

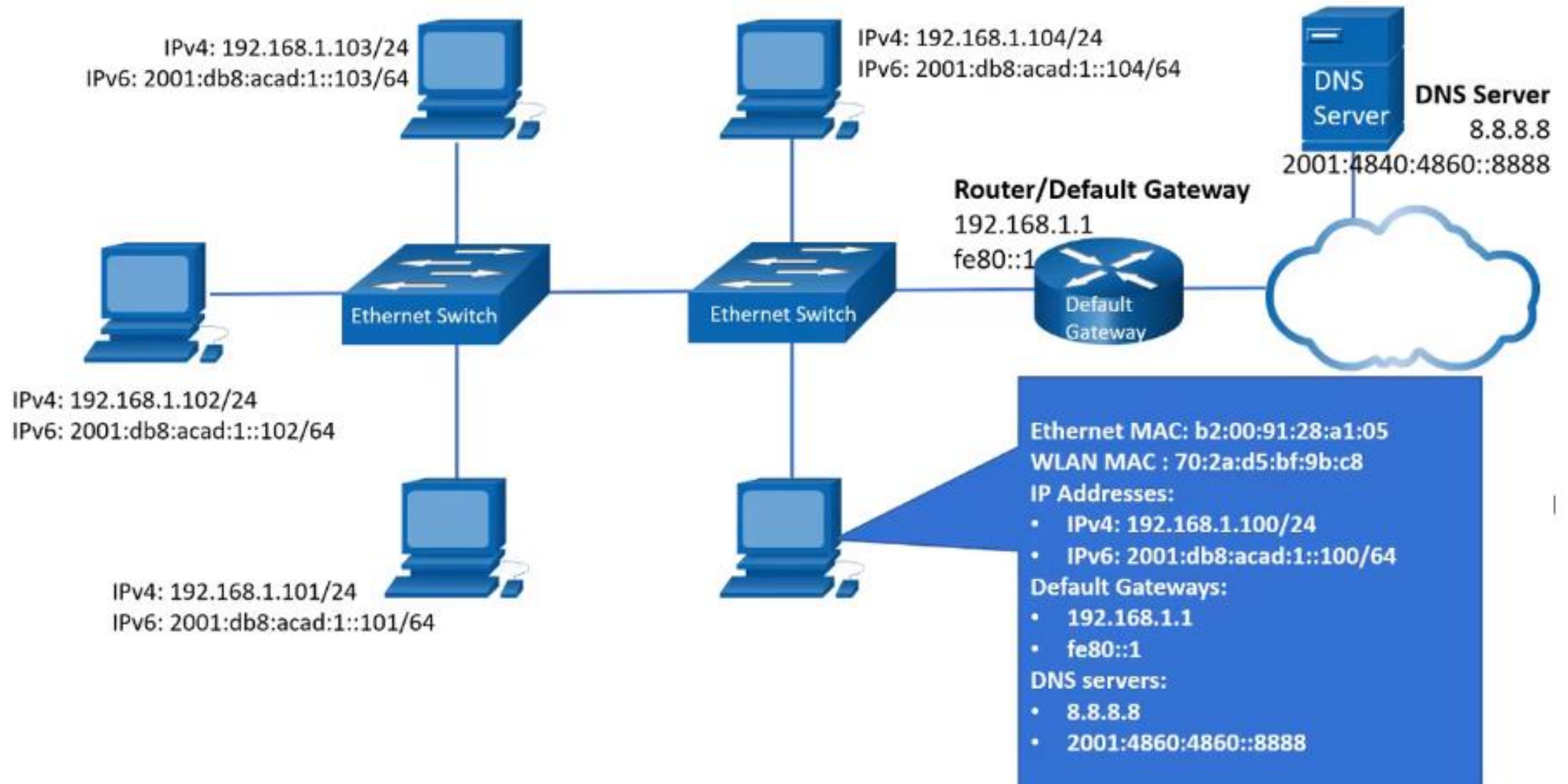
OSI model

<https://www.netacad.com>

Module 3: Protocols and Models



How we "see" the network



This is how a device (computer, mobile phone, etc.) "sees" the network.
It doesn't.



- What is my addressing information? What network am I on?
- Is the destination device on my network or is it on another network?
- Where do I send information when the destination device is on a different network?
- Did the destination device receive the information I sent?
- Do I need to resend any information?

Osnove komunikacije

- Mreže se razlikuju po veličini, obliku i funkciji. Mogu biti složeni kao uređaji povezani preko interneta ili jednostavni kao dva računala izravno povezana jedno s drugim jednim kabelom, i bilo što između.
- Međutim, jednostavno postojanje žičane ili bežične fizičke veze između krajnjih uređaja nije dovoljno za omogućavanje komunikacije. Da bi došlo do komunikacije, uređaji moraju znati "kako" komunicirati.
- Ljudi razmjenjuju ideje koristeći mnogo različitih komunikacijskih metoda. Međutim, sve metode komunikacije imaju sljedeća tri zajednička elementa:
 1. Izvor poruke (pošiljatelj) – izvori poruke su ljudi ili elektronički uređaji koji trebaju poslati poruku drugim osobama ili uređajima.
 2. Odredište poruke (primatelj) – Odredište prima poruku i tumači je.
 3. Kanal - Sastoji se od medija koji osigurava put kojim poruka putuje od izvora do odredišta.
- Slanje poruke, bilo putem komunikacije licem u lice ili putem mreže, regulirano je pravilima koja se nazivaju protokoli. Ovi protokoli su specifični za vrstu komunikacijske metode koja se koristi.
- U našoj svakodnevnoj osobnoj komunikaciji, pravila koja koristimo za komunikaciju putem jednog medija, poput telefonskog poziva, nisu nužno ista kao pravila za korištenje drugog medija, kao što je slanje pisma.

Pravila komunikacije

- Prije međusobnog komuniciranja, pojedinci moraju koristiti utvrđena pravila ili dogovore za upravljanje razgovorom. Razmotrite ovu poruku na primjer:

German Coastguard We are Sinking/ What are you Thinking About

<https://youtu.be/xacdDrylrek?si=rUAEYEjub4XI4xj>

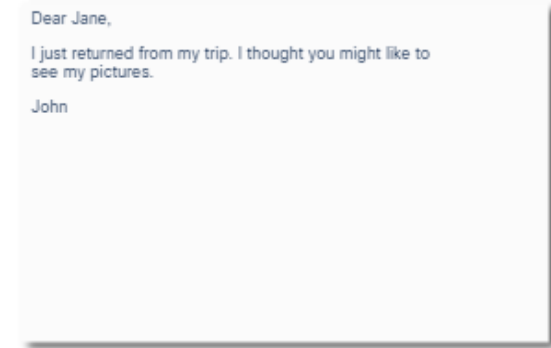
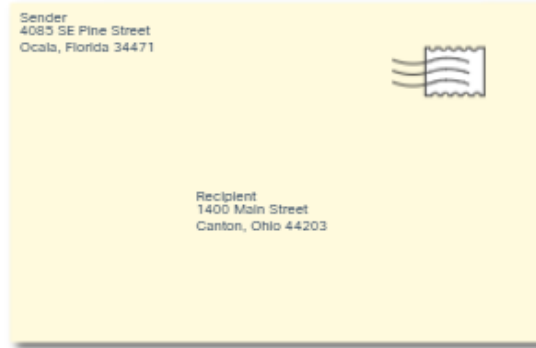
When a Frenchman calls an Indian Call Center : The iRabbit


<https://youtu.be/DxxAwDHgQhE?si=J2Hfo4rh3CuoSxsS>

Protokoli moraju uzeti u obzir sljedeće zahtjeve za uspješnu isporuku poruke koju primatelj razumije:

