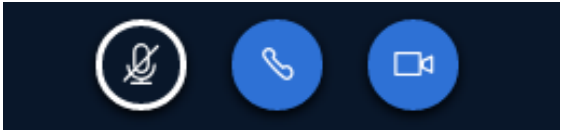
Webinars with BBB - Etiquette

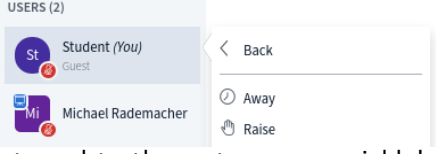
Audio and Video

- **Find a suitable space:**
  - W/o. interruptions
  - W/o. background noise
  - Have good lighting on your face
- Use a **headset** if available
- **Turn ON your camera** unless you are experiencing connection problems
- **Turn OFF your microphone** and only unmute it if you want to participate



Participation

- Click on your Name and "Set status" - "Raise"
- I will call your name
- Ask questions in the Shared Notes. Write "+1" if you have the same question.
- **Lectures (Audio, Video, all Chats) will be recorded**. If you do not like to appear in the recording, let me know



Do NOT hesitate to participate! You will get used to the system very quickly!

Review of required background - Corona Quiz Edition!

Communication in Distributed Systems

2 Review of required background - **Corona Quiz Edition!**

Dr.-Ing. Michael Rademacher

2020-04-28

Discussion of the Reading

MANET Simulation Studies: The Incredibles *

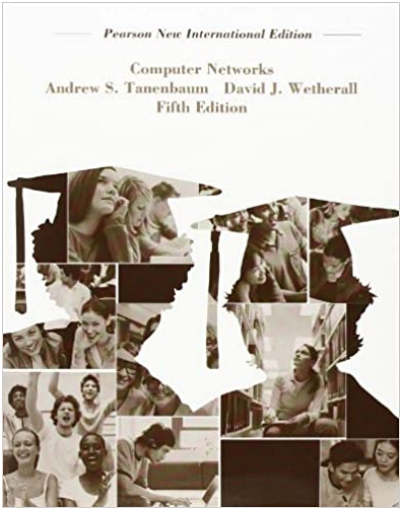
Stuart Kurkowski *skurkows@mines.edu*
Tracy Camp *tcamp@mines.edu*
Michael Colagrosso *mcolagro@mines.edu*
MCS Department, Colorado School of Mines, Golden, Colorado, USA

Talking Points:

- What is the goal of this paper?
- What is the issue with "did not identify the simulator used in the research"
- What is an unbiased simulation study?
- What is a terminating and a steady-state simulation?
- What is the problem with Scenario Development? What is the main statement of Figure 2? How should we fix the problem?
- What is the main challenge when Analyzing the Output of a simulation?
- What did you learn for your paper?

Today is Quiz Time!

- We will use the BigBlueButton poll feature for a little self-assessment
- The results of this self-assessment will **not** be relevant for your final grade
- The questions are **examples** for knowledge we expect you to have
- **Do Not Guess, do not Google**
- You need a pen and a paper
- I will add some explanations after each question when needed
- If you have problems answering the questions review some background by yourself



Andrew S Tanenbaum - Computer Networks

Question

The _____ Layer handles transmission errors and regulates the flow of data on a point-to-point link.

A

Transport

B

Network

C

Data Link

D

Physical

Answer

The _____ Layer handles transmission errors and regulates the flow of data on a point-to-point link.

