



Compte rendu TP2

Virtual Networks

RT4 _ Groupe 1



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Task 1

1-

The screenshot shows the Microsoft Azure portal interface. At the top, there's a navigation bar with icons for VPN, search, and user profile. Below it, the main header says "Microsoft Azure" and "Search resources, services, and docs (G+/)". The main content area is titled "Azure services" and includes links for "Create a resource", "Resource groups", "All resources", "Subscriptions", "Private DNS zones", "Virtual machines", "Virtual networks", "Quickstart Center", "App Services", and "More services". A "Resources" section shows tabs for "Recent" and "Favorite". A modal dialog box is open in the center, prompting the user to "Create storage". It asks for a "Subscription" and has a dropdown menu set to "Azure for Students". There are "Create storage" and "Close" buttons at the bottom of the dialog. A tooltip "Cloud Shell terminal dialog" is visible at the bottom of the dialog box.

The screenshot shows the Microsoft Azure portal interface with the Cloud Shell terminal open. The terminal window has a dark blue background. At the top, it displays "PowerShell" and some connection status messages: "Requesting a Cloud Shell", "Connecting terminal...", "Welcome to Azure Cloud Shell", and "Type "az" to use Azure CLI". Below this, there's a command-line interface with several lines of text, including "MOTD: Azure Cloud Shell now includes Predictive IntelliSense! Learn more: https://aka.ms/CloudShell/IntelliSense", "VERBOSE: Authenticating to Azure ...", "VERBOSE: Building your Azure drive ...", and "PS /home/mouhithbenjemaa>". A context menu is open over the terminal window, showing options: "Upload", "Upload file" (which is highlighted in black), "Download", and "Manage file share". The URL "https://ux.console.azure.com/?region=francecentral&trustedAuthority=https%3A%2F%2Fportal.azure.com&l=en-en-us&feature.azureconsole=true#" is visible at the bottom of the terminal window.

2

Home >

Resource groups

Ministère de l'Enseignement Supérieur et de la Recherche Scientifique (merrs.tn)

+ Create Manage view Refresh Export to CSV Open query Assign tags

Filter for any field... Subscription equals all Location equals all Add filter

0 Unsecure resources 0 Recommendations

No grouping List view

Name ↑ Subscription ↑ Location ↑

cloud-shell-storage-westeurope Azure for Students West Europe

< Previous Page 1 of 1 Next > Showing 1 to 1 of 1 records. Give feedback

PowerShell Terminal container button

```
Welcome to Azure Cloud Shell  
Type "az" to use Azure CLI  
Type "help" to learn about Cloud Shell  
  
MOTD: Azure Cloud Shell now includes Predictive IntelliSense! Learn more: https://aka.ms/CloudShell/IntelliSense  
  
VERBOSE: Authenticating to Azure ...  
VERBOSE: Building your Azure drive ...  
PS /home/mouhibbenjemaa> [ ]
```

Home >

csb10032000621c2bf8

Storage account

Search Events Storage browser Data storage Containers File shares

Upload Open in Explorer Delete Move Refresh Open in mobile CLI / PS Feedback JSON View

Resource group (move) : cloud-shell-storage-westeurope Performance : Standard
Location : West Europe Replication : Locally-redundant storage (LRS)
Subscription (move) : Azure for Students Account kind : StorageV2 (general purpose v2)
Subscription ID : 85030eba-08e4-4093-ab86-fa81b9f39a8b Provisioning state : Succeeded

PowerShell Untitled

```
FILES  
+ .cloudinit  
+ Microsoft  
+ .bash_logout  
+ .bash_profile  
+ .bashrc  
+ .tmux.conf  
+ zshrc  
+ vnetvm-parameters.json  
+ vnetvm-template.json  
  
VERBOSE: Authenticating to Azure ...  
VERBOSE: Building your Azure drive ...  
PS /home/mouhibbenjemaa> [ ]
```

2-

3

Microsoft Azure | portal.azure.com

Home > csb10032000621c2bf8 Storage account

Events | Storage browser | Containers

Upload | Open in Explorer | Delete | Move | Refresh | Open in mobile | CLI / PS | Feedback | JSON View

Essentials

Resource group (move) : cloud-shell-storage-westeurope
Location : West Europe
Subscription (move) : Azure for Students
Subscription ID : 050200ba-09a1-1002-80e6-f0110020a0b1
Provisioning state : Succeeded

PowerShell | Untitled

```
MOTD: Azure Cloud Shell now includes Predictive IntelliSense! Learn more: https://aka.ms/CloudShell/IntelliSense
VERBOSE: Authenticating to Azure ...
VERBOSE: Building your Azure drive ...
PS /home/mouhibbenjemaa> $location1 = 'northeurope'
PS /home/mouhibbenjemaa> $rgName = 'tp2-rg1'
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa> New-AzResourceGroup -Name $rgName -Location $location1

ResourceGroupName : tp2-rg1
Location          : northeurope
ProvisioningState : Succeeded
Tags              :
ResourceId        : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1

PS /home/mouhibbenjemaa>
```

Terminal container button

3-

Microsoft Azure | portal.azure.com

Home > csb10032000621c2bf8 Storage account

Events | Storage browser | Containers

Upload | Open in Explorer | Delete | Move | Refresh | Open in mobile | CLI / PS | Feedback | JSON View

Essentials

Resource group (move) : cloud-shell-storage-westeurope
Location : West Europe
Subscription (move) : Azure for Students
Subscription ID : 050200ba-09a1-1002-80e6-f0110020a0b1
Provisioning state : Succeeded

PowerShell | Untitled

```
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa> New-AzResourceGroup -Name $rgName -Location $location1

ResourceGroupName : tp2-rg1
Location          : northeurope
ProvisioningState : Succeeded
Tags              :
ResourceId        : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1

PS /home/mouhibbenjemaa> $location2 = 'westeurope'
PS /home/mouhibbenjemaa> New-AzResourceGroupDeployment `>> -ResourceGroupName $rgName `>> -TemplateFile $HOME/vnetvm-template.json `>> -TemplateParameterFile $HOME/vnetvm-parameters.json `>> -location1 $location1 `>> -location2 $location2
```

Terminal container button

DeploymentName	:	vnetvm-template	
ResourceGroupName	:	tp2-rg1	
ProvisioningState	:	Succeeded	
Timestamp	:	2/24/2023 9:20:43 PM	
Mode	:	Incremental	
TemplateLink	:		
Parameters	:		
	Name	Type	Value
	vmSize	String	"Standard_D2s_v3"
	location1	String	"northeurope"
	location2	String	"westeurope"
	adminUsername	String	"louaykharouf"
	adminPassword	SecureString	null
Outputs	:		
	DeploymentDebugLogLevel	:	

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Microsoft Azure

Search resources, services, and docs (G+ /)

vnet00

Virtual network

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Address space

Connected devices

PowerShell

PS /home/mouhibbenjemaa> []

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Microsoft Azure

Search resources, services, and docs (G+ /)

Home > Resource groups > tp2-rg1 > vnet00 | Peerings >

Add peering

vnet00

This virtual network

Peering link name *

vnet00_to_vnet01

Traffic to remote virtual network ⓘ

Allow (default)

Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

Allow (default)

Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

Use this virtual network's gateway or Route Server

Use the remote virtual network's gateway or Route Server

None (default)

Remote virtual network

Peering link name *

vnet01_to_vnet00

Add

Microsoft Azure | portal.azure.com

Home > Resource groups > tp2-rg1 > vnet00 | Peerings >

Add peering

vnet00

Peering link name *

Virtual network deployment model Resource manager Classic

I know my resource ID

Subscription *

Virtual network *

Traffic to remote virtual network Allow (default) Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network Block traffic that originates from outside the remote virtual network Allow (default)

Virtual network gateway or Route Server None (default) Use this virtual network's gateway or Route Server Use the remote virtual network's gateway or Route Server

Add

Microsoft Azure | portal.azure.com

Home > Resource groups > tp2-rg1 > vnet00

vnet00 | Peerings

Virtual network

Peerings

Name	Peering status	Peer	Gateway transit
vnet00_to_vnet01	Updating	vnet01	Disabled

Added virtual network peering
Successfully added virtual network peering 'vnet00_to_vnet01' to 'vnet00'.