- Identificirani pošiljatelj i primatelj (IP adrese, MAC adrese, TCP/UDP portovi)
- Zajednički jezik i gramatika (format poruke, način enkapsulacije, veličina poruke, enkripcija itd.)
- Brzina i vrijeme isporuke (sinkronizacija komunikacije-timing, minimalni zahtjevi npr. latencija, jitter, frame rate itd.)
- Zahtjevi za potvrdu ili potvrdu (vrsta komunikacije, pouzdana komunikacija vs. Nepouzdana, upravljanje greškama-error handling)

Pravila komunikacije



Recipient (destination) Location address	Sender (source) Location address	Salutation (start of message indicator)	Recipient (destination) identifier	Content of Letter (encapsulated data)	Sender (source) identifier	End of Frame (End of message indicator)
Envelope Addressing		Encapsulated Letter				
1400 Main Street Canton, Ohio 44203	4085 SE Pine Street Ocala, Florida 34471	Dear	Jane	I just returned from my trip. I thought you might like to see my pictures.	John	

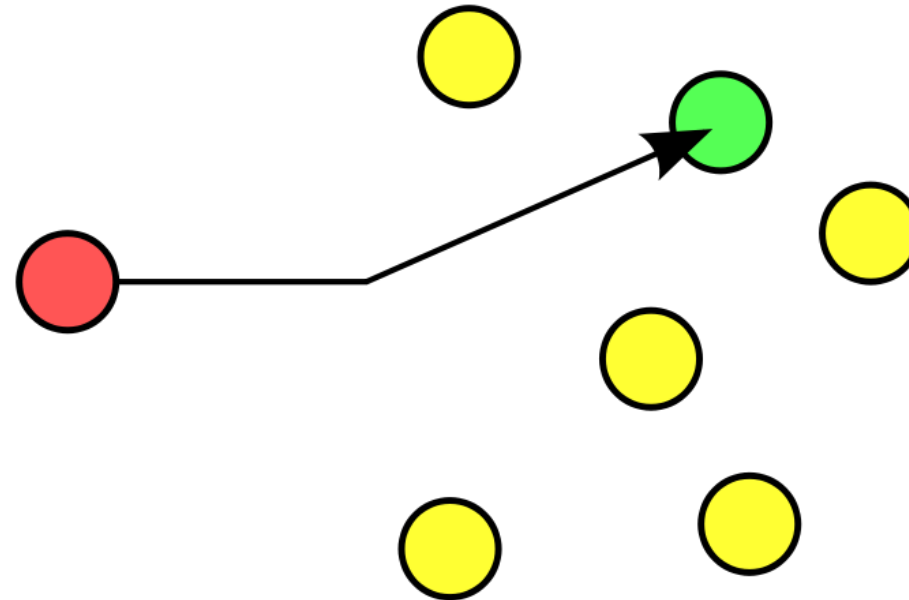
Vrste komunikacije u mreži

Exam question

➤ Unicast (jedan na jedan)

- Primjeri: Ping, uspostava TCP veze, ARP reply, telnet...

Src IP= 192.168.1.10 dst IP=192.168.3.30



Vrste komunikacije u mreži

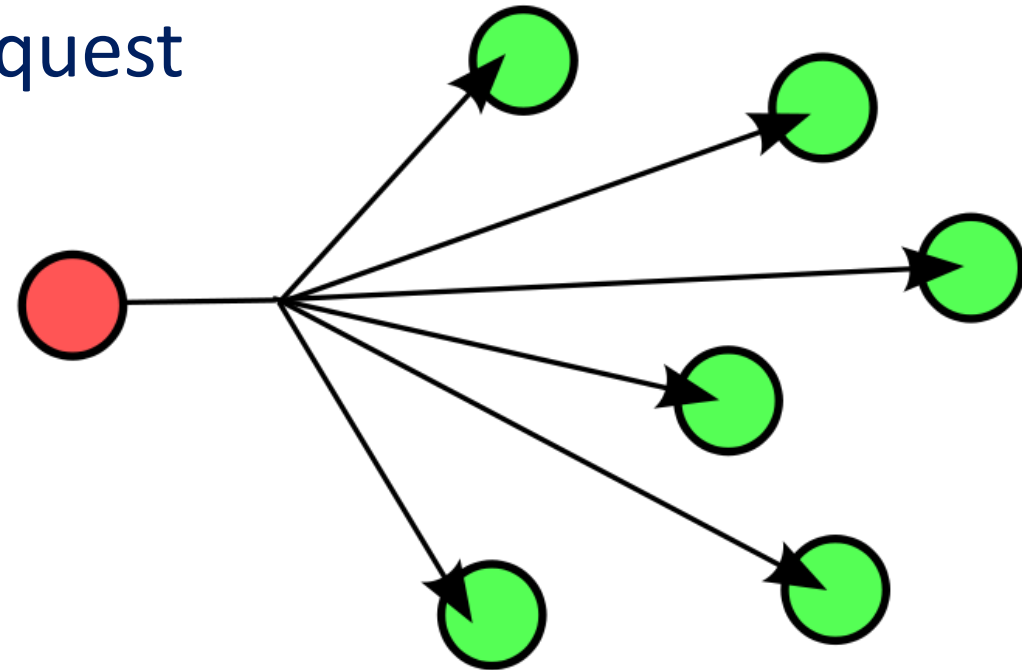
Exam question

➤ Broadcast (jedan na sve)-zaustavlja se na L3 uređajima (Router/Usmjernik)

- Primjeri: DHCP discover, ARP request

Src IP= 192.168.1.10 dst IP=192.168.1.255

L3 255. 255. 255. 255



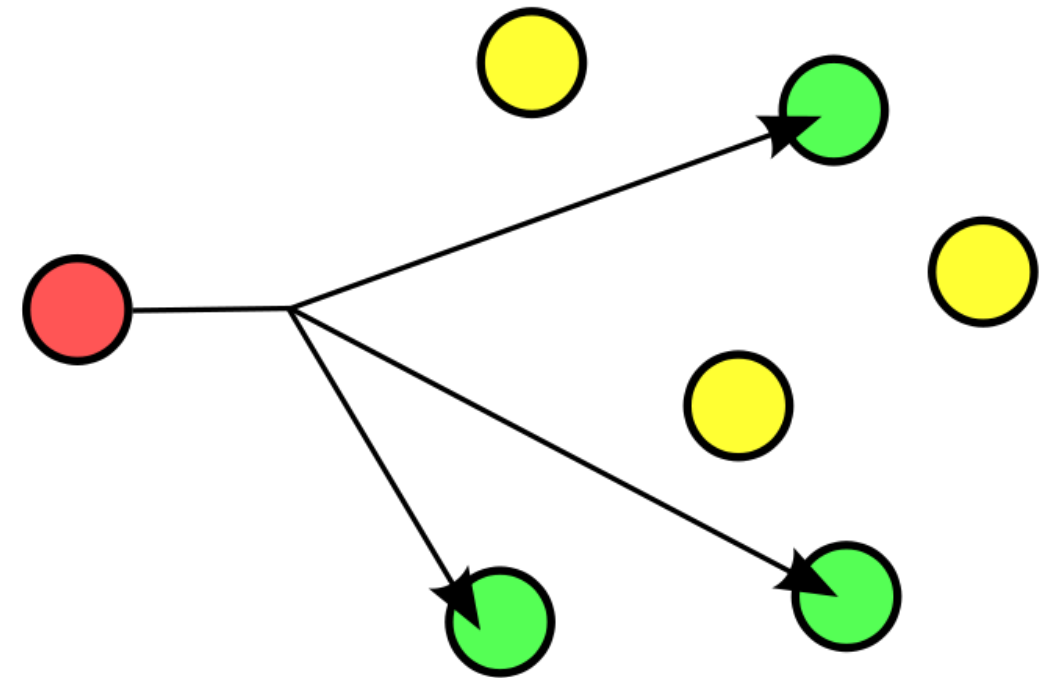
```
Frame 74: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface 0
Ethernet II, Src: HonHaiPr_c9:be:b7 (9c:2a:70:c9:be:b7), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
Internet Protocol Version 4, Src: 172.20.67.87 (172.20.67.87), Dst: 255.255.255.255 (255.255.255.255)
User Datagram Protocol, Src Port: bootpc (68), Dst Port: bootps (67)
Bootstrap Protocol
```


