# Vodafone Business VMware Virtual Edge on AWS and Azure

Customer Deployment Guide R1.0

If you can re-imagine your business, you can improve it Together we can vodafone business

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# **Chapter 1: Overview**

VMware SD-WAN Edges, physical or virtual, are easy to monitor and manage for users working on or off site.

With the VMware SD-WAN Orchestrator, you can monitor the status of Edges and view the details of each Edge, like the WAN links, top applications used by the Edges, usage data through the network sources and traffic destinations, business priority of network traffic, system information, details of Gateways connected to the Edge, and so on.

Customers who have workloads in AWS or Azure are now able to connect these to their SD-WAN via internet. Virtual Edges can be deployed in a customer's cloud domain using a Azure Resource Manager (ARM) template in Azure or CloudFormation template in AWS. The use of default templates provides a common approach to deployment however in some cases templates may need to be altered to accommodate specific environments.

The instantiation of Virtual Edge is a joint Customer and Vodafone activity.

# Using this documentation

The purpose of this document is to provide guidance on how to instantiate a Virtual Machine on Amazon Web Services (AWS) and Microsoft Azure for the purposes of activating and connecting a VMware SD-WAN Cloud Virtual Edge to the rest of your SD-WAN network.

In scope:

- Installation of VMware Cloud Virtual Edge to AWS and Azure Public Cloud.
- VeloCloud SD-WAN Virtual Edge deployed as virtual instance in AWS and Azure clouds.
- Providing all necessary information for instantiating Virtual Machine as VMware SD-WAN Cloud Virtual Edge on AWS and Azure.

Out of scope:

- Troubleshooting.
- Guidance on creating the architecture and design or building an AWS or Azure Cloud.
- Advising or recommending the Customer where to instantiate the Virtual Machine (for example: which VPC, VNet, Security Group or Resource group).
- Deployment in other cloud platforms, such as Google Cloud Platform, private cloud or hybrid.
- Non SD-WAN connectivity via Partner Gateways using IPsec for AWS/Azure.

# Vodafone and Customer Responsibilities

Vodafone is responsible for completing the following actions:

- Provide the Azure Resource Manager (ARM) or AWS Cloud Formation template.
- Create the Edge in VMware SD-WAN Orchestrator.
- If required, configure the cluster between two cloud Edges.
- Configure the GRE/BGP on Edges ONLY for interconnecting with Customer configuring the Customer's AWS Transit Gateway or Azure Virtual WAN.

Vodafone are providing a managed SD-WAN service but will not own, build, or deploy the customer cloud environment on which the Virtual Computing Environment (VCE) is instantiated.

The Customer is responsible for completing the following actions:

- Provide a tested Cloud environment before the SD-WAN Virtual Edge deployment can commence.
- Create the Cloud environment for the Virtual Edge. If you require support for this activity, please contact your Vodafone Sales Team for Professional Services.
- Provide internet connectivity to the Cloud infrastructure, suitable to support the SD-WAN service.
- Provide Vodafone with the configuration parameters in VMware SD-WAN Orchestrator.

# Prerequisites

It is a pre-requisite for the customer to provide a tested Cloud environment before the SD-WAN Virtual Edge deployment can commence.

Also, before you attempt to instantiate a Virtual Machine on wither AWS or Azure, make sure you have received the following information from Vodafone:

- The VMware Edge Activation Key This is a key generated when an Edge is created on VMware SD-WAN Orchestrator. It is used for authentication by the Virtual Edge to Authenticate itself.
- The VMware SD-WAN Orchestrator Domain name (FQDN) This is the address used by Virtual Edge to identify the correct VMware SD-WAN Orchestrator.
- The Software Version of VeloCloudEdge In the template you can select from multiple versions. If the latest version is not listed as an option in the template, select the latest from the template options and the Virtual Edge during will update itself during activation to the configured version on VMware SD-WAN Orchestrator.

# Chapter 2: Deploying Virtual Edges in AWS

This section contains information about:

- 'The Deployment Process in AWS' on page 8
- 'Step 1. Configure AWS VPCs and Subnets' on page 10
- 'Step 2. Apply AWS Cloud Formation Template' on page 14
- 'Step 3. Configure AWS Transit Gateway' on page 17

# **The Deployment Process in AWS**

Deploying a Virtual Edge requires doing configurations in both VMware SD-WAN Orchestrator and in the Amazon Web Services (AWS) Portal and Console. All the VMware SD-WAN Orchestrator configurations done by Vodafone and the AWS configurations are done by the Customer.

In summary, the configurations required in order are as follows:

Step	Task	Where	Who si responsible	When
1	Configure AWS Cloud Virtual Edge profile.	VMware SD-WAN Orchestrator	Vodafone	Pre- activation
2	Configure VPCs and subnets (optional step, in case they do not exist).	AWS	Customer	Pre- activation
3	Download Cloud Formation template.	Customer Self- Service Portal	Customer	Pre- activation
4	Create Edge and send Activation Key other details.	VMware SD-WAN Orchestrator	Vodafone	Activation
5	Update Cloud Formation template and deploy Virtual Edges.	AWS	Customer	Activation
6	Create Transit Gateway and configure connectivity to VPCs. Send Transit Gateway connectivity details to Vodafone (applicable if VMware Edges and Customer applications are in Multi VPC setup).	AWS	Customer	Activation
7	Configure Transit Gateway as Non SD-WAN Destination (applicable if VMware Edges and Customer applications are in multi VPC setup).	VMware SD-WAN Orchestrator	Customer	Activation

Step	Task	Where	Who si responsible	When
8	Configure Transit Gateway tunnel connectivity from Virtual Edge LAN. (applicable if VMware Edges and Customer applications are in multi VPC setup).	VMware SD-WAN Orchestrator	Vodafone	Activation
9	Perform verifications to ensure that all the tunnels and the connectivity are functioning.	VMware SD-WAN Orchestrator and AWS	Vodafone and Customer	Activation

The following sections provide details on the steps performed by the Customer.

# Step 1. Configure AWS VPCs and Subnets

The pre-requisites to deploying a Virtual Edge in Amazon Web Services (AWS) are:

- a Connector or an AWS Transit Gateway to connect your Amazon Virtual Private Clouds (VPCs).
- at least two Subnets.

Both AWS Connect VPC and subnets contain a Route table which are important to configure properly.

The following procedure is a basic configuration guideline which can be adjusted based on your environment:

 In your AWS Management Console, select the right Region, and then navigate to AWS VPC service > Your VPCs > Create VPC.

VVC databased KCC Claduatives (G G																		
CLC Classifier         Q. Survit         Image: U	VPC dashboard	×	îΥ	our VPCs	(14) info											C Actions v	Crea	te VPC
FRer by VC:         Name         V         VPC ID         State         V         IPv4 CDR         IPv4 CDR         V         IPv6 CDR         IPv4 CDR         V         IPv6 CDR         IPv4 CDR         V         IPv6 CDR	EC2 Global View 🖸			Q, Search													< 1	> ©
Select of VC         VTV resolution structures         Select of VC         VEX.xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx	Filter by VPC:		0	Name		<b>v</b>	VPC ID	v	State	 IPv4 CIDR	v	IPv6 CIDR	~	DHCP option set	▼	Main route table	▼	Main netwo
Virtual private cloud         -	Select a VPC	Ŧ	1.1	J 1000	PERFERING CONNECTOR FOR		APPENDING INVESTIGATION OF A PARTY OF A PART		C Primane	10.100.4.0/43		-		uupi-ua rea rauzwearra.		110-01347008104320000		01110.00110
Vitual private (ood Your WCs         Customer WC 3 (level)         Social Statistication         Available         Double         10 200/16         -         dogs Contel STR024xer/lb         rtb-ofr/20084258633         ad Cottable           Your WCs         VIC Vice Could Connext OF         type (Statistication)         to (Statistication)         rtb-ofr/20084258637         ad Cottable         ad Cottable         to (Statistication)         rtb-ofr/20084258637         ad Cottable         ad Cottable         to (Statistication)         rtb-ofr/20084258637         ad Cottable         to (Statistication)         rtb-ofr/20084258647         to (Statistication)         rtb-ofr/20084258647         ad Cottable         to (Statistication)         rtb-ofr/20084258647         ad Cottable         to (Statistication)         rtb-ofr/20084258647         ad Cottable         to (Statistication)         rtb-ofr/20084258647         ad Cottable			L C	] Fortin	vet-COR-VCPD-vpc		vpc-089b8e03e6efaf19e		⊘ Available	10.200.0.0/16		-		dopt-0a1e878b24ea99.		rtb-02c518323baeb34b7		acl-0f4ef575
There VPC3         VPC Web Goud Connect 05         trac 001300000120(1702)         O Available         10.1000.128/77         -         dogs Cu 167782-bergin_         rtb 0x22796d0756x2/6         ad 0011948           200000         VPC Web Goud Connect 05         trac 0x1160bb1(s1/1740)         O Available         10.1000.128/77         -         dogs Cu 167782-bergin_         rtb 0x22796d0756x2/6         ad 0011948           200000         VPC Web Goud Connect 02         trac 0x1160b1(s1/1740)         O Available         10.1000.132/77         -         dogs Cu 167782-bergin_         rtb 0x1270-bergin_Connect 04         ad 0x12006	<ul> <li>Virtual private cloud</li> </ul>		E	Custo	mer VPC 3 (New)		vpc-087dc581306cf8ef4		Available	10.2.0.0/16		-		dopt-0a1e878b24ea99.		rtb-0ef7c2808482fdb33		acl-Odab6cd
VPC-Velo-Goad-Connect-02 ypc-073162eb1c432[540 @Available 10.1000.32/27 - dopt-0.11e778b24ea99 rtb-01e921eee910c6e81 aci-062b09d	Your VPCs		0	VPC-V	Velo-Cloud-Connect-05		ypc-093a504835c1b078b		Available	10.100.0.128/27		-		dopt-0a1e878b24ea99		rtb-0c26295ddf736ac36		acl-081f3d8
	30000003		0	VPC-V	Velo-Cloud-Connect-02		ypc-07316beb1c432f340		⊘ Available	10.100.0.32/27		-		dopt-0a1e878b24ea99		rtb-01e921eee910c6e81		ad-062b09d
Notice Looks         VPC-Velo-Cloud-Connect-01         ypc:/bb/05/2ece/cloud         Q Available         10.100.0/27         -         dspt:/dst/05/2ece/cloud/6ed555422         ad-06/de875	House tables		0	VPC-V	/elo-Cloud-Connect-01		vpc-0b40f32ecec9c05cd		Available	10.100.0.0/27		-		dopt-0a1e878b24ea99.		rtb-052f10a868d555422		acl-035489f

- 2. Under VPC Settings, select VPC and more to create subnets and default Network connections (the Internet gateway) automatically. Click VPC only to perform manual configuration. Example of fields to be filled:
  - Under Name tag auto-generation, provide a VPC name.
  - Enter the CIDR under IPv4 CIDR block. No IPv6 CIDR needed.
  - Set the **Tenancy** dropdown to **Default**.
  - Under **Number of Availability Zones (AZs**), choose the number of AZ based on customer requirement. 1 AZ is selected in this example.
  - One Public subnet needs to be selected for each AZ. Meaning, for 2 AZ, select 2 public subnets.
  - For Internet only use cases, one **Private subnet** is required for each AZ to be used on the LAN.
  - Under NAT Gateways (\$), select one of the options:
    - None (for NAT Gateway and VPC Endpoint)
    - In 1 AZ
    - 1 per AZ
  - Under DNS Options, select both Enable DNS hostnames and Enable DNS resolution.