A

Transport

B

Network

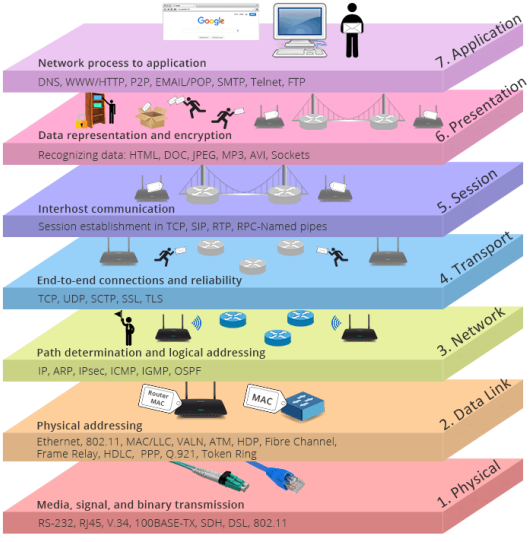
C

Data Link

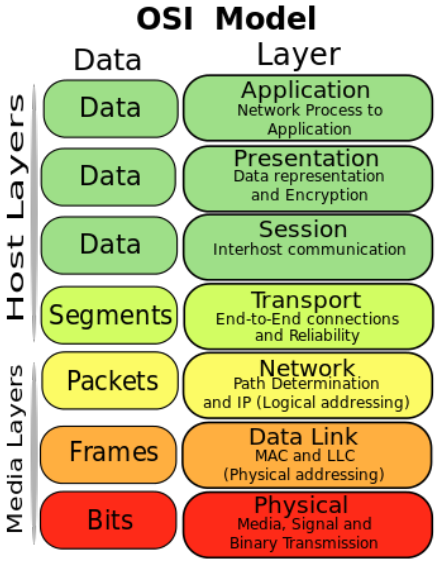
D

Physical

Explanation



https://securitystack.co/2019/02/08/security-stack-sheet-39/



https://commons.wikimedia.org/wiki/File:Osi-model-jb.svg

Question

IPv4 is a _____ protocol.

A

reliable

B

connection-oriented

C

both A and B

D

none of the above

Answer

IPv4 is a _____ protocol.

A

reliable

B

connection-oriented

C

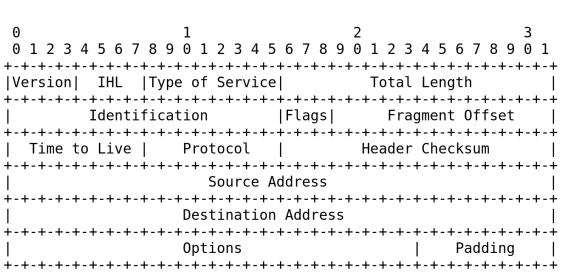
both A and B

D

none of the above

Additional Explanation

Reliability:



Example Internet Datagram Header

https://tools.ietf.org/html/rfc791

A **reliable** protocol **notifies** the sender whether the delivery of data to intended recipients was **successful**.

Connection-oriented / Connection-less:

- Connection-oriented:
  - Usually operates in three distinct phases
    1. Connection setup to initialize a state
    2. Data unit transfer
    3. Connection release
- Connection-less:
  - Immediate data unit transfer
  - No connection setup
  - Packets can arrive out-of-order through different paths

Question

In _____ transmission, the channel capacity is shared by both communicating devices at all times.

A

simplex

B

half-duplex

C

full-duplex

D

half-simplex

Answer

In _____ transmission, the channel capacity is shared by both communicating devices at all times.

