



# **Garbage Collection: Using Flow to Understand Private Network Data Leakage**

**Sid Faber**  
**[sfaber@cert.org](mailto:sfaber@cert.org)**



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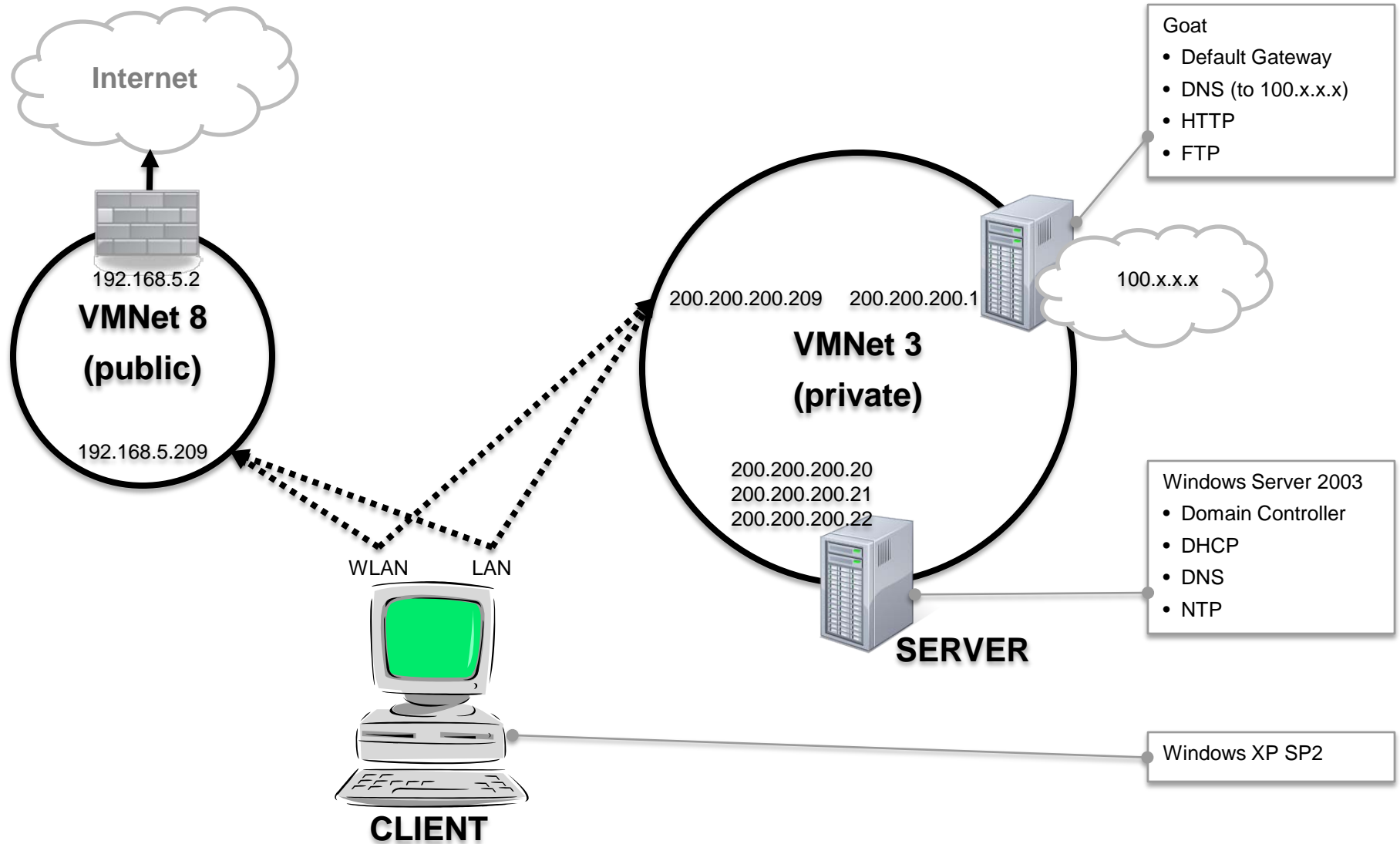
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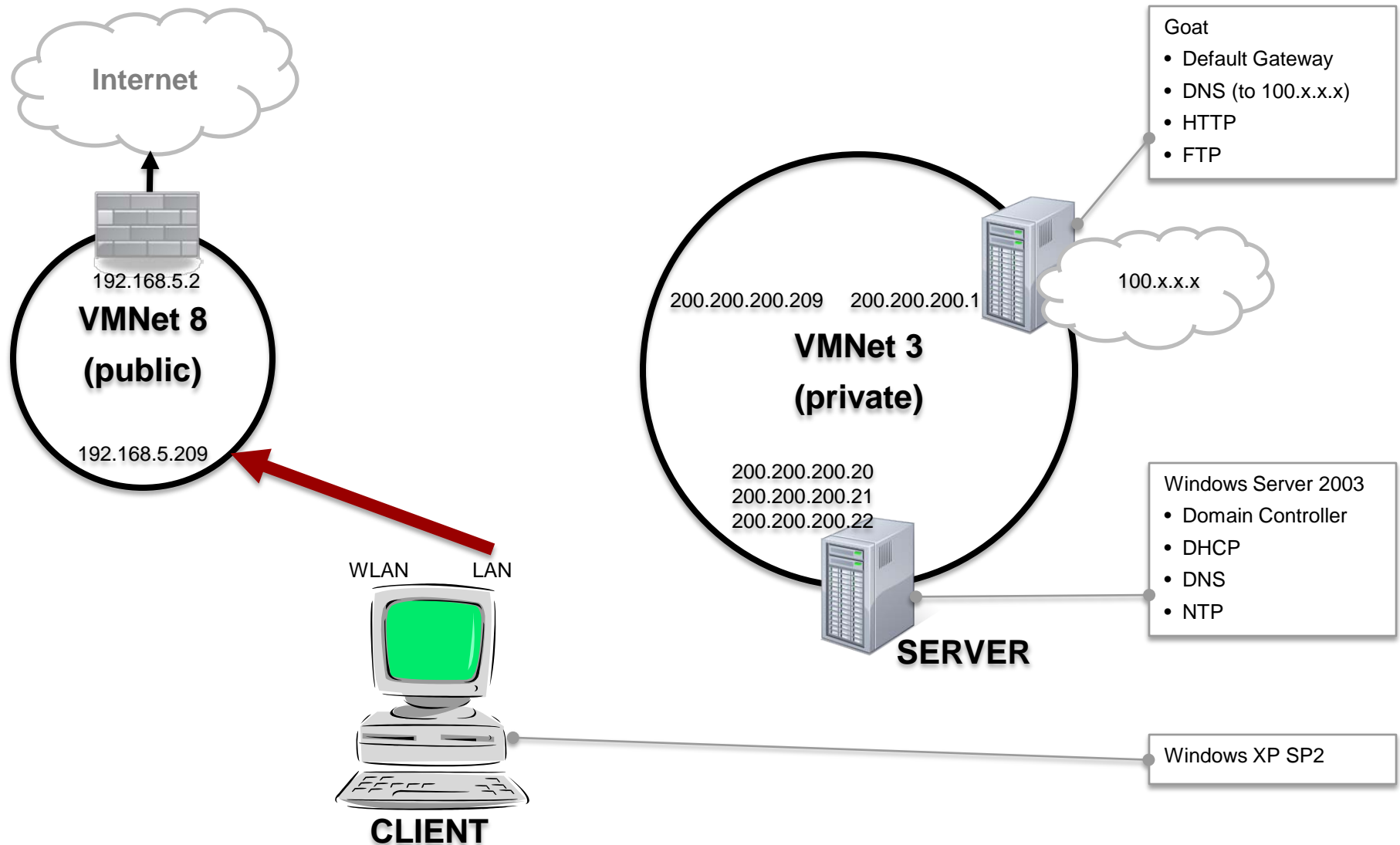
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# Virtual Layout



