

acontis technologies GmbH

SOFTWARE

Hypervisor-UbuntuGuest-Guide

acontis Real-time Hypervisor and Ubuntu guest

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1 Introduction

This guide describes how to set up a Ubuntu guest in the *acontis Hypervisor*. It is assumed, the steps listed in the *Hypervisor Quick Start Guide* have been successfully executed.

The last chapter describes how to set up an *additional* Ubuntu guest, if 2 (or *more*) Ubuntu guests are to be used.



2 Copy Ubuntu ISO installation media to Hypervisor Host

In a first step, we need to copy the Ubuntu installation media (ISO file) from a Windows (or Linux) system into the Hypervisor Host filesystem.

2.1 Using Filezilla (recommended)

- Open a shell (right click on desktop and select 'Open Terminal here' or press CRTL + ALT + T) on the Hypervisor Host.
- Determine the IP address of the system (with ifconfig command and through inet entry):

```
rte@RTV-TP104:~$ ifconfig
enp2s0: flags=4163<UP, BROADCAST, RUNNING, MULTICAST> mtu 1500
   inet 172.17.10.5 netmask 255.255.0.0 broadcast 172.17.255.255
   inet6 fe80::ccbb:85f1:38d3:fa2a prefixlen 64 scopeid 0x20<link>
   ether 90:1b:0e:18:c9:83 txqueuelen 1000 (Ethernet)
   RX packets 4618420 bytes 4033770375 (4.0 GB)
   RX errors 0 dropped 8865 overruns 0 frame 0
   TX packets 1460482 bytes 96608727 (96.6 MB)
   TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
   inet 127.0.0.1 netmask 255.0.0.0
   inet6 ::1 prefixlen 128 scopeid 0x10<host>
   loop txqueuelen 1000 (Local Loopback)
   RX packets 6864 bytes 427092 (427.0 KB)
   RX errors 0 dropped 0 overruns 0 frame 0
   TX packets 6864 bytes 427092 (427.0 KB)
   TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
vnet0: flags=99<UP, BROADCAST, NOTRAILERS, RUNNING> mtu 1500
   inet 192.168.157.1 netmask 255.255.255.0 broadcast 192.168.157.
<u>→</u>255
   ether 00:60:c8:00:00 txqueuelen 1000 (Ethernet)
   RX packets 765775 bytes 74216258 (74.2 MB)
   RX errors 0 dropped 0 overruns 0 frame 0
   TX packets 767935 bytes 74780268 (74.7 MB)
   TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
```

In this *example* the IP address is 172.17.10.5.

Hint: The device name enp2s0 differs on different PC/IPC's!

• Open Filezilla (get current version from https://filezilla-project.org/) and create new connection entry:





Fig. 2.1: Create new entry through site manager.

- 1. Push New site button
- 2. Give a qualified name
- 3. Select SFTP SSH File Transfer Protocol
- 4. Give Hypervisor Host IP/name. In screenshot above the last byte is X-ed out. Replace it with the 'detected' IP address.
- 5. Enter User name (same as at Hypervisor install)
- 6. Enter password (same as at Hypervisor install)
- 7. Push Connect button

Site Manager	×
Select entry:	General Advanced Transfer Settings Charset
□	Protocol: 3 SFTP - SSH File Transfer Protocol Host: 4 172.17.10.XX Port:
2 TestPC	Logon Type: Normal V User: rte Password: ••••••
	Background color: None ~ Comments:
1 <u>N</u> ew site New <u>f</u> older	^
New Book <u>m</u> ark <u>R</u> ename	
Delete Dupl <u>i</u> cate	×
	7 <u>C</u> onnect <u>Q</u> K Cancel

Fig. 2.2: Site manager dialog.

Select the installation media file (the .iso image) in the *Local* tab on the left and *upload* it to /hv/guests/examples/ubuntu into the *Server* tab on the right.





Fig. 2.3: Download installation media

2.2 Using a Windows Share

Here we will show how this can be accomplished using a network share (// NameOrIpAddressOfPcWithShare/NameOfShare) in the Windows system. We assume the network share has a directory /hv containing the file ubuntu-22.04-desktop-amd64.iso. We need to install the network client software (cifs) in the Hypervisor Host and then mount the Windows network share.

```
$ sudo apt-get install cifs-utils
```

```
$ sudo mount -t cifs //NameOrIpAddressOfPcWithShare/NameOfShare /mnt -o

→ user=NameOfUserWithAccessToShare
```

Copy the Ubuntu ISO image to /hv/guests/examples/ubuntu.

```
$ cp /mnt/hv/ubuntu-22.04-desktop-amd64.iso

→ /hv/guests/examples/ubuntu/ubuntu-22.04-desktop-amd64.iso
```

The mount point /mnt isn't needed anymore and thus will be unmounted.

