Name: _____ Date: _____ Score: _____

Mullvad Security

Analyzing Mullvad VPN security architecture including diskless RAM-only servers, audited zero-logs policies, local key generation, WireGuard encryption, and quantum-resistant tunnel configurations.

MULLVAD SECURITY LEARNING OVERVIEW

LEARNER
STUDENT STATUS
Network Defender Track

SECURE
CONNECTION STATUS
Shielding data packets

ON
LEAK PROTECTION
DNS & IPv6 leak protection

Welcome! This activity packet guides you through the security architecture of Mullvad. You will explore diskless RAM-only servers, audited zero-logs policies, local key generation, and quantum-resistant tunnels.

WORKSHEET CHECKPOINTS

- [ ] **Part 1-4: Master VPN and network security configurations.**
- [ ] **Part 5-7: Solve crossword & word search puzzles.**
- [ ] **Part 8-9: Solve case studies & cipher challenge.**
- [ ] **Part 10: Review basic & advanced FAQ pages.**
- [ ] **Part 11: Explore 10 interesting real-world facts.**
- [ ] **Bonus: Think Fast challenge.**

Open the VPN.com Best VPNs Guide

URL: https://www.vpn.com/vpn/mullvad/security/

Your Mullvad Security Learning Roadmap

- Analyze the technical architecture and configuration rules of Mullvad Security.
- Configure client settings to prevent IP, DNS, and WebRTC traffic leaks.
- Compare custom pricing, trial, and performance features against standard models.

MULLVAD SECURITY GUIDE INSTRUCTIONS

Answer the multiple choice and true/false questions, complete the fill-in-the-blank sentences using the word bank, match definitions, and solve the crossword and word search puzzles. Apply your knowledge to Mullvad's privacy-first server controls. Finish with the Bonus Activity: Think Fast.

EVALUATING ANONYMITY-FIRST INFRASTRUCTURE & RAM TIERS (INTRODUCTION)

Mullvad does not use standard accounts with passwords, relying on randomly generated 16-digit codes. Their infrastructure is engineered with diskless RAM-only nodes, WireGuard keys generated locally, and audited zero-retention policies.

READ EACH CHECKPOINT CAREFULLY AND SELECT OR WRITE THE CORRECT RESPONSE.

Checkpoint 1: Multiple Choice Challenge

1. **1. Which tunneling protocol is default in Mullvad's app?**
   - A) OpenVPN
   - B) WireGuard
   - C) IKEv2
   - D) PPTP

2. **2. What does Mullvad require to create a new account?**
   - A) Nothing at all
   - B) Email address
   - C) Phone number
   - D) ID document

3. **3. Which cryptographic tunnel protects against quantum computers?**
   - A) AES-256-GCM
   - B) Quantum WireGuard
   - C) RSA-4096
   - D) SOCKS5 Proxy

4. **4. What security mechanism blocks WebRTC leak hazards?**
   - A) Browser Extension
   - B) Network Kill Switch
   - C) Routing WebRTC through the VPN interface
   - D) Split Tunneling

5. **5. Which multihop feature routes traffic through multiple nodes?**
   - A) Double NAT
   - B) WireGuard Multihop
   - C) Chameleon Protocol
   - D) Bypasser

Checkpoint 2: True or False Challenge

6 Question 6

6. Mullvad requires an email address during account generation.

○ True ○ False

7 Question 7

7. SOCKS5 proxies can be configured inside Mullvad tunnels.

○ True ○ False

8 Question 8

8. Mullvad owns and operates all of their server hardware.

○ True ○ False

9 Question 9

9. The Network Kill Switch is always active by default.

○ True ○ False

10 Question 10

10. Cash payments sent by mail are completely non-refundable.

○ True ○ False

Checkpoint 3: Key Term Insertion

Read each sentence below and fill in the blank with the correct term from the Word Bank.

1. Mullvad relies on _____ as its primary high-speed secure tunnel protocol.
2. Routing data through two server locations is called _____ configuration.
3. To prevent data logs on disk, Mullvad deploys _____ dedicated nodes.
4. System traffic is blocked when a tunnel fails via the built-in _____ failsafe.
5. Audit statements confirm Mullvad maintains a strict, verified _____ architecture.
6. Internal application routing can be isolated using a custom _____ setup.
7. Post-quantum encryption algorithms secure data inside a _____ tunnel.
8. Private nameservers are deployed globally to help block dangerous _____ hazards.

