VPC Section

VPC – Crash Course

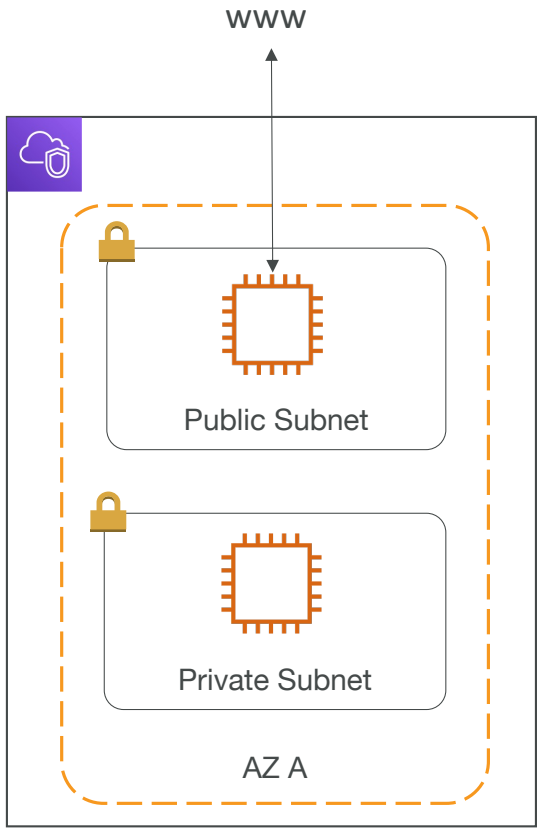
- VPC is something you should know in depth for the AWS Certified Solutions Architect Associate & AWS Certified SysOps Administrator

- At the AWS Certified Cloud Practitioner Level, you should know about:
  - VPC, Subnets, Internet Gateways & NAT Gateways
  - Security Groups, Network ACL (NACL), VPC Flow Logs
  - VPC Peering, VPC Endpoints
  - Site to Site VPN & Direct Connect
  - Transit Gateway

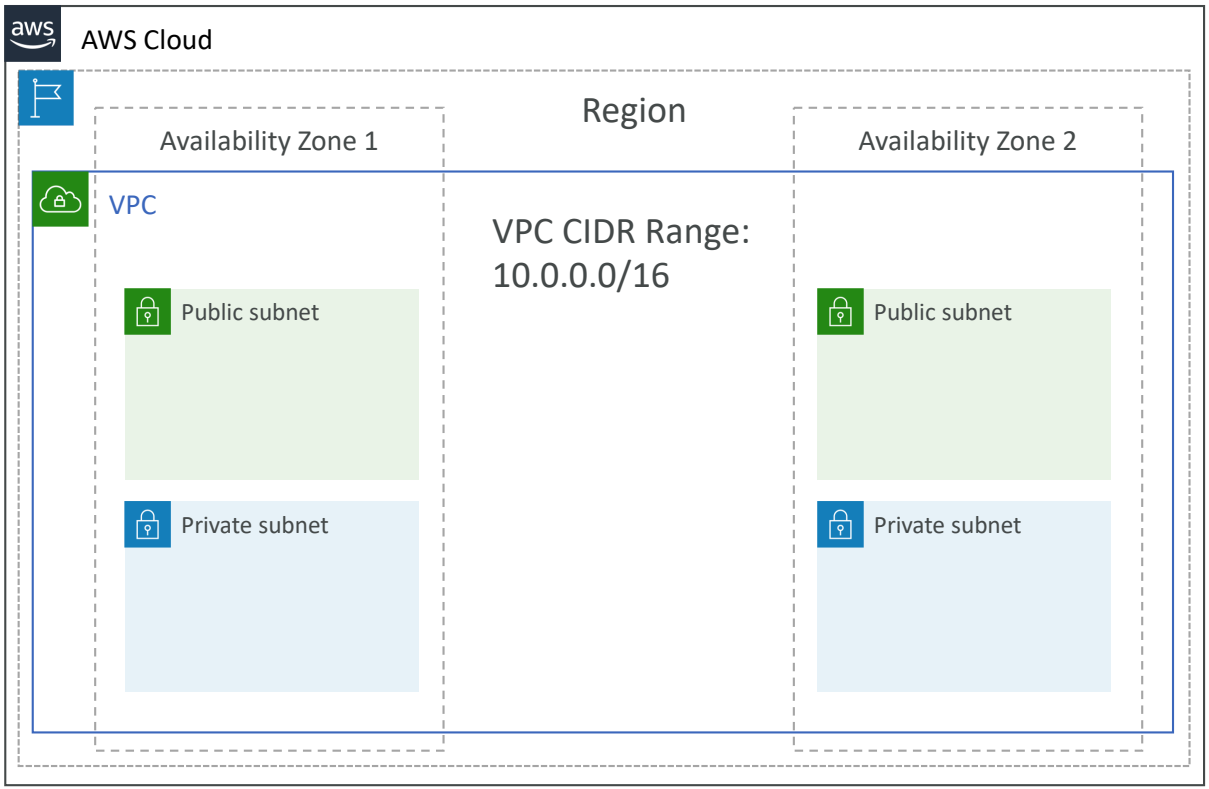
- I will just give you an overview, less than 1 or 2 questions at your exam.
- We'll have a look at the "default VPC" (created by default by AWS for you)
- There is a summary lecture at the end. It's okay if you don't understand it all