The Create VPC window is illustrated below, in 2 images for convenience:

VPC > Your VPCs > Create VPC	
Create VPC Info	
A VPC is an isolated portion of the AWS Cloud populated by AWS objects, such a	as Amazon EC2 instances. Mouse over a resource to highlight
VPC settings	Preview
Resources to create Info         Create only the VPC resource or the VPC and other networking resources.         VPC only         VPC and more	VPC Show details Your AWS virtual network
Name tag auto-generation Info Enter a value for the Name tag. This value will be used to auto-generate Name tags for all resources in the VPC. Auto-generate VMware Connect VPC	VMware Connect VPC-vpc
IPv4 CIDR block Info Determine the starting IP and the size of your VPC using CIDR notation.	
172.31.0.0/16 65,536 IPs	
CIDR block size must be between /16 and /28.	
IPv6 CIDR block Info	
No IPv6 CIDR block	
Amazon-provided IPv6 CIDR block	
Tenancy Info	
Default	

Number of Availability Zones (AZ	s) Info		
Choose the number of AZs in which to two AZs for high availability.	provision subnet	s. We ree	commend at least
1 2 3			
Customize AZs			
Number of public subnets Info		oublic cu	boots for web
applications that need to be publicly a	ccessible over the	e interne	t.
0 1			
Number of private subnets Info			
The number of private subnets to add backend resources that don't need put	to your VPC. Use olic access.	private	subnets to secure
0 1 2			
Customize subnets CIDB bloc			
NAT gateways (\$) Info			
Choose the number of Availability Zon Note that there is a charge for each NA	es (AZs) in which T gateway	to creat	e NAT gateways.
None In 1 AZ	1 per AZ		
VPC and paints unfo			
Endpoints can help reduce NAT gatewa	ay charges and in	nprove se	ecurity by
accessing S3 directly from the VPC. By	default, full acce	ss policy	is used. You can
None S3 Gatewa	ay		
	-		
DNS options Info			
<ul> <li>Enable DNS nostnames</li> <li>Enable DNS resolution</li> </ul>			
_			
Additional tags			
	Can	cel	Create VPC

3. Click Create VPC. Example workflow after a successful VPC creation:

<u>C &gt; Your VPCs</u> > <u>Create VPC</u> > Create VPC resources	<u>C &gt; Your VPCs &gt; Create VPC</u> > Create VPC resources				
reate VPC workflow					
⊘ Success					
▼ Details					
Senable DNS hostnames					
☑ Enable DNS resolution					
Verifying VPC creation: vpc-0ff950e8a78b14bb5					
⊘ Create subnet: subnet-00ce84b5aea80cc27					
⊘ Create subnet: subnet-0dab3283218bd6781					
⊘ Create subnet: subnet-0661c27a30e0957ed					
📀 Create internet gateway: igw-04bf4d27e3d34b1a7 🔀					
⊘ Attach internet gateway to the VPC					
⊘ Create route table: rtb-04500ce8b6c11f59b					
⊘ Create route					
⊘ Associate route table					
⊘ Create route table: rtb-082fdd8804351f6e1					
⊘ Associate route table					
⊘ Create route table: rtb-0e57bd5196dd5182d					
⊘ Associate route table					
⊘ Verifying route table creation					

4. Once the VPC has been successfully created, click the View VPC button.

Select the **Resource map** tab to make sure the Subnets, Route tables and Internet Gateways are created accordingly. Resource Map example:



Take note of the VPC name, Public and Private Subnet names as this info will be required in the next section.

# Step 2. Apply AWS Cloud Formation Template

The AWS Virtual Edge is deployed with Cloud Formation templates. There is an existing template provided by VMware for a brown field environment which means that the template will only create the Virtual Edge but not the VPCs and subnets. This template supports a single public WAN link and a LAN interface.

The Cloud Formation templates provided by Vodafone are available in Customer Self-Service Portal, under **My self care > Documents** section.

The following procedure is recommended for a production environment:

 In your AWS Management Console, select the right Region, and then go to your Amazon Elastic Compute Cloud (Amazon EC2) service and under Key pairs click Create Key Pair. For example:

EC2 Dashboard X	Key	pairs (10) who								C Actions  Create key pair
EC2 Global View	Q,	Find Key Pair by attribute or tog								< 1 > @
Events		Name	¥	Туре	•	Created	<b>v</b>	Fingerprint	10	Ψ
<ul> <li>Instances</li> </ul>		DV7_test		na		2024/01/22 15:23 GMT+0		99.82.da/45.56.9d/4b/75.b4.c0.d1x5.43.78.af.cc.d5:1d.03.35	key-0119c61193d24001	2
Instances		Velo-Pem-VPC02		rsa		2024/03/12 17:45 GMT+D		95:54:21:dc6a:2a:30:4e:8d:b1:72:9cad.2d:28:1c56:90:11:7d	key-0fd26809cb8b17468	
Instance Types		Velo-CC-RP		na		2023/12/06 12:27 GMT+0		79:14:a8:bea8:4a:d3:31:19:85:d8:5a:d5:d6:43:ea:e3:d8:d6:a5	key-0fda6f05559d74fa5	
Launch Templates		UbuntuKey		na		2023/12/14 11:40 GMT+0		df:d5:dd:60:dd:07:44:54:7f:84:d1:d7:95:77:74:6f:72:56:92:64	key-001e9f4be095a711a	
Spot Requests		477692135065-t2-micro-webServer-1		na		2022/01/25 17:16 GMT+D		e4/75/fd/7b/2a/93/77/00/00/ac/69/2a/26.b0/37/84/x1/2frec17	key-062e0863ba1c177af	
Savings Plans		DVT_Fortigate_TVM		na		2024/03/15 12:21 GMT+0		9e8cee58x8x7x11a3e6a97x8113a0e9d93x77382	key-004cab46ae12228d	
Reserved Instances		Fortinet-SDWAN-testfab-keypair		ria -		2023/04/22 19:34 GMT+1		d8:61:7ca6:f5:45:49:7c16:acc5:1d#38:64;f2:20:75:2a:0a	key-0d53dea55bcb1823	2
Dedicated Hosts		Test-kay		na		2024/03/07 05:31 GMT+0		43:57:0c61:03:c3:97:15ub:57:6c30:bb:c1:57:5f.ear7a:20:8f	key-07b567363aa1c980	
Capacity Reservations New		Web-WRT		69		2023/11/10 14:50 GMT+0		2b;b6;46;3d;f9x2;58;69;27:13;dcx9x3;cf;4f;c1;9x06;31;f0	key-0c184d7a6c456bdf7	
♥ Images		DVT_Dual_Fortinet		69		2024/02/27 14:50 GMT+0		7b;b1xf;29:9f;b2;ba;f5:11:87;8e;46:6d;f5:28:vf;a4:0f;6c:83	key-0c0480a914e3ebfd8	
AMI5										
AMI Catalog										
<ul> <li>Elastic Block Store</li> </ul>										
Volumes										
Snapshots										
Lifecycle Manager										
V Network & Security										
Security Groups										
Elastic IPs										
Placement Groups										
Key Pairs										

2. Select right **Region** and then go to your AWS Cloud Formation service and click **Create Stack**.

To create an AWS Cloud Formation Stack, the template can be uploaded on the deployment steps or provide an Amazon S3 reference if the template has been uploaded to an Amazon S3 bucket before.

Prerequisite - Prepare tem	plate	
Prepare template Every stack is based on a template. A tem want to include in the stack.	uplate is a JSON or YAML file that contains configuratio	on information about the AWS resources you
• Template is ready	O Use a sample template	O Create template in Designer
Template source Selecting a template generates an Amazo	on S3 URL where it will be stored.	O Sure from Cit. com
Provide an Amazon S3 URL to your template.	Upload your template directly to the console.	Sync room Git - new Sync a template from your Git repository.
Upload a template file	Upload your template file Upload your template directly to the console.	Sync a template from your Git repository.
Provide an Amazon S3 URL to your template.	volution a template nee Upload your template directly to the console.	Sync a template from your Git repository.

- 3. Click **Next**. The main parameters being asked by the CloudFormation template under **Stack Details** are:
  - a. Provided by Vodafone Build Engineer during Activation:
    - ActivationKey: this is the activation key shown on VMware SD-WAN Orchestrator for the Virtual Edge.
    - SoftwareVersion: the latest software version. Currently, 4.x.x version is the latest software version. But if on VMware SD-WAN Orchestrator the default version is 5.2.x.x, then the Virtual Edge automatically upgrades from 4.x.x to 5.2.x during provision.
    - VCO: VMware Orchestrator domain name.
  - b. Provided by Customer Cloud Engineer during Activation:
    - VeloCloudKeyPairName: the SSH key pair (created in Step 1) that allows a user to connect via SSH to the Virtual Edge.
    - **EC2InstanceType**: the AWS instance type that defines the amount of memory and CPU for the Virtual Edge.
    - **ExistingVPC**: the name of the Connect VPC which the Virtual Edge is deployed. Note that all subnets attached to the Virtual Edge must belong to this selected VPC.

- **ExistingPublicSubnet**: the subnet that provides Internet connectivity and allows the Virtual Edge to hold a public IP.
- ExistingPrivateSubnet: the subnet that provides connectivity on the LAN side.
- **VeloCloudEdgename**: Customer should choose an easily identifiable name of the Virtual Edge EC2 instance in AWS.