Vrste komunikacije u mreži

Exam question

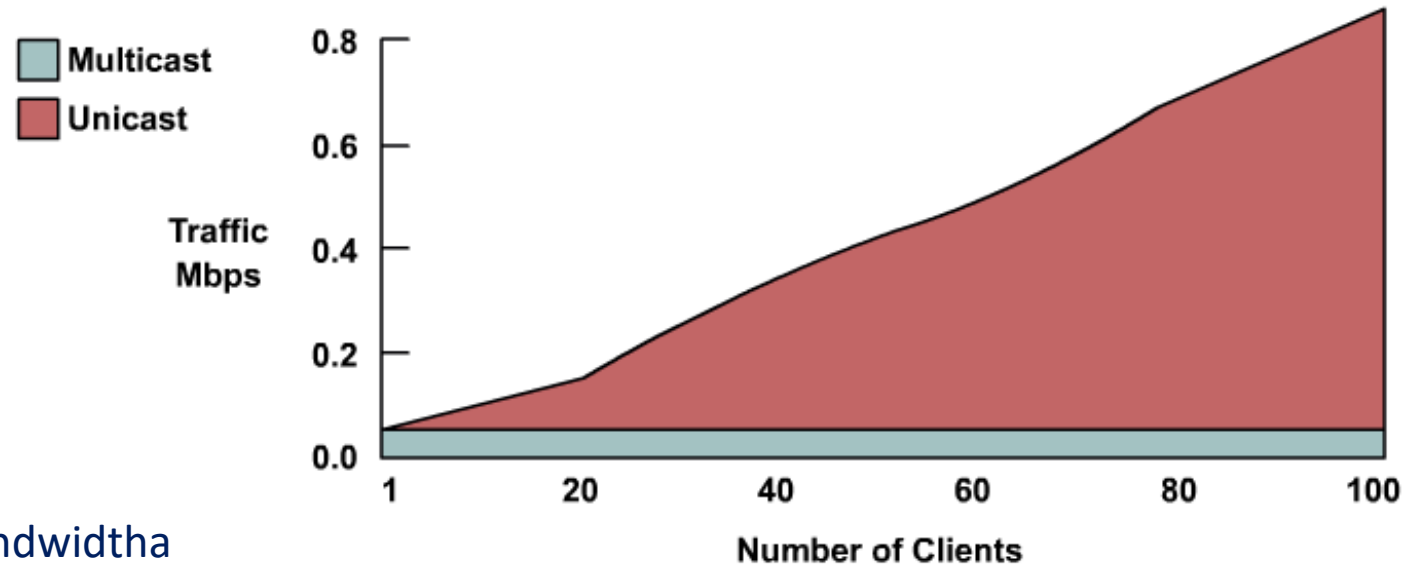
- **Multicast (jedan na grupu)**-uobičajeno zaustavlja se na L3 uređajima (Router/Usmjernik), osim ako ti uređaji nisu konfigurirani da propuštaju/usmjeravaju multicast promet, kao što je slučaj s IP TV prometom
- Primjeri: IP TV, protokoli za usmjeravanje prometa u mreži i drugi „infrastrukturni protokoli” (RIP, EIGRP, OSPF, HSRP, VRRP...)

- 224.0.0.0 do 224.0.0.255 Reserved for special “well-known” multicast addresses. se ne prosljeđuju dalje od linka
- 224.0.1.0-238.255.255.255 Globally-scoped (Internet-wide) multicast addresses.
- 239.0.0.0-239.255.255.255 Organization-Local Scope



Prednosti multicast komunikacije

Exam question



- Efikasnije korištenje Bandwidtha

- ✓ mrežna propusnost je bolje iskorištena, višestruki tokovi podataka se zamjenjuju sa jednim

- Manje opterećenje Servera

- ✓ Server ne mora za svakog klijenta slati poseban stream, što smanjuje trošenje resursa (CPU, RAM, Bandwidth....)

- Manje opterećenje mrežne opreme

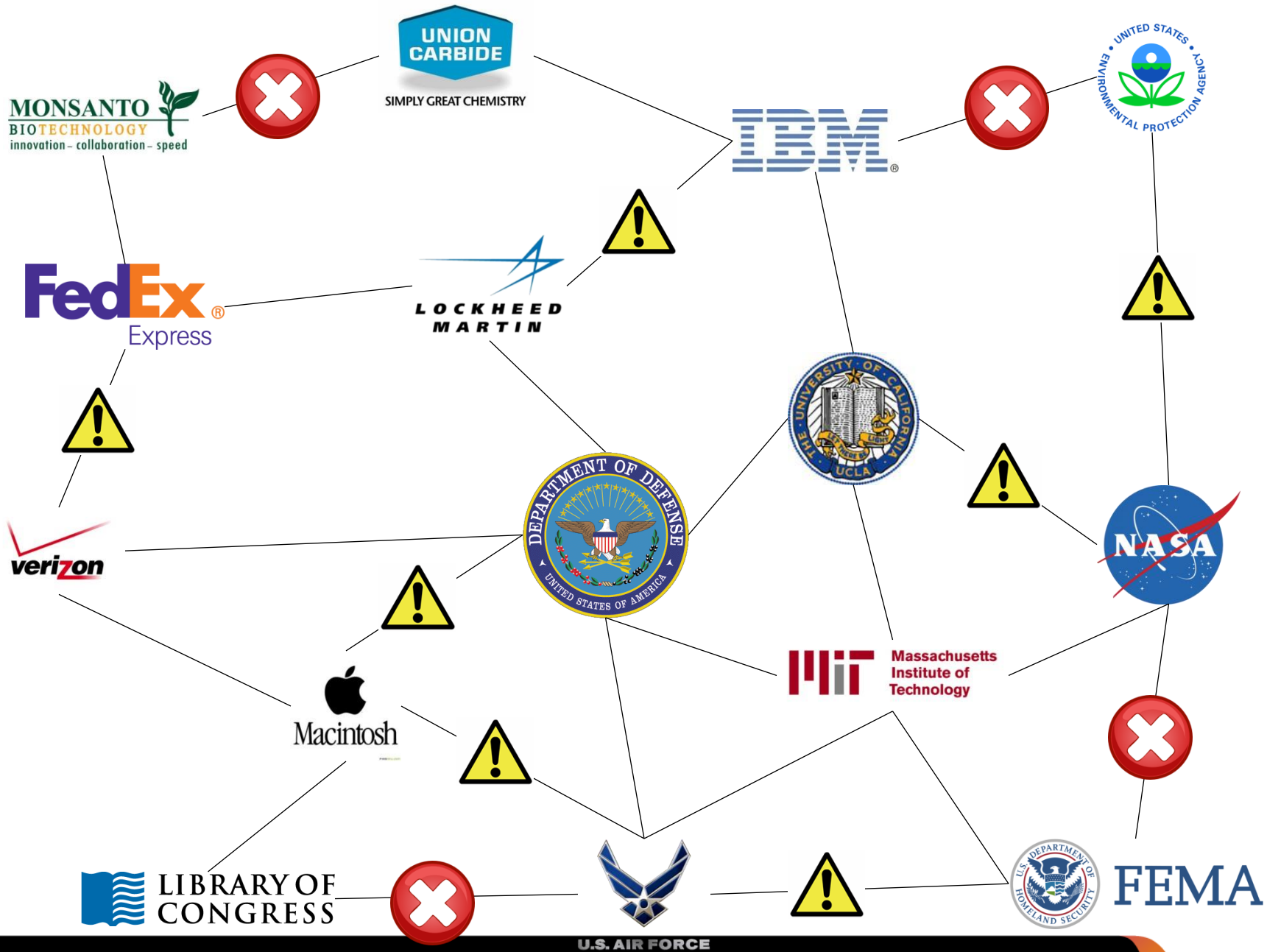
- ✓ manji broj paketa znači i manje prosljeđivanja i procesuiranja