# Experiment 1: Stand-alone boot



# Experiment 1: Procedure

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1. Start ethereal on HOST
2. Start ethereal on GOAT
3. Connect LAN on CLIENT to vmnet8
4. Start CLIENT
5. Verify internet connectivity: browse to [www.cnn.com](http://www.cnn.com) and get a legitimate web page
6. Stop packet capture on HOST and save as vmnet3.pcap.
7. Stop packet capture on GOAT and save as vmnet8.pcap.

# Results 1: Stand-alone boot

Time	0.0.0.0	255.255.255.255	192.168.5.249	192.168.5.207
0.000	DHCP Request			
	(68)	----->		(67)
0.000			DHCP ACK	- Tra
			(67)	-----> (68)

Time	192.168.5.207	192.168.5.2	192.168.5.255	224.0.0.22	207.46.232.182
2.746	NBNS				NBNS: Multi-homed registration NB CLIENT<00>
	(137)	----->		(137)	
7.296	NBNS				NBNS: Registration NB CLIENT<00>
	(137)	----->		(137)	
10.312	NBNS				NBNS: Registration NB WORKGROUP<00>
	(137)	----->		(137)	
14.835	NBNS				NBNS: Registration NB WORKGROUP<00>
	(137)	----->		(137)	
18.358	NBNS				NBNS: Multi-homed registration NB CLIENT<20>
	(137)	----->		(137)	
25.888	NBNS				BROWSER: Host Announcement CLIENT, Workstation, Serv
	(138)	----->		(138)	
26.726	DNS				DNS: Standard query A time.windows.com
	(1025)	----->		(53)	
27.900	IGMP				IGMP: V3 Membership Report / Join group 239.255.255.
	(0)	----->		(0)	

[continued]

# Results 1: Stand-alone boot (2)

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-----|-----|-----|-----|
Time    | 192.168.5.207 | 192.168.5.2 | 207.46.232.182 |
-----|-----|-----|-----|
28.807  |      DNS      |              |                 | DNS: Standard query A time.windows.com
|          | (1025) -----> (53) |              |                 |
30.749  |      DNS      |              |                 | DNS: Standard query response CNAME time.microsoft.akadns.net A 207.46.232.182
|          | (1025) <----- (53) |              |                 |
30.822  |      NTP      |              |                 | NTP: NTP symmetric active
|          | (123)  -----> (123) |              |                 |