The Specify Stack Details window is illustrated below:

Step 2 Specify stack details	Stack name
Step 3	Stack name
Configure stack options	AWS-VF1
	Stack name can include letters (A-Z and a-z), numbers (0-9), and dashes (-).
Step 4	
Review AWS-VF1	
	Parameters Parameters are defined in your template and allow you to input custom values when you create or update a stack.
	ActivationKey Edge Activation Key
	M6D8-68KL-BXJE-MB2Q
	EC2InstanceType Throughput and number of NICs dictate instance type
	c4.large
	ExistingPrivateSubnet Existing Subnet ID for the LAN side
	subnet-190a1237
	ExistingPublicSubnet Existing Subnet ID for the WAN side
	subnet-0ad20a08d2dc89569
	Existing VPc Existing VPC ID
	vpc-6ecce214
	IgnoreCertificateValidation Set to true if using private or self signed certificate on the VCO
	false
	ResourcePrefix Prefix used for naming all resources created by this template
	aws_vf1_velocloud
	SoftwareVersion VeloCloud Virtual Edge Software Version
	431
	VCO Orchestrator IP address or hostname (fgdn)
	vco22-fra1.velocloud.net
	VeloCloudEdgeName Name of Edge to be deployed
	aws_vf1
	VeloCloudKeyPairName Public/Private Key Name of Edge to be deployed
	jcmac

4. Click **Create stack**. Once the AWS CloudFormation Stack is deployed, the Virtual Edge is created and automatically activated:

oudFor	rmation > Stacks > AWS-VF1		
⊡ S	tacks (1)		C
		Filter status	
Q	Filter by stack name	Active 🔻 💽 View nested	< 1 >
	Stacks		
	AWS-VF1		
0	2023-11-06 15:30:04 UTC+0100		
	CREATE_COMPLETE		

The Virtual Edge is displayed as Live in VMware SD-WAN Orchestrator.

# Step 3. Configure AWS Transit Gateway

AWS Transit Gateway is required for multiple VPC communication and for two Virtual Edges in Cluster use cases. If both the virtual Edge and Customer application are hosted in the same VPC, then a Transit Gateway is not required.

The following steps represent a basic configuration guideline which can be adjusted based on the Customer environment.

- 1. First, you must create the AWS Transit Gateway:
  - a. In your AWS Management Console, select the right **Region** and then go to **VPC** > **Transit Gateways** and click **Create Transit Gateway**.
  - b. Provide the **Name**, **CIDR block** and **ASN** which will be required later for the BGP/GRE connectivity with the Virtual Edge. For example:

VPC > Transit gateways > Create transit gateway
Create transit gateway Info
A transit gateway (TGW) is a network transit hub that interconnects attachments (VPCs and VPNs) within the same AWS
account or across AWS accounts.
Details - optional
Name tao
Creates a tag with the key set to Name and the value set to the specified string.
Transit-Gateway-Velo
Description Info
sectine description of your dansic gateway to help you identify it in the rutarie.
Configure the transit gateway
Amazon side Autonomous System Number (ASN) Info
64512
DNS support Info
VPN ECMP support Info
Default route table association Info
Default route table propagation info
Configure cross-account sharing options
Auto accept shared attachments Info
Transit gateway CIDR blocks
CIDD, entired into
Q 100.0.0/24
172.25.00/24 X
T ALLONO KY Y
Tags - optional A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.
Key Value - optional
Q Name X Q Transit-Gateway-Velo X Remove
Add new tag
You can add up to 49 more tags.
Cascal
Cancer Create transit gateway

c. Click Create Transit Gateway. Transit gateway status example:

gw-032895597	78280d20 / transit-	gw1 Info	Actions <b>v</b>
Details			
Transit gateway ID D tgw- 03289559778280d20	Transit gateway ARN D am:aws:ec2:us-east- 1:063825683102:transit- gateway/tgw- 03289559778280d20	Owner ID	Description -
State Ø Available	Default association route table Enable	Default propagation route table Enable	Transit gateway CIDR blocks 1 CIDRs
Amazon ASN	Association route table ID	Propagation route table ID	Multicast support
D 64512	tgw-rtb-0a7d08dca40744569	tgw-rtb-0a7d08dca40744569	Disable
DNS support	Auto accept shared	VPN ECMP support	
Enable	attachments Disable	Enable	

d. Select the right **Region** and then go to **AWS Transit Gateway Attachments** and click **Create Transit Gateway Attachment**.

Transit Gateway will need to have VPC attachment to the Connect VPC where the Virtual Edges are hosted.

e. Provide a name, the allocated the Transit Gateway ID created in Step 1. Set the **Attachment type** dropdown to **VPC**. Select the **Connect VPC** in the **VPC ID** field and assign Virtual Edge LAN subnet under **Subnet IDs** field.

Transit GW VPC attachment for Connect VPC example:

Create transit	gateway attachment Info	
transit gateway (TGW) is ccount or across AWS acco	a network transit hub that interconnects attachments ounts.	(VPCs and VPNs) within the same AWS
Details		
Name tag - <i>optional</i> Creates a tag with the key s	et to Name and the value set to the specified string.	
transit-gw1-vpc1-atta	ch	
Transit gateway ID Inf	0	
tgw-03289559778280	0d20	•
Attachment type Info		
VPC		•
VPC attachment Select and configure your V	PC attachment.	
DNS support Info		
IPv6 support Info		
Appliance Mode sup	port Info	
VPC ID Select the VPC to attach to	the transit gateway.	
vpc-6ecce214	une contest generity.	•
Subnet IDs Info Select the subnets in which	to create the transit gateway VPC attachment.	
us-east-1a	No subnet available	
us-east-1b	No subnet available	
us-east-1c	No subnet available	
✓ us-east-1d	subnet-190a1237	•
us-east-1e	No subnet available	

i Note that if you have several applications hosted in single or Multiple Child VPCs, each VPC that requires to be connected to the Transit Gateway needs an attachment of the **VPC** type. Repeat Steps 2 to 5 for all Child VPCs with relevant VPC ID and Subnet ID.

f. Connect/Transit VPCs hosting Virtual Edges are required to be connected to Transit Gateway using the Connect Attachment.

This is needed to configure GRE over BGP to Virtual Edges. As a transport attachment ID for the connect attachment, select the VPC attachment created in Step 2 of this procedure.

ount or across AWS a	counts.
Details	
Name tag - optional Creates a tag with the ke	y set to Name and the value set to the specified string.
transit-gw1-connect	-attach
Transit gateway ID	nfo
tgw-032895597782	80d20 🔻
Attachment type In	fo
Connect	
Connect attachment all Encapsulation (GRE) and	The stabilish connection between a transit gateway and the third-party appliances using Generic Routing Border Gateway Protocol (BGP).
Connect attachment all A connect attachment all Encapsulation (GRE) and Transport attachment	nent ows you to establish connection between a transit gateway and the third-party appliances using Generic Routing Border Gateway Protocol (BGP). ID Info
Connect attachment all Encapsulation (GRE) and Transport attachment tgw-attach-0b507cc	ment ows you to establish connection between a transit gateway and the third-party appliances using Generic Routing Border Gateway Protocol (BGP). ID Info Icca520e7a26
Connect attachment all A connect attachment all Encapsulation (GRE) and Fransport attachment tgw-attach-0b507cc Fags - optional A tag is a label that you a rour resources or track you	enent ows you to establish connection between a transit gateway and the third-party appliances using Generic Routing Border Gateway Protocol (BGP). t ID Info Ica520e7a26 ssign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter our AWS costs.
Connect attachment all A connect attachment all Encapsulation (GRE) and Transport attachmenn tgw-attach-0b507cc Tags - optional A tag is a label that you a rour resources or track you (ey	■ nent ows you to establish connection between a transit gateway and the third-party appliances using Generic Routing Border Gateway Protocol (BGP). I: ID Info Info Idca520e7a26 ■ ssign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter our AWS costs. Value - optional
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Connect attachment all connect attachment all Encapsulation (GRE) and fransport attachment tgw-attach-0b507cc Fags - optional A tag is a label that you a rour resources or track you (key Q Name Add new tag	ment ows you to establish connection between a transit gateway and the third-party appliances using Generic Routing Border Gateway Protocol (BGP). ID Info tca520e7a26 ssign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter our AWS costs. Value - optional X Q transit-gw1-connect-attach X Remove

- 2. Secondly, you must create a connect peer:
  - a. Under the **Connect** attachment, click the **Connect Transit Gateway Attachments** > **Actions** > **Create Connect Peer**.

Cate connect peer info   Improvement of the Generic Routing Encapsulation (GRE) tunnel within which you can establish Border Gateway Protocol ring to exchange routes.  Details  Adame tag - optional Testes a tag with the key set to Name and the value set to the specified string.  aws_vfl_tgl_peer  Transit gateway ID	-	
nnect peer is a Generic Routing Encapsulation (GRE) tunnel within which you can establish Border Gateway Protocol ing to exchange routes. Petails lame tag - optional restes a tag with the key set to Name and the value set to the specified string. avs_vfl_tgl_peer Transit gateway ID I tgw-017a10c31c51dbccd connect attachment ID I tgw-017a10c31c51dbccd connect attachment ID I tgw-attach-0820394f53e3b48e1	reate connect pe	er Info
Inter you have been and the value set to the specified string.  Setails  Arme tag - optional  Trates a tag with the key set to Name and the value set to the specified string.  aws_vfl_tgl_peer  Transit gateway ID  Transit gateway IRE address - optional Info  Requires a valid IPv4 or IPv6 address.  Transit gateway IRE addres	connect neer is a Generic Routing	Encapsulation (GRE) tunnel within which you can establish Border Gateway Protocol (BG
Interformed and produces.   Details   Armet tag - optional   Treates a tag with the key set to Name and the value set to the specified string.   aws_vfl_tgl_peer   Transit gateway ID   If yw-017a10c31c51dbccd   Connect attachment ID   If yw-017a10c31c51dbccd   Connect attachment ID   If yw-017a10c31c51dbccd   Connect attachment ID   If yw-017a10c31c51dbccd   Configure tunnel options   ustomize GRE tunnel addresses and BGP inside CIDR blocks for your connect peer. Unspecified tunnel options will be auto generated.   Transit gateway GRE address - optional info requires a valid IPv4 or IPv6 address.   10.0.0   Teer GRE address info requires a valid IPv4 or IPv6 address.   10.100.278   GP Inside CIDR blocks IPv4 info requires availd IPv4 CIDR mask.   199.254.100.0/29   GP Inside CIDR blocks IPv4 info requires availd IPv6 CIDR mask.   125.1Pv6 CIDR.   Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN - optional info requires availed EPv6 CIDR. Yeer ASN -	connect peer is a Generic Routing	Encapsulation (GRE) tunnet within which you can establish Border Gateway Protocol (BG
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Arame tag - optional   Ireates a tag with the key set to Name and the value set to the specified string.   aws_vt1_tg1_peer   Transit gateway ID   If tgw-017a10c31c51dbccd   Connect attachment ID   If tgw-attach-0820394f53e3b48e1   Configure tunnel addresses and BGP inside CIDR blocks for your connect peer. Unspecified tunnel options will be auto generated. Iransit gateway GRE address - optional info Inguiers a valid IPv4 or IPv6 address. 10.0.0 Yee GRE address   info Requires a valid IPv4 or IPv6 address. 10.100.2/78 IGP Inside CIDR blocks IPv4   info Requires a valid IPv4 CIDR mask. 1692.54.100.0/29 IGP Inside CIDR blocks IPv4 - optional   info Requires a valid IPv6 CIDR mask. 1725 IPv6 CIDR. Yeer ASN - optional   info Requires a valid BGP ASN. 65101 <b>Figs - optional</b> Info Requires a valid BGP ASN. 65101 <b>Figs - optional</b> Info Requires a valid BdP ASN. 65101 <b>Figs - optional</b> Info Requires a valid BGP ASN. 65101	Potoila	
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	your resources or track your AWS costs	,
ley Value - optional	Key	Value - optional
Q Name X Q aws vf1 to1 peer X Remove	Q Name	X Q aws vf1 tq1 peer X Remove

