

# Configuration virtualization



## Installation manual for system providers

9/8/2021

### Product line neo, version 6.x

The described functions can be used with the following ASC products:

EVOIPneo

Please note that you can always find the most up-to-date technical documentation and product updates in the partner area on our website at <http://www.asctechnologies.com>.

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## General information

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## 2 Introduction

This document describes:

- The configuration in [VMs](#) in VMware
- The installation of a [neo](#) server by means of VMware templates
- The installation of a [neo](#) servers by means of Google templates
- The configuration of [VMs](#) in HyperV
- Further configurations required for the operation of the EVOIP[neo](#) software in virtualized environments



For information about the installation and configuration of Microsoft Windows refer to the respective installation manual for system providers *Configuration Windows Server 2012 R2*, *Configuration Windows Server 2016* or *Configuration Windows Server 2019*.



In virtual environments, you can exclusively use network drives for archiving, import, and export of data. Internal or [USB](#) drives are not supported as performance issues may occur when trying to access a drive that is no longer available.

### 3 System requirements



Exclusively install software approved by ASC!

For information about approved software refer to the current [neo Integration Overview](#) in the ASC Partner Portal.

To be able to configure the virtualization in the application System Configuration, the customer-specific license file must have been imported. For further information about licensing refer to the administration manual *System Configuration - License administration*.



Virtual machines must not be cloned.

The volume IDs of the drives in Windows must be unambiguous in a virtual [neo](#) system. This means that in a distributed [neo](#) system, the volume ID must not exist more than once. You can run a query of the volume IDs in the Windows command line prompt by entering the command `MOUNTVOL /L`.

#### ATTENTION!

[neo](#) is a near real-time application which cannot work with resource sharing. Therefore, all VMware resources must be assigned exclusively to the virtual [neo](#) machines and drives must be configured as *Thick*. If this precondition is not fulfilled, loss of recordings is imminent!

For information about the system requirements for virtual environments refer to the installation manual *Installation requirements*.

## 4 VMware



For a virtualization, VMware Tools must be installed.

## 4.1 Compatible VMware features

VMware ESX/ESXi Server features	Compatibility
VM Templates (OVAs, OVFes)	Partially <sup>3</sup>
Copy Virtual Machine	Partially <sup>4</sup>
Restart Virtual Machine on Different ESXi Host	Yes <sup>1</sup>
Resize Virtual Machine	Yes <sup>1, 2</sup>
Multiple Physical NICs and vNICs	Yes
VMware High Availability (HA)	No
VMware vNetwork Distributed Switch	No
VMware vMotion	No
Long Distance vMotion	No
VMware Storage vMotion	No
VMware Consolidated Backup (VCB)	No
VMware Data Recovery (DR, VDR)	No
VMware Snapshots	Yes <sup>1</sup>
VMware Fault Tolerance (FT)	No
VMware vCenter Converter	Yes
VMware vShield	No
Virtual Appliance Packaging of UC apps	No
3rd-Party VM-based Backup Tools (e. g. Veeam, Viziocore, esXpress)	Yes <sup>1</sup>
3rd-Party Physical To Virtual (P2V) Migration Tools	Yes <sup>1</sup>
VMware Boot from SAN	Yes <sup>1</sup>
All not-listed	On request

<sup>1</sup> Downtimes are possible

<sup>2</sup> No downsizing possible

<sup>3</sup> Only for OVFes provided by ASC

<sup>4</sup> Cloning VM with Windows installation (without *neo*) allowed

## 4.2 Installation and configuration of a neo VM by means of a VMware template

The following recording architecture types may be installed and configured:

- *neo* VM with Core and DB
- *neo* VM with Core and external DB
- *neo* VM without Core and with DB
- *neo* VM without Core and without DB

For the installation and configuration, vCenter is used.

1. Open a browser and connect with the web interface of vCenter.
2. Click on vSphere Client (HTML5) - partial functionality.



Fig. 1: vSphere Client (HTML5) - partial functionality

3. In the entry field *User name*, enter your e-mail address.

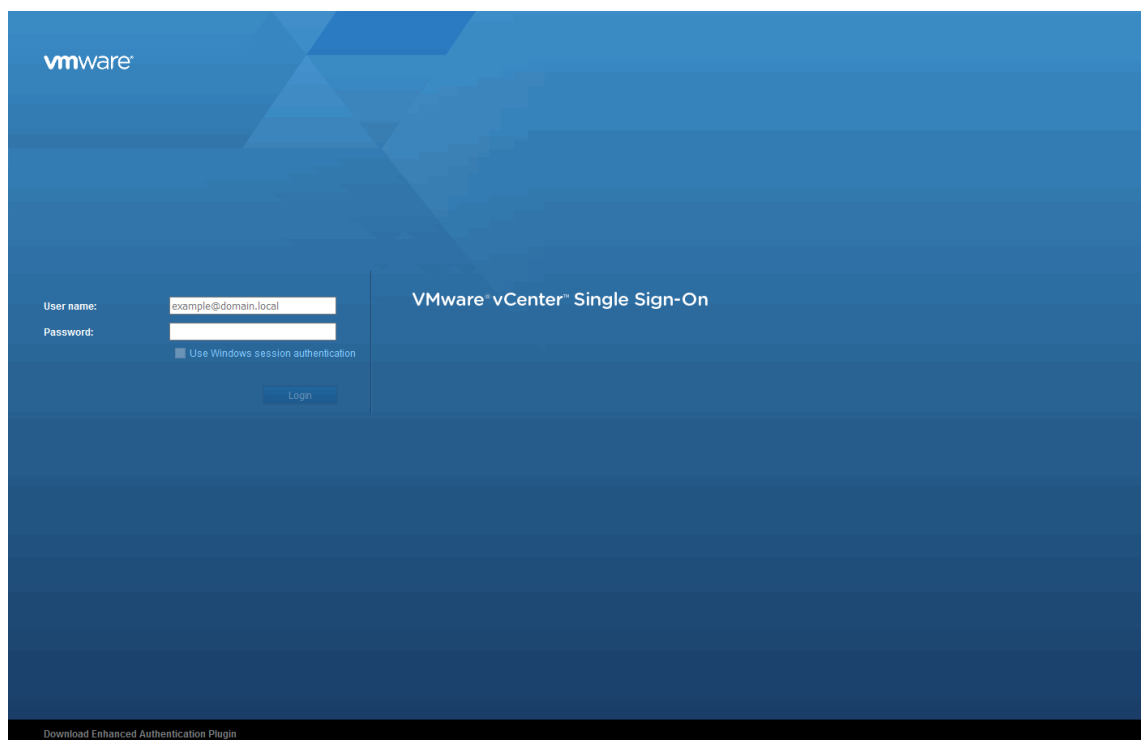


Fig. 2: Enter user name and password

4. In the entry field *Password*, enter your password.
5. Click on the button *Login*.
6. In the structure view, right-click on the directory where you would like to install your VM.
  - ⇒ A context menu appears.
7. Click on the entry *Deploy OVF Template* in the context menu.



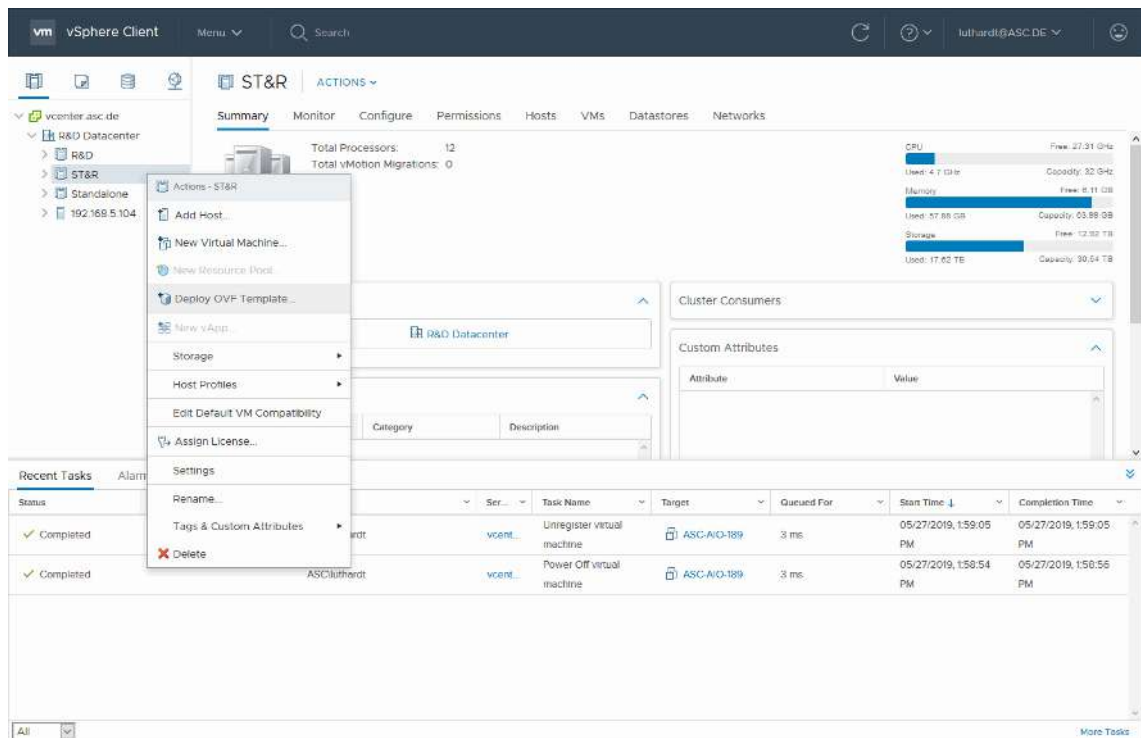


Fig. 3: Deploy OVF template

#### 8. Activate the option *Local file*.

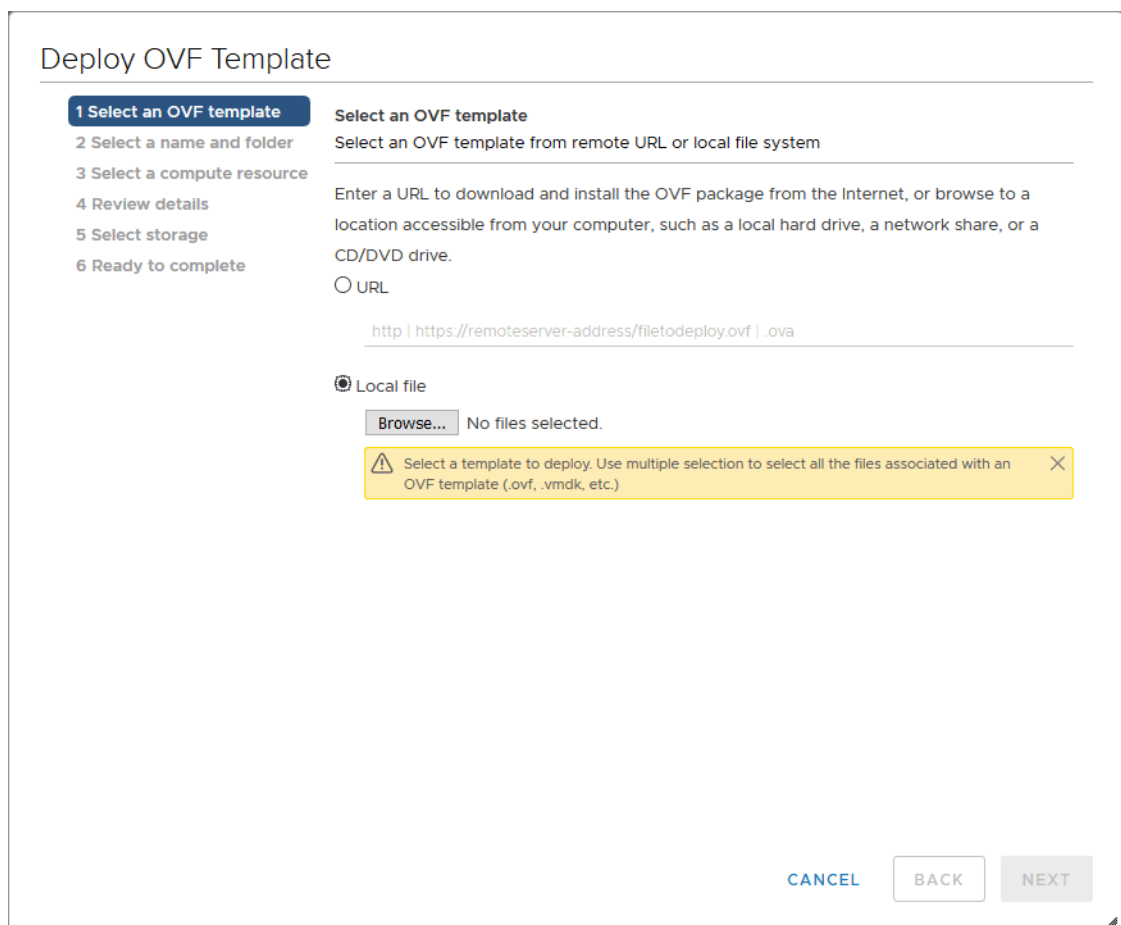


Fig. 4: Select OVF template

#### 9. Click on the button *Browse*.

⇒ The following window appears:

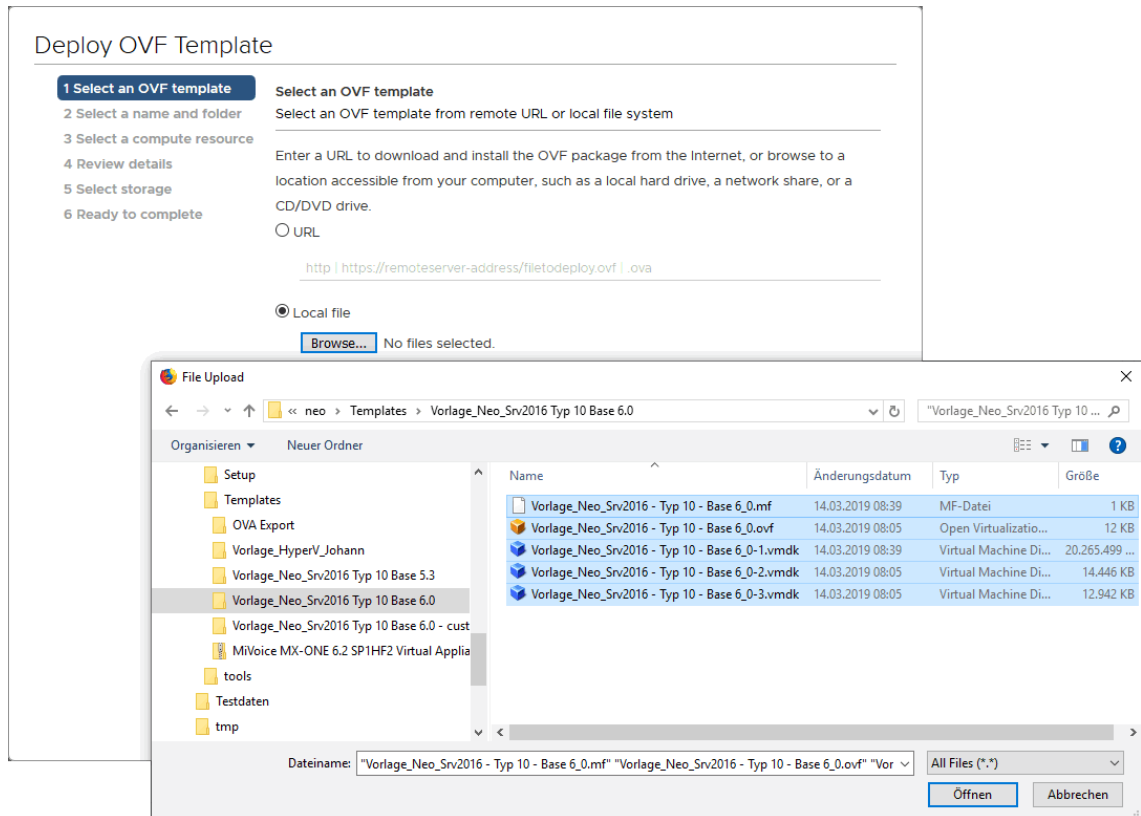


Fig. 5: Select OVF template

10. In the structure view, click on the directory with the neo installation files.
11. Select all files in the structure view.
12. Click on the button *Open*.
13. Click on the button *NEXT*.

## Deploy OVF Template

1 Select an OVF template

2 Select a name and folder

3 Select a compute resource

4 Review details

5 Select storage

6 Ready to complete

### Select an OVF template

Select an OVF template from remote URL or local file system

Enter a URL to download and install the OVF package from the Internet, or browse to a location accessible from your computer, such as a local hard drive, a network share, or a CD/DVD drive.

☐ URL

☒ Local file

5 files selected.

CANCEL

BACK

NEXT

Fig. 6: Select OVF template

14. Enter a name in the entry field *Virtual machine name*.

## Deploy OVF Template

✓ 1 Select an OVF template

**2 Select a name and folder**

3 Select a compute resource

4 Review details

5 Select storage

6 Ready to complete

Select a name and folder

Specify a unique name and target location

Virtual machine name:

Select a location for the virtual machine.

▼ vcenter.asc.de

▼ R&D Datacenter

> Discovered virtual machine

> linked clones Vorlagen

> M&D

> R&D

> SCSI

> **ST&R**

> Standalone

> Templates

> zum löschen

CANCEL

BACK

NEXT

Fig. 7: Select name and folder

15. Select a storage location for the virtual machine.
16. Click on the button *NEXT*.
17. Select the computing resource.

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### Deploy OVF Template

✓ 1 Select an OVF template

✓ 2 Select a name and folder

3 Select a compute resource

4 Review details

5 Select storage

6 Ready to complete

#### Select a compute resource

Select the destination compute resource for this operation

✓ R&D Datacenter

> R&D

✓ ST&R

192.168.5.118

> Standalone

> 192.168.5.104

#### Compatibility

✓ Compatibility checks succeeded.

CANCEL

BACK

NEXT

Fig. 8: Select computing resource

18. Click on the button *NEXT*.
19. Click on the button *NEXT*.

### Deploy OVF Template

✓ 1 Select an OVF template

✓ 2 Select a name and folder

✓ 3 Select a compute resource

**4 Review details**

5 Select storage

6 Select networks

7 Customize template

8 Ready to complete

Review details

Verify the template details.

Publisher	No certificate present
Product	NEO - Base Installation
Version	5.3.0
Description	[Verantwortlicher] Schillinger [Betriebssystem] Windows Server 2016 [IP] -- [Kommentar] Vorlage für Neo Template (extern)
Download size	Unknown
Size on disk	Unknown (thin provisioned)
	270.0 GB (thick provisioned)

CANCEL

BACK

NEXT

Fig. 9: Check details

20. For *Select virtual disk format*, select the required format for the **VM** from the drop-down list.

### Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- 5 Select storage**
- 6 Select networks
- 7 Customize template
- 8 Ready to complete

**Select storage**  
Select the storage for the configuration and disk files

☐ Encrypt this virtual machine (Requires Key Management Server)

Select virtual disk format: Thin Provision

VM Storage Policy: Datastore Default

Name	Capacity	Provisioned	Free	Type
local-118	1.08 TB	2.98 TB	9.22 GB	VM
V10-ISOs	90.22 GB	17.11 GB	73.11 GB	NF
VM-0	1.46 TB	435.64 GB	1.16 TB	VM
VM-1	1.5 TB	979 MB	1.5 TB	VM
VM-10	1.46 TB	153.52 GB	1.31 TB	VM
VM-11	1.46 TB	1,011.47 GB	616.48 GB	VM
VM-12	1.46 TB	475.37 GB	1 TB	VM
VM-3	1.46 TB	980 MB	1.46 TB	VM

Compatibility

✓ Compatibility checks succeeded.

CANCEL BACK NEXT

Fig. 10: Select storage location

21. Select the storage location for the **VM** storage policy.
22. Click on the button **NEXT**.
23. In the field *Destination Network*, select the required format for the DMZ2 network from the drop-down list.

### Deploy OVF Template

✓ 1 Select an OVF template

✓ 2 Select a name and folder

✓ 3 Select a compute resource

✓ 4 Review details

✓ 5 Select storage

**6 Select networks**

7 Customize template

8 Ready to complete

#### Select networks

Select a destination network for each source network.

Source Network	Destination Network
DMZ2	DMZ2
1 items	

#### IP Allocation Settings

IP allocation: Static - Manual

IP protocol: IPv4

CANCEL

BACK

NEXT

Fig. 11: Select networks

24. Click on the button *NEXT*.
25. Complete all required fields.



### Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- ✓ 5 Select storage
- ✓ 6 Select networks
- 7 Customize template**
- 8 Ready to complete

#### Customize template

Customize the deployment properties of this software solution.

