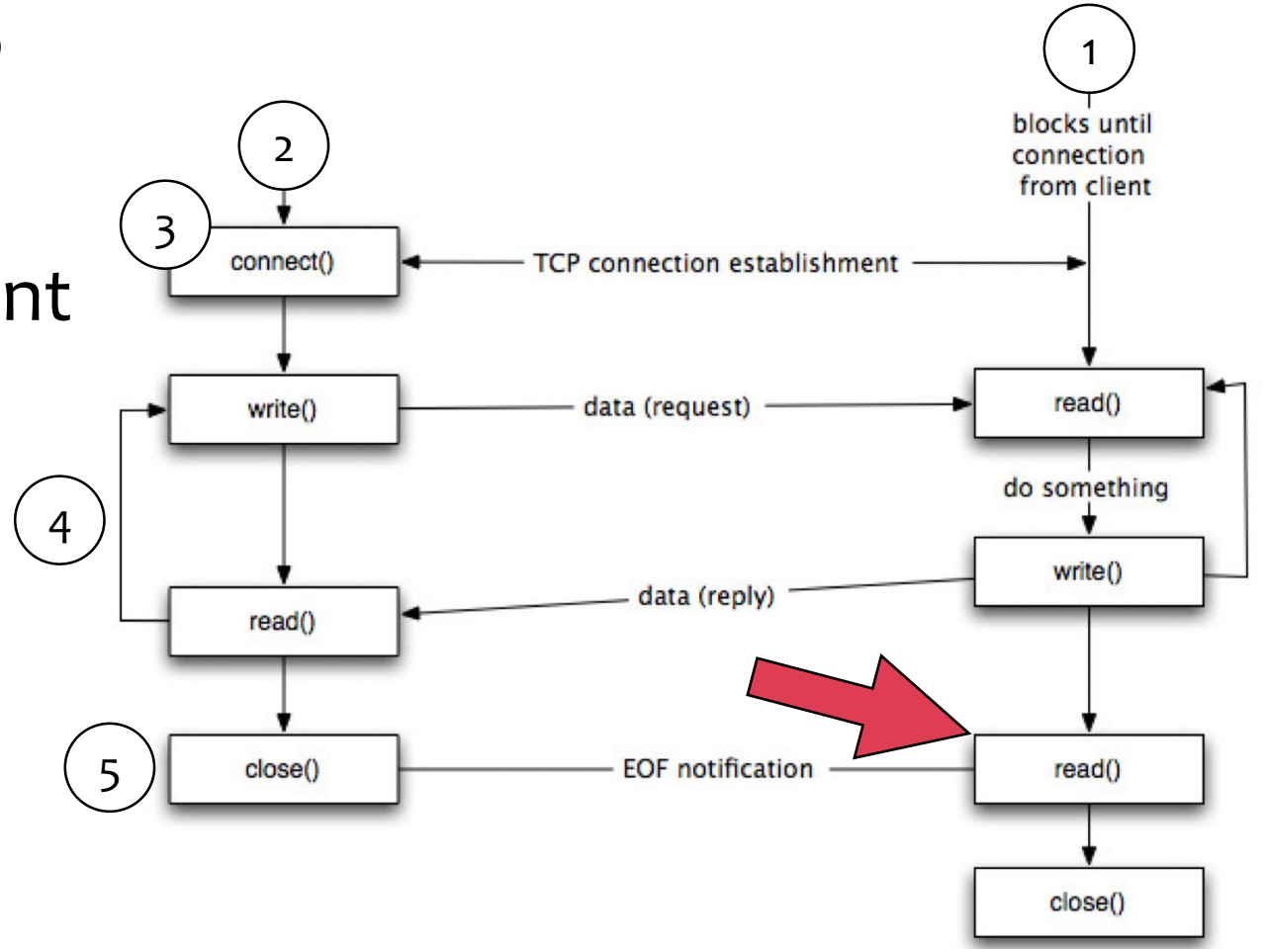
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission
5. Closing connection



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Question 2 (b)