VPC & Subnets Primer

- **VPC - Virtual Private Cloud:** private network to deploy your resources (regional resource)
- **Subnets** allow you to partition your network inside your VPC (Availability Zone resource)
- A **public subnet** is a subnet that is accessible from the internet
- A **private subnet** is a subnet that is not accessible from the internet
- To define access to the internet and between subnets, we use **Route Tables.**



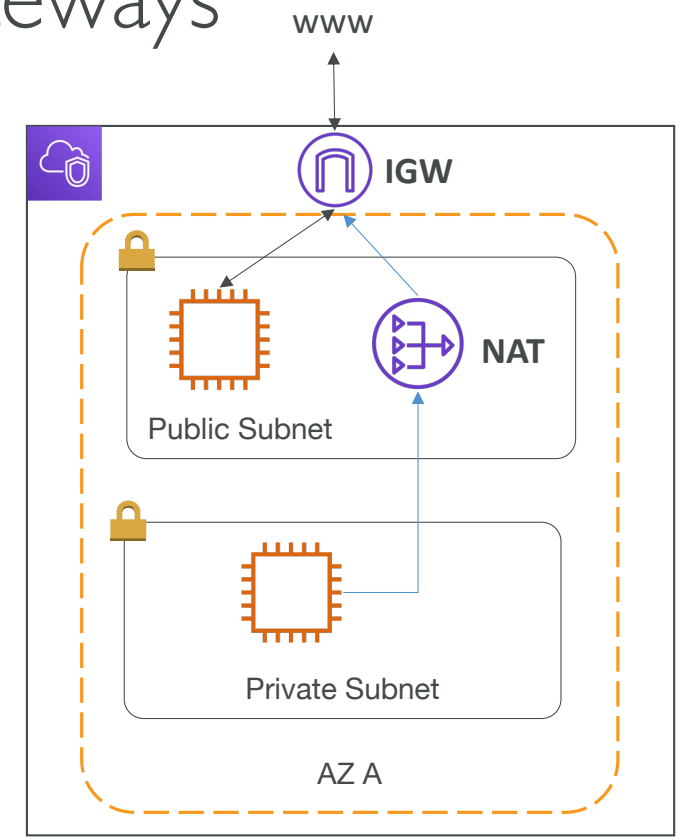
VPC Diagram



Internet Gateway & NAT Gateways

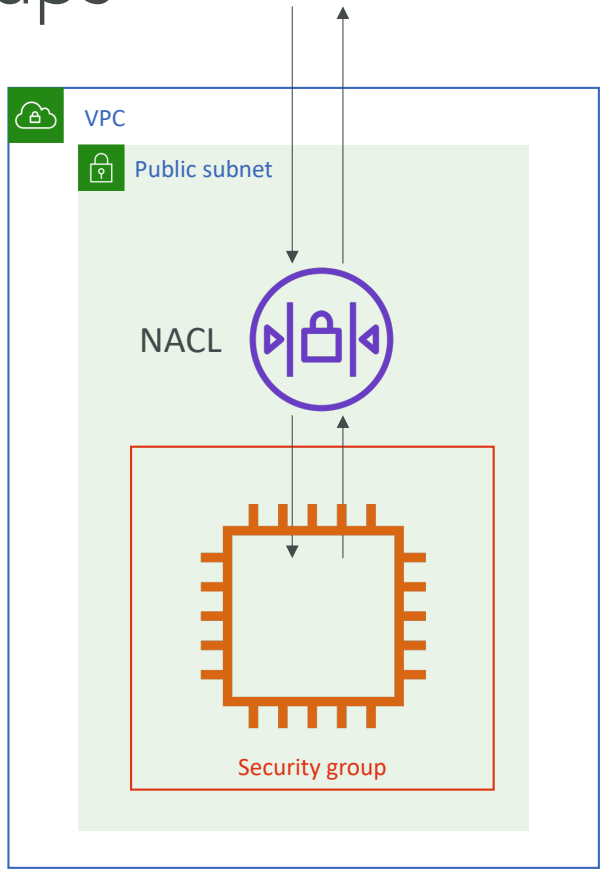
- **Internet Gateways** helps our VPC instances connect with the internet
- Public Subnets have a route to the internet gateway.

- **NAT Gateways** (AWS-managed) & **NAT Instances** (self-managed) allow your instances in your **Private Subnets** to access the internet while remaining private



Network ACL & Security Groups

- NACL (Network ACL)
  - A firewall which controls traffic from and to subnet
  - Can have ALLOW and DENY rules
  - Are attached at the **Subnet** level
  - Rules only include IP addresses