✓ All properties have valid values
×

Uncategorized	20 settings
INSTALLUSER	Asc-User
NEOLANGUAGE	en_US;de_DE
IP-address	192.168.171.189
INSTALLPATH	\\rd-nas2\neo\Setup\6.0.0
NEOMODE	AllInOne
DBPORT	port of database server
DBTYPE	for external db only Postgres
DNSERVER	192.168.168.11

CANCEL
BACK
NEXT

Fig. 12: Adjust template

The following parameters are available:

Parameter	Description
<i>INSTALLUSER</i>	Enter the user to access the installation path.
<i>NEOLANGUAGE</i>	Enter the languages to be installed for <i>neo</i> , <i>en_US</i> ; <i>de_DE</i> .
<i>IP-address</i>	Enter the IP address of the network.
<i>INSTALLPATH</i>	Enter the path to the <i>neo</i> installation files. The path must not contain more than one ISO file. The ISO file is used automatically for the setup.
<i>NEOMODE</i>	From the drop-down list, select one of the following options: <ul style="list-style-type: none"> <li><i>AllInOne</i> = <i>neo-VM</i> with Core and with <i>DB</i></li> <li><i>external db</i> = <i>neo-VM</i> with Core and with external <i>DB</i></li> <li><i>without core</i> = <i>neo-VM</i> without Core and with <i>DB</i></li> <li><i>without core/db</i> = <i>neo-VM</i> without Core and without <i>DB</i></li> </ul>
<i>DBPORT</i>	Enter the value 1433 for MSSQL Standard. If a Named Instance is used, enter the differing port. Enter the value 5432 for POSTGRES.  This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>DBTYPE</i>	From the drop-down list, select one of the following options: <ul style="list-style-type: none"> <li><i>Postgres</i></li> <li><i>MSSQL</i></li> </ul> This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .

Parameter	Description
<i>DNSSERVER</i>	Enter the IP address for the DNS network.
<i>AIPADDRESS</i>	Enter the IP address for the <a href="#">AIP</a> (Core).  This information is not required for NEOMODE <i>AllInOne</i> or for <i>external db</i> .
<i>DBINSTANCE</i>	If you use MSSQL and Named Instance, enter the name of the Named Instance. If no information is entered, the ASC default is entered.  This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>POSTGRESHOST</i>	Option:  Enter the IP address for the DB which requires remote access (e. g. with remote recorder). You can create several IP/Netmasks separated by semicolons. The format IP/Netmask is mandatory.
<i>INSTALLPASSWORD</i>	Enter the password to access the installation path.
<i>COMPUTERNAME</i>	Option:  Enter the computer name. Observe Microsoft's conventions!
<i>DBUSER</i>	Enter the external DB user. If no information is entered, the ASC default is entered.  This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>DEFAULTNTP</i>	Option:  Enter the IP address for the <a href="#">NTP</a> server of <i>neo</i> .
<i>CLUSTERID</i>	Option:  Enter the cluster ID. The server name is entered as default ID here. For All-in-One systems you can apply this ID. If you set up a multi-server system with several application servers, you must replace the default ID for all application servers with another arbitrary cluster ID which is identical for all application servers.
<i>DBIP</i>	Enter the IP address for the external DB.  This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>default gateway</i>	Enter the IP address for the network.
<i>netmask</i>	Enter the IP address for the network mask.
<i>DBPASSWORD</i>	Enter the password for the external DB. If no information is entered, the ASC default is entered.  This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .

26. Click on the button *NEXT*.

27. Click on the button *FINISH*.

### Deploy OVF Template

- ✓ 1 Select an OVF template
- ✓ 2 Select a name and folder
- ✓ 3 Select a compute resource
- ✓ 4 Review details
- ✓ 5 Select storage
- ✓ 6 Select networks
- ✓ 7 Customize template
- 8 Ready to complete**

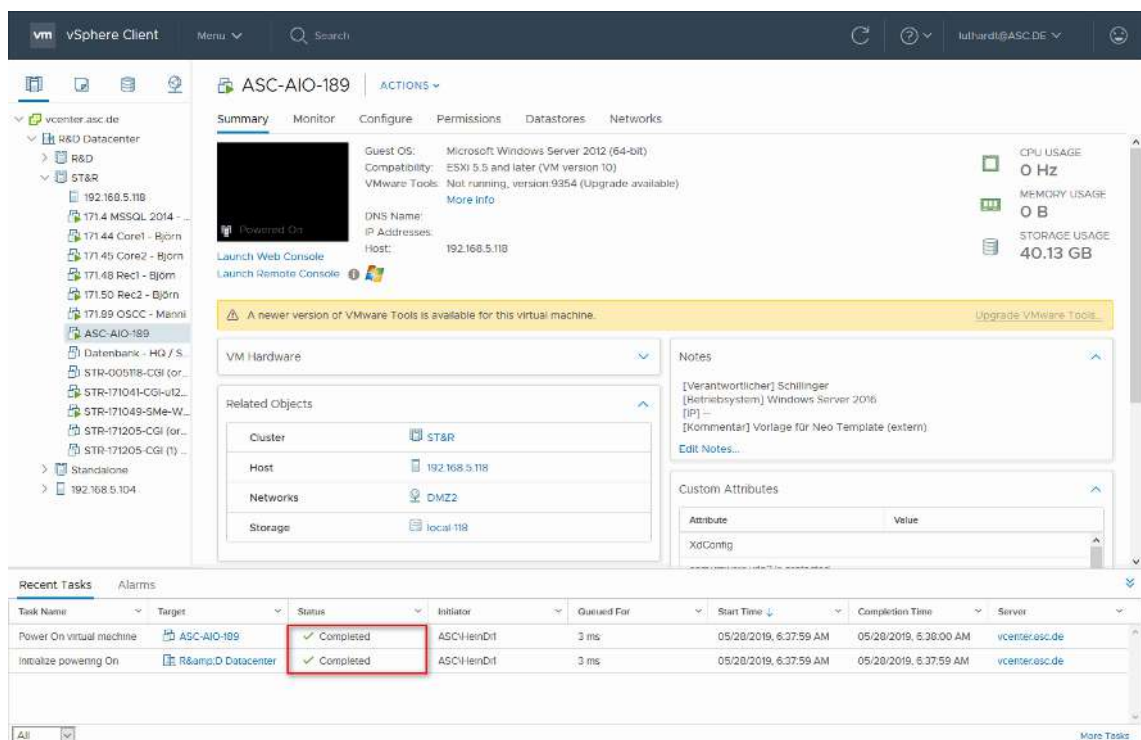
**Ready to complete**  
Click Finish to start creation.

Provisioning type	Deploy from template
Name	ASC-AIO-189
Template name	Vorlage_Neo_Srv2016 - Typ 10 - Base 6_0
Download size	Unknown
Size on disk	270.0 GB
Folder	ST&R
Resource	192.168.5.118
Location	local-118
Storage mapping	1
All disks	Datastore: local-118; Format: Thick Provision Lazy Zeroed
Network mapping	1
DMZ2	DMZ2
IP allocation settings	
IP protocol	IPV4
IP allocation	Static - Manual

[CANCEL](#)
[BACK](#)
[FINISH](#)

Fig. 13: Ready to finish

28. The successful completion of creating the VM is displayed in the table.



The screenshot shows the vSphere Client interface. On the left, a tree view shows the hierarchy: vcenter.asc.de > R&D Datacenter > ST&R > 192.168.5.118 > ASC-AIO-189. The main pane shows the 'Summary' tab for the VM 'ASC-AIO-189'. It displays details like Guest OS (Microsoft Windows Server 2012), Compatibility (ESX: 5.5 and later), and DNS Name. A yellow banner indicates a newer version of VMware Tools is available. Below, the 'VM Hardware' section shows the configuration: Cluster (ST&R), Host (192.168.5.118), Networks (DMZ2), and Storage (local-118). At the bottom, the 'Recent Tasks' table shows two completed tasks:

Task Name	Target	Status	Initiator	Queued For	Start Time	Completion Time	Server
Power On virtual machine	ASC-AIO-189	✓ Completed	ASCH-tenDf	3 ms	05/20/2019, 6:37:59 AM	05/20/2019, 6:38:00 AM	vcenter.asc.de
Initialize powering On	R&D Datacenter	✓ Completed	ASCH-tenDf	3 ms	05/20/2019, 6:37:59 AM	05/20/2019, 6:37:59 AM	vcenter.asc.de

Fig. 14: VM creation completed

29. In the structure view, right-click on the directory where you have created the new VM.

⇒ A context menu appears.

30. Click on the entry *Power > Power On* in the context menu.

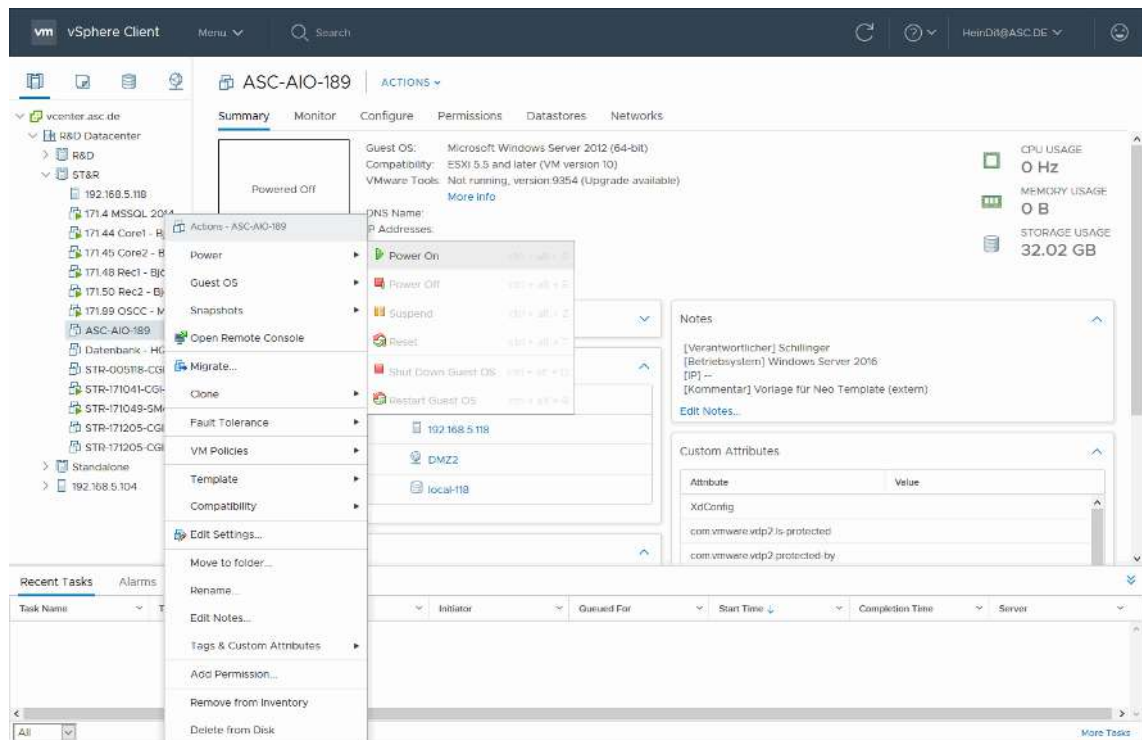


Fig. 15: Power on

31. The configurations script is started automatically.

32. Click on the small **VM** window to see the progress of the configuration.

⇒ The **VM** is displayed in a separate tab.

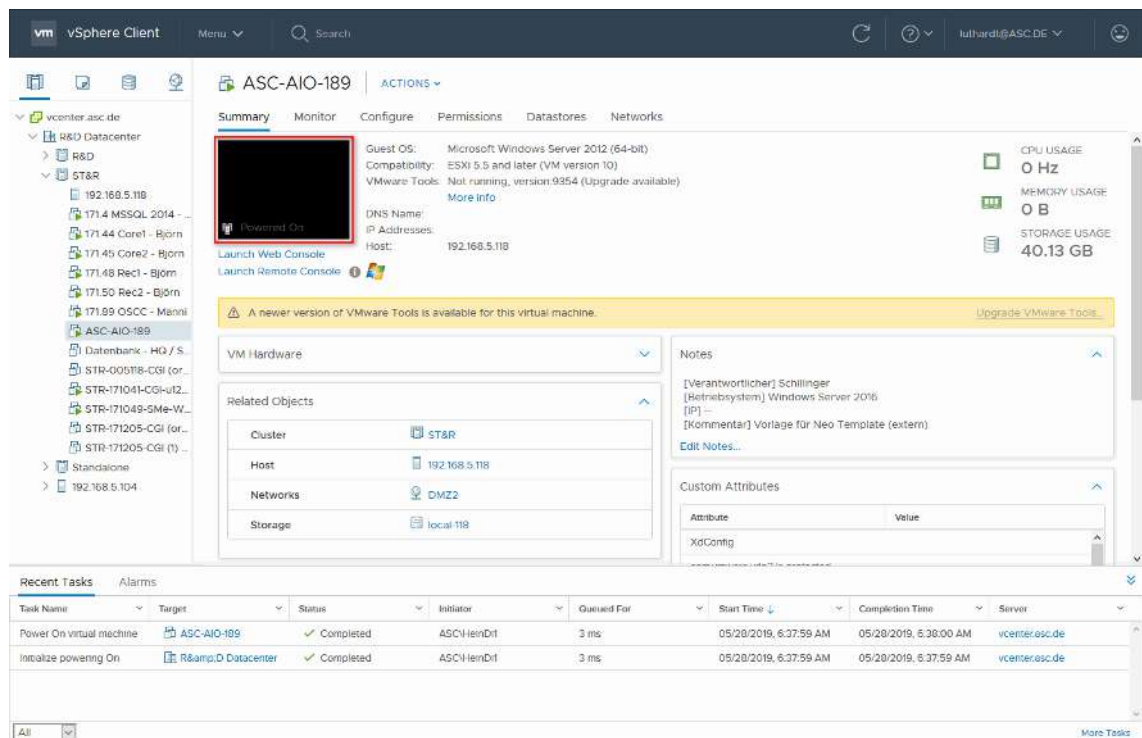


Fig. 16: Display VM in a separate tab of the browser

33. Change to the tab **VM** in the browser.

34. During the configuration, the **VM** is restarted several times automatically.

35. Upon completing the basic configuration, the **VM** is switched off automatically.

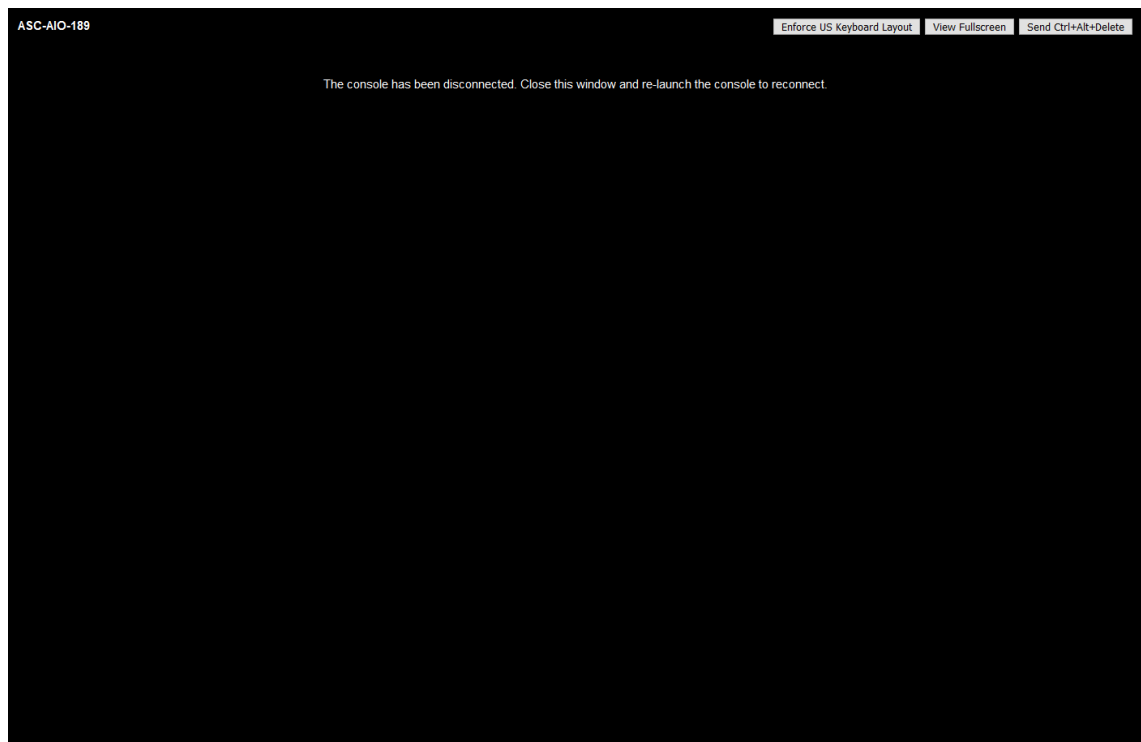


Fig. 17: VM switched off automatically

36. Close the tab **VM**.

37. In the structure view, right-click on the directory where you have created the new **VM**.

⇒ A context menu appears.

38. Click on the entry **Power > Power On** in the context menu.

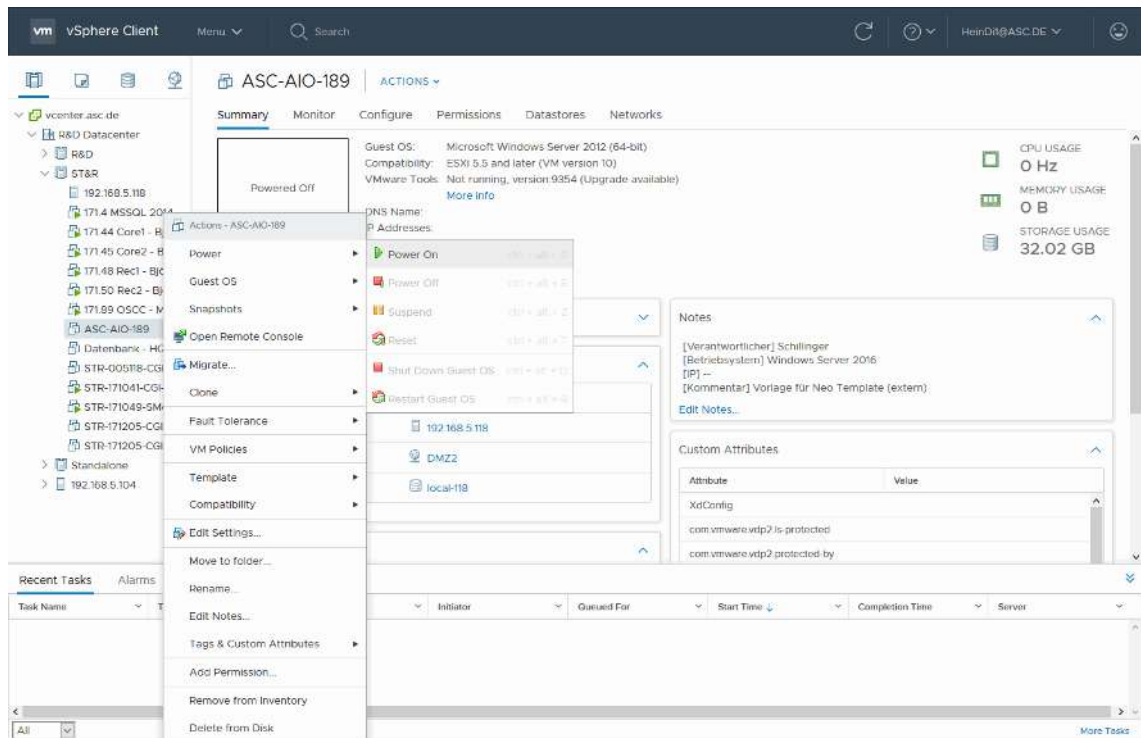


Fig. 18: Power on

39. Click on the small **VM** window.

⇒ The **VM** is displayed in a separate tab.

40. Change to the tab **VM** in the browser to configure Windows.
41. Select the respective language from the drop-down lists.