A

simplex

B

half-duplex

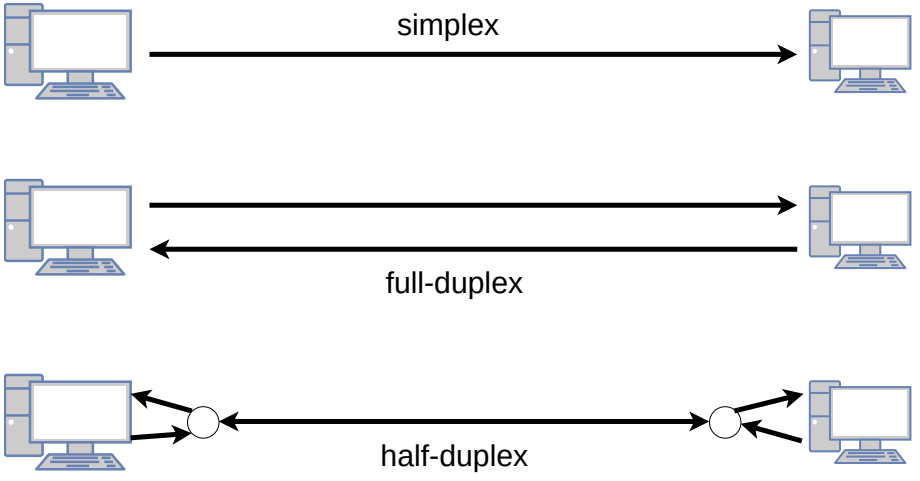
C

full-duplex

D

half-simplex

Explanation



- Keyboard
- Fiber
- WiFi

Question

A client-server system uses a satellite network, with the satellite at a height of 30,000 km. What is the best-case round-trip delay in response to a request. Provide a reasonable estimation.

A

0.4 ms

B

4 ms

C

400 ms

D

4 s

Answer

A client-server system uses a satellite network, with the satellite at a height of 30,000 km. What is the best-case round-trip delay in response to a request. Provide a reasonable estimation.

A

0.4 ms

B

4 ms

C

400 ms

D

4 s

Explanation

$$2 * \frac{30\,000\,\text{km}}{3 \times 10^5\,\text{km/s}} = 2 * \frac{3\,\text{km}}{30\,\text{km/s}} = 2 * 0.1\,\text{s} = 0.2\,\text{s} = 200\,\text{ms}$$

Route	Distance	Time in vacuum	Time in fiber	RTT in fiber
New York to San Francisco	4,148 km	14 ms	21 ms	42 ms
New York to London	5,585 km	19 ms	28 ms	56 ms
New York to Sydney	15,993 km	53 ms	80 ms	160 ms
Equatorial circumference	40,075 km	133.7 ms	200 ms	200 ms

Question

How long does it take to transmit a 1 Gigabyte[a] file using a link with a goodput of 50 Mbps.

[a] Assume the decimal definition, i.e. 1000 bytes = 1 kilobyte.

A

16 s

B

160 s

C

320 s

D

640 s

Answer

How long does it take to transmit a 1 Gigabyte[a] file using a link with a goodput of 50 Mbps.

[a] Assume the decimal definition, i.e. 1000 bytes = 1 kilobyte.

A

16 s

B

160 s

C

320 s

D

640 s

Explanation

Wired communication technologies			
Fiber optic	PON	155 Mbps–2.5 Gbps	Up to 60 km
	WDM	40 Gbps	Up to 100 km
	SONET/SDH	10 Gbps	Up to 100 km
DSL	ADSL	1–8 Mbps	Up to 5 km
	HDSL	2 Mbps	Up to 3.6 km
	VDSL	15–100 Mbps	Up to 1.5 km
Coaxial Cable	DOCSIS	172 Mbps	Up to 28 km
PLC	HomePlug	14–200 Mbps	Up to 200 m
	Narrowband	10–500 kbps	Up to 3 km
Ethernet	802.3x	10 Mbps–10 Gbps	Up to 100 m
Wireless communication technologies			
Z-Wave	Z-Wave	40 kbps	Up to 30 m
Bluetooth	802.15.1	721 kbps	Up to 100 m
ZigBee	ZigBee	250 kbps	Up to 100 m
	ZigBee Pro	250 kbps	Up to 1600 m
WiFi	802.11x	2–600 Mbps	Up to 100 m
WiMAX	802.16	75 Mbps	Up to 50 km
Wireless Mesh	Various (e.g., RF mesh, 802.11, 802.15, 802.16)	Depending on selected protocols	Depending on deployment
Cellular	2G	14.4 kbps	Up to 50 km
	2.5G	144 kbps	
	3G	2 Mbps	
	3.5G	14 Mbps	
	4G	100 Mbps	
Satellite	Satellite Internet	1 Mbps	100–6000 km

https://doi.org/10.1016/j.comnet.2014.03.029

$$
\begin{aligned}
time &= \frac{size}{goodput} \\
&= \frac{8 \times 10^9\,\text{Bit}}{50 \times 10^6\,\text{Bit/s}} \\
&= 160\,\text{s}
\end{aligned}
$$

Question

The _____ identifies a process on a host.