- Omogućava efikasnije korištenje distribuiranih aplikacija

- ✓ aplikacije i servisi koje su namijenjene većem broju korisnika nisu moguće u unicast izvedbi iz razloga što unicast nije skalabilan

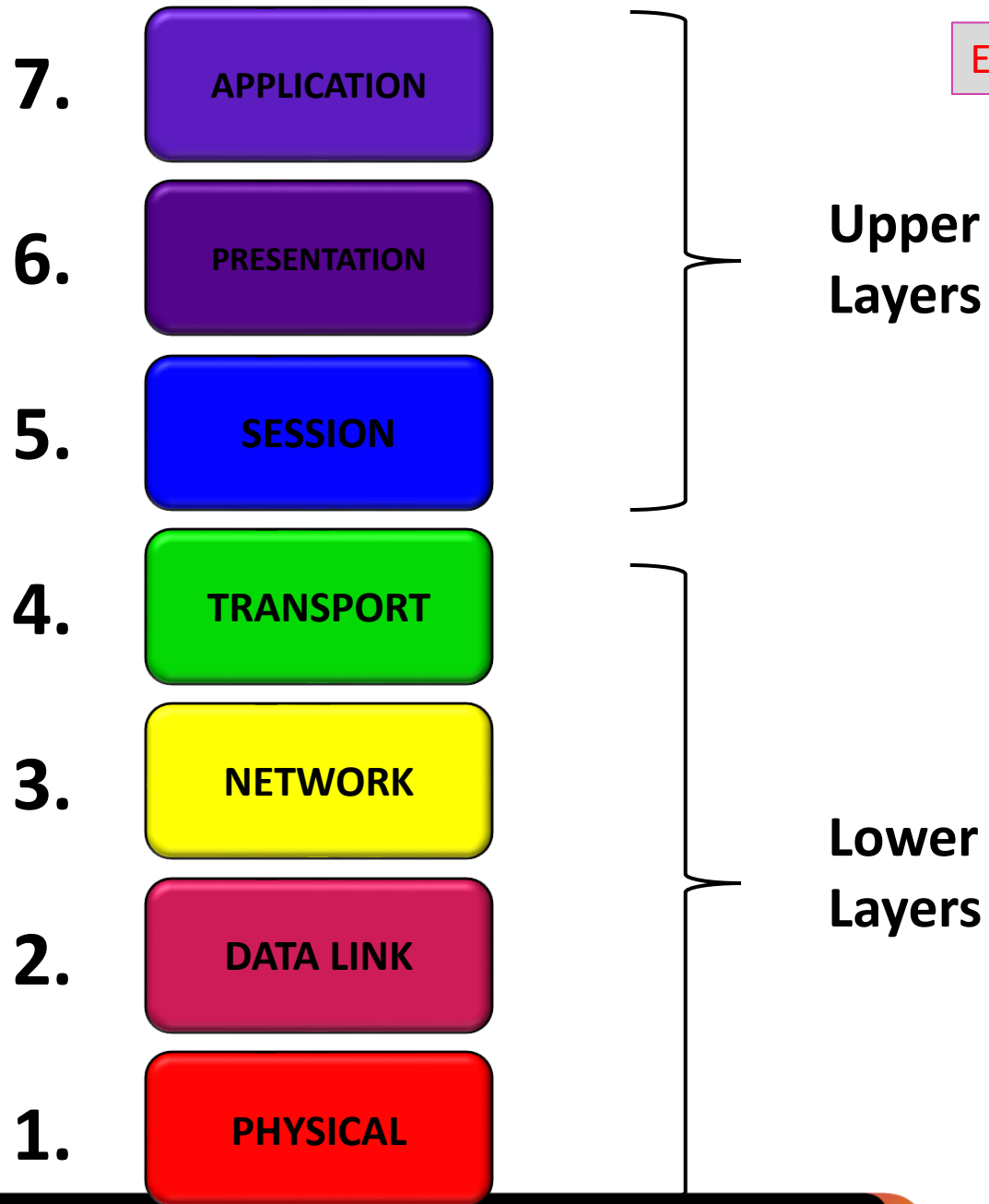


?