-----|-----|-----|-----|

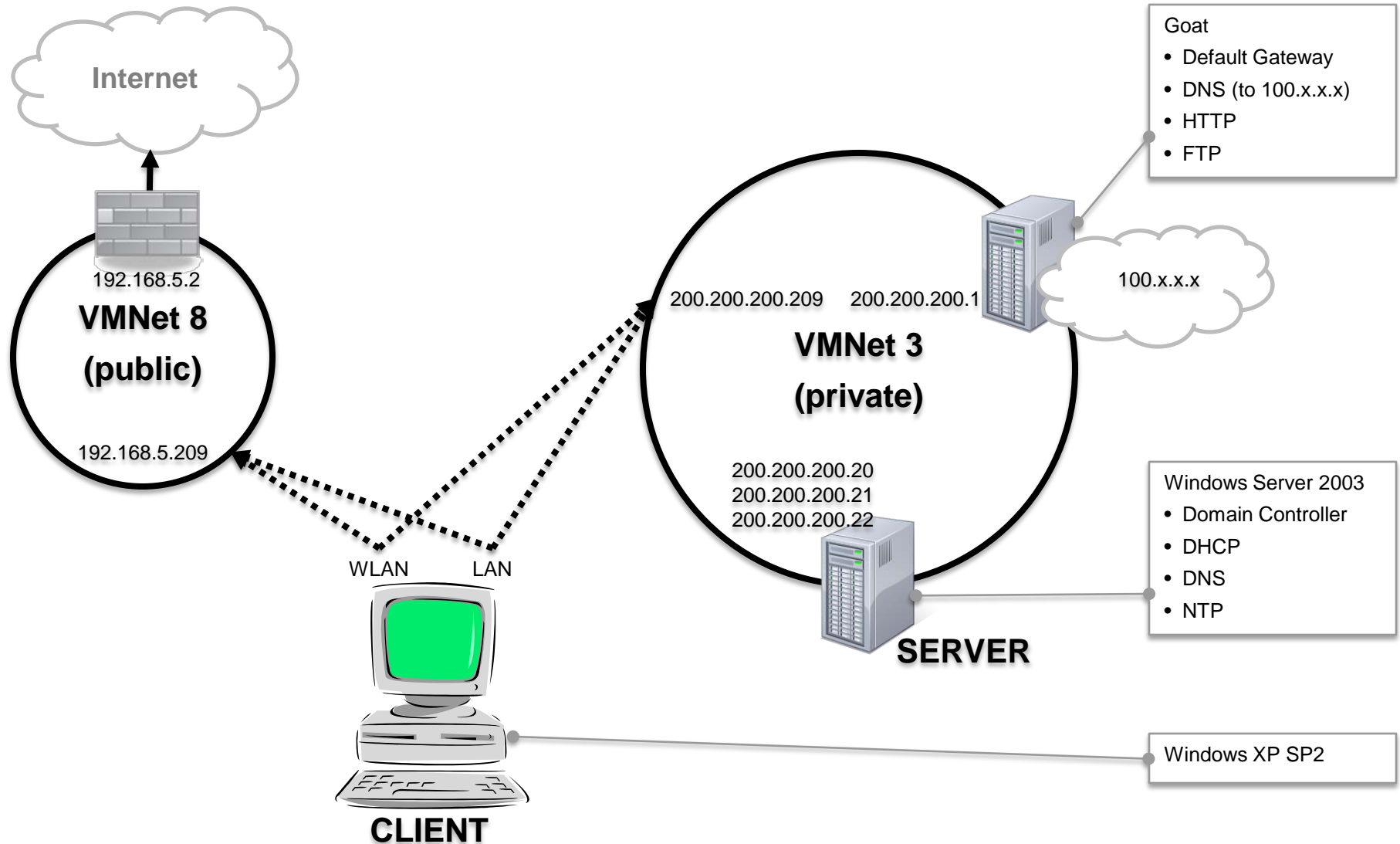
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-----|-----|-----|-----|
Time    | 192.168.5.207 | 192.168.5.2 | 157.166.226.25 |
-----|-----|-----|-----|
72.489  | Standard query A ww |              |                 | DNS: Standard query A www.cnn.com
|          | (1025) -----> (53) |              |                 |
73.490  | Standard query A ww |              |                 | DNS: Standard query A www.cnn.com
|          | (1025) -----> (53) |              |                 |
74.491  | Standard query A ww |              |                 | DNS: Standard query A www.cnn.com
|          | (1025) -----> (53) |              |                 |
76.492  | Standard query A ww |              |                 | DNS: Standard query A www.cnn.com
|          | (1025) -----> (53) |              |                 |
76.604  | Standard query resp |              |                 | DNS: Standard query response A 157.166.226.25 A 157.166.226.26 A 157.166.255.18 A 157.166.25
|          | (1025) <----- (53) |              |                 |
76.625  | iad3 > http [SYN] S |              |                 | TCP: iad3 > http [SYN] Seq=0 Win=64240 Len=0 MSS=1460
|          | (1032) -----> (80) |              |                 |
76.670  | http > iad3 [SYN, A |              |                 | TCP: http > iad3 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460
|          | (1032) <----- (80) |              |                 |
76.682  | iad3 > http [ACK] S |              |                 | TCP: iad3 > http [ACK] Seq=1 Ack=1 Win=64240 Len=0
|          | (1032) -----> (80) |              |                 |
76.722  | GET / HTTP/1.1     |              |                 | HTTP: GET / HTTP/1.1
|          | (1032) -----> (80) |              |                 |
76.722  | http > iad3 [ACK] S |              |                 | TCP: http > iad3 [ACK] Seq=1 Ack=455 Win=64240 Len=0
|          | (1032) <----- (80) |              |                 |
-----|-----|-----|-----|