- b. Under Configure Tunnel Options, the required parameters are:
  - Peer GRE address should be Virtual Edge LAN interface IP. To get this IP, Go to EC2 instance where the Virtual Edge is configured on, then click the Networking tab, and scroll down to Network Interfaces to get the IP of the LAN interface.

stance: i-00a961f3 Network Interfaces (4)	ibb0beeb20 (Velo-Clou	d-Connect-1a-DC-\	/3-vEdge)		:
Q Filter network inter	rfaces				
Interface ID	Description	IPv4 Prefixes	IPv6 Prefixes	Public IPv4 address	Private IPv4 address
🗗 eni- 0187f2dba5a792abd	Management Interface	-	-	-	10.100.2.14
D eni- 0e3cc2b9780830c22	Private WAN Interface	-	-	-	10.100.2.107
D eni- 093eab44d5dfe24ff	WAN Interface	-	-	35.157.207.174	10.100.2.11
🗗 eni- 0f7e01bbcbdc5cc7e	LAN Interface	-	-	-	10.100.2.78

- **Peer ASN**: Virtual Edge BGP ASN (assigned by the Customer).
- **BGP Inside CIDR blocks IPv4**: An internal subnet such as 169.254.100.0/29.
- c. After a Peers is created, go back to the **Connect Peer** section, it will automatically assign a GRE address for each Peer Tunnel. Take note of the Transit Gateway GRE address.

Tran	= Transit gateway attachment: tgw-attach-0820394f53e3b48e1 / TGW Connect Attachment 1a DC							
Det	ails Flow logs	Connect	Peers Tags					
<b>Co</b> ସ	nnect peers (3)							
	Name	$\nabla$	Connect peer ID	$\nabla$	Connect attachment ID 🛛 🗢	State 🗸	Transit gateway GRE address ⊽	Peer GRE address ▼
0	aws_vf1_tg1_peer		tgw-connect-peer-0572aa	cf0c143b518	tgw-attach-0820394f53e3b48e1	Pending	172.25.0.37	10.100.2.78
0	TGW_1a_DC_peer_	_secondary	tgw-connect-peer-07834d	964e928fc33	tgw-attach-0820394f53e3b48e1	⊘ Available	172.25.0.69	10.100.2.78

- d. Optionally:
  - You can add a Secondary Tunnel. Use a different name and BGP inside CIDR IP block. ASN and Peer GRE IP should be the same.
  - If two vEdges/Cluster is required, create them with different names, ASN and BGP inside CIDR IP block, for the second Edge to Transit Gateway GRE Tunnel. Peer GRE IP should be the same.
- 3. Next, configure a route from Virtual Edge private LAN to Transit Gateway Subnet:
  - a. Go to the VPC configuration where the Virtual Edge(s) are hosted. Go to **Resource Map**, then click on the route table for the Private LAN.

etails Info					
PC ID Ĵ vpc-0a5169d77d00433f4		State Ø Available		DNS Enab	hostnames bled
nancy sfault		DHCP option set dopt-0901c8bcdc0ca8745		Main rtb-0	n route table 070c07995552bebfc
efault VPC		IPv4 CIDR 10.10.0.0/16		IPv6 -	pool
twork Address Usage metrics			well a de energe		
sabled		Route 53 Resolver DNS Fire	wait rule groups	Own D	477692135063
source map CIDRs   Flow logs   Ti	ags Integrations	Route 55 Resolver DNS Fire	war rue groups	ð	477692135063
esource map CIDRs Flow logs Transmission of the second sec	ags Integrations	Route 55 Resolver DNS Fin	wait rule groups	Own.	477692135063
esource map CIDRs Flow logs Ti esource map Info	ags Integrations Subnets (2)	Route 55 Resolver DNS Hir Failed to load rule group	Route tables (3)	Own D	A77692135063 Network connections (2)
esource map CIDRs Flow logs Tr esource map Info VPC Show details Your AWS virtual network:	ags Integrations Subnets (2) Subnets within this VP	Route 55 Resolver DNS Hir Failed to load rule grou	Route tables (3) Route network traffic to resources	own o	A77692135063  Network connections (2) Connections to other networks
sabled  CIDRs Flow logs Tr  csource map Info  VPC show details Your AWS virtual network: VELO_CONNECT_VBI-vpc	ags Integrations Subnets (2) Subnets within this VP us-east-1a	Route 55 Resolver DNS hir Failed to load rule grou	Route tables (3) Route network traffic to resources rtb-070c07995552bebfc		Network connections (2) Connections to other networks VELO_CONNECT_VBI-ligw

- b. On the route table for Private LAN, click Edit routes > Add route> As Destination.
- c. Add the Transit Gateway Subnet defined in Step 1 as Target, and add the Transit Gateway created in Step 1 *as Destination.*

VPC > Route tables > rtb-03f8e68d0404bc656 > Edit routes Edit routes				
Destination		Target		Status
pl-63a5400a		vpce-02070445b1743c83d		⊘ Active
10.10.0.0/16		local	Ŧ	Active
		Q. local	×	
Q, 172.16.0.0/24	×	Transit Gateway	۳	⊘ Active
		Q, tgw-0c00901197d7bec29	×	
Add route				

- d. Click Save changes to save the route.
- 4. Finally, provide the following details to Vodafone, so that Vodafone can configure the Transit Gateway Tunnel under the Customer Instance, in VMware SD-WAN Orchestrator:
  - BGP ASN for Virtual Edge. It will be 2 BGP ASNs for 2 vEdges in Cluster.
  - BGP ASN of Transit Gateway.
  - Transit Gateway GRE addresses.
  - Peer GRE addresses.
  - BGP inside IP block and Mask for each Transit Gateway Peer.

Once you have completed the steps, it is recommended to verify your deployment. To do so, see 'Verifying your Virtual Edges Deployment' on page 39.

# Chapter 3: Deploying Virtual Edges in Azure

This section contains information about:

- 'The Deployment Process in Azure' on page 25
- 'Step 1. Configure Azure VNet and Subnets ' on page 27
- 'Step 2. Use Azure Template' on page 30
- 'Step 3. Configure Azure Virtual WAN' on page 35

# The Deployment Process in Azure

Deploying a Virtual Edge requires doing configurations in both VMware SD-WAN Orchestrator and in the Microsoft Azure Portal. All the VMware SD-WAN Orchestrator configurations done by Vodafone and the Azure configurations are done by the Customer.

In summary, the configurations required in order are as follows:

Step	Task	Where	Who si responsible	When
1	Configure Azure Edge profile.	VMware SD-WAN Orchestrator	Vodafone	Pre- activation
2	Create Edge and send Activation Key.	VMware SD-WAN Orchestrator	Vodafone	Activation
3	Configure VPCs and subnets (optional step, in case they do not exist).	Azure	Customer	Pre- activation
4	Download Azure Resource Manager template.	<i>TBD</i> (maybe Customer Self-Service Portal	Customer	Pre- activation
5	Update Azure Resource Manager (ARM) template and deploy Virtual Edges.	Azure	Customer	Activation
6	Create Azure Virtual WAN and configure connectivity to VNets. Email Virtual WAN connectivity details to Vodafone (applicable if VMware Edges and Customer applications are in Multi VPC setup).	AWS	Customer	Activation

Step	Task	Where	Who si responsible	When
7	Configure Virtual WAN tunnel connectivity from Virtual Edge LAN (applicable if VMware Edges and Customer applications are in multi VPC setup).	VMware SD-WAN Orchestrator	Customer	Activation
9	Perform verifications to ensure that all the tunnels and the connectivity are functioning.	VMware SD-WAN Orchestrator and AWS	Vodafone and Customer	Activation

The following sections provide details on the steps performed by the Customer.

# Step 1. Configure Azure VNet and Subnets

The pre-requisites to deploying a Virtual Edge in Azure are a VNet and at least two Subnets.

Both Azure VNet and Subnets contains a **Route table** and **Network Security Group**, which are important to configure properly.

The following procedure is a basic configuration guideline which can be adjusted based on your environment:

1. In your Azure Portal, click **Create a Resource group** in the desired Azure Region. For example:

		م			
Home > Resource groups >					
Create a resource group					
Basics Tags Review + create Resource group - A container that holds resources for the solution, or only those allocate resources to resource groups ba Project details	related resources for an Azure solution. The resource group can includ resources that you want to manage as a group. You decide how you w sed on what makes the most sense for your organization. Learn more (	le all the ant to ♂			
Subscription * ①	vf.group.enterprise.products.readynetworks.cor-azure.test	$\sim$			
Resource group * 🛈	Velocloud_Cloud_Connect1	~			
Resource details					
Region * 🕕	(Europe) UK South	$\sim$			

- 2. Search for Virtual Networks in Azure Portal and click Create a Virtual Network. Then:
  - a. Under the **Basic** tab, select the Resource Group from step 1, provide a name and region.