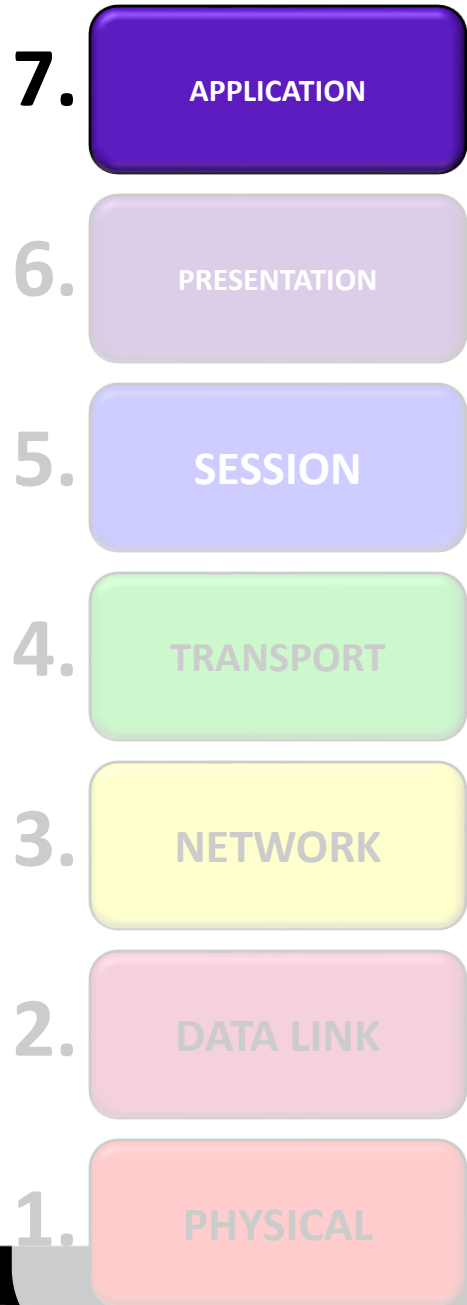


OSI model

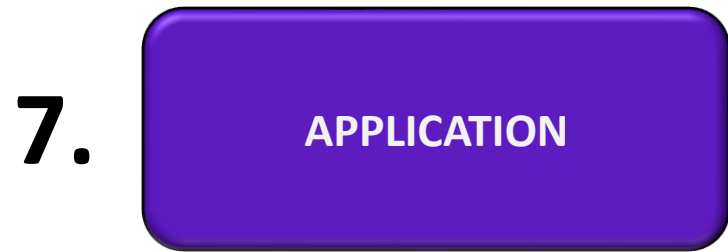
Open
System
Interconnection
model

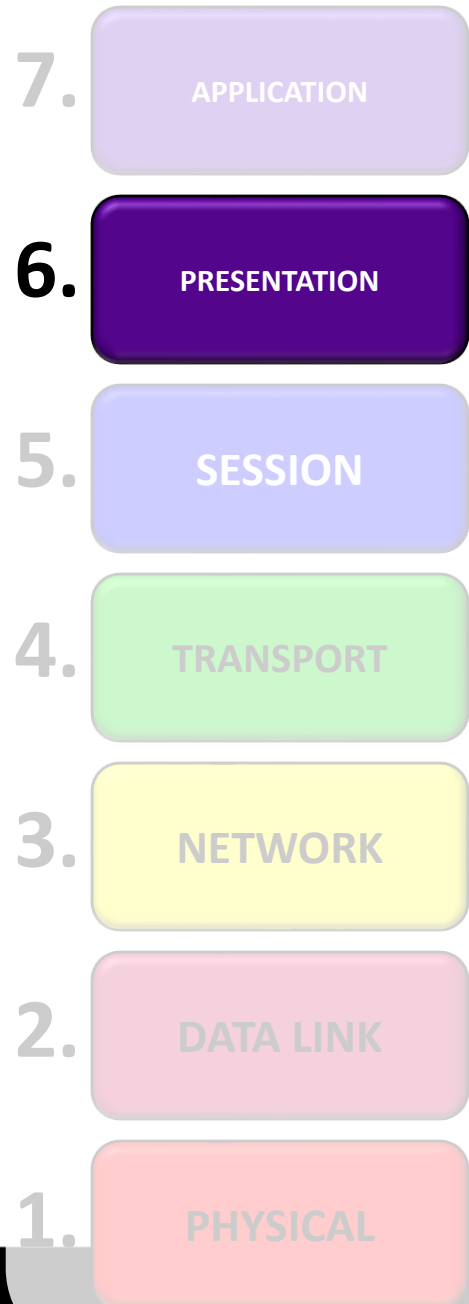


Exam question



- Procedure za prijenos podataka
- Veza između korisnika i računala
- Identifikacija partnera komunikacije
- Određivanje raspoloživih resursa
- Sinkronizacija komunikacije





- Formatiranje podataka
- Kompresija
- Enkripcija i dekrepcija

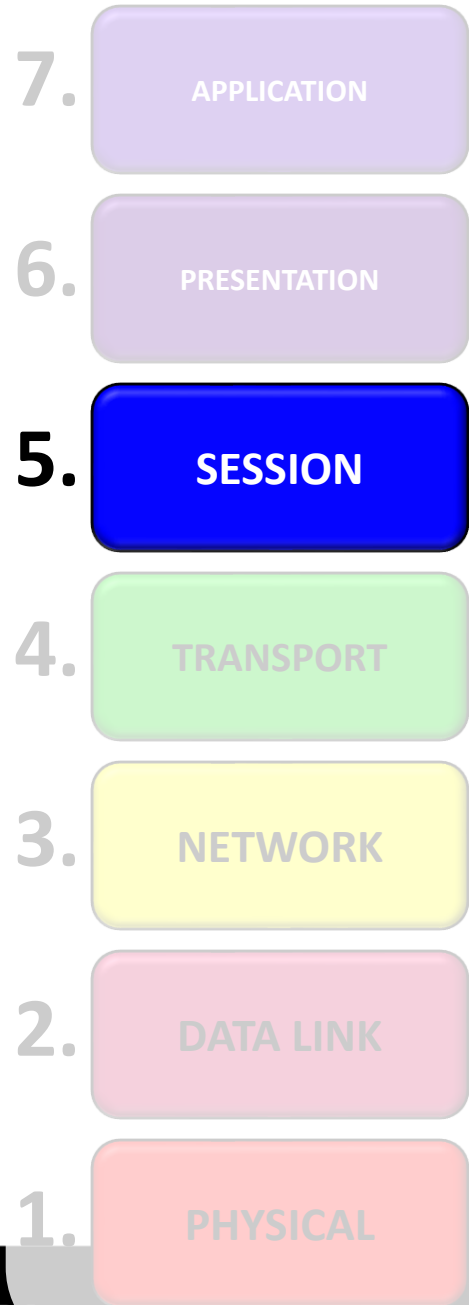


.txt .doc .docx .jpg .png

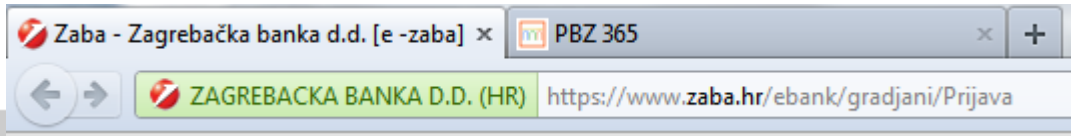
Dođi kući na čaj od šipka.