PS /home/mouhibbenjemaa> \$vnet00 = Get-AzVirtualNetwork -Name 'vnet00' -ResourceGroupName \$rgname
 PS /home/mouhibbenjemaa> \$vnet02 = Get-AzVirtualNetwork -Name 'vnet02' -ResourceGroupName \$rgname
 PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet00_to_vnet02' -VirtualNetwork \$vnet00 -
Add-AzVirtualNetworkPeering: A positional parameter cannot be found that accepts argument '-'.
 PS /home/mouhibbenjemaa> RemoteVirtualNetworkId \$vnet02.Id
RemoteVirtualNetworkId: The term 'RemoteVirtualNetworkId' is not recognized as a name of a cmdlet, function, script file, or executable program.
 Check the spelling of the name, or if a path was included, verify that the path is correct and try again.
 PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet00_to_vnet02' -VirtualNetwork \$vnet00 - RemoteVirtualNetworkId \$vnet02.Id
Add-AzVirtualNetworkPeering: A positional parameter cannot be found that accepts argument '-'.
 PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet00_to_vnet02' -VirtualNetwork \$vnet00 - RemoteVirtualNetworkId \$vnet02.Id

```
Name          : vnet00_to_vnet02
Id           : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet00/virtualNetworkPeerings/vnet00_to_vnet02
Etag         : W/"5650cc4d-f03a-4a73-9607-608eb623e924"
ResourceGroupName : tp2-rg1
VirtualNetworkName   : vnet00
PeeringSyncLevel    : RemoteNotInSync
PeeringState        : Initiated
ProvisioningState   : Succeeded
RemoteVirtualNetwork : {
    "Id": "/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet02"
}
AllowVirtualNetworkAccess : True
AllowForwardedTraffic  : False
AllowGatewayTransit   : False
UseRemoteGateways    : False
RemoteGateways       : null
PeeredRemoteAddressSpace : {
    "AddressPrefixes": [
        "10.52.0.0/22"
    ]
}
```

PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet00_to_vnet02' -VirtualNetwork \$vnet00 - RemoteVirtualNetworkId \$vnet02.Id

```
Name          : vnet00_to_vnet02
Id           : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet00/virtualNetworkPeerings/vnet00_to_vnet02
Etag         : W/"5650cc4d-f03a-4a73-9607-608eb623e924"
ResourceGroupName : tp2-rg1
VirtualNetworkName   : vnet00
PeeringSyncLevel    : RemoteNotInSync
PeeringState        : Initiated
ProvisioningState   : Succeeded
RemoteVirtualNetwork : {
    "Id": "/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet02"
}
AllowVirtualNetworkAccess : True
AllowForwardedTraffic  : False
AllowGatewayTransit   : False
UseRemoteGateways    : False
RemoteGateways       : null
PeeredRemoteAddressSpace : {
    "AddressPrefixes": [
        "10.52.0.0/22"
    ]
}
RemoteVirtualNetworkAddressSpace : {
    "AddressPrefixes": [
        "10.52.0.0/22"
    ]
}
```

PS /home/mouhibbenjemaa> [Terminal container button]

PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet02_to_vnet00' -VirtualNetwork \$vnet02 -RemoteVirtualNetworkId \$vnet00.Id

```
Name          : vnet02_to_vnet00
Id           : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet02/virtualNetworkPeerings/vnet02_to_vnet00
Etag         : W/"0668fe8-cb56-4094-8257-08219921e9be"
ResourceGroupName : tp2-rg1
VirtualNetworkName   : vnet02
PeeringSyncLevel     : FullyInSync
PeeringState         : Connected
ProvisioningState    : Succeeded
RemoteVirtualNetwork  : {
    "Id": "/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet00"
}
AllowVirtualNetworkAccess : True
AllowForwardedTraffic  : False
AllowGatewayTransit    : False
UseRemoteGateways      : False
RemoteGateways        : null
PeeredRemoteAddressSpace : {
    "AddressPrefixes": [
        "10.50.0.0/22"
    ]
}
RemoteVirtualNetworkAddressSpace : {
    "AddressPrefixes": [
        "10.50.0.0/22"
    ]
}
```

PS /home/mouhibbenjemaa> []

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PS /home/mouhibbenjemaa> \$vnet01 = Get-AzVirtualNetwork -Name 'vnet01' -ResourceGroupName \$rgname

PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet01_to_vnet02' -VirtualNetwork \$vnet01 -RemoteVirtualNetworkId \$vnet02.Id

```
Name          : vnet01_to_vnet02
Id           : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet01/virtualNetworkPeerings/vnet01_to_vnet02
Etag         : W/"989e10b6-bca6-430b-b423-bb58e44aaa23"
ResourceGroupName : tp2-rg1
VirtualNetworkName   : vnet01
PeeringSyncLevel     : RemoteNotInSync
PeeringState         : Initiated
ProvisioningState    : Succeeded
RemoteVirtualNetwork  : {
    "Id": "/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet02"
}
AllowVirtualNetworkAccess : True
AllowForwardedTraffic  : False
AllowGatewayTransit    : False
UseRemoteGateways      : False
RemoteGateways        : null
PeeredRemoteAddressSpace : {
    "AddressPrefixes": [
        "10.52.0.0/22"
    ]
}
RemoteVirtualNetworkAddressSpace : {
    "AddressPrefixes": [
        "10.52.0.0/22"
    ]
}
```

PS /home/mouhibbenjemaa> Add-AzVirtualNetworkPeering -Name 'vnet02_to_vnet01' -VirtualNetwork \$vnet02 -RemoteVirtualNetworkId \$vnet01.Id

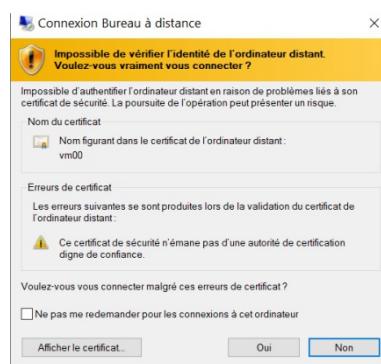
```

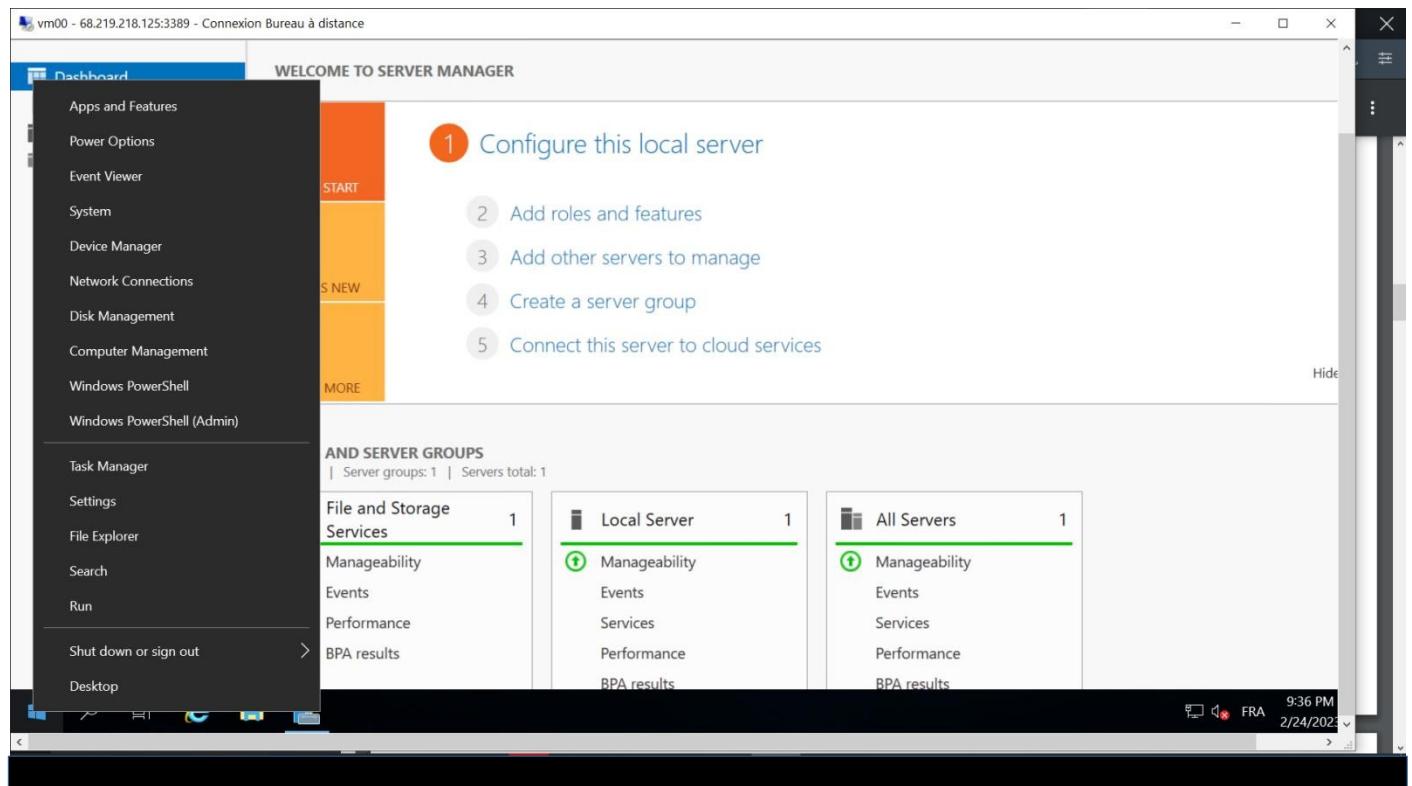
Name          : vnet02_to_vnet01
Id           : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet02/virtualNetworkPeerings/vnet02_to_vnet01
Etag         : W/"1b11e0fe-89b3-42d9-bfe5-b98cfab0bd15d"
ResourceGroupName : tp2-rg1
VirtualNetworkName : vnet02
PeeringSyncLevel : FullyInSync
PeeringState    : Connected
ProvisioningState : Succeeded
RemoteVirtualNetworkId : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet01
AllowVirtualNetworkAccess : True
AllowForwardedTraffic : False
AllowGatewayTransit : False
UseRemoteGateways : False
RemoteGateways : null
PeeredRemoteAddressSpace :
  "AddressPrefixes": [
    "10.51.0.0/22"
  ]
RemoteVirtualNetworkAddressSpace :
  "AddressPrefixes": [
    "10.51.0.0/22"
  ]
}

