Beth Isreal Lahey Health (CareGroup)

Network Administration

Team 8 - Network Admin.

TEAM MEMBERS

Daniel Thach
Christian Najera
Angel Contreras

CIS 4900, Dr. Howell

Meet the team

Christian Najera - Team Lead

Angel Contreras – Project Coordinator

Daniel Thach – Technical Coordinator

Team Lead:
- Guides delegation of meetings
- Ensures deliverables are produced
- Responsible for final submission

Project Coordinator:
- Leads project timeframes
- Guides delegation of deliverables

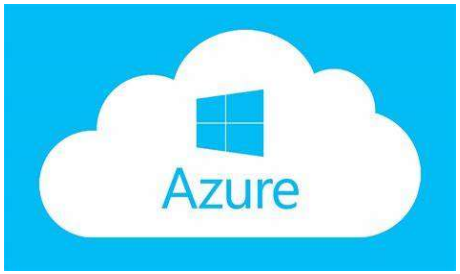
Technical Coordinator:
- Leads feedback review
- Ensures consistency of reports
- Guides technical review

CareGroup/BILH

- 100+ year old medical network
- State-of-the art inpatient/outpatient facilities
- Manages over 39,000 employees
- Committed to excellence in healthcare
- Notorious for IT collapse of 2002

Virtualization - A comprehensive solution

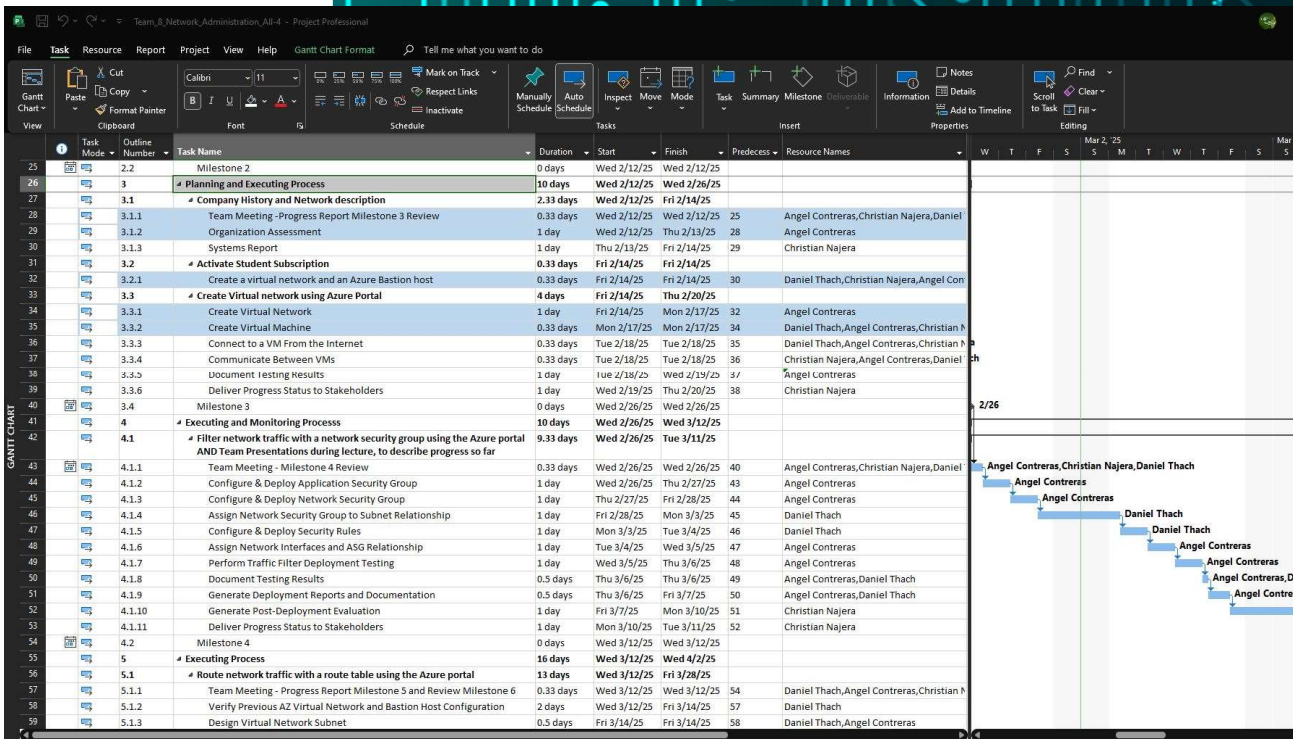
- An inarguable need
- Tailored to accessibility
- Tailored to scalability
- Virtualization on Microsoft Azure Platform