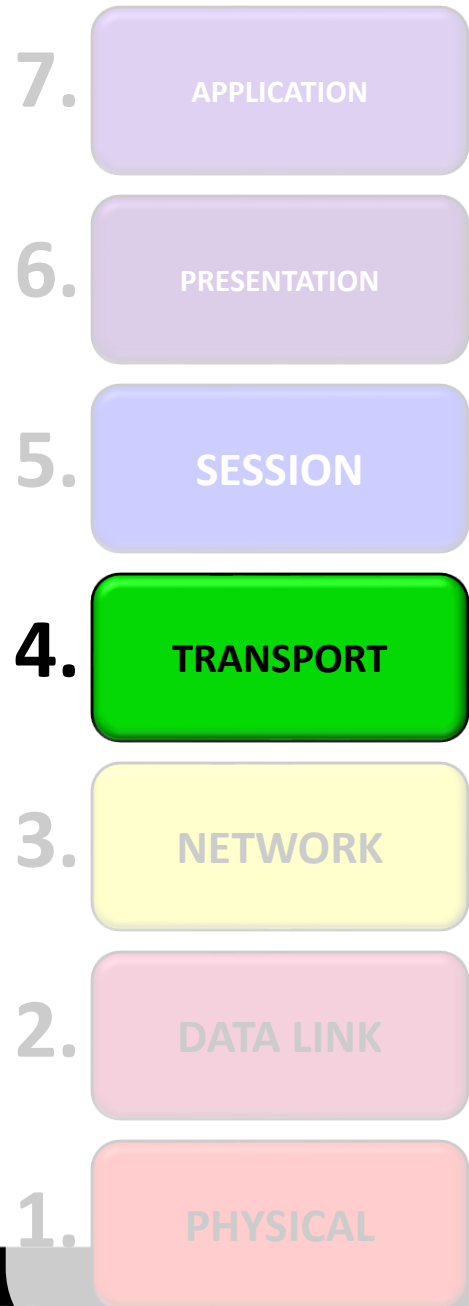


Dođi kući na čaj od šipka



- Uspostava komunikacije
- Održavanje komunikacije
- Zatvaranje komunikacije

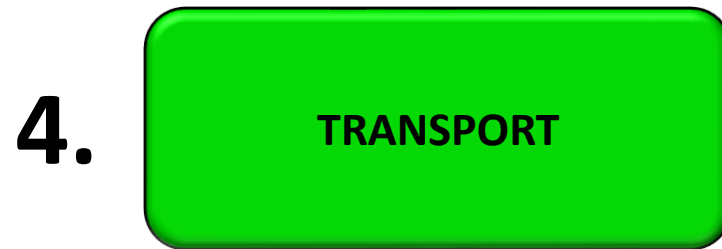




- Pouzdanost komunikacije
- Kontrola protoka podataka
- Izbjegavanje zagušenja

TCP – transmission control protocol

UDP – user datagram protocol



- 7. APPLICATION
- 6. PRESENTATION
- 5. SESSION
- 4. TRANSPORT
- 3. NETWORK**
- 2. DATA LINK
- 1. PHYSICAL

• ROUTING

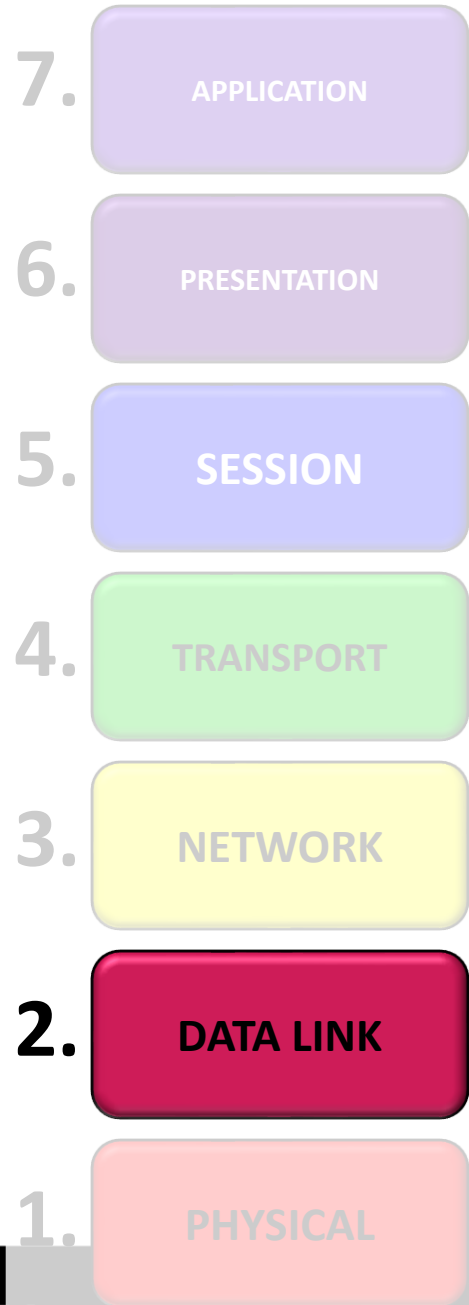
Internet Protocol (IPv4 i IPv6)

IP adresa: 192.168.0.11



3. NETWORK





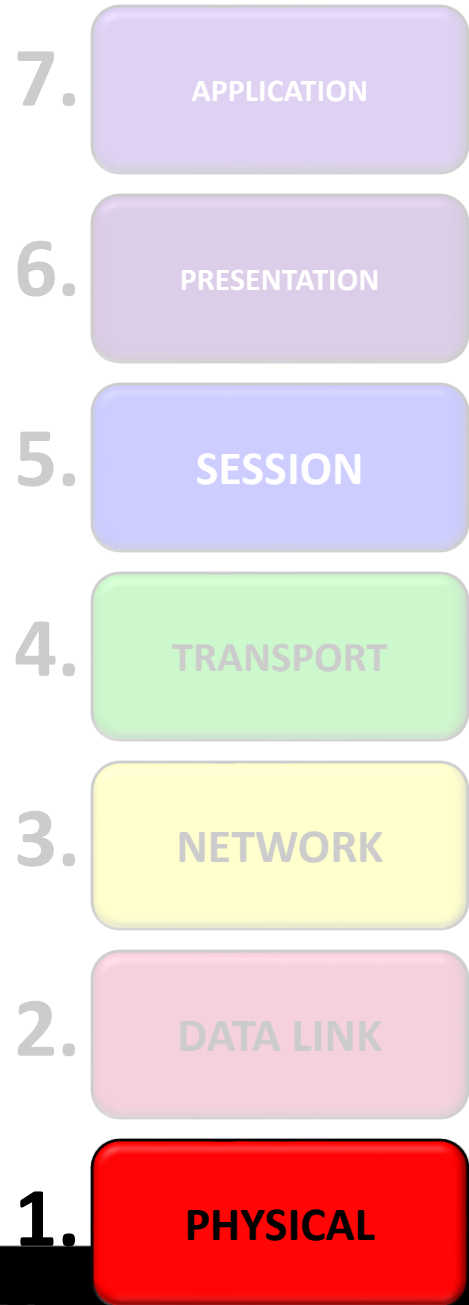
• SWITCHING

- Kontrola pristupa mediju
- Kontrola grešaka...

ETHERNET protocol

MAC sdresa 001C:001B:001A





- Električni signali
- Kablovi
- Konektori

5 V 600 MHz 850 nm

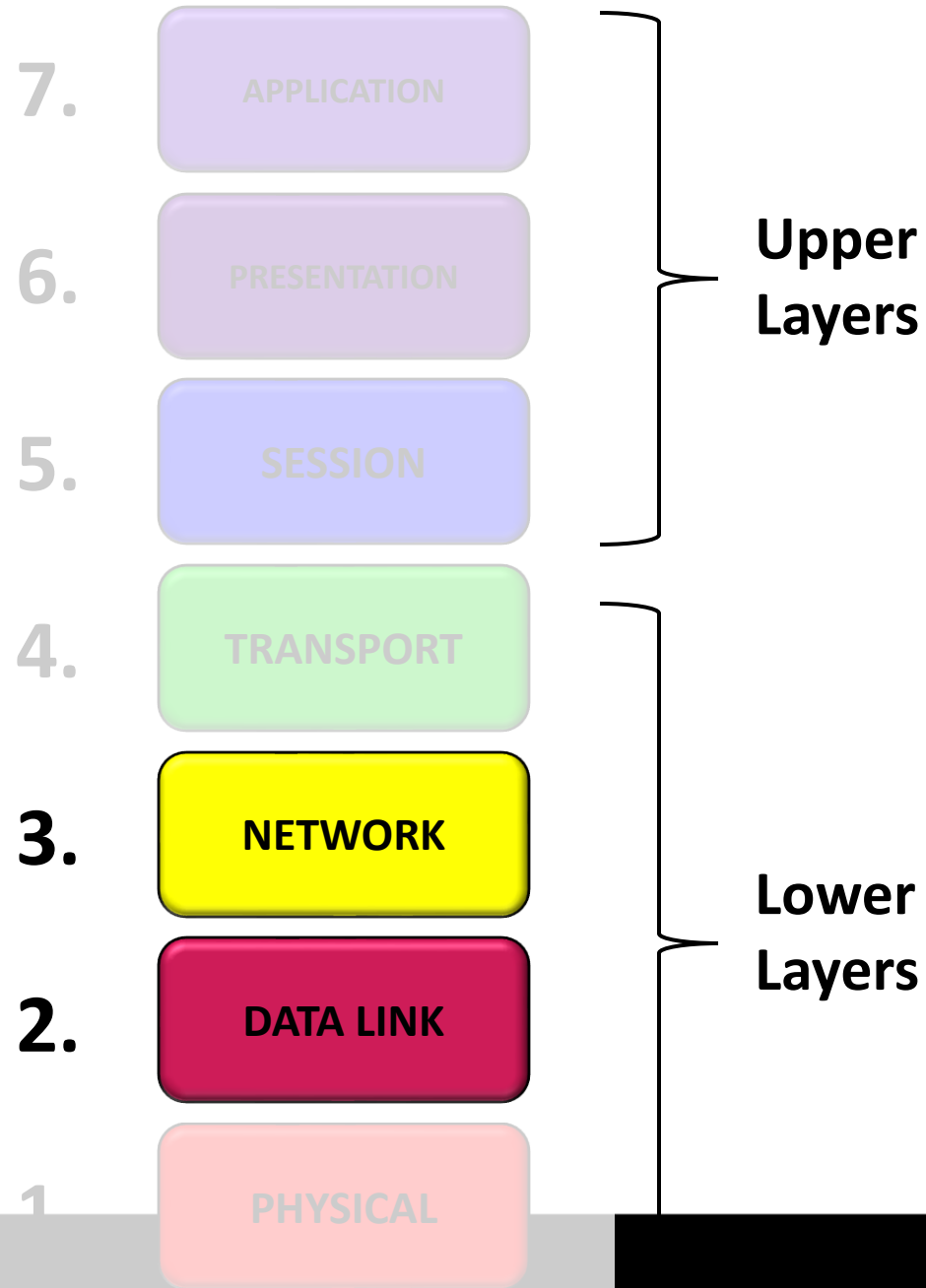
1. **PHYSICAL**



OSI model

- Referenti model koji opisuje način na koji se odvija komunikacija između dva računala.