```

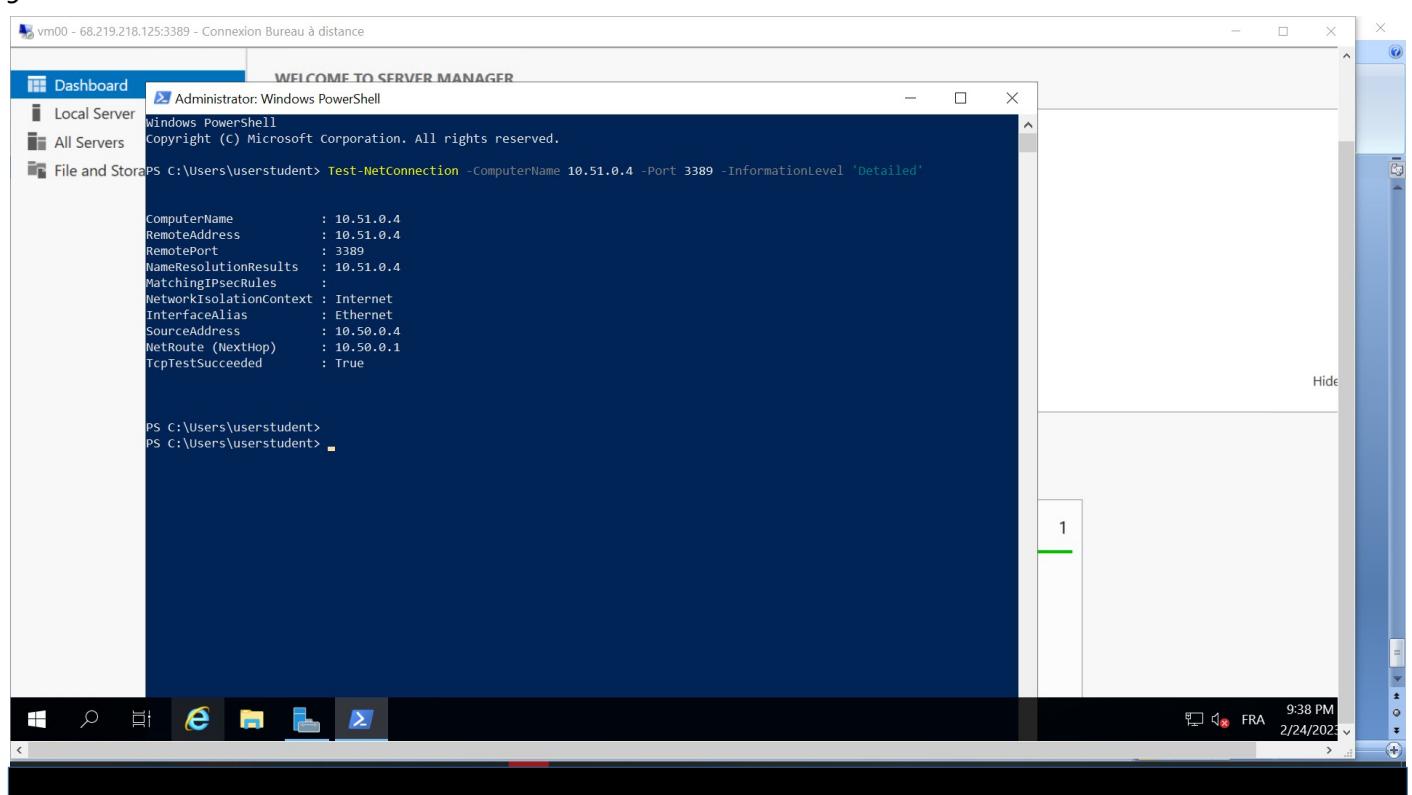
Terminal container button

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9-



10

10-

```
Administrator: Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\userstudent> Test-NetConnection -ComputerName 10.51.0.4 -Port 3389 -InformationLevel 'Detailed'

ComputerName      : 10.51.0.4
RemoteAddress    : 10.51.0.4
RemotePort       : 3389
NameResolutionResults : 10.51.0.4
MatchingIPsecRules   :
NetworkIsolationContext : Internet
InterfaceAlias    : Ethernet
SourceAddress     : 10.50.0.4
NetRoute (NextHop) : 10.50.0.1
TcpTestSucceeded  : True

PS C:\Users\userstudent>
PS C:\Users\userstudent> Test-NetConnection -ComputerName 10.52.0.4 -Port 3389 -InformationLevel 'Detailed'

ComputerName      : 10.52.0.4
RemoteAddress    : 10.52.0.4
RemotePort       : 3389
NameResolutionResults : 10.52.0.4
MatchingIPsecRules   :
NetworkIsolationContext : Internet
InterfaceAlias    : Ethernet
SourceAddress     : 10.50.0.4
NetRoute (NextHop) : 10.50.0.1
TcpTestSucceeded  : True
```

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```
Administrator: Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

PS C:\Users\userstudent> Test-NetConnection -ComputerName 10.52.0.4 -Port 3389 -InformationLevel 'Detailed'

ComputerName      : 10.52.0.4
RemoteAddress    : 10.52.0.4
RemotePort       : 3389
NameResolutionResults : 10.52.0.4
MatchingIPsecRules   :
NetworkIsolationContext : Internet
InterfaceAlias    : Ethernet
SourceAddress     : 10.51.0.4
NetRoute (NextHop) : 10.51.0.1
TcpTestSucceeded  : True