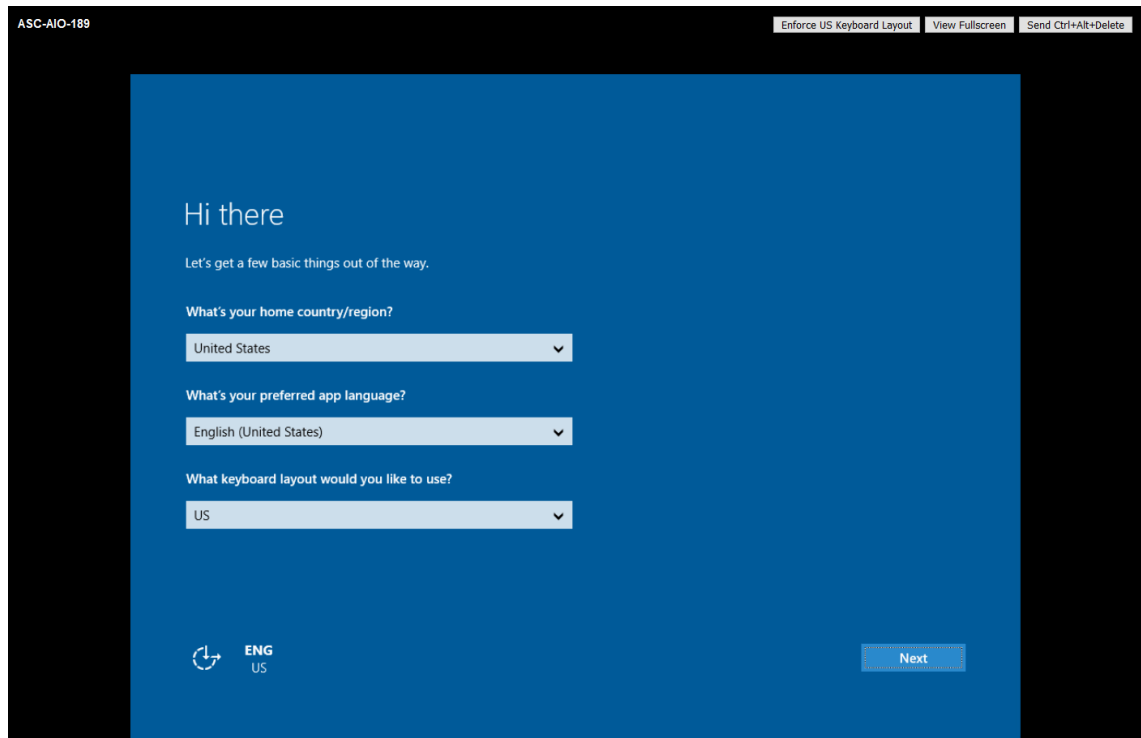


Fig. 19: Select language

42. Click on the button **NEXT**.
43. Enter the Windows product key.

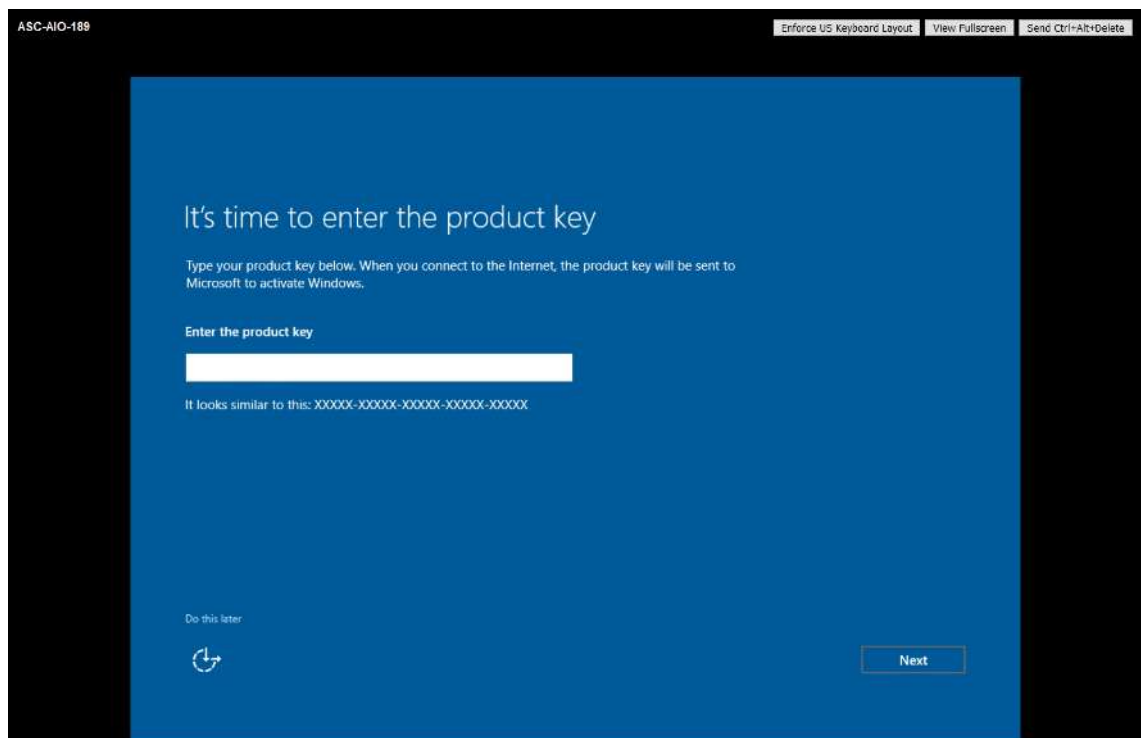


Fig. 20: Enter Windows product key

44. Click on the button **NEXT**.
45. Click on the button **Accept** to accept the license terms.

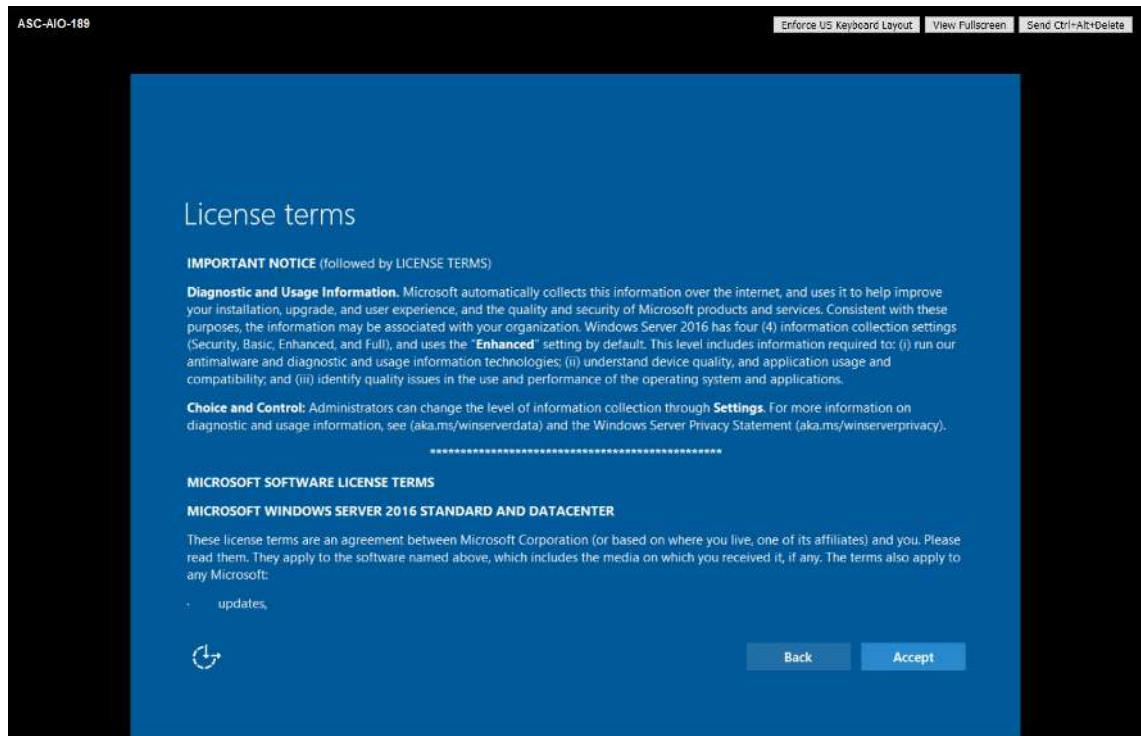


Fig. 21: Accept license terms

46. In the field *Password*, enter the password for the local administrator.
47. In the field *Reenter password*, enter the password again.

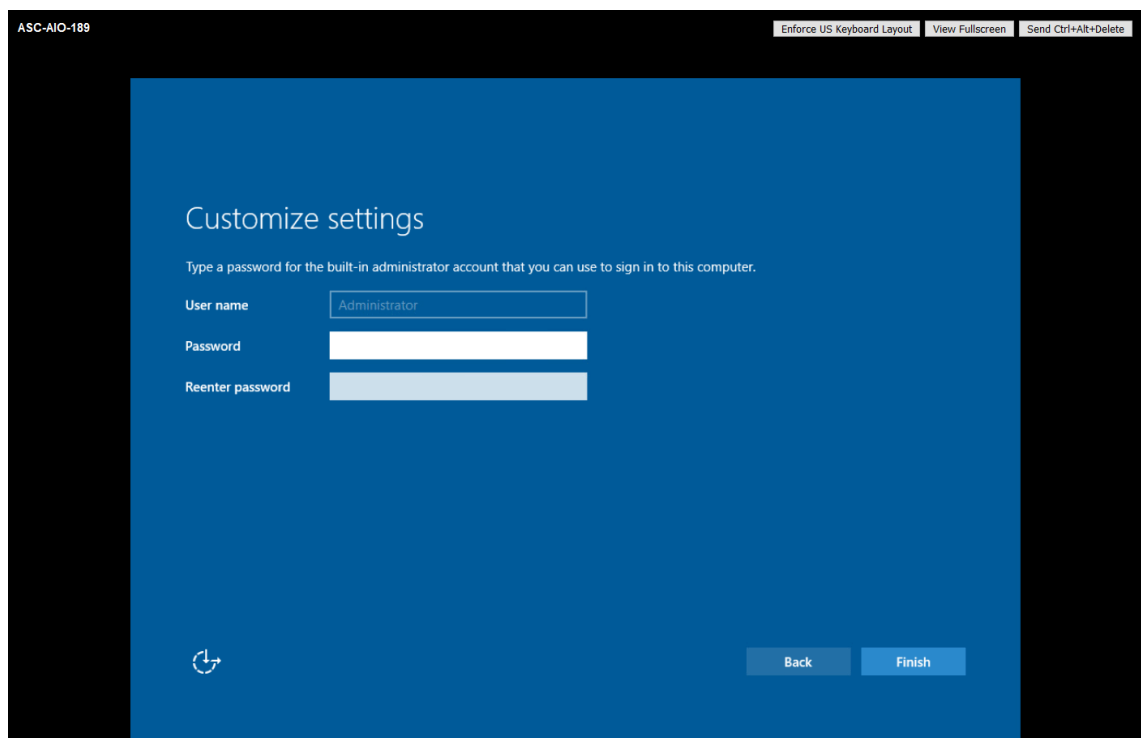


Fig. 22: Enter password for local administrator

48. Click on the button *Finish*.
49. Click on the button *Send Ctrl+Alt+Delete*.
50. Enter the password for the local administrator and press the Enter key.
  - ⇒ The last adaptations are made before the window *Neo version installed successfully - press button for reboot* appears.



51. Click on the button *Reboot VM* to finish the configuration.

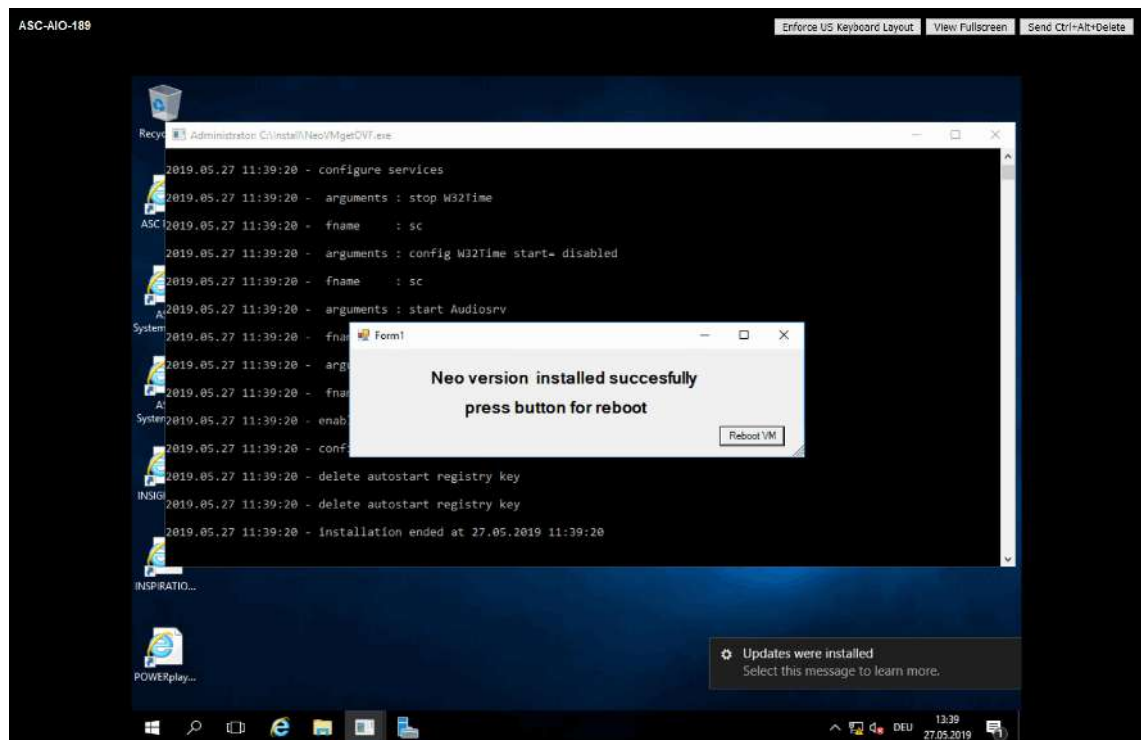


Fig. 23: neo version installed successfully

52. Close the tab *VM*.

### 4.3 Configuration vNetwork standard switches

The following chapters of this document describe the configuration of vSwitches for VMware ESXi servers by means of the VMware vSphere client or the VMware vCenter client. The configuration is necessary to guarantee that the ASC software functions correctly if it is supposed to be used in an ESXi-hosted virtual network.

This document merely covers the basic configuration of the vSwitches of the VMware ESXi software and not the basic installation or configuration of the VMware ESXi software in general. Neither the installation nor the configuration of the VMware vSphere Client and the VMware vCenter client are part of this document. This information can be found in the manufacturer documentation *Manual for the server configuration for ESXi*.

vNetwork standard switches are abstract network devices which fulfill the following tasks in a VMware ESXi-hosted virtual network:

- Control of the data traffic between virtual machines and external physical networks
- Control of the data traffic between virtual machines
- Combination of the bandwidth of several network adapters
- Distribution of the data traffic of several network adapters
- Mapping of failover scenarios in physical network adapters
- Substitution of a physical ethernet switch

When two or more virtual machines have been connected to the same vSwitch, the network data transfer between these virtual machines is controlled locally. When an uplink adapter is connected to the vSwitch, any virtual machine can access the external network that the adapter is connected to. In order to emulate the connection of the ASC software to a physical network best possible, two vSwitches have to be created. One for the administration of the ASC software and the ESXi server as well as another for the purpose of passive recording.



The following paragraphs of this chapter describe the setup of the vSwitches if the ASC software is supposed to be used in a VMware ESXi-hosted network.



For more information about the switch configuration refer to the administration manual *Configuration switch for passive VoIP recording*.

### 4.3.1 vSphere client

#### 4.3.1.1 Create vSwitch for administration

For communication with the ASC software for configuration and maintenance purposes a separate vSwitch is required which is created as follows:

1. Log into the vSphere Client and click on the host in the inventory list window.
2. Click on the tab *Configuration*.

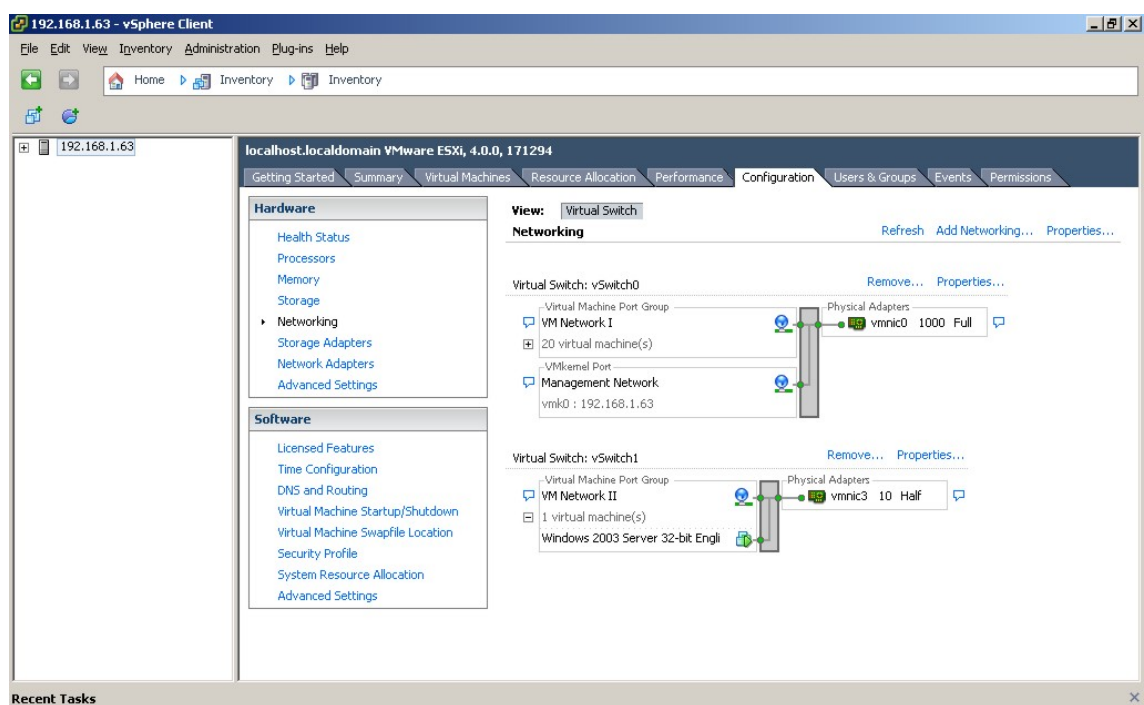


Fig. 24: vSphere Client (example)

3. Click on the menu item *Networking*.
4. Select the view *Virtual Switch*.
5. Click on *Add Networking*.
6. Accept the default connection type *Virtual Machine* and click on the button *Next*.

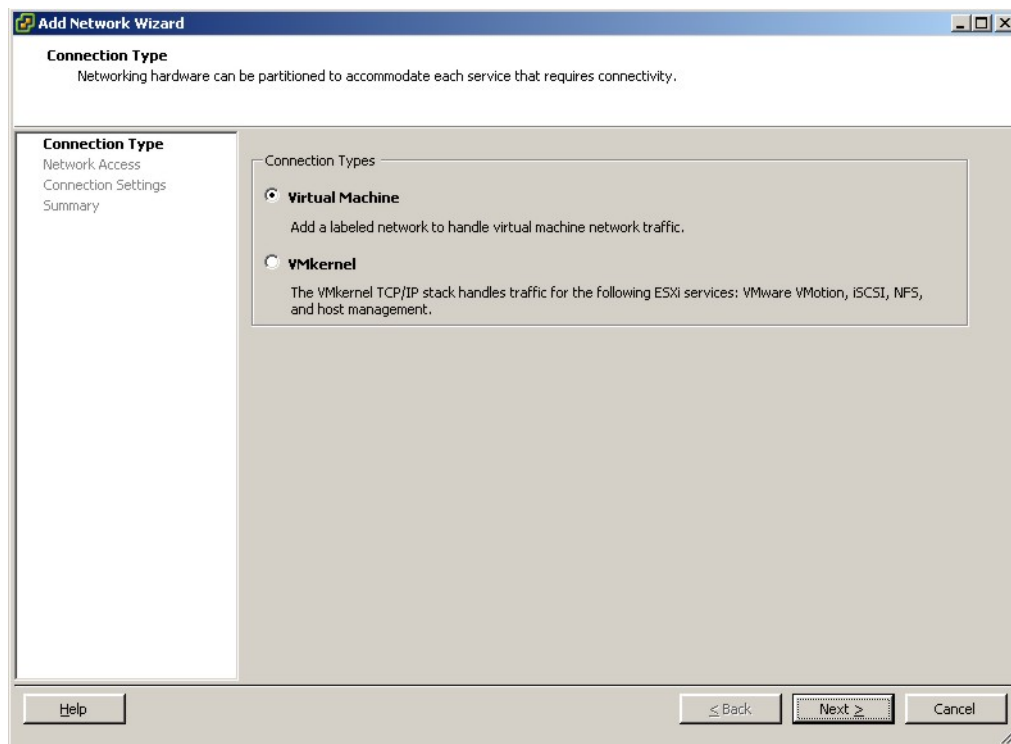


Fig. 25: Add virtual machine

7. Activate the option *Create a virtual switch* and the assigned physical adapters which are supposed to be connected to this vSwitch.

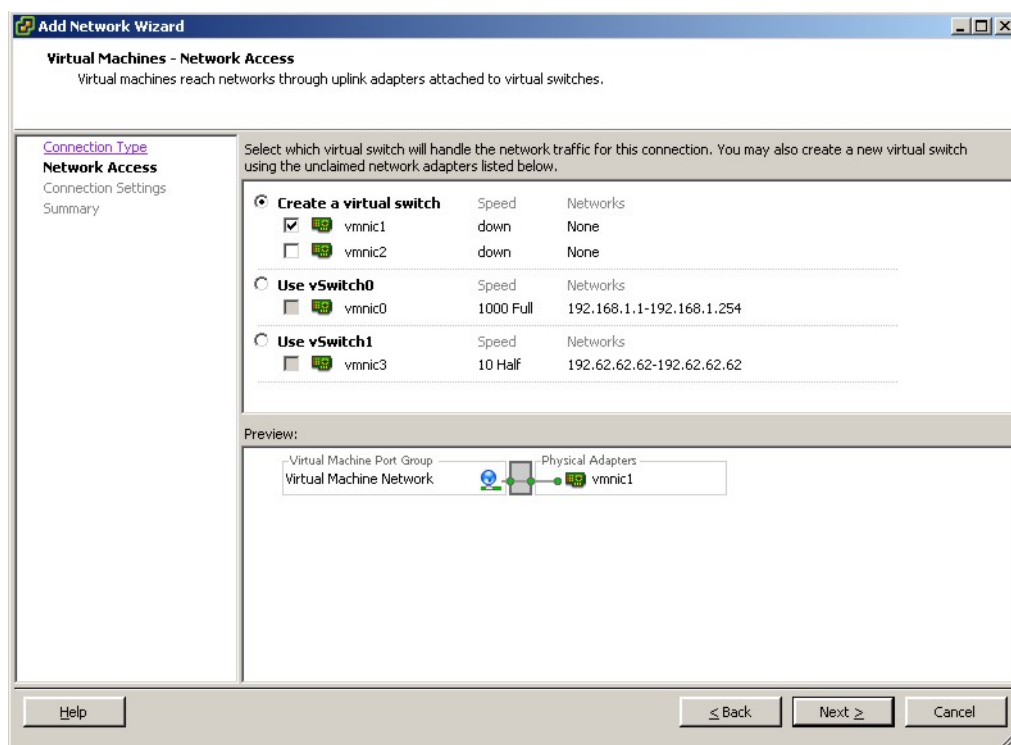


Fig. 26: Create a virtual switch (example)

8. Click on the button *Next*.
9. In the entry field *Network Label*, enter a term for the port group to be created (e. g. VM Network I).