VOCABULARY WORD BANK

DNS LEAKS | KILL SWITCH | MULTIHOP | NO-LOGS | QUANTUM | RAM-ONLY | SOCKS5 | WIREGUARD

Write your answers here:

1.
2.
3.
4.
5.
6.
7.
8.

Checkpoint 4: VPN & Network Concept Match

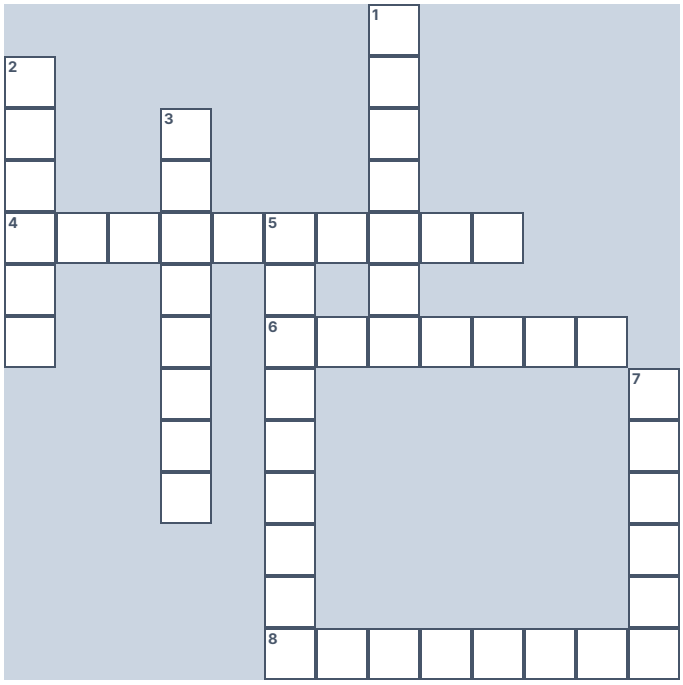
DEFINITION MATCHING

Match each vocabulary term on the left with its correct definition on the right by writing the corresponding letter (A-H) in the fillable input box.

☐	1. WIREGUARD	A	A safety feature that cuts traffic when a VPN drops.
☐	2. MULTIHOP	B	A lightweight, high-performance secure tunneling protocol.
☐	3. RAM-ONLY	C	An internal proxy protocol used to isolate client applications.
☐	4. KILL SWITCH	D	Routing traffic through an entry and exit server node.
☐	5. NO-LOGS	E	Encryption mechanisms designed to resist quantum attacks.
☐	6. SOCKS5	F	Exposure of DNS query destinations outside the VPN tunnel.
☐	7. QUANTUM	G	Volatile memory server hardware that retains no data upon reboot.
☐	8. DNS LEAKS	H	Zero-retention data standard verified by independent audits.

Checkpoint 5: Crossword Puzzle

Solve the crossword puzzle by typing letters into the active white boxes. The numbers correspond to the clues below.



ACROSS CLUES

4. A safety feature that cuts traffic when a VPN drops (10)

6. Volatile memory server hardware that retains no data upon reboot (7)

8. Exposure of DNS query destinations outside the VPN tunnel (8)

DOWN CLUES

1. Encryption mechanisms designed to resist quantum attacks (7)

2. An internal proxy protocol used to isolate client applications (6)

3. Routing traffic through an entry and exit server node (8)

5. A lightweight, high-performance secure tunneling protocol (9)

7. Zero-retention data standard verified by independent audits (6)

Checkpoint 5 Alternative: Accessible Crossword Clues

Screen-reader and keyboard users can type the crossword answers directly in the text fields below.

ACROSS CLUES

4 Across: A safety feature that cuts traffic when a VPN drops (10 letters):

6 Across: Volatile memory server hardware that retains no data upon reboot (7 letters):

8 Across: Exposure of DNS query destinations outside the VPN tunnel (8 letters):

DOWN CLUES

1 Down: Encryption mechanisms designed to resist quantum attacks (7 letters):

2 Down: An internal proxy protocol used to isolate client applications (6 letters):

3 Down: Routing traffic through an entry and exit server node (8 letters):

5 Down: A lightweight, high-performance secure tunneling protocol (9 letters):

7 Down: Zero-retention data standard verified by independent audits (6 letters):

Checkpoint 6: Hidden Word Search

Find the 8 key vocabulary terms hidden in the grid below. Words can be horizontal, vertical, or diagonal.