A

physical address

B

IP address

C

port

D

none of the above

Answer

The _____ identifies a process on a host.

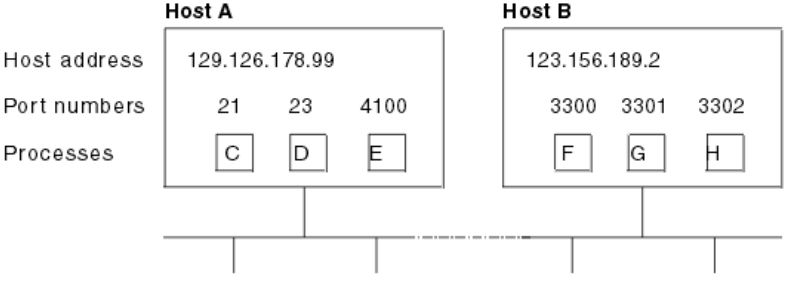
A
physical address

B
IP address

C
port

D
none of the above

Explanation



https://www.ibm.com/support/knowledgecenter/SSGMCP_5.6.0/fundamentals/graphics/DFHTM13.gif

name	port	protocol
http	80	tcp
ipp	631	udp
snmp	161	udp
ntp	123	udp
telnet	23	tcp
https	443	tcp
ftp	21	tcp
smtp	25	tcp
pop3	110	tcp

Question

A periodic signal completes one cycle in 0.001 s. What is the frequency?

A

1 Hz

B

100 Hz

C

1 kHz

D

1 MHz

Answer

A periodic signal completes one cycle in 0.001 s. What is the frequency?

A

1 Hz

B

100 Hz

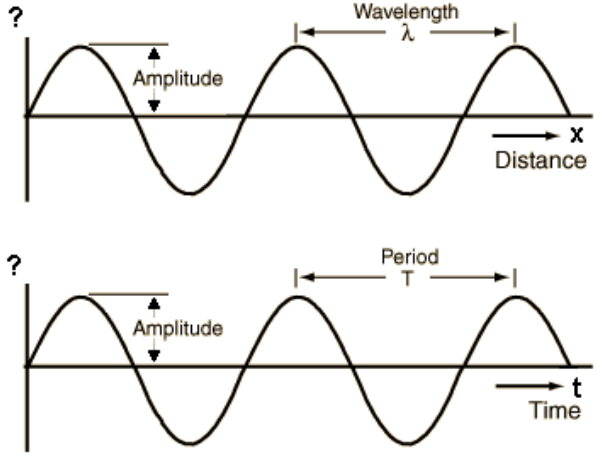
C

1 kHz

D

1 MHz

Explanation



- Period: $T = 1/f$
- Frequency $f = 1/T = c/\lambda$
- Wavelength $\lambda = c/f$
- Wave Speed $c = \lambda f$

Question

For a _____ channel, we need to use the Shannon–Hartley theorem to find the maximum bit rate.

A

noisy

B

noiseless

C

bandpass

D

low-pass

Answer

For a _____ channel, we need to use the Shannon–Hartley theorem to find the maximum bit rate.