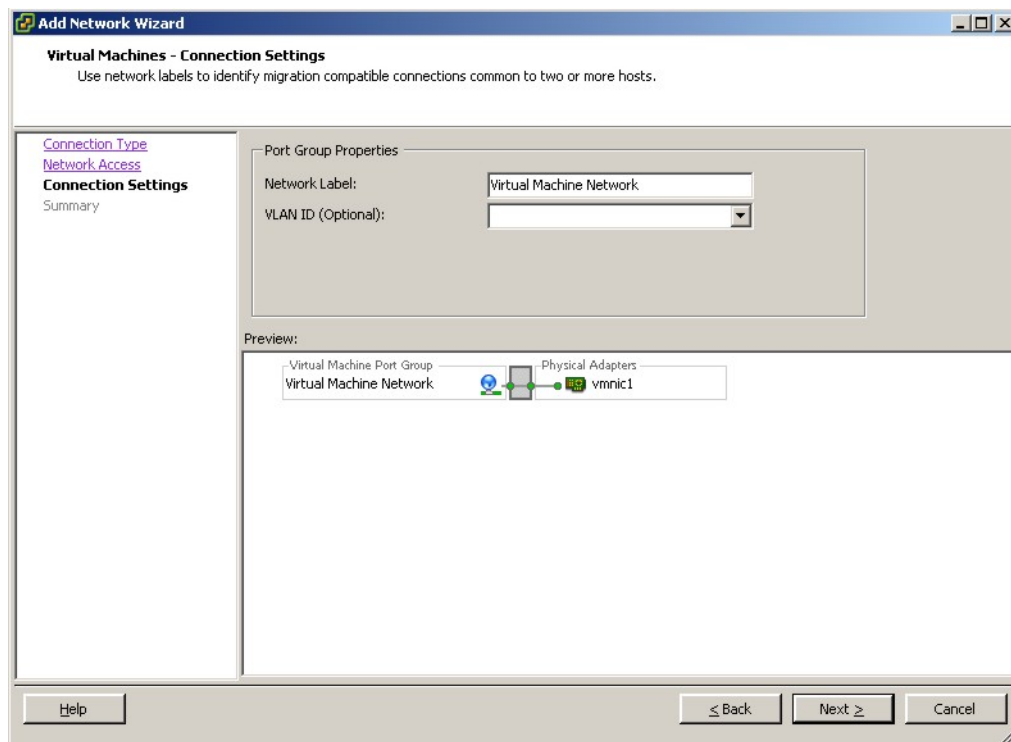


Fig. 27: Enter network label (example)

10. Click on the button *Next*.
11. Verify that the vSwitch has been configured properly.

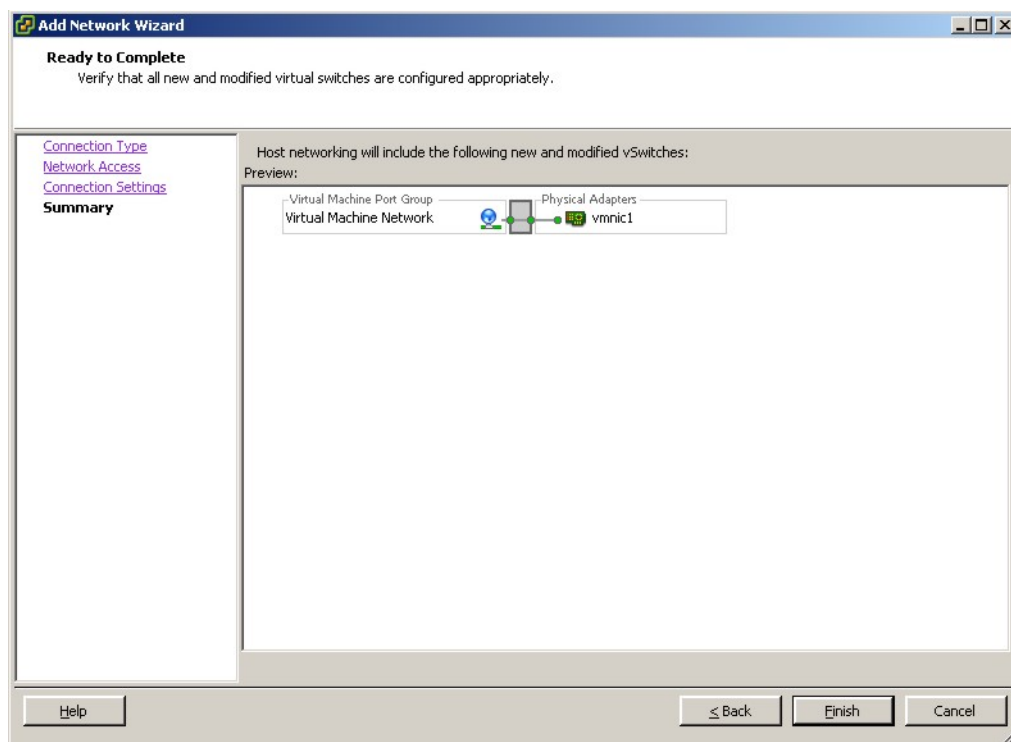


Fig. 28: Configuration ready to finalize (example)

12. Click on the button *Finish*.

When all configuration steps mentioned above have been concluded, the vSwitch has been created successfully and is ready for enhanced configuration.

#### 4.3.1.2 Configure vSwitch for administration

For the new vSwitch for administration to be used with the ASC software, the following configuration steps have to be carried out:

1. Click on the *Properties* of the corresponding vSwitch.
2. Click on the configuration *vSwitch*.

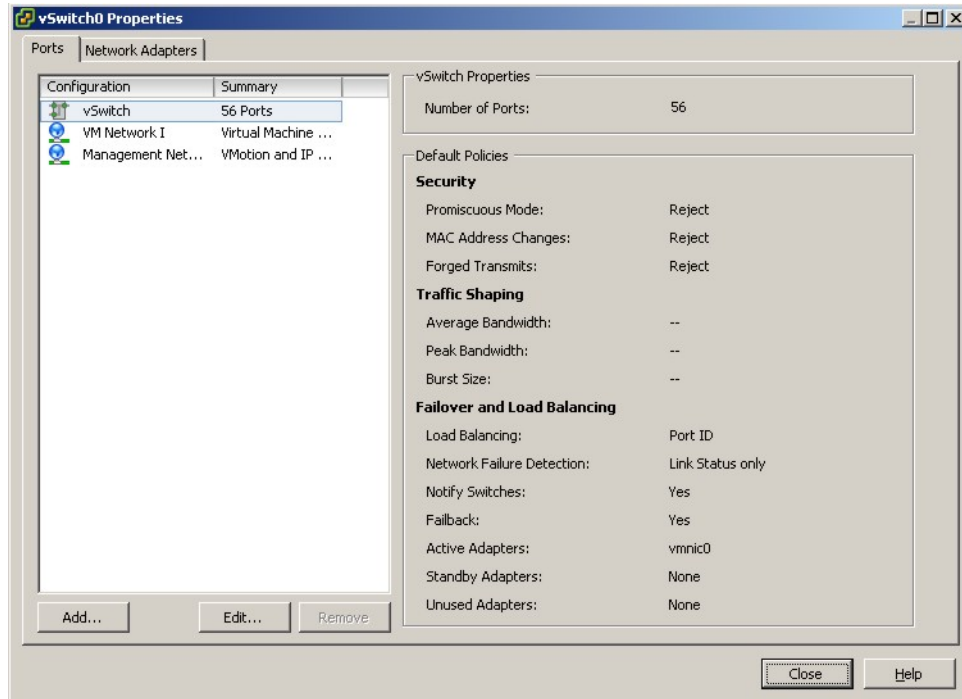


Fig. 29: Edit vSwitch (example)

3. Click on the button *Edit*.
4. Click on the tab *Security*.

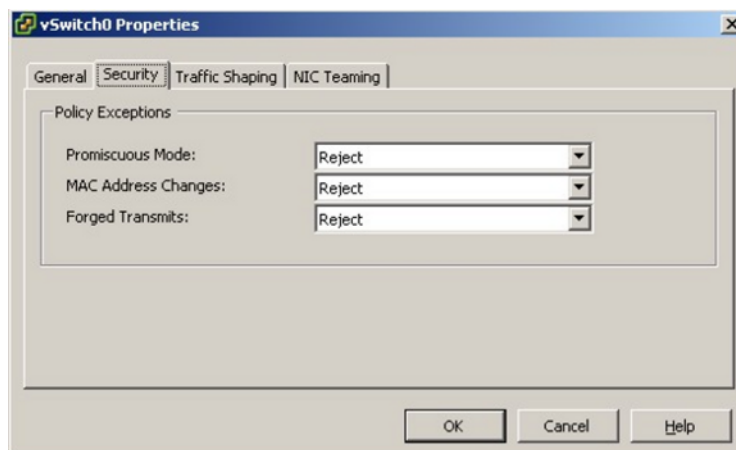


Fig. 30: Define policy exceptions

5. From the drop-down list, select the parameter *Reject* for the following options:
  - *Promiscuous Mode*
  - *MAC Address Changes*
  - *Forged Transmits*
6. Click on the button *OK*.
7. Verify the configuration.

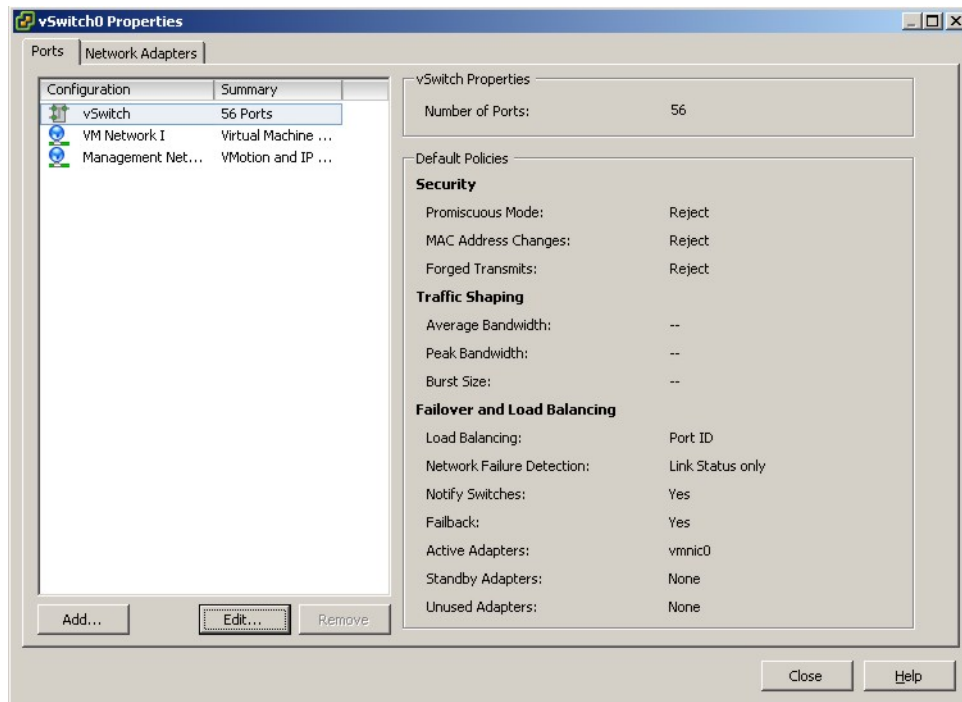


Fig. 31: Verify vSwitch configuration (example)

8. Select the respective virtual network which you have created in one of the previous configuration steps.

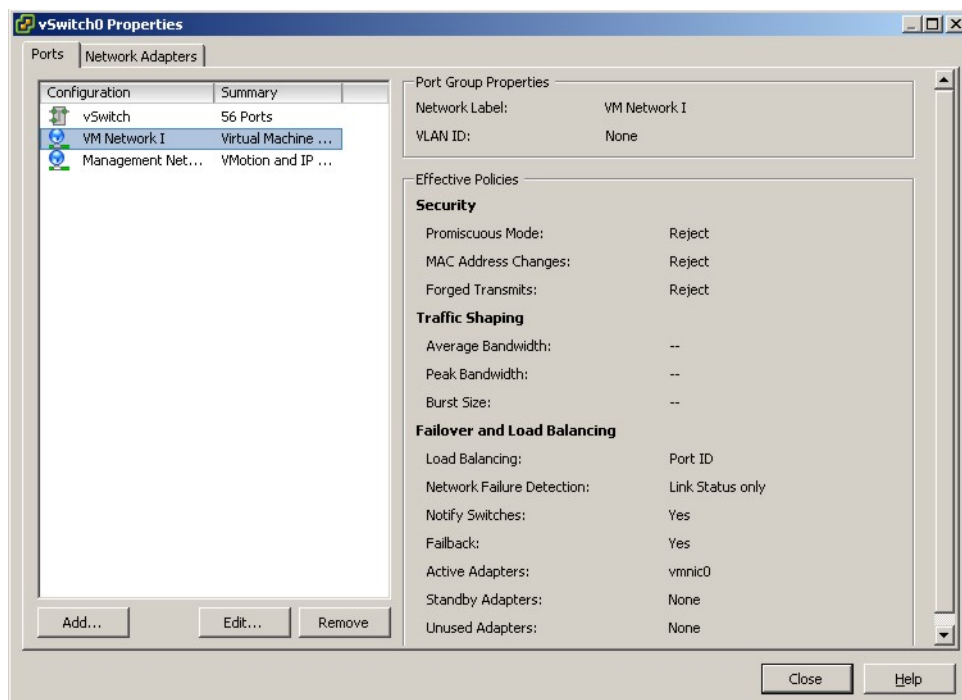


Fig. 32: Edit VM Network I (example)

9. Click on the button *Edit*.
10. Click on the tab *Security*.

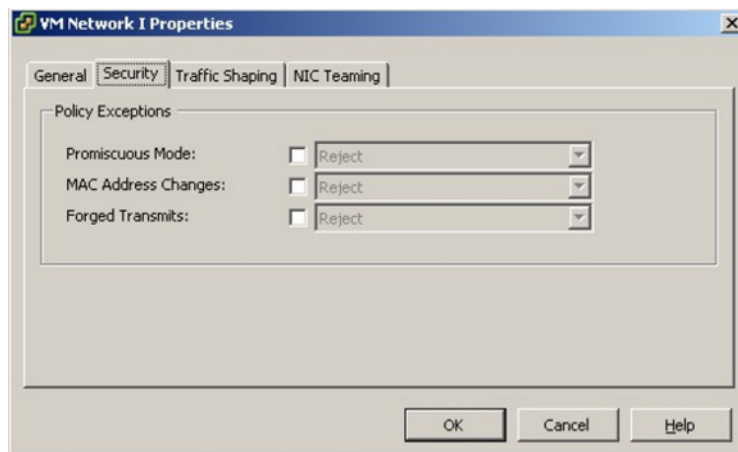


Fig. 33: Define policy exceptions

11. From the drop-down list, select the parameter *Reject* for the following options:

- *Promiscuous Mode*
- *MAC Address Changes*
- *Forged Transmits*

12. Click on the button *OK*.

When all mentioned configuration steps have been carried out successfully, the ASC software can be configured via this interface.

#### 4.3.1.3 Create vSwitch for passive recording

For passive recording by means of the ASC software, a separate vSwitch is required which is created as follows:

1. Log into the vSphere Client and click on the host in the inventory list window.
2. Click on the tab *Configuration*.

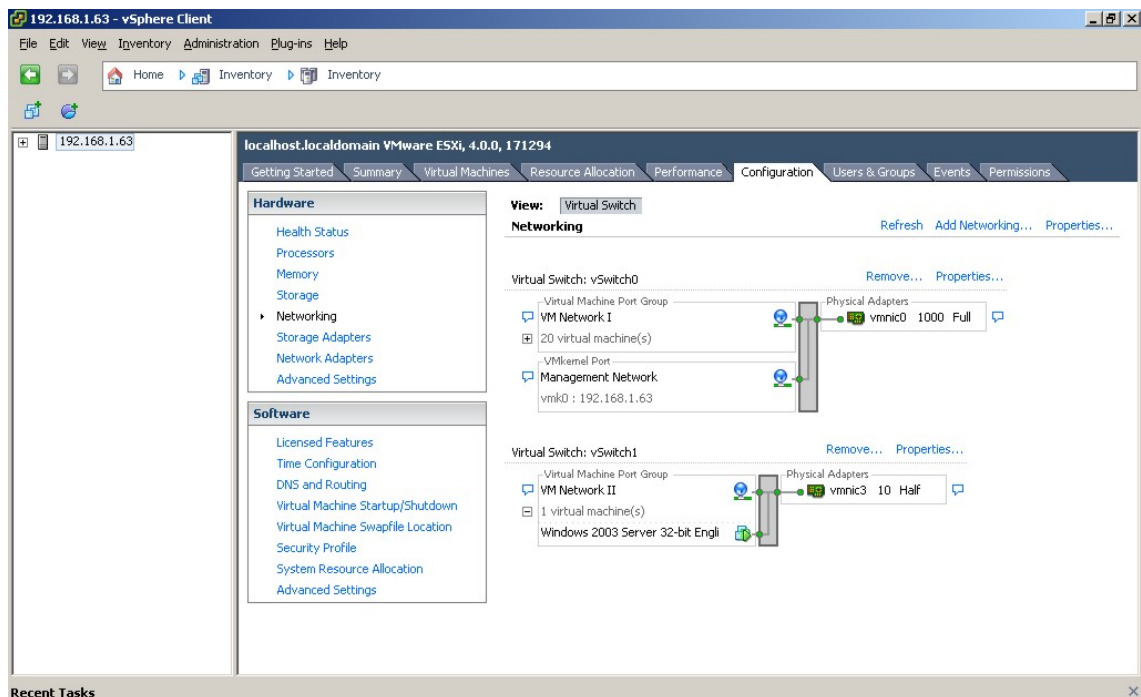


Fig. 34: vSphere Client (example)

3. Click on the menu item *Networking*.
4. Select the view *Virtual Switch*.

5. Click on *Add Networking*.
6. Accept the default connection type *Virtual Machine* and click on the button *Next*.

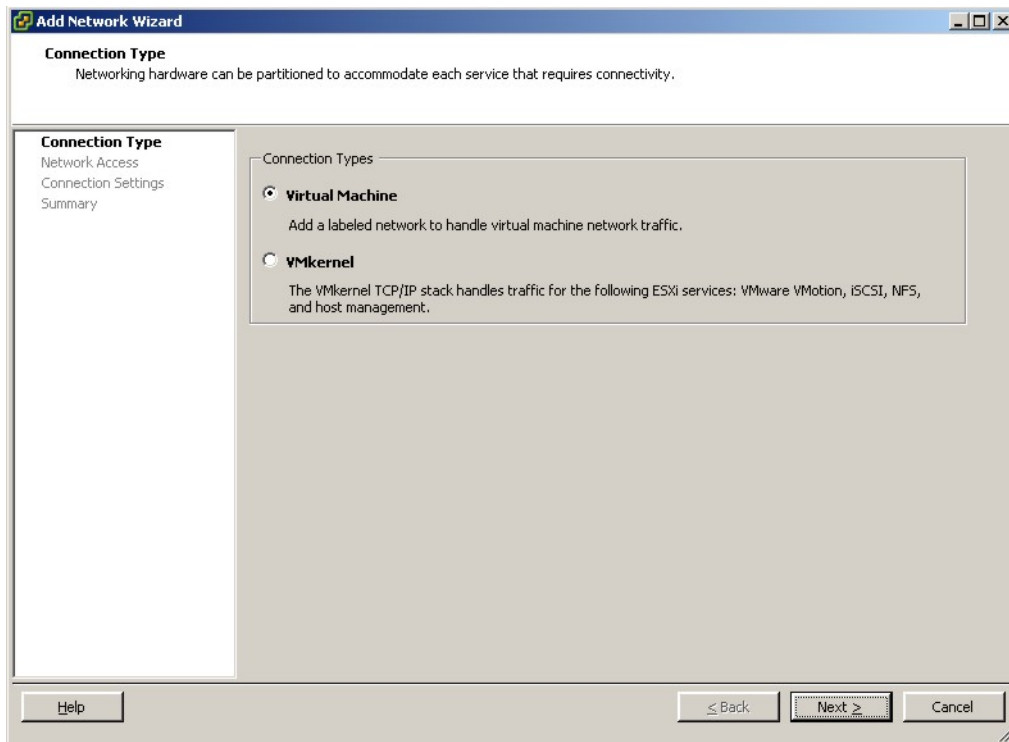


Fig. 35: Add virtual machine

7. Activate the option *Create a virtual switch* and the assigned physical adapters which are supposed to be connected to this vSwitch.