C R S I G N R R M P X Q O C U
S T G E L J B A A B Q C P X L
K Y O K X T K M D Q U M J D I
D N L N K Q P O G M A M Q R S
R T O T G K C N S Q N O H M S
A B N W D I S L Z V T C Z U W
U F K H Z L D Y D N U D Q L X
G P C U B L A Z N N M D K T A
E D O D F S H I S D R Q M I E
R I R Z S W S F L Q V F A H A
I Q O N P I O T E X Q K R O U
W S D N Y T C B A F S X W P J
A R Z Y Y C K L K G I M R J M
L T O H Q H S Q S H Z A O V G
U B Y R Y B 5 H L Z G J O P N

VOCABULARY WORD LIST

WIREGUARD MULTIHOP RAMONLY KILLSWITCH NOLOGS SOCKS5
QUANTUM DNSLEAKS

Checkpoint 6 Alternative: Accessible Vocabulary Matching

Match each of the 8 vocabulary terms from the Word Search to its correct definition by writing the letter (A-H) in the blank space.

VOCABULARY TERMS

- **A. WIREGUARD**
- **B. MULTIHOP**
- **C. RAMONLY**
- **D. KILLSWITCH**
- **E. NOLOGS**
- **F. SOCKS5**
- **G. QUANTUM**
- **H. DNSLEAKS**

DEFINITIONS & MATCH FIELDS

1. An internal proxy protocol used to isolate client applications.
2. Encryption mechanisms designed to resist quantum attacks.
3. A lightweight, high-performance secure tunneling protocol.
4. Volatile memory server hardware that retains no data upon reboot.
5. A safety feature that cuts traffic when a VPN drops.
6. Routing traffic through an entry and exit server node.
7. Exposure of DNS query destinations outside the VPN tunnel.
8. Zero-retention data standard verified by independent audits.

Checkpoint 7: Scrambled Word Challenge

Unscramble the letters below to reveal key Virtual Private Network (VPN) concepts and terms. Write your answers in the input boxes provided.

1. UGEIWARDR
2. RMYLNOA
3. NLOSGO
4. MUTNUQA
5. IHUPTMOL
6. CSLITKIWHL
7. SSK5CO
8. LNESDKAS

Bonus Activity: Think Fast

3 ITEMS FROM EACH CATEGORY. FIRST PERSON TO COMPLETE THE LIST WINS.

1	Security features in Mullvad			
2	Questions for Mullvad customer support			
3	Ways to make a strong password			
4	People you would recommend Mullvad to			
5	Things an audit can check			
6	Countries known for strong privacy laws			
7	Things you do online every day			
8	Countries where you'd want Mullvad servers			
9	Settings you turn on for extra security			
10	Things encryption protects			
11	Types of VPN leaks			
12	Security words you learned in this worksheet			
13	Threats on public Wi-Fi			
14	Apps you would use together with Mullvad			
15	Devices you would install Mullvad on			

Checkpoint 8: VPN & Network Case Studies

Apply the concepts you have learned to solve the real-world scenarios below.

CASE STUDY 1: QUANTUM RESISTANCE INTEGRATION

Scenario: A financial company needs to secure file transfers against future quantum decryption.

Discussion Question: What tunnel configuration should they deploy within Mullvad's app?

CASE STUDY 2: STEALTH INVESTIGATIVE ROUTING

Scenario: An investigator wants to double route their network to mask their entry point.

Discussion Question: Which Mullvad feature should be enabled to achieve multi-server routing?

Checkpoint 9: Decrypting the Cipher

A network engineer secures routing channels and client tunnels. Use the Letter-to-Number key below to decrypt the message by writing the matching letters in the blank spaces.