ROUTING • IP
SWITCHING • ETHERNET



Exam question

Please **Do Not Throw Sausage Pizza Away !!**

Exam question

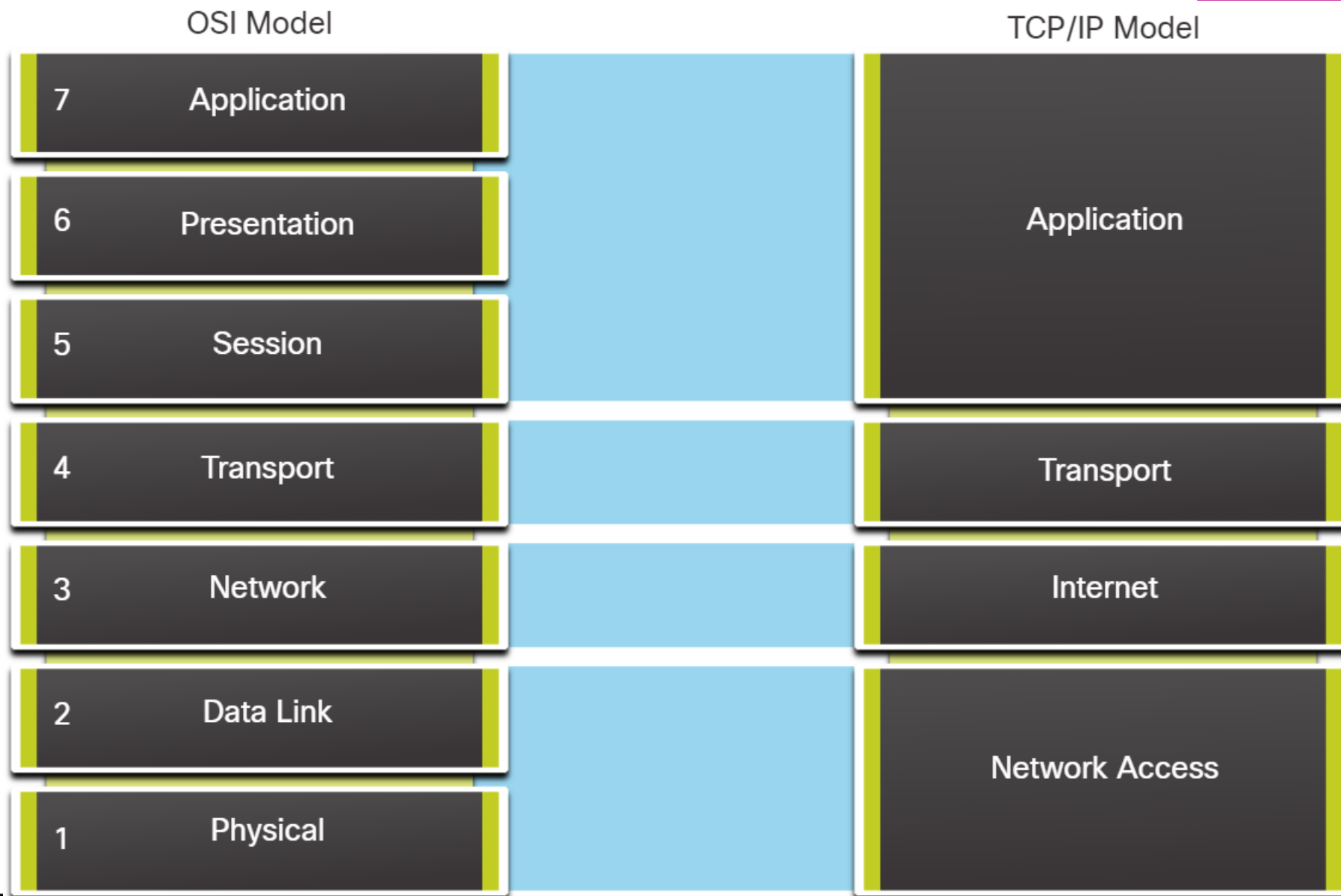


Različiti protokoli kroz vrijeme-danas je TCP/IP standard

TCP/IP Layer Name	TCP/IP	ISO	AppleTalk	Novell Netware
Application	HTTP DNS DHCP FTP	ACSE ROSE TRSE SESE	AFP	NDS
Transport	TCP UDP	TP0 TP1 TP2 TP3 TP4	ATP AEP NBP RTMP	SPX
Internet	IPv4 IPv6 ICMPv4 ICMPv6	CONP/CMNS CLNP/CLNS	AARP	IPX
Network Access	Ethernet ARP WLAN			

Usporedba OSI modela s TCP/IP modelom

Exam question

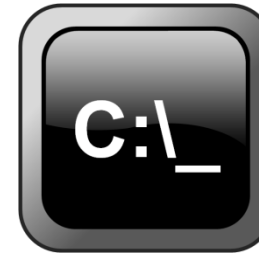


CMD.EXE

Start



cmd.exe



*Ethernet

File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help



icmp

No.	Time	Source	Destination	Protocol	Length	Info
437	9.411436	192.168.0.16	8.8.8.8	ICMP	74	Echo (ping) request id=0x0001, seq=330/18945, ttl=128 (reply in 438)
438	9.435588	8.8.8.8	192.168.0.16	ICMP	74	Echo (ping) reply id=0x0001, seq=330/18945, ttl=113 (request in 437)
483	10.421933	192.168.0.16	8.8.8.8	ICMP	74	Echo (ping) request id=0x0001, seq=331/19201, ttl=128 (reply in 484)
484	10.445469	8.8.8.8	192.168.0.16	ICMP	74	Echo (ping) reply id=0x0001, seq=331/19201, ttl=113 (request in 483)
501	11.433613	192.168.0.16	8.8.8.8	ICMP	74	Echo (ping) request id=0x0001, seq=332/19457, ttl=128 (reply in 502)
502	11.459854	8.8.8.8	192.168.0.16	ICMP	74	Echo (ping) reply id=0x0001, seq=332/19457, ttl=113 (request in 501)
512	12.446651	192.168.0.16	8.8.8.8	ICMP	74	Echo (ping) request id=0x0001, seq=333/19713, ttl=128 (reply in 513)
513	12.469439	8.8.8.8	192.168.0.16	ICMP	74	Echo (ping) reply id=0x0001, seq=333/19713, ttl=113 (request in 512)
851	42.489192	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=334/19969, ttl=1 (no response found!)
852	42.489474	192.168.0.1	192.168.0.16	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
853	42.490451	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=335/20225, ttl=1 (no response found!)
854	42.490622	192.168.0.1	192.168.0.16	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
855	42.491168	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=336/20481, ttl=1 (no response found!)
856	42.491337	192.168.0.1	192.168.0.16	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
1010	48.073919	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=337/20737, ttl=2 (no response found!)
1011	48.082184	10.208.8.1	192.168.0.16	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
1012	48.085571	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=338/20993, ttl=2 (no response found!)
1013	48.096034	10.208.8.1	192.168.0.16	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
1014	48.099399	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=339/21249, ttl=2 (no response found!)
1015	48.109082	10.208.8.1	192.168.0.16	ICMP	70	Time-to-live exceeded (Time to live exceeded in transit)
1132	53.664766	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=340/21505, ttl=3 (no response found!)
1133	53.673489	100.64.0.89	192.168.0.16	ICMP	110	Time-to-live exceeded (Time to live exceeded in transit)
1134	53.676774	192.168.0.16	8.8.8.8	ICMP	106	Echo (ping) request id=0x0001, seq=341/21761, ttl=3 (no response found!)
1135	53.685555	100.64.0.89	192.168.0.16	ICMP	110	Time-to-live exceeded (Time to live exceeded in transit)