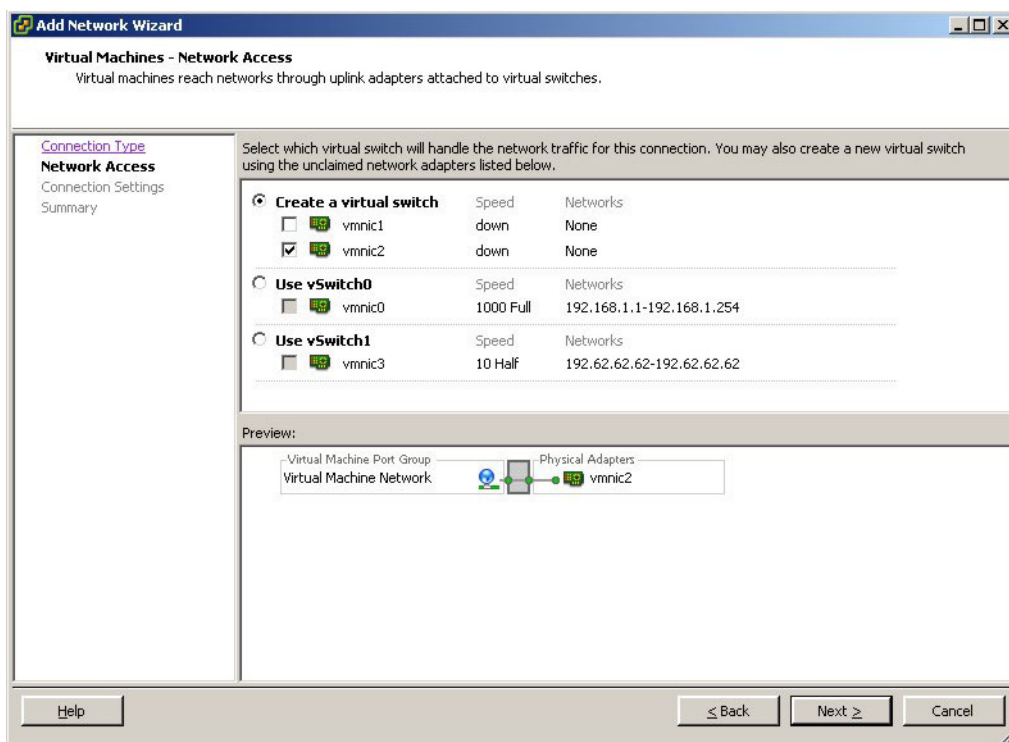


Fig. 36: Create a virtual switch (example)

8. Click on the button *Next*.
9. In the entry field *Network Label*, enter a description of the port group to be created (e. g. VM Network II).



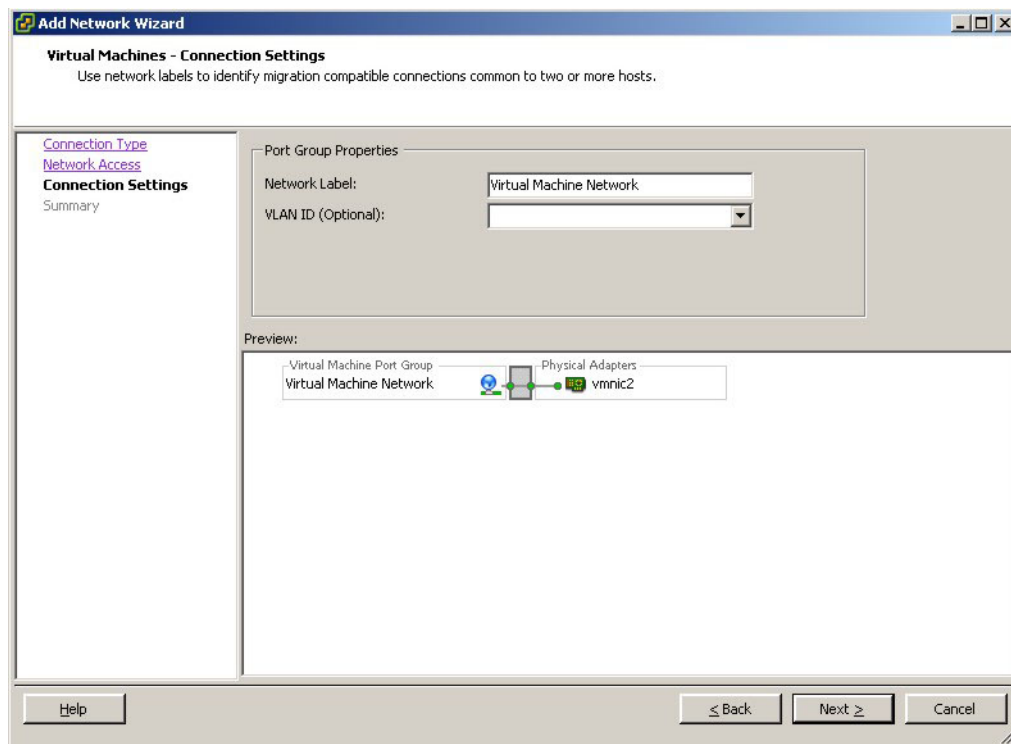


Fig. 37: Enter network label (example)

10. Click on the button *Next*.
11. Verify that the vSwitch has been configured properly.

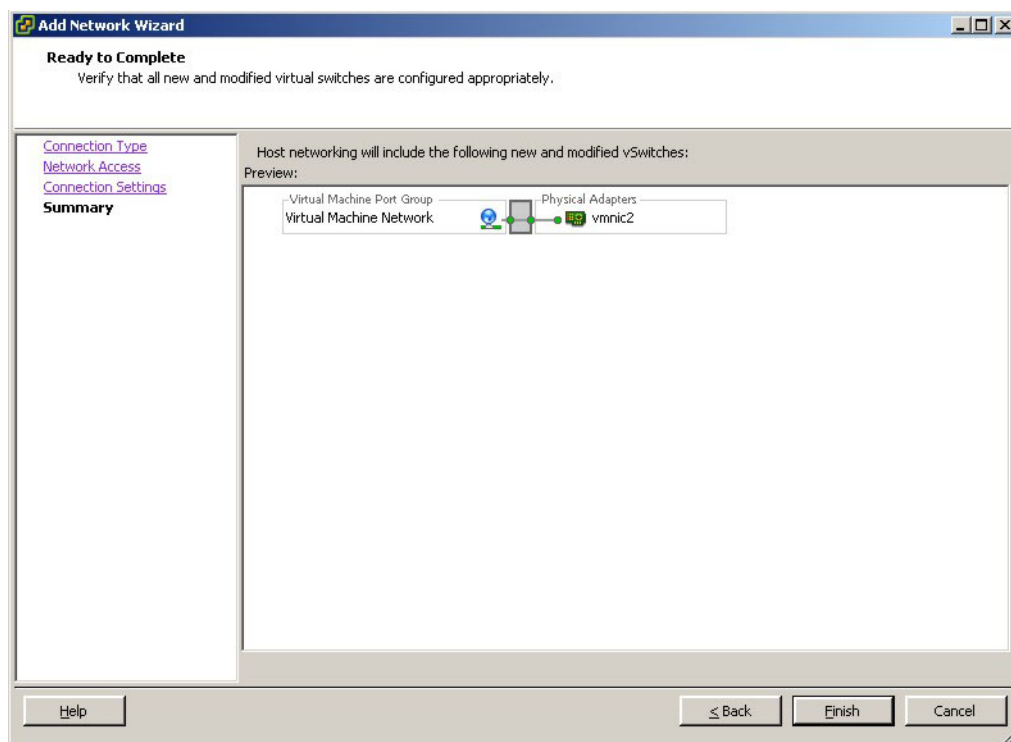


Fig. 38: Configuration ready to finalize (example)

12. Click on the button *Finish*.

When all configuration steps mentioned above have been concluded, the vSwitch has been created successfully and is ready for enhanced configuration.



#### 4.3.1.4 Configure vSwitch for passive recording

For the new vSwitch for passive recording to be used with the ASC software, the following configuration steps have to be carried out:

1. Click on the *Properties* of the corresponding vSwitch.
2. Click on the configuration *vSwitch*.

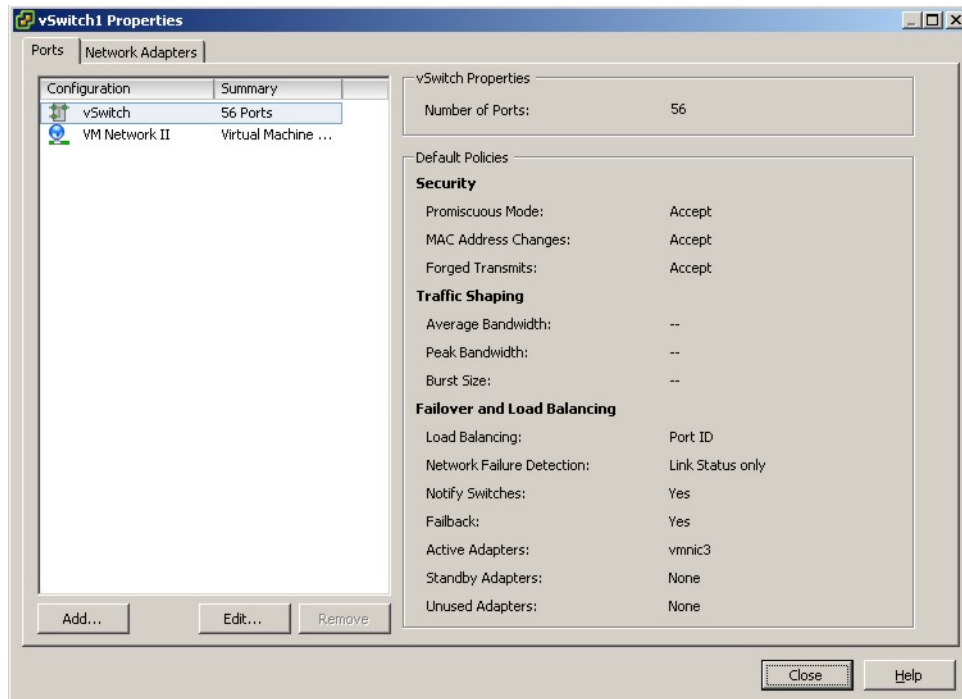


Fig. 39: Edit vSwitch (example)

3. Click on the button *Edit*.
4. Click on the tab *Security*.

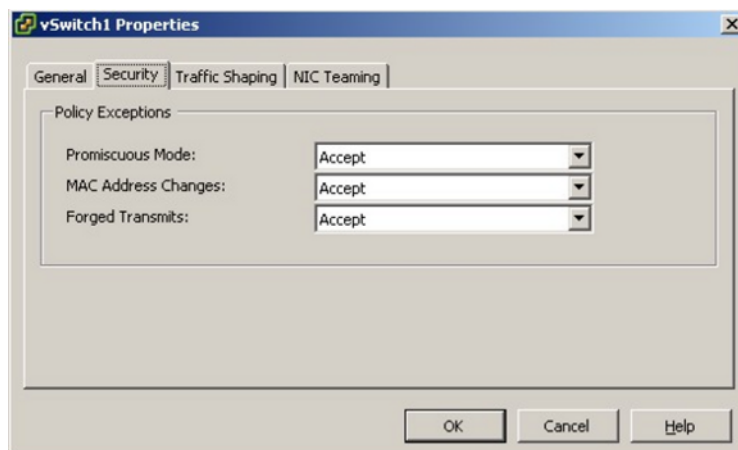


Fig. 40: Define policy exceptions

5. From the drop-down list, select the parameter *Accept* for the following options:
  - *Promiscuous Mode*
  - *MAC Address Changes*
  - *Forged Transmits*
6. Click on the button *OK*.
7. Verify the configuration.

8. Select the respective virtual network which you have created in one of the previous configuration steps.

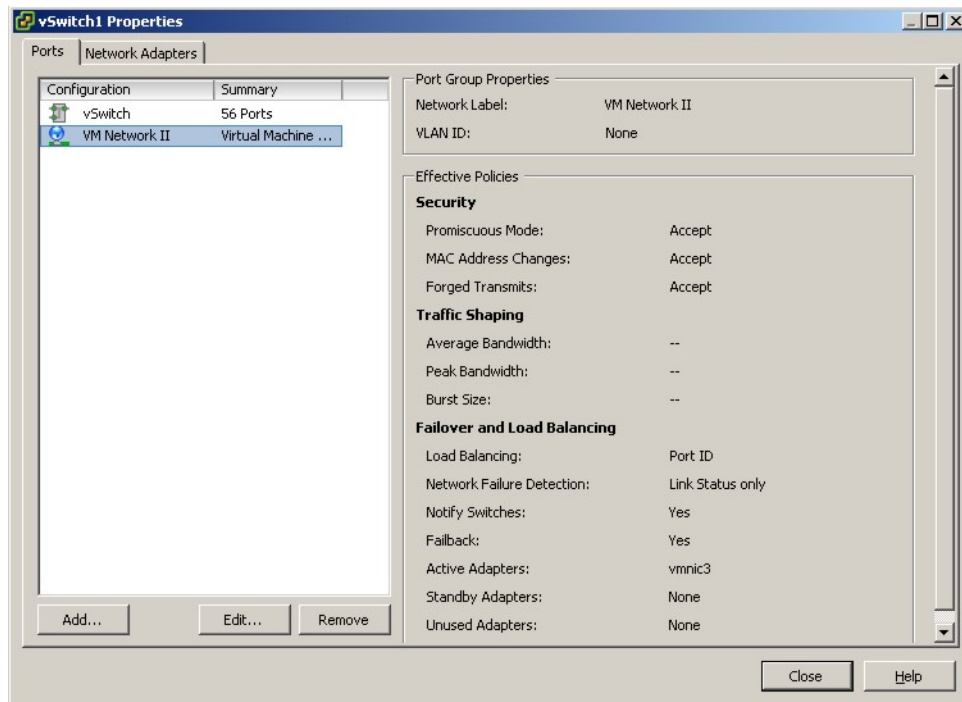


Fig. 41: Edit VM Network II (example)

9. Click on the button *Edit*.
10. Click on the tab *Security*.

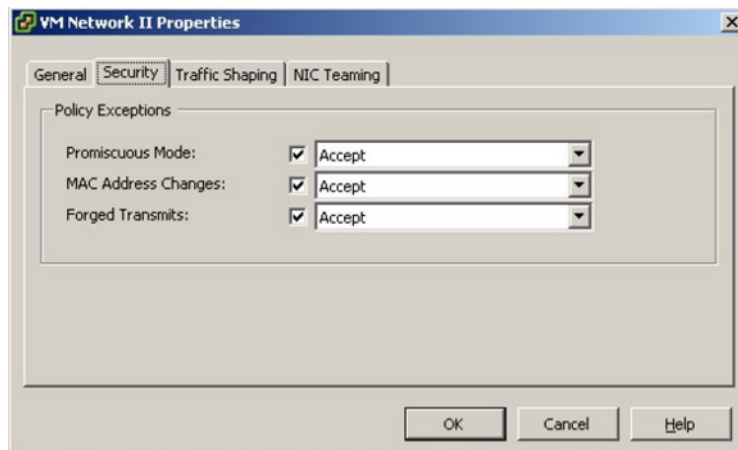


Fig. 42: Define policy exceptions

11. From the drop-down list, select the parameter *Accept* for the following options:
  - *Promiscuous Mode*
  - *MAC Address Changes*
  - *Forged Transmits*
12. Click on the button *OK*.

When all mentioned configuration steps have been carried out successfully, the ASC software can be used for passive recording via this interface.

### 4.3.2 vCenter client

#### 4.3.2.1 Configuration vCenter standard switches

To communicate with the ASC software for configuration and maintenance purposes, a separate vSwitch is required which is created and configured as follows:

1. Log in to the vCenter client and click on the host in the inventory list window.
2. Click on the tab *Configure*.
3. Click on *Networking > Virtual switches*.
4. Open the virtual switch *Standard Switch: vSwitch8*.
5. Under the virtual switch *Standard Switch: vSwitch8*, click on the button *ADD NETWORKING*.

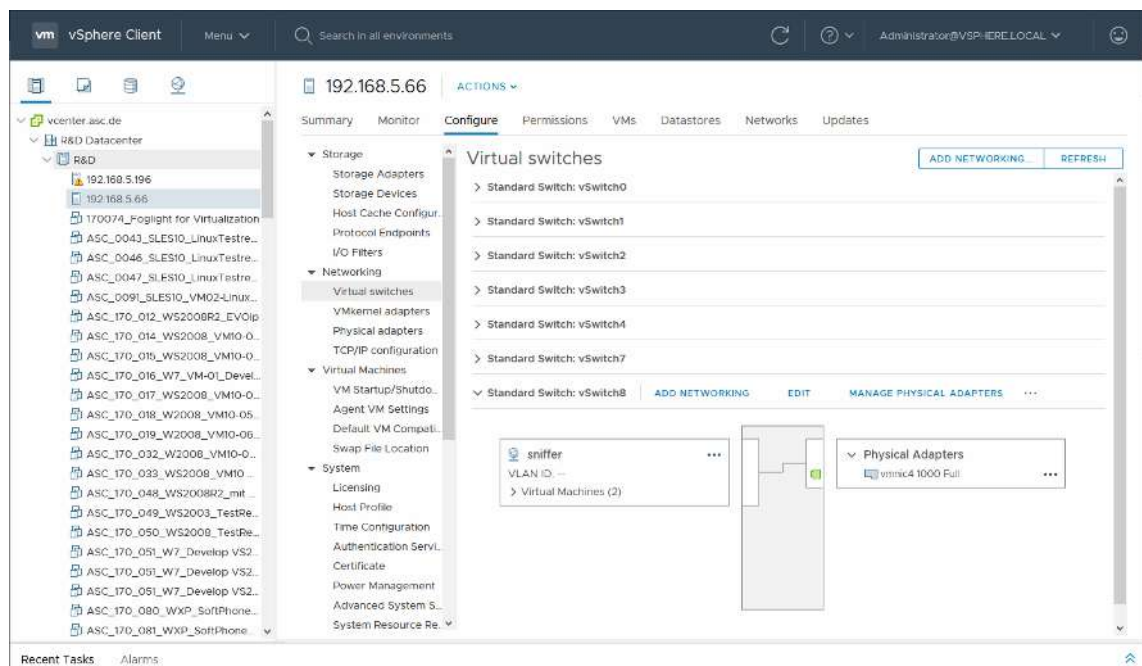


Fig. 43: Configure virtual switches (example)

6. Select the option *Virtual Machine Port Group for a Standard Switch* and click on the button *NEXT*.

192.168.5.66 - Add Networking

1 **Select connection type**  
 2 Select target device  
 3 Connection settings  
 4 Ready to complete

Select connection type  
 Select a connection type to create.

☐ VMkernel Network Adapter

The VMkernel TCP/IP stack handles traffic for ESXi services such as vSphere vMotion, iSCSI, NFS, FCoE, Fault Tolerance, vSAN and host management.

☒ Virtual Machine Port Group for a Standard Switch

A port group handles the virtual machine traffic on standard switch.

☐ Physical Network Adapter

A physical network adapter handles the network traffic to other hosts on the network.

CANCEL BACK NEXT

Fig. 44: Add networking (example)

Select either the option *Select an existing standard switch* or the option *New standard switch* as required.

### Select an existing standard switch

1. Select the option *Select an existing standard switch*.
2. Click on the button *BROWSE*.

192.168.5.66 - Add Networking

✓ 1 Select connection type  
 2 **Select target device**  
 3 Connection settings  
 4 Ready to complete

Select target device  
 Select a target device for the new connection.

☒ Select an existing standard switch

vSwitch8 BROWSE ...