LETTER-TO-NUMBER ENCRYPTION KEY

A=1 B=2 C=3 D=4 E=5 F=6 G=7 H=8 I=9 J=10 K=11 L=12 M=13

N=14 O=15 P=16 Q=17 R=18 S=19 T=20 U=21 V=22 W=23 X=24 Y=25 Z=26

13	21	12	12	22	1	4		1	3	3	15	21	14	20	19		21	19	5

14	15		16	1	19	19	23	15	18	4		15	18		5	13	1	9	12

Decoded message:

TIP: EACH NUMBER REPRESENTS THE POSITION OF THAT LETTER IN THE ALPHABET (E.G. 1 = A, 2 = B, 26 = Z).

Checkpoint 10: Basic VPN FAQs (Part A)

Review the most common questions and answers regarding Virtual Private Networks (VPNs) and tunneling.

Q1: How does Mullvad secure accounts?

Mullvad uses a generated 16-digit account number with no password or email required. [1]

Q2: What protocol does Mullvad prioritize?

Mullvad prioritizes WireGuard due to its speed, simplicity, and modern cryptography. [9]

Q3: Are Mullvad servers audited?

Yes, third-party security firms perform regular infrastructure and code audits.

Q4: Does Mullvad support OpenVPN?

No, Mullvad removed OpenVPN on 15 January 2026; it is WireGuard-only. [7]

Q5: What is the Mullvad kill switch?

It is an integrated firewall rule that prevents internet traffic if the VPN fails.

Checkpoint 10: Basic VPN FAQs (Part B)

Review the most common questions and answers regarding Virtual Private Networks (VPNs) and tunneling.

Q6: Is IPv6 supported by Mullvad?

Yes, Mullvad supports native IPv6 routing and leak protection.

Q7: Does Mullvad offer multihop?

Yes, WireGuard multihop allows chaining multiple server locations.

Q8: Can I use custom DNS resolvers?

Yes, custom DNS addresses can be configured inside the Mullvad client settings.

Q9: How are logs prevented?

System configurations disable logging and clean caches on all server daemons.

Q10: Where is Mullvad incorporated?

Mullvad is incorporated in Gothenburg, Sweden, under Swedish jurisdiction.

Checkpoint 10: Advanced VPN FAQs (Part C)

Explore advanced technical aspects of VPN tunneling protocols, mobile client integrations, and enterprise deployment.

Q1: How does key rotation work?

The app rotates WireGuard keys automatically; the CLI default interval is 30 days. [3]

Q2: What are quantum-resistant tunnels?

They add ML-KEM and Classic McEliece key exchange to WireGuard to resist future quantum attacks. [2]

Q3: How are RAM-only nodes secure?

These nodes write no data to hard drives, rendering theft of physical servers useless.

Q4: What is the SOCKS5 proxy function?

It helps route specific app traffic within the tunnel, preventing leaks to external networks.

Q5: Does Mullvad protect against WebRTC leaks?

Yes, the app forces WebRTC queries through the VPN interface to shield local IPs.

Checkpoint 10: Advanced VPN FAQs (Part D)

Explore advanced technical aspects of VPN tunneling protocols, mobile client integrations, and enterprise deployment.

Q6: How does Mullvad handle police raids?

Mullvad holds zero user database logs, meaning no user information can be extracted.

Q7: What is the Swedish jurisdiction risk?

Sweden is a 14-Eyes member, but Mullvad's zero-logs architecture removes data risk.

Q8: Are client app audits open-source?

Yes, the apps are open source (GPL-3) and audited by firms such as X41 D-Sec. [6]

Q9: How does split tunneling operate?

It uses operating system routing tables to exclude specific apps from VPN overhead.

Q10: How does Mullvad handle cash payments?

Cash is mailed with a token code, manually credited, and envelopes are shredded.

Part 11: 10 Real-World VPN Facts & Insights

Review real-world facts regarding VPN encryption speeds, protocol audits, mobile connectivity, and enterprise remote work.