A

noisy

B

noiseless

C

bandpass

D

low-pass

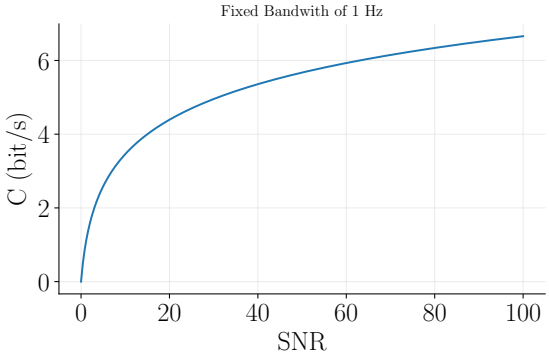
Explanation

$$C = B \log_2(1 + \frac{S_P}{N_0 * B})$$

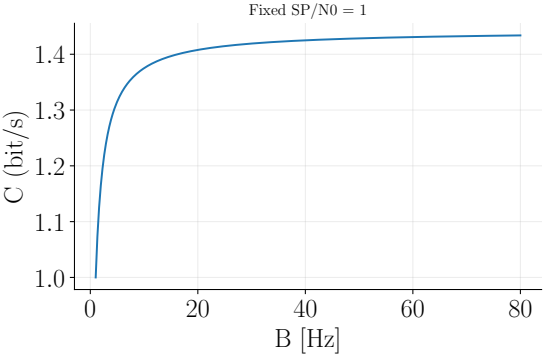
- C: Capacity (bits/s)
- B: Bandwidth (Hz)
- N_0: Noise (W/Hz)
- S_P: Signal power (W)
- $\frac{S_P}{N_0 * B}$: SNR

- Increasing the **SNR** increases the channel capacity
- Increasing the **channel bandwith** increases the channel capacity
- Depending on wheter B or S_P is more precious, we can increase one and reduce the other, and yet maintain the same capacity
- **But, there are limits**

Explanation 2



Limit of increasing the SNR



Limit of increasing the Bandwidth

- Observation: If $B \to \inf$, C approaches $\frac{SP}{N_0} \log_2(e)$.
- Can you proof this?
  - **Write me a mail if you can!**

Question

The _____ address, also known as the link address or physical address, is the address of a node as defined by its LAN or WAN.

A

MAC

B

IP

C

port

D

specific

Answer

The _____ address, also known as the link address or physical address, is the address of a node as defined by its LAN or WAN.

A

MAC

B

IP

C

port

D

specific

Question

The decibel is a way of describing a _____

A

logarithmic / ratio

B

linear / ratio

C

linear / sum

D

logarithmic / sum

Answer

The decibel is a way of describing a _____

A

logarithmic / ratio

B

linear / ratio

C

linear / sum

D

logarithmic / sum

Explanation

- **dB is a logarithmic ratio of powers**

$$\frac{P_1}{P_2}[dB] = 10\log_{10}(\frac{P_1[W]}{P_2[W]})$$

- $P_1 = 2 * P_2$ is equivalent to saying $\frac{P_1}{P_2} \widehat{=} 3dB$, because

$$10\log_{10}(\frac{P_1}{P_2})[dB] = 10\log_{10}(\frac{2 * P_2}{P_2}) = 10\log_{10}(2) \approx 3[dB]$$

- dBm and dBW are (logarithmic) units to measure powers
- The ratio of the power you want to express relative to a reference power
- 1W for dBW and 1mW for dBm

A table to remember:

Power Ratio	in dB
$^1/_{10}$	-10 dB
$^1/_2$	-3 dB
1	0 dB
2	3 dB
10	10 dB
100	20 dB

- What is 36 dBm in Watt?
- $20 + 10 + 3 + 3$
- 100 * 10 * 2 * 2
- 4000mW = 4W

Question

Using _____, the chance of collision can be reduced since a station senses the medium before trying to use it.

A
TDMA

B
CSMA

C
FDMA

D
CDMA

Answer

Using _____, the chance of collision can be reduced since a station senses the medium before trying to use it.