\$ sudo umount /mnt



3 Guest Configuration

Prior to installing the guest, we need to configure the respective virtual machine (e.g. number of CPU cores, network settings etc.). The configuration files guest_config.sh and usr_guest_config.sh are located in the guest folder. The meaning of each configuration setting is explained in detail in those files. You need to edit these files and adjust them according to your needs and environment.

Caution: If the guest is controlled by the System Manager tool, you must not change the guest_config.sh file (the content may be overwritten by the System Manager), instead uncomment the respective settings in usr_guest_config.sh.

Example guests located in /hv/guests/examples are not controlled by the System Manager.

The number of CPU cores must **not** exceed the number of physical cores available in the system and not assigned to Real-time guests. For example, if on a *quad core* CPU, you need 2 cores for Real-time guests, the number of cores for the Windows guest must not exceed 2. The default parameters should fit for most cases.

```
$ gedit /hv/guests/examples/ubuntu/guest_config.sh (and/or

→ usr_guest_config.sh)
```

```
# Adapt following lines to your system and needs:
vmname=...
vmid=...
windows_guest=...
cdrom_iso=...
num_cpus=...
ramsize=...
```

You have to set the cdrom_iso parameter to the appropriate folder where the installation media ISO file had been copied before.

By default, the network connection is set up automatically (using DHCP). Please check the Hypervisor Manual for other settings.

Caution: Automatic network setting will only work, if the Ethernet cable is connected!

Caution: Please do not configure more CPUs than physically available (CPUs used for the Realtime OS are not available for the Windows guest). Example: The maximum number of of CPUs on a quad-core CPU where 1 CPU is used for the Real-time OS is 3.

Caution: Please do not configure more RAM than available. The VM may unexpectedly crash if too much RAM is configured. You can determine the available RAM as follows:

\$ cat /proc/meminfo | grep MemAvailable



4 Guest installation

After VM configuration you need to start the guest for the first time. The guest console will be shown then (the guest output or desktop).

\$ cd /hv/guests/examples/ubuntu
\$ hv_guest_start -view

The installation media iso file will be detected by the virtual bios, you need to press a key to boot from it:



Fig. 4.1: Boot from ISO file.

Hint: In case no key was pressed in time or the installation media was not found, the EFI shell will be started.

- Option a) You can leave into BIOS by entering exit. If you also leave BIOS the boot begins again and you can press a key to boot from CD.
- Option b) You can manually start the CD's bootloader by entering

- \$ FS0: - \$ \EFI\BOOT\BOOTX64.EFI



5 Ubuntu Installation

Follow the steps as usual for Ubuntu. In this guide the **default** cases are used where applicable.

• GRUB selection menu





• Select Install Ubuntu



	Jun 14 06:45	Å ● U
	Install	×
Welcome		
English Español Español Euskara Français Gaeilge Galego Hrvatski Íslenska Italiano Kurdî Latviski Lietuviškai Magyar Nederlands No localization (UTF-8) Norsk bokmål	Try Ubuntu Install Ubuntu Try Ubuntu Install Ubuntu Vacuum try Ubuntu without making any changes to your computer, directly from this CD. Or fayu're ready, you can install Ubuntu alongside (or instead of) your current operating system. This shouldn't take too long. Vourany wish to read the release notes. ••••••••••	



• Select your Keyboard layout -> Continue

Jun 14	4 06:46	- • U
Inst	stall	×
Keyboard layout		
Choose your keyboard layout:		
English (Australian) English (Cameroon) English (Cameroon) English (Chana) English (South Africa) English (UK) English (UK) Esperanto Estonian Paroese Filipino Finnish French Type here to test your keyboard Detect Keyboard Layout	English (US) English (US) - Cherokee English (US) - English (Colemak) English (US) - English (Colemak-DH ISO) English (US) - English (Colemak-DH) English (US) - English (Dvorak, IL English (US) - English (Dvorak, alt. intl.) English (US) - English (Dvorak, alt. intl.) English (US) - English (Dvorak, intl., with dead keys) English (US) - English (Dvorak, right-handed) English (US) - English (Macintosh) English (US) - English (Norman) English (US) - English (VS, Symbolic) Continue Quit Back	2
	In: Keyboard layout: English (Australian) English (Australian) English (Cameroon) English (Chana) English (Nigeria) English (Nigeria) English (Nigeria) English (UK) English (US) Esperanto Estonian Faroese Filipino Finnish French Type here to test your keyboard Detect Keyboard Layout	Jun 14 06/46 Install Choose your keyboard layout: English (Australian) English (US) English (Australian) English (US) English (Chana) English (US) English (Chana) English (US) English (US) English (US) Finnish English (US) French English (US) Type here to test your keyboard Quit Back

Fig. 5.3: Select keyboard layout.

