Garbage Collection: Using Flow to Understand Private Network Data Leakage

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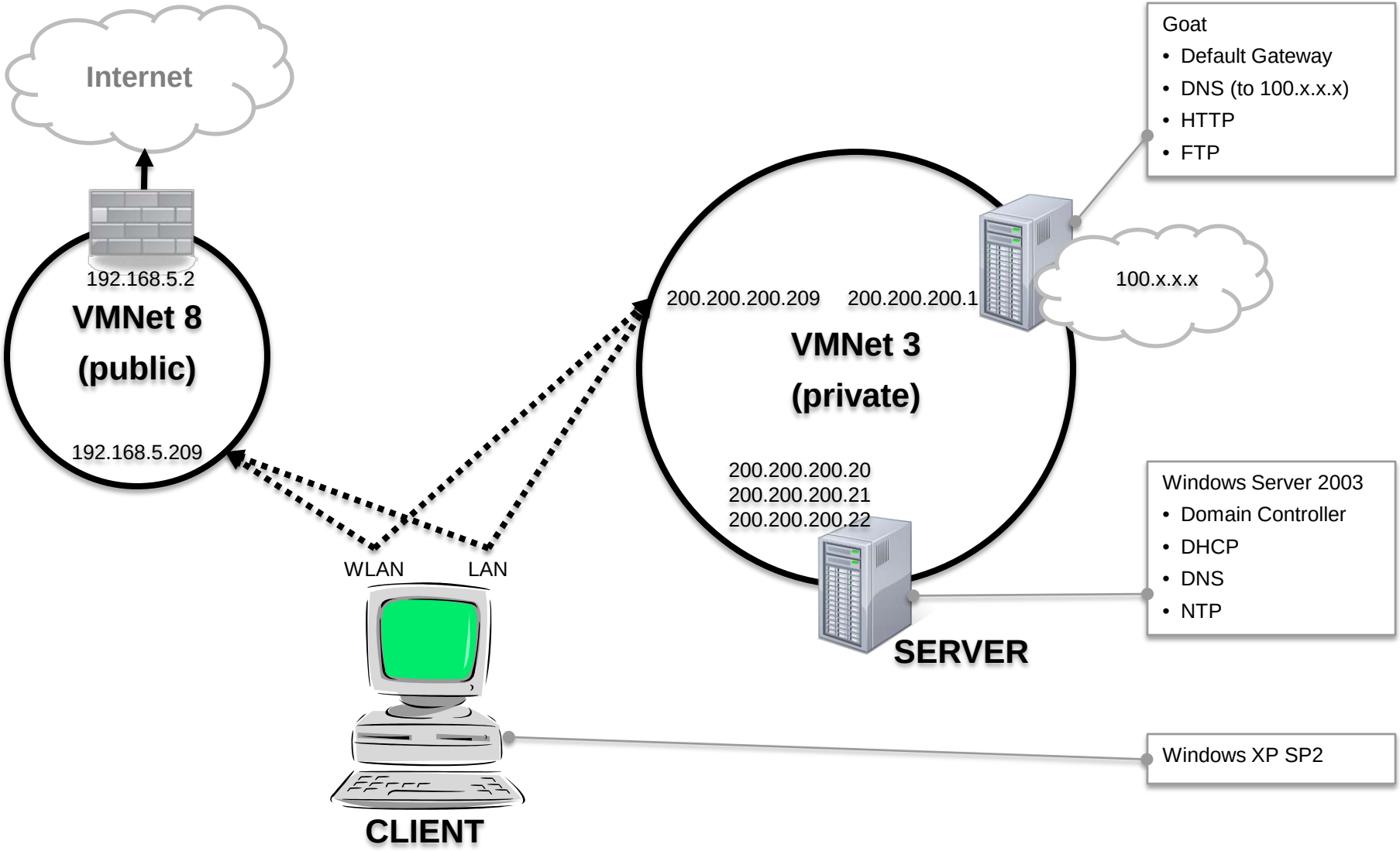
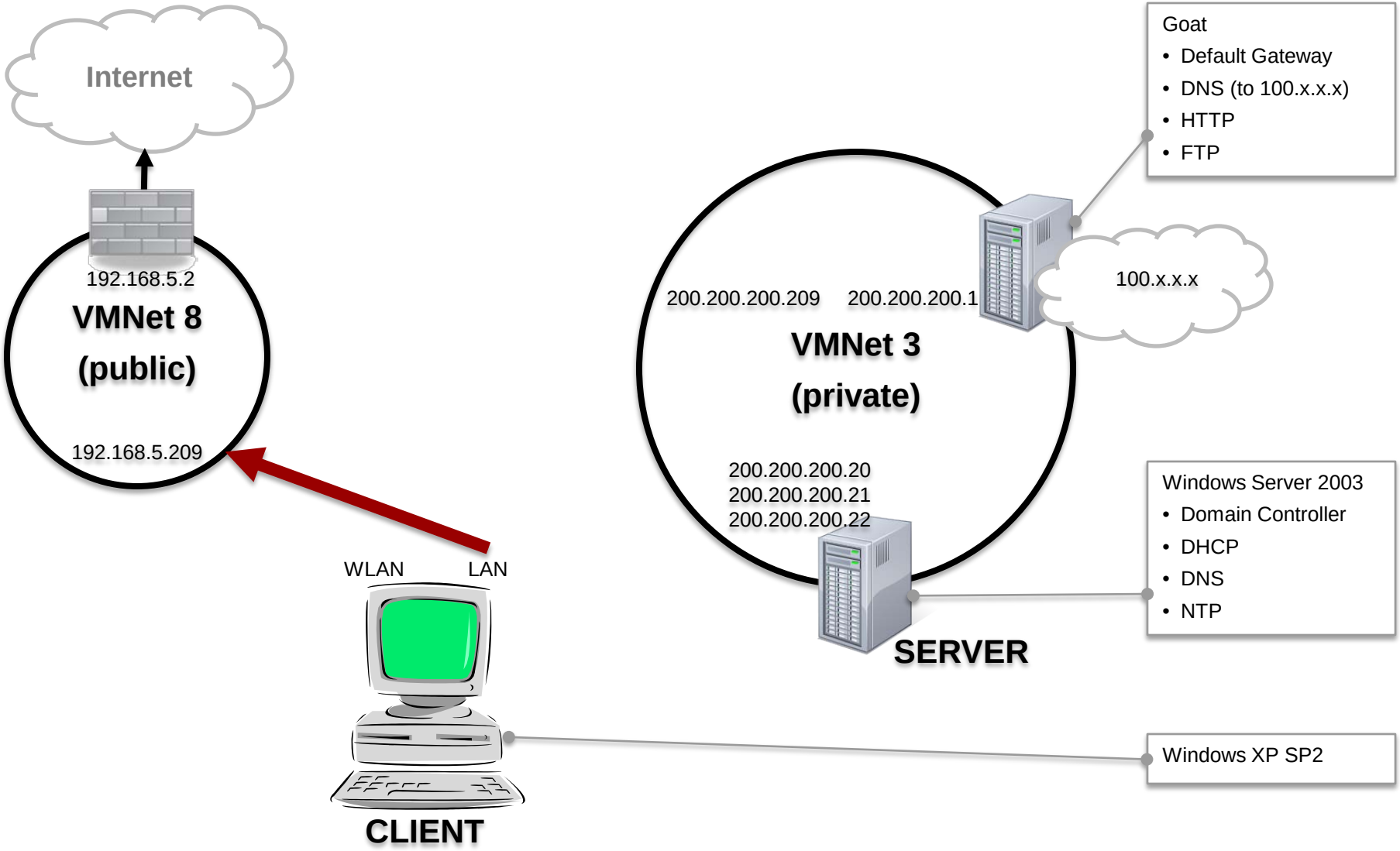