PS C:\Users\userstudent>
PS C:\Users\userstudent>
```

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```

ResourceGroupName : tp2-rg1
VirtualNetworkName : vnet02
PeeringSyncLevel : FullyInSync
PeeringState : Connected
ProvisioningState : Succeeded
RemoteVirtualNetwork : {
    "Id": "/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg1/providers/Microsoft.Network/virtualNetworks/vnet01"
}
AllowVirtualNetworkAccess : True
AllowForwardedTraffic : False
AllowGatewayTransit : False
UseRemoteGateways : False
RemoteGateways : null
PeeredRemoteAddressSpace : {
    "AddressPrefixes": [
        "10.51.0.0/22"
    ]
}
RemoteVirtualNetworkAddressSpace : {
    "AddressPrefixes": [
        "10.51.0.0/22"
    ]
}

PS /home/mouhibbenjemaa> Remove-AzResourceGroup -Name 'tp2-rg1' -Force -AsJob

```

Id	Name	PSJobTypeName	State	HasMoreData	Location	Command
2	Long Running O...	AzureLongRunni...	Running	True	localhost	Remove-AzResourceGroup

PS /home/mouhibbenjemaa> █

Task 2:

FILES

- ▶ .azure
- ▶ .Azure
- ▶ .cache
- ▶ .local
- ▶ clouddrive
- ▶ Microsoft
- .bash_logout
- .bash_profile
- .bashrc
- .tmux.conf
- .zshrc
- vnetvm-parameters_2.json
- vnetvm-parameters.json
- vnetvm-template_2.json
- vnetvm-template.json

Untitled

PS /home/mouhibbenjemaa> █

Upload destination: /home/mouhibbenjemaa
 vnetvm-template_2.json
COMPLETE

2-

```
PS /home/mouhibbenjemaa> $location = 'northeurope'
PS /home/mouhibbenjemaa> $rgName = 'tp2-rg2'
PS /home/mouhibbenjemaa> New-AzResourceGroup -Name $rgName -Location $location

ResourceGroupName : tp2-rg2
Location         : northeurope
ProvisioningState : Succeeded
Tags              :
ResourceId       : /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg2

PS /home/mouhibbenjemaa>
```

3-

```
PS /home/mouhibbenjemaa> New-AzResourceGroupDeployment `>> -ResourceGroupName $rgName `>> -TemplateFile $HOME/vnetvm-template_2.json `>> -TemplateParameterFile $HOME/vnetvm-parameters_2.json

DeploymentName      : vnetvm-template_2
ResourceGroupName   : tp2-rg2
ProvisioningState   : Succeeded
Timestamp          : 2/24/2023 9:56:38 PM
Mode               : Incremental
TemplateLink       :
Parameters          :
    Name      Type           Value
    ======  =====  =====
    vmSize    Array          ["Standard_D2s_v3", "Standard_D2s_v3", "Standard_DS1_v2"]
    vmName    String         "vm0"
    vmCount   Int            3
    adminUsername String        "userstudent"
    adminPassword SecureString null

Outputs          :
DeploymentLogLevel :
```

4-

A screenshot of a Microsoft Azure PowerShell terminal window. The title bar says "Microsoft Azure" and the address bar shows "portal.azure.com". The terminal content displays the output of a deployment command, including resource group details, parameters, and deployment logs.

```
ResourceGroupName : tp2-rg2
ProvisioningState : Succeeded
Timestamp        : 2/24/2023 9:56:38 PM
Mode             : Incremental
TemplateLink     :
Parameters       :

Name          Type      Value
vmSize        Array     ["Standard_D2s_v3","Standard_D2s_v3","Standard_DS1_v2"]
vmName         String    "vm0"
vmCount        Int      3
adminUsername  String    "userstudent"
adminPassword  SecureString

Outputs        :
DeploymentLogLevel : Information
```

```
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa> $location = (Get-AzResourceGroup -ResourceGroupName $rgName).location
PS /home/mouhibbenjemaa> $vmNames = (Get-AzVM -ResourceGroupName $rgName).Name
PS /home/mouhibbenjemaa> foreach ($vmName in $vmNames) {
>>   Set-AzVMExtension `
>>     -ResourceGroupName $rgName `
>>     -Location $location `
>>     -VMName $vmName `
>>     -Name 'networkWatcherAgent' `
>>     -Publisher 'Microsoft.Azure.NetworkWatcher' `
>>     -Type 'NetworkWatcherAgentWindows' `
>>     -TypeHandlerVersion '1.4'
>> }
```

A screenshot of a Microsoft Azure PowerShell terminal window. The title bar says "Microsoft Azure" and the address bar shows "portal.azure.com". The terminal content displays the output of a deployment command, including resource group details, parameters, and deployment logs. A "Terminal container button" is visible in the bottom right corner.

```
vmCount        Int      3
adminUsername  String    "userstudent"
adminPassword  SecureString

Outputs        :
DeploymentLogLevel : Information
```

```
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa> $location = (Get-AzResourceGroup -ResourceGroupName $rgName).location
PS /home/mouhibbenjemaa> $vmNames = (Get-AzVM -ResourceGroupName $rgName).Name
PS /home/mouhibbenjemaa> foreach ($vmName in $vmNames) {
>>   Set-AzVMExtension `
>>     -ResourceGroupName $rgName `
>>     -Location $location `
>>     -VMName $vmName `
>>     -Name 'networkWatcherAgent' `
>>     -Publisher 'Microsoft.Azure.NetworkWatcher' `
>>     -Type 'NetworkWatcherAgentWindows' `
>>     -TypeHandlerVersion '1.4'
>> }
```

RequestId	IsSuccess	Status Code	ReasonPhrase
	True	OK	OK
	True	OK	OK
	True	OK	OK

```
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa>
PS /home/mouhibbenjemaa>
```

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[Home](#) > [tp2-rg2](#) > [vnet01](#)

vnet01 | Properties

Virtual network

Name: vnet01

Location: northeurope

Resource group: tp2-rg2

Subscription ID: 85030eba-08e4-4093-ab86-fa81b9f39a8b

Resource ID: /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg2/providers/Microsoft.Network/virtualNetworks/vnet01

Resource GUID: 7efffe64-a190-40d0-80b7-3dc273cbd46c

Properties

- DNS servers
- Peerings
- Service endpoints
- Private endpoints
- Locks
- Monitoring

 - Alerts
 - Metrics
 - Diagnostic settings
 - Logs
 - Connection monitor (classic)
 - Diagram

- Automation

/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg2/providers/Microsoft.Network/virtualNetworks/vnet01

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[Home](#) > [tp2-rg2](#) > [vnet02](#)

vnet02 | Properties

Virtual network

Name: vnet02

Location: northeurope

Resource group: tp2-rg2

Subscription ID: 85030eba-08e4-4093-ab86-fa81b9f39a8b

Resource ID: /subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg2/providers/Microsoft.Network/virtualNetworks/vnet02

Resource GUID: 9791d114-6db4-480a-babb-7dfde841dba7

Properties

- Bastion
- DDoS protection
- Firewall
- Microsoft Defender for Cloud
- Network manager
- DNS servers
- Peerings
- Service endpoints
- Private endpoints
- Locks
- Monitoring

 - Alerts
 - Metrics
 - Diagnostic settings

/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg2/providers/Microsoft.Network/virtualNetworks/vnet02

7-

Home > tp2-rg2 > vnet00 | Peerings >

Add peering

vnet00

This virtual network

Peering link name *

 ✓

Traffic to remote virtual network ⓘ

Allow (default)

Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

Allow (default)

Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

Use this virtual network's gateway or Route Server

Use the remote virtual network's gateway or Route Server

None (default)

Remote virtual network

Peering link name *

 ✓

Add

Home > tp2-rg2 > vnet00 | Peerings >

Add peering

vnet00

Virtual network deployment model ⓘ

Resource manager

Classic

I know my resource ID ⓘ

Resource ID *

 ✓

Traffic to remote virtual network ⓘ

Allow (default)

Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

Allow (default)

Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

Use this virtual network's gateway or Route Server

Use the remote virtual network's gateway or Route Server

None (default)

Add

8-

Home > tp2-rg2 > vnet00 | Peerings >

Add peering

vnet00

This virtual network

Peering link name *****

vnet00_to_vnet02 ✓

Traffic to remote virtual network ⓘ

Allow (default)

Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

Allow (default)

Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

Use this virtual network's gateway or Route Server

Use the remote virtual network's gateway or Route Server

None (default)