• Updates and other software (default state) -> Continue



Jun 14 06:46	• • U
Install	
Updates and other software	
What apps would you like to install to start with? Normal installation Web browser, utilities, office software, games, and media players. Minimal installation Web browser and basic utilities.	
Other options	
C Download updates while installing Ubuntu This saves time after installation.	
Install third-party software for graphics and Wi-Fi hardware and additional media formats	
This software is subject to license terms included with its documentation. Some is proprietary.	
Quit Back Continue	
$\bullet \bullet \bullet \bullet \circ \circ \circ$	

Fig. 5.4: Leave Updates and other software as default.

• Installation type -> Erase disk and install Ubuntu -> InstallNow

Jun 14 06:47	+ •) ()
Install	×
Installation type	
This computer currently has no detected operating systems. What would you like to do? Carase disk and install Ubuntu Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems. Advanced features None selected Something else You can create or resize partitions yourself, or choose multiple partitions for Ubuntu.	
Quit Back Install Now	
$\bullet \bullet \bullet \bullet \bullet \circ \circ$	

Fig. 5.5: Select Erase disk and install Ubuntu at installation type page.

• Confirm Write the changes to disks? dialog -> Continue



	Install	
Ins	tallation type	
This	computer currently has no detected operating systems. What would you like to do? Erase disk and install Ubuntu Warning: This will delete all your programs, documents, photos, music, and any other files in all operating systems. Advanced features None selected	
	Write the changes to disks?	
	If you continue, the changes listed below will be written to the disks. Otherwise, you will be able to make further changes manually. The partition tables of the following devices are changed: Virtual disk 1 (vda)	
	The following partitions are going to be formatted: partition #1 of Virtual disk 1 (vda) as ESP partition #2 of Virtual disk 1 (vda) as ext4	
	Go Back Continue	
	Back Install Now	

Fig. 5.6: Confirm Write the changes to disks? dialog.

• Where are you -> Continue



Fig. 5.7: Select where you are.

• Create credentials -> Continue



	Jun 14 08:50		♣ ● U
	lastell.		
	Install		
Who are you?			
Your name:	rte	•	
Your computer's name:	TP-RTE		
	The name it uses when it talks to other computers.		
Pick a username:	rte 🔮		
Choose a password:	Fair password		
Confirm your password:	••••••		
	O Log in automatically		
	Require my password to log in		-
	Use Active Directory		
	You'll enter domain and other details in the next step.		
		Back Continue	
	• • • • • • •		

Fig. 5.8: Fill in the credentials.

Hint: In this guide the default user used is rte. It's recommended to supply a password.

• Restart -> RestartNow

Jun 14 08:57	よ 🐠 (り
Installation Complete	×
Installation is complete. You need to restart the cor in order to use the new installation.	nputer Now

Fig. 5.9: Restart guest.



• Press enter -> ENTER



Fig. 5.10: Press ENTER.

• Login (in this example with user rte and the supplied password)



Fig. 5.11: Login into guest.

OPTIONAL Update guest -> InstallNow





Fig. 5.12: Update guest.



6 Running Ubuntu guest

After successfully installing Ubuntu, you need to shutdown Ubuntu.

• Shutdown Ubuntu

Important: You need to shutdown the guest (do **NOT** reboot Ubuntu!). If this not possible inside the guest, please run hv_guest_stop in the guest folder (/hv/guests/examples/ubuntu).

• Adjust the file usr_guest_config.sh (to avoid booting the installation media again)

\$ gedit /hv/guests/examples/ubuntu/usr_guest_config.sh

comment "cdrom_iso" with #

- Start the Ubuntu guest
 - \$ hv_guest_start -view

Hint: Due to hardware changes, Ubuntu may automatically reboot once. Mouse and desktop may still not work properly. In this case, please install all of the latest Ubuntu updates.



7 RTOS Communication Support

7.1 Installation

To communicate with an RTOS via the Hypervisor we need to run install_attach.sh which will install the required drivers and packages.

The installation is provided in a mountable directory. To access this directory we need to install the network client software (cifs-utils) and mount the SMB drive from QEMU where the installation is located.

Open a console prompt in the Ubuntu guest and enter the following:

```
$ sudo apt-get update
$ sudo apt-get install cifs-utils
$ sudo mkdir /mnt/qemu
$ sudo mount -t cifs //10.0.2.4/qemu /mnt/qemu -o guest
$ sudo /mnt/qemu/files/LinuxTools/install_attach.sh
```



Fig. 7.1: Setup command.

With the installation process, the directory /hv is created. This is where all the essential binaries and files, required for the hypervisor in the Ubuntu guest environment, are stored.

Hint: If you encounter problems like hvconnectpackage depends on <package-name> when running the command install_attach.sh, you may have to install missing packages. Read the messages to see which package is missing. Then install the missing package. Before you can call install_attach.sh skript again you must first remove the aborted installation.