> Frame 513: 74 bytes on wire (592 bits), 74 bytes captured (592 bits) on interface \Device\NPF_{AD0DC399-0FDE-42A5-9E28-581B7FDE22A8}, id 0
 > Ethernet II, Src: HonHaiPr_94:10:53 (fc:01:7c:94:10:53), Dst: ASRockIn_92:09:2a (70:85:c2:92:09:2a)
 > Internet Protocol Version 4, Src: 8.8.8.8, Dst: 192.168.0.16
 > Internet Control Message Protocol

CMD.EXE-osnovne naredbe

Exam question

- ipconfig
- ipconfig /all
- route print (netstat -r)
- arp -a
- telnet
- tracert
- ping
- netstat -a
- Nslookup
- ipconfig /flushdns
- ipconfig /release
- Ipconfig /renew

➤ tracert

- Tracert 178.79.149.215
- Tracert -d 178.79.149.215
- Tracert -h 10 178.79.149.215
- Tracert -h 10 -d 178.79.149.215

➤ telnet

- telnet 178.79.149.215 80

➤ ping

- Ping -n 7 178.79.149.215
- Ping -a 178.79.149.215
- Ping -t 178.79.149.215
- Ping -l 1500 178.79.149.21
- Ping -w 10 178.79.149.215

Priprema za vježbu

What is OSI model (10 min)

<https://www.cloudflare.com/learning/ddos/glossary/open-systems-interconnection-model-osi/>

What is wireshark (5min)

https://www.wireshark.org/docs/wsug_html_chunked/ChapterIntroduction.html#ChIntroWhatIs

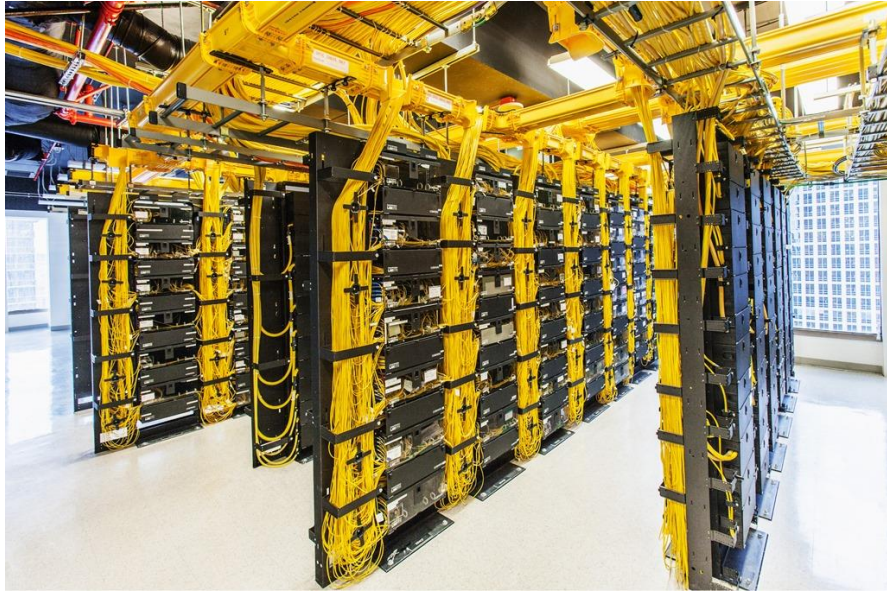
What is OSI Model? (9 min)

https://www.youtube.com/watch?v=llk7UXzV_Qc

Wireshark Tutorial for Beginners (14 min)

<https://www.youtube.com/watch?v=TkCSr30UojM>

CIX (Croatian Internet exchange)

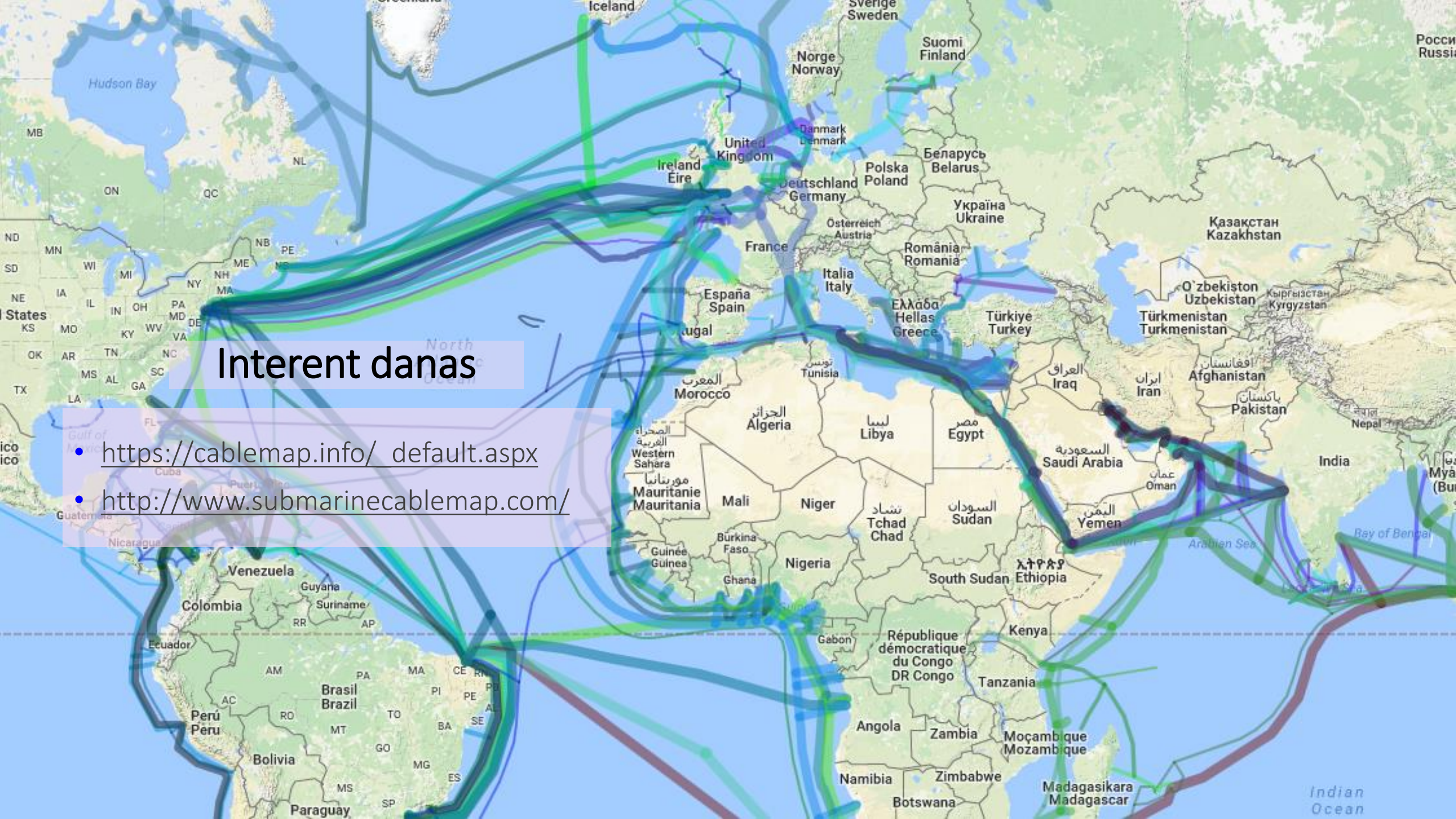


Exam question

<https://www.cix.hr/clanice/clanice>

Interent danas

- <https://cablemap.info/default.aspx>
- <http://www.submarinecablemap.com/>





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**Hvala na
pažnji!**