Milestone 3

Planning and Executing Process

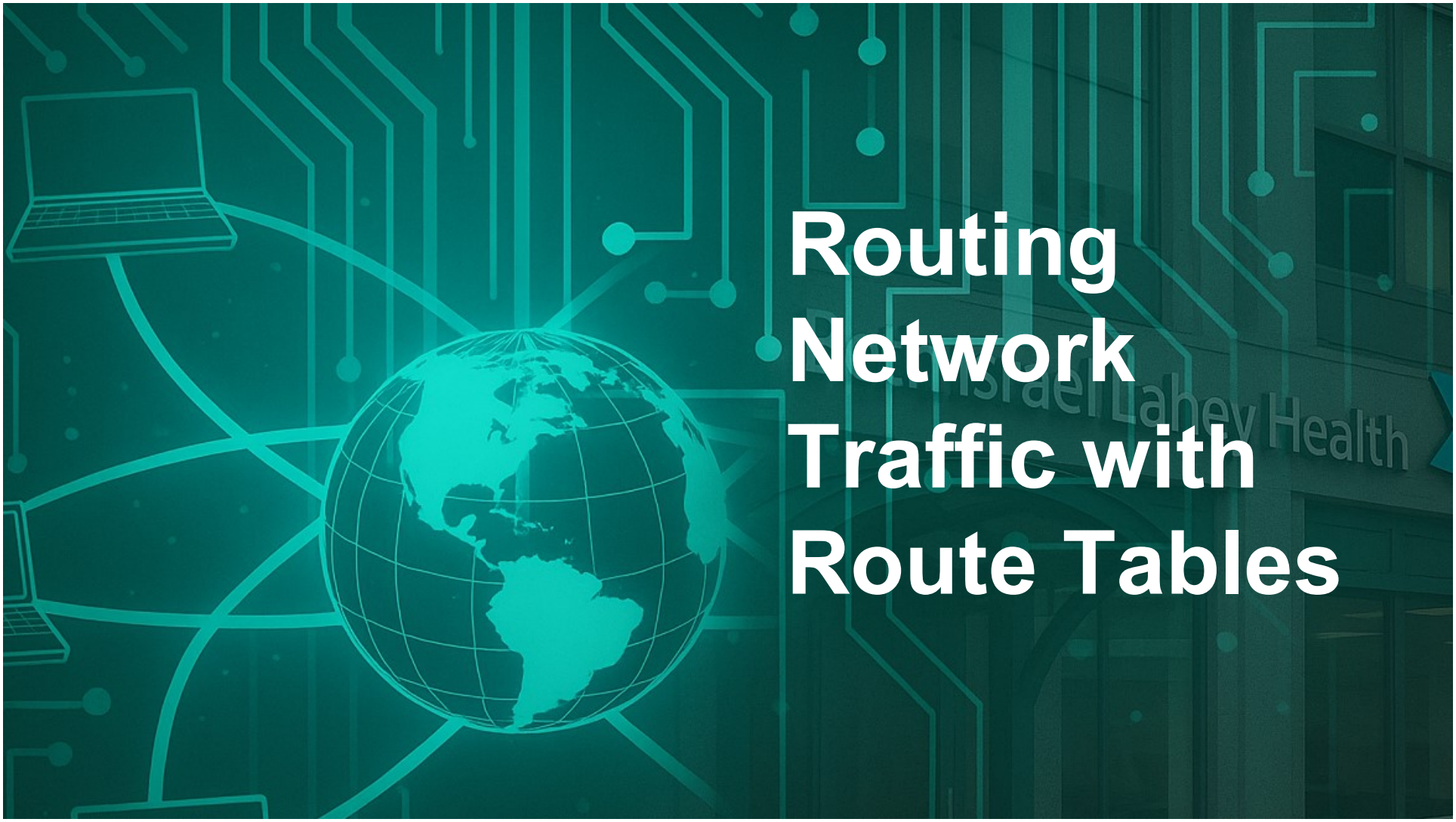
- Project Scope
- Roles & Responsibilities
- Virtual Network for Beth Isreal Lahey Health



Milestone 4

Executing and Monitoring Process

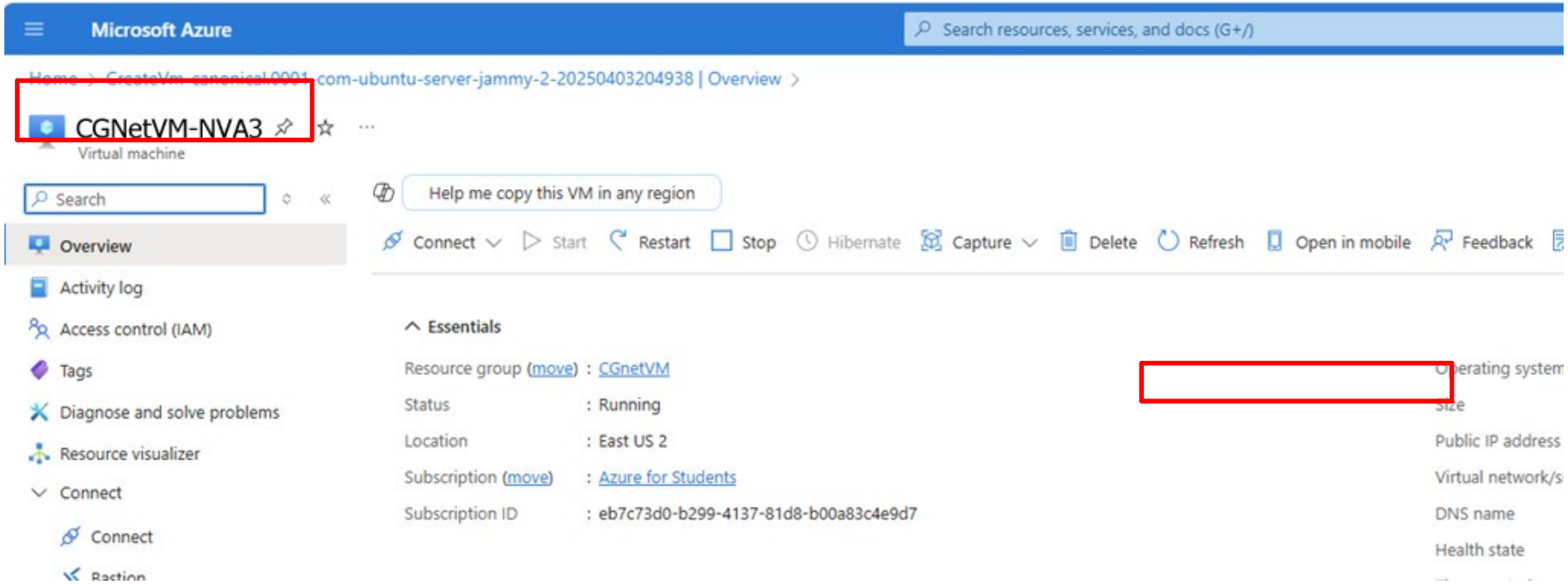
- PowerPoint Outline
- Networking Lab Guides
- Tested Traffic Filters