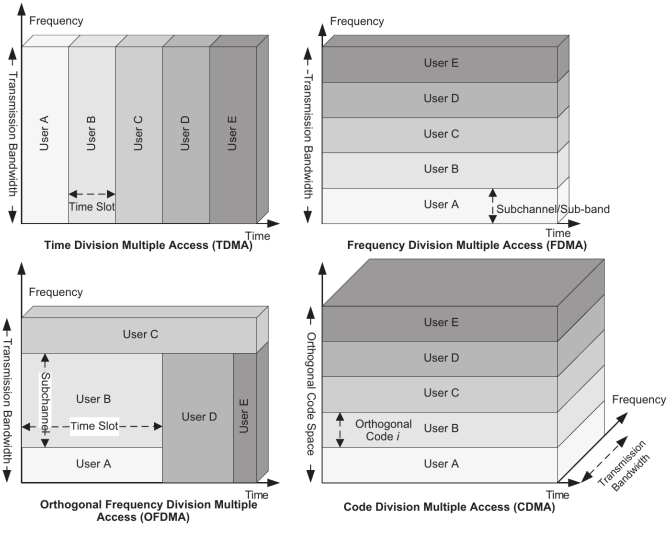
A
TDMA

B
CSMA

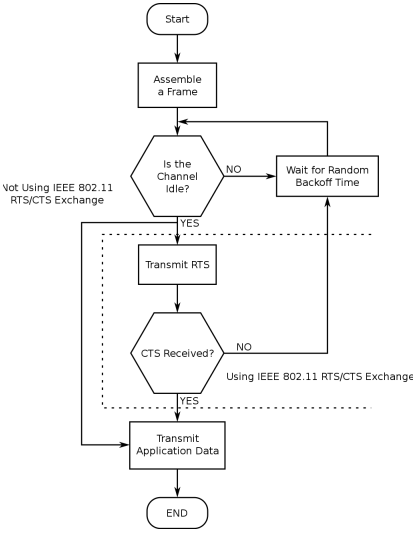
C
FDMA

D
CDMA

Explanation



https://doi.org/10.1016/B978-0-12-374964-2.10009-8



https://en.wikipedia.org/wiki/Carrier-sense_multiple_access_with_collision_avoidance

Question

IPv4 as best-effort delivery service includes _____.

A

error checking

B

error correction

C

datagram acknowledgment

D

none of the above

Answer

IPv4 as best-effort delivery service includes _____.

A

error checking

B

error correction

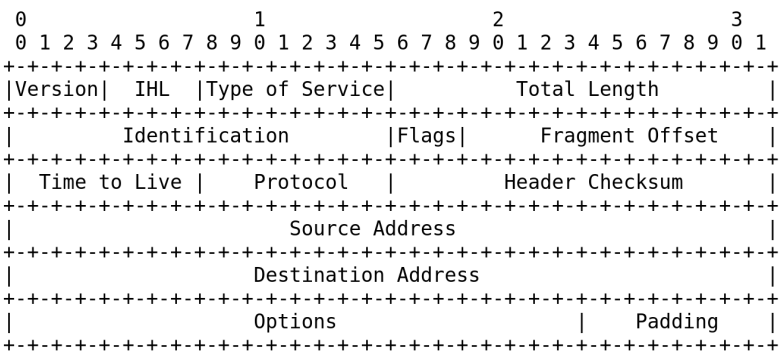
C

datagram acknowledgment

D

none of the above

Explanation



Example Internet Datagram Header

https://tools.ietf.org/html/rfc791

"The type of service is used to specify the treatment of the datagram during its transmission through the internet system."

Question

UDP is called a _____ transport protocol.

A

connectionless, reliable

B

connection-oriented, unreliable

C

connectionless, unreliable

D

none of the above

Answer

UDP is called a _____ transport protocol.

A

connectionless, reliable

B

connection-oriented, unreliable

C

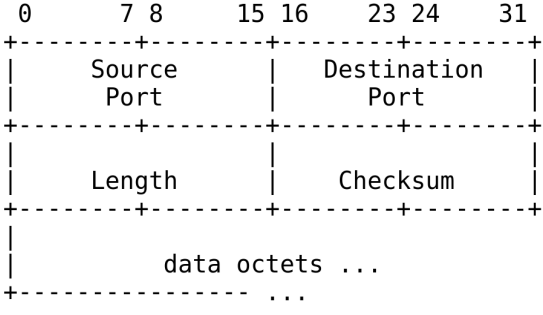
connectionless, unreliable

D

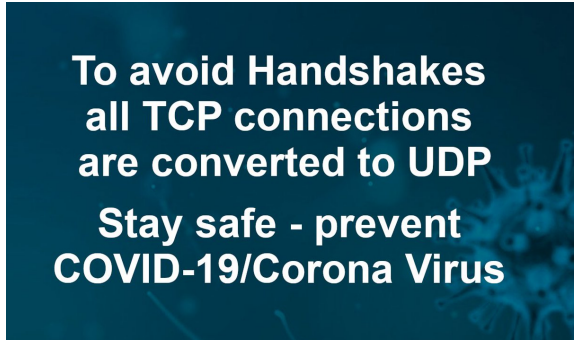
none of the above

Explanation

- UDP is equal to “fire and forget”
- Ordering of packets is not guaranteed
- Lightweight with very few overhead



https://tools.ietf.org/html/rfc768



Question

TCP uses _____ to check the safe and sound arrival of data.