Remote virtual network

Peering link name *****

vnet00_to_vnet02 ✓

Add

Home > tp2-rg2 > vnet00 | Peerings >

Add peering

vnet00

Virtual network deployment model ⓘ

Resource manager

Classic

I know my resource ID ⓘ

Resource ID *

/subscriptions/85030eba-08e4-4093-ab86-fa81b9f39a8b/resourceGroups/tp2-rg2/providers/Microsoft.Network/virtualN... ✓

Traffic to remote virtual network ⓘ

Allow (default)

Block all traffic to the remote virtual network

Traffic forwarded from remote virtual network ⓘ

Allow (default)

Block traffic that originates from outside the remote virtual network

Virtual network gateway or Route Server ⓘ

Use this virtual network's gateway or Route Server

Use the remote virtual network's gateway or Route Server

None (default)

Add

Home > tp2-rg2 > vnet00

vnet00 | Peerings

Virtual network

Add Refresh Sync

Name	Peering status	Peer	Gateway transit
vnet00_to_vnet01	Connected	vnet01	Disabled
vnet00_to_vnet02	Updating	vnet02	Disabled

Search Filter by name... Peering status == all

Address space
Connected devices
Subnets
Bastion
DDoS protection
Firewall
Microsoft Defender for Cloud
Network manager
DNS servers
Peerings
Service endpoints
Private endpoints
Properties
Locks

9-

Home > Network Watcher

Network Watcher | Connection troubleshoot

Subscription: Azure for Students

Resource group: tp2-rg2

Source type: Virtual machine

Virtual machine: vm00

Destination: Select a virtual machine (Specify manually)

URI, FQDN or IP address: 10.61.0.4

Protocol: TCP

Destination port: 3389

Metrics

Usage + quotas

Home > Network Watcher

Network Watcher | Connection troubleshoot

Microsoft

Search

Check

Status
Reachable

Agent extension version
1.4

Source virtual machine
vm00

Grid view Topology view

Hops

Name	IP address	Status	Next hop IP address	RTT
vm00	10.60.0.4	✓	10.61.0.4	2
nic1	10.61.0.4	✓	-	-

Average Latency in milliseconds
1

Minimum Latency in milliseconds

This screenshot shows the Microsoft Azure Network Watcher Connection troubleshoot interface. It displays a summary of the connection status, including the agent extension version (1.4) and the source virtual machine (vm00). The 'Grid view' section shows the network hops between the source and destination, with latency metrics. Below this, average and minimum latency are displayed.

10-

Home > Network Watcher

Network Watcher | Connection troubleshoot

Microsoft

Search

Source

Subscription * ⓘ
Azure for Students

Resource group *
tp2-rg2

Source type *
Virtual machine

Virtual machine *
vm00

Destination

Select a virtual machine Specify manually

URI, FQDN or IP address *
10.62.0.4

Probe Settings

Protocol ⓘ
TCP ICMP

Destination port * ⓘ
3389

This screenshot shows the configuration page for a connection probe. It specifies the source as a virtual machine named 'vm00' in the 'tp2-rg2' resource group of the 'Azure for Students' subscription. The destination is set to 'Specify manually' with the URI/FQDN/IP address '10.62.0.4'. The probe settings are configured for TCP on port 3389.

Home > Network Watcher

Network Watcher | Connection troubleshoot

Status
Reachable
Agent extension version
1.4
Source virtual machine
vm00

Grid view Topology view

Hops	Name	IP address	Status	Next hop IP address	RTT
1	vm00	10.60.0.4	Reachable	10.62.0.4	2
	nic2	10.62.0.4	Reachable	-	-

Average Latency in milliseconds
1
Minimum Latency in milliseconds
1
Maximum Latency in milliseconds
1

11-

This screenshot shows the Microsoft Azure Network Watcher Connection troubleshoot interface. It displays a network topology with a single hop from source VM 'vm00' to destination 'nic2'. The status is 'Reachable' for both. Metrics show average latency at 1ms, minimum at 1ms, and maximum at 1ms. The left sidebar includes options like Topology, Connection monitor (classic), and Network Performance Monitor.

Home > Network Watcher

Network Watcher | Connection troubleshoot

Subscription * Azure for Students
Resource group * tp2-rg2
Source type * Virtual machine
Virtual machine * vm01
Destination
Select a virtual machine Specify manually
URI, FQDN or IP address * 10.62.0.4
Probe Settings
Protocol TCP ICMP
Destination port * 3389

This screenshot shows the configuration for a new connection probe. The source is set to 'vm01' and the destination is '10.62.0.4' on port '3389'. The protocol is set to 'TCP'. The left sidebar includes options like IP flow verify, NSG diagnostics, and Next hop.

Network Watcher | Connection troubleshoot

Virtual machine *: vm01

Destination: Select a virtual machine or Specify manually

URI, FQDN or IP address *: 10.62.0.4

Probe Settings: Protocol (TCP)

Destination port *: 3389

Advanced settings

Check

Verify that the status is Unreachable since the two virtual networks are not peered with each other (virtual network peering is not transitive).

→ Configure routing between the virtual networks (vnet01 and vnet02) by enabling IP forwarding on the network interface of the vm00 virtual machine, enabling routing within its operating system, and configuring user-defined routes on the virtual networks.

nic0 | IP configurations

IP forwarding settings: Enabled

Virtual network: vnet00

IP configurations: Subnet *: subnet0

Name	IP Version	Type	Private IP address	Public IP address
ipconfig1	IPv4	Primary	10.60.0.4 (Dynamic)	-

13-

The screenshot shows the Microsoft Azure portal interface. On the left, there's a sidebar with various options like Bastion, Auto-shutdown, Backup, etc. The main area shows a virtual machine named 'vm00' with a 'Run command' section selected. A 'Run Command Script' dialog is open, titled 'Run PowerShell Script'. It displays a message 'Script execution complete' and a PowerShell script log. The log shows the command 'Install-WindowsFeature RemoteAccess -IncludeManagementTools'. Below the log is a 'Run' button. At the bottom, there's an 'Output' section with a table showing success, restart needed, exit code, and feature result for the command.

Run Command Script

RunPowerShellScript

Script execution complete

PowerShell Script

```
1 Install-WindowsFeature RemoteAccess -IncludeManagementTools
```

Run

Output

Success	Restart Needed	Exit Code	Feature Result
True	No	Success	{Remote Access}

https://portal.azure.com/?Microsoft_Azure_Education_correlationId=26d4284c8bd849fda998b5295c250348&Microsoft_Azure_Education_newA4E=true&Microsoft_Azure_Education_asoSubGuid=85030eba-08e4-4093-ab86-fa81b9f...

14- 15-

This screenshot is similar to the previous one but shows a different PowerShell script being run. The 'Run Command Script' dialog shows a log with four commands: 'Install-WindowsFeature -Name Routing -IncludeManagementTools -IncludeAllSubFeature', 'Install-WindowsFeature -Name "RSAT-RemoteAccess-Powershell"', 'Install-RemoteAccess -VpnType RoutingOnly', and 'Get-NetAdapter | Set-NetIPInterface -Forwarding Enabled'. The 'Output' section at the bottom shows the results of these commands, indicating success for all steps.

Run Command Script

RunPowerShellScript

Script execution complete

PowerShell Script

```
1 Install-WindowsFeature -Name Routing -IncludeManagementTools -IncludeAllSubFeature
2 Install-WindowsFeature -Name "RSAT-RemoteAccess-Powershell"
3 Install-RemoteAccess -VpnType RoutingOnly
4 Get-NetAdapter | Set-NetIPInterface -Forwarding Enabled
```

Run

Output

Success	Restart Needed	Exit Code	Feature Result
True	No	Success	{RAS Connection Manager Administration Kit...}
True	No	NoChangeNeeded { }	

16-

The screenshot shows the Microsoft Azure portal interface for creating a new route table. The top navigation bar includes the Microsoft Azure logo, a search bar, and various account and service icons. The main title is "Create Route table". Below it, there are tabs for "Basics", "Tags", and "Review + create".

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription *: Azure for Students

Resource group *: tp2-rg2

Instance details

Region *: North Europe

Name *: route12

Propagate gateway routes *: No (radio button selected)

At the bottom, there are buttons for "Review + create", "< Previous", and "Next : Tags >".