☐ New standard switch

MTU (Bytes) 1500

CANCEL BACK NEXT

Fig. 45: Add networking (example)

3. Click on the required switch, e. g. *vSwitch8*.
4. Click on the button *OK*.

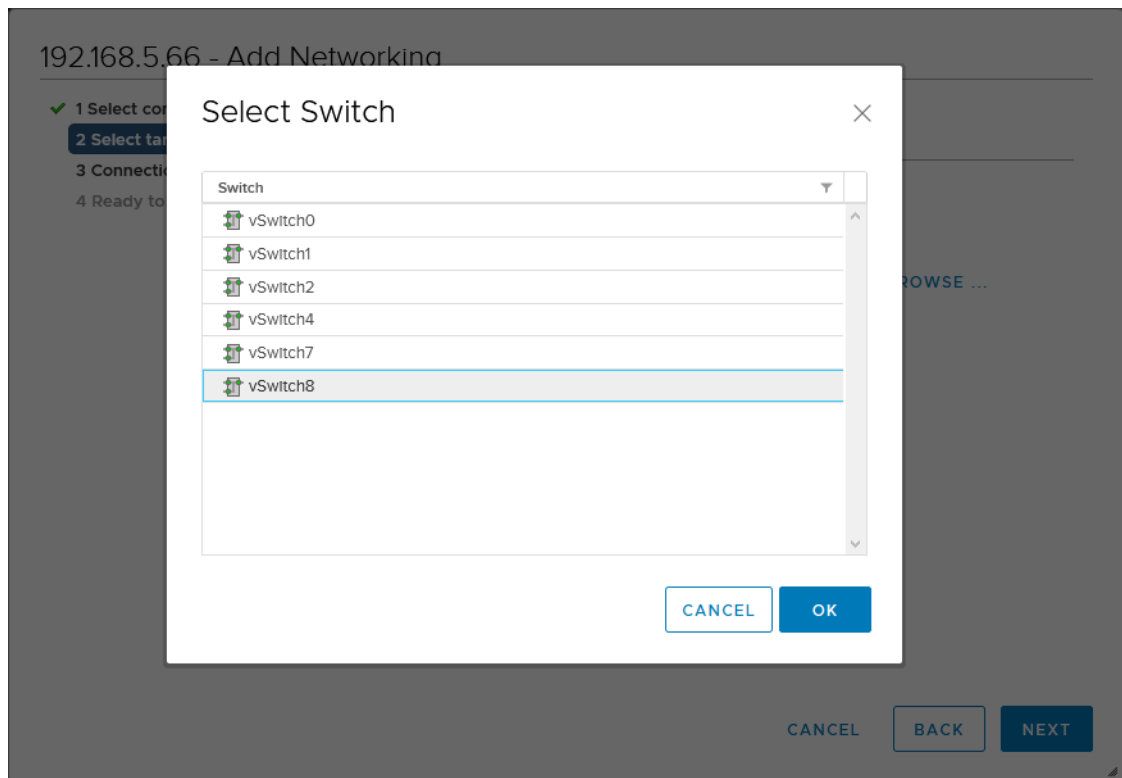


Fig. 46: Select switch (example)

5. Click on the button *NEXT*.
6. In the entry field *Network label*, enter a name for the network, e. g. *VM Network*.
7. Click on the button *NEXT*.

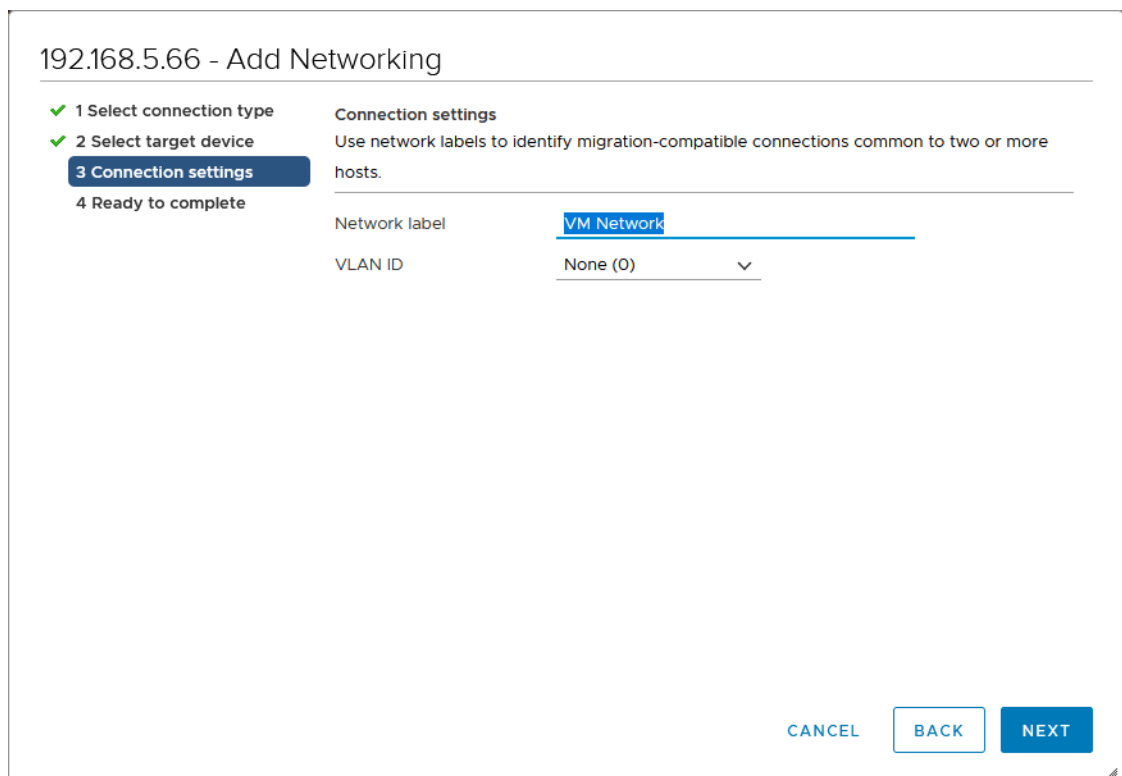
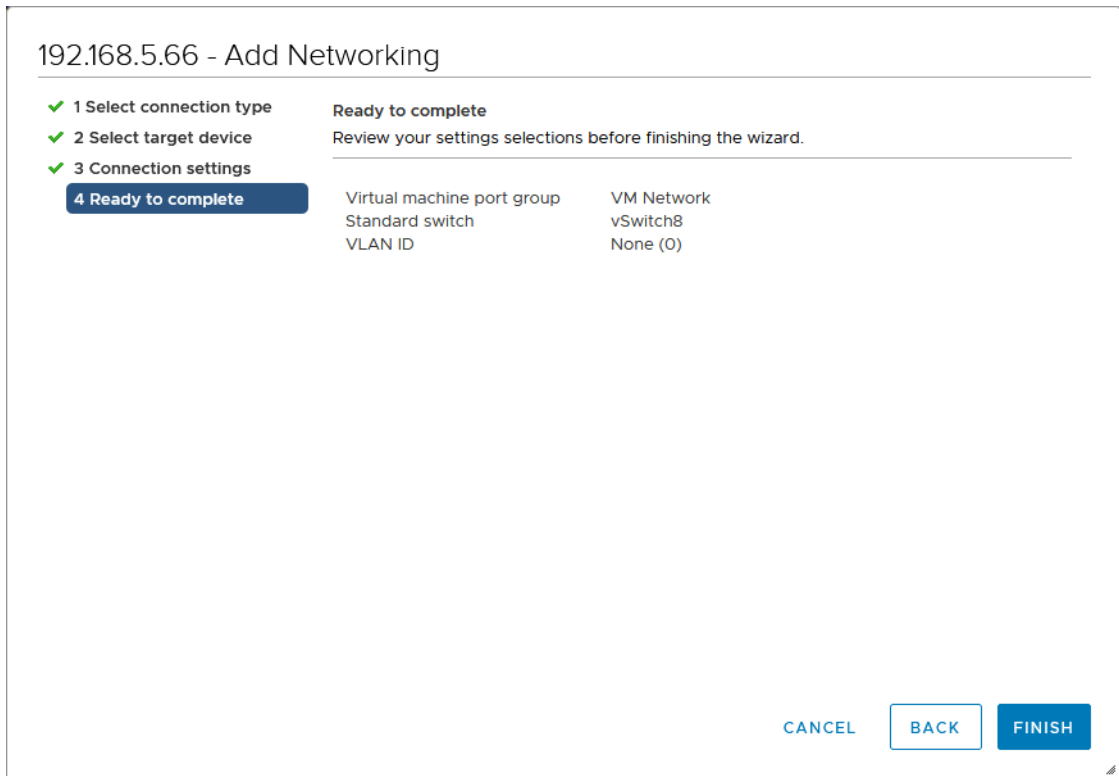


Fig. 47: Add networking (example)

- Click on the button *FINISH*.



192.168.5.66 - Add Networking

✓ 1 Select connection type  
✓ 2 Select target device  
✓ 3 Connection settings  
**4 Ready to complete**

**Ready to complete**  
Review your settings selections before finishing the wizard.

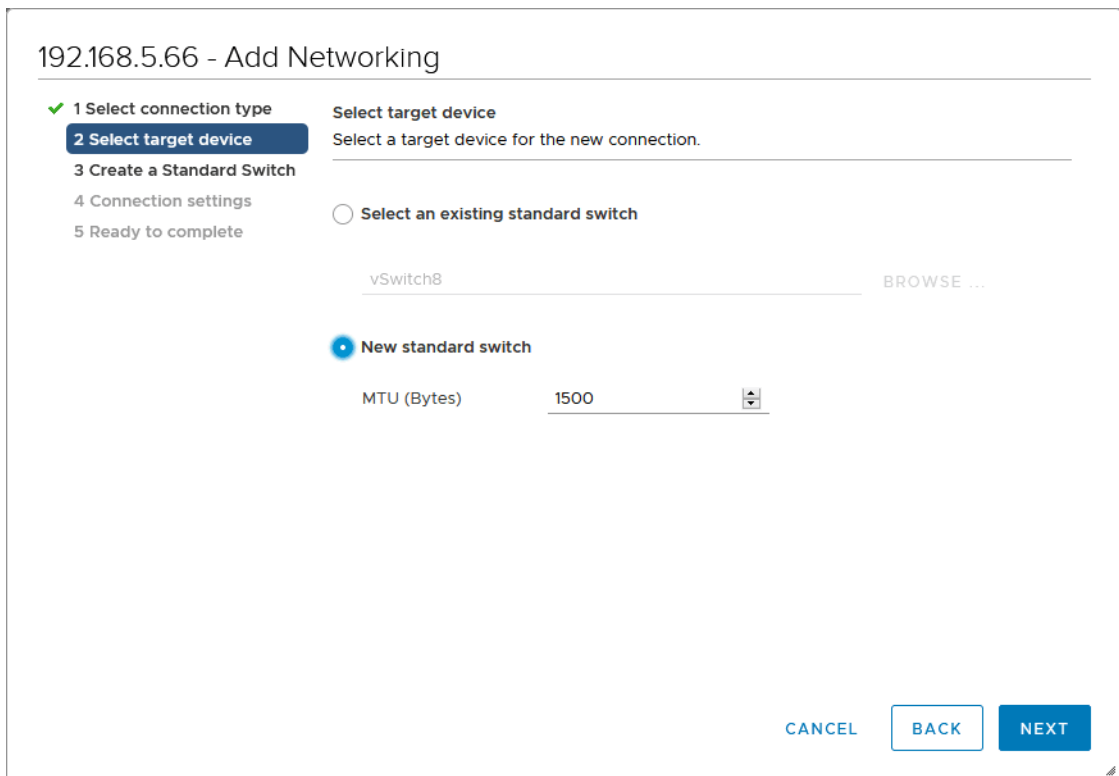
Virtual machine port group	VM Network
Standard switch	vSwitch8
VLAN ID	None (0)

CANCEL BACK FINISH

Fig. 48: Add networking (example)

### New standard switch

- Select the option *New standard switch* and click on the button *NEXT*.



192.168.5.66 - Add Networking

✓ 1 Select connection type  
**2 Select target device**  
3 Create a Standard Switch  
4 Connection settings  
5 Ready to complete

**Select target device**  
Select a target device for the new connection.

☐ Select an existing standard switch


vSwitch8 BROWSE ...

☒ **New standard switch**

MTU (Bytes) 1500

CANCEL BACK NEXT

Fig. 49: Add networking (example)

- Click on *Active adapters*.
- Click on the icon  (*Add adapter*).

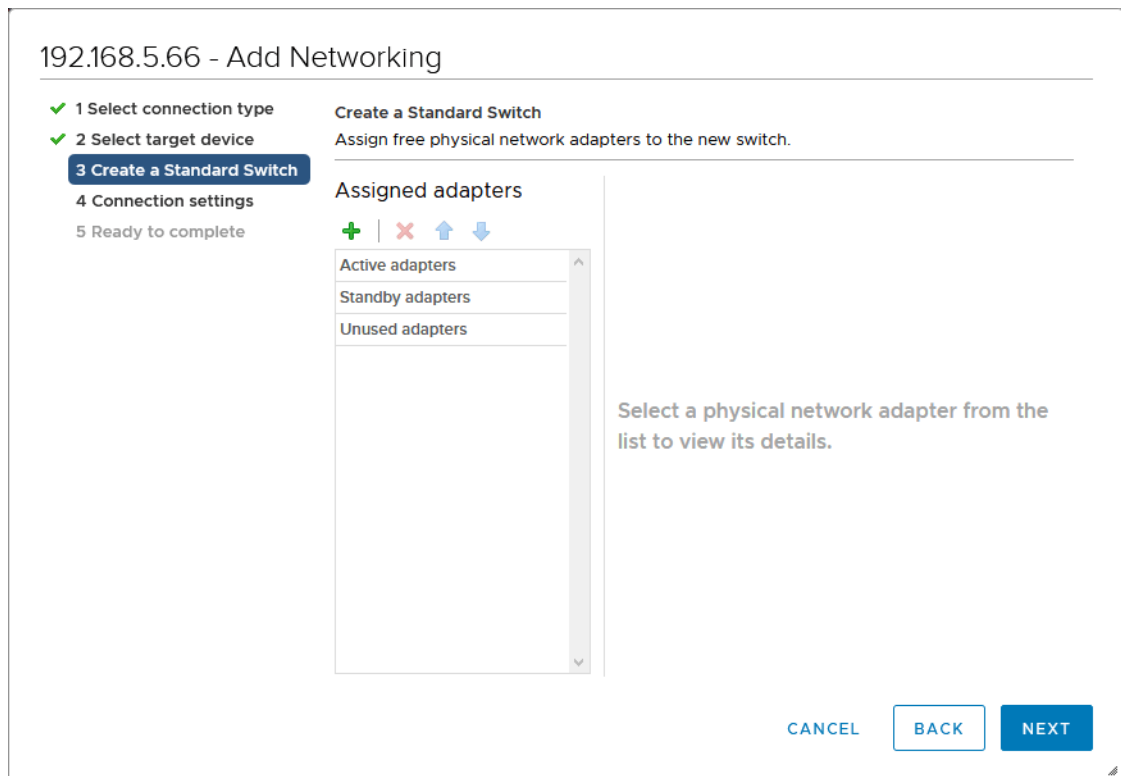


Fig. 50: Add networking (example)

4. Click on the respective network adapter, e. g. *vmnic5*.
5. Click on the button **OK**.

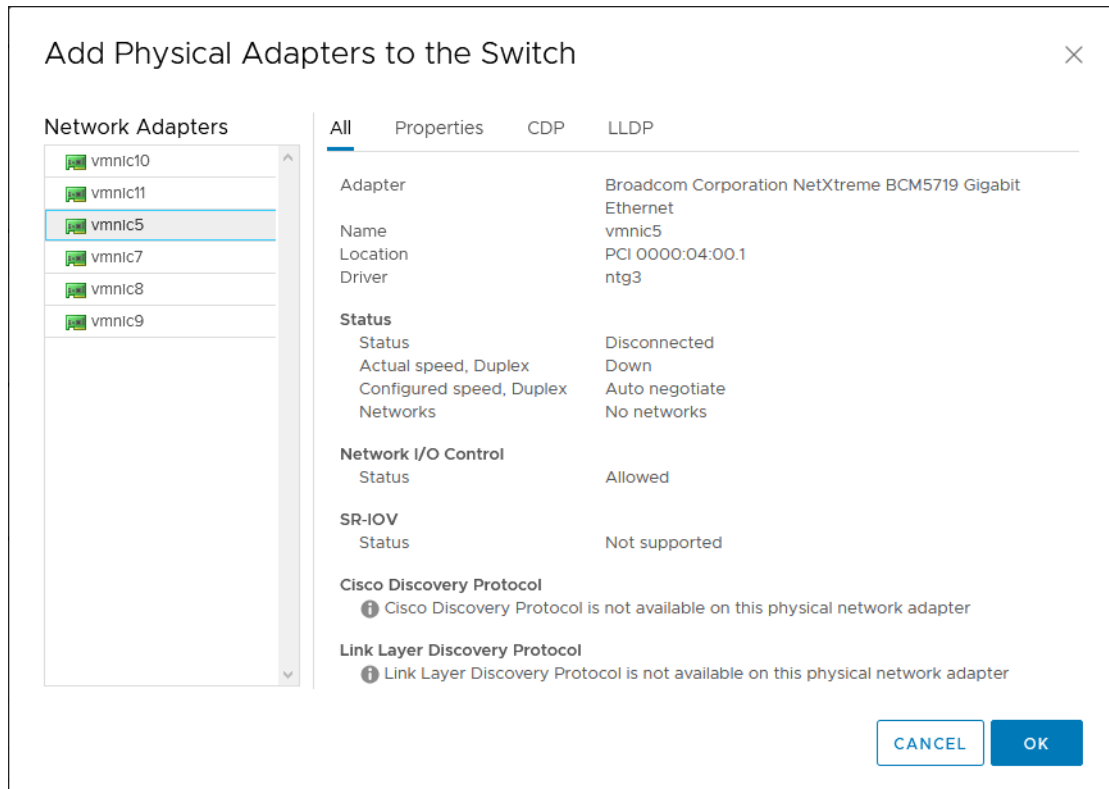


Fig. 51: Add Physical Adapters to the Switch (example)

6. Click on the button **NEXT**.

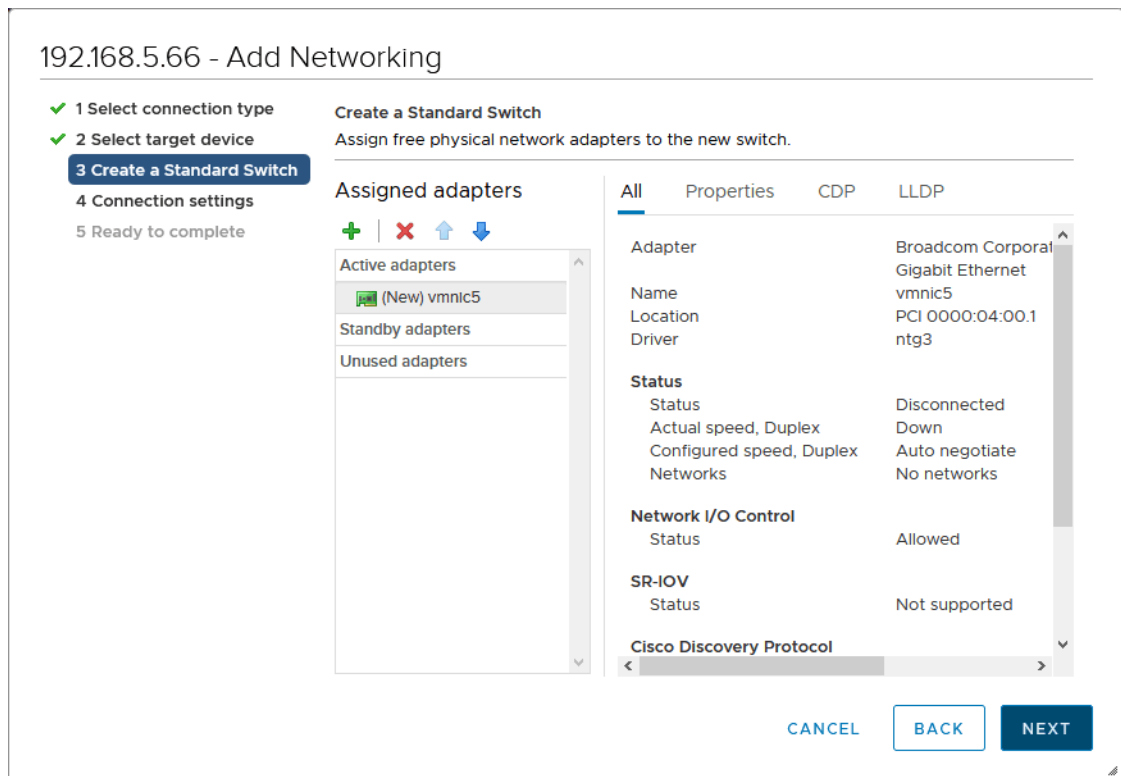


Fig. 52: Add networking (example)

7. Click on the button **OK**.

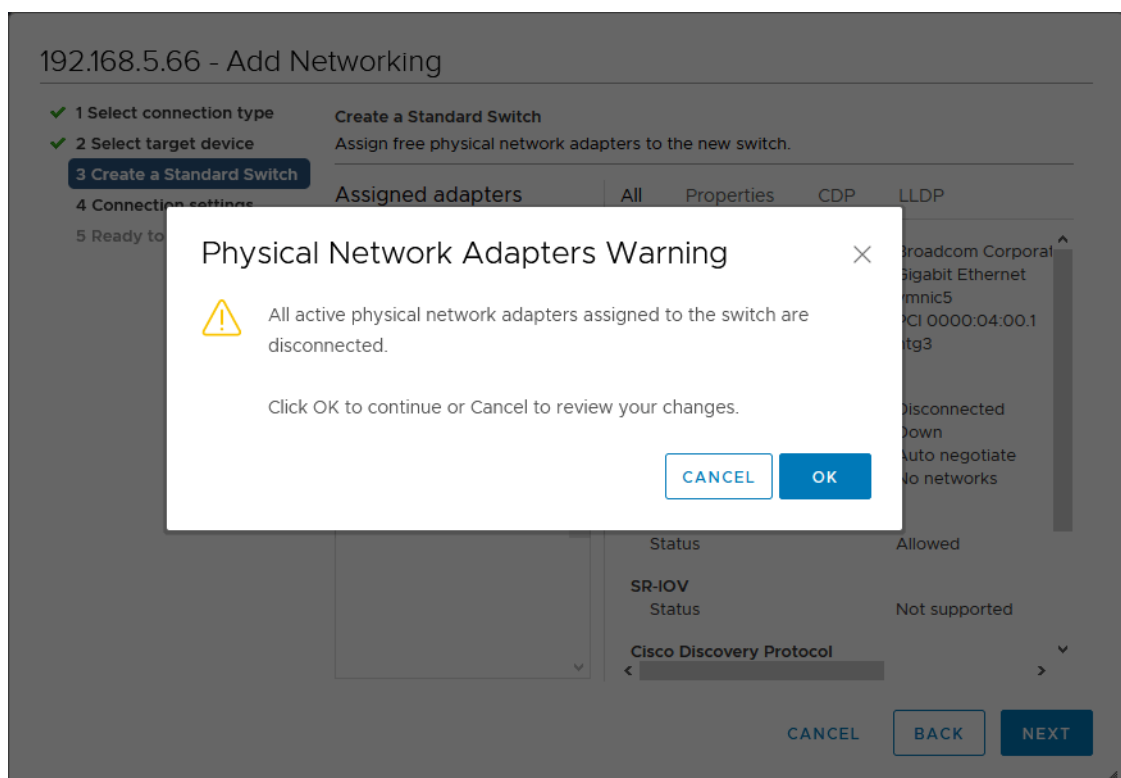


Fig. 53: Physical Network Adapters Warning

8. In the entry field *Network label*, enter a name for the network, e. g. *VM Network*.
9. Click on the button **NEXT**.