- Security Groups
  - A firewall that controls traffic to and from **an ENI / an EC2 Instance**
  - Can have only ALLOW rules
  - Rules include IP addresses and other security groups



Network ACLs vs Security Groups

Security Group	Network ACL
Operates at the instance level	Operates at the subnet level
Supports allow rules only	Supports allow rules and deny rules
Is stateful: Return traffic is automatically allowed, regardless of any rules	Is stateless: Return traffic must be explicitly allowed by rules
We evaluate all rules before deciding whether to allow traffic	We process rules in number order when deciding whether to allow traffic
Applies to an instance only if someone specifies the security group when launching the instance, or associates the security group with the instance later on	Automatically applies to all instances in the subnets it's associated with (therefore, you don't have to rely on users to specify the security group)

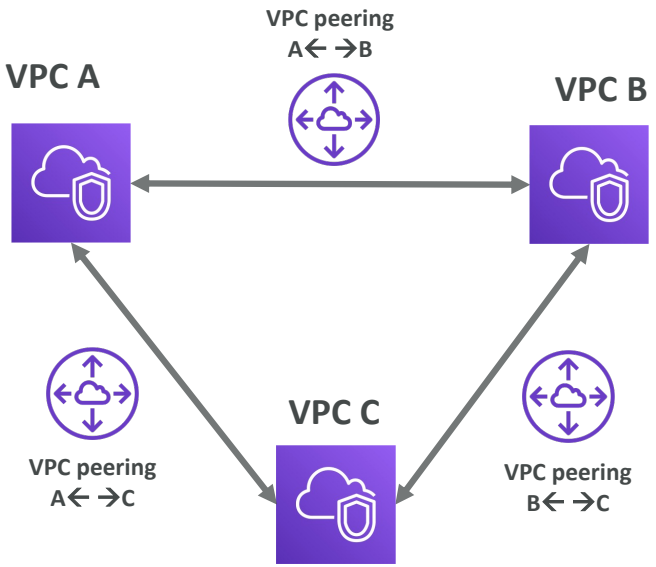
https://docs.aws.amazon.com/vpc/latest/userguide/VPC_Security.html#VPC_Security_Comparison