17-

The screenshot shows the Microsoft Azure portal displaying the deployment overview for a completed route table creation. The title is "Microsoft.RouteTable-20230224233512 | Overview".

Deployment

Overview (selected) **Inputs** **Outputs** **Template**

Your deployment is complete

Deployment name: Microsoft.RouteTable-20230224... Start time: 2/24/2023, 11:36:59 PM
Subscription: Azure for Students Correlation ID: ddb4e427-02bc-42d0-945b-5521d4101f42
Resource group: tp2-rg2

Deployment details **Next steps**

Go to resource

Give feedback **Tell us about your experience with deployment**

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The screenshot shows the Microsoft Azure portal interface. The left sidebar is for a route table named "route12". The main area displays the "Subnets" section. A modal dialog titled "Associate subnet" is open, prompting for a virtual network and a subnet. The "Virtual network" dropdown is set to "vnet01 (tp2-rg2)". The "Subnet" dropdown is set to "subnet0". An "OK" button is visible at the bottom right of the dialog.

The screenshot shows the Microsoft Azure portal interface. The left sidebar is for a route table named "route12". The main area displays the "Subnets" section. The "Associate" button has been clicked, and the results are shown in a table. One row is present: "Name" is "subnet0", "Address range" is "10.61.0.0/24", "Virtual network" is "vnet01", and "Security group" is "-". An ellipsis button is available for more actions.

Create Route table

Basics Tags Review + create

Project details

Select the subscription to manage deployed resources and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * Resource group * Create new

Instance details

Region * Name * Propagate gateway routes * Yes No

Microsoft.RouteTable-20230224234018 | Overview

Your deployment is complete

Deployment name: Microsoft.RouteTable-20230224... Start time: 2/24/2023, 11:40:54 PM
Subscription: Azure for Students Correlation ID: 48627ce2-4f9c-4ed9-8829-cb918b224d0c
Resource group: tp2-rg2

Deployment details

Next steps

[Go to resource](#)

[Give feedback](#)
[Tell us about your experience with deployment](#)

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20-

The screenshot shows the Microsoft Azure portal interface. The top navigation bar includes 'Microsoft Azure', a search bar, and various icons. The main title is 'route21 | Routes'. On the left, a sidebar lists 'Overview', 'Activity log', 'Access control (IAM)', 'Tags', 'Diagnose and solve problems', 'Settings' (with 'Configuration' selected), 'Routes' (selected), 'Subnets', 'Properties', and 'Locks'. Under 'Monitoring' and 'Automation', there are 'Alerts' and 'Automation' sections respectively. At the bottom, there are page navigation controls ('Page 1 of 1').

Add route

Route name * route-vnet2-to-vnet1

Address prefix destination * IP Addresses

Destination IP addresses/CIDR ranges * 10.61.0.0/22

Next hop type * Virtual appliance

Next hop address * 10.60.0.4

Ensure you have IP forwarding enabled on your virtual appliance. You can enable this by navigating to the respective network interface's IP address settings.

Add

21-

The screenshot shows the Microsoft Azure portal interface, similar to the previous one. The top navigation bar includes 'Microsoft Azure', a search bar, and various icons. The main title is 'route21 | Routes'. On the left, a sidebar lists 'Overview', 'Activity log', 'Access control (IAM)', 'Tags', 'Diagnose and solve problems', 'Settings' (with 'Configuration' selected), 'Routes' (selected), 'Subnets', 'Properties', and 'Locks'. Under 'Monitoring' and 'Automation', there are 'Alerts' and 'Automation' sections respectively. At the bottom, there are page navigation controls ('Page 1 of 1').

Successfully added route

Successfully added route 'route-vnet2-to-vnet1' to route table 'route21'.

Name	Address prefix	Next hop type	Next hop IP address	...
route-vnet2-to-vnet1	10.61.0.0/22	VirtualAppliance	10.60.0.4	...

Microsoft Azure | portal.azure.com

Home > Route tables > route21

Route tables

Ministère de l'Enseignement Supérieur et de la Re...

+ Create Manage view ...

Filter for any field...

Name
route12
route21

Page 1 of 1

route21 | Subnets

Route table

+ Associate

Overview

Activity log

Access control (IAM)

Tags

Diagnose and solve problems

Settings

Configuration

Routes

Subnets

Properties

Locks

Monitoring

Alerts

Automation

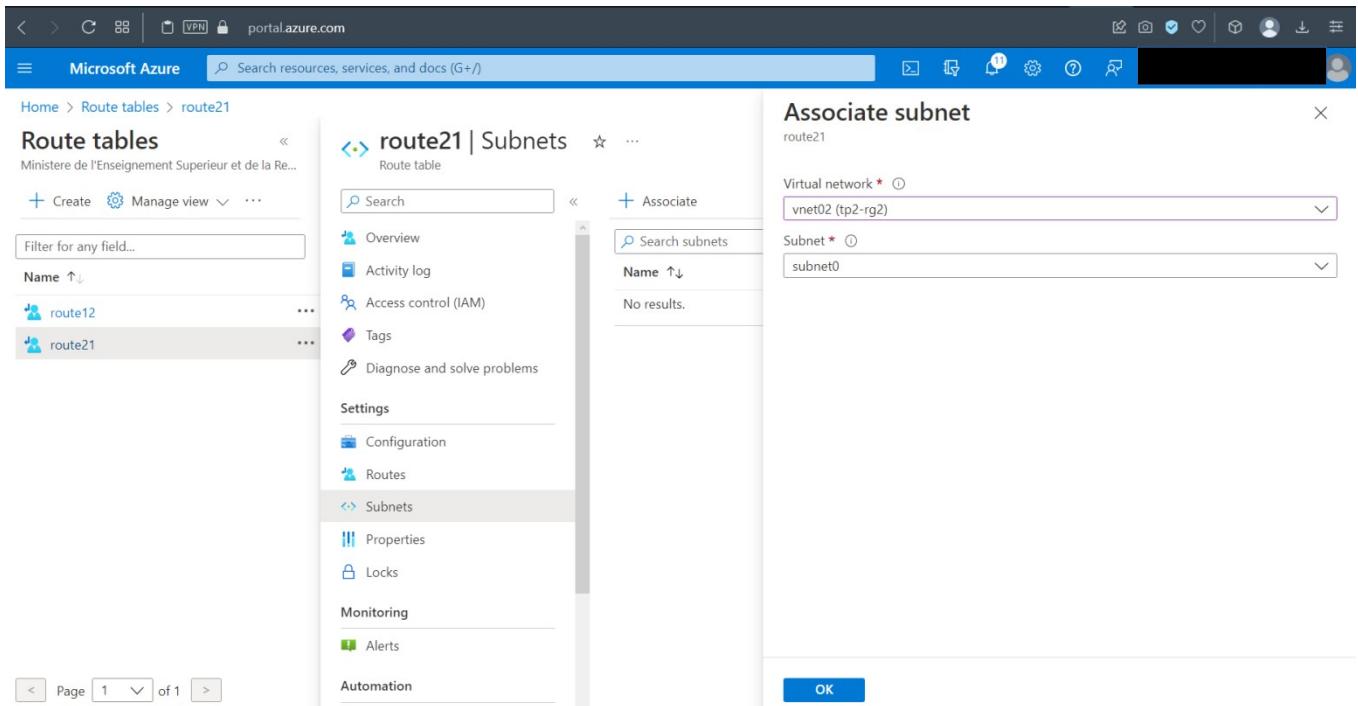
Associate subnet

route21

Virtual network * ⓘ
vnet02 (tp2-rg2)

Subnet * ⓘ
subnet0

OK



Microsoft Azure | portal.azure.com

Home > Route tables > route21

Route tables

Ministère de l'Enseignement Supérieur et de la Re...

+ Create Manage view ...

Filter for any field...