Virtual Layout



Experiment 1: Stand-alone boot



Experiment 1: Procedure

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 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)      |                  |
|---------|------------------|------------------|------------------|------------------|------------------|
```

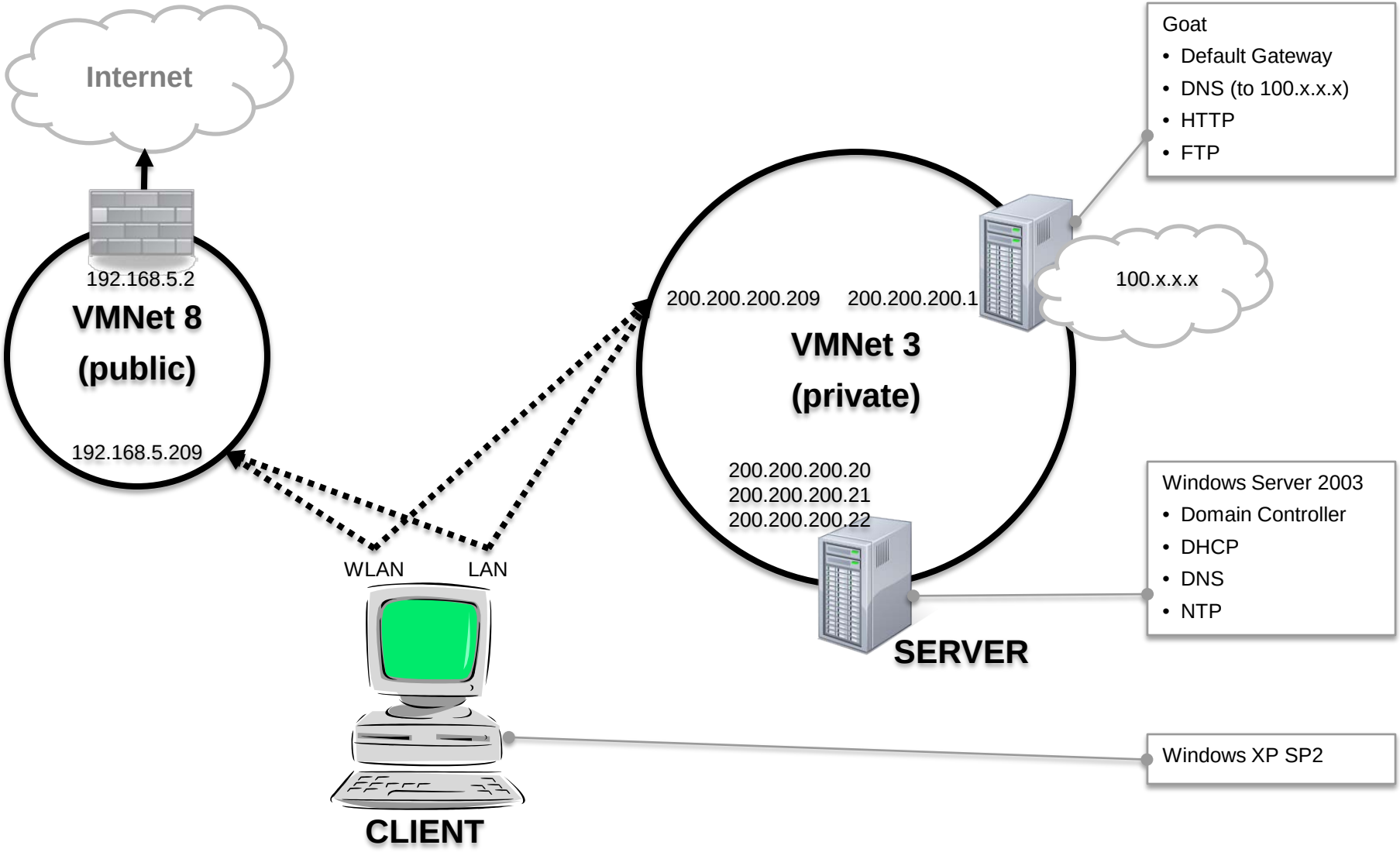
[continued]

Results 1: Stand-alone boot (2)