1. VPN INSIGHT
Mullvad was founded in 2009 by Amagicom AB in Gothenburg, Sweden.

2. VPN INSIGHT
Account numbers are the sole identifier used to credit and access accounts.

3. VPN INSIGHT
No names, emails, passwords, or phone numbers are stored in the user DB.

4. VPN INSIGHT
WireGuard keys are generated locally on client devices to prevent server-side compromise.

5. VPN INSIGHT
Cure53's 2024 infrastructure audit found no flaw breaking VPN traffic anonymity. [5]

6. VPN INSIGHT
Every Mullvad WireGuard server runs a SOCKS5 proxy, reachable only in the tunnel. [8]

7. VPN INSIGHT
WireGuard traffic can be obfuscated with Shadowsocks, QUIC or LWO to pass firewalls. [10]

8. VPN INSIGHT
Mullvad completed its migration to RAM-only VPN servers in September 2023. [4]

9. VPN INSIGHT
ML-KEM and Classic McEliece negotiate a post-quantum preshared key for WireGuard. [2]

10. VPN INSIGHT
Cash envelopes and their non-money contents are shredded after time is credited.

Technical References & Sources

The study guide and interactive puzzles are compiled from global technical standards, specifications, and regulatory frameworks.

SCHOLARLY & INDUSTRY REFERENCES

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[3] Mullvad VPN. (n.d.). CLI commands for using WireGuard.
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[12] WireGuard. (n.d.). Protocol & Cryptography.
https://www.wireguard.com/protocol/

Answer Key: Checkpoint 1 - Multiple Choice

1 Question 1

Correct Answer: B

TEACHING NOTE

Which tunneling protocol is default in Mullvad's app? → WireGuard

2 Question 2

Correct Answer: A

TEACHING NOTE

Clicking "generate account" gives you an account number; no email or other personal info is asked.

3 Question 3

Correct Answer: B

TEACHING NOTE

Mullvad's quantum-resistant WireGuard tunnels use ML-KEM and Classic McEliece to agree a preshared key. [2]

4 Question 4

Correct Answer: C

TEACHING NOTE

What security mechanism blocks WebRTC leak hazards? → Routing WebRTC through the VPN interface

5 Question 5

Correct Answer: B

TEACHING NOTE

Which multihop feature routes traffic through multiple nodes? → WireGuard Multihop

Answer Key: Checkpoint 2 - True or False

6 Question 6

Correct Answer: False

TEACHING NOTE

False: Mullvad never asks for an email; accounts are identified only by a generated number.

7 Question 7

Correct Answer: True

TEACHING NOTE

SOCKS5 proxies can be configured inside Mullvad tunnels.

8 Question 8

Correct Answer: False

TEACHING NOTE

False: Mullvad owns some servers but also rents dedicated servers from providers.

9 Question 9

Correct Answer: True

TEACHING NOTE

The Network Kill Switch is always active by default.

10 Question 10

Correct Answer: True

TEACHING NOTE

Cash payments sent by mail are completely non-refundable.

Vocabulary Keys & Grading Rubric

Instructor Grading Rubric: Award 1 point for each correct matching (8 points total) and context term (8 points total).

CHECKPOINT 4: CONCEPT MATCH KEY

B 1. WIREGUARD	D 2. MULTIHOP	G 3. RAM-ONLY	A 4. KILL SWITCH
H 5. NO-LOGS	C 6. SOCKS5	E 7. QUANTUM	F 8. DNS LEAKS

CHECKPOINT 3: KEY TERM KEY

1 WIREGUARD	2 MULTIHOP	3 RAM-ONLY	4 KILL SWITCH
5 NO-LOGS	6 SOCKS5	7 QUANTUM	8 DNS LEAKS

CHECKPOINT 6 ALTERNATIVE: VOCABULARY MATCH KEY

1 F – SOCKS5	2 G – QUANTUM	3 A – WIREGUARD	4 C – RAMONLY
5 D – KILLSWITCH	6 B – MULTIHOP	7 H – DNSLEAKS	8 E – NOLOGS

DISCUSSION NOTES FOR INSTRUCTORS

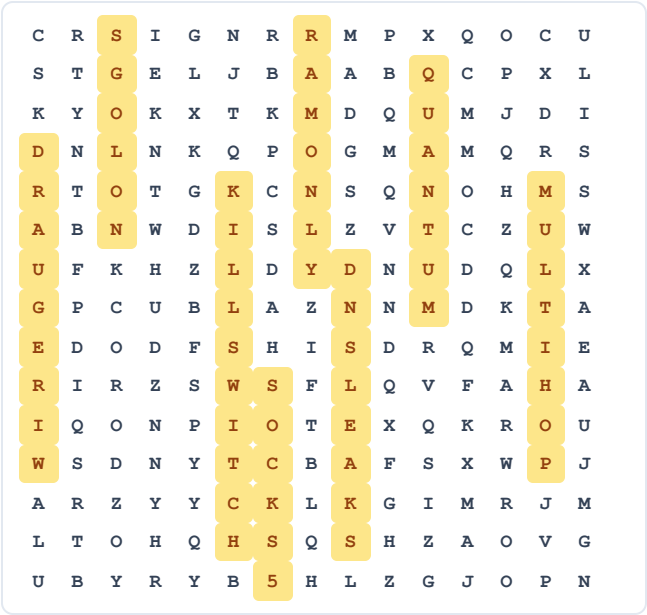
Key Terms:
Check that students can explain WIREGUARD, MULTIHOP and RAM-ONLY in their own words and give an example of each.