VPC Flow Logs

- Capture information about IP traffic going into your interfaces:
  - **VPC** Flow Logs
  - **Subnet** Flow Logs
  - **Elastic Network Interface** Flow Logs
- Helps to monitor & troubleshoot connectivity issues. Example:
  - Subnets to internet
  - Subnets to subnets
  - Internet to subnets
- Captures network information from AWS managed interfaces too: Elastic Load Balancers, ElastiCache, RDS, Aurora, etc…
- VPC Flow logs data can go to S3 / CloudWatch Logs

VPC Peering

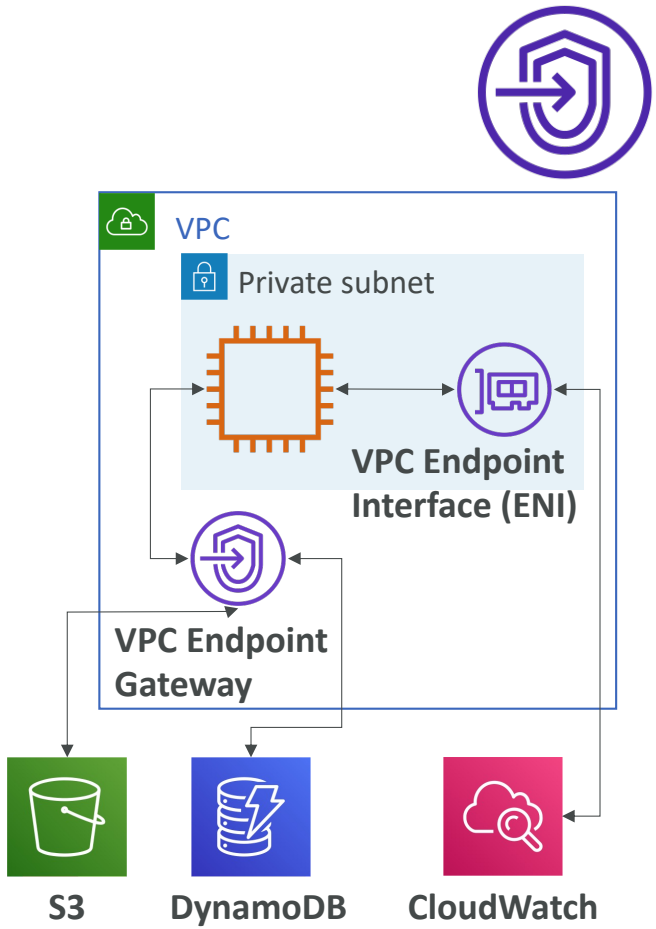
- Connect two VPC, privately using AWS' network
- Make them behave as if they were in the same network
- Must not have overlapping CIDR (IP address range)
- VPC Peering connection is **not transitive** (must be established for each VPC that need to communicate with one another)



VPC Endpoints

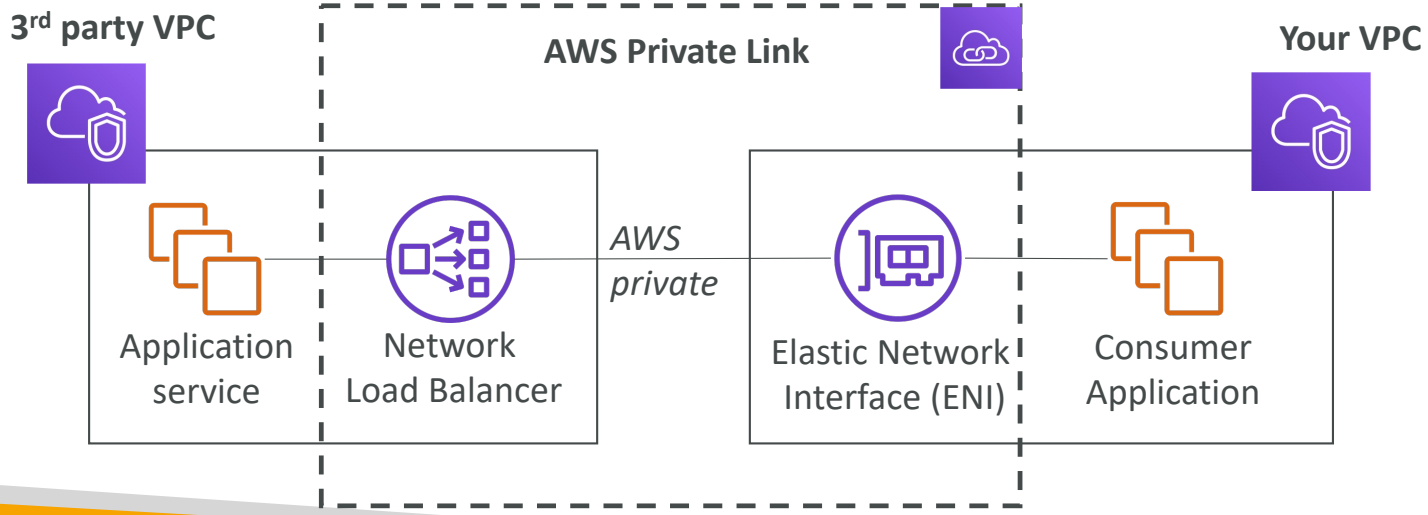
- Endpoints allow you to connect to AWS Services **using a private network** instead of the public www network
- This gives you enhanced security and lower latency to access AWS services