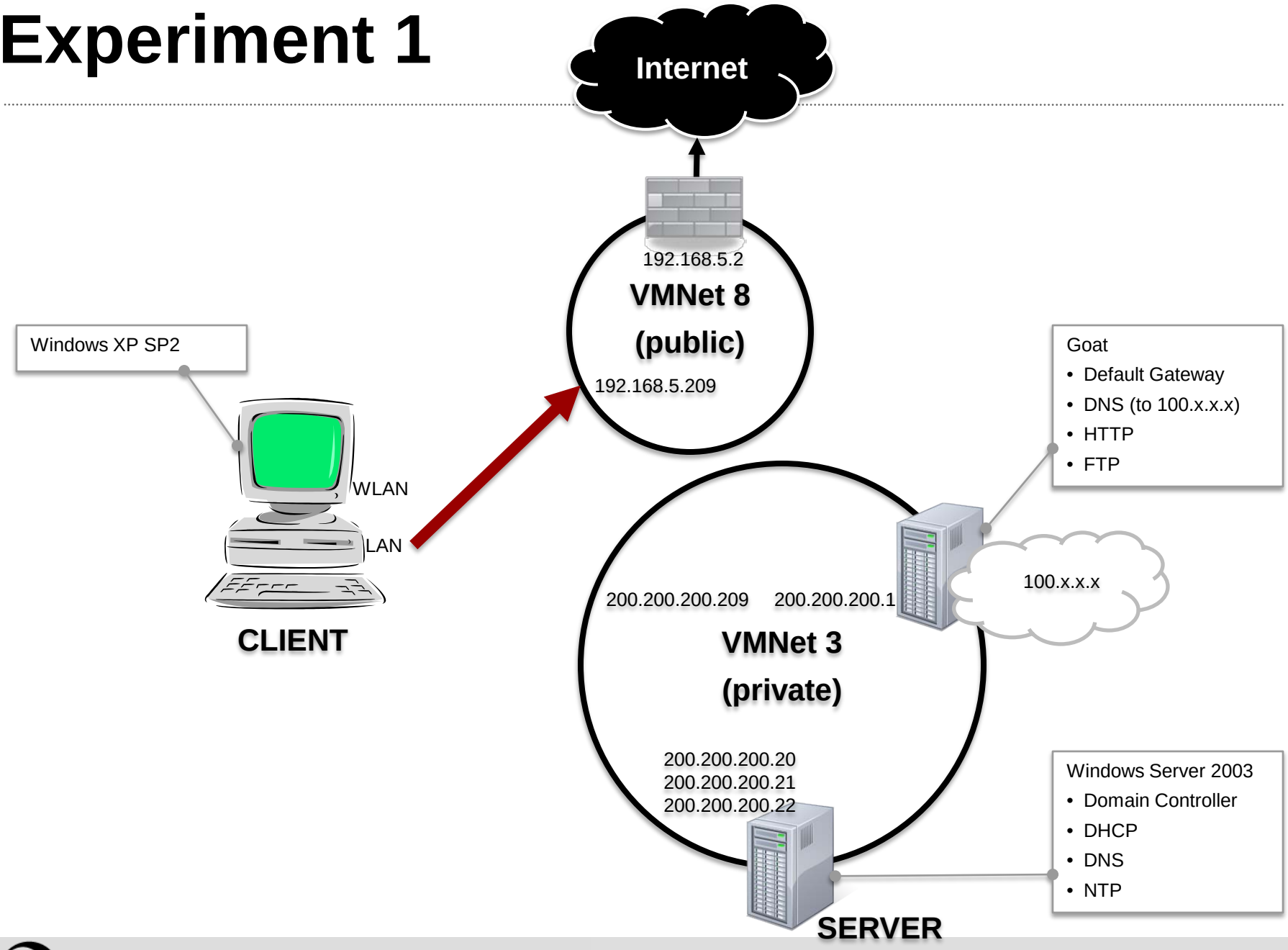
```
|---------|------------------|------------------|------------------|
|Time     | 192.168.5.207    | 192.168.5.2      | 207.46.232.182   |
|---------|------------------|------------------|------------------|