Routing
Network
Traffic with
Route Tables

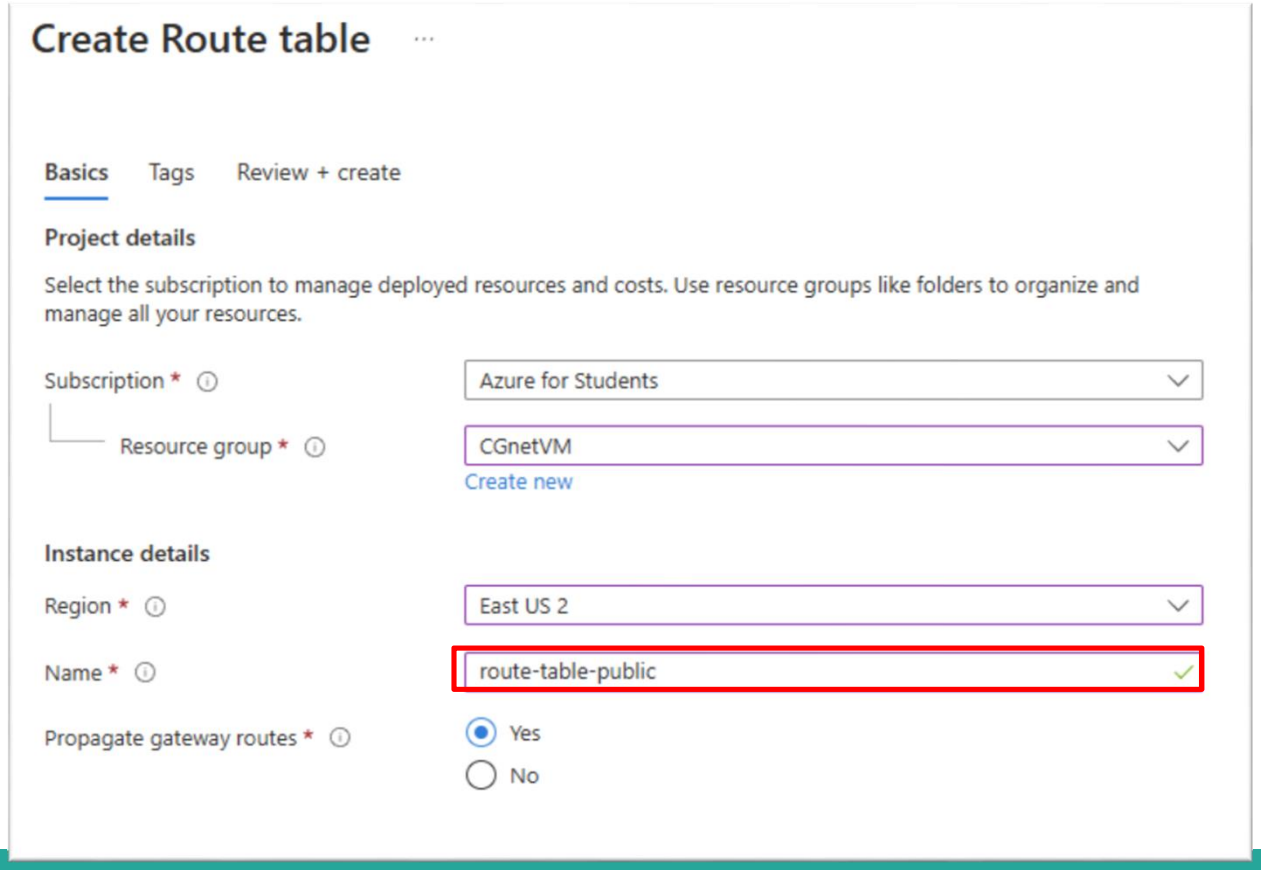
Routing Network Traffic with Route Tables

- Creating a NVA
- Creating a Route Table
- Creating a route
- Configuring IP forwarding
- Protocol Mapping