- VPC Endpoint **Gateway:** S3 & DynamoDB
- VPC Endpoint **Interface:** the rest



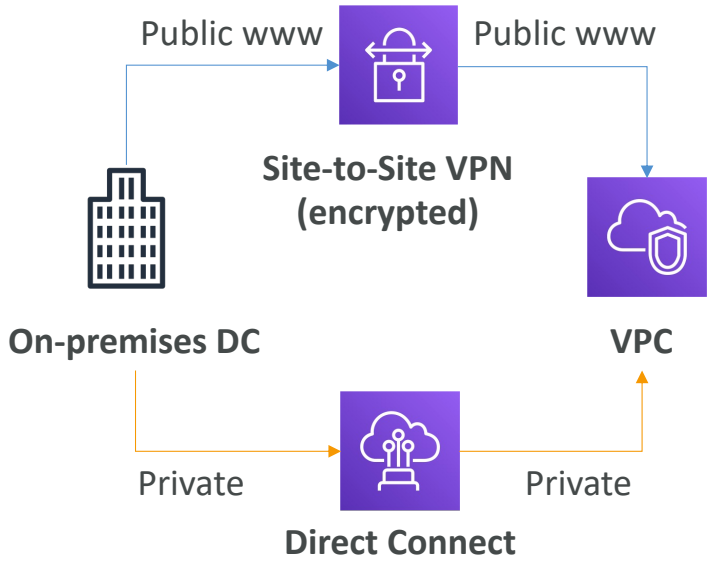
AWS PrivateLink (VPC Endpoint Services)

- Most secure & scalable way to expose a service to 1000s of VPCs
- Does not require VPC peering, internet gateway, NAT, route tables…
- Requires a network load balancer (Service VPC) and ENI (Customer VPC)



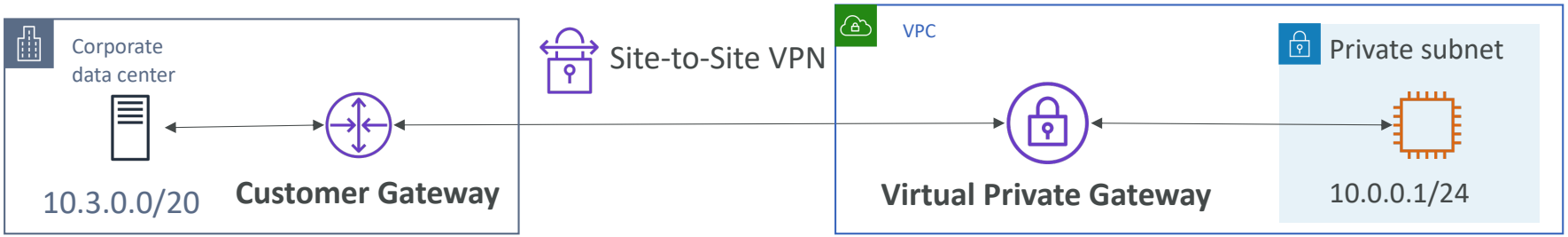
Site to Site VPN & Direct Connect

- Site to Site VPN
  - Connect an on-premises VPN to AWS
  - The connection is automatically encrypted
  - Goes over the public internet
- Direct Connect (DX)
  - Establish a physical connection between on-premises and AWS
  - The connection is private, secure and fast
  - Goes over a private network
  - Takes at least a month to establish