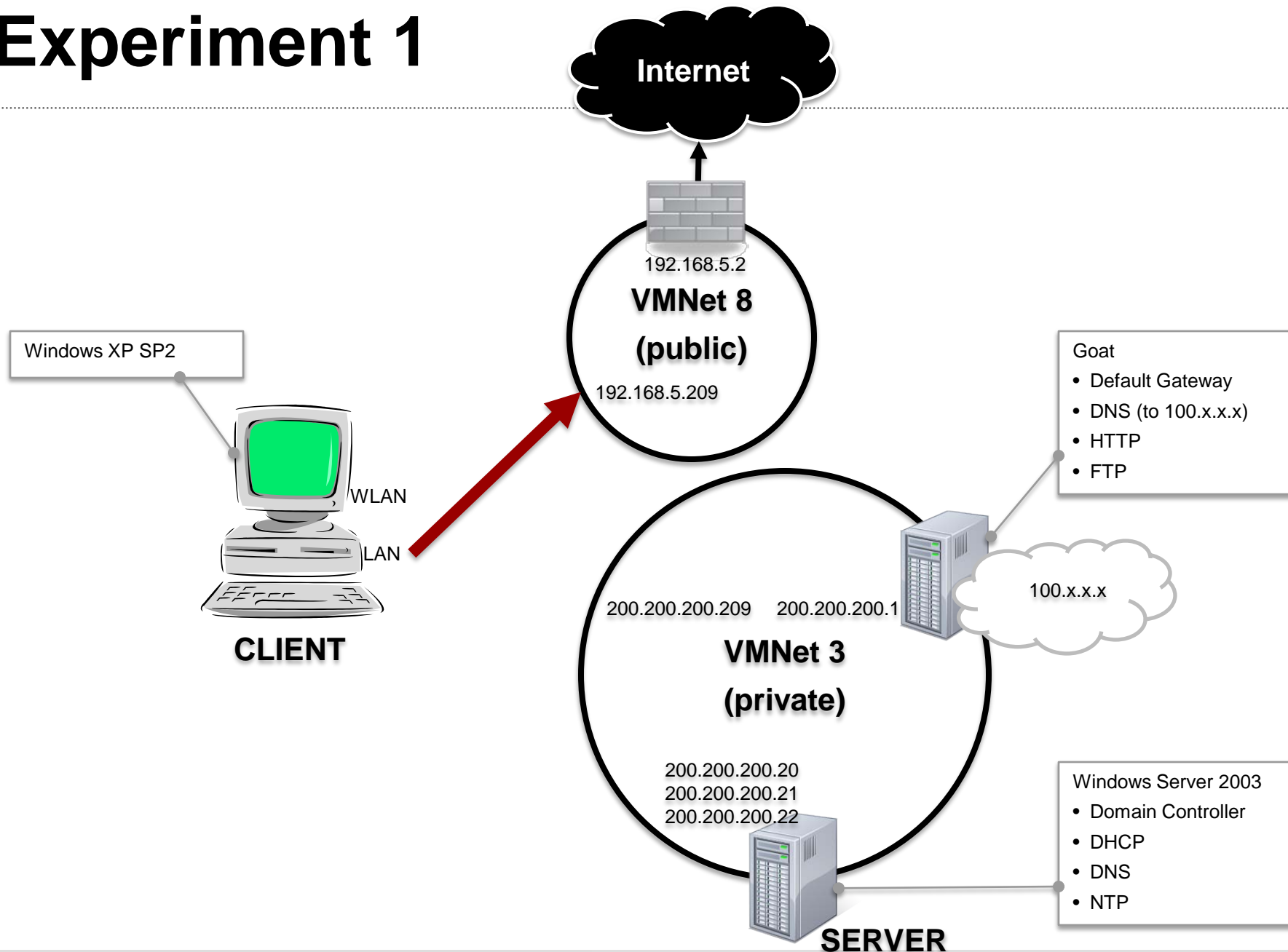
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# Scenario 2: Standalone boot on private