Microsoft Azure		P Search resources, services, and docs (G+)
Home > Virtual networks >		
Create virtual network		
Basics Security IP addresses T	ags Review + create	
Azure Virtual Network (VNet) is the fundam Azure resources, such as Azure Virtual Mac networks. VNet is similar to a traditional ne benefits of Azure's infrastructure such as so Learn more. C	nental building block for your private network in Azure. VNet enables many type hines (VM), to securely communicate with each other, the internet, and on-prem twork that yourd operate in your own data center, but brings with it additional cale, availability, and isolation.	s of ises
Project details		
Select the subscription to manage deploye your resources.	d resources and costs. Use resource groups like folders to organize and manage	all
Subscription *	vf.group.enterprise.products.readynetworks.cor-azure.test	$\sim$
Resource group *	Velocloud_Cloud_Connect	~
	Create new	
Instance details		
Virtual network name *	Transit_vNET	
Region * 🛈	(Europe) UK South	$\sim$
	Deploy to an Azure Extended Zone	

b. Under the **IP addresses** tab, define the address space and add the subnets as required. one public WAN subnet, one private LAN subnet is required for all use cases.

Create vi Basics Secur	rtual netwo	ork …				
Basics Secur						
Basics Secur						
	ity IP addresse	s Tags Review +	+ create			
Configure your	virtual network addr	ress space with the IPv4 a	nd IPv6 addresses and subr	nets you	need. Learn more 🖒	
Define the addr	ess space of your vir	rtual network with one or	more IPv4 or IPv6 address	ranges. (	Create subnets to segr	nent the
virtual network	address space into s urce an IP address f	maller ranges for use by	your applications. When yo	u deploy	resources into a subr	iet, Azure
assigns the reso	urce an in address i		ore of			
Add IPv4 ad	dress space $-1$ $\vee$					
<u>^ 10 100 3 0</u>	/25				Delete addres	
10 100 3	0	/25		$\overline{}$	<ul> <li>Delete addres</li> </ul>	space
10.100.3.0	- 10.100.3.127	128 addres	ses			
+ Add	a subnet					
Subnets		IP address range	Size	NA	T gateway	
Transit_v	NET_public_subnet	10.100.3.0 - 10.100.3.15	/28 (16 addresses)		0	
Transit_v	NET_private_LAN_s	10.100.3.16 - 10.100.3.3	1 /28 (16 addresses)		0	
Transit_	NET_private_WAN_	10.100.3.32 - 10.100.3.4	7 /28 (16 addresses)	-	0	۵

- c. When all configurations are created, go to the **Review + create** tab and click **Create**.
- 3. Create multiple security groups for each subnets created in Step 2 of this procedure:

		P se
Home > Network security groups >		
Create network securit	ty group	
Basics Tags Review + create		
Project details		
Subscription *	vf.group.enterprise.products.readynetworks.cor-azure.test	$\sim$
Resource group *	Velocloud_Cloud_Connect Create new	$\sim$
Instance details		
Name *	Transit_vNET_LAN_NSG	~
Region *	UK South	$\sim$

4. Under **Settings**, go to **Inbound Security Rule** to assign **Security Groups** to Public Subnet to allow at least the port UDP/2426 for SDWAN tunnels to the Virtual Edge. Optionally SSH port can also be opened.

Outbound Security Rules should be left as it is with default rules.

To assign Security Groups to adjacent Subnets:

- a. Click Subnets under Settings.
- b. Click on Associate.
- c. Then select adjacent VNet and Subnets.

SDWAN_PUBLIC_SE	CURITY_GROUP	Inbound secu	rity rules 🔅				×
	🕂 Add 👒 Hide defau	ult rules 💍 Refresh 📋	Delete 🔗 Give feedb	ack			
Overview	Network security aroup sec	urity rules are evaluated by	priority using the combin	ation of source, source por	t. destination. destination	port, and protocol to allow	v or deny the
Activity log	traffic. A security rule can't	have the same priority and o	lirection as an existing ru	e. You can't delete default	security rules, but you car	override them with rules	that have a
Access control (IAM)	ngna prony. common						
🗳 Tags	Filter by name		Port == all Prot	ocol == all Source	== all Destination	Action ==	all
X Diagnose and solve problems	Priority 1	Name ↑↓	Port ↑↓	Protocol ↑↓	Source ↑↓	Destination $\uparrow_\downarrow$	Action $\uparrow_{\downarrow}$
Settings	100	AllowAnySSHInbo-	22	TCP	Any	Any	🕑 Allow
inbound security rules	110	AllowAnySDWANTunn-	2426	UDP	Any	Any	🕑 Allow
Outbound security rules	65000	AllowVnetInBound	Any	Any	VirtualNetwork	VirtualNetwork	Allow
Network interfaces	65001	AllowAzureLoadBalan	Any	Any	AzureLoadBalancer	Any	🕑 Allow
<ul> <li>Subnets</li> </ul>	65500	DenyAllInBound	Any	Any	Any	Any	🙁 Deny
III . Descention							

5. Create a Route Table and associate it with the VNet:

For a Public WAN via Internet Route Table:

 a. Under Settings, click Routes then click Add. Provide a Route name, select Destination type to be IP Addresses, add 0.0.0.0/0 in Destination IP ranges field and select Internet to be Next hop type.

$\equiv$ Microsoft Azure		
Home > Route tables > Create Route table …		
Basics Tags Review + create Project details Select the subscription to manage deploy manage all your resources.	ed resources and costs. Use resource groups like folders to organize and	
Subscription * ①	vf.group.enterprise.products.readynetworks.cor-azure.test	$\sim$
Resource group * 🛈	Velocloud_Cloud_Connect Create new	$\sim$
Instance details		
Region * 🛈	UK South	$\sim$
Name * 🛈	Transit_vNET_public_WAN_RT	~
Propagate gateway routes * 🛈	<ul> <li>Yes</li> <li>No</li> </ul>	

b. Under Settings, click Subnets then click Associate. Select the VNET created in Step 2 for Virtual network dropdown menu. Similarly, select the Public WAN Subnet created in Step 2 for Subnet dropdown menu.

4	Transit_vNET_public_	WAN_RT ☆ ☆				
٩	Search $\diamond$ «	$ ightarrow$ Move $\lor$ 📋 Delete	🖒 Refresh 🛛 🗖 Give fe	edback		
*	Overview	∧ Essentials				
	Activity log	Resource group (move) : Ve	locloud Cloud Connect			Associations : 1 subnet associations
್ಗಿ	Access control (IAM)	Location : UP	K South			
0	Tags	Subscription (move) : vf.	group.enterprise.products.read	lynetworks.cor-azure.test		
×	Diagnose and solve problems	Subscription ID : 1	Project : Velocloud-SDWAN-DVT	ie81144		
$\sim$	Settings	Tags (edit) : F	Project : Velocloud-SDWAN-DV	т		
	💼 Configuration	Routes				
	🔼 Routes	Search routes				
	Subnets	Name	↑↓	Address prefix	$\uparrow_{\downarrow}$	Next hop type
	Properties	public_WAN_RT		0.0.0.0/0		Internet
	🔒 Locks	Subnets				
>	Monitoring					
>	Automation	Name	î↓	Address range	↑↓	Virtual network
>	Help	Transit_vNET_public_subne	t			Transit_vNET

Route Table for Private LAN is optional based on the Customer's setup.

# Step 2. Use Azure Template

The Azure Virtual Edge is deployed with an Azure template. This document assumes a brown field deployment which means the VNets, Availability Zones (AZs) and Subnets already exists with the necessary configurations.

The Azure template provide by Vodafone is available in Customer Self-Service Portal, under **My self care > Documents** section:

## image

The current Azure template supports a single public WAN link and a LAN interface. This template is appropriate for use cases with Internet Only.

The following procedure is recommended for a production environment:

- 1. In your Microsoft Azure Portal, search for SSH keys in the search bar and click Create.
- 2. In the Create an SSH Key window:
  - a. Select the desired Resource group,
  - b. Provide a Key pair name,
  - c. Select Generate new key pair as SSH Public key source,
  - d. Click **Review + create**.

$\equiv$ Microsoft Azure		,₽ Se
Home > SSH keys >		
Create an SSH key		
Basics Tags Review + create		
Creating an SSH key resource allows you Learn more	to manage and use public keys stored in Azure with Linux virtual machines.	
Project details		
Select the subscription to manage deplo your resources.	yed resources and costs. Use resource groups like folders to organize and manage	ge all
Subscription * 🛈	vf.group.enterprise.products.readynetworks.cor-azure.test	$\sim$
Resource group * ()	Velocloud_Cloud_Connect	$\sim$
	Create new	
Instance details		
Region ①	(Europe) UK South	$\sim$
Key pair name *	Velo-Cloud-Connect-SSH-keyPair	~
SSH public key source	Generate new key pair	$\sim$

- 3. Search for **Templates** in Azure Portal search bar and click **Create**.
- 4. In the Add Template window:
  - a. On the General tab, provide a Name and Description.
  - b. On the ARM Template tab, add the relevant ARM Template then click Add:



c. After the ARM template is added, click the **More Actions** icon (...) of the newly created template and click **Deploy**:

Templates ☆ … Vodafone Group (vodafone.onmicrosoft.com)   PREVIEW			×
+ Create ≡≣ Edit columns 🕐 Refresh 🖗 Fe	edback 🛛 🧑 Assign tags		
1 Templates will be retired after March 2025. We recon	nmend converting your existing templates to template specs, to make	ke it easier to share and link templates. Learn more about converting to template	e specs. X
Directory Vadafana Group (undafana appirecent com	) - Subscriptions: Don't cap a subscription? Open Directory (	Subscription settings	
Directory: Vodafone Group (vodafone.onmicrosoft.com Filter by name	n) – Subscriptions: Don't see a subscription? Open Directory +	Subscription settings	ard
Directory: Vodafone Group (vodafone.onmicrosoft.com Filter by name No grouping	n) – <b>Subscriptions</b> : Don't see a subscription? Open Directory +	Subscription settings ✓ All tags ✓ Pin to dashbox Deploy Edit	ard
Directory: Vodafone Group (vodafone.onmicrosoft.com Filter by name	n) – <b>Subscriptions</b> : Don't see a subscription? Open Directory + :	Subscription settings ✓ All tags Shared with ✓ Pin to dashbox Deploy Edit Delete	ırd

- 5. In the Custom Deployment window, the following parameters which must be filled in by Customer Cloud Engineer:
  - a. The following parameters are provided by Vodafone Build Engineer during Activation:
    - VCO: VMware Orchestrator domain name.
    - Activation Key: Virtual Edge Activation Key generated by Vodafone Build Engineer in VMware SD-WAN Orchestrator
    - Edge Version: For the template it should be 4.5.2. But If on VMware SD-WAN
       Orchestrator the default Edge SW is 5.2.x.x, then the Virtual Edge will upgrade from 4.5.2 to 5.2.x.x automatically during provision.
  - b. The following parameters are provided by the Customer Cloud Engineer during Activation:
    - **Resource Group**: Select the right resource group where all Virtual Edge services are already configured. Location should automatically be assigned.