- Step 1: Run Ubuntu console
- Step 2: Input the command in the window: sudo dpkg -r hvconnectpackage and press Enter.



- Step 3: Input the command in the window: sudo apt install <fill in missing packages here> and press Enter.
- Step 4: Input the command in the window: sudo /mnt/qemu/files/LinuxTools/ install_attach.sh and press Enter.

7.2 Load the driver at startup

For enabling communication between the Hypervisor Host and other RTOS systems on the hypervisor the driver /hv/bin/rtosdrv.ko needs to be loaded. To accomplish this you can start the service manually with /hv/bin/load_rtosdrv.sh or link the service /hv/services/hv_loadrtosdrv.service to the autostart function and enable it.

Open console prompt in Ubuntu guest and enter the following:

Upon system startup, this service triggers the execution of the script /hv/bin/load_rtosdrv.sh. The purpose of this script is to verify the compatibility of the driver, recompile it if necessary, and then initiate it. This process guarantees the ability to load the driver even in the event of an operating system update.

7.3 Prepare for shared memory

In order to use shared memory between Ubuntu guest and RTOS, modifications must be made to /etc/ default/grub. These adjustments are executed automatically during the installation process, after which grub is updated. Before these changes take place, a backup copy of the grub file is created and stored the /etc/default directory.

The installation process adds noexec=off and clearcpuid=nx to the GRUB_CMDLINE_LINUX line within the grub file.

7.4 Verify installation

To verify whether the installation was successful, you can invoke the driver with the command hv_attach -osid <OSID>. The needed OSID was set with export rtosOsId=<OSID> in guest_config. sh when installing the Ubuntu guest. If hv_attach responds with 'Finished successfully', it indicates that the driver was correctly loaded and a connection was successfully established.

In this case, you can also check if a virtual network has been set up using ip address. Here you should see a vnet address.







8 Ubuntu and Real-time guest in parallel

Caution: The hv.config configuration file is a link to the RT-Linux example guest configuration file. See also chapter **Example guest folders** in the Hypervisor Manual for more information.

In this step, we will run Ubuntu and Real-Time Linux in parallel.

- Shutdown Ubuntu, do NOT reboot!
- Run the Real-Time Linux guest

```
$ cd /hv/guests/examples/rt-linux
$ hv_guest_start -view
```

- Open a second shell (right click on desktop and select 'Open Terminal here' or press CRTL + ALT + T)
- Start the Ubuntu guest
 - \$ cd /hv/guests/examples/ubuntu
 - \$ hv_guest_start -view
- After logging in into Ubuntu, execute "Hypervisor Attach" (Desktop icon) or open a shell and call hv_attach -osid OSID

The needed OSID was set with export rtosOsId=<OSID> in guest_config.sh when installing the Ubuntu guest.

-			vm1 (1) - Remote Viewer	- + ×
File	View Ser	nd key Help		
Act	ivities		Jun 22 15:09 🛱 de 🗳	. ¢⁄ (U
1		Â	attach.sh -wait – 🗆 🗙	
9) F	Home	[sudo] password for hwuser: Attaching to hwuservisor	
			Please enter the osid: 1 Finished successfully,	
			Press any key or wait 10 seconds to finish	
			hvuser@ubuntu-gast: /etc/systemd/system 🔍 🗏 🗕 🗆 🗙	
?		hvuser@u Attachir	<pre>buntu-gast:/etc/systemd/system\$ hv_attach -osid 1 g to hypervisor</pre>	
		Finished	successfully.	
۰X			buntu-gast:/etc/system4/system\$ []	
•				at
			Hypervi	sor Attach
0				
			8	
			hyp D	etach

Fig. 8.1: Hypervisor Attach.

• To open the RT-Linux shell in Ubuntu guest: execute ssh root@192.168.157.2 in Ubuntu shell







Hint: With hv_attach, the driver establishes a virtual TCP/IP connection to the Hypervisor Host and the initiated RTOS systems on the hypervisor using the built-in rtosvnet driver. The IP Address is configured in guest.config:

[Rtos2\\Vnet\\0]
"IpAddress"="192.168.157.3"
"MacAddress"="AA:BB:CC:DD:EE:03"

- Log into Real-Time Linux and run the *Real-time* demo:
 - \$ vmf64 login: root
 - \$ password: root
 - \$ RealtimeDemo



9 Add an additional Ubuntu guest [OPTIONAL]

To clone an existing VM, follow the same steps as described in the Hypervisor manual.

As an *alternative* to cloning the installed Ubuntu image, it's also possible to use the ubuntu.iso installation media again – like in the previous chapters – and install it into another guest folder /hv/guests/ examples/ubuntu2. See the Hypervisor manual for more details.

Hint: The *same* changes of *this* chapter applies accordingly for more Ubuntu guests (like ubuntu3, ubuntu4, etc).