192.168.5.66 - Add Networking

- ✓ 1 Select connection type
- ✓ 2 Select target device
- ✓ 3 Create a Standard Switch
- 4 Connection settings**
- 5 Ready to complete

**Connection settings**  
Use network labels to identify migration-compatible connections common to two or more hosts.

Network label	<u>VM Network</u>
VLAN ID	None (0) ▼

CANCEL BACK NEXT

Fig. 54: Add networking (example)

10. Click on the button *FINISH*.

192.168.5.66 - Add Networking

- ✓ 1 Select connection type
- ✓ 2 Select target device
- ✓ 3 Create a Standard Switch
- ✓ 4 Connection settings
- 5 Ready to complete**

**Ready to complete**  
Review your settings selections before finishing the wizard.

New standard switch	vSwitch3
Virtual machine port group	VM Network
Assigned adapters	vmnic5
Switch MTU	1500
VLAN ID	None (0)

CANCEL BACK FINISH

Fig. 55: Add networking (example)

### Configure security settings

- To configure security settings, click on the button *EDIT* under the virtual switch *Standard Switch: vSwitch8*.

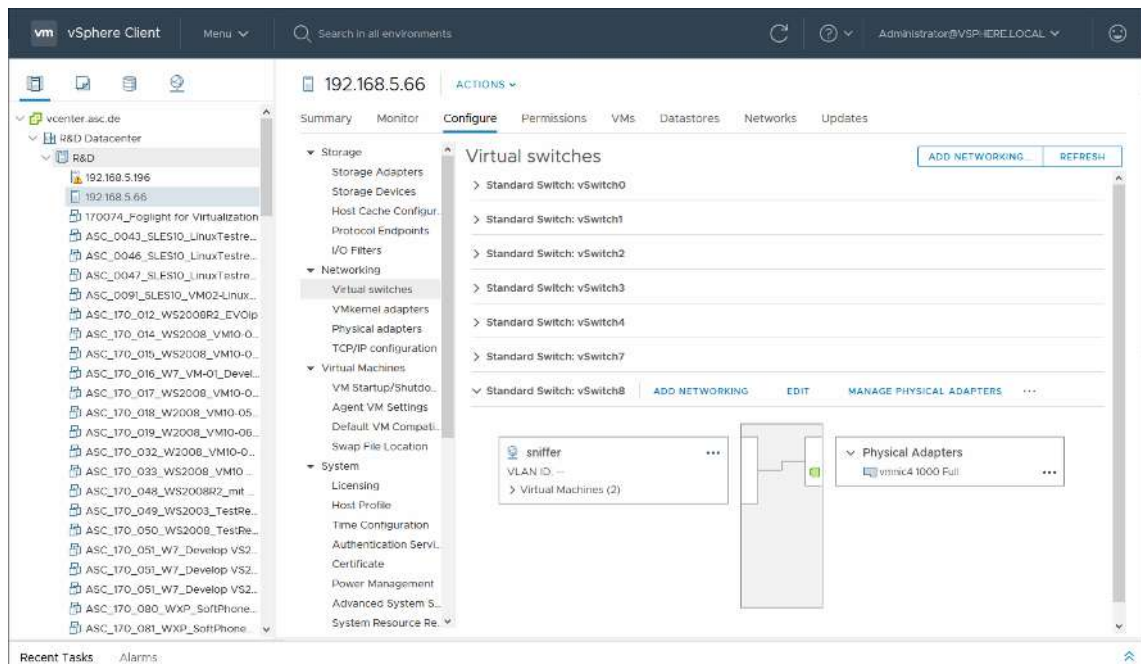


Fig. 56: Configure virtual switches (example)

- Click on the menu item **Security**.

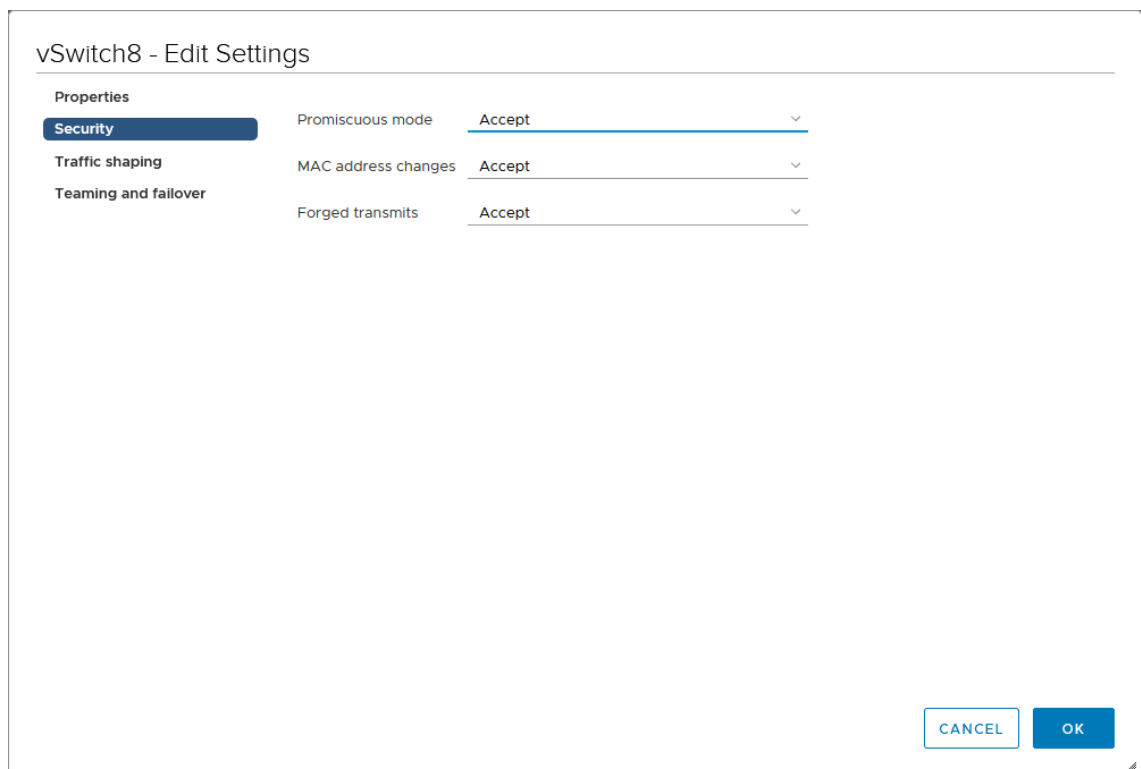


Fig. 57: Edit settings (example)

- From the drop-down list, select the parameter *Accept* for the following options:
  - Promiscuous mode*
  - MAC address changes*
  - Forged transmits*
- Click on the button **OK**.

## Installation and configuration of a neo VM in the Google Cloud by means of a template

The following recording architecture types may be installed and configured:

- [neo VM](#) with Core and [DB](#)
- [neo VM](#) with Core and external [DB](#)
- [neo VM](#) without Core and with [DB](#)
- [neo VM](#) without Core and without [DB](#)

For the installation and configuration, the application *Windows PowerShell ISE (x86)* and the *gcloud* command line tool are used.

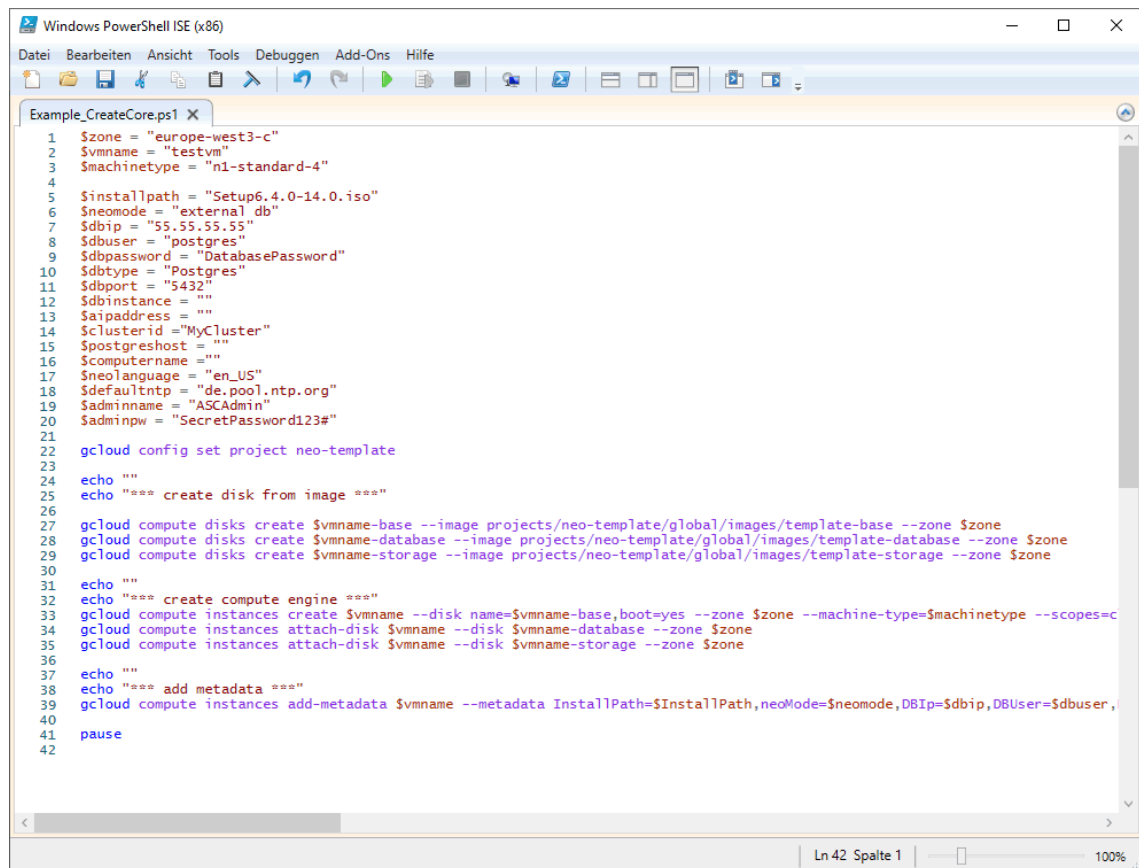
The *gcloud* command line tool is part of Google Cloud SDK. You must download Google Cloud SDK and install and initialize it on your computer before you can use the *gcloud* command line tool.



To be able to copy templates from the ASC Google project, ASC must assign the respective rights and permissions to the service administrator in advance. Contact your local ASC support or call ASC support at +49 700 27278776 and transmit the e-mail address to be used for the service account.

### Create script file

1. Open the Windows Explorer.
2. In the manual package, change to the directory *\4\_Tools*.
3. Right-click on the script file *Example\_CreateCore.ps1*.
  - ⇒ The context menu appears.
4. Click on *Edit* in the context menu.
  - ⇒ The script file *Example\_CreateCore.ps1* is opened in the application *Windows PowerShell ISE (x86)*.



```

1 $zone = "europe-west3-c"
2 $vmname = "testvm"
3 $machinetype = "n1-standard-4"
4
5 $installpath = "Setup6.4.0-14.0.iso"
6 $neomode = "external db"
7 $dbip = "55.55.55.55"
8 $dbuser = "postgres"
9 $dbpassword = "DatabasePassword"
10 $dbtype = "Postgres"
11 $dbport = "5432"
12 $dbinstance = ""
13 $aipaddress = ""
14 $clusterid = "MyCluster"
15 $postgreshost = ""
16 $computername = ""
17 $neolanguage = "en_US"
18 $defaultntp = "de.pool.ntp.org"
19 $adminname = "ASCAdmin"
20 $adminpw = "SecretPassword123#"
21
22 gcloud config set project neo-template
23
24 echo ""
25 echo "=== create disk from image ==="
26
27 gcloud compute disks create $vmname-base --image projects/neo-template/global/images/template-base --zone $zone
28 gcloud compute disks create $vmname-database --image projects/neo-template/global/images/template-database --zone $zone
29 gcloud compute disks create $vmname-storage --image projects/neo-template/global/images/template-storage --zone $zone
30
31 echo ""
32 echo "=== create compute engine ==="
33 gcloud compute instances create $vmname --disk name=$vmname-base,boot=yes --zone $zone --machine-type=$machinetype --scopes=c
34 gcloud compute instances attach-disk $vmname --disk $vmname-database --zone $zone
35 gcloud compute instances attach-disk $vmname --disk $vmname-storage --zone $zone
36
37 echo ""
38 echo "=== add metadata ==="
39 gcloud compute instances add-metadata $vmname --metadata InstallPath=$InstallPath,neoMode=$neomode,DBIp=$dbip,DBUser=$dbuser,
40
41 pause
42

```

Fig. 58: Example of a script file (Example\_CreateCore.ps1) to create an All-in-One neo system with external Postgres database

### Explanation of the parameters in the script file

Rows 1-3:

Here, you define the zone in which the Google Cloud VM is supposed to be created as well as the name and the type of the VM.

Rows 5-20:

Here, you define the PowerShell variables with the necessary details of the installation. As depicted in the example, variables not relevant for the installation can be left out or defined as an empty string.

In case of the Google Cloud, the parameter *InstallPath* (see fig. row 5) must be filled with the name of the neo ISO image file. The respective names of the neo ISO image file are available at our website. Log in to ASC XCHANGE on our website <https://www.asc.de/partner> and open the respective directory in the area *Software Download* e. g. *neo suite > NEO 6.4* to view the respective neo ISO image file, e. g. *Setup6.4.0-13.0.iso*.

The following parameters are available:

Parameter	Description
<i>installpath</i>	Enter the name of the <u>neo</u> ISO image file. Example: "Setup6.4.0-13.0.iso"
<i>neomode</i>	Enter one of the following options: <ul style="list-style-type: none"> <li>• <i>AllInOne</i> = <u>neo</u>-VM with Core and with DB</li> <li>• <i>external db</i> = <u>neo</u>-VM with Core and with external DB</li> <li>• <i>without core</i> = <u>neo</u>-VM without Core and with DB</li> <li>• <i>without core/db</i> = <u>neo</u>-VM without Core and without DB</li> </ul> Example: "external db"

Parameter	Description
<i>dbip</i>	Enter the IP address for the external DB. This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>dbuser</i>	Enter the external DB user. If no information is entered, the ASC default is entered. This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>dbpassword</i>	Enter the password for the external DB. If no information is entered, the ASC default is entered. This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>dbtype</i>	Enter one of the following options: <ul style="list-style-type: none"> <li>• <i>Postgres</i></li> <li>• <i>MSSQL</i></li> </ul> This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>dbport</i>	Enter the value <i>1433</i> for MSSQL Standard. If a Named Instance is used, enter the differing port. Enter the value <i>5432</i> for POSTGRES. This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>dbinstance</i>	If you use MSSQL and Named Instance, enter the name of the Named Instance. If no information is entered, the ASC default is entered. This information is not required for NEOMODE <i>AllInOne</i> or for <i>without core</i> .
<i>aipaddress</i>	Enter the IP address for the <a href="#">AIP</a> (Core). This information is not required for NEOMODE <i>AllInOne</i> or for <i>external db</i> .
<i>clusterid</i>	Option: Enter the cluster ID. The server name is entered as default ID here. For All-in-One systems you can apply this ID. If you set up a multi-server system with several application servers, you must replace the default ID for all application servers with another arbitrary cluster ID which is identical for all application servers.
<i>postgreshost</i>	Option: Enter the IP address for the DB which requires remote access (e. g. with remote recorder). You can create several IP/Netmasks separated by semicolons. The format IP/Netmask is mandatory. Example: " <i>192.168.170.0/24</i> "
<i>computername</i>	Option: Enter the computer name. Observe Microsoft's conventions!
<i>neolanguage</i>	Enter the language to be installed for <a href="#">neo</a> . Example: " <i>en_US;de_DE</i> "
<i>defaultntp</i>	Option: Enter the IP address for the <a href="#">NTP</a> server of <a href="#">neo</a> .
<i>adminname</i>	Enter the user name of the administrator.

Parameter	Description
<i>adminpw</i>	Enter the password of the administrator.
<i>postbuildscript</i>	Enter the PowerShell script file which is supposed to be executed after the installation.

Row 22:

The script changes to the target project. Enter the respective project of the GCP (Google Cloud Platform).

Rows 27-29:

The virtual hard disks of the **VM** are copied from the ASC template project.

Rows 33-35:

The virtual machine is created and the hard disks are attached.

Row 39:

Here, the metadata of the **VM** is filled with the installation parameters from rows 5-20.

5. Adjust the parameters in the script file according to your requirements.
6. Select the menu item *File > Save as*.  
⇒ The window *Save As* appears.
7. Select a storage location and enter a file name for the script file, e. g. *C:\Install\Create-Core\_neo.ps1*.
8. Click on the button *Save*.  
⇒ The script file is saved and the window *Save As* is closed.

## Execute script file

1. In the Windows Explorer, change to the storage location of the recently created script file, e. g. *C:\Install*.
2. Right-click on the recently created script file, e. g. *CreateCore\_neo.ps1*.
3. Click on the menu item *Execute with PowerShell* in the context menu.  
⇒ The **VM** is created. The preinstalled ASC tool *ImageMan* executes the *neo* installation and configuration with the transmitted parameters.  
⇒ Log files of this process can be found on the **VM** in the path *C:\Install*.
4. During the configuration, the **VM** is restarted several times automatically. Do not start or stop the **VM** manually before the installation has been completed.



Please be aware that *Hyper-V Live-Migration* is not supported.

Since *Hyper-V* works with its own [NTP](#) server, you have to use one of the following options to ensure an accurate time synchronization:



- The same *NTP* servers must have been configured for the recording system and for [Hyper-V](#).
- Switch off the [NTP](#) server in the recording system.
- Remove the [NTP](#) server in the recording system.

For further information about the administration of the [NTP](#) servers of the recording system refer to the installation manual *Configuration of servers and recording architectures*.

### When using passive recording solutions

To use *Hyper-V* in promiscuous mode to monitor external data traffic in virtual environments, enter the following commands with your configuration parameters in the Hyper-V console:

#### Examples:

```
Set-VMNetworkAdapter MyVM -PortMirroring Destination
Get-VMNetworkAdapter MyVM | ? MacAddress -eq 'xxxxxxx' | Set-
VMNetworkAdapter MyVM -PortMirroring Destination
$portFeature=Get-VMSystemSwitchExtensionPortFeature -FeatureName "Ethernet
Switch Port Security Settings"
# None = 0, Destination = 1, Source = 2
$portFeature.SettingData.MonitorMode = 2
Add-VMSwitchExtensionPortFeature -ExternalPort -SwitchName MySwitch -
VMSwitchExtensionFeature $portFeature
```

## 7

## Installation and configuration Digi AnywhereUSB

For the operation of the ASC recording software in a virtual environment a permanent Internet connection to ASC or alternatively a USB dongle is required. The Digi AnywhereUSB box can be used to connect USB components such as a USB dongle.

The following chapter describes the installation and the configuration of the Digi AnywhereUSB box which is required for the operation in a virtual environment.



The Digi AnywhereUSB box can only be operated with one server at the same time.

## 7.1

### Install drivers

1. Connect the Digi AnywhereUSB box to the power supply.
2. Connect the Digi AnywhereUSB box to your network.
3. Download the driver and, if required, the latest firmware from the homepage indicated below:  
<https://www.digi.com/support/productdetail?pid=3747>
4. Install the appropriate driver according to the setup instructions.
5. After the installation of the drivers, a CMD window is opened automatically. Verify that the message *System driver installed successfully!* is displayed.