- **Virtual Machine Size**: The Azure instance type that defines the amount of memory and CPU for the Virtual Edge.
- **Public Key**: the SSH key pair that allows a user to connect via SSH to the Virtual Edge.
- VNet name & Prefix: the name and address space of the VNet which the Virtual Edge is deployed. All Subnets attached to the Virtual Edge must belong to this selected VNet.
- **Public Subnet**: the public WAN subnet name and subnet that provides Internet connectivity and allows the Virtual Edge to hold a public IP.
- **Private Subnet**: the private subnet name and subnet range that provides connectivity on the LAN side.
- EdgeGE3LANIP: the IP address to assign on the LAN.

The Custom Deployment window:

9 resources	Edit template Edit paramet Lear	1 m more
Subscription *	Azure access VMware	~
	ue	~
Resource group *	Create new	÷
Location	(US) East US	$\sim$
SETTINGS		
Virtual Machine Size 🛈	Standard_DS3_v2	
Edge Version 🕕	Virtual Edge 3.x	$\sim$
vco 💿	vco22-fra1.velocloud.net	
ignore Cert Errors 💿	false	~
Activation Key 💿	Y3U6-4LWM-FVYG-2KMS	
Edge Name 💿	SDWAN-Azure-V1	
Ssl Public Key 💿	ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAABAQCvaaLmF1Krpr2362rOuJ4	likJ
Virtual Network New Or Existing 💿	existing	$\sim$
/ Net Name 💿	SDWAN_VNET1	
/ Net Prefix 💿	10.10.0/16	
Public Subnet Name 💿	SDWAN_PUBLIC_SUBNET1	
Public Subnet 💿	10.10.10.0/24	
Private Subnet Name 💿	SDWAN_PRIVATE_SUBNET2	
Private Subnet 💿	10.10.20.0/24	
Edge GE3LANIP 🛈	10.10.20.4	
TERMS AND CONDITIONS		
Marketplace; both are subject to cha	inge at any time prior to deployment.	
Neither subscription credits nor mor purchases are billed separately.	netary commitment funds may be used to purchase non-Microsoft offerings. T	hese
If any Microsoft products are include licensed by Microsoft and not by an	ed in a Marketplace offering (e.g. Windows Server or SQL Server), such produc y third party.	ts are
I asses to the terms and condition	or stated shows	

6. Once all the details are filled in, you must select the checkbox to agree to the Terms and Conditions.

7. Click the **Purchase** button.

The Azure Template activates the Virtual Edge automatically and appears as live in VMware SD-WAN Orchestrator.

# Step 3. Configure Azure Virtual WAN

 Azure Virtual WAN is required for multiple VNet communication and for two Virtual Edges in Cluster Use cases. If both the virtual Edge and Customer application are hosted in same VNet, then Virtual WAN is not required.

The following procedure is a basic configuration guideline which can be adjusted based on the Customer environment:

- 1. Search for Virtual WAN in Azure Portal search bar and click Create.
- a. Select the relevant **Resource group** and **Region** from the dropdowns, provide a name and set the **Type** dropdown to **Standard**.

$\equiv$ Microsoft Azure	
Home > Virtual WANs >	
Create WAN	
Basics Review + create	rtual overlay of your Azure network and is a collection of multiple resources. <u>Learn</u>
Project details	
Subscription *	vf.group.enterprise.products.readynetworks.cor-azure.test
Resource group *	Velocloud_Cloud_Connect  Create new
Virtual WAN details	
Region *	UK South 🗸
Name *	Velo_vWAN_CloudConnect ✓
Туре 🛈	Standard V

- b. Click Review + Create:
- 2. On the Virtual WAN page created in previous step, select **Hubs** from **Connectivity** dropdown.
  - a. Click New Hub.
  - b. On the Create Virtual Hub page, provide relevant details under **Basics** tab.

Home > Virtual	WanDeployment   Oven	view > Velo_vWAN_CloudConnect   Hubs >	
Create vi	rtual hub		
Basics Site t	to site Point to site	ExpressRoute Tags Review + create	
A virtual hub is a your on-premise	a Microsoft-managed virtu es network (vpnsite). <u>Lear</u>	រal network. The hub contains various service endpoints to enable connect <u>n more</u> ជ <sup>8</sup>	ivity from
Project details			
The hub will be	created under the same su	ubscription and resource group as the vWAN. 🗗	
Subscription		vf.group.enterprise.products.readynetworks.cor-azure.test	$\sim$
Resource	e group	Velocloud_Cloud_Connect	$\sim$
Virtual Hub De	etails		
Region *		UK South	$\sim$
Name *		Velo_vWAN_UK_HuB	~
Hub private add	Iress space * 🕡	10.20.0.0/24	~
Virtual hub capa	acity * 🕕	2 Routing Infrastructure Units, 3 Gbps Router, Supports 2000 VMs	$\sim$
Hub routing pre	ference * 🕕	ExpressRoute	$\sim$

- c. Assign **Virtual hub capacity** and **Hub routing preference** based on your Azure Environment.
- d. Optionally, you can add information on other tabs.
- e. Click Create under the Review + create tab.

Example of Virtual WAN Hub created successfully:

	P Sea	rch resources, services, and docs	(G+/)			S 🖉 🛛 🛈	R vijayaram palaniappan. иссичени сисси россичени	
mect								
Velo_vWAN_CloudCo	nnect   Hubs ☆							×
🔎 Search 🔍 «	🕂 New Hub 🙁 Refresh							
🔿 Overview	P Search for hubs by name	Clear all Days						
Activity log	The Add Silver							
Access control (IAM)	A was seen	history and the second	Region	Line day	Address Texas	Relative state	Empresidente Circulto	
<ul> <li>Tags</li> </ul>	HUV I	Prov status	Region	And Parks	Address space	Poert to she	Expressione Circuits	
X Diagnose and solve problems	* WOUWAN, UK HUR	Succeeded	UK South		10.20.0.0/24			
Settings								
Configuration								
1 Properties								
🔒 Locks								
Connectivity								
🔆 Hubi								

i Before being able to continue with the Virtual WAN Hub configuration, the **Routing Status** of the Hub must in the **Provisioned** state. Note that it could take up to 30 minutes.

Snach K	🖉 Edit virtual hub 🔋 Delete 🖒 Refeeds	🖯 Reset router 💧 Reset Hub			
Connectivity Connectivity VVHs (Clar to site)  Connectivity Clar to site) Connectivity Connecti	Accentrals     Accentrals		Router ve Routing y Hub rout Merica	minn i Lannt htus i 🕜 Provisioned ing preterrora : Expensionar - Yens in Adves Manifer	
Route Maps (Invited)     Routing Interest and Routing     Policies     Route Tables     Route Tables     Hockies Routes	Writual network connections           Connect virtual networks to a virtual hub.         virtual connections:	VPN (Site to site) Connect a VPN Site to a visual hub VPN Cateway.     No galaxay (Create)	User VMV (Point to site)     Connect a User VMV Configuration to a     while hub User VMV Calevay.     No gativesy (Create)	Convect an Expressibute circuit to a vitraul hub Expressibute Circuit to a vitraul hub Expressibute Cateway.	Azure Firewall Secure your virtual hub by insta Acure Firewall ® No firewall (Seale)
Accer Forwall and Forwall Manager Third party providers Particult Virsul Applance Stati Solutions Maciliar	Network Virtual Appliance     Deploy their party appliance is your     virtual hub for connectivity or frewal     purposes.     Pio gateway (Create)				

- 3. Next, you must create an Azure Virtual WAN Hub VNet Connection:
  - a. On the Virtual WAN page, select **Virtual Network connections** from the **Connectivity** dropdown.
  - b. Click **Add connection** to create Connection to the VNet that the Virtual Edge is deployed.
  - c. Provide a connection name, select the relevant Hub, the resource group and the VNet for the connection.
  - d. Click Create.

nect				Add connection			×
Velo_vWAN_Cloud	Connect   Virtual	network connecti	ions 🛪 …				
Q fauch	+ Add connection (C)	Referch		Connection name *			
		NETEN		Velo_vWAN_Hu8_Transit_vNET_connection			~
Overview	Hub	Hub region	Virtual network	Hubs* 💿			
Activity log	Velo_vWAN_UK_Hu8	UK South	Virtual networks (7)	Velo_vWAN_UK_Hu8			~
Access control (IAM)				Subscription *			
🤣 Tags				vf.group.enterprise.products.readynetworks	Loor-azune.test		$\sim$
X Diagnose and solve problems				Resource group *			
Settings				Velocloud,Cloud,Connect			~
Configuration				Virtual network *			
The formation				Transit_vNET			~
0 tools				Routing configuration ()			
L008				Propagate to none			
Connectivity				Ves No			
🔆 Hubs				Associate Route Table			
VPN sites				Default			$\sim$
User VPN configurations				Propagate to Route Tables			
ExpressRoute circuits				Default			$\sim$
Virtual network connections				Propagate to labels 🔘			
Monitor				default			~
Connection monitor				Static routes ()			
💡 Insights				Route name	Destination prefix	Next hop IP	
Automation							]
👶 Tasks (preview)				Bypass Next Hop IP for workloads within this	VNet O		
Export template				Yes No			
Help				Propagate static route O			
Getting started							
Support - Troubleshooting							
				Create			

The VNet hosting Virtual Edge should not have any VNet GWs.

- 4. If you have several applications hosted in single or Multiple Child VNets, repeat Step 3 for all Child VNets with relevant details. Each VNet that requires to be connected to the Virtual WAN Hub will need have Virtual Network connections configured.
- 5. On the Virtual WAN Hub page created in Step 2, click **BGP Peers** from the **Routing** dropdown then click **Add**.
  - a. Add a name.
  - b. Allocate a Virtual Edge BGP ASN.
  - c. Add the IP Address. This is the IP of the Virtual Edge LAN Interface (Edge GE3LANIP) which you have allocated in the provisioning template in Section 4.1.2.3.
  - d. Select Virtual Network connection to the Virtual Edge VNET from the dropdown menu.
  - e. Click Add.
- Navigate to Routing > BGP Peers section to see the Azure BGP details which are automatically assigned. For example, in the following image, ASN 65515 and IP 10.20.0.68, 10.20.0.69 are assigned for Azure end.