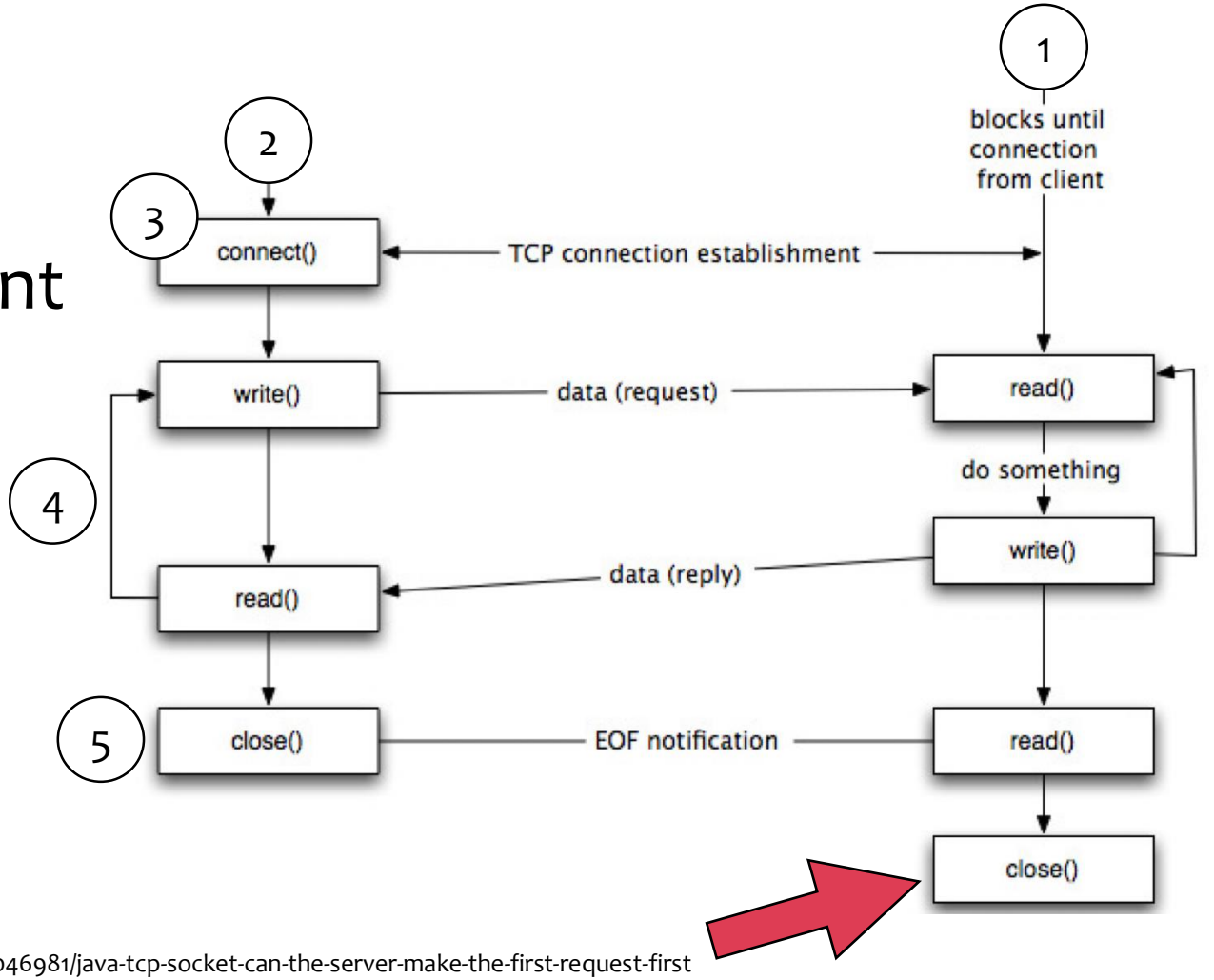
1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission
5. Closing connection



https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

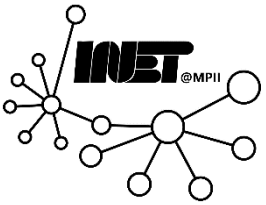
Question 2 (b)

1. Server TCP socket setup
2. Client TCP socket setup
3. Connection establishment
4. Data transmission
5. Closing connection



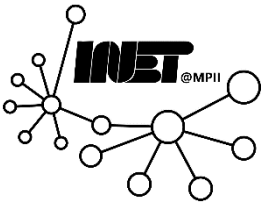
https://stackoverflow.com/questions/40046981/java-tcp-socket-can-the-server-make-the-first-request-first

Questions?



Question 3

Using a programming language of your choice, implement a "file-sharing" client- server application.



Question 3

Using a programming language of your choice, implement a "file-sharing" client- server application.

Hands on solution!