Name
route12
route21

Page 1 of 1

route21 | Subnets

Route table

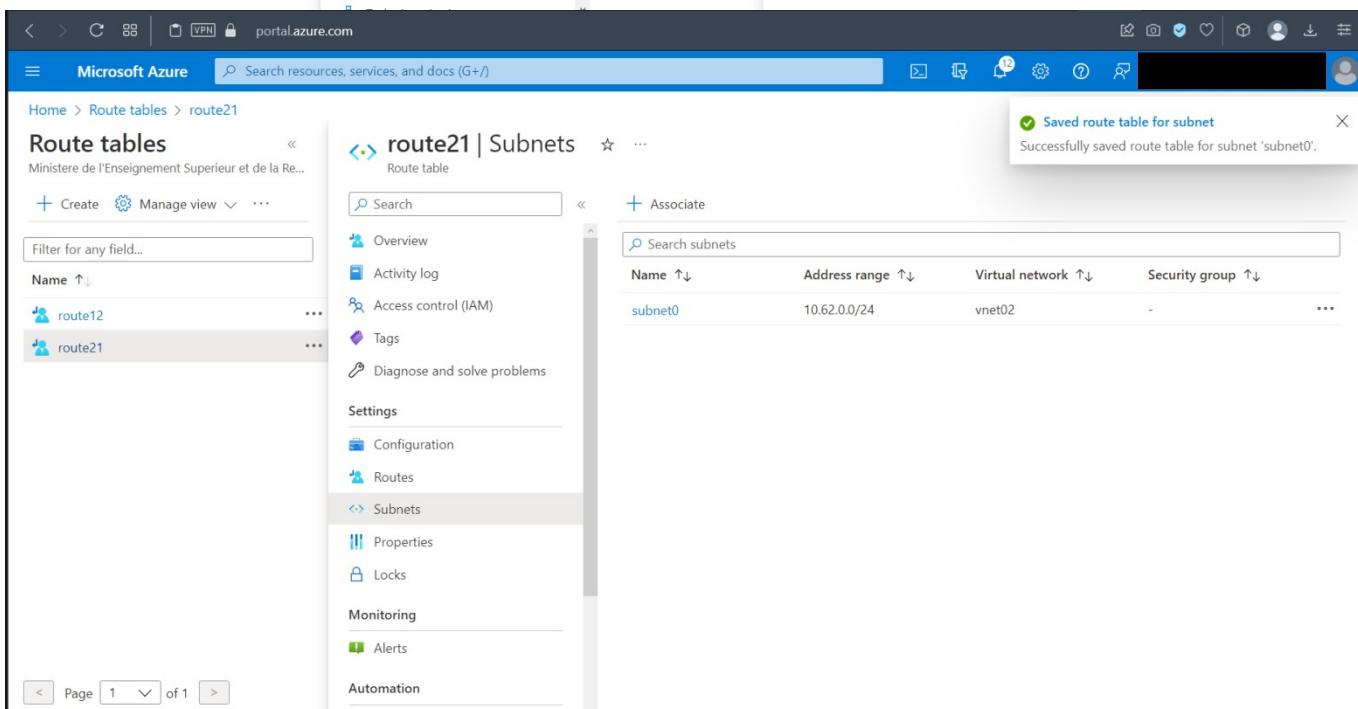
+ Associate

Search subnets

Name	Address range	Virtual network	Security group
subnet0	10.62.0.0/24	vnet02	-

Saved route table for subnet

Successfully saved route table for subnet 'subnet0'.



22-

The screenshot shows the Microsoft Azure portal interface for Network Watcher. The left sidebar lists various tools: Topology, Connection monitor (classic), Connection monitor, Network Performance Monitor, Network diagnostic tools (IP flow verify, NSG diagnostics, Next hop, Effective security rules, VPN troubleshoot, Packet capture, Connection troubleshoot), Metrics, and Usage + quotas. The 'Connection troubleshoot' option under 'Network diagnostic tools' is selected. The main pane displays a configuration form for a connection troubleshoot job. The 'Source' section includes 'Subscription' (Azure for Students) and 'Resource group' (tp2-rg2). The 'Source type' is set to 'Virtual machine' (vm01). The 'Destination' section has 'Specify manually' selected, with 'URI, FQDN or IP address' (10.62.0.4) and 'Destination port' (3389). Probe Settings show 'Protocol' (TCP) selected. A status bar at the bottom indicates 'Checking'.

The screenshot shows the Microsoft Azure portal interface for Network Watcher. The left sidebar is identical to the previous screen. The main pane displays the results of the connection troubleshoot job. It shows the 'Status' as 'Unknown' and the 'Agent extension version' as '1.4'. The 'Source virtual machine' is listed as 'vm01'. Below this, there are two tabs: 'Grid view' (selected) and 'Topology view'. The 'Grid view' section shows a table of 'Hops' with two rows: 'vm01' (IP 10.61.0.4, Status green, Next hop IP 10.62.0.4, RTT -) and 'Destination (10.62.0.4)' (IP 10.62.0.4, Status green, Next hop IP -, RTT -). Below the table, it says 'Probes Sent' 0 and 'Probes Failed' 0. A status bar at the bottom indicates 'Checking'.

23-

```

< > C 🌐 portal.azure.com
Microsoft Azure Search resources, services, and docs (G+)
PowerShell | ⚡ ? 🚧 📁 { } 🖼
Requesting a Cloud Shell. Succeeded.
Connecting terminal...
Welcome to Azure Cloud Shell
Type "az" to use Azure CLI
Type "help" to learn about Cloud Shell

MOTD: Azure Cloud Shell now includes Predictive IntelliSense! Learn more: https://aka.ms/CloudShell/IntelliSense

VERBOSE: Authenticating to Azure ...
VERBOSE: Building your Azure drive ...

PS /home/mouhibbenjemaa> Remove-AzResourceGroup -Name 'tp2-rg2' -Force -AsJob
Id      Name          PSJobTypeName   State       HasMoreData    Location        Command
--      --          --           --           --           --           --
2      Long Running 0... AzureLongRunni... Running     True          localhost      Remove-AzResourceGroup
PS /home/mouhibbenjemaa>

```

Terminal container button

Conclusion

❖ Sous-réseaux (subnets) :

Les sous-réseaux permettent aux utilisateurs de segmenter le réseau virtuel en un ou plusieurs sous-réseaux.

Ces sous-réseaux peuvent être séparés logiquement, et chaque sous-réseau est constitué d'un serveur.

On peut encore diviser un sous-réseau en deux types :

- ❖ Privé - Les instances peuvent accéder au web avec la passerelle NAT (Network Address Translation) qui est présente dans le sous-réseau public.
 - ❖ Public - Les instances peuvent accéder directement au réseau.
- ➔ Les réseaux virtuels et leurs pairage (peerings) peuvent être créés directement à partir du powershell du portail Azure, ce qui peut faciliter le travail et le processus du déploiement.

❖ L'appairage de réseaux virtuels (virtual network peering) :

L'appairage de réseaux virtuels (virtual network peering) permet d'établir une connection deux ou plusieurs réseaux virtuels dans Azure. Les réseaux virtuels apparaissent comme un seul réseau. Le trafic entre les machines virtuelles dans les réseaux virtuels pairs utilise l'infrastructure « Microsoft backbone ». Le trafic qui circule dans ces réseaux virtuels pairs est acheminé uniquement par le réseau privé de Microsoft, comme un trafic qui circule entre des machines virtuelles appartenant au même réseau.