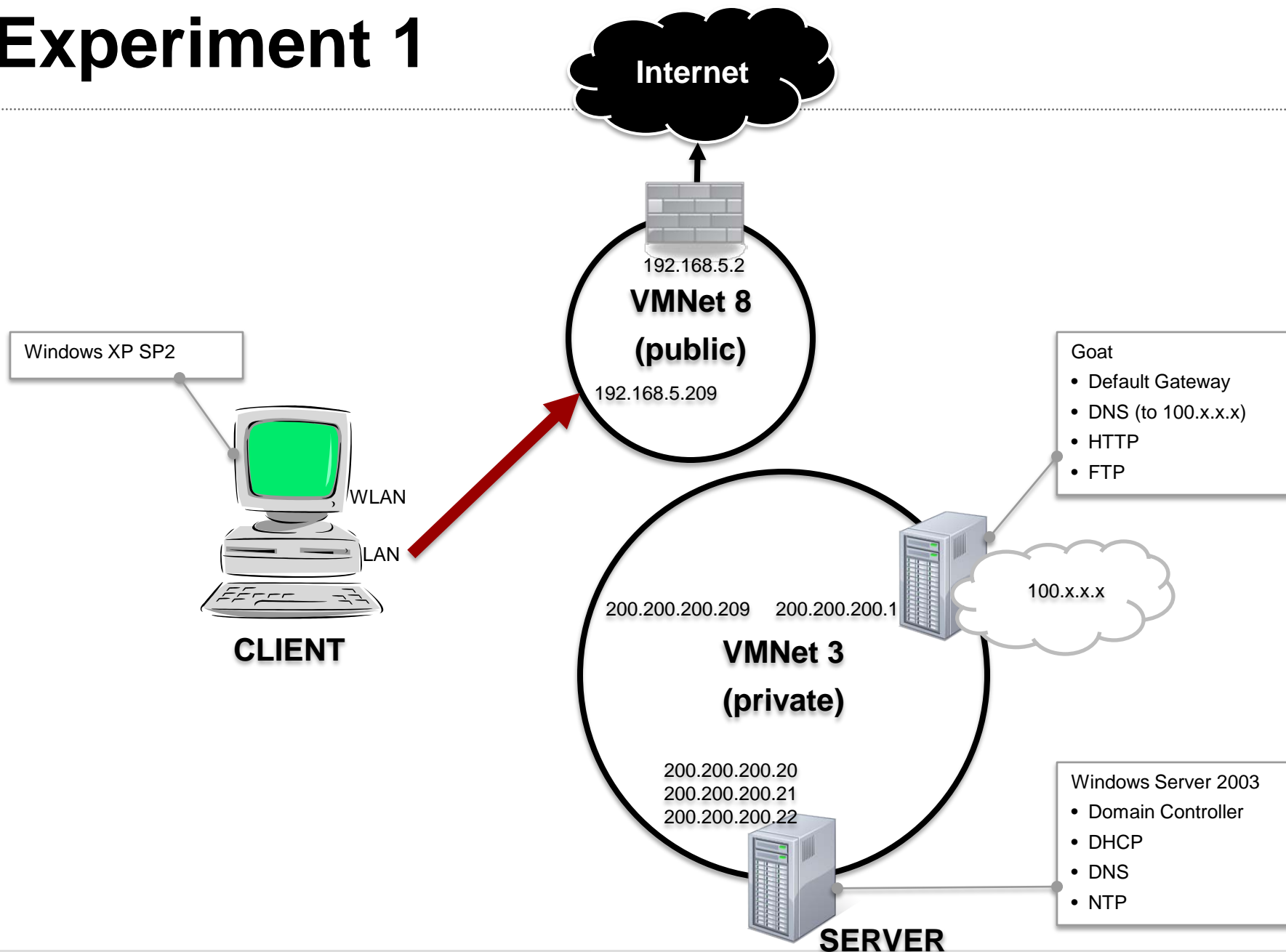




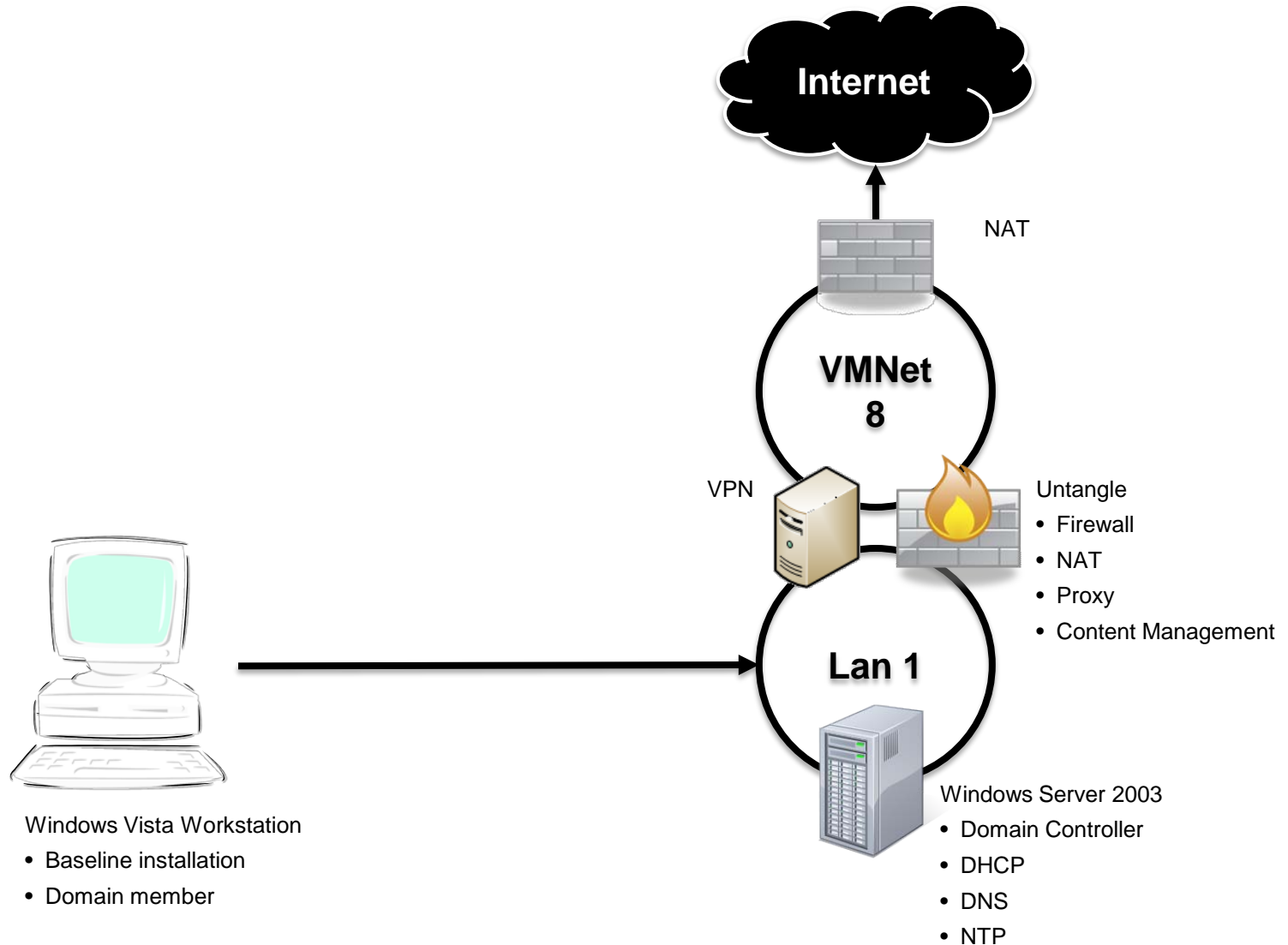
# Experiment 1