|28.807   |         DNS      |                  |                  |DNS: Standard query A 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)   |
|---------|------------------|------------------|------------------|
```

```
|---------|------------------|------------------|------------------|
|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)    |
|---------|------------------|------------------|------------------|
```

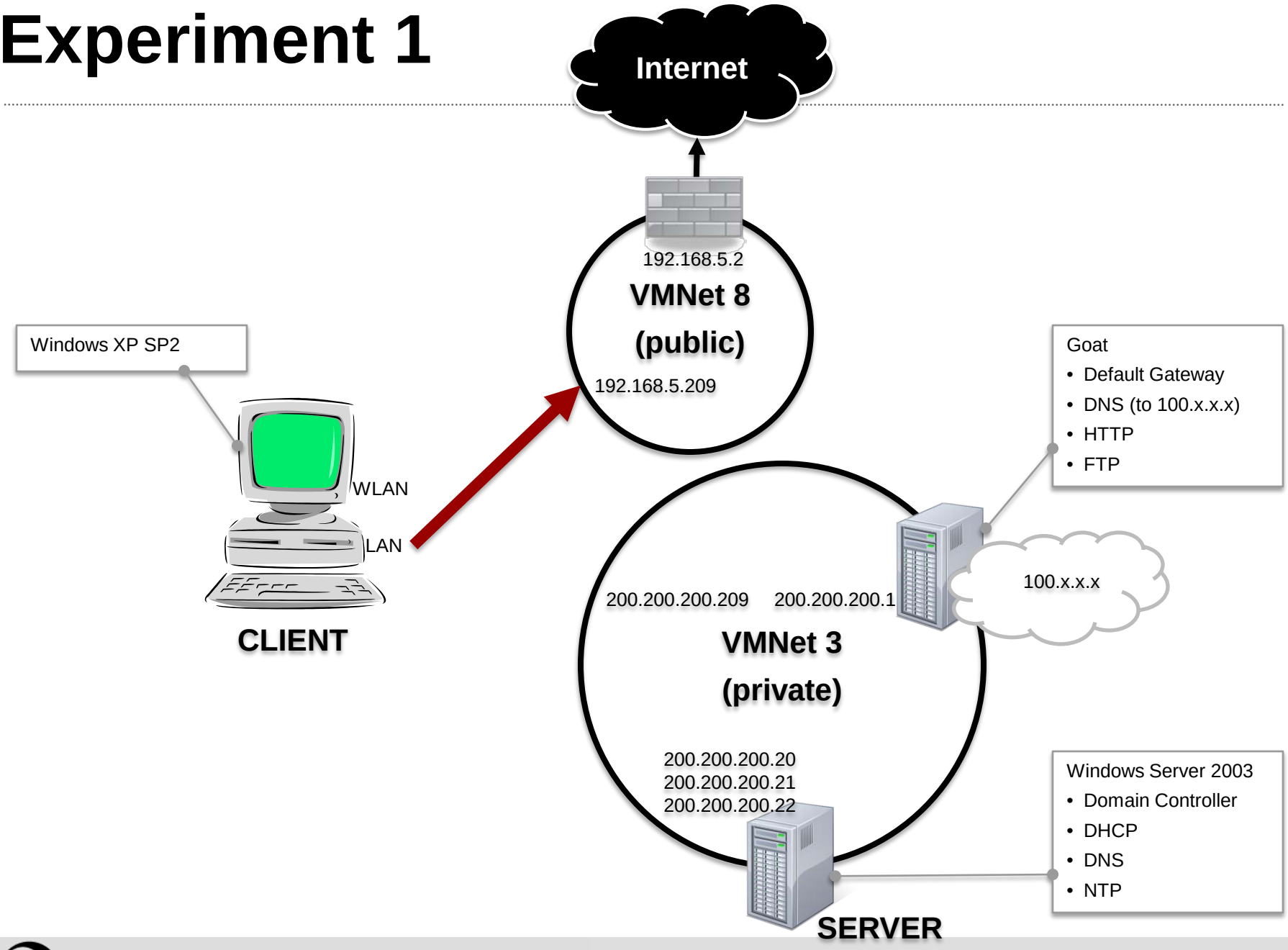
Scenario 2: Standalone boot on private



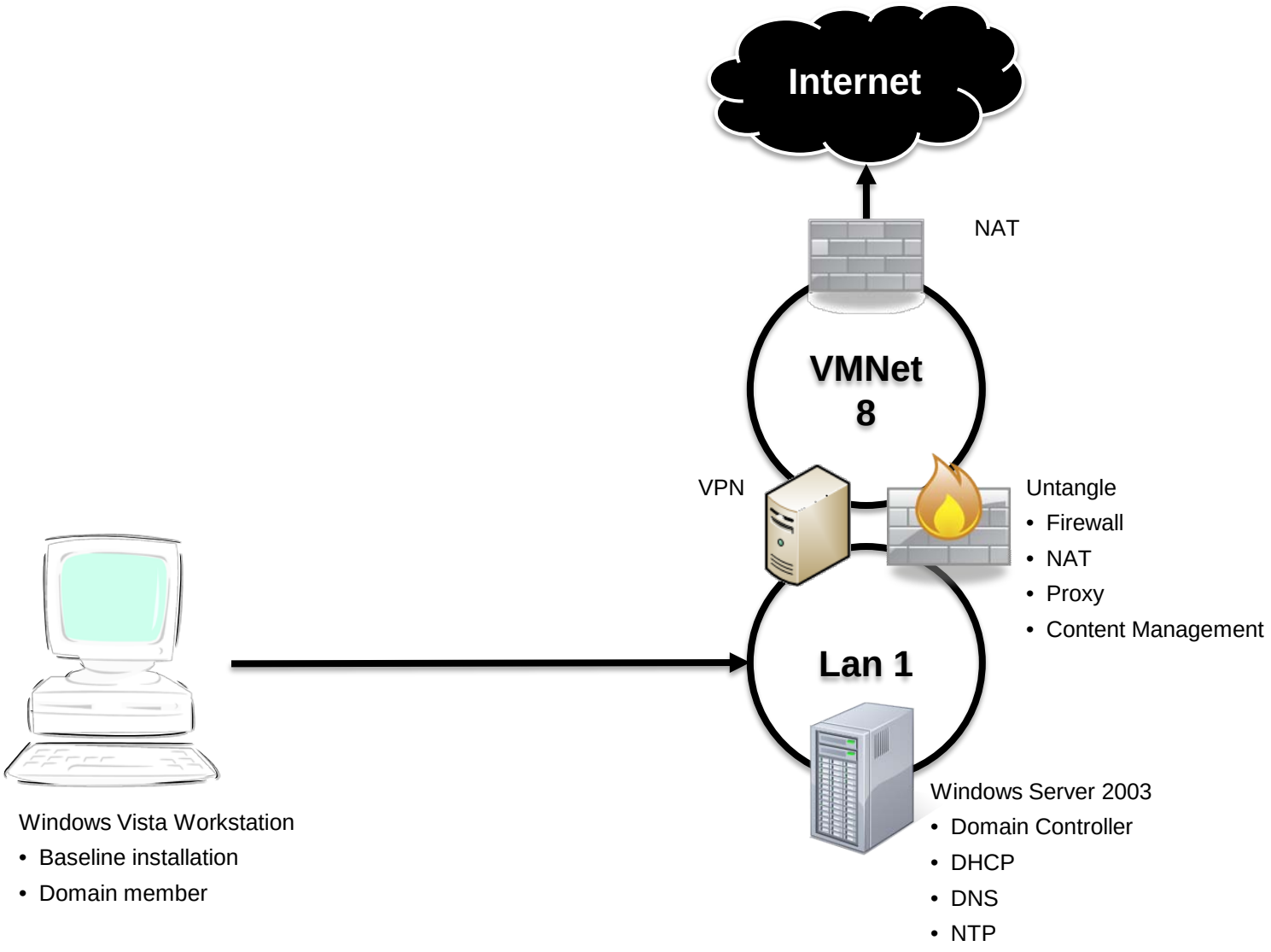
Experiment 1



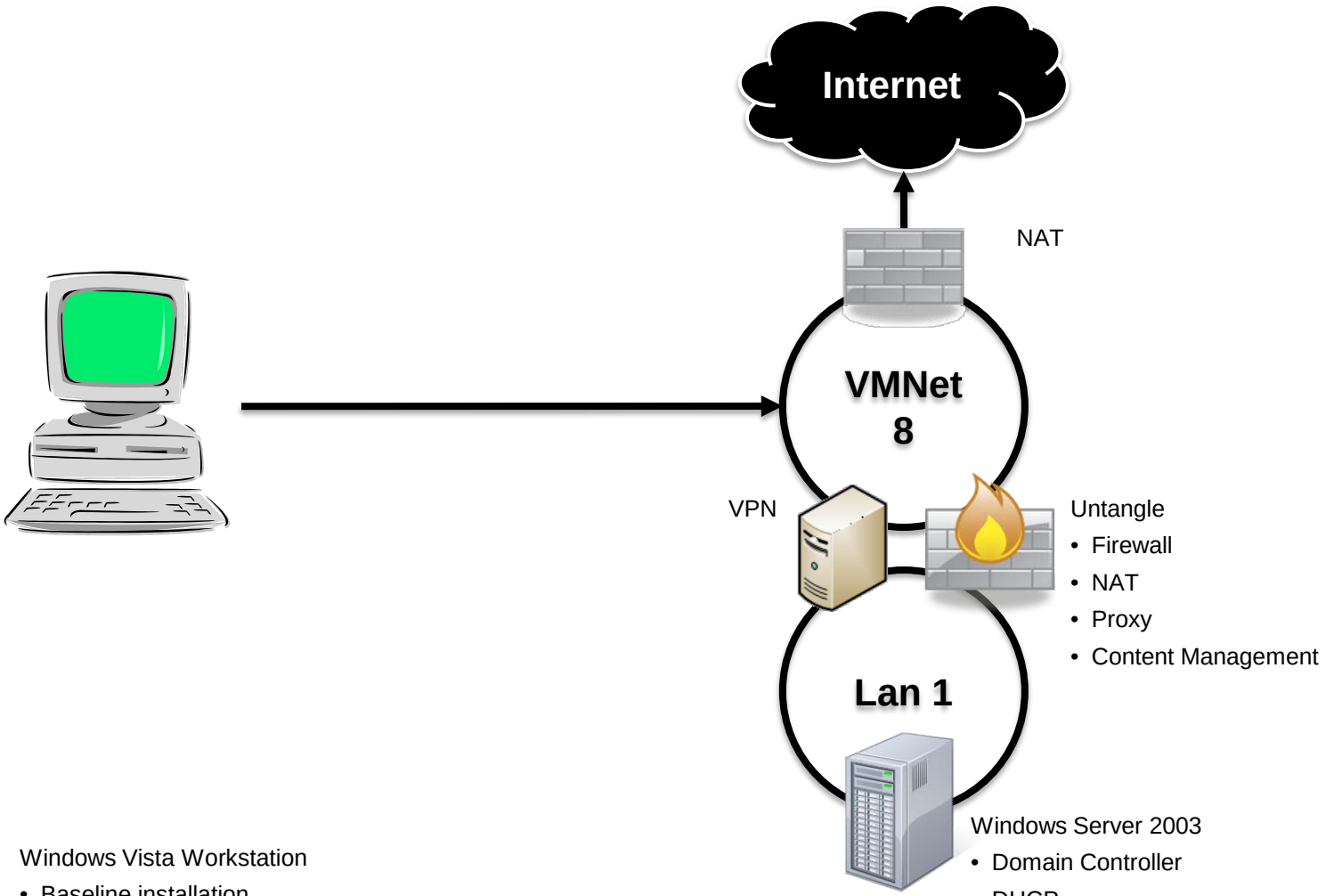