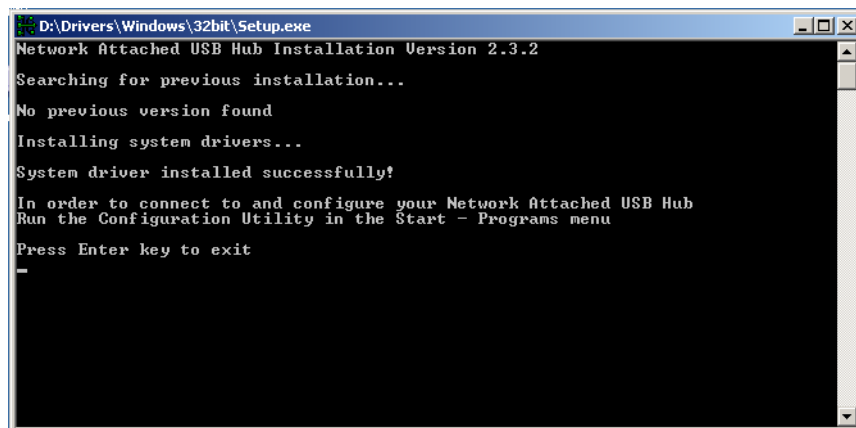


Fig. 59: Message informing about successful installation of driver


6. Press the [Enter] key to close the CMD window.

## 7.2

### Configure Digi AnywhereUSB

## 7.2.1

#### Establish connection to the VMware server

1. Press the Windows key.
2. Click on the icon .
  - ⇒ The installed apps are displayed.
3. Click on *AnywhereUSB Configuration Utility*.
  - ⇒ The following window appears:



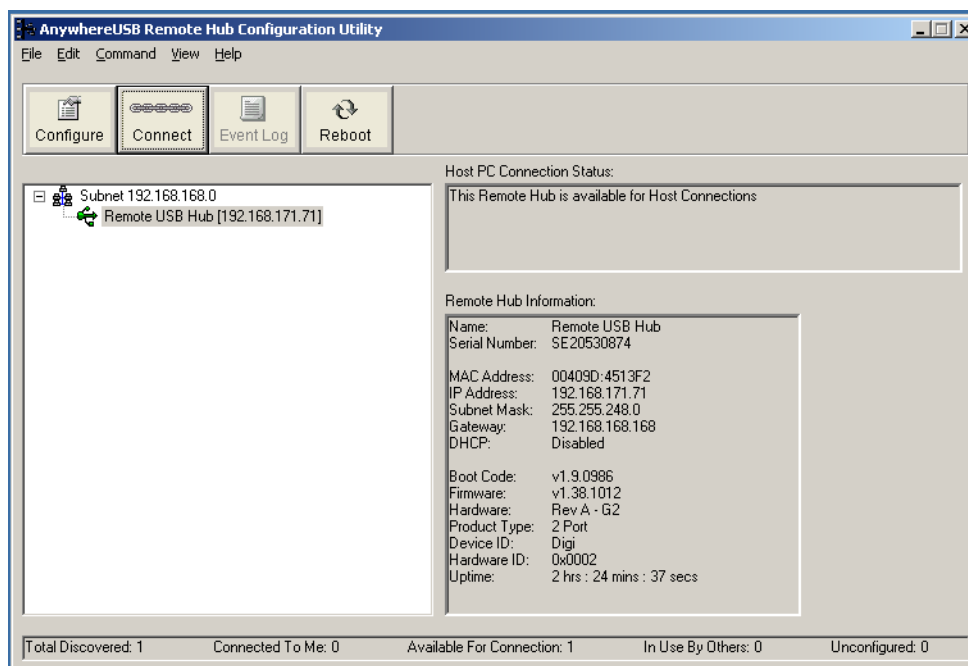



Fig. 60: Connect VMware server

4. Click on the button *Connect*.

### 7.2.2 Change connection to the VMware server

If the Digi AnywhereUSB box is supposed to be used on another VMware server, proceed as follows:

1. Press the Windows key.
2. Click on the icon .
  - ⇒ The installed apps are displayed.
3. Click on *AnywhereUSB Configuration Utility*.
  - ⇒ The following window appears:

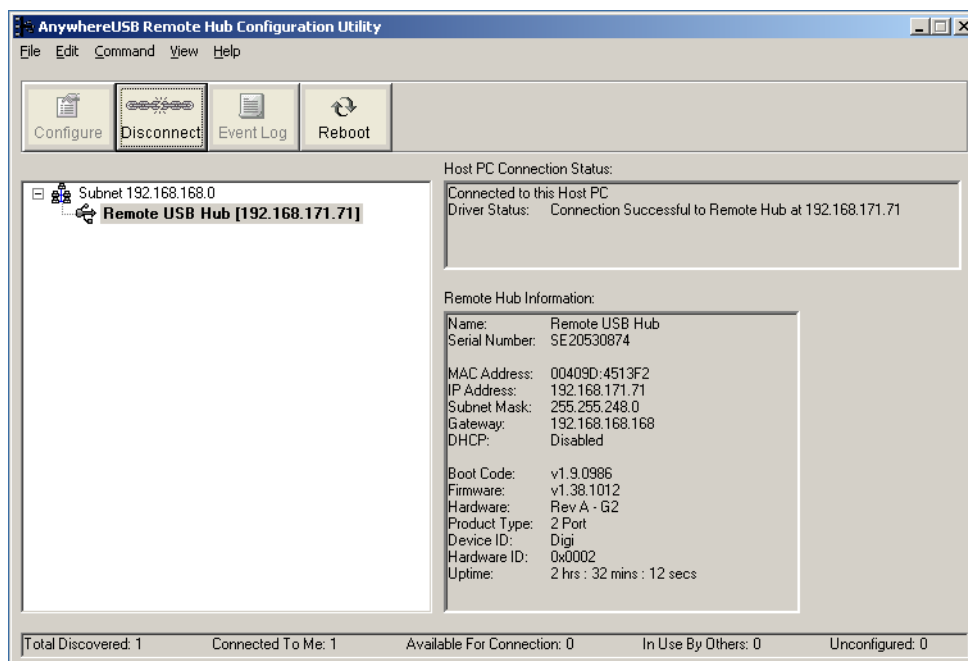


Fig. 61: Disconnect connection

4. Click on the button *Disconnect*.

5. Repeat all steps as described in [chapter "Install drivers", p. 48](#).
6. Repeat all steps as described in [chapter "Establish connection to the VMware server", p. 48](#).

### 7.2.3 Change IP address

By default, the Digi AnywhereUSB box has a **DHCP** network address. After the installation of the drivers, the Digi AnywhereUSB box is found automatically and the IP address of the VMware server is applied. This option has already been activated in the default setting.

To change the IP address, proceed as follows:

1. Start a browser.
2. Enter the IP address `https://192.168.175.20` in the address bar.
3. The configuration program *AnywhereUSB/2 Configuration and Management* is opened.

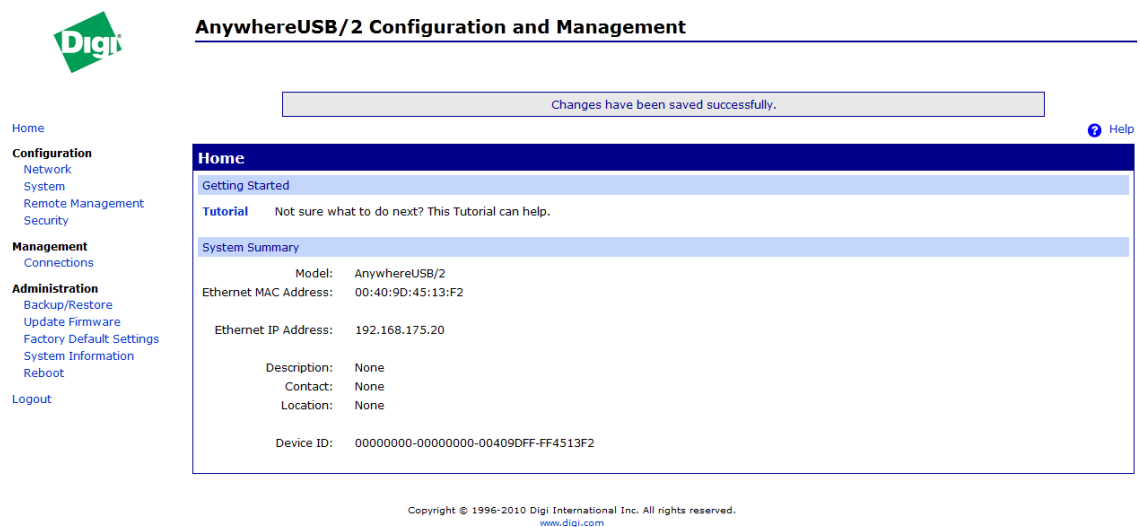


Fig. 62: Configuration program *AnywhereUSB/2 Configuration and Management*

4. Select the menu item *Configuration > Network* in the structure view.

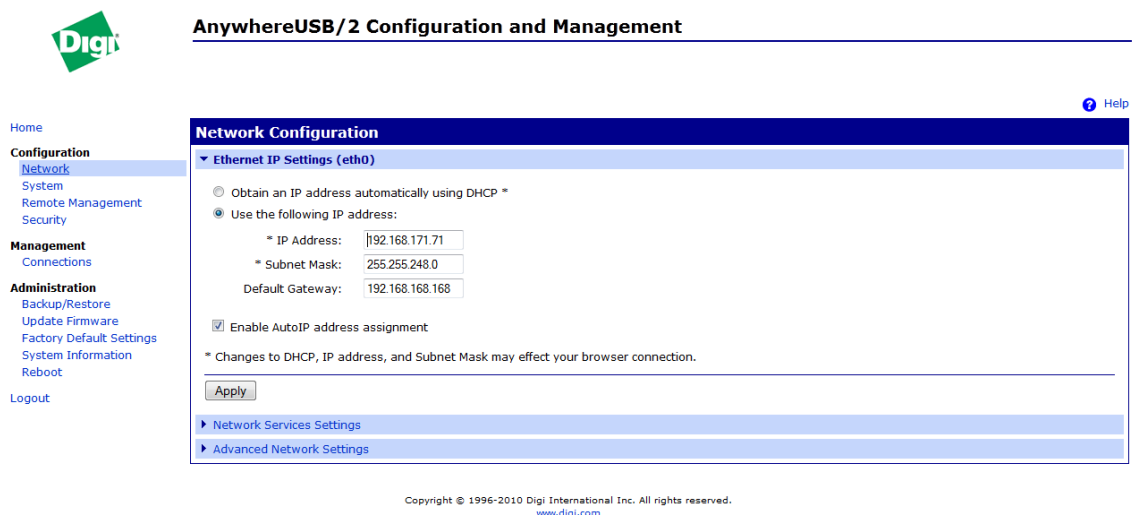


Fig. 63: Change IP address

5. In the field *Use the following IP address > IP Address*, enter the new IP address.
6. Click on the button *Apply*.
7. Confirm the security prompt with *Apply*.



## AnywhereUSB/2 Configuration and Management

? Help

**Apply Changes**

The configuration changes will cause your network settings to take effect immediately.

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www.digi.com

Fig. 64: Confirm change

8. The VMware server recognizes the change of the IP address automatically. The connection to the Digi AnywhereUSB box is reestablished.



## AnywhereUSB/2 Configuration and Management

? Help

**Reconnect In Progress**

The AnywhereUSB/2 with MAC address 00:40:9D:45:13:F2 is currently updating the network settings. You will be reconnected automatically in approximately 15 seconds.

If you are not reconnected automatically [click here](#) or use the discovery utility that was provided on your CD to find this device on the network.

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www.digi.com

Fig. 65: Reconnect VMware server

9. In the configuration menu, the message *Changes have been saved successfully* appears.



## AnywhereUSB/2 Configuration and Management

Changes have been saved successfully.

? Help

Home

**Configuration**

- Network
- System
- Remote Management
- Security

**Management**

- Connections

**Administration**

- Backup/Restore
- Update Firmware
- Factory Default Settings
- System Information
- Reboot

[Logout](#)

**Home**

[Getting Started](#)

**Tutorial** Not sure what to do next? This Tutorial can help.

**System Summary**

Model:	AnywhereUSB/2
Ethernet MAC Address:	00:40:9D:45:13:F2
Ethernet IP Address:	192.168.171.71
Description:	None
Contact:	None
Location:	None
Device ID:	00000000-00000000-00409DFF-FF4513F2

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Fig. 66: Change of the IP address completed successfully

## 8 Configuration System Configuration

To be able to operate the recording system in a virtual environment, you have to adjust the following configurations in the Servers module of the application System Configuration:

1. Activate the VM support, see [chapter "Tab Usage", p. 52](#).
2. Enter the connection data to the dongle, see [chapter "Tab Keystore/Virtualization", p. 53](#).
3. To save the settings, click on the button **Save** in the detail view.

For information about starting and using the application System Configuration refer to the user manual *Usage System Configuration*.

### 8.1 Tab Usage

In this tab, you can configure the purpose of the selected server.

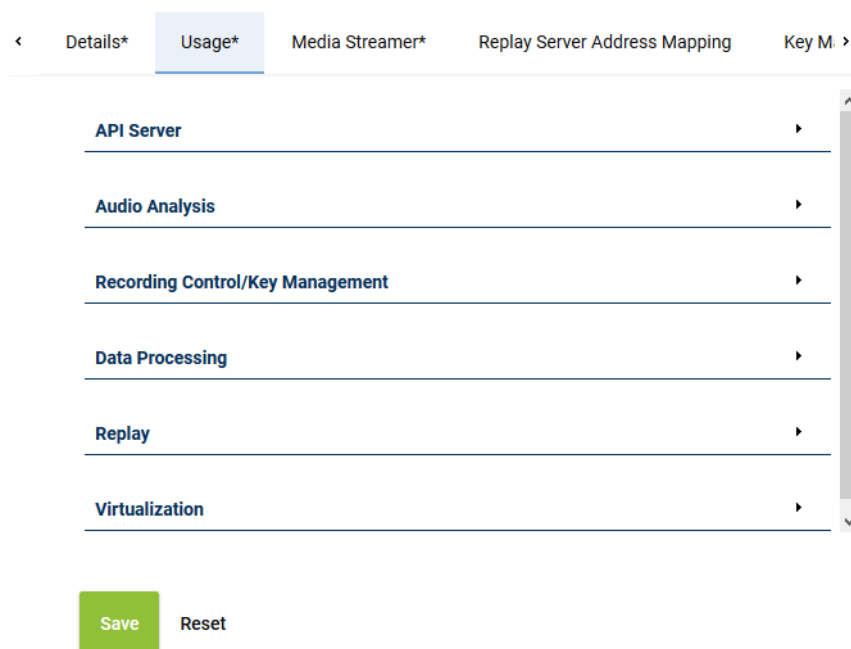


Fig. 67: Servers module - tab Usage

#### Group field Virtualization

1. Open the group field *Virtualization*.



Fig. 68: Group field Virtualization

2. Enter the following parameters:

**VM without Trusted License** If the system runs in a virtual environment and if no *TRUSTED\_VIRTUALIZATION* license has been installed, you must activate the function *VM without Trusted License*.

☒ = Function has been activated.  
☐ = Function has not been activated.

When activating this functionality, the Licensing module has to authenticate on one of the following instances:  
 Dongle Manager or ASC License Management System

The system therefore requires a permanent connection either to the ASC License Management System at the ASC headquarters or to a dongle on one of the servers of the system. About the configuration of the connection data, see [chapter "Tab Keystore/Virtualization", p. 53](#).

**NOTICE!** This functionality can only be activated on servers with an Enterprise Core.

**NOTICE!** This function can only be activated if the system has been installed in a virtual environment.



For *virtualization* without an Internet connection, a Trusted License is required.

## 8.2

### Tab Keystore/Virtualization

1. Click on the tab *Keystore/Virtualization* in the detail view.

In this tab, you can configure the connection data for the service *DongleMan* for the *neo* key management and for the authentication of the *VM*.



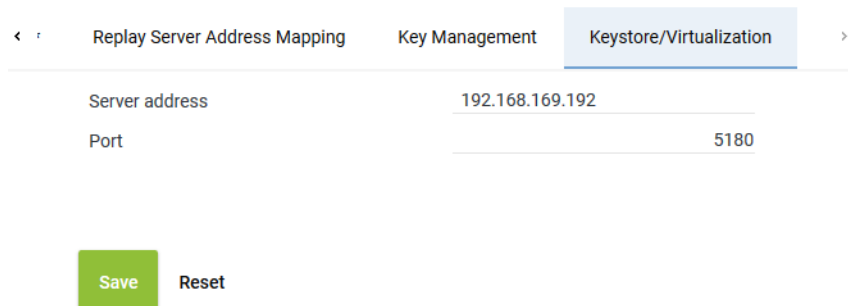
If your system has been installed in a virtualized environment and you are deploying a dongle, the port that the dongle has been plugged in to must have been assigned to the server that the application of the Dongle Manager has been installed on to enable access to the dongle.



For detailed information about neo key management refer to the administration manual *Encryption of recordings*.

For Keystore/Virtualization, the following constellations are possible:

- Hardware without dongle with key management  
In this case, the keystore, i. e. the Dongle Manager, must be configured.
- Hardware with dongle with key management  
In this case, the keystore, i. e. the Dongle Manager, must be configured.
- *VM* with dongle without key management  
In this case, the Dongle Manager must be configured.  
Only valid for inventory systems. No longer supplied.
- *VM* with connection to *licensing.asc.de* without key management  
The connection to *licensing.asc.de* must be configured.
- *VM* with *TRUSTED\_VIRTUALIZATION* license with key management  
In this case, the Dongle Manager must be configured.



Servers module - tab Keystore/Virtualization	
Server address	192.168.169.192
Port	5180
<div> <div>Save</div> <div>Reset</div> </div>	

Fig. 69: Servers module - tab Keystore/Virtualization

**Server address** Enter the address of the server for the connection.

- If you use the hardware with neo key management:

	<p>IP address of the server where the service <i>DongleMan</i> has been installed.</p> <ul style="list-style-type: none"> <li>If you use the VM with dongle without neo key management: IP address of the server where the service <i>DongleMan</i> has been installed.</li> <li>If you use the VM without neo key management, you can authenticate the VM via ASC License Management System, too. In this case, enter the following address: <i>licensing.asc.de</i></li> <li>If you use the VM with <i>TRUSTED_VIRTUALIZATION</i> license and neo key management: IP address of the server where the service <i>DongleMan</i> has been installed.</li> </ul>
Port	<p>Enter the port for the connection.</p> <p>5180 = Dongle Manager</p> <p>8181 = ASC License Management System</p>

## 9 Quick guide

## 9.1 Create and configure vSwitch for administration

- Create vSwitch:

Register vSphere Client > in the inventory window on host > **Configuration > Networking > Virtual Switch > Add Networking > Virtual Machine > Next > Create a virtual switch and activate adapter > Next > Enter network label > Next > Finish.**

- Configure vSwitch:

Select vSwitch > **Properties > vSwitch > Edit > Security > Promiscuous Mode: Reject > MAC Address Changes: Reject > Forged Transmits: Reject > OK > Click on previously created network > Edit > Security > Promiscuous Mode: Reject > MAC Address Changes: Reject > Forged Transmits: Reject > OK.**

## 9.2 Create and configure vSwitch for passive recording

- Create vSwitch:

Register vSphere Client > in the inventory window on host > **Configuration > Networking > Virtual Switch > Add Networking > Virtual Machine > Next > Create a virtual switch and activate adapter > Next > Enter network label > Next > Finish.**

- Configure vSwitch:

Select vSwitch > **Properties > vSwitch > Edit > Security > Promiscuous Mode: Accept > MAC Address Changes: Accept > Forged Transmits: Accept > OK > Click on previously created network > Edit > Security > Promiscuous Mode: Accept > MAC Address Changes: Accept > Forged Transmits: Accept > OK.**

## 9.3 Install and configure Digi AnywhereUSB



- Install drivers:

Download drivers from homepage and follow setup instructions.

- Establish connection to the VMware server:

**Windows key > icon  > AnywhereUSB Configuration Utility > Connect.**

- Change connection to the VMware server:

**Windows key > icon  > AnywhereUSB Configuration Utility > Disconnect > follow setup instructions > Install Drivers > Windows key > icon  > AnywhereUSB Configuration Utility > Connect.**

## 9.4 Configure virtualization in System Configuration

- Activate VM without Trusted License:

**Servers module > Usage > Virtualization > Activate VM without Trusted License > Save**

- Enter connection data for authentication:

**Servers module > Keystore/Virtualization > Server address:** enter `licensing.asc.de` or IP address of the server with the dongle > **Port:** enter port (default: 5180) > **Save**

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## Glossary

### AIP

Asynchronous Integration Platform

---

### DB

Database

---

### DHCP

A Dynamic Host Configuration Protocol allows integrating computers into an existing network without configuring the network interface manually. Necessary information such as IP address, net mask, gateway, name server (DNS) and additionally required settings are distributed dynamically. (Source: Wikipedia 5th April 2017)

---

### NTP

Network Time Protocol NTP is a standard for the synchronization of clocks in computer systems via packet-based communication networks. NTP uses the connectionless transport protocol UDP. It has been developed with the objective to guarantee reliable time verification across networks with variable packet runtime. (Source: Wikipedia 12th June 2018)

---

### USB

Universal Serial Bus

---

### VM

Virtual machine

---