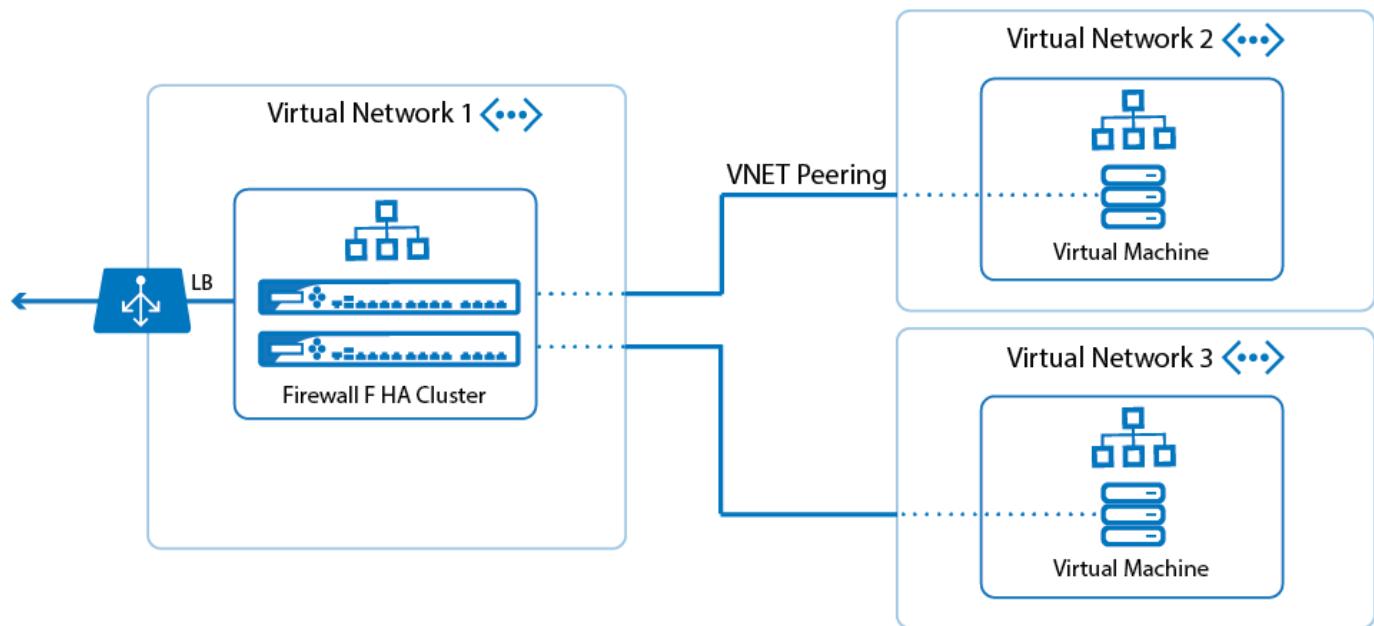
On peut citer 2 types d'appairage qui existent chez Azure :

- ❖ **L'appairage de réseaux virtuels :** Connexion de réseaux virtuels au sein d'une même région Azure.
- ❖ **Appairage de réseau virtuel global :** Connexion de réseaux virtuels entre régions Azure.

Parmi les avantages d'utilisation du peering de réseau virtuel on peut citer :

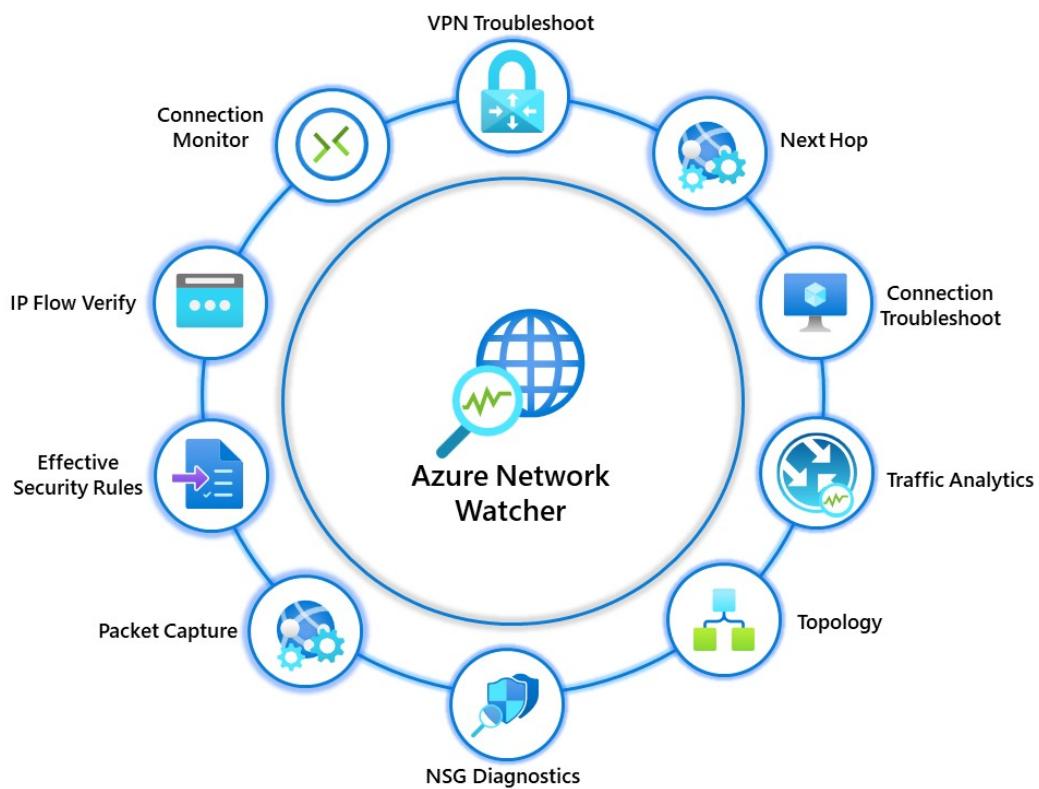
- ❖ La possibilité d'avoir une connexion ayant une faible latence et une large bande passante entre les ressources de différents réseaux virtuels.
- ❖ La possibilité de communiquer avec les ressources d'un autre réseau virtuel.
- ❖ La possibilité d'établir un transfert des données entre les réseaux virtuels à travers les abonnements Azure, les locataires Azure Active Directory, les modèles de déploiement et les régions Azure.
- ❖ La possibilité de faire un peering des réseaux virtuels créés par le gestionnaire de ressources Azure.
- ❖ La possibilité de mettre en parallèle un réseau virtuel créé via le Resource Manager avec un réseau virtuel créé via le modèle de déploiement classique.
- ❖ Aucun temps d'arrêt des ressources dans l'un ou l'autre des réseaux virtuels lors de la création de l'appairage, ou après la création de l'appairage.
- ❖ Le trafic réseau entre les réseaux virtuels appariés est privé. Comme on a déjà mentionné, le trafic des réseaux virtuels est conservé sur le réseau fédérateur de Microsoft. La communication entre les réseaux virtuels ne nécessite ni Internet public, ni passerelles, ni cryptage.

❖ **Exemple de virtual network peering :**



❖ **Azure network watcher :**

Il fournit des outils pour surveiller, diagnostiquer, afficher les métriques et activer ou désactiver les journaux pour les ressources d'un réseau virtuel Azure. Network Watcher est conçu pour surveiller et réparer la santé du réseau des produits IaaS (Infrastructure-as-a-Service), notamment les machines virtuelles (VM), les réseaux virtuels (VNets), les passerelles d'application, les équilibreurs de charge, etc. On l'a utilisé dans ce TP pour qu'il nous affiche l'état du peering des virtual networks, il affichera si les machines virtuelles (ou ressources qui font partie d'un certain réseau virtuel) sont « reachable » ou « unreachable » selon les configurations faites par celui qui configure les ressources via le portail Azure. C'est un outil très intéressant.



❖ Remote Access Server role :

Remote Access est un rôle serveur dans Microsoft Windows Server 2012 et Windows Server 2012 R2 qui fournit aux administrateurs un tableau de bord pour gérer, configurer et surveiller l'accès au réseau.

Remote Access peut être installé à l'aide de l'assistant d'ajout de rôles et de fonctionnalités.

Le rôle de serveur a trois méthodes ou technologies permettant l'accès au réseau :

- ❖ **Routing and Remote Access Service** - utilise un réseau privé virtuel (VPN) pour prendre en charge la connectivité.
- ❖ **DirectAccess** - permet aux utilisateurs finaux distants d'une organisation d'accéder en toute sécurité à des fichiers, des documents et d'autres ressources sans avoir besoin d'un VPN.
- ❖ **Web Application Proxy** - prend en charge l'accès des utilisateurs finaux aux applications depuis l'extérieur d'un réseau d'entreprise en utilisant l'authentification par proxy inverse.

➔ Dans le cadre de ce TP nous avons utilisé la première méthode : Routing and Remote Access Service (RRAS) avec la commande powershell « *Install-RemoteAccess -VpnType RoutingOnly* ».

Le service de routage et d'accès à distance (RRAS) est une suite de services réseau de la famille Windows Server qui permet à un serveur d'assurer les services d'un routeur classique. RRAS comprend une interface de programmation d'applications (API) qui facilite le développement d'applications et de processus pour l'administration d'une gamme de services réseau.