Experiment 1



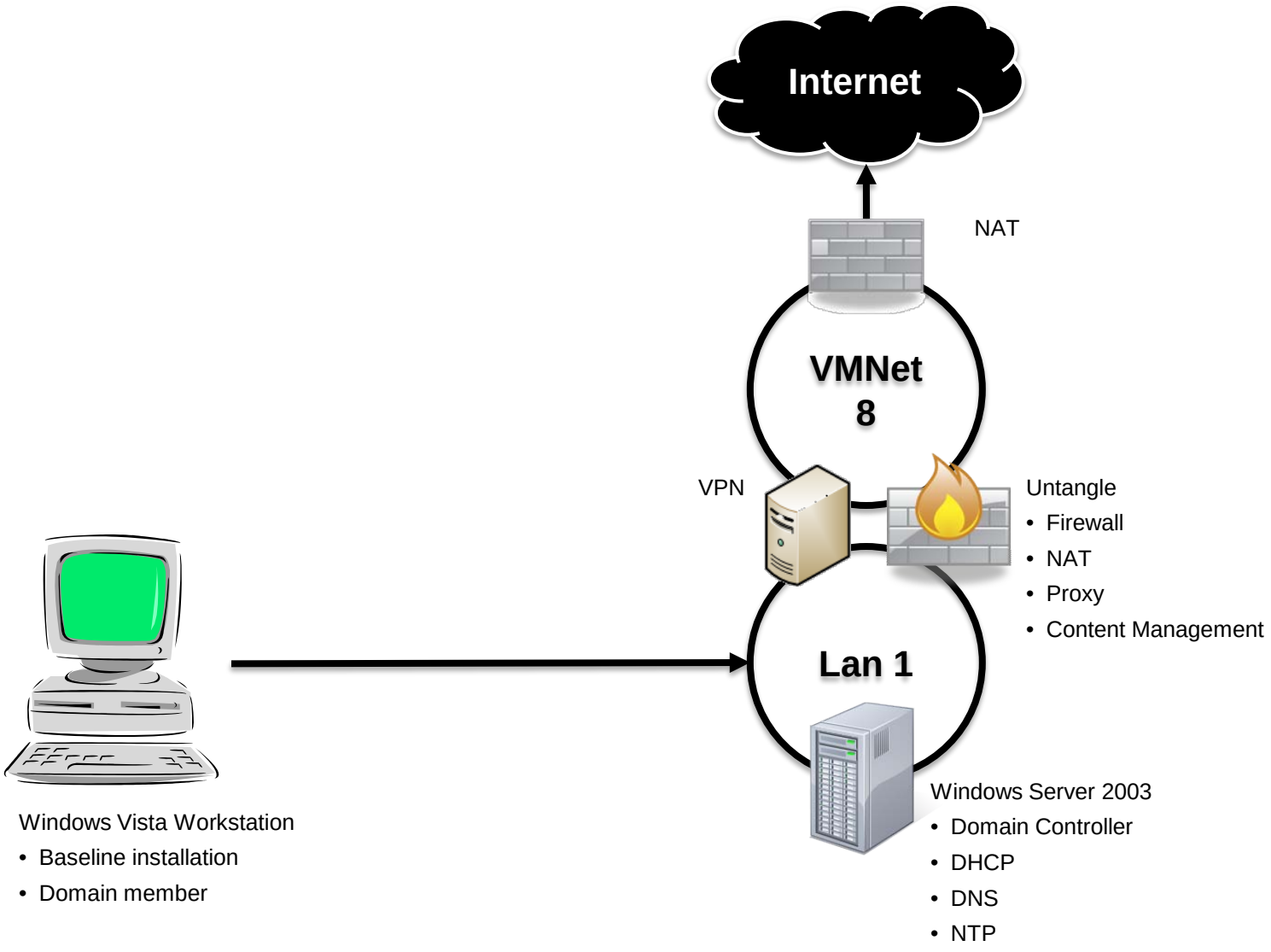
Scenario 1: Restart on Another Network



Scenario 1: Restart on Another Network



Scenario 2: Move to Another Network



Scenario 2: Move to Another Network