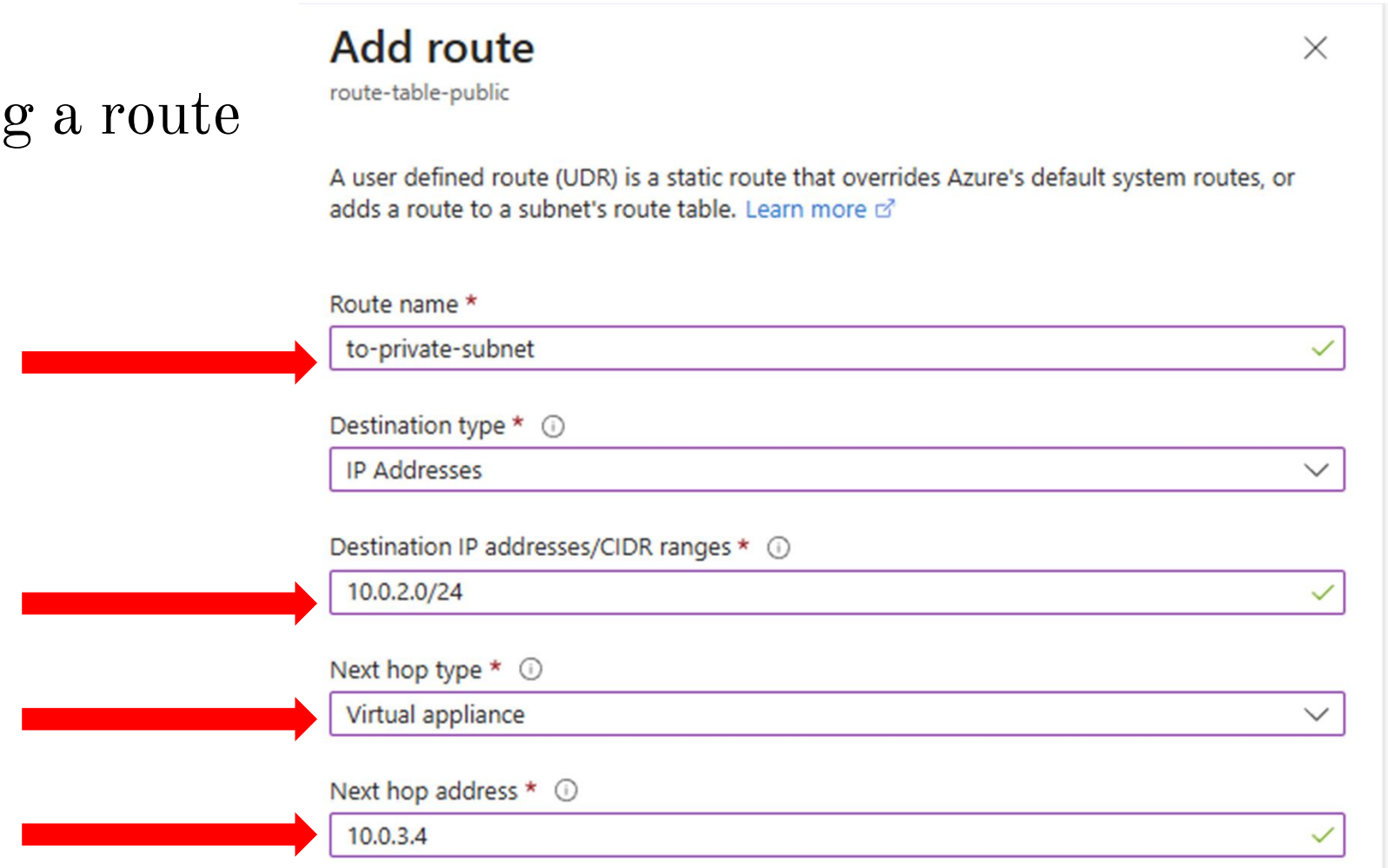
Creating a Network Virtual Appliance



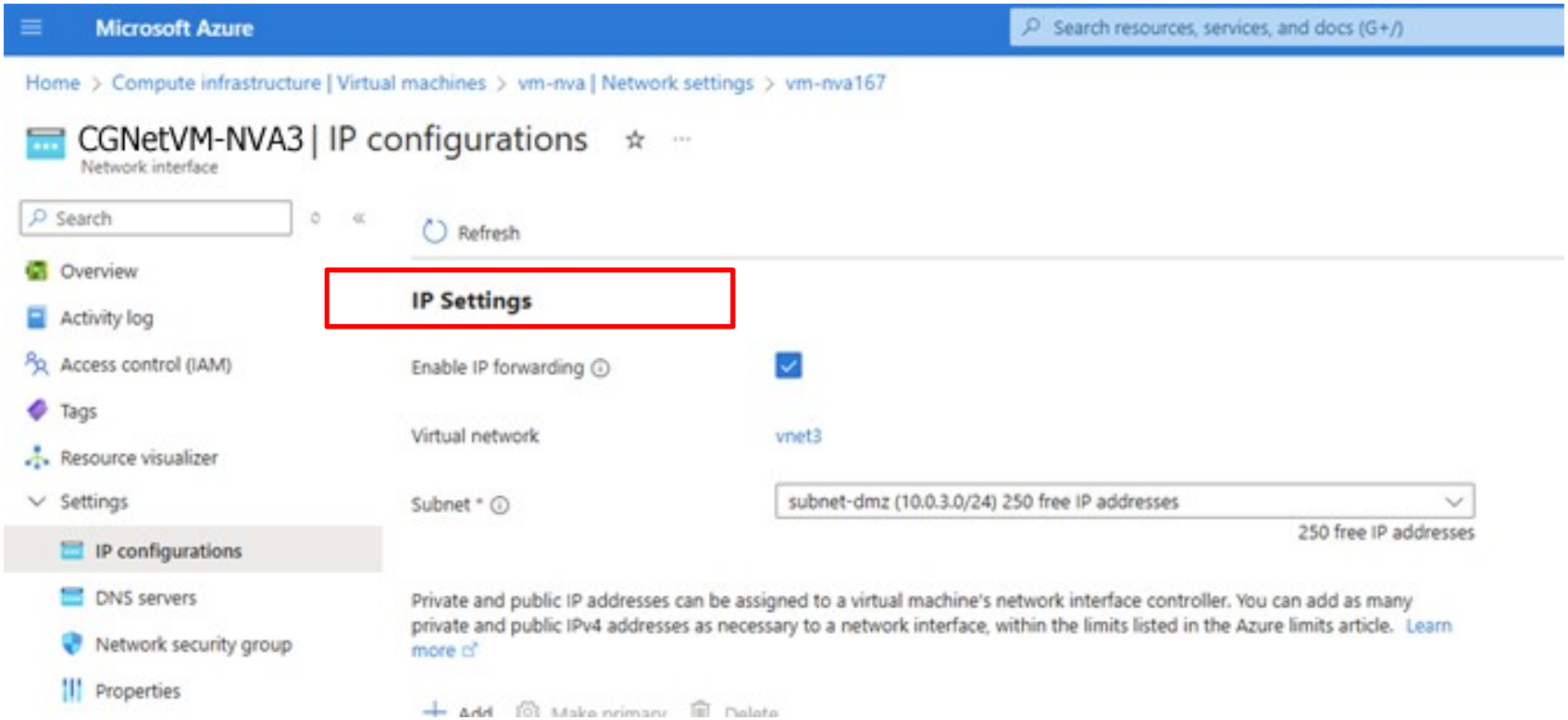
Creating a Route Table



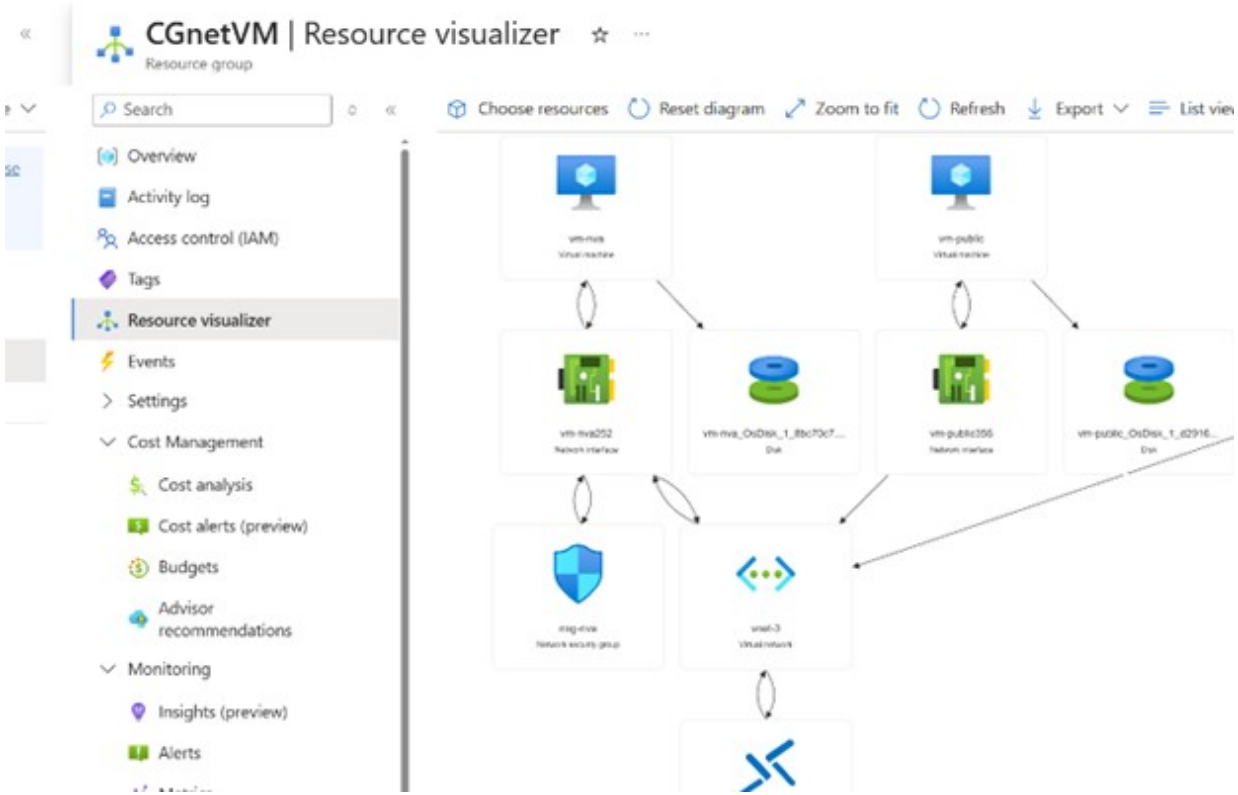
Adding a route



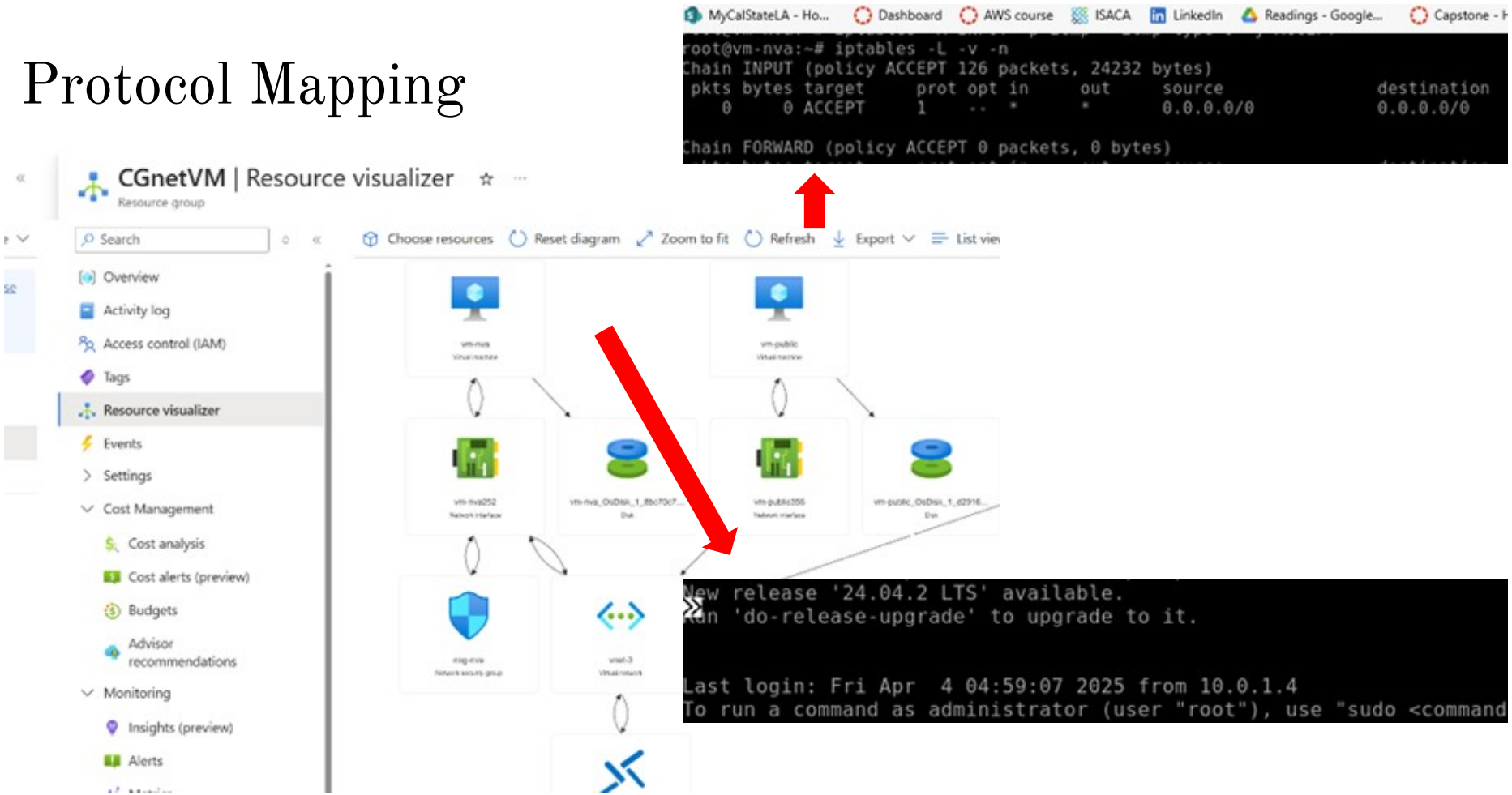
Configure IP Forwarding



Protocol Mapping



Protocol Mapping

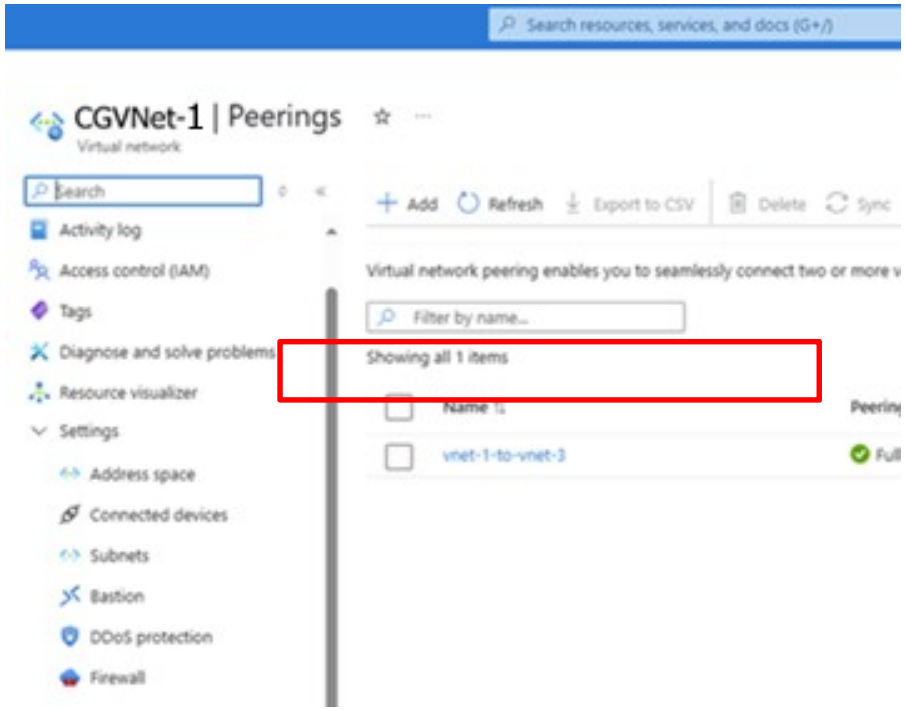


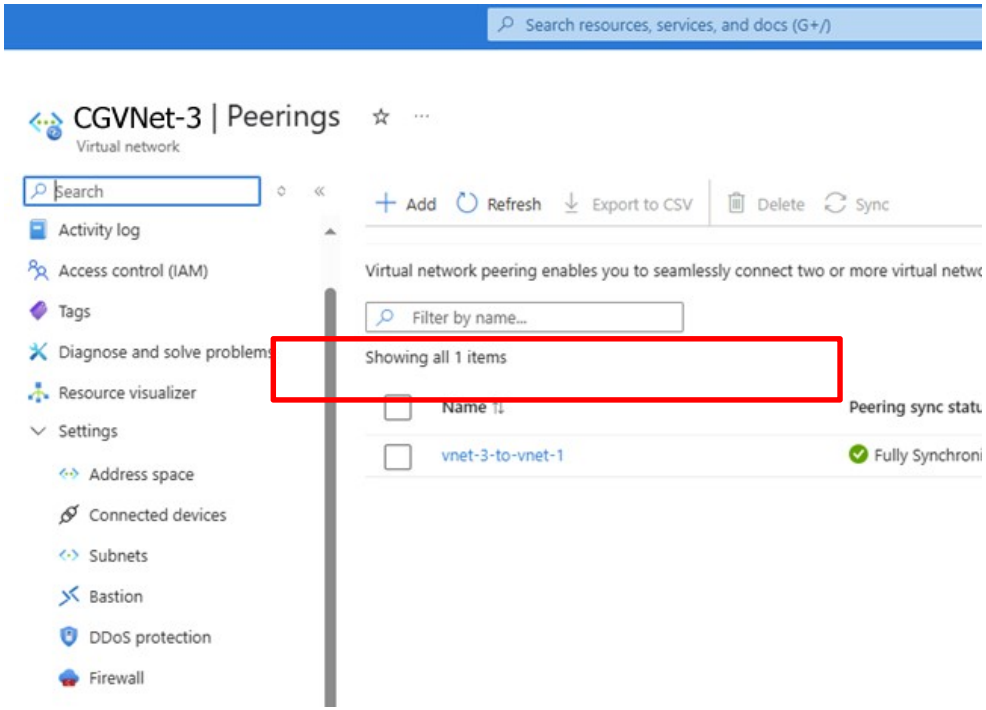

Connecting
Virtual
Networks
and Peering

Connecting Virtual Networks

- Connecting Virtual Networks via Peering
- Testing the Peering connection

Connecting Virtual Networks and Peering





Testing the Peering connection

```