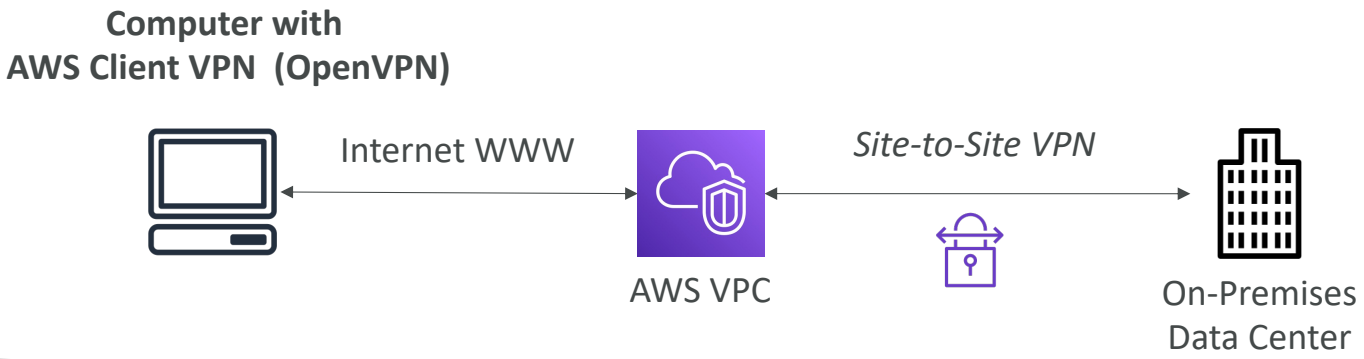
Site-to-Site VPN

- On-premises: must use a **Customer Gateway** (CGW)
- AWS: must use a **Virtual Private Gateway** (VGW)