A

an acknowledgment mechanism

B

out-of-band signalling

C

the services of another protocol

D

none of the above

Answer

TCP uses _____ to check the safe and sound arrival of data.

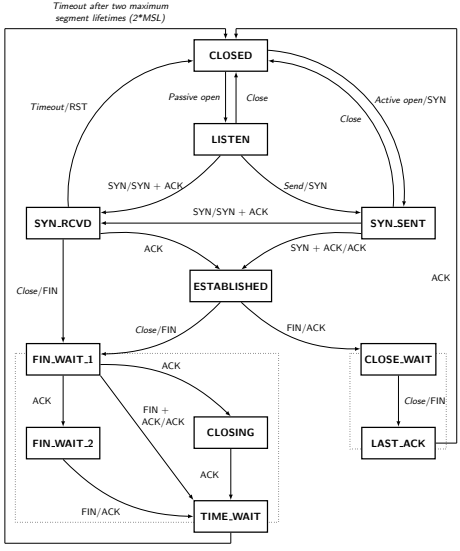
A
an acknowledgment mechanism

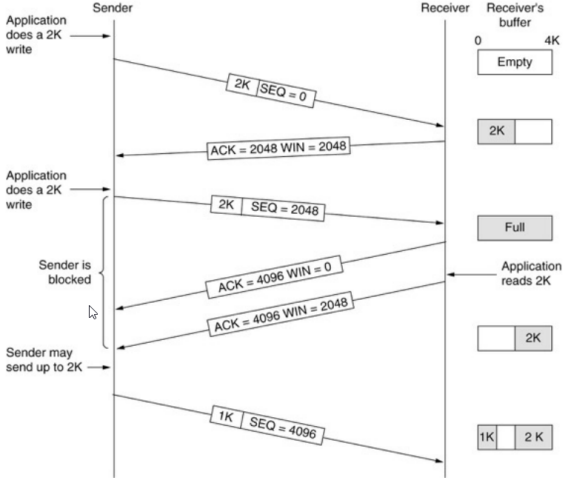
B
out-of-band signalling

C
the services of another protocol

D
none of the above

Explanation





HTTP over UDP: an Experimental Investigation of QUIC

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Abstract: It is often said that the Internet is ubiquitous in our daily lives, but this holds true only for those who can easily access it. In fact, billions of people are still digitally disconnected, as bringing connectivity to certain zones does not make a good business case. The only solution for these unsatisfied potential users is to directly undertake the building of the infrastructure required to obtaining access to the Internet, typically forming groups in order to share the corresponding cost. This article presents a global classification and a summary of the main characteristics of different Alternative Network deployments that have arisen in recent years with an aim to provide Internet services in places where mainstream network deployments do not exist or are not adequate solutions. The "Global Access to the Internet for All" Research Group of the Internet Research Task Force, where all authors actively participate, is interested in documenting these emerging deployments. As an outcome of this work, a classification has converged by consensus, where five criteria have been identified and, based on them, four different types of Alternative Networks have been identified and described with real-world examples. Such a classification is useful for a deeper understanding of the common characteristics behind existing and emerging Alternative Networks.[1]

Thank you for your attention.
Are there any questions left?

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References I

[1] Saldana, J., Arcia-Moret, A., Sathiaseelan, A., Braem, B., Pietrosemoli, E., Zennaro, M., Simo-Reigadas, J., Komnios, I., and Rey-Moreno, C.
Alternative Networks: Toward a Global Access to the Internet for All.
IEEE Commun. Mag. (2017), 2–8.