- 7. Send the following BGP connectivity details to Vodafone so that Azure BGP neighbours can be configured in VMware SD-WAN Orchestrator.
  - Azure end ASN & IP addresses,
  - Virtual Edge ASN & IP address.

Once you have completed the steps, it is recommended to verify your deployment. To do so, see 'Verifying your Virtual Edges Deployment' on page 39.

# Chapter 4: Verifying your Virtual Edges Deployment

This section can be used to check if all the configurations in previous sections are valid, and the relevant services functioning as expected.

# Verifications in VMware SD-WAN Orchestrator

Perform these verifications in VMware SD-WAN Orchestrator for Virtual Edges deployed in AWS or Azure:

1. To check if the Virtual Edges are connected, navigate to **Monitor > Edges**:

Monitor Configure Diagno	stics Service Settings				
Network Overview  Edges Network Services	Edges Q. Search ① ▼ ▲ csv > Map Distribution				
Routing	Name	Status 🔿	Secrets Encryption	HA (Mode) (j)	Links
Alerts	uccenv-vrt-12	Connected			1
Firewall Logs	Velo-Cloud-Connect-vEdge-Dublin	Connected			1
Reports	AVN-ZEU-VEL-640-03	Connected			2
	Velo-Cloud-Connect-2-vEdge-Frankfurt-Ib [A	Connected		Cluster	2
	Velo-Cloud-Connect-1-vEdge-Frankfurt-1a-DC [	Connected		Cluster	1

 To check if the Virtual Edges' Software Version is 5.2.x.x or above, navigate to Configure > Edges. Note that GRE/BGP do not work on Edges with Software Version below 5.2.x.x.

Edges							
Q, Search	ـ ■						
+ ADD EDGE	SSIGN PROFILE - 🗸 ASSIG	IN EDGE LICENSE 🚽 DOWNI	LOAD MORE				
Name Name	Certificates	Profile	Operator Profile	Analytics	НА	Device	Software version
AVN-ZEU-VEL-	40-03 1 View	AWS-profile-branch	R5202-20240123-GA-12267 •	None		🔧 View	5.2.0.2
aws_vf1	0	AWS-profile-branch	5.0.0 Firmware Image (20230518)	None		Niew	
uccenv-vrt-10	0	AWS-profile-branch	R5202-20240123-GA-12267 .	None		🗞 View	4.3.1
uccenv-vrt-12	1 View	AWS-profile-branch	R5202-20231107-GA-125647-b452968bf3 •	None		🔧 View	5.2.0.2
Velo-Cloud-Con	nect-1-vEdge-Fr 1 View	Cluster-New-profile	R5202-20240123-GA-12267 ●	None	Cluster	🔨 View	5.2.0.2
Velo-Cloud-Con	nect-2-vEdge-Fi 1 View	Cluster-New-profile	R5202-20240123-GA-12267 .	None	Cluster	🔨 View	5.2.0.2
Velo-Cloud-Con	nect-vEdge-Dut 1 View 🕐	AWS-profile-branch-vEdge	R5202-20231107-GA-125647-b452968bf3 •	None		🔧 View	5.2.0.2

3. To check all BGP are functioning, navigate to **Monitor > Routing > BGP Edge Neighbor State**.

cs Service Settings									
Routing									
Multicast Groups PIM Neighbors BGP Edge Neigh	hbor State BFD	BGP Gateway Neighb	or State Gateway	Route Table					
Q, Search									
Edge Name	Segment	Neighbor IP	State	State Changed Time	# Msg Received	# Mag Sent	# Events	Up/Down	# Prefix Received
Velo-Cloud-Connect-1-vEdge-Frankfurt-1a-DC	Global Segment	169.254.100.2	<ul> <li>Established</li> </ul>	Mar 25, 2024, 3:46:42 PM 19 hours ago	5,548	5,545	16	15:22:54	10
Velo Cloud Connect-1-vEdge-Frankfurt-Ia-DC	Global Segment	169.254.100.3	<ul> <li>Established</li> </ul>	Mar 25, 2024, 121:09 PM I day ago	5,549	5,550	18	15:22:54	10
Velo-Cloud-Connect-1-vEdge-Frankfurt-1a-DC	Global Segment	169.254.101.2	<ul> <li>Established</li> </ul>	Mar 25, 2024, 4:08:08 PM 19 hours ago	5,548	5,551	19	15:22:54	10
Velo-Cloud-Connect-1-vEdge-Frankfurt-1a-DC	Global Segment	109.254.101.3	<ul> <li>Established</li> </ul>	Mar 25, 2024, 121:09 PM1 day ago	5,548	5,550	19	15:22:54	10

4. To verify the tunnels' status, navigate to Monitor > Network Services > Non SD-WAN

Destinations via Edge:

Network Services						
Non SD-WAN Destinations via Gateway	Non SD-WAN Destinations via Edge	Cloud Security Servio	ce Sites	Zscaler laasSubscription ①	Edge Clusters	Edge VNFs
Name	T Public IP	Υ	Tunnel St	atus	Used By	
AWS TGW 1a Frankfurt AWS Transit Gateway Connect			2 Up	Φ	1 Edge	
AWS TGW 1b Frankfurt AWS Transt Gateway Connect			2 Up	Φ	1 Edge	

## **Verifications in AWS Management Console**

Perform the following verifications in your AWS Management Console for Virtual Edges deployed in Amazon Web Services (AWS).

1. To check if the Virtual Edge is running and the right configurations are applied (such as Instance Type, Security, Networking, and others), go to the Amazon EC2 service and then select the instance type that has the Virtual Edge.

Insta	nces (1/11) Info							
Q F	ind Instance by attribute or tag (case-sensitive)		All	states 🔻				
Insta	nce state = running X Clear filte	rs						
	Name 🖉 🗸 🗸	Instance ID	Instance state	Instance type	$\nabla$	Status check	Alarm status	Availability Zone
	VPC-1: Web-Server-1	i-0202e93d705930f80		t2.micro		Ø 2/2 checks passed	View alarms +	eu-central-1b
	Frankfurt_VPC1_TRex	i-0462ed797fb27793a	⊘ Running @ Q	c5.2xlarge		Ø 2/2 checks passed	View alarms +	eu-central-1b
	VF-On-prem-Demo-Lab-csr-1	i-0a8449a64eeb096b7		c5.xlarge		⊘ 2/2 checks passed	View alarms +	eu-central-1b
	Velo-Cloud-Connect-2-vEdge	i-0f1b939cb59dc3fbb		c4.xlarge		⊘ 2/2 checks passed	View alarms +	eu-central-1b
	Fortinet-SDWAN-testlab-fortigate-1	i-0e592d600b0880b5e	⊘Running @ Q	t3.small		Ø 2/2 checks passed	View alarms +	eu-central-1a
	Fortinet-CC-WIN1	i-07308cf96a7e2dd24		t2.micro		⊘ 2/2 checks passed	View alarms +	eu-central-1a
	AWS_CiscoSdwan-csr-0	i-04a5ed8cbaf24337f	⊘ Running @ Q	c5.xlarge		Ø 2/2 checks passed	View alarms +	eu-central-1a
	Velo-Cloud-Connect-1a-DC-v3-vEdge	i-00a961f3bb0beeb20	⊘ Running ④ Q	c5.xlarge		⊘ 2/2 checks passed	View alarms 🕂	eu-central-1a
	VPC02-LNX-NEW	i-0a52a3f94b50e4d4c	⊘Running @ Q	c5.large		⊘ 2/2 checks passed	View alarms 🕂	eu-central-1a
	AWS_CiscoSdwan-csr-1	i-04ab23930a95d7553	⊘ Running ④ Q	c5.xlarge		Ø 2/2 checks passed	View alarms +	eu-central-1b
	Velo-Cloud-Connect-1b-DC-v3-vEdge	i-09a0d4c85fdd806c9	⊘Running @ Q	c5.xlarge		Ø 2/2 checks passed	View alarms +	eu-central-1b
Insta	nce: i-00a961f3bb0beeb20 (Velo-	Cloud-Connect-1a-DC-v3-	vEdge)				=	
Detail	s Status and alarms New Monitor	ing Security Network	king Storage	Tags				
▼ Sec	urity details							
IAM R	ole			Owner ID				
-				D 47769	213506	3		
Securi	ty groups							
ට් sg ට් sg	-07408d7421c5829a2 (Velo-Cloud-Connect-1 -0a8c94b05223a1073 (Velo-Cloud-Connect-1	a-DC-v3-VelocloudLANSecurityGr a-DC-v3-VelocloudWANSecurityG	oup-6F04GVZIQCVT) roup-13QNJDX1SK3M0	))				

2. To check BGP status, navigate to the Transit Gateway Attachment service for the connect attachments, then click on **Connect peers** and scroll to view the columns on the right:

C	onne Q, <i>Fill</i>	ect peers	(3) peer									C Actions	▼ Create connect peer < 1 > ⊚
	Ŧ	State	Ψ	Transit gateway GRE address 🛛	Peer GRE address 🗢	<b>BGP Inside CIDR blocks</b>	Transit gateway ASN 🛛	Peer ASN V	Peer BGP address V	Transit gateway BGP 1 address 🛛	Transit gateway BGP 1 Status 🛛	Transit gateway BGP 2 address 🛛	Transit gateway BGP 2 Status 🛛
b48	e1	O Deleter	đ	172.25.0.37	10.100.2.78	169.254.102.0/29	65501	65101	169.254.102.1	169.254.102.2	O Down	169.254.102.3	O Down
648	e1	⊘ Availab	ie -	172.25.0.69	10.100.2.78	169.254.101.0/29	65501	65201	169.254.101.1	169.254.101.2	Ø Up	169.254.101.3	Ø Up
648	e1	Ø Availab	ie .	172.25.0.21	10.100.2.78	169.254.100.0/29	65501	65201	169.254.100.1	169.254.100.2	@ Up	169.254.100.3	Ø up

3. To check if the Transit Gateway is getting all the VPC and connect attachment routes, go to **Transit Gateway** (VPC feature) then click on the **Transit Gateway ID**. In the next screen select the **Association** route table ID and then click on **Association** or click on **Routes**.