Chain ufw-user-input (1 references)
target     prot opt source               destination

Chain ufw-user-limit (0 references)
target     prot opt source               destination
LOG        all  --  anywhere             anywhere            limit: avg 3/min burst 5 LOG lU
FW LIMIT BLOCK] "
REJECT     all  --  anywhere             anywhere            reject-with icmp-port-unreachae

Chain ufw-user-limit-accept (0 references)
target     prot opt source               destination
ACCEPT     all  --  anywhere             anywhere

Chain ufw-user-logging-forward (0 references)
target     prot opt source               destination

Chain ufw-user-logging-input (0 references)
target     prot opt source               destination

Chain ufw-user-logging-output (0 references)
target     prot opt source               destination

Chain ufw-user-output (1 references)
target     prot opt source               destination
dthach2@vm-5:~$ sudo ufw status
Status: active
dthach2@vm-5:~$
```

```
Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


The list of available updates is more than a week old.
To check for new updates run: sudo apt update


The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

dthach2@vm-5:~$ ping -c 4 10.1.0.4
PING 10.1.0.4 (10.1.0.4) 56(84) bytes of data.

--- 10.1.0.4 ping statistics ---
4 packets transmitted, 0 received, 100% packet loss, time 3057ms

dthach2@vm-5:~$ ping -c 10.0.0.4
ping: invalid argument: '10.0.0.4'
dthach2@vm-5:~$ ping -c 4 10.0.0.4
PING 10.0.0.4 (10.0.0.4) 56(84) bytes of data.
64 bytes from 10.0.0.4: icmp_seq=1 ttl=64 time=1.70 ms
64 bytes from 10.0.0.4: icmp_seq=2 ttl=64 time=0.913 ms
64 bytes from 10.0.0.4: icmp_seq=3 ttl=64 time=1.09 ms
64 bytes from 10.0.0.4: icmp_seq=4 ttl=64 time=0.723 ms

--- 10.0.0.4 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3051ms
rtt min/avg/max/mdev = 0.723/1.107/1.702/0.367 ms
dthach2@vm-5:~$
```