Case Studies:
Ask students to support their recommendations with facts from the worksheet rather than assumptions.

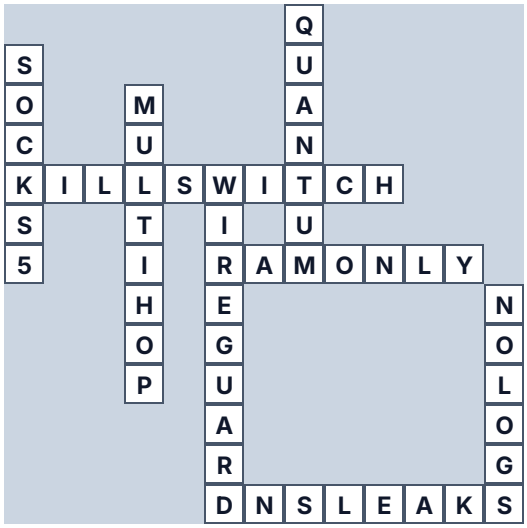
Source Evaluation:
Have students verify at least one claim against the worksheet references, and discuss why figures, prices and rules can change over time.

Puzzles Keys & Instructor Notes

WORD SEARCH SOLUTION



CROSSWORD SOLUTION



INSTRUCTOR GUIDE FOR CROSSWORD SOLUTIONS

ACROSS CLUES

4 Across: KILLSWITCH A safety feature that cuts traffic when a VPN drops (10 letters)

6 Across: RAMONLY Volatile memory server hardware that retains no data upon reboot (7 letters)

8 Across: DNSLEAKS Exposure of DNS query destinations outside the VPN tunnel (8 letters)

DOWN CLUES

1 Down: QUANTUM Encryption mechanisms designed to resist quantum attacks (7 letters)

2 Down: SOCKS5 An internal proxy protocol used to isolate client applications (6 letters)

3 Down: MULTIHOP Routing traffic through an entry and exit server node (8 letters)

5 Down: WIREGUARD A lightweight, high-performance secure tunneling protocol (9 letters)

7 Down: NOLOGS Zero-retention data standard verified by independent audits (6 letters)

Scrambled Words & Cipher Solution Key

Grading key for the vocabulary word unscramble activity and Secret Cipher Challenge.

WORD UNSCRAMBLE KEY

1. UGEIWARDR	WIREGUARD	5. IHUPTMOL	MULTIHOP
2. RMYLNOA	RAMONLY	6. CSLITKIWHL	KILLSWITCH
3. NLOSGO	NOLOGS	7. SSK5CO	SOCKS5
4. MUTNUQA	QUANTUM	8. LNESDKAS	DNSLEAKS

SECRET CIPHER CHALLENGE KEY

"MULLVAD ACCOUNTS USE NO PASSWORD OR EMAIL"

Case Studies Solution Key

A CASE STUDY 1: QUANTUM RESISTANCE INTEGRATION

Instructor Solution

GRADING GUIDELINE

Student answers should cover the following points:

- Scenario Analysis: A financial company needs to secure file transfers against future quantum decryption.
- Recommended Strategy & Solution: Deploy Quantum-resistant WireGuard tunnels using post-quantum preshared keys.

B CASE STUDY 2: STEALTH INVESTIGATIVE ROUTING

Instructor Solution

GRADING GUIDELINE

Student answers should cover the following points:

- Scenario Analysis: An investigator wants to double route their network to mask their entry point.
- Recommended Strategy & Solution: Enable Mullvad's WireGuard Multihop feature to cascade entry and exit nodes.