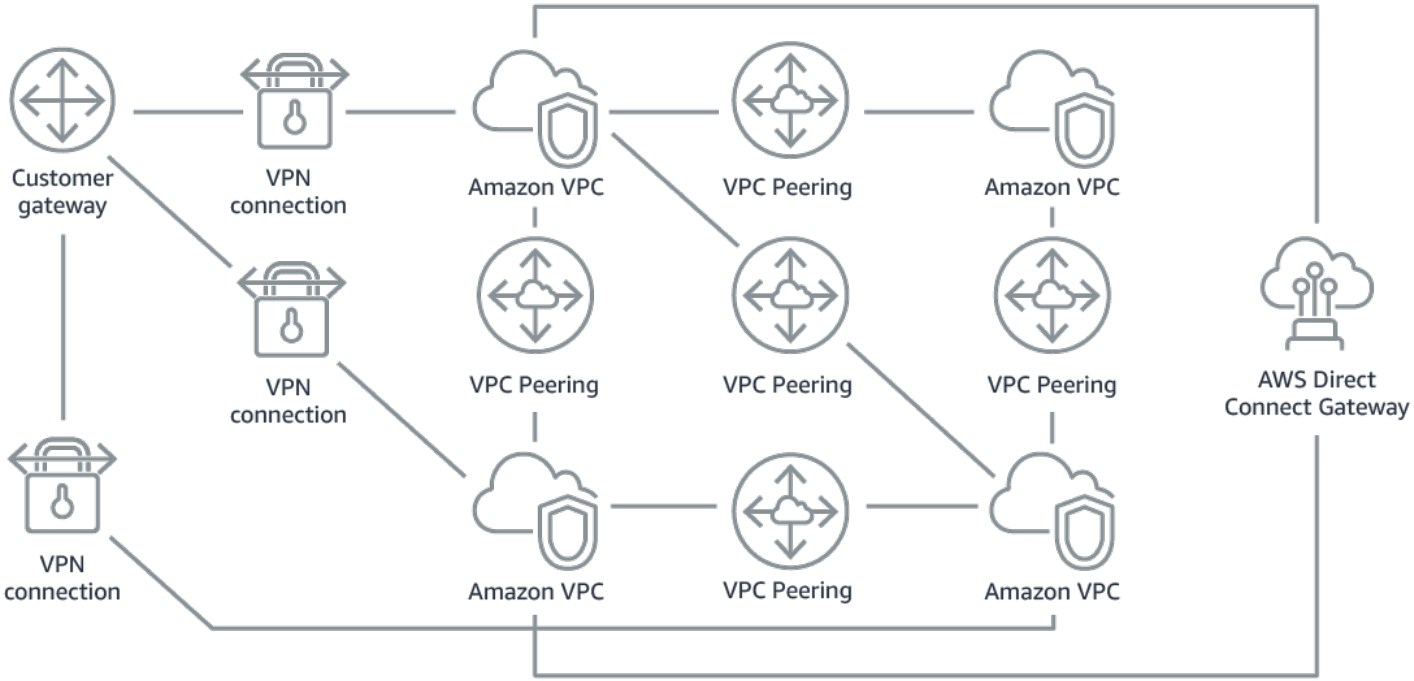


AWS Client VPN

- Connect from your computer using OpenVPN to your private network in AWS and on-premises
- Allow you to connect to your EC2 instances over a private IP (just as if you were in the private VPC network)
- Goes over public Internet

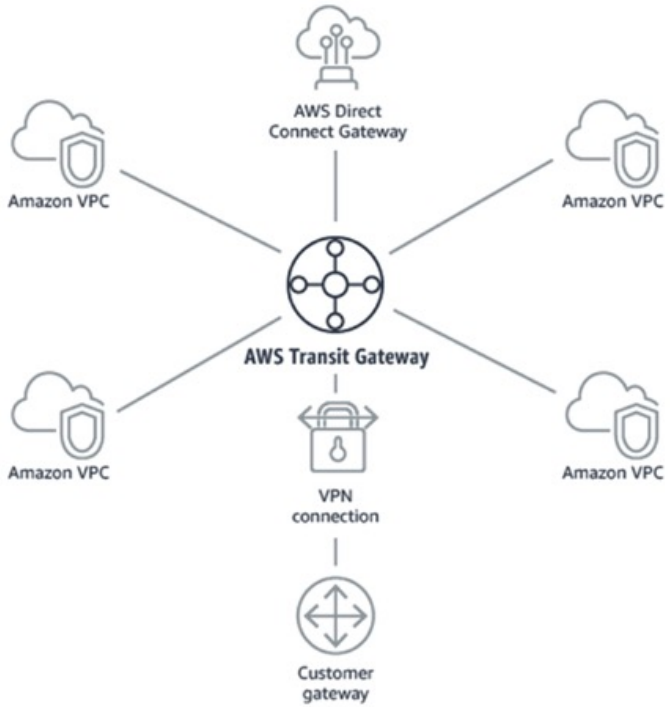


Network topologies can become complicated



Transit Gateway

- For having transitive peering between thousands of VPC and on-premises, hub-and-spoke (star) connection
- One single Gateway to provide this functionality
- Works with Direct Connect Gateway, VPN connections



VPC Closing Comments

- **VPC:** Virtual Private Cloud
- **Subnets:** Tied to an AZ, network partition of the VPC
- **Internet Gateway:** at the VPC level, provide Internet Access
- **NAT Gateway / Instances:** give internet access to private subnets
- **NACL:** Stateless, subnet rules for inbound and outbound
- **Security Groups:** Stateful, operate at the EC2 instance level or ENI
- **VPC Peering:** Connect two VPC with non overlapping IP ranges, nontransitive

VPC Closing Comments

- **VPC Endpoints:** Provide private access to AWS Services within VPC
- **PrivateLink**: Privately connect to a service in a 3rd party VPC
- **VPC Flow Logs:** network traffic logs
- **Site to Site VPN:** VPN over public internet between on-premises DC and AWS
- **Client VPN:** OpenVPN connection from your computer into your VPC
- **Direct Connect:** direct private connection to AWS
- **Transit Gateway:** Connect thousands of VPC and on-premises networks together