	-rth_0b8ece/19928=	a126f	) / Velo-TGW R	oute-tab	ole 🗤					
gw	-1tb-0b0ece455208		,							
Det	tails									
Tran	nsit gateway route table ID tgw-rtb-0b8ece49928a126f0			Transit gateway tgw-017a10c31	ID c51dbccd		State Ø Available			Default association rout Yes
Defa Yes	ault propagation route table									
Asso	ociations Propagations Pro	efix list ref	rrences Routes Tag	5						
	Filter router by CIDP (2)									
Exac	ct CIDR			.ongest prefix n	natch		Supernet of match			Subnet of match
ielec	ct a valid IP4 or IPv6 CIDR.						Extent a could the solid the first			Salart a valid IDA or IDv6 CIT
14	0.0.0.0/0, ::/0			0.0.0.0, ::	IPv6 and press enter.		Q 0.0.0/0, ::/0			Q, 0.0.0.0/0, ::/0
u	. 0.0.0.0/0, ::/0			0.0.0.0; =	IPv6 and press enter.		Q 0.0.0.0/0, :/0			Q 0.0.0.0/0, ::/0
Rou	0.0.0.0/0, ::/0 utes (11) info			0.0.0.0; ::	Prof and press enter.		Sect a fact of the red con.			Q 0.0.0.0/0, ::/0 0.0.0.0/0 X ::/0 X
Rou	utes (11) into Find route by attribute or tag		Attachment ID		Pv6 and press enter.	T Become here	See 1 400 Pro Cox.	Posta bina		Q 0.0.0.0/0 =/0
Rou	. 0.0.0/0, ::/0 utes (11) into Find route by attribute or tag CIDR 0.0.0.00	⊽	Attachment ID	viter a valid link or 0.0.0.0, :: •	P-6 and press enter.  Resource ID  P detources	v Resource type	Sect 1 100 1 4 0 1 4 0 1 4 0 0 1 4 0 0 1 4 0 0 0 0	Route type	v Ro	Q 0.0.0.0/0 :=/0 0.0.0.0/0 X =/0
Rou	0.0.0.0,0,20  utes (11) infe  Find route by attribute or tog      0.0.0/0      100      0.0.0/0      100      100      102      12/27	▼	Attachment ID 2 Attachments Foresttab - 00000 7466800	v 461	P-6 and press enter.  Resource ID Among Antipology Among Am	▼ Resource type Connect VPC	xect 1 and 2 d a vec (co.	Route type Propagated Propagated	v Ro	Q 0.0.0.0/0/0 0.0.0.0/0 X/0 state Active Active
Rou	co.o.o.o.o.o.o.o.o.o.o.o.o.o.o.o.o.o	♥	Attachment ID 2.Attachments tgw-attach-06070b74668900 tgw-attach-07057428925bb	v   0.0.0.0, :: v   461	Resource ID Resource ID Resource ID Resource ID Resource I Resour	♥ Resource type Connect VPC VPC	sect 1100 4 0 4 40 Co. [0, 0.0.0.0/0,/θ]	Route type Propagated Propagated Processited	v Ro	(Q. 0.0.0/0, ;/) (0.0.0.0/0 X) =/0 (0.0.0.0/0 X) =/0 =/0 =/0 =/0 =/0 =/0 =/0 =/0
Rou	0.0.0.0,0; 2;0 utes (11) inte . Find route by ottribute or tag . COR . 0.0.0,0 . 0.0.0,0 . 10,100.0.32/27 . 10,100.0.96/27 . 10,100.0.96/27 . 10,100.0.95/25	Ÿ	Attachment ID 2.05547/mmtts 1gw-attach-0267087260466900 1gw-attach-027691259a66	v   0.0.0.0, :: v   461 48	PAG and press unite: PAG and press unite: Resource ID 2.Resource ID 2.Resource ID vpc-073160eb1c4327540 vpc-0743160eb1c4327540	♥ Resource type Connect VPC VPC VPC	xect 1100 4 G M (Co.) (0, 0.0.0.0)(0, γ)0 ▼	Route type Propagated Propagated Propagated Propagated	♥ Rea ⊙ ⊙ ⊙	Q 0.0.0,0,0, √0     Q 0.0.0,0 X = √0     Q 0.0.0,0 X = √0     Q 0.0.0,0 X = √0     C V     C V 0     C V     C V 0     C V     C V 0     C V     C
Rou Q 0 0	acacacya: _20      inter (11)    inte         Find reads by attribute or tag         cone         cone         cone         cone         10:100.03/07         10:100.03/07         10:100.03/07         10:100.03/07         10:100.23/25         10:100.24/28	♥	Attachment ID 2.Attachments tgw-attach-0070b7466890 tgw-attach-007501662catl tgw-attach-007501662catl 2.Attachments	v 461 4461 448	Pink and press onter: Resource ID 2 Resource yop: 071506/std152 yop: 071506/std152 2 Resource 2 Resource	♥ Resource type Connect VPC VPC VPC Connect		Route type Propagated Propagated Propagated Propagated	♥ 8aa ⊙ ⊙ ⊙ ⊙	Q         0.0.0.0/0√0
Rou Q 0 0 0 0 0 0 0 0 0 0 0 0 0	0.00.013 .00     Conception     Conceptin     Conception     Conception     Conception     Conception	⊽	Attachment ID 2.Attachments tgw-attach-0e070b74668900 tgw-attach-0e075071662ce11 2.Attachments	v   v   461 451	PAG and press onter:	V     Resource type       Connect     VPC       VPC     VPC       Connect     Connect	v	Route type Propagated Propagated Propagated Propagated Propagated	▼   Ra0 ⊙ ⊙ ⊙ ⊙ ⊙	Q         0.0.0.0/070           0.0.0.0/070         2/070           0.0.0.0/070         2/070           ote state         660           Active         660
Rou Q 0 0 0 0 0 0 0 0 0 0 0 0 0	cosseq _0      rest 11)      we      Find mark by attribute or tag      cos      cos	⊽	Attachment ID 2.httachments typ-attach-0027097466890 typ-attach-002769935904 2.httachments 2.httachments 2.httachments	v   v   461 451	PAL and press onter: PRESSURE ID Resource ID 2.Resources upc-073166xb1r4327340 upc-07346452174ab/faa upc-07346452174ab/faa 2.Resources 2.Resources	♥     Resource type       Connect     VPC       VPC     VPC       Connect     Connect       Connect     Connect	<u>Q</u> <u>aaadq</u> ;p	Route type Propagated Propagated Propagated Propagated Propagated Propagated	▼   file ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘ ⊘	de saae de saa
	concerts (11) into     test (11) into     Find marke by attribute or tag     conc     conconc     conconc     conc     conc     conco	▼	Attachment ID Zutachment ID Insertach-007107466800 tgw-attach-00710716620a1 tgw-attach-00710716820a1 Zutachments Zutachments Zutachments Zutachments	v   v   461 451	Ped and press onter: Pedearce ID 2.feroneces vpc-073156ab1c4327140 vpc-0846452174648faa vpc-0846452174648faa vpc-0846452174648faa 2.feroneces 2.feroneces 2.feroneces	V         Resource type           Connect         VPC           VPC         VPC           Connect         Connect           Connect         Connect	Q 66660 39	Route type Propagated Propagated Propagated Propagated Propagated Propagated Propagated	▼ 800 ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙ ⊙	Q         0.00.000 X         z/0           0.00.000 X         z/0 X           state         kchve           kchve         kchve
	cosso(1) :00     coss(1) :00     coss     c	⊽	Attachment ID 2.Attachment ID 3.Attachments type-attach-06/76975464690 type-attach-06/76975464690 2.Attachments 2.Attachments 2.Attachments 2.Attachments	vala 44 61 468 468	Privat presenter. Presource 10 2.8msource 10 2.8	♥ Resource type Connect VPC VPC Connect Connect Connect Connect	Q 0.00.00, 39	Route type Propagated Propagated Propagated Propagated Propagated Propagated Propagated Propagated	▼ 8m 000000000000000000000000000000000000	Q         0.00.000 X         200           0.00.000 X         200 X         200 X           de state         64500         64500           Active         64500         64500
	concerts _00     c	Ψ	Artachment ID 2.httachments 19ar-4ttach-076498259aa6 19ar-4ttach-076498259aa6 19ar-4ttach-076591259aa6 2.httachments 2.httachments 2.httachments 2.httachments 2.httachments	v (0.0.0.0. = 0.0.0.0. = 461 461 468	Product procession Resources 10 2.8mscness up-of710405142(2)400 up-of8045142(2)400 up-of804512(2)400 up-of804512(2)400 2.8mscness	Resource type     Connect     VPC     VPC     VPC     Connect     Connect     Connect     Connect     Connect     Connect     Connect     Connect	Q 0.00.00 30 ▼	Roste type Propagated Propagated Propagated Propagated Propagated Propagated Propagated Propagated	▼ 8m 00 00 00 00 00 00 00 00 00 00 00 00 00	Q         0.00.000 X         200 X           0.00.000 X         200 X         200 X           ste state         500 X         500 X           ktive         500 X         500 X

# **Chapter 5: Glossary**

## <u>A</u>

## ASN

An Autonomous System Number (ASN) is a globally unique number which enables a group of networks to be identified over the internet and exchange routing data with other networks.

## AZ

Availability Zones (AZ) consist of one or more discrete data centers, each with redundant power, networking, and connectivity, and housed in separate facilities.

## В

## BGP

To enable access between your VMs and the outside world, you can configure an external or internal Border Gateway Protocol (BGP) connection between a gateway and a router in your physical infrastructure.

## <u>C</u>

## CIDR

Classless Inter-Domain Routing (CIDR) is a method for allocating IP addresses for IP routing.

## G

## GRE

Generic Routing Encapsulation (GRE) tunnels can be added to gateways to connect on-premises and cloud networks.

## Ν

## NAT

Network address translation (NAT) is a method of mapping an IP address space into another by modifying network address information in the IP header of packets while they are in transit across a traffic routing device.

## S

## S3

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance.

## Subnet

A subnet, or subnetwork, is a network inside a network.

## V

## VCO

An acronym that refers to VMware SD-WAN Orchestrator.

## VM

A Virtual Machine (VM) is a compute resource that uses software instead of a physical computer to run programs and deploy apps. One or more virtual "guest" machines run on a physical "host" machine.

## VNet

A Virtual Network (VNet) in Azure is the primary building block for private networks within the cloud, analogous to AWS's Virtual Private Cloud (VPC)

## VPC

Virtual Private Cloud (VPC) is a secure, isolated private cloud hosted within a public cloud.