Takeaways and
Considerations

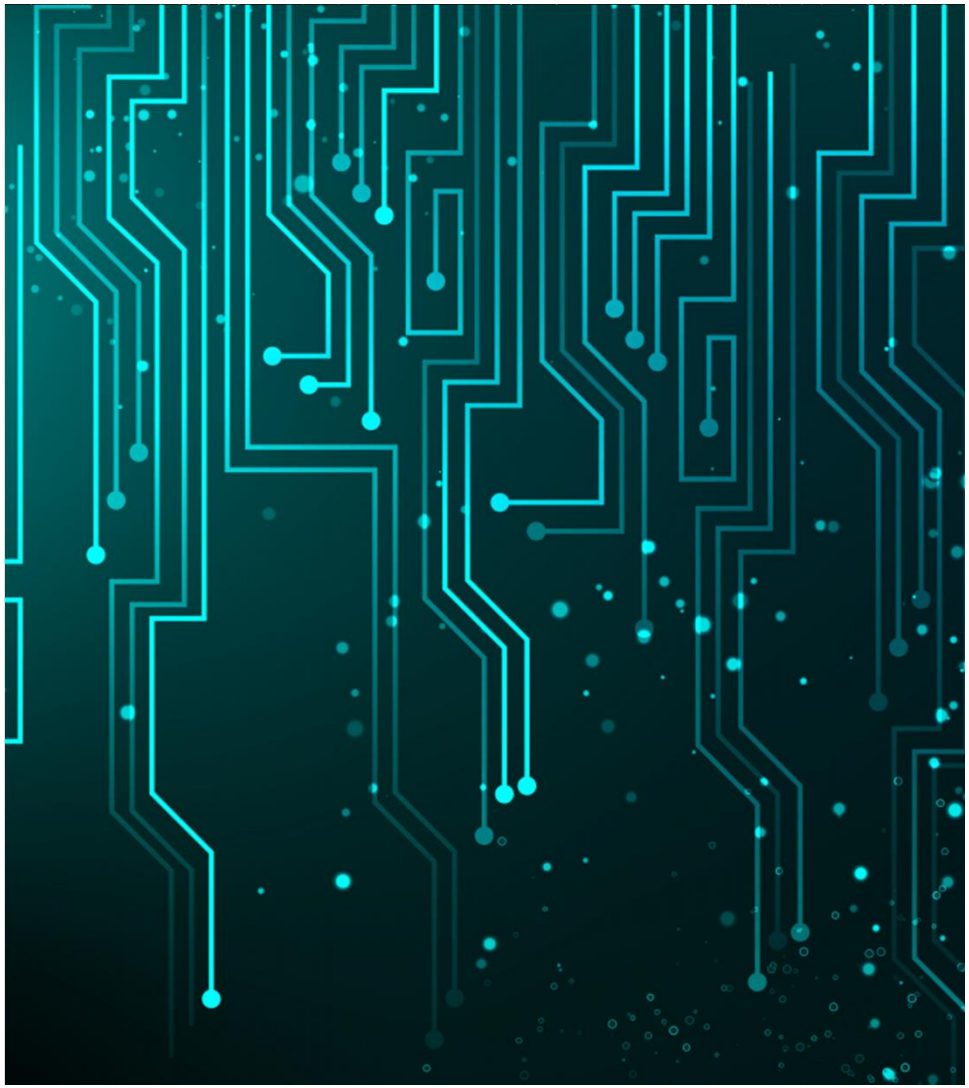
Summary

- Designed to support BILH's mission of secure, scalable, and collaborative healthcare.
- Built a virtual network with public and private VMs for flexibility and security.
- Implemented NSGs and ASGs to manage traffic and protect resources.
- Used route tables and NVAs to control traffic flow securely.
- Tested connectivity and routing to validate configurations.

Considerations

- Balance between accessibility and security in VM deployment.
- Complex configuration of NSGs, ASGs, and routing requires accuracy.
- Compliance with healthcare regulations requires ongoing updates.
- Early planning is essential for future scalability and integration.

QUESTIONS?



REFERENCES

asudbring. (2023, May 4). *Network security group – How it works*. Microsoft. https://learn.microsoft.com/en-us/azure/virtual-network/network-security-group-how-it-works

asudbring. (2024, August 20). *Tutorial: Filter network traffic with a network security group (NSG)*. Microsoft. https://learn.microsoft.com/en-us/azure/virtual-network/tutorial-filter-network-traffic?tabs=portal

GeeksforGeeks. (2022, July 22). *Fundamentals of virtual networking*. https://www.geeksforgeeks.org/fundamentals-of-virtual-networking/

Khan, A. (2023, March 6). *How network security groups filter network traffic*. LinkedIn. https://www.linkedin.com/pulse/how-network-security-groups-filter-traffic-ali-khan-/

KumudD. (n.d.). *Route network traffic – Tutorial – Azure Portal*. Microsoft. https://docs.microsoft.com/en-us/azure/virtual-network/tutorial-create-route-table-portal

Massachusetts Health Policy Commission. (2018). *Final CMIR report – Beth Israel Lahey Health – Executive summary*. https://www.mass.gov

McFarlan, F. W., & Austin, R. D. (2005). *CareGroup* (Case No. 9-303-097). Harvard Business School.

Microsoft. (2024a). *What is Azure Virtual Network?* https://learn.microsoft.com/en-us/azure/virtual-network/virtual-networks-overview

Microsoft. (2025a). *What is a virtual machine and how does it work | Microsoft Azure*. https://azure.microsoft.com/en-us/resources/cloud-computing-dictionary/what-is-a-virtual-machine/?msockid=1b50d6747d616ea30770c3467cf36f18

Samanro. (n.d.). *Microsoft cloud architecture models – Enterprise resource planning*. Microsoft. https://docs.microsoft.com/en-us/microsoft-365/solutions/cloud-architecture-models?view=o365-worldwide

Susnjara, S., & Smalley, I. (2024, March 3). *What is a virtual machine (VM)?* IBM. https://www.ibm.com/think/topics/virtual-machines