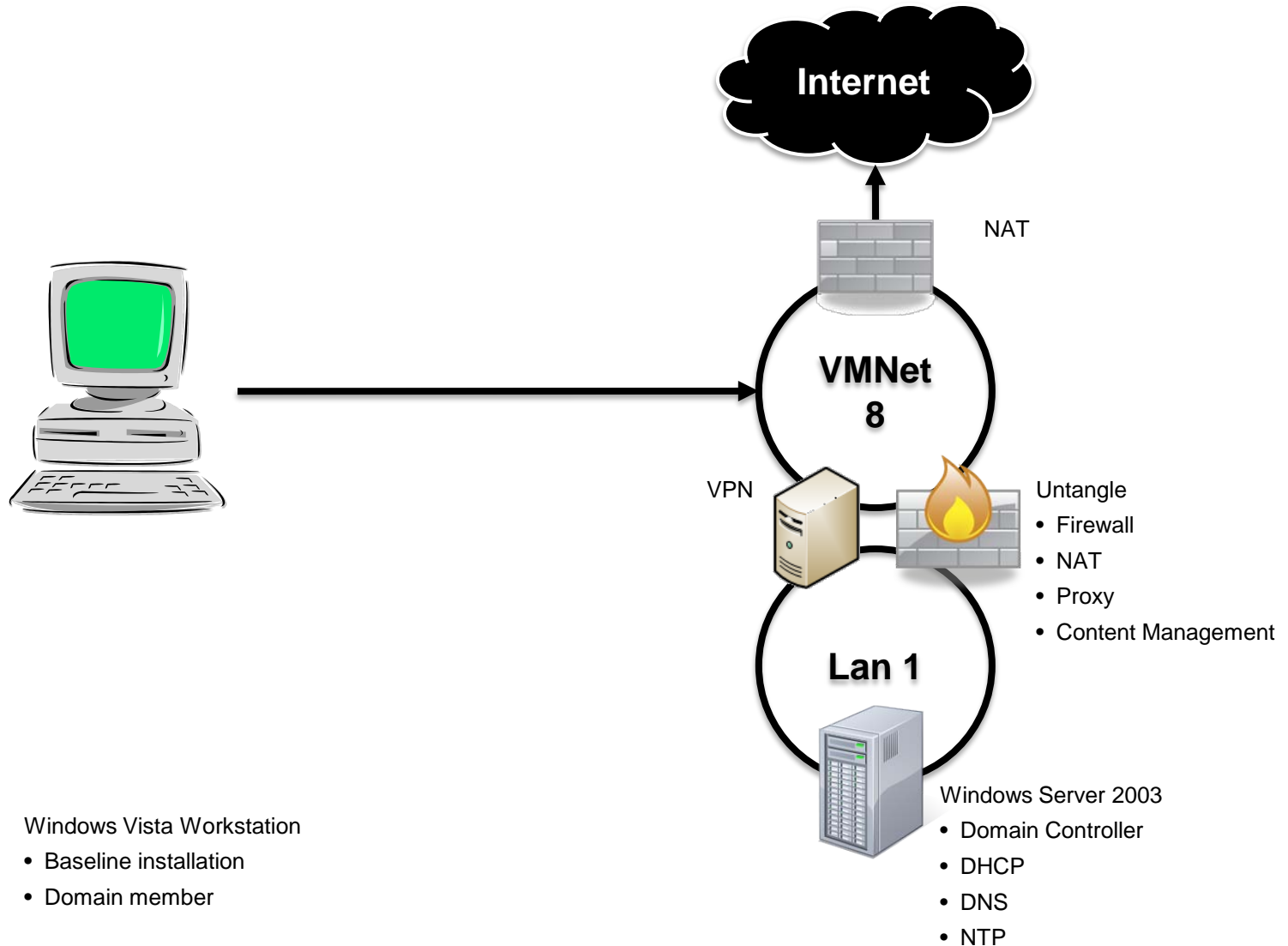
# Experiment 1



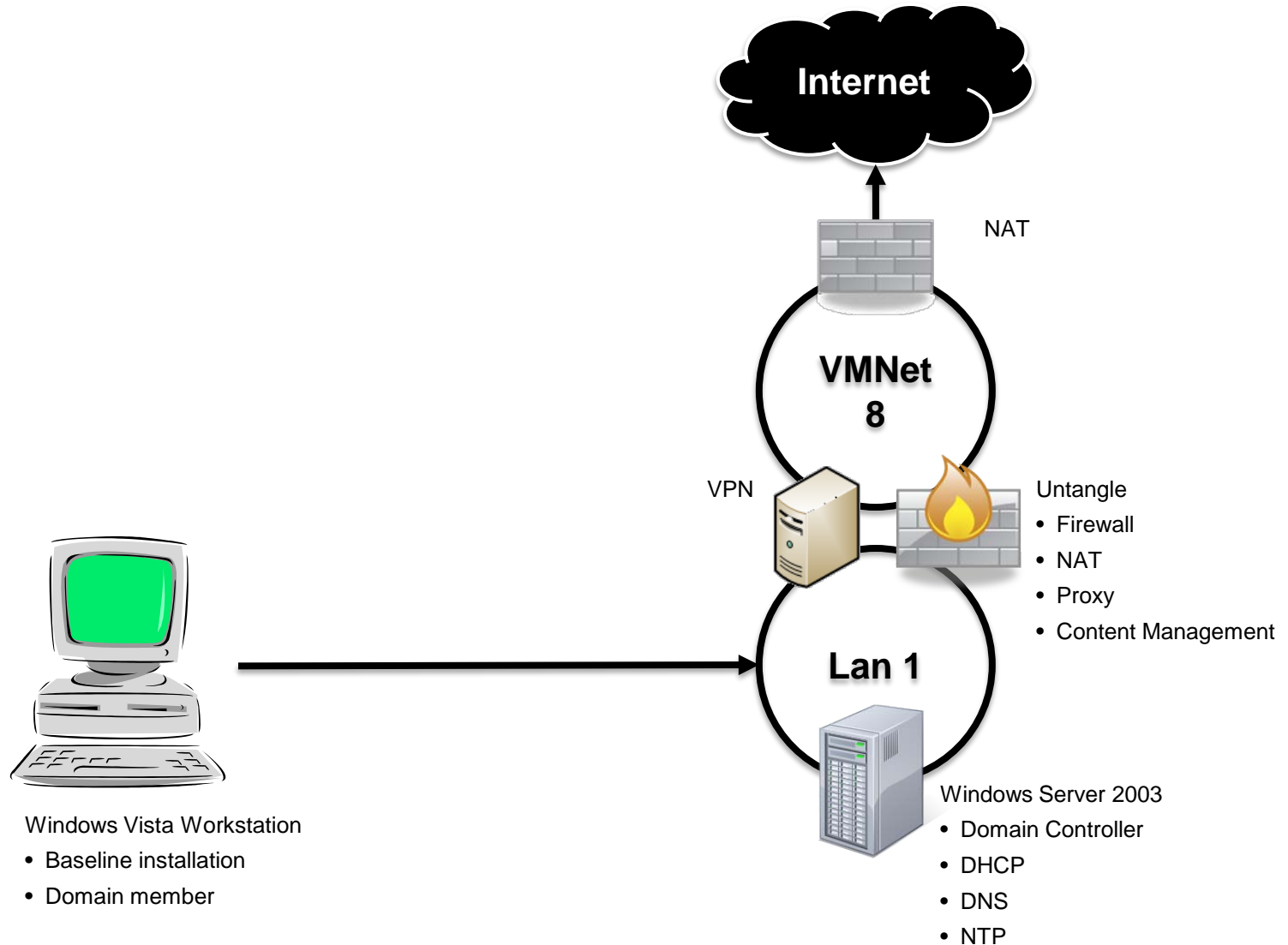
# Scenario 1: Restart on Another Network



# Scenario 1: Restart on Another Network



# Scenario 2: Move to Another Network



# Scenario 2: Move to Another Network

